



THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY,

INCLUDING

ZOOLOGY, BOTANY, AND GEOLOGY.

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

CONDUCTED BY

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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.”—BRUCKNER, *Théorie du Système Animal*, Leyden, 1767.

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

J. TAYLOR, *Norwich*, 1818.



CONTENTS OF VOL. XVI.

[SIXTH SERIES.]

NUMBER XCI.

	Page
I. Natural History Notes from H.M. Indian Marine Survey Steamer 'Investigator,' Commander C. F. Oldham, R.N.—Series II., No. 19. Report upon the Mollusca dredged in the Bay of Bengal &c. during the Season 1893–94. By EDGAR A. SMITH. (Plates I. & II.)	1
II. Some new Species of Odonata of the "Légion" <i>Lestes</i> , with Notes. By ROBERT M'LACHLAN, F.R.S.	19
III. On a Collection of Reptiles and Batrachians from Ferguson Island, D'Entrecasteaux Group, British New Guinea. By G. A. BOULENGER, F.R.S.	28
IV. On some new or little-known Reptiles obtained by W. H. Crosse, Esq., on the Niger. By G. A. BOULENGER, F.R.S.	32
V. Note on the Japanese <i>Rhipidoceridæ</i> : a new Genus and Species. By G. LEWIS, F.L.S.	35
VI. Descriptions of some new Species of Heterocera from Tropical America. By HERBERT DRUCE, F.L.S.	36
VII. Some Javan <i>Perichetidæ</i> . By W. BLAXLAND BENHAM, D.Sc. (Lond.), Hon. M.A. (Oxon.), Aldrichian Demonstrator in Comparative Anatomy, Oxford. (Plate III.)	40
VIII. Descriptions of Five new African Shrews. By OLDFIELD THOMAS	51
IX. On small Mammals from Nicaragua and Bogota. By OLDFIELD THOMAS	55
X. On some Coccidæ obtained by Mr. C. A. Barber in the Island of Antigua, W.I. By T. D. A. COCKERELL, Entomologist of the New Mexico (U.S.A.) Agricultural Experiment Station	60
XI. New Bees of the Genus <i>Halictus</i> from New Mexico, U.S.A. By T. D. A. COCKERELL, Entomologist of the New Mexico (U.S.A.) Agricultural Experiment Station	63
XII. On some <i>Perichæta</i> from the Eastern Archipelago collected by Mr. Everett. By FRANK E. BEDDARD, M.A., F.R.S., and SOPHIE M. FEDARB	69

	Page
XIII. Notes on some of the <i>Solifuge</i> contained in the Collection of the British Museum, with Descriptions of new Species. By R. I. Pocock. (Plate IV.)	74
XIV. On the <i>Dascillidae</i> and Malacoderm Coleoptera of Japan. By G. LEWIS, F.L.S. (Plate VI.)	98
XV. Description of a new Species of Butterfly of the Genus <i>Amauris</i> obtained by Mr. Scott Elliot in East Central Africa. By ARTHUR G. BUTLER, Ph.D., F.L.S., &c.	122
<i>New Book</i> :—Manual of Conchology, Structural and Systematic. Second Series.—Pulmonata. Vol. IX. By H. A. PILSBRY ..	123
Correction to p. 521 ('Annals,' June 1895); On the Production of Males and Females in <i>Melipona</i> and <i>Trigona</i> , by J. Perez; On the Development of the Body in the Prawn (<i>Palæmon serratus</i> , Fabr.) and the Crayfish (<i>Astacus fluviatilis</i> , Gesn.), by Louis Roule	125—127

NUMBER XCII.

XVI. Notes on some Genera and Species of <i>Coccide</i> . By W. M. MASKELL, New Zealand.	129
XVII. Description of Two new Spiders obtained by Messrs. J. J. Quelch and F. McConnell on the Summit of Mount Roraima, in Demerara; with a Note upon the Systematic Position of the Genus <i>Desis</i> . By R. I. Pocock, of the British Museum	139
XVIII. Natural History Notes from H.M. Indian Marine Survey Steamer 'Investigator,' Commander C. F. Oldham, R.N., commanding.—Series II., No. 18. On a new Species of Viviparous Fish of the Family <i>Ophidiidae</i> . By A. ALCOCK, Superintendent of the Indian Museum	144
XIX. Further Notes on <i>Cutiterebra</i> : On the Identity of certain Species described by the late Bracy Clark. By E. E. AUSTEN, Zoological Department, British Museum	147
XX. A new Pupoid Type of <i>Helicidae</i> . By HENRY A. PILSBRY..	155
XXI. Descriptions of new Coleoptera in the British Museum. By CHARLES O. WATERHOUSE, F.E.S.	157
XXII. Preliminary Diagnoses of new Mammals from Northern Luzon, collected by Mr. John Whitehead. By OLDFIELD THOMAS.	160
XXIII. On a new Species of <i>Eliurus</i> . By OLDFIELD THOMAS ..	164
XXIV. On the Reptiles and Batrachians obtained by Mr. E. Lort-Phillips in Somaliland. By G. A. BOULENGER, F.R.S. (Plate VII.)	165
XXV. Descriptions of Four new Batrachians discovered by Mr. Charles Hose in Borneo. By G. A. BOULENGER, F.R.S.	169

	Page
XXVI. Descriptions of Two new Snakes from Usambara, German East Africa. By G. A. BOULENGER, F.R.S.	171
XXVII. The Subfamilies, Genera, and Species of the Copepod Family <i>Ascomyzontidae</i> , Thorell: Diagnosis, Synonymy, and Distribution. By Dr. WILH. GIESBRECHT, Naples.....	173
XXVIII. Description of new Genera and Species of Trapdoor Spiders belonging to the Group <i>Trionychi</i> . By R. I. Pocock, of the British Museum. (Plate V.)	187
XXIX. Description of a new Species of Squirrel from Central Africa. By W. E. DE WINTON	197
Proceedings of the Geological Society	198—201
A Query as to the Synonymy of <i>Rhysota Armiti</i> , Smith, by C. Hedley, F.L.S.; The Breeding-habits of the Crayfish, by E. A. Andrews, The Breeding-habits of the Earthworms, by E. A. Andrews; Note on the Origin of the Bell-Nucleus in <i>Physalia</i> , by Seitaro Goto	201—203

NUMBER XCIII.

XXX. Notes on Amphipoda, old and new. By the Rev. THOMAS R. R. STEBBING, M.A. (Plates VIII.—X.)	205
XXXI. On Budding in <i>Perophora</i> . By GEORGE LEFEVRE	213
XXXII. Notes on the Identity of some of the Types of <i>Mygalomorphæ</i> in the Collection of the British Museum. By R. I. Pocock, of the British Museum	223
XXXIII. On a new Sound-producing Organ in a Spider. By R. I. Pocock, of the British Museum of Natural History	230
XXXIV. The <i>Pholadidae</i> : Note on the Early Stages of Development. By C. P. SIGERFOOS	233
XXXV. On African Mole-Rats of the Genera <i>Georychus</i> and <i>Myoscalops</i> . By OLDFIELD THOMAS	238
XXXVI. Description of a new Chinese Squirrel. By OLDFIELD THOMAS	242
XXXVII. On the Structure of the Skull in <i>Peloneustes philarchus</i> , a Pliosaur from the Oxford Clay. By C. W. ANDREWS, F.G.S., Assistant in the Geological Department, British Museum. (Plate XIII.)	<i>ib.</i>
XXXVIII. The Hydroids of St. Andrews Bay. By Rev. J. H. CRAWFORD, F.L.S., St. Andrews Marine Laboratory	256
XXXIX. Natural History Notes from H.M. Indian Marine Survey Steamer 'Investigator,' Commander C. F. Oldham, R.N.—Series II., No. 20. Report upon some Mollusca dredged in the Arabian Sea during the Season 1894-95. By EDGAR A. SMITH	262

	Page
<i>New Book</i> :—A Manual for the Study of Insects. By JOHN HENRY COMSTOCK, Professor of Entomology in Cornell University and in Leland Stanford Junior University; and ANNA BOTSFORD COMSTOCK, Member of the Society of American Wood-Engravers.	266
Proceedings of the Geological Society	270
The Name of <i>Galeodes intrepidus</i> , by R. I. Pocock; On the <i>Acræa cynthius</i> of Drury, by Arthur G. Butler, Ph.D., F.L.S., &c.; Note on the Protoplasmic Connexion of Lasso-cells in <i>Physalia</i> , by Seitaro Goto	270, 271

NUMBER XCIV.

XL. Notes on the Madreporarian Genus <i>Astræopora</i> , as represented by the Specimens in the British Museum (Natural History). By H. M. BERNARD, M.A. Cantab., F.L.S., F.Z.S. (Plate XIV.)..	273
XLI. The Life-history and Growth-rate of the Lesser Sand-Eel (<i>Ammodytes tobianus</i>). By ARTHUR T. MASTERMAN, B.A. (Cantab.), Assistant Professor of Zoology, St. Andrews University	282
XLII. Description of Two new Chætogonaths (<i>Spadella schizoptera</i> and <i>Sagitta hispida</i>). By F. S. CONANT.....	288
XLIII. New Species of Indian <i>Epiplemidæ</i> , <i>Geometridæ</i> , <i>Thyrididæ</i> , and <i>Pyralidæ</i> . By Colonel C. SWINHOE, M.A., F.L.S., &c. ..	293
XLIV. On Rhætic Foraminifera from Wedmore, in Somerset. By FREDERICK CHAPMAN, F.R.M.S. (Plates XI. & XII.)	305
XLV. On the <i>Geometridæ</i> , <i>Pyralidæ</i> , and allied Families of Heterocera of the Lesser Antilles. By G. F. HAMPSON, B.A., F.E.S. ..	329
XLVI. A new West-African Insect. By W. H. NUNNEY	349
Note on <i>Rhysota Armiti</i> , by Edgar A. Smith; Descriptions of some new <i>Araneidæ</i> of New South Wales, by W. J. Rainbow..	351, 352

NUMBER XCV.

XLVII. On some new and rare British Copepoda. By THOMAS SCOTT, F.L.S., Naturalist to the Fishery Board for Scotland, and ANDREW SCOTT, Fisheries Assistant, University College, Liverpool. (Plates XV.-XVII.)	353
XLVIII. Descriptions of Five new Species of Land-Shells from New Guinea. By EDGAR A. SMITH. (Plate XX.).....	362
XLIX. Remarks on the Value of certain Cranial Characters employed by Prof. Cope for distinguishing Lizards from Snakes. By G. A. BOULENGER, F.R.S.....	366

	Page
L. Descriptions of Four small Mammals from South America, including one belonging to the peculiar Marsupial Genus " <i>Hyra-codon</i> ," Tomes. By OLDFIELD THOMAS	367
LI. Newly-discovered Stridulating-Organs in the Genus <i>Scytodes</i> . By F. O. PICKARD-CAMBRIDGE	371
LII. On the Lamellicorn Coleoptera of Japan, and Notices of others. By G. LEWIS, F.L.S.	374
LIII. Descriptions of Two new Reptiles obtained by Mr. A. S. Meek in the Trobriand Islands, British New Guinea. By G. A. BOULENGER, F.R.S.	408
LIV. Descriptions of new Genera of <i>Zephroniidae</i> , with brief preliminary Diagnoses of some new Species. By R. I. POCKOCK	409
LV. Descriptions of new Species of <i>Planema</i> in the Collection of the British Museum. By A. G. BUTLER, Ph.D. &c.	415
LVI. Some Remarks on the Dispersal of Marine Animals by means of Seaweeds. By RUPERT VALLENTIN	418
LVII. Description of a new Species of <i>Scolopendra</i> from the Solomon Islands. By R. I. POCKOCK	423
On the Status of the Names <i>Aplysia</i> and <i>Tethys</i> , by Henry A. Pilsbry; On the Origin of the Triradial Spicules of <i>Leucosolenia</i> , by E. A. Minchin	424—427

NUMBER XCVI.

LVIII. The Pectoral and Pelvic Girdles of <i>Muraenosaurus plicatus</i> . By C. W. ANDREWS, F.G.S., Assistant in the British Museum (Natural History)	429
LIX. Description of a supposed new Species of Land-Mollusk of the Genus <i>Parmarion</i> from Pulo Laut, an Island off the South-east Coast of Borneo. By Lieut.-Col. H. H. GODWIN-AUSTEN, F.R.S., F.Z.S., &c. (Plate XIX.)	434
LX. Description of a new Species of <i>Symphædra</i> . By PHILIP CROWLEY, F.L.S. &c.	437
LXI. On a Collection of Hymenopterous Insects from the Philippines. By Lieut.-Col. C. T. BINGHAM, F.Z.S.	438
LXII. A Revision of the Jurassic Bryozoa.—Part II. The Genus <i>Proboscina</i> . By J. W. GREGORY, D.Sc., F.G.S.	447
LXIII. Notes on the Palæozoic Bivalved Entomostraca.—No. XXXII. Some Carboniferous Ostracoda from Yorkshire. By Professor T. RUPERT JONES, F.R.S., and JAMES W. KIRKBY, Esq. (Plate XXI.)	452
LXIV. New Genera and Species of <i>Pyralidæ</i> , <i>Thyrididæ</i> , and <i>Epiplemidæ</i> . By W. WARREN, M.A., F.E.S.	460
LXV. Descriptions of Five new Species of <i>Ennea</i> from South Africa. By JAMES COSMO MELVILL, M.A., F.L.S., and JOHN HENRY PONSONBY, F.Z.S. (Plate XVIII.)	478
LXVI. Description of a new Characinoid Fish of the Genus <i>Parodon</i> . By G. A. BOULENGER, F.R.S.	480

	Page
LXVII. Descriptions of Two new Snakes of the Genus <i>Calamaria</i> . By G. A. BOULENGER, F.R.S.	481
LXVIII. Australian Entomophytes, or Entomogenous Fungi, and some Account of their Insect-Hosts. By ARTHUR SIDNEY OLLIFF, Government Entomologist New South Wales, Fellow Ent. Soc. London, Life-Member Ent. Soc. France	482
<i>New Book</i> :—Catalogue of the Marine Mollusks of Japan. By HENRY A. PILSBRY	488
On rapid Change of Colour in <i>Gasterosteus</i> , by James Dallas, F.L.S., Curator of the Albert Memorial Museum, Exeter; On Sexual Dimorphism in the Nautilus, by A. Vayssière; On the Structure of the Ectoderm and Nervous System in Parasitic Platyhel- minthes (Trematodes and Cestodes), by Léon Jammes . .	489—493
Index	495

PLATES IN VOL. XVI.

PLATE I. {	New Mollusca from the Bay of Bengal &c.
II. {	
III.	Javan Perichætidæ.
IV.	New Solifugæ.
V.	New Trapdoor Spiders.
VI.	Japanese Dascillidæ and Malacodermidæ.
VII.	New African Reptiles.
VIII. {	New Amphipoda.
IX. {	
X. {	
XI. {	Rhætic Foraminifera.
XII. {	
XIII.	Skull of <i>Peloneustes philarchus</i> .
XIV.	Structure and mode of growth of the genus <i>Astræopora</i> .
XV.	British Copepoda.
XVI. {	
XVII. }	
XVIII.	New Species of <i>Ennea</i> .
XIX.	<i>Parmarion Dohertyi</i> .
XX.	New Land-Shells from New Guinea.
XXI.	Palæozoic Bivalved Entomostraca.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SIXTH 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 conchylia succo."
N. Parthenii Giannettasii Ecl. 1.

No. 91. JULY 1895.

I.—*Natural History Notes from H.M. Indian Marine Survey Steamer 'Investigator,' Commander C. F. Oldham, R.N.—Series II., No. 19. Report upon the Mollusca dredged in the Bay of Bengal and the Arabian Sea during the Season 1893–94. By EDGAR A. SMITH.*

[Plates I. & II.]

THIS collection contains several very remarkable new forms, among which the two species of the new genus *Pontiothauma* are worthy of special notice. The *Calliostoma*, the *Dentalium*, the two new forms of *Cryptodon* are also species of considerable interest. The occurrence of the characteristically Japanese *Ranella perca* in the Indian Ocean is remarkable, and the discovery of a British *Lucina* and an Atlantic *Poromya* in these southern latitudes is of still greater interest. Another instance of wide distribution is that of the *Solenomya patagonica*. In my former paper I also described a *Lucina* which was hardly separable from a species occurring in the Straits of Magellan.

PONTIOTHAUMA*, gen. nov.

Testa fusiformis, haud umbilicata, antice rostrata, oblique plicata, spiraliter lirata et sulcata; apertura antice breviter canaliculata; columella simplex, haud plicata; labrum tenue, postice late sed haud profunde sinuatum; operculum nullum.

Animal cæcum, rostro magno, late expanso instructum; radula nulla.

The examination of the soft parts of this remarkable mollusk has kindly been undertaken by Mr. S. Pace, and the results of his investigation will be published subsequently. From a preliminary examination he is inclined to believe that its relationship will prove to be with the Pleurotomatidæ. The enormously expanded rostrum, and the absence of eyes, radula, and operculum, at once separate this genus from any which it approaches in shell-characters. Conchologically it bears some resemblance to the plicate forms of *Sipho* (*S. fusiformis*, &c.).

Pontiothauma mirabile. (Pl. I. fig. 1.)

Testa fusiformis, turrita, alba, epidermide plus minus induta; spira elongata, acuminata; anfractus 10?, superstientes septem convexi, regulariter lente accrescentes, oblique et flexuose costati (costis supra et infra evanescentibus), spiraliter fortiter et confertim lirati, ultimus subtumidus, costis obliquis gracilioribus et minus prominentibus instructus, antice breviter rostratus; apertura elongata, antice in canalem brevem producta, longit. totius $\frac{1}{2}$ paulo minor, intus alba; columella rectiuscula; labrum haud incrassatum, prope suturam late, sed haud profunde sinuatum, in medio prominens, arcuatum.

Longit. 136 millim., diam. 52; apertura 65 longa, 27 lata.

Hab. Off the Malabar coast, lat. 10° 7' 50" N., long. 74° 42' 30" E., in 1250 fathoms.

When viewed from behind this remarkable shell bears a strong resemblance to an elongate specimen of the common whelk, *Buccinum undatum*. It has all the aspect of a northern form, and one can scarcely credit the fact of its living so far south as the Indian Ocean. Only a single specimen was obtained.

Pontiothauma abyssicola. (Pl. I. fig. 2.)

Testa elongata, turrita, solidiuscula, imperforata, alba, epidermide tenui pallide olivaceo-viridi induta; anfractus sex, superne exca-

* πόντιος, marine; and θαύμα, a wonder.

vati, oblique et nodose plicati, ad latera levissime convexi, sutura obliqua sejuncti, striis spiralibus incisus numerosis, lineisque incrementi tenuibus obliquis flexuosis sculpti, ultimus mediocriter convexus, undique transversim striatus, striis circa basin latis, sulciformibus; apertura oblonga, alba, longit. totius $\frac{1}{2}$ paulo minor, inferne brevissimo et latissime canaliculata, subrecurva; labrum tenue, in excavationem infra suturam leviter sinuatum, infra arcuatum; columella alba, callosa, in medio paulo arcuata, inferne oblique torta; operculum nullum.

Longit. 50 millim., diam. 24; apertura 22 longa, 10 lata.

Hab. Station 134, off Kistna, Bay of Bengal, in 753 fathoms.

The depression or concavity at the upper part of the whorls produces a marginate appearance at the suture, and upon the margination the lines of growth are slightly puckered. The spiral striæ are somewhat deep and have rather a regular look to the naked eye. The nodose plications at the angulation above do not extend far downwards, but soon become obsolete, so that the lower part of the whorls has a nearly even surface.

Like the type of the genus, this species has neither radula nor operculum. It differs, however, in possessing eyes. Until the soft parts have been more fully examined, its position in the genus *Pontiothauma* must be considered uncertain.

Pleurotoma vagata. (Pl. I. fig. 3.)

Testa fusiformis, turrata, alba, epidermide tenuissima induta, incrementi lineis flexuosis striata; spira elongata, acuminata; anfractus 12, superne excavati, in medio carina quadrata tuberculata instructi, superne infra suturam carino-marginati, undique spiraliter striati, infra medium liris spiralibus 1-2 cincti, ultimus transversim striatus et liratus, antice elongato-rostratus; apertura cum canali longit. totius $\frac{1}{2}$ haud æquans, intus alba, liris intrantibus circiter decem armata; labrum tenue, subprofunde incisum; columella rectiuscula, leviter obliqua; canalis elongatus, angustus, subrecurvus.

Longit. 65 millim., diam. 23; apertura cum canali 28 longa, in medio 7 lata.

Hab. Station 172, off Trincomalee, Ceylon, in 200-350 fathoms.

This species belongs to that group of *Pleurotoma* which includes *P. Kieneri*, Doumet, *P. carinata*, Gray, and a few others which are characterized by a tuberculated keel upon the middle of the whorls.

A single specimen only was obtained.

Pleurotoma præsignis. (Pl. I. fig. 4.)

Testa fusiformis, turrata, alba, epidermide tenui flavescente induta; anfractus 11-12?, regulariter lente crescentes, superne ad suturam fortiter carinati, in medio prominentes, serie nodularum subacutarum instructi, infra nodulas linea filiformi (in anfr. superioribus obsoleta), et supra nodulas lineis duabus gracillimis cincti, ultimus infra medium angustatus, brevirostratus, infra nodulas circiter quatuor aliisque tenuioribus circa caudam ornatus; apertura alba, cum canali longit. totius $\frac{1}{3}$ æquans; labrum tenue, ad nodulas mediocriter profunde et latissime sinuatum, infra sinum prominens, arcuate productum; columella supra medium leviter incurvata, inferne paulo obliqua; canalis brevis, subrecurvus.

Longit. 42 millim., diam. 15; apertura cum canali 16 longa, in medio $5\frac{1}{2}$ lata.

Hab. Off Colombo, Ceylon, in 675 fathoms.

The prominent row of tubercles around the middle of the whorls, the keel beneath the suture, and the broad sinus in the labrum are the principal features of this species. The apex of the spire being broken away makes it impossible to state with certainty the exact number of whorls, but they would probably amount to eleven or twelve. The entire surface exhibits fine flexuous lines of growth.

Drillia fugata. (Pl. I. figs. 5, 5 a.)

Testa elongata, turrata, alba, epidermide tenui flavo-olivacea induta, spiralter striata, oblique costulata; spira elongata, acuminata; anfractus decem, convexiusculi, superne excavati, ad suturam undulate subcarinati, infra excavationem costis obliquis (in anfr. ultimo 11-12 inferne attenuatis et evanescentibus) instructi, ultimus antice paulo attenuatus; apertura angusta, alba, longit. totius $\frac{1}{2}$ paulo minor; labrum superne ad excavationem haud profunde sinuatum; columella rectiuscula, callo tenui albo induta; canalis mediocriter latus, brevis, leviter recurvus.

Longit. 45 millim., diam. 14; apertura 20 longa, 6 lata.

Var. Testa striis latioribus transversim sculpta, interstitiis liriformibus supra costas continuis (fig. 5 a).

Hab. Station 172, off Trincomalee, in 200-350 fathoms.

The greater breadth of the spiral striæ and the more conspicuous intervening ridges give the variety a somewhat distinct appearance from the type. The character of the costæ, the depression *above* them, the thickened wavy margination beneath the suture, and the epidermis are, however, similar.

Nassa turrifera. (Pl. I. fig. 6.)

Testa elongata, turrata, albida, nitida, costata; spira acuminato-pyramidalis, turrata; anfractus octo, supremi tres (nucleus) convexi, læves, cæteri tabulati, lateribus planiusculis, costis tenuibus supra tuberculatis (in anfr. penultimo circiter 12) instructi, spiraliter striati et lirati, ultimus antice constrictus, infra medium fortius liratus, liris supra costas subtuberculatis; apertura parva; labrum extra varicosum, intus tuberculis paucis, quorum medianum maximum, munitum; columella callo, tuberculis paucis parvis instructo, induta; canalis brevis, obliquus, recurvus. Longit. 10 millim., diam. 5.

Hab. Station 162, lat. 13° 51' 12" N., long. 80° 28' 12" E., off Coromandel coast, in 145-250 fathoms.

This species is remarkable for its elongate turreted form and the smallness of the aperture. The ribs are noduled at the upper end, almost perpendicular, and the least curved. The sutural line is prettily undulating. Of the three specimens of this interesting species one is more elongate than the others; in this the aperture is about one third the total length of the shell, whereas in the shorter examples it rather exceeds that proportion.

Columbella (Mitrella) Pacei. (Pl. I. fig. 7.)

Testa breviter fusiformis, sordide albida, lævis, circa basin anfractus ultimi oblique sulcata; spira elongata, acuminata; anfractus 8, tres embryonales pellucidi, convexi, cæteri turrati, planiusculi, vel levissime convexi, sutura obliqua, profunda discreti, infra suturam stria unica marginati, ultimus infra medium constrictus, transversim striatus, circa caudam oblique sulcatus; apertura elongata, medio-criter angusta, antice canaliculata, longit. totius $\frac{1}{2}$ paulo minor; canalis brevis, recurvus, obliquus; columella supra arcuata, infra obliqua, callo tenui induta, tuberculis parvis 2-3 instructa; labrum ad marginem acutum, extra varice incrassatum, intus subtuberculatum, suturam versus leviter sinuatum. Longit. 12 millim., diam. $5\frac{1}{2}$; apertura cum canali $5\frac{1}{2}$ longa, in medio 2 lata.

Hab. Station 162, off Coromandel coast, in 145-250 fathoms.

Judging from the four specimens of this species, the spire is liable to erosion at the apex. In the perfect example the apical whorl is almost globular, and the two following are also convex; these three, forming the embryonic shell, are pellucid and pinkish beneath the suture.

I have named this interesting species after Mr. S. Pace,

who has made a special study of the Columbelloidæ, and has kindly examined it for me.

Ranella (Biplex) perca (Perry).

Hab. Station 151, off Colombo, in 142–400 fathoms.

The examples of this well-known shell in the present collection are practically identical with the ordinary Japanese form. The knowledge of the extended range of this species lends support to the statement by Reeve, that it was obtained at the Philippine Islands by Mr. Cuming. It is interesting to note that Mr. G. B. Sowerby has also recorded the occurrence of another Japanese form (*Xenophora pallidula*) from 188 fathoms off the Andaman Islands.

Natica albospira. (Pl. I. fig. 8.)

Testa parva, globosa, anguste umbilicata, pallide fuscescens, infra suturam et circa basin alba; spira brevis, parva, ad apicem minuta; anfractus $5\frac{1}{2}$, convexi, celeriter accrescentes, sutura profunda canaliculata discreti, superiores $2\frac{1}{2}$ læves, cæteri infra suturam oblique plicati, plicis inferne sensim evanidis, ultimus globosus, striis spiralibus obsoletis sculptus; umbilicus parvus, callo intrante crasso semiimpletus; apertura semicircularis; columella obliqua, incrassata, labro callo tenui juncta; operculum testaceum, griseum, supra spiram olivaceo tinctum, planum, margine externo arcuato porca duplici incrassato, liris paucis inconspicuis porcæ parallelis striisque radiantibus haud conspicuis sculptum.

Diam. maj. $12\frac{1}{2}$ millim., min. 9, alt. 12; apertura $9\frac{1}{2}$ longa, $5\frac{1}{2}$ lata.

Hab. Station 172, off Trincomalee, Ceylon, in 200–350 fathoms.

Judging from the single specimen in the collection, it seems probable that this species may sometimes exceed the dimensions given above. It differs from the young of *N. rufa* in the absence of the pale peripheral zone, in the greater number of whorls, the stronger plications, smaller nucleus, and different operculum.

Natica candidula. (Pl. I. fig. 9.)

Testa parva, globosa, alba, infra suturam zona opaco-albida picta, mediocriter umbilicata; spira prominula; anfractus quatuor, convexi, læves, sed infra suturam oblique obsolete plicati; umbilicus profundus, pervius, simplex; apertura semicircularis; columella obliqua, leviter incrassata, superne callo reflexo labro juncta.

Diam. maj. 9 millim., min. 7, alt. 9; apertura 6 longa, 4 lata.

Hab. Station 151, off Colombo, in 142–400 fathoms.

A small white species, without any striking features. The spire is somewhat prominent and the umbilicus without any callus within. The single specimen was dredged dead, without the operculum. It has much the general aspect of the British *N. Montaguï*, but has no trace of an umbilical callus.

Sigaretus parvus. (Pl. I. fig. 10.)

Testa parva, depressa, obliqua, auriformis, minute perforata, tenuis, albida, epidermide flavescente plus minus induta; spira brevis, apice minuto fusco terminata; anfractus 4, convexiusculi, superiores duo spiraliter tenuissime striati, ultimus liris spiralibus filiformibus subconfertis undulatis circa medium planulatis instructus, lineis incrementi arcuatis conspicuis sculptus; apertura obliqua, ovata; peristoma tenue, marginibus conniventibus, callo tenui junctis, columellari paulo incrassato, reflexo, umbilicum minutum fere obtegente.

Diam. maj. $12\frac{1}{2}$ millim., min. 9, alt. 10; apertura $8\frac{1}{2}$ longa, $6\frac{1}{3}$ lata.

Hab. Station 170; off Coromandel coast, in 107 fathoms.

Of a different form to that of *S. tener**, also from the Bay of Bengal.

Bathybembix Wood-Masoni. (Pl. I. fig. 11.)

Testa imperforata, solida, pyramidalis, sub epidermide tenuissima, dilute fusco-grisea, alba, submargaritacea, ad peripheriam acute carinata; spira acute conica, lateribus fere rectis; anfractus 9-10?, lente accrescentes, superiores fere plani, supra suturam levissime concavi et tuberculis minutis acutis ornati, tres ultimi haud tuberculati, striis incrementi obliquis regularibus sculpti, ultimus leviter convexus, sed prope carinam paulo concavus, infra convexiusculus, striatus, circa regionem umbilici carina obtusa instructus; apertura obliqua, longit. totius $\frac{2}{3}$ subæquans; peristoma leviter incrassatum, album, levissime expansum, margine columellari fortiter reflexo, appresso, callo lato albo superne labro juncto; operculum tenue, corneum, anfractibus decem.

Diam. maj. 25 millim., min. 22, alt. 23.

Hab. Station 150, off Northern Maldive Atoll, 719 fathoms.

This is rather solid for a deep-water form, and the thickness of the calcareous layer above the nacre is sufficient to almost conceal it. However, in certain lights a slight iridescence is observable. The tubercles upon the upper whorls have the appearance of minute denticles overhanging the suture, which gradually pass away upon the penultimate whorl. In the

* Smith, Ann. & Mag. Nat. Hist. 1894, vol. xiv. p. 165, pl. iv. fig. 8.

young state this species is probably umbilicated. The basal keel is crossed by the incremental lines and has an irregular subnodose appearance. In addition to the lines of growth, indistinct spiral sulci are traceable upon the last two whorls, and one of the two specimens examined exhibits a slender elevated line revolving up the spire a little below the suture.

The general form is like that of *B. æola*, Watson, which is a much less solid form than the present species, and has a different style of sculpture.

I have associated with this remarkable species the name of the late Professor J. Wood-Mason, who has published several valuable reports upon portions of the 'Investigator' collections.

Calliostoma sublæve. (Pl. I. fig. 12.)

Testa acute conica, imperforata, dilute flavo- vel roseo-fusca, infra pallida, nitida, iridescens, ad peripheriam acute carinata; spira acute conica, lateribus levissime concavis; anfractus 8, apicales 1-2 albi, subglobosi, cæteri plani, inferne ad suturam carinati, carina crenulata, spiraliter obsolete substriati, lira supra carinam cincti; anfr. tertius et quartus cancellati, ultimus infra planiusculus, obsolete tenuissime concentrice striatus, circa regionem umbilici liris tribus ornatus; umbilicus callo obtectus; apertura obliqua, subquadrata, intus lævis, iridescens; columella brevis, obliqua, margaritacea.

Diam. maj. 20 millim., min. 17, alt. 18.

Hab. Station 172, off Trincomalee, Ceylon, in 200-350 fathoms.

The nucleus of the spire consists of two white convex whorls. The two following are obliquely costate, the costæ being tuberculate above and below at the channelled suture, a third row of tubercles being round the middle; upon the next whorl the costæ die away, but the tubercles still remain above and below, forming a carination at both sutures. The rest of the whorls are smooth, with very oblique and fine lines of growth and the faintest appearance of spiral striation. They are prominently keeled above the suture, the keel being crenulated or finely subtuberculated. Above and close to this carina a prominent lira revolves up the last three volutions. Upon the body-whorl the angle is bordered below with one or two less prominent liræ. Of the three or four liræ surrounding the umbilical region, the inner one bordering the central callus is somewhat tuberculated.

Calliostoma tranquebaricum (Pfeiffer) appears to be the nearest ally of this species. It is, however, not so elevated or acutely conical, the base is flatter, the whorls are more

strongly striated, the keel is smooth, the apical whorls are differently sculptured, and the base of the shell is more strongly concentrically striated. The pale brown spots and dots, which characterize that species, are altogether absent in the present form. The localities of these species being in the same ocean and so close together, seems to suggest that they may be modifications of one and the same form.

Dentalium mirificum. (Pl. II. fig. 1.)

Testa parva, versus apicem valde curvata et acuminata, quadrate tubiformis, latere incurvato latiore quam exteriore, longitudinaliter tenuiter striata, lineis incrementi tenuissimis sculpta, inter angulos subconcaeva.

Longit. 19 millim., diam. max. $2\frac{1}{2}$.

Hab. Station 172, off Trincomalee, in 200–350 fathoms.

This little species is remarkable for the sharply curved end and the subquadrate form. The four angles are acute at the tip, but gradually become obtuse as the shell increases. The incurved side is the broadest of all, and up the middle of it, especially towards the apex, there is a raised striation more conspicuous than the rest. This is so prominent at the end that, when viewed with the opening towards the eye, five angles are visible. The two angles on the excurved side, which is the narrowest of all, become almost obsolete near the aperture.

The form of the aperture, owing to the greater width and flatness of the incurved side, is very like the letter **D**.

Siphodentalium quinquangulare, Forbes, is a much more slender species, and more circular in section near the aperture.

I have placed this species temporarily in *Dentalium*, as the tips of the four specimens examined are all damaged. Possibly more perfect examples may exhibit slits, as in *Siphodentalium*.

Venus juvenilis. (Pl. II. figs. 2, 2 a.)

Testa minima, inæquilateralis, postice subquadrata, antice angustior, rotundata, pallida, vel dilute fuscescens, liris radiantibus tenuissimis, lamellis concentricis numerosis supra liras subnodosis, minute cancellata; umbones antemediani, incurvati, erosi; lunula cordiformis, sulco circumdata; pagina interna alba, margine undique minutissime denticulato; cicatrices magnæ; sinus pallii haud profundus, triangularis.

Longit. 9 millim., alt. 8, diam. $5\frac{1}{2}$.

Hab. Station 162, Bay of Bengal, off Coromandel coast, in 142–400 fathoms.

Probably one of the smallest, if not actually the smallest, species in the genus. It has not the appearance of being immature. The crenulation of the valve-margins is very minute and extends all round excepting beneath the ligament.

Tellina parvula. (Pl. II. fig. 3.)

Testa parva, æquivalvis, inæquilateralis, tenuis, pellucido-albida, ovata, postice acuminata, mediocriter compressa, concentrice tenuiter striata, nitida, carina levi in utraque valva, ab umbone usque ad extremitatem posticam decurrente, instructa; valva dextra lunulata; umbones parvi, acuti, postmediani; margo dorsi anticus leviter declivis, vix arcuatus, posticus brevior, rectiusculus, magis obliquus, ventralis late arcuatus; latus anticum magnum, curvatum, posticum acuminatum; dentes cardinales et laterales normales; pagina interna nitida, obsolete radiatim substriata. Longit. 15 millim., alt. 11, diam. 5.

Hab. Station 166, lat. $13^{\circ} 34' 55''$ N., long. $80^{\circ} 32' 12''$ E., Bay of Bengal, off Coromandel coast, in 133 fathoms; Station 176, lat. $13^{\circ} 01' 06''$ N., long. $80^{\circ} 36' 56''$ E., off Coromandel coast, in 107 fathoms.

The narrow lunule is nearly all in the right valve, and is bordered by a distinct keel.

Abra maxima (Sowerby).

Abra maxima, Smith, Ann. & Mag. Nat. Hist. 1894, vol. xiv. p. 169.

Hab. Station 112, lat. $13^{\circ} 47' 30''$ N., long. $92^{\circ} 36'$ E., west of Andaman Islands, in 561 fathoms.

This species has now been dredged at four different stations in the Bay of Bengal, at depths varying from 128 to 677 fathoms.

Abra convexior. (Pl. II. figs. 4, 4 a.)

Testa *A. maximæ* simillima, sed minor et convexior, postice vix carinata, umbonibus prominentioribus. Longit. 18 millim., alt. $11\frac{2}{3}$, diam. 7.

Hab. Station 172, off Trincomalee, in 200–350 fathoms.

A. maxima, Sow., *A. convexior*, and *A. philippinensis*, Smith, are very closely allied. The first is much larger than the present species, not quite so triangular, less convex, and has more distinct carinations from the beaks behind. To show the difference in the convexity, I may state that a specimen of *A. maxima* 23 millim. long is only 6 in diameter, whereas an example of *A. convexior* only 18 in length has a thickness of $6\frac{2}{3}$.

A. philippinarum is more pointed behind, not so triangular, the umbones being less prominent, and the dorsal margins are less oblique than in the present species. The hinge, ligament-pit, muscular scars, and the inner surface of the valves are similar in both. In all three forms the umbo in the left valve is the slightest, more prominent than that of the right.

Poromya (Cetoconcha) tornata, Jeffreys.

Pecchiolia tornata, Jeffreys, Ann. & Mag. Nat. Hist. 1876, vol. xviii. p. 494.

Verticordia tornata, Smith, Lamellibranchiata 'Challenger' Exped. p. 170, pl. xxv. figs. 9-9*b*; Pelseneer, Anatomy Deep-sea Mollusca 'Challenger' Exped. p. 20.

Hab. Station 110, lat. 9° 34' N., long. 85° 43' 15' E., east of Ceylon, in 1997 fathoms.

Beyond a very slight difference in form there is nothing to separate the single specimen from the above locality from this species, hitherto only known from great depths (1850 fathoms) in the Atlantic. It differs from the two specimens obtained by the 'Challenger' in being very slightly longer, or, in other words, the ends have a faintly produced appearance. But the two Atlantic shells are not exactly similar in form, a character which is liable to variation in every species. The sculpture and hinge-characters are exactly the same in all. To show how slight is the difference in the relative proportions of the Atlantic and Indian-Ocean specimens, I append the following measurements:—

	Length. millim.	Height. millim.	Diam. millim.
Atlantic specimen	13½	13½	10
Indian-Ocean specimen . .	14½	13½	10½

Pelseneer has shown that this species is anatomically the same as *Poromya*, not *Verticordia*.

Solenomya patagonica, Smith.

Solenomya patagonica, Smith, Lamellibranch. 'Challenger' Exped. p. 208, pl. xi. figs. 1, 1*a*.

Hab. Off west coast of Patagonia, in 245 fathoms ('Challenger'); Station 151, off Colombo, in 142-400 fathoms ('Investigator').

The single Indian-Ocean specimen is a little smaller than the type, and was dredged alive. The valves do not exhibit the thickening within, beneath the hinge-line, referred to in

the description of the type; but this is probably due to age. The form of the valves, the muscular scars, and the radiately ridged and grooved character of the epidermis are similar in both examples. The fringed character of the latter, as described, was due to splitting when dry. In the present shell it is entire along the edge and curls over within the valves, being plicate and puckered at the anterior end. The valves are connected along the entire hinge-line by the epidermis, and the ligament is black, posterior to the beaks, and has no extension within the valves.

Cuspidaria macrorhynchus. (Pl. II. figs. 5, 5a.)

Testa tenuis, alba, haud nitida, subglobosa, postice longissime et anguste rostrata, lineis incrementi tenuibus sculpta; rostrum rectum, carina obliqua debile dimidiatum, ad extremitatem curvate truncatum; umbones involuti, contigui; valva dextra dente unico laterali tenui instructa; sinistra edentula; locus ligamenti minimus, obliquus, postice declivis, infra umbonis apicem situs; pagina interna lactea.

Longit. 22 millim., alt. 9, diam. 8.

Hab. Station 177, lat. 13° 47' 49" N., long. 73° 7' E., off west coast of India, in 636 fathoms.

In certain lights, in addition to the lines of growth, very faint traces of radiating sculpture are observable.

Cuspidaria Wollastonii, Smith, from the Atlantic, resembles this species in the general outline of the body of the shell; but its rostrum is shorter and broader, and is bisected by a sharper keel. On comparison of the left valves (only one valve of *C. Wollastonii* is known) slight differences in the ligament-pit and the dorsal margin are observable.

Lucina spinifera (Montagu).

Lucina spinifera, Forbes and Hanley, Brit. Moll. vol. ii. p. 49, pl. xxxv. fig. 1; Jeffreys, Brit. Conch. vol. ii. p. 240, vol. v. pl. xxxii. figs. 6, 6a; Reeve, Conch. Icon. pl. vii. fig. 39.

Hab. Station 172, off Trincomalee, Ceylon, in 200-350 fathoms.

Three specimens from the above locality I am unable to separate from this European species. The form in northern specimens is more or less variable, and the same variation occurs in the Indian-Ocean examples. The concentric lamellæ are stronger near the umbones and rather more distant, and the posterior dorsal margin is straighter than

usual. The hinge and the muscular impressions are precisely similar. Mr. Brazier has just recorded *Cryptodon flexuosus*, another British species, from New South Wales and Tasmania, and it is gratifying to strengthen his statement by recording the occurrence of another species from our coasts in tropical seas.

Cryptodon investigatoris. (Pl. II. figs. 6, 6 a.)

Testa oblonga, subquadrata, valde inæquilateralis, antice concave truncata, alba, æquivalvis; valva dextra crassiuscula, concentrice tenuiter striata, antice profunde lunulata, carina mediocriter acuta ab umbone ad latus posticum decurrente instructa, inter carinam et marginem dorsalem valde excavata, infra carinam leviter depressa, carina secunda acuta, margini dorsi subparallela instructa; umbo terminalis, antice curvatus, acutiusculus; margo dorsi postice tenuis, acutus, parum arcuatus, versus umbonem pro ligamento anguste sulcatus, posticus superne sinuatus, in medio ad finem carinæ inferioris prominens, infra levissime sinuatus, deinde curvatus; margo inferior rectiusculus, dorsali subparallelus, antice subincurvatus; lunula profunda, carina obtusa marginata; pagina interna antice et versus lineam pallii radiatim striata; cicatrix posterior parva, sub extremitate marginis dorsalis sita, antica indistincta; linea pallii simplex; carinæ externæ intus sulcis subprofundis indicatæ.

Longit. 38 millim., alt. 27, diam. 26.

Hab. Station 151, off Colombo, Ceylon, in 142-400 fathoms.

Only two right valves of this species were obtained; but, judging from the even level of the margin and the position of the pallial line, there is little doubt but that this shell is equivalve. The deep groove from the umbo to the posterior end of the valve is much deeper than in the type of the genus, *Cryptodon flexuosus*, and the keel which limits it beneath is very acute, but not so acute as the carina which marks off the area between it and the dorsal line.

Cryptodon philippinarum (Hanley).

Lucina philippinarum, Hanley, Cat. Biv. Shells, p. 348, pl. xiv. fig. 18; Reeve, Conch. Icon. pl. iv. figs. 18 a, b.

Lucina (Anodontia) philippinarum, Martens, Journ. Linn. Soc. Lond. 1887, vol. xxi. p. 174.

Austriella sordida, Tenison-Woods, Trans. R. Soc. Vict. 1881, vol. xvii. p. 83, pl. (unnumbered) figs. 10, 11.

Lucina induta, Stoliczka, Martens, *op. cit.* p. 174.

Hab. Philippines and Mergui (Hanley); Manila and

Singapore (*Reeve*); Mergui Archipelago (*Martens*); Port Denison, Queensland (*Tenison-Woods*); Port Canning, Bengal (*H. F. Blanford, in Brit. Mus.*); Station 172, off Trincomalee, in 200–350 fathoms (*'Investigator'*).

Only two or three young specimens, $\frac{3}{4}$ inch long, were obtained at the above station. At this age they are very flat, being not more than 6 millim. in diameter.

Cryptodon acuticarinatus. (Pl. II. figs. 7, 7 a.)

Testa inæquilateralis, æquivalvis, mediocriter ventricosa, tenuis, alba, prope marginem externam epidermide tenui lutescente induta, concentricè tenuiter striata; valvæ tenues, postice acute bicarinatæ, inter carinas profunde sulcatæ; margo dorsi utrinque declivis, anterior longior, vix arcuatus; latus anticum rotundatum, posticum sinuatum; margo inferior late curvatus; umbones subacuti, antice versi, pone medium siti; lunula elongato-cordata, haud profunda, area dorsalis postica angusta, utrinque acuminata, carinis acutis marginata; pagina interna alba, radiatim substriata; cicatrices et linea pallii indistinctæ.

Longit. 17 millim., alt. 14, diam. $10\frac{1}{2}$.

Hob. Station 173, lat. $8^{\circ} 35' 45''$ N., long. $81^{\circ} 17' 43''$ E.; off Trincomalee, Ceylon, in 609 fathoms.

In addition to the feeble depression which defines the lunule, there is in each valve a second faint impression curving from the umbo to the anterior end. Viewed from behind the shell has a very acutely carinate and deeply sulcate appearance.

Modiola Watsoni, Smith.

Modiola Watsoni, Smith, Lamellibranchiata 'Challenger' Exp. p. 275, pl. xvi. figs. 5–5 c.

Modiola, sp., Wood-Mason and Alcock, Ann. & Mag. Nat. Hist. 1891, vol. vii. p. 19.

Hab. Off Luzon, Philippines, in 700 fathoms, and near Arrou Islands, in 800 fathoms (*'Challenger'*); Station 144, lat. $15^{\circ} 5' 6''$ N., long. $72^{\circ} 48' 10''$ E., in 172 fathoms; Station 133, lat. $15^{\circ} 43' 30''$ N., long. $81^{\circ} 19' 30''$ E., in 678 fathoms.

Messrs. Wood-Mason and Alcock remark that this species is "an almost characteristic inhabitant of the mud of the Bay of Bengal, as at present explored, in and near 100 fathoms." "The byssus is a large bunch of fine silky threads saturated with fine mud usually. Met with in beds in thick mud in 89 to 93 fathoms, and on sand in 98 to 102 fathoms."

Some of the Indian-Ocean specimens are of a darker greyer

colour than the specimens obtained by the 'Challenger,' and the valves are also deeper in proportion to the length. The largest specimen is 30 millim. long and $12\frac{1}{2}$ in diameter, whereas the finest 'Challenger' example is 43 by $13\frac{1}{2}$. "The rust-like incrustation adhering to the anterior or umbonal region" noticed in the type is also present in all the Indian-Ocean specimens.

Limopsis indica, Smith.

Limopsis indica, Smith, Ann. & Mag. Nat. Hist. 1894, vol. xiv. p. 171, pl. v. fig. 7.

Hab. Immediately off Minnikoy Island, Maldive group, in 1200 fathoms.

The specimens from the above depth are quite free from the "rust-red earthy deposit" which more or less coated the typical examples.

Nucula donaciformis. (Pl. II. fig. 8.)

Testa triangularis, solidiuscula, valde inæquilateralis, antice oblique truncata, ad extremitatem subangulata, postice acuminata rotundata, sub epidermide olivacea, albida, vel plus minus livida, liris tenuibus arcuatis dorsum versus utrinque obsolete, instructa, lineis incrementi decussata; area anto umbones sublunulata, in medio prominens, impressione haud profunda circumscripta, fere lævis; area postica vix sculpta, haud limitata, in medio anguste excavata; margo dorsi anticus rectiusculus, valde descendens, posticus longior, leviter arcuatus; margo ventris late curvatus; umbones incurvati, antice versi; pagina interna albo-margaritacea, radiatim obsolete striata, margine inferiore pulcherrime denticulato; dentes anteriores cardinis circiter 11, posteriores 18-20; fossa ligamenti parva, obliqua.

Longit. 15 millim., alt. 11, diam. $7\frac{1}{2}$.

Hab. Station 162, lat. $13^{\circ} 51' 12''$ N., long. $80^{\circ} 28' 12''$ E.; Bay of Bengal, in 145-250 fathoms.

The form of this species is very triangular, and the ventral margin is unusually straight. It somewhat recalls *N. sulcata*, Brown, but it is more angular anteriorly, the radiating lines are fewer, and the concentric sculpture finer. The denticulation within the ventral edge of the valves is also coarser than in the British species.

Nucula bengalensis. (Pl. II. fig. 9.)

Testa acuminata ovata, valde inæquilateralis, tenuis, epidermide polita olivacea induta, lineis incrementi tenuibus, striisque tenuis-

simis radiantibus obsoletis sculpta; margo dorsi anticus valde descendens, subarcuatus, posticus longior, magis curvatus, ventralis late arcuatus; area dorsalis antica in medio prominens et carinata, prope umbones lunulam parvam exhibens; area postica in medio anguste sulcata, sulco fusiforme utrinque acute marginato; umbones incurvati, circiter in $\frac{1}{4}$ longitudinis collocati; pagina interna iridescens, margaritacea, radiatim minutissime substriata; dentes cardinis anteriores circiter octo, posteriores circa viginti; fossa ligamenti angusta, obliqua, postice declivis. Longit. 17 millim., alt. 12, diam. $7\frac{1}{2}$.

Hab. Station 162, lat. $13^{\circ} 51' 12''$ N., long. $80^{\circ} 28' 12''$ E., off Coromandel coast, in 145–250 fathoms.

N. Strangei, A. Adams, from New Zealand, is very like this species in general form; but a careful comparison reveals certain differences. It is smaller and more solid, the anterior area has not the peculiar central keel-like prominence, and the posterior side lacks the narrow fusiform escutcheon observable in the present species. The hinge-plate is stronger, the teeth fewer, and the ligament-pit less oblique, &c.

Nuculana fumosa. (Pl. II. figs. 10, 10 a.)

Testa parva, subtriangularis, postice breviter rostrata, inæquilateralis, epidermide polita fumose olivacea induta, incrementi lineis leviter striata; margo dorsi anticus obliquus, levissime excurvatus, posticus æque declivis, longior, paulo concavus; margo ventralis late arcuatus; latus anticum acute rotundatum, posticum obtuse nasutum; area dorsalis anterior vix lunulata, haud circumscripta, posterior in medio excavata, concavitate carina obtusa circumdata; linea cardinis crassiuscula, dentibus anticis ad 14 posticisque circiter 17 instructa; fossa ligamenti minuta; pagina interna cæruleo-grisea.

Longit. 7 millim., alt. 4, diam. $3\frac{1}{2}$.

Hab. Station 162, Bay of Bengal, off Coromandel coast, 145–250 fathoms.

This species somewhat recalls the *Portlandia pygmæa* of Norway and Greenland, but is more pointed behind, and covered with a darker epidermis; the posterior dorsal area is more excavated, the escutcheon being lanceolate and bounded by a distinct ridge on each side.

Nuculana indica. (Pl. II. figs. 11, 11 a.)

Testa triangulariter ovata, postice acuminata, rostrata, antice acute rotundata, paulo inæquilateralis, epidermide flavescenti-viridi induta, sublævis, sed supra medium valvarum plicis paucis concentricis utrinque obsoletis instructa, striisque incrementi sculpta;

margo dorsi anticus vix arcuatus, leviter declivis, posticus longior, subconcausus, æqualiter descendens, ventralis late curvatus; area dorsalis utrinque anguste excavata, area postica distinctius marginata quam antica; umbones concentricè fortiter striati, antemediani; pagina interna albida; dentes posteriores 20, anteriores circiter 18; sinus pallii latus, mediocriter profundus.

Longit. 12 millim., alt. $7\frac{1}{2}$, diam. 6.

Hab. Station 162, Bay of Bengal, off Coromandel coast, 145–250 fathoms.

The transverse plicæ on the central part of the valves, which become obsolete on each side, are very fine and only just visible to the naked eye. Like *Nuculana lugubris*, A. Adams, this species has no internal cartilage, the ligament being placed on the hinge-line, beneath and on each side of the umbones.

Malletia conspicua. (Pl. II. fig. 12.)

Testa inæquilateralis, transversim oblonga, mediocriter convexa, subtenuis, antice angustata, postice latior, concentricè tenuiter striata, epidermide tenui, nitida, dilute olivacea induta; area dorsalis utrinque umbones linearis, excavata, carinis marginata; margo dorsi anticus brevis, rectus, leviter obliquus, posticus fere horizontalis, duplo longior; margo ventralis late arcuatus, utrinque curvate adscendens; umbones paulo prominentes, approximati, in $\frac{1}{3}$ longitudinis siti; linea cardinis mediocriter tenuis, dentibus acutis anterioribus circiter 18 et posticis 30 instructa; pagina interna nitens, albida, lineam pallii late sed haud profunde sinuatam exhibens; ligamentum parvum, convexum, prominens, olivaceo-fuscum.

Longit. $21\frac{1}{2}$ millim., alt. 13, diam. 8.

Hab. Station 177, lat. $13^{\circ} 47' 49''$ N., long. $73^{\circ} 7'$ E., depth 636 fathoms (Arabian Sea, off west coast of India).

The valves are very thin and sharp at the ventral and lateral margins, and become somewhat thicker and stronger towards the umbones. The difficulty of closing the parted valves makes it impossible to say to what extent this species may gape at the ends; but, so far as I am able to judge, the valves would not quite close either in front or behind. The striæ upon the greater part of the surface are strong and regular, but posteriorly as they curve up to the dorsal margin they become weaker, so that this part of the valves has a slightly smoother appearance.

M. arrouana, Smith, is an allied species, but of a somewhat different form, with less regular and not such close concentric striæ.

M. angulata, Sowerby *, another Indian-Ocean species, is well distinguished from the present form by its different and remarkable shape. It was dredged in the Bay of Bengal at a depth of 200 fathoms.

Amussium caducum, Smith.

Amussium caducum, Smith, Ann. & Mag. Nat. Hist. 1894, vol. xiv. p. 173.

Hab. Station 135, lat. 15° 29' N., long. 72° 41' E.; off Goa, west coast of India, in 559 fathoms.

This species has now been obtained on both sides of the Indian peninsula, and also in the China Sea, at depths ranging from 410 to 700 fathoms.

Lima (Limatula) subtilis. (Pl. II. figs. 13, 13 a.)

Testa æquivalvis, convexa, tenuissima, ovata, inferne lateraliter subacuminata, pellucido-albida, liris tenuissimis radiantibus circiter 24, medianis lateralibus confertioribus, lineisque incrementi supra liras minute squamosis subcancellata; umbones acuminati, subapproximati; linea cardinis tenuis; area ligamenti fusiformis, angusta; pagina interna radiatim sulcata, sulcis liris externis convenientibus; margines valvarum ad extremitates lirarum minute dentati.

Alt. 10 millim., longit. 6, diam. 5½.

Hab. Station 176, lat. 11° 47' 6" N., long. 73° 57' 30" E.; off Malabar coast, in 1070 fathoms.

This species, of which only a single specimen was obtained, is extremely thin, and has an oblique appearance, on account of the most prominent acute ventral curve being somewhat lateral. It is more or less coated with a thin rust-red earthy deposit.

EXPLANATION OF THE PLATES.

PLATE I.

- Fig. 1. Pontiothauuma mirabile.*
Fig. 2. — abyssicola.
Fig. 3. Pleurotoma vagata.
Fig. 4. — præsignis.
Figs. 5, 5 a. Drillia fugata.
Fig. 6. Nassa turrifera.
Fig. 7. Columbella (Mitrella) Pacei.
Fig. 8. Natica albospira.
Fig. 9. — candidula.

* Proc. Zool. Soc. 1888, p. 208, pl. xi. fig. 15.

- Fig. 10. *Sigaretus parvus*.
 Fig. 11. *Bathybembix Wood-Masoni*.
 Fig. 12. *Calliostoma sublaeve*.

PLATE II.

- Fig. 1. *Dentalium mirificum*.
 Figs. 2, 2 a. *Venus juvenilis*.
 Fig. 3. *Tellina parvula*.
 Figs. 4, 4 a. *Abra convexior*.
 Figs. 5, 5 a. *Cuspidaria macrorhynchus*.
 Figs. 6, 6 a. *Cryptodon investigatoris*.
 Figs. 7, 7 a. — *acuticarinatus*.
 Fig. 8. *Nucula donaciformis*.
 Fig. 9. — *bengalensis*.
 Figs. 10, 10 a. *Nuculana fumosa*.
 Figs. 11, 11 a. — *indica*.
 Fig. 12. *Malletia conspicua*.
 Figs. 13, 13 a. *Lima (Limatula) subtilis*.

II.—Some new Species of Odonata of the "Légion" Lestes,
 with Notes. By ROBERT M'LACHLAN, F.R.S.

MOST of the species described in this paper have been in my collection for years, and form a small portion of the undetermined materials in the "légion" that I possess.

ORTHOLESTES, Calvert.

This genus was originally described by Mr. P. P. Calvert (who is doing most excellent work in American Odonata) in the Ent. News, vol. ii. p. 199 (1891), to receive an insect from Jamaica which he termed *O. clara*. In the Proc. Acad. Nat. Sci. Philad. for 1893, pp. 377-383, he amplified the original description for both genus and species, and added a second species from Haiti, which he termed *O. Abbotti*, the two being evidently much allied, and the latter known by only one male.

I have long had many males and four females of an *Ortholestes* from "Samana Bay, S. Domingo." According to the locality these should be *O. Abbotti*, but they agree better with the description of *O. clara*, only the "more apical" tooth of the superior appendages, instead of being "slightly notched," is distinctly bifid (but not deeply so), the upper portion usually slightly longer and distinctly more slender than the lower. Of *O. Abbotti* it is written that "the more apical tooth is transformed into a slender acute curved spine." I think that insects of the same lot from Samana Bay received by

M. de Selys were identified by him with a species from the island of Trinidad standing under a MS. name in his collection. At present I consider my insects as *O. clara*, and hesitate to describe them as a local race until we know more about the possible effects of locality as causing variation in the structure of the appendages in this genus.

I think *Ortholestes* may conveniently head the "légion."

Megalestes major, Selys.

The original locality given for this species was "Inde méridionale." I am not in a position to say this was incorrect; but all the numerous recent examples I have seen have been from North India, and, according to special localities, it is probable it is found the whole length of the southern slopes of the Himalayas, and sometimes at great elevations.

Archilestes californica (Selys, MS.), sp. n.

Wings hyaline. Pterostigma ochreous, dilated, 3 millim. long, surmounting $3\frac{1}{2}$ cellules, enclosed in thickened black nervures; 12-13 postnodal nervules in the anterior wings. Neuration black, but the median nervure and the costa externally are yellowish. Nodal sector commencing $1\frac{1}{2}$ cellules after the nodus in the anterior and one cellule after in the posterior.

Head above dark brownish, slightly varied with paler, clothed with sparse cinereous pubescence, with a cuneate blackish spot on either side enclosed in pale lines; labrum olivaceous; mandibles shining black at the tips; labium and back of head whitish yellow. Prothorax blackish, its hind margin regularly curved and narrowly yellowish, and there is a semicircular line of the same colour on either side. Thorax brownish above; on either side of the dorsal crest is a long blackish space completely enclosed in fine yellowish lines; sides pale yellowish, with a large oval isolated black (or bronzy-brownish) median spot, whitish pruinose above the posterior legs; interalar area slightly pruinose. Legs yellowish; a line before the apex of the femora externally (nearly complete on the intermediate), tibiæ above, tarsi, and spines black. Abdomen greyish brown, dark brown above after the sixth segment (there are vague indications that the ninth and tenth may be paler in life), the sutures darker, and there is a fine blackish ventral line.

♂. Tenth segment with an elevated dorsal carina, the margin with a deep triangular excision. Superior appendages forcipate, black, the apices touching but not suddenly

incurved; longer than the tenth segment; on the median portion externally are 6-7 small teeth; internally near the base is a very strong acute triangular tooth, after which the margin presents two dilatations, with a strong constriction after the second, the apex again dilated. Inferior appendages yellowish, scarcely one third the length of the superior, triangular, inner edges nearly touching at the base, then divergently oblique, the outer edge straight; the tips rounded, with yellowish hairs.

♀ unknown.

Length of abdomen (cum append.) 37 millim.; expanse of wings 62 millim.; length of posterior wing 30 millim.

Hab. California (*Henry Edwards*). One adult male.

I received this example from Mr. Edwards many years ago; it bears his printed locality label "California," without more precise indication. M. de Selys, to whom it was submitted, labelled it with the name I have adopted, but it has never been described.

The species should be placed in *Archilestes*, according to the *ensemble* of structural characters; but in the practical absence of bronzy or metallic colour of the body it diverges widely from the typical *A. grandis*, Rbr., and also from the majority of species of the "légion" *Lestes*.

OROLESTES, gen. nov.

Wings for the greater part opaque blackish in the male, petiolated up to the first postcostal basal nervule, which latter is placed nearer the level of the second than of the first antenodal nervule. Nodal sector commencing $8\frac{1}{2}$ cellules after the nodus in the anterior wings ($7-7\frac{1}{2}$ after in the posterior); ultra-nodal sector commencing 3-4 cellules after the nodal. None of the sectors distinctly broken (angulose), excepting the inferior of the triangle at its apex (the ultra-nodal and short sectors very slightly broken); one supplementary sector (and the rudiment of another) interposed between the nodal sector and the median. *Pterostigma* very large, dilated, more than four times as long as broad, surmounting 5-6 cellules. Quadrilateral broad, the lower side quite twice the length of the inner, the outer angle somewhat acute.

Abdomen slender. Spines of legs moderate.

Hab. North India.

Differs from all the other genera of the "légion" by the coloured wings (of the male, at any rate) and structurally by the very large pterostigma and the distant point of departure of the nodal sector.

Orolestes Selysi, sp. n.

Wings hyaline only at the base and apex, the rest of the wing occupied by a very broad brownish-black band, with steel-blue reflexions, commencing in an oblique manner (and extended along the costal margin) before the nodus, and ending in a straight manner (but the edge slightly irregular) about one cellule before the pterostigma (in this dark portion the centre of each of the cellules is occupied by a small rounded paler spot, and the margins of the nervules are seen to be also very narrowly paler, more conspicuous when viewed by transmitted light); in the pale apical portion of the wing the dark band is margined by lacteous in an irregular manner, the lacteous portion appearing as if forming a very pale brownish cloud in certain lights. Pterostigma $3\frac{1}{2}$ millim. long, dark brown, enclosed in very strong black nervures. 21-24 postnodal nervules in the anterior wings. Neuration black.

Head black above, the ocelli testaceous; labrum and a large spot on either side of it olivaceous green; labium and back of head yellowish white. Prothorax olivaceous green, darker in the centre, its hind margin raised and regularly curved. Thorax above bronzy green, not metallic, somewhat paler (yellowish?) on either side of the dorsal crest; sides of thorax pale olivaceous green (probably yellowish in immature examples), the darker green of the upper surface continued in an irregular manner below the humeral suture, and above the median suture are traces of the same colour. The olivaceous colour of the sides of the thorax is continued broadly on the sides of the first and second abdominal segments, and narrowly along the sides of the third to fifth and part of sixth segments; abdomen above with a large spot occupying most of the first segment bronzy green, and the second segment wholly of this colour; from the third to tenth bronzy black, but there is a long bluish space on the third and fourth, which are black only at base and apex. Legs black; the femora brownish or yellowish beneath.

♂. Posterior margin of the seventh to ninth segments above with fine denticulations; posterior margin of tenth slightly notched in the middle. Superior appendages black, quite one half longer than the tenth segment, slender, forcipate, the tips regularly incurved, finely denticulate externally in the apical half; internally there is a basal tooth, but near the base the usual dilatation (which is very slight) commences in an obtuse manner and ends below the apex in a large triangular, broad, acute tooth; the extreme apices con-

tigulous, subobtuse. Inferior appendages scarcely one fourth the length of the superior; viewed from beneath they are broad and triangular, with straight and contiguous inner edges, the basal half black, the apical yellowish.

♀ unknown.

Length of abdomen (cum append.) 57 millim.; expanse of wings 73–79 millim.; length of posterior wing 36–39 millim.

Hab. Darjiling.

I have long had an old and mutilated male; more recently I received a fresh and perfect male.

The presence of median dark bands on the wings of *Agrionina* is very rare, and is probably seen in a less intensified degree only in some species of *Chlorolestes* and *Disparoneura*. It should be remarked that the dark portion of the wings shows a few irregular spots where the pigment has not developed, such as occurs so frequently in *Calopteryx maculata*, Beauv., &c.

I dedicate this fine insect to a venerable and venerated naturalist and friend, who has devoted more than sixty years of a long life to the study of the Odonata.

Lestes albicauda (Selys, MS.), sp. n.

Wings hyaline. Pterostigma brown, narrowly paler on the costal edge (giving the appearance of an indistinct paler longitudinal line at that part), about twice as long as broad, surmounting nearly two cellules; 11–14 postnodal nervules in the anterior wings; external angle of the quadrilateral considerably acute.

Head bronzy green above; ocelli testaceous; labrum whitish and fringed with hairs of the same colour; labium and back of head whitish yellow. Prothorax dusky yellowish or smoky. Thorax dusky whitish yellow, above with a bronzy-green band on each side of the dorsal crest, very irregular externally, there being a median projection followed by a broad excision towards the base, this band followed beneath by a smoky band; there is usually a black spot on the humeral suture above the base of the anterior wings; a short black line under the base of these wings, another at the base of the median suture; pectus with a black median longitudinal line and at least two black spots anteriorly and posteriorly. Legs whitish yellow; a black line on the femora and tibiæ (posterior femora excepted) above; tarsi blackish except at the base; spines black, very long. Abdomen very slender, bronzy blackish above, varied with whitish yellow as follows:—First segment whitish yellow, with two large con-

tiguous or united blackish spots on the posterior half; second whitish yellow at the anterior margin and on an anterior triangular space, and again on each side towards the posterior end; third to sixth with a whitish-yellow narrow anterior annulation, and a broader one before the posterior end; *tenth segment and appendices conspicuously whitish in both sexes*; on the sides the abdomen is almost wholly whitish yellow, shading into smoky, but the posterior ends of segments 3 to 7 are broadly of the dark colour of the upper surface.

♂. Posterior margin of tenth segment with a broad semi-circular excision, furnished with numerous minute black teeth. Superior appendages of the length of the tenth segment, geniculate in the middle; the outer edge (beyond the geniculation) with 3 to 4 small but conspicuous black teeth; internally the basal portion is dilated, and forms an obtuse angle before the constriction at the geniculation; the apical portion again gradually dilated, and with a long acute tooth before the obtuse apex, which latter is darker in colour. Inferior appendages very short, in the form of two contiguous broadly triangular plates fringed with whitish hairs.

♀. Posterior margin of the tenth segment with a broad shallow excision with black denticulations; appendages shorter than the tenth segment, in the form of acute styles; the ventral laminæ broad, strongly denticulated beneath, the appendages filiform and upcurved.

Length of abdomen, ♂ (cum append.) 32-34 millim., ♀ 29 millim.; expanse of wings, ♂ 34-39 millim., ♀ 40 millim.; length of posterior wing, ♂ 19-21 millim., ♀ 20 millim.

Hab. Aru Islands and New Guinea. Two males and one female from the Wallace collection; formerly examined by M. de Selys, and labelled by him with the name I have adopted.

Probably allied to the Australian group of species.

Lestes tridens, sp. n.

Wings hyaline. Pterostigma smoky brown, rather more than twice as long as broad, surmounting two cellules; 9-10 postnodal cellules in the anterior wings.

Head dark brown above; labrum olivaceous; labium pale yellowish; back of head blackish near the eyes, but yellowish more internally. Prothorax dusky testaceous, darker at the sides and there somewhat pruinose. Thorax ochreous; a rather broad black band on either side of the dorsal crest, its edge irregular externally, and there showing two broad

excisions, the lower of which is filled in by a bright pale yellow oblong space; posteriorly the bands are bordered with brown beneath; on the sides there are rudiments of post-humeral blackish bands, with three black spots in the median area, two others on the margin of the pectoral area, and, again, others and a fine black longitudinal line on the pectus itself. Legs yellow; on the femora externally are two black lines, fine, separated by the pale ground; tibiæ black externally; tarsi and spines black. Abdomen bronzy black above, shading into dark brown towards the apex (the ninth and tenth segments probably whitish pruinose in life); sutures of the third to seventh segments with a yellowish ring; first segment yellowish at its base, and the second with a yellow excision on either side in its middle; sides and beneath yellowish, with a blackish ring at the sutures.

♂. Tenth segment with a semicircular excision on its posterior edge, furnished with minute black denticulations. Superior appendages pale yellow, black at base and apex, longer than the tenth segment, the apices regularly incurved; externally there are three or four fine black teeth on the apical portion; internally are *three nearly equidistant strong teeth*, the basal broad and very acute, its lower edge black, the second also acute but rather less strong, the third (forming the apex of the dilated inner portion) obtuse; beyond this is a slight constriction before the cylindrical apical portion, which is obtuse at the tip. Inferior appendages short, scarcely reaching to the basal tooth of the superior if viewed from above, distant, conical, and black, furnished with a tuft of hairs at the tip directed inwardly; viewed from beneath these appendages are broad at the base, the edge excised, so that the two appendages appear as if separated by a broad semicircular space.

♀ unknown.

Length of abdomen (cum append.) $31\frac{1}{2}$ millim.; expanse of wings 42 millim.; length of posterior wing 20 millim.

Hab. Delagoa Bay. One male.

Perhaps allied to *L. pallida*, Rbr., but it can scarcely be the undescribed male of that species. Possibly allied to the eastern *L. præmorsa*, Selys, by the lacinate dorsal bands of the thorax.

Lestes simulatrix, sp. n.

Wings hyaline. Pterostigma smoky brown, not more than twice as long as broad, surmounting two cellules. Ten postnodal nervules in the anterior wings.

Head black above, but with broad ochreous anterior margin; narrow orbital margins of the same colour, and varied with ochreous about the ocelli (or the colour might be taken as ochreous, with a very broad transverse black band); clypeus broadly margined with black; labrum dark brown; labium and back of head pale yellow. Prothorax yellow, with two median blackish lines and a brown band above the insertion of the legs; posterior margin elevated and blackish in the middle. Thorax ochreous; above with a bronzy-black (or bronzy-green) band on either side of the dorsal crest; its external edge at first straight, then very deeply excised in the middle (a golden-yellow oblong spot in the excision), so that its breadth is reduced to a fine line, afterwards dilated posteriorly in a triangular manner, the rounded apex of the dilatation not touching the mesothoracic suture; below these bands are vestiges of a like-coloured posthumeral band, reduced to two isolated spots (the inferior of which is oblique) connected by a brown line; still more inferiorly are four or five black spots on the median and metathoracic areas, which, and also the pectus, are whitish pruinose. Legs pale yellow; femora with two fine black lines; tibiæ black externally, tarsi and spines black. Abdomen very slender, above dark bronzy green, changing to bronzy brown after the third segment; posterior half of the ninth segment and the whole of the tenth yellowish (probably pruinose in life), with black edges; on the first segment are two dark green spots, divided by a yellow median line; second with a median line, an excision on either side, and the suture yellow; third to fifth yellowish at the anterior suture; sides and beneath yellow, with black spots on the first and second segments, and a blackish ring (complete ventrally) at the end of segments 1 to 5.

♂. There are minute black teeth on the posterior margin of the ninth segment above; tenth segment with a broad triangular median excision, with small black teeth on the edge of it. Superior appendages slightly longer than the tenth segment, black, strong, the apices regularly but somewhat suddenly incurved (not geniculate); externally with four or five rather strong denticulations on the apical portion; on the internal edge there is a very strong triangular black tooth, rather distant from the base, after which the edge is straight for some distance, and also there is a smaller acute tooth, followed immediately by a large subquadrate blunt tooth before the commencement of the short slender inturned apical portion of the appendage. Inferior appendages about half the length of the superior; viewed from above they are dilated at the base, incurved, gradually becoming more

slender towards the black apex; viewed from beneath they approximate at the base and then gradually diverge, the apices slightly incurved.

♀ unknown.

Length of abdomen (cum append.) 33 millim.; expanse of wings 40 millim.; length of posterior wing 19 millim.

Hab. Madagascar. One male.

Having some resemblance to the preceding species in the form of the dark bands of the thorax above and pale ground-colour, but differing very much in the structure of the appendages.

Lestes unicolor, sp. n.

Wings hyaline or with a very slight smoky-yellowish tinge. Pterostigma dark brown (more ochreous in the female), between strong black nervures, three times as long as broad, surmounting two cellules; 11-13 postnodal nervules. Neuration black.

Nearly the whole upperside of the body brown, the sides and beneath paler, more yellowish (in some examples are faint indications of darker humeral lines); a small isolated elongate black spot on either side of the pectus close to the pectoral area; a slender darker annulation just before the apex of segments 2 to 7 above, extending to the sides; some black marks on the first abdominal segment beneath, and the ventral suture narrowly black. Legs yellow; a blackish line (partly double) on the intermediate and anterior femora and tibiæ; spines (those on the tibiæ very long) black; tips of tarsal joints and claws black.

♂. Hinder margin of ninth segment with minute black denticulations; a slight carina on the dorsal surface of the tenth segment, not reaching the base, followed by a triangular excision of the margin, the edge of which bears black denticulations. Superior appendages stout, longer than the tenth segment, yellow, the short, blunt, inturned apical portion black, the outer edge with 4-5 small black denticulations just before the inturned portion; inner edge with a strong black triangular tooth near the base at the commencement of a rather broad flattened dilatation, the edge of which is straight, ending in an angle scarcely produced into a (second) tooth, with minute serrations, and closely followed by another slight projection just before the constriction. Inferior appendages, viewed from above, extending to the basal tooth of the superior, distant, cylindrical, blackish, and furnished with black hairs on the tips; viewed from beneath, the basal

portions are pale and nearly contiguous, each ending in a black cylindrical process.

♀. Tenth segment above with a slight broad excision in the middle of its posterior margin. Appendages yellow, conical, acute, shorter than the tenth segment. Ventral valvules having the lower edge microscopically denticulate, from between them arises a straight blackish process; their appendages filiform, black, curved downward.

Length of abdomen (cum append.), ♂ 33 millim., ♀ 36 millim.; expanse of wings, ♂ 42–44 millim., ♀ 46–48 millim.; length of posterior wing, ♂ 21 millim., ♀ 22–23 millim.

Hab. Tamatave, Madagascar. Two males and two females.

In coloration this considerably resembles the Asiatic *L. umbrina*, Selys. No doubt it is allied to *L. icterica*, Gerst., from Mombas on the Zanzibar mainland, which was based on a single mutilated example; but, according to the description, the latter cannot be identical, it being smaller, paler, with longer pterostigma, the longitudinal nervures yellow, no black lines on the legs, &c.

III.—*On a Collection of Reptiles and Batrachians from Ferguson Island, D'Entrecasteaux Group, British New Guinea.* By G. A. BOULENGER, F.R.S.

A LARGE collection of Reptiles and Batrachians was made on Ferguson Island by Mr. A. S. Meek, from which a series has been selected for the British Museum. A list is given of the species represented in the collection, five of which prove to be undescribed.

REPTILES.

1. *Gymnodactylus pelagicus*, Gir.
2. — *lousiadensis*, De Vis.
3. *Gehyra mutilata*, Wiegman.
4. *Gecko vittatus*, Houtt.
5. *Gonycephalus dilophus*, D. & B.
6. — *papuensis*, Macleay.
7. *Varanus indicus*, Daud.
8. — *kordensis*, Meyer.
9. *Tiliqua gigas*, Schn.

10. *Lygosoma elegantulum*, Peters & Doria.
11. — *jobiense*, Meyer.
12. — *smaragdinum*, Less.
13. — *Semoni*, Oudemans.

14. *Lygosoma miotis*, sp. n.

Section *Lirolepisma*. Habit lacertiform; the distance between the end of the snout and the fore limb is contained once and three fifths in the distance between axilla and groin. Snout moderate, pointed. Lower eyelid with an undivided transparent disk. Nostril pierced in the nasal; no supranasal; frontonasal a little broader than long, forming a broad suture with the rostral and a narrow one with the frontal; frontal as long as frontoparietal and interparietal together, in contact with the first and second supraoculars; four supraoculars, first and second subequal in length; frontoparietals fused; interparietal nearly as long as frontoparietal; parietals forming a suture behind the interparietal; three pairs of nuchals; fifth upper labial entering the orbit. Ear-opening small, not larger than the palpebral disk, without projecting lobules. 24 smooth scales round the middle of the body, two median dorsal rows largest. A pair of enlarged præanals. The adpressed limbs overlap. Digits cylindrical at the base, compressed at the end; subdigital lamellæ smooth, 20 under the fourth toe. Tail once and two fifths length of head and body. Golden brown above, with small blackish spots and a light dorso-lateral streak, bordered beneath by confluent black spots; a whitish, black-edged spot on the occiput; lips brown-spotted; tail with longitudinal series of brown spots beneath; belly whitish.

	millim.
Total length.....	114
Head.....	10
Width of head.....	6
Body.....	39
Fore limb.....	12
Hind limb	17
Tail	65

A single specimen.

In form and coloration this lizard strikingly resembles *L. noctua*, from which it differs, however, in the broader frontonasal, the single interparietal, and the much smaller ear-opening.

15. *Lygosoma fuscum*, D. & B.
16. — *cyanurum*, Less.
17. — *Mivarti*, Blgr.
18. — *cyanogaster*, Less.
19. — *Baudinii*, D. & B.

20. *Lygosoma tetractænia*, sp. n.

Section *Emoa*. Habit lacertiform; the distance between the end of the snout and the fore limb is contained once and one third to once and two fifths in the distance between axilla and groin. Snout rather long, pointed. Lower eyelid with an undivided transparent disk. Nostril pierced between three small shields—a nasal, a postnasal, and a supranasal; fronto-nasal as long as broad, in contact with the rostral and with the frontal; frontal shorter than the frontoparietal, which is single and fused with the interparietal, in contact with the first and second supraoculars; parietals in contact behind; four supraoculars, second and fourth longest; seven supraciliaries; a pair of nuchals and a pair of temporals border the parietals; five upper labials anterior to the large subocular. Ear-opening oval, a little larger than the palpebral disk, with three very short lobules anteriorly. 26 or 28 scales round the middle of the body, all smooth; dorsals, especially the two vertebral rows, largest, laterals smallest. Præanal scales feebly enlarged. The hind limb reaches the elbow or the axilla. Digits moderately elongate, flattened, except at the end, which is subcylindrical; subdigital lamellæ very fine, smooth, about 50 under the fourth toe. Tail nearly twice as long as head and body. Olive above, with four broad black stripes, the outer of which extend to the end of the snout, passing through the eyes; belly whitish or bluish; throat and lower surface of limbs bluish or greenish.

	millim.
Total length	169
Head	14
Width of head	8
Body	45
Fore limb	20
Hind limb	32
Tail	110

Several specimens.

21. *Lygosoma atrocostatum*, Less.
22. — *albofasciolatum*, Gthr.
23. *Lialis papuanus*, Peters & Doria.
24. *Enygrus carinatus*, Schn.
25. *Tropidonotus picturatus*, Schleg.

26. *Stegonotus Guentheri*, sp. n.

Rostral much broader than deep, the portion visible from above measuring one fourth to one third its distance from the frontal; internasals shorter than the præfrontals; frontal as long as broad, as long as its distance from the rostral, much shorter than the parietals; loreal about twice as long as deep; one præ- and two postoculars; temporals 1 + 2; eight upper labials, fourth and fifth entering the eye; four or five lower labials in contact with the anterior chin-shields, which are longer than the posterior. Scales in 15 rows. Ventrals 180–197; anal entire; subcaudals 75 pairs. Black or blackish brown above, turning to pale brown on the sides; upper lip and lower parts white.

Total length 1150 millim.; tail 230.

Several specimens.

27. *Stegonotus reticulatus*, sp. n.

Rostral much broader than deep, the portion visible from above measuring one fifth to one fourth its distance from the frontal; internasals shorter than the præfrontals; frontal as long as broad, as long as its distance from the rostral, much shorter than the parietals; loreal once and a half to twice as long as deep; two præ- and two postoculars; temporals 2 + 3; eight upper labials, fourth and fifth entering the eye; four or five lower labials in contact with the anterior chin-shields, which are as long as or a little longer than the posterior. Scales in 17 rows. Ventrals 201–203; anal entire; subcaudals 78 pairs. Pale greyish brown above, white on the sides, each scale edged with black; head uniform black above; lower parts white.

Total length 1140 millim.; tail 250. The larger specimen, with mutilated tail, measures 1080 millim. from snout to vent.

Two specimens.

28. *Dendrophis calligaster*, Gthr.

29. — *lineolatus*, Hombr. & Jacq.

30. *Dendrophis Meeki*, sp. n.

Maxillary teeth 32 or 33. Eye very large, as long as its distance from the centre or the anterior border of the nostril. Rostral nearly twice as long as deep, just visible from above; internasals as long as the præfrontals; frontal once and one third to once and a half as long as broad, as long as its distance from the end of the snout, much shorter than the parietals; loreal once and two thirds or twice as long as deep; one præ- and two postoculars; temporals 2 + 2 or 3; eight or nine upper labials, fourth and fifth or fourth, fifth, and sixth entering the eye; five lower labials in contact with the anterior chin-shields, which are shorter than the posterior. Scales in 13 rows, vertebrals about as large as outer. Ventrals 170-178; anal divided; subcaudals 139-147. Dark olive above; upper lip white, sharply limited above by a black line passing through the eye; lower parts pale olive, more or less freckled with darker.

Total length 1160 millim.; tail 420.

Several specimens.

This species is very closely allied to *D. lineolatus*, from which it may be distinguished by the longer parietal shields and the black demarcation line running along the upper border of the labials. I am not able to identify it with any of the doubtful species described by Macleay and Douglas Ogilby.

31. *Dipsas irregularis*, Merr.

32. *Diemenia Muelleri*, Schleg.

BATRACHIANS.

1. *Rana papua*, Less.

2. *Cornufer corrugatus*, A. Dum.

3. *Hyla dolichopsis*, Cope.

4. — *thesaurensis*, Peters.

IV.—On some new or little-known Reptiles obtained by W. H. Crosse, Esq., on the Niger. By G. A. BOULENGER, F.R.S.

THE snakes here described were contained in an extensive collection of Reptiles and Batrachians made by W. H. Crosse, Esq., Principal Medical Officer in the Territories of the Royal Niger Company, near Asaba, about 150 miles up

the Niger, and presented by him to the British Museum. Among the numerous species represented in the collection the following may be mentioned as of special interest:—*Lygosoma guineense*, Ptrs.; *Chamaeleon basiliscus*, Cope; *Ch. parvulobus*, Blgr.; *Glauconia narirostre*, Ptrs.; *Tropidonotus variegatus*, Ptrs.; *Atractaspis irregularis*, Rhdt.; *A. aterrima*, Gthr.; and *Rana galamensis*, D. & B.

A small collection previously received from Mr. Crosse yielded the type of a new *Typhlops* (*T. Crossii*, Blgr.).

Simocephalus Crossii, sp. n.

Eye moderately large. Rostral much broader than deep, just visible from above; internasals broader than long, two thirds the length of the præfrontals; frontal as long as broad, as long as its distance from the end of the snout, much shorter than the parietals; loreal deeper than long; one præ- and two postoculars; temporals 2+3; seven upper labials, third and fourth entering the eye; four lower labials in contact with the anterior chin-shields, which are short, like the posterior. Scales strongly keeled, in 17 rows. Ventrals 234; anal entire; subcaudals 53. Blackish above and on the outer ends of the ventrals, yellowish white beneath.

Total length 410 millim.; tail 50.

A single female specimen.

Dromophis lineatus, D. & B.

Snout once and a half to once and two thirds as long as the eye. Rostral as deep as broad, visible from above; nostril between two shields; internasals one third to one half the length of the præfrontals; frontal once and two thirds to twice as long as broad, not or but slightly narrower in the middle than the supraocular, as long as its distance from the end of the snout, as long as or a little shorter than the parietals; loreal once and a half to once and two thirds as long as deep; one præocular, not reaching the frontal; two (rarely three) postoculars; temporals 1+1 or 2; eight upper labials, fourth and fifth entering the eye; four (rarely five) lower labials in contact with the anterior chin-shields, which are as long as or a little shorter than the posterior. Scales in 17 rows. Ventrals 140–159; anal divided; subcaudals 78–105. Olive, most of the scales black-edged, with three greenish-yellow longitudinal lines, one on the vertebral row of the scales, the others on the fourth and fifth rows; outer row of scales greenish yellow, like the belly, its upper border

black; young with light cross-bars on the occiput and nape; præ- and postoculars and upper lip greenish yellow; some of the labials with the sutures black; belly and tail below greenish yellow or pale green, uniform or with a series of black dots or short lines on the outer ends of the ventrals.

Total length 1090 millim.; tail 330.

Several specimens, one of which (a young) is an albino.

Specimens from Liberia, Zanzibar, and Central Africa are also in the British Museum, where they were confounded with *Psammophis sibilans*. The type is from the Upper Nile.

Notwithstanding its resemblance to *Psammophis sibilans*, this snake was referred to *Dryophylax* by Duméril and Bibron on account of its dentition. The solid maxillary teeth, ten in number, form an uninterrupted series, the middle ones gradually and but moderately enlarged, as in *D. præornatus*, the type of Peters's genus *Dromophis*. *D. lineatus* may further be distinguished from all species of *Psammophis* by the equal depth of the three anterior upper labials.

Naia Goldii, sp. n.

Rostral a little broader than deep, the portion visible from above half as long as its distance from the frontal; internasals as long as the præfrontals, not reaching the præocular; frontal once and a half as long as broad, as long as its distance from the end of the snout, as long as the parietals; one or two præ- and two postoculars; two or three suboculars; temporals 1 + 3; seven upper labials, fourth narrowly entering the eye, sixth largest; four lower labials in contact with the anterior chin-shields, which are a little longer than the posterior. Neck non-dilatable. Scales in 15 rows on the neck as well as on the body. Ventrals 195; anal entire. Black above, with transverse series of small whitish spots; sides of head and end of snout white, with most of the sutures between the shields black; ventrals white, with a black-edge, which becomes gradually broader until, on the posterior fourth of the body, the shields are entirely black; subcaudals black.

Total length 1750 millim. (end of tail mutilated).

Only one specimen, a male.

This handsome snake, which is nearest allied to *N. anchietæ*, Bocage, is named in honour of Sir George Taubman Goldie, the Governor of the Royal Niger Company, who, through the great interest he takes in the natural history of the Niger, has given much assistance to Mr. Crosse in forming the collection reported upon in this note.

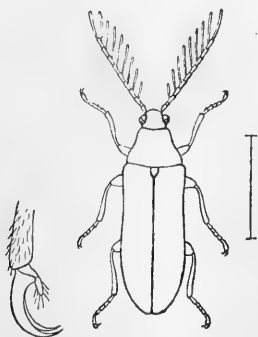
V.—Note on the Japanese Rhipidoceridæ: a new Genus and Species. By G. LEWIS, F.L.S.

THERE are only two species of this family known to me from Japan, and of these one is a species of *Sandalus*, described and roughly figured as *S. segnis*, Lew., Ent. xx. p. 315, 1887, and for the other it seems necessary to establish a new genus.

HORATOCERA (*visibilis*, *cornuta*), gen. nov.

The characters of this genus are in the greater part the same as those of *Callirrhapis*, the differences chiefly being that the antennæ are inserted in the head much wider apart, and the joints 3 to 10 are longer and coequal and about a quarter to a third of the length of the appendage they bear; the eyes are more prominent, smaller, and much more clearly faceted; the scutellum much longer than broad; the prosternal process is shortened posteriorly, and does not reach beyond a point which corresponds to the middle of the coxæ; the inner process of the claws is much less conspicuous.

Type *H. niponica* (the figure gives the outline of the species and the claw of the hinder tarsus).



I possess a second species from the Andaman Islands.

In *Callirrhapis* the prosternal process is long and narrow posteriorly and overlaps the anterior part of the mesosternum; in some of the species, notably *C. fasciatus*, Waterh., it is very long, but in the type of the genus, *C. Dejeani*, Latr., it is of moderate length.

Horatocera niponica, sp. n.

♂. Elongata, nigra, vix nitida; thorace rufo in medio canaliculato, utrinque foveolato; elytris basi anguste obscuro-brunneis.

L. 12-14 mill.

♀. Tota nigra; antennis brevibus.

L. 17 mill.

Elongate, black, somewhat shining; the head, surface uneven, rather coarsely and rather rugosely punctate, with a median concavity behind the antennæ; the antennæ, first joint rather long, somewhat bent, surface punctulate, second very short, third and those following to the tenth nearly coequal, but the appendages to the third and fourth are distinctly shorter than those of the others, eleventh joint is longer than the first, second, and third together, and has no appendage; the thorax red, with a tawny pubescence, widest posteriorly, narrowest anteriorly, sinuate laterally near the middle, with a longitudinal median channel and a deep fovea on each side of it rather behind the middle, posterior margin very narrowly edged with black; the scutellum nearly as long again as broad, with the edges raised posteriorly, irregularly punctured; the elytra black, with their bases obscurely brown, coarsely sculptured, punctate, with the interstices of the punctures raised, vaguely costate, with the sutural and epipleural margins a little elevated; the legs black, with the claws in both sexes reddish; anterior tibiæ not crenulate nor denticulate*. The female is wholly black, with shorter antennæ, a wider head, with a transverse ridge between the antennæ and a bilobed depression between the eyes. There is a variety of the male in which the head and elytra are reddish brown; but in no case is the colour so bright as that of the thorax.

Hab. Fukushima, Nara, and Usui-togé. Nine males and one female.

VI.—*Descriptions of some new Species of Heterocera from Tropical America.* By HERBERT DRUCE, F.L.S.

Arctiidæ.

Robinsonia sabata, sp. n.

Primaries and secondaries pure white: primaries, the costal margin edged with pale brown from the base nearly to the

* This character is noticed because *Homæorhipis*, Fairm., 1887, is a genus in which the species have the tibiæ crenulate, and *Callirrhypis Pascoe*, Waterh., has the tibiæ denticulate.

apex; the base and a small spot on the inner margin also pale brown; a white dot close to the base of the wing; the fringes of both wings white. The head yellow, the front of the head white; collar and tegulæ white; thorax grey; abdomen yellow above, white on the underside; a central row of white dots extends from the base of the abdomen to the anus; antennæ and palpi black; front legs brown, the others white.

Expanse $2\frac{1}{10}$ inches.

Hab. British Honduras, Belize (*Mus. Druce*).

A very distinct species.

Robinsonia deiopea, sp. n.

Primaries and secondaries white: primaries, the costal, outer, and inner margin and two bands crossing the wing pale fawn-colour; the first band is broad, and crosses the wing about the middle from the costal margin to the anal angle; the second band is narrow and near the apex; a long white spot at the anal angle; the fringe brown: secondaries, the fringe white. Head yellow, the front of the head white; antennæ and palpi black; collar and tegulæ white, the tegulæ edged with fawn-colour; thorax fawn-colour, with a large white spot at the base; abdomen above yellow, on the underside white, two black spots on each side of the abdomen near the anus; legs greyish white.

Expanse 2 inches.

Hab. British Honduras, Belize (*Mus. Druce*).

A very distinct and fine species, allied to *Robinsonia Grotei*, Schaus.

Robinsonia sanae, sp. n.

Primaries and secondaries white: primaries, the costal margin broadly bordered with yellowish brown, from which four fine yellowish-brown lines cross the wing, three to the outer margin and one to the inner margin; the base of the wing yellowish brown, from which two fine brown lines extend along the inner margin, the outer margin yellowish brown; the fringe brown: secondaries with the fringe white. Head white; collar white, shaded with yellow; tegulæ and thorax white; abdomen yellowish brown above, white on the underside.

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

Hab. Panama, Chiriqui (*Trötsch, Mus. Staudinger*).

Amastus cymothoë, sp. n.

Male.—Primaries semihyaline, the costal margin, apex, outer

and inner margin clouded with dark grey, the costal and inner margin banded with greyish white, the veins blackish grey; a small spot close to the base of the wing yellowish brown; the veins beyond the cell red; the fringe grey: secondaries whitish hyaline; the fringe brown. Head and collar grey, banded with brown; thorax and upper part of the abdomen thickly clothed with yellowish-brown hairs; tegulæ greyish white, streaked with black down the middle; abdomen red, with the anus and each side of the abdomen banded with black; underside of the thorax reddish brown, of the abdomen greyish white; antennæ and legs dark brown.—*Female* very similar to the male, but the primaries more clouded with brown.

Expanse, ♂ $1\frac{4}{10}$, ♀ $1\frac{6}{10}$ inch.

Hab. Bolivia (*Mus. Druce*).

This species is allied to *Amastus mansueta*, H. Edwards, but quite distinct.

Notodontidæ.

Ophitis pulcheria, sp. n.

Primaries brownish fawn-colour, marked with darker brown spots at the base and partly along the costal margin; a waved brown band partly crosses the wing beyond the middle, extending from the inner margin about two thirds across the wing, where it joins a fine zigzag white line, which extends to the costal margin just above the apex; the fringe brown: secondaries pale fawn-colour, slightly darker round the outer margin; two short brownish-black lines at the anal angle; the fringe greyish brown. Head, antennæ, thorax, and abdomen brownish fawn-colour, the thorax with some greyish scales; the third segment from the base of the abdomen dark blackish brown; legs pale brown.

Expanse 3 inches.

Hab. Panama, Chiriqui (*Mus. Druce*).

Allied to *O. cyllota*, Druce, but a much smaller insect and very distinct.

Noctuidæ.

HELIOTHINÆ.

Grotella pyronæa, sp. n.

Primaries chalk-white, crossed beyond the middle from the costal to the inner margin by a very faint broken black line, which in some specimens is entirely wanting; the fringe

white: secondaries smoky brown, darkest on the costal margin and at the apex; the fringe white; the underside of both wings smoky brown. Antennæ black; head and thorax white; abdomen brownish white; palpi and legs blackish brown.

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

Hab. Mexico, Amula in Guerrero, 6000 feet (*H. H. Smith*).

Grotella salacon, sp. n.

Male.—Primaries glossy chrome-yellow: secondaries pale primrose-yellow, with the apex, outer margin, and fringe chrome-yellow. Underside of both wings pale glossy yellow. Head, thorax, and tegulæ deep chrome-yellow; abdomen pale yellow; anus dark chrome-yellow; antennæ black.—*Female* almost identical with the male.

Expanse 1 inch.

Hab. Mexico, Tierra Colórada in Guerrero, 2000 feet (*H. H. Smith*).

Grotella samula, sp. n.

Primaries and secondaries pale citron-yellow; primaries slightly the darkest, and with the inner margin and a spot at the end of the cell very pale brown. Underside the same as above, but without the brown markings. Head, antennæ, and thorax yellowish; abdomen wanting.

Expanse $\frac{3}{4}$ inch.

Hab. Mexico, Tonalapa, Guerrero (*H. H. Smith*).

One specimen.

Pyralidæ.

Pachynoa (?) *Buckleyi*, sp. n.

Primaries glossy brownish black, crossed by two semihyaline bluish-white bands, neither of them reaching the margin of the wing; the first band is at the end of the cell, the second beyond nearer the apex; the fringe brownish black: secondaries brownish black, crossed beyond the middle by a wide semihyaline bluish-white band; a wide semihyaline bluish-white streak extends from the base almost to the outer margin near the anal angle. Head, antennæ, thorax, abdomen, and legs brownish black. The underside of the wings very similar to the upperside, but slightly paler in colour.

Expanse 3 inches.

Hab. Ecuador, Sarayacu (*Buckley, Mus. Druce*).

VII.—*Some Javan Perichætidæ.* By W. BLAXLAND BENHAM, D.Sc. (Lond.), Hon. M.A. (Oxon.), Aldrichian Demonstrator in Comparative Anatomy, Oxford.

[Plate III.]

I HAVE to thank Dr. Arthur Willey for collecting some earth-worms during his brief stay at Java, on his way to the South Sea, whither he was travelling for the purpose of investigating the development of *Nautilus*. I wish at present to describe three species, which are nearly allied to one another and to others previously recorded from Java.

Several of the Javan species possess a peculiar and characteristic spermatheca; in the majority of the family Perichætidæ the spermatheca consists of two parts—(a) a sac, and (b) a muscular *diverticulum*—having different structure and different functions (see Beddard, Michaelsen, and others). In these particular Javan worms the sac is thin-walled, of large size, and somewhat ovoid in shape; its duct is quite short, and receives a very long diverticulum—longer than the greater diameter of the sac—which is curved round one side of the sac, or, it may be, spirally coiled; this cylindrical tube carries at its free end a small saccule, which communicates with the tube by a very narrow neck. Spermathecæ with such a diverticulum thus constricted near its free end and terminally dilated occur in *P. capensis*, Horst*, *P. operculata*, Rosa†, *P. Tenkatei*, Horst‡, *P. tjibodæ*, Horst§, and, as far as I am aware, in no other species||. In all these species there are two pairs of spermathecæ, opening between the segments 7/8, 8/9, and the anatomy of all is very closely similar; indeed, it is not an easy matter to determine whether all are really different species.

Now, amongst the worms sent to me by Dr. Willey I find two which present certain characters common to the above. I shall have occasion to refer to *P. capensis* during the description of the new species. This species was first

* 'Notes from the Leyden Museum,' v. 1883, p. 195; and Zool. Ergebnisse einer Reise in Niederl. Ind. herausgeg. v. Dr. Max Weber, ii. 1892, p. 62.

† "Die exotisch. Terricol." &c., Ann. des k. k. naturhist. Hofmuseum, 1891, p. 398.

‡ 'Notes from the Leyden Museum,' xv. p. 321.

§ *Ibid.* p. 326.

|| *P. inflata*, Horst (*loc. cit.*), has a somewhat similar diverticulum, which, however, is dilated below the constriction. Ude's species *P. parva* appears to be identical with Horst's species.

described by Horst in 1883 from an imperfectly preserved specimen; he added new facts about it in 1892, but in neither case does he mention the *colour* of the worm, and it appears to be a very important point to note in the Perichætidæ, as Beddard has already pointed out.

Later still, Ude (1893) *, as a result of his examination of numerous specimens, added the fact that the colour is lighter or darker brown.

Horst and Ude regard Rosa's *P. operculata* as being synonymous with this species; but the latter describes his worm as "flesh-coloured;" and there are one or two anatomical points which seem to me to differentiate the two forms.

The first worm I wish to describe is so distinctively coloured that, although it agrees more or less closely with *P. capensis*, I believe it to be entitled to a new name. I call it after my friend Dr. A. Willey, to whom my thanks are due for his kindness in finding time to collect and carefully preserve these worms.

Perichæta Willeyi, sp. n. (Pl. III. figs. 1-6.)

It is represented by a single mature and well-preserved specimen, collected in the humus around an epiphyte, *Asplenium nidus*, occurring at the Gedeh volcano, near Tjibodas.

The worm measures 140 millim. ($5\frac{1}{2}$ inches) in length and 6 millim. in diameter; it consists of ninety-two segments. It is thus a larger and fatter worm than the succeeding species. Its coloration in spirit is quite distinct from that of any Perichæte of which I can find a description †, and recalls very strongly the common "Brandling" (*Allolobophora fætida*).

The general ground-tint is yellow, the rings or ridges carrying the chætæ are white. The dorsal surface of every segment is marked by two transverse bands of rich brownish red—one rather broader band behind the chætigerous ring, and a rather narrower band in front of the ring—so that the intersegmental furrows are yellow. These bands are broadest dorsally, but at each side, below the level of the lateral line, narrow rather suddenly; at the same time the tint becomes lighter, and gradually disappears at about the level of the male pores. Anteriorly these dark bands become wider and send prolongations between the chætæ, so that on the first

* Ude, "Beit. z. K. ausländ. Regenwürmer," Zeit. f. wiss. Zool. lvii.

† *P. fasciata*, Rosa, from Engano, appears to have a somewhat similar plan of colouring (Annal. del Mus. Civico d. Stor. Nat. d. Genova (ser. 2) xii. 1892, p. 543.

six segments or so the white chætigerous ring is interrupted, and each chæta or two or three chætæ lie in a white patch; moreover, on these segments the bands extend further and further ventralwards, till on the first three segments they meet ventrally, though the depth of colour is slightly less here than on the dorsal surface. On the clitellum these bands, though faint, are still recognizable.

Unfortunately Dr. Willey did not inform me of the true colours of the living worm; and no doubt the colours will soon fade in spirit.

A somewhat similar banding occurs in *P. pulchra**, from Luzon, and *P. pictus*†, from Borneo; but in both these species the dark bands are intersegmental. The anatomy, moreover, is quite distinct. In *P. annulatus*, Horst‡ states that the worm is "blackish, with a white ring round the middle of each segment." But in these three cases no mention is made of the light intersegmental ring.

In *P. Willeyi* the chætæ form practically a complete circle, but the median dorsal space is about twice the length of the ordinary intersetal spaces; and across this space there is frequently a dark line joining the dark transverse bands; so that the worm appears to have a darker longitudinal median stripe along its back. The ventral chætæ are somewhat closer together than the dorsal ones; there is no ventral gap. The number of chætæ is 54 on the thirty-fifth segment, 48 on the nineteenth, 44 on the twelfth, 28 on the second.

The *prostomium* is small and not dovetailed; but as the buccal region is everted, it is difficult to be positive on this point. The limits of segments i. and ii. quite distinct.

The *clitellum* is confined to the three segments xiv., xv., xvi., and has very distinct limits.

The first *dorsal pore* is between segments xii. and xiii.; there are none on the clitellum, nor are chætæ present here.

The *male pores* are very evident, slightly oblique, curved slits surrounded by a prominent margin, which is anteriorly crenate, but posteriorly rounded and more projecting (as in *P. operculata*, where, however, the "operculum" is formed by the anterior lip). Surrounding the projecting margin or lips is a circular area reaching to the boundaries of the segment. There are ten chætæ between the male pores.

The *oviducal pore* is median and distinct. There are two

* Michaelsen, "Terricol. d. Berliner Zool. Sammlung," Arch. f. Naturgesch. 1892, p. 25.

† *Ibid.* p. 38.

‡ 'Notes from the Leyden Museum,' v.

pairs of *spermathecal pores*, between segments vii./viii. and viii./ix., and separated by fourteen chætæ.

Internal Anatomy.—It may be noted that the gizzard occupies segments viii., ix., and x., and is of the same shape as in *P. capensis*, viz. bell-shaped. The sacculated intestine commences as usual in segment xv.; there is a pair of cæca in segment xxvi., their blind ends reach to the twenty-third segment. The septa viii./ix. and ix./x. are absent.

The sperm-sacs have the usual position.

The large *spermathecæ* lie in segments vii. and viii. The tubular *diverticulum* is spirally coiled or merely curved, just as Ude has observed to be the case in *P. capensis*. As a matter of detail, those of segment vii. were coiled, those of the eighth were more simply curved, apparently because of the greater space in which the organs lie. When spirally coiled the terminal saccule lies in the axis of the spire, as in fig. 4; when curved it is bent sharply round.

The *prostate* is multilobate, but the lobes differ in shape from those of *P. capensis*; they are longer, less rounded at their ends, and more flattened. The organ is about twice as long as it is wide, and is more opaque, of a more dead white colour than in the species next to be described. The penial duct does not open into any apparent bursa.

It will be seen that in one or two points *P. Willeyi* resembles *P. operculata*, Rosa, and *P. capensis*, Horst; but it differs from both in the position of the spermathecæ, and, in the single specimen at my disposal, in the size and coloration.

In the character of the generative pore it resembles to some extent *P. operculata*; but I confess that I do not lay great stress on this, for I believe that the "operculum" externally and the absence of a "bursa" internally are related and depend on whether the penial duct is or is not fully introverted.

I am inclined to lay considerable stress on the colour and dimensions of the worms, for in our endemic forms these characters are very constant; and in other groups of animals colour—within certain limits, varying in different groups—is a useful specific character. We have yet to learn how far the size of the prostate and the size of the diverticula of the spermathecæ are liable to variation, either in relation to functional activity or to other circumstances, though I believe it would be useful to have careful measurements of the length and breadth of the prostate, for probably the proportions of the organ remain fairly constant. Further, the shape of the lobes

in this organ ought to be noted; most authors are content to describe the prostate as "multilobate," or some such term.

Michaelsen * has recently shown that in one and the same species, viz. *P. indica*, the prostate may present differences in size, and may even be absent, though the specimens are otherwise mature. He had previously noted this lack of prostate in *P. Hilgendorfi* †; and Beddard ‡ records the same fact for two other species, *P. nipponica* and *P. masatakæ*. The last three species are Japanese (Beddard's *P. rokugo* appears to be identical with *P. Hilgendorfi*, Mich.). Michaelsen suggests that these species are all closely allied to *P. indica*.

Perichæta sexta, sp. n. (Pl. III. figs. 7-9.)

Two specimens were collected at Buitenzorg.

The general colour (in spirit) is a rich brown anteriorly and dorsally, becoming lighter posteriorly; the ventral surface is yellowish; running down the middle of the back is a dark line. The chætæ are set in narrow light (? white) rings, which become less marked anteriorly, till in the first six or seven segments the rings are scarcely noticeable. A purplish iridescence is exhibited by the anterior region of the body. The dorsal pores are surrounded by a light ring, or, rather, the lips are light (? white), so that the pores are very distinct. The clitellum is a much darker brown. This coloration agrees with that of *P. capensis*, as described by Ude, except that no mention is there made of the dorsal pores.

The two specimens differ in length: one is 95 millim. long and 4 millim. in diameter, and possesses eighty-two segments; while a smaller and immature specimen consists of one hundred segments.

The small *prostomium* is dovetailed into the peristomium (buccal segment) for about one third the length of the latter; but as there is no transverse boundary, it is difficult to fix the actual depth of the dovetail (Ude and Horst say that in *P. capensis* it reaches nearly to the middle of the first segment).

The number of chætæ is fifty-six behind the clitellum and thirty-eight on the third segment (which closely agrees with the numbers for *P. capensis*). They form a complete circle, though the distance between the two most dorsal chætæ

* "Die Regenwurm-Fauna von Florida und Georgia," Zool. Jahrb. viii.

† "Terricol. d. Berliner Zool. Sammlung," ii. p. 27, in Arch. für Naturgesch. 1892.

‡ "On some Perichætidæ from Japan," Zool. Jahrb. vi.

exceeds slightly the usual interval; however, the spaces between the chaetæ of a circle are not of uniform extent.

The first *dorsal pore* is behind the seventh segment; that this is not a fixed point appears from the description of *P. capensis* given by Horst and by Ude, for the latter found it to vary from vii./viii. to xi./xii.

The *male pores* are not carried by papillæ; they are, however, quite distinct, as transverse slits surrounded by crenate lips, rather sunk below the general surface. Each pore is surrounded by a circular area—not a papilla—of slightly different structure and appearance from the rest of the epidermis; this ring does not extend to the intersegmental furrows. Between the two pores there are eight chaetæ; there are eight to twelve in Horst's and Ude's specimens of *P. capensis*. Horst describes the pore as being oblique and carried by a papilla; Ude states that it is "sickle-shaped," and that one lip of the pore projects as a kind of operculum, as in Rosa's *P. operculata*. This difference should be borne in mind, for, as I have mentioned, I believe it depends on whether the penial duct is wholly or only partly retracted, so that it does not form an important point of distinction.

The *spermathecal pores* are not very distinct; they are situated between segments vii./viii. and viii./ix., rather more laterally than the male pores.

The *oviducal pore* is distinct, light-coloured (? white), and median.

Internally the anatomy agrees very closely with the descriptions already given for *P. capensis*; but there are one or two points of difference, the relative importance of which is not altogether certain. The septa 8/9, 9/10 are absent, and the *gizzard* occupies the whole length of the space between septa 7/8 and 10/11—that is to say, it occupies segments viii., ix., x.,—whereas both Horst and Ude for *P. capensis* refer it to only the first two of these segments. Horst states that the septum 10/11 is absent; Ude finds it present.

There is the usual pair of intestinal cæca in segment xxvi.; each has a length of three segments.

The *sperm-sacs* lie in segments xi. and xii.

The *spermathecæ* are in segments vii. and viii.; and it is here that the only real tangible difference exists between my specimen and those previously described, for both the above-named authors place these sacs in segments viii. and ix. But there is no mistake on my part; the first spermatheca is in front of the gizzard, the second lies alongside of it. Each spermatheca has the characteristic shape already referred to, and already figured by Horst and by Ude for *P. capensis*,

though there is a slight difference in the two drawings; the diverticulum in the figure (pl. iii. fig. 25) of the former is relatively longer and narrower than in Ude's figure (pl. iv. figs. 8, 9) or in my own. Is this a specific difference, or is it merely due to a difference in functional activity? Certainly Horst's drawing more nearly resembles the spermatheca of the worm described above (*P. Willeyi*, sp. n.), and Ude's resembles Rosa's *P. operculata*, which is regarded as a synonym of *P. capensis*.

Another character which always has to be noted in the Perichætidæ is that presented by the *prostate*. In the present worm it is more than three times as long as wide (its actual measurement is 7×2 millim.), and consists of very many rounded notched lobes, forming as a whole a flattened, slightly yellowish organ, which extends through segments 16-20. From near the middle of its inner border the penial duct issues, at first narrow, with thin wall, but soon becoming wider and having muscular walls. It opens into a circular flattened "bursa," as is figured by Horst for *P. capensis*.

Thus the only differences between this present worm and *P. capensis* appear to lie in the position of the spermathecæ (and it is to be noted that in one of Horst's specimens a third spermatheca occurred on one side of the worm in segment vii.) and in the character of the male pore; and although my worm agrees in nearly all other features with *P. capensis* or with *P. operculata*, yet, as these two points are regarded as of specific value, I give a new name to this worm. Nevertheless I conceive that it is quite possible that it may be a hybrid or an abnormal specimen.

The five species, *P. capensis*, *P. operculata*, *P. tjibodæ*, *P. sexta*, and *P. Willeyi*, are very closely allied, and came from the same neighbourhood; to these must be added *P. Tenkatei*, Horst, from the island of Soemba. They all have two pairs of spermathecæ, with peculiarly modified diverticulum: they all have a much lobed prostate. All agree pretty well in size—from 50 millim. in *P. tjibodæ* to, more commonly, 100 millim., as in *P. capensis*, the largest being 140 millim. (*P. Willeyi*). The number of segments, too, does not vary to any great extent—again, *P. operculata* forms the first and lowest of the series, with its sixty segments; the others have one hundred or a few more.

The number of chætæ in a postlitellian ring appears to be about fifty to fifty-six (Rosa does not give any number for this region), which is reduced to about thirty-eight in the region of the spermathecæ.

In none of them is the male pore carried by a prominent papilla, but the shape of the pore appears to some extent diagnostic—that is, it may be transverse to the axis of the body, as in *P. sexta*, or more or less oblique; and some of them are stated to have an “operculum.” I think we may leave this feature out of our reckoning. There remains, then, but very few points, and these are very small, which serve to distinguish these five species.

I have already suggested that (1) the relative length and breadth of the diverticulum, (2) and of the prostate, with a careful drawing of the lobes of the latter, (3) the form of the prostomium, (4) the general coloration, and (5), within certain limits, the size and number of segments of the worm are points that should be carefully recorded. Sundry other anatomical characters occur in other groups of species of *Perichæta*. What I have written above refers more particularly to this particular “*capensis*” group of species from Java; so closely allied are they that it seems possible that their common ancestor is not many generations back. It is very difficult to distinguish some of these six species from one another by a mere study of the descriptions; and it may well be that two or more are varieties or synonyms.

I append, therefore, a table (p. 48) illustrating the more important apparent differences.

Perichæta caducichæta, sp. n. (Pl. III. figs. 10–12.)

Three specimens of a rather slim worm possess characters which do not exactly coincide with other Javan worms. One very striking feature is the *absence of chætæ on the tenth segment* in adult worms. Of the three specimens one—the most mature—was collected on the volcano Gedeh, the two others at Buitenzorg.

They *measure* 120, 130, 133 millim. respectively, and the diameter is 3 to 4 millim. The body tapers somewhat anteriorly, and the colouring is faint in the preserved specimens. There is a dark purplish line along the middle of the back; the dorsal surface of the body anteriorly is light purplish brown, and each segment is marked by a white chætigerous ring. The *clitellum* is darker and browner; there are no chætæ on it, but three faint light rings; it occupies the usual position.

The following description refers to the largest of the three specimens:—It consists of 105 segments, the last three of which are without chætæ.

	Colour.	Size.	Segments.	Chætæ.	First dorsal pore behind	Male pores.	Segment with spermatheca.	Spermathecal diverticulum.	Prostate duct.
<i>P. capensis</i> . . .	Brown; light or dark.	mm. 85-110 x 3-4	90-110	50; 40 on viiiith	viii. to xi.	Oblique, separated by 8-12 chætæ.	viii, ix.	Long, narrow, coiled; or shorter, wider, and curved.	Nearly straight; a bursa.
<i>P. operculata</i> .	Flesh-coloured; brown clitellum.	70 x 5	60	? 40 on viiith	viii.	Oblique, with "operculum."	viii, ix.	Short, wide, curved.	Straight; no bursa.
<i>P. Tenkatei</i> . .	?	85	100	50	xi.; also on clitellum.	Oblique, with operculum.	?	Long, wide, curved.	?
<i>P. fibodæ</i> . . .	Olive-brown; grey anteriorly and clitellum.	50	?	44	?	Triradiate, eight chætæ between.	vii, viii.	Short, wide, curved.	Much coiled; bursa.
<i>P. Willeyi</i> . . .	Transversely dark-striped; intersegmental light rings.	150 x 6	92	54	xii.	Oblique, with operculum; ten chætæ between.	vii, viii.	Long, narrow, coiled or curved.	Straight; no bursa.
<i>P. sexta</i>	Brown.	95 x 5	82-100	56	vii.	Transverse, eight chætæ between.	vii, viii.	Long, thick, curved or coiled.	Curved, with bursa.

The number of *chætæ* is 38 on segment xxiii.

” ” ” 30 ” viii.

” ” ” 20 ” iv.

” ” ” 12 ” ii.

There is a slight dorsal gap, equal to two to three times an ordinary gap.

There are no chætæ on the tenth segment in this specimen; in one of the others there are but six at very unequal distances on the ventral surface, and in the third specimen twelve.

It appears, then, that the *chætæ* drop out of this segment on maturity, a peculiarity hitherto unrecorded amongst earth-worms.

On segment xi. there are fewer *chætæ* than on ix. or xii.

The segments x., xi., xii. are distinctly triannulated, and, though scarcely perceptibly larger in the spirit-specimen, it is quite possible that they may be larger in life. Such a fact has been recorded for *P. falcata*, Horst *, from East Flores, and in the case of *P. Sluiteri*, Horst †, from Billiton; and the same author noted that the tenth segment of *P. indica* is larger than its neighbours. But in no case do I find any record of the *absence* of *chætæ* on this segment.

The *prostomium* is long and narrow and dovetailed into the first segment for three fourths of its length.

The first *dorsal pore* is between segments xii./xiii.

The *male pore* is slit-like, with crenate lips slightly projecting, so as to form rather prominent structures; there are six *chætæ* between the two pores.

The two pairs of *spermathecal pores* are scarcely visible; they lie between segments vii./viii., viii./ix., at about the level of the ninth *chæta* from the ventral mid-line.

The *oviducal pore* is as usual.

Internally the septa viii./ix., ix./x., x./xi. are absent, and the gizzard appears to occupy segments viii., ix., and x. The pair of intestinal *cæca* arise in segment xxvi., and reach as far forward as xxii.

The sperm-sacs are, as usual, in xi. and xii.

The *spermathecæ* are characteristic; they lie in segments viii., ix.; each consists of a nearly globular thin-walled sac, opening by a short, thick, muscular, distinct duct at the anterior margin of these segments. This duct receives a long twisted diverticulum, which gradually enlarges distally, and here appears shining. On one side this diverticulum lies

* 'Notes from the Leyden Museum,' xv. p. 316.

† *Ibid.* vol. xii. p. 234.

anteriorly to the septum, *i. e.* in segment vii., the sac being in segment viii.

The *prostate* is relatively small; it measures 4×3 millim.; so that the general outline is nearly circular; it occupies segments 17-19. It is divided into only a few main lobes, each of which is rounded distally and notched in a variety of ways; the penial duct is short and straight, and opens through a feebly marked circular "bursa."

Though this worm bears a general likeness to several other species from Java and the neighbouring region, yet on comparison I have been unable to identify it with any of these. In general form it recalls *P. indica*, Horst*, which, however, possesses four pairs of spermathecæ, and the ventral chætæ are larger than the rest. *P. falcata*, Horst, from East Flores, has more numerous (sixty) chætæ, and the diverticulum of the spermatheca is very much shorter than in my specimens, though the two structures bear a close resemblance to one another; the prostate is much more deeply lobed.

P. sumatrana, Horst †, is only about half the size of the new species, though it possesses about the same number of chætæ; the spermatheca appears to be somewhat similar.

Again, *P. Sluiteri*, Horst, from Billiton, is larger, has more numerous chætæ, which are distinctly closer together ventrally; the spermathecæ have a terminally dilated diverticulum; and the prostate recalls that of the worm just described.

All these worms seem to belong to a group of species differing from that containing *P. Willeyi*, *P. tjibodæ*, &c. in the character of the spermathecal diverticulum, and in the presence of less numerous chætæ per segment, as well as in a few other points; but these are details, and the two groups are not very widely separated from one another.

EXPLANATION OF PLATE III.

Perichæta Willeyi, sp. n.

- Fig.* 1. Portion of the worm, dorsal view, to show banding.
Fig. 2. Side view of a portion of the worm. The arrow indicates the anterior direction.
Fig. 3. View of the male pores.
Fig. 4. A spermatheca from the seventh segment, $\times 7$. *s*, sac; *d*, diverticulum; *e*, terminal saccule.

* 'Notes from the Leyden Museum,' v.; and Beddard, Proc. Zool. Soc. 1886 and 1890.

† 'Notes from the Leyden Museum,' v.

Fig. 5. A spermatheca from segment viii., $\times 7$. Letters as before.

Fig. 6. Prostate, $\times 7$.

Perichæta sexta, sp. n.

Fig. 7. Male pores. Unfortunately the lithographer has indicated *ten* chætæ, instead of eight, between the male pores.

Fig. 8. Prostate, $\times 7$. *a*, penial duct; *b*, bulbus.

Fig. 9. Spermatheca, $\times 7$. Letters as before.

Perichæta caducichæta, sp. n.

Fig. 10. Segments ix., x., xi., xii., $\times 7$, to exhibit annulation of segments and the absence of chætæ on segment x.

Fig. 11. Prostate, $\times 7$.

Fig. 12. Spermatheca, $\times 7$.

VIII.—*Descriptions of Five new African Shrews.*

By OLDFIELD THOMAS.

IN examining a shrew obtained by Dr. Donaldson Smith's expedition in Somaliland an attempt has been made to determine the other African shrews in the British Museum collection, with the result that the following species prove to need description:—

Crocidura (*Croc.**) *Smithii*, sp. n.

Coloration that characteristic of the *C. albicauda* and *Fischeri* group, but size smaller than in any known species of it. Face, crown, and back pale slaty grey; lips, cheeks, chin, chest, sides, and belly white, as are also the whole of the limbs. Ears short, almost naked, their few fine hairs brown. Lateral glands distinct (in male), the hairs above and below them stained rufous in the type. Tail barely half the length of the head and body, thick, tapering, rather thinly haired, pure white throughout.

* In using the terms "*Crocidura*" and "*Pachyura*," I do so only because they serve as convenient formulæ by which the number of the teeth may be most readily shown. In agreement with Dobson, Lataste, Trouessart, and others, I have little doubt that they do not represent natural genetic groups, and that, for example, the large *Pachyuræ* are more closely allied to the large *Crociduræ* than they are to the pygmy species having the same dental formula. In fact, some four or five cases are known in which a specimen is a *Pachyura* on one side of the mouth and a *Crocidura* on the other, although it must be admitted that, on the whole, there is a great constancy as to the presence or absence of the fourth unicuspid within any given species, and that we ought not to allow ourselves to be too much influenced by such exceptional cases as these. Pending further knowledge on this most difficult subject, I prefer to use the large genus *Crocidura*, taking advantage of the subgeneric terms simply to indicate the dental formulæ of the species described.

Anterior incisor with a very long vertical cusp. Third upper unicuspid smaller than second, pressed close against the antero-internal side of the large premolar, behind whose antero-external cusp it is half hidden.

Dimensions of the type (an adult male, in spirit):—

Head and body 64 millim.; tail 31; hind foot 11; ear 7·5; forearm and hand 15·6.

Skull: basal length 18; extreme length (including incisors) 20·6; greatest breadth 9; palate length 8·6, breadth outside molars 6·2; tip of $\frac{i.1}{i.1}$ to tip of $\frac{p.4}{p.4}$ 4·9.

Hab. Webi Shebeli, Somaliland.

Type collected and presented by Dr. E. Donaldson Smith.

This well-marked species is readily distinguishable by its small size from any known species presenting its coloration, which seems to be characteristic of several East-African shrews. In its general proportions it has a curious youthful appearance, although, as shown by its skull and feet, the specimen is fully adult.

I have named this shrew in honour of its donor, Dr. Donaldson Smith, whose scientific explorations have already done so much towards increasing our knowledge of the fauna and flora of Somaliland.

Crocidura (Cr.) somalica, sp. n.

Size small, form slender. General colour above slaty grey, more or less variegated with brown. Belly clear grey; chin white. Ears whitish, very finely haired. Hands and feet white. Tail fairly long, slender, not markedly incrassated, but yet thicker at its base, whence it evenly tapers to its tip; pale brown above, white below, the bristles white. Lateral gland not visible in the type (female), but present in a second specimen (a male), as to whose specific identity with the type there can be little or no doubt.

First upper incisor small and delicate, conspicuously weaker than in *C. Smithii*; second and third upper unicuspids approximately equal both vertically and horizontally.

Dimensions of the type (an adult female, in spirit):—

Head and body (rather shrunk) 53 millim.; tail 39; hind foot 11·2; forearm and hand 15·6.

Skull: basal length 16·7; extreme length (including incisors) 19·5; greatest breadth 8·4; palate length 8·2, breadth outside molars 5·9; tip of $\frac{i.1}{i.1}$ to tip of $\frac{p.4}{p.4}$ 4·2.

Hab. Webi Shebeli, Somaliland.

Type: B.M. 93.6.30.7; presented and collected by Col. A. Paget.

Besides the type, which was obtained by Col. Paget in 1892, the Museum possesses a second specimen collected in the same region by the lamented Prince Ruspoli, who sent it with others to the Museo Civico, Genoa, by whose authorities it was later presented to the British Museum.

This species superficially resembles the common European *C. russula*, with which it fairly agrees in size and proportions, but from which it may be readily distinguished by its paler colour and evenly tapering tail.

Crocidura (Cr.) silacea, sp. n.

Size and proportions of *C. pilosa*, Dobs. Fur close and velvety. Colour dark slaty grey above, rather paler beneath. Ears not specially hairy or tufted. Fore claws short and strongly curved; upper surface of hands and feet brownish grey. Tail rather long, slender, not incrassated at base, thinly haired, brown above, slightly paler below. Lateral gland not present, at least in the female.

Skull and dentition not appreciably different from those of *C. pilosa*.

Dimensions of the type (an adult female, in spirit):—

Head and body 65 millim.; tail 44; hind foot 12; forearm and hand 16·5; ear from notch 9.

Skull (of a second specimen from the same locality): basal length 16·6; extreme length (including incisors) 19·5; greatest breadth 8·8; palate length 7·7, breadth 5·7; tip of $\frac{i.1}{1}$ to tip of $\frac{p.4}{4}$ 4·1.

Hab. Figtree Creek, De Kaap, Transvaal. Coll. Dr. Percy Rendall.

Type: B.M. 93.11.26.29.

This species seems to be most nearly allied to *C. pilosa*, to which I assign a specimen from Pretoria, presented to the Museum by Mr. W. L. Distant in 1890. It differs, however, by its grey instead of brown colour, its paler feet, less hairy ears and tail, and by its shorter and more strongly curved anterior claws.

Crocidura (Cr.) Crossei, sp. n.

Size small, less than in any described West-African species except *C. bicolor*, Boc. Colour of body uniform slaty grey above and below. Ears very thinly haired, grey. Chin white. Upper surface of metapodials grey, of digits white. Tail rather long as compared with most species, thin, not specially incrassated at base, but nevertheless evenly tapering to its tip; its colour grey-brown above, rather paler below;

longer bristles fairly numerous, evenly scattered throughout except at the extreme tip. Lateral gland well developed.

Anterior upper incisors small and delicate. Second and third unicuspid subequal, their tips about level with the basal cusp of $\underline{P.4}$.

Dimensions of the type (an adult male, in spirit):—

Head and body 60 millim.; tail 51; hind foot 12; forearm and hand 16·7.

Skull: basal length 17; greatest length (including incisors) 19·1; greatest breadth 8·2; interorbital breadth 3·7; palate length 8·2, breadth 5·4; tip of $\underline{i.1}$ to tip of $\underline{P.4}$ 4·2; $\underline{i.1}$, horizontal length 1·6, height 2·1.

Hab. Asaba, 150 miles up the River Niger.

Typ.: B.M. 95.5.3.4. Presented and collected by Dr. W. H. Crosse.

With this species, which seems to be smaller than any of the ordinary grey-coloured shrews as yet described from West Africa, Dr. Crosse obtained specimens apparently referable to *C. Manni*, Pet., and *C. soricoides*, Murray, of the latter of which the Museum possesses the type, and of the former two topotypes.

Crocidura (Pachyura) varilla, sp. n.

Size very small, but not so minute as in the *C. madagascariensis* group. Fur soft, not crisp, fairly long, the hairs of the back 4–5 millim. long. General colour finely variegated grey, almost exactly similar to that of *Myosorex varius*; the hairs slaty grey for two thirds their length, the subterminal sixth whitish and the tips brown. Under surface paler grey, the tips of the hairs white. Ears of normal development, projecting but little beyond the fur; almost naked. Upper surface of hands and feet white. Tail about equal in length to the body without the head; cylindrical, not thickened at base, well-haired, the longer bristles particularly numerous, pale brown above, white below, the bristles all white. Lateral gland small but distinct (male).

Third upper unicuspid slightly higher vertically than the second. Fourth of fair size, clearly visible externally.

Dimensions of the type (an adult male, in spirit):—

Head and body 52 millim.; tail 32; hind foot 9·1; forearm and hand 14·2.

Skull: extreme length (c.) 17·4; tip of $\underline{i.1}$ to tip of $\underline{P.4}$ 3·7.

Hab. East London, British Caffraria. Presented by Lieut. H. Trevelyan.

Type: B.M. 78.1.22.1.

The only question that arises in describing this very pretty little shrew is its relationship to *C. gracilis*, Blainv., said to come from the Cape. That animal, however, is evidently, from the accounts given of it by de Blainville, Coquerel, and Trouessart, a member of the group of true pygmy shrews, to which *C. madagascariensis* belongs, all of which are decidedly smaller than *C. varilla*, and have short, crisp, and uniformly coloured fur. In addition, *C. gracilis* is said to be chestnut-brown above ("brun-marron"), and to have an incrassated tail, in both of which respects it differs materially from the animal now before us.

Besides the type, the Museum possesses three other specimens which I refer with some doubt to this species, the doubt being due to their bad condition. One of them was sent by Verreaux from the Cape, and the other two came from the collection of Sir Andrew Smith, who no doubt supposed they belonged to his *C. capensoides*, a species which, as the type shows, is not a *Pachyura*, is somewhat larger, and differs in other details from *C. varilla*.

IX.—*On small Mammals from Nicaragua and Bogota.*

By OLDFIELD THOMAS.

THE Museum has obtained from Dr. E. Rothschuh a few small mammals collected by him when at Managua, Nicaragua; and one of them proving to need description as new, a few notes on the others may be given at the same time.

1. *Lichonycteris obscurus*, gen. et sp. n.

One specimen.

LICHONYCTERIS*, gen. nov.

Dentition.—I. $\frac{2}{0}$, C. $\frac{1}{1}$, P. $\frac{2}{3}$, M. $\frac{2}{2} \times 2 = 26$.

Deciduous lower incisors and an anterior deciduous upper premolar may be present in early life.

Upper incisors small, not touching each other, standing equidistant in an even curve between the canines. Canines and cheek-teeth above and below very slender and delicate, almost as much so as in *Chæronycteris*; the molars narrow, with scarcely a trace of W-shaped cusps.

Skull light and papery, the elevation of the crown above

* λείχω, I lick. The bats of the present group feed by licking out the contents of berries &c. with their long fringed tongues.

the face more than in *Glossophaga*, less than in *Chæronycteris*, the general form being also intermediate between these two. Zygomatics absent. Bony palate extending backwards almost to the level of the most anterior point of the glenoid facets.

Nose-leaf as in *Glossophaga*, but shorter. Ears and tongue as in that genus. Interfemoral membrane well developed, equal to that of *Chæronycteris*. Wings to the terminal part of the metatarsals. Calcar distinct.

This genus adds another to the group of Glossophagine bats, of which there are now eight genera, all closely allied and only distinguished from each other by the various proportions in which they divide some half a dozen characters. The cheek-teeth range from 4 to 6 above and 5 to 6 below; but it is not always quite easy to tell whether, when the number is below 6, the missing teeth are premolars or molars. On the whole, in the present case it seems fairly clear that the missing teeth above are the anterior premolar and the posterior molar, and that the latter tooth is missing below. This would make the formula as above given and similar to that of *Leptonycteris*.

On the whole, important as the number of teeth may seem to be, I am inclined to consider *Lichonycteris* most nearly allied to *Chæronycteris*, from which, as from *Glossophaga*, *Monophyllus*, *Lonchoglossa*, and *Anura*, it differs by the reduction of its cheek-teeth to the number possessed by *Leptonycteris*. *Phyllonycteris* has the same total number in the lower jaw, but they have been differently assigned to molars and premolars (P. $\bar{2}$, M. $\bar{3}$), a point on which I can at present express no opinion.

Lichonycteris obscura, sp. n.

Size and general appearance of *Glossophaga soricina*. Nose-leaf about equally high as broad. Ears short, evenly rounded off above, their outer margin concave below the tip and notched again below opposite the tip of the tragus. Antebrachial membrane mostly naked above, but the basal third of the forearm is thickly clothed with fur, and some of this extends on to the membrane; metacarpal bone of thumb hairy; rest of wings naked except along the sides of the body to a line from the middle of the humerus to the middle of the femur. Interfemoral membrane extending to the level of the end of the tibiæ, its upper surface naked. Tail reaching to the level of the knee, its tip appearing on the upper surface of the membrane. Below, the antibrachial membrane is hairy, as is the basal third of the forearm, and the wings between the humerus and the flanks.

Colour uniformly smoky brown above and below, darker than in *Glossophaga soricina*.

Dimensions of the type (B.M. 95.4.27.1: an adult female, in spirit):—

Head and body 46 millim.; tail 6·7; ear 10; forearm 33; lower leg 12·6; calcar 5·8; hind foot, without claws, 7·5; interfemoral membrane in centre 17.

Skull: basal length 16·8; greatest length 19·7; breadth of brain-case 8·1; interorbital breadth 4; palate length 11, breadth outside last molar 4·4; front of canine to back of last molar 6·4, the same below 6·4.

Hab. Managua, Nicaragua. Coll. Dr. Rothschuh.

This interesting little bat, on whose discovery Dr. Rothschuh is to be congratulated, has a superficial resemblance to the common *Glossophaga soricina*, found in the same region. Without any very exhaustive examination, however, it may be easily distinguished by its hairy forearms, extension of wings to metatarsus, minute upper incisors not touching one another, and the entire absence, at least in the adult, of lower incisors. These points would all be visible in a freshly killed specimen without extraction of skull, and may be commended to the attention of collectors.

2. *Oryzomys Couesi*, Alst.

One specimen, male.

3. *Oryzomys gracilis*, Thos.

Three specimens, all males.

This is a considerable extension of the known range of *O. gracilis*, which was founded on a skin from Concordia, Colombia. The three specimens from Managua, while obviously of the same species, differ considerably among themselves, and show that a good deal of allowance for variability should be made when studying these rats. Thus one of them, like the type, has a partially bicolor tail, while the other two have this member wholly dark; the interparietal of one is narrow and straight anteriorly, of the second broad and straight in front, and of the third convex anteriorly; the palatal foramina are in no two quite alike, those of one being fairly similar to those of the type, while in the other two they are broader in different degrees.

The measurements of a spirit-specimen are as follows:—

Head and body 92 millim.; tail 107; hind foot, without claws, 27; ear 16.

4. *Marmosa* * *murina*, L.

One specimen.

From Bogota some skins of Muridæ have been received, among which are specimens apparently referable to *Oryzomys minutus*, Tomes, *O. spinosus*, Thos., *O. gracilis*, Thos., and, in addition, the following new species:—

1. *Oryzomys princeps*, sp. n.

Size large, proportions very much as in *Mus rattus*. Fur long (about 14 millim. on back), soft, but not specially fluffy. General colour a rich orange-rufous, darkened along the middle line above, richer along the sides, brightest though palest on the belly, where the hairs for their terminal third are a clear orange-buff. Line of demarcation not marked. Ears of medium size, fairly well haired, black. Hands and feet dark brown on the metapodials mesially, silvery whitish laterally and on the digits; fifth hind toe reaching just past the base of the fourth. Tail very long, well haired but not tufted, uniformly blackish brown throughout.

Skull with a long flattened muzzle, so that the profile is perfectly straight from the vertex on the middle of the parietals to the tip of the nasals. Interorbital space narrow, concave above mesially, its edges square but not beaded. Zygomatic plate straight in front, not projecting. Palatal foramina large and well open, reaching back just to the level of the front of $\frac{m.1}{1}$. Bullæ small.

Molars very large, broad and squarish, the projecting cusps prominent.

Dimensions of the type (an adult male skin):—

Head and body 181 millim.; tail 226; hind foot 35; ear (c.) 17.

Skull: basal length 36, basilar length 33.3, greatest breadth 21.8; nasals 15.6×4.9 ; interorbital breadth 5.2; interparietal 4.1×11.8 ; palate length from henselion 18; diastema 10.6; palatal foramina 8.2×3.5 ; length of upper molar series 7.5.

This fine species is one of the handsomest of the whole group, equalling or surpassing in beauty the Rio Janeiran *O. ferrugineus* described last year, although its colour is

* MARMOSA, Gray (1821).

Syn. *Asagis*, Gloger (1841).

Micoureus, Less. (1842). See Ann. & Mag. Nat. Hist. (6) xv. p. 190, footnote.

darker and less brilliant than in that species. As to its real affinities, I am unable to speak with certainty, but it seems to be one of the group of *Oryzomys* which show a tendency towards *Rhipidomys*, although, so far as I know, there is no described species with which it could possibly be confounded.

2. *Oryzomys Childi*, sp. n.

Size medium. Fur rather long (11–12 millim. on back), straight, of medium texture. General colour dull grizzled grey-brown, the hairs dark slate, with pale brown tips. On the middle part of the back all the hairs are without brown tips, and the slate-colour being here specially dark, a long oval blackish patch is formed. Under surface greyish white, the tips of the hairs white; line of demarcation fairly well defined. Ears large, finely haired, black. Feet long, whitish above, a faint brownish discoloration on the metatarsals; fifth hind toe, without claw, reaching just past the middle of the first phalanx of the fourth. Tail long, slender, thinly haired, bicolor, brown above, whitish beneath.

Skull smooth, rounded, and little ridged. Interorbital edges rounded, not beaded. Palatal foramina rather short. Molars as in typical *Oryzomys*.

Dimensions of the type (an adult female skin):—

Head and body 131 millim.; tail 143; hind foot 31; ear (c.) 16.

Skull: front corner of interparietal to tip of nasals 29·5; greatest breadth 16·8; nasals $12 \times 3\cdot7$; interorbital breadth 5; length of zygomatic plate 3·8; palate length from henselion 14·2; diastema 8·5; palatal foramina $5\cdot6 \times 2\cdot4$; length of upper molar series 5·5.

O. Childi is by the shape of its skull evidently closely allied to *O. meridensis*, Thos., from which it mainly differs by its dull brown instead of rufous coloration, longer fur, and its blackish dorsal area.

The name of this species is given in honour of Mr. George D. Child, through whose kind instrumentality the specimens have been obtained.

3. *Oryzomys laniger*, sp. n.

Fur long, hairs on back about 12 millim. in length; very soft and fluffy. General colour above dull olivaceous grey; the hairs dark slate for nine tenths of their length, their tips olive. Under surface similar, but paler, the tips of the hairs dull yellowish; line of demarcation not defined. Ears fairly large, naked. Metapodials brown mesially, their edges and

the whole of the digits white; hind feet very short in proportion to the general size; fifth hind toe very long, reaching, without claw, nearly to the end of the second phalanx of the fourth. Tail slender, finely haired, uniformly dark brown throughout.

Skull rather thin and papery for its size, with a large rounded brain-case, and broad rounded interorbital space, whose edges are quite unbeaded, scarcely even angular. Zygomatic plate narrow, slanting backwards in front. Palatal foramina large and open, not quite reaching backwards to the level of the front of $\frac{m.1}{m.3}$. Posterior edge of palate level with the middle of $\frac{m.3}{m.1}$. Bullæ small.

Molars large and oblong, as in *Oryzomys* and *Rhipidomys*.

Dimensions of the type (an adult female skin):—

Head and body 117 millim.; tail 123; hind foot (moistened) 21·8; ear (c.) 17.

Skull: basal length 24, basilar length 21·7, greatest breadth 15·4; nasals 10·3 × 3·6; interorbital breadth 5; interparietal 3·2 × 10·2; length of zygomatic plate 2·2; palate length from hensenion 12; diastema 7·8; palatal foramina 5·5 × 2·4; length of upper molar series 4·7.

This fluffy-haired Vesper Mouse has very much the appearance of an *Acodon*, say of *A. olivaceus*, but its short feet and broad heavy molars show that it is essentially different from any member of that group.

X.—On some Coccidæ obtained by Mr. C. A. Barber in the Island of Antigua, W.I. By T. D. A. COCKERELL, Entomologist of the New Mexico (U.S.A.) Agricultural Experiment Station.

WHEN leaving Antigua Mr. Barber was so kind as to send me a parcel of scale-insects which he had collected there; and as the specimens prove to be of considerable interest, the following notes are offered.

(1) *Orthezia insignis*, Douglas.

On roots and stems of *Clitorea ternatea* and stems of *Coleus*; very destructive to the latter. This extremely troublesome species is getting very widespread; out of doors in the tropics and in temperate regions in hothouses.

(2) *Dactylopius longispinus*, Targ.-Tozz.
(*longifilis*, Comstock).

On *Adiantum* and other ferns (*Dr. Freeland*). "Very destructive to the more delicate ferns." I have no doubt that this is correctly identified, though the material being all in alcohol makes the determination difficult.

(3) *Phenacoccus yuccæ*, Coquillett (*Dactylopius mexicanus*, Ckll.), var. *Barberi*, v. nov.

♀. Length about 5, breadth about $2\frac{1}{2}$ millim. Specimens in alcohol look like a *Monophlebus*, and are whitish, nude, shiny, with the segmentation distinct. Legs and antennæ pale reddish brown, shiny.

Antennæ 9-jointed, joint 9 about one third longer than 8; 7 a little longer than 8; 6 about as long as 7—in fact 4, 5, 6, and 7 practically equal; 3 a little longer than 4, 1 about as long as 2.

Tibia and femur with rows of bristles; tibial bristles about twelve in a row, femoral about seven. Trochanter with five bristles and a long hair. Digitules all filiform. Claw with a small denticle on its inner side.

Anogenital ring with six stout bristles.

Sides of segments with patches of small spines.

This may be a distinct species, but I cannot be sure of this without seeing living, or, at least, dry (not alcoholic) specimens.

Found on *Allamanda* and *Thunbergia grandiflora*, and also on *Coleus* and *Croton* near the *Thunbergia*. It is not confined to Antigua; Mr. Barber sent it also from St. Kitts, on plant unknown; and Mr. Urich sends it from St. Ann's, Trinidad, on orange. The typical form of the species is found in California and Mexico. Sometimes the antennæ have only eight joints in Mexican specimens; it was on such that I founded my *Dactylopius mexicanus*.

(4) *Lecanium batatæ*, sp. n.

♀. Length 3, breadth $2\frac{1}{2}$, height 1 millim. Soft, pale ochreous, shiny; posterior incision short, less than $\frac{1}{2}$ millim. long. Outline of scale broad oval. Legs extremely small, very pale brown. Margin with fairly stout and large simple spines, the largest of which are indistinctly bifid at tips. Spiracular spines stout, one long and two short.

Legs ordinary; trochanter with a very long bristle. Tibia about as long as femur; tarsus more than half length of tibia.

Claw curved, digitules of claw extremely large and stout, extending considerably beyond claw. Tarsal digitules filiform, with small knobs.

Antennæ 8-jointed, tapering; joint 3 longest, much longer than 2 or 4; 2 subequal with 4 or a little longer; 5 shorter than 4; 6 and 7 equal and shorter than 5; 8 about or hardly as long as 4.

Anal plates triangular, the outer sides subequal; hind ends rounded, and bearing four short bristles.

Derm colourless, with extremely large but indistinct round gland-pits.

On the tuberous roots of the batata or sweet potato (*Ipomæa batatas*), Feb. 25, 1893.

The discovery of a *Lecanium* in such a situation as this was quite unexpected. The species has a general resemblance to *L. terminaliæ* in shape and size, but does not seem to be very closely allied to any described form.

(5) *Chionaspis minor*, Maskell.

In great quantity on twigs of *Hibiscus*; Clare Hall, and from Dr. Freeland.

(6) *Chionaspis citri*, Comstock.

It is unfortunate that this species, so destructive to *Citrus*-trees, has reached Antigua.

(7) *Parlatoria Pergandei*, Comstock,
var. *crotonis*, v. nov.

♀. Scale white or brownish, second skin pale reddish brown, suffused with black in the middle. ♀ insect practically as in *Pergandei*; a Jamaican specimen shows the grouped glands present, caudolaterals 5, cephalolaterals 6. On *Croton* (Dr. Freeland). I also found it on *Croton* in Jamaica, at Kingston. It does not seem to live at all on *Citrus*, the food-plant of typical *Pergandei*; the latter has not been found in Antigua or Jamaica.

(8) *Aspidiotus rapax*, Comstock.

On cones of *Casuarina*. Many specimens show parasite-holes.

Las Cruces, New Mexico, U.S.A.,
April 25, 1895.

XI.—*New Bees of the Genus Halictus from New Mexico, U.S.A.* By T. D. A. COCKERELL, Entomologist of the New Mexico (U.S.A.) Agricultural Experiment Station.

(1) *Halictus tripartitus*, sp. n.

♀. Long. 6 millim.; head, seen from in front, somewhat broader than long, black, with a perceptible greenish tinge; face and cheeks thinly clothed with pale hairs; mandibles and antennæ piceous, the latter, straightened, reaching about to anterior border of scutellum, with the head thrown back. Punctuation of face strong and very close.

Clypeus pitch-black, lacking the greenish tinge of face, with large, rather sparse punctures, its anterior margin with a shining fringe of very pale golden hairs.

Thorax broadly oval; mesothorax, pleuræ, and metathorax blue-black; scutellum and postscutellum dark greenish, contrasting. Hairs on dorsum of thorax ochraceous, those on pleura whitish. Enclosed portion of metathorax rugulose, finely longitudinally wrinkled at sides.

Legs dark, with moderately dense pale pubescence, which has a golden tinge in some lights, on tibiæ and tarsi.

Wings hyaline, nervures and stigma honey-yellow; third submarginal narrowed more than one-half towards marginal.

Abdomen black, shiny, densely punctate; segments 1 to 4 with marginal bands of pale ochreous hairs, that on first segment failing in the middle.

Hab. Santa Fé, N.M., June 27, 1894, from alfalfa in Mr. Andrews's orchard (Ckll. 1140).

Very near to *H. fasciatus*, but that species differs in its green (not black) mesothorax, somewhat larger size, and in its head being slightly longer than broad, whereas in *tripartitus* it is slightly broader than long. *H. trizonatus*, Cr., is another allied species; I have a specimen from Sta. Fé which may be referable to *trizonatus* or may be a new species closely allied to it. It differs from *tripartitus* by its short third submarginal cell and black face and scutellum.

(2) *Halictus sisymbrii*, sp. n.

♀. Long. about 9 millim.; black, with sparse whitish pubescence. Head broad; ocelli shining pinkish brown; face densely punctured; clypeus nearly bare. Mesothorax finely and closely punctured, shiny. Enclosed portion of metathorax longitudinally wrinkled. Sides of metathorax

with fairly dense and long white hairs. Tegulæ shining, testaceous. Wings hyaline, nervures and stigma dark brown; third submarginal narrowed not quite one-half towards marginal. Abdomen black, shiny, very finely punctate, with a very narrow band of white pubescence at the base of second and third segments. Hairs on tarsi more or less golden.

Hab. College Farm, Las Cruces, N.M., April 16, 1895; one swept from *Sisymbrium canescens* (Ckll. 2572).

This species will be readily distinguished by its large size, unarmed cheeks, black colour, and two narrow abdominal hair-bands. The enclosed portion of the metathorax is truncate behind, not rounded as in *pectoralis*.

(3) *Halictus pectoraloides*, sp. n.

♀. This species had been confounded with *H. pectoralis*, Smith, which it much resembles. Mr. Robertson has sent me an Illinois specimen of true *pectoralis*, and the following differences are at once apparent:—

pectoralis.

Mesothorax rather dull; punctures comparatively large and close. Parapsidal grooves obscure.

Hair-patches at lateral bases of abdominal segments 2 and 3 obscure.

Third transverso-cubital nervure gently curved.

Sculpture of metathorax coarser.

pectoraloides.

Mesothorax very shiny; punctures comparatively sparse.

Parapsidal grooves very apparent.

White hair-patches at lateral bases of abdominal segments 2 and 3 very distinct.

Third transverso-cubital distinctly bent. This is sometimes not very apparent.

Sculpture of metathorax finer.

Among the New Mexico species *pectoraloides* is recognized by its black (not at all blue or green) colour, the shiny mesothorax, and the patches of white pubescence at sides of abdominal segments 2 and 3.

In the Mesilla Valley, N.M., *pectoraloides* is very abundant. Sweeping *Sisymbrium canescens* on the College Farm, I got but two on April 12th; but on the 16th they were out in full force, and I captured eleven. While the *pectoraloides* thus became more numerous, *H. pruinosus*, Rob., swept from the same flowers, diminished. Sweeping at random from the *Sisymbrium*, I got on April 12th ten *pruinosis*, on the 16th but four. Did the *pectoraloides* drive them away?

Other dates for *pectoraloides* are:—Las Cruces, Aug. 5, 1893; Las Cruces, July 13, 1893, on *Solanum eleagnifolium*; College Farm, April 26, 1894, at flowers of *Erigeron strigosus*.

The first abdominal segment is often more or less covered by brown mites.

(4) *Halictus subobscurus*, sp. n.

♀. Length about 6 millim.; black, pubescence whitish, sparse. Head moderately broad; face below antennæ more or less covered with short white hairs (but not densely snow-white pubescent, as in some species), vertex minutely roughened. Antennæ brownish towards tips. Mesothorax quite dull, parapsidal grooves not apparent.

Postscutellum with pale pubescence. Enclosed portion of metathorax rounded behind, not truncate; its margin not indicated by a sharp elevated ridge, but by a rounded raised portion free from hairs; its surface anteriorly rather feebly longitudinally wrinkled. Sides of metathorax hairy; descending hind end of metathorax with a group of about 16 well-separated very distinctly plumose hairs on each side of the middle.

Tegulæ testaceous. Wings hyaline, nervures and stigma dull yellowish brown. Third submarginal narrowing rather less than half to marginal. Legs with short hairs; tarsi fulvous.

Abdomen fairly shiny, very minutely and closely punctate; not fasciate, but apical margins of segments obscurely testaceous (not distinctly so, giving the appearance of bands, as in some species). Ventral segments with bands of hairs, only conspicuous when viewed sideways.

Hab. On *Sisymbrium canescens*, College Farm, Mesilla Valley, N.M., April 12, 1895 (Ckll. 2689).

The following table has been prepared to distinguish several species more or less similar to *subobscurus* :—

Mesothorax very shiny; median and lateral grooves distinct; stigma dark; abdomen with four lateral patches of white hairs.	<i>pectoraloides</i> , Ckll.
Mesothorax not so shiny.	
Stigma dark; abdomen with four more or less defined lateral patches of white hairs.	
Head decidedly longer than broad; mesothorax with larger punctures; metathorax more coarsely sculptured	<i>pectoralis</i> , Sm.
Head nearly round; mesothorax with smaller punctures; metathorax more finely sculptured	<i>quadrimaculatus</i> , Rob.
(<i>pectoraloides</i> has the shape of head intermediate between these two.)	
Stigma yellowish.	
Head large and broad	<i>arcuatus</i> , Rob.
Head small, moderately broad.	<i>subobscurus</i> , Ckll.
Head comparatively narrow.	<i>gracilis</i> , Rob.

An *Halictus* taken at Las Cruces on August 14, 1893, differs from *subobscurus* in having the margins of the segments very distinctly testaceous, after the manner of *lusorius*, Cr. I doubt whether it is a distinct species; it is not *lusorius*.

(5) *Halictus semicæruleus*, sp. n.

♀. Length about $5\frac{1}{2}$ millim. Head bronzy green, thorax dark blue, abdomen black. Head rather narrow; face somewhat longer than wide, strongly punctate; clypeus blackish at end, mandibles more or less reddish. Cheeks strongly bluish. Flagellum only slightly brownish towards end. Mesothorax shiny, with large punctures; median groove deep and distinct, parapsidal grooves obscure. Scutellum with large, rather sparse punctures, and between the punctures microscopically striate. Postscutellum with rather long scattered hairs. Enclosure of metathorax finely rugulose, subreticulately wrinkled, bounded by a raised but not carinate border, rounded, not truncate, behind. Sides of metathorax and pleura with whitish hairs.

Tegulæ testaceous. Wings hyaline, nervures and stigma pale honey-yellow, subcostal nervure black. Third submarginal squarish, little narrowed towards marginal; third transverso-cubital and second recurrent nervures very faint. Legs dark; tarsi (except first joint) reddish.

Abdomen black, with a greenish reflection; sides of segments 1 and 2 and whole of dorsal segments 3 and 4 thinly covered with short whitish hairs.

Hab. Santa Fé, N.M., June 20, 1894 (Ckll. 987).

The following table has been prepared to separate the species liable to be confused with *semicæruleus*:—

Mesothorax blue; tegulæ not punctured; stigma pale honey	<i>semicæruleus</i> , Ckll.
Mesothorax green (or blue-green, with tegulæ punctured, in <i>palustris</i>).	
First two abdominal segments constricted at apex; abdomen dark æneous	<i>coactus</i> , Cress.
Abdomen normal.	
Tegulæ punctured; metathorax short, broad, strongly truncate	<i>palustris</i> , Rob.
Tegulæ and metathorax normal.	
Mesothorax dull: dark blue-green	<i>floridanus</i> , Rob.
Mesothorax dull: brassy green	<i>pilosus</i> , Smith.
Mesothorax more or less shiny.	

(Robertson says the mesothorax of *pruinus* is not shiny; it is so in our New Mexico form, which otherwise agrees with the description, and which has been seen by Mr. Robertson.)

Face and metathorax bluish or blue-green.. *pruinus*, Rob.

Face and metathorax brassy green

Of the species found in New Mexico, it resembles only *pruinusus*.

(6) *Halictus meliloti*, sp. n.

♀. Length about $6\frac{1}{2}$ millim. This very closely resembles *fasciatus*, and is only to be distinguished by a comparative description:—

fasciatus.

Vertex more depressed, dark bluish green, more coarsely punctured.

Mesothorax dark bluish green, median groove very distinct.

Second submarginal cell but little higher than broad.

Sculpture of enclosed space of metathorax rather coarser and a little more punctiform.

Apical bands of first two segments of abdomen distinct, though interrupted in the middle.

meliloti.

Vertex more rounded, strongly bronze-green or olive-green, more finely punctured.

Mesothorax bronze-green or olive-green, median groove indistinct.

Second submarginal very distinctly higher than broad.

Sculpture of enclosed space of metathorax consisting of very fine longitudinal grooves.

Apical bands on first two segments of abdomen hardly perceptible, those on segments 3 and 4 distinct.

Hab. College Farm, Mesilla Valley, N.M., May 1, 1895; swept from *Melilotus indica*. Of the New-Mexico species, *meliloti* resembles *tripartitus*, but is at once distinguished by the colour and shape of the head.

(7) *Halictus semibrunneus*, sp. n.

♀. Length about 5 millim. Shiny; head and thorax dark blue; abdomen piceous, with the segments faintly testaceous at apical margins. Face broad, inner orbits nearly parallel, cheeks unarmed. Pubescence of head, thorax, and abdomen sparse, short, whitish; on abdomen largely covering the bases of the second and third and the whole dorsal surface of the fourth and fifth segments. Flagellum dark reddish brown. Vertex very finely punctate. Mesothorax very shiny, with rather large but sparse punctures, median groove distinct. Scutellum shiny, sparsely punctured; postscutellum not tomentose. Upper portion of metathorax not enclosed by a raised line, very minutely roughened, very obscurely striatulate. Abdomen impunctate. Legs dark, ordinary. Wings hyaline; nervures and stigma pale honey-yellow; third submarginal narrowed less than half to marginal.

Hab. College Farm, Mesilla Valley, N.M.; taken on the

occasion of a meeting of the College Field Club, April 27, 1894.

This species might be confounded with the Sta. Fé *H. semicæruleus*; but that differs in being larger, especially in the thorax, in its more distinctly sculptured metathorax, its conspicuous erect pale brownish hairs on postscutellum, its more strongly and closely punctured mesothorax, its somewhat differently shaped head, with a green face, and its dark antennæ.

Of other species, *H. reticulatus* and *H. Hartii* differ at once from *semibrunneus* by the reticulated mesothorax; *H. apokensis*, a Florida species, is like *semibrunneus* in lacking this reticulation, but it has the mesothorax only moderately shiny and its head and thorax are greenish.

(8) *Halictus perdificilis*, sp. n.

♀. Length about $6\frac{1}{2}$ millim. Head dark blue-green; mesothorax and scutellum brassy green; metathorax so dark blue as to be almost black. Abdomen piceous, apical margins of segments 2, 3, and 4 slightly testaceous. Pubescence of head and thorax sparse, thin, with a slightly yellowish tinge. Head moderately small; face not very broad, the portion between ocelli and antennæ strongly and closely punctured; flagellum dark chocolate-brown, not at all yellowish.

Mesothorax minutely roughened and strongly and rather closely punctured; median groove very distinct. Scutellum strongly punctured; postscutellum with long subochraceous hairs. Enclosure of metathorax rounded behind, not bounded by a distinct line, rather strongly subreticulately wrinkled. Sides of metathorax with numerous whitish hairs.

Legs dark, ordinary. Wings hyaline; nervures and stigma pale honey-yellow; subcostal nervure black. Third submarginal not narrowing one-half to marginal.

Abdomen pruinose from short greyish-white pubescence, except dorsum of first and second segments, which are bare. First segment with very fine scattered punctures; second segment with much closer punctures. The shape of the abdomen is rather longer and more cylindrical than is usual.

Hab. Santa Fé, N.M., July 4, 1894 (Ckll. 1228).

At first it seemed very difficult to clearly separate *perdificilis* from its allies; but close scrutiny shows it to be distinct.

From *semibrunneus* it is recognized by its larger size, dullish thorax, mesothorax not so sparsely punctured and strongly green, and pruinose abdomen.

H. pruinus has the abdomen broader than that of *per-*

difficilis and distinctly green; the metathorax also is different and the punctuation of the first abdominal segment very much closer. *H. Cressonii* has the pubescence of the abdomen pale fulvous and the metathorax blue-green.

It may be added here that the altitude of Las Cruces is about 3800 feet, while that of Sta. Fé is 7000 feet.

Las Cruces, New Mexico, U.S.A.,
May 2, 1895.

XII.—On some *Perichætæ* from the Eastern Archipelago collected by Mr. Everett. By FRANK E. BEDDARD, M.A., F.R.S., and SOPHIE M. FEDARB.

IN the present paper we propose to describe some new species of *Perichætæ* from the East which were collected by Mr. Everett and kindly forwarded to one of us some months ago.

Although there are nearly one hundred species of *Perichæta* known to science at the present time, the bulk of them being natives of the Oriental Region, the particular islands, viz. Borneo and Palawan, from which our specimens come have been but little investigated as regards the present group of animals. We were not, therefore, surprised to find that the majority of the species were new. In addition to the new species, the collection also contained the following, which have not been previously recorded from this part of the world:—

Pontoscolex corethrurus (F. Müller). Merabah, North Borneo.

Megascolex armatus, F. E. B. Padas Valley, North Borneo.

Both these species are widely distributed forms.

Perichæta Everetti, sp. n.

The length of this species is about 300 millim. and the diameter at the widest part 12 millim.

It has a marked reddish-purple colour dorsally.

The clitellum occupies the segments xiv.—xvi. and is without setæ.

The male pores are separated by sixteen setæ.

The genital papillæ are developed on segments xix.—xxi. There is a pair on each of these segments, long and narrow in

shape and placed just in front of the row of setæ. Their length is equivalent to about eight setæ, and each papilla is separated from its fellow by about the same number of setæ.

The dorsal pores commence between segments xii. and xiii.

The gizzard very exceptionally lies in segment viii., not extending into adjacent segments. The only other species of *Perichaeta* in which a similar state of affairs has been hitherto recorded is *P. pentacystis*, in which the gizzard lies also in segment viii. The intestine is entirely without the characteristic cæca of this genus.

Septa iv./viii. and xi./xiv. are thickened.

The last pair of hearts are in segment xiii.

The spermathecæ are, as in *P. Stelleri*, very numerous. There are 12 and 17 in segments vi. and vii. respectively. Each spermatheca has a single diverticulum. There are a distinct pair of egg-sacs in segment xiv., which seem to be unusually large. A second pair in segment xiii. may be egg-sacs or may possibly be a posterior pair of sperm-sacs. The point was not definitely settled; but it appears that in some species there are a second pair of egg-sacs in segment xiii., while in others the same segment contains a pair of sperm-sacs.

Hab. Mount Kina Balu.

Perichaeta papillata, sp. n.

The length is 500 millim., the diameter 7 millim. These measurements, however, are probably not quite natural, as the individual is much softened.

The clitellum occupies segments xiv.–xvi., and is entirely without setæ.

The male pores are separated by ten setæ.

On each of the ten following segments is a pair of papillæ, lying closer to the middle line than do the male pores, and in front of the line of setæ of their segments.

The dorsal pores commence between segments xii. and xiii.

The intestine has no cæca.

Septa iv./viii. and ix./xiii. are thickened.

The last hearts lie in segment xii.

The sperm-sacs are in segments xi. and xii.

There are a pair of egg-sacs in segment xiii.

The spermathecæ lie in segments vi. and vii. There are 7 in each segment. Each has a small coiled diverticulum, ending in an oval sac.

The spermiducal glands extend through three segments. Their duct does not terminate in a dilated muscular sac.

Hab. Merabah, N. Borneo.

Perichæta sarawacensis, sp. n.

The length of this species is about 300 millim., the diameter is 7 millim.; the number of segments is 260. There was no pigment in the skin of the preserved specimens.

The clitellum is as in the last two species.

On each of segments xix.-xxii. are a pair of papillæ, which are like those of *P. papillata*.

The dorsal pores commence between segments xii. and xiii.

The intestine has no cæca.

Septa v./viii. and x./xiv. are thickened.

The last pair of hearts is in segment xiii.

The sperm-sacs are in segments x., xi., and xii.

The egg-sacs in segment xiii.

The spermathecæ are in segments vi. and vii., about 14 in each. Each spermatheca has a single diverticulum.

The spermiducal glands are rather different, extending through three segments.

This species, as will have been inferred from the description, is somewhat intermediate between the last two. The internal structure is more like that of *P. Everetti*, while the papillæ are more like those of *P. papillata*, though not so numerous.

Hab. Sarawak.

Perichæta kinabaluensis, sp. n.

The length of this species is 150 millim. and the diameter 9 millim. Number of segments 200. The red coloration noticeable in *P. Everetti* also characterizes this species. The implantation of the setæ is marked by white lines.

The clitellum as in the last species.

The male pores are separated by sixteen setæ.

On each of segments xix. and xx. is a single median papilla. On segment xxi. the left half only of the papilla was developed.

The dorsal pores commence between xi. and xii.

The gizzard is in segment viii. The intestine has no cæca.

Septa v./viii. and x./xiv. are thickened.

The last pair of hearts are in segment xii.

The sperm-sacs are in segments x., xi., and xii.

The egg-sacs lie in segment xiii.

The spermathecæ are in segments vi. and vii., 11 and 17 in each.

The diverticula as in *P. Everetti*.

The spermiducal glands are large and compact; they are limited to one segment, but the bounding septa are bulged out to make room for the gland. The duct has no terminal muscular sac.

Hab. Tamburungare, Kina Balu, Borneo, at an altitude of 7700 feet.

Perichaeta merabahensis, sp. n.

The length of this worm is 204 millim. and the diameter 4 millim. It has 146 segments.

The body-wall, when preserved, is extremely soft and partly transparent. The species shows a tendency to individual variation, especially in the size of the cæca, one individual having none. Out of twenty-nine adults one was deformed, having the right male pore in the normal position in segment xviii. and the left at xv., with the spermiducal gland correspondingly displaced.

The clitellum extends from xiv.–xvi., and is without setæ.

The first dorsal pore lies between segments xi./xii.

The male pores are close together and rather tumid, but no genital papillæ are present.

The gizzard lies in segments viii. and ix.

The intestine commences in segment xv.

There are cæca in segment xxvi., which are quite small and insignificant. In some specimens they are most obscure and nearly empty; while one individual had apparently none whatever.

The hearts are in segments xi.–xiii.

The septa v./viii. are much thickened.

There are three pairs of spermathecæ in segments vi., vii., and viii. The pouch is of considerable size, and the duct short and stout. The diverticulum is single and small, and attached to the duct by a long delicate tube.

In segments x., xi., and xii. are three pairs of sperm-sacs, approximately the same size.

The ovaries lie in segment xiii.

The spermiducal glands are tongue-shaped, cut up into loose lobes. There is a large muscular sac in segment xviii., narrowing into a duct in xix. The glandular part extends from the posterior end of segment xix. to the commencement of xxii.

Hab. Padas Valley, N. Borneo.

Perichæta padasensis, sp. n.

A stout worm; length 280 millim., diameter 6 millim.; 96 segments.

The clitellum occupies segments xiv.–xvi., not quite inclusively. In preserved specimens it is very marked in colour, being much darker than the rest of the body. It has no setæ.

The male pores are very distinct, but not particularly tumid. They are separated by 10 setæ (9 in some individuals). There are no genital papillæ.

The dorsal pores commence between segments xii./xiii.

The gizzard lies in segments viii. and ix.

The intestine commences in segment xv.

There is a pair of cæca originating in segment xxvii. and reaching forward through five segments, viz. as far as xxiii.

The septa v./viii. are slightly thickened; those between v./vi. and vi./vii. in a specimen from Merabah had numerous processes arising from them, making them appear almost racemose.

There are three large pairs of hearts in segments xi., xii., and xiii.

There are four pairs of spermathecæ in segments vi., vii., viii., and ix. The duct of each is large and wide and about as long as the pouch, which latter contains, in many instances, some whitish solid bodies, possibly spermatophores. The diverticula are very small, sometimes single, or, more frequently, two or three of graduated sizes springing from the same spot on the delicate tube that attaches them to the duct.

The sperm-sacs are paired in segments x., xi., xii., and xiii.; those in xi. and xii. are the largest, and each of these has a small process pointed towards the dorsal blood-vessel. These processes approach so closely to one another from the opposite sides that at first sight they seem joined. The pair of sacs in segment xiii. are very small indeed.

The ovaries are in segment xiii. and the egg-sacs in xiv.

The spermiducal glands are fan-shaped, cut up into two or three distinct lobes. They have a large muscular sac in segment xviii., while the glandular part spreads through xviii.–xvii. and partly into xvi.

Hab. Merabah and Padas Valley.

XIII.—*Notes on some of the Solifugæ contained in the Collection of the British Museum, with Descriptions of new Species.* By R. I. POCOCK.

[Plate IV.]

Genus GALEODES.

The species of this genus seem to me to be but little understood. That there is a large amount of variation in the genus can be observed by anyone who works through a mass of material from various localities; but it is very difficult to find the specific characters that obtain consistently in individuals of all ages and both sexes.

The adult males and females (at least of some species) appear to be recognizable by the following characters:—

♀. *Head* larger, to support the larger strongly toothed *mandibles*, which have no flagellum and no spiniform hairs. *Palpi* shorter as compared with the width of the head and slighter; *legs* also shorter, the tarsi of the fourth normally clothed below with simple hairs. *Malleoli* shorter and altogether smaller. The two halves of the *genital operculum* enlarged and united across the middle line to form a single large plate. There are no peculiar bacilliform hairs on the abdomen.

♂. *Head* narrower, to support the smaller weakly toothed *mandibles*, which are provided with a flagellum and with a large number of erect spiniform hairs to protect the flagellum when at rest. *Palpi* longer and stouter. *Legs* longer; tarsus of the fourth clothed below with modified hairs. *Malleoli* longer and larger. The two halves of the *genital operculum* distinct, with two smaller plates appearing in the middle line between them. The fifth and often other sternal plates of the abdomen provided with modified bacilliform hairs.

Male examples have been described without the hairs on the fourth tarsi and on the abdomen. It is not certain, however, I suppose, that these male examples were mature. Moreover, the shape of these hairs has been used for distinguishing species; but an examination shows that in some individuals no two of the abdominal bacilliform hairs are alike, and that they vary on the same sternite from being short and stout to long, slender, and cylindrical. On the fourth tarsi, too, the hairs have sometimes blunt points, sometimes filiform points; but it seems highly probable that the latter kind is transformed into the former simply by the process of wear.

Anyhow, it seems to me to be perfectly certain that the stout spines on the palpi of adults result from the fracture of hairs which in the young are long and filiform.

In this paper I have ventured to establish several new species, basing them largely upon differences in colour and relative length of appendages and their segments.

Galeodes barbarus, Lucas.

Galeodes barbarus, Lucas, Expl. Sci. Alg., Arachn. p. 270, pl. xviii. fig. 7.

The British Museum has a single male example of this species.

It may be recognized from the other males known to me by the presence of the shovel- or spoon-shaped spines on the lower surface of the tarsi of the fourth leg and by the thick, flattened, and pointed spines on the lower surface of the fifth abdominal sternite.

In his monograph of the species of this group Mons. Simon, as he has already pointed out, identified as the male of *barbarus* the male of another species, which appears to differ from that of *barbarus* in possessing long bacilliform spines on the fifth abdominal sternite and in having the tarsus of the fourth leg clothed with normal setæ. This latter species Mons. Simon described as *G. occidentalis* (Expl. Sci. Tunisie, Arachn. p. 44), but in his comparative diagnosis of this and the male of *barbarus* he has fallen into the curious and puzzling error of ascribing the abdominal spines of *barbarus* to *occidentalis*, and *vice versâ*. This, at least, is the only explanation which reconciles his first statement about the male of *occidentalis*, when he described it as *barbarus*, with his subsequent one, when he recognized its specific distinctness. Moreover, the male of *barbarus* that I have seen agrees with Simon's last diagnosis of this species, if we make the necessary alteration with regard to the nature of the abdominal spines.

Galeodes intrepidus (Sav. & Aud.).

Solpuga intrepida, Savigny and Audouin, Aran. d'Égypte, p. 178, fig. 8 (1827); C. Koch, Die Arachn. xv. p. 89, fig. 1479.

Galeodes scalaris, C. Koch, tom. cit. p. 87.

Galeodes leucophæus, id. ibid. p. 88.

Galeodes Savignyi, Simon, Ann. Soc. Ent. Fr. 1879, p. 105.

It seems to me to be in the highest degree probable that *G. intrepidus* of Savigny is referable to the same species as *scalaris* of C. Koch. So far as can be judged from Savigny's figures, his *intrepidus* differs from his *araneoides* (= *arabs*) in

being smaller and in having the hairy clothing of the legs thicker. Apart from colouring, these are, perhaps, the first distinctive characters to strike the eye. The colouring, however, is very different, *intrepidus* being provided with a continuous median dorsal black band, the sides of the abdomen being clothed with white or yellow hairs, and the hairs on the distal segments of the legs and palpi being of a bright greenish yellow, those on the distal half of the appendages and on the head and mandibles being greyer. The spine-armature of the legs is as in *arabs*, except that the spines are perhaps longer. Moreover, the lower surface of the tibia of the second, third, and fourth legs is furnished with a few hairs which are markedly stouter than the rest, and the anterior spine at the distal end of the lower surface is considerably stouter, and there appear to be always three pairs of spines on the first tarsal of the second and third legs. In the male the tarsus of the fourth pair of legs is clothed beneath with ordinary slender setiform hairs, and the fifth (and sixth) sterna of the abdomen are furnished with slender bacilliform spines, as in *arabs*.

I need hardly add that Simon's reason for changing the name *intrepidus* into *Savignyi*, because Dufour wrongly identified one of his species as *intrepidus*, is utterly untenable. Birula's *Savignyi* (Zool. Anz. 1890, p. 206), from Turkestan, which has six spines on the protarsus of the fourth leg, is probably different from what I believe to be *intrepidus*, as, indeed, might have been imagined from the locality. So, too, does Simon's *scalaris*, from Central Abyssinia, differ in having three pairs of spines confined to the distal half of the protarsus of the fourth leg. It resembles my specimens, however, in its small ocular tubercle; and I am not inclined to lay very much stress upon the presence of an extra spine upon the posterior side of the protarsus of the fourth leg, because there seems to be a tendency in this species for hairs to become spiniform, and in two of the British Museum specimens, which otherwise do not seem recognizable from the rest of the examples of *intrepidus*, there are six spines on this protarsus, the additional one being, however, not a pair to the one that is usually unpaired, but occupying a corresponding position on the anterior surface, but nearer the proximal end. One of the examples presenting this is a female from Oran, the other a male without locality. In addition to these two, the Museum has another example (a female, without locality), three (two males, one female) from Aden, one (female) from Perim Island, and two (male and female) from the island of Shadwan in the Red Sea.

Galeodes arabs, C. Koch.

Galeodes araneoides, Oliv. Voy. dans l'Emp. Ottoman, vol. vi. p. 304, Atlas, pl. xlii. fig. 3 (1807); Sav. & Aud. Descr. Egypte, Hist. Nat. i. pt. 4, p. 176, pl. viii. fig. 7 &c. (not *araneoides* of Pallas).

Galeodes arabs, C. Koch, Die Arachn. xv. p. 85 (1848).

Galeodes Lucasii, L. Dufour, Mém. Ac. Sci. St. Pétersbourg, xvii. p. 385, pl. ii. fig. 5 (1862).

Galeodes arabs, *araneoides*, and ? *græcus*, Butler, Tr. Ent. Soc. 1873, p. 418.

Galeodes araneoides and *græcus*, Simon, Ann. Soc. Ent. Fr. 1879, pp. 99, 100 (at least in part).

This species is spread from S. Algeria (Dufour's *Lucasii*), through Egypt, where it is evidently abundant, into Arabia. It also goes further to the north, spreading into Asia Minor.

The British Museum has upwards of forty examples from the following localities:—Smyrna, Midian, Baghdad, Euphrates, El Tor (Red Sea), Egypt (various spots), White Nile, Somali, Arabia, Aden, and Muscat.

The colouring is very characteristic. The ground-tint is a pale whitish or reddish yellow, but the cephalic plate is fuscous on each side, and the mandibles are usually furnished above with two stripes of the same colour; the tibia of the palpus is mostly fuscous, but its two ends retain their yellow tint, and the protarsus is furnished with a fuscous band in its proximal half, its proximal extremity, distal half as well as the tarsus, remaining yellow; and, lastly, there is usually a median dorsal fuscous band, though not a continuous one, extending over the free thoracic segments to the end of the abdomen, and the femora of the legs are sometimes slightly infusate.

The spine-armature of the feet is normally as follows:—

Second and third pair of legs: *tibia*, 1 short superior distal spine, 2 inferior distal setiform spines; *protarsus*, 5 spines along posterior edge, 3 below in the distal half (*i. e.* a distal pair and 1 posterior spine before the pair); in the legs of the third pair the 5 posterior spines of the protarsus are arranged in two alternating rows, an upper of 3 and a lower of 2; *tarsus*, 7 spines, a pair on the second segment, two pairs at the distal end of the first segment, and one anterior spine near the proximal end of this segment.

Fourth pair of legs: *tibia* without a superior distal spine; *protarsus* armed below with 5 spines (1 anterior near its middle, 2 at the distal end, and 2 midway between the single one and the distal pair); *tarsus* armed below with 8 spines in four pairs (three pairs on the proximal segment and one pair on the second), the third segment being usually unarmed.

Galeodes hector, sp. n.

Closely allied to *G. arabs*.

The ground-colour rather redder, the upper side of the mandibles more infuscate; femur of palp very slightly infuscate above distally; tibia marked above with a median fuscous band which extends from end to end; protarsus and tarsus entirely fuscous above; legs uniformly reddish yellow or slightly infuscate; abdomen and free thoracic segments with a crescentic black spot on the middle of each tergum.

Spine-armature of legs as in *G. arabs*, but the posterior proximal spine upon the first tarsal of the second and third legs more generally present than in *arabs*.

♂. Spines on fifth abdominal sternite slender, long, cylindrical, pointed distally, but scarcely narrowed at the base; those on the fourth tarsus scarcely expanded mesially, but narrowed to a long hair-like process; the malleoli, however, are much shorter, the heads smaller and with their points more rounded; the external one is not so long as the flagellum of the mandible.

Measurements in millimetres of types (♀).—Total length of trunk 48, of coxal area 17; width of cephalic plate 10·5, of eye-tubercle 1·5; length* of mandible 14·2; palp 39, femur 14, tibia 12·5, protarsus 10, tarsus 3; width of tibia and of protarsus 1·8; length of fourth leg 51·5.

♂. Total length of trunk 30, of coxal area 14; width of head 6·8; length of mandible 10·5, of flagellum almost 4, of palp 43, femur 16·5, tibia 14, protarsus 11, tarsus 3; length of fourth leg 53; length of external coxal hammer 3, of handle 2, of head 2·5.

Lcc. Smyrna; S. of Smyrna (*R. MacAndrew*); Budrum, in Asia Minor (*H.M.S. 'Supply'*).

This species seems to come very near to the genuine *G. araneoides* of the Russian steppes; but since the latter species is unknown to me, I am unable to compare the two.

It may be recognized from *arabs* by the colouring of its palpi, shorter legs, and the different shaped malleoli of the male.

In addition to the female type described above, all the other specimens that I have seen are males. One of these, ticketed "Arabia," is considerably larger than the one described, the

* In this and all cases the length of the mandible is taken along its external surface from its point of articulation to the apex of the immovable fang. The rest of the appendages are measured along the upper side.

head measuring 9·5 millim. in width, the mandible 13·5 long, and the whole trunk (with distended abdomen) 45 millim., the palp 51·5, and the fourth leg 65. The next largest male example from S. of Smyrna has the head measuring 9 millim. and the palp 50, mandible 13, flagellum 4, distal malleolus 4·5.

A male of *Galeodes arabs* which has the cephalic plate 8 millim. wide, and is thus rather smaller than the above-mentioned example from the S. of Smyrna, gives the following measurements:—Length of mandible 11·5, of flagellum 3·5, of palp 53·5, of last leg 66·5, of external malleolus 6. This specimen well illustrates the most notable distinctive features of the males of the two species, the palpi and legs being considerably longer in *arabs* and the malleolus much longer as compared with the flagellum.

Galeodes cyrus, sp. n.

♂.—*Colour*. Anterior third of cephalic plate fuscous, tubercle black; rest of the cephalothorax pale; *mandibles* furnished above with three longitudinal greenish-fuscous stripes, which coalesce before the base of the upper jaw into a continuous dark patch, extending externally to the base of the movable digit; *palpi* with the three distal segments completely blackish brown throughout, the rest of the appendage and the legs clear yellow, with perhaps a suspicion of infuscation on the upperside of the femora; abdomen a uniform dirty brown throughout (perhaps due to the colour of the food-contents).

Cephalic region high, sloped upwards at about an angle of 45°; the ocular tubercle very high and wide, the distance between the eyes about equalling a diameter, the frontal process low and rounded.

Mandibles of average size for a male, flagellum normal; the lower digit armed with three teeth, the proximal the largest, the distal the next, the median close to the base of the distal; the upper digit armed with an external row of 8 smallish teeth, which vary a little in size, but are all very distinctly defined.

Palpi very long and slender; the femur considerably longer than the tibia and twice and a half times the length of the width of the carapace, armed anteriorly and interiorly on its distal half with long, irregularly arranged, spiniform hairs; *tibia* a little more than twice the width of the carapace, slender, cylindrical, furnished below with an external series of four spiniform hairs and an internal row of five; between the two rows there are other scattered and smaller spiniform

hairs, of which the proximal, however, is as large as those of the lateral series.

Protarsus shorter than tibia, distally narrowed, armed normally below with five or six pairs of short fractured spines, the area between the spines thickly studded with hairs; tarsus long, much narrowed at the base.

Legs long; second tibia armed distally and posteriorly with 1 stout spine and below at its distal end with 2 setiform spines; *protarsus* armed behind with a row of 5 stout longish spines and below with 3, a pair at the distal end and one posterior unpaired spine further up the segment; proximal tarsal armed with 4 spines, one submedian at its proximal end and three at its distal end, *i. e.* two constituting a pair and one posterior behind them; distal tarsal armed with 3 spines, two in front and one behind.

Third leg armed like the second, except that two of the five spines on the posterior side of the protarsus are lower, the series being thus broken up into two.

Fourth leg: protarsus armed with the normal 5 spines; proximal tarsal with 6 spines in three pairs, the median tarsal with 4 spines in two pairs, and the distal tarsal with 2 spines in one pair; the lower surface of this segment clothed with normal setæ. The malleoli long, the head with nearly straight distal edge, the handle fixed nearer its middle than in *G. arabs*.

Stigmatic combs composed on each side of about twenty or a few more spines, separated like the teeth of a rake; internally the series is simple, externally above the main series there are some irregularly arranged smaller spines. The median aperture of the third pair of tracheæ distinct.

No modified hairs on the posterior border of the fifth segment.

Measurements in millimetres.—Length of trunk 32, of the inferior coxal area 17.5; width of cephalic plate 8.5, length 6.2; width of tubercle 2.5; length of mandible 11.5; length of palp (exclusive of coxa) 59, femur 22, tibia 20 (width 1.5), protarsus 14 (width 1), tarsus 3.5 (distal width 1); length of first leg 38, of second (including claw) 35.5, of third 48, of fourth 61; length of distal hammer-shaped organ 6.3, of handle 4, width of head 5.5.

Loc. Fa'o, on the Persian Gulf (*W. D. Cuming*). A single male example, probably not quite mature.

This species differs from *G. arabs* in the colouring of its head, mandibles, palpi, and ? abdomen; in its more vertical and less convex head and larger tubercle; in having the proximal tarsal of the second and third legs armed with four

instead of five spines, and the distal tarsal with three instead of two spines; and in having on the fourth leg the hairs of the tarsus normal, two pairs of spines instead of one pair upon the median tarsal, and one pair instead of none upon the distal tarsal, and in having the handle of the malleoli nearer the centre of the head.

Galeodes darius, sp. n.

♀. Head, mandibles, and legs entirely lemon-yellow; ocular tubercle black; tibia and protarsus of palp fuscous; tarsus and femur yellow; abdomen and thoracic segments pale, the tergal plates only very faintly infuscate.

Measurements in millimetres.—Total length of trunk 41, width of head 12, of ocular tubercle 2·5; length of mandible 17, of palp 62, its tibia 20, protarsus 15; of fourth leg 81, its protarsus 15·5.

Loc. Fao, on the Persian Gulf (*W. D. Cuming*).

Apart from its colouring, this species may be easily recognized from *G. arabs* by the enormous length of its legs and palpi. For instance, in adult females of *arabs* the width of the carapace is about equal to the length of the protarsus of the palp or of the fourth leg; but in *G. darius* the protarsi in question are far longer than the width of the head. The following measurements of an example of *arabs* from Muscat will illustrate the differences:—Total length 43; width of head 12·5, of ocular tubercle 2·5, of palp 49, its tibia 16, protarsus 12; length of fourth leg 64, its protarsus 11·5.

It may thus be seen that, although actually smaller in the head, *G. darius* has the appendages actually considerably longer.

It is possible that this species may prove to be the female of *G. cyrus*, since the two come from the same locality. I refrain, however, from uniting them, on account of the difference in colour that the two present and from the fact that the ocular tubercle is not unusually large in *G. darius* and the spine-armature of the feet is normal, except that the distal tarsal of the fourth foot has two spines upon it, as in *G. caspius*.

Galeodes citrinus, sp. n.

Colour a rich lemon-yellow throughout, except for a faint median band down the back and very slight infuscation on the anterior edge of the cephalic shield; ocular tubercle black, pale sometimes in the middle.

Legs entirely pale; palpi with femur and tarsus pale, but

tibia and protarsus black from end to end, a fine yellow line merely marking the joint between them.

Measurements in millimetres.—♂ (adult). Total length of trunk 40; width of head 10, of ocular tubercle 2; length of mandible 15, of palp 61, its tibia 20·5, protarsus 14·5, of fourth leg 73.

♀ (probably not quite mature). Total length of trunk 35; width of head 10, of ocular tubercle 2; length of mandible 15, of palp 46·5, its tibia 15, protarsus 11·5, fourth leg 59.

Loc. Jask, in Persia, on the Gulf of Oman, close to the confines of Beluchistan. Two young specimens obtained by Mr. B. T. Finch and four examples, including those described above, collected by Mr. Butcher.

Resembling *G. arabs*, but having the tibiæ and protarsi of the palp more completely fuscous and the trunk and legs less so. In colouring it resembles *G. darius*, but differs so markedly from it in the greater shortness of its legs, that it is impossible without further evidence to regard the two as identical.

Galeodes afghanus, sp. n.

♂.—*Colour.* Carapace anteriorly infusate; mandibles flavous above; palpi with femur infusate in its distal half and tibia infusate, as in *G. arabs*, but the protarsus and tarsus entirely flavous; anterior two pairs of legs flavous; third pair with femur infusate, fourth pair absent; (abdomen discoloured).

Flagellum of mandibles with its basal cylindrical part much shorter than its distal expanded part, as in the Indian *G. fatalis*; the lower jaw of the mandible with 3 small teeth between the two primary teeth on the right side and two on the left; on the latter, however, the space remains where the third tooth has been.

The second and third legs like those of *G. arabs*, except that there are 8 spines on the tarsi instead of 7, the posterior spine of the first pair being retained.

Malleoli not certainly distinguishable from those of *G. arabs*.

Measurements in millimetres.—Total length of trunk 34; length of head 6·5, width 9; length of mandible 13·5, of palp 54·5, its tibia 18·5, protarsus 13·5.

Loc. Between Quetta and Kandahar. A single male specimen presented by Col. Godwin-Austen.

This species differs from *araneoides*, *caspius*, *arabs*, and *orientalis* in having the protarsus and tarsus of the palpi

entirely pale, while the tibia and femur are infusate, as in those species.

Genus SOLPUGA.

Solpuga ferox, sp. n. (Pl. IV. fig. 3.)

♀.—*Colour*. Cephalic plate, mandibles, and appendages reddish yellow; abdominal terga pale yellow, the membrane at the sides of the plates and between them slightly infusate.

Cephalic plate in width a little greater than the length of the tibia of the palpus and a little less than the length of the tarsus and protarsus of that appendage; width of ocular tubercle about equalling the length of the tarsus of palp; distance between eyes less than a diameter.

Mandibles furnished inside with nine or ten ridges, which inferiorly decrease in length; the upper jaw armed distally with 3 large conical subequal teeth, between the second and third of which there are two smaller teeth, of which the posterior is much larger than the anterior; this jaw is armed behind with an external series consisting of 4 teeth and an internal consisting of 3, of which the anterior is long and stout; lower jaw armed with 3 teeth, of which the first and third are subequal, and the second situated upon the base of the third mall.

Palpi moderately long and slender; femur furnished below with long setæ; tibia also furnished below with long setæ and thickly clothed above and below with short erect hairs; protarsus, which is attenuate in its distal half, clothed like the tibia, but its lower surface is furnished with a number of erect short truncate hairs, which may have resulted from the breaking of the long setæ.

Legs of first pair clothed with short close-set hairs and long slender setæ; those of *second pair* covered with fine hairs above, and on the lower surface of the tibia with setæ which increase in stoutness towards the distal end of the segment, the distal pair being stout and spiniform; this segment is armed above with a single stout distal spine; the protarsus armed above with five strong spines and below in its distal half with two spines behind and three in front; tarsus armed below with seven pairs of spines—four pairs on the first and one pair upon the second, third, and fourth segments, of which those of the third to fifth pairs are the strongest; *third leg* resembling the second, except that there are two spines on the upperside of the tibia, and the interval between the third and fourth spines on the upperside of the protarsus is greater than in the second leg, and the segment is armed below with

six spines in three pairs; on the *fourth leg* the protarsus is armed below with three spines behind and five in front; tarsus armed below with ten pairs of spines, those from 1 to 7 on each side gradually increasing in strength up to the seventh; tibia of this appendage longer than the protarsus, but a little shorter than width of the cephalic plate. *Malleoli* short. Inner angles of the two halves of the *genital operculum* convexly rounded, the posterior border of each half at right angles to the median groove.

♂. Resembling female in colour; a little smaller, but with legs much longer as compared with width of head, *i. e.* the tibia and protarsus of palp and fourth leg greater than width of head; protarsus of palp scopulate beneath. Upperside of head-plate and of mandible furnished with a small number of stout spiniform setæ. Dentition of the mandibles very much as in the female, except that the distance between the second and third large fangs of the upper jaw is greater and the anterior of the two small denticles which occupy this space is considerably removed from the posterior. Moreover, owing to the shortness of the terminal fang, the first tooth is closer to its apex than in the female; and, lastly, upon the upper-side of the terminal fang and close to the base of the recurved portion of the flagellum there is an additional forwardly directed tooth. The proximal portion of the flagellum, *i. e.* the piece that is attached to the mandible and lies forwards, is high and rounded, the remaining part, *i. e.* the recurved portion, is very short, broad, flattened, narrower at the base, pointed at the apex, not projecting backwards beyond the point of origin of the basal portion. On the inner side of the apex there is an extra small tooth.

Measurements in millimetres.—♀. Total length from ocular tubercle to anus 31·5; length of head 7·3, width 9·8, width of ocular tubercle 2·2; length of mandible 13, of palp 31, its tibia 9·8, protarsus and tarsus 10·8; of fourth leg 46·5, its tibia 8·8, its protarsus 8·5.

♂. Width of head 7·5, length 6; width of tubercle 1·8; length of mandible 9·5, of palp 34·5, its tibia 11, tarsus and protarsus 11·2; length of fourth leg 49, its tibia 9·6, protarsus 9·3.

Loc. Port Elizabeth (*I. L. Drège*).

Solpuga paludicola, sp. n. (Pl. IV. fig. 4.)

♀. Resembling *S. ferox* in colour, *i. e.* in having the limbs, head, &c. of a uniform reddish yellow; the femur of the fourth leg, however, is lightly infuscate in its distal half, and

the tergal plates of the abdomen are a shade darker than the lateral membrane.

Ocular tubercle very slightly smaller than in *S. ferox*; structure of mandibles the same. Palpi and legs longer, the tibia of palp being distinctly longer than the width of the cephalic plate, which is only very slightly wider than the tibia or patella of the fourth leg. Spine-armature of legs as in *ferox*; the spine on the posterior side of the lower surface of the third tarsal segment of the second and third pairs of legs is very generally absent.

Genital operculum with its posterior border a little more convex than in *ferox*; its two halves distinctly more thickly chitinized.

♂. Smaller than female, but with much longer legs (*cf.* measurements); the femur, tibia, and protarsus of the palp, the femora of the third and fourth legs, and the tibia of the fourth as well, lightly infusate. *Malleoli* long.

Mandibles: teeth numerically the same as in the female, the two small ones on the upper jaw which lie between the second and third of the large ones are subequal, conical, and evenly spaced; the *flagellum* has the bulbous portion high and black, the distal recurved portion is stout at the base but very short, its apex, which is truncate and pubescent, not projecting posteriorly beyond the point of origin of the basal piece.

Measurement in millimetres.—♀. Total length 37; length of cephalic plate 7·2, width 10; width of tubercle 2; length of mandible 13, of palp 34, its tibia 11; protarsus and tarsus 11·8; fourth leg about 53, its tibia and protarsus about 9·8.

♂. Total length 34; length of cephalic plate 7·5, width 8·5, of tubercle 2; length of mandible 9·8, of palp 43·5, its tibia 14·5; protarsus and tarsus 14·2, of fourth leg 63, of its tibia 12·8, protarsus 13.

Loc. Lake Nyasa (Universities' Mission), and Zomba, south of Lake Nyasa (*H. H. Johnson*).

The female, of which the measurements are given above, is not by any means the largest in the Museum collection. One sent by Miss Woodward from Lake Nyasa has the trunk 46 millim. long and the cephalic plate 11·5 millim. wide; the legs and palps are correspondingly longer, the proportion of the segments remaining the same.

Of all the species that have been hitherto described, this new one appears to be most nearly related to *S. merope* of Simon, from Zanzibar. The latter, however, seems to be smaller, seeing that the length given for several females is only 25 millim.; moreover, the cephalothorax and chelicerae

are said to be a more or less obscure olivaceous brown, and the tibia of the palp lightly infuscate above. I can find no other satisfactory differential characters. The male of *merope* is undescribed.

I have only seen two males of my species, one from Lake Nyasa and the other from Zomba. The former is dry, and I have consequently been compelled to take my measurements from the latter, which differs in having the femora and tibiæ of the legs more distinctly fuscous. The flagellum of the male of this species seems to resemble in its shortness that of *S. niassa* of Karsch, which is presumably from nearly the same locality. In *S. niassa*, however, the flagellum is rather longer, distally pointed, and dentate near the base.

Solpuga Keyserlingii, sp. n. (Pl. IV. fig. 5.)

Colour. Head, mandibles, palpi, and legs flavous; free thoracic segments and abdomen fusco-olivaceous.

Head flattish, nearly as long as wide, tubercle large.

Legs and *palpi* long, the latter normally robust, with its tibial segment as long as the tarsus and protarsus and nearly twice the width of the head; tibia of fourth leg a little shorter than that of the palpus.

Mandibles with the internal ridges about twice as long as in *S. paludicola*. The terminal fang long, curved, pointed, slender, with only one small tooth just in front of the third large fang. *Flagellum* with its basal part low and short, the recurved part rather short, not extending half across the distance between its point of origin and the base of the upper surface of the mandible; slender throughout, but gradually pointed towards the apex, which is sinuate.

Measurements in millimetres.—Length of trunk 28, of head 6·5; width of head 7·5, of ocular tubercle 2; length of mandible 10·5, of palp 43, its tibia 13·5; of protarsus and tarsus 13·8; of fourth leg 62, its tibia 12·4, protarsus 11·9.

Loc. —? A single male example belonging to the late Count Keyserling's collection.

Apart from the very obvious distinctions between this species and the preceding two which is supplied by the form of the flagellum, it may be recognized easily from the male of *S. ferox* by the greater length of its legs and palpi, relatively longer head, wider ocular tubercle, longer mandible, &c. In length of palpi and legs it more resembles *S. paludicola*; but although the head is actually narrower in *Keyserlingii*, the ocular tubercle is the same size and the mandible distinctly longer, owing to the greater length of its terminal fang.

Of the previously described species, which are unknown to me, it perhaps approaches the Algerian *S. aciculata* in the structure of its mandibles. The latter, however, has the basal portion of the flagellum very high, the terminal portion more elevated in consequence, and the terminal fang of the upper jaw short. It may also be allied to *S. Schweinfurthi* of Karsch.

Solpuga Monteiri, sp. n. (Pl. IV. fig. 6.)

♀. Colour entirely pale except for indications of blackness upon the cephalic plate.

Allied to female of *ferox*, but with legs and palpi relatively shorter and stouter; cephalic plate equalling in width the length of the tibia of the palp, tibia of palp equalling the protarsus and tarsus taken together; the latter clothed below with soft hairs and not presenting those short, erect, truncate hairs which are observable in *S. ferox*.

♂. *Head* and *mandibles* infusate above; head about as wide as long, its anterior border produced forwards, tubercle large. Mandibles with the internal ridges longish, as in *S. Keyserlingii*; terminal fang of the upper jaw rather short, slightly curved at the apex, the two anterior teeth well developed and sharp, followed by two minute and separated denticles; *flagellum* with its basal portion low, mostly pale; distal portion, which begins to take its backward curve on a level with the second tooth of the upper jaw, very long and slender, projecting backwards past the ocular tubercle, slightly sinuate in its distal third. *Palpi* longish and robust (*cf.* measurements).

Measurements in millimetres.—Adult ♀. Total length (abdomen small) 33; width of head 12, length 9; width of tubercle 2.5; length of mandible 16.5, of palp 38, its tibia 12, protarsus and tarsus 12.2; length of fourth leg 56, of tibia 10.5, of protarsus 10.

♂. Total length 30, of head 7, width of head 7, width of tubercle 2; length of mandible 10; palp 36, its tibia 11.5, protarsus and tarsus 11.3; of fourth leg 52.5, its tibia 10.

Loc. Delagoa Bay (*Mrs. Monteiro*).

A third specimen, a female measuring, with distended abdomen, 33 millim., but with the head about 7.8 millim. wide, has the palpi relatively longer, the tibia being 8.5, and therefore noticeably longer than the width of the head; the latter, too, is distinctly fuscous above; moreover, the free thoracic segments and the abdominal dorsal plates are lightly infusate.

Apart from the form of the flagellum, the male of this species may be recognized from the male of *Keyserlingii* and of *paludicola* by its longer head, shorter legs and palpi.

The female is harder to discriminate.

In the structure of its flagellum the male approaches *S. chelicornis* of Licht. and Herbst (= *jubata*, Koch), a species which is unknown to me. But the three figures that have been published of the mandible of that species agree at least in one respect, namely in showing that the recurved portion of the flagellum starts a long distance behind the apex of the upper jaw.

Solpuga nigrescens, sp. n.

Colour black or very deep green throughout, hairs on abdomen and the long ones on the appendages reddish; the genital operculum pale in the middle; coxal racquets also entirely pale.

In general structure this species resembles *S. ferox*, but, apart from colour, certain other differential characters may be made out. The ocular tubercle is smaller (*cf.* measurements) and the legs and palpi are shorter, *i. e.* the protarsus and tarsus of the palp are shorter than the width of the cephalic plate, whereas in *ferox* they are longer; so, too, are the tibia of the palp and the tibia and protarsus of the fourth leg more noticeably shorter than the width of the cephalic plate than in *ferox*; and, lastly, the posterior borders of the two halves of the genital operculum are more convex than in the last species.

Measurements in millimetres.—Total length of trunk 34, of head 6·7; width of head 10, of ocular tubercle 1·6; length of mandible 13, of palp 26·5, its tibia 8, protarsus and tarsus 9·2; of fourth leg 42, its tibia and protarsus about 8.

Loc. Lower Zambesi (*J. Grant*).

The above measurements show that, although the cephalic plate of *S. nigrescens* is actually slightly wider than that of *S. ferox*, the ocular tubercle is noticeably narrower, and the segments of the palpi and legs noticeably shorter.

Solpuga Butleri, sp. n.

♀. *Colour* (dry example). Head, mandibles, legs, and palpi entirely fuscous; abdomen pale.

Cephalic plate not very high, equalling in width the protarsus of the fourth leg, but noticeably less in width than the tibia of the fourth and the tibia and protarsus and tarsus of the palpus. *Ocular tubercle* low, moderately wide. *Mandibles* with their dentition as in *S. ferox*, *i. e.* with two small

teeth between the second and third large teeth of the upper jaw. *Palpi* slender, longish; tibia slightly shorter than the tarsus and protarsus together, the latter thickly clothed beneath with longish hairs.

Legs longish (*cf.* measurements).

Genital operculum with the posterior borders of its two halves lightly convex, the inner angle not thickened and produced.

Measurements in millimetres.—Total length of trunk 54, of head 8·5; width of head 11·5, of ocular tubercle 2·5; length of mandible 18; tibia of palp 14·5, its protarsus and tarsus 15; tibia of fourth leg 14, protarsus 12.

Loc. Congo.

In the black colouring of its legs, palpi, mandibles, and head-plate this species resembles *S. nigrescens*; it appears, however, to differ in having the abdomen pale and the head much narrower as compared with the length of the palpi and legs.

The type of the species is the example from the Congo referred by Mr. Butler to *S. lethalis* of Koch.

Solpuga hostilis (White). (Pl. IV. fig. 7.)

Solpuga hostilis (White), Appendix to Methuen's 'Life in the Wilderness,' p. 317, pl. ii. fig. 5 (1846).

This species, of which there are two (♂ ♀) typical examples in the British Museum, seems to me to be identical with those that Simon has described as *S. setifera* of Olivier. But since there is very little evidence that it is *setifera* of Olivier, I prefer to retain the name that White applied to it.

In the male the upper jaw of the mandible is slightly depressed proximally, with the apex a little upturned; on its lower edge there are two small equal teeth a little behind the apex; these teeth are followed by a concave toothless area, behind which come the normal double series, but the first tooth of the inner series is enormously long and conical; on the lower jaw the three teeth are small, erect, sharp, and situated far behind the middle of the blade, the distal half of which is very long and curved; the *flagellum* has a high basal piece, and the slender portion runs forwards nearly to the apex of the fang before curving sharply backwards to terminate at a point beyond the ocular tubercle on the carapace.

Simon's figure differs from the structure here described in showing the two distal teeth on the upper jaw larger and the

first tooth of the posterior series small; moreover, the apex of the terminal fang is directed downwards.

In the female there is only one small tooth between the second and third large ones on the upper jaw, and the posterior angles of the genital operculum are produced. The head, mandibles, legs, and palpi are brownish or yellowish red, and there is a dark stripe down the middle of the back, which becomes black towards the hinder end.

Some of the measurements of the two species are as follows:—

♀. Length (abdomen shrivelled) 20; length of head-plate 5·5, width 7·5, of tubercle 1·2; length of mandible 10·5; tibia of palp 7; protarsus and tarsus 7·5; tibia of fourth leg 7·5, protarsus 6·5.

♂. Width of head 6, length 5; length of mandible 9; tibia of palp 9·3, protarsus and tarsus (noticeably curved) 9·8; tibia of fourth leg 9, protarsus 7·5.

Loc. "S. Africa, near the tropic of Capricorn."

The male example of this species is the one that Mr. Butler identified as *S. chelicornis*.

Solpuga Derbiana, sp. n. (Pl. IV. fig. 8.)

=*S. jubata*, Koch, Butler, Tr. Ent. Soc. 1873, p. 421.

♂. *Colour* (dry) rufo-fuscous, with a dark median dorsal band, posteriorly blacker, on the abdomen; clothed with white hairs; the palpi and legs of the fourth pair become nearly black distally.

Head as wide as the length of the protarsus of the fourth leg, but shorter than the tibia of the palp. *Mandible* much resembling that of *S. hostilis*, but with the upper jaw straighter, extending further beyond the flagellum, not or scarcely toothed on its inner side; on the lower jaw the teeth are larger, conical, and more to the front; the first, moreover, is on both sides small and apically bifid, somewhat as Karsch has described for *S. scopulata*; the *flagellum* does not approach so near the apex of the jaw as in *hostilis*, and, curving more sharply backwards, fails to reach the edge of the carapace.

The palpi have the *protarsus* less bowed than in *hostilis*, and the scopula is composed of red hairs, and not of grey ones, as in that species.

Measurements in millimetres.—Total length 25; width of head 7·5, length 5; length of mandible 10·5, of tibia of palp 8·5, protarsus and tarsus 9; tibia of fourth leg 8, protarsus 7·5.

Loc. Interior of S. Africa (*Earl of Derby*).

The above-given measurements show that this species further differs from *hostilis* in having the legs shorter as compared with the width of the cephalic plate.

In the structure of its mandibles it seems to approach *S. producta* of Karsch (= *vincta* (C. Koch), Simon); but the teeth on the lower jaw of the mandible are more to the front, the curvature of the flagellum is much more abrupt, the upper jaw projects further in front of it and is not hooked at the apex.

Solpuga Marshalli, sp. n. (Pl. IV. figs. 9, 9 a.)

♂. Colour of head, mandibles, palpi, and anterior three pairs of legs reddish brown; the distal segments of the fourth leg, *i. e.* from the tibia to the tarsus, black; abdomen with a broad median black band, which spreads in front on to the posterior thoracic segments, clothed at the sides with long yellowish-white hairs.

Head exceeding in width the length of the protarsus of palp, but shorter than tarsus and protarsus taken together.

Mandible with upper fang straight and parallel-sided from base to point, where, in addition to the terminal fang, it is armed with two blunt teeth; *flagellum* almost as in *S. hostilis*, White, but rising from an upstanding semicircular plate and running forwards almost up to the apex of the fang, then turning abruptly backwards and terminating in a slightly upcurled point above the ocular tubercle.

Palpi short and moderately robust; the protarsus much less strongly bowed than in *hostilis*.

Measurements in millimetres.—Total length of trunk 21; width of head 5; length of mandible 9, of palp 22, of its tibia 7, tarsus and protarsus 7; length of fourth leg 36, its tibia 7·2, protarsus 6·2.

Loc. Fort Salisbury (Mashonaland). A single specimen obtained by Mr. G. A. K. Marshall, to whom I have great pleasure in dedicating the species.

This species is nearly allied to *S. hostilis* and *derbiana*, but may be recognized from both by the form of its mandibles.

Genus RHAX.

Rhax miranda, sp. n. (Pl. IV. fig. 1.)

♂.—*Colour.* Head black, with a small yellow spot on each side near the ends of the anterior border; mandibles entirely black; posterior two thoracic segments yellowish white;

anterior nine tergal plates of abdomen yellowish white; the sides of the abdominal segments and the entire anal segment black, lower surface of abdomen yellow in front, black posteriorly; palpi and legs clear reddish yellow, with the coxa, trochanter, and protarsus and tarsus of palp black, and the tarsus and distal end of protarsus of legs of first pair also black; edge of the malleoli blackish.

Ocular tubercle oval, flattish, without accessory setæ; the surface between the eyes flat, not sulcate, and about equalling an eye's diameter in width. *Mandibles* with the terminal fangs only moderately long; the anterior denticle on the lower jaw very minute. *Protarsus* of palp and of first leg normally spined; no spines on tarsal segment of palp; tibia of palp longer than protarsus and tarsus; tarsus of fourth segment provided only with setiform spines. *Coxæ* marked with a few spines.

♀. Larger than male, with abdomen enormously distended, and differing in the usual sexual characters.

Measurements in millimetres.—♂. Total length of trunk 28·5, of abdomen 17, of head 5, of mandible 11·8; width of head 8·5; length of palp 18·5, of fourth leg 26·5.

♀. Total length 63, of abdomen 50, of head 6·8; width of head 11·5; length of mandible 15·5, of palp 22, of fourth leg 27·5.

Loc. Gambia. Two examples (♂ ♀), collected and presented by Sir A. Moloney in 1885.

The locality of this species is of peculiar interest, inasmuch as it is, so far as is at present known, the most southern limit for the genus *Rhax* on the west coast of Africa. The species itself seems to be most nearly related to the Nubian *R. melanocephala* of Simon, which is unknown to me. The following differential characters, however, may be recognized from Simon's description:—In *R. melanocephala* the thoracic segments are mesially brown, and the protarsus of the first leg is entirely black; moreover, the ocular tubercle is said to be nearly round and mesially striate. In *R. miranda* the thoracic segments are pale, the protarsus of the first leg blackish only distally; the ocular tubercle is oval and not striate.

It also closely resembles in colour the Transcaspian *R. Eytlandti*, of which the British Museum has two examples; but in *R. Eytlandti* the median dorsal pale stripe on the abdomen narrows anteriorly upon the first tergite, is not directly continuous with the white of the thoracic segments, expands towards the posterior end, and extends on to the tenth or anal segment; whereas in *R. miranda* this stripe is

parallel-sided, extends only to the ninth segment, and is anteriorly continuous with the white of the thoracic segments.

Rhax ornata, sp. n. (Pl. IV. figs. 2, 2 a.)

Colour. Head black, yellow along the antero-lateral border; mandibles fulvous above, infuscate externally; thoracic segments behind the head white; first, second, and third abdominal terga black; fourth yellow; fifth yellow in the middle, black at the sides; sixth and seventh black; eighth and ninth yellow; tenth black; sides and lower surface of abdomen brownish; legs and palpi yellow, ringed with black, palp with a band round the femur and another round the tibia; tarsus and distal half of protarsus also black; first leg with a black ring round the femur, tarsus deep brown; second and third legs also with a ring round the femur; fourth leg with a black spot on the lower side of the femur.

Ocular tubercle without additional setæ.

Mandibles powerful, the anterior denticle on the movable digit far in advance of the posterior; on the immovable digit there is a wide space between the second and third teeth; the terminal fangs of both digits long and slender.

Legs and palpi slender and longish; tibia of palp considerably longer than the protarsus and tarsus, the latter unarmed beneath, the protarsus, like that of the legs of the first pair, normally spined below. Spine-armature of the remaining legs also normal, but the spines prolonged distally into setiform terminations; coxæ of the first, second, and third legs armed below with a pair of spines set transversely (when the spines have been broken off, their situation may be easily recognized by the scars).

Measurements in millimetres.—Total length of body, from ocular tubercle to anus, 30; length of abdomen 17·5, of head 7; width of head 12; length of mandible 18, of palp 25, of its tibia 9·3, protarsus and tarsus 7·5, of fourth leg 35.

Loc. Mombasa. A single male example.

Somewhat resembling the male of *Rhax termes* of Karsch, judging from the description of the latter, but certainly differing in having black markings on the appendages, white thoracic segments, and the fourth and fifth abdominal terga pale above; moreover, the structure of the mandible is quite different in the two species (compare figures).

Genus GLUVIA.

Gluvia nigrimanus, sp. n. (Pl. IV. fig. 10.)

♂. *Colour* entirely pale yellow, except for the black ocular tubercle, the blackish fangs, and the dense black protarsus and tarsus of the palp, this segment, counting them as one, being only pale-coloured quite at its proximal and distal extremity.

Carapace with its anterior border lightly concave in the middle, owing to the slight forward production of the membrane of the lateral portion in advance of the buttress which supports the mandible.

Ocular tubercle hairy behind and in front, two of the anterior setæ longer than the rest.

Mandibles smooth above at the base, then strongly elevated before the base of the fang, armed above and externally with stout spiniform hairs and internally above at the base with a tuft of short hairs, and distally with a tuft of straight, long, thin hairs extending along the inner side of the upper fang as far as its apex; the upper fang rising abruptly from its base directed outwards and downwards, its upper edge nearly straight, only slightly depressed towards the apex, its inner edge entirely unarmed, carinate, and very lightly sinuate, the vertical area lying between the bases of the two fangs unarmed above, but furnished below with an external series of four teeth and an internal of three, the upper on each side being much larger than the rest, which gradually decrease in size; lower jaw furnished with two teeth only in its proximal half, one very large, the other much smaller and situated posteriorly on the inner side of the large tooth; the area in front of the large tooth slightly elevated.

Palpi longish and slender; femur and tibia spinous internally; protarsus and tarsus distinctly arcuate, closely hairy, but not spined.

Legs long and slender.

Measurements in millimetres.—Total length of trunk 24; width of head 7, length 5; width of tubercle 1; length of mandible 9, of palp 26.5, its tibia 9.2, protarsus and tarsus 8.5; of fourth leg 34.

Loc. —? (probably Meshed, Afghanistan; obtained by the Afghan Delimitation Commission).

In colouring and structure of its mandibles this species approaches *G. magna* (Hancock), from Texas; but the latter has the upper jaw of the mandible cylindrical, and not carinate below; the lower jaw is strongly curved distally,

with its large fang recurved; the protarsus of the palp, too, has spines mixed up with the hairs of its lower surface, and is less arcuate. Moreover, all the appendages are stouter and shorter.

Gluvia tolteca, sp. n.

(Preliminary description.)

♂.—*Colour*. Head ferruginous, anteriorly infuscate; free thoracic segments and abdomen black above, clothed with white hairs; appendages of a uniform pale ferruginous tint, only lightly infuscate.

Mandible as in *G. nigrimanus*, except that the superior edge of the upper fang follows the slope of the basal portion and the lower edge is less carinate; the area just above the joint of the lower fang armed with two series of teeth, of which the outer consists of five and a series of minute denticles and the inner of five; the lower jaw armed with two large teeth and two small ones between them. *Palpi* unspined, furnished with long hairs.

Loc. Mexico. A single male example.

PARACLEOBIS, nom. nov.

= *Gluvia*, Simon, Ann. Soc. Ent. Fr. 1879, p. 127 &c.; not *Gluvia* C. Koch, Arch. Nat. 1842, p. 355, and Die Arachn. xv. p. 95.

Since none of the species referred by C. Koch to *Gluvia* are generically identical with those that Simon referred to this genus, it is clear that the latter are nameless.

I propose that *Paracleobis* be established for their reception, with the Spanish species *dorsalis*, Latr., as the type; and, since Mons. Simon recharacterized *Gluvia* as *Datames*, the two must be regarded as synonyms, *Gluvia* having the priority.

Paracleobis Balfouri, sp. n.

♀. *Colour* entirely pale yellow, with the exception of the black ocular tubercle, black mandibular fangs, and a broad black band round the distal half of the protarsus of the palp; distal extremity of the tarsus pale.

Carapace with its anterior border lightly convex; tubercle with a series of hairs surrounding the eyes in the inner side and a cluster in front, of which two are stronger than the rest; space between the eyes about equal to a diameter.

Mandibles with long, sharply defined, stridulating ridges; the lower jaw dentate, somewhat as in *P. dorsalis*, but in the

upper the anterior two teeth are large and subequal, as large, in fact, as the fourth—the third, fifth, and following ones being small.

Palp with its *protarsus* studded below with two series of longish spines.

Measurements in millimetres.—Total length 16; width of head 4, length 3; length of mandible 5·3, of palp 12, its protarsus and tarsus 4, of fourth leg 18.

A single female example from Socotra (*I. B. Balfour*).

Genus CLEOBIS.

Cleobis gryllipes (Gervais).

Galeodes gryllipes, Gervais, L'Institute, 1842, p. 76; Ins. Apt. iii p. 91 (*Solpuga*).

In his description of this species Gervais wrongly asserts its locality to be Martinique. The type specimen preserved in this Museum, labelled, apparently, by Gervais himself and agreeing accurately with his description, bears a ticket on which Jamaica is distinctly written. In the British Museum there is no example of *Solifugæ* belonging to this or any other genus from Martinique.

The type of the species in question is a male, and it may be recognized from both males and females of the other species known to me by the presence of two minor teeth between the two large teeth on the lower fang of the mandible.

Cleobis Gervaisii, sp. n.

Colour. Cephalic plate and mandibles entirely pale yellow; palpi with femora, proximal end of tibia, and proximal half of protarsus flavous, the rest fuscous; legs, with the exception of the basal segments, infusate, the anterior pair paler than the posterior (fourth pair missing in type); free thoracic segments and abdomen fuscous above.

Ocular tubercle represented merely by a slight prominence, projecting anteriorly between the eyes, which look forwards, upwards, and outwards, the space between them about equal to a diameter.

Mandibles with a distinct crest at the base of the upper fang; the first and second teeth about as large as the fourth, the third small; in the lower jaw there is one small tooth between the two large ones.

Palp without spines, except for a few small ones on the inner side of the lower surface of the protarsus.

Loc. Type specimen ticketed “? S. America;” but the

other specimens in the Museum belonging apparently to the same species, but too mutilated and shrivelled for accurate determination, are labelled "Guayaquil and Colombia."

Cleobis Stollii, sp. n.

(Preliminary diagnosis.)

Colour. Head and mandibles entirely pale yellow; upper surface of the free thoracic segments and of the anterior seven abdominal segments pale yellow in the middle, infusate at the sides; palp with tibia lightly infusate above, protarsus with its proximal third pale, the rest of it infusate, the two tints gradually blending; first and second legs slightly infusate distally, third more strongly so, with a pale band round the distal end of the tibia and protarsus; fourth leg with femur, tibia, and tarsus deeply infusate, especially the latter two segments, which, however, have their distal ends ringed with flavous; coxæ, trochanters, and tarsi of all the legs pale.

Loc. Retalhuleu in Guatemala (*Dr. O. Stoll*).

This species and the preceding resemble *C. cubæ*, Lucas, as described by Mons. Simon, in the structure and dentition of their mandibles, spinulose armature of protarsus of palp, &c. *C. Stollii* further resembles *C. cubæ* in having the upperside of the abdomen adorned with a median flavous band; but it appears to differ in having the first, second, third, and fourth legs infusate, with a conspicuous flavous ring round the distal end of the tibia of the fourth. According to Simon *C. cubæ* has the first, second, and third legs pale, and the fourth reddish brown, with the base of the femur, extremity of the metatarsus, and the tarsus clear testaceous.

C. Gervaisii differs from *C. cubæ* in having no distinct median pale band on the abdomen, in having the second and third legs infusate, and a wide, sharply defined, flavous band upon the proximal half of the protarsus of the palp.

EXPLANATION OF PLATE IV.

- Fig. 1.* *Rhax miranda*, sp. n., ♂, nat. size.
Fig. 2. *Rhax ornata*, sp. n., ♂, nat. size.
Fig. 2 a. Ditto. Mandible.
Fig. 3. *Solpuga ferox*, sp. n. Mandible of male.
Fig. 4. *Solpuga paludicola*, sp. n. Mandible of male.
Fig. 5. *Solpuga Keyserlingii*, sp. n. Mandible of male.

Fig. 6. *Solpuga Monteiri*, sp. n. Mandible of male.

Fig. 7. *Solpuga hostilis*, sp. n. Mandible of male.

Fig. 8. *Solpuga Derbiana*, sp. n. Mandible of male.

Fig. 9. *Solpuga Marshalli*, sp. n. Mandible of male (inner view).

Fig. 9 a. Ditto. Ditto (outer view).

Fig. 10. *Gluvia nigrimanus*, sp. n. Mandible of male.

XIV.—*On the Dascillidæ and Malacoderm Coleoptera of Japan.* By G. LEWIS, F.L.S.

[Plate VI.]

THIS paper is supplementary to those written by Kiesenwetter in 1874 and 1879; the first was published in the 'Berliner ent. Zeitschrift,' xviii. pp. 241–288, and the second in the 'Deutsche ent. Zeitschrift,' xxiii. pp. 305–320. But this paper does not include the Lycidæ nor the Lampyridæ, as a revision of these sections was given by Gorham in the Trans. Ent. Soc. Lond. pp. 393–411 (in 1883), and the Cleridæ, also included in the Malacodermata, have been dealt with by myself in the Ann. & Mag. Nat. Hist. (6) x. pp. 183–192, in 1892. A note on the synonymy of the last paper will be found at the end of this memoir; and I hope to describe and figure during the current year a remarkable new species with pectinate antennæ, and, perhaps, allied to *Tenerus*.

The numbers of species at present known from Japan in the various families are represented by the following figures:—Dascillidæ 27, Telephoridæ 39, Drillidæ 5, Melyridæ 19, Lycidæ 20, Lampyridæ 8, and Cleridæ 23, making a total of 141 species.

Owing to some authors using the name of *Cantharis* for *Telephorus*, species are recorded in the 'Zoological Record' of 1879 (Ins. p. 65) amongst the Cantharidæ; it is very inconvenient using two names, such as *Telephorus* and *Cantharis*, of different genders, as the species, when transferred from one to the other, require different specific terminations. In Kiesenwetter's paper of 1879 no sizes are given for his species; but it is not a matter of great importance, as the measurements of species in this section of the Coleoptera necessarily take a wide range, as individuals vary greatly in size, and entomologists seeking to name their specimens by Kiesenwetter's descriptions will not be misled by the omissions.

Dascillidæ.

Paralichas pectinatus.

Odontonyx pectinata, Kies. Berl. ent. Zeit. p. 242 (1874).

This species belongs to White's genus *Paralichas* (Ann. & Mag. Nat. Hist. iii. p. 284, 1859), and his name has two years' priority over Guérin's name of *Eucteis*. White figured the type of his genus, and gave some interesting illustrations of the pupal cases; similar cases may be constantly seen on the trunks of large trees in Japan in early summer. White did not observe that the claws of the species of this genus are finely but very clearly pectinate, and the tarsi are not dilated. Harold (Deutsche ent. Zeit. p. 73, 1878) erroneously stated that the *Odontonyx pectinata*, Kies., was the same as *Eucteis bimaculata*, Guérin; I have taken both species, and I find them distinct. The elytral striæ of the males vary very much in depth in both species, and I consider that Fairmaire (Ann. Soc. Ent. Fr. vi. p. 336, 1886) is right in regarding *Eucteis bimaculata*, Guérin, and *Paralichas Guerini*, White, as the same species.

Hab. Nagasaki, Miyanoshita, Kobé, and Nikko.

Paralichas higonie, sp. n. (Pl. VI. fig. 1.)

Niger, subnitidus, griseo-pubescent; thorace basi et lateribus scutelloque rufis; ♀ antennis articulo ultimo testaceo.
L. 7-8½ mill.

Black, somewhat shining, with grey pubescence, pubescence most conspicuous on the elytral sutural margin; the head somewhat densely but not clearly punctured; the thorax broadly red on the basal half, with this colour extending anteriorly along the margin to the anterior angle; the scutellum wholly red; the elytra, striæ fairly well-marked, interstices granulate and finely rugose; the legs black, with the apices of the femora obscurely reddish, claws pectinate; the antennæ also black, but in the female the terminal joint is testaceous, in the male the articulations are strongly pectinate, the appendages arising from the bases of the articulations. In the male of *P. pectinatus*, Kies., the appendages of the antennæ rise from the apical portions of the articulations; but in the female the form is closely similar to that of *P. higonie*.

Hab. Taken between Ichiuchi and Hitoyoshi in some numbers on the 2nd May, 1881. The specimens were flying round willows by the bank of the river, and now and then settled on the leaves.

Epilichas flabellatus.

Octoglossa flabellata, Kies. Berl. ent. Zeit. p. 243 (1874).

I think it is impossible to assign this species to the South-American genus *Octoglossa*, and White's genus is sufficiently characterized for adoption, being founded on a species (*E. Candezei*) from Hong Kong. *Epilichas Candezei* has the thorax very conspicuously and transversely convex behind the neck, and the thorax is not distinctly punctured; in colour it agrees with the variety of *E. flabellatus* with the thorax red. The claws in this genus are simple, and the tarsi are dilated and padded. I have a smaller undescribed species of this genus from Kiukiang, China, measuring $9\frac{1}{2}$ millim., but in other respects it is very close to *E. flabellatus*.

Hab. Nagasaki (very common in the flowers of the dog-rose), Nara, and Kobé.

Epilichas brunneicornis, sp. n.

Rufo-brunneus, supra nigro-piceus, nitidus, pubescens; antennis pedibusque brunneis.

L. 11 mill.

Reddish brown, pitchy black above, shining, with dark pubescence; the head somewhat densely and rather obscurely punctulate; maxillary palpi, terminal joint small and feebly securiform; the thorax less distinctly punctured than the head, margins broadly reddish brown; the scutellum reddish brown; the elytra striate, striæ most deeply impressed apically, interstices distinctly punctate, sutural and epipleural margins narrowly, base more broadly, reddish brown; the legs and antennæ obscurely reddish brown; male antennæ with joints 3-10 strongly pectinate, basal joint bulbiform, second small, third with an appendage arising close to the base and nearly as long as the joint itself, fourth with one arising at the base and longer than the joint, 5 to 7 of similar form, in 8 to 10 the appendages arise from the middle of the joints, terminal joint elongate; except the head the whole of the under surface is reddish brown.

The facies of this species is not very dissimilar to *E. flabellatus*, Kies., but the palpi and antennæ possess important

differences; in Kiesenwetter's species the appendages to the joints of the antennæ all start from the bases, and the tarsal joints are more dilated.

Hab. Junsai. Two male examples.

Epilichas atricolor, sp. n.

Ater, nitidus, pubescens; antennis nigris; thorace transverso; pedibus nigro-piceis.

L. 10-11 mill.

This species is a little smaller than *E. flabellatus*, with a relatively smaller head and a thorax markedly shorter and transverse; the maxillary palpi have the terminal joint intermediate in size between *E. flabellatus* and *brunneicornis*, the two basal joints of the antennæ and the legs piceous; the tarsi are slightly more robust than those of *E. brunneicornis*, but much less dilated than those of *E. flabellatus*; the antennæ are slender and the appendages fine, and all clearly arise from the bases of the articulations. The elytral striæ are vague as compared with those of *E. brunneicornis*.

Hab. Nikko and Miyanoshita. Three male examples.

Epilichas niponicus, sp. n.

Piceo-brunneus, nitidus, pubescens; capite parvo; thorace convexo vix punctulato; elytris striis vage impressis, interstitiis subrugosis, punctatis.

L. 6 mill.

Pitchy brown, shining, with brownish pubescence; the head rather narrow, eyes small, somewhat rugose, and obscurely punctured; the thorax markedly convex on the disk, transverse, posterior angles somewhat projecting, with a depression within the angle, obscurely punctulate; the scutellum smooth; the elytra, striæ vague except the sutural, which is clearly impressed, especially near the scutellum, interspaces somewhat rugosely punctate; the legs reddish brown; the antennæ darker, third joint scarcely pectinate, appendage apical and very short, joints 4 to 10 pectinate, the appendages not so long as the joint itself, and clearly arising from its centre; the tarsi slender; the maxillary palpi, terminal joint scarcely securiform.

Hab. Nikko and Miyanoshita. Three males and one female.

I have a fifth species from Yuyama in Higo; it measures 7 millim., and is wholly piceous brown in colour, with reddish legs. The species is not very unlike *E. niponicus*, but I only know the female.

DRUPEUS, gen. nov.

I propose to establish this genus to receive three small species, which in general outline are very similar indeed to a species of *Epilichas*. The maxillary palpi are very slender, with the terminal joint simple, not securiform; the two basal joints of the antennæ are very small, and the third joint not pectinate, and the tarsi are very long and simple, almost filiform, and quite as long as the tibia that bears them. The antennæ are pectinate, somewhat like those of an *Epilichas*; but the appendages are all clearly apical.

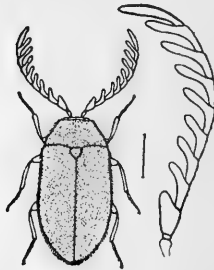
Drupeus lætabilis, sp. n. (Woodcut, fig. 1.)

Niger, nitidus; antennis basi, thorace angulis, femoribus tarsisque testaceis.

L. $5\frac{1}{2}$ mill.

Black, shining, with blackish pubescence; two basal joints of the antennæ, hind angles of the thorax, thighs, and tarsi testaceous, tibiæ somewhat darker; the head rather closely,

Fig. 1.



finely, but clearly punctulate; the thorax narrowest anteriorly, broadest posteriorly, convex behind the neck, not so clearly punctulate as the head, hind angles rather broadly testaceous, basal edge crenulate; the scutellum cordiform, punctulate; the elytra finely and rugosely punctulate, vaguely

striate, epipleural rim raised; the antennæ, first joint small and bulbiform, second very small, third three-sided and produced on the anterior inner edge, fourth to tenth apically pectinate, pectinations being longer than the joints; the legs black and tarsi pale and very slender.

Hab. Kashiwagi, 19th June, 1881. Two male examples.

Drupeus vittipennis, sp. n.

Piceo-brunneus, nitidus; elytris striga humeralis, cum marginibus suturali, pedibusque testaceis.

L. 5-5½ mill.

Pitchy brown, shining, with tawny pubescence; the antennæ, terminal joint apically and the second joint partly, and the legs wholly testaceous; the thorax, basal rim, the elytral epipleuræ, sutural margins, and a humeral vitta, which stretches a little obliquely to the middle of the dorsum, testaceous; the head clearly punctulate; the thorax similarly punctured, widest just before the hinder angles, posterior edge distinctly crenulate and widely sinuous on each side, with the intermediate space on the edge before the scutellum evenly arched; the elytra, striæ not well-defined, somewhat striate-punctate, interstices finely punctulate and rugose; the antennæ, first joint small and almost moniliform, second much smaller, third gradually thickened and flattened out from the base to the apex and triangular, 5 to 10 pectinate, pectinations coequal in length with the joints, terminal a little longer than the tenth; the inner side of the third and the pectination of the fourth and fifth, with the apical half of the terminal joint, are testaceous.

Hab. Kashiwagi, 15th June, 1881. Three males.

Drupeus brevis, sp. n.

Ovalis, fuscus, subopacus; thorace marginibus obscure brunneis; tarsis testaceis.

L. 3¾ mill.

Oval, the elytra being feebly wider than the thorax, fuscous, and rather opaque; the head, eyes somewhat prominent, roughly sculptured, sculpture dense and somewhat leather-like; the thorax arched at the sides, lateral rim elevated, obscurely brown on the edges, sculpture similar to that of the head; the scutellum relatively large and triangular; the elytra much more coarsely sculptured than the

thorax, sutural margins obscurely brown; the legs infusate, tarsi testaceous; the antennæ, two basal joints obscurely brown, joints 3 to 9 formed somewhat like those here figured for *D. lætabilis*, but the appendages are relatively much longer; thus the appendages to joints 9 and 10 are four times as long as the articulation itself.

At first I hesitated to include this species in the genus *Drupeus*; but the maxillary palpi, slender and similarly formed tarsi, and the antennæ correspond in their general structure almost exactly.

Hab. Nara. One male example, 25th June, 1881.

EUBRIANAX, Kiesenwetter.

Eubrianax, Kiesenwetter, Berl. ent. Zeit. p. 249 (1874).

Placonycha, Horn, Trans. Am. Ent. Soc. viii. p. 111 (1880).

There is a Chinese species of *Eubrianax* in the British Museum labelled in Dr. Horn's handwriting "*Placonycha*," and Leconte's description of the American species evidently refers to one belonging to the genus *Eubrianax*. The claws in this genus are slender and simple, moderately dilated at the base, with a slender membranous appendage arising from the base, which is nearly as long as the claw itself. I found three species in Japan and two species in Ceylon; and it is probable species occur over the greater part of Asia.

Eubrianax granicollis, sp. n. (Pl. VI. fig. 2.)

Ovatus, parum convexus, niger, nitidus; thorace antice producto, dense granulato; antennis pedibusque nigris.

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

This species differs only from *E. ramicornis*, Kies., in one or two particulars. The antennal ramifications are little more than half the length, the thorax is densely granulate anteriorly and protrudes over the neck, the tibiæ, especially the intermediate pair, are stouter and shorter, and the legs wholly black.

Hab. Nagasaki and Subashiri. Eight examples.

Eubrianax pellucidus, sp. n.

Ovatus, niger, nitidus; thorace lateribus late antice angusto pallido; antennis basi pedibusque testaceis.

L. 4 mill.

This species differs also very little from *E. ramicornis*; the

differences are :—the thorax is more transverse and pale and pellucid, except on the disk ; the disk is black, and leaves only a very narrow pale margin behind the neck ; the antennæ are less strongly pectinate (being in this respect intermediate between *E. ramicornis* and *granicollis*), and the joints 1 to 5 are testaceous, but the pectinations on joints 3 to 5 are black.

Hab. Fukushima, 26th July, 1881. Two examples, both males.

Prionocyphon sexmaculatus, sp. n.

Ovalis, convexus, testaceus, pubescens ; thorace transverso ; elytris 6-maculatis, maculis piceis ; antennis pedibusque concoloribus.
L. $4\frac{3}{4}$ mill.

Oval, convex above, palish testaceous, rather densely pubescent ; the head scarcely punctured, very shiny, transverse ; the thorax also very shiny, sinuous before and behind, very transverse and very short, with a faint leather-like sculpture ; the scutellum large, triangular, and feebly punctulate ; the elytra rounded off at the shoulder, with a large oval blackish spot on each side on the scutellar region, a second about half the size of the first below the shoulder and near the outer margin, and a third large lobe-shaped spot behind the middle of the dorsum, which leaves a sutural and epipleural margin of about the same width ; the antennæ, basal joint rather large, second and third small, especially the third ; the legs with the antennæ wholly pale.

Hab. Nikko. One example.

Scirtes ovatulus, sp. n.

Ovalis, fuscus, nitidus, pubescens ; antennis basi pedibusque obscure brunneis.
L. $2\frac{3}{4}$ mill.

This species is very similar to *S. sobrinus*, but it is less circular in outline, having longer elytra, and the antennæ are more robust, the joints feebly increasing in size towards the apices ; the legs also are wholly but obscurely brown.

Hab. Hakodate.

Scirtes sobrinus, sp. n.

Breviter ovalis, piceus, pubescens ; antennis pedibusque pallide brunneis.
L. $2\frac{1}{2}$ – $2\frac{3}{4}$ mill.

Broadly oval, pitchy brown, shining, pubescent ; the head

and thorax finely punctulate, eyes convex and rather prominent; the thorax transverse, hind angles rectangular; the scutellum triangular, obscurely punctulate; the elytra punctulate, but the punctuation is ill-defined; the antennæ, five basal joints palish brown, the others apically infusate; the legs also palish brown, with the bases of the thighs sometimes dusky.

This species closely resembles *S. hemisphæricus*, Linn.

Hab. Bukenji, near Yokohama. Four examples, 29th June, 1880.

Helodes dux, sp. n.

Ovalis, convexus, nitidus, pubescens; capite nigro; thorace rufiflavo; elytris nigris, undique punctulatis, griseo-pubescentibus. L. 6 mill.

Oval, convex above, shining, with somewhat long pubescence; the head black, sparsely punctured, eyes rather prominent; the thorax reddish yellow, with pubescence of the same colour, anteriorly arched from the posterior angles, base bisinuous, behind the neck there is a pellucid space, which permits the blackness of the neck to appear through, very finely punctulate; the elytra evenly and wholly punctulate, with greyish pubescence; the antennæ, three basal joints yellowish, others infusate; the legs, anterior coxæ, and bases of the anterior thighs flavous, the rest infusate, claws and terminal segments of the abdomen flavous.

In this genus the first joint of the hind tarsus is very long.

Hab. Okamayama, near Hitoyoshi, 8th May, 1881; also at Miyanoshita, Nikko, and Fukushima.

Helodes flavicollis, Kies.

Helodes flavicollis, Kies. Berl. ent. Zeit. p. 22 (1859), p. 245 (1874).

Sacodes protectus, Har. Mitt. Münch. Ver. iv. p. 169 (1880).

Kiesenwetter decided that this Japanese species was identical with the European one, and, as he probably possessed his own type and had made a comparison, I have allowed his determination to remain. It does not appear that Harold knew *Helodes flavicollis*, Kies., and in the Munich Catalogue he regards the genus *Sacodes* as synonymic with *Helodes*. The Japanese type of *H. flavicollis* has red antennæ; but I have not seen Kiesenwetter's original description nor any European example.

Hab. Generally distributed in Kiushiu,

Helodes inornatus, sp. n.

Ovalis, fuscus, nitidus, pubescens; antennis basi pedibusque anticis brunneis vel obscure testaceis.

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

Oval, dusky brown, shining, with grey pubescence; the head sparsely punctate; the thorax much more distinctly and closely punctate, widely impressed on each side before the posterior angles, arched anteriorly from the posterior angles; the scutellum triangular, somewhat closely punctate; the elytra more finely punctate than the thorax, more especially on the dorsal and apical regions than at the bases; the antennæ, four or five basal joints, with the palpi and anterior legs, brownish or obscurely testaceous.

Hab. Nagasaki, Kiga, Miyanoshita, and Nikko. In swampy places.

Helodes scapularis, sp. n.

H. inornato proxime similis, sed minor et angustior; elytris macula humerali flavo-testacea.

L. 3 mill.

This species is narrower and much smaller than *H. inornatus*, and it has a very distinct pale humeral spot.

Hab. Nagasaki and Hitoyoshi. Two examples.

Cyphon variabilis, Thunbg.

In the Munich Catalogue this species has seven synonyms, and is said to occur in Europe and North America. Kiesenwetter considered a specimen of mine (which, inadvertently, he did not return to me) belonged probably to Thunberg's species. I have three or four species of *Cyphon* from Japan; but the specimens are not sufficiently good for description. One is a species from Hakodate measuring $4\frac{1}{2}$ millim.

CYPHONIDARUM.

Cyphonidarum, Kies. Berl. ent. Zeit. xviii. p. 245 (1874).

This genus was not characterized by Kiesenwetter, and remains still undescribed. Of the species Kiesenwetter referred to I have seen only two specimens.

Ptilodactyla ramea, sp. n.

Piceo-brunnea; antennis pedibusque vix dilutioribus; capite tho-

raceque parum dense punctatis; elytris vage punctato-striatis, interstitiis tenuiter rugoso-punctulatis.

L. $4\frac{1}{2}$ - $6\frac{1}{4}$ mill.

Pitchy brown; antennæ and legs less dark, with tawny pubescence; the head somewhat densely punctate, not convex between the eyes; eyes large in male, smaller and further apart in female; the thorax a little more densely punctate than the head, anterior rim smooth and elevated, widest before the posterior angles, compressed behind the eyes, bisinuous at the base; the scutellum cordiform, with a marginal fovea at the base; the elytra punctate-striate near the suture, but not distinctly so, outer striæ more vague and 5 to 6 are striate-punctate; the antennæ, ♀ joints 5 to 10 widen out inwardly at their apices, ♂ 4 to 10 are very strongly pectinate, the processes are longer than the joints and are inserted in their bases; the legs dull brown, posterior femora with one long spine and a short one at the tarsal end.

Some of the characters given are generic, but they will help to enable the Japanese student to recognize the species. I found three species of *Ptilodactyla* in Ceylon, and one is recorded from Java. In the Munich Catalogue the names of twenty-five American species are given.

Hab. Nagasaki, Fukushima, Oiwake, and Nara. Beaten from the dead branches of trees.

Malacodermidæ.

TELEPHORINI.

Podabrus Heydeni, Kies.

Podabrus Heydeni, Kies. Deutsche ent. Zeit. xxiii. p. 306 (1879).

Podabrus Reini, Heyd. l. c. p. 351; Lew. Ent. xxvi. p. 151 (1893).

Heyden has kindly allowed me to see the type of his species, which agrees precisely with the type of *P. Heydeni*, Kiesenwetter, returned to me. I have an example which is almost wholly black and two examples received from Herr Hiller with the elytra wholly cinereous; these last are labelled *P. Hilleri*, Kies., in Kiesenwetter's handwriting.

Hab. Yuyama, Miyanoshita, Nikko, and Suyama.

Podabrus temporalis, Harold.

Podabrus temporalis, Harold, Deutsche ent. Zeit. p. 73 (1878).

Hab. Miyanoshita, Yokohama, Tokio, Nikko, and Sapporo. Apparently common.

Podabrus lictorius, sp. n.

Niger; capite rugoso-punctato, antice transversim testaceo; thorace punctato, lateribus testaceis; pedibus pallidis vel infuscatis.
L. 8-8½ mill.

The head behind the eyes and snout black, roughly and thickly punctured, mouth-organs and a transverse area in which the antennæ are inserted, two or three basal joints of the antennæ, thoracic lateral margins, sutural and lateral margins of the elytra, and legs pale testaceous; antennæ, joints 4 to 11 and sometimes the third infuscate; the pale margins to the elytra usually join at the bases; the thorax is rather less coarsely and rugosely punctured than the head, truncate at the base, hind angles somewhat acute, sides arched behind the anterior angle, wholly testaceous beneath; the scutellum infuscate in all the colour-forms; the abdominal segments infuscate; the coxæ sometimes marked with black.

Like *P. malthinoides*, Kies., this species has a variety with the head and elytra wholly black and the legs wholly dusky. Except in size, the facies of the two species is not very dissimilar; but the tarsi are relatively longer in *P. lictorius* than in *P. malthinoides*, this character being especially noticeable in the basal joints.

Hab. Yuyama, Tosamachi, Nishimura, Miyanoshita, and Nikko.

In the following genus the antennal grooves are much shorter than in *Athemus*.

Themus episcopalis.

Cantharis episcopalis, Kies. Berl. ent. Zeit. p. 269 (1874).

In 1881 I obtained some fine specimens of this species which measure 26 millim. *Cantharis midas*, Kies., may also be placed in the genus *Themus*. In *Themus* the antennal grooves of the male are very short.

Hab. Oyayama in Higo; also Nagasaki.

Themus cyanipennis, Motsch.

Themus cyanipennis, Motsch. Etud. Ent. p. 28 (1857), p. 10 (1860).

Cantharis venatrix, Kies. Berl. ent. Zeit. p. 271 (1879).

I have an example in which the thorax is wholly cyaneous.

Hab. Miyanoshita, Yokohama, Nikko, Hakodate, and other places.

ATHEMUS, gen. nov.

The characters of this genus are, in a great part, the same as those of *Themus*; but it may be separated on several important characters. The head is less robust, the thorax longer than broad, with the lateral edges less explanate, and the basal portion is occupied by two lobe-shaped raised areas; the antennæ has the *second* joint much shorter than the third, and the legs are notably stouter, a character especially observable in the tibiæ.

There are sexual characters also. The female has a conspicuous inner process within the anterior and intermediate claws; the male has long antennal grooves in joints 4 to 8, and the hind tibiæ bent.

Type: *Telephorus suturellus*, Motsch.

I have a species from Shanghai which is, perhaps, undescribed.

Athemus suturellus.

Telephorus suturellus, Motsch. Etud. Ent. p. 10 (1860).

Var. *Cantharis luteipennis*, Kies. Berl. ent. Zeit. p. 273 (1874).

Var. *Telephorus melanopus*, Har. Deutsche ent. Zeit. p. 74 (1878).

Var. *T. roninus*, vel sp. nov.

The type of this species is described as having pale tibiæ and infusate femora, with the sutural margin dusky. Kiesenwetter described a variety in which the female has a diffused dusky spot before the apex of the elytra. Harold's species is another colour-variety with black legs. I found a small colony at Miyanoshita under the large trees of a dense forest which are entirely black (var. *roninus*). Harold (*l. c.* p. 74) notices the sexual characters of this species.

Hab. Found in all the islands abundantly.

Athemus attristatus.

Cantharis attristata, Kies. Berl. ent. Zeit. p. 272 (1874).

It is very doubtful whether this is or is not a variety of the last, but it is considerably less in size. I have only six specimens. In colour it differs from *A. roninus*, var., in having the thoracic lateral margins, and sometimes the tarsi, wholly pale. Sometimes the antennæ are testaceous, sometimes black.

Hab. Nikko. Taken in the dense forest above the temples.

Telephorus insulsus, Har.

Telephorus insulsus, Har. Deutsche ent. Zeit. p. 76 (1878).

Hab. Miyanoshita and Oyama, in Sagami. Appears very early in the spring in the flowers of *Edgworthia*.

Telephorus ciusianus.

Cantharis ciusiana, Kies. Berl. ent. Zeit. pp. 267, 275 (1874).

Cantharis Reini, Kies. Deutsche ent. Zeit. p. 307 (1879).

Kiesenwetter printed his description of this curiously named species twice. *C. Reini*, Kies., is a variety with black elytra, for seeing the type of which I am much indebted to Major L. von Heyden. The males have short antennal grooves.

Hab. Hitoyoshi, Subashiri, Nikko, and Miyanoshita.

Telephorus vitellinus.

Cantharis vitellina, Kies. Berl. ent. Zeit. p. 277 (1874).

The male of this species has the sixth and seventh joints of the antennæ obscurely grooved.

Hab. Nagasaki, Kiga, Tokio, and Kashiwagi.

Telephorus dichrous, sp. n.

♂. Atratus, subopacus, nigro-hirtus; thorace rufo; antennis pedibusque concoloribus.

L. 10 mill.

Densely black, somewhat opaque, thorax only a clear red; the head finely and rather closely punctulate, transversely impressed behind the antennæ; the thorax nearly quadrate, margin narrowly raised on all sides, clothed with black hair, surface uneven, with a faint median channel; the scutellum black, impressed longitudinally; the elytra, striæ vague, sculpture close and fine; the antennæ rather long and slender, second joint a little shorter than the third, 4 to 7 coequal and longer than the third. The female measures 14 millim. and the head is much broader than in the male.

Hab. Kashiwagi. Two examples.

Telephorus adusticollis.

Cantharis adusticollis, Kies. Berl. ent. Zeit. p. 274 (1874).

Hab. Nara, Seba, and Junsai. Commonest in S. Yezo.

Telephorus ægrota.

Cantharis ægrota, Kies. Berl. ent. Zeit. p. 275 (1874).

Hab. Kiga. Two examples only.

Telephorus viaticus, sp. n.

Niger, nitidus; capite antice, antennis basi, femoribus et tibiis testaceis, tarsis nigris.

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

Black, shining, parallel; head in front of the eyes, mouth-organs, three basal antennal joints, thighs, and tibiæ clear testaceous. The head biimpressed between the eyes, black portion finely punctulate; the thorax nearly quadrate, lateral and posterior edges elevated, anterior angles rounded off, median channel wide and ill-defined; the scutellum rather long, punctulate, and widest at the base; the elytra rather long, parallel at the sides, finely and rather rugosely sculptured; the antennæ, second joint a little longer than the third, three basal joints more or less testaceous; the legs clear testaceous, tarsi blackish, claws with strong inner tooth.

Hab. Fukushima. Two examples.

Telephorus japonicus.

Cantharis japonica, Kies. Berl. ent. Zeit. p. 266 (1874).

This species is, perhaps, the commonest and most generally distributed of any in Japan. The claws of the male are bifid. Sometimes, though rarely, the thorax and elytra are wholly testaceous.

Hab. Found in all the islands. Very common at Miyano-shita in May and in Nagasaki in March and April.

Telephorus vulcanus, sp. n.

Fuscus; capite antice, antennis thorace (plaga in medio excepta) pedibusque anterioribus testaceis.

L. $6\frac{1}{2}$ mill.

Dusky grey, head, mouth-organs, antennæ, thorax (except a central patch), elytral margins, anterior legs, intermediate and posterior thighs testaceous; the head feebly punctulate; the thorax little broader than long, anterior angles well rounded off, hinder margin just before the angle feebly sinuous, anterior and posterior edges raised, sides somewhat explanate; the scutellum semicircular apically, clothed like the elytra; the elytra, the pale margin widens out from the middle of the dorsum to the scutellum, outer margins narrower; the legs, tibiæ and tarsi of the two hinder pair infuscate, claws simple.

This species is shorter and more robust than any other of this series.

Hab. Junsai. One female example only.

Silis pectinata, sp. n. (Pl. VI. fig. 3.)

Nigra, nitida, parallela, griseo-pubescentis; thorace rufo inciso; antennis valde pectinatis, nigris.

L. 5 mill.

Black, shining, parallel at the sides, with greyish pubescence; the head widest at the eyes, gradually narrowing to the neck, microscopically punctulate; the thorax clear red, transverse, as wide as the elytra, deeply incised at the basal angle, with a deep fovea or pit just within the lateral margin at the widest part; the scutellum widest at the base; the elytra evenly but rather rugosely sculptured; the legs, tibiæ palish, thighs and tarsi infuscate; the antennæ, second joint very small, joints 3 to 10 apically strongly pectinate, joints 5 to 9 having appendages longer than the joint itself.

The pectination of the antenna is very unusual in *Silis*, if not altogether exceptional in the genus.

Hab. Nakatsugawa and in Higo. Six examples, apparently all males.

ELIANUS, gen. nov.

Antennæ simple, each articulation smallest at the base, first constricted before base, second short, third and fourth nearly as long again as the second, fifth and sixth coequal and each as long as the fourth, seventh to the eleventh each a little shorter than the preceding one; the palpus, terminal joint somewhat elongate, club-shaped; the head not narrowed posteriorly, eyes clearly faceted and prominent; the thorax transverse, with an external elevated rim; the scutellum nearly quadrate, but rounded off posteriorly; the elytra long and parallel; the legs somewhat robust, claws with a basal tooth, fourth joint of the hind tarsus thin and pellucid.

Elianus rugiceps, sp. n. (Pl. VI. fig. 4.)

Elongatus, parallelus, niger, nitidus, pubescens; antennis basi, thorace pedibusque rufis.

L. $4\frac{1}{2}$ –5 mill.

Elongate, parallel, black, shining, with grey pubescence; the head punctured and very rugose, mouth-organs reddish; the thorax red, transverse, vaguely rugose, rim elevated; the scutellum somewhat obscurely reddish; the elytra black, rugosely sculptured, epipleural margin reddish; the legs wholly red; the antennæ, three basal joints usually red, and sometimes one or more at the apex reddish; there are no remarkable external sexual characters to notice.

Hab. Nikko. About a dozen examples.

Ichthyurus atriceps, sp. n.

Niger, subnitidus; thoraco marginibus anguste, elytris marginibus externis antennisque basi flavis.

♀. L. 6 mill.

Black, somewhat shining, pubescent; the head black, except narrowly round the bases of the antennæ, obscurely punctulate and very feebly rugose; the thorax similarly sculptured, with the rim yellow; the scutellum black; the elytra black, with the sides from the shoulder narrowly yellow, apices broadly yellow, with the rims conspicuous, elevated, more distinctly sculptured than the thorax; the abdominal segments are laterally yellow; the legs, anterior and intermediate pairs obscurely brown and infusate in parts, hinder pair blackish; the antennæ, three basal joints brownish and the others black.

This species is larger and much more robust than *I. niponicus*, Lew., and is very different in colour. In *I. niponicus* the elytra are yellow along the bases in the male, but not in the female, and in the latter sex the yellow part of the head is confined to the region of the antennæ and the thighs are not enlarged.

Hab. Wada-togé, 1st August, 1881.

Biurus pennatus, sp. n.

Niger, nitidus; antennis articulis duobus primis flavescentibus; elytris valde dehiscentibus, apice late flavis; pedibus pallide flavis vel tenuiter infusatis.

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

Black, shining, with griseous pubescence on the head and elytra; the head uneven, without punctuation; the thorax with ill-defined raised spaces, but without carinæ or tubercles; the scutellum rather deeply incised posteriorly; the elytra apically and about one third of the wing-case yellow; the abdomen infusate, with the margins of the segments (except the last) testaceous; the last segment is incised, the incision being nearly semicircular in outline; the legs are pale yellow or slightly infusate, varying much in various examples; the antennæ are dusky, with the two basal joints pale, and sometimes the third. In this genus, and also in *Ichthyurus*, there is a curious polished tubercle attached to the bases of the elytra, and in the male the eyes are very large and the space between them narrow.

I have no doubt about this insect being congeneric with *Biurus sylvicola* and *sublateralis*, Motsch.; but whether it is

congeneric with *B. apicalis*, Motsch., the type of the genus, is doubtful, because the author says of this species that the claws of the tarsi are simple. In the Ceylonese species of *Biurus* and in *B. pennatus* the claws are formed as in *Ichthyurus*, that is, with two conspicuous inner processes. Harold catalogues the genus as *Diurus*.

Hab. Kashiwagi, Fukushima, and other places on the Nakasendo.

Malthodes kobensis, sp. n.

Niger, opacus; capite thoraceque dense granulatis; antennis nigris; pedibus infuscatis.

L. 5 mill.

Black, opaque; the head and thorax densely sculptured, sculpture granulate, the former with prominent eyes and narrowed from the eyes to the neck; the thorax nearly quadrate, anterior angles obtuse, posterior angles a little produced; the elytra somewhat less opaque than the thorax, with sculpture also less remarkable, striæ faintly visible; the legs, basal half of the thighs palish brown, the rest with the tibiæ and tarsi infuscate.

Hab. Kobé and Kashiwagi. Three examples.

DRILINI.

Cyphonocerus marginatus, sp. n.

C. ruficollis similis, sed differt in colore; thorace elytrisque obscure brunneo-piceis et marginibus rufo-brunneis; antennis pedibusque infuscatis.

L. 7½ mill.

This species is very similar to *C. ruficollis*, Kies., but the colour is very different, being brownish with a darker shade; the thorax and the elytra (except at the base) have both reddish-brown margins; the thorax is more perfectly arched in outline, and the oblique carina at the posterior angle is more conspicuous, being red, and the appendages to the antennal joints are as long again as in *C. ruficollis*.

Hab. Kuma Kuni in Higo. One male example.

Drilaster unicolor, sp. n.

Niger, vix nitidus; elytris dense rugoso-punctatis; antennis pedibusque concoloribus.

L. 6¾ mill.

This species is extremely similar to *D. axillaris*, Kies.,

but it is broader and wholly black; the antennæ are shorter and stouter, especially the terminal joint, and the legs and tarsi are also thicker.

Hab. Higo. One example.

Drilaster axillaris, Kies. (Pl. VI. fig. 6.)

Drilaster axillaris, Kies. Deutsche ent. Zeit. p. 311 (1879).

Hab. Main island and in Yezo.

In the collection of the Rev. H. S. Gorham there is an undescribed species from Borneo.

MELYRINI.

Laius niponicus, sp. n. (Pl. VI. fig. 8.)

Niger vel cyaneo-niger, nitidus, griseo-pubescent; antennis rufis, apicibus exceptis; elytra rufo-fasciatis; femoribus nigris vel rufis, tibiis tarsisque rufis.

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

Black, or with a bluish tint, shining, with grey pubescence; the head densely punctured, eyes prominent; the thorax also densely punctate at the sides, more or less smooth in the middle, as wide as long; the elytra with a wide red fascia, which widens out both at the suture and on the epipleural margin; the legs, femora usually black, but sometimes the anterior and intermediate pairs are red; tibiæ and tarsi red, claws infuscate; the antennæ, five or six apical joints blackish, the rest red, the third joint in male is formed like a wide lobe-shaped plate excavated on the upper surface, in the female it is simply enlarged.

Hab. Hakodate sand-hills; also at Kobé.

Laius Kiesenwetteri, Lew.

Laius Kiesenwetteri, Lew. Cat. 1874, no. 1215.

Laius flavicornis, Kies. Berl. ent. Zeit. xviii. p. 283 (1874).

The first name is proposed because Kiesenwetter's name was occupied by Fabricius.

Malachius vitticollis, Kies.

I know not this species, nor do I remember having seen a species of *Malachius* in Japan with a pale-coloured thorax and black centre. I think the type is a Chinese specimen I gave to Herr Kiesenwetter, and he has made an error in publishing the locality, and I do not propose to give it a place in the Japanese Catalogue at present.

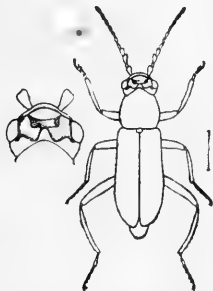
Malachius eximius, sp. n. (Woodcut, fig. 2.)

Viridi-cyaneus, parum opacus, griseo-pubescentis; ♂ fronte transversim excavata, pedibus anticis testaceis; ♀ fronte biimpressa, pedibus anticis æneis vel testaceis.

L. $4\frac{1}{2}$ –5 mill.

Greenish blue, somewhat opaque, with short grey pubescence. ♂. The head is curiously excavated, between the eyes it is transversely and deeply cut out, so that the upper portion of the eye rests on a very narrow base, in the middle projecting over the excavation is a triangular process, which, viewed from above, seems to interrupt the channel, but looked at sideways it is seen to be a projection; in front of the excavation and behind the antennæ is a concave area, formed partly by a depression and partly by the surrounding edges

Fig. 2.



being raised; the thorax is rounded off before and behind, rather longer than broad, and behind the middle of the neck it somewhat overlaps the head, opaque, and without apparent sculpture; the elytra very finely punctulate, with vague striæ; the antennæ, first to sixth joints æneous above, the others vaguely so, third and fourth, and the fifth slightly, flattened out; the mouth-organs clear yellow; the legs, anterior pair wholly testaceous, intermediate thighs testaceous, tipped with metallic green, tibiæ brownish, tarsi infuscate, hind legs wholly æneous. ♀. The head biimpressed between the eyes; antennæ, joints 3 to 5 slightly enlarged; the legs wholly æneous or, rarely, anterior tibiæ pale.

Hab. Nagasaki, Osaka, Nikko, Kiga, and Yokohama.

Attalus elongatulus, sp. n.

Elongatus, cyaneo-niger, nitidus; antennis basi obscure testaceis pedibus nigris; elytris dense punctulatis, subtiliter rugulosis.

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

Elongate, bluish black, shining; the head impressed between the eyes and very finely punctulate; the thorax about as long as wide, arched anteriorly; the elytra rather long and parallel, densely punctulate and finely rugose; the antennæ long and lax in male, not serrate, female articulations much shorter and thicker, three or four basal joints obscurely testaceous on the under surfaces; the legs rather long, black or bluish black, anterior tibiæ of male longer than those of female and somewhat bent; male anterior tarsus, second joint dentate at its apex, third affixed to its base and resting at right angles to it.

The anterior tarsus of male is formed like that of *A. elegans*, Fairm., a species from Gibraltar. This character is much less observable in *A. japonicus*, Kies., a species which differs also in having serrate articulations to the antennæ.

Hab. Nagasaki. Two males and two females.

Dasytes constrictus, sp. n. (Pl. VI. fig. 9.)

Nigro-cæruleus, nitidus, breviter griseo-pubescentis; capite thoraceque dense punctatis; antennis basi obscure brunneis; pedibus nigris. L. $4\frac{1}{2}$ mill.

Blackish blue, densely punctate, with short grey pubescence; the head densely punctate and constricted behind the eyes; the thorax similarly punctate, narrowest anteriorly, widest behind, without lateral margin; the scutellum small; the elytra, punctuation less dense than that of the thorax, without striæ; the legs black; the antennæ nearly moniliform, not enlarged on the inner side, second and third joints brownish, basal joint less clearly so.

The shortness of the antennæ and the absence of a thoracic marginal carina may make it desirable later to found a genus for this species.

Hab. Hitoyoshi and Yuyama in Higo. Two examples.

CELSUS, gen. nov.

This genus must be placed near *Dasytes*; but I do not know any species of similar facies to the insect on which it is founded. It is to be regretted that my specimen is unique. Maxillary palpus rather long, with the terminal joint large and securiform; the antennæ, first joint robust and longer than the second, but not larger in girth, second smaller and bulbiform, third to sixth very small, third largest; seventh to the tenth larger than the second, dilated on the inner edges, and all coequal; terminal joints similar to the tenth in width,

but oval; the head widest at the eyes and slightly narrowed to the neck; the thorax rounded off anteriorly, arched at the sides, and abruptly separated from the lower half by a lateral marginal carina; the scutellum semicircular behind; the elytra well rounded off at the humeral angles, not striate; the legs, tarsi very slender, claw and inner processes very fine.

Celsus spectabilis, sp. n. (Pl. VI. fig. 10.)

Elongatus, niger, subnitidus, hirsutus, supra grosse punctatus; elytris area subovata ante apicem polita.

L. 4 mill.

Elongate, black, rather shining, clothed with long, grey, erect, detached hairs, entirely punctured above, punctures large and some are ocellate; the elytra before the apex, nearer to the outer than the sutural margin, have a very conspicuous polished smooth space nearly oval in form; the antennæ and legs black.

Hab. Ichibusayama, near Yuyama. One example, 10th May, 1881.

OMINEUS, gen. nov.

Elongate; head narrower than the thorax, elytra gradually widening until well behind the posterior coxæ. The head widest at the eyes, obliquely narrowed behind them; the antennæ short and rather thick, first and second and fourth to seventh joints moniliform, first nearly as large again as the second, third slightly elongate and feebly constricted at the base, eighth to tenth slightly transverse, terminal oval; the maxillary palpi robust, terminal joints feebly securiform; the thorax slightly wider than broad, without a lateral carina; the scutellum obtusely acuminate behind; the elytra without striæ; the legs much more robust than in the last genus, with the claws strongly toothed at their bases. Other characters similar to those of *Dasytes*.

Omineus humeralis, sp. n. (Pl. VI. fig. 11.)

Elongatus, piceus, subnitidus, hirsutus, supra grosse punctatus; elytris striga humerali rufa; antennis pedibusque concoloribus.

L. 4-4½ mill.

Elongate, pitchy brown, somewhat shining, clothed not very thickly with grey hairs; the head and thorax deeply and densely punctate; the elytra a little less deeply and not so closely punctured; humeral angle with a red patch or stripe,

the form somewhat differing in different specimens; the antennæ and legs coloured like the body, claws alone palish.

Hab. Kashiwagi, on Mount Omine, and near the Iken-chaiya. Seven examples.

XERASIA, gen. nov.

I propose this name for an insect which cannot be placed in *Melyris*; but the characters are not widely different. The general structure of the body and appendages agree, but the outline, both of the body and the antennæ, as seen in the figure, prevent its inclusion in *Melyris*. The tarsi are short, but the joints which bear the claws are very large, as in *Melyris*; the elytra are without striæ, and the three apical joints only of the antennæ are enlarged.

Xerasia variegata, sp. n. (Pl. VI. fig. 12.)

Brunnea, nitida, griseo-pubescent; capite thoraceque punctatis; elytris griseo-variegatis; palpis infuscatis.
L. 5 mill.

Brown, shining, clothed with grey pubescence; the head somewhat irregularly punctured, eyes rather small, somewhat coarsely faceted, neck scarcely narrowed; palpi, three apical joints nearly the same size, infusate; antennæ, first and second joints stout, second rather smaller than the first, third longer than the second but less robust, fourth to the seventh about the same size, eighth smaller, ninth and tenth widened out, terminal of the same size as the tenth but conical; the thorax, anterior angles obtuse, inconspicuous, posterior angles gradually rounded off, external rim entire but very fine, punctured, punctures finer than those of the head and more evenly set; the elytra without striæ, variegated with grey markings, the transverse marking before the apex being indistinctly dentate-sinuate; the legs and antennæ wholly brown.

Hab. Hitoyoshi. Taken in the forest of Okama on a mountain of considerable elevation, 8th May, 1881. One example.

List of Species, with Synonymy.

DASCILLIDÆ.

Paralichas pectinatus.

— *Odontonyx pectinata*, Kies.

— *higoniæ.*

Epilichas flabellatus.

— *Octoglossa flabellata*, Kies.

Epilichas brunneicornis.

— *atricolor.*

— *niponicus.*

Drupeus lætabilis.

— *vittipennis.*

— *brevis.*

Eubrianax ramicornis, *Kies.*
 (Placonycha, *Horn.*)
 — granicollis.
 — pellucidus.
 Grammeubria nitida, *Kies.*
 — opaca, *Kies.*
 Cyphonidarum (gen. ined. *Kies.*).
 Prionocyphon ovalis, *Kies.*
 — fuscipennis, *Kies.*
 — sexmaculatus.
 Scirtes japonicus, *Kies.*
 — ovatulus.
 — sobrinus.
 Helodes dux.
 — flavicollis, *Kies.* 1859.
 Sacodes protectus, *Har.*
 1880.
 — inornatus.
 — scapularis.
 Cyphon puncticeps, *Kies.*
 — variabilis, *Thunbg.*
 Ptilodactyla ramea.

MALACODERMIDÆ.

Telephorini.

Podabrus Heydeni, *Kies.* 1879.
 Reinii, *Heyd.* 1893.
 Hilleri, *Kies.* (in litt.).
 — temporalis, *Har.*
 — lictorius.
 — macilentus, *Kies.*
 — ochraceus, *Kies.*
 — malthinoides, *Kies.*
 Themus episcopalis (Cantharis),
 Kies.
 — midas, *Kies.*
 — cyanipennis, *Motsch.*
 Cantharis venatrix, *Kies.*
 Athemus suturellus.
 Telephorus suturellus,
 Motsch.
 Cantharis luteipennis, *Kies.*
 Telephorus melanopus,
 Har. 1878.
 — roninus, var. ?
 — attristatus.
 Cantharis attristata, *Kies.*
 Telephorus insulsus, *Har.*
 — ciusianus, *Kies.*
 — vitellinus, *Kies.*
 — dichrous.
 — cedemeroides, *Kies.*
 — adusticollis, *Kies.*
 — plebejus, *Kies.*

Telephorus curtatus, *Kies.*
 — ægrotus, *Kies.*
 — badius, *Kies.*
 Hildendorfi, *Har.*
 — modestus, *Kies.*
 — viaticus.
 — japonicus, *Kies.*
 — vulcanus.
 Rhagonycha provida.
 Cantharis provida, *Kies.*
 Silis pectinata.
 Elianus rugiceps.
 Ichthyurus niponicus, *Lew.*
 — atriceps.
 Biurus pennatus.
 Malthinus humeralis, *Kies.*
 — mucoreus, *Kies.*
 — mutilatus, *Kies.*
 Malthinellus bicolor, *Kies.*
 Malthodes niponicus, *Kies.*
 — sulcicollis, *Kies.*
 — kobensis.
 Podistra japonica, *Kies.*

Drilini.

Drilonius striatulus, *Kies.*
 Cyphonocerus ruficollis, *Kies.*
 — marginatus.
 Drilaster axillaris, *Kies.*
 — unicolor.

Melyrini.

Laius niponicus.
 — Kiesenwetteri, *Lew.*
 flavicornis, *Kies.* 1874, nec
 Fabricius.
 — histrio, *Kies.*
 Malachus bipustulatus, *Linn.*
 — prolongatus, *Motsch.*
 foveifrons, *Kies.*
 — eximius.
 — xantholoma, *Kies.*
 Attalus japonicus, *Kies.*
 — elongatulus.
 Ebræus pcticollis, *Kies.*
 — chlorizans, *Kies.*
 Hyberbæus oblongulus, *Kies.*
 Carphurus plagiatus, *Kies.*
 Dasytes japonicus, *Kies.*
 — constrictus.
 Celsus spectabilis.
 Omineus humeralis.
 Prionocerus fuscipennis, *Lew.* 1879.
 Xerasia variegata.

Cleridæ, new Synonymy.

Cladiscus obeliscus, Lew. 1892.*Cymatoderma strangulata*, Kies. 1879, nec *Cladiscus strangulatus*, Chevr. 1843.*Opilo carinatus*, Lew. 1892.*Opilo niponicus*, Lew., var.*O. mollis*, L., Gorb. 1877.

Sisynophorus bicolor, Lew., 1891, I consider now belongs to the Cleridæ, not the Telephoridæ, but it is very difficult to assign any certain place for it in the Cleridæ at present.

EXPLANATION OF PLATE VI.

Fig. 1. *Paralichas higoniæ*.Fig. 2. *Eubrianax granicollis*.Fig. 3. *Silis pectinata*.Fig. 4. *Elianus rugiceps*.Fig. 5. *Drilonius striatulus*, Kies.Fig. 6. *Drilaster axillaris*, Kies.Fig. 7. *Cyphonocerus ruficollis*, Kies.Fig. 8. *Laius niponicus*.Fig. 9. *Dasytes constrictus*.Fig. 10. *Celsus spectabilis*.Fig. 11. *Omineus humeralis*.Fig. 12. *Xerasia variegata*.

XV.—Description of a new Species of Butterfly of the Genus *Amauris* obtained by Mr. Scott Elliot in East Central Africa. By ARTHUR G. BUTLER, Ph.D., F.L.S., &c.

Two examples of a very distinct species of the *A. echeria* group were obtained, both males—one taken at Ruwenzori, 5000–6000 feet alt., the other on the way from Salt Lake to Wawamba Co.

Amauris Ellioti, sp. n.

♂. Form of *A. echeria*, larger: primaries black, slightly brownish towards the base; all the markings deep ochreous, as follows:—a broad oblique spot across the middle of the discoidal cell and a second (slightly larger) before the middle of the first, or lower, median interspace, a small elongated spot above the upper extremity of the discoidal cell, a quadrid spot beyond the cell, its two upper divisions smallest, the third division largest, a bifid subcostal spot towards apex and two small spots (the upper one larger than the under) obliquely below it; three conspicuous nearly equidistant oval spots, one below each median branch towards outer margin and three nearly marginal points towards the middle of the

margin ; the general distribution of these markings, therefore, is similar to that of *A. echeria*, but their relative proportions are more nearly as in *A. lobengula* ; the quadrifid spot beyond the cell is, however, different in character from that of all the known species : secondaries browner, sericeous towards anal angle, and with the sexual patch somewhat ill-defined ; an elbowed ochreous belt occupying the basal two fifths and traversed by the black subcostal vein and part of its first branch ; a discal irregular series of eleven large ochreous spots, of which the first, sixth, and eighth are distinctly larger than the others ; a nearly marginal series of seven to eight dots in pairs, commencing from the second subcostal vein : body pitchy black-brown, with two white points on the head. Wings below brown, the apical area of the primaries and outer three fifths of the secondaries somewhat olivaceous ; all the ochreous markings paler than above, and several additional small spots or dots near to the outer margin in all the wings.

Expanse of wings 80 millim.

Two male examples.

Perhaps the most distinctive characters in this species are the position of the ochreous belt of the secondaries at, instead of a short distance from, the base, the consequent widening of the dark external area, and the great size of the spots of the discal series on these wings, reminding one of *Tirumala limniace*.

BIBLIOGRAPHICAL NOTICE.

Manual of Conchology, Structural and Systematic. Second Series.—
Pulmonata. Vol. IX. By H. A. PILSBRY. 8vo. Philadelphia,
1894.

A LONG-FELT want has been experienced by the conchological student of a sound arrangement and classification of that enormous assemblage of mollusks familiarly known as Helices. Many classifications have from time to time been proposed, but experience has shown them to be more or less unsatisfactory. Being based to a great extent upon conchological characters, or characters derived from the study of some special organ, this might naturally be expected. Perhaps the best of these arrangements was that worked out by Dr. E. von Martens in the second edition of Dr. J. C. Albers's 'Die Heliceen.' Although this work has held its own for some thirty years past, and, to a great extent, formed the basis of the last system of classification—that of Dr. L. Pfeiffer—it has long

proved inadequate to the requirements of systematists. The great increase in the number of known species, and the numerous new types which have been discovered of recent years, together with the increased knowledge of the anatomy of a large number of forms, have rendered those old classifications more or less obsolete. The volume before us will therefore be most acceptable to conchologists, for it not only furnishes us with an up-to-date classification, but one which is based upon an extensive study of the soft parts, besides those ordinal characters which may be found in the shells also. This system is not founded upon the modifications of a single organ, such as the jaw, the radula, or the shell, but all the organs of the animal, internal and external, have been taken into account with very gratifying results. The author has not only taken advantage of the anatomical researches of others, but himself has prepared more than five hundred dissections.

The two families Endodontidæ and Helicidæ are treated of in this volume. The former is divided into two tribes or sections—Polyplacognatha and Haplogona—respectively containing two and five genera. Five sections are suggested for the Helicidæ, namely, Protogona, Macrogonia, Teleophallogona, Epiphallologona, and Belogona, and these contain as many as fifty-two genera. Besides these, four other genera of doubtful affinities are included in this family. A synopsis of all the genera of these two families is followed by two keys to them, one derived from anatomical, the other from shell characters. The remainder of the forty-eight introductory pages of this volume contain remarks on the distribution of Helices in time and space, instructions with regard to the preparation of land-snails for anatomical study, and a short note on nomenclature. The bulk of the volume consists of detailed descriptions of the various genera, an account of their mutual relationship, the facts in connexion with their geographical distribution, and, finally, what will be most useful and valued by the collector, a list of the species included in each genus. The pictorial portion of the work consists of 71 plates, containing 561 figures of shells and 571 illustrating the anatomy; and of these 330 were drawn by the author.

From our own experience, and from the opinions expressed by practical conchologists, we can speak with much confidence of the great merit and usefulness of this work; and Mr. Pilsbry is to be congratulated upon the completion of a book entailing such a vast amount of research and containing a classification of such an enormous group as the Helices, which will be indispensable to the student of land Mollusca, and, indeed, will form for many years to come the standard work upon the subject treated of.

In conclusion, we would express the hope that Mr. Pilsbry may be induced to undertake a companion volume on the Zonitidæ and Agnatha, which is hinted at in his prefatory remarks.

MISCELLANEOUS.

Correction to p. 521 ('Annals,' June 1895).

SINCE I drew up (on the 19th of April) the description of the new Batrachian discovered by Mr. Quelch, I have seen the number of the 'Zoologischer Anzeiger' for April 8, in which Prof. O. Boettger describes a new Engystomatoid genus from Halmaheira under the name of *Oreophryne*. I therefore propose to change the name suggested by me to *Oreophrynella Quelchii*.—G. A. BOULENGER.

On the Production of Males and Females in Melipona and Trigona.

By J. PEREZ.

The few observations that we possess on the subject of the inner life of colonies of *Melipona* and *Trigona* were such as to lead us to suppose that, in the case of these exotic bees, the production of sexual individuals, males and females or queens, does not present any essential difference from what we know to take place in that of the hive-bee. As a matter of fact, among the large number of species of *Melipona* and *Trigona* there are some in which the phenomena take place in a precisely similar manner, and the young queens are found existing in the nest at the same time as the males. This is the case, for instance, in *Melipona scutellaris*, of which I have observed simultaneously a number of individuals of both sexes at the close of autumn, a few days before the whole colony was destroyed by the cold.

On the other hand, a nest of *Trigona clavipes*, Fabr. (*quadrangula*, Lep.), throughout the many weeks during which I was enabled to observe it, contained a fairly large number of males and not a single young female.

From the observation of a little *Trigona* from Uruguay, which I succeeded in keeping from the commencement of November 1891 until the middle of October 1894, and which consequently passed through three summers under my eyes, I have learnt some facts that were entirely unexpected.

During the first year the colony produced nothing but workers. Though I was every day on the watch, so to speak, for the slightest differences that might appear in the shape and dimensions of the freshly constructed cells, and lead one to suppose that a queen- or male-cell was being produced, I never noticed anything peculiar in the building operations, and never witnessed the emergence of any but workers.

The following year (1893), about August 10, I noticed in the centre of a comb in course of construction a cell wider and taller than the ordinary ones, above the level of which it projected by about a millimetre and a half. On August 28 the cell was open, and I soon discovered the young queen which had emerged from it, and which, owing to her light colour still more than to her size, was conspicuous against the black background formed by the population of the colony. She lived in the nest until the end of September, when she disappeared, having gone out during bright sunshine to take,

according to the expression customary in apiculture, her nuptial flight, which, however, was rendered useless by the absence of males. She did not return. Nothing more took place during the year: not a single other female nor any male emerged.

In 1894 a female cell was constructed on June 15, and several others were built in the course of July; but none came to any good. A parasitic disease seemed to have attacked the colony; many larvæ died in their cells, and they soon perished in numbers every day; the queen herself was attacked, and succumbed at the commencement of October, while the last workers died a few days later. No male had yet appeared.

It was important to see whether the workers, which were still fairly numerous when the queen died, would not set to work to make a new one for themselves, as normally happens in the case of our hive-bees when accidentally bereft of their egg-producer. Nothing of the kind took place, and this was, *à priori*, to be foreseen. In the case of the hive-bee the larvæ are fed according to their daily wants, so that, when the queen happens to disappear, the workers have only to supply some larva with the *royal jelly*, instead of the paste that produces the workers, and the selected larva, which would have become a worker, will develop into a queen. In the case of *Melipona* the cell when constructed is immediately provisioned, and receives the whole of the food necessary for the development of the larva; the queen deposits an egg in it, and the cell is at once sealed up. The larva that will be hatched in the cell will therefore develop entirely removed from any intervention on the part of the workers, and the destiny of the future bee is consequently irrevocably fixed from the very beginning. As a matter of fact, no change was made in the cells already constructed. *Trigona* is incapable of replacing, as the hive-bee does, the vanished mother of the nest.

An interesting point still to be determined was whether, as appears to be the case in certain instances, but not always, in our common bees when they have lost their queen, the faculty of oviposition would be manifested by some of the workers. Building operations were continued for several days longer; a few large queen cells were constructed at the edge of the last comb and received their store of paste. In this task the workers displayed very great activity, and often waited several hours while the queen visited the cells to perform her function. Eventually they became tired; the paste was soon delivered up to pillage, and consumed in a few moments. More than once the cells were sealed up, and it was possible to believe that an egg had been deposited in them by a worker which I had not succeeded in detecting in the act. Before long, however, the cells were reopened and the contents devoured. After being provisioned and sealed up afresh, they again underwent the same fate. Then all operations ceased, and the workers succumbed one after the other.

To recapitulate: in the space of three years a colony of *Trigona* produced a queen in the second, and virtually several queens in the third year, but never a single male. Since observations were arrested by the premature death of the queen, we are left in doubt

as to whether she would have continued throughout her life to produce only females, or whether, at a more advanced age, her progeny would have been males, as was seen in the colony of *Trigona clavipes*, mentioned above. In any case the non-simultaneous production of individuals of the two sexes in one and the same colony points, in certain species of Meliponids, to the indispensable intervention of cross-fertilization, the advantages of which are well known to naturalists.—*Comptes Rendus*, t. cxx. no. 5 (February 4, 1895), pp. 273–275.

On the Development of the Body in the Prawn (Palæmon serratus, Fabr.) and the Crayfish (Astacus fluviatilis, Gesn.). By LOUIS ROULE.

For several years past I have prosecuted researches upon the development of the two crustaceans mentioned in the title of this note. The facts that I have observed are for the most part known; but several of the principal among them have not been described with great accuracy, and the interpretations that have been given of them seem to me to be incorrect.

The ovum of these animals is chiefly composed of food-yolk; the formative yolk, at the moment of fertilization, collects into a little cicatrice, which alone produces all the elements of the embryonic economy. Contrary to what happens in the case of *Porcellio*, to the embryogeny of which I have devoted a recently published memoir*, the cicatrice does not commence by surrounding the entire ovum, to give rise afterwards to the appendages; it develops on the spot and increases slowly, while giving rise in succession to the organs and the paired limbs. The ovum of *Porcellio* is globular; the young embryo is itself spherical from the very first; it subsequently elongates, increasing in size principally in the direction of the future longitudinal axis, and thus arrives at its definitive condition. The case is different both in the prawn and in the crayfish. At the very commencement of the embryonic development of these latter forms the cicatrice divides, following a plane almost tangential to the surface of the ovum, into two superimposed parts. This cleft commences as a superficial depression, which extends across and sinks little by little into the cicatrice, dividing it in such a way that the latter, instead of remaining full and compact, appears divided into two halves, one of which is folded back beneath the other. This arrangement persists, while the cicatrice increases in size, giving rise to the appendages and the organs; the halves enlarge and preserve their relations, one of them being tucked beneath the other. Finally, when the development is concluded and the body formed, the latter lies bent double; the portion folded back corresponds to the abdomen, and the other to the cephalothorax. At the moment of hatching the curvature is effaced by the straightening of the whole, and the abdomen, assuming its

* "Études sur le développement des Crustacés."—1^{re} Partie; 1^{re} Mémoire: "Étude sur le développement du Cloporte (*Porcellio scaber*, Leach)." Annales des Sciences naturelles, Zoologie, 1894.

ultimate position, extends in the direction of the longitudinal axis of the body.

The important fact in this series of phenomena is the singular manner in which the curvature is produced. The latter does not take place gradually, by the folding upon itself of the young embryo; it appears all at once, by means of a cleft, which penetrates into the cicatrice, divides it into two planes, and increases in size with the latter. This cleft does not enter into the composition of the body; it forms part of the surrounding space and is destined to disappear. Authors have already alluded to its presence; but in my opinion they have strangely mistaken its real value. They have considered the rudiment of it as corresponding to a gastrular invagination, and this as much on account of its very early appearance as of its origin and mode of growth. On carefully following the series of embryonic stages, we perceive that this invagination in no way contributes to the formation of the digestive cavities, it remains independent of these, preserves its autonomy while increasing in size, and finally becomes the cleft which, in the embryo doubled upon itself, separates the cephalothorax from the abdomen.

A division of this kind is not peculiar to certain of the higher Crustacea; it exists, although less pronounced, in other more simple representatives of the class—in *Asellus aquaticus*, Fabr., for example. The embryogeny of the latter proceeds, as regards the extension of the cicatrice, similarly to that of *Porcellio*, at least in its general features; only the body of the young embryo, which is at first spherical, assumes the definitive elongated form by cleaving in its dorsal region, leaving the ventral portion undivided and separating the halves one from the other after the manner of two valves. This phenomenon is most important, for it represents in a relatively simple condition and at an advanced stage of development the precocious fission of the cicatrice in the prawn.

With reference to comparative embryology, this fission corresponds to a displacement in space. The body of the embryo enclosed in its egg-shell comes all at once, by its means and without any other modification, to acquire a recurved shape, which enables it to be contained in the cavity limited by the shell. Undoubtedly the cause in such a case must be sought for in the abundance of the food-yolk: the latter renders the ovum very bulky and prevents all folding back. This displacement involves very remarkable consequences with respect to the position of the rudiments of several organs. Thus, the extremity of the abdomen arises beneath and in front of the head; the anus breaks through immediately behind the mouth, and so on. These phenomena proceed from the foregoing. All the organs are afterwards restored to their places by the straightening of the body, the effacement of the curvature, and the disappearance of the cleft. Among the alterations introduced into the embryonic processes by the presence in the ovum of a large quantity of food-yolk, the production on the spot of a doubling back of the entire animal, by means of the simple formation of the free space which separates the two folded portions, is one of the most curious.—*Comptes Rendus*, t. cxx. no. 5 (February 4, 1895), pp. 271-273.

THE ANNALS

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[SIXTH SERIES.]

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XVI.—*Notes on some Genera and Species of Coccidæ.*
By W. M. MASKELL, New Zealand.

1. *The Genus Dactylopius.*

ABOUT seven miles from the town of Wellington, in New Zealand, is a flat valley, about 10 miles long and perhaps 2 or 3 wide at the base, through which the lower part of the river Hutt flows into the head of Wellington Harbour. The land in this valley, which has been subject to innumerable overflows of the river, is very rich, and is mostly taken up by small farms or market gardens, and much fruit is grown there. During the summer of 1894-95 (September to March) the gooseberry-trees in these gardens and the grape-vines in the glasshouses were subject to a very annoying attack by an insect which was readily recognized as a "mealy-bug," but which had not previously appeared in such great numbers. After awhile the depredations of the insects became so bad and their numbers so large that quite a "scare" was produced, and the usual talk began of applying to the government for assistance. Many fruit-growers used remedies in the form of sprayed liquids, but seemingly without much success; and as I write the pest seems (from the accounts I have had) to be nearly as bad as ever.

Specimens of the insects were submitted to me for identification, and I was particularly asked to say whether the insects

on the gooseberries out of doors differed from those on the vines under glass. After careful examination I found that the two were essentially identical, and that they corresponded almost exactly with the species known in Europe as "*Dactylopius adonidum*," or the common mealy-bug. I say "almost exactly," because neither in them nor in any similar insects have I ever been able to detect one external character which is mentioned by Signoret ('Annales de la Soc. Entom. de France,' Dec. 23, 1874, p. 307) and also by Douglas ('Entom. Monthly Magazine,' vol. xxv. p. 314) in their descriptions of this species, viz.:—"Une bande brune sur le milieu du dos" (*Sign.*); "a broad brown or livid band-like shade" (*Dougl.*). During my study of Coccidæ, which extends now over twenty years, I have persistently endeavoured to minimize the importance of mere external colours and to lay stress upon anatomical characters only. But the occurrence of this insect in such suddenly injurious numbers, and its consequent importance, here led me to look into this question more closely in regard to the whole genus *Dactylopius*, and to try to tabulate, if possible, a principal character which might serve for ready differentiation in future.

I may say here that I am clearly of opinion that the insect in the Hutt Valley is not indigenous to New Zealand. All the European species of *Dactylopius* (so far as I know) exhibit on their lateral margins a number of white cottony tassels of varying length. In New Zealand I have described seven species believed to be indigenous, and none of them possesses this very distinct feature. Moreover, although the Hutt Valley was in former times very densely clothed with heavy forest, it is now almost entirely cleared. Further, the Coccids in question have appeared only in gardens and houses devoted to European plants.

The insects belonging to the genus *Dactylopius* may vary a good deal in their external appearance, and amongst the fifty or sixty which have been described some are aerial, some subterranean, some simply covered with thin meal, some having, in addition, cottony tassels, while others surround themselves with masses of cotton, and others form separate cottony sacs. Probably the best character by which to separate the species is one which requires by no means a difficult examination—I mean the relative lengths of the antennal joints in the adult female. This character may be very well made out without any long and tedious preparation of a specimen, and is therefore useful as a first guide to identification. I am not to be supposed to ignore other perhaps very distinct characters.

One of the reasons which led me to attach the Hutt Valley insects to *D. adonidum* was the exact correspondence of the adult female antenna with that of the European species; and for comparison I had the advantage of possessing not only the descriptions and figures of Signoret, Comstock, and Douglas, but also a mounted specimen of *D. adonidum* from Paris, which had been sent to me (unmounted, *in situ*) by Dr. Signoret himself. I am obliged here to draw attention to a rather curious error in Professor Comstock's description (Rep. of Entom. U.S. Dep. Agric. 1880). He there says:—"The antennæ are composed of eight joints, of which the eighth is the longest, and the third *and* the second, fourth and fifth the shortest and of equal length." This is meant to be translated from Signoret; but Signoret's words are "huit articles, dont le huitième le plus long, puis le troisième et le second, quatrième et cinquième d'égal longueur et les plus courts," which very clearly means that the third and second come next to the eighth and the fourth and fifth are the shortest and equal; and this is borne out by the actual specimens, as I show in the table below. The error is quite excusable, the original French being rather obscure; but it might lead to much confusion.

The following table will show the *formulæ* of the antennal joints in the species already described. For convenience I have grouped these species in the first place according to their external appearance, with or without cottony tassels, sacs, &c. The figures give the sequence of the joints, beginning with the longest, and those which are bracketed are intended to mean *equal* or *subequal*, the first in a bracket being perhaps longer than the others.

GENUS DACTYLOPIUS.

Section I.—*Exhibiting dorsal meal and lateral cottony tassels.*

Species.	Author.	Locality.	♀ antennal formula.
<i>adonidum</i> (Linn.)	Signoret.	Europe.	8321 (67) (54).
<i>affinis</i>	Maskell.	Australia.	83215 (746).
<i>alaterni</i>	Signoret.	Europe.	832 (4567) *.
<i>brevipes</i>	Cockerell.	West Indies.	(38)(12)(54)(67).
<i>bromeliæ</i> (Bouché)	Signoret.	Africa; India.	(238) 1 (4567).
<i>ceratonie</i>	Signoret.	Europe.	8237456 *.
<i>citri</i> (Boisduval)	Signoret.	Europe.	(38) 2 (57) (46) *.
<i>Crawii</i>	Coquillett.	N. America.	(238) 5 (47) (61).
<i>cyperii</i>	Signoret.	Europe.	8 (32) (567) 4 *.
<i>destructor</i>	Comstock.	N. America.	83 (27) (56) 4 *.
<i>ephedre</i>	Coquillett.	N. America.	8 (23) 561 (47).
<i>ficus</i>	Signoret.	Europe.	83 (24567) *.

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Species.	Author.	Locality.	♀ antennal formula.
<i>hoyæ</i>	Signoret.	Europe.	?
<i>indicus</i>	Signoret.	Europe.	38 (2765) 4*.
<i>lavandulæ</i>	Signoret.	Europe.	38 (67) 2 (45)*.
<i>liliacearum</i> (Bouché) ..	Signoret.	Europe.	?
<i>lobulatus</i>	Maskell.	Australia.	823645 (71).
<i>longifilis</i>	Comstock.	N. America.	832 (15) 467.
<i>mamillaræ</i> (Bouché) ..	Signoret.	Europe.	8234 (567)*.
<i>nipæ</i>	Maskell.	Demerara.	8 (317) (246) 5.
<i>pteridis</i>	Signoret.	Europe.	382 (4567)*.
<i>robinia</i>	Signoret.	Europe.	382 (576) 4*.
<i>Ryani</i>	Coquillett.	N. America.	(238) 1 (457) 6.
<i>solani</i>	Cockerell.	West Indies.	82 (31) 7 (56) 4.
<i>talini</i>	Green, MS.	Ceylon.	831257 (46).
<i>theobromæ</i>	Douglas.	S. America?	8 (32) 1 (576) 4.
<i>tuliparum</i> (Bouché) ..	Signoret.	Europe.	?
<i>viburni</i>	Signoret.	Europe.	(38) 2 (54) 67*.
<i>vitis</i> (Niedielski)	Signoret.	Europe.	3824567*.
<i>Walkerii</i>	Newstead.	Europe.	83 (1245) (67).

Section II.—*Without lateral cottony tassels; often with much cotton, but not forming separate sacs or cushions.*

<i>acaciæ</i>	Maskell.	Australia.	71 (24) (36) 5.
<i>arecæ</i>	Maskell.	New Zealand.	83 (21) 4567, or 73 (21) 4 (56).
<i>aurilanatus</i>	Maskell.	New Zealand.	38 (456721)
<i>calceolaria</i>	Maskell.	New Zealand; Fiji; West Indies.	28153 (46) 7.
<i>cocotis</i>	Maskell.	Fiji; India.	8231 (4567), or 7 (231) 465.
<i>ericicola</i>	Maskell.	Australia.	7 (213) (65) 4.
<i>eucalypti</i>	Maskell.	Australia.	345 (216) 7.
<i>filamentosus</i>	Cockerell.	N. America.	7 (12) (34) (56).
<i>glaucus</i>	Maskell.	New Zealand.	831 (257) (46).
<i>iceryoides</i>	Maskell.	New Zealand.	812 (357) (46).
<i>mexicanus</i>	Cockerell.	Mexico.	384 (215) (67).
<i>poæ</i>	Maskell.	New Zealand.	8 (23) 1 (4567).
<i>simplex</i>	Cockerell.	West Indies.	(83) 217 (456).
<i>virgatus</i>	Cockerell.	West Indies.	(83) 214 (567).

Section III.—*Without cottony tassels; forming cushions of cotton.*

<i>albizziæ</i>	Maskell.	Australia.	81 (24) 3 (567), or 71 (24) 3 (56).
<i>herbicola</i>	Maskell.	Australia.	8 (12) (34) (56) 7, or 7 (12) (34) (56).
<i>hibbertiæ</i>	Maskell.	Australia.	8 (1234567).

Section IV.—*Without lateral cottony tassels; employing a plant-scale as a covering.*

<i>obtectus</i>	Maskell.	New Zealand.	8 (1234567).
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Section V.—Without lateral cottony tassels; forming separate cottony sacs.

Species.	Author.	Locality.	♀ antennal formula.
<i>alpinus</i>	Maskell.	New Zealand.	(8312) (456) 7.
<i>globosus</i>	Maskell.	Australia.	8 (231) 5 (467), or 7 (241) 356.
<i>graminis</i>	Maskell.	Natal.	8 (345) (721) 6.
<i>lobulatus</i>	Maskell.	Australia.	823645 (71).
<i>Steelii</i>	Cockerell.	N. America.	8 (12) 3 (4567).
<i>Townshendi</i>	Cockerell.	N. America.	7 (123) 465.
<i>vastator</i>	Maskell.	Sandwich Isl.	7 (21364) 5.

In the foregoing list *D. lobulatus* appears twice, for the reason that it exhibits the lateral tassels and also constructs a cottony sac.

In the insects marked * I find no mention of the first antennal joint. As a rule this joint is nearly equal to the second, but there are exceptions.

I incline to the belief that *D. hoyæ*, *D. liliacearum*, and *D. tuliparum* are only synonyms of *D. adonidum*.

Cockerell ('Entomologist,' 1893, p. 267) says that *D. destructor*, Comstock, "is now regarded as a synonym of *citri*." The antennal formulæ of the two, according to the foregoing list, indicates some difference.

In my 'Further Coccid Notes,' 1894, just published, I describe *D. vastator* from the Sandwich Islands, and mention that it approaches the Mexican species *D. Townshendi*, Cockerell. Here, again, the antennal formulæ indicate divergence, although in this case I think that probably it is not sufficiently marked to constitute by itself a *specific* character. But, taking it in conjunction with the differences noted by me in the feet, spinnerets, and marginal spines, I shall still for the present leave *D. vastator* separate.

D. theobromæ, Douglas, is placed by its antennæ very close indeed to *D. longifilis*, Comstock, and not far from *D. ficûs*, *D. pteridis*, and *D. brevipes*; and *D. talini* would also come into this group were it not for another character (long radiating glassy threads) which distinguishes it.

On the whole, whilst these "antennal formulæ" cannot be considered as decisive for the whole genus *Dactylopius*, I believe that they may be very fairly used to separate the species belonging to Section I.; indeed, they are probably the best guides for that section. As regards the other sections, they may be usefully considered in conjunction with other characters, and may often indicate near relationships; for example, in Section II. *D. simplex* and *D. virgatus* are

remarkably close to each other, with a variation only in the seventh joint, and as (from the descriptions given) there seems to be no other important differentiating character, these two will very likely be found to be identical, or, at most, varieties. In Section III. all the three species have nearly identical formulæ; but there is a marked difference between the cottony secretion of *D. herbicola* and those of the others, and *D. albizzia* also differs a good deal in the same particular from *D. hibbertia*. As for *D. obtectus*, whilst its formula is near to those of *D. alpinus* and *D. Steelii*, the employment by it of the plant-scales as a shelter is amply sufficient for separation.

2. The Genus *Planchonia*.

For several years past I have been endeavouring to establish the fact that all the forms which have been placed by various observers under the several names of *Pollinia*, *Asterolecanium*, *Lecaniodiaspis*, *Planchonia*, are really only variations or species of one genus; and I have affirmed that all these names, with the exception of *Planchonia*, ought to be abandoned. To that opinion I still adhere; and the more I am enabled to examine insects of this kind, the more I am convinced that my view is correct. In this place I may observe that, whilst hitherto I have not devoted much space to *Pollinia* and *Lecaniodiaspis*, these two are not really different from the others. It has been thought by some that *Pollinia* is characterized by the absence of a marginal fringe; yet it has precisely the same spinnerets as *Planchonia*, and, besides, the marginal fringe is by no means always conspicuous in any species; I have seen a twig covered with scores of insects, of which at least half exhibited no fringe at all, while the rest had a very fine one. *Lecaniodiaspis*, on the other hand, is said to differ from *Planchonia* by the presence of antennæ; but this, taken alone, and without any other distinguishing character to be made out, is surely an insufficient basis for the erection of a new genus, more especially as in *Planchonia* itself the antennæ are present, although in an atrophied or rudimentary form.

Consequently I stand by the sole genus *Planchonia* as far as this particular section of Coccidæ is concerned. Now in my paper (Trans. New Zealand Institute, 1894) I have divided this genus into three groups:—

1. Females having subcircular or elliptical tests;
2. Females having narrow elongated tests;
3. Females having irregular tests.

For the present I propose to consider only the first of these, leaving the others for future enquiry. This group may be said to include the following forms reported up to the present by various authors in different countries:—

1. *Planchonia* (*Pollinia*) *costæ*, Targioni.
2. — (*Asterolecanium*) *aurea*, Boisduval.
3. — (—) *quercicola*, Bouché.
4. — (—) *bambusæ*, Boisduval.
5. — *fimbriata*, Boyer de Fonscolombe.
6. — *arabidis*, Lichtenstein.
7. — *hederæ*, Lichtenstein.
8. — *epacridis*, Maskell.
9. — *stypheleæ*, Maskell.
10. — (*Lecaniodiaspis*) *sardoa*, Targioni.
11. — *oncidii*, Cockerell.
12. — *pustulans*, Cockerell.
13. — (*Lecaniodiaspis*) *yuccæ*, Riley.
14. — (*Asterolecanium*) *massalongiana*, Targioni.
15. — *ventruosa*, Maskell.

Three of the foregoing—*P. arabidis*, *P. hederæ*, and *P. yuccæ*—have never yet, so far as I am aware, been fully described, and cannot be included in our consideration on that account. I do not, however, think it probable that they will be found to depart in any important manner from the type.

I am not acquainted with *P. massalongiana*.

During the last summer (in February 1895) I received from Mr. R. J. Kingsley some twigs of oak trees thickly covered with thousands of insects, which I at once recognized as a species of *Planchonia*. I was informed that they are doing great damage to oaks near Nelson, in this colony, and I have heard subsequently that they have been noticed there for twelve or fourteen years. I found that these insects, both in their tests and in their anatomical characters, corresponded exactly with specimens which had been sent to me of *Planchonia quercicola*, Bouché, by Dr. Signoret about 1880. The occurrence of this species here in such numbers led me to look more closely still into the relationships of the genus *Planchonia*, and to cast about to find, if possible, some character which would be better adapted for proper discrimination than the mere outward appearance or colours of the test and the fringe. As regards the test, several writers have laid stress upon the differences which they have detected between "yellow" and "green" or "yellowish" and "greenish." I have found it many times very difficult to satisfy myself (although not in the least colour-blind) as to what specimens

have been "yellow" and what "green." The fringes, again, are sometimes white and sometimes pink; and authors have used these as separating characters. But I have found species in which the fringe varied in colour according to the bark of the twig they were on; so that this also is fallacious. Taking the insects themselves, it is also very difficult to detect differences. All of them are of a more or less sub-globular, elliptical, slightly tapering form. None of them exhibit any feet. All (with the exception of *P. sardoa*) have quite atrophied antennæ. All have precisely similar rostra and setæ. But it occurred to me that possibly some clue might be obtained from the arrangement of the peculiar figure-of-eight spinneret-orifices, pores, or glands (or whatever they are) which are common to all the species, but which do show, when closely examined, certain differences.

With this object I have studied with some care a number of prepared specimens, with the result that I find them as follows:—

One marginal row of 8's; one row of simple orifices; no dorsal 8's or tubes	<i>fimbriata.</i>
Do. Do. Do.	<i>quercicola.</i>
Do. Do. Do.	<i>pustulans.</i>
Do. Do. Do.	<i>epacridis.</i>
One marginal row of 8's; one row of simple orifices (not numerous): many dorsal tubes	<i>stypheleæ.</i>
One marginal row of 8's; one row of simple orifices; scattered 8's on dorsum (not numerous)	<i>bambusæ.</i>
One marginal row of 8's; one row of simple orifices; scattered 8's on dorsum (numerous)	<i>oncidii.</i>
Two marginal rows of 8's; scattered (numerous) simple orifices.	<i>ventruosa.</i>

According to this classification *epacridis*, *pustulans*, and *quercicola* would be varieties of *fimbriata*; *stypheleæ* would be close to them, but removed by the dorsal tubes which spring from simple orifices; *oncidii* would be a variety of *bambusæ*; and *ventruosa* would stand alone. As for *costæ*, *sardoa*, and *massalongiana*, I imagine that they will be found hereafter to be very close to *fimbriatu*.

I fully acknowledge that there are many difficulties in the way of a satisfactory arrangement of this very peculiar genus; and I admit that the external appearance and colours of the tests do vary somewhat, *e. g.* as between *epacridis* and *quercicola* or *oncidii* and *bambusæ*. Yet it is, to me, undoubted that the real basis of all study of Coccidæ ought to be the study of the characters of the insects themselves, much more than that of their external coverings. I have already (in my paper of 1893, N. Z. Transactions, vol. xxvi.) observed how

easily one can mistake a Psyllid for a Coccid by considering only the waxy pupal test; and if it is so easy to make such a mistake between two different families, how much more so would it be to confuse two species of the same genus. There is little risk of such a thing if the characters of the insects themselves are made the principal points of separation.

3. *The Antennal Joints of Coccidæ.*

The study of Coccids differs from that of most other insects in that, as a rule, their extreme minuteness obliges us to adopt means of classification which are not necessary amongst the Lepidoptera, Coleoptera, &c. Moreover, in a large proportion of cases they not only are so covered by different kinds of secretion as to make it nearly impossible to judge from external marks or colours on the epidermis, but also usually shrivel up and become deformed at gestation, so that their very form is not a sure guide. Consequently, in order to arrive at anything like a clear classification, we have to use such characters as the number of antennal joints, the arrangement of certain hairs or processes, the form and proportions of the feet, and so on—things which, to a lepidopterist, for example, would seem absurd and useless.

In a very interesting paper by Herr Karel Sulc, published at Prague in 1894, on a new Coccid named by the author *Ortheziola Vejdovskyi*, it is stated that one of the characters separating this from the genus *Orthezia* is "the number of joints of the antennæ (in *Orthezia* 8-9, in *Ortheziola* 3 only)," and in the description of the insect Herr Sulc says: "the head is furnished with two frontal processes, to the apex of which are attached the antennæ." In the excellent plate appended to the paper the antennæ and the "processes" are clearly shown (figs. 2 and 8).

I have ventured to draw the attention of Herr Sulc to the fact that in this description he is departing from the usual custom of students of the Coccidæ, which has hitherto been to consider what he terms the "frontal process" as the first joint of the antenna. I cannot affirm that the rule is absolute and universal, as there are exceptions; but it has been followed by such authorities as Signoret, Targioni, Comstock, &c., and, I think, by all the modern writers. Indeed, Herr Sulc, in the sentence quoted above, ascribes to the adult *Orthezia* "8-9 joints," which cannot be, unless the "frontal process" is counted as one; and in a paper of his own, in the 'Entomologist's Monthly Magazine,' February 1895, he

gives to *Lecanium Douglasi* the normal antenna of eight joints, including of course the "process."

Beyond the question of uniformity in dealing with Coccid classification, there remains of course the further one, whether the usual system is correct or not. In one sense it would not matter much which course might be followed: if we all agreed to ignore the "first joint," we should simply have to reduce by one the numbers given by authors hitherto. Yet I think there is a point which may be useful as indicating a real reason for the rule. In my paper of 1893 (Trans. N. Z. Institute, vol. xxvi. p. 86) I mentioned that in the Dactylopinæ and Acanthococcinæ the "anal tubercles" seem usually to be more chitinous than the rest of the abdominal epidermis, and that in nearly all Coccids the antennæ, feet, and rostrum present the same character. Since seeing Herr Sulc's paper I have examined a large number of specimens of many genera, mounted after preparation with potash, and find that whilst there is, almost without exception, a clear difference noticeable between the antenna and the epidermis of the head, that difference is as clear in the first joint as it is in the others. A difference indeed, such as I refer to, may be seen in fig. 2 of Herr Sulc's plate of *Ortheziola*. This being so, I cannot help thinking that a feature which pervades the whole Coccid family may be accepted as showing that the so-called "frontal process" is a part of the antenna rather than a part of the head. In fact, as we do not consider the coxa of the foot as only a "lateral process" of the thorax, but as really the first joint of the foot, it seems that we ought also rightly to speak of the first joint of the antenna as springing direct from the head. According to this view, *Ortheziola Vejdovskyi* will have antennæ of *four* joints.

It may be admitted that the question here raised is quite open to discussion; and some entomologists may possibly deem it unimportant, though it has some importance in the study of Coccids, which, as remarked just now, must proceed on somewhat different lines from that of other insects.

Wellington, New Zealand,
May 1895.

XVII.—Description of Two new Spiders obtained by Messrs. J. J. Quelch and E. McConnell on the Summit of Mount Roraima, in Demerara; with a Note upon the Systematic Position of the Genus *Desis*. By R. I. POCOCK, of the British Museum.

MYGALOMORPHÆ, Poc.

Family Theraphosidæ, Thor.

Subfamily BARYCHELINÆ, Sim.

Genus CYRTOGRAMMOMMA, nov.

This genus is most nearly related to *Idiophthalma* of Cambridge. The characters of the two may be contrasted as follows:—

IDIOPHTHALMA.—Posterior row of *eyes* much wider than anterior row (nearly twice as wide), distance between anterior lateral eyes about twice a diameter.

Cephalothoracic fovea strongly procurved (*teste* Simon; the type in the British Museum of *I. suspectum*, Cambr., has been pinned through this spot).

Mandibular rake formed of a single transverse series of shortish spiniform teeth.

Labium without teeth; *maxillæ* with only two teeth.

Legs short and robust.

CYRTOGRAMMOMMA.—Posterior row of *eyes* only slightly wider than anterior; distance between anterior laterals about four times a diameter.

Cephalothoracic fovea strong and straight.

Mandibular rake merely represented by a few spiniform setæ, which are only a little stouter than the normal setæ which clothe the rest of the mandible.

Labium wider than long, almost unarmed, furnished with 3 spinules; *maxillæ* furnished with a small cluster of irregularly arranged spinules.

Sternum circular, with marginal impressions.

Legs longer and thinner.

Cyrtogrammomma monticola, sp. n.

Colour a uniform coffee-brown.

The entire *body* covered with a clothing of short hairs.

Carapace high, oval, much longer than wide, the length equal to the patella and tibia of the first leg, the width to the

tibia and half the patella; ocular tubercle spherical, ocular area a trifle wider than long; median eyes a little larger than the anterior lateral, and separated from them by a space which slightly exceeds their diameter; posterior lateral eye smaller than anterior lateral, but about twice as large as the posterior median, which are situated quite close to them, but about their diameter's distance from the anterior median.

Mandible with external surface naked below; the inferior margin armed internally with 8-9 strong teeth and a few minute granules behind; fang long, slender, and smooth.

Legs long and slender, 4, 1, 2, 3, the fourth exceeding the first by the length of its tarsus; protarsi of first and second scopulate nearly to the base, of third scopulate in its distal half, of fourth scopulate at the apex; tarsal scopulæ of first and second legs entire, of third and fourth intermixed with setæ and rather thin; unguis large; legs 1 and 2 almost unspined, although some of the setæ are stout; a series of spiniform setæ on the upperside of the femur of the first and one on that of the second; two upon the lower surface of the tibiæ and one at the base of the scopula on the protarsi; tibiæ and protarsi of posterior legs copiously spined; patellæ of all the legs unspined, but furnished with a distinct posterior wart; claws with a single series of five strong teeth on their outer edges.

Tibia of *palp* with several long spines below.

Internal *spinners* short and contiguous; external with the basal segment the longest, stoutest, and geniculate, the apical small and rounded.

Measurements in millimetres.—Total length 14; length of carapace 6.5, width 5; length of first leg (from base of femur) 16, of second 15, of third 14, of fourth 20.

A single female example from the summit of Mount Roraima (8500 feet).

ARACHNOMORPHÆ, Poc.

Family Anyphænidæ.

Genus AYSHA, Keyserling.

(‘Die Spinnen Amerikas: Brasilianische Spinnen,’ 1891, p. 129.)

Aysha Quelchii, sp. n.

♂.—*Colour.* Carapace, palpi, coxæ, and femora of legs reddish yellow; mandibles, sternum, and distal extremities of the legs much darker; abdomen bluish black, without any very definite pattern.

Carapace high, heart-shaped, longer than broad, its length about equal to the length of the femur of the first leg; width equal to length of tibia of third leg.

Ocular area transversely elongate, much wider than long, anterior median eyes about half the size of the rest, which are subequal; *eyes* of anterior row viewed from above rather strongly recurved, when viewed from the front about straight, the distances between the individual eyes narrow and about equal to the radius of a median eye; eyes of the posterior row slightly procurved, the space between the median nearly equal to their diameter, space between median and lateral rather greater; all the eyes are round, the anterior median being dark-coloured, the rest pale. *Clypeus* about equal to twice the diameter of the anterior median eye.

Mandibles long and strong, narrowed, diverging a little distally; edges of the groove upon which the fang closes toothed, the posterior edge with 6 small teeth, the anterior with 5 much larger teeth; in front of the latter and extending to the base of the fang is a cluster of long setæ.

Labium more than twice as wide as long, a little narrowed distally, with lightly emarginate anterior border.

Maxillæ surpassing the labium by more than a third of their length, rectangularly pointed at the apex, the inner edge of the apex straight and strongly hairy, the outer convex and bearing a strong serrula.

Legs 1, 2 and 4, 3 with robust femora and very slender protarsi and tarsi; femora 1 and 2 armed above with 9 long filiform spines, 3 and 4 with 7; unarmed below; tibiæ with 12 long spines below and at the sides; patella armed with 1 posterior spine; protarsi with many spines, intermixed with hairs; tarsi not spined, thickly hairy below, the unguis tufts conspicuous; claws furnished with 5 (? more) very long and strong teeth.

Palpi with femur bowed, armed above with 4 spines; patella armed above with about 3 spines; tibia excelling the patella by about one third of its length, armed with 3 long spines above; its lower surface furnished distally with two processes—a smaller simple conical internal one and a large bifid laminate external one; on the proximal side of these a deep smooth depression or notch; tarsus oval, far surpassing the bulb, for structure of which see figure (p. 142).

Distance between the tracheal slit and the spinners more than three times as great as the distance between the tracheal slit and the generative orifice.

Anterior mammillæ much thicker and a little shorter than the posterior.

Measurements in millimetres.—Total length 11; length of carapace 5·5, width 4; length of first leg 21, of second 20, of third 16·5, of fourth about 20.



Loc. Summit of Mount Roraima, 8500 feet. An adult male and an immature female.

The genus *Aysha* is essentially Neotropical in its distribution. The known species have been recorded from St. Domingo, Bogota, and Rio Grande do Sul.

Note.—From a morphological point of view the genus *Aysha*, and, indeed, the entire group of the Anyphænidæ, is of considerable interest on account of the retention by the tracheal stigma of a more primitive position than is found in most dipneumonous spiders. In the genus *Anyphæna* the aperture in question is placed almost in the middle of the area that lies between the generative orifice and the spinning-mammillæ. In *Aysha*, however, it is even further forwards, and lies, as stated in the description given above, in the anterior fourth of this area, that is, only very slightly behind the position that the tracheal stigmata occupied when first formed in the embryo, although showing the specialization of union. In most families of Arachnomorphæ these stigmata have travelled the greatest possible distance over the abdominal ventral surface, and have been compelled to halt immediately in front of the spinning-mammillæ. Leaving aside the so-called Cribellatæ and Haplogynæ, and turning to the Ecribellate Entelegynæ*, we find that the tracheal stigmata are removed from the mammillæ in a few groups, namely in the Argyronetidæ, Anyphænidæ, and in two genera allied to *Pachygnatha*. In the case of the Anyphænidæ and the allies of *Pachygnatha* the abnormality is difficult to explain; but in *Argyroneta* it is probably connected with the aquatic life of the animal. There are, however, other spiders which are known to live in the water, namely *Desis* and *Robsonia*, which

* I here use these terms merely for convenience' sake, and without in any way wishing to pledge myself to a recognition of the groups they signify.

frequent the coral-reefs and rocky pools of the Austro-Malayan and New Zealand seas. To discover, if possible, whether their mode of life has affected their breathing-organs in any way comparable to what has occurred in *Argyroneta*, I examined specimens of *Desis Martensii* from Singapore and an example of *Robsonia marina* from New Zealand, with the immediate result of finding a conspicuous slit-like tracheal aperture in the posterior half of the abdominal region, but well in advance of the spinning-mammillæ. The shape of the aperture is slightly procurved; its anterior lip is smooth and at the sides has a thickened horny rim, which defines more clearly the position of the trachea inside. In one specimen in which the aperture was more agape than in others there appeared to be a distinct membranous partition passing from the anterior to the posterior wall of the cavity, apparently indicating that, although the two stigmata are sunk within a fold of the integument, no actual union between them has taken place.

Now these two genera, *Desis* and *Robsonia*, are usually referred to the family Agalenidæ; but it appears to me that this anterior position of the tracheal stigma, taken in conjunction with other well-established peculiarities of these spiders, justifies their elevation to the rank of a special family, which may be called Desidæ.

Another interesting fact, moreover, has been ascertained from looking into the literature of this group. This is the identity between the spider named *Dandridgia dysderoides* by White and *Robsonia marina* by Hector. The latter was described by its author as an *Argyroneta*, but it subsequently received the name *Robsonia* from the Rev. O. P. Cambridge. The last-named author considered this genus to be different from *Desis* of Walckenaer. The type of the latter genus I unfortunately do not know; but it appears to me to be very doubtful whether the New Zealand *marina* can be looked upon as generically distinct from the Singapore species *Martensii*. They seem to be nothing but well-marked species of the same genus, as Mr. Powell supposed. If this be so, the synonymy of the species will stand as follows:—

Desis marinus (Hector).

Dandridgia dysderoides, White, Proc. Zool. Soc. 1849, p. 5 (the specific name *dysderoides* being preoccupied by Walckenaer for the type species of *Desis* cannot be maintained for this one).

Argyroneta marina, Hector, Tr. N. Z. Inst. x. p. 399 &c. (1877).

Desis Robsoni, Powell, Tr. N. Z. Inst. xi. p. 263 (1879).

Robsonia marina, Cambr. Proc. Zool. Soc. 1879, p. 686.

If, however, this species is generically distinct from the type of *Desis*, it must be known by the names that White ascribed to it.

XVIII.—*Natural History Notes from H.M. Indian Marine Survey Steamer 'Investigator,' Commander C. F. Oldham, R.N., commanding.*—Series II., No. 18. *On a new Species of Viviparous Fish of the Family Ophidiidæ.* By A. ALCOCK, Superintendent of the Indian Museum.

Family Ophidiidæ.

DIPLACANTHOPOMA, Günther.

Diplacanthopoma, Günther, 'Challenger' Deep-sea Fishes, p. 115.

Diplacanthopoma Rivers-Andersoni, sp. n.

The tail (caudal included) is not quite half, the head is considerably more than one fourth, the height of the body is about one fifth of the total length (caudal included).

The head (including the branchiostegal rays and the greater part of the isthmus, but excluding the occiput), and also the greater part of the dorsal and anal fins, are invested in a thick glandular scaleless skin, which is of a much darker colour than, and is very definitely delimited from, the scaly covering of the body. The head is without any armature except the two sharp, flat, oblique spines, which project freely, one at the upper, the other at the lower angle of the operculum.

The eye, which is about two thirds the length of the depressed snout and between one sixth and one seventh the length of the head, is sunk beneath thick transparent skin, without any orbital fold.

The nostrils are situated one in front of the eye, the other near the tip of the snout, on either side.

The mouth is large; the maxilla, which reaches a little behind the after limit of the eye, is half the length of the head, and is not overhung by the snout, but overlaps the mandible. Villiform teeth are present in bands on the jaws, vomer, and palatines, the bands on the jaws being rather widely interrupted at the symphyses. The tongue is short and broad and has only the tip free.

The gill-openings are extremely wide; the branchiostegal rays are eight in number and their membranes are quite free; there are three large lanceolate gill-rakers on the outer border of the first arch, but elsewhere the gill-rakers are tuberculi-form. There are no traces of pseudobranchiæ.

The lateral line appears to have been present only on the anterior part of the trunk.

The dorsal fin begins about an eye-length behind the level

of attachment of the pectoral rays; it and the anal are continuous with the caudal.

The pointed pectorals are not much more than one third the length of the head, and the ventrals are still shorter.

The ventrals, which are inserted less than an eye-length behind the pectoral symphysis, consist on each side of a single ray, which, however, has its surface fluted, as if it were made up of several rays bound together and fused.

The stomach is siphonal; the intestine is in three long folds, and, as in *D. brachysoma*, there are no pyloric cæca. A large thick-walled air-bladder is present.

The ovaries, which open on a fleshy cushion behind the vent, are, in the single specimen obtained, closely packed with embryos and ova.

Colours in spirit: body purplish brown; head much darker, inclining to the colour of the fins, which are purplish black.

Total length a little over 15 inches.

Loc. Arabian Sea, lat. 22° 14' 25" N., long. 67° 8' 55" E., 947 fathoms.

The present species differs from *Diplacanthopoma brachysoma*, Gthr., in the following particulars:—

1. It is much larger and is viviparous. The 'Challenger' specimen of *D. brachysoma* is stated to be $4\frac{1}{2}$ inches long; and a single female of *D. brachysoma* dredged by the 'Investigator' in 1888 is $4\frac{1}{4}$ inches long, and has ovaries full of large ova in which no traces of an embryo can at the present moment be detected.

2. The length of the head is not half the combined length of the head and trunk; whereas in *D. brachysoma* the head is more than half this measure.

3. The eye is smaller, its length being two thirds that of the snout, less than one sixth that of the head, and not very much more than half the width of the interorbital space; whereas in *D. brachysoma* the eye is as long as the snout, one fifth the length of the head, and equal to the width of the interorbital space.

4. The dorsal fin arises an appreciable distance behind the base of the pectoral; whereas in *D. brachysoma* it arises immediately behind the base of the pectoral.

5. The ventral fins arise at the level of the posterior border of the operculum, instead of beneath the middle of the operculum as in *D. brachysoma*.

In other respects, as well as in general appearance, the two species have the closest resemblance.

The ovaries of *Diplacanthopoma Rivers-Andersoni* consist of a densely packed mass of embryos and ova enclosed in a thin but extremely tough capsule. The capsule is abundantly supplied with blood by the ramifications of a large branch of the mesenteric artery.

There is no attachment or adhesion of any kind between the ovarian capsule and its contents.

The embryos form a thick surface layer immediately beneath the capsule, enclosing a central mass of largish (a little over 1 millim. diameter) ova, which consist entirely of yolk-spherules, without any trace of an embryo or even of a germinal area.

Whether these unchanged ova would have developed subsequently to the birth of the present superficial layers of embryos, or whether they were destined for the intra-ovarian nourishment of the present embryos, are questions which it is impossible in an isolated case to discuss; but from their large size, which precludes any suggestion of immaturity, it would seem probable that they were intended for present use rather than for a future brood.

The embryos, which are long and eel-like—6 to 8 millim. long—lie matted together, and firmly adhering to one another by their tails by means of a coagulated secretion.

The vertical fins only are represented by a long fold of integument, which runs from the occiput, round the tip of the tail, to the vent. This fold of integument consists of layer upon layer of large-nucleated cells. The remains of the yolk-sac are enclosed in the abdomen, causing a bulging of the abdominal wall along its whole length, from the throat to the vent; but there is no vitelline constriction or pedicle.

I am inclined to think that the vertical fold of the integument, which is really only an extended sheet of embryonic cells, is an absorbent (nutritive) surface, somewhat as in the embryos of certain fishes of the family Embiotocidæ, in which the interradian membranes of the vertical fins have been shown to play the part of a foetal placenta.

In the present case, however, there is no vascular connexion, at any rate on the foetal side; and I am inclined to think that the nutrient material is absorbed not so much from the thin tough ovarian capsule as from the ovary itself, namely from those ova in which no trace of a germinal vesicle can be found.

An embryo taken at random measures 8 millim., namely 2 millim. from the snout to the vent and 6 millim. from the vent to the tip of the tail.

XIX.—*Further Notes on Cutiterebra: On the Identity of certain Species described by the late Bracy Clark.* By E. E. AUSTEN, Zoological Department, British Museum.

Cutiterebra atrox, Clark.

In the May number of this Magazine (Ann. & Mag. Nat. Hist. ser. 6, vol. xv. p. 378) I suggested that a species of *Cutiterebra* from Trinidad, which I there described as *C. funebris*, sp. n., might after all prove to be identical with *C. atrox*, Clk., from Mexico. At that time I had seen neither Clark's type nor his original description, and consequently was unable to express a final opinion upon the question. By the courtesy of Prof. Poulton, however, I have recently received for examination from the Oxford University Museum the type of *C. atrox*, as well as that of *C. detrudator*, Clk., besides a copy of Clark's "Addenda 1848," in which these two species are described. A glance at the type of *C. atrox*, Clk., was sufficient to show that this species is altogether distinct from my *C. funebris*, while a moment's further study proved that *C. atrox*, Clk., is identical with *C. terrisona*, Walk. Of the five triangular spots of yellow pollen which I described (*loc. cit.* p. 382) as resting on the inner margin of each eye in the type of the latter species, the two lowermost are alone present in the case of Clark's type, while the upper of the two, corresponding to the longest in the case of *C. terrisona*, is here reduced to a small triangular point, and the lower one, resting on the inferior angle of the eye, is also diminished in size. Another minor difference is that the oval spot of yellow pollen surrounding the extremity of the vertical fissura frontalis on each side in *C. terrisona* is wanting in the type of *C. atrox*. The type of the latter, however, is apparently a male, while that of *terrisona* is a female; so that if the smaller number of pollinose spots on the face and cheeks of *C. atrox* is not due to denudation, the differences in question are in all probability sexual, just as we find that in the case of *C. americana*, F., the jagged yellow pollinose border present on the cheeks in the female is absent in the male. Clark's type is in an excellent state of preservation and much cleaner than Walker's specimen; so that the narrow yellowish pollinose margins to the abdominal segments, which I mentioned in my notes on the type of *terrisona*, are here much more conspicuous. On the fifth segment the irregular pollinose markings have collected to form a jagged transverse band on the front margin. On the pleuræ, in front of and

parallel with the narrow oblique tuft of yellow pile before the base of the wings, the type of *atrox* shows a broader bare mark covered with yellowish pollen; this is also visible in the type of *terrisona*, and again, though faintly, owing to the bad state of preservation, in the 'Biologia' specimen which I referred to that species in my former paper. In the latter specimen, by the way, which is apparently also a male, three triangular flecks of yellow pollen are faintly visible, resting on the lower part of the inner margin of each eye. The dimensions of the type of *C. atrox*, Clk., agree very closely with those given in my previous paper (p. 382) for the type of *C. terrisona*, Walk.; the vertex, however, is slightly narrower. Since *C. atrox* was described in 1848, while the description of *C. terrisona* was not published until the following year, Clark's name has the priority. The synonymy will therefore run as follows:—

Cutiterebra atrox, Clk.

Cuterebra atrox, Clark, Addenda 1848, fig. 5; Brauer, Monographie der Cestrinen, pp. 241, 242 (1863).

Cuterebra terrisona, Walker, List Dipt. Ins. in Coll. British Museum, iii. p. 683 (1849); Brauer, Monographie der Cestrinen, pp. 244, 245 (1863); Austen, Ann. & Mag. Nat. Hist. ser. 6, vol. xv. pp. 382, 383 (1895) [*Cutiterebra*].

Cuterebra approximata, v. d. Wulp, p. p. (nec Walk.), Biol. Centr.-Am., Diptera, vol. ii. p. 2 (1888).

On comparing the types of *Cutiterebra atrox*, Clk., *C. approximata*, Walk., and *C. funebris*, Austen, I find it possible to tabulate the specific differences as follows:—

Black species (abdomen metallic, either plum-purple or greenish black), clothed with black hair, either entirely or with the exception of a tuft of yellow pile on the pleuræ.

- I. Pleuræ with narrow oblique tuft of yellow pile in front of base of wings; margins of abdominal segments narrowly yellowish pollinose. *atrox*, Clk.
- II. Pleuræ clothed entirely with black pile; margins of abdominal segments not yellowish pollinose.
 - a. Abdomen greenish black; a round shining black tubercle on each cheek; tarsi very broad: large species *funebris*, Austen.
 - b. Abdomen dark violet or plum-purple; cheeks rugose, but with no tubercle; front pair of tarsi, at any rate, scarcely more than half the width of the corresponding pair in *C. funebris*: medium-sized species *approximata*, Walk.

Cutiterebra detrudator, Clk.

Cuterebra detrudator, Clark, Addenda 1848, fig. 4; Brauer, Monographie der Cestriden, p. 245 (1863).

On examining the type (a female) of this species I found, to my intense surprise, that if my species *nigricineta* (Ann. & Mag. Nat. Hist. ser. 6, vol. xv. pp. 388-390) does not represent the other sex of this, it is, at any rate, very closely allied to it. Brauer did not know the species, and unfortunately his translation of the original description commences with a very serious blunder, which is entirely misleading. Clark himself makes a slip, but his meaning is clear enough; he writes, "Caedit (*sic*) maximis hujus generis," which Brauer renders by "Sehr grosse Art." As a matter of fact, although, as will be seen, the dimensions of Clark's type correspond very closely with those of the type of *nigricineta*, owing to the somewhat narrower abdomen the former looks considerably smaller, and it is certainly not even a large specimen of the genus. A copy of Clark's original description of *detrudator*, as well as of that of *atrox*, will be found below, and it will be seen that the former at any rate is too brief and inaccurate to be of any value; indeed, the species is quite unrecognizable from the description, but as I described the type of *nigricineta* very fully in my former paper, it will be sufficient now, after giving the dimensions of Clark's type, to point out in what respects it differs from mine.

C. detrudator, Clk.—Type a ♀. Length $19\frac{1}{3}$ millim.; width of vertex 3 millim.; width of head $8\frac{1}{3}$ millim.; width of thorax at base of wings $8\frac{1}{3}$ millim.; width of abdomen (second segment) $8\frac{2}{3}$ millim.; length of wing $15\frac{2}{3}$ millim.

Front nearly bare, with a somewhat shining elongate black area on each side, dark brown in the centre; above the *lunula frontalis* faintly suffused with pale golden pollen and with a little short pile of the same colour. *Thorax* with no golden pile on the anterior surface, and with only a small and inconspicuous group of such hairs in the median line near the anterior margin of the dorsum, instead of a conspicuous semi-lunar patch; but with a few golden hairs on either side of the median line in front of the scutellum. *Abdomen*: all the segments (including the fifth) metallic and bluish green instead of brassy green; pile clothing the third to the fifth segments sparser, and pale yellow instead of rich golden yellow; a much broader transverse band of black pile on the third segment, occupying very nearly the whole of the posterior half of the segment; hind margin of fourth segment also clothed with black pile on each side.

It will thus be seen that the most conspicuous differences between the type of *detrudator* and that of *nigricineta* are, in the case of the former, the narrower abdomen, the paler and thinner pile on the last three segments, the much broader black band on the third and the presence of black pile on each side of the hind margin of the fourth segment; and on the thorax the absence of golden pile on the anterior surface and the almost entire absence of any indication of a semi-lunar patch of similar pile on the anterior margin of the dorsum. The absence of golden pollen on the *front* of *detrudator* may be due to denudation, though the typical specimen, especially if we take its age into consideration, is in a good state of preservation. On the third and fourth segments of the abdomen there is a tapering band of greyish pollen on each side (most conspicuous when the specimen is viewed from behind); as in the type of *nigricineta*.

Although I think it quite possible, or even probable, that my *nigricineta* will eventually prove to be the male of *detrudator*, further material is imperatively necessary before the question can be decided with certainty. I therefore content myself for the present with having drawn attention to the differences between the typical specimens.

Before proceeding to give a reprint of the original descriptions of Bracy Clark's two species which are discussed above, it seems worth while to say a word or two as to the remarkable paper in which they appeared, as it is probable that very few living dipterists have ever seen a copy. The paper in question, quoted by Brauer as "Essay. Addenda . . . 1848," and by Hagen ('*Bibliotheca Entomologica*') as "Addenda 1848," is a single page of quarto size, printed only on one side of the paper, and headed with the title given to it by Hagen, without any stop between the word and the date. "Addenda 1848" is therefore its proper designation. The upper part of the page is devoted to a reprint of a "Note on the Bot infesting the Stag" [*Pharyngomyia picta*, Mg.], from '*Zoologist*,' 1847, pp. 1569-1570. This, as originally published, was signed "Bracy Clark," but no signature whatever appears on the "Addenda 1848;" so that for proof of authorship we have to depend upon internal evidence. Above the "Note" it is stated that:—"The following communication was sent by me to the '*Zoologist*' of my friend Edward Newman, No. 1, for January, for the year 1847;" and, as I have just stated, the note as originally published was signed. References to "our Monograph, 2nd Supplement," meaning, as pointed out by Westwood in a marginal manuscript note

on the Oxford copy before me, Clark's paper published in Trans. Linn. Soc. xix. pp. 81-94, and to "my 'Treatise' on this genus, pl. 1. fig. 40" (*i. e.* the "Essay on the Bots of Horses and other Animals"), also occur. At the top of the page are five woodcuts, three of which refer to *Pharyngomyia picta* (here called by Clark *Æstrus cervi*), but which are not the same as the three figures with which the "Note" as originally published in the 'Zoologist' is headed, while the other two represent the types of *Cutiterebra detrudator* and *C. atrox*. The latter figures are very bad, especially that of *C. detrudator*, which is not only valueless, but also misleading. The top right-hand corner of the Oxford copy bears the following in Westwood's handwriting:—"(Zool. 1847) and published separately by the Author for distributⁿ with the additⁿ of the 2 n. sp. from Mus. Westwood." This statement of Westwood's is supported by the fact that "Addenda 1848" is not contained in any of the following libraries: British Museum (W.C.), British Museum (Natural History), Royal College of Surgeons, Linnean Society, Zoological Society, and Entomological Society; while Messrs. Dulau and Co. endeavoured in vain to procure a copy for me. Under these circumstances it certainly appears to be open to question whether the descriptions of the two species of *Cutiterebra* which will be found below were ever published at all, in the proper sense of the term. Since, however, the names were accepted by Prof. Brauer in his Monograph, while, as I have mentioned above, the paper is quoted by Hagen, I do not propose to interfere with them. The descriptions of *C. detrudator* and *atrox* occupy the rest of the page beneath the "Note" &c., referred to above, and run exactly as follows:—

"*Detrudator*.—Cuterebra, nigra, holosericea, abdomine glabro caerulescenti nigro, lateribus albo bicingulatis, posticèque rufo.

"*Habitat* calidioribus Americis* (*sic*). Ex Museo Dom. Westwood. Vid. fig. 4.

"*Descr.* Caedit (*sic*) maximis hujus generis. Caput obtusum, vertice atro, inter oculos rufum, ore et inferne latè album hirsutum. Thorax ater holosericeus, infra insertiones alarum et subtus, albus. Halteres concavæ concolores, erectæ. Alae longiores aurulento-fuliginosæ. Abdomen lactè caeruleum ad latera cingulis duobus latis albis, apiceque hirsuto flavescenti rufo. Pedes omnino atri tarsis praelongis articulis sagittato-acutis.

* In the Oxford copy Westwood has struck out the words "calidioribus Americis," written a ? above "calidioribus," and "[? J. O. W.]" in the margin.

"*Atrax*.—Cut. atra, glabra, abdomine caerulescenti-atro marginibus segmentorum albis.

"Habitasse creditur in Africâ*, v. fig. 5. Ex Museo D. Westwood.

"*Descr.* Facile inter maximas hujus generis omninò atro caerulescens, lucidus. Thorax anticè scabriusculus, posticè glaber. Halteres scutellum circumcingentes, erectae, maximae. Alae parùm pucolatae (*sic*), obscurè aurulento, fuliginosae. Abdomen latum, obtusum, incurvatum, atro caeruleum incisurarum marginibus, albis. Ad latera et subtus albo latè conspersum. Pedes atri geniculis tiliarum extus albicantibus."

It will have been observed that in both the above descriptions Clark writes "halteres" for "alulæ."

Cutiterebra fontinella, Clark.

Cuterebra fontinella, Clark, Trans. Linn. Soc. xv. pp. 410, 411 (1827); Clark, Essay on the Bots of Horses and other Animals, pl. ii. fig. 23 (1815) [figure only]; Brauer, Monographie der Cestriden, p. 242 (1863) [translation of Clark's description]; (nec Townsend, Insect-Life, v. pp. 319, 320, 1893); Austen, Ann. & Mag. Nat. Hist. ser. 6, vol. xv. pp. 384-386 (1895) [*Cutiterebra*].

Cuterebra fontanella, Clark, Trans. Linn. Soc. xix. p. 88 (1845).

Cuterebra americana, Walker (nec Fabricius), List Dipt. &c. iii. p. 683 (1849).

The library of the Zoological Department of the British Museum contains two copies of Clark's "Essay on the Bots of Horses &c.," one with coloured, the other with uncoloured plates. The uncoloured copy contains two figures that are not included in the plates in the other, namely fig. 40, pl. i. and fig. 23, pl. ii.† On turning to the Oxford copy of the

* Westwood has struck out "Habitasse creditur in Africâ" in the Oxford copy, and written "[Habitat certe in Mexico. J. O. W.]" in the margin. As was stated in my former paper, *Cutiterebra* is confined to the Nearctic and Neotropical Regions. Prof. Brauer, in his Monograph, merely translates the descriptions of *atrox* and *detrudator*, as he did not know the species; but he gives the patria of *atrox* as "Mexico," and writes "Vaterland?" in place of that of *detrudator*, thus apparently having been informed of Westwood's emendations mentioned above. However, he goes on to state with reference to *C. detrudator* (p. 245):—"Clark vermuthet wohl irrthümlich, dass die Art aus Afrika stamme. Einer Mittheilung Westwood's zufolge hat Clark die Angaben über das Vorkommen bei dieser Art und der *Cut. atrax* verwechselt." But in applying Clark's statement as to the locality of *C. atrax* to *C. detrudator* Brauer himself has blundered. The type of *atrox* is labelled "Mexico," but that of *detrudator* bears no locality, unless it be an illegible word to which a note of interrogation is prefixed.

† Bracy Clark seems to have had a weakness for republishing his papers with alterations in the figures; cf. the instance of the figures to his "Note on the Bot infesting the Stag," mentioned in the remarks on the "Addenda 1848" above.

“Essay &c.,” which was kindly forwarded to me by Prof. Poulton for inspection with the “Addenda 1848,” I found that it has coloured plates, but that these correspond to the uncoloured ones in the British Museum copies, *i. e.* they possess the extra figures. In other respects the three copies of the “Essay &c.” before me appear to be identical, and there is no reference to the extra figures in any one of them. Fig. 40, pl. i., however, is referred to in *Trans. Linn. Soc.* xix. p. 92 (1845), and in the “Note &c.” in the “Addenda 1848,” and the references show that the figure in question is intended to represent *Pharyngomyia picta*, Mg. When writing my former paper I did not realize what fig. 23, pl. ii., in the uncoloured Museum copy was meant for; but on seeing the coloured figure in the Oxford copy I at once saw that it must be intended for *Cutiterebra fontinella*, Clk. This conclusion is confirmed by the reference on p. 88 of *Trans. Linn. Soc.* xix., quoted above, which I have recently come across; the passage in question is as follows:—“The above species described by Pallas [*i. e.* *Æstrus leporinus*, Pall.] is very nearly allied to, or the same with, my *C. fontanella* (*sic*), described in the *Linnean Transactions*, vol. xv. p. 410, and figured in my *Treatise* [*i. e.* ‘*Essay &c.*’], pl. ii. fig. 23.”* The figure places the specific identity of the three specimens in the British Museum collection, which I mentioned in my former paper, beyond doubt. The entire insect is shown in profile, with four visible segments in the abdomen, of which the last alone is yellowish white. Since the first abdominal segment in *Cutiterebra*, as in other genera of *Æstridæ*, is concealed by the scutellum, and practically invisible, the abdomen appears to be composed of only four segments, so that the last segment visible from above, which is apparently the fourth, is really the fifth. Clark’s figure, by showing the first three segments of the abdomen purplish, and only the last segment yellowish white, therefore makes it clear that in writing “*segmentis duobus postremis hirtis*” (which was my only reason for doubting that our specimens were really *fontinella*) the author either made a slip or else meant to refer to the small sixth segment as well as to the fifth, the former of which, though concealed beneath the latter, is actually also clothed with pale golden-yellowish pile. The discovery of the reference on p. 88 of *Trans. Linn. Soc.* xix. to fig. 23, pl. ii. of the “*Essay &c.*” therefore proves

* *Æstrus leporinus*, Pall., which Brauer (‘*Monographie*,’ pp. 145, 146) doubtfully assigns to the genus *Æstromyia*, is a species from the Altai Mountains, which is at once proved by its mouth-parts to be in no way related to *Cutiterebra*.

that the three female specimens mentioned on p. 384 of my former paper really belong to this species, but that those of Townsend must be referred to some other.

It is very desirable that the types of the other species of *Cutiterebra* described by Bracy Clark, if still in existence, should be subjected to a re-examination, although of the seven species described and figured by him the identity of all but *cuniculi* is now established. Of these species *C. purivora* (= *C. buccata*, Fab.) and *fontinella* were described from specimens in Clark's own collection; *cuniculi*, *horripilum*, and *cauterium* (= *americana*, Fab.) from specimens in the possession of John Francillon; while the types of *atrox* and *detrudator*, as already shown, formerly belonged to Westwood and are now preserved in the University Museum, Oxford. In all probability Clark was careless about his types, and had no idea of the value that nowadays is attached to typical specimens. At any rate in an original letter from Clark to Westwood, dated "7/11-42," which I have had the privilege of inspecting among the Oxford papers, and which is a response to a request from Westwood to be permitted to examine Clark's *Æstridæ*, Clark writes: "having given to one or another of my specimens I have but few left." Francillon's collection of insects was dispersed after the owner's death by the sale held at King's Sale Room, 38 King Street, Covent Garden, June 11-19, 1818. On p. 44 of the catalogue ("A Catalogue of the Very Superb and Celebrated Collection of Foreign Insects of the late John Francillon, Esq. &c. &c."), I find included two specimens each of *Cutiterebra cauterium* and *C. horripilum*, which were doubtless the types. It may be worth while to add that on the previous page one specimen of *Æstrus phobifer*, Clk., is mentioned; and as Clark states in his description that the species was contained in the collection of his friend Francillon, this is no doubt likewise a type. I mention these particulars in the faint hope that the missing types may still be in existence, and that these lines may be read by someone into whose hands they have come. If so, I need hardly add that I should be extremely grateful if the fortunate possessor would communicate with me.

In conclusion, I would point out that in characterizing the larva of *Cutiterebra* as being "quite thickly beset with variously shaped pointed spines and thorns" (Wien. ent. Z. vi. p. 11) Prof. Brauer is in error. The pupa-cases of

C. funebris, Austen, and the two specimens referred by Van der Wulp ('*Biologia Centrali-Americana*,' Diptera, vol. ii. p. 1) to *C. emasculator*, Fitch, but which appear to me undoubtedly to belong to *C. analis*, Mcq. (? is *C. emasculator*, Fitch, merely a synonym of *C. analis*, Mcq.?), besides Fitch's description ('*Third Report on the Noxious, Beneficial, and other Insects of the State of New York*,' p. 162, 1859) of the larvæ of his species, prove beyond doubt that the external covering of the larva of *Cutiterebra* consists, not of spines or thorns, but of imbricated scales.

XX.—*A new Pupoid Type of Helicidæ.*

By HENRY A PILSBRY.

IN the '*Archiv für Naturgeschichte*' for the present year, at p. 103, the distinguished malacologist of Berlin, Dr. Eduard von Martens, has given a *résumé* of previous knowledge of the geographic distribution and systematic position of the curious Austrian land-mollusk known as *Pupa obtusa*, Drap., *Bulimus obtusus* of authors. To this he adds several new localities, and, best of all, an account of the soft anatomy of the creature, hitherto quite unknown. Figures of the genitalia, jaw, and dentition are given, from dissections by Mr. A. Protz.

The species under consideration has a cylindrical shell, of equal diameter at the two ends, which are blunt and rounded; and it is of rather chalky texture. In placing it in the genus *Pupa* Draparnaud approximated as nearly to the true position of the animal as was possible to a naturalist of his time. In 1833 Fitzinger, who was, it is well known, a terrible splitter of genera, made a new one—*Cylindrus*—for this species, but without characterizing it. Albers, in '*Die Heliceen*,' places *Cylindrus* in the genus *Bulimus*, between the group of *Buliminus montanus* and that of *B. detritus*. This would be thought an excellent estimate from shell-characters alone. *Cylindrus* is rather less happily grouped in the second edition of Albers's work by Dr. E. von Martens, where it is placed in *Pupa* between the subgenera *Leucochila* and *Faula*.

In the paper now before us Dr. von Martens considers *Cylindrus* of generic rank; but he expresses no opinion upon the family position of the genus or upon its relationships with other genera of land-snails. It remains for me, therefore, to indicate the systematic position and affinities of this interesting form.

Mr. Protz's figure and description of the genitalia show the penis to be short, suddenly narrowing above; this narrow portion is not, as he supposed, part of the penis, but is an epiphallus, the penis being only the large lower portion, which at its apex undoubtedly contains a fleshy wall, and probably a papilla perforated for the passage downward of the contents of the epiphallus. The latter bears at its middle the retractor muscle, and terminates in the vas deferens and a flagellum. The vagina bears above two blind sacs, one containing a curved "dart" with short blades at apex, the other empty. Both of these I take to be dart-sacs, and in this case the mucous glands are atrophied. The globular spermatheca is borne upon a long duct, which branches at about its lower third in a short diverticulum.

This combination of characters occurs in but one group of mollusks, viz. that group or subfamily of Helicidæ which the writer has called *Belogona*. Nothing of the sort is known in Pupidæ or among the *Bulimi*. And since *Cylindrus* lacks lobed or flattened mucous glands inserted upon the dart-sacs themselves, which are characteristic of the *Belogona Euadenia*, it evidently belongs to the division *Belogona Siphonadenia*, in which the mucous glands are tubular and inserted upon the vagina above the dart-sac or sacs, but are occasionally atrophied in part or entirely.

Among the genera of *Belogona Siphonadenia*, *Cylindrus* resembles *Helicella* (*Xerophila*, Held.) in the conspicuously earthy texture and blunt unexpanded lip of the shell; also in the doubling of the dart-sac, of frequent occurrence in *Helicella*. It may be added that *Helicella* has given rise to some forms with the spire high and conical, the umbilicus reduced or absent, such as *H.* (*Cochlicella*) *ventricosa*, Drap., and *acuta*, Müll. On the other hand, *Cylindrus* differs from all known forms of *Helicella* in the compactly cylindrical contour of the shell, the small globular spermatheca on a very long duct, and the branching of that duct to form a diverticulum; species of the other genus having a spermatheca of irregular elongated form on a duct which is invariably branchless and of moderate length or short. The most remarkable feature of *Helicella*, however, remains to be noticed. The right eye-stalk is *retracted to the left of the genital system*, not between the male and female branches, as in ordinary Helices. It is much to be regretted that Mr. Protz neglected to state the position of this retractor muscle in *Cylindrus*, for an important clue is thus lost to us. Should this detail of musculature prove to be as in *Helicella*, it is clear that the position of *Cylindrus* in the system will be between *Leucochroa*, an

ancient genus preserving most of the essential features of *Belogona Euadenia*, and *Helicella*, an early branch of the *Belogona Siphonadenia*, but decidedly nearer to the latter genus. Should the myologic character mentioned prove to be as in ordinary *Helices*, *Cylindrus* will stand near *Helicella* and the genus *Hygromia* (*Fruticicola* of authors).

In either event, I contend that *Cylindrus* is a genus of Helicidæ belonging to the division *Belogona Siphonadenia*; that it has no affinity with the *Pupa* or *Buliminus* groups beyond the bond uniting all Pulmonata Geophila; and that it is only another instance of that parallelism or homoplasy which has in many times and places moulded creatures of widely diverse structure into a deceptive external similarity.

XXI.—*Descriptions of new Coleoptera in the British Museum.* By CHARLES O. WATERHOUSE, F.E.S.

Lucanidæ.

DIGONOPHORUS, gen. nov.

General form parallel, depressed. Mentum transverse, obliquely narrowed in front, with the front margin emarginate. Antennæ not very long, flattened, and, when at rest, lying in a distinct but shallow impression at the side of the submentum; the seventh joint about as broad as long, shining; the eighth, ninth, and tenth forming a rather small club, the joints pilose, except the base of the eighth. Prosternal process horizontal, convex, nearly parallel, narrow, only very slightly narrowed towards the apex, vertical posteriorly. Mesosternum swollen and convex between the coxæ, only slightly sloping, almost vertical anteriorly. Anterior tibiæ formed much as in *Cladognathus bison* ♂, four posterior tibiæ without spines. Tarsi densely pilose below.

I think this curious insect must be placed next to *Cladognathus*, from which it differs in the small antennal club, short transverse mentum, narrow subparallel prosternal process, and convex rather prominent mesosternum, &c.

The female is unknown to me.

Digonophorus Atkinsoni, sp. n.

♂. Elongatus, parallelus, depressus, piceo-rufus, nitidus; mandibulis capite duplo longioribus, depressis, parallelis, ante apicem intus processu valido antrorsum obliquo directo instructo; capite

postice leviter angustato, antice supra impresso, arcuatim late emarginato; thorace antice angustato, lateribus pone medium denticulis duobus sat approximatis instructis, dein oblique sinuatim angustatis; elytris thorace angustioribus, subparallelis, ad latera minus nitidis, subtiliter granulosis, sutura anguste infuscata; tarsis nigris.

Long. (mandib. incl.) 17, lat. 4 lin.

Hab. Singapore (*Coll. Atkinson*).

This species has somewhat the colour of *Cladognathus MacClellandi*, but it is more shining, much depressed. The head is broadest at the eyes, moderately narrowed to the base, the sides almost rectilinear; the surface is densely and extremely finely punctured. In front it is widely emarginate, the part in front of this emargination vertical. The mandibles are twice the length of the head, flat, shining, rather widely separated at the base, nearly straight and subparallel, and without teeth for three quarters their length; from this point to the apex they are curved inwards, and are pointed at the apex. At one quarter from the apex there is a large, flat, oblong process directed forwards, having three blunt teeth at its apex; between this process and the apex there are four small teeth. The thorax has the usual angle at the sides before the base, and has another angle just in front of it slightly more projecting. The anterior tibiæ have on the outer edge near the apex three small acute teeth.

Rutelidæ.

ECHMATOPHORUS, gen. nov.

Form short oblong. Epistome narrowed anteriorly, bidentate. Mandibles with the apex visible from above, reflexed, obliquely truncate, appearing slightly bidentate in certain positions. Thorax short and very broad, the sides impressed and with incrassate margins, the posterior angles slightly projecting beyond the shoulders. Scutellum moderately large, about twice as broad as long. Elytra as broad as long, with an impression within the shoulder, which consequently appears raised. Pygidium exposed. Legs short, especially the anterior; the anterior tibiæ with three teeth on the outer edge; intermediate tibiæ with apical half of the outer edge emarginate, so that the apical half of the tibia is much narrower than the basal half, the apical angle produced into a sharp spine; the posterior tibiæ also narrowed beyond the middle, but not in such a marked degree. Claws of the anterior tarsi small, simple; the anterior claw of the intermediate and posterior tarsi strongly bifid. Sternal process

very long, sloping down, rounded at the apex, the apical portion rather narrow, subcylindrical.

This genus must be placed near *Caelidia*, from which it differs in the long subcylindrical sternal process and the somewhat curiously formed intermediate tibiæ, &c.

Echmatophorus Pascoei, sp. n.

Breviter oblongus, crassus, sat depressus, niger, nitidus; capite antice rugoso, postice punctato; thorace rufo-flavo, basi medio macula magna nigra notato; scutello lævi; elytris brunneo-flavis, sat fortiter striato-punctatis, humeris nigro cinctis; abdomine supra pygidioque brunneo-flavis, hoc transversim subtiliter striolatis, medio macula ovali signato.

Long. 6-7, lat. 4-5 lin.

Hab. Penang.

This species has somewhat the appearance of some *Antichiræ*. The epistome is much narrowed in front, terminating in two short, triangular, reflexed teeth. Between the antennæ there is a slight transverse ridge, which is interrupted in the middle. The thorax is very distinctly punctured, except at the extreme base, the punctures moderately separated from each other. The sides are somewhat impressed posteriorly, with a distinct but shallow fovea close to the posterior angle.

Rhipiceridæ.

Callirhipis Pascoei, sp. n.

♀. Elongatus, ellipticus, convexus, niger, nitidus; thorace elytrorumque fascia lata rufo-ochraceis.

Long. 5½ lin.

Hab. Penang.

Head deflexed, convex, closely and strongly punctured, with a transverse impression between the eyes and a longitudinal one on the convex forehead. Antennæ with the second joint reddish; the fourth to tenth joints about twice as long as broad, the branch emitted by the sixth to tenth joints about four times the length of the joint from which they arise. Thorax convex, with three impressions at the base, moderately strongly and rather closely punctured, the punctures a little more separated from each other on each side of the disk than in the middle, where there is an indication of a slight channel which terminates anteriorly in a shallow impression. The anterior angles (which are scarcely visible

from above) and all the margins are narrowly edged with black. The elytra are subparallel for two thirds their length, and then are arcuately narrowed to the apex, very coarsely punctured except at the base, with a tendency to form lines on the disk only; the reddish-yellow fascia occupies about one third of the length. The tibiæ are densely clothed with short black pubescence; the anterior and intermediate pairs beset on their outer edge with short acute spines, which make them appear crenulate in certain positions. Tarsi stout, the fifth joint longer than the four previous joints taken together; claws red at their base. Trochanters more or less red.

V-72
 XXII.—*Preliminary Diagnoses of new Mammals from Northern Luzon, collected by Mr. John Whitehead.* By OLDFIELD THOMAS.

THE following new mammals, which are so distinct from anything hitherto known as to represent quite a new fauna, have been obtained by Mr. John Whitehead in the highlands of Northern Luzon. A full account of the collection will, it is hoped, be published later.

RHYNCHOMYS, gen. nov.

Muzzle enormously elongated. Incisors short and feeble. Molars minute, only two in number above and below.

Form not unlike that of a gigantic shrew. Feet and tail rat-like.

Rhynchomys soricoïdes, sp. n.

Size about that of *Mus rattus*. Fur very thick, close and velvety. General colour uniform dark olivaceous grey, without decided markings anywhere. Under surface dirty grey, not sharply defined; a white patch on throat sometimes present. Ears about as in *Mus rattus*, their visible surface, when folded, clothed with blackish hairs. Metapodials brown, digits whitish. Tail shorter than head and body, fairly clothed, but not tufted, blackish above, scarcely paler below.

Dimensions of type (♂):—

Head and body 215 millim.; tail 146; hind foot (moistened) 41.

Skull: basal length 44; diastema 16·8; length of the two upper molars 2·5.

CHROTOMYS, gen. nov.

Structure of teeth as in *Hydromys*, but molars $\frac{3}{3}$ in number. Skull intermediate between *Hydromys* and *Xeromys*. Form Murine, as in the last-named. Mammæ 0—2=4.

Chrotomys Whiteheadi, sp. n.

Size of *Mus rattus*. Fur soft and thick. Ground-colour grey-brown, tending in some specimens to rufous; a well-defined bright buff or orange line extending from the middle of the face nearly to the root of the tail, shown up on each side by a broad shining black band. Under surface slaty buff, not sharply defined. Metapodials shining grey; digits white. Tail shorter than head and body, thinly haired, blackish above, rather paler below.

Dimensions of type (♂):—

Head and body 196 millim.; tail 111; hind foot (moistened) 35.

Skull: basal length 38; greatest breadth 21·7; length of upper molar series 5·1.

Xeromys (?) *silaceus*, sp. n.

General appearance very similar to that of *Rhynchomys soricoides*, to which there is really no relationship whatever, the real alliance being with *Chrotomys*. Size of a small rat. Fur soft, close and velvety. Colour uniform slaty grey, very finely grizzled with whitish. Belly but little paler, with a buffy tinge. Ears and feet like body. Tail short, very thinly haired, brown above basally, whitish below and at the tip. Skull very similar in form and structure to that of *Chrotomys Whiteheadi*, although rather smaller; but there are only two molars, as in *Xeromys*, to which the species is provisionally referred.

Dimensions of type (♂):—

Head and body (probably rather stretched) 195 millim.; tail 110; hind foot (moistened) 33·4.

Skull: basal length 34; greatest breadth 19; length of the two upper molars 4.

CARPOMYS, gen. nov.

Form more or less Myoxine. Fur thick and woolly. Pollex with a large nail. Tail long, well-haired. Mammæ 0—2=4.

Skull with a large rounded brain-case and short face.

Teeth somewhat as in *Mus*, but upper molars each with an additional posterior lamina.

Type *C. melanurus*.

Carpomys melanurus, sp. n.

Size and length of tail as in *Mus rattus*. Fur soft, thick, and woolly. General colour deep fulvous, coarsely lined with black. Ears thickly haired, black. Under surface dull yellowish white, the bases of the hairs slate. Metapodials silvery brown; digits white. Tail thickly furry like the body for its basal two inches; the remainder cylindrical, closely covered with shining black hairs some 5 to 7 millim. in length, entirely hiding the scales; not specially tufted at tip.

Skull large and heavy, with very large molars.

Dimensions of type (♂):—

Head and body 197 millim.; tail 211; hind foot (moistened) 34·2.

Skull: basal length 39·3; greatest breadth 25; interorbital breadth 5·8; palatal foramina 7·5; length of upper molar series 8·8.

Carpomys phæurus, sp. n.

Similar to, and of the same general colour as, *C. melanurus*, but smaller, with the ears less hairy, the tail brown instead of black, less thickly haired, and with the fur of the body not extending on to its base; chin, chest, and belly white.

Skull smaller than that of *C. melanurus*, and with proportionally smaller molars, which still, however, show the same essential structure.

Dimensions of the type (♂):—

Head and body 195 millim.; tail 178; hind foot (moistened) 31.

Skull: basal length 36; greatest breadth 23; interorbital breadth 6; palatal foramina 7·6; length of upper molar series 6·1.

BATOMYS, gen. nov.

Molar structure of *Mus*. Supraorbital edges not beaded. Tail thickly haired, as in *Carpomys*. Hind feet short and broad; fore feet elongated.

Batomys Grantii, sp. n.

General appearance very like that of *Carpomys melanurus*, from which at first sight it only differs by its shorter tail and

less hairy ears. Fur of medium length and texture; general colour coarsely grizzled fulvous brown, the longer hairs black, the shorter ones with orange or rufous tips. Face greyer. Ears of medium length, only thinly haired as in ordinary *Mus*. Under surface dull slaty buff, not sharply defined; a whitish mesial line sometimes present. Metapodials brown mesially, silvery white laterally; hands apparently unusually elongated; feet rather short, with large sole-pads. Tail thickly and uniformly clothed (except for its basal half-inch) with dark brown, almost black, hairs some 7 to 9 millim. in length, the scales quite hidden.

Skull long, rounded, the supraorbital edges not ridged; zygomatic plate slightly concave anteriorly; bullæ small; third upper molar as long as second.

Dimensions of type (♂):—

Head and body 204 millim.; tail (doubtfully perfect*) 121; hind foot (moistened) 35.5.

Skull: basal length 40.5; interorbital breadth 5.4; palatal foramina 8.1; upper molar series 7.6.

Mus luzonicus, sp. n.

Closely allied to, and of the same size and dorsal colour as, *M. Everetti*, Günth., which also occurs in the Luzon collection. Fur much longer and softer. Tail shorter. Belly dull slaty buff; the hairs slate for their basal four fifths, buff at their tips.

Skull with less ridged supraorbital edges, smaller bullæ, broader molars, and shorter palatal foramina, which do not reach back to the level of the front of $\underline{m.1}$.

Measurements of type (♀):—

Head and body 240 millim.; tail imperfect (of another specimen 200); hind foot (moistened) 47.

Skull: basal length 44; length of upper molar series 9.3; breadth of $\underline{m.1}$ 3.2.

The collection also contains specimens apparently referable to *Mus chrysocomus*, Hoffm., *M. neglectus*, Jent., and *M. ephippium*, Jent.

CRATEROMYS, gen. nov.

General external appearance as *Phlæomys*, but claws smaller and tail bushier.

Skull with a narrow interorbital region, the frontal and

* An immature specimen, 165 millim. long, has a tail 117 millim. in length.

parietal bones not expanded. Zygomatic plate not projected forwards. Bullæ small.

Molars complex, cuspidate, quite unlike the simply laminate molars of *Phlæomys* and more like those of a gigantic *Mus*.

Type *Phlæomys Schadenbergi*, Meyer, of which Mr. Whitehead has sent several specimens.

Dr. Meyer had for description only a skin without skull from Mount Data, and it speaks much for his acuteness that the skulls sent by Mr. Whitehead so fully bear out his suggestion as to the probable generic distinction of "*Phlæomys*" *Schadenbergi* from *P. Cumingi*.

That the animals sent by Dr. Schadenberg and Mr. Whitehead are the same is shown conclusively by some photographs of the type and its feet kindly prepared and sent to me by Dr. Meyer.

XXIII.—On a new Species of *Eliurus*.

By OLDFIELD THOMAS.

H-2067
AMONG a collection of Madagascar animals received from Dr. C. I. Forsyth Major, the eminent palæontologist, there occurs a specimen belonging to the interesting genus *Eliurus*, but representing a second species of it. It may be called

Eliurus Majori, sp. n.

Size about as in *E. myoxinus*, but the tail is decidedly longer and much less bushy. Instead of being clothed with hairs comparable to those of *Platacanthomys**, this organ is scarcely more long-haired than in *Rhipidomys* and many other climbing rats, nor is there the least trace of a distichous arrangement of the hairs. Fur very soft. General colour grey; an indistinct ring round the eyes, the ears, metapodials, and the whole of the tail, including the terminal pencil, blackish brown. Under surface dirty whitish, the bases of the hairs slate-coloured; line of demarcation on sides not sharply marked. Fifth hind toe reaching to end of second phalanx of fourth.

Dimensions of the type, an adult male in skin:—

Head and body (c.) 155 millim.; tail (vertebræ *in situ*) 153; hind foot (moistened) 27; ear from notch 16.6.

Skull: basal length 30.6; greatest length 36.2; greatest

* See Milne-Edwards, Ann. Sci. Nat. (6) xx., article 1 bis (1885).

breadth 19; nasals, length 14.2, interorbital breadth 5, interparietal 4.4×11 ; palate length from henselion 17; diastema 10.3; palatine foramina 5.8; length of upper molar series 6.6.

Hab. Ambolimitombo Forest, Central Madagascar. Alt. 4500 feet.

Type collected Jan. 24, 1895.

Owing to the small number and peculiar character of the Madagascar rodents, this addition to their number is of much interest. It is unfortunate that the teeth of the only specimen are too much worn for me to venture to make any suggestion as to the affinities of the genus *Eliurus*, the only thing that is clear being its wide difference from any other Mascarene genus.

XXIV.—*On the Reptiles and Batrachians obtained by Mr. E. Lort-Phillips in Somaliland.* By G. A. BOULENGER, F.R.S.

[Plate VII.]

THE small but interesting collection of Reptiles and Batrachians presented to the British Museum by Mr. Lort-Phillips was formed by him in the Goolis Mountains, 60 miles inland of Berbera, and between them and the sea. Two of the lizards prove to belong to undescribed species, with which I have much pleasure in connecting the name of their discoverer.

REPTILES.

1. *Pristurus crucifer*, Val.

2. *Pristurus Phillipsii*, sp. n. (Pl. VII. figs. 1, 1 a.)

Head short and deep; snout obtuse, scarcely longer than the diameter of the orbit; forehead not concave; ear-opening small, oblique. Hind limb reaching the ear, digits and claws moderate. Head and body covered with small granules, largest on the snout and belly. Rostral large, twice as broad as deep, with median cleft above; nostril pierced in a single nasal, which is notched and fissured above; six upper and four lower labials; symphyseal large, rounded behind; no chin-shields. Tail compressed, with a low serrated crest above. Grey above, with dark brown cross-bars enclosing red dots; these bars interrupted on the vertebral line; sides with three or four longitudinal series of oval or round deep

black spots; a blackish line along each side of the tail; lower parts white, throat marbled with grey.

	millim.
Total length.....	60
Head.....	8
Width of head.....	5
Body.....	20
Fore limb.....	12
Hind limb.....	18
Tail.....	32

A single specimen.

3. *Hemidactylus jubensis*, Blgr.

4. *Tarentola ephippiata*, O'Shaughn.

This Senegambian species is represented by three specimens, which differ from the type in having the three pairs of chin-shields in contact with the labials, as in one of the Senegambian specimens presented to the Museum by Sir A. Moloney.

5. *Holodactylus africanus*, Bttgr. (Pl. VII. fig. 2.)

This curious lizard was described by Prof. Boettger from an imperfectly preserved specimen from Abdallah, Somaliland, which he referred to the Geckonidæ in the neighbourhood of *Ceramodactylus*, Blanf. With the two well-preserved specimens of Mr. Lort-Phillips's collection before me, I am able to state that *Holodactylus* belongs to the Eublepharidæ, as it possesses connivent eyelids, procœlous dorsal vertebræ without intercentra, and fused parietal bones. It comes so near the West-African *Psilodactylus*, Gray, that one would hesitate to refer it to a distinct genus. But, as has been pointed out by Mr. Stejneger in 1893, the name *Psilodactylus* is preoccupied; and the name proposed to replace it, *Hemitheconyx*, Stejneger (May 31, 1893), being later than *Holodactylus*, Boettger (April 10, 1893), *Holodactylus africanus* will, at all events, have to be retained as the proper denomination of the species here redescribed and figured.

Snout short and very convex, as long as the distance between the orbit and the ear-opening; latter small, oval, oblique. Head and body covered with uniform minute granules, largest on the upper surface of the head; nostrils between a crescentic nasal and several small scales; rostral twice as broad as deep, with short median cleft above, separated from the nostril by three series of granular scales; ten

or eleven upper and nine or ten lower labials; symphysial small, much broader than long; no chin-shields. The hind limb does not quite reach the elbow of the adressed fore limb. Tail very short, spindle-shaped, covered with small granular scales. The coloration is that of an *Eublepharis*. Pale grey-brown or cream-colour above, with or without brown dots or vermiculations, and with four undulous brown cross-bands on the body, edged with darker; a dark brown streak on the loreal region and a dark blotch below the eye; eyelids edged with white; lower parts white.

	millim.
Total length.....	78
Head.....	16
Width of head.....	11
Body.....	43
Fore limb.....	20
Hind limb	24
Tail	19

Two specimens.

6. *Agama colonorum*, Daud.

The true *A. colonorum* had not yet been recorded from East Africa.

7. *Agama Phillipsii*, sp. n. (Pl. VII. fig. 3.)

Head depressed; snout as long as the diameter of the orbit; nostril lateral, slightly tubular, on the canthus rostralis. Upper head-scales smooth or obtusely keeled; occipital not enlarged; groups of small spinose scales near the ear; latter entirely exposed, much larger than the eye-opening. Throat much plicate; no gular pouch. Body much depressed, with a fold on each side of the back; scales on vertebral region enlarged, polygonal, smooth, minute and granular on the sides of the back, larger and keeled on the flanks; ventral scales small, smooth. Scales on limbs large and imbricate, strongly keeled, nearly as large as caudals. Fourth finger slightly longer than third; fourth toe a little longer than third, fifth extending beyond first. Tail scarcely compressed, covered with strongly keeled mucronate scales, forming rather irregular annuli. Male with two rows of large præanal "pores." Back blackish, with small greenish-white spots and a broad greenish-white vertebral stripe; head, limbs, and tail olive above; throat with a wide-meshed blackish network; belly and lower surface of limbs bluish grey; præanal pores orange; lower surface of tail yellowish.

	millim.
Total length	228
Head	20
Width of head	17
Body	60
Fore limb	40
Hind limb	60
Tail	148

Two male specimens.

This species is closely allied to *A. annectens*, Blanf., from which it is easily distinguished by the larger scales on the limbs and the less strongly compressed tail.

8. *Latastia longicaudata*, Reuss.

A single male specimen. 60 scales across the body. 10 femoral pores on each side.

9. *Eremias sextæniata*, Stejneger.

Numerous specimens confirm the validity of this species, which is closely allied to *E. Spekii*, Gthr.

10. *Eremias mucronata*, Blanf.

11. *Mabuia varia*, Ptrs.

12. *Mabuia striata*, Ptrs.

13. *Lygosoma modestum*, Gthr.

Two specimens. The nostril is pierced between two nasals, an upper and a lower. 26 scales round the middle of the body.

14. *Psammophis biseriatus*, Ptrs.

A single female specimen. Nine upper labials, fourth, fifth, and sixth entering the eye. Ventrals 154; anal divided; subcaudals 100.

15. *Naiia nigricollis*, Reinh.

A single young specimen. 27 scales across the neck, 25 across the middle of the body. Ventrals 201; subcaudals 68. Pale reddish brown above, head darker; brownish white beneath; a broad black ring round the neck.

BATRACHIANS.

1. *Rana Delalandii*, D. & B.
2. *Bufo regularis*, Reuss.
3. *Bufo Blanfordii*, Blgr.

EXPLANATION OF PLATE VII.

- Fig. 1. *Pristurus Phillipsii*.
 Fig. 1 a. Ditto: side view of head, \times .
 Fig. 2. *Holodactylus africanus*.
 Fig. 3. *Agama Phillipsii*.

XXV.—*Descriptions of Four new Batrachians discovered by Mr. Charles Hose in Borneo**. By G. A. BOULENGER, F.R.S.

Rhacophorus Hosii.

Vomerine teeth in two oblique series between the rather large choanæ, commencing from their inner front edge. Snout truncate, as long as the diameter of the orbit; nostril close to the tip of the snout; canthus rostralis angular; loreal region concave; interorbital space as broad as the upper eyelid; tympanum distinct, half the diameter of the eye. Fingers with a slight rudiment of web; toes nearly entirely webbed, the penultimate phalanx of the fourth toe free; disks smaller than the tympanum; subarticular tubercles moderate; a small inner metatarsal tubercle. The knee reaches the shoulder, the tibio-tarsal articulation far beyond the tip of the snout. Skin finely granulate above, coarsely on the belly. Dark grey-brown above, lips with darker vertical bars; one or two small black spots above the axil; limbs with dark cross-bands; anal region black; hinder side of thighs dark brown; whitish beneath, throat marbled with brown, belly dotted with brown.

From snout to vent 48 millim.

A single female specimen from the Pata River, North Sarawak.

Rhacophorus fasciatus.

Vomerine teeth in two long oblique series between the moderately large choanæ, commencing from their inner front

* The specimens described are now in the British Museum.

edge. Snout pointed, as long as the diameter of the orbit; nostril equally distant from the orbit and the end of the snout; canthus rostralis angular; loreal region slightly concave; interorbital space broader than the upper eyelid; tympanum distinct, one half or three fifths the diameter of the eye. Fingers webbed to the disks, which are nearly as large as the tympanum; toes webbed to the disks, which are smaller than those of the fingers; subarticular and inner metatarsal tubercles very small; no tarsal fold. The tibio-tarsal articulation reaches the tip of the snout. Skin smooth above, granulate on the belly. Pale reddish brown above, minutely speckled with brown and with six brown cross-bands, the first across the snout, the second between the eyes, the third, broadest, between the ears; a fine yellow brown-edged line borders the head above, from the tip of the snout along the canthus rostralis and supraciliary border to above the tympanum; limbs with dark cross-bands; lower parts and hinder side of thighs colourless. Male with an internal vocal sac.

From snout to vent 54 millim.

Two specimens, male and female, from the mountains of the Akar River, North Sarawak.

Rhacophorus nigropalmatus.

Vomerine teeth in two long, slightly curved, transverse series between the front edges of the moderately large choanæ. Snout rounded, as long as the diameter of the orbit; nostril near the tip of the snout; canthus rostralis feeble; loreal region concave; interorbital space broader than the upper eyelid; tympanum distinct, two thirds the diameter of the eye. Fingers webbed to the disks, which are smaller than the tympanum; toes webbed to the disks, which are a little smaller than those of the fingers; subarticular and inner metatarsal tubercles very small. Tibio-tarsal articulation reaching the tip of the snout. Skin finely granulate above, coarsely on the belly; a strong dermal fold along the outer edge of the forearm and tarsus and at the heel. Purple above, finely speckled with black, and with scattered minute white dots; one or two small white spots on the upper surface of the femur; flanks white, veined with black; interdigital webs black at the base, grey veined with black towards the border; lower parts white.

From snout to vent 80 millim.

A single female specimen from the Akar River.

Nectophryne macrotis.

Head small, a little longer than broad; snout short, prominent, obliquely truncate; canthus rostralis strong; loreal region vertical, concave; interorbital space broader than the upper eyelid; tympanum very distinct, quite as large as and close to the eye. Fore limb very slender, as long as the distance between the eye and the vent. Fingers moderate, webbed at the base, dilated and truncate at the end; first finger very short, half as long as second; toes three-fourths webbed, less strongly dilated than the fingers; a flat inner metatarsal tubercle. The tibio-tarsal articulation reaches the posterior border of the eye. Above with scattered small warts irregular in size; beneath granulate. Olive above, spotted with black; some of the warts red; limbs barred with black; yellowish beneath, much spotted with black.

From snout to vent 28 millim.

A single female specimen from the Akar River.

XXVI.—*Descriptions of Two new Snakes from Usambara, German East Africa.* By G. A. BOULENGER, F.R.S.

OLIGOLEPIS, gen. nov.

Allied to *Xenurophis*, Gthr. Maxillary teeth 30, small, closely set, equal; mandibular teeth equal. Head distinct from neck; eye large, with round pupil. Body cylindrical; scales finely striated, without pits, oblique, in 13 rows; ventrals rounded. Tail rather long; subcaudals in two rows.

Oligolepis macrops.

Eye nearly as long as the snout. Rostral nearly twice as broad as deep, just visible from above; internasals broader than long, a little shorter than the præfrontals; frontal once and a half as long as broad, longer than its distance from the end of the snout, slightly shorter than the parietals; loreal twice as long as deep; one præ- and two postoculars; temporals 1+2; nine upper labials, fifth and sixth entering the eye; five lower labials in contact with the anterior chin-shields, which are shorter than the posterior. Scales in 13 rows on the body, in 4 rows on the tail. Ventrals 148; anal divided; subcaudals 75. Olive above, with rather irregular light cross-bars; upper lip and lower parts white.

A single young specimen, measuring 215 millim.; tail 57.

Aparallactus Wernerii.

Diameter of the eye greater than its distance from the oral margin. Rostral twice as broad as deep, the portion visible from above nearly half as long as its distance from the frontal; internasals much shorter than 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, in contact with the præocular; two postoculars, in contact with the anterior temporal; temporals 1+1; six upper labials, second and third entering the eye; first lower labial in contact with its fellow behind the symphysial; two pairs of chin-shields, the anterior broader and a little longer and in contact with three lower labials. Scales in 15 rows. Ventrals 147-160; anal entire; subcaudals 32-41. Blackish above, with a deep black, somewhat light-edged nuchal collar; upper lip blackish below the eye, yellowish in front and behind; lower parts uniform yellowish.

Total length 390 millim.; tail 65.

Two specimens, male (V. 147; C. 41) and female (V. 160; C. 32).

The genus *Aparallactus*, Smith, 1848, is identical with *Uriechis*, Peters, 1854, as I have pointed out before. Eleven species may be distinguished:—

I. Two præfrontals.

A. Symphysial not in contact with the chin-shields.

1. Two postoculars, in contact with a temporal; nasal entire, in contact with the præocular.

Third and fourth upper labials entering the eye. 1. *A. Jacksonii*, Gthr. (E. Africa.)

Second and third upper labials entering the eye. 2. *A. Wernerii*, Blgr. (E. Africa.)

2. A single postocular; one labial in contact with the parietal.

Nasal entire, not in contact with the præocular. 3. *A. concolor*, Fischer. (E. Africa.)

Nasal divided, in contact with the præocular. . . 4. *A. lunulatus*, Ptrs. (E. Central Africa, Mozambique.)

B. Symphysial in contact with the chin-shields.

1. Third and fourth upper labials entering the eye.

Nasal divided; ventrals 154-180; subcaudals 51-59. 5. *A. Guentheri*, Blgr.* (E. & C. Africa, Angola.)

* *Uriechis capensis*, part., Günther, 1888, Bocage, 1895.

- Nasal entire; ventrals 191; subcaudals 44 6. *A. Bocagii*, Blgr. *
(Angola.)
- Nasal entire; ventrals 138-166; subcaudals
37-53 7. *A. capensis*, Smith †.
(E. & S.E. Africa.)
2. Second and third upper labials entering
the eye.
- Ventrals 110-149; subcaudals 21-40 8. *A. nigriceps*, Ptrs.
(Mozambique, Nyassaland.)
- Ventrals 161; subcaudals 41 9. *A. punctatolineatus*,
Blgr. † (Angola.)
- II. A single præfrontal.
- Frontal as long as its distance from the end of
the snout 10. *A. lineatus*, Ptrs.
(Guinea.)
- Frontal longer than its distance from the end of
the snout 11. *A. anomalus*, Blgr.
(Gold Coast.)

The types of the new snakes described above are in the British Museum, and formed part of a small collection on which Dr. F. Werner has recently reported (Verh. zool.-bot. Ges. Wien, xiv. 1895, p. 190). I take this opportunity to observe that the lizard described as *Gymnodactylus africanus*, Werner, is a *Gonatodes*, closely allied to the Indian *G. ornatus*. It should stand as *Gonatodes africanus*.

XXVII.—The Subfamilies, Genera, and Species of the Copepod Family Ascomyzontidæ, Thorell: Diagnosis, Synonymy, and Distribution. By Dr. WILH. GIESBRECHT, Naples.

Tribus AMPHARTHANDRIA, Giesbr. 1892.

Both anterior antennæ of male transformed into clasping-organs, adapted for copulation.

Family Ascomyzontidæ, Thorell, 1859.

Lips forming a siphon, produced or not into a shorter or longer suctorial tube. Mandible stilet-shaped, enclosed in the siphon. Head coalescent with first thoracic segment. Abdo-

* *Uriechis capensis*, part., Bocage.
† *Cercocalamus collaris*, Günther.
‡ *Uriechis capensis*, part., Bocage.

men of ♀ 3- or 4-, of ♂* 4- or 5-jointed; genital aperture lateral; furca with 6 setæ. Anterior antennæ of ♀ 8- to 21-jointed, with a single æsthetask (sensorial appendage); clasping-antennæ of ♂ 10- to 17-jointed, with one or several æsthetasks. Posterior antennæ prehensile, 4- or (rarely) 3-jointed; exopodite 1-jointed. Mandible-palp 1-branched (1- or 2-jointed) or wanting. Maxilla 2- or (rarely) 1-lobed. Anterior and posterior foot-jaws strong prehensile organs. First four pairs of feet swimming-organs; their exo- and endopodites in general 3-jointed (sometimes both branches of first pair 2-jointed, inner branch of fourth pair 2-jointed or wanting). Fifth pair of feet rudimentary, 2 jointed (first joint often coalescent with fifth thoracic segment), or (rarely) setiform. Sexes differ in size and form of body, in segmentation of abdomen (♂ having one segment more than ♀), and in form, segmentation, appendages, and function of anterior antennæ.

Subfamily 1. ASCOMYZONTINÆ, nov.

Anterior antennæ of ♀ 11- to 21-jointed; the æsthetask-bearing joint followed by 2 or 3 apical joints; clasping-antennæ of ♂ 17- (*Cycloplicera*, *Asterocheres*), or 16- (*Acontiophorus ornatus*), or 13- (*Dermatomyzon*) jointed, rarely (*Acontiophorus*) with additional æsthetasks. Mandible with palp. Maxilla consisting of a short basal joint and two lobes, each bearing 3-5 setæ. Last joint of outer branch of third and fourth feet with 3 or 4 setæ at inner margin. Thoracic segments laterally rounded off, rarely produced into lateral processes. Abdomen of ♀ 3- or 4-, of ♂ 4- or 5-jointed. Siphon usually without, sometimes with, suctorial tube. Inner branch of fourth foot normal, similar to the inner branches of preceding feet. Terminal joint of fifth foot oval or elongated.

Genus 1. CYCLOPICERA, Brady, 1872 †.

Thoracic segments laterally rounded off. Rostrum flat. Abdomen of ♀ 3-, of ♂ 4-jointed. Anterior antennæ of ♀ 21-, of ♂ 17-jointed; with one æsthetask in both sexes.

* Males are known of *Cycloplicera echinicola*, *violaceum*, *minutum*, *Dermatomyzon elegans*, *Asterocheres Lilljeborgii*, *Clausomyzon gracilicauda*, *Acontiophorus ornatus*, *Dyspontius* sp. I have also examined males of *Cycloplicera echinicola*, *Bradypontius chelifera*, *Pteropontius cristatus*, *Gallopontius fringilla*, *Dyspontius Thorellii*, *capitalis*, and *brevifurcatus*.

† According to Canu the genus *Isopodius*, Kriczagin (Mitth. nat. Ver. Kiew, vol. iii. p. 398, t. xiv.), is probably a synonym of *Cycloplicera*. I have not seen Kriczagin's work, which is written in Russian.

Exopodite of posterior antennæ shorter than penultimate joint. Siphon without tube. Mandible-palp 1-jointed, rod-shaped; setæ not plumose. Setæ of maxilla plumose or not. Swimming-feet: last joint of outer branch with 4, 4, 4, 4 plumose setæ, of inner branch with 6, 6, 6, 5 setæ; marginal spines of outer branches small. Terminal joint of fifth foot with 3 setæ.

1. *Cycloplicera echinicola*, Norman.

Ascomyzon echinicola, Norman, Rep. Brit. Assoc. for 1868, p. 300.

Cycloplicera latum, Brady, Ann. & Mag. Nat. Hist. ser. 4, vol. x. p. 8, t. iii., and Mon. iii. p. 56, tt. lxxxix., xc.; I. C. Thompson, Proc. Lit. & Phil. Soc. Liverpool, vol. ii. p. 189, and Trans. Lit. & Phil. Soc. Liverpool, vol. vii. p. 36; Th. Scott, Eleventh Rep. Fish. Board Scotland, p. 210, t. iii., and ? Trans. Linn. Soc., 2nd ser. Zool. vol. vi. p. 127, t. xiii. figs. 25-30.

Length of ♀ 0.8-0.85, of ♂ 0.55-0.6 millim. Nearly colourless. The last two abdominal segments of ♀ equal in length, rather longer than the furca. Twelfth to eighteenth joints of anterior antennæ of ♀ longer than broad; the last three joints narrower than the preceding. Outer lobe of maxilla scarcely half as long and broad as the inner; setæ not plumose.

Distr. British Seas; Naples.

2. *Cycloplicera violaceum*, Claus.

Echinocheres violaceus, Claus, Arb. Wien, vol. viii. p. 356, t. v.

Length of ♀ 1.15, of ♂ 0.75 millim. Violaceous, black-pigmented, similar to the host (*Strongylocentrotus lividus*). Last abdominal segment of ♀ as long as the furca and shorter than the preceding. Seventeenth and eighteenth joints of the anterior antennæ of ♀ longer than broad; the preceding four joints as long as broad; the last three joints much narrower. Outer lobe of maxilla narrower (and shorter?) than the inner, which has a long plumose seta and three short setæ.

Distr. Triest; Naples?

3. *Cycloplicera minutum*, Claus.

Echinocheres minutus, Claus, *ibid.* p. 356, tt. v., vi.

Length of ♀ 0.5, of ♂ 0.4 millim. Brownish, black-spotted. The last two abdominal segments and the furca nearly equal in length. No joint of anterior antennæ of ♀ longer than broad (if any, the eighteenth), most of them much

broader than long; the last three joints scarcely narrower than the preceding. Maxilla as in *violaceum*.

Distr. Triest.

Genus 2. ASTEROCHERES, Boeck, 1859.

Thoracic segments laterally rounded off. Rostrum narrow, not prominent. Abdomen of ♀ 3-, of ♂ (probably) 4-jointed. Anterior antennæ of ♀ 19-, of ♂ 17-jointed; with one æsthetask in both sexes. Exopodite of posterior antennæ shorter than penultimate joint. Siphon without tube. Mandible-palp 2-jointed, rod-like. Setæ of maxilla not or scarcely plumose. Terminal joint of fifth foot with two setæ.

4. *Asterocheres Lilljeborgii*, Boeck.

Asterocheres Lilljeborgii, Boeck, Forh. Vid.-Selsk. Christiania, 1859, p. 6, t. ii.; ? Canu, Cop. Boulonnais, p. 264, t. xxvii.
Artotrogus Lilljeborgii, Brady, Mon. iii. p. 64.

Length of ♀ 1, of ♂ (?) 0.6 millim. Mandible-palp long; first joint twice as long as second. Terminal joint of fifth foot large, margins ciliated. Cephalothorax of ♀ circular; genital segment longer than broad.

Distr. Norway; Ireland; English Channel?

5. *Asterocheres Renaudi*, Canu.

Asterocheres Renaudi, Canu, Cop. Boulonnais, p. 263, t. xxvi.

Length of ♀ 0.85 millim. Mandible-palp short; the two joints rather equal in length. Chitine of siphon and appendages of head transversely rippled. Fifth foot small. Cephalothorax elongated; genital segment of ♀ broader than long.

Distr. English Channel.

Genus 3. DERMATOMYZON, Claus, 1889.

Thoracic segments laterally rounded off. Rostrum blunt. Abdomen of ♀ 4-, of ♂ 5-jointed. Anterior antennæ of ♀ 19-, of ♂ 13-jointed; with one æsthetask in both sexes. Exopodite of posterior antennæ shorter than the penultimate joint. Siphon without tube. Mandible pointed, scarcely denticulated; palp 1-jointed, rod-like; setæ not plumose. Setæ of maxilla not plumose. Swimming-feet: last joint of outer branch with 5, 5, 4, 4 plumose setæ, of inner branch with 6, 6, 5, 4 setæ. Terminal joint of fifth foot with five setæ.

6. *Dermatomyzon nigripes*, Brady and Robertson.

Cyclopicera nigripes, Brady, Mon. iii. p. 54, t. lxxxix.; Th. Scott, Tenth Rep. Fish. Board Scotland, p. 267; I. C. Thompson, Trans. Lit. & Phil. Soc. Liverpool, vol. vii. p. 36.

? *Ascomyzon Thorelli*, Sars, Arch. Math. Nat. vol. iv. p. 474.

? *Cyclopicera nigripes*, Sars, Norske Nordh. Exp., Crust. ii. p. 79

Length of ♀ 1·2–1·25 millim. Swimming-feet smoky black. First joint of anterior antennæ with a long sharp spine.

Distr. British seas; Spitsbergen?

7. *Dermatomyzon elegans*, Claus*.

Dermatomyzon elegans, Claus, Arb. Wien, vol. viii. p. 351, t. vi.; Canu, Cop. Boulonnais, p. 260, t. xxvi.

Length of ♀ 1–1·35, of ♂ 0·9–1 millim. Feet colourless. First joint of anterior antennæ with seta.

Distr. Triest; English Channel; Naples.

Genus 4. CLAUSOMYZON, gen. nov.

Thoracic segments laterally rounded off. Abdomen of ♀ 4-, of ♂ 5-jointed. Anterior antennæ of ♀ 20-, of ♂ ?-jointed. Exopodite of posterior antennæ shorter than penultimate joint. Siphon without tube. Mandible denticulated at the oblique apex; palp reduced to a rather short plumose seta. Setæ of maxilla (probably) not plumose. Terminal joint of fifth foot curved, elongated, bluntly serrated at the apex.

8. *Clausomyzon gracilicauda*, Brady.

Cyclopicera gracilicauda, Brady, Mon. iii. p. 58. t. lxxxiii.; I. C. Thompson, Trans. Lit. & Phil. Soc. Liverpool, vol. vii. p. 36; Th. Scott, Tenth Rep. Fish. Board Scotland, p. 262.

Ascomyzon comatulæ, Rosoll, Sitzungsab. Akad. Wien, vol. xcvi. p. 189, t. i.

Distr. British seas; Triest.

Genus 5. RHYNCHOMYZON, gen. nov.

♀. Thoracic segments produced laterally into processes, which are directed backwards and conspicuous in dorsal

* *Dermatomyzon gibberum*, Th. & A. Scott (Ann. & Mag. Nat. Hist. ser. 6, vol. xiii. p. 144, t. ix.) and Th. Scott (Twelfth Rep. Fish. Board Scotland, p. 260, t. x.), from the Firth of Forth, having only three abdominal segments, should be excluded from the genus *Dermatomyzon*; the species agrees in this respect with *Cyclopicera* and *Asterocheres*.

view. Rostrum very prominent, beak-shaped. Abdomen 4-jointed. Anterior antennæ 13- to 16-jointed. Exopodite of posterior antennæ shorter than penultimate joint. Siphon without tube. Mandible large, denticulated at the oblique apex; palp rod-like, with scarcely plumose seta. Setæ of maxilla not plumose. Swimming-feet: last joint of outer branch with 5, 4, 4, 4 plumose setæ, of inner branch with 6, 6, 5, 4 setæ. Terminal joint of fifth foot with three setæ. ♂ unknown.

9. *Rhynchomyzon falco*, sp. n.

♀. Length 1.45–1.5 millim. Head triangular in dorsal view. Processes of thoracic segments largely produced; anterior abdominal segments with similar processes. Furca as long as the last abdominal segment; length: breadth = 3:2. Anterior antennæ 13- or 14-jointed; first joint with spine, last joint granulate.

Distr. Naples.

10. *Rhynchomyzon purpurocinctum*, Th. Scott.

Cycloplicera purpurocinctum, Th. Scott, Eleventh Rep. Fish. Board Scotland, p. 209, t. iii.

♀. Length 0.85–1 millim. Head elliptical in dorsal view; processes of thoracic segments much less produced than in *falco*, of abdominal segments nearly wanting. Furca longer than the last two abdominal segments combined, five times as long as broad. Anterior antennæ 16-jointed; first joint without spine, last joint not granulate.

Distr. Firth of Forth, Mull; Naples.

Genus 6. ASCOMYZON, Thorell, 1859.

♀. Thoracic segments laterally rounded off. Rostrum not prominent. Abdomen 3-jointed. Anterior antennæ 20- (21-?) jointed. Exopodite of posterior antennæ shorter than penultimate joint. Siphon with tube. Mandible-palp rod-like, long, 2-jointed; setæ not plumose. Maxilla large; the two lobes unequal; setæ not plumose. Setæ of swimming-feet probably as in *Cycloplicera*. Terminal joint of fifth foot with two (three?) setæ.

11. *Ascomyzon Lilljeborgii*, Thorell*.

Ascomyzon Lilljeborgii, Thorell, K. Svensk. Vet.-Akad. Handl. Stockholm, vol. iii. p. 78, t. xiv.; ? Aurivillius, Öfv. K. Vet.-Akad. Förh. Stockholm, 1882, p. 105, t. xvi.

* Another species of the genus, *Ascomyzon calvum*, Brady and Robertson (Rep. Forty-fifth Meet. Brit. Assoc. 1876, p. 197), appears to have never been described.

? *Artotrogus Boeckii*, Brady, Mon. iii. p. 61, t. xci.; ? Bourne, Journ. Mar. Biol. Assoc. ser. 2, vol. i. p. 317; ? Th. Scott, Eleventh Rep. Fish. Board Scotland, p. 210; I. C. Thompson, Trans. Lit. & Phil. Soc. Liverpool, vol. vii. p. 37.

Non *Artotrogus Boeckii*, G. M. Thomson, Trans. N. Zeal. Inst. vol. xv. p. 112, t. ix.

Distr. Bohuslän; British seas?

Genus 7. ACONTIOPHORUS, Brady, 1880.

Thoracic segments laterally rounded off. Rostrum flat. Abdomen of ♀ 3-, of ♂ 4-jointed. Anterior antennæ of ♀ 11- to 16-jointed; number of æsthetascs on the antennæ of ♂ augmented. Exopodite of posterior antennæ longer than penultimate joint. Siphon with long tube. Mandible-palp small, with large plumose seta. Setæ of maxilla plumose. Swimming-feet: last joint of outer branch with 5, 4, 3, 3 plumose setæ, of inner branch with 6, 6, 5, 4 setæ. Terminal joint of fifth foot with five setæ.

12. *Acontiophorus scutatus*, Brady and Robertson.

Solenostoma scutatum, Brady and Robertson, Ann. & Mag. Nat. Hist. ser. 4, vol. xii. p. 141.

Acontiophorus scutatus, Brady, Mon. iii. p. 69, t. xc.; ? G. M. Thomson, Trans. N. Z. Inst. vol. xv. p. 113, t. viii.; Claus, Arb. Wien, vol. viii. p. 359, t. vii.; Canu, Cop. Boulonnais, p. 270, t. xxix.; I. C. Thompson, Proc. Lit. & Phil. Soc. Liverpool, vol. ii. p. 69, and Trans. Lit. & Phil. Soc. Liverpool, vol. vii. p. 37.

? *Acontiophorus angulatus*, I. C. Thompson, Journ. Linn. Soc., Zool. vol. xx. p. 153, tt. xii., xiii.

♀. Length 0·9–1 millim. Cephalothorax elongated. Posterior margin of abdominal segments not angulated. Furca nearly three times as long as broad. Anterior antennæ 11-jointed. Tube of siphon reaches to near end of body.

♂ unknown.

Distr. British seas; New Zealand; Triest; Madeira?; Naples.

13. *Acontiophorus ornatus*, Brady and Robertson*.

Ascomyzon ornatum, Brady and Robertson, Rep. Forty-fifth Meet. Brit. Assoc. 1876, p. 197.

Acontiophorus armatus, Brady, Mon. iii. p. 71, t. lxxxii.; Claus, Arb. Wien, vol. viii. p. 359, t. vii.

Length of ♀ 1·5, of ♂ 1 millim. Cephalothorax large.

* *Acontiophorus elongatus*, Th. & A. Scott (Ann. & Mag. Nat. Hist. ser. 6, vol. xiii. p. 145, t. ix.) and Th. Scott (Twelfth Rep. Fish. Board Scotland, p. 261), from the Firth of Forth, should be excluded from

Anterior segments of abdomen laterally angulated. Furca scarcely longer than broad. Anterior antennæ in both sexes 16-jointed. Tube of siphon reaches to near end of thorax.

Distr. Yorkshire; Triest; Naples.

Subfamily 2. *DYSPONTIINÆ*, nov.

Anterior antennæ of ♀ 8-12-jointed; æsthetask on the last joint; clasp-antennæ of ♂ 10- or 11-jointed, with thirteen additional æsthetasks. Mandible without palp, consisting only of the stilet. The two lobes of maxilla stiff, each bearing one or two, rarely (*Parartrogus*) three and five setæ. Last joint of outer branch of third and fourth feet with five setæ on the inner margin. Abdomen of ♀ 4-, of ♂ 5-jointed; thoracic segments rarely rounded off laterally; usually produced into lateral processes, conspicuous in dorsal view. Siphon with suctorial tube (except *Parartrogus*). Inner branch of fourth foot either as in preceding feet, or 3-jointed, with rudimentary setæ, or 2-jointed, or wanting. Terminal joint of fifth foot small, oblong or knob-like.

Genus 8. *PARARTROGUS*, Th. & A. Scott, 1893.

♀. Thoracic segments laterally rounded off. Anterior part of genital segment scarcely broader than posterior. Anterior antennæ 9-jointed. Posterior antennæ 4-jointed. Siphon "rudimentary" (without tube?). Lobes of maxilla short, one with three spines and two setæ, the other (much smaller) with two setæ. Both branches of first foot and inner branch of fourth foot 2-jointed, latter with plumose setæ. Terminal joint of fifth foot oblong.

14. *Parartrogus Richardi*, Th. & A. Scott.

Parartrogus Richardi, Th. & A. Scott, Ann. & Mag. Nat. Hist. ser. 6, vol. xi. p. 210, t. vii.; Th. Scott, Eleventh Rep. Fish. Board Scotland, p. 210, t. iv.

Distr. Firth of Forth.

this genus, because (1) the authors describe the exopodite of the posterior antenna as "very small"; (2) they find the anterior antennæ 17-jointed (although the æsthetask-bearing joint is followed by only one joint), and only three setæ on the terminal joint of the fifth foot; (3) they do not mention the large plumose seta of the mandible-palp. I cannot identify the genus to which the species belongs, in the absence of any notice of the mandible-palp. Another species, described by G. M. Thomson (Trans. N. Zeal. Inst. vol. xv. p. 112, t. xi.) as *Artotrogus ovatus*, seems to be related to *Acontiphorus*, the exopodite of posterior antennæ having the same proportional length; but the species differs from this genus in the absence of a suctorial tube and in the number (8 or 9) of joints in the anterior antennæ.

Genus 9. ARTOTROGUS, Boeck, 1859.

Important characters of the genus being problematic or entirely wanting in Boeck's paper, it is impossible at present to draw up a diagnosis of *Artotrogus*; therefore I give here a critical abstract of the author's description of the typical species.

15. *Artotrogus orbicularis*, Boeck.

Artotrogus orbicularis, Boeck, Forh. Vid.-Selsk. Christiania, 1859, p. 2, t. i.; Hansen, Dijnphna, 1886, p. 78; I. C. Thompson, Trans. Lit. & Phil. Soc. Liverpool, vol. vii. p. 37; non Brady and Robertson, Rep. Forty-fifth Meet. Brit. Assoc. 1876, p. 197.

Body circular. Thoracic segments perhaps with lateral processes. Segmentation of abdomen doubtful (Boeck's figure shows three short and one long segment—impossible in a mature female). Furca broader than long. Anterior antennæ 9-jointed. Posterior antennæ 3- (?) jointed. Tube of siphon reaches to the middle of the interval between foot-jaws and first foot. Inner lobe of maxilla (considered by Boeck as mandible-palp) 2-jointed (?), with two setæ, outer lobe with one seta. Swimming-feet with 3-jointed branches. (Boeck says five pairs of feet, *i. e.* two pairs of foot-jaws, named by him first and second pair of feet, and three pairs of swimming-feet; so the figured "pes unus quarti paris" is really a foot of the second pair. Consequently Boeck has overlooked one pair of swimming-feet; and since this pair may be the fourth, as well as the third or second, it remains doubtful whether the fourth pair has a normal or rudimentary inner branch. The structure of the fourth foot remains doubtful, too, if we admit* that the specimen described by Boeck was immature, and had really only three pairs of feet; this being the case, the appendage which Boeck calls the rudimentary foot would be the not yet developed fourth pair.) An accurate redescription of this oldest species of Ascomyzontidæ is required, perhaps not for recognizing the species, but for determining the systematic position of the genus. If the inner branch of the fourth foot is found to be 3-jointed and its setæ rudimentary, the genus *Bradypontius* should perhaps be withdrawn.

Another genus, probably belonging to the subfamily Dyspontiniæ, but quite insufficiently characterized, is

* This conjecture accords with the above-mentioned segmentation of the abdomen; but the length of body (2 millim.) found by Boeck is greater than the length of the ova-bearing specimen dredged by I. C. Thompson (1.65 millim.).

CONOSTOMA, G. M. Thomson.

Species: *ellipticum* (cf. Trans. N. Z. Inst. vol. xv. p. 3, t. v.).

"Abdomen greatly abbreviated, only two segments being apparent . . . anterior antennæ about 9-jointed; posterior 4-jointed, secondary branch wanting . . . feet of the first pair with both branches only 2-jointed; next three pair almost similar." Mandible and maxilla are not mentioned.

Genus 10. MYZOPONTIUS, gen. nov.

♀. Thoracic segments scarcely produced into lateral processes, neither are the abdominal. Rostrum flat. Anterior part of genital segment scarcely broader than posterior. Anterior antennæ 9- to 12-jointed. Tube of siphon reaches between the second and fourth feet. Inner lobe of maxilla oval. Foot-jaws very slender. Inner branch of fourth foot similar to those of preceding feet; last joint of outer branch of first foot with five, second joint of inner branch with two plumose setæ. Terminal joint of fifth foot oblong.

♂ unknown.

16. *Myzopontius pungens*, sp. n.

Distr. Naples.

Genus 11. BRADYPONTIUS, gen. nov.

Thoracic segments produced laterally into processes, which are directed backwards and conspicuous in dorsal view. Rostrum short. Anterior part of genital segment of ♀ broader than posterior. Anterior antennæ of ♀ 8- to 10-, of ♂ (*chelifer*) 11-jointed. Posterior antennæ 4-jointed. Tube of siphon reaches behind the foot-jaws or to the middle of abdomen. Inner branch of fourth foot 3-jointed, almost destitute of setæ; last joint of outer branch of first foot with five, second joint of inner branch with two plumose setæ. Fifth foot knob-like.

17. *Bradypontius magniceps*, Brady.

Artotrogus orbicularis, Brady and Robertson, Rep. Forty-fifth Meet. Brit. Assoc. 1876, p. 197.

Artotrogus magniceps, Brady, Mon. iii. p. 61, t. xciii.; I. C. Thompson, Trans. Lit. & Phil. Soc. Liverpool, vol. vii. p. 37.

Length of ♀ 1.25 millim. Head without crista. Furca scarcely longer than broad. Anterior antennæ 10-jointed;

first and second joints long. Tube of siphon reaches to the posterior margin of the first body-segment. First foot-jaw similar to that of *siphonatus*. Inner branch of fourth foot shorter than first and second joints of outer branch together.

♂ unknown.

Distr. England.

18. *Bradypontius siphonatus*, sp. n.

Length of ♀ 1.6 millim. Head without crista. Furca scarcely as long as broad. Anterior antennæ 10-jointed; first and third joints long, second joint short. Tube of siphon reaches to behind the middle of abdomen. Hook of first foot-jaw elongated, with slender apical claw. Inner branch of fourth foot longer than first and second joints of outer branch together.

♂ unknown.

Distr. Naples.

19. *Bradypontius Normani*, Brady and Robertson.

Dyspontius Normani, Brady and Robertson, Rep. Forty-fifth Meet. Brit. Assoc. 1876, p. 197.

Artotrogus Normani, Brady, Mon. iii. p. 63, tt. xci.-xciii.; I. C. Thompson, Trans. Lit. & Phil. Soc. Liverpool, vol. vii. p. 37, and ? Journ. Linn. Soc., Zool. vol. xx. p. 154; ? Canu, Cop. Boulonnais, p. 266, t. xxvii.

Length of ♀ 1.6 millim. Head without crista. Furca longer than broad. Anterior antennæ 9-jointed; first and second joints long. Tube of siphon reaches rather behind the posterior margin of first body-segment. First foot-jaw as in *siphonatus*. Inner branch of fourth foot nearly as long as the first and second of outer branch together.

♂ unknown*.

Distr. Durham; Isle of Man; Madeira?; Wimereux?

20. *Bradypontius chelififer*, sp. n.

Length of ♀ 1.15, of ♂ 0.85 millim. Head with crista. Furca longer than broad. Anterior antennæ of ♀ 8-, of ♂ 11-jointed; first and second joints long. Tube of siphon reaches to the posterior margin of first body-segment. Hook of first foot-jaw thick, cheliform; apex tumid, claw stout. Inner branch of fourth foot rather shorter than first and second joints of outer branch together.

Distr. Naples.

* The diagnosis is given according to Canu, although the identity of his *Normani* with Brady's *Normani* is not certain.

Genus 12. PTEROPONTIUS, gen. nov.

Thoracic and anterior abdominal segments produced laterally into large angular processes. First body-segment with dorsal crista, reaching from frontal to posterior margin. Rostrum triangular. Anterior antennæ of ♀ 8-, of ♂ 10-jointed. Posterior antennæ 3-jointed. Tube of siphon reaches to the posterior foot-jaws. Fourth foot destitute of inner branch. Branches of first foot 2-jointed. Fifth foot knob-like.

21. *Pteropontius cristatus*, sp. n.

Distr. Naples.

Genus 13. GALLOPONTIUS, gen. nov.

Thoracic segments produced laterally into processes. Forehead with dorsal cap-like convexity. Rostrum prominent. Anterior part of genital segment of ♀ broader than posterior. Anterior antennæ of ♀ 9-, of ♂ 11-jointed. Posterior antennæ 4-jointed. Tube of siphon thick, rippled inside, and reaching beyond the fourth foot. Inner branch of fourth foot wanting. Fifth foot knob-like.

22. *Gallopontius fringilla*, sp. n.

Distr. Naples.

Genus 14. DYSPONTIUS, Thorell, 1859.

Thoracic segments produced laterally into processes. Rostrum not prominent. Anterior part of genital segment of ♀ broader than posterior. Anterior antennæ of ♀ 9- to 10-, of ♂ 10- to 11-jointed. Posterior antennæ 4-jointed. Tube of siphon reaches between foot-jaws and third foot. Inner branch of fourth foot wanting. Fifth foot knob-like.

23. *Dyspontius striatus*, Thorell.

Dyspontius striatus, Thorell, Sv. Vet.-Akad. Handl. Stockholm, vol. iii. p. 81, t. xiv.; ? Norman, Rep. Brit. Assoc. 1866, p. 198; ? Brady, Mon. iii. p. 66, t. xcii.; ? I. C. Thompson, Proc. Lit. & Phil. Soc. Liverpool, vol. iii. p. 189; ? Canu, Cop. Boulonnais, p. 266, t. xxviii.

♀. Length 1.25 millim. Cephalothorax rather broader than long. Furca rather longer than broad, less than half as long as the last abdominal segment. Anterior antennæ 9-jointed; first and second joint long. Tube of siphon reaches to the third thoracic segment. Inner lobe of maxilla scarcely

longer than outer, with one seta. Outer margin of outer branches of swimming-feet not denticulate*.

Distr. Christineborg; Hebrides?; British seas?; Wime-reux?

24. *Dyspontius Thorellii*, sp. n.

Length of ♀ 1.15–1.2, of ♂ 0.85–0.95 millim. Cephalothorax and furca longer than broad. Anterior antennæ of ♀ 10-, of ♂ 11-jointed; first and third joints long, second joint short; third joint of antennæ of ♂ followed by four short joints and a longer joint, which bears at the anterior margin a movable spine. Tube of siphon reaches between first and third foot. Inner lobe of maxilla nearly twice as long as outer, with short seta at apex. First foot: first joint of outer branch with one, last joint with four, second joint of inner branch with one plumose seta; second joint of inner branch of first to third feet with a double tooth at outer margin; outer margin of outer branch of second to fourth feet denticulate.

Distr. Naples:

25. *Dyspontius tenuis*, sp. n.

♀. Length 1.1 millim. Cephalothorax and furca longer than broad. Anterior antennæ 9-jointed; first and third joints long, second joint short. Siphon as in *Thorellii*. Inner lobe of maxilla about $1\frac{1}{3}$ times as long as outer, with short seta. Swimming-feet as in *Thorellii*.

♂ unknown.

Distr. Naples.

26. *Dyspontius capitalis*, sp. n.

Length of ♀ 1.35–1.45, of ♂ 1.1–1.2 millim. Cephalothorax broader than long, furca scarcely longer than broad. Anterior antennæ similar to those of *Thorellii*. Tube of siphon does not reach to the first foot. Inner lobe of maxilla nearly twice as long as outer, with long plumose seta at apex. Swimming-feet as in *Thorellii*.

Distr. Naples.

* According to Thorell. Brady differs from the author of the species in several respects: length of body (1.8 millim.), of siphon (reaches to the posterior margin of the cephalothorax), proportional length of the furca (as long as last abdominal segment), &c. Neither do the descriptions of the male of *striatus* given by Brady and Canu agree; the clasping-antennæ of Brady's specimen resemble those of *brevifurcatus*, the antennæ of Canu's those of *Thorellii*.

27. *Dyspontius brevifurcatus*, sp. n.

Length of ♀ 0·95, of ♂ 0·75–0·85 millim. Cephalothorax nearly $1\frac{1}{2}$ times as long as broad; furca broader than long. Anterior antennæ of ♀ 9-, of ♂ 10-jointed; first and second joints long; second joint of antennæ of ♂ followed by five short joints and a longer joint, which bears at the anterior margin an immovable tooth. Tube of siphon as in *Thorellii*. Inner lobe of maxilla about $1\frac{1}{3}$ times as long as outer, with long seta at apex. First foot: first joint of outer branch without seta, last joint with five, second joint of inner branch with two plumose setæ; tooth at outer margin of second joint of inner branch of first to third foot simple; outer margin of outer branch of second to fourth foot not or scarcely denticulated.

Distr. Naples*.

Subfamily 3. *PONTÆCIELLINE*, nov.

♀. Anterior antennæ 8-jointed; æsthetask on the antepenultimate joint. Mandible without palp. Maxilla consisting of a single lobe. Last joint of outer branch of third and fourth feet with three setæ on inner margin. Fifth foot consisting of one seta on each side. Abdomen 4-jointed. Tube of siphon short. Last joint of anterior antennæ long. Basale of second foot-jaw 1-jointed. Outer margin of last joint of outer branch of swimming-feet with less than three spines. Inner branch of fourth foot normal.

Genus 15. *PONTÆCIELLA*, gen. nov.

♀. Thoracic segments laterally rounded off. Rostrum flat. Anterior part of genital segment scarcely broader than posterior. Ventral seta of furca peculiarly shaped. Exopodite of posterior antennæ knob-like. Hook of first foot-jaw angled. Apical saws of outer branches of swimming-feet long.

♂ unknown †.

28. *Pontæciella abyssicola*, Th. Scott.

Artotrogus abyssicolus, Th. Scott, Trans. Linn. Soc., 2nd ser. Zool. vol. vi. p. 128, tt. xii., xiv.

Distr. 2° N.–4° S., 6°–10° E. (?235–360 fathoms); Naples; 99° W., 3° S. (?1800 m.); 124° W., 9° N. (1000 m.) (*Expedition of the 'Vettor Pisani'*).

* Whether *Dyspontius striatus*, *marginatus*, and *conspicuus*, Hesse (Ann. Sc. Nat. 5 sér. vol. vi. p. 69, t. iv.), really belong to this or to some other genus, is not possible to decide.

† The specimens regarded by Scott as males can scarcely be such; neither are they mature males, as the anterior antennæ are not clasping-organs, nor immature, as the abdomen is said to be 6-jointed.

XXVIII.—Description of new Genera and Species of Trapdoor Spiders belonging to the Group Trionychi. By R. I. POCOCK, of the British Museum.

[Plate V.]

THE subfamily Miginæ of Simon, all the species of which, so far as is known, make their trapdoor-nests upon the trunks of trees, embraces three genera—*Moggridgea*, *Migas*, and *Myrtale*. In the present paper I have ventured to add three fresh ones to the group, all of them, like *Myrtale*, coming from Madagascar. One of these, namely *Thyropæus*, is so well marked that no one can doubt of its validity; but with regard to the stability of the others I myself have some misgivings. In the first place, since they differ from each other principally in the relative size of the eyes of the front row, species intermediate between the two will very likely turn up; and, in the second place, if the figure of the carapace of *Myrtale* that M. Simon has published is inaccurate in nearly all its details, as I suspect but have no right to assume, then there can be little doubt that *Paramigas* will prove to be synonymous with *Myrtale*—perhaps even the two type species will prove identical.

Of the South-African genus *Moggridgea* four species have been described—*M. Dyeri*, Cambr., *M. Abrahami*, Cambr., *M. Tidmarshi*, Lenz, and *M. Meyeri*, Karsch. But M. Simon states that *M. Abrahami* must be transferred to the New-Zealand genus *Migas*. In this I cannot agree with him, since specimens of *M. Abrahami* from Grahamstown, sent by the Rev. N. Abraham to the British Museum in 1887, belong merely to a well-marked species of *Moggridgea*. Moreover, the assertion that the nest of this species is furnished with a back as well as with a front door, is not strictly in accordance with facts, seeing that six specimens of the nest sent with the above-mentioned spiders are of the usual one-doored type. Mr. Cambridge, indeed, mentions that only one of the two specimens examined by him was provided with a posterior door; so that we must consider it to be the exception rather than the rule in this species, as also in *M. Dyeri*, for there to be a second trapdoor.

There can, I think, be no grave reasons for doubting that the species under discussion was also described by Lenz as *M. Tidmarshi*; in which case the name employed by Mr. Cambridge has about six months' priority, and the synonymy may be set forth as follows:—

Moggridgea Abrahami, Cambr. P. Z. S. 1889, p. 41 (published in April).

Moggridgea Tidmarshi, Lenz, Zool. Anz. xii. p. 578, 1889 (published in November).

PARAMIGAS, gen. nov.

Carapace smooth and polished, moderately elevated, the area between the fovea and the eyes horizontal, a little longer than broad, the greatest width equal to the area between the eyes and the posterior border; cephalic region a little wider than the distance between its front border and the apex of the fovea. *Fovea* triangularly recurved, trifid as in *Myrtale*, but each of the side-branches only equal in length to half the width of the ocular area; the impressions at the inner ends of the cephalic grooves shallow.

Ocular area transversely oblong, twice as wide as long, the two lines about equal; the anterior slightly procurved, the median eyes of the anterior row a little larger than the lateral, round, separated by a space which is about equal to their radius, but separated from the lateral, which are oval, by a space almost equal to their diameter; the posterior lateral eyes about as large as the anterior lateral and separated from them by a narrow space, which is less than half their short diameter; posterior median small, round, about half the size of the lateral, with which they are almost in contact; distance between the anterior lateral eye and the edge of the clypeus equal to a little less than its long diameter.

Mandibles short, their upper surface rather abruptly sloped downwards from the base, inner surface flat, outer surface strongly inflated below; the lower surface, which is fringed externally and internally with long setæ, armed with two rows of teeth, 6 on the outer and 5 on the inner, those of the latter row the largest, except for the posterior tooth of the outer which is very long. *Fang* closing obliquely inwards and backwards, occupying a position intermediate between that which is typical of the *Mygalomorphæ* and the *Arachnomorphæ*; short, stout, with two cutting-edges, of which the external is serrulate, and two strong crests running along its convex surface.

Maxillæ with distinct though short apophysis, not hollowed basally for the reception of the labium, with a thick scopula along its anterior (inner) border, and the anterior half of its lower surface covered from base to apex with about 50 scattered spicules.

Labium soldered with sternum and lying in almost the same plane, the two separated by a smooth area, armed in its

distal half with about 40 spicules arranged in from four to six transverse rows.

Sternum piriform, flat, a little longer than wide, widest between the coxæ of the second and third legs, the scars (impressions) indistinct; a pair of long oval indistinctly defined scars in the posterior half of the plate and about as far from each other as from the margins of the sternum.

Legs 4, 1, 2, 3, the first and second pair much stronger than the third and fourth, and with their distal segments (patella, tibia, &c.) furnished below with a clothing of long woolly hairs; femora with normal hairs; the tibiæ, protarsi, and tarsi flat below, convex above, with a marginal external and internal row of stout close-set spines; the third and fourth legs not spiny, apically slender, and not flattened below; all the legs furnished above with hairs arranged in longitudinal lines; on the third leg the femur has a large triangular membranous area in the distal part of its lower surface; the anterior surface of the patella is covered thickly with short spiniform setæ, and similar short spinules are to be observed upon the distal end of the tibia, which has a smooth, shallow, saddle-shaped depression at its proximal end, and an upstanding ridge along its anterior edge.

The *palpi* resemble the legs of the first pair, but have no woolly clothing below and only one spine upon the proximal end of the inner edge of the tibia. *Claw* of left palp with a strong basal tooth, of right unarmed (? broken); claws of first and second legs with three teeth, of which the middle is usually the strongest; claws of third and fourth leg with one long tooth, with an accessory basal denticle on the anterior claw on the third leg.

Abdomen globular, covered with very fine short hairs. *Median spinners* slender, nearly cylindrical; exterior short, stout, with the basal segment longer than the second and third, the second a little longer than the third and hemispherical.

Paramigas subrufus, sp. n. (Pl. V. figs. 1-1 b.)

Colour. Carapace and limbs above of a rich reddish black; coxæ and sterna clear yellowish red; tarsi deep, almost blood-red; abdomen a deep bluish, greyish black.

Measurements in millimetres.—Total length of trunk 20, of carapace 8.5, width 7.3; distance of fovea from anterior margin 4.2; width of ocular area 3; length of one side of angular fovea 1.3.

Loc. Senbendrana, near Tamatave, Madagascar (*Majaster Coll.*).

This new genus, of which some of the characters given may prove, when other species are discovered, to be merely of specific value, is allied to *Myrtale* of Simon, of which but one species also, *M. Perroti*, is known (Ann. Soc. Ent. Fr. 1891, p. 300). In many points, indeed, the two are so strikingly alike that I was at first disposed to regard them as the same. But the figure of the carapace of *Myrtale*, published on p. 82 of vol. i. of 'Hist. Nat. Araignées,' makes such a reference impossible; for, if at all accurate, this figure shows that the carapace and especially the head of *Myrtale* are much narrower than in *Paramigas*, and that the branches of the thoracic fovea are much longer, the external one, for instance, being as wide as the ocular area. Simon also says that the claws of the legs in *Myrtale* have only one tooth, and that the labium is only spined at the apex, whereas in *Paramigas*, at least, its distal half is spined.

With the two specimens of this species were received two trapdoor-nests, evidently taken from the trunk of a tree. One of these is short, its length from the hinge to the base being only once and a half the width of the door and only a little greater than the width of the nest; the other one, however, is much longer, the length from the hinge being twice the width of the door. The doors are of the wafer type, and are covered, like the sides and upper surface, with moss, lichen, and pieces of bark.

MICROMESOMMA, gen. nov.

Nearly allied to *Paramigas*, *Moggridgea*, and *Myrtale*.

Carapace resembling that of *Paramigas* in having the cephalic sulci well developed, but the fovea, which is so deep in *Moggridgea*, shallow; posterior portion of carapace marked with three pairs of marginal impressions; the median impression of the fovea not so deep as in *Paramigas*.

Eyes arranged as in *Paramigas*, but the anterior median less than half the size of the anterior lateral, which are relatively enormous and nearly spherical; the distance between the anterior median eyes about equal to their diameter; posterior laterals minute, barely half the size of the anterior medians, and noticeably smaller than the posterior medians, which, although elongate, are about as large as the anterior medians.

Mandibles, maxillæ, labium, and sternum as in *Paramigas*, but the sternum distinctly less narrowed between the coxæ of the first pair of legs; *coxæ* of the second and third legs armed posteriorly at the base with a distinct cluster of spinules; indications of these on the coxæ of the first leg.

Legs and palpi as in *Paramigas*, but the legs not woolly beneath; the impression of the upper surface of the tibia of the third deeper, and a cluster of spinules at the distal end of the upper surface of the first and second tibiæ; a couple of slender spines on the lower surface of the protarsus of the fourth; claws of first and second legs armed with a couple of long teeth, those of the third leg with one long tooth and a small one behind it, that on the fourth with one long tooth.

Abdomen and spinners as in *Paramigas*.

Micromesomma Cowani, sp. n.

Colour deep yellowish brown throughout, a little paler below; abdomen blackish grey.

Measurements in millimetres.—Total length of trunk 16·5, of carapace 5·5, width of latter 5; length of first leg 11, of second 10, of third 9·5, of fourth 13.

Loc. Central Madagascar (*Rev. Deans Cowan*).

THYROPÆUS, gen. nov.

Carapace very slightly longer than wide, smooth, with cephalic region high, wide, and convex, with the sides nearly perpendicularly sloped, widest between the coxæ of the second pair of legs, very strongly narrowed backward from this point. *Fovea* as in *Paramigas*, but not angular, only lightly recurved, the median impression projecting further backwards than the lateral; the cephalic sulcus and impressions shallow. *Ocular area* very wide, half the length of the carapace and about twice the width of the fovea; eyes of anterior row straight, of posterior row slightly recurved and not so wide; all the eyes small, the lateral particularly being indistinct; the median eyes on a very low tubercle, separated by a space which is slightly larger than their diameter, but which is barely one third of the space between them and the lateral, which are smaller and very narrow, almost linear; the posterior lateral also nearly linear, separated from the anterior lateral and from the posterior median by spaces which are a little greater than the distance between the anterior medians; the posterior median eyes a little smaller than the anterior median. *Clypeus* very large, its length equal to the distance between an anterior median and anterior lateral eye.

Mandibles constructed as in *Paramigas*, but relatively stronger; the inferior edge armed externally with 3 or 4 strong teeth and internally with 4; the space between them finely denticulate; some of the setæ on the inner surface

of the mandible at the base of the fang stiff and spiniform; external edge of fang not serrulate.

Maxillæ furnished with a long distal apophysis; a few long slender spinules intermixed with the hairs of the scopula extending along its anterior edge.

Labium large, conical, its width at the base equal to its length, armed only at the apex with spinules; united with the sternum, but separated from it by a conspicuous, transverse, smooth, pale, shallow depression.

Sternum cordiform, but less narrowed in front than in *Paramigas*, its width between the coxæ of first legs greater than half its greatest width between the coxæ of the second and third pairs. Two very conspicuous scars *, consisting of short crescentic impressions in the anterior half of the sternum, about as distant from each other as each is from the edge; the rest of the impressions obsolete.

Palpi and anterior two pairs of *legs* as in *Paramigas*, but not woolly below, and the tibia of the palp with several spines on its inner edge; the third and fourth pairs, however, much stronger than the first and second, as in *Pachylomerus*, *Idiops*, &c.; femur of the third almost wholly membranous below, its tibia deeply impressed at the base and shorter than the patella when measured along the upper surface; claws of first two pairs of legs armed, as in *Paramigas*, with one large and one or two smaller teeth; those of the third and fourth pairs armed with one enormous tooth, which is as large almost as the curved half of the principal claw; anterior claw of the fourth smaller than the posterior and directed forwards; the inferior claw on the third leg small.

Abdomen and *spinners* as in *Paramigas*.

Thyropæus mirandus, sp. n. (Pl. V. figs. 2-2 b.)

Colour. Carapace olive-brown; legs blacker; anterior coxæ and anterior part of sternum deep brown, posterior part of sternum and posterior coxæ much paler; abdomen brownish grey.

Measurements in millimetres.—Total length of trunk 43, of carapace 18; width of carapace 16·5; distance of fovea from anterior border 11; width of ocular area 8·5; length of clypeus 3; length of palp 20, of first leg 30, of second 28, of third 28, of fourth 35.

* Typically, or, rather, primitively, in spiders of this group there seem to have been four pairs of sternal scars placed close to the coxæ of the palpi and first three pairs of legs. Those opposite the palpi become the groove between the labium and the sternum.

A single female specimen from South Central Madagascar (J. Last Coll.).

This is, perhaps, one of the best-marked genera of trapdoor spiders that has been described for some years. Unfortunately nothing is known for certain of its habits; but, from its structural features, there can be little doubt that it resembles *Moggridgea*, *Myrtale*, and *Paramigas* in building its home on the trunks of trees. But, although approaching the genera just mentioned in many particulars, it yet presents many points of likeness, although perhaps not in every case of affinity, with many other genera of Ctenizidæ. For instance, its small scattered eyes remind us of *Eriodon*, its maxillary apophyses recall those of *Stasimopus*, and its long clypeus suggests the same area in *Bothriocyrtum*.

NEOCTENIZA, gen. nov.

Carapace polished, sparsely hairy; fovea deep, transverse; cephalic region strongly elevated and convex; ocular area wide and transverse; eyes rather scattered, anterior median the smallest of the set, separated by a space which is greater than their diameter and barely half the distance between these eyes and the anterior lateral; the two lateral eyes subequal in size and separated by a space which about equals their short diameter, the posterior median larger than the anterior median and nearly midway between them and the posterior lateral; anterior line of eyes slightly procurved, posterior slightly recurved and a little wider. *Clypeus* narrow, sloped, and bristly.

Mandibles furnished apically with glistening red hairs, which become spiniform below; the apophysis long and armed with half a dozen or more strong and longish teeth; its lower border armed with two rows of about six or seven teeth, which become intermingled behind; fang for the most part smooth and polished.

Maxillæ longer than wide, with a conical distal apophysis, internally scopulate, below covered with spiniform setæ, but only furnished with about a couple of denticles on the front edge of the proximal surface.

Labium conical, convex, armed only with stout setæ, its two sides continuing the slope of the sides of the sternum.

Sternum widest just behind the coxæ of the second legs, strongly narrowed forwards from this point, its anterior part marked with a deep longitudinal groove, which is continuous with the groove defining the labium, and forms with it a Y-shaped sulcus. The sternal scars very indistinct, the au-

terior pair small, close to the edge of the sternum, the remaining two pairs represented by indistinct elongate naked areas extending from near the edge towards the centre of the sternum.

Legs: third and fourth pairs stronger than first and second pairs; tarsi and protarsi of first and second pairs thickly and strongly spined on their margins, scantily hairy below; tibiae of the legs furnished with a few spines in the same position; in the third leg the femur is enormously stout, its width being about three quarters of its length; the patella thickly covered in front and above with stout short spines, forming a regular comb along the distal border; the tibia also, which is much shorter than the patella, armed in the same way in front and above with two clusters of spines; protarsus much thinner than the tibia, armed above with two series of spines and one long distal spine below; tarsus unarmed; femur of fourth leg armed apically above and anteriorly with a small cluster of spines; patella with a few spines intermingled with setæ, tibia unarmed except for a few setiform spines below; protarsus armed with many long spines; tarsus unarmed; *claws* armed with one very long tooth, behind which on the third and fourth leg there is an additional spinule and one in front of it on the anterior claw of the first and second leg; the inferior claw long and strong.

Palp with tarsal segment strongly spined from base to apex without and within; a number of spines, too, on the anterior aspect of the tibia and a few on its posterior aspect.

Genital plate mesially thick, horny, and black.

Spinners conical, the basal segment longer than the two distal segments, of which the apical is the shorter.

This genus is most nearly allied to *Cyrtocarenum*, but certainly differs in the width of the ocular area and in the form of its sternal impressions.

Neocteniza Sclateri, sp. n. (Pl. V. figs. 3-3 b.)

Colour yellowish brown on the carapace and limbs, blackish grey upon the abdomen.

Measurements in millimetres.—Total length of trunk 14.5, of carapace 6.5, width of latter 5.5; length of first leg 10, of second 10, of third 10.5, of fourth 13.2.

Loc. Demerara. A single female example obtained by Mr. W. L. Sclater.

. ANEMESIA, gen. nov. (Pl. V. fig. 4.)

Allied to *Nemesia*, *Hermacha*, and *Rhachias* in having the

claws furnished with two rows of teeth, the posterior tarsi hairy and not spined, and the space between the lateral eyes narrow. Tarsal claw obsolete on the legs of the first pair, distinct on the others. Maxillæ armed basally on the inner side with a cluster of spinules. The posterior sternal impressions, *i. e.* those corresponding to the legs of the third pair, elongated, large, about twice as far from each other as from the lateral margin; the impressions opposite the second legs small, but removed from the margin.

Clypeus narrow, but vertical. Eyes not raised on a tubercle; the ocular area large and transverse; anterior line of eyes slightly procurved; lateral eyes larger than anterior median. Fovea deep, transverse.

Mandibles without anterior angular prominence; the margin above the base of the fang armed with a thick cluster of setiform spines, without the thick spines observable in *Nemesia*; fang long, distinctly geniculate at the base.

Type *Nemesia tubifex*, Pöc. Tr. Linn. Soc., Zool. v. pt. 3, pp. 112, 113, pl. xiii. fig. 2, from Gulran.

According to Dr. Aitchison this species does not close the aperture of its burrow with a movable lid. In this particular it differs from all the known species of *Nemesia*.

Genus ACTINOPUS, Perty.

Actinopus Hartii, sp. n.

Colour. Carapace greenish chestnut, mandibles rather darker; abdomen greyish black above, pale at the sides and below; femora of legs and palpi the same colour as the carapace; the rest of the segments clear yellowish red; sternum and coxæ pale yellow; maxillæ and labium reddish brown.

Eyes apparently as in *A. scalops* of Simon, the anterior and posterior rows equal in width; the anterior row almost straight, with a slight procurvature; posterior row recurved; eyes of the latter row close together, the median subequal to or a little smaller than the lateral; anterior lateral larger than median and separated from the edge of the clypeus by a space which evidently exceeds their diameter; median eyes separated from each other by a space which about equals their diameter, and from the laterals by a space about four times as great.

Mandibles smooth above externally, hairy internally; hairs stouter above the base of the fang; the apical process (rastellum) long, more than a third of the length of the fang, studded with blunt short processes, which are longer on its inner edge at the apex; fang stout, four-sided, striate; lower

edge of mandible furnished with an external edge of 6 stout blunt teeth and an inner one of 4 or 5, of which the apical is the stronger, and on the inner side of the latter row with two irregular rows of smaller teeth.

Labium long, conical, thickly clothed in its distal half with stout hairs, amongst which at the apex there is a thick cluster of spinules, which appear to have arisen from the fracture of stout setæ. *Maxillæ* all along their inner border clothed with setæ intermixed with spinules.

Sternum with a deep smooth median depression on its anterior half; from the posterior end of this three pairs of shallower impressions, representing the normal muscular scars, radiate in the direction of the coxæ of the first, second, and third legs.

Palpi as long as the legs of the first pair, but stouter; patella armed with a few spines amongst the setæ on its inner surface; the tibia and tarsus with an external and internal cluster of stout short spines, which are much more numerous on the tarsus. In the first and second legs the tarsi and protarsi are armed like the tarsus of the palp; the tibia of the first has from 8 to 12 spines in front and about the same number behind, of which the two lowest are the longest; tibia of second leg with from 1 to 3 spines in front and a cluster of spinules behind, of which one of the lower is very long. Patella and tibia of third marginally spined above, the protarsus and tarsus also thickly spined, especially posteriorly; patella of the fourth spinulose in front; tibia unarmed, protarsus with a few long spines anteriorly in its distal half; tarsus also thickly spined in front. *Claws* of palp unarmed; of leg with a single basal tooth, which is smaller on the posterior legs.

Measurements in millimetres of type specimen.—Total length of trunk 23, of carapace 10, width 9·5; length of appendages from base of femur: of palp 17, of first leg 17·2, second leg 17·5, third leg 18, fourth leg 22·5.

Loc. Trinidad (*J. H. Hart*).

In the *Ann. & Mag. Nat. Hist.* (6) xi. p. 409, I identified the specimens here described as *A. scalops*, Simon (*Ann. Soc. Ent. Fr.* 1889, p. 177); but the figure that I gave of the nest (pl. xix. fig. 3), with its peculiarly thickened hinge, does not tally with that of the nest of *A. scalops* published by Simon. The specific characters, too, of *scalops* do not seem applicable to *S. Hartii*. For instance, we are led to infer that the tibia of the second leg is unarmed in front and that the tibia of the first has fewer spines in *scalops* than in *Hartii*.

It is interesting to record that in young specimens 11 millim. in length the spine-armature of the appendages is weaker and

the anterior lateral eyes are close to the edge of the clypeus and are relatively larger, and that the anterior line of eyes is slightly wider than the posterior. The young thus seem to occupy the same relations towards the adult that *valenciana*, Sim., does towards *scalops*.

EXPLANATION OF PLATE V.

Fig. 1. *Paramigas subrufus*, gen. et sp. n., ♀, nat. size.

Figs. 1 a, 1 b. Ditto. Two views of nest.

Fig. 2. *Thyropæus mirandus*, gen. et sp. n., ♀, nat. size.

Fig. 2 a. Ditto. Sternum.

Fig. 2 b. Ditto. Maxilla.

Fig. 3. *Neosteniza Sclateri*, gen. et sp. n. Eyes (lateral eyes a little too prominent).

Fig. 3 a. Ditto. Side view of carapace.

Fig. 3 b. Ditto. Labium and part of sternum.

Fig. 4. *Anemesia tubifex* (Poc.), gen. nov. Sternum.

XXIX.—Description of a new Species of Squirrel from Central Africa. By W. E. DE WINTON.

By the kind permission of the authorities of the British Museum I have been enabled to examine the series of African Squirrels in the National Collection; and though I contemplate publishing full notes later on, I now describe one species the distinctiveness of which has hitherto been overlooked.

The specimens were obtained by Emin Pasha, and I name the species in his honour.

Sciurus Eminii, sp. n.

In form and general distribution of colour resembling *S. pyrrhopus* (F. Cuv.), but considerably smaller in size and much plainer in colouring. The outer-fur of the back and sides is black, with a subterminal band of golden olive, the soft under-fur being slate-black tipped with golden brown; a very narrow pale stripe on either side runs from the shoulder to the hip, formed by the outer-fur of this part lacking the black tips; the sides of the face from the nose to the ears, embracing the eyes, the fore and hind limbs, foxy red, the border-lines not sharply defined; the crown of the head and front of the face more rufous than the back, the hairs being still black but banded with reddish instead of golden olive; the jowl is yellowish; the chin orange; the throat, belly, and inner side of legs, white more or less suffused with red, the inner side of the hind legs being orange-rufous save for the under-fur, which is always white; there is no sharp line

between the colours of the upper- and underparts; tail as in the other members of the group; the fur is extremely soft. In the female the colours are not so bright, and the red on the underparts is almost wanting.

Measurements of the type, in skin (♂):—

	millim.
Head and body	188
Hind foot without claw	43
Tail (broken)	—
Tail of female without fur	143
" " with fur	180

Hab. Tingasi, Monbuttu.

Specimens examined:—

Brit. Mus. 87.12.1.33. ♂. Killed 16.9.83. (Type.)

 " " 87.12.1.39. ♀. " 10.10.83.

These specimens were mentioned by Mr. Oldfield Thomas (P. Z. S. 1888, p. 9) under *S. pyrrhopus*, with a note saying that Tingasi was by far the most easterly recorded locality for the species; also (P. Z. S. 1890, p. 447) under *S. pyrrhopus typicus* (partim).

PROCEEDINGS OF LEARNED SOCIETIES.

GEOLOGICAL SOCIETY.

April 3, 1895.—Dr. Henry Woodward, F.R.S.,
President, in the Chair.

The following communication was read:—

‘On a Comparison of the Permian Freshwater Lamellibranchiata from Russia with those from the Karoo Formation of Africa.’ By Dr. Wladimir Amalitsky, Professor of Geology in Warsaw University.

The freshwater shells from the Russian Permian deposits belonging to the genus *Palæomutela* are also known from the Karoo Beds of South and Central Africa, as pointed out by the Author in 1892. He has recently had the opportunity of studying the actual specimens from the Karoo Beds, and finds in them species of the groups *Palæomutela inostranzewi*, *P. Keyserlingi*, *P. Verneuilii*, and *P. Murchisoni*; also of a new genus, the forms of which he had previously referred to *Naiadites*, Dawson. All these groups are found also in Russia, and he gives a list of species found in the upper horizons (A, B, and C) of the Permian beds of Russia and in the Karoo beds. These upper beds of Russia have been determined by the Author as the freshwater equivalents of the Zechstein; consequently the Beaufort Beds of the Karoo Series, if considered as the

homotaxial equivalent of the European strata referred to above, should be regarded as Upper Permian. The Upper Permian group of freshwater lamellibranchiata of Russia, which bears traces of genetic relationship with the Carboniferous Anthracosidæ, and which was already well represented in Permo-Carboniferous and Lower Permian times, is, according to the Author, much older than the African fauna of the Beaufort Beds. These may be concluded to have migrated from Russia, the Gondwana Beds of India having probably been the connecting-link between all these deposits.

The Author gives a description of the fossils of the Karoo Series which he has examined, including a diagnosis of the new genus in which he places the fossils already alluded to as having been previously referred to the genus *Naiadites*.

April 24, 1895.—Dr. Henry Woodward, F.R.S.,
President, in the Chair.

The following communication was read:—

‘Supplementary Notes on the Systematic Position of the Trilobites.’ By H. M. Bernard, Esq., M.A., F.L.S., F.Z.S.

Since the publication of a paper by the Author in the ‘Quarterly Journal of the Geological Society’ for 1894, two important papers by Dr. Beecher have appeared, giving details as to the structure and appendages of *Triarthrus*.

In the present paper the Author discusses in detail the more recent discoveries in the light of the affinity between *Apus* and the trilobites, and endeavours to show how the results obtained by Dr. Beecher bear on the larger question as to the suggested origin of both of these animals from a chætopod annelid modified in adaptation to a new manner of feeding.

May 22, 1895.—Dr. Henry Woodward, F.R.S.,
President, in the Chair.

The following communications were read:—

1. ‘On a Human Skull and Limb-bones found in the Palæolithic Terrace-Gravels at Galley Hill, Kent.’ By E. T. Newton, Esq., F.R.S., F.G.S.

A human skull with lower jaw and parts of the limb-bones were obtained by Mr. R. Elliott from the high-terrace gravels at Galley Hill, in which numerous Palæolithic implements have been found.

The skull is extremely long and narrow, its breadth-index being about 64, it is hyperdolichocephalic; it is likewise much depressed, having a height-index of about 67. The small extent of the cranium in both height and width shows that it has undergone little or no post-mortem compression, although it has become somewhat twisted in drying. The supraciliary ridges are large, the forehead somewhat receding, the proboscis prominent, and the occiput flattened below. All the chief sutures are obliterated. Three lower molars and two premolars are in place and are well worn, the three molars being as

nearly as possible equal in size. The limb-bones indicate an individual about 5 ft. 1 in. in height.

These remains are compared with the fossil human relics which have been found in Britain and on the Continent of Europe, as well as with the dolichocephalic races now living, and their relations to the 'Spy,' 'River-bed,' 'Long-barrow,' 'Eskimo,' and other types are pointed out.

The gravels, in which these human bones were found, overlie the Chalk at a height of about 90 feet above the Thames, and are about 10 feet thick. They form part of the high-terrace gravels extending from Dartford Heath to Northfleet, and their Palæolithic age is shown by the numerous implements which have been found in them, as well as by the mammalian remains which have been met with in similar beds near by, although not at Galley Hill. The human bones were seen *in situ* by Mr. R. Elliott and Mr. Matthew Heys, both of whom, in letters, speak positively as to the undisturbed condition of the 8 feet of gravel which overlay the bones when discovered.

2. 'On some Foraminifera of Rhætic Age, from Wedmore in Somerset.' By Frederick Chapman, Esq., F.R.M.S. (Communicated by Prof. T. Rupert Jones, F.R.S., F.G.S.)

1. The Author has examined six samples of clays and limestones from different horizons; these were collected by Mr. W. A. Sanford, F.G.S., from a quarry south-east of the village of Wedmore, which has yielded Megalosaurian remains. The rocks in this quarry are regularly stratified, and characteristic Rhætic fossils have been obtained from them by Mr. Sanford.

2. The microscopical details of the various clay-washings are given, and the great abundance of some forms of the acervuline foraminifer *Stacheia* is noticed, included amongst which are forms that have been previously described under the name of '*Psammosiphon*' by Vine, and '*Plaques de Rayonnés*' and '*Asteracanthion*' by MM. Terquem and Berthelin; the former occurring in Silurian strata, and the latter in the Lias. The Rhætic examples of the genus *Stacheia* have numerous aggregated crystals of zeolites (?), of which however only impressions remain, included in the material of the tests.

3. In a comparison made with the foraminiferal faunæ of the older and younger rocks respectively, the Rhætic fauna shows marked affinities with both the Upper Palæozoic and the Liassic facies.

The bathymetrical aspect of the foraminifera from Wedmore is, generally speaking, that of a shallow-water deposit. The genus *Stacheia* is represented so abundantly in some of these Rhætic rocks that the fossils constitute distinct layers in the beds of clay in which they are found. *Stacheia* appears to resemble *Polytrema* in reference to its habitat, and also in the microscopical structure of its test, with the exception that *Stacheia* includes in the test-wall minute sand-grains and other foreign material.

4. Twenty-six species of foraminifera, chiefly of arenaceous types, are described, nine of which are new forms, viz.: *Haplophragmium rhaeticum*, *Ammodiscus auriculus*, *A. fusiformis*, *Nodosinella wedmoriensis*, *Stacheia intermedia*, *S. triradiata*, *S. dispansa*, *S. cuspidata*, and *Truncatulina stelligera*.

MISCELLANEOUS.

A Query as to the Synonymy of Rhysota Armiti, Smith.

By C. HEDLEY, F.L.S.

THOSE who have had occasion to deal with the revision of species, either fauna by fauna or region by region, have observed that when an author has described a species without figuring it succeeding writers on the same subject have frequently renamed such species, but that when the first reporter also gave a figure of his species such usually escaped the infliction of synonymy. Thus Gray first received several common New-Zealand land-shells and gave unfigured descriptions of them; Gould and Pfeiffer succeeded him in the study of this fauna, and gave several of his species new names. Again, Brazier was the first to name, without illustrations, several common Papuan forms; but Tapparone Canefri, who wrote later on a collection from the identical localities, so failed to understand his predecessor that he renamed most of them. It was once remarked by Dr. P. P. Carpenter that, "with the best desires for accuracy and the greatest care, it is hardly possible for an author to so describe that his readers shall see shells as he sees them."

These reflections are suggested by a perusal of Mr. E. A. Smith's article "Descriptions of new Species of Land-Shells from New Guinea" (*A. & M. N. H.* 1895, xv. pp. 230-233), and especially a description therein contained of *Rhysota Armiti*, sp. n. As I have endeavoured to show, no positive identification can be made from any mere description, even from one as good as Mr. Smith's invariably are. With this reservation, I should conclude that examples of my *R. flyensis* (*P. L. S. N. S. W.* (2) vi. p. 71) stood for this literary portrait—because, firstly, I have received from Capt. Armit and recorded (*op. cit.* (ix.) p. 390) from Mount Maneao (not Maneau, as Mr. Smith writes) specimens of *R. flyensis*; secondly, because size alone, a variable feature in this genus, appears the only written discrepancy in the descriptions of each; and, thirdly, Mr. Smith seems in comparing *Armiti* with *hercules* to be unaware of the existence of *flyensis*.

The Breeding-habits of the Crayfish. By E. A. ANDREWS.

The breeding-habits of the European crayfish, *Astacus*, have been studied and recorded; but nothing is known of the processes of conjugation in the American species.

A study of *Cambarus affinis* kept in confinement shows that conjugation takes place in the autumn and in the spring, and that it differs in important respects from what is known in *Astacus*.

That peculiar organ of the female, the annulus, proves to be an essential secondary sexual character. The male passes the sperm into the cavity of the annulus of the female, and does not distribute it elsewhere. The annulus, then, serves as a sperm-receptacle, and thus corresponds to the similarly situated organ described by Bumpus as a sperm-receptacle in the lobster, *Homarus americanus*. The well-known hooks on the ischiopodites of the third walking-legs of the male serve to hold the two animals firmly together, and are necessary secondary sexual organs. They are hooked over the firm ridges on the basipodites of the fourth legs of the female.

The special instincts and actions of the male and female are complex, and are very accurately interadjusted to secure the deposition of sperm in the annulus. The male, at a definite stage in the process of conjugation, passes either the right or the left fifth walking-leg across below his thorax in such a way as to support and guide the first and second pleopods, or intromittent apparatus, and thus secure effective function.

In the only case in which eggs were laid the sperm was removed from the annulus by the female soon after laying; the eggs, however, did not develop; various conditions were abnormal.—*Johns Hopkins University Circulars*, vol. xiv. no. 119, p. 74.

The Breeding-habits of the Earthworms. By E. A. ANDREWS.

The only detailed and accurate account of the complex phenomena of mutual conjugation in earthworms is that given by Hering for the European *Lumbricus terrestris*.

In studying the much smaller *Allolobophora fœtida* I find that it conjugates beneath the surface, and cannot therefore be directly observed.

Momentary immersion in boiling corrosive sublimate or boiling water followed by Perenyi's liquid preserves the conjugating individuals in the natural position, so that they may be studied by dissection and by the serial section method.

This study shows that the process is essentially as in *Lumbricus*. The union is, however, a much firmer and more intimate one, each individual being almost completely enveloped by the clitellum of the other, and firmly fastened to it by a stout enveloping case of mucus.

An important anatomical difference—the fact that the sperm-receptacles of *Allolobophora* open on to the dorsal surface, and not on to the ventral surface as they do in *Lumbricus*—necessitates a change in our conception of the method of sperm-transfer. The peculiar muscular contractions of the clitellum described by Hering are obviously insufficient to explain the filling of these dorsal sperm-receptacles, and we must apparently suppose there is some aspirating action of the receptacles involved in the process.

Light is also thrown upon the question of the origin of the so-called spermatophores, or "penes" of the older writers.

The sections show that they are formed opposite the openings of the vasa deferentia. Each is a secretion of skin-glands poured out from the lips of the vas deferens, and adhering firmly to the body of

the opposite animal, about the region of the twenty-first somite. Each is filled with a mass of sperm that issues from the vas deferens.

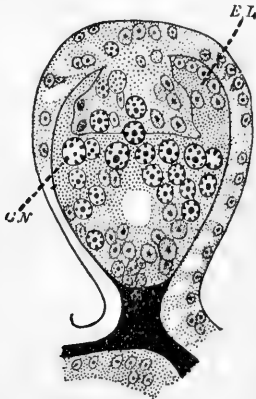
The idea advanced by Vejdovsky—that the spermatophores in *Lumbricus* are formed from the sperm-receptacles—does not hold in *Allolobophora*. A renewed study of *Lumbricus terrestris* by the above method of hardening *in situ* with boiling water and Perenyi's liquid shows that here also the spermatophores are opposite the vasa deferentia.

Until reasons for other views are given we may tentatively hold that the spermatophores in terrestrial Oligochætæ are not of the importance they assume elsewhere, but that they are to a large extent accidental results of secretions taking place during conjugation, and that they play no part in the subsequent processes leading to fertilization of the eggs.—*Johns Hopkins University Circulars*, vol. xiv. no. 119, p. 74.

Note on the Origin of the Bell-Nucleus in Physalia.

By SEITARO GOTO.

At the beginning of the present academic year Dr. Brooks kindly placed at my disposal specimens of *Physalia*, which had been collected and preserved by him some years ago, with the desire that I should make a study of them, with special reference to the nature of the so-called female gonophores (Haeckel). I also had occasion to make observations on the development of the male gonophores; and it has turned out that there is a peculiar feature in the formation of the bell-nucleus to which attention has, so far as I know, never been called. In this short preliminary note I propose to describe the process briefly. In the accompanying diagram I have



Longitudinal section of a young male gonophore.
EL, entodermal lamella; *GN*, germ-nucleus.

represented a longitudinal section of an early stage in the development of the male gonophore. In this particular specimen the

bell-nucleus forms a flattened conical mass; but in most other specimens that have come under my observation it is more elongated at this stage. The migration of the germ-nuclei have already begun. These are characterized by having their chromatic substance concentrated in a comparatively small number of large pieces, one of which usually occupies the centre of the nucleus and is larger than the rest, while the others are in most cases situated close to the nuclear membrane. The germ-nuclei are, as a rule, considerably larger than those of the ordinary entodermal cells and are spherical in form. In the accompanying diagram four germ-nuclei have already passed into the bell-nucleus, and a fifth is just passing the supporting layer.

Now the point to which I wish to call special attention is *the formation of the bell-nucleus by the wandering in of interstitial cells from the ectoderm*. This fact I believe to have satisfactorily proved, at least to myself, by a comparison of a large number of sections. I have never seen any of the definitive ectoderm-cells undergoing mitosis; but, on the contrary, the interstitial cells can be observed in all stages of migration to form the bell-nucleus. In the section from which the accompanying diagram has been drawn a stream of protoplasm could be observed around many of the migrating nuclei; and in most of the sections numerous interstitial cells with amœboid processes are everywhere present in the ectoderm of the gonophoral bud. This indicates that they are in active migration. I believe also that some of the interstitial cells divide in the gonophore, for in some sections I have observed spherical nuclei with a vesicular appearance and with a small number of large chromatin pieces. This I take to be an indication that they are undergoing reconstruction from a recent mitosis. Two such nuclei are drawn in the diagram at the entrance of the bell-nucleus.

The youngest stage of the so-called female gonophore that I have been able to obtain was far more advanced than the male gonophore represented in the diagram. The cavity of the bell-nucleus has been formed and is lined by a distinct epithelium of columnar cells. But exactly the same process that takes place in the male gonophore can be observed to occur with even greater distinctness. The interstitial cells of the ectoderm crowd in towards the entrance of the bell-nucleus, and are there seen to arrange themselves one by one into a distinct epithelium, and form a part of the lining of the cavity of the bell-nucleus. In the so-called female gonophore the cells that have wandered in and formed a part of the epithelium afterwards undergo repeated division, while in the male gonophore no such has been observed.

It seems to me that *Physalia* presents in this respect an intermediate stage between those forms in which the bell-nucleus is formed as a solid mass of cells from the ectoderm and such form as *Coryne pusilla*, in which, according to Weismann, cells migrate singly into the endoderm and there form the bell-nucleus afterwards. —*Johns Hopkins University Circulars*, vol. xiv. no. 119, p. 80.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SIXTH SERIES.]

No. 93. SEPTEMBER 1895.

XXX.—*Notes on Amphipoda, old and new.*
By the Rev. THOMAS R. R. STEBBING, M.A.

[Plates VIII.—X.]

THE family Photidæ was divided in Boeck's system into three subfamilies—Photinæ, Leptocheirinæ, and Microdeutopinæ. Though the name *Microdeutopus* alludes to the peculiarity of the animal's second gnathopods being smaller than the first, the Microdeutopinæ included species in which the first gnathopods are smaller than the second. For this and other reasons explained in the 'Challenger' Amphipoda, p. 1062, and Sars's 'Crustacea of Norway,' p. 538, it has seemed desirable to relinquish Boeck's subdivision of the family. Della Valle, in his 'Gammarini,' p. 351, carries the process of amalgamation further, and unites the Photidæ and the Podoceridæ in one rather unwieldy family with the Corophiidæ. It is quite true that the three families are intimately related, but it is certainly a matter of convenience to keep them separate, and for this purpose the dorso-ventrally depressed body in the Corophiidæ and the hooked uropods in the Podoceridæ are useful characters, neither of them being present in the Photidæ. To borrow the words which Professor T. Thorell uses on a similar occasion—"The groups are *on the whole* and *in their typical forms* sufficiently different to deserve their separate denominations and the rank in the system which it has hitherto been customary to give them."

Our present concern is with that section of the Photidæ in which the first gnathopods are larger than the second, especially in the male sex.

In *Aora* the first gnathopod of the male has the fourth joint greatly produced, so as, in combination with the long finger, to make the limb complexly subchelate.

In *Microdeutopus* it is the fifth joint, instead of the fourth, which is produced to meet the finger.

In *Stimpsonella* (the name proposed by Della Valle for Spence Bate's preoccupied *Stimpsonia*) the first gnathopod agrees with that of *Microdeutopus*, but the second gnathopod has the prehensile angle of the sixth joint more or less produced. Bate and Westwood (vol. i. p. 284) say:—"This genus probably bears too close a resemblance to *Microdeutopus* to be retained as generically distinct." Sars also ('Crustacea of Norway,' p. 540) remarks that it is closely allied to *Microdeutopus*, "and should, perhaps, more properly be combined with it." An opinion to the same effect is rather more decidedly expressed in the 'Challenger' Amphipoda, p. 334. One is the more encouraged in regarding the character on which *Stimpsonella* is founded as of not more than specific value, because Della Valle distinguishes his own *Autonoë spiniventris* from two other species of the same genus by the mark that it has the prehensile angle of the first gnathopods in the male *not* prolonged, whereas in the other two species it *is* prolonged into a spiniform process. It may be noticed that on page 400 of Della Valle's work "gnatopodi posteriori" is merely a misprint for "gnatopodi anteriori." But in closely related forms a difference cannot consistently be given generic value in one gnathopod if it has only specific importance in the other.

In *Autonoë*, as it is commonly called, the first gnathopods of the male are simply instead of complexly subchelate, there being no process either of the fourth or the fifth joint to meet the finger. Here, too, the sixth joint is as broad and as large as the fifth, which is far from being the case in *Microdeutopus*. As regards the name of the genus, it seems clear that the discarded *Lembos* ought to be restored. Under this name, published without description in 1856, a genus was instituted by Spence Bate in 1857 with four species, of which some indeed belong to the earlier *Microdeutopus*, but one of them, *Lembos Websterii*, has been referred alike by Boeck, Sars, and Della Valle to *Autonoë*. Now *Autonoë* was not instituted by Bruzelius before 1859. To it he ascribed six species, two of which he wrongly supposed to be new, while the whole set belonged in fact to no less than five already established genera.

The definition which he gave of the genus was so comprehensive, therefore, as to be practically no definition at all. As five of his species could not fail to be distributed among the genera *Aora*, *Microdeutopus*, *Gammaropsis*, and *Protomedeia*, the only one left to be the type of the new genus was that which he calls *Autonoë longipes* (Lilljeborg). The minutely accurate observation of Sars distinguishes this by some rather small differences from the *Lembos Websterii* of Spence Bate, which Della Valle considers to be a synonym of it. The last-named author recognizes the inadequacy of the definitions given both by Bate and Bruzelius, but assigns the preference to the name *Autonoë*, because in 1870 it was redefined satisfactorily by Boeck. This is introducing into the rules of nomenclature a new principle which might lead to much confusion. *Autonoë* having become a synonym of the earlier *Lembos*, it was not open to Boeck to make a choice between the two. His reason for giving the preference to *Autonoë* may have rested on a misapprehension that *Lembos* had lapsed as a synonym of *Microdeutopus*, an error in which he has been followed by several writers. The genus *Lembos* will now contain the species *Websterii*, Bate, *longipes* (Lilljeborg), *megacheir* (Sars), *arcticus* (Hansen), *spiniventris* (Della Valle), *philacantha* and *kerqueleni* from the 'Challenger' expedition, possibly, as Sars has suggested, *tenuis* (Dana), and, lastly, a new species to be presently described.

Lembos hirsutipes, sp. n. (Pls. VIII. & IX. B.)

The first side-plates in the male subacutely produced, sub-rhomboidal in the female. The third pleon-segment with the postero-lateral angles scarcely rounded.

The eyes are small. The first antennæ have a rather long and stout first joint, the remainder being broken off in all the specimens. In the second antennæ the third joint is less than once and a half as long as it is deep, much deeper than the fourth joint, which is as long as the first of the upper pair; the fifth joint is a little shorter than the fourth. The flagellum of four or five joints scarcely equals the length of the fifth joint of the peduncle. The mouth-organs do not appear to offer any distinctive features.

First Gnathopod.—In the male the second joint is broad, with a brush of very long setæ at the distal end of the hind margin, as in *Lembos longipes* (Lilljeborg); the small third joint has distally a transverse row of setæ, the fourth has two small groups on the hind margin, and the fifth has three. The fifth joint or wrist is considerably shorter than

the hand, but nearly as broad. The large and very broad hand has some small groups of setæ on its inner surface, on the hind margin, and near the palm, but none are very conspicuous. The palm has a deep narrow cleft between a broad inner and a long and narrow outer tooth. Beyond the latter, which is much longer than the corresponding tooth in *Lembos longipes*, the denticulate finger projects a little. The varying shape of this palm in different species of the genus will not easily be appreciated without comparison either of specimens or of figures. In the female the first joint is neither broad nor ornamented with setæ, and the palm has a comparatively small triangular indentation. The hand is much longer and slightly broader than the wrist, both being much broader than the second joint.

Second Gnathopod.—In the male the second joint is expanded, as in *Microdeutopus gryllotalpa*, Costa, oval, very nearly as broad as the side-plate, which is of about equal length and depth. The wrist is longer and broader than the hand, and has numerous groups of setæ adjoining each margin, those near the apices being the longest, the subapical of the hind margin curving towards and reaching beyond the hind margin of the hand. The hand has the front and hind margins nearly parallel, the setæ projecting from the former being very numerous and long, those of the latter forming six small groups of moderate length. The finger is small, curved, with its apex bending over beyond the palm. In the female none of the joints are broad; their relative lengths are about the same as in the male, but the hand is a little longer as compared with the wrist, neither of these joints having the front margin conspicuously setiferous except that the wrist has a bunch of long setæ at the apex; the hind margins are furnished as in the other sex; the finger does not reach beyond the palm.

First and Second Peræopods.—The two pairs are alike. In the male the large fourth joint in each is thickly clothed on both sides with long unfeathered setæ. The sixth joint has the front margin very convex. The finger is tolerably long, with the opening for the glandular secretion at a little distance from its apex. In the female the fourth joint has no conspicuous armature in either pair. All the marsupial plates are oval.

Third Peræopod.—The fourth joint has a spine at the apex of the hind margin; the fifth has two in this position and two on its inner surface; the sixth joint is twisted round, so that the short finger points backward instead of forward.

Fourth Peræopod.—The second joint carries several groups

of feathered setæ on its hind margin. The armature of the succeeding joints is nearly the same as in the third pair, but the sixth joint is straight instead of curved, and not twisted round.

Fifth Peræopods.—There is little doubt that these exceed in length the preceding pair, but none were found actually attached to the specimens.

Pleopods.—These carry two slender coupling spines on the peduncle and two cleft spines on the inner ramus. Each ramus has ten joints, but nevertheless the outer ramus is considerably shorter than the inner.

Uropods.—In the first two pairs the outer ramus is shorter than the inner; in the third pair there is no sensible difference in the length.

Telson.—The length and breadth are about equal. The apex is rounded, projecting a little beyond the usual pair of lateral processes, each of which is accompanied by a couple of setæ or slender spines.

The length of the animal, without the antennæ, is about three-twentieths of an inch, or 4 millim.

The specific name refers to the very distinctive feature that here the second peræopod of the male has the same hirsute adornment as the first peræopod. In this respect it differs from all species of the genus hitherto described.

For the locality see the remarks on the next species, the specimens of which were mixed up with those of *Lembos hirsutipes*.

LEMBOIDES, gen. nov.

As in *Lembos*, the first gnathopod has neither the fourth nor the fifth joint produced to meet the finger, but the fifth joint is much broader and longer than the sixth, and the finger does not overlap the palm. The secondary appendage of the upper antennæ is shorter than the third joint of the peduncle.

The mouth-organs, peræopods, uropods, and telson are in general agreement with those of *Aora*, *Microdeutopus*, and *Lembos*, and, as in those genera, the gnathopods of the female differ much from those of the male. In the type species the third uropods, as well as the first and second, have the outer ramus shorter than the inner. It is at present doubtful whether this circumstance can usefully be included in the generic character.

Lemboides afer, sp. n. (Pls. IX. A. & X.)

The first side-plates in the male are longer than any of the

following pairs, but they are not acuminate. The large third segment of the pleon has its postero-lateral angles rounded; the sixth segment is scarcely visible dorsally.

The eyes are small and dark.

First Antennæ.—The first joint is rather longer and much stouter than the second; the third is rather more than a third of the first in length. The flagellum consists of about fifteen joints, of which the last is minute, the rest moderately long. The secondary flagellum is very narrow, two-jointed, not equal to the first of the primary, with the terminal joint minute. On one antenna of a female specimen this appendage consisted of three joints, of which the first was shorter than the second, the whole appendage equalling in length the first joint of the principal flagellum. The appendage of the companion antenna was normal.

Second Antennæ.—The third joint is equal in length and depth, having a winged appearance on the lower side. The fourth joint is much narrower, but more than two and a half times as long. The fifth joint is shorter and much narrower than the fourth, but longer than the three- to four-jointed flagellum. The lower antennæ, though with a much longer peduncle, are, on the whole, considerably shorter than the upper.

The mouth-organs offer no specially distinguishing features.

First Gnathopod.—In the male the second joint is moderately broad, carrying but few setæ; the fourth joint has a very acute apex; the fifth is of great length and breadth, much broader than the second, which it partially receives in a channelling of its front margin; its hind margin is serrulate and setiferous. On its straight distal border is seated the much narrower hand, which has several small groups of setæ on each margin and some on the inner surface. The palm is formed by a strong tooth near the hinge of the finger and a very small tooth at the other extremity, between them being a tooth of intermediate size, separated from the largest tooth by a broad denticulate cavity. The finger, with serrate inner margin, exactly reaches the small tooth of the palm, below which is inserted a stout spine. In the female the wrist is not much broader than the second joint or the hand. It is densely setose on the hind margin. The hand is abundantly setose on both margins; its palm is not dentate and is overlapped by the serrate finger. The second joint has several setæ projecting from the front border; there is a group on the apex of the third and several groups on the fourth joint.

Second Gnathopod.—In the male the second, third, and fourth joints are nearly as in the first pair, but on a smaller scale;

the wrist about equals the second joint in length and breadth, it is adorned with long feathered setæ on the front and shorter groups on the hind margin; the hand, which is considerably shorter than the wrist and narrower, though not extremely so, is similarly furnished; its palm has a single denticulate excavation between the point where the palmar spine is inserted and the tooth adjoining the hinge of the finger; the latter does not overlap the palm, and appears to have but one denticle on its inner margin. In the female the second joint carries some very long feathered setæ on the front, and this is the case also with the fourth joint. The wrist is not quite so long as the hand, proximally very narrow, but distally widest of all the joints, fringed with long feathered setæ on the front and shorter setæ on the back of the widened part. The long and rather narrow hand is similarly furnished, but with its width little varying throughout. The small finger just fits the convex palm.

First Peræopod.—The fourth joint is ornamented on the front margin with two slightly separated series of long plumose setæ. The marsupial plates are comparatively elongate.

Second Peræopod.—As in some other species within this group of genera, this pair of limbs is less setose than the preceding. The fourth joint has two series of setæ on the front margin, but the upper one is insignificant and the lower less developed than in the preceding pair.

The other peræopods are of the usual type.

Pleopods.—There are two coupling spines and three cleft spines to each pleopod. Each ramus has from fifteen to seventeen joints, but the outer is considerably shorter than the inner, its joints being smaller than those of its companion.

Uropods.—In all three pairs the outer ramus is decidedly shorter than the inner. The inner ramus of the second pair is stouter than any of the other rami.

Telson.—The length and breadth are equal, the apex shallowly rounded, the lateral processes accompanied by five spinules apiece.

Length, without the antennæ, about a quarter of an inch.

The specific name refers to the locality where the specimens were found, this being at or near the Cape of Good Hope. They were presented to the Copenhagen Museum by Professor Studer, and have been entrusted to me for examination by Dr. H. J. Hansen. The contents of two tubes had, Dr. Hansen informs me, for some reason been put together into a single tube. Upon inspection it proved that there were mixed up

males of two species and females of two species. As is well known, in this section of the Amphipoda the females differ rather strikingly from the adult males of their respective species. Nevertheless there can be little doubt that the sexes have been assorted rightly, as there are numerous points of resemblance between the specimens which have been classed as male and female of the same species, and between the two species there is a considerable difference of size to be taken into account with other important distinctions.

Helaidæ.

This family at present contains only the remarkable genus *Neohela*, S. I. Smith, which Sars refers provisionally to the Corophiidæ, and which Della Valle places in the Icilidæ. The latter author rightly remarks that the *Neohela serrata* of the 'Challenger' Amphipoda cannot properly stand in that genus, and suggests that it comes near to *Mæra rubromaculata* in the Gammaridæ. As soon, however, as the account of the species of *Melphidippa*, Boeck, appeared last year in the admirable and masterly work on the Crustacea of Norway by G. O. Sars, there could be no hesitation in assigning the 'Challenger' species to that genus; and, though the two fragmentary specimens of what now provisionally becomes *Melphidippa serrata* came from Kerguelen Island, far in the south, it is not altogether impossible that the new name may be a synonym of *Melphidippa borealis*, Boeck.

Dulichiidæ.

In this family Sars makes the *Cyrtophium Darwinii* of Spence Bate a synonym of *Lætmatophilus tuberculatus*, Bruzelius. This, however, is an oversight, since in *Lætmatophilus* there are only two pairs of uropods, whereas *Cyrtophium*, or *Platophium* as it is more properly called, has three pairs. *Platophium Darwinii* (Bate) is identified by Della Valle with *Platophium brasiliense*, Dana. In any case, the species named by Spence Bate is common on the south coast of England, and the character of its pleon agrees with the figures and description given of it by Bate and Westwood ('Sessile-eyed Crustacea,' vol. i. p. 481), although from the erratic lettering of their figures confusion may easily arise.

EXPLANATION OF THE PLATES.

PLATE VIII.

Lembos hirsutipes, ♂.

Lateral view of the animal, with line above showing the actual length.

a.s., first joint of upper antenna; *a.i.*, lower antenna; *m.*, mandible; *l.i.*, lower lip; *mx. 1*, first maxilla; *mxp.*, maxillipeds; *gn. 1*, *gn. 2*, first and second gnathopods; *prp. 2, 3, 4*, second, third, and fourth peræopods; *plp.*, a pleopod; *ur. 1, 2, 3*, first, second, and third uropods; *T*, telson.

PLATE IX. A.

Lemboides afer, ♀.

a.i., lower antenna; *gn. 1*, *gn. 2*, first and second gnathopods; *prp. 1, 2*, first and second peræopods.

PLATE IX. B.

Lembos hirsutipes, ♀.

a.i., lower antenna; *gn. 1*, *gn. 2*, first and second gnathopods; *prp. 1*, first peræopod.

PLATE X.

Lemboides afer, ♂.

Lateral view of the animal, with line above showing the actual length.

a.s., upper antenna; *a.i.*, lower antenna; *l.s.*, upper lip; *m.*, mandible; *l.i.*, lower lip; *mx. 1*, first maxilla; *mx. 2*, second maxilla; *mxp.*, maxillipeds; *gn. 1*, *gn. 2*, first and second gnathopods; *prp. 2, 3, 5*, second, third, and fifth peræopods; *ur. 1, 3*, first and third uropods; *T*, telson.

XXXI.—On Budding in Perophora.

By GEORGE LEFEVRE*.

WHILE the Johns Hopkins Marine Laboratory was stationed at Beaufort, N. C., during the summer of 1894, I collected material for the purpose of studying the development of the buds of this Ascidian. *Perophora viridis*, Verrill, was found growing luxuriantly on the wharf-piles, and ample material was easily obtained.

My main object in undertaking this work was to compare the bud-development of this form with that of *Botryllus*, as described by Hjort †, and especially to determine, if possible, the origin of the nervous system.

* From the 'Johns Hopkins University Circulars,' vol. xiv. no. 119, pp. 75-77.

† Mitth. Zool. Stat. Neapel, x. Bd., 1891-1893.

The material at my disposal, which had been prepared in various ways, proved to be most excellent for my purpose, as it contained unlimited numbers of buds in every stage of development.

I might mention here that I have made use of Patten's method of orientation to much advantage, and have found it of invaluable assistance in manipulating the very small young buds; in this way I was enabled to cut sections with great accuracy in any plane desired.

I was soon led to believe that in the early development of the buds *Perophora* presents novel and interesting features; moreover, some of the results arrived at are at variance with those which have been obtained by previous workers on this and other Ascidians.

The very young bud consists of two vesicles, one within the other, which enclose between them many free mesenchyme-cells. The outer one is derived directly from the stolonian ectoderm, while the double-walled partition of the stolon gives rise to the inner or endodermal vesicle.

This partition, which is made up of flat cells, is continuous throughout the entire length of the stolon as a double-walled plate which divides the stolon in half longitudinally and extends from one side to the other.

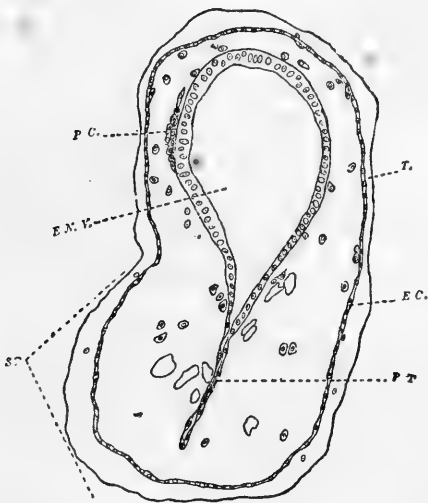
The buds always arise in the plane of the stolonian partition, but may appear on either side of the stolon. When the ectodermal wall of the stolon begins to push out to form the ectoderm of the bud, the free border of the partition evaginates at this point to give rise to the endodermal vesicle of the bud.

The bud-rudiment lies at first almost at right angles to the long axis, but soon becomes inclined towards the free tip of the stolon, the inclination being due to an elongation in this direction. Instead of having a spherical shape, as at first, the bud-rudiment now assumes the form of an ellipsoid. By this process of growth the connexion with the stolon comes to be placed at the posterior portion of the bud, while the anterior end lies free along the surface of the stolon. The anterior end is therefore directed towards the free growing tip of the stolon; the side next the stolonian wall is the ventral surface, and that turned away from it is the dorsal.

If a transverse section of a bud, when it consists merely of two simple concentric vesicles, be examined, it will be found that the wall of the endodermal vesicle is thicker on the right side than elsewhere. In such a section, which is represented in fig. 1, the ectoderm of the stolon is seen to be continuous with that of the bud-rudiment, and the connexion of the inner vesicle with the stolonian partition is clearly shown.

At this stage there is found a collection of cells applied closely to the outer surface of the endodermal vesicle high up on the right side. These cells (fig. 1, *PC.*) appear when the vesicle is still spherical, and form a somewhat elongated mass lying in the posterior portion of the bud; they give rise later to the *pericardium*, which is therefore the first organ to make its appearance. At first the rudiment consists merely of a single layer of cells joined loosely end to end, but it soon becomes thicker and more compact.

Fig. 1.



That the pericardium is formed by the coming together of *free mesenchyme-cells* I believe there can be scarcely a doubt. At the stage represented in fig. 1 the similarity between the cells scattered freely about in the space between the two vesicles and those which form the rudiment of the pericardium is perfectly apparent. And, moreover, I cannot find the slightest evidence that proliferation of the wall of the endodermal vesicle occurs at this place; the line of demarcation between the two structures is distinct throughout, and shows no interruption in its continuity.

A peculiar change of position now takes place in the inner vesicle. By a process of rotation of this vesicle through 90° the thickened right wall is carried down gradually until it comes to lie along the ventral side—that is, the side next the stolon, where it will later form the floor of the pharynx. The

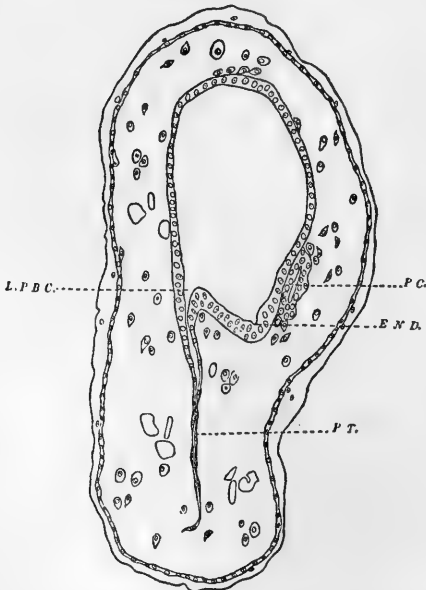
connexion with the stolonie partition remains stationary, and the rotation occurs on this as a fixed point.

The pericardial rudiment, which is attached to the outer surface of the vesicle, is borne down towards the ventral side, and during the rotation is increasing in size by cell-division and by further additions of mesenchyme-cells. The rudiment is at first solid, but some time before the rotation is completed a lumen appears in the centre of the mass of cells. When it reaches the ventral side, the pericardium is seen as an elongated closed vesicle formed of a single layer of cells and lying at the posterior end of the bud-rudiment immediately to the right of the median line; this is the definitive position.

The heart is formed later in the usual way by invagination of the dorsal wall of the pericardium.

At the stage shown in fig. 2 the rotation has proceeded to a considerable extent and the pericardial rudiment has acquired a lumen.

Fig. 2.



Many transitional stages between figs. 1 and 2 have been examined, and from these it is evident that the rotation is due to a rapid growth and flattening of the cells forming the inner

vesicle, except on the side where the wall is thick; as development proceeds the relative difference in thickness of this portion and the rest of the vesicle becomes greater.

While the rotation is taking place the ventral wall of the inner vesicle in the posterior region is folded up at the point indicated in fig. 2 by the line *L. PBC*. As this furrow deepens a portion of the vesicle which is connected with the stolon partition is thus gradually folded off to form the *left peribranchial sac*.

Ritter*, in a recent note on the budding of *Perophora*, says that "when the differentiation of the 'endoderm' into the branchial and two peribranchial sacs takes place, it does so in such a way that the developing blastozoid is connected with the double-walled partition of the stolon, not by the branchial sac, as has been hitherto supposed, but by the left peribranchial sac." He, however, does not describe how the process takes place; from an examination of figs. 2 and 3 this can be clearly seen.

I cannot confirm Ritter's statement (page 367 of the paper just referred to) that the connexion between the stolon partition and the left peribranchial sac is lost at an early stage, namely "at a time when the two peribranchial pouches have merely begun to envelope the branchial sac." I find that it persists until a much later time and is still present, although greatly constricted, at a stage when the gill-slits are about to be formed.

The *right peribranchial sac* is formed before the rotation is completed at about the stage shown in fig. 2 by a longitudinal folding-in of the right wall of the inner vesicle. The fold first appears anterior to the rudiment of the pericardium and at about the level of the upper border of the latter structure; as it deepens and extends posteriorly the portion of the inner vesicle thus folded off is carried down towards the ventral side as the rotation continues, in the same way as the pericardial rudiment.

The section drawn in fig. 2 is taken too far back to show the fold of the right peribranchial sac.

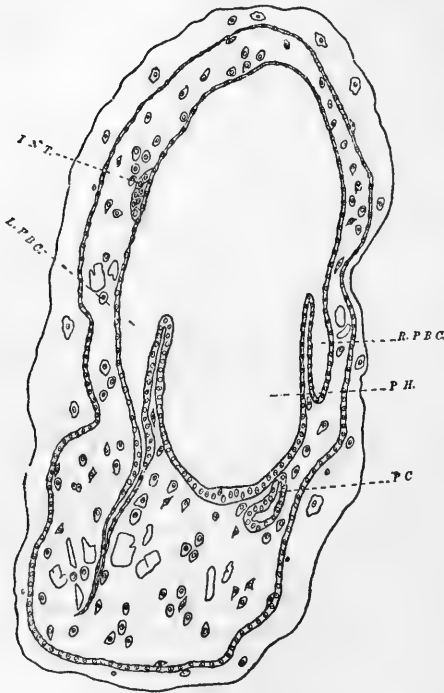
Fig. 3 represents a stage when the rotation is about completed, and the two folds of the peribranchial sacs are now symmetrically placed, one on each side of the median ventral line.

In this figure a collection of cells (*INT.*) is seen lying against the outer surface of the left peribranchial sac; these represent the extreme tip of the intestine where the section has passed

* 'Anatomischer Anzeiger,' x. Bd., no. 11, p. 367.

through the wall of the latter. At about the time when the fold of the right peribranchial sac first appears the gut is formed as a blind diverticulum at the posterior end of the branchial sac. At the point of origin it turns sharply towards

Fig. 3.



the left, and, growing rapidly upwards and forwards against the outer surface of the left peribranchial sac, it finally reaches the mid-dorsal line, where it opens eventually into the median portion of the peribranchial cavity.

In fig. 2 is seen a groove (*END.*) on the inner surface of the endodermal vesicle just below the pericardium. This is the rudiment of the *endostyle*, but when it first appears its position is much higher up than it is in this figure; during the rotation the relative position of pericardium and endostyle is not changed.

By a study of a most complete series of stages I have been led to conclusions in regard to the origin of the common rudiment of the dorsal tube and nerve-ganglion in *Perophora*

which agree neither with those of Hjort on *Botryllus** and *Glossophorum* †, of Hjort and Bonnevie on *Distaplia* ‡, nor with the results obtained by Ritter on *Perophora* §.

In all of the above-mentioned Ascidians except *Perophora* the rudiment arises as an evagination of the dorsal wall of the inner vesicle, and in *Perophora*, according to Ritter, by migration of cells from the dorsal portion of the endodermal vesicle into the rudiment. For the reasons given below I believe that in *Perophora viridis* the structures in question have a common *mesenchymatous origin*.

The first appearance of the rudiment is at a stage when the rotation of the endodermal vesicle is about half accomplished and before there is any indication of the fold which is to give rise to the right peribranchial sac.

In the anterior region of the bud a little to the left of the median dorsal line there is seen a slender elongated mass of cells loosely grouped together and lying against the outer surface of the inner vesicle.

Although I have examined my sections with the greatest care, I have failed to find any indication of cell-migration from the endodermal vesicle, and hence cannot confirm Ritter's statements that an "indistinguishable transition from the cells of the 'endoderm' to those of the neuro-hypophyseal anlage is to be traced," and also that cells can be traced "in the act of migrating from the endoderm into the anlage."

In the first place the line of separation between the rudiment and the vesicle is seen with perfect clearness to be everywhere intact, and, furthermore, the cells of the rudiment are identical in appearance with the free mesenchyme-cells; the latter are, moreover, more numerous in this region than elsewhere. During the early stages of development, that is, before the rudiment has become very compact, the similarity between these cells is very evident (fig. 4, *A*). I therefore conclude that, just as in the case of the pericardium, the *common rudiment of the dorsal tube and nerve-ganglion is formed by free mesenchyme-cells*.

The cells of the rudiment are at first loosely and irregularly piled on one another; but soon the mass becomes more closely packed and assumes a cylindrical form (fig. 4, *B*). Other mesenchyme-cells are added to the string from the outside and active cell-division goes on within the mass.

When the rotation of the inner vesicle is completed the nerve-rudiment has been carried up from the left side to the

* Mitth. Zool. Stat. Neapel, x. Bd.

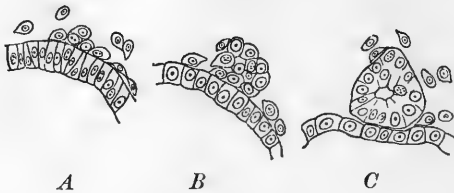
† 'Anatomischer Anzeiger,' x. Bd. no. 7.

‡ *Ibid.* no. 12.

§ *Ibid.* no. 11.

dorsal mid-line. By this time a lumen has appeared in the centre, and around this the cells gradually arrange themselves into an epithelium to form the dorsal tube (fig. 4, C). The

Fig. 4.



latter fuses later at its anterior extremity with the dorsal wall of the pharynx, and an opening breaks through; at no time is there any communication posteriorly between the tube and the peribranchial cavity.

The nerve-ganglion is formed by a thickening of the *dorsal* wall of the tube, which eventually becomes constricted off in the manner described by Hjort for *Botryllus*, although in the latter it is the ventral wall of the tube which gives rise to the ganglion.

Summary.

1. By a peculiar process of rotation of the endodermal vesicle through 90° the thickened right wall of the vesicle is carried down to the ventral side of the bud-rudiment, where it forms the floor of the future pharynx. This process seems to be due to rapid growth and flattening of the cells composing the vesicle except in the thickened portion.

2. The pericardial rudiment, which is the first organ to appear, is formed from the free cells of the blood. It arises on the right side of the inner vesicle, and through the rotation of the latter is brought down to the ventral side.

3. The peribranchial sacs arise asymmetrically. As the rotation takes place, the ventral wall of the inner vesicle is folded up immediately to the right of the point where the stolon partition joins the vesicle, to form the left peribranchial sac. The portion of the vesicle thus folded off is continuous with the stolon partition; the connexion with the latter persists until quite a late stage. A fold appearing on the right side of the vesicle gives rise to the right sac, which then moves ventrally as the rotation continues.

4. No epicardium is present; in this respect *Perophora* differs strikingly from *Clavelina* and some other Ascidiens.

5. The endostyle appears early as a longitudinal groove in

the middle of the thickened portion of the inner vesicle. From its position on the right side it is moved down to the ventral mid-line by the rotation of the vesicle.

6. The common rudiment of the dorsal tube and nerve-ganglion arises as a solid string of mesenchyme-cells, which are closely applied to the outer surface of the inner vesicle a little to the *left* of the median dorsal line. The cord acquires a lumen, which later communicates with the pharynx. When the rotation is completed the dorsal tube lies in its definitive position in the median line. The nerve-ganglion is constricted off from the dorsal wall of the tube.

BOTRYLLUS.

In the latter part of the summer of 1894 I was given an opportunity, through the kindness of Col. Marshall MacDonald, the Commissioner, to work in the laboratory of the U.S. Fish Commission at Woods Holl, Mass. While there I collected material for the study of the bud-development of a species of *Botryllus*—*B. Gouldii*, Verrill—which was found in great abundance.

The results of my work on this Ascidian show such a complete agreement with Hjort's description of the bud-development of this genus that scarcely a word need be added. The inner vesicle of the bud is derived from the wall of the peribranchial sac in both larvæ and buds, and gives rise to all the important organs. As the peribranchial sacs in the larva are derived from the ectoderm, it follows that all the important organs of the bud are ultimately of ectodermal origin.

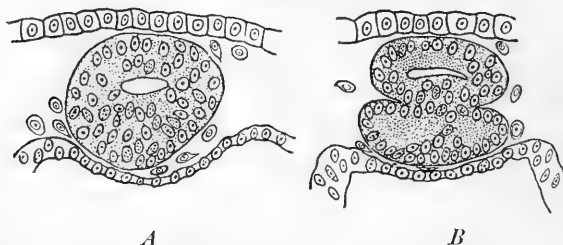
The peribranchial sacs are formed, as Hjort states, by two parallel ventral infoldings, which cut off from the inner vesicle a saddle-shaped bag surrounding the median vesicle dorsally and laterally. The dorsal portion connecting the lateral sacs is not formed by a fusion of the latter, but is present from the beginning. The dorsal tube is formed as an anteriorly directed diverticulum of the dorsal wall of the inner vesicle in the region which becomes the median portion of the peribranchial cavity. The tube secondarily acquires an opening into the pharynx before the communication with the peribranchial cavity is lost.

I might also state that my sections entirely confirm Hjort's description of the formation of the ganglion, and directly contradict Pizon's statement* that the constriction of the ganglion from the dorsal tube cannot be established.

* Ann. Sciences Nat. 1892 and 1893.

In fig. 5 are shown two sections of the tube and ganglion taken from the same bud, *A* being more anterior than *B*. The series of sections from which these are taken shows a gradual transition from the one to the other, and establishes

Fig. 5.



in the clearest way possible that the ganglion is pinched off from the thickened ventral wall of the tube, the constriction beginning posteriorly and gradually proceeding towards the anterior end. This fact I have verified not only on *B. Gouldii*, but also on an undetermined species of *Botryllus* obtained in Jamaica.

EXPLANATION OF THE FIGURES.

<i>EC.</i> Ectoderm.	<i>PC.</i> Pericardium.
<i>END.</i> Endostyle.	<i>PH.</i> Pharynx.
<i>EN. V.</i> Endodermal vesicle.	<i>PT.</i> Double-walled partition of stolon.
<i>INT.</i> Intestine.	<i>ST.</i> Stolon.
<i>L. PBC.</i> Left peribranchial sac.	<i>T.</i> Test.
<i>R. PBC.</i> Right peribranchial sac.	

All the figures are drawn with the camera.

Figs. 1, 2, and 3 are transverse sections of the posterior region of buds of *Perophora viridis*, Verrill. Fig. 5 is taken from a specimen of the Jamaica species of *Botryllus*.

- Fig. 1.—Very young bud. Shows connexion with the stolon, rudiment of the pericardium, and thickened wall of inner vesicle. This figure differs from figs. 2 and 3 in that its right side is the left side of the latter, and *vice versa*; in fig. 1 the face of the section is towards the anterior end of the bud, whereas in figs. 2 and 3 it is towards the posterior end.
- Fig. 2.—Somewhat older bud. Rotation of the inner vesicle has proceeded to some extent. Formation of left peribranchial sac is beginning.
- Fig. 3.—Still older bud. Rotation is nearly completed; right peribranchial sac is present.
- Fig. 4.—Shows three stages in development of rudiment of nerve-ganglion and hypophysis in *Perophora viridis*, V.
- Fig. 5.—Transverse sections of dorsal tube and ganglion of a *Botryllus* bud, showing constriction of ganglion from thickened ventral wall of the tube. *A* is more anterior than *B*.

XXXII.—Notes on the Identity of some of the Types of Mygalomorphæ in the Collection of the British Museum.
By R. I. Pocock, of the British Museum.

Aganippe subtristis, Cambr. Ann. & Mag. Nat. Hist. (4) xix. p. 28 (1877).—In the thickly scopulate distal segments of the legs of the first and second pairs, as well as in the absence of marginal rows of spines, the genus *Aganippe* falls into the *Cyrtachenieæ*, as Simon rightly surmised. The claws of the legs are armed with only a few teeth, of which one is very large. The three sternal impressions are distinct, the first marginal, the second removed from the margin a small distance, both being smallish; but the third or posterior pair are much larger, oval, and approaching the middle of the sternum, although further from each other than from its borders.

Idiops Cambridgei, Ausserer (Verh. z.-b. Ges. Wien, 1876, p. 145), from Bogota, belongs to the genus *Pseudidiops*, Sim. (= *Dendricon*, Cambr.). It may be synonymous with *P. opifex* of Simon, from Guiana and Venezuela, but it differs from *P. rastratus*, Cambr., from Bahia, in having the posterior median eyes subequal to the anterior median *, and separated from each other by a space which equals twice their diameter, and from the posterior lateral by a space which about equals their diameter; whereas in *P. rastratus* the posterior median eyes are much smaller than the anterior median, closer to the posterior lateral, and separated from each other by a space equal to about three diameters.

Bolostromus venustus, id. (*op. cit.* p. 149), is congeneric with *Phænothele Gaujoni*, Sim., inasmuch as the claws of the posterior legs have two rows of denticles and the anterior line of eyes is straight.

Eucteniza mexicana, id. (*op. cit.* p. 149).—The genus *Eucteniza* seems to fall partly into the tribe *Cyrtachenieæ* and partly into that of *Ctenizeæ*. The tarsus of the palp is distinctly pyriform and lightly scopulate, with two external, two internal, and two apical spines. The tarsi and protarsi of the first and second pairs of legs are also lightly scopulate, and the tarsi are only armed towards the apex with two or

* The anterior median eyes are those that form the middle row, and not those that are placed on the marginal tubercle, these being the anterior lateral.

three spines and the protarsi internally with two spines and externally with four, the tibiæ being almost unarmed. The claws of these legs are armed with one large tooth and one or two smaller ones. The sternum offers the usual small marginal impressions opposite the coxæ of the first and second legs, and, in addition, near the middle of its length a pair of large somewhat bean-shaped scars, which are close together but some distance from the lateral margin.

Cteniza antipodum and *C. hexops*, White (P. Z. S. 1849, p. 5), are synonymous, the latter being nothing but a younger specimen of the former. The species belongs to the genus *Macrothele*, and is, perhaps, identical with *M. Huttoni* of Cambridge, which is unknown to me. In an evil moment Ausserer proposed the genus *Hexops* for White's second species, trusting the author's statement respecting the number of the creature's eyes. The statement, however, is erroneous, the normal number of eyes being clearly visible. Of course Ausserer had no right to change the *specific* name into *Whitei* when choosing to take for his fancied new genus the specific name that White proposed; but unfortunately *Hexops* antedates *Macrothele*, and some authors will perhaps boldly say that, notwithstanding its inappropriateness, it must consequently supersede it.

Trechona zebrata (Walck.).—A specimen in the British Museum of this species, bearing Walckenaer's ticket, has the inferior claw on the feet strongly developed. It is thus not congeneric with the species described by Ausserer as *Trechona venosa* (Latr.); and since *zebrata* is the type of the genus *Trechona*, it is not characteristic of the latter to lack the lower claw, as Ausserer states. In fact the genus will probably prove synonymous with *Eudiplura*, Sim.

Ischnothele caudata, Auss. (*op. cit.* p. 163), from Yucatan, is nearly allied to *Mygale guianensis*, Walck. The two species are undoubtedly congeneric. Simon refers Walckenaer's species to *Thelechoris* of Karsch, which is based upon a Mascarene species, but whether rightly or not I cannot say. Upon *à priori* grounds I should be inclined to think wrongly; but if rightly, the genus must stand as *Ischnothele*.

Thalerommata gracile, id. (*op. cit.* p. 182), is, as Mons. Simon declares, very difficult to classify. The absence of the lower claw and the presence of long and thick unguis tufts of hairs on the feet refer it either to Simon's *Barychelinae* or

Aviculariinae. But the spinning-mammillæ appear to be constructed differently from the plan that is characteristic of either of these sections. The posterior mamillæ are short, the segments being thick and gradually decreasing in length from the first to the third; the first, moreover, is much thicker at its distal end, while the third, on the contrary, is pointed and conical; the anterior spinners are slender, cylindrical, about half the length of the basal segment of the posterior, and separated by a space which is equal to about twice their own thickness. There is no true rastellum on the mandible, although the setæ above the fang seem stout at the base and the scopulæ of the feet are very scanty, yet apparently entire. The maxillæ are basally spinulose, and there are a few (two or three) apical spinules on the labium. I think it is probable that the genus will prove to be related to some of the American species of *Leptopelmateæ*.

Idiommata Blackwallii, Cambr. (Proc. Zool. Soc. 1870, p. 154).—The type of this species (a male) has Wood-Mason's stridulating-organ well developed. The female is unknown to me, and so also are the males of the other Australian species that have been referred to *Idiommata*. But the females of what I believe to be *reticulatum* of L. Koch, as well as of other species, show no trace of this organ. It is possible, therefore, that it may be present only in the males of this genus. This, however, does not seem probable; so that the safer course is to regard the two sets of species—*i. e.* that typified by *Blackwallii* and that by *reticulatum*—as generically distinct. The latter in that case will probably have to take the name *Encyocrypta*.

Ischnocolus obscurus, Auss. (*op. cit.* p. 171), from Bogota, appears to be congeneric with the species previously named by the author *Hapalopus formosus*, of which the Museum has a single female specimen from the locality just mentioned.

Ischnocolus sericeus, id. (*op. cit.* p. 119), from Yucatan, is based upon a young specimen of undetermined genus.

Ischnocolus hirsutus, id. (*op. cit.* p. 170), is based upon a young specimen belonging probably to some species of *Lasiodora*.

Ischnocolus parvus, Keys., is apparently the young of a species of *Eurypelma*.

Ischnocolus gracilis, Keys. ('Spinnen Amerikas,' iii. p. 11),

from Rio, is an immature rubbed specimen belonging to an indeterminable genus.

Ischnocolus rubropilosus, Keys. (*op. cit.* p. 12), from Neu Freiburg, is based on the young of one of the Homæommateæ.

Ischnocolus janeirus, id. (*op. cit.* p. 13), belongs apparently to the genus *Magulla*, Simon.

Hapalopus villosus (adult ♂), *Ischnocolus pilosus* (very young ♀), *Ischnocolus nigrescens* (half-grown ♀), *Crypsidromus perfidus* (adult ♀), *Crypsidromus funestus* (adult ♀) (Keys. *op. cit.* pp. 7-15), are all based upon different sexes and ages of the same species, and this bears a suspicious likeness to *Mygale fusca* of Perty. Amongst species known to me it is most nearly allied to *Homæomma versicolor*, Koch. At all events, it is not an *Ischnocolus* nor a *Hapalopus*, nor probably a *Crypsidromus*. I am not, however, acquainted with the type species of the latter genus, but some of the other species that Ausserer referred to it, e. g. *Crypsidromus macropus*, are undoubtedly not congeneric with *villosus*.

Cyrtosternum cursor, Auss. (*op. cit.* p. 176).—The chief character of the genus *Cyrtosternum*, of which the name, on the grounds of its preoccupation, has been altered by Simon into *Cyrtopholis*, is the strong convexity of the sternum. There appear to me to be no reasons for supposing that the species from which Simon drew up his diagnosis of *Cyrtopholis* ('Hist. Nat. Araignées,' i. p. 143) is congeneric with *C. cursor*.

Crypsidromus pernix and *C. macropus*, id. (*op. cit.* pp. 178, 179), from Mexico, are not congeneric, since the former has the two tibial spurs of the male well developed and of normal form, and the latter is without them. Which of the two, if, indeed, either, will prove to be a *Crypsidromus* in reality, *i. e.* congeneric with the type *C. isabellinus*, I cannot say, since I am not acquainted with the last-named species, and no one, so far as I am aware, has described the male. Simon's *Crypsidromus* is of the *macropus* type.

Callyntropus convexus (C. Koch).—The specimen in Keyserling's collection identified by Ausserer as *convexus* of C. Koch, upon which Ausserer based his genus *Callyntropus*, appears to me to be the young of a *Lasiadora* or of some genus of Theraphosææ. The British Museum has other examples from British Guiana which fall into *Callyntropus*,

but they are evidently immature specimens of some larger species.

Eurypelma Jheringii, Keyserling (*op. cit.* p. 19), from Taquara, belongs to the Homæommateæ, and not to *Eurypelma*. It appears to be ascribable to *Homæomma* as characterized by Simon ('Hist. Nat. Araignées,' i. p. 162), which, however, is not, I believe, the true *Homæomma* of Ausserer and Cambridge. In the latter the palpal bulb bears at its base a tuberculiform tooth and the apex is not "*simpliciter tenuissimus*," as Simon says, but stout and strongly curved. Moreover, in the specimens that I have examined in the Museum there is no apical scopula on the fourth protarsi. They appear, in fact, to be referable to *Agathostola*, Simon, which will prove, I think, to be a synonym of *Homæomma*.

Lasiodora immanis, Ausserer (*op. cit.* p. 195), as the diagnosis clearly proves, belongs to Simon's later genus *Xenesthis*.

Phlogius cervinus, Thorell ('The Spiders of Burma,' London, 1895, p. 5), is based upon two specimens (a male and a female), which are, however, specifically distinct. The male, which may be taken as the type, belongs to the genus *Musagetes*, Poc.; the female also belongs to the same genus, and is specifically identical with the species I have named *Musagetes bicolor* (Ann. & Mag. Nat. Hist. (6) xv. pp. 172, 174).

Phlogius fuliginus, id. (*op. cit.* p. 8), is correctly referred to its genus. It seems to me, however, that the genus *Phlogius*, Sim., must be regarded as synonymous with the older genus *Selenocosmia* of Ausserer, the distinction between the two, based upon the presence or absence of a divisional line of setæ on the tarsal pads of the fourth leg, being, I believe, not of generic value*.

Phlogius sericeus, id. (*op. cit.* p. 10), from Rangoon, belongs to the genus *Chilobrachys* of Karsch, the claws of the legs being minutely dentate and the inferior claw often visible. The young specimens illustrate very forcibly the law of the growth of the tarsal scopulæ that I have enunciated above.

* In the synopsis of the genera of Selenocosmiidæ in Ann. & Mag. Nat. Hist. (6) xv. p. 170, I stated that the protarsal pads of the third leg in *Phlogius* and *Selenocosmia* cover only half the segment. This is not strictly accurate, since the scopula in question extends over about two thirds or even more of the protarsus.

One example, with the carapace only 4 millim. long, has the pads on the palpi, as well as on the legs, divided by a band of setæ. In fact, on the fourth tarsi nearly the entire sole of the foot is covered with setæ, which at the sides are merely intermixed with scopular hairs. In the adult the fourth tarsal pad is very visibly divided, and in the female with the young the pad of the third tarsus is similarly, though less distinctly, traversed by a row of setæ.

Phlogius oculatus, Thorell (*op. cit.* p. 13), from Akyab, also belongs to the genus *Chilobrachys*. The tarsi of the third leg, as well as of the fourth, is divided by a band of setæ.

From the above data it is evident that most of the so-called South-American species of *Ischnocolus* must drop out of the Neotropical fauna, and it is in the highest degree probable that the rest will follow in their train when the types have been re-examined. To what extent the species from the tropical parts of the Old World that have been ascribed to *Ischnocolus* will have to be similarly dealt with I am not in a position to say.

The explanation of the strange errors referred to above in connexion with the identification of some of the smaller genera of Neotropical Aviculariidae is not far to seek. The genera have been largely established upon the entirety or divisions of the tarsal pads or *scopulae*—a character which was regarded by Ausserer and later on by Mons. Simon as being of the first importance. But if the young stages of a species in which, when adult, the pads are complete, that is, show no median divisional line of normal hairs, be examined, it will be found that at first the tarsi are clothed with setæ, and these later on become intermixed with scopular hairs. As the animal increases in size the scopular hairs increase in number, gradually spreading over the tarsus, and apparently replacing the normal setæ. But the replacement does not take place at a uniform rate all over the foot; on the contrary, the pad, beginning at the sides, encroaches by degrees inwards, and, as a consequence, the last part to remain unoccupied is the middle line of the sole, which thus retains longest its primitive clothing of setæ.

In the second place, it will further be noticed that the tarsal pads of the four legs do not reach their full development contemporaneously, the order of their appearance corresponding with the order of the legs from before backwards—the first tarsus being covered before the second, the second before the third, and the third before the fourth, so that when the pads

on the first or second legs are complete, those on the fourth or even the third may still retain their divisional line.

This generalization with regard to the growth of the pads will perhaps be found to admit of some exceptions in detail; but, on the whole, I believe it will prove to represent the facts of the case with tolerable accuracy. Hence it is worthy of remembrance in connexion with the determination of the genera and species of the group. For instance, Mons. Simon primarily divides his vast family Aviculariinae as follows:—

- A. Scopulæ at least of the posterior tarsi divided.
- a. Scopulæ of all the tarsi divided *Ischnocoleæ*.
- b. Scopulæ only of the posterior tarsi divided.
- a. Scopulæ of third and fourth tarsi divided *Chætopelmateæ*.
- b. Scopulæ of the fourth tarsi divided *Crypsidromeæ* (and *Phlogiæ* *).
- B. Scopulæ of all the tarsi undivided *Aviculariæ*, *Theraphoseæ*, *Eurypelmateæ*, *Homæommateæ* (*Selenocosmiæ*, *Pæcilotheriæ* †).

But in accordance with what has been said regarding the growth of the scopulæ, it follows that a species of section B will in its early days fall into the *Ischnocoleæ*, a little later into the *Chætopelmateæ*, then into the *Crypsidromeæ*. And, similarly, a species belonging to the *Crypsidromeæ* will have to pass through sections a and a before reaching its destination in b.

Hence it follows that the division of the scopulæ may be nothing but a sign of immaturity. I am particular to emphasize the verb in this sentence because I do not wish to be misunderstood to say that the character belongs necessarily to undeveloped forms. This is certainly not the case, since many adults are found with some or all of their tarsal pads divided. But I consider that one cannot too strongly insist upon the necessity for caution in the use of this character on the part of authors who are systematically studying the Mygalomorphæ, seeing that both Ausserer and Keyserling, who are looked upon as high authorities in arachnology, have established a large number of spurious species, perhaps even genera, upon this very character, when occurring in specimens

* The *Phlogiæ* need not here be taken into consideration, since I have already endeavoured to show that they form part of a group to which I gave the family name *Selenocosmiidæ*, and have no particular relationship with the *Crypsidromeæ* (*Ann. & Mag. Nat. Hist.* (6) xv. pp. 165–169).

† Already discussed, *ibid.*

which no person, one would have thought, could mistake for anything but immature. No doubt this is partly to be explained by the unfortunate circumstance that in the case of the females of this group of spiders—this being the sex which most frequently comes to hand—it is very hard to tell the adults from the immature. Consequently the generic status of every species, referred to sections *a*, *a*, or *b* of the above table, that rests solely upon a female specimen, must be regarded as of questionable validity, unless the maturity of the type specimen is beyond dispute. With the males the case is different. As a rule generic characters in this sex are pretty obvious; and it may safely be stated that, until we know the males of the different species of Neotropical Theraphosidæ, the classification of this family will remain more or less chaotic.

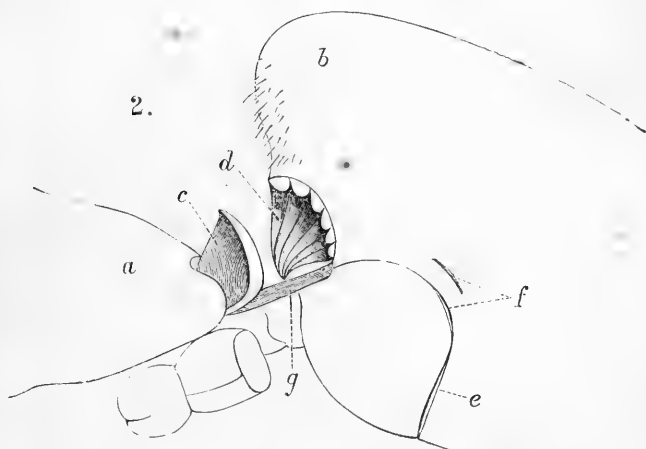
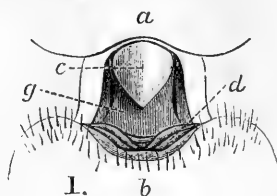
So far, however, as I can judge from the material at my disposal, the Homæommateæ, Eurypelmateæ, Theraphoseæ, Aviculariæ, Crypsidromeæ, Chætopelmateæ, and Ischnocoleæ form a compact and natural assemblage which may be called Theraphosidæ *sensu stricto*. But touching the Ischnocoleæ, I must speak with some caution, since the genus *Ischnocolus*, from the Mediterranean, is unknown to me.

XXXIII.—*On a new Sound-producing Organ in a Spider.*

By R. I. POCOCK, of the British Museum of Natural History.

IN January of the current year I published in 'Natural Science' a brief summary of the present state of our knowledge of the structure, position, mechanism, and function of the various kinds of stridulating-organs that occur in spiders, and I suggested that the available evidence seems to point to the conclusion that these organs have been evolved within the group in response to two needs, which, although totally different in their nature, are, in their way, alike of vital importance to the welfare of the species. In one set of species the sound is attractive and in the other repellent, the sense of attraction lying between members of opposite sexes of the same species and that of repulsion being experienced by enemies that might otherwise with intent or by accident destroy the spider if not warned of its presence and formidable nature. In connexion with the stridulating-organs that belong to the first category and are of sexual significance, it was pointed out that they are either absent or imperfectly developed in the females, and are perfected only in the males; whereas

when their significance is protective they are equally well developed in both sexes, and appear at a very early age in the life-history of the individual*.



Stridulating-organ in the male of *Cambridgea antipodiana* (White).

Fig. 1.—Dorsal view of the organ and adjacent parts. *a*, posterior region of carapace; *b*, anterior region of abdomen; *c*, heart-shaped horny tooth; *d*, cavity with arched ridges; *g*, horny plate of pedicel.

Fig. 2.—Partially diagrammatic side view of the organ and adjacent parts, the cavity with its arched ridges being represented as seen in section. Lettering as in fig. 1, with the addition of *e*, stigma of pulmonary sac, and *f*, muscular scars.

Upon working through some of the spider material contained in the collection of the British Museum, I chanced

* I am not aware whether the stridulating-organs of the Theridiidæ and Linyphiidæ are present in immature members of the male sex or whether they are developed only at the period of the last moult, when sexual maturity is attained. If, as in the case of the Mygalomorphæ, they are practically as perfect in the young as in the adult, it seems to me that the evidence of their being solely of a sexual function will be considerably weakened. But if, on the other hand, they appear, like typical sexual characters, either only just before or simultaneously with the attainment of maturity, there will, I think, be no reasonable grounds for doubting that they are exclusively of sexual significance.

upon the type of *Tegenaria antipodiana* described by White nearly half a century ago. A glance showed me that this spider belongs to the genus *Cambridgea* of L. Koch; but the most interesting fact revealed by an examination of the specimen was the presence of a conspicuous, although hitherto unnoticed, organ, which appears to be a sound-producer of considerable power. Upon depressing the abdomen and looking at it from the front a large cave-like hollow overhanging the pedicel may be noticed. The roof of this excavation is hairless, smooth, and horny, and is sculptured out into a series of six black, shining, strong, transverse arches or ridges, which become gradually shorter as they recede from the mouth of the hollow to its opposite end. The scraper that rubs against these ridges is a large heart-shaped tooth that rises from the anterior of the two sclerites which strengthen the upper surface of the pedicel. The pedicel, both above and below, is rather strongly supported by chitinous pieces, that on the lower surface being Y-shaped, the stem of the letter representing the anterior rod, which is immovably fused with the posterior apex of the sternum, while the arms correspond to two pieces which embrace the sides of the stalk. The upper surface of the stalk is furnished with the ordinary posterior median piece, which at the sides is contiguous with a pair of thicker sclerites, and the anterior piece, as mentioned above, is converted into the upstanding heart-shaped tooth, the point of which is thickened and slightly recurved.

That the function of this new organ is to produce sound can, I think, hardly be disputed. In its position and in some of the details of its structure it resembles that of the stridulating Theridiidæ (*Steatoda*)*. In the latter there is, at the base of the abdomen, a circular depression, the edge of which, in the males at least, is armed with re-entering teeth. By the movements of the abdomen these teeth are scraped against a series of ridges and grooves upon the posterior area of the carapace, and give rise to a sound. Similarly I conceive that in the case of *Cambridgea* sound must result from the rubbing of the arched ridges backwards and forwards across the upstanding tooth upon the pedicel.

But a further resemblance between this new organ and that of *Steatoda* consists in its being confined to the male sex †.

* *Vide* F. M. Campbell, Journ. Linn. Soc., Zool. xv. p. 152 (1880).

† For an opportunity to establish this fact I am indebted to the Rev. O. P. Cambridge, who kindly sent to me for examination three specimens of the genus which he has in his collection. The first of these,

In both the adult females that I have examined there is no trace of the ridged hollow on the abdomen, and the only trace of the tooth on the pedicel is a slight angulation of the dorsal sclerites. The absence of the organ in the female and the high development that it attains in the male permit us to conclude that the sound emitted is used as a sexual call.

XXXIV.—*The Pholadidæ: Note on the Early Stages of Development.* By C. P. SIGERFOOS*.

DURING the summer of 1894, while with the Johns Hopkins Marine Laboratory at Beaufort, I was employed by the U.S. Fish Commission to study the natural history of the ship-worms on account of their great economic importance. While so engaged I observed the early stages in the development of four species of the Pholadidæ; these were *Pholas truncata*, *Teredo navalis*, *T. norvegica*, and *T. (Xylotrya) fimbriata*. *T. navalis* is the common ship-worm of Europe, and has been frequently studied. It is found but sparingly at Beaufort, and is of little economic importance there. The

from Chatham Island, is the male example that Mr. Cambridge has figured in the 'Transactions of the New Zealand Institute,' 1873, p. 202; the second is the female from Canterbury, the type of *C. fasciata*, L. Koch; and the third is an additional female from Waikato, which Dr. L. Koch also examined and identified. Koch's type is an adult female; but since its carapace measures only a little over 3 millim. in length, I find it hard to believe, without further evidence, that the male from Chatham Island, which has the carapace 10.5 millim. long, is co-specific with it. It appears to me too that the second female, the one from Waikato, is also distinct from *fasciata*, since it is of considerably larger size (carapace 6.5 millim. long), and the impressions on the vulva have a different form. I may add that in both of them there is a very distinct tubercular tooth (omitted from Koch's figure) at the anterior end of the median groove of the vulva; that the anterior lateral eyes in *C. fasciata* are round, and only oval, as Koch has figured them, when seen in perspective; that the posterior spiracles are in front of the *colulus*, and are not placed in the integumental fold that Koch mentions and compares with that of *Anyphæna*; and that the additional stigma that Mr. Cambridge figured and described is a muscular scar.

Two species, then, of the genus have been described, namely *Cambridgea antipodiæna* (White) (P. Z. S. 1849, p. 5), with which *C. fasciata*, Cambr. (Tr. N. Z. Inst. 1873, p. 202), is synonymous, and *C. fasciata*, L. Koch ('Die Arachn. Australiens,' i. p. 358, pl. xxviii. fig. 2, 1871). These two must, I think, be provisionally regarded as distinct, on account of the enormous disparity in size between the two sexes, the male being so very much larger than the female.

* From the 'Johns Hopkins University Circulars,' vol. xiv. no. 119, pp. 78, 79.

other two species have been little studied. They are very abundant at Beaufort, and in the warm waters of our southern coast grow with great rapidity, so that they are extremely destructive to all kinds of woodwork. *T. norvegica* may, under favourable conditions, attain a length of 4 feet in two years in hard piles. Its burrow is almost or quite an inch in diameter, so that a few of them may soon ruin a heavy pile.

The present note is published through the courtesy of the U.S. Fish Commission. A fuller account of the natural history of the ship-worms will be published by the Commission.

Pholas.

Pholas is found in the stiff mud between tide-marks. It spawns the latter part of April and during May, so that the breeding-season is limited to a period of a few weeks. The sexes are separate and found in about equal proportions. The eggs are rather transparent, and hence favourable for study among marine Lamellibranchs, though their small size and the uniformity in the size of the micromeres make them unfavourable objects for studies of cell-lineage. Artificial fertilization is easy and the embryos develop with great uniformity. Development is very rapid, and on warm days the embryos may be free-swimming within three hours of the time the eggs are fertilized.

The first two planes of cleavage are meridional, giving rise to the four-cell stage which has so often been described and figured for various Lamellibranch eggs. The next plane of cleavage is equatorial, giving rise to an eight-cell stage, consisting of a large macromere and seven micromeres of almost, if not quite, equal size. A sixteen-cell stage and a seventeen-cell stage are formed just as Lillie has recently described for *Unio* (Journ. Morph., Jan. 1895). In fact, his description for *Unio* of the formation of the blastomeres to the seventeen-cell stage applies strictly also for *Pholas*, except in the size of the micromeres.

After the seventeen-cell stage I could not follow cleavage with certainty as to the lineage of the cells. The axes of the embryo are approximately indicated by the position of the polar bodies, which persist till after the embryo has become free-swimming. The posterior mesoderm arises as a single cell, as usually described, and soon afterwards the macromere divides into right and left entoblasts. Soon afterwards the mesoblast also divides into right and left halves, and bilateral symmetry is established.

The two entoblasts soon divide into anterior and posterior

portions, the latter somewhat larger than the former. The left entoblast always divides first. The cilia appear at the stage with two entoblasts. The two or three apical cilia are more than twice as long as the embryo. The pre-oral cilia are not arranged on circles of cells. Each cell which bears them has three or more. The apical cilia turn spirally, causing the embryo to rotate on its long axis in the direction of the hands of a clock.

Gastrulation is partly epibolic, partly by invagination. The entoblast-cells continue to divide. The spindles are always transverse to the long axis of the cells, so that the primitive gut comes to be formed of very high cells. Small cells are not separated from them into the cleavage-cavity. After gastrulation begins the ectoblast continues to grow forward slightly at the posterior border of the blastopore, so that it becomes crescent-shaped. It does not close, but persists as the mouth.

Professor Brooks several years ago pointed out a transitory change in shape of the oyster embryo. This is present in all of the four species I studied, and I believe to be connected with the formation of a second mesoblastic element. In addition to the mesoblast as usually described there is an anterior mesoblastic element, formed at about the time that the entoblast consists of four cells. The embryo becomes flattened in its dorso-ventral axis, and while so a pair of ectoblast-cells *migrate* from the surface and are deposited on the summit of the entoblast. The point on the surface from which they migrate soon closes over and leaves no trace of their inwandering. The embryo soon afterwards resumes its spherical shape.

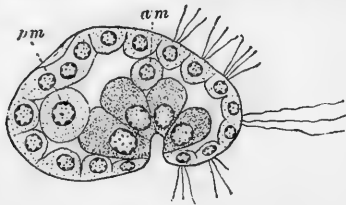
Summing up: The first two planes of cleavage are meridional, followed by an equatorial. Segmentation is such that bilateral symmetry is not established till after the formation of the germ-layers. The entoblast-cells divide into almost equal parts, and gastrulation is partly epibolic, partly by invagination. The blastopore persists as the mouth. The first cilia are irregularly arranged; the apical cilia are very large; the embryo rotates on its long axis, in the direction of the hands of a watch. In addition to the mesoblast, as usually described, there is a second factor derived from the ectoblast after the embryo is free-swimming.

Teredo norvegica.

I am indebted to Professor Dall for the determination of this species. It is found abundantly at Beaufort, grows

rapidly to great size, and is very destructive. The sexes are separate and of about equal proportions. I found specimens sexually mature during the spring and until the middle of July. The breeding-season probably lasts all summer. The eggs are cast into the water, and, if the sexual products are mature, they are extruded through the siphons when the animals are taken from their tubes. The eggs are of about the same size as those of *Pholas*, but more opaque and of somewhat slower cleavage. The segmentation of the egg and the derivation of the germ-layers are step by step as in *Pholas*, so that to describe them would be but a repetition of every detail—planes of cleavage, establishment of bilateral symmetry, gastrulation and division of the entoblast-cells, double origin of the mesoblast, ciliation and rotation of the embryo, persistence of the crescent-shaped blastopore as the mouth.

The accompanying figure represents a longitudinal section



of an embryo of *T. norvegica* with eight entoblast-cells. The apical end is to the right. The posterior mesoblast, *pm*, lies in the cleavage cavity, as does also the smaller anterior mesoblast, *am*, upon the entoblast-cells. The four entoblast-cells shown are of subequal size. The shell-gland is just beginning to form.

Teredo (Xylotrya) fimbriata.

This species is equally as abundant at Beaufort as the preceding, but of smaller size. The sexes are separate and of about equal proportions. The eggs develop in the water, but are not extruded as are those of *T. norvegica*. They are easily fertilized artificially and develop rapidly. The embryos are hardy in aquaria. Except for the greater opacity of the egg, I think it impossible to distinguish the segmenting egg and embryo from those of *Pholas*. All of the features summarized for *Pholas* are true for this species.

Teredo navalis.

As is well known, the eggs and embryos of this species are retained in the gills till the larvæ have reached a somewhat

advanced stage of development. It is found but sparingly at Beaufort, so that my observations on this form were not extensive. However, one set of embryos which I secured were just at the end of segmentation and at the time of the derivation of germ-layers. In most of the eggs the large mesoblast was already formed; but in one, more tardy than the others, it was derived from the right entoblast. The two large entoblasts are of equal size. The left in all cases divides first into two cells, the anterior slightly the smaller. The right soon follows, dividing like the left. Soon those of the left divide again, followed by division of the right, so that the entoblast consists of eight subequal cells, each quite high, bordering on the blastopore, and with the nucleus nearer the outer end. The ciliation of the embryo is less perfect and developed later than in the preceding three species. It is flattened as in the other forms; but I could not observe with certainty the inwandering of the ectoblast-cells to form mesoblast. Soon after this stage the embryos became irregular.

The actual migration of ectoblast-cells to form part of the mesoblast, I believe, has not been described before. Lillie traces a "larval mesoblast" to one of the ectoblasts of *Unio*. This migration of cells from the surface into the cleavage-cavity is present in great uniformity as to time and position of formation in the first three species I have described; and I think we must believe that a like condition holds for *T. navalis*.

This second origin of the mesoblast I take to be of double significance, in so far as it touches Hatschek's description for *T. navalis* ('Arbeiten Zool. Inst. Wien,' vol. iii. 1881). The early stages in the formation of the gut (the division of the entoblasts) are exactly like those of the other three forms—like all marine Lamellibranchs which have been accurately studied. At least during the early stages there is an invagination of the entoblasts, and there is no evidence that small cells are formed from the single large entoblasts of either side, which later arrange themselves to form the gut. Hatschek says he had no stages between those he represents in figs. 13 and 14 a. The embryos I had bridge this gap. His error in describing the formation of the gut arose, I believe, from his finding small cells lying on the entoderm in slightly later stages. These, as I have shown, are mesodermal elements derived from the ectoderm which come to lie on the entoderm. I think the evidence is that the Pholadidæ in their early stages develop in the same manner, even to minute details. I see no reason to believe that *T. navalis* departs from the other

species so much as to have different planes of cleavage of the egg, a different derivation of the germ-layers, and a different mode of formation of the gut. Nor do I think its egg and embryo are symmetrical before the germ-layers are differentiated.

In his accurate study of the cell-lineage of *Unio*, Mr. Lillie finds that each of the cells of the four-cell stage contains entodermal elements. In the marine forms the derivation of the entoderm from the large macromere alone is interesting, since in the early stages of cleavage the lineage of the cells in the various Pholadidæ is so like that in *Unio*, even to minute details.

XXXV.—*On African Mole-Rats of the Genera Georychus and Myoscalops.* By OLDFIELD THOMAS.

I. *A new Species of Georychus from Mashonaland.*

THE arrival of two small collections of admirably prepared skins from Mazoe and Salisbury, Mashonaland, presented respectively by Mr. J. Ffolliott Darling and Mr. Guy A. K. Marshall, in each of which there are two specimens of a *Georychus*, has involved the re-examination of the Museum material in that genus. Of the species found in Angola Prof. Barboza du Bocage has recently given an account*, dividing them into several groups or forms, which he wisely does not venture to define specifically, both on account of their exceeding difficulty and for want of better material than is as yet possessed by any museum. The South-African ones, however, are perhaps more easily arranged, at least provisionally, for instead of the considerable number of different forms found in Angola there seem to be only three or four altogether, and these well separated geographically.

Thus, *G. capensis* of the western Cape Colony is perfectly distinct from the others, while all the specimens from the eastern part of the colony, from Natal northwards to the Limpopo, seem fairly referable to *G. cæcutiens*, from which I cannot at present distinguish *G. hottentottus*, Less., *G. Ludwigii*, A. Sm., or *G. holosericeus*, Wagn.† North-westwards

* J. Sci. Lisb. (2) iv. p. 269 (1890).

† This species was founded on three specimens from different localities which might hereafter prove to be of different species; but as Graaf Reinet is the first-mentioned locality, the one from there should be taken as the type.

in Damaraland occurs the larger *G. damarensis*, Ogilb., of which the type in the British Museum remains the only authentic specimen known; those referred to it from Central Africa, as appears below, being really different.

Now on the plateau of Mashonaland, isolated by lower ground all round, there occurs the little species obtained by Messrs. Darling and Marshall, which may be called

Georychus Darlingi, sp. n.

Size about as in *G. cæcutiens*, Brants, to which I provisionally refer all the S.-African plain-coloured unspotted forms. Fur short, close, and velvety, barely 5 millim. in length on the back. General colour uniform drab*, modified by the slaty-grey bases of the hairs showing through. Belly precisely similar or rather more slaty. Crown with a large and prominent triangular white patch, averaging about 14 millim. long by 8 wide, not extending along the nape; remarkably similar in size and shape in all four specimens. Corners of mouth stained brown in some specimens, not so in others. Feet and tail as usual, the latter perhaps less broad than in *G. cæcutiens*.

Skull broad and heavy, with a large rounded brain-case. Nasals short, evenly expanded on each side, not constricted anteriorly, and running backwards to a point, which scarcely attains to the level of the lacrymal projection. Ascending processes of premaxillaries surpassing the nasals posteriorly by about 2 millim., broadened and closing in towards the middle line behind the nasals. Anteorbital foramina higher than broad, the base forming their outer boundary nearly as thick as that forming their floor. Molars as usual.

Dimensions of the type (♂), measured in the flesh by the collector:—

Head and body 128 millim.; tail 12; hind foot 22.

Skull: basal length 28·6; basilar length to henselion 26·8; greatest breadth 22·6; nasals 10·8 × 3·1; interorbital breadth 10; intertemporal breadth 7; supra-auricular breadth 14·1; height of anteorbital foramen 3; palate length from henselion 19·3; diastema 10·1; upper molar series 5·7.

Hab. Plateau of Mashonaland: type from Salisbury, 5000 feet; others from Mazoe, 4000 feet.

Type: B.M. 95.7.16.4. Collected May 14, 1895.

Although this species is compared in the description with *G. cæcutiens*, as the best-known species of the group, it is probably really most nearly allied to *G. damarensis*, which

* Nearest to the "drab-grey" of Ridgway.

shares with it the possession of a white crown-patch, short fur, and thickened outer wall to the anteorbital foramen, all of which characters separate it from *G. cæcutiens*. From *G. damarensis* it may be distinguished by its conspicuously smaller size, less extended crown-patch, and much shorter nasal bones.

The species having been first obtained by Mr. Darling, I have named it in his honour, although I have found it most convenient to take one of Mr. Marshall's Salisbury specimens as the actual type.

Mr. Darling states that the native name is "Nōta," and both collectors say that it is very common on the open veldt.

Since it is so common, I venture to hope that both collectors will send many more specimens, so that, at least in one species of this difficult group, we may learn something definite about the seasonal, age, and sexual variations—a knowledge that would be of the utmost value in working out other members of the group.

II. *The Central-African Georychi.*

In 1887 * Prof. Leche, of Stockholm, in working out a collection received from Emin Pasha, mentioned and figured two large *Georychi* as *G. damarensis*, Og., and *G. ochraceo-cinereus*, Heugl. The first of these determinations was made on my authority after a comparison with the type, as at that date I by no means realized the importance of the difference in colour and locality between the two. Later on †, influenced by the character of size and by the resemblance of the smaller animal to *G. damarensis*, I suggested that the names should be reversed, and that the smaller sandy-coloured animal should be called *damarensis* and the larger smoky-grey one *ochraceo-cinereus*.

In now re-examining the subject, I have come to the conclusion that Prof. Leche was in the first instance perfectly correct in referring the sandy-coloured species to Heuglin's *G. ochraceo-cinereus*, and that this also is the most nearly allied to *G. damarensis*, while the darker species is equally distinct from both, and therefore needs a new name.

As it was entirely due to my original error that this species was not described by Prof. Leche in the first instance, I venture now to name it, in honour of that distinguished mammalogist,

* Zool. Jahrb. iii. p. 120 (1887).

† P. Z. S. 1888, p. 14.

Georychus Lechei, sp. n.

Size large. Fur fine, of medium length, about 7 millim. long on the back. Colour above and below dark smoky grey, with a brownish tinge in certain lights. White crown-patch very large, and extending as a white line down the neck on to the anterior back. Median line below also with a tendency to be white. Hands and feet practically naked, the few fine hairs whitish.

Skull large and strongly built. Nasals long, rather narrow, not constricted anteriorly. Ascending processes of premaxillaries narrow, slightly exceeding the somewhat irregular nasals posteriorly. Middle portion of the skull rather long and parallel-sided, but the postorbital processes are well developed and separate off a well-defined orbital fossa in front. Anteorbital foramina small, their diameter less than that of the bars which bound them.

Dimensions of the type (an adult male skin) :—

Head and body 212 millim.; tail 10; hind foot 30.

Skull: basal length 3; basilar length 38; greatest breadth 42; nasals 17.5×4.3 ; interorbital breadth 10; intertemporal breadth 9; palate length from henselion 26.5; diastema 14.5; upper molar series 6.1.

Hab. Bellima, Monbuttu.

Type: B.M. 87.12.1.96. Collected by Emin Pasha, July 14, 1883, and presented by him to the British Museum.

Further details about this species and its differences from *G. ochraceo-cinereus* may be obtained from Prof. Leche's paper, where both are excellently figured on plate iv., fig. 1 being *G. Lechei* and fig. 2 Heuglin's sandy-coloured animal.

III. *The Species of Myoscalops.*

During the work on the skulls of the large *Georychi*, those of *Myoscalops*, which represents *Georychus* in East Africa, have been examined, and among these there appears to be a character to separate the mole-rats of Zambesia from those of East Africa proper. This is that the former—the true *M. argenteo-cinereus*, Peters—have a quite parallel-sided inter-orbitotemporal region, while in the latter there is developed a distinct orbital concavity on each side, defined behind by a projecting postorbital process. Should this difference prove to be constant, and all the skulls and figures I have seen agree with it, the name for the East-African animal will be *M. albifrons*, Gray, based on a young specimen obtained by Capt. Speke, in which the above characteristics are already clearly discernible.

XXXVI.—*Description of a new Chinese Squirrel.*

By OLDFIELD THOMAS.

I OWE to the kindness of Mr. F. W. Styan, of Shanghai, the opportunity of describing the following striking new species of squirrel:—

Sciurus pyrrhomerus, sp. n.

Allied to and of the same size as *S. rufigenis*, Blanf., and *S. Pernyi*, M.-Edw., with both of which it shares the olivaceous back, grey and white belly, yellowish post-auricular spots, and characteristically coloured tail, white-grizzled black above and brilliant red below. Sides of cheeks with a vague orange suffusion; anal region greyish white, like rest of underside. A large and prominent blotch on the outer side of each thigh brilliant rufous.

Skull with an enormously elongated muzzle, far longer than that of either of the above-named species, and but little excelled even by *S. (Rhinosciurus) laticaudatus*, a very different squirrel in all other respects. Postorbital processes very short.

Dimensions of the type (an adult female, in skin):—

Head and body 220 millim.; tail 124; hind foot 49.

Skull: greatest length 58; greatest breadth 30; nasals 19.2×6 ; tip of nasals to middle of a line connecting anterior corners of orbits 27; interorbital breadth 16.2; postorbital processes, length behind 2.4; palate length from hensenion 25; diastema 14; upper molar series (excluding $p.^3$) 9.2.

Hab. Ichang, Yang-tse-kiang.

Coll. F. W. Styan, Nov. 1893.

This handsomely marked squirrel may be readily distinguished from its only near allies, *S. rufigenis* and *S. Pernyi*, by having no red either on the cheeks or anal region and by the red patch on the hips. Its extraordinarily long muzzle also widely separates it from any of its allies.

XXXVII.—*On the Structure of the Skull in Peloneustes philarchus, a Pliosaur from the Oxford Clay.* By C. W. ANDREWS, F.G.S., Assistant in the Geological Department, British Museum.

[Plate XIII.]

THE structure of the skull in the post-triassic Sauropterygia is still in some respects very imperfectly known, a circumstance that may be accounted for partly by the comparatively

rare occurrence of that portion of the skeleton, and partly by the crushed condition of most of the existing specimens.

The first account of the cranial osteology of these animals is that given by Conybeare in his description of a *Plesiosaur* from the Lias of Street *; and it is with the skulls of several species from deposits of that age that most of the more important papers on this subject deal, those of *Plesiosaurus rostratus*, *P. homalospondylus*, and *P. dolichodirus* having been described by Owen †, that of *P. Etheridgei* by Huxley ‡, and that of *P. Conybeari* and *P. megacephalus* by Sollas §. An important note on the structure of the palate in *P. dolichodirus* has recently been published by Lydekker ||.

Of the post-liassic forms, portions of the skull of *Muraenosaurus Leedsi* have been described by Seeley ¶, an imperfect specimen of that of *Pliosaurus macromeris* ** by Owen, who has also given an account of an incomplete cranium referred by him to a member of the genus *Polyptychodon* ††.

Recently Williston †† has given an account of a skull of *Cimoliosaurus*, and the same specimen is the subject of a paper by Cope §§. The upper surface and the single temporal arcade are described; these appear to differ in several points from the same regions in the skull which is the subject of the present paper. The more important of these differences will be referred to below.

The relation of the Sauropterygia to other reptiles has been discussed by Baur |||; and Koken ¶¶, in an important paper on some remains of *Nothosaurus*, has given a valuable summary of our present knowledge of the Plesiosaurian skull, which renders any detailed account of the earlier papers unnecessary here.

* "Additional Notices on the Fossil Genera *Ichthyosaurus* and *Plesiosaurus*," Trans. Geol. Soc. ser. 2, vol. i. p. 119.

† "Fossil Reptilia of the Liassic Formations," pt. 3 (Mon. Pal. Soc. 1865).

‡ Quart. Journ. Geol. Soc. vol. xiv. (1858) p. 281.

§ *Ibid.* vol. xxxvii. (1881) p. 440.

|| Catal. Foss. Rept. Brit. Mus. pt. ii. (1889) p. 257, no. 41101.

¶ Quart. Journ. Geol. Soc. vol. xxx. (1874) p. 197.

** "Foss. Rept. Kimmeridge Clay," pt. 3 (Mon. Pal. Soc. 1869), p. 3.

†† "Foss. Rept. Cretaceous Form.," Suppl. 3 (Mon. Pal. Soc. 1860), p. 20, pl. iv.

‡‡ Trans. Kansas Acad. Sci. vol. xii. (1890) pp. 174-178.

§§ Proc. Amer. Phil. Soc. vol. xxxiii. no. 144, Jan. 1894, pp. 109-113, pl. x.

||| "On the Phylogenetic Arrangement of the Sauropsida," Journal of Morphology, vol. i. (1887) p. 97.

¶¶ "Beiträge zur Kenntniss der Gattung *Nothosaurus*," Zeitschrift d. deutschen geol. Gesellschaft, 1893, Bd. xlv. Heft 3, p. 337.

All the specimens described in the present paper were obtained by Mr. Leeds from pits in the Oxford Clay in the neighbourhood of Peterborough. In all cases these specimens are more or less crushed; but they are free from matrix, and supply much valuable information concerning some important points in the cranial anatomy of the group. The Leeds collection includes portions of skulls of animals referable to the genera *Peloneustes*, *Pliosaurus*, *Murcenosaurus*, and *Cryptochlidus*. Only the skull of *Peloneustes philarchus* will be considered now, the other genera being reserved for a future occasion.

The Skull of Peloneustes philarchus (Seeley).

The specimens upon which the following description is founded consist of:—(1) a skull (Leeds coll. no. 42), of which the anterior portion is fairly complete and uncrushed, but the posterior dorsal region and the temporal arcades are greatly broken and distorted; the palate is in a fairly good condition (Pl. XIII. fig. 1): (2) the upper portion of a skull almost uncrushed in the rostral region; the palate and a large part of the alveolar borders are wanting (Pl. XIII. fig. 3): (3) numerous crushed fragments of a skull.

All the above are in the British Museum.

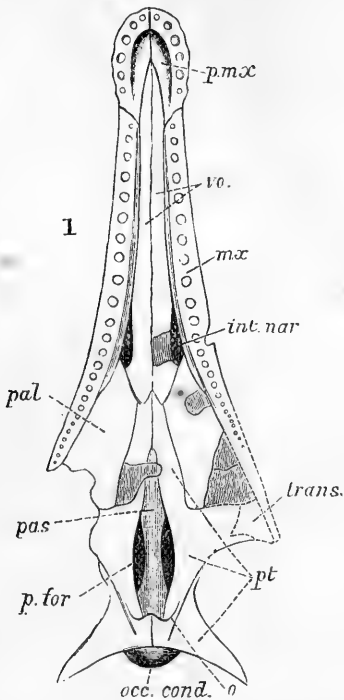
The description of the palate is taken mainly from a specimen (no. 4) in Mr. Leeds's private collection, in which this region is well preserved and the sutures easily determinable (Pl. XIII. fig. 2).

These specimens will be referred to by the numbers affixed to them above.

The general outline of the skull is that of an isosceles triangle, of which the apex is blunt and the height about two and a half times the length of the base, that is, the width of the hinder end. The length of specimen 1 from the tip of the snout to the hindermost point of the occipital condyle is 60·5 centim., and the distance from the same point to the front of the pineal foramen is 46·5. In specimen 2 this latter measurement is about 50 centim. Specimen 4 is exactly the same length as 1. Other measurements will be given in the description of the various parts.

The anterior portion of the snout, composed of the premaxillæ, is somewhat depressed and expanded, its greatest width being opposite the fourth alveolus, where it measures about 6·5 centim. At the point where the suture between the premaxilla and maxilla crosses the alveolar border it is

about 1 centim. less, but behind this point there is a gradual increase in the width of the skull.



Palatal aspect of a skull of *Peloneustes*, from a specimen (no. 4) in the Leeds Collection.—*int.nar.*, internal nares; *m.x.*, maxilla; *p.m.x.*, premaxilla; *pal.*, palatine; *pt.*, pterygoid; *pas.*, parasphenoid; *p.for.*, posterior palatine vacuities; *oc.cond.*, occipital condyle; *o*, ridge on pterygoid; *vo.*, vomer.

The *premaxillæ*, which are separated from one another by a distinct suture, each bear six tooth-sockets, of which the first is the smallest and is directed forward and downward, the second is larger, the third and fourth the largest of the series, while the fifth and sixth decrease in size successively. None of the alveoli in any of the specimens retain the teeth, but at the hinder inner edges of several the tips of the young replacing teeth are visible. The suture between the premaxilla and maxilla crosses the alveolar border immediately behind the sixth tooth and runs upwards and backwards on to the side of the rostrum in a curve, convex anteriorly. When it

reaches a point about 17 centim. from the anterior end of the snout and 2 centim. from the middle line, it runs straight backwards parallel to the corresponding suture of the opposite side to a point considerably behind the external nares, and forms the outer limit of the extremely long facial process of the premaxilla, which is about 2 centim. wide and with its fellow of the opposite side forms a long ridge, convex transversely, which separates the nasals and extends back to the frontals. These latter thrust themselves slightly between the premaxillæ, with which they form an irregular V-shaped suture.

The extension of the premaxillæ on the palate is very small. From the point where the hinder edge of the bone crosses the alveolar border it runs backward for about 2 centim., being here united by suture with the maxilla; it then turns forward at a very acute angle, running first forward parallel to the axis of the skull, then turning inwards and meeting its fellow of the opposite side at a point 6.2 centim. from the tip of the snout; during this part of its course it is in contact with the anterior portion of the vomers, which thus thrust themselves some distance between the premaxillæ.

On the inner side of the alveoli, both in the maxilla and premaxilla, there is a groove which is only interrupted for a short distance at the junction of the two bones. It is at the bottom of this groove near its inner border that the tips of the replacing teeth make their appearance. In the premaxillary region the inner border of this depression forms a considerable ridge, which stands out some distance beyond the level of the intercalated vomers.

The *maxilla* is a very large bone bearing about twenty-eight to thirty teeth. The first and second of these are comparatively small; the next four, which are subequal, are very large, the largest in the maxilla. Behind these there is a gradual decrease in size to the hinder end of the series. The palatal portion of the bone forms only a narrow strip, in which lies the groove above mentioned. In front this palatal portion of the maxilla unites with the premaxilla for a short distance, behind this with the vomer as far as the middle of the internal nares, of which it thus forms the outer anterior margin. From this point it is united with the palatines, and posteriorly to these apparently with the transpalatines.

The facial region of the maxilla is large; as far back as the external nares, the outer edge of which it forms, it is bounded superiorly by the premaxilla, but behind these openings its form and relations cannot be determined in any of the specimens, owing to the crushing they have under-

gone; it can, however, be seen that the bone gradually narrows to a thin backward prolongation which extends about 4.5 centim. behind the last tooth. The upper edge of the hindermost portion unites with an element which appears to be a jugal, the relations of which will be described below; the lower edge forms the junction with the transpalatine above mentioned.

The *vomers* are extremely large; in specimen 4, from which the following description of the palate is mainly taken, they measure 29 centim. in length, or nearly half the total length of the skull (61 centim.). Anteriorly they run between the premaxillæ, terminating in front in a point. From the premaxillæ to the anterior angle of the internal narial aperture they unite externally with the maxillæ, increasing gradually in width. At the nares, of which they form the inner border, they are contracted, measuring together about 3 centim. across at the narrowest part. Their widest point is immediately behind the nares, from which openings their border runs inwards and backwards in a curve, convex posteriorly, in the anterior half of which they form a squamous union with the palatines, and in the posterior half with the pterygoids, which thus completely shut out the palatines from the middle line.

The *palatines* are bounded externally by the maxillæ, internally by the internal nares, of which they form the postero-external margin, by the vomers, and, to the greatest extent, by the pterygoids. In no specimen is the whole of the posterior border of the palatines preserved, but its inner portion united with the anterior edge of the lateral wing of the pterygoid in a straight suture running nearly at right angles to the long axis of the skull, while the outer portion seems to have joined the transpalatine, there having been no vacuity in front of this bone, or, at any rate, only a small one.

The *internal nares*, the borders of which, as has already been mentioned, are formed by the vomers internally and the maxillæ and palatines externally, are slits measuring approximately 3 or 4 centim. long by 1 centim. wide. Their anterior angle lies about 28 centim. from the anterior extremity of the skull.

In specimen 1 the internal nares open considerably in front of the external; this anomalous condition may be partly accounted for by the crushing which the skull has undergone, but, even allowing for this, the arrangement would be essentially the same. This relative position of the external and internal narial openings is well shown in a skull of *Pliosaurus*

which will be described on a future occasion. That these apertures are the true internal nares there can be no doubt, since their relations to the surrounding bones are exactly similar to those found in *Nothosaurus*, according to the descriptions and figures of Koken and Lydekker. Moreover, their position is essentially similar to that of the internal nares in *Sphenodon* and many *Lacertilia*. In the former, indeed, the skull presents several striking resemblances to that of *Peloneustes*, *e. g.* in the relations of the vomers, palatines, and pterygoids to one another.

In his paper on *Plesiosaurus Etheridgei* Huxley stated that he believed that these posterior fossæ (*i. e.* the posterior palatine vacuities) had been mistaken for the posterior nares, which were really situated much farther forward; and the position of these apertures was correctly determined by Sollas in *Plesiosaurus megacephalus*. He, however, describes the whole of the plate of bone behind the vomers as palatines, the suture between these bones and the pterygoids being either obliterated or really represented by the fissures, which he states "might easily be mistaken for sutures," and which occur exactly where the junction between the palatines and the anterior wing of pterygoids might be expected to be found: if we accept this last alternative as the correct one, the pterygoids met the vomers in the genus *Plesiosaurus* also; the form of the hinder border of the united vomers would lead one to suspect that this was the case even if no trace of suture were visible. The same arrangement has been recorded by Lydekker in the case of *Plesiosaurus dolichodirus*.

The *pterygoids* (woodcut 1, *pt.*, p. 245), the largest bones in the palate, are peculiarly complex. They may be described as triradiate bones, each consisting of an anterior, a lateral, and a posterior ramus. The anterior ramus terminates in front against the vomer; externally it is bounded by the palatine, the suture with which at first runs straight backwards, then curves outwards (see woodcut 1), afterwards resuming its backward course as far as the hinder border of the palatine, at which point the pterygoid is about twice as wide as it is opposite the posterior end of the vomers.

The anterior border of the lateral pterygoid ramus is nearly straight and unites with the hinder margin of the palatine in a suture which runs at right angles to the axis of the skull. Its outer margin joins the transpalatine (*ectopterygoid*) in a somewhat complicated suture, which first runs backwards and inwards, then turns sharply outwards and cuts a large oval tuberosity with a truncate rugose extremity, so that

one half is on the transpalatine, the other on the pterygoid * ; it then passes backwards, and reaches the hinder border of the palate about 8 centim. from the middle line (see woodcut 3).

The posterior border of the lateral ramus is thickened and passes by a curve into the lateral border of the posterior wing, the two forming the anterior and internal lower borders of the temporal fossa. The lateral border of the posterior ramus is somewhat concave, and its edge is thick and rounded; posteriorly it passed outward and backwards, forming the front border of the long posterior prolongation of the bone which unites suturally with the inner edge of the quadrate immediately above the condyle for the mandible; this posterior process extends considerably behind the occipital surface.

In the middle line for about 10 centim. behind the vomers the pterygoids unite with one another; behind this point they are separated by a median bone, which is here regarded as a parasphenoid. Viewed from the dorsal surface it can be seen that this bone extends nearly to the vomers, but ventrally it is overlapped by the pterygoids as far back as the point mentioned. About opposite the hinder border of the lateral ramus, at a spot about 11 centim. in advance of the hindermost point of the occipital condyle, the median borders of pterygoids become thickened and rounded, and, curving outwards, diverge from the parasphenoid. Further back they again approach the median line, and finally unite with one another in a median suture about 3 centim. (?) long, overlapping the basisphenoid and anterior portion of the basioccipital, the former of which is completely covered by them. The two foramina thus enclosed between the pterygoids and the *basis cranii* are about 6 centim. long by 1 to 2 wide; they were described by Owen in an imperfect skull referred by him to *Plesiosaurus rostratus*. He, however, considered that the pterygoids, and not the *basis cranii*, formed the median bar, and that these bones met the palatines opposite the anterior end of these foramina, which he calls the "palato-nares," apparently supposing that the nasal passages were prolonged backward to this level by the union of the palatines and pterygoids, somewhat as in the Crocodilia. The true internal nares, as was shown in the foregoing description, and as Huxley suspected, lie very much farther forward, and these posterior openings, which may be spoken of as the *posterior palatine vacuities*, have nothing to do with the

* This downwardly-projecting process of the palate is homologous with an exactly similarly constituted process in *Sphenodon*, many Lacertilia, the Crocodiles, and, apparently, the Theriodontia.

nasal passage. In a subsequent paper on the skull of *Pliosaurus grandis* from the Kimmeridge Clay, Owen* again refers to these openings as palato-nares, and describes the true internal nares as nervo-vascular foramina.

The postero-external angle of the hinder portion of the pterygoids is prolonged outwards and backwards into the strong bar which unites at its distal end with the quadrate, as described above.

On the palatal surface of the posterior ramus a high crest commencing near the hinder end of the posterior median suture runs outward and forward in a curve; externally it passes into the thickened hinder edge of the lateral ramus. This crest is shown in Pl. XIII. fig. 2, where it is marked O. In the hinder part of its course in specimen 4 it is 2·5 centim. high.

On the dorsal surface of the pterygoid immediately external to the posterior palatine vacuities may be seen in specimen 1 the base of the *columella cranii* (*epipterygoid*): this region being much crushed in all the specimens, no detailed description of this bone is possible; it can, however, be seen that its upper extremity closely united with the lower edge of the parietal (Pl. XIII. fig. 1, *col.*). In a skull of *Pliosaurus* in the British Museum this structure is better preserved, and will be described on a future occasion.

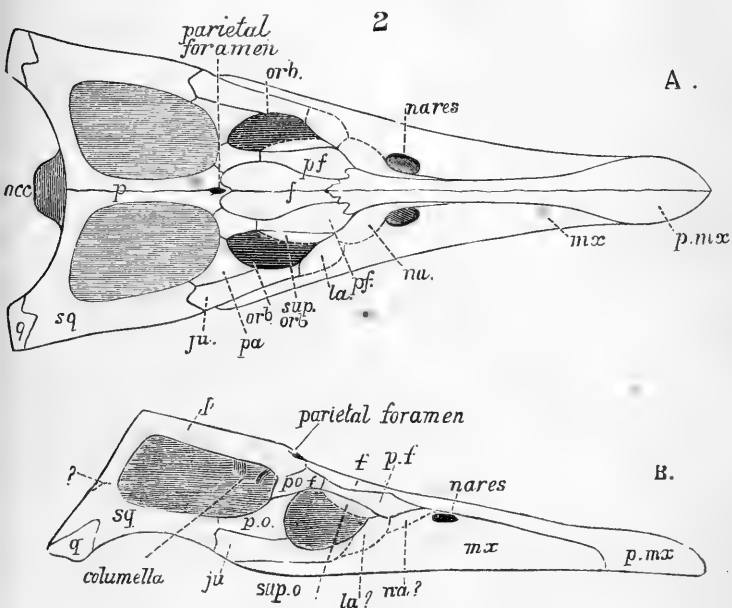
Before attempting to determine the structure of the temporal arch and of the dorsal surface of the skull the bones of the *basis cranii* may be noticed.

The *basioccipital* is a very massive structure; it bears the whole of the occipital condyle, which is very convex and slightly oval in outline, its longest diameter being transverse and measuring 4 centim. The lateral regions of the ventral surface of the bone are prolonged outward into a pair of very stout processes, the truncated ends of which look outward and downward and are very rugose; they probably served for the attachment of muscles, but their anterior portion may have been covered by the pterygoids. The upper surface bears two roughly triangular slightly depressed areas for union with the exoccipital. The interval between these surfaces is very small, the basioccipital having taken but a small share in forming the actual margin of the *foramen magnum*.

The exoccipitals which formed the lateral borders of this opening are massive bones, but in all the available specimens are too crushed for description. It can, however, be seen that they—or, rather, the opisthotic, which is no doubt fused

* "Fossil Reptilia from the Kimmeridge Clay," part 3 (Mon. Pal. Soc. 1869) p. 4.

with them—bore a paroccipital process. In the skull of *Pliosaurus* above mentioned this process is long and has a spatulate expansion at its outer end, which apparently abuts against the inner surface of the quadrate at its junction with the posterior bar of the pterygoid.



Diagrams showing the structure of the skull in *Peloneustes*. A, from above; B, from side.—*f.*, frontal; *ju.*, jugal; *la.*, lachrymal; *mx.*, maxilla; *na.*, nasal; *orb.*, orbit; *p.*, parietal; *p.f.*, prefrontal; *p.o.*, postorbital; *po.f.*, postfrontal; *p.mx.*, premaxilla; *sup.orb.*, (P) supraorbital; *occ.*, occipital condyle; *q.*, quadrate; *sq.*, squamosal.

The *basisphenoid* is not sufficiently well preserved for description in any of the specimens; it is entirely covered by the pterygoids below. In front of it is seen the bone here regarded as a *parasphenoid*. This is of an elongate lanceolate shape and terminates anteriorly in a point. It separates the posterior palatine foramina from one another, and anteriorly unites with the pterygoids in the manner above described. Its upper surface is slightly channelled in the median line for about the middle third of its length. In some specimens of the skull of *Cryptoclidus* the posterior part of this bone is

seen to be closely applied to the ventral surface of the basi-sphenoid, and in one young individual the line of separation between the two bones is visible. It is a thin plate-like structure, and is evidently a membrane bone.

In consequence of the crushing undergone by all the available specimens the arrangement of the bones in the upper surface of the skull is very difficult to determine; the present description is therefore brief and must be regarded as in part provisional.

The *parietals* form a high crest between the temporal fossæ; they descend considerably on to the side of the brain-case, and at the anterior end their lower edge unites with the upper end of the epipterygoid. Posteriorly they unite ventrally with the supraoccipitals and send out lateral processes, which, together with the upper rami of the squamosals*, form the post-temporal bars; but the exact share of the two elements in these structures cannot be determined, all trace of the suture between them being obliterated.

The structures here spoken of as lateral processes of the parietals have been described by Cope on a skull of *Cimoliosaurus* as distinct elements (supramastoids); but both here and in the skull of the young *Plésiosaur* figured in the 'Geological Magazine' for June 1895 there is no trace of any suture dividing these processes from the parietals, although in the latter specimen the opisthotic is still imperfectly united with the exoccipital, and the bones of the basis cranii are still separate.

Between the parietals, immediately opposite the anterior end of the temporal fossæ, is the pineal foramen, an oval aperture of considerable size, looking upward and forward.

The boundary between the parietals and frontals cannot be made out very satisfactorily. It seems to have passed just in front of the pineal foramen, part of the anterior border of which may indeed have been formed by the frontals: the probable position of the suture is shown in woodcut 2 A; this agrees with the arrangement found in *Murænosaurus* and very nearly with that shown in Owen's figure of an imperfect cranium of *Polyptychodon* †.

If their line of union with the parietals is rightly determined, the frontals have the form shown in woodcut 2 A. Their narrow anterior extremity is in sutural union with the

* The term "squamosal" is here used in the sense employed by Koken, and the triradiate bone designated by it is probably formed by a fusion of the supratemporal and squamosal.

† "Foss. Rept. Cretaceous Form.," Suppl. 3 (Mon. Pal. Soc. 1858) pl. iv. fig. 1.

facial processes of the premaxillæ, while laterally they are bordered by the prefrontals in front, and probably for a short distance only by the postfrontals behind.

The inner border of the *postfrontal* united with the parietals; its anterior boundary is not seen in any of the specimens, but it probably met the prefrontal in a suture running outwards nearly at right angles to the axis of the skull, as in the above-mentioned skull of *Pliosaurus*. It evidently formed part of the upper posterior margin of the orbit and of the anterior border of the temporal fossæ. Its lower extremity apparently united with the postorbital. The relations of this bone to the surrounding structures, apart from its anterior junction with the prefrontal, are very similar to those of the postfrontal of *Sphenodon*.

The *prefrontal* is bounded internally by the frontal and posterior end of the premaxillæ; posteriorly, as has just been mentioned, it is probably in contact with the postfrontal; anteriorly it joins the nasals (?), and externally it is slightly overlapped by a thin plate of bone, here regarded as a supra-orbital, the presence of which in a skull of *Plesiosaurus dolichodirus* was long ago pointed out by Owen*.

It has not been possible to determine the form and relations of the nasals, but they seem to have sent forward a wedge-shaped process forming the greater portion of the inner margin of the nostrils, and separating them from the facial processes † of the premaxillæ. I cannot say whether a *lachrymal* was present or not. The probable structure of this part of the skull is shown in woodcut 2 A.

The relations of the bones of the frontal and nasal regions of the skull are much better shown in the skull of *Pliosaurus*, to which frequent reference has already been made.

The lower border of the orbit is formed in great part by the *jugal* (woodcut 2 B). This bone is supported below by the backward prolongation of the maxilla, which extends considerably behind the orbit; its hinder portion unites above with the postorbital, and posteriorly it joins the anterior ramus of the squamosal, but takes no share in the formation of the upper margin of the temporal bar, being excluded therefrom by the backward extension of the postorbital to meet the squamosal.

The *postorbital* is a triangular bone; its apex must have joined the postfrontal, but in no specimen is the actual junction preserved, though there can be no doubt that it

* "Rept. Lias Form.," pt. 3 (Mon. Pal. Soc. 1865) p. 9, pl. iii. fig. 1.

† The upper portions of these processes were described as the nasals by Owen, Sollas, and others.

existed, since in some specimens the upper angle is well preserved, and shows that it united in a suture with the adjoining element.

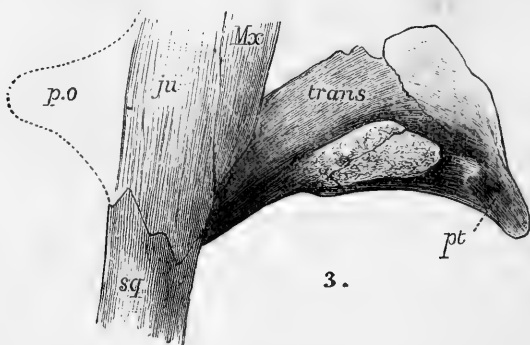


Figure showing the relations of the transpalatine to the surrounding bones.

The anterior edge of the postorbital formed the hinder margin of the orbit, and the posterior a part of the anterior border of the temporal fossa. Its lower edge, as already stated, joins the upper edge of the jugal, while its posterior angle is truncated by a short suture with the anterior ramus of the squamosal.

The relations of the postorbital, jugal, and maxilla to one another and to the squamosal are almost precisely the same as those found by Sollas in a skull of *Plesiosaurus Conybeari* (see Quart. Journ. Geol. Soc. vol. xxxvii. 1881, p. 444, pl. xxiv. fig. 1); moreover, they bear out Huxley's statement that the postfrontal (=postorbital) articulates with a bone that is the homologue of the squamosal of the crocodile. Williston, on the other hand, states that in *Cimoliosaurus* there is no trace of the T-shaped suture between the jugal, postorbital, and squamosal, and that if it existed the squamosal would necessarily articulate with the maxilla. This is not the case in skulls of *Peloneustes*, in which the posterior end of the maxilla approaches the squamosal, but remains separated from it by the jugal. Cope, in his paper on the same skull of *Cimoliosaurus*, describes an arrangement of bones in the temporal arch which differs widely from that found in *Peloneustes* and also in *Plesiosaurus*. He figures the suture between the jugal and squamosal as lying far back near the hinder end of the temporal arcade, so that the postorbital unites with the jugal only, and is widely

separated from the squamosal (supratemporal of Cope). What is here spoken of as the superior ramus of the squamosal is figured by him as a distinct element, the supramastoid. No trace of any suture in the position indicated occurs in *Peloneustes*; but since complete fusion with the parietal has also taken place, this does not prove that no such suture existed. It has already been pointed out that in the skull of the young individual of *Cryptoclidus* recently noticed by the present writer in the 'Geological Magazine,' June 1895, the parietals bear postero-lateral processes that certainly are not distinct elements, and it is with the posterior surfaces of these processes the ends of the upper rami of the squamosal unite, overlapping them so far that they nearly meet in the middle line behind the parietals. In *Sphenodon* the upper rami of the squamosal join the front of these processes. I am not sure whether, in the young specimen mentioned, the upper ramus of the "squamosal" is not a distinct element; but if this is so, it would seem to show, not that the lateral processes of the parietals in *Sphenodon* are distinct elements, but that the "squamosal" is, as is commonly supposed, a compound bone.

The ventral ramus of the squamosal is closely united to the quadrate, but the exact relation of the two bones to one another is difficult to determine. It can be seen that a process of the squamosal is closely attached to the anterior surface of the quadrate, down which it extends nearly to the condyle. On the posterior surface there also appears to be a plate of bone, the lower edge of which forms a rounded curved ridge a little above the condyle; but it is not quite clear whether this is a distinct bone or a process of the squamosal.

I have not been able to determine whether the small quadrato-jugal described by Williston and Cope in *Cimoliosaurus* is present or not.

The quadrate is a stout, massive bone which in its natural position seems to have been directed rather outwards and backwards. Internally it is supported by the backward prolongation of the pterygoid, which unites with it by suture; externally it is rigidly fixed by the extensive overlap of the squamosal. Moreover, judging from the Pliosaur skull referred to above, it was further supported by the paroccipital process, the outer end of which unites either with the upper end of the quadrate or with the portion of the pterygoid immediately adjoining. Between the paroccipital process and the post-temporal bar there must have been a post-temporal fossa of considerable size.

The condyle for the mandible is transversely elongate and

forms a curve with the concavity forward. The articular surface is divided into two parts by a ridge which runs obliquely from its inner posterior angle to about the middle of its anterior border. The outer portion is considerably the larger and is concave from side to side and convex from before backwards; the inner is convex in both directions.

It will be convenient to defer the comparison of the cranial structure of the Plesiosauria with that of other reptiles until the skulls in some of the other genera have been described, especially since very considerable differences exist between the short-snouted Plesiosaurs of the Lias and the later Pliosaurus. It may, however, be mentioned that these latter appear to approach the Triassic Nothosaurs more nearly in the structure of the palate than do the former.

EXPLANATION OF PLATE XIII.

Fig. 1. Dorsal surface of an imperfect skull of *Peloneustes philarchus*, (Seeley) (specimen 1).

Fig. 2. Ventral surface of ditto (specimen 4).

Fig. 3. Frontal region of ditto (part of specimen 2).

<i>f.</i> Frontal.	<i>p.f.</i> Prefrontal.
<i>ju.</i> Jugal.	<i>par.for.</i> Parietal foramen.
<i>la.</i> (?) Lachrymal.	<i>p.mx.</i> Premaxilla.
<i>mx.</i> Maxilla.	<i>post.pal.vac.</i> Posterior palatine vacuities.
<i>na.</i> Nasal (?).	<i>q.</i> Quadrate.
<i>o.</i> Ridge on pterygoid.	<i>sup.orb.</i> (?) Supraorbital.
<i>oc.c.</i> Occipital condyle.	<i>vo.</i> Vomer.
<i>pal.</i> Palatine.	
<i>p.o.</i> Postorbital.	

XXXVIII.—*The Hydroids of St. Andrews Bay.* By Rev. J. H. CRAWFORD, F.L.S., St. Andrews Marine Laboratory.

SINCE the first list of Hydroids was published in the *Ann. & Mag. Nat. Hist.* in 1874 (vol. xiii.) by Prof. M'Intosh* several additional species have been procured.

During the present season, again, a few forms have been added to the local Hydroids, which seem to show that the bay is probably richer than has been supposed. Many of the Athecata are known to attach themselves by preference to the red seaweeds and to *Zostera marina*. Unfortunately the west rocks, where *Delesseria sanguinea* grows most luxu-

* And also copied in 'Invertebrate Marine Fauna and Fishes of St. Andrews,' 1875.

riantly, are covered with young mussels, and the bed of *Zostera* on the far side of the Eden has not yet been examined.

ATHECATA.

Clava multicornis.—The commonest form. Found everywhere on stones between tide-marks.

Hydractinia echinata.—Colonies occur on various empty shells.

Coryne vaginata.—On *Delesseria sanguinea*.

Syncoryne decipiens.—From débris of fishing-nets.

Eudendrium ramosum.—From deep water.

— *capillare*.—On *Antennularia ramosa*.

Tubularia indivisa.—From deep water.

— *coronata*.—From deep water.

— *larynx*.—From deep water.

In addition to such positive results, the detached Medusa-buds occur with sufficient regularity to make it practically certain that the corresponding hydroids are present, and the distribution is often sufficiently local to indicate the position those should occupy. In March or beginning of April we look for *Lizzia (Rathkea) octopunctata*; in May *Hybocodon prolifer*; in June *Syncoryne eximia*, *Sarsii*, and *gravata*, *Stauridium productum*, *Perigonimus repens*, *Bougainvillia fruticosa*, *Ectopleura Dumortierii*; in July *Bougainvillia ramosa* and *Syncoryne pulchella*. *Euphysa aurata*, the most beautiful of our smaller hydroids, occurs in great numbers from the latter end of July till the beginning of September.

MEDUSÆ.

Lizzia octopunctata. April.

Hybocodon prolifer. May.

Syncoryne Sarsii. June.

— *eximia*. June.

— *gravata*. June.

Stauridium productum. June.

Perigonimus repens. June.

Bougainvillia fruticosa. June.

Ectopleura Dumortierii. June.

Bougainvillia ramosa. July.

Syncoryne pulchella. July.

Euphysa aurata. August.

The Thecaphora are indicated in the following comparative list.

In Athecata, St. Andrews compares unfavourably with the other two stations, the proportion being 10 species against 16 for Heligoland, and 25 for Plymouth. In Thecaphora, on the other hand, St. Andrews has a decided advantage, numbering 53 species, against 35 for Heligoland and 36 for Plymouth. When Athecata and Thecaphora are placed together, St. Andrews still retains the lead, with 63 against 61 and 51. In Medusoids the numbers recorded are still more decidedly in favour of St. Andrews.

The Plymouth Hydroids and Medusæ are taken from the 'Journal of the Marine Biological Association' for November 1890 and 'Faunistic Notes at Plymouth during 1893-1894,' by Walter Garstang, M.A.; those of Heligoland from 'Beiträge zur Meeresfauna von Helgoland.—IV. Die Cœlenteraten Helgolands,' vorläufiger Bericht von Dr. Cl. Hartlaub, 1894.

ATHECATA.

	St. Andrews.	Plymouth.	Heligoland.
I. CLAVIDÆ.			
Clava multicornis	*	*	*
— squamata .....	..	..	*
— cornea .....	..	*
— leptostyla .....	..	*
Tubiclava cornucopiæ .....	..	*
II. HYDRACTINIDÆ.			
Hydractinia echinata	*	*	*
III. PODOCORYNIDÆ.			
Podocoryne cornea	M	*	
IV. CORYNIDÆ.			
Coryne vaginata	*	*	
— Van Benedenii .....	..	..	*
— vermicularis .....	..	*
— pusilla .....	..	*
— fruticosa	M	*	
Syncoryne Sarsii	M	..	*
— eximia	M	*	* M

ATHECATA (continued).

	St. Andrews.	Plymouth.	Heligoland.
<i>Syncoryne pulchella</i>	M		
— <i>gravata</i>	M		
— <i>decipiens</i>	*		
V. STAURIDIIDÆ.			
<i>Stauridium productum</i>	M		
VI. MYRIOTHELIDÆ.			
<i>Myriothelia phrygia</i> .....	..	*
VII. EUDENDRIIDÆ.			
<i>Eudendrium rameum</i>	*	*	*
— <i>ramosum</i>	*	*	*
— <i>capillare</i>	*	*	*
VIII. ATRACTYLIDÆ.			
<i>Garveia nutans</i> .....	..	*
<i>Perigonimus repens</i>	M	*	*
— <i>vestitus</i> .....	..	*
<i>Dicoryne conferta</i> .....	..	..	*
<i>Bougainvillia ramosa</i>	M	*	*
— <i>fruticosa</i>	M		
IX. TUBULARIIDÆ.			
<i>Tubularia indivisa</i>	*	*	*
— <i>coronata</i>	*	..	*
— <i>larynx</i>	*	*	*
— <i>humilis</i> .....	..	*
— <i>bellis</i> .....	..	*
— <i>simplex</i> .....	..	*	M
<i>Ectopleura Dumortierii</i>	M		
<i>Corymorpha nutans</i>	M	*	* M

THECAPHORA.

	St. Andrews.	Plymouth.	Heligoland.
I. CAMPANULARIIDÆ.			
<i>Clytia Johnstoni</i>	* M	*	*
<i>Obelia geniculata</i>	* M	*	*
— <i>dichotoma</i>	*	*	*
— <i>longissima</i>	*	*	*
— <i>heligolandica</i> .....	..	..	*
— <i>Adelungi</i> .....	..	..	*
<i>Campanularia Hincksii</i>	*		
— <i>volubilis</i>	*	*	*
— <i>verticillata</i>	*	*	*
— <i>flexuosa</i>	*	*	*
— <i>raridentata</i>	*	*	
— <i>angulata</i>			
<i>Thaumantias inconspicua</i>	M	M	M
<i>Lovenella clausa</i>	*	..	*
<i>Gonothyræa Loveni</i>	*	..	*
— <i>hyalina</i>	*	..	*
— <i>gracilis</i>	*	..	*
II. CAMPANULINIDÆ.			
<i>Campanulina acuminata</i>	M	*	*
— <i>repens</i>	*		
<i>Opercularella lacerta</i>	*		
III. LEPTOCYPHIDÆ.			
<i>Leptocyphus tenuis</i>	*		
<i>Calycella syringa</i>	*	*	*
IV. LAFOËIDÆ.			
<i>Lafoëa pocillum</i>	*		
— <i>pygmæa</i>	*	..	*
— <i>dumosa</i>	*	*	*
— <i>fruticosa</i>	*	*	
<i>Cuspidella humilis</i>	*		
— <i>costata</i> .....	..	*
<i>Filellum serpens</i>	*	..	*
V. COPPINIDÆ.			
<i>Coppinia arcta</i>	*	..	*

THECAPHORA (continued).

	St. Andrews.	Plymouth.	Heligoland.
VI. HALECIDÆ.			
Haloikema Lankesterii	*	
Halecium halecinum	*	*	*
— muricatum	*	..	*
— Beanii	*	*	*
— labrosum	*	..	*
— tenellum	*	..	*
VII. SERTULARIIDÆ.			
Sertularella polyzonias	*	*	*
— Gayi	*	
— rugosa	*	..	*
— tenella	*		
Diphrasia pinaster	*	
— rosacea	*	..	*
— tamarisca	*		
— attenuata	*		
— pinnata	*		
Sertularia pumila	*	*	*
— operculata	*		
— filicula	*		
— abietina	*	*	*
— argentea	*	*	
— cupressina	*	*	*
Hydrallmania falcata	*	*	*
Thuiaria articulata	*	
— thuia	*		
VIII. PLUMULARIIDÆ.			
Antennularia antennina	*	*	
— ramosa	*	*	*
Aglaophenia tubulifera	*	
— pluma	*	
— myriophyllum	*	*	
Plumularia frutescens	*	*	
— Catharina	*	*	*
— setacea	*	*	*
— similis	*	*	
— echinulata	*	*	
— pinnata	*	*	*

* indicates the presence of the Hydroid.

M	”	”	Medusa.
* M	”	”	both Hydroid and Medusa.

*Noticeable Features of Hydroids and the corresponding
Medusæ.*

1. Comparative abundance of Thecaphora and poverty of Athecata, possibly owing in part to insufficient search for the latter.

2. The appearance in considerable numbers of *Hybocodon* in May and *Euphysa* in August. *Steenstrupia* may yet be found if searched for at sufficient depths; I netted it in great numbers in Sullom Voe, Shetland, after a westerly gale had stirred up the bottom; the second day I obtained a few as the mass were settling down, and after that I got no more.

3. The singularly interesting and beautiful budding forms—*Hybocodon*, with its heavy group of buds round the tentacle-bulb; *Rathkea*, budding round the short thick manubrium within the subumbrella; and the graceful *Codonium gemmiferum* (August), with the buds spirally arranged round the long manubrium mainly outside the umbrella. That figured in Forbes's Monograph is a young form evidently recently detached. The adult resembles in the length of the manubrium and other details Haeckel's *Sarsia siphonophora*.

The very occasional appearance, often entire absence for the season, of *Siphonophora* perhaps merits incidental mention.

XXXIX.—*Natural History Notes from H.M. Indian Marine Survey Steamer 'Investigator,' Commander C. F. Oldham, R.N.—Series II., No. 20. Report upon some Mollusca dredged in the Arabian Sea during the Season 1894-5.*
By EDGAR A. SMITH.

WITH the exception of the *Amussium andamanicum*, all the species quoted in this paper are from comparatively shallow water, and consequently have not that special interest which is attached to deep-water forms. It is proposed to give figures of the new species in a subsequent communication.

Pleurotoma marmorata, Lamarck.

Pleurotoma marmorata, Lamk., Reeve, Conch. Icon. fig. 21; Kiener, Icon. Coq. Viv. pl. vi. fig. 1; Weinkauff, Conch.-Cab. ed. 2, pl. iii. fig. 4; Tryon, Man. Conch. vol. vi. pl. ii. figs. 16, 16 a.
Jun. = *P. hastula*, Reeve, op. cit. fig. 139.

Hab. Red Sea, Indian Ocean to Polynesia; lat. 20° 37' 15"

N., long. 69° 24' 20" E., Arabian Sea, off Gujerat, in 44 fathoms ('Investigator').

These specimens differ from what may be regarded as the typical form in having the periphery of the whorls marked with a double instead of a simple acute keel.

Nassa pseudoconcinna.

Testa elongato-pyramidalis, turrita, albida, subpellucida, fasciis tribus dilute rufis supra anfractum ultimum picta; anfractus 8, convexi, supremi quatuor læves, in medio carinati, cæteri costis numerosis arcuatis sulco infra suturam bisectis instructi, in interstitiis spiraliter sulcati, ultimus prope basin costis plus minus nodosis; apertura irregulariter subovalis, longit. totius $\frac{1}{2}$ vix æquans; labrum ad marginem acutum intus paulo incrassatum, tuberculis circiter 9 munitum, extus leviter varicosum; columella arcuata, callo tenui circumscripto induta, tuberculo minuto superne instructa; canalis anterior latus, obliquus, brevissimus, recurvus.

Longit. 15 millim., diam. 8; apertura 7 longa, 4 lata.

Hab. Lat. 21° 30' 15" N., long. 68° 05' 45" E., Arabian Sea, off Gujerat, in 82 fathoms.

N. concinna, Powis, appears to be the nearest ally of this species. It is, however, larger, has ten less convex whorls, the body-whorl is more contracted at the base, the basal canal is narrower, the outer lip more strongly varixed. In *concinna* the three brown bands extend over the varix, whereas in the present species they stop short of it, so that it has a pallid look. The thickening within the lip is faintly yellowish and slightly removed from the acute edge.

In describing *N. turritifera* (Ann. & Mag. Nat. Hist. 1895, vol. xvi. p. 5) I regret having overlooked *N. babylonica* of Watson, which is quite identical, and was obtained in 375 fathoms off the Philippine Islands.

Distortrix cancellina (Roissy), var.

Triton cancellinus (Roissy), Reeve, Conch. Icon. sp. 45; Kobelt, Conch.-Cab. ed. 2, p. 200, pl. lvii. figs. 5, 6; Kiener, Icon. Coq. Viv. p. 21, pl. xiv. fig. 1; Tryon, Man. Conch. vol. iii. p. 35, pl. xvii. fig. 175; Kiener, Icon. Coq. Viv. pl. xiv. fig. 1 (as *T. clathratum*, Lam.).

Hab. Philippines, China, Ceylon.

Var. *ridens*.

Triton ridens, Reeve, *l. c.* fig. 46; Tryon, pl. xvii. fig. 177; Kobelt, pl. lviii. fig. 4.

Hab. Philippines.

Var. *decipiens*.

Triton decipiens, Reeve, fig. 102; Tryon, pl. xvii. fig. 178; Kobelt, pl. lxxvii. fig. 7.

Hab. Philippines (Reeve); lat. 21° 30' 15" N., long. 68° 05' 45" E., Arabian Sea, off Gujerat, in 82 fathoms ('Investigator').

The specimens obtained by the 'Investigator' more closely resemble the last variety than any other. The colour of the outer lip and the columellar callus is the same. The form of the aperture is quite similar, but there is only a single parietal tubercle instead of three or four, as usual in this variety. They are clothed with a hairy epidermis, the hairs being placed in longitudinal rows upon the ridges. In the interstices the epidermis is minutely reticulated and setose, and the general appearance is fibrous. The embryonic shell consists of three smooth, convex, glossy whorls, and the normal volutions have a more regular convex and less distorted aspect than in Reeve's type.

Triton constrictus of Reeve is considered synonymous with this species by Tryon, who remarks that it, together with *T. ridens* and *T. decipiens*, "have no claim to rank even as varieties." Although in general conformation *T. constrictus* resembles the other forms mentioned, I consider that its great solidity, the much more distorted spire, coarser sculpture, and heavy labrum are sufficient to separate it specifically. The geographical range also is quite different. With regard to the generic name to be applied to this group of "Tritons," there appears to be some divergence of opinion. Casting aside the uncharacterized Boltenian catalogue-name of *Distorsio*, the most available appears to be *Distortrix* of Link (1805).

Capulus irregularis.

Testa pileiformis, apice postice valde recurvato, sordide albida, pallido-rufo radiatim obscure picta, lamellis irregularibus concentricis undulatis instructa; anfractus 3, apicales duo (nucleus) globosi, læves; forma aperturæ irregularis, vel rotundata, vel elongata, etc.; superficies interna albida, plus minus rufo tincta, nitida; peristoma antice tenue, postice intus incrassatum.

Diam. maj. 15½ millim., min. 12; alt. 8.

Hab. Lat. 20° 37' 15" N., long. 69° 24' 20" E., Arabian Sea, off Gujerat, in 44 fathoms.

Like *Capulus lissus*, Smith, this species has no radiating

sculpture. In general form it recalls some examples of the West-Indian *Hipponyx antiquatus* (L.). The apex is so much recurved as to pass the posterior margin of the aperture.

Crassatella indica.

Testa valde inæquilateralis, crassiuscula, antice rotundata, postice subquadrata, costis concentricis crassiusculis numerosis utrinque attenuatis instructa, albida, epidermide haud nitida, lutescente induta; margo dorsi anticus valde descendens, concavus, posticus longior, minus obliquus, rectus; umbones prominentes, longe antemediani, incurvati, vix contigui, acuti; lunula cordata profunde excavata, lineis incrementi tenuibus striata; area dorsi postica excavata, lanceolata; pagina interna alba vel cæruleo-alba; cicatrices parvæ, subprofundæ, subæquales; margo valvarum inferior intus tenuiter denticulatus; cardo normalis, dentibus principalibus striatis.

Longit. 28 millim., alt. 24, diam. $17\frac{1}{2}$.

Hab. Lat. $21^{\circ} 30' 15''$ N., long. $68^{\circ} 05' 45''$ E., Arabian Sea, off Gujerat, 82 fathoms.

Distinguished from allied species by difference of form and costulation. The ribs near the posterior extremity are more or less obsolete or concealed by the periostracum.

Amussium andamanicum, Smith.

Amussium andamanicum, Smith, Ann. & Mag. Nat. Hist. 1894, vol. xiv. p. 172, pl. v. figs. 13, 14.

Hab. Lat. $15^{\circ} 11' N.$, long. $72^{\circ} 28' 45'' E.$, Arabian Sea, west of Goa, in 931 fathoms.

Two specimens from this locality are rather larger than the type from the Andaman Sea, being 43 millim. in length and 51 high. The greater development of the concentric lamellæ towards the lower margin of the left valve, as shown in the figure, appears to be characteristic of the species; also the feebleness of the central radiating liræ within the valves is maintained. The microscopic structure of the valves is different. The right valve is minutely punctate everywhere, and the fine concentric ridges towards the umbo are crossed by very short minute striæ. The left valve, on the contrary, may be described as smooth. The conspicuous difference in the structure of the valves is best seen by means of transmitted light.

BIBLIOGRAPHICAL NOTICE.

A Manual for the Study of Insects. By JOHN HENRY COMSTOCK, Professor of Entomology in Cornell University and in Leland Stanford Junior University; and ANNA BOTSFORD COMSTOCK, Member of the Society of American Wood-Engravers. 8vo. Ithaca, N. Y., 1895. Pp. xii, 701. Coloured frontispiece, 5 plain plates, and woodcuts.

It is no longer possible, as when Fabricius published his 'Systema Entomologiæ' in 1775, to compress the descriptions of all the known insects of the world into a single volume; nor is it possible to compress the results of all the best work on all the orders of insects into two moderate-sized volumes, as was still the case in 1840, when Westwood published his great work on the 'Modern Classification of Insects,' a work still of the greatest value to entomologists, and which could never be superseded except by a whole library written by a very large syndicate of specialists. We have not even any later book dealing with British Entomology on the lines of Westwood's 'Introduction,' our books on general British Entomology being only popular works, chiefly of value to beginners.

But in North America they are more fortunate; for Prof. Packard's 'Guide to the Study of Insects,' first published in 1869, deals with American insects as comprehensively, though somewhat more popularly, than Westwood dealt with the insects of the world; and we are glad to add that the book has been fully appreciated, having run through more editions in a comparatively short time than perhaps any other entomological book ever published. And now Professor Comstock, already known to all entomologists by much valuable work, among which we may specially mention his writings on scale-insects (Coccidæ) and on the neuration of insects, has published a 'Manual for the Study of Insects,' which, though treating almost exclusively of North-American insects, will yet be found indispensable to all students of entomology who study those groups of insects which the author has discussed in adequate detail.

The book is handsomely got up, even as regards the outside, being bound in light grey, with silver lettering, and having a butterfly resting on a flower on the back and a spider's web in the corner of the upper cover. The paper and print are very good; there is a coloured frontispiece representing plants, butterflies, and beetles, and the book is crowded with illustrations, including both woodcuts and plain plates. In fact it is almost too well got up, for it weighs twice as much as would be expected from its size, which cannot be considered an advantage in any book.

Although Prof. Comstock does not include the Crustacea, Arachnida, and Myriapoda among the insects (the two latter are treated by Dr. Packard, with the Insects, as subclasses of Tracheata), yet they receive a brief mention at the commencement of his volume,

the orders of Arachnida and the principal families of spiders being treated almost as fully as some of the smaller orders of insects.

Turning now to the Insects, which form the chief subject of Prof. Comstock's work, we find that he divides them into nineteen orders, instead of the seven into which they are frequently compressed by European entomologists, although Westwood, in 1840, admitted thirteen, exclusive of Thysanura and Parasita (= Anoplura and Mallophaga), which he did not regard as true insects. Prof. Packard, however, admits only eight, including the Thysanura. Prof. Comstock's nineteen orders are as follows:—Thysanura, Ephemera, Odonata, Plecoptera, Isoptera, Corrodentia, Mallophaga, Euplexoptera, Orthoptera, Physopoda, Hemiptera, Neuroptera, Mecoptera, Trichoptera, Lepidoptera, Diptera, Siphonaptera, Coleoptera, Hymenoptera. Of these the following names are in less general use than the others:—Plecoptera (Perlidae), Isoptera (Termites), Corrodentia (Psocidae), Physopoda (Thrips), Mecoptera (Panorpidæ and Bittacidæ), and Siphonaptera (Pulicidae). The Neuroptera (which name we should prefer to retain for the Odonata) include the families Mantispidae, Raphidiidae, Sialidae, Coniopterygidae, Myrmecoleonidae, Hemerobiidae, and Chrysopidae. Two or three of the old orders admitted by Westwood disappear as orders; thus, the Hemiptera are divided into three suborders—Heteroptera, Parasita (Pediculidae), and Homoptera—and the Strepsiptera are treated as a family of Coleoptera, as by most recent authors.

Several of these orders are treated very briefly indeed; thus, only four pages are given to the Odonata, or Dragonflies, which are said to form "only a single family." Considering that the Rhynchophora, or Weevils, are treated as a suborder of Coleoptera (though far less anomalous than some of the aberrant Heteromera, the Meloidæ for example), it is strange to see a group of nearly 2000 known species, and containing three main families as distinct as the Libellulidae, Æschnidae, and Agrionidae, dismissed with even less notice than is given to the compact little order of the Siphonaptera or Fleas, and with scarcely an observation of the slightest scientific, or even popular, value. In Prof. Packard's work, which we suppose has served as the model of Prof. Comstock's, the Odonata are much more fully dealt with, although still inadequately.

It must be allowed that it would be unfair to expect the writer of a general work like this to make it equally complete in every group; but it is difficult to account for such a scant notice of such an important group as the Odonata. On the other hand, most of the larger orders are treated of as elaborately as the character of the work and the available space will allow, no less than 222 pages being allotted to the Lepidoptera alone.

Many figures are given of wing-neuration in all the orders, but more especially in the Lepidoptera, which, as is well known, Prof. Comstock proposes to divide into two suborders. The first suborder is the Jugatæ, or Lepidoptera with similar neuration to the fore and hind wings, and with a small lobe projecting from the base of the fore wings beneath the costal margin of the hind wing.

This structure is called the jugum, or yoke, and is found only in the Hepialidæ and Micropterygidæ. The Frenatæ form the second suborder, and include the other families of Lepidoptera, in which the fore and hind wings have different neuration and are connected by a frenulum, a bristle, or bundle of bristles, or by its substitute, a large humeral angle of the hind wing. But it will require a more extensive examination of the neuration of exotic Lepidoptera before we can determine the exact value of these characters, which appear hardly sufficient by themselves to justify the division of the Lepidoptera into two main groups.

Notwithstanding the importance attached by the author to the neuration of insects and to the desirability of establishing a uniform system of nomenclature for the wing-veins, which he bases largely on the system adopted by Redtenbacher, he is content to refer for details to his essay on evolution and taxonomy. This, we think, is a great mistake. He has adopted an elaborate system of notation by Roman numerals, and expresses his opinion that veins iv. and vi. do not exist in the Lepidoptera, Diptera, and Hymenoptera; yet he gives no illustration of a typical wing, nor what would have been of almost equal importance, a series of typical illustrations of wings of insects of various orders, illustrating his ideas of the homologies of the wing-veins. There are, indeed, a great number of illustrations of the wings of insects, but, so far as we have noticed, all those in which the wing-veins are numbered belong to the very orders in which the typical neuration is stated by Prof. Comstock to be defective. Are we to infer that his system breaks down when applied to orders with a more complicated neuration? We do not think that special attention should have been called to a question like neuration without fuller explanations having been given in the book itself; it is not enough to refer to another.

Prof. Comstock estimates the probable number of existing species of animals at one million. We presume he must have been quoting some old estimate, in order to avoid startling his readers too much. At present there cannot be much less than half a million nominal species of insects alone on our lists; and, although a certain proportion of these will undoubtedly prove to be synonyms, yet the most moderate recent computation of the actual number of existing species of insects fixes them at 2,000,000; and many of those entomologists who are best competent to form an opinion agree with Prof. Riley in regarding 10,000,000 as no exaggerated estimate. And can it be true that there are only three kinds of true clothes-moths in North America, and even these all common European pests?

Prof. Comstock has, however, succeeded in packing an enormous amount of information of all kinds into the moderate compass of his book; nor would it be just to pass over the work of the accomplished lady, of whom her husband speaks as the "Junior Author," and whose share in the book entitles her to a place beside her predecessors, who have done so much good work, alone or conjointly, and both with pen and pencil, ever since the dawn of entomology. It

is enough to mention Madame Merian, Miss Jerimyn, Miss Catlow, Frau Lienig, Mrs. W. F. Kirby, and Miss Ormerod, the last of whom is still with us and by no means one of the lesser names among our English entomologists.

“Nearly all of the woodcuts have been engraved from nature by the Junior Author. . . . Although the chief work of the Junior Author has been with the pencil and graver, many parts of the book are from her pen.” So writes Prof. Comstock; and the excellence of the work can speak for itself. All the illustrations, however, are not new, nor was it necessary or desirable that they should be. Thus, the illustrations of scale-insects are taken from one of Prof. Comstock’s reports on the subject; and at p. 68 Lyonnet’s figures of the muscles of the larva of *Cossus ligniperda* (the Goat Moth) are reproduced, which we do not remember to have seen in any recent popular work on entomology. The woodcuts are numbered up to 757; but several of them are repeated twice, and, in one instance, even three times in different parts of the book, a proceeding which, though far from indefensible, is yet fairly open to criticism.

Much information about the habits of insects is scattered through the book, and a great many typical American forms are figured and fully described, especially among the Lepidoptera and the other orders which are most fully discussed. But, although we are fully in accord with the author as to the extent of the field of entomology and the desirability of original observation in any promising direction, yet we cannot quite agree with his concluding remarks:—“There is a large literature concerning the intelligence of bees; but those who love to see rather than merely to think about interesting things will find keenest pleasure in intimate associations with these little communists.” Surely study and observation must go hand-in-hand, or we shall merely repeat and, perhaps, misunderstand what others have often observed and probably misinterpreted before us; whereas, if we know what has already been done, we need waste no time in going over old ground, but proceed at once and intelligently to the study of points which still require verification or elucidation.

We must now take our leave of a book which, though not perfect in all points (as what book is?), is yet one of the most important general introductions to entomology which have come under our notice; while, as regards most orders of insects, it will prove of great value, not only to those interested in entomology in general, but to specialists as well. We must not forget to add that there is a good index, as well as a table of contents. Few books are now published without the former; but, unfortunately, some recent authors seem to undervalue the importance of the latter.

PROCEEDINGS OF LEARNED SOCIETIES.

GEOLOGICAL SOCIETY.

June 19, 1895.—Dr. Henry Woodward, F.R.S.,
President, in the Chair.

The following communication was read:—

‘On the Occurrence of Radiolaria in Chalk.’ By W. Hill, Esq., F.G.S., and A. J. Jukes-Browne, Esq., B.A., F.G.S.

The Authors notice the rarity of records of Cretaceous Radiolaria, and allude to those which have been made, including those by Rüst and Sollas. They have recently discovered spherical bodies resembling in form and general appearance certain calcified and partially destroyed radiolarian tests from some of the Barbadian rocks; microscopic examination of these has proved that many of them, at any rate, are Radiolaria. They occur in the nodules of the lower beds of the Melbourn Rock at Melbourn, Royston, near Hitchin, Legrave near Luton, Pitstone and Tring, Watlington, the Richmond boring, the lower part of the ‘Grit Bed’ at Dover, Sutton Waldron and Burcombe (Dorset), and in a nodular chalk which may be considered as the equivalent of the Melbourn Rock from Bindon Cliffs, near Axmouth, Devon. Similar organisms have recently been found in the Chalk Marl of Lincolnshire, Yorkshire, and Norfolk, but have not been noticed in any other parts of the Chalk. It is suggested that they occurred in many portions of the Chalk-ooze, but were usually rapidly and completely dissolved, and contributed to that solution of silica which furnished the substance of flint-nodules; and the Authors conclude that the preservation of traces of the Radiolaria in the nodules of the Melbourn Rock is due to some specially favourable conditions.

A description of the changes undergone by Barbadian Radiolaria is given to illustrate the instability of radiolarian tests. Here all stages are traceable, from the perfect siliceous test to a structureless ball or disc filled with calcareous matter, or a mere patch of clear crystalline material.

A description of forms recognized in the nodules of the Melbourn Rock is given.

MISCELLANEOUS.

The Name of Galeodes intrepidus.

By R. I. Pocock.

ON pp. 75 and 76 of the July number of this Magazine I fell into the error of thinking that the name *intrepidus* of Audouin antedated that of *intrepidus* of Dufour. As a matter of fact the latter was published in Ann. Gén. Sci. Phys. Bruxelles, iv. p. 370 (1820), and the former not until some years later. Consequently C. Koch's name *scalaris* will stand for the species I termed *intrepidus*.

On the Acræa cynthius of Drury. By ARTHUR G. BUTLER,
Ph.D., F.L.S., &c.

In Drury's 'Illustrations of Exotic Insects' (vol. iii. pl. xxxvii. fig. 5) a butterfly is figured which has given great trouble to lepidopterists; the older authors identified it correctly, and then by some means a totally distinct species became confounded with it, and has ever since borne the name.

The true *A. cynthius* is undoubtedly an albino female of *A. bonasia* of Fabricius. An example exactly agreeing with Drury's figure was purchased by the Trustees at the sale of Milne's collection, and may even be the type of Drury's species (*vide* Preface to my 'Catalogue of Fabrician Diurnal Lepidoptera'); indeed, the fact that it was entered in the Old Register as Drury's species and as from Sierra Leone, combined with the fact that it closely agrees with the original figure, seems to make this well nigh a certainty.

This point therefore being satisfactorily settled, it becomes necessary to give a name to the common yellow-banded species allied to *A. cabira*, which has hitherto wrongly borne the name of *A. cynthius*? in the Museum collection as well as in all others, and has been well figured under that name by M. Charles Oberthür ('Études d'Entomologie,' xvii. pl. i. fig. 5, 1893). I think one cannot do better than call it *A. Oberthürii*, as a slight recognition of the services rendered to entomology by the numerous admirable coloured illustrations published by that lepidopterist.

Note on the Protoplasmic Connexion of Lasso-cells in Physalia.
By SEITARO GOTO.

In view of the facts that have been brought out on the subject, there are, as it seems to me, three possibilities in the mechanism by which the cnidoblasts are discharged. One is to suppose that the stimulation of the protoplasm of the lasso-cells by foreign bodies coming in contact with the cnidocil causes it, or, more accurately speaking, its muscular portion, to contract, and brings about the discharge of the cnidoblast; another is to suppose that the contact of the cnidocil with foreign bodies is transmitted as a sensation to the ganglionic cells of the subepithelial layer, and that from these cells a new impulse goes out to the lasso-cells, and causes the latter to discharge. This, however, is regarded by von Lendenfeld (*Zeitschr. f. wiss. Zool.* Bd. xxxviii. p. 366, ff.) as highly improbable. A third way is that the stimulation of the cnidocil be transmitted to the subepithelial ganglionic cells, and there converted into a reflex, which causes the discharge of lasso-cells. We may, however, suppose that the stimulation proceeds from the sensory cells instead of from the cnidocils. Considering the fact that a mere contact with inert foreign body, such as a grain of sand, does not bring about the

discharge of lasso-cells, it seems to me very probable that this last alternative is what takes place in the seizure of prey.

During my study of the gonophores of *Physalia* I had also occasion to make some histological observations, so far as the condition of my materials permitted. One of the most interesting of these is the protoplasmic connexion of the lasso-cells with each other. This I first observed in some siphons mounted *in toto*. In these four or five, or sometimes more, cells were distinctly seen to be connected with each other by means of protoplasmic processes. These cells were generally arranged in a line parallel to the long axis of the siphon, and each cell was therefore bipolar. In some of the cells, however, I have observed one or more lateral processes; but whether these proceeded to other lasso-cells or to ganglionic cells I have not been able to make out. All the lasso-cells that I have observed connected together were not yet fully developed; some of them were still very young, but in others the vacuole, which afterwards becomes the capsule, had already attained a large size, and contained a horse-shoe-shaped deeply staining body, which is so characteristic of the lasso-cells in this species. I have tried to demonstrate the same connexion in the ripe lasso-cells, but hitherto I have not been successful. This I think can hardly be surprising when we consider how reduced the cytoplasmic mantle of the capsules finally becomes, and how comparatively far they stand from each other, thus necessitating a considerable lengthening and consequent diminution in thickness of the protoplasmic processes. I have observed the same connexion in sections of young siphons, although, as is to be expected, I have in this case never seen more than two cells connected together. One or both of them, however, had usually a second process.

The facts already known afford a sufficient clue to the probable mechanism, by which a large number of lasso-cells are discharged simultaneously; for, the connexion of the ganglionic cells with each other as well as with the lasso-cells being proved, we have only to assume the transmission of impulse from one ganglionic cell to another, in order that a simultaneous discharge of numerous lasso-cells should take place. But the observation above recorded requires a certain modification of our conception of the matter, in that it does not necessitate us to assume the connexion of every lasso-cell with a ganglionic cell. It perhaps justifies us in supposing that the protoplasmic connexion among lasso-cells subsists to the last, and furnishes the passage for the direct transmission of impulse from one cell to another, whether this impulse be originally supplied in one or the other of the ways above mentioned. Further observation will perhaps bring to light a similar connexion of lasso-cells in other forms.—*Johns Hopkins University Circulars*, vol. xiv. no. 119, p. 80.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SIXTH SERIES.]

No. 94. OCTOBER 1895.

XL.—Notes on the Madreporarian Genus *Astræopora*, as represented by the Specimens in the British Museum (*Natural History*). By H. M. BERNARD, M.A. Cantab., F.L.S., F.Z.S.

[Plate XIV.]

THE genus *Astræopora* was founded by de Blainville in 1830* to contain specimens selected from Lamarck's genus *Astræa*. In working over the same ground again for the publication (in 1836) of his 'Manuel d'Actinologie' de Blainville transferred one of his species of *Astræopora* to his genus *Gemmipora* (*Turbinaria*). This apparently suggested to him the possible close affinity between the two genera. Dana † accepted this affinity, but with a note of interrogation; he evidently took it on authority, and in spite of its inconsistency with his principles of classification according to the methods of budding. The budding of *Gemmipora* he described as inferior, a description which could not certainly apply to that of *Astræopora*; hence his hesitation. No such grounds for hesitation existed in the system of Milne-Edwards and Haime, and the two genera were definitely classed together by these authors in a subfamily Turbinariinæ, first in 1851 ‡, and then by Milne-Edwards in the third volume of 'Les Coralliaires.' This classification has persisted ever since, being accepted by

* Dict. des Sciences Naturelles, t. lx. p. 348.

† 'Zoophytes,' p. 115.

‡ Les Polyp. foss. d. Terr. palæozoïques, p. 141.

Martin Duncan* in his revision of Milne-Edwards's system in 1884.

This definite association of *Astræopora* with *Turbinaria* as members of the same subfamily led to the recognition of an important generic distinction. *Turbinaria* was distinguished from *Astræopora* by its well-developed columella. This led again to the transference of another of de Blainville's *Astræopora*s to the *Turbinarians*; *Astræopora stellulata*, possessing a columella, became *Turbinaria stellulata*, and has since been looked upon as a transition form connecting the two genera. My own study of the specimens of the two genera contained in the British Museum collection has led me to the conclusion that there is no close affinity between them. They are independent developments of cœnenchymatous corals, their respective specializations being too distinct to be deducible one from the other.

I desire again to tender my sincerest thanks to Dr. Günther, F.R.S., the Keeper of the Zoological Department of the Museum, for the kindly interest he has taken in my work, and to Professor Bell for his readiness to assist me in every way.

There are thirty specimens of *Astræopora* in the National Collection, this small number being probably indicative of the rarity of the genus. In his recent visit to the west coast of Australia, Mr. Saville Kent only succeeded in obtaining a single specimen. These thirty specimens fall into fourteen groups, sufficiently distinct to rank as species. The number of species hitherto recorded is only five; hence there are at least nine new species represented in the collection.

Three of the five recorded species were established by Lamarck. His descriptions are very short and inadequate, and their identification is at once difficult and uncertain. Of the other two recorded species the single (type) specimen of one (*A. expansa*, Brüggemann †) was fortunately in the collection, and four figures of the other (*A. profunda*, Verrill) are given by Dana ‡ in the Atlas to his 'Zoophytes' under the title of *A. pulvinaria*, Lamarck.

Accepting Lamarck's suggestion that two of his species—*A. myriophthalma* and *A. pulvinaria*—might be different growths of the same, the established species were reduced to four, and the thirty specimens belonging to the Museum were ultimately arranged into fourteen species, ten of which are new.

* 'Journal of the Linnean Society,' Zoology, vol. xviii. (1885).

† Described in Ann. & Mag. Nat. Hist. (4) vol. xix. p. 416 (1877).

‡ Plate xxix. figs. 3, 3a, 3b, 3c.

Earliest known Stage.—The youngest colony discovered (on the dead portion of a larger specimen*) is a minute plate-like growth of cœnenchymatous reticulum, not quite 3 millim. in longest diameter. There is a central calicle (the parent calicle of the colony), readily distinguishable by its size, and an irregular ring of smaller (daughter) calicles. The whole is contained in a saucer-like epitheca, with edges bent up all round free of the substratum. The colony has apparently grown unsymmetrically; instead of being a complete circle, the corallum has spread out symmetrically only on one side of the parent calicle, as shown in the figure (Pl. XIV. fig. 1). There are two cycles of septa, the first being conspicuous. The daughter calicles develop in the cœnenchyma, and one (*a*) is seen at the extreme edge of the colony, part of its wall being formed by the epitheca. There is no connexion between the calicles other than the canal-system of the cœnenchyma. The typical structure of the cœnenchyma is not visible at this stage; it can only be detected in the larger specimens.

Later Developments.—Comparison of adult specimens showed that there are at least three fairly distinct methods of growth, according to which such an initial colony as that just described may develop further. I have therefore divided the genus primarily according to the methods of growth.

First Method of Growth: Explanate.—The corallum expands chiefly laterally, the growth in thickness being slow and irregular. The epitheca continues to grow and to support the edge of the corallum. The most perfect example of this is Brüggemann's species *Astræopora expansa* †, which is purely explanate, the thin expanding edges rising freely but gradually from the substratum, accompanied and supported by a well-developed concentrically wrinkled epitheca. The calicles are far apart and for some distance from the edge appear, on being held up against the light, to penetrate right down to the epitheca.

Another but less perfect example is Lamarck's *myriophthalma*, which forms large plates; these, when young, may be thin and flat, but when old become irregular and humpy, ultimately forming great mounds as successive growths creep over their uneven predecessors. There is in the collection a good series showing these changes; but for the presence of the intermediate growths the oldest and youngest specimens would almost certainly be classed as distinct species.

In this and other explanate forms the relation between the epitheca and the expanding edges is of considerable interest.

* The registered number of which is 91.3.6.34.

† Ann. & Mag. Nat. Hist. (4) vol. xix. p. 416.

Where the epitheca follows the growing edge closely, the latter tends to grow upwards free of the substratum, but where the epitheca lags behind the growing edge, the latter tends either to droop, which is the more usual, or (*A. myriophthalma*) to send down long pendent and twisted calicular tubes, which are gradually enveloped and closed by the advancing epitheca. It is obvious that this explanate growth may merely creep over the substratum as a simple incrusting corallum.

I have distinguished in all five explanate species, three of which are new.

Second Method of Growth: Pulvinate.—The growth is in this case chiefly in thickness. The calicles grow rapidly in length, tabulæ being developed at intervals, as is the case in the lengthening calicles of glomerate Turbinarians. New calicles appear for a time at the expanding edges of the corallum, and others between the lengthening calicles as they diverge (fig. 2). In time the lower portions of the stock die, and no new calicles are added round the edge of the original epitheca (*e'*). The living top, on the other hand, goes on expanding by the continued divergence of the calicles and the addition of new ones between the old. This uppermost living layer tends to hang down over the old dead portions, in which case a new (secondary) epitheca (*e''*) appears, restraining the downward growth of the edges. As layer succeeds layer, enormous top-heavy bolster- or cushion-shaped masses are produced. The top-heaviness is obviously due to the fact that the early death of the lower portions limits the size of the base.

Sooner or later such masses break off and roll over. The living layer will then be confined to the uppermost portion of the overturned stock, on which it soon forms another great top-heavy mass (see fig. 3, in which *a* is the original upper surface of an overturned stock).

Among the specimens in the collection are several showing this method of growth. There is a complete series from Tongatabu, which I have named *A. Listeri*, after Mr. J. J. Lister, who generously presented them to the Museum. Fig. 3 represents the largest specimen, forming a great mushroom-like mass 7 inches in diameter.

Many of the other specimens which I attribute to this method of growth are unfortunately only fragments. All these fragments, however, show enormously long calicles with tabulæ, and, further, the living ends of the calicles bend outwards and form at the edge an overhanging margin such as that shown in the diagram fig. 2. These growths are thus obviously not explanate, nor are they globular. As far

as it is possible to judge from a fragment, everything points to their growth being of the type described.

I have arranged five new species under this division. The only specimen previously named is one of Dr. Klunzinger's "*A. myriophthalma*" from Koseir. It is unfortunately only a fragment, but it shows all the features just mentioned and has an overhanging edge. It could hardly, therefore, belong to the explanate forms. In Dr. Klunzinger's original description* we read of the coral as being incrusting, 1½ centim. thick; but the greater number of the specimens gathered were massive, 6–8 centim., with "incrusting edges." This at first sight looks as if the same species may adopt either the explanate or the pulvinate type of growth. This assumption is, however, not necessary; overturned blocks are grown over by the living layer in such a way as entirely to justify the term "incrusting." On the whole, therefore, Dr. Klunzinger's description is quite consistent with the interpretation of the species here given. Besides, I was compelled to give Dr. Klunzinger's specimen another name, having identified several large, flat, humpy specimens as the true *myriophthalma* of Lamarek. The new name, "*A. Ehrenbergi*," is based upon Dr. Klunzinger's discovery that his specimens are specifically identical with Ehrenberg's (*Madrepora*) *Phyllopora sphaerostoma* et *leptostoma* †.

The name "pulvinate," or cushion-shaped, given to this type of growth was suggested by Lamarek's species "*pulvinaria*," which, being only a different growth of *A. myriophthalma*, does not really belong here; but having once temporarily arranged it under this heading, I felt at liberty to retain the name for this division, especially as the species "*pulvinaria*," being suppressed, could lead to no confusion.

Third Method of Growth: Globular.—This form appears to be due to the great lengthening of the calicles, accompanied by the rolling of the cœnenchymatous skeleton over the edge of the epitheca. The earliest stages I have unfortunately not seen; but examination of the available specimens leaves little doubt that this is what really takes place. The globes thus formed often appear to be free, and may have started on a projection or loose portion of the substratum. New layers cover the old, so that the mass is in time composed of a system of concentric shells, the upper one alone living (fig. 4). As in the glomerate Turbinarians, each new growth seems to start from the summit of the globe and to creep down all

* 'Die Korallenthier des rothen Meeres,' Th. ii, p. 53 (1879).

† 'Beiträge zur Kenntniss d. Korallenthier des rothen Meeres,' 1836, p. 114.

round. The advancing edge is generally restrained by an epitheca, which may form a regular pocket-like fold, even covering up the calicles. The cœnenchyma may, however, roll over this fold and continue to descend (figs. 4 and 5 a).

These balls are sometimes overturned, in which case what was the former under-surface is grown over; Lamarck describes his specimen of *A. punctifera* as being like a cannon-ball without any scar of attachment. The single specimen in the National Collection, which I have identified with Lamarck's species, shows that the innermost ball (1) round which the recent growths have crept had been rolled over (fig. 5).

The difficulty of ascertaining the exact method of development of the globular growth is increased by the fact that the dead coral of the older central portions is very often hollowed out by boring mollusks. There is, however, in the collection a young specimen (too young to name) closely investing a dead and corroded fragment of some branched coral. This may perhaps be the nucleus of a globular form.

There are, again, other single specimens which appear as if they might belong as well to the pulvinate as to the globular growth; without further material their true position can only be guessed. While the pulvinate method of growth is quite distinct from the globular, it is possible that there is another form of growth connecting the two.

There were in all four different species showing this method of growth, of which two are new*.

The Calicles.—The calicles are chiefly remarkable for their great depth and for the feeble development of the septa, which may be present in as many as three cycles. The primaries alone project towards the centre as thin lamellæ, and generally only far down in the fossa. The third cycle seldom consists of more than fine ridges at the margin, extending but a short way down the fossa.

As in the glomerate Turbinarians, the calicles form tabulæ when, in the pulvinate method of growth, they have to lengthen.

The chief characters of taxonomic value presented by the calicles are their average size, their distance from one another, the fine structure of their margins, and, when protuberant, the character of the protuberance—hemispherical, conical, or papilliform.

* Martin Duncan (Mem. Geol. Survey India, ser. xiv. p. 99, pl. xxv. fig. 6) has described a fossil Astræoporan from Sind, *A. hemisphærica*. The base was covered with epitheca and the corallites shallow (?). This appears to have belonged to this type of growth.

The Cœnenchyma.—The most characteristic feature of the genus is afforded by the cœnenchyma. It is constructed of two elements—the costæ, which, instead of being lamellate, break up into long tapering echinulæ (fig. 6). The echinulæ all bend upwards and are united with one another by regular, nearly horizontal floors, for the support of which the echinulæ act as pillars. These are thick near the polyp-cavities, but thin halfway between them. The synapticular floors are, at least in the uppermost layers, perforated by large round holes.

The different appearances presented by the coralla is largely due to the respective developments of these two elements. When, as in cases of rapid growth in thickness, the costal elements are most developed, the surface is highly echinulate. The synapticular floors, on the other hand, are then often feebly developed. Again, in cases of explanate growth, the echinulæ may be feebly developed and the horizontal floors strongly developed. Dana proposed to divide the genus into two groups (which might “constitute different genera”) according to this distinction. But no such division would be admissible; the structure is essentially the same.

Other variations in the cœnenchyma are due to irregularities in the growth of the two elements, so that the texture may here and there appear confusedly reticulate, or foliate, or (by the thickening and nodulation of the elements) granular.

On the Relation of Astræopora to Turbinaria.—In my recent paper in this Magazine* on the latter genus I suggested that it was possible that *Astræopora* represented a more primitive cœnenchymatous coral than either *Madrepora* or *Turbinaria*. *Madrepora* could perhaps be deduced from a simple incrusting form like *Astræopora* by the special growth and lateral budding of some of the corallites, while, again, *Turbinaria* might be deduced from *Madrepora* by the further specialization of this lateral budding. The following are the chief reasons which make me now think it highly improbable that *Astræopora* has any close affinity with *Turbinaria*:—

(a) The epitheca in *Astræopora* persists and plays an important part in the development of the corallum. As we have seen, the earliest buds develop round the parent polyp contained within a common saucer-like epitheca. This epitheca follows and more or less supports the edges of the expanding corallum.

* Ser. 6, vol. xv. June 1895, p. 499.

When the corallum grows in thickness and the basal portions die, a secondary epitheca appears under the edges of the living layer as it creeps over the older dead portions. In *Turbinaria* the earliest buds arise from the parent polyp above and free from the epitheca, which merely spreads out as a cementing substance beneath the expanding base or foot of the cup-shaped corallum. But here again also a secondary epitheca, which can have no connexion with the original epitheca, may develop under flat horizontally expanding leaves and under the edges of incrusting glomerate forms. The two genera, however, rise up so very differently from their respective epithecæ that there are no grounds for attempting to deduce one from the other.

(b) The cœnenchyma in *Astræopora* is far more highly specialized than it is in *Turbinaria*.

(c) In *Turbinaria* the intracalicular portions of the septa are, as a rule, highly developed, uniting at the base of the fossa to form the conspicuous columella. The extracalicular portions show no special development, but merely form the cœnenchyma connecting the polyps. In *Astræopora* the intracalicular portions of the septa are very feebly developed, only the first cycle even approaching the centre. As each polyp advances in age and length, the new cycles, second and third, are less and less developed. On the other hand, the extracalicular or costal portions of the septa are highly specialized, forming the characteristic cœnenchyma of the genus.

While both genera therefore are cœnenchymatous corals, *i. e.* in both the whole corallum which rises freely above the epitheca is a product of the septa, and *may* be related, we have no evidence to support such relationship; indeed, they differ from one another as far almost as such corals could differ, from the very outset of their respective life-histories.

Parasites and Commensal Annelids.—It is worth noting that the Balanids which infest some of the highly echinulate *Astræoporans* defend themselves from being overgrown by the cœnenchyma by formidable series of spikes on their shells, which closely resemble in size the echinulæ of their hosts. The Balanids infesting the *Turbinarians* with their less echinulate cœnenchyma are defended by a much less pronounced arrangement of teeth.

There are several records of commensal Annelids whose calcareous tubes are worked up with the skeletal formations of corals. The most remarkable case, perhaps, is that of

*Heliopora cærulea**, in which the tubes of the Annelids are more numerous than the polyp-cavities, and must exercise a powerful influence on the growth of the corallum.

Among the *Astræoporans* I have found two cases. One is a single specimen (*A. Kenti*, sp. n.) discovered by Mr. Saville Kent on the west coast of Australia, in which only a few tubes were present, and appeared somewhat to disturb the coral. The other (*A. gracilis*, sp. n.) is from the Solomon Islands, and was discovered by Dr. Guppy. In this case the worm-tubes interlace with the long polyp-cavities, and open on the surface in great numbers, both coral and worm being apparently adapted to one another. The tubes are often pink, and even red, in colour, and much larger than those found in *Heliopora*, ca. $\frac{3}{4}$ millim. in diameter, as compared with ca. $\frac{1}{4}$ millim.

EXPLANATION OF PLATE XIV.

- Fig. 1.* The youngest specimen found, consisting of a parent-polyp (*pc*), with a group of daughter-polyps developed chiefly on one side, the whole corallum contained in a saucer-like epitheca (*e*). The daughter-polyp (*a*) is developing in contact with the epitheca, which forms part of its wall.
- Fig. 2.* Diagram to explain the pulvinate method of growth. The corallum rises from the original epitheca *e'*, the corallites lengthening greatly in the middle. As the lower parts die, the top expands as shown; under the edge of the overhanging top a secondary epitheca, *e''*, develops, and appears to restrain the downward flow.
- Fig. 3.* Largest specimen, showing the pulvinate type of growth, developed on the edge of a dead overturned previous growth. *a*, the former top of the dead growth.
- Fig. 4.* Diagram illustrating the globular method of growth. The original youngest growth is hollowed out by boring mollusks. *e'*, the edges of the original epitheca; *e''*, *e'''*, *e'v*, folds of secondary epitheca which have restrained the downward flow of the living layers. At *a* the living layer is beginning to roll over the epithecal fold.
- Fig. 5.* Specimen of *Astræopora punctifera*, Lamarck, showing four layers. The first (I) has been overturned; its corroded upper face is seen in the plane of the paper; at *a* the cœnenchyma is rolling over the epitheca.
- Fig. 6.* Typical structure of the cœnenchyma (from *A. Ehrenbergii*, = *A. myriophthalma*, Klunzinger, non Lamarck). The synapticular floors form nearly regular tiers, supported by tapering costal echinulæ.

* Cf. Moseley, Phil. Trans. vol. clxvi. pt. 1, 1876, p. 96, and Saville Kent's 'Great Barrier Reef,' pp. 192-194; also, for the case of *Mycedium fragile*, cf. Fewkes, 'American Naturalist,' vol. xvii. p. 595 (1883).

XLI.—*The Life-history and Growth-rate of the Lesser Sand-Eel* (*Ammodytes tobianus*). By ARTHUR T. MASTERMAN, B.A. (Cantab.), Assistant Professor of Zoology, St. Andrews University.

SINCE I have had my attention turned to the subject of the growth of fishes Professor M'Intosh has kindly handed over to me for examination a unique and very complete collection of the lesser sand-eel. Almost every size and stage is represented, from the embryo to the adult, and in many cases in such abundance as to give valuable data upon the subject at hand. In the 'Twelfth Annual Scottish Fishery Board Report' there appeared a table which purported to set forth the sizes of this collection, and I had hoped to avail myself of this; but an inspection led one to detect so many inaccuracies and wide approximations that the table is practically useless as a record of facts*. I have therefore gone through the whole collection except one bottle (labelled April 18, 1891), which was kindly worked through by my friend Mr. H. C. Williamson, M.A., B.Sc., a certain proportion being measured and the rest counted.

Without inquiring in too much detail into any reasons for the inaccuracy of Fullarton's table, we must mention that the sizes given by him amongst the March bottom-net series,

* 'On the Oviposition and Growth of the Lesser Sand-Eel,' by J. H. Fullarton. We may give one instance from this paper to show to what kind of work our remarks refer (p. 317). The same specimens are entered twice:—

Date of capture.	No. of Specimens.	Length in millims.
May 1	1	10
	6	9
	33	8
	53	7
	39	6
	13	5
	4	4
May 4	1	10
	6	9
	33	8
	53	7
	39	6
	13	5
	4	4

which are so largely in excess of mine in length, are accounted for by the fact that there were included in the bottles a number of larval herrings, which he appears to have measured and added to his list of sand-eels; and these, although recently hatched, are much longer than the older sand-eels occurring with them. Apart from the more attenuated form, the presence in some of the yolk-sac, the difference in pigmentation and in the position of the arms, are points which at once distinguish the two forms.

In my last paper upon the plaice* I dealt with a fish whose spawning-period is accurately known within fairly narrow limits, and therefore the base-line or starting-point of any growth-curve is also known. In this case, on the contrary, there is a good deal of doubt concerning the spawning-period, and it is hoped with this series to form a growth-curve which may help to the determination of this difficult point. At the risk of redundancy it is well to recapitulate the views held by various observers.

Couch † describes in accurate and detailed language the spawning process of the sand-eel, and as the result of his observations gives the shortest days of the year as the spawning-period on the south coast.

Thompson corroborates this observation, but also gives July as the spawning month in Ireland. Day ‡ finds the ovaries advanced in August and September, and M'Intosh § finds the same condition in May and June. Fulton § states that ripe specimens are caught in the end of June at Dunbar. Fullarton || describes having met with spawning females in July.

These divergent opinions by various observers can only be reconciled in one way, namely, by assuming that the lesser sand-eel has two spawning-periods, more or less confluent. It will be seen that the summer spawning-habit is proved by the observations of Thompson, M'Intosh, Fulton, and Fullarton; whilst the winter is proved by Couch and Thompson, and possibly by Day. The herring, whose larval form resembles the sand-eel closely in habits and *general* features, is known to have two spawning-periods, and we shall see below that on no other assumption can the facts with which we have to deal be explained. In Table I. are placed all the

* "On Rate of Growth of the Plaice," Thirteenth Annual Scott. Fishery Board Report.

† 'Fishes of the British Islands,' vol. iii.

‡ 'British Fishes,' vol. i.

§ 'Ninth Scott. Fishery Board Report.'

|| 'Twelfth Scott. Fishery Board Report.'

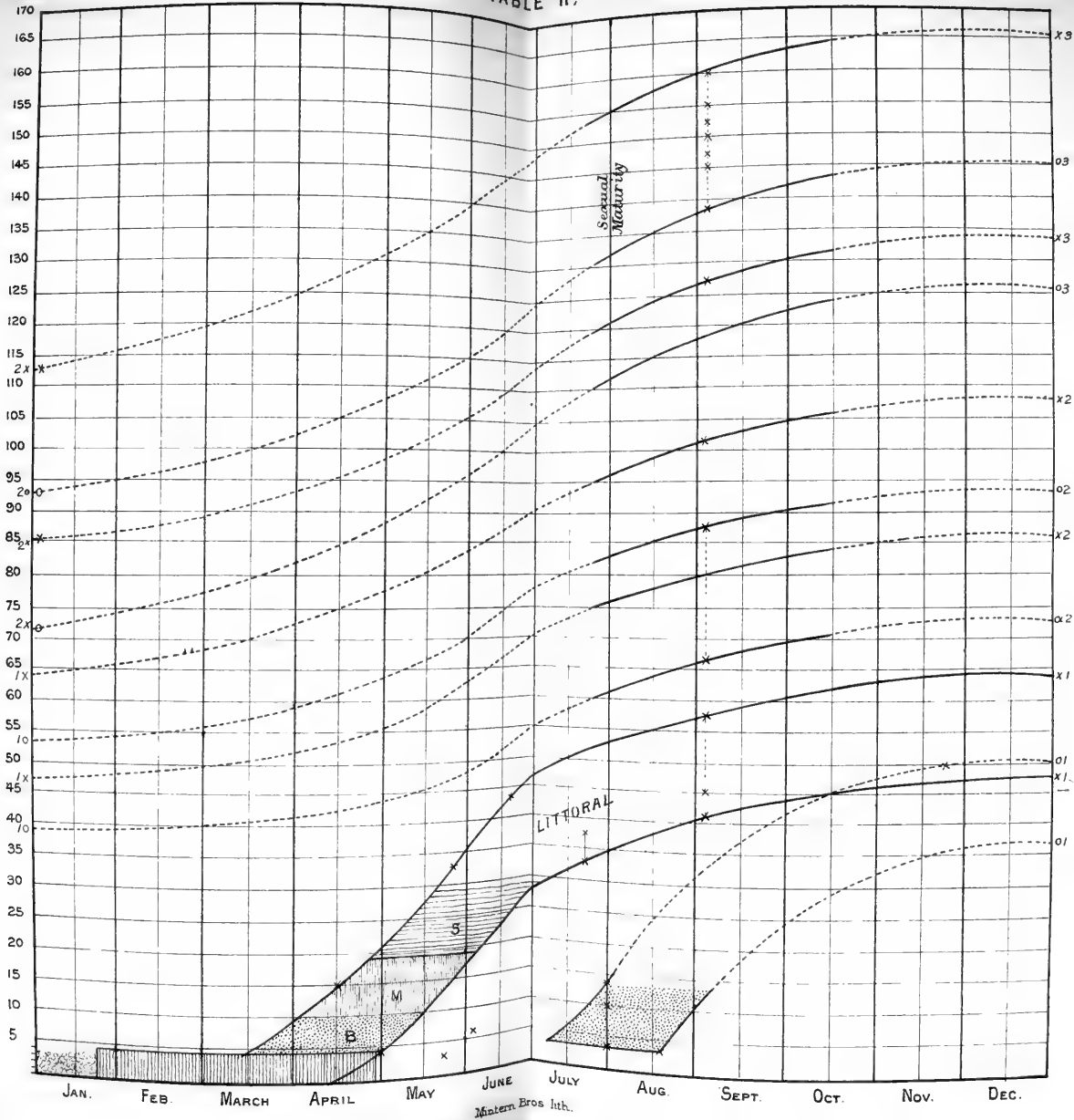
measured specimens, grouped according to the months; and, without going further, it is evident that there is a series of larval sand-eels found in March and April, and another series, in lesser numbers, in the end of July and August. The enormous quantities of larvæ which suddenly make their appearance in March at the sandy bottom some way from shore show a gradation in size, the smallest being 3·8 to 4 millim. (in spirit); and, by the presence of an oil-globule and traces of yolk, they must have just reached the end of the larval period. The period of hatching is in the summer about ten days, so that a period of incubation of three weeks would not be excessive for the mid-winter time (see my remarks on plaice). The larval period will also be considerably prolonged. For the summer larvæ a more or less quiescent larval period of two weeks would not be abnormal from the analogy of other species, and this is probably understating the case. This will give us a larval period of four weeks in the winter at least, and therefore we may say that the larvæ found in early March were probably spawned at the end of the year (incubation three weeks, larval period four or five weeks). This date would agree with the observations of Couch, quoted above, on the date of spawning. We know that the sand-eel lays its eggs *in* the sand, and it would not be a great assumption to suppose that the newly-hatched larvæ avail themselves of the protection afforded by their surroundings to remain in the sand until, the yolk being nearly absorbed, they emerge from their concealment and suddenly appear in countless numbers upon the sandy bottom. There are facts to hand which point to the conclusion that some young littoral pleuronectids (plaice &c.) take refuge during the winter months by embedding themselves in the sand. (On this point see also Petersen, 'Report Danish Biol. Stat.,' 1893.)

Although there is a certain amount of hypothesis in this account, yet it must be said that it agrees exactly with the facts at present known, and no other theory has yet fulfilled these conditions. Fullarton has put forward the suggestion that the little March larvæ are from the previous summer's spawning:—"Those captured in March, April, and May . . . may be considered as having been hatched towards the latter part of the previous spawning-period." This assumption would require that these little larvæ with oil-globules and, in some cases, traces of yolk, many not exceeding in size the just-hatched summer forms, must be at least seven months old, the first three of which are the hottest and best growing months of the year. This difficulty is got over by assuming that the spawning-period extends from "June till



LENGTH
OF FISH.
MMS.

TABLE II.



October." No proof whatever is given for this statement; but an age of five months is assigned quite arbitrarily to the March and April larvæ, in the face of their very "young" characters, and from this it is supposed that the spawning-period must be assumed to last till October. "The," as he remarks, "purely conjectural estimate" of five months as the age of the larvæ—although disagreeing with all the facts and quite a needless over-estimate—is taken as a *proof* of the second assumption:—"The duration of the spawning-period . . . may therefore be set down as from the end of June till October."

Following up the young forms of March and April, we find a complete transition in sizes, and the growing sand-eel may be traced from the bottom into the mid-water and to the surface. In Table II. the supposed quiescent period in the sand is represented by longitudinal shading, and the average duration of the bottom-residence is indicated by dotted lines; the passage through the mid-water is indicated by dots and lines, and the surface-habit by transverse lines. The two limiting lines of the curve are plotted from the limiting sizes which occur in the collection, set forth in Table I. If the upper line were exactly parallel to the lower, then the growth-rate of all the fish would be exactly equal—the fact that they are so closely parallel speaks strongly in favour of the theory put forward in a former paper (place) that the difference in size shown in "hauls" of larvæ is due directly or indirectly to the prolonged spawning-period. The earlier-hatched forms, with a slight superiority in competition, show a little faster growth, so that the lines diverge slightly. It will be observed by comparing Tables I. and II. that this March curve, up to some 55 millim., is not hypothetical except in a very slight degree, the points on the curve being plotted out in accordance with a great number of forms, only a few leading ones being indicated by crosses. The second and third year curves must be conjectural, but at any rate offer an explanation agreeing with the facts.

Coming to the July forms, we have the same occurrence in few numbers of the small post-larval sand-eels, which, taken in conjunction with their absence in May and June, is strong evidence in favour of the occurrence of two spawning-periods. In this case the first larvæ occur in the third week of July, and a larval period of two weeks, added to an incubating period of ten days, takes us back to a spawning-date of the latter part of June, which has already been observed by M'Intosh and confirmed by Fulton (see above). The only difficulty one has to overcome is that there is not appa-

rent the enormous outburst of larvæ in July or August which one finds in March. I think this is not insuperable. For a long time the eggs of the sand-eel defied all efforts at detection*, and it was eventually shown that the female deposited them in the sand below tide-mark, in water too shallow for the ordinary trawling-operations. These observations were made during the June spawning-period, and it is more than probable that the July and August swarms of young forms remain in the shallow water *upon* the sand, after they have completed their larval period. Our laboratory attendant, A. Brown, who has an intelligent knowledge of the fauna of the Bay, tells me that in the July series the closer inshore one works the more abundant are the little sand-eels, whereas in the March series one finds the greatest number some $\frac{3}{4}$ to 1 mile seawards.

These facts probably find their explanation in the different conditions of existence in the two periods of the year. In the calm summer months the eggs can be laid without risk in the sand of the shallows, where a high temperature favours the development, whereas in the winter months the eggs, laid by the parent in the sand of the deeper water, avoid all risk from storms or great reduction of temperature. It may therefore be a simple case of the adaptation of an animal, guided by its instincts, to its changed surroundings. We may notice the same kind of phenomena in allied species, in which those spawning earlier in the year have a spawning-place further out to sea and those spawning late a spawning-place much nearer inshore, *e. g.* cod, haddock, and whiting. (See also 'Eleventh Fishery Report,' "Report on Pelagic Eggs.") During July and August a few forms are found at the bottom seawards, and they probably join the March series later in the surface-water away out in the offshore-water.

The July series is shown in Table II. More observations are required to corroborate the course of the lines; it is assumed that they follow much the course of the March series.

We must here mention the surface-stage in the March series.

The young sand-eels in May are found in the surface-water in millions. There are before me four jars of these May post-larval forms, taken 15 miles off Aberdeen, Montrose, and Stonehaven, and their number may be estimated at about 50,000.

Thus the young sand-eel forms a very important supply of

* See Prof. McIntosh, 'Ninth Fishery Board Report.'

food to other fishes, both in its early post-larval stage, when it covers the sandy shallows with innumerable hosts, and later, in the surface-water, before assuming the adult habit.

As regards the actual rate of growth of the sand-eel, it is obvious that a line equidistant from the two limiting lines in Table II. will furnish the mean growth-curve.

Summarizing, we may say that a sand-eel spawned in December or January, after a (conjectural) quiescent larval period imbedded in the sand, emerges upon the surface of the latter at a length of about 4 to 5 millim. At this stage the supply of yolk-material is usually exhausted, and the oil-globule only remains.

The post-larval sand-eel remains at the bottom till a length of about 10 millim. is reached. Living alongside of it are found great numbers of larval and post-larval herrings, usually somewhat larger, and young *Sagittæ*. There is a remarkable superficial resemblance, caused solely by the attenuated form of these three very diverse organisms, which is, of course, entirely absent in the adult stages.

At a length of somewhat over 10 millim. the young sand-eel commences its migration upwards through the mid-water, and at this period its growth is very rapid. The average date for this change of habit will be seen to be about the end of April (see Table II.), sometimes earlier*. By about the third week in May, or sometimes earlier, the surface will be reached, and in the three weeks' migration through the mid-water the little fish will have grown from 10-11 millim. to 17-18 millim., a very rapid rate of growth. The surface † period lasts from 17 millim. to about 30 millim., and extends from the third week in May till about the second week in June or thereabouts, when the adult habitat is adopted. Here, again, in about three weeks, the young sand-eel grows from 17-18 millim. to about 30 millim. Sand-eels of larger sizes are caught at the surface, as almost everywhere, the universal distribution of this species being well known, so that the term "littoral" used in Table II. merely implies that sooner or later, at any rate by the spawning-time, a migration shorewards is effected.

I have recently worked over a number of bottles containing sand-eels, and have also been through a list of larval and post-larval fishes which appears in this year's 'Scottish Fishery Board Report.' I have thus been enabled to have access

* Large numbers of sand-eels 15 to 16 millim. in length are found amongst the pelagic ova of the food-fishes near the surface in April (*vide* M'Intosh, Trawling Report, 1885).

† By "surface" is meant the upper waters.

to a large number of additional sand-eels at various stages. The greater number of them merely confirm the deductions given here; but there are one or two exceptions. A few, such as

“Liston Bank, 9 fathoms, 13th April, 1891.—Sand-eel, 15 millim.,”

have enabled me to carry the upper curve-line (Table II.) further up than by Table I. only.

There are, again, two cases—

“St. Andrews Bay, 20th May, 1895.—Sand-eel, 3 millim.

“St. Andrews Bay, 6th June, 1895.—Sand-eel, 7 millim.”

—which have a peculiar importance. They are the only two instances of post-larval sand-eels of so small a magnitude occurring in May or June (see Table II.), and indicate that the two spawning-periods are only those of the predominating number, and that isolated cases may occur which bridge over the hiatus between them. At the same time it is just possible that fresh facts may come to hand and show that these cases are so numerous as to warrant our regarding the spawning-habit of the sand-eel as being prolonged over a period from January to June inclusive.

I have, in conclusion, to thank Prof. McIntosh for kindly giving me many valuable opportunities for investigating this interesting subject.

XLII.—*Description of Two new Chætognaths* (*Spadella schizoptera* and *Sagitta hispida*). By F. S. CONANT*.

WHILE at Bimini, one of the Bahama Islands, in June 1892, Dr. Andrews obtained three specimens of an unknown Chætognath, which have been very kindly placed at my disposal. As it proves to be a somewhat aberrant form, a description may be not without interest; to it may be added a description of another new species, which we found in abundance at Beaufort, N. C., from April to July of 1894.

1. *Spadella schizoptera*, sp. n.

The specimens were taken in the tow-net at rising tide, and belong to that class of Chætognaths whose life is spent for

* From the ‘Johns Hopkins University Circulars,’ vol. xiv. no. 119, pp. 77, 78.

the most part near the bottom among the algæ, to which they have the power of attaching themselves, undoubtedly in order to escape observation. Their colour seems to be appropriate to this habitat; for while most of the Chætognaths live on or near the surface, and are very transparent, these are opaque or only slightly translucent, of a yellowish-brown colour. The tactile prominences appear as spots of darker brown, and there are irregularly distributed areas having a reddish tinge, resembling a calcareous alga common to the region. Their length is 4 millim., and the breadth unusually great in proportion to the length. The caudal segment is half the total length. Fins 5: two paired lateral and the unpaired caudal. The anterior extend on each side from a point a little posterior to the abdominal ganglion to the openings of the ovisperm ducts. The middle fins are connected with the anterior by a narrow area where the ovisperm ducts open, and extend along the caudal segment as far as the spermatoc vesicles. Posteriorly each is split up into four villus-like processes, which extend backward and downward below the level of the rest of the fin, and have at their tips masses of adhesive cells for attachment. In this splitting-up of the middle fins *S. schizoptera* is unlike any Chætognath described, and upon it accordingly the name has been based. The regularity of the processes in all three specimens and the arrangement of the adhesive cells show beyond question that the structure is normal.

The caudal fin begins at the posterior margin of the spermatoc vesicles, and is spatulate, as in the Spadellas ordinarily. Jaws 8. Anterior teeth 2 or 3 on each side, according to the specimen; long and recurved. Posterior teeth wanting. Corona ciliata (Hertwig's "Geruchsorgan") of a peculiar three-cornered shape and limited to the head and neck. It is unlike any form heretofore figured. There are no diverticula from the intestine anteriorly. The ovaries extend the entire length of the body-segment, and contain ova nearly mature. The ovisperm duct shows a marked difference from all other Chætognaths in being connected in the posterior part of its course with its fellow of the other side. It runs as follows:—Beginning as a blind tube at the anterior end of the ovary, midway between dorsal and ventral surfaces of the body, it passes backward, at first ventral to the ovary, then lateral and external, to its funnel-shaped opening between the anterior and middle lateral fins. At a point a little anterior to the septum between body and caudal segments it gives off a branch of comparatively wide lumen, which seems to contain spermatozoa like a receptaculum seminis, and which passes

inwards and downwards to join a similar branch from the ovisperm duct of the opposite side, the two growing narrower as they approach, and finally fusing to form a small blind tube, directed anteriorly, on the mid-line underneath the intestine.

The spermatic chambers of the caudal segment are without accessory longitudinal septa, but nevertheless show the peculiar circulation of the masses of developing spermatozoa. There is a transverse musculature in the anterior part of the body-segment, limited to the ventral half. The dorsal surface of the lateral fins and the adjoining surface of the body bear heavy masses of glandular cells.

2. *Sagitta hispida*, sp. n.

The form taken at Beaufort last year leads an active life on the surface and was an almost constant factor in the tow. The length of mature specimens varies from 7 to 11 millim. Fins 5: the anterior long and rather slender, the middle always broader than the anterior, both broadest in their posterior part. Caudal segment one third total length. The anterior fins extend from near the level of the abdominal ganglion to a point posterior to the centre of the total length. The middle are completely separated from them by a clear space, and are situated more on the caudal than on the body segment. Jaws 8 or 9. Anterior teeth 4 or 5. Posterior vary from 8 to 14 or 15. Corona ciliata extends from a point on the head anterior to the eyes along the dorsal mid-line almost to the level of the abdominal ganglion. Its outline is narrow and sinuous. The mature ovaries may extend beyond the anterior extremity of the anterior fins. The intestine has two well-marked lateral diverticula at its beginning. The spermatic chambers of the caudal segment are divided by incomplete accessory longitudinal septa, about which the spermatic masses circulate. The spermatic vesicles have a kind of cap such as described by Grassi for *S. bipunctata*.

The tactile prominences, with the sensory hairs springing from them, are especially numerous and manifest, and give the species the bristling appearance from which it is named. In the anterior part of the body they are arranged in some twelve more or less definite longitudinal rows. Each of the middle fins has a tactile prominence on its posterior third on both upper and lower surfaces, and the caudal has six on each surface, almost constantly, arranged as in the figure (fig. 2).

S. hispida closely resembles *S. bipunctata* and *S. minima*, but differs too much to be classified with either, as a comparison of Grassi's description will show.

Fig. 2.

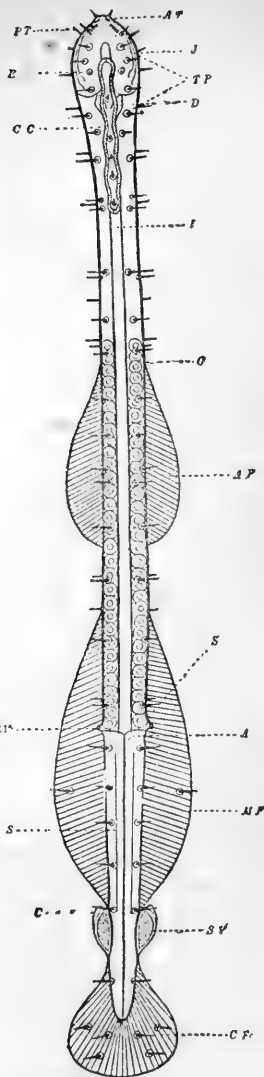


Fig. 1.

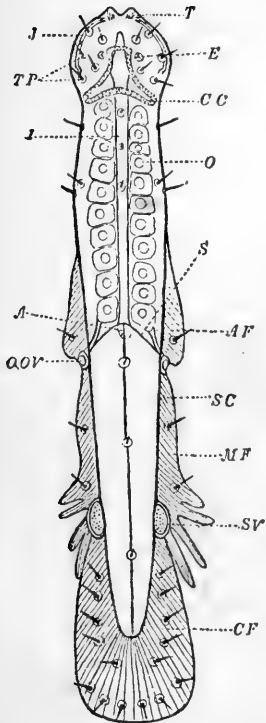


Fig. 1.—*Spadella schizoptera* (reduced from camera drawing). *T*, anterior teeth; *J*, jaws; *E*, eye; *TP*, tactile prominences; *CC*, corona ciliata; *I*, intestine; *O*, ovary; *S*, septum between body and caudal segments; *A*, anus (ventral); *AF*, anterior fin; *O. OV*, external opening of ovisperm duct; *SC*, spermatic chamber; *MF*, middle fin; *SV*, spermatic vesicle; *CF*, caudal fin. (Magnified 24 ×.)

Fig. 2.—*Sagitta hispida* (reduced from camera drawing of a small specimen). *AT*, anterior teeth; *PT*, posterior teeth; *D*, diverticula of intestine; *C*, cap of spermatic vesicle; *AS*, accessory longitudinal septa of spermatic chambers. Other letters as in fig. 1. (Magnified 26 ×.) The tufts of sensory hairs springing from the tactile prominences have been exaggerated in both figures.

Notes on the Classification of Chætognaths.

Three systems have been advocated by the writers, and as none of them seems satisfactory when tested by *Spadella schizoptera*, it may be appropriate to review them briefly.

Langerhans (*Zeitschr. für wissensch. Zool.* Bd. xxxiv. pp. 132-136, 1880) forms three genera, based on fins and teeth:—*Sagitta*, with five fins (a caudal and two pairs of lateral) and two series of teeth; *Krohnia*, with three fins (caudal and one pair of lateral) and one series of teeth; and *Spadella*, with three—the caudal and lateral, however, being connected and lying wholly on the tail-segment—and two series of teeth. Strodttmann (*Archiv für Naturgesch.* Year 58, 1892) follows Langerhans.

O. Hertwig (*Die Chætognathen*, "Jenaische Zeitschr." Bd. xiv. 1880) makes two genera on the basis of fins alone:—*Sagitta*, with five fins; *Spadella*, with three.

Grassi ('Fauna und Flora d. Golfes von Neapel,' no. 5, 1883) takes the ground that fins and teeth are not of sufficient morphological importance, and bases his two genera on the following anatomical characteristics:—*Sagitta*: transverse musculature, adhesive and glandular cells present, some tactile prominences somewhat buried in the epidermis. The lack of these features characterizes the genus *Spadella*.

Since the Chætognaths that have these three features are in general those that have three fins, it will be seen that while this classification of Grassi's does not affect the constituency of the two genera, it interchanges the names, so that a *Sagitta* of Hertwig is a *Spadella* of Grassi. This reversion of the accustomed names gives rise to unfortunate confusion.

The difficulty with *Spadella schizoptera* now is that it has the fins of one genus with the morphological characteristics of the other. According to Langerhans' or Hertwig's systems it would have to be called a *Sagitta*, as having five fins, in spite of its distinctively *Spadella* characteristics. On the strength of a single external resemblance it would thus be separated from its nearest allies. Grassi's system, while keeping it in the same genus as its fellows, would reverse the usual name of that genus and call it *Sagitta*. As the distinctive features of the new form did not appear to warrant establishing a new genus, it seemed best to classify it, at any rate provisionally, according to a combination of Hertwig's and Grassi's systems—determining its genus according to the morphological characteristics of Grassi, so that it might be kept with its nearest allies, but retaining for that genus the name (*Spadella*) it would have in the classification of Langerhans or of Hertwig.

XLIII.—*New Species of Indian Epiplemidæ, Geometridæ, Thyrididæ, and Pyralidæ.* By Colonel C. SWINHOE, M.A., F.L.S., &c.

Epiplemidæ.

Epiplema sponsa, sp. n.

♂. Cream-coloured, tinged with pink, with black markings and bands; thorax with some black marks; abdomen black above, with cream-coloured segmental thin bands: fore wings with a broad black broken band, composed of a large patch on the costa and another on the hinder margin, limited by a thin sinuous cream-white band; on the interior side of this the two patches run into each other; the costa between this band and the base is also broadly smeared with blackish colour; between the white band and the outer margin is another large black blotch in the middle of the space and a deep black subapical dot: hind wings with a black spot at the end of the cell; a black fascia in the middle from the base to the discal white band, and a black outer patch somewhat similar to that on the fore wings; a submarginal row of black lunules in the middle of the border of both wings. Underside cream-coloured, without markings: fore wings with blackish suffusion.

Expanse of wings $\frac{9}{10}$ inch.

Shillong. Two examples.

Geometridæ.

Zamarada minimaria, sp. n.

♂. Head and body purple-brown; abdomen with a dorsal row of luteous dots on each segment. Wings pale luteous: fore wings with a brown ringlet at the end of the cell; three thin purple-brown transverse bands—subbasal, medial (running through the ringlet), and discal—the two former connected by a thin band on the hinder margin; the medial and discal bands also crossing the hind wings, the latter sinuous and limiting on both wings a broad marginal purple-brown band; cilia luteous, with brown patches opposite the interspaces.

Expanse of wings $\frac{7}{10}$ inch.

Karachi. One example.

Erythrolophus semiustus, sp. n.

Erythrolophus semiustus, Swinhoe, MS.; Hampson, Moths, iii. p. 452.

♂. Antennæ, thorax, and fore wings dark olive-grey; top of head and base of antennæ white: fore wings with a brown spot in centre of cell and another at the end; apex with a large circular space rich reddish ochreous, limited by a brown line, which encircles it and runs to the margin just below the costa, and is crossed by a sinuous blackish-brown line, and some with brown marks and red-brown veins: hind wings rich reddish ochreous; costal border broadly dark olive-grey; wings crossed by two blackish-brown sinuous lines and marked with some reddish irrorations and red-brown veins; both wings with a red-brown marginal line and olive-grey cilia.

Expanse of wings 1 inch.

Cherra Punji. Two examples.

Chrysocraspeda phænicosoma, sp. n.

♂. Top of head and thorax cream-coloured; abdomen pale dull brickdust-pink colour; both wings also of this colour, with a black dot at the end of each cell; a broad subbasal band on fore wings cream-coloured, and a broad marginal band on both wings of the same colour, which is tinged with pink, is well defined, and is limited by a whitish line, which is sinuous from the costa of fore wings beyond the middle to near the outer margin before the middle, and then curves uniformly with the outer margin, and is much narrower on the hind wings; marginal lunules black. Underside cream-coloured, with some grey suffusion on fore wings and a discal line on both wings corresponding to the border limitation above.

Expanse of wings $\frac{9}{10}$ inch.

Cherra Punji. Three examples.

Chloroclystis subtrigalba, sp. n.

♂ ♀. Pale grey, marbled with olive-grey: fore wings with blackish-brown patches on the costa, in the disc, on the outer margin, and on the grey cilia; hind wings with two similar patches on the abdominal margin: both wings crossed by several whitish minutely dentated lines, one discal and one submarginal being the most prominent. Underside greyish brown, with a dark brown discal band angled outwards in the middle of both wings and edged with luteous grey; in

some examples, especially in the females, the underside is mostly pale luteous grey.

Expanse of wings $\frac{7}{10}$ inch.

Shillong and Cherra Punji. Numerous examples.

Chloroclystis sinuosa, sp. n.

♂ ♀. Pale grey; costal margin of fore wings and outer margin of both wings brown, the latter contains a fine pale sinuous and semidentate pale line; both wings crossed by an outwardly pale-edged brown thin band, angled outwardly in the centre; on the fore wings is also a brown, somewhat sinuous, antemedial thin band, and across both wings is a medial indistinct sinuous pale line, but this is not visible in all examples. Underside pale grey, with the discal and marginal bands prominent, and with grey streaks on the veins.

Expanse of wings $\frac{6}{10}$ inch.

Cherra Punji. Many examples.

Chloroclystis acygonia, sp. n.

♂. Grey, suffused with olive-brown, transverse thin bands deep black—first subbasal, second antemedial on fore wings only, outwardly curved, third discal, across both wings, angled acutely outwards in the centre on each wing, and outwardly edged with whitish; costa of fore wings with some black marks; marginal borders darker than the rest of the wing and include a submarginal dentate whitish line; marginal line black; cilia grey, with pale pinkish points. Underside paler and glossy; a black mark at end of each cell; discal band prominent, veins with grey streaks.

Expanse of wings $\frac{7}{10}$ – $\frac{8}{10}$ inch.

Shillong. Several examples.

A larger insect than *C. sinuosa*; apex of fore wings more acute, bands blacker, more complete, with the angles much more acute.

Eupithecia chlorophora, sp. n.

♂. Fore wings olive-brown, the basal third crossed by several brown slightly sinuous lines, very close together, the outer ones angled outwardly above a small black streak at the end of the cell; the medial part for a short space free of lines; three or four outwardly curved semidentate discal lines close together, followed by a white recurved line, and then some indistinct pale lines near the margin; marginal lunules black, cilia grey, with a brown band: hind wings pale grey, whitish

at the base, with faint indications of pale discal bands and marginal black lunules. Underside of a uniform pale grey; both wings crossed by many outwardly curved darker grey bands.

Expanse of wings $\frac{8}{10}$ inch.

Cherra Punji. Several examples.

Eupithecia melanolopha, sp. n.

♂. Grey, smeared with pinkish brown, the pink reflections being most distinct on the outer portions of the fore wings, the costa of which has some blackish marks and a broad black patch in the middle, limited by a thin white discal band, followed by a submarginal similar band: hind wings dark grey, some black patches on the abdominal margin, which are at the ends of several white bands, one discal and one submarginal being more distinct than the others: marginal black lunules on both wings, and cilia grey, with pale basal line.

Expanse of wings $\frac{7}{10}$ inch.

Cherra Punji. One example.

Eupithecia nigrinotata, sp. n.

♂. Pinkish grey, with very faint indications of darker grey transverse discal and submarginal bands; costa of fore wings with four black marks, the last two close together, join a black spot at the end of the cell, and form a large wedge-shaped prominent black patch: hind wings with some black marks on the abdominal margin and an irregular black central band.

Expanse of wings $\frac{6}{10}$ inch.

Shillong. Numerous examples.

Gymnoscelis polyodonta, sp. n.

♂. Grey; thorax spotted with olive-brown, abdomen banded with the same colour; wings thickly crossed with many semidentate and sinuous olive-brown bands close together, one in the disk and another antemedial being most prominent and outwardly edged with white; marginal line black; cilia grey, with brown patches.

Expanse of wings $\frac{6}{10}$ inch.

Shillong and Cherra Punji. Numerous examples.

Xiridava rufinigra, sp. n.

♂. Pale pink-grey, with a red tinge; thorax with a broad blackish-brown band in front, corresponding to a similar

costal and subcostal band, which are close together; a large square brown mark at the end of the cell, two larger marks close together running into the apex, and some brown intermediate costal marks, the whole forming an irregular costal broad brown band: hind wings with a broad brown marginal band on the anal half containing two white lunular spots; both wings crossed by indistinct grey lunular bands, one in the disk having black points; a row of black dots close to the margin, one in the centre of fore wings being much the largest; marginal line grey; cilia with small brown marks opposite the veins.

Expanse of wings $\frac{9}{10}$ inch.

Cherra Punji. One example.

Coremia plumbeotincta, sp. n.

♂. Head and body dark brown-pink; abdomen with pale segmental bands: fore wings grey, suffused with pink, with the basal, costal, and apical portions broadly dark pink-brown; veins pale; an indistinct discal row of pale points: hind wings grey-brown, unmarked; marginal line in both wings brown; cilia pinkish, banded with brown. Underside pale sordid grey, some brown marks on the costa, otherwise unmarked; cilia as above.

Expanse of wings $\frac{9}{10}$ inch.

Shillong. Several examples.

Coremia buda, sp. n.

♂. Body brown; wings pink-grey: fore wings with the basal two thirds brown, limited by a white thin band, with an outward dentation near the costa, crossed also by an antemedial brown line edged with white on each side, and by two or three indistinct grey sinuous lines; a brown subapical costal patch and a brown subapical streak composed of two patches; two indistinct grey sinuous discal lines and a submarginal semidentate pale submarginal line; brown marginal lunules, and broad cilia in the basal half brown, outer half pink-grey, with brown patches: hind wings dark grey, suffused with pink, with two broad grey discal bands, each containing a pale thin fascia; marginal lunules and cilia as in fore wings.

Expanse of wings $\frac{9}{10}$ inch.

Cherra Punji. Several examples.

Thyrididæ.

Rhodoneura rhodosticta, sp. n.

♂. Of a uniform bright chocolate-brown, tinged with pink; both wings very uniformly and minutely covered with dark brown strigæ; below the apex of fore wings these strigæ are formed into a sort of subapical line; the costa of fore wings with luteous dots at even distances along its entire length. Underside pale pinkish, nearly white; the fore wings suffused with ochreous and pink on their inner portions, the strigæ prominent on the whitish portions.

Expanse of wings $\frac{7}{16}$ inch.

Cherra Punji. Two examples.

Rhodoneura melanostigmalis, sp. n.

♂. Pinkish grey: fore wings paler than the hind wings, covered with greyish-brown strigæ, which form ringlets of a uniform size all over both wings, those on the fore wings being larger than those on the hind wings; the ringlets on the fore wings are filled in with brown towards the base and on the hinder margin, and on the whole of the hind wings except at the base; the costa of fore wings and the abdominal border of hind wings are marked with black, the marks on the fore wings being square, and the two above the large brown spot at the end of the cell are conjoined with it; two black dots submarginal above the middle on fore wings, and marginal black dots on both wings.

Expanse of wings 1 inch.

Shillong. One example.

Rhodoneura setifera, sp. n.

♂. Pink-grey, striated with olive-brown, with some pale brown patches and a broad brown band across both wings, which widens gradually upwards from centre of abdominal margin of hind wings, and terminates before reaching costa of fore wings in a rounded form. Underside whitish, tinged with pink, with the striations and central band more pronounced.

Expanse of wings $\frac{9}{16}$ inch.

Shillong. One example.

Rhodoneura pralanis, sp. n.

♂. Creamy white, with a very slight luteous tinge; thorax brown in front, abdomen with a brown dorsal band. Wings

uniformly covered with fine chocolate-coloured strigæ, filled in with pale bright chocolate in parts, forming four transverse bands on fore wings and two on the hind wings; the central band across both wings the broadest, and thickened out above the middle: fore wings with a blackish-brown submarginal spot above the middle, a smaller spot near it, both being included in a small subapical band.

Expanse of wings $1\frac{2}{10}$ inch.

Cherra Punji. One example.

Rhodoneura jubralis, sp. n.

♂. Olive-brown; the ground-colour of the wings is of a creamy white, but the entire surface of both wings is covered with very small brown striations, forming minute rings, making both wings brown with the exception of a small portion of the abdominal area of hind wings; both wings are also crossed by many brown lines, two or three of them on fore wings from the base to near the middle of the wing being straight and erect; the remainder are more or less sinuous, and many of them on the hind wings are twisted into ringlets; there is a white spot below the centre of fore wings and two white spots below the centre of hind wings.

Expanse of wings $1\frac{1}{10}$ inch.

Cherra Punji. One example.

Allied to *R. tetragonata*, Walker.

Pyralidæ.

Niphopyralis suffidalis, sp. n.

♂. Milk-white, wings thickly clothed: fore wings pure white, with a few black specks at the end of the cell and on the lower portions of the wing; two minute black dots near the hinder angle, and some black dots on the outer margin towards the apex and one below the middle; cilia marked with pale grey: hind wings, all but the base suffused with grey irrorations; cilia pure white, with a faint grey interline. Underside with the fore wings suffused with grey; cilia pure white; hind wings entirely white and without markings; fore legs brown above, the tarsi with brown bands.

Expanse of wings $\frac{9}{10}$ inch.

Bombay. One example.

Ambia magnificentis, sp. n.

♂. Dark chocolate: fore wings with a white semihyaline

medial subcostal spot; below the costal fold a white streak of three or four conjoined spots from the costa one third from the apex; a white spot beyond the middle above the hinder margin; an ochreous marginal band divided by the veins, lined inwardly with black, followed by a line of white spots: hind wings with a white subcostal spot beyond the middle; a discal white band disconnected in its centre; ochreous marginal band as in fore wings; both wings with black marginal line; dark grey cilia, with a pale basal line, followed by a subbasal deep black line.

Expanse of wings $\frac{8}{10}$ inch.

Cherra Punji. One example.

Loxocorys obscuralis, sp. n.

♂. Greyish brown, with a golden sheen: hind wings slightly paler than fore wings; veins of both wings dark grey, inner band obsolete, discal band grey, outwardly much curved on fore wings, slightly curved on hind wings; outer margin dark grey; cilia concolorous with the wings, with a pale basal line. Palpi deep black above and on the outer sides. Underside paler, much as above.

Expanse of wings $\frac{8}{10}$ inch.

Shillong. Four examples.

Aulacophora fuscinervalis, sp. n.

♂. Body buff-coloured, marked with grey; top of head whitish: fore wings greyish white, veins and basal fourth grey; a grey discal band from a blackish spot on the costa one third from apex, much curved outwardly, coming close to the outer margin, bends inwards at vein 2, then straight to hinder margin a little beyond the middle; another blackish mark on costa before the middle: hind wings white; both wings with the outer margin grey; cilia grey, interlined with white. Underside, including cilia, whitish.

Expanse of wings $\frac{7}{10}$ inch.

Cherra Punji. One example.

Bostra igneusta, sp. n.

♂. Palpi and head pinkish grey; thorax pinkish brown; abdomen coloured like the hind wings. Wings luteous grey, tinged with pink: fore wings irrorated with dark pinkish-brown atoms, the irrorations thickest in the upper and outer portions; a brown lunular mark at end of cell inwardly edged with whitish; the veins brown; a brown discal band, nearly

straight, from centre of hinder margin to costa one fourth from apex; a thin brown irregular marginal band; cilia purple-grey, very broad, with a very fine pale basal line: hind wings pale, very finely irrorated with grey; a grey marginal line; cilia whitish, doubly interlined with grey. Underside of a uniform pale pinkish grey; fore wings with cell lunule and discal band very distinct; hind wings with a pale grey discal band.

Expanse of wings $\frac{9}{10}$ inch.

Shillong. One example.

Surattha fuscilella, sp. n.

♂. Smoky brown, tinged with chocolate, very uniform in colour; markings very obscure: fore wings with a brown spot at the end of cell and indications of three brown bands—subbasal, medial, and discal—the two former erect, the discal band outwardly curved, but very indistinct, and apparently double; an ochreous tinge on the costa between the two latter bands, and spear-shaped black points on the outer margin; cilia of both wings with a very fine luteous basal line.

Expanse of wings $\frac{7}{10}$ inch.

Raipur, Central India. Two examples.

Pleonectusa sagittalis, sp. n.

♂. Luteous grey, irrorated with very minute black atoms: fore wings with a black dot in middle of the cell; two black marks at the end; a nearly straight black transverse band, also a black discal band, bent inwards and forming a tooth above the middle and inwards again below the middle, and then downwards to the hinder margin one third from the hinder angle: hind wings with a discal much waved black band; the marginal space on both wings beyond the band dark; cilia brown, with a pale interline.

Expanse of wings $\frac{7}{10}$ inch.

Hydrabad, Sind. Three examples.

Hypsopygia olivalis, sp. n.

♀. Head, thorax, and fore wings grey, densely covered with black irrorations: fore wings with a black spot at the end of the cell; two black transverse thick lines, ante-medial and discal, the former sinuous and edged with whitish on its inner side, the latter oblique, with an acute outward angle above the middle, and edged with whitish on its outer

side : hind wings pale, being white, irrorated with pale grey atoms, with a grey discal band outwardly edged with white ; both wings with brown marginal points and pale cilia, doubly interlined with grey.

Expanse of wings $\frac{7}{16}$ inch.

Mahableswar. One example.

Notaspis carnealis, sp. n.

♂. Head and body pale flesh-colour ; palpi darker. Wings pale yellowish, tinged with flesh-colour : fore wings suffused with red, orbicular and reniform brown, on a pale space ; veins and cilia red, the latter with pale tips : hind wings without markings, with a thin red marginal line. Underside of a uniform pale whitish flesh-colour, with the orbicular and reniform very distinct.

Expanse of wings 1 inch.

Cherra Punji. Two examples.

Mabra nigriscripta, sp. n.

♂. Dark bright ochreous ; wings crossed by darker ochreous lines—first subbasal, curving outwards on fore wings, black on the costa, nearly straight on hind wings, but stopping short of the abdominal margin ; the second medial, sinuous on hind wings, its place on fore wings being taken by an endless band, like a figure of 8, the upper portion touching a black loop on the costa and encircling a reniform mark, its lower portion not reaching the hinder angle ; an orbicular pale spot between this and the first line ; third line discal, rather near the outer margin, bent inwards on its lower portion on both wings ; an antecilia ochreous band, an ochreous-grey suffusion on its inner side ; cilia with a deep black marginal band and white fringe. Underside uniformly pale ochreous ; markings as above.

Expanse of wings $\frac{7}{10}$ inch.

Shillong. Two examples.

Bocchoris trivitalis, sp. n.

♂. Pale luteous, thickly marked and banded with dark chocolate ; some marks near the base ; a double antemedial band, much curved outwardly and well separated on fore wings, touching each other in the centre on hind wings, followed on fore wings by a dark space containing a large kidney-shaped pale spot ; a similar and larger central spot on hind wings on a pale ground, with another below it ; two

more pale spots on fore wing, discal and one above the other ; a submarginal series of rings or festoons on both wings, the largest ring of the series near the costa of fore wings ; marginal border dark chocolate ; cilia luteous, with a black patch on centre of fore wings ; a pale thin basal line, followed by a black band, this band not extending much above centre of fore wings.

Expanse of wings $\frac{8}{10}$ inch.

Shillong. One example.

A very pretty insect, very difficult to describe.

Sameodes pictalis, sp. n.

♀. Bright ochreous : fore wings with the inner two thirds suffused with brown, on which are three large semidiaphanous luteous spots—the first subcostal, one third from base, the other two medial, one elongated in the centre of the wing, the other above it, square in shape and subcostal ; another pale small spot outside the cell, in the disc of the wing at the termination of the brown suffusion, and surrounded by a pinkish-red suffusion, which is limited by a discal recurved line of pale red lunules ; this discal line is also represented on the hind wings, inside of which are some bright pinkish-red marks ; a pale subbasal dot, an antemedial pale dot with blackish marks on its inner side and a square black-margined mark above it ; a well-marked grey submarginal band on both wings ; cilia pale yellow, with a basal grey interline. Underside pale luteous, with the markings much as above, except that the brown suffusion on the upper half of fore wings extends to the apex.

Expanse of wings $1\frac{1}{10}$ inch.

Cherra Punji. One example.

Chalcidoptera rufilinealis, sp. n.

♂. Pale luteous ; body and wings banded with reddish brown : fore wings with a basal patch ; costa broadly, outer and hinder margin narrowly red-brown ; a spot in the cell and a patch at its end ; a line from costa one fourth from base to hinder margin, and curving upwards in the centre of the wing to the median vein, then downwards and again upwards to the costa, forming the usual discal line and making the bends in the inner portion of the wing look like a figure of 8 ; a subapical streak, a patch on the hinder angle touching the bend of the discal line, and nearly all the veins marked with red ; cilia with brown patches : hind wings with a square

nearly central patch ; a discal recurved line, with its lower portion joining the patch along vein 2 ; a marginal band and brown cilia from vein 2 upwards ; cilia luteous on its lower portion.

Expanse of wings $1\frac{1}{10}$ inch.

Cherra Punji. One example.

Paracymoriza aurantialis, sp. n.

♂. Body golden brown ; top of head white ; thorax with a broad white stripe on each side ; abdomen with white segmental bands. Wings golden ochreous, with pure white bands lined with black on each side : fore wings with two at the base, elbowed outwards in their centres ; another before the middle, slightly angled outwards in its centre, followed by a white space ; then another black-bordered thin white band, very acutely angled, towards the hinder angle of the wing, where it nearly touches a submarginal band, which is disconnected in its centre and has two white streaks running inwards ; between these two bands is a white streak from the apex, with an inward hook at its lower end, and which is interlined with a black line : hind wings with two white basal bands ; a broad central white band with black-margined white lines on each side, and a submarginal black-bordered white line ; both wings with marginal black lines and white cilia tipped with black.

Expanse of wings $1\frac{2}{10}$ inch.

Cherra Punji. Two examples.

Cataclysta trigonalis, sp. n.

♂. Pale chocolate-brown : fore wings with a white central spot ; a wedge-shaped white mark from the costa beyond the middle ; a white submarginal band, outwardly lined with black and followed by a marginal pink band, the margin with black lunules : hind wings white at the base, limited by a dark grey thin band, the remainder of the wing pale pink tinged with ochreous ; a submarginal white line, indistinct as it runs upwards, edged with grey on both sides, followed by a pinkish marginal band containing a row of well-separated deep black spots, the central ones the largest ; cilia of both wings grey, with a basal white interline.

Expanse of wings $1\frac{6}{10}$ inch.

Shillong. Four examples.

XLIV.—*On Rhætic Foraminifera from Wedmore, in Somerset.*
By FREDERICK CHAPMAN, F.R.M.S.

[Plates XI. & XII.]

Introductory.

THE following paper is the result of a microscopical examination of various samples of clays, argillaceous sands, and shelly limestones of Rhætic age, which were obtained by Mr. W. A. Sanford, F.G.S., from a quarry to the south-east of the village of Wedmore. For the opportunity of examining these interesting and important deposits I am indebted to Dr. Henry Woodward, F.R.S., Pres.G.S., &c., who very kindly placed the material in my hands for description.

There were six distinct samples of rocks, taken from different horizons, and all of these have been subjected to a careful microscopical examination. With one exception, namely that from bed no. 9, these samples were of such a nature that they could be reduced by washing without much difficulty. In order to examine the hard limestones of bed no. 9 it was necessary to prepare thin slices; and these yielded distinct evidence of the presence of hyaline Foraminifera in this group of rocks, although their remains are by no means common.

There appears no reason to doubt the Rhætic age of the Wedmore beds, since Mr. Sanford has found characteristic Rhætic fossils in the various strata. The measurements of the various beds seen in the quarry yielding Megalosaurian remains at Wedmore have already been published by Mr. Sanford *, and they are here repeated for convenience:—

	inches.
"1. Top soil.....	12-15
"2. Dark sticky clay. Maximum	29
"3. Thin shaly or concretionary bed, locally gravelly.	1-3
"4. Somewhat similar; some clay and shale mixed, irregular in composition; large <i>Septaria</i>	About 8
"5. Light-coloured sandy clay, with some few fossil teeth and shells	9
"6. Darker clay, with small <i>Septaria</i> numerous, some teeth, and bits of bone	9
"7. Saurian bed; the bones generally found next	

* Proc. Somerset Arch. and Nat. Hist. Soc. vol. xl. (1894) p. 234.

	inches.
the rock; many teeth of reptiles, fish, and batrachians (?), vegetable remains.....	9-10 or 12
“8. A bed found in places, and next the rock, generally near the larger bones, whitish or even quite white, like mortar.....”	$\frac{1}{2}$ -1
“9. The Wedmore stone, described above, in three beds generally, from a few inches to 2 feet 6 inches.”	

Details (chiefly microscopical) of the Beds examined.

The descriptions of the rocks and the microscopical appearance of the washings of each of the samples selected and numbered by Mr. Sanford are as follows, the beds being described in descending order.

Bed no. 2.—A note made by Mr. Sanford and attached to the specimen reads thus:—“Upper dark sticky clay, almost absolutely black, and tending to split up when only slightly dried. It varies much in thickness, and the measurement in this quarry is about 29 inches. In another quarry, about $\frac{1}{4}$ mile S. or S.E. of this, the bed is covered by a succession of strata, more or less irregular, and which closely resembles that between this clay and the ‘Wedmore Stone’ (bed no. 9). There are hardly any fossils to be seen excepting one or two fragments of bone. This clay thins out in a very short distance to nothing.”

The residuum of bed no. 2, after washing away the fine argillaceous material, consists of fine angular and subangular quartz-grains, and some of the latter exhibit secondary outgrowths and envelopes. From the sand-grains a fine example of a doubly terminated quartz-crystal was picked out, measuring $\frac{1}{48}$ inch (.52 millim.) in length, and with perfectly sharp edges. A large portion of the washed material consists of the sandy tests of arenaceous Foraminifera, chiefly of the genera *Ammodiscus* and *Haplophragmium*, and there were also a few examples of *Stacheia*. Many of the tests of the Foraminifera in these washings are almost chalky white, but some are slightly stained with ferruginous material, or, more rarely, composed of ferruginous particles mingled with quartz-sand. The remainder of the washed material consists of ferruginous particles and some bone-fragments. This sample was the only one which showed the presence of carbonate of lime on treatment with acid.

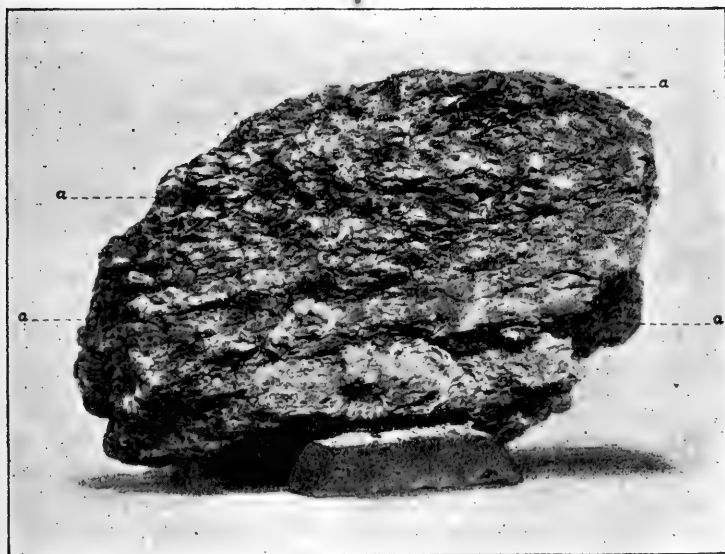
Bed no. 3.—This is a bluish-grey sandy clay, with thin limonitic partings. The residuum after washing is seen to consist of fine angular quartz-grains, ferruginous particles, and a few glauconite grains of no definite shape. Examples of *Haplophragmium* and *Stacheia* also occur in these washings,

but the latter are not so clearly defined in outline as those of bed no. 5, and they are more fragmentary.

(This sample appears to agree in part with no. 5 of Mr. Sanford's section.)

Bed no. 4.—A pale brown friable sandstone, coarsely laminated. It contains some clay, which is apparent on crushing the rock under water. The residuum, after washing, consists of brown and white sand-grains. The coarser brown particles, when mounted in balsam and viewed under a tolerably high power, are seen to be in many cases more or less perfect examples of obscure arenaceous Foraminifera belonging to the genus *Haplophragmium*. A single specimen of *Stacheia* was also met with. The white sand is much finer and consists of sharp angular quartz-grains.

Bed no. 5.—A blue sandy clay, with ochreous and ferruginous layers, which consist almost entirely of the remains of



A small block of clay showing *Stacheia* in regular layers at *a a*; from bed no. 5 of the Rhaetic series, Wedmore. Reduced to $\frac{3}{4}$ nat. size.

Stacheia. These organisms form layers about 4 millim. thick, which conspicuously mark the planes of sedimentation. This is shown in the woodcut, which is from a photograph kindly taken by my brother, Mr. R. S. Chapman.

The residuum, after washing, is 12 per cent. of the whole,

and consists of a coarse brownish sand, the larger grains of which are more or less perfect examples of various forms of *Stacheia* and *Nodosinella*, the organisms constituting about 8 per cent. of the natural rock.

This coarse material, consisting of the fragments of *Stacheia* and *Nodosinella*, was tested for chitin, since the microscopic structure of the test has all the appearance of such. The chemical analysis, however, gave no evidence of the presence of chitin; and therefore it seems conclusive that the delicate areolate tissue observed in these fossils, though originally chitinous, has been chemically replaced by another substance. For this analysis I am indebted to Mr. W. Tate, F.C.S., of the Royal College of Science. Also, with a view of obtaining information regarding the nature of the intricate tissue of the test of *Stacheia*, staining was resorted to, for which purpose a specimen of *S. dispansa* was treated with a solution of methylene blue, and, after being washed and dried, cut for a microscopic section. Examined under a $\frac{1}{4}$ -inch objective the section evidenced staining throughout the cementing tissue, whilst sand-grains and sponge-spicules with other mineral substances worked into the test were left clear.

The finer material from the washings consists almost entirely of the tests of minute and obscurely septate specimens of *Haplophragmium*, the tests of which are constructed of ferruginous and quartzose particles. In the washings there are also occasional quartz-grains with well-rounded outlines.

Bed no. 6.—Blue sandy clay, with ferruginous partings, but with the latter character not so marked as in bed no. 5.

The washings consist of a somewhat fine sand, with ferruginous or limonitic particles, a few angular quartz-grains, some glauconite-grains, and a few bone-fragments. There are also some examples present of arenaceous Foraminifera, such as *Haplophragmium* and *Ammodiscus*, but they are not abundant.

Bed no. 9.—This bed is known as the "Wedmore Stone." Three distinct varieties were examined in thin sections. The specimens are compact limestones. One of these is of a yellowish-brown colour, and is composed chiefly of remains of molluscan shells; it is, however, much altered and partly recrystallized. A microscopical section of this specimen showed a globose-chambered foraminifer which has the outline of *Nodosaria radricula* (L.), and there were also many fragments of similar organisms, but with no specially recognizable characters.

The second specimen is of a bluish-grey colour, and, seen under the microscope, it appears to consist of finely crystal-

lized calcite; and included in the matrix are unaltered remains of lamellibranch shells, echinoderm plates, &c. No Foraminifera were noticed in this rock.

The third specimen is a hard shelly limestone, somewhat porous in texture, and composed almost entirely of the remains of molluscan shells. There are also some traces of Foraminifera, amongst which an elongate form of *Ammodiscus*, *Nodosaria radricula*, and *Marginulina glabra* (?) were noticed.

In the above descriptions of the contents of the various washings mention has been made of the occurrence of examples of the genus *Stacheia*, hitherto known only from the Carboniferous formation, but which is here present in large numbers, especially in bed no. 5. On the surface of the test of this arenaceous foraminifer sharply defined and geometrically shaped cavities may be seen, evidently formerly occupied by adventitious crystals. Also, when the cylindrical tests of *Nodosinella* are broken across, radially grouped cavities of prismatic form are not uncommonly seen, apparently having their origin in radial clusters of crystals. There can, therefore, scarcely be any question that this organism constructed its test in part of these small crystals. This is the more apparent when thin slices of the tests of *Nodosinella* and *Stacheia* are examined; the crystals which have left cavities are then seen to have been built into the minute structure of the test, quite unlike what one would expect to find if these crystals had been developed subsequently to fossilization. Professor Judd, who kindly examined these curious cavities in *Stacheia*, has suggested that there is great probability of the lost crystals having once been of the nature of small zeolites, such as phillipsite or christianite, a mineral which has lately been discovered in some abundance in the red clays and radiolarian oozes of the Central Pacific and Indian Oceans during the voyage of the 'Challenger,' and described by Drs. Murray and Renard*.

It has been pointed out by the above authors † that the principal reason to be adduced for the occurrence of these zeolitic crystals solely in deep-water deposits is that in the red clay the formation and deposition of the crystals are carried on free from the disturbing action of waves, tides, and currents, the stability of the waters containing the material in solution having thereby the opportunity to deposit the substance.

* Chall. Rep., "Deep-sea Deposits" (1891), pp. 400-411, pl. xxii. figs. 1-4; woodcut (p. 402), fig. 36.

† *Op. cit.* pp. 409, 410.

In reference to the supposed zeolitic crystals in the tests of the Rhætic Foraminifera, it may be presumed that they may have been formed in tranquil water and subsequently washed by tidal or other action within reach of the numerous Foraminifera, which utilized them in the construction of their tests.

Remarks on the Rhætic Foraminifera as compared with those from other Geological Horizons.

So far as I am aware no records have been published of Foraminifera having been found in strata of undoubted Rhætic age. They are not unknown in the older (Triassic) beds, notably from the Muschelkalk of Thuringia* ; and the younger strata of Liassic age contain Foraminifera in abundance.

In his paper on "The Range in Time of Foraminifera" † Professor T. Rupert Jones gives a table of genera, in which fifteen spaces are filled up in the Rhætic column. These genera are again recorded in the 'Catalogue of the Fossil Foraminifera of the British Museum' ‡. In the earlier of these works, however, Professor Rupert Jones has remarked § : "*Nubecularia* [the remark applying also to the other genera mentioned] is Rhætic in origin (taking the blue clay of Chellaston as of that age)." The Foraminifera of the clay supposed to have come from Chellaston were originally described as of Triassic age || ; they have, however, since been determined by Professor Rupert Jones to be neither of Triassic nor even Rhætic age, as was formerly supposed, but to have a true Liassic facies, and probably from Leicestershire. A comparative study of the Rhætic Microzoa shows that they bear some close resemblances to the fauna obtained from Upper Palæozoic strata. Several of the species of *Ammodiscus* found at Wedmore were already known from Permian and Carboniferous rocks, whilst many forms belonging to the genus *Stacheia* were previously known only from Carboniferous and Silurian ¶ strata.

* L. G. Bornemann, "Beiträge zur Kenntniss des Muschelkalks, insbesondere der Schichtenfolge und der Gesteine des Unteren Muschelkalks in Thüringen," Jahrb. k. preuss. geol. Landesanst. Berlin, 1885.

† Proc. Geol. Assoc. vol. ii. (1872) p. 175.

‡ 1882, pp. xiv & xv.

§ *Op. supra cit.* p. 178.

|| Jones and Parker, "On some Fossil Foraminifera from Chellaston, near Derby," Quart. Journ. Geol. Soc. vol. xvi. (1860) p. 452.

¶ The Silurian specimens under the name of *Psammosiphon*, Vine.

The affinity which these Rhætic Foraminifera bear towards the younger (Jurassic) strata is also marked, since many characteristic arenaceous forms present in the Rhætic clays have their analogues in the faunæ of the Swiss Jurassic (Argovian) beds of the zones of *Ammonites transversarius* and *A. bimammatus* (=Corallian) described by Dr. Rudolf Hæusler*.

As regards the foraminiferal facies of the Lias, a complete comparison cannot be made with the Rhætic fauna, for the former group of beds have yielded a large preponderance of the perforate Foraminifera, whilst the arenaceous types, which are so well represented in the Rhætic beds of Wedmore, are poorly represented in the Lias. In a sample of the Upper Lias (*Leda-ovum* beds) of Northampton, kindly given me by Mr. J. Harrison, of the Royal College of Science, I have, however, found examples of *Ammodiscus*, such as *A. anceps*, *A. centrifugus*, and *A. Robertsoni*, which brings the range of these forms from the Carboniferous up to the Lias strata.

The examination of the Rhætic clays of Wedmore has resulted in the discovery of certain species of *Stacheia* which are comparable with the hitherto obscure and imperfectly known fossils described by Mr. G. R. Vine in 1882 †, and for which he proposed the generic name of *Psammosiphon*, placing it in the class Vermes, and regarding the fossils as being related to the tubicolate Polychæta. Two species of *Psammosiphon* were described by Vine—*P. amplexus* and *P. elongatus*. The original specimens were obtained from Silurian strata of Wenlock age—the Coalbrookdale beds and the Tickwood beds. During the examination of similar fossils from the Rhætic such evidence was obtained as to fully establish them as true Rhizopods, and belonging to the well-known Carboniferous genus *Stacheia*. I have since found similar fossils in some numbers in the Silurian strata (Wenlockian) of the island of Gothland; for a sample of the clay I am indebted to Mr. F. A. Bather, M.A., F.G.S. For the opportunity of examining in thin sections some of the original specimens of *Psammosiphon amplexus* in the Vine collection at the Royal College of Science I wish to express my sincere thanks to Professor Judd, C.B., F.R.S.

In the elucidation of these somewhat problematic fossils much assistance has been afforded me by the loan of some rare

* "Monographie der Foraminiferen-Fauna der Schweizerischen *Transversarius*-Zone," Abhandl. der Schweiz. palæontogr. Gesellsch. vol. xvii. (1890).

† Quart. Journ. Geol. Soc. vol. xxxviii. (1882) pp. 390-392, pl. xv. fig. 8.

arenaceous types of recent Foraminifera from Mr. F. G. Pearcey, and I am indebted to Mr. John Smith, of Kilwinning, for allowing me a sight of his specimens of *Psammosiphon*, selected from the Silurian shale-washings, amongst which are individuals apparently referable to *P. elongatus* of Vine; but otherwise no figure has been given and only a short description*.

In Terquem and Berthelin's "Microscopical Study of the Clays of the Middle Lias of Essey-les-Nancy" † some fossils are figured and described which are precisely analogous in their external forms to certain Rhætic examples of *Stacheia*.

Concerning the bathymetrical aspect of the Rhætic Microzoa there is not very direct evidence, although what there is points in the main towards the shallow-water nature of the deposits. The genera which are most commonly represented in these beds are *Ammodiscus* and *Haplophragmium*, both of which are quite unrestricted as to depth, occurring in shallow water and down to depths of 3000 fathoms or more. Their small size and stunted appearance would lead one to suppose that these organisms had lived at great depths, although that feature might also be (and, in this case, probably is) occasioned by their having lived under unfavourable conditions, such as would result from a change to brackish water. The modern representatives of *Stacheia* are most probably the *Polytremata* and similar adherent forms with acervuline aggregates of chamberlets; although the latter are hyaline types, yet one series is possibly only a modification of the other. This relationship would indicate shallow-water conditions, since *Polytrema* is characteristic of such deposits.

The occurrence of bone- and teeth-fragments in nearly all of the various beds examined also points to the shallow-water origin of these deposits.

The presence of crystal-impressions in the tests of these fossils (presuming they were once occupied by a zeolite) is somewhat opposed to the idea of its being a shallow-water fauna, since crystals of phillipsite occur in the deeper deposits of the ocean.

I take this opportunity of expressing my best thanks for invaluable aid in many particulars to Professor T. Rupert Jones, F.R.S., to Professor J. W. Judd, C.B., F.R.S., to Mr. Fortescue W. Millett, F.R.M.S., and to Mr. C. Davies Sherborn, F.Z.S.

* Quart. Journ. Geol. Soc. vol. xxxviii. (1882) p. 390.

† Mém. Soc. Géol. France, sér. 2, vol. x. (1875), Mém. iii. p. 103, pl. ix. figs. 1 a-c, p. 105, figs. 3 a-f.

Description of the Foraminifera from Wedmore.

Family Lituolidæ.

Subfamily LITUOLINÆ.

REOPHAX, Montfort, 1808.

1. *Reophax difflugiformis*, Brady. (Pl. XI. fig. 1.)

Reophax difflugiformis, Brady, 1879, Quart. Journ. Micr. Sci. vol. xix. n. s. p. 51, pl. iv. figs. 3 a, b; id. 1884, Chall. Rep. vol. ix. p. 289, pl. xxx. figs. 1-5; Hæusler, 1885, Neues Jahrb. f. Min., Beil. Bd. iv. p. 9, pl. i. fig. 1; id. 1890, Abhandl. Schweiz. palæontogr. Gesellsch. vol. xvii. p. 26, pl. iii. figs. 1-3, pl. v. figs. 25-27.

This simple form is represented in the Rhætic washings by one example only, although many of the irregular flask-shaped aggregates common in the sand are probably the arenaceous tests of similar organisms. The specimen resembles very closely the figure given by Dr. Brady in the 'Challenger' Report in pl. xxx. fig. 5. *R. difflugiformis* has been lately described by Dr. Hæusler from the Upper Jurassic beds of Switzerland; and it is also known as a fossil from beds of post-tertiary age.

In recent soundings it is unrestricted as regards depth.

From the Rhætic of bed no. 2, Wedmore; one specimen.

HAPLOPHRAGMIUM, Reuss, 1860.

2. *Haplophragmium agglutinans* (d'Orbigny).

(Pl. XI. figs. 2 a, b.)

Spirolina agglutinans, d'Orbigny, 1846, Foram. Foss. Vienne, p. 137, pl. vii. figs. 10-12.

Spirolina simplex, Reuss, 1855, Sitzungsber. k. Ak. Wiss. Wien, vol. xviii. p. 232, pl. ii. fig. 30.

Haplophragmium rectum, Brady, 1876, Monogr. Carb. and Perm. Foram. (Pal. Soc.) p. 66, pl. viii. figs. 8, 9.

Haplophragmium agglutinans, Brady, 1884, Chall. Rep. vol. ix. p. 301, pl. xxxii. figs. 19-26; Sherborn and Chapman, 1889, Journ. Roy. Micr. Soc. p. 484, pl. xi. fig. 8; Hæusler, 1890, Abhandl. Schweiz. palæontogr. Gesellsch. vol. xvii. p. 26, pl. iii. figs. 32-36, pl. iv. figs. 5, 6, 18; Chapman, 1892, Journ. Roy. Micr. Soc. p. 324, pl. v. fig. 14.

The Rhætic specimens of *H. agglutinans* closely resemble the forms which Dr. Brady described from Carboniferous rocks, but differ in many slight details from those of later ages. The species is known from nearly all fossiliferous strata from the Carboniferous formation upwards.

Occurs in the Rhætic of Wedmore, in bed no. 2; rare.

3. *Haplophragmium rhæticum*, sp. n.
(Pl. XI. figs. 3, 4.)

Test free, compressed, consisting of an involute plano-spiral series of chambers, which in their later growth take on a linear arrangement. The sutures of the chambers are well-marked superficially, and the edge of the dorsal margin is constricted at the sutural points, thus giving the test an angulated appearance. Shell-texture coarsely arenaceous. Length of a perfect specimen $\frac{1}{8}$ inch (1.6 millim.); breadth of spiral portion $\frac{1}{30}$ inch (.85 millim.).

This species resembles *H. elegans** of the Gault in the angulate contour of the test; the morphological types of the two forms are, however, quite distinct, since the Rhætic species is strongly compressed on the umbilical axis and the segments are in the later growth disposed in a linear manner. The crozier-like shape of the test of *H. rhæticum* recalls the form of *H. agglutinans*; but in the latter the spiral series of chambers is evolute.

H. rhæticum is found in the Rhætic series at Wedmore, in bed no. 2, where it is rare, and in no. 6, very rare.

4. *Haplophragmium canariense* (d'Orbigny).
(Pl. XI. figs. 5 a, b.)

Nonionina canariensis, d'Orbigny, 1839, Foram. Canaries, p. 128, pl. ii. figs. 33, 34.

Lituola nautiloidea, var. *canariensis* (pars), Parker and Jones, 1865, Phil. Trans. vol. clv. p. 406, pl. xv. figs. 45 a, b.

Haplophragmium canariense, Brady, 1884, Chall. Rep. vol. ix. p. 310, pl. xxxv. figs. 1-5; Häusler, 1885, Neues Jahrb. f. Min., Beil. Bd. iv. p. 12, pl. i. figs. 17-20; id. 1890, Abhandl. Schweiz. palæontogr. Gesellsch. vol. xvii. p. 34, pl. iv. figs. 1-3.

The oldest fossil deposits in which the above species has hitherto occurred are those of the Middle Lias. Some of the specimens found in the Neocomian beds of Surrey, and described under the name of *Haplophragmium nonioninoides*, Reuss, are perhaps referable to the above species †. In the Rhætic specimen the sutural lines are rather obscure; otherwise it is comparable with typical examples.

H. canariense was found in the Rhætic of bed no. 6, at Wedmore. One specimen.

* Chapman, 1892, Journ. Roy. Micr. Soc. p. 322, pl. v. fig. 10.

† Chapman, Quart. Journ. Geol. Soc. vol. l. (1894) p. 695.

5. *Haplophragmium emaciatum*, Brady.

(Pl. XI. fig. 6.)

Haplophragmium emaciatum, Brady, 1884, Chall. Rep. vol. ix. p. 305, pl. xxxiii. figs. 26-28; Hæusler, 1890, Abhandl. Schweiz. palæontogr. Gesellsch. vol. xvii. p. 37, pl. iv. figs. 8-10.

Dr. Hæusler has found this species in the Upper Jurassic beds of Switzerland, and it has also occurred in the Lower Greensand of Guildford*. It is represented in recent soundings from the West Indies and the Arabian Sea, and is found at moderate depths.

One specimen of *H. emaciatum* was found in bed no. 2 of the Rhætic series at Wedmore.

6. *Haplophragmium neocomianum*, Chapman.

(Pl. XI. fig. 7.)

Haplophragmium neocomianum, Chapman, Quart. Journ. Geol. Soc. vol. 1. (1894) p. 695, pl. xxxiv. figs. 2 a, b.

In the Rhætic washings innumerable thin brown platy aggregates occur with more or less regular outlines. On rendering these transparent by immersion in Canada balsam or turpentine, their foraminiferal nature is easily recognized. The septation of the test is seen to be perfectly regular in many specimens, and the commencing involute spiral can also be made out. These obscure organisms differ in no essential character from the Neocomian specimens of the Lower Greensand in the neighbourhood of Dorking, and, like them, these Rhætic examples are always of a ferruginous-brown colour.

H. neocomianum occurs in the Rhætic clays of Wedmore, in bed no. 2, rare; no. 3, frequent; no. 4, very abundant; no. 5, very abundant; no. 6, frequent.

Subfamily TROCHAMMININÆ.

AMMODISCUS, Reuss, 1861.

7. *Ammodiscus incertus* (d'Orbigny).

(Pl. XI. figs. 8, 9.)

Operculina incerta, d'Orbigny, 1839, Foram. Cuba, p. 49, pl. vi. figs. 16, 17.

Orbis infimus, Strickland, 1848, Quart. Journ. Geol. Soc. vol. ii. p. 30, fig. a.

Involutina silicea, Terquem, 1862, Mém. Acad. Imp. Metz for 1861-1862, p. 450, pl. vi. fig. 11 (Deuxième Mém. Foram. du Lias).

* Chapman, Quart. Journ. Geol. Soc. vol. 1. (1894) p. 694.

- Involutina aspera*, Terquem, 1863, *ibid.* for 1862-1863, p. 221, pl. x. fig. 21 (Troisième Mém. Foram. du Lias).
- Cornuspira oolithica*, Schwager, 1867, in Waagen's Ueber die Zone des *Amm. Sowerbyi*, vol. i. pt. iii. p. 655, pl. xxxiv. (xi.) fig. 4.
- Trochammina incerta*, Parker, Jones, and Kirkby, 1869, *Ann. & Mag. Nat. Hist.* ser. 4, vol. iv. p. 388, pl. xiii. fig. 1.
- Cornuspira helvetica*, *C. eichbergenensis*, *C. elliptica*, &c., Kübler and Zwingli, 1870, *Foram. Schweiz. Jura*, pp. 13, 17, 24. Figures distributed in pls. ii., iii., and iv.
- Cornuspira granulosa*, *C. infraoolithica*, &c., Terquem, 1870, *Troisième Mém. Foram. du Syst. Oolithique*, pp. 242-244, pl. xxv. figs. 12-20.
- Trochammina incerta*, Brady, 1876, *Monogr. Carb. and Perm. Foram.* (Pal. Soc.), p. 71, pl. ii. figs. 10-14; Tate and Blake, 1876, *The Yorkshire Lias*, p. 452, pl. xvii. fig. 17; Häusler, 1883, *Neues Jahrb. f. Min. Bd. i.* p. 59, pl. iv. fig. 1.
- Ammodiscus incertus*, Brady, 1884, *Chall. Rep.* vol. ix. p. 330, pl. xxxviii. figs. 1-3; L. G. Bornemann, 1886, *Beiträge zur Kenntniss des Muschelkalks*, *Jahrb. k. preuss. geol. Landesanst.*, Berlin, p. 293, pl. xiii. figs. 3, 4; Häusler, 1890, *Abhandl. Schweiz. paläontogr. Gesellsch.* vol. xvii. p. 55, pl. ix. figs. 1-21; Crick and Sherborn, 1891, *Journ. Northampton Nat. Hist. Soc.* vol. vi. p. 209, fig. 1.

The above synonymy refers to the more important notices of *Ammodiscus incertus*, and relates chiefly to its occurrence in Palæozoic and Jurassic strata. The specimens of *A. incertus* from the Rhætic beds of Wedmore often show a tendency to depart from the ordinary plano-spiral and circular form, being more or less elliptical and irregularly coiled; in the latter character they closely approach *A. gordialis*. These features are not unusual with many of the Carboniferous and Permian examples recorded by Dr. H. B. Brady, and also in the Jurassic forms described by Dr. Häusler. In the Rhætic specimens the tests are composed of fine quartzose sand, and some of the fossils have a conspicuously opaque white appearance in the washings, whilst others, more obscure in their general external characters, are of a brown colour.

This species occurs commonly in many British Carboniferous limestones, in the Permian magnesian limestones of England, and in the Zechstein and Muschelkalk of Germany. It is also abundant in Jurassic strata, and is met with in nearly all later fossiliferous deposits.

Frequent in the Rhætic of Wedmore, bed no. 2.

8. *Ammodiscus anceps* (Brady). (Pl. XI. figs. 10 a, b.)

Trochammina anceps, Brady, 1876, *Monogr. of Carb. and Perm. Foram.* (Pal. Soc.) p. 76, pl. iii. figs. 8 a, b.

The characters of this species as given by Dr. H. B. Brady apply very nearly to the Rhætic specimens, and are as

follows:—"Test free, convoluted, discoidal, thin, consisting of a spuriously septate tube coiled in one plane. Septa marked externally by oblique slightly depressed lines. Diameter $\frac{1}{80}$ inch (.4 millim.)."

This species was regarded by Brady as a transitional form between *A. incertus* and the septate Trochamminæ of the type *T. inflata*. Since the arenaceous tube is not definitely septate, the species is here placed in the genus *Ammodiscus*. In the Rhætic specimens the peripheral edge of the test is somewhat sharper than that of the Carboniferous examples, and its diameter averages $\frac{1}{75}$ inch (0.34 millim.).

The occurrence of *A. anceps* in beds of Rhætic age is of exceptional interest, seeing that it was described by Dr. Brady from the Carboniferous rocks of England and Scotland, and was there very rarely met with. I have since found this form in the Upper Lias of Northampton.

Found in bed no. 2 of the Rhætic series at Wedmore, very common.

9. *Ammodiscus centrifugus* (Brady). (Pl. XI. fig. 11.)

Trochammina centrifuga, Brady, 1873, Mem. Geol. Survey Scotland, Expl. Sheet 23, p. 95; id. 1873 (in Young and Armstrong's Catal.), Trans. Geol. Soc. Glasgow, vol. iv. p. 271; id. 1876, Monogr. of Carb. and Perm. Foram. (Pal. Soc.) p. 74, pl. ii. figs. 15-20.

This form is probably only a variety of *A. incertus*, as was suggested by Dr. Brady, the only difference consisting in the straight extension of the last turn of the coiled shell. The Rhætic specimens have the surface of the test much wrinkled.

A. centrifugus was found in the Lower Carboniferous Limestone of England and Scotland, at which horizon it occurred rarely, and in the Upper Carboniferous Limestone of both countries frequently. One or two examples, probably referable to this form, have also occurred in washings of Upper Lias clay from Northampton.

This species occurs in the Rhætic series of Wedmore in bed no. 2, where it is rare.

10. *Ammodiscus milioloides* (Jones, Parker, and Kirkby). (Pl. XI. figs. 12, 13.)

Trochammina milioloides, J., P., & K., 1869, Ann. & Mag. Nat. Hist. ser. 4, vol. iv. p. 390, pl. xiii. figs. 9-14; Brady, 1876, Monogr. Carb. and Perm. Foram. (Pal. Soc.) p. 79, pl. iii. figs. 11-15.

This species was hitherto essentially Permian, found in the

Lower and Middle Magnesian Limestone of the North of England.

The specimens of *A. milioloides* from Wedmore are more compressed than those obtained from Permian deposits, but they agree in the general plan of growth. The Rhætic specimens are also much smaller than those of Permian age, measuring only $\frac{1}{45}$ inch (0.56 millim.) in length, whilst the latter are $\frac{1}{14}$ inch (1.75 millim.).

A. milioloides occurs in the Rhætic clay, bed no. 2, at Wedmore, and is common.

11. *Ammodiscus pusillus* (Geinitz).

(Pl. XI. fig. 14.)

Serpula pusilla, Geinitz, 1848, Verstein. Zechst. Roth. p. 6, pl. iii. figs. 3-6.

Foraminites serpuloides, King, 1848, Cat. Perm. Foss. Northumb. p. 6.

Serpula? *pusilla*, Jones, 1850, in King's Monogr. Perm. Fossils, p. 57, pl. vi. figs. 7-9, pl. xviii. figs. a-d.

Trochammina pusilla, Jones, Parker, and Kirkby, 1869, Ann. & Mag. Nat. Hist. ser. 4, vol. iv. p. 390, pl. xiii. figs. 4-6 &c.; Brady, 1876, Monogr. Carb. and Perm. Foram. (Pal. Soc.) p. 78, pl. iii. figs. 4, 5; Hæusler, 1882, Ann. & Mag. Nat. Hist. ser. 5, vol. x. p. 58, pl. iv. figs. 27-30; L. G. Bornemann, 1885, Jahrb. k. preuss. geol. Landesanst., Berlin, p. 293, pl. xiii. figs. 6, 7.

Ammodiscus pusillus, Hæusler, 1890, Abhandl. Schweiz. palæontogr. Gesellsch. vol. xvii. p. 60, pl. ix. figs. 39-43.

The Rhætic examples of the above species are both rare and very small; the test is finely arenaceous, as is the case with most of the specimens from the black Rhætic clay.

A. pusillus is a common form in the Permian (lower and middle Magnesian Limestone) of the north of England (associated with *A. milioloides*); it is also recorded from the Zechstein of Germany; also from Triassic rocks in Thuringia by L. G. Bornemann; and from the Upper Jurassic beds of Switzerland by Hæusler.

Found rarely in bed no. 2 of the Rhætic series at Wedmore.

12. *Ammodiscus Robertsoni* (Brady).

(Pl. XI. figs. 15, 16, 17 a, b.)

Trochammina Robertsoni, Brady, 1876, Monogr. Carb. and Perm. Foram. (Pal. Soc.) p. 80, pl. iii. figs. 6, 7.

One of the commoner forms in the washings of the black Rhætic clay of Wedmore is the elegant little species of *Ammodiscus* which Dr. Brady found in the Carboniferous shales of the west of Scotland. The finely arenaceous texture of the test of the Rhætic specimens exactly accords with the

original description of the type forms. I have also found this form in the Upper Lias clay of Northampton.

The species might easily be mistaken for a minute sandy Quinqueloculine form; but the tube is merely constricted at each turn by an infolding of the shell-wall, and is not truly septate.

Found in bed no. 2 at Wedmore, common.

13. *Ammodiscus auricula*, sp. n.
(Pl. XI. figs. 18 a, b.)

Test free, ear-shaped, greatly compressed, consisting of a coiled tube, which is spuriously septate at intervals. The test sometimes exhibits a central inflated kidney-shaped pseudo-chamber. The peripheral edge is usually thinner than the rest of the test, so that the margin is flange-like. Aperture a slit, situated vertically, on the lower edge of the termination of the compressed tube, at its junction with the previous whorl. Test arenaceous, thin, and delicate. Length about $\frac{1}{10}$ inch (0.63 millim.).

This form is not common in the Rhætic washings, but several characteristic examples were found. Its nearest representative is *A. Robertsoni*, but it differs from that species in the peculiar shape and the extreme compression of the test.

From the Rhætic, bed no. 2, Wedmore; frequent.

14. *Ammodiscus jurassicus*, Häusler.
(Pl. XI. fig. 19.)

Trochammmina jurassica, Häusler, 1882, Ann. & Mag. Nat. Hist. ser. 5, vol. x. p. 58, pl. iv. figs. 31-40; id. 1882, Neues Jahrb. f. Min. p. 59, pl. iv. fig. 4.

Ammodiscus jurassicus, Häusler, 1885, Neues Jahrb. f. Min., Beil. Bd. iv. p. 26, pl. iii. figs. 33, 34; id. 1890, Abhandl. Schweiz. palæontogr. Gesellsch. vol. xvii. p. 61, pl. ix. figs. 44-47.

This is not a common foraminifer in the Rhætic washings. Fairly typical examples were, however, met with at various horizons. Dr. Häusler records *A. jurassicus* from the Upper Jurassic beds of Switzerland, and he also notes it from the Lower Cretaceous.

This species was found in the Rhætic of Wedmore, in bed no. 2, rare; no. 5, frequent; no. 6, very rare.

15. *Ammodiscus fusiformis*, sp. n.
(Pl. XI. figs. 20 a, b.)

Test free, spindle-shaped, and sometimes curved; consisting of a tube sharply bent on itself at each end of the

longer axis, with the coil twisted through several planes during its growth, so that the test has a Quinqueloculine aspect. The tube forming the test is also constricted at various points between the two extremities. Texture of shell finely arenaceous. Aperture a circular orifice, formed by the open end of the tube; the aperture is angulated or margined in the specimen taken for figuring. Length $\frac{1}{52}$ inch (0.48 millim.).

This species is related to *A. Robertsoni* in the general Quinqueloculine plan of growth; but the cross section of the test of the latter species would show a considerably greater amount of lateral compression and breadth.

A. fusiformis was found in the Rhætic clay of bed no. 2, at Wedmore; common.

Subfamily *ENDOTHYRINÆ*.

NODOSINELLA, Brady, 1876.

General characters (after Brady, emended).—Test free, straight, arcuate, or crooked, never spiral; formed either of a tube constricted at intervals, or of a single series of segments variously combined. Test arenaceous, often smooth externally, imperforate, but sometimes having pustulate orifices at various points on the surface. Wall of test thick, with a labyrinthic structure. Aperture variable, simple or compound.

16. *Nodosinella wedmoriensis*, sp. n.

(Pl. XI. figs. 21–24.)

(?) *Psammosiphon elongatus*, Vine, 1882, Quart. Journ. Geol. Soc. vol. xxxviii. p. 390.

Test more or less cylindrical, tapering towards the ends, straight, arcuate, or sharply recurved; sometimes flattened or outspread at the distal end. The interior divided at intervals by partitions, forming a series of chambers; no indications of internal septation visible on the surface of the test. Texture finely arenaceous; the test of a brown colour; the outer surface smooth, but with evidences of foreign substances, such as the impressions of crystals which were used to build up the test. Wall of test thick and labyrinthic in structure. Length of longest specimen found $\frac{1}{4}$ inch (6.25 millim.), breadth $\frac{1}{10}$ inch (1.25 millim.).

A large number of this species were selected from the Rhætic washings. They invariably show the septation of the tube when cut through longitudinally, and it was owing

to this fact, and also to its peculiar form, that it was at first thought probable that we were dealing with some ancestral form of the recent *Aschemonella*. When the true nature of the labyrinthic test was worked out it was seen that the fossil form had characters in common with *Nodosinella*, a genus hitherto known through Dr. Brady's researches on the Carboniferous Foraminifera. The present species, *N. wedmorensis*, differs materially from the Carboniferous *N. cylindrica* * in the absence of external evidences of septation and in having a more irregular form, sometimes being even bent at right angles.

This species occurs in bed no. 3 of the Rhætic at Wedmore, very rare; bed no. 5, very common.

STACHEIA, Brady, 1876.

"Plaques des Rayonnés," &c., Terquem and Berthelin, 1875.

Psammosiphon, Vine, 1882.

General characters (after Brady, emended).—Test adherent or free; composed of numerous segments subdivided in their interior, or of an acervuline mass of chamberlets, sometimes arranged in layers, sometimes confused, or of a thick-walled test with acervuline or labyrinthic structure, and with the interior subdivided into numerous elongate sinuous cavities (the latter characters especially applying to the Rhætic representatives of the genus). Apertures simple, but irregular, terminal or scattered over the surface of the test. Texture subarenaceous, composed of fine sand, sometimes admixed with coarser material, and with a calcareous or chitinous cement; imperforate.

The above genus was proposed by Dr. H. B. Brady in 1876 to include some adherent subarenaceous Foraminifera which he had discovered in the Carboniferous Limestone formation of England and Scotland, and which had affinities morphologically pertaining to the genera *Polytrema*, *Tinoporos*, and other perforate types.

In his 'Monograph of the Carboniferous and Permian Foraminifera' Dr. Brady lays particular stress upon the fact that in the Carboniferous strata *Stacheia* is always parasitic (adherent); and such is undoubtedly the case with the specimens from that formation. In the Rhætic assemblage the tests are more often perfectly free in their mode of growth. The flat complanate or frondose form (*S. dispansa*) is by far

* Brady, 1876, Monogr. Carb. and Perm. Foram. (Pal. Soc.) p. 104, pl. vii. figs. 4-7.

the best represented species, in point of numbers, in the Rhætic washings; and this form appears to have flourished on the sea-bottom, spreading horizontally and growing so numerous as to make quite a separation band at frequent intervals in the clay deposits.

There are, however, a few examples of *Stacheia* from the Rhætic beds which were without doubt attached forms; and this feature is especially characteristic of *S. cuspidata* and *S. intermedia*.

It will also be seen from the reference given above that the genus is represented in the Lias by fossils which have been referred to parts of Echinodermata.

17. *Stacheia intermedia*, sp. n. (Pl. XI. fig. 25.)

Test normally attached or sometimes free, irregularly cylindrical, and often turned outwardly at one end, thus forming a base of attachment. Subdivided internally in an irregular manner; with a terminal aperture, and also some other orifices of an irregularly stellate outline opening out upon the surface of the test. Texture subarenaceous. Wall of test of considerable thickness and with a finely labyrinthic structure. Colour pale brown. Length about $\frac{1}{4}$ inch (6.25 millim.).

S. intermedia may be an irregularly cylindrical modification of the flat wild-growing form *S. dispansa*; but the apparently attached mode of growth of the former organism seems to justify its separation under a distinct specific name.

It occurs in bed no. 3 of the Rhætic at Wedmore, very rare; bed no. 5, frequent.

18. *Stacheia congesta*, Brady. (Pl. XII. figs. 1, 2.)

Stacheia congesta, Brady, 1876, Monogr. Carb. and Perm. Foram. (Pal. Soc.) p. 117, pl. ix. figs. 1-5.

Characters (after Brady, emended).—Test elongate, sub-cylindrical, rounded or fusiform; either adherent, clustering around foreign bodies, or free. Chambers very numerous, irregular in shape, closely packed, confused in arrangement; the boundary-walls of those composing the superficial layer sometimes indicated by the areolation of portions of the exterior of the test. Surface otherwise granular or nearly smooth. Apertures at the extremities of the fusiform varieties or disposed over the surface in an irregular manner. Length of the Rhætic specimens about $\frac{1}{10}$ inch (2.5 millim.).

Many examples from Wedmore are exactly comparable in

form with those figured by Dr. Brady from the Carboniferous Limestone of England and Scotland. The specimens from the latter formation are somewhat smaller than those from the Rhætic beds.

S. congesta occurs in bed no. 3 of the Rhætic series at Wedmore, common; bed no. 5, common.

19. *Stacheia triradiata*, sp. n. (Pl. XII. figs. 3-5.)

"*Asteracanthion*," Terquem and Berthelin, 1875, Mém. Soc. Géol. France, sér. 2, vol. x., Mém. no. 3, p. 103, pl. ix. figs. 1 a-c.

Test free, consisting of three somewhat short and irregularly cylindrical arms, radiating nearly at right angles to one another; surface smooth or finely granular and of a pale brown colour. Interior having an irregular central cavity; the tubular arms divided at intervals by transverse septa. Wall of test thick and with distinct labyrinthic structure; texture finely arenaceous. Each arm terminates in a small orifice, which leads back into a larger cavity. Average diameter of test $\frac{1}{8}$ inch (3.125 millim.).

Amongst the specimens of "*Psammosiphon*" in the Vine collection at the Royal College of Science there is one undoubted example of *Stacheia triradiata* collected from the Wenlock Shales, so that this form, as well as *S. amplexa*, ranges back into the Silurian strata.

S. triradiata was found at Wedmore in bed no. 5, frequent.

20. *Stacheia amplexa* (Vine). (Pl. XII. figs. 6, 7.)

Psammosiphon amplexus, Vine, 1882, Quart. Journ. Geol. Soc. vol. xxxviii. p. 391, pl. xv. fig. 8.

Test free or attached, in the latter case having a flattened base. Irregularly subspherical in form, with a warty surface, caused by the numerous papillose terminations to the tubular system of the interior. Interior traversed by cylindrical tubes, which are disposed in a sinuous manner. Wall of test thick and with labyrinthic structure. The Rhætic specimens are of a pale brown colour, and the shell-texture is subarenaceous, consisting of a fine sand, mixed with coarser material and crystalline aggregates, cemented together by material which was formerly chitinous. Length about $\frac{1}{5}$ inch (5 millim.).

S. amplexa has been recorded by Vine under the name of *Psammosiphon amplexus* from the Wenlock Shales (the Coalbrookdale and the Tickwood beds); and the same author notes it also from the Hairmyres shales of Carboniferous age

in material collected by Mr. John Young, of the Hunterian Museum, Glasgow. It also occurs in the Silurian clay of the island of Gothland. The arenaceous material constituting the test of the Silurian specimens, unlike that of Rhætic examples, is cemented by calcareous matter.

The tests of *S. amplexa* from Wedmore have been largely constructed of the crystalline aggregates to which reference has previously been made, and of which only moulds now remain to testify to their former existence. These crystalline bodies were also used in the construction of the tests of the other large subarenaceous species from the Rhætic washings, belonging to the genera *Nodosinella* and *Stacheia*; but they occur in *S. amplexa* in particular abundance.

S. amplexa was found in the Rhætic series at Wedmore, in bed no. 3, frequent; no. 5, common.

21. *Stacheia dispansa*, sp. n. (Pl. XII. fig. 8.)

Test free, compressed, and generally irregular in outline; some more or less perfect examples, however, have a leaf-like form with deeply incised margins. Interior traversed by irregular sinuous cavities, which are at intervals transversely divided. The positions of the apertures in this compressed form are—(1) around the margin, appearing as an interrupted slit communicating directly with the interior, and constituting a plane of weakness through the median plane of the test; (2) disposed over the surfaces of the test as a series of irregularly circular orifices, which are often siphonate, that is, borne on the end of a short tube projecting at right angles from the general surface, the latter being in some cases modified by lateral compression, thus giving the orifice an elliptical or slit-like form. Wall of test very thick and with a finely labyrinthic structure. Length of one of the more perfect specimens $\frac{1}{2}$ inch (12.5 millim.), breadth $\frac{1}{4}$ inch (6.25 millim.), thickness $\frac{1}{25}$ inch (1 millim.).

The fragmentary remains of this species constitute a large proportion of the washed material from one stratum of the Rhætic series at Wedmore. *S. dispansa* does not seem to have ever been attached to any foreign bodies like some of its congeners, but to have lived on the surface of the deposit forming at that time. One of the specimens found has a very definite outline, taking a form such as one would imagine to arise from the extrusion of the sarcode in an amoebiform or lobulate manner. The majority of the specimens of *S. dispansa* have, however, no very distinct shape, and are always more or less fragmentary, since the mere separation of the

clay from the coarser particles, although very carefully conducted, is sufficient to break up the excessively friable tests.

Moulds of crystals observed in the other subarenaceous forms of the Rhætic Foraminifera are also present in the test of *S. dispansa*, but they do not seem to have been so largely utilized in this form.

The test of this species, as previously noted, has a tendency to split horizontally along the median plane. This is owing to the restriction of the internal cavities exactly to the median portion of the test and to the marginal series of apertures, with which the chambers communicate.

The above species was found in bed no. 3 of the Rhætic series at Wedmore, frequent; bed no. 5, very common.

22. *Stacheia cuspidata*, sp. n. (Pl. XII. figs. 9, 10.)

"Plaques des Rayonnés," Terquem and Berthelin, 1875, Mém. Soc. Géol. France, sér. 2, vol. x., Mém. no. 3, p. 105, pl. ix. figs. 3 a-f.

Test normally adherent, compressed, and irregularly discoid, but having the peripheral edge indented or cuspidate. The lower, attached surface slightly concave, and the shell-wall of that surface thin, so that the figure of the central stellate cavity can be seen through the shell. Test somewhat coarsely arenaceous, and the wall moderately thick and having a finely labyrinthic structure. The apertures are arranged almost as in *S. dispansa*, some orifices appearing on the peripheral margin, whilst others, curiously shaped and of a cuspid outline, are seen on the superior face of the test; in some cases these are lengthened out to an extraordinary degree. Diameter of test $\frac{1}{5}$ inch (2·8 millim.), thickness of test $\frac{1}{10}$ inch (0·63 millim.), more or less.

This is a discoidal variety closely allied to *S. dispansa*. It is fairly constant in its essential characters, and, unlike *S. dispansa*, always shows the adherent modification of the inferior surface, although no specimens were found actually attached to foreign objects.

The forms figured by Terquem and Berthelin from the Lias, and referred to above, are very variable, but exhibit the essential features of the species.

S. cuspidata occurs in bed no. 5 of the Rhætic series at Wedmore, frequent.

Family Textulariidae.

Subfamily BULIMININÆ.

BULIMINA, d'Orbigny, 1826.

23. *Bulimina pyrula*, d'Orbigny. (Pl. XII. fig. 11.)

Bulimina pyrula, d'Orbigny, 1846, *Foram. Foss. Vien.* p. 184, pl. xi. figs. 9, 10; Brady, 1884, *Chall. Rep.* vol. ix. p. 399, pl. l. figs. 7-10.

This species has hitherto been known from Liassic strata, and it occurs commonly in nearly all Tertiary beds.

The Rhætic specimen undoubtedly belongs to this type, which is perhaps the most rudimentary form of the genus. The test of the example found is finely arenaceous.

One specimen, from bed no. 2, at Wedmore.

Family Lagenidae.

Subfamily LAGENINÆ.

NODOSARIA, Lamarck, 1816.

24. *Nodosaria radricula* (L.). (Pl. XII. fig. 12.)

Nautilus radricula, Linné, 1767, *Syst. Nat.* 12th ed. vol. ii. p. 1164. no. 285; Montagu, 1803, *Test. Brit.* p. 197, pl. vi. fig. 4.

Nodosaria Geinitzi, Reuss, 1854, *Jahresb. Wetterauer Gesellsch.* vol. for 1851-1853, p. 77, fig. 12; Richter, 1855, *Zeitschr. deutsch. geol. Gesellsch.* vol. vii. p. 532, pl. xxvi. fig. 26.

Nodosaria radricula, Parker and Jones, 1859, *Ann. & Mag. Nat. Hist.* ser. 3, vol. iii. p. 476; id. *ibid.* vol. iv. p. 344; id. *ibid.* 1863, vol. xii. p. 209.

Nodosaria Geinitzi, Reuss, 1861, in Geinitz's *Dyas*, Heft i. p. 121, pl. xx. fig. 28.

Nodosaria Kingi, id. *ibid.* p. 121, pl. xx. fig. 29.

Nodosaria Kirkbyi, Richter, *ibid.* p. 121, pl. xx. fig. 30.

Nodosaria Jonesi, id. *ibid.* p. 121, pl. xx. fig. 31.

Nodosaria radricula, Jones and Parker, 1860, *Quart. Journ. Geol. Soc.* vol. xvi. p. 453, figs. 1-5; Brady, 1867, *Proc. Somerset Arch. and Nat. Hist. Soc.* vol. xiii. p. 106, pl. i. fig. 4; Tate and Blake, 1876, *Yorkshire Lias*, p. 456, pl. xviii. fig. 17; Brady, 1876, *Monogr. of Carb. and Perm. Foram. (Pal. Soc.)* p. 124, pl. x. figs. 6-16; id. 1884, *Chall. Rep.* vol. ix. p. 495, pl. lxi. figs. 28-31; Sherborn and Chapman, 1886, *Journ. Roy. Micr. Soc.* p. 746, pl. xiv. fig. 24; Häusler, 1887, *Neues Jahrb. f. Min.* vol. i. p. 179, pl. v. figs. 40, 45, 48, 49; id. 1890, *Abhandl. Schweiz. palæontogr. Gesellsch.* vol. xvii. p. 92, pl. xiii. figs. 31-33, 39-60, pl. xiv. figs. 1, 3-5, 16.

This species, which is so well distributed through the Secondary and Tertiary formations, is not known from strata earlier than the Permian. It is one of the few hyaline Foraminifera which were noticed in thin sections of the "Wedmore

Stone." In some parts the test exhibits the tubulation of the calcareous wall characteristic of the group.

Three specimens of *Nodosaria radricula* were seen in the limestone (bed no. 9) of Wedmore.

MARGINULINA, d'Orbigny, 1826.

25. *Marginulina glabra* (?), d'Orbigny.

(Pl. XII. fig. 13.)

Marginulina glabra, d'Orbigny, 1826, Ann. Sci. Nat. vol. vii. p. 259, no. 6, Modèle, no. 55; Parker, Jones, and Brady, 1865, Ann. & Mag. Nat. Hist. ser. 3, vol. xvi. p. 27, pl. i. fig. 36; Brady, 1867, Proc. Somerset Arch. and Nat. Hist. Soc. vol. xiii. p. 109, pl. ii. fig. 22; Häusler, 1890, Abhandl. Schweiz. palæontogr. Gesellsch. vol. xvii. p. 106, pl. xiv. figs. 35-40, 42, 43.

The above species has been noticed from various strata of Secondary age. There is not much doubt that the Wedmore specimen is referable to the same type, although it is not safe to speak with certainty, since we have only the vertical section of the test in the thin rock-slice.

This specimen was found in the porous-textured rock, and the test has been apparently dissolved away in places, leaving a cavity of the exact outline of the fossil; and into this space numerous minute scalenohedra of calcite project from each wall. Other parts of the test show tubulation of the calcareous shell.

One example from the limestone of bed no. 9 at Wedmore.

Family Rotaliidæ.

Subfamily ROTALIINÆ.

TRUNCATULINA, d'Orbigny, 1826.

26. *Truncatulina stelligera*, sp. n.

(Pl. XII. figs. 14 a, b.)

Superior face flat, with three whorls, the initial chamber spherical and prominent; inferior face strongly convex. Surface of test distinctly punctate. The convex face has raised lines of shell-substance radiating from the umbilicus; the rays are thickest in the middle and taper towards the ends. Peripheral edge rounded. Diameter of test $\frac{1}{50}$ inch (0.5 millim.), height $\frac{1}{20}$ inch (0.21 millim.).

The genus *Truncatulina* is represented in strata as old as the Carboniferous Limestone. The above species differs from any form previously described chiefly in the sutural ornamentation of the inferior face, and which resembles that seen

in *Nonionina stelligera*, d'Orbigny. *T. stelligera* is the only example amongst the hyaline Foraminifera which was found in the washings of the Wedmore clays.

One specimen from the Rhætic of bed no. 2 at Wedmore.

EXPLANATION OF THE PLATES.

PLATE XI.

- Fig. 1. *Reophax difflugiformis*, Brady. $\times 33$.
 Fig. 2. *Haplophragmium agglutinans* (d'Orb.). *a*, lateral aspect; *b*, peripheral aspect. $\times 40$.
 Fig. 3. *Haplophragmium rhæticum*, sp. n. Lateral aspect. $\times 20$.
 Fig. 4. Ditto. Ditto. $\times 33$.
 Fig. 5. *Haplophragmium canariense* (d'Orb.). *a*, lateral aspect; *b*, peripheral aspect. $\times 13$.
 Fig. 6. *Haplophragmium emaciatum*, Brady. Lateral aspect. $\times 33$.
 Fig. 7. *Haplophragmium neocomianum*, Chapman. Lateral aspect. $\times 13$.
 Fig. 8. *Ammodiscus incertus* (d'Orb.). Lateral aspect. $\times 33$.
 Fig. 9. *Ammodiscus incertus* (d'Orb.), near *A. gordialis* (Parker and Jones). Lateral aspect. $\times 33$.
 Fig. 10. *Ammodiscus anceps* (Brady). *a*, lateral aspect; *b*, peripheral aspect. $\times 40$.
 Fig. 11. *Ammodiscus centrifugus* (Brady). Lateral aspect. $\times 40$.
 Fig. 12. *Ammodiscus milioloides* (Jones, Parker, and Kirkby). Lateral aspect. $\times 33$.
 Fig. 13. Ditto. Distorted specimen. $\times 33$.
 Fig. 14. *Ammodiscus pusillus* (Geinitz). Lateral aspect. $\times 33$.
 Fig. 15. *Ammodiscus Robertsoni* (Brady). Lateral aspect. $\times 40$.
 Fig. 16. Ditto. Another specimen; lateral aspect. $\times 33$.
 Fig. 17. Ditto. Compressed variety: *a*, lateral aspect; *b*, peripheral aspect. $\times 33$.
 Fig. 18. *Ammodiscus auricula*, sp. n. *a*, lateral aspect; *b*, peripheral aspect. $\times 33$.
 Fig. 19. *Ammodiscus jurassicus*, Hæusler. Lateral aspect. $\times 27$.
 Fig. 20. *Ammodiscus fusiformis*, sp. n. *a*, lateral aspect; *b*, oral aspect. $\times 33$.
 Fig. 21. *Nodosinella wedmoriensis*, sp. n. $\times 8$.
 Fig. 22. Ditto. Test laid open longitudinally, showing the septate interior of the test and thickness of the shell-wall. $\times 7$.
 Fig. 23. Ditto. An example with an outspread termination. $\times 8$.
 Fig. 24. Ditto. Curved specimen, showing crystal impressions at one end. $\times 8$.
 Fig. 25. *Stacheia intermedia*, sp. n. $\times 7$.

PLATE XII.

- Fig. 1. *Stacheia congesta*, Brady. Typical form. $\times 10$.
 Fig. 2. Ditto. An example similar to one from the Carboniferous Limestone. $\times 8$.
 Fig. 3. *Stacheia triradiata*, sp. n. $\times 10$.
 Fig. 4. Ditto. A horizontal section of the test, showing the central cavity and constricted apertures. $\times 13$.
 Fig. 5. Ditto. A section of the test, showing the areolate character of the cementing tissue of the shell-wall. $\times 200$.

- Fig. 6. *Stacheia amplexa* (Vine). $\times 5$.
 Fig. 7. Ditto. Test broken open, showing the impressions of crystals once included in the shell-structure. $\times 7$.
 Fig. 8. *Stacheia dispansa*, sp. n. A nearly perfect example, showing the sinuous outline of the platy test. $\times 3$.
 Fig. 9. *Stacheia cuspidata*, sp. n. *a*, superior aspect; *b*, inferior aspect. $\times 10$.
 Fig. 10. Ditto. An example with an elongate aperture on the upper surface. $\times 7$.
 Fig. 11. *Bulimina pyrula*, d'Orbigny. $\times 33$.
 Fig. 12. *Nodosaria radricula* (L.). A longitudinal section in the "Wedmore Stone." $\times 20$.
 Fig. 13. *Marginulina glabra* (?), d'Orbigny. A longitudinal section in the "Wedmore Stone." $\times 10$.
 Fig. 14. *Truncatulina stelligera*, sp. n. *a*, superior aspect; *b*, inferior aspect. $\times 33$.

XLV.—On the Geometridæ, Pyralidæ, and allied Families of *Heterocera* of the Lesser Antilles. By G. F. HAMPSON, B.A., F.E.S.

THE following paper on the Uraniidæ, Geometridæ, Thyrididæ, Pyralidæ, and Sesiidæ collected by Mr. H. H. Smith in the islands of Grenada, St. Vincent, and the Grenadines for the West-India Exploration Committee of the Royal Society and British Association is a continuation of the series of papers already published on the Coleoptera, parasitic Hymenoptera, Formicidæ, Odonata, and other groups.

The Geometridæ are represented by very few species in the Lesser Antilles compared with the large numbers that exist in other parts of the Neotropical Region both north and south of the isthmus; and almost all the species are identical with those found on the mainland.

The Pyralidæ are represented by a much greater diversity of species; but these, as in other parts of the world, are very wide-ranging, most of the species being also found in Brazil and Venezuela, some being identical with forms found in the United States, whilst others range down to Chili, others again being spread throughout nearly the whole tropical zone; whilst, even of the species described as new, several are represented in the British Museum or other collections by specimens from continental localities.

Uraniidæ.

Psamathia obliteraria, Wlk. xxiii. 845.

St. Vincent, windward side.

Geometridæ.

BOARMIINÆ.

Nepheloleuca politia, Cram. Pap. Exot. ii. 65.

St. Vincent, windward side.

Hyperythra decrepitaria, Hübn. Zutr. ii. 29, 186, figs. 371, 372.

St. Vincent: windward side and leeward side, Mount Gay, St. George's.

Macaria everiata, Guen. Phal. ii. 80.

Grenada: windward side, Balthazar; leeward side, Mount Gay Estate.

Oxydia vesulia, Cram. Pap. Exot. iii. 79, pl. ccxl. B, C.

Grenada: leeward side, Grand Etang Road.

Dilinea vulneraria, Hübn. Zutr. figs. 319, 320.

Grenada.

Apicia subsinuosa, sp. n.

♀. Olive-brown; vertex of head greyish. Fore wing irrorated with ochreous, most thickly on medial costal area; ante- and postmedial olive lines, the former sharply angled on median nervure, the latter very highly angled below costa and slightly excurved from thence to inner margin; a dark discocellular speck, with an oblique olive striga from costa above it. Hind wing with curved olive medial line. Under-side ochreous yellow, irrorated with brown; an indistinct curved postmedial line, the area beyond it slightly suffused with rufous and grey.

Hab. Grenada: leeward side, Mount Gay Estate. *Exp.* 28 millim.

Azelina denticulata, Butl. Ann. & Mag. Nat. Hist. 1881, ii. p. 42.

Grenada: windward side, Balthazar. St. Vincent.

Azelina hædularia, Guen. Phal. i. 158.

St. Vincent, windward side.

LARENTIINÆ.

Scotosia stellata, Guen. Phal. ii. 443.

Grenada : windward side, Balthazar. St. Vincent : windward side.

Cambogia obada, Druce, Biol. Centr.-Am., Het. ii. p. 112, pl. lii. figs. 1, 2.

St. Vincent, windward side.

ACIDALIINÆ.

Craspedia umbilicata, Guen. Phal. i. 504.

Grenada : windward side, Balthazar. Grenadines ; Union Isle.

Craspedia defixaria, Wlk. xxii. 731.

Grenada : windward side, Balthazar ; leeward side, Mount Gay Estate. St. Vincent.

Craspedia figurinata, Guen. Phal. i. 473.

Grenada : windward side, Balthazar ; leeward side, Mount Gay Estate. St. Vincent ; windward side.

Acidalia verrucifera, sp. n.

♂. Antennæ ciliated ; hind tibiæ slender, curved and without spurs. Fore wing with the membrane of inner area distorted and ridged, containing on underside a tuft of long hair.

Pale ochreous. Fore wing with the costa pinkish at base ; both wings with traces of discocellular specks and sinuous postmedial line.

Hab. Grenada : windward side, Balthazar. *Exp.* 12 millim.

Rhodostrophia botydata, Wlk. xxii. 727.

Grenada : windward side, Balthazar.

Rhodostrophia rubricosta, sp. n.

Antennæ of male with fasciculate cilia.

White ; head crimson, with some white between base of antennæ ; abdomen with a pair of black specks on basal segment. Fore wing with the costa crimson, with four dentate marks at origin of the antemedial, medial, postmedial,

and submarginal lines, which on both wings are pale rufous, sinuous, and with prominent dark specks on the veins; a prominent marginal series of dark specks.

Hab. Grenada: windward side, Balthazar. St. Vincent.
Exp. 18 millim.

Rhodostrophia pyraustaria, Butl. Trans. Ent. Soc. 1881,
p. 336.

St. Vincent, windward side.

Rhodostrophia phorcaria, Guen. Phal. i. 470.

Grenada: leeward side, Mount Gay Estate. St. Vincent,
windward side.

Rhodostrophia rubripictata, sp. n.

♀. Purplish crimson, some yellow on metathorax and abdomen. Fore wing with broad yellow medial band not reaching the costa, and with sinuous edges, followed by a crimson band, broad beyond the cell; the outer area yellow, with conjoined crimson patches on apical half and a small patch on inner margin. Hind wing similar; the yellow areas broader; the postmedial sinuous crimson band narrow, and with crimson patches beyond it at middle only.

Hab. Grenada: windward side, Balthazar. St. Vincent.
Exp. 16–18 millim.

Somatina terminata, Guen. Phal. i. 483.

Grenada: windward side, Balthazar; leeward side, Mount Gay Estate. St. Vincent, windward side.

GEOMETRINÆ.

Geometra frondaria, Guen. Phal. i. 376.

Grenada: windward side, Balthazar; leeward side, Mount Gay Estate.

Eucloris ocellata, Stoll, Cram. Pap. Exot. v. p. 156, pl. xxxiv.
fig. 9.

A form with the discocellular spot of each wing reduced to a speck and the projections of the marginal band much reduced.

Grenada: windward side, Balthazar. St. Vincent, windward side.

Nemoria glauciptera, sp. n.

Grey; frons, antennæ, and fore legs pinkish brown; vertex of head white. Fore wing with the costa ochreous, waved white antemedial and postmedial lines defined by green. Hind wing with discocellular line; a waved white postmedial line, defined by green and produced between veins 3 and 4: both wings with fine marginal white line; the cilia grey.

Hab. Grenada: leeward side, Mount Gay Estate. St. Vincent, windward side. *Exp.* ♂ 16, ♀ 18 millim.

Thyrididæ.

Rhodoneura myrsusalis, Wlk. xix. 892.

Grenada: windward side, Balthazar, Chantilly Estate. St. Vincent.

Pyralidæ.

PYRAUSTINÆ.

Genus **NEUROPHYSETA**, nov.

Type *N. clymenalis*, Wlk.

Palpi with the second joint porrect, extending about twice the length of head, the third upturned, long, and acuminate; maxillary palpi short and filiform; frons rounded; antennæ of male thickened and flattened by appressed serrations; tibiæ with the spurs long. Fore wing with veins 4 and 5 from angle of cell; 6 present; 7 and 10 free. Hind wing with vein 3 from before angle of cell; 4 and 5 from angle; 6 and 7 from upper angle; 7 anastomosing with 8.

Neurophysetis clymenalis, Wlk. xvii. 459.

St. Vincent: windward side, Kingstown.

Sufetula diminutalis, Wlk. xxxiv. 1315.

St. Vincent, windward side.

γ *Homophysa falcatalis*, sp. n.

♂. Fore wing with slight costal fold fringed with hair on upperside, the apex produced and highly falcate.

Fulvous yellow. Fore wing with indistinct dark dentate subbasal line, oblique towards inner margin; a dark medial line with pale inner edge, slightly sinuous and angled on vein 2; a dark discocellular spot; a dark-edged, white,

minutely crenulate postmedial line excurved from costa to vein 2; a marginal series of minute black and white specks. Hind wing paler, with indistinct curved postmedial line; some marginal black specks usually present towards apex.

Hab. Grenada: windward side, Balthazar; leeward side, Mount Gay Estate. St. Vincent, windward side. *Exp.* 18-22 millim.

Homophysa leucostictalis, sp. n.

♀. Head white; thorax and abdomen fulvous yellow. Fore wing with the basal area golden yellow, the outer area fulvous yellow; a fine white sinuous medial line; a similar postmedial line excurved from costa to vein 2; a marginal series of white and black specks, somewhat irregular in size and interrupted at middle. Hind wing pale; the outer area fulvous at middle, crossed by a fine white postmedial line and with some white specks on margin.

Hab. Grenada: windward side, Balthazar. St. Vincent: windward side, Kingstown. *Exp.* 16 millim.

Zinckenia perspectalis, Hübn. Pyr. fig. 101.

Grenada: windward side, Balthazar; leeward side, Mount Gay Estate. St. Vincent, windward side.

Pycnarmon levinia, Cram. Pap. Exot. iv. 131, pl. ccclvii. K.

Grenada: windward side, Balthazar.

Haritala bipunctalis, sp. n.

Bright orange; palpi with black bands at base and extremity of second joint; fore tibiæ banded with black; abdomen with a black spot on terminal segment. Fore wing with black spot at base of costa; a slightly curved antemedial fuscous line, black towards costa; a discocellular lunule; a postmedial sinuous line, oblique from costa to vein 2, then retracted to below angle of cell. Hind wing with discocellular spot; a slightly sinuous postmedial line, oblique from costa to vein 2, then retracted to below angle of cell, and terminating near anal angle: both wings with fine black line at base of cilia.

Hab. Grenada: leeward side, Mount Gay Estate. Espiritu Santo, Brazil. *Exp.* 28 millim.

Haritala fuscicostalis, sp. n.

♀. Orange; palpi black, white at base; frons and shoulders fuscous. Fore wing with the basal half of costal

area fuscous; traces of an antemedial line; a black spot in cell; both wings with larger discocellular spot; a post-medial line nearly straight from costa to vein 4, then curved and retracted to below angle of cell.

Hab. Grenada: leeward side, Mount Gay Estate. *Exp.* 24 millim.

Haritala xanthozonalis, sp. n.

Antennæ long, thickened and flattened in male; fore wing with the apex rounded; male with a ridge of long curved scales below cell on underside and fovea on upperside. Bright fuscous grey; vertex of head, patagia, sides of abdomen, and, in female, a patch on dorsum, yellow. Fore wing with an orange subbasal oblique band from cell to inner margin; an antemedial band from below costa to inner margin; in female a spot at lower angle of cell; a postmedial band sharply angled at vein 3. Hind wing with the basal half orange, with an antemedial fuscous band from cell to inner margin; the outer half fuscous.

Hab. Grenada: windward side, Granville. *Exp.* 18 millim.

Haritala foviferalis, sp. n. = ~~1000~~

Antennæ of male thickened and flattened; a large hyaline fovea in end of cell of fore wing and an elongate hyaline depression in cell of hind wing.

♂. Yellowish fuscous; palpi black, white at base; abdomen ringed with fuscous. Fore wing with dark sinuous antemedial line; a postmedial sinuous line bent inwards to the fovea, then outwards and very highly crenulate between veins 5 and 2, then retracted to below angle of cell. Hind wing with similar medial line: both wings with dark marginal line and line through the cilia.

Hab. Grenada: windward side, La Force Estate. *Exp.* 20 millim.

Sylepta elevata, Fabr. Ent. Syst. no. 325.

Grenada: windward side, Balthazar. St. Vincent, windward side.

Sylepta campalis, Guen. Delt. et Pyr. p. 344.

Grenada: windward side, Balthazar; leeward side, Mount Gay Estate. St. Vincent.

Sylepta penumbralis, Grote, Can. Ent. ix. p. 106.

Grenada: windward side, Balthazar. St. Vincent, windward side.

Sylepta anormalis, Guen. Delt. et Pyr. p. 352.

Grenada: windward side, Balthazar; leeward side, Mount Gay Estate. St. Vincent, windward side.

Sylepta matutinalis, Guen. Delt. et Pyr. p. 195.

St. Vincent, windward side.

♂ *Samea contortilinealis*, sp. n.

♀. Head, thorax, and abdomen black-brown, banded with white. Fore wing brown, suffused with black; an irregular white subbasal band, traversed by a black line and emitting a tooth below the cell; a white spot in cell; a medial white band, expanding at middle, and with large black annulus on it; a postmedial triangular white patch extending from costa to vein 2, and traversed by a curved black line; a white speck on costa before apex and interrupted marginal line. Hind wing brown, suffused with black; a broad irregular subbasal white band; a broad postmedial white band, traversed by a black line, which is nearly straight from costa to vein 2, then retracted at an acute angle to lower angle of cell, and sinuous to inner margin; an interrupted marginal white line: both wings with the outer margin excised below apex.

Hab. Grenada: leeward side, Mount Gay Estate. *Exp.* 14 millim.

Samea ecclesialis, Guen. Delt. et Pyr. p. 194, pl. vi. fig. 7.

Grenada: windward side, Balthazar; leeward side, Mount Gay Estate. St. Vincent, windward side.

Hedylepta apygalis, Guen. Delt. et Pyr. p. 229.

Grenada: windward side, Balthazar.

Hedylepta stenialis, Guen. Delt. et Pyr. p. 231.

Grenada: windward side, Balthazar. St. Vincent, windward side.

Hedylepta ebulealis, Guen. Delt. et Pyr. p. 351.

Grenada: windward side, Balthazar.

Hedylepta inguinalis, Guen. Delt. et Pyr. p. 346.

St. Vincent.

Hedylepta vulgaris, Guen. Delt. et Pyr. p. 202, pl. vi. fig. 8.

Grenada : windward side, Balthazar ; leeward side, Mount Gay Estate. St. Vincent, windward side.

Hedylepta zoilusalis, Wlk. xviii. 603.

Grenada : windward side, Balthazar ; leeward side, Mount Gay Estate. St. Vincent, windward side.

Hedylepta amissalis, Guen. Delt. et Pyr. p. 351.

St. Vincent, windward side.

Syngamia florella, Cram. Pap. Exot. iv. 114, pl. cccxlviii. L.

Grenada : windward side, Balthazar ; leeward side, Mount Gay Estate. St. Vincent, windward side.

Syngamia hæmorrhoidalis, Guen. Delt. et Pyr. p. 201.

Grenada : windward side, Balthazar ; leeward side, Mount Gay Estate.

Syngamia violescentalis, sp. n.

♀. Dark purplish grey ; wings irrorated with bright scales ; a nearly straight medial rufous line and curved post-medial line. Hind wing with nearly straight medial line and obliquely curved postmedial line : both wings with the cilia pure white, with a dark line at base.

Hab. Grenada : windward side, Balthazar. *Exp.* 10 millim.

Syngamia tytiusalis, Wlk. xviii. 605.

Grenada : windward side, Balthazar ; leeward side, Mount Gay Estate. St. Vincent, windward side.

Syngamia squamosalis, Wllngrn. Eug. Resa, p. 382.

Grenada : windward side, Balthazar.

Marasmia cochrusalis, Wlk. xix. 959.

Grenada : windward side, Balthazar.

Ercta hemialis, Guen. Delt. et Pyr. p. 248.

Grenada : windward side, Balthazar ; leeward side, Mount Gay Estate.

Pagyda traducalis, Zell. Lep. Caffr. p. 54.

Grenada : leeward side, Mount Gay Estate. St. Vincent.

Ann. & Mag. N. Hist. Ser. 6. Vol. xvi.

24

Pseudanaltes dryalis, Wlk. xviii. 573.

Grenada : windward side, Balthazar ; leeward side, Mount Gay Estate.

Eulepte concordalis, Hübn. Samml. exot. Schmett. vi. iii. i.
B. 1, figs. 1-4.

Grenada : windward side, Balthazar ; leeward side, Mount Gay Estate. St. Vincent, windward side.

Carbaca Smithii, Möschler, Lep. Portorico, p. 137, fig. 18.

St. Vincent, leeward side.

Carbaca Krugii, Möschler, Lep. Portorico, p. 296, fig. 2.

Grenada : leeward side, Mount Gay Estate.

Ædiodes ufeus, Cram. Pap. Exot. ii. 2, pl. xcvi. E.

Grenada : windward side, Balthazar ; leeward side, Mount Gay Estate. St. Vincent.

Omiodes omphasalis, Wlk. xviii. 735.

Grenada : windward side, Balthazar ; leeward side, Mount Gay Estate. St. Vincent.

Omiodes olivia, Butl. P. Z. S. 1878, p. 434.

Grenada : leeward side, Mount Gay Estate.

Omiodes humeralis, Guen. Delt. et Pyr. p. 356.

Grenada : windward side, Balthazar.

Glyphodes quadristigmalis, Guen. Delt. et Pyr. p. 304.

St. Vincent.

Glyphodes imitalis, Guen. Delt. et Pyr. p. 306.

Grenada : windward side, Balthazar, Granville ; leeward side, Mount Gay Estate. Grenadines, Union Isle.

Glyphodes sibillalis, Wlk. xvii. 506.

Grenada : windward side, Balthazar. St. Vincent, windward side.

Glyphodes nitidalis, Cram. Pap. Exot. iv. p. 160, pl. ccclxxi.
fig. 7.

Grenada : windward side, Balthazar.

Glyphodes elegans, Möschl. Lep. Portorico, p. 299.

St. Vincent, windward side.

Glyphodes lucidalis, Hübn. Verz. p. 359.

Grenada: windward side, Balthazar.

Glyphodes hyalinata, Linn. Syst. Nat. iii. 2, p. 279.

Grenada: windward side, Balthazar. St. Vincent, windward side.

Leucinodes elegantalis, Wlk. xvii. 393.

Grenada: windward side, Balthazar. St. Vincent, windward side.

Ommatospila narcaeusalis, Wlk. xix. 972.

Grenada: leeward side, Mount Gay Estate.

Hellula phidilealis, Wlk. xix. 972.

Grenada: leeward side, Mount Gay Estate. St. Vincent, windward side.

Tegostoma dinichealis, Wlk. xix. 986.

Grenada: windward side, Mount Gay Estate.

Stenophyes huronalis, Guen. Delt. et Pyr. p. 198.

Grenadines, Union Isle. St. Vincent, windward side.

Stenophyes rufifrontalis, sp. n.

Hind legs with tuft of hair on tibiae between the spurs and on first tarsal joint above; hind wing with thick tuft of hair on inner area above anal angle.

White; palpi rufous, white below; frons and shoulders rufous; abdomen suffused with rufous on dorsum, and with a rufous band on second segment. Fore wing with the costa rufous; a subbasal rufous line; a narrow white-centred discocellular spot conjoined to the rufous on costa, and with a waved line below it from vein 2 to inner margin; a crenulate postmedial line bent outwards at vein 5 and ending at outer angle; some rufous on apical part of outer margin. Hind wing with a rufous spot at apex.

Hab. St. Vincent, windward side. St. Lucia. *Exp.* 34 millim.

Genus MICROCAUSTA, nov.

Palpi porrect, extending about twice the length of head, down-curved at extremity, and the third joint buried in hair; maxillary palpi triangularly scaled; frons rounded; antennæ annulate; hind tibiæ of male fringed with extremely long hair on outer side and with tufts of hair towards extremity; the spurs absent, the first joint of tarsus fringed with hair. Fore wing broad, the apex produced and acute; veins 3, 4, and 5 from close to angle of cell; 7 from upper angle; 10 free. Hind wing with veins 3 and 5 from angle of cell; 4 absent; 6 and 7 from upper angle; 7 anastomosing with 8.

Microcausta ignifimbrialis, sp. n.

♂. Head, thorax, and abdomen fulvous, the last with some fuscous on dorsum and fiery red at extremity. Fore wing purplish pink; some fulvous on basal inner area; an indistinct sinuous, curved, dark antemedial line; two almost conjoined yellow discocellular spots; a curved black submarginal line, bent inwards to costa; an oblique white apical streak; some fuscous suffusion on margin; the cilia fiery red. Hind wing pale fuscous; the cilia grey.

Hab. Grenada: windward side, Balthazar. St. Vincent, windward side. *Exp.* 10 millim.

Lineodes serpulalis, Led. Wien. ent. Mon. 1863, p. 417, pl. xv. fig. 8.

St. Vincent.

Pionea taniolalis, Guen. Delt. et Pyr. p. 172.

Grenada: windward side, Balthazar. St. Vincent: windward side, Kingstown.

Pionea syphaxalis, Wlk. xviii. 604.

Grenada: windward side, Balthazar.

Pionea inclusalis, Wlk. xviii. 631.

St. Vincent, windward side.

Pionea eupalusalis, Wlk. xviii. 605.

Grenada: windward side, Balthazar.

Pionea vinotinctalis, sp. n.

Head, thorax, and abdomen fulvous brown; palpi white below. Fore wing ochreous brown, slightly suffused with

purple; an indistinct obliquely curved antemedial line; a discocellular speck; a postmedial fuscous line, very much ex-curved from costa to vein 2, then retracted to lower angle of cell and nearly straight to inner margin; a marginal fuscous line; the cilia suffused with fuscous. Hind wing whitish; the marginal area suffused with fuscous; the cilia white at tips and towards anal angle.

Hab. Grenada: windward side, Balthazar; leeward side, Mount Gay Estate. *Exp.* 16 millim.

Pionea pulchripictalis, sp. n.

Orange; palpi white below; frons with white line at sides; fore tarsi white, with the extremity black and a black spot on first joint; abdomen with the extremity black in male. Fore wing with slightly sinuous antemedial dark line; an indistinct discocellular lunule; a postmedial line slightly sinuous from costa to vein 4, then incurved to below angle of cell and straight to inner margin, the area beyond it strongly suffused with purple; a marginal black line; the cilia yellow, black at apex and below middle. Hind wing with discocellular speck; a black fascia below the cell, widening to outer margin; a postmedial black line, angled at vein 2, the area beyond it black, with two purplish lines from vein 6 meeting at vein 2; the cilia yellow, with black line at base and black at apex and middle.

Hab. Grenada: windward side, Balthazar. *Exp.* 16 millim.

Pionea seriopunctalis, sp. n.

Ochreous brown, slightly suffused with fuscous; palpi white below. Fore wing narrow; an antemedial series of three dark specks; a discocellular speck with black spot below it at lower angle of cell; a postmedial slightly curved series of specks on the veins. Hind wing with discocellular speck and postmedial series of specks: both wings with marginal brown line and line at base of cilia.

Hab. Grenada: windward side, Balthazar, Granville. *Exp.* 16 millim.

Pionea arenacea, Warr. Ann. & Mag. Nat. Hist. (6) ix. p. 431.

Fore wing of male with a large fovea at base of median nervure.

Grenada: windward side, Balthazar; leeward side, Mount Gay Estate.

Pachyzancla phæopteralis, Guen. Delt. et Pyr. p. 349.

Grenada : windward side, Balthazar ; leeward side, Mount Gay Estate. Grenadines, Union Isle. St. Vincent.

Pachyzancla detritalis, Guen. Delt. et Pyr. p. 347, pl. iv. fig. 10.

Grenada : windward side, Balthazar ; leeward side, Mount Gay Estate. Grenadines, Union Isle.

Pachyzancla agavealis, Wlk. xviii. 575.

Grenada : windward side, Balthazar. St. Vincent.

Pachyzancla semilaniata, sp. n.

♂. Both wings with the basal half clothed with rough woolly hair on upperside, becoming a ridge of flocculent white wool on costa of fore wing ; the patagia fringed with curled hair.

Fuscous ; palpi white below ; abdomen with the anal tuft white. Fore wing with indistinct antemedial dark line ; a discocellular lunule ; a dark postmedial line with pale outer edge, nearly straight and oblique from costa to vein 2, then retracted to lower angle of cell and straight to inner margin. Hind wing with dark discocellular speck ; a postmedial dark line with pale outer edge slightly retracted at vein 2 : both wings with the cilia white at tips.

Hab. St. Vincent. *Exp.* 34 millim.

Aphytoceros ostrealis, Guen. Delt. et Pyr. p. 327.

Grenada : windward side, Balthazar ; leeward side, Mount Gay Estate.

Epicorsia mellinalis, Hübn. Zutr. i. 24, 69, figs. 137, 138.

Grenada : windward side, Balthazar ; leeward side, Mount Gay Estate. St. Vincent, windward side.

Pyrausta lucilla, Butl. P. Z. S. 1878, p. 494.

Grenada : leeward side, Mount Gay Estate.

Pyrausta opalizalis, Guen. Delt. et Pyr. p. 172.

St. Vincent, windward side.

Pyrausta panopealis, Wlk. xvii. 318.

Grenada : leeward side, Mount Gay Estate. St. Vincent, windward side.

HYDROCAMPINÆ.

Danaga bufalis, Guen. Delt. et Pyr. p. 245.

Grenada: windward side, Balthazar; leeward side, Mount Gay Estate.

Cataclysta æalis, Wlk. xix. 953.

Grenada: windward side, Balthazar.

Cataclysta moniligeralis, Led. Wien. ent. Mon. 1863, p. 454, pl. xviii. fig. 10.

Grenada: windward side, Balthazar, La Force Estate.

Cataclysta opulentalis, Led. Wien. ent. Mon. 1863, p. 453, pl. xviii. fig. 7.

Grenada: windward side, Balthazar, La Force Estate.

Cataclysta axis, sp. n.

Fulvous and white. Fore wing fulvous yellow, darker towards costa; two broad, more or less conjoined, subbasal white bands, not reaching the costa; a slightly oblique medial white band; a white fascia in and beyond end of cell, interrupted by the dark-edged discocellular lunule, and often conjoined to a large patch on inner area; an oblique triangular postmedial white patch from costa to vein 2; a dark-edged orange marginal band, with a wedge-shaped white mark on its inner side from costa to vein 2; cilia white. Hind wing fulvous yellow; the base, inner area, and a medial band white; a white patch on outer area with four black and silvery-purple, more or less double, ocellate marks, the one nearest apex with a black line over it.

Hab. Grenada: windward side, Balthazar, Chantilly Estate. St. Vincent, Kingstown. *Exp.* 12 millim.

Cataclysta annulalis, Guen. Delt. et Pyr. p. 266.

Grenada: windward side, Balthazar.

Hydrophysa plumipedalis, sp. n.

♂. Dark fulvous brown; fore coxæ and femora fringed with dark hair; hind tibiæ with fringes of very long dark hair on each side of inner medial spur; a white line above the eyes; abdomen with pale bands. Fore wing with subbasal pale line angled at middle; two medial white lines, the inner sharply angled on vein 1, the outer produced to a long point on vein 1; a very oblique white-edged wedge-shaped

postmedial mark on costa, terminating on vein 5; a black-edged fulvous marginal band expanding into a black spot at apex, and with some white on it at costa and on its inner edge. Hind wing fuscous, with slightly sinuous pale antemedial, postmedial, and submarginal lines, terminating near anal angle; cilia white, with a dark line at base.

Hab. Grenada: windward side, Balthazar. *Exp.* 18 millim.

Hydrophysa scuthesalis, Wlk. xix. 950.

Hydrocampa tortalis, Led. Wien. ent. Mon. 1863, p. 452, pl. xviii. fig. 3.

Grenada: windward side, Grand Etang.

Ambia leucostictalis, sp. n.

♀. Dark fulvous brown; thorax marked with white. Fore wing with white spot at base and subbasal band toothed on median nervure; a postmedial white spot on inner margin; a slightly curved postmedial white band from costa to vein 4; a black-edged marginal fulvous band with white marks on its inner edge; cilia white, dark below apex and middle. Hind wing with white subbasal and antemedial lines, the latter becoming a broad band towards costa; a curved postmedial white band from costa to vein 4 and vein 2 to inner margin; a marginal dark-edged band, with some white marks on its inner edge; cilia white.

Hab. Grenada: windward side, Balthazar. *Exp.* 10 millim.

Stenia lutealis, Snell. Tijd. v. Ent. xviii. p. 245, pl. xiii. figs. 17, 18.

Grenada: windward side, Balthazar; leeward side, Mount Gay Estate. St. Vincent, windward side.

Diathrausta neronalis, Wlk. xix. 929.

St. Vincent, windward side.

CHRYSAUGINÆ.

Salobrena tecomæ, Riley, Am. Ent. iii. p. 286, figs. 152, 153.

Grenada: windward side, Balthazar.

Hyperparachma bursarialis, Wlk. xxxiv. 1231.

Grenada: windward side, Balthazar; leeward side, Mount Gay Estate. St. Vincent, windward side.

Torda leucospilalis, sp. n.

♂. Dark rich red-brown. Fore wing with the antemedial line represented by a series of white specks; a round pure white spot on costa just beyond middle; a large yellow patch irrorated with red and crossed by a dentate red line on inner margin beyond middle; a postmedial white speck on costa; cilia yellow below apex. Hind wing fuscous, with an indistinct pale postmedial line angled at vein 2; a marginal series of white specks.

Hab. Grenada: windward side, La Force Estate. *Exp.* 22 millim.

Torda vacuana, Wlk. xxviii. 441.

St. Vincent, windward side.

Genus PACHYPALPIA, nov.

Palpi porrect, extending about the length of head, down-curved at extremity, the end of second joint and the third clothed with curled hair; frons with a slight tuft; antennæ of male thickened and flattened; mid and hind tibiæ slightly fringed with hair; the first joint of hind tarsus with a large tuft of hair. Fore wing with the apex somewhat produced and acute; the outer margin slightly angled at vein 4; veins 3, 4, and 5 from close to angle of cell; the discocellulars highly angled; 8 and 9 given off from 7; 10 absent. Hind wing with the outer margin slightly angled at vein 3; vein 3 from near angle of cell; 4 and 5 from angle; 6 and 7 from upper angle, 7 anastomosing slightly with 8.

Pachypalpia dispilalis, sp. n.

♂. Rufous. Fore wing irrorated with dark brown; a white subbasal speck in cell and striga below it; an antemedial yellowish-white spot on costa, with traces of a sinuous line arising from it; a postmedial yellowish-white spot on costa with a curved dark line arising from it, the area beyond it rather browner. Hind wing reddish brown, the base and basal half of costal and inner areas pale; underside purplish grey with dark irroration; a medial line from costa to middle of discocellulars, and a slightly curved postmedial line.

Hab. St. Vincent. *Exp.* 20 millim.

Genus STREPTOPALPIA, nov.

Palpi extending about twice the length of head, angled in front of frons, then down-curved and thickly scaled; frons

with a slight tuft; antennæ of male slightly serrate and ciliated; mid and hind tibiæ with tufts of hair at middle and extremity, the tarsal joints tufted. Fore wing with the apex produced, acute, and turned down; vein 3 from near angle of cell; 4 and 5 from angle; 7, 8, 9, and 10 stalked, 7 being given off near the margin. Hind wing with vein 3 from near angle of cell; 4 absent; 6 and 7 from upper angle, 7 anastomosing with 8.

Streptopalpia ustalis, sp. n.

Head and thorax purplish red, irrorated with grey; abdomen brownish. Fore wing red with a slight purplish tinge, the scales on basal half tipped with grey; a slightly curved medial white line; two obliquely placed discocellular black specks; an obliquely curved postmedial white line ending close to outer angle. Hind wing whitish, suffused with red on apical area; traces of a pale postmedial line angled on vein 2.

Hab. Grenada: windward side, Balthazar; leeward side, Mount Gay Estate. St. Vincent: windward side, Kingstown. *Exp.* 14 millim.

Caphys bilinea, Wlk. xxvii. 13.

Grenada: windward side, Balthazar. St. Vincent, windward side.

Caphys dubia, Warr. Ann. & Mag. Nat. Hist. 1891, vii. p. 495.

Grenada: windward side, Mount Gay Estate.

Bonchis munitalis, Led. Wien. ent. Mon. 1863, p. 345, pl. vi. fig. 13.

Grenada: windward side, Balthazar; leeward side, Mount Gay Estate. St. Vincent, windward side.

EPIPASCHINÆ.

Genus *ISLOPHA*, nov.

Palpi porrect, extending about twice the length of head, the second joint fringed with long hair above, the third well developed, naked, and acute; maxillary palpi filiform; antennæ of female minutely ciliated; vertex of head roughly scaled; tibiæ smooth. Fore wing with the apex rectangular; vein 3 from near angle of cell; 4 and 5 from a point; 7, 8, and 9 stalked; 10 and 11 free; a fan of scales at end of cell and a slight medial ridge of scales. Hind wing with vein 3 from near angle of cell; 4 and 5 from a point; 6 and 7 from upper angle, 7 anastomosing with 8.

Islopha lactealis, sp. n.

♀. Pale ochreous; abdomen suffused with black above and with red at base. Fore wing with the basal half cream-coloured, with some rufous and black on costal area and a black streak above base of inner margin; an obliquely curved ill-defined pale medial line; a diffused postmedial pale band slightly excurved at middle, the medial area suffused with rufous and black, paler towards costa; the veins of outer area streaked with black; a dark rufous marginal band. Hind wing yellowish white; the apical area suffused with fuscous down to vein 2.

Hab. Grenada: leeward side, St. George's. *Exp.* 24 millim.

PHYCITINÆ.

Myelois transitella, Wlk. xxvii. 54.

Grenada: windward side, Balthazar.

Myelois ochrodesma, Zell. Hor. Ent. Ross. xvi. p. 209, pl. xi. fig. 26.

Grenada: leeward side, Mount Gay Estate. St. Vincent, windward side.

Phycita Mæschleri, Rag. Nouv. Gen. p. 12.

St. Vincent, windward side.

✓ *Phycita ptyonopoda*, sp. n.

Maxillary palpi filiform; antennæ ciliated and without sinus and tuft; a very large tuft of ochreous hair from base of hind femora.

Head and thorax purplish red; abdomen fuscous, with some purplish red at base. Fore wing purplish red; the base of costa suffused with black in male; an oblique diffused greyish antemedial band; some grey scales diffused over discal and outer areas; two dark discocellular specks; a minutely dentate greyish submarginal line excurved between veins 6 and 2; a marginal series of dark specks. Hind wing pale semihyaline; the veins and a marginal line dark.

Hab. St. Vincent: windward side, Kingstown. *Exp.* 16 millim.

Phycita lignosella, Zell. Isis, 1848, p. 883.

Grenada: windward side, Granville. St. Vincent, windward side.

Phycita rubedinella, Zell. Isis, 1848, p. 885.

Grenada: leeward side, Mount Gay Estate. St. Vincent, windward side.

Nephoptyx pellucens, Zell. Isis, 1848, p. 866.

St. Vincent, windward side.

Phidotricha erigens, Rag. Ann. Soc. Ent. Fr. 1888, p. 139.

St. Vincent, windward and leeward sides.

Ancylostomia stercorea, Zell. Isis, 1848, p. 873.

Grenada: windward side, Balthazar. St. Vincent, windward side.

Etiella zinckenella, Treit. ix. 1, p. 201.

Grenada: windward side, Balthazar.

Nephoptyx infusella, Zell. Isis, 1848, p. 869.

St. Vincent.

Euzophora tramitella.

Grenada: windward side, Balthazar; leeward side, Mount Gay Estate.

Ancylosis anticella, Zell. Hor. Ent. Ross. xvi. p. 185, pl. xi. fig. 14.

Grenada: windward side, Balthazar.

Syria simplicula, Zell. Hor. Ent. Ross. xvi. p. 246, pl. xii. fig. 49.

St. Vincent, windward side.

Homæosoma impeditella, Zell. Hor. Ent. Ross. xvi. p. 229, pl. xii. fig. 37.

Grenada: windward side, Balthazar, La Force Estate; leeward side, Mount Gay Estate. St. Vincent, windward side.

Ephestia parvula, Zell. Hor. Ent. Ross. xvi. p. 249, pl. xii. fig. 51.

St. Vincent.

SCHÆNOBIINÆ.

Scirpophaga albinella, Cram. pl. cclxxiv. D.

Grenada: windward side, Balthazar.

CRAMBINÆ.

Platytes pusillalis, Hübn. Zutr. figs. 167, 168.

Grenada: windward side, Balthazar.

Diatræa saccharalis, Fabr. Ent. Syst. iii. 2, p. 238.

Grenada: leeward side, Mount Gay Estate. St. Vincent, windward side.

Diatræa canella, sp. n.

♂. Differs from *saccharalis* in being grey, irrorated with fuscous instead of ochreous. Abdomen with the base fulvous, suffused with fuscous on dorsum. Fore wing thickly irrorated with fuscous; the oblique medial line prominent and excurved round the discocellular speck; the curved postmedial and marginal series of specks prominent; no oblique apical streak. Hind wing yellowish white; the apical area greyish and with some dark marks on the margin.

♀. More suffused with white; the markings of fore wing more or less obsolete; the hind wing wholly white.

Hab. Grenada: windward side, Balthazar; leeward side, Mount Gay Estate. Brazil. *Exp.* ♂ 24-28, ♀ 32 millim.

Crambus fissiradiellus, Wlk. xxvii. 160.

Grenada: windward side, Balthazar. St. Vincent, windward side.

Crambus chrysoporellus, sp. n.

Silvery white; palpi orange at sides; collar with two orange stripes which unite on thorax. Fore wing with some golden orange at base of costa; a curved medial golden line; an obliquely curved line from costa beyond middle to outer angle; two golden lines across apex uniting into a patch on margin with two black spots on it; cilia golden.

Hab. Grenada: windward side, Balthazar. St. Vincent, windward side. *Exp.* 12 millim.

Ptochostola pygmæa, Zeil. Hor. Ent. Ross. xvi. p. 173, pl. xi. fig. 10.

Grenada: windward side, Balthazar. St. Vincent: windward side, Kingstown.

Sesiidæ.

Sciapteron geliformis, Wlk. vii. 46.

St. Vincent, windward side.

XLVI.—A new West-African Insect.

By W. H. NUNNEY.

ODONATA.

Ceratogomphus? æneothorax, Nunney.

A short while ago I received, amongst other insects from West Africa, a fine species of *Gomphina*, which, I believe, has not been described, and which I have provisionally located

in this subgenus, though it is either a very aberrant species or the type of a closely allied genus—I am inclined to think the latter. Should it eventually be considered not congeneric, I propose the name of *Ceratopyga*.

The description of the species is as follows:—

♂. Head moderate, hardly broader than the thorax; vertex deeply bilobate, of shining metallic green. Eyes moderate, not contiguous, but very closely approximated, brown. Occiput metallic green, produced in two obtuse cones. Front very hairy, the hairs black and, together with the labium, of a reddish yellow. Thorax moderate, nearly square, slightly sloping in front, which part is hairy, the hairs brownish, of a dark brownish hue, with dark metallic green reflections, and a faint yellow line medially on each side; beneath reddish brown. Wings hyaline, somewhat pointed; neuration black, the reticulation wide, becoming finer towards hinder and apical margins; 17 antecubitals; hypertrigonal space 4-celled in upper wings, 3-celled in hind



Ceratogomphus? æneothorax, Nunney.—A. Appendages from above.
B. Final segments and appendages in profile.

wings; nodus nearer the pterostigma than the base in upper wings, as in *Corduliinæ*. Pterostigma short, black, covering two and a half cellules. Membranule short, narrow, black. The legs are long, dull black, somewhat spiny; the femora with a lateral carina outwardly and a row of small teeth inwardly; the tibiæ have a lateral carina inwardly and a row of minute teeth outwardly. The tarsi are black, with long, deeply bifid, divaricate, curved claws.

The body is long and narrow, cylindrical to the sixth segment, where it dilates to the eighth segment, the final segments decreasing gradually in width. Somewhat prominent rounded oreillettes occur on the second segment, and the

third segment is somewhat constricted. The second segment is ornamented by a narrow yellow half-ring dorsally and laterally, excluding the oreillettes. The third and fourth segments bear on each side a subtrigonal yellow spot, the two succeeding segments being unornamented. The seventh segment bears at its basal third a yellow semicircle; the following segments are unornamented, the seventh and eighth of equal length. The ninth segment has a short spine at its hinder margin above. The tenth segment is provided dorsally with an acute retroverted horn, sparsely haired and with a minute obconic plate attached to its base. This horn is equal in height to the length of the tenth segment. There are small crenatures on the hinder margins of the last three segments. The appendages are black: the superior sub-cylindric, approached until their terminal third, where they become divaricate; they are slightly curved upwards and forwards seen in profile; the apices are obtuse; they are sparsely haired and are of the length of the eighth segment. The inferior appendages are somewhat shorter, conical, bifid at the tip, and with a deep conical groove basally, the apex pointing outwards; they are much thickened at the base, and seen in profile the extremities curve slightly upwards: like the superiors, they are slightly hairy.

The wing-expanse is $3\frac{1}{2}$ inches and the length 2 inches 9 lines.

The affinities of this species are curious. It has an undoubted affinity to *Ceratogomphus* in its general facies and the abdominal dorsal spine, but the anal appendages (*C. pictus*) are widely different; no lateral plates occur, as in *Ceratogomphus pictus*. Again, it approaches *Anormogomphus* in the oreillettes, whilst the Corduliine character of the position of the nodus of the upper wings is peculiar.

The female is unknown, as likewise the exact habitat of the described male. I believe, however, it is a Cameroon species. One specimen in my own collection.

MISCELLANEOUS.

Note on Rhysota Armiti. By EDGAR A. SMITH.

IN the August number of these 'Annals' some observations appeared from the pen of Mr. C. Hedley upon the identity of this species with the *R. flyensis* of that author. If in *R. Armiti* I have redescribed Mr. Hedley's species (which at present seems very doubtful), I must lay the blame either upon his description and

figure or upon the amount of variation assumed by this form. I fully concur with Mr. Hedley with regard to the importance of figures, which, however, should be correct, for an inaccurate figure is almost worse than none.

I find other differences, however, besides that of size, which certainly is not "the only written discrepancy in the descriptions of each." Differences of form, of colour, and sculpture are also indicated. The whorls of *R. flyensis* are said to be "above rather convex," whereas in *R. Armiti* they are flattish ("vix convexiusculi"). The lower surface of the latter is concentrically striated, a feature not noticed in the description of *R. flyensis*. The spire in Mr. Hedley's figure is much higher than in my species, and the strongly marked subperipheral band is also wanting in *R. Armiti*. I compared it with *R. hercules*, not because I was ignorant of Mr. Hedley's description and figure of *R. flyensis*, but because it seemed to me to have a closer relationship with that species, and because specimens were at hand for comparison.

In conclusion, I would remark that Mr. Hedley's observations would have appeared with more propriety if he had been writing upon the fauna of New Guinea. Some Americans are said to be very jealous of interference by Europeans with their fauna; and it seems almost as if the "green-eyed monster" were tripping in the Antipodes.

Descriptions of some new Araneidæ of New South Wales.

By W. J. RAINBOW.

Three new species of orb-weavers of the genus *Nephila* from New England and Sydney are described. The fact is recorded of a young bird (probably *Estrelda temporalis*) having been caught in the web of *N. ventricosa* in the vicinity of Sydney; also that Mr. A. J. Thorpe, of the Australian Museum, had seen an emu-wren (*Stipiturus malachurus*) entangled in the web of one of the *Nephilæ* at Madden's, near Belle Plains (N.S.W.); also at Cape York several of the blue warblers, notably *Malurus Brownii* (Vig. & Horsf.) and *M. amabilis* (Gould). The writer points out that it is only young birds and those of weak wing-power that are arrested by such webs, and he expresses doubt as to the correctness of the assertion of some writers that birds so caught are devoured by the spiders; he points out that each web is placed in position by the unerring instincts of the spider, simply because the situation is such as will assure abundance of food in the shape of insects, and that it is merely an accident when a bird becomes entangled in the toil. The paper concludes with a description of the mode of coition in the *Nephilæ* and a list of the previously described Australian species of the genus.—*Abstract of Proceedings of the Linnean Society of New South Wales*, June 26, 1895, p. i.

THE ANNALS

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[SIXTH SERIES.]

No. 95. NOVEMBER 1895.

XLVII.—*On some new and rare British Copepoda.* By THOMAS SCOTT, F.L.S., Naturalist to the Fishery Board for Scotland, and ANDREW SCOTT, Fisheries Assistant, University College, Liverpool.

[Plates XV.—XVII.]

Stenhelia Blanchardi, sp. n. (Pl. XV. figs. 1–10.)

Description.—*Female.* Length 1·15 millim. ($\frac{1}{2}$ of an inch). Body elongate, moderately stout; rostrum prominent and somewhat curved. Antennules long and slender, eight-jointed, the first and second joints much longer than any of the others; the fifth, sixth, and seventh joints subequal and very short; the first and second joints are very sparingly setiferous, but the others are provided with a number of moderately long setæ. The proportional lengths of the various joints are as follows:—

Proportional lengths of the joints.	27	26	10	9	5	5	5	9
Number of the joints	1	2	3	4	5	6	7	8

Antennæ moderately stout; secondary branch elongate; the first joint is nearly twice the length of the terminal one, but the middle joint is very short; there are several setæ on the secondary branches, as shown by the drawing (fig. 3). Mandibles large and furnished with a broad biting-part; the basal portion of the mandible-palp, which is about as large as the mandible, becomes gradually more dilated outwardly; the distal branch is larger than the other and one-jointed, but the

smaller branch is two-jointed (fig. 4). Posterior foot-jaws moderately stout; terminal joint very narrow and about three times as long as broad, and armed at the apex with a moderately long slender claw and two setæ; the proximal half of the inner margin of the second joint is fringed with hairs, and near the distal end of the margin is a moderately long plumose seta (fig. 6). The inner branches of the first pair of swimming-feet are long and slender; the first joint extends to the end of the outer branches; the second joint is short, while the third is very narrow and nearly three times the length of the second joint (fig. 7). Outer branches of the second, third, and fourth pairs elongate; inner branches much shorter (fig. 8). Fifth pair large; inner portion of the basal joint long and narrow and tapering towards the apex; the outer margin, which is nearly straight, is fringed with minute hairs, while four spiniform setæ spring from the distal half of the inner margin and apex; the two upper marginal setæ are stout and comparatively short and distinctly bifid at the end; the apical seta is also short, but the lower marginal seta is elongate and slender except towards the base, which is moderately stout; the secondary joint is elongate, narrow, and extends somewhat beyond the extremity of the basal joint; the distal end of the exterior margin is produced outwards into a triangular hook-like process; there are a few small setæ on the exterior margin and on the distal end of the inner margin and apex (fig. 9). Caudal stylets narrow and rather longer than the last abdominal segment (fig. 10).

Habitat. Off Arisaig, Argyllshire; a few specimens from dredged material collected in 1892.

Remarks. This species is at once distinguished by the form and armature of the fifth pair of thoracic feet; the hook-like process at the end of the secondary joints, as shown by the drawing, is characteristic of all the specimens examined, and the two upper setæ on the inner margin of the basal joint are distinctly bifid; the structure of the antennules, the form of the first pair of swimming-feet, and the elongate caudal stylets also form a combination of characters not observed in any other species known to us. We have much pleasure in giving to this species the name of our esteemed friend and correspondent, Dr. Raphael Blanchard, of Paris.

Thalestris peltata (Boeck).

(Pl. XV. figs. 11-15; Pl. XVI. figs. 1-8.)

Amenophia peltata, Boeck, Oversigt Norges Copepoder, p. 45 (1864).

Thalestris peltata, Brady, Mon. Brit. Copepoda, vol. ii. p. 138, pl. liii. figs. 11-19.

Description.—*Female.* Length $\cdot 6$ millim. ($\frac{1}{42}$ of an inch).

Body stout, depressed, somewhat like *Zaus spinatus* in general appearance; rostrum short, truncate. Antennules moderately stout, nine-jointed, setiferous and gradually tapering from the base; the fifth, seventh, and eighth joints much shorter than any of the others. The annexed formula shows the proportional lengths of the various joints:—

Proportional lengths of the joints..	14	18	13	11	5	8	4	3	8
Number of the joints	1	2	3	4	5	6	7	8	9

Secondary branches of the antennæ two-jointed, stout, and furnished with several plumose setæ, the first joint rather shorter than the other (Pl. XV. fig. 13). Mandible-palp narrow-elongate, sinuate, provided with two small marginal and one-jointed branches (Pl. XV. fig. 14). Anterior foot-jaws short, dilated, and armed with a strong terminal claw, and with three short setiferous marginal processes (Pl. XV. fig. 15). Posterior foot-jaws stout, of moderate length, and furnished with a strong slightly hooked terminal claw (Pl. XVI. fig. 2). First pair of swimming-feet robust; the second basal joint is provided interiorly and near the distal end with a short hook-like spine; the first joint of the outer branches is equal to nearly half the length of the second, while the end-joint is very short; the marginal spines of the first and second joints are long and slender; the end-joint, which bears two small setæ on the exterior margin, is armed at the apex with two stout claw-like spines, fringed on the outer edge with minute hairs, and with an elongate and moderately stout seta; a small seta also springs from the distal end of the inner margin of the second joint; the first joint of the inner branches, which are elongate and fringed with small hairs on both margins, bears a moderately long plumose seta on the middle of the inner aspect; the second and third joints are very small; each of the inner branches is armed with an elongate and powerful terminal claw, fringed with minute hairs on the outer edge, and with also a terminal spiniform seta; both branches are of nearly the same length (Pl. XVI. fig. 3). In the fourth pair, which are comparatively slender, the inner branches extend only to about the end of the second joint of the outer branches (Pl. XVI. fig. 5). The fifth pair are foliaceous; the basal joint, which is broadly subtriangular (its greatest length being equal to only about two thirds of the breadth), is provided with five setæ—one on the lower half of the inner margin and four at the apex; the two middle apical setæ are long and plumose, but all the others are short; the secondary joint is moderately long and subovate, the inner

edge is nearly straight and provided with a few small and equidistant fascicles of minute hairs; the outer margin is gently curved, densely setose on the upper half and with several setæ on the lower half and apex (Pl. XVI. fig. 6). Caudal stylets short, scarcely equal in length to the last abdominal segment.

Male. The male is similar to the female except in the following particulars:—The antennules, which are moderately stout, are modified for grasping (Pl. XV. fig. 12). The second pair of swimming-feet are very similar to those of the male of *Thalestris harpactoides*, Claus, except that the second and third joints of the inner branches are coalescent (Pl. XVI. fig. 5). In the fifth pair the basal joint is much shorter than in the female, being scarcely produced interiorly; it bears three moderately stout apical setæ, the middle one of which is about twice the length of the others; the secondary joint is somewhat similar to that of the female fifth pair, and is furnished with six stout spiniform setæ, three on the outer margin and three at the apex (Pl. XVI. fig. 7).

Habitat. Firth of Forth; collected April 1895.

Remarks. *Thalestris peltata* (Boeck) is not very unlike *Zaus spinatus* in general appearance; moreover, in the structure of some of its appendages, and especially of the first pair of swimming-feet, it resembles certain species of *Dactylopus*. The chief points of difference between *Thalestris* and *Dactylopus* seem to be these—in *Thalestris* the outer and inner branches of the first pair of swimming-feet are usually of equal length, or the outer may be slightly longer than the inner, and the middle joint of the outer branches is usually considerably longer than the first or third joints, whereas in *Dactylopus* the outer branches are usually shorter than the inner branches, and the middle joint of the outer branches usually equal in length to, or only slightly longer than, the first or third joints. But in *Thalestris peltata* and *Dactylopus tisboides* the two genera approach somewhat closely to each other. The description and figures of this species in Dr. Brady's 'Monograph of British Copepoda' agree very well with our observations, except that he describes the secondary branch of the antennæ as three-jointed. He had only one specimen to describe from; and as we have obtained both males and females, we thought that a set of drawings showing their sexual differences might be of interest. We did not observe the eyes mentioned by Boeck.

Dermatomyzon gibberum, T. & A. Scott.
(Pl. XVII. fig. 14.)

This species was described in the Ann. & Mag. Nat. Hist. for February 1894; at that time only a single specimen had been obtained from a tow-net gathering collected near the mouth of the Firth of Forth. This year (1895) we have taken a considerable number of specimens of the same species, not only in the Firth of Forth, but also in Liverpool Bay; they were obtained by washing a number of specimens of the common starfish (*Asterias rubens*) in a bottle containing methylated spirit mixed with water, and afterwards examining the sediment. Several of the specimens from both localities were apparently mature, and a few of them carried ovisacs; these apparently adult forms differed in general appearance from the one figured in the Ann. & Mag. Nat. Hist. in being more globose in outline; but a careful dissection and examination of one or two of these adult specimens showed that this was the only difference of importance; the structure of their various appendages was apparently identical with the structure of the appendages of the specimen first described and figured in February 1894. We, therefore, at the present time do not think it is necessary to repeat these structural drawings, but, instead, we give here a full-size drawing of one of the adult forms from Liverpool Bay (see fig. 14), as the full-size figure in the Ann. & Mag. Nat. Hist. for February 1894 is evidently that of a somewhat immature specimen.

Alcyonicola fusiformis, gen. et sp. n.
(Pl. XVI. figs. 10-14; Pl. XVII. fig. 13.)

Description. Body elongate-fusiform; the last two abdominal segments distinct, all the others coalescent. Head somewhat produced and furnished with both antennules and antennæ. The abdominal segments are unequal in length, the penultimate one being nearly four times longer than the other, which is very short. Caudal stylets well developed and equal to about three fourths the length of the penultimate abdominal segment; they diverge considerably, and each stylet is provided with three stout spiniform setæ, which are at least three times the length of the stylet; the middle one is straight, but the one on each side diverges at the base and then curves round towards the end of the middle seta; each stylet has also one or two small hairs on the lateral aspect. Fig. 13, Pl. XVII., is a full-size drawing representing a dorsal view of one of the more perfect specimens of this Copepod.

Length of this specimen 1·23 millim. ($\frac{1}{20}$ of an inch). The antennules are four-jointed and sparingly setiferous; a filament much longer than the antennule springs from the end of the second last joint, and possesses what looks like an articulation at about a third of its length from the proximal end, where also are two setæ-like appendages; the basal joint is larger than the others and somewhat dilated, the other three are of nearly equal length, but the last is much narrower than the two preceding ones (Pl. XVI. fig. 10). The antennæ are long and slender and three-jointed; the middle joint is longer than either the first or the third, and the third is armed with a stout and claw-like terminal spine (Pl. XVI. fig. 11). We have been unable to make out the mouth-appendages. The first and second pairs of feet are fairly well developed; they each consist of a stout one-jointed basal part, which bears a short and robust two-jointed branch, and, in the second pair at least, what looks like a rudimentary second branch; in both pairs the outer two-jointed branches are each armed with two powerful terminal claws, while a stylet-like spine springs at nearly right angles from the distal half of the outer margin of the first joint. In the first pair the lower part of the basal joint is considerably gibbous and produced into a stout tuberculiform process; in the second pair the basal joint is not so much dilated as in the first pair, but is furnished with a stout stylet-shaped spine on its inferior aspect (Pl. XVI. figs. 12 and 13). This spine may represent a rudimentary second branch, as already stated. The third, fourth, and fifth pairs of feet appeared to be entirely absent, and no ova were observed upon or within any of the specimens examined.

Habitat. On *Alcyonium digitatum*. Firth of Forth, and also in the Moray Firth.

Remarks. Though this organism has been known to us for several years, we have not hitherto observed any description of it in any of the works on natural history within our reach. It seems to be a true though a somewhat abnormal Copepod, and also we think there can be no doubt that it is parasitic on *Alcyonium digitatum*. The method usually adopted by us for obtaining specimens is to immerse fragments or whole specimens of the zoophyte in diluted methylated spirit, and, after washing them thoroughly, the residue is examined; by adopting this method we seldom fail in obtaining one or two specimens. The parasite does not, however, appear to be very common, and may not be generally distributed.

? *Enterocola Beaumonti*, sp. n.
(Pl. XVI. fig. 9; Pl. XVII. figs. 9-12.)

Description.—*Female.* Length 2.2 millim. ($\frac{1}{11}$ of an inch). Body composed of five segments, seen from above stout and subcylindrical, the anterior half tapering slightly towards the broadly rounded forehead; the last body-segment with two stout tubercles at the distal end, one on each side of the dorsal aspect; abdomen short, subtriangular, three-jointed; caudal stylets in the form of two short, divergent, and pointed tooth-like processes (Pl. XVII. fig. 9). Seen from the side the last body-segment is strongly gibbous on the posterior dorsal aspect (Pl. XVII. fig. 10). Antennules short and stout, four-jointed; the first is about twice the entire length of the other three; the last is very short (Pl. XVII. fig. 11). Antennæ three-jointed; the first joint, which bears two tooth-like spines near the middle of the inner edge, has the base dilated, but tapers rapidly towards the distal end; the second joint is about three times longer than broad, and has the inner margin obscurely three-toothed; the last joint, which is small, forms a stout tooth-like claw (Pl. XVII. fig. 12). Posterior foot-jaws strong; first joint stout and rather longer than broad, the second and third short; the third joint is armed with a short but strong terminal claw (Pl. XVI. fig. 9). There are four pairs of thoracic feet, all of which are somewhat similar in structure, and resemble those of the next species; they each consist of a short and dilated basal joint, to the upper part of which is attached a single two-jointed branch; the first joint of the branch is moderately stout and elongate, the second joint is short and has two claw-like processes on the outer aspect, as shown by fig. 8 (Pl. XVII.), which represents one of the fourth pair of *Enterocola hibernica*.

Habitat. Taken from an Ascidian, obtained at Valentia, Ireland.

Remarks. This Ascidian parasite somewhat resembles a form obtained by us in the Firth of Forth in 1891, and described and figured in the Ann. & Mag. Nat. Hist. for September 1892; it differs, however, very distinctly in the structure of the antennules, and the dorsal processes on the last body-segment are much less developed; it also differs in the structure of the thoracic feet, and is likewise a smaller species.

This and the following parasites were discovered by Messrs. W. I. Beaumont, B.A., of Cambridge, and F. W. Gamble, M.Sc., of Owens College, Manchester, whilst

carrying out some scientific researches at Valentia, Ireland, from whom we received them for examination. We have much pleasure in attaching Mr. Beaumont's name to this species.

(?) *Enterocola hibernica*, sp. n.
(Pl. XVII. figs. 3-8.)

Description. In general outline somewhat like the preceding species, but considerably larger, being about 4.5 millim. in length ($\frac{2}{11}$ of an inch). Head separated from the body by a distinct joint; body indistinctly segmented; the abdomen, which is coalescent with the last body-segment, terminates in a short and somewhat pyriform caudal process (figs. 3 and 4). Antennules stout, four-jointed, shorter than those of *Enterocola Beaumonti*; basal joint scarcely longer than the combined lengths of the next three; third joint rather longer than the second, end-joint very short (fig. 5). Antennæ short and stout; basal joint without marginal teeth; second joint shorter than the second joint of the antennæ in *Enterocola Beaumonti*, and with a single small tooth near the distal end of the inner margin (fig. 6). Posterior foot-jaws robust; first and second joints of nearly equal length, but the first is more dilated; third joint much smaller, and armed with a short but powerful hooked claw (fig. 7). Thoracic feet similar to those of *Enterocola Beaumonti*. Ovisacs narrow, cylindrical, and elongate.

Habitat. The same as *Enterocola Beaumonti*.

Remarks. *Enterocola hibernica*, though somewhat similar to the species previously described, is quite distinct: not only is it a much larger species, but the structural differences are very marked. The body is indistinctly segmented and the abdomen is coalescent with the last body-segment; whereas in *Enterocola Beaumonti* both body and abdomen are distinctly segmented, and the abdomen is not so rudimentary; the cephalic appendages also show distinct differences.

Though we have ascribed these Ascidian parasites to the genus *Enterocola* of van Beneden, we are not satisfied that this is their true position; but whether a new genus should be established for them, we are not prepared to say.

Lomanoticola insolens, gen. et sp. n.
(Pl. XVII. figs. 1, 2.)

Description.—*Female.* Length about 2 millim. ($\frac{1}{12}$ of an inch). Body broadly subovate; head narrow, subconical, with the apex somewhat truncate; between the head and

thorax there is on each side a deep lateral sinus, and the body is furnished on each side with four large elongate tooth-like processes that overlap each other on the ventral aspect; the abdomen is short and narrow, two-jointed; the terminal joint, which is about three times the length of the first, has the end somewhat trilobed and is furnished with three very small terminal hairs. Ovisacs large, broadly oblong, divergent, each ovisac extending laterally beyond the body of the animal.

Habitat. Parasitic on the nudibranch mollusc *Lomanotus Genei*, Ver., obtained at a depth of 8 fathoms in Valentia Harbour, Ireland.

Remarks. In this remarkable parasite there is no apparent segmentation of the body, and the head is distinguished from the body only by the lateral sinuses already described; on the other hand, the abdomen is distinctly jointed, and consists of two segments, as shown in the drawing. The parasite was entirely buried in the body of the mollusc with the exception of the last abdominal segment and the ovisacs. Figure 2 represents the mollusc with the parasite *in situ*. No antennules, antennæ, or mouth-organs could be observed. The parasite was slightly injured during its removal from the body of the mollusk, and the appendages on one side somewhat displaced; but the drawing shows them in what we believe to be their natural position. We have been unable to identify this parasite with any described genus or species.

Additional Note.—In the 'Journal of the Marine Biological Association,' vol. i., n. s., p. 426, Mr. Garstang, in an article on "The Opisthobranchiate Mollusca of Plymouth," refers to "a remarkable parasitic Copepod" which he had observed on a specimen of *Lomanotus Genei*, and which he at first supposed to be the eggs of the mollusc; probably this parasite may be similar to the form now described.

EXPLANATION OF THE PLATES.

PLATE XV.

Stenhelia Blanchardi, sp. n.

Fig. 1. Female, seen from the side, $\times 53$. 2. Antennule, $\times 126$. 3. Antenna, $\times 168$. 4. Mandible, $\times 190$. 5. Anterior foot-jaw, $\times 380$. 6. Posterior foot-jaw, $\times 380$. 7. Foot of first pair of swimming-feet, $\times 190$. 8. Foot of fourth pair, $\times 126$. 9. Foot of fifth pair, $\times 168$. 10. Abdomen and caudal stylets, $\times 80$.

Thalestris peltata (Boeck).

Fig. 11. Female, seen from above, $\times 80$. 12. Antennule of male, $\times 253$.
13. Antenna (female), $\times 380$. 14. Mandible, $\times 253$. 15. Anterior foot-jaw, $\times 380$.

PLATE XVI.

Thalestris peltata (Boeck).

Fig. 1. Antennule of female, $\times 253$. 2. Posterior foot-jaw, $\times 253$.
3. Foot of first pair of swimming-feet, $\times 380$. 4. Foot of fourth pair, $\times 126$. 5. Foot of second pair (male), $\times 168$. 6. Foot of fifth pair (female), $\times 380$. 7. Foot of fifth pair (male), $\times 253$. 8. Abdomen and caudal stylets, $\times 168$.

(?) *Enterocola Beaumonti*, sp. n.

Fig. 9. Posterior foot-jaw, $\times 380$.

Alcyonicola fusiformis, gen. et sp. n.

Fig. 10. Antennule, $\times 760$. 11. Antenna, $\times 380$. 12. Foot of first pair, $\times 380$. 13. Foot of second pair, $\times 380$. 14. Mouth.

PLATE XVII.

Lomanoticola insolens, gen. et sp. n.

Fig. 1. Female, seen from below, $\times 250$. 2. *Lomanotus*, with parasite *in situ*, $\times 10$.

(?) *Enterocola hibernica*, sp. n.

Fig. 3. Female, dorsal view, $\times 10$. 4. Ditto, side view, $\times 12$. 5. Antennule, $\times 380$. 6. Antenna, $\times 380$. 7. Posterior foot-jaw, $\times 380$. 8. Foot of fourth pair of swimming-feet, $\times 380$.

(?) *Enterocola Beaumonti*, sp. n.

Fig. 9. Female, dorsal view, $\times 26$. 10. Ditto, seen from the side, $\times 26$.
11. Antennule, $\times 380$. 12. Antenna, $\times 380$.

Alcyonicola fusiformis, gen. et sp. n.

Fig. 13. Dorsal view, $\times 40$.

Dermatomyzon gibberum, T. & A. Scott.

Fig. 14. Female, dorsal view, $\times 70$.

XLVIII.—*Descriptions of Five new Species of Land-Shells from New Guinea.* By EDGAR A. SMITH.

[Plate XX.]

THE species described in this paper were collected in German New Guinea in the neighbourhood of Constantin Hafen, on

the north-east coast. The remaining species figured on the accompanying plate are also from New Guinea, and were described in the Ann. & Mag. Nat. Hist. 1895, vol. xv. pp. 230-233.

1. *Nanina amblytropis*, Smith. (Pl. XX. figs. 5, 6.)

Nanina amblytropis, Smith, Ann. & Mag. Nat. Hist. 1895, vol. xv. p. 230.

2. *Nanina lissorhapse*, Smith. (Pl. XX. figs. 1, 2.)

Nanina lissorhapse, Smith, *op. cit.* p. 230.

3. *Rhysota Armiti*, Smith. (Pl. XX. figs. 3, 4.)

Rhysota Armiti, Smith, *op. cit.* p. 231.

4. *Helix (Hadra) stiophora*, Smith.
(Pl. XX. fig. 9.)

Helix (Hadra) stiophora, Smith, *op. cit.* p. 231.

5. *Helix (Dorcasia) subplicifera*, Smith.
(Pl. XX. fig. 12.)

Helix (Dorcasia) subplicifera, Smith, *op. cit.* p. 232.

6. *Helix (Chloritis) ephamilla*, Smith.
(Pl. XX. fig. 10.)

Helix (Chloritis) ephamilla, Smith, *op. cit.* p. 232.

7. *Helix (Chloritis) perambigua*, Smith.
(Pl. XX. fig. 11.)

Helix (Chloritis) perambigua, Smith, *op. cit.* p. 233.

8. *Helix (Cristagibba) Musgravei*, Smith.
(Pl. XX. figs. 13-15.)

Helix (Cristagibba) Musgravei, Smith, *op. cit.* p. 233.

9. *Nanina juvenis*. (Pl. XX. figs. 7, 8.)

Testa parva, depressa, acute carinata, anguste perforata, tenuis, subpellucida, cornea, supra vix nitens, infra polita; spira brevis, leviter convexuscula, ad apicem obtusa; anfractus quinque, lente regulariter accrescentes, plano-convexi, apicales duo radiatim, rugose et minute striati, cæteri striis incrementi obliquis arcuatis tenuibus sculpti, lineis spiralibus paucis obsolete decussati, ultimus supra medium acute carinatus, supra et infra carinam compressus, inferne convexus, nitens, incrementi lineis substriatus; sutura distincta, carina marginata; apertura oblique lunata, ad

carinam angulata; peristoma tenue, marginibus distantibus, columellari leviter incrassato, ad insertionem breviter reflexo, perforationem semiobtegente.

Diam. maj. 10 millim., min. 9, alt. 5.

The specimen here described may not represent the full dimensions attained by this species. It does not, however, appear to be the young state of any of the known forms.

10. *Helix (Coliolum) Canefriana*. (Pl. XX. fig. 16.)

Testa anguste umbilicata, depresso trochiformis, ad peripheriam carinata, supra rufo-fusca, infra pallidior vel olivaceo-fusca, epidermide fugaci fibrata, fusciscente induta et laciniata; spira concave conica, mediocriter elata, ad apicem mamillata; anfractus octo, lente accrescentes, tres superiores convexiusculi, spiralter tenuissime striati, cæteri minus convexi, striis obliquis validis arcuatis sculpti, in medio et ad suturam epidermide laciniato ornati, ultimus subacute carinatus, supra et infra æqualiter convexus, sed inferne lævior, striis tenuioribus sculptus, antice descendens; apertura purpureo-fusca; peristoma continuum, pallidum, leviter incrassatum, supra angulatum, haud reflexum, margine inferiore anguste expanso et reflexo.

Diam. maj. 18½ millim., min. 16½, alt. 11.

This interesting species is very distinct from all the forms at present known from the island. It agrees with the type of the section *Coliolum*, *C. arfakiensis*, Canefri, in having the upper whorls spirally striate and the rest roughly striate; the epidermis is fringed at the middle and base of the whorls, the apex is mamillated, and the form and character of the peristome are the same. The present species, named in remembrance of the late Dr. C. Tapparone Canefri, has a much less elevated spire and a more acute peripheral keel than *C. arfakiensis*.

11. *Pupina nasuta*. (Pl. XX. fig. 18.)

Testa ovata, obliqua, superne acuminata, rufescenti-cornea, subpellucida, polita; anfractus 5, convexi, sutura rufo-lineata sejuncti, penultimus magnus, paulo inflatus, ultimus pone oblique descendens; apertura fere circularis, rufescens; peristoma paulo incrassatum, pallido-rufo marginatum, antice leviter effusum, margine columellari supra producto, curvato, infra ad canalem prominente, nasuto; sinus posticus mediocris; fissura columellaris angustissima, obliqua, extra sinum amentiformem formans.

Longit. 7 millim., diám. 4½; apertura intus 2½.

In this species the anterior slit is situated considerably below the middle of the aperture.

12. *Pupinella Fultoni*. (Pl. XX. fig. 17.)

Testa imperforata, oblongo-ovata, superne acuminata, pallide fuscescens vel sordide flavescens, haud nitida, oblique tenuiter striata; anfractus 6-6½, convexiusculi, penultimus paulo inflatus, ultimus pone oblique descendens, ad labrum breviter ascendens, supra aperturam vix planatus; apertura fere circularis, intus sordide albida; peristoma extra incrassatum, albo-fuscescens; fissura columellaris obliqua, angustissima, extra sinum irregulariter rotundatum formans.

Longit. 14 millim., diam. 7; apertura intus 4 lata.

In form this species agrees with *Bellardiella Martensiana*, Canefri (Ann. Mus. Civ. Genova, 1883, vol. xix. pl. x. figs. 20, 21). The unclosed columellar slit, the absence of an umbilicus, and the smaller size serve to separate this species.

13. *Helicina papuana*. (Pl. XX. fig. 19.)

Testa parva, depresso trochiformis, acute carinata, pallide flavescens; spira subconvexe conoidea, ad apicem submucronata; anfractus 4½, apicalis convexus, lævis, cæteri subceleriter crescentes, planiusculi, lineis incrementi obliquis arcuatis tenuibus striati, ultimus carina compressa acuta circumdatus, infra convexus, radiatim striatus; apertura obliqua, intus flavescens; labrum album, anguste expansum, margine inferiore ad columellam subdentato; callus basalis pellucidus.

Diam. maj. 7 millim., min. 6, alt. 4½.

The keel around the body-whorl is faintly tinted with a pale flesh-colour. Besides the lines of growth, indistinct spiral striæ or scratches are discernible on the upper and lower surfaces.

EXPLANATION OF PLATE XX.

Figs. 1, 2. *Nanina lissorhaphæ*.

Figs. 3, 4. *Rhysota Armiti*.

Figs. 5, 6. *Nanina amblytropis*.

Figs. 7, 8. *Nanina juvenis*.

Fig. 9. *Helix (Hadra) stirophora*.

Fig. 10. *Helix (Chloritis) ephamilla*.

Fig. 11. *Helix (Chloritis) perambigua*.

Fig. 12. *Helix (Dorcasia) subplicifera*.

Figs. 13, 14, 15. *Helix (Cristagibba) Musgravei*.

Fig. 16. *Helix (Coliolus) Canefriana*.

Fig. 17. *Pupinella Fultoni*.

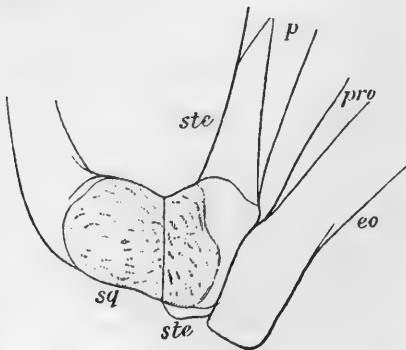
Fig. 18. *Pupina nasuta*.

Fig. 19. *Helicina papuana*.

XLIX.—*Remarks on the Value of certain Cranial Characters employed by Prof. Cope for distinguishing Lizards from Snakes.* By G. A. BOULENGER, F.R.S.

IN a note in the September number of the 'American Naturalist' for 1895 (p. 855) Prof. Cope has attempted to recharacterize the suborders Lacertilia and Ophidia on some cranial features which, I submit, are inadequate for that purpose.

The bone I have hitherto termed Supratemporal (Squamosal of many authors, Paroccipital of Cope), to which the quadrate is attached in most snakes, is stated by Prof. Cope in the Lacertilia to merely touch the latter bone, which articulates solely with the exoccipital; and he gives figures, taken from *Varanus griseus*, illustrating this point. Prof. Cope has evidently contented himself with the examination of only a few types of Lacertilian skulls. It is otherwise inconceivable how such a general statement could have been made. In many Lacertilia the quadrate articulates with the squamosal and the supratemporal to the total exclusion of the exoccipital; whilst in some in which the squamosal is absent the articulation is with the exoccipital and the supratemporal (*Uroplates*), or with the exoccipital, supratemporal, and parietal (*Gecko*). I here give a figure of the bones in an



Suspensorium of *Chlamydosaurus Kingii*, from below and forwards.—*eo*, exoccipital; *p*, parietal; *pro*, prootic (petrosal, Cope); *sq*, squamosal (supratemporal, Cope); *ste*, supratemporal (paroccipital, Cope).

Agamoid lizard, *Chlamydosaurus Kingii*, on the model of the American author's pl. xxxi., with the articulating surface for the quadrate dotted.

Furthermore, it is difficult to understand how "Quadrated bone articulating with paroccipital" can be given as a diagnostic character of the Ophidia, when we remember that the supratemporal [paroccipital, Cope] is absent in three families of that suborder (Typhlopidae, Stenostomatidae, Uropeltidae), where the quadrated articulates with the prootic or with the prootic and the exoccipital.

In stating that "Johannes Müller first placed the distinction on a sound basis by showing that in the Ophidia the frontal and parietal bones descend to the basicranial axis as in no other vertebrates," Prof. Cope appears to ignore that such an arrangement is not universal in Snakes, since in some (e. g. *Psammophis*) the frontals do not descend, and are widely separated from the sphenoid in front of the parietals, which do not actually close the brain-case in front. That some Lacertilia agree with the Ophidia in the downward extent of the parietals the author himself admits; and as the teeth of a slow-worm are as much devoid of "dentinal roots" as those of a snake, it may be asked, What remains of Prof. Cope's new definition of the suborders of the Squamata?

L. — *Descriptions of Four small Mammals from South America, including one belonging to the peculiar Marsupial Genus "Hyracodon," Tomes.* By OLDFIELD THOMAS.

235
CÆNOLESTES*, nom. nov.

Hyracodon, Tomes, P. Z. S. 1863, p. 50; *nec* Leidy, Proc. Ac. Philad. viii. p. 91 (1856).

Type: *C. fuliginosus*, Tomes, *l. c.*

Cænolestes obscurus, sp. n.

Very much as described in *C. fuliginosus*, but double the size.

Rather smaller than *Mus rattus*. Fur soft, thick and close. General colour uniform brown (approximately bistre-brown of Ridgway) all over, rather darker along the median line of the back; but otherwise there are no variations or markings

* *καινός*, modern; *ληστής*, a pirate or other predatory person. The affix "-lestes" is connected in mammalogy with small and ancient fossil marsupials, e. g. *Microlestes*, *Amphilestes*, &c., so that the above name may be considered to represent an existing animal with ancient fossil relatives. The question whether this should be "-lestes" or "-leistes" has been carefully considered and submitted to classical authorities, by whom I am informed that as the iota subscript in *ληστής* would not have been pronounced at all, the proper transliteration is as above.

anywhere. Under surface little paler than back. Ears short, practically naked, brown. Hands and feet brown. Tail about the length of the head and body, slender, very finely haired, the terminal part naked below.

Dimensions of the type (a male in skin):—

Head and body 151 millim.; tail 144; hind foot (moistened) 23; ear (moistened) 12×11.5 ; heel to end of hallux 14.2; hallux 3.2.

Skull: basal length 33.5; greatest breadth 18; nasals, length 17.8; intertemporal breadth 7; palate length from gnathion 20.7; length of palatine foramina 6.2; combined lengths of $\frac{m.1-3}{i.1}$ 5.1. Lower jaw: tip of $\frac{i.1}{i.1}$ to condyle 28.5.

Hab. Bogota. Coll. by G. D. Child, May 7, 1895.

Tomes's "*Hyracodon*" *fuliginosus* was said to be of the size of a water-shrew (P. Z. S. 1860, p. 213), and the measures given in its fuller description in 1863 show that this comparison was not incorrect, while his account of the teeth gives no indication that his example was young. The specific distinction of the Bogota form seems therefore clear.

The rediscovery of this long-lost genus, whose wide distinction from all other living marsupials its original describer does not appear to have at all fully appreciated, is one of the most interesting events in mammalogy that has happened for many years. A full description of the animal, its skull and dentition, will be given elsewhere; but it may be here briefly stated (1) that *Cænolestes* represents among the marsupials a family, and, perhaps, a suborder, entirely different from any other now living; and (2) that it is closely related to, and evidently a surviving representative of, some of the fossil marsupials from the Santa Cruz beds of Patagonia. In fact it seems undoubtedly to fall into the family Epanorthidæ of the suborder Paucituberculata, both groups founded by Señor F. Ameghino. The beds from which the fossil Epanorthidæ were obtained have been said by Mr. Lydekker, to whom I am indebted for assistance in tracing the relationships of *Cænolestes*, to be of Upper Oligocene or early Miocene age, while Señor Ameghino considers them to be Eocene.

Apart from this, the survival to the present day of a member of so ancient a group, otherwise wholly extinct, is a fact of the utmost interest, and one whose discovery will be welcomed by every zoologist.

Oryzomys instans, sp. n.

A middle-sized *Oryzomys* with forwardly projected incisors. Fur soft and straight, about 8 millim. long on the middle

of the back, apparently nearly entirely composed of wool-hairs, but with a few longer hairs intermixed. Colour uniform dark slaty grey, the hairs being almost wholly of this colour, but with their *extreme* tips whitish grey. Ears of medium size, naked, grey. Under surface quite like back. Hands and feet brown; fifth hind toe reaching to the base of the second phalanx of the fourth. Tail long, slender, thinly haired, uniformly brown.

Skull delicate, with a large rounded brain-case and small slender muzzle. Nasals narrow, evenly converging backwards. Interorbital space smooth, its edges just showing a trace of squareness. Upper incisors unusually thrown forwards, so that in a vertical view of the skull they are clearly visible in front of the nasals; no part of their profile, even at their tips, slanting backwards towards the mouth, as is usually the case. Lower incisors long and very slender. Palatal foramina very short, not nearly reaching to the level of m.1. Molars of the squarish form typical of *Oryzomys*.

Measurements of the type (in skin):—

Head and body 99 millim.; tail 130; hind foot (moistened) 22·7; ear (moistened) 14·1.

Skull: basal length 21; basilar length 19·8; basion to tip of nasals 21·2; basion to tip of incisors 21·3; greatest breadth 13·6; nasals 8·6 × 2·7; interorbital breadth 4·6; interparietal 3 × 7; anterior zygoma-root 2·2; diastema 7·1; palatal foramina 3·5 × 1·9; length of upper molar series 3·7.

Hab. Bogota. Coll. G. D. Child.

This remarkable species is only placed provisionally in *Oryzomys*, and may hereafter prove to represent a peculiar group. It is distinguished from all others by its forwardly projecting incisors, rounded supraorbital edges, and short palatine foramina.

Acodon bogotensis, sp. n.

Intermediate in size between *A. caliginosus* and *A. teguina*, both of which it resembles in its uniformly finely grizzled blackish-brown colour. Ears of medium size, black. Limbs and tail dark brown. Belly scarcely lighter than back. Fifth hind toe reaching to the end of the first phalanx of the fourth.

Skull with a narrow muzzle and broad interorbital region, whose edges are almost square, not rounded. Palatine foramina reaching just to the front edge of m.1. Outer wall of anteorbital foramina unusually short. Molars small in proportion to the general size.

Dimensions of the type (an old individual, in skin) :—

Head and body 91 millim.; tail 70; hind foot (moistened) 19·2; ear (moistened) 13·2.

Skull: basal length 20; basilar length 18·5; greatest breadth 12·4; nasals $9·7 \times 2·6$; interorbital breadth 4·8; interparietal $6·4 \times 1·6$; breadth of zygomatic plate 1·4, diastema 6; palatal foramina 4·3; length of upper molar series 3·5.

Hab. Plains of Bogota. Coll. by G. D. Child, May 20, 1895.

A. bogotensis is distinguished from the first species above named by its smaller, and from the second by its larger size, the hind feet of old specimens of the three species being approximately as follows:—16–17, 19, and 22–23 millim. Its dark colour separates it from any other species known to me. In the unusually slender lower portion of its anterior zygoma-root it also seems to differ from all its allies.

Acodon hirtus, sp. n.

General external appearance very much as in *A. longipilis*, Waterh., with which the specimens have hitherto been confounded. Fur shorter, coarser, and shaggier. General colour paler, especially on the sides and under surface, on which latter the tips of the hairs are almost white. Ears short, hairy, scarcely projecting beyond the fur. Hands and feet white; fifth hind toe reaching to the middle of the first phalanx of the fourth. Tail markedly bicolor, dark brown above, white below.

Skull with the general character of that of *A. longipilis*, but the muzzle is not elongated in the same striking way, a difference which at once distinguishes the species. Interorbital region smoothly rounded.

Dimensions of the type (an adult skin) :—

Head and body 113 millim.; tail 84; hind foot (moistened) 23; ear (moistened) 12.

Skull: basal length 24·5; basilar length 22·5; greatest breadth 14; interorbital breadth 5; diastema 7·5; palatal foramina 6·3; upper molar series 4.

Hab. Fort San Rafael, Mendoza. Coll. T. Bridges.

Type: B.M. 60.1.5.15. Presented by G. R. Waterhouse, Esq.

This species is evidently the representative of the Chilian *A. longipilis* on the eastern side of the Andes, just as *A. macronyx* is of *A. megalonyx*.

LI.—*Newly-discovered Stridulating-Organs in the Genus Scytodes.* By F. O. PICKARD-CAMBRIDGE.

THE presence of organs, in various parts of the body of certain spiders, whose function seems to be primarily, at all events, the production of sound, has long been a matter of common knowledge to most arachnologists.

These organs, usually consisting of a hard chitinous plate, whose surface is set more or less closely with transverse ridges or rough corrugations, on the one hand, in opposition to one or more cusps, spines, or tubercles developed on some other adjacent portion of the structure, will always prove of great interest to the scientific student as well as to the general nature-loving public; the more so, perhaps, because their exact significance in the natural economy of their owners, and their ultimate value as factors in a natural classification of members of the order, have not yet been ascertained with any show of certainty.

These "organs of stridulation" are found developed on two widely different portions of the body—the abdomen on the one hand, and the mandibles on the other. Nevertheless in both cases they appear to be modifications of essentially the same plan; for whether they appear on the mandibles working in correlation with the adjacent femoral joint of the palpus or on the abdomen with the more or less produced basal margin of the cephalothorax, these organs consist of a series of grooves or ridges in cooperation with spines or tubercles, which, when in motion, pass over the former just as one might draw a stick rapidly over a series of wooden palings, with a somewhat similar effect, though on a very much smaller scale.

Of the organs which are found on the mandibles and palpi none are more remarkable than those discovered by the late Prof. Wood-Mason, and recently described and figured by Mr. R. I. Pocock, of the Natural-History Museum, South Kensington, in several species of various genera of the Theraphosidæ. In these the hairs become modified and highly specialized, forming very beautiful organs of sound. They consist of a series of longer and shorter hard, shining, chitinous keys, fastened at one end, free at the other, and raised above the surface of the exoskeleton of the mandibles or palpus, as the case may be; for these keys are developed sometimes on the coxal joint of the palpus, sometimes on the outside of the mandibles, and in the Theraphosidæ in both sexes alike.

In *Musagetes*, for instance, the spines which play across the

keys are set in the lower margin of the basal joint of the mandible, while the keys themselves are on the inner face of the coxal joint of the palpus. In *Phormingochilus*, on the other hand, this position is reversed, the keys or rods being on the mandible, while the opposing spines are on the palpus. These beautiful structures, as represented in the two genera mentioned above, have been described and figured in a most interesting paper published in 'Natural Science,' vol. vi. p. 35, Jan. 1895, entitled "Musical Boxes in Spiders."

Amongst other spiders which exhibit an organ of somewhat similar character in the male sex and in a rudimentary form in the female sex, in connexion with the mandibles and palpi, we may mention the genus *Leptyphantes* of the family Theridiidæ and some other genera commonly included under the name *Tmeticus*. The organ in this case consists of a series of transverse grooves, opposed by a small spine set in the apex of a minute conical prominence, situated near the base on the inner side of the femoral joint of the palpus, which works upon and across the grooves.

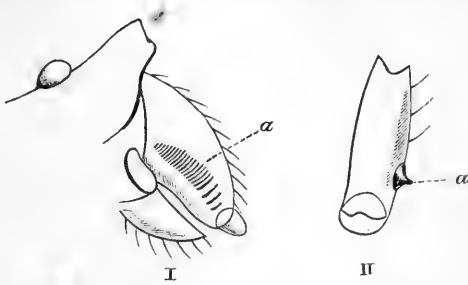
These organs were described and figured long ago by Mr. F. Maule-Campbell, of Hoddesdon.

The sound which these minute organs would emit, if indeed any, would of course be far too insignificant to be heard by the human ear.

More interesting on the whole, perhaps, than these is a somewhat similar organ discovered on the mandible of the genus *Thomisoides*, consisting, in this case also, of an extended series of very highly specialized transverse ridges upon the outer surface, while on the opposing surface of the femur of the palpus appear from four to six (the number varying in different species) small separate tubercles. This structure has been described and figured by M. Simon in 'Histoire Naturelle des Araignées,' pp. 268 and 269, and also by Mr. Pocock in the paper mentioned above, and is found in both sexes of *Thomisoides*.

During the past year I have discovered in all the specimens of the genus *Scytodes*, and in both sexes which have come to hand from various parts of the world, a structure very similar to those in *Leptyphantes*, consisting of a series of short transverse ridges, more pronounced and more widely separate towards the apex, becoming finer and more closely adjacent towards the base (fig. I., a). On the femoral joint of the palpus near the inner basal angle there is a stout conical prominence, its apex terminating in a short blunt spine (fig. II., a). This would, when the palpi were moved to and

fro, pass over the ridges on the mandible, and perhaps produce a strident sound of greater or less intensity (see figures I. and II.).



Of several other genera, *Loxosceles* and *Dictis*, for instance, which M. Simon regards as closely allied to *Scytodes* and *Thomisoides*, it is noteworthy that they show no signs of either ridges on the mandibles or spines on the palpus. At any rate, the species which I have been able to examine—*Loxosceles rufescens*, L. Duf., and *Dictis gilva*, Thor.—do not.

M. Simon, in 'Histoire Naturelle des Araignées,' regards the generic term *Dictis* as a synonym of *Scytodes*. One would, however, be inclined to think that the absence of this organ might be a sufficient reason for keeping the genera *Scytodes* and *Dictis* quite distinct, as originally contemplated by Dr. Thorell.

Of those other organs to which I have briefly referred above, consisting of a deep fovea in the base of the abdomen, just above the pedicle, working in correlation with the roughened or developed and prominent end of the cephalothorax, I may refer to those visible in certain genera of the family Theridiidæ, as, for instance, in *Steatoda*, *Asagena*, *Pedanostethus*, &c.

But by far the most remarkable and the most highly specialized of these organs yet observed is that recently discovered by Mr. Pocock in the male of *Cambridgea antipodiana* (White), and described, with figures, in the Ann. & Mag. Nat. Hist. ser. 6, vol. xvi., Sept. 1895, in a paper entitled "On a new Sound-producing Organ in a Spider."

In this case the upper surface of the pedicle is produced in the form of a sharp, curved, triangular blade, which, when the abdomen is moved, works in and across a deeply corrugated fovea in the base of the abdomen.

LII.—*On the Lamellicorn Coleoptera of Japan, and Notices of others.* By G. LEWIS, F.L.S.

ALTHOUGH twenty years have elapsed since the publication of Waterhouse's paper on the Lamellicornia of Japan in the 'Transactions of the Entomological Society of London,' his memoir remains the only important one on this section of the Japanese Coleoptera. Approximately Waterhouse enumerated 100 species, and my list to-day gives but 123. There is an unexpected limit to the number of the species. The fauna fails in *Aphodii*, of which I have no new species to record, and in this respect corresponds with the tropical region of Eastern Asia; and it lacks *Onthophagi*, which in Southern and Central China are particularly numerous. It is possible that the finest species are local and remain to be discovered. No species of *Euchirus* is at present known to occur in the Archipelago, but it is very probable one exists, and it should be sought for in autumn in the large elevated forests of the central and southern provinces.

The Cetoniidæ are not generally dealt with here, because they were the subject of an article in this Magazine in 1887 (xix. pp.196–202), and beyond two species of *Cetonia* described by Janson in 1888 and one new species of *Paratrichius* described in the note at the end of this paper, there is nothing further to record.

I consider that the following species have been erroneously included in the catalogues and papers on the Japanese Coleoptera, and I have not given their names a place in my list:—*Onthophagus dama*, F.; *Geotrupes splendidus*, F.; *Serica brunnea*, L.; *Phyllopertha horticola*, L.; *Phyllopertha arenaria*, Brullé; *Anomala oblonga*, Scop.; and *Mimela testaceoviridis*, Blanch. Regarding the synonymy set forth in the List of Species, I believe it is correct; and when it differs from lists previously published I have given in the body of this paper the reasons for my conclusions.

Three species of *Aphodii* have been very indifferently described by Motschulsky, and Waterhouse, failing to refer them to any species in the collection formerly in his hands, transcribed Motschulsky's descriptions verbatim, to enable students not having the 'Etudes' to judge of their value. After studying Motschulsky's papers and becoming familiar with the author's work generally, I think I have assigned his names to the right species; but in consideration of the incompleteness (and, in one case, false measurement) of his descriptions, I think his names are not entitled to the right

of precedence. It is better to regard them as manuscript names.

A curious species of a genus allied to *Uroxys* has been found lately on Oshima, the largest island of the Riuikuan group, and it is described and figured here: this group of islands must not be confounded with the Chinese islands lying further to the south, and usually known as the Luikiu Islands, because there is no corresponding sound to the R in the Chinese language, while the Japanese language lacks the L.

PANELUS, gen. nov.

This genus is established for the reception of a small species in many respects similar to a species of *Scatinus* and *Saphobius*. Body somewhat ovate; terminal joint of maxillary palpi elongate; the mentum small and distinctly incised anteriorly; the head, eyes visible from above, clypeus bidentate on the anterior edge, frontal suture invisible, lateral edge minutely notched; the mesosternum pointed anteriorly; the thorax, anterior angles largely excavated for the reception of the antennal clubs; the legs, anterior tibiæ feebly dilated apically, apex without tarsal grooves, intermediate and posterior tibiæ bent, not dilated towards the tarsi, anterior tarsi very short. In the figure the tarsi are drawn a little too long; the figure represents the form of the intermediate tarsus, which, like the hind tarsus, is stout at the base.

Type *Temnoplectron parvulum*, Waterh.

Fig. 1.

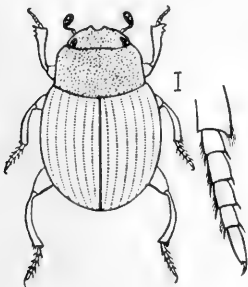
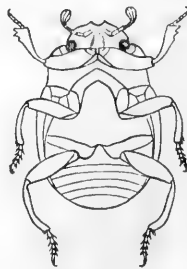


Fig. 2.



Panelus parvulus. (Woodcut, figs. 1, 2.)

Temnoplectron parvulum, Waterh. Ent. M. M. p. 175 (1874).

Waterhouse's description is as follows:—

“Elongatum, subovatum, piceum, nitidum. Capite magno, leviter

convexo, subrotundato, subtilissime et crebre punctulato; margine antico depresso, in medio bidenticulato atque inter denticulos emarginato. Thorace crebre et distincte punctato, longitudine duplo latiori, sat convexo, antice angustato, margine antico leviter emarginato, postice rotundato, lateribus ad angulos anticos subito oblique angustatis, angulis anticis rectis, posticis obtusis. Elytris sat convexis, lævibus, longitudine non brevioribus, infra humeros latioribus, dein ad apicem arcuatim angustatis, singulis tenuissime septem-striatis. Tibiis compressis, arcuatis, tarsis compressis. Antennarum clava nigro-fusca.

“L. $2\frac{1}{2}$ mill., lat. $1\frac{1}{2}$ mill.”

Hab. Nagasaki and its neighbourhood. Occurs under dead leaves in the early days of April, and is not uncommon.

MARAXES, gen. nov.

Body oblong; the maxillary palpi, terminal joint long and very feebly securiform; the mentum narrow, emarginate anteriorly; the head angularly explanate laterally, eyes semicircular in outline, invisible above; the clypeus anteriorly 4-dentate, frontal suture invisible; the thorax transverse, with cavities in the anterior angle for the reception of the antennal club; the scutellum invisible externally; the elytra widest in the middle, humeral angle rectangular, but a little prominent; the pygidium invisible from above; the coxæ, anterior pair contiguous, intermediate widely separate, posterior approximate; the legs, anterior tibiæ gradually dilated to the apex, apices grooved for the reception of the tarsi in repose.

This genus may be placed near *Uroxys*.

Maraxes dentifrons, sp. n. (Woodcut, figs. 3, 4)

Oblongus, convexus, niger, nitidus; capite vix dense punctato, clypeo antice 4-dentato; thorace transverso, minus dense punctato; elytris punctato-striatis, interstitiis lævibus; pygidio lævi, transversim leviter sulcato.

L. 5 mill.

Oblong, convex, black, shining; the head, edge of the clypeus 4-dentate, lateral edge notched before the median angle, widest before the eyes, upper surface rather densely punctate; the thorax transverse, the punctures a little less closely set than those of the head, anterior angles obtuse, posterior angles rectangular; the elytra clearly punctate-striate, interspaces smooth; the pygidium smooth, with a rather fine transverse sulcus near the base, which is V-shaped in the middle; the legs, tibiæ widen out to the apices, anterior

pair 3-dentate, intermediate and posterior spinose on the outer edge and without grooves; the underside is strongly punctate except in the area near the intermediate coxæ.

Fig. 3.

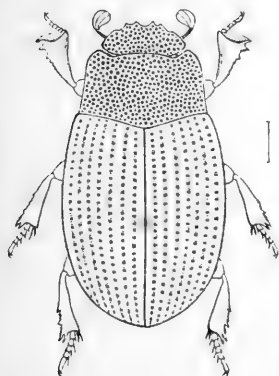
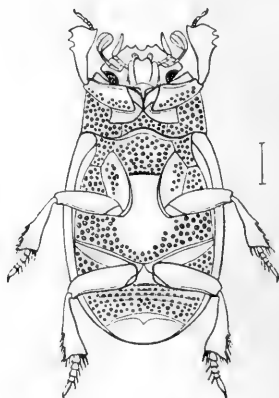


Fig. 4.



Hab. Oshima.

I am much indebted to Monsieur René Oberthür for an example of this species.

Copris ochus.

Catharsius ochus, Motsch. Etud. Ent. p. 13 (1860); Waterh. Trans. Ent. Soc Lond. i. p. 73 (1875).

There is only one carina on the hind tibia of this species; *Catharsius* is distinguished from *Copris* in having two.

L. 20-26 millim.

Hab. Simabara, Kobé, Nikko, and Hakodate. Abundant on sandy areas.

Copris acutidens, Motschulsky.

Copris acutidens, Motsch. Etud. Ent. 1860, p. 13; Waterh. l. c. p. 75 (1875).

Large examples of this species measure 16 millim., and there is a small race which measures only 10 millim.

Hab. Abundant in all the islands in sandy places.

Copris pecuarius, Lewis.

Copris pecuarius, Lew. Wien. ent. Zeit. iii. Heft i. p. 17 (1884).

“*C. lunari* affinis, sed major. Niger, nitidus, elytris punctato-

striatis, interstitiis subtiliter alutaceis; pygidio sat dense punctato, in medio linea longitudinali lævi subelevata.

Long. 20-23 mm.

"This species is closely allied to *Copris lunaris*, L., but besides the size, it has several well-marked characters to distinguish it. The horn in the male is one third longer and without any notch at the base; the thorax has the elevations more decidedly separated and formed as in *acutidens*, Motsch., but less acute. In both sexes the sculpture of the elytral interstices gives an appearance of opacity; the pygidium is somewhat closely punctured, and down the centre of it is a smooth well-defined line, which is slightly elevated."

Hab. Nikko, very abundant; also at several places on the Nakasendo.

Onthophagus nikkoensis, sp. n.

Oblongo-ovatus, æneo-niger, parum opacus; capite thoraceque ocellato-punctatis; elytris interstitiis basi et apicali rufis; pygidio dense ocellato-punctato; tibiis anticis truncatis.

L. 5½-6 mill.

Oblong-ovate, brassy black, rather opaque; the head, clypeus anterior edge incised in the middle, surface strongly and closely punctate, punctures transversely confluent, the suture is indicated by an evenly arched carina, behind the carina the forehead is densely ocellate-punctate, punctures not confluent, in front of the neck a second transverse carina; the thorax densely and clearly ocellate-punctate, in ♀ there is a gibbose elevation behind the middle of the head, in ♂ the gibbosity is more transverse and divided into three parts; the elytra distinctly but not deeply striate, interstices opaque, with two longitudinal rows of small granules, rows most regular on the interstices near the suture, interstices usually reddish at the apices and bases; the pygidium clearly ocellate-punctate; the legs and antennæ pitchy brown, the ends of the anterior tibiæ are truncate like those of *O. jessoensis* and *brevis*.

Hab. Nikko and Nara. Abundant at Nikko in June.

Onthophagus vacerrosus, sp. n.

Breviter ovalis, piccus, setosus, nitidus; capite bicarinato, punctato; thorace convexo, undique punctato; elytris obscure brunneis.
L. 4 mill.

Shortly oval, piccous, setose, shining; the head, clypeus feebly emarginate, with confluent punctures, divided from the

head by a well-marked transverse carina, before the neck there is a second transverse carina, equal in length to the first, punctures between the carinae not confluent nor so large and deep as those in the clypeus; the thorax convex on the disk, evenly, not coarsely punctured throughout, punctures obsoletely ocellate, at the side near the middle of the lateral edge is a small ill-defined boss; the elytra dull brown, striae somewhat faint, interstices flat, with two rows of granules; the pygidium punctate, punctures frequently confluent; the legs and antennae obscurely brown, tibiae tridentate, the apical tooth is at right angles to the tibia, leaving the end truncate.

The species is about the size of *O. brevis*, Waterh.; the thorax is more convex than any other of this series. I believe my example is a male.

Hab. Awomori. One specimen, 31st August, 1880.

Onthophagus ocellato-punctatus, Waterhouse.

Onthophagus ocellato-punctatus, Waterh. *l. c.* p. 79 (1875).

The male has a slender and somewhat straight horn on the posterior edge of the head; this sex was unknown to Waterhouse.

Hab. Hiogo in August 1871, and on the sand-hills at Hakodate in September 1880.

Note.—*Caccobius* is a generic name proposed for such species of *Onthophagus* in which the tarsal end of the tibia is truncate; but intermediate forms occur between *Caccobius* and the typical *Onthophagi*, and the genus is now considered to be of doubtful validity.

Aphodius Solskyi, Harold.

Aphodius Solskyi, Har. *Deutsch. ent. Zeit.* p. 251 (1871).

Aphodius diversus, Waterh. *Trans. Ent. Soc. Lond.* i. p. 82 (1875).

Aphodius castaneipennis, Waterh. *l. c.* p. 83 (1875).

Calamosternus rectus, Motsch. *Bull. Mosc.* p. 169 (1866).

Chilo thorax vitta, Motsch. *l. c.* p. 170 (1866).

Waterhouse thought that Motschulsky's words "angulis posticis subacutis" did not apply to his *Aphodius diversus*; but the few words of description he gives of *C. rectus* apply in other respects, and some latitude of interpretation is necessary with this author. I also consider that the *C. vitta*, Motsch., is the common colour-variety of *A. Solskyi*, Har., very abundant in Japan. There is nothing except the words "tenue punctato-striatis" as applied to the elytra, against the "punctato-striatis" applied to *C. rectus*, that can throw

doubt on the matter. I do not think Motschulsky's names are entitled to first rank, as, if allied species had been found (as in the case of his *Holotrichia parallela*), the descriptions are so vague that they would probably apply to all. His measurement of *Chilothorax vitta* is 4 lines by $1\frac{1}{2}$ line, an impossible measurement for an *Aphodius* said to be "elongato-subovatus."

Hab. Very common in Japan and in many parts of China.

Aphodius brevisculus, Motschulsky.

Aphodius brevisculus, Motsch. Bull. Mosc. i. p. 170 (1866); Waterh. l. c. p. 82.

This species is generally black, but sometimes the thorax is broadly margined with brown and the elytra wholly brown; in other specimens the elytra are black, with a brownish spot on the humeral angle. The elytra are punctate-striate.

L. $3\frac{1}{2}$ –5 mill.

Hab. Hakodate. Many examples.

Aphodius eccoptus, Bates.

Aphodius eccoptus, Bates, Ent. Month. Mag. xxv. p. 297 (1889).

"Subgen. *Melinoptero* (Muls.) referendus. Elongatus, parum convexus, nigro vel castaneo-fuscus, femoribus ventroque sordide testaceis, elytris haud dense recumbente fulvo-pubescentibus; capite discrete punctulato, inermi, clypeo semicirculari, genis haud productis, obtusis; thorace apud angulos posticos valde sinuato, margine laterali incrassato, basali medio immarginato, disco æqualiter discrete punctulato; elytris punctato-striatis, interstitiis medio convexis sparse punctulatis, striis 3–7 apice abbreviatis; tibiis posticis apice spinis inæqualibus."

L. 8 mill.

This species differs from all in this series in the situation in the hind angles of the thorax.

Hab. Nikko and on the Mikuni-togé. I took it very abundant at Nikko in company with *Copris pecuarius*, Lew., and *Oniticellus phanæoides*, Westw.

Aphodius lividus, Olivier.

Aphodius lividus, Ol. Ent. i. p. 86, t. xxvi. fig. 22.

This species is usually regarded as a cosmopolitan insect; in the Munich Catalogue the synonymy consists of fourteen names; Olivier figured it and Fabricius described it three times.

Hab. Oyayama, Awomori, and Hakodate. Ten examples.

Aphodius ovalis, Waterhouse.*Aphodius ovalis*, Waterh. l. c. p. 89.

Hab. This species appears to be local. The original example came from Nagasaki, and on the 16th February, 1881, I obtained four more specimens at Ipongi, a place about four miles from the town.

Aphodius variabilis, Waterhouse.*Aphodius variabilis*, Waterh. l. c. p. 90.*Melinopterus nigrotessellatus*, Motsch. Bull. Mosc. p. 170 (1866).

I consider that the above names apply to the same species. Motschulsky's description is not sufficient to allow his name precedence; the form of this insect is "elongato-subovatus" (the same as *Chilothorax vitta*) and the measurement 2 lines by 1 line. The punctuation of the thorax varies in density in *A. variabilis*, and the scutellum is black, piceous, or red in various examples. I have three specimens from Yokohama in which the dorsal spots unite and form a broad transverse band, which, however, leaves the sutural interstice obscurely brown.

Hab. Nagasaki, Kobé, and Yokohama. Common where it occurs.

Aphodius urostigma, Harold.*Aphodius urostigma*, Har. Berl. ent. Zeit. p. 170 (1862); Waterh. l. c. p. 90.

Harold in 1878 (Munich Cat. p. 1055) considered this species to be the same as *A. pallidicornis*, Walker; but Waterhouse, having access to Walker's type in 1875, pointed out the differences.

Hab. Nagasaki, Oyayama, Nikko, and Awomori. Waterhouse gives China and Ceylon as localities, and Harold's typical specimen came from Java.

CÆLIUS, gen. nov.

The species for which this genus is established has a corporal outline like *Saprosites*, long and parallel at the sides, and it inhabits the recesses of old trees. From the colour and the difficulty I had in obtaining a few specimens, it probably rarely comes near the surface. Head anteriorly semicircular in outline, frontal suture well marked, mentum rather narrow, arched not incised in front, terminal leaflet of the antennal club much less transverse than in *Saprosites*; the anterior and posterior coxæ contiguous, intermediate moderately

separated; the pygidium exposed. *Cælius* differs from *Saprosites* in the form of the clypeus, which is depressed but not deflexed, the scutellum is less narrow, and the anterior thoracic angles are somewhat acute. In *Saprosites* the frontal suture is not visible, the clypeus is deflexed and emarginate.

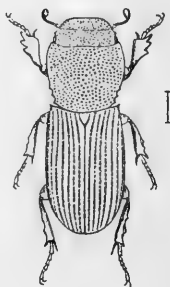
Cælius denticollis, sp. n. (Woodcut, fig. 5.)

Elongatus, parallelus, rufo-brunneus; capite punctulato, linea transversa distincte impressa et utrinque fusco-maculata; thorace antice minute disco grosse punctato; antennis pedibusque concoloribus.

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

Elongate, parallel, reddish brown, shining; the head punctulate, punctures variable in size and not very closely set, clypeus anteriorly with a widely arched outline, not emarginate, frontal suture very distinct, with two dusky spots like those in *Ægialia rufa*, F. (*nec* Leconte), eyes small; the thorax with large, round, and deep punctures, irregularly and not closely set, intermixed with smaller points, the punctuation anteriorly gradually lessening in size until the edge behind the neck, where it is very fine, the lateral edge is obscurely crenulate anteriorly, the crenulations gradually increase in distinctness until they form a series of denticulations round the posterior angles; the scutellum obsoletely punctulate; the elytra evenly punctate-striate, interstices smooth with crenulate edges; the metasternum is longitudinally subcanaliculate in the middle, with large punctures in the channel and a few on the side of the plate outside it; the legs, anterior tibiæ strongly tridentate.

Fig. 5.



Hab. Miyanoshita, Kiga, and Nikko. Four examples from old and decaying trees.

Saprosites naræ, sp. n.

Elongatus, parallelus, piceo-brunneus, nitidus; capite convexo, genis haud prominulis nec acutis; thorace subquadrato, punctato; elytris fortiter striatis, striis fortiter punctatis, interstitiis convexis, lævibus; mesosterno antice circulari impresso.

L. 3 mill.

This species is much smaller than *S. japonicus*, Waterh., and of a different colour. The cheeks are less prominent and

the sculpture above less coarse, but the most important difference lies in the anterior portion of the mesosternum. The mesosternum anteriorly in *S. japonicus* is raised and the elevated part has a securiform outline; in *S. naræ* this part is occupied by a circular impression more or less deep. The impression is usually well defined, but in one specimen out of twelve the impression is very shallow. The thorax also is distinctly less transverse.

Hab. Nara. On the 30th June, 1881, I found it abundantly under bark, and later in the year I obtained one specimen on Oiwake, a mountain on the Nakasendo.

Oxyomus jugosus, sp. n. (Woodcut, fig. 6.)

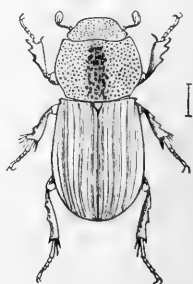
Oblongus, piceus, subnitidus; clypeo leviter emarginato, bituberculato; thorace rugoso; elytris 8-costatis.

L. $4\frac{1}{3}$ mill.

Oblong, piceous, somewhat shining; the head, clypeus very transverse, feebly but widely emarginate, with a small tubercle on each side of the emargination, surface uneven, with an ill-defined marginal impression and a feebly-raised disk in the middle, rugosely sculptured with punctures of various sizes, cheeks obtusely produced; the thorax, anterior angles a little prominent, arched laterally, hind angles obsolete, sculpture rough and coarse and somewhat variolose, with a median impression before the scutellum; the scutellum small and triangular; the elytra 8-costate, with the sutural edges markedly elevated and the epipleural margin finely carinate, the second and fourth costæ are the most conspicuous, the second agreeing with the sutural costa, interstices not very distinctly sculptured, but the sculpture appears to consist of two longitudinal rows of short linear carinæ, humeral angle obtuse, elytra widest behind the posterior coxæ and rather narrower at the base; the legs pitchy brown, anterior tibiæ carinate, with small transverse ridges on the outer side of the carina.

Hab. Nagasaki. I took one specimen from under dead leaves near the Temple of Suwasama on the 23rd March, 1881.

Fig. 6.



Rhyssemus asperulus, Waterhouse.*Rhyssemus asperulus*, Waterh. l. c. p. 94.

Hab. Nagasaki, Kobé, Yokohama, and Nikko. I found this species in garden rubbish commonly as far north as Nikko; at Hakodate I took a broader insect, which may be a different species.

Psammодиус айну, sp. n.

Oblongus, niger, subnitidus; capite rugoso, obsolete punctato; thorace transversim 5-costato; elytris 9-carinatis, interstitiis seriatim punctatis.

L. $2\frac{3}{4}$ mill.

Oblong, black, somewhat shining; the head very rugose, the rugosities obliterating the punctuation, before the neck are irregular transverse ridges, varying in distinctness in different specimens, clypeus feebly emarginate and reddish on the edge; the thorax with five transverse ridges narrowly broken in the middle; the elytra with nine longitudinal carinæ (inclusive of the sutural and epipleural margins), the interstices have single rows of shallow punctures.

Without comparison this species might be mistaken for the European *P. sulcicollis*, Ill.

Hab. Hakodate. Four examples from the sand-hills.

Psammодиус convexus, Waterhouse.*Psammодиус convexus*, Waterh. l. c. p. 94 (1875).

Hab. Kobé, Kioto, Niigata, and Sapporo. In sandy places.

Psammодиус японический, Harold.*Psammодиус японический*, Har. Deutsche ent. Zeit. xxii. Heft i. p. 69 (1878).

“Elongato-oblongus, nitidus, piceus, subtus cum pedibus obscure rufo-piceus; capite æqualiter granulato; thorace parce punctato, ad latera antice transversim impresso; elytris punctato-striatis, interstitiis planis lævibus.”

L. 4 mill.

The thoracic impression is a distinctive character in this species.

Hab. Nagasaki and Enoshima. Hagi (*Hiller*).

Psammодиус комис, sp. n.

Elongato-oblongus, niger, nitidus; capite rugoso-granulato, trans-

verso; thorace grosse punctato, utrinque foveolato; elytris punctato-striatis; pedibus piceis.

L. $4\frac{1}{4}$ mill.

Elongate, oblong, black, shining; the head transverse, anterior outline broadly arched, not emarginate, edge narrowly reflexed; the thorax also transverse, with large punctures evenly distributed but not closely set and a fovea on each side well within the margin; the elytra deeply punctate-striate, interstices rather wide, convex, and smooth; the antennæ and mouth-organs reddish brown; the legs piceous, tarsi rather paler.

In general outline and size this species resembles *P. japonicus*, Har., but it is not opaque; the head more transverse and not emarginate and the thorax is without any lateral impression.

Hab. Nikko. One example from the bed of the river.

Ægialia nitida, Waterhouse.

Ægialia nitida, Waterh. *l. c.* p. 95.

This species measures $3\frac{1}{2}$ –4 mill., not 4 lines.

Hab. Hakodate, on the sand-hills. Four examples in September 1880.

Ochodæus maculatus, Waterhouse.

Ochodæus maculatus, Waterh. *l. c.* p. 95, pl. 3. fig. 1.

Hab. Kiushiu and on the main island. This species originally came from Simabara and Tagami close to Nagasaki. In May 1882 I caught two flying at dusk above Mogi also close to Nagasaki. Mr. Pryer found one on Oyama near Yokohama. In the British Museum there is a similar species from Java.

Bolboceras nigro-plagiatum, Waterhouse.

Bolboceras nigro-plagiatum, Waterh. *l. c.* p. 96, ♀.

The male of this species was not noticed by Waterhouse. On the head there is a somewhat stout and rugose horn, slightly emarginate at the apex; the thorax has a transverse ridge behind the neck, and on each side of it is a tubercle similar to those of *Copris lunaris*, L., or *C. pecuarius*, Lew. There is a specimen in the British Museum from Korea which is either a variety of this species or one very similar to it, the sculpture of the head and thorax is different and the dark coloration of the elytra extends to the middle of each wing-case.

Hab. Tokio, Yokohama, and Kobé. Not very common.

Ann. & Mag. N. Hist. Ser. 6. Vol. xvi.

Geotrupes auratus, Motschulsky.

Geotrupes auratus, Motsch. Etud. Ent. 1857, p. 31; Jekel, Ann. Soc. Ent. Fr. 1865, p. 587; Waterh. *l. c.* p. 97.
Geotrupes purpurascens, Waterh., Lew. Ent. 1893, p. 150.

Hab. Japan, common in all the islands. At Nanai near Hakodate, on the 17th September 1880, I observed it in great profusion. A note in my diary says "50 specimens occurred in one of their attractions and this repeatedly. Many scores were alive and crawling about without abdomens; a species of *Corvus* had been feeding on them, but only eating the softer part of their bodies." At Kashiwagi I found only the blue variety and captured about 30 examples. The colour-varieties are noticed in the Ent. p. 150 (1893). Waterhouse records specimens from Tartary and Heyden from Manchuria. Celebes has been given in error.

The colours of this species are blue-black, blue-green, blue, golden green, golden red, and bright copper, with some intermediate tints. The smallest specimen I have measures 14 mill., the largest 21 mill.

Geotrupes levistriatus, Motschulsky.

Geotrupes levistriatus, Motsch. Etud. Ent. p. 32 (1857), ♀; Waterh. *l. c.* p. 97 (1875), ♂ & ♀.
Geotrupes Deyrollei, Jekel, Ann. Soc. Ent. Fr. v. p. 586 (1865).
Geotrupes amæus, Jacobsohn, Hor. Soc. Ent. Ross. xxvii. p. 120 (1893), ♂.

Jacobsohn's description corresponds with the female characters of this species, but he states that his type is a male. The descriptions by Motschulsky, Jekel, and Waterhouse were presumably unknown to Jacobsohn, as they are not referred to by him.

Hab. Japan, abundant (in many varieties) in all the islands and occurs also in Manchuria. The locality "Celebes" has been given in error, owing to a small series of Japanese species in the British Museum being so labelled by Mr. Bowing before presentation to that institution. Occurs also on Kotoi, one of the Kurile Islands.

Trox chinensis, Bohem.

Trox chinensis, Bohem. Eugen. p. 52 (1858).
Trox obscurus, Waterh. *l. c.* p. 98.

This species is smaller than *T. inclusus*, Walker, but both species belong to the section of the genus in which the scutellum is coarctate at the base. The genus *Trox* is now divided into 4 or 5 genera.

Hab. Simabara. Four examples in 1869. I did not meet with it on my second visit to Japan.

Trox setifer, Waterhouse.

Trox setifer, Waterh. l. c. p. 98.

Hab. I found this species in single examples at Nagasaki, Simabara, Nikko, and Hakodate; it has therefore a wide range in Japan.

Trox opacotuberculatus, Motschulsky.

Trox opacotuberculatus, Motsch. Etud. Ent. p. 14 (1860); Waterh. l. c. p. 99.

This species has two wide circular depressions which occupied the median area of the thorax and two others on each side of them of corresponding size. Motschulsky's description should, I think, read "thorace transverso, antice et postice late trifoveolato," not "thorace transverso, antice et postice lato, trifoveolato"; but the depressions are not properly described as foveæ.

Hab. Nagasaki, Nikko, and on the plain of Fujisan. According to Kraatz (Deutsche ent. Zeit. xxiii. p. 231, 1879) it occurs in the Amur region.

Trox niponensis, sp. n.

Elongato-oblongus, opacus, clypeo semicirculari; capite punctato; thorace transverso, in medio longitudinaliter canaliculato, utrinque obsolete bi-impresso; elytris striatis, striis minime profundis.
L. 5½ mill.

Elongate oblong, opaque, setose; the head semicircular anteriorly, arched at the sides, punctate, with two transverse carinæ (somewhat obscure) in the middle in a line with the eyes; the thorax transverse, rather parallel laterally, anterior angles a little acutely produced, with a longitudinal median, rather shallow channel, and a fainter circular impression on each side of it rather nearer the base than the anterior edge, surface punctate; the elytra striate, striæ shallow with irregular edges, there is a sutural row of setose tubercles and on the third interstice similar but larger and more isolated tubercles, fifth and seventh interstices also tuberculate, the other interstices have smaller tubercles; the elytra somewhat parallel at the sides, but slightly widest behind the posterior coxæ; the legs, tibiæ not dilated, agreeing in this respect with *T. opacotuberculatus*, Motsch.

This small species in general outline agrees best with *Trox setifer*, Waterh., but the thorax is not bisinuous anteriorly, nor are the anterior tibiæ dilated. The scutellum is similar in form but relatively narrower. The scutellum in *T. opacotuberculatus* is nearly as wide again as in *T. niponensis*.

There are four specimens in the British Museum from St. Paul's Island in the Indian Ocean and one from Hakodate. One of the specimens is labelled "*Trox Eversmanni*, Kry. (*rugulosus*, Fald.);" but the thorax of *T. Eversmanni* is described as being subcordate and deeply punctate, and this does not apply to the Japanese species; Faldermann's name has not been published.

Hab. Hakodate. Taken from a dead animal on the sand-hills.

Anthypna pectinata, sp. n.

♂. Oblonga, ænea vel viridi-ænea, nitida, grisco-hirta; capite carinato; thorace granulato-punctato; elytris dense transverso-strigosis. Femina latet.

L 9 mill.

Oblong, brassy or greenish brassy, shining, and clothed with long grey hair; the head, surface microscopically strigose, punctured, punctures not densely set and appearing sometimes as granules or little bosses owing to their rims being raised, each bears a hair, carinate before the eyes, the carina sometimes joins anteriorly, and in such specimens the carina can be traced in a bowed line behind the eyes; the thorax feebly sinuous on either side on the basal edge, hind angle obtuse with a concavity within it which reaches halfway along the thoracic edge; the scutellum rather densely sculptured; the elytra wholly strigose-rugose; the antennæ and legs greenish or coppery, claws and tibial spines reddish brown.

This genus, so far as I am aware, has hitherto only been represented by two Italian species and two Asiatic species described by Semenow in 1891.

Hab. Tokio. Six specimens found in a garden, all males.

Ectinohoplia obducta.

Hoplia obducta, Motsch. Etud. Ent. 1857, p. 33.

Hoplia sabulicola, Motsch. l. c. p. 34.

Ectinohoplia variolosa, Waterh. l. c. p. 99, pl. iii. fig. 2.

This species is very variable, Waterhouse's figure represents the commonest form, but specimens entirely velvety black above are very common, and intermediate varieties are often found. The remarkable claws in this species are noticed by Motschulsky.

Hab. Nagasaki, Hitoyoshi, Nikko. It is one of the most abundant species in Japan.

Hoplia gracilipes, sp. n.

Nigra, dense squamulis aureo-viridibus tecta; thorace angulis posticis subrotundatis, scutello parvo; pedibus longis et gracilibus, brunneis vel testaceis.

L. 7-8 mill.

This species is very similar to *H. Reini*, Heyd., and *H. communis*, Waterh. It differs from the first in the hind angles of the thorax being rounded, and from the second in being more elongate in form, thorax a little less wide, and (this is a very remarkable character) in the under rim of the thorax projecting out underneath the posterior angle, giving at first sight, when viewed from above, the impression that the hind angle is acute; the scutellum is one third less in size than that of *H. communis*, and the femora and tibiæ are much more slender and longer.

Hab. Oshima (*Ferrie*, 1895). Communicated by the kindness of Mons. René Oberthür.

Hoplia Reini, Heyden.

Hoplia Reini, Heyd. Deutsche ent. Zeit. p. 339 (1879).

This species is described as being similar to *H. parvala*, Krynicki, an insect I have not seen. It hardly differs from *H. communis*, Waterh., except that the hind angles of the thorax are angular, not rounded off. This, however, is a very marked distinction. I apparently overlooked this species, mistaking it when alive for *H. communis*, and I find I have only three or four specimens. Like Dr. Rein I found these in Kiushiu, near Hitoyoshi, early in May.

Hab. Kiushiu.

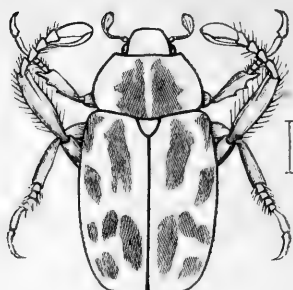
Hoplia maculata, Bates. (Woodcut, fig. 7.)

Hoplia maculata, Bates, Ent. Month. Mag. xxv. p. 298 (1889).

“*H. aureole* (Pall.) proxime affinis et quod formam simillima; differt supra squamis pallide fulvis haud metallicis et corpore subtus femoribus pygidioque læte aureis: oblonga, supra breviter sat sparsim setosa, thorace vittis duabus medianis, clytris utrinque striga irregulari haud procul a sutura postice divergenti maculisque tribus lateralibus (prima humerali) strigisque vagis marginalibus fusco-nigris; clypeo sicut in *H. aureola* brevi antice angustato margineque sinuato; thorace medio rotundato angulis posticis obtusis; tibiis et tarsis nigris sparsissimo squamosis. Ungues sicut in *H. aureola*.”

♂. L. 8 mill.

Fig. 7.



Hab. Satsuma (*Leech*). I took an example on Mitsudake, near Nagasaki, in April, and nine examples from the flowers of the wild rose at Hitoyoshi, 3rd May, 1881. This species appears to occur only in Kiushiu. The drawing shows a position the insect usually assumes when resting in flowers.

SERICANIA, Motschulsky.

Sericania, Motschulsky, Schrenck's Reisen, p. 136 (1860).

The characters of this genus are very similar to those of *Serica*; I find no valid character except in the antenna of the male. Five terminal joints are foliate (Motschulsky's figure only contains four); the first leaflet is peculiar, being a shorter and more slender appendage than the others, and it rises from the base of a rather long joint, and this position separates it from the four terminal leaflets. The compilers of the Munich Catalogue did not notice that Motschulsky, in a note of "errata" at the end of the volume of Schrenck's 'Reisen,' corrects the spelling of this genus. *Sericaria* is a misprint.

Sericaniu mimica, sp. n.

Elongata, piceo-rufa, nitida; capite rugose punctato, clypeo rufo-brunneo; thorace parum grosse punctato; elytris punctatis, punctis confluentibus.

L. 9-11 mill.

Elongate (outline similar to that figured for *Pellaplonys flavidus*, Waterh.), pitchy red, shining; the head roughly and densely punctate, clypeus reddish brown, outer edge more or less raised, head dark brown between the eyes; the thorax bisinuous anteriorly, transverse, narrowest in front, widest behind, evenly arched at the sides, lateral edges narrowly raised, base feebly sinuous on each side, punctate, points larger

and less closely set than those of the head; the scutellum punctate, somewhat elongate, obtuse behind; the elytra with eight or nine shallow furrows occupied with confluent punctures, interspaces feebly convex and smooth; the pygidium irregularly, not densely punctured; the antennæ and legs concolorous.

Hab. Miyanoshita, Hakone, Subashiri, Ontake, Nikko, and Yokohama. Sixteen examples.

Sericania fuscolineata, Motschulsky.

Sericania fuscolineata, Motsch. Schrenck's Reisen, p. 136, tab. ix. fig. 10 (1860).

If I have determined this species correctly, it is very variable in colour. I have only one specimen, which agrees in having the dark lines on the elytra. The elytra are usually pale with the sutural interstice infusate, or sometimes wholly pale; the head sometimes is, with the thorax, wholly æneous, but generally the clypeus is testaceous.

Hab. Yokohama and Chiuzenji; island of Askold (*Heyden*, 1884).

SERICA, MacLeay.

Serica, MacLeay, Hor. Ent. i. p. 146 (1819).

In this genus the intermediate coxæ of typical species are approximate and the antennæ usually 3-foliate; but I have included three species in it in which the antenna of the male is 4-foliate. The genus *Serica*, as it formerly stood, has lately been divided into three or four genera.

Serica similis, sp. n.

Oblongo-ovata, rufo-brunnea, subopaca; *Serice brunneæ* persimilis. L. $7\frac{1}{2}$ –8 mill.

This species has been standing in the Catalogue as *S. brunnea*, Linn.; but, although the colour agrees in both species, there are structural differences. In *S. similis* the eyes are smaller and less convex, the anterior thoracic angles are acute and less depressed, the elytra are shorter and less parallel, the mesosternum is wider between the intermediate coxæ, and the tarsi more slender. This comparison has been made with the males of both species. The head is sometimes wholly pale, sometimes black between the eyes, and some specimens are piceous beneath; the elytral sculpture also differs slightly in the two species.

Hab. Nagasaki, Hitoyoshi, Nikko, and on the Wada-togé. Rather common.

Serica grisea, Motschulsky.

Serica grisea, Motsch. Bull. Mosc. i. p. 171 (1866); Waterh. *l. c.* p. 101.

Serica polita, Gebler, Nouv. Mém. Mosc. ii. p. 52; Waterh. *l. c.* p. 102.

Whether the names above refer to one or two species I cannot decide. Both Motschulsky's and Gebler's descriptions seem to apply to one species; but I have given preference to the first because Gebler's species came from Dauria, and also because Motschulsky (Schrenck's Reis. p. 137) refers to *S. polita* as an insect known to him. *Serica grisea* is a very variable species in colour.

Hab. Kiushiu and main island.

Serica nigrovariata, sp. n.

Oblonga, nigra, griseo-pubescent, opaca; elytris brunneis, marginibus nigris, dorso nigro-guttato; antennis pedibusque infuscatis.
L. 7 mill.

Oblong, black, opaque; the head, clypeus emarginate anteriorly, with the rim, especially at the sides, strongly raised, surface rugosely punctured and shining; the head between the eyes opaque, with scattered shallow punctures; the thorax punctured like the head, anteriorly bisinuous, with somewhat acute angles, posterior angles very blunt, lateral rim finely raised; the scutellum obscurely punctured, longer than wide, obtuse behind; the elytra striate, interstices somewhat roughened, black on the outer and sutural margins, within reddish brown with black markings; the antennæ and legs dusky or obscurely black.

Hab. Mayebashi. One example only.

The four following species in male have a 4-foliate antennal club:—

Serica angulata, sp. n.

Elongata, picea, opaca; capite grosse et dense punctato; thorace angulis anticis acute prominulis, utrinque bisinuato; elytris punctatis, interstitiis convexis; antennis pedibusque rufo-piceis.
L. 10 mill.

Elongate, piceous, opaque; the head shining, clypeus very densely and somewhat rugosely punctate, between the eyes the punctures are larger and not quite so closely set; the thorax, anterior angles acute and prominent, lateral edge bulges out in the middle, forming sinuosities before and behind, punctures much smaller and more scattered than those

of the head, with an obscure reddish disk in the middle of the lateral edge and a narrow reddish margin at the base; the scutellum obtuse behind, impressed on the lateral margins, obscurely punctured; the elytra irregularly punctured, interstices 3 to 5 distinctly raised towards the base; the antennæ and legs pitchy red.

This species is remarkable in having acute anterior thoracic angles.

Hab. Oyayama. Two examples.

Serica quadrifoliata, sp. n.

Elongata, picea, opaca; capite sparse punctato; thoraco lateribus obscure rufis; elytris irregulariter punctatis, interstitiis convexiusculis, lævibus; antennis clava 4-foliata.

L. 10 mill.

Elongate, piceous, opaque; the head, clypeus somewhat rough, with shallow irregular punctures, between the eyes the punctures are smaller and more scattered; the thorax punctured like the head on the disk and sides, but along the base, especially before the scutellum, the points are more closely set, bisinuous behind the eyes, feebly bisinuous at the base, narrowest anteriorly, widest behind, sides evenly arched and obscurely red laterally, anterior angles obtuse; the scutellum obtuse behind, wholly punctate; the elytra with lines of irregular punctures separated by interstices, somewhat convex and smooth, truncate behind; the antennæ and legs reddish brown.

Hab. Nikko. One male example.

Serica brevicornis, sp. n.

Oblonga, testacea, azureo-micans, parum nitida; capite thoraceque irregulariter punctatis; scutello triangulari; elytris striatis, interstitiis parum latis, lævibus.

L. 7-7½ mill.

Oblong, pale testaceous, opalescent in parts, somewhat shining; the head, surface uneven, irregularly punctured, punctures shallow and of various sizes, largest irregular in outline, not closely set; the thorax transverse, anterior angles depressed and obtuse, laterally somewhat bulging in the middle, and sometimes feebly emarginate before the hind angles, surface sculptured like the head; the scutellum punctured irregularly, triangular, three sides coequal; the elytra striate, with punctures faintly seen in the lines, interstices convex, smooth, and rather wide; the antennæ small and short, club usually infusate, palpi dusky; the legs pale.

In some examples the thorax is infuscate in parts and the elytra in others are dusky on the second interstice, part of the lateral border, and, rarely, apically.

Hab. Nikko and Shinkano in July and August.

Serica higonía, sp. n.

Oblonga, parum nigra vel nigro-brunnea, azureo-micans, subnitida; capite thoraceque irregulariter punctatis; scutello elongato-triangulari; elytris obscure punctato-striatis, interstitiis convexis; pedibus brunneo-testaceis; antennis basi pallidis, clava infuscata.

L. 6-6½ mill.

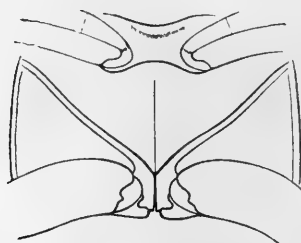
This species closely resembles *S. brevicornis* in facies and surface-sculpture, but the head is less robust, the antennæ are as large again, the thorax is more convex on the disk, distinctly emarginate before the hind angle, arched in front of the emargination, and without any anterior angle; the scutellum is nearly one third longer than wide; the antennæ are pale at the base, with the club dark. One example is reddish brown, with the head between the eyes, two blotches on the thorax, and the elytral, sutural, and outer margins dusky with an æneous tinge.

Hab. Hitoyoshi, Konosé, and Yuyama. Four examples.

ASERICA, gen. nov.

This generic name is proposed for a considerable number of species hitherto included in *Serica*. It differs essentially from *Serica* in having smaller eyes, the scutellum wide at the base, the hind femora considerably widened and truncate at

Fig. 8.



the apices, posterior tibiæ also dilated, tarsi more robust, and the intermediate coxæ widely separated. The antennæ are 3-foliolate, and the other characters resemble those of *Serica*.

In *Serica brunnea*, L., and allies the intermediate coxæ are approximate. The form of the metasternum in *Aserica* and the wide area between the coxæ is shown in the accompanying woodcut. In the drawing (fig. 8) the mesosternum appears to be more narrow than it is, because it is almost perpendicular; in *Serica brunnea* it is only oblique.

The form of the femora and tibiæ correspond somewhat with those of a species of *Popilia*.

Type *Serica japonica*, Motsch.

Aserica japonica. (Woodcut, fig. 8.)

Serica japonica, Motsch. Etud. Ent. p. 15 (1860); Waterh. l. c. p. 102.

Serica piceorufa, Fairm. Rev. d'Ent. vii. p. 118 (1888).

Waterhouse notices Motschulsky's measurements; my measurements are $9\frac{1}{2}$ –11 millim. This species is rightly described by Motschulsky as "ovate" and the next species as "obovate." Some of my specimens are in colour light brown.

Hab. South Japan and Hongkong.

Aserica orientalis.

Serica orientalis, Motsch. Etud. Ent. p. 33 (1857); Waterh. l. c. p. 102.

"Obovata, convexa, punctata, opaca, picea, supra nigra, velutina; thorace antice angustato, lateribus minus arcuatis; elytris ovatis, striatis, interstitiis alterius læviter elevatis, sparsim punctatis; antennis testaceis.

"L. $3\frac{1}{2}$, lat. 2 lin.

"Cette espèce est extrêmement voisine de notre *S. holosericea*, mais elle est un peu plus grande, présente un corps plus élargi postérieurement, un corselet plus trapézoïde, une ponctuation moins serrée et une surface plus veloutée. Elle se rencontre aussi en Mongolie."

My measurements are 8 to 9 millim. I give Motschulsky's description, as Waterhouse omitted it.

Like the last species, it is now and then of a light brown colour.

Hab. Found throughout Japan and Mongolia, as above.

Apogonia niponica, sp. n.

Oblongo-ovata, brunnea vel piceo-brunnea; capite dense, scutello sparse et irregulariter punctatis; thorace angulis anticis parum acutis.

L. $6\frac{1}{4}$ – $7\frac{1}{2}$ mill.

Oblong-ovate, brown or piceous brown, shining, sometimes

with a faint greenish or coppery tint; the head, frontal area densely and rather clearly punctate, clypeus rather more densely and somewhat roughly punctate, edge narrowly reflexed and arcuate in outline; the thorax wholly punctate like the head; this punctuation is much more dense than that of *A. splendida*, Bohm., anterior angles rather acute; the scutellum is sparingly but irregularly punctured; the elytra, striæ more or less obsolete, punctuation (sometimes linear) larger and less dense than that of the thorax; the pygidium, form and punctuation similar to that of *A. splendida*; the legs and under surface darker than the elytra.

The more oblong form, colour, and size, as well as the dense punctuation, distinguish this insect at once from ordinary examples of *A. splendida*, Bohm.; but I have specimens of the last-named which are brown or piceous, and from these the somewhat acute angles of the thorax serve to separate it. *A. splendida* has an impunctate scutellum.

A. cupreoviridis, Kolbe, is said to differ from *A. splendida* (Bates, Proc. Zool. Soc. 1888, p. 375) in having a more arcuate outline to the clypeus, an outline which describes a segment of a circle, and is not flattened as in *A. splendida*. In this respect *A. niponica* agrees with it; but the form (oblong-ovate) and the punctuation of the scutellum &c. distinguish it. Kolbe gave two names to his species: one specimen, measuring $9\frac{1}{2}$ millim., he called *A. fusana*.

Apogonia mæsta, Knock (Schönfeldt, Ent. Nachr. xvi. p. 170, 1890), is said to occur in Oshima; but I have not seen the description, nor does Schönfeldt supply a reference to it. *Apogonia mæsta*, Burm. (Handb. iv. 2, p. 257, 1842), I consider a nondescript of a Sumatran species, as Burmeister's description is worthless; but Kolbe refers to it (Arch. f. Nat. i. p. 193, 1886), so I presume he has seen the type.

Lachnosterna inelegans, sp. n.

Ancylonycha parallela, Motsch. Etud. Ent. p. 64 (1854).

Elongata, nigro-picea, nitida; capite grosse parum dense punctato; thorace minus dense punctato, autice margine impunctato; scutello lævi vel parte punctato; elytris punctatis, obsolete costatis.

L. 16-20 mill.

Elongate, pitchy or pitchy black, shining; the head coarsely and somewhat densely punctate, the punctures on the clypeus are clearly separate, those on the forehead are in some examples confluent, the rim of the clypeus clearly elevated, the punctures more or less obscure on the frontal suture; the thorax

posteriorly rectangular, anterior angles obtuse, the lateral margin more or less bulges in the middle, the anterior margin is a narrow smooth rim, general surface less closely punctate than the head; the scutellum transverse, sometimes smooth, more often with a few irregular punctures variously placed in different specimens; the elytra, sutural margin smooth and convex, surface punctate, punctuation rough and irregular and more or less obliterates two or three longitudinal costæ; the pygidium punctate, punctures not densely set nor so deep as those of the thorax, rather wider just behind the base than the space from the middle of the base to the apex.

This species has been assigned by Waterhouse and others to *Ancylonycha parallela*, Motsch.; but Motschulsky's diagnosis applies equally well to *Holotrichia picea*, Waterh., and *Lachnosterna diomphalia*, Bates, and his specific name is preoccupied. Under these circumstances I have redescribed the species under a new name.

Hab. Throughout Japan and at Fusan, in Korea. Generally abundant.

Lachnosterna picea.

Holotrichia picea, Waterh. Trans. Ent. Soc. Lond. p. 103 (1875).

This species is easily recognized by the characters given by Waterhouse, especially by the transverse smooth margin to the neck. A minor character, but one which does not vary in my series of eight examples, is that the anterior rim of the thorax is not clearly free of punctures; the punctures encroach on the posterior edge. This rim or margin is quite smooth in *L. inelegans*, Lew.

Hab. Nagasaki, Chiuzenji, and Yokohama.

Lachnosterna diomphalia, Bates.

Lachnosterna diomphalia, Bates, Proc. Zool. Soc. p. 373 (1888).

"*L. parallela* (Motsch.) affinis et simillima, sed differt pygidio ♂ valde convexo ante apicem bicalloso.

"L. 20 mill.

This species is extremely like *L. inelegans*, Lew., and *L. picea*, Waterh., but it differs from the first in the scutellum which widens out at the base, and from both in the curious gibbosities on the pygidium. Bates only knew the male; the pygidium is bigibbous in both sexes.

Lachnosterna morosa, Waterhouse.

This species is peculiar in having the rim of the clypeus

very moderately raised and the raised edge ceases before the eyes; the pygidium is not transverse like the other species of this series, it is nearly as long as broad.

Hab. Nagasaki. Also at Chefoo in China.

Lachnosterna niponensis, sp. n.

Brunnea, parum parallela, convexa, subnitida; capite thoraceque punctatis; scutello lævi haud punctato; elytris punctatis, interstitiis parum convexis.

L. 19–21 mill.

Brown, subparallel, convex above, rather shining; the head roughly and closely punctate, punctures on the clypeus dense, especially in the middle of the base, anterior rim of the clypeus distinctly raised and feebly emarginate in the middle, neck smooth, but the smooth space is of irregular outline; the thorax irregularly punctate, punctures rather less closely set than those of the head, lateral edges widely crenulate, transverse and slightly bulging in the middle of the lateral edges, angles before and behind obtuse; the scutellum widest at the base, with anterior portion clothed with golden-tawny hair; the elytra, interstices uneven and punctate, punctures not so dense as those of the thorax, sutural margin rather broadly elevated from the base to the apex, the next raised costa is similarly broad but shortened before and behind, both smooth and almost impunctate, outside there are other costæ ill-defined and vague; the pygidium uneven and sometimes closely but shallowly punctured, rather broad and somewhat arched at the base, slightly convex; the legs, apices of thighs, and the club of the antenna dusky.

This species is the largest of the genus known from Japan; in colour it corresponds with *Serica brunnea*, L. The scutellum is quite smooth in some examples, irregularly punctate in others, and in one specimen closely punctate; sometimes it is rounded off behind, but usually it is obtusely acuminate.

Hab. Nagasaki, Goto Islands and Fusan in Korea. Forty specimens. Also in the collection of the British Museum.

HEPTOPHYLLA, Motschulsky.

The author of this genus says of it: "Antennes de 11 articles, dont le 4^{ième} très court; massue longue, de 7 articles." The basal joint of the antenna is long and very similar to that of *Rhizotrogus*; the second is apically bulbiform and constricted at the base; the third elongate, but not so long as the first, and is minutely angulate on the inner edge; the fourth is short, with a small acute appendage; the fifth is

foliate, but the appendage varies in size from a quarter to half the length of the one succeeding it; articulations 6 to 10 are leaflets, of which 8 and 9 are the largest. There are only ten joints, and the name is unfortunate. Just before the suture which indicates the limit of the clypeus is a well-marked transverse carina, which usually stretches from side to side; but in one of eighteen specimens it is interrupted in the middle. Motschulsky says:—"Carènes frontales transversales peu marquées et interrompues;" this is not the case usually.

Heptophylla picea, Motschulsky.

Heptophylla picea, Motsch. Etud. Ent. p. 32 (1857).

Holotrichia transversa, Motsch. l. c. p. 15 (1860).

I have united the two names above chiefly on the evidence relating to the frontal carina. If I am right, this is not the only instance of Motschulsky describing an insect twice and placing it in different genera.

Hab. Kiushiu, main island, and Yezo. Very common.

Rhizotrogus niponicus, sp. n.

Elongatus, pallide testaceus, nitidus; capite piceo vel rufo-brunneo; thorace sparse et grosse punctato; elytris punctatis, punctis interdum confluentibus; pygidio apice parum explanato.

L. 12 mill.

Elongate, pale testaceous, shining; the head piceous or reddish brown, surface uneven between the eyes, roughly and coarsely punctured, punctures less close along the anterior margin of the clypeus; eyes black and large as compared with those of *R. solstitialis*, L.; the thorax, surface uneven, crenulate laterally, anteriorly rectangular, posteriorly feebly angulate, punctate, punctures less closely set than those of the head; the scutellum transverse, irregularly punctured; the elytra punctate, somewhat similarly to the thorax, but punctures sometimes confluent, sutural margin convex, smooth, with two similar but shorter feebly raised costæ near the centre of the wing-case; the pygidium somewhat rugose, the rugosity nearly obliterating the shallow punctures, apical rim distinctly but narrowly explanate; the legs and antennæ pale, inner dentation of the claws on the first very conspicuous.

Hab. Gotoshima. Two males.

Polyphylla laticollis, Lewis.

Polyphylla laticollis, Lew. Ent. Mon. Mag. xxiii. p. 231 (1887).

Fairmaire in 1888 described two species of *Polyphylla* from China, which agree, I believe, with the above in having the

thorax transverse and much broader than that of *P. fullo*, Linn.

Hab. Three specimens obtained in the province of Sakami.

Granida albolineata, Motschulsky.

Granida albolineata, Motsch. Etud. Ent. p. 8 (1861); Waterh. Trans.

Ent. Soc. Lond. p. 106, pl. 3. fig. 7 (1875); Har. Deutsche ent. Zeit. p. 71 (1878).

Polyphylla Schoenfeldti, Brenske, Ent. Nachr. xvi. p. 198 (1890).

After the lapse of twenty-nine years, and after being well figured by Waterhouse, this well-known and conspicuous species has been redescribed as a *Polyphylla* by Brenske. Schönfeldt has kindly sent me an example representing Brenske's type. Sometimes the female has three denticulations on the fore tibia, as seen in a specimen in the British Museum.

Hab. Nagasaki, Kobé, Niigata, and Akita. Also Oshima in the Ruikiuan group. I reached Niigata on the 4th September, 1881, and found the great stretches of sand which surround this port were strewn with the remains of this beetle, but I only found one (dead) good enough to preserve. I was told that three weeks before it was extremely abundant, flying into houses in the evening. There are examples in the British Museum from the Chinese islands to the south of the Ruikiuan group.

Phyllopertha irregularis, Waterhouse.

Phyllopertha irregularis, Waterh. l. c. p. 107, pl. 3. fig. 4.

Phyllopertha yezoensis, Lew. in litt. Cat. Jap. Col. no. 972 (1879).

There are examples in my collection wholly coppery green, and others with the thorax golden coppery and the elytra dark purple. In other specimens the elytra are pale, but I have not seen an example with an entirely pale thorax. The figure given by Waterhouse represents a very common variety. The dark variety has been mistaken for *P. horticola*, Linn.

Phyllopertha conspurcata, Harold.

Phyllopertha conspurcata, Har. Deutsche ent. Zeit. p. 71 (1878).

Phyllopertha arenaria, Waterh. (*nec* Brullé) l. c. p. 108 (1875).

Hab. Nagasaki, Hiogo, Hagi, and Tokio. Common. Korea (*Kolbé*).

Anomala geniculata, Motschulsky.

Anomala geniculata, Motsch. Bull. Mosc. i. p. 171 (1866); Lew. Ann.

M. N. Hist. xix. p. 197 (1887).

Anomala daimiana, Har. Deutsche ent. Zeit. p. 354 (1877).

Anomala triangularis, Schön. Ent. Nachr. xvi. p. 171 (1890).

I have received specimens from Harold and Schönfeldt.

Hab. All the islands, including Oshima, and occurs in Korea.

Anomala Sieversii, Heyden.

Anomala Sieversii, Heyd. Hor. Ent. Ross. xxi. p. 266 (1887).

This insect should be placed next to *A. octocostata*, Burm.; it is a species which does not vary in colour.

Hab. Tsushima, and at Fusan in Korea.

Anomala holosericea, Fab.

This well-known species occurs apparently rarely in Japan; it is constant in colour.

Hab. Chiuzenji and in S. Yezo. Only four specimens.

Anomala rufo-cuprea, Motschulsky.

Anomala rufo-cuprea, Motsch. Etud. Ent. p. 14 (1860); Bates, Proc. Zool. Soc. p. 373 (1888).

Anomala lucidula (*Rhombonyx*), Motsch. Bull. Mosc. p. 171 (1866), nec Guér. (1830), nec Faldm. (1835).

Anomala lucens, Ballion, Bull. Mosc. p. 155 (1871).

Anomala Motschulskyi, Har. Deutsche ent. Zeit. p. 351 (1877).

This species varies in colour from being entirely of a deep blue, green, or brassy green, and from a pale testaceous colour to others with a green thorax and testaceous elytra, and some examples are coppery red.

Hab. All the islands; the imagoes usually fed on the leaves of *Salix* and *Lespedeza*.

Anomala difficilis, Waterhouse.

Anomala difficilis, Waterh. l. c. p. 111.

This species has the thorax testaceous, wholly green, or ornamented with two green triangular blotches. My specimens measure 11 to 14 millim.

Hab. Kobé, Nikko, Chiuzenji, and other places.

Anomala orientalis.

Phyllopertha orientalis, Waterh. l. c. p. 108 (1875).

Anomala orientalis, Waterh., Har. Abh. Brem. p. 126 (1876); Heyden, Deutsche ent. Zeit. p. 345 (1879).

Phyllopertha xanthogastra, Har. MT. Münch. ent. Ver. v. p. 90 (1881).

A very common variety of this species is black with an æneous tinge and a few testaceous spots on the elytra. A rarer variety is wholly testaceous, with two spots on the head and two triangular blotches on the thorax green. In my series no two are precisely alike.

Hab. All the islands.

Anomala pubicollis, Waterhouse.

This species is not very variable.

Hab. Nagasaki, Kobé, Miyanoshita, Nikko, and Yokohama. Appears early in April.

Anomala mongolica, Faldermann.

Euchlora mongolica, Fald. Mém. Ac. St. Pétersb. ii. p. 379 (1835); Lew. Ent. p. 151 (1893); Bates, Proc. Zool. Soc. p. 374 (1888).

Bates considers this to be a species of *Anomala*, as it has the lower branch of the large anterior tarsal claw in the male angularly dilated, which he states is a character which separates the typical *Anomalæ* from *Euchlora viridis*, Fab., a common Chinese insect, and the type of *Euchlora*.

Hab. Niigata and Akita. A few examples.

Euchlora gracilis, Schönfeldt.

Euchlora gracilis, Schön. Ent. Nachr. xvi. p. 171 (1890).

Schönfeldt considers this a variety of *A. albopilosa*, Hope. The characters which, however, separate it appear to me to be constant, and I prefer at present to regard it as distinct. In my specimens the thorax has a pale lateral margin.

Hab. Oshima, the largest of the Ruikiuan group.

Euchlora multistriata, Motschulsky.

Heteroplia multistriata, Motsch. Etud. Ent. p. 7 (1861).

Euchlora multistriata, Motsch., Waterh. l. c. p. 112.

Anomala puncticollis, Har. Deutsche ent. Zeit. p. 351 (1877); Heyd. ibid. p. 344 (1879).

The colours in this species are not very variable.

Hab. All the islands.

Mimela lucidula, Hope.

Mimela lucidula, Hope, Trans. Ent. Soc. Lond. p. 113 (1835).

Mimela Gaschkevitchii, Motsch. Etud. Ent. p. 32 (1857).

This species is usually of a fine green colour, but it is often of a rich coppery colour, or green with a golden tinge on the elytra. Waterhouse records a black variety from Hakodate. At Numata, August 29th, 1881, I found it in large numbers on some sallows, and the examples were mostly of the copper-coloured variety.

Hab. All the islands.

[*Mimela simplex*, Bates, 1866, = *M. lucidula*, Burm., 1842.]

Popilia japonica, Newman.

Popilia japonica, Newm. Trans. Ent. Soc. Lond. p. 43 (1841).

Popilia bisignata, Sturm, Cat. p. 120 (1843).

Hab. South Japan. Very common; but I did not meet with it north of Ontaki on the Nakasendo.

Popilia insularis, sp. n.

P. japonicæ simillima, sed paullo minor et thorace sparse punctato, elytrisque margine exteriori late viridi-metallicis.

Long. 10-10½ mill.

Oval; head, thorax, scutellum, and pygidium brilliant green like those of *P. japonica*, Newm.; the elytra are widely margined with a band of metallic green, which leaves the second to the fifth and part of the sixth interstices from the base to the middle of the dorsum yellowish brown. There is not much variation in colour between the examples before me. The head, margin of clypeus well and evenly raised, punctures on the clypeus close and somewhat rugose, punctures between the eyes more distinct, but many confluent, punctures before the neck more sparse; the thorax, anterior angles less acute than in *P. japonica*, and the punctuation finer and more scattered; the scutellum punctured very similarly to that of *P. japonica*, but distinctly less acutely pointed behind; the under surface and legs are wholly dark metallic green.

Hab. Oshima (*Ferrie*, 1895). Four examples examined.

Adoretus tenuimaculatus, Waterhouse.

Harold and von Heyden consider this a variety of *A. umbrosus*, F., a species with a synonymy of nine names in the Munich Catalogue; the localities given there are Senegal, Java, Sumatra, &c. I have allowed Waterhouse's name to remain, as I think the synonymy doubtful.

Hab. South Japan. Very common in July and August.

List of Species, with Synonymy.

SCARABÆIDÆ.

Panelus parvulus.

Temnoplectron parvulum,
Waterh.

Maraxes dentifrons.

Copris ochus (*Catharsius*), *Motsch.*

— *pecuarius*, *Lew.*

— *tripartitus*, *Waterh.*

— *acutidens*, *Motsch.*

Onthophagus Lenzii, *Har.*

— *fodiens*, *Waterh.*

— *ater*, *Waterh.*

— *japonicus*, *Har.*

— *viduus*, *Har.*

— *atripennis*, *Waterh.*

— *nitidus*, *Waterh.*

— *nikkoensis*.

— *vacerrosus*.

- Onthophagus ocellato-punctatus*,
Waterh.
 — *jessoensis* (Caccobius), *Har.*
 microcephalus (Caccobius), *Har.*
 — *brevis* (Caccobius), *Waterh.*
Oniticellus phanæoides, *Westw.*
 excavatus (*Onthophagus*),
 Redt.
 minutus (*Phanæus*),
 Motsch.
Aphodius apicalis, *Har.*
 — *major*, *Waterh.*
 — *globulus*, *Har.*
 var. *bisectus*, *Waterh.*
 — *elegans*, *All.*
 — *lividipennis*, *Waterh.*
 — *Solskyi*, *Har.* 1871.
 diversus, *Waterh.*
 castaneipennis, *Waterh.*
 rectus (*Calamosternus*),
 Motsch.
 vitta (*Chilothorax*),
 Motsch.
 — *breviusculus*, *Motsch.*
 — *nigerrimus*, *Waterh.*
 — *4-punctatus*, *Waterh.*
 — *uniplagiatus*, *Waterh.*
 — *uniformis*, *Waterh.*
 — *eccoptus*, *Bates.*
 — *impunctatus*, *Waterh.*
 — *lividus*, *Oliv.*
 — *pallidicinctus*, *Waterh.*
 — *obsoletoguttatus*, *Waterh.*
 — *pallidiligonis*, *Waterh.*
 — *punctatus*, *Waterh.*
 — *obsoletus*, *Waterh.*
 — *ovalis*, *Waterh.*
 — *rufangulus*, *Waterh.*
 — *urostigma*, *Har.*
 — *variabilis*, *Waterh.*
 nigrotessellatus (*Melino-*
 pterus), *Motsch.*
 — *atratus*, *Waterh.*
 — *rugosostriatus*, *Waterh.*
 — *Lewisii*, *Waterh.*
Ammœcius nitidus, *Waterh.*
Cælius denticollis.
Saprosites japonicus, *Waterh.*
 — *naræ*.
Oxyomus jugosus.
Rhyssenus asperulus, *Waterh.*
Psammodytes ainu:
 — *convexus*, *Waterh.*
 — *japonicus*, *Har.*
 — *comis*.
Ægialia nitida, *Waterh.*

GEOTRUPIDÆ.

- Ochodæus maculatus*, *Waterh.*
Bolboceras nigro-plagiatum,
Waterh.
Geotrupes auratus, *Motsch.*
 purpurascens, *Waterh.*
 — *lævistriatus*, *Motsch.*
 Deyrollei, *Jekel.*
 amæus, *Jac.*

TROGIDÆ.

- Trox chinensis*, *Bohem.*
 obscurus, *Waterh.*
 — *setifer*, *Waterh.*
 — *opacotuberculatus*, *Motsch.*
 — *niponensis*.

GLAPHYRIDÆ.

- Anthypna pectinata*.

MELOLONTHIDÆ.

- Ectinohoplia obducta*.
 Hoplia obducta, *Motsch.*
 — *sabulicola*, *Motsch.*
Ectinohoplia variolosa,
Waterh.
Hoplia communis, *Waterh.*
 — *gracilipes*.
 — *Reinii*, *Heyd.*
 — *maculata*, *Bates.*
 — *mœrens*, *Waterh.*
Sericania mimica.
 — *fuscilineata*, *Motsch.*
Serica similis.
 brunnea, *Waterh.*, nec
 Linn.
 — *grisea*, *Motsch.*
 polita, *Gelb.*
 — *nigrovariata*.
 — *angulata*.
 — *quadrifoliata*.
 — *boops*, *Waterh.* (*Ophthalmos-*
 serica, *Brenske*).
 — *brevicornis*.
 — *higonia*.
Aserica japonica.
 Serica japonica, *Motsch.*
 — *piceorufa*, *Fairm.*
 — *orientalis*.
 Serica orientalis, *Motsch.*
Apogonia major, *Waterh.*
 — *splendida*, *Bohem.*
 — *niponica*.

- Lachnosterna inelegans.
 Ancyloxycha parallela, Waterh.
 Motsch.
 — picea (Holotrichia), Waterh.
 — diomphalia, Bates.
 — morosa, Waterh.
 — castanea, Waterh.
 — niponensis.
 Pollaplonyx flavidus, Motsch.
 Heptophylla picea, Motsch.
 Holotrichia transversa,
 Motsch.
 Rhizotrogus niponicus.
 Polyphylla laticollis, Lew.
 Granida albolineata, Motsch.
 Schönfeldti (Polyphylla),
 Brenske.
 Hoplosternus japonicus, Har.
 Melolontha japonica, Burm.
- RUTELIDÆ.
- Phyllopertha diversa, Waterh. *
 — irregularis, Waterh.
 yessoensis, Lew. in litt.
 — conspurcata, Har.
 arenaria, Waterh., nec
 Brullé.
 Anomala costata, Hope.
 — testaceipes, Motsch.
 costata, Har., nec Hope.
 — geniculata, Motsch.
 daimiana, Har. 1877.
 triangularis, Schön. 1890.
- Anomala flavilabris, Waterh.
 — octocostata (Rhombonyx),
 Burm.
 Phyllopertha 8-costata,
 Waterh.
 — Sieversii, Heyd. 1887.
 — holosericea, Fab.
 — rufo-cuprea, Motsch. 1860.
 lucidula, Motsch. 1866.
 lucens, Har. 1871, nec
 Balkion.
 Motschulskyi, Har. 1877.
 — difficilis, Waterh.
 — orientalis (Phyllopertha),
 Waterh.
 xanthogastra, Har.
 — pubicollis, Waterh.
 — mongolica, Faldm.
 Euchlora cuprea, Hope.
 — albopilosa, Hope.
 — gracilis, Schön.
 — multistriata, Motsch.
 puncticollis, Har.
 Mimela lucidula, Hope.
 Gaschkevitchii, Motsch.
 Popilia japonica, Neum.
 bisignata, Sturm.
 — insularis.
 Adoretus tenuimaculatus, Waterh.
- DYNASTIDÆ.
- Xylotrupes dichotomus, Linn.
 Phileurus chinensis, Faldm.

The following notes refer to previous papers on Japanese Coleoptera.

Cetoniidæ.

Cetoniidæ, Ann. & Mag. Nat. Hist. xix. pp. 196-202 (1887).

In the Deutsche ent. Zeit. p. 91 (1890), Kraatz has stated that *Cetonia brevitarsis*, Lew., = *C. intricata*, Saund. Saunders's type is in the British Museum, and belongs to the same section of the genus as *C. mandarinea*, Weber, and *C. culta*, Waterhouse. *C. brevitarsis* belongs to the group of which *C. submarmorea* is the best-known type.

Gnorimus 17-guttatus, Snellen v. Voll.

Trichius septemdecimguttatus, Snell. v. Voll. Tijdsch. Ent. Nederl. vii. p. 159; Waterh. l. c. p. 115, pl. iii. fig. 8; Lew. Ann. & Mag. Nat. Hist. xix. p. 200 (1887).

This species should be placed in the genus *Gnorimus*.

Paratrichijs duplicatus, sp. n.

Paratrichijs longicornis simillimus, sed paullo minor; elytris 8-maculatis, maculis haud transversis.

L. 11-12 mill.

♀. Black, somewhat opaque; the head rugosely sculptured, without definite punctuation, the clypeus transversely red before the base, anterior edge reflexed and distinctly emarginate, feebly impressed; the thorax punctate, punctures large but not deep, and somewhat sparsely set, anterior angles obtuse, from the anterior angles to the middle of the lateral edge the thorax is more or less oblique, lateral edge and base margined with yellow, a median line which does not touch the edge before or behind and a bent line on each side of it also yellow; the elytra, epipleural rim, sutural margin, and the dorsal region on interstices 3 to 6 black, median black marking surrounded with a broad red band, on the ninth interstice close to the margin is a small yellow spot, and parallel to it behind the base is a large spot occupying interstices 4 to 6, behind the middle is a third blotch on interstices 4 and 5 and overlapping interstices 3 to 6, behind the last spot on the second interstice is a fourth yellow spot; the pygidium has a broad crescent-shaped yellow band at its base, disk black, apex red; the legs and antennæ reddish brown, tibiæ more or less infuscate. Another female is black, with yellow markings on the thorax and elytra similar to above; and a male before me is black, with similar markings, and the elytra in the region of the scutellum and the anterior edge of the thorax margined with yellow.

Hab. Oshima (*Ferrie*, 1895).

Paratrichijs Donitzi, Harold.

Gnorimus Donitzi, Har. Deutsche ent. Zeit. xxiii. p. 366 (1879).

Paratrichijs longicornis, Jan, Cist. Ent. ii. p. 611, pl. xi. fig. 1; Lew. Ann. & Mag. Nat. Hist. xix. p. 200 (1887).

The clypeus of this species in the male is excavated, with a well-marked lateral carina, the antennal leaflets are one third longer than in *P. duplicatus*, the scutellum is wider, and the elytral markings are irregular transverse lines, not blotches, and, so far as I know, the females alone are entirely black.

Buprestidæ.

Chalcophora japonica, Gory.

Schönfeldt (Ent. Nachr. xvi. p. 172, 1890) has given the varietal name of *C. oshimana* to the bright examples of this species found in the Rukian Islands.

Elateridæ.

CRYPTOHYPNUS.

Students of this genus should refer to Champion's note (Ent. Month. Mag. p. 93, 1895); and in the 'Biologia' some curious sexual characters will be noticed.

Athous virens, Candèze.

Athous virens, Cand. Mém. Liège, p. 24 (1873).

Athous subcyaneus, Motsch. Bull. Mosc. p. 166, 1866 (absque charact.).

I made an error of determination of this species in the Ann. & Mag.

Nat. Hist. xiii. p. 199 (1894), and I consider now the synonymy given above is correct. The fine species noted last year (*l. c.* p. 199) I propose now to describe as *Athous prænobilis*.

Hab. Kobé on Maiyasan, Wada-togé, Chiuzenji, and Nikko.

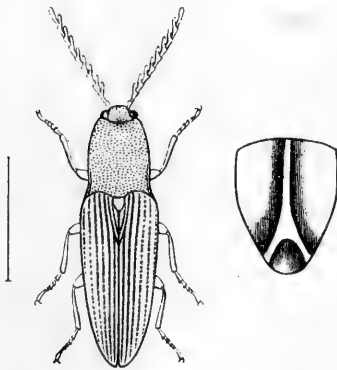
Athous prænobilis, sp. n. (Woodcut, fig. 9.)

Niger, nitidus, supra atro-cyaneus; thorace sparse nigro-hirto; scutello conspicue carinato; antennis valide pectinatis.

L. 13-20 mill.

Black, shining, head faintly, thorax more visibly, elytra distinctly cyaneous; sutural interstice frequently with a purple tinge. The head, frontal edge widely arcuate, punctate, punctures not closely set; the thorax more clearly and somewhat more finely punctured, with scattered

Fig. 9.



black hair, anterior angles obtuse; the scutellum conspicuously elevated with a median carina, which bifurcates posteriorly (see figure); the elytra punctate-striate, interspaces somewhat convex and punctulate, sutural edges carinate, apices with inconspicuous black hairs; the antennæ black, articles 3 to 10 strongly pectinate, terminal joint narrowed at the tip; the legs black, apices of thighs and claws reddish brown.

Hab. Chiuzenji, Oyama, Oyayama, and Junsai.

Lycidæ.

Mesolycus atrorufus, Kiesenwetter.

Mesolycus puniceus, Gorh. Trans. Ent. Soc. Lond. p. 399, pl. xvii. fig. 3 (1883), = *Eros atrorufus*, Kies. Deutsche ent. Zeit. p. 305 (1879).

Herr R. Hiller has kindly lent me Kiesenwetter's type, a specimen he obtained at Hagi in Yamaguchi.

Taphes granicollis.

Eros granicollis, Kies. Deutsche ent. Zeit. xxiii. p. 305 (1879); Gorh. Trans. Ent. Soc. Lond. iv. p. 400 (1883).

The type of this species also has been lent to me by Hiller. It measures 4 millim. and has ten joints only in the antenna. Mr. Gorham considers

that it is a species of *Taphes*; but the specimen being unique and fragile, has not been thoroughly examined.

Tenebrionidæ.

Pedinus (Blindus) japonicus, Seidlitz in litt.

In the *Ins. Deutschland*, v. p. 376 (1893), Dr. Georg Seidlitz notices, in the middle of a long paper on European Coleoptera (a mode of publication certainly open to censure), a Japanese species of *Pedinus*. He says perhaps it is a variety of *P. strigosus*, a well-known and very common Japanese insect, but his descriptive lines are not sufficient to entitle his name to more than a manuscript value. All he says is "prothorace basi parum emarginato, punctis vix elongatis, haud confluentibus obsito, femoribus posticis maris paullo curvatis, subtus basi tenuiter pubescentibus." L. 8-9 mill. Dr. Seidlitz's specimens came from Hildendorf, whose collections, some years prior to 1893, were examined and written about by Harold, and it seems probable Harold saw the specimens to which Seidlitz refers.

LIII.—*Descriptions of Two new Reptiles obtained by Mr. A. S. Meek in the Trobriand Islands, British New Guinea.* By G. A. BOULENGER, F.R.S.

Lygosoma longiceps.

Section *Liolepisma*. Habit lacertiform; the distance between the end of the snout and the fore limb nearly equals the distance between axilla and groin. Head twice and a half as long as broad; snout very long and pointed, much depressed. Lower eyelid with an undivided transparent disk; nostril pierced in the middle of the nasal; no supranasal; anterior loreal as deep as the nasal; frontonasal longer than broad, forming a broad straight suture with the rostral; præfrontals forming a median suture; frontal small, acutely pointed behind, as long as the frontoparietals and interparietal together, in contact with the first and second supraoculars; four supraoculars, first large; seven supraciliaries; frontoparietals distinct, nearly as large as the interparietal, which is smaller than the frontal; parietals forming a suture behind the interparietal; three pairs of nuchals; five upper labials anterior to the subocular. Ear-opening oval, smaller than the eye-opening, without lobules. 24 smooth scales round the middle of the body, dorsals largest, laterals smallest. Two enlarged præanals. The hind limb reaches the wrist of the adpressed fore limb. Digits depressed at the base, compressed at the end, third and fourth equal; subdigital lamellæ smooth, 19 under the fourth toe. Dark brown above, with three

white, black-edged longitudinal streaks, the middle extending to the end of the snout, the outer to the eyes; tail golden; upper lip and lower parts white.

	millim.
Total length.....	85
Head.....	11
Width of head.....	4.5
Body.....	30
Fore limb.....	11
Hind limb	14
Tail	44

A single specimen.

Dendrelaphis papuensis.

Maxillary teeth 21 or 22. Eye as long as its distance from the nostril. Rostral broader than deep, visible from above; internasals as long as the præfrontals; frontal once and a half to once and two thirds as long as broad, as long as its distance from the end of the snout, a little shorter than the parietals; loreal elongate; one præ- and two postoculars; temporals 2 + 2; eight upper labials, fourth and fifth entering the eye; five or six lower labials in contact with the anterior chin-shields, which are shorter than the posterior. Scales in 13 rows. Ventrals 185-190; anal divided; subcaudals 119-126. Olive-brown above, head and neck dark, blackish; a black streak on each side of the head and neck, passing through the eye; upper lip white; vertebral scales on anterior part of body lighter, edged with whitish in front; ventrals and subcaudals pale olive.

Total length 1050 millim.; tail 310.

Several specimens.

The same collection contains, among other more widely distributed reptiles, examples of *Lepidodactylus pulcher*, Blgr.; *Lygosoma virens*, Ptrs. (with 32 or 34 scales round the body); *L. Mivarti*, Blgr.; and *Hyla infrafrenata*, Gthr.

LIV.—*Descriptions of new Genera of Zephroniidae, with brief preliminary Diagnoses of some new Species.* By R. I. POCKOCK.

Genus SPHÆROTHERIUM, Brandt.

Sphærotherium, Brandt, Bull. Mosc. vi. p. 198, 1833 (= *Oligaspis*, Wood).

Resembling *Zephronia* in the structure of the *vulva*; the copulatory feet of the second pair in the male differing in being furnished with a strong stridulating-ridge.

Tarsi as in *Zephronia* or approaching in structure those of *Sphæropæus*.

Type *S. rotundatum*, Brandt.

Distribution. S. Africa.

Sphærotherium monticola, sp. n.

♂. *Colour* piceo-olivaceous.

Nuchal plate marginally punctured; the other terga coarsely but irregularly punctured.

Anal tergite punctured and hairy and marked mesially with a narrow vertical area, densely beset with piliferous punctures.

Length 17 millim.

Loc. Table Mountain (*H. A. Spencer*).

Sphærotherium granulatum, sp. n.

Colour deep green, with posterior borders of tergites ferruginous.

Related apparently to *S. rotundatum* and *compressum*, but differing from both, as from all the other species of the genus known to me, in having the anal tergite finely and thickly granular.

Length 15 millim.

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

Genus ZOOSPHÆRIUM, nov.

Closely allied to *Arthrosphæra* in the *vulva*, but having the external of the two distal laminae of this organ deeply notched. *Antennæ* usually long, with the apical segment cylindrical in both sexes.

Tarsi nearly intermediate in structure between those of *Arthrosphæra* and *Zephronia*.

Type *Z. neptunus* (Butler).

Distribution. Madagascar.

Genus ARTHROSPHÆRA, nov.

Vulva composed of three distinct segments, one proximal and the others distal, arranged in the form of a cone.

Copulatory feet. Movable digit of anterior pair armed with lobe-like teeth and much larger than the immovable digit, with its basal portion often segmented: in the posterior pair the immovable is compressed and blade-like, with its cutting-edge finely toothed; the movable not segmented, armed posteriorly with a set of granuliform teeth and internally with two membranous processes.

Legs truncate at the apex, the spine situated on the upper angle, some distance above the claw which is articulated to the inferior angle.

Apical segment of *antennæ* enlarged, larger in male than in female.

Type *A. heterosticta* (Newport).

Distribution. Ceylon and India.

Synopsis of new Species.

- a. Margin of the second tergite not suddenly thickened on a level with the eye.
 - a¹. Lower edge of anal tergite distinctly grooved; colour deep green, with a bright yellow transverse stripe close to the hinder border of the tergite . . . *Wroughtoni.* Kanara.
 - b¹. Lower edge of anal tergite not sulcate; colour greenish or yellowish, spotted with black, with a fine black stripe along the posterior border of the tergites. *Thurstoni.* Nilghiri Hills.
- b. Margin of second tergite with a large or small but abrupt thickening on a level with the eye; lower edge of anal tergite not grooved.
 - a². The greater part of the body entirely pale yellow; the second segment mostly chestnut-brown, with a thin stripe of the same colour on the posterior border of segments 3 to 7 *bicolor.* Salem.
 - b². Colour various, mostly of a uniform dark green or brown, often mottled, but not arranged as in *bicolor*.
 - a³. Posterior inferior angles of terga 8 to 10 thickened and out-turned; all the terga, except the extreme posterior margin, densely corrugated; irregularly mottled black and yellowish. . . *Hendersoni.* Kodaikanal.
 - b³. Posterior inferior angles of terga not thickened and out-turned, and the hinder half of the terga either finely punctured or smooth.
 - a⁴. Colour a deep olive-yellow, spotted with black, and a large black patch on each side of the terga *disticta.* Yercand.
 - b⁴. Colour a deep olive-green or brown, often variegated, but not marked with a large lateral patch on the terga.
 - a⁵. Anal tergite and posterior two thirds of the others perfectly smooth and polished; deep olive-green; mottled *nitida.* Kodaikanal.
 - b⁵. Anal tergite punctured throughout, or at least above.
 - a⁶. Anterior half of the terga

- densely pubescent in the adult
(terga entirely pubescent in
young) *Dalyi*. Lone Cottage.
- ♂⁶. Terga not pubescent.
- a*⁷. Posterior half of terga (ex-
 cepting the anal) smooth
 and polished; anal without
 anterior angular impres-
 sions *fumosa*. Koimbatour.
- b*⁷. Posterior half of terga not
 polished, dull, punctulate;
 anal tergite with a pit-like
 impression on its anterior
 inferior angle *Davidsoni*. Koimbatour.

Genus SPHÆROPÆUS, Brandt.

Sphæropæus, Brandt, Bull. Mosc. vi. p. 200 (1833).

This genus may be recognized from *Zephronia* of Gray, which it resembles in the structure of its genital organs, by having the tarsi constructed as in *Arthrosphæra*.

Type *hercules*, Brandt.

The following synopsis of the species of *Sphæropæus* is based upon those that are known to me:—

- a*. Tergites smooth, not closely punctured and not granular in front.
- a*¹. Laminate portion of second tergite enormously expanded *hercules*, Br. Sumatra.
- b*¹. Laminate portion exceedingly small .. *zonatus*, sp. n. Malacca.
- b*. Tergites densely punctured and granular in front.
- a*². All the tergites pubescent, variegated yellow and dark green.
- a*³. Antennæ and legs deep green; tergites with a distinct yellow spot on each side *bimaculatus*, sp. n. Singa-
 [pore.]
- b*³. Antennæ and legs (except tarsi) pale; lateral portions of tergites entirely yellow *variegatus*, sp. n. Loc. ?
- b*². Tergites not pubescent, less finely punctured and not variegated with colours.
- a*⁴. Male with terminal fang on mandible and distal segments of first two pairs of legs enormously enlarged; anal tergite saddle-shaped and without inner crest *gladiator*, Poc. Sumatra.
- b*⁴. Mandible and anterior legs normal; anal tergite evenly convex and bearing an internal crest *Stollii*, sp. n. Batavia.

Genus ZEPHRONIA, Gray.

Zephronia, Gray, Griffith's Animal Kingdom, xiv. pl. cxxxv. fig. 5; also xv. p. 796 (1832).

Vulva composed of two pieces, a proximal hairy piece bearing the aperture and a distal usually polished piece.

Copulatory feet. Movable digit of anterior pair either larger or smaller than the immovable, not strongly toothed, and with its apex often segmented off; movable digit of posterior pair bisegmented.

Tarsi distally narrowed, claw terminal, the upper spine close to but behind the claw.

Type *Z. ovalis*, Gray.

Distribution. Assam, Burma, Java.

Zephronia anthracina, sp. n.

Entirely black, shining; tergites exceedingly minutely and closely punctured, smooth in front; anal tergite with its anterior and posterior margin smooth, the rest of its surface minutely and closely punctate; lamina of second tergite very large; two spines above the claw.

Length 52 millim.

Loc. Perak (Malay Peninsula).

Zephronia impunctata, sp. n.

Allied to *Z. anthracina* and *Z. semilævis*.

Pitchy black, the posterior borders of the terga obscurely ferruginous; legs olivaceous.

Terga polished; the anal and the posterior borders of the eleventh and twelfth minutely punctulate.

Length 36 millim.

Loc. Penang (Mr. Stanley Flower, Northumberland Fusiliers).

Zephronia Dollfusi, sp. n.

Olivaceous. Tergites exceedingly finely and closely punctured throughout. Lamina of the tergite scarcely developed; anal tergite evenly convex, inner crest represented by a black tubercle. One spine above the claw.

Length 28.5 millim.

Loc. Cochin China (*Adrien Dollfus*).

Genus CASTANOTHERIUM, nov.

Resembles *Zephronia* in most particulars, but differs in that

the movable digit of the posterior pair of copulatory feet is composed of but one segment, while the immovable is widely spatulate, with a rounded apex.

Type *C. Hosei*, sp. n.

Synopsis of some new Species.

- a. Tarsi armed with two spines above the claw.
- a*¹. Of large size (60 millim.); tergites with a wide transverse pubescent band, granular in front, punctured behind as in the rest of the species; second tergite neither grooved nor crested in front *Hosei*. Baram.
- b*¹. Smaller (35 millim.); tergites without pubescent band, second with a crest and shallow groove in front *Everettii*. N.W. Borneo.
- b. Only one spine above the claw on the legs.
- a*². Of large size (60 millim.); tergites as in *Hosei*, but the second grooved and crested; terga yellow in front and laterally, green posteriorly *Whiteheadi*. Kina Balu.
- b*². Of small size (about 30 millim.); tergites without transverse pubescent band, at most covered with small bristles.
- a*³. Terga corroded with dense anastomosing punctures; apical antennal segment in ♀ cylindrical and bearing only four sensory papillæ *porosum*. Philippine Isl.
- b*³. Terga less deeply punctured.
- a*⁴. Antennæ yellow; inner crest on anal tergite long *fulvicorne*. Albay.
- b*⁴. Antennæ deep green; inner crest nearly absent *hirsutellum*. Palawan.

Genus CYLIOSOMA, nov.

Tarsi as in *Zephronia*.

Vulva as in *Zephronia*, but the proximal plate divided into two distinct pieces, whereof the external partially overlaps the internal.

The movable digits of both pairs of copulatory forceps composed of a single segment.

Type *C. angulatum* (Butler).

Distribution. Eastern Australia, New Zealand.

Cyliosoma striolatum, sp. n.

Colour greenish black; terga covered with black spots.

Terga densely punctulate throughout.

Loc. Greymouth (New Zealand, South Island).

Allied to *C. de Lacyi* (White), from Waikato, but differs in having the punctuation finer and closer, in having the anal tergite compressed, and in being spotted with black. From *liosoma* (Hutton), from Dunedin, it may be recognized by having the infero-lateral portion of the tergites more strongly emarginate and the edge of the anal tergite laterally notched.

LV.—*Descriptions of new Species of Planema in the Collection of the British Museum.* By A. G. BUTLER, Ph.D. &c.

WHILST recently rearranging the Museum collection of *Acræinæ* of the Old World, and incorporating the fine series presented by Messrs. Godman and Salvin, I came upon the following undescribed species of *Planema*:—

Planema Salvini, sp. n.

Nearest to *P. camerunica*, the male with the discoidal area of primaries, the area below the cell, and the band crossing the centre of the wing golden orange instead of tawny; the transverse band itself more regular, especially along its outer margin; secondaries with the basal spots arranged as in *P. formosa* and followed by a diffused whitish band, more distinctly white on the under surface: the female chiefly differing from that sex of *P. camerunica* in the much less irregular inner edging of the white belt on the primaries (which is less distinctly continued below the first median branch) and its less prominent external angle, so that the deep-brown apical area is broader in this species: the secondaries much more nearly resemble those of the female of *P. formosa*, but the white belt across them is broader and more diffused. Expanse of wings, ♂ 75 millim., ♀ 93 millim.

Fernando Po and Cameroons (from the Godman & Salvin Collection).

The natural position of this species is undoubtedly between *P. formosa* and *P. camerunica*.

Planema Godmani, sp. n.

Allied to *P. camerunica* and *P. alcinoe*; the male has almost the same pattern on the primaries as the latter species, excepting that the inner blackish edging of the central band is usually almost wholly lost, so that these wings become

divided into two equal parts, the apical half smoky blackish, the basal half bright orange-tawny; the blackish inner edging, however, is always faintly, and sometimes strongly, represented: the secondaries are quite distinct from those of *P. alcinoe*, the basal spots being small and more restricted upon a reddish-tawny ground; beyond them is a diffused band (traversed by the dark veins and internervular streaks), its centre golden orange, its extremities whitish; the external area smoky brown, paler internally, sometimes becoming almost white as it merges into the central band. The female has primaries like those of *P. camerunica* ♀, but the basal spots of the secondaries are more restricted and their outer limit forms a straighter line than in *P. camerunica*, whilst the brown basal patch on which these spots are usually placed is infringed upon by the broader white central belt; the latter is more regular and of more uniform width throughout. Expanse of wings, ♂ 69–78 millim., ♀ 88 millim.

Sierra Leone (B.M. and Salvin & Godman Colls.).

We had long had a pair of this species in the Museum collection as *P. alcinoe* of Felder; the latter, however, is quite distinct, both sexes showing a well-defined and rather narrow dusky border to the secondaries. We have a pair from Accra.

Planema indentata, sp. n.

The male has smoky-brown primaries, similar to other species of the *P. alcinoe* group, but the belt across the wing, excepting that it is broader and golden orange, resembles that on the primaries of *P. elongata* ♂; the secondaries are like those of *P. macaria*, but much paler, the central area being broadly pale yellowish, almost inclining to whity brown, of course interrupted by the usual dusky veins and streaks; the female has the primaries marked somewhat as in *P. camerunica* ♀, but the broad white band has its inner edge nearly straight, two small notches alone indicating the angular excavations which characterize this band in *P. camerunica*: the secondaries are quite distinct, pale sandy yellow, the base narrowly brown, so that all the outer black spots are thrown into strong relief; the external border almost as narrow as in *P. alcinoe* ♀, but emitting much more prominent internervular blackish streaks to the middle of the wing. Expanse of wings, ♂ 78 millim., ♀ 100 millim.

One pair, Cameroons (Godman & Salvin Coll.).

The female was taken by Dr. Preuss at Barombi.

Quite recently Dr. Karsch has described a female *Planema* from Uganda under the name of *P. albicolor*, which he says

corresponds with the same sex of *P. consanguinea* so closely that the only difference of marking which he is able to point out is the slightly smaller size of the basal spots of the hind wings. "In the ♀ from Uganda, however, all the yellow and red-brown of the wings and body of *Planema consanguinea* are entirely white," a most singular statement! He means to say that the yellow and red-brown areas of *P. consanguinea* are replaced by white in the female from Uganda. I must express my positive conviction that this *P. albicolor* is nothing whatever but the rare albino form which constantly recurs in many species of *Acræa*, and which may also exist in some species of *Planema*. It is true, indeed, that the white forms of many species of *Acræa* have been described as distinct, but they always occur with the typical forms as either seasonal developments or simple sports; the following may be cited:—

<i>Tawny form.</i>	<i>Yellow or white form.</i>
1. <i>Acræa Johnstoni</i> , ♂.	<i>Acræa flavescens</i> , ♂.
2. " / <i>alciope</i> , ♀.	" <i>carmentis</i> , ♀.
3. " <i>esebria</i> , ♂ ♀.	" <i>protea</i> , ♂ ♀.
4. " <i>metaprotea</i> , ♂ ♀.	" <i>Monteironis</i> , ♂ ♀.
5. " <i>apecida</i> , ♂ ♀.	" <i>Cabira</i> , ♂ ♀.
6. " <i>vinidia</i> , ♂ ♀.	" <i>tenella</i> , ♂ ♀.
7. " <i>Sganzini</i> , ♂ ♀.	" <i>lycia</i> , ♂ ♀.
8. " <i>stenobæa</i> , ♂ ♀.	" <i>cæcilia</i> , ♂ ♀*.
9. " <i>caldarena</i> , ♂ ♀.	" <i>neluska</i> , ♀ only.
10. " <i>acara</i> , ♂ ♀.	" <i>pseudolycia</i> , ♀ only.
11. " <i>marmorata</i> , ♂ ♀.	" <i>turna</i> , ♂ ♀.
12. " <i>percussa</i> , ♂.	" <i>igati</i> , ♂.

Several other species have a white as well as a tawny form of female; so that to found a new species upon a female alone, which (to all intents and purposes) differs in nothing but its white colouring from its nearest ally, is in the highest degree venturesome. Differences of pattern are alone to be relied upon in the *Acræinæ*, the ground-colour varies enormously, the width of the black apical patch varies seasonally, the number of spots on the under surface varies a good deal in certain species, but the position of the spots, the outlines of the bands, and width of the hind wing border do not appear to be variable in *Planema*, or very slightly so; but in *Acræa* the width of the outer border varies considerably.

* This is rather a pale than a white form, and is perhaps a climatic variety.

LVI.—*Some Remarks on the Dispersal of Marine Animals by means of Seaweeds.* By RUPERT VALLENTIN.

THANKS to the patient investigations of Berkeley, Darwin, Sir Charles Lyell, and others, there are sufficient evidences of the dispersion of land-animals over the globe; but in the case of marine animals it is different. I have hunted in vain through the various publications to which I have had access to find records relating to the subject of this communication.

Early in the summer of last year while surface-netting in my boat about three miles south of Falmouth harbour, I noticed a large mass of *Fucus serratus* being swept away to sea by the ebbing tide. On further examination I found that this weed was suspended vertically in the water, the extremities of the fronds being just level with the calm surface of the sea. On securing this mass of weed, I discovered a large stone attached to its base which weighed three quarters of a pound. Numerous specimens of Hydroids and Polyzoa were also noticed attached to the fronds of this seaweed. Since then I have paid attention to these floating seaweeds when out in my boat, and have recorded my observations in a notebook kept for that purpose.

Attention may here be directed to the fact that the following remarks relate only to our in-shore waters, viz. at a distance not exceeding five miles from land, which is the farthest I have deemed it prudent to venture in so small a craft. Fortunately, however, I was successful in enlisting the co-operation of my friend Mr. J. Tucker, who went during last August from the Clyde to Norway. He was good enough to secure during the voyage specimens of seaweed which were floating in the water or else left stranded on the deck by the waves which occasionally swept over it during the exceptionally wild weather experienced while crossing the North Sea. The weeds thus collected were placed in seawater in his cabin. Unfortunately the steward, not knowing for what purpose they had been gathered, threw them overboard. I was, however, able to discover that specimens of *Fucus* had been collected in abundance floating in the North Sea long distances from land.

We have had during the past summer strong winds from the west and south-west; and when these winds have been accompanied by a strong ebb-tide great quantities of *Zostera*, *Fucus*, *Chorda*, and other seaweeds are torn from their respective habitats and thrown on shore in the nearest cove. On many occasions the wind has suddenly changed to the

north-west or north, and if the sea has reached a higher level than before the change of wind occurred, large masses of various species of seaweed can be observed being carried to sea by the wind and tide during the following ebb. In addition to this I have quite recently noticed in the numerous creeks with which Falmouth harbour abounds single shells and stones resting on the muddy or sandy sea-bottom with specimens of *Fucus* of various sizes attached to them in a flourishing condition. In every instance the weed is able to maintain a vertical position in the water owing to the presence of the numerous air-vessels on the fronds. In some cases the weed is so large that it can almost float the stone or shell on which it is growing; in others, some time will have to elapse before that can be accomplished. Without much difficulty during any calm day at low-water one can secure similar specimens in all stages of growth.

Attention may here be directed to the rate of flow of the retiring waters during ebb-tides. I am informed by the pilots frequenting this port that under favourable conditions a floating body such as a mass of seaweed would easily be driven five miles from the harbour during an ordinary ebb-tide. If, however, this were supplemented by a fresh north or north-west wind these floating masses would be driven even beyond that limit. Possibly one tide would be spent before the influence of the shore currents would be lost on these floating objects, and before the channel tides would be able to exert their influence on them; but when once these latter came into play there is no knowing where they might be swept to.

Before proceeding further, I will now record some experiments I have made as to the powers of flotation of some of our common seaweeds in sea-water. I have had portions of *Fucus nodosus* floating in vessels of sea-water for eleven and a half weeks, and *F. serratus* for upwards of seven weeks. On the other hand, *Fucus vesiculosus* never floated longer than five weeks. Specimens of *Holidrys siliquosa* floated in some instances for three weeks, and other examples for as many months. Many specimens of *Zostera marina* were found to float never longer than three days; they then invariably sank to the bottom of the jar in which they had been placed. Attempts were also made to discover how long the fronds of *Chorda filum* remained floating in the water, and during calm days several examples were moored in very sheltered places in the harbour. But these experiments were invariably unsuccessful, mainly owing to the surface-motion produced by passing steamers. I may mention that all these various

species of seaweed were obtained either in the bay or harbour, where they were drifting about in the tideways after being detached from their respective habitats by the force of the waves.

As my most interesting results have been obtained from the class Mollusca it will be convenient to take my starting point from those animals. Mr. Wallace (1)*, under the heading of "Means of dispersal of Mollusca," writes as follows:— "The marine, fresh-water, and land mollusca are three groups whose powers of dispersal and consequent distribution are very different and must be separately considered. The Pteropoda and Ianthina and other groups of floating mollusks drift about in mid-ocean, and their dispersal is probably limited chiefly by temperature, but perhaps also by the presence of enemies or the scarcity of proper food. The univalve and bivalve mollusca, of which the whelk and cockle may be taken as types, move so slowly in their adult state, that we should expect them to have an exceedingly limited distribution; but the young of all these are free-swimming embryos, and they thus have a powerful means of dispersal, and are carried by tides and currents so as ultimately to spread over every shore and shoal that offers conditions favourable for their development." Prof. W. Sollas (2) remarks as follows:— "Perhaps one of the commonest ways by which marine animals obtain a distribution over extensive areas is by means of free-swimming larvæ. The peopling of the sea by slow-moving or attached forms has certainly been accomplished chiefly, if not almost wholly, in this manner."

I have been fortunate enough to secure two specimens of bivalve mollusks while being dispersed by floating seaweed; and, strange as it may appear, one was a specimen of *Cardium edule*, a long frond of *Chorda filum* being attached to the left valve by its base. This mollusk was secured a mile from land, and was found on examination to be alive and in a healthy condition. Unfortunately this specimen and the attached weed were placed after examination on the deck of my canoe, and were washed overboard by a wave. A short time later a fine living example of *Mytilus edulis* was secured under similar circumstances and weighed 23·3 grms. The weed, *Chorda filum*, was also in this instance firmly fixed to the left valve; it measured 310 centim. in length and weighed 43·3 grms. Had these mollusks escaped the notice of cod, pollock, or other fish which frequent the mid-water regions, they might have been carried by the currents on some shoal or bank, and so founded fresh colonies.

As *Chorda filum* invariably floats vertically, I have found

* These numbers refer to bibliographical list at end.

it very difficult to detect specimens drifting in the sea, unless there is an almost complete calm accompanied with bright sunshine.

Numerous examples of single valves of *Tapes pullastra*, *Ostrea edulis*, fragments of *Corallina*, and stones of various sizes have frequently been observed drifting in the tideways attached to the roots of *Chorda filum* and various species of *Fucus*.

Only two species of Nudibranchs have been secured on drift-weed. Two specimens of *Polycera quadrilineata* were found early in July, and several examples of *Acanthidoris pilosa* were captured early during the following month on masses of *Fucus serratus* while travelling seawards. On a similar clump of weed a large coil of spawn, deposited by *Aplysia hybrida*, was once noticed. Microscopical examination of these ova showed that segmentation was just completed.

The polychæte annelid, *Spirorbis borealis*, is very common on the fronds of *Fucus serratus*. It will be remembered that the embryos of this species are kept inside its tube until they are in an advanced condition and almost ready to lead an independent life. This fact doubtless greatly assists in the propagation of the species. Specimens of this annelid attached to the fronds of *Fucus serratus* can be secured in the tideways on almost any occasion.

Very frequently, particularly during the months of June, July, and August, specimens of *Idotea tricuspidata* have been found holding fast to the fronds of *Halidrys siliquosa*. These crustaceans are exceedingly difficult to detect, as they invariably adapt their colour to suit their surroundings, and also hold the stem of the drifting weed longitudinally.

The undermentioned species of Hydroids have been observed on drift seaweed: *Clava multicornis* and *Sertularia pumila* occur in abundance on the fronds of *Fucus vesiculosus* and *F. serratus*, and *Aglaophenia pluma* at times covers the fronds of *Halidrys siliquosa*. The following examples of Polyzoa will be sufficient for my present purpose:—*Bicellaria ciliata* and *Mimosella gracilis* are both to be secured in abundance on the fronds of *Halidrys siliquosa*. *Membranipora pilosa*, *Flustra foliacea*, and *Valkeria uva* have repeatedly been observed alive and in a healthy condition growing on detached portions of *Fucus serratus* gathered in the bay and harbour. The common anemone, *Anthea cereus*, is usually to be found adhering to rocks in pools of water between tide-marks; it also luxuriates on the fronds of *Laminaria* a few feet below low-water mark. In sheltered places in Falmouth harbour large areas exist covered with sea-grass (*Zostera*

marina), to the leaf-like fronds of which these anemones delight to adhere with their broad disks. Indeed in this district this actinian seems to prefer this weed to any other, a fact I have not seen recorded in any of the scientific publications to which I have had access. During the fall of every year the blade-like portions of this weed become detached and are soon carried by the currents into the tideways. A single extract from my note-book will be sufficient to confirm this fact. On the 7th of September, while standing on the extremity of the eastern breakwater, I noticed large quantities of *Zostera marina* being swept to sea by the ebbing tide, and in one instance three specimens of *Anthea cereus* were observed adhering to the same weed with their tentacles fully expanded.

Geographical Distribution of the above-mentioned Species.

According to Messrs. Forbes and Hanley (3) "*Cardium edule* has a wide range, extending southward to the Canary Isles." *Mytilus edulis*, according to the same authorities, "ranges all round the coasts of the North Atlantic, on both its eastern and western sides, and into the Mediterranean."

Acanthodoris pilosa and *Polycera quadrilineata* are both generally distributed around the British coasts; while *Aplysia* is found along the shores of the Mediterranean and also at Madeira.

The polychæte annelid *Spirorbis borealis*, in addition to being generally distributed along the shores of Great Britain and Ireland, is also found on the coasts of Norway, France, and Denmark.

Idotea tricuspidata has been captured on the Cornish and Devonshire coasts, and also along the south-western shore of Ireland and the western coast of Scotland. This species is abundant in the Mediterranean.

Turning now to Hydroids and Polyzoa. According to Mr. T. Hincks (4), *Clava multicornis* is "generally distributed on our coasts." *Sertularia pumila* is also "generally distributed."

Aglaophenia pluma, according to that author (4), "is much more at home in the south and west than in the north. . . . Throughout the north it seems to be sparingly distributed, whilst along the south-western coasts it is extremely abundant and of great size and beauty." This species has been recorded on the Belgian coast, and is not uncommon in the Bay of Naples.

Bicellaria ciliata, *Membranipora pilosa*, and *Flustra foliacea* are all generally distributed round our British coasts (5), the two former being also found on the east coast of France,

and the last-named extending all along the shores of the Mediterranean as far as Suez. *Mimosella gracilis* is only found on the shores of Devon and Cornwall.

According to Mr. Gosse (6), *Anthea cereus* is found at Madeira.

I think the foregoing examples are sufficient to demonstrate clearly that seaweeds, and particularly those furnished with air-vessels, have played in the past, as they continue to do at present, a most important part in the dispersal of many of our littoral forms over the globe.

References.

- (1) WALLACE, ALFRED R.—The Geographical Distribution of Animals. London, 1876.
- (2) SOLLAS, W. J.—On the Origin of Freshwater Faunas: a Study in Evolution. Sci. Trans. Royal Dublin Society, vol. iii. (ser. ii.) part 5. Nov. 1884.
- (3) FORBES, E., and HANLEY, S.—A History of British Mollusca and their Shells.
- (4) HINCKS, THOMAS.—A History of British Hydroid Zoophytes.
- (5) HINCKS, THOMAS.—A History of British Marine Polyzoa.
- (6) GOSSE.—A History of British Sea-Anemones and Corals.

LVII.—*Description of a new Species of Scolopendra from the Solomon Islands.* By R. I. Pocock.

Scolopendra metuenda, sp. n.

Colour. The terga a deep olive-chestnut, head nearly black; antennæ, legs, and sterna rather greener than the terga; at the posterior end of the body the chestnut colour predominates on the somites.

Head without sulci, finely punctured, a little wider than long.

Antennæ long and slender, composed of 19 or 20 long cylindrical segments, whereof the basal five are smooth, though punctured, and the rest pubescent.

Maxillipedes finely punctured, the precoxal plates very short, but wide, with convex distal edges, each furnished with upwards of a dozen or more small, in parts nearly obsolete, teeth, which present the appearance of having been worn away; the femoral process simple, small, and curved back against the appendage.

Tergites. First without either longitudinal or transverse sulci; on the rest the longitudinal sulci start upon the third and extend to the twentieth, but are everywhere faint (except upon the extreme anterior and posterior edges of the terga), and almost die out in the middle of the body; a faint shallow median longitudinal furrow upon the terga. The lateral margin from the third to the twenty-first elevated.

Sternites smooth and shining, weakly bisulcate.

Anal somite small; *tergite* not mesially sulcate, its width equal to the length of its lateral margin, but a little less than its median

length; pleuræ densely porous, terminating in a blunt process, which is tipped with 4 or 5 small spines; *sternite* long and narrow, posteriorly attenuate, with truncate hinder edge, its basal width about two thirds of its length; *legs* long and slender, nearly four times the length of the head, the segments cylindrical and about four times as long as wide; femora armed with about 14 small spines, 3, 3, 2 in three longitudinal rows on the inner surface and 3, 3 in two rows on the external half of the lower surface; the femoral process armed with from 4 to 10 small spines; no tarsal spur, claws basally spurred.

The rest of the *legs* long and slender, with a tarsal spur.

Measurements in millimetres.—Total length 163, of antenna 37, of anal leg 41; width of head 10·5, length 10; width of twelfth tergite 14, of twenty-first S.

Loc. New Georgia (Solomon Islands).

A couple of specimens of this species were obtained by Commander Barker, R.N., of H.M.S. 'Penguin.' The second specimen is a little smaller than the type, being 145 millim. long, and much more uniformly chestnut in colour.

In its general features this handsome new species presents considerable resemblance to the cosmopolitan *S. subspinipes* of Leach, but may be at once recognized by the spine-armature of its anal legs, the former species having only two or three spines on the lower surface of the anal femora and only three or four on the inner surface. It also has but five or six teeth on the precoxal plates of the maxillipedes, whereas in *S. metuenda* there are a large number of minute more or less obsolete teeth on these plates. In this respect *S. metuenda* would seem to approach *S. polyodonta*, Daday (Term. füzetek, xvi. p. 109, pl. v. fig. 7 &c.), from New Guinea; but the latter has the anal femora unarmed, as in the variety of *S. de Haanii* named *inermis* by Newport.

MISCELLANEOUS.

On the Status of the Names Aplysia and Tethys.

By HENRY A. PILSBRY.

IN the course of my studies on the "Sea-Hares," preliminary to the preparation of a monograph of this group of tectibranch mollusks for the 'Manual of Conchology,' my attention was early forced to the fact that in Linnæus's tenth edition of the 'Systema Naturæ' the genus *Tethys* was proposed for the animal now known as *Aplysia*, and included nothing else. Moreover, by the terms of the generic diagnosis, such creatures as that known as *Tethys* in modern times are excluded.

In the twelfth edition of the 'Systema' *Tethys* is given a completely different meaning, and the new term *Aplysia* (*Laplysia*) is brought forward to include the species of the earlier *Tethys*. This later usage has been accepted by zoologists until the present day.

The question then arises, Shall we apply to Linnæus himself the canons of nomenclature which would be rigorously enforced were the claims of his successors in question? It is with a view to obtaining the opinions of those who are expert in these matters that we present below a full synopsis of the literature bearing upon the questions at issue.

The facts in this case have doubtless been fully unearthed by many investigators; but, probably believing it best to "let sleeping dogs rest," no one* has to my knowledge seriously raised the questions to which I desire now to direct attention.

The genus *Tethys* was founded by Linné in the tenth edition of the 'Systema Naturæ,' p. 653, for two species, thus:—

"254. TETHYS. *Corpus* oblongum, bilabiarum: corpusculo medio cartilagineo oblongo. *Tentacula* duo, cuneiforma. *Foramina* duo, spirantia.

"limacina 1. T. auriculis quatuor.

"*Habitat in Oceano Australi.*

"*Corpus oblongum, antice quasi 4 auriculis acutis instructum.*

"leporina. 2. T. corpore rubro, margine membranaceo, auriculis duobus.

"[a] *Rond. pisc. 1. p. 520.* *Lepus marinus.*

"[b] *Bell. aquat. 437.* *Lepus marinus.*

"[c] *Gesn. aquat. 475.* *Lepus marinus.* *Aldr. exsangu. 78.*
Lepus marinus 1.

"*Habitat in M. Mediterraneo.*

"*Conf. Column. aqu. t. 26, f. 2, 3.*"

It will be noticed that the above description of *limacina* contains nothing diagnostic of a species, though the genus is clearly indicated. As Linné gives us no reference to earlier writers, we have absolutely no means of learning what *Tethys limacina* is, and the name must be dropped.

In the case of *leporina*, Linné gives ample references to the sources whence his information was derived. These we analyze as follows:—

[a] Gulielmi Rondeletii, etc., *Libri de Piscibus Marinis*, etc. (1554), *Liber xvii. p. 520*, figures an *Aplysia* which seems to be the *A. fasciata* of authors (for it lacks the conspicuous shell-foramen of *depilans* and the broadly united parapodia of *punctata*). [b] *La Nature & diversité des poissons, avec leurs pourtraicts, representez au plus pres du naturel, par Pierre Belon du Mans (Paris, 1555)*, p. 437, seems to be an undeterminable species of "Lievre Marin" from the Cyclades, known to Belon through the ancient authors only. [c] *Conradi Gesneri medici Tigurini Historiæ Animalium, Liber IIII. qui est de Piscium & Aquatiliū Animantium natura (1558)*, p. 561 (Linné wrongly gives 475 as the page). A reversed copy of Rondelet's figure is given, Gesner's information being wholly second hand. [d] *Ulyssis Aldrovandi etc., De Reliquis Animalibus*

* Except R. Bergh, who in *Mal. Unters. i. p. 33*, in Semper's 'Reisen,' 2ter Theil, has made the bald statement that Linnæus's earlier *Tethys* was an *Aplysia*, but who continues to use *Tethys* for the Nudibranch.

exanguibus, libri quatuor, post mortem eius editi Nempe De Mollibus, Crustaceis Testaceis, et Zoophytis (1606), De Mollibus, liber I. p. 78. In this work, which is purely a compilation, all of Rondelet's figures again do service, and Linnæus's reference will naturally be confined to the first of these. Aldrovandus also figures (p. 82) a couple of species of *Doris* as "*Leporis marini alia species*," and (p. 83) two other figures possibly representing *Aclesia*. Linné's "conf. Columna" refers us to figures of the Nudibranch commonly known as *Tethys fimbria*; but this figure is merely cited for comparison, not as a representation of the species *T. leporina*.

It would therefore seem that Linné originally intended *Tethys* for the *Aplysia* species, his generic diagnosis and references unmistakably indicating the "*Lepus marinus*" of the early zoological renaissance authors.

In the twelfth edition of the 'Systema,' p. 1089, Linné wholly alters the diagnosis of *Tethys*, as follows:—

"289. TETHYS. Corpus liberum, oblongiusculum, carnosum, apodum. Os proboscide terminale, cylindrica, sub labis explicato. Foramina 2 ad latis colli sinistrum.

"leporin. 1. T. labro ciliato. †

"Column. aquat. 27. †. 26. Lepus marinus major.

"Rondel. pisc. 526. Leporis marini tertia species.

"Habitat in Mari Mediterraneo.

"fimbria. 2. T. labro crenulato.

"Bohads. mar. 54 t. 5. f. 1, 2. Fimbria.

"Habitat in mari adritico.

"Videtur a præcedenti distincti species."

All of these references belong to the one Mediterranean species (see Bergh, in Semper's 'Reisen,' 2ter Theil, ii. p. 348), known as *Tethys fimbria* or *leporina* *.

On page 1082 of the twelfth edition the new genus *Aplysia* or *Laplysia* ‡ is proposed, thus:—

* The specific name of this Nudibranch must stand *fimbria*, Linn., the binomial combination *Tethys leporina* being preoccupied by Linnæus, 1758. The synonymy of the genus is as follows:—

1761. *Fimbria*, Bohadsch, 1761 (a mononym).

1767. *Tethys*, L. 1767, not *Tethys*, L. 1758.

1801. *Tethys*, Lam. Syst. An. s. Vert. p. 63.

1808. *Thethys*, Cuvier, Ann. du Mus. d'Hist. Nat. xii. p. 257.

1808. *Thetis*, Meckel, Beytr. zu vergleich. Anat. I. i. p. 9, not *Thetis*, J. Sowb. Min. Conch. 1826.

1817?. *Thetys*, Fér. Tabl. Syst. p. 28.

1819. *Phoenicurus*, Rudolphi, Entozoorum Synopsis, p. 573.

1823. *Vertumnus*, Otto, Nov. A. Ac. C. Leop. Nat. Cur. xi. pp. 294-300.

Of these names, the first was not distinctly proposed as a genus, Bohadsch's nomenclature being strictly mononymic. The seventh and eighth were founded on minute appendages of the animal, supposed to be parasitic worms; and certainly the genus could not be identified by these descriptions. The other names are variants on Linnæus's original *Tethys*.

‡ The spelling "*Laplysia*" is evidently a typographical error or over-

" 283. LAPLYSIA. *Corpus repens, obvelatum membranis reflexis.*

" *Clypeo dorsali, membranaceo, pulmones obtegente.*

" *Foramen laterale, dextrum, pro genitalibus.*

" *Anus supra extremitatem dorsi.*

" *Tentacula quatuor, anterieus sita.*

" depilans. 1. LAPLYSIA.

" *Syst. Nat.* 10. p. 653. *Tethys limacina.*

" *Rond. pisc.* 1. p. 520. *Lepus marinus.*

" *Gesn. aquat.* 475. *Lepus marinus Rondeletii.*

" *Bohads. mar.* 3. t. 1, 2, 3. *Lernea graphice.*

" *Seb. mus.* 3. t. 1, f. 8, 9.

" *Habitat in M. Mediterraneo; sanie depilans tactu.*

" (B. 51.) *foetidissima ad nauseam usque.*"

The description of the genus is implied for the species *depilans*, and it is also said to be the *Tethys limacina* of the tenth edition*. The second reference is to the same figure of Rondelet formerly cited for *Tethys leporina*. The third reference repeats the earlier citation to Gesner, with the same mistake as to the page. The fourth reference is to the excellent figure of Bohadsch's *Lernea*, representing unmistakably the *Aplysia depilans* of authors. The reference to Seba is less happy, the figures being too ambiguous for certain determination. It is perfectly evident that Linnæus's generic characters of *Laplysia* were derived from Bohadsch's work; and as the best figures were from the same source, the traditional identification of *depilans* is fully sustained.

SUMMARY.—From the foregoing facts it would appear that (1) the generic name *Tethys*, Linn. 1758, must replace *Aplysia* and *Laplysia*, Linn. 1767; and (2) as a substitute for *Tethys*, Linn. 1767, not 1758, we will probably be compelled to adopt either one of the new spellings of this name proposed in the early part of the century or an entirely new generic term.—*Proc. Acad. Nat. Sci. Philad.* August 27, 1895, pp. 347-350.

On the Origin of the Triradiate Spicules of Leucosolenia.

By E. A. MINCHIN.

In *Leucosolenia coriacea* the youngest spicules are found to be surrounded by six cells, which are similar in all their characters to the cells of the external flat epithelium of the sponge, and undoubtedly derived from this layer. It appears that three cells of the external epithelium wander inwards, and give rise to six by division of each cell into two, the six cells being arranged in such a way that three are placed more internally, *i. e.* towards the gastral

sight, for the first use of the word, on page 1072 of the *Syst. Nat.* 12, is in the correct form "*Aplysia*." The generic diagnosis given on this page is brief, but sufficient:—"283. *Aplysia* Tentacula 4. Anus supra postica."

* We would not replace the specific name *depilans* by *limacina*, because the latter was not recognizably defined in Linnæus's earlier edition.

surface of the body-wall, and three more externally, towards the dermal surface. Each of these sets of three cells has a form which might be compared to a trefoil, and the whole mass may be described as two such trefoils superposed, the cells of one trefoil exactly corresponding to those of the other.

The spicule is formed by the three inner cells, a ray being formed by each cell. In many instances it appears as if the three rays were formed quite separately and afterwards fused at the centre.

The three outer cells soon lose their rounded form, and, by throwing out processes, assume an amœboid appearance. After the spicule-rays have attained a length of 10 or 15 μ , the three outer cells are no more to be found, having apparently rejoined the flat epithelium from whence they came. The three inner cells alone secrete the rays, and continue to do so until the spicule is full-grown.

The spicule-rays soon appear to project beyond their formative cells, but are in reality covered by a thin layer of protoplasm. At the same time the spicule-sheath makes its appearance as a denser layer of substance between the protoplasm of the formative cell and the calcareous spicule, and it is by continued calcification of the sheath that the spicule grows.

The spicule-rays attain their full thickness at their bases before they have reached their full length. The formative cells remain at the bases of the rays until this portion is built up to its full thickness. Each formative cell then migrates along its ray towards the tip, building up the ray to its full thickness as it goes. In the fully formed ray the formative cell is found adherent to the extreme tip.

Theoretical considerations.

(1) The origin of the spicule-forming cells—that is to say, of the whole connective-tissue system in these sponges—from the external flat epithelium, is another nail in the coffin of the so-called mesoderm in these forms. Sponges are to be regarded as two-layered animals, composed of a dermal and a gastral layer. The dermal layer is differentiated into (1) an external flat contractile epithelium, the neuro-muscular system, and (2) an internal connective-tissue layer. The gastral layer consists of the collar-cells. The amœboid wandering cells are perhaps also to be reckoned with the gastral layer.

(2) The fact that each ray of a triradiate spicule is formed by a single cell shows that each triradiate spicule must be regarded as derived from the fusion of three originally separate monactinal spicules. This supports Schulze's theory, namely, that the triradiates of the more primitive Ascons have arisen as an adaptation to the structure of the sponge, and goes against Dreyer's theory that the primitive spicule of all sponges is a tetraxon, a form explained by him as the direct mechanical outcome of the vesicular structure of living bodies.—*Proc. Roy. Soc.* vol. lviii. no. 350, pp. 204, 205.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SIXTH SERIES.]

No. 96. DECEMBER 1895.

LVIII.—*The Pectoral and Pelvic Girdles of Murænosaurus plicatus.* By C. W. ANDREWS, F.G.S., Assistant in the British Museum (Natural History).

PHILLIPS, in the 'Geology of Oxford' (p. 313), described under the name *Plesiosaurus plicatus* certain cervical and dorsal vertebræ from the Oxford Clay of Shotover. From the same horizon in the neighbourhood of Peterborough numerous more or less complete skeletons of a species of Plesiosaur have been collected in which the vertebræ are of a similar character. These specimens present a considerable range of variation both in size and in the degree to which fusion of the elements of the vertebræ has taken place; in some the neural arches and cervical ribs are still quite free, in others they are co-ossified with the centra. It was on one of the skeletons in which the latter condition obtains that Professor Seeley founded his description of *Murænosaurus Leedsi*. The genus *Murænosaurus* is distinguished from *Cryptoclidus*, to which the greater number of specimens from this locality are referable, by the enormous length of the neck (about seven times that of the head), caused not only by the much larger number (forty-four) of cervical vertebræ, but also by the greater length of the individual centra. There are also numerous differences in the pectoral girdle and limb-bones which fully establish the right of this type of Plesiosaurian skeleton to generic rank.

With regard to the species there is some difficulty. Mr. Lydekker has included under *Cimoliosaurus plicatus* Phillips's species *Plesiosaurus plicatus*, *P. hexagonalis*, and *P. infra-planus*, as well as Professor Seeley's *Murænosaurus Leedsi*. For the specimen (Leeds Coll. 28), the limb-girdles of which are figured in the present paper, he has suggested the specific name *Cimoliosaurus durobrivensis*, considering it separable from *C. plicatus* on account of its somewhat shorter cervical vertebræ. Comparison of some six or seven more or less complete sets of cervical vertebræ (including those of the type specimens of *Murænosaurus Leedsi* and *Cimoliosaurus durobrivensis*) with one another shows that, apart from variations in size and in the extent to which the arches and ribs have fused with the centra, no important differences are to be found. The size and condition of ossification are probably dependent merely on the age and sex of the individual. It is, however, possible that the comparatively small individuals in which fusion between the arches and centra has already occurred may be specifically distinct, in which case the name *Murænosaurus Leedsi* must be applied to them, the type specimen of that species being of this form. On the other hand, as already remarked, these differences may be merely sexual, and, as Mr. Boulenger has shown in the case of the *Chelonia**, the fusion of other elements with the vertebral centra takes place very irregularly, and consequently is of little systematic value. For the present, therefore, it seems best to regard all the specimens possessing cervical vertebræ of the type of *Plesiosaurus plicatus* as belonging to that species.

In the present note specimens of the pectoral and pelvic girdles which have lately been mounted for exhibition at the Natural History Museum are described. These belong to the same individual (R. 2428, Leeds Coll. 28), which is that for which Mr. Lydekker proposed the name *Cimoliosaurus durobrivensis*.

The Pectoral Girdle. (Fig. 1.)

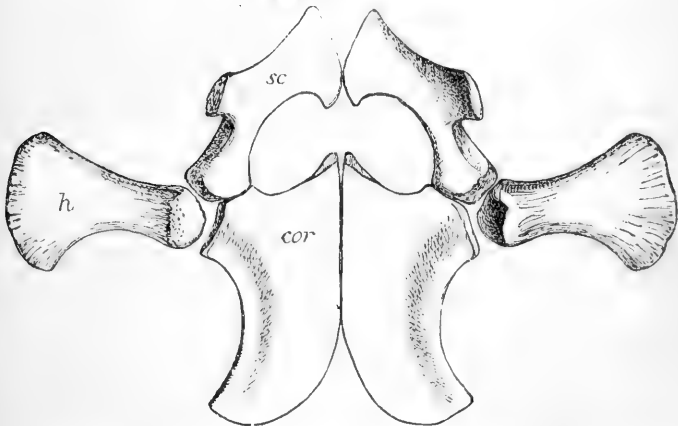
In general form the *scapula* (*sc*) resembles that of *Cryptoclidus*, but differs from it in several points, *e. g.* (1) the posterior border of the dorsal ramus near its upper end bears a sharp crest, apparently for the insertion of muscle; (2) the dorsal ramus widens out much more rapidly towards its base and its anterior edge is thin and sharp; (3) the ventral ramus is considerably wider, and also has a comparatively thin anterior

* Trans. Zool. Soc. vol. xiii. pt. 8, p. 309.

edge, which bears no tubercle such as occurs in *Cryptoclidus* (see this Magazine, ser. 6, vol. xv. p. 337, fig. 2 A, t). The median portion of the ventral bars had already begun to grow back to form a junction with the anterior prolongations of the coracoids, but were still separated from them by a considerable interval; other pectoral girdles in the collection show this junction. The scapulæ had not yet quite met in median symphysis, and anteriorly were separated from one another by a wide V-shaped interval. In life this space was wholly or partially closed by the clavicular arch, which unfortunately is wanting in this specimen. The scapulæ anteriorly curve inwards and upwards in such a way that, with the clavicles, they formed the anterior wall of the thorax.

The general form of the *coracoids* (*cor*) is shown in the figure (fig. 1). Between the glenoid surfaces the bones are very thick and massive, and unite in a strong median symphysis

Fig. 1.



Pectoral girdle of *Murænosaurus* from above. *sc*, scapula; *cor*, coracoid; *h*, humerus. About $\frac{1}{10}$ nat. size.

about 5 centim. deep at the thickest part. In this region the visceral surface of the coracoids is concave from side to side, forming an arc of a circle whose radius is about 28 centim. Behind this strong transverse ridge the visceral surface is depressed, owing to the rapid thinning of the bone, which, except near the outer border, is less than a centimetre thick. In this thin posterior region the coracoids meet at an angle of about 120° . The outer concave border is somewhat thickened, but is not produced backwards and outwards into

projecting processes as in the fully ossified coracoid of *Cryptoclidus*. The thin inner posterior portion of the bone is frequently broken away, and the remaining portion, consisting of the thickened anterior and external borders, has then the form shown by Prof. Seeley in his figure of the coracoids of *Murænosaurus Manselli* *.

The posterior convex margin in the present specimen bears rough grooved surface for cartilage, showing that growth was still in progress in this direction. Anteriorly the coracoids are prolonged forwards in the middle line in short pointed processes, which extend towards the backward processes of the scapulæ, but do not reach them; both bones, however, bear surfaces for cartilage, and were probably already united by a bar of that substance.

The dimensions of the pectoral girdle are:—

	centim.
Extreme length from anterior end of scapulæ to hinder border of coracoids	59
Width across coracoids in a straight line between the hinder edges of the glenoid facets	38
Extreme length of coracoids	40
Width of coracoids at narrowest point	27

The humerus (*h*) figured measures about 31 centim. long; the smallest circumference of its shaft is 21 centim., and the width of its expanded distal extremity is 19 centim.

The Pelvic Girdle. (Figs. 2, 3.)

The pelvis represented in figs. 2 and 3 gives a clearer idea of the structure of that portion of the Plesiosaurian skeleton than any other specimen or figure with which I am acquainted.

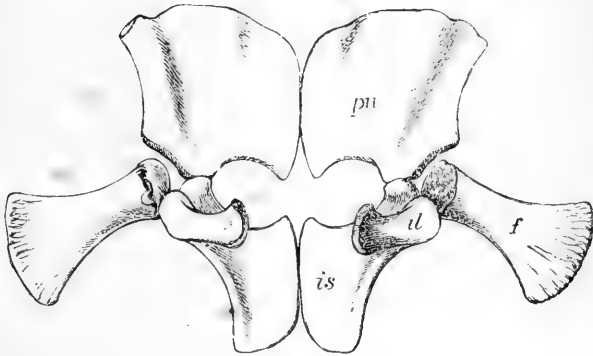
The *pubis* (*pu*) is a broad nearly flat plate of bone, very thin except near the median border and the articular surfaces for the ischium and femur; the posterior margin is also somewhat thickened. The width of the bone from the antero-external to the antero-internal angle is 28 centim., the length from the ischial surface to the anterior border 25.5 centim. The length of the acetabular surface is about 8 and of the ischial surface 4 centim. In the specimen figured the left pubis has been restored in plaster. The two pubes seem to have made an angle of about 120° with one another; they were still separated in the middle line by a pad of cartilage, which was widest in front and behind; whether the posterior portion of this cartilage extended back to join that lying between the

* Quart. Journ. Geol. Soc. vol. xxx. (1874) p. 437, fig. 2.

ischia, thus enclosing an *obturator foramen* on either side, cannot be determined, but it probably did so.

The *ischia* (*is*) are hatchet-shaped bones, the upper thickened ends of which bear three articular surfaces—an anterior one

Fig. 2.



Pelvic girdle of *Muraenosaurus* from above. *pu*, pubis; *is*, ischium; *il*, ilium; *f*, femur. About $\frac{1}{17}$ nat. size.

locking forwards for union with the pubes, a middle, looking outwards, forming the median portion of the acetabulum, and a posterior, looking upwards and backwards, for the ilium.

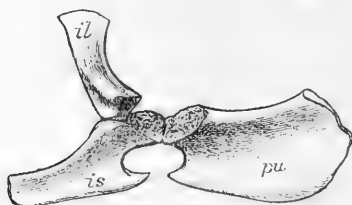
The ventral expanded portion measures 21 centim. at the widest place; the median border is slightly curved and bears the impress of the cartilage which still separated the two bones; these also made an angle of about 120° with one another. The symphysis of the pubes and ischia forms a curved line, convex dorsally. Each obturator foramen (if closed) was oval, the shorter axis (antero-posterior) measuring 10 centim., the longer 12.

The *ilium* (*il*) is a slightly curved, stout, rod-like bone 18.5 centim. long. Its lower end is stout and massive and bears two articular surfaces, one for union with the ischium, the other forming the hindermost portion of the acetabulum*.

* The separation of the ilium from the pubis in *Muraenosaurus* has been pointed out by Seeley (Proc. Roy. Soc. vol. li. (1892) p. 137); the same arrangement is described by Cragin in *Trinaeromerum* ('American Geologist,' vol. viii. (1891) p. 174), and is also shown in Conybeare's restoration of the pelvic girdle of *Plesiosaurus dolichodeirus* (Trans. Geol. Soc. ser. 2, vol. i. (1824) pl. xlix. fig. 4). It also occurs in *Pliosaurus*, *Peloneustes*, and *Cryptoclidus*, and, indeed, is probably universal among the Plesiosauria.

The middle of the bone is rounded and measures 9·5 centim. in circumference; its upper portion is compressed laterally, so that it is only about 1 centim. thick; its greatest width is

Fig. 3.



Pelvic girdle of *Murænosaurus* from the side. *pu*, pubis; *is*, ischium; *il*, ilium. About $\frac{1}{11}$ nat. size.

5·7 centim.; the upper border is curved and bears a groove for cartilage. The inner surface bears scarcely any trace of its junction with the sacral ribs, and the connexion with the vertebræ must have been a very slight one, the whole pelvis having been held firm chiefly by the greatly expanded pubes. The distance between the upper ends of the ilia is about 13 centim.

The dimensions of the associated femora are:—

	centim.
Length	28
Circumference of shaft at the narrowest point	18
Width of distal end	16

Numerous cervical vertebræ, as well as some dorsals and caudals of the same individual, are preserved in the collection.

LIX.—*Description of a supposed new Species of Land-Mollusk of the Genus Parmarion from Pulo Laut, an Island off the South-east Coast of Borneo.* By Lieut.-Col. H. H. GODWIN-AUSTEN, F.R.S., F.Z.S., &c.

[Plate XIX.]

IN a collection of land-shells preserved in spirit, collected by Mr. William Doherty, of Cincinnati, in the islands of the Malay Archipelago, I found two specimens of a slug-like form from Pulo Laut, the island off the south-east coast of Borneo. I hasten to describe it, having early this year, in conjunction with Mr. Walter E. Collinge, published a paper

in the 'Proceedings of the Zoological Society of London' (March 1895, p. 241) on some species from Kina Balu Mountain and Sarawak, in Borneo itself. The animal being very similar in outward appearance, it was a surprise to me to find it, on closer examination, to differ considerably from those we had described. I have great pleasure in naming it after its discoverer, who has proved himself to be a most indefatigable collector, not only of land-mollusca, but more particularly of the Lepidoptera, on which he has written several papers very valuable as regards geographical distribution. Among the land-shells he has placed in my hands are many very interesting species.

Parmarion Dohertyi, sp. n.

Hab. Pulo Laut Island.

Animal (Pl. XIX. figs. 1 and 2).—Length of the largest specimen 20 millim., visceral mass about 6 millim.; length of the smallest 15 millim. The mucous gland and the extremity of the foot is similar to the species from Borneo, placed in *Microparmarion*; but the shell is more globose, and the round, solid, spiral, visceral mass shows this even after the shell is detached. The thicker portion of the shell (fig. 3, $\times 4$) is oval above, flat, thin, becoming a transparent membrane on the posterior and lower portions; its colour is a faint ochraceous tint. It has about $1\frac{1}{2}$ whorls, and the apex being rather closely wound, it is impossible to extract the animal without breaking away a large part of the membranaceous interior portion. This is shown in fig. 4 (a view of the lower side), where a portion is still intact, while it was once continuous over all anteriorly.

The largest shell measures in major diameter 8.0 millim., minor diameter 5.5 millim.

The specimens I have to describe from, having been plunged too suddenly into strong spirit, are very much contracted and hardened; the eye-tentacles are protruding and the anterior portion of the mantle is rolled up, the edges being turned in underneath, so that it is not altogether clear what the form of the shell-lobes might have been when alive and what the portion near the respiratory orifice was like. I have drawn the largest exactly as it is preserved.

The mantle is very closely and distinctly papillate, as is also the posterior side of the foot; this is sharply keeled above. The sole of the foot has a central area. The tentacles are apparently long and dark-coloured. The pallial margin of the foot is not so distinctly marked off from the

portion above as in *Damayantia Smithi* and *Microparmarion*; but the extreme contraction of the specimen may have produced this appearance. This margin of the foot is quite pale in contrast to the very dark colour of the animal.

The shell-lobes are continuous all round the margin of the shell, and would in life leave a more or less exposed apical area of the same; they are clearly divided into right and left lobes. There is a small right neck-lappet.

Anatomy.—The visceral mass is globose and distinctly coiled about one and a half times, terminating bluntly.

The jaw (fig. 8) is curved slightly, with a curvilinear cutting-edge. The lingual ribbon is long and of good breadth; the central tooth is elongate, on a broad base, having a moderately long central point, with basal cusps on either side (as in *Microparmarion pollonerai*); the median teeth are also elongate, with a single cusp on the outer side. The laterals are narrow and elongate, with long, nearly equal, bicuspid points; they become short in length near the extreme margin and of very irregular blunt form (see figs. 9 a-c). The teeth are arranged thus: +30—18—1—18—30+.

Generative Organs (figs. 5, 6, and 7).—The *vas deferens* is given off from the extreme free end of the male organ, there being no flagellum or calc-sac; the position of the retractor muscle was not well made out, but appeared to be given off rather low down on the muscular sheath. The male organ is folded on itself in S-form, and contained a long spermatophore in process of formation (fig. 6), the short curved spines being observable. Neither the albumen-gland nor the hermaphrodite duct and gland were extracted, as I did not wish to destroy the visceral mass of the largest specimen remaining, and in the small one I failed to find these parts. The spermatheca (fig. 5, *sp.*) was broken near the base, so whether it is ovoid or sessile or elongate is somewhat uncertain; but, judging from the spermatophore, it is of the latter form. The amatorial organ (D) was also incomplete at the free or posterior end, but fortunately the whole of the "sagitta" was well preserved, and on this rested considerable interest; it proved to be very long, rising from a funnel-shaped base and terminating in a fine sharp point, being cut off obliquely like a pen, the total length being 2.6 millim. (figs. 7, 7 a). It is comparable with that of *Parmarion pupillaris* of Java, figured by Heinrich Simroth (pl. viii. fig. 17) in his paper on this group of land-shells in 'Zoologische Ergebnisse einer Reise in Niederländisch Ost-Indien,' 1893. This form of the amatorial organ combined with the other characters places this species very satisfactorily in the genus *Parmarion*,

and extends its range thus further to the eastward. At the same time it is proved to be distinct from *Damayantia* and *Microparmarion*, lately described in the Proc. Zool. Soc.

The type specimen will be sent to the National Collection, South Kensington.

EXPLANATION OF PLATE XIX.

- Fig. 1.* Animal of *Parmarion Dohertyi*, right side, with shell removed. $\times 4$.
Fig. 2. Ditto, ditto, seen from above. $\times 4$.
Fig. 3. Shell. $\times 4$.
Fig. 4. Ditto, lower side. $\times 8$. *a, a*, portion broken away.
Fig. 5. Generative organs (portion of). $\times 8$. *P*, male organ; *v.d.*, vas deferens; *D*, amatorial organ; *sp.*, spermatheca.
Fig. 6. Male organ. $\times 30$. *r.m.*, retractor muscle?
Fig. 7. The sagitta amatoria. $\times 24$.
Fig. 7 a. The point of same. $\times 30$.
Fig. 8. Jaw. $\times 24$.
Fig. 9. Central teeth of radula. $\times 368$.
Figs. 9 a-c. Central and outermost teeth, very much enlarged.

LX.—Description of a new Species of *Symphædra*.

By PHILIP CROWLEY, F.L.S. &c.

Symphædra albo-punctata, sp. n.

Male.—Upperside dark chocolate-brown. Fore wing with two very distinct white subapical spots, and a smaller one halfway between the lower subapical spot and the apex of the cell; basal spots small, golden yellow. Hind wing with a submarginal series of small bluish spots and an inner series of similar spots rather larger in size.

Underside brown, tinged with green. Fore wing with the two subapical and the smaller white spots showing very clearly; several other white spots similar to those in *S. cyanipardus*. Under-wing with faint spots of greenish white similarly situated as in *S. cyanipardus*. Antennæ black, with fulvous points.

Female.—Upperside similar to *S. cyanipardus*, but with the spots whiter and larger, the two subapical being very distinct.

Underside similarly marked to *S. cyanipardus*, the colour being much more yellow. Antennæ black, with fulvous points.

Expanse, ♂ 3·6, ♀ 4·4 inches.

Hab. Siam. One male, three females.

LXI.—On a Collection of Hymenopterous Insects from the Philippines. By Lieut.-Col. C. T. BINGHAM, F.Z.S.

A SMALL collection of Hymenopterous insects sent by Mr. Whitehead from Cape Engano, Luzon, in the Philippines, has been kindly entrusted to me by Mr. Ogilvie Grant. The collection contains sixty-seven specimens belonging to twenty-seven species, a list of which is here given.

Fam. *Apidæ*, Leach.

1. *Xylocapa bryorum*, Fabricius.

Apis bryorum, Fabr. Ent. Syst. ii. p. 321. 28, ♂.

Bombus bryorum, Fabr. Syst. Piez. p. 348. 28.

Xylocapa dimidiata, Lepel. Hym. ii. p. 199. 44, ♀; Smith, Cat. Hym. Ins. B. M. ii. p. 357. 66; Journ. Linn. Soc. xi. (1867) p. 394. 25.

Xylocapa bryorum, Smith, Mon. Gen. *Xylocapa*, Tr. Ent. Soc. (1874) pt. ii. p. 275. 59, ♂ ♀; Bingham, Journ. Bomb. Nat. Hist. Soc. v. (1890) p. 251. 25.

Two females in the collection which agree with Lepeletier de St.-Fargeau's description of *X. dimidiata*, which species, I think, there is no doubt is the female of the *Apis bryorum* of Fabricius. The present species occurs in South Tenasserim, where I have taken both sexes.

2. *Xylocapa collaris*, Lepeletier.

Xylocapa collaris, Lepel. Hym. ii. p. 189. 26, ♀; Smith, Cat. Hym.

Ins. B. M. ii. p. 353. 47; Journ. Linn. Soc. xi. (1867) p. 393. 11; Mon. Gen. *Xylocapa*, Tr. Ent. Soc. (1874) pt. ii. p. 270. 46, ♂ ♀.

Xylocapa Dejeanii, Lepel. Hym. ii. p. 209. 59, ♂; Smith, Cat. Hym. Ins. B. M. ii. p. 357. 62; Journ. Linn. Soc. xi. (1867) p. 394. 21.

One specimen in collection (a male), which has the clypeus of a curious reddish tint instead of yellowish white. Lepeletier's two species were united on the authority of M. Mouhot, who forwarded the sexes from Siam. The species is common in Burma and Tenasserim, and extends to India and Ceylon. I have taken a long series of both sexes near Maulmain.

3. *Megachile atrata*, Smith.

Megachile atrata, Smith, Cat. Hym. Ins. B. M. i. p. 182. 112, ♀; Journ.

Linn. Soc. xi. (1867) p. 388. 15; Bingham, Journ. Bomb. Nat. Hist. Soc. v. (1890) p. 247. 19.

One female in the collection of the variety noted by Smith as having yellowish wings. This species was originally described from the Philippines.

4. *Megachile lachesis*, Smith.

Megachile lachesis, Smith, Proc. Linn. Soc. v. (1861) p. 133. 2, ♀;
Journ. Linn. Soc. xi. (1867) p. 389. 37.

One female in collection.

5. *Megachile clotho*, Smith.

Megachile clotho, Smith, Proc. Linn. Soc. v. (1861) p. 134. 3, ♀;
Journ. Linn. Soc. xi. (1867) p. 389. 38.

One female in collection. The last two species were originally described from Batchian.

6. *Crocisa nitidula*, Fabricius.

Melecta nitidula, Fabr. Syst. Piez. p. 386. 2.

Crocisa nitidula, Latr. Gen. Crust. Ins. iv. p. 172; Lepel. Hym. ii. p. 448. 1, ♂ ♀; Smith, Cat. Hym. Ins. ii. p. 277. 3; Journ. Linn. Soc. xi. (1867) p. 390. 1.

Three females and one male in collection, typical specimens, with very brilliant colouring.

7. *Anthophora zonata*, Linnæus.

Apis zonata, Linn. Syst. Nat. i. p. 955. 19.

Andrena zonata, Fabr. Ent. Syst. ii. p. 311. 19.

Megilla zonata, Fabr. Syst. Piez. p. 331. 13.

Anthophora zonata, Lepel. Hym. ii. p. 25. 1; Smith, Cat. Hym. Ins. B. M. ii. p. 336. 90; Journ. Linn. Soc. xi. (1867) p. 392. 1; Sich. Suppl. Hym. 'Novara' Exp. p. 153.

Four typical females in the collection.

8. *Cælixys philippensis*, sp. n.

♂. L. 12 millim., exp. 21 millim.

Black; head and thorax coarsely punctured, the abdomen finely punctured, the first segment with short snow-white pubescence above; the anterior wings dark fuscous, with purple iridescence; the posterior wings clear hyaline, their apex faintly fuscous. Head broad, as broad as the thorax; the mandibles black and shining, their base exteriorly slightly rugose; the clypeus somewhat convex, its anterior margin rounded; the front of the face, the clypeus, and behind the eyes covered with short white pubescence; the vertex coarsely punctured and shining; the antennæ piceous. Thorax coarsely punctured; the scutellum arched posteriorly and carrying a short conical tooth on each side; the metathorax covered with a thin white pubescence; the legs finely punctured, the tarsi piceous; the anterior wings dark fuscous

with a purple iridescence; posterior wings clear hyaline, their apex fuscous. Abdomen closely and rather more finely punctured than the thorax, the first segment entirely covered with short white pubescence above; the rest of the segments with a thin line, broadening laterally, of white pubescence at their bases; the fourth and fifth segments with a deeply impressed transverse line before their posterior margins, beyond which the margins of the segments are smooth and shining; the penultimate segment has a short conical tooth on each side, and the apical segment six rather longer spines or teeth, two laterally and four at the apex; beneath, the segments of the abdomen have a line of white pubescence at their basal margins, and the extreme apex a tuft of rather rigid white hairs, tinged fulvous.

Somewhat resembles *C. fuscipennis*, Smith, in the colour of the wings, which, however, are much darker in the present species. It also differs entirely from Smith's species in the form of the apical segment and in having the basal segment of the abdomen above covered with snow-white pubescence.

Fam. Mutillidæ, Leach.

9. *Mutilla nigra*, Smith.

Mutilla nigra, Smith, Proc. Linn. Soc. iii. p. 151. 4, ♂; Journ. Linn. Soc. xi. (1867) p. 339. 54, ♂.

One specimen in the collection.

10. *Mutilla suspiciosa*, Smith.

Mutilla suspiciosa, Smith, Proc. Linn. Soc. ii. p. 84. 5, ♂; Journ. Linn. Soc. xi. (1867) p. 339. 41.

Eight males and three females. One pair taken *in cop.* One specimen (a male) differs considerably from the rest; it may represent a distinct species. The wings are a much darker brown, and only the basal segment and the base below and sides of the second segment of the abdomen are red, the remainder of the abdomen being black and shining. The form and sculpturing of the thorax, however, do not differ from those of *suspiciosa*, and so I have provisionally identified it with that species.

Smith described the male. The female has the head and abdomen black, the thorax red. The head is closely and not very finely punctured, and has a little silvery pubescence between the antennæ. The thorax is coarsely punctured, compressed and slightly emarginate at the sides; the legs are black, with the calcaria and pubescence fulvous. The abdo-

men black and very finely and closely punctured; the second segment has two oval silvery spots, one on either side, on its dorsal surface; the third is covered with silvery pubescence above, and the fifth has a fringe on its posterior margin of stiff hairs of a somewhat yellower tint. Below, the segments are fringed with silvery hairs.

Fam. Scoliidæ, Leach.

11. *Liacos (Triliacos) analis*, Fabricius.

Scolia analis, Fabr. Syst. Piez. p. 245. 37.

Scolia dimidiata, Guér. Voy. Coq. ii. p. 247, ♂; Burm. Scol. p. 15. 2, ♂; Smith, Cat. Hym. Ins. B. M. pt. iii. p. 114. 138.

Campsomeris Urvillii, Lepel. Hym. iii. p. 503. 12, ♂.

Scolia Urvillii, Smith, Cat. Hym. Ins. B. M. pt. iii. p. 114. 138.

Scolia penangensis, Sauss. Mém. Hym. p. 39. 17 (♀ var.).

Liacos (Triliacos) analis, Sauss. & Sich. Cat. Spec. Gen. Scol. p. 133. 1, ♂ & ♀; Cam. Hym. Orient., Mem. & Proc. Manch. Lit. & Phil. Soc. ser. 4, vol. iv. pt. iv. p. 1. 1.

Two specimens (a male and female), typical. This species occurs also in India and Burma.

12. *Scolia (Triscolia) Whiteheadii*, sp. n.

♀. L. 49 millim., exp. 86 millim.

♂. L. 41 millim., exp. 80 millim.

Female.—Black, with black pubescence; a crown-shaped mark on the front and vertex of the head above the antennæ; the scutellum and postscutellum yellow; the head, the mesothorax, and the abdomen sparsely punctured, the last black, shining, and immaculate; the pro- and metathorax more closely and coarsely punctured, the latter with sparse black pubescence; the sides of the pronotum produced laterally into well-marked rather acute tubercles or cones.

Male.—Resembles the female, but is more slender in form, with longer antennæ and thicker pubescence. It wants the yellow on the head, and the lateral angles of the pronotum are not produced.

The above brief description sufficiently characterizes this well-marked species. It is closest to *S. procer*, Illig., from which it differs in the shape of the prothorax and the sculpturing of the thorax generally. It is also quite distinct from *Scolia frontalis*, Saussure (*coronata*, Smith). I have ventured to name it after Mr. Whitehead, its discoverer.

13. *Elis (Dielis) aurulenta*, Smith.

Scolia aurulenta, Smith, Cat. Hym. Ins. B. M. pt. iii. p. 102. 80, ♀.

Elis (Dielis) aurulenta, Sauss. & Sich. Cat. Spec. Scol. p. 206. 221;

Smith, Journ. Linn. Soc. xi. (1867) p. 349. 9; Cam. Hym. Orient., Mem. & Proc. Manch. Lit. & Phil. Soc. ser. 4, vol. iv. pt. iv. p. 16. 24.

One very richly coloured female in collection, and a male which I provisionally assign to this species. This latter is not *E. agilis*, Smith, which it somewhat resembles in its slender form, nor is it *E. iris*, Lepel., nor *Campsomeris ceylonica*, Kirby, with specimens (males) of which in the collection of the British Museum I have compared it.

Fam. Pompilidæ, Leach.

14. *Macromeris violacea*, Lepeletier.

Macromeris violacea, Lepel., Guér. Mag. Zool. xiv. (1831) pl. xxx. fig. 1, ♂; Hym. iii. p. 464. 2; Smith, Cat. Hym. Ins. B. M. pt. iii. p. 181. 2; Journ. Linn. Soc. xi. (1867) p. 356. 1; Kohl. Gatt. der Pomp., Verh. der. k. k. zool.-bot. ges. Wien, 1884, p. 41. 1; Cam. Hym. Orient., Mem. & Proc. Manch. Lit. & Phil. Soc. ser. 4, vol. iv. pt. iii. p. 435. 1; Bingham Journ. Bomb. Nat. Hist. Soc. viii. (1893) p. 367. 1.

One specimen in collection.

15. *Salius (Priocnemis) peregrinus*, Smith.

Priocnemis peregrinus, Smith, Tr. Ent. Soc. (1875) pt. i. p. 37, ♂ ♀; Journ. Asiat. Soc. of Beng. vol. xlvii. (1878) pt. ii. p. 168. 3.
Salius peregrinus, Cam. Hym. Orient., Mem. & Proc. Manch. Lit. & Phil. Soc. ser. 4, vol. iv. pt. iii. p. 452. 46; Bingham Journ. Bomb. Nat. Hist. Soc. vol. viii. (1893) p. 375. 20.

Three males and six females in the collection, which correspond exactly with Smith's description. In the British Museum collection at South Kensington there is a *Salius* from Sumatra labelled *bipartitus*, Smith, the label being, as I am informed, in the late Mr. Smith's own writing. I have been unable to find the original description of this insect or any reference to it in Mr. Smith's papers; but the specimen labelled *bipartitus* is nothing more nor less than a large fine specimen of *peregrinus*. The species is very common in Sikkim, Burma, and Tenasserim; and I have a series of over a hundred specimens of both sexes which, *inter se*, show great variation in size.

Fam. Sphegidæ, Leach.

16. *Pelopæus violaceus*, Fabricius.

Sphex violacea, Fabr. Ent. Syst. ii. p. 201. 12.
Pepsis violaceus, Fabr. Syst. Piez. p. 211. 16.
Chalybion violaceum, Dahlb. Hym. Eur. i. p. 21. 1.

- Chalybion bengalensis*, Dahlb. Hym. Eur. i. p. 433. 2.
Pelopæus violaceus, Lepel. Hym. iii. p. 321. 21.
Pelopæus flebilis, Lepel. Hym. iii. p. 321. 22.
Pelopæus violaceus, Costa, Prosp. d. Imenott. Ital. fasc. i. p. 21. 6.
Pelopæus bengalensis, Smith, Cat. Hym. Ins. B. M. pt. iv. p. 230. 15;
 Journ. Linn. Soc. xi. (1867) p. 360. 19; Smith and Horne, Tr. Zool.
 Soc. vii. (1870) pt. iii. p. 163, pl. xxi. figs. 2, 2 a; Cam. Hym.
 Orient., Mem. & Proc. Manch. Lit. & Phil. Soc. ser. 4, vol. iv. pt. i.
 p. 11. 2.

One specimen in collection.

17. *Sphex maurus*, Smith.

- Sphex maura*, Smith, Cat. Hym. Ins. B. M. iv. p. 255. 61, ♀; Journ.
 Linn. Soc. xi. (1867) p. 361. 10.
Sphex maurus, Kohl. Termész. Füzetek, ii. P. 2^a, p. 199, ♂ ♀; Ann. d.
 k. k. Naturhist. Hofmus. v. p. 411. 102.
Sphex tyrannica, Bingham. (nec Smith) Journ. Bomb. Nat. Hist. Soc.
 v. (1890) p. 241. 13.

One male and five females in the collection, all of which are rather larger than the type described by Smith.

18. *Sphex morosus*, Smith.

- Sphex morosa*, Smith, Proc. Linn. Soc. v. (1861) p. 122. 7, ♂; Journ.
 Linn. Soc. xi. (1867) p. 362. 20.
Sphex morosus, Kohl. Ann. d. k. k. Naturhist. Hofmus. v. p. 448. 67.

One specimen in the collection (a female), which I provisionally identify with this species, though it differs both from the type and Smith's description in having the petiole and the first segment of the abdomen slightly reddish. In size, however, and in the colour of the wings and of the rest of the body, it agrees with both the type and the description of *S. morosa*.

Fam. *Cerceridæ*, Wesm.

19. *Cerceris vafra*, sp. n.

♀. L. 20 millim., exp. 38 millim.

Head, thorax, and the greater part of the abdomen black, the first, second, and third segments of the last variegated with red.

Head broad, broader than the thorax; the mandibles at the base above piceous, jet-black at the tips; the clypeus sparsely and finely punctured, with a very short elevated carina down the centre, not reaching the anterior margin; below the carina there is a small square spot, which is black and shining; the rest of the head and face finely and closely punctured; the antennæ black, opaque; the sides of the face

with silvery pile only observable in certain lights; the thorax closely punctured; the legs black; the inside of the tibiæ and tarsi of the anterior and posterior legs and the calcaria testaceous brown; wings fuscous, with a purple effulgence, hyaline at their base; abdomen closely and finely punctured, the first segment at base, and the second and third segments in the centre above black; the rest of these segments blood-red, the fourth and apical segments black.

One specimen in the collection. This species is closest to *C. sepulchralis*, Smith, from Borneo, but is very much larger, wants the yellow markings on the thorax, and has only the base of the abdomen variegated with red.

Fam. **Eumenidæ**, Westwood.

20. *Eumenes curvatus*, Saussure.

Eumenes curvatus, Sauss. Mon. Guêp. Sol. Suppl. p. 145. 38, t. viii. fig. 1.

Eumenes curvata, Smith, Cat. Hym. Ins. B. M. pt. v. p. 25. 33; Journ. Linn. Soc. xi. (1867) p. 372. 18.

One specimen in the collection.

Fam. **Vespidæ**, Stephen.

21. *Polistes philippensis*, Saussure.

Polistes philippensis, Sauss. Mon. Guêp. Soc. p. 58. 14, ♀; Smith, Cat. Hym. Ins. B. M. pt. v. p. 104. 19; Journ. Linn. Soc. xi. (1867) p. 381. 12.

Two specimens in the collection.

Fam. **Aulacidæ**, Shuck.

22. *Megischus coronator*, Fabricius.

Pimpla coronator, Fabr. Syst. Piez. p. 118. 28.

Megischus coronator, Brullé, Hym. iv. p. 538. 1; Westw. Trans. Ent. Soc. iii. p. 276. 2; Smith, Journ. Linn. Soc. xi. p. 399. 1.

One specimen in the collection.

Fam. **Ichneumonidæ**, Leach.

23. *Cryptus verticalis*, sp. n.

♀. L. 10 millim., exp. 21 millim.

Black, variegated with creamy white; the base of the posterior legs reddish brown. Head black; the clypeus transverse, slightly convex, its anterior margin arched; the

flagellum of the antennæ from the seventh to the thirteenth joint and the front and vertex of the head, except a rectangular black space enclosing the ocelli, creamy white, the back of the head emarginate; the thorax black; the pro- and mesonotum smooth and shining, the latter divided above by deeply impressed obliquely longitudinal lines into three sub-triangular portions; the scutellum prominent, convex; the metanotum opaque, very finely punctured; the tegulæ, two spots on the side beneath the wings, the scutellum, and the apical half of the metathorax creamy white; the wings hyaline, the nervures testaceous brown; legs, the anterior and intermediate coxæ, the tibiæ, and the last two joints of the tarsi of the posterior legs black; the trochanters of the anterior and intermediate legs on the outside and the three basal joints of the posterior tarsi white; the rest of the legs testaceous brown, on the posterior pair deepening to reddish brown; the abdomen black, very finely and closely punctured; the posterior margins of the first, second, and fourth, and the whole of the apical segment, white, the ovipositor black.

24. *Cryptus præpes*, sp. n.

♀. L. 10 millim., exp. 18 millim.

Ferruginous, the apical third of the antennæ and the eyes jet-black.

Head broad, as broad as the thorax, yellow, lighter in front and ferruginous towards the vertex; the mandibles yellow, black at the tips; the clypeus transverse and slightly convex; antennæ with their basal third ferruginous, the middle yellow and the apex black; thorax ferruginous, very finely punctured; the scutellum prominent; the metathorax posteriorly slightly rugose, with three slightly raised but well-marked longitudinal carinæ and a short obtuse tubercular spine on each side; the wings hyaline yellow, the nervures ferruginous; legs ferruginous, the anterior legs in front and the intermediate and posterior tarsi yellowish, the claws blackish; the abdomen ferruginous, finely punctured, beneath slightly paler, the ovipositor yellowish.

25. *Pimpla (Euxorides?) furcifer*, sp. n.

♂. L. 17 millim., exp. 30 millim.

Black, variegated with white; the wings hyaline; the anterior and intermediate legs white, the posterior pair black, variegated with white and testaceous brown.

Head black, smooth, emarginate behind; cheeks rather swollen; the clypeus, mandibles, and front of the scape of the

antennæ testaceous brown; the palpi white; the flagellum of the antennæ black, with the eighth to the sixteenth joints pure white; thorax black; the tegulæ, the scutellum (which is prominent and convex), and an oblique stripe and two spots under the base of the wings white; the mesothorax smooth and shining, with two oblique longitudinally impressed lines above; the metanotum opaque, coarsely punctured, gently declivous to the apex, and covered with a thin griseous pubescence, its apex ending in obtuse, rather prominent lateral tubercles; wings hyaline, the nervures brown; the anterior legs white, the four apical joints of their tarsi black; the intermediate legs white, the outside of the trochanters and a stripe on the inside of the tibiæ black; the posterior legs testaceous brown, white on the tarsi, their femora at the base, the greater part of the tibiæ, and the three apical joints with the claws of the tarsi black, the calcaria white; abdomen black, smooth and shining, its base and the posterior margins of all the segments except the sixth white, the apical segment entirely white.

The three species of ichneumons sent by Mr. Whitehead were all, so far as I have been able to make out, previously undescribed.

Fam. **Braconidæ**, Westwood.

26. *Bracon deceptor*, Smith.

Bracon deceptor, Smith, Proc. Linn. Soc. v. (1861) p. 65. 1, ♀; Journ. Linn. Soc. xi. (1867) p. 408. 37.

Four specimens in the collection.

Fam. **Tenthredinidæ**, Leach.

27. *Senoclia albocærulea*, sp. n.

♂. L. 11 millim., exp. 24 millim.

Deep blue, the posterior portion of the thorax white; wings hyaline, infuscated at apex; legs white, with black markings.

Head and thorax deep blue, shining and pubescent; the clypeus, scutellum, and posterior portion of the thorax white; antennæ black, covered with long depressed hairs; wings hyaline for half their length from base, fuscous beyond, the anterior wings darker than the posterior; legs black, variegated with white; abdomen deep blue and shining, with short scattered pubescence.

Resembles *S. cærulea*, Cameron, from Ceylon, but differs in having the posterior portion of the thorax from the scutellum white.

LXII.—A Revision of the Jurassic Bryozoa.—Part II. The Genus *Proboscina*. By J. W. GREGORY, D.Sc., F.G.S.

[Continued from vol. xv. p. 228.]

Family Tubuliporidæ (continued).

Genus *PROBOSCINA*, Audouin, 1826.

Diagnosis.—Tubuliporidæ in which the zoœcia form flat adnate multiserial zoaria. The zoaria are mainly in linear bands, which may or may not branch. The zoœcia are tubular. The peristome is either flush with the surface of the zoarium or somewhat raised.

Type species: *P. Boryi*, Audouin.

The retention of this genus is somewhat reactionary, for most authors now place it as a synonym of *Stomatopora*, *Berenicea*, *Diastopora*, or even *Entalophora*. It is certainly nearest to *Stomatopora* and *Berenicea*, between which it is intermediate. Pergens* has described a specimen which begins as a *Diastopora*, then gives rise to branches of *Proboscina*, and these end as *Stomatopora*; and upon the evidence of this specimen he merges the two latter. This specimen, however, proves either too much or too little. If its evidence is to be accepted, then the three genera ought to be united. But Pergens retains *Stomatopora* as distinct from *Diastopora* in spite of it. To do otherwise would be practically to abandon the use of genera in the Cyclostomata. I frankly admit that there are specimens intermediate between *Proboscina* and *Diastopora* on the one hand, and between the former and *Stomatopora* on the other: nevertheless, there is a large group of species which exhibit the characters of the above diagnosis, and the genus is therefore a convenient one; and to expect genera of Cyclostomata to be more than convenient groups of species, seems hopeless at present. *Proboscina* is therefore accepted as a genus which differs from *Stomatopora* by having a multiserial zoarium, and from *Berenicea* by having its zoœcia arranged in bands instead of in broad sheets.

1. *Proboscina Eudesi*, Haime, 1854.

Proboscina Eudesi, J. Haime, 1854, Jur. Bry., Mém. Soc. géol. France, sér. 2, t. v. p. 167, pl. vi. figs. 9 a, b.

* E. Pergens, "Revision des Bryozoaires du Crétacé figurés par d'Orbigny, Part I. Cyclostomata," Bull. Soc. belge Géol. t. iii. 1890, Mém. p. 327.

Proboscina Davidsoni, Haime, 1854, *op. cit.* p. 167, pl. vi. fig. 11.

Proboscina Buchi, Haime, 1854, *op. cit.* p. 168, pl. vii. fig. 10.

Stomatopora (P.) Davidsoni, Vine, 1884, 4th Rep. Foss. Polyz., Rep. Brit. Assoc. 1883, p. 186.

Diagnosis.—*Zoarium* formed of fairly regular, anastomosing bands, composed usually of from four to six zoecia. Each branch in section appears as a rounded ridge.

Zoecia regularly cylindrical.

Peristomes usually in regular transverse lines, slightly raised. *Zoecia* of medium length.

*Formula**.— $p s l r = 1 0 2 \frac{4}{7}$.

Distribution.—Great Oolite and Inferior Oolite: England. Bathonian of France and Germany; Bajocian, France.

2. *Proboscina Jacquoti*, Haime, 1854.

Proboscina Jacquoti, Haime, 1854, Bry. Jur., Mém. Soc. géol. France, sér. 2, t. v. p. 169, pl. vii. figs. 5 a, b.

Reptotubigera Jacquoti, Terquem, 1855, Pal. dép. Moselle (sep. copy), p. 28.

Proboscina Jacquoti, Brauns, 1879, Bry. mitt. Jura, Metz, Zeit. deut. geol. Ges. Bd. xxxi. p. 324.

Stomatopora (P.) Jacquoti, Vine, 1884, 4th Rep. Foss. Polyz., Rep. Brit. Assoc. 1883, p. 186.

Proboscina thrapstonensis, Vine, 1893, Polyz. Thrapston, Proc. Yorksh. Geol. Soc. vol. xii. p. 257, pl. xii. fig. 6.

Proboscina ornata, id. *ibid.* p. 257, pl. xiii. fig. 10.

Diagnosis.—*Zoarium* consisting of two or more flabellate expansions arising from a narrow stolon-like band of zoecia.

Zoecia long, cylindrical, irregularly placed. In the typical form from one to five zoecia in each branch. In some forms (var. *expansa*) spreading out into multiserial *Berenicea*-like sheets, which are fenestrate.

Formula.— $2 0 3 \frac{1}{12}$.

Distribution.—England: Cornbrash. Foreign: Bajocian, France, Germany.

3. *Proboscina Desoudini* (Haime), 1854.

Stomatopora Desoudini, Haime, 1854, Jur. Bry., Mém. Soc. géol. France, sér. 2, t. v. p. 165, pl. vi. figs. 5 a, b.

Diagnosis.—*Zoarium* very irregular; composed of narrow bands anastomosing to an irregular network, each band from one to three zoecia in width.

Zoecia narrow, of medium length, often slightly sinuous;

* The formulæ are the same as those used for *Stomatopora* (Ann. vol. xv. p. 227), except that the last term indicates the number of zoecia in a branch.

in crowded areas the zoëcia are pyriform*. Transverse ribbing well marked.

Peristomes slightly raised.

Formula.—1' 2 2 1-2.

Distribution.—England: Cornbrash. Foreign: Bajocian, France; Bathonian, France and Germany.

4. *Proboscina Cunningtoni*, sp. n.

Diagnosis.—*Zoarium* formed of loose flabelliform *Stomatopora*-like tufts; these may radiate from a centre, to form a circular zoarium. The branches begin uniserially, and may end in sheets containing twelve zoëcia in width.

Zoëcia regularly cylindrical, front wall ornamented by a transverse wrinkling; of medium length, broad.

Peristomes with somewhat thickened rims slightly raised.

Formula.—1 0 1 1-3.

Distribution.—Fuller's Earth, Bruton (B. M. Cunnington Coll. no. 88742); Cornbrash, Corsham.

Affinities.—This species is well characterized by its loose *Stomatopora*-like zoarium. Some branches end in sheets, and these ally it to *P. Rigauxi* (Sauv.). From this, however, it may be distinguished by the looseness of the zoarium. Its nearest ally is the recent *P. major* (Johnst.). (See Hincks, Brit. Mar. Polyz. p. 427, pl. lviii.) This, however, has a formula 2 0 2 1/4, and may be distinguished by the greater elevation of the peristomes and length of the zoëcia.

I have much pleasure in naming this species after William Cunnington, Esq., from whom the British Museum received the specimen taken as the type, and whose careful collecting has added so greatly to the knowledge of Jurassic palæontology.

5. *Proboscina Rigauxi* (Sauvage), 1889.

Stomatopora Rigauxi, Sauvage, 1889, Bry. Jur. Boul., Bull. Soc. géol. France, sér. 3, t. xvii. p. 42, pl. iii. figs. 6-8.

Stomatopora, sp., G. R. Vine, 1887, Jur. Poly. North., Journ. Northamp. Nat. Hist. Soc. vol. iv. p. 204, pl. i. fig. 2.

Proboscina clementina, var. *minuta*, Vine, 1893, Polyz. Thrapston, Proc. Yorksh. Geol. Soc. vol. xii. p. 256, pl. xiii. fig. 9.

Proboscina clementina, var. *depressa*, id. *ibid.* p. 256.

Diagnosis.—*Zoarium* forming dense circular tufts. The branches end in crowded tufts, which almost form *Berenicea*-like sheets.

Zoëcia cylindrical, short, thick; front wall with a well-marked transverse ribbing. Surface punctulate.

Peristomes raised into a thickened rim, but not reflexed.

* Haime shows some pyriform and others elongated and cylindrical.

Formula.—1 0 2 1–12.

Distribution.—Cornbrash, Fuller's Earth, and Inferior Oolite, England. Fuller's Earth, France.

6. *Proboscina morinica* (Sauvage), 1889.

Stomatopora morinica, Sauvage, 1889, Bry. Jur. Boul., Bull. Soc. géol.

France, sér. 3, t. xvii. p. 41, pl. iii. fig. 5, pl. iv. figs. 6, 7.

? *Proboscina obscura*, Vine, 1893, Polyz. Thrapston, Proc. Yorksh. Geol. Soc. vol. xii. p. 255, pl. xiii. fig. 7.

Diagnosis.—*Zoarium* of an irregular reticulate encrustation. Branches made up of from one to five zoecia.

Zoecia short, thick, with wide orifices. Shape in places almost hippothoiform, otherwise elliptical.

Peristomes irregular, slightly raised.

Formula.—2 2 1 1/4.

Distribution.—Cornbrash, England. Oxfordian, France.

7. *Proboscina spatiosa*, Walford.

Proboscina spatiosa, Walford, 1889, Bry. Shipton, Part I., Quart. Journ.

Geol. Soc. vol. xlv. pp. 566, 567, pl. xvii. figs. 1–3, pl. xviii. figs. 1–5.

Diagnosis.—*Zoarium* of irregular, narrow, irregularly branching bands, each composed of from one to four zoecia in width.

Zoecia pyriform or subpyriform, of medium length; wall coarsely wrinkled and punctate.

Peristomes much raised; apertures elliptical or circular.

Formula.—3 2 1 1–4.

Distribution.—Inferior Oolite, England.

8. *Proboscina liasica*, Quenstedt, 1852.

Diastopora liasica, Quenst. 1852, Handb. Petref. p. 637, pl. lvi. fig. 10.

Berenicea Edwardsi, Terquem, 1855, Pal. dép. Moselle, p. 26.

Proboscina Edwardsi, Terquem & Piette, 1865, Lias inf. Est France, Mém. Soc. géol. France, sér. 2, t. viii. p. 125, pl. xiv. figs. 21, 22 (non 25–26, as in text).

Proboscina prorepens, Waagen, 1868, *Zone Amm. Sowerbyi*, Geogn. pal. Beitr. Bd. i. pp. 535, 647, pl. xxxiii. fig. 3.

Diagnosis.—*Zoarium* of narrow branching bands, composed of from three to five zoecia in width.

Zoecia cylindrical, of medium length; fine transverse lines traverse the walls.

Peristomes slightly raised; orifices somewhat elliptical.

Formula.—1 0 1 3–5.

Distribution.—Inferior Oolite, England (fide *Walford*). Lias, France and Germany; Bajocian, Germany.

Indeterminable Species.

1. *Proboscina Alfredi*, Haime.

Proboscina Alfredi, Haime, 1854, Bry. Jur., Mém. Soc. géol. France, sér. 2, t. v. p. 168, pl. vi. fig. 8.

Distribution.—Bajocian, Germany.

2. *Proboscina ammonitorum* (d'Orb.).

Idmonea ammonitorum, d'Orbigny, 1849, Prod. Pal. t. i. p. 288.

Distribution.—Bajocian, France.

3. *Proboscina complanata* (d'Orb.).

Idmonea complanata, d'Orbigny, 1849, *op. cit.* t. i. p. 288.

Distribution.—Bajocian, France.

4. *Proboscina divisa*, Vine (non Étall.).

Proboscina divisa, Vine, 1893, Polyz. Thrapston, Proc. Yorksh. Geol. Soc. vol. xii. p. 256, pl. xiii. fig. 8.

Distribution.—Cornbrash, England.

5. *Proboscina elegantula* (d'Orb.).

Idmonea elegantula, d'Orbigny, 1849, *op. cit.* t. i. p. 288.

Distribution.—Bajocian and Bathonian, France.

6. *Proboscina expansa*, Étallon.

Proboscina expansa, Étallon, 1860, Jura Graylois, Ann. sci. phys. nat. Lyon, sér. 3, t. iv. p. 175.

Distribution.—Corallian, France.

7. *Proboscina gracilis*, d'Orbigny.

Idmonea gracilis, d'Orbigny, 1849, Prod. Pal. t. i. p. 317.

Distribution.—Bathonian, France.

Synopsis of Species.

I. Zoecia all cylindrical.

- Peristomes well raised; zoarium flat *Jacquoti*.
- Peristomes low; zoarium in linear bands, mostly biserial, frequently branched *Cunningtoni*.
- Multiserial, seldom branched.
 - Zoarium flat *liasica*.
 - Zoarium ridged *Eudesi*.
 - Zoarium in tufts and sheets *Rigauxi*.

II. Zoecia pyriform.

- Peristomes well raised *spatiosa*.
- Peristomes low; zoecia long *Desoudini*.
- Zoecia short *morinica*.

LXIII.—Notes on the Palæozoic Bivalved Entomostraca.—
No. XXXII.* *Some Carboniferous Ostracoda from Yorkshire.* By PROFESSOR T. RUPERT JONES, F.R.S., and
JAMES W. KIRKBY, Esq.

[Plate XXI.]

SOME years ago we received five "slides" of Carboniferous Ostracoda from our friend the late Dr. H. B. Brady, then of Newcastle-on-Tyne. These slides having now been examined, we describe the results without further delay.

These mounted Ostracoda had been obtained in the examination of washings of shale from two localities. One of these is given as "Hurst, head of Swaledale; under the Underset Chert:" the other as "Downholme, Swaledale; beneath Red Beds." Dr. Brady wrote that he had received the material from Mr. E. Wood, of Richmond, and that it was "from the Yoredale Rocks, from the head of Wensleydale, or somewhere there"†. This is all we know about the geological position or the neighbourhood of the localities; both are undoubtedly good places for fossil Ostracoda, and well worth further search.

The specimens are numerous and very well preserved. Among them are some extremely rare forms, besides one or two that are not easy to determine. Otherwise the species are well known from the Yoredale Rocks of the north of England and the Carboniferous-Limestone series of Scotland.

Ostracoda from the localities above mentioned were described by the late Mr. G. R. Vine in 1883 in the 'Proceedings of the Yorkshire Geological and Polytechnic Society,' n. s. vol. viii. 1884, pp. 226-238. His specimens were obtained by Mr. John Harker, of Richmond; but particulars as to where Hurst and Downholme are situated were not given to him. He records eleven species, all of which, except *Bairdia curta*, M'Coy, appear to occur in our lot. The forms figured by him as *Kirkbya umbonata* and *K. bipartita* (which we have not found) are probably varieties of

* No. XXXI. was published in the Ann. & Mag. Nat. Hist. ser. 6 vol. xv. 1895, pp. 59-67.

† For the geology of Swaledale see the 'Memoirs Geol. Survey, Explanation of Quarter-sheet 97, N.W., New Series, Sheet 40, 1891. The "Underset Chert" of the Yoredale Series is mentioned at pages 108 and 110, and the "Red Beds" at pages 96, 99, 110, and 170.

Downholme is 5 miles S.W. of Richmond, Yorkshire. Quarter-sheet 97, N.W., Geol. Survey Map.

Wensleydale and the head of Swaledale are about 4 miles apart.

Kirkbya oblonga, J. & K. It is not easy in all cases, however, to make out what species are represented by the figures in that paper.

The following are lists of the species we have determined, with notes on such of the forms as appear to require it.

1. *List of Species from Hurst (Yoredale Series).*

1. *Cytherella recta*, Jones and Kirkby, Mon. Carb. Entom., Pal. Soc. 1884, p. 74, pl. vii. fig. 2.
2. — *scrobiculata*, J. & K., Mon. Carb. Entom., Pal. Soc. 1884, p. 76, pl. vi. fig. 10.
3. — *æqualis*?, J. & K., Mon. Carb. Entom., Pal. Soc. 1884, p. 74, pl. vi. figs. 14–16.
4. — *reticulosa*, J. & K., Ann. & Mag. Nat. Hist. ser. 5, vol. xviii. 1886, p. 262, pl. viii. figs. 22, 23.
5. — sp., ? *C. concinna*, J. & K., Mon. Carb. Entom., Pal. Soc. 1884, p. 71, pl. vi. figs. 9, 12, and 19.
6. *Leperditia Armstrongiana*, J. & K., Ann. & Mag. Nat. Hist. ser. 5, vol. xviii. 1886, p. 253, pl. vii. fig. 1.
7. *Beyrichia Bradyana*, J. & K., Geol. Mag. 1886, p. 438, pl. xii. fig. 11.
8. *Kirkbya oblonga*, J. & K., Ann. & Mag. Nat. Hist. ser. 5, vol. xv. 1885, p. 181, pl. iii. fig. 3.
9. — *permiana*, Jones, Ann. & Mag. Nat. Hist. ser. 5, vol. xv. 1885, p. 177, pl. iii. fig. 1.
10. — *Urei*, Jones, Ann. & Mag. Nat. Hist. ser. 5, vol. xv. 1885, p. 189, pl. iii. fig. 19.
11. *Bairdia plebeia*, Reuss, Quart. Journ. Geol. Soc. vol. xxxv. 1879, p. 569, pl. xxviii. figs. 9–19.
12. — *ampla*, Reuss, Quart. Journ. Geol. Soc. vol. xxxv. 1879, p. 571, pl. xxviii. figs. 20–23, pl. xxix. fig. 3.
13. — *subelongata*, J. & K., Quart. Journ. Geol. Soc. vol. xxxv. 1879, p. 573, pl. xxx. figs. 1–11 and 16; Ann. & Mag. Nat. Hist. ser. 5, vol. xviii. 1886, p. 267, pl. ix. fig. 44.
14. — *brevis*, J. & K., Quart. Journ. Geol. Soc. vol. xxxv. 1879, p. 575, pl. xxxi. figs. 1–8.
15. — *amputata*, Kirkby, var., Quart. Journ. Geol. Soc. vol. xxxv. 1879, p. 576, pl. xxxi. figs. 15–18.
16. — *Hisingeri* (Münster), and var. (Pl. XXI. fig. 1), Ann. & Mag. Nat. Hist. ser. 3, vol. xv. 1865, p. 408, pl. xx. figs. 12 *a-c*; Quart. Journ. Geol. Soc. vol. xxxv. 1879, p. 570, pl. xxix. figs. 1–10.
17. *Bythocypris cornigera*, J. & K., var. *robusta*, nov. (Pl. XXI. fig. 2), Ann. & Mag. Nat. Hist. ser. 5, vol. xviii. 1886, p. 251, pl. vi. figs. 8, 9.
18. — *cuneola*, J. & K., Ann. & Mag. Nat. Hist. ser. 5, vol. xviii. 1886, p. 250, pl. vi. figs. 3–7.
19. — *bilobata* (Münster), Ann. & Mag. Nat. Hist. ser. 3, vol. xv. 1865, p. 409, pl. xx. figs. 10 *a, b*.
20. *Bythocythere Youngiana*, J. & K., Ann. & Mag. Nat. Hist. ser. 5, vol. xviii. 1886, p. 263, pl. ix. fig. 4.
21. *Phreatura concinna*, J. & K. (Pl. XXI. figs. 3 *a, b*), Proc. Geol. Assoc. vol. ix. 1886, p. 509, woodcuts, figs. 3, 4.

The *Cytherellæ* in this list do not require many remarks. Perhaps the reference to *C. æqualis*, J. & K., is somewhat doubtful, though probably right. The examples of *C. scrobiculata*, J. & K., are worn, or in such condition as not to show the surface-ornamentation; otherwise they agree exactly with that species. The unnamed *Cytherella* resembles *C. concinna*, J. & K., in its elongately oval outline, and may belong to it.

Of *Leperditia Armstrongiana*, J. & K., there is only a single carapace of either a young or a dwarf individual. It is easily distinguished by its large antero-dorsal spine or "eye-spot" and its very convex and obliquely gibbose ventral border.

The only *Beyrichia* from Hurst is *B. Bradyana*, J. & K., which is probably its first noticed occurrence out of Scotland. In the latter country it is found in the lower portion of the Carboniferous-Limestone series.

The three species of *Kirkbya* are all fairly common. The examples of *K. permiana*, Jones, are in beautiful preservation. So also are those of *K. oblonga*, in some of which the surface-reticulation takes the form of, or gives place to, regularly arranged stellate pits, similar to what Dr. John Young has noticed in rare examples of *K. permiana*. Such specimens are of great beauty under the microscope. The presence of *K. Urei*, Jones—the "ancient Scot" * of this genus—so far south is very interesting, though previously known from Northumberland and North Lancashire on the English side of the border.

Bairdiæ are the most common Ostracods at Hurst, and are well represented in species and varieties. *B. subelongata*, J. & K., is perhaps the most abundant. *B. Hisingeri* (Münster) occurs in the long, slender, and altogether more elegant form that usually characterizes it in Yoredale Rocks, as well as in the Magnesian Limestone. Some of these specimens show a little peculiarity in their slightly oblique and rather subangulate dorsal border (see Pl. XXI. fig. 1). The specimens referred to *B. amputata*, Kirkby, differ from the type form in their more finely pitted or punctate surface and in the less truncate posterior extremity.

Bythocypris cuneola, J. & K., and *B. cornigera*, J. & K., are abundant, as they usually are when present at all. The latter is larger and more robust than we have ever seen it (Pl. XXI. fig. 2); but in some individuals the horns are

* Ancient, because it is one of those Carboniferous Ostracoda which the Rev. David Ure, of Rutherglen, collected in the West of Scotland so far back as 1793 or before.

almost obsolete. *B. bilobata* (Münster) is rare. This species, in fact, is never plentiful, either in the Yoredale Rocks or in the Scar Limestone, where it is more often seen.

The presence of a single carapace of *Bythocythere Youngiana*, J. & K., is of interest, for it is otherwise known only from Brockley, Lanarkshire, and Lowick, Northumberland.

Phreatura concinna, J. & K. (Pl. XXI. figs. 3 *a, b*), occurs both at Hurst and Downholme; and the specimens, which are all carapaces and not single valves, agree exactly in size and other features with the type examples from Gleaston Castle, 4 miles N.E. of Barrow-in-Furness, which is the only other locality known for this species.

2. List of Species from Downholme (Yoredale Series).

1. *Cytherella recta*, J. & K.*
2. — *reticulosa*, J. & K.*
3. — *intercalaris*, sp. n. (Pl. XXI. fig. 4.)
4. *Leperditia Okeni* (Münster), Ann. & Mag. Nat. Hist. ser. 3, vol. xv. 1865, p. 486, pl. xx. figs. 1 *a-c*, 2 *a-c*, 3.
5. ? — sp.
6. *Kirkbya permiana*, Jones*.
7. — *Urei*, Jones*.
8. — *spinosa*, J. & K., Ann. & Mag. Nat. Hist. ser. 5, vol. xv. 1885, p. 185, pl. iii. figs. 12 *a, b*.
9. — *oblonga*, J. & K.*
10. *Bairdia Hisingeri* (Münster)*.
11. — *plebeia*, Reuss*.
12. — *brevis*, J. & K.*
13. — *subelongata*, J. & K.*
14. — *submucronata*, J. & K., Quart. Journ. Geol. Soc. vol. xxxv. 1879, p. 572, pl. xxix. figs. 12-18.
15. *Bythocypris bilobata* (Münster)*.
16. — *cuneola*, J. & K.*
17. — *cornigera*, J. & K.*
18. *Argillæcia* (*Bythocypris*?) *æqualis* (?), J. & K., Ann. & Mag. Nat. Hist. ser. 5, vol. xviii. 1886, p. 263, pl. ix. fig. 6 *a*.
19. *Youngiella rectidorsalis*, J. & K. (*Youngia*) Proceed. Geol. Assoc. vol. ix. 1886, p. 515, woodcuts, figs. 5-7. (Pl. XXI. figs. 5 *a-d*.)
20. *Phreatura concinna*, J. & K.*

Among the *Cytherellæ* from Downholme are some smooth, plump, subovate carapaces that are difficult to determine. In lateral outline they somewhat resemble *C. scrobiculata*, but have none of its other features. Their relative height (width) is too great for the highest examples of *C. Benniei*, J. & K., that we have seen, though, with this exception, they would come near to that species in general outline. They have some resemblance also to the smaller species, *C. brevis*,

* Also from Hurst; see p. 453.

J. & K., but the latter has the greatest height near the centre and is suboval rather than subovate. Pl. XXI. fig. 4 represents a side view of this *Cytherella*, which we propose to name *C. intercalaris*.

Individually the *Kirkbyæ* are less numerous than at Hurst; but the genus is represented by an additional species, *K. spinosa*.

There is an Ostracod from Downholme that we cannot place satisfactorily with any described species. It has the outline of a *Beyrichia* or *Kirkbya*, or some feeble *Leperditia* forms, but with simply convex smooth valves, without either pit, furrows, lobes, or tubercles; it is wider and higher at one end than the other; one valve (the right, the high end being taken as the posterior) overlaps the other on its free margins, as in *Leperditia*. It resembles *Aparchites* in outline and smoothness, but there is no overlap in this genus. Possibly the specimen under notice is an extremely weak *Leperditia*. It is left for the present as a doubtful form.

At Downholme single valves are met with, not showing the peculiar denticulate hinge-line of *Youngiella*, but in other respects (such as minuteness, elongate-oblong shape, straight dorsal border, slight obliquity of valves, and faint reticulation of the surface) their characters agree exactly with *Youngiella rectidorsalis*, J. & K., the only known species of the genus (Pl. XXI. figs. 5 a-d). This is the *Youngia rectidorsalis*, J. & K., 1886; but the generic term "*Youngia*" had been already used for a Swedish Trilobite by Prof. G. Lindström in the 'Oversigt k. Vetenskap-Akad. Forhandl.,' no. 6, 1885, p. 49; therefore we have adopted the name *Youngiella*.

The Ostracod placed doubtfully as *Argillæcia æqualis*, J. & K., is very like a somewhat dwarfed individual of this species; but we are not sure about it. It might be regarded as a variety of *Bythocypris cuneola*, J. & K., which already contains varieties not unlike it, including similar small forms of doubtful affinities. *A. æqualis* is essentially a Lower-Carboniferous species. Its presence in the Yoredale strata is not well authenticated.

3. Notes on other Carboniferous Ostracoda from Yorkshire.

As supplementary to the preceding observations we give the following list of species from another locality in Yorkshire. The Ostracoda from which this list was determined were sent to us by Mr. James Bennie, of the Geological Survey of Scotland, and were found by Mr. Rhodes, Collector to the Geological Survey of England. The locality given is Dow-

gill, Settle; and the geological position is the Carboniferous Limestone. Thus the species occur lower in the series (earlier in time) than those from Hurst and Downholme.

List of Species from Dowgill (Carboniferous Limestone).

1. *Leperditia Okeni* (Münster)*.
2. — *Armstrongiana*, J. & K.*
3. *Kirkbya permiana*, Jones*.
4. — *umbonata* (d'Eichwald), Ann. & Mag. Nat. Hist. ser. 5, vol. xv. 1885, p. 180, pl. iii. fig. 2.
5. *Bairdia plebeia**, var. *alta*, nov. (Pl. XXI. fig. 6.)
6. — *Hisingeri* (Münster)*.
7. — *Hisingeri* (Münster)*, var. *contracta*, nov. (Pl. XXI. fig. 7.)
8. — *submucronata*, J. & K.*
9. — *brevis*, J. & K.*
10. *Bythocypris bilobata* (Münster)*.
11. *Argillæcia* (*Bythocypris*?) *æqualis*, J. & K.*, var. *acuta*, nov. (Pl. XXI. fig. 8.)
12. *Bythocypris*? *breviata*, sp. n. (Pl. XXI. fig. 9.)

The *Bairdiæ* here referred to as nos. 5 and 7 are related to *B. plebeia* and *B. Hisingeri*; and somewhat similar forms are not rare in some Lower-Carboniferous localities, and have been referred to in former papers as *Bairdia grandis* or its varieties. No. 5 (Pl. XXI. fig. 6) is a relatively short and high variety of *B. plebeia*, with angular dorsal margin, taking fig. 11, pl. xxviii. Quart. Journ. Geol. Soc. vol. xxxv. 1879, as a type. It is from $\frac{1}{12}$ to $\frac{1}{10}$ inch in length, less than one and a half times its height, which is greatest at the anterior third. Subpentagonal in outline. Dorsal border short and straight on the hinge-line, sloping at the anterior extremity, and joining the sharp posterior angle with an elegant hollow curve. Ventral border gently sinuous, curving up anteriorly to form the bluntly projecting end of the valve in front. We term this variety *B. plebeia*, var. *alta*, nov.

No. 7 (Pl. XXI. fig. 7) is a relatively short and high form of *B. Hisingeri*, with the front end rounded as in the modification of this species figured in Quart. Journ. Geol. Soc. vol. xxxv. pl. xxix. fig. 9. Suboblong in outline, with one end (anterior) rounded; the other obliquely truncate, ending below in a blunt prow-like angle; dorsal edge feebly convex, rounding off at the ends; ventral border gently sinuous. We regard this as *B. Hisingeri*, var. *contracta*, nov.

Argillæcia (*Bythocypris*?) *æqualis* derived its specific name from its nearly equally rounded extremities. But in some

* Also from Hurst or Downholme; see pp. 453 & 455. Carboniferous *Bairdiæ* are often difficult of determination. As in the present instance one of us holds the opinion that the *Bairdia* fig. 6 would be as well left with *B. grandis* as placed as a variety of *B. plebeia*.—J. W. K.

localities individuals occur having one end (posterior) bluntly pointed instead of being rounded like the other; and the Settle specimens, which are placed with this species, have this extremity more acuminate than any that have hitherto come under our notice, simulating somewhat *Macrocypris Jonesiana*, Kirkby, though not at all belonging to that species. Possibly it may be a new species, though just as likely it extends our knowledge of the old one. Any way, until other examples turn up it is retained in *A. (B.?) æqualis* as var. *acuta* (Pl. XXI. fig. 8).

The only other specimen from Dowgill that requires notice is a small tumid carapace (Pl. XXI. fig. 9) that has the dorsal border gibbose, being boldly arched, and the ventral feebly convex: it is highest and widest behind, with the anterior moiety of the carapace longer and more acute than the other portion. It also has the left valve overlapping the right moderately all round (most so ventrally), and the surface is smooth.

This specimen much resembles *Carbonia fabulina*, J. & K.; and had it been found in Coal-measures or other strata where that species might have been looked for, it would very possibly have been referred to it. It differs, however, in the hinging, which is more that of *Bythocypris* than *Carbonia*. Moreover, the latter seems to have been peculiar to the fresh or brackish waters of the Coal-measure areas; and, though it may have been occasionally commingled with estuarine and marine species, its occurrence among such a marine group as that in the Carboniferous Limestone of Dowgill would be very unlikely. We place it therefore with *Bythocypris* as *B. breviata*.

In connexion with this new form, it may be mentioned that we have notes and a sketch of a similar *Carbonia*-shaped carapace from Braehead, Lanarkshire, in the collection of Dr. David Robertson, which had also been found along with marine fossils. It is, however, a little larger, and has the surface deeply pitted.

4. With this notice of Carboniferous Ostracoda from Yorkshire may be mentioned a few species that we found in some washed shale sent us by Mr. Rhodes and Mr. James Bennie from the "Crow Beds, River Tees, Darlington," though we are not certain whether the shale was obtained from the Yorkshire or the Durham side of the river. The species found are *Leperditia Okeni*, *Kirkbya permiana*, *K. Urei*, *Bairdia plebeia*, and *B. brevis*; none of these were plentiful, and all were flattened by pressure. Possibly the Crow Beds are referable

to strata associated with one or two seams of coarse coals, locally termed "Crow Coals," that occur in the Yoredale Rocks of North Yorkshire and Durham.

Higher up the Tees, near to Barnard Castle, Dr. James Barron, of Sunderland, found a shale containing *Leperditia Okeni*, *Kirkbya permiana*, *Beyrichia* sp., and *Bairdia plebeia*, associated with marine fossils.

Lastly, many years ago we received from Mr. J. H. Burrow, of Settle, some fragments of "Lower Scar-Limestone" containing specimens of *Bairdia* and evidently varieties of *B. plebeia*.

The adjoining Table includes all the species of Carboniferous Ostracoda (the Cypridinidæ and allied families excepted) already known from Yorkshire. Rather oddly, there is not a single form to record as known from the Upper Coal-measures, nor from any horizon in the Lower Coal-measures, Gannister Beds, and Millstone-Grit, notwithstanding the thickness of these deposits and the wide area of their outcrop.

Table of Ostracoda occurring in the Carboniferous Rocks of Yorkshire.

	Carboniferous Limestone.	Yoredale Rocks.
1. <i>Cytherella recta</i> , J. & K.	*
2. — <i>scrobiculata</i> , J. & K.	*
3. — <i>æqualis</i> , J. & K.	*
4. — <i>reticulosa</i> , J. & K.	*
5. — sp.	*
6. — <i>intercalaris</i> , sp. n. (Pl. XXI. fig. 4.)	*
7. <i>Leperditia Okeni</i> (Münster)	*	*
8. — <i>Armstrongiana</i> , J. & K.	*	*
9. ? — sp.	*
10. <i>Beyrichia Bradyana</i> , J. & K.	*
11. <i>Kirkbya permiana</i> , Jones	*	*
12. — <i>oblonga</i> , J. & K.	*
13. — <i>spinosa</i> , J. & K.	*
14. — <i>Urei</i> , Jones	*
15. — <i>umbonata</i> (d'Eichwald)	*	*
16. <i>Bairdia plebeia</i> , Reuss	*	*
17. — —, var. <i>alta</i> , nov. (Pl. XXI. fig. 6.)	*	*
18. — <i>ampla</i> , Reuss	*
19. — <i>subelongata</i> , J. & K.	*
20. — <i>brevis</i> , J. & K.	*	*
21. — <i>amputata</i> , Kirkby	*

Table of Ostracoda (continued).

	Carboniferous Limestone.	Yoredale Rocks.
22. <i>Bairdia Hisingeri</i> (Münster). (Pl. XXI. fig. 1.) . .	*	*
23. ———, var. <i>contracta</i> , nov. (Pl. XXI. fig. 7)	*	*
24. ——— <i>submucronata</i> , J. & K.	*	*
25. <i>Bythocypris cornigera</i> , J. & K., var. <i>robusta</i> , nov. (Pl. XXI. fig. 2.)	*
26. ——— <i>cuneola</i> , J. & K.	*
27. ——— <i>bilobata</i> , J. & K.	*	*
28. ——— <i>equalis</i> , J. & K.	*
29. ———, var. <i>acuta</i> , nov. (Pl. XXI. fig. 8.)	*	*
30. ? ——— <i>breviata</i> , sp. n. (Pl. XXI. fig. 9.)	*	*
31. <i>Bythocythere Youngiana</i> , J. & K.	*
32. <i>Phreatura concinna</i> , J. & K. (Pl. XXI. fig. 3.)	*
33. <i>Youngiella rectidorsalis</i> , J. & K. (Pl. XXI. fig. 5.)	..	*

EXPLANATION OF PLATE XXI.

- Fig. 1.* *Bairdia Hisingeri* (Münster). Carapace, showing the right valve. Narrow form. From Hurst. × 25 diam.
- Fig. 2.* *Bythocypris cornigera*, J. & K., var. *robusta*, nov. Carapace, showing the right valve. From Hurst. × 25 diam.
- Fig. 3.* *Phreatura concinna*, J. & K. *a*, carapace, showing the right valve; *b*, edge view. From Hurst. × 50 diam.
- Fig. 4.* *Cytherella intercalaris*, sp. n. Carapace, showing the left valve. From Downholme. × 25 diam.
- Fig. 5.* *Youngiella rectidorsalis*, J. & K. *a*, left valve; *b*, inside of the same; *c*, inside of another individual; *d*, edge view of carapace. From Dunholme. × 50 diam.
- Fig. 6.* *Bairdia plebeia*, Reuss, var. *alta*, nov. Carapace, showing the right valve. From Dowgill. × 25 diam.
- Fig. 7.* *Bairdia Hisingeri* (Münster), var. *contracta*, nov. Carapace, showing the left valve. From Dowgill. × 25 diam.
- Fig. 8.* *Argillæcia* (*Bythocypris*?) *equalis*, J. & K., var. *acuta*, nov. Carapace, showing the right valve. From Dowgill. × 25 diam.
- Fig. 9.* *Bythocypris breviata*, sp. n. Carapace, showing the right valve. From Dowgill. × 25 diam.

LXIV.—New Genera and Species of Pyralidæ, Thyrididæ, and Epiplemidæ. By W. WARREN, M.A., F.E.S.

THE insects of which the description is given in the following paper formed part of different consignments received during the last year or so, mainly from collectors in India and Australia; those from India are chiefly from the Khasia

Hills, the Australian from N. Queensland; besides these are a few taken by Mr. Doherty in S. Celebes, Pulo Laut, and at Humboldt's Bay, New Guinea. The types of all the species here described are now in the possession of the Hon. Walter Rothschild, and will be found in the Tring Museum.

In the extensive subfamily Pyraustinæ the formation of several new genera appeared unavoidable.

Family Pyralidæ.

Subfamily *EPIPASCHINÆ*.

Genus *STERICTA*, Led.

Stericta atribasalis, sp. n.

Fore wings with whole basal third dark brownish black, the outer edge vertical, irregularly defined, followed by a whitish line, edged externally with dark grey; second line blackish at two thirds, interrupted, running outwards to middle, then bluntly angled and denticulate to inner margin before anal angle; it is followed on the costa by a whitish spot; central area between the lines pale ochreous, thickly dusted with dull brick-red and fuscous scales, the subcostal and median nervures dull green, undusted, as is also a small blotch at the extreme base of costa; cell-spot blackish brown, with raised scales; marginal area dark reddish grey, with whitish scales interspersed, and forming an indistinct zigzag line towards hind margin; fringes glossy, reddish grey, with a line of dark spots along hind margin before their paler base. Hind wings smooth, dark grey; fringes reddish grey. Palpi, face, vertex, thorax, and abdomen reddish grey, with paler and darker scales intermixed; second joint of palpi with a pale ring at summit; third joint pale-tipped. Underside glossy: fore wings dark grey towards hind margin, reddish along costa, and pearly whitish on inner margin: hind wings paler, whitish towards base, mottled with reddish along costa, with a dark curved line at two thirds before the dark reddish-grey hind margin.

Expanse of wings 32 millim.

One female from Queensland.

Stericta picta, sp. n.

Fore wings of mixed tints, chiefly ferruginous brown; basal patch bright ferruginous along costa, mixed and shaded with olive-fuscous below; first line black, curved; second line black, denticulate, and sinuous, from costa at two thirds

running obliquely outward towards hind margin, curving on the second and third medians, running inwards between first and second medians, and again curving to inner margin before anal angle; costa ferruginous, with scattered black scales beyond first line; the second line on costa passes through a squarish white patch with pale ferruginous scales; in the cell are two tufts of brown-black scales, one behind the other; the lower three fourths of the whole central area is a mixture of olive-brown and ferruginous, as is also the marginal area, except in the middle, where there is a paler space without suffusion; fringes reddish olive, chequered with blackish opposite the veins. Hind wings dark brownish grey, with the fringes paler. Palpi dark brown; face and vertex ferruginous; collar a mixture of dark brown, ferruginous and pale scales; patagia black at base, becoming ferruginous at their tips; abdomen blackish on top, paler and mottled at sides. Underside glossy, darker towards the margins: fore wings with costa ferruginous ochreous; a blackish patch of scales in the middle of the cell, preceded and followed by pale ochreous scales; inner margin broadly pearly white: hind wings towards the base straw-colour, dusted with blackish, with a blackish round cell-spot, and a dark curved exterior line like that in the fore wings.

Expanse of wings 32 millim.

One male from Queensland.

Stericta? prasina, sp. n.

Fore wings grey-green, with dark grey markings; first line at one fifth thick, blackish, towards the costa still thicker; second line at two fifths, straight, rather oblique inwards, approaching first line on inner margin; discal spot blackish, distinct; exterior line at three fifths, running obliquely outwards, denticulated to the middle, then curving inwards to inner margin at four fifths; the central fascia is thus much broader on the inner margin than on the costa, and is much darkened with grey scales before the exterior line on the inner margin, and in a less degree on the costa after the second line; submarginal line angled and slightly denticulate, much thickened in its upper part towards the costa; hind margin with a row of black spots; fringes reddish grey. Hind wings blackish, deeper before the fringes, which are reddish grey. The basal area of fore wings and all the body, including face, palpi, head, thorax, and abdomen, are yellow-ochreous in the only example I have seen, but were almost certainly concolorous green with the rest of the wings. Underside glossy,

very dark grey or blackish, tinged with reddish, especially along costa of fore wings.

Expanse of wings 24 millim.

One female from Queensland.

Stericta? rubroviridis, sp. n.

Fore wings dull grey-green, very thickly dusted with olive-fuscous and reddish scales; first line about one third, indistinct, paler, edged with fuscous; second line at two thirds, running obliquely outwards to middle, then dentate and vertical to inner margin before anal angle, followed by a paler green line, which is again followed by a dark smoky shade, through which the veins all show as black streaks; marginal area paler green; fringes pale green, chequered with dark fuscous opposite the veins, and with a row of fuscous blotches along the hind margin between the veins. Hind wings dark grey, especially towards hind margin; fringes pale grey. Thorax and abdomen cinereous. Face, collar, and patagia, as well as basal area of fore wings, dull pink; but it is possible that these were once green. Underside reddish fuscous, with indistinct markings.

Expanse of wings 30 millim.

One female, Queensland.

Stericta? seminivea.

Fore wings snow-white, with black markings; a large black costal blotch not quite touching the base and reaching to one third, bounded beneath on the submedian fold by a lengthened tuft of white scales, the space below the tuft being a mixture of black and white scales; the whole basal area is sharply defined and straight externally, and is followed on the inner margin by a short oblique black streak; discal spot round, black, containing on its inner edge a small tuft of raised white scales, and with a small black costal blotch above it; exterior line thick, black, subdentate, curving outwards from costa at two thirds, then inwards, and again slightly outwards before inner margin; the lower part of the sinus is filled up with a thick black shade, with some ochreous scales on its inner edge; marginal area broadly black at apex, narrowly at anal angle and greyish white between, the whole separated from outer line by a distinct curved white line, which is interrupted so as to form two white spots opposite the cell; fringes whitish, chequered with black opposite the veins, especially towards apex, and with a row of black squares along the hind margin at their base between the veins. Hind wings

pale grey at base, becoming dark grey towards hind margin; fringes dark grey, especially at apex, with paler tips and a darker dividing line. Face, vertex, base of antennæ, and patagia white; collar black; palpi black, except the terminal joint, which is white with the extreme tip black; abdomen grey, with the basal segments ochreous. Underside glossy greyish black; costa of fore wings with a white spot at the beginning of the exterior line.

Expanse of wings 32 millim.

One female, Queensland.

Subfamily *PYRALIDINÆ*.

Genus *PYRALIS*, Linn.

Pyralis funebris, sp. n.

Fore wings dingy fuscous grey, with a slight reddish tinge; basal and marginal areas deeper than central; first line at one fourth, curved and wavy, white, thicker on costa; second at three fourths, vertical for a short distance from costa and inner margin, and forming a shallow sinus between, wavy and indistinct except at costa, where it forms a prominent white tooth-shaped spot; discal spot blackish; costa between the lines with seven or eight white dots; fringe concolorous. Hind wings like fore wings, with two wavy whitish lines at one third and two thirds; basal area and outer half of central area darkest; marginal space dusted with purplish grey. Head, thorax, and abdomen fuscous; face, palpi, and antennæ paler. Underside dull cinereous; the second line on hind wings showing pale.

Expanse of wings 36 millim.

One female from the Khasias.

This species rivals our European *farinalis* in size. It may be a dull local form of *P. albiguttata*, Warr., which occurs in India as well as Japan.

Genus *ORTHOPLYGIA*, Rag.

Orthopygia subolivescens, sp. n.

Wings dull olive, dusted with fuscous or blackish atoms, and sometimes tinged with yellowish or ochreous; first line generally indistinct, paler edged externally, with an agglomeration of the blackish scales towards the inner margin; exterior line at five sixths, sinuous, paler, edged internally with darker scales throughout; the line is indented inwards opposite the cell and on the submedian fold; hind margin preceded

by a row of largish black spots; fringe iron-grey, with a fine pale basal line; costa dotted with black along the central area; a black cell-spot. Hind wings more cinereous, with less dark dusting; a curved pale line at two thirds. Head, thorax, and abdomen concolorous. Underside like upper, but less green, more cinereous.

Expanse of wings 18 millim.

Three males from the Khasia Hills.

Orthopygia atomosalis, sp. n.

Fore wings pale greyish ochreous, almost entirely suffused with blackish atoms, slightly mixed with reddish (in the specimen which served for type the central area has been rubbed and appears paler), basal patch darker, but ill-defined; second line at two thirds, slightly bent outwards opposite the cell, then curved inwards, dark grey, separated from the dark marginal space by a paler line; discal dot large, black; costa distinctly and regularly marked with black and white; fringes dark, with a pale line at base, and their tips towards the apex of wing whitish. Hind wings with two wavy dark central lines enclosing a middle space slightly darker than the rest of the wing, which is thickly dusted with dark scales. Head, thorax, and abdomen ochreous, dusted with dark atoms. Underside the same, but much clearer, the ground-colour being paler, less suffused, and the markings darker and more defined; exterior line on hind wing denticulated.

Expanse of wings 22 millim.

One male from the Khasias.

Orthopygia fascialis, sp. n.

Fore wings smooth, olive-green; the lines black, the first at one third, vertical and sinuous, the second at two thirds, forming a large sinus outwards in middle and reaching inner margin shortly before anal angle; it is edged throughout by a pale ochreous line; cell-spot large, dark; costa between lines blackish, with six clear pale ochreous spots; hind margin with a row of rather large black spots before the fringe, which is greyish. Hind wings with a central curved black fascia, the inner edge of which is even and the outer wavy; hind margin and fringes as in fore wings. Head, thorax, and abdomen concolorous with fore wings. Underside cinereous, with a greenish tint; only the exterior line marked plainly in black, with a paler edge on both wings.

Expanse of wings 26 millim.

One female from the Khasias.

Orthopygia subviridescens, sp. n.

Wings ochreous, suffused with pale olive; basal area of fore wings olive, edged by the paler vertical wavy first line; second line ochreous, broad, forming a strong sinus outward in the middle of the wing; the central area is tinged with yellowish and sparsely dusted with blackish scales, and contains a small dark cell-spot; the costa is dark olive, with four white dots; beyond the second line is a dark grey shade, not reaching the hind margin; fringe olive, with some irregular black dots and spots along the base. Hind wings paler, with two dark pale-edged curved lines, forming the edges of a central fascia; fringe and marginal spots as in fore wings. Head, thorax, and abdomen concolorous. Underside paler, but with the basal two thirds of both wings darker; the white costal dots continued to the base.

Expanse of wings 20 millim.

One female from the Khasia Hills.

Genus COMARIA, Rag.

Comaria ruptilinealis, sp. n.

Fore wings greyish ochreous, varied with fuscous-olive and reddish-brown scales, the basal and marginal areas filled up with dark reddish brown; the edge of the basal patch runs obliquely inwards from costa as far as the submedian fold, then outwards, rounded to inner margin; it is marked by a slightly paler line; second line at seven eighths, near and parallel to hind margin, red-brown, separated from dark marginal space by a pale line; a darker spot on the discocellular; the costa indistinctly spotted dark and light reddish; fringes reddish brown. Hind wings dull ochreous whitish, with a curved grey line at two thirds and a reddish blotch from hind margin along the first median nervule; hind margin marked by a wavy blackish line; fringe ochreous grey, with a broad fuscous line near base. Head, thorax, and abdomen reddish grey, the abdomen rather darker grey. Underside dull cinereous reddish.

Expanse of wings 22 millim.

One female from the Khasias.

Genus STEMMATOPHORA, Guen.

Stemmatophora semiochrea, sp. n.

Fore wings vinous red, much dusted with blackish scales; lines dull ochreous, first at one third, vertical, forming an angle

outwards on the submedian fold, second at two thirds, forming an angle outwards on the median nervure (on the left wing there is no angle, but a simple sinus); some ochreous costal dots between the lines; cell-spot dark, rather large; fringe dark grey, with a darker inner line. Hind wings dull golden ochreous, fuscous grey towards base and along hind margin, and with a large grey cell-spot; fringe dark grey, as in fore wings. Head, thorax, and abdomen dark reddish grey. Underside like upper, but duller.

Expanse of wings 22 millim.

Several from the Khasias.

Easily distinguished by the dull ochreous hind wings.

Subfamily *ENDOTRICHINÆ*.

ENDOTRICHOPSIS, gen. nov.

Agreeing in shape and markings of the wings and in neuration with *Endotricha*, as well as in the lengthened patagia, which, in fact, reach almost to the end of the abdomen. The antennæ, however, resemble those of *Zania*, Wlk. (= *Endotrichodes*, Rag.), having an enlarged basal joint prolonged on the outside into a tooth; the antennæ themselves are long, subdentate, with short fascicles of cilia (in the single specimen from which the diagnosis is taken there appear traces of some long scales in tufts some little distance before the apex); the labial palpi are strongly upcurved in front of face, ending in sharp pencils of hair which reach well above the forehead; ocelli present, but minute, almost hidden beneath the base of the thickened basal joint of antennæ.

Type *Endotrichopsis rhodopteralis*, sp. n.

Endotrichopsis rhodopteralis, sp. n.

Fore wings shining rosy, tinged towards the base and costa with dull ferruginous; interior line invisible; exterior line only indicated for a short distance below costa, straight, whitish, with a darker outer edge; costa with a regular series of semielliptic white spots; fringes bright rosy at apex and lower two thirds, white between. Hind wings brighter rosy, slightly ferruginous, with faint indications of two paler curved darker-edged lines; fringe white, with the base unevenly rosy brown. Head, thorax, patagia, and abdomen testaceous, rosy-tinged. Underside the same, with the markings clearer; the costal markings of fore wings more largely developed, each with a reddish centre and brown edge; a small dark cell-

spot; costal region before exterior line rather bright ferruginous; hind wings with the two lines distinct.

Expanse of wings 24 millim.

One male from Japan.

Endotricha acrobasis, Snell. (Tijd. v. Ent. xxxv. 1892, p. 155, pl. x. fig. 1), evidently belongs to this genus, and may be the same species, but it is not represented as being rosy.

PERISSERETMA, gen. nov.

Fore wings triangular, costa hardly convex; apex blunt; hind margin oblique; anal angle well marked. Hind wings triangular, with both angles well-marked, and the hind margin nearly straight. Antennæ of male with long and very fine ciliations; maxillary palpi weak, laxly scaled, upcurved in front of face; labial palpi of abnormal length, twice as long as maxillary, curved horizontally in front of face, like the mandibles of a beetle, with long lax hairs on the inner side; tongue well-developed; patagia of male nearly as long as abdomen; hind tibiæ with four spurs. Neuration: fore wings, cell two fifths of wing; first median nervule at four fifths, second from lower angle of cell, third and lower radial on a common stem; upper radial from upper angle of cell; last three subcostals on common stem from just before the angle, first and second free: hind wings, medians as in fore wings; costal and first subcostal united; second subcostal from upper angle of cell; discocellular angulated, the lower arm oblique.

Type *Perisseretma endotrichalis*.

I am inclined to believe that the position of the labial palpi, as above described, in the single example examined is not the natural one. It is more probable that in the natural condition they are upcurved in front of face, as in the genus *Endotrichopsis*, to the labial palpi of which genus they bear a strong resemblance.

Perisseretma endotrichalis, sp. n.

Fore wings dull vinous, dusted and in part suffused with dark grey; basal area indistinctly darker, edged by an oblique streak of undusted ground-colour from costa near middle to inner margin at one fourth; second line also of clear ground-colour from costa at two thirds to middle of inner margin, slightly elbowed in the middle; discal spot large, black; space between the two lines from median to submedian occupied by an oblique subquadrate black blotch; a diffuse

blackish cloud before hind margin ; a row of small black dots at base of fringes ; fringes reddish in their inner half, dark leaden grey in their outer ; costa between the two lines with three or four black spots. Hind wings rather paler ; with two parallel dark grey lines before the middle and two more beyond, followed by a third less distinct ; fringes and hind margin as in fore wings. Head, face, patagia, and abdomen concolorous with wings. Underside, except the fringes, less red ; fore wings with one, hind wings with two dark fasciæ.

Expanse of wings 16 millim.

One male from Masuri.

PETTA, gen. nov.

Akin to *Diploseustis*, Meyr. Fore wings long and narrow : hind wings twice as broad as fore wings ; both with an indentation on the hind margin below the apex ; agreeing also in the palpi and ocelli, but the tongue is absent ; in the fore wings the first median appears to be wanting, the other two with the lower radial are on a common stalk from the lower end of the cell, which is short, as far as can be made out without denudation ; the first two and the other three subcostals are on a common stem. In the hind wings the first median nervule is present, as in *Diploseustis*.

Type *Petta alternata*, sp. n.

Petta alternata, sp. n.

Fore wings whitish, largely suffused with dark grey ; first line white, edged with dark, oblique from costa, then curved inwards parallel to hind margin ; second line white, near hind margin and parallel to it except opposite the indentation, where it forms a very distinct right angle outwards ; above the anal angle it runs suddenly basewards, becoming obsolete for a short distance, and reaches the inner margin just beyond the middle as a curved white mark ; on the costa between the two lines are three broad oblique black blotches, finely edged with white, the third being much smaller than the other two ; both the lines are flanked on either side by a thick grey shade ; a fine marginal dark grey shade ; fringe dark grey, with a darker line near base, which is white. Hind wings whiter, with a dark grey cloud in middle, and a much curved outer white line, edged with dark from before costa to above anal angle ; margin and fringes as in fore wings. Thorax and abdomen grey ; collar, face, and palpi white, the hairs of the second joint of the palpi externally black ; antennæ ochreous, each segment above with a round black spot. Underside

duller, with the inner lines not marked; discal spot of fore wings dark.

Expanse of wings 10 millim.

Several from the Khasias.

Genus TRICHOPHYSETIS, Meyr.

Trichophysetis nigridiscalis, sp. n.

Fore wings white, the whole of the disk except the basal, costal, and marginal area suffused with blackish; a short dark line close to base; an oblique thick black line, parallel to hind margin just before middle, obsolete before costa, but with its origin there denoted by a short oblique brown streak; an exterior blackish line from costa at two thirds, oblique outwards, nearly parallel to costa, then highly curved, and becoming parallel to hind margin, its lower course being somewhat dentate and geminated; its subcostal shoulder is followed by a small black dot; submarginal line excurved below apex and followed by an orange apical space; fringe white. Hind wings less suffused with blackish; with two curved black lines at one third and two thirds, the second geminated, and a blackish discal spot. Thorax and abdomen white, the latter spotted with black. Underside dull whitish.

Expanse of wings 18 millim.

Several from the Khasias.

Genus COTACHENA, Moore.

Cotachena? fenestralis, sp. n.

Fore wings pale yellow, semitransparent; costa broadly brown from base to outer line; inner line indistinct, visible on inner margin near base as a fine brown thread; cell very short; containing a round brown spot close to base and a triangular one on the discocellular, the space between them being transparent, devoid of scales; exterior line represented by an inwardly oblique brown streak from costa at two thirds and a blotch on inner margin in the middle; apex of wing dark brown, bounded internally by a darker brown submarginal line, which runs to inner margin before anal angle; fringes yellow, preceded in the upper half of the wing by some brown dots in the apical blotch. Hind wings with discal spot, central and submarginal lines brownish. The space between submarginal line and margin in both wings more thickly scaled and yellowish. Head, thorax, and base of abdomen pale yellow; face, collar, patagia, and hind

segments of abdomen deeper; palpi externally dark brown. Underside like upper, with less distinct markings, but apical patch darker.

Expanse of wings 22 millim.

One male from Queensland.

Subfamily PYRAUSTINÆ.

Genus SYLLYTHRIA, Hübner.

Syllythria cruoralis, sp. n.

Wings dull purplish grey, with a yellow sinuous fascia just beyond middle, forming a short outward sinus across the median nervules, narrowing towards costa and inner margin; in the hind wings running from middle of costa, where it is broad, to the anal angle; fringes of both wings yellow, those of the hind wings tinged with reddish at the anal angle; discal spot of fore wings dull leaden red. Head, thorax, and abdomen dull red, tinged with yellow; palpi dark brownish. Underside dull yellowish, with the red area of the upperside cinereous.

Expanse of wings 20 millim.

Several from the Khasias.

Syllythria rubritinctalis, sp. n.

Fore wings with the pale yellow ground-colour almost wholly hidden by a profusion of red scales; costa and hind margin wholly deep red; a thick curved red line at one third and an indistinct exterior one, which does not appear to reach the costa, forms a small sinus towards anal angle, runs in along the first median nervule, and attains the inner margin shortly before the anal angle; fringe pale yellow. Hind wings yellowish white, with a faint reddish tinge about the discal spot and in middle of hind margin; fringe concolorous. Head, thorax, and abdomen yellow, suffused with red; palpi deep brown-red. Underside dull yellowish; the fore wings tinged a little with red; the costal region broadly dark brownish red.

Expanse of wings 20 millim.

One female from the Khasias.

Genus RHECTOTHYRIS, Warr.

Rhectothyris hyalodiscalis, sp. n.

Fore wings yellow, but the ground-colour is visible only along the costa and hind margin, the rest of the wing being

uniformly suffused with smoky grey; the lines black and thick, first from one fourth of costa to one third of inner margin, bent and wavy; second from three fifths of costa to middle of inner margin, very thick, bent outwards just beyond cell and approaching first line on inner margin; at the end of cell is a hyaline white spot, broader above than below, edged on both sides with blackish; the median vein is tinged with yellowish and the cell is fulvous; the costa at base and beyond second line is likewise tinged with fulvous; the costa between the lines remaining bright yellow like the hind margin. Hind wings smoky grey, with an indistinct central curved darker line; hind margin yellow; fringes of both wings yellow. Thorax and abdomen smoky grey; collar, vertex, face, and palpi, as well as tip of abdomen, yellow. Underside like upper; underside of abdomen and legs white.

Expanse of wings 24 millim.

A few from the Khasias.

Genus ISOCENTRIS, Meyr.

Isocentris unicolor, sp. n.

Wings dull brick-red; the lines very fine, blackish, first at one fourth, blackish on costa only, reddish below; second line in the usual place and of the usual form, but hardly wavy, darker on costa; submarginal line wavy, blackish. Hind wings uniform brick-red, with the costa broadly pearly white; central line angulated; submarginal line as in fore wings; fringes pure white, with the usual slightly wavy deep black basal line; discal lunule of fore wings slender, indistinct. Head, thorax, and abdomen dull brick-red; the patagia slashed with brighter red; legs white and red; palpi and antennæ brick-red. Underside shining ochreous grey, the hind wings lighter.

Expanse of wings 26 millim.

One female from Queensland.

Distinguished from all the other species of the genus by the uniform pale brick-red colour of both wings; the exterior line is fine and continuous throughout, not broken up into dots.

Leucocraspeda auratalis, sp. n.

Fore wings deep yellow, flushed with darker; costa at base and the lines dull orange; first at one fourth, oblique, slightly curved; second at three fourths, a little wavy and curved outwards, runs towards anal angle as far as first median, is

obsolete along the vein, and from beneath discocellular runs straight, inclined slightly inwards, to inner margin; discal mark lunular, brownish; a slight orange cloud obliquely below it; a very fine dark marginal line; fringes silvery white, with a broad black basal line. Hind wings the same, without inner line and lunular cell-spot. Head, thorax, and abdomen concolorous with wings. Underside duller yellow, but glossy, with only the outer line brownish.

Expanse of wings 24 millim.

One female, Japan.

MIMOCOMMA, gen. nov.

Fore wings elongate; costa straight; apex blunt; hind margin obliquely curved; inner margin slightly convex and hairy. Hind wings narrow, with rounded hind margin. Abdomen of male long, vertex hairy; antennæ four fifths of wing, filiform; the basal joint swollen, notched inside in front, the shaft above the notch again swollen and produced angularly; labial palpi porrect, rostriform; maxillary?; tongue present; ocelli distinct; in the single hind leg remaining the tibia has only one middle spur, and that long and slender. Neuration: fore wings, first median at three fourths; second, third, and lower radial approximating from near end of cell; upper radial from below upper angle; last subcostal from upper angle as well as the common stem of the second, third, and fourth; first subcostal free. Hind wings: first subcostal anastomosing with costal halfway.

Type *Mimocomma fulvimargo*, sp. n.

Mimocomma fulvimargo, sp. n.

Fore wings smoky brown, the costa and hind margin dull fulvous and the apex pale fulvous; lines blackish, indistinct, first at one third, oblique outwards, second at two thirds, sinuous outwards to first median, then incurved and reaching inner margin at two thirds; cell-spot dark, obscure; fringe fulvous towards apex, smoky towards anal angle. Hind wings and the fringe wholly smoky brown; costa broadly whitish. Thorax and abdomen smoky brown; apex of abdomen ochreous; collar, head, face, and palpi yellowish fulvous. Underside glossy, pale cinereous.

Expanse of wings 26 millim.

One male from the Khasias.

DISCOTHYRIS, gen. nov.

Fore wings with costa straight till shortly before apex,

which is bluntly subfalcate; hind margin bulged below middle, indented below apex, and oblique above anal angle; anal angle well marked. Hind wings with apex falcate; anal angle strongly marked, hind margin bulged in centre; the fore wings have an oval scaleless patch at the base of the cell between the first and second median nervules, and the spaces between the second and third and the third and the lower radial are also partially semitransparent; the hind wings have prominent tufts of hair along vein 2 on the upper-side. These peculiarities are to be found in both sexes. Palpi porrect, rostriform; antennæ long, two thirds of fore wings, filiform, ciliated in male. Neuration normal.

Type *Discothyris ferruginata*, Moore (*Agrotera*).

vestigialis, Snell. (*Gonocausta?*), Tr. E. S. 1890, p. 628, also belongs here.

Genus CAVIFRONS, Zell.

Cavifrons simplex, sp. n.

Wings very pale straw-colour, glossy; fringes concolorous; head and thorax whitish; abdomen probably the same, but greased. Underside of hind wings like upper-side; of fore wings suffused with cinereous along the middle, the costa remaining straw-colour, and the inner margin pure white.

Expanse of wings 28 millim.

One male from Larima County, Colorado.

Of the same size as, but rather paler than, *Cavifrons biundulalis*, Zell., from which it is distinguished by the entire absence of markings; the palpi are shorter than in the type species.

Genus SPILODES, Guen.

Spilodes fraudulentalis, sp. n.

Fore wings pinkish fawn-colour, without markings, except a broadish pale yellow fascia parallel to hind margin at two thirds, not reaching the costa; fringes dull yellowish. Hind wings the same, but the fascia approaching the margin towards anal angle and curved and somewhat diffuse. Head, thorax, and abdomen concolorous. Underside like upper; the legs pearly white.

Expanse of wings 32 millim.

Several males from the Khasias.

This species mimics Moore's *flavofasciata*, but the ground-colour of the wings is not so dark and the yellow fascia straighter.

MONOCROCIS, gen. nov.

Distinguished from *Sclerocona*, Meyr., *Mesotympana*, Warr., and allied genera by the male having on the underside of fore wings only a small tuft of curled raised scales beyond the upper angle of the cell, which is about half as long as the wings. The retinaculum is not at all enlarged, and there is no apparent distortion of the cell or nerves.

Type *Monocrocis flavofasciata*, Moore (*Hapalia*).

LEPIDOPLAGA, gen. nov.

Fore wings elongate; costa straight till shortly before apex, then slightly curved; apex produced, pointed; hind margin oblique; anal angle obtuse. Hind wings narrow, with both angles and the hind margin rounded. Forehead slightly produced below, forming a slope; labial palpi rostriform, porrect, bent, decumbent; maxillary palpi present; tongue well developed; antennæ of male long, filiform. Neuration: cell not half as long as wing, with a depression beyond it above, which is covered on the underside by a flat tuft of glossy scales; scale-crest below the retinaculum, on the submedian fold, strongly developed.

Type *Lepidoplaga flavicinctalis*, Snell.

Lepidoplaga fulvidalis, sp. n.

Fore wings yellowish fulvous, with deeper fulvous markings; costa broadly deep fulvous, also the basal area; a blotch contiguous to the costal streak over the discocellular, and containing the small fovea, which is conspicuously impressed; exterior line curved outwards to the first median, then running in to below the discocellular, and thence running straight to inner margin; a broad curved submarginal fascia. Hind wings paler, with the exterior curved line and submarginal fascia darker fulvous; fringes concolorous. Head, face, thorax, and abdomen all deep fulvous; pectus and lowest joint of palpi white; fore legs white, with brown patches. Underside of wings and abdomen and the other legs pale gilded yellow; the scale-tufts paler.

Expanse of wings 24 millim.

One male from the Khasias.

In markings very much resembling *Lepidoplaga uniformis*, but quite different in coloration.

Lepidoplaga multidentalis, sp. n.

Fore wings pale yellowish; the costa, transverse lines, and stigmata fuscous; first line close to base, dentate; second from two thirds of costa to near middle of inner margin, strongly dentate and incurved above the inner margin; a straight dark fuscous shade from costa before apex to inner margin just before anal angle also strongly and regularly dentate; fringes concolorous, with a row of minute dark brown dots at their base. Hind wings paler, with a short central fuscous line and a broad shade, continuing that on fore wings, starting below the costa and ending in hind margin at one third from anal angle. Abdomen and back of thorax pale yellow; outside of palpi and front of thorax fuscous; face fuscous yellow, edged with whitish. Underside paler; both crests of scales very glossy.

Expanse of wings 35 millim.

One male from the Khasias.

Lepidoplaga uniformis, sp. n.

Fore wings uniform pale yellow, with the subcostal region slightly deeper tinged and the costa very narrowly white; lines slightly darker, indistinct, first before one third, oblique, second at two thirds, oblique and straight towards anal angle for two thirds, then curved in to below discocellular, and again at an acute angle outwards to inner margin at two thirds; no discal spot, but the fovea at end of cell clearly indicated, that towards the base hardly visible; fringe concolorous. Hind wings rather paler, with the exterior line reproduced, beyond which the ground-colour becomes greyer. Head, thorax, and abdomen concolorous with wings. Underside very glossy, the fore wings greyish, the hind wings paler.

Expanse of wings 21 millim.

One male from the Khasias.

PACHYBOTYS, gen. nov.

Fore wings elongate; costa straight; apex rounded; hind margin curved; anal angle rounded off. Hind wings narrow, with round hind margin. Antennæ simple in both sexes; labial palpi shortly porrect, laxly scaled; maxillary palpi insignificant; tongue and ocelli present; legs thickened with hairs.

A genus of insects of stouter and thicker build than *Opsi-botys*, with denser scaling and quite different pattern of

markings; the two stigmata are well expressed and large; the exterior line rectangularly produced outwards in the middle, followed by a well-developed submarginal line.

Type *P. spissalis*, Guen. (*Botys*).

Pachybotys minialis, sp. n.

Wings dull vermilion-red, with dull black markings; a spot at the base of the fore wings and the whole costa blackish; first line at one third, thick, straight and oblique, parallel to hind margin; second line before two thirds, at first parallel to hind margin, then running abruptly outwards, describing a quadrangular sinus, and ending on inner margin at two thirds as a straight oblique line in a line with the costal arm; discal mark lunular; space between the lines thickly dusted with blackish, except immediately beyond discal lunule, which remains of the ground-colour; submarginal line curved, rather interrupted; fringe paler, with a dark broad basal line. Hind wings paler red, especially along costa, with traces of a dark line at two thirds, distinct only near inner margin, and of a submarginal one, much thinner; fringe reddish, with no black basal line. Head, thorax, abdomen, and legs all vermilion-red. Underside rather duller; the fore wings blackish beyond the submarginal line.

Expanse of wings 26 millim.

Three females from Queensland.

Pachybotys plenistigmalis, sp. n.

Wings deep yellow, suffused over the basal half with brownish yellow; costa at base ferruginous; lines deeper yellow, first at one fourth, curved outwards, second at three fourths, at first straight from costa, then forming a shallow sinus of three teeth, and running in to touch the base of the reniform stigma, where it forms a dark brown spot, and descends to the inner margin; traces of a curved and sinuous submarginal line; stigmata dark ferruginous, large, the first round, the second 8-shaped, with traces of a metallic centre. Hind wings with an angulated deep yellow central line and a broadish submarginal band, both lustrous; fringes of both wings yellow. Head, thorax, and abdomen dark yellow; palpi ferruginous. Underside paler yellowish white, with the stigmata and lines showing through.

Expanse of wings 26 millim.

A few from the Khasia Hills.

[To be continued.]

LXV.—*Descriptions of Five new Species of Ennea from South Africa.* By JAMES COSMO MELVILL, M.A., F.L.S., and JOHN HENRY PONSONBY, F.Z.S.

[Plate XVIII.]

THE following species of *Ennea*, in most instances considerably smaller than those hitherto described from the South-African region, were received by Mr. Wotton from the neighbourhood of Grahamstown, and by him placed in our hands for determination.

Ennea cimolia, sp. n. (Pl. XVIII. fig. 2.)

E. testa cylindræa, minuta, recta, tenui, nitida, apud apicem compressa; anfractibus sex, ventricosis, nitidis, ad suturas paullum impressis, omnino lævibus; apertura ovata, labro incrassato, pellucido, dentibus vel plicis tribus instructo, plica parietali magna, intrante, dente labiali conspicuo, plica marginem subtus columellarem semicelata, effusa.

Long. 2·75, lat. 1·25 mm.

Hab. Grahamstown.

A very delicate transparent shining little mollusk, with whorls perfectly smooth; mouth ovate; peristome with three processes, of which the parietal plait is deep-seated, the labial tooth conspicuous, the columellar plait being effuse, large, and half-concealed.

Ennea Farquhari, sp. n. (Pl. XVIII. figs. 3-5.)

E. testa minuta, rimata, dolioliformi, tenui, nitida; anfractibus sex, ventricosis, ad suturas multum impressis, undique longitudinaliter pulchre striatis; apertura ovato-triangulari, labro incrassato, dentibus vel plicis quatuor instructo, plica parietali magna, acinaciformi, acuta, valde prominente, dente labiali bipartito, plica columellari minore, simplici.

Long. 3, lat. 1 mm.

Hab. Grahamstown.

Several specimens, two being in exceptionally fine and live condition, quite transparent, with yellow-rose hue. The species being somewhat variable, we give three representations of it. It is tun-shaped, minute, thin, shining, six-whorled; whorls ventricose, beautifully longitudinally striate, beneath triangularly ovate; outer lip thickened, mouth adorned with four processes, the parietal plait being large, scimitar-shaped,

acute and prominent, the labial tooth bifurcate; the columellar plait, however, is smaller and simple.

This is a very beautiful form, though so small.

Ennea labyrinthea, sp. n. (Pl. XVIII. figs. 7, 8.)

E. testa perminuta, rimata, breviter cylindracea, tenui, delicate pellucente; anfractibus quinque, nitidis, ventricosulis, apud suturas compressis, undique longitudinaliter fere rectistriatis; apertura ovata; peristomate pellucente, crassiusculo, deute parietali permagno, dente labiali apud medium sulcato, parte inferiore subrecto, basali minimo, plica columellari magna, effusa, valde intrante.

Long. 1.50, lat. .85 mm.

Hab. Grahamstown.

An exceedingly minute but very wonderfully constructed species, of which we have seen as yet only two specimens. The shell is transparent, extremely delicate, and needing the aid of a lens of considerable power to show effectively the complicated peristomatal processes. The parietal plait is large and prominent, the labial tooth furrowed bipartitely, the lower division being effuse, extending far across the aperture, and curving upwards. The basal tooth is very small, but the columellar plait is conspicuous and deep-seated. In fact the mouth is almost closed by these labyrinthine elaborations; whence the specific name chosen. This, the smallest of the many *Enneæ* known from South Africa, is unquestionably the most remarkable.

Ennea Margaretteæ, sp. n. (Pl. XVIII. fig. 1.)

E. testa breviter cylindriformi, tenui, lævi, nitida, ad suturas crenulata; anfractibus sex, longitudinaliter lævissime striatulis; apertura trigonali, labro exteriori valde sinuoso, dentibus plicisve quatuor instructo, parietali acuto, conspicuo, labiali basaliqve parvis, plica marginem infra columellarem effusa, interna.

Long. 3.50, lat. 1.50 mm.

Hab. Grahamstown.

Allied to *E. cimolia*, but abundantly distinct from that species. The penultimate and antepenultimate whorls are narrower than the corresponding whorls of *cimolia*, the shell is larger, and the shape of the mouth different, the exterior lip being sinuous and bearing the processes (labial and basal) on the bends of such sinuosities.

Ennea Wottoni, sp. n. (Pl. XVIII. fig. 6.)

E. testa subrimata, obtusa, cylindracea, corneo-fusca; anfractibus septem vel octo, ad suturas impressis, ventricosulis, omnibus

longitudinaliter oblique crassistriatis, duobus apicalibus brevibus, cæteris lente accrescentibus; apertura rotunda, peristomate albo, nitente, dentibus plicisve tribus instructo, plica parietali conspicua, acinaciformi, dente labiali prominente, plica columellari interna subtus marginem columellarem.

Long. 5, lat. 2 mm.

Hab. Grahamstown.

This is the largest species of the minute *Enneæ* described in this paper. We have seen four specimens, all precisely alike. The shell is of the *infans* type, and is conspicuous for its rounded aperture, the lip bearing a very prominent parietal plait; only one external tooth (the labial), while a deep-seated internal plait below the columellar margin is the third and only other process observable.

EXPLANATION OF PLATE XVIII.

- Fig.* 1. *Ennea Margaretæ*.
Fig. 2. — *cimolia*.
Figs. 3-5. — *Farquhari*.
Fig. 6. — *Wottoni*.
Figs. 7, 8. — *labyrinthea*.

LXVI.—*Description of a new Characinoid Fish of the Genus Parodon.* By G. A. BOULENGER, F.R.S.

Parodon caliensis.

Dentition as in *P. suborbitalis*, C. & V., $\frac{2-8-2}{3-3}$; præmaxillary teeth fringed. Depth of body $3\frac{1}{2}$ to $3\frac{1}{2}$ in total length, length of head 4 to $4\frac{1}{4}$ times. Snout prominent; diameter of eye equal to length of snout, $3\frac{1}{2}$ to $3\frac{2}{3}$ times in length of head, interorbital width 3 times. Dorsal 12, originating a little nearer end of snout than base of caudal, the last rays above base of ventrals, longest rays $\frac{3}{4}$ length of head. Anal 8, longest rays $\frac{2}{5}$ length of head. Pectorals a little shorter than head. Ventrals not reaching vent. Caudal deeply forked. Scales 39-40 $\frac{5}{7}$, 5 between lateral line and base of ventral. Silvery, olive-brown on the back; seven or eight dark vertical bars on each side.

Total length 75 millim.

Several specimens from the Cali River, near Cali, Colombia, 3200 feet, collected by Mr. W. F. H. Rosenberg.

LXVII.—*Descriptions of Two new Snakes of the Genus Calamaria*. By G. A. BOULENGER, F.R.S.*Calamaria brachyura*.

Rostral a little broader than deep, visible from above; frontal longer than broad, more than twice as broad as the supraocular, shorter than the parietals; one præ- and one postocular; diameter of the eye equal to its distance from the mouth; five upper labials, third and fourth entering the eye, fourth smallest; first lower labial in contact with its fellow behind the symphysial; two pairs of chin-shields in contact with each other. Scales in 13 rows. Ventrals 201; anal entire; subcaudals 9. Dark grey-brown above, with six black longitudinal lines, which disappear on the anterior half of the body; two outer rows of scales black and white; a narrow yellow cross-band on the nape; head black above, with a small yellow spot on each præfrontal and parietal shield; upper lip white; lower parts white, with a black spot at the outer end of each ventral shield; a black line along the middle of the tail.

Total length 275 millim.; tail 8.

A single specimen from Mount Kina Balu, N. Borneo, collected by Mr. A. Everett.

Calamaria mindorensis.

Rostral a little broader than deep, visible from above; frontal longer than broad, twice as broad as the supraocular, shorter than the parietals; a præ- and a postocular; diameter of the eye equal to its distance from the mouth; five upper labials, third and fourth entering the eye; symphysial in contact with the anterior chin-shields; two pairs of chin-shields in contact with each other. Scales in 13 rows. Ventrals 193; anal entire; subcaudals 15. Brown above, with longitudinal series of black dots; a yellow spot on each side of the neck; a white spot on each scale of the outer row; upper lip and lower parts yellowish; a black spot at the outer end of each ventral; a black line along the middle of the tail.

Total length 240 millim.; tail 13.

A single specimen from Mindoro, Philippine Islands, collected by Mr. A. Everett.

LXVIII.—*Australian Entomophytes, or Entomogenous Fungi, and some Account of their Insect-Hosts.* By ARTHUR SIDNEY OLLIFF, Government Entomologist New South Wales, Fellow Ent. Soc. London, Life-Member Ent. Soc. France*.

THE Entomophytes, or Entomogenous Fungi, a remarkable group of parasitic plants which live upon and at the expense of various insects, appear to attain their highest development in Australia, Tasmania, and New Zealand. They may be said to be more or less familiar objects to the tourist, to whom dried but seldom perfect specimens are offered for a few pence, and for whose benefit wonderful stories are related as to their origin. At many of the smaller hostelrys bundles of specimens may be seen ready for the curiosity-seeker; and others are commonly to be obtained from the guides, both white and Maori, in the holiday resorts, especially in the hot-lakes district of Rotorua. These travellers' tales, to some of which we have alluded in detail, have a curious interest of their own, and are by no means confined to the casual observer. They have received currency even at the hands of entomologists and botanists, from whom some hesitation might have been expected in accepting the wild statements made by persons entirely ignorant of the habits and structure of both insects and fungi. It is singular that certain obviously erroneous statements regarding the identity of the hosts upon which these parasitic fungi thrive (although long since corrected by competent observers resident in the countries where the Entomophytes occur) should recur again and again in books of travel and in the writings of systematic entomologists. The worse offenders in this respect, as an examination of the literature of the subject will show, are the lepidopterists, especially those who confine themselves, with a mere pretence of an examination of structural characters, to describing the wing-markings and colouring of such specimens as come before them, a class from which we, in Australia, are unhappily not entirely free. Strangely enough, when other workers holding different views as to the value of the so-called species, established by these describers by methods which can only be compared to those employed in matching pieces of floor-cloth, find it desirable to combine or to disregard these alleged species, it is this very class of lepidopterists who

* From a separate pamphlet issued by the Department of Agriculture, New South Wales, for which we are indebted to the Author.

are loudest in their talk of the necessity for careful breeding of the insects and the observation of their habits and transformations, although wholly disregarding these points themselves. Truly where there is most noise there is least hurt, and it is not to this class of worker that we look for reliable information.

The first, and to this day (from the entomological point of view) the most complete, account of these insect-fungi was issued in 1858 by the late George Robert Gray, Assistant Keeper of the Zoological Department of the British Museum*. This memoir was privately printed, and bears only the writer's initials; but as it has had a tolerably wide circulation, and can be obtained from natural-history booksellers without much difficulty, it may be regarded, for all practical purposes, as having been duly published. It contains a very complete account of all the insects known to the author as being hosts of Entomophytes, or Entomogenous Fungi, and is the most important and original contribution on the subject that has yet appeared. The conspicuous and well-known group of fungi (*Cordyceps*) affecting the larvæ and pupæ of root-eating insects (the Australian species of which are the special subject of the present paper) are dealt with at considerable length; and the observations and conclusions regarding them, except in one particular to be noticed presently, may be accepted as accurate and reliable.

Thirty-four years later, in 1892, a more popular treatise on these parasitic fungi was published by Dr. M. C. Cooke †. In this handy and inexpensive volume, which is issued under the auspices of the Society for Promoting Christian Knowledge, will be found an excellent summary of all that was known of the Entomophytes, and it has a special value as coming from a recognized authority on the larger fungi. For the ludicrous title of the book we believe Dr. Cooke is not responsible. Presumably it is an inspiration of some luminary in the editorial office of the Society for Promoting Christian Knowledge, who, in striving after a popular designation, has succeeded in wholly hiding the subject of the book. It is almost needless to say that none of these fungi, or the insects upon which they live, have any connexion with worms; and

* Notices of Insects that are known to form the bases of Fungoid Parasites, by G. R. G.: pp. 22, with 5 plates. 4to, London (privately printed), 1858.

† 'Vegetable Wasps and Plant-Worms—a popular history of Entomogenous Fungi, or Fungi parasitic upon Insects,' by M. C. Cooke: pp. 354, with four plates and woodcuts. London, 1892. Here quoted as Hist. Ent. Fungi.

that if the term "plant-worm" has any meaning it should be applied to those minute eel-like worms, properly called Nematodes, which are the cause of numerous plant-diseases. In this work, as the author points out, a free use has been made of Gray's observations, and, indeed, as far as the larger species, which more particularly interest us, are concerned, Dr. Cooke's remarks are almost entirely based on the work of Gray. The whole subject, however, and the questions of the origin, habits, and mode of growth of these curious fungi, must obviously be investigated by the entomologist as well as the botanist before satisfactory conclusions can be arrived at; and it is from the botanist's point of view mainly that Dr. Cooke's observations have a special value. The classification put forward by him is here adopted, and the characters upon which the genus *Cordyceps* has been subdivided (the name given by Fries to the species which live as parasites on root-eating and truly subterranean insects) are taken from his work.

One of the fancy stories in regard to the origin of these fungi which has gained wide currency is that the seeds of the rata-tree (*Metrosideros robusta*) are swallowed by the caterpillar, that they then germinate, kill the caterpillar, and grow in the ordinary way. Some, indeed, are so firmly convinced that these vegetable caterpillars are the veritable roots of the trees, that instances have been known where they have been deliberately planted in the confident belief that a row of rata-trees would result. Another singular and equally erroneous belief is that the sweet-potato (*Convolvulus batatus*) may be grown in a similar way, a superstition which has probably arisen from the fact that the caterpillars of the large convolvulus hawk-moth (*Protoparce* or *Sphinx convoluti*, Linn.) have, by many ill-informed writers, been supposed to be the hosts of these fungi. This supposition, as far as I have been able to ascertain, has not a particle of evidence to support it, although it has gained considerable credence, particularly from observers in the early part of the century.

According to Pereira * a Chinese species (*Cordyceps sinensis*, Berk.) is used for medicinal purposes. He states that it is "used only in the Emperor's palace, as a strengthening and renovating substance, and is supposed to possess properties similar to those ascribed to ginseng †. It is recommended in cases where the powers or the system have been reduced by over-exertion or sickness. A duck is stuffed with five drachms of the fungus, and the bird roasted by a slow fire.

* Quoted by Gray, 'Notices of Insects, &c.,' p. 12.

† Another Chinese medicine.

The virtue of the fungus is supposed to pass into the flesh of the bird, which is to be eaten twice daily for eight or ten days." Unless it is to be supposed that the virtue is confined to those found in Chinese soil, here is a hint for the numerous Mongols in our midst.

Having referred to the old error that the hosts of the various species of *Cordyceps* are the caterpillars of hawk-moths of the family Sphingidæ, we have to notice another and more widely spread delusion with regard to the identity of their hosts which is equally erroneous. This is that the hosts are the larvæ of the large lignivorous Lepidoptera of the family Hepialidæ, known as *Charagia* or *Ænetus*; and the larvæ of certain species of Cossidæ (*Endoxyla*, *Zeuzera*, &c.), which are also wood-eaters. The larvæ of these insects, like those of the gigantic ghost-moth or bent-wing moth (*Zelotypia Stacyi*, Sc.), are lignivorous, living within the stems and branches of the various native trees and shrubs; and it is obvious that it would be impossible for large and highly developed fungi, such as *Cordyceps*, which are sometimes of large dimensions and which are frequently found growing at right angles to the axis of the body of their host, to grow within the narrow limits of the burrows made by these larvæ within their food-plants. With whom the mistake of associating the hosts with *Charagia* originated I have not been able to ascertain; but the error is an old one, as it occurs in the late Dr. George Bennett's 'Gatherings of a Naturalist in Australasia' * and in Gray's 'Notices,' &c., where the male of *Charagia virescens*, Walk. † (said by him to be the perfect stage of the host of the New Zealand fungus *Cordyceps larvarum*, Westw.), is figured; and the error recurs, although long since corrected, in the writings of Butler, Buchanan White, Steele, and Tisdall. As long ago as 1864 the late Mr. A. W. Scott ‡ corrected the error into which Dr. Bennett had fallen, and indicated the true hosts of the *Cordyceps*; but his observations appear to have been overlooked by subsequent writers. In treating of the genus *Pielus* Mr. Scott says:—"We are induced, as being applicable to the matter now in hand, to offer a few observations respecting those Australasian Lepidopterous caterpillars afflicted by *Sphæria* (*Cordyceps*) which have come under our notice, conceiving that this subject has hitherto been treated more in a botanical light than the one interesting to the entomologist; and to do so more effectually it is necessary to exhibit clear outlines of

* P. 288 (1860).

† *Charagia rubroviridens*, Walk., is the female of this moth.

‡ 'Australian Lepidoptera and their Transformations,' pp. 5 and 12.

some of the larvæ with which we are acquainted. By comparing these with the one similarly affected which we obtained here, and also with the delineation on the plate of the living larvæ, together with the appended observations of several writers, a fair conclusion can be arrived at respecting the genus of moth, which, in its two preparatory stages, is liable to the fatal attacks of this fungus. In order, therefore, to carry out the necessary comparison, we copy a lignified larva found at Barrabool Hills, Victoria, and the well-known New-Zealand species. To these we have added sketches of one obtained near Sydney by Mr. Shepherd, and another by ourselves at the Hunter River." Our author then proceeds to summarize the observations of Mr. W. H. Hawkes on *Cordyceps Hawkesii* found at Launceston, Tasmania; and the observations of Mr. John Allen and the Rev. R. Taylor on *Cordyceps Taylori* from Yass, New South Wales. In each case he concludes that the host is the caterpillar of a species of *Pielus*, and, after noting that in the case of the New Zealand form *Cordyceps larvarum*, the host has been incorrectly identified with the larvæ of *Charagia* by Hooker, Dieffenbach, Doubleday, and Taylor, he adds:—"We think it probable that the stems and trunks of the *Metrosideros* furnish sustenance for the larvæ of the *Charagia virescens*; but these live and undergo their metamorphoses *within* the wood, effectually protected against injury from this particular fungus; and it is equally probable that the *external* portions of the finer roots of the same or neighbouring plants afford nutriment to the larvæ of such genera as pass their lives wholly in the earth, a state of existence which would render them exposed to the attacks of the *Sphaeria (Cordyceps)*."

In my opinion we have in these remarks the truth of the matter, and I am inclined to go even further, and to assert that all the larger fungi of the genus *Cordyceps* live upon and at the expense of subterranean larvæ and pupæ. In support of this assertion I would point to the fact that all the bulky species of which the hosts are definitely known have been found on root-feeding insects. As instances I need only cite the Dynastidæ, Melolonthidæ, Elateridæ, and Lucanidæ amongst the beetles, *Cicada* amongst the Homoptera, and *Pielus* and *Trictena* amongst the moths. In all these cases the hosts are subterranean, and it follows that it is idle to speak of any connection between these parasitic fungi and the larvæ of wood-boring or foliage-eating and free-living insects. The best-known and the most abundant species are found on the early stages—larvæ and pupæ—of *Lepidoderma*, *Lepidiota*,

Rhyssonotus, *Cicada*, *Pielus*, and *Trictena*, all of which live underground at the roots of plants.

For an account of the general structure and development of the entomogenous fungi we cannot do better than turn to the writings of Dr. Cooke. This writer* says, "there are four groups under which the fungi parasitic upon insects would primarily arrange themselves, and these, in the order of their importance, would be: first, the ascigerous or *Cordyceps* group, which have mostly a fleshy stroma, a club-like shape, and sporidia contained in asci, including also those imperfect forms or conidial states which belong or are allied to *Isaria*. . . . The first group consists of . . . entomogenous species, to which at first the generic name of *Clavaria* was applied, until their structure and fructification were ascertained, but which were afterwards transferred to the large genus *Sphaeria*, on account of their possessing the cells called perithecia, in which the sporidia were developed, enclosed in long delicate sacs or asci. When a division of *Sphaeria* took place subsequently a new genus, termed *Cordyceps*, was characterized, to which the entomogenous species, with some few others, were assigned, on account of their fleshy vertical stroma and perithecia, with long filiform sporidia.

"The general and typical form in *Cordyceps* is a somewhat club-shaped erect body, sometimes only a few millimetres and sometimes several inches in height, with a naked, sterile, solid stem, attached by threads of mycelium, and a thicker head, globose, oval, or elongated, which is covered on all sides with nearly globose perithecia, immersed in the substance, and only visible externally by their dot-like mouths or orifices. In a few instances the perithecia are only partially immersed or nearly free, but such instances are rare. At first the perithecia contain only a minute drop of grumous gelatin, but finally this is differentiated into very long cylindrical asci, with a thin membrane, each containing eight long thread-like sporidia, which are commonly nucleate, then septate, breaking up finally into separate joints, each of which is a reproductive unit.

"The vegetative portion, or mycelium, at the base pervades the body of the host-insect, commencing in many instances during life, and at length absorbing the whole interior, converting it into a fungoid mass. The external stroma, constituting the fungus proper, notwithstanding all that has been written to the contrary, is not developed until the whole interior is absorbed, and consequently the insect is dead."

* Hist. Ent. Fungi, p. 1.

This quotation will serve to answer the question often asked in this country as to the truth of the statement that these large parasitic species of *Cordyceps* are found on living caterpillars. It may safely be asserted that they are not; after the germination of the spores, which, I believe, usually occurs in the stomach and intestines, the host-insect quickly dies, and life is certainly extinct long before the stem and other external parts of the fungus are developed.

[This is followed by a synopsis of the species, with descriptions of several new ones, accompanied with four Plates, to which we must refer the reader.—W. F.]

BIBLIOGRAPHICAL NOTICE.

Catalogue of the Marine Mollusks of Japan. By HENRY A. PILSBRY. 8vo. Frederick Stearns, Detroit; Kegan Paul, Trench, Trübner, & Co., London, 1895.

PROBABLY more attention has been bestowed upon the marine Molluscan fauna of Japan than upon that of any country, with the exception of Europe, N. America, and some of the British colonies. Within the last thirty-four years two more or less complete catalogues of the known forms were issued by the late Dr. W. Dunker, three very valuable and beautifully illustrated quarto volumes were published by the late Dr. C. E. Lischke, and an enormous number of genera and species were described by Mr. A. Adams from material which he himself collected. In addition, very numerous and important papers have appeared in various journals, and very many species have been described in monographic works and in the reports of the 'Samarang,' 'Challenger,' and other voyages.

The volume before us is the latest contribution to our knowledge of this fauna. It resulted "from the research incidental to the identification of the Mollusca procured by Mr. Frederick Stearns (the publisher) during two visits to Japan."

It consists of a few prefatory remarks by the author, a short introduction by Mr. Stearns, a list of the principal works quoted, and 196 pages of text, containing the list of species, with references and descriptions of about thirty new ones, illustrated by eleven excellent plates.

The whole of the text is not, however, devoted to the marine mollusks, as might be inferred from the title of the work. Only 154 pages have reference to that part of the Japanese fauna, the remainder containing two appendices, respectively on the "Land

and Freshwater Mollusks collected in Japan by Frederick Stearns," and on the "Mollusca in the Collection of Frederick Stearns from the Middle Loo-Choo Islands;" also a generic index and an explanation of the plates.

A Catalogue of this description is of enormous value to the student if it possesses the one all-important feature—completeness. Lacking this, its utility is in a great measure diminished. It is satisfactory to find that in the present Catalogue this condition has been in a great measure realized. To ensure no omissions, however, would be all but impossible, and entail enormous labour and research. One catalogue we have examined contains more than twenty species, quoted from Japan, which are unrecorded by Mr. Pilsbry; but as this was issued as recently as January 1894, it may have escaped the author's attention. It is possible that a few other oversights could be pointed out; but, considering the extent of the task, the author is to be congratulated on the success achieved. "The current generic nomenclature has been revised in certain cases;" but Professor Pilsbry appears to object to emended names, as *Rissoia* is still left *Rissoa*, *Scutum* remains *Scutus*, and *Solemya* is preferred to *Solenomya*. On p. 28 *Neptunea* has crept in in place of *Chrysodomus*, two species of *Macoma* have gone astray on p. 124, and certain untenable generic names, such as *Volvula*, *Aspergillum*, *Macrodon*, and *Leda*, are still retained.

The Catalogue is the most complete as yet published; it is issued in a convenient octavo form, very clearly printed, and the eleven plates, two of which are reproductions from the Proc. Acad. Nat. Sci. Philadelphia, 1891, are excellent. The artist is fortunate in possessing a "conchological eye," and seems to have caught the individuality of the numerous forms depicted.

To the student of Japanese Mollusca this useful work will be found indispensable.

MISCELLANEOUS.

On rapid Change of Colour in Gasterosteus. By JAMES DALLAS,
F.L.S., Curator of the Albert Memorial Museum, Exeter.

SOME time ago I made the following memorandum of observations upon a stickleback, which has until now been mislaid.

On the 28th January I obtained a solitary specimen of a stickleback (*Gasterosteus aculeatus*), which was placed in an aquarium at some distance from the window, and where consequently the light was at no time brilliant, and was generally dull. When first captured the fish was of a bright dark-greenish colour on the dorsal

and silvery white on the ventral surface. Towards the end of March it had lost its dark colour and was of a palish olive-yellow, but the red colour, which seems to be connected with the phenomena of reproduction, and which is frequently very vivid in full-grown males about the region of the head and gills, was slightly developed. On the 30th March my fish made a curious small excavation in the sandy bottom of the aquarium, and for the next two days I observed that it went frequently to this nest, apparently for the purpose of sexual deposition. On the 1st April I obtained a further supply of sticklebacks, which were placed in the aquarium on the evening of the same day. These were dark in colour, and presented a marked contrast to the pale yellow of the original tenant. It is needless to say that violent warfare ensued upon the introduction of the strangers. The nest was destroyed almost immediately, and its erstwhile proprietor devoted itself to making savage attacks upon the newcomers. On examining the pale-coloured individual about half an hour later it appeared to me, and to a friend who had throughout followed my observations, that it had assumed a somewhat darker hue, while in two hours it could not be distinguished from the darkest of the later introductions. We had, however, no difficulty in still recognizing the original specimen by certain habits it had acquired during its solitary confinement, and notably by the fact that it would attack the end of the finger or a pencil placed in the water, whereas the new arrivals immediately retreated.

This rapid and complete change of colour struck me as very remarkable, the more so as it seems quite impossible to account for it. No change was made in the quality of the water, nor was there any change in the quality or quantity of light, even for the shortest time, so that the alteration observed seems to be attributable solely to inexplicable sympathetic influence. I am not aware that such a change has heretofore been observed in any animal, and I thought it might be worth recording in your pages.

On Sexual Dimorphism in the Nautilus. By A. VAYSSIÈRE.

Our knowledge of the external sexual differences of Cephalopods is in many respects still deficient.

As I had the privilege, in 1887, of examining some specimens of *Nautilus macromphalus*, Sow., and this year of studying a certain number of *N. pompilius*, L., I have thought that it would be interesting to point out the external sexual dimorphism that is found to exist in these mollusks.

On examining a certain number of *Nautilus* shells, taking care to place them with their mouths facing us and the outer lips of the latter uppermost, we find that the shape of the mouth of the shell is somewhat variable. The orifice is sometimes ovoido-conical,

sometimes elliptical, no matter which of the two species we are examining.

If we then notice, as I have been able to do, what is the sex of the animal, we observe that all the individuals having the mouths of their shells broad and more or less rounded are males, and that those occupying the shells with ovoido-conical, that is to say laterally compressed, orifices are females.

It is true that between these two forms of orifice a few intermediate ones occur, but they generally approach the rounded shape and belong to young male individuals, or, at least, to those in which the copulatory organ is not very greatly developed. These differences in the shape of the orifice are due to the larger or smaller size of the spadix, which, situated on the right side of the buccal bulb, eventually equals the latter in bulk and requires a somewhat considerable space to contain it, while it even thrusts the bulb a little to the left. The presence of these two organs, placed side by side, thus gives to this portion of the body a breadth almost as great as that of the region situate on the level of the eyes.

In the female nothing of the kind takes place; the tips of all the tentacles can converge towards the same point without any difficulty, and this gives to the whole an elongate conical shape.

The last whorl of the *Nautilus* shell is consequently found to be more swollen in the males, while in the females it is more elliptical and has a slight tendency to be carinate; we may further add that the rim of the shell is a little more undulating in the females than in the males.

The appearance of the hood likewise varies according to the sex; it is necessary, however, to make allowance for the effects produced upon the tissues by the preservative fluids, and especially by the state of extension in which the animal was at the moment of being plunged into these fluids. If the animal was strongly retracted when it was placed in alcohol, its hood, instead of having a regular shape, is more or less twisted upon itself, in which case it is a matter of some difficulty to detect the sexual differences that may be exhibited by this portion of the body.

In the male the hood is broader, and, as Van der Hoeven very justly remarks, its breadth exceeds that of the female hood of equal length by nearly two centimetres: it follows from this condition that the lateral margins of the hood almost entirely conceal the eyes and the tentacles in the males, while in the opposite sex, since the hood is less extended transversely, the eyes, as well as the first pair, or sometimes the first two pairs, of tentacles, are quite uncovered. It may also be mentioned that in the females the margins of the hood are more sinuous and more incurvate at the level of the eyes.

As regards the mantle, which in the male, according to Van der Hoeven, is shorter and leaves the eyes almost uncovered, while according to the same author it extends higher up in the female, this organ did not exhibit these differences in the individuals that I

examined. If in some of these the mantle enveloped the pedal region to a smaller extent, this seemed to me to be entirely due to the bad condition of the visceral mass, which, pressing upon the bottom of the sac, caused the whole to recede from the pallial investment.

In the present note I pass over the sexual characters based upon the number, structure, and position of the tentacles, since it is my intention to deal with them shortly, and also because I would now insist only upon the characters that can be determined almost without the necessity of extracting the specimen from its shell.

These variations in the shape of the last whorl of the shell in *Nautilus macromphalus* and *N. pompilius* naturally lead us to inquire whether these indications could not be utilized in palæontology.

In the course of his investigations upon ammonites d'Orbigny put forward the theory, in 1841, that the variations in the size of the shell in these cephalopods, observed in the same species and among individuals of the same diameter, might be due to sexual differences; in his opinion the more swollen shells should belong to females.

This idea has been adopted by several naturalists, among whom I would mention especially P. Reynès. M. Douvillé likewise appears to entertain the same opinion.

M. Munier-Chalmas, the learned professor of the Sorbonne, while admitting the sexual dimorphism of the ammonites, which he regards as dibranchiate cephalopods allied to *Spirula*, does not entirely adopt d'Orbigny's point of view. To the differences in size he adds the presence in the males of jugal apophyses, which he considers to be wanting in the females. In an important note on "the possibility of admitting a sexual dimorphism in the ammonites," published in December 1892 in the 'Comptes rendus des séances de la Société géologique de France,' he shows that groups of ammonites may be considered as the males of other groups which would be the females (thus *Oecotraustes* would be the male of *Oppelia*, *Normanites* the male of *Cadomites*, &c.).

Without following this geologist into the study of the variations which he points out in a large number of types of Ammonitidæ, I would remark that, according to my observations upon ten specimens of *Nautilus* preserved in spirit, and also according to those made upon a very large number of shells belonging to the two most widely distributed species, *Nautilus pompilius* and *N. macromphalus*, the differences that are found to exist in the dimensions of the shell, although quite appreciable, are never very considerable, and that, as I have already stated, it is the shell of the male that, with an equal diameter, exhibits the larger size, contrary to that which, according to the geologists, is observed in the ammonites.

It would be of some interest to pursue investigations of this kind in the group of fossil Nautilidæ, in order to see whether in the shells of these cephalopods there do not exist variations in size sufficiently

constant in the same species to admit of a comparison with those which I have just described in the shells of the living *Nautilus*.—*Comptes Rendus*, t. cxx. no. 25 (June 24, 1895), pp. 1431–1434.

On the Structure of the Ectoderm and Nervous System in Parasitic Platyhelminthes (Trematodes and Cestodes). By LÉON JAMMES.

The results of my investigations upon the organization and development of Nematelminthes, which I have recently published, contain a detailed study of the ectoderm in these animals. The layer in question is constituted at its first appearance by a continuous epithelium, the superficial growth of which slackens at an early period. Stretchings result from this fact, and consequently a more and more complete dissociation of the entire layer. The cells preserve their epithelial character or become transformed into nerve-elements, fibrils, and granulations. The nerve-elements are differentiated on the spot. The fibrils result from the elongation, accompanied by a special transformation of the epithelial elements; they occupy the spaces left by the non-multiplication or cessation of growth of the cells of the primitive epithelium. The granules are due to the breaking-up of the fibrils. These different elements appear in varying proportions, according as one examines the successive stages of the same individual or of different individuals; they form a single and unique tissue, in which the nerve-elements remain scattered; the latter constitute, by their accumulation at various points of the body, the nervous regions of authors.

These investigations, extended to the Platyhelminthes, have enabled me to determine that the ectoderm of the latter exhibits in its structure numerous points of resemblance to its homologue in the Nematelminthes. We find in both cases epithelial cells, nerve-cells, fibrils, and granulations. Certain authors have described a layer applied to the cuticle; on account of its appearance they have called it *granular*; but by the greater number of them it has been assigned to the mesoderm. This layer really corresponds to the ectoderm, transformed by processes similar to those which I have described in the case of the Nematelminthes.

My investigations have been made upon a Trematode, *Distoma hepaticum*, and upon two Cestodes, *Tenia solium* and *Tenia inermis*. The continuous descriptions of the nervous system of these animals are not such as to enable us to understand its relations to the rest of the ectoderm. Authors have constantly sought to isolate it and to give it definite and precise contours. The regularly increasing complications which they have described in its structure, in proportion as fresh nervous points were recognized, have led us to imagine the existence of a complex framework capable of uniting all the nervous elements distributed in the bodies of these animals. In

reality the nervous system has no definite outlines; the regular arrangements, consisting of sharply defined rings and of divergent cords, which have been attributed to it, cannot be considered as an expression of facts. The apparatus is diffuse and united with the rest of the ectoderm.

In *Distoma hepaticum* the nervous elements present in the various parts of the body appear especially numerous in the cephalic region and at the level of the genital sinus. Around the pharynx in particular we see them surrounding the passage and filling the rounded groove bounded by the external face of this organ and the inner surface of the cuticle enveloping the body. The special reagents show that this mass of nerve-elements, instead of having definite outlines, merges at its margins into the granular layer. The nerves of authors are nothing else than thickenings of this same tissue. It follows that *Distoma hepaticum* possesses, in place of a nervous system consisting of a principal centre (cerebral ganglia) and dependent parts, a fibro-cellular ectoderm in which nerve-elements exist at places, while these elements are especially developed in the regions in communication with the exterior, *i. e.* mouth and genital sinus.

The same state of things exists in the Cestodes which I have studied. Only the changes undergone by the ectodermal layer are perhaps easier to grasp because they appear at different stages in the same individual and according to the age of the segments.

The history of the granular layer of the Platyhelminthes is the same in its general features as that of the ectoderm in the Nematelminthes. Authors have sought at the outset to isolate the nervous system by distinguishing in it centres and dependent parts; this course tended to make of the apparatus of communication an autonomous whole, which it was necessary to delimit. The study of its relations to the ectoderm, which I hope to be able to complete, shows, on the contrary, its entire continuity with the latter, and even thereby obliterates the contours which determined it.

This structure of the ectoderm, common to Platyhelminthes and Nematelminthes, is to be connected with the presence in all these animals of a thick and resistant cuticle; I have already insisted upon this point in my paper on the Nematelminthes; I believe that I am confronted with a histological structure, connected with the existence of an impermeable envelope, which almost suppresses or, in all cases, greatly modifies the relations of the ectoderm to the external medium*.—*Comptes Rendus*, t. cxxi. no. 5 (July 29, 1895), pp. 268-270.

* This paper was prepared at the Natural History Laboratory of the Faculty of Sciences of Toulouse.

INDEX TO VOL. XVI.

- ABRA, new species of, 10.
 Acidalia, new species of, 331.
 Acodon, new species of, 369.
 Acræa, new species of, 271; note on *A. cynthius*, Drury, 271.
 Actinopus, new species of, 195.
 Agama, new species of, 167.
 Alcock, A., on a new species of viviparous fish, 144.
 Alcyonicola, characters of the new genus, 357.
 Allobophora fœtida, on the breeding-habits of, 202.
 Amalitsky, Prof. W., on a comparison of the Permian freshwater Lamellibranchiata from Russia with those from the Karoo formation of Africa, 198.
 Amastus, new species of, 37.
 Amauris, new species of, 122.
 Ambia, new species of, 299, 344.
 Ammodiscus, new species of, 319.
 Ammodytes tobianus, on the life-history and growth-rate of, 282.
 Amphipoda, notes on, 205.
 Andrews, C. W., on the structure of the skull in *Peloneustes philarchus*, 242; on the pectoral and pelvic girdles of *Murænosaurus plicatus*, 429.
 Andrews, E. A., on the breeding-habits of the crayfish, 201; on the breeding-habits of the earthworms, 202.
 Anemesia, characters of the new genus, 194.
 Annelids commensal on *Astræopora*, on some, 280.
 Anthypna, new species of, 338.
 Aparallactus, new species of, 172.
 Apicia, new species of, 330.
 Aplysia, on the status of the name, 424.
 Apogonia, new species of, 395.
 Arachnida, new, 78, 139, 187.
 Araneidæ of New South Wales, on some new, 352.
 Archilestes, new species of, 20.
 Arthrosphæra, characters of the new genus, 410.
 Ascomyzontidæ, on the Copepod family, 173.
 Aserica, characters of the new genus, 394.
 Astacus fluviatilis, on the development of the body in, 127.
 Astræopora, on the Madreporarian genus, 273; relation of to *Turbinaria*, 279.
 Athemus, characters of the new genus, 110.
 Athous, new species of, 407.
 Attalus, new species of, 117.
 Aulacophora, new species of, 300.
 Austen, E. E., on *Cutiterebra*, 147.
 Aysha, new species of, 140.
 Bathybembix, new species of, 7.
 Batomys, characters of the new genus, 162.
 Batrachia, new, 169.
 Beddard, F. E., on *Perichætæ* from the Eastern Archipelago, 69.
 Benham, Dr. W. B., on some Javan *Perichætidæ*, 40.
 Bernard, H. M., on the systematic position of the Trilobites, 199; on the Madreporarian genus *Astræopora*, 273.
 Bingham, Lieut.-Col. C. T., on Hymenopterous insects from the Philippines, 433.
 Biurus, new species of, 114.
 Bocchoris, new species of, 302.
 Books, new:—Pilsbry's *Manual of Conchology*, vol. ix., 123; J. K. and A. B. Comstock's *Manual for the Study of Insects*, 266; Pilsbry's *Catalogue of the Marine Mollusks of Japan*, 488.
 Bostra, new species of, 300.
 Botryllus Gouldii, the bud-development of, 221.
 Boulenger, G. A., on reptiles and batrachians from New Guinea, 28; on reptiles from the Niger, 32; on reptiles and batrachians from Somaliland, 165; on new batrachians from Borneo, 169; on two new E. African snakes, 171; on cranial characters distinguishing lizards from snakes, 366; on new Reptiles from New Guinea, 408; on a new species of *Parodon*, 480; on two new species of *Calamaria*, 481.

- Bradypontius, characters of the new genus, 182.
 Bryozoa, revision of the Jurassic, 447.
 Butler, Dr. A. G., on a new species of *Amauris*, 122; on *Acræa cynthius*, Drury, 271; on new species of *Planema*, 415.
 Cælius, characters of the new genus, 381.
 Cænolestes, definition of the new generic name, 367.
 Calamaria, new species of, 481.
 Calliostoma, new species of, 8.
 Callirhipis, new species of, 159.
 Cambarus affinis, on the breeding-habits of, 201.
 Cambridge, F. O. P., on stridulating-organs in the genus *Scytodes*, 371.
 Cambridgea antipodiana, on a new sound-producing organ in, 230.
 Capulus, new species of, 264.
 Carpomys, characters of the new genus, 161.
 Castanotherium, characters of the new genus, 413.
 Cataclysta, new species of, 304, 343.
 Cavifrons, new species of, 474.
 Celsus, characters of the new genus, 118.
 Ceratogomphus, new species of, 349.
 Ceratopyga, characters of supposed new genus, 350.
 Cerceis, new species of, 443.
 Chæto gnaths, on two new, 288.
 Chalcidoptera, new species of, 303.
 Chapman, F., on *Rhætic Foraminifera* from Wedmore, 200, 305.
 Chloroclystis, new species of, 294.
 Chrotomys, characters of the new genus, 161.
 Chrysocraspeda, new species of, 294.
 Clausomyzon, characters of the new genus, 177.
 Cleobis, new species of, 96.
 Coccidæ, on some, from Antigua, 60; on some genera and species of, 129.
 Cockerell, T. D. A., on some Coccidæ from Antigua, 60; on new species of *Halictus*, 63.
 Cœlioxys, new species of, 439.
 Coleoptera, new, 35, 98, 157, 374.
 Columbella, new species of, 5.
 Comaria, new species of, 466.
 Conant, F. S., on two new *Chæto gnaths*, 288.
 Copepoda, on new and rare British, 353.
 Cordyceps, notes on the genus, 484.
 Coremia, new species of, 297.
 Cotachena, new species of, 470.
 Crambus, new species of, 349.
 Crassatella, new species of, 265.
 Crateromys, characters of the new genus, 163.
 Crawford, Rev. J. H., on the *Hydroids* of St. Andrews, 256.
 Crayfish, on the breeding-habits of the, 201.
 Crocidura, new species of, 51.
 Crowley, P., on a new species of *Symphædra*, 437.
 Crustacea, new, 178, 207, 353.
 Cryptodon, new species of, 13.
 Cryptus, new species of, 444.
 Cuspidaria, new species of, 12.
 Cutiterebra, notes on the genus, 147.
 Cylindrus, on the systematic position of the genus, 155.
 Cyliosoma, characters of the new genus, 414.
 Cyphonocerus, new species of, 115.
 Cyrtogrammomma, characters of the new genus, 139.
 Dactylopius, remarks on the genus, 129.
 Dallas, J., on rapid change of colour in *Gasterosteus*, 489.
 Dascillidæ of Japan, on the, 98.
 Dasytes, new species of, 118.
 Dendrelaphis, new species of, 409.
 Dendrophis, new species of, 32.
 Dentalium, new species of, 9.
 Dermatomyzon gibberum, remarks on, 357.
 Desis, on the systematic position of the genus, 143.
 Diatræa, new species of, 349.
 Digonophorus, characters of the new genus, 157.
 Diplacanthopoma, new species of, 144.
 Discothyris, characters of the new genus, 473.
 Distoma hepaticum, on the structure of the ectoderm and nervous system in, 493.
 Drilaster, new species of, 115.
 Drillia, new species of, 4.
 Dromophis lineatus, remarks on, 33.
 Druce, H., on new *Heterocera*, 36.
 Drupeus, characters of the new genus, 102.
 Dyspontiinæ, characters of the new subfamily, 180.
 Dyspontius, new species of, 185.

- Earthworms, on the breeding-habits of the, 202.
- Echmatophorus, characters of the new genus, 158.
- Elianus, characters of the new genus, 113.
- Eliurus, new species of, 164.
- Endotrichopsis, characters of the new genus, 467.
- Ennea, new species of, 478.
- Enterocola, new species of, 359.
- Entomophytes, observations on Australian, 482.
- Entomostraca, notes on the Palæozoic bivalved, 452.
- Epilichas, new species of, 100.
- Epiplema, new species of, 293.
- Epiplemidæ, new Indian, 293.
- Erythrolophus, new species of, 294.
- Eubrianax, new species of, 104.
- Eupithecia, new species of, 295.
- Fedarb, S. M., on Perichætæ from the Eastern Archipelago, 69.
- Fishes, new, 144, 480.
- Foraminifera, on Rhætic, from Wedmore, 200, 305.
- Fungi, on Australian entomogenous, 482.
- Galeodes, new species of, 78.
- intrepidus, on the name of, 270.
- Gallopontius, characters of the new genus, 184.
- Gasterosteus, on rapid change of colour in, 489.
- Geological Society, proceedings of the, 198, 270.
- Geometridæ, new Indian, 293; new West Indian, 329.
- Georychus, new species of, 238.
- Giesbrecht, Dr. W., on the Copepod family *Ascomyzontidæ*, 173.
- Gluvia, new species of, 94.
- Godwin-Austen, Lieut.-Col. H. H., on a supposed new species of land-mollusk, 434.
- Goto, S., on the origin of the bell-nucleus in *Physalia*, 203; on the protoplasmic connexion of lasso-cells in *Physalia*, 271.
- Gregory, Dr. J. W., revision of the Jurassic Bryozoa, 447.
- Grotella, new species of, 38.
- Gymnoscelis, new species of, 296.
- Halictus, new species of, 63.
- Hampson, G. F., on Heterocera from the Lesser Antilles, 329.
- Haplophragmium, new species of, 314.
- Haritala, new species of, 334.
- Hedley, C., on the synonymy of *Rhysota Armiti*, 201.
- Helicidæ, on a new Pupoid type of, 155.
- Helicina, new species of, 365.
- Helix, new species of, 364.
- Helodes, new species of, 106.
- Hill, W., on the occurrence of *Radiolaria* in Chalk, 270.
- Holodactylus africanus, note on, 166.
- Homophysa, new species of, 333.
- Hoplia, new species of, 389.
- Horatocera, characters of the new genus, 35.
- Hydroids of St. Andrews Bay, on the, 256.
- Hydrophysa, new species of, 343.
- Hymenoptera, new, 63, 438.
- Hypsopygia, new species of, 301.
- Hyracodon, new species of, 367.
- Ichthyurus, new species of, 114.
- Islopha, characters of the new genus, 346.
- Isocentris, new species of, 472.
- Jammes, L., on the structure of the ectoderm and nervous system in parasitic Platyhelminthes, 493.
- Jones, Prof. T. R., on Carboniferous Ostracoda from Yorkshire, 452.
- Jukes-Browne, A. J., on the occurrence of *Radiolaria* in Chalk, 270.
- Kirkby, J. W., on Carboniferous Ostracoda from Yorkshire, 452.
- Lachnosterna, new species of, 396.
- Laius, new species of, 116.
- Lamellibranchiata, on a comparison of the Permian freshwater, from Russia with those from the Karoo formation of Africa, 198.
- Lamellicornia of Japan, on the, 374.
- Lecanium, new species of, 61.
- Lefevre, G., on budding in *Pero-phora*, 213.
- Lemboides, characters of the new genus, 209.
- Lembos, new species of, 207.
- Lepidoplaga, characters of the new genus, 475.
- Lepidoptera, new, 36, 122, 271, 293, 329, 415, 437, 461.
- Lestes, new species of, 23.
- Leucocraspeda, new species of, 472.
- Leucosolenia, on the origin of the triradiate spicules of, 427.
- Lewis, G., on the Japanese Rhipido-

- ceridæ, 35; *Dascillidæ* and *Malacodermidæ*, 98; *Lamellicornia*, 374.
- Lichonycteris*, characters of the new genus, 55.
- Lima*, new species of, 18.
- Lizards, on cranial characters distinguishing, from snakes, 366.
- Lomanoticola*, characters of the new genus, 360.
- Loxocorys*, new species of, 300.
- Lygosoma*, new species of, 29, 408.
- Mabra*, new species of, 302.
- M'Lachlan, R., on new species of *Odonata*, 19.
- Malachius*, new species of, 117.
- Malacodermidæ* of Japan, on the, 108.
- Malletia*, new species of, 17.
- Malthodes*, new species of, 115.
- Mammals, new, 51, 55, 160, 164, 197, 238, 242, 367.
- Maraxes*, characters of the new genus, 376.
- Marine animals, on the dispersal of, by means of seaweeds, 418.
- Maskell, W. M., on some genera and species of *Coccidæ*, 129.
- Masterman, A. T., on the life-history and growth-rate of the lesser sand-eel, 282.
- Melipona*, on the production of males and females in, 125.
- Melville, J. C., on new species of *Ennea*, 478.
- Microcausta*, characters of the new genus, 340.
- Micromesomma*, characters of the new genus, 190.
- Mimocomma*, characters of the new genus, 473.
- Mitchin, E. A., on the origin of the triradiate spicules of *Leucosolenia*, 427.
- Mollusca, new, 1, 263, 362, 434, 478.
- Monocrocis*, characters of the new genus, 475.
- Murænosaurus plicatus*, on the pectoral and pelvic girdles of, 429.
- Mus, new species of, 163.
- Mygalomorphæ* in the British Museum, on the identity of some of the types of, 223.
- Myoscalops*, note on the species of, 241.
- Myriapoda, new, 409, 423.
- Myzopontius*, characters of the new genus, 182.
- Naia*, new species of, 34.
- Nanina*, new species of, 363.
- Nassa*, new species of, 5, 263.
- Natica*, new species of, 6.
- Nautilus*, on sexual dimorphism in the, 490.
- Nectophryne*, new species of, 171.
- Nemoria*, new species of, 333.
- Neocteniza*, characters of the new genus, 193.
- Neurophyseta*, characters of the new genus, 333.
- Newton, E. T., on a human skull and limb-bones from Galley Hill, 199.
- Niphopyralis*, new species of, 299.
- Nodosinella*, new species of, 319.
- Notaspis*, new species of, 302.
- Nucula*, new species of, 15.
- Nuculana*, new species of, 16.
- Nunney, W. H., on a new species of *Odonata*, 349.
- Odonata*, new, 19, 349.
- Oligolepis*, characters of the new genus, 171.
- Olliff, A. S., on Australian Entomophytes, 482.
- Omineus*, characters of the new genus, 119.
- Onthophagus*, new species of, 378.
- Ophidiidæ*, on a new species of, 144.
- Ophitis*, new species of, 38.
- Oreophrynella*, definition of the new generic name, 125.
- Orolestes*, characters of the new genus, 21.
- Ortholestes clara*, new variety of, 19.
- Orthopygia*, new species of, 464.
- Oryzomys*, new species of, 58, 368.
- Ostracoda*, on some Carboniferous, from Yorkshire, 452.
- Oxyomus*, new species of, 383.
- Pachybotys*, characters of the new genus, 476.
- Pachynoa*, new species of, 39.
- Pachypalpia*, characters of the new genus, 345.
- Pachyzancla*, new species of, 342.
- Palaemon serratus*, on the development of the body in, 127.
- Panelus*, characters of the new genus, 375.
- Paracleobis*, definition of new genus, 95.
- Paracymoriza*, new species of, 304.
- Paralichas*, new species of 99.
- Paranigas*, characters of the new genus, 188.
- Paratrachus*, new species of, 406.

- Parlatoria Pergandei*, new variety of, 62.
Parmarion, new species of, 435.
Parodon, new species of, 480.
Peloneustes philarchus, on the structure of the skull in, 242.
 Perez, J., on the production of males and females in *Melipona* and *Trigona*, 125.
Perichæta, new species of, 41, 69.
Perichætidae, on some Javan, 40.
Perisseretma, characters of the new genus, 468.
Perophora, on budding in, 213.
Petta, characters of the new genus, 469.
Phenacoccus yuccæ, new variety of, 61.
Pholadidæ, on the development of the, 233.
Phycita, new species of, 347.
Physalia, on the origin of the bell-nucleus in, 203; on the protoplasmic connexion of lasso-cells in, 271.
Pilsbry, H. A., on a new Pupoid type of *Helicidæ*, 155; on the status of the names *Aplysia* and *Tethys*, 424.
Pimpla, new species of, 445.
Pionea, new species of, 340.
Planchonia, remarks on the genus, 134.
Planema, new species of, 415.
Platyhelminthes, on the structure of the ectoderm and nervous system in parasitic, 493.
Pleonectusa, new species of, 301.
Pleurotoma, new species of, 3.
Pocock, R. L., on some Solifugæ in the British Museum, 74; on two new spiders from Mt. Roraima, 139; on new genera and species of trapdoor spiders, 187; on some of the types of *Mygalomorphæ* in the British Museum, 223; on a new sound-producing organ in a spider, 230; on the name of *Galeodes intrepidus*, 270; on new genera of *Zephroniidae*, 409; on a new species of *Scolopendra*, 423.
Podabrus, new species of, 109.
Ponsonby, J. H., on new species of *Ennea*, 478.
Pontiothauma, characters of the new genus, 2.
Pontæciella, characters of the new genus, 186.
Popilia, new species of, 403.
Prionocyphon, new species of, 105.
Pristurus, new species of, 165.
Proboscina, observations on the genus, and new species of, 447.
Psammodius, new species of, 384.
Pteropontius, characters of the new genus, 184.
Ptilodactyla, new species of, 107.
Pupina, new species of, 364.
Pupinella, new species of, 365.
Pyralidæ, new Indian, 299; new West-Indian, 329; new genera and species of, 461.
Pyralis, new species of, 464.
Radiolaria, on the occurrence of, in chalk, 270.
Rainbow, W. J., on some New South Wales *Araneidæ*, 352.
Reptilia, new, 28, 32, 165, 171, 408, 481.
Rhacophorus, new species of, 169.
Rhax, new species of, 91.
Rhectothyris, new species of, 471.
Rhipidoceridæ, on the Japanese, 35.
Rhizotrogus, new species of, 399.
Rhodoneura, new species of, 298.
Rhodostrophia, new species of, 331.
Rhynchomys, characters of the new genus, 160.
Rhynchomyzon, characters of the new genus, 177.
Rhysota Armiti, on the synonymy of, 201, 351.
Robinsonia, new species of, 36.
Roule, L., on the development of the body in the prawn and the crayfish, 127.
Sagitta, new species of, 290.
Samea, new species of, 336.
Sameodes, new species of, 303.
Sand-eel, on the life-history and growth-rate of the lesser, 282.
Saprosites, new species of, 382.
Scirtes, new species of, 105.
Sciurus, new species of, 197, 242.
Scolia, new species of, 441.
Scolopendra, new species of, 423.
Scott, T. and A., on new and rare British Copepoda, 353.
Scytodes, on stridulating-organs in the genus, 371.
Seaweeds, on the dispersal of marine animals by means of, 418.
Senoclia, new species of, 446.
Serica, new species of, 391.
Sericania, new species of, 390.

- Shrews, on new African, 51.
 Sigaretus, new species of, 7.
 Sigerfoos, C. P., on the development of the Pholadidæ, 233.
 Silis, new species of, 112.
 Simocephalus, new species of, 33.
 Skull and limb-bones from Galley Hill, on a human, 199.
 Smith, E. A., on Mollusca from the Bay of Bengal &c., 1, from the Arabian Sea, 262; on Rhysota Armiti, 351; on new land-shells from New Guinea, 362.
 Snakes, on cranial characters distinguishing lizards from, 366.
 Solifugæ, notes on some, 74.
 Solpuga, new species of, 83.
 Spadella, new species of, 288.
 Sphæropœus, synopsis of the species of, 412.
 Sphærotherium, new species of, 410.
 Spider, on a new sound-producing organ in a, 230.
 Spiders, new genera and species of Trapdoor, 187.
 Spilodes, new species of, 474.
 Stacheia, new species of, 322.
 Stebbing, Rev. T. R. R., notes on Amphipoda, 205.
 Stegonotus, new species of, 31.
 Stenmatophora, new species of, 466.
 Stenhelia, new species of, 353.
 Stenophyes, new species of, 339.
 Stericta, new species of, 461.
 Stickleback, on rapid change of colour in the, 489.
 Streptopalpia, characters of the new genus, 345.
 Surattha, new species of, 301.
 Swinhoe, Col. C., on new Indian Lepidoptera, 293.
 Syllithria, new species of, 471.
 Symphædra, new species of, 437.
 Syngamia, new species of, 337.
 Tænia, on the structure of the ectoderm and nervous system in species of, 493.
 Telephorus, new species of, 111.
 Tellina, new species of, 10.
 Teredo, on the development of species of, 235.
 Tethys, on the status of the name, 424.
 Thalestris peltata, remarks on, 354.
 Thomas, O., on new African shrews, 51; on small mammals from Nicaragua &c., 55; on new mammals from Northern Luzon, 160; on a new species of Eliurus, 164; on African mole-rats of the genera Georychus and Myoscalops, 238; on a new Chinese squirrel, 242; on new mammals from South America, 367.
 Thyrididæ, new Indian, 298.
 Thyropœus, characters of the new genus, 191.
 Torda, new species of, 345.
 Trichophyssetis, new species of, 470.
 Trigona, on the production of males and females in, 125.
 Trilobites, on the systematic position of the, 199.
 Trionychi, new genera and species of, 187.
 Trox, new species of, 387.
 Truncatulina, new species of, 327.
 Vallentin, R., on the dispersal of marine animals by means of seaweeds, 418.
 Vayssière, A., on sexual dimorphism in the nautilus, 490.
 Venus, new species of, 9.
 Warren, W., on new genera and species of Pyralidæ, 460.
 Waterhouse, C. O., on new Coleoptera, 157.
 Winton, W. E. de, on a new squirrel, 197.
 Xerasia, characters of the new genus, 120.
 Xeromys, new species of, 161.
 Xiridava, new species of, 296.
 Youngiella, definition of the new generic name, 452.
 Zamarada, new species of, 293.
 Zephronia, new species of, 413.
 Zephroniidæ, descriptions of new genera of, 409.
 Zoospærium, characters of the new genus, 410.

END OF THE SIXTEENTH VOLUME.

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 RED LION COURT, FLEET STREET.



3.



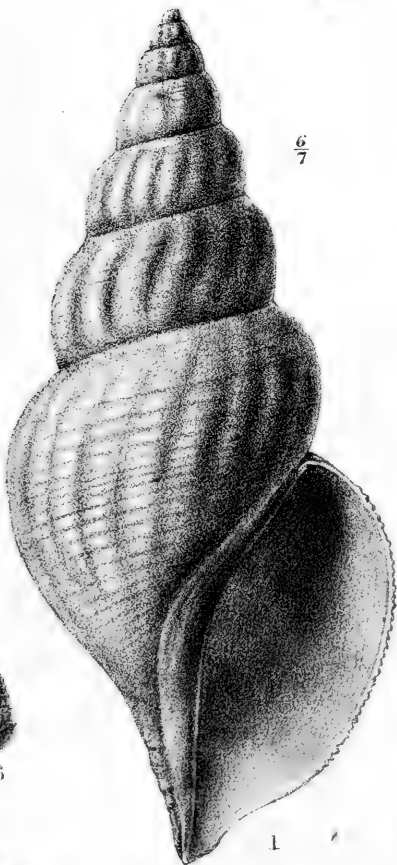
4.



2.



5.



1.

$\frac{6}{7}$



5a.



7.



9.



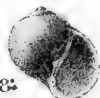
6.



10.



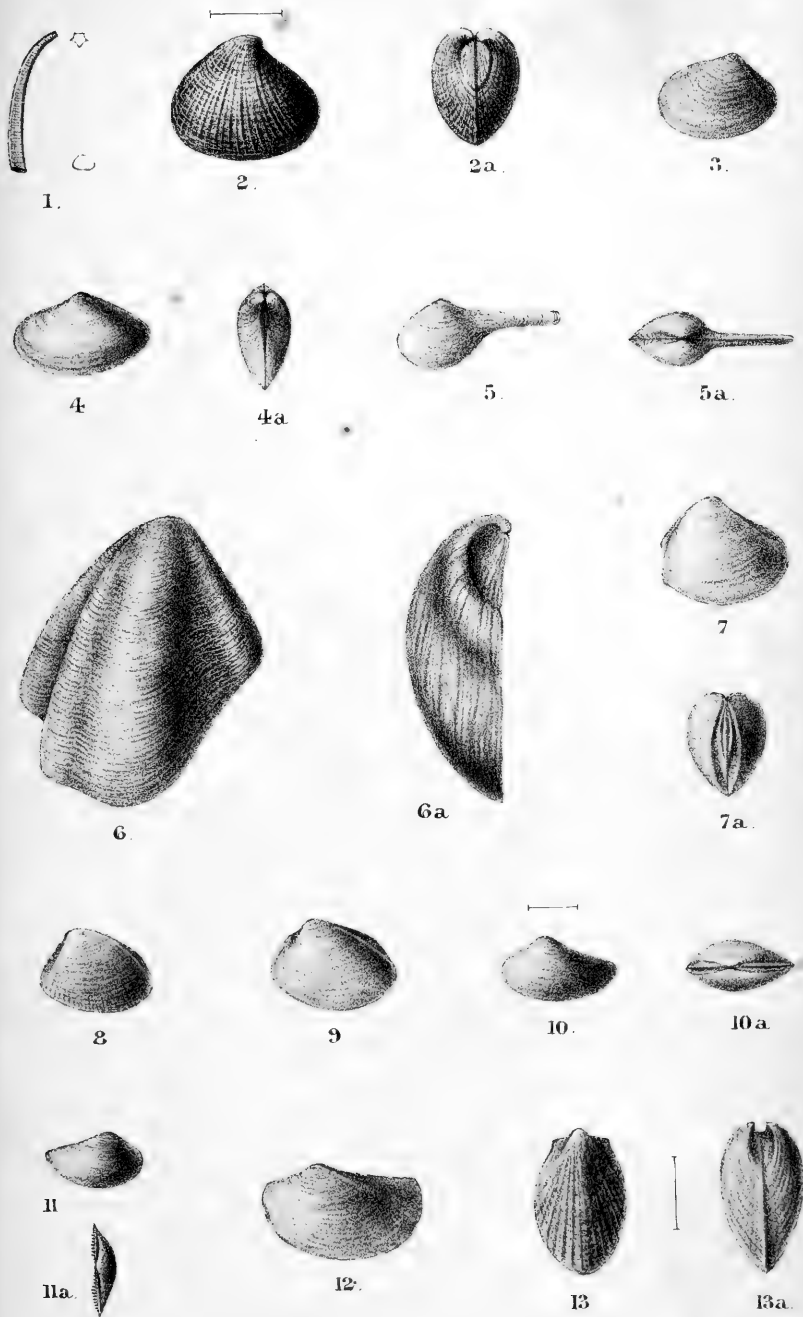
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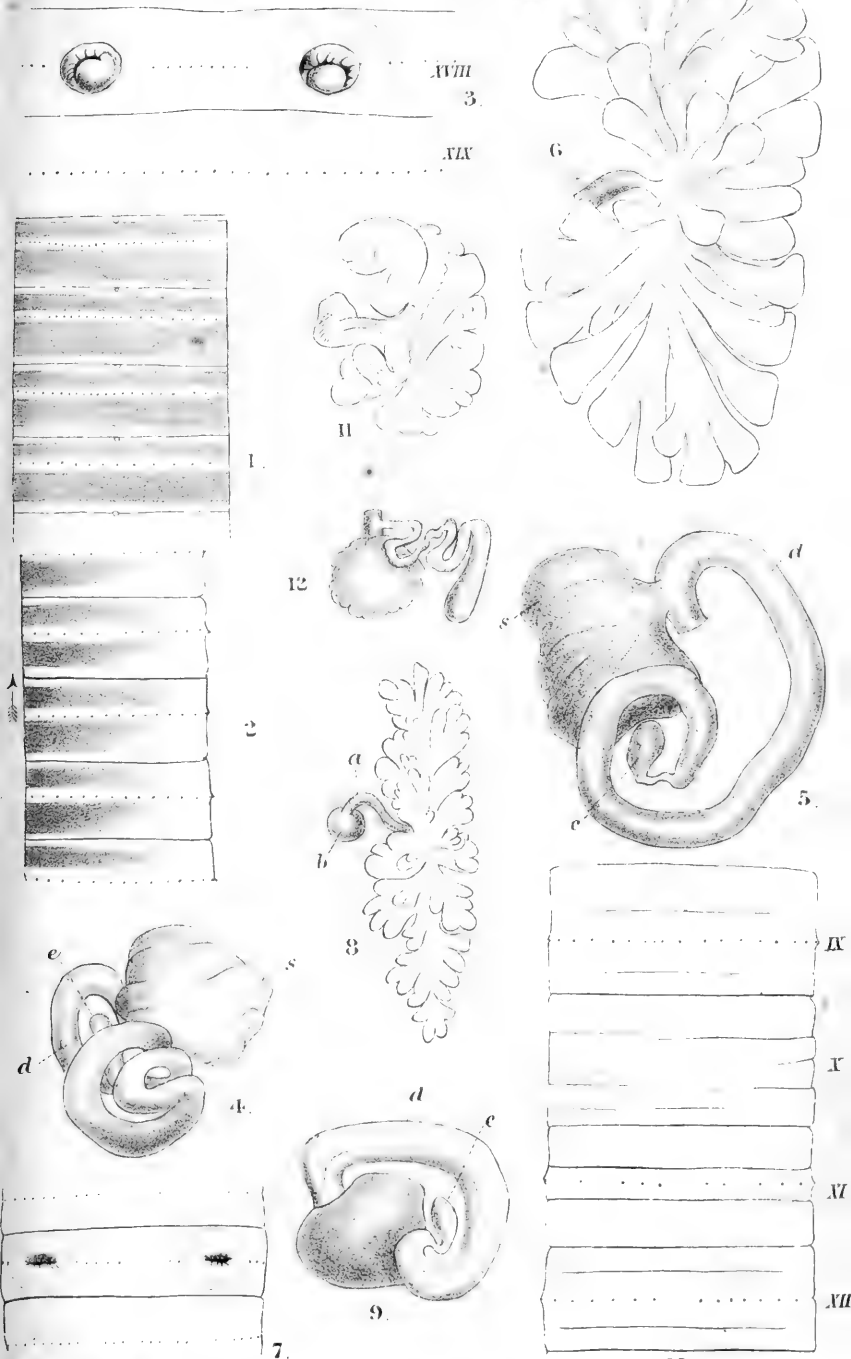


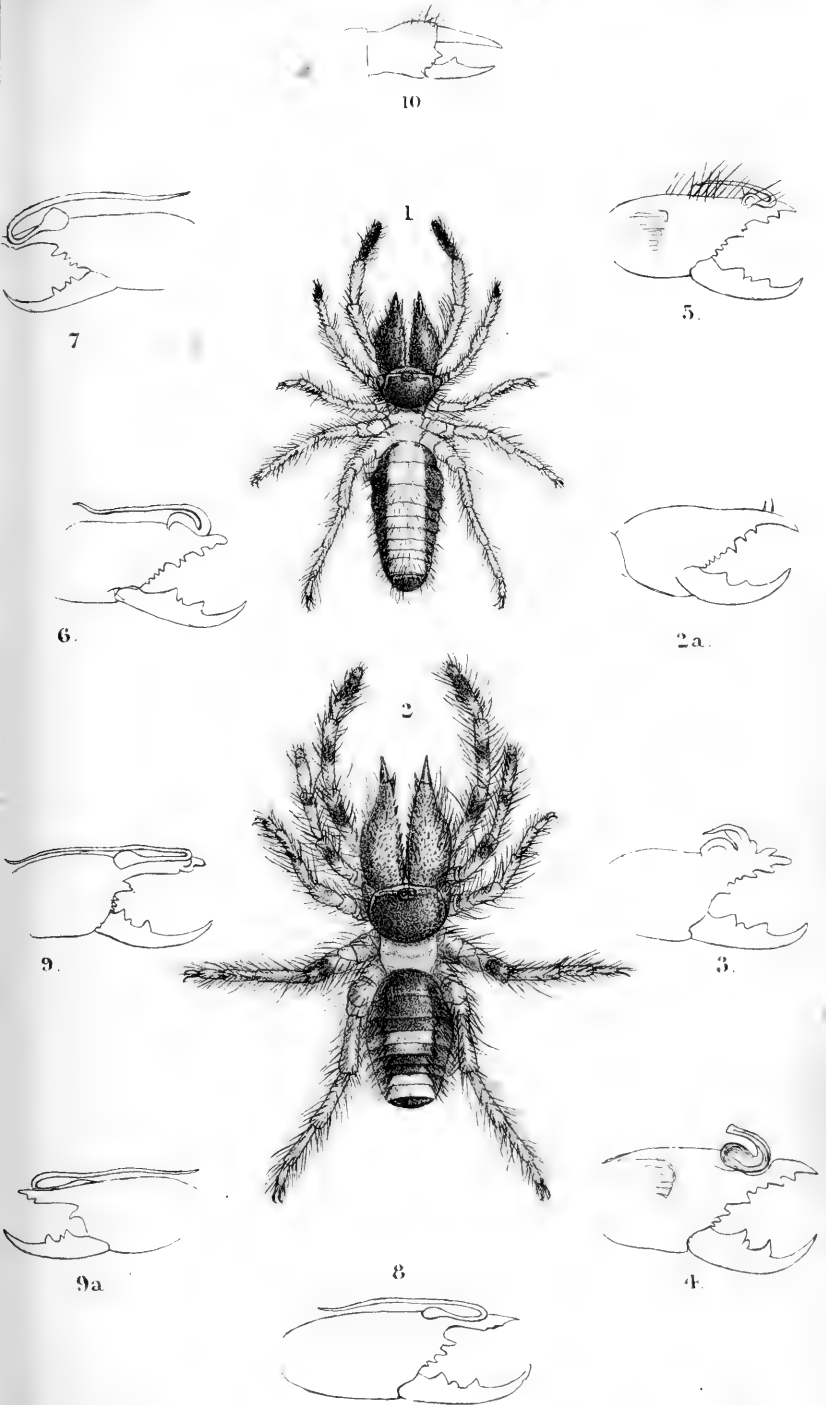
8.



12.



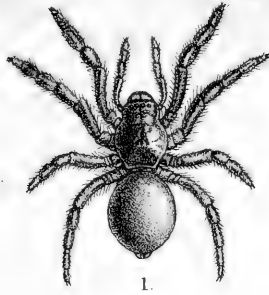




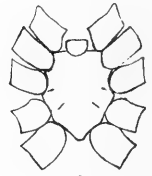
Mintern. Bros. lith.

NEW SOLIFUGÆ





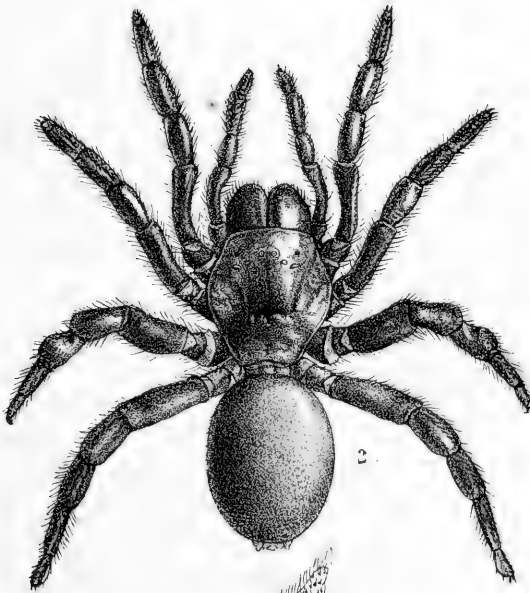
1.



4.



3a.



2.



2a.



3b.



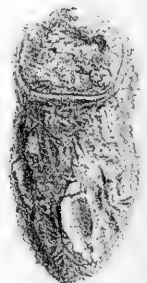
2b.



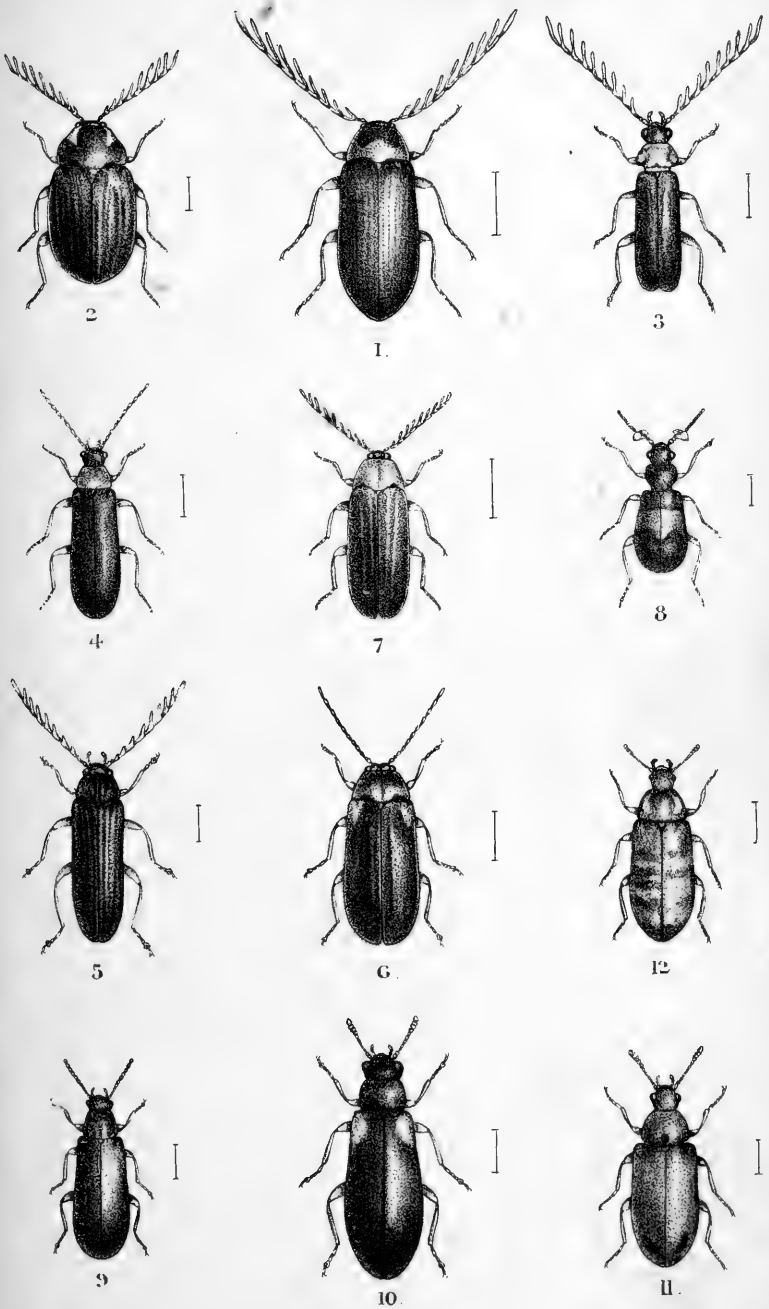
1b.



3.



1a.



M.H. Fisher del. et lith

Minterr. Bros. imp



1a



1



2.



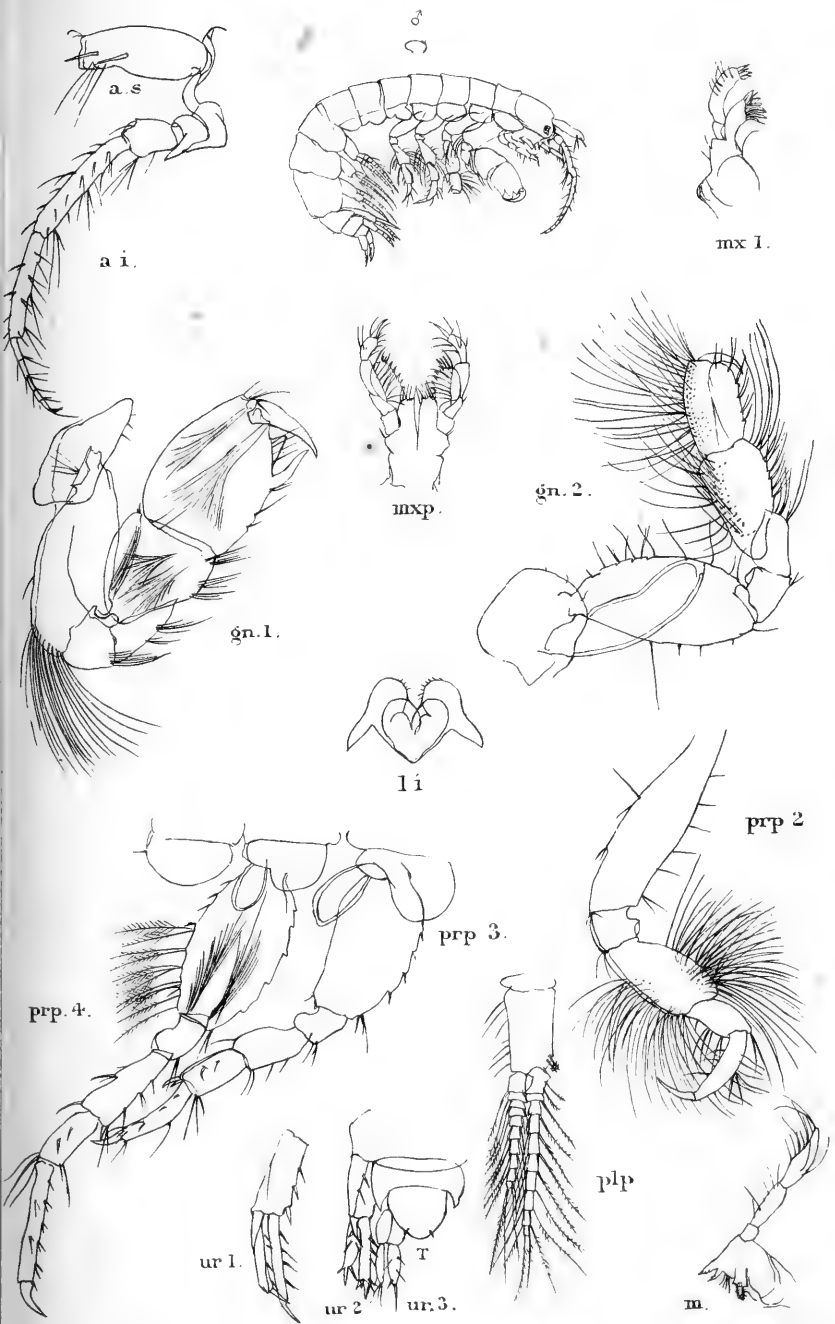
3

Mintern Bros. del et lith.

1. PRISTURUS PHILLIPSII.

2. HOLODACTYLUS AFRICANUS.

3. AGAMA PHILLIPSII.



I.R.R. Stebbing del.

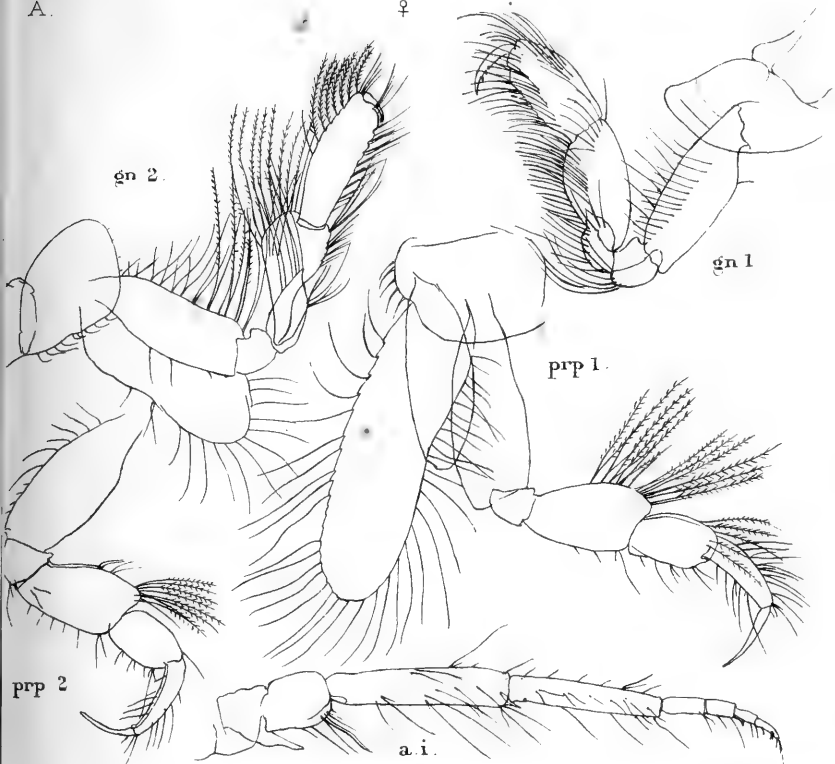
Mintern Bros. lith.

LEMBOS HIRSUTIPES. n sp.



A.

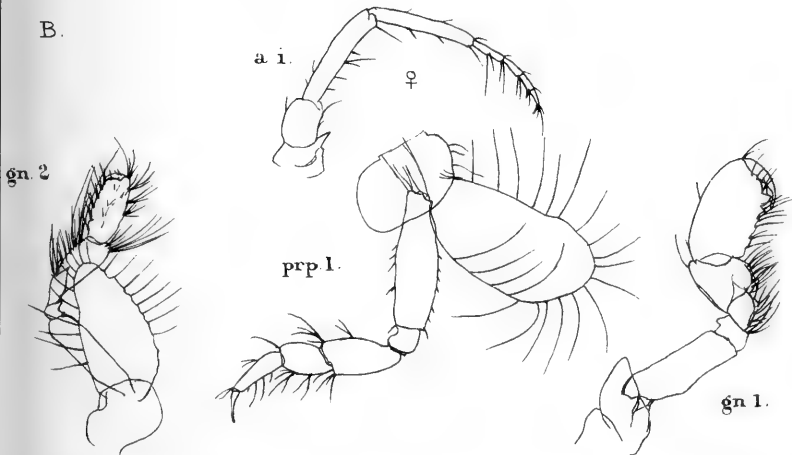
♀



LEMBOIDES AFER. n. g. et sp.

B.

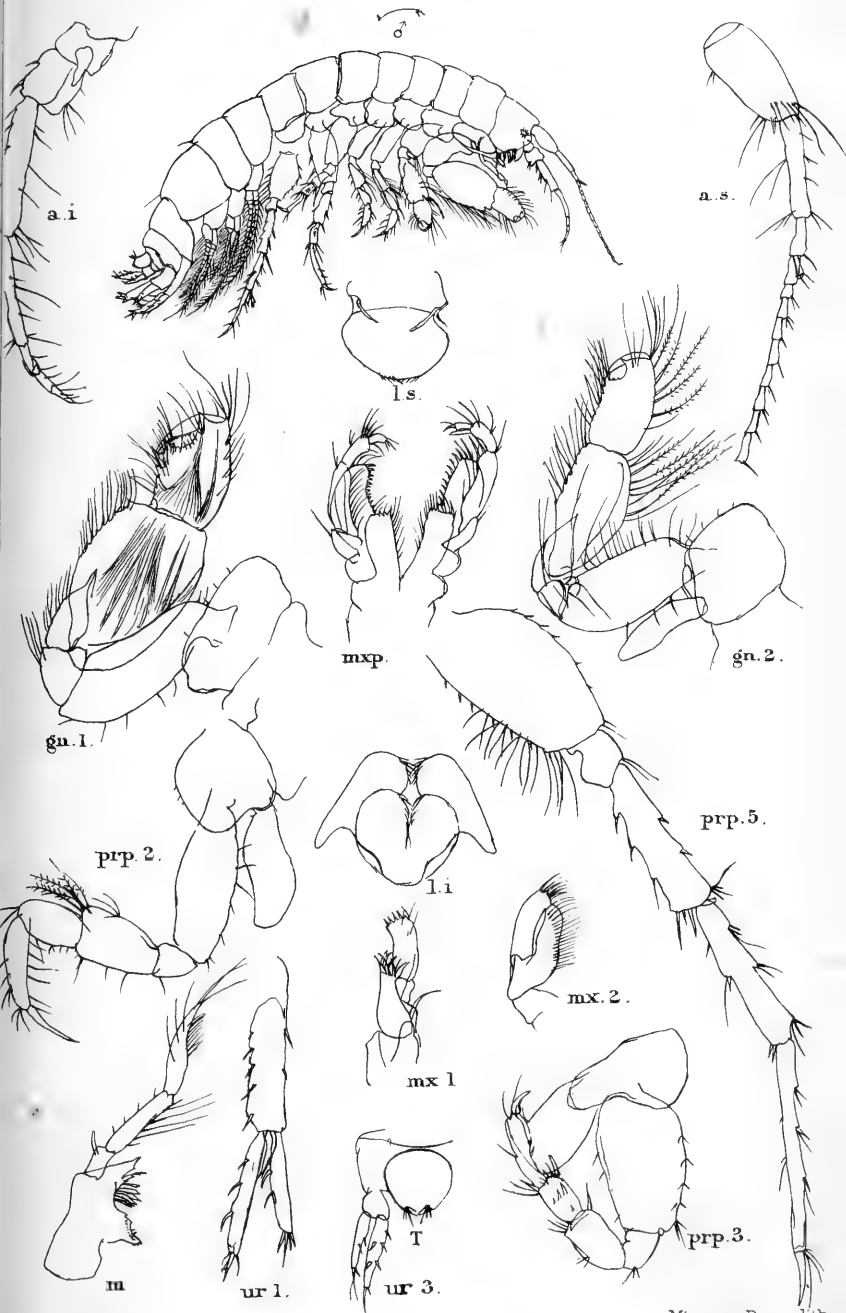
♀



LEMBOS HIRSUTIPES. n. sp.

I. R. R. Stebbing del.

Mintern Bros. lith.



T. R. R. Stebbing del.

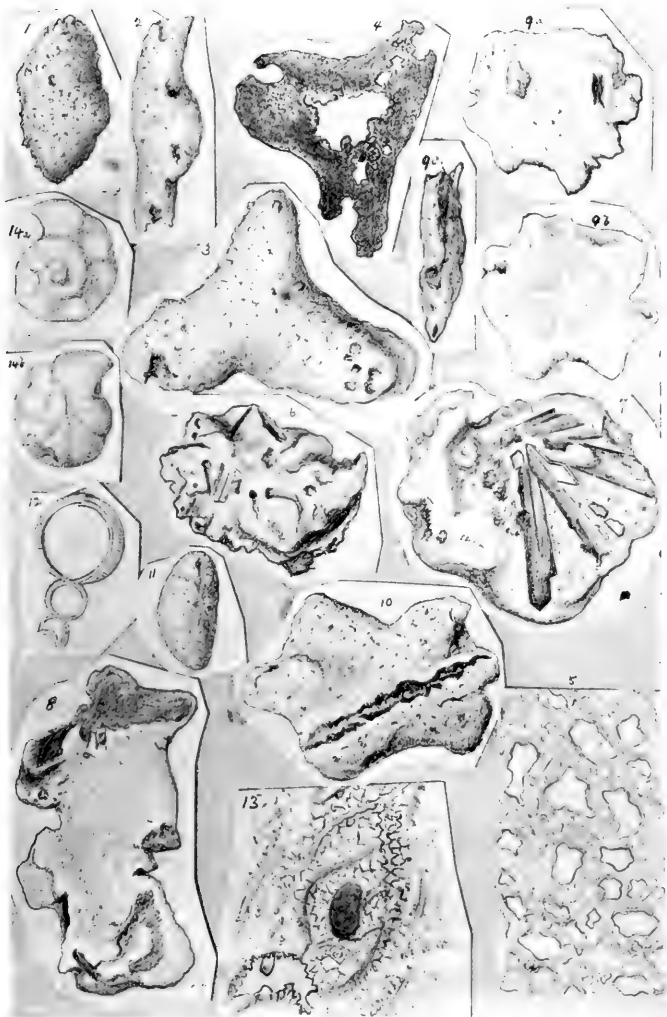
Mintern Bros. lith.

LEMBOIDES AFER. n. g. et sp.



F. CHAPMAN, del.

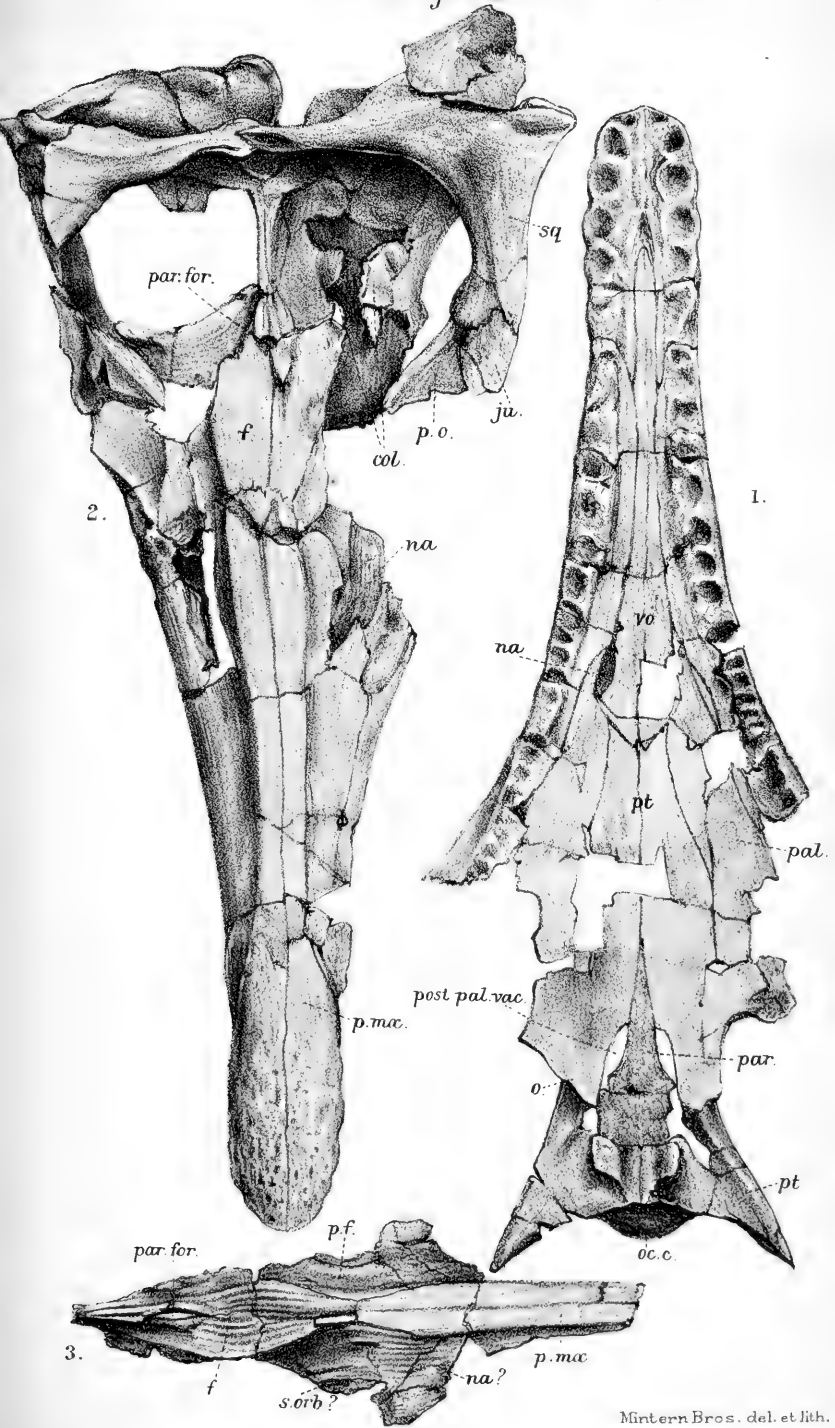
RHÆTIC FORAMINIFERA.



F. CHAPMAN, del.

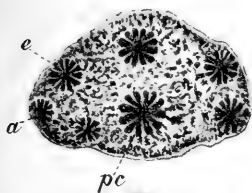
RHÆTIC FORAMINIFERA.





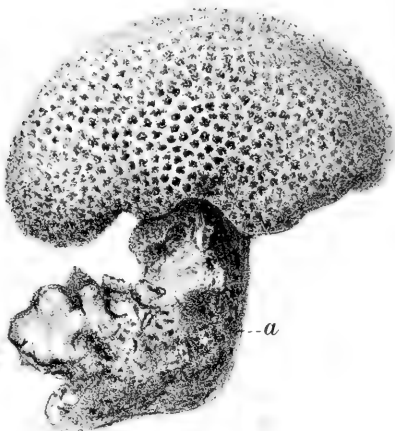


1.

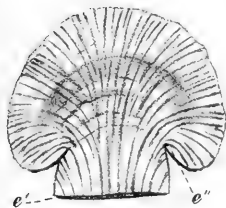


Nat. size

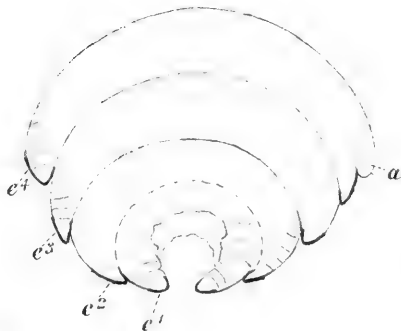
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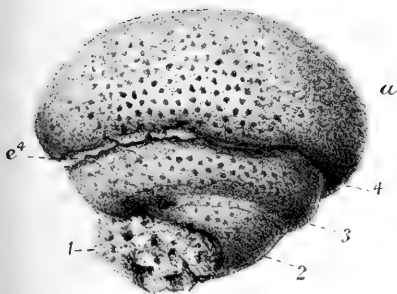
2.



4.



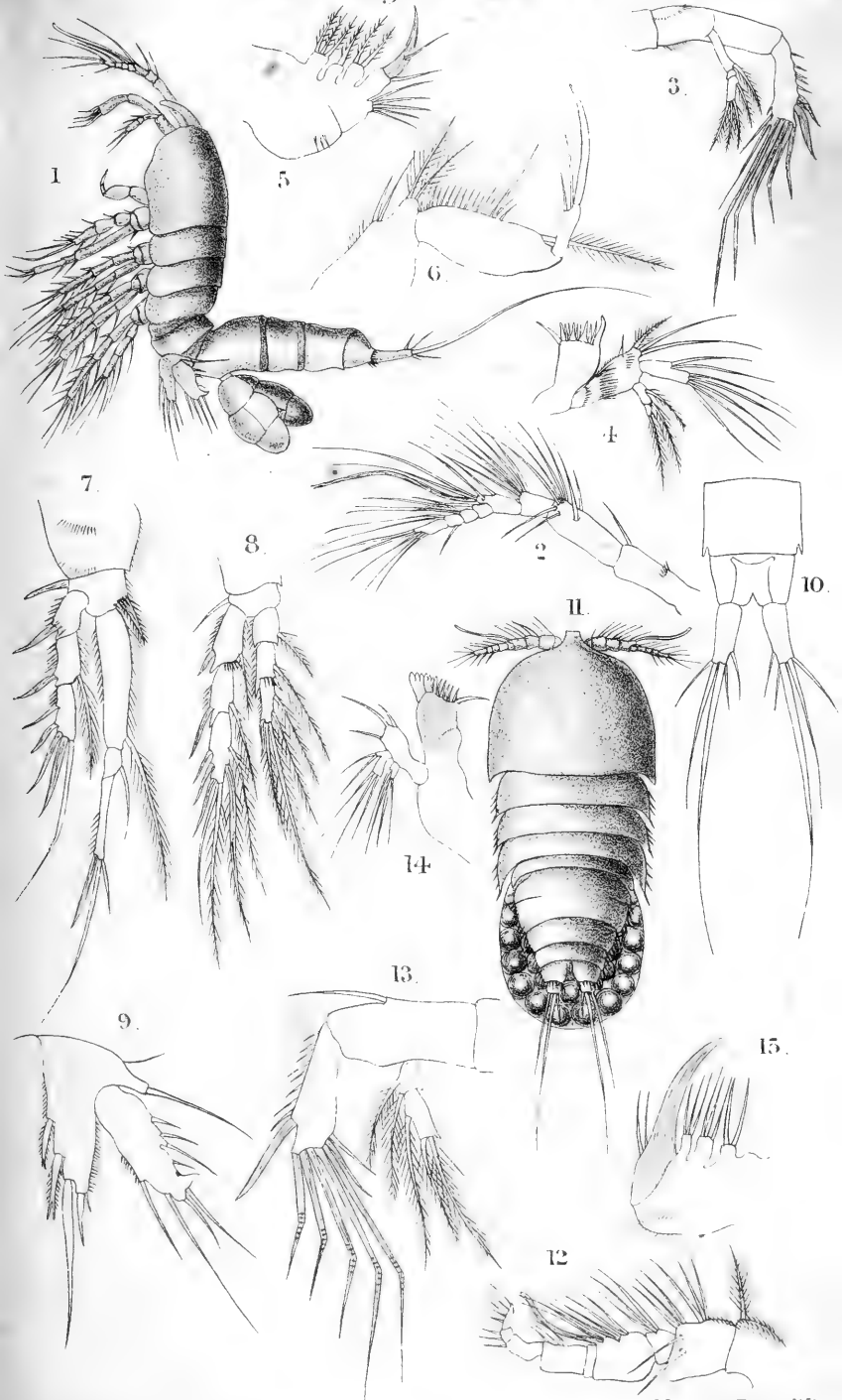
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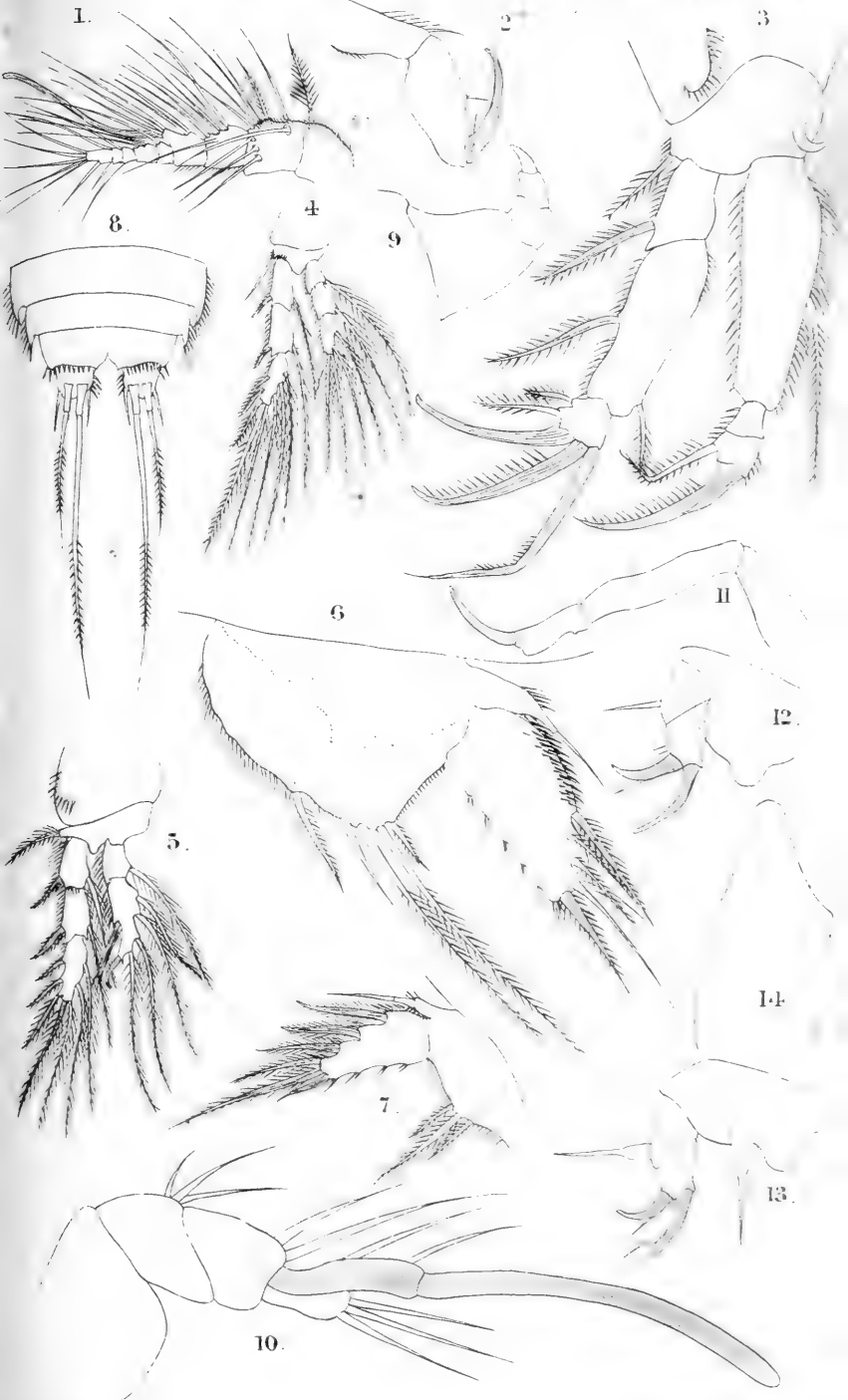
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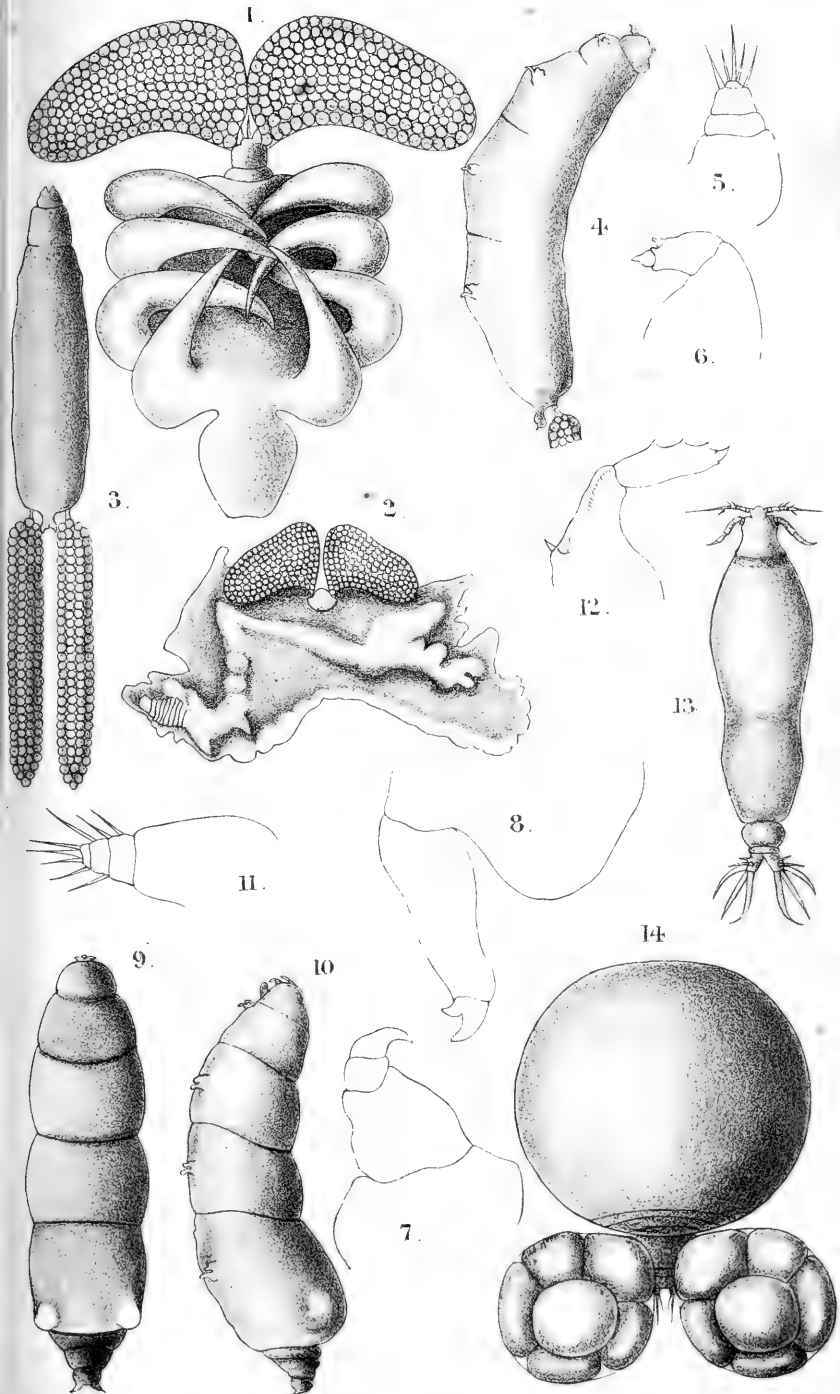








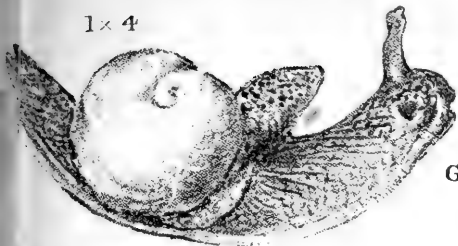




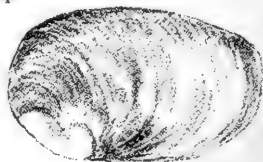




1 x 4

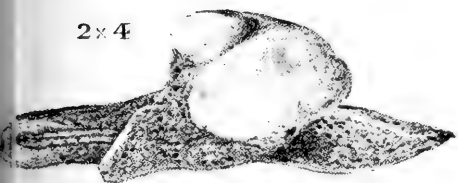


3 x 4

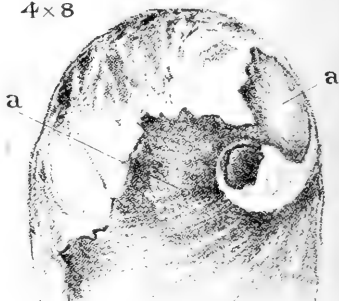


Gen: Ap.

2 x 4



4 x 8



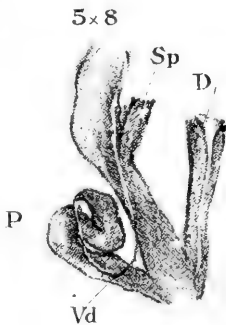
6 x 30



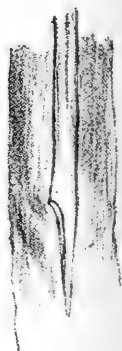
7 x 24



5 x 8



7 x 30



8 x 24



9b



9a



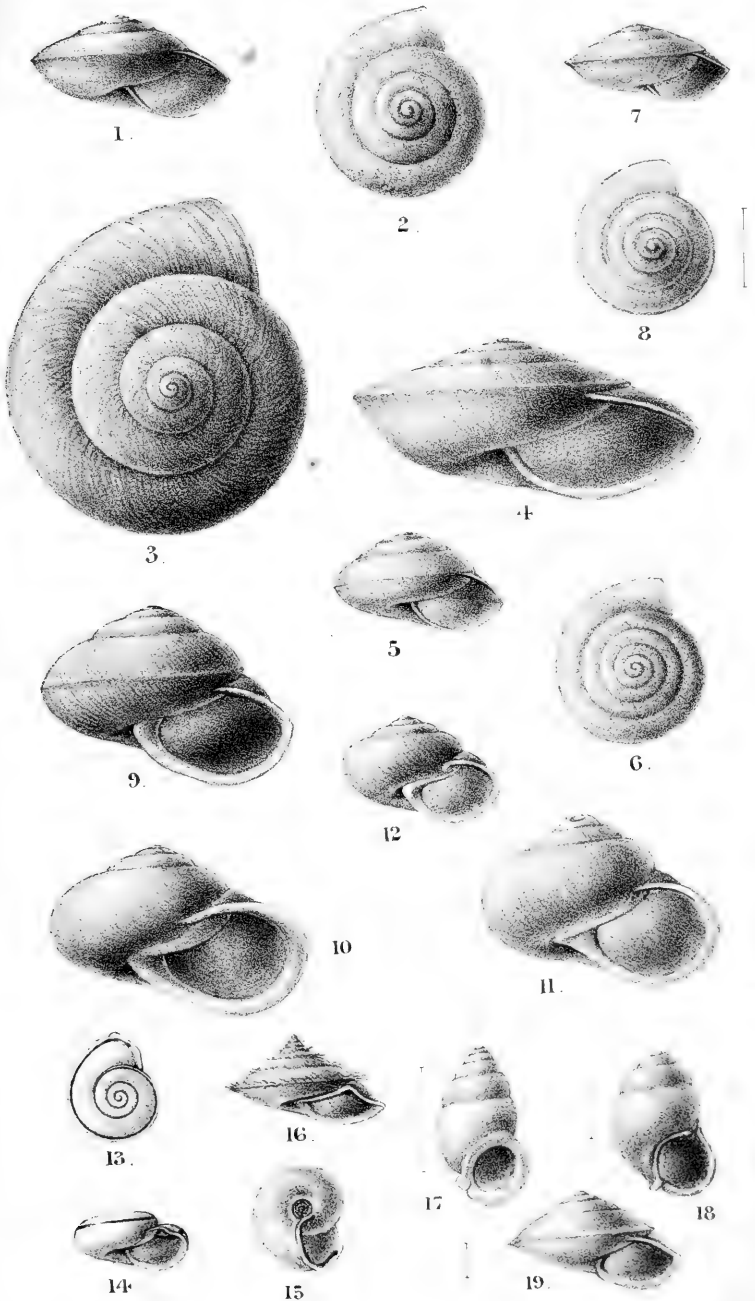
9 368

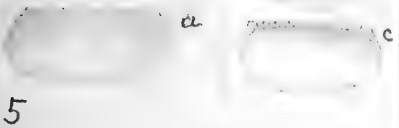
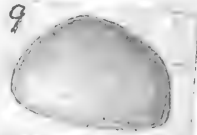
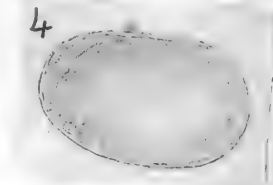
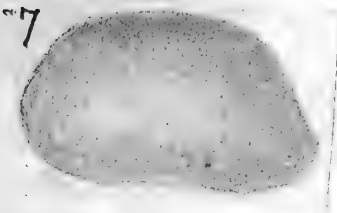
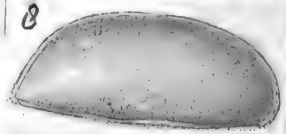
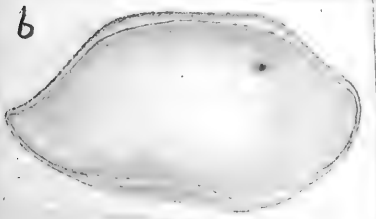
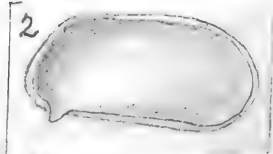
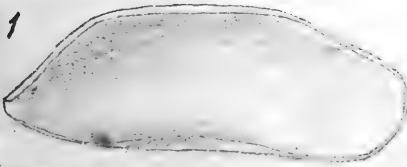


9c

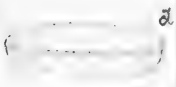
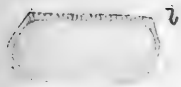








5



3

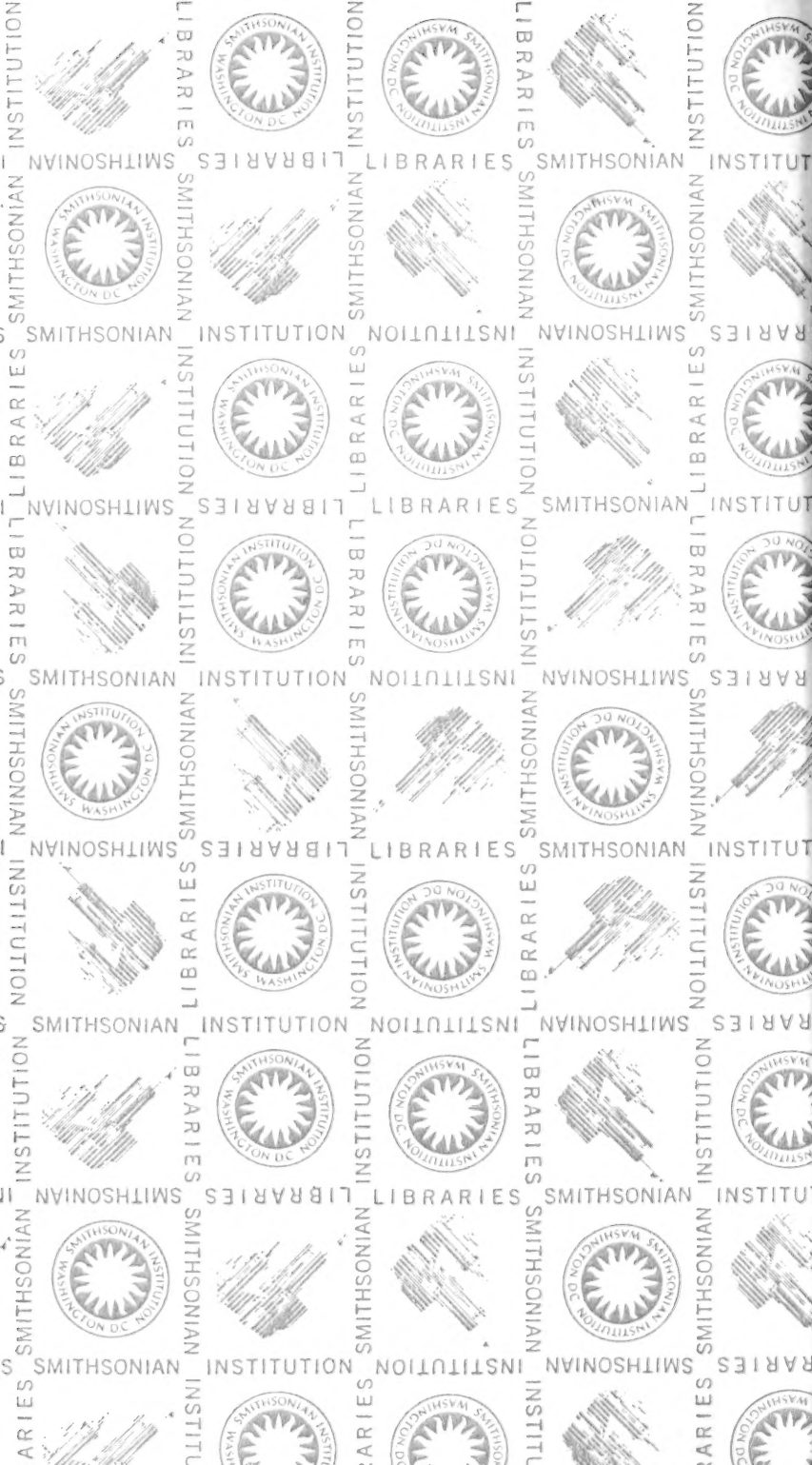


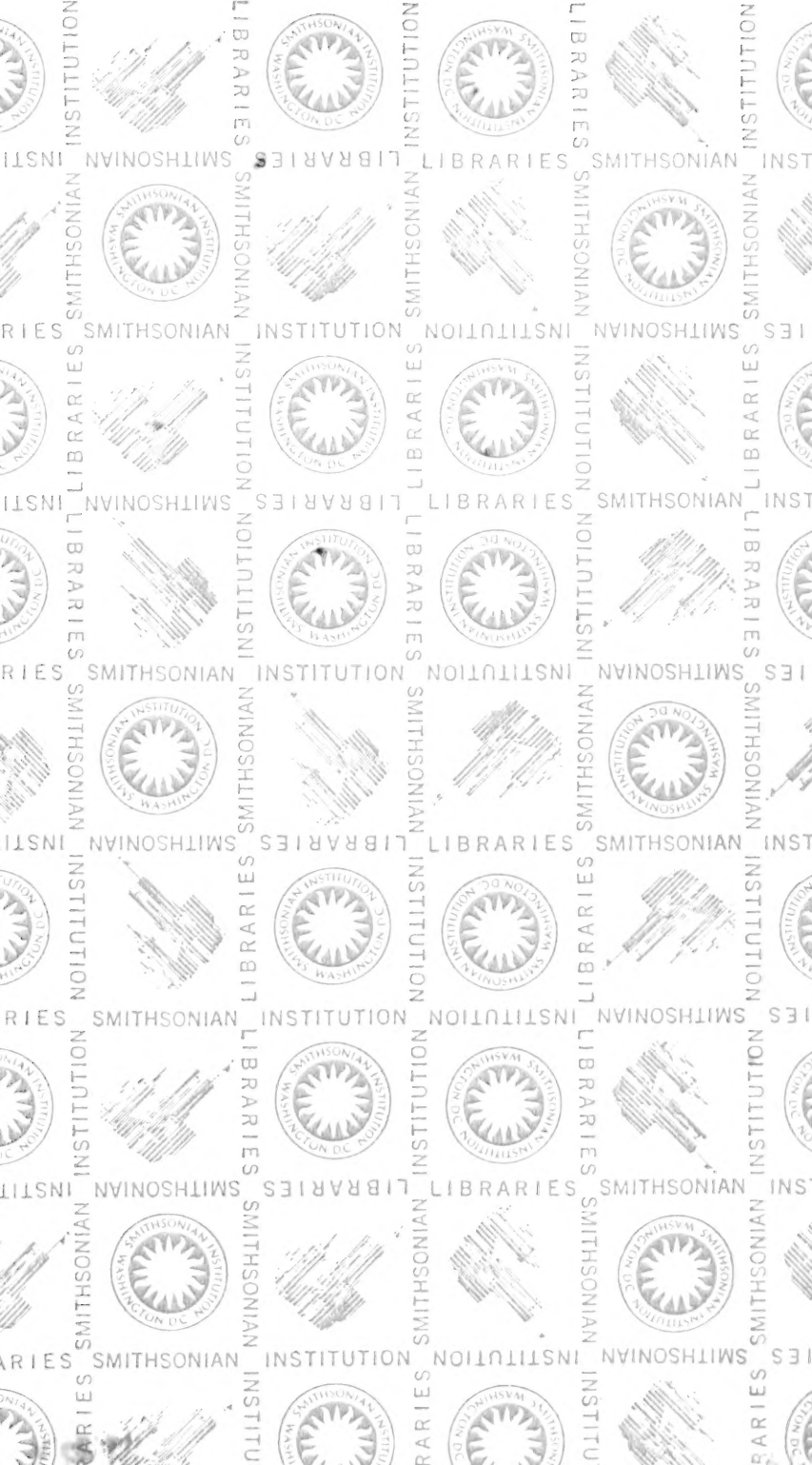
J. W. K. del.

CARBONIFEROUS OSTRACODA FROM YORKSHIRE.









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