

RECORDS
of the
INDIAN MUSEUM

(A Journal of Indian Zoology)

Vol. 54
(For the year 1956)

Edited by
The Director
Zoological Survey of India



PRINTED IN INDIA, BY THE MANAGER, GOVERNMENT OF INDIA PRESS, CALCUTTA,
AND PUBLISHED BY THE MANAGER OF PUBLICATIONS, CIVIL LINES, DELHI, 1964.

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NOTE.—*(An asterisk) preceding a name denotes a new variety or subspecies.

†(A dagger) indicates a new species.

††(A double dagger) indicates a new genus or subgenus.

** (A double asterisk) indicates a new family or subfamily.

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RECORDS

of the

INDIAN MUSEUM

(A Journal of Indian Zoology)

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of the

INDIAN MUSEUM

(A Journal of Indian Zoology)

Abbreviation : *Rec. Indian Mus.*

Vol. 54, Parts 1 & 2 March-June, 1956 Pages 1-106a



Edited by the Director, Zoological Survey of India.

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PRINTED IN INDIA, BY THE MANAGER, GOVERNMENT OF INDIA PRESS, CALCUTTA,
AND PUBLISHED BY THE MANAGER OF PUBLICATIONS, CIVIL LINES, DELHI, 1959.

PUBLISHED : 30th June 1959

FAUNA OF THE KASHMIR VALLEY : LEECHES*

By

T. D. SOOTA

Zoological Survey of India, Calcutta

During May-June, 1954, and July-September, 1955, faunistic surveys were carried out by the parties of the Zoological Survey of India. The present note deals with the collection of leeches made by these parties as well as the earlier named material from the Kashmir Valley present in the collection.

I am grateful to the Director, Zoological Survey of India, Calcutta, for facilities. My thanks are due to Dr. M. L. Bhatia, University of Delhi, for his guidance and help in the identifications.

Family GLOSSIPHONIDAE

Genus *Glossiphonia* Johnson

Glossiphonia complanata (Linnaeus)

List of specimens in the Zoological Survey of India

Z. S. I. Regd. No.	Locality.	Collector.
W 1441/1	Pond, Srinagar	Kashmir Survey Party.
W 1442/1	Achhabal Spring	Do.
W 3909/1	Near Dal Lake gate, Srinagar	Do.
W 3910/1	Chichilura Village	Do.
W 3911/1	Achhabal	Do.
W 3912/1	Ganderbal	Do.
W 3913/1	On way to Kukarnag about 6 miles from Achhabal	Do.
W 3914/1	Nagdandi near Achhabal	Do.
W 4915/1	Tangraarg	Do.

Distribution.—This species “is found in the United States and in Europe, where it is often exceedingly common ; and its range appears to extend through Asia to Japan, where it has been recorded by Oka. That it wanders into parts of Northern India has now been shown by

*A part of this paper was read before the 42nd Session of the Indian Science Congress at Baroda, 1955.

Moore" (Harding and Moore)¹. In India it has so far been recorded from Kashmir only.

It is polytypic having a variety *G. complanata concolor* Apáthy in Europe. Regarding the taxonomic status of this variety, opinions are diverse amongst workers. Apáthy assigns it a specific rank while Harding and Moore (*op. cit.*, p. 58), following Blanchard, consider it only a variety of *Glossiphonia complanata* (Linnaeus).

Glossiphonia weberi Blanchard

List of specimens in the Zoological Survey of India

Z. S. I. Regd. No.	Locality.	Collector.
W 1440/1	Harwan	Kashmir Survey Party.

Distribution.—This species is recorded from Sumatra, Burma, besides being widely distributed throughout India. Harding & Moore (*op. cit.*, p. 62) state that *G. weberi* appears to be a tropical form derived from *G. heteroclita* which is widely distributed in North America and Europe besides occurring in Burma. They further state that the former species "has just, and only just, attained to specific rank". The subspecies *G. weberi lata* Oka has been recorded from Hawaii.

Genus **Hemiclepsis** Vejdovsky

Hemiclepsis marginata asiatica Moore

List of specimens in the Zoological Survey of India

Z. S. I. Regd. No.	Locality.	Collector.
W 3916/1	Achhabal	Kashmir Survey Party.
W 3917/1	Ganderbal	Do.

Distribution.—The forma typica *Hemiclepsis marginata marginata* "extends throughout the greater part of Europe to Western Asia" (Harding & Moore, *op. cit.*, p. 86). In India it has been recorded from Kumaon, Nepal, Orissa, Hoshangabad, Bengal and Bombay.

The subspecies *H. marginata asiatica* Moore is recorded in India from Kashmir and Lucknow (Bhatia, 1939, p. 11)². The form appears to be intermediate between *H. marginata* of Europe and *H. casmiana* Oka from China and Japan. It differs from the forma typica in the position of the eyes, annulation and colouration.

Specimens of this species at Ganderbal were found to have their young ones attached to their ventral side along the lateral margins.

¹ Harding, W.A. & Moore, J. P., *Fauna Brit. India*, p. 60 (1927).

² Bhatia, M. L., *Bull. Dept. Zool. Panjab Univ.*, 2, p. 11 (1939).

Family ERPOBDELLIDAE

Genus *Erpobdella* Blainville*Erpobdella octoculata* (Linnaeus)*List of specimens in the Zoological Survey of India*

Z. S. I. Regd. No.	Locality.	Collector.
W 1428/1	Manasbal lake	Kashmir Survey Party.
W 1429/1	Shadipur	Do.
W 1430/1	Dal lake, Srinagar	Do.
W 1431/1	Srinagar	Do.
W 1432/1	Achhabal	Do.
W 1433/1	A nallah from the Dal lake into Jhelum river	Do.
W 1434/1	Srinagar	Do.
W 1435/1	Wular lake	Do.
W 1436/1	7 miles from Gandarbal on road to Sonamarg	Do.
W 1437/1	Gandarbal	Do.
W 1438/1	Stream from water works leading to Harwan hatchery	Do.
W 3918/1	Nishat bagh, Srinagar	Do.
W 3919/1	Sopore	Do.
W 3920/1	Gulmarg	Do.
W 3921/1	Telbal nalla, Dal lake, Srinagar	Do.
W 3922/1	Ganderbal	Do.
W 3923/1	Achhabal	Do.
W 3924/1	Chashma Shahi, Srinagar	Do.
W 3925/1	Near the Dal lake gate, Srinagar	Do.
W 3926/1	Jhelum river, Baramula	Do.
W 3927/1	Banhal	Do.
W 3928/1	Camping ground channel from Verinag Spring	Do.
W 3929/1	Ningle	Do.
W 3930/1	Katpora	Do.

Distribution.—"This species is widely distributed throughout temperate Europe and Asia, from the British Isles to Japan and from Scandinavia and northern Siberia to the Mediterranean" (Harding & Moore, *op. cit.*, p. 134). In India it is recorded from Kashmir and Lahore.

Bhatia (*op. cit.*, p. 12) recorded the greatest height 7,500 ft. from Kaimul, Kashmir. However, specimens have been collected from an altitude of about 9,000 ft. by me from Gulmarg during July-September 1955. This appears to be a new altitude record in India.

Enquiries made at Harwan hatchery show that the species under report is parasitic on the roe of trout. A careful study of these forms is likely to bring out some interesting ecological facts.

Family HIRUDIDAE

Subfamily HIRUDINAE

Genus **Haemopsis** Savigny

Haemopsis indicus Bhatia

List of specimens in the Zoological Survey of India

Z. S. I. Regd. No.	Locality.	Collector.
W 3931/1	Tangmarg	Kashmir Survey Party.
W 3932/1	Sopore	Do.
W 3033/1	Ganderbal	Do.

Distribution.—This species is endemic in Kashmir.

Bhatia¹ states that this species “is very similar to the typical *Haemopsis* and its genital organs resemble in most of the details with those *H. sanguisuga* (Linnaeus),” which is very widely distributed in the Palaearctic Region.

List of other species known from Kashmir

Besides the above, the following species are also known from Kashmir. These are not, however, represented in the Zoological Survey of India collection. Their range of distribution is given below.

Species.	Distribution.
1. <i>Glossiphonia cruciata</i> Bhatia	Kashmir.
2. <i>G. lobata</i> Bhatia	Do.
3. <i>Helobdella stagnalis</i> (Linnaeus)	Canada, United States from the Atlantic to the Pacific Coast, South America to the greater part of Europe into Western Asia and Kashmir. “It probably occurs throughout the northern and southern temperate regions of the globe.”
4. <i>Theromyzon mathaii</i> Bhatia	Kashmir.
5. <i>Theromyzon sexoculata</i> (Moore)	France, Sweden, Russia, Assam and Kashmir.
6. <i>Barbronia weberi</i> (Blanchard)	Java, Sumatra, Celebes, New Guinea, Borneo, Philippines, Pengona, Hoshangabad, Berar, C. P., Nepal Valley, Kumaon, Simla hills, N. W. F. P. and Kashmir.
7. <i>Hirudinaria</i> (<i>Poecilobdella</i>) <i>granulosa</i> (Savigny).	Widely distributed in India.

SUMMARY

An up-to-date list of specimens in the Zoological Survey of India is given. Taxonomic affinities of some species of interest are also discussed. Besides, a list of species known from Kashmir, but not represented in the Zoological Survey of India collection is also appended.

¹ Bhatia, M. L., *Proc. nat. Acad. Sci., India*, 10, part 4, p. 141 (1940).

**LERNAEA BENGALENSIS, SP. NOV : A COPEPOD PARASITIC
ON CHANNA PUNCTATUS**

By

C. P. GNANAMUTHU

Zoology Laboratory, Madras University, Madras

About a dozen copepod specimens were obtained by Dr. D. P. Sen Superintendent of Fisheries, West Bengal, from *Channa punctatus*. They were attached mainly near the dorsal and caudal fins and near the gill opening and are reported to cause the death of the hosts. The author is thankful to Dr. Sen for the gift of the specimens and they are described herein as *Lernaea bengalensis*, sp. nov. The types will be lodged in the collections of the Zoological Survey of India, Calcutta.

***Lernaea bengalensis*, sp. nov.**

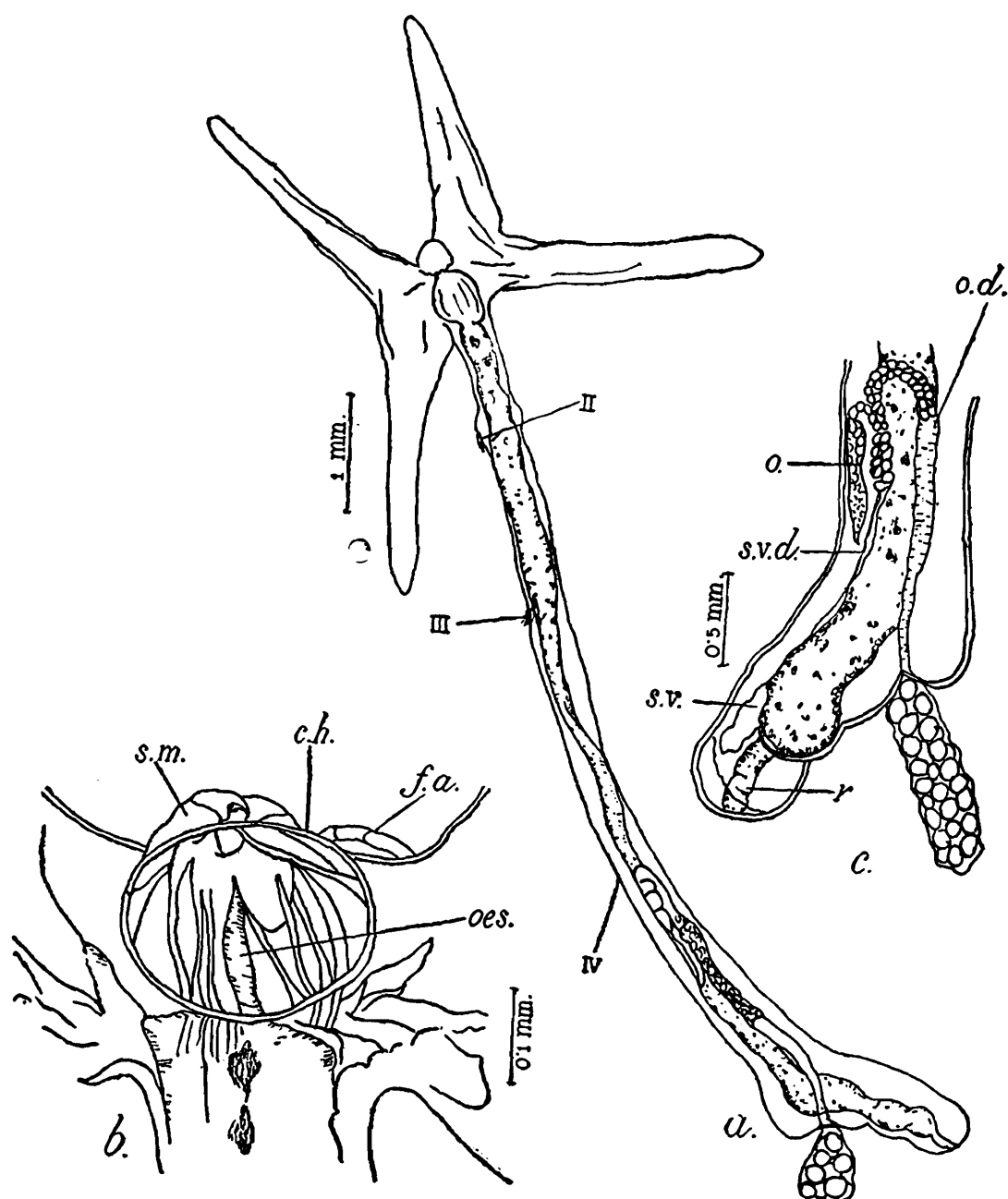
The total length of the adults exclusive of the eggs and cephalic arms varied from 7 mm to 9.42 mm. In a form 9 mm long the head was 0.255 mm long, the first thoracic segment 0.42 mm long and the cephalic arms 2.2 mm and 2.8 mm long, the trunk and abdomen measured 4.7 mm and 1.3 mm respectively. The parasites were thickly covered with colonies of *Carchesium* and algae but the body of the parasite was transparent. Only spirit preserved specimens were examined and these were dirty brown in colour.

Body.—The head is covered by a sub-elliptical lobe ("cephalon" of Wilson). It is fused all round and is not free anteriorly as in *Lernaea chackoensis*¹. The musculature of the lobe is also different, there being eight columns of muscles arranged lengthwise in the present form. The anterior edge of the lobe does not cover the antennae, as well as the tips of the maxillae and maxillipedes. The first thoracic segment fused to the head, is the broadest part of the body and is extended into four arms in four different directions. There was no indication of variability in the shape of the arms as was observed in *L. chackoensis*. The anterior arms were always shorter than the posterior and the lengths of the arms varied slightly in different individuals. The front edges of the anterior arms meet below the head.

The first segment also bears the first pair of legs which are curved towards each other. The neck or free thorax is uniformly slender and bears the second and third pair of legs. Where the second pair of legs is attached there is a node-like swelling while the rest of the trunk bears no external swelling but gradually widens. The genital part of the body which commences only 6 mm behind the front end is the widest part of the body, being slightly less than 1 mm. This bears the 3rd and 4th

¹ Gnanamutbu, C. P., *Parasitol.*, 41, pp. 143-147 (1951).

pairs of legs. The posterior end of the trunk is marked by two large rounded pregenital prominences pressed together to form the "heel." The abdomen which forms the rest of the foot of the parasite is borne at an angle to the trunk. Two constrictions suggest the three-segmented nature of this part of body. Between the abdomen and the heel occur a deep notch in which are situated the two large cylindrical egg sacs.



TEXT-FIG. 1.—*Lernaea bengalensis*, sp. nov.

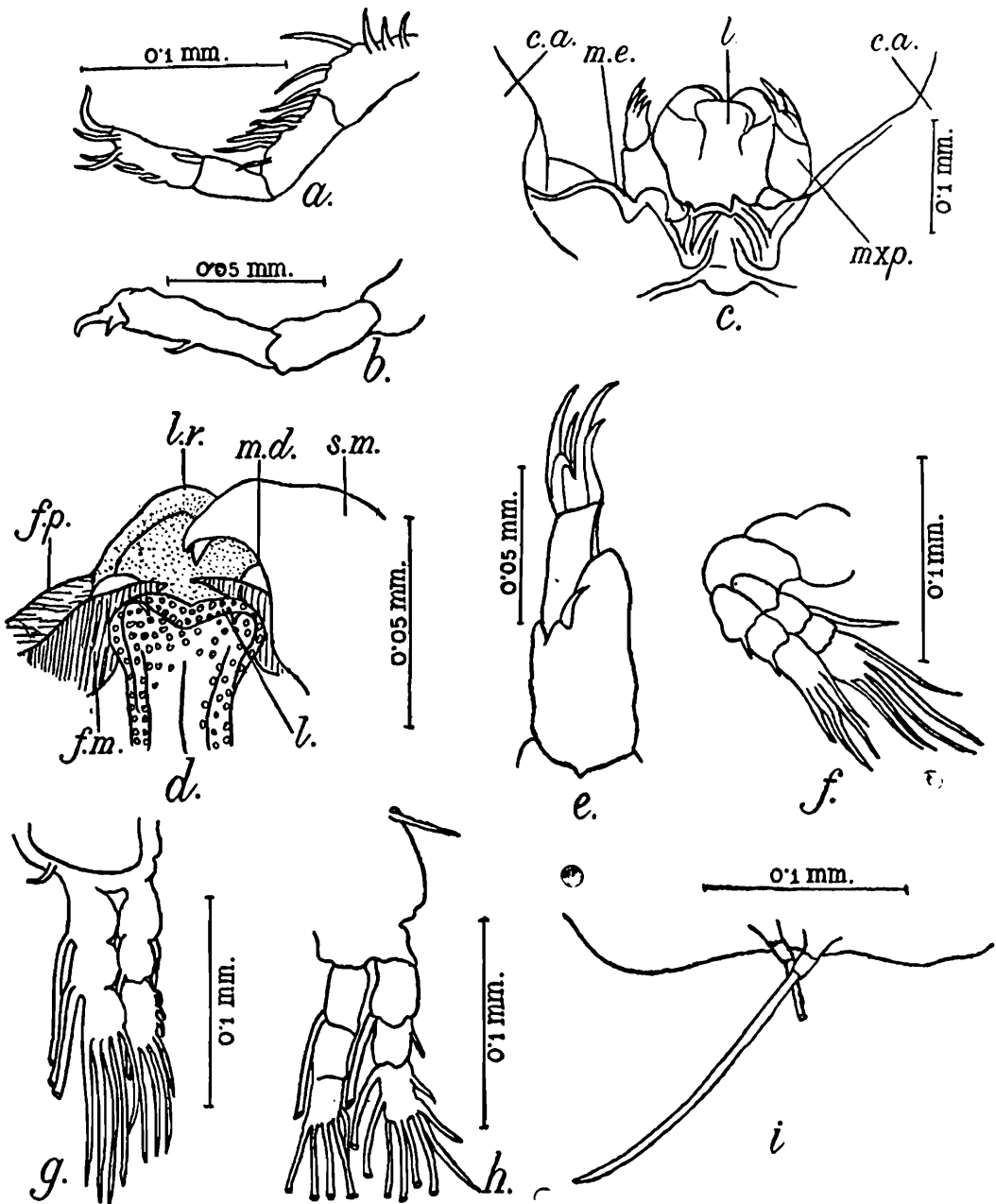
a. Entire animal ; b. Dorsal view of head ; c. Posterior end of body.

c. h., cephalic hood ; f. a., first antenna ; o., ovary ; oes., oesophagus ; r., rectum ; s. m., second maxilla ; s. v., seminal vesicle ; s. v. d., duct of seminal vesicle ; II, III, IV, legs.

The posterior end of the abdomen is bluntly rounded and carry two conical tapering anal laminae bearing a long slender seta each.

Appendages.—The first antenna is four-jointed, each joint bears far fewer setae than that of *L. chackoensis*. The terminal joint, for example, bears only four in the present form while it bears ten in *L. chackoensis*. The second antenna is best seen in a ventral view. The

distal segment bears a small spine in the middle, and three terminal spines of which, the central is recurved and thick. In *L. chackoensis* there are seven hook-like spines. The labrum is formed by a chitinous plate with a median rostral lobe. The labium is a pad with a concave margin in front and with sides supported by muscles. Between the two lips medially starts the narrow oesophagus leading backwards



TEXT-FIG. 2.—*Lernaea bengalensis*, sp. nov.

a. First antenna ; b. Second antenna ; c. Ventral view of head ; d. Dorsal view of mouth parts.

c.a., cephalic arm ; f.m., first maxilla ; f. p., frontal plate ; l., labium ; l.r., labrum ; m.d., mandible ; m.e., median edge of cephalic arm ; mxp., maxillipedes.

into a very wide stomach. On either side of the mouth are seen the two mandibles—if the specimen is dissected or cleared in xylol—from the dorsal side. Each mandible has a stout distal joint which bears a strongly curved sharp tip. The first maxilla has a narrow hook-like blade whereas the second maxilla has a double blade whose tips overlap each other medially. The maxillipedes are long columnar two-jointed.

On the edge of the first joint are two short claws while terminally there occur five long curved spines.

Of the thoracic legs only four pairs were found. It is possible while removing the large masses of algae and vorticellids attached to the trunk, the fifth legs were removed but since out of nearly ten parasites so cleared and examined there was not even a mutilated remnant of the appendages, it is probable that they are absent. The first legs are arched and kept at right angles to the body and may assist the arms in fixing the head of the parasite. Each leg has a two-articled protopodite and two three-jointed rami. The exopod carries eleven spines and the endopod bears seven. The second, third and fourth pairs of legs are held straight and close to the body. They resemble the first pair in setation and structure.

Taxonomic remarks.—This species differs from *L. chackoensis* in the non-variability of the form of the cephalic arms, in the cephalic hood being sub-elliptical and fused all round, and in this lobe having a different pattern of musculature. The trunk is more slender, the abdomen constricted more clearly into three segments and the pregenital prominence being relatively more conspicuous. Of the appendages the first antenna is less setose and ends in far fewer spines; the second antenna bears only 3 terminal spines; the second maxillae are far larger and more conspicuous; the labrum and labium are well marked; the mandible is curved like a scythe. In view of these differences the present form is treated as a new species *L. bengalensis*, and can be defined as follows :—

The cephalon or cephalic hood is sub-elliptical, fused all round and supported by longitudinal muscles; the cephalic arms are four, simple and unlobed, arranged in a crosswise fashion; the second maxillae are large, hooked; prominent upper and lower lips; the mandibles scythe-shaped and the abdomen distinctly constricted into three.

NEW GENERA AND SPECIES OF OLD WORLD REDUVIIDAE (HEMIPTERA-HETEROPTERA)

By

N. C. E. MILLER

Commonwealth Institute of Entomology, London

In the present paper I have described and figured two new genera and eight new species, six of which belong to the subfamily Reduviinae and two to the subfamily Harpactorinae. Some of these are from a collection sent to me for study by Dr. A. P. Kapur of the Zoological Survey of India, Calcutta, and others from the collection of the British Museum (N.H.), London.

The types of *Raipurocoris indicus* gen. et sp. nov., *Empyrocoris kapuri* sp. nov., *Psophis brunneipes* sp. nov., and *Bergrothellus humilis* sp. nov., are in of the Zoological Survey of India, Calcutta, and the types of *Empyrocoris pelia* (Distant), *Empyrocoris annulatus* (Distant), *Empyrocoris arabicus* sp. nov., *Empyrocoris henryi* sp. nov., and *Empyrocoris salvazai* sp. nov., a paratype each of *Empyrocoris kapuri* sp. nov., *Raipurocoris indicus* gen. et sp. nov. and *Bergrothellus humilis* sp. nov., and the type and paratype of *Mastocoris dilatatus* gen. et sp. nov., are in the British Museum (N.H.), London.

I express my thanks to Dr. Kapur for the privilege of being able to study the collection of Reduviidae from the Zoological Survey of India.

Subfamily REDUVIINAE

Genus **Empyrocoris** Miller, 1953

The genus *Empyrocoris* was erected by me in 1953¹ for the species *horridus* from Anuradhapura, Ceylon. In 1954² I transferred to this genus *Edocla annulata* Distant³, and *Edocla pelia* Distant⁴.

With regard to *Edocla pelia* the distribution is given by Distant (*loc. cit.*) as Pegu, (type locality) and Aden. The specimen from Aden in the British Museum (N.H.) placed with *pelia* is not, however, conspecific. It is described and figured herein as a new species.

¹ Miller, N. C. E., *Comment. biol., Helsingf.* XII (17), pp. 12-14 (1953). The type of *horridus* is in the Museum of the University, Helsinki, Finland, and the paratype is in the British Museum (N.H.), London.

² Miller, N. C. E., *Ann. Mag. nat. Hist.* VII (12), p. 639 (1954).

³ Distant, W. L., *Ann. Mag. nat. Hist.* IV (9), p. 73 (1919).

⁴ Distant, W. L., *Fauna Brit. India, Rhyn.* II, p. 275 (1904).

Key to *Empyrocoris* species

- Preantennal elevations feeble, rounded in profile : 2.
 Preantennal elevations strong, triangular in profile 3.
2. Antennae black with basal segment pale testaceous basally *henryi*, sp. nov.
 Antennae testaceous *arabicus*, sp. nov.
3. Posterior lobe of pronotum with a narrow depression medially anteriorly 4.
 Posterior lobe of pronotum without a depression. 5.
4. Posterior lobe of pronotum moderately strongly rugose ; lateral angles of collar bluntly conical . *salvazai*, sp. nov.
 Posterior lobe of pronotum feebly rugose ; lateral angles of collar acutely conical 6.
5. Posterior lobe of pronotum obscurely rugose, distinctly punctate ; lateral angles of collar conical : *annulatus* (Distant)
 Posterior lobe of pronotum moderately distinctly rugose, less distinctly punctate ; lateral angles of collar sub-rectangular . *pelia* (Distant)
6. Humeral spines thick, curved backwards somewhat . *kapuri*, sp. nov.
 Humeral spines thick, straight. . *horridus* Miller

Empyrocoris annulatus (Distant)

(Text-fig. 1)

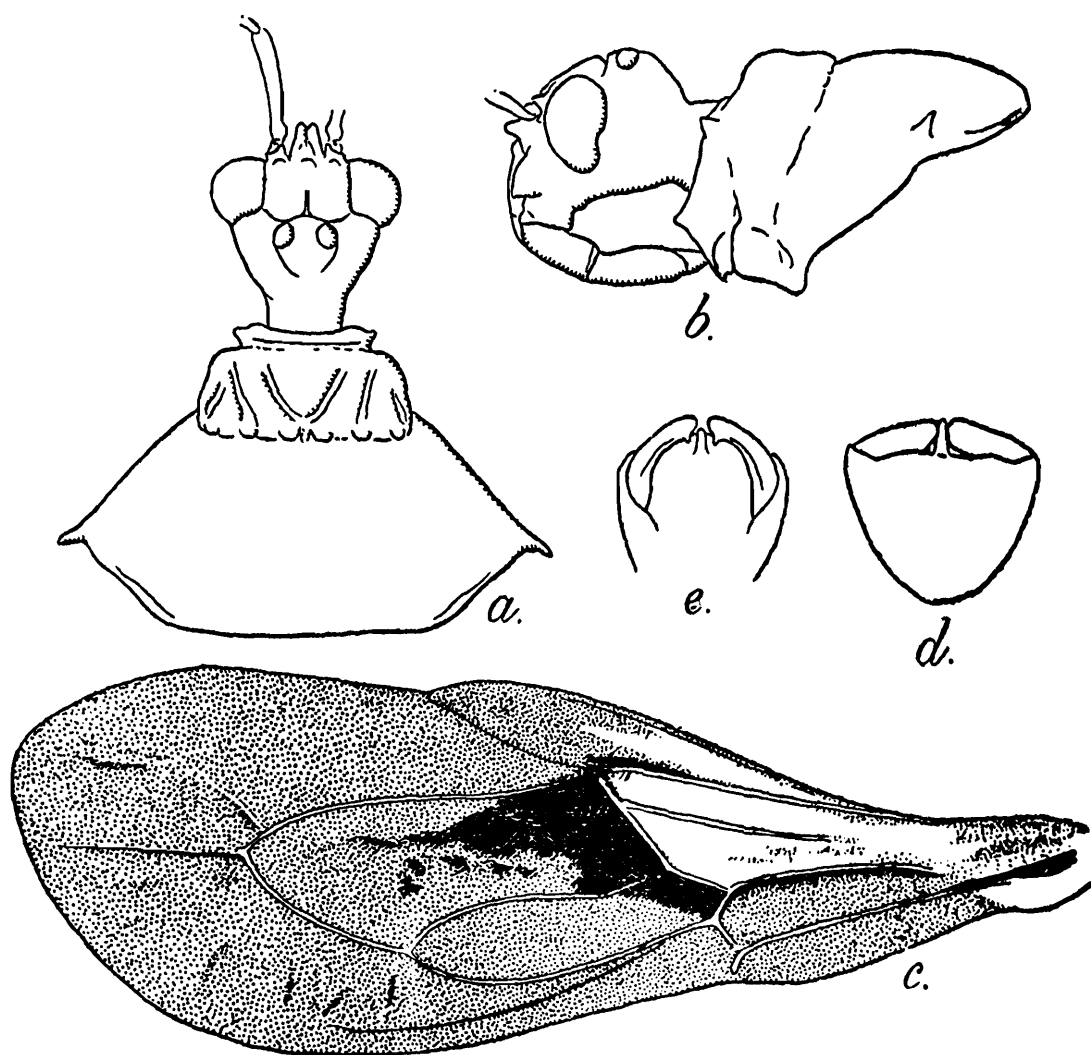
Colour.—Antennae, dorsal surface of head, testaceous. Head laterally and ventrally, rostrum, brown ; interocellar area black. Pronotum pale testaceous ; lateral angles of collar, a large spot on anterior lobe anteriorly, transverse sulcus and a transverse stripe basally on posterior lobe, brown ; acetabula, propleural epimeron, except upper area, pale testaceous ; propleural episternum, upper area of epimeron, meso- and metapleura, brown. Scutellum dark brown ; spine pale testaceous. Abdomen pale testaceous ; connexival segments 2-4 with a small spot basally, segments 5-7 with a large spot basally, segments 6 and 7 ventrolaterally with a suffused spot, dark brown or piceous. Hemelytra with infumate and fuscous pattern as in text-fig. 1. Legs pale testaceous anterior and median tibiae with a sub-basal, median and apical annulation, posterior tibiae with 2 annulations in basal half and a wide apical annulation, anterior and median femora with a wide basal and 2 more or less interrupted annulations in apical half, posterior femora with more or less half basally, wide annulation apically and a suffused spot sub-apically dark brown ; coxae and trochanters piceous. Setae pale fulvous.

Structure.—Median sulcus on vertex and transverse sulcus deep narrow ; vertex with a feeble, rounded elevation anteriorly ; ocelli moderately large ; interspace somewhat wider than an ocellus. Posterior lobe of pronotum punctate and with obscure transverse sulci ; humeral spines short, thick, curved upwards somewhat ; disc of scutellum with a deep oval depression ; apical spine acute, slender. Prosternum feebly conically produced. *Fossula spongiosa* on anterior tibiae a little more than one-third as long, on median tibiae a little less than one-third as long as tibia.

Measurements.—Total length ♂ 8.80 mm, ♀ 7.50 mm ; Hemelytra ♂ 6.50 mm, ♀ 2.00 mm ; Greatest pronotal width (including spines) ♂ 3.20 mm, ♀ 2.80 mm.

In the female which is brachypterous, the hemelytra extend almost to the apex of the 3rd abdominal segment. It differs in colouration from the male in having the connexival segments 4-7 piceous, except a testaceous spot at external apical angle.

Specimens examined.—1 ♂, (holotype), 8 ♂♂, 1 ♀, S. India, Nandidrug. T.V Campbell. (B.M. 1930-599.)



TEXT-FIG. 1.—*Empyrocoris annulatus* (Distant).

a. Head and pronotum (dorsal view); *b.* Head and pronotum (lateral view); *c.* Hemelytron; *d.* Pygophore (terminal view); *e.* Pygophore (dorsal view).

***Empyrocoris pelia* (Distant)**

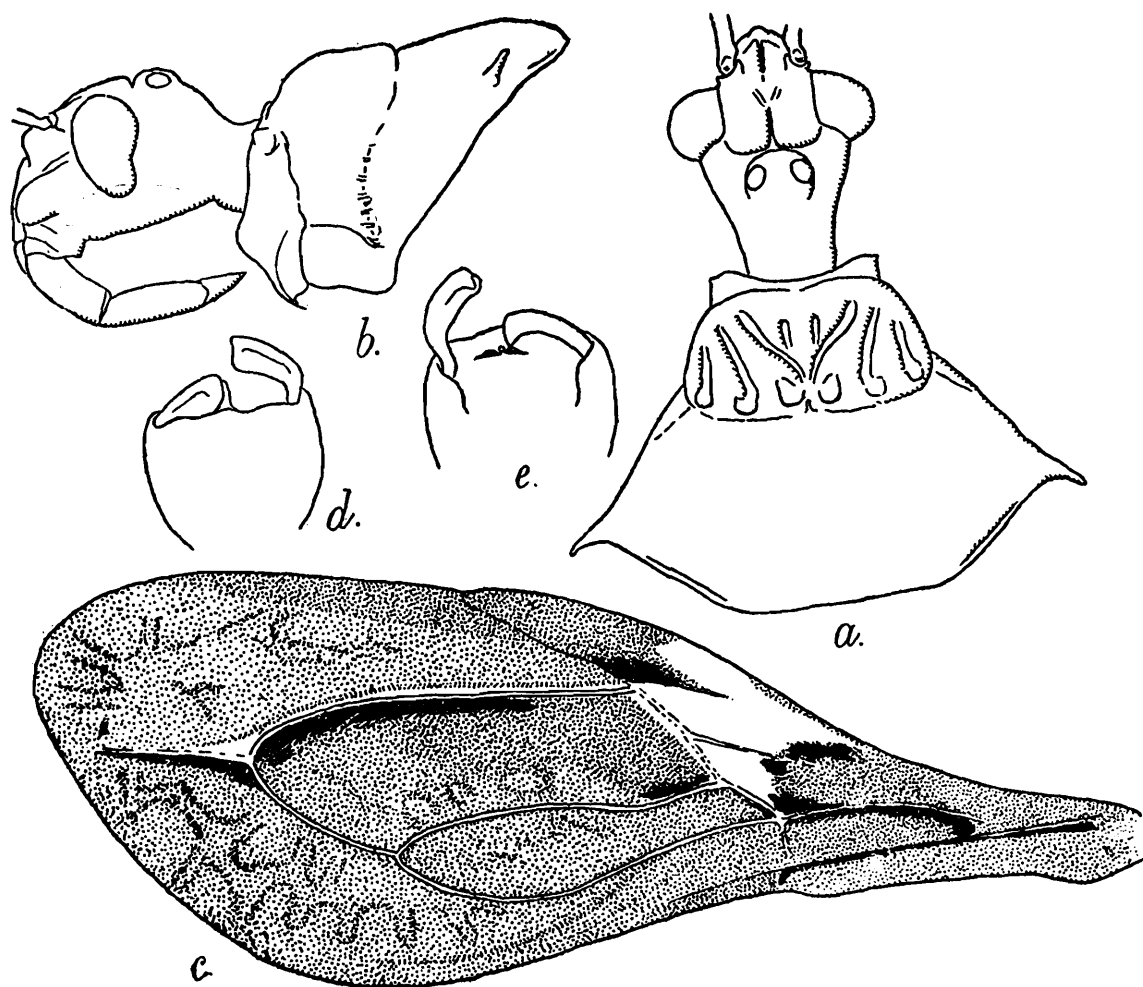
(Text-fig. 2)

Colour.—Antennae pale testaceous. Head, rostrum, anterior lobe of pronotum, propleura, except epimeron, meso and metapleura and sterna, piceous; collar, except lateral angles, elevated areas of anterior pronotal lobe, laterally, posterior lobe, propleural epimeron, anterior acetabula, testaceous; acetabula of meso and metapleura, brown; scutellum piceous; apical spine brown. Hemelytra as in text-fig. 2. Abdomen dark brown ventrally suffused with piceous ventro-laterally; connexival segments testaceous with a quadrate black spot in basal half. Legs pale testaceous; anterior and median tibiae with a basal, median and apical annulation; posterior tibiae narrowly basally and broadly apically, brown; femora broadly basally and narrowly apically and with interrupted narrow stripes, brown; coxae and trochanters piceous.

Structure.—Median sulcus on vertex basally and transverse sulcus very deep; vertex medially with two moderately wide, diagonal depressions; ocelli moderately large; interspace about twice as wide as an ocellus. Posterior lobe of pronotum with somewhat obscure, irregular, transverse sulci; humeral spines feebly curved, moderately thick; median sulcus between lobes deep. *Fossula spongiosa* on anterior and median tibiae a little more than one-third as long as tibia.

Measurements.—Total length 9.50 mm; Hemelytra 8.00 mm; Greatest pronotal width (including spines) 3.00 mm.

Specimen examined.—1 ♂, (holotype), Burma, Pegu. (Distant coll. B.M.. 1911-383).



TEXT-FIG. 2.—*Empyrocoris pelia* (Distant).

a. Head and pronotum (dorsal view); b. Head and pronotum (lateral view); c. Hemelytron; d. Pygophore (terminal view); e. Pygophore (dorsal view).

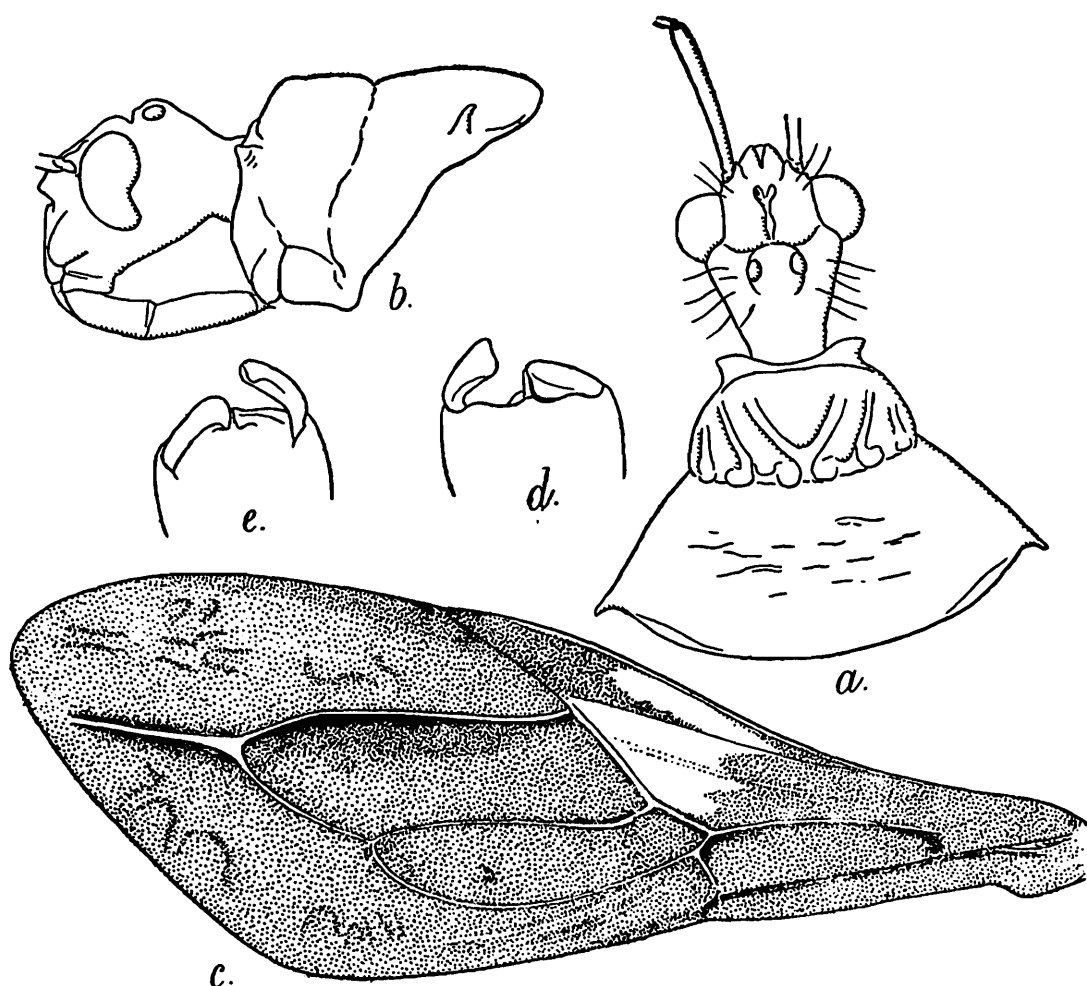
***Empyrocoris arabicus*, sp. nov.**

(Text-fig. 3).

Colour.—Antennae pale testaceous. Head piceous with tylus, a spot on each side of postocular and at base of postocular, pale testaceous. Anterior lobe of pronotum, except collar, and elevated areas, greater part of propleural episternum, meso- and metapleura and sterna, piceous; anterior acetabula, propleural epimeron, testaceous; meso- and metapleural acetabula brown; posterior lobe of pronotum pale testaceous with transverse brown suffusion basally; scutellum piceous; spine testaceous. Hemelytra with fuscous pattern as in text-fig. 3. Abdomen

brown, mid-ventrally suffused with yellow; connexivum pale yellow with a piceous spot basally on each segment. Anterior and median tibiae with a basal, median and apical annulation, posterior tibiae with two annulations in basal half and an apical annulation, anterior and median femora with a little less than half basally and narrowly apically, posterior femora with basal half and apex broadly, dark brown; coxae and trochanters dark brown. Setae pale fulvous.

Structure.—Median sulcus on vertex basally and transverse sulcus deep; vertex medially with two narrow, shallow, diagonal depressions; ocelli moderately large; interspace a little wider than an ocellus. Lateral



TEXT-FIG. 3.—*Empyrocoris arabicus*, sp. nov.

a. Head and pronotum (dorsal view); *b.* Head and pronotum (lateral view); *c.* Hemelytron; *d.* Pygophore (terminal view); *e.* Pygophore (dorsal view).

angles of collar more or less rectangular; posterior lobe of pronotum with obscure, irregular transverse sulci; humeral spines curved upwards and backwards. Scutellar spine sub-acute and with feeble annular constrictions. *Fossula spongiosa* on anterior and median tibiae a little more than one-third as long as tibia.

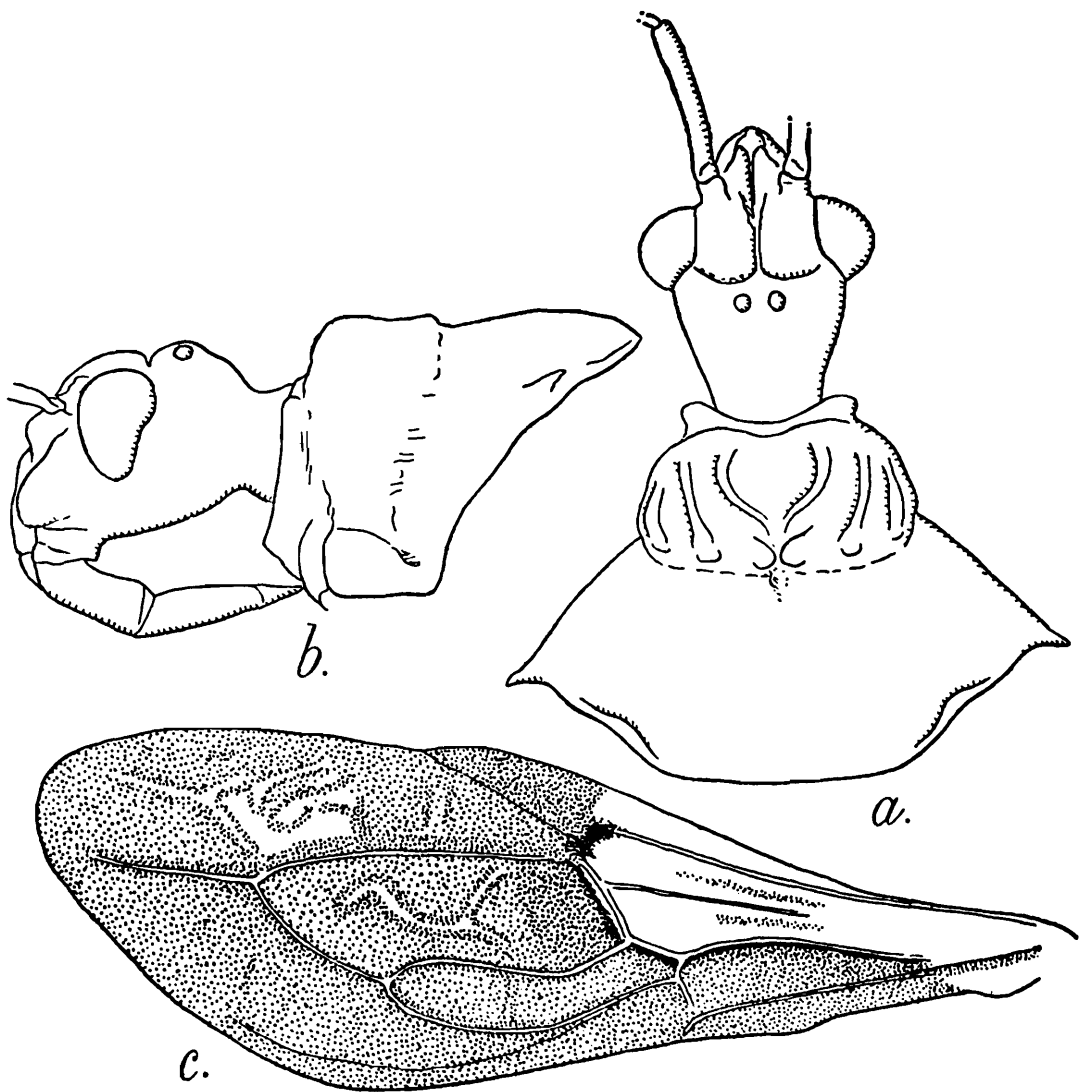
Measurements.—Total length 10.00 mm; Hemelytra 7.50 mm; Greatest pronotal width (including spines) 3.50 mm.

Specimen examined.—1 ♂, (holotype), Aden, Yerbury. (Distant coll. B.M. 1911-383).

Empyrocoris henryi¹, sp. nov.

(Text-fig. 4)

Colour.—Antennae black; basal segment narrowly pale testaceous basally. Head black with vertex basally and laterally, postocular except inter-ocular area, pale testaceous; interocular area with a median, pale, testaceous stripe; segments 1 and 2 of rostrum piceous; segment 3 light brown. Pronotum testaceous; lateral angles of collar, a spot on anterior lobe of pronotum anteriorly, a transverse stripe on posterior lobe basally, median depression on posterior lobe, a spot sub-dorsally basally on anterior lobe, piceous. Pleura piceous; propleural acetabula, a faint spot on propleural epimeron, testaceous. Abdomen black; connexival segments 2 and 3 pale yellow; segment 3 with a small piceous spot at external basal angle, segments 4 and 5 with basal half,

TEXT-FIG. 4.—*Empyrocoris henryi*, sp. nov.

a. Head and pronotum (dorsal view); b. Head and pronotum (lateral view); c. Hemelytron.

segments 6 and 7 with more than half basally, black; segments 3-5 mid-ventrally with a yellow spot. Hemelytra as in text-fig. 4. Legs pale yellowish; anterior and median tibiae with a basal, median and apical annulation, posterior tibiae with 2 wide annulations in basal half and a wide apical annulation, piceous; anterior and median femora black

¹ Dedicated to G. M. Henry, formerly Curator of the Colombo Museum.

with a spot sub-apically and an annulation in apical half, pale yellowish ; posterior femora piceous with a sub-apical pale yellowish annulation ; coxae and trochanters piceous.

Structure.—Preantennal elevations feebly prominent, feebly divergent apically ; median sulcus on vertex deep, wider and shallower anteriorly ; ocelli small ; interspace sub-equal in width to an ocellus. Posterior lobe of pronotum rugose, the rugosities more or less transverse medially ; humeral spines thick. Scutellar spine thick, sub-acute apically. *Fossula spongiosa* on anterior and median tibiae nearly half as long as tibia.

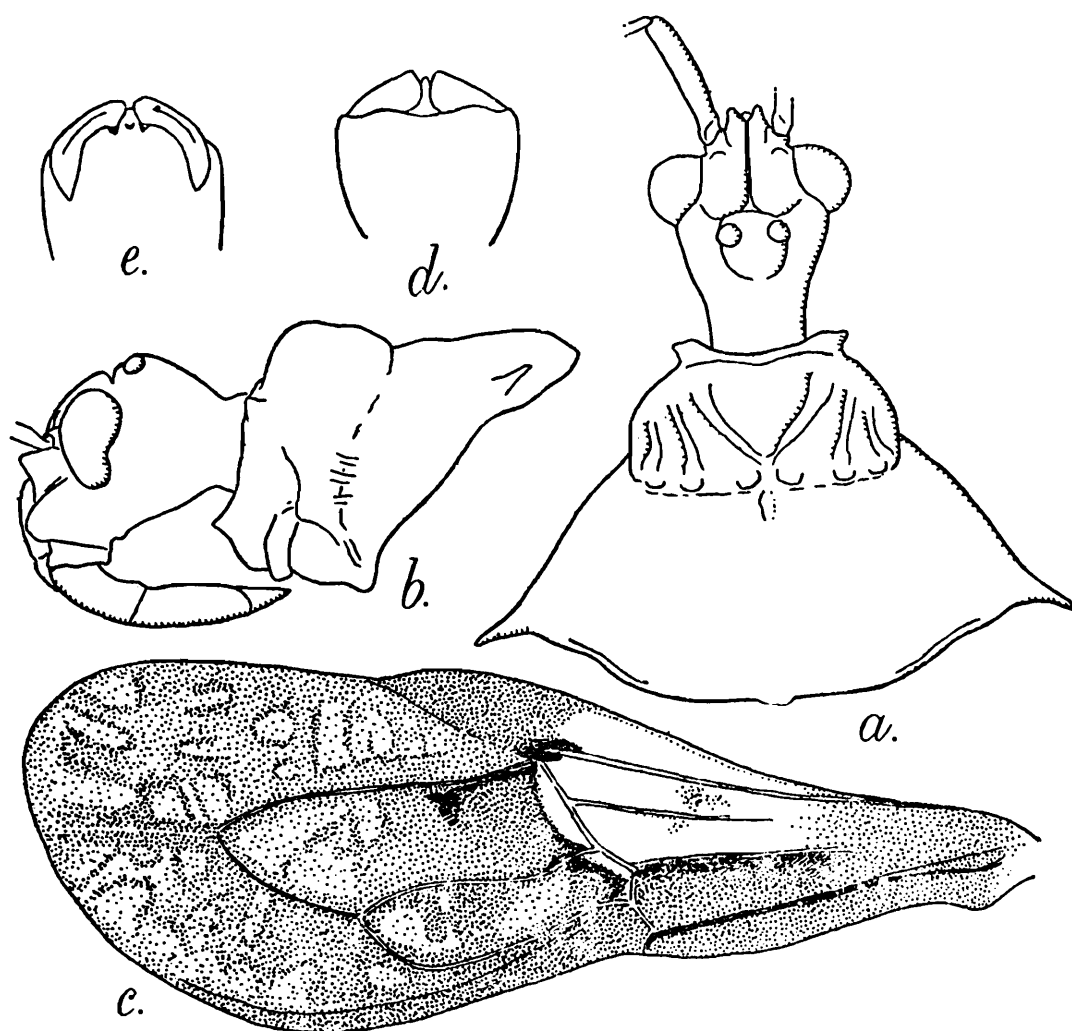
Measurements.—Total length 9.00 mm ; Hemelytra 5.50 mm ; Greatest pronotal width (including spines) 3.00 mm.

Specimen examined.—1 ♀, (holotype), S. India, Top Slip Camp, Nelliampathi Hills, 26. IV. 1937. (British Museum-Colombo Museum Exped. to S. India, April-May 1937.)

***Empyrocoris kapuri*¹, sp. nov.**

(Text-fig. 5)

Colour.—Testaceous. Head laterally, rostrum, brown. Pleura piceous except propleural epimeron, acetabula, a spot on mesopleura posteriorly testaceous. Posterior pronotal lobe with a transverse brown stripe



TEXT-FIG. 5.—*Empyrocoris kapuri*, sp. nov.

a. Head and pronotum (dorsal view) ; b. Head and pronotum (lateral view) ; c. Hemelytron ; d. Pygophore (terminal view) ; e. Pygophore (dorsal view).

¹ Dedicated to Dr. A. P. Kapur, Zoological Survey of India, Calcutta.

basally. Anterior lobe of pronotum with lateral angles of collar and spot anteriorly brown. Scutellum piceous; spine brown. Hemelytra with fuscous pattern as in text-fig. 5. Abdomen ventrally suffused with brown; connexival segments 4-7 pale testaceous with a large piceous spot basally; segment 3 with a small piceous spot basally. Anterior and median tibiae with a sub-basal, median and apical annulation, posterior tibiae with an apical and 2 annulations in basal half, anterior and median femora broadly basally and with 2 interrupted annulations, posterior femora with a little less than half basally, apex moderately broadly piceous; coxae and trochanters brown.

Structure.—Preantennal elevations widely separated. Median sulcus on vertex and transverse sulcus moderately deep. Ocelli relatively small; interspace a little wider than an ocellus. Posterior lobe of pronotum obscurely rugose and with a moderately deep depression medially anteriorly; humeral spines moderately thick. *Fossula spongiosa* on anterior tibiae nearly half as long, on median tibiae a little more than one-third as long as tibia.

Measurements.—Total length 7.40 mm; Hemelytra 5.50 mm; Greatest pronotal width (including spines) 3.00 mm.

Specimens examined.—1 ♂, (holotype), 1 ♂, (para type) India, Barkuda Id., Chilka Lake, Ganjam Dist., Orissa. 3-19. VIII. 1919.

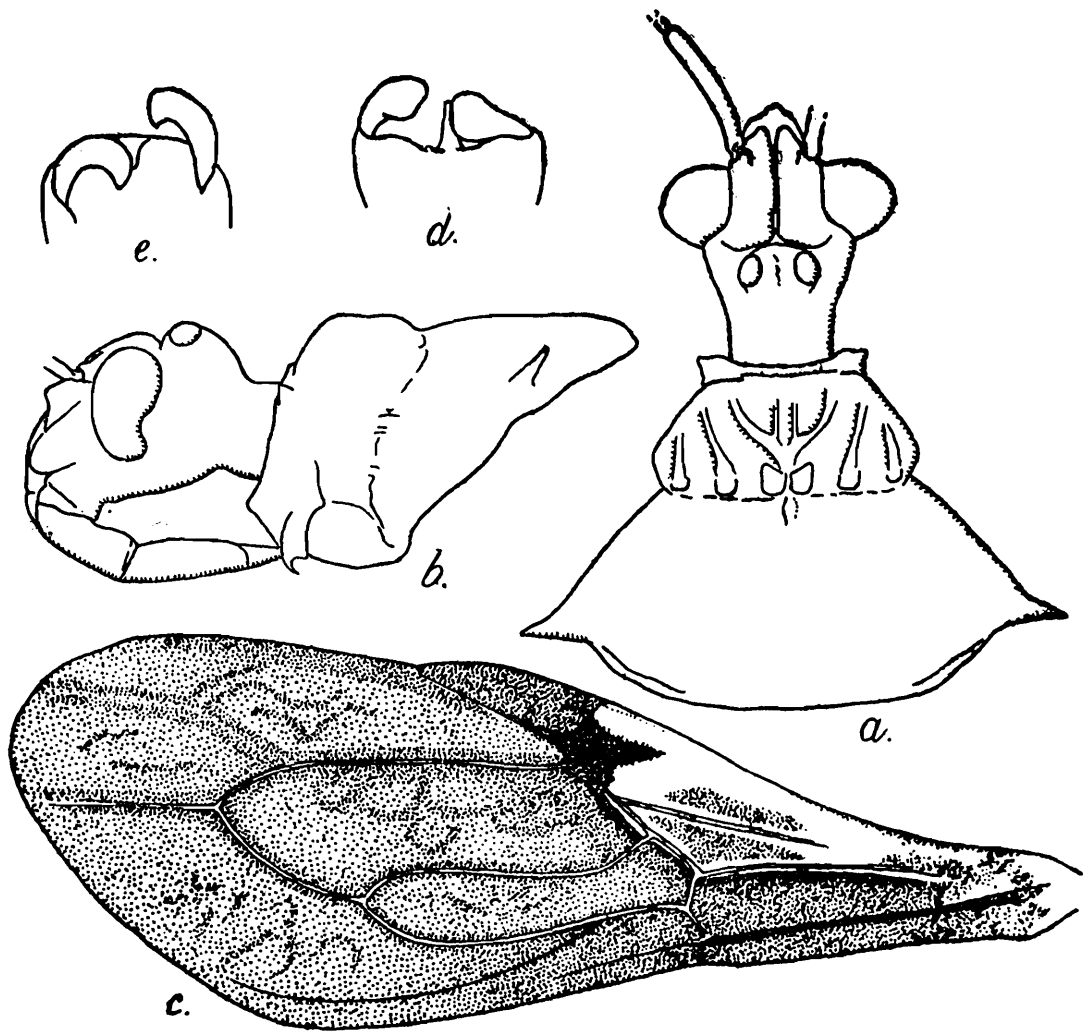
***Empyrocoris salvazai*, sp. nov.**

(Text-fig. 6)

Colour.—Antennae pale testaceous; segment 2 narrowly suffused with brown apically. Head and rostrum dark testaceous; postocular laterally piceous. Pronotum testaceous; lateral angles of collar black; pleura dark brown, except propleural epimeron posteriorly, testaceous. Scutellum dark brown, spine paler. Hemelytra with fuscous and infumate pattern as in text-fig. 6. Abdomen dark brown with testaceous suffusion mid-ventrally; connexivum pale testaceous; segments 4-7 with a piceous spot basally. Legs pale yellowish; anterior tibiae missing; median tibiae broadly apically and with a somewhat indefinite median annulation, posterior tibiae broadly apically and with a narrow suffusion basally, femora with a little less than half basally, posterior femora with apex, piceous; coxae and trochanters dark brown.

Structure.—Preantennal elevations feebly elevated and feebly divergent. Median sulcus on vertex in basal half and transverse sulcus deep; vertex with two shallow diagonal sulci anteriorly; ocelli large; interspace feebly sulcate, about one and a half times wider than an ocellus. Anterior margin of collar feebly concave; lateral margins of anterior pronotal lobe posteriorly rounded, sub-angulate; posterior lobe rugulose and with a median depression anteriorly; humeral spines thick, triangular sub-acute. Disc of scutellum rugose. *Fossula spongiosa* on median tibiae a little more than one-third as long as tibia.

Measurements.—Total length, 10.00 mm; Hemelytra 7.50 mm; Greatest pronotal width (including spines) 3.50 mm.



TEXT-FIG. 6.—*Empyrocoris salvazai*, sp. nov.

a. Head and pronotum (dorsal view); b. Head and pronotum (lateral view); c. Hemelytron; d. Pygophore (terminal view); e. Pygophore (dorsal view).

Specimen examined.—1♂, (holotype) Indo-China, Tonkin, Kampong Kedig, Juillet 1914. R.V de Salvaza. (B.M. 1917-98).

Raipurocoris, gen. nov.

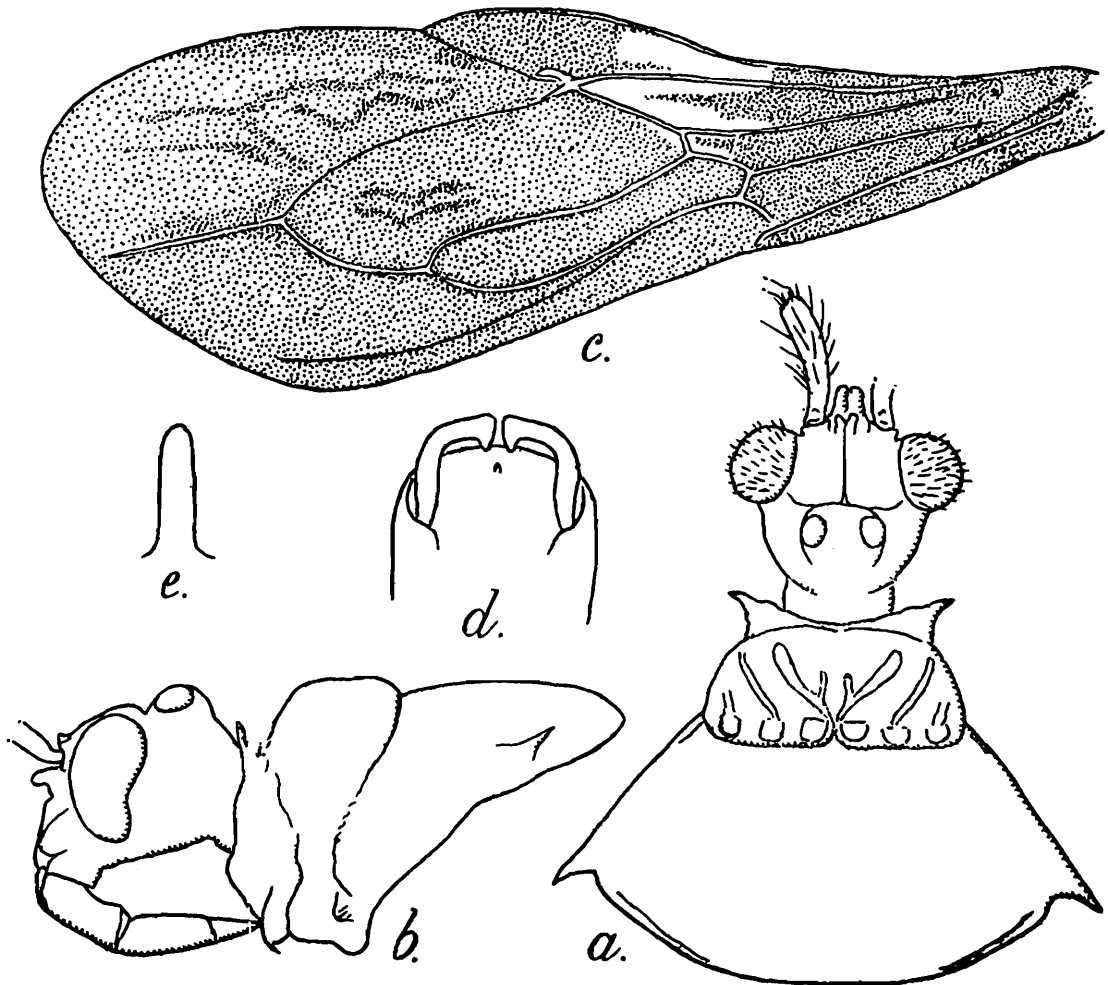
Size small. Basal segment of antennae longer than anteocular. Head with a bifurcate elevation between antennal tubercles and tubercles in front of antennal tubercles. Anteocular declivous, shorter than postocular; eyes prominent; vertex longitudinally sulcate. Segments 1 and 2 of rostrum sub-equal in length. Anterior and posterior pronotal lobes, pleura, granulose; lateral angles of collar and humeral angles produced; anterior lobe shorter than posterior lobe. Scutellum with an apical spine. Connexivum of segment 2 of abdomen with a spine at external apical angle; segments 3 and 4 with angle conically produced. Hemelytra extending beyond apex of abdomen. Anterior and median tibiae with a *fossula spongiosa*.

Type species: **Raipurocoris indicus**, gen. et sp. nov

(Text-fig. 7)

Colour.—Antennae, head and legs pale testaceous. Rostrum brown. Postocular laterally with a wide piceous stripe. Pronotum and pleura piceous; produced humeral angles testaceous. Scutellum piceous, spine somewhat paler than disc. Hemelytra as in text-fig. 7. Abdomen

brown; connexivum piceous with a small testaceous spot on each segment apically. Anterior femora and tibiae with a median, basal and apical annulation, posterior femora with a basal and 2 annulations in apical half, posterior tibiae with an apical annulation and 2 annulations in basal half, brown. Setae pale fulvous. Coxae and trochanters brown.



TEXT-FIG. 7.—*Raipurocoris indicus*, gen. et sp. nov.

a. Head and pronotum (dorsal view); b. Head and pronotum (lateral view); c. Hemelytron; d. Pygophore (dorsal view); e. Median apical process of pygophore.

Structure.—Basal segment of antennae moderately thick, feebly curved half as long as segment 2. Tubercles in front of antennae moderately long, contiguous. Ocelli large; interspace somewhat wider than an ocellus. Lateral spines on collar slender, acute, feebly curved; spines on humeral angles almost smooth. *Fossula spongiosa* on tibiae about one-fourth as long as tibia.

Measurements.—Total length 7.50 mm; Hemelytra 6.50 mm; Greatest pronotal width (including spines) 3.00 mm. Another specimen which I designate as a paratype has the abdomen missing. It appears to be a male and was collected at Sonder, Rhandaru, C.P., India on 8.XII. 1912 by A.D. Imms.

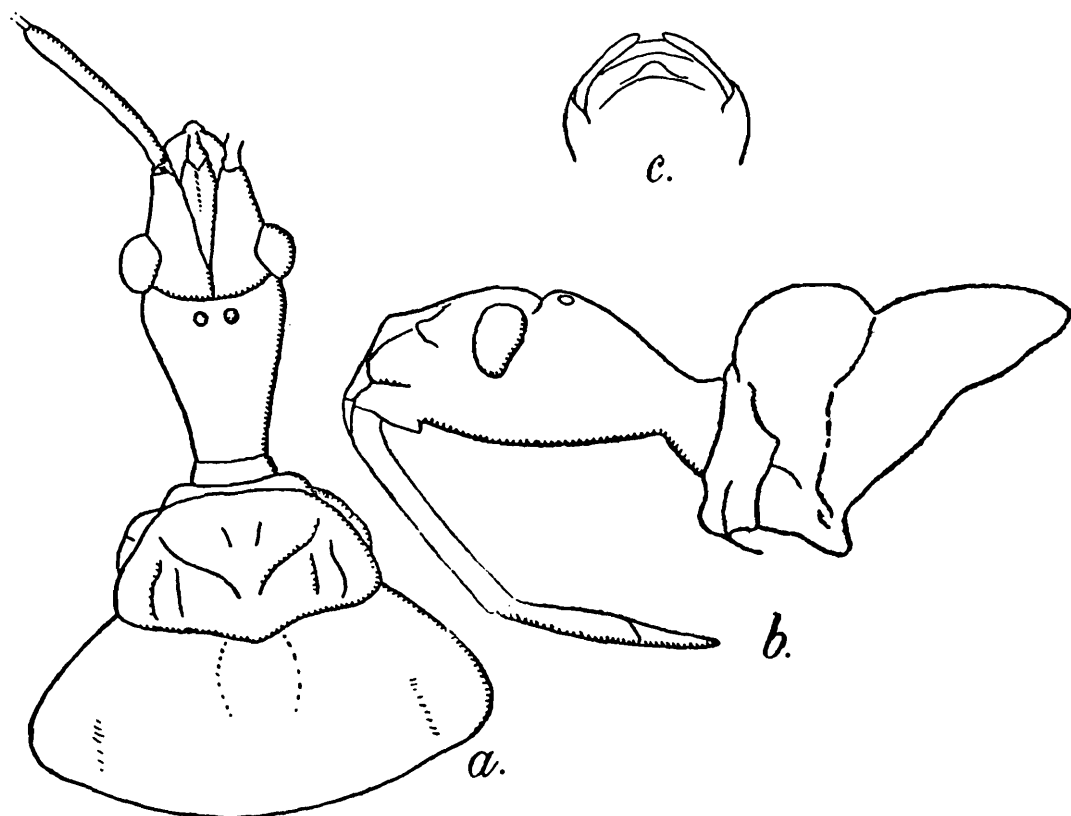
Specimen examined.—1 ♂, (holotype), Raipur, C.P., India, XII. 1939. H.S. Rao.

Remarks.—Allied to *Empyrocoris* Miller (*loc. cit.*) from which it differs in having the anteocular shorter than postocular, tubercles in front of and between antennal tubercles, segments 2-4 of connexivum and lateral angles of collar produced. It also differs in the sculpturation of the pronotum, which is granulose not smooth.

***Psophis brunneipes*, sp. nov.**

(Text-fig. 8)

Colour.—Coral red. Antennae, rostrum and legs piceous; coxae coral red. Clavus, except basal half, membrane, infumate. Setae on tibiae apically pale fulvous.



TEXT-FIG. 8.—*Psophis brunneipes*, sp. nov.

a. Head and Pronotum (dorsal view); b. Head and pronotum (lateral view); c. Pygophore (dorsal view).

Structure.—Sulci on anterior pronotal lobe somewhat shallow; median depression on posterior lobe shallow. Corium minutely, vermiculately rugose.

Measurements.—Total length 10.00 mm; Hemelytra 7.50 mm; Greatest pronotal width 2.50 mm.

Specimen examined.—1 ♂, (holotype), India, Kalimpong, Darjiling Dist., E. Himalayas, 600-4500 ft. 24. IV-10-V 1915. F. H. Gravely.

Remarks.—Differs from all other known species in having piceous legs. Allied to *Psophis consanguinea* Distant (1903). Differs in having relatively longer hemelytra, less globose postocular and the lateral angles of the collar not produced and rounded.

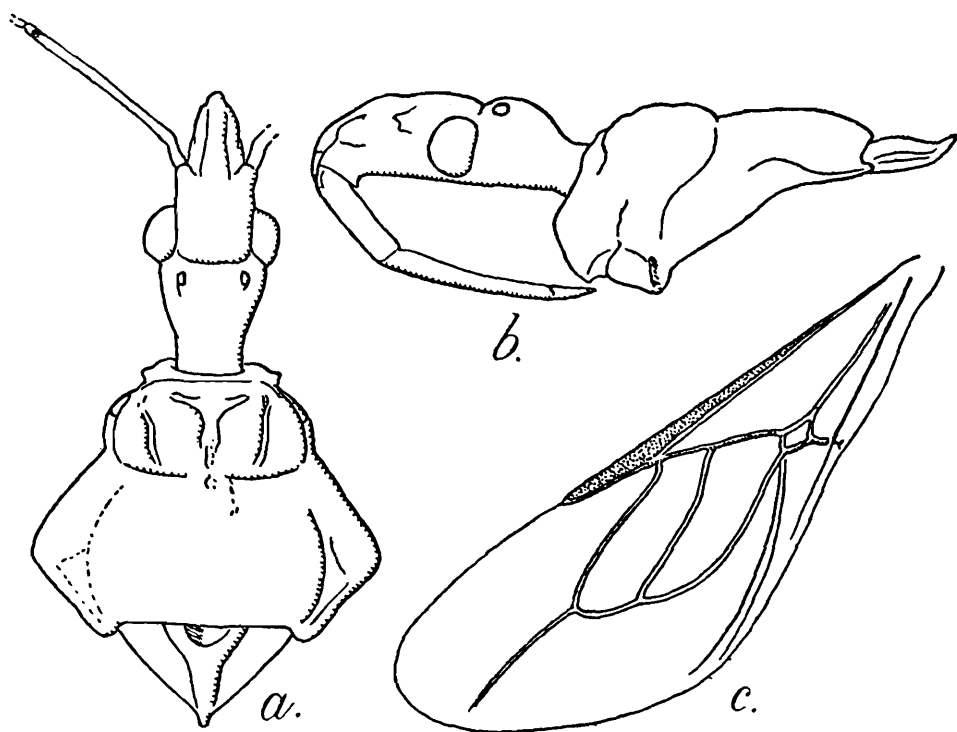
Subfamily *HARPACTORINAE*.***Bergrothellus humilis*, sp. nov.**

(Text-fig. 9)

Colour.—Brown. Greater part of corium, membrane, infumate; veins of membrane piceous; membrane also faintly cupreous. Setae very pale fulvous.

Measurements.—Total length ♂ 9.70 mm, ♀ 9.80 mm; Hemelytra ♂ 5.50 mm, ♀ 6.20 mm; Greatest pronotal width ♂ 3.20 mm, ♀ 3.20 mm.

Specimens examined.—1 ♂ (holotype), India, Chiplun, Vashisti Valley, Ratnagiri Dist., 300 ft. 3-5. V 1912. 1 ♀ (paratype), 3-5. V 1913, I.Z.S. lot No. 150, 1955. F.H. Graveley.



TEXT-FIG. 9.—*Bergrothellus humilis*, sp. nov.

a. Head, pronotum and scutellum (dorsal view); *b.* Head, pronotum and scutellum (lateral view); *c.* Hemelytron.

Remarks.—Allied to *Bergrothellus rufipes* Miller, (1953). Differs in colouration in having the antennae brown, no spot between ocelli, the pronotum entirely brown and the connexivum without spots.

The difference in the structure of the hemelytra in the sexes is interesting. In the female the corium is coriaceous except the clavus and area between claval suture and *Cu*, while in the male only the costal area is narrowly coriaceous. The connexivum of the female has a pale yellow spot on each segment apically and the tibiae are paler than the femora.

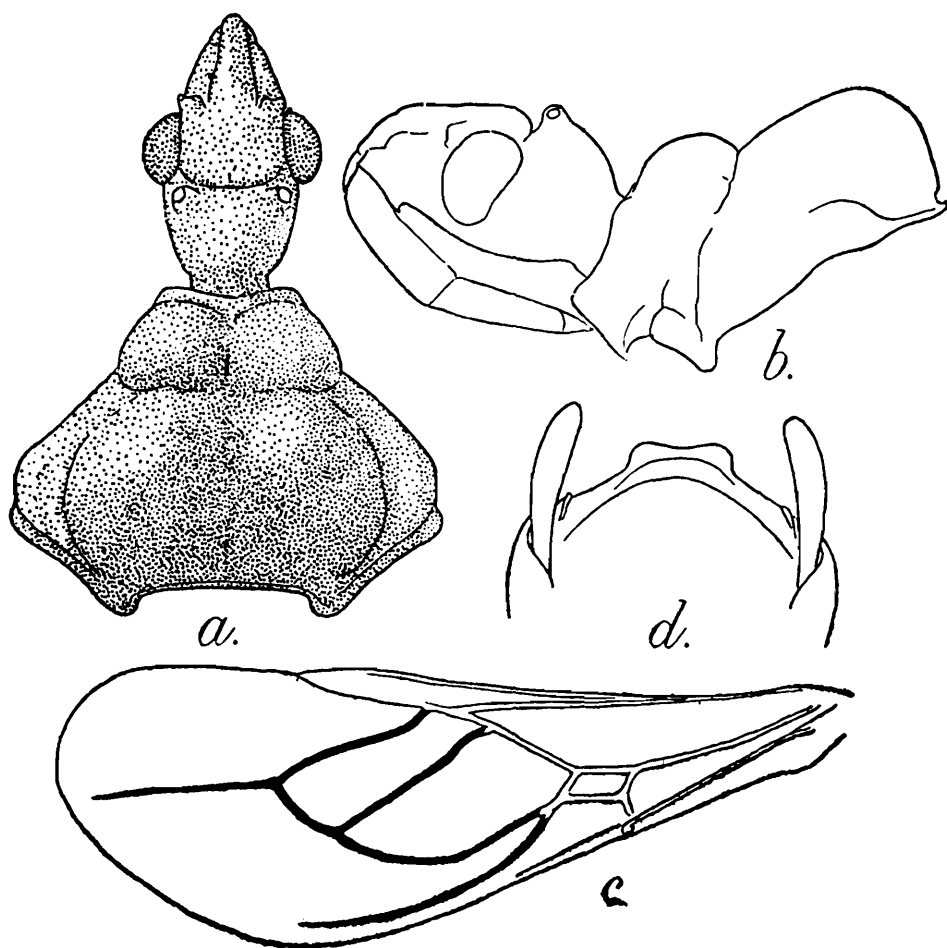
Mastocoris, gen. nov.

Size small. Antennae thick ; basal segment shorter than anteocular ; postocular longer than anteocular, the former globose with a short neck ; ocelli widely separated, pedunculate ; tylus somewhat elevated. Rostrum thick ; basal segment extending to posterior margin of eyes, equal in length to remaining segments together. Anterior lobe of pronotum shorter than posterior lobe, medially longitudinally sulcate, the sulcus extending to transverse sulcus and continuous with median sulcus on posterior lobe ; lateral angles of collar not produced ; posterior lobe strongly elevated, bilobate. Apex of scutellum elevated. Hemelytra hyaline ; base of internal cell of membrane wider than base of external cell. Abdomen ventrally with inter-segmental sutures obsolescent laterally ; spiracles small, located at middle of connexival segments. Legs moderately thick ; femora nodulose with spinous setae ; tarsi with 2 segments.

Type species : **Mastocoris dilatatus**, gen et sp. nov.

(Text-fig. 10)

Colour.—Light brown ; posterior lobe of pronotum, pleura and antennae, venation of corium, testaceous ; venation of membrane piceous. Abdomen ventrally piceous ; connexival segments with a yellowish spot in apical half ; pygophore yellowish.



TEXT-FIG. 10.—*Mastocoris dilatatus*, gen. et sp. nov.

a. Head and pronotum (dorsal view) ; *b.* Head and pronotum (lateral view). *c.* Hemelytron ; *d.* Pygophore (dorsal view).

Structure.—Basal segment of antennae somewhat constricted basally ; segment 2 a little less than half as long as 1. Vertex smooth, about twice as wide as an eye and with a very feeble, median, longitudinal sulcus basally ; distance between external margins of ocelli equal in width to vertex. Lateral angles of collar rounded ; postero-lateral margins of posterior pronotal lobe strongly dorso-ventrally compressed ; posterior lobe obscurely rugose. Hemelytra extending just beyond apex of abdomen.

Measurements.—Total length 5.40 mm ; Hemelytra 3.50 mm ; Greatest pronotal width 3.00 mm.

Specimens examined.—1 ♂ (holotype), 1 ♂ (paratype), India, Tranquebar. 6. V. 1915. G.R. Dutt.

Remarks.—This new genus would appear to be allied to *Sphedanolestes* Stal, (1866, *Öfvers. Vetensk Akad. Förh.*, Stockh., pp. 248, 288).

THREE SEMIPARASITIC COPEPODS FROM THE MADRAS COAST

By

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In the course of a study of the free living copepods, the author found three siphonostomous forms. Since our knowledge of the semiparasitic copepods of the Bay of Bengal, Gulf of Manaar and the Arabian Sea is confined to the few treated by Thompson and Scott¹ and Sewell², and those occurring in Madras waters have not been studied at all, those three forms are dealt with here. Of these, *Asteropontius mycalei* is new to science, and *Asterocheres suberitis* and *Cryptopontius brevifurcatus* are being recorded for the first time in Indian waters. The types have been deposited in the Zoological Survey of India, Calcutta.

Family ASTEROCHERIDAE

Asterocheres suberitis Giesbrecht

1889. *Asterocheres suberitis*, Giesbrecht, *Fauna u. Flora Neapel*, **25**, p. 6, pl. ii, figs. 1—17.

Material examined.—A single male 1.2 mm. in size, from sponges collected at 'Sponge Bay' in Krusadi Islands.

Body.—Robust with the anterior end rounded. The last segment of the metasome is shorter than the previous segment. The genital segment is inflated towards its posterior end and carries a lappet with two setae. The other three segments of the urosome are more or less of the same size. The caudal rami are nearly as long as broad and each ramus carries six setae.

In the first leg, the third segment of the endopod is produced into a broad spinous projection towards the outer side. The fifth leg consists of a small joint with three unequal setae. The basal joint has an outer seta.

Asteropontius mycalei, sp. nov.

Material examined.—4 females of a light yellowish colour and 0.44 mm. in size from the sponge *Mycale mytillosum*³ collected from the Madras Harbour.

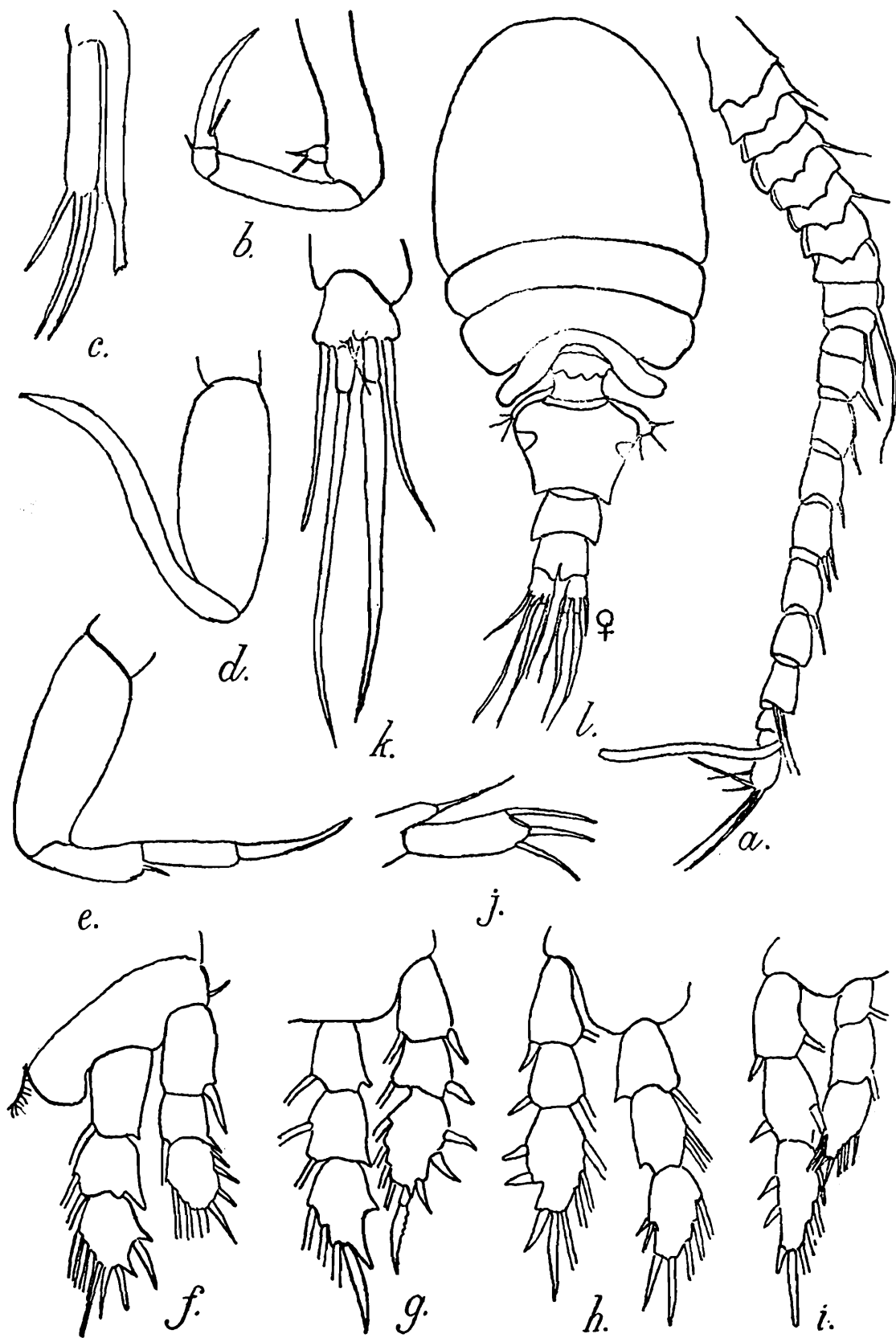
¹ Thompson, I.C. and Scott, A., *Report on the Pearl Oyster Fisheries of the Gulf of Manaar*, Pt. I., *Supplementary Report*, 7 (1903).

² Sewell, R. B. S., *Sci. Rep. Murray Exped.* **9**, No. 2 (1949).

³ I am grateful to my colleague Mr. M. A. Ali for identifying the sponges.

Type-specimen.—Reg. No. C3518/1, Zoological Survey of India, Calcutta.

Body.—Body small, robust, the cephalosome broader than long, the proportion of the length to breadth being 42:51. The anterior margin



TEXT-FIG. 1.—*Asteropontius mycalei*, sp. nov.

a., antennule ; b., antenna ; c., maxillule ; d., maxilla ; e., maxilliped ; f., g., h., i., j., legs 1 to 5 ; k. furcal ramus, right side ; l., female dorsal view.

(All the appendages are under a magnification of 216×360 .)

of the cephalosome is rounded. The metasome is longer than the urosome. The last segment of the metasome is deeply convex in the middle and

has rounded margins. The genital segment is inflated towards the anterior side. The other two segments of the urosome are very small. Furcal rami are broader than long and each ramus has four terminal stout setae and two slender setae. The second and the third inner setae are flattened (Text-fig. 1k.).

The antennule is composed of 20 joints which are stoutly built (Text-fig. 1a). The antenna is 3-jointed with a single jointed endopod tipped with two setae and attached to the basal joint (Text-fig. 1b). The terminal joint carries a claw (?) and two setae. Mouth-parts are as in other members (Text-fig. 1c, d and e) of the genus. The oral siphon reaches upto the basal segment of the first leg. The legs have three-jointed rami. First leg (Text-fig. 1f) Basal² carries an outer seta. First joint of exopod with one outer spine, second joint with one outer and one inner seta and the third joint with 4 outer and three inner setae. The endopod is slightly longer than the exopod and the first endopod joint has one inner seta. The third joint has two outer spines and four inner setae. The second leg (Text-fig. 1g.) differs from the first leg in having an inner seta on the 1st joint of the exopod, three setae, in the terminal joint of the endopod instead of four. Third and the fourth legs resemble the second leg. Fifth leg (text-fig. 1j) consists of a joint with one outer seta and a small distal joint which is longer than broad, tipped with three apical setae.

Remarks.—Thompson and Scott¹, created this genus to include the specimens taken from sponge and general invertebrate washings. Two species, *A. typicus* and *A. attenuatus* were described by them. Since then Sewell² has added one more species, *A. nicobaricus* from Nicobar Islands. The present species agrees with *A. typicus* in the general body shape, but differs in the proportion of the different segments, especially in the convex anterior margin of the last segment of metasome. The antennule has 20 joints and the fifth leg also differs in being longer than broad. It differs from *A. attenuatus* and *A. nicobaricus* in the general shape of the body and structure of fifth legs.

The new species can be defined as follows : Length 0.44 mm. Body robust, broader than long, last segment of the metasome deeply convex in the middle with rounded margins. Genital segment inflated towards the anterior side. Cadual rami with second and third inner setae flattened. Antennule 20-jointed. Antenna 3-jointed. Fifth leg with a small distal joint which is longer than broad, tipped with three apical setae.

With the addition of this new species, the genus comprises 4 species which can be distinguished and identified readily with the help of the following key :

¹ Thompson, I. C. and Scott, A., *Report on the Pearl Oyster Fisheries of the Gulf of Manaar*, Part I, *Supplementary Report*, 7 (1903).

² Sewell, R. B. S., *Sci. Rep. Murray Exped.*, 9, No. 2. (1949).

Key to the Species

- 1. Antennule composed of 18 segments—2
Antennule composed of 19 segments—*A. typicus* Thompson & Scott, 1903.
Antennule composed of 20 segments —*A. mycalei*, sp. nov.
- 2. Distal of the fifth leg carrying 2 setae—*A. attenuatus* Thompson & Scott, 1903.
Distal of the fifth leg carrying 3 setae—*A. nicobaricus* Sewell, 1949.

Family DYPONTIDAE

Cryptopontius brevifurcatus Giesbrecht

1899. *Cryptopontius brevifurcatus* Giesbrecht, *Fauna u. Flora Neapel*, **25**, p. 109, pl. 1, fig. 8, pl. 8, figs. 1—12.
1918 *Cryptopontius brevifurcatus*, Sars, *Crustacea of Norway*, **6**, pp. 120-122, pl. 49.
1944. *Cryptopontius brevifurcatus*, Nicholls, *Rec. S. Aust. Mus.*, **8**, p. 24.

Occurrence.—A single female from the sand dredged off Madras.

Body.—The cephalosome is nearly twice as long as broad and its anterior end is rounded. The other segments of the metasome have well developed epimera. The caudal ramus is nearly as long as broad and carries 5 setae, the 2 middle ones being very long and stout.

Appendages.—The antennule is 11-articled, the terminal one being tipped with an ‘aesthete’ The basal joint of the antenna is 2-jointed, the second joint of which carries a small exopod tipped with two apical setae. The endopod is 2-jointed, the terminal joint of which carries 1 lateral and 3 apical setae. The ‘siphon’ is very long, nearly reaching up to the end of metasome. Other mouth-parts as figured by Sars. The swimming legs have the following setal formula :

				Exopod						Endopod						
				1		2		3		1		2		3		
				sp.	se.	sp.	se.	sp.	se.	sp.	se.	sp.	se.	sp.	se.	
P1	.	.	.	.	1	2	1	1	3	5	0	1	0	2	0	6
P2	.	.	.	.	1	1	1	1	4	5	0	1	0	2	2	4
P3	.	.	.	.	1	1	1	1	4	5	0	2	0	2	2	4
P4	.	.	.	.	1	1	1	1	4	5	Absent.					

Fifth leg consists of a small knob like projection with two terminal setae, and a seta at its base over the outer side.

Remarks.—This is the first record of the occurrence of this species in Indian seas. The Madras form deviates from Sars' in a few minor features like the "pitted" appearance of the metasome, and the presence of two small projections directed posteriorly in the middle of the second metasome segment. It, however, can be easily ascribed to the form figured by Sars by its long cephalosome and the comparative shortness of the other segments of the urosome and metasome.

ACKNOWLEDGMENT

The author thanks Dr. C. P. Gnanamuthu, Director, Zoology Laboratory, Madras University, for guidance and help.

ON A NEW SPECIES OF *LAOPHONTE* (COPEPODA : HARPACTICOIDA) FROM MADRAS

By

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In the course of the study of the harpacticoids of the Madras Coast, fifteen females and eight males of a Laophontid were collected from floating logs which were infested with shipworms. On close examination these proved to be a new species referable to the subgenus *Mesolaophonte* Nicholls. Hence it is described here fully and the types have been deposited in the Zoological Survey of India, Calcutta.

***Laophonte (Mesolaophonte) pseudo-oculata*, sp. nov.**

Type specimen.—Reg. No. C 3520/1, Zoological Survey of India, Calcutta.

Female (Text-fig. 1a—m)

Body.—Slender, much depressed and tapered posteriorly; length 1.25—1.4 mm. The rostrum is obtusely triangular and carries two slender setae. The cephalosome is as long as broad, the outer edge of which is hirsute. A pair of prominent cuticular lenses are found on the dorsal side (Text-fig. 1b) as in *Laophonte oculata* Gurney.¹ In the living condition, the eye is deep red. The metasome segments are narrow with their outer posterior edges slightly drawn out, which bear a bunch of spinules (Text-fig. 1c). The outer margins are hirsute. The anal segment is broader than long, the length and breadth being 16 : 25. The furcal ramus, which is nearly as long as the anal segment, is longer than broad, the length and breadth being 17 : 10. Each ramus carries one outer seta, two long apical setae and two setae on the inner side. A seta arises a little further away from the base of the outer apical seta (Text-fig. 1d).

Appendages.—The antennule (Text-fig. 1e), which is composed of six segments, is short, scarcely reaching the end of the cephalosome. The outer margins of the first three segments are fringed with fine hair. The setae are distributed as follows :—

Segments	1	2	3	4	5	6
No. of setae	—	5	5	2	1	5

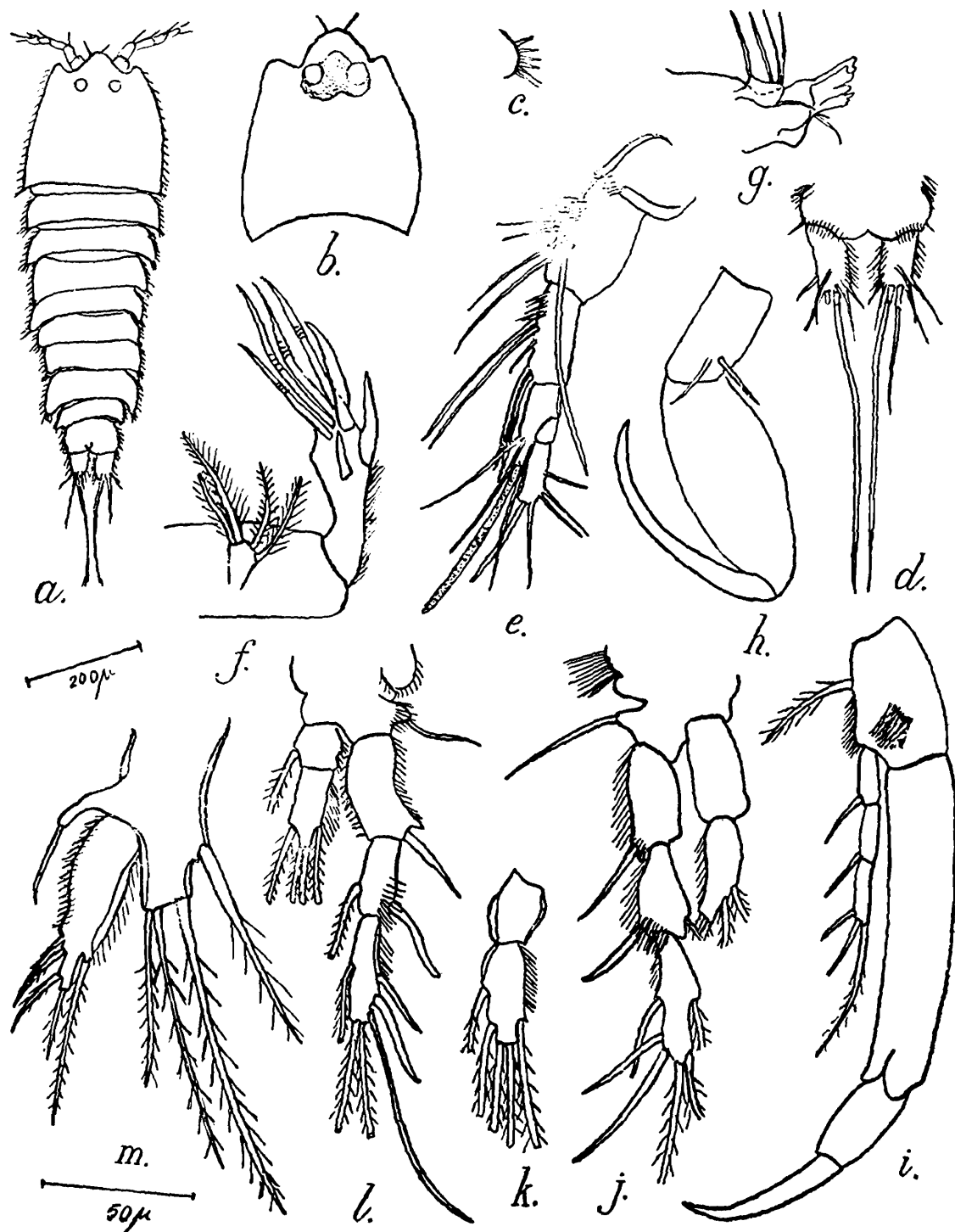
The fourth joint is produced towards its distal outer corner and carries an aesthete.

The antenna (Text-fig. 1f) is well built. The basal joint of the endopod carries the one-jointed exopod which has four plumose setae. The distal joint of the endopod is long and slender, its outer margin is

¹ Gurney, R., *Trans. Zool. Soc. Lond.* 22, pp. 451-577 (1927).

hirsute and carries three spines and four "hastate" setae. The mouth parts are as in other members of the genus (Text-fig. 1*g, h*).

The first leg (Text-fig. 1*i*) has the usual shape of the Laophontids. The basal₂ is longer than broad and carries an outer plumose seta. Its outer margin is hirsute. A bunch of slender hairs arises at the region between the bases of the exopod and the endopod in the joint. The three-jointed exopod is short and slender, the first and second joints

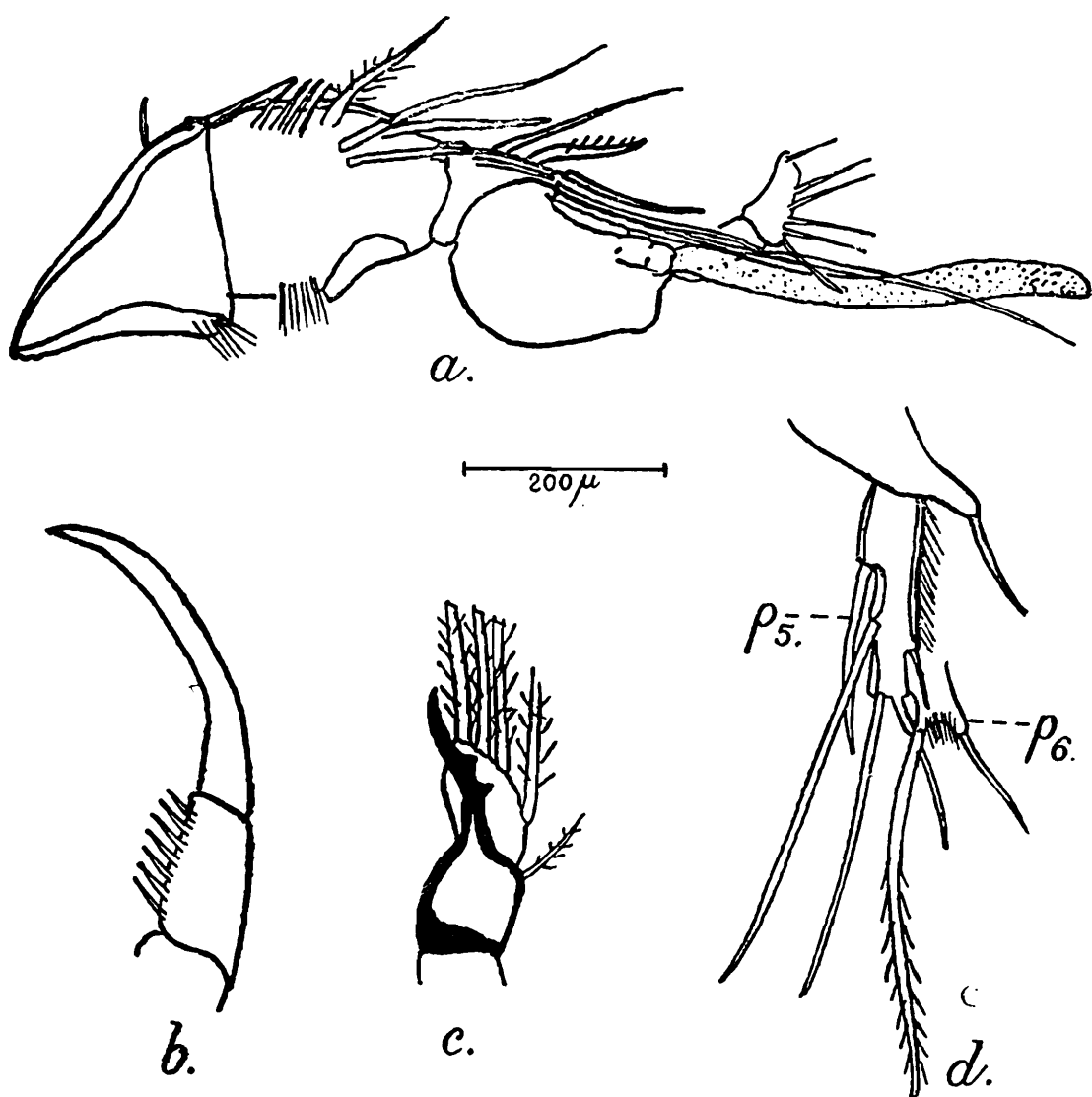


TEXT-FIG. 1.—*Laophonte* (*Mesolaophonte*) *pseudo-oculata*, sp. nov.

a., female, dorsal view; b., cephalosome with cuticular lens; c., bunch of spinules on the outer posterior edges of metasome segments; *gd.*, furcal rami; e., antennule; f., antenna; g., mandible; h., maxillipede; i., first leg; j., second leg; k., third leg; l., leg; m., fifth leg.

carrying an outer spine and the terminal joint two outer spines and an apical plumose seta. In the endopod, the first joint is nearly four times longer than broad and twice as long as the exopod. The second

endopod joint is only a fourth in length of the first joint and carries a long slender claw. In the second leg (Text-fig. 1j) the basal₂ has a bunch of hairs on the outer side and a plumose seta. The exopod is three-jointed, whereas the endopod is only two-jointed. The first and the second joints of the exopod carry an outer spine each and have their outer margins hirsute. The second joint carries an inner seta also. The third joint has three outer spines, one inner and two apical plumose setae. The endopod is very short and the first joint is devoid of setae. The second joint carries two apical and two inner setae and its outer margin is hirsute. In the third leg, the exopod resembles the second one, but the endopod (Text-fig. 1k) differs in having one outer, two apical



TEXT-FIG. 2.—*Laophonte* (*Mesolaophonte*) *pseudo-oculata*, sp. nov. ♂

a., antennule ; b., claw in the endopod of first leg ; c., endopod of the third leg ; d., fifth and sixth legs.

and two inner setae. In the fourth leg, the exopod is as in other legs but the endopod differs in the first segment having one inner seta and the second segment having one seta on the inner as well as the outer side and two setae apically. All the legs are hirsute. In the fifth leg (Text-fig. 1l), the basal expansion carries one outer seta and four setae on the inner side. The distal joint is long and narrow, slightly tapered posteriorly, with the outer as well as the inner margin hirsute. It has one inner, one apical, and three outer setae.

Male (Text-fig. 2a—d)

Resembles the female in the general shape of the body, but is smaller in size; (length: 0.95—1.0 mm.). The urosome is composed of five joints as in other members of this genus. The six-jointed antennule (Text-fig. 2a) is geniculate and powerfully built. The fourth joint is swollen and the fifth and the sixth joints are hinged to it. It also carries a stout aesthete. The setae are distributed as follows:—

Joints	1	2	3	4	5	6
No. of setae	2	4	3	3	—	6

The first leg resembles that of the female in general shape, but differs in the second joint of the endopod carrying spinules on the inner side (Text-fig. 2b).

The second and the fourth legs resemble those of the female. In the third leg, the endopod shows the usual modification. The distal end of the second segment is produced into a spinous projection extending beyond the joint as in *L. nordgaardi* Sars and *L. adduensis* Sewell³. The projection itself carries two outer ridges. The distal joint carries four setae. In the fifth leg (Text-fig. 2c) the basal joint has only an outer spine and there is no inner expansion. The distal joint which is long and slender has a hirsute outer margin and carries one outer, two apical, and two inner setae. The sixth leg (Text-fig. 2d) is represented by a small lamina with a slender outer seta and a thick plumose inner seta.

Remarks.—Since the inception of the genus *Laophonte* by Phillip in 1840, over a hundred species have been described by various authors. Nicholls¹ as well as Lang² in their revision of the genus have split it into a number of sub-genera or have grouped the species in different genera. In the present paper the writer has accepted and followed the classification suggested by Nicholls (*loc. cit.*), according to which the present form is referable to his subgenus *Mesolaophonte* on account of the presence of only two inner setae on the end segment of the third endopod. Among the members of the *Mesolaophonte* the present form belongs to the *exigua* group (*vide* Nicholls, 1941) in the presence of four setae on the end segment of the exopod (1.2.1), but differs from all the other forms of this group. It closely approaches *L. gracilipes* Brady in the presence of four setae on the basal segment of the fifth leg, but differs in other structural details. The presence of corneal lens is a characteristic feature of this species, and has been recorded only in *Laophonte* (*L.*) *oculata* Gurney.

ACKNOWLEDGMENT

I am grateful to Dr. C. P. Gnanamuthu, Director, Zoology Laboratory, University of Madras, for suggestions and interest in this work and to Mr. N. Balakrishna Nair, Senior Govt. of India Scholar, Zoology Laboratory, for helping me to examine the logs infested with Teredos.

¹Nicholls, *Rec. S. Aust. Mus.*, 8, No. 1 (1941).

²Lang, K., *Monographie der Harpacticiden*, Lund. (1948).

³Nicholls, *Ann. Mag. nat. Hist.*, 11, p. 495, fig. 5 (1944).

ON THE BREEDING HABITS AND LARVAL STAGES OF SOME CRABS OF BOMBAY

By

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INTRODUCTION

Extensive studies have been carried out on the larval stages of British and American Brachyura by Lebour (1927-1947), Churchill (1917-18, 1942), and others. However, hardly any studies on this aspect of the problem have been made in India. A few notable exceptions are the works of Menon (1933 ; 1937 ; 1953), Naidu (1951), and Prasad and Tampi (1953). The early developmental stages of *Scylla serrata*, the commonest Indian crab, have also been studied by Arriola (1940) in the Philippines. Barring these sketchy observations, no account of the larval stages of our crabs is available. The present work, therefore, is an effort to increase our knowledge of these stages as they occur in Bombay.

MATERIAL AND METHODS

The zoeae and megalopae were secured by the use of townets operated from the stern of two forty-foot power-boats, the "Vicky" and "Mysis", belonging to the Taraporevala Aquarium. A circular plankton net with a ring diameter of 20 inches and made of fine Swiss organdy cloth was used, a large bottle being tied at the tip of the net. Towsings were made just below the surface and varied from 8-15 minutes. Runs were made, weather and tide permitting, from opposite the Taraporevala Aquarium west to Malabar Hill and beyond. A smaller plankton net with a ring diameter of 10 inches and made of bolting silk was also used for making collections along the shore at Marine Drive, Apollo Bunder and Sassoon Dock. The contents of the bottle were immediately transferred to a larger, shallow jar, and the samples were examined alive in the laboratory and sorted out. They were then kept in aerated dishes or finger-bowls, and fed with diatoms and mollusc larvae. The zoeae were examined with the aid of a binocular microscope, in watch glasses and cavity slides. Appendages were cut off with a pair of entomological needles No. 20 mounted in holders. This was necessary especially in examining the details and making counts of the hairs on the various appendages.

Drawings were made with the aid of a camera lucida. The dimensions of the zoeae were obtained by the use of ocular and stage micrometers on the specimens themselves, and checked by projecting with the camera lucida the markings of the stage micrometer on the drawings made at the same magnification.

BREEDING HABITS

The study of the breeding habits of crabs presents considerable difficulties because of limitations of underwater observations. Consequently, a knowledge of the breeding habits of Indian crabs has been very limited, except for the recent publication by Menon (1952).

A suitable method for observing their breeding habits is to keep a pair of crabs in a tank. This, even in the most suitable environments is, after all, an artificial method which may cause deviation from the normal habits of an animal. However, in the absence of more convenient methods, observations in a large tank in which the environment is made as natural as possible, are quite accurate, and this is what has been done in the present case. Another difficulty in the way of their observation is the readiness with which copulating crabs will separate on the slightest disturbance. Observations on mating habit had, therefore, to be limited to opportunities available at the Taraporevala Aquarium, where luckily a spacious tank 10' $\times$ 4' $\times$ 4' was set aside for this purpose.

Mating habits.—A number of specimens of both sexes of *Scylla serrata*, *Neptunus* (*Neptunus*) *pelagicus* and *Neptunus* (*Neptunus*) *sanguinolentus* were released in large aquarium tank to study their mating habits. Out of the three species, the mating habits of *Neptunus* (*Neptunus*) *pelagicus* and *Neptunus* (*Neptunus*) *sanguinolentus* could be studied with a fair degree of accuracy within the artificial conditions of an aquarium. Although the details of the phenomenon in each species may be slightly different, it is presumed that the general procedure will be somewhat similar. The details of these mating habits in case of *Neptunus* (*Neptunus*) *pelagicus* are as follows :—

In the male, the first and second pair of abdominal appendages act as genital organs. The first pair is a tube-like organ, while the second is a jointed rod. The two are usually separate, but the second is capable of being inserted into the first.

The female is in a "soft" state during copulation, *i.e.*, it has just moulted. Before copulation, the male holds the female with the second pair of walking legs. The female at this stage is upright, with its back against the abdomen of the male, and is quite passive. It is not attracted towards any food, but the cleaning operation of the gills by moving the third pair of maxillipedes to and fro takes place.

The male, on the contrary, is very active and drives away any intruder with its chelipeds. If, however, the intruder persists in advancing the male, catching the female in its legs, it swims away. The pair may thus lie in the same position for two or three days.

Sometimes it happens that the female is "hard" (*i.e.*, not recently moulted) when the male catches her. In that case, the male still holds the female which struggles hard, not to get away from the male, but to get rid of its moult.

When copulation begins, the male turns the female so that the latter is now inverted, with its abdomen apposed to that of the male. The male then inserts the second pair of abdominal appendages inside the first, and both together acting as a penis are thrust into the female openings. The first pair is capable of very little motion in this position, but the second pair of appendages can move freely up and down inside the first, very much like the piston of a pump. In fact, it is a pump forcing the sperms into the female. The rate of motion of the penis is, in this crab, about 15-18 times a minute, while Williamson (1904) observed this motion to take place about once every two seconds in the case of *Carcinus maenas*. Copulation may last for three to four hours, after which the crabs separate.

The abdomen of the male during copulation is shut against the sternum, only the penis protruding, and the abdomen of the female is opened only just sufficiently for the penis to move freely. If the crabs are disturbed during copulation, the act ceases and the crabs readily separate, so that it is difficult to observe complete copulation. Sometimes, during copulation, two or more males will fight for the possession of the female, and in trying to snatch away the female, will tear it to pieces, since at this time it is soft and helpless.

BREEDING SEASON

Determination of the breeding season in crabs is comparatively easy, as instead of liberating the eggs loose into the sea like some of the fishes, they have the eggs attached to the pleopods of the female crabs. Thus, the occurrence of "berried" crabs clearly indicates the breeding period. Various authors (Lebour, 1927-1947; Menon, 1933-1937; Churchill, 1917-1942, etc.) have used this method to determine the breeding season, and have been successful in elucidating the results. In the present study, observations on breeding season and surmises thereabout had to be made on the basis of collection of berried crabs during different periods of the year. In the following table, the days when berried crabs of different species were collected have been furnished as the months in which these crabs were found can roughly be taken to indicate the breeding season of the respective crabs.

TABLE 1

Name of crab						Day of collection	Diameter of egg in millimetres
<i>Matuta lunaris</i>	.	.	.	.	.	{ 12-2-1952 17-11-1952 22-11-1952	0.266
<i>Philyra globosa</i>	.	.	.	.	.	{ 7-12-1952 9-1-1953 3-3-1953	0.233
<i>Doclea gracilipes</i>	.	.	.	.	.	12-2-1952	0.566
<i>Scylla serrata</i>	.	.	.	.	.	24-4-1954	—
<i>Neptunus (Neptunus) sanguinolentus</i>	.	.	.	.	.	{ 27-10-1951 2-11-1951 11-12-1951 22-1-1952 15-4-1952 15-7-1952 20-11-1952	0.233.
<i>Neptunus (Neptunus) pelagicus</i>	.	.	.	.	.	{ 24-10-1951 17-12-1951 22-1-1952 12-2-1952 11-7-1952 25-11-1952	0.233.
<i>Charybdis (Goniosoma) cruciata</i>	.	.	.	.	.	17-12-1951	0.250.
<i>Charybdis (Goniosoma) annulata</i>	.	.	.	.	.	{ 27-11-1951 7-12-1951 24-1-1952	0.233
<i>Charybdis (Goniosoma) callianassa</i>	.	.	.	.	.	3-10-1951	0.266
<i>Charybdis (Goniosoma) orientalis</i>	.	.	.	.	.	{ 11-12-1951 14-12-1951	0.300
<i>Thalamita crenata</i>	.	.	.	.	.	3-11-1951	0.266.
<i>Leptodius exaratus</i>	.	.	.	.	.	{ 20-3-1953 29-3-1953	0.300
<i>Leptodius crassimnus.</i>	.	.	.	.	.	{ 12-11-1951 19-11-1951	0.300.
<i>Myomenippe hardwickii</i>	.	.	.	.	.	—	0.500.

TABLE 1---*contd.*

Name of crab	Day of collection	Diameter of egg in millimetres
<i>Ozius rugulosus</i> .	. { 29-11-1951 10-12-1951 30-6-1952 }	0.333
<i>Pilumnus vespertilio</i>	29-11-1951	0.366
<i>Euryacarcinus orientalis</i>	{ 8-11-1952 21-11-1952 }	0.300
<i>Litocheria angustifrons</i> . .	. { 29-11-1951 20-3-1952 }	0.333
<i>Eucrate crenata dentata</i> .	. { 27-11-1951 7-12-1952 }	0.333
<i>Pinnotheres placunae</i>	—	0.300
<i>Gelasimus annulipes</i>	. { 20-3-1953 31-3-1953 }	0.266
<i>Metopograpsus messor</i> .	20-3-1953	0.350
<i>Pseudograpsus intermedius</i>	. { 17-3-1953 3-4-1953 }	0.288

From the above table it will be seen that the majority of crabs of Bombay State breed from November to March, but a few such as *Neptunus* (*Neptunus*) *sanguinolentus* and *Neptunus* (*Neptunus*) *pelagicus* breed irregularly at different periods throughout the year.

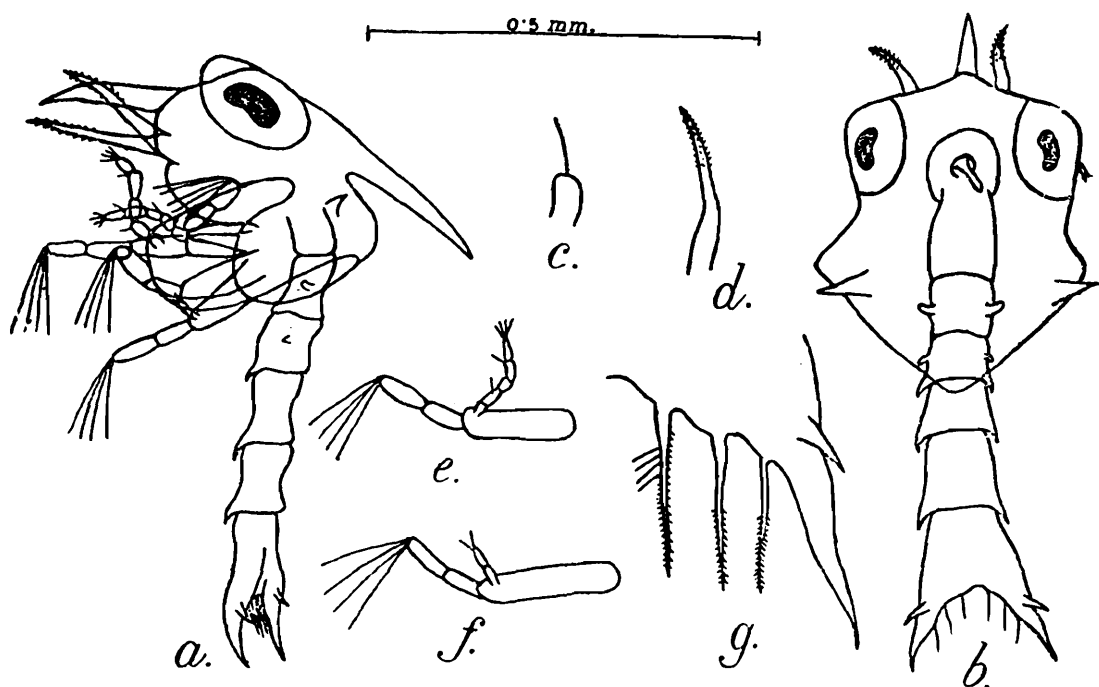
1. First zoea of *Neptunus* (*Neptunus*) *sanguinolentus* (Text-fig. 1)

Measurements in mm. : Body length 0.533 ; body width, between (and including) the eyes 0.266 ; body width between bases of lateral spines 0.360 ; dorsal spine 0.233 ; rostral spine 0.214 ; lateral spine 0.060 ; antenna 0.214.

The carapace is rounded. The dorsal spine is hardly longer than the rostral spine, while the lateral spines are very short. The antennule is an unjointed appendage with a single aesthete. The antenna is much longer than the antennule, it is unjointed and bears spines on its distal half. The first maxillipede consists of a stout basipodite, a two jointed exopodite bearing four hairs at the tip, and an endopodite of five segments with four setae at the tip and others along the joints. The second maxillipede is similar to the first except that the endopodite consists of two joints only, with two hairs at the tip. The abdomen consists of five joints and a telson. The second and third joints bear a pair of lateral hooks, the anterior pair being slightly larger and anteriorly directed, while the second pair is posteriorly directed. The telson is

regularly forked. Inside the fork are three pairs of setae. The innermost pair of setae bears four minute hairs on the inside and a row of spinules on the outer surface. The other setae bear spinules on both their surfaces. There are, in addition, two spines on the dorsal surface of the base of the forks of the telson.

The first zoea of *Neptunus* (*Neptunus*) *sanguinolentus* is very similar to that of *Neptunus* (*Neptunus*) *pelagicus*, but it can be distinguished from the latter in being much smaller and in having only four hairs on the inner border of the innermost setae in the fork of the telson.



TEXT-FIG. 1.—*Neptunus* (*Neptunus*) *sanguinolentus* (Herbst), 1st Zoea.

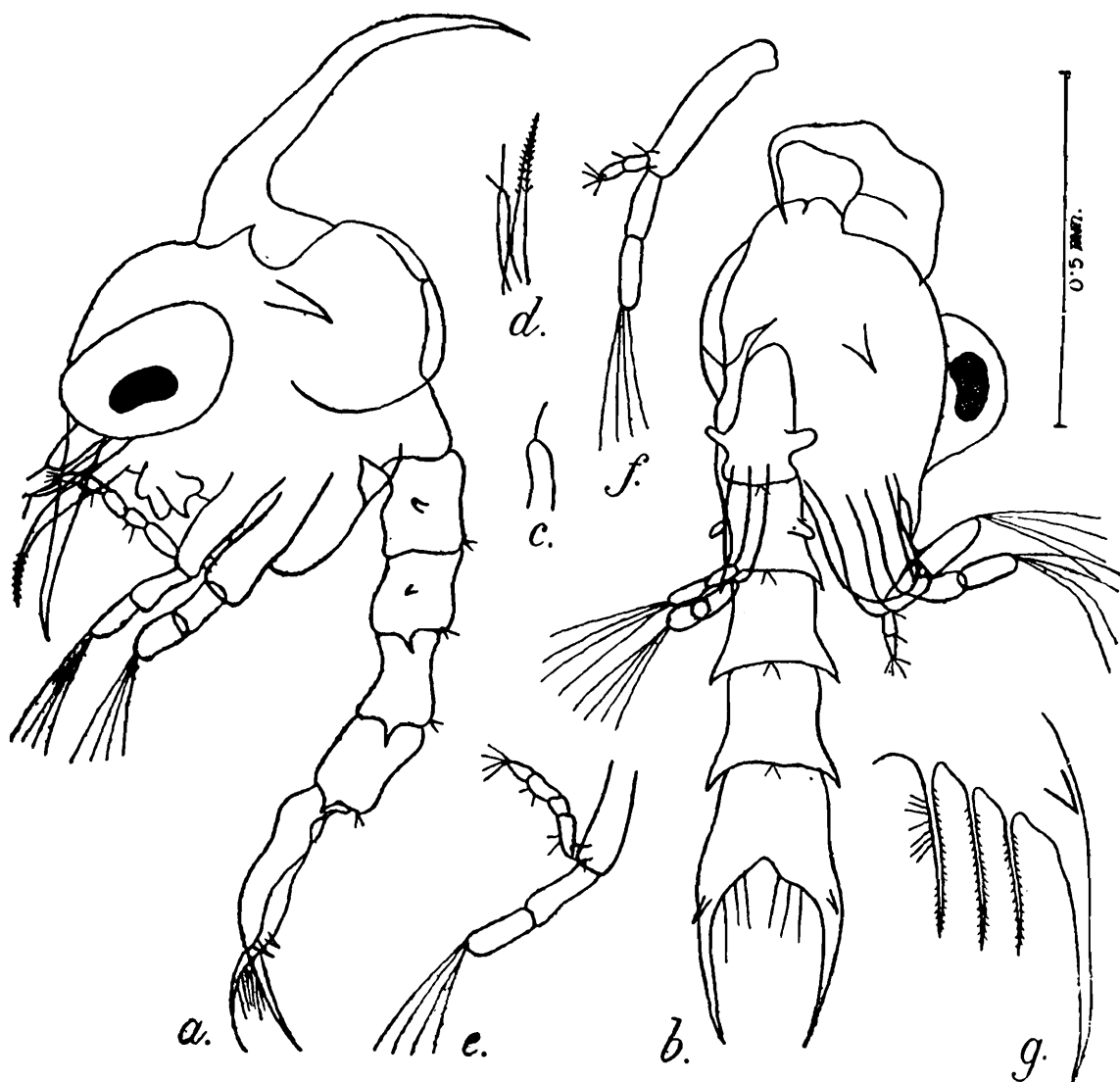
a. Side view; b. Dorsal view; c. Antennule; d. Antenna; e. 1st maxillipede; f. 2nd maxillipede; g. Telson (right half, enlarged).

2. First zoea of *Neptunus* (*Neptunus*) *pelagicus* (Text-fig. 2)

Measurements in mm.: Body length 1.173; body width between the eyes 0.366; body width between bases of lateral spines 0.500; dorsal spine 0.533; rostral spine 0.333; lateral spine 0.133; antenna 0.293.

Though a detailed description of this zoea has been given by Prasad and Tampi (*op. cit.*), the following points noted by the author may be mentioned.

Prasad and Tampi have noted three aesthetes on the tip of the, antennule. Only one aesthete has been noted in the present specimens. Moreover, the endopodite of the second maxillipedes in the present specimens consists of three segments, the first being very short. Prasad and Tampi have mentioned only two segments. On the fork of the telson there are only two spines, as opposed to four given by Prasad and Tampi.



TEXT-FIG. 2.—*Neptunus* (*Neptunus*) *pelagicus* (Linnaeus), 1st Zoea.

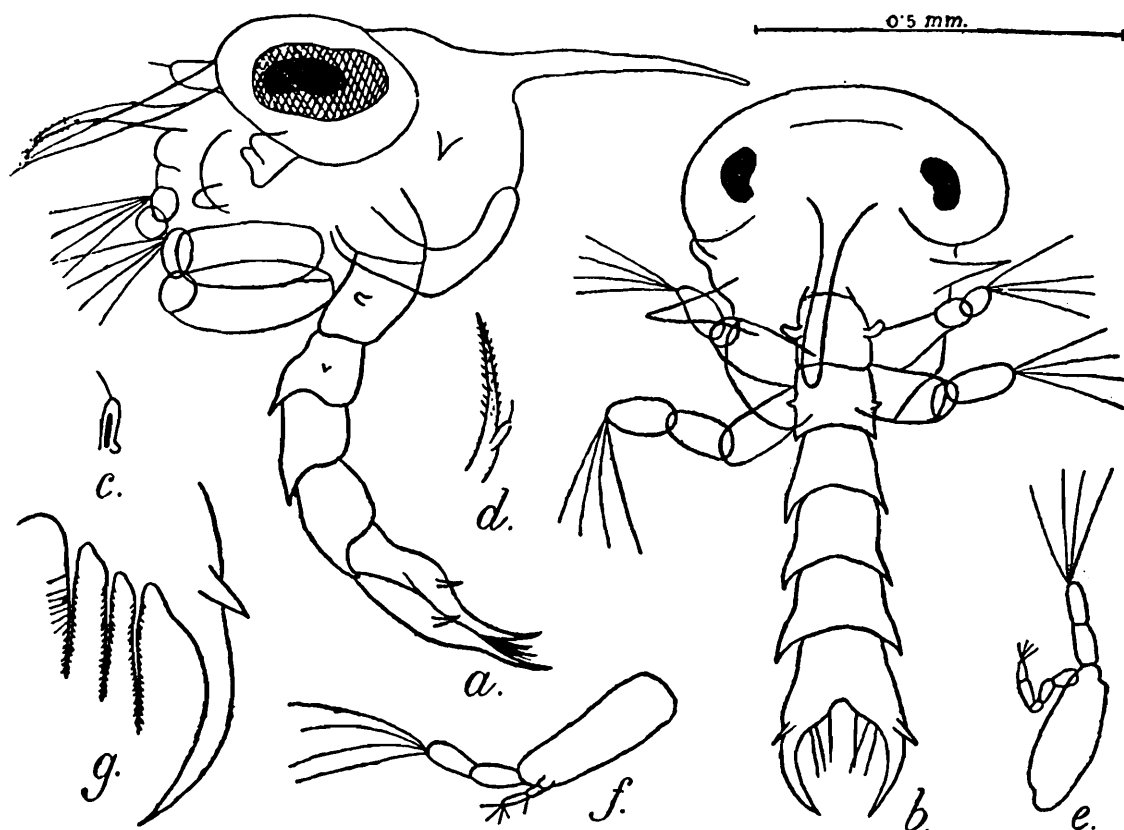
a. Side view ; b. Dorsal view ; c. Antennule ; d. Antenna ; e. 1st maxillipede ; f. 2nd maxillipede ; g. Telson (right half, enlarged).

3. First zoea of *Charybdis* (*Goniosoma*) *orientalis* (Text-fig. 3)

Measurements in mm. : Body length 0.733 ; body width between the eyes 0.288 ; body width between bases of lateral spines 0.420 ; dorsal spine 0.288 ; rostral spine 0.233 ; lateral spine 0.066 ; antenna 0.166.

The carapace is rounded. The dorsal spine is regularly curved and is slightly longer than the straight rostrum. The antennule is a short unjointed pigmented process with a single aesthete. The antenna consists of a well-developed spiniform process which is nearly as long as the rostrum and a small exopodite bearing a setae. The first maxillipede has the usual stout basipodite, an exopodite of two segments with four setae at the tip, and a five-jointed endopodite with four setae at the tip. In the second maxillipede, the endopodite consists of three joints. The abdomen consists of five segments and a telson. The second and third segments have the usual lateral hooks, while the third, fourth and fifth segments have a pair of long downwardly directed spines from the postero-lateral border. The forks of the telson are curiously inbent posteriorly in a regular curve, and bear two spines. There are

seven hairs on the inner border of the innermost pair of setae in the fork of the telson, followed by a few spinules. The outer surface of



TEXT-FIG. 3.—*Charybdis (Goniosoma) orientalis* (Dana), 1st Zoea.

a. Side view ; b. Dorsal view ; c. Antennule ; d. Antenna ; e. 1st maxillipede ; f. 2nd maxillipede ; g. Telson (right half, enlarged).

these setae and both the borders of the other setae are spinulate.

4. First zoea of *Thalamita crenata* (Text-fig. 4)

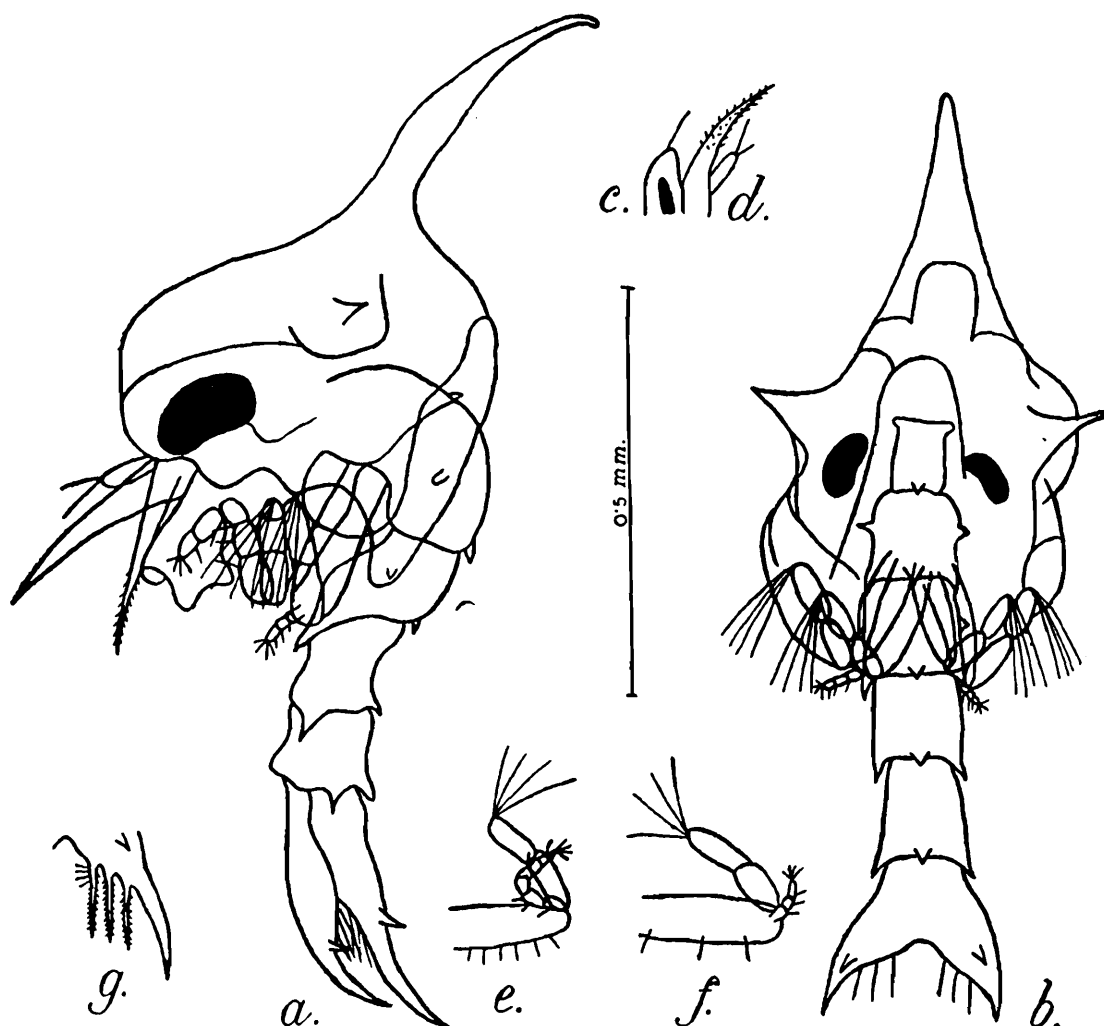
Measurements in mm. : Body length 0.744 ; body width between the eyes 0.300 ; body width between bases of lateral spines 0.212 ; dorsal spine 0.238 ; rostral spine 0.188 ; lateral spine 0.088 ; antennule 0.073 ; antenna 0.177

A description of this zoea has been given by Prasad and Tampi. They have failed to observe a spine on each of the abdominal segments in the middle of the posterior border. The author has noted only one aesthetasc on the antennule, instead of three, and only two spines at the base of the telson instead of four as described by previous authors. Moreover, there are only four hairs on the inner border of the innermost pair of setae in the fork of the telson.

5. First zoea of *Leptodius exaratus* (Text-fig. 5)

Measurements in mm. : Body length 1.00 ; body width between the eyes 0.40 ; body width between bases of lateral spines 0.33 ; dorsal spine 0.40 ; rostral spine 0.33 ; lateral spine 0.11.

The carapace is peculiar in that its posterior dorsal border has two lobes. All four spines are present. The antennule is a short process with two aesthetes. The antenna is long and smooth. The first maxillipede has the usual basipodite, two-jointed exopodite with four setae at the tip, and five-jointed endopodite. The second maxillipede has its endopodite of three joints. The abdomen consists of five segments and a telson. The second and third segments bear lateral hooks, while the third and fourth joints have downwardly directed spines on the postero-lateral border. The forks of the telson are broad in their basal part and become narrow distally. The innermost pair of



TEXT-FIG. 4.—*Thalamita crenata* Milne-Edwards, 1st Zoea.

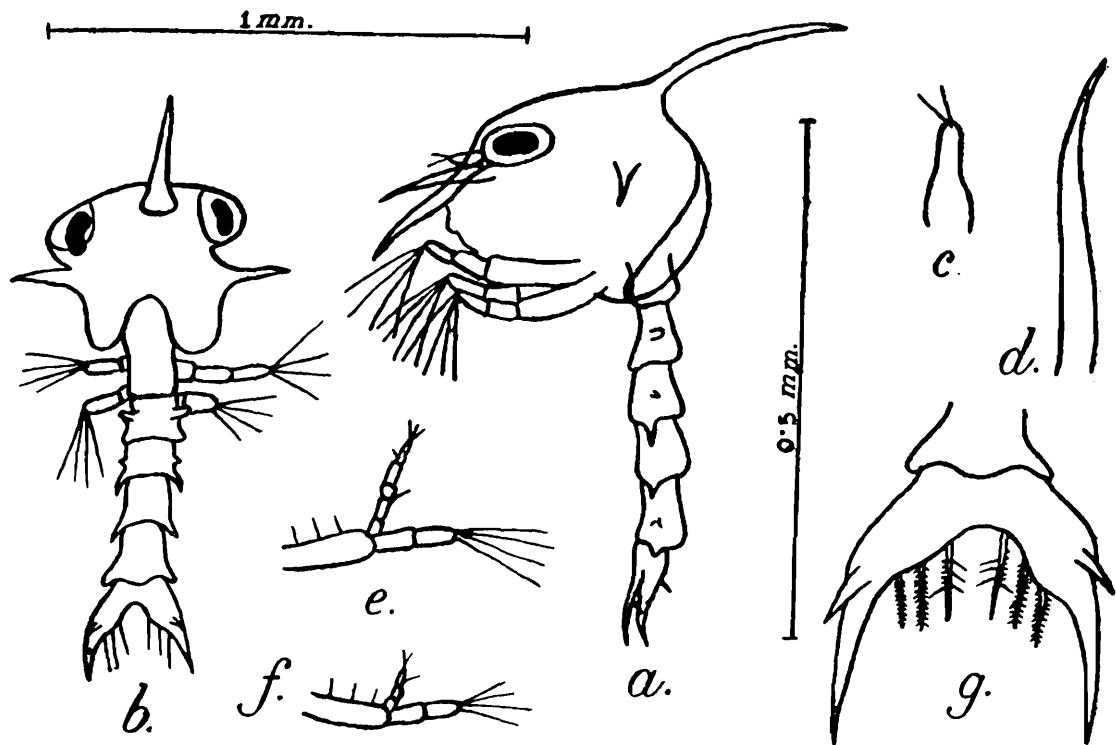
a. Side view ; b. Dorsal view ; c. Antennule ; d. Antenna ; e. 1st maxillipede ; f. 2nd maxillipede ; g. Telson (right half, enlarged).

setae in the fork of the telson bear four hairs on their inner border and a hair and some spinules on the outer border. The other setae bear spinules. The usual pair of spines at the base of the telson is present.

6. First zoea of *Ozius rugulosus* (Text-fig. 6)

Measurements in mm. : Body length 0.900 ; body width between the eyes 0.400 ; body width between bases of lateral spines 0.700 ; dorsal spine 0.433 ; rostral spine 0.400 ; lateral spine 0.166 ; antenna 0.233.

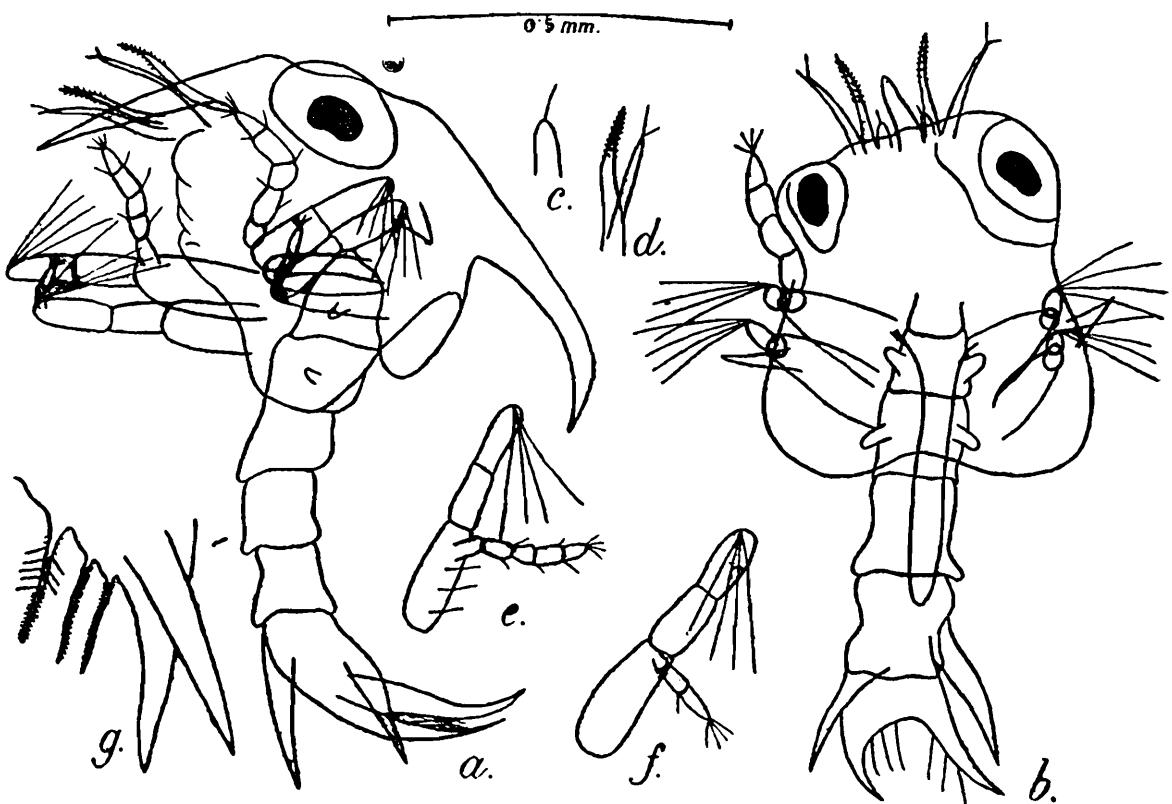
The dorsal spine is curved throughout its length. The lateral spines are very short. The antennule is an unjointed process with



TEXT-FIG. 5.—*Leptodius exaratus* Milne-Edwards, 1st Zoea.

a. Side view ; b. Dorsal view ; c. Antennule ; d. Antenna ; e. 1st maxillipede ; f. 2nd maxillipede ; g. Telson (right half, enlarged).

a single aesthete. The antenna consists of a well developed spiniform process, and a long exopodite bearing two setae. The first and second



TEXT-FIG. 6.—*Ozius rugulosus* Stimpson, 1st Zoea.

a. Side view ; b. Dorsal view ; c. Antennule ; d. Antenna ; e. 1st maxillipede ; f. 2nd maxillipede ; g. Telson (right half, enlarged).

maxillipeds have the usual structure. The abdomen consists of five segments and telson. The lateral hooks on the second and third segments of the abdomen are present. The spines on the base of the telson are very long in this zoea, indeed as long as the fork of the telson. The innermost setae in the fork of the telson bear five hairs and some spinules on the inner border, and there are hairs and some spinules on the outer border. The second pair of setae bear spinules only on their outer border, and the outermost pair only on the inner border.

7. First zoea of *Eucrate crenata dentata* (Text-fig. 7)

Measurements in mm. : Body length 0.933 ; body width between the eyes 0.275 ; body width between bases of lateral spines 0.589 ; dorsal spine 0.566 ; rostral spine 0.366 ; lateral spine 0.589.

The carapace is small and rounded. The dorsal spine is a huge process much like a dunce's cap and is more than half the length of the zoea. The rostrum is also comparatively long, and the lateral spines are directed forward like the horns of a bull. The antennule is thin and club-shaped, and bears a single aesthete. The antenna consists of a long spiniform process, and a smooth exopodite which is longer than the spinous process. The first maxillipede consists of a narrow basipodite, a two-jointed exopodite bearing four setae at the tip, and a five-jointed endopodite with four setae at the tip and others along its length. The second maxillipede is similar to the first, except that its endopodite consists of three segments. The abdomen consists of five segments and a telson. The lateral knobs on the third segment are very minute, almost invisible. The innermost setae in the fork of the telson bear numerous minute hairs on their outer border, but are smooth on the inner border. The middle setae bear hairs on the basal half of their inner border and spinules on their outer border. The outermost setae bear hairs throughout their inner border and spinules on their outer border. The usual spines on the base of the telson are present.

8. First zoea of *Gelasimus annulipes* (Text-fig. 8)

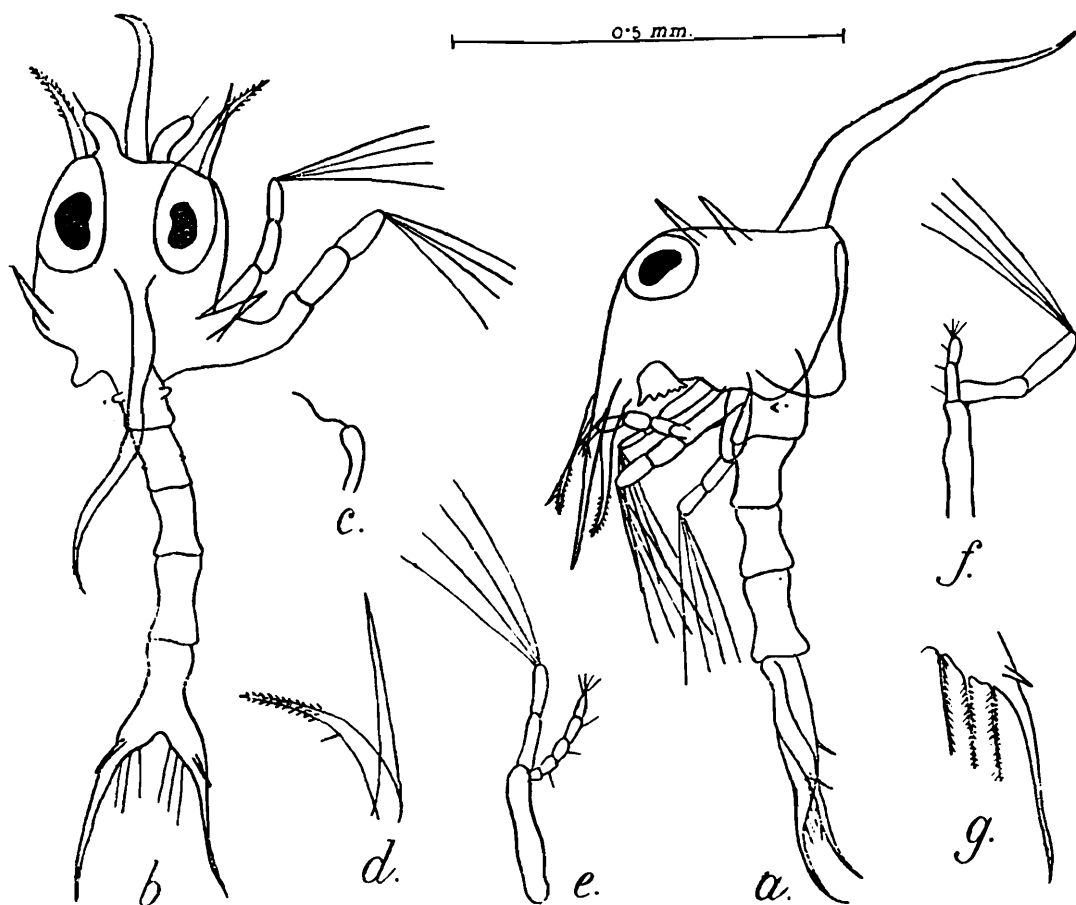
Measurements in mm. : Body length 0.74 ; body width between the eyes 0.25 ; body width 0.18 ; dorsal spine 0.092 ; rostral spine 0.13.

The lateral spines are absent in this zoea, not even indicated by any protuberance. The dorsal spine is shorter than the rostrum. A pair of oval chromatophores are present at the base of the dorsal spine. The antennule is a stout unjointed process bearing two aesthetes. The antenna is a spinous process not much longer than the antennule. The first and second maxillipedes have the usual structure. The abdomen consists of five joints and a telson. The fourth joint is much broader than the others and the next joint is embedded in its posterior border.

9. First zoea of *Metopograpsus messor* (Text-fig. 9)

Measurements in mm.: Body length 1.07; body width between the eyes 0.33; body width between lateral prominences 0.32; dorsal spine 0.33; rostral spine 0.26.

The carapace is rounded. The dorsal and rostral spines are well developed. There are no lateral spines, but indications can be seen as lateral protuberances. The antennule is a stout unjointed process with



TEXT- FIG. 7.—*Eucrate crenata dentata* (Stimpson), 1st Zoea.

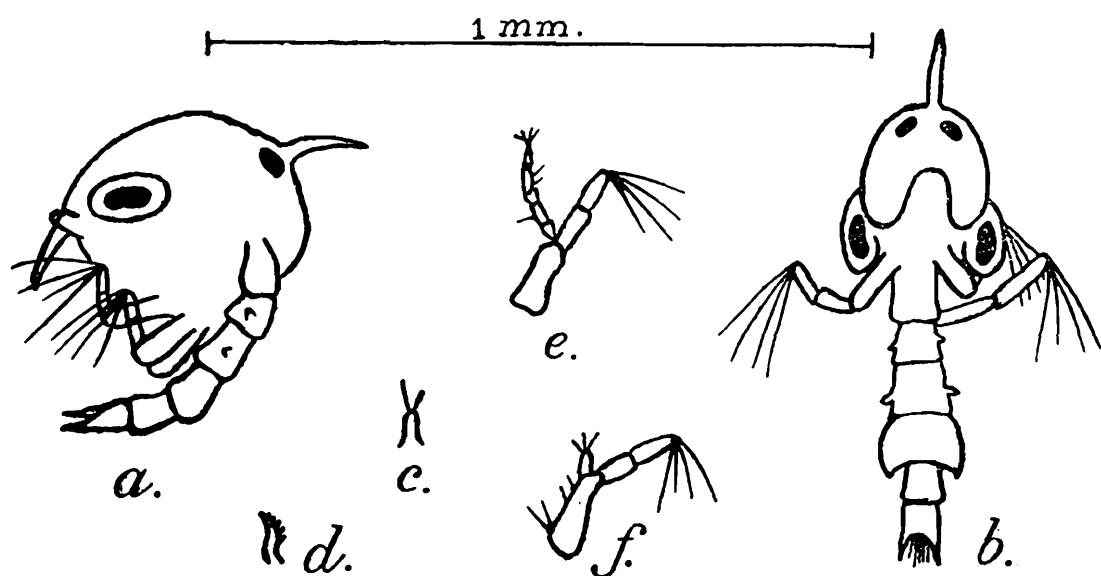
a. Side view; b. Dorsal view; c. Antennule; d. Antenna; e. 1st maxillipede; f. 2nd maxillipede; g. Telson (right half, enlarged).

three aesthetes. The antenna is a bent process with spinules near the tip. The first maxillipede consists of a stout base, a two-jointed exopodite bearing four plumose hairs at the tip, and an endopodite of five joints. The endopodite of the second maxillipede consists of four joints. The abdomen is composed of five segments and a telson. Lateral hooks are present on the second and third segments, while the fifth segment has peculiar fan-like projections on its postero-lateral borders. The innermost setae on the fork of the telson bear spinules along their outer border, while the other setae bear spinules along both the borders.

10. First zoea of *Pseudograpsus intermedius* (Text-fig. 10)

Measurements in mm.: Body length 0.85; body width between the eyes 0.35; body width between lateral protuberances 0.29; dorsal spine 0.16; rostral spine 0.11.

The carapace is rounded. The dorsal and rostral spines are well developed but the lateral spines are rudimentary and seen only as small prominences. The antennule is a short unjointed process with two aesthetes. The antenna is short and smooth. The maxillipedes have the usual structure. The abdomen consists of five segments and a telson. The telson is long and slightly paddle-like. The innermost setae in the fork of the telson bear six hairs on their inner border, while the middle pair bears eight. Both these pairs are smooth along their outer border, as also are both borders of the outermost pair. Two spines are present at the base of the telson.



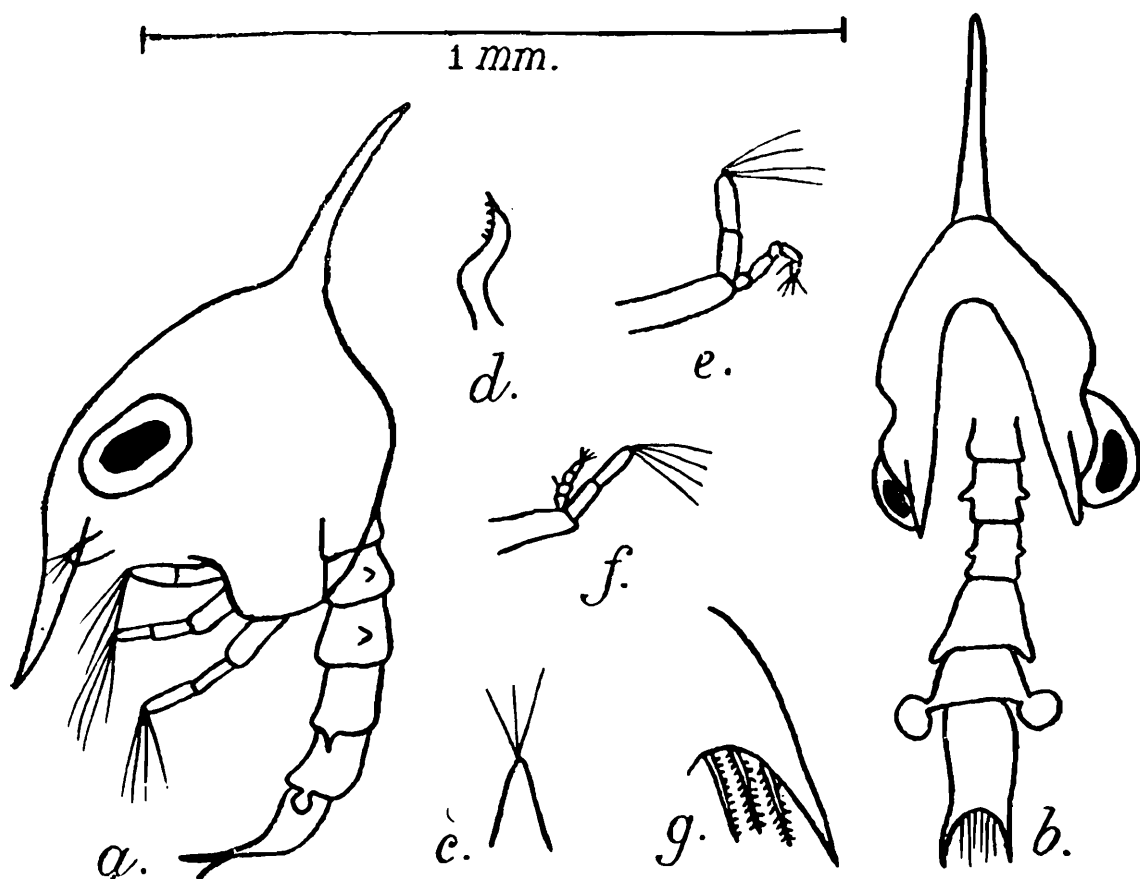
TEXT-FIG. 8.—*Gelasimus annulipes* Latreille, 1st Zoea.

a. Side view ; b. Dorsal view ; c. Antennule ; d. Antenna ; e. 1st maxillipede ; f. 2nd maxillipede.

In the absence of sufficiently extensive material of the zoeae of different species of crabs, previous authors had not furnished keys for the identification of larval Brachyura. The present material, however, is large enough for a comparative study of the external characters of different larvae collected so far and has made it possible to formulate an artificial key to the identification of many of the zoeae of Bombay waters as given under :—

Key of the zoea of Bombay crabs

1. Lateral spines on the carapace well-developed . 2
 - Lateral spines on the carapace absent or rudimentary . 8
2. Dorsal spine shorter or, at the most, as long as carapace . . . 3
 - Dorsal spine much longer than carapace . *Eucrate crenata dentata*
3. Spines on the dorsal surface of telson much smaller than the forks of the telson 4
 - Spines on the dorsal surface of telson almost as long as the forks of the telson . . *Ozius rugulosus*.



TEXT-FIG. 9.—*Metopograpsus messor* (Forskal), 1st Zoea.

a. Side view ; b. Dorsal view ; c. Antennule ; d. Antenna ; e. 1st maxillipede ; f. 2nd maxillipede ; g. Telson (right half, enlarged).

4. Arms of fork of telson pointing straight or outward

5

Arms of fork of telson curving inward

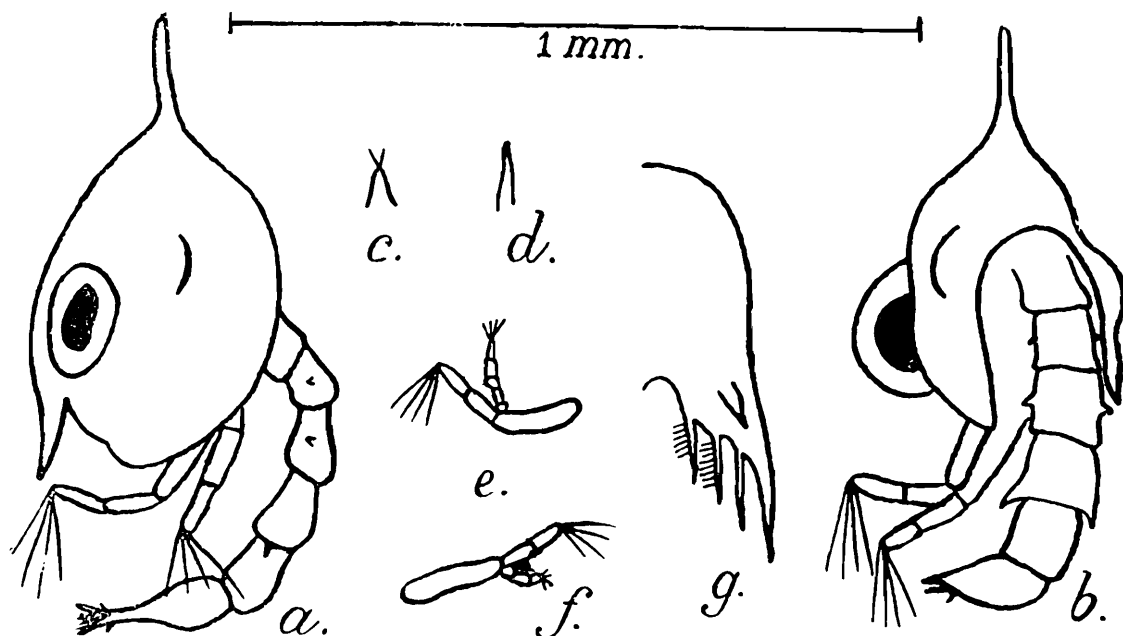
Charibdis (Goniosoma) orientalis

5. No spines on the middle of the dorsal surface of the abdominal segments

6

Spines on the middle of the dorsal surface of the abdominal segments present

Thalamita crenata



TEXT-FIG. 10.—*Pseudograpsus intermedius*, 1st Zoea.

a. Side view ; b. Dorsal view ; c. Antennule ; d. Antenna ; e. 1st maxillipede ; f. 2nd maxillipede , p. Telson (right half, enlarged).

6. Posterior border of carapace simply curved dorsally 7
 Posterior border of carapace dorsally divided into two lobes *Leptodius exaratus*
7. Four hairs on the inner side of the innermost pair of hairs in the fork of the telson *Neptunus (Neptunus) sanguinolentus*.
 Seven hairs on the inner side of the innermost pair of hairs in the fork of the telson *Neptunus (Neptunus) pelagicus*
8. Telson forked 9
 Telson plate-like . . . *Philyra globosa*
9. Lateral spines rudimentary but clearly visible as swellings on the carapace . 10
 No trace of lateral spines . *Gelasimus annulipes*
10. Lateral borders of last abdominal segment normal *Pseudograpsus intermedius*
 Lateral borders of last abdominal segment with fan-like projections *Metopograpsus messor*

Key to the megalopae of Bombay crabs

- 1 Dorsal spines on carapace present, no feelers on last joint of last leg . 2
 No dorsal spines on carapace, feelers on last joint of last leg present 4
2. Rostrum with two horns, ventral cornua absent *Doclea gracilipes*
 Rostrum three-horned, extremely long ventral cornua. *Philyra globosa*
4. Sides of rostrum pointed, but without accessory spinules. . . *Charybdis (Goniosoma) callianassa*
 Sides of rostrum rounded, with two minute spines . *Neptunus (Neptunus) pelagicus*

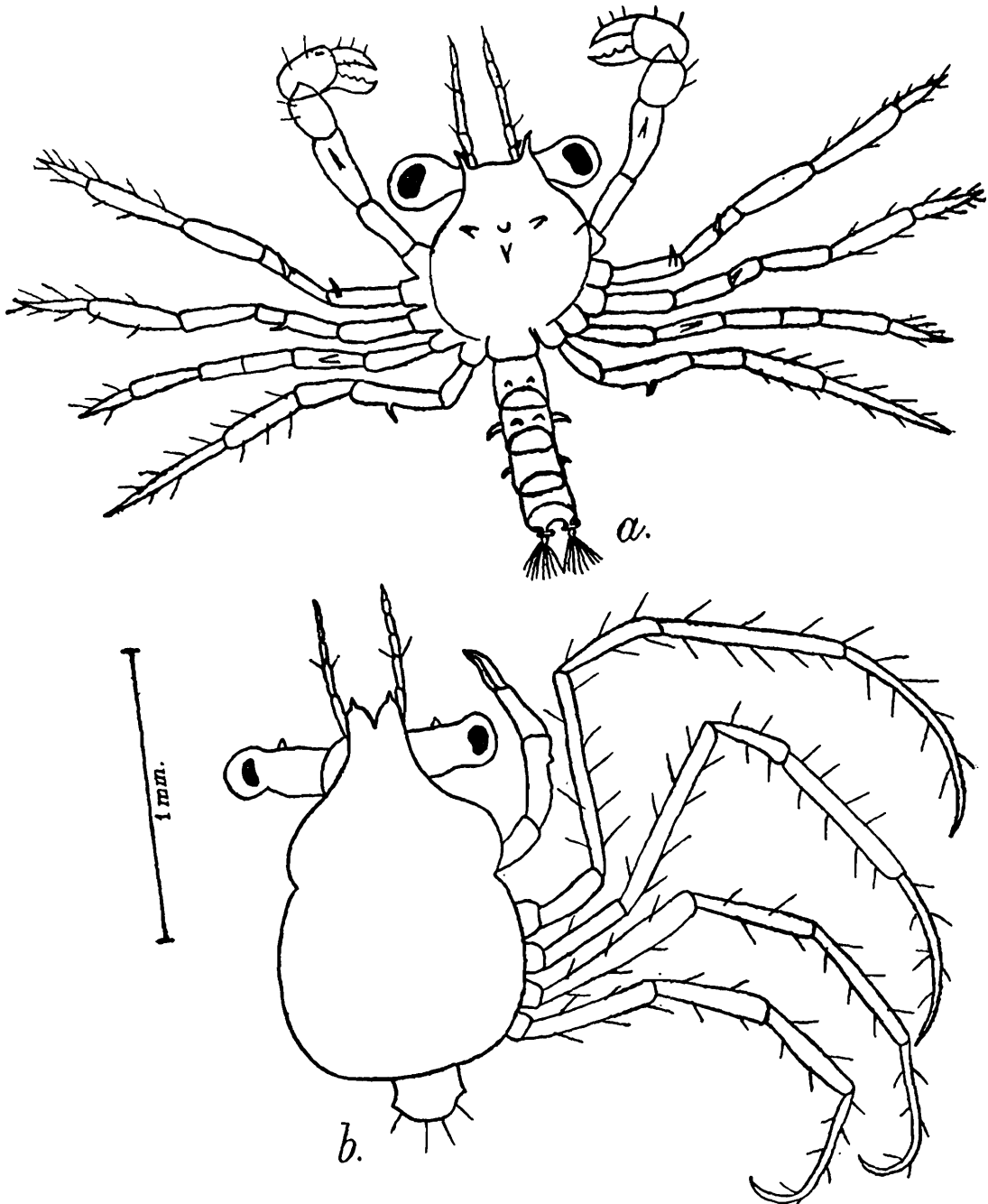
1. Megalopa of *Doclea gracilipes* (Text-fig. 11)

A megalopa was obtained on 7th July, 1952 and metamorphosed on 10th July into the first postlarval instar.

The megalopa is 1.5 mm long. The carapace is rounded, and on the dorsal surface are four spines arranged in the form of a triangle with its base forward and apex pointing backward. The rostrum consists of two horns at the extremity with a transverse border between them. The chelipeds and pereiopods are fully developed and are long. There is a spine in the middle of the meri of the chelipeds and walking legs, and the merus joint is incompletely divided into joints at this place. There is also a spine on the ischium of the first pair of walking legs. There are no feelers on the last joint of the last pair of legs in the shape of coarse curved setae. The abdomen consists of five segments and a telson.

On the dorsal surface of the second and third abdominal segments are two spinules placed side by side, while there are lateral hooks on the third and fourth abdominal segments. The pleopods of the last abdominal segment have eight setae each.

The characters for distinguishing megalopae of different genera and species are :—form of rostrum or front of carapace ; presence or absence



TEXT-FIG. 11.—*Doclea gracilipes* Stimpson. a. Megalopa ; b. 1st instar.

of median dorsal spine, or other spines or prominences, on the carapace ; presence or absence of feelers on the last legs ; number of setae on the last pleopods ; number of hooks on the legs. The megalopa of *Doclea gracilipes* can be distinguished by the presence of four spines on the carapace, two-horned rostrum, and spines on the meri of the pereopods.

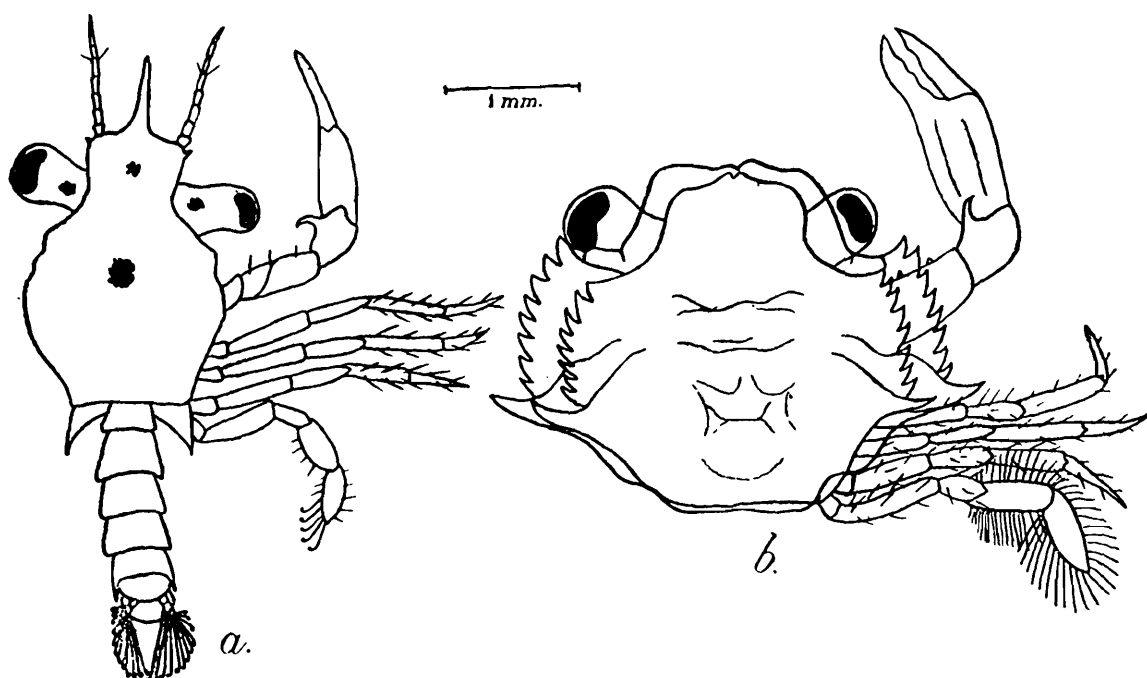
The first postlarval instar has the general proportions of the adult crab, the carapace being rounded, and the legs extremely long. The

rostrum now resembles that of the adult in being deeply cleft, without secondary spinules. The spines on the carapace have not yet developed. The eye stalks bear a minute spinule in their middle.

2. Megalopa of *Neptunus* (*Neptunus*) *pelagicus* (Text-fig. 12)

The megalopa has been described by Prasad and Tampi (*op. cit.*). The following new points may, however, be noted :—

Two minute spinules are present at the outer extremities of the rostrum. There are five coarse, curved setae on the last joint of the last pair of legs. The pleopods on the sixth abdominal segment bear only 12 setae each (Prasad and Tampi have mentioned 20 setae on all the pleopods).



TEXT-FIG. 12.—*Neptunus* (*Neptunus*) *pelagicus* (Linnaeus)

a. Megalopa ; b. 1st instar (with border of carapace of 2nd instar superimposed)

The megalopa was caught on January 2, 1952, and metamorphosed into the first postlarval instar on January 4. This again moulted into the second postlarval instar on January 6. Thus the period for the first postlarval instar before metamorphosing into the second was only two days. (Prasad and Tampi have recorded a uniform period of 6-10 days.) This period, however, varies with the availability of proper food, starved megalopae and crabs taking a much longer interval to moult.

3. Megalopa of *Charybdis* (*Goniosoma*) *callianassa* (Text-fig. 13)

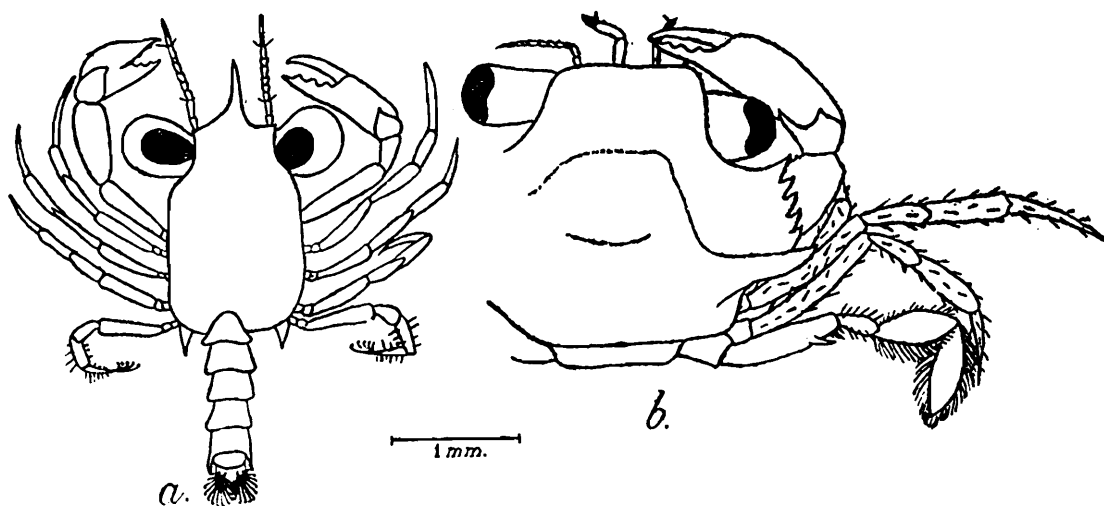
A megalopa was caught on May 23, 1952, and metamorphosed into the first postlarval instar on May 25.

The megalopa is 3.4 mm long. The carapace is elongate ; a rostrum in present and consists of a single long spine. The sides are angular.

A pair of ventral cornua (prolongations of the external plate of the last thoracic segment) is present.

The chelipeds and pereopods are fully developed. The last joint of the last pair of legs is flattened and bears along its inner border five coarse setae with curved tips and three straight setae. The other legs almost resemble those of the crab. The abdomen consists of six segments and a telson. The first segment is comparatively shorter than the rest and bears no pleopods. The postero-lateral borders of the fifth pleon-segment are developed into long spines. The pleopods on the last abdominal segment have 12 setae each.

The first postlarval instar resembles the adult crab. The carapace has widened, and the six serrulate spines on the antero-lateral borders have developed. The last of these is much longer than the rest. The rostral spine of the megalopa has disappeared and the front is a simple transverse curve. The branchio-cardiac groove and the grooves from the last spines on the antero-lateral borders are present. The last pair of legs is adapted into swimming paddles. The abdomen is permanently flexed.



TEXT FIG. 13.—*Charybdis (Goniosoma) callianassa* (Herbst.)
a. Megalopa ; b. 1st instar.

The crab at this stage, is 2.23 mm broad and 2.03 mm long, the distance between the tips of the outstretched legs being 8 mm. Its colour varies from dirty white to a very faint grey, the eyes being yellowish pink and the cornea black.

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SYSTEMATIC POSITION OF FISHES DESCRIBED UNDER *BAGRUS* BY VALENCIENNES, 1839

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Valenciennes in the 14th volume of *Histoire Naturelle des Poissons* included 58 species under the genus *Bagrus*. During the course of a revision of the catfish family Bagridae, it was found that the genus as envisaged by Valenciennes is composite, comprising many species which are at present included under different families. The present paper defines the limits of the species to be included under *Bagrus-Porcus*' (*sensu stricto*) and also thereby shows the latest systematic position of the others. As far as possible, up-to-date reference to literature under each species is given. The type locality and distribution of the species thus defined, is also cited.

By a revision of the generic limits it has been shown in this article that only two species are referable to *Porcus*, as recognised at present, contrary to 58 species broadly included by Valenciennes. To the family Bagridae itself only 21 out of 58 species can be assigned, falling under six genera. Of the remaining 37 species, four belong to Schilbeidae falling under three genera, 13 belong to Tachysuridae falling under five genera and 20 are synonyms of earlier species. Geographically, 10 species belong to the Neotropical, 6 to the Ethiopian and 22 to the Oriental region.

Such heterogenous assemblage of species of different family affinities under one genus may be due to the incomplete and bad delineations of earlier authors like Kuhl and van Hasselt and others as was pointed out by Valenciennes himself who stated that (p. 389) "mais toutes ces espèces se ressemblent si fort qu'il devient très-difficile de les caractéres, surtout quand il faut en tirer les caractères des descriptions si souvent fautives des auteurs et non des originaux"

I am indebted to Dr. S. L. Hora, for his guidance. Thanks are due to the National Institute of Sciences of India, for the award of a research fellowship.

¹ Jayaram, K. C., *Copeia*, No. 4, pp. 248-249 (1956).

TABLE 1

No.	Name and page reference in " Histoire Naturelle des Poissons " Vol. XIV.	Current Scientific name and latest reference.	Type locality.	Current family position.	Distribution of the Species.
1. <i>Bagrus schilbeides</i> , p. 389	}	<i>Eutropius niloticus</i> (Rüppel); Boulenger, G.A., <i>Cat. African</i> <i>Fish. Brit. Mus.</i> , II, p. 283 (1911).	Egypt	Schilbeidae	Africa.
2. <i>Bagrus adansonii</i> , p. 391					
3. <i>Bagrus vacha</i> , p. 392		<i>Eutropiichthys vacha</i> (Hamilton); Hora, S. L., <i>J. Bombay nat.</i> <i>Hist. Soc.</i> , XXXIX, p. 436 (1937).	Gangetic Province	Do.	Sind, Punjab, U.P., Bihar, Bengal Orissa, Burma, and Siam. In India the southernmost limit appears to be the Mahanadi river.
4. <i>Bagrus murius</i> , p. 393		<i>Eutropiichthys murius</i> (Hamilton); Hora, S. L., <i>Op. cit.</i> p. 435.	River Mahananda	Do.	Rivers of Sind, Orissa, Bengal and Assam.
5. <i>Bagrus angius</i> , p. 393	}	<i>Pseudeutropius atherinoides</i> (Bloch); Hora., S. L., <i>Rec.</i> <i>Indian Mus.</i> , XLIII, p. 103 (1941).	Tranquebar	Do.	Burma, Bengal, and Deccan.
6. <i>Bagrus exodon</i> , p. 394					
7. <i>Bagrus urua</i> , p. 395					
8. <i>Bagrus atherinoides</i> , p. 396					
9. <i>Bagrus bayad</i> , p. 397		<i>Porcus bayad</i> (Forsk.); Boulenger, G. A., <i>Op. cit.</i> p. 305.	Egypt	Bagridae	Nile system, Chad Basin, Senegal (Africa).
10. <i>Bagrus docmac</i> , p. 404		<i>Porcus docmac</i> (Forsk.); Boulenger, G. A., <i>Op. cit.</i> p. 309.	River Nile	Do.	Nile delta to Lake Victoria and Shoa tributaries of Blue Nile, Ganama River, Lake Stephanie, Omo, and Sagan Rivers.

11. <i>Bagrus aor</i> , p. 405	<i>Mystus Osteobagrus aor</i> (Hamilton); Jayaram, K. C., <i>Rec. Indian Mus.</i> , LI, (4), p. 549 (1954).	Bengal.	Do.	Sind, Punjab, Delhi, Assam and Burma.
12. <i>Bagrus lamarrii</i> , p. 407	<i>Mystus (Osteoagrus) seenghala</i> (Sykes); Jayaram, K. C., <i>Op. cit.</i> p. 550.	Mutha Mula River, Poona.	Do.	Punjab, Delhi, U. P., Bengal, Burma, Yunnan and Deccan upto Kistna river.
13. <i>Bagrus corsula</i> , p. 408	<i>Mystus (Mystus) menca</i> (Hamilton); Jayaram, K. C., <i>Op. cit.</i> p. 546.	Kosi, Mahananda River, N. Bihar.	Do.	Burma, Assam, Bengal and Orissa.
14. <i>Bagrus cavasius</i> , p. 409	<i>Mystus (Mystus) cavasius</i> (Hamilton); Jayaram, K. C., <i>Op. cit.</i> p. 532.	Gangetic Province	Do.	Whole of India upto Madras in South, south Burma, and Yunnan.
15. <i>Bagrus keletius</i> , p. 411	<i>Mystus (Mystus) keletius</i> (Valenciennes); Jayaram, K. C., <i>Op. cit.</i> p. 540.	Pondicherry	Do.	Pondicherry, Coimbatore, Mysore and Ceylon.
16. <i>Bagrus nigriceps</i> , p. 412	<i>Mystus (Mystus) nigriceps</i> (Valenciennes); Jayaram, K. C., <i>Op. cit.</i> p. 553.	Pondicherry	Do.	Thailand, Malay Peninsula, Java, Sumatra and Borneo.
17. <i>Bagrus vittatus</i> , p. 413	} <i>Mystus (Mystus) vittatus</i> (Bloch); Jayaram, K. C., <i>Op. cit.</i> p. 534.	Tranquebar	Do.	Throughout India, Burma, Siam and Ceylon.
18. <i>Bagrus tenggara</i> , p. 414				
19. <i>Bagrus halepensis</i> , p. 413	<i>Mystus (Mystus) pelusius</i> (Solander); Jayaram, K. C., <i>Op. cit.</i> p. 552	Aleppo, River Coic, Syria.	Do.	Syria.
21. <i>Bagrus stenomus</i> , p. 415	<i>Leiocassis stenomus</i> (Valenciennes); Regan, C. T., <i>Ann. Mag. nat. Hist.</i> (8), XI., p. 548 (1913).	Java	Do.	Thailand, Malay Peninsula, Sumatra, Java and Borneo.

TABLE 1—*contd.*

No.	Name and page reference in ' <i>Histoire Naturelle des Poissons</i> ' Vol. XIV.	Current Scientific name and latest reference.	Type locality	Current family position.	Distribution of the Species.
21. <i>Bagrus albilabris</i> , p. 416	}	<i>Mystus (Mystus) gulio</i> (Hamilton); Jayaram, K. C., <i>Op. cit.</i> p. 542.	Upper parts of Gangetic estuaries.	Bagridae	Estuaries and tidal waters from Ceylon, Sind, India, Burma to Malay Archipelago, Thailand and Sumatra.
22. <i>Bagrus fuscus</i> , p. 417					
23. <i>Bagrus gulio</i> , p. 418					
24. <i>Bagrus birmannus</i> , p. 419					
25. <i>Bagrus abbreviatus</i> , p. 420	}	<i>Mystus (Mystus) planiceps</i> (Valenciennes); Jayaram, K.C., <i>Op. cit.</i> p. 553.	Java	Do.	Thailand, Java, Sumatra, Borneo and Malay Peninsula.
26. <i>Bagrus planiceps</i> , p. 421					
27. <i>Bagrus anisurus</i> , p. 422					
28. <i>Bagrus nemurus</i> , p. 423		<i>Mystus (Mystus) nemurus</i> (Valenciennes); Jayaram, K.C., <i>Op. cit.</i> p. 553.	Java	Do.	Thailand, Malay Archipelago and Java.
29. <i>Bagrus oculatus</i> , p. 424		<i>Mystus (Mystus) oculatus</i> (Valenciennes); Jayaram, K.C., <i>Op. cit.</i> p. 540.	Malabar Coast	Do.	Malabar Coast and Coimbatore district.
30. <i>Bagrus batasio</i> , p. 525		<i>Batasio batasio</i> (Hamilton); Hora & Law, <i>Rec. Indian Mus</i> , XLIII, Part (1), p. 33 (1941).	Brahmaputra	Do.	Teesta river system.
31. <i>Bagrus nigrata</i> , p. 426		<i>Clarotes laticeps</i> (Rüppel); Boulenger, G. A., <i>Op. cit.</i> p. 342.	Nile	Do.	Africa.

32. <i>Bagrus auratus</i> , p. 426	}	<i>Chrysichthys auratus</i> (Geoffroy St. Hil-	Egypt	Do.	Africa.
33. <i>Bagrus capito</i> , p. 430		aire); Boulenger, G. A., <i>Op. cit.</i> p. 325.			
34. <i>Bagrus maurus</i> , p. 431		<i>Chrysichthys nigrodigitatus</i> (Lacepede); Boulenger, G. A., <i>Op. cit.</i> p. 321.	..	Do.	Africa.
35. <i>Bagrus poecilopterus</i> , p. 431		<i>Leicacasis poecilopterus</i> (Valenciennes); Regan, C.T., <i>Op. cit.</i> p. 548.	Java	Do.	Thailand, Java, Sumatra and Borneo.
36. <i>Bagrus tengana</i> , p. 433		<i>Potasio tengana</i> (Hamilton); Hora & Law, <i>Op. cit.</i> p. 36.	Brahmaputra River.	Do.	Darjeeling Himalayas, Assam, Tenasserim, Mergui, Perak and Siam.
37. <i>Bagrus bilineatus</i> , p. 434	}	<i>Tachysurus thalassinus</i> (Rüppel); Chandy, M., <i>Rec. Indian Mus.</i> , LI, p. 15 (1953).	..	Tachysuridae	Bombay and Ceylon.
38. <i>Bagrus netuma</i> , p. 438					
39. <i>Bagrus laevigatus</i> , p. 439					
40. <i>Bagrus arioides</i> , p. 440	}	<i>Tachysurus sona</i> (Hamilton); Chandy, M., <i>Op. cit.</i> p. 12.	Bengal	Do.	Coasts of Bombay, Puri, Penang and Calcutta.
41. <i>Bagrus gagorides</i> , p. 441					
42. <i>Bagrus trachipomus</i> , p. 443					
43. <i>Bagrus sondaicus</i> , p. 444	}	<i>Tachysurus sagor</i> (Hamilton); Chandy, M., <i>Op. cit.</i> , p. 11.	Gangetic estuaries	Do.	Coasts of Bombay, Calcutta, Penang and the Saugor Island.
44. <i>Bagrus javensis</i> , p. 445					
45. <i>Bagrus chinta</i> , p. 445					
46. <i>Bagrus sagor</i> , p. 446					
47. <i>Bagrus doroides</i> , p. 447					
48. <i>Bagrus commersonii</i> , p. 449		<i>Netuma commersonii</i> (Valenciennes); Jordan, D.A. et al., <i>Rept. U. S. Fish. Comm.</i> , p. 149 (1928).	Montevideo	Do.	Uruguay, S. America.

TABLE 1—concl'd.

No.	Name and page reference in "Histoire Naturelle des Poissons" Vol. XIV	Current Scientific name and latest reference.	Type locality.	Current family position.	Distribution of the Species.
49.	<i>Bagrus genidens</i> , p. 452	<i>Genidens genidens</i> Castelnau; Eigenmann, C.H., <i>Rept. Princeton Univ. Exped. Patagonia</i> , III, part 2, No. 4, p. 381 (1910).	Rio de la Plata, Araguay.	Tachysuridae	Araguay, S. America.
50.	<i>Bagrus herzbergi</i> , p. 453	} <i>Selanaspis herzbergi</i> (Bloch) ; Jordan, D. S. & Evermann, B. W., <i>Proc. U. S. nat. Mus.</i> No. 47, Part I, p. 124 (1898).	Surinam	Do.	Coasts of South America from Cayenne to Peru.
51.	<i>Bagrus pemecus</i> , p. 456				
52.	<i>Bagrus mesops</i> , p. 456	<i>Sciadeichthys mesops</i> (Valenciennes) ; Jordan, D. S. & Evermann, W., <i>Op. cit.</i> p. 123.	Guiana	Do.	Guiana, S. America.
53.	<i>Bagrus proops</i> , p. 457	<i>Sciadeichthys proops</i> (Valenciennes) ; Jordan, D. S. <i>et. al.</i> , <i>Rep. U. S. Fish Comm.</i> , p. 148. (1928).	Guiana, Porto Rico	Do.	West Indies.
54.	<i>Bagrus passany</i> , p. 458	<i>Sciadeichthys passany</i> (Valenciennes) ; Jordan, D.S. & Evermann, B. W., <i>Op cit.</i> p. 124.	Cayenne	Do.	Cayenne, S. Ame.ica.
55.	<i>Bagrus couma</i> , p. 459	<i>Tachysurus couma</i> (Valenciennes) ; Günther, A., <i>Op. cit.</i> p. 138.	Cayenne	Do.	Cayenne, S. America.

56. <i>Bagrus albicans</i> , p. 461	<i>Sciadeichthys albicans</i> (Valenciennes); Jordan, D.S. & Evermann, B. W., <i>Op. cit.</i> p. 124.	Cayenne	Do.	Guiana to Amazon, S. America.
57. <i>Bagrus flavescens</i> , p. 462	<i>Sciadeichthys flavescens</i> (Valenciennes); Jordan, D.S. & Evermann, B. W., <i>Op. cit.</i> p. 123.	Cayenne	Do.	Cayenne, S. America.
58. <i>Bagrus temminckianus</i> , p. 463	<i>Sciadeichthys temminckianus</i> (Valenciennes); Jordan, D.S. & Evermann, B. W., <i>Op. cit.</i> p. 124.	Cayenne	Do.	Cayenne, S. America.

STUDIES ON PARASITES OF INDIAN FISHES. V ACANTHOCEPHALA¹

By

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The Acanthocephalan parasites of Indian fishes have been studied by Bhalerao (1931), Datta (1936-1954), Kaw (1941 & 1951), Poddar (1937-1941), Sen (1938), Sarkar (1953), Thapar (1927 & 1931) and Van Cleave (1928).

In the course of my studies on the parasites of freshwater, marine and estuarine fishes, 9 new species of Acanthocephala and new hosts for other known species were found and are described below. In no case was any appreciable pathological effect noticed except in *Setipinna phasa*, the intestinal wall of which was perforated by a female specimen of *Acanthosentis indica*, sp. nov. The tissue at the site of perforation was swollen and reddish in colour.

Living specimens, when obtained, were washed and left in water with a drop of chloroform for about 4 or 5 hours until the proboscis was fully extended and then fixed in alcoholic or aqueous Bouin's fluid. Specimens treated with lactic acid showed clearly the cement glands, the hooks and spines but not the cuticular nuclei.

The following table shows the number of specimens of different species of fish examined and of those infected.

TABLE 1

Host species.	No. examined.	No. infected.	Parasite.
Rajiformes—			
<i>Rhynchobatus djeddensis</i> (Forsk.) ..	1	1	<i>Serrasentis longa</i> , sp. nov.
Pleuronectiformes—			
<i>Cynoglossus lingua</i> Ham.	4	2	<i>Neoechinorhynchus opseyi</i> Poddar (juvenile).
Siluroidea—			
<i>Eutropiichthys vacha</i> (Ham.) ..	14	1	<i>Neoechinorhynchus</i> sp. (Juvenile).

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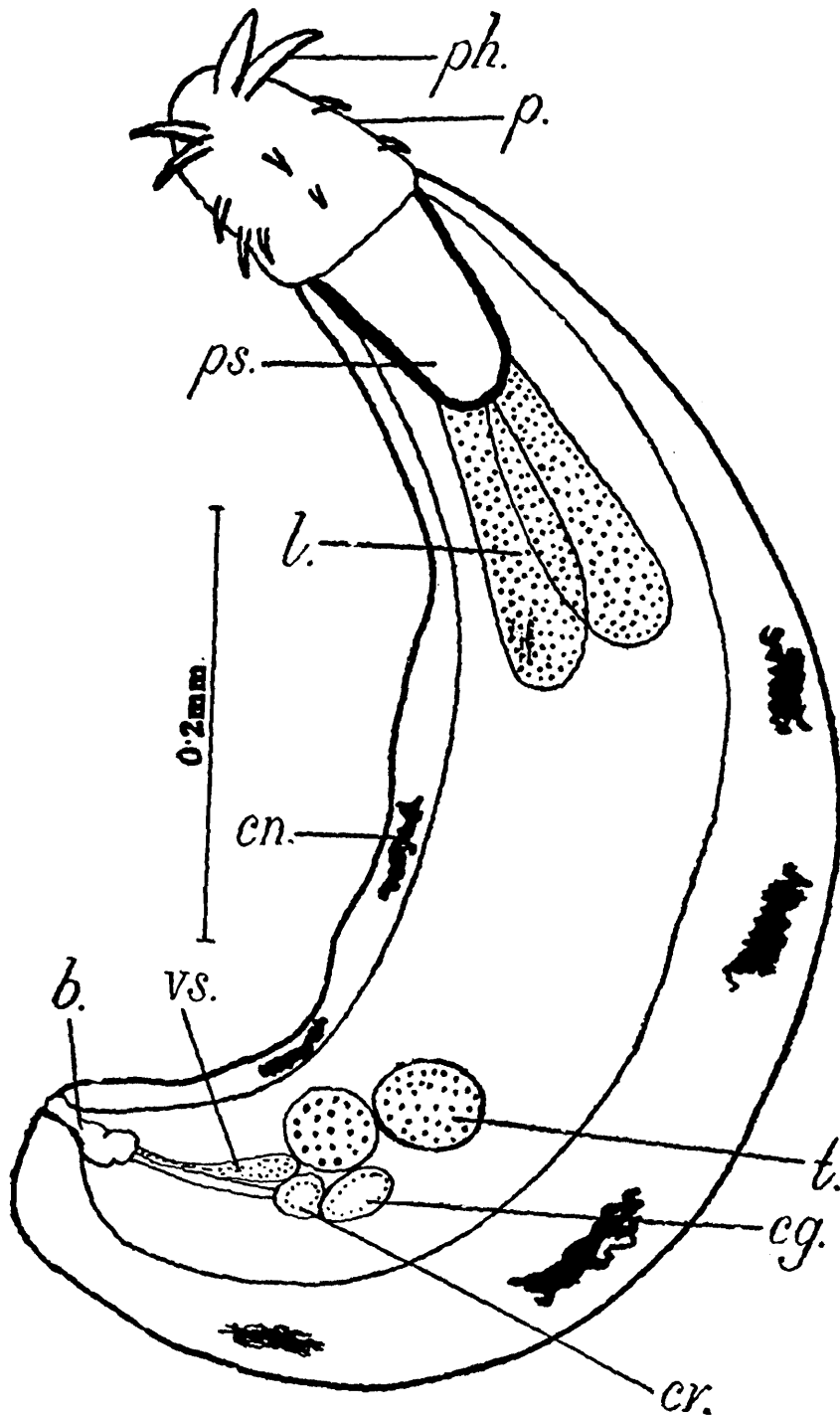
Host species.	No. examined.	No. infected.	Parasite.
Siluroidea.—			
<i>Osteogentiosus militaris</i> Linn. ..	26	5	<i>Mehrarhynchus secundus</i> , sp. nov.
		1	<i>Rhadinorhynchus indicus</i> , sp. nov.
<i>Plotosus canius</i> (Ham.)	6	3	<i>Heterosentis plotosi</i> Yama- guti.
		4	<i>Mehrarhynchus secundus</i> , sp. nov.
<i>Tachrysurus jella</i> (Day)	3	2	<i>Rhadinorhynchus indicus</i> , sp. nov.
Clupeiformes.—			
<i>Elops saurus</i> Linn.	5	1	<i>Neoechinorhynchus ovalis</i> , sp. nov.
<i>Hilsa ilisha</i> (Ham.) .. .	58	42	<i>Acanthosentis indica</i> , sp. nov.
<i>Nematalosa nasus</i> (Bloch). ..	14	1	<i>Neoechinorhynchus nemata- losi</i> , sp. nov.
<i>Setipinna phasa</i> (Ham.) ..	36	25	<i>Acanthosentis indica</i> , sp. nov.
Mugiloidei—			
<i>Mugil dussumieri</i> Cuv. & Val. ..	2	2	<i>Neoechinorhynchus elonga- tus</i> , sp. nov.
<i>Mugil subviridis</i> Cuv. & Val. ..	4	1	<i>Neoechinorhynchus elonga- tus</i> , sp. nov.
<i>Mugil tade</i> Forsk. .. .	2	1	<i>Neoechinorhynchus ban- goni</i> , sp. nov.
Percoidei—			
<i>Pama pama</i> (Ham.) . . .	18	2	<i>Mehrarhynchus secundus</i> , sp. nov.
		1	<i>Neoechinorhynchus</i> sp. (juv.).
Polynemiformes—			
<i>Polynemus paradiseus</i> Linn.. ..	28	4	<i>Neoechinorhynchus topseyi</i> , Poddar.
<i>Polydactylus sextarius</i> Bl. Schn. ..	6	5	<i>Raorhynchus polyneme</i> , gen. et sp. nov.
Cyprinoidei—			
<i>Labeo gonius</i>	1	1	<i>Acanthosentis betuai</i> , sp. nov.

NEOECHINORHYNCHIDAE

Neoechinorhynchus Hamann*Neoechinorhynchus ovalis*, sp. nov.

(Text-fig. 1)

Five specimens (three females and two males) of a new species of *Neoechinorhynchus* were obtained from the intestine of one *Elops*



TEXT FIG. 1.—*Neoechinorhynchus ovalis*, sp. nov. Complete worm (male).

b., bursa ; cg., cement gland ; cn., cuticular nuclei ; cr., cement gland reservoir ; l., lemnisci ; p., proboscis ; ph., proboscis hook ; ps., proboscis sheath ; t., testis.

saurus from the Chilka Lake in October 1952. Only in one male was the proboscis everted, to which my measurements refer.

Body short, plump and oval. Proboscis with longer sheath. Two equal lemnisci, not reaching the testes. Anterior part of the trunk tapered in the region of proboscis sheath, but swollen posteriorly. Cuticular nuclei amoeboid, two ventral and four dorsal. Testes spherical and tandem, in posterior quarter of body. Cement gland pyriform, at the same level as and smaller than posterior testis. Cement gland reservoir half the size and rounded, followed by elongated tapered vesicula seminalis. Bursa small, about the same diameter as reservoir. Uterus, uterine bell and vagina in posterior quarter of body of female. Eggs not developed.

*Measurements*¹.—Male 0.725×0.217 ; trunk of female (proboscis not everted) 0.652×0.203 ; proboscis 0.114×0.091 ; proboscis sheath 0.098×0.06 ; proboscis hooks, first row $0.060-0.068$, second and third row 0.053 ; lemnisci $0.247 \times 0.045-0.049$; uterine bell, uterus and vagina 0.152 long.

Remarks.—This species is characterised by its small size and the relative size of the proboscis hooks. (First row to second and third row as $1 : 0.828$), posterior position of the male genitalia in the last quarter of the body and the small and equal lemniscus. Other species of *Neoechinorhynchus* in which the second and third rows of proboscis hooks are equal are *N. yalei* (Datta), *N. proluxus* Van Cleave and Timmons, and *N. topeseyi* Poddar. The present form differs from all others in size of the hooks and of the body and lemnisci.

***Neoechinorhynchus nematalosi*, sp. nov.**

(Text-fig. 2 a & b)

Three specimens (two females and one male) of a new species of *Neoechinorhynchus* were obtained from the intestine of a single specimen of *Nematalosa nasus* from the Chilka Lake. Unfortunately the male was lost during the preparation of permanent mount but its measurements taken in fresh condition are given below :

Body long with the anterior part of the trunk thinner followed by a slight swelling of the dorsal wall and a thin posterior portion. Proboscis globular, its sheath long and constricted slightly in the middle. Lemnisci very long with slightly swollen ends and not reaching testis and thinner in the anterior portion. Proboscis hooks, unequal in three rows. Testes two, oval and tandem. Cement gland oval, cement gland reservoir and vesicula seminalis small. Bursa not clearly seen. Uterine bell and uterus confined to posterior part in the female. Eggs elliptical.

Measurements.—Male 2.333×0.244 ; female $3.248-7.0 \times 0.29-0.68$; proboscis 0.145×0.145 ; proboscis sheath $0.203-0.217 \times 0.13-0.145$; lemnisci $1.45-2.17$ long ; proboscis hooks, length first row $0.076-0.083$, second row $0.038-0.044$, third row $0.026-0.03$; testis 0.217×0.174 and 0.29×0.174 ; cement gland 0.217×0.145 ; eggs $0.019-0.026 \times 0.0057$

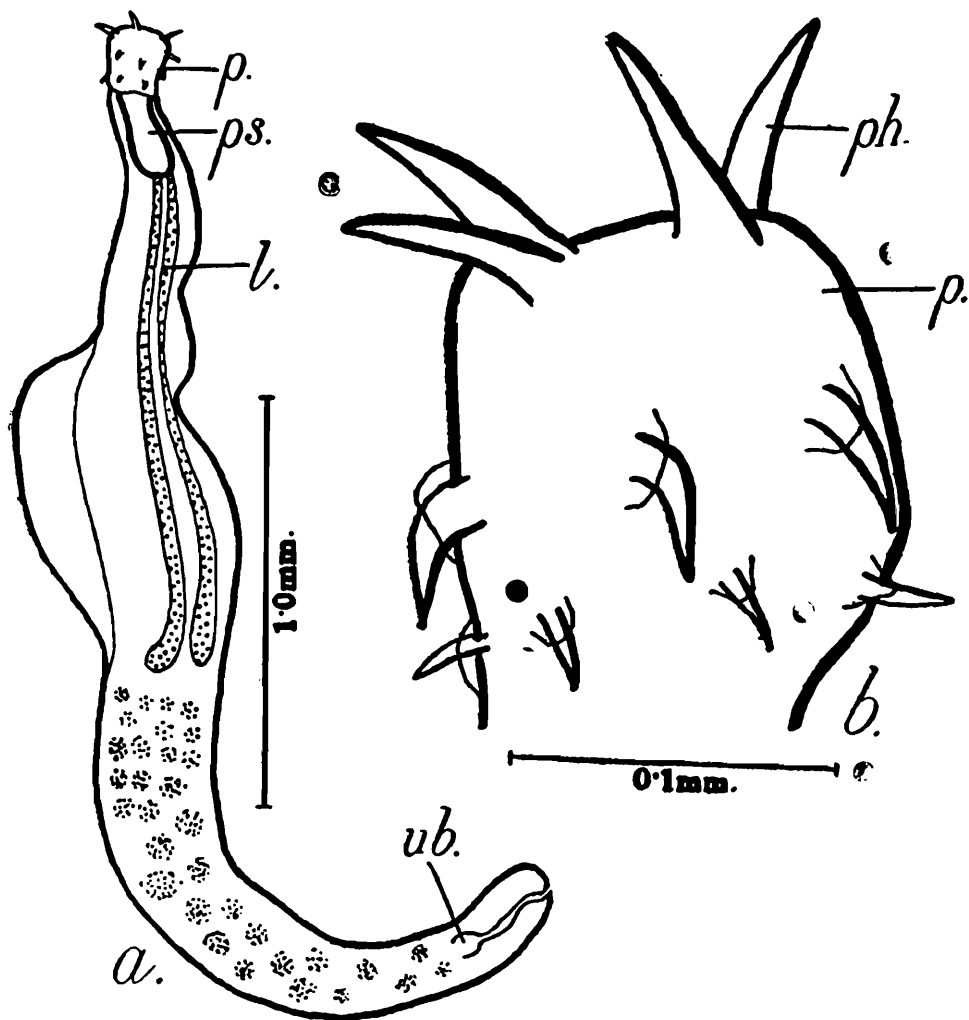
¹ All measurements are in millimeters.

Remarks.—This species is characterised by a swelling in the middle of the body wall, and tapering at the posterior and specially at the anterior end, and the ratio of the size of proboscis hooks.

***Neoechinorhynchus bangoni*, sp. nov.**

(Text-fig. 3)

Many specimens of a new species of *Neoechinorhynchus* were obtained from the intestine of *Mugil tade* (local Bengali name *Bangon*),



TEXT-FIG 2.—*N. nematalosi*, sp. nov.

(a) Complete worm (female). (b) Proboscis.

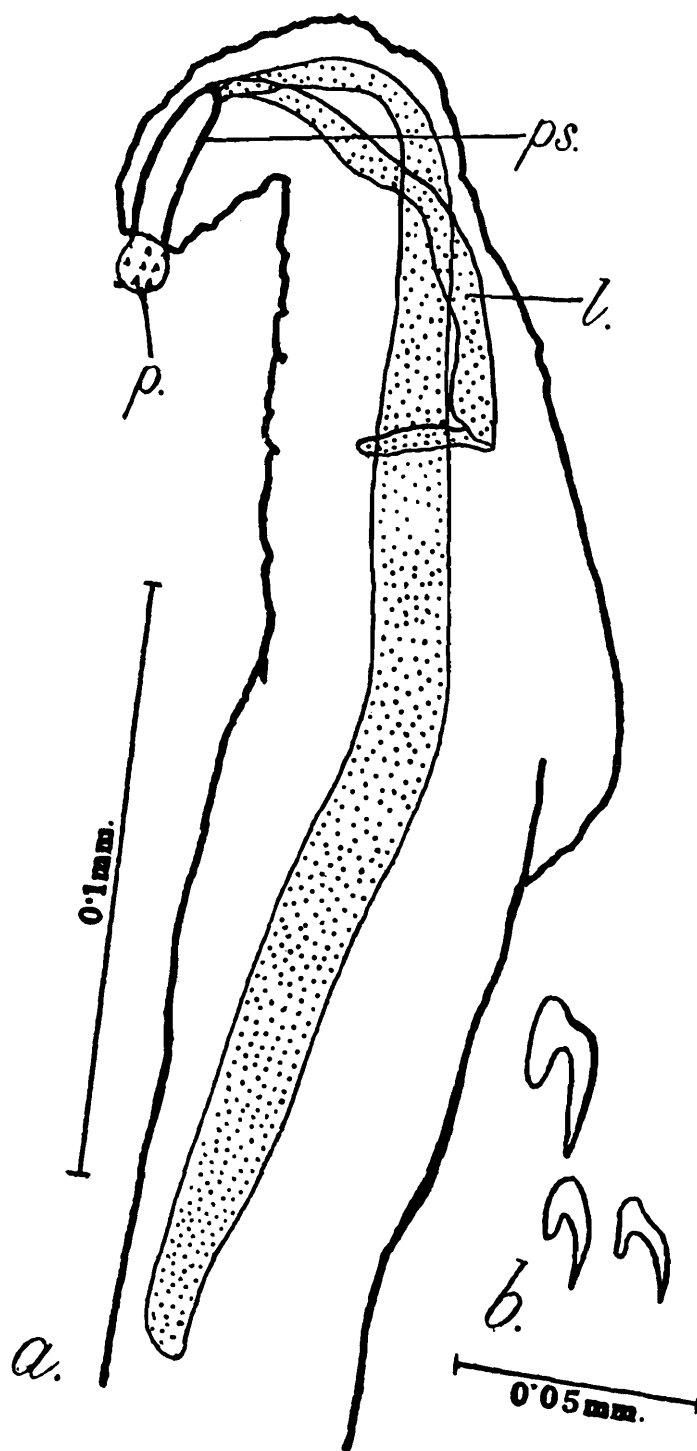
l., lemnisci; b., proboscis; ph., proboscis hook; ps., proboscis sheath; ub., uterine bell.

caught from the fish farm at Ghutiyari Sharif near Calcutta. The specimens were given to me by Dr. T. V R. Pillay. As the parasites were obtained from the preserved specimens of fish, they were neither fully extended nor in a good state of preservation.

The males and females are both very long though the males are the smaller. Proboscis short and globular with a long sheath and six hooks in each of the three circular rows. Hooks of the anterior row longer

than those of the posterior two rows which are equal in size. Lemnisci unequal, one of them two to three times as large as the other, the longer not reaching the testis.

Testes two, elongate oval, the anterior the longer. Cement gland oval, and its reservoir and vesicula seminalis pyriform. Male genitalia in posterior half of the body. Female genital ducts obscured by the elliptical eggs.



TEXT-FIG. 3.—*N. bangoni*, sp. nov.

(a) Anterior part of body. (b) proboscis hooks of first and third row.

l., lemnisci; p., proboscis; ps., proboscis sheath.

Measurements.—Male 9.0—12.0 × 0.725—0.94; female 15.0—20.0 × 0.65—0.94; proboscis 0.076—0.118 × 0.089—0.106; proboscis sheath

0.391—0.71×0.101—0.162 ; lemnisci 1.45—2.07×0.059—0.072 and 2.081—3.99×0.101—0.162 ; proboscis hooks 0.026—0.038 ; 0.019—0.023 and 0.019—0.021 ; testis, anterior 0.94—1.45×0.212—0.36, posterior 0.87—1.305×0.212—0.362 ; cement gland 0.65—1.88×0.26—0.536 ; eggs 0.034—0.038×0.007—0.013.

Remarks.—*N. bangoni*, sp. nov. resembles *N. cristatus* Lynch, *N. venustus* Lynch, *N. distractus* Van Cleave, *N. australis* Van Cleave, and *N. proluxus* Van Cleave and Temmons in having the two lemnisci markedly unequal in size. In *N. distractus*, *N. proluxus* and *N. bangoni* only the longer lemnisci fails to reach the testes while in three other related species the long lemniscus reaches the anterior testis or beyond it. The new species differs from these species in the size of the proboscis and proboscis hooks.

***Neoechinorhynchus elongatus*, sp. nov.**

(Text-fig. 4)

Thirtyfive male and female specimens of a new species of *Neoechinorhynchus* were obtained from the intestine of one *Mugil subviridis* from the Chilka Lake in May 1951 and of two *M. dussumieri* from Bay of Bengal at Madras in April 1954. This species differs from *N. chilkaensis* Poddar and *N. agilis* (Rudolphi) described from *Mugil cephalus* from the Chilka Lake.

Females nearly twice the size of males. Body long and tapering at posterior end in both the sexes. Proboscis small and globular, with three rows of hooks unequal in size and its sheath more than three times as long. Two equal lemnisci not reaching the two oblong testes. Cement gland as long as testes with its reservoir pyriform. Vesicula seminalis long. Male genital organs occupying more than the posterior half of the body. Female genital ducts obscured by elliptical eggs.

Measurements.—Male 5.3—7.1×0.75—0.87 ; female 9.0—13.2×1.45—1.6 ; proboscis, male 0.116×0.087—0.101, female 0.145×0.116 ; proboscis sheath, male 0.337—0.435×0.101—0.116, female 0.651×0.145 ; lemnisci 1.45—1.49×0.087—0.101 ; testis 0.58—0.72×0.333—0.348 ; cement gland 0.652—0.797×0.406 ; cement gland reservoir 0.507×0.29 ; seminal receptacle 0.174—0.188 wide ; proboscis hooks 0.049 ; 0.03 and 0.019 long ; eggs 0.11×0.0266.

Remarks.—This species differs from *N. agilis* and *N. chilkaensis* in the size of the proboscis and its hooks. The size of the anterior rows of hooks is similar to those of *N. hutchinsoni* Datta and *N. mansabalensis* Kaw but the other two rows of hooks differ in all the three species.

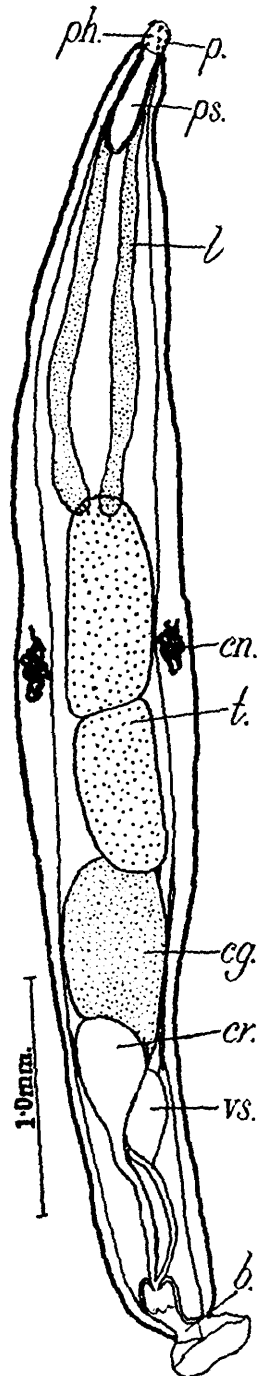
***Neoechinorhynchus topseyi* Poddar**

(Text-fig. 5 a, b & c)

Five specimens of juvenile stage of *N. topseyi* were obtained from the intestine of *Polynemus paradiseus* (its definitive host) and *Cynoglossus*,

lingua from the estuary of the Matla river at Canning in the month of Nov. 1952. Adult forms of this parasite have not been recorded from *Cynoglossus lingua*.

Body elongated, proboscis globular, its sheath twice as long. Proboscis hooks of first two row much longer than those of the second and third rows. Lemnisci long and narrow. Rudiments of female



TEXT FIG. 4.—*N. elongatus* sp. nov. (male).

b., bursa ; cg., cement gland ; cn., cuticular nuclei ; cg., cement gland reservoir ; l., lemnisci ; p., proboscis ; ph., proboscis hook ; ps., proboscis sheath ; vs., vesicula seminalis.

genitalia present. Ovary in one oval mass in the middle of body. Cuticular nuclei long and thin, four on one side and two on the other.

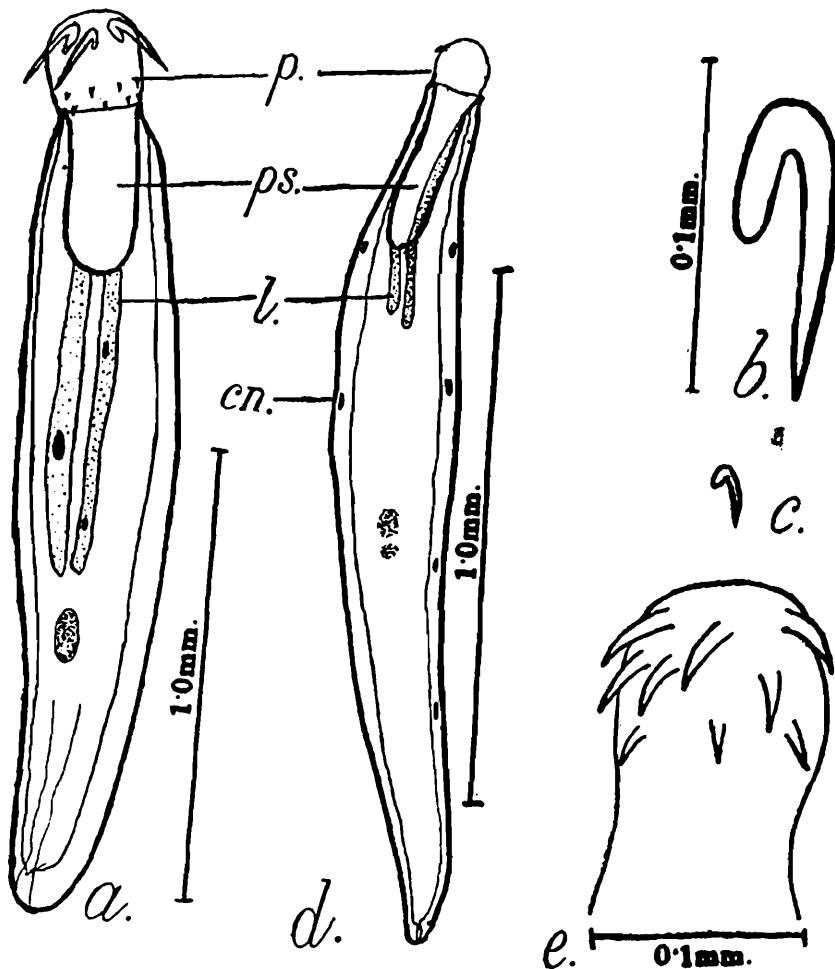
Measurements.—Length 0.957—1.058, breadth 0.145—0.188 ; proboscis 0.087—0.101×0.087 ; proboscis sheath 0.166—0.188×0.058 ; proboscis hooks, first row 0.087, second and third row 0.022.

***Neoechinorhynchus* sp.**

(Text-fig. 5 d & e)

Three juvenile specimens of a species of *Neoechinorhynchus* were obtained from the intestine of one *Pama pama* and one specimen of the same species from *Eutropiichthys vacha* from the River Ganga at Buxar (Bihar).

Body long, proboscis globular, proboscis sheath cylindrical. Lemnisci long, thin and equal. Proboscis hooks of first and second row nearly equal in size and larger than that of the third row. Cuticular nuclei six on one side and two on the other. Rudiments of genital organs present in mid body.



TEXT-FIG. 5 a-c.—*N. topseyi* Poddar ; d-e. *Neoechinorhynchus* sp.

(a). Juvenile form. (b) Hook of first row. (c) Proboscis hook of third row. (d) Complete worm. (e) Proboscis.

cn., cuticular nuclei ; l., lemnisci ; p., proboscis ; ps., proboscis sheath.

Measurements.—Length 1.45—1.696 ; breadth 0.203—0.217 ; proboscis 0.188×0.101 ; proboscis sheath 0.244×0.072 ; proboscis hooks first row 0.041, second row 0.038, third row 0.022—0.026.

Including the six new species of *Neoechinorhynchus* described above there are at present 33 species of *Neoechinorhynchus* known of which 13 occur in India.

There is very little variation in the genus *Neoechinorhynchus* and the specific differentiation is based on absolute dimensions of the

proboscis and its hooks and of the lemnisci and the eggs. The part of the body occupied by the male genitalia and the posterior extent of lemnisci, though useful characters, may sometimes be misleading.

QUADRIGYRIDAE

Acanthosentis Verma & Datta

Acanthosentis indica, sp. nov.

(Text-fig. 6 a)

Several specimens of a new species of *Acanthosentis* were obtained from the intestine of *Setipinna phasa* and *Hilsa ilisha* from the river Ganga at Buxar, from the estuaries of Hooghly and Matla rivers and from the Chilka lake. In *Hilsa* from river Ganga the infection was more during December and January than in September when over 100 parasites in each fish were obtained. In *Setipinna phasa* the infection was always much less. Maximum parasite population per fish varied between 20 to 30.

Males and females are more or less of the same size. Body long. Proboscis small and globular with three rows of six hooks each. Body spines in the anterior rows are bigger than in the posterior rows. Proboscis sheath long with a single muscular layer and nerve ganglion near its posterior end. Lemnisci long and rather narrow, slightly unequal but not reaching the anterior testis.

Anterior part of trunk beset with 19—20 rows of short and recurved spines as in the rose plant. Cuticular nuclei 3 each on dorsal and ventral side.

Testes oval, overlapping. Cement gland a single syncytial mass, spherical, a little wider but not so long as testis. Cement gland reservoir club shaped. Vesicula seminalis pyriform and long. Bursa nearly as wide as testis. Uterine bell triangular funnel shaped, and attached to the genital ligament anteriorly. Uterus and vagina long. Genital pore postero-lateral. Eggs elliptical with three shelled membranes.

Measurements.—Female 7.26—8.55×0.768—0.899 ; male 7.48—8.26×1.01 ; proboscis 0.145—0.217×0.08—0.11, proboscis sheath 0.406—0.435—0.116—0.145 ; lemnisci 1.36—1.98×0.11—0.21 ; testis 1.087×0.58 and 0.87×0.45 ; cement gland 0.942×0.551 ; cement gland reservoir 0.435×0.29 ; vesicula seminalis 0.145 long, bursa 0.7×0.43 ; eggs 0.026—0.03×0.0076—0.0095.

Acanthosentis betwai, sp. nov.

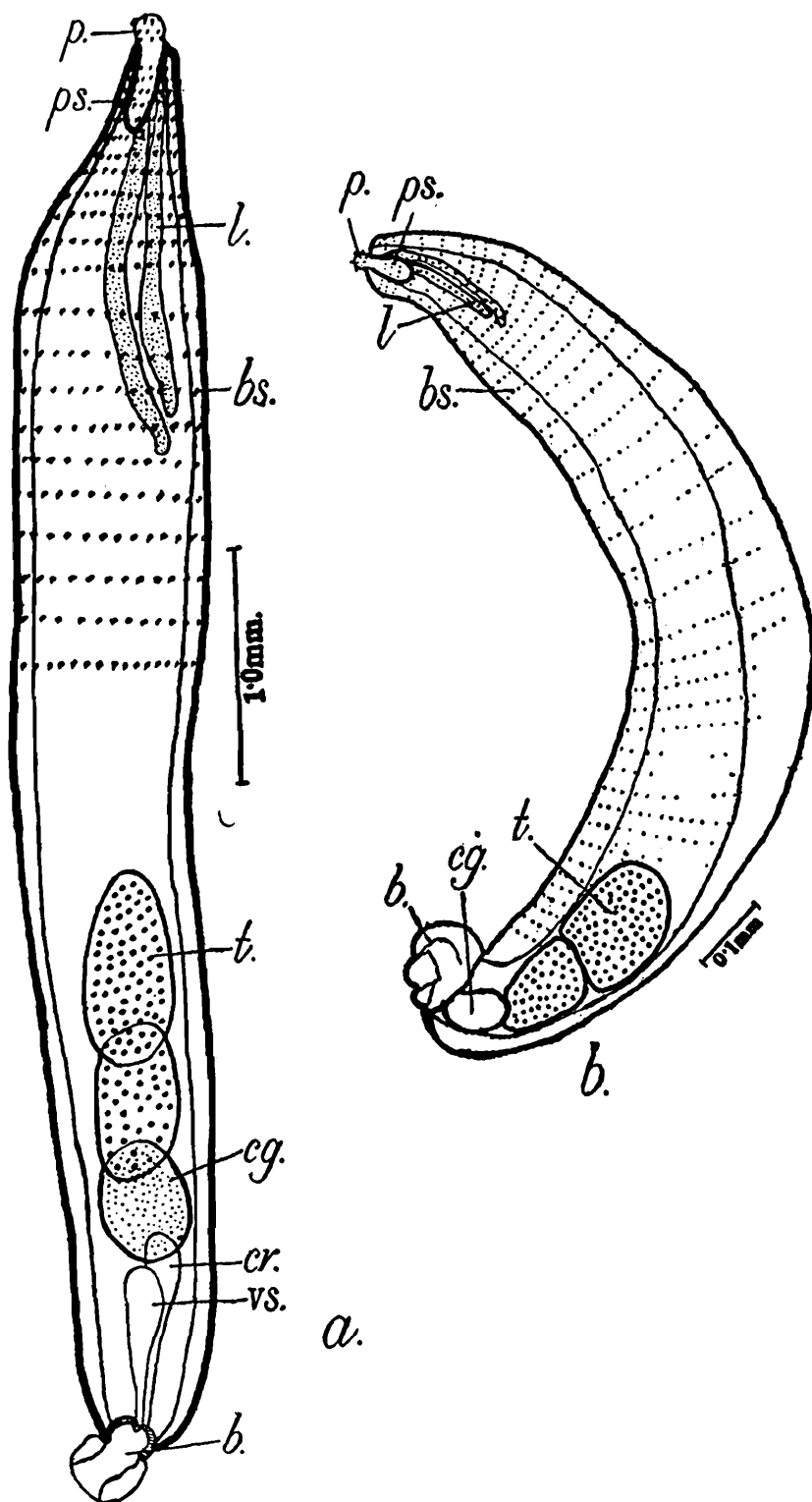
(Text-fig. 6 b)

Three specimens (two females and one male) were obtained from one *Labeo gonius* obtained at Bhopal from the River Betwa in July 1954.

Body long and thick, female longer and thicker than male. Body spines in 42—44 rows extending upto the posterior testis in case of male and nearly to the end of body in case of female. Proboscis small and globular. Proboscis sheath long, thicker in the posterior part. Lemnisci slightly unequal. Testes oval, anterior one bigger than the posterior one. Cement gland small and lateral to pyriform vesicula seminalis.

Uterine bell cup shaped. Uterus and vagina long. Eggs oval and smooth-shelled.

Measurements.—Male 8.75×1.25 , female 9.83×2.08 ; proboscis $0.127-0.133 \times 0.127$; proboscis sheath $0.435-0.483 \times 0.145$; lemnisci 1.04×0.145 , proboscis hooks, first row $0.057-0.068$, second row



TEXT-FIG—6a.—*Acanthosentis indica*, sp. nov. (male); b. *Acanthosentis betwai*, sp. nov. (male).

b., bursa; bs., body spine; cg., cement gland; cr., cement gland reservoir; l., lemnisci; p., proboscis; ps., proboscis sheath; t., testis; vs., vesicula seminalis.

$0.038-0.053$, third row $0.024-0.041$, body spines 42—44 rows (all over the body); testes, anterior 0.942×0.652 , posterior 0.797×0.435 ; egg 0.015 in diameter; uterus and vagina 0.942 long.

TABLE 2

Comparative measurements of eight species of *Acanthosentis*

	<i>A. antespinus</i>	<i>A. betwai</i>	<i>A. dattai</i>	<i>A. holospinus</i>	<i>A. indica</i>	<i>A. sircari</i>	<i>A. tilapae</i>	<i>A. acanthus</i>
	Verma & Datta, 1929	sp. nov.	Poddar, 1938	Sen, 1938	sp. nov.	Poddar, 1941	Baylis, 1947	Cable & Quick, 1954
Total length	♀ 0.85—4.5 ♂ 0.8—2.4	9.03 8.75	1.34—3.34 1.67—9.46	1.6—9.4 0.9—2.4	7.26—8.55 5.54—7.48	2.94—11.89 3.11—4.76	3.0—8.0 2.5—3.5	8.4—15.6 9.12
Breadth	♀ 0.25—1.1 ♂ 0.18—0.67	2.08 1.25	0.44—0.9 0.24—0.42	0.2—0.7 0.2—0.4	0.79—0.92 0.72—1.16	0.39—1.01 0.48—0.67	0.38—1.88 0.8—1.1	0.56—0.97 0.956
Proboscis	0.04—0.25 × 0.04—0.15	0.127—0.133 × 0.127	0.12 × 0.05	0.1 × 0.05	0.145—0.217 × 0.08—0.11	0.188 × 0.115	0.11 × 0.1	0.104—0.128 0.13—0.14
Proboscis sheath	0.17—0.38 × 0.04—0.18	0.435—0.483 × 0.145	0.42 × 0.12	0.3 × 0.8	0.4—0.435 × 0.116—0.145	0.265 × 0.15	..	0.5—0.68 long
Body spines	30 rows in anterior part.	42—44 rows all over body.	All over body	..	20—24 rows in anterior part of body.	Spines in anterior part of body.	All over body	31 rows in ante- rior part of body.
Lemnisci	Equal	Equal	Slightly unequal	..	Equal	Unequal, one × 2 of other.	..	Unequal
Proboscis hooks	I 0.072 II 0.054 III 0.048	0.057—0.068 0.038—0.053 0.024—0.041	0.05—0.057 0.03—0.038 0.026—0.034	.. .. ..	0.041—0.045 0.038 0.026—0.031	0.055 0.048 0.018	0.046—0.048 0.012 0.01	0.063—0.081 0.023—0.024 0.013—0.027
Ratio of hooks I/III	1.5	1.6	1.92	..	1.57	3.05	4.7	1.8
Eggs	0.026 × 0.008	0.015 broad	0.026 long	0.1 long	0.026—0.03 × 0.007	..	..	0.028—0.032 × 0.005—0.006
Host & Locality	<i>Mystus gulio</i> Allahabad. Chilka & Cal- cutta	<i>Labeo gonius</i> Bhopal	<i>Barbus ticto</i> <i>Barbus stigma</i> Bengal.	<i>Barbus stigma</i> Bengal	<i>Hilsa ilisha</i> , <i>Setipinna phasa</i> Bengal Orissa & U.P.	<i>Basborra elonga</i> Bengal.	<i>Tilapia lidole</i> Africa.	<i>Acanthurus cocru</i> <i>lens</i> & <i>A.</i> <i>bahianus</i> , Puer- to Rico.

Remarks.—Baylis (1947) considers *A. dattai* as a synonym of *A. holospinus*. There are then seven valid species in the genus including the two new ones described here. All except *A. indicus* and *A. acanthuri* are from freshwater fishes. *A. indicus* resembles *A. antespinus* in the spines being confined to the anterior part of the body, and in the size of the eggs but differs in the proboscis hooks being smaller than in the latter species and also in the size of the body. *A. betwai* resembles *A. holospinus* (and *A. dattai*) in having spines all over the body but the two species differ in size of the proboscis hooks and the size of various parts of the body. An artificial key to the 7 species is given below :

- | | |
|--|----------------------|
| 1. Lemnisci unequal, one nearly twice of the other | <i>A. sircari</i> |
| 1. Lemnisci nearly equal . . . | 2 |
| 2. Body spines in anterior part of body . . | 3 |
| 2. Body spines all over the body . . | 5 |
| 3. Apical rows of proboscis hooks more than 50 μ long | 4 |
| 3. Apical row of proboscis hooks less than 50 μ in length . . | <i>A. indicus</i> |
| 4. Body long, lemnisci unequal, ratio of size of proboscis hooks of I & III row nearly 3.5 | <i>A. acanthuri</i> |
| 4. Body small, lemnisci equal, ratio of size of proboscis hooks of I & III row nearly 1.5 | <i>A. antespinus</i> |
| 5. Ratio of size of I & III row of proboscis hooks less than two | <i>A. betwai</i> |
| 5. Ratio of size of I & III row of proboscis hooks nearly two | <i>A. holospinus</i> |
| 5. Ratio of size of I & III row of proboscis hooks nearly five | <i>A. tilapae</i> |

RAORHYNCHIDAE fam. nov.

Raorhynchus,¹ gen. nov.

Raorhynchus polynemi, sp. nov.

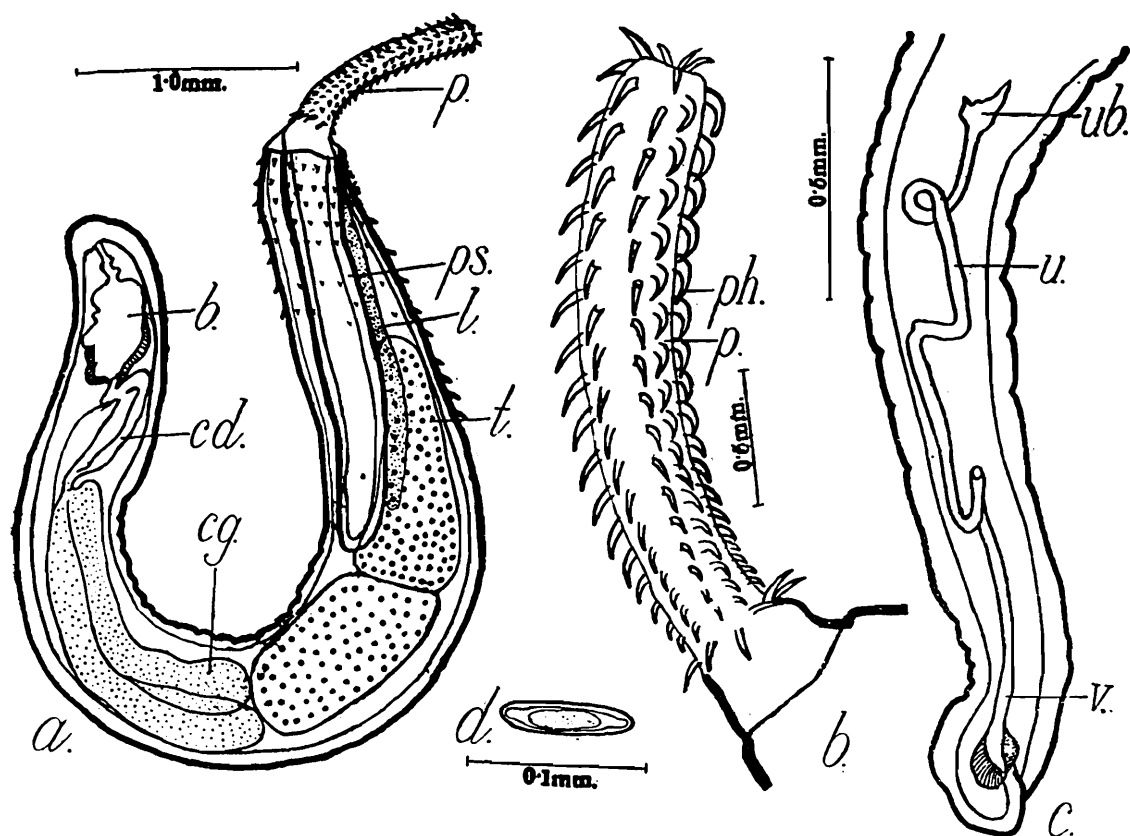
(Text-fig. 7)

Over twentyfive male and female specimens of a new Acanthocephalan parasite were obtained from the intestine of three specimens of *Polydactylus sextarius* from the sea at Puri in December 1953 and 1954. The living parasites were all dorsally curved and deep orange in colour. As they do not fall under the generic characters of hitherto known genera of Acanthocephala, it has become necessary to create a new genus and new family to accommodate them.

Body dorsally reflexed and uniformly thick. Females much longer than males. Proboscis long, studded with a large number of curved hooks arranged in 11-12 long rows of 22-24 hooks each. Hooks on dorsal side smaller, thicker and more curved than the more slender

¹ The genus is dedicated to and named after Dr. H.S. Rao, D. Sc., F.N.I., Chief Research Officer, Central Inland Fisheries Research Station, Calcutta.

ventral hooks. Both dorsal and ventral hooks become smaller posteriorly. The hooks of the last row are abruptly larger than those in penultimate row; they are long, slender and arcuate. Thus the proboscis hooks vary in size dorsoventrally as well as anteroposteriorly. Neck small and without spines. Trunk with spines in the anterior part, in eight rows dorsally and 12 rows ventrally. Proboscis sheath long and double walled. Lemnisci equal and slightly smaller than proboscis sheath. Testes two, oval and reaching half way upto the proboscis sheath. Anterior testis longer than posterior. Cement glands two, tubular and long with their thick ducts opening near the penis. Vesicula seminalis small, near bursa which is circular when everted. Uterine bell thistle-shaped. Uterus long and convoluted. Vagina with sphincter muscles and opening laterally. Eggs three shelled and smooth with the middle one drawn out at the two ends as protuberances.



TEXT-FIG. 7.—*Raorhynchus polynemi*, gen. et sp. nov.

(a). Complete worm (male). (b). Proboscis. (c). [Posterior part of female. (d) Egg.

b., bursa; cd., cement gland duct; cg., cement gland; l., lemnisci; p., proboscis; ph., proboscis hook; ps., proboscis sheath; t., testis; u., uterus; ub., uterine bell; v., vagina.

Measurements.—Female 4.42—9.5 × 0.551—0.696; male 6.06—6.29 × 0.62—0.652; proboscis 0.725—1.23 × 0.116—0.145; proboscis sheath 1.45—1.986 × 0.188—0.203; neck 0.087 × 0.217; lemnisci 1.23—1.52 × 0.145; testes, anterior 0.797—1.087 × 0.275—0.333; posterior 0.58—0.768 × 0.333; cement gland (width) 0.217—0.29; uterus and uterine bell 3.03; egg 0.076 × 0.015.

Remarks.—*Rhadinorhynchus terebra* (Rudolphi) has also two cement glands, a long proboscis, and dorsoventral differentiation of its hooks which are in 24—26 rows each with 36—37 hooks. This species is

therefore transferred to this present new genus and made the type species by order of priority. *R. polynemi*, sp. nov. differs from *R. terebra* in having 11-12 rows with 22-23 hooks on its proboscis.

Diagnosis of RAORHYNCHIDAE

Palaeacanthocephala. Body long and curved with rows of spines on its anterior part. Proboscis long with 12-24 rows of hooks which are dorsoventrally as well as antero-posteriorly differentiated in shape and size. Proboscis sheath with two layers and extending upto or beyond the anterior testis. Lemnisci equal and smaller than proboscis sheath. Testis long. Two cement glands.

Type and only genus.—*Raorhynchus*.

Generic diagnosis.—Same as above.

Type-species.—*R. terebra* (Rudolphi).

GORGORHYNCHIDAE

Serrasentis Van Cleave

Serrasentis longa, sp. nov.

(Text-fig. 8 a & b)

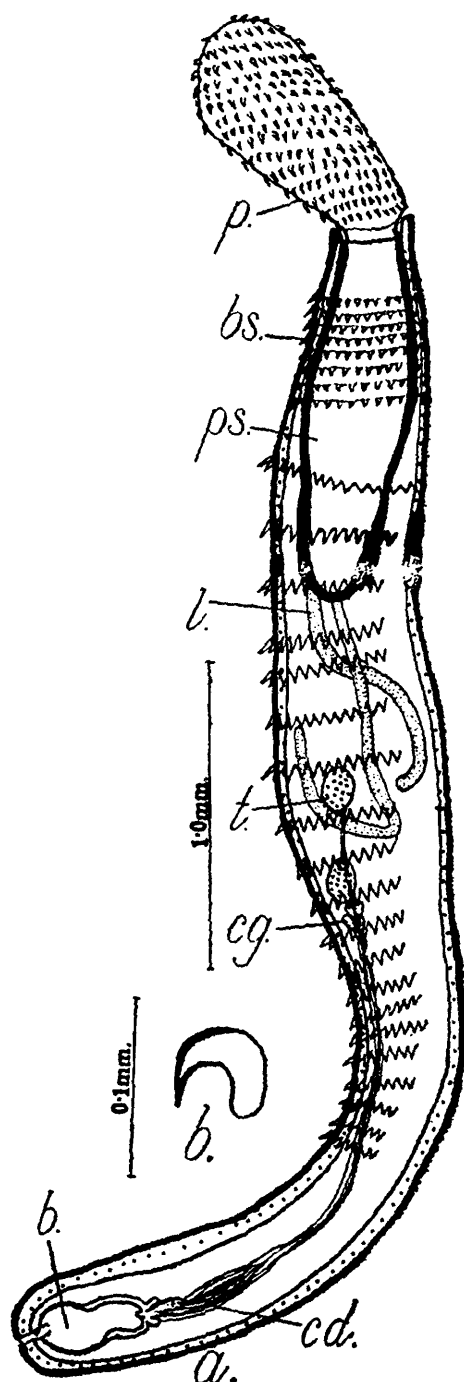
The new species is based on a single male specimen obtained from the intestine of *Rhynchobatus djeddensis* obtained from the sea at Puri in October 1952.

Body long, slightly thinner at posterior end. Proboscis club-shaped wider anteriorly, having 22 spiral rows of 17—18 hooks each. Hooks curved with their roots longer than the body. Neck small and smooth. Anterior part of body with 9 rows of spines each with 10—12 spines and covered with cuticle followed by 19 incomplete rows of fused spines which extend to the posterior $\frac{3}{4}$ part of the body.

Proboscis sheath in two layers, one and a half times longer than proboscis. Lemnisci long, thin and unequal and reaching beyond the testes which are small, oval and not contiguous. Cement glands four, pyriform, situated a little behind the posterior testis with very long ducts. Bursa muscular with ring like sphincter.

Measurements.—Total length 4.93; breadth, anterior part 0.377, middle 0.557, posterior 0.348; proboscis 0.87×0.377 ; proboscis sheath 1.35×0.29 ; neck 0.232×0.319 ; proboscis hooks 0.057, root 0.068, breadth at base 0.019; body spines 0.049×0.015 ; spines of comb 0.0418×0.015 ; testes 0.087×0.13 .

Remarks.—Including the present form there are now five species of *Serrasentis*. Datta (1954) has described a new species *S. chauhani* from the mesentry of intestine wall of *Psettodes erumie* and *Lutianus johnii* from Bombay. The present species differs from all the others in the size and number of proboscis hooks, and rows of cuticular and collar spines on the body. In *S. socialis* there are 18-23 rows of



TEXT-FIG. 8.—*Serrasentis longa* sp. nov.

(a) Complete worm (male). (b). Proboscis hook.

b., bursa ; bs., body spine ; cd., cement gland duct ; cg., cement gland ; l., lemniscus ; p., proboscis. ph., proboscis hook ; ps., proboscis sheath ; t., testis.

cuticular and collar spines, in *S. chauhani* 22 rows and in the present species 19 rows. The body is also smaller in size than in the other species.

Mehrarhynchus Datta**Mehrarhynchus secundus, sp. nov.**

(Text-fig. 9 a-c)

Several male and female specimens of *Mehrarhynchus* Datta, were obtained from the intestine of *Plotosus canius* caught from the Chilka Lake and the estuary of Matla river at Port Canning. The same parasite was obtained from the intestine of *Pama pama* and *Osteogeneiosus militaris* from Chilka Lake.

Males and females nearly of the same size. Proboscis flexed at an angle with the body, club-shaped and broader anteriorly. 16-18 curved hooks in 18-20 longitudinal rows on the proboscis. Root of hook longer than the barb. Neck small without spines. Trunk long and tapering posteriorly, with its anterior part having 9-10 rows of small spines covered with a basal chitinous sheath. Proboscis sheath long, having the nerve ganglion near its posterior end. Lemnisci two, unequal and smaller than proboscis sheath.

Testes spherical to oval, tandem and slightly overlapping. Anterior testis behind or just touching the proboscis sheath. Four pyriform cement glands with long ducts arranged in two pairs. Vesicula seminalis pyriform. Cement gland ducts open near penis. Bursa with thick muscular wall and oval in shape when everted. Uterine bell funnel-shaped, in posterior one third of body. Uterus and vagina long and thin. Vaginal opening with sphincter muscle. Eggs not present.

Measurements.—Female 1.84—2.697 × 0.29—0.4 ; male 2.07—2.49 × 0.377—0.49 ; proboscis 0.551—0.797 × 0.244—0.304 ; proboscis sheath 0.493—0.754 × 0.0145—0.217 ; proboscis hooks 0.049—0.053 ; body spine 0.019—0.022 ; lemnisci 0.785 × 0.029 ; testis 0.116—0.145 × 0.145—0.188 ; cement gland 0.065 wide ; seminal vesicle 0.10 wide ; bursa 0.259 × 0.145 ; uterine bell 0.076 × 0.053 ; uterus 0.087 × 0.049 ; vagina 0.149 × 0.038.

Remarks.—This is the second species of the genus *Mehrarhynchus*, the first being *M. prashadi* Datta from *Pangasius pangasius*. The two differ in the size of the body, and in the number and size of the proboscis hooks. This genus should appropriately be placed in the family *Gorgorhynchidae* Van Cleave and Lincicome, 1940 (see discussion on page 84).

ECHINORHYNCHIDAE**Heterosentis Van Cleave****Heterosentis plotosi Yamaguti, 1935**

(Text-fig. 9 d)

Several specimens of this species were obtained from the intestine of *Plotosus canius* from the Chilka Lake and from the estuary of the Matla river at Port Canning.

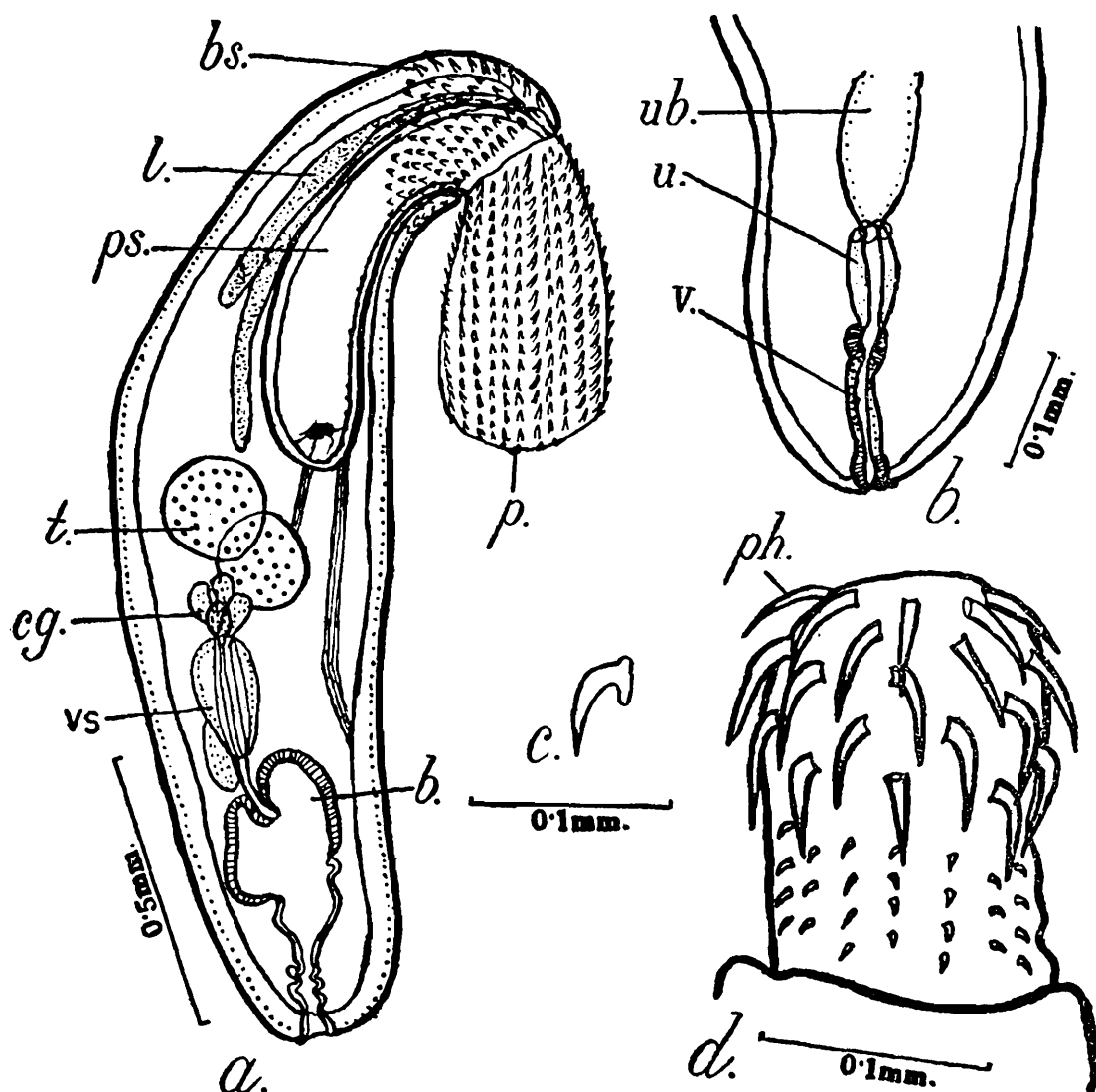
Yamaguti (1935 and 1937) and Fukui and Morishita (1936) described this species from *Plotosus anguillaris* of Japan. The new record in India of this parasite is from a related host. The measurements of this parasite from India are shown in Table 3.

TABLE 3

Showing characters of species of *Heterosentis* Van Cleave, 1931.

	<i>H. fusiformis</i> (Yamaguti)	<i>H. heteracantha</i> (V. Linstow).	<i>H. neobythites</i> (Yamaguti)	<i>H. plotosi</i> (Yamaguti)	<i>H. rhinoplagusia</i> (Yamaguti)	<i>H. spinicaudatus</i> (Cable & Quick)
♀ Total length	5—6 ..	4.75—5.85	8—12.5	5.29	3.16—7.13	..
♂		4.94	5.4—7.3	2.39—2.52	2.45—3.67	2.02
♀ Breadth	2—2.5 ..	0.4—0.79	..	0.72	0.5—0.8.	..
♂		0.59	..	0.36—0.5	0.5	0.52
Proboscis	0.34—1.43 long	0.3 × 0.17—0.2	0.5—0.65 × 0.13—0.2	0.17—0.29 × 0.11—9.2	0.3—0.29 × 0.11—0.2	0.32 × 0.07
Proboscis hooks (number and arrangement).	apical hooks 18, sub-apical 2, alternate rows of 7 hooks, basal 14 rows of 2—3 hooks.	10 long rows of 3—4 hooks each.	17—18 long rows of 11—13 hooks each, apical large, basal small.	Six spiral rows of 5 hooks anteriorly 13—14 long rows of 3—4 hooks each, posteriorly.	14 long rows of 10 hooks each.	10 diagonal longitudinal rows of 13 hooks each. Posterior 4 rows reduced in size.
Proboscis : hooks-size	apical 0.045—0.063 sub-apical 0.188—0.21, basal 0.024—0.069.	..	0.03—0.072	anterior hook 0.057—0.064, Posterior hooks 0.015.	Large hooks 0.042—0.063 : basal hooks 0.016—0.024.	Anterior hooks 0.028—0.03, Posterior hooks 0.012.
Host : Locality	<i>Spheriodes</i> sp : Japan	<i>Atherinichthys microlepidotes</i> Europe. :	<i>Neobythites macropus</i> : Japan.	<i>Plotosus anguillaris</i> <i>P. canius</i> : Japan & India.	<i>Rhinoplagusia faponica</i> : Japan.	<i>Halichoeres bivittatus</i> : Puerto Rico.

Three other species *Arhythmacanthus fusiformis* Yamaguti, 1936, *Acanthocephaloides neobythis* Yamaguti, 1939 and *A. rhinoplagus* Yamaguti, 1936 are also transferred to this genus and their measurements are also given in Table 3. The reasons for this transfer are discussed on page 85.



TEXT-FIG. 9 a-c.—*Mehrarhynchus secundus*, sp., nov.; d. *Heterosentis plotosus* Yamaguti, Proboscis.

(a). Complete worm (male). (b). Posterior part of female. (c). Proboscis hook.

b., bursa; bs., body spine; cd., cement gland duct; cg., cement gland; l., lemnisci; p., proboscis; ph., proboscis hook; ps., proboscis sheath; t., testis; u., uterus; ub., uterine bell; v., vagina.

RHADINORHYNCHIDAE

Rhadinorhynchus Lühe

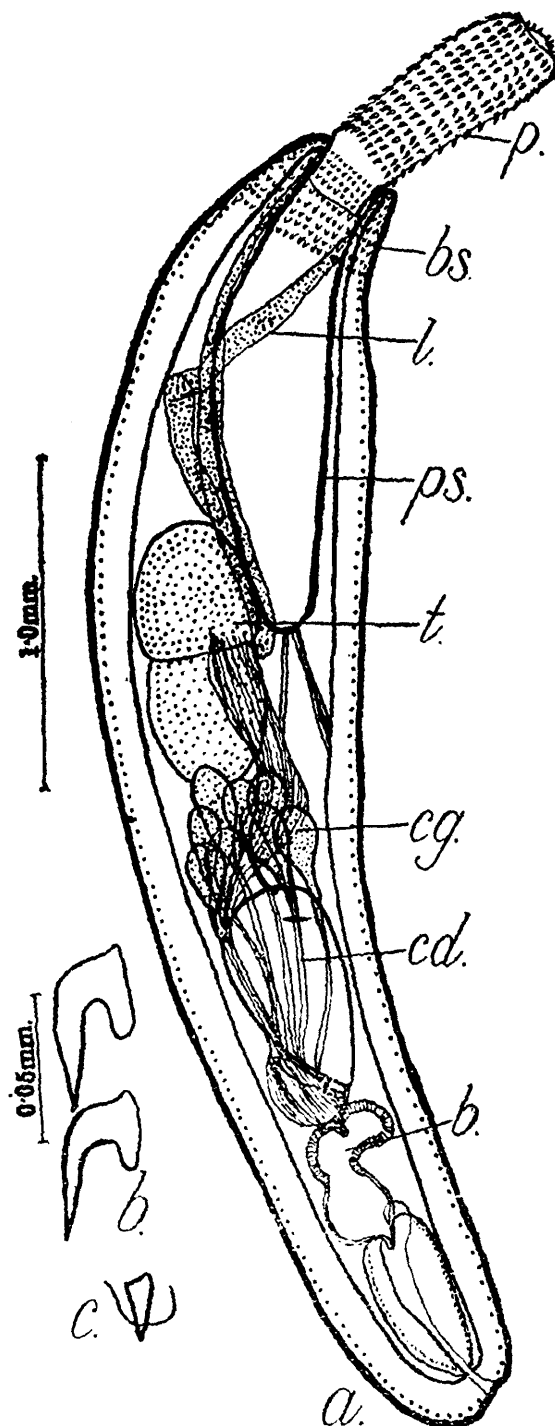
Rhadinorhynchus indicus, sp. nov.

(Text-fig. 10 a-c)

Several male and female specimens of this parasite were obtained from the intestine of *Tachysurus jella* from the sea at Puri and from the Chilka lake. Two males and two females of the same species were obtained from the intestine of another related Siluroid fish *Osteogeneiosus militaris* from the Chilka Lake.

The males are slightly smaller than the females. Proboscis long with 14 curved hooks in each of the 20—22 longitudinally arranged rows. Neck short and spineless. Trunk long and cylindrical with 6—9 circular

rows of body spines in the anterior region. Last row with 36 spines. The two lemnisci are slightly unequal but do reach the posterior testis. Proboscis sheath long with two layers and reaching the anterior testis. The testes are oval, overlapping and in the anterior half of the body. Cement glands 8, small and pyriform with their ducts opening into the ejaculatory duct. Vesicula seminalis pyriform. Bursa occupying pos-



TEST-FIG. 10.—*Rhadinorhynchus indicus*, sp. nov.

(a) Complete worm (male). (b) Proboscis hooks. (c) Body spine.

b., bursa; bs., body spine; cd., cement gland duct; cg., cement gland; l., lemnisci; p., proboscis; ph., proboscis hook; ps., proboscis sheath; t., testis.

terior third of the body. The body was so full of eggs that the female genital ducts could not be made out. Eggs ellipsoidal with three coverings in other species.

Measurements.—See Table 5.

Out of the 23 species shown in Table 4 only six are retained in this genus. Of these, only in two species the males are known. The inadequately described *R. alosae* is unrecognised. The measurement of the valid species are given in Table 5.

TABLE 4

Species	Author	Present generic position	Remarks
1. <i>alosa</i>] . . .	Hermann, 1782	<i>Rhadinorhynchus</i>	Not recognised as valid species
2. <i>aspinosus</i> . . .	Fukui & Morishita, 1937.	<i>Neorhadinorhynchus</i>	
3. <i>carangis</i> . . .	Yamaguti, 1939	<i>Nipporhynchus</i>	
4. <i>ditrematis</i> . . .	Yamaguti, 1939	<i>Nipporhynchus</i>	
5. <i>epinepheli</i> . . .	Yamaguti, 1939	<i>Rhadinorhynchus</i>	Male not known.
6. <i>exilis</i> . . .	Van Cleave, 1928	<i>Rhadinorhynchus</i>	Male not known.
7. <i>horridus</i> . . .	Lühe, 1912	<i>Rhadinorhynchus</i>	Male not known.
8. <i>johnii</i> . . .	Baylis, 1929	<i>Aspersentis</i>	
9. <i>katsuwonis</i> . . .	Harada, 1928	<i>Nipporhynchus</i>	(Syn. of <i>ornatus</i> .)
10. <i>medius</i> . . .	Van Cleave, 1918	<i>Gorgorhynchus</i>	
11. <i>meyri</i> . . .	Heinze, 1934	<i>Rhadinorhynchus</i>	Male not known.
12. <i>miyagawai</i> . . .	Fukui & Morishita, 1937.	<i>Rhadinorhynchus</i>	
13. <i>niloticus</i> . . .	Meyer, 1933	<i>Tenuisentis</i>	
14. <i>nudus</i> . . .	Harada, 1938	<i>Neorhadinorhynchus</i>	
15. <i>ornatus</i> . . .	Van Cleave, 1918	<i>Nipporhynchus</i>	
16. <i>peltorhamphi</i> . . .	Baylis, 1944	<i>Acanthocephalus</i>	
17. <i>pristis</i> . . .	Lühe, 1911	<i>Rhadinorhynchus</i>	
18. <i>selkerki</i> . . .	Van Cleave, 1920		(Syn. of <i>pristis</i> .)
19. <i>tenuicornis</i> . . .	Van Cleave, 1918	<i>Telosentis</i>	
20. <i>terebra</i> . . .	Rudolphi, 1819	<i>Raorhynchus</i>	
21. <i>trachiuri</i> . . .	Harada, 1935	<i>Nipporhynchus</i>	
22. <i>whecleri</i> . . .	Baylis, 1929	<i>Aspersentis</i>	
23. <i>indicus</i> , sp. nov. . .		<i>Rhadinorhynchus</i>	

From Table 5 it is clear that *R. indicus*, sp. nov. differs from all the other species in the number and size of proboscis hooks which are not differentiated dorsoventrally and in the absence of last row of larger hooks on the proboscis.

TABLE 5

		<i>R. epinepheli</i>	<i>R. exilis</i>	<i>R. horridus</i>	<i>R. indicus</i>	<i>R. meyeri</i>	<i>R. pristis</i>
Size		♀20	♀12×0.96	♀19×0.75	♀6.27—7.55× 1.07—1.21 ♂4.9—5.8× 0.84—1.01 18—20	♂25×1.4	♂75.0 long ♂20.0× 0.6—0.9 14—16
Proboscis hooks.	No. of long rows	16	12	14—16		22	
	No. of hooks per row. Size	12—13 Subapical, 0.1, basal 0.06.	32 0.071 0.024. 0.041	31	14 0.041 0.041	43	26
Proboscis		1×0.3	2.5×0.13	1.5×0.18	0.6—0.79×0.29—0.36	0.7×0.32—0.36	..
Proboscis sheath		2.1—2.3×0.26—0.35	..	..	1.45—1.59×0.29—0.36	..	..
Last row of larger hooks proboscis		absent	absent	present	absent	..	present
Body spines		0.033—0.04	0.012—0.018 long.	'Enormous size'.	0.022 long. 9—12 rows.	..	..
Egg		0.096—0.11×	0.053—0.059	..	0.079×0.019.	0.1×0.03	0.12×0.02
		0.036—0.045	×0.012				

Discussion.—Meyer (1931) gave a detailed classification of Acanthocephala based on the characters of the proboscis and the cement glands. Other attempts at classification of this group in recent years are by Travassos (1926), Thapar (1927) and Witenberg (1932). Van Cleave (1936 & 1948) emended the classification of Meyer and raised the Acanthocephala to the status of a Phylum, bringing about necessary changes in the families in his various publications on the basis, mainly of the cement glands. Southwell and MacFie (1925), Thapar (1927) and Baylis (1944) consider the cement glands unsuitable as taxonomic criteria. I agree with Van Cleave (1949) that cement glands could serve as one of the basic characters for distinguishing families and genera if taken together with the hook pattern of the proboscis, spination of the trunk, elongation and/or bulging of the neck or trunk. In such a scheme of classification the male assumes a very important position.

In this paper I have confined myself to the consideration of only those families of Acanthocephala which parasitise fishes and have therefore left out the order Archiacanthocephala, and the family Polymorphidae of the order Palaeacanthocephala. On the basis of the number of cement glands the various families can be arranged as follows :

- | | | |
|------------------------------------|-------|---|
| 1. Cement gland one syncytial mass | .. | Neoechinorhynchidae and Quadrigyridae. |
| 2. Two cement glands | .. | Acanthogyridae, Diplosetidae and Raorhynchidae. |
| 3. Four cement glands | | Gorgorhynchidae. |
| 4. Six cement glands | .. .. | Echinorhynchidae and Pomphorhynchidae. |
| 5. Eight cement glands | | Rhadinorhynchidae. |

This arrangement is probably not phylogenetic but with our present knowledge it may be helpful in systematic studies. A key to the various families is given on page 86.

The family Quadrigyridae differs from the Neoechinorhynchidae only in having body spines. Travassos (1926) and Witenberg (1932) placed the former as a subfamily of the latter, a view with which Baylis (1933 and 1947) was in agreement. Meyer (1931) placed these two families under separate orders. Van Cleave (1936) resolved the divergence of views by the creation of a new order, Eoacanthocephala, divided into two suborders Gyraacanthocephala (for Quadrigyridae and Pallisentidae) and Neoacanthocephala (for Neoechinorhynchidae and Hebesomidae) which were later raised by the same author (1948) to the status of an order. As seen above, these orders of Van Cleave (1948) are based on the presence or absence of the body spines, a character which can serve only for distinguishing genera or at best families. It is suggested here to suppress the order Gyraacanthocephala and the family Quadrigyridae be accommodated in the Neoacanthocephala. Further families Tenuisentidae Van Cleave (1936) and Hebesomidae Van Cleave (1924) be merged with Neoechinorhynchidae and the family Pallisentidae be merged with Quadrigyridae. *Eosentis* Van Cleave, (1928), is accepted as a synonym of *Neoechinorhynchus*.

In this paper a new genus *Raorhynchus* with two cement glands is created, for which a new family Raorhynchidae had also to be created because the genus could not be included either in Acanthogyridae or Diplosetidae (both with 2 cement glands). The characters of the three families are given below in Table 6.

TABLE 6

	Acanthogyridae, Thapar	Diplosetidae, Tubangui	Raorhynchidae, fam. nov.
Proboscis	Short club-shaped	Short club-shaped	Elongate oblong
Proboscis hooks	In 3 long rows, each with 3 recurved hooks.	In 12 long rows each with 8-9 hooks.	In 12-24 long rows each of 22-37 hooks showing dorso-ven- tral differentiation.
Trunk	Spiny	Smooth	Spiny
Lemnisci	Long	Enclosed in a sac and coiled.	Long

Van Cleave and Lincicome (1940) included in the family Rhadinorhynchidae only those genera in which there were 8 cement glands and created a new family Gorgorhynchidae for those having 4 cement glands. The genera *Fessisentis* and *Cavisoma* created by Van Cleave (1931) in the families bearing the generic names were based on the shape of the proboscis and the number of cement glands. In this review these two genera are placed under Gorgorhynchidae and their respective families are suppressed.

Rhadinorhynchoides Fukui and Morishita (1937) was placed by its authors under Centrorhynchidae. Yamaguti (1939) made it a subgenus of *Rhadinorhynchus* having 4 cement glands, no spines on body and 15 long rows each with 5 hooks on proboscis. This genus is placed here under Gorgorhynchidae.

Neorhadinorhynchoides, a subgenus of *Rhadinorhynchoides*, was created by Yamaguti (1939) for *Rhadinorhynchoides aspinosus*, Fukui and Morishita (1937) and *R. nudus* Harada (1937). According to Yamaguti (1939) the proboscis hooks show "no marked difference in the shape and size on dorsoventral side" in this subgenus, but in both these species there are apart from dorsoventral differentiation, the proboscis with 17—25 hooks in each of the 14—18 rows and 4 cement glands. This subgenus has been raised here to the rank of a genus and placed under Gorgorhynchidae. There are now 12 genera under this family of which 7 have spines on their body. A key to the genera is given on page 86.

Meyer (1931) characterised the family Echinorhynchidae as having a long or cylindrical proboscis, six pyriform or tubular cement glands, and

body lacking spines. He included *Echinorhynchus* (Zoega) Müller, *Acanthocephalus* Koelreuther, *Acanthocephaloides* Meyer, *Cavisoma* Van Cleave, and *Pomphorhynchus* Monticelli. Later on *Longicollum* Yamaguti, *Tenuiproboscis* Yamaguti, and *Hypoechinorhynchus* Yamaguti were added to this family. *Cavisoma* has been transferred here to Gorgorhynchidae and *Tenuiproboscis*, *Longicollum* and *Pomphorhynchus* are placed under *Pomphorhynchidae* by Yamaguti (1939). Baylis (1944) does not recognise *Acanthocephaloides* Yamaguti. Dollfus (1951) described a new species *A. chabaunadi* but did not include *Acanthocephaloides rhinoplagus* Yamaguti 1936, *A. neobythitis* Yamaguti 1939 and *A. japonicum* (Fukui and Morishita 1937) Yamaguti 1937. The first two species are transferred here by me to *Heterosentis* Van Cleave, as they have spines on body, 6 cement glands and proboscis hooks of two sizes. These two species (*A. rhinoplagus* and *A. neobythitis*) are placed by Cable and Quick (1954) in a new genus *Neoacanthocephaloides* together with a new species *N. spinicaudatus*. This genus is characterised by having 6 cement glands, body spined, proboscis with two types of hooks—characters which are similar to those of *Heterosentis*. Due to these similarities *Neoacanthocephaloides* is made a synonym of *Heterosentis*.

Acanthocephaloides japonicum is taken as valid species.

Arhythmacanthus Yamaguti (1936) is characterised as having a short proboscis with 3 types of hooks, body spined and 6—8 cement glands. Yamaguti (1936) placed this genus along with *Heterosentis* in the family Arhythmacanthidae. These two genera are similar except that in *Arhythmacanthus* the middle proboscis hooks are largest and apical and posterior hooks smaller while in *Heterosentis* the anterior hooks are larger than posterior ones. It is suggested here to merge *Arhythmacanthus* in *Heterosentis* and thus *A. fusiformis* becomes *Heterosentis fusiformis* and as a result of this the family Arhythmacanthidae is also suppressed.

Meyer (1932) suggested similarities between *Heterosentis* and *Acanthocephaloides*. The hook pattern of the proboscis, the shape and number of the cement glands in these two genera is similar except that the former genus has spines on the body which the latter lacks. On this basis *Heterosentis* is placed under Echinorhynchidae. It has now six species under it, whose measurements are given in Table 3.

A key to the genera of Echinorhynchidae and Pomphorhynchidae is given on page 88.

As stated above the family Rhadinorhynchidae is restricted to six genera having 8 cement glands. A satisfactory key to these genera given by Van Cleave and Lincicome (1940) still holds good and is not repeated here.

Rhadinorhynchus peltorhamphi Baylis, 1947 has six cement glands, proboscis hooks on ventral side are smaller and body lacks spines. This species is placed under *Acanthocephalus* though its proboscis hook pattern is slightly different from that of *Acanthocephalus*.

KEY TO THE GENERA AND FAMILIES OF NEOACANTHOCEPHALA AND
PALAEACANTHOCEPHALA (EXCEPT FAMILY POLYMORPHIDAE).

NEOACANTHOCEPHALA

- | | | | | | |
|------------------------|----|----|----|----|----------------------|
| 1. Body spines present | .. | .. | .. | .. | Quadrigyridae. |
| 1. Body spines absent | .. | .. | .. | .. | Neoechinorhynchidae. |

Family QUADRIGYRIDAE

- | | | |
|--|------|---|
| 1. Three transverse rows of proboscis hooks, each row with 6 hooks. | | <i>Acanthosentis</i> Verma & Datta, 1929. |
| 1. Four transverse rows of proboscis hooks | . 2. | |
| 2. Five hooks in each row, 4 rows of body spines | | <i>Quadrigyris</i> Van Cleave, 1920. |
| 2. First two rows with 6 hooks and posterior two rows with 7 hooks each, 17 rows of body spines. | | <i>Raosentis</i> Datta, 1946. |
| 2. Six hooks in each transverse row, body spines in two groups. | | <i>Pallisentis</i> Van Cleave, 1928. |
| 2. Eight hooks in each transverse row, 5-6 rows of body spines. | | <i>Neosentis</i> Van Cleave, 1928. |

Family NEOECHINORHYNCHIDAE

- | | | |
|---|--------|--|
| 1. Three transverse rows of proboscis hooks | . 2. | |
| 1. More than three transverse rows of proboscis hooks. | 4. | |
| 2. Anterior part of body inflated | . | <i>Eocollis</i> Van Cleave, 1947. |
| 2. Anterior part of body not inflated | . . 3. | |
| 3. Body small, with thick muscular band | . . | <i>Hebesoma</i> Van Cleave, 1928. |
| 3. Body long, lacking muscular band | . . | <i>Neoechinorhynchus</i> Hamann, 1906. |
| 4. Proboscis with 4 transverse rows of 22 hooks each | | <i>Pandosentis</i> Van Cleave, 1928. |
| 4. Proboscis with 6 diagonal rows of five hooks each. | | <i>Paulisentis</i> Van Cleave, 1949. |
| 4. Proboscis with 8 diagonal rows of 7 hooks each | | <i>Floridosentis</i> Ward, 1953. |
| 4. Proboscis with 8 transverse rows, anterior rows with 8 and posterior rows with 16 hooks. | | <i>Atactorhynchus</i> Chandler, 1935. |
| 4. Proboscis with 10—16 transverse rows of 16—20 hooks each. | | <i>Tanaorhamphus</i> Ward, 1918. |
| 4. Proboscis with 23 transverse rows of 16 hooks each. | | <i>Tenuisentis</i> Van Cleave, 1936. |

PALAEACANTHOCEPHALA

Family GORGORHYNCHIDAE

- | | |
|--|--|
| 1. Body with ventral pseudosegmental cuticular combs or fused rows of spines. | <i>Serrasentis</i> Van Cleave, 1928. |
| 1. Body without pseudosegmental cuticular combs or fused rows of spines. | 2. |
| 2. Body spination present | 3. |
| 2. Body spination absent | 7. |
| 3. Proboscis hooks showing dorsoventral differentiation. | 4. |
| 3. Proboscis hooks showing no dorsoventral differentiation. | 5. |
| 4. Proboscis hooks of ventral side more than twice of dorsal side. | <i>Aspersentis</i> Van Cleave, 1929. |
| 4. Proboscis hooks of ventral side less than twice of dorsal side, prominent arcuate hooks present at the base of proboscis. | <i>Nipporhynchus</i> Chandler, 1934. |
| 5. Cement glands very long | <i>Gorgorhynchus</i> Chandler, 1934. |
| 5. Cement glands pear shaped | 6. |
| 6. Proboscis having 16 long rows of 4 hooks each. | <i>Cleavius</i> Subhramanyan, 1927. |
| 6. Proboscis having 12 long rows of 8—9 hooks each. | <i>Micracanthocephalus</i> Harada, 1930. |
| 6. Proboscis having 20—22 long rows of 12—18 hooks each. | <i>Mehrarhynchus</i> Datta, 1940. |
| 7. Dorsoventral differentiation of proboscis hooks. | |
| 7. No dorsoventral differentiation of proboscis hooks. | 9. |
| 8. Proboscis with 15 long rows of 5 hooks each. | <i>Rhadinorhynchoides</i> Fukui & Morishita, 1931. |
| 8. Proboscis with 14—18 long rows of 17—25 hooks each. | <i>Neorhadinorhynchoides</i> Yam-guti, 1934. |
| 9. Proboscis long with 14 long rows of more than 20 hooks each. | <i>Filisoma</i> Van Cleave, 1936. |
| 9. Proboscis cylindrical with 12—16 long rows of 6—8 hooks each. Brain at the posterior end of proboscis sheath. | <i>Fessisentis</i> Van Cleave, 1926. |
| 9. Proboscis cylindrical with 12 long rows 8—10 hooks each, brain in the middle of proboscis sheath. | <i>Cavisoma</i> Van Cleave, 1931. |

Family ECHINORHYNCHIDAE

- | | | |
|---|----|---|
| 1. Hooks on proboscis of same size . . . | 2. | |
| 1. Hooks on proboscis of different size . . . | 3. | |
| 2. Proboscis round, with hooks, in 10 longitudinal rows of 3 and 2 hooks, ganglion at the base of proboscis sheath. | | <i>Hypoechinorhynchus</i> Yamaguti, 1939. |
| 2. Proboscis cylindrical with many hooks, ganglion near the middle of proboscis sheath. | | <i>Echinorhynchus</i> (Zoega) Muller. |
| 3. Gradual decrease in size of proboscis hooks antero-posteriorly, ganglion at the base of receptacle. | | <i>Acanthocephalus</i> Koelreuther, 1776. |
| 3. Proboscis hooks in 2 or 3 distinct size groups . . . | 4. | |
| 4. Body smooth | | <i>Acanthocephaloides</i> Meyer, 1931. |
| 4. Body with spines | | <i>Heterosentis</i> Van Cleave, 1931. |

Family POMPHORHYNCHIDAE

- | | | |
|--|----|--|
| 1. Anterior part of neck swollen to form a bulla, proboscis cylindrical. | | <i>Pomphorhynchus</i> Monticeli, 1905. |
| 1. Anterior part of neck not swollen | 2. | |
| 2. Proboscis filiform, neck long and thin | | <i>Tenuiproboscis</i> Yamaguti, 1936. |
| 2. Proboscis cylindrical, neck long, expanded on one side. | | <i>Longicollum</i> Yamaguti, 1936. |

CONCLUSION

There are at present 36 species of *Acanthocephala* known from 45 species of Indian fishes. Of these 17 are from marine and estuarine fishes and 19 from freshwater fishes. The life history of none of these species has yet been studied, though their taxonomy has received relatively greater attention. It is hoped that future work on this group will be devoted to other aspects such as life history and physiology, etc.

ACKNOWLEDGMENTS

My thanks are due to Dr. H. S. Rao for encouragement in this work and for a critical revision of the manuscript. The new genus *Raorhynchus* and the family Raorhynchidae are in respectful dedication to his interest in the work. My thanks are also due to Dr. T. V. R. Pillay for donation of the specimens of *Acanthocephala* from *Mugil tade* and to Sri M. N. Datta of the Zoological Survey of India for help with literature and confirmation of identifications.

SUMMARY

Ten new species including one new genus and a new family of Acanthocephala are described. Descriptions of juvenile forms of *Neoechinorhynchus topseyi* Poddar and of a hitherto undescribed species of *Neoechinorhynchus* are given. *Heterosentis plotosi* Yamaguti is recorded from India for the first time. The order Gyraacanthocephala is suppressed and various genera of Eoacanthocephala and Palaeacanthocephala (except family Polymorphidae) are re-arranged and key to the genera of the families is given.

CHECK LIST OF ACANTHOCEPHALA DESCRIBED FROM INDIA

I—Systematic List

Class EOACANTHOCEPHALA

Order NEOACANTHOCEPHALA

Family NEOECHINORHYNCHIDAE

Genus *Neoechinorhynchus* Hamann, 1892

<i>Parasite.</i>	<i>Host.</i>	<i>Locality.</i>
1. <i>N. agilis</i> (Rudolphi, 1819)	<i>Mugil cephalus</i>	Chilka lake.
2. <i>N. bangoni</i> , sp. nov. ..	<i>Mugil tade</i>	Calcutta.
3. <i>N. chilkaensis</i> Poddar, 1936.	<i>Mugil cephalus</i>	Chilka lake.
4. <i>N. devdevi</i> (Datta, 1936) ..	<i>Schizothorax planifrons</i> ..	Kashmir.
5. <i>N. elongatus</i> , sp. nov. ..	<i>Mugil dussumieri</i> ..	Madras.
	<i>M. subviridis</i> ..	Chilka.
6. <i>N. hutchinsoni</i> Datta, 1936	<i>Diptychus maculatus</i> ..	Kashmir.
7. <i>N. mansabalensis</i> Kaw, 1951.	<i>Oreinus sinuatus</i>	Kashmir.
8. <i>N. nematalosi</i> , sp. nov. ..	<i>Nematalosa nasus</i> ..	Chilka lake.
9. <i>N. ovalis</i> , sp. nov. ..	<i>Elops saurus</i>	Chilka lake.
10. <i>N. rigidus</i> (Van Cleave, 1928).	<i>Schizothorax zarudnyi</i> ..	Kashmir.
11. <i>N. rutili</i> (Miller, 1776) ..	<i>Nemachilus stoliczkae</i> ..	Kashmir.
	<i>N. vittatus</i>	Kashmir.
12. <i>N. topseyi</i> Poddar, 1937 ..	<i>Polynemus paradiseus</i> ..	Calcutta.
	<i>Cynoglossus lingua</i> (Juvenile form).	Port Canning.
13. <i>N. yalei</i> (Datta, 1936) ..	<i>Schizothorax esocinus</i> ..	Kashmir.
14. <i>Neoechinorhynchus</i> sp. ..	<i>Pama pama</i> & <i>Eutropiichthys wacha</i> .	Buxar (R. Ganga).

Family QUADRIGYRIDAE

Genus **Acanthosentis** Verma & Datta, 1929

1. *A. antespinus* Verma & *Macrones gulio* Calcutta.
Datta, 1929.
2. *A. betwai*, sp. nov. *Labeo gonius* .. Bhopal.
3. *A. holospinus* Sen, 1938 *Barbus ticto* Calcutta.
(Sp. *A. dattai* Poddar, *B. stigma*
1938).
4. *A. indica*, sp. nov. *Hilsa ilisha* & *Setipinna* Ganga, Hooghly &
phasa. Chilka lake.
5. *A. sircari* Poddar, 1941 .. *Rasbora elanga* Calcutta.

Genus **Pallisentis** Van Cleave, 1928(Syn. *Ferzandia* Thapar, 1930)

1. *P. nagpurensis* (Bhalerao, *Channa striatus* .. Nagpur, Calcutta.
1931).
2. *P. nandai* Sarkar, 1953 *Nandus nandus* W. Bengal.

Genus **Raosentis** Datta, 1947

1. *R. poddari* Datta, 1947 *Mystus cavasius* Bengal.

Class METACANTHOCEPHALA

Order PALAEACANTHOCEPHALA

Family ACANTHOGYRIDAE

Genus **Acanthogyrus** Thapar, 1927

1. *A. acanthogyrus* Thapar, *Labeo rohita* Lucknow, Calcutta.
1927. *Catla catla.*

Family RAORHYNCHIDAE, fam. nov.

Genus **Raorhynchus**, gen. nov.

1. *R. polynemi*, sp. nov. .. *Polynemus sextarius* Puri and Madras.

Family GORGORHYNCHIDAE

Genus **Filisoma** Van Cleave, 1928.

1. *F. indicum* Van Cleave, *Scatophagus argus* Chilka.
1928.

1. *R. indicus*, sp. nov, .. *Arius jella* Chilka lake.
Osteogeniosus militaris

2. Host List

Class PISCES

Subclass *ELASMOBRANCHI*

I. Family RHINOBATIDAE

1. *Rhynchobatus djeddensis* Serrasentis longa.
(Forsk.). (M)¹.

Subclass *TELEOSTEI*

Order CLUPEOIDEA

II. Family ELOPIDAE

2. *Elops saurus* Linn. (M. & E.) Neoechinorhynchus ovalis.

III. Family CLUPEIDAE

3. *Hilsa ilisha* (Ham.) (E. & FW.) .. Acanthosentis indica.

IV Family DOROSOMATIDAE

4. *Nematoïosa nasus* (Bloch) (E) Neoechinorhynchus nematalosi.

V. Family ENGRAULIDAE

5. *Setipinna phasa* (Ham.) (E. & FW.) Acanthosentis indica.

Order CYPRINOIDEA

VI. Family CYPRINIDAE

- | | | |
|--|--|----------------------------------|
| 6. <i>Barbus ticto</i> (Ham.) (FW.) | | } Acanthosentis holospinus. |
| 7. <i>B. stigma</i> (Cuv. & Val.) (FW.) | | |
| 8. <i>Catla catla</i> (Ham.) (FW.) .. | | Acanthogyrus acanthogyrus. |
| 9. <i>Diptychus maculatus</i> Stein. (FW.) | | Neoechinorhynchus hutchinsoni. |
| 10. <i>Labeo gonius</i> (Ham.) (FW.) | | Acanthosentis betwai. |
| 11. <i>L. rohita</i> (Ham.) (FW.) | | Acanthogyrus acanthogyrus. |
| 12. <i>Oreinus sinuatus</i> (Heckel) (FW.) | | Neoechinorhynchus mansabalensis. |
| 13. <i>Rasbora elanga</i> (Ham.) (FW.) | | Acanthosentis sircari. |
| 14. <i>Schizothorax esocinus</i> Heckel (FW.) .. | | Neoechinorhynchus yalei. |
| 15. <i>S. planifrons</i> Heckel (FW.) | | N. devdevi. |
| 16. <i>S. stoliczkae</i> Stein. (FW.) | | Acanthocephalus kashmirensis. |
| 17. <i>S. zarudnyi</i> (FW.) | | Neoechinorhynchus rigidus. |
| 18. <i>Schizothorax</i> sp. (FW.) | | Echinorhynchus orientalis. |

¹ [M.—Marine ; E.—Estuarine ; FW.—Fresh water]

VII. Family COBITIDAE

- | | | |
|--|-------|-----------------------------------|
| 19. <i>Botia berdi</i> (Blyth) (FW.) | .. | Pomphorhynchus sp. |
| 20. <i>Nemachilus kashmirensis</i> (FW.) | .. | Pomphorhynchus kashmi-
rensis. |
| 21. <i>N. stoliczkae</i> Stein. (FW.) | .. .. | } Neoechinorhynchus rutili. |
| 22. <i>N. vittatus</i> (Heckel) (FW.) | .. | |

Order SILUROIDEA

VIII. Family SCHILBEIDAE

- | | | |
|--|-------|-------------------------|
| 23. <i>Eutropiichthys vacha</i> (Ham.) (FW.) | .. .. | Neoechinorhynchus sp. |
| 24. <i>Pangasius pangasius</i> (Ham.) (FW.) | | Mehrarhynchus prashadi. |

IX. Family BAGRIDAE

- | | | |
|---|-------|---------------------------|
| 25. <i>Mystus cavasius</i> (Ham.) (FW.) | .. | Raosentis poddari. |
| 26. <i>M. gulio</i> (Ham.) (FW.) | .. .. | Acanthosentis antespinus. |

X. Family TACHYSURIDAE

- | | | |
|--|----|---|
| 27. <i>Tachysurus jella</i> (Day) (M. & E.) | . | Rhadinorhynchus indicus |
| 28. <i>Osteogeniosus militaris</i> (Linn.) (M. & E.) | .. | Mehrarhynchus secundus,
Rhadinorhynchus indiens. |

Family PLOTOSIDAE

- | | | |
|---|------|-----------------------|
| 29. <i>Plotosus canius</i> (Ham.) (M. & E.) | . .. | Heterosentis plotosi. |
|---|------|-----------------------|

Order PERCESOCES

XII. Family POLYNEMIDAE

- | | | |
|---|-------|----------------------------|
| 30. <i>Polynemus paradasius</i> (Linn.) (E) | .. .. | Neoechinorhynchus topseyi. |
| 31. <i>Polydactylus sextarius</i> (Bloch) (M) | .. .. | Raorhynchus polynemi. |
| 32. <i>Eleutheronema tetradactylum</i> Shaw (M. & E.) | . | Neoechinorhynchus topseyi. |

XIII. Family MUGILIDAE

- | | | |
|---|-------|---|
| 33. <i>Mugil cephalus</i> (Linn.) (M. & E.) | | Neoechinorhynchus agilis & N.
chilkaensis. |
| 34. <i>Mugil dussumieri</i> (Cuv. & Val.) (ME.) | .. .. | } Neoechinorhynchus elongatus. |
| 35. <i>Mugil subviridis</i> (Cuv. & Val.) (E) | .. .. |  |
| 36. <i>Mugil tade</i> Forsk. (E) | .. .. | Neoechinorhynchus bangoni. |

Order PERCOMORPHI

XIV Family SERRANIDAE

37. *Sarranus* sp. (M) *Cavisoma magnum*.

XV. Family LUTJANIDAE

38. *Lutjanus johnii* (Bloch) (M) .. *Serrasentis chauhani*.

XVI. Family NANDIDAE

39. *Nandus nandus* (Ham.) (E) *Pallisentis nandai*.

XVII. Family SCIAENIDAE

40. *Pama pama* (Ham.) (E) (FW.) .. *Neoechinorhynchus* sp. & *Mehr-arhynchus secundus*.

XVIII. Family SCATOPHAGIDAE

41. *Scatophagus argus* (Cuv. & Val.) (E) *Filisoma indicum*.

XIX. Family ACANTHURIDAE

42. *Acanthurus strigosus* Bennett (M) *Cavisoma magnum*.

Order OPHICEPHALOIDEA

XX. Family CHANNIDAE

43. *Channa striatus* (Bloch) (FW.) .. . *Pallisentis nagpurensis*.

Order HETEROSOMATA

XXI. Family PSETTODIDAE

44. *Psettodes erumei* (Bl. & Schn.) (M) .. *Serrasentis chauhani*.

XXII. Family CYNOGLOSSIDAE

45. *Cynoglossus lingua* (Ham.) (E) *Neoechinorhynchus topseyi*.

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A CHECKLIST OF GENERA OF INDIAN BIRDS

ADDITIONS AND CORRECTIONS

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In my 'Checklist of genera of Indian birds' [*Rec. Indian Mus.*, 50, pp. 1-62 (1953)], a number of typographical errors and omissions have crept in, mainly because I was away in the field during its printing. The following is a list of the major corrections. I take this opportunity to make a few additions and alterations mostly in the arrangement of species in the light of recent researches.

For drawing my attention to some of the mistakes and for critical opinion on certain items, I have to thank Drs. Ernst Mayr, Dean Amadon, Charles Vaurie and Walter Koelz, Capt. Jean Delacour, Mr. H. G. Deignan and Shri A. K. Mukherjee.

Page 11, line	4.	For ' <i>burmanicus</i> ', read : ' <i>buteo</i> ¹ '.
" " "	10.	The species list should read : ' <i>Spizaetus nipalensis</i> , <i>S. cirrhaius</i> and <i>S. nanus</i> '.
" " lines	22-23.	For ' <i>Ichthyophaga</i> ', read: ' <i>Ichthyophaga</i> '.
" " after line	29.	Add footnote :
		'Includes <i>burmanicus</i> .'
" 12, lines	12-13.	Delete : '(regular visitor)' from <i>C. melanoleucus</i> .
" " line	20.	For ' <i>POLIHIERACINA</i> ', read : ' <i>POLIHIERACINAE</i> '
" " "	23.	Replace ' <i>fringillarius</i> ' by ' <i>horsfieldi</i> '.
" " lines	27-28.	The subgenera may be treated as synonyms.
" 13, line	14.	Add : ' <i>A. speciosa</i> ¹ ' after <i>grayi</i> .
" " "	19.	For ' <i>E. gularis</i> ¹ ', read : ' <i>E. gularis</i> ² '.
" " "	27.	Add : ' <i>I. eurhythmus</i> ³ ' after <i>sinensis</i> .
" " footnotes.		

Add : '¹Status unknown.'

For '¹Includes *asha*', read : '²Includes *schistacea* (syn. *asha*).'

Add : '³Status doubtful.'

- Page 14, line 9. Add : ' 1 ' to *papillosa*.
 „ „ „ 9. Delete : ' and *Ps. davisoni* ' .
 „ „ after line 29. Add footnote :
 ' ¹Includes *davisoni*. '
- „ 15, line 17 For ' *cygnu* ' read : ' *cygnus* ' .
 „ „ „ 31. Delete : ' (regular visitor) ' from *A. platyrhychos*.
 „ 16, „ 8. Delete : ' (regular visitor) ' from *A. fuligula*.
 „ „ after line 21. Add :

' Genus **Clangula** Leach

Species in India—*Clangula hyemalis*² .

- „ „ footnote. Add :

' ²Status not known : there are only a few records of the species from our area. '

- „ 18, line 5. For ' *charlotini* ', read : ' *charltoni* ' .
 „ 19, „ 12. For ' *malacensis* ', read : ' *malacense* ' .
 „ 23, „ 23. Delete : ' (regular visitor) ' .
 „ 24, „ 12. For ' *asiatica* ', read : ' *asiaticus* ' .
 „ „ „ 23. For ' *stagnatalis* ', read : ' *stagnatilis* ' .
 „ 25, „ 10. For ' *canutus* ', read : ' *canuta* ' .
 „ „ „ 11. For ' *albus* ', read : ' *alba* ' .
 „ „ „ 11. Add : ' 1 ' to *ruficollis*.
 „ „ „ 12. Delete : ' *C. minutus* (regular visitor) ' .
 „ „ „ 12. Replace ' *subminutus* ' by ' *minutilla*² ' .
 „ „ „ 13. For ' *acuminatus* (regular visitor) ' read ' *acuminata* (casual visitor) ' .
 „ „ „ 13. For ' *alpinus* ', read : ' *alpina* ' .
 „ „ „ 14. For ' *testaceus* ', read : ' *testacea* ' .
 „ „ after line 36. Add footnotes :

' ¹ Includes *minuta*. '

' ²Includes *subminuta*. '

- „ 27, line 8. Replace ' *melanogaster* ', by ' *acuticauda* ' .
 „ 29, „ 15. Delete : ' (? casual visitor) ' .
 „ „ „ 19. For ' *ketupu* ', read : ' *ketupa* ' .
 „ 33, „ 12. For ' *APODINA* ', read : ' *APODINAE* ' .
 „ „ „ 14. After ' *Collocalia* ', add : ' *lowi*, *C.* '

Page 34,	line	10.	After 'viridis', add : 'M. rafflesi' ¹
" "	"	11.	For footnote indicators '1,2' and '3' read : '2,3' and '4'
" "	"	22.	For 'viridianus', read : 'viridanus'.
" "	"	33.	For footnote indicator '4', read : '5'
" "	footnotes.		Add : ' ¹ Once recorded from our area.' For numbers '2', '3' and '4', read : '3', '4' and '5'.
" 36,	line	24.	Replace 'cucullata' by 'sordida' ⁴
" "	footnotes.		Add : ' ⁴ Includes cucullata.'
" 38,	line	15.	Delete : 'P. dispar' ³ .
" "	"	15.	Add : '3' to melanicterus.
" "	"	15.	After 'melanicterus' ³ , add : 'P. squamatus'
" "	"	18.	After 'simplex' add : 'P. brunneus'.
" "	"	34.	For 'lafresnayi', read : 'lafresnayeri'.
" "	footnotes.		Note '3' should read : ' ³ Includes gularis, dispar and flaviventris.'
" 39,	line	15.	For 'novaehollandiae', read : 'novaehol- landiae'.
" "	"	15.	Before 'C. melaschistos', add : 'C. polioptera'
" "	"	19.	Should read : 'P. igneus, P. solaris, P. roseus' ⁴ , P. peregrinus and P. erythropygia' ⁵ .
" "	"	29.	For footnote indicator '4', read : '6'.
" "	"	34.	After 'sapphira', add : 'F. cyanome- lana (regular visitor)'.
" "	after line	34.	Add : 'Genus Muscicapella Bianchi Species in India— <i>Muscicapella hodgsoni</i> .'
" "	footnotes.		After note '3' add : ' ⁴ Includes cantonensis and divaricatus. ⁵ Includes albifrons'. For number '4', read '6',
" 40,	line	5.	After 'concreta', add : 'N. hainana'.
" "	"	6.	Add : 'and' after 'banyumas' ²
" "	"	6.	Delete : 'and N. hodgsoni'.
" "	"	20.	For 'griseola', read : 'grisola'.
" "	"	29.	Replace 'nigrocapitatum' by 'capis- tratum' ³ .
" "	footnote.		Add : ' ³ Includes nigrocapitatum'.

- Page 41, line 6. After '*erythrogenys*', add : '*erythrocnemis*²'.
- " " " 12. For '*Turdinus* Blyth', read : '*Napothera* G. R. Gray'.
- " " " 13. After 'Syn.', add : '*Turdinus* Blyth,'.
- " " " 14. For '*Turdinus*' read : '*Napothera*'.
- " " " 14. For '*T*', read : '*N.*'.
- " " lines 15, 21. For footnote indicators '2', '3', '4',
22, 24. '5' and '6', read : '3', '4', '5',
'6' and '7'.
- " " line 28. For '*S. striata*⁷', read : '*S. striolata*⁸'.
- " " " 30. For footnote indicator '8', read : '9'.
- " " footnotes. After note '1', add :
'²Includes *mcclellandi* and *odicus*'.
For numbers '2', '3', '4', '5', '6', '7' and '8',
read : '3', '4', '5', '6', '7', '8' and '9'.
- " 42, after line 11. Add :
'Genus *Conostoma* Hodgson
Species in India—*Conostoma aemodium*'.
- " " line 13. Delete : '*Conostoma* Hodgson'.
- " " " 15. Delete : '*Paradoxornis aemodium*'.
- " " " 15. For '*P. unicolor*' read : '*Paradoxornis unicolor*'.
- " " " 16. For '*dravidiana*' read : '*dauidiana*'.
- " " " 33. After '*subunicolor*', add : '*G. henrici*'.
- " 43, " 28. Add : '4' to 'India'.
- " " " 29. For footnote indicator '4' read : '5'.
- " " " 29. After '*cinereiceps*' add : '*A. rufogularis*'.
- " " " 29. After '*poiocephala*', add : '*A. morrisonia*'.
- " " " 32. For footnote indicator '5', read : '6'.
- " " footnotes. After note '3' add :
'⁴Baker [*Faun. Brit. India, Bds.*, 1 : 290-291 (1922)]
included *Alcippe ruficapilla* in the Indian avifaunal
list on a very doubtful record.'
For numbers '4' and '5', read : '5' and '6'.
- " 44, line 13. For '*C. fortipes*³' read : '*C. montana*³'.
- " " footnotes. Note³ should read :
'³Antedates *fortipes* and includes *pallidus*'.
- " 45, line 11. After '*orinus*', add : '*A. bistrigiceps*
(regular visitor)'.
- " " " 12. Delete : '2' from '*stentorius*'.
- " " " 12. Replace '*arundinaceus*' by '*orientalis*'.
- " " " 16. After '*tyleri*', add : '*P. subaffinis*²'.

Page 45, line	18.	Delete : ' (regular visitor) ' from <i>P. armandi</i> .
„ „ footnotes.		Note ' 2 ' should read : Status doubtful.
„ 46, lines	3-4.	The species list should read : ' <i>Orthotomus cucullatus</i> ¹ , <i>O. sericeus</i> , <i>O. sutorius</i> , <i>O. atrogularis</i> and <i>O. sepium</i> ² '.
„ „ „ 9, 10, 17.		For footnote indicators ' 1 ', ' 2 ' and ' 3 ', read : ' 3 ', ' 4 ' and ' 5 '
„ „ after line 14.		Add : ' For a recent review of the sub-family, see Ripley, <i>Postilla</i> (13): 1—48 (1952), which proposes certain changes in the arrangement of the genera and species listed below.'
„ „ line	18.	Delete : ' and '.
„ „ „	18.	After ' (regular visitor) ', add : ' <i>L. obscura</i> ⁶ '.
„ „ „	23.	For ' <i>svecicus</i> ', read : ' <i>suecicus</i> '.
„ „ „	24.	For footnote indicator ' 4 ', read : ' 7 '.
„ „ footnotes.		Add : ¹ Includes <i>coronatus</i> . ² Includes <i>ruficeps</i> . For numbers ' 1 ', ' 2 ', and ' 3 ', read : ' 3 ', ' 4 ' and ' 5 '.
		Add : ' ⁶ Status not known ; only once recorded from our area.'
		For number ' 4 ', read : ' 7 '.
„ 47, line	5.	Replace ' <i>macrourus</i> ' by ' <i>malabaricus</i> '.
„ „ „	16.	For ' <i>eunomus</i> ' read : ' <i>naumanni</i> ⁴ '
„ „ lines	21, 28.	For footnote indicators ' 4 ', and ' 7 ', read : ' 5 ', and ' 6 '.
„ „ line	21.	For ' <i>molissima</i> ', read : ' <i>mollissima</i> '.
„ „ „	23.	Delete : ' 5 ' from ' <i>solitarius</i> '
„ „ „	23.	Add : ' <i>M. rufiventris</i> ,' after <i>solitarius</i> .
„ „ „	24.	For ' <i>gularis</i> ⁶ ', read : ' <i>cinctorhynchus</i> '.
„ „ footnotes.		After note ' 3 ', add : ⁴ Includes <i>eunomus</i> . Delete notes ⁵ and ⁶ . For numbers ' 4 ' and ' 7 ', read : ' 5 ' and ' 6 '.
„ 48, line	14.	For ' <i>ruficapilla</i> ', read : ' <i>ruficapillus</i> '.
„ „ „	31.	For ' <i>spilonetta</i> ', read : ' <i>spinoletta</i> '.
„ 49, „	24.	Replace ' <i>stoliczkae</i> ' by ' <i>nipalensis</i> '.
„ 50, „	6.	Add : ' 2 ' to <i>himalayensis</i> .
„ „ „	6.	Delete : ' <i>S. victoriae</i> '.
„ „ „	11.	Delete : ' 2 ' from ' <i>palustris</i> '.

Page 5),	line	21.	Add : ' 5 ' to ' <i>iouschistos</i> '.
" "	"	22.	Delete : ' <i>Ae. bonvaloti</i> '.
" "	"	25.	For footnote indicator ' 5 ' read : ' 6 '.
" "	footnotes.		Note ' 2 ' should read :
			' Includes <i>victoriae</i> .'
			Add : ' 5 Includes <i>bonvaloti</i> .'
			For number ' 5 ', read : ' 6 '.
" 51,	line	29.	After ' <i>siamensis</i> ', add : ' <i>Z. erythropleura</i> (regular visitor)'
" 52,	"	3.	For ' <i>fucta</i> ', read : ' <i>fucata</i> '.
" "	"	4.	For ' <i>rutilla</i> ', read : ' <i>rutila</i> '.
" "	"	5.	Delete : ' and '.
" "	"	5.	After ' <i>calandra</i> ', add : ' <i>E. elegans</i> (regular visitor) and <i>E. tristrami</i> ³ '.
" "	lines	18, 27.	For footnote indicators ' 3 ' and ' 4 ', read : ' 4 ' and ' 5 '.
" "	footnotes.		After note ' 2 ', add :
			' ³ Only once obtained within our limits.'
			For numbers ' 3 ', and ' 4 ', read : ' 4 ', and ' 6 '.
" 53,	line	12.	For ' <i>erythaea</i> ', read : ' <i>erythaca</i> '.
" "	"	16.	For ' <i>caneipes</i> ' read : ' <i>carnipes</i> '.
" "	"	16.	After ' <i>melanozanthos</i> ', add : ' <i>M. affinis</i> '.
" 55,	"	14.	After ' <i>Oriolus</i> ', add ' <i>O. tenuirostris</i> '.
" "	"	21.	For ' <i>macrocerus</i> ', read : ' <i>macrocercus</i> '.
" 57, col. 2,	line	49.	For ' - ', read : ' = '.
" 58,	" 1,	4.	For ' CERCHNEIS '. read : ' <i>Cerchneis</i> '.
" "	" 1, after "	46.	Add : ' Clangula Leach, 16 '.
" "	" "	51.	For ' <i>Conostoma</i> ', read : ' Conostoma '.
" "	" 2,	53.	For ' ERYTHROPUS ' read ' <i>Erythropus</i> '.
" 59,	" "	5.	For ' HIEROFALCO ', read : ' <i>Hierofalco</i> '.
" "	" "	32.	For ' <i>Ichthyophaga</i> ', read : ' <i>Ichthyophaga</i> '.
" 60,	" "	4.	For ' <i>Muscicapella</i> ', read : ' Muscica- pella '.
" "	" "	13.	For ' <i>Napothera</i> G. R. Gray, preoc- cupied ', read : ' Napothera G. R. Gray, 41 '.
" 61,	" "	22.	For ' RHYNCHODON ', read : ' <i>Rhyncho-</i> <i>don</i> '.
" 62,	" 1,	36.	For ' TINNUNCULUS ', read : ' <i>Tinnun-</i> <i>culus</i> '.
" "	" 2,	9.	For ' Turdinus ', read : ' <i>Turdinus</i> '.

POST-SCRIPT

After the present article was sent to press in 1955, several papers having a direct bearing on the systematics of Indian birds have been published or have come to my notice. Some of those papers cover a number of points contained in this article, while the other papers propose some further changes in my 'Checklist'. The more important such references are :—

- AMADON, D. 1956., Remarks on the starlings, family Sturnidae.—*Amer. Mus. Novit.*, (1803), pp. 1—41.
- AMADON, D., 1957. Remarks on the classification of the perching birds [order Passeriformes].—*Proc. zool. Soc.*, Calcutta, Mookerjee mem. Vol., pp. 259—268.
- BOCK, W. J., 1956. A generic review of the family Ardeidae (Aves).—*Amer. Mus. Novit.*, (1779), pp. 1—49.
- DEIGNAN, H. G., 1956. The Asiatic species of birds of the genus *Criniger* (Pycnonotidae).—*Smithson. Misc. Coll.*, **134**(2), pp. 1—9.
- DEIGNAN, H. G., 1957. A note on some generic names in the Timaliinae.—*Bull. Brit. orn. Cl.*, **77**, p. 103.
- DELACOUR, J. and VAURIE, C., 1957. A classification of the Oscines (Aves).—*Contrib. Sci., Los Angeles Co. Mus.*, (16), pp. 1—6.
- MAYR, E., 1955. Comments on some recent studies of song bird phylogeny.—*Wilson Bull.*, **67**, pp. 33—44.
- MAYR, E. and GREENWAY, J. C., 1956. Sequence of passerine families (Aves).—*Breviora*, (58), pp. 1—11.
- VAURIE, C., 1955. Systematic notes on Palearctic birds. No. 14. Turdinae : the genera *Erithacus*, *Luscinia*, *Tarsiger*, *Phoenicurus*, *Monticola*, [*Saxicola*], *Erythropygia*, and *Oenanthe*.—*Amer. Mus. Novit.*, (1731), pp. 1—30.
- VAURIE, C., 1957. Systematic notes on Palearctic birds. No. 28. The families Remizidae and Aegithalidae.—*Amer. Mus. Novit.*, (1853), pp. 1—21.
- VAURIE, C., 1957. Systematic notes on Palearctic birds. No. 29. The subfamilies Tichodromadinae and Sittinae.—*Amer. Mus. Novit.*, (1854), pp. 1—26.
- WETMORE, A., 1957. The classification of the Oscines Passeriformes.—*Condor*, **59**, pp. 207—209.

Calcutta,
 25th July 1958 }
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B. BISWAS.