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ON A COLLECTION OF MAMMALS FROM ASSAM (INDIA) WITH SPECIAL REFERENCE TO THE RODENTS.

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INTRODUCTION.

The taxonomy of mammals from Assam, especially of the larger mammals, is sufficiently known from the published accounts of various workers. However the systematics of medium sized and smaller mammals, particularly such inconspicuous ones as the Insectivora (moles, shrews, etc.), and the Muridae (rats, mice, etc.) from Assam is not sufficiently known. Thomas (1886) was the first to publish the systematic account of medium sized and the smaller mammals from Assam. Later, Thomas and Wroughton (1921) gave further report on the smaller mammals from the region. The other noteworthy account is the report on the collections of mammals made by the Bombay Natural History Society—Mammal Survey of India, Burma and Ceylon (*vide*, Hinton & Lindsay, 1926). Ellerman (1947 *a-d*) recorded a number of rodents especially rats from Assam. Recently, Roonwal (1948, 1949, 1950 *a-b*) has published an elaborate and detailed account with regard to systematics, ecology and bionomics of mammals especially the smaller mammals, which he studied in connection with tsutsugamushi disease (scrub typhus) in the Assam-Burma War Theatre during 1945. As regards large mammals Allen (1905, pp. 9-10), Higgins (1933, *a-c* ; 1934, *a-b*), and as well as Hinton and Lindsay (1926) may be referred to.

The present report deals with three collections :—

(1) One made by a party of the Zoological Survey of India in February-March 1936, during the " Naga Hills and Manipur Survey " from the Central and Western (along Imphal-Silchar Road) Manipur and immediately adjoining portions of the Naga Hills. The collection, which consists of 20 skins, in unaccompanied by any field notes.

(2) A second very small collection consisting of only five skins was made by Drs. S. L. Hora & M. L. Roonwal during November—December, 1939, from Balipara frontier Tract, in Darrang District. This collection consists field data.

(3) The third collection, made recently by a party of Zoological Survey of India during May-June, 1949, from the Khasi and Jaintia Hills and the Garo Hills. It consists of 50 skins and field notes.

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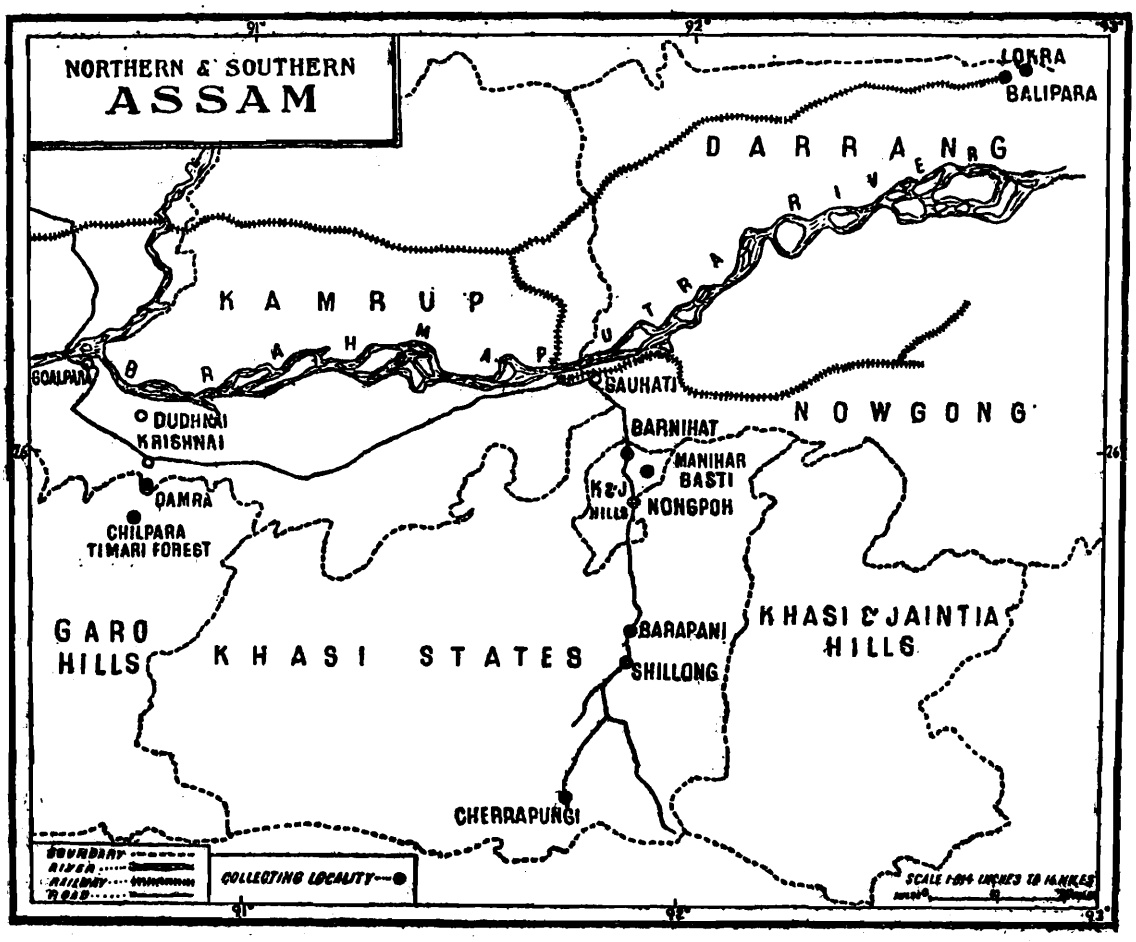
The physiography, etc., of the areas visited in central and western Manipur and immediately adjoining portion of the Naga Hills has already



been described by Roonwal (*vide* Roonwal, 1950), while the physiography, etc., of the areas visited in the Darrang district, Assam has been given by Biswas (1949, p. 225).

As regards the physiography, etc., of the areas visited in the Khasi and Jaintia Hills, and the Garo Hills, *Imperial Gazetter of India* may be consulted.

Below is given the names of different places surveyed in the Khasi and Jaintia Hills, and the Garo Hills.

Khasi & Jaintia Hills—

Nongpoh.—About 32 miles north of Shillong, alt. *ca.* 2,500-4000 ft. Collections were made in the valley and in the Jungle.

Manihar Basti.—8 miles north of Nongpoh, alt. *ca.* 2,500 ft. Collections were made from the Jungle.

Barapani.—6 miles north of Shillong, alt. *ca.* 3,250 ft. Collections were made in the surrounding Jungle.

Shillong.—alt. *ca.* 6,450 ft. Collected in the Jungle and field.

Garo Hills—

Damra.—5 miles from Dudhnai, alt. *ca.* 1,100 ft. Collected in the Jungle.

Chirpara Timari Reserve forest.—6 miles east of Damra, alt. *ca.* 1,150 ft. Collected in the surrounding Jungle and in a village adjacent to it.

The accompanying map (Text-fig. 1) shows the positions of the different localities surveyed.

The above three collections together, comprise 25 species and subspecies (Insectivora 1, Chiroptera 5, Carnivora 1, Primates 1, Rodentia 17). In the following list critical systematic remarks have been given wherever necessary and the following are the principal facts brought to light :—

A new species of mouse *Mus guhai*, from Nongpoh, Khasi Hills, Assam has been described, the full accounts and particulars of which has already been published separately in the *Journ. Zool. Soc. India* IV, No. 1, pp. 85-88, and may be referred to.

Myotis muricola (Hodgson).—The fresh record is now provided from north-east Assam, thus extending its distribution.

Petaurista petaurista albiventer (Gray).—The first record is provided from the Khasi Hills.

Rattus niviventer mentosus Thomas.—This is recorded for the first time from the Khasi Hills. Its distribution was known uptil now from eastern Assam, but it is now extended westward to the Khasi Hills.

The following abbreviations have been used :—

Measurements.—All the measurements are in millimetre. H. & B. (Head and Body) ; Tl. (Tail) ; H. F. (Hind-foot) ; E. (Ear.)

Ad., adult ; av., average ; Juv., Juvenile ; alt., altitude.

All the specimens enlisted here are adults, unless otherwise stated.

Acknowledgments.

I am indebted to the authorities of the* Zoological Survey of India for the facilities provided to me in carrying out this work. I also wish to place on record my deep sense of gratitude to my Director Dr. B. S. Guha for his keen interest and encouragement given to me during the course of the preparation of this paper.

II. SYSTEMATIC ACCOUNT.

Order—INSECTIVORA.

Family—TALPIDAE.

Talpa micrura Hodgson.

(The short—tailed Mole).

1840. *Talpa micrura* Hodgson, *Journ. Asiat. Soc. Bengal* X, p. 910 (Darjeeling, North Bengal).

Specimen examined.—1♂ Manihar Basti, Khasi Hills, June 3, 1949 (Purchased).

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Measurements.—1♂ : H. & B. 118 ; Tl. 8. 1 ; H. F. 19.

Order—CHIROPTERA.

Family—Rhinolophidae.

Rhinolophus perniger Hodgson.

(The Himalayan Horseshoe-Bat).

1843. *Rhinolophus perniger* Hodgson, *Journ. Asiat. Soc. Bengal* XII, p. 414 (Nepal)

Specimen examined.—1♂ Khezhabama, Naga Hills, February 20, 1935.

Measurements.—1♂ : H. & B. 105 ; Fore-arm 71.7 ; E. 39.3 ; Skull : 1♂ : Occipito-premaxillar length 30.5 ; condylobasal length 27.1 ; Zygomatic width 16 ; mastoid width 13·8 ; inter-orbital width 2·9 ; maxillary width 8·5 ; width outside m_3 11·3 ; width of nasal swelling 8·7 ; upper tooth now 12·1 ; lower tooth now 13·2 ; mandibular length 22·1.

Remarks.—This specimen is somewhat intermediate between *Rhinolophus perniger* and *R. luctus* as regards skull characters, but resembles the former more closely. In other respects, however it closely agrees with *R. perniger*.

Family—Vespertilionidae.

Myotis muricola (Hodgson).

(The Mustachioed Bat).

1841. *Vespertilio muricola* Hodgson, *Journ. Asiat. Soc. Bengal* X, p. 908 (Nepal).

Specimen examined.—1♂ : from Lokra, Balipara Frontier Tract, November 7, 1939.

Measurements.—1♂ : H. & B. 43·5 ; Fore-arm 34·9 ; E. 5·1 ; Skull : 1♂ : Occipito-premaxillar length 13·6 ; Condylobasal length 12·5 ; Zygomatic width 8·6 ; cranial width 6·8 ; inter-orbital width 3·8 ; palatal length 6·6 ; maxillary width 3·3 ; width outside m_3 5·5 ; upper tooth row 5·2 ; lower tooth row 5·4 ; mandibular length 9·6 ;

Remarks.—This specimen was collected on pebbles along banks of Bhareli river. It has not been recorded uptil now from this area and I consider it to be the first actual record from the above mentioned area.

Pipistrellus coromandra (Gray).

(The Coromandel Pipistrel).

1838. *Scotophilus coromandra* Gray, *Mag. Zool. Bot.* 11, pp. 498 (Coromandel Coast).

Specimens examined.—1♂ & 1♀ Chekrima, Naga Hills, February 17, 1935.

Measurements.—1♂ : H. & B. 40·9 ; Tl. 29·5 ; Fore-arm 31·5 ; H. F. 6·3 ; and 1♀ : H. & B. 41·2 ; Fore-arm 30·2 ; H. F. 6·4.

Scotomanes ornatus unbrensis Thomas.

(The Assam Harlequin Scotophil).

1922. *Scotomanes ornatus unbrensis* Thomas, *Journ. Bombay Nat. Hist. Soc.* XXVII, p. 772 (Konshnong, Jaintia Hills, alt. 3,000 ft., Assam).

Specimen examined.—1 unsexed, milestone 117, about 16 miles north of Imphal on Dimapur Road, Manipur, alt. *ca.* 3,500 ft., July 22, 1945.

Measurements.—1 unsexed : H. & B. 60·5 ; Fore-arm 52·8 ; E. 14·9.

Remarks.—This bat was found in open ground at the site of collection. It is the first record from eastern Assam (Manipur), thus extending the range of distribution of this bat.

Order—CARNIVORA.

Family—VIVERRIDAE.

Viverra zibetha picta Wroughton.

(The large Indian Civet).

1915. *Viverra zibetha picta* Wroughton, *Journ. Bombay Nat. Hist. Soc.* XXIV (1), p. 64 (H'Kamti, 500 ft., Upper Chindwin).

Specimen examined.—1♂ from Mohin Basti, Khasi Hills, May 28, 1949.

Measurements.—1♂ : H. & B. 800 ; Tl. 442 ; H. F. 127 ; E. 50. Skull : 1♂ : Total length 141·1 ; condylobasal length 136·6 ; zygomatic width 72·8 ; post-orbital width 22·7 ; inter-orbital width 24·3 ; maxillary width 25·3 ; mandibular length 90·5 ; pm° 14 ; m_1 14.

Remarks.—This civet was shot while feeding on a dead caracass at night.

Order. PRIMATES.

Family. HYLOBATIDAE.

Hylobates hoolock (Harlan).

(The Hoolock Gibbon).

1834. *Simia hoolock* Harlan, *Tran. American Phil. Soc.* IV, p. 52, pl. ii. (Garo Hills, Assam).

Specimens examined.—2♂♂, 2♀♀ & 1 Juv. unsexed thus : 2♀♀ 5 & 7 miles west of Nongpoh, Khasi Hills, May 10 & 28, 1949 ; 2♀♀ & 1 Juv. unsexed from Manihar Basti, Khasi Hills, June 15, 1949.

Measurements.—1♂ : H. & B. 500 ; H. F. 147 ; 2♀♀ : H. & B. 500 ; H. F. 152-160. Skull : Total length 2♂♂ 104-107·5, 2♀♀ 108·5-110·5 ; condylobasal length : 2♂♂ 87·4—87·8, 2♀♀ 93·5—94·1 ; zygomatic width : 2♂♂ 63·8—71·6, 2♀♀ 69·5—69·6 ; orbital width : 2♂♂ 58·8—69·5, 2♀♀

69·8—62·7; maxillary width: 2♂♂ 27·8—29·6, 2♀♀ 29·8—30·3; upper cheek teeth: 2♂♂ 33·6—36·5, 2♀♀ 34·6—36; mandibular length: 2♂♂ 72·7—76·5, 2♀♀ 75·8.

Remarks.—These gibbons are quite common between 2,500 ft. and 4,000 ft. in the dense Jungles of Khasi Hills. One female (colln. No. H. 2/5·6·49) was collected with a young attached to its breast. They were seen generally in groups of four to five in number.

Family. Colobidae.

Trachypithecus pileatus pileatus (Blyth).

(The Capped Langur).

1843. *Semnopithecus pileatus* Blyth, *Journ. Asiat. Soc. Bengal* XII, p. 174 (Type-locality-Unknown).

Specimen examined.—1♂ Manihar Basti, Khasi Hills, June 4, 1948.

Measurements.—1♂: H. & B. 570; Tl. 830; H. F. 178; E. 30, Skull: 1♂. Total length 105·3; condylobasal length 81·3; zygomatic width 77·8; orbital width 66·6; maxillary width 30·7; upper cheek teeth 36·4; mandibular length 73·8.

Remarks.—This langur was found to be common in the dense jungles. This specimen does not exactly correspond to the specimens in Zoological Survey of India collection in the colouration. It is pale slaty or smoky grey above and on the outside of the limbs, with the head a little darker; the underside and the whiskers are tinged with buff, and the hands darker than the feet. The outside of the leg above the knee is grey and the end of the tail blackish.

Order. RODENTIA.

Family. Sciuridae (Squirrels etc.)

Petaurista petaurista albiventer (Gray).

(The large red Flying squirrel).

1837. *Pteromys albiventer* Gray, *Charlesworth's Mag. Nat. Hist.* 1, p. 584 (Nepal).

Specimen examined.—1♂ from Nongpoh valley, Khasi Hills, June 15, 1949.

Measurements.—1♂: H. & B. 415; Tl. 570; H. F. 78·5; E. 45. Skull: 1♂: Occipito-premaxillar length 72·3; condylobasal length 69·7; least inter-orbital width 17·4; cranial width 35·15; post-molar length 32·9; auditory length 20·2; palatal length 34·7; length of diastema 14·5; length of palatine formina 5; length of upper molar crowns 15·2; length of tympanic bulla 12·9; mandibular length 45·5.

Remarks.—This specimen was shot at night while coming out of a hole in a tree at a height of 40 ft. from ground. Two more flying-squirrels were also seen in the same hole. The tail in this specimen is brownish rufous or rufous with a well defined black tip which is not so well defined in the specimens examined in the Zoological Survey of India collection. It is the first record from Khasi Hills.

Hylopestes alboniger alboniger (Hodgson).

(The Particoloured Flying-squirrel).

1836. *Sciuropterus alboniger* Hodgson, *Journ. Asiat. Soc. Bengal* V, p. 231 (Kachin, North Burma).

Specimen examined.—2♀♀ from Khezhabama, alt. *ca.* 4815 ft., Naga Hills, January 25, 1935.

Measurements.—2♀♀: H. & B. 264-270; Tl. 210-211; H. F. 39-41, Skull: 2♀♀: Occipito-premaxillar length 42·8-46·4; condylobasal length 41·8-45·4; occipito-nasal length 45·5—48·8; greatest zygomatic width 1♀ 30·6; least inter-orbital width 8·5—10·15; cranial width 21·6—21·8; median depth of occiput 6·2—7·5; post-molar length 19·6—21·6; auditory length 12·8—13·4; length of nasals 12·5—13·7; palatal length 20·6—22·4; length of diastma 9·2—10·2; length of ant. palatine foramina 2·8—3·5; length of upper molar crowns 10—10·8; length of tympanic bulla 8·8—9·6; mandibular length 26·3—28·1.

Remarks.—This specimen was collected in a hill forest.

Ratufa bicolor gigantea (MacClelland).

(The Large Malay squirrel).

1839. *Sciurus giganteus* McClelland, *Proc. Zool. Soc. London*, p. 150, (Assam).

Specimens examined.—4♀♀: Two from Luanglong Khunow and Regaious camp. alt. *ca.* 3,250 ft., on Silchar Road, Manipur, February 10 and 11, 1936; two from Nongpon, Khasi Hills, June 4 & 12, 1949.

Measurements.—3♀♀: H. & B. 360-389; Tl. 470-560; H. F. (in two) 71—81; E. 32 (in one). Skull: 2♀♀: Occipito-premaxillar length 70·1—71·1; condylobasal length 68·9—69·7; occipito-nasal length 75·7—76; greatest zygomatic width 46·6—48·5; least inter-orbital width 28·9—31·1; cranial width 33·3—33·6; occipital breadth 33·3—33·4; median depth of occiput 9·3—9·6; post-molar length 32·1—32·6; auditory length 18·9—20·1; length of tympanic bulla 13·8—15·7; length of nasal 21·3—23; palatal length 28·2—28·7; length of diastema 16—16·7; length of ant. palatine foramina 6·9—7·6; length of upper molar crowns 14·6—15·1; mandibular length 44·9—45·5.

Remarks.—These squirrels were found in pairs on a tall tree in dense forest on a steep hill side, alt. *ca.* 2,400-3,000 ft. in the Khasi Hills. They were quite common in the forest.

Dremomys lokriah macmillani Thomas and Wroughton.

(Macmillan's Squirrel).

1916. *Dremomys macmillani* Thomas & Wroughton, *Journ. Bombay Nat. Hist. Soc.* XXIV (2), p. 238 (Tatkon, on west bank of river Chindwin near kindat, Upper Chindwin district, Burma).

Specimens examined.—2♂♂ from Luanglong khulen, alt. *ca.* 3250 ft., on Silchar Road, Manipur State, February 10, 1939.

Measurements.—1♂: H. & B. 175; Tl. 170; H. F. 45. Skull: 1♂: Occipito-premaxillar length 49·6; condylobasal length 44·6; occipito-nasal length 50·6; inter-orbital width 14·2; cranial width 21·6; post-molar length 20·9; auditory length 12; length of tympanic bulla 8·5; length of nasal 16·5; palatal length 21·1; length of diastema 11·3; length of ant. palatine formina 3·8; length of upper molar crowns 8·2; length of orbit 16·7.

Remarks.—The above two specimens are marked by a very faint buffy yellowish median dorsal line (seen only by close examination) instead of the dark median dorsal line so prominent, and characteristic in the *macmillani*, and thus exhibiting an intermediate stage between premoult and moult stage of seasonal variation.

Callosciurus maclellandi maclellandi (Horsfield).

(The Striped Himalayan Squirrel).

1839. *Sciurus maclellandi* Horsfield, *Proc. Zool. Soc. London*, p. 152 (Assam).

Specimen examined.—1♂ from Regailous Camp, alt. *ca.* 3,250 ft., on Silchar Road, Manipur State, February 11, 1936.

Measurements.—1♂: H. & B. 115; Tl. 95; H. F. 29.

The skull was too badly damaged for taking any measurements.

Callosciurus erythraeus erythraeus (Pallas).

(Pallas Squirrel).

1778. *Sciurus erythraeus* Pallas, *Nov. sp. Quadr. Glir. ord.*, p. 317 (Locality not known).

Specimens examined.—9 (4♂♂ and 5♀♀) thus: 2♂♂ and 1♀ from Manihar Basti, Khasi Hills, June 4 & 5, 1949; 2♂♂ and 3♀♀ from Nongpoh valley and 2 miles and 9 miles east of Nongpoh, Khasi Hills, May 12 & 13 and June 13 & 27, 1949; and 1♀ from Chirpara Timari Reserve Forest, Garo Hills, June 22, 1949.

Measurements.—4♂♂: H. & B. 228–245 (av. 237·5); Tl. 202–228 (av. 216·1); H. F. 50–55 (av. 52·6); E. 20–22 (av. 21·3); and 4♀♀: H. & B. 225–238 (av. 232·1); Tl. 220-243 (av. 233·9); H. F. 51–52 (av. 51·6); E. 17–21 (av. 18·7). The skull measurements are as follows: Occipito-premaxillar length: 4♂♂ 53·8–55·9 (av. 55·07), 3♀♀ 52·5–54·6 (av. 53·66); condylobasal length: 4♂♂ 51·3–53·9 (av. 52·45), 3♀♀ 51·9–52·6 (av. 52·3); occipito-nasal length: 4♂♂ 56·2–57·4 (av. 66·75), 3♀♀ 54·3–57·1 (av. 55·7); greatest zygomatic width: 3♂♂ 32·8–33·7 (av. 32·2), 3♀♀ 32·3–33·9 (av. 33·1); least inter-orbital width: 4♂♂ 20·5–21·2 (av. 20·82), 3♀♀ 18·7–20·5 (av. 19·7); cranial. width: 4♂♂ 25·1–25·6 (av. 25·2), 3♀♀ 24·6–26·4 (av. 25·53); median depth of occiput: 4♂♂ 8·2–9·2 (av. 8·7), 3♀♀ 7·4–8·5 (av. 8·13); post-molar length: 4♂♂ 24·8–25·1 (av. 24·85), 3♀♀ 23·65–24·6 (av. 24·11); auditory length: 4♂♂ 14·8–15·4 (av. 15·2), 3♀♀ 14·5–15·2 (av. 14·8); length of tympanic bulla: 4♂♂ 9·8–10·9 (av. 10·3), 3♀♀ 10-11·3 (av. 10·7); length of nasals: 4♂♂ 16·6-18 (av. 17·2), 3♀♀ 16·5–17·1 (av. 16·8); palatal length: 4♂♂ 23·3–24·5 (av. 23·8), 3♀♀ 23–23·4 (av. 23·2); length of diastema:

4♂♂ 12·6-13·2 (av. 12·85), 3♀♀ 11·8–12·3 (av. 12·2); length of ant. palatine foramina : 4♂♂ 3·3–3·9 (av. 3·62), 3♀♀ 3·7–3·8 (av. 3·73); length of upper molar crowns : 2♂♂ 10·3–10·5 (av. 10·4), 3♀♀ 10·7–10·8 (av. 10·66); post-orbital width : 4♂♂ 18·5–19·4 (av. 18·92), 3♀♀ 18·7–19·5 (av. 19·1); mandibular length 3♂♂ 32·7–33·4 (av. 33), 3♀♀ 32·6-33·1 (av. 32·86).

Remarks.—These squirrels were shot in thick jungles. All the females examined has only two pairs of abdominal mammae. The feet in all the specimens are horney black. The rufous colouration of the tail varies in extant in all these specimens. The tail in one specimen (colln. No. H1/2·6.1949) is rufous throughout, while in others the rufous colouration of the tail varies from the tip of tail to half or three-fourth of the length of tail.

Callosciurus pygerythrus blythi (Tytler).

(Blyth's squirrel).

1854. *Sciurus blythi* Tytler, *Ann. Mag. Nat. Hist.* 2 (XIV), p. 172 (Dacca Bengal, India).

Specimens examined.—13 (6♂♂ & 7♀♀) thus : 1♂ from Lokra, Balipara Frontier Tract, November 9, 1936; 1♂ from Tangla, November 15, 1939; 1♂ & 1♀ from Manihar Basti, Khasi Hills, May 11 and June 4, 1949; 1♂ and 3♀♀ from Nongpoh Valley, June 8, 10, 12, 1949; 1♂ from Noon Mati, Khasi Hills, June 15 and 16, 1949; 2♀♀ from Burnihat, June 20 and 31, 1949; 1 sub-adult from chirpara Timari Reserve forest Garo Hills, June 21, 1949.

Measurements.—5♂♂ : H. & B. 180–197 (av. 190·2); Tl. 171–192 (av. 180·4); H. F. 40–44 (av. 42·2); E. 19–20 (av. 19·5); and 6♀♀ H. & B. 178–194 (av. 18·6); Tl. 181–194·5 (av. 188·2); H. F. 41–46 (av. 43·8); E. 18–20 (av. 19·1).

The skull measurements are as follows :—Occipito-premaxillar length : 2♂♂ 45·8–46·5 (av. 46·2), 6♀♀ 45·7–47·6 (av. 46·73); condylobasal length : 2♂♂ 43·5–43·8 (av. 43·65), 6♀♀ 43·2–45·3 (av. 44·5); occipito-nasal length : 2♂♂ 47·4–48 (av. 47·7), 6♀♀ 47·1–49·6 (av. 48·53); greatest zygomatic width : 2♂♂ 47·4-48 (av. 27·95), 5♀♀ 27·4–29·7 (av. 28·7); least inter-orbital width : 2♂♂ 15·8–15·9 (av. 15·85), 6♀♀ 16·1–17·1 (av. 16·7); cranial width : 2♂♂ 22·6–22·7 (av. 22·65), 5♀♀ 22·2–22·8 (av. 22·6); median depth of occiput : 2♂♂ 7·7–8 (av. 7·85), 6♀♀ 7·7–8·4 (av. 8·05); post-molar length : 2♂♂ 20–20·1 (av. 20·01), 6♀♀ 20—21·3 (av. 20·85); auditory length : 2♂♂ 12·4–12·6 (av. 12·5), 6♀♀ 12·3–12·9 (av. 12·65); length of nasal : 2♂♂ 12·4–12·6 (av. 12·5), 6♀♀ 12·9–14·3 (av. 13·77); palatal length : 2♂♂ 20·5–20·6 (av. 20·5), 6♀♀ 20·1–20·7 (av. 20·45); length of diastema : 2♂♂ 10·5–11·1 (av. 10·8), 6♀♀ 10·7-12·6 (av. 11·78); length of ant. palatine foramina : 2♂♂ 3·4-3·8 (av. 3·6), 6♀♀ 2·9-3·3 (av. 3·15); length of tympanic bulla : 2♂♂ 8·5-8·9 (av. 8·7), 6♀♀ 8·7–9 (av. 8·85); post-orbital width : 2♂♂ 16·5-16·6 (av. 16·5), 6♀♀ 16·2–17·2 (av. 16·72); mandibular length : 2♂♂ 28·5–28·7 (av. 28·6), 6♀♀ 27·5–29·6 (av. 28·6).

Colour of soft parts.—Iris black; feet light brown; nose brown.

Remarks.—These squirrels were collected in dense forest with thick undergrowth and rocks. One specimen (colln. No. H1/8.5.1949) was collected while making nest on a bamboo tree at a height of 21 ft., from ground. All the females collected have only two pairs of abdominal mammae. The colour of the thigh patches varies, out of 13 specimens examined five have them pure white, four have them buffy white and the rest greyish white.

Callosciurus erythraeus erythrogaster (Blyth).

(The Manipur squirrel).

1842. *Sciurus erythrogaster* Blyth, *Journ. Asiat. Soc. Bengal* XI, p. 970 (Manipur, Assam).

1916. *Callosciurus erythraeus nagarum* Thomas & Wroughton, *Journ. Bombay Nat. Hist. Soc.* XXIV (2), p. 228.

1947. *Callosciurus erythraeus erythrogaster* Ellerman, *Journ. Mamm.* XXVIII (3), p. 270.

Specimens examined.—2 (1♂ and 1♀) thus: 1♂ from Regailous camp, alt. *ca.* 3,250 ft., on Silchar Road, Manipur State, February 10, 1936; and 1♀ from Luanglong Khunow, alt. *ca.* 3,250 ft., on Silchar Road, Manipur, February 10, 1936.

Measurements.—1♂: H. & B. 217; Tl. 274; H. F. 55; and 1♀: H. & B. 225; Tl. 270; H. F. 55. Skull: occipito-premaxillar length: 1♂ 53·7; condylobasal length: 1♂ 49·5; occipito-nasal length: 1♂ 53·9; greatest zygomatic width; 1♂ 31·9; least inter-orbital width: 1♂ 18·5; cranial width: 1♂ 25·6, 1♀ 24·4; post-molar length: 1♂ 23·1, 1♀ 24·2; auditory length: 1♂ 13, 1♀ 15·1; length of nasal: 1♂ 16·8, 1♀ 16·7; palatal length: 1♂ 22·5; length of diastema: 1♂ 11·6; length of ant. palatine foramina; 1♂ 3·9; length of tympanic bulla: 1♂ 10·2, 1♀ 10·7; length of upper molar crowns: 1♂ 10, 1♀ 10·1; mandibular length 1♂ 31·3.

Remarks.—These squirrels were obtained in dense jungles. In one specimen only the tail is black near the terminal end, but in other the tail is black to about two-third its total length.

Family. Rhizomydae.

Cannomys badius badius (Hodgson).

(The Bay Bamboo-Rat).

1842. *Rhizomys badius* Hodgson, *Calcutta Journ. Nat. Hist.* II, p. 60, 410 (Nepal).

Specimens examined.—1♂ and 2♀♀ (1 ad. ♀ and 1 Juv. ♀) from Luanglong Khulen, alt. *ca.* 3,250 ft., on Silchar Road, Manipur State, February 9, 1936.

Measurements.—1♂: H. & B. 198; Tl. 67; H. F. 33, and 1♀: H. & B. 180; Tl. 58; H. F. 28. The skull measurements are as follows:—Occipito-premaxillar length: 1♂ 44·6, 1♀ 40·5; condylobasal length 1♂ 46·4, 1♀ 41·8; occipito—nasal length: 1♂ 42·3, 1♀ 37·8; greatest

* The skull of the female specimen is very much damaged, and here the measurements of undamaged parts are given.

zygomatic width: 1♂ 35·7, 1♀ 32; least inter-orbital width: 1♂ 9·2, 1♀ 9·3; cranial width: 1♂ 22·5, 1♀ 22·3; median depth of occiput: 1♂ 8·9, 1♀ 8; post-molar length: 1♂ 16·5, 1♀ 15; auditory length: 1♂ 12·8, 1♀ 12·2; length of tympanic bulla: 1♂ 10·5, 1♀ 9·8; length of nasal: 1♂ 15·8, 1♀ 13·2; palatal length: 1♂ 27·6, 1♀ 24·3; length of diastema: 1♂ 16·6, 1♀ 14·9; length of ant. palatine foramina: 1♂ ·5, 1♀ 4·9; length of upper molar crowns: 1♂ 9·8, 1♀ 8·2; mandibular length: 1♂ 32·4, 1♀ 29·4.

Rhizomys pruinosus pruinosus Blyth.

(The hoary Bamboo-Rat).

1851. *Rhizomys pruinosus* Blyth, *Journ. Asiat. Soc. Bengal* XX, p. 519 (Cherrapunji, Khasi Hills, Assam).

Specimen examined.—1♀ from Luanglong khunow, alt. *ca.* 3,250 ft. on Silchar Road, Manipur, February 9, 1936.

Measurements.—2♂♂: H. & B. 176–185; Tl. 161–194; H. F. 33–37; E. (in one) 21·5. Skull, 1♂: occipito-premaxillar length 42·3; condylobasal length 42·2; occipito-nasal length 43·7; greatest zygomatic width 20·8; least inter-orbital width 6; cranial width 17; post-molar length 19·1; auditory length 10·3; length of nasal 17·6; palatal length 20·7; length of diastema 12; length of ant. palatine foramina 7·8; length of tympanic bulla 6·5; length of upper molar crowns 6·7; mandibular length 23·1.

Family—MURIDAE.

Rattus nitidus nitidus (Hodgson).

(The Nepal Shiny Rat).

1845. *Mus nitidus* Hodgson, *Ann. Mag. Nat. Hist.* XV, p. 267 (Nepal).

Specimens examined.—2♂♂ Nongpoh Valley, Khasi Hills, May 15 and 19, 1949.

Measurements.—2♂♂: H. & B. 176–185; Tl. 164–194; H. F. 33–37; E. (in one) 21·5. Skull: 1♂: occipito-premaxillar length 42·3, condylobasal length 42·2; occipito-nasal length 43·7; greatest zygomatic width 20·8; least inter-orbital width 6; cranial width 17; post-molar length 19·1; auditory length 10·3; length of nasal 17·6; palatal length 20·7; length of diastema 12; length of ant. palatine foramina 7·8; length of tympanic bulla 6·5; length of upper molar crowns 6·7; mandibular length 23·1.

Colour of soft parts.—Irish black; nose pinkish; legs flesh colour.

Remarks.—These specimens were trapped in houses. In the check-teeth of one specimen (colln. no. H8/15.5.1949) m^1 has antero-external tubercle (cusp 1) greatly reduced than in the other specimen.

Rattus niviventer mentosus Thomas.

(The Chin Hills Rat).

1916. *Epimys jerdoni* Wroughton, *Journ. Bombay Nat. Hist. Soc.* XXIV (2), p. 307 (Hakamti and Chin Hills, Upper Burma, Wrong identification *vide.*, Wroughton, 1916).

1916. *Rattus mentosus* Thomas, *Journ. Bombay Nat. Hist. Soc.* XXIV (4), p. 643 (Hkampti=Hakampti=Singkaling Hakampti=Zungkaling Hakampti, Upper Chindwin district, Upper Burma, 5,000 ft.).

Specimen examined.—1♀ from Barapani, Khasi Hills, June 22, 1949.

Measurements.—1♀: H. & B. 138·5; Tl. 186·5; H. F. 28; E. 23·7; Skull (partly broken): 1♀: Inter-orbital width 5·6; nasal length 13·8; cranial width 14·8; palatal length 15·9; length of diastema 9·5; length of ant. palatine foramina 6·6; length of upper molar crowns 5·7; mandibular length 19·5. The measurements of other parts of the skull could not be taken owing to the skull being damaged.

Colour of soft parts.—Irish black; feet and nose pinkish.

Remarks.—This example was trapped in jungle. It had two pairs of thoracic and two pairs of abdominal mammae. The western limit of this form has hitherto been known to be Naga Hills (Ellerman, 1947, p. 377). The present record from Barapani extends the limit of distribution further westward.

Rattus rattus tistae Hinton.

(The Himalayan Tree-Rat).

1918. *Rattus rattus tistae* Hinton, *Journ. Bombay Nat. Hist. Soc.* XXVI (1), p. 68 (Pashok, Sikkim).

Specimens examined.—5♂♂ thus: 2 sub-adult from Nongpoh Valley, May 11 and 12, 1949; and 3♂♂ from Burnihat, Khasi Hills, May 25, 26, 1949.

Measurements.—3♂♂: H. & B. 142–160; Tl. 150–185; H. F. 34-35·7; E. 21-22·5. Skull: 2♂♂: Occipito-premaxillar length 38·8–39·1; condylobasal length 37·9–38·3; occipito nasal length 40·1–40·2; least inter-orbital width 6·3; cranial width (1♂) 16·7; post-molar length 17·1–17·5; auditory length 9·5–10·5; length of nasal 15·7-15·8; palatal length 19·3; length of diastema 10·5–11·2; length of ant. palatine foramina 7·6–7·7; length of tympanic bulla 6·1–6·6; length of upper molar crowns 6·5–6·6; mandibular length 20·5–21·8.

Colour of soft parts.—Irish black; legs and nose light brown.

Remarks.—These specimens were trapped in houses.

Rattus rattus brunneusculus Hodgson.

1845. *Mus. brunneusculus* Hodgson, *Ann. Mag. Nat. Hist. Soc.* XV, p. 267 (Nepal).

Specimens examined.—2♀♀ thus: 1♀ from Manihar Basti, Khasi Hills, June 3, 1949 and 1♀ from Chirpara Timari Reserve Forest, Garo Hills, June 21, 1949.

Measurements.—2♀♀: H. & B. 155–158; Tl. 202–208; H. F. 29–31; E. 15–21. Skull: 2♀♀: occipito-premaxillar length 40·3-40·4; condylobasal length 38·4–39·5; occipito-nasal length 40·2–40·5; greatest zygomatic width 20–21·3; least inter-orbital width 5·3–5·5; post-molar length 1♀ 17·5; auditory length 1♀ 10·2; length of nasal 2♀♀ 14·6–15·6; palatal length 19·5; length of diastema 10·5–10·6; length

of ant. palatine foramina 7·3–7·8; length of tympanic bulla 6·5–7·2; length of upper molar crowns 6·7–6·9; mandibular length 22·9.

Remarks.—These specimens were trapped in jungle.

Bandicota bengalensis bengalensis Gray & Hardwicke.

(The Indian Mole rat).

1833. *Arvicola bengalensis* Gray & Hardwicke, *Illust. Indian Zool.* II, p. 21 (Bengal).

Specimen examined.—1♂ from Sarengma village, Garo Hills, June 23, 1949.

Measurements.—1♂: H. & B. 194; Tl. 132; H. F. 34; E. 24. Skull: 1♂: Occipito-premaxillar length 42·3; condylobasal length 42·7; occipito nasal length 40·8; least inter-orbital width 5·3; post-molar length 18; auditory length 13; length of nasal 12·9; palatal length 21·4; length of diastema 12·9; length of ant. palatine foramina 8·3; length of tympanic bulla 9·6; length of upper molar crowns 6·8; mandibular length 26·6.

Remarks.—This species was not common and was found in evergreen jungle of Oak scrub.

Mus guhai, sp. nov.

Specimens examined.—6 ad. ♂♂ from Nongpoh, alt. *ca.* 2,000 ft. Khasi Hills, Assam, July 15, 1949.

Type.—Zoological Survey of India, Calcutta. Registered No. 11439, adult ♂, Nongpoh, Khasi Hills, Assam; 16 May, 1949; collected by the Zoological Survey of India party.

Measurements of the Type.—1 ad. ♂: H. & B. 79; Tl. 87·5; H. F. 24·5; E. 16. Skull.—Occipito-premaxillar length 27·6; condylobasal length 26·5; occipito-nasal length 28·5; greatest zygomatic width 14·8; least inter-orbital width 5·2; cranial width 14·2; post-molar length 11·8; auditory length 7·6; length of nasal 8·4; palatal length 11·5; length of diastema 7; length of ant. palatine foramina 5·4; length of tympanic bulla 5·2; length of upper molar crowns 4·6.

Range.—Known only from the type-locality.

For further account, particulars and other details which has already been published separately the *Journal Zool. Soc. India* IV, No. 1, pp. 85-88 may be referred.

Family—LEPORIDAE.

Lepus ruficaudatus Geofroy.

(The Common Indian Hare).

1826. *Lepus ruficaudatus* Geofroy, *Dict. d'Hist. Nat.* IX, p. 381, (Bengal).

Specimen examined.—1♀ sub-adult from Barapani, Khasi Hills, June 5, 1949.

Measurements.—1♀ sub-adult: H. & B. 365; Tl. 82; H. F. 96; E. 85. Skull: 1♀ sub-adult: condylobasal length 76·4; occipito-nasal length 74·5; greatest zygomatic width 39·3; least inter-orbital width 14·1; cranial width 28·3; post-molar length 30·8; auditory length 14·4; length of tympanic bulla 11·1; length of nasal 30·5; post-orbital width 11·8; palatal length 26·6; length of diastema 19·9; length of ant. palatine foramina 19·6; length of upper molar crowns 11·4; mandibular length 55·1.

Remarks.—This example was shot at night in a field.

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A NEW SPECIES OF *ERGASILUS* FROM THE GILLS OF *LABEO BATA* (HAMILTON)*

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INTRODUCTION.

A new species of *Ergasilus*, a parasitic copepod, found infecting the gills of the minor carp, *Labeo bata* (Ham.) is described as *E. batae* sp. nov. in the present paper.

Ergasilus batai sp. nov.

Out of 78 specimens of *L. bata* of total lengths ranging from 86 mm. to 342 mm. from various places, (Table I) which were examined, only two fishes (2·56 per cent. infection) were found infected indicating that the parasite has a very limited distribution and is of low incidence. The two infected fish were 165 mm. and 292 mm. in total length and were collected on November 19, 1948 and June 21, 1949, from Serampore and Barrackpore respectively.

TABLE No. I.

Place.	No. of host examined.	Total length range of host in mm.	No. of host infected.	No. of parasites present on host.
1. Serampore (Bengal)	4	117—165	1	7
2. Barrackpore (Bengal)	1	292	1	15
3. Belghuria (Bengal)	4	203—210	..	..
4. Bidhyadhari (Bengal) . .	4	115—166	..	
5. Midnapore (Bengal) .	6	86—108		
6. Hirakud (Orissa)	5	265—270		
7. Cuttack (Orissa)	50	111—342		
8. Ramchandrapuram (Madras)	3	124—168		
9. Rajahmundri (Madras)	1	222		..
	78		2	

Most of the species of *Ergasilus* have been found infecting fresh-water fishes in Europe, America and Asia. In India, so far, only six species have been recorded *viz*: (1) *E. bengalensis* Southwell and Prasad 1918.

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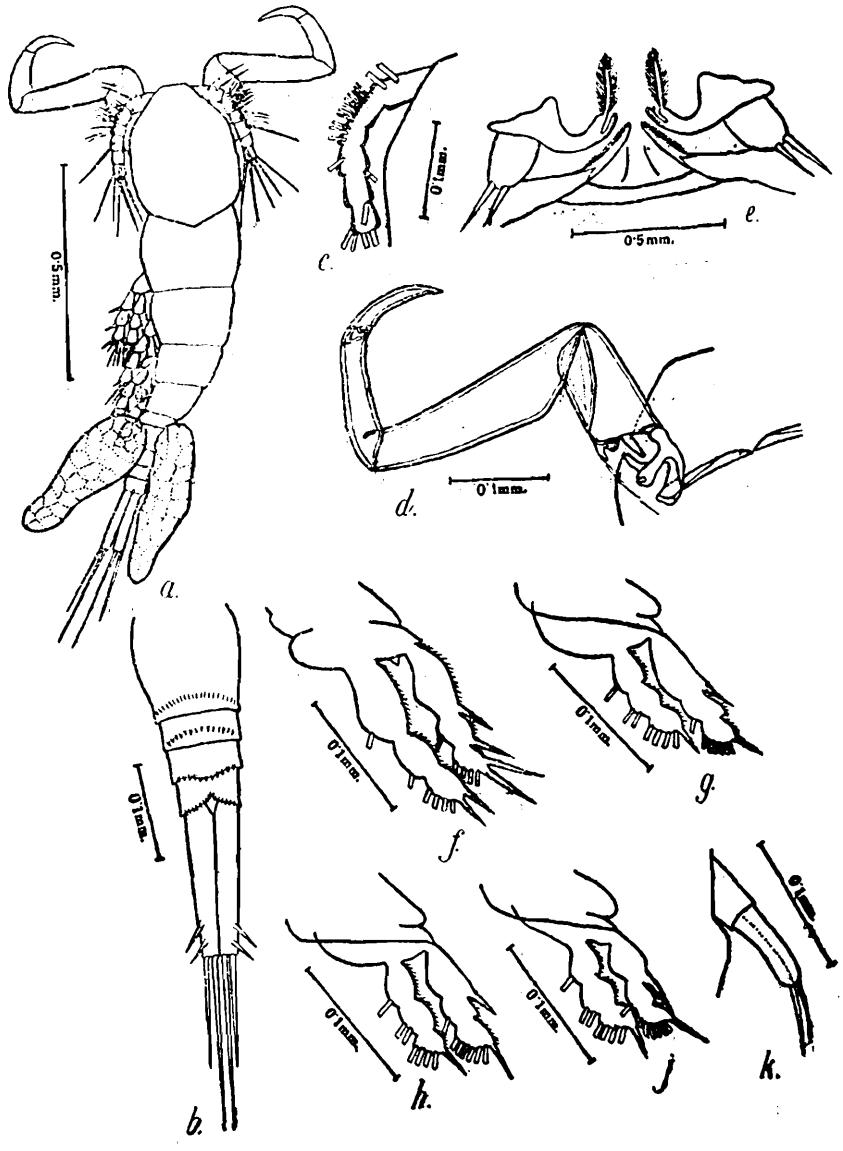
and (2) *E. scotti* Sundara Raj 1923, from *Wallago attu* (3) *E. hamiltoni* Southwell and Prasad 1918, from *Anabas testudineus* (4) *E. nanus* Van Beneden, 1870, from *Mystus gulio* and *Pseudapocryptes laceolatus*, (5) *E. gibbus* Nordmann 1832, from *Ophicephalus gachua*, and (6) *E. polynemi* Redkar, Rangnekar and Murti 1951, from *Eleutheronema tetradactylum*. The first three species are from fresh water, the next two from brackish water and the last one is a marine form. *E. batae* sp. nov. is seventh species found to occur on Indian fishes and is the first record from the gills of an Indian carp.



TEXT FIG. 1 *Ergasilus batai* sp. nov. *a.*—Dorsal view of female. *b.*—Ventral view of abdomen and anal laminae. *c.*—First antenna. *d.*—Second antenna. *e.*—Mouth parts. *f.*—First leg. *g.*—Second leg. *h.*—Third leg. *j.*—Fourth leg. *k.*—Fifth leg.

Description of the Female.—The main body of the parasite was dirty blue and the egg strings were creamy in colour. The parasites were attached in numbers in both the instances only over the anterior hemibranch of the second gill. The heads of the prasites were invariably directed towards the gill-arch. This mode of attachment perhaps offers least resistance to the water flowing through the gill chamber and the parasites do not get washed off from the gill surface. Nauhaus (1929) also has reported the same manner of attachment for *E. siebolde* (Nordmann).

The body (fig. 1*a*) is long and slender, tapering posteriorly and nearly four times as long as its maximum width (maximum width being in the region of the mouth) and about three and half times as long as cephalon. The cephalon is not fused with the first thoracic segment. Its anterior margin is slightly flattened, the lateral sides curved and the posterior margin broadly 'V' shaped. The cephalon is little wider than the first thoracic segment. The five thoracic segments decrease progressively in length and breadth posteriorly. The fifth, the shortest thoracic segment is not easily distinguishable from the genital segment which follows it. The latter is broad anteriorly and tapers gradually towards its posterior end to which are attached two long egg sacs. Each egg sac contains 25—30 eggs. The abdomen (fig. 1*b*) consists of three segments of nearly equal lengths which progressively diminish in width. Ventrally, the posterior margin of each abdominal segment is beset with small setae. The last segment is slightly forked in the middle along its posterior margin and bears two anal laminae which are about 1½ times longer than the abdomen. Each lamina is 7 times as long as wide at its base and bears three setae of which two are attached at its distal end and the third set dorsally. The inner of the two distal setae is longer and the third dorsally placed seta is the shortest of all.

A pair of fused eyes (0·032 mm. in diameter) is situated dorsally in the anterior one third of the cephalon. The first pair of antennae (fig. 1*c*) is six-jointed, the first segment being the longest. The second and third are not clearly demarcated from each other. The rest of the three segments are nearly equal in length. The arrangement of the setae on the segments is as follows: 1st segment—2, 2nd segment—9-10, 3rd segment—3, 4th segment—2, 5th segment—1 and 6th segment—4.

The second pair of antennae (fig. 1*d*) is nearly half of the body length, and two and half times longer than the first pair. It is well developed for prehension and has five segments each. The first segment is short; the second is wedge-shaped; the third is long and slender, four times as long as wide; the fourth segment is shorter than the third; and the fifth is a strongly chitinised-clawed segment. No spines or papillae are present on any of the segments. The mouth is situated ventrally in the posterior third of the cephalon, 0·253—0·3 mm. from the anterior margin. The mouth parts (Fig. 1*e*) consist, as usual, of mandibles, two pairs of maxillae and two lips. The mandible is two-jointed. The first joint is broad at its base, which slowly narrows and is curved anteriorly, where the terminal joint is attached. The terminal joint is beset profusely with fine hairlike setae on its inner and outer margins. The mandibular palp whose inner margin is beset with small hair like setae, is attached to the posterior margin of the first segment. The first maxilla is short and stumpy and has two long setae at its free end. The outer seta is a little longer than the inner one. The second maxilla is two-jointed. The basal segment is long and tapering. The terminal joint is beset with small setae along its outer margin. The terminal joints cross each other anteriorly as in *E. myctarothes* (Wilson 1913). The first four pairs of thoracic legs (figs. 1*f*, *g*, *h* and *j*) are well developed and biramous. All the ramii are three-jointed. The fifth leg (fig. 1*k*) is rudimentary and has two segments. The terminal segment has two long setae. The number

and the arrangement of the spines (in bold numbers) and setae on the legs are as follows:

First pair of legs . . . { Exo. **1—0, 1—1, 2—4**
Endo. **0—1, 0—1, 2—4**

Second pair of legs . . . { Exo. **1—0, 0—1, 1—6**
Endo. **0—1, 0—2, 1—4**

Third pair of legs { Exo. **1—0, 0—1, 1—6**
Endo. **0—1, 0—2, 1—4**

Fourth pair of legs . { Exo. **1—0, 0—1, 1—6**
Endo. **0—1, 0—2, 1—4**

The male is not known.

The measurements (in mm.) of five specimens of *E. batae* sp. nov. are given in the Table II.

Table II.

	I	II	III	IV	V
1. Total length	1·248	1·185	1·169	1·153	1·090
2. Length of cephalon +first thoracic segment.	0·521	0·506	0·490	0·474	0·348
3. Breadth of cephalon	0·284	0·269	0·269	0·237	0·237
4. Distance of cephalic notch from ant. margin.	0·348	0·316	0·332	0·316	0·284
5. Length of abdomen	0·146	0·139	0·139	0·139	0·139
6. Length of anal lamina	0·190	0·174	0·174	0·174	0·174
7. Length of *outer* seta of anal lamina.	0·219	0·219	0·201	0·201	0·201
8. Length of *inner* seta of anal lamina.	0·183	0·183	0·164	0·164	0·164
9. Length of egg-sac	0·474	0·340	0·411	0·332	0·379
10. Breadth of egg-sac	0·142	0·126	0·095	0·079	0·111
11. Length of first antenna		0·223	0·221	0·219	0·215
12. Length of second antenna.	..	0·553	0·553	0·553	..
13. Length of genital segment.	0·091	..	0·080	0·091	..
14. Breadth of genital segment.	0·128	..	0·091	0·113	..

Breeding.—Very little is known about the breeding season of *Ergasilus* in India. In N. America and Central Europe, *Ergasilus* is not known to breed in winter months (Wilson, 1911 and Nauhaus, 1929). According to Wilson (1911), in N. America, there are three peak periods of breeding, namely : April-May, July-August, and October-November. Mature female specimens of *E. batae* sp. nov. were collected by the author in the months of June and November. Southwell and Prasad (1918) collected female specimens of *E. bengalensis* and *E. hamiltoni* with eggs during the months of June and December respectively. Sundara Raj (1923) collected female specimens of *E. scotti* with and without egg-cases in the month of August. The above records indicate that in India *Ergasilus* breeds in summer as well as in winter.

Pathology.—The parasite attaches itself to the gills of the host by the help of the strongly clawed second pair of antennae. This produces small punctures in the gill filaments and causes irritation to the host. Instances of fish mortality are known due to presence of *Ergasilus* in large numbers. Nauhaus (1929) has recorded as many as three thousand specimens of *Ergasilus* from a single Tench, 250 mm. in size. As a remedial measure, he has suggested to neat and clean the fish during the winter when the parasite is not breeding. In the present case the host appeared to be healthy and no hypertrophy of the gill tissue was noticed at the seat of infection.

Remarks.—The outstanding characters of this species are :—long and slender body, shape of the cephalon, markedly elongated second pair of antennae, presence of rows of small setae on the ventral side of the abdominal segments, strikingly elongated anal laminae and serrated spines of the legs.

E. batae sp. nov. differs from six species of *Ergasilus*, so far recorded from India, in various characters as is evident from the artificial key to the species of *Ergasilus*, given below.

E. batae sp. nov. resembles *E. chautauquaensis* Wilson 1911 with regard to the size of the body, shape of the cephalon, presence of rows of setae or teeth on the ventral side of abdominal segments, and number and arrangement of spines and setae on the second and third legs. The two species differ in the size of the anal lamina, the length of second antenna compared to first antenna, number of joints of the fourth leg and the size of fifth leg. In *E. batae*, each lamina is seven and a half times as long as wide, while in *E. chautauquaensis*, it is square. The second pair of antennae is two and a half times longer than the first pair in the former case whereas it is shorter in the latter. In *E. batae*, the exopod of the fourth leg is three-jointed but it is two-jointed in *E. chautauquaensis*. The fifth leg of *E. batae* is longer than that of *E. chautauquaensis*.

An artificial key to the species of *Ergasilus* described from Indian Fishes :

1(6) Head distinctly separated from first thoracic segment by a groove ; exopod of the fourth leg two or three jointed. .2

2(3) Second thoracic segment half the width of the first thoracic segment ; first thoracic segment as wide as head. .

. . . *E. gibbus* Nordmann, 1832.

3(2) Second thoracic segment more than half the width of the first thoracic segment; first thoracic segment little wider or narrower than the head 4

4(5) Anterior margin of the carapace evenly rounded ; first thoracic segment little wider and three times longer than head ; anal laminae nearly as long as last abdominal segment ; expord of the fourth leg two-jointed : fifth leg rudimentary and reduced to an elongated process only. . . . . *E. hamiltoni* Southwell and Prasad, 1918.

5(4) Anterior margin of the carapace flattened ; first thoracic segment little narrower than and about half as long as head ; anal laminae four times as long as last abdominal segment ; exopod of the fourth leg three-jointed ; fifth leg rudimentary, two-jointed, ternial joint with two setae. . . . . *E. batae* sp. nov.

6(1) Head completely fused with the first thoracic segment, exopod of the fourth leg two-jointed.

7(10) Second thoracic segment narrows to less than half the width of cephalothorax ; anal laminae as long as wide, each with three or four setae ; egg-strings longer than the entire length of body 8

8(9) Cephalothorax broad at the anterior end ; third and fourth thoracic segments equal in width ; second pair of antennae distinctly longer than cephalothorax ; anal lamina with three setae ; fifth leg much reduced and of papillae form, ending in couple of spines. . . *E. scotti* Sundara Raj, 1923.

9(8) Cephalothorax greatly narrowed at its anterior end ; third thoracic segment broader than the fourth thoracic segment ; second pair of antennae as long as cephalothorax ; anal lamina with four setae ; fifth leg two-jointed, proximal joint with a small spine, and distal joint with one long and two small setae. . *E. polynemi* Redkar, Rangnekar and Murti, 1951.

10(7) Free thoracic segments regularly decrease in width ; anal laminae rhomboidal or rectangular, each with two or three setae ; egg-strings shorter than the entire length of body..11

11(12) Cephalothorax more or less elliptical ; second pair of antennae distinctly longer than cephalothorax; anal laminae rhomboidal, each with two setae and much longer than the last abdominal joint; fifth leg much reduced, knob like, with single spine. . . . . *E. bengalensis* Southwell and Prasad, 1918.

12(11) Cephalothorax narrowed posteriorly ; second pair of antennae as long as cephalothorax ; anal laminae rectangular, as long as last abdominal segment, each with three setae ; fifth leg three times longer than broad, armed with three setae.

E. nanus Van Beneden, 1870.

ACKNOWLEDGEMENTS.

I am indebted to Mr. Y. R. Tripathi for his guidance, kind help and encouragement in this work. My sincere thanks are due to Dr. T. J. Job and Dr. V G. Jhingran for kindly going through the manuscript critically. My thanks are also due to Messrs. K. H. Alikunhi and H. Chaudhuri for kindly giving me specimens of *Labeo bata* from Ramchandrapuram and Rajahmundri. And finally I am grateful to Mr. G. N. Mitra, Deputy Director of Orissa Fisheries for according facilities for work at Cuttack.

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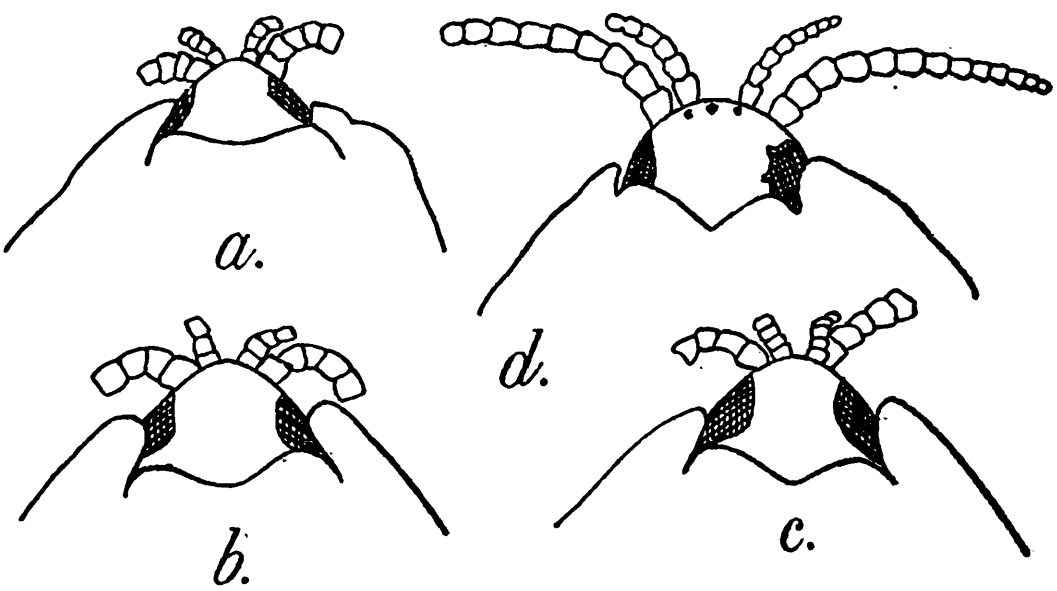
ON A NEW SPECIES OF THE RARE CYMOTHOID GENUS *AGARNA* SCHI. & MEIN., PARASITIC ON THE CLUPEID FISH *NEMATALOSA NASUS* (BL.) IN THE BAY OF BENGAL

By KRISHNA KANT TIWARI, *M.Sc., Ph.D., Assistant Superintendent, Zoological Survey of India, Calcutta.*

(Plate VI.)

Shri M. N. Datta, Assistant Superintendent, Zoological Survey of India, forwarded to me some specimens of a cymothoan parasite from the branchial chamber of a clupeid fish, *Nematalosa nasus* (Bl.), which his son, Shri Malay Kumar Datta, purchased from Bow Bazar, Calcutta. Three of the specimens were detached while one was preserved *in situ* inside the host. The parasites on examination proved to belong to an undescribed species of the cymothoid genus



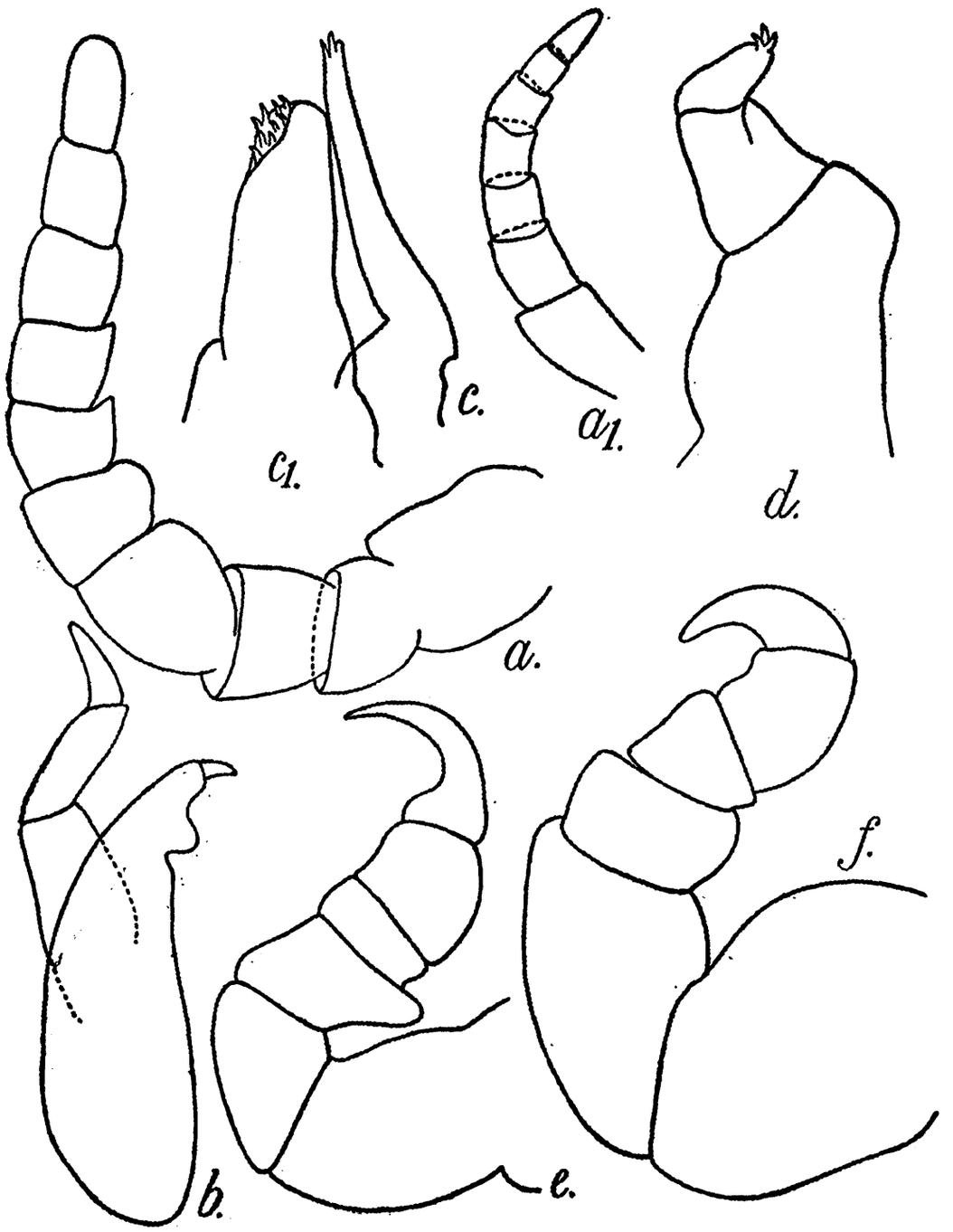
TEXT-FIG. 1.—Head and first thoracic segment of *Agarna malayi*, sp. nov., showing variations in the outline of the anterior margin of the first thoracic segment : × 8.

Agarna Schiodte & Meinert (1884), which is so far known to contain two species only. Some more examples were brought by Shri Malay Kumar Datta later on. This fine series of specimens has enabled me to draw up the following account of the new species which I have great pleasure in associating with the name of Shri Malay Kumar.

Agarna malayi, sp. nov.

The body of the parasite is very asymmetrical and hunched. Seen in dorsal view, one side is almost straight in outline, while the other is strongly arched, the maximum width at the level of the fourth thoracic segment being about two-thirds of the total median length of the body.

The head and the first thoracic segment are almost symmetrical but behind the latter there is an abrupt increase in the width of the thorax which reaches its maximum in the fourth thoracic somite, posterior to which the width again decreases. The hunch, which is roughly pyramidal in shape, likewise begins in the second thoracic segment, reaching its maximum height in the fourth somite.



TEXT-FIG. 2.—*Agarna malayi*, sp. nov.
a. Antenna : × 36 ; a^1, Antennule : × 36 ; *b*. Mandible : × 36 ; *c*. Maxillula : × 36 ; c^1. Maxilla : × 36 ; *d*. Maxilliped : × 36 ; *e*. First peraeopod : × 20 ; *f*. Seventh peraeopod: × 20.

The head is sub-pentagonal in shape (Text-fig. 1 *a-d*) and is broader than long. Its length is about four-fifth of the width of its posterior margin. The anterior border of the head is convex. The eyes are situated in the postero-lateral portion of the head.

The first thoracic segment is longer than the head as well as the following trunk somites. It is about twice as broad as long. Its anterior

margin is generally concave, but its outline is subject to much variation as depicted in Text-figure 1. The antero-lateral angles of the first thoracic segment are conspicuously incised, the corresponding margins having been produced into narrow projections which embrace about half of the posterior region of the head. The posterior margin of the first thoracic segment is convex. The succeeding thoracic somites are all shorter than the first, but distinctly broad, the width increasing posteriorly and reaching its maximum in the fourth. The segments posterior to the fourth are flattened on the longer side of the body. The lateral margins of second to seventh thoracic segments are wider on the longer side and the postero-lateral corners are rounded in segments four to seven. The seventh thoracic segment has its posterior border emarginate.

All the thoracic segments with the exception of the first have epimera, which are almost transversely placed on second and third segments, but in somites four to seven they are obliquely disposed on the antero-lateral face of the lateral margin (Pl. VI, figs. 3, 4). The epimera of fourth to seventh segments are triangular in shape, with the posterior angle produced and free from the somite. The epimera of the two sides are similar in appearance.

The abdomen (Pl. VI, fig. 2) is not narrower than the peraeon. Its median length is slightly more than a third of the total length of the body. The anterior three segments of the pleon are immersed in the concavity of the last trunk somite. The abdominal somites are very short and subequal, and the lateral parts of the first three project beyond the sides of the seventh thoracic segment. The telson is long, being about two-thirds of the total length of the abdomen and is about twice as broad as its median length. Its posterior margin is broadly rounded.

Antennules are short and compressed (Text-fig. 2*a*[1]), their bases are almost contiguous, and they are 8-jointed. Antennae are stout (Text-fig. 2*a*), about twice as long as the antennules, compressed and the number of their joints varies from 10 to 13. The mandible (Text-fig. 2*b*) has an incisor process produced in to a single chitinised tooth, below which there is a small ridge, perhaps representing the molar process. The mandibular palp is three-jointed, the basal joint being very broad, and the apical joint short and bluntly conical. First maxillae (Text-fig. 2*c*) are long and tubular with the usual number of apical spines. The second maxillae (Text-fig. 2*c*[1]) are bilobed and have a number of minute hooks at the apex. The maxillipedes (Text-fig. 2*d*) have a two-jointed palp, the terminal segment of which is armed with two hooks.

The peraeopods are prehensile, and their length increases successively posteriorwards (Text-fig. 2*e* and *f*). The bases of the last four pairs are conspicuously carinated.

The uropods are narrow (Pl. VI, fig. 2) and extend almost up to the posterior margin of the telson on the shorter side.

All the specimens are females, some having eggs in the brood pouch. The table given below gives important dimensions of eight females.

Measurements of *Agarna malayi*, sp. nov. (in millimeters).

	1. ♀	2. ♀	3. ♀	4. ♀	5. ♀	6. ♀	7. ♀	8. ♀
I. *Body :*								
i. Median length	18·6	19·3	17·8	16·7	18·3	17·9	17·2	16·7
ii. Maximum breadth	11·7	11·2	11·3	11·4	12·0	11·7	11·6	9·1
iii. Maximum depth	8·5	6·2	6·0	6·4	7·6	7·9	7·6	5·3
II. *Head :*								
iv. Median length	1·7	1·7	1·4	1·6	1·9	1·8	1·2	1·5
v. Breadth at the posterior margin	2·0	1·9	1·9	1·9	2·1	2·1	1·5	2·0
III. *1st Thoracic segment* :								
vi. Median length	2·4	2·7	2·5	2·7	2·5	2·3	2·5	2·5
vii. Breadth	5·8	5 0	4·8	5·4	5·2	4·9	4·7	5·0
IV. *Abdomen :*								
viii. Median length	7·1	..	6·4	6·3	6·5	6·2	6·6	6·5
ix. Length of last segment (Telson)	4·6	..	4·0	4·2	4·2	4·2	3·6	4·2
x. Breadth of the same	8·3	..	8·0	8·5	8·0	7·7	7·3	7·3
V. *Ratios :*								
xi. Body $\frac{\text{Breadth}}{\text{Length}}$	0·63	0·58	0·63	0·67	0·66	0·66	0·67	0·55
xii. Body $\frac{\text{Depth}}{\text{Length}}$	0·46	0·32	0·33	0·38	0·42	0·44	0·44	0·32
xiii. Head $\frac{\text{Length}}{\text{Breadth}}$	0·85	0·90	0·74	0·84	0·91	0·86	0·80	0·75
xiv. First thoracic segment	0·42	0·54	0·52	0·50	0·48	0·47	0·53	0·50
xv. $\frac{\text{Abdomen length}}{\text{Body length}}$	0·38	..	0·36	0·38	0·35	0·35	0·38	0·39
xvi. Telson $\frac{\text{Length}}{\text{Breadth}}$	0·56	..	0·50	0·50	0·51	0·53	0·47	0·58

Holotype—1♀, Regd. No. C3121/1, Zoological Survey of India.

Paratypes.—6♀♀, Regd. No. C3122/1, Z.S.I.

Host.—*Nematalosa nasus* (Bl.), purchased from Bow Bazar, Calcutta. The parasite was located in the branchial chamber of the fish. (Coll. Shri Malay Kumar Datta, 15-16.iv.1952.)

Remarks.—This species resides in the branchial cavity of the clupeid fish, *Nematalosa nasus* (Bl.), between the operculum and the upper ramus of the first gill arch (Pl. VI, fig. 1). The head of the parasite points anteriorwards, while parts of the telson and the uropods project outside through the opercular slit. The dorsal part of the body of the parasite is closely adpressed against the upper rami of the gill arches of the host and the lining of its branchial cavity, while the soft belly presses against the inner wall of the operculum. Corresponding to the hunch of the animal a depression is formed in the upper part of the branchial cavity of the fish. This depression involves the gill filaments

also which become closely pressed against each other. The longer side of the animal is the one which faces the dorsal aspect of the branchial cavity. Although the legs are prehensile they do not seem to play any part in the attachment of the parasite to the host. In fact once the parasite enters the branchial cavity of the host and grows, it cannot possibly escape as it is too thick to wriggle out through the narrow gill slit.

An examination of a number of parasitised fishes revealed that each fish had only one parasite, either in the right or in the left branchial chamber. Those parasites which inhabited the right brachial chamber were dextrally assymmetrical *i.e.*, the left side was straight and short while the right side was curved and longer, and in those which were obtained from the left branchial cavity the left side was arched and vastly the longer.

Except for the depression formed in the upper part of the branchial cavity there did not appear to be any other visible effect of the presence of the parasite on the host. The operculum did not show any bulging, and but for the protruding part of the pleon the presence of the parasite could easily go undetected in an external examination of the host.

Affinities.—So far only two species of the genus *Agarna* are known to science. The type species, *A. carinata* Schi. & Mein. emanates from St. Croix, West Indies, found parasitic on *Teuthys chirurgus*. The other known species, *A. engraulidis* was described by Barnard (1936) from the operculum (?) of *Engraulis setirostris* caught off the mouth of the Debi River, Orissa coast, in the Bay of Bengal.

The new species, *Agarna malayi,* differs from both the above-mentioned species. Among the obvious characters which separate *A. malayi* from *A. engraulidis* is the shape of the head and the first thoracic segment. In the former species the head is broad and fairly well immersed in the antero-lateral projections of the first thoracic segment, one of which is very prominent and large, and both of which are gibbose. Again the hunch is less prominent in Barnard's species and the bases of the first antennae are fairly wide apart. Further the shape of the epimera in *A. engraulidis* is different from those in *A. malayi* and the telson in the former is distinctly longer than half its breadth.

A. carinata differs from *A. malayi* in the shape of head and the first thoracic segment, the structure and disposition of the epimera and in the shape of the telson. Richardson (1905) states that in *A. carinata* the epimera are absent from the first and the seventh thoracic somites and that the latter has no peraeopods, while the fourth thoracic segment is provided with two pairs of epimera and two pairs of legs. This seems to be a peculiar condition indeed, since in none of the Indian species of *Agarna* the fourth thoracic somite is provided with two pairs of epimera and two pairs of peraeopods. In both the Indian species thoracic segments 2—7 are provided with a pair of epimera each and each trunk somite has one pair of peraeopods. Unless it be an error of observation, the condition described by Richardson for *A. carinata* is really unique and interesting.

ACKNOWLEDGEMENT.

I am thankful to Dr. K. S. Misra for his kindness in identifying the host fish.

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Richardson, H., 1905.—A Monograph on the Isopods of North Americao *Bull. U. S. Nation. Mus.* No. **54**, pp. 1-727 (*A. carinata*, pp. 244-245).

Schiodte, J. C. & Meinert, Fr., 1884.—Symbolae ad Monographiam Cymothoarum Crustaceorum Isopodum Famillae. *Naturhis. Tidss* (3)14,pp. 221-433, pls. vi-xviii. (*Agarna carinata*, pp. 329-334 pl. xiii figs, 1-6),

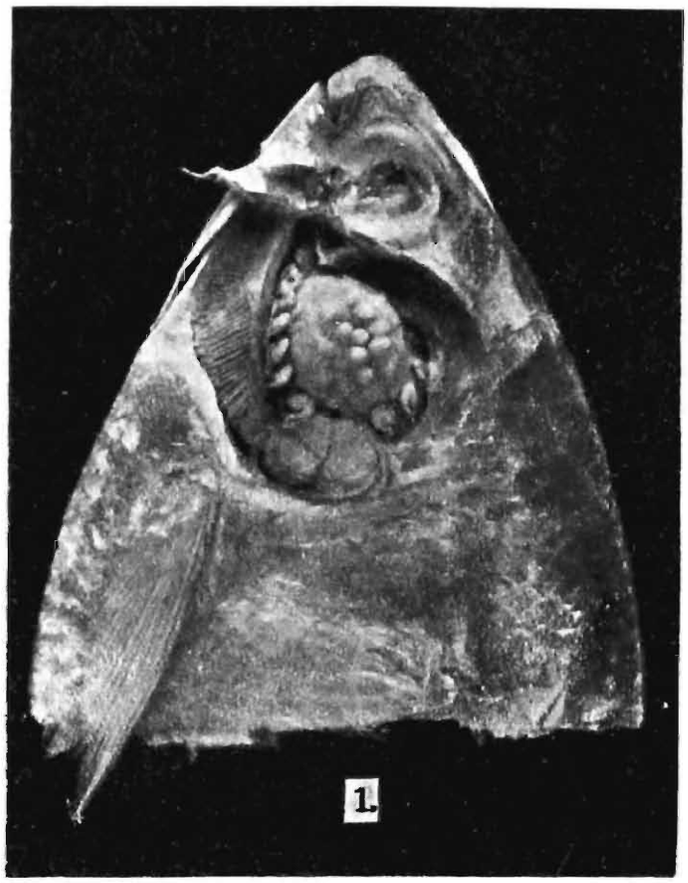
EXPLANATION OF PLATE VI.

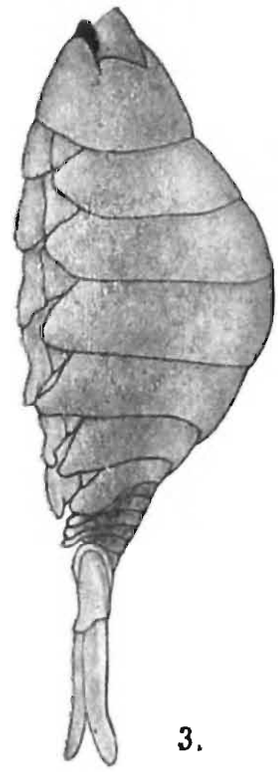
Agarna malayi, sp. nov.

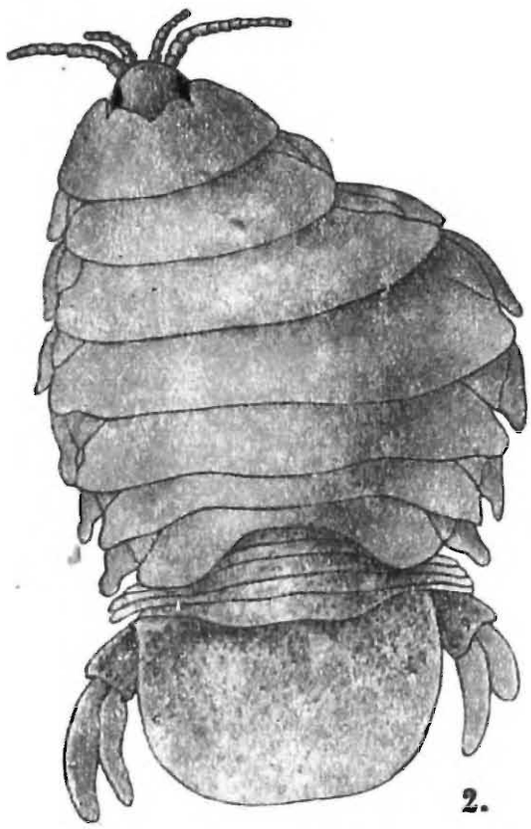
FIG. 1.—Left branchial cavity of *Nematalosa nasus* (Bl.) to show the parasite *in situ* (operculum removed) : × 15.

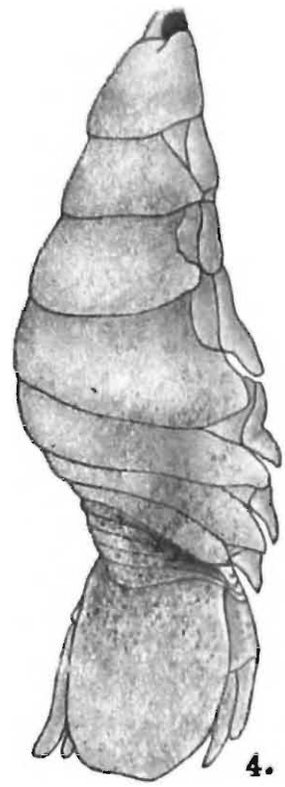
FIG. 2.—Dorsal view of the female of *A. malayi*, sp. nov. × $3\frac{3}{4}$.

FIGS. 3 & 4.—The same viewed from the right side and the left side resp. : × $3\frac{3}{4}$.









Agarna malayi, sp nov.

TAXONOMIC STATUS OF THE CELEBES ASHY-BLACK MONKEY—A REMARKABLE CASE OF CONVERGENCE.

By H. KHAJURIA, *M.Sc., Zoological Survey of India, Indian Museum, Calcutta.*

The ashy-black monkey of Celebes was first described by Ogilby [1] as *Papio ochreatus* [2]. The original description is, however, too inadequate to strictly apply to this monkey, as the most important and conspicuous external character, the extreme reduction of the tail, is not mentioned at all [3]. Sclater [4], however, appears to be sure of the identity of Ogilby's *Papio ochreatus*, and was the first to assign it to the genus *Macaca* after giving a clear definition of its characters. Elliot,[5] realizing the great similarity between the Celebes moor macaque and the form under report, especially with regard to the extreme reduction of tail, separated them under a separate genus, *Magus*, which, as shown by Allen [6], is inadmissible. After a commendable study of the external characters of the Catarrhini, Pocock [7] gave a careful definition of the genus *Macaca* and showed that there was no sound reason for separating the two above-mentioned species under a distinct genus, as proposed by Elliot (*op. cit.*), an opinion readily accepted by subsequent workers; but he (Pocock) appeared to be in favour of recognizing a separate subgenus, *Gymnopyga* Gray, for these forms. The most important point of interest in Pocock's conclusions, however, lies in the fact that his keen observations could not discern any appreciable difference between the two Celebes "macaques" and he remarked "the two forms are probably at most subspecifically distinct." The scope of his observations fully justifies his views which are also supported by those of other workers like Reichenbach [8] and Forbes[9]. In support may also be mentioned a statement by Bartlett (quoted by Murie[10]) who "purchased

[1] Ogilby, W., *Proc. Zool. Soc. London*, p. 56 (1840).

[2] Elliot's (*Rev. Primat.*, II, p. 167, 1913) statement that the species was first described as *Macaca ochreata* is an error.

[3] In this connection it may be pointed out that Ogilby's description of *Papio melanotus* (*Proc. Zool. Soc. London*, 1839, p. 31), barring the supposed locality (Madras), is more applicable to this species, though there is some likelihood of its being confused with the description of *Macaca speciosa* Cuvier also.

[4] Sclater, P. L., *Proc. Zool. Soc. London*, p. 420 (1860).

[5] Elliot, D. G., *Rev. Primat*, II, p. 167 (1913).

[6] Allen, J. A., *Bull. Amer. Mus. Nat. Hist.*, xxxv, p. 50 (1916).

[7] Pocock, R. I., *Proc. Zool. Soc. London*, p. 1569 (1925).

[8] Reichenbach, H. G. L., *Vollstand. Naturg. Affen.*, p. 142, fig. 408 (1862)—not seen in original.

[9] Forbes, H. O., *Handbook Primat.*, p. 12 (1894).

[10] Murie, J., *Proc. Zool. Soc. London*, p. 723 (1872).

two young animals which he, in every way, regarded as representatives of the Bornean Ape (*Macacus inornatus ?=M. maurus*). Much was his astonishment, therefore, to find one of them develop into a typical ashy-black macaque (*M. ochreatus*)". A similar instance has also been given by Sclater [1].

I had also formed an opinion similar to those given above, when I was surprised to find the skull of the ashy-black monkey (Plate I, fig. 2) to be totally different from that of the moor macaque (Plate I, fig. 1). As far as the literature accessible to me shows, no figure of the skull of the former has so far been published, and Elliot's (*op. cit.*) plate alleged to be of the former probably refers to the latter form. The most striking feature of the skull of the ashy-black monkey is the great elongation and flattening of the muzzle in which there is a distinct tendency towards the development of maxillary ridges similar to those present in the skulls of *Cynopithecus* Geoffroy (Plate I, fig. 3) and baboons. Since the latest authoritative definition of the genus *Macaca* as given by Pocock (*op. cit.*) clearly states that the muzzle in this genus is "convex above and without maxillary ridges", the present form cannot be included in the genus. Resemblances with the skull of *Cynopithecus* are considerably more important than those with the other genera; but still the form cannot be considered as a species of that genus as the differences from the only species included in the genus (*C. niger Desmarest*) are much more than those obtaining between the species (see p. 298). It is evident, however, that the ashy-black monkey of the Celebes is more related to *Cynopithecus* than to *Macaca*, and that its remarkable external resemblances with *Macaca maura* Cuvier are of secondary significance. Its affinities with *Cynopithecus* are further attested by the fact that in some young specimens there is a tendency to develop a hairy crest on the crown.

De Beaux [2] describes and figures the penis of a species which he identifies as *Cynopithecus ochreatus* (Ogilby). Pocock (*op.cit.*) is of opinion that as the young ones of *Cynopithecus niger* and the form under discussion are not always easily distinguishable, de Beaux's account probably refers to the former. The original work of de Beaux is not available to me, but I feel almost certain that, though he has not given reasons for transferring this monkey to the genus *Cynopithecus*, he appears to have noticed its affinities with this genus by the study of the male generative organs. Further investigations for the clarification of this point as well as for other anatomical resemblances which this monkey may bear to *Cynopithecus* on one hand and *Macaca* on the other are, however, necessary; and, it is hoped, would be of the utmost interest. But as far as our present knowledge goes it seems reasonable to signify the interesting position of the Celebes ashy-black monkey between the Macaques and the dog-faced monkeys (*Cynopithecus*, baboons, etc.) by distinguishing a separate genus for the species. *Gymnopyga* Gray, having been created for *M. maura*, is unavailable and I, therefore, propose to call it

[1] Sclater, P. L., *Proc. Zool. Soc. London*, p. 223 (1871).
[2] Beaux, O. de, *G. Morf.*, I, fasc. 1, p. 9 (1917).

Cynomacaca, gen. nov.

Muzzle elongated and flattened with a tendency to develop maxillary ridges. Facial profile concave. Adults without hairy crest on crown. Penis, according to de Beaux, without baculum; glans button shaped, short, deep, with their posterior lateral edges convex (not emarginate); shaft attached to glans by very narrow neck.

Genotype.—Papio ochreatus Ogilby.

The principal changes in the taxonomic status of *Cynomacaca ochreata* are indicated below :—

1840. *Papio ochreatus*, Ogilby, *Proc. Zool. Soc. London*, p. 56.

1860. *Macacus ochreatus*, Sclater, *Proc. Zool. Soc. London*, p. 420, pl. lxxxii.

1862. *Macacus maurus ochreatus*, Reichenbach, *Vollstand. Naturg. Affen*· p. 142, fig. 408.

1894. *Macacus maurus*, Forbes, *Handbook Primat.*, p. 12.

1913. *Magus ochreatus*, Elliot, *Rev. Primat.*, II, p. 167, pl. xix.

1917. *Cynopithecus ochreatus* (?), Beaux, *G. Morf.*, I, f. 1, p. 9.

1925. *Macaca maura* (*ochreata*), Pocock, *Proc. Zool. Soc. London*, p. 1560.

The following table, giving the skull measurements [1] and the important characters of *Macaca maura*, *Cynomacaca ochreata*, and *Cynopithecus niger*, will show the distinctness of the three species.

Measurements of skulls.

	Macaca maura	*Cynomacaca ochreata*	*Cynopithecus niger*
Total length . .	147·6	144·8	115·3[2]
Condylobasal length	115·0 (78·0)[3]	116·0 (80·1)	87·0 (75·5)
Zygomatic width . .	95·7 (64·8)	92·7 (64·0)	71·0 (61·6)
Orbital width . .	57·4 (38·1)	57·4 (39·6)	47·1 (40·8)
Maxillary width .	37·5 (25·4)	41·3 (29·9)	31·0 (26·9)
Upper cheek teeth .	43·4 (29·4)	49·1 (33·9)	39·0 (33·8)
Mandibular length .	104·4 (70·7)	102·6 (70·9)	80·0 (69·4)

(Continued on next page.)

Though the phenomenon of convergent evolution is quite widespread in animals, the cases where two different genera may become so closely approximated superficially as to obliterate differences even of subspecific nature and thus mislead even the best experts on the subject,

[1] Measurements are in millimeters and are the shortest distances between the two points defined, that is the measurements of chords. They are taken as follows :—
Total length, measured from anteriormost point on premaxillary symphysis to posteriormost point on occipital surface; *zygomatic width*, greatest distance between outer surfaces of zygomatic arches at right angles to axis of skull; *orbital width*, maximum distance between inner surfaces of outer borders of orbits at right angles to axis of skull; *maxillary width*, measured across outer surfaces of bases of upper canines; *upper cheek teeth*, measured from front of root of upper canine to back of root of last upper molar of that side; *mandibular length*, measured from posteriormost point on mandibular condyle to anteriormost point on symphysis of two rami.

[2] In the case of *Cynopithecus niger*, the skull studied is of a female.

[3] Figure in parenthesis indicates the measurement as a percentage of the total length

Macaca maura	*Cynomacaca ochreata*	*Cynopithecus niger*
Muzzle short, weak, convex above without any indication of maxillary ridges and lateral depressions.	Muzzle long, robust, much flattened above with a distinct tendency towards development of maxillary ridges and lateral depressions.	Muzzle similar to *Cynomacaca ochreata* but maxillary ridges and lateral depressions greatly developed.
Facial profile strongly concave.	Facial profile concave.	Facial profile nearly straight.
Supraorbital ridges highly developed with a very deep depression behind them on sides of cranium.	Supraorbital ridges similar to *Macaca maura*.	Supraorbital ridges very weak and the lateral cranial depressions behind them very shallow.
In the male skull examined sagittal and lambdoidal ridges greatly developed.	Only the lambdoidal ridges developed.	Cranium smooth.
Glans with upper surface long and slightly constricted posteriorly. A well developed baculum.	Glans button-shaped, short, deep with its posterior lateral edge convex (not emarginate). Shaft unique in having no baculum and attached to glans by a very narrow neck.	Not studied.
No hairy crest on crown.	Hairy crest on crown developed on some young ones.	A well marked hairy crest on crown.
Larger, bulky with a macaque-like build. Colour blackish brown.	Similar to *M. maura* but colour in adults turning to ashy-black on certain parts.	Smaller and of slender build. Colour black.

are, I think, very rare, especially among such well known animals as monkeys. The present case, besides furnishing a very instructive case of an extreme degree of convergence, will, it is hoped, also serve as an eye-opener against basing conclusions on external characters alone.

As no critical study of the environment, in which the Celebes monkeys live, has so far been made, it has not been possible to dwell on factors which could possibly bring about this convergence.

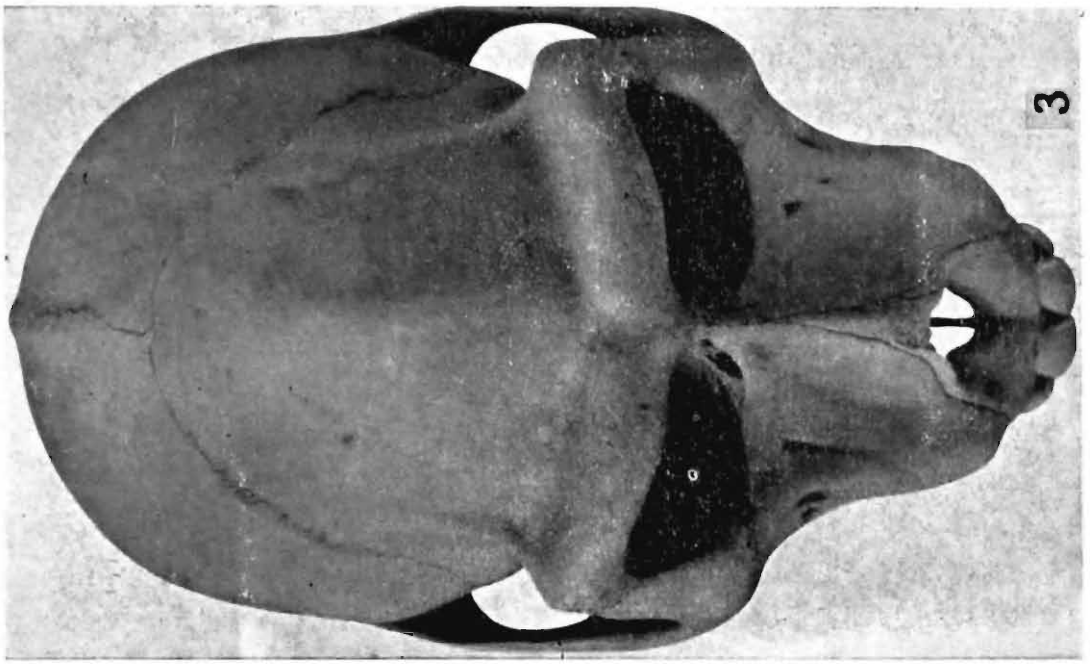
I am much obliged to Dr. S. L. Hora and Dr. B. Biswas of this department for their suggestions.

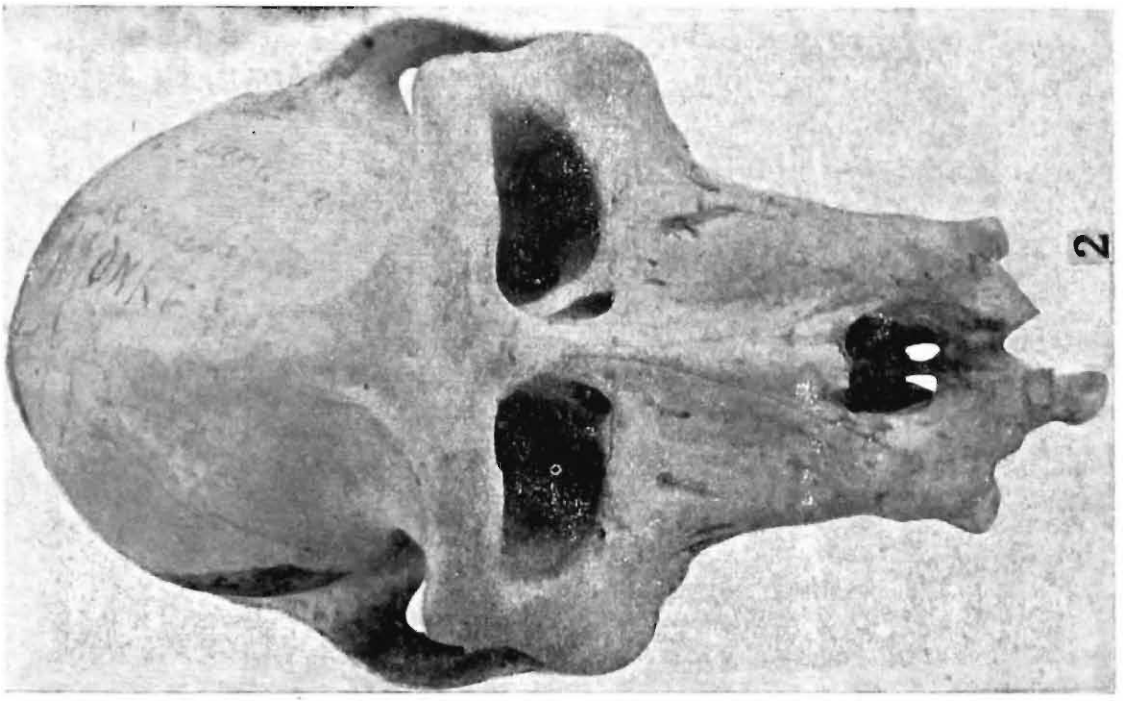
EXPLANATION OF THE PLATE VII.

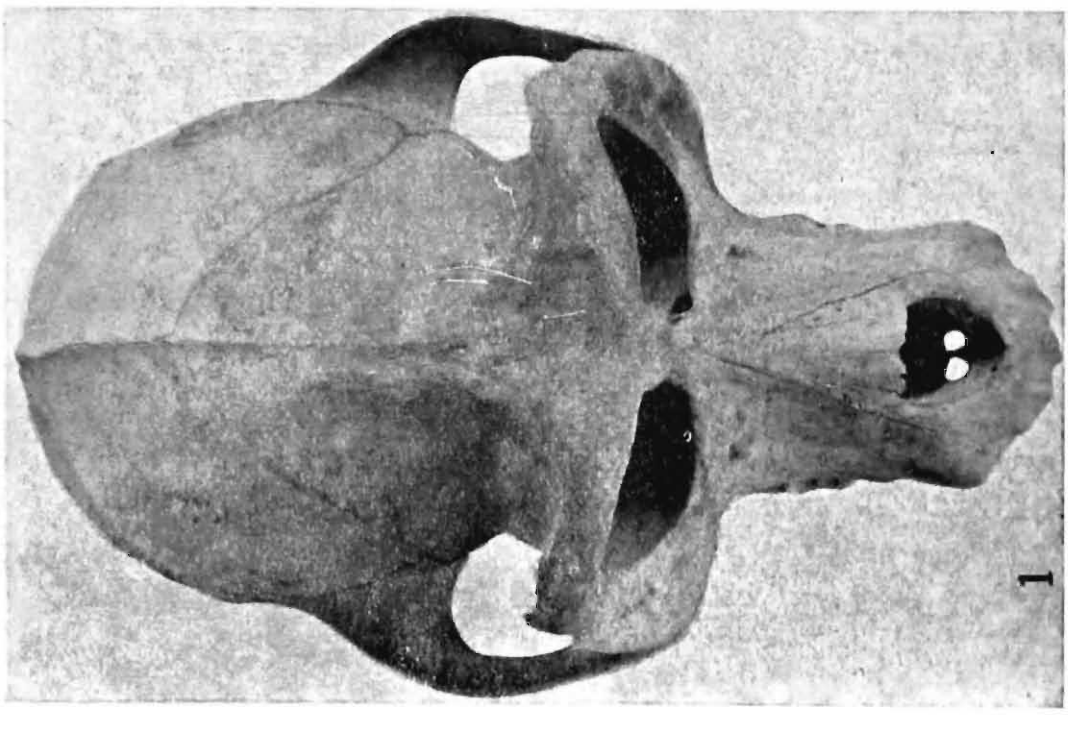
FIG. 1.—Dorsal view of the skull of *M. maura*: × *ca* $\frac{7}{10}$. Z. S. I. Reg. No. 11921.

FIG. 2.—Dorsal view of the skull of *Cynomacaca ochreata*: × *ca* $\frac{7}{10}$. Z. S. I. Reg. No. 12015.

FIG. 3.—Dorsal view of *Cynopithecus niger*: × *ca* $\frac{9}{10}$. Z. S. I. Reg. No. 11881.







Skulls of Celebes monkeys.

SIX NEW SPECIES OF GALL MIDGES (ITONIDIDAE : DIPTERA) FROM INDIA

By S. N. Rao, *M.Sc., Ph. D., F. R. E. S., U. P. Government Research Associate, School of Entomology, St. John's College, Agra.*

The type specimens are deposited in the collections of the Zoological Survey of India, Calcutta.

I thank Prof. M. S. Mani for guidance and facilities for work.

Subfamily. LESTREMIINAE

Tribe. LESTREMIINI

Genus. **Anarete** Haliday

1833. *Anarete*, Haliday, *Ent, Mag.*, 1 : 156.
1913. *Microcerata*, Kieffer, *Gen. Ins.*, 152 : 309.
1938. *Anarete*, Edwards, *Proc. R. ent. Soc. London*, 7(B) :28.
1951. *Anarete*, Pritchard, *Univ. Calif. Publ. Ent.*, 8(6) :258.

Palpi tri-or quadriarticulate ; antenna with 8—10 or 11 segments ; second antennal segment greatly enlarged, subglobose ; R_1 and R_5 united as though by very short R_5, fork of vein M_{1-2} even, claw simple.

Genotype : *Anarete perplexa* (Felt)

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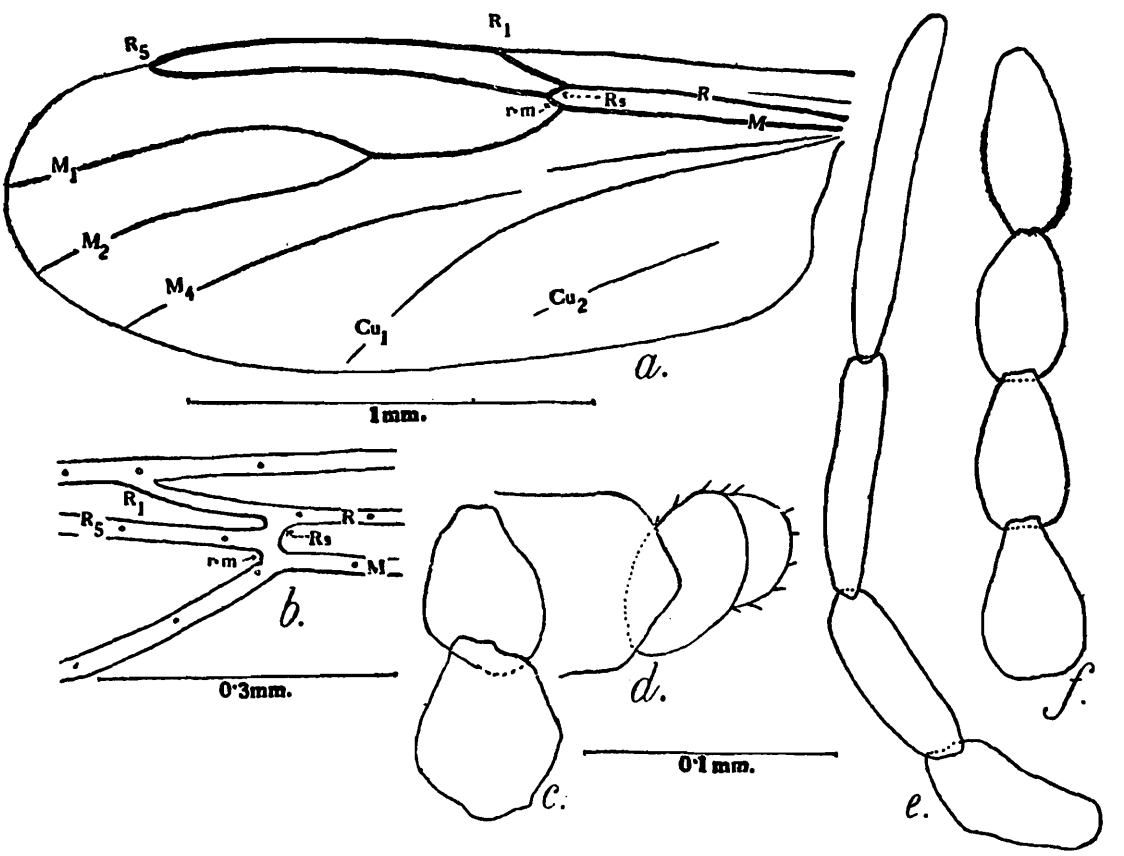
Edwards (*loc. cit.*) considers *Microcerata* Felt to be identical with this genus.

This genus now stands without any Indian species, as *Anarete calcuttaensis* Nayar and *A.* (*Microcerata*) *indica* (Mani) have been transferred by Pritchard to *Conarete* Prtichard (*loc. cit.*).

Anarete manii, sp. nov.

♀ Length 1·8 mm. Dark brown. Eyes confluent above. Palpi (Text-fig. 1, *e*) quadriarticulate, long, moderately setose, light brown, first segment subcylindrical, very slightly narrowed at base, shortest of all length one and one-fifth the thickness in middle, widest at the apical three-fourths ; second segment cylindrical, one and one-third the length of first, thrice its own thickness ; third segment one and one-fourth longer than second, length nearly four times its own thickness ; fourth segment longest of all, one and a half times as long as third and six times as long as thick. Antenna brownish-yellow, a little over one-fourth the length of the body, segments nine, subcylindrical, very sparsely setose, without basal but with very short apical stems ; first two antennal segments invisible in the preparation ; third segment (Text-fig. 1,*c*) widest in middle, length one and two-thirds the maximum thickness ; fourth

segment (Text-fig. 1, *c*) shorter than third, length nearly one and one-fourth the maximum thickness ; fifth segment very slightly narrower and shorter than second, length one and one-third the thickness, sixth segment (Text-fig. 1, *f*) similar to the fifth ; seventh segment (Text-fig. 1, *f*) narrower than sixth, length nearly one and a half times the maximum thickness ; penultimate segment (Text-fig. 1, *f*) as long as the eighth but slightly narrower, length a little less than twice the thickness ; terminal segment (Text-fig. 1, *f*) nearly as long as the third, longer than the penultimate, nearly two and a half times its own thickness. Mesonotum dark brown. Scutellum and post-scutellum slightly paler. Halteres brownish. Abdomen light brown. Wings (Text-fig. 1, *a*) hyaline, nearly rectangular, length a little less than twice the width, microtrichia spread rather thickly on the veins,



TEXT-FIG. 1. *Anarete manii*, sp. nov. *a*. Wing ; *b*. Portion of wing enlarged ; *c*, Third and fourth antennal segments ; *d*. Ovipositor ; *e*. Palpi ; *f*. Terminal four antennal segments.

wing margin interrupted immediately beyond the union of R_5 with costa, rest of the details in (Text-fig 1, *a*, *b*). Legs short, brown, sparsely clothed with setae, tarsi quinquiarticulate, metatarsus long, nearly as long as the rest of the tarsal segments combined, length two and half times the second tarsal segment. Claw stout, dark blackish-brown, simple, evenly curved. Empodium nearly half the length of the claw. Ovipositor (Text-fig. 1, *d*) exserted, terminal lobes elongate oval.

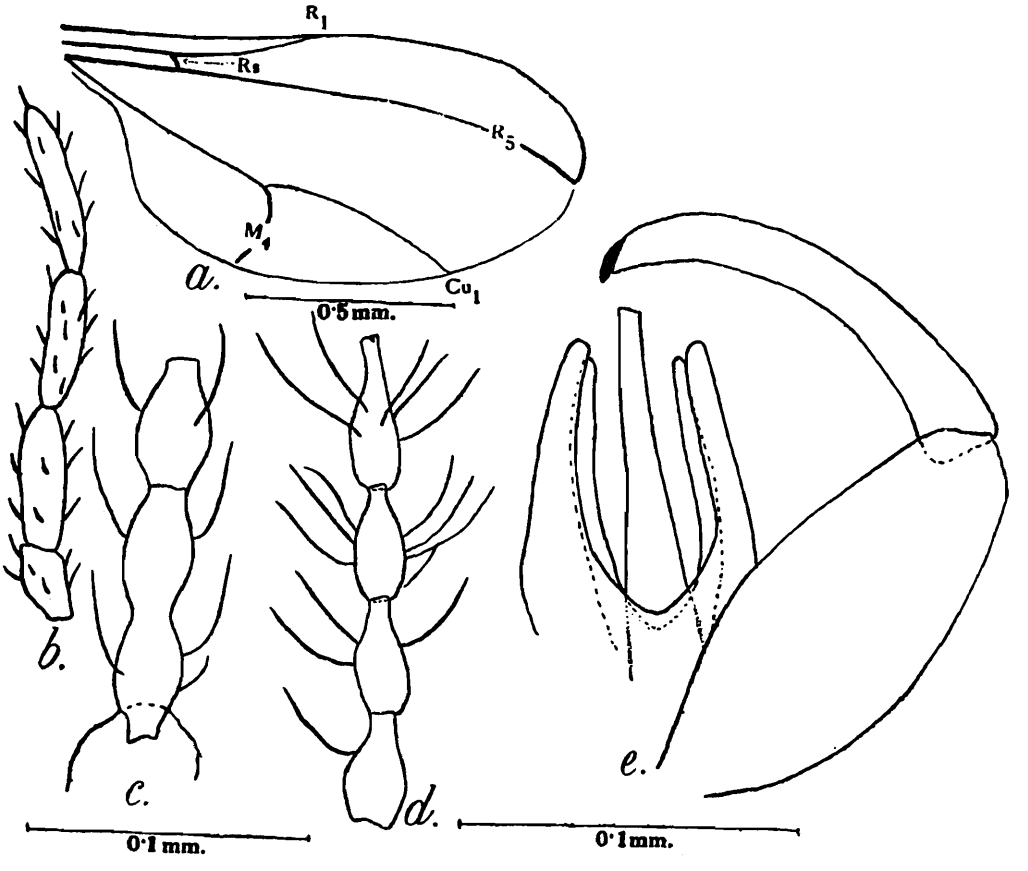
Holotype 1 ♀ on slide No. 2159/H6. " On wing, Zoology Research Laboratory, St. John's College, Agra, M. S. Mani coll., 27. iii. 1950 ".

Paratype 1 ♀ on slide in the collections of the author. " On wing Zoology Research Laboratory, St. John's College, Agra, S. N. Rao coll., 27. iii. 1950 ".

Subfamily. HETEROPEZINAE

Haplusiella indica, sp. nov.

♂ Length 1·10 mm. Yellowish-brown. Eyes confluent above. Trophi elongate. Palpi (Text-fig. 2, *b*) quadriarticulate, whitish-brown, long, sparsely hairy, first segment nearly cylindrical, shortest of all, slightly wider subapically, length one and three-fourths the maximum thickness; second segment a little less than twice the length of the first, cylindrical, length four times the thickness, very slightly narrowed at the extremeties; third segment nearly equal to the second, but narrower, length four and a half times the thickness; fourth segment cylindrical, ends bluntly tapering, longest of all, length a little over six times the median thickness. Antenna light brown, a little longer than half the length of the body, 15-segmented, sparsely hairy, elongate-oval



Text-fig. 2. *Haplusiella indica*, sp. nov. *a*. Wing; *b*. Palpi; *c*. Second to fifth antennal segments; *d*. Twelfth to fifteenth antennal segments; *e*. Genitalia.

with very short apical stems and gradually becoming shorter and slender towards the tip; first two antennal segments invisible in the preparation. Third antennal segment (Text-fig. 2, *c*) confluent with the fourth length a little over twice the thickness, with a very short basal stem, fourth segment (Text-fig 2, *c*) similar to the third with a very short apical stem, fifth segment (Text-fig. 2, *c*) slightly shorter than the fourth, twice as long as thick; sixth segment similar to the fifth; thirteenth segment (Text-fig. 2, *d*) shorter than the sixth, length a little over twice the thickness, apical stem slightly longer than that of the basal segments; penultimate segment (Text-fig. 2, *d*) equal to the eleventh; terminal segment longest of all with an elongately-oval basal and a teat-like apical portions, length of enlargement a little

over twice the thickness, teat nearly half the length of the enlargement and two and a half times as long as thick. Mesonotum brown. Scutellum and postscutellum lighter. Abdomen whitish yellow. Halteres whitish basally and brownish apically. Wings (Text-fig. 2, *a*) hyaline, two and one-fourth times as long as broad, with three pale brown, long veins, costa sparsely setose throughout, R_1 uniting with costa a little before the middle, R_5 distinct and making an obtuse angle with R_5, the latter reaching the wing margin well beyond the apex, slightly curved distally, interrupting the costa at its union; M_4-*m-cu* forked. Legs very long, slender, thickly clothed with short setae, metatarsus nearly equal to the fifth tarsal segment, second tarsal segment nearly equal to the following segments combined. Claw pectinate with five teeth. Empodium shorter than claw. Genitalia (Text-fig. 2, *c*) : basal clasp segment simple, stout, short, twice as long as thick, terminal clasp segment long, slender, length nine times its median thickness, evenly curved, ending in a brown, blunt tooth. Dorsal plate a little longer than the basal clasp segment, broad deeply cleft in the middle almost upto the base, lobes long, narrow ; ventral plate narrower and slightly shorter than the dorsal plate, deeply cleft in the middle, almost to the base, style a little longer than the dorsal plate, broader basally than at apex, length nearly seven times the median thickness.

Holotype 1 ♂ on slide No. 2160/H6 "At light, Bishop French Hostel St. John's College, Agra, S. N. Rao coll., June 1949"

This species differs from *H. pectiniclava* Rao* in the yellowish-brown colour of the body and the differences in the palpi and genitalia.

Subfamily. ITONIDIDINAE.

Tribe TRIFILINI

Diplodontomyia orientalis Rao

1949. *Diplodonto nyia orientalis*, Rao, *Indian J. Ent.*, 11(2): 120

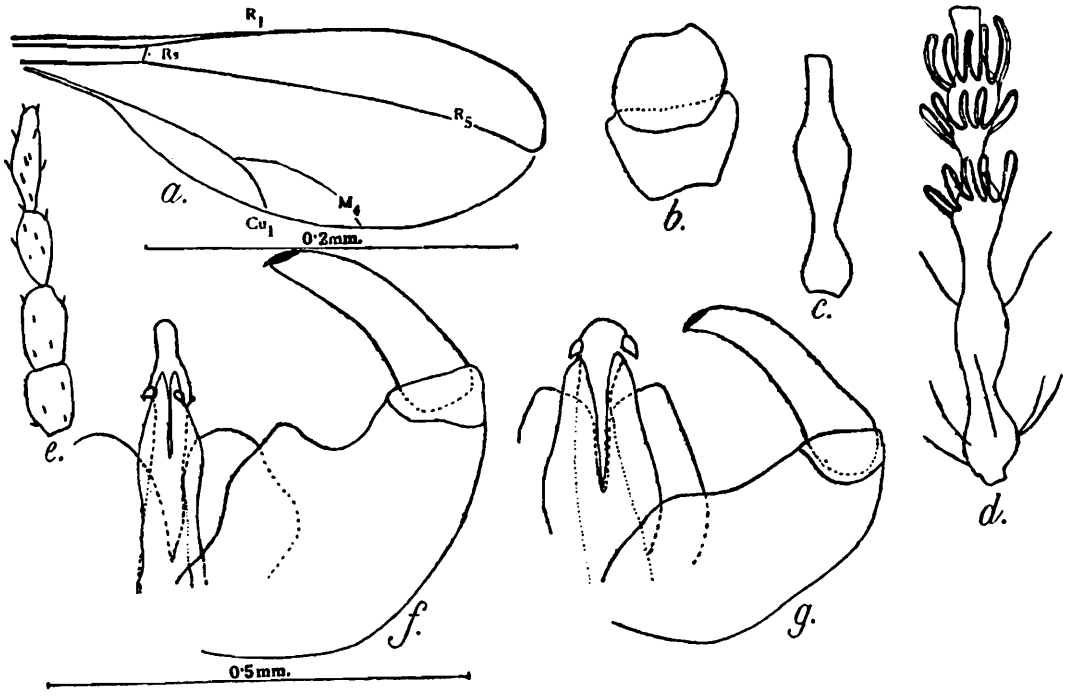
This species was described by me from a single ♂ taken at light by Prof. Mani at Hwett Park, Agra in 1947. I reexamined my type slide and amend my original description of the genitalia as in Text-fig. 3, *g*.

Diplodontomyia deepica, sp. nov.

♂ Length 1·0 mm. Light yellowish-brown. Eyes confluent above. Palpi (Text-fig. 3, *e*) quadriarticulate. Yellowish-white, sparsely setose, first segment cylindrical, shortest of all, length one and two thirds the thickness, second segment longer than the first, twice as long as thick, third segment slender than second, fourth segment longest, cylindrical, one and half times as long as the third and thrice as long as thick. Antenna pale yellow, broken, flagellate segments binodose, with two whorls of long pale-yellow, slender setae and three whorls of circumfilae ; first antennal segment (Text-fig. 3, *b*) short, pale yellow, widest at apex, width at apex two and a half times the length, second segment (Text-fig. 3, *b*) short, pale yellow, globose; third segment (Text-fig. 3, *d*) confluent with the fourth, seven times as long as the

*Rao, S. N. 1952, *Proc. R. Ent. Soc. London*, 21 (3-4): 49.

first, basal enlargement subglobose, basal stem half the length of the basal enlargement, one and one-third as long as thick, apical enlargement one and one-fourth the basal enlargement and nearly one and half times its maximum width, apical stem half the length of the apical enlargement, slightly longer than the basal stem, one and two-thirds as long as thick. Fourth segment (Text-fig. 3, *d*) as long as the third, basal enlargement slightly wider than long, subglobose, length of basal stem slightly less than that of the basal enlargement, and one and two-thirds its own thickness, apical enlargement one and two thirds the basal enlargement, one and half times as long as thick, widest at the apical three-fourths, apical stem slightly longer than the basal and twice as long as thick. Fifth segment (Text-fig. 3, *c*) a little longer than the fourth, but somewhat more slender, basal enlargment nearly globose, basal stem twice as long as thick, as long as the basal enlargement, apical enlargement one and half times the basal enlargement, and also of its



TEXT-FIG. 3. *Diplodontomyia deepica*, sp. nov. *a*. Wing; *b*. First two antenna segments; *c*. Fifth antennal segment; *d*. Third and fourth antennal segments; Palpi; *f*. Genitalia ; *g*. *Diplodontomyia orientalis* Rao-Genitalia.

own thickness, apical stem a little over twice its own thickness and a little longer than the basal stem. Sixth segment similar in all proportions to the fifth. Mesonotum yellowish-brown. Scutellum and post-scutellum light yellow. Abdomen light yellow. Halteres pale yellowish-white. Wings (Text-fig. 3, *a*) hyaline, thrice as long as broad, costa interrupted at its union with R_5, the latter reaching the wing margin at apex, and slightly bent distally. R_5 very distinct, M_4-*m-cu* forked, veins obsolete. Legs long, light yellow, sparsely clothed with hairs, metatarsus nearly equal to the fifth tarsal segment, second segment longest of all, but shorter than the rest of the segments combined, third segment half the second. Claw simple, yellowish-brown, bent at right angles, empodium rudimentary. Genitalia (Text-fig. 3, *f*) basal clasp segment short, stout, length a little less than or twice the thickness, with a small triangular lobe basally ; terminal clasp segment stout, shorter than the

basal clasp segment, thickest at base and gradually tapering towards the tip and ending in a blunt tooth, very slightly curved, length four times its thickness in the middle; dorsal plate narrow, broadened subapically, longer than the ventral plate, deeply incised, lobes pointed apically, thickened and fringed with spines on the margins; ventral plate deeply incised in the middle, lobes bluntly rounded apically, apical and ventral margins of lobes thickened with innumerable spines.

Holotype 1 ♂ on slide No. 2161/H6. " At light, Bishop French Hostel, S. N. Rao coll., Agra, June 1949 "

This species differs from *D. orientalis* Rao* in the different porportions of the stems and enlargements of the antennal segments, in the differences in the palpal segments, in the rudimentary empodium, in the basal clasp segment having a rather prominent lobe, in the rounded apical margins of the ventral plate, in the subapical arrangement of the teeth on the style and in the yellowish-brown colour of the body.

Genus **Charidiplosis** Tavares

1918. *Charidiplosis*, Tavares, *Broteria*, 16 : 80.
1925. *Charidiplosis*, Felt, *Bull. N. Y. St. Mus.*, 257 : 166.
1929. *Charidiplosis*, Felt, *Lingnan Sci. J.*, 7 : 453.
1945. *Charidiplosis*, Mani, *Indian J. Ent.*, 7 : 221.

Palpi quardriarticulate. Antenna with 14 segments, flagellate segments all binodose, with three whorls of circumfilae and two whorls of setae, loops of the circumfila all of the same length in a single whorl. Wings hyaline, vein *Rs* wanting, R_5 reaching the wing margin beyond apex. Legs long, thickly clothed with setae, claw simple, bent at right angles. Basal clasp segment with a triangular lobe, terminal clasp segment shorter than basal clasp segment, slender, dorsal plate broad, deeply notched; ventral plate longer than dorsal plate, style longer than ventral plate.

Genotype : *Charidiplosis concinna* Tavares

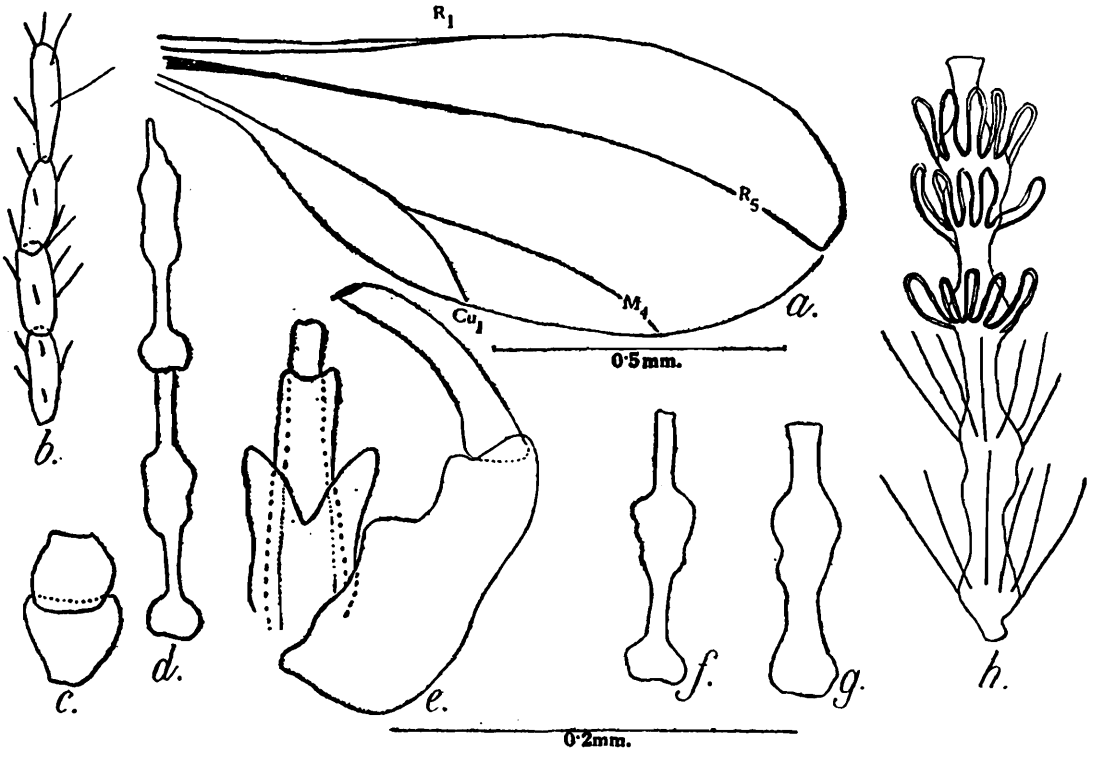
This is the first record of the genus from the Old World.

Charidiplosis indica, sp. nov.

♂ Length 1·3 mm. Brown. Eyes confluent above. Trophi slightly produced. Palpi (Text-fig. 4, *b*) quardriarticulate, pale brown, sparsely setose, first segment cylindrical, shortest, length nearly twice the thickness, second segment cylindrical, equal to the first, stouter, less than twice its own thickness, third segment cylindrical, as long as but slightly narrower than the second, length three and one-third the thickness, fourth segment subcylindrical, narrower basally than at apex, longest of all, length four times the median thickness. Antenna brown, nearly one and one-fourth the length of the body, segments 14, flagellate segments all binodose, basal enlargements globose, with one whorl of long setae and a whorl of circumfila, apical enlargements with a slight constriction a little before the middle, with one whorl of setae and two

*Rao, S. N. 1949. *Indian J. Ent.*, 11(2) : 120.

whorls of circumfilae, segments gradually becoming narrower towards the apex; first segment (Text-fig. 4, *c*) brown, wider apically than at base, length four-fifths the width at apex; second segment (Text-fig. 4, *c*) globose, as long as the first; third segment (Text fig. 4, *h*) confluent with the fourth, with a small stem at the extreme base, basal enlargement globose, basal stem shorter than the basal enlargement, length nearly one and a half times the thickness, apical enlargement longer than the basal, length a little less than twice the thickness, apical stem longer than the basal stem, length twice the thickness; fourth segment (fig. 4, *h*) as long as the third, basal enlargement globose, basal stem slightly shorter than the basal enlargement, length a tittle less than twice the thickness, apical enlargement less than twice the basal enlargement and a little less than twice its own thickness, apical stem longer than the basal stem, three-fourths the length of the apical



Text-fig. 4. *Charidiplosis indica*, sp. nov. *a*. Wing; *b*. Palpi; *c*. First two antennal segments; *d*. Terminal two antennal segments; *e*. Genitalia; *f*. Eleventh antennal segment; *g*. Fifth antennal segment; *h*. Third and fourth antennal segments.

enlargement and two and two-thirds its own thicnkess; fifth segment(Text-fig. 4, *g*) slightly shorter than the fourth, basal enlargement wider than long, subglobose, length of basal stem two and one-third the thickness, apical enlargement one and a half times the length of the basal enlargement, and also of its own thickness, apical stem as long as the apical enlargement, thrice as long as thick; seventh segment very slightly shorter than the fifth, basal enlargement wider than long, length five times the thickness, length of basal stem two and one-third the thickness, apical enlargement one and a half times as long as thick, apical stem as long as the apical enlargement, thrice as long as thick; penultimate segment (Text-fig. 4, *d*) slightly shorter than the terminal segment, basal enlargement wider than long, basal stem three and a half times as

long as thick, apical enlargement a little less than twice the length of the basal enlargement, and also of its own thickness, apical stem as long as the apical enlargement, six times as long as thick; terminal segment (Text-fig. 4, *d*) slightly longer than the penultimate segment, basal enlargement wider than long, length nearly two-thirds the thickness, basal stem long, four times as long as thick, apical enlargement more than twice the basal enlargement, a little less than thrice its own thickness, apical stem wider at base, length nearly three and a half times the thickness. Mesonotum brown. Scutellum and postscutellum lighter. Abdomen yellow. Halteres pale yellow. Wings (Text-fig. 4, *a*) hyaline, a little over twice as long as broad, with three long veins, costa sparsely setose, R_1 uniting with costa about the basal one-third, R_5 reaching the wing margin well beyond the apex, R_5 wanting M_4-*m-cu* forked, the fork faint. Legs long, yellowish-brown, thickly clothed with setae, metatarsus slightly shorter than the fifth tarsal segment, second segment longest of all, shorter than the following segments combined. Claw brown, slender, bent at right angles. Empodium shorter than claw. Genitalia (Text-fig. 4, *e*) yellowish, basal clasp segment with an inner triangular lobe, three and a half times as long as broad, terminal clasp segment short, slender, evenly curved and tapering in a blunt tooth at apex, length seven times the thickness in the middle. Dorsal plate broad, broadly and deeply incised in the middle, fringed with small setae; ventral plate narrower, nearly one and a half times the dorsal plate, very shallowly incised at apex; sytle longer than the ventral plate, nearly seven times as long as thick.

Holotype 1 ♂ on slide No. 2158/H6. " At light, Zoology Research Laboratory, St. John's College, Agra, S. N. Rao coll., 31×1950.".

Genus **Macrodiplosis** Kieffer

1877. *Diplosis* (Partim), Fr. Löw, *Verh. Zool.-bot. Ges. Wien.*, 27 : 14.
1886. *Cecidomyia* (partim), Liebel, *Zeitscher. f. Naturwiss.*, 59 : 563.
1895. *Macrodiplosis*, Kieffer, *Bull. Soc. Ent., France*, 64 : 194.
1913. *Macrodiplosis*, Kieffer, *Gen. Ins.*, 152 : 222.
1925. *Macrodiplosis*, Felt, *Bull. N. Y. St. Mus.*, 257 : 165.
1929. *Macrodiplosis*, Felt, *Lingnan Sci.* J., 7 : 425.
1945. *Macrodiplosis*, Mani, *Indian J. Ent.*, 7 : 221.

Palpi quadriarticulate. Eyes confluent. Flagellar segments in ♂ with a basal subglobose and an apical elongate enlargements. Vein R_5 curved and reaching the wing margin at apex. Claw simple, slightly curved, longer than empodium. Basal clasp segment slightly swollen basally with an internal lobe. Terminal clasp segment large. Lobes of the dorsal plate subtriangular. Ovipositor elongately exserted.

Genotype : **Macrodiplosis dryobia** (Fr. Löw)

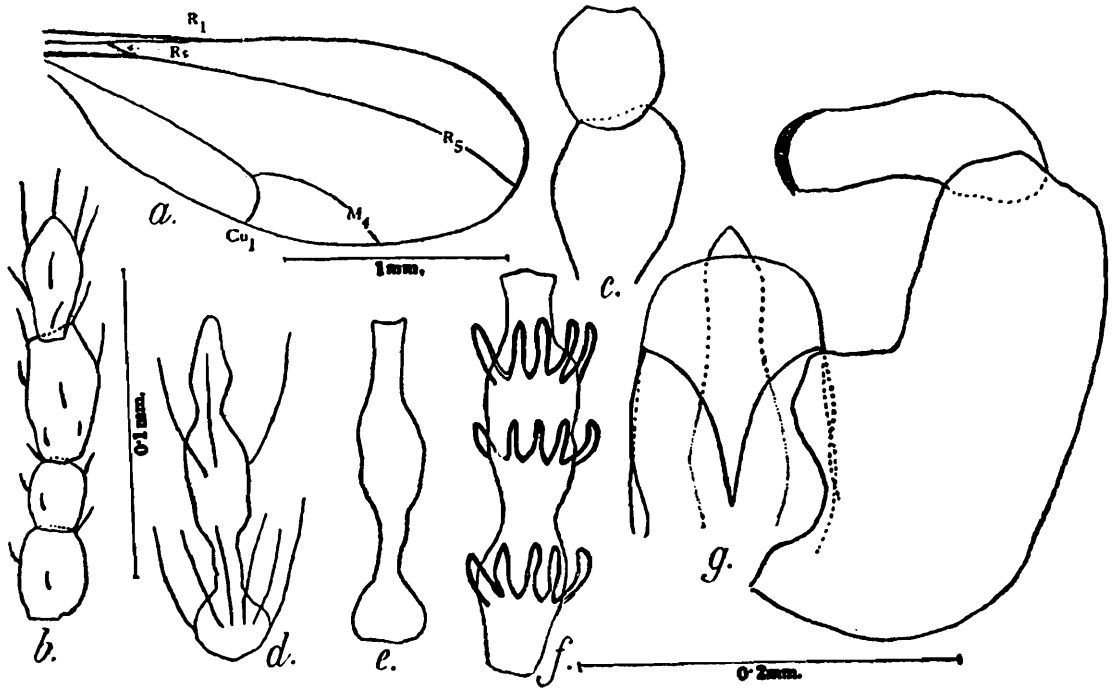
This genus is being recorded here for the first time from India. I describe below a new species from two ♂♂ taken on wing at Dehra Dun.

Macrodiplosis visvanathi, sp. nov.

♂ Length 2·1 mm. Dark brown. Eyes confluent above. Palpi (Text-fig. 5, *b*) quadriarticulate, short, very finely setose and very

sparsely hairy, yellowish-brown, first segment cylindrical, length one and two-fifths the thickness, second segment cylindrical, shorter than the first, one and a half times as long as thick; third segment subcylindrical, thickest at the middle, one and a half times as long as the second and a little less than twice its own thickness; terminal segment longest, twice as long as thick, thickest in the middle. Antenna nearly equal to the length of the body, brown, segments 14, flagellate segments all binodose,with two whorls of long setae, one on the basal enlargement and the second on the apical enlargement, with three whorls of short circumfilae, first antennal segment (Text-fig. 5, *c*) brown, wider apically than at base, length four times the maximum width; second segment (Text-fig. 5, *c*) globose, brown; third segment (Text-fig. 5, *f*) not confluent with the fourth, one and a half times the length of the first and second segments combined, basal enlargement cylindrical, thickest in the middle, ends, tapering, length nearly one and a half times the median thickness, basal stem very short, wider than long, nearly one-fourth the length of the basal enlargement, length a little less than half the thickness apical enlargement as long as the basal, but slightly slender, very slightly wider at apcial three-fourths length nearly one and a half times the maximum thickness, apical stem longer than the basal stem, two-fifths the length of the apical enlargement, one and two-fifths as long as thick; fourth segment (Text-fig. 5, *e*) slightly shorter than the third, basal enlargement globose, basal stem three-fifths the length of the basal enlargement, one and one-fifth as long as thick, apical enlargement nearly equal to the basal enlargement and basal stem combined, length a little over one and a half times its thickness in the middle, very slightly wider at the apical three-fourths, apical stem one and a half times longer than the basal stem, a little over half the length of the basal enlargement, and a little less than twice as long as thick; fifth segment very slightly longer than the fourth, basal enlargement globose, basal stem four-fifths the basal enlargement, and one and two-fifths as long as thick, apical enlargement twice the length of the basal stem, and one and two-fifths as long as thick, apical stem two and one-fourth times as long as thick; seventh segment as long as the fifth, basal enlargement globose, basal stem a little less than the basal enlargement, length a little less than thrice the thickness, apical enlargement one and a half times the length of the basal enlargement, length one and two-thirds the thickness, apical stem two-thirds the length of the apical enlargement and two and a half times its own thickness; eleventh segment slightly shorter than the seventh, basal enlargement wider than long, length of basal stem a little less than thrice the thickness; twelfth segment very slightly shorter than the eleventh, basal enlargement sub-globose, length a little greater than the thickness, basal stem nearly twice as long as thick, apical enlargement a little less than twice the basal enlargement and nearly twice its own thickness, apical stem two and one-fourth the thickness; penultimate segment as long as the twelfth, basal enlargement globose, length of basal stem two and two-thirds the thickness, apical enlargement nearly one and a half times the length of the basal enlargement and a little

less than twice its own thickness, apical stem longer than the basal stem, length a little over two and a half times the thickness; terminal segment slightly longer than the penultimate (Text-fig. 5, *d*), basal enlargement wider than long, length of basal stem a little over twice the thickness, apical enlargement twice the basal enlargement, twice its own thickness, length of apical stem two and a half times its own thickness. Mesonotum dark brown, scutellum and postscutellum lighter. Abdomen brown. Halteres brown. Wings (Text-fig. 5, *a*) hyaline, length two and one-third the width, with three long brown veins, costa sparsely setose, R_1 joining the costa at its basal third, R_5 slightly curved distally, reaching the wing margin well beyond the apex, *Rs* wanting, M_4-*m-cu* forked. Legs long, brown, metatarsus three-fourths the length of the fifth tarsal segment, second tarsal



TEXT-FIG. 5. *Macrodiplosis visvanathi*, sp. nov. *a*. Wing; *b*. Palpi; *c*. First two antennal segments; *d*. Terminal antennal segments; *e*. Fourth antennal segment; *f*. Third antennal segment; *g*. Genitalia.

segment longest of all, shorter than the following segments combined. Claw simple, well developed, dark brown, curved at the distal third, empodium equal to claw. Genitalia (Text-fig. 5, *g*) brown, very sparsely hairy, basal clasp segment swollen basally with a small triangular lobe, length two and two-fifths the median thickness, terminal clasp segment short, stout, slightly narrowed distally, thrice as long as thick, ending in a dark brown blunt tooth; dorsal plate broad, short, deeply notched in the middle, lobes narrowed, tips of lobes pointed; ventral, plate broad, long, longer than the dorsal plate, laterally and subapically emarginate, with short stiff setae, style a little longer than the ventral plate, nearly five times as long as the median thickness, slightly wider at base than at apex.

Holotype 1 ♂ on slide No. 2157/H6. "At light, Officers' Guest House Indian Forest Research Institute, Dhera Dun, M. Visvanath coll., 7. vii 1950".

Paratype 1 ♂ on slide in the author's personal collection.

Genus **Microplecus** Kieffer

1913. *Microplecus*, Kieffer, *Bull. Soc. Hist. Nat. Metz.*, 28 : 107.
1913. *Microplecus*, Kieffer, *Gen. Ins.*, 152 : 190.
1925. *Microplecus*, Felt, *Bull. N. Y. St. Mus.*, 257 : 170.
1929. *Microplecus*, Felt, *Lingnan Sci. J.*, 7 : 456.
1945. *Microplecus*, Mani., *Indian J. Ent.*, 7 : 225.

Palpi (not counting the palpiger) with three short segments. Flagellate segments unequally binodose, basal enlargements globose, with one whorl of circumfila and setae, the circumfila not reaching one-fourth the setae, terminal enlargements oval, with two whorls of circumfila and setae, the circumfila not reaching one-fourth the setae ; third and fourth antennal segments connate, the third without stem, slightly longer than the fourth. R_5 slightly curved, reaching the margin at apex. Claw small, simple, empodium very short. Basal clasp segment with a chitinous, spinous, mediun process in the middle. Terminal clasp segment very slender, gradually reduced, curved, rarely sparsely covered with short setae, dorsal plate bilobed, the lobes rounded, ventral plate longer, gradually widened apically and broadly rounded, style very long, cylindrical and truncate, the tip chitinised, crenulated ventrally and uniformly curved dorsally.

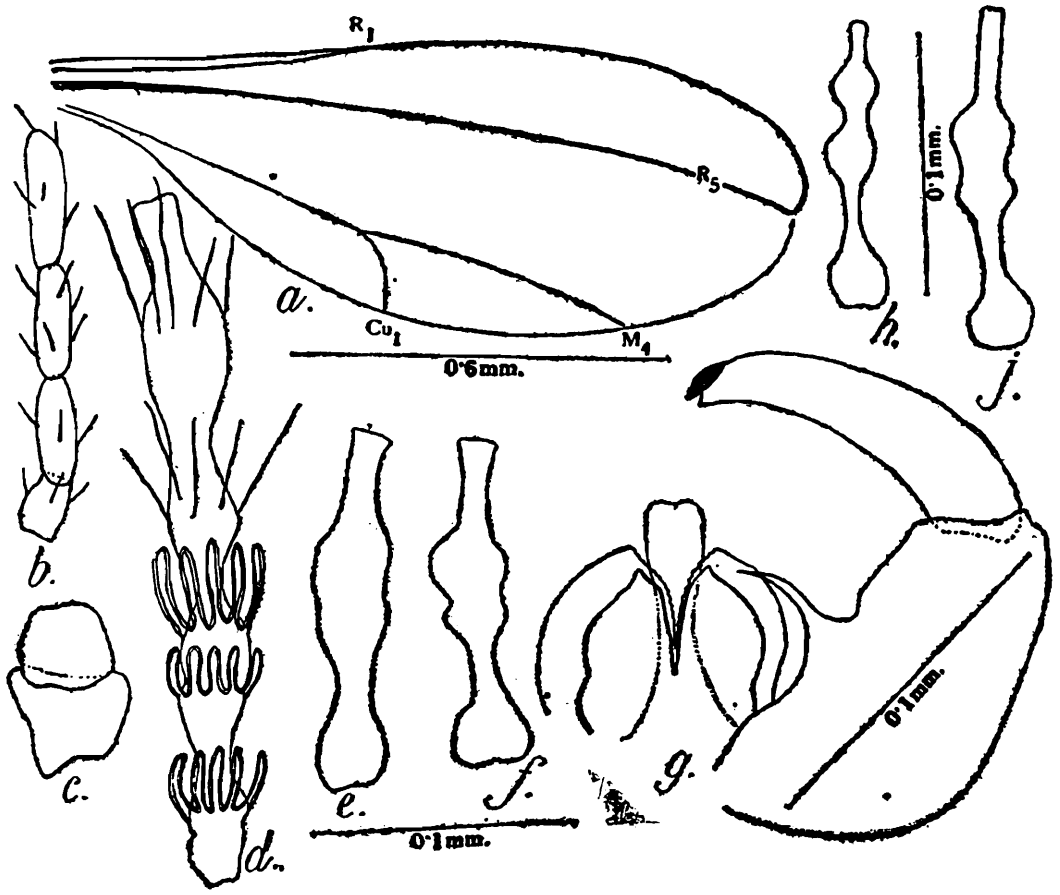
Genotype: **Microplecus brevipalpi** Kieffer

This monotypic genus so far known only from East Africa is being recorded here for the first time from India.

Microplecus longipalpi, sp. nov.

♂ Length 1·3 mm. Brown. Eyes confluent above. Palpi (Text-fig. 6, *b*) counting the palpiger, quadriarticulate, pale brown, sparsely haired first segment subcylindrical, shortest, very slightly narrowed at apex, length one and one-fourth the thickness, second segment cylindrical, little less than twice the first, thrice its own thickness, third segment as long as the second, but slightly narrow, thrice as long as thick, fourth segment longest of all, slightly broader apically than at base, one-third longer than the third segment and four times as long as thick. Antenna pale brown, longer than body, with 14 segments, flagellate segments binodose, with three whorls of circumfilae, two whorls of setae, the setae long, circumfila as long as or a little longer than the diameter of the enlargements, basal enlargements globose, apical enlargements cylindrical, but with a slight constriction in the middle suggesting the close union of two small, similar segments, this condition more pronounced in the terminal segments where the segments are almost trinodose (Text-fig 6, *h*, *j*). First antennal segment (Text-fig. 6, *c*) pale brown, widest at apex, length one and one-fourth the width at apex ; second segment (Text-fig. 6, *c*) pale brown, subglobose, length three-fourths the width ; third segment (Text-fig. 6, *d*) confluent with the fourth, basal enlargement subglobose, length a little over the median thickness, basal stem a little less than half the length of the basal enlargement and one-third its own thickness,

apical enlargement a little longer than the basal, and one and two-thirds as long as thick, apical, stem slightly longer than the basal, half the length of the apical enlargement, and one and two-thirds its own thickness; fourth segment as long as the third, basal enlargement slightly shorter and narrower than that of the third segment, length one and three-fourths the thickness, basal stem half the length of the basal enlargement, and one and one-third the thickness, apical enlargement longer than the basal, length one and two-thirds the thickness, apical stem three-fifths the length of the apical enlargement and twice its own thickness; fifth segment (Text-fig. 6, *e*) very slightly shorter than the fourth, basal enlargement globose, length of basal stem one and two-thirds the thickness, apical enlargement longer than the basal, length



Text-fig. 6. *Microplecus longipalpi*, sp. nov. *a*. Wing; *b*. Palpi; *c*. First two antennal segments; *d*. Third and fourth antennal segments; *e*. Fifth antennal segment; *f*. Ninth antennal segment; *g*. Genitalia; *h*. Terminal antennal segment; *j*. Penultimate antennal segment.

one and a half times its thickness, apical stem shorter than the apical enlargement, length a little less than thrice its thickness; sixth segment similar in all proportions to the third; eleventh segment slighly longer than the seventh, the stems and enlargements narrower, basal enlargement subglobose, slightly wider than long, basal stem longer than the basal enlaregment, length thrice its own thickness, apical stem nearly equal to the apical enlargement, four times as long as thick; penultimate segment (Text-fig. 6, *j*) longer than the eleventh segment, basal enlargement globose, basal stem long and narrow, length nearly five times the thickness, apical enlargement constricted in the middle, length twice the thickness, apical stem long and narrow, length four times the thickness; terminal segment (Text-fig. 6, *h*) shorter than the

penultimate, basal enlargement globose, basal stem long and narrow, length nearly five times the thickness, apical enlargement constricted in the middle, presenting the trinodose condition, length two and a half times the thickness, apical stem short, four times as long as thick. Mesonotum brown. Scutellum and post scutellum lighter. Halteres thickly setose, pale yellow. Abdomen brownish yellow. Wings (Text-fig. 6, *a*) hyaline, two and three-fifths as long as wide, with three long veins, without vein *Rs*, costa interrupted at its union with R_5, the latter reaching the wing margin beyond apex, M_4-*m-cu* forked. Legs long, pale brown, thickly clothed with setae, metatarsus a little over half the fifth tarsal segment, second tarsal segment longest, equal to the following segments combined, third segment nearly half the second, fourth segment two-thirds the third, terminal segment three-fifths the fourth. Claw dark brown, slender, simple, bent at right angles. Empodium half the claw. Genitalia (Text-fig. 6,*g*) brown, basal clasp segment broad, nearly twice as long as thick, broader at base than at apex, with a slightly curved prominent median spine internally ; terminal clasp segment nearly equal to the basal clasp segment, slender, thickest at base, gradually narrowed, slightly curved and ending in a blunt tooth at apex, length five and a half times the thickness in the middle ; dorsal plate dark reddish-brown, very slightly shorter and narrower than the ventral plate, incised in the middle, lobes heavily sclerotized, pointed at apex in to a blunt spine ; ventral plate pale brown, broad, broadly and deeply incised in the middle, very slightly longer than the dorsal plate, lobes bluntly angulated at the internal apicies and fringed internally ; style pale brown, longer than the ventral plate, broad at base and spatulate at tip, thinnest in the middle, length nine times the median thickness.

Holotype 1 ♂ on slide No. 2156/H6. " At light, Bishop French Hostel, St. John's College, Agra, S. N. Rao coll., September, 1949 ".

Paratypes 2 ♂♂ on slides in the collections of the school of Entomology.

This species differs from the only other known species in the following : R_5 joining the wing margin beyond the apex of wing, the circumfila fully half the length of the setae, third and fourth antennal segments equal, ventral plate lobed and nearly equal to the dorsal plate and not widened apically, lobes of dorsal plate not rounded apically, but ending in blunt sclerotized spine-like points and the tip of the style not chitinized.

THE ORIENTAL TIPULIDAE IN THE COLLECTION OF THE INDIAN MUSEUM. PART III.

By CHARLES P. ALEXANDER, *Amherst, Massachusetts, U. S. A.*

(Contribution from the Department of Entomology, University of Massachusetts.)

The two preceding parts under this general title were published in the *Records of the Indian Museum* XXIX, pp. 167-214, 1927, and XLIV, pp. 29-72, 1942. At this time I am recording some further materials based on the study of collections made by the Zoological Survey of India, and have also included rather numerous records from other sources in order to add to our still very insufficient knowledge of the vast crane-fly fauna of India and surrounding countries. A particular attempt has been made to provide illustrations of several rare and little-known species that are here figured for the first time. It seems evident that in the present potentially destructive era in which we have entered collections throughout the World are no longer safe and in time many of these may be destroyed through one cause or another. This makes it more than advisable to provide adequate illustrations, particularly of type materials, in order to assure the identity of the species in the event of loss.

I wish to express my sincere thanks and appreciation to Dr. Sunder Lal Hora and Dr. A. P. Kapur for continued aid and encouragement in studying the Tipuloidea of India. The geographical area treated includes India, Kashmir, Pakistan, Ceylon, Burma, and adjoining parts of Tibet, being the region covered in the great series of volumes of the *Fauna of British India.*

LIST OF THE GENERA AND SUBGENERA OF INDIAN TIPULIDAE.

Since the appearance in press of Brunetti's *Catalogue of Oriental and South Asiatic Nemocera, Rec. Ind. Mus.* XVII, pp. 1—300, 1920, there have been many changes in nomenclature within the family Tipulidae as well as rather numerous additions of genera and subgenera. It seems appropriate to provide an arrangement of these groups as at present known from the area.

TIPULINAE

Tanyptera Latreille

Dictenidia Brullé

Pselliophora Osten Sacken

Prionota van der Wulp

Subgenus *Plocimas* Enderlein

Ctenacroscelis Enderlein

Longurio Loew

Subgenus *Macromastix* Osten Sacken

Nephrotoma Meigen

Tipula Linnaeus

Subgenus *Brithura* Edwards

Nippotipula Matsumura

Yamatotipula Matsumura

Tipulodina Enderlein

Vestiplex Bezzi

Arctotipula Alexander

Bellardina Edwards

Schummelia Edwards

Formotipula Matsumura

Acutipula Alexander

Indotipula Edwards

Oreomyza Pokorny

Lunatipula Edwards

Dolichopeza Curtis

Subgenus *Sinoropeza* Alexander

Mitopeza Edwards

Nesopeza Alexander

Oropeza Needham

CYLINDROTOMINAE

Cylindrotoma Macquart

Phalacrocera Schiner

Stibadocera Enderlein

Stibadocerella Brunetti

LIMONIINAE

LECHRIINI

Lechria Skuse

Trichoneura Loew

Subgenus *Xipholimnobia* Alexander

LIMONIINI

Limonia Meigen

Subgenus *Limonia* Meigen

Libnotes Westwood

Discobola Osten Sacken

Dicranomyia Stephens
Geranomyia Haliday
Rhipidia Meigen
Alexandriaria Garrett
Thrypticomyia Skuse
Euglochina Alexander
Pseudoglochina Alexander
Antocha Osten Sacken
Subgenus *Antocha* Osten Sacken
Orimargula Mik
Thaumastoptera Mik
Dicranoptycha Osten Sacken
Orimarga Osten Sacken
Subgenus *Orimarga* Osten Sacken

PEDICIINI

Ula Haliday
Subgenus *Ula* Haliday
Metaula Alexander
Malaisemyia Alexander
Pedicia Latreille
Subgenus *Tricyphona* Zetterstedt
Eucyphona Alexander
Nasiternella Wahlgren
Nipponomyia Alexander
Dicranota Zetterstedt
Subgenus *Amalopinodes* Alexander
Euamalopina Alexander
Amalopina Brunetti
Rhaphidolabina Alexander
Plectromyia Osten Sacken
Rhaphidolabis Osten Sacken

HEXATOMINI

Paradelphomyia Alexander
Subgenus *Oxyrhiza* de Meijere
Phyllolabis Osten Sacken
Epiphragma Osten Sacken
Subgenus *Epiphragma* Osten Sacken
Polymera Wiedemann

Subgenus *Polymera* Wiedemann
Troglophila Brunetti
Pseudolimnophila Alexander
Limnophila Macquart
Subgenus *Limnophila* Macquart
Elæophila Rondani
Dicranophragma Osten Sacken
Eupilaria Alexander
Pilaria Sintenis
Hexatoma Latreille
Subgenus *Hexatoma* Latreille
Eriocera Macquart
Atarba Osten Sacken
Subgenus *Atarbodes* Alexander
Elephantomyia Osten Sacken
Subgenus *Elephantomyia* Osten Sacken
Elephantomyodes Alexander

ERIOPTERINI

Conosia van der Wulp
Clydonodozus Enderlein
Crypteria Bergroth
Cladura Osten Sacken
Neolimnophila Alexander
Dasymallomyia Brunetti
Gnophomyia Osten Sacken
Gonomyia Meigen
Subgenus *Protogonomyia* Alexander
Idiocera Dale
Gonomyia Meigen
Lipophleps Bergroth
Teucholabis Osten Sacken
Subgenus *Teucholabis* Osten Sacken
Gymnastes Brunetti
Subgenus *Gymnastes* Brunetti
Paragymnastes Alexander
Trentepohlia Bigot
Subgenus *Trentepohlia* Bigot
Anchimongoma Brunetti
Mongoma Westwood

Plesiomongoma Brunetti
Lipsothrix Loew
Rhabdomastix Skuse
Subgenus *Rhabdomastix* Skuse
Riedelomyia Alexander
Cryptolabis Osten Sacken
Subgenus *Bœoura* Alexander
Ormosia Rondani
Erioptera Meigen
Subgenus *Empeda* Osten Sacken
Psiloconopa Zetterstedt
Symplecta Meigen
Teleneura Alexander
Erioptera Meigen
Meterioptera Alexander
Molophilus Curtis
Subgenus *Molophilus* Curtis
Styringomyia Loew
Toxorhina Loew
Subgenus *Toxorhina* Loew
Ceratocheilus Wesché

PREOCCUPIED NAMES

As was the case in the preceding two parts under this title, various names in the family that have been found to be preoccupied are renamed. As before, my thanks are extended to Dr. Alan Stone, of the United States National Museum, for calling to my attention certain of the names in question.

Ctenacroscelis cressida, nom. nov., for *Ctenacroscelis serricornis* Brunetti; *Tipula serricornis* Brunetti, *Fauna Brit. India, Dipt. Nemat.*, pp. 309-310, 1912 ; nec *Tipula serricornis* Zetterstedt, *Ins. Lapponica ponica, Diptera*, p. 844, 1838 ; nec *Tipula serricornis* Macquart, *Dipt. exot.*, suppl. 1, p. 13, 1846.

Nephrotoma dorsata, nom. nov., for *Nephrotoma dorsalis* (de Meijere), *Bijd. tot de Dierkunde* XVII, p. 89, 1904 ; nec *Nephrotoma dorsalis* Fabricius, *Spec. Ins.*, II, p. 403, 1781.

Tipula (*Nippotipula*) *flavostigmalis*, nom. nov., for *Tipula* (*Nippotipula*) *xanthostigma* Edwards, *Journ. Fed. Malay States Mus.* XVII, p. 291, 1933 ; nec *Tipula xanthostigma* Dietz, *Ent. News*, XXVIII, pp. 150-151, 1917.

Tipula (*Vestiplex*) *subbifida*, nom. nov., for *Tipula bifida* Alexander, *Bull. Mus. d'Hist. Nat.*, Paris, 1921, pp. 539-540, 1921 ; nec *Tipula doanei bifida* Dietz, *Trans. Amer. Ent. Soc.*, XL, pp. 354-355, 1914.

Tipula (*Vestiplex*) *mimica*, nom. nov., for *Tipula* (*Vestiplex*) *vicina* Lackschewitz, *Trav. de l'Inst. Zool. Acad. Sci. l'URSS*, IV, pp. 262-263, 1936 ; nec *Tipula* (*Yamatotipula*) *vicina* Dietz, *Ent. News*, XXVIII, pp. 148-149, 1917.

Tipula (*Arctotipula*) *centrodentata*, nom. nov., for *Tipula* (*Arctotipula*) *mediodentata* Alexander, *Ann. Ent. Soc. America*, XLIII, p. 422, 1950 ; nec *Tipula* (*Eumicrotipula*) *mediodentata* Alexander, *Ann. Mag. Nat. Hist.* (11) XI, p. 293, 1944.

Tipula (*Schummelia*) *pterotricha*, nom. nov., for *Tipula* (*Schummelia*) *macrotrichiata* Alexander, *Ann. Ent. Soc. America*, XVII, pp. 443-444, 1924 ; nec *Tipula* (*Eumicrotipula*) *macrotrichiata* Alexander, *Bull. d'Hist. Nat.*, Paris, 1922, p. 74, 1922.

Dolichopeza (*Dolichopeza*) *disseminata*, nom. nov., for *Dolichopeza* (*Dolichopeza*) *thysbe* Alexander, *Ann. Mag. Nat. Hist.* (11) XIV, p. 395, 1947 ; nec *Dolichopeza* (*Nesopeza*) *thisbe* Alexander, *Philip. Journ. Sci.*, LXVI, p. 111, 1938.

Limonia (*Libnotes*) *whiteana*, nom. nov., for *Limonia* (*Libnotes*) *distincta* Senior-White, *Mem. Dept. Agr. India*, Ent. Ser. VII, pp. 133-134, 1922 ; nec *Limonia* (*Geranomyia*) *distincta* Doane, *Journ. N. Y Ent. Soc.* VIII, p. 186, 1900.

Limonia (*Dicranomyia*) *pictithorax argyrophora*, nom. nov., for *Limonia* (*Dicranomyia*) *pictithorax argentifera* Alexander, *Ann. Mag. Nat. Hist.* (9) XIII, p. 565, 1924 ; nec *Limonia* (*Geranomyia*) *argentifera* de Meijere, *Tijd. voor Ent.* LIV, p. 29, 1911.

Limonia (*Dicranomyia*) *contraria*, nom. nov., for *Limonia* (*Dicranomyia*) *sordidipennis* Alexander, *Proc. R. Ent. Soc. London*, (B) XVII, p. 19, 1948 ; nec *Limonia* (*Dicranomyia*) *sordidipennis* Alexander, *Lingnan Sci. Journ.* XIX, p. 111, 1940.

Limonia (*Dicranomyia*) *whitei monacha*, nom. nov., for *Limonia* (*Dicranomyia*) *whitei brevispinula* Alexander, *Ann. Mag. Nat. Hist.* (10) XII, p. 344, 1933 ; nec *Limonia* (*Geranomyia*) *brevispinula* Alexander, *Journ. N. Y Ent. Soc.*, XXXVIII, p. 110, 1930.

Limonia (*Geranomyia*) *lycaon*, nom. nov., for *Limonia* (*Geranomyia*) *pallidula* Alexander, *Philip. Journ. Sci.* XL, p. 247, 1929 ; nec *Limonia* (*Dicranomyia*) *pallidula* Santos Abreu, *Mem. Real Acad. Cien. Art. Barcelona*, XVIII, No. 4, p. 12, 1923.

Limonia (*Geranomyia*) *militaris*, nom. nov., for *Limonia* (*Geranomyia*) *viridula* Alexander, *Journ. N. Y Ent. Soc.*, XXXVIII, pp. 110-111, 1930 ; nec *Limonia* (*Limonia*) *viridula* Alexander, *Insec. Inscit. Menst.* X, pp. 79-80, 1922.

Limonia (*Doaneomyia*) *fijicola*, nom. nov., for *Limonia* (*Doaneomyia*) *fijiensis* Alexander, *Ann. Mag. Nat. Hist.* (9) XIII, pp. 33-34, 1924; nec *Limonia* (*Libnotes*) *fijiensis* Alexander (as *Teucholabis*), *Ann. Ent. Soc. America* VII, p. 240, 1914.

Dactylolabis sexmaculata dilutior, nom. nov., for *Dactylolabis sexmaculata diluta* Lackschewitz, *Ann. Naturhist. Mus. Wien*, 1939, p. 79, 1940; nec *Dactylolabis diluta* Alexander, *Insec. Inscit. Menst.* X, p. 183, 1922.

Limnophila casta profuga, nom. nov., for *Limnophila casta pallidithorax* Alexander, *Ann. Mag. Nat. Hist.* (10) III, p. 482, 1929; nec *Limnophila pallidithorax* Edwards, *Sarawak Mus. Journ.* III, p. 267, 1926.

Hexatoma (*Eriocera*) *paenulatoides*, nom. nov., for *Hexatoma* (*Eriocera*) *subpaenulata* Edwards, *Spolia Zeylanica*, XIV, p. 123, 1927; nec *Hexatoma* (*Eriocera*) *subpaenulata* Edwards, *Sarawak Mus. Journ.* III, p. 270, 1926.

Teucholabis (*Teucholabis*) *walkeriana*, nom. nov., for *Teucholabis* (*Teucholabis*) *exclusa* Walker (as *Limnobia*), *Proc. Linn. Soc. London* VIII, p. 105, 1865; nec *Limnobia exclusa* Walker (now *Dicranota*), *List Dipt. Brit. Mus.* I, p. 49, 1848.

Gonomyia (*Paralipophleps*) *neobifida*, nom. nov., for *Gonomyia* (*Paralipophleps*) *bifida* Alexander, *Ann. Ent. Soc. America* XIX, p. 167, 1926; nec *Gonomyia bifida* Tonnoir, *Bull. Soc. Ent. Belgique*, II, pp. 144-145, 1920.

Ormosia (*Ormosia*) *romanovichiana*, nom. nov., for *Ormosia nubila* Osten Sacken (as *Erioptera*), *Proc. Acad. Nat. Sci. Phila.* 1859, p. 227, 1859; nec *Erioptera* (*Empeda*) *nubila* Schummel, *Beitr. zur Ent.* I, p. 147, 1829.

Ormosia (*Ormosia*) *staegeriana*, nom. nov., for *Ormosia similis* Staeger (as *Erioptera*), *Naturhist. Tidsskr.* III, p. 53, 1840; nec *Erioptera* (*Symplecta*) *similis* Schummel, *Beitr. zur Ent.*, I, p. 156, 1829.

Molophilus (*Molophilus*) *lackschewitzianus*, nom. nov., for *Molophilus* (*Molophilus*) *hastatus* Lackschewitz, *Ann. Naturhist. Mus-Wien*, 1939, pp. 20-21, 1940; nec *Molophilus* (*Molophilus*) *hastvtus* Alexander, *Ann. Mag. Nat. Hist.* (9) XX, pp. 359-361, 1927.

Family PTYCHOPTERIDAE

Ptychoptera annandalei Brunetti.

1918. *Ptychoptera annandalei*, Brunetti, *Rec. Ind. Mus.* XV, p. 256.

Described from Kalaw, Southern Shan States, Burma, altitude 4,000-4,500 feet, March 10, 1917. A few further males have been found, takeu

on Road 40 km. east of Taunggyi, Southern Shan States, September 25—October 13, 1934 (Malaise) ; in Stockholm Museum.

The species has not been fully described and supplementary notes are provided. *Male.*—Length about 7·5—8 mm. ; wing 7-7·5 mm. ; antenna about 5 mm.

Rostrum brownish black, labella yellow, palpi yellow, the tip of the last segment infuscated. Antennae (male) moderately long, approximately two-thirds the wing ; scape, pedicel and first flagellar segment yellow, succeeding segments black ; flagellar segments long-cylindrical, the outer ones progressively shorter to the last which is about one-fourth longer than the penultimate ; verticils shorter than the segments, those of outer face longer and arranged in a more or less distinct single row. Head blue black.

Pronotum obscure brownish yellow. Mesonotum blue black, the small central portion of the scutellum and adjoining part of mediotergite restrictedly obscure yellow, in cases the mesonotum almost uniformly darkened. Pleura, including pleurotergite, brown, evidently paler than the notum in dry specimens. Halteres dusky. Legs with the coxae and trochanters weakly infuscated ; femora brownish yellow, the tips narrowly blackened ; tibiae and basitarsi obscure yellow, the tips blackened, outer tarsal segments black. Wings pale yellowish subhyaline, the prearcular and costal fields clearer yellow ; a restricted brown pattern, including narrow crossbands at cord and across the outer forks, the stigmal part of the latter still darker, neither band reaching the posterior border of wing ; veins brown, paler in the brightened fields. Venation : *Rs* very short and straight, approximately two-thirds to threefourths as long as *r-m*, in extreme cases nearly as long as this crossvein.

Abdomen with basal four segments yellow, the caudal borders ringed with brown, the second tergite with an additional brown ring at before midlength ; outer segments, including hypopygium, blackened. Male hypopygium (text-fig. 1*a*) with the tergite profoundly divided, each arm, *9t*, slender, the outer surface provided with abundant long pale setae, at apex with a dense brush of short but conspicuous blackened setae. Dististyle, *d*, small, the two principal lobes presenting a more or less distinct forceps-like appearance ; outer lobe short and stout, provided with relatively few but very long pale setae, the longest of these approximately three-fourths as long as the lobe itself ; inner lobe and main stem of style with a series of blackened peglike retrorse spines distributed over the entire length, relatively few on the slender lobe, more numerous on the stem ; basal lobes of dististyle relatively inconspicuous, the most basal one pendant, provided with inconspicuous setae. Sternite with a pair of fingerlike pale lobes, the upper surface with stellate groups of microscopic setulae, the lower edge with unusually long and dense setae, towards the midline becoming shorter but so dense as to appear almost squamose, each bristle terminating in a delicate hairlike point.

Family TIPULIDAE

Subfamily *TIPULINAE*

Pselliophora laeta (Fabricius).

1792. *Tipula laeta*, Fabricius, *Ent. Syst.* IV, p. 239.
1886. *Pselliophora laeta*, Osten Sacken, *Berlin. Ent. Zeitschr.* XXX, p. 168.

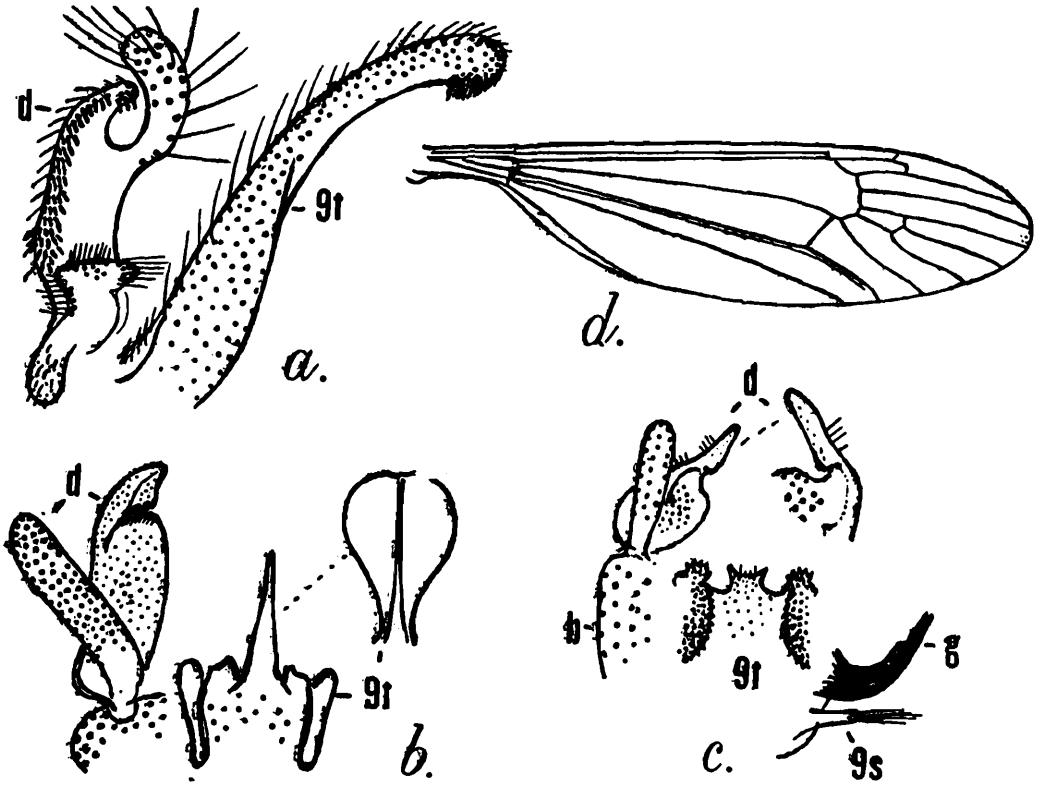
Additional records, Siruvani, Coimbatore District, South India, altitude 3,000 feet, August 11, 1938 (Susai Nathan). Nilgiri Hills, Cherangode, altitude 3,400 feet, May 1949 ; Gudalur, altitude 3,500 feet, April 1949 ; Mango Range, altitude 3,800 feet, May 1949 (Susai Nathan).

Dolichopeza (Nesopeza) compressior Alexander.

1952. *Dolichopeza* (*Nesopeza*) *compressior*, Alexander, *Ann. Mag. Nat. Hist*, (12) in press.

Described from Naduvatam, Nilgiri Hills, South India, altitude 6,000 feet, September 20-21, 1950 (Susai Nathan).

Male hypopygium (text-fig. 1*b*) relatively large and complex. Ninth tergite, *9t*, extended into a deep compressed median blade, comprised of two halves that are capable of being flattened into a broad depressed central plate, on either side of this with a more sclerotized blackened lobe that is bilobed, the outermost lobe obtusely rounded. Outer dististyle, *d*, a simple dusky lobe ; inner style shorter, its apex truncated. Phallosome large and complex, pale horn-colored. Eighth sternite not produced or armed.



Text-fig. 1*a*. *Ptychoptera annandalei* Brunetti ; *b*. *Dolichopeza* (*Nesopeza*) *compressior* Alexander ; *c*. *Dolichopeza* (*Nesopeza*) *laetipes* Alexander ; *d*. *Dolichopeza* (*Mitopeza*) *kanagaraji* Alexander ; male hypopygium and venation.

Dolichopeza (Nesopeza) laetipes Alexander.

1952. *Dolichopeza (Nesopeza) laetipes*, Alexander, *Ann. Mag. Nat. Hist.* (12) in press.

The type was from Cherambadi, Nilgiri Hills, South India, altitude 3,300 feet, November 9, 1950 (Susai Nathan).

Male hypopygium (text-fig. 1*c*) relatively small. Caudal border of ninth tergite, *9t*, with a flattened central blackened plate, more or less rectangular in outline, the outer angles produced into points, the slightly concave margin with a row of setae ; lateral tergal lobes appearing as conspicuously blackened plates, provided with several spinulae, the plates produced backward along the ventral margin of the tergite. Outer dististyle, *d*, of moderate length, clavate, its length about 4 to 4·5 times the greatest width ; inner style with the beak elongate. What appear to be gonapophyses, *g*, jut from the genital chamber as a pair of curved blackened rods. Region of ninth sternite pale, submembranous, near its dorsal portion on either side of the midline with a slender finger-like lobe, *9s*, that is tufted with a few very long bristles, these subequal in length to the lobes. Eighth sternite short, unmodified.

Dolichopeza (Mitopeza) kanagaraji Alexander.

1952. *Dolichopeza (Mitopeza) kanagaraji*, Alexander, *Ann. Mag. Nat. Hist.* (12) in press.

Described from Naduvatam, Nilgiri Hills, South India, altitude 6,000 feet, September 27, 1950 (Susai Nathan).

The wing is illustrated (text-figure 1*d*).

Nephrotoma cornicina (Linnaeus).

1758. *Tipula cornicina*, Linnaeus, *Syst. Nat.*, Ed. X, p. 586.

Sind Valley, Baltistan, altitude 9,000 feet, June 14, 1934 (Vivien Hutchinson).

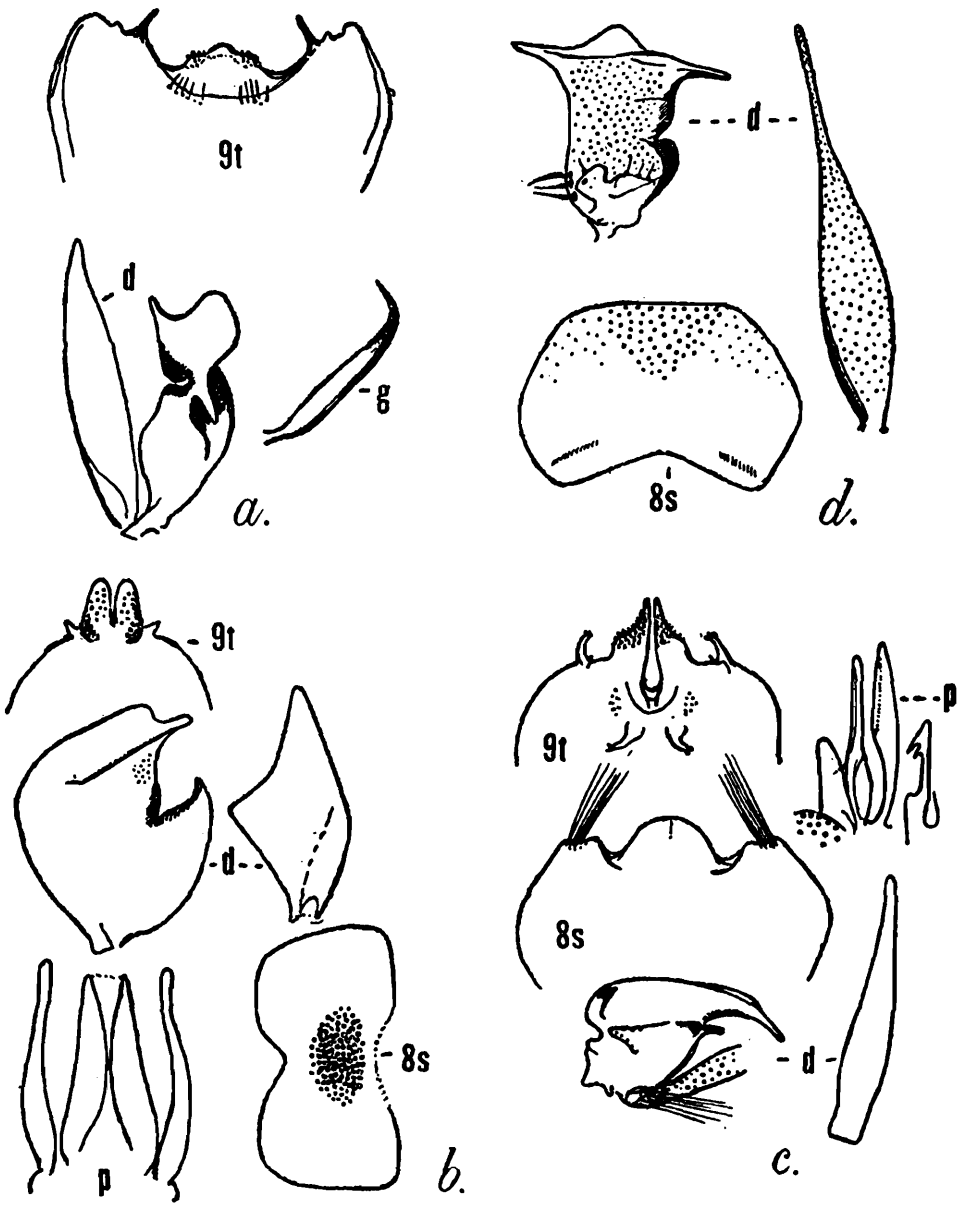
Nephrotoma dodabettæ Alexander.

1951. *Nephrotoma dodabettæ*, Alexander, *Ann. Mag. Nat. Hist.* (12) IV, pp. 886-887.

Described from Dodabetta Peak, Ootacamund, Nilgiri Hills, South India, altitude 8,000 feet, May 5, 1950 (Susai Nathan).

Male hypopygium (text-fig. 2*a*) with the tergite, *9t*, broad, the central portion of the posterior border emarginate but farther produced into a low lobe that is provided on its lateral shoulders with a few microscopic black spicules and scattered setae ; on either side of the emargination with a single slender blackened spine. Inner dististyle, *d*, with the outer basal lobe produced into conspicuous blackened blades ; beak slender ; dorsal crest high. Gonapophysis, *g*, appearing as a slender reddish rod, the tip narrowed into a curved black spine. Ninth sternite extensive, profoundly emarginate, the notch with an elevated darkened flange on either side, this becoming higher behind. Eighth sternite only moderately sheathing, the caudal border very slightly emarginate, the posterio$_r$

margin with long delicate setae that are longer and more conspicuos at and near the midline.



Text-fig. 2*a*. *Nephrotoma dodabettæ* Alexander; *b*. *Nephrotoma fletcheriana* Alexander; *c*. *Nephrotoma globata* Alexander; *d*. *Nephrotoma nigrohalterata* Edwards; male hypopygia.

Nephrotoma fletcheriana Alexander.

1952. *Nephrotoma fletcheriana*, Alexander, *Ann. Mag. Nat. Hist.* (12) in press,

Described from various stations in India and Burma. Mayuyo, Burma, March 22, 1918; Katihar, Purneah district, North Bengal, August 7-31, 1910; Pusa, Bihar, March 17, 1914.

Male hypopygium (text-fig. 2*b*) with the ninth tergite, *9t*, transverse the caudal margin produced into a pair of flattened-compressed blades that lie vertically side by side at the midline, the surface with black setae, the lower margin with blackened spicules; at base on either side the blade subtended by a strong acute spine. Region of ninth sternite very short, without a lobe. Outer dististyle, *d*, relatively short and broad, the lower margin at near midlength produced into a rectangular lobe, somewhat as in *kodaikanalensis* but less accentuated. Inner dististyle with the beak slender, passing abruptly into the more elevated sclerotized dorsal crest; no posterior crest; lower beak blackened, narrowed to an acute point. Phallosome, *p*, with the gonapophyses appearing as very slender rods,

gradually narrowed into pale membrane at apex. Eighth sternite, *8s*, small, not sheathing, the apex emarginate and filled with pale membrane; center of disk with unusually abundant long yellow setae, much more numerous than in *kodaikanalensis*.

Nephrotoma globata Alexander.

1951. *Nephrotoma globata*, Alexander, *Ann. Mag. Nat. Hist.* (12) IV, pp. 1087-1089.

Described from Kodaikanal, Palni Hills, South India, altitude 7,000 feet, August 11-17, 1921 (Fletcher).

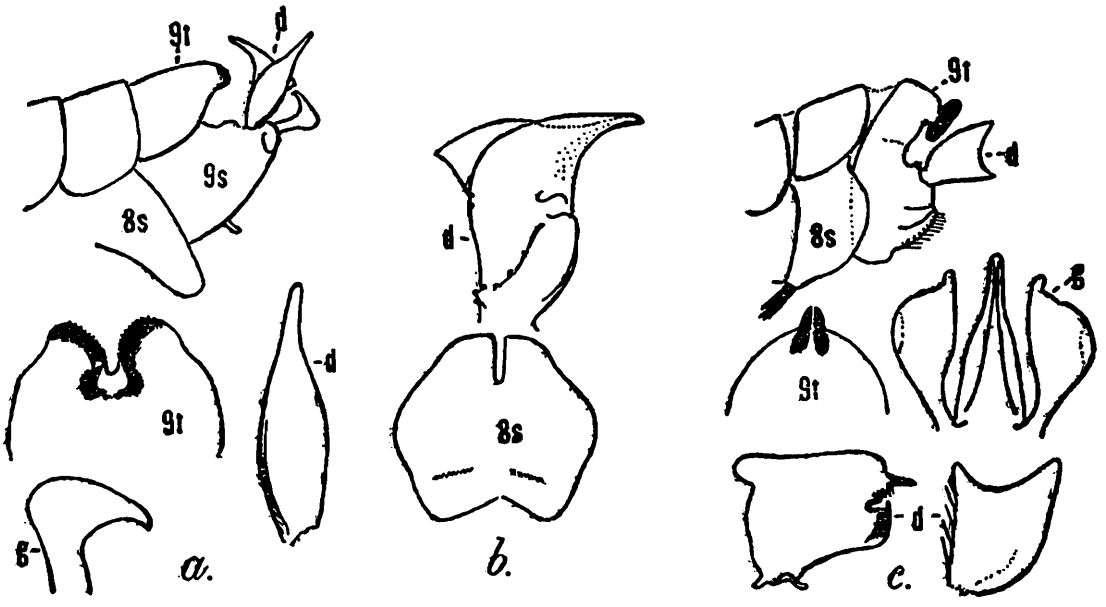
Male hypopygium (text-fig. 2*c*) with the caudal border of the ninth tergite, *9t*, produced into two pairs of lobes, including a larger pair on either side of a deep and narrow median incision, the mesal edge of these blades extended into an acute glabrous point; lateral marginal arms slender, each tipped with two or three spicules. Outer dististyle, *d*, long and slender; inner style long and narrow, the beak especially so, lower beak a slender blackened rod. Phallosome, *p*, complex, consisting of two sets of structures subtending a microscopic pair of arms. Eighth sternite, *8s*, large and sheathing, the caudal border trilobed; lateral lobes widely separated, with a brush of long setae; median lobe large, appearing as a flattened semicircular plate.

Nephrotoma kaulbacki Alexander.

1951. *Nephrotoma kaulbacki*, Alexander, *Ann. Mag. Nat. Hist.* (12) IV, pp. 1094-1096.

The type was from Poshö, Kyari Dzong, East Tibet, altitude 12,500 feet, June 27, 1936, taken by R. J. H. Kaulback.

Male hypopygium (text-fig. 3*a*, 3*b*), with the outer half of the ninth tergite, *9t*, slightly narrowed, with a deep median notch, the lateral lobes thickened and blackened, spiculose. Inner dististyle, *d*, with the beak slender; posterior crest produced backward as pale membrane. Eighth sternite, *8s*, large, strongly sheathing, its posterior border with a very deep and narrow notch.



Text-fig. 3*a*. *b*. *Nephrotoma kaulbacki* Alexander. c. *Nephrotoma kodaikanalensis* Alexander; male hypopygia.

Nephrotoma kodaikanalensis Alexander.

1951. *Nephrotoma kodaikanalensis*, Alexander, *Ann. Mag. Nat. Hist.* (12) IV, pp. 1089-1090.

Described from Kodaikanal, Palni Hills, South India, altitude 7,000 feet, August 13,15, October 8, 1921 (Fletcher).

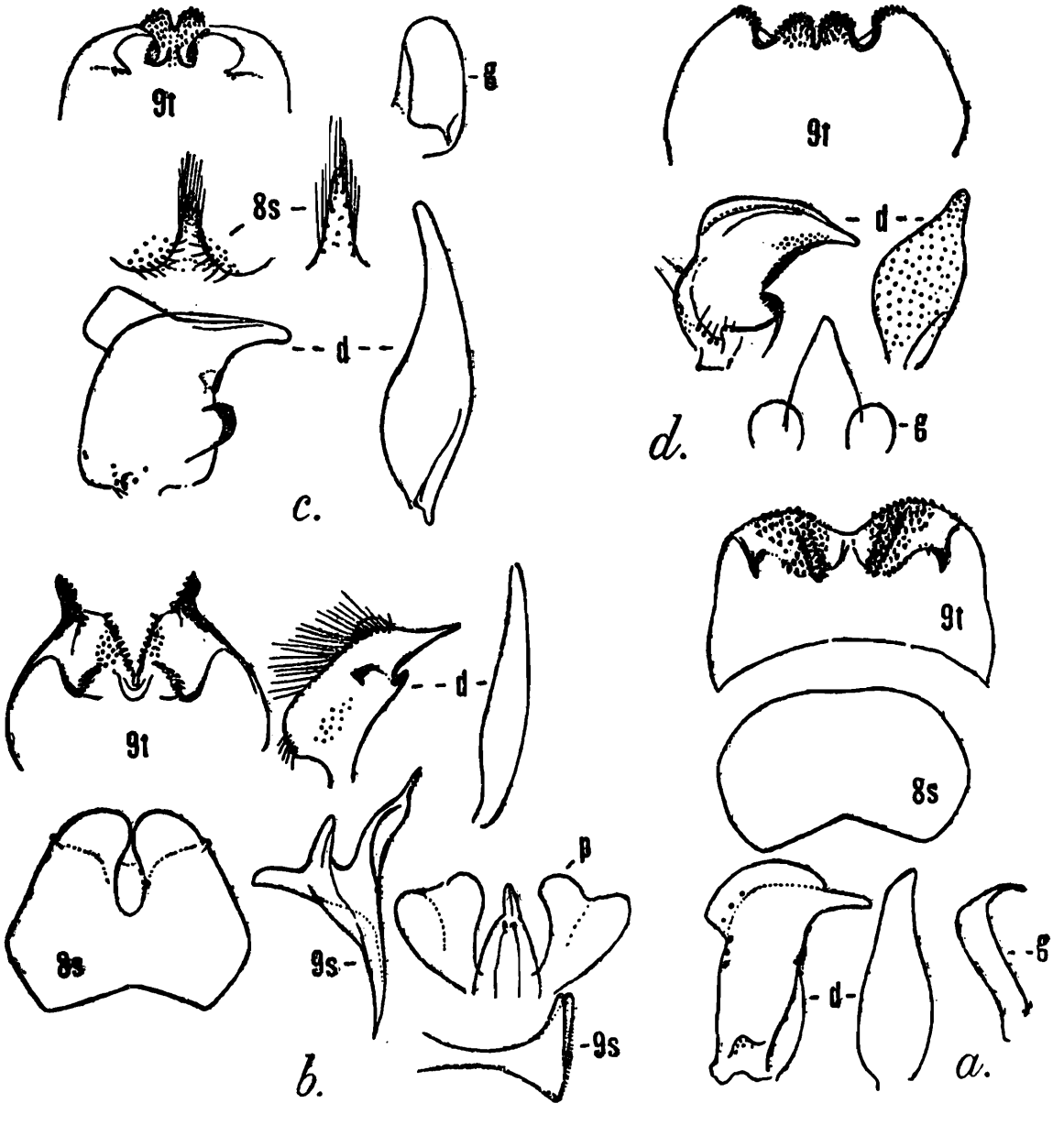
Male hypopygium (text-fig. 3*c*) with the ninth tergite, *9t*, relatively small, its posterior end produced into two flattened black blades that lie vertically, their surface with blackened spicules. Outer dististyle, *d*, bearing a strong pointed lobe on outer or upper margin; inner style with the beak narrowed abruptly into a slender point; posterior crest large. Gonapophyses, *g*, appearing as expanded flattened blades.

Nephrotoma libra Alexander.

1951. *Nephrotoma libra*, Alexander, *Ann. Mag. Nat. Hist.* (12) IV, pp. 1092-1094.

Type from Gyantse, Tibet, altitude 13,000 feet, July 19, 1928, taken by Lt. Col. F. M. Bailey.

Male hypopygium (text-fig. 4*a*) with the caudal margin of tergite, *9t*, thick and blackened, the outer lateral angle produced into a decurved spine. Basistyle with a smooth blackened plate on mesal face. Inner dististyle, *d*, with an unusually high and conspicuous glabrous dorsal crest. Gonapophysis, *g*, appearing as a flattened yellow blade, the slender apex bent at a right angle, gradually narrowed to the slightly decurved tip,



Text-fig. 4*a*. *Nephrotoma libra* Alexander; *b*. *Nephrotoma megascapha* Alexander; *c*. *Nephrotoma maktesarensis* Alexander; *d*. *Nephrotoma quadrilata* Alexander; male hypopygia.

Nephrotoma megascapha Alexander.

1951. *Nephrotoma megascapha*, Alexander, *Ann. Mag. Nat. Hist.* (12) IV, pp. 891-893.

The types were from Naduvatam, Nilgiri Hills, South India, altitude 6,000 feet, May 3—20, 1950 (Susai Nathan).

Male hypopygium (text-fig.4*b*) with the tergite, *9t*, deeply emarginate, the outer lateral angles produced into strong arms that bear several blackened spines at apex and along the inner face; on either side of ventral surface of tergite with a strong sclerotized plate that bears further blackened spines, including a linear retrorse series. Outer dististyle, *d*, unusually long and narrow, obtuse at tip, the greatest width about one-sixth the length; inner style with the beak slender; a high glabrous crest at summit of style behind the beak; dorsal margin with unusually long setae that form a more or less distinct comb. Phallosome, *p*, consisting of the relatively small aedeagus and unusually large and flattened bilobed gonapophyses. Ninth sternite, *9s*, with a broad oval membranous area, from the posterior ends of which extend strong irregularly bifid structures that subtend the phallosome; from the base of the cephalic region of the sternite in the notch of the eighth sternite, a strong median arm arises, projecting backward, enlarged at apex into a two-pointed head. Eighth sternite, *8s*, very large, projecting caudad about to the level of the remainder of the hypopygium, its caudal margin deeply split to form two unusually large flattened plates that form a scoop, these plates densely covered by microscopic setulae.

Nephrotoma muktesarensis Alexander.

1952. *Nephrotoma muktesarensis*, Alexander, *Ann. Mag. Nat. Hist.* (12) in press.

Described from Muktesar, Kumaon, United Provinces, altitude 7,500 feet, August 10-12, 1923, July 26—28, September 11, 1924, all collected by Sen.

Male hypopygium (text-fig. 4*c*) with the ninth tergite, *9t*, transverse, the posterior border truncate, with the lateral shoulders rounded; median area with a pale membranous part that is produced into two obtusely triangular spiculose lobes, separated by a small V-shaped notch. Ninth sternite with an erect fingerlike setiferous lobe at the base of an elongate-oval central emargination. Outer dististyle, *d*, relatively long and narrow, its basal half more dilated, thence narrowed to the tip; inner style subquadrate in general outline, the beak relatively slender; lower beak obtusely rounded; dorsal crest lacking; posterior crest conspicuously produced into a flattened blade, its tip truncate. Gonapophysis, *g*, appearing as a small pale blade, the tip obtuse. Eighth sternite, *8s*, large and sheathing, the posterior border conspicuously emarginate, with pale membrane, the lobes obtuse, provided with coarse black setae that are directed inward; in the notch lies a stout fingerlike lobe directed strongly cephalad, this provided with long yellow setae.

Nephrotoma nigrohalterata Edwards.

1928. *Nephrotoma nigrohalterata*, Edwards, *Ann. Mag. Nat. Hist.* (10) I, p. 700,

Edwards's types, two females, were from Tibet. I have a male metatypical specimen from Poshö, East Tibet, received through an exchange with Edwards. This shows that the species is very close to

Nephrotoma attenuata Alexander (1935) and the two flies may prove to be identical.

Male hypopygium (text-fig. 2*d*) with the outer dististyle, *d*, unusually long and slender, especially on its outer two-fifths ; inner style with the beak long and slender, the posterior crest produced backward, slender, having approximately the same outline as the beak ; dorsal crest slightly elevated ; region of the outer basal lobe with three strong black setae. Ninth sternite with a deep notch, at the base of which is a brown fingerlike lobe, directed ventrad. Eighth sternite, *8s*, broad, the posterior border truncated, the central part back of the border with abundant long retrorse setae, the margin produced ventrad into a small pale fleshy lobe.

Nephrotoma pleurinotata Brunetti.

1912. *Pachyrhina pleurinotata*, Brunetti, *Fauna Brit. India, Dipt. Nomat.* pp. 343-344.

Described from Ceylon. Now known from various stations in South India-Kollar, altitude 1,000 feet, July 1947 ; Walayar Forest, South Malabar, altitude 2,000 feet, September 18, 1947 (Susai Nathan).

Nephrotoma pratensis (Linnaeus).

1758. *Tipula pratensis*, Linnaeus, *Syst. Nat.*, Ed. X, p. 586.

One female, Dü Chu Valley, Poshö, East Tibet, altitude 12,000 feet, July 7,1936, collected by Kaulback ; British Museum (Natural History). I can see no significant differences between this female and comparable European specimens of *pratensis*, although it is possible that the male sex will reveal such distinctions.

Nephrotoma quadrilata Alexander.

1951. *Nephrotoma quadrilata*, Alexander, *Ann. Mag. Nat. Hist.* (12) IV, pp. 887-889.

The types were from Naduvatam, Nilgiri Hills, South India, altitude 6,000 feet, May 5-20, 1950 (Susai Nathan).

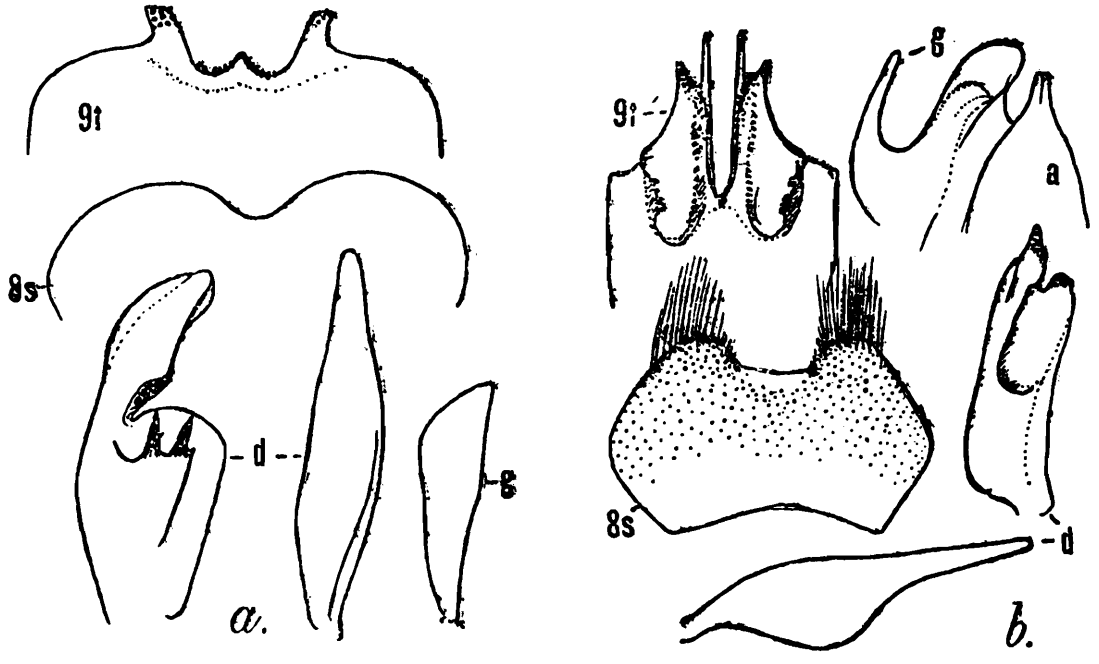
Male hypopygium (text-fig. 4*d*) with the tergite, *9t*, transverse, its caudal margin with four unusually short and stout lobes that are tipped with short blackened spinous pegs, the more basal ones of the intermediate lobes more setoid. Outer dististyle, *d*, relatively short and broad, the width about one-half the total length ; inner dististyle unusually small and simple, the dorsal crest long and low, entirely glabrous, extending from the beak back to the posterior outer part of style. Gonapophysis, *g*, appearing as an unusually broad obtuse blade that subtends the short stout aedeagus. Ninth sternite deeply emarginate medially, at cephalic end of the notch with protuberant pale membrane to form a more or less distinct lobe. Eighth sternite with the caudal margin notched, the surface with sparse setae.

Nephrotoma rajah Alexander.

1951. *Nephrotoma rajah*, Alexander, *Ann. Mag. Nat. Hist.* (12) IV, pp. 1091-1092.

Types from Glen Morgan, Nilgiri Hills, South India, altitude 6,500 feet, May 22, 1948 (Susai Nathan).

Male hypopygium (text-fig. 5*a*) with the tergite, *9t*, transverse, the caudal margin unequally trilobed, including a pair of lateral lobes that are tipped with blackened spicules and a smaller median triangular point, the sides of which bear a few similar spicules; margin of the incision thickened; no development of sclerotized armature on ventral surface of plate. Outer dististyle, *d*, of moderate length, its greatest width approximately one-fifth the length; inner style with the beak much prolonged, the outer margin subtended by pale membrane to form a crest; lower beak very low and obtuse, blackened; on face of style with a flattened black plate, its apex produced into two strong spines, with one or two further tiny points. Gonapophysis, *g*, appearing as a flattened blade, gently widened outwardly, broadest across the outer half; inner margin of blade nearly straight, the outer strongly convex, particularly on outer half. Ninth sternite incised medially, with protruding membrane at base of notch. Eighth sternite, *8s*, transverse, only moderately sheathing;



Text-fig. 5*a*. *Nephrotoma rajah* Alexander; *b*. *Nephrotoma semicincta* Alexander; male hypopygia.

posterior border with a small emargination, provided with long conspicuous setae.

Nephrotoma semicincta Alexander.

1951. *Nephrotoma semicincta*, Alexander, *Ann. Mag. Nat. Hist.* (12) IV, pp. 893-895.

Described from the Nilgiri Hills, South India, taken at Naduvatam altitude 6,000 feet, May 4-5, 1950, and at Glen Morgan, altitude 6,500 feet, May 22, 1948 (Susai Nathan).

Male hypopygium (text-fig. 5*b*) with the caudal margin of the ninth tergite, *9t*, with a very deep and narrow median notch that is subtended by flattened blades that are provided with numerous blackened spicules; on ventral face of tergal plate on either side of the notch with a long slender blade that is directed caudad, its surface with further spicules. Outer dististyle, *d*, relatively long, narrow basally, at near one-third the length conspicuously dilated on the inner margin, thence narrowed to the obtuse

tip; inner style unusually long and narrow, without a dorsal crest; both the beak and lower beak more blackened, the latter obtusely rounded. Gonapophysis, *g*, complex, appearing as an irregularly bilobed blade, its outermost arm slender, the inner one subtending the small aedeagus. Ninth sternite with a prow-shaped median lobe that is directed ventrad, placed at the base of a deep central notch. Eighth sternite, *8s*, conspicuously emarginate, the low obtuse lateral lobes with long setae.

Nephrotoma seniana Alexander.

1952. *Nephrotoma seniana*, Alexander, *Ann. Mag. Nat. Hist.* (12) in press.

Described from Muktesar, Kumaon, United Provinces, altitude 7,500 feet, July 24, 1924 (Sen).

Text-fig. 6*a*. *Nephrotoma seniana* Alexander; *b*. *Nephrotoma subopaca* Alexander; *c*. *Nephrotoma toda* Alexander; male hypopygia.

Male hypopygium (text-fig. 6*a*) with the ninth tergite, *9t*, transverse, the caudal margin virtually trilobed, including lateral sclerotized blades, their tips obtuse, each with three or four blackened spicules on face; central lobe microscopically notched at tip by a tiny emargination but appearing virtually entire, with a triangular outline, the whole surface with abundant spicules. Outer dististyle, *d*, about three and one-half times as long as the greatest width, this just before midlength, then rather suddenly narrowed to the obtuse tip; inner style with the beak relatively slender; no dorsal or posterior crests; setae of the outer margin long but sparse, yellow; lower beak viewed from the side appearing long and slender, gently curved, when viewed from above more spatulate, broadest before the subobtuse apex. Phallosome, *p*, with the aedeagus very short, subtended by the subequal pale gonapophyses, the latter unequally bilobed, the outer lobe a flattened-compressed blade. Eighth sternite

transverse, the membrane beneath the posterior border with a small fleshy lobe, *8s*, this directed caudad, the surface densely covered with microscopic setulae.

Nephrotoma serricornis Brunetti.

1912. *Pachyrhina serricornis*, Brunetti, *Fauna Brit. India, Dipt. Nemat.*, p. 341.

Between Therriaghat and Mahadeo, Khasi Hills, Assam, April 7, 1927 (Gopi Ram); Indian Museum No. 6.

Nephrotoma subopaca Alexander.

1952. *Nephrotoma subopaca* Alexander, *Ann. Mag. Nat. Hist.* (12) in press.

Types from Kashmir, taken at Yusimarg, altitude 7,500 feet, August 6—15, 1923, and at Killarmarg, altitude 10,000 feet, July 19, 1923, taken by T. B. Fletcher.

Male hypopygium (text-fig. 6*b*) with the ninth tergite, *9t*, transverse, slightly narrowed posteriorly, each lobe broad and low, separated by a narrow U-shaped notch, the lobes provided with abundant blackened spicules, the more mesal end of the lobe a little more produced. Ninth sternite short. Outer dististyle, *d*, relatively short, the length about two and one-half times the greatest width which is just beyond midlength; inner style with the beak relatively slender; dorsal and posterior crests glabrous; region of the outer basal lobe produced to produce an outline almost like that of the posterior crest. Gonapophysis, *g*, very small, only about one-half as long as the aedeagus, at apex a trifle dilated into a weak head. Eighth sternite unarmed, the posterior border truncated or virtually so.

Nephrotoma toda Alexander.

1951. *Nephrotoma toda*, Alexander, *Ann. Mag. Hat. Hist.* (12) IV, pp. 889-891.

The type is from the Wood Estate, Nilgiri Hills, South India, altitude 4,200 feet, May 24, 1950 (Susai Nathan).

Male hypopygium (text-fig. 6*c*) with the caudal margin of the ninth tergite, *9t*, with a deep rectangular notch, the subtending lobes appearing as flattened blades that project caudad beyond any other part of the tergite, armed with spiculose points, including a concentration on the outer margin before the narrowed apex; laterad of these blades with a shorter slender rod that is likewise provided with spiculose points; ventral surface of tergite with a lateral blackened arm and a more mesal flattened plate. Outer dististyle, *d*, excessively long and narrow, the length exceeding ten times the greatest width; inner style small and compact, beak slender; dorsal crest very low to barely indicated; posterior end of style blackened. Phallosome consisting of elongate bladelike gonapophyses, *g*, and a gently curved structure of slightly greater length, presumably representing the aedeagus. Ninth sternite, *9s*, at apex with a brush of long setae and a small flattened lobe or appendage, at base of the latter with a small slender horn; median area of sternite filled with dark-colored pigmented membrane, outlining a more or less cordate area. Eighth sternite, *8s*, with the posterior border emarginate, with a median

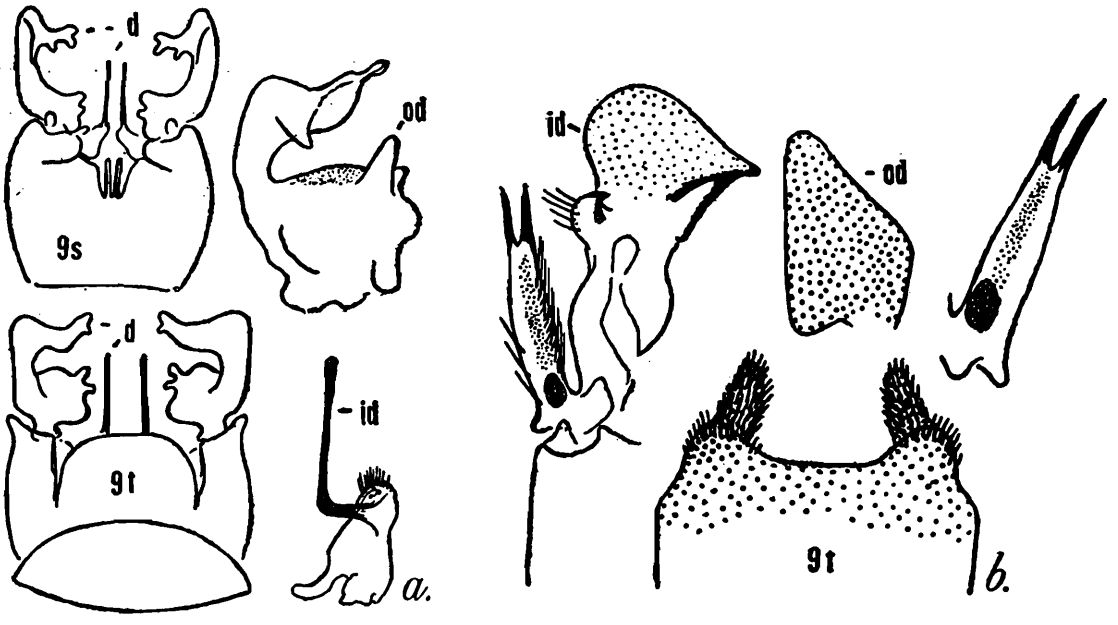
lobe, the apex of which is microscopically setuliferous; lateral lobes low and obtuse, with unusually long setae. Seventh sternite with a pale membranous border, the median part of which is further produced into a small setuliferous lobule.

Tipula (Bellardina) cranbrooki Alexander.

1951. *Tipula (Bellardina) cranbrooki*, Alexander, *Ann. Mag. Nat. Hist.* (12) IV, pp. 1074-1076.

Described from Lung Sa, Adung Valley, Northeast Burma, altitude 12,000 feet, July 1—August 12, 1931 (Kingdon Ward and Lord Cranbrook).

Male hypopygium (text-fig. 7*a*) with the ninth tergite, *9t*, on ventral surface near posterior border with a small bilobed appendage. Ninth sternite, *9s*, with two narrow sclerotized rods arising from the base of the



Text-fig. 7*a*. *Tipula (Bellardina) cranbrooki* Alexander; *b*. *Tipula (Tipulodina) xanthippe* Alexander; male hypopygia.

U-shaped ventral notch. Outer dististyle, *od*, very irregular in outline, including an outer arm that is expanded apically and is unequally bilobed. Inner dististyle, *id*, much smaller, extended caudad as a slender black rod that is encased in pale membrane.

Tipula (Bellardina) exquisita Alexander.

1935. *Tipula (Sinotipula) exquisita*, Alexander, *Philip. Journ. Sci.*, LVII, pp. 95-97.

East Tibet. Poshö, altitude 14,000 feet, July 23—24, 1936, and the Dü Chu Valley, altitude 13,000—13,500 feet, July 13, 1936, taken by R. J. H. Kaulback; British Museum (Natural History).

Tipula (Tipulodina) brunettiella Alexander.

1923. *Tipulodina brunettiella*, Alexander, *Ann. Ent. Soc. America*, XVI, p. 75.

Described from Ceylon. Singara, Nilgiri Hills, South India, altitude 3,400 feet, April 28, 1948 (Susai Nathan).

Tipula (Tipulodina) xanthippe Alexander.

1951. *Tipula* (*Tipulodina*) *xanthippe*, Alexander, *Ann. Mag. Nat. Hist.* (12) IV, pp. 882-884.

The unique type was from the Mango Range, Nilgiri Hills, South India, altitude 3,800 feet, May 1950 (Susai Nathan).

Male hypopygium (text-fig. 7*b*) with the posterior border of the ninth tergite, *9t*, broadly emarginate, the lateral lobes with strong black setae; on ventral face of each lobe with an even longer and more conspicuous secondary lobe, clothed with black setae. Outer dististyle, *od*, with the basal half dilated, the short outer portion obtuse at apex. Inner dististyle, *id*, with the beak short and obtuse, blackened, the crest very high, obtusely rounded, its basal lobe produced into a blackened beak; outer arm of style a powerful structure that splits at apex into two subparallel blackened spines; surface of arm with the sensory area at its base and with a row of abundant long yellow setae over most of the length.

The most similar regional species is *Tipula* (*Tipulodina*) *simillima* Brunetti, likewise from South India, which has the outer arm of the inner dististyle quite different, being profoundly bifid, with both arms blackened and more or less setiferous. The exact homologies of this powerful outer arm or spine found on the male hypopygium of the various species of *Tipulodina* have been uncertain. In an earlier paper (*Philip. Journ. Sci.* LVII, p. 115, 1935) I had considered the structure as representing a disconnected prolongation of the basistyle, rather than being a part of the dististyle. Edwards called it an ' outer style ', a term generally restricted to the different outer dististyle. From better preserved materials it now appears that the spine actually is part of the inner dististyle and represents a structure additional to the usual outer basal lobe, common to virtually all members of the genus. This additional or supplementary arm is not limited to the subgenus *Tipulodina* but is found in at least three western Nearctic species of the subgenus *Lunatipula* Edwards—*albofascia* Doane, *bifalcata* Doane, and *cladacantha* Alexander. That the structure is actually part of the inner dististyle is confirmed by the fact that it bears the so-called ' sensory area ', a compact group of pores that is usually found on the main body of the inner dististyle.

Tipula (Vestiplex) bisentis Alexander.

1951. *Tipula* (*Vestiplex*) *bisentis*, Alexander, *Ann. Mag. Nat. Hist.* (12) IV, pp. 1080-1082.

Described from Lung Sa, Adung Valley, Northeast Burma, altitude 12,000 feet, July 4—19, 1931 (Kingdon Ward and Lord Cranbrook).

Male hypopygium (text-figs. 8*a*, 8*b*) with the caudal border of the ninth tergite, *9t*, broadly emarginate, the lateral lobes obtuse; at base of notch and lying more ventral are two smaller blackened knobs with spiculose tips. Basistyle, *b*, bispinous, the more dorsal spine longer. Appendage of ninth sternite, *9s*, bearing a small finger-like lobe with three long setae.

Tipula (Vestiplex) gandharva Alexander.

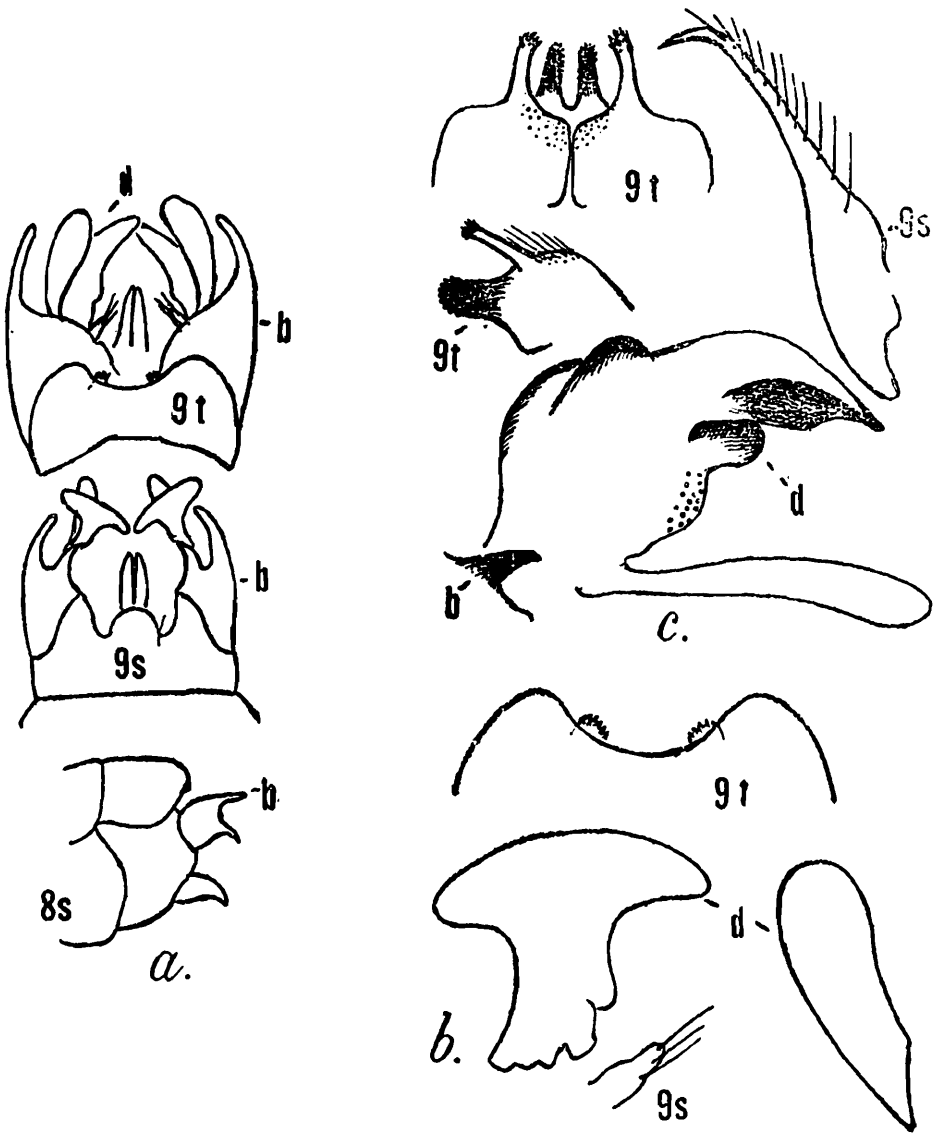
1951. *Tipula* (*Vestiplex*) *gandharva*, Alexander, *Ann. Mag. Nat. Hist.* (12) IV, pp. 1076-1078.

The type was from the Adung Valley, Northeast Burma, altitude 8,000 feet, June 4, 1931 (Kingdon Ward and Lord Cranbrook).

Male hypopygium (text-fig. 8*c*) with the caudal margin of the ninth tergite, *9t*, bearing two pairs of lobes, an outer slender pair and two blackened blades that lie close together and at a lower level. Basistyle, *b*, terminating in a short stout spine. Inner dististyle, *d*, massive, the lower surface of beak conspicuously blackened. Appendage of ninth sternite, *9s*, a long simple rod, its basal third more dilated.

Tipula (Vestiplex) halteroptera Alexander.

1951. *Tipula* (*Vestiplex*) *halteroptera*, Alexander, *Ann. Mag. Nat. Hist.* (12) IV, pp. 1078-1080.



Text-fig. 8*a*, *b*. *Tipula* (*Vestiplex*) *bisentis* Alexander; *c*. *Tipula* (*Vestiplex*) *gandharva* Alexander; male hypopygia.

Type material from the Adung Valley, Northeast Burma, altitude 13,000 feet, July 1, 1931 (Kingdon Ward and Lord Cranbrook).

Male hypopygium (text-fig. 9*a*) with the tergite, *9t*, having a deep V-shaped notch, the mid-area with pale membrane; a blackened flange or beak on ventral face of each lobe. Basistyle, *b*, unarmed. Appendage of ninth sternite, a flattened yellow blade that bears two setae at near three-fourths the length, the blade about five times as long as broad.

Tipula (Vestiplex) mitchelli Edwards.

1927. *Tipula mitchelli*, Edwards, *Ann. Mag. Nat. Hist.* (9) XX, pp. 229-230.

Sonamarg, Kashmir, altitude about 9,000 feet, Station 7, June 17-23, 1921 (Kashmir Survey).

Tipula (Vestiplex) nigroapicalis Brunetti.

1911. *Tipula nigroapicalis*, Brunetti, *Rec. Ind. Mus.* VI, p. 257.

The types were taken by Brunetti at Darjiling in October 1905. A male metatype from Muktesar, Kumaon, altitude 7,500 feet, taken on September 10, 1924, by Sen; determined by Edwards.

Tipula (Vestiplex) ravana sp. nov.

Antennae with the pedicel light yellow, scape light brown; femora brownish black, their bases obscure yellow, with an obscure yellow subterminal ring; wings medium brown, variegated with cream-yellow areas; basal abdominal segments reddish brown, the outer ones black; male hypopygium with the ninth tergite having the lateral lobes low and obtuse, from their ventral surface with an acute blackened spine, directed caudad; basistyle and eighth sternite unarmed; appendage of ninth sternite boomerang-shaped, the margin with four scattered setae.

Male.—Length about 14 mm.; wing 16 mm.; antenna about 4·5 mm.

Type badly discoloured and the pattern describable in general terms only. Frontal prolongation of head light brown, nasus distinct; palpi yellowish brown, the terminal segments darkened. Antennae (male) moderately long, if bent backward ending about at the wing root; scape light brown, pedicel yellow, flagellar segments dark brown, the basal swellings of moderate size; longest verticils subequal to the segments. Head brown, gray pruinose, with a narrow darker brown median stripe; vertical tubercle low, entire.

Pronotum brown, sparsely pruinose. Mesonotal praescutum badly discoloured, apparently brownish black, the interspaces with a gray pruinosity persisting; scutellum apparently with a still darker central stripe. Pleura dark, the dorsopleural membrane buffy brown. It seems evident that in fresh material, the entire thoracic ground color is heavily gray pruinose. Halteres with stem and apex of knob obscure yellow, base of the latter dark brown. Legs with the coxae reddish brown; trochanters obscure yellow; femora brownish black, the bases obscure yellow, more extensively so on some legs, presumably the posterior pair (all legs detached); a narrow obscure yellow subterminal ring; tibiae and tarsi dark brown to brownish black; claws (male) toothed. Wings with the ground medium brown, variegated with cream yellow areas, including the prearcular field; two irregular pale bands cross the wing before the cord, the first forking behind to form two pale marginal areas in cell *2nd A*, the second band ending virtually at *Cu*; beyond the cord a similar extensive area in bases of cells of outer radial field; obliterative areas before stigma and crossing the base of cell *1st* m_2; veins brown. Venation: *Rs* relatively long, slightly exceeding twice *m-cu*; R_{1+2} entire; petiole of cell M_1 and *m* subequal; *m-cu* shortly before fork of m_{3+4}.

Abdomen with proximal six segments reddish brown, vaguely patterned with darker; outer segments blackened. Male hypopygium (text-fig. 9*c*) with the sutures separating the ninth tergite and basistyle from the ninth sternite entire. Ninth tergite, *9t*, transverse; viewed from above, the caudal border with a very shallow V-shaped notch, the lateral lobes very low, on their ventral surface with a blackened spine, directed caudad and slightly upturned; viewed from above with the base thickened and with a small tooth on the mesal face. Basistyle entirely unarmed. Outer distintyle, *d*, a flattened dusky spatula; inner style massive, beak short but slender, heavily blackened, especially beneath; lower beak pale, very deep; a double dorsal crest, including a long low setiferous one, extending the whole length of the dorsal surface and a small glabrous flange immediately back of the beak. Appendage of ninth sternite, *9s*, boomerang-shaped, narrowed very gradually to the obtuse tip, the concave margin with four setigerous punctures, three being grouped near the tip. Aedeagus, *a*, with the tip decurved, the lower face with a large flattened flange, this apparent from the lateral aspect. Eighth sternite, *8s*, entirely unarmed.

Habitat.—India (United Provinces).

Holotype, male, Jabharket, on Mussoorie-Tehri Road, ca. 4 miles from Mussoorie, Dehra Dun District, June 20—25, 1930 (B. N. Chopra); Station 4, found in damp places in jungle near water trickling from a spring; Zoological Survey of India No. 62.

The present fly is readily told from all other generally similar regional species by the structure of the male hypopygium, particularly the tergite, unarmed basistyle, and the appendage of the ninth sternite. The most similar of these species are *Tipula* (*Vestiplex*) *stylifera* Alexander and *T.* (*V.*) *inaequidentata* Alexander.

Tipula (Vestiplex) scandens Edwards.

1928. *Tipula scandens*, Edwards, *Ann. Mag. Nat. Hist.* (10) I, p. 691.

East Tibet: Poshö, Dzongra, altitude 14,500—16,000 feet, July 4 20, 1936 (R. J. H. Kaulback); British Museum (Natural History).

Tipula (Vestiplex) styligera Alexander.

1927. *Tipula styligera*, Alexander, *Rec. Ind. Mus.* XXIX, pp. 179-180.

The unique type was taken at Darjiling, altitude 7,000 feet, May 23, 1910, by Brunetti, and no further specimen appears to have been taken. The two drawings of the male hypopygium (text-fig. 9*d*) showing the ninth tergite, *9t*, and the basistyle, *b*, were made from the dry type.

Tipula (Vestiplex) subreposita Alexander.

1942. *Tipula* (*Vestiplex*) *subreposita*, Alexander, *Rec. Ind. Mus.* XLIV, pp. 39-41.

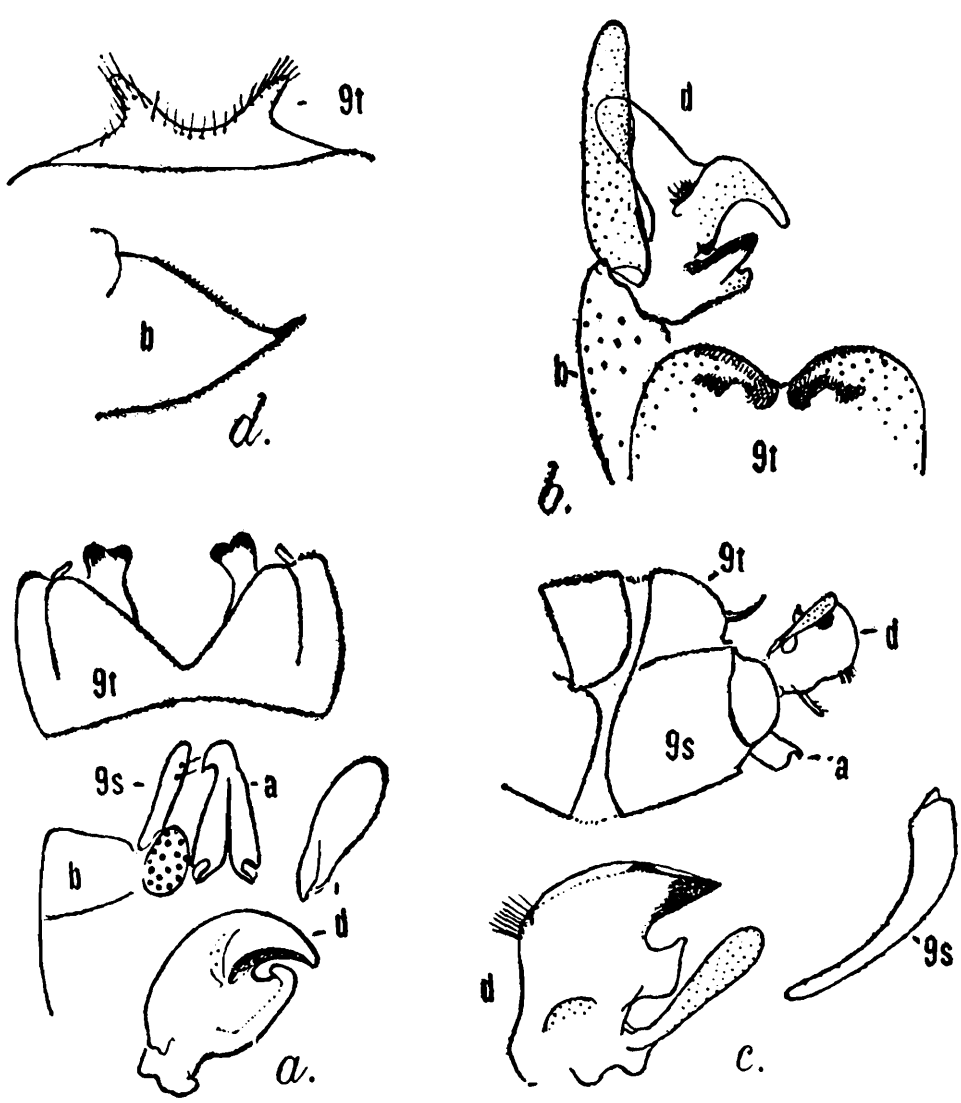
The type was from Sureil, Darjiling District, taken in April-May 1917, by Kemp. One further male, Company Khud, below Landour Bazar, Mussoorie, Dehra Dun District; Station 3, June 18, 1930, taken by B. N. Chopra; Zoological Survey of India No. 39.

Tipula (Schummelia) nicothoe Alexander.

1953. *Tipula (Schummelia) nicothoe*, Alexander, *Ann. Mag. Nat. Hist.* (12) in press.

The type was from the Dü Chu Valley, East Tibet, altitude 13,500 feet, taken July 13, 1936, by R. J. H. Kaulback; British Museum (Natural History).

Male hypopygium (text-fig. 9*b*) with the ninth tergite, *9t*, large, transverse, the caudal margin with two broadly rounded blackened lobes that are separated by a V-shaped notch; on ventral surface of lobe with a conspicuous blackened flange that appears emarginate by a small U-shaped notch. Outer dististyle, *d*, elongate, pale, gradually narrowed



Text-fig. 9*a*. *Tipula (Vestiplex) halteroptera* Alexander; *b*. *Tipula (Schummelia) nicothœ* Alexander; *c*. *Tipula (Vestiplex) ravana*, sp. nov.; *d*. *Tipula (Vestiplex) styligera* Alexander; male hypopygia.

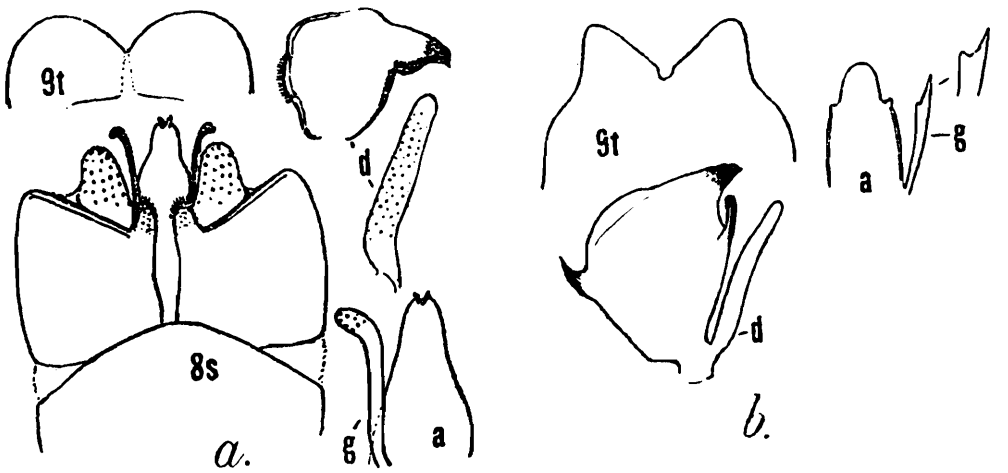
to the obtuse tip; inner style with the posterior crest very long, yellow, directed backward; beak slender, near its base produced into a blackened flange; lower beak with the surface microscopically corrugated; sensory area placed at base of beak, each area with a long coarse seta.

Tipula (Oreomyza) baileyi Alexander.

1952. *Tipula (Oreomyza) baileyi*, Alexander, *Ann. Mag. Nat. Hist.* (12) in press.

The types were from Tibet, taken at Yatung, altitude 12,000 feet, September 21, 1928, and Changu, altitude 12,500 feet, October 1, 1928, by Lt. Col. F. H. Bailey.

Male hypopygium (text-fig. 10*a*) with the ninth tergite, *9t*, transverse, the caudal border very gently emarginate to produce two low rounded lobes, their margins with sparse delicate setae. Outer dististyle, *d*, long and relatively slender, narrowed very gradually to the obtuse glabrous tip, the remaining surface sparsely setiferous; inner style a compressed-flattened blade, the beak blackened, its tip highly polished and microscopically pointed beneath. Gonapophysis, *g*, a slender rod, the dilated spatulate tip bent slightly dorsad, provided with a few scattered spicules. Aedeagus, *a*, stout, darkened, broadest across base. Ninth sternite, *9s*, extensive, viewed from beneath showing a narrow central strip that is delimited by two nearly parallel pale lines; accessory sternal sclerites completely cut-off at ends of sternite, dark-coloured, provided with abundant long yellow setae. Eighth sternite, *8s*, with the caudal margin entirely unarmed and glabrous, gently convex.



Text-fig. 10*a*. *Tipula* (*Oreomyza*) *baileyi* Alexander; *b*. *Tipula* (*Oreomyza*) *garuda* Alexander; male hypopygia.

Tipula (Oreomyza) garuda Alexander.

1953. *Tipula* (*Oreomyza*) *garuda*, Alexander, *Ann. Mag. Nat. Hist.* (12) in press.

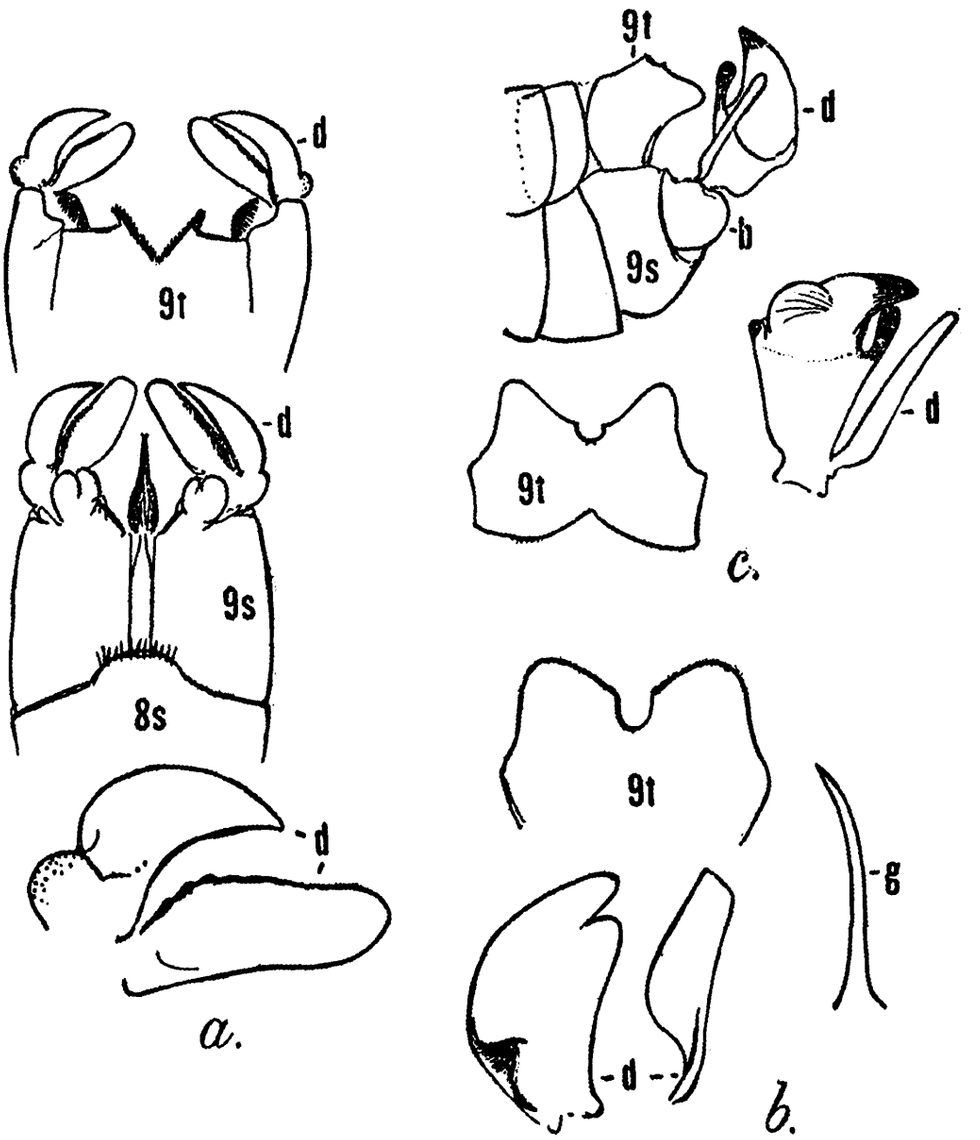
Types from Adung Valley, Northeast Burma, altitude 10,000 feet, taken June 6—7, 1931, by Kingdon Ward and Lord Cranbrook; British Museum (Natural History).

Male hypopygium (text-fig. 10*b*) with the ninth tergite and basistyle entirely separate from the ninth sternite. Ninth tergite, *9t*, transverse, broadest across basal half, the apex produced into two conspicuous lobes with obliquely truncated apices, separated by a U-shaped notch. Basistyle simple, unproduced in any manner. Outer dististyle, *d*, relatively long and slender, narrowed to the obtuse tip, the latter with conspicuous setae that are longer than elsewhere-on the style; inner style compressed, the beak stout, blackened; lower beak long and slender, subcylindrical, the tip obtuse; posterior border of style with an acute black spine, directed outwardly. Gonapophysis, *g*, a small weak blade, the tip notched to form two unequal lobes, one of which is acute. ninth sternite divided

medially by pale membrane to its very base, the outer end of notch widened, on either side with a small complete accessory sclerite. Eighth sternite transverse, its posterior border truncate to scarcely emarginate unarmed.

Tipula (Oreomyza) letifera Alexander.

1951. *Tipula (Oreomyza) letifera*, Alexander, *Ann. Mag. Nat. Hist.* (12) IV, pp. 1084-1085.



Text. fig. 11*a*. *Tipula (Oreomyza) letifera* Alexander; *b*. *Tipula (Oreomyza) harva* Alexander; *c*. *Tipula (Oreomyza) wardiana* Alexander; male hypopygia.

The unique type was from Shugden Gompa, Southeast Tibet, altitude 13,000 feet, taken August 18, 1935, by R. J. H. Kaulback; British Museum (Natural History).

Male hypopygium (text-fig. 11*a*) with the ninth tergite, *9t*, transverse, its posterior border truncate, with a V-shaped median notch, the margins of the latter narrowly blackened, produced outward as slender lobes. Outer dististyle, *d*, broad, its dorsal margin narrowly blackened and crenulate; inner style with the main body a flattened blade that narrows to the acute beak, the outer margin evenly convex. Eighth sternite,

8s, slightly sheathing, the central part of caudal border produced into a low rounded lobe that is fringed with about a dozen black setae.

Tipula (Oreomyza) sharva Alexander.

1953. *Tipula* (*Oreomyza*) *sharva*, Alexander, *Ann. Mag. Nat. Hist.* (12) in press.

The types were from the Adung Valley, Burma, altitude 12,000—14,000 feet, June 22—July 18, 1931, taken by Kingdon Ward and Lord Cranbrook.

Male hypopygium (text-fig. 11*b*) with the sutures separating the tergite, sternite and basistyle complete. Ninth tergite, *9t*, large, the caudal border produced into two broad and thin obtuse lobes, separated by a U-shaped notch. Outer dististyle, *d*, narrowed at base, the apex truncate ; inner style with both the beak and lower beak obtuse, blackened ; region of the posterior crest behind darkened and elevated into a blackened ridge. Gonapophysis, *g*, long and slender, acicular. Eighth sternite unarmed.

Tipula (Oreomyza) wardiana Alexander.

1951. *Tipula* (*Oreomyza*) *wardiana*, Alexander, *Ann. Mag. Nat. Hist.* (12) IV, pp. 1082-1083.

Types from the Adung Valley, Northeast Burma, altitude 8,000 feet, taken June 5, 1931, by Kingdon Ward and Lord Cranbrook.

Male hypopygium (text-fig. 11*c*) with the caudal border of the ninth tergite, *9t*, biemarginate, there being a major outer shallow notch, with a small circular one at its base. Outer dististyle, *d*, long and narrow, only slightly wider near base than near apex ; inner style massive, lower beak elongate, dilated at apex into an obtusely rounded head.

Tipula (Acutipula) deva Alexander.

1952. *Tipula* (*Acutipula*) *deva*, Alexander, *Ann. Mag. Nat. Hist.* (12) in press.

The unique type was from the Adung Valley, Northeast Burma, altitude 9,000 feet, taken June 6, 1931, by Kingdon Ward and Lord Cranbrook.

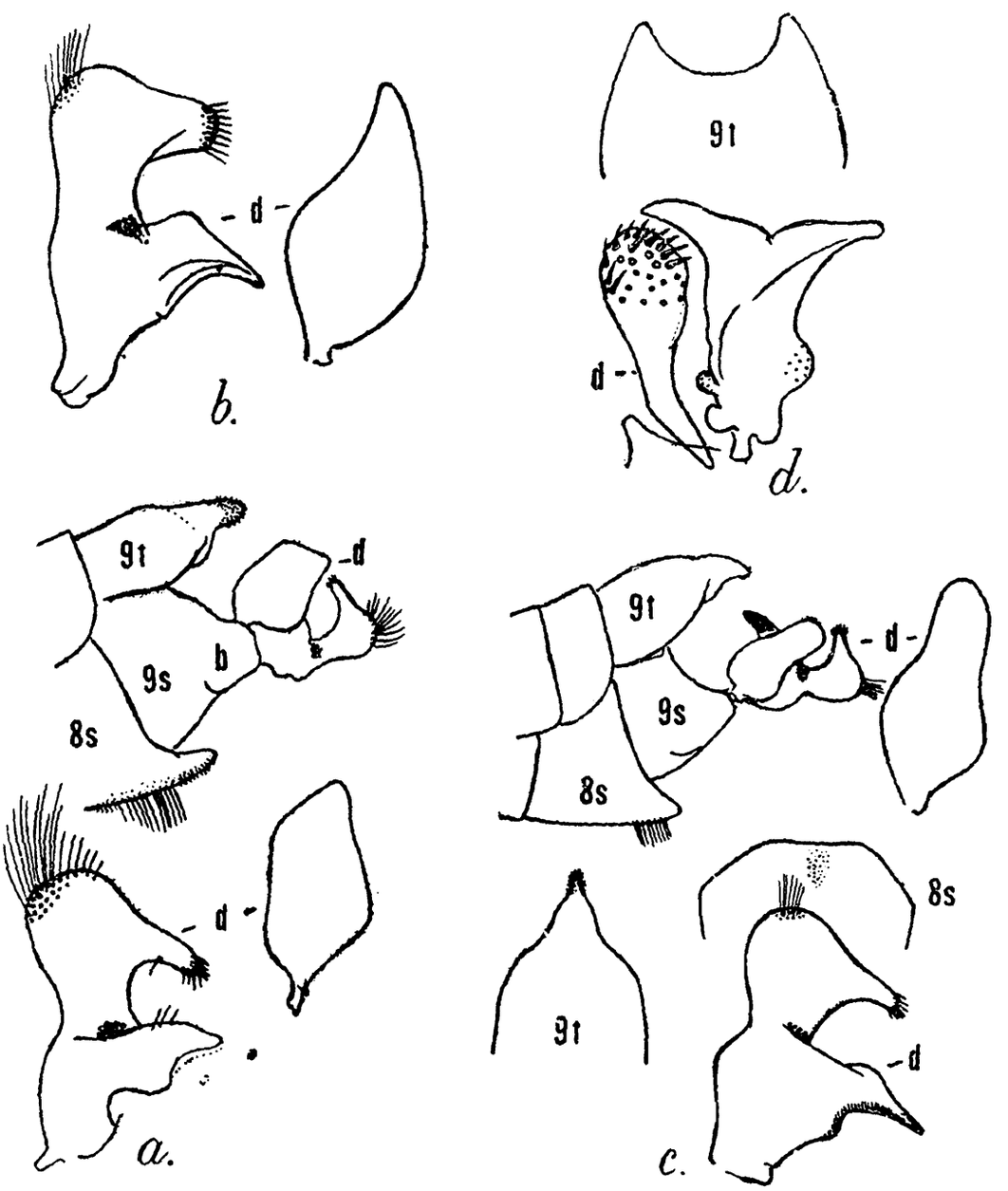
Male hypopygium (text-fig. 12*a*) with the median lobe of the tergite *9t*, simple, relatively narrow, compressed-flattened, densely set with black spiculose points. Outer dististyle, *d*, white, relatively short and broad, widest across basal half, the tip obliquely truncate ; inner style with its outer lobe large and erect, the summit with about thirty strong setae, those nearest the apical lobe shorter ; subterminal lobe or beak broken at tip, its exact length and contour unknown. Eighth sternite, *8s*, with a lobe that is somewhat like that of the tergite but broader, depressed-flattened, the apex with spiculae, the more basal part beneath with long yellow setae, the outer ones longest.

Tipula (Acutipula) epicaste Alexander.

1952. *Tipula* (*Acutipula*) *epicaste*, Alexander, *Ann. Mag. Nat. Hist.* (12) in press.

The unique type was taken in the Adung Valley, Northeast Burma, altitude 12,000 feet, August 1, 1931, by Kingdon Ward and Lord Cranbrook.

Male hypopygium (text-fig. 12*b*) with the tergite produced into a slender median lobe, its apex simple, spiculose. Outer dististyle, *d*, broadest at about opposite midlength, the distance exceeding one-half the length, apex narrowly obtuse ; inner style with the apex of rostrum of outer lobe very broad and obtuse, with strong setae ; summit of lobe obtuse, with a smaller group of more delicate setae placed back of the exact summit ; beak slender. Eighth sternite broad, with weak brushes of yellow setae back from the border.



Text-fig. 12*a*. *Tipula* (*Acutipula*) *devx* Alexander ; *b*. *Tipula* (*Acutipula*) *epicaste* Alexander ; *c*. *Tipula* (*Acutipula*) *radha* Alexander ; *d*. *Tipula pullimarge* Alexander male hypopygia.

Tipula (Acutipula) radha Alexander.

1952. *Tipula* (*Acutipula*) *radha*, Alexander, *Ann. Mag. Nat. Hist.* (12) in press.

The unique type was from Zayul, Atakwg, Southeast Tibet, altitude 10,000 feet, taken July 16, 1933, by Kingdon Ward and Kaulback.

Male hypopygium (text-fig. 12*c*) with the sutures between the tergite and sternite complete, that between the basistyle and sternite represented

only beneath. Ninth tergite, *9t*, produced far beyond the level of the eighth sternite into a simple lobe, at its apex very slender, terete, provided with small microscopic points; more basally, on sides of tergite with abundant long coarse setae. Outer dististyle, *d*, relatively long, obtuse attip broadest on basal half; inner style with outer lobe yellowed, the summit obtuse, provided with a small brush of erect setae; the produced beaklike portion tipped with shorter stouter spinous setae; beak of style slender, on outer margin back from the blackened part with a low crest; sensory pores abundant. Eighth sternite, *8s*, broad, only moderately sheathing, the apex truncated; just back of margin at midline with a small brush of relatively short setae, directed ventrad and slightly caudad.

Tipula (Indotipula) palnica Edwards.

1932. *Tipula (Indotipula) palnica*, Edwards, *Stylops I*, pp. 235, 236.

Mango Range, Nilgiri Hills, South India, altitude 3,800 feet, May 1949, collected by Susai Nathan.

Tipula (Lunatipula) marmoratipennis Brunetti.

1912. *Tipula marmoratipennis*, Brunetti, *Fauna Brit. India, Dipt. Nemat*, pp. 319-320.

1942. *Tipula (Lunatipula) marmoratipennis*, Alexander, *Rec. Ind. Mus.* XLIV, pp. 49-50.

The type was from Darjiling, altitude 7,000 feet, taken May 24, 1910, by Brunetti.

One female, Jabharket, on the Mussoorie-Tehri Road, ca. 4 mile from Mussoorie, Dehra Dun District; Station 4-Found in damp places in jungle near water trickling from a spring, June 20-25, 1930 (B. N. Chopra); Zoological Survey of India No. 51.

Tipula (Lunatipula) trialbosignata Alexander.

1935. *Tipula (Lunatipula) trialbosignata*, Alexander, *Philip. Journ. Sci.* LVI, pp. 346-348.

Sind Valley, Kashmir, altitude 9,000 feet, June 14, 1934 (Miss Vivien Hutchinson).

Tipula pullimargo Alexander.

1951. *Tipula pullimargo*, Alexander, *Ann. Mag. Nat. Hist.* (12) IV, pp. 1086-1087.

Types from the Adung Valley, Northeast Burma, altitude 8,000 feet, May 30-June 13, 1931, taken by Kingdon Ward and Lord Cranbrook.

Male hypopygium (text-fig. 12*d*) with the ninth tergite, *9t*, narrowed outwardly, the caudal margin with a broad shallow median notch, the lateral lobes slender. Outer dististyle, *d*, a short compact club, the head set with numerous strong black spinous setae; inner style a larger flattened structure, dilated outwardly to form two subequal blades, the beak and posterior crest both being of approximately equal size and outline, the former more obtuse at tip; beak with more abundant punctures than the crest.

Subfamily *LIMONIINAE.*

Tribe LIMONIINI.

Limonia (Libnotes) bidentata brunettii Alexander.

1912. *Limnobia nigra*, Brunetti, *Fauna Brit. India, Dipt. Nemat.*, pp. 404-405, preoccupied.

1921. *Limnobia brunettii*, Alexander, *Insec. Inscit. Menst.* IX, p. 180.

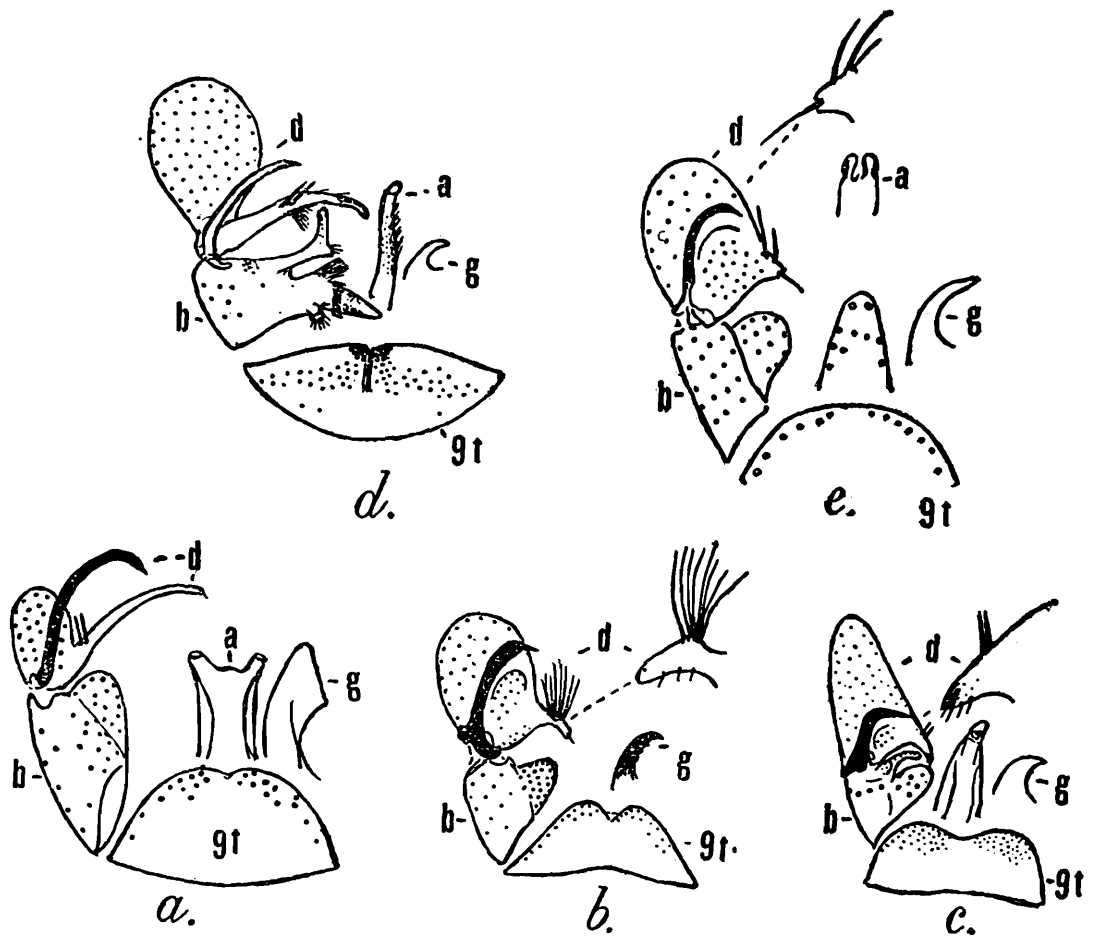
Singara, Nilgiri Hills, South India, June 1948 (Susai Nathan).

Limonia (Libnotes) whiteana Alexander.

1922. *Libnotes distincta*, Senior White, *Mem. Dept. Agr. India*, VII, pp. 133-134, preoccupied.

1952. *Limonia (Libnotes) whiteana*, Alexander, *Rec. Ind. Mus.*, this paper, page 56.

Singara, Nilgiri Hills, South India, altitude 3,400 feet, October 1948 (Susai Nathan).



Text-fig. 13*a*. *Limonia (Limonia) dravidiana* Alexander; *b*. *Limonia (Rhipidia) impictipennis* Alexander; *c*. *Limonia (Dicranomyia) reductissima* Alexander; *d*. *Limonia (Dicranomyia) vamana* Alexander; *e*. *Limonia (Euglochina) dravidica* Alexander; male hypopygia.

Limonia (Libnotes) greeni (Edwards).

1928. *Libnotes greeni*, Edwards, *Journ. Fed. Malay St. Mus.* XIV, pp. 76, 82.

Cinchona, Anamalai Hills, altitude 4,000—5,000 feet, September 25, 1946 (Susai Nathan).

Limonia (Libnotes) notata (van der Wulp).

1878. *Libnotes notata*, van der Wulp, *Tijd. voor Ent.* XXI, p. 194.

Coimbatore, South India, October 19, 1947 (Susai Nathan).

Brunetti omitted this from both his 1912 and 1918 reports on the Indian Tipulidae but included it from Ceylon and South India in his *Catalogue* (1920).

Limonia (Limonia) dravidiana Alexander.

1951. *Limonia dravidiana*, Alexander, *Ann. Mag. Nat. Hist.* (12) IV, pp. 895-897.

Types from Naduvatam, Nilgiri Hills, South India, altitude 6,000 feet, May 21, 1950 (Susai Nathan).

Male hypopygium (text-fig. 13*a*) with the tergite, *9t*, large, roughly semicircular in outline, the caudal border convexly rounded, with a very small median notch. Basistyle, *b*, with the ventromesal lobe very stout, occupying the whole inner face of the style. Dorsal dististyle, *d*, a curved blackened rod, narrowed to the acute tip; ventral dististyle small, oval, its area, excluding the prolongation, only about as great as the ventromesal lobe of the basistyle, conspicuously hairy; rostral prolonggation unusually long and slender, fully as long as the style itself and approximately two-thirds the dorsal dististyle; rostral spines two, relatively long, pale, placed close together near the base of the prolongation. Gonapophysis, *g*, with the mesal apical lobe appearing as a broad darkened blade, its apex obliquely truncated. Aedeagus, *a*, broad, the tip conspicuously bilobed.

Limonia (Limonia) flavocincta (Brunetti).

1918. *Limnobia flavocincta*, Brunetti, *Rec. Ind. Mus.* XV, p. 289.

Cinchona, Anamalai Hills, South India, altitude 4,000—5,000 feet, September 18, 1946 (Susai Nathan).

Limonia (Rhipidia) impictipennis Alexander.

1952. *Limonia (Rhipidia) impictipennis*, Alexander, *Ann. Mag. Nat. Hist.* (12) in press.

The unique type was from the Adung Valley, Northeast Burma, altitude 12,000 feet, August 5, 1931, taken by Kingdon Ward and Lord Cranbrook.

Male hypopygium (text-fig. 13*b*) with the tergite, *9t*, strongly narrowed outwardly, the caudal margin notched. Dorsal dististyle, *d*, stout, widened outwardly, suddenly narrowed into a long straight spine; ventral style of moderate size, its area approximately twice that of the basistyle; rostral spines eight in number, long and conspicuous, the longest subequal to the prolongation. Gonapophysis, *g*, with the mesal-apical lobe blackened, the slightly curved tip acute, the concave inner margin with a few scattered microscopic points.

Limonia (Dicranomyia) perobtusa Alexander.

1945. *Limonia (Dicranomyia) perobtusa*, Alexander, *Lingnan Sci. Journ.* XXI, pp. 23-24.

The unique type specimen was from Kunming, Yunnan, China, altitude 2,100 meters, taken July 7, 1940, by J. L. Gressitt.

A male, Poshö, East Tibet, Kyari Dzong, altitude 12,500 feet, June 27, 1936 (R. J. H. Kaulback).

Limonia (Dicranomyia) reductissima Alexander.

1952. *Limonia (Dicranomyia) reductissima*, Alexander, *Ann. Mag. Nat. Hist.* (12) in press.

Male hypopygium (text-fig. 13*c*) with the tergite, *9t*, transverse, the caudal margin gently emarginate, the obtuse lobes provided with unusually abundant long pale setae. Basistyle, *b*, short, the main body with only about four to six strong setae, arranged in a transverse row near outer end; ventromesal lobe narrowed outwardly, provided with relatively few setae; besides this latter lobe, with two smaller lobes lying still farther distad at extreme outer end of mesal face, one a small oval lobule, the other appearing as a long slender pale lobe, narrowed gradually to the obtuse tip. Dorsal dististyle, *d*, a strongly curved darkened sickle, widened at the bend, thence narrowed to the long acute terminal spine; ventral style long and fleshy, its area more than twice the total area of the basistyle; rostral prolongation stout, its tip narrowly blackened, subacute; rostral spines placed on outer margin near base of prolongation, close together, without evident basal tubercles. Gonapophysis, *g*, with mesal-apical lobe stout, blackened, bent laterad into an acute point.

Limonia (Dicranomyia) sjostedti Alexander.

1934. *Limonia (Dicranomyia) Sjostedti*, Alexander, *Arkiv for Zoologi* XXVII A, No. 17, pp. 18-19.

The types and only other known specimens were from Kung-tze-tägga, Tsaluk Valley, Min-shan, Kina, Kansu, Western China, collected at 3,028 meters, July 20, 1930, by David Hummel. One further male, Dü Chu Valley, East Tibet, altitude 13,000 feet. July 13, 1936 (R. J. H. Kaulback); British Museum (Natural History).

Limonia (Dicranomyia) vamana Alexander.

1952. *Limonia (Dicranomyia) vamana*, Alexander, *Ann. Mag. Nat. Hist.* (12) in press.

The type was from Ootacamund, Nilgiri Hills, South India, altitude 7,500 feet, September 18, 1950 (Susai Nathan).

Male hypopygium (text-fig. 13*d*) of the same general type as in *gracilis* Doane and *halterella* Edwards. Ninth tergite, *9t*, transverse, the anterior margin evenly convex, the posterior border more nearly transverse, with a deep median split, on either side of which about ten long setae. Basistyle, *b*, relatively small, its ventromesal lobe very complicated by outgrowths, the most caudal being a geniculate darkened lobe; outermost lobe gradually narrowed to a tonguelike pale lobule, before the ligulate portion with two different setiferous areas, one consisting of a dense collar of relatively short setae; at base of the ventromesal lobe on lower margin with a bilobed appendage provided with very long erect setae. Dorsal dististyle, *d*, only slightly curved; ventral style in total area somewhat less than the basistyle, the slender rostral prolongation nearly cut-off from the oval outer lobe; rostral spines two,

on face of prolongation at near midlength, opposite a tuft of setae on the lower face. Aedeagus, *a*, slender, with abundant long pale setae.

Limonia (Euglochina) dravidica Alexander.

1951. *Limonia (Euglochina) dravidica*, Alexander, *Ann. Mag. Nat. Hist.* (12) IV, pp. 1097-1098.

Cinchona, Anamalai Hills, South India, altitude 4,000—5,000 feet, August 29—September 25, 1946 (Susai Nathan).

Male hypopygium (text-fig. 13*e*) with the posterior border of tergite, *9t*, gently rounded, the setae mostly marginal in position. Dorsal dististyle, *d*, strongly curved, narrowed to the acute apex; ventral style less than one-half more extensive than the total area of the basistyle; rostral prolongation short and stout, terminating in a single strong seta; two rostral spines on basal half of outer face, the more proximal one a trifle longer and rising from a low tubercle. Gonapophysis, *g*, with the mesal-apical lobe pale, curved to the subacute tip.

Antocha (Antocha) nebulipennis Alexander.

1931. *Antocha (Antocha) nebulipennis*, Alexander, *Philip. Journ. Sci.* XVL, pp. 352-353.

Chumbi Valley, Tibet, altitude 10,000 feet, June 9, 1928 (Lt. Col. F. M. Bailey); British Museum (Natural History).

Antocha (Antocha) pterographa Alexander.

1952. *Antocha (Antocha) pterographa*, Alexander, *Ann. Mag. Nat. Hist.* (1) in press.

The unique type was from Gautsa, Tibet, altitude 13,000 feet, taken June 13, 1928, by Lt. Col. F. M. Bailey.

Male hypopygium (text-fig. 14*a*) with the tergite, *9t*, transverse, narrowed outwardly, the posterior border truncated; surface with numerous setae, distributed chiefly as a transverse band some distance back from the caudal margin. Outer dististyle, *d*, a gently curved darkened rod, the tip obtuse; inner style little longer, its apex obtuse, inner margin with numerous long strong setae. Phallosome, *p*, with the apophyses very different in appearance, the outer pair being short flattened blades, the inner pair as slender sinuous rods, the acute tips paler. Proctiger with numerous long strong setae. Aedeagus, *a*, strongly decurved at apex.

Dicranoptycha malabarica Alexander.

1941. *Dicranoptycha malabarica*, Alexander, *Philip. Journ. Sci.* LXXVI, pp. 50-51.

Walayar Forests, South Malabar, South India, altitude 1,500—2,000 feet, August 8—28, September 9, 1938; Siruvani, Coimbatore District, South India, altitude 3,000 feet, August 11, 1938 (Susai Nathan).

Thaumastoptera (Thaumastoptera) nilgiriensis Alexander.

1951. *Thaumastoptera (Thaumastoptera) nilgiriensis*, Alexander *Ann. Mag Nat. Hist.* (12) IV, pp. 898-899.

Described from Naduvatam, Nilgiri Hills, South India, altitude 6,000 feet, taken May 21, 1950, by Susai Nathan.

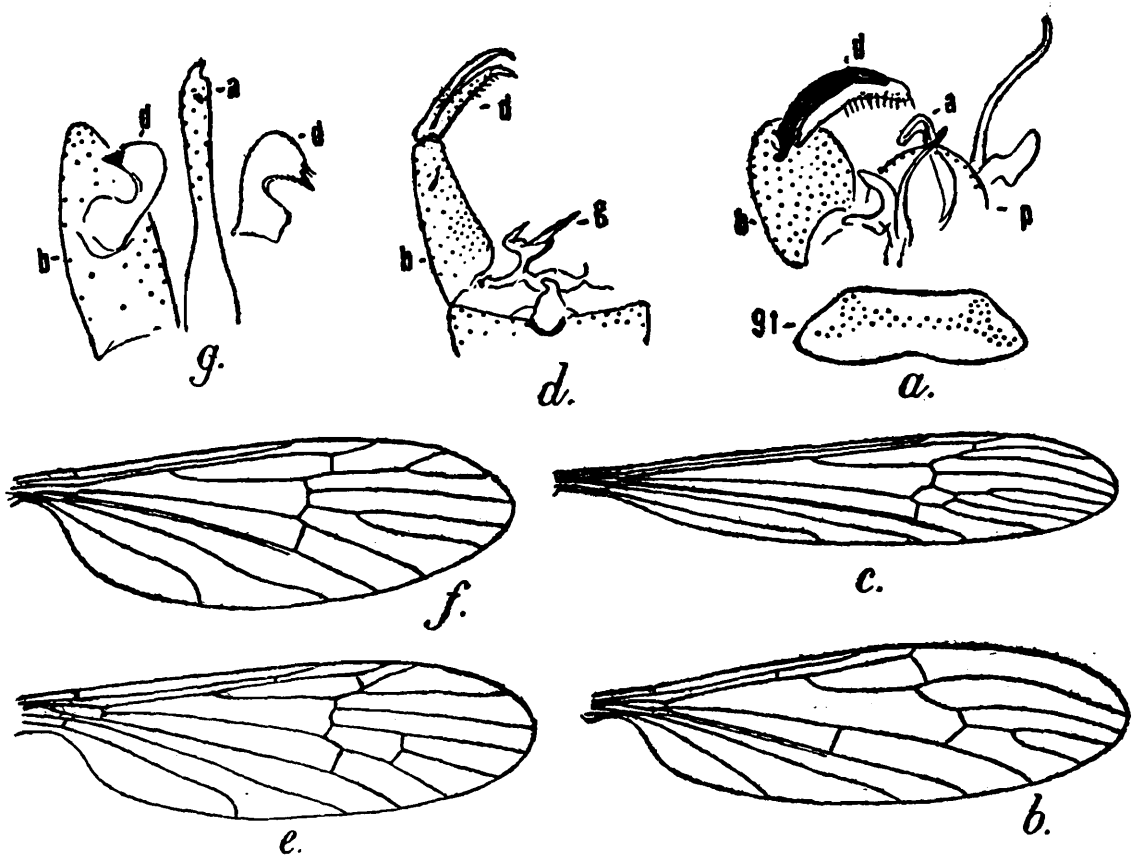
The wing of the type is shown (text-fig. 14*b*).

Tribe HEXATOMINI.

Pseudolimnophila (Pseudolimnophila) productivena Alexander.

1951. *Pseudolimnophila productivena*, Alexander, *Ann. Mag. Nat. Hist.* (12) IV, pp. 899-900.

The unique type was from Naduvatam, Nilgiri Hills, South India, altitude 6,000 feet, May 21, 1950, taken by Susai Nathan.



Text-fig. 14*a*. *Antocha* (*Antocha*) *pterographa* Alexander; *b*. *Thaumastoptera* (*Thaumastoptera*) *nilgiriensis* Alexander; *c*, *d*. *Pseudolimnophila productivena* Alexander; *e*. *Gymnastes* (*Paragymnastes*) *catagrapha* Alexander; *f*, *g*. *Gymnastes* (*Paragymnastes*) *imitator* Alexander; male hypopygia and venation.

The venation is shown (text-fig. 14*c*). Male hypopygium (text-fig. 14*d*) with both dististyles, *d*, slender, the subglabrous outer one a trifle longer, its tip a curved spine; inner style conspicuously setiferous, the tip narrowed. Gonapophysis, *g*, bispinous.

Linmnophila multipunctata Brunetti.

1912. *Limnophila multipunctata*, Brunetti, *Fauna Brit. India, Dipt. Nemat.*, p. 569.

Cherangode, Nilgiri Hills, South India, altitude 3,500 feet, November 1950 (Susai Nathan).

Hexatoma (Eriocera) tripunctipennis (Brunetti).

1912. *Eriocera tripunctipennis*, Brunetti, *Rec. Ind. Mus.* XV, p. 338.

Cherangode, Nilgiri Hills, South India, altitude 3,500 feet, May 24, 1950 (Susai Nathan).

Tribe ERIOPTERINI.

Conosia irrorata (Wiedemann).

Bhadrowati, Mysore State, altitude 1908 feet, at light, August 2, 1938; Nedungadu, Tanjore District, South India, January 24, February 25, 1938 (Susai Nathan).

Trentepohlia (Anchimongoma) simplex (Brunetti).

1918. *Anchimongoma simplex*, Brunetti, *Rec. Ind. Mus.* XV, p. 316.

Naduvatam, Nilgiri Hills, South India, altitude 6,000 feet, May 2, 1950 (Susai Nathan).

Gonomyia (Idiocera) metatarsata de Meijere.

1911. *Gonomyia metatarsata*, de Meijere, *Tijd. voor Ent.* LIV, p. 48.

Gudalur, Nilgiri Hills, South India, altitude 3,500 feet, April 1949 (Susai Nathan).

Gymnastes (Paragymnastes) catagrapha Alexander.

1929. *Gymnastes catagrapha*, Alexander, *Philip. Journ. Sci.* XL, pp. 342-344.

The unique type male was from Castle Rock, North Canara District, Southwest India, October 11—26, 1916, taken by Kemp; Type in the Indian Museum. The wing of the type is shown (text-fig. 14*e*).

Gymnastes (Gymnastes) imitator Alexander.

1951. *Gymnastes (Paragymnastes) imitator*, Alexander, *Ann. Mag. Nat. Hist.* (12) IV, pp. 904-906.

Types from Cherangode, Nilgiri Hills, South India, altitude 3,500 feet, May 17—22, 1950 (Susai Nathan).

The venation is shown (text-fig. 14*f*). Male hypopygium (text-fig. 14*g*) small and simple in construction. A single dististyle, *d*, placed at near two-thirds the length of the basistyle, *b*, expanded at proximal end, thence narrowed, the apex a subtriangular head that narrows to a beaklike point, the lower margin of this with two or three further microscopic denticles. Aedeagus, *a*, long and slender, with scattered setae.

Erioptera (Teleneura) nebulifera Alexander.

1952. *Erioptera (Teleneura) nebulifera*, Alexander, *Ann. Mag. Nat. Hist.* (12) in press.

Described from Naduvatam, Nilgiri Hills, South India, altitude 6,000 feet, September 1950 (Susai Nathan).

Male hypopygium (text-fig. 15*aj*) with the posterior border of the tergite, *9t*, conspicuously emarginate, the lobes with abundant spinous setae. A single dististyle, *d*, slender, much shorter than the basistyle, provided with a small tubercle on outer margin near base. Phallosome, *p*, consisting of a central depressed plate and a pair of gonapophyses, the

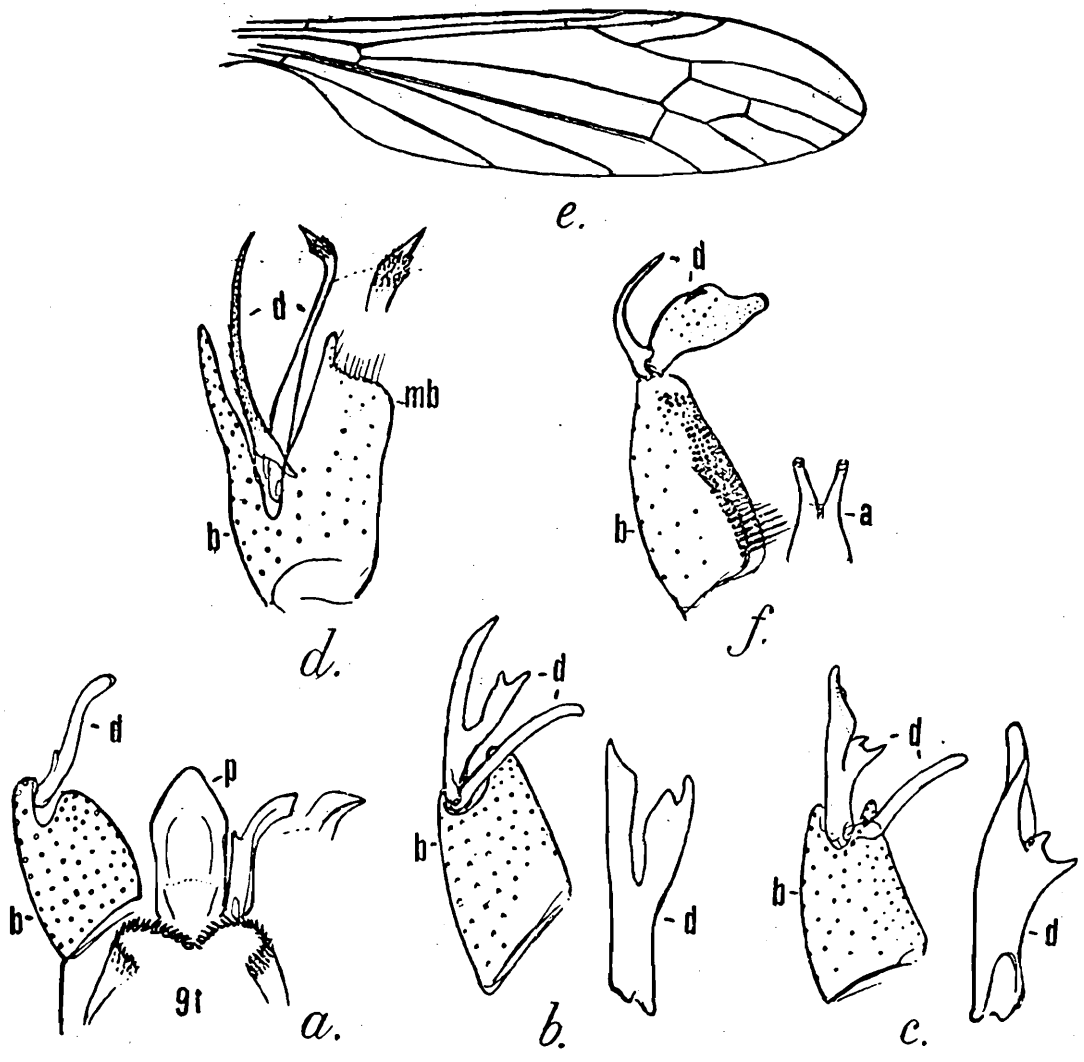
latter appearing as relatively narrow yellow blades, with a strong tooth on inner margin at near midlength.

Erioptera (Erioptera) orbitalis Alexander.

1924. *Erioptera (Erioptera) orbitalis*, Alexander, *Philip. Journ. Sci.* XXIV, p. 584.

1927. *Erioptera ornatifrons* Edwards, *Spolia Zeylancia*, XIV, pp. 122-123.

Singara, Nilgiri Hills, South India, altitude 3,400 feet, May 11, 1948 (Susai Nathan)



Text-fig. 15 *a. Erioptera (Teleneura) nebulifera* Alexander; *b. Erioptera (Empeda) accomoda* Alexander; *c. Erioptera (Empeda) simplicior* Alexander; *d. Molophilus (Molophilus) lancifer* Alexander; *e. Toxorhina (Ceratocheilus) brevifrons* Brunetti; *f. Toxorhina (Toxorhina) brevirama* Alexander; male hypopygia and venation.

Erioptera (Erioptera) orientalis Brunetti.

1912. *Erioptera orientalis*, Brunetti, *Fauna Brit. India. Dipt. Nemat.*, p. 453-454.

1921. *Erioptera dictenidia* Alexander, *Ann. Ent. Soc. America* XIV, pp. 115-116.

Naduvatam, Nilgiri Hills, South India, altitude 6,000 feet, May 12, 1950 (Susai Nathan)

Erioptera (Empeda) accomoda Alexander.

1951. *Erioptera (Empeda) accomoda*, Alexander, *Ann. Mag. Nat. Hist.* (12) IV, pp. 906-907.

Described from Cherangode, Nilgiri Hills, South India, altitude 3,500 feet, May 1950 (Susai Nathan).

Male hypopygium (text-fig. 15*b*) with the outer dististyle, *d*, entirely blackened, profoundly bifid, the outer arm a simple blackened rod, its tip subacute ; inner arm shorter and stouter, at apex unequally bidentate, the innermost point a little longer.

Erioptera (Empeda) simplicior Alexander.

1951. *Erioptera* (*Empeda*) *simplicior*, Alexander, *Ann. Mag. Nat. Hist.* (12) IV pp. 907-908.

Described from Singara, Nilgiri Hills, South India, altitude 3,400 feet, taken May 12, 1948, by Susai Nathan.

Male hypopygium (text-fig. 15*c*) with the outer dististyle, *d*, heavily blackened, unusually simple, appearing as a straight rod that narrows to an apical blade ; at near midlength on inner margin with two strong teeth, the more basal ones a little longer and more slender ; inner style long and narrow, yellow.

Molophilus (Molophilus) lancifer Alexander.

1952. *Molophilus* (*Molophilus*) *lancifer*, Alexander, *Ann. Mag. Nat. Hist.* (12) in press.

The type was from Cherangode, Nilgiri Hills, South India, altitude 3,500 feet, taken November 1950, by Susai Nathan.

Male hypopygium (text-fig. 15*d*) with the dorsal lobe of the basistyle *b*, slender, projecting caudad to about two-thirds the length of the outer dististyle, with setae virtually to the tip ; mesal lobe of basistyle, *mb*, a broadly flattened lobe, its inner apical angle a trifle more produced. Both dististyles, *d*, simple, the outer a slender rod that narrows gradually into an elongate spine, the surface of the intermediate portion with abundant microscopic spinulae ; inner style nearly as long, narrowed outwardly to near three-fourths the length, thence slightly expanded, terminating in a short acute spine, the dilated head with microscopic spinulae.

Todorhina (Ceratocheilus) brevifrons (Brunetti).

1918. *Conithorax brevifrons*, Brunetti, *Rec. Ind. Mus.* XV, p. 300.

The wing of the holotype specimen is shown (text-fig. 15*e*).

Toxorhina (Toxorhina) brevirama Alexander.

1952. *Toxorhina* (*Toxorhina*) *brevirama*, Alexander, *Ann. Mag. Nat. Hist.* (12) in press.

Described from Naduvatam, Nilgiri Hills, South India, altitude 6,000 feet, taken in September 1950 by Susai Nathan.

Male hypopygium (text-fig. 15*f*) with the mesal face of the basistyle, *b*, with a longitudinal row of strong black setae and abundant long erect more delicate bristles. Outer dististyle, *d*, a slender curved rod, narrowed to the acute tip ; inner style longer, broad, the apex obtuse ; outer margin beyond midlength with a powerful recurved black spine. Arms of aedeagus, *a*, short.

ON INDIAN TADPOLES WITH A SUCTORIAL DISC.

By MIRA KRIPALANI, *M.Sc., Zoological Survey of India, Calcutta.*
(With One Plate.)

While working on the distribution and evolution of the species of frogs with tadpoles having a ventral suctorial disc, a specialised structure for life in torrential streams, it was found necessary to study in detail the Indian forms. For this purpose, both named and unnamed materials in the collection of the Zoological Survey of India were examined. As a result of this study, three species of tadpoles of this group have been established from India, *viz.*, *Staurois*[1] *afghana* (Günther), *S. himalayana* (Boulenger) and a new form. The range of the well known *S. afghana* has been extended from the Eastern to the Western Himalayas. *S. himalayana* tadpoles have now been definitely characterized. The new form is described here. A key to all the known species of tadpoles with suctorial discs has been given to distinguish the new tadpole.

I wish to acknowledge my sincere thanks to Dr. S. L. Hora, Director, Zoological Survey of India, for his kind help and encouragement throughout the preparation of this paper.

Staurois afghana (Günther).

(Plate, Fig. 1.)

1920. *Rana latopalmata*, Boulenger, *Rec. Ind. Mus.*, **20**, p. 217 (see this work for earlier references).
1930. *Rana latopalmata*, Cochran, *Proc. U. S. Nat. Mus. Washington*, **77**, p. 5.
1940. *Staurois afghanus*, Pope & Boring, *Peking Nat. Hist. Bull.*, **15**, p. 47.
1950. *Staurois afghanus*, Liu, *Fieldiana Zoology Memoirs*, **2**, p. 358.

Material Examined

Reg. No.	Locality.	Date and Donor/ Collector.	Number of specimens.
19752	Charan Khad below Dharamsala, Kangra dist., Punjab.	22-26. V. 1926. S. L. Hora.	11
20574	Kokla nalla, about ½ mile above its junction with Kosi River, Nepal.	29. I. 48. Kosi Survey.	7
19166	Manjhitar, Sikkim (The Great Rangit River).	VI. 1913. B. L. Chowdhury.	3
17768, 18448, 18453, 18456, 18457, 18458.	Darjiling dist., alt. 1000-3000 ft.	V-VI. 1912. Lord Charmichael.	17

[1]The generic name *Staurois* is used here as defined by Noble (*Ann. N. Y. Acad. Sci.* **30**, p. 107, 1927), without prejudice to the propriety or otherwise of its nomenclatorial usuage.

Material Examined—contd.

Reg. No.	Locality.	Date and Donor/ Collector.	Number of specimens.
17796	Kalimpong, Darjiling district, alt. 600-4, 500 ft.	IV-V 1915. F. H. Gravely.	67
19341	Pashok, Darjiling dist., E. Himalayas, alt. 3000 ft.	25. V. 1914. F. H. Gravely.	53
20576	Rilli River, below Kalimpong, Darjiling district.	29. I. 1931 S. L. Hora.	1
20572	A stream midway between Gille Khola Station and Tista bridge, Darjiling district.	3. II. 1931. S. L. Hora.	3
20573	A stream midway between Gille Khola Station and Tista bridge, Darjiling district.	1-14. VI. 1934. S. L. Hora.	22
18983[1], 19340.	Hill stream, above Tura, Garo Hills, Assam.	VI. 1917. S. W. Kemp.	15
16360, 16332	Cherrapunji, Khasi Hills, Assam.	B. Warren	2
10096, 10106, 10119.	Cherrapunji, Khasi Hills, Assam.	.. J. B. Bourne.	3
19935.	Non-priang stream below Cherrapunji, Khasi hills, alt. 1200 ft. Assam.	20-24. II. 1923. S. L. Hora.	3
20571.	Dumpep, Khasi Hills, Assam	IV. 1930. J. L. Bhadhuri.	Many
16966, 16967.	Yembung, Eastern side of Dihang River, Assam.	.. Abor Exped.; (Kemp.).	4
10205	Pegu, Burma	.. Major Berdmore.	1

Remarks.—The tadpoles of *S. afghana* can be readily distinguished from the other two Indian species by (i) the dental formula being $5^{3}5/1_{2}1$ and (ii) the margin of the posterior lip being, as a rule, slightly wavy and sometimes fimbriate.

A short but good description of the tadpole of *Staurois* (=*Rana*) *afghana* was given by Boulenger[2] in 1887, but in view of the large number of specimens examined it would not seem out of place to offer some further remarks on the tadpoles of this species.

There is always a row of papillae on the margin of the lip folds round the corners of the mouth, rarely extending to the margins of the posterior lip. Sometimes an extra row is present inside the postero-lateral margins of the anterior lip and beneath the outermost row of the labial teeth (Fig. 1).

[1]Registered numbers 18983 and 19340 previously determined as *R. livida* are now referred to *S. afghana* =*R. afghana*).

[2]Boulenger, G. A., *Am. Mus. Genova*, (2) 5, p. 420 (1887).

Most of the tadpoles have the colour of their jaws and labial teeth very dark but the lighter shade is not uncommon. This is well indicated, though was probably not noticed, by Dr. Hora[1] in the plate showing the development of the tadpole.

Sometimes there is a white marking on the upper jaw varying from the size of a dot to a V-shaped patch and sometimes even extending round its whole margin. It was due to this variable nature of the white marking that Smith was led to repudiate in 1929[2] his earlier identification of similar tadpoles as *Rana livida.*[3]

A few specimens (9 out of a lot of 250 tadpoles)[4] have jaws as well as labial teeth absolutely or nearly white. All these tadpoles have fore limbs fairly well developed and ventral sucking discs rather less prominently demarkated. Rest of the tadpoles, with black jaws and labial teeth, are without any trace of fore limbs, which, when present, are very minute. It is thus evident that the whiteness of the jaws and labial teeth indicates an advanced stage in the metamorphosis of the tadpole towards adulthood.

Colour of body olive above, with dark markings, if present. The specimens from Nepal are nearly black in colour with irregular ashy markings. The ventral surface is lighter and without markings. The tail portion is, as a rule, of the same colour as the body.

Measurement of a specimen with hind legs half developed: total length, 52 mm.; length of head and body, 17 mm.; body width, 11 mm.; tail length, 35 mm.; tail height, 8 mm.

Geographical distribution.—So far it has been recorded from the Eastern Himalayas (Sikkim & Darjiling), Khasi hills in Assam, Southern Yunnan, hills of Burma as far south as Tenasserim and Siam. Its range is here extended to Western Himalayas in Nepal and Kangra district of the Punjab.

Staurois himalayana (Boulenger).

(Plate, Fig. 2).

1920. *Rana himalayana*, Boulenger, *Rec. Ind. Mus.*, **20**, p. 219 (see for earlier references).

1951. *Rana himalayana*, Acharji, & Kripalani *Rec. Ind. Mus.*, **49**, p. 183.

Material Examined.

Reg. No.	Locality.	Date and Donor/ Collector.	Numbers of specimens.
17879[5]	Darjiling district. . .	III. 1914. Lord Charmichael.	2
20575	Rilli River below Kalimpong, Darjiling district.	29. I. 1931. S. L. Hora.	14

[1]Hora, S. L., *Trans. Roy. Soc. Edin.*, 57, pp. 469-472, (1932).

[2]Smith, M. A., *Rec. Ind. Mus.*, **31**, p. 78 (1929).

[3]Smith, M. A., *Rec. Ind. Mus.*, **26**, p. 139 (1924).

[4]These 9 specimens have Z. S. I. Nos. 10096, 10106, 10119, 18448, 18456-18458 and two specimens out of 53 registered under No. 19341.

[5]The two specimens under No. 17879 bear the label *R. formosa* determined by Boulenger. They are now referred to *S. himalayana.* The tadpoles of *R. formosa* have not yet been described.

Material Examined—contd.

Reg. No.	Locality.	Date and Doner/ Collector.	Number of specimens.
20577	A stream midway between Tista Bridge and Gille-Khola station, Darjiling district.	1-14. VI. 1934. S. L. Hora.	33
20579	Sikkim, alt. 2000 ft.	25. I. 1922. Major F. M. Bailey.	1

Remarks.—Annandale collected a tadpole with a suctorial disc from a stream at Kurseong situated at a height of 5,000 ft. in the Darjiling district during May 21st to May 29th, 1906. He described it as *Rana sp*[1]. Boulenger in his monograph on *Rana*, in 1920 doubtfully referred it to *Staurois* (=*Rana*) *himalayana*. He differentiated it from the tadpoles of *afghana*, then known as *latopalmata*, by its fringed lip, the dental formula $4\frac{3}{3}4/1_{\frac{1}{2}}1$ and uniform colouration. There are 20 tadpoles in the Z. S. I[1]. Collection as listed above which agree with Annandale's description and are almost identical with those of *Staurois lifanensis* Liu of Szechwan in Western China. Liu[2], while discussing the relationships of *Staurois lifanensis*, remarked on the very close relationship between the adults of *S. lifanensis* and *S. himalayana*.

The tadpoles of *S. himalayana* are distinguished from the other two Indian species by (i) the dental formula being $4\frac{3}{3}$-$4/1_{\frac{1}{2}}1$ and (ii) the margin of the posterior lip being distinctly fimbriate and notched in the middle. The tadpole of *S. lifanensis* is almost indentical with that of *S. himalayana* except that the margin of the posterior lip, though fimbriate, is not notched in the middle. Thus, the *himalayana* tadpole is more closely related to that of *Staurois lifanensis*[3] Liu of Szechwan in Western China than to the other forms in Darjiling.

There is a row of marginal papillae round the postero-lateral margin of the upper lip ; these are continued on the margin of the folds round the corners of the mouth and finally extend round the margin of the lower lip. An extra row is present inside the postero-lateral margins of the upper lip. There are some papillae present beneath the outermost row of the labial teeth (Fig. 2).

Colour of the body is olive above with markings, if present, dark. Under surface is lighter and without markings. The tail muscle is of the same colour as the body.

Measurement of a specimen with hind legs about half developed.—Total length 37 mm. ; length of head and body 13 mm. ; body width 9 mm. ; tail length 24 mm. ; tail height 8 mm.

Geographical distribution.—It has been recorded from Western Himalayas in Kangra district of the Punjab (only 2 young frogs known) and

[1]Annandale, *Journ. As. Soc. Bengal*, (2) **2**, p. 290 (1906).
[2]Liu, C. H., *Fieldiana, Zoology Memoirs*, **2**, p. 345 (1950).
[3]Liu, C. H., *Fieldiana, Zoology Memoirs*, **2**, p. 347 (1950).

Eastern Himalayas in Darjiling district of North Bengal. This is the first record from Sikkim. If future researches show that *S. lifanensis* is identical with this species then the range of *S. himalayana* will more or less be co-extensive with that of *S. afghana.*

A NEW TADPOLE.

(Plate, Figs. 3-9.)

A tadpole with a suctorial disc registered under number 20578, Zoological Survey of India, was collected by Dr. S. L. Hora, from a stream between Gille-khola Station and Tista bridge in the Darjiling district of N. Bengal, during the first fifteen days of June 1934. A short description is being given as it happens to be a hitherto unknown tadpole.

The tadpole seems to live in much stronger mountain streams than *Staurois afghana* and *S. himalayana.* Obviously due to that reason it has not been collected in larger numbers along with them. It seems to have been accidently collected along with others but its precise habitat remains to be determined.

It differs from *Staurois afghana* (Gunther) and *S. himalayana* (Boulenger) in being better equipped for fixing itself by having (i) the dental formula $5\frac{3}{3}5/1\frac{1}{1}1$, thus more rows of series of teeth on the posterior lip, (ii) spinous processes on its dorsal and ventral surfaces and (iii) suctorial disc with numerous patches of cornified tissue on the friction area.

The tadpole is of quite a large size, the length of the specimen, with hind legs about half developed, is 73 mm. The body is dorso-ventrally flattened with the snout region depressed. The snout is broadly rounded. The nostrils are much nearer to the eyes than to the tip of the snout, the distance between them being less than the interorbital width. The eyes are more dorsal than lateral, a little nearer to the spiracle than to the tip of the snout. The Pupils are round. The spiracle, which is sinistral, is placed very low down on the side of the body, directed upwards and backwards, ending in a short tube. It is nearer the base of the tail than to the tip of the snout. The vent is median and tubular. The tail which is more than twice as long as head and body, is gradually pointed at the tip. The tail fin is deeper dorsally than ventrally, decreasing in height towards the base of the tail. There is no fin dorsally or ventrally for a short distance from the base of the tail. The muscular portion is strongly developed.

A large suctorial disc is present ventrally (Fig. 7). It has a free border all round except at the anterior end where it is replaced by the posterior lip of the mouth. The central portion of the disc is depressed in the form of a saucer. The skin of this region is thin and through it prominences of muscles and tendons are seen clearly. On the sloping postero-lateral sides surrounding the central portion is the friction area, the skin of which is hardened due to the presence of cornified and tuberculated tissue slightly similar to that of *S. afghana*[1] and *S. himalayana* but arranged here in the form of numerous and irregular patches with microscopic spines (Fig. 8). which undoubtedly help in the adhesion

[1]Bhadhuri, J. L., *Trans. Roy. Soc. Edin.*, **58**, p. 346, pl. figs. 6 & 8 (1934).

of the disc. Surrounding the friction area is the friction rim, the margin of which forms the free border of the suctorial disc. The mouth (Fig. 6) is surrounded by anterior and posterior lips which are continuous and are slightly folded at the corners of the mouth. The anterior lip is horseshoe shaped, posterior lip is thick, straight with fimbriated margin and notched in the middle. There are only 3 papillae on the lips at the corners of the mouth. Labial teeth well developed. There are eight rows on the anterior lip, first 3 continuous and remaining 5 interrupted with the innermost row shortest. There are 5 rows on the posterior lip, the innermost interrupted and outer 4 continuous. Jaws well developed, and moderately serrated.

Two pairs of glandular patches of granules are present. One pair placed behind and below each eye, another quite large and irregular placed laterally at the extreme end of the body (Fig. 3).

Spinous processes are present. These are abundant and rather regularly arranged on the dorsal surface of head (Figs. 4 & 5) while ventrally on each of the postero-lateral side of the disc, are 3 spinous processes directed posteriorly. These may be assisting in the fixation of the disc by hooking in co-ordination with the movements of the disc and lips. Few spinous processes are present on the under surface of toes (Fig. 9).

Colour of the body and muscular portion of the tail is dark brown with irregular darker markings. The under surface is brown without any markings.

Measurement of the specimen with hind legs half developed. Tail length 73 mm.; length of head and body 22 mm.; body width 15·5 mm.; tail length 51 mm.; tail height 11 mm.

Key for the identification of Tadpoles with suctorial Disc.

1.	More than 3 series of teeth on posterior lip .	**2**
	3 Series of teeth on posterior lip . .	**7**
2.	More than 6 series of teeth on posterior lip Dental formula $4\frac{4}{4}/5\frac{5}{5}$ Burma, Siam, Malayasia & Philippines) .	*S. jerboa* (Günther).
	Less than 6 series of teeth on posterior lip .	**3**
3.	8-11 series of teeth on anterior lip . . .	**4**
	4-5 series of teeth on anterior lip . .	**6**
4.	11 series of teeth on anterior lip . . . Dental formula $8^{2}8/1\frac{1}{1}1$ (Borneo)	*S. cavitympanum* (Blgr.).
	Less than 11 series of teeth on anterior lip . .	**5**
5.	Dental formula $5\frac{4}{4}5/1\frac{1}{1}1$ (Malay P. & Borneo) . .	*S. larutensis* (Blgr.).
	Dental formula $5^{2}5/1\frac{1}{1}1$ (N. Bengal) . .	*Tadpole nov.*
6.	Dental formula $3^{1}3/1\frac{1}{3}1$ (Malayasia)	*S. hosii* (Blgr.).
	Dental formula $3^{2}3/1\frac{1}{1}1$ (Borneo & Java)	*S. whiteheadi* (Blgr.).
	Dental formula $3^{1}3/1\frac{1}{1}1$ (Borneo) . . .	*S. guttatus* (Günther).
7.	4-5 Series of teeth on anterior lip .	**8**
	6-8 Series of teeth on anterior lip .	**9**
8.	Dental formula $2^{2}2/1\frac{1}{2}1$ (Hainan)	*S. hainanensis* (Blgr.).
	Dental formula $4/1\frac{1}{2}1$ (N. W., E. China and Tonking)	*S. ricketti* (Blgr.)

9.	8 Series of teeth on anterior lip .	
	Dental formula $5^{3}5/1_{\frac{1}{2}}1$ (Himalayas, Burma, Siam & S. W. China).	*S. afghana* (Günther).
	Less than 8 series of teeth on anterior lip	**10**
10.	Without extra papillae inside of marginal papillae of latero-posterior region of anterior lip.	
	Dental formula $3^{3}3/1_{\frac{1}{2}}1$ (N. W. & E. China)	*S. chunganensis* (Pope).
	With extra papillae inside of marginal papillae of latero-posterior region of anterior lip.	
	Dental formula $4^{3}4/1_{\frac{1}{2}}1$ . .	**11**
11.	Without some papillae beneath outermost row of labial teeth of posterior lip (N. W. China).	*S. mantzorum* (David).
	With some papillae beneath outermost row of labial teeth of posterior lip.	**12**
12.	Posterior lip notched in the middle (N. Punjab, Sikkim, N. Bengal).	*S. himalayana* (Blgr.).
	Posterior lip not notched in the middle . .	**13**
13.	2 Sub-branchial muscles round, parallel and not meeting diaphragmatoprecardialis (N. W. China).	*S. kangtingensis Liu.*
	2 Sub-branchial muscles oval, converging and in contract with diaphragmatocardialis (N. W. China).	*S lifanensis* Liu.

EXPLANATION OF PLATE VIII.

FIG. 1.—*Staurois afghana ;* mouth. $\times 7\frac{4}{5}$.

FIG. 2.—*Staurois himalayana ;* mouth. $\times 10\frac{4}{5}$.

FIG. 3.—New tadpole ; lateral view. $\times 1\frac{4}{5}$.

FIG. 4.—New tadpole ; dorsal view of head showing Spinous processes. $\times 3\frac{3}{5}$.

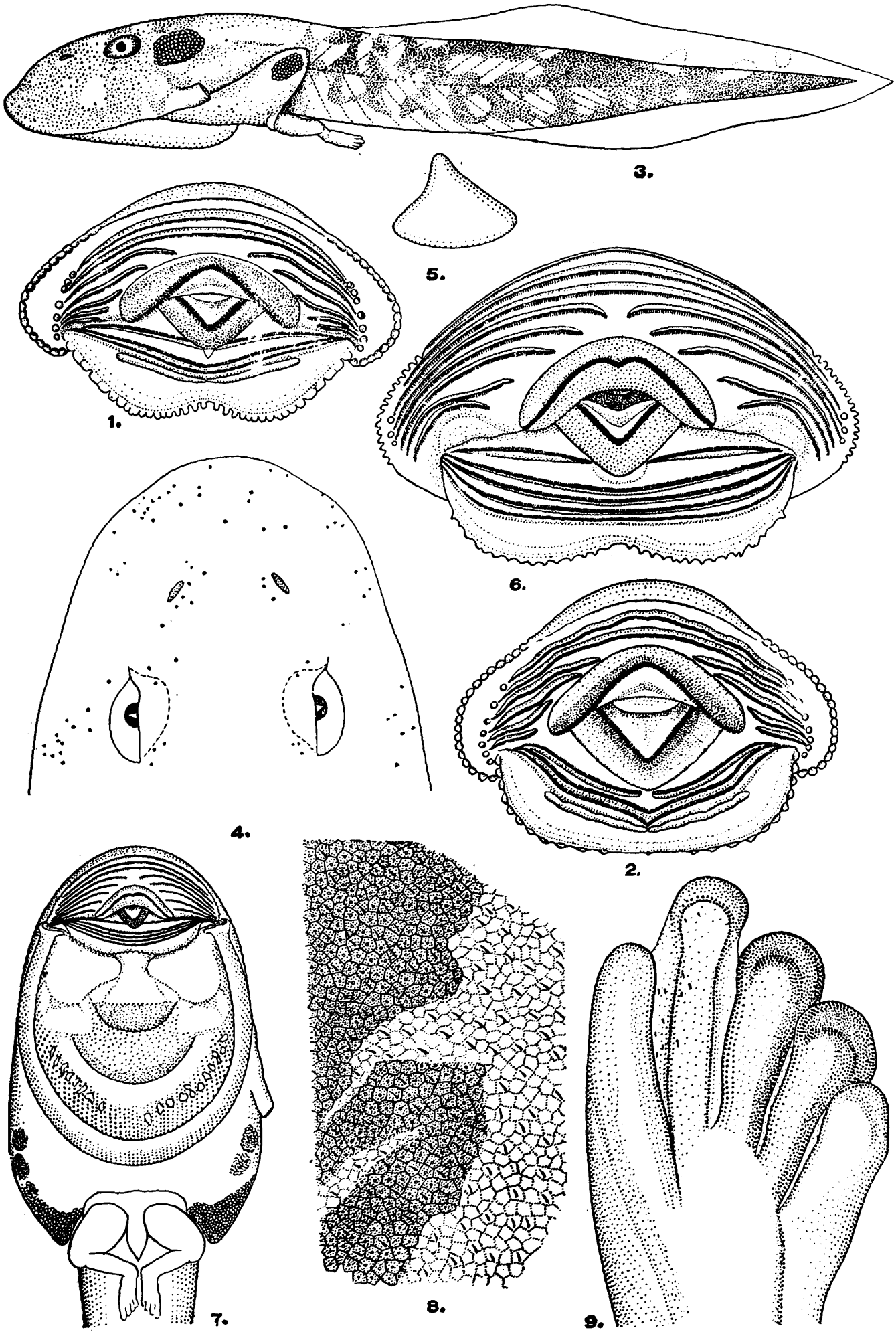
FIG. 5.—New tadpole ; a spinous process from head. $\times 97\frac{1}{5}$.

FIG. 6.—New tadpole ; mouth. $\times 6$.

Fig. 7.—New tadpole ; ventral view. $\times 2\frac{2}{5}$.

FIG. 8.—New tadpole ; a patch of tuberculated tissue from the friction area showing spinous processes. $\times 72$.

FIG. 9.—New tadpole ; ventral view of foot with spinous processes. $\times 3$



Indian Tadpoles with suctorial discs.

AN AID TO THE IDENTIFICATION OF THE FISHES OF INDIA, BURMA, AND CEYLON. II. CLUPEIFORMES, BATHYCLUPEIFORMES, GALAXIIFORMES, SCOPELIFORMES AND ATELEOPIFORMES

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INTRODUCTION.

The second part of the " Aid to the identification of the Fishes " which deals with Clupeiformes, Bathyclupeiformes, Galaxiiformes, Scopeliformes, and Ateleopiformes of India, Burma, and Ceylon has been adopted exactly after part I* already published.

The key is entirely regional in its application and deals with species occurring in India, Burma, Ceylon, and Pakistan though the Dominion of Pakistan has not been mentioned in the title of the paper.

Fin formula, scale and branchiostegal counts have been provided wherever possible against the names of the respective species. Regarding illustrations, those copied from other works are duly acknowledged in the legends of the figures.

I am very grateful to Mr. M. A. S. Menon, M.Sc., Scientific Assistant, Zoological Survey of India, for kindly going through the manuscript.

Calcutta, K. S. MISRA.

1st October, 1952.

Key to classes of series PISCES.

1.	Skeleton cartilaginous	3.
2.	Skeleton bony ..	Class TELEOSTOMI.
3.	Single pair of lateral gill-openings : teeth united to form grinding plates or tritors ..	Class HOLOCEPHALI.
4.	5-7 pairs of lateral or ventral gill-openings : teeth not united to form grinding plates or tritors ..	Class ELASMOBRANCHII.

Key to subclasses of class TELEOSTOMI.

1.	Radials of paired fins arranged biserially (mostly fossils, not yet found in the Indian region) ..	Subclass *CROSSOPTERYGII*
2.	Radials of paired fins not arranged biserially (mostly living, found in the Indian region)	Subclass *ACTINOPTERYGII.*

*For part I of "An Aid to the identification of the Fishes" dealing with Elasmobranchii and Holocephali reference may be made to *Rec. Ind. Mus.* XLIX, pp. 89-137 (1952).

Key to orders of subclass ACTINOPTERYGII.

1.	Photophores always present (except in genus *Scopelengys* and family Synodidae) ..	Order SCOPELIFORMES.
2.	Photophores always absent (except in suborder Stomiatoidei of order Clupeiformes) ..	3.
3.	Pelvics always jugular ..	5.
4.	Pelvics abdominal (except in genus *Tauredophidium* where it is jugular and in genus *Raconda* where it is absent)	7.
5.	Pelvics reduced to long cartilaginous rods: dorsal origin in front of anal origin: scales absent	Order ATELEOPIFORMES.
6.	Pelvics not reduced to cartilaginous rods: dorsal origin behind anal origin: scales present	Order BATHYCLUPEIFORMES.
7.	Body much elongate, subcylindrical	Order GALAXIIFORMES.
8.	Body not much elongate, laterally compressed	Order CLUPEIFORMES.

Key to suborders of order CLUPEIFORMES.

1.	Photophores present	Suborder *STOMIATOIDEI.*
2.	Photophores absent	3.
3.	Adipose fin present	Suborder *SALMONOIDEI.*
4.	Adipose fin absent	5.
5.	Dorsal fin situated in caudal region of body ..	7.
6.	Dorsal fin situated in trunk region of body ..	9.
7.	Body elongate, narrow: anal fin short (less than 40 rays): caudal bifurcate: dorsal fin always present	Suborder *CHIROCENTROIDEI.*
8.	Body neither elongate nor narrow: anal fin very long (more than 100 rays): caudal not bifurcate: dorsal fin present or absent	Suborder *NOTOPTEROIDEI.*
9.	Mouth small, terminal: gill-membranes entirely united below: accessory branchial organ present	Suborder *CHANOIDEI.*
10.	Mouth large, not terminal: gill-membranes entirely separate below: accessory branchial organ absent ..	Suborder *CLUPEOIDEI.*

Key to superfamilies of suborder CLUPEOIDEI

1.	Abdomen smooth non-keeled	3.
2.	Abdomen serrated or keeled or both ..	Superfamily CLUPEOIDAE.
3.	Gular plate present	Superfamily ELOPOIDAE.
4.	Gular plate absent ..	5.
5.	Eye moderate with well-developed adipose lids (non-deep sea forms)	Superfamily ALBULOIDAE.
6.	Eye large with adipose lids (deep sea forms) ..	Superfamily ALEPOCEPHALOIDAE.

Key to families of superfamily ELOPOIDAE.

1.	Scales small (L.l. above 90): anal short (less than 20 rays)	Family ELOPIDAE.
2.	Scales large (L. l. below 50); anal moderate (more than 20 rays)	Family MEGALOPIDAE.

Class TELEOSTOMI.

Subclass *ACTINOPTERYGII.*

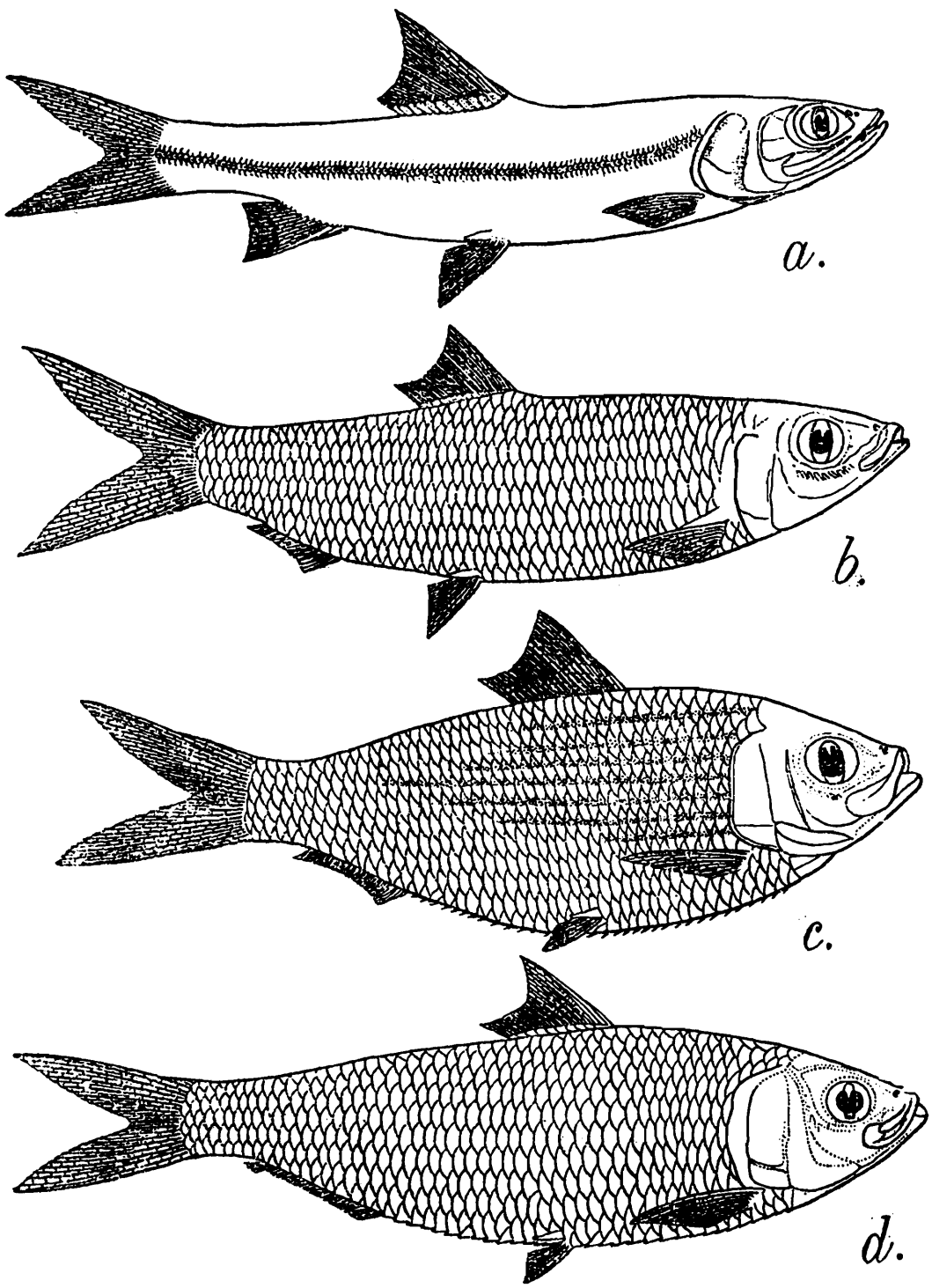
Order CLUPEIFORMES.

Suborder *CLUPEOIDEI.*

Superfamily ELOPOIDAE.

Family ELOPIDAE.

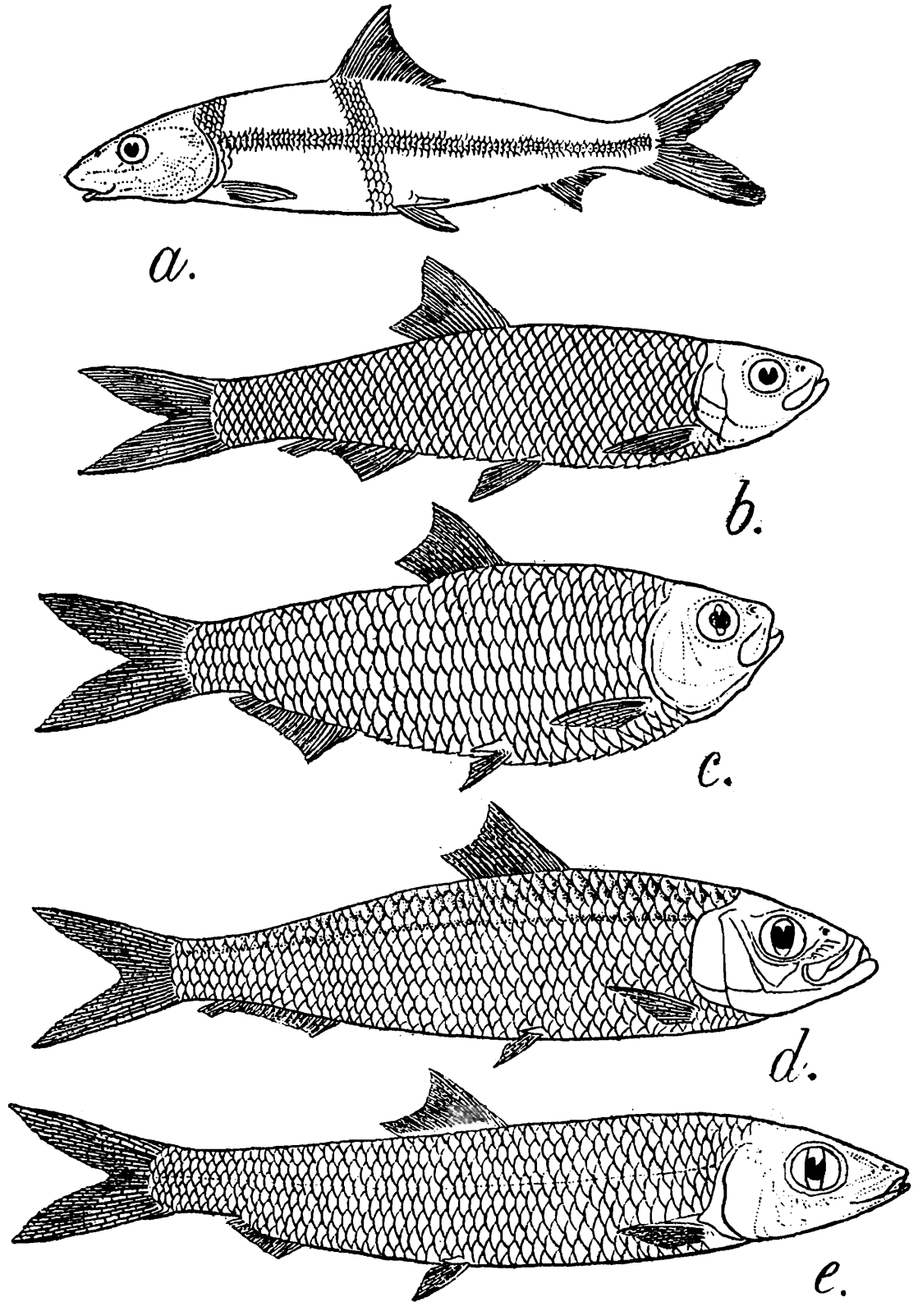
Genus **Elops** L.



TEXT-FIG. 1.—*a. Elops saurus* L. (after Day) ; *b. Dussumieria acuta* C. V. (after Day); *c. Sardinella albella* (C. V.) (after Day) ; *c. Sardinella fimbriata* (C.V.) (after Day).

Body elongate, compressed, scales small. Cleft of mouth oblique ; maxilla extends beyond postorbital margin. Gular plate present. Eye with well developed adipose lid. Abdomen neither keeled nor serrated. Pelvic origin opposite to dorsal origin. Anal short. Adipose fin absent. Caudal deeply forked.

E. sauras L. (text-fig. 1*a*), is the only species of the genus found in India, Burma, and Ceylon. (B. 28-35 ; D. 21-24 ; A. 15-17 ; L. 1.94-100 ; L. tr. 12-14).



Text-fig. 2.—*a. Albula vulpes* (L.) (after Boulenger) ; *b. Corica soborna* Ham. (after Day) ; *c. Kowala coval* (C.) (after Day) ; *d. Sardinella sindensis* (Day) (after Day) ; *e. Dussumieria hasselti* Blkr. (after Day).

Distribution.—Red Sea, Arabia, East Coast of Africa, Mauritius, Madagascar, India, Pakistan, Ceylon, Andamans, Malay Peninsula, Malay Archipelago, Philippines, China, Japan, Queensland, Hawaii.

Family MEGALOPIDAE.

Genus **Megalops** Lac.

Body elongate, compressed, scales large. Cleft of mouth moderately oblique ; maxilla extends to the postorbital margin. Gular plate present. Eye with narrow adipose lid. Abdomen neither keeled nor serrated. Pelvic origin opposite to dorsal origin. Anal moderate. Adipose fin absent. Caudal deeply forked.

M. cyprinoides (Brouss.) is the only species of the genus found in India, Burma, and Ceylon. (B. 23-27 ; D. 16-21 ; A. 23-28 ; P. 14-15 ; V 10-11 ; L. 1. 37-42 ; L. tr. 11-12).

Distribution.—East Africa, Zanzibar, Natal, Madagascar, India, Pakistan, Ceylon, Burma, Malay Peninsula, Malay Archipelago, Siam, China, Formosa, Japan, Australia, Melanesia, Mirconesia, Polynesia.

Superfamily ALBULOIDAE.

Family ALBULIDAE.

Genus **Albula** Scopoli.

Body elongate, slightly compressed, scales small. Mouth small, horizontal ; maxilla extends only to anterior margin of orbit. One supplemental bone. Gular plate absent. Eye moderte, with well developed adipose lid. Abdomen neither keeled nor serrated. Pelvic origin behind dorsal origin. Pectorals low. Anal short. Adipose fin absent. Caudal deeply forked.

A. vulpes (L.) (text-fig. 2*a*), is the only species of the genus found in India and Ceylon. (B. 14-16 ; D. 17-19 ; A. 9 ; P. 16-18 ; V 9-11 ; L.1.70-80 ; L. tr. 17-20).

Distribution.—Red Sea, Zanzibar, Natal, Mauritius, India, Pakistan, Ceylon, Malay Peninsula, Malay Archipelago, Japan, Korea, Queensland, New South Wales, Melanesia, Micronesia, Polynesia, Hawaii.

Superfamily CLUPEOIDAE.

Key to families of superfamily CLUPEOIDAE.

1.	Upper jaw prominent, projecting over lower jaw : maxillaries much elongated	Family ENGRAULIDAE.
2.	Upper jaw not prominent and not projecting over lower jaw : maxillaries not much elongated	Family CLUPEIDAE.

Key to subfamilies of family CLUPEIDAE.

1.	Abdomen serrated ..	3.
2.	Abdomen not serrated	Subfamily *DUSSUMIERIINI*
3.	Toothless	Subfamily *DOROSOMATINI*.
4.	Toothed ..	Subfamily *CLUPEINI*.

Key to genera of subfamily DUSSUMIERIINI.

1.	Dorsal origin nearer caudal origin than snout tip	3.
2.	Dorsal origin nearer snout tip than caudal origin	Genus **Stolephorus.**
3.	Lateral line scales less than 40 (35-38): enlarged scales at base of caudal ..	Genus **Ehirava.**
4.	Lateral line scales more than 39 (40-56): no enlarged scales at base of caudal ..	Genus **Dussumieria.**

Family CLUPEIDAE.

Subfamily *DUSSUMIERIINI.*

Genus **Dussumieria.** C. V.

Body elongate, more or less compressed, scales large, deciduous; no enlarged scales at base of caudal. Cleft of mouth moderate; maxilla extends to anterior margin of eye. Two supplemental bones present. Gular plate absent. Eye with well developed adipose lid. Abdomen rounded, non-serrated. Pelvic origin opposite to dorsal origin. Anal short. Adipose fin absent. Caudal deeply forked.

Distribution.—South Arabia, India, Ceylon, Burma, Malay Peninsula, Malay Archipelago, China, Formosa, Queensland.

Key to species of genus **Dussumieria.**

1.	Lateral line scales 40-42: depth of body 5-5¼ times in total length	*D. acuta* C.V. (text-fig.1*b*) (B. 14-15; D. 19-20; P. 14-15; V. 8; A. 15-17; L. l. 40-42; L. tr. 11-12).
2.	Lateral line scales 52-56: depth of body 5⅔-6⅓ times in total length	*D. hasselti* Blkr. (text-fig. 2*e*) (B. 15-19; D. 17-20; P. 14-15; V. 8; A. 15-16; L. l. 52-56; L. tr. 12-13).

Genus **Ehirava** Deraniyagala.

This genus resembles *Dussumieria* in almost every respect, except that there are, however, two enlarged scales at base of the caudal fin which distinguish it from *Dussumieria.*

E. fluviatilis Deraniyagala (text-fig. 4*b*), is the only species of the genus found in Ceylon. (B. 6; D. 13; P. 12-14; V. 8; A. 15; L.l.35-38; L.tr. 6-7).

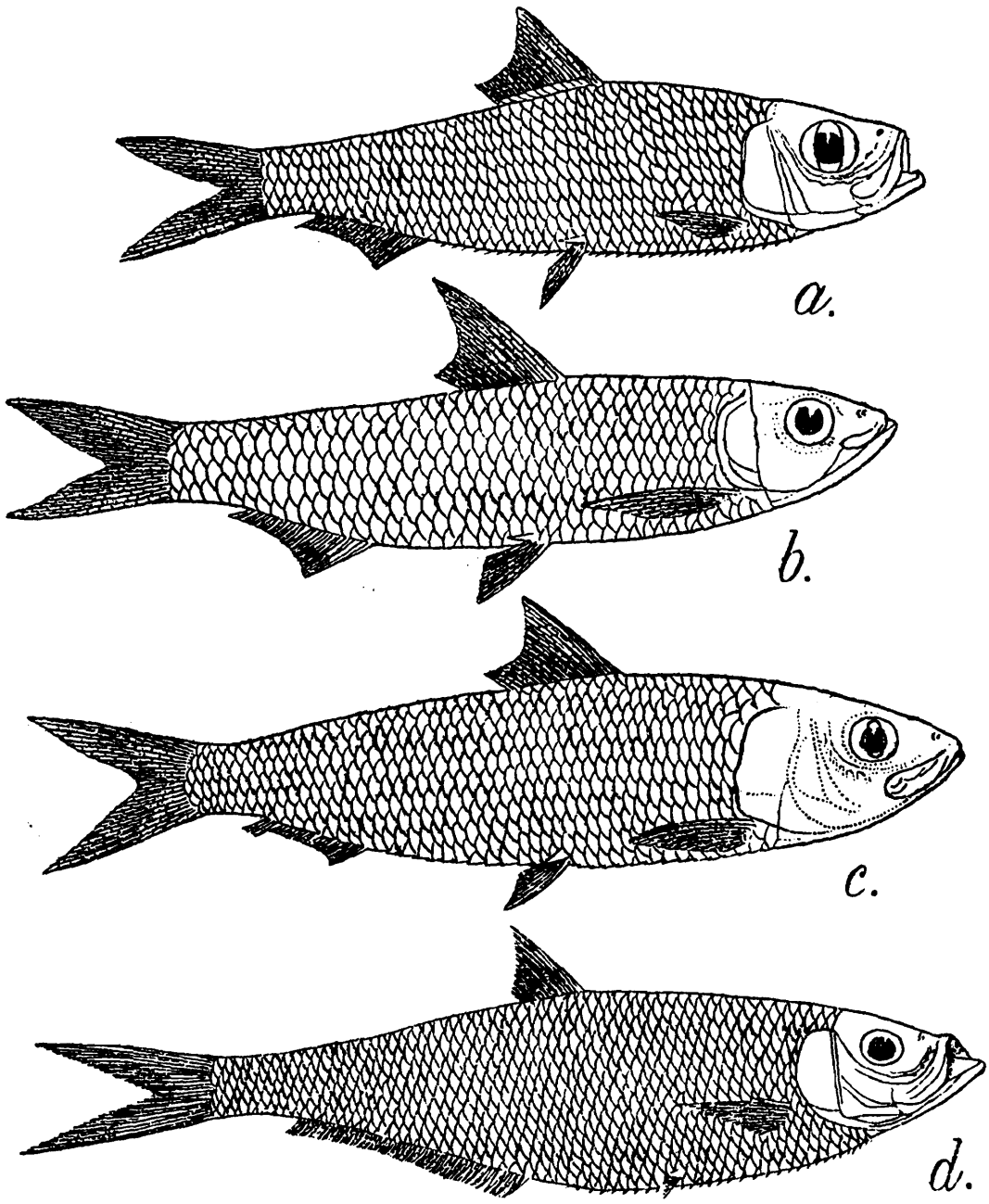
Distribution.—Ceylon.

Genus **Stolephorus** Lac.

Body elongate, moderately compressed, scales moderate, deciduous. Cleft of mouth oblique; maxilla extends only to anterior margin of orbit. Two supplemental bones present. Eye without adipose lid. Abdomen non-serrated. Pelvic origin opposite to dorsal origin. Anal short. Adipose fin absent. Caudal deeply forked.

S. malabaricus (Day) (text-fig. 3*b*), is the only species of the genus found in India. (B. 6 ; D. 13-14 ; P. 13 ; V. 8 ; A. 18-19 ; L. 1.38 ; L. tr. 9).

Distribution.—India.



Text-fig. 3.—*a. Harengula punctata* (Rüpp.) (after Day) ; *b. Stolephorus malabaricus* (Day) (after Day) ; *c. Sardinella longiceps* C. V. (after Day) ; *d. Ilisha elongata* (Benn.) (after Day).

Subfamily *Clupeini.*

Key to genera of subfamily Clupeini.

1.	Anal one, continuous	3.
2.	Anal two, divided (second detached as two enlarged connected rays)	Genus **Corica.**
3.	Anal moderate (rays 14-22) : jaws equal or subequal : pelvics well developed ..	5.
4.	Anal long (rays 36-95) : lower jaw prominent : pelvics small or absent	13.

5.	Lateral line scales less than 50 (39-49) ..	7.
6.	Lateral line scales more than 79 (80-110)	Genus **Gudusia**
7.	Dorsal origin before pelvic origin	9.
8.	Dorsal origin behind pelvic origin	Genus **Kowala**
9.	Upper jaw without median notch	11.
10.	Upper jaw with distinct median notch	Genus **Hilsa.**
11.	Last 2 anal rays enlarged	Genus **Sardinella.**
12.	Last 2 anal rays not enlarged	Genus **Harengula.**
13.	Pelvics absent . ..	15.
14.	Pelvics present	17.
15.	Dorsal fin present	Genus **Opisthopterus.**
16.	Dorsal fin absent	Genus **Raconda.**
17.	Occipital ridges subparallel behind : oral edge of upper jaw with a toothed bone between maxillary and premaxillary ..	Genus **Pellona.**
18.	Occipital ridges converging behind : oral edge of upper jaw with a ligament between maxillary and premaxillary	Genus **Ilisha.**

Genus **Harengula** C. V

Body more or less oblong, compressed, scales moderate. Cleft of mouth more or less oblique ; maxilla extends only to anterior margin of orbit. Supplemental bone present. Jaws subequal. Upper jaw without median notch. Eye without adipose lid. Abdomen keeled and serrated. Pelvic origin opposite to dorsal origin. Anal single, short, last two anal rays not enlarged. Adipose fin absent. Caudal forked.

Distribution.—Red Sea, Arabia, Reunion I., Zanzibar, Madagascar, Seychelles, India, Pakistan, Ceylon, Andamans, Nicobars, Singapore, Malay Archipelago. Siam, Japan, Queensland, Melanesia, Micronesia, Polynesia.

Key to species of genus **Harengula.**

1.	Lateral line scales 40 : postventral scutes 11 : anal as long as dorsal ..	*H. vittata* (C. V.) (B. 6 ; D. 15-16 ; P. 13-15 ; V. 8 ; A. 18-19 ; L. l. 38-40 ; L. tr. 10-11).
2.	Lateral line scales 43-45 : postventral scutes 13 : anal shorter than dorsal	*H. punctata* (Rüpp.) (text-fig. 3*a*) (B. 6 ; D. 17-19 ; P. 15-16 ; V. 8 ; A. 17-18 ; C. 20 ; L. l. 43-45 ; L. tr. 10-12).

Genus **Sardinella** C. V

Body more or less oblong, well compressed, scales large. Cleft of mouth more or less oblique ; maxilla extends to postorbital margin. Supplemental bone present. No distinct median notch in upper jaw. Jaws subequal. Eye with small adipose lid. Abdomen keeled and serrated. Dorsal origin before pelvic origin. Anal single, moderate last 2 anal rays enlarged. Adipose fin absent. Caudal forked.

Distribution.—East Africa, Mauritius, Madagascar, Zanzibar, Seychelles, Red Sea, Arabia, India, Pakistan, Ceylon, Andamans, Burma,

Singapore, Amboina, Malay Archipelago, Siam, Indo-China, China, Philippines, Formosa, Australia, Micronesia, Polynesia.

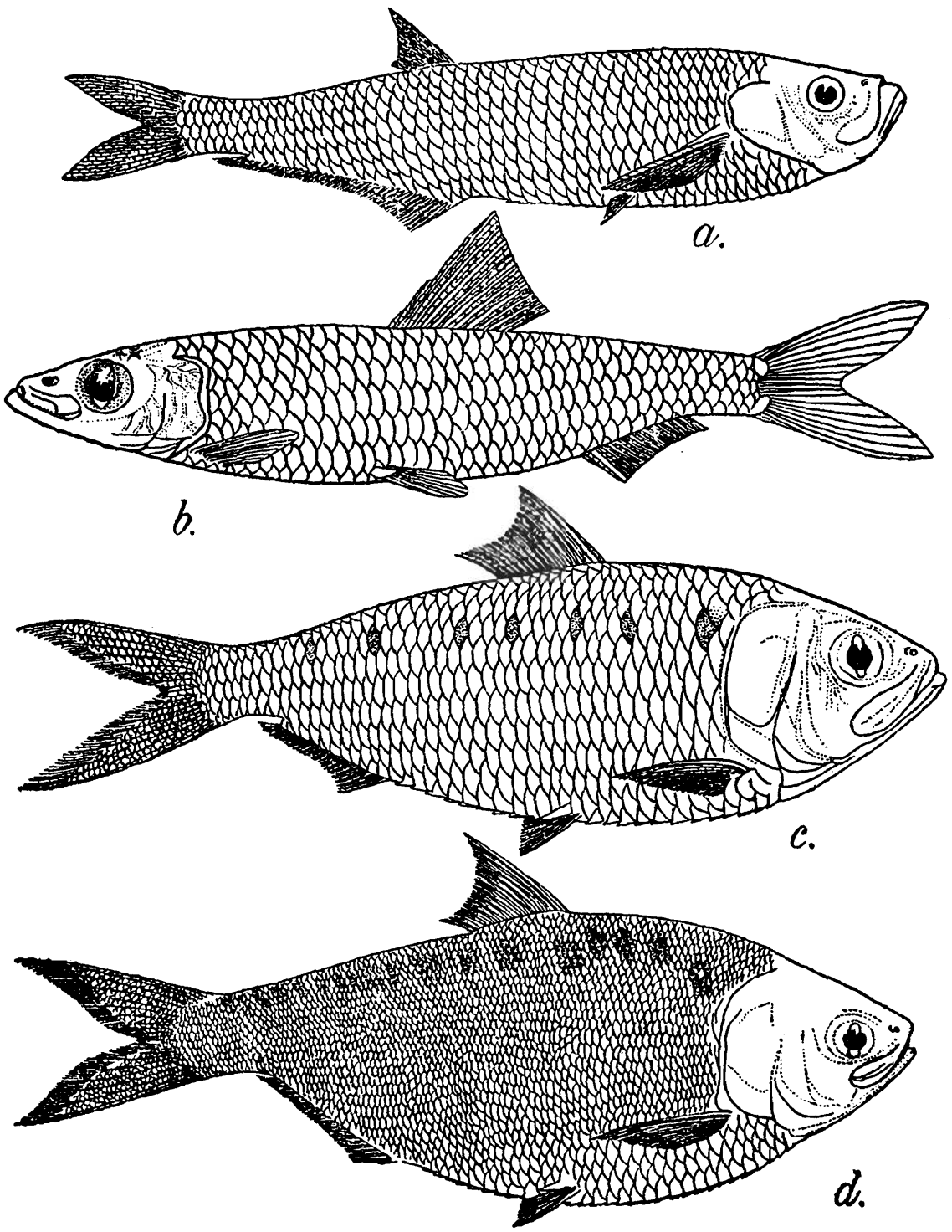
Key to species of genus **Sardinella.**

1.	Ventral scutes sharp, keeled and exposed	**5.**
2.	Ventral scutes little evident, less exposed	**3.**
3.	Maxillary reaching eye : 18 preventral and 16 postventral scutes : lateral line scales 47	*S. clupeoides* (Blkr.) (B. 6 ; D. 15 ; 17 ; A. 16-19 ; L. l. 35-42).
4.	Maxillary not reaching eye : 16 preventral and 13-14 postventral scutes : lateral line scales 40 ..	*S. sirm* (Rüpp.) (B. 5 ; D. 17-19 ; V. 8 ; A. 17-20 ; L. l. 42-45 ; L. tr. 12).
5.	Depth of body between 2¾-4 times in total length	**7.**
6.	Depth of body between 4½-5½ times in total length	**13.**
7.	Lower gill-rakers more than 100 : 16 preventral and 14 postventral scutes	*S. dayi* Regan (B. 6 ; D. 16-18 ; V. 8 ; A. 19-20 ; L. l. 38-44 ; L. tr. 12).
8.	Lower gill-rakers less than 100 : 17-18 preventral and 12-15 postventral scutes ..	**9.**
9.	Lower gill-rakers 50-65 ..	**11**
10.	Lower gill-rakers 70-75	*S. fimbriata* (C. V.) (text-fig. 1*d*) (B. 6 ; D. 18-19 ; V. 8 ; A. 18-21 ; L. l. 45 ; L. tr. 12).
11.	Gill filaments 1¼ times in eye diameter : lower gill-rakers 50-55	*S. gibbosa* (Blkr.) (B. 6 : D. 17-20 ; P. 14-17 ; V. 8 ; A. 17-19 ; C. 20 ; L. l. 44-48 ; L. tr. 11-13).
12.	Gill filaments equal to eye diameter : lower gill-rakers 55-65	*S. albella* (C. V.) (text-fig. 1*c*) (B. 6 ; D. 17-20 ; P. 14-17 ; V. 8 ; A. 18-22 ; C. 20 ; L. l. 44-45 ; L. tr. 11-13).
13.	Eye 5-6 times in head : lower gill-rakers 180-250	*S. longiceps* C. V. (B. 6 ; D. 16-18 ; V. 9 ; A. 14-16 ; L. l. 46-48 ; L. tr. 12-13).
14.	Eye 3¼-3¾ times in head : lower gill-rakers 38-62	**15.**
15.	Lower gill-rakers 38-44 ; caudal tipped black	*S. melanura* (C.) (B. 6 ; D. 18-19 ; V. 8 ; A. 16-18 ; L. l. 44-46 ; L. tr. 12-13).
16.	Lower gill-rakers 58-62 ; caudal not tipped black ..	*S. sindensis* (Day) (text-fig. 2*d*) (B. 6 ; D. 17-19 ; V. 8 ; A. 18-21 ; L. l. 44-48 ; L. tr. 11-13).

Genus **Hilsa**.

Body oblong, well compressed, scales large. Maxilla extends to post-orbital margin. Supplemental bone present. Jaws subequal. Upper

jaw with distinct median notch. Eye with adipose lid. Abdomen keeled and serrated. Dorsal origin before pelvic origin. Anal single, moderate, last 2 anal rays not enlarged. Adipose fin absent. Caudal deeply forked.



Text-fig. 4.—*a. Ilisha sladeni* (Day) (after Day); *b. Ehirava fluviatilis* Deraniyagala (after Deraniyagala); *c. Hilsa kanagurta* (Blkr.) (after Day); *d. Gudusia variegata* (Day) (after Day).

Distribution.—Aden, Zanzibar, Iraq, Persian Gulf, India, Pakistan, Ceylon, Burma, Malaya, Siam, Malay Archipelago, Philippines, China, Formosa, Japan.

Key to species of genus **Hilsa.**

1. Lateral transverse scales less than 16 : 16-18 preventral and 11-13 postventral scutes 3.

2. Lateral transverse scales more than 16 (17-19) : 16-17 preventral and 14-15 postventral scutes .. .. *H. ilisha* (Ham.) (text-fig. 5*b*) (B. 5 ; D. 18-20 ; P. 15 ; V. 9 ; A. 18-22 ; C. 19 ; L. l. 45-49 ; L. tr. 17-20).

3. Parietal ridges expanded and striated : length of head 4¼ times in total length .. .. *H. kanagurta* (Blkr.) (B. 5 ; D. 17-20) ; P. 16 ; V. 8 ; A. 19-22 ; L. l. 42-45 ; L. tr. 13-14).

4. Parietal ridges narrow and covered with smooth skin : length of head 5-5½ times in total length .. .. *H. toli* (C. V.) (text-fig. 5*d*) (B. 5 ; D. 17-19 ; P. 14 ; V. 9 ; A. 18-21 ; L. l. 39-40 ; L. tr. 13-15).

Genus **Gudusia** Fowler.

Body oblong, well compressed, scales very small. Maxilla extends to middle of orbit. Supplemental bone present. Eye with adipose lid. Abdomen serrated and keeled. Dorsal origin before pelvic origin. Anal single, moderate ; last anal rays not enlarged. Adipose fin absent. Caudal deeply forked.

Distribution.—India, Pakistan, Burma, Penang, Philippines.

Key to species of genus **Gudusia.**

1. Anal fin longer, 24-26 rays : 10 preventral and 10 postventral scutes .. .. *G. variegata* (Day) (D. 15-18 ; P. 17 ; V. 8 ; A. 24-29 ; C. 17 ; L. l. 90 ; L. tr. 35).

2. Anal shorter, 21-24 rays : 18-19 preventral and 9-10 postventral scutes .. .. *G. chapra* (Ham.) (text-fig. 5*a*) (D. 14-16 ; P. 13 ; V. 8 ; A. 21-24 ; C. 17 ; L. l. 80-110 ; L. tr. 33-35).

Genus **Kowala** C. V.

Body oblong, well compressed, scales large. Maxilla extends to middle of orbit. Supplemental bone present. Eye with adipose lid. Abdomen keeled and serrated. Dorsal origin before pelvic origin. Anal single, moderate ; last anal rays not enlarged. Adipose fin absent. Caudal deeply forked.

K. coval (C.) (text-fig. 2*c*), is the only species of the genus found in India, Burma, and Ceylon. (D. 12-15 ; P. 13 ; V. 8 ; A. 14-20 ; L. l. 38-41; L. tr. 9-11).

Distribution.—India, Pakistan, Ceylon, Burma, Malaya, Malay Archipelago, China.

Genus **Corica** Ham.

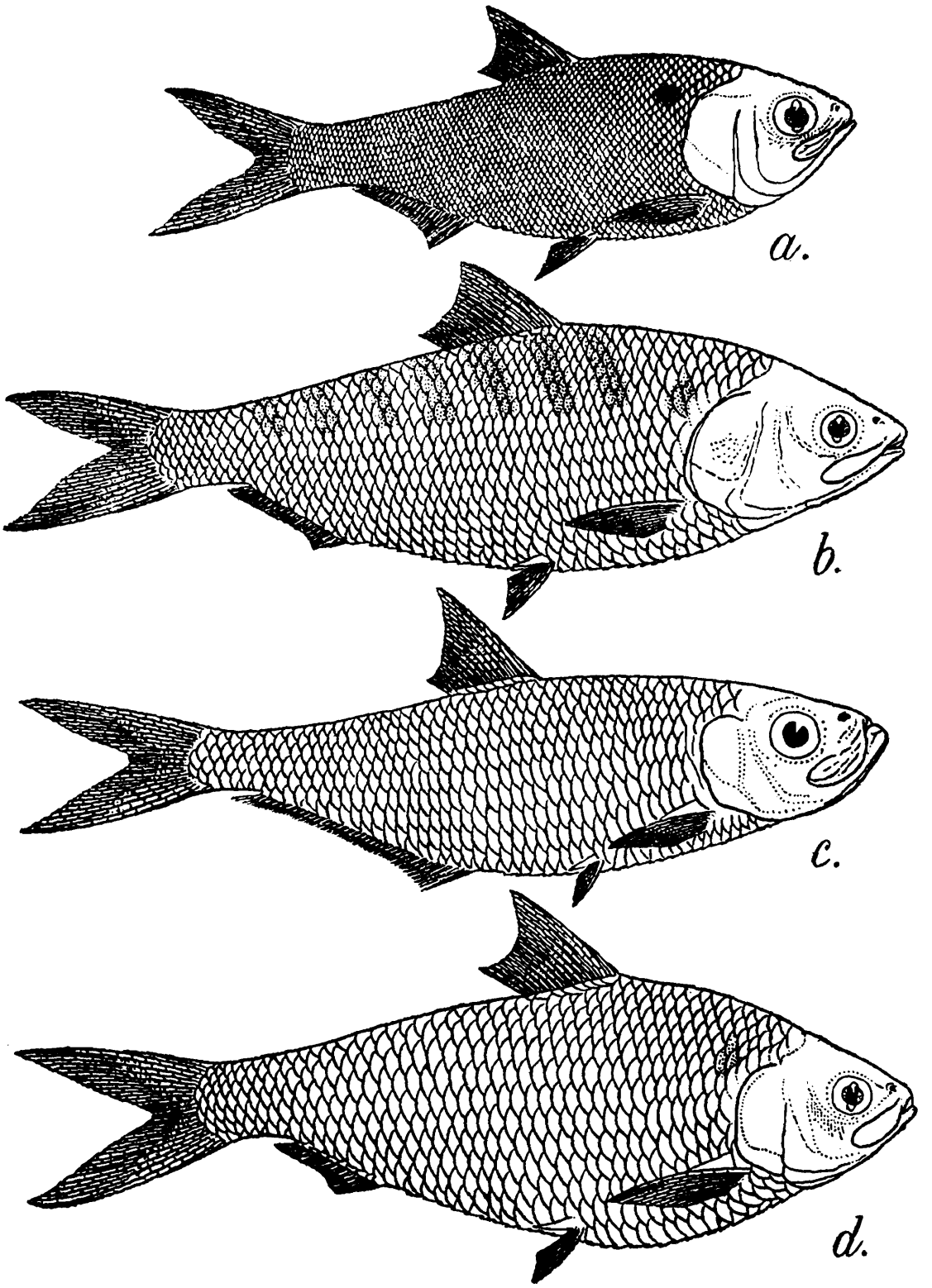
Body moderately elongate, abdomen slightly compressed, scales moderate. Maxilla extends to anterior margin of orbit. Eye with adipose lid. Abdomen keeled and serrated. Dorsal origin opposite to pelvic origin. Anal moderate, as 2 fins, the second fin formed by thickened elongated rays. Adipose fin absent. Caudal forked.

C. soborna Ham. (text-fig. 2 *b*), is the only species of the genus found in India. (B. 6 ; D. 12-16 ; A. 12-15+ii ; L. l. 40-42 ; L. tr. 10).

Distribution.—India, Pakistan, Philippines.

Genus **Ilisha** Rich.

Body elongate, compressed, scales large. Maxilla extends to middle of orbit. Two supplemental bones present. Edge of upper jaw with



Text-fig. 5.—*a. Gudusia chapra* (Ham.) (after Day); *b. Hilsa ilisha* (Ham.) (after Day); *c. Ilisha motius* (Ham.) (after Day); *d. Hilsa toli* (C.V.) (after Day).

a ligament extending from lateral end of premaxillary to prominent middle of maxillary. Eye with adipose lid. Occipital ridges converging behind. Abdomen keeled and serrated. Dorsal origin opposite to

pelvic origin. Anal single, long. Adipose fin absent. Caudal deeply forked.

Distribution.—East Africa, India, Ceylon, Pakistan, Burma, Malay Peninsula, Malay Archipelago, Java, Siam, Cochin-China, Philippines, Formosa, China, Japan.

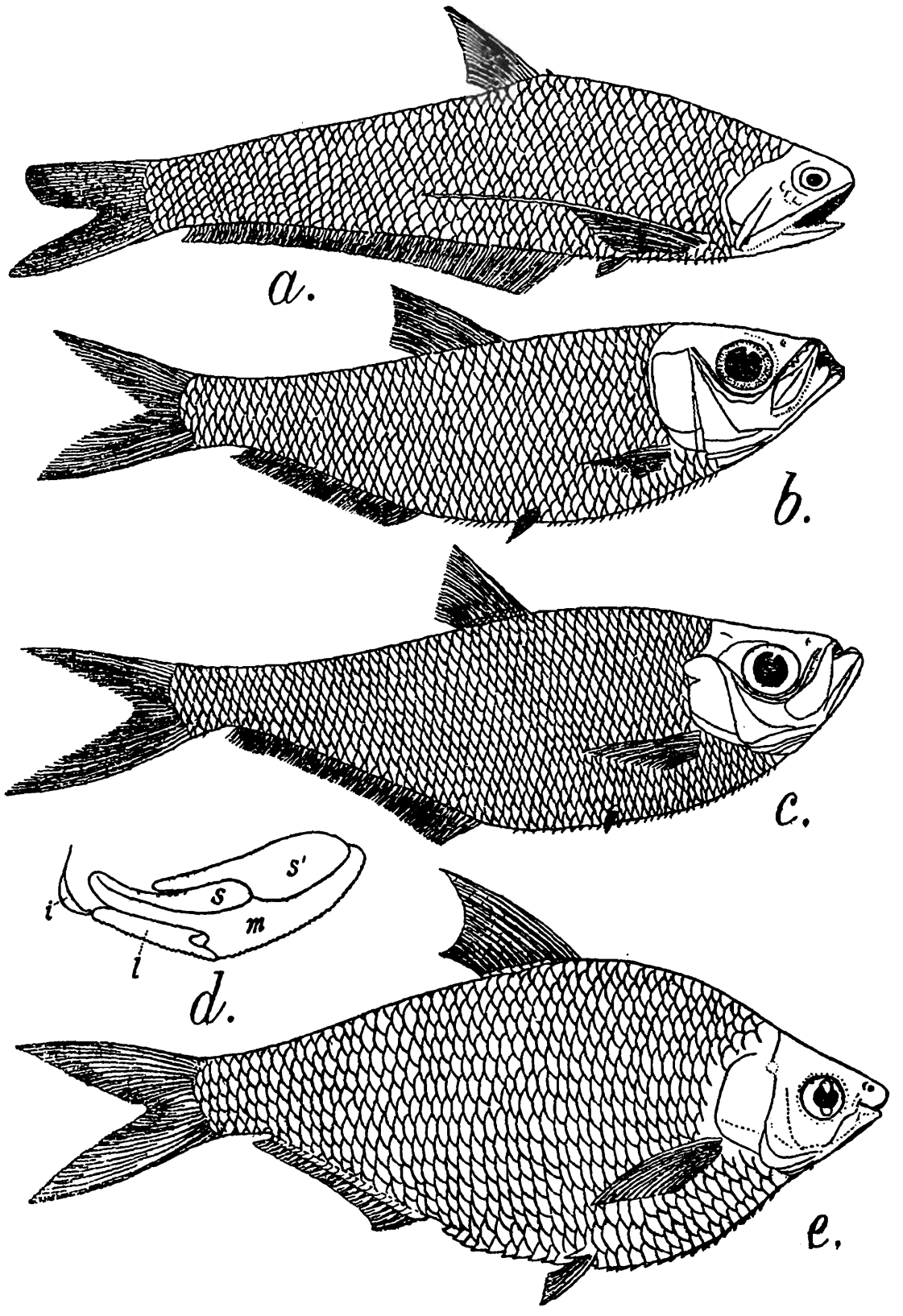
Key to species of genus **Ilisha.**

1.	Anal origin clearly behind dorsal origin ..	**3.**
2.	Anal origin not behind dorsal origin	**5.**
3.	Lateral transverse scales 14-16 : 20-24 preventral and 8-10 postventral scutes : lateral line scales 46-56 ..	*I. elongata* (Benn.) (text-fig. 3*a*) (B. 6; D. 15-17; P. 15-17; V. 7; A. 40-50; C. 17; L. l. 46-56; L. tr. 14-16).
4.	Lateral transverse scales 12-13; 15-16 preventral and 7-8 postventral scutes : lateral line scales 43-45	*I. motius* (Ham.) (text-fig. 5*c*) (B. 6; D. 16-17; P. 15; V. 7; A. 40-41; L. l. 43-45; L. tr. 12-13).
5.	Anal origin opposite to dorsal origin ..	*I. sladeni* (Day) (text-fig. 4*a*) (B. 6; D. 13; P. 11; V. 7; A. 44; C. 21; L. l. 48; L. tr. 10).
6.	Anal origin not opposite to dorsal origin ..	**7.**
7.	Lateral line scales 70	*I. leschenaulti* (C.V.) (B. 6; D. 21: P. 17; V. 8; A. 42; C. 27: L. l. 70).
8.	Lateral line scales 40-50	**9.**
9.	Height of body $3\frac{2}{3}$ times in total length ..	**11.**
10.	Height of body $3\frac{1}{4}$-$3\frac{1}{2}$ times in total length	**15**
11.	Lateral line scales 48-50	**13.**
12.	Lateral line scales 43	*I. kampeni* (Web. deBfrt.) (B. 6; D. 15-16; P. 15; V. 7; A. 42; L. l. *ca.* 44; L. tr. *ca.* 15).
13.	Pelvics nearer to pectoral base than to anal origin : lower gill-rakers 18-19 : 10-12 postventral scutes ..	*I. filigera* (C. V.) (text-fig. 6*c*) (B. 6; D. 18-19; P. 17; V. 8; A. 46-50; C. 19; L. l. 50; L. tr. 15-16).
14.	Pelvics midway between pectoral base and anal origin : lower gill-rakers 19-21 : 8 postventral scutes	*I. melastoma* (C.) (B. 6; D. 17-18; P. 17; V. 7; A. 43-50; C. 17; L. l. 43-44; L. tr. 14-15).
15.	Anal rays 46 51	*I. brachysoma* (Blkr.) (B. 6; D. 17-17; P. 16; V. 7; A. 46-51; C. 17; L. l. 43-44; L. tr. 14-15).
16.	Anal rays 39-42 ..	**17.**
17.	Dorsal origin nearer to caudal base than to tip of snout	*I. novacula* (C. V.) (B. 6; D. 17-18; V. 7; A. 42; L. l. 45-50; L. tr. 14-15).
18.	Dorsal origin nearer to tip of snout than to caudal base ..	*I. indica* (Swns.) (B. 6; D. 17; P. 16; V. 7; A. 39-40; C. 17; L. l. 44; L. tr. 13-14).

Genus **Pellona** C. V.

This genus differs from genus *Ilisha* in having a toothed bone between the premaxillary and maxillary and in having the occipital ridges subparallel.

P. ditchela C. V (text-fig. 6*b*, *d*), is the only speices of the genus found in India, Burma, and Ceylon. (D. 15-18 ; P. 17 ; V. 7 ; A. 33-38 ; L. l. 40-44 ; L. tr. 11-13).



Text-fig. 6.—*a. Setipinna phasa* (Ham.) (after Day) ; *b. Pellona ditchela* C.V. (after Day) ; *c. Ilisha filigera* (C.V.) (after Day) ; *d. Pellona ditchela* showing the intermaxillary *i*, maxillary, *m*, ossified ligament between them, *l*, and supplemental bones *s*, *s*, (after Weber & Beaufort) ; *e. Gonialosa manmina* (Ham.) (after Day).

Distribution.—East Africa, Madagascar, India, Ceylon, Burma, Malaya, Malay Archipelago, Siam, Queensland.

Genus **Opisthopterus** Gill.

Body oblong, compressed, scales moderate, deciduous. Maxilla extends obliquely to midorbit. Two supplemental bones present. Eye without adipose lid. Abdomen keeled and serrated. Pelvics absent. Anal single, very long. Anal origin in front of dorsal origin. Adipose fin absent. Caudal forked.

O. tardoore (C.) (text-fig. 7*c*), is the only species of the genus found in India, Pakistan, Burma, and Ceylon. (B. 6 ; D. 12-17 ; A. 53-66 ; L. 1. 43-50 ; L. tr. 12-15).

Distribution.—India, Burma, Ceylon, Malaya, Malay Archipelago, Siam, China.

Genus **Raconda** Gray.

This genus differs from genus *Opisthopterus* in having no dorsal fin.

R. russelliana Gray (text-fig. 7 *b*), is the only species of the genus found in India and Burma. (P. 13 ; A. 83-92 ; L. 1. 60-64 ; L. tr. 12).

Distribution.—India, Pakistan, Burma, Malay Peninsula, Malay Archipelago, Cochin-China.

Subfamily *DOROSOMATINI.*

Key to genera of subfamily DOROSOMATINI.

1.	Last dorsal ray prolonged into a filament ..	**3.**
2.	Last dorsal ray not prolonged into a filament	**5.**
3.	Pelvics below or in advance of dorsal origin : lateral line scales 44-50 : transverse scales 14-21	Genus **Nematalosa.**
4.	Pelvic origin behind dorsal origin : lateral line scales 48-58 : transverse scales 20-23 ..	Genus **Clupanodon.**
5.	Pelvic origin behind dorsal origin : lateral line scales 40-42 : transverse scales 12-15 ..	Genus **Anodontostoma.**
6.	Pelvic origin a little in front of or behind dorsal origin : lateral line scales 45-65 : transverse scales 16-25	Genus **Gonialosa.**

Genus **Clupanodon** Lac.

Body oblong, compressed, scales large. Mouth toothless. Maxilla extends to below anterior part or middle of eye. One supplemental bone present. Abdomen keeled and serrated. Last dorsal ray prolonged into a filament. Pelvic origin behind dorsal origin. Anal single, moderate. Adipose fin absent. Caudal forked.

Distribution.—India, Ceylon, Philippines, China, Formosa, Japan, Polynesia.

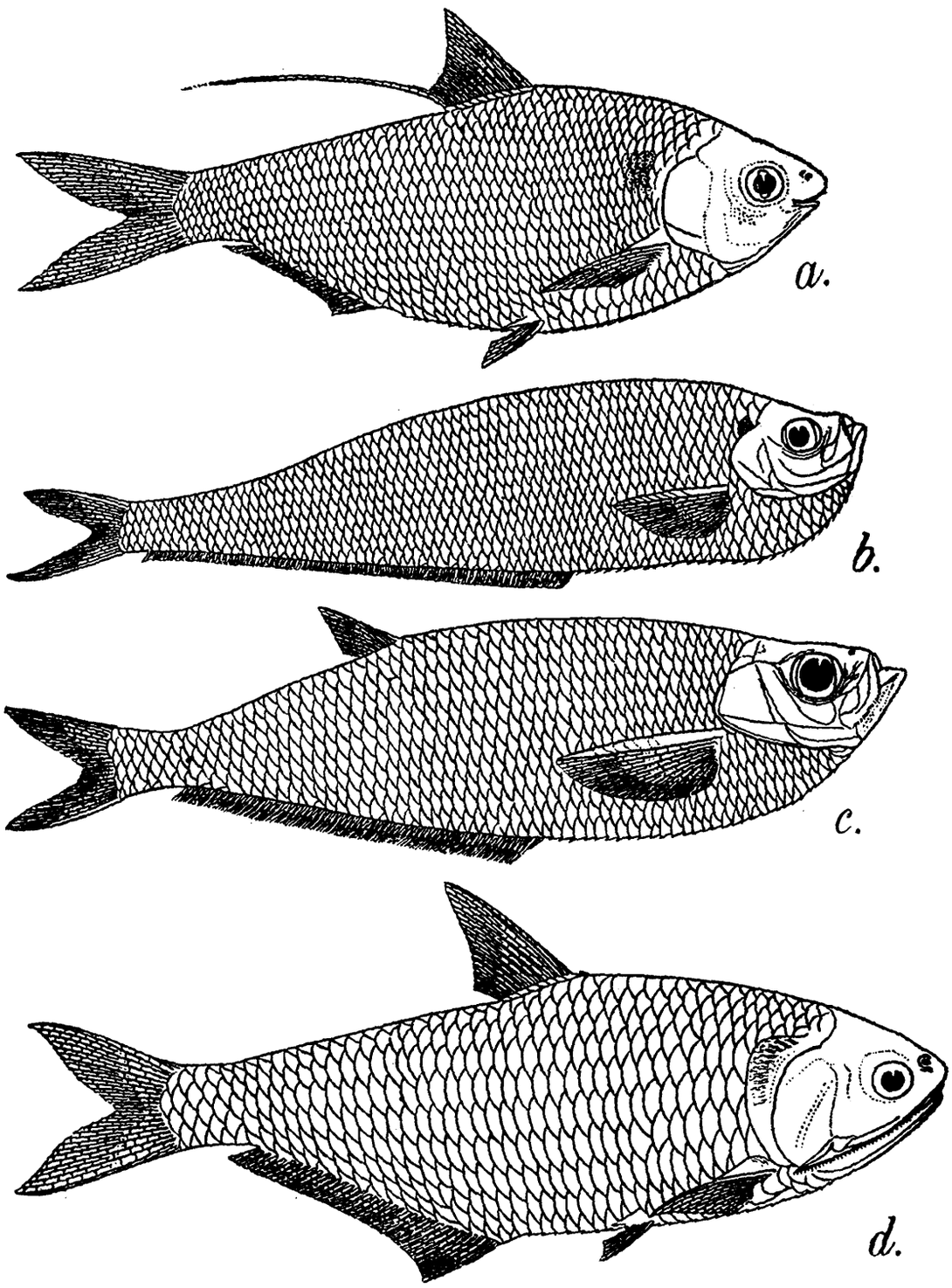
Key to species of genus **Clupanodon.**

,	Lateral line scales 48 : height of body 22-3¼ in total length	*C. thrissa* (L.) (D. 15-16 ; V. 8 ; A. 22-27 ; L. 1. 48 ; L. tr. 20).

2. Lateral line scales 53-58 : height of body 3-3½ in total length — *C. punctatus* (Schl.) (D. 16-18 ; V. 8 ; A. 20-25 ; L. l. 53-58 ; L. tr. 20-23).

Genus **Gonialosa** Reg.

Body, oblong, compressed, scales small. Mouth toothless. Maxilla extends to below middle of orbit. One supplemental bone present.



Text-fig. 7.—*a. Nematalosa nasus* (Bl.) (after Day) ; *b. Raconda russelliana* Gray (after Day) ; *c. Opisthopterus tardoore* (C.) (after Day) ; *d. Thrissocles malabaricus* (Bl.)(after Day).

Abdomen keeled and serrated. Last dorsal ray not prolonged into a filament. Pelvic origin before or behind dorsal origin. Anal single, moderate. Adipose fin absent. Caudal deeply forked.

Distribution.—India, Pakistan, Burma.

Key to species of genus **Gonialosa.**

1.	Lateral line scales 45-47 : lateral transverse scales 16-18	*G. modestus* (Day) (text-fig. 6*e*) (D. 14-16 ; P. 16 ; V. 8 ; A. 27-28 ; C. 21 ; L. 1. 45-47 ; L. tr. 16-18).
2.	Lateral line scales 55-65 : lateral transverse scales 21-25	*G. mannina* (Ham.) (D. 14-15 ; P. 15 ; V. 8 ; A. 22-24 ; L. 1. 58-65 ; L. tr. 21-25).

Genus **Nematalosa** Reg.

Body oblong, compressed, scales moderate. Mouth toothless. Maxilla short, not extending to even below anterior edge of orbit. One supplemental maxillary present. Abdomen keeled and serrated. Last dorsal ray prolonged. Pelvic origin below dorsal fin. Anal single, moderate. Adipose fin absent. Caudal forked.

N. nasus (Bl.) (text-fig. 7*a*), is the only species of genus found in India, Pakistan, Burma, and Ceylon. (D. 15-17 ; V 8 ; A. 21-24 ; L. 1. 45-50 ; L. tr. 15-19).

Distribution.—Iraq, India, Burma, Ceylon, Philippines.

Genus **Anodontostoma** Blkr.

Body oblong, compressed, scales moderate. Mouth toothless. Maxilla short, not extending to middle of orbit. One supplemental maxillary present. Abdomen keeled and serrated. Last dorsal ray not prolonged. Pelvic origin behind dorsal origin. Anal single, short. Adipose fin absent. Caudal forked.

A. chacunda (Ham.) (text-fig. 8*c*), is the only species of the genus found in India and Burma. (D. 17-19 ; V 8 ; A. 18-21 ; L. 1. 40-42 ; L. tr. 12-15).

Distribution.—India, Andamans, Pakistan, Burma, Malay Peninsula, Malay Archipelago, Siam, Melanesia.

Family ENGRAUDIDAE.

Key to genera of family ENGRAULIDAE.

1.	Caudal forked, not united with anal : upper pectoral ray produced or not produced	3.
2.	Caudal pointed, united with anal : upper pectoral rays always produced	Genus **Coilia.**
3.	Upper pectoral ray produced	Genus **Setipinna.**
4.	Upper pectoral ray not produced	5.
5.	Abdominal scutes restricted only between pectorals and pelvics : a lateral silvery band : anal short	Genus **Anchoviella.**
6.	Abdominal scutes not restricted between pectorals and pelvics : no lateral silvery band : anal long	7.
7.	Teeth in jaws partly canine ..	Genus **Xenengraulis.**
8.	Teeth in jaws minute, uniform	Genus **Thrissocles.**

Genus **Setipinna** Swns.

Body elongate, compressed, tapering behind, scales large, deciduous. Maxilla extended behind, not reaching beyond gill-opening. Abdomen keeled and serrated. Upper pectoral ray produced. Pelvic origin in advance of dorsal origin. Anal single, very long, origin just before or in front of dorsal origin. Adipose fin absent. Caudal forked, not united with anal.

Distribution.—India, Pakistan, Burma, Ceylon, Andamans, Malay Peninsula, Malay Archipelago, Siam, Cochin-China, Philippines, China.

Key to species of genus **Setipinna.**

1.	Anal origin in front of dorsal origin : lower gill-rakers 13-18 : anal rays 60-80 ..	**3.**
2.	Anal origin behind dorsal origin : lower gill-rakers 15-16 : anal rays 51-60 ..	*S. taty* (C.V.) (text-fig. 8*b*) (B. 11-12 ; D. 14-16 ; A. 51-60 ; C. 19 ; L. l. 42-46 ; L. tr. 12).
3.	Anal rays 70-80 : lower gill-rakers 18 : lateral line scales 52 ..	*S. phasa* (Ham.) (text-fig. 6*a*) (B. 12-13 ; D. 15-16 ; P. 15 ; V. 71 ; A. 70-80 ; C. 19 ; L. l. 52 ; L. tr. 14).
4.	Anal rays 60-66 : lower gill-rakers 13 : lateral line scales 54-56	*S. breviceps* (Cant.) (B. 16-19 ; D. 18 ; P. 14 ; V. 7 ; A. 60-66 ; C. 17 ; L. l. 54-55 ; L. tr. 14).

Genus **Coilia** Gray.

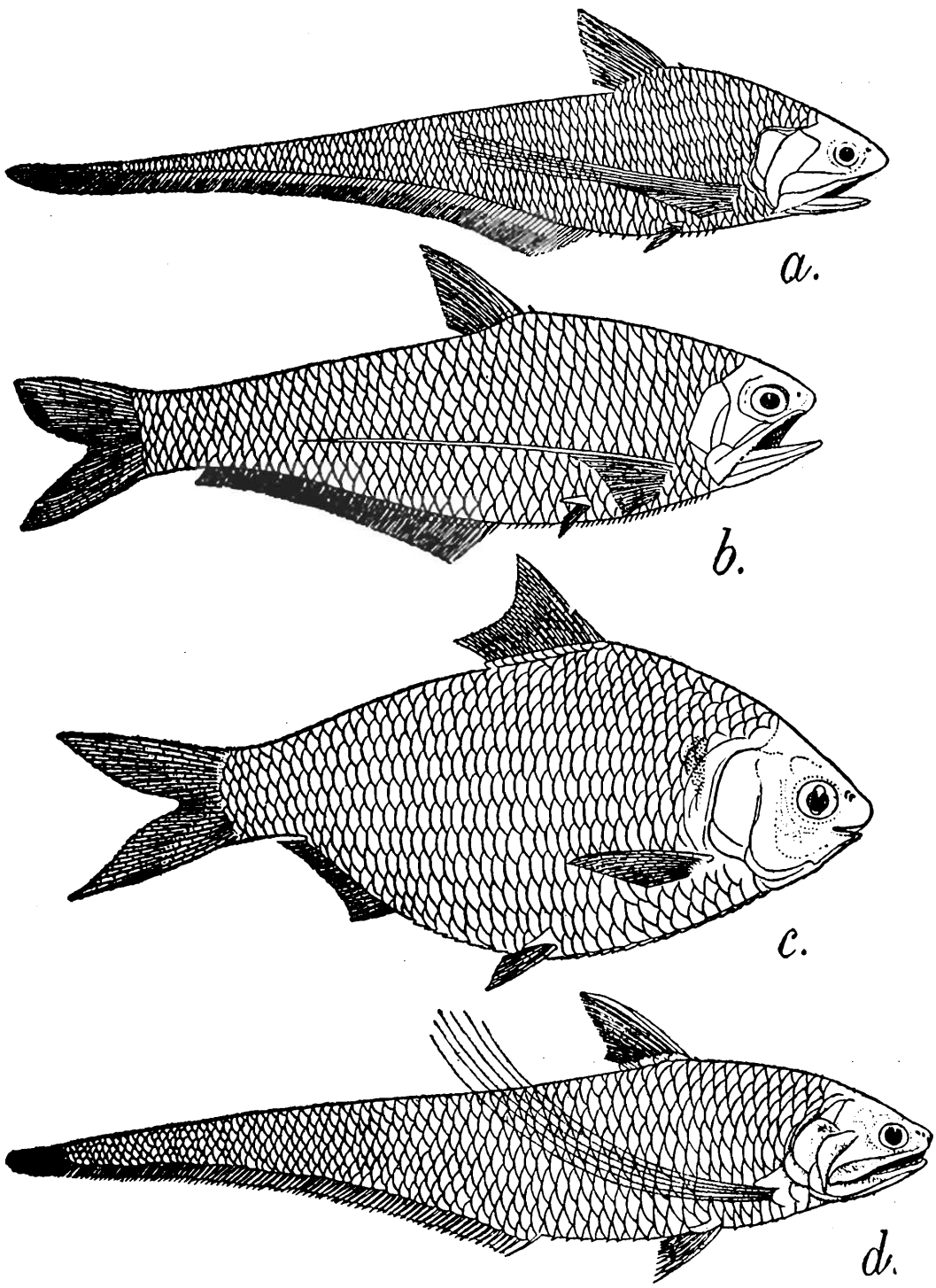
Body elongate, compressed, tapering behind to a long slender tail. Scales moderate or small. Maxilla more or less extended, but not reaching gill-opening. Abdomen keeled and serrated. Dorsal origin more or less opposite to pelvic origin. Five to twelve pectoral rays filamentous and much produced. Anal single, very long, united with caudal. Adipose fin absent. Caudal pointed.

Distribution.—India, Pakistan, Ceylon, Burma, Malaya, Malay Archipelago, Siam.

Key to species of genus **Coilia.**

1.	Maxillary extending beyond head ..	**3.**
2.	Maxillary not extending beyond head ..	**5.**
3.	5-6 free pectoral filaments : anal rays 105	*C. dussumieri* C.V. (text-fig. 8*a*) (B. 11 ; D. 1+13-15 ; P. 9+v-vi ; V. 7 ; A. 105 ; C. 12 ; L. l. 80 ; L. tr. 9).
4.	9-12 free pectoral filaments : anal rays 77-95..	*C. borneensis* Blkr. (B. 10 ; D 1.+4 ; P. 6+ix-xi ; V. 7 ; A. 77-95 ; L. l. 76 ; L. tr. 9).
5.	12 free pectoral filaments	*C. reynaldi* C.V. (B. 9 ; D. 1.+14 ; P. 5-6+xii ; V. 6 ; A. 116 ; C. 10 ; L. l. 55 ; L. tr. 10-11).
6.	6 free pectoral filaments	**7.**
7.	Anal rays 95-110	*C. ramcarati* (Ham.) (text-fig. 8*d*) (B. 11 ; D. 1+14 ; P. 6+vi ; A. 95-110 ; L. l. 70 ; L. tr. 9-10).

8.	Anal rays 35-75	**9.**
9.	Height of body 4¼ in total length : anal rays 35-42	*C. quadragesimalis* C.V. (B. 10 ; D. 15 ; P. 6+vi ; V. 8 ; A. 42 ; C. 25 ; L. 1. 35).
10.	Height of body 6⅓ in total length : anal rays 75	*C. cantoris* Blkr. (B. 9 ; D. 1+13 ; P. 6+vi ; V. 7 ; A. 75 : C. 10 · L. 1. 58).



TEXT-FIG. 8.—*a. Coilia dussumieri* C.V. (after Day) ; *b. Setipinna taty* (C.V.) (after Day) ; *c. Anodontostoma chacunda* (Ham.) (after Day) ; *d. Coilia ramcarati* (Ham.) (after Day).

Genus **Anchoviella** Fowler.

Body elongate, scales moderate. Maxilla almost reaches gill-opening. Abdomen somewhat keeled and serrated, with not more than 7 preventral

scutes. Dorsal origin behind pelvic origin. Upper pectoral ray not produced. Anal single short, behind dorsal fin. Adipose fin absent. Caudal forked.

Distribution.—Zanzibar, Red Sea, Mauritius, India, Ceylon, Burma, Malaya, Malay Archipelago, Siam, Philippines, China, Melanesia, Polynesia, Australia, Fiji Island.

Key to species of genus **Anchoviella.**

1.	Anal origin behind dorsal origin	*A. hetereolobus* (Rüpp.) (B. 12-13 ; D. 13-14 ; P. 13 ; V. 7 ; A. 16-18 ; L. 1. 35-36 ; L. tr. 8-9).
2.	Anal origin below dorsal base	3.
3.	Abdominal scutes between pectorals and pelvics 7	*A. commersonii* Lac. (text-fig. 9*b*) (B. 11-13 ; D. 15-16 ; P. 14-15 ; V. 7 ; A. 20-21 ; L. 1. 38-40 ; L. tr. 8-9).
4.	Abdominal scutes between pectorals and pelvics 4-5	5.
5.	Maxillary reaching front border of preopercle	*A. indica* (v. Hass.) (B. 11 ; D. 16 ; P. 14-16 ; V. 7 ; A. 19-21 ; L. 1. 40 ; L. tr. 8-9).
6.	Maxillary reaching gill-opening ..	*A. tri* (Blkr.) (B. 11 ; D. 14-15 ; P. 12-13 ; V. 7 ; A. 20-23 ; L. 1. 32-35 ; L. tr. 8-9).

Genus **Thrissocles** Jordan & Evermann.

Body elongate, compressed, scales moderate, deciduous. Teeth in laws minute, uniform. Maxilla moderate, produced or extended. Abdomen keeled and serrated. Pectorals reach pelvics ; upper ray of pectoral not produced. Dorsal origin behind pelvic origin. Anal single, moderate, behind dorsal origin. Adipose fin absent. Caudal forked.

Distribution.—Red Sea, Arabia, Madagascar, Mauritius, Seychelles, India, Pakistan, Ceylon, Burma, Malay Archipelago, Siam, Cochin-China, China, Melanesia, Micronesia, Polynesia, Queensland, Philippines, Australia.

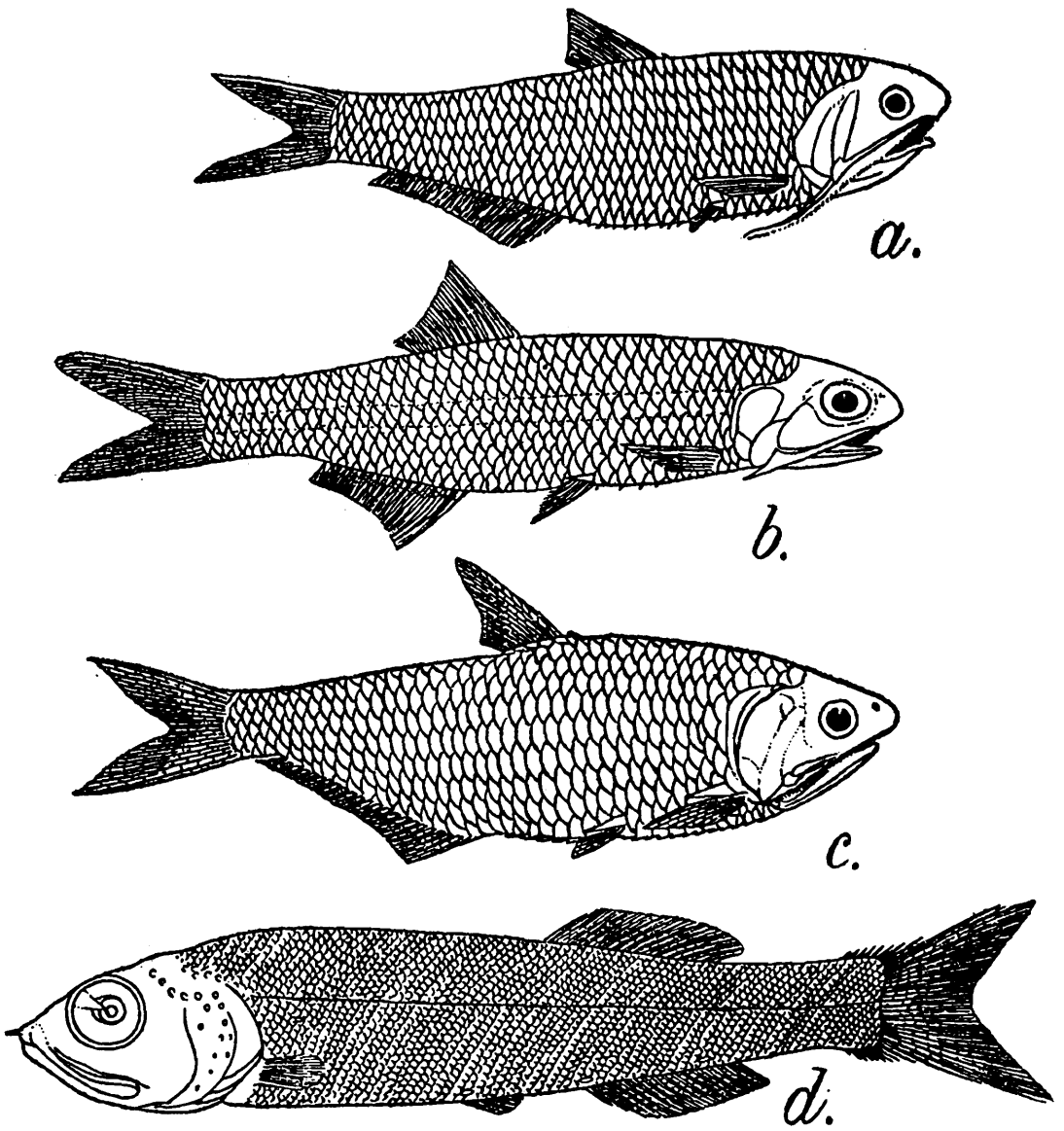
Key to species of genus **Thrissocles.**

1.	Maxillary extending beyond gill-opening ..	3.
2.	Maxillary not extending beyond gill-opening	11.
3.	Maxillary reaching pectoral base	5.
4.	Maxillary reaching beyond pectoral base ..	9.
5.	Lower gill-rakers 13 : anal more than 3 times in standard length	*T. mystax* (Schn.) (B. 12-14 ; D. 14-16 ; P. 12 ; V. 7 ; A. 35-38 ; C. 19 ; L. 1. 45 ; L. tr. 12).
6.	Lower gill-rakers 11 : anal 2⅔ times in standard length	7.
7.	Height of body 4¼ to 4½ times in total length	*T. purava* (Ham.) (B. 12 ; D. 14 ; P. 15 ; V. 6 ; A. 45-47 ; L. 1. 46 ; L. tr. 12).
8.	Height of body 3⅔ times in total length ..	*T. annandalei* Chaudhuri. (D. 12 ; P. 14 ; V. 8 ; A. 45 ; L. 1. 50 ; L. tr. 13).

9.	Maxillary reaching pelvic base : lower gill-rakers 12 : abdominal scutes 28 ..	*T. setirostris* Brouss. (B. 10-11 ; D. 15-17 ; P. 14 ; V. 6 ; A. 34-38 ; C. 17 ; L. l. 36-44 ; L. tr. 11).
10.	Maxillary nearly reaching pelvic base : lower gill-rakers 14-20 : abdominal scutes 22-25 ..	11.
11.	Anal origin a little behind dorsal base : gill-rakers 16-20 : abdominal scutes 22-24 ..	*T. dussumieri* (C.V.) (text-fig. 9*a*) (B. 12 ; D. 14-16 ; P. 12 ; V. 7 ; L. l. 40-42 ; L. tr. 9-10).
12.	Anal origin below dorsal base : lower gill-rakers 14-17 : abdominal scutes 25 ..	*T. valenciennesi* Blkr.
13.	Preventral scutes present : lower gill-rakers 13-27	15.
14.	Preventral scutes absent : lower gill-rakers 20	*T. baelama* (Forsk.) (B. 11 ; D. 14-16 ; P. 13 ; V. 7 ; A. 29-32 ; C. 20 ; L. l. 41 ; L. tr. 8).
15.	Lower gill-rakers 13 : abdominal scutes 26..	*T. hamiltonii* (Gray) (B. 12 D. 14 ; P. 12 ; V. 7 ; A. 40-41 ; C. 19 ; L. l. 44 ; L. tr. 11-12).
16.	Lower gill-rakers 21-37 : abdominal scutes 23-27	17.
17.	Abdominal scutes 27 : lower gill-rakers 21-25..	*T. malabaricus* (Bl.) (text-fig. 7*d*) (B. 12 ; D. 15-16 ; P. 14 ; A. 40-43 ; C. 20 ; L. l. 39-40 ; L. tr. 11-12).
18.	Abdominal scutes 22-23 : lower gill-rakers 10-27	19.
19.	Lower gill-rakers 27 : snout equal to eye ..	*T. kammalensis* (Blkr.) (text-fig. 9*c*) (B. 10-11 ; D. 14-15 ; P. 12 ; A. 34-38 ; C. 19 ; L. l. 36-38 ; L. tr. 9-10).
20.	Lower gill-rakers 10-17 : snout less than eye diameter	21.
21.	Gill-rakers 10	*T. kempi* (Chaudhuri) (D. 12 ; P. 14 ; V. 8 ; A. 40 ; L. l. 45 ; L. tr. 12).
22.	Gill-rakers 17 ..	*T. rambhae* (Chaudhuri) (D. 11 ; P. 13 ; V. 7 ; A. 40 ; L. l. 46 ; L. tr. 12).

Genus **Xenengraulis** Jordan & Seale.

Body elongate, compressed, scales small, deciduous. Teeth in jaws partly canine-like. Maxilla reaches gill-opening. Abdomen keeled and serrated. Dorsal origin behind pelvic origin. Pectorals reach middle of pelvics. Anal single, moderate, behind dorsal origin. Adipose fin absent. Caudal forked.



TEXT-FIG. 9.—*a. Thrissocles dussumieri* (C.V.) (after Day); *b. Anchoviella commersonii* (Lac.) (after Day); *c. Thrissocles kammalensis* (Blkr.) (after Day); *d. Bathytroctes rostratus* Gthr. (after Alcock).

X. spinidens J. & S. is the only species of the genus found in India and Burma. (D. 14; V 7; A. 46; L. 1.42; L. tr. 12).

Distribution.—India, Burma, Siam.

Superfamily ALEPOCEPHALOIDAE.

Key to families of superfamily ALEPOCEPHALOIDAE.

1. Anterior portion of head produced into a long tube terminating in a narrow mouth: gill-openings narrow, not surpassing level of pectorals .. .. Family DOLICHOPTERYGIDAE.

2. Anterior portion of head not produced into a long tube: gill openings wide, surpassing level of pectorals .. .. .. Family ALEPOCEPHALIDAE.

Family ALEPOCEPHALIDAE.

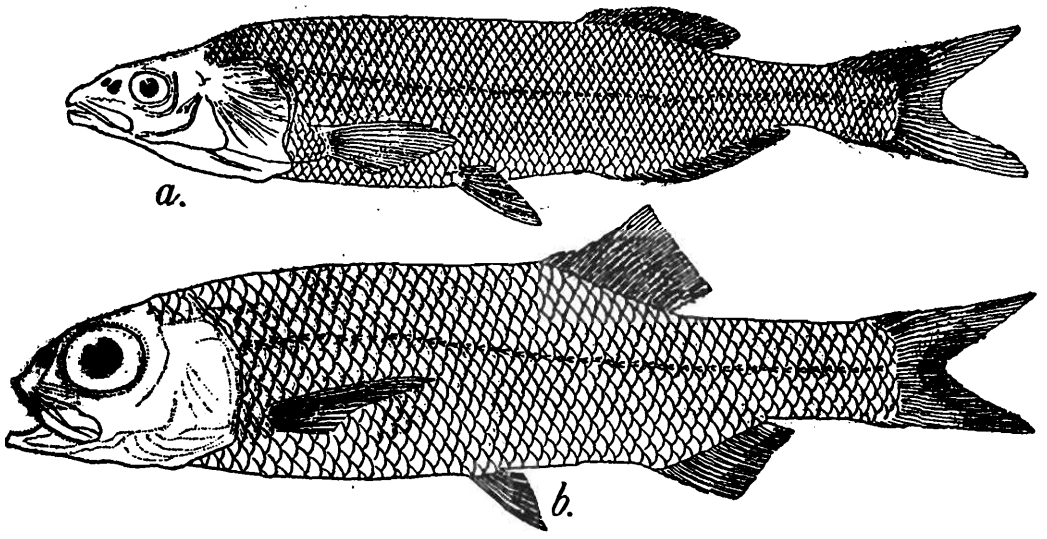
Key to genera of family ALEPOCEPHALIDAE.

1.	Trunk scaly	3.
2.	Trunk naked	11.
3.	Eyes reduced, completely hidden beneath skin	Genus **Tauredophidium.**
4.	Eyes prominent, not hidden beneath skin	5.
5.	Pelvics present : body elongate ..	7.
6.	Pelvics absent : body short and elevated ..	Genus **Platytroctes.**
7.	Branchiostegals 6	Genus **Alepocephalus.**
8.	Branchiostegals 7	9.
9.	A single series of teeth on premaxilla and maxilla	Genus **Bathytroctes.**
10.	Several series of teeth on premaxilla and maxilla	Genus **Narcetes.**
11.	Dorsal and anal fins short : body moderately elongate	Genus **Xenodermichthys.**
12.	Dorsal and anal fins very long : body exceedingly elongate	Genus **Leptoderma.**

Genus **Alepocephalus** Risso.

Body elongate, compressed, scales moderate, deciduous. Eye prominent. Snout moderate, not produced into a long tube. Premaxillary palatine and, sometimes, vomer toothed. 6 branchiostegals Gill-openings wide, surpassing level of pectorals. Dorsal and anal fins short : their origins nearly opposite to each other. Pelvic origin in advance of dorsal origin. Adipose fin absent. Caudal forked.

Distribution.—Gulf of Aden, Arabian Sea, Bay of Bengal, Flores Sea, Malay Archipelago.



TEXT-FIG. 10.—*a. Alepocephalus bicolor* Alc. (after Alcock) ; *b. Bathytroctes squamosus* Alc. (after Alcock).

Key to species of genus **Alepocephalus.**

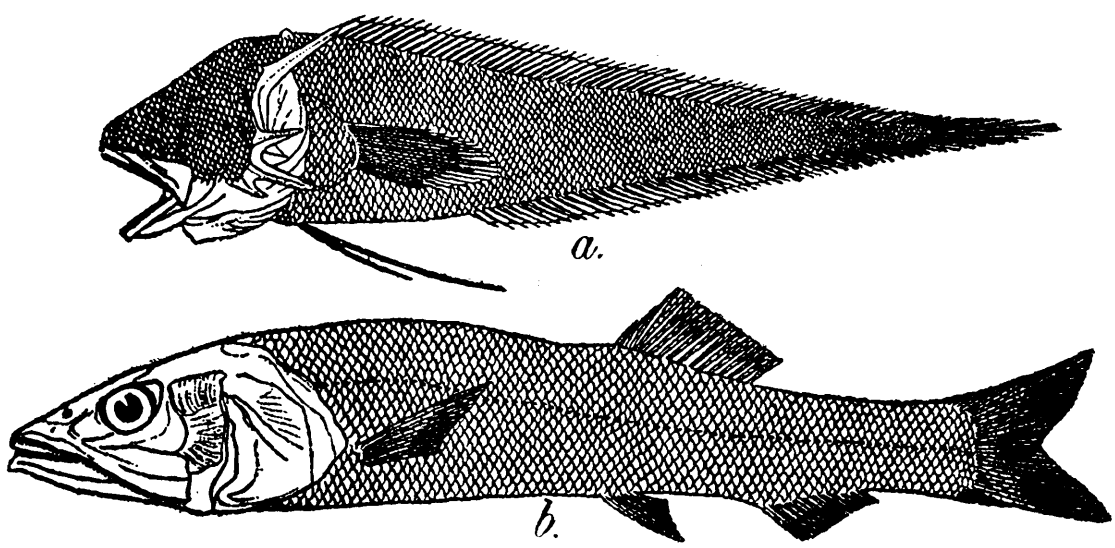
1.	Anal origin well behind middle of body (measured with caudal)	3.
2.	Anal origin exactly in middle of body (measured with caudal)	*A. edentulus* Alc. (text-fig. 13c) (B. 6 ; D. 29 ; P. 9 ; V. 6 ; A. 85 ; L. l. *ca.* 50 ; L. tr. 15).
3.	Maxilla long, extending beyond anterior border of orbit	5.
4.	Maxilla short, not extending beyond anterior border of obit	9.

5.	Dorsal origin before anal origin ..	*A. bicolor* Alc. (text-fig. 10*a*) (B. 6; D. 21; P. 10; V. 8; A. 28; L. 1. 62; L. tr. 18).
6.	Dorsal origin opposite to anal origin	7.
7.	Head long, 2½ times in standard length	*A. macrops* Lloyd (B. 6; D. 17; P. 8; V. 8; A. 20; L. 1. 50; L. tr. 16).
8.	Head short, 3 times in standard length	*A. blanfordii* Alc. (B. 6; D. 16; P. 11; V. 6-7; A. 17: L. 1. *ca.* 70).
9.	Dorsal and anal equal, with their origins opposite	*A. longiceps* Lloyd (B. 6; D. 20; P. 10; V. 6; A. 23; L. 1. 52; L. tr. 12).
10.	Dorsal shorter than anal, with its origin behind anal origin	*A. microlepis* Lloyd (B. 6; D. 20-22; P. 10; V. 5-6; A. 30-33; L. 1. 125; L. tr. 30-35).

Genus **Bathytroctes** Gthr.

Body elongate, compressed, scales moderate, deciduous. Eye prominent. Snout moderate, not produced into a long tube. A single series of teeth on premaxilla and maxilla. Gill-openings wide, surpassing level of pectorals. Branchiostegals 7. Dorsal and anal fins short: dorsal origin in advance of anal origin. Pelvic origin in advance of dorsal origin. Adipose fin absent. Caudal forked.

Distribution.—N. E. Coast of Africa, between Seychelles and Zanzibar, Arabian Sea, Andaman Sea, Pernambuco, Bali Sea, North of Celebes.



TEXT-FIG. 11.—*a. Tauredophidium hextii* Alc. (after Alcock); *b. Narcetes erimelas* Alc. (after Alcock).

Key to species of genus **Bathytroctes**.

1.	Maxilla extending to level of midorbit ..	3.
2.	Maxilla extending beyond level of midorbit.	5.
3.	Lateral line scales 42	*B. macrolepis* Gthr. (B. 7; D. 15; V. 8; A. 11; L. 1. 42).
4.	Lateral line scales 50	*B. squamosus* Alc. (text-fig. 10*b*). (B. 7; D. 17; P. 10; V. 9; A. 17; C. *ca.* 35; L. 1. *ca.* 50; L. tr. 15).
5.	Lateral line scales 100: maxilla reaching postorbital level	*B. rostratus* Gthr. (text-fig. 9*d*). (B. 7; D. 17; P. 17; A. 17; L. 1. 98; L. tr. 22).

6.	**Lateral line scales 70 : maxilla not reaching postorbital level .. .. ..**	*B. microlepis* Gthr. (B. 7 ; D. 16 ; V. 8 ; A. 17 ; L. l. *ca.* 70).

Genus **Narcetes** Alc.

Body elongate, compressed, scales moderate. Eye rather small. Snout moderate, not produced into a long tube. Premaxilla, maxilla, mandible, palatine and vomer toothed : tooth on premaxilla and mandible pleuriserial. Gill-openings wide, surpassing level of pectorals. Branchostegals 7. Dorsal fin in posterior half of body : dorsal origin in advance of anal origin. Pelvic origin opposite to or before dorsal origin. Anal entirely behind dorsal. Adipose fin absent. Caudal forked.

Distribution.—Gulf of Oman, Arabian Sea.

Key to species of genus **Narcetes.**

1.	**Pelvic origin opposite to dorsal origin**	*N. erimelas* Alc. (text-fig. 11*b*) (B. 7 ; D. 15-16 ; P. 10-11 ; V. 9 ; A. 12 ; C. *ca.* 35 ; L. l. 68).
2.	**Pelvic origin before dorsal origin ..**	*N. affinis* Lloyd (B. 7 ; D. 17 ; P. 13 ; V. 10 ; A. 14 ; L. l. 73 ; L. tr. 23).

Genus **Platytroctes** Gthr.

Body oblong, elevated, compressed, scales small. Eye large. Snout not produced into a long tube. Premaxilla, maxilla, mandible and vomer uniserially toothed. Gill-openings wide, surpassing level of pectorals. Branchiostegals 6. Dorsal and anal fins in posterior half of body : their origins opposite to each other. Pelvics absent. Adipose fin absent. Caudal forked.

P. apus Gthr. is the only species of the genus found in the Arabian Sea. (D. 18 ; P. 20 ; A. 17 ; L. l. *ca.* 100).

Distribution.—Atlantic Ocean, Arabian Sea.

Genus **Xenodermichthys** Gthr.

Body low, moderately elongate, compressed, scaleless. Snout moderate, not produced into a long tube. Premaxilla, maxilla and mandible toothed : palate toothless. Gill-openings wide, surpassing level of pectorals. Branchiostegals 6. Dorsal and anal fins in posterior half of body : their origins opposite to each other. Pelvic origin far in advance of dorsal origin and almost in the same horizontal line with the pectoral origin. Adipose fin absent. Caudal forked.

Distribution.—Gulf of Aden, Arabian Sea, Bay of Bengal, Andaman Sea, West Coast of Sumatra.

Key to species of genus **Xenodermichthys.**

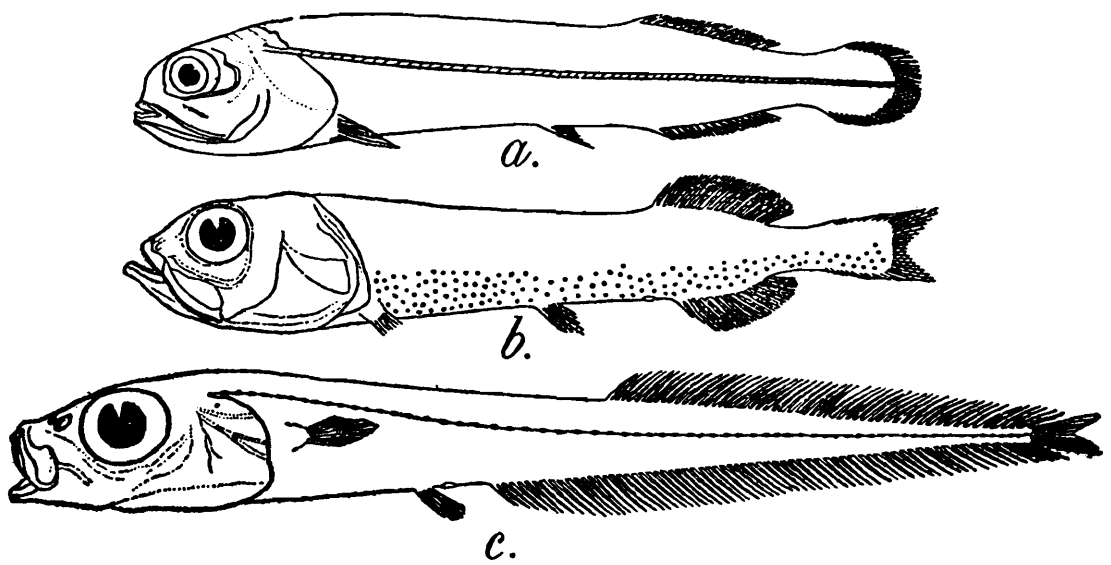
1.	**Lateral line inconspicuous, without scales ..**	**3.**
2.	**Lateral line conspicuous, with underlying scales .. ..**	**5.**
3.	**D. 15 ; A. 14 .. .. ..**	*X. guentheri* Alc. (text-fig. 12*b*) (B. 6 ; D. 15 ; P. 52 ; V. 6 ; A. 14).
4.	**D. 18 ; A. 17 ..**	*X. nudus* (Br.) (B. 7 ; D. 18 ; P. 7 ; V. 6 ; A. 17).
5.	**Height of body 6 times in standard length ..**	*X. squamilaterus* Alc. (text-fig. 12*a*) (B. 6 ; D. 20 ; P. 6 ; V. 6 ; A. 18).
6.	**Height of body 4½ times in standard length**	*X. lividis* (Br.) (text-fig. 13*a*) (D. 19-21 ; P. 7-8 ; V. 7 ; A. 18-19).

Genus **Leptoderma** Vaill.

Body low, exceedingly elongate, tail tapering almost to a filament, without scales. Eye large. Snout moderate, not produced into a long tube. A series of small teeth in both jaws; none on palate. Gill-openings wide but not surpassing level of pectorals. Dorsal and anal very long, ending near caudal: anal the longer. Dorsal origin behind anal origin. Pectorals high. Pelvic origin in advance of dorsal origin. Adipose fin absent. Caudal small, forked.

L. affinis Alc. (text-fig. 12c), is the only species of the genus found in the Bay of Bengal. (D. *ca*, 66 ; V. 5 ; A. *ca*. 85).

Distribution.—Bay of Bengal.



Text-fig. 12.—*a. Xenodermichthys squamilaterus* Alc. (after Alcock); *b. Xenodermichthys guentheri* Alc. (after Alcock); *c. Leptoderma affinis* Alc. (after Alcock).

Genus **Tauredophidium** Alc.

Body elongate, compressed, tapering to the tail, with scales. Eye reduced, completely hidden beneath skin. Snout short, not produced into a long tube. Mandibular, vomerine and palatine teeth in narrow villiform bands. Gill-openings wide, surpassing level of pectorals. Branchiostegals 8. Dorsal and anal fins confluent with caudal. Dorsal origin in front of anal origin and above pelvic base. Pelvics jugular, in the form of 2 filaments arising far apart on bony bases. Adipose fin absent. Caudal fin confluent with dorsal and anal.

T. hextii Alc. (text-fig. 11*a*), is the only species of the genus found in the Bay of Bengal. (D. 64 ; P. 18 ; V. 2 ; A. 58 ; C. 10).

Distribution.—Bay of Bengal.

Family Dolichopterygidae.

Genus **Aulastomatomorpha** Alc.

Body elongate, scales minute. Eye large. Snout produced into a long tube ending in a small mouth. Uniserial teeth in jaws only.

Gill-openings wide below, contracted above, where it does not surpass level of pectoral fins. Branchiostegals 5. Dorsal fin short, in the posterior part of body. Dorsal origin behind anal origin. Pelvic origin in front of anal and dorsal origins. Anal very long. Adipose fin absent. Caudal forked.

A. phospherops Alc. (text-fig. 14*b*), is the only species of the genus found in the Arabian Sea. (B. 5 ? ; D. 21 ; P. 7 ; V. 6 ; A. 41).

Distribution.—Arabian Sea.

Suborder *CHIROCENTROIDEI.*

Family CHIROCENTRIDAE.

Genus **Chirocentrus** C.

Body low, elongate, scales small, deciduous ; without photophores. Cleft of mouth wide, superior. Teeth in narrow bands on palatine, pterygoid and tongue. Abdominal edge keeled, with hair-like rays ; non-serrated. Dorsal fin short, in the caudal region of body, opposite to anal. Pelvic origin in front of dorsal origin, nearly between pectoral and anal origins. Anal longer than dorsal. Adipose fin absent. Caudal deeply forked.

C. dorab (Forsk.) (text-fig 13*d*), is the only species of the genus found in India, Burma, Ceylon. (B. 8 ; D. 16-17 ; P. 14-15 ; V. 6-7 ; A. 31-36 ; C. 19).

Distribution.—Red Sea, Zanzibar, Natal, Mauritius, India, Pakistan, Ceylon, Burma, Malay Peninsula, Siam, China, Formosa, Malay Archipelago, Melanesia, Australia.

Suborder *CHANOIDEI.*

Family CHANIDAE.

Genus **Chanos** Lac.

Body moderately elongate, compressed, scales small ; without photophores. Eye with broad adipose lid. Mouth small, terminal. Teeth absent. Gill-membranes entirely united below, free isthmus. Abdominal edge rounded, non-serrated. Dorsal fin longer than anal. Dorsal origin opposite to pelvic origin. Anal short. Adipose fin absent. Caudal deeply forked.

C. chanos (Forsk.) (text-fig. 13*a*), is the only species of the genus found in India, Ceylon. (D. 13-16, P. 16 ; A. 9-10 ; L. l. 80-90 ; L. tr. 12-15).

Distribution.—Red Sea, East Coast of Africa, India, Ceylon, Malay Peninsula, Malay Archipelago, Philippines, China, Japan, Australia, Melanesia, Polynesia.

Suborder *SALMONOIDEI.*

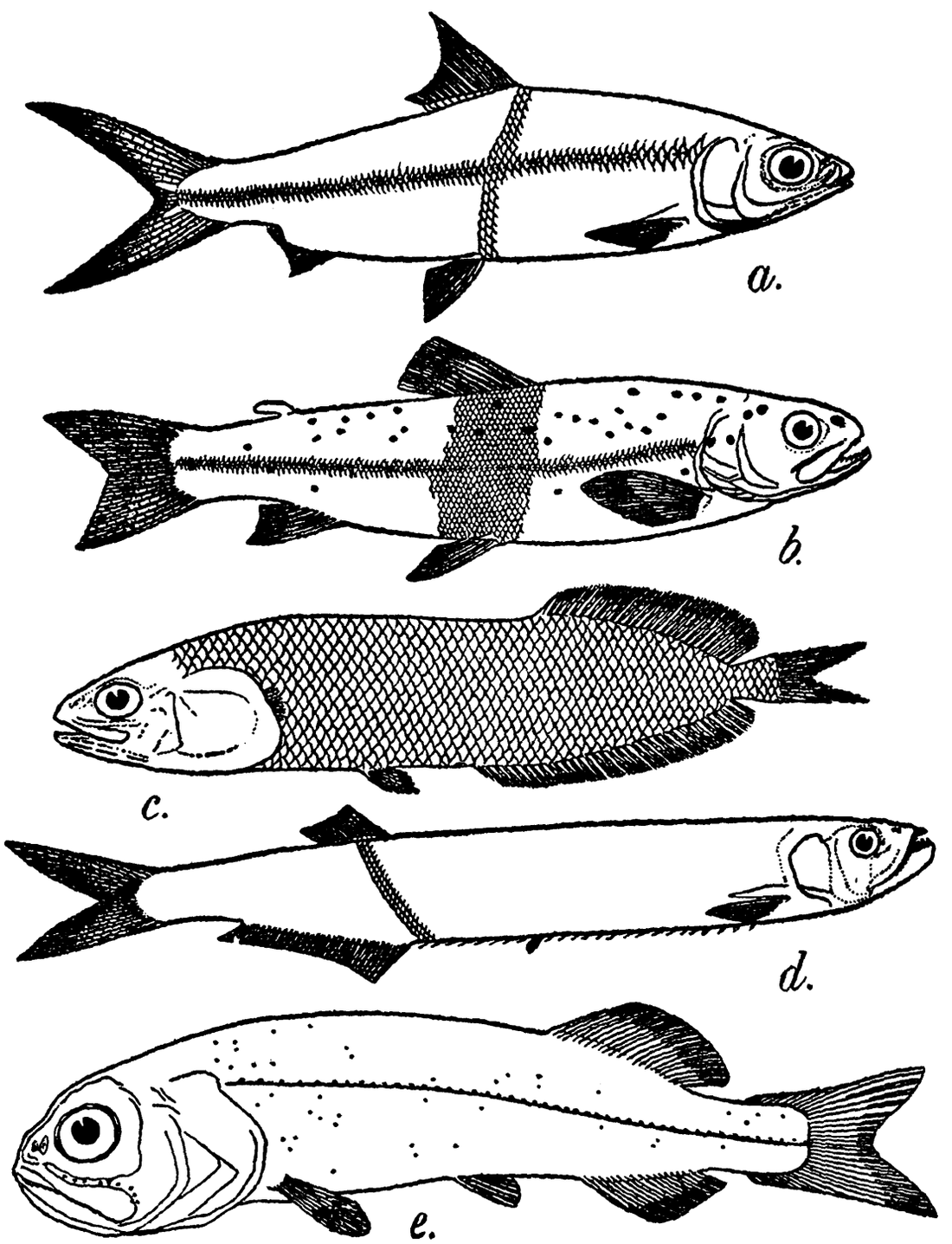
Key to families of suborder SALMONOIDEI.

1. Mouth wide, oblique : adipose fin present (in young and adult) .. .. .. Family SALMONIDAE.
2. Mouth small, terminal : adipose fin absent present in young only) .. .. Family MICROSTOMIDAE.

Family Salmonidae.

Genus **Salmo** L.

Body elongate, scales small. Head scaleless. Photophores absent. Eye moderate. Cleft of mouth wide. Teeth on jaws, vomer, palatine and tongue, absent from pterygoid. Anterior dorsal fin with 10-15 rays : dorsal origin in front of pelvic origin. Anal fin with 10-13 rays.



Text-fig. 13.—*a. Chanos chanos* (Forsk.) (after Day); *b. Salmo levenensis* Walker (after Day); *c. Alepocephalus edentulus* Alc. (after Alcock); *d. Chirocentrus dorab* (Forsk.) (after Day); *e. Xenodermichthys lividis* (Br.) (after Brauer).

Adipose dorsal fin present both in young and adult. Anal origin in front of adipose fin origin. Caudal crescentic to forked.

Distribution.—South Africa (introduced), India (introduced), Pakistan (introduced), Ceylon (introduced), Australia (introduced), S. America

(introduced), North America, British Columbia to California, England, Scotland, Eurasia.

Key to species of genus **Salmo**.

1.	Head long, about 4 times in standard length : lateral line scales 115-145 : spotted below lateral line, colour greenish or brownish .. **3.**	
2.	Head short, about 5 times in standard length : lateral line scales 127-160 : not spotted below, colour steel blue	*S. gairdnerii gairdnerii* Rich. (B. 11-12 ; D. 11/0 ; A. 12 ; L. l. 127-160).
3.	Colour brownish : lateral line scales 115-130.	*S. trutta fario* L. (B. 10-12 ; D. 12-14/0 ; P. 13-14 ; V. 9 ; A. 11-13 ; C. 18-19 ; L. l. 115-130 ; L. tr. 24-27 / 32-38).
4.	Colour greenish : lateral line scales 120-130	*S. levenensis* Walker (text-fig. 13*b*) (B. 10-12 ; D. 12-14/0 ; P. 12-14 ; V. 9 ; A. 10-12 ; C. 19 ; L. l. 120-130 ; L. tr. 24-28 / 26-30).

Family MICROSTOMIDAE.

Genus **Nansenia** Jordan & Evermann.

Body elongate, cylindrical, scales large. Photophores absent. Eye large. Mouth small, terminal. Teeth on lower jaw and vomer. Dorsal fin with 11 rays : origin in front of pelvic origin. Anal fin with 10 rays. Adipose dorsal well developed in young only. Caudal forked.

N. graenlandicus (Reinhardt), is the only species of the genus found in the Arabian Sea.

Distribution.—N. Atlantic, Arabian Sea.

Suborder *STOMIATOIDEI.*

Key to superfamilies of suborder STOMIATOIDEI.

1.	Tail markedly short in relation to length of trunk : body always naked	Superfamily ASTRONESTHOIDAE (Gymnophotodermi).
	Tail not markedly short in relation to length of trunk : body naked or scaly .. **3.**	
3.	Gill-rakers rudimentary or absent : body elongate	Superfamily STOMIATOIDAE (Lepidophotodermi).
4.	Gill-rakers present : body elongate or elevated ..	Superfamily GONOSTOMOIDAE (Heterophotodermi).

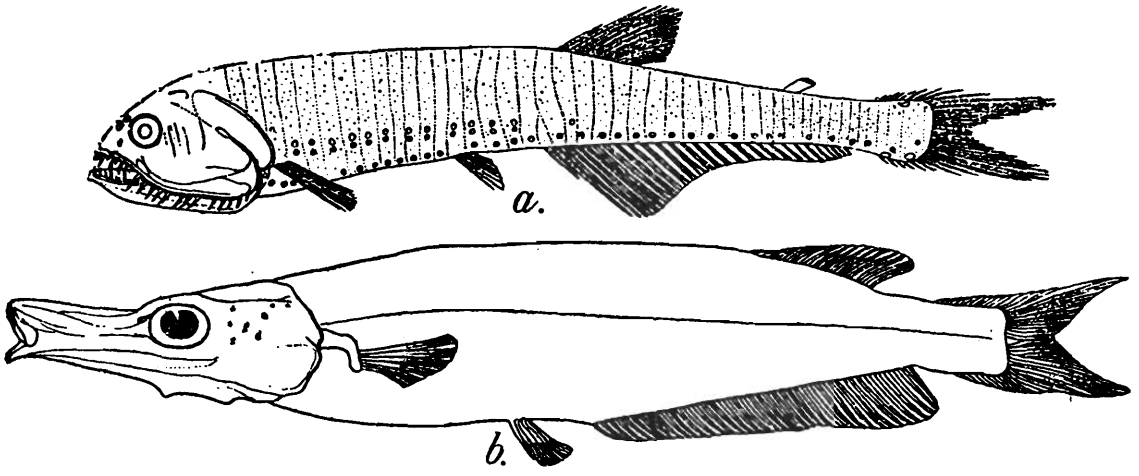
Key to families of superfamily GONOSTOMOIDAE.

1.	Body elongate, low : gape of mouth oblique ..	Family GONOSTOMIDAE.
2.	Body short, elevated : gape of mouth vertical ..	Family STERNOPTYCHIDAE.

Family GONOSTOMIDAE.

Key to genera of family GONOSTOMIDAE.

1.	Dorsal origin in advance of anal origin	3.
2.	Dorsal origin opposite to or behind anal origin ..	7.
3.	No additional serial photophores on sides of body : anal rays 14-32 ..	5.
4.	With additional serial photophores on sides of body : anal rays 57-61	Genus **Triplophos.**
5.	Anal rays 23-32	Genus **Yarrella.**
6.	Anal rays 14-15	Genus **Vinciguerria.**
7.	Serial photophores on body more or less distinctly divided into groups : pseudobranchiae present	Genus **Valenciennellus.**
8.	Serial photophores on body arranged in continuous longitudinal rows : pseudobranchiae absent	9.
9.	Premaxillary toothed : eye moderate : anal rays 22-31	Genus **Gonostoma.**
10.	Premaxillary not toothed : eye small : anal rays 16-20	Genus **Cyclothone.**



TEXT-FIG. 14.—*a. Gonostoma elongatus* Gthr. (after Brauer) ; *b. Aulostomatomorpha phospherops* Alc. (after Alcock).

Genus **Gonostoma** Rafinesque.

Body elongate, compressed, scales large, more or less concealed in skin : with 2 uninterrupted series of photophores on each side of body. Eye moderate. Gape of mouth very wide. Teeth in premaxillary, palatine, pterygoid. Vomerine teeth present or absent. Gill-openings very wide. Pseudobranchiae absent. Gill-rakers long, few in number. Dorsal fin with 13-15 rays : origin somewhat nearer to root of pectoral than to base of caudal and opposite to anal. Pelvic origin in advance of dorsal origin. Anal fin with 22-31 rays, extending nearly to base of caudal. Adipose fin present. Caudal forked.

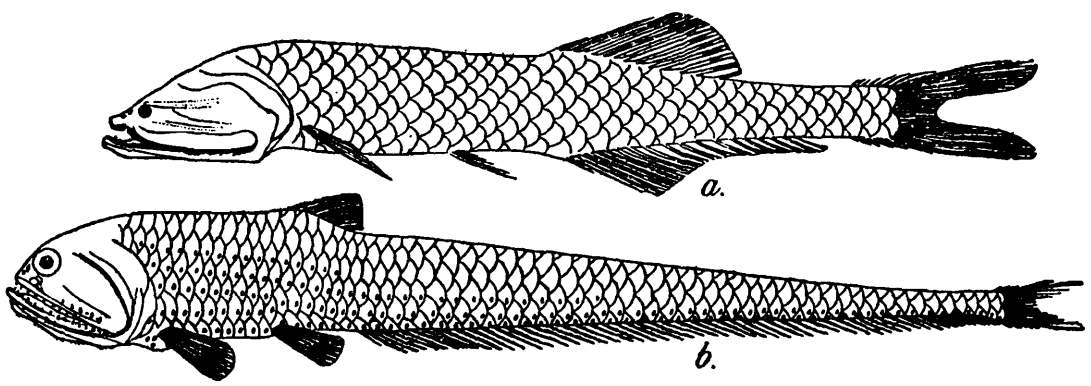
G. elongatus Gthr. (text-fig. 14*a*), is the only species of the genus found in the Arabian Sea. (B. 14 ; D. 13 ; P. 11-13 ; V 7-8 ; A. 27-30).

Distribution.—East Coast of North and Central America, Gulf of Guinea, Arabian Sea, West of Sumatra, Flores Sea, Banda Sea, Arfura Sea.

Cyclothone G. B.

Body elongate, somewhat compressd, scaly or scaleless: with uninterrupted lateral series of photophores. Eye small. Gape of mouth very wide. Premaxillary not toothed: palatine, pterygoid and vomer toothed. Gill-openings wide. Pseudobranchiae absent. Gill-rakers numerous. Dorsal fin with 13-15 rays: origin nearer to caudal base than to root of pectoral and opposite to anal origin. Pelvic origin in advance of dorsal origin. Anal fin with 16-20 rays. Adipose dorsal, when present, small. Caudal forked.

Distribution.—Atlantic and Indian Oceans, Gulf of Aden, Arabian Sea, Bay of Bengal, Seas of Malay Archipelago, Arctic and Antarctic Oceans.



TEXT-FIG. 15.—*a. Cyclothone obscura* Br. (after Brauer); *b. Triplophos elongatus* Br. (after Brauer).

Key to species of genus **Cyclothone.**

1. Photophores present along sides of body ..	3.
2. Photophores absent along sides of body ..	*C. obscura* Br. (text-fig. 15*a*) (B. 13; D. 13-15; P. 9-10; V. 6; A. 17-19).
3. Ground colour white: scales absent: precaudal photophores absent	5.
4. Ground colour dark: scales present: precaudal photophores present	7.
5. 7 photophores in lateral row: 4 photophores between pelvic and anal in ventral row ..	*C. signata* Garm. (B. 12-13; D. 13-14; P. 9; V. 6; A. 19-20).
6. 6 photophores in lateral row: 3 photophores between pelvic and anal in ventral row ..	*C. signata alba* Br. (text-fig. 17*b*).
7. Pectorals almost reaching pelvic bases: distance between pelvic and anal origins equal to distance between pelvic and pectoral origins	*C. acclinidens* Garm. (text-fig. 19*a*) (B. 14; D. 13-14; P. 10; V. 6; A. 18-20).
8. Pectorals not reaching pelvic bases: distance between pelvic and anal origins contained twice in the distance between pelvic and pectoral origins	9.
9. Length of head 4 times in standard length: area between pelvic and anal fins unpigmented	*C. microdon pallida* Br. (text-fig. 19*b*).

10. Length of head 5 times in standard length : area between pelvic and anal fins pigmented. *C. microdon* (Gthr.) (B. 12-13 ; D. 13-14 ; P. 9-10 ; V. 6 ; A. 19.)

Genus **Vinciguerria** G. B.

Body elongate, compressed, scales thin, deciduous : with uninterrupted series of lateral photophores. Eye large. Gape of mouth wide. Teeth on both jaws, palatine, pterygoid and vomer. Gill-openings wide. Gill-rakers well developed. Dorsal fin with 14 rays : origin midway from snout to base of caudal and in advance of anal origin. Pelvic origin in advance of dorsal origin. Anal with 14-15 rays. Adipose fin present. Caudal equally forked.

Distribution.—Atlantic, Arabian Sea, Bay of Bengal, Indo-Pacific.

Key to species of genus **Vinciguerria.**

.Symphysial photophores present .. *V. lucetius* (Garm.) (text-fig. 18*c*) (B. 11 ; D. 13-14/0 ; P. 8-9 ; V. 7 ; A. 14-15).

2. Symphysial photophores absent *V. nimbarius* (J. & W.).

Genus **Valenciennellus** J. & E.

Body moderately elongate, much compressed, scales deciduous with interrupted series of lateral photophores. Eye large. Gape of mouth wide. Both jaws with a single series of minute teeth ; a single transverse row of similar teeth on head of vomer. Gill-openings very wide. Pseudobranchiae well developed. Gill-rakers long, numerous. Dorsal with 78 rays : origin opposite to anal origin. Pelvic origin in front of dorsal origin. Anal with 23-25 rays. Adipose fin absent. Caudal fairly forked.

V stellatus Garm. is the only species of the genus found in the Arabian Sea and Bay of Bengal. (B.9 ; D. 12/0 ; P. 12 ; V 8 (9) ; A. 23).

Distribution.—Atlantic, Arabian Sea, Bay of Bengal.

Genus **Yarrella** G. B.

Body elongate, compressed, scales deciduous ; with uninterrupted series of lateral photophores and without additional serial photophores on sides of body. Eye moderate. Gape of mouth wide. Both jaws, palatines and pterygoids toothed ; teeth present or absent on vomer. Gill-openings very wide. Pseudobranchae absent. Gill-rakers numerous. Dorsal with 10-12 rays : origin in front of anal, midway between pelvic and anal. Anal with 23-32 rays. Adipose fin present. Caudal forked.

Y corythaeolum (Alc.) (text-fig. 17*a*), is the only species of the genus found in India. (B. 12 ; D. *ca.* 11/0 ; P. 10 ; V 7 ; A. *ca.* 24).

Distribution.—Natal coast, Zanzibar, Gulf of Aden, Maldives, Andaman Sea, Southern Australia.

Genus **Triplophos** Br.

Body elongate, compressed, scaly : with uninterrupted series of lateral photophores and additional serial photophores. Eye moderate.

Gape of mouth very wide. Premaxillary, maxillary and mandible, each with a single series of small unequal teeth ; 2 or 3 teeth on vomer and a single series of palatine. Gill-openings wide. Dorsal with 10 rays : origin in front of anal origin and more than twice as near to tip of snout as to base of caudal. Pelvic origin opposite to dorsal origin. Anal very long with 57-61 rays : origin immediately behind vertical from dorsal fin. Adipose fin absent. Caudal deeply forked.

T. elongatus Br. (text-fig. 15*b*), is the only species of the genus found in Ceylon. (B. 17 ; D. 10 ; P. 10 ; V 6 ; A. 57 ; L. 1.60).

Distribution.—South of Ceylon.

Family STERNOPTYCHIDAE.

Key to genera of family STERNOPTYCHIDAE.

1.	Dorsal fin preceded by a large triangular transparent plate : an abrupt ventral constriction between trunk and tail ..	3.
2.	Dorsal fin preceded by a forked spine : no abrupt ventral constriction between trunk and tail	Genus **Polyipnus.**
3.	Eye normal : anal undivided : ventral constriction between trunk and tail with an integumentary plate	Genus **Sternoptyx.**
4.	Eye telescopic : anal divided : ventral constriction between trunk and tail without integumentary plate	Genus **Argyropelecus.**

Genus **Sternoptyx** Herm.

Body short, elevated, compressed, scaleless, with an almost ventral constriction between trunk and tail : with photophores. Eye large, nontelescopic. Gape of mouth wide, subvertical. Gill-openings wide. Pseudobranchiae present. Dorsal fin with 9-12 rays, preceded by a large triangular plate with its upper border dentated, and strengthened along its hind margins by a short spine. Pectoral long, low. Pelvics small : origin behind dorsal, arising on a broad transparent integumentary fold between trunk and tail. Adipose fin low, begining immediately behind dorsal and extending to anterior rays of caudal. Caudal broad, forked.

S. diaphana Herm. is the only species of the genus found in Indian waters.

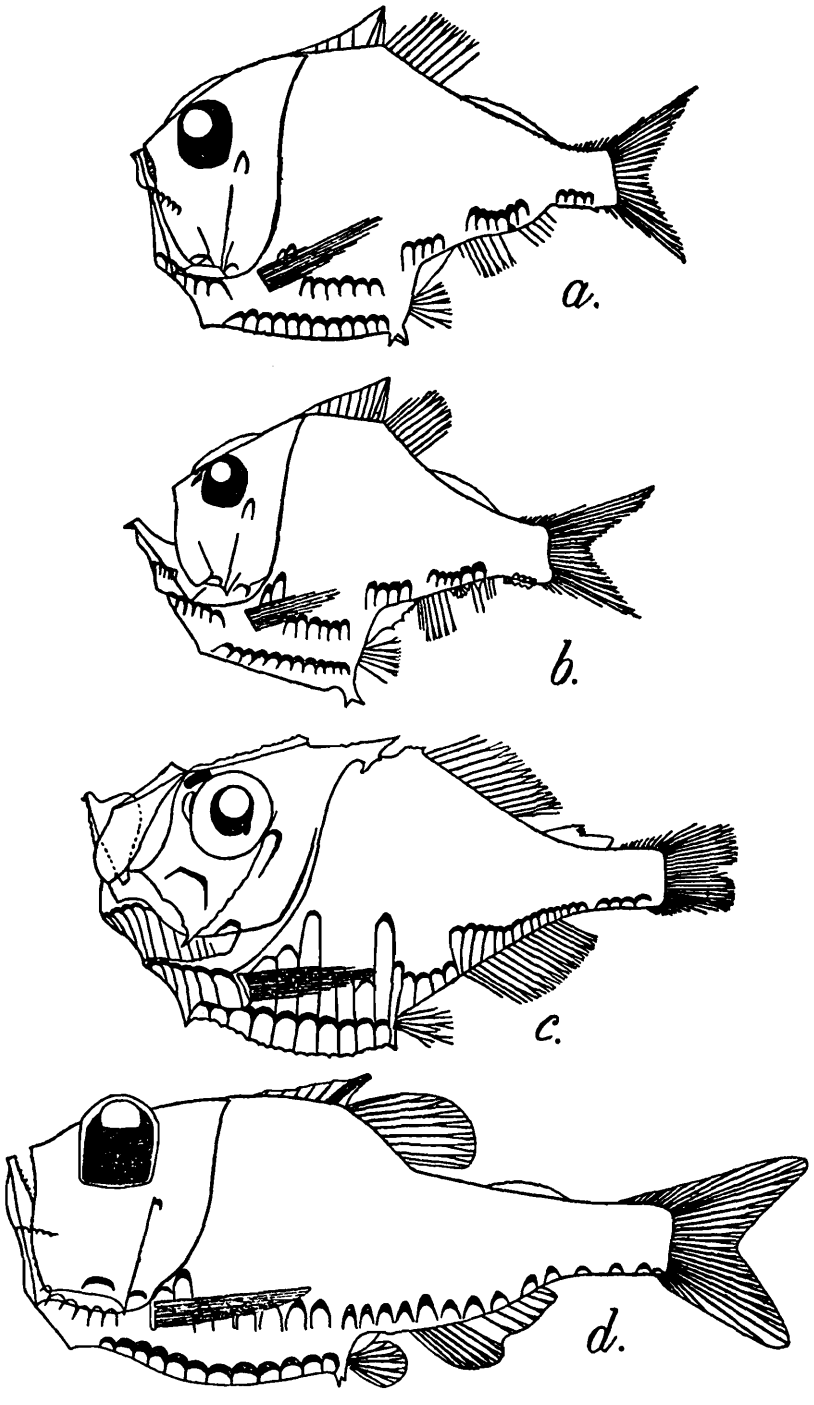
Distribution.—Atlantic, Indo-Pacific.

Genus **Argyropelecus** Cocco.

Body elevated, compressed, scaleless, with the posterior part sharply deflected from the anterior : with photophores. Eye large, telescopic. Cleft of mouth wide, subvertical. Upper jaw with minute teeth, lower jaw and palatines with a series of small curved teeth. Gill-openings wide. Pseudobranchiae present. Anterior 7 to 9 rays of dorsal fin transformed into a foliaceous, serrated plate, succeeded by 7 to 9 normal rays originating before anal origin. Pelvics small : origin behind dorsal

Pectorals large, low. Anal (VII-7) divided in the middle by a free interspace : origin behind dorsal. A low, long adipose fin in the middle, between dorsal and caudal. Caudal broad, forked.

Distribution.—Atlantic Ocean, Mediterranean, Gulf of Aden, Arabian Sea, Maldive area, Bay of Bengal, Indo-Pacific, Antarctic.



TEXT-FIG. 16.—*a. Argyropelecus olfersii* (C.) (after Brauer) ; *b. Argyropelecus aculeatus* C.V. (after Brauer) ; *c. Polyipnus spinosus* Gthr. (after Brauer) ; *d. Argyropelecus affinis* Garman (after Brauer).

Key to species of genus **Argyropelecus.**

1. Photophores forming a nearly continuous series .. .. *A. affinis* Garm. (text-fig. 16*d*).
2. Photophores, forming groups (preanal, supraanal and caudal) .. .. **3.**

3.	A single serrated abdominal spine ..	*A. hemigymnus* Cocco (B. 9; D. viii+7-8/0; P. 11; V. 6; A. vi+5).
4.	A pair of smooth abdominal spines ..	5.
5.	Posterior abdominal spine longer than anterior: double series of spines on lower edge of caudal peduncle	*A. aculeatus* C. V. (text-fig. 16*b*) (B. 9; D. ix+9/0; P. 9; V. 6; A. vii+5).
6.	Posterior abdominal spines subequal or shorter: no spine on caudal peduncle ..	7.
7.	Lower preopercular spine curved, the upper very small or absent: depth of body about 1½ times in standard length	*A. olfersii* (C.) (text-fig. 16*a*) (B. 9; D. vii+9/0; P. 11; V. 6; A. vii+5).
8.	Lower preopercular spine straight, the upper moderate or small: depth of body 1⅔ or more times in standard length ..	*A. sladeni* Reg. (D. vii+9/0; P. 11; V+5; A. vii+5).

Genus **Polyipnus** Gthr.

Body elevated, compressed, scales deciduous, without abrupt ventral constriction: with photophores. Eye large, nontelescopic. Gape of mouth vertical, rather small. Gill-openings wide. Pseudobranchiae present. No triangular or foliciaceous plate before dorsal fin. Dorsal fin with 12-13 rays: origin nearly midway in length of body: preceded by a short bifid spine. Pectorals long, low. Pelvics small: origin opposite to dorsal origin. Anal undivided, with 15-17 rays. Adipose fin present. Caudal forked.

P. spinosus Gthr. (text-fig. 16*c*), is the only species of the genus found in India. (D. 12-13/0; P. 12; V. 5; A. 15-16).

Distribution.—Gulf of Guinea, Bay of Bengal, Seas of Malay Archipelago, Sandwich Islands.

Superfamily STOMIATOIDAE.

Key to families of superfamily STOMIATOIDAE.

1.	Adipose fin absent	Family STOMIATIDAE.
2.	Adipose fin present	Family CHAULIODONTIDAE.

Family STOMIATIDAE.

Key to genera of family STOMIATIDAE.

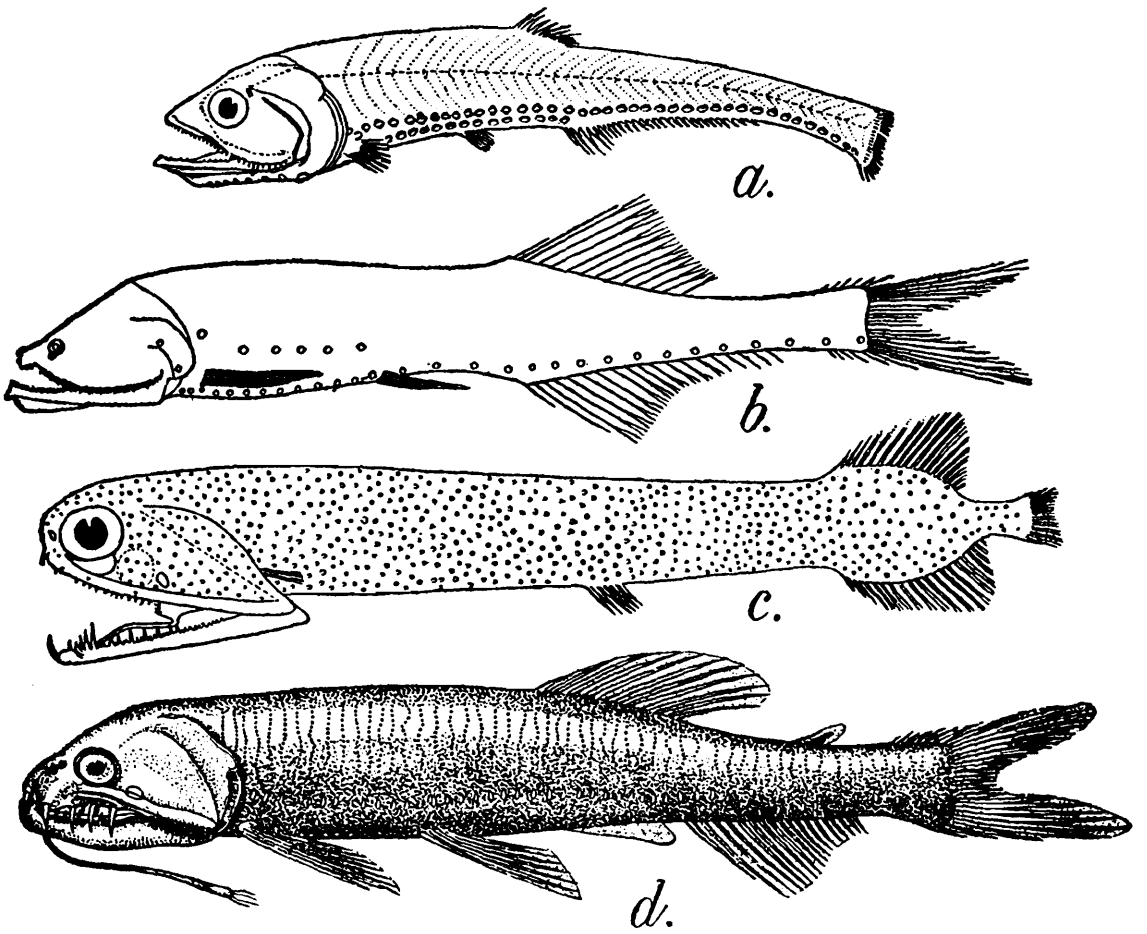
1.	Pectorals present: dorsal origin behind anal origin	Genus **Stomias**.
2.	Pectorals absent: dorsal origin opposite anal origin	Genus **Photostomias**.

Genus **Stomias** C.

Body low, elongate, compressed, scales deciduous: with photophores. Eye moderate. Gape of mouth wide, oblique. Teeth in maxilla numerous, small, approximate: those on intermaxilla and mandible more or less curved, large, wide apart; vomer with a pair of

fangs: palatine and tongue with smaller pointed teeth. Chin with fleshy barbel ending in 3 filaments. Gill-openings moderate. Gill-rakers absent. Pseudobranchiae absent. Dorsal, anal, and pelvics in posterior one third of body. Dorsal fin with 16-19 rays, behind anal origin. Pectorals present. Pelvics prolonged reaching anal: origin in front of dorsal origin. Anal with 21-22 rays. Adipose fin absent. Caudal small, forked.

Distribution.—Atlantic Ocean, Gulf of Guinea, W. & E. Coasts of Africa, Gulf of Manaar, West Coast of Sumatra, Malay Archipelago, Indo-Pacific.



TEXT-FIG. 17.—*a. Yarrella corythaeolum* (Alc.) (after Alcock); *b. Cyclothone signata alba* Br. (after Brauer); *c. Malacosteus indicus* Gthr. (after Brauer); *d. Astronesthes martensii* Klunz. (after Brauer).

Key to species of genus **Stomias.**

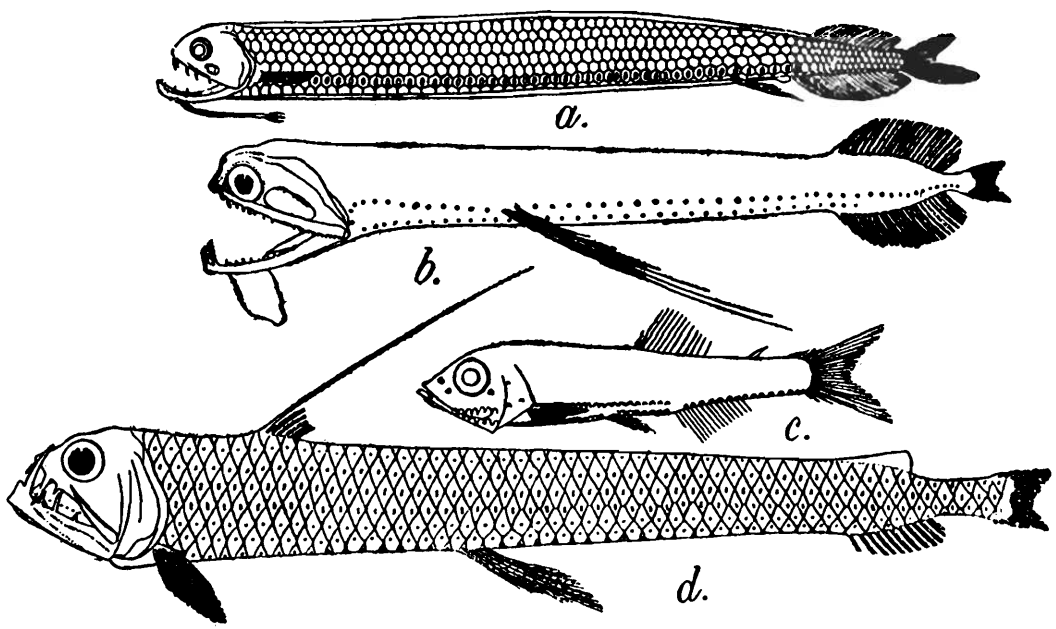
1.	Depth of body 10-12 times in total length ..	3.
2.	Depth of body 16 times in total length ..	*S. affinis* Gthr. (D. 19; P. 6; V. 6; A. 21).
3.	Photophores between pectoral and pelvic bases 34-38: depth of body 12 times in total length	*S. nebulosus* Alc. (B. 16-17; D. 16-17; P. 6; V. 5; A. 21; L. 1. *ca.* 62).
4.	Photophores between pectoral and pelvic bases 43-46; depth of body 10 times in total length	*S. valdiviae* Br. (B. 17; D. 18-19; P. 6; V. 5; A. 21; L.1. *ca.* 62).

Genus **Photostomias** Collett.

Body low, elongate, compressed, scaleless : with photophores. Eye moderate. Gape of mouth very wide, oblique. Teeth acute, unequal, in single series in premaxilla, maxilla, mandible and palatine ; none on tongue. Gill-openings very wide ; gill-covers rudimentary ; gill-rakers rudimentary. One dorsal fin, with 23 rays : origin opposite to anal. Anal fin with 25 rays, situated in the posterior one fourth of the body near the caudal. Pectoral absent. Pelvic origin very much in advance of dorsal origin, situated in the anterior half of body. Adipose fin absent. Caudal deeply forked.

Photostomias atrox (Alc.) (text-fig. 18*b*), is the only species of the genus found in the Bay of Bengal. (D. 23 ; P. O ; V. 6 ; A. 25 ; C. *ca.* 25).

Distribution.—Bay of Bengal.



TEXT-FIG. 18.—*a. Stomias valdiviae* Br. (after Brauer) ; *b. Photostomias atrox* (Alc.) (after Alcock) ; *c. Vinciguerria lucetius* (Garm.) ; *d. Chauliodus pammelas* Alc. (after Alcock).

Family CHAULIODONTIDAE.

Genus **Chauliodus** Bl. Schn.

Body low, elongate, compressed, scales deciduous, with photophores. Eye moderate. Gape of mouth very wide, oblique. About four, large fangs in each premaxilla, about five in mandible ; palatine with a single series of small teeth ; no teeth on tongue. Chin with a rudimentary barbel. Gill-openings very wide ; gill-rakers absent. Pseudobranchiæ absent. Dorsal fin with 16-18 rays, in advance of anal fin, placed far forwards on the body about two head-lengths from snout end. Pelvic origin behind dorsal origin. Anal fin with 12 rays, situated far back near the caudal fin. Adipose dorsal present : adipose ventral present or absent. Caudal forked.

Distribution.—Atlantic, Mediterranean, Gulf of Aden, Gulf of Oman, Arabian Sea, Maldive Area, Bay of Bengal, Malay Archipelago.

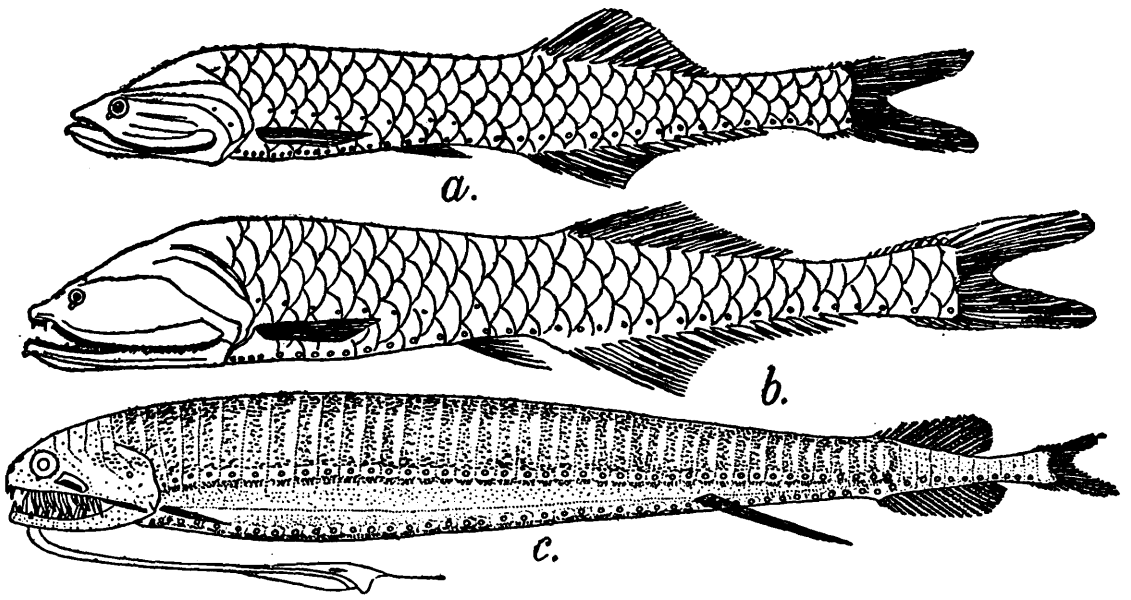
Key to species of genus **Chauliodus.**

1. Luminous organs very prominent, those between pelvics and anal 23-26 : preanal adipose ventral present ..	*C. sloani* Bl. Schn. (B. 18-20 ; D. 6/0 ; P. 12-13 ; V. 7 ; A. 0/12 ; L.l. 60-61).
2. Luminuous organs less prominent, those between pelvics and anal 20-21 : preanal adipose ventral absent	*C. pammelas* Alc. (text-fig. 18*d*) (B. 16 ; D. 6/0 ; P. 11-12 ; V. 7 ; A. 12 ; L.l. 55-56).

Superfamily Astronesthoidae.

Key to families of superfamily Astronesthoidae.

1. Dorsal and anal very long : their rays with lateral spines at base ..	Family Idiacanthidae.
2. Dorsal and anal short : their rays without lateral spines at base ..	3.
3. Adipose dorsal present : dorsal fin not confined to tail	Family Astronesthidae.
4. Adipose dorsal absent : dorsal fin confined to tail ..	Family Melanostomiatidae.



Text-fig. 19.—*a. Cyclothone acclinidens* Garm. (after Brauer) ; *b. Cyclothone microdon pallida* Br. (after Brauer) ; *c. Melanostomias melanops* Br. (aftr Brauer).

Family Astronesthidae.

Genus **Astronesthes** Rich.

Body elongate, compressed, scaleless : with photophores. Eye moderate. Gape of mouth wide, oblique. Teeth in the intermaxilla and mandible unequal, widely set and a few of them fanglike ; vomer edentulous ; palatine and tongue with a series of small pointed teeth. Chin with a well developed, fleshy barbel. Gill-openings wide ; gill-rakers minute. Pseudobranchiae absent. Dorsal fin with 11-14 rays, placed nearer to snout end than to caudal end : origin in advance of anal fin. Pelvics inserted near middle of body : origin shortly before or opposite to dorsal fin. Anal fin with 14-20 rays, near caudal base. Dorsal and ventral adipose fins present. Caudal forked.

Distribution.—Atlantic Ocean, Red Sea, Arabian Sea, Ceylon.

Key to species of genus **Astronesthes.**

1.	Dorsal fin terminating in advance of anal origin	*A. martensii* Klunz. (text-fig. 17*d*) (B. 23; D. 11/0; P. 8; V. 7; A. 0/18).
2.	Dorsal fin not terminating in advance of anal origin	3.
3.	Dorsal rays 16 : chin without barbel ..	*A. cyaneus* (Br.) (text-fig. 20*b*) (B. 18; D. 20/0; P. 8; V. 7; A. 0/16).
4.	Dorsal rays 20 : chin with barbel ..	*A. indicus* (Br.) (text-fig. 20*a*) (B. 18-19; D. 16/0; P. 8; V. 7; A. 0/14).

Family MELANOSTOMIATIDAE

Key to genera of family MELANOSTOMIATIDAE.

1.	Chin with barbel : distance between pelvic and anal origins about 3 times in the distance between pelvic and pectoral ..	Genus **Melanostomias**
2.	Chin without barbel : distance between pelvic and anal origins about 1½ times in the distance between pelvic and pectoral ..	Genus **Malacosteus.**

Genus **Melanostomias** Br.

Body elongate, compressed, scaleless : with photophores. Eye moderate. Gape of mouth wide, oblique. Intermaxilla and mandible with large, bicuspid, depressible teeth ; maxilla anteriorly with large and posteriorly with small teeth ; vomer, palatine and tongue toothed. Chin with a well developed fleshy barbel. Gill-openings wide. Pseudobranchiae absent. Dorsal and anal fins placed far behind near the caudal. Dorsal fin with 13-16 rays and anal fin with 16-20 rays are opposite to each other with their bases equal in length. Pectorals short. Pelvic origin before dorsal fin and well behind middle of body. Adipose fin absent. Caudal forked.

Distribution.—West Coast of Sumatra.

Key to species of genus **Melanostomias.**

1.	28-30 photophores in ventral row between pectoral and pelvic fins : barbel 2-3 times as long as head	*M. melanops* Br. (text-fig. 19*c*) (B. 12; D. 14; P. 5; V. 8; A. 17).
2.	25 photophores in ventral row between pectoral and pelvic fins : barbel shorter than head	*M. valdiviae* Br. (B. 11-12; D. 13; P. 5; V. 6; A. 18).

Genus **Malacosteus** Ayres.

Body elongate, compressed, tapering behind head, scaleless : with photophores. Eye moderate. Gape of mouth extremely wide, oblique. Unequal, pointed teeth in a single series in both jaws and in pairs on tongue. Barbel absent. Gill-openings wide : gill-rakers absent. Dorsal

fin with 16-18 rays and anal fin with 18-20 rays, situated in the last one third of body and opposite to each other. Pectoral rather long, and narrow. Pelvic origin before dorsal origin and a little behind middle of body. Adipose fin absent. Caudal small, forked.

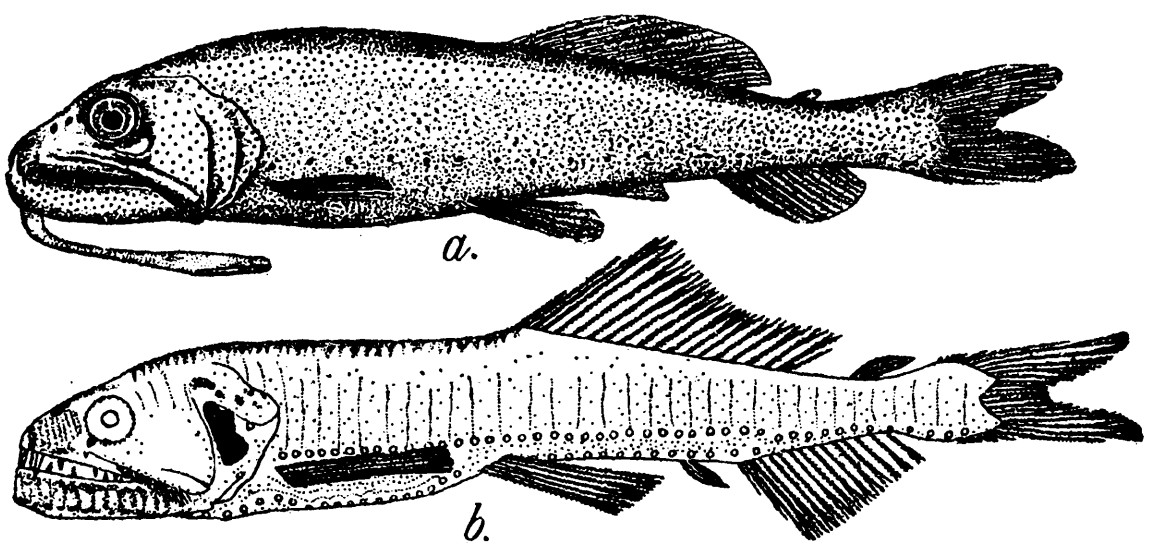
M. indicus Gthr. (text-fig. 17*c*), is the only species of the genus found in Indian waters. (D. 16-18 ; P. 2-3 ; V 6 ; A. 18-20).

Distribution.—West Coast of S. Africa, Arabian Sea, Bay of Bengal, Andaman Sea, Celebes Sea, South of Philippines.

Family Idiacanthidae.

Genus **Stylophthalmus** Br.

Body elongate, scaleless : with photophores. Eyes in the very young ones on long immovable cartilaginous stalks, which become reduced



Text-fig. 20.—*a. Astronesthes indicus* Br. (after Brauer) ; *b. Astronesthes cyaneus* (Br.) (after Brauer).

with age. Minute, sharp teeth in jaws, Dorsal with about 60 rays and anal with about 43 rays, both very long : dorsal origin before anal origin. Pelvics absent. Caudal forked or rounded.

S. paradoxus Br. (text-fig. 21 *a, b*), (which probably seems to be the larval and juvenile stage of an unknown Stomiatid), is the only species of the genus found in Indian Waters. (D. *ca.* 60 ; A. *ca.* 33).

Distribution.—Atlantic Ocean, Arabian Sea, Bay of Bengal, Antarctic Ocean.

Suborder *NOTOPTEROIDEI.*

Family Notopteridae.

Genus **Notopterus** Lac.

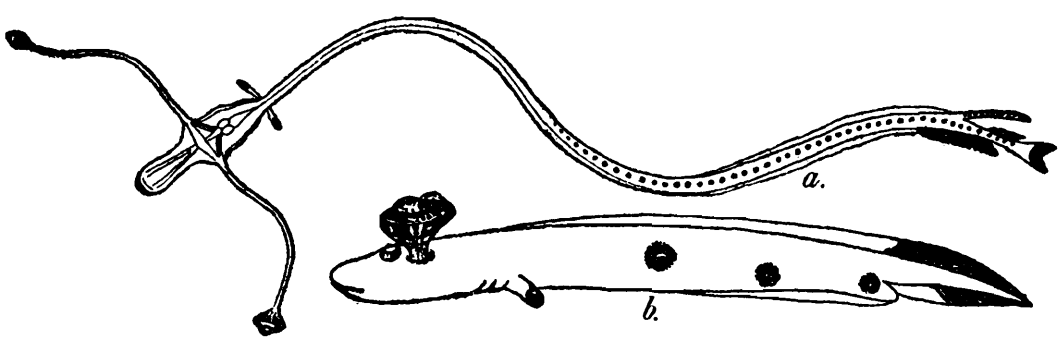
Body oblong, compressed, deep, caudal region long and tapering with minute scales, without photophores. A double series of (28-46) spines along the abdomen. Eye moderate. Head scaled. Cleft of month moderate, lateral. Small teeth on premaxillary, maxillary, vomer, palatine, pterygoid and tongue. Pharyngeal teeth absent

Dorsal fin when present with 8-10 rays, situated in the caudal region; origin far behind anal origin. Pelvics thoracic, rudimentary, united at their base, close before anal; origin in advance of dorsal origin. Anal fin with 100-135 rays, very long, confluent with caudal fin. Adipose fin absent. Caudal not forked.

Distribution.—India, Pakistan, Burma, Malay Peninsula, Malay Archipelago, Siam, Philippines.

Key to species of genus **Notopterus.**

1. Opercular scales much larger than those on body: maxilla not extending beyond hind edge of orbit	*N. notopterus* (Pallas) & N. *osmani* Rahimullah & Das (text. fig. 24*c*) (B. 8; D. 7-8; V. 5-6; A. 100-110; C. 19; L. 1. 225).
2. Opercular scales not larger than those on body: maxilla extending far beyond hind edge of orbit	*N. chitala* (Ham.) (text. fig. 22 *b*) (B. 8-9; D. 9-10; A. 110-125 (135); C. 12-14; L. 1. 180; L. tr. 75).



TEXT-FIG. 21.—*a.* Larval stage of *Stylophthalmus paradoxus* Br. (after Brauer); *b.* Juvenile stage of *Stylophthalmus paradoxus* Br. (after Brauer).

Order BATHYCLUPEIFORMES.

Family BATHYCLUPEIDÆ.

Genus **Bathyclupea** Alc.

Body oblong, compressed, scales large, deciduous; without photophores. Abdomen smooth, rounded. Eye large, about third in head length. Cleft of mouth very oblique; lower jaw prominent. Minute villiform teeth in jaws, palatine and vomer. Dorsal fin with 10 rays, often with a spine, placed in the posterior half of body; origin behind anal origin. Pelvics small, subjugular. Pectorals large, extending beyond anal origin. Anal fin with 33 rays, and a spine. Adipose fin absent. Caudal forked.

B. hoskynii Alc. (text-fig. 22*c*), is the only species of the genus found in Indian waters. (B. 7; D. 10; P. 29; V 6; A. 33; L. 1. *ca* 38).

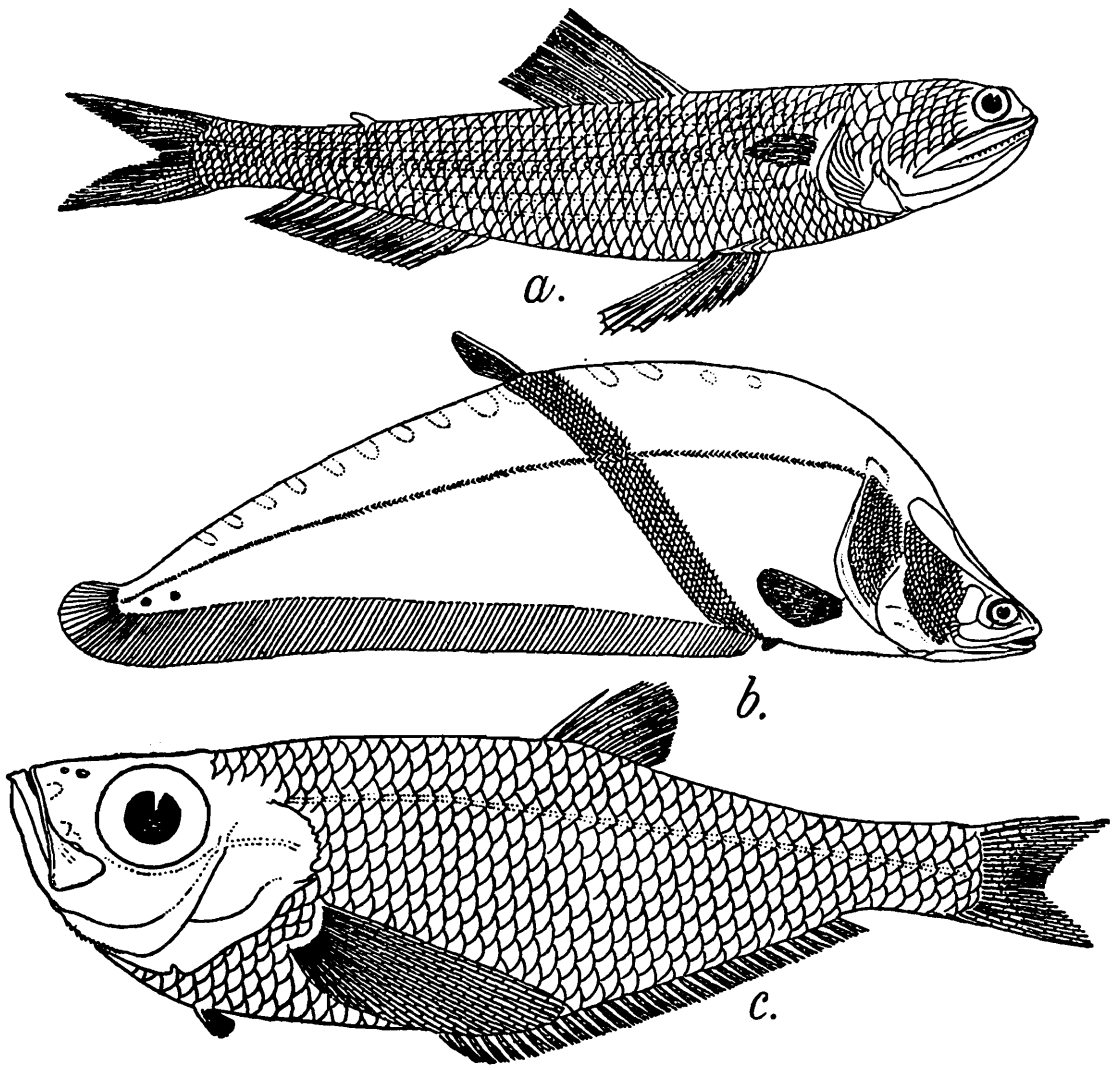
Distribution.—Andaman Sea.

Order GALAXIIFORMES.

Family Galaxiidæ.

Genus **Galaxias** C.

Body elongate, low, scaleless: without photophores. Abdomen smooth, rounded. Eye moderate. Cleft of mouth moderate; upper jaw prominent. Small, conical teeth in both jaws, vomer and palatine;



Text-fig. 22.—*c. Trachinocephalus myops* (Bl. Schn.) (after Day); *b. Notopterus chitala* (Ham.) (after Day); *c. Bathyclupea hoskynii* Alc. (after Alcock).

large teeth on tongue. Dorsal fin with 13 rays placed in the posterior one third of body; origin opposite to anal origin. Pelvic origin far in advance of dorsal origin and nearer to pectoral base than to caudal base. Anal fin with 18 rays. Adipose fin absent. Caudal forked.

G. indicus Day (text-fig. 25*a*), is the only species of the genus found in Indian waters. (B. 9; D. 13; P. 10; V 8; A. 18; C. 15).

Distribution.—India.

Order SCOPELIFORMES.

Key to families of order SCOPELIFORMES.

1. Photophores present .. Family Scopelidae (except genus *Scopelengys*).

2. Photophores absent	3.
3. Body totally naked (inclusive of lateral line) ..	Family EVERMANNELLIDAE.
4. Body not totally naked .. 5.	
5. Eye telescopic	Family SCOPELARCHIDAE.
6. Eye normal	7.
7. Cleft of mouth very oblique and wide, extending upto operculum : teeth prominent : eye moderate	Family SYNODIDAE.
8. Cleft of mouth neither oblique nor very wide (except in genus *Bathypterois* where the cleft of mouth is horizontal) : teeth not prominent : eye large (except in genus *Bathypterois* where eye is poorly developed)	Family SUDIDAE.

Family SYNODIDÆ (Sauridae, Synodontidae).

Key to genera of family SYNODIDÆ.

1. Caudal fin trilobed : pelvic origin almost opposite to dorsal origin	Genus **Harpodon.**
2. Caudal fin bilobed : pelvic origin clearly in front of dorsal origin	3.
3. Inner rays of pelvics much longer than outer ones : a single band of teeth on each side of palate	5.
4. Inner rays of pelvics not much longer than outer ones : a double band of teeth on each side of palate	Genus **Saurida.**
5. Snout pointed, longer than eye diameter : vent nearer to base of caudal than to base of pelvics	Genus **Synodus.**
6. Snout blunt, shorter than eye diameter : vent a little nearer to base of pelvics than to base of caudal	Genus **Trachinocephalus.**

Genus **Harpodon** Le Sueur.

Body elongate, somewhat compressed, scales deciduous : without photophores. Snout short, rounded. Eye small, with adipose lid. Cleft of mouth very wide. Unequal, partly curved teeth in a band on jaws ; teeth in one or two rows on vomer, palatine ; pterygoid and tongue. Gill-openings very wide. Pseudobranchiœ present. Dorsal fin with 12-14 rays, placed nearly in middle of body length ; origin far in advance of anal origin. Pectorals long, inserted above middle of height. Pelvics very long reaching beyond anal origin : origin almost opposite to dorsal origin. Anal fin with 14-15 rays, originating much nearer to caudal base than to pelvic base ; anal base extends almost to caudal. Adipose dorsal present. Caudal fin trilobed.

Distribution.—Zanzibar, India, Pakistan, Burma, Malaya, Malay Archipelago, China.

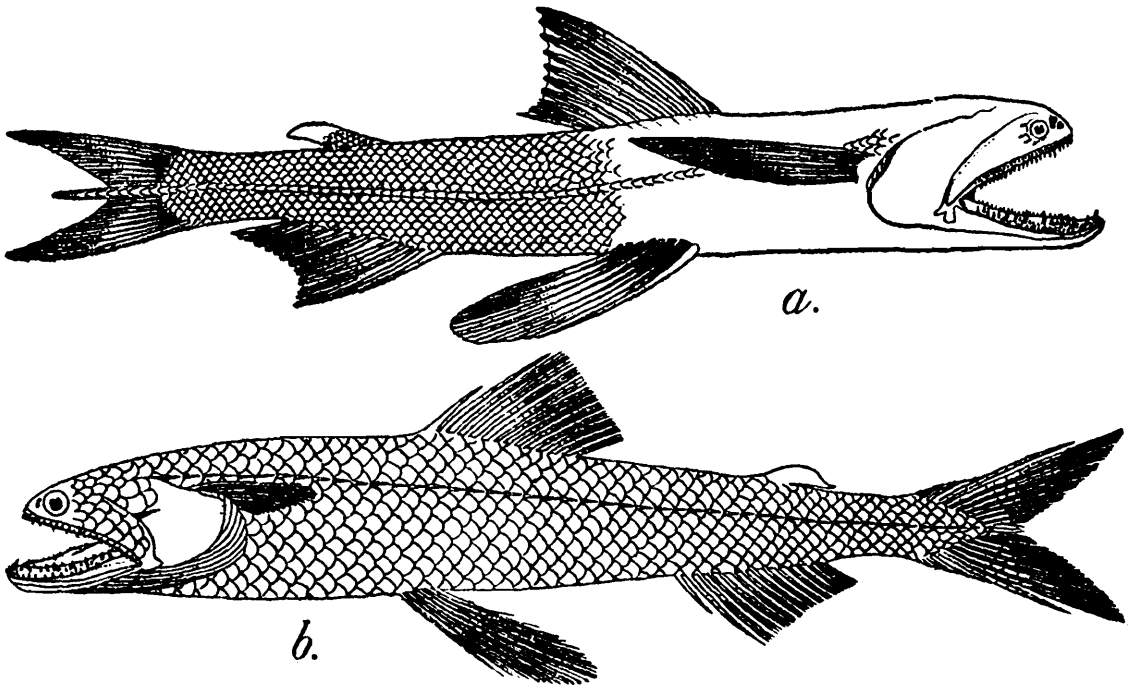
Key to species of genus **Harpodon.**

1. Pectorals long, reaching to below middle of dorsal fin : pelvics long, reaching anal fin ..	*H. nehereus* (Ham.) text. fig. 23*a*) (D. 12-13/0 ; P. 11-12 ; V. 9 ; A 13-15 ; C. 19).

2. Pectorals short, not reaching to below dorsal origin : pelvics short not reaching anal fin — *H. squamosus* Alc. (text. fig. 23*b*) (B. 17 ; D. 12-14/0 ; P. 10 ; V. 9 ; A. 13-15).

Genus **Saurida** C.V.

Body elongate, more or less rounded, scales deciduous : without photophores. Snout obtusely pointed, rather short. Eye moderate with anterior and posterior adipose lids. Cleft of mouth very wide. Teeth in jaws in several series ; a double band of teeth on each side of palate ; vomer and tongue with teeth. Gill-openings wide. Pseudobranchiae present. Dorsal fin with 10-13 rays, situated nearly in middle of length : origin far in advance of anal origin. Pectorals rather short, inserted above middle of height. Pelvics anterior, with the inner rays not much longer than outer ones : origin in front of dorsal origin. Anal with 9-12 rays : origin nearer to caudal base than to ventral base : anal base widely separated from caudal. Adipose dorsal present. Caudal bilobed.



Text-fig. 23.—*a. Harpodon nehereus* (Ham.) (after Day) ; *b. Harpodon squamosus* Alc. (after Alcock).

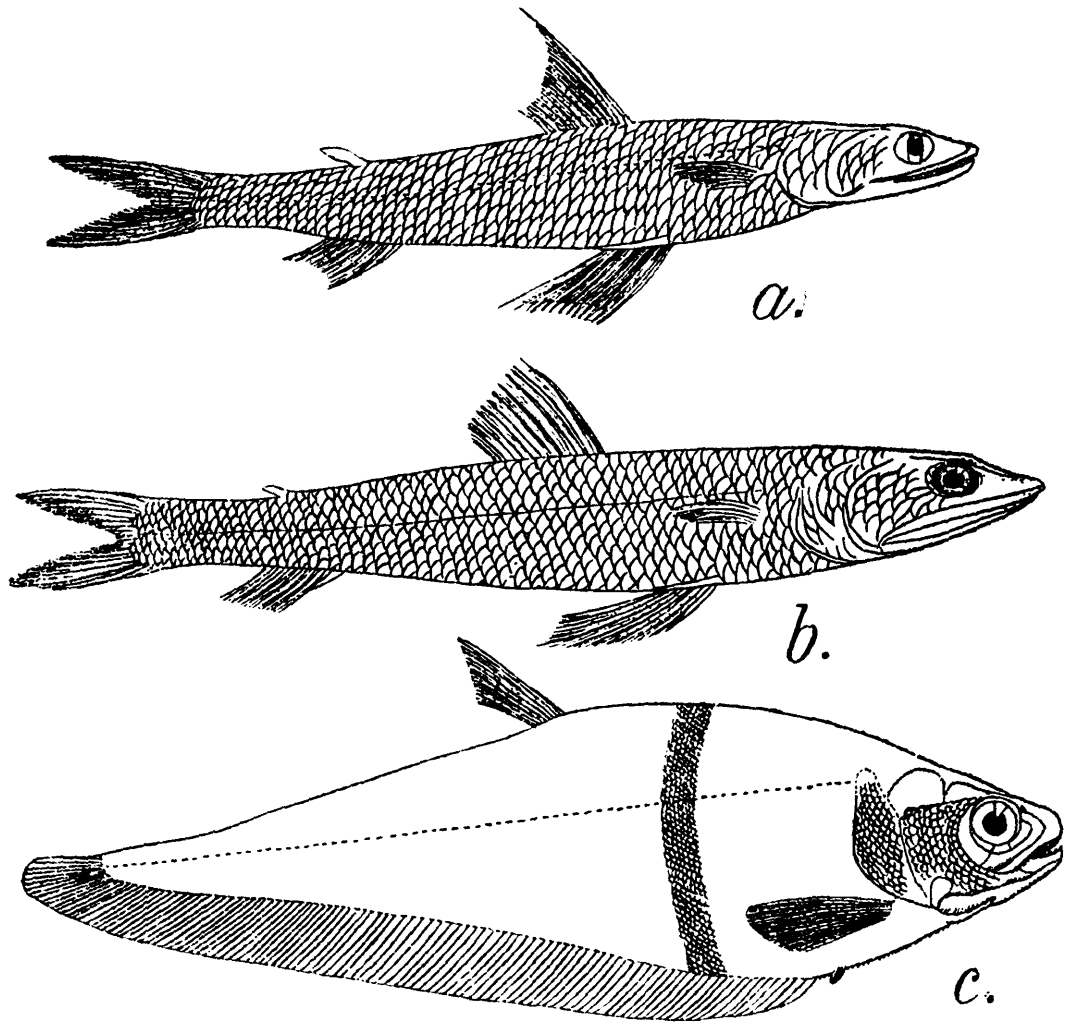
Distribution.—Red sea, East coast of Africa, Madagascar, Mauritius, Zanzibar, Gulf of Oman, Maldives, India, Andamans, Pakistan, Ceylon, Singapore, Malay Archipelago, Philippines, Formosa, China, Japan, Australia, Sandwich Islands.

Key to species of genus **Saurida**.

1. Pectoral rays 12-13 : axillary scale short, broad : back and sides mottled and blotched — *S. gacilis* (Q.G.) (B. 12-13 ; D. 11/0 ; P. 12-12 ; V. 9; A. 9-10 ; L. l. 50-52 ; L. tr. 3½/6).

2. Pectoral rays 14-16 : axillary scale long, pointed : back and sides of uniform coloration or with rather indistinct darker marking .. .. 3.

3. Outer bands of palatine teeth in 3 rows anteriorly : pectoral $1\frac{4}{5}$-$2\frac{1}{10}$ times in head	*S. tumbil* (Bl) (text. fig. 24*a*) (B. 14-16 ; D. 11/O ; P. 14-15 ; V. 9 ; A. 10-11 ; L. l.54-63 ; L. tr. $14\frac{1}{2}$/7).
4. Outer bands of palatine teeth in 2 rows anteriorly : pectoral $\frac{4}{5}$-$1\frac{2}{3}$ times in head	5.
5. Pectoral long $\frac{4}{5}$-$\frac{7}{8}$ times in head ..	*S. longimanus* Norman (D. 11-12/0 ; P. 14 ; V. 9 ; A. 10-11 ; L. l. 45-49).
6. Pectoral short $1\frac{1}{5}$-$1\frac{2}{3}$ times in head ..	*S. undosquamis* (Rich.) (D. 11-12/O ; P. 14-15 ; V. 9 ; A. 10-12 ; L. l. 45-46).



TEXT-FIG. 24.—*a. Saurida timbil* (Bl.) (after Day) ; *b. Synodus indicus* (Day) (after Day) ; *c. Notopterus notopterus* (Pallas) (after Day).

Genus **Synodus** Scopeli.

Body elongate, more or less rounded, scales deciduous : without photophores. Snout more or less pointed, triangular. Eye moderate with anterior and posterior adipose lids. Cleft of mouth wide, more or less oblique. Upper jaw with one or two series of unequal teeth : a band of similar teeth in lower jaw ; a single band of teeth on each side of palate : teeth on tongue. Gill openings wide. Pseudobranchiae present. Dorsal fin with 10-15 rays, placed nearly in middle of length : origin far in advance of anal origin. Pectorals rather short, inserted above middle of height. Pelvics anterior, with the long inner rays much longer than the outer ones ; origin in front of dorsal origin. Anal

fin with 8-15 rays : origin much nearer to caudal base than to pelvic base : anal base widely separated from caudal. Adipose dorsal present. Caudal bilobed.

Distribution.—South East Africa, Natal Coast, Zanzibar, Madagascar, Mauritius, Arabia, Gulf of Aden, Maldives, Andamans, Malay Archipelago, China, Japan, Bismarck Archipelago.

Key to species of genus **Synodus.**

1. Lateral line scales 58-62 : scales between middle of dorsal fin and lateral line $5\frac{1}{2}$—$6\frac{1}{2}$ (rarely $4\frac{1}{2}$) .. .. .. *S. variegatus* (Lac.) (B. 15-16 ; D. 12/0 ; P. 12-13 ; V. 8 ; A. 8-9 ; L. l. 60-64 ; L. tr. $\left(\frac{5\text{-}6}{10\text{-}11}\right)$.

2. Lateral line scales 55-57 : scales between middle of dorsal fin and lateral line $3\frac{1}{2}$ .. *S. indicus* (Day) (text. fig. 24*b*) (B. 15 ; D. 13/0 ; P. 14 ; V. 8 ; A. 9; L. l.55-57 ; L. tr. $3\frac{1}{2}$/7).

Genus **Trachinocephalus** Gill.

Body elongate, more or less laterally compressed, scales deciduous : without photophores. Snout blunt, short. Eye moderate, with adipose lid. Cleft of mouth wide, oblique. Jaws and tongue with small, closely set teeth ; a similar single band of teeth on each side of palatine. Gill-openings wide. Pseudobranchiœ present. Dorsal fin with 11-13 rays : origin a little nearer to end of snout than to adipose fin and in advance of anal origin. Pectorals short, inserted above middle of height. Pelvics anterior, with long inner rays much longer than the outer ones : origin in front of dorsal origin. Anal fin 15-16 rays : origin approximately between pelvic and caudal bases. Adipose dorsal present. Caudal bilobed.

T myops (Bl. Schn.) (text-fig. 22*a*), is the only species of the genus found in Indian waters. (B.16 : D. 12-13/0; P. 12-13; A. 15-16; L. .l 54-58).

Distribution.—Natal, India, Malay Archipelago, Philippines, Formosa, China, Japan, Oceania.

Family SCOPELARCHIDAE.

Genus **Scopelarchus** Alc.

Body elongate, compressed, scales deciduous : without photophores. Eye large. Cleft of mouth wide. A single row of small teeth in the premaxilla ; a double row of teeth in mandible and palatine : tongue also toothed. Gill-openings wide. Pseudobranchiae present. Dorsal fin with 9 rays, in the anterior third of total length with its base lying between pectorals and pelvics and its origin far in advance of anal origin. Pectorals large. Pelvic origin behind dorsal origin. Anal with 26 rays, much longer than dorsal, occupying the greater part of tail. Adipose dorsal present. Caudal forked.

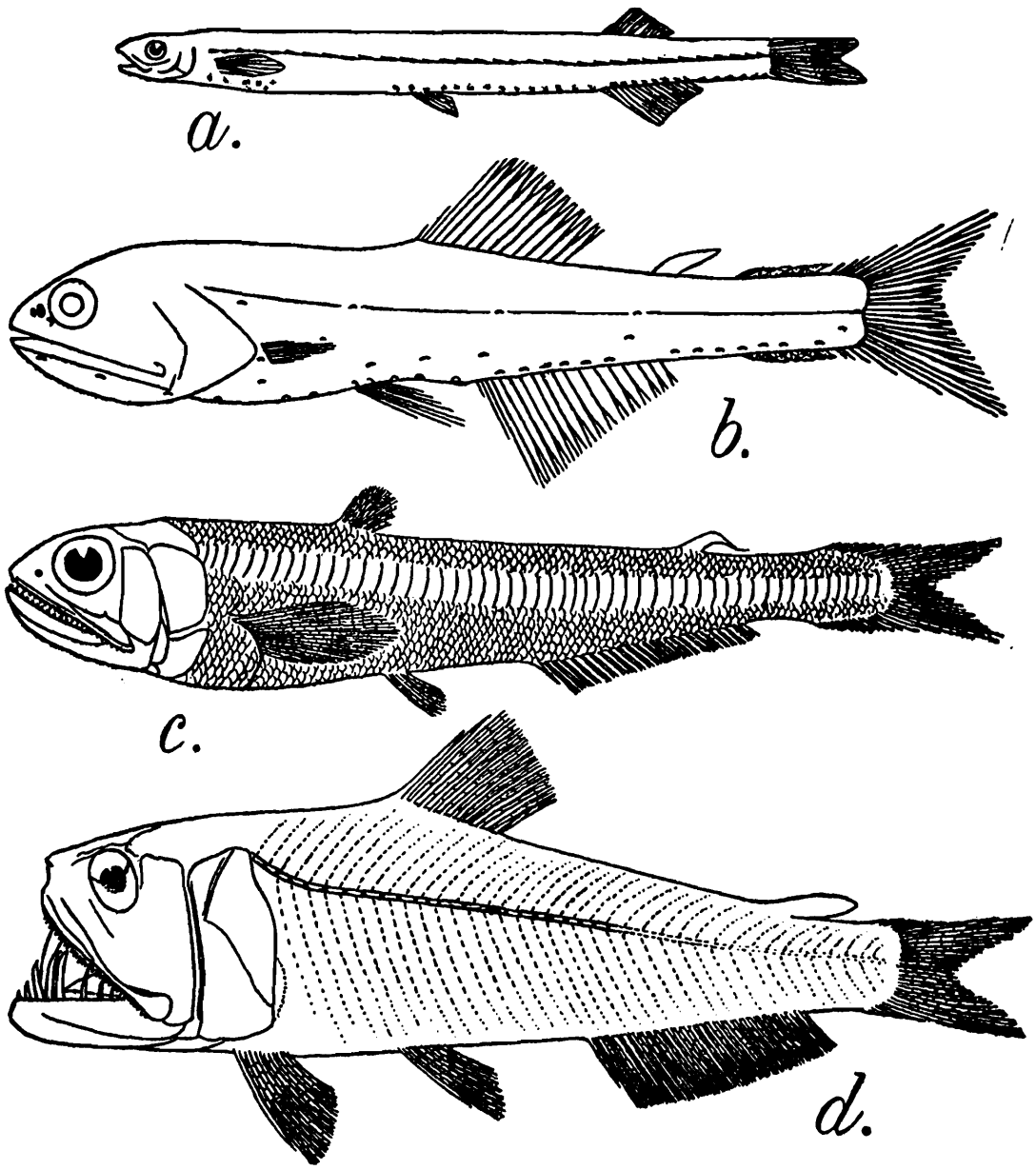
S. guentheri Alc. (text-fig. 25c), is the only species of the genus found in Indian waters. (D. 9/0; P. 19; V 8; A. 26; L. 1. *ca* 50).

Distribution.—India.

Family EVERMANNELLIDAE.

Genus **Evermannella** Fowler.

Body moderately elongate, compressed, totally naked, without photophores. Snout short. Eye large, orbit of great vertical depth and with a broad transparent membranous lateral fold or wall. Cleft



TEXT-FIG. 25.—*a. Galarias indicus* Day (after Day); *b. Lampanyctus micropterum* Br. (after Brauer); *c. Scopelarchus guentheri* Alc. (after Alcock); *d. Evermannella atratus* (Alc.) (after Alcock).

of mouth very wide. Premaxilla with a series of small teeth of equal size: lower jaw, vomer and palatine with a few depressible fangs of enormous size. Gill-openings wide; gill-rakers absent Pseudobranchiae well developed. Dorsal fin with 11 rays, in the anterior half of body: origin in advance of anal origin. Pectorals low, inserted near the ventral profile. Pelvic origin slightly behind dorsal origin and

nearly between pectoral base and anal origin. Anal fin with 26 rays, much longer than dorsal, occupying greater part of tail. Adipose dorsal present. Caudal forked.

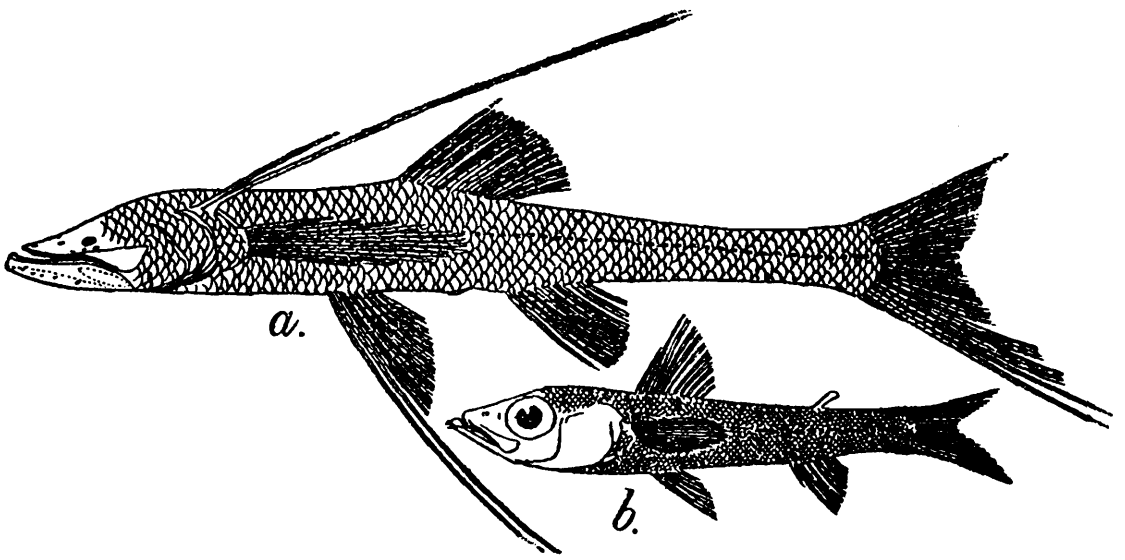
E. atratus (Alc.) (text-fig. 25*b*), is the only species of the genus found in Indian waters. (B. 8; D. 11/0; P. 12; V 8; A. 26).

Distribution.—Chagos Archipelago, Bay of Bengal.

Family SUDIDAE.

Key to genera of family SUDIDAE.

1.	Tail not shorter than trunk: body covered with scales, minute or moderate size: origin of dorsal and pelvic base nearer to snout end than to caudal end ..	3.
2.	Tail shorter than trunk: body naked except for scale-like structures along lateral line: origin of dorsal and pelvic base nearer to caudal end than to snout end	Genus **Lestidium.**
3.	Eye well developed: anal fin opposite to adipose dorsal: pelvic, pectoral and caudal rays normal	Genus **Chlorophthalmus.**
4.	Eye poorly developed: anal fin below dorsal fin: some of pectoral, pelvic and caudal rays unusually prolonged	Genus **Bathypterois.**



TEXT-FIG. 26.—*a. Bathypterois insularum* Alc. (after Alcock); *b. Chlorophthalmus agassizi* Bonap. (after Alcock).

Genus **Chlorophthalmus** Banaparte.

Body moderately elongate, subcylindrical, scaly: without photophores. Tail about equal to trunk. Snout pointed. Eye large. Cleft of mouth moderately wide. Teeth minute, in narrow bands on jaws, vomer and palatine. Gill-openings wide. Pseudobranchiae well developed. Dorsal fin with 11 rays, in the anterior half of body: origin far in advance of anal origin. Pectorals large, inserted about middle of height. Pelvic origin slightly behind dorsal origin, nearer to pectoral base than to anal origin. Anal fin with 9 rays, in the posterior part of tail: origin behind dorsal origin. Adipose dorsal present. Caudal fin deeply forked.

C. agassizi Bonap. (text-fig. 26*b*), is the only species of the genus found in India and Ceylon. (B. 8 ; D. 11; P. 14; V 9 ; L. 1. *ca.* 55).

Distribution.—Mediterranean, N. E. Coast of Africa, Ceylon, Bay of Bengal, West Coast of Sumatra, Hawaian Islands.

Genus **Lestidium**[1] Gilbert.

Body elongate, strongly or moderately compressed, entirely naked (except for a series of very small scales or scale-like structures along the lateral line) : without photophores. Abdomen keeled or not keeled. Tail much abbreviated in relation to trunk. Snout bluntly pointed. Eye large. Cleft of mouth moderate, more or less oblique. Dorsal fin with 8-10 rays, situated in posterior half of body : origin in front of anal. Pectorals placed below middle of height. Pelvic origin slightly behind dorsal origin. Anal fin with 20-26 rays, longer than dorsal fin, origining much behind the latter and extending to caudal base. Adipose dorsal present. Caudal forked.

Key to subgenera of genus **Lestidium.**

1. Body strongly compressed, with midventral keel ; maxilla not reaching vertical from anterior margin of orbit	Subgenus **Lestidium**.
2. Body moderately compressed, without or with only feebly developed mid-ventral keel ; maxilla reaching vertical from anterior margin of orbit	Subgenus **Bathysudis**.

L. (*Bathysudis*) *speciosum* Bellotti[2] (=*Omosudis elongatus* Br.) is the only species of the genus found in India and Ceylon. (B. 8; D. 10/0 ; P. 12 ; A. 25-26).

Distribution.—Atlantic Ocean, South of Ceylon, Bay of Bengal.

Genus **Bathypterois** Gthr.

Body elongate, slightly compressed, with scales : without photophores. Tail longer than trunk. Snout, long, bill-like. Eye very small or entirely reduced. Cleft of mouth very wide, horizontal. Villiform teeth in narrow bands on jaws ; vomerine teeth present or absent : no teeth on palatine and tongue. Gill-openings very wide : gill-rakers long, numerous. Pseudobranchiae absent. Dorsal fin with 13-15 rays, in middle of back : origin in front of anal origin. Pectorals high on the shoulder, remarkably developed, with the upper rays isolated and enormously prolonged. Pelvics abdominal with their outermost rays usually produced : origin in front of dorsal origin. Anal fin with 10-11 rays, in anterior part of tail : origin behind dorsal origin. Adipose dorsal present. Caudal fin well developed, deeply forked, with its lowermost rays often prolonged.

Distribution.—Coast of S. Africa, Laccadive Islands, Arabian Sea, Bay of Bengal.

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(1) *Omosudis elonatus* Br. (*vide Rec. Ind. Mus.* XLV, p. 427 : 1947), which is synonymous with *Lestidium* (*Bathysudis*) *speciosum* Bellotti, has been relegated to Sudidae thereby deleting Omosudidae from previous reference.

(2) Parr, A.E., *Bull, Bingham. Ocean. Coll.* III, art. 3, p. 42 (948).

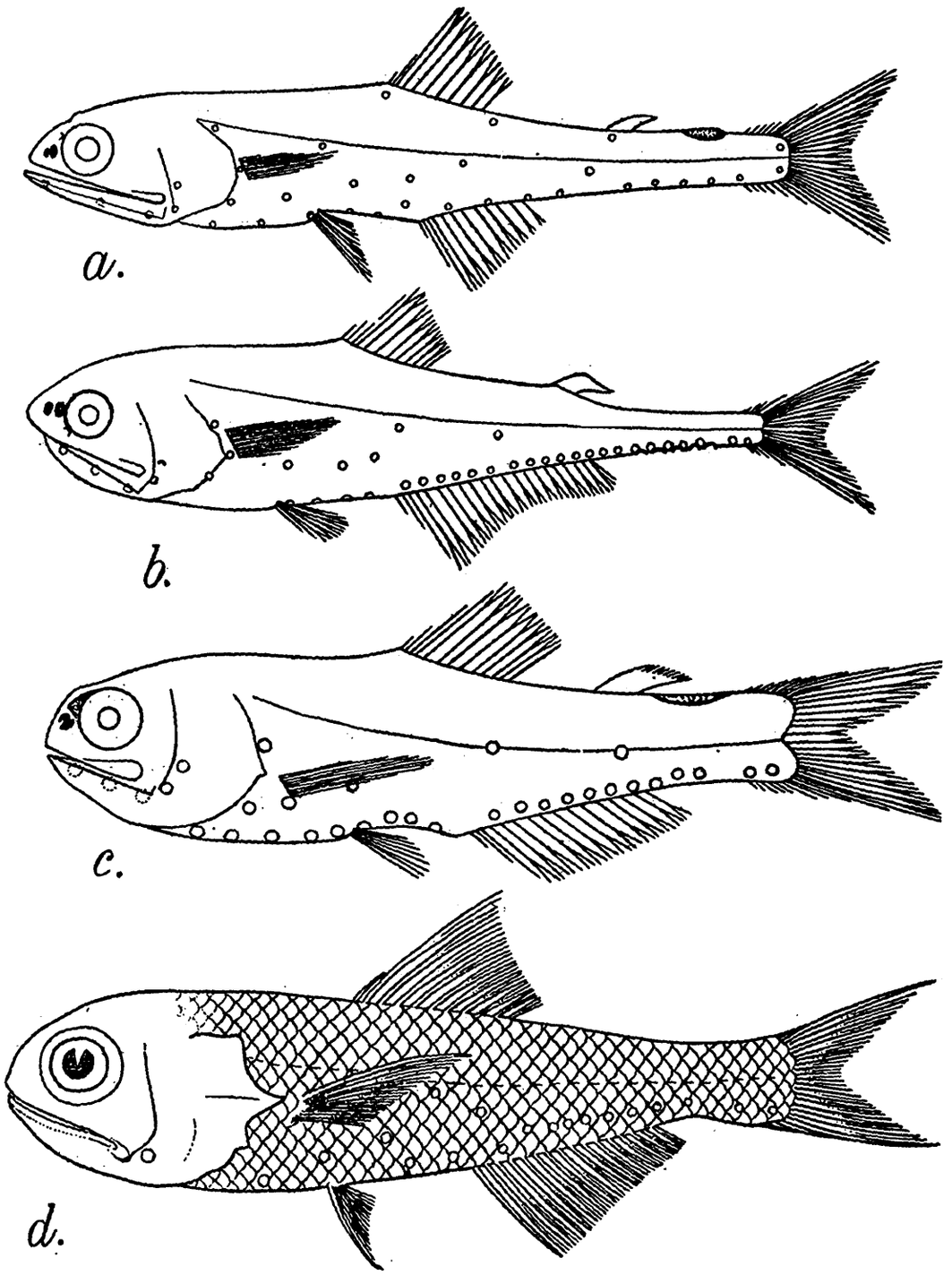
Key to species of genus **Bathypterois.**

1. Ventral outline of tail notched at base of lower caudal rays .. . .. *B. atricolor* Alc. (text-fig. 29*a*) (B. 12; D. 15/0; P. 2/12; V. 9; A. 10; L. l. 52; L. tr. 15).

2. Ventral outline of tail not notched .. 3.

3. 6 rays in upper part of pectoral fins : outer pelvic and lower caudal rays strongly produced *B. guentheri* Alc. (B. 12; D. 13/0; P. 2/5/6; V. 7-8; A. 11; L. l. *ca.* 55).

4. 4 rays in upper part of pectoral fin ; outer pelvic and lower caudal rays moderately produced .. .. *B. insularum* Alc. (text-fig. 26*a*) (B. 13-14; D. 12-13/0; P. 2/12-13 ; V. 9; A. 10; L. l. 48-51; L. tr. 13).



TEXT-FIG. 27.—*a. Myctophum valdiviae* Br. (after Brauer) ; *b. Myctophum coccoi* (Cocco) (after Brauer) ; *c. Myctophum laternatum* Garm. (after Brauer) ; *d. Myctophum aterotus* Alc. (after Alcock).

Family SCOPELIDAE.

Key to genera of family SCOPELIDAE.

1.	Photophores present	**3.**
2.	Photophores absent	Genus **Scopelengys.**
3.	Photophores limited to definite and separate series	**5.**
4.	Photophores not limited to definite and separate series	Genus **Neoscopelvs.**
5.	Antorbital photophores conspicuously enlarged; precaudal photophores 4	Genus **Diaphus.**
6.	Antorbital photophores not conspicuously enlarged : precaudal photophores 2-6 ..	**7.**
7.	Precaudal photophores always 2	Genus **Myctophum.**
8.	Precaudal photophores never 2 but 3-6 ..	Genus **Lampanyctus.**

Genus **Mycptophum** Rafinesque.

Body moderately elongate, compressed, with scales and photophores. Photophores limited to definite and separate series ; precaudal photophores always two, rarely confluent with the posteroanal series : antorbital photophores not markedly enlarged. Snout short. Eye large. Cleft of mouth wide. Villiform teeth in bands on jaws, palatine, pterygoid, tongue and often on vomer. Gill-openings wide ; gill-rakers long numerous. Pseudobranchiae well developed. Dorsal fin with 10-15 rays in or nearly in middle of back : origin in front of anal origin. Pectorals moderate, marked a little below middle of height. Pelvic origin in front of or opposite to dorsal origin. Anal fin with 15-23 rays, longer than dorsal : origin below or behind dorsal fin. Adipose dorsal present. Caudal forked.

Distribution.—Atlantic Ocean, Gulf of Panama, Madeira, Canaries Island, Gulf of Guinea, S. W Africa, N. W. coast of Africa, Mediterranean, Gulf of Aden, Arabian Sea, Indian Ocean, Bay of Bengal, Sandwich Islands, Pacific Ocean, West Coast of Central America.

Key to species of genus **Myctophum.**

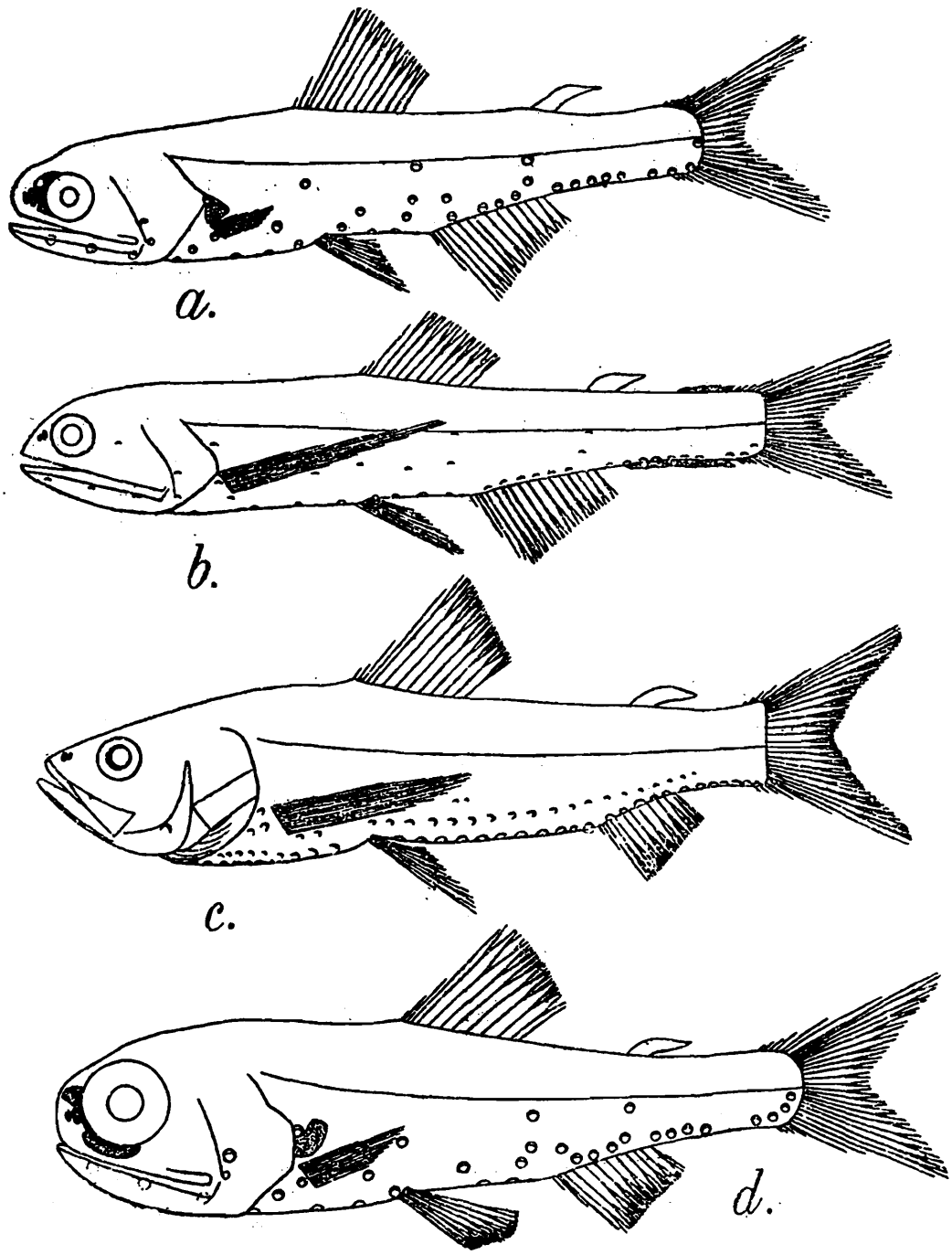
1.	4 photophores present above lateral line ..	*M. valdiviae* Br. (text-fig. 27*a*) (D. 11-12/0; P. 14; V. 8; A. 12-13; L. 1. 30).
2.	No photophores above lateral line ..	**3.**
3.	One Pol (postero-lateral organ) : AO (anal organs) in one or two separate groups ..	**5.**
4.	Two Pol : AO always in two groups ..	*M. reinhardti* (Lutken) (D. 12-14/0 : P. 14-15; V. 8; A. 17-19; L. 1. 39-140).
5.	Second VO (ventral organs) more or less elevated from rest of the series	**7.**
6.	Second VO in a line with rest of the series ..	**11.**

7. First SAO (supra anal organs) in an approximately straight line between VLO (supra ventral organ) and second SAO : SAO broadly angulate	*M. pterotus* Alc. (text-fig. 27*d*) (D. 11-13/0; P. 12-16; V. 8; A. 17-19 ; L. l. 28-34).
8. First SAO lower than second SAO and much lower than VLO falling far below the line between these two organs	**9.**
9. Second Prc (precaudal) well below lateral line, scarcely elevated at all : AO 5 7+2-4 ..	*M. laternatum* Garm. (text-fig. 27*c*) (D. 11-12/0; P. 10-11; V. 8; A. 15-16; L. l. 32-34).
10. Second Prc in the lateral line : AO 5-7+4-6	*M. fibulatum* Gilbert & Cramer (D. 12/0; P. 16; V. 8; A. 19; L. l. 27-28).
11. Upper jaw extending only to vertical through postorbital margin	*M. indicus* Day (D. 10/0; P.14 ; V. 8; A. 18; L. l. 43; L. tr. 3½/5).
12. Upper jaw extending far behind vertical through orbital margin	**13.**
13. Gill-rakers in first branchial arch long ..	*M. coccoi* Cocco (text-fig. 27*b*) (D. 10-12/0; P. 14-15; V. 8; A. 19-21; L. l. 39-41).
14. Gill-rakers in first branchial arch very short	*M. spinosum* (Steind.) (D.13-14/0 P. 14; V. 8; A. 19-20; L. l. 40).

Genus **Lampanyctus** Bonaparte.

Body moderately elongate, compressed, with scales and photophores Photophores limited to definite and separate series : precaudal photophores, when separate from postero-anal series, present in numbers 3-6 but never two only : the lower precaudals, in some forms, are confluent with posteroanals in which case their number cannot be made out : entorbital photophores not enlarged. Snout short. Eye large. Cleft of mouth wide. Villiform teeth in bands on jaws, palatine, pterygoid, tongue and often on vomer. Gill-openings wide : gill-rakers long, numerous. Pseudobranchiae present. Dorsal fin with 13-24 rays, equal to, slightly shorter or longer than anal, placed in or nearly in middle of back : origin in front of anal origin. Pectorals very long, inserted a little below middle of height. Pelvic origin in front of or opposite to dorsal origin. Anal fin with 13-19 rays, equal to, or slightly shorter or longer than dorsal and originating below dorsal. Adipose dorsal present. Caudal forked.

Distribution.—Atlantic Ocean, Madeira, Gulf of Guinea, N. E. Coast of Africa, Gulf of Aden, Arabian Sea, Seychelles, Chagos Archipelago, South of Ceylon, Bay of Bengal, Cocos Islands, West Coast of Sumatra.



Text-fig. 28.—*a. Diaphus splendidum* (Br.) (after Brauer); *b. Lampanyctus gemmifer* G.B. (after Brauer); *c. Neoscopelus macrolepidotus* Johnson (after Brauer); *d. Diaphus rafinesquei* (Cocco) (after Brauer).

Key to species of genus **Lampanyctus.**

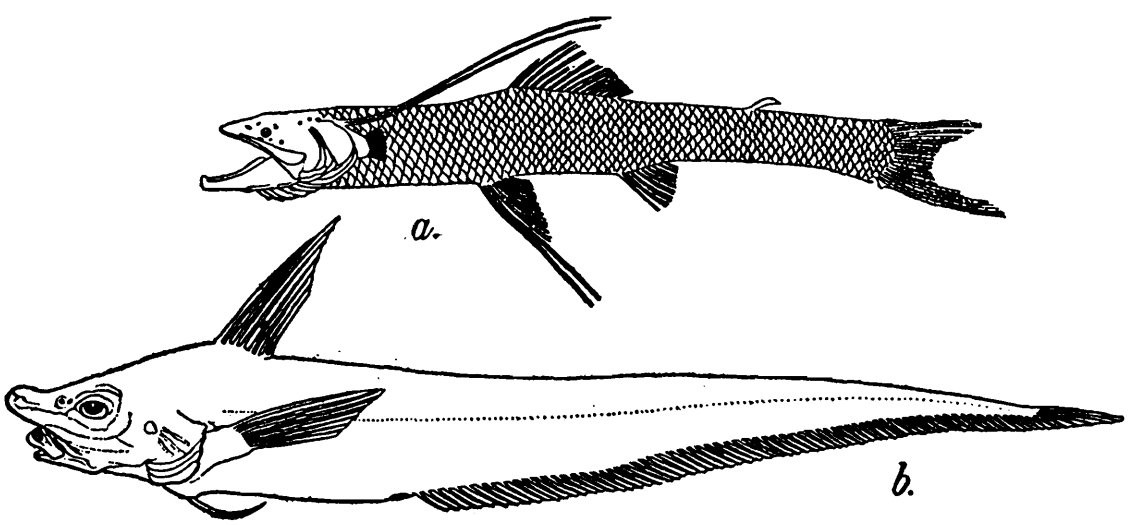
1.	Pectorals very long, reaching anal: AO 3-7+3-8; Prc. 3-4	**3.**
2.	Pectorals short not reaching anal AO 5-7+6-8; Prc 3	*L. micropterum* Br. (text-fig. 25*b*) (D. 13-16/0; P. 10-12; V. 8; A. 16-18; L. 1. 35).
3.	Postorbital photophores, present: eye large 3 times in head length ..	**5.**
4.	Postorbital photophores absent: eye small, 4-5 times in head	**7.**
5.	Lateral line scales 29: AO 3; Prc. 3 ..	*L. pyrsobolus* (Alc.) (text-fig. 30*b*) (D. 12/0; P. 12; A. 13; L. 1. 29).
6.	Lateral line scales 35-36: AO 4-6+3-5; Prc. 3 ..	*L. longipes* Br. (D. 11-13/0; P. 12; V. 8; A. 13-15; L. 1. 35-36).

7. One photophore on each shoulder: origin of anal fin under middle of dorsal fin: AO 4-6 +8-10; Prc. 3	*L. macropterum* Br. (D. 12-14/0; P. 13; V. 8; A. 18-19; L. 1. 35).
8. No photophores on shoulder: origin of anal fin nearly opposite to vertical from dorsal base: AO 5-7+6-8; Prc 4	*L. gemmifer* G. B. (text-fig. 28*b*) (D. 13-14/0; P. 12; V. 8; A. 16-17).

Genus **Diaphus** Eigenmann and Eigenmann.

Body moderately elongate, compressed, with scales and photophores. Photophores limited to definite and separate series: precaudal photophores usually or always separate from postero-anal series, their number being 4: antorbital photophores greatly enlarged. Snout blunt, short. Eye large, prominent. Cleft of mouth wide. Villiform teeth in bands on jaws, palatine, pterygoid, and tongue. Gill-openings wide: gill-rakers long, numerous. Pseudobranchiae present. Dorsal fin with 12-17 rays, in or nearly in middle of back: origin in front of anal origin. Pectoral short, low. Pelvic origin opposite to or slightly in front of dorsal origin. Anal with 12-17 rays: origin below or behind dorsal origin. Adipose dorsal present. Caudal forked.

Distribution.—Atlantic, Mediterranean, Gulf of Guinea, Coast of Africa, Zanzibar, Chagos Island, Gulf of Aden, Red Sea, Arabian Sea, Mauritius, Seychelles, Maldive Area, West Indies, India, Andaman Sea, West Coast of Sumatra, Celebes, Hawaii, Philippines.



Text-fig. 29.—*a. Bathypterois atricolor* Alc. (after Alcock); *b. Podateles indicus* (Wood-Mason & Alcock) (after Wood-Mason & Alcock).

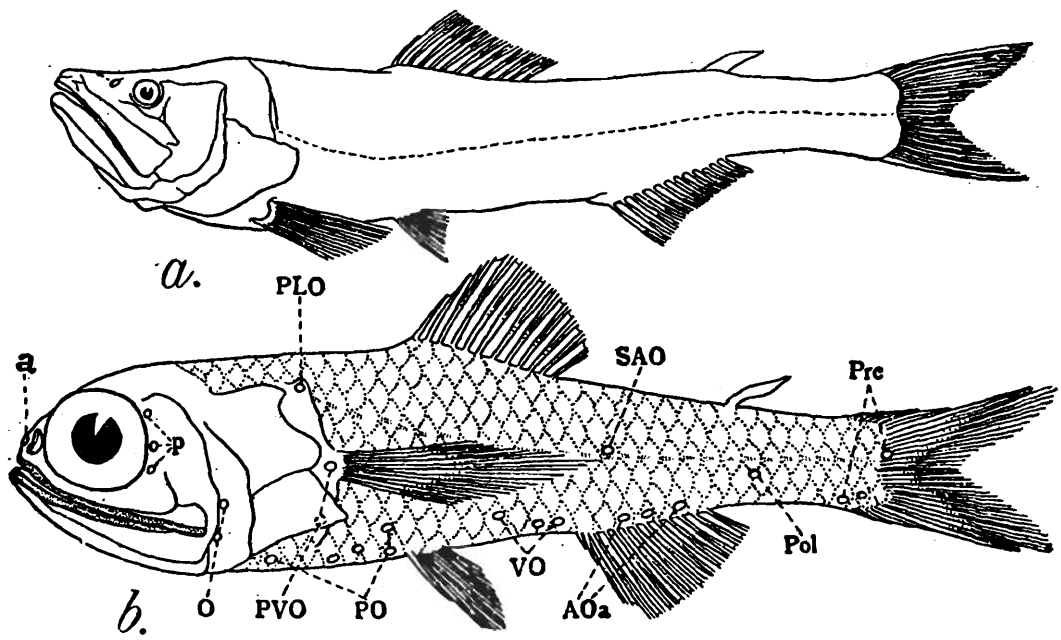
Key to species of genus **Diaphus.**

1. Origin of anal fin behind vertical from end of dorsal base	5.
2. Origin of anal fin in front of vertical from end of dorsal base	3.
3. Pelvics short, not reaching anal fin: VLO (supra ventral organ) midway between base of pelvics and lateral line	*D. garmani* Gilb. (D. 14/0; P. 12; V. 8; A. 15; L.l. 34).
4. Pelvics long, almost reaching anal fin: VLO nearer to lateral line than to base of pelvics	*D. lutkeni* (Br.) (D. 15-16/0; P. 11; V. 8; A. 16; L.l 36).

5. One antorbital on each side	**7.**	
6. Two antorbitals on each side	**9.**	
7. a (antorbital) large, widely separated from each other : first AO anterior elevated : AO 5+4 ; Prc. 4	*D. rafinesquei*(Cocco) (text-fig. 28*d*) (D. 12/0 ; P. 9-10 ; V. 8 ; A. 12-14 ; L.l 32-36).	
8. a (antorbital) small, only narrowly separated from each other : first AO anterior not elevated : AO 6—8+4—6 ; Prc. 4 ..	*D. dumerili* Blkr. (D. 15-16/0 ; P. 12 ; V. 8-9 ; A. 15-16 ; L.l *ca.* 34)	
9. Upper SAO (supra anal organs), Pol (postero-lateral organs) and Prc (precaudal organs) far below lateral line : origin of pelvics in front of dorsal origin	*D. coeruleus* (Klunz.) (D. 12-14/0 ; P. 10-12 ; V. 8-9 ; A. 15 ; L.l 37.)	
10. Upper SAO, Pol and Prc near lateral line : origin of pelvics below dorsal fin ..	*D. splendidum* (Br.) (text-fig. 28*a*) (D. 13-15/0 ; P. 11 ; V. 8 ; A. 15-16 ; L.l 38-39).	

Genus **Neoscopelus** Johnson.

Body moderately elongate, compressed, scales spiny : with photophores. Photophores not limited to definite and separate series, they being present only on ventral part of body. Snout rather long, depressed. Eye moderate. Cleft of mouth moderate. Villiform teeth on jaws, palatine, pterygoid, tongue and vomer. Gill-openings wide ; gill-rakers numerous. Pseudobranchiae well developed. Dorsal with 13 rays : origin midway between tip of snout and adipose dorsal and



TEXT-FIG. 30.—*a. Scopelengys tristis* Alc. (after Alcock) ; *b. Lampnayctus pyrsobolus* (Alc.) illustrating the arrangement of photophore groups (after Misra).

much in advance of anal origin. Pectorals moderate, slightly below middle of height. Pelvic origin below dorsal fin. Anal with 11-13 rays : origin far remote from dorsal origin. Adipose dorsal present. Caudal forked.

N. macrolepidotus Johnson (text-fig. 28c), is the only species of the genus found in Indian waters. (B. 9 ; D. 13/0 ; P. 15-16 ; V 8 ; A. 13 ; L l. 30).

Distribution.—Madeira, West Indies, Coast of Morocco, Arabian Sea, Maldive Area, Andamans, West Coast of Sumatra, Malay Archipelago, New Zealand, Sandwich Islands.

Genus **Scopelengys** Alc.

Body elongate, compressed (scales unknown) : without photophores. Snout moderate ; eye small. Cleft of mouth wide, oblique. Villiform teeth in premaxilla, mandible, palatine and head of vomer ; no teeth on tongue. Gill-openings wide ; gill-rakers closely set. Pseudobranchiae rudimentary. Dorsal fin with 12 rays, placed in anterior half of body measured with caudal ; origin far in advance of anal origin. Pectorals inserted close to ventral profile. Pelvic origin opposite to dorsal origin. Anal fin with 13 rays, in posterior half of body measured with caudal and originating far remote from dorsal origin. Adipose dorsal present. Caudal forked.

S. tristis Alc. (text-fig. 30*a*), is the only species of the genus found in Indian waters. (B. 8 ; D. 12/0 ; P. 15 ; V. 8 ; A. 13).

Distribution.—Arabian Sea, Laccadive Islands, West Coast of Central America.

Order ATELEOPIFORMES (Chondrobranchi).

Family Ateleopidae.

Genus **Podateles** Blgr.

Body elongate, somewhat compressed, tapering to the pointed tail, with scaleless, gelatinous skin : without photophores. Snout projects well beyond small, inferior, protractile mouth. Teeth minute, villiform ; in a band in upper jaw only, or in both jaws ; palate smooth. Gill-openings fairly wide ; gill-rakers short, cartilaginous. Pseudobranchiae absent. Dorsal fin with 8 rays, short, in anterior one fourth of body and above pectoral fins ; origin considerably in front of anal origin. Pectorals long pointed, inserted a little below middle of height. Pelvics jugular, consisting of a single, short filament formed by two closely coherent rays ; origin a little ahead of dorsal origin. Anal fin with 76 rays, very long, occupying more than half length of body, continuous with caudal and originating far remote from dorsal origin. Adipose dorsal absent. Caudal pointed united with anal fin.

P. indicus (Wood-Mason & Alcock) (text-fig. 29*b*), is the only species of the genus found in Indian waters. [B. 8 ; D. 8 ; P. 12 ; V.2 (fused to form a single ray) ; A.+C. 76-80].

Distribution.—Arabian Sea, Maldive area, Andaman Sea, Philippines.

ON A COLLECTION OF AQUATIC COLEOPTERA FROM THE METTUR DAM, SALEM DISTRICT, MADRAS, WITH THE DESCRIPTION OF A NEW SPECIES.

By T. G. VAZIRANI, *B.Sc.* (*Hons.*), *Zoological Survey of India, Calcutta.*

INTRODUCTION.

A small party of the Zoological Survey of India, with the author as one of the members, spent about three weeks, during February-March 1952, making collections and field studies at and around Mettur Dam on the Cauvery river, in Salem Dist., Madras State. The present report is based on the material of aquatic beetles collected by the party.

Most of the collections were made below the Dam up to 8 miles down the course of the river and at Hoganical Falls, which are situated just above the Dam. The river bed was rocky and very slippery. The water level of the river had gone down very considerably, owing to protracted drought for three years.

The Gyrinidae were collected around aquatic plants and shaded portions between stones in the main channel of the river. Dytiscid and Hydrophilid beetles were mostly netted from the pools in the river bed which were generally covered with aquatic vegetation. At Hoganical Falls collections were made in almost similar ecological conditions.

The collection comprises 16 species, including a new species of *Neptosternus*, spread over 13 genera. Two species, *viz.*, *Coelostoma stultum* and *Hydrous* (*Hydrous*) *indicus*, are being recorded from South India for the first time.

I am grateful to Dr. S. L. Hora, Director, Zoological Survey of India, for allowing me to work out this collection. I wish to express my indebtedness to Mr. J. Balfour Browne of the British Museum, London, for kindly confirming my identification of the new species.

SYSTEMATIC ACCOUNT.

Family DYTISCIDAE

Canthydrus laetabilis (Walk).

Reg. No.	*Loc.*	*Dt. of coll.*	*No. of exps.*
8521/H4	Hoganical falls	27.II.1952	1

Remarks.—It has been previously recorded from Ceylon, Madras and Konbir.

Canthydrus luctuosus (Aube).

Reg. No.	*Loc.*	*Dt. of coll.*	*No. of ex.*
8522/H4	Cauvery river, Mettur Dam.	15.II.1952	1

Remarks.—It was described from Bombay and has since been recorded from various places in S. India and Bengal. Outside India it has been recorded from Arabia, Persia, Syria and Mesopotamia.

Laccophilus sharpi Reg.

Reg. No.	*Loc.*	*Dt. of coll.*	*No. of ex.*
8523/H4	Cauvery river, Mettur Dam.	25.II.1952	1
8524/H4	Do.	26.II.1952	1
8525/H4	Do.	3.III.1952	1

Remarks.—This species has a distribution extending from Mesopotamia to Japan and in the Southern Hemisphere up to Australia. Its recorded distribution in India is from Sind, Konbir (Chota Nagpur), Mandar (Chota Nagpur) and Mahe.

Neptosternus circumductus Reg.

Reg. No.	*Loc.*	*Dt. of coll.*	*No. of ex.*
8526/H4	Cauvery river, Mettur Dam.	25.II.1952	1

Remarks.—This species was described from Genji in S. Arkot district of the State of Madras. The present record is not far from the type locality. I have however examined 9 examples from Mandla, Madhya Pradesh (23. V. 1927; H. S. Pruthi coll.) and determined by Gschwendter, in which case the median yellow markings of the elytra are more elongate than described and figured by Regimbert (1899 p. 268, fig. 33). In some cases the anterior quadrate spot and the posterior triangular projection of the lateral yellow line are joined by this marking. However the present specimen conforms more or less to the figure given by Regimbert.

Neptosternus horai, sp. nov.

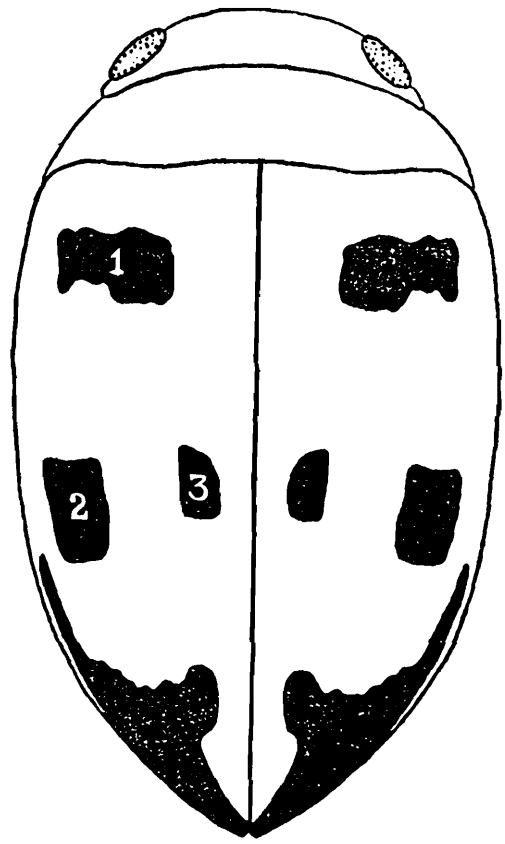
Diagnosis.—Body 2·6 mm., oblong, oval, obliquely attenuated at the apex, slightly convex. Head and pronotum yellow, elytron black with three yellow spots besides the yellow lateral marginal line, starting from the middle of the elytron and posteriorly dilating into a somewhat triangular spot near the apex. Numbering the spots from top to bottom and left to right; No. 1 equidistant from the base and the lateral margin, roughly twice as wide as long; Nos. 2 and 3 situated about the transverse median line of the elytron. No. 2 situated towards the lateral margin and about one and half times longer than broad, almost equidistant from the spot No. I and the apical yellow triangle.

No. 3 situated near the suture and separated from No. 2 by about twice the distance between it and the suture, more than twice as long as wide, attenuated on the inner side towards the base of the elytron.

Ventral side testaceous, antennae and legs also testaceous, epipleurae darker in colour and slightly reddish brown.

Holotype :—Probably a Female Reg. No. 8527/H4, Hoganical Falls, Madras state ; 27.II. 1952, Coll. T. G. Vazirani ; Zoological Survey of India.

Remarks.—This species resembles *N. circumductus* Reg. but can be easily separated from it by the typical arrangement of the elytral spots and also by its smaller size. The lateral yellow marginal line runs from the base to the apex where it dilates into the traingular spot in case of *N. circumductus* while it starts from the middle of the elytron in the present species.



TEXT FIG. 1 :—*Neptosternus horai* sp. nov. × ca. 34 (The black spots in the figure indicate yellow coloration, on the elytra).

Hydrovatus confertus, var. **subtilis** Sharp.

Reg. No.	*Loc.*	*Dt. of coll.*	*No. of ex.*
8528-30/H4	Cauvery river, Mettur Dam.	25.II.1952	3
8531-34/H4	Hoganical falls	27.II.1952	4

Remarks.—Originally described from Siam, the species has been reported in India from Konbir (Chota Nogpur) and Pondicherry. Outside India it has been recorded form Ceylon, Burma, Cochin China, Java, Sumatra, Borneo.

Hydaticus vittatus Fabr.

Reg. No.	*Loc.*	*Dt. of coll.*	*No. of ex.*
8535-49/H4	Cauvery river, Mettur Dam.	25.II.1952	15
8550/H4	Do.	3.III.1952	9 (in spirit)

Remarks.—In India it has been recorded from Pedong (E. Himalayas) and Mahe. It has a wide distribution in South East Asia. It occurs in Japan, Formosa, China, Malacca, Siam, Java, Sumatra, Borneo, Celebes, Philippine Islands and Ceylon.

Cybister tripunctatus asiaticus Reg.

Reg. No.	*Loc.*	*Dt. of coll.*	*No. of ex.*
8551-54/H4	Cauvery river	21.II.1952	4
8555-56/H4	Do.	25.II.1952	2

Remarks.—The fresh specimens have metallic dark green colour which gradually turns to black in the cabinet drawers. This is one of the commonest of the Indian species and is very widely distributed in the Indo-Malayan region.

Family Gyrinidae.

Orectochilus (Patrus) haemorrhous Reg.

Reg. No.	*Loc.*	*Dt. of coll.*	*No. of ex.*
8557/H4	Cauvery river	25. II.1952	many ex. in spirit

Remarks.—Very common in S. India. Not known from outside Indian region so far.

Orectochilus (Patrus) limbatus Reg.

Reg. No.	*Loc.*	*Dt. of coll.*	*No. of ex.*
8558/H4	Cauvery river, Chinnapallam, Mettur Dam.	21.II.1952	many ex. in spirit
8559/H4	Do.	17.II.1952	many ex. in spirit

Remarks.—Very common in S. India.

Family Hydrophilidae.

Coelostoma stultum Walk.

Reg. No.	*Loc.*	*Dt. of coll.*	*No. of ex.*
8560/H4	Cauvery river, Mettur Dam.	25.II.1952	1

Remarks.—This species is widely distributed in the Indo-Malayan region. It was described from specimens collected in Ceylon. In India, it has since been recorded from Assam. It is now being recorded from S. India for the first time.

Helochares (Helochares) pallens (Macleay).

Reg. No.	*Loc.*	*Dt. of coll.*	*No. of ex.*
8561/H4	Cauvery river, Mettur Dam.	21.II.1952	1
8562-64/H4	Do.	25.II.1952	3
8565/H4	Do.	3.II.1952	1

Remarks.—It is a widely distributed species, having been recorded from Java, Sumatra, N. Oceania, Philippine Islands, Federated Malay States, Tonkin, India, Syria, Sudan, Egypt and Madagaskar. In India it has been recorded from Abor country Pondicherry, and Genji (Madras).

Sternolophus (Sternolophus) rufipes Fabr.

Reg. No.	*Loc.*	*Dt. of coll.*	*No. of ex.*
8566-81/H4	Cauvery river, Mettur Dam.	20.II.1952	16
8582-8620/H4	Do.	21.II.1952	39
8621-39/H4	Do.	25.II.1952	19
8643/H4	Do.	3.III.1952	17 ex. in spirit
8640/H4	Cauvery river, Chinnapallam, 8 miles from Mettur Dam.	17.II.1952	9 ex. in spirit
8641/H4	Hoganical falls	27.II.1952	5 ex. in spirit
8642/H4	Thoppiar river, a tributary of Cauvery river, Thoppiar Town.	1.III.1952	9 ex. in spirit

Remarks.—Very common in the Oriental region and is also the commonest species occurring in this area, during this period as is evident from the large number of specimens collected.

Hydrous (Hydrous) indicus (Bedel).

Reg. No.	*Loc.*	*Dt. of coll.*	*No. of ex.*
8644/H4	Cauvery river, Mettur Dam.	25.II.1952	1

Remarks.—Described and recorded from N. India, this species is now being reported from S. India.

Berosus (Enoplurus) indicus Mots.

Reg. No.	*Loc.*	*Dt. of coll.*	*No. of ex.*
8645-46/H4	Cauvery river, Mettur Dam.	25.II.1952	2
8647/H4	Do.	3.III.1952	1
8648/H4	Hoganical falls	27.II.1952	1

Remarks.—It has been recorded from Ceylon, India, Burma, China, Formosa, Siam, Cambodia, Sumatra, Java, Federated Malay States and Philippine Islands. In its record from India, no particular locality has been mentioned.

Regimbartia attenuata (Fabr).

Reg. No.	*Loc.*	*Dt. of coll.*	*No. of ex.*
8650-52/H4	Cauvery river	20.II.1952	3
8653/H4	Do.	21.II.1952	1
8654/H4	Do.	25.II.1952	1
8655-61/H4	Hoganical falls	27.II.1952	7
8649/H4	Do.	27.II.1952	1

Remarks.—A very common and widely distributed species in South East Asia and Australia.

MGIPC—M—3 ZSI—3-8-53—450.