

RECORDS

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APRIL, 1908.

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ERRATA.

Page 212, line 12. For "in the Dacca District" read "at Jhajakati in the Backergunj District."

„ 249, line 5 from bottom. For "figs. 2 and 3" read "figs. 2 and 1."

„ 253, under "Mishmi average" and opposite "Length of horn." For "571" read "509."

„ 322, line 13 from bottom. For "*P. squammatum*" read "*L. squammatum*."

„ 322, lines 1 and 13 from bottom, and page 323, line 9 from top. For "Zelenka" read "Zelinka."

„ 359, line 7, and page 368, line 4. For "Taunghi" read "Tonglu."

„ 363, line 22. For "*Anthrena burkelli*" read "*Anthrena burkilli*."

„ 383, lines 12 and 19. For "*marginipunctata*" read "*margininotata*."

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[*N.B.*—An asterisk (*) preceding a line denotes a new variety or sub-species; a dagger (†) indicates a new species; and a double-dagger (‡), a new genus: in the case of synonyms the page numbers are printed in *Italics*.]

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Account of the Triaxon (Hexactinellid) sponges collected by the R.I.M.S. "Investigator." By F. E. Schulze, Ph.D., M.D.	16	0	Echinoderma of the Indian Museum: Shallow-water Holothurioida collected by the R.I.M.S. "Investigator." By R. Kœhler and C. Vaney	2	0
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Aids to the identification of Rats connected with Plague in India. By W. C. Hossack, M.D.	0	8	Echinoderma of the Indian Museum: Shallow-water Ophiuroidea collected by the R.I.M.S. "Investigator." By R. Kœhler	4	0
Catalogue of the Archæological Collections in the Indian Museum, Parts I and II. By J. Anderson, M.D., LL.D., F.R.S.	4	12	Figures and Descriptions of Nine Species of Squillidæ from the Collection of the Indian Museum. By J. Wood-Mason, F.Z.S., etc., edited by A. Alcock, M.B., C.M.Z.S.	2	0
Catalogue of Coins of the Indian Museum, Parts I to IV. By C. J. Rodgers, M.R.A.S., M.N.S.	24	0	Guide to the Zoological Collections exhibited in the Bird Gallery of the Indian Museum. By F. Finn, B.A., F.Z.S.	0	12
Catalogue of the Coins in the Indian Museum, Calcutta, including the Cabinet of the Asiatic Society of Bengal. Part I.—The Early Foreign Dynasties and the Guptas. Part II.—Ancient Coins of Indian Types. Part III.—Persian, Mediæval, South Indian, and Miscellaneous Coins. By Vincent A. Smith, M.A., F.R.N.S., M.R.A.S., I.C.S., Retd.	22	8	Guide to the Zoological Collections exhibited in the Fish Gallery of the Indian Museum. By A. Alcock, M.B., C.M.Z.S.	0	8
Catalogue of Indian Crustacea. Part I.—Introduction and Brachyura Præmigenia. By A. Alcock, M.B., LL.D., F.R.S.	7	0	Guide to the Zoological Collections exhibited in the Invertebrate Gallery of the Indian Museum. By A. Alcock, M.B., C.M.Z.S. (<i>Out of print.</i>)		
Catalogue of the Indian Decapod Crustacea. Part II.—Anomura. Fasciculus I.—Pagurides. By A. Alcock, M.B., LL.D., F.R.S., C.I.E.	14	0	Guide to the Zoological Collection exhibited in the Reptile and Amphibia Gallery of the Indian Museum. By A. Alcock, M.B., C.M.Z.S. (<i>Out of print.</i>)		
Catalogue of the Indian Decapod Crustacea. Part III.—Macrura. Fasciculus I.—The Prawns of the Peneus Group. By A. Alcock, M.B., LL.D., F.R.S., C.I.E.	7	0	Hand List of Mollusca in the Indian Museum, Parts I and II, and Fasciculus E. By G. Nevill, C.M.Z.S., etc. Index Parts I and II. By W. Theobald	7	4
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Catalogue of Mantodea in the Indian Museum, Parts I and II. By J. Wood-Mason, F.Z.S., etc.	2	0	Monograph of the Asiatic Chiroptera and Catalogue of the Species of Bats in the Indian Museum. By G. E. Dobson, M.A., M.B., F.R.S.	3	0
			Monograph of the Oriental Cicadidæ, Parts I to VII. By W. L. Distant, F.E.S.	31	14

The above can be obtained from the Superintendent of the Indian Museum, Calcutta, and from Messrs. Friedlander & Sohn, 11, Carlstrasse, Berlin.

Other Publications edited and sold by the Superintendent of the Indian Museum (also obtainable from Messrs. Friedlander & Sohn) issued by the Director of the Royal Indian Marine.

Illustrations of the Zoology of the R.I.M.S. "Investigator" 1892. Fishes, Plates I to VII. Crustacea, Plates I to V, 1894. Fishes, Plates VII to XIII. Crustacea, Plates VI to VIII. Echinoderma, Plates I to III, 1895. Echinoderma, Plates IV and V. Fishes, Plates XIV to XVI. Crustacea, Plates IX to XV, 1896. Crustacea, Plates XVI to XXVII, 1897. Fishes, Plate XVII. Crustacea, Plates XXVIII to XXXII. Mollusca, Plates I to VI, 1898. Fishes, Plates XVIII to XXIV. Crustacea, Plates XXXIII to XXXV. Mollusca, Plates VII and VIII, 1899. Fishes, Plates XXV and XXVI. Crustacea, Plates XXXVI to XLV, 1900. Fishes, Plates XXVII to XXXV. Crustacea, Plates XLVI to XLVIII. Index, Part I, 1901. Crustacea, Plates XLIX to LV. Mollusca, Plates IX to XIII, 1902. Crustacea, Plates LVI to LXVII. Crustacea, Plates LXVIII to LXXVI. Fishes, Plates XXXVI to XXXVIII, 1905. Crustacea (Malacostraca), Plates LXXVII to LXXIX. Crustacea (Entomostraca), Plates I and II. Mollusca, Plates XIV to XVIII, 1907.—Re. 1 per plate.

THE RETIREMENT OF LIEUTENANT-COLONEL ALCOCK

Lieutenant-Colonel A. W. Alcock, C.I.E., M.B., LL.D., F.R.S., came to India as a member of the Indian Medical Service in April 1886, having already had considerable experience of the country, and having also been Assistant Professor of Zoology in the University of Aberdeen under the late Professor H. A. Nicholson, F.R.S. After two years spent on the North-west Frontier as Medical Officer, he was appointed Surgeon Naturalist to the Indian Marine Survey. In 1891 he officiated for some months as Resident Physician and Professor of Pathology at the Calcutta Medical College, and in September 1892 was appointed Deputy Sanitary Commissioner, Metropolitan and Eastern Bengal Circle. In May 1893 he became Superintendent of the Indian Museum and Professor of Zoology at the Medical College; from June 1895 to January 1896 he was on special duty with the Pamir Commission. He retired from the Indian Medical Service and the Superintendship of the Museum on December 29th, 1907. The Trustees of the Museum, at their meeting held on December 6th, passed the following resolution as regards his retirement, and directed that a notice of his connection with the Museum should be published as a mark of their esteem:—

“As Lieutenant-Colonel Alcock’s approaching retirement from Government service has been gazetted since the last meeting of the Trustees, they take the earliest opportunity to express their sense of the value of his work in India to the Museum and to the science of Zoology. It is not within their province to comment upon his scientific researches, which have received the approbation of the scientific world in Europe and America, but they are well aware that it is to Colonel Alcock that the excellent arrangement of the bulk of the research collections in the Museum and of several of the public galleries is entirely due. His wide knowledge, untiring diligence, and scientific acumen are acknowledged by all who have been connected with the Museum. The Trustees are gratified to hear that Colonel Alcock does not intend to sever his connection with the Museum entirely, but proposes to continue in England his invaluable work upon the collection of Crustacea.”

Colonel Alcock’s connection with the Indian Museum may be said to have commenced when he became Surgeon Naturalist on the Indian Marine Survey Ship “Investigator.” Year by year in the monsoon season when the ship was laid up in Bombay harbour, he came to work in Calcutta on the material dredged during the preceding winter, and thus established an association with the late

Mr. J Wood-Mason, his predecessor as Superintendent, that was fruitful in scientific work. On the death of Mr. Wood-Mason his services were put at the disposal of the Trustees, and he became Superintendent, without, however, leaving the Indian Medical Service.

In the Museum Colonel Alcock made it his aim to work out, so far as it was possible for one man to do, the fauna of the deeper parts of the Indian seas, to set in order the marine collection in the Museum, and to exhibit to the public a judicious selection of the animals identified or described by himself and others. The scientific side of this work, in its more general aspect, is known to all marine zoologists, being embodied in numerous papers and monographs and in his book "*A Naturalist in Indian Seas*," of which there is more to be said. It was mainly on account of his monographs on marine zoology that Colonel Alcock was elected a Fellow of the Royal Society and received the honorary degree of LL.D. from his old University of Aberdeen. The work of arranging and exhibiting the collections of the Museum has naturally a more limited renown. There are few Museums, however, which can boast that their marine collections are in better order and better displayed than is the case in Calcutta. The gradual development which has made it possible to claim for the Indian Museum its place among the great reference collections of the world is almost entirely due to Colonel Alcock's work in this direction.

He did not, however, confine his attention, while connected with the Museum, to marine zoology, as his reports on the zoology of the Pamir Commission and on the reptiles of the Afghan Frontier Commission of 1895 and his biological notes in the publications of the Asiatic Society of Bengal attest, while the many dissections and other preparations he set up in the public galleries of reptiles and other terrestrial vertebrates prove his care for the interests of the students of the Calcutta Medical College, to whom he lectured in disheartening circumstances as regards the absence of all opportunity for practical classes and the humble place as yet given to zoology in the Indian medical curriculum. The bird and mammal galleries are still perhaps the least satisfactory parts of the Museum, but one man could not bring every section to equal perfection, and those who remember their previous state can alone appreciate what was done to improve them in Colonel Alcock's time.

The "*Naturalist in Indian Seas*" (1902) may be regarded as an epitome and a popularization (in the best sense of the word) of the greater part of Colonel Alcock's scientific work in India. It is a book that owes its value not only to its erudition and perspicuity but hardly less to its literary style, in which the strong infusion of Shakespeare and other Elizabethan authors is never pedantic, never frivolous, and never dull. The skill with which such apparently incongruous elements are fused even into the guide books he prepared for the Museum galleries can only be realized by one who has attempted, and failed, to complete a work of the kind he left unfinished.

No account of Colonel Alcock's zoological work in India would be complete without some reference to his connection with the Asiatic Society of Bengal, the scientific collections of which formed the nucleus of the Indian Museum. He became a member of this Society in February 1888, was elected Natural History Secretary in May 1894, General Secretary in April 1895, and Vice-President in February 1901; for several years his papers were by far the most important contributed to the zoological section of the Society's *Journal*.

Colonel Alcock has worked, so far as his service in India is concerned, for his successors rather than himself; but it is fortunately impossible to think that his own work for India is finished. We may confidently hope that it will continue for many years in his retirement to bear the fruit of his unsurpassed accuracy of observation, his many-sided enthusiasm, and his literary talent. As his immediate successor I may be permitted to express my gratitude not only for the zoological knowledge acquired from him and for his unfailing kindness in the Museum and in private life, but also for that sound versatility which prevented the Museum, understaffed as it is now acknowledged to have been, from becoming a lumber-room with one corner set in order by a specialist. The admirable organization of his office, which enabled his successor to take up the threads of routine mechanically, is another matter for which it is impossible to be too grateful: although changes will necessarily take place as the Museum grows and develops, the groundwork will always be that constructed by Colonel Alcock, too often without recognition and in spite of obstacles of which nothing was known beyond the Museum walls.

N. ANNANDALE,

CALCUTTA :
January 22nd, 1908.

Superintendent, Indian Museum,
Natural History Section.



LIST OF PAPERS, ETC, ON INDIAN
ZOOLOGY PUBLISHED BY
A. W. ALCOCK, 1890—1907

I. GENERAL MEMOIRS.

(i) *On Marine Zoology.*

1. Note on the Results of Deep-sea Dredging in 1889-1890.
(Jointly with J Wood-Mason.)
[Ann. Mag. Nat. Hist. (6), vii, 1891, pp. 1-19 and 186-272.]
2. On the Deep-sea Dredging of the season 1890-91.
(Jointly with J Wood-Mason.)
[Ann. Mag. Nat. Hist. (6), viii, 1891, pp. 427-452, pl. xvii.]
3. An Account of the Deep-sea Collection made by the "Investigator" during the season of 1892-93.
[J A. S. B., lxii, pt. ii, No. 4, 1893, pp. 169-184, pls. viii-ix.]
4. A Summary of the Deep-sea Zoological Work of the R.I.M.S. "Investigator" from 1884-1897.
[Scientific Memoirs by Medical Officers of the Army of India, pt. xi, 1899, pp. 1-49.]
5. Zoological Gleanings from the R.I.M.S. "Investigator."
[Scientific Memoirs by Medical Officers of the Army of India, pt. xii, 1901, pp. 1-42.]
6. A Naturalist in Indian Seas, or four years with the R.I.M.S. "Investigator," London, 1902, pp. i-xxiv and 1-318; 98 figs. and a map.

(ii) *On Bionomic Subjects.*

7. Observations on the Gestation of some Sharks and Rays.
[J A. S. B., lix, pt. ii, No. 1, 1890, pp. 51-56, pl. i.]
8. On the uterine villiform Papillæ of *Pteroplatea micrura*, and their Relation to the Embryo.
(Jointly with J Wood-Mason.)
[Proc. Roy. Soc., xlix, 1891, pp. 359-367, pls. 7 and 8.]
9. Further Observations on the Gestation of Indian Rays.
(Jointly with J Wood-Mason.)
[Proc. Roy. Soc., 1, 1891, pp. 202-209.]

10. On a Viviparous Bathybial Fish from the Bay of Bengal.
[Proc. Zool. Soc., 1891, pp. 226-227.]
11. On Utero-gestation in *Trygon bleekeri*.
[Ann. Mag. Nat. Hist. (6), ix, 1892, pp. 417-427, pl. xix.]
12. Some Observations on the Embryonic History of *Pteroplatea micrura*.
[Ann. Mag. Nat. Hist. (6), x, 1892, pp. 1-8, pl. iv.]
13. A Case of Commensalism between a Gymnoblastic Anthomedusoid (*Stylactis minoi*) and a Scorpænoid Fish (*Minous inermis*).
[Ann. Mag. Nat. Hist. (6), x, 1892, pp. 207-214.]
14. On a New Species of Viviparous Fish of the family *Ophidiidæ*.
[Ann. Mag. Nat. Hist. (6), xvi, 1895, pp. 144-146.]
15. An Instance of the Natural Repellent Effect of "Warning Colours."
[J. A. S. B., lxx, pt. ii, No. 3, 1896, pp. 539-540.]
16. On the Toxic Properties of the saliva of certain "non-poisonous" Colubrids.
(Jointly with L. Rogers.)
[Proc. Roy. Soc., lxx, 1902, pp. 446-454.]
17. On the occurrence of *Anopheles (Myzomyia) listoni*, a malaria-carrying mosquito, in Calcutta.
(Jointly with J. R. Adie.)
[Proc. Roy. Soc., lxxvi, 1905, pp. 319-321.]

II. SYSTEMATIC PAPERS.

'i) Anthozoa.

18. On some Newly-recorded Corals from the Indian Seas.
[J. A. S. B., lxii, pt. ii, No. 2, 1893, pp. 138-149, pl. v.]
19. On some *Actiniaria* from the Indian Seas.
[J. A. S. B., lxii, pt. ii, No. 3, 1893, pp. 151-153.]
20. Note on *Calypterinus allmani*.
[Ann. Mag. Nat. Hist. (6), xii, 1893, pp. 29-30.]
21. On some New and Rare Corals from the Deep Waters of India.
[J. A. S. B., lxiii, pt. ii, No. 3, 1894, pp. 186-188.]
22. An Account of the Deep-sea *Madreporaria* collected by the R.I.M.S. "Investigator," 29 pp., 3 pls.
23. Report on the Deep-Sea *Madreporaria* of the "Siboga-Expedition."
[Siboga-Expeditie, 1899-1900. Resultats des Explorations Zoologiques, Botaniques, Oceanographiques et Geologiques. Publiés par Max Weber. 4to. Pt. xvi a, 1902, *Madreporaria*.]

24. Diagnoses and Descriptions of New Species of Corals from the "Siboga-Expedition."

[Tijdschr. d. Ned. Dierkund, Vereen. (2), vii, 3, 1902, pp. 89-115; 116-123.]

(ii) *Echinoderma.*

25. An Account of the Collection of Deep-sea *Asteroidea*.

[Ann. Mag. Nat. Hist. (6), xi, 1893, pp. 73-121, pls. iv-vi.]

(iii) *Brachiopoda.*

26. A New Brachiopod.

[J. A. S. B., lxiii, pt. ii, No. 2, 1894, pp. 139-140, pl. viii.]

(iv) *Crustacea.*

27. On the Deep-sea Crustacea collected by the "Investigator" in 1890-91.

[Ann. Mag. Nat. Hist. (6), xiii, 1894, pp. 225-245, 321-334, 400-411.]

28. An Account of a Recent Collection of Deep-sea Crustacea from the Bay of Bengal and Laccadive Sea.

(Jointly with A. R. S. Anderson.)

[J. A. S. B., lxiii, pt. ii, No. 3, 1894, pp. 141-185, pl. ix.]

29. List of the Shore and Shallow-water *Brachyura* collected by the "Investigator" in 1893-94.

(Jointly with A. R. S. Anderson.)

[J. A. S. B., lxiii, pt. ii, No. 4, 1894, pp. 197-209.]

30. Materials for a Carcinological Fauna of India. No. 1. The *Brachyura Oxyrhyncha*.

[J. A. S. B., lxiv, pt. ii, No. 2, 1895, pp. 157-291, pls. iii-v.]

31. Materials for a Carcinological Fauna of India. No. 2. The *Brachyura Oxystoma*.

[J. A. S. B., lxv, pt. ii, No. 2, 1896, pp. 134-296, pls. vi-viii.]

32. Description of a New Species of *Branchipus* from Calcutta.

[J. A. S. B., lxv, pt. ii, No. 3, 1896, pp. 538-539, pl. x.]

33. Materials for a Carcinological Fauna of India. No. 3. The *Brachyura Cyclometopa*. Pt. i. The Family *Xanthidae*.

[J. A. S. B., lxvii, pt. ii, No. 1, 1898, pp. 67-233.]

34. Materials for a Carcinological Fauna of India. No. 4. The *Brachyura Cyclometopa*. Pt. ii. The Families *Portunidae*, *Cancridae* and *Corystidae*.

[J. A. S. B., lxviii, pt. ii, No. 1, 1899, pp. 1-104.]

35. An Account of the Deep-sea *Brachyura* collected by the R.I.M.S. "Investigator," pp. 1-85, 4 pls.

36. Materials for a Carcinological Fauna of India. No. 5. The *Brachyura Primigenia* or Dromiacea.

[J A. S. B., lxviii, pt. ii, No. 3, 1899, pp. 123-169.]

37. An Account of the Deep-sea Crustacea dredged by the "Investigator" in 1897-98.

(Jointly with A. R. S. Anderson.)

[Ann. Mag. Nat. Hist. (7), iii, 1899, pp. 1-27, 278-292.]

38. Materials for a Carcinological Fauna of India. No. 6. The *Brachyura Catometopa*.

[J A. S. B., lxix, pt. ii, No. 3, 1900, pp. 279-456.]

39. A Descriptive Catalogue of the Deep-Sea *Crustacea*, *Macrura* and *Anomala* in the Indian Museum, 1901, pp. 1-286, pls. i-iii.

40. Catalogue of Decapod Crustacea in the Indian Museum. Pt. i. *Brachyura*. Fascicle i. Introduction and Dromides or Dromiacea (*Brachyura primigenia*), 1901, pp. i-ix and 1-80, pl. A, i-vii.

41. Catalogue of the Indian Decapod Crustacea in the Indian Museum. Pt. ii. *Anomura*. Fascicle i. Pagurides, 1905, pp. i-xi and 1-197, pls. i-xvi.

42. Catalogue of the Indian Decapod Crustacea in the Indian Museum. Pt. iii. *Macrura*. Fascicle i. The Prawns of the *Peneus* group, 1906, pp. i-ii and 1-55, pls. i-vii.

43. Marine Crustaceans, *Paguridæ*.

[Fauna and Geography of the Maldivé and Laccadive Archipelagoes. Stanley Gardener II, pt. iv, pp. 827-835, pl. lxviii.]

44. On a new species of the Dorippoid genus *Cymonomus* from the Andaman Sea, considered with reference to the geographical distribution of the *Dorippidæ*.

[Ann. Mag. Nat. Hist. (7), xv, 1905, pp. 565-576, pl. xviii.]

45. A Revision of the genus *Peneus*.

[Ann. Mag. Nat. Hist. (7), xvi, 1905, pp. 508-532.]

(v) Fishes.

46. List of the *Pleuronectidæ* obtained in the Bay of Bengal in 1888 and 1889, with Descriptions of New and Rare Species.

[J A. S. B., lviii, pt. ii, No. 3, 1889, pp. 279-295, pls. xvi-xviii.]

47. Descriptions of some New and Rare Species of Fishes from the Bay of Bengal, obtained during the season of 1888-89.

[J. A. S. B., lviii, pt. ii, No. 3, 1889, pp. 296-305, pl. xxii.]

48. On the Bathybial Fishes of the Bay of Bengal and neighbouring waters, obtained during the seasons 1885-89.

[Ann. Mag. Nat. Hist. (6), iv, 1889, pp. 376-399 and 450-461.]

49. On the Bathybial Fishes collected in the Bay of Bengal during the season 1889-90.
[Ann. Mag. Nat. Hist. (6), vi, 1890, pp. 197-222, pls. viii-ix.]
50. On the Bathybial Fishes of the Arabian Sea, obtained during the season 1889-90.
[Ann. Mag. Nat. Hist. (6), vi, 1890, pp. 295-311.]
51. On some Undescribed Shore-Fishes from the Bay of Bengal.
[Ann. Mag. Nat. Hist. (6), vi, 1890, pp. 425-443.]
52. On the Deep-sea Fishes collected by the "Investigator" in 1890-91.
[Ann. Mag. Nat. Hist. (6), viii, 1891, pp. 16-34, 119-138, pls. vii-viii.]
53. On the Bathybial Fishes collected by the "Investigator" in 1891-92.
[Ann. Mag. Nat. Hist. (6), x, 1892, pp. 345-365, pl. xviii.]
54. An Account of a Recent Collection of Bathybial Fishes from the Bay of Bengal and from the Laccadive Sea.
[J. A. S. B., lxiii, pt. ii, No. 2, 1894, pp. 115-137, pls. vi-vii.]
55. A Supplementary List of Marine Fishes of India, with Descriptions of two new Genera and eight new Species.
[J. A. S. B., lxv, pt. ii, No. 3, 1896, pp. 301-338.]
56. A note on the Deep-sea Fishes, with Descriptions of some new Genera and Species, including another probably Viviparous Ophidioid.
[Ann. Mag. Nat. Hist. (7), ii, 1898, pp. 136-156.]
57. An Account of the Deep-sea Fishes collected by the R.I.M.S. "Investigator"; being a descriptive Catalogue of the Deep-sea Fishes contained in the collection of the Indian Museum.

(vi) *Reptilia and Amphibia.*

58. On a New Species of Flying Lizard from Assam.
[J. A. S. B., lxiv, pt. ii, No. 1, 1895, pp. 14-15, pl. iii.]
59. An Account of the Reptilia collected by Dr. F. P. Maynard, Capt. A. H. McMahon, C.I.E., and the Members of the Afghan-Baluch Boundary Commission of 1896.
(Jointly with F. Finn.)
[J. A. S. B., lxv, pt. ii, No. 4, 1896, pp. 550-566, pls. xi-xv.]
60. Description of, and Reflections upon, a new species of Apodous Amphibian from India.
[Ann. Mag. Nat. Hist. (7), xiv, 1904, pp. 267-272, pl. vii.]



I.—THE FAUNA OF BRACKISH PONDS
AT PORT CANNING, LOWER BENGAL

PART VII.—FURTHER OBSERVATIONS ON THE POLYZOA,
WITH THE DESCRIPTION OF A NEW GENUS
OF ENTOPROCTA.

By N. ANNANDALE, D.Sc., Superintendent, Indian Museum.

A considerable change has taken place in the Polyzoa of the ponds this winter, apparently owing to last summer's floods, which broke down the embankment that separated the ponds from the river, joining them together temporarily. It will, therefore, be well to publish the observations arising from a visit to Port Canning in December, 1907, both as regards the species already recorded and as regards a new genus that appears to have been introduced since last winter. A comparison with European specimens, moreover, has also made it necessary to recognize the Bengal *Victorella* as a distinct species

ECTOPROCTA.

Victorella bengalensis, sp. nov.

*V. pavid*a, Kent, Annandale, *Rec. Ind. Mus.*, i, p. 200.

The numerous colonies recently obtained in the ponds are more luxuriant than any I have seen before in India. Thanks to the kindness of Mr. R. Kirkpatrick, of the British Museum, and Mr. C. F. Rousselet, I have been able to compare them with some exceedingly beautiful preparations of the true *Victorella pavid*a made by the latter. In my former account of the form that occurs at Port Canning, I stated that I had found no specimens in which the proliferation was comparable in complexity with that of the colony of which a part is figured by Kræpelin in fig. 75, pl. iii of his *Süsswasser-Bryozoen*. Examples taken in the ponds this winter, however, are quite as complicated. The general appearance of the colonies is that of a thick fur coating the grass stems, etc., on which they grow. When free from green algæ they are of a very pale flesh-colour as a whole, some of the zoecia being tinged with yellow, but the majority being practically colourless. The exact tint of the stomach depends on its contents, but it has intrinsically a

faint yellowish tinge. The complexity of budding is well illustrated by the accompanying figure (fig. 1) of the upper part of a parent zoecium with its buds of the first, second, third and fourth degrees. As a rule buds of the first degree arise direct from the upper part of a large zoecium, but sometimes a short tubular outgrowth intervenes, such outgrowths being more common in the case of buds of younger generations. A common form of what we may take as the unit of the colony (*viz.*, a parent zoecium and its direct offspring produced by budding) is that of an upright stem (the parent zoecium) with a single antler-like branch, consisting of buds and their buds, at one side; but two or more such branches are not infrequently produced.

No trace of resting buds was found in specimens killed on December 24th.

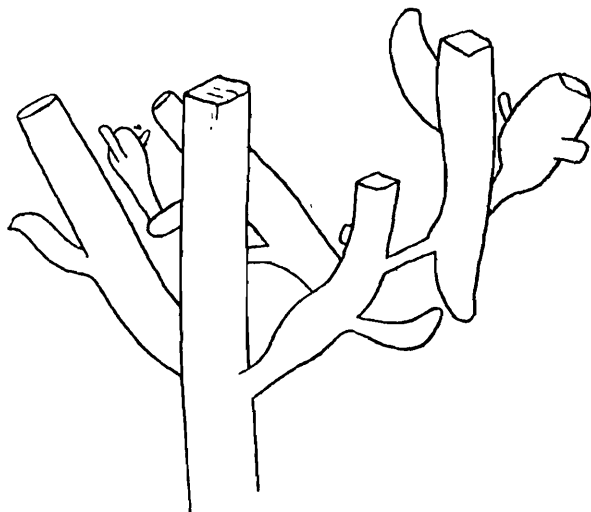


FIG. 1.—*V. bengalensis*, Port Canning, Dec. 1907.

In the following points the Indian species differs from the European examples of *V. pavidus* I have examined :—

- (1) in the small size of the swelling from which the zoecia arise ;
- (2) in the fact that a considerable number of zoecia are frequently grouped together with very short intervening false stola ;
- (3) in the more powerful development of the gizzard ;
- (4) in the fact that the distal part of *some* of the adult zoecia is approximately circular in cross-section.

In the first two of these points, and to some extent in the fourth, *V. bengalensis* resembles Rousselet's recently described *V. symbiotica*¹ from Lake Tanganyika ; but we have no details of the anatomy of this African form, which was found growing in the substance of a freshwater sponge very much in the same way as the *coralloides* phase of *Plumatella fruticosa* grows in

¹ *Proc. Zool. Soc.*, 1907 (i), p. 255. The colonies seen by Mr. Rousselet were apparently devoid of lateral buds, but so are many examples of *V. bengalensis*.

Spongilla lacustris in Europe and in *S. carteri*, *S. reticulata* and *S. crassissima* in India. The Port Canning form of *Victorella* has not as yet been found in close connection with the sponge (*S. alba*) so common in the same ponds, but owing to the small area of the objects to which the colonies are attached, the zoecia are crowded together in very much the same way as would be the case if they were included in the substance of a sponge; they stand to one another, to put the matter in a different way, in much the same relation as the zoecia of *Plumatella coralloides* stand to the tissues of the sponge in which they are inclosed.

All the zoecia of *V. symbiotica* figured by Rousselet are circular in cross-section throughout; while in *V. bengalensis* some are circular or nearly so, some distinctly square.

The nature of the gizzard, which in the Indian form though thin-walled (as compared with that of *Bowerbankia*) is decidedly muscular, may be a more important feature from a systematic point of view. Saville Kent denied that *V. pavidata* had a gizzard at all, while Bousfield called attention to its existence. That the statement of the former author was due to a misapprehension is very possible, for even Hincks, whose experience of the Polyzoa was very much greater, at first placed the form he afterwards called *Bowerbankia caudata* in the genus *Valkeria*, on the ground that it had no gizzard. In this case, however, Hincks had only somewhat badly preserved specimens on which to base his diagnosis in the first instance, while Kent observed his specimens alive and was accustomed to minute microscopic investigation. I cannot, therefore, see any ground at present for separating the *Victorella* of Lower Bengal generically from that of Europe, although I am forced to regard it as a new species, for it is possible that the nature of the gizzard is a variable character, while the exact form of the connection between the zoecia is one that actually differs in different parts of the same colony: as a rule it has the quadrigonate formation regarded as so important by Rousselet, whose remarks on this point (*op. cit.*, p. 252) are in full agreement with mine (*Rec. Ind. Mus.*, i, p. 201) on the "false stolon" of the Paludicellidæ.

I have recently found *Victorella* in a pond of fresh water near Calcutta, the specimens agreeing in every respect with those taken this winter at Port Canning.

Bowerbankia caudata (Hincks).

I have been able to observe no difference between the specimens taken last year and those taken this. In several of the tanks I found colonies of the species interlaced with colonies of the hydroid *Irene ceylonensis*, which the floods already alluded to have apparently enabled to extend its range in the ponds considerably, as it was previously found in one of them only but is now common in nearly all. It will, I think, be convenient to distinguish the Port Canning form as "race *bengalensis*."

ENTOPROCTA.

Among dense masses of *Victorella*, *Bowerbankia* and *Irene* on grass stems I noticed, in some preserved material obtained from Port Canning at the beginning of December, 1907, numerous little polypoid organisms, evidently Entoproctous polyzoa. Their condition made it impossible to examine them properly, but on December 24th I was able to collect living specimens. An investigation based on these and on carefully preserved material proved them to represent a new genus, for which I have coined the name *Loxosomatoides*, in order to indicate its resemblance in one important character to *Loxosoma*; in some of its characters, however, it resembles *Pedicellina* more closely, and in others *Urnatella*, while it is perhaps more closely allied to the American *Myosoma* than to any other genus.

LOXOSOMATOIDES, gen. nov.

Colonial, deciduous Entoprocta arising from a creeping stolon; the calyx separated from the stalk by a diaphragm, with a slanting or vertical lophophore, and bearing on its aboral surface a chitinous shield, which is absent from the stalk.

Loxosomatoides colonialis, sp. nov.

Colony consisting of a large number of polypides, which arise, singly and at considerable intervals, from a sparsely branched, unsegmented stolon. Stalk smooth, minutely and irregularly annulated, variable in length. Calyx with from twelve to sixteen tentacles, which are bluntly pointed and relatively short. The shield borne on the aboral surface covering the whole of one side of the calyx, of an oval shape, covered with a large number of minute subrectangular depressions, which are separated from one another by narrow ridges, giving the whole structure a reticulated appearance; stout spines, very variable in number and size, scattered irregularly on the shield. Alimentary canal more or less asymmetrical, the colon emerging from the stomach at one side; stomach subspherical, very large.

Two distinct forms of the species can be distinguished. It is impossible to separate them specifically, because polypides intermediate between them occur, but the colonies representing them are quite easy to distinguish as colonies, and the differences are probably due to differences in environment.

Form A.—Stalk much longer than calyx, clean; calyx of full-grown polypide measuring about 0.414 mm. in vertical length; spines on shield not very strongly developed (figs. 2, 3).

Form B.—Stalk not or very little longer than calyx, encrusted with inorganic debris; calyx of full-grown polypide measuring about 0.357 mm. in vertical length; spines on shield strongly developed, black at the tip (fig. 4).

Form A was found growing amidst dense colonies of *Victorella*, *Bowerbankia* and *Irene*, while Form B was by itself on grass stems.

The structure of the new Entoproct does not differ materially from that of other members of the group; its main outlines are

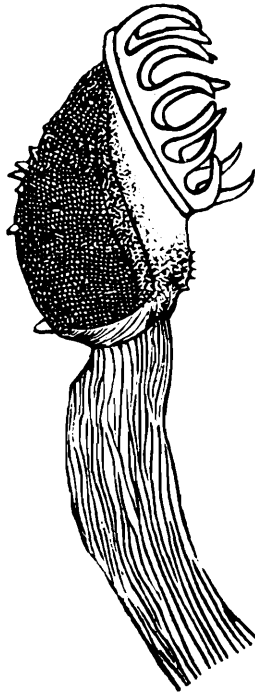


FIG. 2.

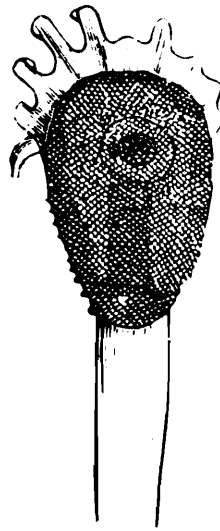


FIG. 3.

FIGS. 2 AND 3.—*L. colonialis*, form A, $\times 70$ (from preserved specimens).

clearly shown in fig. 5, which is drawn from a camera-lucida sketch of a carefully stained specimen. It will be well, however, to give a brief description of the more important and conspicuous organs.

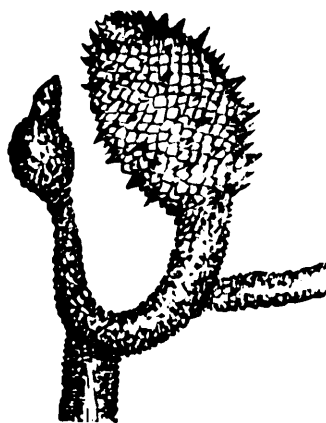


FIG. 4.—*L. colonialis*, form B, $\times 70$ (from preserved specimen).

Lophophore—

The extended lophophore bears a very close resemblance to that of *Urnatella* as figured by Leidy, owing not only to the direction of its main axis but also to the outline of the sphincter muscle, which in the living polypide has, when relaxed, a

peculiarly delicate and at the same time expanded appearance; it extends as a delicate, web-like structure for a considerable distance beyond the circle of tentacles. The tentacles are distinctly webbed at the base, apart from the sphincter, and, like those of *Pedicellina*, terminate somewhat abruptly. The fringe of cilia appears to be continuous round the distal extremity. When the tentacles are folded and the sphincter is contracted, the integument drawn together forms a papilla on the surface, the aperture being extremely minute and having a tubular form. The direction of the lophophore is capable of a certain change. When contracted, it stands parallel to the main axis of the calyx, but when the sphincter is fully relaxed it slants considerably.

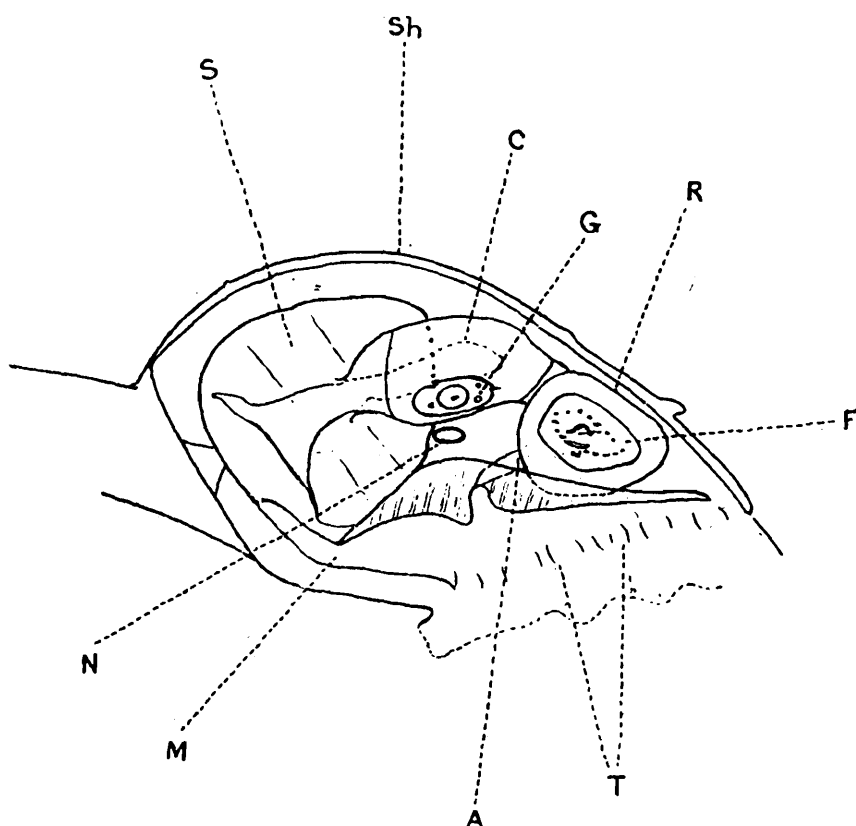


FIG. 5.—Anatomy of *L. colonialis*: A=anus; C=colon; F=faecal pellet; G=young ovary; M=mouth; N=ganglion; R=rectum; S=stomach; Sh=aboral shield; T=base of tentacles.

Calyx—

Owing to the presence of the aboral shield, the calyx is more rigid and less liable to change in outline than is the case with some Entoprocta. It has an ovoid and slightly flattened shape, the flattening being in the plane at right angles to the main axis of the calyx. The cuticle is fairly thick, but smooth and quite transparent on what may be called, in *Loxosomatoides*, the oral surface of the calyx; on the aboral surface it is thickened and chitinized to form the aboral shield. The spines are variable in outline; as a rule they are bluntly pointed; when they are well developed their tips are pigmented. Otherwise the shield has a yellowish

colour in living polypides and in specimens preserved in spirit. In specimens which have been cleared with cedar-wood or clove oil and mounted in canada balsam, however, the whole shield practically disappears, unless some method of double staining is employed.

Alimentary Canal—

When the tentacles are unfolded the circle of the lophophore surrounds a relatively large vestibule, the floor of which is often rather deeply concave, its exact form depending on the state of the alimentary canal. It is covered with long cilia which waive towards the mouth, a large circular aperture situated at the lower end of the vestibule. The mouth leads into a funnel-shaped œsophagus, which opens in its turn into the stomach, to which it is at right angles; the opening is almost exactly in the middle of the anterior ("oral") surface of the stomach. There is no epistome. The colon, a wide tube which can be entirely shut off from the stomach by a constriction, starts from one side of the latter but bends round behind it in such a way that the rectum, which is separated from the colon by a distinct constriction, comes to lie parallel to the œsophagus. The rectum is capable of great contraction and often takes on a spherical outline. In this condition it does not

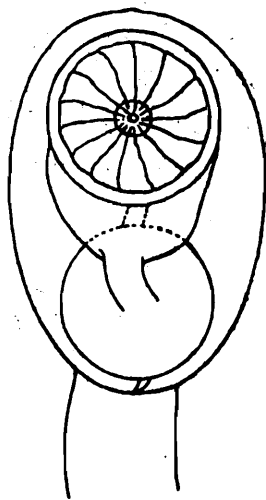


FIG. 6.—*L. colonialis*, polypide with retracted lophophore, from in front.

reach the floor of the vestibule but lies at the base of a narrow pit devoid of cilia. When the rectum is extended, however, the anus opens on the floor of the vestibule a short distance from its upper limits. Of all the divisions of the alimentary canal the stomach is by far the most bulky, filling up the greater part of the space in the calyx. Its anterior and posterior walls consist of greatly elongated cells; its base is fastened to the base of the calyx by means of a strand of tissue apparently resembling a dice-box in shape but very difficult to distinguish clearly as it takes all the stains I have tried on it feebly. The only part of the animal (except the shield) that is not absolutely colourless, is the stomach, which has a faint yellowish tinge.

Gonads—

The gonads arise as a pair of small reniform bodies, one lying on each side of the stomach. They branch as they develop, however, and become at first lobate, then dendritic, and finally form a broad zone, interrupted in front and behind, round the calyx, the branches being closely pressed together. All the colonies I have examined have been either male or female as colonies, but there were some indications in the female ones of protandry having occurred. I have not seen fully ripe ovaries or embryos, and am uncertain whether a brood-pouch exists.

Nervous System—

A relatively large ganglion exists near the centre of the calyx, in the bend of the alimentary canal, and sends off radiating nerves. Its position is the same as that occupied by the ganglion of *Pedicularia*.

Musculature—

I have been unable to detect muscles in the calyx, unless the structure joining the stomach to the base of the calyx is of this nature. The greater part of the stalk consists of vertical, nucleated muscle-fibres.

Stalk—

The stalk is covered by a smooth, minutely annulated cuticle, not very thin but quite transparent and colourless. Within the cuticle, for a short distance below the calyx, there is a single layer of flattened cells with nuclei that stain deeply; but this layer only extends for a short distance. The diaphragm is tangential to the main axis of the stalk. The remainder of the stalk apparently consists of a uniform mass of muscle-fibres. Whether flame-cells occur in this mass I am unable to say, not having cut sections. The calyx apparently dies at not very infrequent intervals and falls off, leaving a pointed tip to the stalk. A new calyx is then formed within the distal part of the stalk, apparently from that part of it which possesses a layer of flattened cells immediately within the cuticle.

Movements—

The movements of the polypide are slow, except in the case of the tentacles and sphincter muscle, which are folded in and contracted with great rapidity. The tentacles, when extruded, are usually held with their tips bent inwards towards the centre of the circle outlined by the lophophore, but they can be straightened out so as to lie parallel to the main axis of the polypide, and their tips can be applied together when they are fully extended, in order that food, consisting of various minute organisms, may be seized between them. I am indebted to my friend, Mr. F. M. Howlett, for the sketches reproduced in figure 7 and representing living polypides in various attitudes.

The calyx, when the tentacles are stretched out, either stands up vertically on the stem or is bent backwards so that its main axis is at right angles to that of the stalk and the lophopore is parallel or almost parallel to the stolon. When the animal is disturbed the calyx bends forwards and the aboral shield is presented in the direction from which danger threatens. At the same time slow writhing movements, which seldom cease altogether, cause the stalk to curl into a loose spiral with a single whorl. There is not, however, any nodding of the calyx such as takes place in some Entoprocta with deciduous calices.

Affinities—

In its mode of growth *Loxosomatoides* closely resembles *Pediclellina*, from which the direction of the lophophore at once distinguishes it; *Loxosoma* it only resembles in this one particular. The polypides bear a very close resemblance to young polypides

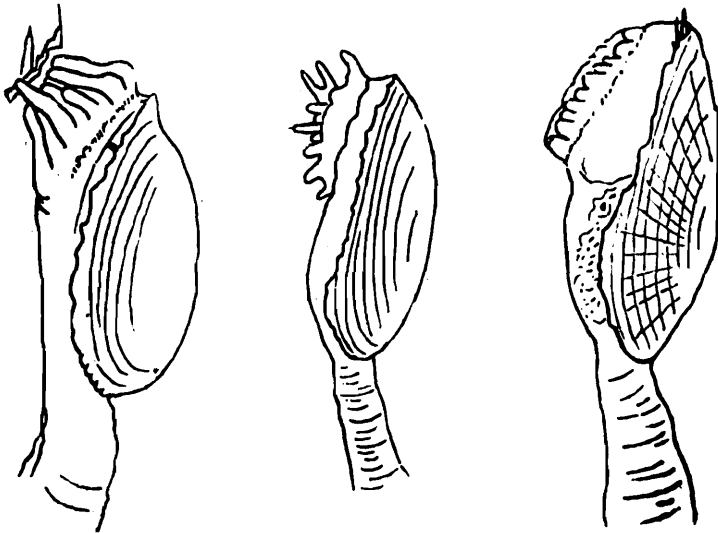


FIG. 7.

of the freshwater North American genus *Urnatella*¹ in which the stalk has not yet become segmented; this is particularly the case as regards the lophophore and the sphincter muscle. Probably, however, the closest affinities are with *Myosoma*,² in which an aboral shield is developed but extends down the aboral surface of the stalk. This genus, as its name is intended to indicate, is distinguished by the possession of definite muscles in the calyx, a character which I have been unable to detect in *Loxosomatoides*. The aboral shield of the new genus and of *Myosoma* is possibly homologous with the zoecium of the Ectoprocta, but a study of its development would be necessary before it would be possible to make a definite statement on this point.

¹ Leidy, *Journ. Acad. Nat. Sci. Philadelphia*, ix (2), p. 5, pl. 1, fig. 5, 1884.

² Robertson, "Studies in Pacific Coast Entoprocta," *Proc. California Acad. Sci.*, ii (3), p. 324, 1900.

II.—DESCRIPTION OF A NEW DICTYONINE SPONGE FROM THE INDIAN OCEAN.

By R. KIRKPATRICK

(Plate i.)

On the occasion of a visit to the Indian Museum, Calcutta, I was kindly permitted by Dr. Annandale, the Superintendent of the Museum, to inspect the collection of Sponges. Among the treasures obtained from the Indian Ocean by the "Investigator," were several dictyonine sponges of very elegant and remarkable form, all belonging to a species which had not been described before. For reasons stated below I consider the species to come under *Eurete*, despite the fact that there is no "beautiful network" of anastomosing tubes, but simply a vertical hollow stem with hollow separate lamellæ. Dr. Annandale entrusted the material to me for description, and I propose to name the new species *Eurete annandalei*.

Family EURETIDÆ, F. E. Schulze.

Genus EURETE, Semper.

1868. *Eurete*, Semper. *Verhandl. Würzburg phys. med. Gesellsch.*, Neue Folge, band i. *Sitzb.*, July 18, 1868, p. xxix.
 1887. *Eurete*, Schulze. "Challenger" Report, Hexactinellida, p. 289.
 1899. *Eurete*, Schulze. *Amerikanische Hexactinelliden*, p. 106.
 1904. *Eurete*, Wilson. *Mem. Mus. Comp. Zool. Harvard*, vol. xxx. No. 1, "Albatross" Exp., 1891, Sponges, p. 62.

Eurete annandalei, sp. nov.

Sponge in form of an erect, hollow, sub-cylindrical column with four vertical longitudinal series of lamellate branches at right angles to the central column and arranged in opposite pairs, each pair forming angles of 50° and 130° with the pair immediately above and below. Lamellate branches tubular at place of origin, then explanate and obcordate, and with thin margin; with a well-defined round orifice on the upper and under surface of each lamella. With two kinds of scopulæ, with small hexactins, and micro-discohexasters.

Localities.—One specimen, $\frac{\text{Z.E.V } 1422}{7}$ (fig. 2), from Lat.

7°55' N., Long. 81° 47' E., 506 fathoms; six specimens, $\frac{\text{Z.E.V } 2145}{7}$

(fig. 1), from Station 321, Lat. $5^{\circ} 4' 8\frac{1}{2}''$ N., Long. $80^{\circ} 22'$ E., 660 fathoms.

Of the seven specimens the best preserved is the broken one (B) depicted in fig. 2, in which many of the flesh spicules still remain, but neither in this nor the others are there any traces of the spicules of the dermal or gastral layers.

The other specimens consist only of the dictyonal network; and the central tube is mostly filled with mud.

In the longest specimen (A, fig. 1) the central sub-cylindrical column is 17 cm. in length, 1.4 cm. in diameter near the base, and 1 cm. in diameter at the upper end. The specimen rises from a solid disk-like base 3 cm. in diameter. In three of the smaller specimens the basal disk is perforated by an opening leading into the axial gastral cavity. The thickness of the wall of the central column varies from 1.1 to 1.2 mm. In the inner wall are four vertical rows of orifices leading to the lamellate branches.

In several of the specimens the lumen of the central tube is filled with mud; in one instance there are several minute Ophiurids. In five of the specimens the inner wall is smooth and the lumen bare of structure. The upper end of the central cylinder opens by an oval orifice with the long axis forming angles of 50° and 130° with the axis of the lamellar pair immediately below, and with the margins slightly flared out. In specimen A is an incomplete (?) vertical partition of slender dictyonal network, so that there is an appearance of a double tube. The presence of mud makes it difficult to discover whether the partition is complete or not; possibly at first there is a complete partition which becomes ruptured as the sponge grows. In specimen B there are, on the inner wall, alternating pairs of longitudinal vertical ridges situated on a level with the orifices leading to the branches and in a plane at right angles to them.

The lamellate branches or lamellæ—

The lamellæ are arranged at right angles to the central tubular axis, and in opposite pairs, each pair forming angles of 50° and 130° with the pair above or below it, the open or obtuse angle of the $\times$ thus formed (fig. 8) being 130° and the acute angle 50° . A botanical colleague informs me that the four rows are orthostichous, and that the arrangement in opposite pairs alternately crossing, but not at right angles might be described as spuriously decussate. Looking down on the specimen from above, the wall of the central tube is visible along the course of the opposite obtuse angles, but is concealed by the overlapping lamellæ along the line of the acute angles. Again, viewed in front there is an appearance of bilateral symmetry, *i.e.*, of two series of alternating lamellæ on each side of the spaces bounded by the opposite obtuse angles; but the branches or lamellæ develop in opposite pairs, accordingly the bilateral symmetry is a secondary development.

Specimen A has twenty pairs of lamellæ, *i.e.*, four vertical series of ten.

The lamellæ, in the well-preserved specimen B, have a short, sub-cylindrical, laterally compressed stem ; but this is less obvious in the other specimens, in which the branches come off at once as flat leaflets. The lamellæ are saddleshaped with the lateral edges curving downwards ; accordingly, in the fragmentary specimen B, it was possible to see at a glance which were the upper and lower ends of the specimen.

The lowest and oldest branches are reduced almost to mere ridges. A fully formed lamella is 19 mm. long, and 18 mm. wide.

The single circular orifices on the upper and lower surfaces are 4 mm. in diameter, and with well-defined slightly raised rim.

The upper orifice, obliquely directed and pointing upwards and outwards, is further away from the central column than the lower, which points downwards and outwards. In two instances there is a third orifice near the upper edge, suggesting an atavistic return to the form of colony with anastomosing tubes such as is found in the less specialised species of *Eurete*.

The orifices on the lower surface of the lamella persist to a greater degree than those on the upper. Along one vertical series, for instance, all the ten lower surface ones are open, but only the four highest of the upper surface ones. In the orifices more recently closed up it is still possible to see the outline below the thin layer of dictyonal skeleton.

Several of the lamellæ in B have a denticulate process or tongue on the inner margin of the upper orifice and a larger one on the outer margin of, or quite external to, the lower orifice.

The lamellæ are hollow at their origin, but beyond the orifices the upper and lower laminæ meet to form a thin edge.

The Skeleton.—The dictyonal network does not present any striking peculiarities. The network has square or oblong meshes, sometimes of considerable length, below the surface ; but at the surface the meshes form polygonal areas, each polygon being divided by spokes radiating from a centre, into triangular spaces.

From the nodes arise spines varying in length, shape, thickness and character of surface, but for the most part cylindrical, knobbed and slightly tuberculated, and sufficiently numerous to give the surface of the sponge a hirsute appearance to the naked eye. The spines round the lamellar orifices are very short and terminate in spherical knobs. Among these spines are numerous specimens of a Lituoline Foraminifer, which often so closely resembles the spines, that it is not easy to distinguish them from the latter. This organism is cylindrical, with a bulbous base, and with a surface layer of overlapping, fine, diamond-shaped, vitreous plates. The resemblance between the skeletal spines and the Foraminifer is so close as almost to suggest protective mimicry ; though at the same time it is difficult to imagine how such a minute organism could profit in this manner.

The dictyonal network does not fine off at the growing edges into a single layer as commonly happens in *Farrea*, and rarely in *Eurete*.

Spicules.—Scopulæ of two kinds. 1. With four or five knobbed prongs (fig. 10), $436\ \mu$ in total length, the prongs being $62\ \mu$ long; the shaft, which is slightly swollen at the point of origin of the prongs, is roughened at the upper and lower end; the lower end is blunt-pointed; the prongs are coarsely granular; and the pyriform knobs provided with retrocedent spines; the shaft, which is swollen at the cladal origin, is roughened at the upper and lower ends; the lower end rather blunt-pointed usually; the prongs, $62\ \mu$ long, are coarsely granular, and the pyriform knobs provided with retrocedent spines. 2. Scopulæ with lanceolate prongs (fig. 11), total length $694\ \mu$; the whole surface smooth; shaft $6.5\ \mu$ thick at centre, swollen at cladal end to $11\ \mu$. Prongs, usually five in number, smooth, lanceolate, $82\ \mu$ in length.

I found both kinds of scopulæ on the dermal side, and was unable to make out any distinction between dermal and gastral scopulæ.

Small hexactins, varying a good deal in size, but with rays on an average 400 to $450\ \mu$ in length, with finely spined surface.

Discohexasters $44.5\ \mu$ in total diameter, with smooth primary rays $6.25\ \mu$ long, each primary with four roughened curved, secondary rays $16\ \mu$ long, each ending in minute disk with finely denticulate edge.

Affinities.—The new species in its general form comes nearer to *Eurete erectum*, F. E. Schulze (*l.c.*, *supra*, p. 106), and its varieties (Wilson, *l.c.*, *supra*, p. 62, *et seq.*), than to other species of the genus, but at the same time there are great differences.

In *E. erectum* there is a tendency to form a long axial growth rather than a clump of anastomosing tubes. In *E. erectum* var. *tubuliferum*, Wilson, there is only a single axis with lateral branches, as in the new species; in this variety the lateral branches are at first cup-like, with flaring edges, which latter in more developed branches curve over and meet in such a way as to leave an orifice at each end of the line of junction.

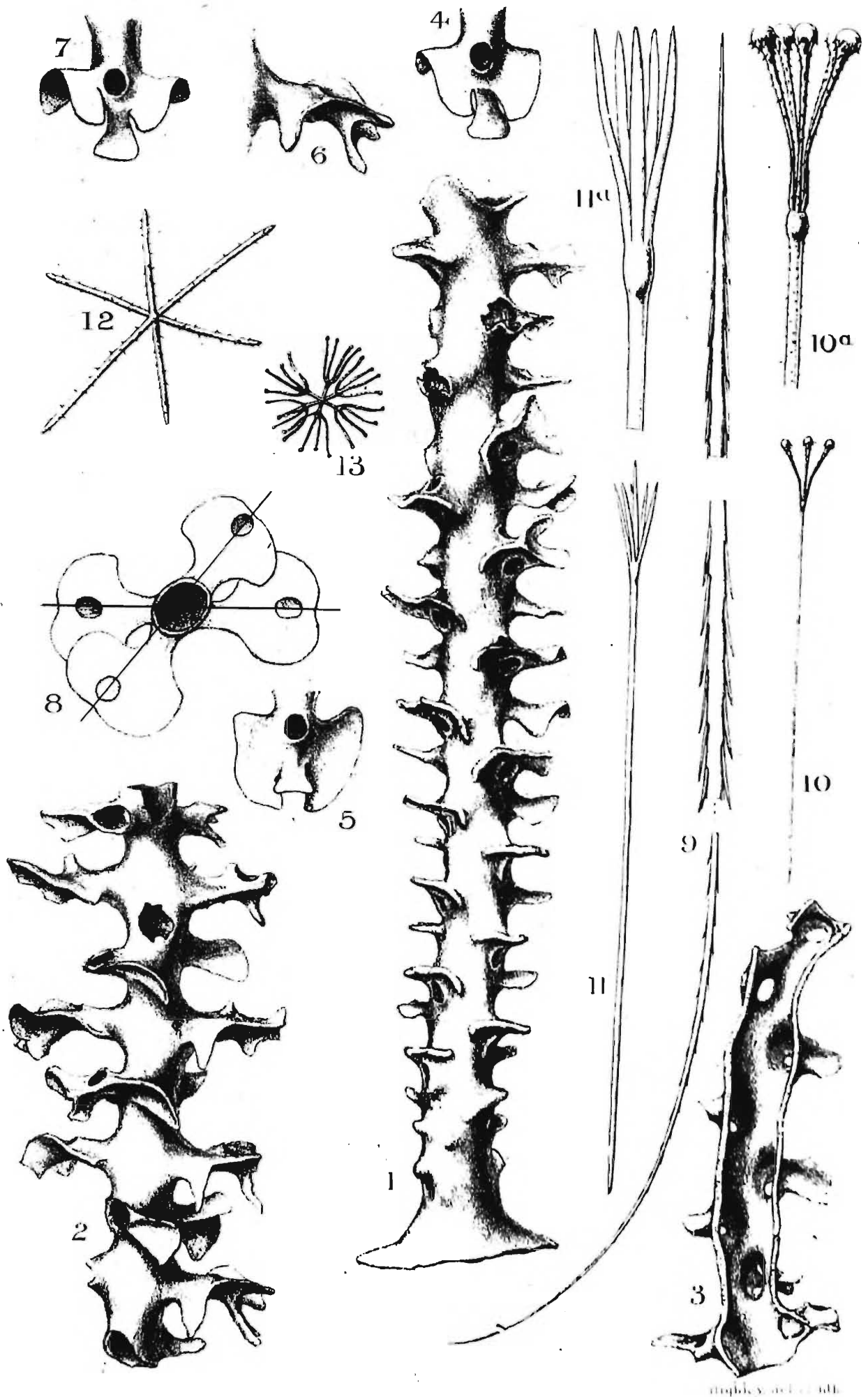
In *E. annandalei* a great degree of specialisation has arisen, the simple tube or cup expands into a hollow lamella in which the coalescent edges form the margin of a leaf-like lamina.

The upper and lower laminar orifices represent the openings left by the partial fusion of the edges of the simple tubular branch.

In spite of the high degree of specialisation attained in this species by the branches and their openings, it did not seem necessary to place the form under a new genus. In other Euretid sponges we find great divergence from the anastomosing tubular growth even within the limits of the same species, as in *Farrea occa* (Bowerbank) var. *laminaris*, Topsent (*Résult. Camp. Sci. Monaco*, fasc. xxv, p. 44, pl. vi, figs. 1, 2), and *F. occa* var. *foliascens*, Topsent (*Bull. Mus. Oceanograph. Monaco*, November 1906, p. 1).

EXPLANATION OF PLATE I.

- FIG. 1.—*Eurete annandalei*, sp. nov. Specimen A, nat. size.
,, 2.—Specimen B, nat. size.
,, 3.—Section of a third specimen showing interior of axial column, nat. size.
,, 4.—Upper surface of a lamella, nat. size.
,, 5.—Under surface of same, nat. size.
,, 6.—Side view of same, nat. size.
,, 7.—Front view of same, nat. size.
,, 8.—Diagrammatic transverse section to show angle at which branches cross.
,, 9.—Uncinate, $\times 160$.
,, 10.—Knobbed scopula, $\times 160$; 10 a, cladal end of another spicule, $\times 425$.
,, 11.—Lanceolate scopula, $\times 160$; 11 a, cladal end of another spicule, $\times 425$.
,, 12.—Hexactin, $\times 160$.
,, 13.—Discohexaster, $\times 425$.



EURETE ANNANDALEI n. sp.

III.—NOTES ON FRESHWATER SPONGES.

By N. ANNANDALE, D.Sc., Superintendent, Indian Museum.

VIII.—PRELIMINARY NOTICE OF A COLLECTION FROM WESTERN INDIA, WITH DESCRIPTIONS OF TWO NEW SPECIES.

The following sponges were collected in November last in the Gwalior Tank, Bombay, in the lake and in a small pond at Igatpuri in the Western Ghats, and in the Godaveri River at Nasik on the eastern side of the same range of hills.—

- Spongilla lacustris*, auctorum, in a pond at Igatpuri.
- „ *cinerea*, Carter, on stones in the Godaveri at Nasik.
- „ *carteri*, Bowerbank, in different situations at Bombay and Igatpuri.
- „ *bombayensis*, Carter, on stones in the lake at Igatpuri.
- „ *indica*, sp. nov., on stones in the Godaveri at Nasik.
- „ *lapidosa*, sp. nov., together with the last and on stones at Igatpuri.

Ephydatia indica, Annandale, on stones in a pond at Igatpuri.

The specimens of *Spongilla lacustris* are small, but typical; those of *S. cinerea*, *S. carteri*, *S. bombayensis* and *Ephydatia indica* I have compared with types or co-types. A full account of the collection will be published later, but the following preliminary descriptions will serve as diagnoses of the two new *Spongillæ* represented. The types are in the collection of the Indian Museum, but co-types will be sent to the British Museum.

Spongilla indica, sp. nov.

Closely allied to *S. sumatrana*, Weber.

Sponge forming a very thin layer, of a bright green or pale grey colour; surface smooth, minutely hispid; pores and oscula inconspicuous, the latter approached in some instances by radiating furrows; subdermal space small; texture compact, rather hard. Skeleton incoherent, somewhat massive owing to the large number of spicules present; spicules forming triangular meshes and occasionally arranged in vertical lines several spicules broad but without spongin. Skeleton spicules straight or nearly straight, slender, cylindrical, amphistrongylous, uniformly covered with minute, sharp spines; flesh spicules slender, sharply pointed, straight or curved, irregularly covered with relatively long, straight, sharp spines,

abundant in the dermal membrane, scarce in the substance of the sponge. Gemmules spherical, somewhat variable in size, with a single aperture, which is provided with a trumpet-shaped foraminal tubule and is situated at one side of the gemmule in its natural position; the inner chitinous coat devoid of spicules, closely covered by an outer coat composed of a darkly coloured chitinous substance, in which the gemmule spicules are embedded, lying parallel or almost parallel to the inner coat. The outer coat forms a kind of mantle by means of the skirts of which the gemmule is fastened to the support of the sponge and which is pierced by the foraminal tubule;

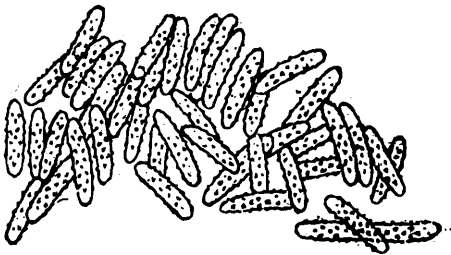


FIG. 1.



FIG. 2.

FIGS. 1 AND 2.—*Spongilla indica*: fig. 1 = group of gemmule spicules, $\times 240$; fig. 2 = a gemmule, $\times 70$.

gemmules distinct from one another; gemmule spicules short, stout, sausage-shaped, covered with minute, straight spines, which are sometimes absent from the extremities.

Average length of skeleton spicules	0.2046 mm.
„ breadth of skeleton spicules	0.0172 „
„ length of flesh spicules	0.053 „
„ breadth of flesh spicules	0.0053 „
„ length of gemmule spicules	0.044 „
„ breadth of gemmule spicules	0.0079 „

Spongilla lapidosa, sp. nov.

Allied to *S. loricata*, Weltner.

Sponge encrusting, black or grey, extremely hard, its surface with occasional groups of spicules projecting; dermal membrane adhering closely to the surface; oscula very small, sometimes conspicuously elevated. Skeleton incoherent, broad groups of spicules arranged vertically occurring irregularly but being devoid of any binding substance and only traversing a small part of the thickness of the sponge; transverse fibres absent; in the inferior part of the sponge the direction of a large proportion of the spicules is horizontal, the number arranged vertically being greater in the upper part. Skeleton spicules sausage-shaped, sometimes slightly swollen at the ends, as a

rule smooth but occasionally a little rough, variable in proportions, probably slender and pointed when young. Gemmule spicules sausage-shaped, covered with short, straight spines, which are sometimes absent from the extremities, variable in length. Flesh spicules birotulate, usually occurring in groups; their shafts smooth, slender, straight or curved, variable in length; their rotulæ consisting of six or seven backwardly curved spines. Gemmules congregated in groups at the base of the sponge, oval or sausage-shaped, with a single depressed aperture situated on one of the longer sides; each gemmule contained in an oval case of spicules and a dense chitinoid



FIG. 3.—Gemmule of *Spongilla lapidosa* in its case, the roof of which is omitted, from below, $\times 30$.

substance, and having, apart from this, only an inner coat, in which the spicules are embedded horizontally like a mosaic; the case consisting of an inner layer of skeleton spicules, occasionally mixed with birotulate flesh spicules, and an outer one formed of gemmule spicules massed together irregularly and held in position by the chitinoid substance, the side walls of each case being partly coincident with those of others. There is a dense membrane at the base of the sponge with which the outer layer of the gemmule cases is in continuity.

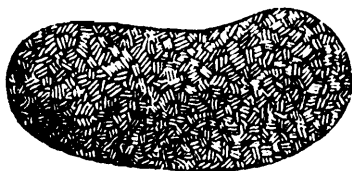


FIG. 4.

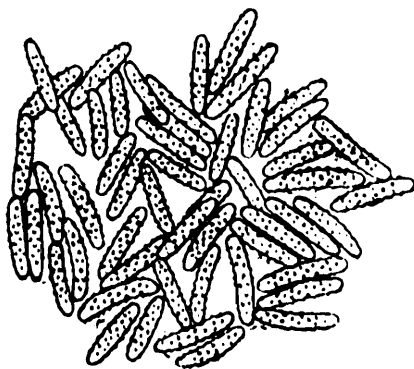


FIG. 5.

FIGS. 4 AND 5.—*Spongilla lapidosa*: fig. 4 = sausage-shaped gemmule, $\times 30$; fig. 5 = a group of spicules from the same, $\times 240$.

Measurements of skeleton spicules		From $0\cdot279 \times 0\cdot079$ to $0\cdot231 \times 0\cdot0186$ mm.
„ flesh spicules		Length of shaft from $0\cdot159$ to $0\cdot046$ mm. Breadth of shaft= $0\cdot0026$ mm. Diameter of rotule = $0\cdot0106$ mm.
„ gemmule spicules	..	$0\cdot026$ to $0\cdot039 \times 0\cdot0106$ mm.
„ gemmules		$0\cdot38 \times 0\cdot29$ to $0\cdot55 \times 0\cdot25$ mm.



IV.—REMARKABLE CASES OF VARIATION.

By R. E. LLOYD, M.B., B.Sc., Capt., I.M.S., formerly Surgeon Naturalist, Marine Survey of India.

I.—*Squilla* INVESTIGATORIS.

Anyone who examines large numbers of animal organisms and attempts to fit them into the established specific groups, must be sometimes in doubt as to the propriety of placing certain of them into any particular group. This doubt is by no means always felt. As a rule organisms can be readily placed in established groups, or new ones or species defined for their reception. Occasionally, however, a number of individuals are found living together in the same environment, and resembling one another so closely in most respects that we hesitate to place them in more than one species, although in certain particular features they differ widely, one from the other. To establish several species for such a collection seems most inappropriate, for by so doing the offspring of even the same parents might be described as different species. If certain of the crustacea here described had been taken from widely separate localities there is no doubt that they would have been regarded as separate species. Animals which show such a wide range of variation are rare in comparison with ones showing a limited range, but they undoubtedly occur. They are perhaps less uncommon among the marine fauna of tropical seas than in other environments.

During the early part of 1906, the R.I.M. Survey ship "Investigator" trawled at ten stations along the south-west coast of Arabia. At one of these (Lat. $15^{\circ} 8' 30''$ N. Long. $51^{\circ} 52' 15''$ E.), from a depth of 110 fathoms, a very large number of a species of *Squilla* was obtained. It is much to be regretted that the interesting features of the species were not recognised at the time of their capture, and that only some twenty complete specimens were retained. Seventeen of these are now available for examination in the Indian Museum; this number, however, is quite sufficient to illustrate the remarkable variability of the species.

The seventeen specimens resemble one another very closely in all parts of their outer structure with one exception. The number of spinous teeth on the dactyle of the raptatorial claw varies from ten to eighteen among this small collection of seventeen individuals. Furthermore, as regards this appendage, they show no less than eleven different types displayed in the following table :—

Type.	TEETH PRESENT IN TYPE.		Number of individuals of the type.
	Left claw.	Right claw.	
I	10	16	1 (figured, pl. iii).
2	13	13	3
3	14	13	1
4	14	14	2
5	15	15	2
6	16	15	1
7	16	16	3
8	16	17	1
9	17	16	1
10	17	17	1
11	17	18	1
TOTAL			17

Besides this great variation in the number of teeth, their curvature and proximity one to the other are very variable. It was thought well to illustrate them fully (plate ii). The dactylus, in each case, was drawn under a low power of the microscope by the aid of the camera lucida. The resulting outline drawings, which were each twelve times the size of the object they represented, were reduced in the process of reproduction to more convenient dimensions. By these means accurate figures were obtained.

Owing to the great similarity of all their other features and to the fact of their community, they were regarded as one species and described as such under the name *Squilla investigatoris* (*Rec. Ind. Mus.*, i, p. 10), though it is impossible to say whether the species has 13, 14, 15 or 16 teeth on its claw. Perhaps if larger numbers were available, a clear majority might be found to possess claws bearing teeth to the value of only one of these numbers. A remarkable feature of this variation is that it occurs in an organ which is very stable in other species of the genus.

The genus *Squilla* has been defined as having no more than six teeth on the raptatorial claw, but in spite of this there can be little doubt that this variable species has been correctly assigned to the genus *Squilla*.

In his report on the "Challenger" *Stomatopoda* Brooks defines the genus as follows:—

2. Dactyle of raptatorial claw not dilated at the base, but usually armed with marginal spines.

- (1) Primary marginal spines of the telson small, with no more than four secondary spines between the submedian and the intermediate; outer

spine of the basal prolongation of the uropod usually longer than the inner; dactyle of raptatorial claw with not less than six marginal spines

Genus *Lysiosquilla*.

- (2) Primary marginal spines of telson large, with more than four secondary spines between the intermediate and the submedian; inner spine of the basal prolongation of the uropod longer than the outer; dactyle of the raptatorial claw usually with no more than six marginal spines

Genus *Squilla*.

Bigelow, in a report on the Stomatopods collected by the "Albatross," follows Brooks in his definition of the genus (*Proc. U. S. Nat. Museum*, vol. 17, 1894).

Of the three features chosen to define *Squilla* from *Lysiosquilla*, the "Investigator" species exhibits only two, for *Lysiosquilla* is the genus which possesses, according to the above definition, not less than six raptatorial spines (some species of this genus have ten). In the form of the telson and uropods, however, the new species is obviously a true *Squilla*; the figure (plate iii) shows this better than any verbal description.

At least two other species of *Squilla* possess a larger number of raptatorial teeth than six. *Squilla raphidea*, a very widely distributed species, has eight: *S. armata* is referred to by Bigelow (*ant. cit.*) as having, "7 to 9 teeth on the raptatorial claw, rarely 6"; this species evidently resembles *S. investigatoris* in the nature of its variability, though this occurs to a less degree in the former species.

Except for these two species the genus *Squilla* seems to be remarkably constant as regards the raptatorial claw. In order to test and illustrate the stability of this appendage, the number of teeth on the claws of all the *Squillas* in the Indian Museum was counted. The collection is a large one and in excellent order; as can be seen from the following list, it has been gathered from eastern tropical seas in a wide sense, though chiefly from the Bay of Bengal and the Arabian Sea. It should be mentioned that all of one species from one named locality have been included in one group, although they may have been received from different donors at different times. For example, the 71 specimens of *S. interrupta* from Hongkong were received on four separate occasions, the 39 specimens of *S. hemischista* were obtained from three separate stations on the Orissa coast; the same may be said of the 55 specimens of *S. hemischista* from Madras. Although included in one group the specimens were

probably collected from widely separate places. Only species of the true genus *Squilla* have been included. *Lysosquilla*, *Pseudo-squilla* and *Protosquilla* were not counted.

Species.	Locality	Number of normal specimens.	Number of abnormal specimens.
<i>S. interrupta</i>	Sandheads (mouth of Hooghly).	15 ($\frac{6}{8}$)	0
"	Hongkong	71 ($\frac{6}{8}$)	2 ($\frac{6}{8}$, $\frac{6}{7}$)
"	Karachi	14 ($\frac{6}{8}$)	0
"	Bombay	18 ($\frac{6}{8}$)	0
"	Orissa coast (B. of Bengal)	3 ($\frac{6}{8}$)	0
"	Mutlah light (mouth of Hooghly).	1 ($\frac{6}{8}$)	0
"	Singapore	3 ($\frac{6}{8}$)	0
"	Akyab (Burma)	1 ($\frac{6}{8}$)	0
"	Camorta I. (Nicobars)	1 ($\frac{6}{8}$)	0
"	Vizagapatam coast	1 ($\frac{6}{8}$)	0
<i>S. affinis</i>	Hongkong	19 ($\frac{6}{8}$)	0
"	Yokohama	1 ($\frac{6}{8}$)	0
"	Nagasaki	1 ($\frac{6}{8}$)	0
<i>S. holoschista</i>	Madras	28 ($\frac{6}{8}$)	3 ($\frac{5}{8}$, $\frac{6}{7}$, $\frac{6}{9}$)
"	Sandheads	1 ($\frac{6}{8}$)	0
"	Colombo	2 ($\frac{6}{8}$)	0
"	Vizagapatam	1 ($\frac{6}{8}$)	1 ($\frac{7}{8}$)
<i>S. hemischista</i>	Madras	55 ($\frac{6}{8}$)	0
"	Orissa coast	39 ($\frac{6}{8}$)	1 ($\frac{5}{8}$)
"	Sandheads	4 ($\frac{6}{8}$)	0
"	Cochin	8 ($\frac{6}{8}$)	0
"	Penang	4 ($\frac{6}{8}$)	0
"	Singapore	1 ($\frac{6}{8}$)	0
"	Ganjam coast	1 ($\frac{6}{8}$)	0
"	Bombay	2 ($\frac{6}{8}$)	0
"	Ganjam port	8 ($\frac{6}{8}$)	0
"	Vizagapatam coast	4 ($\frac{6}{8}$)	0
"	Hongkong	2 ($\frac{6}{8}$)	0
<i>S. stridulans</i>	Orissa coast (68 fathoms)	17 ($\frac{6}{8}$)	0
"	"B. of Bengal" (240 fathoms).	2 specimens, only one claw present, bearing 6 spines.	
"	Godavery coast (95 fathoms).	4 ($\frac{6}{8}$)	0
<i>S. multicarinata</i>	Hongkong	8 ($\frac{5}{8}$)	0
<i>S. tenuispina</i>	Arakan coast	1 ($\frac{1}{4}$)	0
"	Off L. Andaman I. (188 fathoms).	3 ($\frac{1}{4}$)	0
"	Ganjam coast	1 ($\frac{1}{4}$)	0
"	Godavery coast (95 fathoms).	2 ($\frac{1}{4}$)	0

Species.	Locality.	Number of normal specimens.	Number of abnormal specimens.
<i>S. leptosquilla</i> (closely resembling <i>S. tenuispina</i>).	"B. of Bengal" (270—419 fathoms).	3 ($\frac{4}{4}$)	0
<i>S. polita</i>	Madras	13 ($\frac{8}{8}$)	1 ($\frac{1}{8}$)
"	Pondicherry	3 ($\frac{8}{8}$)	0
"	Bombay	1 ($\frac{8}{8}$)	1 ($\frac{8}{8}$)
"	Hongkong	2 ($\frac{8}{8}$)	0
"	Orissa coast	1 ($\frac{8}{8}$)	0
<i>S. fasciata</i>	Andamans	1 ($\frac{8}{8}$)	0
<i>S. gorypetes</i>	Cheduba straits (Burma)	1 ($\frac{8}{8}$)	0
<i>S. gilesii</i>	"B. of Bengal" (65 fathoms).	4 ($\frac{8}{8}$)	0
<i>S. scorpio</i> (<i>immaculata</i>).	Hooghly estuary	7 ($\frac{8}{8}$)	0
<i>S. scorpio</i> (<i>genuina</i>)	Karachi	1 ($\frac{8}{8}$)	0
"	Bombay	1 ($\frac{8}{8}$)	0
<i>S. raphidea</i>	Mergui	3 ($\frac{8}{8}$)	1 ($\frac{8}{8}$)
"	Bombay	14 ($\frac{8}{8}$)	0
"	Sandheads	10 ($\frac{8}{8}$)	0
"	Rangoon	1 ($\frac{8}{8}$)	0
"	Andamans	1 ($\frac{8}{8}$)	0
"	Singapore	1 ($\frac{8}{8}$)	0
"	Persian Gulf	1 ($\frac{8}{8}$)	0
"	Karachi	1 ($\frac{8}{8}$)	0
"	Hongkong	23 ($\frac{8}{8}$)	0
"	Gulf of Martaban (61 fathoms).	1 ($\frac{8}{8}$)	0
"	Off Cape Negrais (Burma)	1 ($\frac{8}{8}$)	0
<i>S. ovatoria</i>	Bombay	1 ($\frac{8}{8}$)	0
<i>S. supplex</i>	"	1 ($\frac{8}{8}$)	0
<i>S. chlorida</i>	Hongkong	6 ($\frac{8}{8}$)	0
<i>S. foveata</i>	Ye (Burma)	1 ($\frac{8}{8}$)	0
TOTAL	19	63	10

The 451 specimens are, therefore, remarkably stable as regards number of raptatorial teeth. Variations from the normal type of the species only occurring to the extent of about 2 per cent. In their other features the members of this collection seem also very stable, and in these other features *S. investigatoris* is itself very stable: for example, on the outer border of the tail of a *Squilla* (exopod of uropodite) are eight movable spines; this number is very constant throughout the genus, and all of the seventeen specimens of *S. investigatoris* possess eight spines in this situation. The stability of this feature is in striking contrast to the variability of the claw in the same species.

The following facts seem, therefore, to be well established :—

- (1) The great variability of one feature (the raptatorial claw) in a particular race of the genus *Squilla*.
- (2) The comparative stability of the same feature in other races of the genus from neighbouring seas.

In reference to the same subject the following statements may also be made, though the supporting evidence is much less sure :—

- (3) This variable race of the genus is very common in one locality ; but is rare (or does not occur) outside that locality.

No exception can be taken to the first part of this statement. The number of specimens actually taken at one haul of the net was recorded as over 500. It is not usual to obtain a new species in such large numbers, though the records of deep-sea dredging show similar results from time to time.

The second part of the statement, that this variable race is rare outside the particular locality where it was found, is, of course, open to the objection that the fauna of Indian seas is very imperfectly known. How far this is true of the genus *Squilla* is fully shown in the above table, which shows the wide distribution of some of the species on both sides of the Indian Peninsula.

- (4) This variable race occupies an environment (beneath 110 fathoms of water, far from terrestrial influences) which must be comparatively constant in any one place, through considerable periods of time : furthermore, the circumstances of this environment cannot differ widely from those met with close to the 100-fathom line in neighbouring seas.

This statement does not rest on any definite evidence, though it appears generally true that the conditions of life beneath 100 fathoms of water must be less liable to change than in very shallow water or on land.

The genus *Squilla* is usually found in shallow water. It is comparatively rare in depths of over 50 fathoms. In the above list, the depth has been noted in the case of specimens taken from other than shallow water. It is not likely that increased depth of water could in itself produce variation in the direction of an increase of raptatorial spines. That it has no such influence is shown by the species *S. stridulans*, which has been taken from 68, 240 and 95 fathoms but shows only six raptatorial teeth, still more so by the species *S. tenuispina* and *S. leptosquilla* which have been taken from 188, 95, 270 and 419 fathoms, for these species have only four teeth.

Theoretical considerations.

Taking into consideration the number of teeth on the raptatorial claw of all the known species of *Squilla*, it is difficult to believe

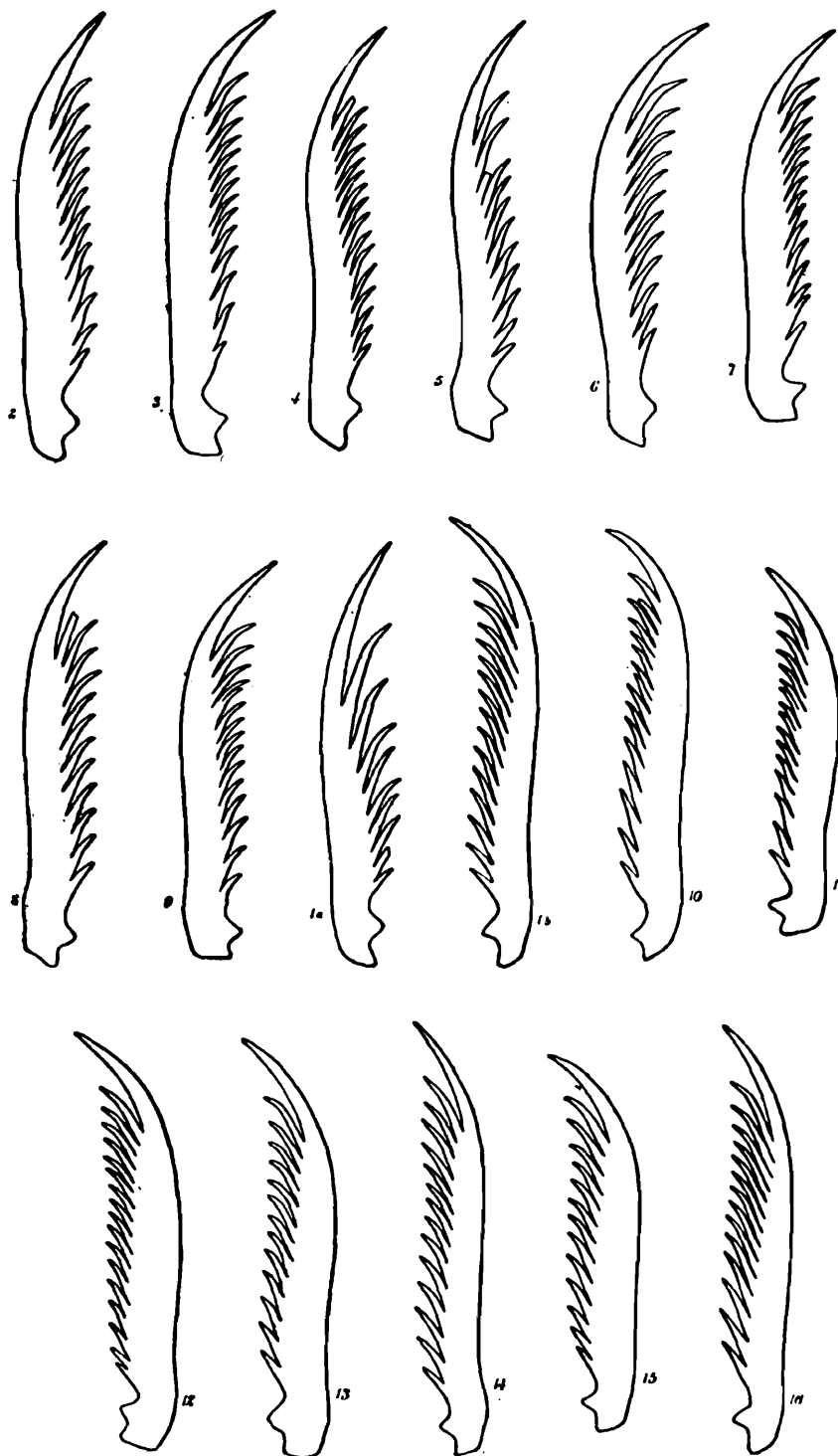
otherwise than that this variable and many-toothed species has been derived from a form which had a smaller number of teeth. This number was probably six, for this is most common throughout the genus.

One who holds strictly to the idea that such changes are brought about by the perpetuation and accumulation of minute variations which occur in any direction, must suppose that the widely distributed members of the genus are kept constant as regards number of teeth, because that number suits some peculiarity of their environment. Any individuals showing variations from that number are usually unable to reach maturity, for abnormal specimens appear among a collection of adults to the extent of only 2 per cent.

In order to explain how a form having fifteen teeth was derived from one having but six, one must believe, if the theory of gradual change is true, that a series of ancestors having 7, 8, 9, 15 teeth must have existed. Starting from the point when the six-toothed form gave rise to one having seven teeth, one must imagine a change in the environment which favoured the few seven-toothed variations, so that few as they were among the myriads of young, a comparatively large percentage of them began to reach maturity and to transmit the new character to their offspring, until seven-toothed adults formed a majority and a new species was formed.

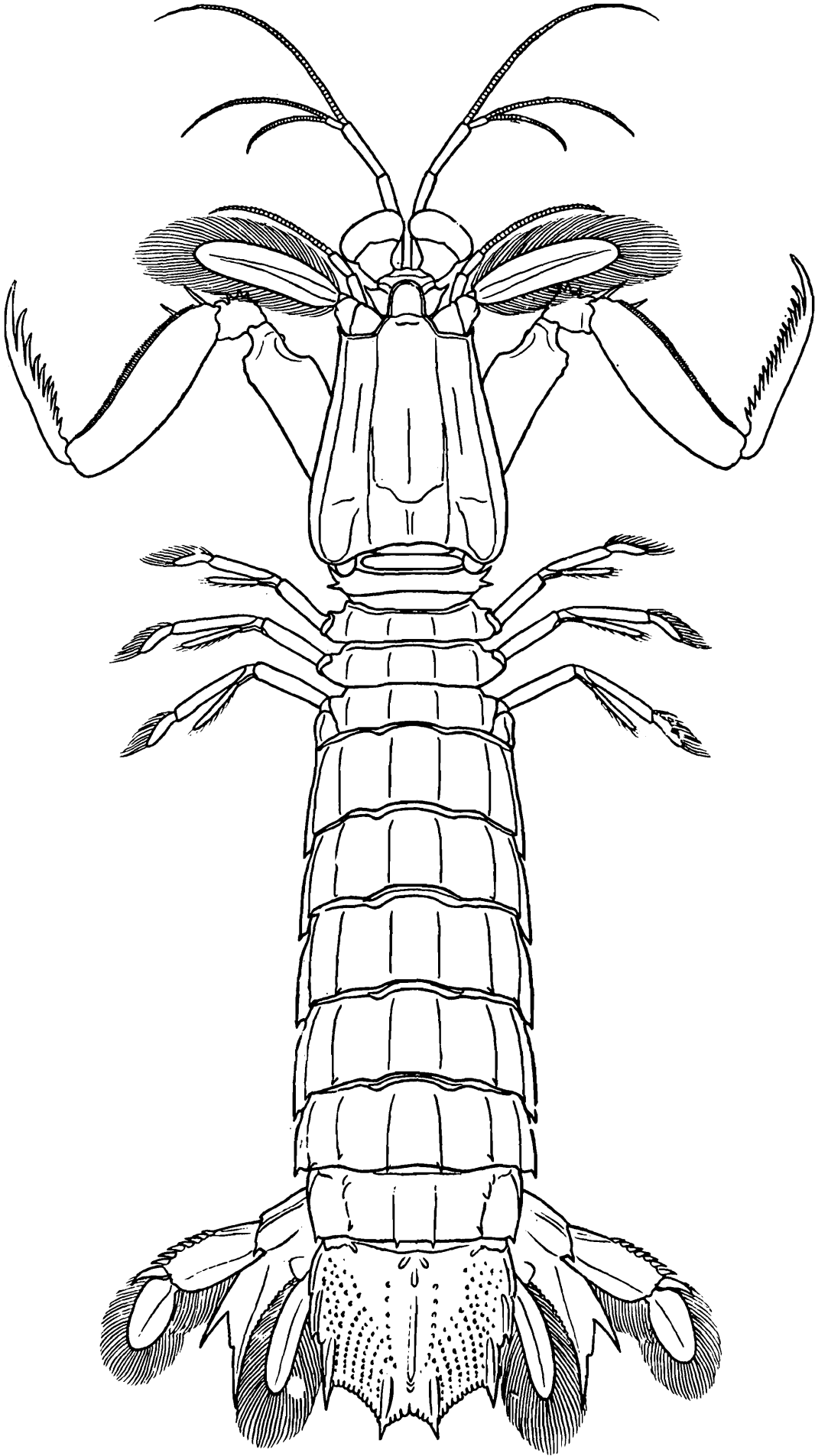
By a like process this gave rise to a species having eight teeth. The change of environment which caused the production of the seven-toothed form out of the six-toothed, could not produce the eight-toothed form from the seven-toothed. To produce this a further change in the environment appears to be necessary. This change must have been similar in nature to the first change, for it produced a like effect, but it must have been of increased intensity. If it were not so, the race would remain seven-toothed. In other words there must have been a continuous and increasing change of some particular feature of the environment to have caused the change in number of teeth from six to fifteen. What this change could have been is not easy to imagine. The supposition might be made of a gradual diminution in the size of the favourite prey, favouring an increase in number of the raptatorial teeth. However, if one examines, side by side, the claw of a *Squilla* with six teeth, and that of one with fifteen teeth, it seems impossible to imagine a small animal which could escape from either when the dactyle is closed down into its opposing groove; still less can this supposition account for an increase of one tooth at a time.

The facts of the case, which do not seem to be in favour of the "Theory of gradual change," are recorded here as a contribution to the study of animal variation available for comparison with similar cases which may be recorded.



The dactyles of sixteen specimens of *Squilla investigatoris* drawn with the camera lucida, $\times 4$. 1a and 1b are the left and right dactyles of the specimen shown on plate iii.

Certain of the figures (notably 9, 10 and 11) show a tendency for the teeth to be distributed in pairs as though increase in the number of teeth has been brought about by duplication in the middle of the series.



Mondul del. SQUILLA INVESTIGATORIS, × 2.

V.—DESCRIPTION OF A NEW SPECIES OF
LIZARD OF THE GENUS *SALEA*
FROM ASSAM

By N. ANNANDALE, D.Sc., Superintendent, Indian Museum.

The range of the genus *Salea* was thought until recently to be confined (with a possible extension into Ceylon) to Southern India, where two species (*S. horsfieldii* and *S. anamallayana*) occur. In my "Notes on the Oriental Lizards in the Indian Museum" (*loc. post. cit.*, p. 81), however, I recorded two specimens from North-Eastern India, one collected by the late Dr. Stoliczka at Moulmein in Lower Burma and one by Col. Godwin Austen in North Assam. The former specimen, a female, agrees in every respect with examples of *S. horsfieldii* from the Nilgiris, but the latter must, I now think, be recognized as the type of a new species, which is here described.

Salea austeniana, sp. nov.

S. horsfieldii, Gray, Annandale (partim), *Journ. Asiat. Soc. Bengal*, 1905, p. 86.

Habit rather stout, the adpressed hind limb reaching the anterior border of the orbit; tail compressed. Tympanum about half as large as the orbit, its distance from which is distinctly less than the length of the snout; width of the orbit a little less than the length of the snout; canthus rostralis and superciliary ridge angular; snout slightly concave above, sloping. A curved fold covered with granular scales in front of the shoulder; scales on the back and sides of diverse sizes, bluntly pointed, occasionally split at the tip, rather feebly keeled, relatively broad; ventrals triangular, without a terminal spine, feebly keeled, strongly imbricate; gulars smooth, no larger than some of the ventrals; scales on the upper surface of the limbs and the lower surface of the tail strongly keeled. Dorsal and nuchal crests continuous, consisting of a single row of scales (in the female) which are lanceolate on the neck and triangular on the body, continued on the tail as a slightly serrated ridge. Colour dull green mottled on the sides with brown and diversified on the head with the following markings: a narrow longitudinal line between the eyes that bifurcates in front and behind, the anterior bifurcation forming the two posterior sides of a lozenge in outline on the snout, and the posterior one the two equal sides of an isosceles triangle on the back of the vertex; two slanting-shaped lines on the supraocular regions, one on each side; a dark streak extending from the lower posterior limit of the

orbit nearly to the nape ; a series of fine lines radiating from the eye.

Locality—Hills near Harmatti, Assam.

The type (apparently a female) was collected during the Dafla Expedition of 1874-75, and is numbered 3976 in the Indian Museum register of reptiles. Its dimensions are as follows :—

Length of head and body	90 mm.
Width of head	14 „
Length of snout	10 „
Width of orbit	8 „
Length of tail	230 „
Length of fore limb	52 „
Length of hind limb	76 „

Boulenger's " key " to the genus in *Faun. Brit. Ind., Reptiles*, p. 131, will have to be emended as follows to include the new species :—

A. No fold in front of the shoulder.

(a) Snout not more than once and a half as long as the diameter of the orbit *S. horsfieldii*.

B. A fold in front of the shoulder.

(a) Snout nearly twice as long as the diameter of the orbit *S. anamallayana*.

(b) Snout only slightly longer than the diameter of the orbit *S. austeniana*.

Mr. L. L. Fermor, of the Geological Survey of India, has recently sent to the Museum a specimen of *S. horsfieldii* captured at the height of 8,000 feet in the Nilgiris.



VI.—THE FAUNA OF BRACKISH PONDS AT PORT CANNING, LOWER BENGAL

PART VIII.—PRELIMINARY DESCRIPTION OF AN OLIGOCHÆTE WORM OF UNCERTAIN POSITION.

By J STEPHENSON, *Major, I.M.S., Professor of Biology,
Government College, Lahore.*

The worm which forms the subject of the following notice was sent to me along with a colony of *Victorella pavid*a (on which, as well as on *Bowerbankia caudata* and *Loxosomatoides*, it lives) by Dr. Annandale, having been found by him in the brackish pools at Port Canning. The specimens were in a good state of preservation; but, with the exception of the general outlines of the alimentary canal, details of internal anatomy are scarcely to be recognised in preserved specimens; and the following description has mainly to do with the general external characters and the setæ.

The worms were whitish in colour, and measured (probably in a somewhat contracted condition) from 1·5 to 4·5 mm. in length; the average was from 3 to 4 mm. There is a well-marked prostomium, bluntly conical in shape; the anterior part of the body is somewhat swollen in an ovoid manner; then follows a short, slightly constricted region; after which the body, enlarging again, maintains a cylindrical shape to the posterior end. It is possible that in preserved specimens the anterior end appears more swollen than during life, since the setal bundles are placed closer together here; the anterior portion of the body having contracted more, probably, than the posterior. There are no eyes.

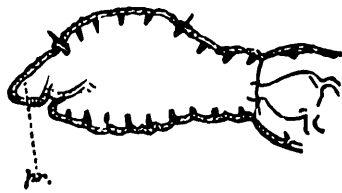


FIG. 1.—Side view of anterior part of body, showing the arrangement of the setal bundles of one side: *pr.*, prostomium.

The number of segments varies from about 20 to about 30. The posterior, regularly cylindrical part of the body is constituted by all the segments after the tenth, the anterior ovoid portion comprises the first eight or nine, and the constricted region

consists of the tenth and perhaps the ninth segment also. In the anterior part of the body the segments may be delimited on the ventral surface by a series of narrow, groove-like, transverse markings.

There are two dorsal and two ventral setal bundles in all segments from the second onwards. The setæ are of two kinds, hook-setæ and needle-setæ; the most anterior bundles, both dorsal and ventral, consisting of needle-setæ, the posterior of hook-setæ.

The needle-setæ are from $\cdot 08$ to $\cdot 12$ mm. in length, finely pointed, not bifid, the extreme point being slightly recurved. They are somewhat bayonet-shaped, and appear to be definitely strengthened or thickened along the convexity of the angle of their chief curve (v. text-fig. 2). They project from the body-wall for about half their length, that is, from the region of the angle; the angle looks forwards, and the distal pointed extremity backwards

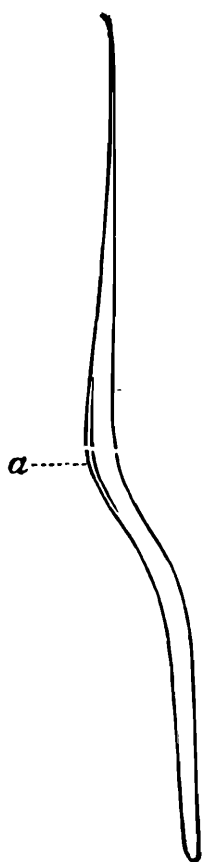


FIG. 2.

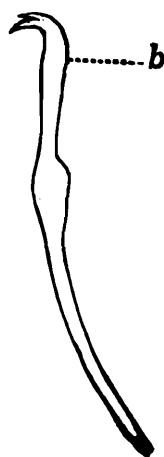


FIG. 3.

FIG. 2.—A needle-seta: *a.*, Apparent ridge-like thickening of needle-seta at its most prominent angle.

FIG. 3.—A hook-seta: *b.*, the slightly thicker part of the hook-seta, near its free end.

The hook-setæ are from $\cdot 033$ to $\cdot 055$ mm. in length. In the most anterior segments (vi—viii) in which they occur, they are longer ($\cdot 05$ — $\cdot 055$ mm.) than is the case posteriorly (mostly $\cdot 035$ — $\cdot 04$ mm.). They are bifid at the free end; the proximal prong of the fork is considerably longer and stouter than the distal, and its axis is about at right angles to the shaft of the seta. There

is a nodule at the junction of the middle and distal thirds of the shaft, and between the nodule and the terminal hook the shaft is again slightly thickened. The proximal portion of the shaft shows a gentle curve in a direction the reverse of that of the hook, the whole being thus somewhat $\int$ -shaped (v. text-fig. 3). These setæ project very slightly from the surface of the body.

The dorsal bundles as far as the seventh segment are generally (or always, with perhaps the exception of the seventh itself) made up of needle-setæ alone; the eighth segment may bear dorsally either needles, or hooks, or both; the ninth and succeeding segments bear hooks only. The ventral bundles, as far as the fifth segment, have only needle-setæ; those of the sixth and seventh, needles, or hooks, or both; posterior to this the ventral bundles consist of hooks only. The needle-setæ, therefore, extend somewhat further back dorsally than ventrally.

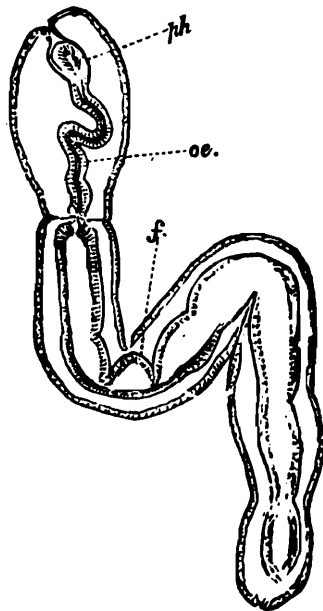


FIG. 4.—Showing the general shape and the outlines of the alimentary canal; the setæ are not shown: /., black particles in intestinal wall; œ., œsophagus; ph., pharynx.

The number of setæ in a bundle is three or four in the anterior and middle portions of the animal's length, diminishing to two or one at the posterior end.

The pharynx is a somewhat globular organ in the second and third segments; the œsophagus, a narrow tube with comparatively thick walls, forms in the preserved specimens a series of curves, passing through a stout septum behind the tenth segment (septum $\frac{1}{11}$), and widens abruptly into the intestine. This latter tube may be regularly dilated and constricted throughout a large part of its length, the constrictions being probably due to its passage through the septa. The epithelium shows within its component cells, through a large part of its extent, a number of fine black particles (text-fig. 4).

Although no signs of asexual reproduction have been seen in any of the specimens so far examined, the general appearance and structure of the worm would seem to indicate that it belongs to the Naididæ. The peculiar arrangement of setæ has not, so far as I know, been described in any form hitherto known; and I would therefore propose for its reception the creation of a new genus *Matla*, adopting for this purpose the native name of Port Canning, where the animal was found; as its specific name I would suggest *bengalensis*. Both these names I owe to the kindness of Dr. Annandale, who discovered the worm and gave me the opportunity of examining it.



VII.—DESCRIPTION OF A NEW CAVERNICO-
LOUS PHASGONURID FROM
LOWER SIAM

By W F. KIRBY, *British Museum (Nat. Hist.)*.

Diestrammena annandalei, sp. nov.

Female brownish chestnut, rather shining, the segments of the abdomen often banded with brown behind; legs lighter than the body, indistinctly banded with dusky, at least towards the base on the outer surface. Legs long and slender, front tibiæ at least twice as long as the pronotum, and longer than the femora; middle tibiæ hardly longer than the femora; hind tibiæ considerably longer. Ovipositor two-thirds as long as the body, slightly curved.

Long. corporis	14-16 mm
„ pronoti	5-6 „
„ femorum anticorum	13-14 „
„ „ posticorum	18-21 „
„ tibiæ posticarum	22-25 „
„ ovipositis	9-10 „

Differs from *D. unicolor*, Brunn., which is in the British Museum collection from Tsur Island, and which is recorded from Vladivostok, Pekin and Moulmein, by its much longer legs, and in the tibiæ being distinctly longer than the femora.

Dr. Annandale has submitted nine specimens to me, all females. As the bodies are considerably arched, the dimensions are probably somewhat understated.

Locality.—Limestone caves in hills near Biserat, Jalor, Siamese Malay States (*Annandale and Robinson*).

VIII.—DESCRIPTIONS OF NEW SPECIES OF
MARINE AND FRESHWATER SHELLS
IN THE COLLECTION OF THE
INDIAN MUSEUM, CALCUTTA

By H. B. PRESTON, F.Z.S.

Bittium insulsum, sp. nov.

Shell elongately fusiform, narrowly perforate, yellowish white with a broad circular band of pale reddish brown; whorls 9, cancellate with transverse ribs and spiral grooves; aperture oval; peristome simple.

Altitude	3 mm.
Diam., major	1 „
Habitat—Galle, Ceylon.	

Type in Indian Museum, Calcutta.

Gottonia andamania, sp. nov.

Shell conical, very solid, white, strongly keeled at periphery; whorls 5, rather flat, spirally lirate and transversely costate, presenting a somewhat minutely nodilous appearance; sutures impressed, aperture circular; peristome thickened.

Altitude	2 mm.
Diam., major	1 „
Habitat—Andaman Islands.	

Type in Indian Museum, Calcutta.

Bithynia pygmæa, sp. nov.

Shell ovately fusiform, dark olive-brown; whorls $3\frac{1}{2}$, convex, smooth; sutures well impressed; aperture oval; peristome simple, continuous; umbilicus narrow; operculum shelly, spiral with central nucleus.

Altitude	3.25 mm.
Diam., major	2 „
Aperture, alt.	1.75 „
„ diam.	1 „
Habitat—Myetmyo, Burma.	

Type in Indian Museum, Calcutta.

Odostomia pfeifferi, sp. nov.

Shell fusiform, semi-transparent white; whorls 6, spirally striate; sutures well impressed; aperture elongately, inversely auriform; columella bearing a coarse plait; peristome simple.

Altitude	1.5 mm.
Diam., major	5 "
Habitat—Andaman Islands.	

Type in Indian Museum, Calcutta.



FIG. 1.



FIG. 2.

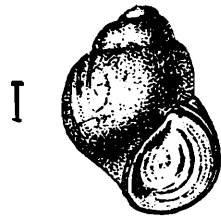


FIG. 3.

FIG. 1.—*Bittium insulsum*, sp. nov.
FIG. 2.—*Gottonia andamanica*, sp. nov.
FIG. 3.—*Bithynia pygmæa*, sp. nov.

Miralda gemma, sp. nov.

Shell oblong ovate, white; whorls 4, somewhat inflated, sculptured on the upper part with coarse costæ, below which appears a spiral liration; lower half of body whorl and base of shell spirally lirate; sutures well impressed; aperture ovate; peristome simple above, somewhat dilated at base.

Altitude	125 mm.
Diam., major	5 „
Habitat—Oman.	

Type in Indian Museum, Calcutta.

Limnæa simulans, sp. nov.

Shell fusiform, brownish horn colour ; whorls 5 ; sutures impressed ; umbilicus narrow, partly concealed by the reflexed columella ; columella arched, thick, extending into a callus which reaches the lip above ; peristome simple ; aperture inversely auriform.

Altitude	7'75 mm.
Diam., major	4'25 „
Aperture, alt.	4 „
„ diam.	2 „
Habitat—Pharping, Nepal,	

Though the shell itself is of a brownish horn colour, all the specimens before me are covered with a thick blackish coating of some substance, probably of a vegetable nature.

Type in Indian Museum, Calcutta.

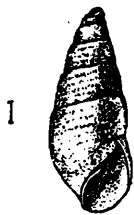


FIG. 4.



FIG. 5.



FIG. 6.

FIG. 4.—*Odostomia pfeifferi*, sp. nov.

FIG. 5.—*Miralda gemma*, sp. nov.

FIG. 6.—*Limnæa simulans*, sp. nov.

Unio siliguriensis, sp. nov.

Shell inequilateral, ovate oblong, reddish brown, sculptured with concentric lines of growth and oblique transverse wrinkles, these latter being especially marked posteriorly; anterior side rounded; posterior side acuminate rounded; dorsal margin arched; ventral margin very slightly contracted in the middle; umboes much eroded; interior of shell iridescent, pale bluish white.

Long. 21 mm.

Lat. 37° 75' "

Habitat—Siliguri, N. Bengal.

Type in Indian Museum, Calcutta.



FIG. 7.

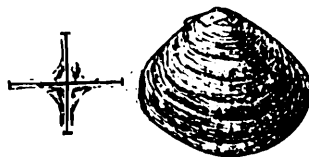


FIG. 8.

FIG. 7.—*Unio siliguriensis*, Preston (type), sp. nov.

FIG. 8.—*Corbicula sylhetica*, Preston, sp. nov.

Corbicula sylhetica, sp. nov.

Shell nearly equilateral, tumid, subtrigonal, pale olive-green, sculptured with fine irregular concentric striæ; anterior side rounded;

posterior side somewhat angularly rounded ; lateral margins sloped ; ventral margin rounded, slightly contracted towards the posterior side ; umboes large ; interior of shell purplish white.

Long. 10.5 mm.

Lat. 12 „

Habitat—Phenchooganj, Sylhet, Assam.

Allied to *C. irawadica*, Benson, but is more trigonal and more swollen.

Type in Indian Museum, Calcutta.



IX.—NOTES ON ORIENTAL SYRPHIDÆ
WITH DESCRIPTIONS OF
NEW SPECIES.

PART I.

By F. BRUNETTI.

(N.B.—The plates herein referred to, are to be found in vol. i of the
Rec. Ind. Mus.,¹ following p. 380.)

Since Van der Wulp's Catalogue of 1896, little work has been done on Oriental *Syrphidæ*. So far as I am aware, less than twenty new species have been described and no paper of importance published. The following notes, collected during a revision of the Indian Museum collection of *Syrphidæ*, may prove of interest. The recently recorded species are referred to and descriptions of thirty-nine new species added, the types of which exist either in the Museum collection or my own.

A number of species named by Bigot, but apparently not described, are in the Museum collection, and these I have described herein.

The tables of species are drawn up partially from descriptions, to serve as aids to their identification *pro tem.*, pending a more thorough revision of this family, and are therefore not intended to represent an ultimate view of their characters and affinities. Mr. Verrall's sequence of sub-families has been followed, but the genera are not arranged in any special order. Circumstances permitting, I hope to deal later on with some of the genera not touched upon in this paper. In the explanation of the plates (given in previous volume) belonging to this paper, the terms "anterior" and "posterior" *leg*, would be more correctly replaced by "fore" and "hind" leg respectively; throughout the text the terms "anterior legs" and "posterior legs" are used in their correct sense, to designate the two front pairs or two hind pairs respectively.

¹ In the explanation of pl. xi on p. 379, opposite "fig. 9," Macquart is given as the author of the species *Volucella nubeculosa*. This is an error; it should be Bigot.

BACCHA, F.

Twenty-one species of *Baccha* have been recorded from the East. Mr. Austen's paper on some new species of this genus in the British Museum (Proc. Zool. Soc. Lond., 1893, p. 132) contains descriptions of seven from the Orient, excellently illustrated, and to these I add three more which appear to be new.

B. robusta, mihi, sp. nov. (Pl. xi, figs. 3, 4.)

♂ ♀ Lower Burma (Mergui). Long. 10–12 mm.

♂ Front above antennæ triangular, nearly wholly occupied by a shining black triangle; the remainder grey; vertex shining black; below antennæ dull black, seen from below, but brilliant, shining, silvery white seen from above. Eyes subcontiguous at nearest point of approach, rather widely separated at vertex. Antennæ bright red, tip of 3rd joint brown above.

Thorax: dorsum cinereous, with three darker stripes, of which only the centre one attains the fore border. Humeral calli testaceous; sides of thorax grey. Scutellum dull testaceous.

Abdomen only slightly contracted at base; 2nd and 3rd segments pale tawny, posterior borders widely blackish, 4th segment all black, with an arched band near base, of pale shining grey, interrupted in the middle; extreme posterior border of segment brown.

Legs black; four anterior femora, basal half of hind femora, and basal half of all the tibiæ, yellowish tawny; tips of anterior femora sometimes darkened above.

Wings clear; stigma yellow, halteres yellowish.

♀ Front rather broad, grey, the callosity above antennæ shining black, oblong, nearly reaching from eye to eye; upper part of frons shining black, reaching from vertex nearly to the callosity. Abdomen black; 2nd segment with a vertically elongated pale spot on each side, nearly meeting in the centre on the fore-border; 3rd and 4th with a transverse hoary yellowish grey oval spot on each side, nearly on the fore border; 4th segment with brown posterior border; last segment brown.

Described from six ♂♂ and four ♀♀ in the Indian Museum collection from Mergui.

B. nigricosta, mihi, sp. nov. (Pl. xi, fig. 5.)

♂ Lower Himalayas (Bhim Tal, 4,500 feet). Long. 10 mm.

Front above and below antennæ grey dusted. Eyes quite contiguous nearly to the vertex, which is very small and shining black. Below antennæ a wide shining black stripe; frontal triangle above antennæ shining black seen from the front. Antennæ reddish brown, the two basal joints black. Proboscis black, tip red.

Thorax shining black, minutely pubescent, unmarked, sides blackish grey; scutellum rather large, shining black, with a few pale hairs.

Abdomen: 1st segment broadly semi-circular, of exactly the same shape and size as scutellum, 2nd very pedicellate, 3rd narrow at base, thence sharply widening; general colour of abdomen black, moderately shining, with rather long blackish grey hairs at sides of 2nd and 3rd segments, and faint traces of a pair of spots at the middle of the sides of 3rd segment, and towards the base (at the sides) of 4th segment.

Legs pale tawny, hind femora and tibiae with a dark band towards the tip, hind tarsi blackish.

Wings blackish, nearly clear at base. Stigma black, much elongated and a blackish cloud immediately below it, and a small blackish spot at extreme tip of costa.

Described from one ♂ taken by Dr. Annandale (19-22-ix-06) at Bhim Tal, Kumaon, now in the Indian Museum collection.

***B. tinctipennis*, mihi, sp. nov. (Pl. xi, fig. 6.)**

♀ Lower Himalayas (Bhim Tal, 4,500 feet). Long. 8-9 mm.

Head: front broad, narrowing towards vertex, grey dusted, nearly wholly occupied above antennæ by a broad black band with ill-defined edges; filling the whole vertex, and resolving itself into a shining black callosity above antennæ. Under side of face grey dusted, with a black central line, slightly prominent; mouth-border and proboscis tawny; antennæ tawny.

Thorax shining black with minute grey pubescence; humeri and a vertical short stripe just before base of wing, pale; scutellum shining black, immediately above the pronotum, giving the appearance of two scutelli, one above the other.

Abdomen brown, 1st segment wholly pale yellow; extreme tip of 2nd, base of 3rd and 4th, and two very small spots on the sides at the base of 5th, pale yellow-brown.

Legs pale yellow, a brown ring at tip of hind femora; hind tibiae brown, except base and tips; hind tarsi darker.

Wings clear, iridescent, a dark brown oblong spot forming a stigma, and a dark spot at tip of subcostal cell, also at tip of wing, the discal cross-vein, and a streak from just below the mediastinal vein down to and enclosing the lower cross-vein blackish.

Described from one ♀ taken by Dr. Annandale (22-27-ix-06) at Bhim Tal, Kumaon, now in the Indian Museum collection. Some specimens taken by me at Kobe in Japan, 15-v-06, which I consider to be the same species, differ only in the 1st abdominal segment being all black instead of yellow.

I also took at Darjiling and Lucknow respectively a specimen each of what may be two additional new species.

Of *B. dispar*, Wlk., a ♀ named by Bigot is in the Indian Museum collection—this being the only other Oriental species I have seen. Van der Wulp added in 1898 (Termés. Füzet., xxi, 423) two species from Papua new to his list these were *rubella* and *mundula*.

PARAGUS, Latr.**P. luteus**, mihi, sp. nov. (Pl. xi, fig. 1.)

♀ Persia (Bushire). Long. 5 mm.

Head pale yellowish white, vertex black, with a thin stripe (slightly enlarged in the middle) leading to a large black roughly-square shining spot above antennæ. Antennæ brown, base paler. Frons gradually narrowed towards vertex.

Thorax wholly shining ænous, a whitish hairy stripe, commencing in front of the insertion of the wings, and reaching downwards; scutellum yellow, base black.

Abdomen yellow, basal segment black, and a thin black line almost (but not absolutely) on the border of 2nd segment, a similar line just below centre of 3rd segment, and a black mark on each side at the edge of the 4th segment.

Legs all yellow, a brown ring towards tip of hind femora.

Wings absolutely clear, no stigma.

Described from the above type in the Indian Museum collection.

P. serratus, F.

A common species variable both in size, and coloration of the abdomen. The species is the only one with serrated scutellum, and the specimens in the Indian Museum collection, added to those of my own collecting, show a distribution from Calcutta to Nepal and reaching as far west as Karachi and as far south as Bangalore.

PIPIZELLA, Rond.**P. indica**, mihi, sp. nov.

♂ ♀ Lower Himalayas (Simla and Nepal). Long. 5 mm.

Head yellow; vertex, eyes, mouth and proboscis black. A black central line on the frons in the ♀, which slightly narrows on the vertex; just below the antennæ it is hardly one-third the width of the head.

Thorax smooth, shining black, with a little gold-brown hair on the posterior half, and a little white hair on the lower anterior portion of the sides.

Abdomen shining black, minutely pubescent, especially on last segment, and distinctly so along the sides of all the segments.

Legs tawny yellow, basal half of the four anterior, and basal three-fourths of the hind femora black; tibiæ yellowish white towards the base.

Wings clear, stigma very pale yellow: halteres yellow.

Described from a ♂ and two ♀ ♀ in the Indian Museum collection from the Simla district and from Katmandu in Nepal.

The genus has not previously been recorded from the East. This species does not agree with any European one known to me,

but there are two of which I have not been able to obtain descriptions, viz., *P. curvinervis*, Str., and *P. sculpeonata*, Rond.

***P. rufocincta*, mihi, sp. nov.**

♂ Burma (type) and India. Long. 6 mm.

Face yellowish white with a narrow black line below antennæ, which are blackish brown; mouth and proboscis black; vertex shining black, narrowing rather suddenly to the eyes, which are contiguous for only a very short distance.

Thorax black, shining, with a slight ænous tinge; a few white hairs on the sides, in front of insertion of wings; dorsum with short greyish hair; scutellum unicolorous with grey hair.

Abdomen shining black, with very short pale pubescence, the whole 3rd segment reddish testaceous, and, in the type-specimen, extreme tip of abdomen reddish.

Legs yellowish white; coxæ, a narrow ring at base of four anterior femora, and the basal two-thirds of hind femora black.

Wings quite clear.

Described from two ♂♂ taken by me at Rangoon, 23-xii-04 to 3-i-05 (type), and from one ♂ taken by me at Umballa (N.-W. India; altitude 900 feet), 8-13-v-05. In my collection. Most species of *Pipizella* have unmarked abdomens, but this species is certainly of this genus, and apparently widely distributed.

MELANOSTOMA, Sch.

Dr. Annandale took specimens of *M. ambiguum*, Flh., and *M. dubium*, Zett., at Matiana (8,000 feet; Simla district), both species being European ones and unrecorded previously from the East.

PLATYCHIRUS, St. Farg.

Four males of *P. albimanus*, F., are in the Indian Museum collection from the Simla hills (8,000 feet); taken by Dr. Annandale between 27-iv-07 and 3-v-07. These differ in no way from European specimens.

SPHÆROPHORIA, St. Farg.

The Oriental species in this genus will require careful revision and comparison with European forms, allied to which the Indian Museum possesses several species; I have a fair amount of material of my own collecting, showing considerable variation of forms, from India, the Himalayas and South China.

Herr Kertész, in the Termés. Füzet. (1899), xxii, 177 and 178, describes two species from Papua new to Van der Wulp's list: *distinctus* and *novæ-guinææ*.

DIDEOIDES, mihi, gen. nov.

Allied to *Didea*, Macq., from which it is separated by two characters, *viz.*, (1) distinctly and closely pubescent eyes, and (2) by the 3rd longitudinal vein (cubital, Verrall) being nearly straight, as in *Syrphus*, and not dipped, *Eristalis*-like, into the cell below. In all other respects it resembles *Didea*, Macq., having a bare arista and the large flat ovate abdomen in both sexes much wider than the thorax, and bearing the distinct, ridged margin as in that genus.

D. ovata, mihi, sp. nov.

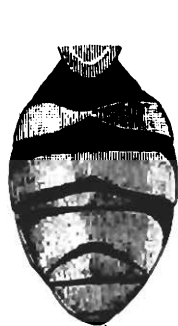
♂ ♀ Sikkim. Long. 12–16 mm.

Head, ♂ : face moderately produced above the mouth and just below the antennæ; in depth descending only a little below the eyes. Face and frons bright yellow, with moderately thick yellow hair, which above the antennæ is replaced by black hairs. Eyes touching for half the distance from the top of the frons to the triangular elongated vertex, which is black with black hairs and prominent reddish ocelli. Eyes with close grey pubescence. Antennæ reddish brown, situated on a tawny (darker on upper side) protuberance; 3rd joint of antennæ darker on upper side, arista orange, bare. Mouth and proboscis black, latter with some grey hair at tip. Back of head greenish grey; posterior orbit of eyes with a thick fringe of short bright yellow hair, of equal length all round.

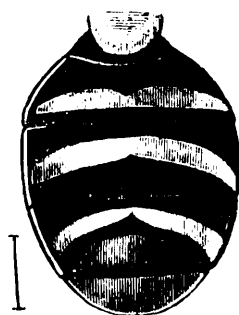
In the ♀ the frons bears a broad greenish black stripe from the vertex down to and enclosing the upper part of the antennal protuberance, the black hairs being thicker than in the ♂. The antennæ are nearly all black except the under side of the first two joints, and the under side of the 3rd at the base; the arista is more brownish than in the ♂, the pubescence of the eyes almost yellowish, especially on the lower part; but the rest of the characters are as in the other sex.

Thorax: dorsum dull greenish ænous with three central, narrow, well-separated, not very distinct brownish lines reaching from the anterior nearly to the posterior margin. Sides concolorous, rather darker behind; with a broad yellow vertical stripe just in front of the wing, descending to and terminating on, the metapleuræ, this stripe bearing a rather thick fringe of bright yellow hair. In the ♀ all the pleuræ are dull greenish yellow, and the hair is rather more abundant. The dorsum is covered with soft short yellow hair, which around the wing-insertion is bright orange. Scutellum rather dull orange-yellow, covered with soft black hairs; an orange elongated callosity on each side in front with bright orange-brown hair, forming posterior corners to the dorsal surface of the thorax. Metanotum black.

Abdomen black, with an unbroken, deep brown raised edge around the entire dorsal surface, closely beset with very short bristles: 1st segment greenish black, sub-metallic, very short; 2nd segment aënous at base, with two orange elongated spots, placed transversely, forming a band, interrupted in the centre; this band being enlarged at the ends (foreshortened in front) in the ♂, and contracted at the ends and barely attaining the ridged edges of the segment in the ♀. A bunch of yellow hairs on the shoulders of this segment in both sexes.



Dideoides ovata, mihi, sp. nov., ♂.



Dideoides ovata, mihi, sp. nov., ♀.

The 3rd segment bears a transverse orange band across the centre, the anterior edge being slightly convex forward, the posterior edge forming two straight lines narrowing the band in its centre and leaving the remainder of the segment as a flattened black triangle, the extreme posterior edge being sub-metallic dark brown with a fringe of very short black hairs. The sides of this orange cross-band are parallel with the sides of the abdomen, to the ridges of which they extend.

On the 4th segment is a similar, but rather narrower and slightly more arched band, with a second orange band (as a flattened triangle, sub-metallic posteriorly) on the posterior part of the segment, the extreme edge of which is sub-metallic brassy, with a fringe of longish yellowish hair. The ♀ shows no trace of the sub-metallic tinge. The 5th segment is orange, with black at the base in some specimens of ♂♂; yellow haired. The whole abdomen bears yellow hairs on the yellowish parts (longest towards the tip), and shorter, black hairs on the black parts. Genitals: in the ♂ rather prominent, orange, with some short black hairs; in the ♀ small, elongated, dark coloured.

Belly in the ♂ black with narrow yellowish bands at the juncture of the segments, widest on the posterior border of the 2nd. In the ♀ black, with two semi-circular large yellow spots at the base of the 2nd, 3rd and 4th segments; the posterior border of the 1st, widely, of the 3rd, narrowly, and of the 2nd, very narrowly (with enlargements at the corners) yellow. Belly nearly bare, a little short yellow sparse hair.

Legs: coxæ and base of femora black with some short black hair; remainder of legs entirely orange-yellow, the upper sides

of the tarsi being a little browner. The anterior femora bear a little pale hair on their under side, but the black hairs on the hind pair extend almost to the tip below, the upper apical part being bare. All the tibiæ bear very short golden yellow pubescence the hind pair having a row of short black bristles on the outer side.

Wings pale yellowish grey, slightly tawny on the basal and anterior parts. Halteres orange. Tegulæ bright orange-yellow with concolorous fringe.

Described from four ♂♂ and two ♀♀ (one, a melanic ♀ described below) all from Sikkim and in the Indian Museum collection in good condition.

One specimen (a melanic ♀) has the antennæ almost entirely black (another characteristic of *Didea*), the abdomen black with a dark blue sub-metallic reflection, beset with short black hairs, the only marks being a transverse band across the centre of the 2nd segment, composed of two narrow straight oblong spots, extending to the distinct ridged edge which runs round the entire abdomen; some yellow hair on the 2nd segment. Belly black, but with the two pale yellow spots at the base of the 2nd, 3rd and 4th segment exactly resembling those in the typical form; posterior edge of segments narrowly yellow, showing a tendency to spread at the sides on the 2nd segment.

N.B.—I had some hesitation before deciding to establish a new genus for the reception of this well-marked species, but probably if I had not done so, some other author would. It appears to be intermediate between *Didea* and *Syrphus*, having the broad ovate and ridged abdomen of the former genus, but differing in the straight 3rd longitudinal vein and pubescent eyes.

The pubescence of the eyes, and the dip of the 3rd longitudinal vein are neither of them conclusive characters, and as *Syrphus* contains species some with bare and others with hairy eyes, and also species with straight and dipped cubital veins, I think *Didea* might well do the same, and I would have kept the species in that genus, except for the reason given above.

ERIOZONA.

E. ruficauda, mihi, sp. nov. (Pl. xi, fig. 2.)

♀ Sikkim. Long. 13 mm.

Face prominent, bright yellow, shining, with minute yellow pubescence, smooth; cheeks and lower part of face black with very inconspicuous black hairs. Front above antennæ to vertex blackish with black hairs, with a pale irregularly-shaped yellow spot immediately over the antennæ, which are black. Eyes pubescent, wide apart, frontal space gradually widening from vertex to cheeks.

Thorax quadrate, blackish above, sides dark brown with brownish yellow hairs, hair on dorsum less thick; scutellum brown with yellowish hairs,

Abdomen with thick black hair on basal half, 4th and 5th segments with thick orange-red hair, and with a small dark triangle in the middle of the posterior border of each; the 2nd segment has traces of a lighter basal band, somewhat resembling that of *Leucozona lucorum*. Belly pubescent, basal half black, apical half red.

Legs tawny, basal half of all femora blackish.

Wings pale grey, a broad brown band in the middle, narrowing posteriorly from foreborder up to just across the base of the discal cell; base of wing brown.

Described from three ♀ ♀ from Sikkim in the Indian Museum collection.

N.B.—This genus has only recently been known from the East. In 1901 Herr Kertész described a species, *analís*, which also came from Sikkim (Termés. Füzet., xxiv, 414).

SYRPHUS, F.

This genus I dare not touch upon at present in view of the large number of supposed species described from Oriental regions, and their close affinities.

I have seen several species from the hills that are common in Europe, the specimens showing generally little or no difference; amongst them are *balteatus*, DeGeer; *torvus*, Os. Sac.; *pyrastri*, L.; *luniger*, Mg.; and *umbellatarum*, F.; all taken by Dr. Annandale in the Simla district, and all, except *balteatus*, are new to the Oriental fauna.

RHINGIA, Scop.

Until quite recently (1904) this genus appears to have been unrecorded from the East, but in that year Meijere described a new species, *cincta*, from Java, whilst I have taken a new species occurring in Mussoorie and Darjiling, and also a second one, represented by a single ♂ from Darjiling; moreover the Indian Museum collection supplies a third undescribed species from Darjiling and Simla. Meijere's species, therefore, is still the only one from a tropical locality. The two common European species, *rostrata*, L., and *campes- tris*, Mg., are both likely to occur in the north of India. The former would be easily recognised from all the other species by its ash-blue-grey thorax (the others being cinereous grey or ænous); and the latter can be distinguished from *cincta* and *binotata* by its tawny instead of mainly blackish abdomen.

Table of Oriental species of Rhingia.

Scutellum distinctly bright ferruginous tawny.

Abdomen with three or four pale bands.

Long. 9 mm. *cincta*, Meij.

Abdomen black, 2nd segment with two

lateral spots

Long. 9 mm. *binotata*, mihi, sp. nov.

Scutellum cinereous grey.

Posterior border of abdominal segments

widely black. Long. 7-9 mm. *laticincta*, mihi, sp. nov.

Posterior border of abdominal segments

very narrowly black. Long. 8 mm. *angusticincta*, mihi, sp. nov.

R. laticincta, mihi, sp. nov. (Pl. xi, fig. 7.)

♂ ♀ Mussoorie, Darjiling, 7,000 to 12,000 feet. Long. 7 to 9 mm. (without snout).

Head: snout tawny; lower part of head shining grey; antennæ tawny; eyes quite contiguous as far as the vertex; frons in ♀ of about the usual width in the genus, cinereous grey.

Thorax cinereous grey, with ænous reflections and soft black-and-grey hair; four blackish longitudinal stripes, not always very distinct, the two outer ones interrupted at the suture, the two inner ones close together on the front, diverging widely posteriorly, where they become diffused and meet the ends of the outer pair just in front of the scutellum. Scutellum unicolorous, similarly haired, a row of stiff black hairs on posterior edge, from which a fringe of soft pale yellow hair hangs down.

Abdomen bright tawny, with soft yellow hair, thickest at the base on the sides; 1st segment very narrowly black edged, 2nd, 3rd and 4th with a broad black band on posterior border, interrupted in the centre in front, but continuous on the extreme edge of segment; a vertical long black spot on the dorsum of each segment forms a sort of longitudinal dorsal stripe. Belly tawny brown.

Legs all pale tawny, all the femora black at the base, and an indistinct blackish wide ring around the centre of the hind tibiæ; feet darker. In the ♀ the femora are nearly all pale and the ring on the hind tibiæ is less distinct.

Wings pale grey, stigma yellowish.

Described from a ♂ (Darjiling) and ♀ (Mussoorie) in the Indian Museum collection (types), and a ♂ and ♀ in my own collection.

Var. fasciata, ♂ ♀ (Pl. xi, fig. 8.)

What I take to be a variety of *laticincta* differs by the abdominal bands being reduced to semi-circular spots placed on the posterior borders of the segments and joined by a very narrow line on the extreme edge. The legs in the ♂ are paler, and show only very slight traces of black at the base of the femora; in the ♀ they are wholly pale, almost livid, with only the faintest indication of a dark band on the hind tibiæ. Another point of difference is that the pubescence on the thorax is much shorter, and almost absent on the posterior part, and the scutellum is practically bare, except for some long hairs towards the tip.

I have four specimens (♂ ♂ ♀ ♀) taken by myself at Darjiling (7,000 feet), 10-15-X-05, and am not at all sure that it is not specifically distinct, for which reason I have given it a name. In my collection.

R. angusticincta, mihi, sp. nov.

♂ ♀ Darjiling and Simla, 8,000 to 12,000 feet. Long. 8 mm. (without snout).

This species resembles *laticincta*; the points of difference being as follows: the snout is distinctly shorter; the abdominal transverse bands are extremely narrow, and not interrupted, this being the main, but a consistent, difference.

Described from a ♂ and ♀ taken by Dr. Annandale at Simla and Theog (Simla district) respectively. The Indian Museum possesses these types, also what is apparently an additional ♂ from Darjiling (9,000 to 12,000 feet), 2-x-06, but in this specimen the thorax is darker, and all the tibiæ have a distinct broad black ring.

R. binotata, mihi, sp. nov.

♂ Darjiling. Long. 9 mm.

Head: frons and upper part of snout deep black; lower part of both face and snout tawny yellow. Antennæ brownish red. Vertex very small, with a few black hairs; short yellow hairs behind the head above, and rather close whitish hair on lower part; proboscis black.

Thorax yellowish grey, with four rather indistinct dorsal, slightly darker stripes; the two outer ones wide, and interrupted at the suture; the two inner ones very narrow and close together. The dorsum with rather thick, short bright yellow hair; sides of thorax cinereous grey, darker posteriorly, some yellow hair just below wings; scutellum bright tawny, dorsum bare, a fringe of short yellow hairs at base, and a fringe dependent from posterior margin, on which margin is set another fringe of long yellow hairs, projected posteriorly, by which character this species differs from all the others.

Abdomen æneous black, covered with thick, short, bright yellow hair; the 1st segment appears pale, and on the 2nd on each side, towards the base, is a lateral, oval, pale yellow spot.

Legs orange-yellow, basal half of all femora black; the femora with soft yellow hair, the rest of the legs practically bare.

Wings yellowish grey, slightly darker in front; stigma pale yellowish brown; halteres yellowish brown.

Described from one ♂ in perfect condition, captured by me at Darjiling, 13-x-05. In my collection.

The three species, herein described as new, are quite distinct and good species, and quite different from the two European species, *rostrata* and *campestris*, and from Herr Meijere's species *cincta* from Java.

VOLUCELLA, Geoff.

To this handsome genus I introduce four new species, whilst Meijere has added one from Darjiling to the five in Van der Wulp's

catalogue. The following table is made up partly from descriptions, as, beyond my own species, the only one before me is a headless specimen of what I have identified as *nubeculosa*, Big. (see pl. xi, figs. 9, 10).

Table of Oriental species of Volucella.

- Quite small species Long. 7 mm. *opalina*, Wied.
 Larger species. Long. 13 to 16 mm.
 Non-pubescent (not *Bombus*-like) species.
 Thorax and abdomen only slightly
 and shortly hairy.
 Abdomen yellow, with two spots and
 tip black Long. 13 mm. *trifasciata*, Wied.
 Abdomen black; marked or not.
 Thorax bright tawny.
 Abdomen with two narrow
 pale cross-bands; wing
 suffused in centre and at
 tip Long. 16 mm. *nubeculosa*, Big.
 Abdomen entirely black;
 wings pale brown, un-
 marked. Long. 16 mm. *discolor*, mihi, sp.
 nov.
 Thorax black.
 Abdomen with only one
 transverse narrow basal
 pale spot. Long. 16 mm. *basalis*, mihi, sp. nov.
 Abdomen with more than a
 single spot.
 Abdomen marks in the
 form of spots.
 Long. 13 mm. *peleterii*, Macq.
 Abdominal marks in the
 form of three yellow
 bands. Long. 14 mm. *decorata*, Wlk.
 Pubescent (*Bombus*-like) species. Thorax
 and abdomen with long thick hair.
 Tip of abdomen black haired.
 Long. 17 mm. *ursina*, Meij.
 Tip of abdomen yellow or red.
 Belly uniformly black.
 Long. 14-15 mm. *ruficauda*, mihi, sp.
 nov.
 Belly with 2nd and 3rd
 segments livid.
 Long. 15-16 mm. *lividiventris*, mihi, sp.
 nov.
 The above species all appear quite well separated.

V. basalis, mihi, sp. nov. (Pl. xi, figs. 11, 12.)

♀ Sikkim district (Mungphu). Long. 16 mm.

Head entirely bright orange, frons narrows towards vertex, which is black; mouth-border brown; proboscis and extreme lower part of cheeks black; eyes bare. The face is considerably produced into a large snout, which is cut away just below the antennæ; antennæ small, orange.

Thorax moderately shining black, bare, sides black; scutellum very dark brown, almost bare, except for a row of strong bristles near posterior edge.

Abdomen black, a little shining, almost bare; the basal half of the 2nd segment occupied by a large transverse livid yellow elongated spot, which is contracted in the middle behind and does not reach the sides of the segment except at the extreme base, where it joins a large livid spot on the same segment of the belly.

Legs all black and bare.

Wings grey, yellow at base, a yellowish brown suffusion from the centre of the costa reaching half way to the posterior border, and a similar suffusion at the wing-tip extending inwards just beyond the subapical and postical cross-veins. Halteres yellow.

Described from one ♀ in the Indian Museum collection.

This species bears a considerable general resemblance to the *V. pellucens*, L., of Europe, but in that species the *whole* of the 2nd segment is livid yellow, the colour passing over the side of the segment in its full width, whereas in *basalis* it is narrowed to the extreme base of the segment; also in *pellucens* the sides of the thorax along their upper edge are always brownish yellow, of which there is no trace in my species; moreover, the scutellum in *pellucens* is bright tawny, whereas in *basalis* it is nearly black.

V. ruficauda, mihi, sp. nov. (Pl. xi, fig. 13.)

♂ ♀ Sikkim. Long. 14-15 mm.

Head black, epistome well produced, shining black; eyes densely hairy in ♂, distinctly hairy in ♀, but to a much less extent; vertex crowned by a tuft of long bright yellow hairs; eyes in ♀ separated by narrow shining black frons. Antennæ ferruginous; first two joints nearly black.

Thorax black with black hair, dorsum covered with dense long bright ferruginous red hair which also covers the bright ferruginous red scutellum.

Abdomen black with rather thick black hair; posterior border of 3rd segment and the whole of the 4th and 5th segments covered with yellowish red hair. Belly entirely black, with black hair.

Legs slender, wholly black with short black hair.

Wings pale yellowish grey, a rather large brown irregular spot in the centre of the fore border, and reaching half-way across the

wing; a brown suffusion along the recurrent portions of the subapical and postical (4th and 5th longitudinal) veins and extending to the costa about the termination of the marginal cell. Between this suffusion and the outer margin the wing is darker grey, base of wing slightly yellowish. Halteres black.

Described from eight ♂ ♂ and eight ♀ ♀ in the Indian Museum collection from Sikkim.

V. lividiventris, mihi, sp. nov.

♂ ♀ Sikkim. Long. 15-16 mm.

Very near *ruficauda*, but distinct. The hair on the thoracic dorsum is distinctly grey, the tuft of hair on the vertex is greyish white, while the belly has the 2nd and 3rd segments livid grey with unicolorous hair. A bunch of grey hair is found on each of the two basal abdominal segments at the sides, and the sides of the 2nd segment in front have a perceptible subdued livid reflection when seen from behind.

Described from three ♂ ♂ and a ♀ from Sikkim in the Indian Museum collection.

V. discolor, mihi, sp. nov.

(*Id. id.*, Bigot, *nom. nud.*)

♂ Assam. Long. 10 mm.

Head: eyes not quite contiguous, black, facets small, uniform. Vertex, frons, and entire face bright orange, bare. Face immediately below antennæ flush with the eyes, but from thence projecting well forward, forming a large squarish prominence, not reaching downwards much below the eye-level. Antennæ on a barely perceptible prominence, orange, with orange plumose arista. Back of head and under side orange, a little orange-yellow hair below.

Thorax wholly uniformly bright orange, with close short golden yellow hair on dorsum, changing to longer orange hair on the edge, on the posterior part, and on the pleuræ. Scutellum pinkish orange, a little yellow hair round the sides.

Abdomen: 1st segment (hardly visible) dark coloured, remainder wholly shining black, with microscopic black pubescence. On each extreme anterior corner is a small bunch of rather short yellow hairs. Belly black, unmarked.

Legs wholly bright orange, with short golden yellow hair, which is a little longer on the coxæ. The tarsi very narrowly black between the joints.

Wings uniformly pale brown, outer half towards the anterior margin a little darker. Halteres bright orange.

Described from one perfect ♂ from Sibsagar in the Indian Museum collection.

GRAPTOMYZA, Wied.

Van der Wulp's reference in his catalogue is incorrect, as the genus was described ten years previously in Wiedemann's *Nova Dipteriorum* (1820), and redescribed in his *Auss. Zweifl.*, ii (1830).

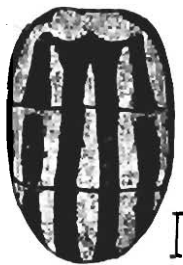
Since that catalogue, no new Oriental species have been described. Osten Sacken treats of the genus in the *Berl. Ent. Zeits.*, xxvi, 117, where he gives a table of species.

G. longirostris, Wied.

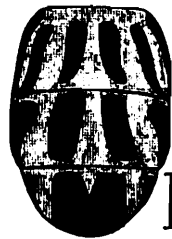
Var. nov. *12-notata*, mihi.

(*Graptomyza 12-notata*, Bigot, *nom. nud.*)

A specimen in the Indian Museum collection seems to be but a variety of *longirostris*, Wied., although presumably the type of Bigot's species *12-notata* (*nom. nud.*). It, however, agrees quite well with both Wiedemann's description and his three figures, except that the longitudinal stripes are interrupted at the juncture of the segments, thus being divided into twelve separate elongated spots placed in four longitudinal rows, the "stripes"



Graptomyza longirostris, Wied.



Graptomyza longirostris, Wied, var. *12-notata*, Big., *nom. nud.*

being simply broader. On the strength of this close resemblance I can only admit it provisionally as a variety. A second specimen in the collection (from Tenasserim) agrees more closely still with Wiedemann's figure of the abdomen, the black longitudinal stripes being narrower, and continuous.

Bigot's second species "*6-notata*" must be near *ventralis*, Wied.; according to Osten Sacken's table, from which it would be separated by the six well-defined sub-triangular spots on the abdomen, which is bordered on each side by a rather wide dark brown line.

G. sexnotata, mihi, sp. nov.

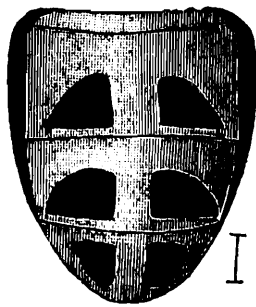
(*Id. id.*, Bigot, *nom. nud.*)

♀ Sikkim. Long. $7\frac{1}{2}$ mm.

Head: frons, vertex, face, entirely yellow, eyes blackish brown, with very short greyish pubescence; frontal space less than one-third the width of the head. Antennæ, entirely uniformly dark yellow, with plumose orange arista. A dark brown square spot on frons above the antennæ is continued as a stripe below to the

end of the rostrum; a broad brown stripe on each side of the rostrum. Proboscis brown; palpi, pale yellow. Back of head and below yellow, centre part apparently black.

Thorax orange-yellow, the dorsum occupied by a shining black quadrate spot, which leaves only a yellow anterior margin, wider lateral margins and a squarish spot in front of the scutellum. A rather wide dark brown vertical stripe extends from between the fore and middle coxæ, to the lateral yellow edge of the dorsum, thence curving backwards to just above and behind the root of the wing; a shorter similar stripe is immediately below the wing-insertion, with a roundish brown spot behind it. Dorsum nearly bare, a few yellow hairs on pleuræ; scutellum yellow, dorsum dark brown, indented; some yellow hairs round the margin.



Graptomyza 6-notata, mihi, sp. nov., ♀

Abdomen orange yellow, with a rather thick moderately broad lateral dark brown margin, narrowing posteriorly and disappearing at tip. On the hind border of the 2nd segment two moderately large, dark brown triangular spots; reproduced on the 3rd segment, but a little larger, and with rounded angles; and again on the 4th segment, more triangular and of the same size as those on the 2nd segment, but placed quite clear of the hind border. Dorsum of abdomen practically bare, but with some short yellow hairs towards the tip

Legs yellow, fore coxæ with short pale yellow hairs; femora with a brown streak below; tibiæ pale yellowish brown, the hind leg (one leg missing) showing the brown almost as a wide band; tarsi, yellowish, brownish on upper side. Legs with short yellow hair, a little thicker on the tibiæ.

Wings clear yellowish grey, tip of subcostal cell tawny-brown, forming a not very well-defined stigma at the tip of the mediastinal vein. Halteres orange-yellow.

Described from one ♀ in fair condition in the Indian Museum collection from Sikkim.

HELOPHILUS, Meig.

In dealing with this genus, the short descriptions of the species, many of which are very closely allied, have materially hindered satisfactory progress. The following table is made up mainly from descriptions. My material in the genus has been three species in the Indian Museum collection determined by myself,—*bengalensis*

W., *quadrivittatus*, W., and *insignis*, Dol.; plates of *curvigaster*, Mcq., *notabilis*, Mcq., *insignis*, Dol., and *pilipes*, Dol.; two new species in the Indian Museum collection which I have named *aënus* and *tuberculatus*, both very distinct from all others, and descriptions only of the remainder. I think the table may assist as an introduction to the better study of this genus, but I find great difficulty in understanding the true affinities of Walker's species.

Table of Oriental species of Helophilus.

- A Face perpendicular, not produced as usual, nor excavated below antennæ, nor gibbous above mouth. Hind tibiæ incrassated. Long. 11 mm. *celebes*, O.S.
- AA Face distinctly and normally produced (exceptionally so in *notabilis*, Mcq.). Hind tibiæ not incrassated.
- B Thorax with transverse bands of pubescence. Long. 8 mm. *curvigaster*, Macq.
- BB Thorax with ground colour longitudinal black and yellow stripes.
- C Body aënous. Long. 10 mm. *aënus*, mihi, sp. nov.
- CC Body yellow and black, not aënous.
- D Abdomen very elongated.
- E Middle legs not denticulated. Long. 22 mm. *caudatus*, Meij.
- EE Middle legs strongly denticulated. Long. 17-25 mm. *tuberculatus*, mihi, sp. nov.
- DD Abdomen of the ordinary oval or ovate shape.
- F Anterior femora and tibiæ with dense yellow hair. Long. 12 mm. *pilipes*, Dol.
- FF Anterior femora and tibiæ moderately and normally haired.
- G Length 14 to 16 mm.
- H Abdomen with two luteous bands.
- J Shining blue above antennæ. Long. 16 mm. *doltschalli*, mihi. (Change of name from *insignis*, Dol.)
- JJ Blackish brown above antennæ. Long. 15 mm. *vestitus*, W.
- HH Abdomen with three luteous bands.
- L Side stripe on thorax yellow. Long. 16 mm. *insignis*, Wlk.
- LL No side stripe (presumably). Long. 14 mm. *notabilis*, Macq.
- OO Length 9 to 11 mm. (in *mesoleucus* 13).
- M Sides of thorax with broad oblique yellow stripe.
- N Legs mainly luteous, "shaded with black," wings green. Long. 10 mm. *conclusus*, Wlk.
- NN Legs mainly black, base of tibiæ pale, wings not green. Long. 10-11 mm. *albiceps*, Wulp.

- MM Sides of thorax cinereous or grey ; without yellow stripe.
- O Length 13 mm. Long. 13 mm. *mesoleucus*, Wlk.
- OO Length 9 to 10 mm.
- P Posterior femora incrassated. Long. 10 mm. *consors*, Wlk.
- PP Posterior femora only ordinarily thickened.
- Q 4th abdominal segment with an inverted V-mark Long. 9-10 mm. *bengalensis*, Wied.
- QQ 4th abdominal segment without such mark Long. 9-10 mm. *quadrivittatus*, Wied

H. aënus, mihi, sp. nov. (Pl. xii, fig. 15.) •

♀ Nepal (Soondrijal). Long. 10 mm.

Head black, face moderately produced, very shining and bare above antennæ, but changing to dull velvet black on vertex with black hair, frontal space narrowing above, ocelli very close together. Face below antennæ, dull black, with, seen from above, silvery grey hair ; a central shining bare black line. Antennæ dark brown. Back of eyes with a thin silvery white line, with unicolorous hair.

Thoracic dorsum, ash-blue-grey, with two transverse black bands ; one across the centre, and one on the posterior border. Anterior part of thorax cinereous, with two faint, narrow darker bands in centre, which disappear on reaching the 1st transverse black band ; whole dorsum covered with short bright yellow hair. Sides of thorax light cinereous grey, with some yellow hair. Scutellum blue ash-grey, basal half black ; entirely covered with bright yellow hair.

Abdomen aënous, 1st segment paler ; 2nd with a rather broad dead black velvet line on base, joined by a stem to a similar band on the posterior border, which, however, is curved upward a little in the middle, clear of the posterior border ; 3rd segment with a central round spot joined to two moderately broad lines which proceed obliquely almost to the posterior corners ; 4th segment with a nearly similar pattern, the oblique lines joining one another in the centre—without being enlarged into a dorsal spot. All these abdominal marks dull velvet black. The whole upper surface of the abdomen with rather close, short yellow hair. Belly black.

Legs : femora black, hind pair more shining, all with yellow hair below ; tibiæ and tarsi tawny yellow, with some yellow hair ; hind pair with apical half black.

Wings pale grey, costal cell absolutely clear, stigma brown, small, veins brownish ; halteres and tegulæ pale yellow.

Described from one ♀ in the Indian Museum collection (October).

It reminds one very much of the European species *Eristalis sepulchralis*, L., and, more so, of the North American species *dimidiata*, Wied., and *saxorum*, Wied., but is distinctly smaller.

H. tuberculatus, mihi, sp. nov. (Pl. xii, figs. 16, 17.)

♂ ♀ Calcutta. Long. 19–25 mm.

Head: epistome normally produced. Front black, shining just above antennæ, dull in the ♀ from thence to vertex. Eyes contiguous (♀) at base of supra-antennal triangle, diverging gently to the vertex. Front in ♀ moderately wide, narrower above; face below antennæ blackish or reddish, with grey or yellow hair, antennæ ferruginous brown to black; 3rd joint sometimes quite greyish; first two joints with a few black hairs. Front, vertex, and back of head with short, stiff, all-black hair.

Thorax rather elongated, yellowish, with three broad black long stripes of equal width (third abbreviated behind) placed close together, so that the yellow intermediate space is very narrow; dorsum covered with short yellow hair. Humeral calli brown, with yellowish hair; posterior calli oval, distinct, shining. Sides of thorax blackish grey with mixed tufts of brown, white and yellow hair; scutellum yellow with yellow hair.

Abdomen quite elongated, resembling that of a *Milesia*; in the ♂ the 1st segment very short, yellow; 2nd tawny, with a thin basal black line produced downwards across the disc to a rather wide, very indistinct blackish band towards posterior border; 3rd segment, basal half tawny, apical half brown; 4th segment similar, but only basal fourth yellowish; 5th segment uniformly rich brown. In the ♀ the transverse bands across the hind parts of the segments are black instead of brown.

In the ♂ the first three segments are covered with soft yellow hair, much thicker on 2nd segment; this hair appears to be sparser in the ♀

Legs all black, knees of four anterior legs tawny; *all the femora much thickened in the ♂*, but *only the posterior pair moderately so in the ♀*. In the ♂, the hind femora bear a distinct tooth in the centre of the under side, and an erect fringe of bright yellow hair on upper side for three-fourths of the length from the base, the remaining fourth bearing black hair. The middle femora bear a transverse ridge below near the tip, followed by a small blunt tooth; the middle tibiæ are suddenly incrassated before the middle, and bear two pairs of blunt teeth at the base.

All the legs with short black pubescence, longest on femora and posterior tibiæ.

Wings brownish grey; apical half, anteriorly, darker.

Described from two ♂ ♂ and three ♀ ♀ from Calcutta in the Indian Museum. A remarkable species, and one which, from the elongated, almost cylindrical abdomen, and denticulated middle legs in the ♂, will no doubt require the erection of a new genus for its reception. I, however, refrain from doing this prematurely; in all other respects it agrees with *Helophilus*. Moreover, it must be closely allied to a recently described species by Meijere, from the Aru Islands (*H. caudatus*), from which, however, the denticulation of the middle tibiæ at once distinguishes it

H. celeber, O. S.**H. curvigaster**, Macq.**H. ænus**, mihi, sp. nov.

These three are quite distinct from all the other species, and may be instantly recognised respectively by the perpendicular face and incrassated hind tibiæ in *celeber*; the transverse bands of pubescence on the thoracic dorsum in *curvigaster*; and the wholly ænous and *Eristalis*-like appearance of my new species.

H. caudatus, Meij.**H. tuberculatus**, mihi, sp. nov.

These two species stand out from all others by their elongated abdomens, my new species being easily differentiated from Meijere's by the presence of the strong denticulation of the middle tibiæ, a feature which he does not mention as being present in his specimen; the latter was a ♂, the middle legs of which were, moreover, not missing, as he describes their coloration.

H. pilipes, Dol.

The author figures his species, and distinctly shows the thick pubescence of the *first* pair of femora and tibiæ, the *middle* pair being nearly bare; so that the specimen in the Indian Museum collection named "*pilipes*, Dol.," by Bigot is erroneously identified.

This specimen (♂) I have figured in pl. xii, figs. 18, 19, 20, a lateral view being given, because the specimen is partly curled up, and also to show the formation of the anal segments. The anterior and middle legs are also shown, the hind pair being missing. It approximates to *insignis*, Dol., but the hairy middle legs separate it; I therefore figure it, so that perhaps some other dipterologist may recognise it. In the Indian Museum collection are a ♂ and ♀ approaching *pilipes*, Dol., but they have *clear* wings and *no yellow hair* on anterior legs. This species (a ♂ from Calcutta) I also figure in pl. xii, figs. 11 and 12.

Doleschall distinctly says his *pilipes* is near the *pendulus*, Meig., of Europe, but smaller.

H. vestitus, Wied.**H. doleschalli**, mihi (*nom. nov.* for *insignis*, Dol.). (Pl. xii, figs. 7, 8, 9.)**H. notabilis**, Mcq.**H. insignis**, Wlk.

The specific name *insignis* was employed by Walker and Doleschall for two different species, both in the same year (1857). I venture to change Doleschall's specific name to *doleschalli* and

let Walker's name stand, because the introduction (by Mr. W. W. Saunders) to Walker's paper in the Proceedings of the Linnean Society of London is dated Jan. 14th, 1856, whereas Doleschall's paper is dated March 16th, 1857. I have, however, no means of deciding which was *published* first, both appearing in 1857.

H. doleschalli extends from Calcutta to Assam.

H. conclusus, Wlk.

H. albiceps, Wulp.

These two species stand out from the remainder by the broad oblique yellow stripe on the side of the thorax, which is absent in the other four, and the recorded green wings of *conclusus* should easily identify it.

H. mesoleucus, Wlk.

H. consors, Wlk.

H. bengalensis, Wied. (Pl. xii, figs. 4, 5, 6.)

H. quadrivittatus, Wied. (Pl. xii, figs. 1, 2, 3.)

These four species must be closely allied, but a comparison of specimens of the two latter species (which are not uncommon in Calcutta, and are identified by me from Wiedemann's Auss. Zweifl.) with Walker's types of the other two species, may allow me to speak definitely later on.¹ Walker says of *mesoleucus*, "hind femora thick," and of *consors*, "hind femora incrassated, hind tibiæ curved." The femora are always thickened in this genus, and in most cases the hind tibiæ are curved also, although, of course, a case of very distinct incrassation would clearly define a species. As regards *H. bengalensis*, Wied., and *quadrivittatus*, Wied., they are both good and distinct species although extremely closely allied. Of the latter species Wiedemann saw only a single ♂ and expressed doubts as to its being distinct from the former one. His distinctions as to the whiteness of the face and the coloration of the legs I do not find reliable, but the differences of markings on the 4th abdominal segment are quite consistent in both species.

In *bengalensis* the 4th segment has a mark which varies greatly in colour,—yellow, red, brown, and deep black,—but it is always present, is clearly cut, and in the form of an inverted V (or, sometimes, that of a bow) stretched out right across the segment. In *quadrivittatus* this mark is absent, the segment being black with whitish dust at each side, the ground colour showing roughly in the form of a triangle with its apex on the base of the segment. Both species are moderately common in Calcutta and I have examined a good many of both sexes of each, including a long series of *quadrivittatus* from Bangalore, South India, in the

¹ Specimens determined by me as *H. bengalensis*, Wied., have been confirmed as such by Herr. Handlirsch of the Vienna Museum after comparison with the type.

Indian Museum collection, and a good series of *bengalensis* taken in Calcutta.

In pl. xii is a figure (fig. 10) of what I at first thought might be a different species, but now consider only a variety of *bengalensis*. Several specimens from various parts of India and Assam are present in the collection.

In addition to the described species enumerated herein, there is a ♀ specimen (wings missing) in the Indian Museum collection taken on the Second Yarkand Expedition and apparently a different species to any known to me. I therefore figure it in pl. xii, figs. 13 and 14, showing the abdomen and the markings of the legs. The black on the middle femora, however, is at the *base*, and not in the form of a distinct band removed from the base, as it appears in the figure. It may be a variety of some Palæarctic species. The last figure (pl. xii, fig. 21) is of a Calcutta specimen, which may be a variety of *bengalensis*, or may be distinct.

ERISTALIS, Latr.

I do not propose to deal with this genus in the present paper to any extent, its intricacies being far too extensive, considering the limited amount of material at my disposal. Two species were omitted by accident from Van der Wulp's Oriental Catalogue; these are—

E. tortuosus, Wlk., 1861, Proc. Linn. Soc. Lond., v, 266; Tond.

E. (Eristalomyia) sapphirina, Big., 1880, Ann. Soc. Ent. Fr. (v), x, 230; Papua.

One non-Oriental species crept into the catalogue by error; this is *E. semicirculus*, Wlk., the habitat of which is Honduras.

E. ursinus, Big.

I propose to change this name to *himalayensis*, as the species is found at Mussoorie, Sikkim, Darjiling, Simla, and several localities in Nepal.

Bigot's species (of which the type is in the Indian Museum collection) was described by him in the Ann. Soc. Ent. Fr. (1880) (5), x, 215 from "Hindustan," but the name was preoccupied by Jænnicke in 1868 in "Neue exot. Dipt.," 93, for a very different species, from Java. The present is a furry species, belonging to the *intricarius* group, and to which Wiedemann's *orientalis* also belongs. Of the latter species the Indian Museum possesses a short series of both sexes from Sikkim.

N.B.—Amongst some unnamed species of *Eristalis* in the Indian Museum collection is a ♀ from Sikkim closely resembling *intricarius*, L., but with the face much more produced, the hair on the major part (apical) of the abdomen bright red, the legs wholly black, and the arista plumose nearly to the tip. The produced face makes it appear specifically distinct,

E. tenax, L.

This nearly cosmopolitan species, including the variety *campestris*, Mg., appears quite widely distributed in the Palæarctic districts of the east, as it comes from every station in the Himalayan hills. I have taken it myself at Mussoorie and Darjiling, also from localities further east (Hongkong, Shanghai, and in Japan); yet I have seen only a very few specimens from the Indian plains (Bareilly, Meerut) and none at all from any more tropical locality.

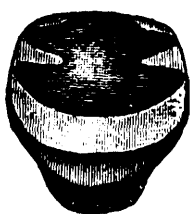
E. solitus, Wlk.

My identification of this species is corroborated by Mr. Austen, who has kindly compared specimens with the type in the British Museum. A considerable series in the Indian Museum collection shows specimens from Sikkim, Shillong, Kurseong and Mussoorie, all of which agree well with my own collected examples from Mussoorie, Darjiling, China and Japan, and with others taken by Dr. Annandale at Naini Tal. Walker originally described it from Nepal.

MEGASPIS, Macq.

This is a good genus, but the roughness on the frons, which distinguishes it, is not always easily visible.

A new species closely allied to, yet quite distinct from, *errans*, F., gave me much trouble but Mr. Austen confirms it as distinct, and Osten Sacken's note (Ann. Mus. Gen., xvi, 441) about the presence of the metallic spots on the 3rd and 4th abdominal segments, as remarked after comparison by him with the types, con-



Megaspis errans, F.

vinced me that I had correctly determined *errans*, F., from Wiedemann's description in his Auss. Zweifl., although that author did not mention these spots. What hindered my recognition was that a specimen of *errans* was in the Indian Museum collection (apart from other undetermined specimens of the species) labelled in Bigot's handwriting *Erist. cognatus*, Wied., a species which is evidently of similar appearance but is a true *Eristalis*, Wiedemann marking off very clearly those of his species of "*Eristalis*" which we now place in *Megaspis*. The spots vary from shining brassy almost to steel colour and exist in a less degree in my new species,

The species *sculptatus* of V d. Wulp seems to be separated from *crassus*, F., only by the absence of the large red-and-black spine on the underside of the hind femora, and the abnormal width of the 2nd abdominal segment, which the author says forms the major part of the abdomen, whereas in the common *crassus* it is of normal width.

Table of Oriental species of Megaspis.

- A Basal half of wing entirely quite black.
 B Hind femora bright tawny red, with black tips.
 Hind femora untoothed below; 2nd abdominal segment abnormally wide Long. 11 mm. *sculptatus*, V Wulp
 Hind femora with distinct black-and-red tooth below, near tip; 2nd abdominal segment normal. Long. 12-15 mm. *crassus*, F.
 BB Hind femora wholly black. Long. 15 mm. *chrysopygus*, Wied.
 AA Basal half of wing not black; only normally a little tawny brown.
 1. Hind femora, basal half tawny, rest blackish brown with soft yellow hair. Thorax almost wholly occupied by an ill-defined blackish square dorsal spot, with a tendency to be divided transversely from each side by a light, very narrow cross-band. Abdomen (more or less *tenax*-like), with a large black triangular spot on the posterior border of each segment, barely reaching the sides. Wings pale yellow, without distinct suffusion, merely the mediastinal cell tawnyish, also base of wings. Face, seen from above, pinkish tawny (♂); greyish with black hair (♀) Long. 10-12 mm. *errans*, F.¹
 2. Femora unicolorous, but varying from light brown to blackish; hind pair *never* with tawny basal half and dark apical half. Thorax with a wide, well-defined, quite black uninterrupted transverse band, occupying one-third the vertical length of the dorsum.

¹ In the accompanying diagram of the thorax of this species the dorsal dark marks are shown much more distinct than they really are; the shape of the markings will, however, clearly distinguish the species.

Abdomen (more or less *tenax*-like) with posterior edges of segments black, sometimes showing a tendency in the centre to form a dorsal stripe.

Wings practically as in *errans*.

Face, seen from above, quite white (♂), or yellowish grey, with black vertex (♀).

Long. 11-15 mm. *transversus*, sp. nov.¹

3. All femora wholly quite black, hind pair with short, stiff, bristly hair.

Thorax blackish, covered with close black hair which on anterior border is reddish yellow.

Abdomen not *tenax*-like, somewhat *intricarius*-like, though not so pubescent; 2nd segment with a broad, bright yellow band, covering nearly the whole segment.

Wings nearly clear, with a distinct blackish brown suffusion in the middle of the anterior border and in a less degree at the base also.

Face grey, with blackish hairs (♂ ♀).

Long. 11-15 mm. *zonalis*, F.

M. transversus, mihi, sp. nov.

♂ ♀ India. Long. 11-14 mm.

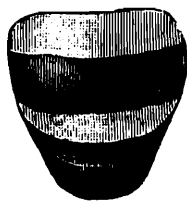
Head: ground colour of frons and face, blackish with white hair (seen from above) in the ♂, and yellowish grey hair with blackish vertex in the ♀. A black frontal stripe more or less visible. Eye-facets small, uniform. Antennæ reddish brown, on very short shining brown prominence; 3rd joint blackish. Back of head grey, posterior orbit of eyes yellow on vertex with short yellowish hair, greyish at sides and below with snow-white short hair. Under side of face blackish. Mouth and proboscis dark brown.

Thorax: dorsum greyish tawny (sometimes greenish yellow in front) with yellowish or greyish hair; crossed transversely by a clear-cut wide black band (ground colour) with close short blackish brown hair; this band occupies rather more than one-third the vertical length of the dorsum and is narrowed at the sides. A patch of tawny red hair on each shoulder. Sides cinereous grey

¹ In the accompanying diagram of the thorax of this species the dorsal dark marks are shown much more distinct than they really are; the shape of the markings will, however, clearly distinguish the species.

with sparse hair. Scutellum, of the usual great width, black, with close very short black hair, and some pale hairs on the margin.

Abdomen tawny, posterior borders of segments with a black band, wider in some specimens than in others, and with a tendency sometimes on the 2nd segment to form a dorsal band. Centre of 1st segment black. At each of the fore corners of the 3rd and 4th segments is a triangular brassy metallic spot (not strikingly conspicuous, as the colour is so similar to the ground colour) which is somewhat raised, and does not attain the ridged sides of these segments. Whole dorsum covered with short yellow hair, which is darker on the posterior part of each segment; a minute row of black hairs on the extreme edge of each segment. Belly tawny with some yellow hair, centres and posterior halves of the segments more or less blackish.



Megaspis transversus, mihi, sp. nov.

Legs: coxæ blackish grey, hind pair with a little yellow hair; femora wholly brown, sometimes lighter, sometimes nearly black, but *always unicolorous*, except that the extreme tip is occasionally lighter, with light golden yellow hair; tibiæ, rather variable, usually with tawny basal half and lighter or darker brown apical half, with yellowish or whitish hair, which is brown or black on the darker parts; tarsi dark brown, with yellowish grey hair below, which is sometimes golden brown under hind pair.

Wings nearly clear, a little tawny brown suffusion at base, in the mediastinal cell, and near the base of the discal cell. Halteres yellow.

Described from four ♂♂ and four ♀♀ in fair condition (supplemented by a long series of both sexes in indifferent condition) in the Indian Museum collection from Bangalore and Calcutta. Allied to *errans*, F., but quite distinct. The sub-metallic raised triangles on the abdominal 3rd and 4th segments are identical with those in *errans*, F., but the hind femora are *never* pale on the basal half and dark on the apical. This character alone, or the thoracic markings, will at once separate the two species.

POLYDONTA, Macq.

(?) *P. orientalis*, mihi, sp. nov.

(*Id. id.*, Bigot, *nom. nud.*)

♂. Orient. Long. 11 mm.

Head: eyes touching for a short space only, facets small, uniform; vertex small, with some black hair. Antennæ on a moderate

prominence, both blackish, 3rd joint brownish orange, with orange arista. Frons and face with whitish hair, yellowish brown mixed with black above the antennæ; facial callus of moderate size, shining, bare; proboscis and mouth, brownish black. Back of head dark grey, with a narrow fringe of short greyish yellow hair, which is longer below the head.

Thorax blackish, covered with light yellowish grey pubescence which also occurs in front of the wing-insertion, on the cinereous grey sides of the thorax. Scutellum tawny, with rather long yellowish grey erect pubescence.

Abdomen light chestnut-brown; 1st segment and base of 2nd in middle, blackish; 2nd segment, towards the posterior border, 3rd and 4th segments, both at base and towards posterior borders, with broad black transverse bands, slightly elevated; extreme edges of segments pale. Whole abdomen lightly clothed with pale yellow hair, which is much longer and thicker on the yellowish belly, on which some traces of black transverse bands can be seen. The abdomen consists of only the four distinct segments as described; unless a fifth segment can be recognised in a bare brown curved plate twisted to the *left side* of the large genital process, which is shining brown, bare, biglobular; the lower globe bearing on its under side some further small appendages.

Legs: coxæ dark brown, with pale yellow hair; trochanters much lengthened, brown, with some black marks and yellow hairs; anterior femora blackish, except pale tips, with soft yellow hair; hind pair enormously enlarged, blackish on upper side, and on apical half below, with a broad black ring round the middle, most distinct on the outer side; on the lower side (apical half) is a collection of short black spines, whilst soft yellow hair occurs rather thickly on the upper side, and on the basal half below; scattered long yellow hairs occurring over the whole femur more or less. The basal half of the femur below is considerably cut away, the vacancy being replaced by a prominent, tawny yellow tooth, closely covered with long yellow hair. Tibiæ brown, lighter at base, with yellow short pubescence; hind pair shining chestnut-brown, much curved, almost bare, and terminating in a point inwards. Tarsi dark brown, the metatarsus thicker than the rest of the joints.

Wings very pale grey—not darker at base; two minute blackish suffusions at the stigma, and on the spurious vein just below the fork of the 3rd longitudinal vein. Halteres very short, pale yellow, covered wholly by the dirty white tegulæ, which bear whitish hairs on the margins.

Described from a single ♂ in fair condition in the Indian Museum collection, bearing no data, but marked "Inde" in Bigot's handwriting.

N.B.—I leave this species in *Polydonta*, as being the most suitable genus to receive it, as the shape of the abdomen, venation, and pointed curved hind tibiæ all agree perfectly with Macquart's description and figure. There are, however, several points in

which it very materially differs from the definition given by Macquart.

Firstly, he says the front in the ♂ (the only sex given) is moderately wide, whereas in my specimen the eyes touch for a distinct space; but possibly Macquart's specimen was a ♀; secondly, the hind femora in my species are very greatly enlarged, in the same proportion as in *Syritta*, whereas Macquart's description is only "épaisses"; moreover they are barely curved at all, much less possessing the extraordinary curvature shown in Macquart's figure (Dip. Ex. Supp. iv, pt. 1, pl. xiii, fig. 6 c.). Again, though that figure shows a small tooth at the base below, it is not so conspicuous as in *orientalis*.

The genus was established for *bicolor*, Macq., from Nova Scotia, and has not been previously recorded from the East; but, knowing of no other in which to place the Oriental species, I leave it here, where Bigot placed it.

Apart from the question of the location of *orientalis* in *Polydonta*, the genus requires renaming, being preoccupied in Mollusca by Fischer in 1807.

I might add that Bigot's label reads "*Polydnota*," but I presume he means *Polydonta*.

The type-specimen only possessed one tarsus, which has, unfortunately, been broken off since my describing it, but I noticed particularly, the slight thickening of the metatarsus below, mentioned by Macquart.

EUMERUS, Mg.

E. argyropus, Dol.

(*E. argentipes*, Wlk.)

There are three ♂ ♂ and a ♀ from Assam in the Indian Museum collection which I have identified with this species.

E. nepalensis, mihi, sp. nov.

♀ Nepal (Chonebal). Long. 8 mm.

Head very shining black, face below antennæ, black, antennæ bright tawny red, the *edge* of the 3rd joint black.

Thorax dark shining aënous black, with tawny grey pubescence on dorsum, and grey pubescence at the sides; scutellum unicolorous, with soft, rather long yellowish grey hair, posterior border with a flat edge which is serrated above.

Abdomen shining black, with two oval, oblique pale spots on 2nd segment, their ends touching the posterior border of the segments near the side margin; extreme posterior border of segments very narrowly tawny. On the 3rd segment are two smaller and narrower spots similarly situated; on the 4th segment, two hardly visible pale grey similar spots with white hair. Sides and tip of abdomen with white hair. Belly black, pale in centre.

Legs black, femora fringed with whitish hair below, posterior femora with black hair on upper side; the basal half and tips of the femora, four anterior tarsi, tip of posterior metatarsus, and apical half of next joint, tawny yellow: under side of whole posterior tarsi with bright golden yellow pubescence; four anterior tarsi with some white hairs at base.

Wings clear, iridescent, veins well marked, stigma brown; tegulæ and halteres yellowish.

Described from the one type-specimen in the Indian Museum collection. It is near *argyropus*, Dol., but distinct by the wholly clear wing.

N.B.—I have a *Eumerus* taken by me at Mussoorie, 20-24-vi-05, and another species taken by me at Lucknow, 2-xii-04, but shall reserve these for further consideration. The first I cannot identify with any of Schiner's species, but in view of the forty known European species, any one of which it may be, I refrain from describing it as new.

SYRITTA, St. Farg. et Serv.

In a subsequent paper I hope to deal with this genus. Five species have been recorded from the East, all apparently bearing considerable resemblance to one another. *S. pipiens*, L., the very common European and North American species, has not been recorded, but I have taken it myself not only at Mussoorie and Darjiling, but from the Indian plains also. My first impressions derived from a study of the Oriental species of this genus are that there may be only three species: (1) *pipiens*, L., of which *orientalis*, Mcq., and *indica*, W., may be synonyms; (2) a species with the pairs of spots replaced by entire bands which, when interrupted, are only very slightly so. This species would be *amboinensis*, Dol., with *illucida*, Wlk., as a possible synonym, although in the latter the bands are straight, whilst in *amboinensis*, Dol., they are not so. The third species varies from both, but approximates most to *pipiens*.

On the other hand there may be eight or ten good species. One specimen in my own collection taken by me at Agra, 4-iv-05, has the posterior femora nearly wholly bright red and the 2nd pair of abdominal spots also reddish.

An example in the Indian Museum collection has the second pair of spots nearly as large as the first pair, whilst a third species, which occurs in Calcutta and elsewhere (Karachi), has a broad pale entire band occupying two segments. This is labelled *S. laticincta*, Bigot, which is I believe a *nomen nudum*, but the *species* may be a good one. Other specimens in inferior condition in the Indian Museum collection may prove to be still further species.

XYLOTA, Meig.

The Indian Museum possesses specimens named by Bigot, *cuprina*, *cupropicta*, *flavitaris*, and *auronitens*, all being his own

species. Of these *cuprina*¹ is a described species and the ♂ and ♀ ♀ of it apparently are co-types, and therefore, presumably, correctly identified. *Cupropicta* and *flavitaris* (two ♀ ♀ and one ♀ respectively) are certainly only the same species as *cuprina*, and are probably *nomina nuda*. The other species, *auronitens*, is apparently a good species, which I describe here, with a second very distinct species from Assam.

X. *auronitens*, mihi, sp. nov.

(*Id. id.* ; Bigot, *nom. nud.*)

♂ Assam. Long. 12 mm.

Head: vertex shining black, a few yellow hairs immediately above junction of eyes, which are contiguous for only half the distance from the frontal prominence to the crown of the head. Facets small, of uniform size, except being a little larger where the eyes touch; ocelli distinct, no ocellar prominence. Frons shining black, grey dusted round the margins, with lower edge immediately above the antennæ, tawny. Cheeks and lower part of face blackish, with a brownish blue tinge, with whitish reflections in certain lights. Antennæ reddish brown, 3rd joint lighter, whitish dusted; arista reddish brown. Mouth and proboscis brown. Back of head grey, encompassed by a fringe of gold-yellow hair, which is shortest behind the upper corners of the eyes.

Thorax: dorsum golden brassy, with gold-yellow hairs, which are absent in the centre, giving an appearance, seen from behind, of a dark dorsal stripe. Humeral calli, bluish black, with a few yellow hairs. Sides of thorax blackish, shining, with some scattered yellow hairs. Mesopleura, pteropleura and sternopleura, ænous grey, shining, with yellow hairs. Metanotum ænous, bare. Scutellum brassy gold, with rather close, moderately short, yellow hair.

Abdomen: 1st segment ænous, with a slight brassy tinge; 2nd, tawny brown, shining, posterior border blackish; the colour extending forward in the centre as a partial dorsal stripe; 3rd, tawny brown, shining, posterior part, blackish; the colour widest in the centre; 4th, ænous shining, reddish brown towards posterior border. Tip of abdomen reddish brown. Belly red-brown, black at base. The whole abdomen—dorsum, sides and belly—is covered with short, soft yellow hair.

Legs: coxæ shining ænous, posterior pair with yellow hair on outer sides; femora ænous, with soft yellow hair, extreme tips tawny; tibiæ and tarsi bright tawny with yellowish pubescence, apical half of tibiæ blackish, especially in fore and hind pair, the fore tibiæ bearing a fringe of long yellow hair on their inner sides.

¹ This specific name has been used for a second time by Coquillett for a species from Japan described by him in 1898 (Proc. U. S. Nat. Mus., xxi, 327). Bigot's species therefore antedates this latter by thirteen years.

Wings pale grey, mediastinal cell uniformly brownish yellow ; no distinct stigma. Halteres bright yellowish red. Tegulæ whitish grey.

Described from a single ♂ in good condition in the Indian Museum collection from Margherita.

This species must be very near *nigroaënescens*, Rond., but his description of the abdomen does not quite agree, and he says the antennæ are black, whereas in *auronitens* they are bright reddish brown. My longer description will enable some author to decide whether it is synonymous with Rondani's species or not.

X. assamensis, mihi, sp. nov.

♀ Assam (Kohima). Long. 13 mm.

Frons shining black narrowing towards vertex, a slight trace of a grey pollinose line across the centre ; face below antennæ tawny, with minute not very strongly marked silvery white pubescence ; proboscis blackish brown ; antennæ brown ; a fringe of yellowish hair behind eyes at the sides.

Thorax, dull violet bronze, nearly bare, sides black, some yellow hairs in front, at the base of the wing ; scutellum unicolorous, yellow hair at sides and on posterior border.

Abdomen, dull violet ænous, nearly bare, but with minutely yellowish pubescence seen from in front.

Legs, bright red tawny, with very slight yellow hair ; coxæ black ; posterior femora with traces of a brown mark in the middle of the upper side.

Wings, pale yellowish tawny, stigma tawny. Halteres brown, alulæ brown with a fringe of thick yellow hair behind.

Described from one ♀ in the Indian Museum collection.

The Oriental species of this genus may be separated thus—

Abdomen with distinct bands or spots.

Legs black.

Long. 11 mm. *nigroaënescens*, Rond.

Legs partly tawny.

Abdomen with two broad interrupted testaceous bands.

Thorax unstriped ; antennæ black ; basal half of femora pale ..

Long. 8 mm. *calopus*, Big.

Thorax with two testaceous tomentose stripes ; antennæ tawny ; femora chalybeous.

Long. 10 mm. *conformis*, Wlk.

Abdomen with six bands.

Long. 12 mm. *æqualis*, Wlk.

Abdomen unicolorous, or at least, without distinct bands or spots.

Legs tawny or red.

Abdomen tawny towards the base.

Long. 10 mm. *æthusa*, Wlk.

Abdomen all shining violet.

Long. 13 mm. *assamensis*, mihi, sp.

Legs not tawny (metallic blue, green, nov.
aëuous or black: in *ventralis* "dingy
testaceous").

Belly with two very broad testaceous
stripes

Long. 9 mm. *ventralis*, Wlk.

Belly without pale stripes.

Long. 10-11 mm. *cuprina*, Big.

MILESIA, Latr.

In this genus there is little to record.

Only two new species have been described recently; these are—

M. balteata, Kert., 1901, Termés. Füzet., xxiv, 414; Sikkim.

M. semifulva, Meijere, 1904, Bijd. Dierk., xviii, 19; Darjiling
(figured).

To these I add two undescribed species in the Indian Museum collection named by Bigot *variegata* and *himalayensis*.

For a table of most of the species up to 1882, Baron Osten Sacken's notes in the Berl. Ent. Zeits., vol. xxvi, 187, can be consulted.

Two other species are in the Indian Museum collection determined by Bigot; two ♂♂ of *conspicienda*, Wlk., from Sandakari, and two ♂♂ of *gigas*, Mcq. (*Sphixea*), without data.

M. variegata, mihi, sp. nov.

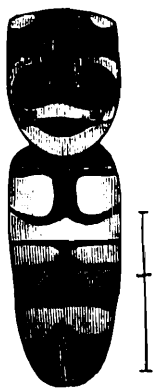
(*Sphixea variegata*, Bigot, *nom. nud.*)

♂ Sikkim. Long. 20 mm.

Head: vertex narrow, black, with black hairs; a small yellow triangle just above the juncture of the eyes, which are contiguous for only a short space. Frons and face bright lemon-yellow, with a broad, shining black stripe on each cheek; frontal prominence, blackish brown. Antennæ red-brown, 1st and 2nd joints with one or two strong bristles above and below towards the tips. Proboscis blackish brown. Back of head grey, posterior orbit of eyes with yellow hair, longest below.

Thorax mainly blackish. Humeral calli with a small oblong spot below each; præalar calli, meso-, ptero-, sterno-, and metapleuræ, also posterior border of thoracic dorsum, bright lemon-yellow. Two greyish stripes, narrowed behind, extend from the anterior margin to the centre of the dorsum, where they meet two similar ones extending inwards from either præalar callus. Scutellum black, the posterior half yellow, with yellow hair; the whole thorax and scutellum covered with short, soft yellowish grey hair.

Abdomen : 1st segment shining black, yellowish towards each side in front ; 2nd segment lemon-yellow with a very narrow black posterior border ; a dorsal, clean-cut, rather narrow black stripe extends more than half the distance from the base, when it meets a transverse narrow line, almost parallel with the posterior border, but curved forward towards the sides ; 3rd and 4th segments pinkish brown, with very narrow, black posterior borders, and a short narrow, dorsal stripe, which immediately divides, and extends to each side in the shape of a loop, attaining the edge just before the middle of the segment. Posterior half of 3rd segment



Milesta variegata, mihi, sp. nov., ♂.

blackish, the colour extended forwards in the middle ; the 4th segment is narrowly black at the base. Genitalia not conspicuous, yellowish brown. The whole abdomen is covered with short yellow hair on the yellow parts, and short black on the remainder, with rather long yellow hair at the sides, and with a row of moderately long black hairs on posterior border of the 4th segment.

Belly yellow on basal half, with a blackish, narrow central line ; blackish on posterior half, all covered with light yellow soft fluffy hair.

Legs : fore coxæ shining black with soft yellow hair ; posterior coxæ apparently yellow, with a black streak below, all covered with close long yellow hair. Femora orange-yellow, with a long black streak on under side ; hind pair with a diffused black streak above also, and bearing a moderately long orange-yellow spine below, near the tip. All the femora with long yellow hair, with some short rows of black hair intermixed ; the hair being scarcest on the upper side of the four anterior femora, and thickest on the lower and inner sides of the hind pair. Tibiæ tawny brown, the fore pair darker towards the tip, the middle pair much lighter, the hind pair darker ; all the tibiæ with minute yellow pubescence, and with long yellow hair on the under side, consisting of a single shorter fringe on the fore pair, a long and a short fringe on the middle pair, the hind pair being densely covered on the whole of the lower and inner sides. Tarsi yellowish tawny, with short yellow pubescence ; upper sides blackish brown.

Wings pale grey, brownish along anterior margin, and the

slightest possible trace of a dark diffusion towards tip. Halteres: stems yellow, knob red-brown.

Described from a perfect ♂ in excellent condition in the Indian Museum collection from Sikkim. A very conspicuous species.

N.B.—This may be the ♂ of Walker's *M. lamus*, described from an unknown locality. The description of the abdomen agrees very well, but my specimen has no frontal stripe from the antennæ to the mouth. The markings on the sides of the thorax do not quite agree; my species has no distinct black spots on the belly, nor does Walker, in spite of his minute description of the feet, mention the conspicuous streaks on the under side of the femora, which are present in *variegata*. The black band across the vertex, with a second stripe extending to the antennæ would probably be a sexual character. The black posterior border of the 3rd segment extends to the base of the 4th, therefore there is less difference between Walker's "fore border" of 4th segment, and my "posterior border of 3rd," than would at first appear.

***M. himalayensis*, mihi, sp. nov.**

(*Sphyxæa himalayensis*, Bigot, *nom. nud.*)

♂ ♀ Assam and North India. Long.: ♂, 20 mm.; ♀, 17 mm.

Head: ♂: vertex shining black, a very small grey-haired triangle just above the junction of the eyes. Frons and face blackish grey, shining, with silvery reflections, seen from above; frontal prominence, dark brown (antennæ missing). Back of head grey, posterior orbit of eyes with a little short greyish hair.

♀: frons yellowish grey; a broad shining bare black stripe (occupying nearly the whole width of the frontal space) extends from the vertex to the frontal prominence. Lower part of face and cheeks shining black, nearly bare, without whitish reflections, but with traces of a greyish stripe on cheeks. Antennæ tawny.

Thorax: ground colour blackish, covered with close ferruginous brown hair (♂); or greenish yellow tomentose, with greenish yellow hair (♀). Humeral calli concolorous in ♂, yellow, with yellowish hair in ♀, with a small, oval, yellow spot below them. Sides of thorax, dark grey, with considerable brownish, rough hair in ♂; barer in ♀ with a little sparse grey hair, and a stripe below wing-insertions, extending to the scutellum, which is light brown in ♂ and yellow in ♀, in both sexes with yellow hair.

Abdomen in ♂ dark brown; in ♀ shining metallic blue; in both sexes, with a broad bright lemon-yellow band at the base of the 2nd segment, occupying more than half of it. A very narrow yellow band near the base of the 3rd segment in ♀

The dorsum is covered in the ♂ with yellow hair mixed with black, but wholly yellow on the cross-band. That on the sides of the abdomen is brown, except towards the base, where it is longest, and is yellow and silky. In the ♀ the dorsum is clothed with yellow hair on the cross-band, and minute black hair elsewhere,

except at the sides towards the base, where it is thick and yellow, but shorter than in the ♂

Legs black, shining, with some blackish brown hairs on hind pair, a not very strong black tooth on under side near tip (♂ ♀). Femora black, tips tawny, some black short bristly hair, mixed with yellow hairs on the lower side of the fore pair: the middle pair have long brownish yellow hair above and below (much longer in the ♂); the hind pair in the ♂ are covered with long yellow hair on the upper side, and longer brown hair on the under side; in the ♀ there is short yellow silky hair on the upper side, and brown hair below, which is neither as long or as thick as in the ♂. The fore tibiae (♂ ♀) are tawny, with a long black streak in front, extending from the tip nearly to the base. In the ♂ there are minute black hairs in front, and longer black silky hair behind; in the ♀ they are nearly bare, only a few short, black hairs being present. The middle pair are bright lemon-yellow (♂ ♀), and have soft pale yellow hair in the ♂, which is very long behind; whereas in the ♀ they are almost bare, except for some moderately long pale yellow hairs behind. The hind tibiae are blackish brown (darker in ♂); the tips narrowly brown (♂) or the colour spread more or less over the upper side towards the tip (♀). The ♂ has a row of long and very thick dark brown hair on the front, outer and innermost sides, being longest on the latter, whilst the ♀ has only very short black hairs, which attain to a short row of bristly hair on the upper side; and some moderately long silky brownish black hair on the lower side. Tarsi blackish brown, with short black hairs; basal joint of middle pair pale yellow in ♀ above and below; under side of hind pair with gold-brown short pubescence.

Wings pale grey, a little darker yellowish brown from the anterior margin to about the 3rd longitudinal vein. Halteres tawny. Tegulae pale yellow, with long yellow hair.

Described from a ♂ from Assam (Sibsagar) and a ♀ from Sikkim, both in the Indian Museum collection in excellent condition. A very conspicuous species.

DEINECHES, Wlk.

D. simioides, mihi, sp. nov.

(*Id. id.*, Bigot, *nom. nud.*)

♂ Orient. Long. 18 mm. (without snout).

Head: vertex black. Eyes reddish bronze, facets uniform, touching for only a short space above frontal prominence. Antennae light reddish brown, situated on a short black prominence. Snout produced. Face black, shining, with a greyish dusted wide stripe on each side. Back of head blackish grey, nearly bare.

Thorax obscure blackish grey (apparently). Humeral calli brown; a greyish stripe on sides. Scutellum blackish, hairy. The whole dorsum and sides of thorax clothed with thick blackish grey and brown hair.

Abdomen clothed with dense *Bombus*-like pubescence, which is yellowish on basal half (except the extreme base, which is barer and apparently tawny), followed by a wide blackish band of hair; the tip of the abdomen being clothed with red hair. Belly blackish; the last segment covered with dense black and reddish hair. Genital organ black, shining.

Legs reddish brown; fore femora with broad dark brown band near tip; middle pair with a black streak on inner under side, and a shorter one on outer side near tip; hind pair apparently unmarked. All the femora with more or less scattered black hair, which on under sides becomes longer and bristly. All the tibiæ with short stiff black hairs. Tarsi with short black hair, mixed with some yellowish ones; under side of hind tarsi rich golden brown.

Wings brown; anterior half and basal half much darker; centre of 1st and 2nd posterior cells very slightly clearer. Halteres yellow.

Described from one ♂ in the Indian Museum collection.

No distinct locality is given on the specimen, the label bearing the statement "*Deineches simioides*, Big., sp. nov., Inde," "Inde" being a general expression of that author's to include Malay species as well as Indian ones.

Owing to the bad condition of the specimen, I would not have described this species, except that, in spite of its state, the specific characters are sufficiently obvious and the generic characters agree perfectly with Walker's description and plate in *Ins. Saunds. Dipt.*

Moreover, the genus has not been recorded from the Orient before, having been established for a species from New South Wales.

AZPEYTIA, Wlk.

A. bifascia, mihi, sp. nov. (Pl. xiii, figs. 1—5.)

♂ Assam (Margherita). Long. 14 mm.

Head black, antennæ prominence small; front, vertex, and lower part of face with strong black hairs; eyes absolutely contiguous for a short space, slightly diverging towards vertex; antennæ dark brown, arista black, but base very distinctly thicker, and distinctly ferruginous; outer ocular orbit with a fringe of short yellow hairs.

Thorax black, moderately shining, with a rather thick covering of short bright yellow hair, which is, however, invisible if viewed directly from above. This yellow pubescence extends over the sides also. Scutellum nearly of the full width of thorax, tawny, darker at base, covered with thick yellow hair.

Abdomen black, moderately shining, with very short, rather thick black hair. On the sides of the 2nd segment, a very large pale aënous triangular spot, covered with yellowish grey hair;

extreme edge of the abdomen, except just before the tip, with a fringe of short bright yellow hair.

Legs wholly brown, with yellow hair on outer side of all tibiæ, on the coxæ, and on hind femora; the latter with a fringe of brown hair on more than the apical half below.

Wings yellow, veins tawny brown, stigma tawny brown, placed near tip of wing; halteres and tegulæ yellowish brown.

Described from the type-example in the Indian Museum collection.

It is interesting to add a second species to this curious genus originally described by Walker from Papua. The inflexed portions of the 3rd and 4th longitudinal veins (Verrall's subapical and postical veins) are considerably curved, exactly as in *Merodon*.

LYCASTRIS, Wlk.

L. albipes, Wlk. (Pl. xi, figs. 14, 15.)

(Syn. *Xiphopheromyia glossata*, Big.)

A ♂ from Mussoorie in the Indian Museum collection agrees with the author's description, except that the pubescence is yellowish instead of white, yet I have no doubt of it being this species. Walker says the legs are white. The specimen only possesses one leg (fore leg), which is yellow with black base to the femora.

L. flavohirta, mihi, sp. nov. (Pl. xi, figs. 16, 17.)

♂ Darjiling. Long. 10 mm.

Antennæ protuberance and snout all shining black, except a yellowish streak each side, commencing broadly at the eye, just below the antennæ, and gradually narrowing, extending nearly to the tip of the snout. Proboscis black. Antennæ black, 3rd joint dark reddish brown, arista bare. Eyes quite bare, contiguous only immediately above the antennæ, thence diverging rather widely to the vertex, which is yellowish black with a few long grey hairs; ocelli distinct, small, well separated. Sides and under side of head with pale yellow hairs, shortest above, longest near the mouth.

Thorax ænous, blackish grey at sides, dorsum and sides with long pale greenish yellow hair, thickest on posterior part. Scutellum unicolorous, with long yellow hair.

Abdomen bright yellow, 1st segment wholly ænous black on dorsum, the colour extending to the 2nd segment in the form of a triangle on the base of the segment. The whole abdomen covered with long soft hair, which is greenish yellow on basal segments, and bright yellow on the rest. Belly wholly yellow, with short yellow hair.

Legs bright yellow, coxæ, and about basal half of femora, black; anterior tarsi wholly, middle pair at tip, black; posterior metatarsus very long, and with extreme tip of tibiæ red, tips of posterior tarsi black. All the femora have a fringe of yellow hair,

longest in the centre; anterior tibiæ bare, middle pair with fringe of long yellow hair, posterior pair with yellow hair behind on apical half.

Wings grey, yellowish at base, slightly suffused at base of 2nd and 3rd longitudinal veins; over the discal cross-vein, and at wing-tip; discal cross-vein is placed nearly at the tip of the discal cell, and is very oblique; and the spurious vein is very distinct and complete; a few veinlets between the subcostal vein and the costa (this latter peculiarity being also the case in *L. albipes*). Halteres very small, knob brown, tegulæ pale grey, edge yellow, with short yellow hair.

Described from one ♂ in my collection taken by me at Darjiling, 10-15-ix-05 (type), and a ♂ in the Indian Museum collection also from Darjiling, taken 25-ix-06.

BRACHYPALPUS, Macq.

(?) *B. dives*, mihi, sp. nov.

♂ Assam (Kohima). Long. 17 mm.

Whole face yellow with silvery yellow tomentum; antennæ yellow, 3rd joint darker, eyes contiguous for half the distance to the vertex; proboscis brown, posterior orbit of head entirely encircled by a fringe of bright yellow hair.

Thorax ground colour ænous with a slight violet tinge on the dorsum, covered with rather thick short yellow hair. No signs of stripes or bands. Sides of thorax cinereous, with a thick elongated bunch of yellow hair just in front of and below the insertion of the wings, scutellum ænous, thickly covered with yellow hair; the extreme edge is narrowly ridged all round and is yellow.

Abdomen elongated, much narrower than thorax and only slightly narrowing toward apex, brilliantly shining golden yellow, 1st joint dull ænous green, the whole abdomen thickly covered with golden yellow hair which is longest at the sides and tip. Belly yellow, nearly bare.

Legs bright yellow, fore pair normal, the femora rather thickly yellow haired; the middle femora are distinctly, though not greatly enlarged towards the tip, with a fringe of long golden yellow hair in front and behind and a shorter fringe above; the middle tibiæ have, above and below, excessively long and thick golden yellow hair; the hind femora are slightly and uniformly thicker, very slightly pale brownish with a blackish streak on upper side, and are covered with moderately long golden yellow hair—the tooth on the under side is near the tip and is followed by a semicircular protuberance marked with black; the hind tibiæ are well curved, yellowish brown, darker on inner side, slightly narrow at the base, near which is a distinct tooth; black hairs on the inner side and a narrow row of pale yellow hair on the outside. The four anterior tarsi yellow, with some small black spines at the tip of each joint, hind tarsi similar, but brownish, with golden brown thick short

pubescence on under side and long black hair, bushy and straggly, on the outer side.

Wings pale yellowish, anterior border to the subcostal (1st longitudinal) vein, a little deeper yellow. Halteres, yellowish brown; tegulæ yellow, both with a fringe of thick yellow hair.

Described from one ♂ in perfect condition in the Indian Museum collection.

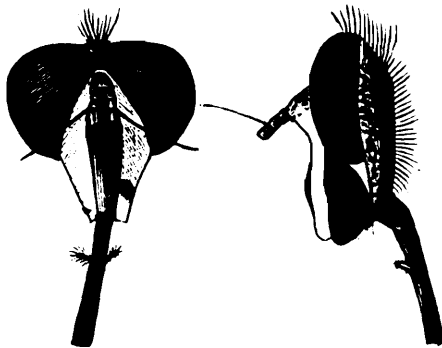
I am not certain of the position of this species here, but the only difference it shows from *Brachypalpus* is its insufficiently thickened posterior femora. It is a magnificent species.

CRIORHINA, Mg.

(?) *C. dentata*, mihi, sp. nov.

♂ Simla district. Long. 11 mm.

Head: antennal protuberance rather prominent, face much excavated below antennæ, and bearing a central knob. Eyes black, sub-contiguous for only a very short space, facets smaller round the outer parts. Vertex moderately narrow, raised, black, with long



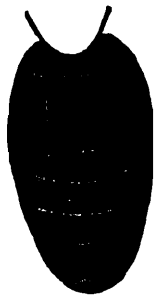
Criorhina dentata, mihi, sp. nov., ♂.

black hair in front, and tawny brown hair behind, on posterior edge. Face dull yellowish, with, seen from above, a silvery white dusted reflection; upper side of antennal prominence shining black. Antennæ red-brown; a few hairs on upper side of basal joints; arista, orange, bare. Whole side of the produced snout, from the eyes to the tip, shining black, bare; a central wide bare shining brown stripe from base of antennæ to tip of snout, mouth black, proboscis dark brown, rather long. Back of head grey; posterior orbit of eyes with a fringe of grey hair which is shortest behind the vertex and longest on under side.

Thorax ænous, with a slight reddish coppery tinge, closely covered with thick long light brown hair, which extends over the concolorous scutellum, but is almost absent at the base of the latter and longest of all and erect on the posterior border of the same. Sides of thorax blackish grey, shining, with thick long brownish grey hair. A small yellow callus a little below the shoulder bearing apparently microscopic cream-coloured pollinosity. A small oval

callus, hollowed in centre, above each hind coxa, bearing very short cream-coloured pubescence. Metanotum, shining black, bare.

Abdomen: 1st segment dull bluish grey, blackish at base with a bunch of pinkish brown hairs in the centre of the posterior border; 2nd, 3rd and 4th segments with the basal half sub-metallic dull bluish black, and the apical half sub-metallic brownish black with a light brown posterior edge (widest on 4th segment). Each segment is indented transversely by a narrow grey band bearing short grey hair, the hair in front of it being light brownish grey and on apical half brownish black. Tip with brown hairs, genitals black, concealed, globular, with black hairs. Belly blackish, with greyish hairs, posterior borders of segments tawny.



Criorhina dentata, mihi, sp. nov., ♂.

Legs: coxæ blackish, fore pair with whitish reflection and grey hair; hind pair yellowish, streaked with black above, with yellowish grey hair below. Femora black, extreme tips orange-yellow, basal half of middle pair below, and a basal band on hind pair, orange-yellow. The hind femora are barely thicker than the others and bear a distinct wide tooth on the under side near the base. All the femora considerably covered with light greyish hair, mixed with some brown hairs, the under sides bearing the longest hair. Tibiæ: rather more than basal half of anterior pairs brownish yellow, the rest black, hind pair nearly all black; all with short whitish hair. Tarsi: anterior four brownish yellow, with darker tips and traces of a darker central line; hind pair dark brown, with the upper side mainly black.

Wings pale grey; stigma dark brown; cross-veins lightly suffused for a small space with brown. Halteres yellow. Tegulæ, transparent white, with yellowish brown border bearing long white hair.

Described from a ♂ in the Indian Museum collection taken at Kodiali, Simla district.

N.B.—This species may require the erection of a new genus, as it varies from typical *Criorhinæ* in several particulars, but I know of no other genus in which it can be placed. Its points of difference are the prominent antennal protuberance, the distinct central knob on face, the contiguity (sub) of the eyes for only the shortest possible distance, the straight outer side of the 3rd antennal joint and the barely thickened hind femora bearing a distinct tooth,

SERICOMYIA, Mg.

S. himalayensis, mihi, sp. nov. (Pl. xiii, figs. 6, 7, 8.)

♂ Sikkim. Long. 12 mm.

Entire frons, cheeks and lower part of head bright yellow, with some yellow hair immediately below eyes, at the sides of the cheeks, and lower part of head behind; eyes comparatively rather small, contiguous for only the shortest space, facets very small, especially on lower part, but with no distinct line of demarcation; vertex very small, slightly raised, with a few black hairs; a few black hairs also just above the antennæ, which are rather small, black and plumose above and below.

Thorax yellowish grey, entirely covered with moderately thick yellow hair, which is longest at the sides and on the posterior border; dorsum cinereous, with short yellow pubescence, and black hairs in the centre, this pubescence being hardly visible from above. Scutellum tawny, with rather long yellow hair.

Abdomen bright yellow with a black band, indistinct in the middle, on the posterior borders of 2nd, 3rd and 4th segments; the whole abdomen with minute yellow pubescence and some longer yellow hair at the tip; belly bright yellow.

Legs tawny, with thin yellow hair; femora (except tips) brownish; posterior pair nearly black; tarsi tips brown.

Wings pale grey, a dark brown moderately broad band from beyond the tip of costal cell, reaching from the fore border to the upper part of the discal cell and the lower transverse vein.

Described from one ♂ from Sikkim in the Indian Museum collection.

This genus has not been previously recorded from the Orient.

CHRYSTOXUM.

C. sexfasciatum, mihi, sp. nov. (Pl. xiii, fig. 9.)

♀. India. Long. 13 mm.

Entire head yellow, with an orange central facial line below antennæ. Vertex shining blackish bronze reaching from eye to eye, moderately broad in front of the three ocelli, back of head continuously yellow above, but whitish behind lower portions of eyes, yellow haired above, white haired on lower part of orbit. Face minutely yellow haired. Eyes bare, facets very small. Antennæ protuberance brown, black at base above; antennæ, 1st two joints tawny brown, 3rd joint black, base tawny brown, arista tawny brown. Proboscis yellow, base black.

Thorax tawny yellow, parts of the pleuræ brassy, sides of dorsum lemon-yellow, dorsum aënous with two narrow central pale stripes placed near together; scutellum lemon-yellow, centre darker; whole dorsum of thorax and scutellum clothed with short soft pale yellow hair.

Abdomen tawny yellow; 1st segment very short, posterior border narrowly black; 2nd, 3rd and 4th segments more yellow on basal half and tawny on apical half, with two black oblique elongated oval streaks in the disc, pointing to posterior corners, those on the 2nd segment meeting towards the base of the segment in the centre. The base of 2nd, 3rd and 4th segments towards the sides and widening at the edge, black; 5th segment tawny brown with two oblique oval semi-lunate lemon-yellow fascia.

Legs yellow, coxæ brown.

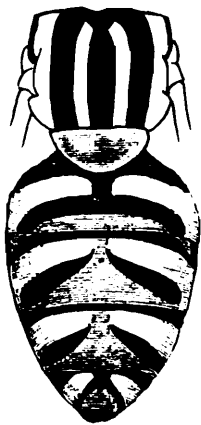
Wings nearly clear, slightly yellow below the pale brown stigma. Halteres pale yellow.

Described from the above type in the Indian Museum collection taken 23-31-xi-07, at Rampore Chaka, Bijnor district, United Provinces.

C. citronellum, mihi, sp. nov.

♂ Ceylon. Long. 12 mm.

Head: vertex very small, black with a few black hairs; ocelli distinct, red, well separated. Eyes touching for half the distance from vertex to frontal triangle, facets very small, uniform. Frontal triangle small, black, with blackish brown hairs, lower part shining. Antennæ, base black (rest missing). Face bright greenish yellow, bare, with a black stripe from the antennæ, continued distinctly into the mouth cavity for some distance, each side of this stripe being narrowly tawny. Proboscis short, black. Under side of head pale livid orange. Back of head black; posterior orbit of eyes whitish, with a fringe of short white hairs, replaced behind the vertex by yellowish hairs.



Chrysotoxum citronellum, mihi, sp. nov., ♂.

Thorax: sides of dorsum occupied by a thick, wide greenish yellow stripe. Rest of dorsum shining greenish black, with two central, longitudinal, moderately wide ochreous yellow stripes, separated from each other by about the width of one of them. Sides of thorax shining black, with some yellow hairs. Mesopleuræ and an oval spot on upper part of sternopleuræ, greenish yellow; metapleuræ pale yellowish grey. Scutellum, disc, brownish, shining with brownish hairs, posterior edge, greenish yellow.

Abdomen : tricolorous ; greenish yellow, black and tawny orange, in about equal proportions. Difficult to decide on a ground colour. The best plan is to consider the abdomen as black : 1st segment very narrow, brownish, with some hairs. On each of the 2nd, 3rd and 4th segments are a pair of arched greenish yellow lunules of uniform width, almost contiguous at the base of the segment, and curving thence (convex side uppermost) to the posterior corners, where they attain the border, slightly widened. These lunules are repeated on the 5th segment, on which they are almost perpendicular. The posterior border of the 2nd, 3rd and 4th segments is tawny orange, being much wider in its centre on the 2nd segment ; whilst on the 3rd and 4th segments it spreads forwards in the shape of a triangle, of which the apex distinctly attains the base of the segment, where it separates the two lunules. This pattern is repeated on the 5th segment, but in a more exaggerated form perpendicularly (as though laterally compressed) ; thus reducing the black part between the yellow lunules and the orange triangle to two narrow streaks. The whole dorsum is very sparsely covered with short yellow hairs, and there is a fringe of very short black hairs along the edge of the whole abdomen, and a bunch of yellowish hair on the anterior corners of the abdomen. Genitalia inconspicuous.

Legs : fore coxæ greenish yellow, bare ; posterior coxæ, dark brown, shining, with a little brownish hair. Femora and tibiæ mainly greenish yellow, distal half of hind femora and tibiæ, and all the tarsi, wholly, tawny orange. Legs practically bare, but the femora have some very short light yellow hairs on the under side.

Wings pale grey ; anterior border slightly tawny ; subcostal cell dark grey. Halteres pale yellow. Tegulæ whitish, with tawny edges and a little yellow hair.

Described from a unique ♂ in my own collection, sent by Mr. E. Green, taken at Kandy (Ceylon), December 1907. The specimen is perfect, except for the missing antennæ. At first I thought it was the ♂ of my *sexfasciatum*, but am now convinced it is quite distinct. The three colours in the abdomen stand out very clearly.

MICRODON, Mg.

Six species are given in V d. Wulp's catalogue ; to which are added the following :—

M. obscurus, V d. Wulp, 1898, Termés. Füzet., xxi, 421 ; Papua.

M. metallicus, Meijere, 1904, Bijd. Dierk., xviii, 98 ; Darjiling.

M. annandalei, mihi, sp. nov. (Pl. xiii, fig. 10.)

♂ Nepal (Soondrijal). Long. $9\frac{1}{2}$ mm.

Head black ; frons narrowed just above antennæ, covered with close silver-white hair, only visible from above ; vertex

black; antennæ black; 3rd joint one-and-a-half times as long as 2nd, or as long as 1st and 2nd together. Under side of head black, eyes bare, very shining and smooth.

Thorax black, with very sparse gold-grey hair towards the posterior part, seen best from behind; scutellum similar, with a slight indentation in centre of posterior border.

Abdomen and belly uniformly brick-red, with traces of minute whitish pubescence on posterior half; base of 1st segment black.

Legs black, with fine silvery white hair on coxæ and outside of tibiæ.

Wings pale blackish.

Described from one ♂, the type, in the Indian Museum collection.

I have much pleasure in naming this handsome species after the Superintendent of the Indian Museum, at whose hands I have received so much assistance and consideration in my study of Oriental Diptera.

***M. cæruleus*, mihi, sp. nov.**

♀ Assam (Margherita). Long. 5 mm.

Frons shining black with very sparse and short yellowish hair; vertex forming a slightly raised triangle reaching almost to the base of the antennæ, which are blackish brown. 3rd joint a little flattened, three or four times as long as 2nd, 1st much shorter than 3rd; mouth-border pale.

Thorax (much broken) violet-black; scutellum likewise, with two short blunt but distinct spines.

Abdomen deep violet-black, posterior borders of segments and tip of abdomen with whitish hair.

Legs bright tawny red, base of fore femora brown, middle femora and tibiæ brownish grey, base of hind femora and apical half of posterior tibiæ brown.

Wings pale grey, the recurrent portions of 4th and 5th longitudinal veins almost straight.

Described from above type, which is in the Indian Museum.

***M. flavipes*, mihi, sp. nov.**

♀ Lower Burma. Long. $7\frac{1}{2}$ mm.

Frons and vertex blackish, the former with dense gold-yellow hair, only visible from above; eyes bare, shining, bright brown, antennæ and antennal stem brown, 3rd joint twice as long as 2nd; 1st as long as 2nd and 3rd together.

Thorax brown, dorsum black, with gold hair; scutellum black, with gold hair.

Abdomen brown with gold pubescence, which is very minute on 1st three segments, seen only from in front, and forming a gold spot extending over the edges at the sides of the 3rd and 4th

segments. Two broad gold hair spots, meeting towards the apex of the abdomen, form a V.

Legs entirely bright tawny, with minute silver-yellow pubescence on outside of tibiæ and tarsi.

Wings quite clear, 4th longitudinal vein quite straight on the recurrent portion.

Described from four ♀ ♀ (including type) from Mergui in the Indian Museum collection.

M. ruficaudus, mihi, sp. nov. (Pl. xiii, fig. 11.)

♀ Calcutta. Long. 14 mm.

Entire face above and below antennæ ferruginous red, with short tawny hair; frons one-fourth width of head; ocelli very close together; antennæ tawny red, 3rd joint brownish black. Eyes bare, shining, facets very small.

Thorax blackish, with fiery red ferruginous hair; scutellum similar.

Abdomen obconical, distinctly longer than thorax; basal half black; apical half tawny red with short golden red hair. Belly bare, basal half black, apical half red.

Legs ferruginous red, practically bare; coxæ, a streak at base below middle femora, hind femora wholly except tip, and a spot on outer side of hind tibiæ at tip, black.

Wings tawny yellow. Halteres tawny.

Described from the one ♀ taken by me in Calcutta, 26-ix-04. Type in my collection.

M. apicalis, V d. Wulp.

As the specific name *apicalis* has been used in this genus I propose *wulpii* for this species.

M. auricinctus, mihi, sp. nov.

♀ Ceylon. Long. 13 mm.

This species bears considerable resemblance to my *ruficaudus*, its differences being as follows:—

The antennæ are black, except the dark red basal half of the 1st joint. The hair on the face is thick, golden yellow. Metanotum shining black. The 2nd abdominal segment is black in the centre, and ferruginous red towards the sides; nearly the whole segment, including the posterior border, being covered with short, fiery golden-reddish tomentose hair. 2nd segment black; a stripe of short bright golden hair across the base, continued downwards over the edge, and along the sides, below. A stripe also of similar hair on the posterior border, also carried over the edge to the under side. 4th segment, wholly ferruginous red, nearly bare, except for a little concolorous hair at tip.

Fore coxæ tawny, posterior coxæ blackish, all coxæ with bright short golden yellow hair. Remainder of legs wholly bright tawny red, unmarked.

Wings dark grey, distinctly blackish at tip and bright yellowish tawny from the anterior border down to the *vena spuria*, this colour extending distally to a little beyond the end of the upper basal cell.

Described from a perfect unique example sent me by Mr. E. Green, taken at Kandy in October 1907. In my collection.

The full list of Oriental species will now stand thus—

1. *stilboides*, Wlk., 1849, List Dip. Br. Mus., ii, 538; East India.
2. *indicus*, Dol., 1857, Nat. Tijd. Ned. Ind., xiv, 404 (*Ceratomyia*); Amboina.
3. *fulvicornis*, Wlk., 1859, Pr. Linn. Soc. Lond, iii, 94; Aru Islands.
4. *apicalis*, Wlk., 1859, Pr. Linn. Soc. Lond, iii, 94; Aru Islands.
5. *sumatranus*, Wulp, 1892, Dipt. Sum. Exp., 29; Sumatra.
6. *wulpii*, Wulp, 1892 (change of name from *apicalis*, V d. Wulp), Dipt. Sum. Exp., 29; Sumatra.
7. *obscurus*, Wulp, 1898, Termés. Füzet., xxi, 421; Papua.
8. *metallicus*, Meijere, 1904, Bijd. Dierk., xviii, 98; Darjiling.
9. *annandalei*, mihi, sp. nov., ♂; Nepal.
10. *cæruleus*, mihi, sp. nov., ♀; Assam.
11. *flavipes*, mihi, sp. nov., ♀; Assam.
12. *ruficaudus*, mihi, sp. nov., ♀; Calcutta.
13. *auricinctus*, mihi, sp. nov., ♀; Ceylon.

CERIA, F.

To the six species of this genus given in V d. Wulp's catalogue, are to be added five others, two being described recently, and three of mine described below.

C. metallina, V d. Wulp, 1898, Termés. Füzet., xxi, 420; Papua.

C. trinotata, Meijere, 1904, Bijd. Dierk., xviii, 97; Darjiling.

C. obscura, mihi, sp. nov. (Pl. xiii, fig. 12.)

♀ Sikkim. Long. 12½ mm.

Frons and vertex all black; a yellow thin V-mark below antennæ, which are all black, the three joints being about equal in length, and the antennal stem a little longer than the 1st joint.

Thorax dull black, humeral calli tawny; scutellum black, the posterior edge narrowly yellow.

Abdomen black; basal three-fourths of the contracted 2nd segment brown; posterior borders of 2nd and 3rd segments narrowly yellow; 4th with a distinctly wider black border; 5th black, small.

Legs all dark brown, the outer sides of the tarsi with a little grey pubescence.

Wings grey, dark brown from the costal border; the colour extending over both basal cells, and to about half way between the 3rd and 4th longitudinal veins, and reaching to the wing-tip at the termination of these two veins. The lower half of the discal cell is thus clear.

Described from one ♀ in the Indian Museum collection, from Sikkim.

C. compacta, mihi, sp. nov. (Pl. xiii, fig. 13.)

♀ Lower Himalayas (Mussoorie). Long. $11\frac{1}{2}$ mm.

Vertex broadly black, also a wide stripe below antennæ and lower part of face and a transverse line just below the vertical black spot; rest of face red, antennal protuberance reddish brown, antennæ dark brown, 3rd joint nearly black. A little white hair behind the eyes and on lower part of head.

Thorax all black except red shoulder spots and a vertical red stripe each side of the thorax a little in front of the wings; scutellum entirely red.

Abdomen black, dull, posterior edges of 2nd, 3rd and 4th segments with a thick but narrow red border.

Legs red; coxæ, a narrow ring at the base of the four anterior femora, and extending to about two-thirds on the hind femora (extreme base red), and a narrow, somewhat interrupted ring on apical half of all the tibiæ, black.

Wings clear; brown from fore border to just beyond the 3rd longitudinal vein and including the whole of the lower basal cell. Halteres yellowish red.

Described from one ♀ taken by me at Mussoorie, 22-vi-05. In my collection.

C. apicata, mihi, sp. nov.

(*Id. id.*, Bigot, *nom. nud.*)

♂ South India. Long. 18 mm.

Head: face wholly bright orange-yellow, bare; cheeks and mouth with a raspberry-red tinge. Antennæ raspberry-red, the apical half of 3rd antennal joint yellowish grey. Vertex narrowly yellow, ocellar elevation small, reddish. Proboscis and palpi black. Eyes dark bronze-brown. Back of head yellow.

Thorax reddish brown, bare. Humeral and præalar calli orange-yellow. Meso-, ptero- and sternopleuræ, brownish yellow. Scutellum and metanotum red-brown; posterior border of scutellum yellow.

Abdomen reddish brown, with very minute pubescence. Posterior border of 2nd segment narrowly yellow, a wider yellow border on the 3rd segment, widening at the sides; 4th segment

yellow, narrowly dark red-brown at base, and with a thick yellow posterior border, narrowest in the centre, and widened and extended forwards along the sides. Genitals raspberry-brown.

Legs red-brown; a yellow streak on the under side of fore pair, and the basal half of hind femora yellow.

Wings clear; basal half of costa yellowish, also base of wing; a blackish spot at the tip, limited posteriorly by the 4th longitudinal vein. Anal vein suffused with yellow, as far as the cross-vein. Halteres small, blackish.

Described from a ♂ in the Indian Museum collection taken at Ganjam (Madras Presidency). One of each pair of legs is missing: the species appears quite a distinct one.

Of the previously described species, *C. eumenoides*, Saunders, is represented in the Indian Museum collection by two ♀ ♀ (one from Calcutta), and *C. javana*, Wied., by a pair from Tenasserim.

A specimen from the Naga Hills in the collection, labelled *C. vittigera*, Big., is only *C. javana*, Wied., the former name being a *nomen nudum*.

X —DESCRIPTION OF A NEW VARIETY OF *SPONGILLA LORICATA*, WELTNER.

By R. KIRKPATRICK.

(Plate ix.)

Among the unnamed and undescribed specimens of freshwater sponges in the collection of the Natural History Museum, London, is a very fine example from Burma, belonging to *Spongilla loricata*, Weltner, but representing a new variety of that species. Weltner, who described the species in 1895 (*Archiv. Naturg.*, 61st year, bd. 1, p. 138), had only very scanty material to work with, viz., a few gemmules on shells of *Ætheria* from an unknown locality in Africa; some of the larger skeletal spicules were adhering to the gemmules, but none of the body of the sponge remained. Consequently it would be well to give a fuller description of the sponge from the abundant material now available; and, further, as Dr. Annandale, Superintendent of the Indian Museum, is bringing out a monograph of the freshwater sponges of India, it is desirable to describe the specimen without further delay, so that the information may be incorporated in that work.

I have to thank Professor Dr. Weltner for his courtesy in sending me two micro-slide preparations of the gemmules of the type-specimen.

Spongilla loricata, Weltner, var. *burmanica*, var. nov.

1895, *Spongilla loricata*, Weltner, *Archiv. für Naturgeschichte*, 61st year, band 1, p. 138.

The specimen consists of seven firm, hard, thin slabs about 7·5 mm. thick and of a pale brown colour; when joined together, the pieces cover an area of a square foot. Mr. E. W. Oates, who collected and presented the sponge, writes that the specimen was found encrusting the vertical and horizontal surfaces of the bottom beam of a lock gate, where it covered an area of six square feet. The beam had been tarred several times before the sponge was discovered.

The portion of the gate on which the sponge was growing was submerged from November to May for eight hours a day at spring tides, but was entirely dry during the six days of neap tides. From May to October it was constantly submerged. The sponge was found in April. Although the canal is subject to the tides, the water at the lock is always fresh. The colour of the sponge during life was the same as in its present condition.

Description.—The upper surface of the sponge is coarsely prickly and spinous, and with numerous small cylindrical chimney-like oscules rising vertically above the general surface to a height of about 6 mm., the diameter at the orifice being from 2 to 2.5 mm.; the outer wall of the oscules is provided with longitudinal spinous ridges.

The spines are either single and pointed, and from 1 to 2 mm. in height, or broader, and divided only near the summit; or again they may be united into small ridges with slender prickles along the edges.

The under or encrusting surface is level; here and there are gemmules isolated or in groups; and over considerable areas is a reticulate pattern, each mesh of the reticulum having a small circular rim near its centre; these markings are formed by the front walls of the zoecia of the Polyzoon *Hislopia lacustris*, the circular rims being the orifices of the zoecia; the posterior walls of the zoecia have been left behind on the wooden beam.

The dermal membrane is firmly attached, and there is not a differentiated dermal skeleton. The dermal membrane roofs over a fine surface reticulum, the meshes of which are about .2 to .4 mm. in area; groups of these fine meshes are often sunk in concavities between groups of the larger spines; the pores are not visible.

Skeleton.—A thin vertical section of the crust in balsam shows vertical pillars continued up as spines. The pillars, which vary from .2 to .4 mm. in thickness, are from 1 to 2 mm. apart; they do not arise from the base, but at a point a little above the base, or even half way up; the section shows, also, traces of horizontal lines of cleavage, marking possibly stages of growth or temporary arrest of growth.

Between the vertical pillars is a fine reticulum with meshes rounded or oval in section, and about .2 to .6 mm. in diameter, the strands being about 2 to 7 spicules thick. The *gemmules* are situated in the encrusting base of the sponge. They are either single and spheroidal and about .8 mm. in diameter, or double and oval and about 1×1.3 mm. in diameter. There are three layers—an outer shell of large smooth strongyles similar to those of the general skeletal framework, a middle layer of finely spined micro-strongyles, and a thick, inner chitinous coat; the middle layer again is divided into two—an outer one applied to the inner surface of the outer shell, and an inner one embedded in the chitinous shell.

The poral tube (fig. 5), best seen in specimens which have been desilicified with hydrofluoric acid, is nearly cylindrical and 45μ in length.

Spicules, megascleres, strongyles (fig. 6), smooth, slightly curved, occasionally a little swollen at the ends, 270×195 on an average; very commonly with one or more fusiform swellings.

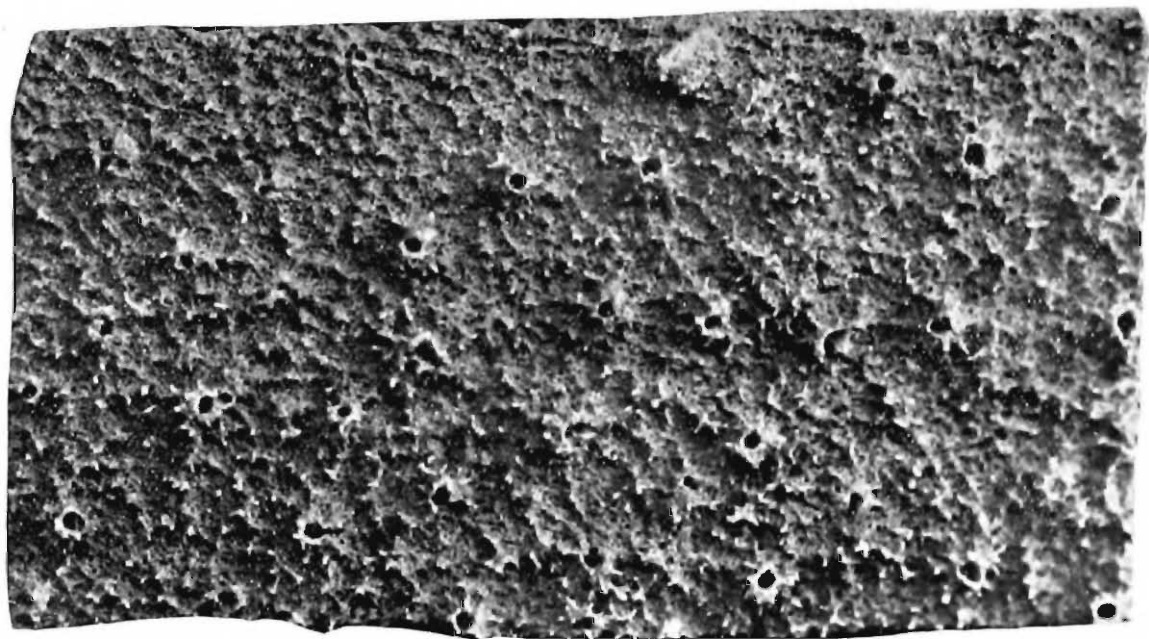
Microscleres amphidisks (fig. 7), numerous and scattered about in the flesh, $30-45 \mu$ long, with slender curved smooth shaft, and with 4-5 prongs to each disk.

Microstrongyles of the gemmules (fig. 8) in all sizes up to $49 \times 7.85 \mu$; curved, and with surface granular owing to fine spines.

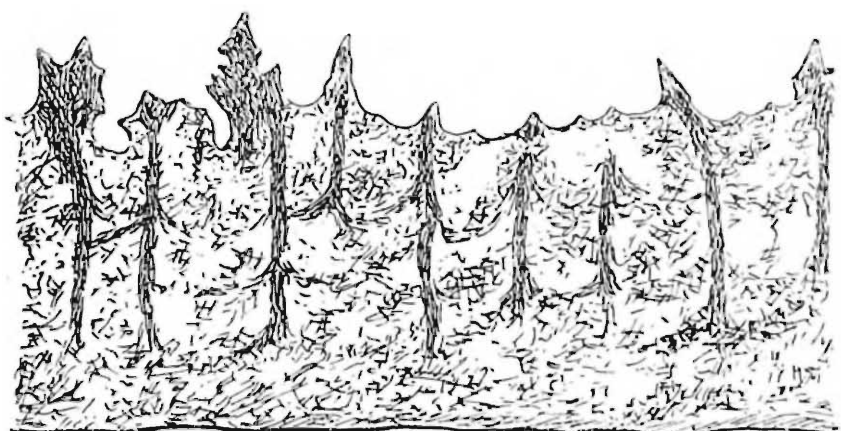
The main difference between the typical African form and the Burmese variety consists in the former having much larger microstrongyles ($83 \times 15.7 \mu$) with larger and coarser spines (fig. 10); Mr. Highley's careful camera-lucida drawings show clearly the great difference in this respect. Judging from Prof. Weltner's sections of gemmules, these bodies lack the definite outer shell of smooth macrostrongyles, though this may not improbably be due to the breaking down and removal of this layer. A further difference consists in the presence, in the African specimen, of slender, finely spined strongyles (figs. 9, 9a), these being absent in the Burmese form, though perhaps this fact is not of much importance.

EXPLANATION OF PLATE IX.

- FIG. 1.—A portion of the sponge. Photo., nat. size.
- FIG. 2.—Vertical section, $\times 4$.
- FIG. 3.—Skeletal network, $\times 45$.
- FIG. 4.—Gemmule, $\times 45$.
- FIG. 5.—Gemmule, desilicified by means of hydrofluoric acid, showing the poral tube, $\times 45$.
- FIG. 6.—Strongyle of skeletal framework, $\times 250$.
- FIG. 7.—Amphidisk, $\times 700$.
- FIG. 8.—Microstrongyle, $\times 700$.
- FIG. 9.—Strongyle with knobbed ends (amphityle), and with rough surface, from Prof. Weltner's African specimen, $\times 250$.
- FIG. 9a.—End of same, $\times 425$.
- FIG. 10.—Microstrongyle of gemmule, from Prof. Weltner's specimen, $\times 700$.

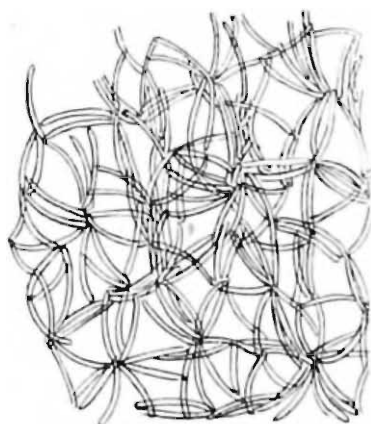


1



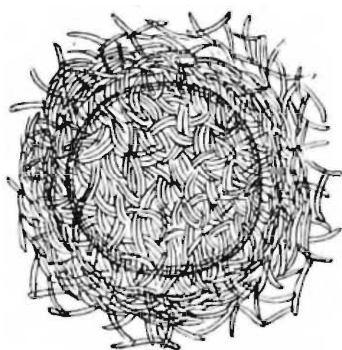
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x 4



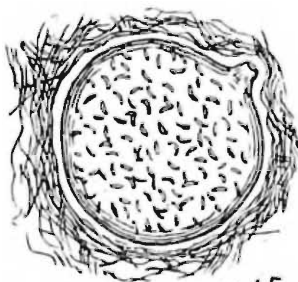
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4

x 45



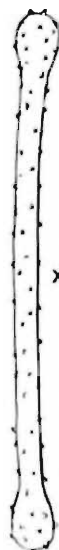
5

x 45



6

x 250



x 425

9^a



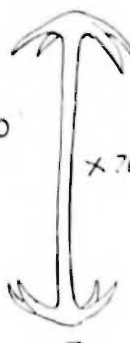
x 250

9



8

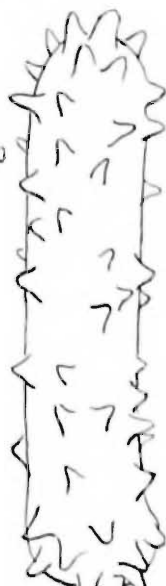
x 700



x 700

7

x 700



10

SPONGILLA LORICATA VAR BURMANICA.

XI.—NOTES ON ORIENTAL DIPTERA.

V.—DESCRIPTION OF A NEW SPECIES OF PSYCHODID OF THE GENUS *PHLEBOTOMUS*.

By N. ANNANDALE, D.Sc., Superintendent, Indian Museum.

Several records (*opp. post. cit.*) of the existence in India of blood-sucking flies of the family Psychodidæ have been published, but no species from the Oriental region appears as yet to have been described specifically. I have therefore thought it worth while to publish a description of the form most common in Calcutta, and have drawn up, in consultation with Mr. Brunetti, a diagnosis sufficiently detailed to ensure recognition of the species, adding certain notes on the scales and bristles.

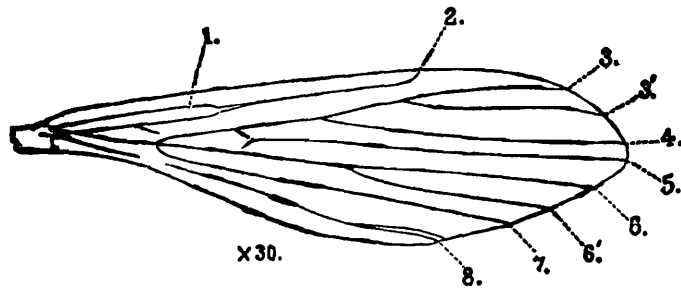
Phlebotomus argentipes, Annandale and Brunetti, sp. nov.

♂ ♀ Calcutta. Long. 1.5 mm.

Head (including mouth-parts), dorsum of thorax, abdomen blackish¹ or brown, the abdomen paler than the head and dorsum of the thorax; antennæ dark grey owing to the presence of long, flattened hairs and bearing spatulate scales on the two basal joints and on the proximal half of the first joint of the flagellum. First (basal) joint of the antenna conical, truncate distally; second joint sub-spherical, bearing a circle of about twelve slender, spatulate, curved scales and, nearer the base, a circle of alternating flattened bristles; first joint of the flagellum about four times as long as the preceding joint (*i.e.*, distal joint of the scape) and twice as long as the first of the remaining thirteen joints of the flagellum, the length of which gradually diminishes towards the tip of the antenna. Head small, eyes large, black, separated narrowly on the dorsal surface; rostrum stout, sausage-shaped; proboscis equally developed in the two sexes; the rostrum bearing several groups of upright curved bristles. Thorax tumid above, with a middorsal sulcation anteriorly, the dorsum bearing bunches of long, blackish, more or less erect, curved, flattened bristles, which are similar to those on the rostrum, but stouter, and arise from sockets provided with raised rims; these bristles exhibiting silvery reflections in certain lights. Pleuræ and sternum cream-coloured, devoid of bristles except at the base of the legs. Abdomen slender in both sexes, covered with long scattered, blackish bristles like those on the thorax but finer.

¹ The exact tint of the darker part varies considerably. It is possible that individuals occur in which the head, thorax and abdomen are uniformly pale.

Legs very long, the hindermost being about three times as long as the thorax and abdomen together ; femora much shorter than tibiae ; metatarsi in all cases at least as long as the remaining joints of the tarsi together ; legs grey with very strong reflections, which make the tibiae and tarsi appear silvery white in certain lights ; femora bearing fine hairs and bristles similar to those on the abdomen but finer, also flattened spatulate scales ; tibiae and tarsi covered with angularly bent scales and bearing, especially at the joints, stiff straight, slender hairs.



Wing of *Ph. argentipes* denuded of hairs and scales.

Wings¹ narrow, obtusely pointed at the tip, iridescent, silvery grey with a hoary fringe on the posterior border, immaculate. The fourth vein joins the third some distance in front of the apex of the upper anal cell and almost on a level with the bifurcation of the sixth vein. Ninth vein obsolete, indistinguishable from the anal furrow. Upper anal cell long and narrow ; lower anal cell incomplete, its apex a considerable distance behind that of the upper cell. Cell formed by junction of first and second veins very long and narrow. Scales at base of wing only ; halteres covered with scales.

Genital apparatus of the male conspicuous ; the superior appendages long and stout, their distal joint bearing five long, stout, broadly arched, sickle-shaped chætæ, viz., a single chæta about a third of the distance between the two ends of the joints from its base, a pair of slightly unequal chætæ near the middle of the joint, and a terminal equal pair ; the ventral surface of the basal joint deeply grooved and provided with a row of stiff hairs ; inferior appendages long and rather slender, bearing a large bunch of stout bristles at the tip.

Ph. argentipes occurs not uncommonly in Calcutta, especially during the winter months. It is nocturnal in its habits and is often found in the basements of houses. Possibly it is identical with the species figured recently by Maxwell-Lefroy,² but its legs appear to be longer. The palpi of the species figured by Giles³

¹ The numbering of the veins follows the diagram published by Eaton in 1893 (*Ent. Mon. Mag.* (2), iv, p. 7). It has seemed best to use numbers for the veins rather than names. Schiner numbers the veins differently, but the venation of our species agrees with his description precisely.

² *Prel. Account of the Biting Flies of India*, pl. ii, fig. 4 (1907).

³ *Gnats or Mosquitoes* (second ed.), p. 5, fig. 2 (1902).

as a *Phlebotomus* do not agree with Schiner's¹ and with Eaton's definition of the genus, while the "moth fly" described by Captain Franklin³ appears, so far as it is possible to say, to belong to a very different genus probably allied to *Pericoma*.

NOTE ON THE SCALES, BRISTLES, ETC.

The scales are all very minute ; two kinds can be distinguished. Those on the antennæ, palpi, halteres, extreme base of the wings and the femora have a colourless, more or less cylindrical, short base, and a flattened, more or less expanded blade of much greater length in which a grey pigment appears to be suffused. They are solid but bear on the surface a number of very minute longitudinal striations. They vary considerably in breadth and in longitudinal curvature, but are always thin and spatulate and are never bent at anything approaching an angle. The scales on the tibiæ and tarsi, on the other hand, are colourless and are bent near their middle in such a way that the two halves form or nearly form an angle with one another. Moreover, these scales contain numerous very fine longitudinal tubules full of air, which produce the silvery appearance of the parts they clothe. Both kinds of scale are usually more or less imbricate, but those on the palpi are scattered, while those on the second joint of the antennæ alternate with bristles situated nearer the base of the segment. Those on the femora, halteres and third joint of the antenna lie nearly flat, while those on the palpi and antennæ slope outwards or upwards, and are curved inwards in different degrees. The peculiar scales on the tibiæ and tarsi are arranged more or less distinctly in annular series separated by circles of stiff hairs, this arrangement being most distinct on the distal joints of the tarsi.

The "flattened bristles" to which constant reference has been made, resemble scales in several particulars when examined minutely but appear on examination with a lens or a low power of the microscope so like ordinary bristles that we have described them as such; it is difficult to draw any exact line between them and ordinary hairs. They have, however, like the scales, a short, more or less cylindrical colourless basal portion, but the distal portion is very long and only slightly flattened, always remaining relatively narrow but varying considerably in this respect. Like the blade of the scales of one type this flattened portion of the bristle apparently contains a dark pigment, but it is frequently, if not always, hollow and filled with air. Such bristles vary greatly in length and in degree of curvature. They are longest and stoutest on the thorax, to which they give an untidy, "unbrushed" appearance owing to the fact that they stand up and slope in different directions, always being more or less bent. Their sockets are

¹ *Fauna Austriaca*, ii, p. 630 (1864).

² *Ent. Mon. Mag.*, xl, p. 55 (1904).

³ *Ind. Med. Gazette*, xli, p. 350, fig. 4 (1906).

very conspicuous on the dorsum of the thorax and have pear-shaped outlines, the stalk of the pear pointing in the direction towards which the bristle that arises from it slopes. The bristles on the genital apparatus of the male appear to have similar characters, but are straight or nearly so, and arise from circular sockets. The hairs on the wings, and many of those on the body and legs, are not provided with sockets with raised rims, but there are fine bristles on nearly all parts of the body with sockets whose rims are a little raised. The chætæ of the superior appendages of the male are flattened and have a yellowish colour. They have not depressed sockets, but arise from bases more or less clearly raised and differentiated from the general surface of the appendage to which they belong. The claws on the feet are very small and inconspicuous.

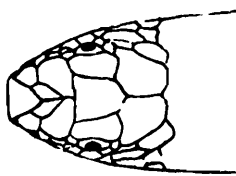
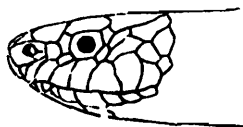


MISCELLANEA

REPTILES.

REMARKS ON *Simotes splendidus*.—I am indebted to Dr. N. Annandale for the privilege of examining a rare snake, *Simotes splendidus*, from Kyaukse, Upper Burma.

For many years this species was only known from a single specimen in the British Museum described by Günther in 1875.¹ This specimen was captured in the Wynaad. In 1900, Major (then Captain) Evans and I acquired the head and neck of a snake from Sagaing, Upper Burma, which we referred to this species with some hesitation, firstly, from the fact that there were four præfrontals in a transverse series as well as four internasals, secondly, the great distance separating the locality that produced the type-specimen, and that in which our example was obtained; and thirdly, owing to the imperfect character of this specimen. We published some remarks on this example.² Later Major Evans procured two perfect specimens of what appeared obviously the same species as that just referred to. These were both obtained in Upper Burma (the Ruby Mines and Yamethin District). These examples were remarked upon by Major Evans in the *Bombay Natural History Journal*,³ and he expressed the opinion that the specimen agreed with Mr. Boulenger's description of the type-specimen.⁴



Head of *Simotes splendidus*, nat. size.

As Major Evans does not describe his specimens, and Upper Burma is so far removed from the Wynaad, I think a further description and figure of Dr. Annandale's lately acquired specimen may serve to clear up any doubt in identity.

¹ *Proc. Zool. Soc.*, 1875, p. 231, and plate xxiii.

² *Bom. Nat. Hist. Journ.*, vol. xlii, p. 537.

³ Vol. xvi, p. 362.

⁴ *Fauna Brit. Ind., Reptilia*, 1890, p. 310.

Length about 2 feet (stiffened by spirit), the tail $3\frac{1}{8}$ inches. Costals two headlengths behind head 21, midbody 21, two headlengths before vent 17. In the step from 21 to 19 the second and third rows above the ventrals coalesce on the left side, and the third disappears on the right side; in the step from 19 to 17, the fourth and fifth rows above the ventrals coalesce. The last row is not or barely enlarged. No keels and no apical pits. Ventrals: 169, angulate. Anal entire. Subcaudals: 41, divided. Rostral: in contact with eight shields, the sutures made with the anterior nasals rather largest; portion visible above equals its distance to the frontal. Internasals: four, subequal, in a transverse series, the median projected backwards so as to separate about two-thirds of the length of the præfrontals. Præfrontals: a pair; the suture between them about half the præfronto-frontal suture; in contact with median and lateral internasals, postnasal, loreal, præocular, supraocular and frontal. Frontal: touches six shields, the sutures made with the supraoculars largest, about one-third greater than those with the parietals, which are the smallest. Supraoculars: length subequal to frontal, breadth two-thirds frontal. Nasals: divided in contact with 1st and 2nd labial by equal sutures, the posterior subdivided into two superposed parts; the anterior is much the largest; the nostril occupies the upper two-thirds of the suture, the suture runs to the 2nd labial. Loreal: one, height rather exceeds length. Præoculars: two, the lower small and cuneate, wedged between the 3rd and 4th labials. Postoculars: two. Temporals: two, the lower in contact with the 6th and 7th labials. Labials: eight, the 4th and 5th touching the eye, the 6th and 7th largest, and subequal. Infralabials: five, the 5th largest, broader than the posterior sublingual and in contact with the scales posteriorly; the suture between the first about half that between the anterior sublingual fellows. Anterior sublinguals: longer than posterior. Posterior sublinguals: touching the 4th and 5th infralabials. Colour: light stone colour with sixteen large, dark dorsal marks, indented before and behind vertebally, and midcostally. In the latter region the indentations sometimes meet, and detach fragments. These marks are well defined with darker margins. A pale vertebral streak, and a pale vertebral supracaudal streak. Head obscurely mottled above. Belly whitish with somewhat obscure, lateral, dark roundish spots with a tendency to be distributed on alternate ventrals. Tail beneath whitish, unpotted.

It is very unusual for the suture from the nostril to run to the 2nd labial in land snakes. It does so in the genus *Callophis*, but I cannot recall another instance. In the sea snakes (Hydrophiidæ) it is the rule, and has very few exceptions.

The head was badly damaged, so that the head outlines may be somewhat faulty, but the relationship of shields is accurate.

F. WALL, Major, I.M.S.

INSECTS.

CORRECTIONS TO NO. IV (*Limnophora* AND *Anthomyia*) OF "NOTES ON ORIENTAL DIPTERA" (*Rec. Ind. Mus.*, i, p. 381).—My *Limnophora himalayensis*, described on p. 381 of the first volume of these Records, is a *Spilogaster*, the arista being distinctly, though rather shortly, plumose. The figures 3 and 3a in pl. xv (*loc. cit.*) become incorrect, in consequence of the omission of this character.

A second error of mine occurs in the description of *Anthomyia bisetosa*, Thoms., in which the arista is stated to be bare, whereas it is shortly pilose, as described by the author. Figures 4, 4a, 5 and 5a become correspondingly incorrect.

The new Palæarctic Catalogue confirms the synonymy of *Anthomyia lobalis*, Thoms., with *Limnophora tonitruui*, Wied. (*Anthomyia id.*). *Anthomyia illocata*, Wlk., is retained in that genus in the new Catalogue.

E. BRUNETTI.

CRUSTACEA.

A NOTE ON THE ISOPOD GENUS *Tachæa*.—When lately describing *Tachæa spongillicola*, sp. nov., an Isopod found by Dr. Annandale in the canals of a freshwater sponge at Calcutta (*Journ. Linn. Soc. London*, vol. xxx, p. 39, 1907), I unfortunately omitted from the list of known species of the same genus all mention of *Tachæa lacustris*, Max Weber, published in 1892 (*Zool. Ergebn. einer Reise in Nederl. Ost. Ind.*, vol. ii, p. 551). Professor Max Weber has now very kindly given me the opportunity of comparing his species with my own, and agrees with me in thinking them distinct, though closely related. His species has the seventh joint of the maxillipeds distinct, and the sixth joint of the first gnathopods long and narrow. It was taken in Sumatra, from the Lake of Singkarah, at a height of 362 metres above the sea, where it lodged, together with *Rocinela typus*, Milne Edwards, on the skin of various Cyprinoids.

T. R. R. STEBBING.

THE HABITS OF THE AMPHIPOD *Quadrivisio bengalensis*, STEBBING.—This interesting species is very abundant in the brackish ponds at Port Canning. An active swimmer, it shelters itself during the cold weather among grass-roots overgrown with sponges and amidst the filaments of green algæ, while in summer it buries itself in the mud at the bottom of the ponds, from which, however, it is very easily aroused.

As regards oviposition, which takes place in winter, it is gregarious, a favourite nursery for the eggs being the cavities in living sponges (*Spongilla alba*, Carter), in which several individuals may often be found keeping joint guard over a mass of small white eggs. No nest is built.

N. ANNANDALE.

MOLLUSCA.

NEW VARIETIES OF *Nanina berlangeri* AND *Corbicula fluminalis*, MÜLLER, FROM INDIA.—

1. *Nanina berlangeri* var. *globosa*, Schl.

Diagnosis.—This form differs from the type by its small size, and more globular shape.

Dimensions.—Specimens all about 20 mm. in height and width.

Locality.—Neighbourhood of Vellore (North Arcot) in the Madras Presidency [coll. mihi].

2. *Corbicula fluminalis*, Müll., var. *holstiana*, Schl.

Diagnosis.—This form is decidedly more arched than *Corbicula fluminalis*, of which it is certainly a variety.

The examples have a striking resemblance to *Corbicula syriaca*, Müller, which I possess from Homs (Syria), but the specimens are very large, etc.

Locality.—It was found in company with *Limnæa stagnalis*, Linné, at Hoti-Mardan, near Peshawar, in the North-West Frontier Province of India, by Miss Holst, M.D., in whose honour I name the form.

HANS SCHLESCH,

January 10th, 1908.

Copenhagen.

ENTOZOA.

RECENT ADDITIONS TO THE COLLECTION OF ENTOZOA IN THE INDIAN MUSEUM.—Specimens of the following species have recently been added to the collection, and have been identified by Dr. von Linstow of Göttingen :—

CESTODES.

Cittotænia bursaria, v. Linstow (*Spolia Zeylanica*, vol. iii, p. 184 ; pl. ii, figs. 39, 40), from the intestine of *Lepus ruficaudatus* ; Songara, United Provinces (R. Hodgart, Ind. Mus. Colltr.).

Tænia polycalcaria, v. Linstow (Centralblatt f. Bakteriologie, Infectionskrank, xxxii, p. 532 ; figs. 1-2), from the intestine of *Felis pardus* ; Dhakna Bagh, Nepal Terai (R. Hodgart, Ind. Mus. Colltr.).

Solenophorus megaloccephalus from the intestine of *Felis tigris* ; Oncha Gaon, United Provinces (R. Hodgart, Ind. Mus. Colltr.).

“ Certainly a pseudoparasite from Python ; the tiger must have eaten a python shortly before.”

Pterocercus spp. (larvæ), from the mesentery of *Dendrophis pictus*, from the intestine of *Bungarus fasciatus*, from the peritoneum of *Tropidonotus piscator*, and from under the skin of *Coluber radiatus* (all collected by Major F. Wall in Assam).

“The Pterocerci are larvæ, probably of a species of *Bothriocephalus*; the sexual forms of these species in snakes are perhaps to be found in large birds of prey.”

NEMATODES.

Ascaris attenuata, Molin, from the intestine of *Python molurus*; Kichha, Naini Tal district, United Provinces (R. Hodgart, Ind. Mus. Colltr.).

Ascaris ? *mystax*, Rud., from the intestine of *Felis pardus*, two imperfect males; Dhakna Bagh, Nepal Terai (R. Hodgart, Ind. Mus. Colltr.).

Ascaris spp. (larvæ and immature forms), from the stomach of *Bungarus fasciatus* (Major F. Wall, I.M.S.), from the stomach and mesentery of *Tropidonotus piscator* (Major F. Wall, I.M.S.), from the mesentery of *Otolithus maculatus* (I. H. Burkill), and from the body cavity of *Dysalotus alcockii* from 705 fathoms (Indian Marine Survey).

Kalicephalus willeyi, v. Linstow (*Spolia Zeylanica*, vol. i, p. 99; pl. i, figs. 14-18), from the stomach of *Bungarus fasciatus*; Dibrugarh, Assam (Major F. Wall, I.M.S.)

LINGUATULIDÆ.

Porocephalus brotali, Thunb., from the outer wall of the stomach of *Bungarus fasciatus*; Dibrugarh, Assam (Major F. Wall, I.M.S.).

POLYZOA.

A SUB-FOSSIL POLYZOON FROM CALCUTTA.—In the *Records of the Geological Survey of India*, vol. xxi, p. 175, Mr. E. Vredenburg describes briefly an oyster bed discovered under one of the streets of Calcutta. Several molluscs were found in this bed, all of them belonging either to freshwater species or to species still found in brackish water in the estuaries of the Ganges. Some of the oyster shells were incrustated by a Polyzoon, which was diagnosed in the Museum as a species of *Lepralia*. A fragment was submitted through Mr. R. Kirkpatrick to Mr. A. W. Waters, who reports upon it as follows:—

“Zoarium is in places in two layers, and from the fragment it looks as though there may have been two or more layers.

Zoöcia irregularly quadrate with large pores over the surface ; the zoöcia are divided by raised ridges ; the aperture is surrounded by a thick border with an elevation at each side and one below the aperture. Triangular avicularium to the side of the aperture, but only to a few zoöcia. Ovicell raised, globular, with a small sunk area perforated by a few large pores.

This is in many respects like *Lepralia* (*Escharoides*) *occlusa*, Busk, but the zoöcia are much smaller and the avicularia have a different shape. The oral aperture is similar in shape, but smaller. The ovicell is quite the same.

Possibly it is a marked variety of *Lepralia occlusa*, or an ancestor."

CORRECTIONS AS TO THE IDENTITY OF INDIAN PHYLACTOLÆMATA.

—In a recent note on a *Lophopus* from the Kumaon Himalayas (*Rec. Ind. Mus.*, i, p. 145), I named it *L. lendenfeldi* var. *himalayanus*. Having now had an opportunity, thanks to the kindness of Mr. R. Kirkpatrick, of examining a co-type of Ridley's Australian species, and having found numerous examples of Hyatt's "*Pectinatella*" *carteri* in a lake in the Western Ghats of Bombay, I am convinced that the Kumaon form is not specifically identical with *L. lendenfeldi* but allied to Hyatt's species, which I still see no reason to separate from the genus *Lophopus*. Whether "*himalayanus*" is a temporary phase or a local race of the latter species it is impossible to say at present, but the statoblasts of my specimens of the Kumaon form *without* hooks are certainly mature. Another identification in my former paper on the freshwater polyzoa of India (*Journ. Asiat. Soc. Bengal*, vol. iii, No. 2, 1907, p. 88) proves to be incorrect, viz., that of *Plumatella repens* of Linné. What exactly was the form originally so named is a little uncertain, but it is impossible to regard as absolutely trustworthy any identification in the genus *Plumatella* that is not vouched for in Allman's monograph (1856), unless the species has been described since that date. In any case, the common species in Calcutta is not, as I formerly thought, what Allman calls *P. repens*, Linn., but *P. fruticosa*, Allman, which Kraepelin regards as a variety of his own *P. princeps*, but which seems to me to be a constant and distinct form worthy of specific rank. I have not found the true *P. repens* according to Allman as yet in India. The examination of a considerable number of European specimens, which I owe to the kindness of Dr. F. Harmer and Messrs. R. Kirkpatrick, W. Evans and C. F. Rousselet, and of a great deal of Indian material collected by myself at different seasons and in different conditions, convinces me that a safe distinction between the two forms may be based not only on the proportions of the statoblast but also on the shape of the stomach, a feature well shown in Allman's beautiful plates. *P. fruticosa* occasionally enters into an "*Alcyonella*" phase in Calcutta, and changes into Allman's *P. coralloides* when surrounded by a freshwater sponge.

N. ANNANDALE.

PROTOZOA.

NOTES ON A PECULIAR FORM OF *Euglena*.—This animalcule occurs in large numbers in the tank at the Shálámár Gardens, Lahore. It forms a continuous layer on the surface of the water, giving it a deep red to greenish colour. In places exposed to direct sunlight the colour is usually deep red, while in shady places it is greenish.

The animal is characterised by the presence of numerous deep red granules in the whole of the body. The granules are quite distinct from the endoplasm, and, if the body of the animal is ruptured by a slight pressure on the coverslip, they are scattered about in all directions. They are in all respects like the eye-like pigment-spot, but smaller in size. It is difficult to see the inner structure of the animal clearly on account of the presence of these granules.

Examined with the $\frac{1}{12}$ -in. oil immersion lens, the ectoplasm is seen to be striated at the margins obliquely, but the ordinary magnification does not show these striations. The green colour of the endoplasm can usually be seen without any difficulty in the living animal, but it can be seen much more easily if the body be ruptured by pressure, when the endoplasm comes out in the form of small, round, uniformly green globules, and the red granules and the paramylum bodies are scattered about.

In the free-swimming condition the animal is highly plastic, assuming various shapes very rapidly. In its elongated state it is generally cylindrical (sometimes oval owing to the posterior part being larger than the anterior) ending posteriorly rather abruptly in a small tail-like process which is generally hyaline, but may be coloured like the rest of the body. The anterior extremity is bilabiate, one tip being larger than the other. The flagellum arises out of the mouth and is equal in length to the length of the body. The body in the elongated state is $\frac{1}{100}$ to $\frac{1}{200}$ of an inch long, the breadth being one-fourth of the length. The large bright red eye-like pigment-spot is situated anteriorly a little behind the mouth. The vacuole is close to the pigment-spot, a little behind and to one side. The paramylum bodies are numerous and of various sizes. The largest have the size and shape of human red corpuscles. They are biconcave or flat round or slightly oblong bodies. The endoplast is very indistinct on account of the red granules.

When the flagellum is present the animal moves forward very rapidly, but when it is lost, as is frequently the case, the forward movements are very slow. The euglenoid movements in both cases are very active.

In the encysted condition this animal resembles *Euglena tuba*, Carter, very greatly, the encysted form being like a flask. It differs from that species, however, in that it does not form any mucilaginous network, in the tubular meshes of which that animal is met with. The Lahore *Euglena* forms a flat homogeneous layer

on the surface of the water. The neck of the flask-like cyst, moreover, is never so long as in *Euglena tuba*.

In the description of *Euglena tuba* given in Saville Kent's *Manual of Infusoria* (part iii, page 385), it is stated that the motile and the encysted forms were not observed together, and that on account of the peculiar shape of the encysted form it was doubtful if the two forms belonged to one and the same animal. I do not know if the two forms have been seen together since then, but in the present species the motile animals were seen many times by the writer coming out of the temporary encystment. In fact, empty round or flask-shaped bodies can always be seen lying here and there near the free-swimming animals, and the escape of the animals can be easily observed by keeping the water containing them for a few hours in a closed vessel. The animals may come out of the encystment while it is round, or may come out when it has assumed the flask-shaped form. In the latter case, the animal never comes out through the mouth of the flask, nor has it ever been seen by the writer coming out of the side opposite the mouth; it appears always to get out laterally. The wall is ruptured on one side and the anterior end of the animal with a small flagellum projects forward. Gradually the whole animal passes through the opening. For a short time after coming out of the encystment the movements of the animal are very slow. At one time during the escape of the animal, it appears to be divided into two equal halves by a constriction in the middle caused by the narrow opening. In three or four minutes the whole animal is out. The mouth of the flask is always striated, but the neck and the body are quite homogeneous and transparent.

When the encysted animal is exposed to bright daylight, the red granules come to the surface, and thus the individual animal and the whole surface of the water have a deep red colour. In shady places the red pigment is collected at one end of the body and the remaining part is perfectly green, and the colour of the water, therefore, is greenish.

The animal greatly resembles *Euglena tuba*, Carter. The chief points in which it differs from the latter are—

1. The presence of the red granules.
2. The absence of network in the encysted condition.
3. The smaller length of the flagellum.
4. The smaller length of the neck.

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