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FRESHWATER SPONGES

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INTRODUCTION

A perusal of literature reveals that after the pioneering works of Annandale (1906 - 1916) on the freshwater sponges of India including those of West Bengal a single paper by Soota and Pattanayak (1982) is available wherein only 7 species from this state have been dealt with. It may be mentioned here that so far a total of 31 species belonging to 18 genera have been recorded from India (Prakash et.al., 1972; Khera and Chaturvedi, 1976; Malhotra et.al. 1977; Soota and Pattanayak, 1982; Soota and Pattanayak, 1983) and 14 species under 8 genera were recorded from West Bengal.

In order to make an upto date account of the freshwater sponge fauna of West Bengal a number of faunistic surveys were undertaken in different areas of the state during the years 1985-1988. As a result of above surveys a total of 66 lots of freshwater sponges were collected which belong to 9 species under 6 genera. In addition to this, 7 more species under 3 genera records are available in literature. As a result the total species of freshwater sponges of West Bengal goes upto 16 under 9 genera. These are being dealt with in this paper. Out of these one genus and two species are recorded for the first time in Indian region and 7 species are forming new locality records. Key to the genera and species of freshwater sponges of West Bengal and their distribution by charts and maps are also included in this paper. The classification of sponges is based on Penney and Racek (1968).

MORPHOLOGY AND TERMINOLOGY

Acerate : A type of microscleres with their central portion bear a number of long perpendicular radiating rays. (Text-fig. 19)

Amphioxea : Spicule with tapering or pointed at both ends. (Text-fig. 1)

Amphistrongyle : Spicule with blunt or rounded at both ends. (Text-fig. 9)

Aster : A type of microscleres with several rays originating from the same centre. (Text-fig. 18)

Basal lamina : The attachment surface of a sponge.

Birotulate : A type of gemmoscleres with a cylindrical shaft with two rotules at both ends (Text-fig. 20)

Body colour : Colouration of spongillids depends on the presence or absence of zoochlorellae within the tissue of the sponge, rarely by the presence of green or purple pigments or by adventitious sediments. Except some well-established cases, the colouration seems therefore of little taxonomic significance.

Form and consistency : Form of spongebody depends on the growth. In mature sponge, form may range from thin to thick crusts or cushions, be of bulbous or otherwise massive nature, or

display branching, subbranching or pseudobranching projections. Consistency depends on the spongin present in the skeletal meshwork, this may be hard, soft or brittle.

Foramen : An orific of the gemmule.

Foraminal tubule : A horny tube that surrounded the foramina of some gemmule.

Gemmosclere : Spicule of the gemmule.

Gemmule : A desiccation-resistant asexual reproductive body composed of a mass of archaeocytes charged with reserves and enclosed in a non-cellular protective envelope.

Megasclere : A structural spicule.

Microsclere : Spicule that lie free in the symplasm.

Osculum : An aperture through which water is ejected from the sponge.

Pneumatic coat : A horny or chitinous layer on the surface of the gemmule containing air-spaces. If these spaces are of regular form and arrangement it is said to be cellular; if they are minute and irregular it is called granular.

Spicule : A discret element of the sponge skeleton. Usually composed mainly of silica or calcium carbonate but spongin spicules do occur rarely. In Spongillidae spicules are of silicious type.

Stellate : A type of microscleres consisting of many rays projecting from a distinct central globular nodule.

Symplasm : The inner mass of spongebody.

SYSTEMATIC ACCOUNT

| | |
|--------|-------------------|
| Phylum | PORIFERA |
| Class | DEMOSPONGIAE |
| Order | HAPLOSCLERINA |
| Family | SPONGILLIDAE Gray |

1. Genus *Spongilla* Lamarck
 - (1) *Spongilla lacustris* (Linnaeus)
 - (2) *Spongilla alba* Carter
2. Genus *Eunapius* Gray
 - (3) *Eunapius carteri* (Bowerbank)
 - * (4) *Eunapius fragilis* (Leidy)
 - (5) *Eunapius calcuttanus* (Annandale)
 - (6) *Eunapius crassissimus* (Annandale)
3. Genus *Stratospongilla* Annandale
 - (7) *Stratospongilla indica* (Annandale)

4. Genus ***Corvospongilla*** Annandale
 - (8) *Corvospongilla lapidosa* (Annandale)
 - (9) *Corvospongilla caunteri* Annandale
5. Genus ***Radiospongilla*** Penney and Racek
 - (10) *Radiospongilla indica* (Annandale)
 - (11) *Radiospongilla cerebellata* (Bowerbank)
6. Genus ***Ephydatia*** Lamourox
 - (12) *Ephydatia meyeri* (Carter)
- *7. Genus ***Umborotula*** Penney and Racek
 - * (13) *Umborotula bogorensis* (Weber)
8. Genus ***Dosilia*** Gray
 - (14) *Dosilia plumosa* (Crater)
9. Genus ***Trochospongilla*** Vejdovsky
 - (15) *Trochospongilla latouchiana* Annandale
 - (16) *Trochospongilla philottiana* Annandale

* indicates first record from India

Family SPONGILLIDAE Gray, 1867

Diagnosis : Freshwater sponges, with a soft cavernous structure most noticeable just below the surface. Spicules smooth or spined oxeas, or strongyles or birotulates; organised into bundles or tracts and bound by spongin. Reproduction by gemmules, coated with pneumatic layer of loosely packed spongin; complex microscleres sometimes associated with the gemmule coat.

KEY TO GENERA

1. Microscleres absent..... 2
 Microscleres present 6
2. Gemmoscleres birotulates 3
 Gemmoscleres amphioxea or amphistrongyla..... 5
3. Rotules flat in lateral view ***Ephydatia***
 Rotules not flat in lateral view 4
4. Rotules circular, with entire margin ***Trochospongilla***
 Rotules umbonate, with margine bearing large number of small regular indentations.....
 ***Umborotula***
5. Gemmoscleres with characteristic arrangement of terminal spines ***Radiospongilla***
 Gemmoscleres either with uniformly distributed spines or entirely smooth ***Eunapius***

6. Microscleres microbirotulates **Corvospongilla**
7. Microscleres either distinct aster or acerate **Dosilia**
 Microscleres amphioxea or amphistrongyla 8
8. Foramen tubular **Stratospongilla**
 Foramen never tubular, simple to slightly cup-shaped **Spongilla**

1. Genus *Spongilla* Lamarck, 1816

1758. *Spongia* Linnaeus, *Systema Naturae*, 10th ed., 1, Animalia : 1348.

1816. *Spongilla* Lamarck, *Histoire naturelle des animaux sans vertebres*, 2 : 98.

1968. *Spongilla*, Penney and Racek, *Bull. U.S. natn. Mus*, No. 272 : 7.

1982. *Spongilla*, Soota and Pattanayak, *Rec. zool. Surv. India*, 80 : 223.

Type-species *Spongia lacustris* Linnaeus, 1758

Diagnosis : Megasccleres-slender to stout, smooth, amphioxea. Microscleres-slender, spined, amphioxea and different from gemmoscleres.

Gemmoscleres stout, curved, strongly spined amphioxea or amphistrongyla.

Gemmules spherical, large, abundant and scattered throughout the sponge; pneumatic layer granulated with very small nonpolygonal air spaces, gemmoscleres embedded tangentially in it; foramen cup-shaped, never tubular.

Distribution : Cosmopolitan.

Key to Species

- Microscleres with small spines or granules of almost equal size and distribution *S. lacustris*
 Microscleres with spines much longer and more prominent in central part *S. alba*

1. *Spongilla lacustris* (Linnaeus, 1758)

(Text fig. 1-3)

1758. *Spongia lacustris* Linnaeus, *Systema Naturae*, 10th ed., 1, Animalia : 1348.

1968. *Spongilla lacustris*, Penney and Racek, *Bull. U.S. natn. Mus.*, No. 272 : 9.

1982. *Spongilla lacustris*, Soota and Pattanayak, *Rec. zool. Surv. India*, 80 : 224.

Material examined : Bankura Dist 2 lots, Aral Bansi, 27.XI.1986; one lot, Bansi, 27.XI.1986; One lot, Gard Kotalpur, 30.XI.1986; 3 lots, Saltora, 29.XI.1986; Coll. J. G. Pattanayak. Birbhum Dist One lot, Nalhati, 27.XI.1983; Coll. K. R. Halder. Barddhaman Dist - One lot, Galsi, 6.XII.1986; Coll. J. G. Pattanayak. Hugli Dist One lot, Hooghly, 12.XII.1986; Coll. J. G. Pattanayak. Maldah Dist One lot, Bamangola, 13.IX.1987; one lot, Gajal, 14.IX.1987; Coll. J. G. Pattanayak. Medinipur Dist One lot, Talpurkur, 4 Km S. of Tamluk, 13.IV.1986; Coll. J. G. Pattanayak.

Description : Sponge consisting of a flat or rounded thin basal portion with long free cylindrical branches; surface hispid; oscula small and star shaped; dermal membrane well developed; consistency soft and easily compressed.

Megascleres straight, sharply pointed, smooth amphioxea; length range .225-.410 mm, width range .006-.009 mm.

Microscleres abundant, straight, long, slender, amphioxea with small spines of almost equal size and distribution; length range .075-.090 mm, width range .0035-.006 mm.

Gemmoscleres resembling the microscleres but stout and slightly to strongly curved; amphioxea; covered with strong curved spines; length range .045-.095 mm, width range .0035-.006 mm.

Gemmules abundant, present throughout the body, large, spherical; pneumatic layer thick, granular in which the spicules tangentially arranged, foramen not tubular, simple, bearing a shallow peripheral collar; diameter of gemmule .50-.60 mm.

Colour in life Generally bright green due to presence of zoochlorellae, otherwise pale white to light grey in colour.

Distribution : INDIA : West Bengal Bankura, Birbhum, Bardhaman, Calcutta, Hugli, Maldah, Medinipur and South 24 Parganas districts; Assam; Bihar; Himachal Pradesh; Jammu and Kashmir; Karnataka; Maharashtra; Orissa; Punjab; Rajasthan and Tamilnadu. OUTSIDE INDIA : Northern hemisphere, with its greatest expansion in cold-temperate regions.

Remarks : This species is widely distributed in India.

2. *Spongilla alba* Carter, 1849

(Text fig. 4-6)

1849. *Spongilla alba* Carter, *Ann. Mag. Nat. Hist.*, 4 : 83

1968. *Spongilla alba*, Penney and Racek, *Bull. U. S. natn. Mus.*, No. 272 : 16.

1982. *Spongilla alba*, Soota and Pattanayak, *Rec. zool Surv. India*, 80 : 224.

Description Sponge forming massive growth of moderate thickness; surface smooth with irregular projection; oscula moderate or large size, never very conspicuous; dermal membrane closely adherent to symplasm; consistency hard but brittle.

Megascleres feebly curved, slender to stout and fusiform, smooth amphioxea; length range .265-.330 mm, width range .012-.019 mm.

Microscleres numerous in dermal membrane; slightly curved, slender, amphioxea with erect spine more prominent and longer in central region; length range .065-.125 mm, width range .002-.004 mm.

Gemmoscleres feebly curved, slender, cylindrical amphiostrongyla; covered with large recurved spines, more numerous at the tips than near the middle of the shaft; length range .085-.110 mm, width range .005-.0085 mm.

Gemmules abundant, scattered throughout the body large spherical; pneumatic layer moderately thick granular, gemmoscleres embedded in this layer with their tips projecting beyond outer surface of layer; foramen not tubular but cup-shaped; diameter range .45-.60 mm.

Colour in life : whitish.

Distribution : INDIA : West Bengal Calcutta, North and South 24 Parganas districts; Kerala; Maharashtra; Orissa; Rajasthan. OUTSIDE INDIA : Africa, Australia, South America and South East Asia.

Remarks : During the present survey no material of this species is available; hence the description is based on the material present in National Zoological Collections.

2. Genus *Eunapius* Gray, 1867

1851. *Spongilla* Leidy, *Proc. Acad. Nat. Sci. Philadelphia*, 5 : 278.

1867. *Eunapius* Gray, *Proc. Zool. Soc. London*, 1867 : 558.

1968. *Eunapius*, Penney and Racek, *Bull. U.S. natn. Mus.*, No. 272 : 21.

1982. *Eunapius*, Soota and Pattanayak, *Rec. zool. Surv. India*, 80 : 219.

Type species *spongilla carteri* Bowerbank, 1863

Diagnosis Megascleres - stout, smooth, amphioxea or amphistrongyla, rarely spined.

Microscleres absent.

Gemmoscleres slender to robust, slightly curved, strongly spined amphioxea or amphistrongyla.

Gemmules somewhat flattened, comparatively small abundant and scattered singly or in groups or forming distinct pavement layer at the base; pneumatic layer well developed with conspicuously polygonal air spaces, gemmoscleres embedded in this layer strictly tangentially over the gemmules; foramen tube straight or strongly curved.

Distribution : Widely distributed throughout the world.

Key to Species

1. Megascleres amphistrongyla *E. crassissimus*
 Megascleres amphioxea 2
2. Megascleres amphioxea with a lanceolate apical projections..... *E. calcuttanus*
 Megascleres amphioxea with smooth tapering ends..... 3
3. Gemmoscleres similar in shape and structure to megascleres but smaller in size *E. carteri*
 Gemmoscleres not similar in shape and structure to megascleres and covered with spines
 *E. fragilis*

3. *Eunapius carteri* (Bowerbank, 1863)

(Text-fig. 7 & 8)

1849. *Spongilla friabilis* Carter, *Ann. Mag. Nat. Hist.*, 4 : 83

1863. *Spongilla carteri* Bowerbank, *Proc. Zool. Soc. London*, 1863 : 469.

1867. *Eunapius carteri* Gray, *Proc. Zool. Soc. London*, 1867 : 552.

1968. *Eunapius carteri* Penney and Racek, *Bull. U.S. natn. Mus.*, No. 272 : 23.

1982. *Eunapius carteri*, Soota and Pattanayak, *Rec. zool. Surv. India*, 80 : 221.

Material examined : Bankura Dist : One lot, Bishnupur 28.XI.1986; one lot, Joyrambati, 1.XII.1986; two lots, Saltora, 29.XI.1986; One lot, Susunia, 2.XII.1986; Coll. J. G. Pattanayak.

Birbhum Dist Two lots, Nalhati, 27.IX.1983; one lot, Sainthea, 28.IX.1983; Coll. K. R. Halder. Koch Behar Dist Two lots, Mathabhanga, 16.IV.1987; Coll. J. G. Pattanayak. Hugli Dist One lot, Chinsura, 12.XII.1986; Coll. J. G. Pattanayak. Haora Dist Two lots, Bagnan, 7.IV.1986; Coll. J. G. Pattanayak. Jalpaiguri Dist : Two lots, Alipurduar, 17.IV.1987; Coll. J. G. Pattanayak. Maldah Dist : One lot, Maldah town, 12.XI.1987; Coll. J. G. Pattanayak. Medinipur Dist One lot, Contai, 25.III.1986; one lot, Ghatal, 28.III.1986; two lots Gopiballavpur, 30.III.1986; five lots, Midnapore town, 26.III.1986; one lot, Naradari, 5 Km. S. of Tamluk Town, 13.IV.1986; Coll. J. G. Pattanayak. Nadia Dist One lot, Krishnanagar, 16.IX.1983; Coll. K. R. Halder. Purulya Dist One lot, Bagmundi, 3.IV.1986; one lot, Manbazar, 2.IV.1986; one lot, Raghunathpur, 4.IV.1986; Coll. J. G. Pattanayak. N. 24 Parganas Dist One lot, Ankhola Nabapally, 28.III.1986; Coll. I. B. Dutta. West Dinajpur Dist One lot, Raiganj, 7.VI.1987; Coll. J. G. Pattanayak.

Description - Sponge massive, forming irregular masses of varying dimension; surface hispid; oscula large, rounded and conspicuous but not raised above the surface of sponge; dermal membrane well developed; consistency of live sponge moderately soft and has a peculiarly strong and offensive smell.

Megascleres slightly curved, stout fusiform, smooth amphioxea; length range .265-.350 mm. width range .011-0.25 mm.

Microscleres absent.

Gemmoscleres similar in shape and structure of megascleres but much smaller in size; length range .150-.200 mm, width range .005-.008 mm.

Gemmules numerous, scattered singly throughout the body; comparatively large, spherical or flattened at the base; pneumatic layer very thick, consisting of several layers of relatively large polygonal air-spaces, gemmoscleres embedded in this layer tangentially or in an irregular manner, foramen tubular, resembling an inverted bottle in shape; diameter range .445-.560 mm.

Colour in life : greyish.

Distribution : INDIA : West Bengal Bankura, Birbhum, Calcutta, Koch Behar, Hugli, Haora, Jalpaiguri, Maldah, Medinipur, Nadia, North 24 Parganas, Purulya, South 24 Parganas and West Dinajpur districts; Bihar; Kerala; Maharashtra; Orissa; Punjab; Rajasthan Tamilnadu; Uttar Pradesh. OUTSIDE INDIA : Africa, Burma, China, Hungary, Indonesia, Iran, Malaysia, Turkestan, and USSR.

Remarks : This species is widely distributed in West Bengal as well as in other parts of India.

4. *Eunapius fragilis* (Leidy, 1851)

(Text-fig. 11 & 12)

1851. *Spongilla fragilis* Leidy, *Proc. Acad. Nat. Sci. Philadelphia*, 5 : 278.

1968. *Eunapius fragilis* Penney and Racek, *Bull. U.S. natn. Mus.*, No. 272 : 25.

Material examined : Hugli Dist. One lot, Janai, 11.XII.1986; coll. J. G. Pattanayak. Haora Dist. Two lots, Mourigram, 6.VI.1986; Coll. J. G. Pattanayak. Medinipur Dist.- One lot, Kolaghat, 29.III.1986; two lots, Naradari, 5 km S. of Tamluk, 4.V.1986; Coll. J. G. Pattanayak.

Description : Thin to thick flat crusts forms on aquatic weeds or hard substances; surface smooth and even; oscula small, numerous, flat and producing distinct radial canals; consistency very soft and fragile.

Megascleres nearly straight, moderately stout, smooth amphioxea; length range .210 - .270 mm, width range .008 - .013 mm.

Microscleres absent.

Gemmoscleres slightly curved or straight, moderately stout, amphioxea or amphistrongyla, covered with spines aggregated at the tips of scleres; length range .065 - .110 mm width range .005 - .007 mm.

Gemmules abundant, either forming free groups of 2-5 or forming a flat layer at the base of sponge; small, spherical; pneumatic layers consisting of several thick cellular coat of layer with large polygonal air spaces and forming a continuous coat over all gemmules where bound together in groups, gemmoscleres embedded in the pneumatic coat tangentially and arranged in two separate tiers above the gemmule, separated from each other by thick pneumatic coat; foraminal tubule relatively long and stout, projecting outwards through the pneumatic coat and opening outwards; diameter range .20 - .30 mm.

Colour in life light grey to whitish, when zoochlorelae present its colour is green.

Distribution : INDIA : West Bengal Hugli, Haora, Medinipur. OUTSIDE INDIA : Truly cosmopolitan, found in all countries.

Remarks : Though this species in cosmopolitan is distribution but it is recorded for the first time from India.

5. *Eunapius calcuttanus* (Annandale, 1911)

(Text-fig. 13 & 14)

1911. *Spongilla fragilis* var. *calcuttana* Annandale, *The Fauna of British India, including Ceylon and Burma*, p. 96.

1968. *Eunapius calcuttanus* Penney and Racek, *Bull. U.S. natn. Mus.*, No. 272 : 28.

1982. *Eunapius calcuttanus*, Soota and Pattanayak, *Rec. zool. Surv. India*, 80 : 220.

Material examined : Bardhaman Dist. : One lot, Rayna, 7.XII.1986; Coll. J. G. Pattanayak. Haora Dist. : One lot, Amta, 6.IV.1986; two lots, Bagnan, 7.IV.1986; one lot, Shyampur, 7.IV.1986; Coll. J. G. Pattanayak.

Medinipur Dist. One lot, Garbeta, 27.III.1986; one lot, Tamluk, 12.IV.1986; Coll. J. G. Pattanayak. South 24 Parganas Dist. One lot, Dhaniram chak, 23.XI.1987; Coll. B. G. Mandal.

Description : Sponge body elongated, bulbous; surface smooth; oscula small, numerous, flat and producing distinct radial canals; texture soft and fragile.

Megascleres slender, fusiform, smooth amphioxea, with abruptly pointed or rounded at the tips forming a peculiar lanceolate shaped apical projections; length range .180-.225 mm, width range .009-.012 mm.

Microscleres : absent.

Gemmoscleres curved, slender, cylindrical, amphistrongyla with small spines throughout their length; length range .080-.110 mm, width range .002-.005 mm.

Gemmules abundant, small, spherical; pneumatic layer well developed, thick and consisting of large polygonal air spaces, gemmoscleres embedded in the pneumatic coat tangentially; foramen tubular and opening outward; diameter range 0.20-0.225 mm.

Colour in life light grey to light brown.

Distribution INDIA : West Bengal Bardhaman, Calcutta, Haora, Medinipur and south 24 Parganas.

Remarks : This species is endemic in West Bengal.

6. *Eunapius crassissimus* (Annandale, 1907)

(Text-fig. 9 & 10)

1907. *Spongilla crassissima* Annandale, *Journ. & Proc. Asiatic Soc. Bengal*, **3** : 17.

1968. *Eunapius crassissimus* Penney and Racek, *Bull. U.S. natn. Mus.*, No. 272 : 30.

Material examined : Bankura Dist. two lots, Gard Kotalpur, 30.XI.1986; one lot, Tejpal, Bishnupur, 28.XI.1986; Coll. J. G. Pattanayak. Koch Behar Dist. one lot, Mathabhanga, 16.iv.1987; coll. J. G. Pattanayak. Jalpaiguri Dist. one lot, Lataguri, 11.IV.1987; Coll. J. G. Pattanayak.

Description : Sponge body forming spherical, spindle shaped or irregular masses without branches; surface hispid; oscula star-shaped, surrounded by radiating furrows; dermal membrane well developed; consistency very hard and strong.

Megascleres feebly curved, stout cylindrical, smooth amphistrongyla, often bearing at each end a minute terminal projections; immature megascleres slender amphioxea; length range .25-.30 mm, width range .007-.028 mm.

Microscleres absent

Gemmoscleres curved, slender, cylindrical, amphistrongyla with small spines throughout their length; length range .080-.105 mm. width range .003-.009 mm.

Gemmules moderate in number; found in the basal region, moderate in size, spherical; pneumatic layer thick, consisting of large polygonal air spaces; gemmoscleres embedded in this layer tangentially and forming two separate tiers above the gemmules; foraminal tube moderately long, rarely projecting beyond surface of pneumatic layer; diameter of gemmule .275-.310 mm.

Colour in life nearly black, sometimes dull green due to presence of zoochlorelae.

Distribution : INDIA : West Bengal Bankura, Calcutta, Koch Behar, Jalpaiguri; Orissa. OUTSIDE INDIA : Tropical S.E. Asia; Australia.

Remarks : This species is recorded for the first time from the places mentioned under "material" column and restricted to eastern India only.

3. Genus *Stratospongilla* Annandale, 1909

1909. *Spongilla (Stratospongilla)* Annandale, *Zool. Jahrb.*, **27** : 561.

1968. *Stratospongilla* Penney and Racek, *Bull. U.S. natn. Mus.*, No. 272 : 40.

1982. *Stratospongilla*, Soota and Pattanayak, *Rec. zool. Surv. India*, **80** : 226.

Type species : *Spongilla bombayensis* Carter, 1882.

Diagnosis : Megascleres-stout, smooth or roughened, amphioxea or amphistrongyla.

Microscleres short, slender, straight, spined amphioxea.

Gemmoscleres either strongly bent amphistrongyla or slightly curved amphioxea or combination of both; covered with minute spines.

Gemmules spherical, large and flattened base, generally aggregated in the basal membrane, sometimes free in the inner symplasm; pneumatic layer not well developed, situated entirely outside the layer of gemmoscleres; gemmoscleres embedded tangentially in the outer gemmular membrane, in one or more compact layers; foraminal tubule either short and straight or long and recurved.

Distribution : Essentially a tropical genus with greatest abundance in Asia and Africa and also present in S. America but absent in tropical Australia.

7. *Stratospongilla indica* (Annandale, 1908)

1908. *Spongilla indica* Annandale, *Rec. Indian Mus.*, **2** : 25

1968. *Stratospongilla indica* Penney and Racek, *Bull. U.S. natn. Mus.* No. 272 : 44.

1982. *Stratospongilla indica*, Soota and Pattanayak, *Rec. zool. Surv. India*, **80** : 226.

Description : Sponge body forming shallow cushions on solid support and not branching; surface smooth; oscula minute; consistency compact, rather hard but brittle.

Megascleres almost straight, cylindrical, short and minute spined, amphistrongyla; length range .002-.215 mm, width range .012-.015 mm.

Microscleres straight, amphioxea, covered with relatively long and irregular spines; length range .040-.047 mm, width range .003-.004 mm.

Gemmoscleres feebly curved, stout, amphistrongyla, densely covered with blunt spines; length range .035-.043 mm, width range .007-.008 mm.

Gemmules less numerous, present in the inner symplasm; subspherical with flattened base; pneumatic coat ill-developed without discernible air spaces, forming a basal membrane by which gemmules fastened; gemmoscleres forming a dense, tangentially arranged mosaic layer over inner gemmular membrane; foraminal tubule short and straight; diameter of gemmules .470-.500 mm.

Colour in life grey, but green when zoochlorelae present.

Distribution : INDIA : West Bengal North 24 Parganas; Maharashtra. OUTSIDE INDIA : Thailand, Africa.

Remarks : During the present survey no material of this species is available, hence the description is based on the material present in the National Zoological Collections.

4. Genus *Corvospongilla* Annandale, 1911.

1911. *Corvospongilla* Annandale, *The fauna of British India, including Ceylon and Burma*, p. 122.

1968. *Corvospongilla*, Penney and Racek, *Bull. U.S. natn. Mus.* No. 272 : 51.

Type species : *Spongilla loricata* Weltner, 1895.

Diagnosis : Megascleres-robust, slightly curved, smooth or granulated, amphistrongyla; occasionally amphioxea.

Microscleres birotulates with smooth or spined shafts.

Gemmoscleres curved, spined amphistrongyla.

Gemmules large, spherical, with flattened base; generally found in groups at the base of the sponge; pneumatic coat ill defined or absent; gemmoscleres embedded in inner gemmular membrane and forming a mosaic layer; foramen tubular; when free gemmules present, they differ in form and structure of pneumatic coat.

Distribution : Tropical regions of Africa and Asia.

Key To Species

Megascleres amphistrongyla..... *C. lapidosa*
 Megascleres amphioxea..... *C. caunteri*

8: *Corvospongilla lapidosa* (Annandale, 1908)

1908. *Spongilla lapidosa* Annandale, *Rec. Indian Mus.*, 2 : 26.

1911. *Corvospongilla lapidosa* Annandale, *The fauna of British India, including ceylon and Burma*, p. 124.

1968. *Corvospongilla lapidosa*, Penney and Racek, *Bull. U.S. natn. Mus.*, No. 272 : 55.

1982. *Corvospongilla lapidosa*, Soota and Pattanayak, *Rec. zool. Surv. India*, 80 : 217.

Description : Sponge forming a thin layer; external surface without spicular projections. smooth; oscula small, some of them raised above the surface; texture extremely hard.

Megascleres : stout, feebly curved, smooth amphioxea; length range .220-.230 mm and width range .017-.021 mm.

Microscleres : birotulates with a smooth shaft and terminally with a smaller number of recurved hooks; length range .030-.034 mm; diameter of rotules .008-.011 mm.

Gemmoscleres : stout, slightly curved, blunt amphistrongyla, covered with small blunt spines except at their extremities; length range .050-.060 mm width range .012-.015 mm.

Gemmules : not very abundant, firmly adhering to substrum, subspherical; pneumatic coat feebly developed, without discernible air spaces; Gemmoscleres arranged in one or two mosaic like covering of inner gemmular membrane; foramen tube small and straight; diameter of gemmules ranging from .600-.650 mm.

Colour in life grey.

Distribution : INDIA : West Bengal North 24 Parganas; Maharashtra.

Remarks : This species is endemic in India. During the present survey no material of this species could be collected, hence the description is based on the material present in the National Zoological Collection.

9. *Corvospongilla caunteri* Annandale, 1911

1911. *Corvospongilla caunteri* Annandale, *The fauna of British India, including Ceylon and Burma*, p. 243.

1968. *Corvospongilla caunteri*, Penney and Racek, *Bull U.S. natn. Mus.*, No. 272 : 60.

1982. *Corvospongilla caunteri*, Soota and Pattanayak, *Rec. zool. Surv. India*, 80 : 216.

Description : Sponges forming thin crusts; surface smooth, basal membrane well developed and stout; oscula inconspicuous, surrounded by shallow and ill-defined radiating furrows; consistency moderately hard but friable.

Megascleres moderately stout, almost straight, smooth amphioxea; length range .170-.270 mm and width range .015-.025 mm.

Microscleres feebly curved, birotulates with smooth shaft, terminal hooks short and recurved; length range .025-.035 mm, diameter of rotules .008-.010 mm.

Gemmoscleres slightly curved, slender, amphioxea or amphistrongyla with irregular spines; length range .043-.051 mm, width range .010-.012 mm.

Gemmules free in lower parts of inner symplasm; spherical to somewhat depressed; pneumatic coat thick with small air spaces; below this pneumatic layer a single layer of gemmoscleres lying parallel to the gemmule; foramen depressed; diameter of gemmules .550-.600 mm.

Colour in life Bright green.

Distribution : INDIA : West Bengal : Calcutta; Uttar Pradesh.

Remarks : This species is endemic in India. During the present survey no material of this species is available, hence the description is based on the material present in National Zoological Collection.

5. Genus *Radiospongilla* Penney and Racek, 1968.

1863. *Spongilla* Bowerbank, *Proc. zool. Soc. London*, 1863 : 465.

1882. *Meyenia* Potts, *Proc. Acad. Nat. Sci. Philadelphia*, 12.

1895. *Epydata* Weltner, *Arch. f. Naturg.*, 61, pt. 1 : 114.

1915. *Pectispongilla* Annandale, *Rec. Indian Mus.*, 11 : 245

1968. *Radiospongilla* Penney and Racek, *Bull. U.S. Natn. Mus.*, No. 272 : 61.

Type species : *Spongilla sceptroidae* Haswell, 1882.

Diagnosis : **Megascleres** moderately stout to slender, spined, amphioxea.

Microscleres absent.

Gemmoscleres slender, long, strongly spined, amphioxea or amphistrongyla; spines aggregated in the vicinity of the tips of the scleres, forming club or scepter-like terminal structure or pseudorotules.

Gemmules spherical, large, abundant and scattered throughout the sponge; pneumatic layer thick and strong with small air spaces; gemmoscleres embedded in pneumatic coat radially; foramen tube straight or slightly curved, rarely projecting beyond outer gemmular membrane.

Distribution : Tropical and subtropical regions of all continents, rarely ranging into cold-temperate climates of both hemispheres.

Key To Species

Megascleres amphistrongyla.....*R. indica*
Megascleres amphioxea.....*R. cerebellata*

10. *Radiospongilla indica* (Annandale, 1907)

(Text fig. 21 & 22)

1907. *Ephydatia indica* Annandale, *Journ & Proc. Asiatic Soc. Bengal*, 3 : 20.1909. *Ephydatia fluviatilis* var. *ramsayi* Annandale, *Nova Guinea*, 5 : 421.1932. *Ephydatia crateriformis* Gee, *Philippine Journ. Sci.*, 48, pt.4 : 533.1968. *Radiospongilla indica* Penney and Racek, *Bull. U. S. natn. Mus.*, No. 272 : 68.

Material examined : Hugli Dist : One lot, Hugli, 12.XII.1968; Coll. J. G. Pattanayak. Maldah Dist - One lot, Gajal, 14.XI.1987; Coll. J. G. Pattanayak.

Description : Mature sponge forming flat cushions, surface smooth and even; oscula inconspicuous; dermal membrane well developed; consistency soft, loose texture.

Megascleres long, subcylindrical, amphistrongyla, spines scattered in central portion and more dense on the tip region; length range .180-.250 mm, width range .004-.010 mm.

Microscleres - absent.

Gemmoscleres slightly curved or straight, slender, amphistrongyla with spined shafts; terminal spines large and forming flat pseudorotules and other spines small conical; length range .060-.075 mm, width of shaft .020-.004 mm, diameter of pseudorotules .007-.008 mm.

Gemmules - abundant, scattered through out the skeletal meshes; small, spherical; pneumatic layer thick, consisting of minute air space, in which a single layer of gemmoscleres embedded radially, foraminal tube porus, short and straight; diameter of gemmule .230-.30 mm.

Colour in life Greyish.

Distribution : INDIA : West Bengal Calcutta, Hugli, Maldah and South 24 Parganas; Maharashtra. OUTSIDE INDIA : Indonesia, New Guinea, Philippines.

Remarks : This species is recorded for the first time from the places mentioned under "Material examined" column.

11. *Radiospongilla cerebellata* (Bowerbank, 1863)1863. *Spongilla cerebellata* Bowerbank, *Proc. Zool. Soc. London*, 1863 : 465.1968. *Radiospongilla cerebellata* Penney and Racek, *Bull. U. S. natn. Mus.*, No. 272 : 73.1982. *Radiospongilla cerebellata*, Soota and Pattanayak, *Rec. zool. Surv. India*, 80 : 222.

Description : Sponges small and shallow cushions to bulbous form; surface uneven; Oscula conspicuous; dermal membrane well developed; consistency of live sponge soft, texture loose.

Megascleres fusiform, feeble curved to straight, smooth amphioxea; length range .250-.30 mm, width range .010-.012 mm.

Microscleres absent.

Gemmoscleres cylindrical, curved, spined amphistrongyla, spines erect and less in number on the central portion of shaft but recurved and more in number toward the extremities; length range .065-.085 mm, width range .002-.003 mm.

Gemmules numerous, scattered throughout the body; spherical; pneumatic coat thick, consisting of minute spherical air spaces; gemmoscleres embedded in this coat in two distinct layers; foraminal tube porus, slender and straight; diameter of gemmules .450-.500 mm.

Colour in life yellowish grey to dark green.

Distribution : INDIA : West Bengal South 24 Parganas, Calcutta; Assam; Himachal Pradesh; Kerala; Maharashtra; Orissa; Tamilnadu. OUTSIDE INDIA : Tropical and subtropical regions of Africa, China, Indo Pakistan subcontinent, Indonesia, New guinea, Philippines, U.S.S.R. and also some parts of south Eastern Europe.

Remarks : During the present survey no material of this species is available, hence the description is based on the material present in National Zoological collection.

6. Genus *Ephydatia* Lamouroux, 1816

1758. *Spongia* Linnaeus, *Systema Naturae*, 10th ed., 1, Animalia, p.1348.

1816. *Ephydatia* Lamouroux, *Histoire des polypiers coralligenes flexibles, vulgairement nommes zoophytes*, p. 2.

1968. *Ephydatia*, Penney and Racek, *Bull. U. S. natn. Mus.*, No. 272 : 80.

Type species *Spongia fluviatilis* Linnaeus, 1758.

Diagnosis : Megascleres slender and fusiform to rather robust and cylindrical, smooth or spiny amphioxea.

Microscleres absent.

Gemmoscleres birotulates; rotules of nearly identical, flat in lateral view; shafts slender, smooth, or incipiently spined, or rather covered with acute spines.

Gemmules abundant, scattered throughout the sponge; large, spherical to subspherical; pneumatic layer well developed with minute air spaces; gemmoscleres embedded in pneumatic coat strictly radially in one or more layers; foramen tube porus, simple, elevated, surrounded by a narrow peripheral collar.

Distribution Cosmopolitan.

12. *Ephydatia meyeri* (Carter, 1849)

1849. *Spongilla meyeri* Carter, *Ann. Mag. Nat. Hist.*, 4 : 84.

1867. *Ephydatia meyeri* Gray, *Proc. Zool. Soc. London*, 1867 : 550.

1968. *Ephydatia meyeri*, Penney and Racek, *Bull. U. S. natn. Mus.* No. 272 : 84.

Material examined : Haora Dist one lot, Domjur, 5.IV.1986; Coll. J. G. Pattanayak.

Description : Massive growth of irregular outline, surface uneven; oscula inconspicuous; dermal membrane well developed; consistency firm and moderately hard.

Megascleres long, cylindrical, smooth amphioxea; length range .275-.300 mm, width range .010-.013 mm.

Microscleres absent.

Gemmoscleres birotulates; shaft moderately stout, usually smooth but some are armed with 1-3 sharp spines; rotules flat in shape, irregularly and deeply incised; length range .028-.035 mm, diameter of rotules .025-.30 mm.

Gemmules abundant, scattered throughout the sponge; spherical; pneumatic coat consisting of minute spherical air spaces in which two layers of gemmoscleres embedded; foramen distinctly elevated but not tubular; diameter of gemmules .500-.575 mm.

Colour in life brown.

Distribution : INDIA : West Bengal Calcutta, Haora; Kerala; Maharashtra; Rajasthan; Tamil Nadu; Uttar Pradesh. OUTSIDE INDIA China.

Remarks : This species forming new locality records.

7. Genus *Umborotula* Penney and Racek, 1968

1890. *Ephydatia* Weber, *Zoologische Ergebnisse einer Reise nach Niederlandisch ost-Indien*, 1 : 33.

1960. *Meyenia* Penney, *Univ. South Carolina Publ.*, ser. 3, 3, pt.1 : 33.

1986. *Umborotula* Penney and Racek, *Bull. U. S. natn. Mus.*, No. 272 : 121.

Type species - *Ephydatia bogorensis* Weber, 1890.

Diagnosis Megascleres - long, slender, spined amphioxea.

Microscleres absent.

Gemmoscleres birotulates of equal length; shafts long with large conical spines; rotules umbonate and of equal size; margin of rotules slightly recurved with small and regular indentions.

Gemmules - less in number, large, spherical; pneumatic coat well developed with regular air spaces; gemmoscleres embedded in this layer strictly radially; foramen tube delicate and small.

Distribution : Southeast Asia.

Remarks : The genus is recorded for the first time from India

13. *Umborotula bogorensis* (Weber, 1890)

(Text fig. 15 & 16)

1890. *Ephydatia bogorensis* Weber, *Zoologische Ergebnisse einer Reise nach Niederlandisch Ost-Indien*, 1 : 33.

1968. *Umborotula bogorensis* Penney and Racek, *Bull. U. S. natn. Mus.*, No. 272 : 122.

Material examined : Hugli Dist. one lot, Kamarpukur. I.XII.1986; Coll. J. G. Pattanayak.

Description : Sponges forming irregular crusts on aquatic plants; surface slightly hispid due to projecting spicule fibers; oscula small and inconspicuous; consistency very soft and fragile.

Megascleres slender, feebly curved, fusiform, amphioxea, spined except at their tips; length range .280-.350 mm, width range .010-.015 mm.

Microscleres - absent.

Gemmoscleres - birotulates with long and spiny shafts, equal umbonate rotules with margins distinctly recurved and regularly incised; length range .065-.072 mm, width range of shafts .060-.085 mm, diameter of rotules .025-.028 mm.

Gemmules very less in number and scattered throughout the meshwork of sponge; spherical; pneumatic coat granular and consisting of very minute air spaces; gemmoscleres embedded in this layer radially; foramen tube short and porous; diameter of gemmules .450-.500 mm.

Colour in life light brown.

Distribution : INDIA : West Bengal Hugli Dist. OUTSIDE INDIA : Australia, China, Indonesia, Malaysia and Thailand.

Remarks : This species is recorded for the first time from India.

8. Genus *Dosilia* Gray, 1867

1849. *Spongilla* Carter, *Ann. Mag. Nat. Hist.*, 4 : 85

1867. *Dosilia* Gray, *Proc. Zool. Soc. London*, 1867 : 550

1968. *Dosilia*, Penney and Racek, *Bull. U. S. natn. Mus.* No. 272 : 126.

Type Species *Spongilla plumosa* Carter, 1849

Diagnosis : Megascleres slender, fusiform, smooth or spined amphioxea.

Microscleres either asters or rough amphioxea with a number of long perpendicular radiating rays in the central portion, or a combination of both.

Gemmoscleres birotulates with strongly spined shafts, terminally with distinctly umbonatic rotules of equal diameter.

Gemmules abundant, large, subspherical; pneumatic layer consisting of minute spherical air spaces; foramen tube short and straight.

Distribution : Tropical and subtropical regions.

14. *Dosilia plumosa* (Carter, 1849)

(Text-fig. 17-20)

1849. *Spongilla plumosa* Carter, *Ann. Mag. Nat. Hist.*, 4 : 85.

1867. *Dosilia plumosa* Gray, *Proc. Zool. Soc. London*, 1867 : 551.

1968. *Dosilia plumosa*, Penney and Racek, *Bull. U. S. natn. Mus.* No. 272 : 128.

1982. *Dosilia plumosa*, Soota and Pattanayak, *Rec. zool. Surv. India*, 80 : 218.

Material examined : Bankura Dist. one lot, Susunia, 2.XII.1986; Coll. J. G. Pattanayak.

Description : Form bulbous; surface uneven, lobose; oscula small but conspicuous; dermal membrane well developed; consistency moderately soft but very fragile.

Megascleres fusiform, curved, smooth amphioxea; length range .400-480 mm, width range .013-.018 mm.

Microscleres abundant; stellate spicules consisting of 8-12 rays; rays smooth, terminating in a small number of minute recurved distal spines; some microscleres are granulated amphioxea bearing in the central portion a number of radiating and perpendicular rays; length range extremely variable, radius of rays not exceeding 15-18 μ .

Gemmoscleres birotulates with strongly spined shafts; rotules umbonate and of equal size and shape, margins incised into numerous blunt and recurved teeth; length range .070-.080 mm, thickness of shafts .003-.005 mm, diameter of rotules .019-.022 mm.

Gemmules abundant; subspherical to ovoid; pneumatic layer granulated, consisting of minute spherical air spaces; foramen tube short and straight; diameter of gemmules; .500-.600 mm.

Colour in life green and pale brown.

Distribution : INDIA : West Bengal Bankura Dist; Maharashtra; Orissa. OUTSIDE INDIA : Philippines and S.E.Asia.

Remarks : This species is recorded for the first time from West Bengal.

9. Genus *Trochospongilla* Vejdovsky, 1883.1883. *Trochospongilla* Vejdovsky, *Anh. K. Bohm. Ges. Wiss.* **12**, pt.5 : 31.1968. *Trochospongilla*, Penney and Racek, *Bull. U. S. natn. Mus.* No. 272 : 133.*Type species* *Spongilla erinaceus* Lieberkühn, 1856.*Diagnosis* : Megascleres short, stout, smooth or spined, amphioxea or amphistrongyla.

Microscleres absent.

Gemmoscleres - minute birotulates; shafts stout, short, smooth; rotules with entire margin.

Gemmules abundant, small and subspherical; pneumatic coat very thin, consisting of small rounded air spaces; gemmoscleres embedded in the pneumatic coat radially; foramen tube some that elevated.

Distribution : Widely distributed throughout the world.

Key To Species

Megascleres entirely smooth..... *T. latouchiana* Annandale, 1907.Megascleres covered with conial spines..... *T. Philottiana* Annandale, 1907.15. *Trochospongilla latouchiana* Annandale, 1907.1907. *Trochospongilla latouchiana* Annandale, *Journ. & Proc. Asiatic Soc. Bengal*, **3** : 21.1968. *Trochospongilla latouchiana*, Penney and Racek, *Bull. U. S. natn. Mus.*, No. 272 : 140.*Description* : Sponge forming shallow cushions, surface uneven; oscula few but conspicuous; consistency very rigid but often brittle.

Megascleres straight or feebly curved, cylindrical, smooth amphioxea; length range .220-.290 mm. width range .010-.014 mm.

Microscleres absent.

Gemmoscleres minute birotulates; shaft slender; rotules of unequal diameter, upper rotule recurved to form a bowl-like structure; length range of shafts .013-.018 mm, its thickness .033-.004 mm; diameter of lower rotules .015-.019 mm of upper rotules .013-.016 mm;

Gemmules abundant small, scattered throughout the sponge, pneumatic layer thin and granular; gemmoscleres embedded in this coat in one layer; foramen tube conical, short and porous; diameter of gemmules 0.180-.020 mm.

Colour in life brownish.

Distribution : INDIA : West Bengal Calcutta. OUTSIDE INDIA : Australia, China, S. E. Asia.*Remarks* : Since Annandale's (1911) discovery of this species from Calcutta, it is not recorded elsewhere in India. During the present investigation thorough search has been made in the type locality as well as other parts of West Bengal but author is unable to collect this species.

16. *Trochospongilla philottiana* Annandale, 1907

1907. *Trochospongilla philottiana* Annandale, *Journ. & Proc. Asiatic Soc. Bengal*, 3 : 22.

1968. *Trochospongilla philottiana*. Penney and Racek, *Bull. U. S. natn. Mus.*, No. 272 : 142.

Description : Flat crusts, surface rather even but distinctly hispid; oscula few in number and inconspicuous; consistency rigid but relatively brittle.

Megascleres slender, feebly curved, spined amphystrongyla, length range .170-.190 mm, width range .009-.010 mm.

Microscleres absent.

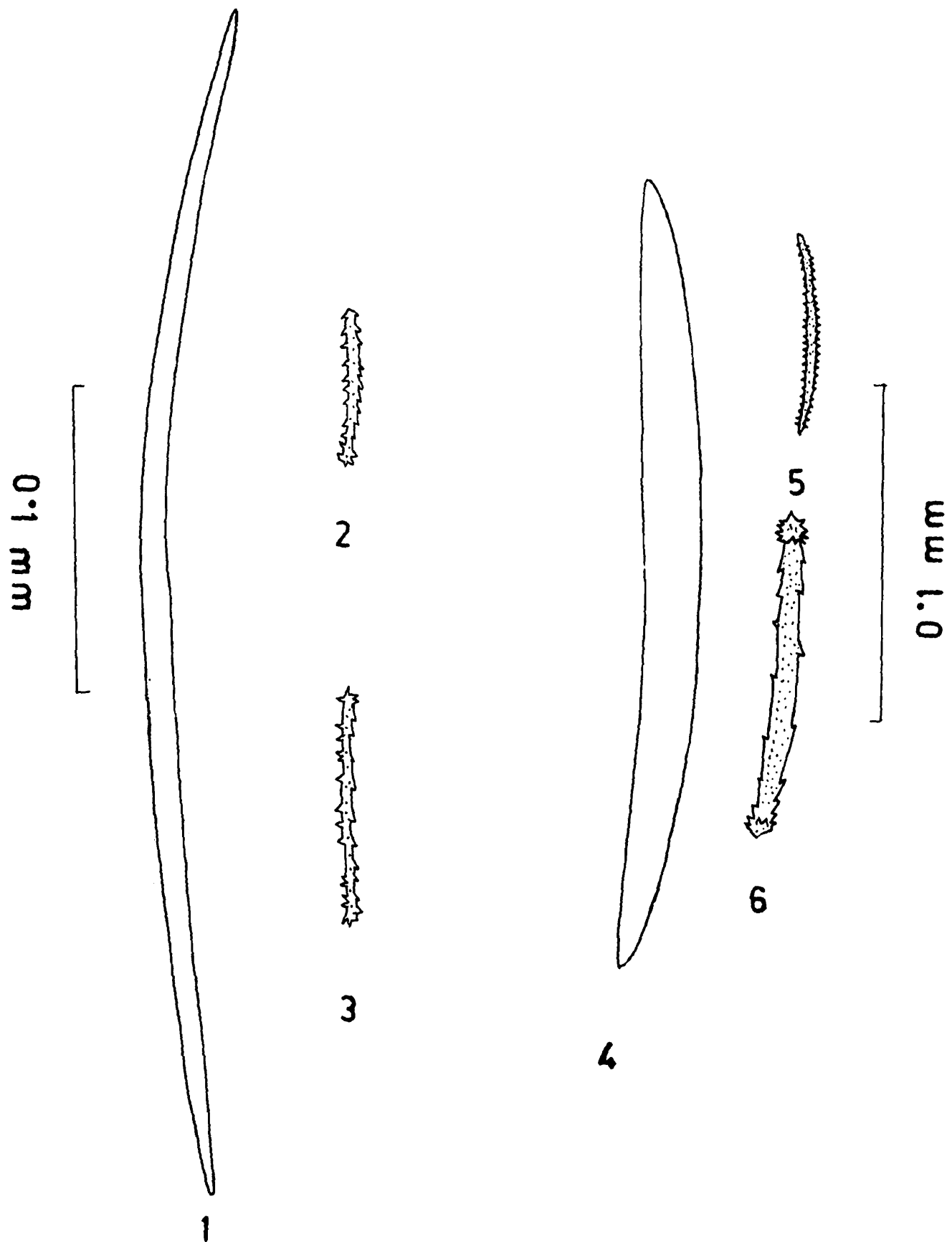
Gemmoscleres birotulates; shafts slender, smooth; rotules circular and unequal in diameter, upper rotule forming a bowl-like structure; length of shaft .014-.016 mm, its thickness .003-.004 mm; diameter of lower rotule .016-.019 mm, of upper .015-.018 mm.

Gemmules abundant, small, situated at the base of sponges, spherical, minute; surrounded by a capsule of normal megascleres; pneumatic coat thin, granular, gemmoscleres embedded in this coat in a single layer; foramen tube short, conical and porous; diameter of gemmule ranging 0.265-0.320 mm.

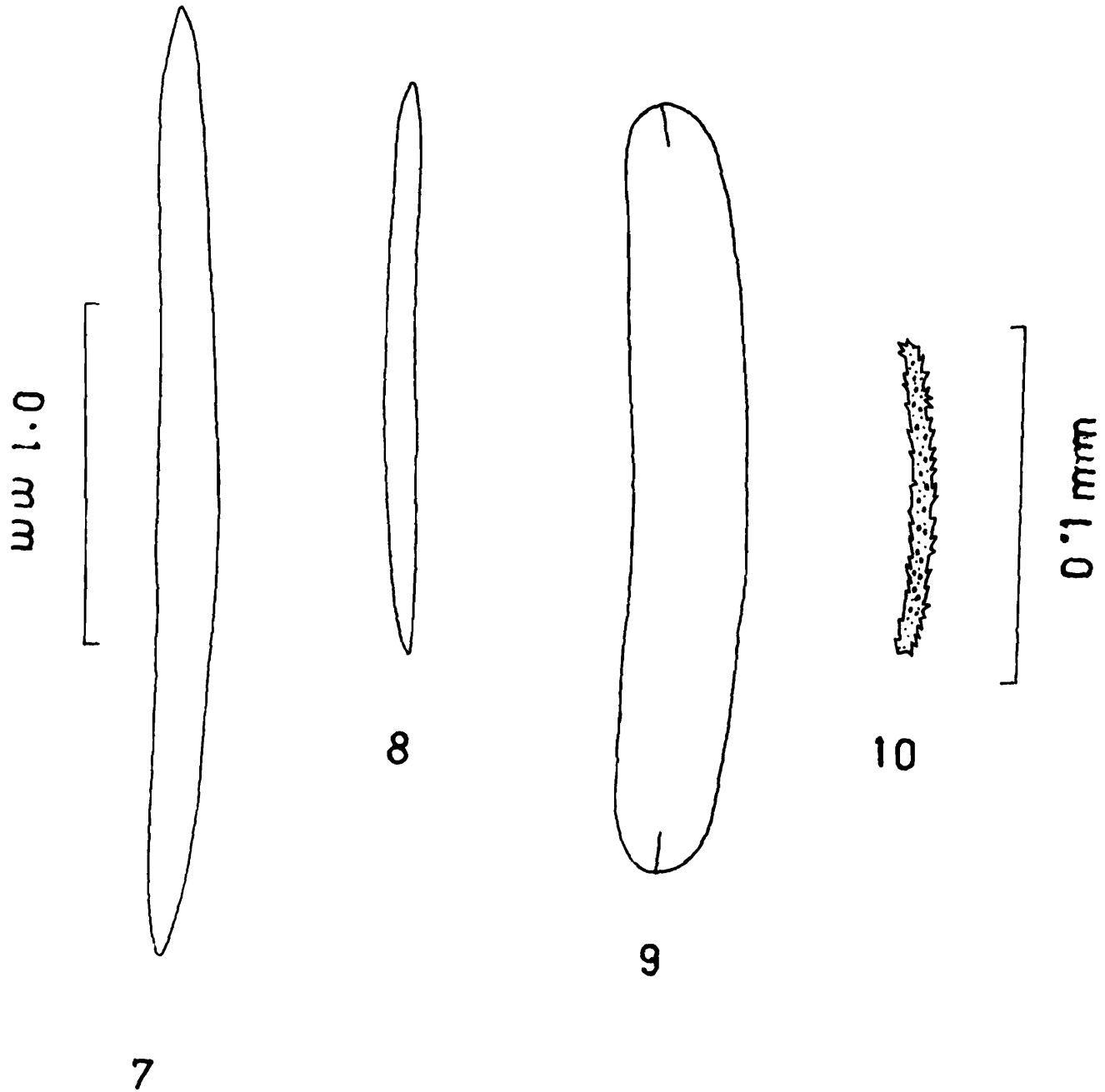
Colour in life pale yellow to light brown.

Distribution : INDIA : West Bengal Calcutta. OUTSIDE INDIA : Africa, China, Philippines; S. E. Asia.

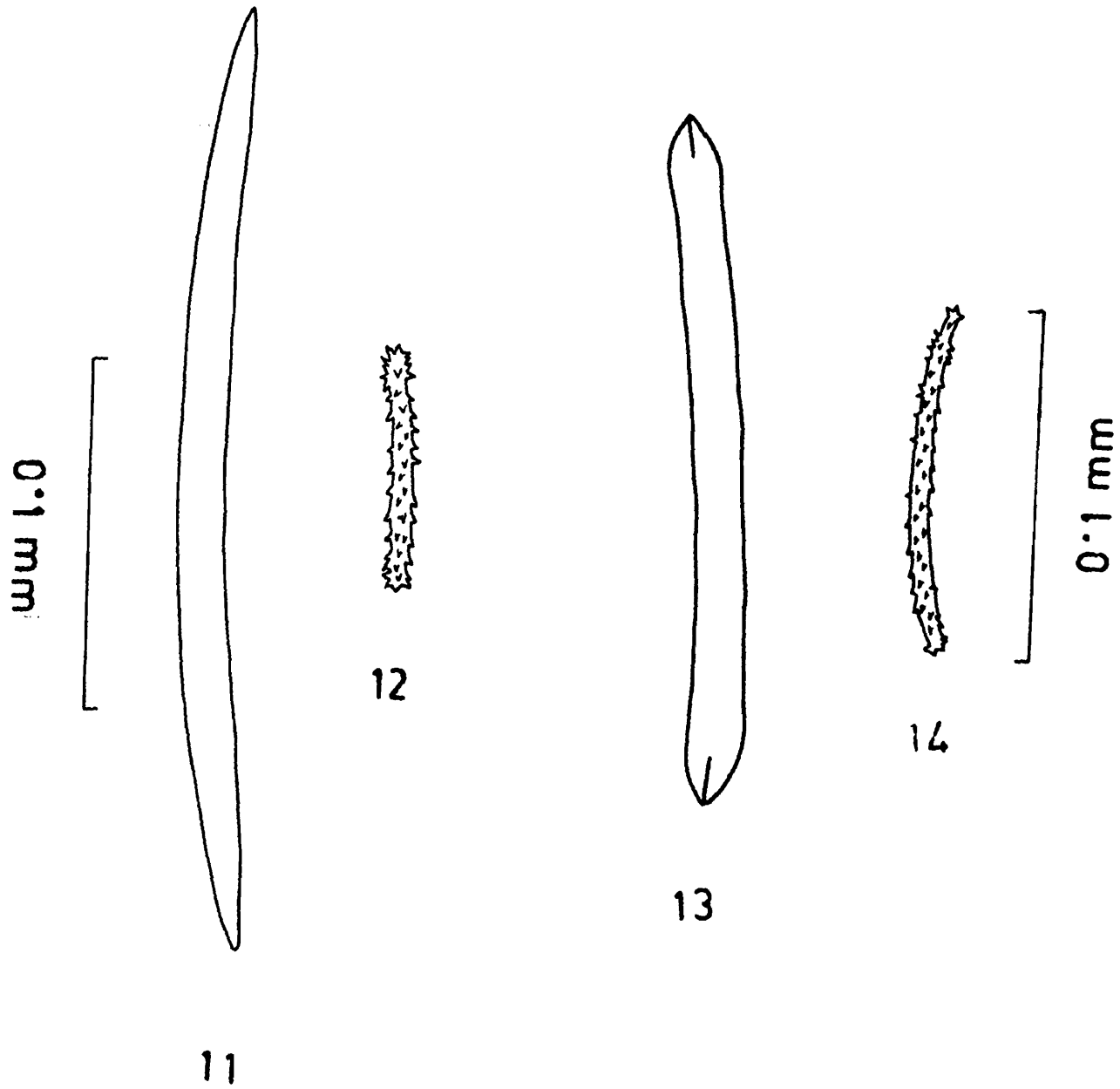
Remarks : Annandale (1911) reported this species from Calcutta. Since then it has not been recorded elsewhere by any other worker. During the present survey the present author also could not collect this species in spite of thorough search in type locality as well as other parts of West Bengal.



Figs. 1-3, *Spongilla lacustris* (Linnaeus) 1. Megasclere, 2. Gemmoscleres, 3. Microscleres.
Figs. 4-6, *Spongilla alba* Carter – 4. Megascleres, 5. Microsclere, 6. Gemmosclere.

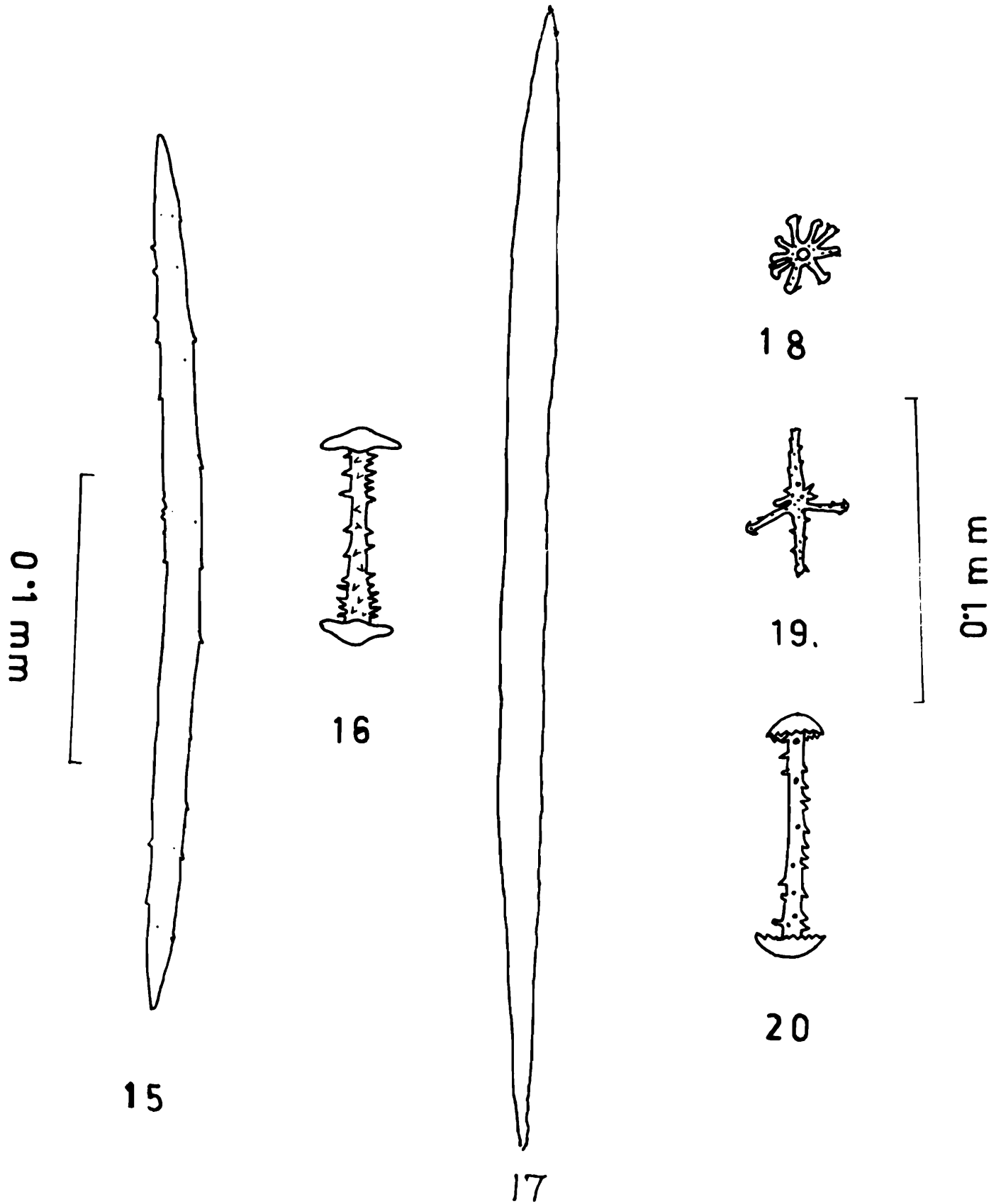


Figs. 7 and 8, *Eunapius carteri* (Bowerbank) 17. Megasclere, 8, Gemmosclere.
 Figs. 9 and 10, *Eunapius craninimus* (Annandale) 9. Megasclere, 10. Gemmosclere.



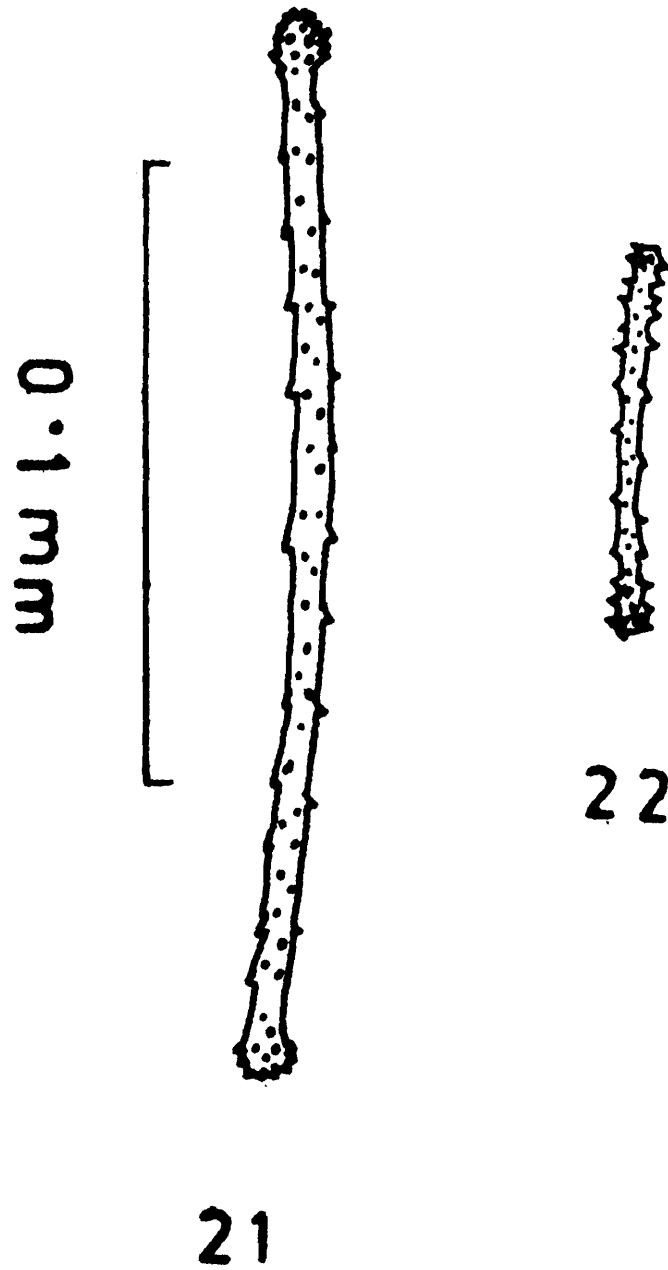
Figs. 11 and 12, *Eunapius fragillis* (Leidy) - 11, Megasclere, 12. Gemmosclere.

Figs. 13 and 14, *Eunapius calcuttanus* (Annandale) 13. Megasclere, 14. Gemmosclere.



Figs. 15 and 16, *Umborotula bogorensis* (Weber) 15. Megasclere, 16. Gemmosclere.

Figs. 17 28, *Dosilia plumosa* (Carter) 17. Megasclere, 18 & 19. Microscelere, 20. Gemmosclere.



Figs. 21 & 22, *Radiospongilla indica* (Annandale) 21. Megasclere, 22. Gemmosclere.

TABLE 1
Districtwise distribution of fresh-water Sponges in West Bengal

| Sl. No. | Names of the District Name of the Species | Bankura | Birbhum | Bardhaman | Calcutta | Kochbihar | Darjeeling | Hugli | Haora | Jalpaiguri | Malda | Medinipur | Murshidabad | Nadia | Purulia | North 24 Parganas | South 24 Parganas | West Dinajpur |
|---------|--|---------|---------|-----------|----------|-----------|------------|-------|-------|------------|-------|-----------|-------------|-------|---------|-------------------|-------------------|---------------|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| 1. | <i>Spongilla lacustris</i> | + | + | + | + | | | + | | | + | + | | | | | | + |
| 2. | <i>Spongilla alba</i> | | | | + | | | | | | | | | | | + | + | |
| 3. | <i>Eunapius carteri</i> | + | + | | + | + | | + | + | + | + | + | | + | + | + | + | + |
| 4. | <i>Eunapius fragilis</i> | | | | | | | + | + | | | + | | | | | | |
| 5. | <i>Eunapius calcuttanus</i> | | | + | + | | | | + | | | + | | | | | | + |
| 6. | <i>Eunapius crassissimus</i> | + | | | + | + | | | | + | | | | | | | | |
| 7. | <i>Stratospongilla indica</i> | | | | | | | | | | | | | | | + | | |
| 8. | <i>Corvospongilla lapidosa</i> | | | | | | | | | | | | | | | + | | |
| 9. | <i>Corvospongilla caunteri</i> | | | | + | | | | | | | | | | | | | |
| 10. | <i>Radiospongilla indica</i> | | | | + | | | | | | | | | | | | | + |
| 11. | <i>Radiospongilla cerebellata</i> | | | | + | | | | | | | | | | | | | + |
| 12. | <i>Ephydatia meyeri</i> | | | | + | | | | + | | | | | | | | | |
| 13. | <i>Umborotula bogorenses</i> | | | | | | | + | | | | | | | | | | |
| 14. | <i>Dosisia plumosa</i> | + | | | | | | | | | | | | | | | | |
| 15. | <i>Trochospongilla latouchiana</i> | | | | + | | | | | | | | | | | | | |
| 16. | <i>Trochospongilla philottiana</i> | | | | + | | | | | | | | | | | | | |

TABLE II
Freshwater Sponges of West Bengal - distribution in other states of India

| Sl. No. | Names of States Name of Species | Names of States | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---------|------------------------------------|--------------------|----------------|-------------------|-------|-------|-----|---------|---------|------------------|-----------------|-----------|--------|-----------|----------------|-------------|---------|-----------|---------|----------|--------|------------|--------|-----------|--------|------------|---------|---------------|
| | | Andaman & Nicobars | Andhra Pradesh | Arunachal Pradesh | Assam | Bihar | Goa | Gujarat | Haryana | Himachal Pradesh | Jammu & Kashmir | Karnataka | Kerala | Laccdives | Madhya Pradesh | Maharashtra | Manipur | Meghalaya | Mizoram | Nagaland | Orissa | Pandicheri | Punjab | Rajasthan | Sikkim | Tamil Nadu | Tripura | Uttar Pradesh |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 |
| 1. | <i>Spongilla lacustris</i> | | | | + | + | | | | + | + | + | | | | + | | | | | + | | + | + | | + | | |
| 2. | <i>Spongilla alba</i> | | | | | | | | | | | | + | | | + | | | | + | | | + | | | | | |
| 3. | <i>Eunapius carteri</i> | | | | | + | | | | | | | + | | | + | | | | | + | | + | + | | + | | + |
| 4. | <i>Eunapius fragilis</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5. | <i>Eunapius calcuttanus</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6. | <i>Eunapius crassissimus</i> | | | | | | | | | | | | | | | | | | | | + | | | | | | | |
| 7. | <i>Stratospondilla indica</i> | | | | | | | | | | | | | | | + | | | | | | | | | | | | |
| 8. | <i>Corvospongilla lapidosa</i> | | | | | | | | | | | | | | | + | | | | | | | | | | | | |
| 9. | <i>Corvospondilla caunteri</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | + |
| 10. | <i>Radiospongilla indica</i> | | | | | | | | | | | | | | | + | | | | | | | | | | | | |
| 11. | <i>Radiospongilla cerebellata</i> | | | | + | | | | | + | | | + | | | + | | | | | + | | | | | + | | |
| 12. | <i>Ephydatia meyeri</i> | | | | | | | | | | | | + | | | + | | | | | | | | + | | + | | |
| 13. | <i>Umborotula bogorensis</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14. | <i>Dosilia plumosa</i> | | | | | | | | | | | | | | | + | | | | | + | | | | | | | |
| 15. | <i>Trochospongills latouchiana</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16. | <i>Trochospongills philottiana</i> | | | | | | | | | | | | | | | | | | | | | | | | | | | |

SUMMARY

The paper deals with sixteen species of freshwater sponges (Porifera : Spongillidae) which are so far known from West Bengal, India. One genus and two species are recorded for the first time from Indian region and seven species constitute new locality records. Diagnostic keys for nine genera and sixteen species and their distribution chart in West Bengal and in the Indian region have also been furnished.

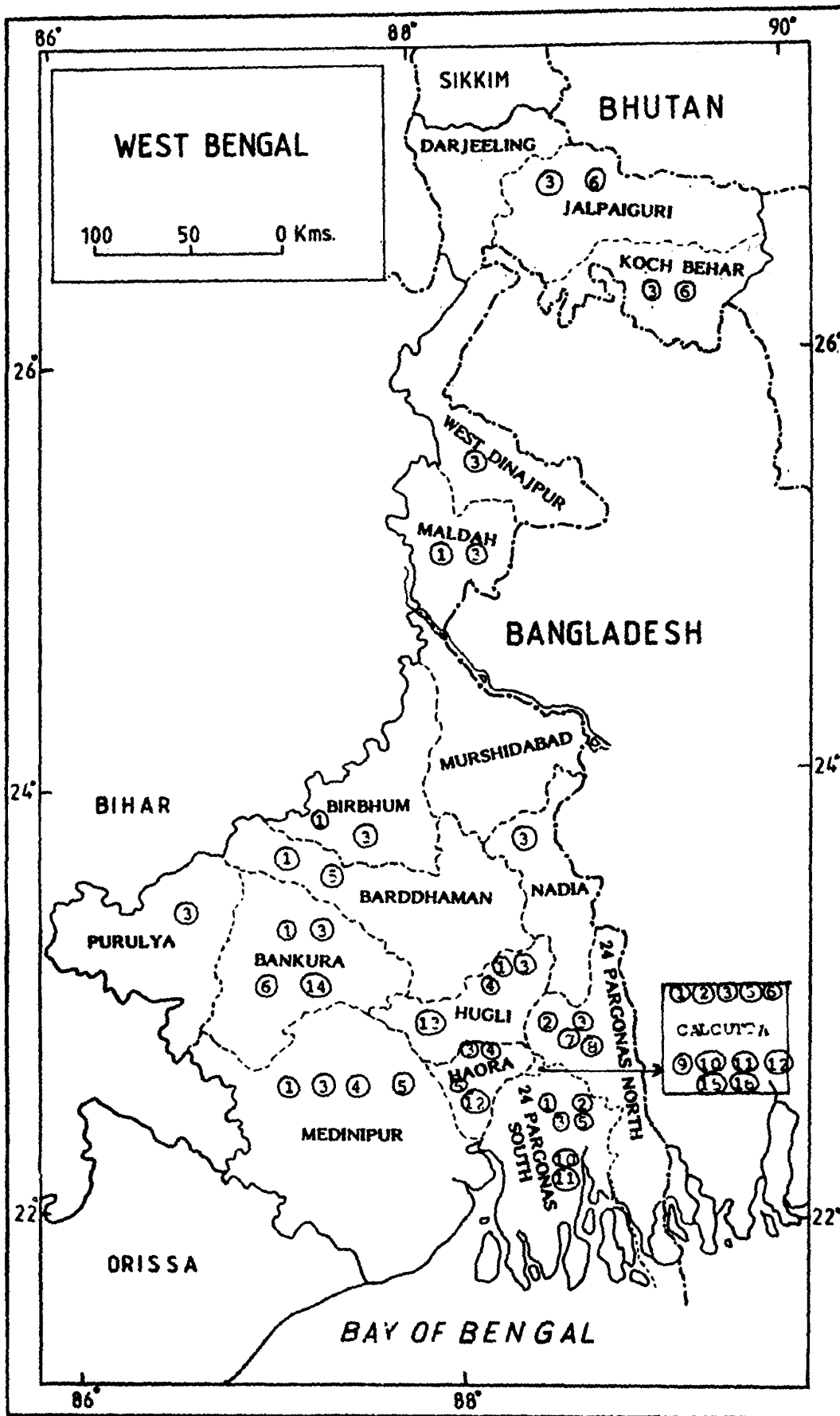
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CNIDARIA : SEA ANEMONES

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INTRODUCTION

Actinarians, popularly called 'sea-anemones' belong to the phylum Cnidaria having relatively simple body organisation and form an important group of intertidal invertebrate organisms distinguished by their habit, habitat and beautiful colouration. Literature on sea-anemones reveals that the group has been worked out in India by Annandale (1907 & 1915), Carlgren (1925), Panikkar (1936), Parulekar (1968), Seshaiya and Cuttress (1971), Misra (1975 & 1976), Misra and Soota (1981) and Anonymous (1987). As a result total of 20 species under 17 genera and 10 families have been reported from India which include 7 species from the state of West Bengal.

The present work is an attempt to study the systematics of this group of the state. Material for this study was collected during 1985 to 1988 from Hooghly-Matla estuarine belt of 24 Parganas and Digha coast of Midnapore districts. Altogether 9 species belonging to 7 genera and 5 families have been worked out. Of these, only two species, namely, *Paracondylactis indica* and *Edwardsia tinctoria*, have been added as new to the fauna of the state.

The present paper deals with the diagnostic characters, distribution and key for identification of the nine species hitherto known from West Bengal. It also furnishes a general account of morphology and terminology as well as the method of collection and preservation techniques of the group. Synonymies have been reduced to avoid over repetition but include the original and most recent references and authors responsible for major changes in nomenclature.

MORPHOLOGY AND TERMINOLOGY

The sea-anemones, so called from the flower-like appearance of the expanded oral disc, are among the most familiar animals of the sea-shore and muddy intertidal belt of the estuary. The solitary, cylindrical body is divided into oral disc, column and base.

Oral disc : Flat, with a circular, sometimes lobed or bilobed margin and provided with tentacles.

Tentacles : Usually of simple conical form, tapering to a point bearing nematocysts. All the tentacles either branched or inner cycles simple and outer branched or vice-versa or outer ones elongated and inner ones reduced. Arranged in a single marginal cerclet, when a few in number or disposed in two to many alternating circles when more numerous, or in radiating rows or both. Tentacles of one cycle usually of the same size or form, but those of different cycles differ in one or both regards.

Margin : Junction of oral disc and column and sometimes marked by a groove.

Column : Thin transparent to a thick leathery condition and often marked by longitudinal lines i.e., attachment of septa. Differentiated into capitulum and scapus.

Capitulum : Upper short delicate, thin wall region of the column.

Cuticle : Some species secrete a cuticle on the surface of column and pedal disc.

Scapus : Lower thick wall region the principal and longest zone of the column - often provided with tentacle or tubercles.

Scapulus : A thick walled zone above the scapus differing from it in histological construction and general appearance.

Base : Base separated from column by a constriction, limbus and usually expanded into a circular pedal disc for adhering to stones shells and other hard objects.

Internally, some characters are of taxonomically important. These are :

Acontia : Thin threads attached at one end to mesenteries, as a rule below the filaments, while the other end free and laden with extra-ordinary numerous nematocysts of variable categories.

Actinopharynx : Throat, stomodaeum; the tube which leads from the mouth into the coelenteron.

Basilar muscles : In forms with a pedal disc, the parietal muscles, found on both faces of the septa, running out onto the disc more or less parallel to it.

Filament : A thickened rim running along the free border of a mesentery from the end of the actinopharynx downwards. In its lower part the filament simple, in its upper part usually a tripple cord.

Mesenterial muscles : One side of each mesentery occupied by longitudinal muscles, the other by transverse and *parietobasilar muscles*; the latter usually run obliquely from column to pedal disc. The longitudinal muscles usually more or less concentrated, forming more or less strong *retractors*. Sometimes, especially in elongated Athenaria, the longitudinal muscles very weak apart from retractors. Close to bodywall they increase in size and form, together with parietobasilar muscles a *parietal* muscle.

Mesenterial arrangement : Mesenteries arranged in pairs, each consisting of two mesenteries adjacent to one another. Usually the arrangement of the pairs six-rayed (hexamerous), sometimes eight-rayed (octamerous) or tenrayed (decamerous). In elongate forms the perfect mesenteries often strongly differentiated from in-perfect ones. The former, *macrocnemes*, with very strong retractors, gonads and filaments, while the latter, *microcnemes*, lacks these organs.

Nematocysts : Stinging capsules the thread of which shows several types of structure : (a) *atrachs* - thread without a differentiated basal shaft and with barbs, smooth. (b) *holotrichs* : thread without a differentiated basal shaft but with barbs along its whole length. (c) *basitrichs* - thread without shaft but with barbs at its base only.

Physa : the aboral ampullaceous end of certain Athenaria.

Pharynx : The mouth opens into a space called pharynx which in turn opens into the gastrovascular cavity.

Sphincter : The endodermal circular muscles of the column are often accumulated at or near the margin and form a sphincter which is endodermal or embedded in the mesogloea, when it is called a mesogloal sphincter.

Verrucae : More or less ampullaceous, adhesive evaginations of the column, simple or more rarely compound, with modified ectoderm, without nematocysts in their central part. Rarely as in *Diadumene*, there evagination absent, but the ectoderm shows same structure as that of the verrucae proper and is adhesive (*suckers*).

METHOD OF COLLECTION, NARCOTIZATION AND PRESERVATION

Athenarian for this study were collected from the intertidal zone of estuarine belt of West Bengal. The mud burrowing anemones suddenly contract and go deep into the mud, even on the slightest disturbance, the best method of collection was to insert a spade into the mud without disturbing the animal and lever up the mud along with the anemone. Specimens were picked up carefully and brought to the camp laboratory in estuarine water.

Thenarian anemones usually observed on the decaying woods sunked into the shallow water or from empty molluscan shells. It was collected to cut the decaying wood with the specimens by knife or along with the empty molluscan shells and brought to the camp laboratory in estuarine water.

The specimens were left in a tray and allowed to expand in the estuarine water, with just enough water to cover them. A few crystals of menthol were added to the water. When the animals were fully expanded and ceased to respond to stimuli, hot 40% formalin was poured over them. The anemones should not be left long in menthol, since the tissues are affected, and the column often becomes unusually distended. Fixed specimens were preserved in 4% formalin.

SYSTEMATIC ACCOUNT

Order ACTINIARIA

Sub-order NYNATHEAE

- I. Family EDWARDSIIDAE
1. Genus *Edwardsia* Quatrefages
 - (1) *Edwardsia jonesii* Seshaiya & Cuttress
 - (2) **Edwardsia tinatrix* Annandale
- II. Family HALIACTIIDAE Carlgren
2. Genus *Pelocoetes* Annandale
 - (3) *Pelocoetes exul* Annandale
 - (4) *Pelocoetes minima* Panikkar
 3. Genus *Phytoetes* Annandale
 - (5) *Phytoetes gangeticus* Annandale
 4. Genus *Phytoeteopsis* Panikkar
 - (6) *Phytoeteopsis ramunni* Panikkar
- III. Family NEVADNEIDAE Carlgren
5. Genus *Nevadne* Stephenson
 - (7) *Nevadne glauca* (Annandale)
- IV. Family DIADUMENIDAE Stephenson
6. Genus *Diadumene* Stephenson
 - (8) *Diadumene schilleriana* (Stoliczka)

V. Family ACTINIIDAE (Gosse)

7. Genus *Paracondylactis* Carlgren(9) * *Paracondylactis indica* Dave

The taxa new to West Bengal is marked by asterisk (*)

KEY TO THE FAMILIES

1. Basilar muscles present 2
Basilar muscles absent 3
2. Acontia present DIADUMENIDAE
Acontia absent ACTINIIDAE
3. Acontia present HALIACTIIDAE
Acontia absent 4
4. Mesenteries divisible into macrocnemes and microcnemes EDWARDSIIDAE
Mesenteries not divisible into macrocnemes and microcnemes NEVADNEIDAE

I Family EDWARDSIIDAE

Diagnosis : Body vermiform elongated, divided into two regions, a long scapus provided with a cuticle and a short upper scapus. Physa naked, at the aboral end. Capitulum very thin and short below the tentacles. Sphincter or acontia absent. mesenteries divided into 8 macrocnemes and at least 4 microcnemes. Parietal muscles always distinct.

Distribution : South Africa, United Kingdom (U.K.), Artic Sea of Siberia (USSR), Japan, Morocco, Pakistan, India, Vietnam; New Guinea, New Zealand, Gilbert Island; Greenland, North America and South America.

Remarks : The family is represented in West Bengal by one genus.

1. Genus *Edwardsia* Quatrefages1842. *Edwardsia* Quatrefages, *Ann. Sci. nat.*, **18**(2) : 68(Type species : *E. beautempsi* Quatrefages)

Diagnosis : Body divided into physa, scapus, scapulus and capitulum. Scapus long with batteries of nematocysts sunk in the mesogloea. Tentacles at least 12, shorter or longer. Ventral siphonoglyph weak.

Distribution : India : West Bengal, Orissa, Tamil Nadu, Goa, Maharashtra.

Remarks : The genus is represented in India by only two species, namely, *E. tinatrix* and *E. jonesii*.

Key to the species of *Edwardsia*

- Tentacles 12 *E. jonesii*
 Tentacles 16 *E. tinctorix*

1. *Edwardsia jonesii* Seshaiya & Cuttress

1971. *Edwardsia jonesii* Sheshaiya & Cuttress, *J. Mar. biol. Ass. India*, **11**(1&2) : 73, Figs. 1,2.

1987. *Edwardsia jonesii* : Anonymous, Mangrove Ecosystem of sundarbans, Department of Marine Science, Calcutta University : 71.

Material examined : 9 exs, Gangasagar, 8.vii.1975; 2 exs, Gosaba, 25.v.1985; 7 exs, Jalakhati, 21.ii.1986; 26 exs, Jharkhali, 22.ii.1986; 4 exs, Purandar, 26.ii.1986; 16 exs, Narayangung, 5.iv.1987; 9 exs, Iswarpur, 7.iv.1987; 17 exs, Kakdwip, 6.iv.1987; 20 exs, Sagar Island, 23.xii.1987.

Diagnosis : Tentacles 12, smooth and arranged in two cycles of 6 each. Body distinctly divided into capitulum, Scapulus, scapus and inflatable physa without cuticle. Capitulum thin-walled, almost transparent, smooth and without cuticle. Scapus thick-walled, covered with thick shaggy rusty-red cuticle. Actinopharynx with 8 longitudinal ridges, siphonoglyph indistinct.

Habitat : Burrowing forms in soft muddy substratum of intertidal zone.

Distribution : India : West Bengal South 24 Parganas District; Orissa; Tamil Nadu.

Remarks : This species is a common form in the estuarine areas of West Bengal (Misra, 1976; Anonymous, 1987). However, record of this species from Andaman and Nicobars (Tikkdar et al., 1985) is doubtful.

2. *Edwardsia tinctorix* Annandale

1915. *Edwardsia tinctorix* Annandale, *Mem. Ind. Mus.*, **5** : 92, pl.6, fig.3; pl.7, figs.5, 5a; pl.7a, fig.5; text figs.7. A-C.

1986. *Edwardsia tinctorix* : Parulekar, *J. Bombay nat. Hist. Soc.*, **65**(1) : 140, pl.1, fig.1.

Material examined : 1 ex, Maynapara Khal, Kakdweep, 26.xii.1987.

Diagnosis : Tentacles 16, smooth and arranged in two cycles. Physa well developed at the aboral end. Periderm of the scapus thick. Nemathybomes 8 arranged in longitudinal rows on a worm like column.

Habitat : Burrowing form in soft muddy substratum of intertidal zone.

Distribution : India : West Bengal : South 24 Parganas District; Orissa; Goa; Maharashtra.

Remarks : This is the first record of this species from estuarine region of West Bengal. It is restricted in India, not recorded elsewhere.

II. Family HALIACTIIDAE

Diagnosis : Body elongated and rounded; column smooth. Distinct sphincter absent. Acontia present. Macrocnemes 6 pairs, filamented and fertile while microcnemes variable in numbers, non-filamented and sterile.

Distribution : Arctic waters; India; New Zealand.

Remarks : The family is represented by 3 genera in West Bengal.

Key to the genera of *Haliactiidae*

1. Oral disc thrown into very distinct lobes *Pelocoetes*
 Oral disc not lobed..... 2
2. Tentacles and acontia typically arranged..... *Phytocoetes*
 Tentacles and acontia atypically arranged, youngest tentacles situated nearer the mouth than the next youngest.....*Phytocoetopsis*

2. Genus *Pelocoetes* Annandale

1915. *Pelocoetes* Annandale, *Mem. Ind. Mus.*, 5 : 86

Diagnosis : Elongated vermiform body. Column divided into capitulum, scapus and physa. Scapus with longitudinal rows of warts. Distinct sphincter absent. Actinopharynx long. Upper part of capitulum and oral disc thrown out into 6 long outgrowths (pedicels) each bifurcating two or three times.

Distribution : West Bengal; Orissa; Tamil Nadu; Kerala; Maharashtra.

Remarks : This genus is represented by two species in West Bengal.

Key to the species of *Pelocoetes*

- Tentacles arranged in 6 cycles *P. exul*
 Tentacles arranged in 4 cycles *P. minima*

3. *Pelocoetes exul* Annandale

1915. *Pelocoetes exul* Annandale, *Mam. Ind. Mus.*, 5 : 86, pl.6, fig.1; pl.7, figs.3,3a,3b; text fig.5.

1987. *Pelocoetes exul* : Anonymous, *Mangrove Ecosystem of Sundarbans, Department of Marine Science (C.U.)* : 71.

Material examined : South 24 Pargans : 5 exs, Basanti, 25.ii.1985; 1 ex, Gosaba, 25.v.1985; 12 exs, Jharkhali, 22.ii.1986.

Diagnosis : Basal disc reduced. bluntly tapering and without physa. Column elongated. Longitudinal rows of nematocyst batteries alternating with cinclides on column. Tentacles branched hexamerously arranged (6+6+12+24+48, the last cycle more or less complete). Oral disc lobed.

Habitat : Soft mud burrowing form in the intertidal zone.

Distribution : India : West Bengal : South 24 Parganas and Gangetic Delta; Orissa; Tamil Nadu; Kerala; Goa; Maharashtra.

Remarks : This species is widely occurring in various places of eastern sector of Sundarban but surprisingly absent in its western sector.

4. *Pelocoetes minima* Panikkar

1939. *Pelocoetes minima* Panikkar, *Proc. Zool. Soc.*, 108B : 669.

1987. *Pelocoetes minima* : Anonymous, *Mangrove Ecosystem of Sundarbans, Department of Marine Science (C.U.)* : 71.

Diagnosis : Column vermiform without demarcation into scaphus, capitulum, and physa. Rows of stinging warts not developed, but the nematocysts of the ectoderm are arranged in groups, forming minute stinging spots. Tentacles arranged in four cycles : 6+6+12+24 : Total 48. All tentacles except the first cycle arranged in pedicels. Pairs of mesenteries 6+6+12; the last cycle occurring only near the oral disc. Parietal muscles weak. Acontia long and slender, one for each macrocneme.

Habitat : Marine form, occurring in estuary also.

Distribution : India : West Bengal : South 24 Parganas; Tamil Nadu.

Remarks : The specimen of this species is neither available in our National Zoological Collection of the Z.S.I. nor collected by the present author in recent survey. However, the name of the species appeared in the list of mangrove ecosystem of Sundarbans (Anonymous, 1987). Hence, diagnostic characters is given after Panikkar (1939).

3. Genus *Phytocoetes* Annandale

1907. *Metridium* Annandale, *Rec. Ind. Mus.*, 1(1) : 48.

1915. *Phytocoetes* : Annandale, *Mem. Ind. Mus.*, 5 : 79.

Diagnosis : Elongated body not divisible into regions. Proximal end physa-like. Column smooth, with rows of cinclides in its upper part. Sphincter absent. Tentacles long, inner tentacles longer than the outer ones. Oral disc not divided into lobes.

Distribution : India - West Bengal; Tamil Nadu; Kerala; Maharashtra.

Remarks : Endemic in India.

5. *Phytocoetes gangeticus* Annandale

1907. *Metridium schillerianum* var. exul. Annandale, *Rec. Ind. Mus.*, 1(1) : 47.

1915. *Phytocoetes gangeticus* : Annandale, *Mem. Ind. Mus.*, 5 : 79, pl.7a, figs.3,3a,3b; text fig.3.

1968. *Phytocoetes gangeticus* : Parulekar, *J. Bombay nat. Hist. Soc.*, 65(1) : 141, pl.1, Fig.4.

Material examined : South 24 Parganas : 1 ex, Mandirtola, Sagar Island, 28.x.1974, A. Misra; 1 ex, Maligwalinighat, Sagar Island, 23.xii.1987, B. P. Halder.

Diagnosis : Tentacles simple, 36 in number. Column elongated, smooth with longitudinal rows of cinclides. Sphincter not visible on the anterior surface. Base narrow physa-like.

Habitat : Soft mud burrowing from in the intertidal zone.

Distribution : India : West Bengal : South 24 Parganas (Canning, Sagar Island); Tamil Nadu; Kerala; Goa; Maharashtra.

Remarks : Endemic from widely reported from various places of the Indian coast.

4. Genus *Phytocoeteopsis* Panikkar

1936. *Phytocoeteopsis* Panikkar, *Proc. Zool. Soc.*, Part I : 229-249.

Diagnosis : Body vermiform divisible into 3 indistinct regions, capitulum, scapus and physa-like base. Column elongated, smooth and without suckers or cuticle. Sphincter absent. Oral disc

with radial muscles. Tentacles numerous, arranged in five to six cycles. Those of the last cycles atypically arranged in as much as the youngest tentacles situated nearer the mouth than the next youngest. Acontia well developed, atypically arranged.

Distribution : India : West Bengal (Gangetic Delta); Tamil Nadu; Kerala.

Remarks : Endemic in India.

6. *Phytocoeteopsis ramunnii* Panikkar

1936. *Phytocoeteopsis ramunnii* Panikkar, *Proc. Zool. Soc.*, Part I : 231, Text figs.1, 2A, 3,6,8.

1981. *Phytocoeteopsis ramunnii* : Misra & Soota, *Bull. Zool. Surv. Ind.*, 4(2) : 151.

Material examined : South 24 Parganas 2 exs, Mandirtola, Sagar Island, 28.x.1978, A. Misra; 6 exs, Jharkhali, 22.ii.1986.

Diagnosis : Tentacles 96, arranged in five cycles. Base usually reduced, physa-like and without ectodermal cinclides. Column thin and smooth. capitulum narrow, Scapus thick and long, and very broad above and vermiform below.

Habitat : Soft mud-burrowing in the intertidal zone.

Distribution : India : West Bengal South 24 Parganas-Gangetic delta (Sagar Island); Tamil Nadu; Kerala.

Remarks : Endemic in India.

III. Family NEVADNEIDAE Carlgren

1925. Nevadneidae Carlgren, *Ark. Zool.* 17A(21) : 3.

Diagnosis : Basilar muscles absent. Column with longitudinal muscles in its upper part and without spirocyst. Sphincter absent. Tentacles not deciduous, atypically arranged. Longitudinal muscles of tentacles and radial muscles of rostral disc ectodermal. Siphonoglyphs weak and perfect mesenteries more than 6 pairs.

Distribution : India West Bengal; Orissa; Tamil Nadu.

Remarks : Due to peculiar origin of the youngest mesenteries and tentacles Carlgren (1925) erected this family to accommodate the genus Nevadne Stephenson.

5. Genus *Nevadne* Stephenson

1915. *Gyrostoma* Annandale, *Mem. Ind. Mus.*, 5 : 70.

1922. *Nevadne* : Stephenson, *Q. Jlmicr. Sci.*, 66 : 264.

Diagnosis : Body elongated with small pedal disc, distal part broader than in the proximal. Column smooth but its nematocysts probably arranged in small groups. Outermost tentacles largest. Mesenteries double in the youngest cycle.

Distribution : India West Bengal; Orissa; Tamil Nadu.

Remarks : This is a monotypic genus.

7. *Nevadne glauca* (Annandale)

1915. *Gyrostoma glaucum* Annandale, *Mem. Ind. Mus.*, 5 : 70, pl. 7a. fig.1, text figs.1a, b (type)

1987. *Nevadne glauca* : Anonymous, *Mangrove Ecosystem of Sundarbans, Department of Marine Sci. (C.U.)* : 71.

Diagnosis : Pedal disc small. Tentacles about 144 arranged in 6 cycles, 4th and 6th cycles being exocoel tentacles. Oral disc narrow and set with tentacles. Actinopharynx well developed with weak siphonoglyphes. Pairs of mesenteries 6+6+12+48, last cycle only in uppermost part of the body. Mesenteries of the three first cycles perfect but those of second and third order perfect only in the upper most part of the actinopharynx.

Habitat : Marine form occurring in 5 to 7 feet under in water.

Distribution : India : West Bengal : South 24 Parganas (Sundarbans); Orissa; Tamil Nadu.

Remarks : The present author fails to collect this species inspite of through search in different areas of Sundarbans. However, the species has been listed by Anonymous (1987).

IV. Family DIADUMENIDAE Stephenson

1920. Diadumenidae Stephenson, *Q. Jlmicr. Sci.*, **64** : 520.

Diagnosis : Basilar muscles present. Body divided into scapus and capitulum. Scapus with cinclides. Distinct sphincter absent. Tentacles long and numerous inner tentacles provided with atrichs and holotrichs.

Distribution : North America : New York to North Carolina; United Kingdom; Holland; West Germany; Atlantic coast of France; Africa; India; New Zealand.

Remarks : The family is represented by one genus in West Bengal.

6. Genus *Diadumene* Stephenson

1869. *Sagartia* Stoliczka, *J. Asiat. Soc. Bengal*, **38** : 28.

1907. *Metridium* Annandale, *Rec. Ind. Mus.* **1**(4) : 47.

1920. *Diadumene* Stephenson, *Q. Jlmicr. Sci.*, **64** : 521.

Diagnosis : Body divided into scapus with cinclides and capitulum with collar. Tentacle long and numerous, inner tentacles thicker than the other tentacles. Basal disc well developed and attached forms. Distinct sphincter absent.

Distribution : North America : United Kingdom; Holland; West Germany; France; India; New Zealand.

Remarks : The genus is represented by only one species *D. schilleriana* in West Bengal.

8. *Diadumene schilleriana* (Stoliczka)

1869. *Sagartia schilleriana* Stoliczka, *J. Asiat. Soc. Bengal*, **38**(2) : 31, pls.10,11.

1915. *Metridium schillerianum* (Stoliczka) : Annandale, *Mem. Ind. Mus.*, **5** : 76, pl.7, fig.1; text fig.2.

1987. *Diadumene schilleriana* (Stoliczka) : Anonymous, *Mangrove Ecosystem of Sundarbans, Department of Marine Science (C.U.)* : 71.

Material examined : South 24 Parganas 30 exs. Kachuberia Sagar Island, 1.viii.1974, A. Misra.

Diagnosis : Body very short, 12-19 mm in length and diameter greater than that of column and provided with longitudinal rows of warts. Basal disc strong and adhesive. Column divided into scapus and capitulum. Tentacles long, numerous, more or less regularly arranged and inner tentacles thicker than the outer. Distinct sphincter absent.

Habitat : Attached to decaying wood in the intertidal zone and shallow water of the estuary.

Distribution : India : West Bengal : South 24 Parganas(Canning, Diamond Harbour, Sagar Island); Orissa : Maharashtra.

Remarks : *Metridium schilleriana* represents the type of the genus *Diadumene* (Stephenson 1920, 1922).

V. Family ACTINIIDAE (Gosse)

1858. *Actiniidae*. Gosse, *Ann. Mag. Nat. Hist.*, I (3).

Diagnosis : Column smooth or provided with projections in the form of verruca, marginal spherules, pseudospherules or vesicles. Sphincter absent or endodermal diffuse to circumscribed. Tentacles simple, arranged in cycles. Mesenteries not divisible into macrocnemes and microcnemes. Perfect pairs of mesenteries rarely six, as a rule more than six.

Distribution : Cosmopolitan.

Remarks : This family is represented in West Bengal by one genus.

7. Genus *Paracondylactis* Carlgren

1908. *Condylactis* Wassilieff, *K. Bayar. Akad. Wiss.* 2(1) : 11.

1934. *Paracondylactis* Carlgren, *Report Sci. Results Michael Sars North Atlantic Deep-Sea Exped* : 23.

Diagnosis : Body elongated and pedal disc narrow. Column smooth, sometimes with nematocysts. Sphincter diffuse. Tentacles hexamerously arranged. Retractors strong but diffuse.

Distribution : India, China and Japan.

Remarks : This genus is represented in the West Bengal by one species.

8. *Paracondylactis indica* Dave

1957. *Paracondylactis indica* Dave, Study of Anthozoa, M.Sc. Thesis (Unpublished).

1986. *Paracondylactis indica* : Parulekar, *J. Bombay nat. Hist. Soc.*, 65(1-3) : 143.

Material examined : 2 exs, South 24 Parganas - Bakkhali, 11.iv.1978, G. C. Rao; 4 exs, Digha Midnapur Dist., 12.ii.1978, A. Misra.

Diagnosis : Column elongated and tapering. Pseudospherules present on column. Pedal disc flattened but distinct. Tentacles 96, white in colour, arranged in five cycles.

Habitat : In the muddy sand of lower littoral zone, The anemone can retreat up to a depth of 120 cm.

Distribution : India : West Bengal : South 24 Parganas dist., (Sagar Island); Midnapur Dist., Digha; Maharashtra.

Remarks : Endemic to India. Previously this species was reported from Maharashtra and presently collected from several places of West Bengal.

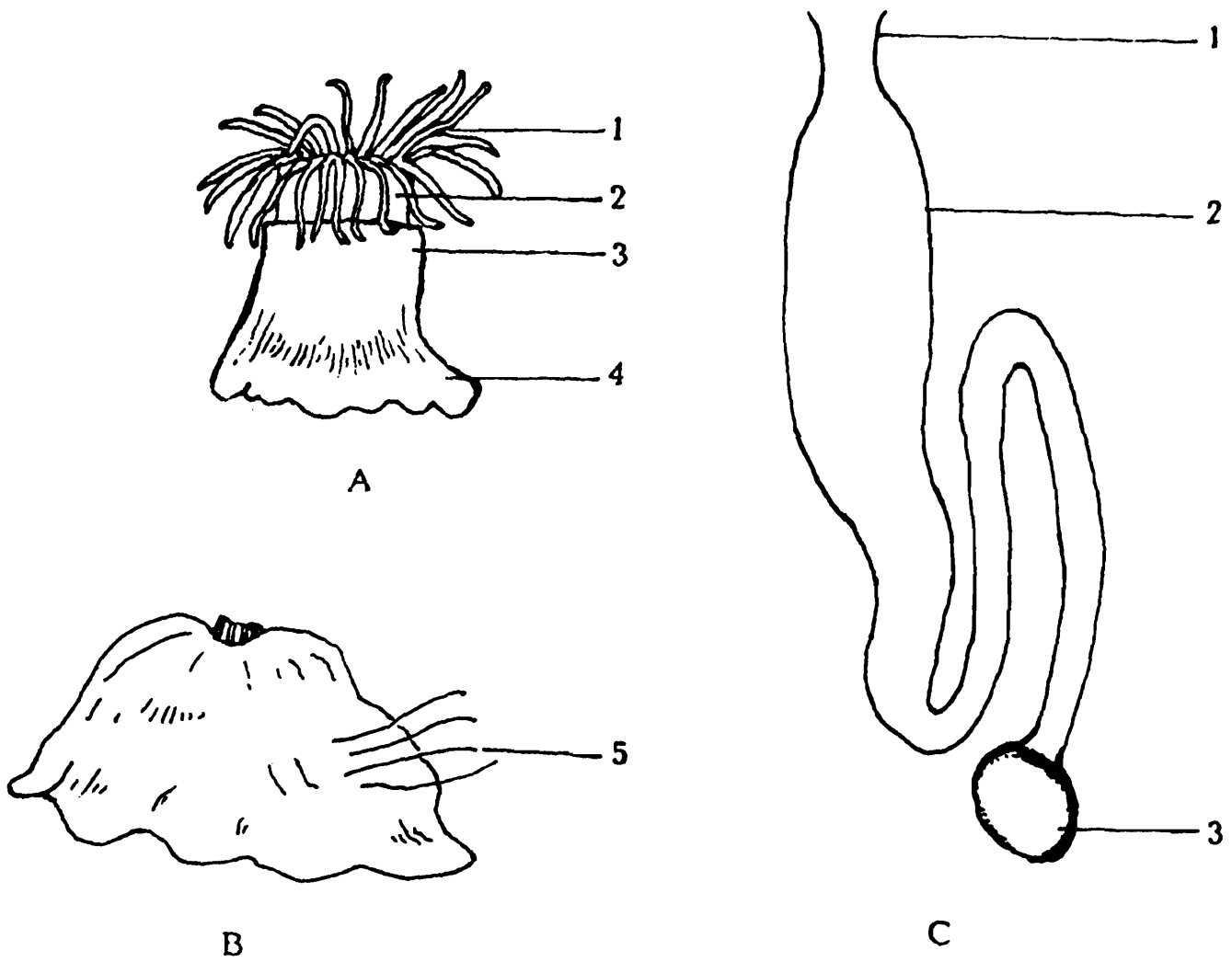


Fig.1.A. Yount specimen of *Diadumene*, from life expanded; 1, tentacles; 2, capitulum; 3, scapus; 4, pedal disk. B. The same specimen contracted with acontia; 5, acontia. C. Diagram illustrating the general shape of the column in *P. ramunnii*; 1, capitulum; 2, scapus; 3, physa-like base.

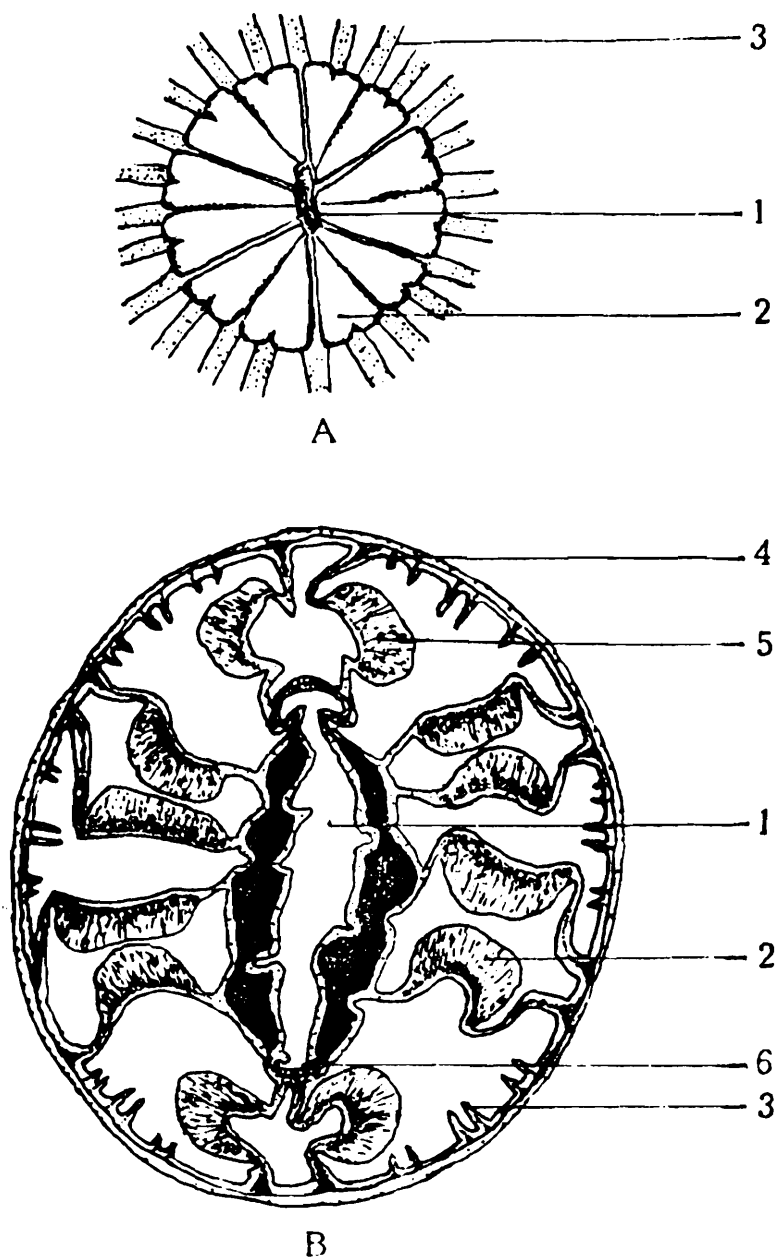


Fig.2.A. The first whorl of tentacles in *P. ramunnij*; 1, apparent mouth; 2, throat; 3, tentacles. B. Transverse section passing through the upper half of the Halcampactiidae. Partly diagrammatic; 1, actinopharynx; 2, macrocneme; 3, microcneme; 4, parietal muscle; 5, retractor; 6, siphonoglyphe.

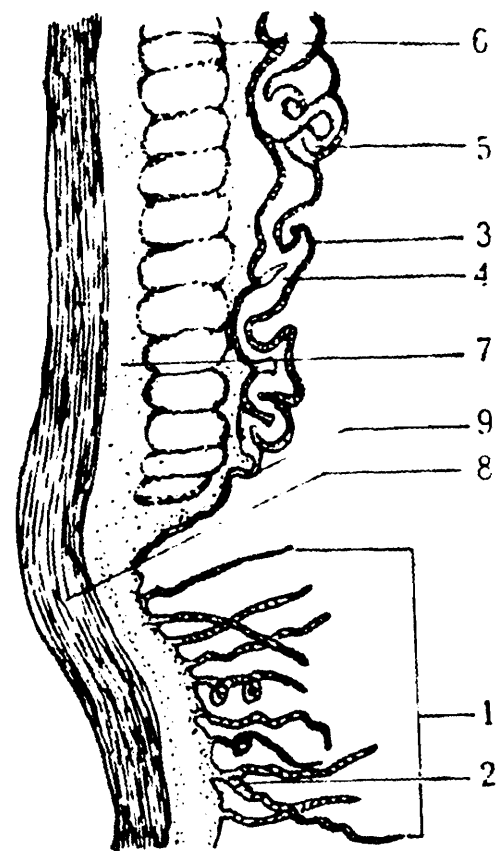
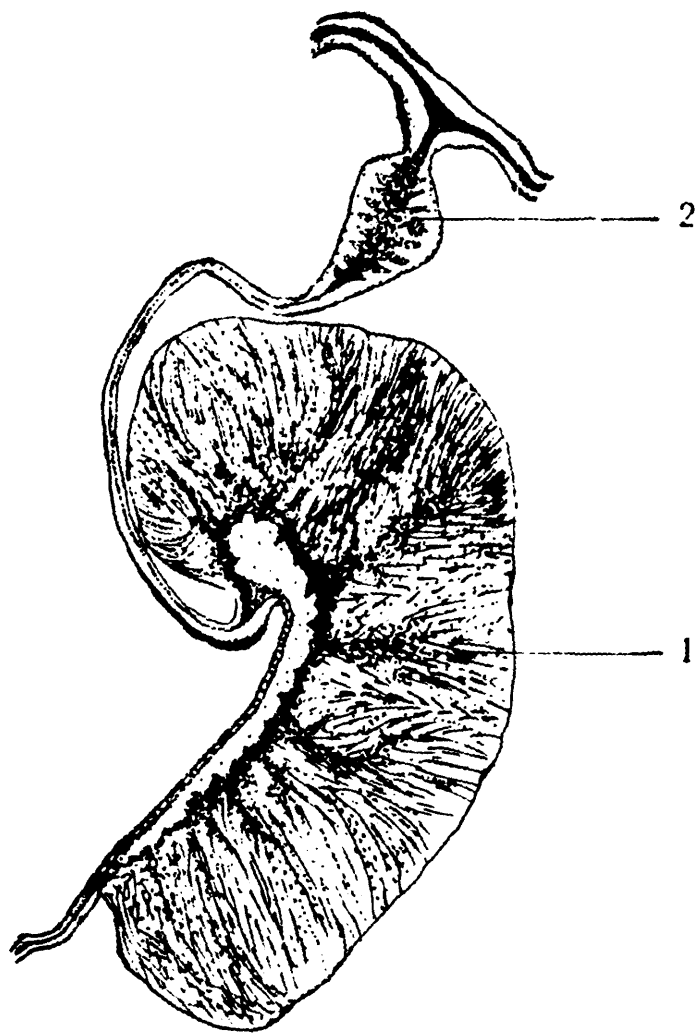
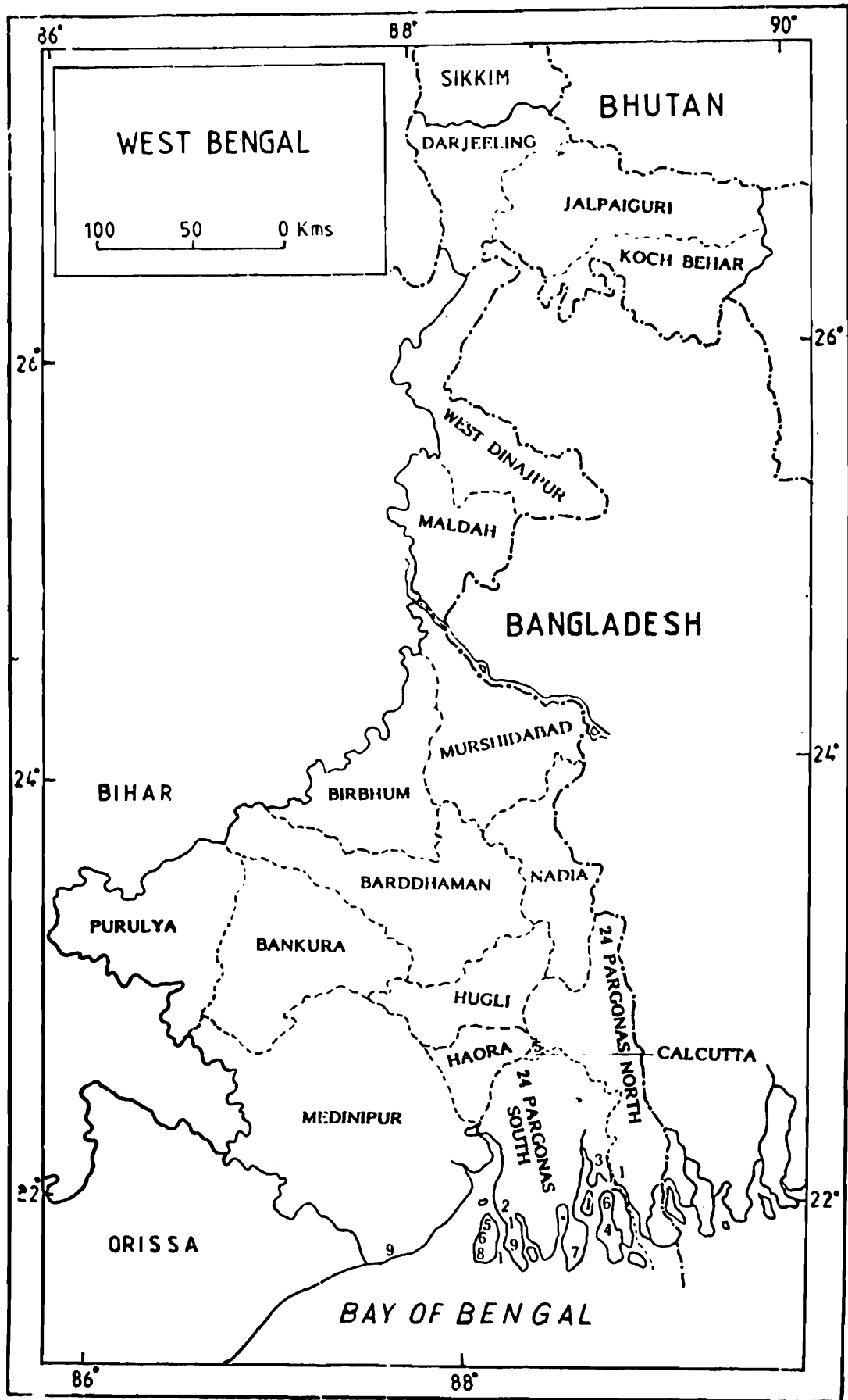


Fig.3. Transverse section of the parietal and retractor muscles of *P. ramunni*; 1, retractor; 2, parietal.

Fig.4. Lateral view of a portion of a macrocneme showing the serial acontia of *P. ramunni*; 1, serial acontia; 2, two acontia forming a pair; 3, ciliated tract; 4, cnidoglandular tract; 5, filament; 6, gonad; 7, lamellar part of the nesentery between the retractor and the gonads; 8, retractor; 9, termination of the filament.



Serial Nos. 1 - 9 denotes the serial number of species

TABLE SEA ANEMONES OF WEST BENGAL AND DISTRIBUTION IN OTHER STATES OF INDIA

| Sl. No. | Name of States Name of species | Maharashtra | Goa | Kerala | Tamil Nadu | Orissa | West Bengal |
|---------|-----------------------------------|-------------|-----|--------|------------|--------|-------------|
| 1. | <i>Edwardsia jonesii</i> | | | | + | + | + |
| 2. | <i>Edwardsia tinctoria</i> | + | + | | | + | + |
| 3. | <i>Pelocoetes exul</i> | + | + | + | + | + | + |
| 4. | <i>Pelocoetes minima</i> | | | | + | | + |
| 5. | <i>Phytocoetes gangeticus</i> | + | + | + | + | | + |
| 6. | <i>Phytocoeteopsis rdmunnii</i> | | | + | + | | + |
| 7. | <i>Nevadne glauca</i> | | | | + | + | + |
| 8. | <i>Diadumene schilleriana</i> | + | | | | + | + |
| 9. | <i>Paracondylactis indica</i> | + | | | | | + |

SUMMARY

The present account deals with 9 species from West Bengal. Of these, two species, namely *Nevadne glauca* (Annandale) and *Pelocoetes minima* Panikkar, are not available in the present collection but reported earlier from this area. It may be mentioned that two other species, viz., *Edwardsia tinctoria* Annandale and *Paracondylactis indica* Dave are recorded for the first time from the area. The diagnostic characters and keys for identification of genera and species of sea-anemone have been provided. A general account of morphology and terminology, and methods of collection, narcotisation and preservation have been included.

ACKNOWLEDGEMENTS

The author is thankful to Prof. Md. Samim Jairajpuri, Director, Zoological Survey of India, Calcutta for providing all sorts of facilities during the present investigation. Greatful thanks are also due to Dr. A. K. Ghosh, Joint Director for his initiative and interest during the entire period of studies and for his proper guidance.

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TREMATODA

(Vertebrates hosts excluding fishes)

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INTRODUCTION

Trematodes or Flukes, as they are commonly called, constitute an important group of parasites in the phylum Platyhelminthes. In adult state they are parasitic in vertebrates, infecting almost every organ system, while as larva they complete part of their life-cycle in invertebrates, particularly molluscs, and lower vertebrates.

Formerly class Trematoda was divided into two subclasses, viz. Monogenea and Digenea. Bychowsky (1957) accepted Monogenoidea as a class. Baer and Euzet (1961) gave Monogenea (syn. Monogenoidea) the status of class since the discovery of *Chimaeriocla* Brinkman, 1957 and *Callorbynchicola* Brinkman, 1957 belonging to Monogenea and concluded that monogeneans show much closer affinities to cestodes than digenetic trematodes. Mackiewicz (1984) discussed the problem in detail evaluating various aspects of 'Cercomer Theory' and relationships of Monogenea. This contention has been accepted by majority of workers (Mehra, 1970, 1980).

In the present work Trematoda has been accepted to contain two subclasses Aspidogastrea and Digenea, as proposed by La Rue (1957) and modified by Mehra (1970, 1980). The classification of Digenea in taxon above family level is yet to find wide acceptance. Many workers like Stunkard (1946), Hyman (1951), Dawes (1946) are of the opinion that the classification of Digenea is still in a controversial position and the association of families into higher taxonomic units is tentative waiting more complete knowledge concerning all stages in the life-cycle of more species and the information afforded by the study of both adult and larval stages portraying genetic relationships and evolutionary history of the group. However, general acceptance is gaining ground as Stunkard (1961 p.809) points out, "Until recently taxonomic work has been based almost entirely on the morphology of sexually mature worms, but increased knowledge of life-cycles and larval stages has provided basis for a more adequate and realistic concept of these trematodes." In the present studies no attempt has been made to classify the worms above family level.

Tropical countries provide optimum conditions for these parasites to thrive and propagate and India thus abounds with a rich trematode fauna. These flukes play a vital role in the economy of man because all the domestic animals harbour these parasites which impair their efficiency. For this reason alone these worms have received considerable attention from parasitologists, the world over. In spite of so much attention our knowledge of these parasites from Indian region is still inadequate. The multiplicity of genera and species of both parasites and the hosts they inhabit has acted as limiting factor in our knowledge. Of 373 species of mammals, 1277 of birds, 428 of reptiles and 204 of amphibia hardly 10% to 20% have been screened for trematode infection. The record from West Bengal is still meagre.

In the present communication 97 species belonging to 69 genera spread over 30 families of trematodes parasitising amphibians, reptiles, birds and mammals of West Bengal have been described. The report is based partly on the material collected and studies by the authors and partly on the collection present in the Zoological Survey of India and those reported in the literature (marked by an asterisks). The trematodes of fishes have not been included as they are dealt with else where. Helminthology in West Bengal had been a neglected study and is only in late forties of the present century that the work on trematode parasites of this region started getting some attention. In earlier days some collections made by Scientists of Indian Museum and School of Tropical Medicines used to be sent to outside specialists for identification and these reports were few and far between.

It has been our endeavour to include all the trematode species so far reported from West Bengal and provide short diagnosis and workable keys to the species for the workers in the group. A host-parasite list has been added which may help future workers to screen other species of vertebrates for trematode infection which have not been covered so far. Illustrations have been provided for most of the species as far as practicable.

HISTORICAL BACKGROUND

The study of zoology in India educational curriculum was introduced by Hodgson in 1929 but helminthological research was yet to receive recognition in the research activities of the Zoologists. The mention of two kind of worms by Gilchrist (1841-1846) in his book, "*A practical treatise on the diseases of elephants, camels and horned cattle*" under the name 'Mussodee' appears to be the first reference of trematodes from Indian region. These two worms were *Fasciola jacksoni* and *Pseudodiscus hawkesi*. Cobbold (1869-1882) reported *Paragonimus westermanii* from *Viverra zibetha* and also parasites of elephant, cattle, gangetic dolphin and *Orcella brevirostris* in a series of papers. Caster (1862) recorded *Fasciola hepatica* and *Distoma intestinale* from a man in Dacca. Lewis *et.al.*, (1872, 1876) described *Opisthorchis neverca* and *Gastrodiscoides hominis* from man. The credit for these earlier works in helminthology goes to the officers of medical and veterinary services who collected these parasites during their routines duties and sent them to European specialists for identification and report. It was only in twenties of the present century that the helminthological research found recognition in the research activities of Zoologists. This interest was triggered when Dr. R.T. Leiper, head of Bilharzia Mission (1914-1918) drew the attention of Government of India about the possibility of spread of Schistosomiasis in India by the soldiers returning from Egypt and Middle East during First World War and the statement of Milton (1919) that "Human Schistosomiasis is in all probability endemic in India and yet has hitherto entirely escaped the notice of medical men practicing in this country." The search for a suitable intermediate molluscan host was started by Sewell, Kemp and Gravely etc., of the Zoological Survey of India and the study resulted in the publication of Sewell's monograph "*Cercariae Indicae*" in 1922.

The history and progress of helminthological studies in India have been lucidly discussed by Thapar (1937, 1956). Bhalerao (1939, 1948), Chauhan (1963), Ghosh and Chauhan (1975), Srivastava (1990, 1991).

Though stray records of trematodes from Bengal were made from time to time, no concerted effort was made to study the trematode fauna of this area till the thirties of the present century. Three centres, Allahabad, Lucknow and Mukteswar which had developed for the study of helminthology,

confined their studies in those areas. The collections made by School of Tropical Medicines, mostly from Calcutta Zoo animals and those present in Indian Museum were sent to outside specialists in the country, working on these parasites. A scheme to study helminthiasis in domestic animals of North India was undertaken by Prof. G.S. Thapar in 1937 and trematodes were recorded from West Bengal. Mr. S.C. Verma (1936) of Allahabad University mostly worked on trematode collections of School of Tropical Medicines sent to him, and described a number of species of bird trematodes from Bardhaman and Calcutta.

Blanford (1887) reported uncinatc eggs of *Schistosoma haematobium* in the large intestine of a transport bullock from Calcutta, which was later proved to be *S. indicum*. Chandler (1925) described *Schistosoma incognitum* and worked out parasites of cats in Calcutta and also sent some specimens recorded from the stool of a man to Dr. G.D. Bhalerao which were identified as *Isoparorchis hypselobagri*. Bhalerao (1931) recorded *Opisthorchis noverca*, *Paryphostomum sufartyfex*, *Gastrodiscoides hominis* from pigs. He (1936) described *Haplorchis taichui* from cats in Calcutta and *Eurytrama pancreaticum* from cow. Mapiestone and Bhaduri (1939, '40, '42) reported helminth parasites from dogs and rats respectively of Calcutta and discussed their public health importance. Sporadic records of other trematodes were also being made from West Bengal.

In recent years valuable contributions on the trematode fauna of amphibia, reptile, bird and mammal of West Bengal have been made by Chauhan (1947), Mukherjee (1966-1970), Ghosh (1967-1992) Mukherjee and Ghosh (1967-1972), Srivastava (1968, 1974), Srivastava and Ghosh (1967, 1968, 1969, 1975), Soota and Ghosh (1977), Ghosh and Srivastava (1976, 1979), Ghosh and Chauhan (1975, 1977), Srivastava and Chauhan, (1973), Vasantha Kumari and Srivastava (1976), Mukherjee, M. and Srivastava (1992), Manna (1982-1992) and Hafeezullah and Dutta (1985) and few others. As already indicated earlier there is still ample scope to study the trematode fauna of these animals from West Bengal as hardly 10-20% host have so far been screened for trematode infection due to obvious reasons.

MATERIAL AND METHOD

The material for the present study is based on (i) the collection made by the authors from different part of the state, (2) collections present in the platyhelminthes section brought by different survey parties.

The hosts were dissected and different organs were examined in normal saline. The trematodes thus collected were flattened under slight pressure of coverslip and fixed in 4% formalin, 90% Alcohol or Bouin's fluid as and when required.

After preservation standard methods for staining and mounting were followed. Best results were obtained by Acetoacid carmine. Other stains like Ehrlich's haemotoxylin, Borax carmin were also used.

All the measurements were taken in millimeters with help of ocular micrometer and camera lucida drawings were made.

In case of species included from the literature the diagnosis and diagrams have been mainly adopted from the original descriptions, unless otherwise stated.

MORPHOLOGY

Trematodes generally inhabit the alimentary canal and associated organs like liver, bile duct, gall bladder, pancreatic duct, lungs, bladder and blood vessels, of vertebrates. They can easily be distinguished from other helminths by their relatively simple external characters. Some of the taxonomic characters may be enumerated as follows :

External Features : Body is mostly dorsoventrally flattened but some are fleshy thick or round in cross-section. There are two suckers; the oral sucker generally guarding the mouth opening, except in gasterostomes where they are known as anterior sucker; the acetabulum or ventral sucker the position of which varies. Bodywall is composed of elastic cuticle which may be naked or beset with spines.

Digestive system : The alimentary canal is well developed with pharynx, oesophagus and branched caeca except in gasterostomes where it is saccular. Anus may or may not be present.

Reproductive System : Male : There are generally two testes but may be single to many. Vas deferens join to form vesicula seminalis, enclosed in cirrus sac or free in parenchyma in species lacking cirrus sac. The cirrus sac encloses prostate gland cells, ejaculatory duct and muscular cirrus. The position of genital pore is variable and of taxonomic importance.

Female : Generally there is a single ovary but may be follicular also; is pre-inter or post-testicular, normally median but the position may vary. The oviduct is joined by receptaculum seminis, Laurer's canal before it joins the ootype which is surrounded by Mehli's gland. Vitelline follicles may be lateral or extensive; common vitelline duct joins the ootype. Uterus starts from the ootype and after making few loops opens at the genital pore. Its terminal part at times thickens to form metraterm. The eggs may be round or elliptical, thick or thin shelled, operculate or not, with or without filament or spine.

Excretory system : is protonephridial. The excretory canals join the excretory bladder which may be 'I' 'V' or 'Y'-shaped having systematic importance. Excretory pore is posteroterminal.

SYSTEMATIC ACCOUNT

(* – species recorded from literature)

I. Family Lecithodendriidae Odhner, 1911

Subfamily Ganeoninae Yamaguti, 1958

1. Genus *Ganeo* Klein, 1905

1. *G. srinagarensis* Kaw, 1950
2. *G. ankhalaensis* Hafeezullah and Dutta, 1985
3. *G. tigrinum* Mehra and Negi, 1928

Subfamily Prosotosinae Yamaguti, 1958

2. Genus *Prosotocus* Loose, 1899

4. *P. bengalensis* Hafeezullah and Dutta, 1985

3. Genus *Mehraorchis* Srivastava, 1934

5. *M. ranarum* Srivastava, 1934

Subfamily Pleurogeninae Travassos, 1921

4. Genus *Pleurogenoides* Luhe, 1901

6. *P. gastroporus* (Luhe, 1901) Travassos, 1921

Subfamily Prosthodendrinae Yamaguti, 1958

5. Genus *Prosthodendrium* Dollfus, 1931

7. *P. ovimagnosum* (Bhalerao, 1926) Yamaguti, 1971

6. Genus *Parabascus* Looss, 1907

8. *P. macrorchis* (Gogate, 1939) Skrjabin, 1970

9. *P. ovatus* (Tubangui, 1928) Skrjabin, 1970

II. Family Brachycoeliidae Johnston

Subfamily Brachycoeliinae Looss, 1899

7. Genus *Tremiorchis* Mehra and Negi, 1926

10. *T. ranarum* Mehra & Negi, 1926

Subfamily Mesocoeliinae Faust, 1926

8. Genus *Mesocoelium* Odhner, 1910

11. *M. sociale* (Luhe, 1901) Odhner, 1911

12. *M. burdwanensis* Mukherjee, 1968

III. Family Plagiorchiidae Luhe, 1901

Subfamily Astiotrematinae Baer, 1924

9. Genus *Astiotrema* Looss, 1900

13. *A. odhneri* Bhalerao, 1934

14. *A. reniferum* (Looss, 1899) Stossich, 1904

15. *A. sudarshani* Mukherjee and Ghosh, 1970

Subfamily Styphlodorinae Dollfus, 1937

10. Genus *Styphlodora* Looss, 1899

16. *S. horida* (Leidy, 1851) Odhner, 1910

17. *S. nicolli* Bhalerao, 1936

Subfamily Plagiochiinae Luhe, 1901 : Pratt, 1902

11. Genus *Bilorchis* Mehra, 1937

18. *B. indicus* Mehra, 1937

12. Genus *Xenopharynx* Nicoll, 1912

19. *X. solus* Nicoll, 1912
 Subfamily Encyclometrinae Mehra, 1931
13. Genus *Encyclometra* Baylis and Cannon, 1924
 20. *E. colubrimurorum* (Rudolphi, 1819) Dollfus, 1929
 21. *E. bungara* Srivastava and Ghosh, 1968
 22. *E. japonica* Yoshida and Ozaki, 1929
- IV. Family Dicrocoeliidae Odhner, 1910
14. Genus *Dicrocoelium* Dujardin, 1945
 23. *D. dendriticum* (Rudolphi, 1819) Stiles and Hassal, 1898
15. Genus *Paradistomoides* Travassos, 1844
 24. *P. orientalis* (Narayan and Das, 1929) Travassos, 1944
16. Genus *Eurytrema* Looss, 1907
 25. *E. pancreaticum* (Jonson, 1889) Looss, 1907
 26. *E. bhaleraoi* Mukherjee and Srivastava, 1992
17. Genus *Lyperosomum* Looss, 1899
 27. *L. (L) reangensis* Soota and Ghosh, 1977
 *28. *L. kakea* Bhalerao, 1926
- V. Family Stomylotrematidae Travassos, 1922 : Poche, 1926
 Subfamily Stomylotreminae Travassos, 1922 : Poche, 1926
18. Genus *Stomylotrema* Looss, 1900
 29. *S. travassosi* Mehra, 1938
- VI. Family Hemiuridae Luhe, 1901
 Subfamily Halipeginae Ejsmont, 1931
19. Genus *Halipegus* Looss, 1899
 30. *H. mehransis* Srivastava, 1933
- Subfamily Lecithochiriinae Luhe, 1901
20. Genus *Lecithochirium* Luhe, 1901
 31. *L. acutum* Chauhan, 1945
- VII. Family Anchitrematidae Mehra, 1935
 Subfamily Anchitrematinae Mehra, 1935
21. Genus *Anchitrema* Looss, 1899
 32. *A. sanguineum* (Sonsino, 1894) Looss, 1899
- VIII. Family Ommatobrephidae Poche, 1926
 Subfamily Ommatobrephinae Poche, 1926 : Dubois and Mohan, 1959

22. Genus *Ommatobrephus* Nicoll, 1914
 33. *O. bengalensis* Mukherjee and Ghosh,
 34. *O. lobatum* Mehra, 1928
- IX. Family Microphallidae Ward, 1901
 Subfamily Microphallinae Ward, 1901
 23. Genus *Megalotriotrema* Rao, 1969
 35. *M. dicaecus* (Mukherjee and Ghosh, 1967)
- X. Family Proterodiplostomidae Dubois, 1936
 Subfamily Proalarioidinae Yamaguti, 1971
 24. Genus *Proalarioides* Yamaguti, 1933
 36. *P. tropidonotis* Vidyarthi, 1937
- XI. Family Cyathocotylidae Muhling, 1898
 Subfamily Muehlinginae Mehra, 1950
 25. Genus *Muehlingina* Mehra, 1950
 *37. *M. lutrai* Mehra, 1950
 Subfamily Szidatiinae Dubois, 1938
 26. Genus *Gogatea* Luhe, 1935
 38. *G. serpentium* (Gogate, 1932) Lutz, 1935
- XII. Family Echinostomatidae Poche, 1925
 Subfamily Echinostomatinae Poche, 1925
 27. Genus *Echinostoma* Rudolphi, 1809
 39. *E. revolutum* (Froelich, 1802) Looss, 1899
 40. *E. eduardoi* Ghosh and Chauhan, 1979
 41. *E. malayanum* Leiper, 1911
28. Genus *Vermatrema* Srivastava, 1974
 42. *V. longitestis* (Verma, 1936) Srivastava, 1974
29. Genus *Echinoparyphium* Dietz, 1909
 * 43. *E. gizzardai* Verma, 1936
 Subfamily Psilorchiinae Mehra, 1980
 30. Genus *Psilorchis* Thapar and Lal, 1935
 44. *P. indicus* Thaper and Lal, 1935
 Subfamily Pseudoechinostominae Mehra, 1980
 31. Genus *Pseudoechinostomum* Odhner, 1911
 * 45. *P. indicus* Mehra, 1944

- Subfamily Chaunocephalinae Travassos, 1922
32. Genus *Chaunocephalus* Dietz, 1909
46. *C. similiferox* Verma, 1935
- Subfamily Microparyphiinae Mendheim, 1943
33. Genus *Microparyphium* Dietz, 1909
47. *M. montei* Verma, 1936
- Subfamily Echinochasminae Odhner, 1910
34. Genus *Episthmium* Luhe, 1909
48. *E. caninum* (Verma, 1935) Yamaguti, 1959
- * 49. *E. corvus* (Bhalerao, 1926) Mehra, 1980
35. Genus *Echinochasmus* Dietz, 1903
- * 50. *E. perfoliatus* (Ratz, 1908) Godoelst, 1911
- XIII. Family Psilostomidae Looss, 1900
- Subfamily Psilostominae Looss, 1900
36. Genus *Psilochasmus* Luhe, 1909
51. *P. oxyurus* (Creplin, 1825) Luhe, 1909
- XIV. Family Fasciolidae Railliet, 1895
- Subfamily Fasciolinae, Railliet, 1895 : Stiles and Hassal, 1898
37. Genus *Fasciola* Linnaeus, 1758
52. *F. gigantica* Cobbold, 1855
53. *F. hepatica* Linnaeus, 1758
- * 54. *F. jacksoni* Cobbold, 1869
- Subfamily Fasciolopsinae Odhner, 1910
38. Genus *Fasciolopsis* Looss, 1899
55. *F. buski* (Lankester, 1857) Stiles, 1901
- XV. Family Schistosomatidae Stiles & Hassal, 1898 : Poche, 1907
- Subfamily Schistosomatinae Stiles and Hassal, 1898
39. Genus *Schistosoma* Weinland, 1858
56. *S. indicum* Montgomery, 1906
57. *S. nasale* Rao, 1933
- * 58. *S. incognitum* Chandler, 1926
- * 59. *S. haematobium* (Bilharz, 1852) Weinland, 1858
- XVI. Family Cephalogonimidae Looss, 1899

- Subfamily Cephalogoniminae Looss, 1899
40. Genus *Cephalogonimus* Poirier, 1886
60. *C. gangeticus* Pande, 1932
- XVII. Family Acanthostomidae Nicoll, 1914, Poche, 1926
- Subfamily Acanthostominae Nicoll, 1914
41. Genus *Acanthostomum* Looss, 1899
61. *A. burminis* (Bhalerao, 1926) Bhalerao, 1940
- XVIII. Family Strigeidae Railliet, 1919
- Subfamily Strigeinae Railliet, 1919
42. Genus *Strigea* Abildgaard, 1790
- * 62. *S. elongata* Yamaguti, 1935
- XIX. Family Diplostomidae Poirier, 1886
- Subfamily Diplostominae Poirier, 1886 : Dubois, 1936
43. Genus *Diplostomum* Brandes, 1892
- * 63. *D. (D.) splendens* Manna and Chaudhury, 1973
44. Genus *Neodiplostomum* Railliet, 1919
64. *N. cochleare* (Krause, 1914) La Rue, 1926
- Subfamily Alariinae Hall et Wigdor, 1918
45. Genus *Alaria* Schrank, 1788
- * 65. *A. alata* (Goeze, 1782) Krause, 1914
- XX. Family Heterophyidae Leiper, 1909 : Odhner, 1914
- Subfamily Haplorchinae Looss, 1899
46. Genus *Haplorchis* Looss, 1899
- * 66. *H. taichui* (Nishigori, 1924) Chen, 1936
- Subfamily Heterophyinae Leiper, 1909
47. Genus *Heterophyes* Cobbold, 1886
- * 67. *H. heterophyes* (Siebold, 1852) Stiles and Hassal, 1900
- XXI. Family Ophisthorchiidae Looss, 1899 : Braun, 1891
- Subfamily Opisthorchiinae Looss, 1899
48. Genus *Opisthorchis* Blanchard, 1895
- * 68. *O. felineus* (Rivolta, 1884) Blanchard, 1895
49. Genus *Amphimerus* Barnar, 1911
- * 69. *A. noverca* (Braun, 1902) Barner, 1911
- Subfamily Pseudamphistominae Yamaguti, 1958

50. Genus *Pseudamphistomum* Luhe, 1908
 * 70. *P. truncatum* (Rudolphi, 1819) Luhe, 1908
- XXII. Family Spirorchidae Stunkard, 1921
 Subfamily Spirorchinae Stunkard, 1921 : Yamaguti, 1958
51. Genus *Hemiorchis* Mehra, 1939
 * 71. *H. bengalensis* Mehra, 1940
- XXIII. Family Isoparorchidae Poche, 1925
 52. Genus *Isoparorchis* Southwell, 1913
 72. *I. hypselobagri* (Billet, 1898) Ejsmont, 1932
- XXIV. Family Balfouridae Travassos, 1951
 53. Genus *Balfouria* Leiper, 1909
 73. *B. monogama* Leiper, 1909
- XXV. Family Cyclocoelidae Stossich, 1902
 Subfamily Cyclocoelinae Stossich, 1902
 54. Genus *Cyclocoelum* Brandes, 1898
 74. *C. (C.) mutabile* (Zeder, 1800)
- XXVI. Family Prosthogonimidae Luhe, 1909
 55. Genus *Prosthogonimus* Luhe, 1899
 75. *P. putschkowskii* Skrjabin, 1912
 76. *P. elongatus* Mukherjee, 1967
- XXVII. Family Brachylaimidae Miller, 1936
 Subfamily Brachylaiminae Miller, 1936
 56. Genus *Glaphyrostomum* Braun, 1901
 77. *G. indicum* Mukherjee, 1964
- XXVIII. Family Notocotylidae Diesing, 1839
 Subfamily Notocotylinae Diesing, 1839 : Kossack, 1911
 57. Genus *Notocotylus* Diesing, 1839
 * 78. *N. attenuatus* (Rudolphi, 1809) Kossack, 1911
- XXIX. Family Paragonimidae Dollfus, 1939
 58. Genus *Paragonimus* Braun, 1889
 * 79. *P. westermanii* (Kerbert, 1878) Braun, 1899
- XXX. Family Paramphistomidae Fiscoeder, 1901
 Subfamily Paramphistominae Fiscoeder, 1901
 59. Genus *Paramphistomum* Fiscoeder, 1900

80. *P. cervi* (Zeder, 1790) Fiscoeder, 1901
81. *P. explanatum* (Creplin, 1847) Fiscoeder, 1901
60. Genus *Cotylophoron* Stiles and Goldberger, 1910
82. *C. cotylophorum* (Fiscoeder, 1901) Stiles and Goldberger, 1910
83. *C. indicum* Stiles and Goldberger, 1910
84. *C. orientalis* Harshey, 1934
61. Genus *Ceylonocotyle* Nasmark, 1937
85. *C. scoliocoelium* (Fiscoeder, 1909) Nasmark, 1937
- * 86. *C. cuonum* (Bhalerao, 1937) Mukherjee and Chauhan, 1965
- * 87. *C. maplestoni* (Bhalerao, 1937) Mukherjee and Chauhan, 1965
- Subfamily Gastrodiscinae Monticelli, 1892
62. Genus *Gastrodiscus* Leukart, 1877
- * 88. *G. secundus* Looss, 1907
- * 89. *G. aegyptiacus* (Cobbold, 1877) Railliet, 1892
63. Genus *Gastrodiscoides* Leiper, 1913
90. *G. hominis* (Lewis & Mc Connell, 1876) Leiper, 1913
- Subfamily Cladorchiinae Fiscoeder, 1901
64. Genus *Olveria* Thaper & Sinha, 1945
- * 91. *O. indica* Thaper & Sinha, 1945
- Subfamily Gastrothylacinae Stiles and Goldberger, 1910
65. Genus *Gastrothylax* Poirier, 1883
92. *G. crumenifer* Creplin (1847) Otto, 1896
66. Genus *Fishchoederius* Stiles and Goldberger, 1910
93. *F. elongatus* (Poirier, 1883) Stiles and Goldberger, 1910
94. *F. cobboldi* (Poirier, 1883) Stiles and Goldberger, 1910
- Subfamily Orientodiscinae Yamaguti, 1971
67. Genus *Orientodiscus* Srivastava, 1938
95. *O. lobatum* Srivastava, 1938
- Subfamily Diplodiscinae Cohn, 1904
68. Genus *Diplodiscus* Diesing, 1836
96. *D. amphicrus* Tubangui, 1933
- Subfamily Zygocotylineae Ward, 1917
69. Genus *Stunkardia* Bhalerao, 1931
- * 97. *S. dilymphosa* Bhalerao, 1931

I. Family Lecithodendriidae Odhner, 1911

Key to subfamilies

1. Vitellaria confined to neck region..... 2
 Vitellaria extending along caeca, posterior to ovary or testesGaneoninae
2. Testes symmetrical, in shoulder region precaecal..... Protococinae
 Testes in acetabular region 3
3. Cirrus pouch claviform; Vitellaria clustered in shoulder region Pleurogeninae
 Cirrus pouch round..... 4
4. Testes symmetrical, vitellaria precaecal, pretesticular..... Prosthodendriinae

Subfamily Ganeoniae Yamaguti, 1958

1. Genus *Ganeo* Klein, 1905

Key to species

1. Vitellaria bilateral 2
 Vitellaria unilateral *G. ankholaensis*
2. Ovary posterolateral or overlapping ventral sucker *G. tigrinum*
 Ovary postacetabular 3
3. Ovary in between testes *G. srinagarensis*

1. *Ganeo srinagarensis* Kaw, 1950

1950. *Ganeo srinagarensis* Kaw, *Indian J. Helminth*, 2(2) : 67-126.

Material : Host : *Rana cyanophlyctis*.

Diagnosis : Body length 2.48. Cuticle spinose anteriorly. Acetabulum pre equatorial, larger than oral sucker. Intestinal caeca terminate 0.6 from posterior end. Testes preacetabular, symmetrical, intercaecal seminal vesicle tubular, dorsal to acetabulum. Genital pore at level of middle of oesophagus. Ovary postacetabular, in between testes. Vitellaria lateral, approximately occupy one-fourth of body length from post acetabulum, level; uterus intercaecal, postacetabular with transverse loops, terminal part forms metraterm. Eggs 0.026-0.03 × 0.012-0.018.

Distribution : India : West Bengal (North 24-Parganas); Kashmir.

Other records : Pakistan.

2. *Ganeo ankholaensis* Hafeezullah and Dutta, 1985

1985. *Ganeo ankholaensis* Hafeezullah and Dutta, *Bull. Zool. Surv. India*, 7(1) : 69-82.

Material : Host : *Rana cyanophlyctis*.

Diagnosis : Body length 1.28. Cuticle spined, oral sucker slightly smaller than acetabulum. Ratio 1 : 1.2. Intestinal caeca do not extend upto posterior end. Testes obliquely tandem. Right testis overlapping caecum, left testis intercaecal. Seminal vesicle tubular, ejaculatory duct long opening

into genital atrium. Genital pore marginal opposite to ovarian side, at midlevel of oesophagus. Ovary behind right testes. Vitellaria follicular, only on one side, overlapping left caecum. Uterus postovarian, filling most of intercaecal hind body, extending much beyond caecal end. Metraterm conspicuous, opening into genital atrium independently. Eggs 0.021-0.023 × 0.014-0.015.

Distribution : India : West Bengal (Calcutta, Beliaghata).

Remarks : As many as four species have already been described under the genus *Ganeo* mainly on the possession of one sided vitellaria, viz. *G. bufonis* Fotedar, 1959; *G. gazipurensis* Pandey and Chakrabarty, 1986; *G. kawi* Dwivedi and Chauhan, 1970; *G. vitellosinistrum* Dwivedi and Chauhan, 1970. Ciurea (1933), Dawes (1945), Kaw (1950), Ghosh and Srivastava (1976), Mukherjee (1977), Gupta (1977) etc., opined that one sided vitellaria in species of the genera where normally bilateral symmetry is present should be considered as an aberration, not having systematic importance. As such all these species along with the present one are considered as abnormal specimens only. Transverse connection and crenulation of excretory arms should not be considered a character to be taken into account for differentiating species as this condition has not been taken into account by earlier workers. Moreover ramification of excretory tubules is a common phenomenon in trematodes.

3. *Ganeo tigrinum* Mehra & Negi, 1928

(Fig. 1)

1928. *Ganeo tigrinum* Mehra & Negi, (Fig. 1) *Allahabad Univ. Stud.*, 4 : 63-118.

Material : Host : *Rana cyanophlyctis*; *Rana tigrina*, *Bufo melanostictus*. *Bufo viridis*. *Chameleon zeylanicus*.

Diagnosis : Body length 3.03-3.42. Cuticle spined. Oesophagus 0.18-0.31 divides into two caeca at the level of genital pore. Caeca extend upto two third of body length. Ventral sucker at anterior third, larger than oral sucker, 0.12-0.19 × .012-0.14. Testes diagonally tandem, around acetabular zone. Vesicula seminalis curved, anterolateral to ventral sucker. Spines on terminal part of ejaculatory duct, genital atrium and metraterm. Ovary posterolateral to or overlapping the ventral sucker, vitellaria follicular, from posterior end of ventral sucker to some distance short of caecal end. Genital pore on lateral margin around the level of oesophageal bifurcation. Eggs 0.026-0.029 × 0.012.

Distribution : India : West Bengal (Digha, 24-Parganas, Haora, Bankura); Uttar Pradesh. Andhra Pradesh. Kashmir.

Other records : Bangladesh, China, Vietnam.

Subfamily Prosotocinae Yamaguti, 1958

Key to genera

1. Caeca short..... 2
 Caeca long 3
2. Uterine coils extend in forebody; Genital pore at varying level from pharynx to caecal bifurcation
 Prosotocus
3. Uterine coils confined in hind body; Genital pore close to anterior extremity *Mehraorchis*

2. Genus *Prosotocus* Looss, 18994. *Prosotocus bengalensis* Hafeezullah and Dutta, 1985

1985. *Prosotocus bengalense* Hafeezullah and Dutta, *Bull. Zool. Surv. India*. 7(1) : 69-82.

Material Host : *Rana cyanophlyctis*.

Diagnosis : Body length 0.64-1.18. cuticle spined. Oral sucker smaller than acatabulum; ratio 1 : 1.3-1.8; oesophagus bifurcate in testicular region. Caeca short, may extend upto the level of posterior margin of acetabulum. Testes extracaecal, symmetrical on both side of oesophagus. Cirrus sac muscular. Genital atrium well developed, genital pore near margin of pharyngeal level. Ovary intracaecal, behind right testis, overlapping caecum, vitellaria follicular on right side only. Uterine coils massive in hind body. Metraterm well developed, opens independently. Eggs 0.028-0.031 × .014.

Distribution : India : West Bengal (Calcutta).

Remarks : Taking into account the intraspecific variations observed by different workers in *P. kasabia* Raw, 1950, this species may be conspecific with it.

3. Genus *Mehraorchis* Srivastava, 1934

(Fig. 2)

5. *Mehraorchis ranarum* Srivastava, 1934

M. jainiformes Bharadwaj, 1977 Syn. nov.

M. cyanophlyctis Karyakarte, 1973 Syn. nov.

1934. *Mehraorchis ranarum* Srivastava, *Bull. Acad. Sc. U.P. Agra and Oudh. Allahabad* 3(4) : 239-256.

Material : Host : *Rana cyanophlyctis*.

Diagnosis : Body length 3.42-6.63, eleptical, cuticle with spines, oesophagus bifurcates in front of ovary, caeca extend upto hinder end with dilation posteriorly. Testes oblong, extracaecal in anterior region. Cirrus sac large, prebifurcal 0.54-0.99 × 0.23-0.42. Ovary preacetabular or posterolateral. Vitellaine glands extend from pharyngeal zone to a little behind ventral sucker, overlap caeca and ovary in some cases. Uterine coils in postovarian zone, filling all available space of hind-body: anteriorly extends upto genital atrium. Eggs 0.034-0.036 × .014.

Distribution : India : West Bengal (Calcutta, Puruliya, North & South 24-Parganas): Uttar Pradesh, Andhra Pradesh, Madhya Pradesh, Maharashtra.

Subfamily Pleurogeninae Travassos, 1921

4. Genus *Pleurogenoides* Luhe, 19016. *Pleurogenoides gastroporus* (Luhe, 1901) Travassos, 1921

(Fig. 3)

Syn. *P. jamshedpurensis* Hussain and Sahay, 1987 Syn. nov.

1901. *Pleurogenes gastroporus* Luhe, *Zenbl. Bakterial, Parasitkde.*, 30(14) : 166-177.

1921. *Pleurogenoides gastroporus* Travassos, *Arch. da Esc. Sup. de Agric. Med. vet. Nichtheray* 5(1-2) : 73-79.

Material : Host : *Bufo melanostictus*; *Rana tierina*; *R. cyanophlyctis*.

Diagnosis : Body length 1.17-1.78. Cuticle spined anteriorly, ventral sucker in equatorial level. Caeca short, extend upto mid level of ventral sucker. Testes symmetrical on either side of ventral sucker; cirrus pouch anterior to ventral sucker. Genital pore lateral, opening right or left of oral sucker. Ovary pretesticular anterior to right or left testis. Vitellaria confined to forebody, contiguous around pharynx and oesophageal zone. Eggs 0.029-0.036 × .01-02.

Distribution : India : West Bengal (North & South 24-Parganas, Hughli, Medinipur); Uttar Pradesh, Andhra Pradesh.

Other records : Brazil.

Remarks : Hussain and Sahay (1987) described *P. jamshedpurensis* mainly on the basis of single testis beside some other variable characters. Dawes (1946), Ghosh and Srivastava (1979) and several other workers recorded single testes in several species of trematodes and considered such cases as an abnormality, having no systematic importance.

Subfamily Prosthodendriinae Yamaguti, 1955

Key to genera

1. Caeca short, widely divergent, do not cross acetabular level..... *Prosthodendrium*
Caeca longer 2
2. Caeca extend beyond acetabular level *Parabascus*

5. Genus *Prosthodendrium* Dollfus, 1931

7. *Prosthodendrium ovimagnosum* (Bhalerao, 1926) Yamaguti, 1971

1926. *Prosthogonimus ovimagnosum* Bhalerao, *J. Burma Res. Soc.*, 15(3) : 101-195.

1971. *Prosthodendrium ovimagnosum* Yamaguti, *Synopsis of Digenetic trematodes of vertebrates*. Keigaku Publ. Tokyo : 1074-

Material . Host : Dog, Bat.

Diagnosis : Body broader than long, 0.36 length and 1.04 in breadth, cuticle smooth. Caeca short, widely divergent, do not cross testicular level. Testes symmetrical widely separated in acetabular region. Cirrus pouch preacetabular. Genital atrium unspined, opening at preacetabular level. Ovary lobed, preacetabular, submedian. Vitellaria form bunches in neck or anterior region in postcaecal zone. Eggs 0.026 × 0.014.

Distribution : India : West Bengal (Calcutta); Punjab.

Other records : Burma, Somaliland, China, Phillipines.

Remarks : This is a common parasite of bats recorded from various parts of India. Bhalerao (1941) recorded this parasite from a dog in Calcutta.

6. Genus *Parabascus* Looss, 1907

Key to species

1. Caeca terminate in middle third of body *P. ovatum*
Caeca extends further 2
2. Caeca terminate in posterior third of body. Testes round, symmetrical *P. macrorchis*

8. *Parabascus macrorchis* (Gogate, 1939) Skrjabin, 19701939. *Palitrema macrorchis* Gogate, *Rec. Ind. Mus.*, 41(1) : 57-601970. *Parabascus macrorchis* Skrjabin *Trematodes. of animals and man* 23 ; 1-308.*Material* : Host : *Hemidactylus flaviviridis*, *Calotes versicolor*.

Diagnosis : Body length 1.25–2.96 oval to elliptical, cuticle spined anteriorly. Oral sucker and acetabulum almost of equal size. Oesophagus .09-0.39, bifurcate into two caeca which terminate in posterior third of body. Testes large, oval, postacetabular, symmetrical or slightly oblique, cirrus sac muscular, 0.24-0.43 in length. Genital pore on anterolateral margin of left testis. Ovary adjacent to acetabulum. Vitellaria follicular, spread transversely across the body from level of pharynx or intestinal bifurcation to level of acetabulum, contiguous. Uterus with many loops mostly postacetabular, overlaps anterior margin of ovary. Metraterm present, Eggs 0.03-0.05 × .03-0.04.

Distribution : India : West Bengal (Bardhaman, Calcutta, Bankura, Medinipur); Uttar Pradesh.9. *Parabascus ovatus* (Tubangui, 1928) Skrjabin, 1970

(Fig. 4)

1928. *Postorchigens ovatus* Tubangui, *Philipp. J. Sc.*, 36 : 351-371.1970. *Parabascus ovatus* Skrjabin, *Trematodes of animals and n vol. 23*. Moscow, 1-308.*Material* : Host : *Calotes versicolor*, *Hemidactylus flaviviridis*.

Diagnosis : Body length 1.50-0.70. Oral sucker slightly larger than acetabulum, oesophagus very small, caeca terminates in middle third of body. Testes postacetabular symmetrical, or slightly diagonal. left testis ahead of right one. Cirrus sac 0.18-0.26. Genital pore on left side at antrolateral margin of left testis. Ovary right of acetabulum, vitellaria transversely across the body, from pharynx to acetabulum. Uterus mostly in hind body. Eggs 0.01–0.03 × 0.007–0.015.

Distribution : India : West Bengal (Bardhaman, Puruliya, North & South 24-Parganas); Uttar Pradesh.

Other records : Phillipines, Burma.

Remarks : Chakravorty and Manna (1982) recorded *Postorchigenes ovatus ovatus* Tubangui, 1928 which belong to above species.

II. Family Brachycoeliidae Johnston, 1912

Key to subfamilies

1. Ovary pretesticular; vitellaria limited Brachycoeliinae
- Ovary not pretesticular 2
2. Ovary posttesticular, vitellaria extends upto caecal end..... Mesocoeliinae

Subfamily Brachycoeliinae Looss, 1899

7. Genus *Tremiorchis* Mehra & Nagi, 192610. *Tremiorchis ranarum* Mehra & Nagi, 1926

(Fig. 5)

Syn. *T. spinophlyctis* Kalyankar and Palladhar, 1977*T. tigrinarum* Sinha, Sahay and Prasad, 1974 syn. nov.1926. *Tremiorchis ranarum* Mehra & Negi, *Parasitology.*, 18 : 168-181.

Material : Host : *Rana tigrina*.

Diagnosis : Body length 4.09-4.14, anteriorly covered with spines. Oesophagus 0.36-0.58 long. bifurcates into caeca which usually runs upto middle of anterior testis. Cirrus sac curved around ventral sucker extending a little behind it. Genital pore just anterior to ventral sucker. Ovary pretesticular, posterolateral to ventral sucker. Vitellaria follicular. in two lateral field. overlapping caecae extend from level of ventral sucker to a little behind ventral sucker, intruding intercaecal field occasionally. Uterine coils continue to preequatorial level and extend anteriorly through intertesticular space to genital pore. Eggs $0.026-0.031 \times .009-0.012$.

Distribution : India : West Bengal (Calcutta, Digha, Bankura, Barddhaman); Uttar Pradesh, Andhra Pradesh, Madhya Pradesh, Orissa.

Remarks : Sinha et al (1974) differentiated their species mainly on the difference of measurement in body organs and position of vitellaria. Kalyankar and Palladhar (1977) differentiated their species in the position of anterior testis, not completely intercaecal and on spinulation over the body. All these characters are much variable in this species, not having systematic importance.

Subfamily Mesocoeliinae Faust, 1924

8. Genus *Mesocoelium* Odhner, 1910

Key to species

1. Caeca wide, not extending beyond preequatorial acetabular level.....*M. burdwanensis*
Caeca long 2
2. Caeca extend laterally upto posterior third of body, much beyond equatorial level.
Vitellaria along caecal length*M. sociale*

11. *Mesocoelium sociale* (Luhe, 1901) Odhner, 1901

1901. *Distoma sociale* Luhe, *Zentblse. Bakt. Parasitkde.* Abt. 1. 30(4) 171.

1911. *Mesocoelium sociale* Odhner, *Zool. Anz.*, 38(4) : 97-117.

Material : Host : *Bufo melanostictus* *Bufo viridis*.

Diagnosis : Body length 2.8-3.5. Oral sucker larger than acetabulum. Pharynx present. Testes symmetrical on both side of acetabulum. Ovary posttesticular, postacetabular in position. Caeca almost upto 1.06-1.57 from posterior end. Receptaculum seminis $0.071-0.125 \times 0.041-0.07$. Eggs $0.031-0.033 \times 0.02-0.022$.

Distribution : India : West Bengal (Calcutta, Digha).

Other records : Burma, Phillipines, North Bornea.

12. *Mesocoelium burdwanensis* Mukherjee, 1968

(Fig. 6)

1968. *Mesocoelium burdwanensis* Mukherjee, *Indian J. Helminth.*, 19 (2) : 188-191.

Material : Host : *Calotes versicolor*.

Diagnosis : Body length 1.84×0.45 . Oesophagus small 0.045, bifurcates into two very small intestinal caeca, extending laterally only upto preacetabular level. Testes extracaecal, symmetrical or slightly diagonal on two sides of acetabulum. Cirrus sac well developed, intercaecal. 0.16×0.15 . Genital pore postbifurcal, median. Ovary posttesticular; uterine coils mostly postacetabular, uterus passes through ventral side of cirrus pouch and opens in the genital pore. Vitellaria with large follicles, few in number, from pharyngeal level to caecal end, extracaecal. Eggs $0.026-0.028 \times 0.014-0.017$.

Distribution : India West Bengal (Bardhaman).

III: Family Plagiorchiidae Luhe, 1901

Key to subfamilies

1. Ovary wide apart from acetabulum 2
Ovary more or less close to acetabulum 3
2. Vitellaria extending in lateral fields of hind body Astiotrematinae
Vitellaria limited, extensive between acetabular and testicular level Styphlodoriinae
3. Uterus passing between testes Plagiorchiinae
Uterus not passing between testes Encyclometrinae

Subfamily Astiotrematinae Baer, 1924

9. Genus *Astiotrema* Looss, 1900

Key to species

1. Intestinal caeca not extending beyond posterior testis 2
Intestinal caeca longer 3
2. Oesophagus straight *A. odhneri*
Oesophagus 'S' shaped *A. sudarshani*
3. Ovary in equatorial level, testes kidney shaped *A. reniferum*

13. *Astiotrema odhneri* Bhalerao, 1936

1936. *Astiotrema odhneri* Bhalerao, *J. Helminth.* 14(3) : 163-180.

Material : Host : *Kachuga kachuga*; *Trionyx triangularis*.

Diagnosis : Body length upto 4.6. Oral sucker larger than ventral sucker. Oesophagus of moderate length, divides into two caeca extending upto posterior testes and not crossing beyond that. Ventral sucker in anterior third of body, median, just below intestinal bifurcation. Testes, lobed, beyond equatorial zone. Ovary pretesticular in anterior third of body length. Cirrus pouch extending beyond ventral sucker. Genital pore preacetabular caecal at post bifurcation vitellaria lateral, extracaecal, from below the level of intestinal bifurcation in pretesticular level to some distance below ovarian zone. Uterus mostly confined to hind body, and uterine coils pass between testes and ovary to genital pore. Metratrem distinguishable. Eggs $0.026-0.029 \times 0.01-0.011$.

Distribution : India : West Bengal (Digha; 24-Parganas, Maldah) : Maharashtra.

Other records Africa.

14. *Astiotrema reniferum* (Looss, 1898) Stossich, 19041898. *Distoma reniferum* Looss, *Zool. Jahrb. Syst.*, 12 : 521-784.1904. *Astiotrema reniferum* Stossich *Ann. Mus. Zool. R. Univ. Napoli*. n.s. 1(16) : 1-2.*Material* : Host : *Kachuga dhongoka*, *Trionyx nilotica*.

Diagnosis : Body length 2.54. Oral sucker larger than ventral sucker. Intestinal caeca extend beyond testes. Testes, entire, kidney shaped, beyond midlevel of body. Ovary in anterior third, postacetabular. Vitellaria from around postacetabular level to caecal end. Uterus in hind body extending beyond caecal length, passes anteriorly in between testes, opens in the genital pore through metraterm. Genital pore median, preacetabular, below intestinal bifurcation. Eggs 0.04-0.046 × .018-0.02.

Distribution : India : West Bengal (Calcutta, Haora, North & South 24-Parganas) Uttar Pradesh.

Other records : Africa.

15. *Astiotrema sudarshani* Mukherjee and Ghosh, 1968

(Fig. 7)

1968. *Astiotrema sudarshani* Mukherjee and Ghosh, *Indian J. Helminth.* 22 (1) : 61-78.*Material* : Host : *Bufo melanostictus*.

Diagnosis : Body length 1.46-1.77. Cuticle spinose anteriorly, oval. Oral 0.13-0.14 × 0.03-0.05. Ventral sucker almost equal in size with oral sucker 0.12-0.14 in diameter. Oesophagus S-shaped. Caeca extend upto middle or anterior level of posterior testes. Testes diagonally tandem postacetabular. Cirrus sac 0.27-0.38 × 0.07-0.16, curved, extends much beyond ventral sucker. Ovary pretesticular. Recepticulum seminis between anterior testes and ovary. Uterus fills all available space in hind body and extends between testes, may overlap the caeca, laterally. Genital pore median, in between ventral sucker and caecal bifurcation. Vitellaria lateral, extracaecal, overlap caeca, extend from bifurcal zone to caecal termination. Eggs 0.029-0.034 × .01-0.117.

Distribution : India : West Bengal (Birati, South 24-Parganas).

Subfamily Styphlodoridae Dollfus, 1937

10. Genus *Styphlodora* Loss, 1899

Key to species

1. Vitellaria extending upto posterior end of posterior testis.....*S. horrida*
 Vitellaria more extensive.....
2. Vitellaria extending upto posterior end of anterior testis; testes oblique*S. molli*

16. *Styphlodora horrida* (Leidy, 1851) Odhner, 19101851. *Plagiorchis horrida* Leidy, *Proc. Acad. Nat. Sc. Phil.*, 5(9) : 205-210.1910. *Styphlodora horrida* Odhner, *Zool. Anz.*, 35 : 432-433.*Material* Host : *Natrix piscator*, *Python molurus*, *Boa constrictus*

Diagnosis : Body length and breadth 4.26×0.74 . Cuticle spiny. Oesophagus short, caeca do not extend upto posterior end. Acetabulum smaller than oral sucker. Testes diagonal, postacetabular. Cirrus pouch overlap acetabulum. Genital pore median, preacetabular, postbifurcal. Ovary submedian, postacetabular; vitellaria in bunches, lateral, from acetabular level to caecal end. Uterus intercaecal, from caecal bifurcation to posterior end. Eggs $0.037-0.043 \times 0.019-0.022$.

Distribution : India : West Bengal (North 24-Parganas, Medinipur).

Other records : America.

17. *Styphlodora nicolli* Bhalerao, 1936

1936. *Styphlodora nicolli* Bhalerao, *J. Helminth.*, 14(4) : 181-206.

Material : Host : *Zamenis mucosus*.

Diagnosis : Body shape elliptical, length 2.65-2.9. Oral sucker and ventral sucker almost of same size. Testes obliquely situated. Cirrus sac straight or slightly curved, $0.3-0.37 \times 0.08-0.10$, terminating anterior to ovary. Ovary round, immediately posterior to ventral sucker. Uterine coils pass between testes anal ovary. Metraterm muscular. Vitelline follicles extend from middle of ventral sucker to second third or posterior end of anterior testis. Operculated eggs $0.032-0.042 \times 0.018-0.022$.

Distribution : India : West Bengal (Calcutta Zoo).

Subfamily Plagiorchiinae Luhe, 1901 : Pratt, 1902

Key to genera

1. Cirrus pouch extend upto middle of acetabulum; vitellaria upto caecal ends *Bilorchis*
 Cirrus pouch preacetabular 2
2. Vitellaria extensive in forebody, extend upto the level of anterior testis *Xenopharynx*

11. Genus *Bilorchis* Mehra, 1937

18. *Bilorchis indicus* Mehra, 1937

1937. *Bilorchis indicus* Mehra, *Z. Parasitkde.*, 9(4) : 429-469.

Material Host : *Lissemys punctata*, *Kachuga intermedia*, *Trionyx gangeticus*.

Diagnosis : Body 2.3-3.0, tapered anteriorly. Oral sucker larger than acetabulum. Caeca upto posterior extremity. Testes symmetrical, in middle third of body, cirrus pouch may extend upto middle of acetabulum. Ovary posterolateral to acetabulum. Uterus extensive, in posttesticular area, extending to caeca, overlapping it. Vitellaria lateral, from level of pharynx to caecal ends. Eggs $0.033-0.36 \times 0.018-0.024$.

Distribution : India : West Bengal (Calcutta, Digha); Uttar Pradesh.

12. Genus *Xenopharynx* Nicoll, 1912

19. *Xenopharynx solus* Nicoll, 1912

Syn. *X. moradabadensis* Sahay and Prosad, 1977 Syn. nov.

1912. *Xenopharynx solus* Nicoll, *Proc. Zool. Soc. London*, 11(4) 767-770.

Material : Host : *Naja naja*. *Tropidonotus piscater*.

Diagnosis : Body length 5.0-5.7 × 1.5-2.0. Oral sucker and acetabulum almost of the same size. Oesophagus short. Caeca terminating at posterior end. Testes in middle third of body, widely separated; cirrus pouch preacetabular, small. Genital pore at caecal bifurcation. Ovary pretesticular posterolateral to acetabulum. Vitellaria lateral, in hind body, extracaecal, extensive in forebody from pharyngeal level to the level of anterior testis, overlapping caeca; uterus, in between testes and ovary, extending as far back as posterior testis but not upto hind end, cross caeca laterally. Eggs 0.038-0.039 × 0.015-0.018.

Distribution India : West Bengal (North & South 24-Parganas, Puruliya) : Uttar Pradesh, Andhra Pradesh.

Other state : Africa, Burma.

Remarks The species described by Sahay and Proshad (1977) is differentiated on the equal size of suckers, diagonal nature of testes, genital pore on right caecal bifurcation and vitelline glands intruding in intercaccal zone. All these characters have been recorded as intraspecific variations in nature.

Subfamily Encyclometrinae Mehra, 1931

13. Genus *Encyclometra* Baylis & Cannon, 1924

Key to species

1. Testes symmetrical *E. bungara*
- Testes tandem or slightly diagonal 2
2. Intestinal caeca equal in size *E. colubrimurorum*
- Intestinal caeca unequal 3
3. Seminal vesicle coiled *E. japonica*

20. *Encyclometra colubrimurorum* (Rudolphi, 1819) Dollfus, 1929

(Fig. 8)

1819. *Distoma colubrimurorum* Rudolphi, *Entozorum synopsis cri accedunt mantissa duplex atindices locerptctissinli* Berol. 811 p.

1929. *Encyclometra colubrimurorum* Dollfus, *Fauna des colonies francaises*, 3(2) : 73-114.

Material : Host : *Tropidonotus colubrimurum*.

Diagnosis : Body length 2.13-4.2. Cuticle smooth. Oesophagus short. Caeca upto posterior end. Acetabulum larger than oral sucker, in preequatorial zone. Testes tandem, postequatorial; cirrus pouch preacetabular. Genital pore anterodorsal to acetabulum. Vitellaria lateral, extending along the length of caeca. Uterus reaching to posterior extremity. Eggs 0.060-0.088 × 0.030-0.043.

Distribution : India : West Bengal (Zoo Garden, Calcutta, South 24-Parganas, Hughli, Puruliya, Medinipur); Uttar Pradesh, Maharashtra.

Other records : Burma.

21. *Encyclometra bungara* Srivastava and Ghosh, 1968

(Fig. 9)

1968. *Encyclometra bungara* Srivastava and Ghosh, *Indian J. Helminth.*, 20(2): 132-135.*Material* : Host : *Bungarus fasciatus*.

Diagnosis : Body elliptical 1.89 in length, cuticle smooth, Intestinal caeca reach upto posterior end. Acetabulum preequatorial, slightly larger than oral sucker. Testes symmetrical or obliquely symmetrical; cirrus sac crescent shaped, just above acetabulum. Ovary pretesticular, median, below acetabulum; uterus mostly in posterior half, passes between testes. Genital pore at anterolateral margin of acetabulum, near left caecum. Vitellaria follicular from ovarian zone to posterior extremity. Eggs $0.021 \times 0.01-0.012$.

Distribution : India : West Bengal (Sagarpuur, South 24-Parganas).22. *Encyclometra japonica* Yoshida and Ozaki, 1929

(Fig. 10)

1929. *Encyclometra japonica* Yoshida and Ozaki, *Annot. zool. Jap.*, 12(1) : 239-243.*Material* : Host : *Natrix piscator*, *Ptyas mucosus*, *Atretium schistosum*, *Naja naja*.

Diagnosis : Body length 3.7-6.2. Caeca lateral, terminating at posterior end, unequal in size. Acetabulum larger than oral sucker, preequatorial. Testes tandem, postequatorial; cirrus pouch overlapping acetabulum. Seminal vesicle coiled. Genital pore just preacetabular, postbifurcal. Ovary postacetabular, pretesticular; seminal receptacle small. Vitellaria lateral, extending from caecal bifurcation to caecal ends. Uterus extend in hind body, intercaecal, passes through testes dorsally. Eggs $0.078-0.09 \times 0.05-0.053$.

Distribution : India : West Bengal (Hughli, North & South 24-Parganas, Puruliya); Bihar, Uttar Pradesh, Orissa, Tripura.

Other records : Japan, Africa, China, Burma.

IV. Family Dicrocoeliidae Odhner, 1910

Key to genera

- | | |
|---|------------------------|
| 1. Testes symmetrical | 2 |
| Testes diagonal or tandem, | 3 |
| 2. Testes postacetabular | <i>Eurytrema</i> |
| Testes posterolateral to acetabulum..... | <i>Paradistomoides</i> |
| 3. Genital pore anterior to acetabulum..... | <i>Dicrocoelium</i> |
| Genital pore otherwise..... | 4 |
| 4. Genital pore at caecal bifurcation | <i>Lyperosomum</i> |

14. Genus *Dicrocoelium* Dujardin, 184523. *Dicrocoelium dendriticum* (Rudolphi, 1819) Stiles and Hassal, 18981819. *Distoma dendriticum* Rudolphi, *Entozootu synopsis cui Accedunt martissa duplex et indices locupletissim.*, 811.

1898. *Dicrocoelium dendriticum* Stiles and Hassal, *Arch. Par.*, 1(1) : 81-99.

Material : Host : Goat.

Diagnosis : Body length 2.1-8.0, wider in preequatorial level. Oesophagus short, caeca terminate some distance away from hind end. Acetabulum smaller than oral sucker, in anterior third of body, Cirrus pouch preacetabular. Genital pore at caecal bifurcation. Ovary just postacetabular. Vitellaria lateral at middle portion of body, extracaecal, limited in extent. Uterus occupy most of the open space in hind body. Eggs dark brown in mature specimens, 0.36-0.50 × 0.22-0.30.

Distribution : India : West Bengal (Darjeeling).

Other records : Cosmopolitan.

15. Genus *Paradistomoides* Travassos, 1944

24. *Paradistomoides orientalis* (Narain & Das, 1929) Travassos, 1944

1929. *Dicrocoelium orientalis* Narain & Das, *J. Bombay Nat. Hist. Soc.*, 33 (2) : 250-251.

1944. *Paradistomoides orientalis* Travassos, *Monogr. Inst. Osw. Cr.*, 2 : 357.

Material : Host : *Calotes versicolor*, *Hemidactylus flaviviridis*.

Diagnosis : Body length 4.16-4.83. Oral sucker smaller than acetabulum. Oesophagus short, caeca extend a little short of posterior extremity. Testes symmetrical to ovary. Cirrus pouch preacetabular. Genital pore at caecal bifurcation. Ovary posttesticular, closer to antiporal testis. Uterine coils mostly postovarian, overlaps caeca; vitellaria lateral, extracaecal, from caecal bifurcation to some distance short of caecal ends. Eggs 0.032-0.033 × 0.031-0.032.

Distribution : India : West Bengal (Calcutta, Bardhaman, Bankura, Hughli); Orissa, Uttar Pradesh, Andhra Pradesh.

Other records : Singapore.

16. Genus *Eurytrema* Looss, 1907

Key to species

Caudal appendage present; oral sucker bigger than acetabulum, testes 1/10 of body length.....
.....*E. pancreaticum*

Caudal appendage absent, oral sucker smaller than acetabulum, testes 1/5 to 1/3 of body length....
.....*E. bhaleraoi*

25. *Eurytrema pancreaticum* (Jonson, 1889) Looss, 1907

1889. *Distoma pancreaticum* Jonson, *Note explicative des objets deskomaha* Paris : 92.

1907. *Eurytrema pancreaticum* Looss, *Ann. Trop. Med. Parasit.*, 1 : 121-154.

Material : Host : Cow.

Diagnosis : Length 9-12.5, caudal appendage present. Cuticle smooth. Acetabulum smaller than oral sucker. Pharynx oval, oesophagus straight or bent. Intestinal caeca sinuous. Testes deeply lobed. Cirrus sac anterior to ventral sucker or overlaps it. Ovary lobed, lobes 3-8, variable in depth. Uterus

passing between testes and ovary. Vitellaria follicular, extracaecal, in groups or in continuous mass. Eggs $0.038-0.048 \times 0.022-0.032$.

Distribution : India : West Bengal (North 24-Parganas, Calcutta) widely distributed.

Other records : Cosmopolitan.

26. *Eurytrema bhaleraoi* Mukherjee and Srivastava, 1992

(Fig. 11)

1992. *Eurytrema bhaleraoi* Mukherjee and Srivastava *Acta Parasitologia* 37(2) : 60.

Material : Host : Cow.

Diagnosis : Body lanceolate. leaf-like, tapering at both ends, $3.825-10.28 \times 2.12-4.25$, caudal appendage absent. Acetabulum larger than oral sucker. Testes very large, elongated, symmetrical, deeply lobed, $0.675-2.52 \times 0.675-1.70$ & $0.637-2.52 \times 0.637-1.30$. Ratio of testes and body length 1/5 to 1/3. Ovary 3-7 lobed, posttesticular, postacetabular, $0.187-0.476 \times 0.336-0.490$. Eggs $0.0375-0.0425 \times 0.0187-0.028$.

Distribution : India : West Bengal (Kalimpong).

17. Genus *Lypersomum* Looss, 1899

27. *Lypersomum (Lypersomum) reangensis* Soota and Ghosh, 1977

(Fig. 12)

1977. *Lypersomum (Lypersomum) reangensis* Soota and Ghosh, *Rec. Zool. Surv. India*, 3 : 223-228.

Material : Host : *Picus flavinucha flavinucha*.

Diagnosis : Body length 4.34, cuticle smooth. Acetabulum larger than oral sucker 1 : 2 in ratio. Testes oblique, just postacetabular. Ovary posttesticular round, submedian. Recepticulum seminis and Mehlis gland complex on posterolateral side of ovary. Vitellaria confined to midthird of body, asymmetrical, from behind the level of posterior testis to the last quarter; uterus extensive in hind body and anteriorly upto pharyngeal level. Eggs $0.36-0.48 \times 0.22-0.26$.

Distribution : India : West Bengal (Darjeeling).

28. *Lyperosomum kakea* Bhalerao, 1926

1926. *Lypersomum kakea* Bhalerao, *Parasitology*, 18 : 387.

Material : Host : *Corvus splendens*.

Diagnosis : Length 3.36. Ratio of oral sucker diameter and acetabulum 5 : 9. Ovary smaller than testes. Vitellaria asymmetrical. Eggs 0.03×0.02 .

Distribution : India : West Bengal (Calcutta).

Other records : Burma.

V. Family Stomylotrematidae Travassos, 1922 : Poche, 1926

Subfamily Stomylotreminae Travassos, 1921

18. Genus *Stomylotrema* Looss, 1900

29. *Stomylotrema travassosi* Mehra, 1938

1938. *Stomylotrema travassosi* Mehra, *Libr. Jub. Prof. Travassos*, 307-314.

Material : Host : *Metapodius indicus*.

Diagnosis : Body length 2.45. Oral sucker large. Oesophagus very small; caeca upto posterior extremity. Acetabulum postequatorial, larger than oral sucker. Testes symmetrical, preacetabular. Cirrus pouch oblique to body axis. Genital pore marginal, in level with oral sucker or pharynx. Ovary submedian, pretesticular, Vitellaria lateral, from preacetabular region to posterior end. Uterine coils surrounding acetabulum. Eggs $0.024-0.03 \times 0.018-0.021$.

Distribution : India : West Bengal (Barddhaman).

Remarks : Metacercaria of this species has been recorded in *Calotes versicolor* from Barddhaman, West Bengal by Srivastava and Ghosh (1975).

VI. Family Hemiuridae Luhe, 1901

Key to subfamilies

1. Body elongate, with tail.....Lecithochiriinae
- Body without tail..... 2
2. Genital pore at bifurcal zone..... Halipeginae

Subfamily Halipeginae Ejsmont, 1931

19. Genus *Halipegus* Looss, 1899

30. *Halipegus mehransis* Srivastava, 1933

1933. *Halipegus mehransis* Srivastava, *Bull. Acad. Sc. U.P. Agra and Oudh. Allahabad*, 3(1) : 41-60.

Material : Host : *Rana cyanophlyctis*, *R. tigrina*, *Uromastix* sp.

Diagnosis : Body length 1.7-4.5. Oral sucker almost half the diameter of acetabulum. Acetabulum 0.5-0.7 in diameter, equatorial. Intestinal caeca arise directly behind pharynx. Caeca broad, wavy, extend upto posterior end. Testes large, extracaecal, oblique in position, postacetabular. Vesicula seminalis lies a little behind intestinal bifurcation, submedian. Ductus ejaculatorius $.08 \times .01$, open on a papilla in genital atrium. Ovary intercaecal, in front of left vitelline gland, median. Vitellaria compact, at postcaecal end, 4-5 lobed. The uterine coils do not extend behind vitelline glands. terminal part lies parallel to vesicula seminalis. Uterus opens on the genital papilla. Eggs with long filament at one end, measure 0.045×0.018 ; filament 0.32 in length.

Distribution : India : West Bengal (North & South 24-Parganas, Digha); Uttar Pradesh, Maharashtra, Bihar.

Subfamily Lecithochiriinae Luhe, 1901

20. Genus *Lecithochirium* Luhe, 1901

31. *Lecithochirium acutum* Chauhan, 1945

1945. *Lecithochirium acutum* Chauhan, *Proc. Indian Acad. Sc.*, 21 : 160-173.

Material : Host : *Enhydrina schistosa*.

Diagnosis : Body length 5.4 elongate with tail. Oral sucker with preoral lobe. Caeca reaching upto tail end. Acetabulum almost of the same as oral sucker, near anterior extremity. Testes diagonal, postacetabular; seminal vesicle constricted medially, anterodorsal to acetabulum. Genital pore at bifurcal zone. Ovary post testicular; seminal receptacle present. Vitellaria two lobed mass, below ovary, uterus not extending to tail, mostly between ovary and genital pore, may extend posteriorly beyond ovarian zone. Eggs 0.015×0.01 .

Distribution : India : West Bengal (Digha); Bombay.

Remarks : Skrjabin and Gushanskaja (1955) transferred this species to the genus *Brachyphallus*. This species and genus is recorded from fish only. So this present record might be a case of accidental infection.

VII. Family Anchitremitidae Mehra, 1935; Ghosh, 1981

Subfamily Anchitrematinae Mehra, 1935

21 Genus *Anchitrema* Looss, 1899

32. *Anchitrema sanguineum* (Sonsino, 1894) Looss, 1899

(Fig. 13)

1894. *Distoma sanguineum* Sonsino, *Ali Sol. Tosc. Sc. Nat., Proc. verb.*, 9 : 110-116.

1899. *Anchitrema sanguineum* Looss, *Zool. Jahrb Syst.*, 12 : 521-784.

Material : Host : *Pipistrellus mimus*, *Suncus murinus*.

Diagnosis : Body length 1.16. Caeca run laterally upto posterior end. Testes extracaecal, placed in distinctive notch of the caecum of respective side, symmetrical, equatorial in position. Seminal vesicle enclosed in globular sac. 0.09×0.08 . Genital pore median, preacetabular. Ovary intercaecal, median, postequatorial. Vitelline glands with small follicles, extracaecal, from posttesticular field to some distance short of posterior end. Uterine coils mostly postovarian, intercaecal. Eggs. $0.016-0.024 \times 0.009-0.015$.

Distribution : India : West Bengal (Calcutta, South 24-Parganas, Bankura); Uttar Pradesh, Madhya Pradesh, Rajasthan, Andhra Pradesh.

Other records : Africa, Europe, Australia.

Remarks : This is a common parasite of bats, Ghosh (1981) recorded this parasite from a shrew.

VIII. Family Ommatobrephidae Poche, 1926

Subfamily Ommatobrephinae Poche, 1926 : Dubois & Mohan, 1959

22. Genus *Ommatobrephus* Nicoll, 1914

Key to species

1. Testes lobed.....*O. lobatum*
Testes not lobed..... 2
2. Testes smooth, oblong, ovary submedian, anterodorsal to antiporal testes *O. bengalensis*

33. *Ommatobrephus bengalensis* Mukherjee and Ghosh, 1971

(Fig. 14)

1971. *Ommatobrephus bengalensis* Mukherjee and Ghosh, *Proc. Indian Acad. Sc.*, 67(6) : 104-108.

Material : Host : *Natrix stolata*.

Diagnosis : Body length 1.91. Oesophagus 0.31 long Ratio between oral sucker and ventral sucker 1 : .3. Caeca extend upto middle region of testes at posterior end of body. Testes at caudal end. symmetrical, oblong, entire. Cirrus sac 0.23 in length. is situated in between caecal bifurcation and ventral sucker Genital pore near intestinal bifurcation. Ovary round, in front of right testis. Vitellaria lateral. overlap caeca, from postacetabular region to caecal ends. Eggs operculated 0.08-0.09 × .04-0.05.

Distribution : India : West Bengal (South 24-Parganas).

34. *Ommatobrephus lobatum* Mehra, 1928

(Fig. 15)

1928. *Ommatobrephus lobatum* Mehra, *Proc. Ind. Sci. Cong.*, 15, 199.

1931. *Ommatobrephus lobatum* Mehra, *Allahabad Univ. Stud.*, 7 : 31-52.

Material : Host : *Varanus bengalensis*, *Natrix piscator*, *Zamenis mucosus*.

Diagnosis : Body length 2.4-4.00 and breadth 0.9-1.3 at hind end. Cuticle smooth. Oral sucker much smaller than ventral sucker. Ventral sucker equatorial, large. Pharynx well developed. Oesophagus long. Caeca reaching to posterior extremity. Testes symmetrical at posterior extremity. lobed. Cirrus pouch pyriform, preacetabular, seminal vesicle convoluted. Genital pore bifurcal. Ovary entire. submedian, pretesticular. Vitellaria follicular, lateral, between acetabulum and testis. Uterus intercaecal, between acetabulum and testes, occupying the intercaecal space. Eggs operculated 0.079-0.082 × 0.037-0.039.

Distribution : India : West Bengal (Calcutta, North & South 24-Parganas, Haora, Medinipur, Birbhum); Uttar Pradesh, Madhyapradesh, Andhra Pradesh.

Other records : Africa (Madagascar).

IX. Family Microphallidae Ward, 1901

Subfamily Microphallinae Ward, 1901

23. Genus *Megalotriotrema* Rao, 1969

35. *Megalotriotrema dicaecus* (Mukherjee and Ghosh, 1967) Rao, 1969

(Fig. 16)

Syn. *Microphallus indicus* Mukherjee and Ghosh, 1967

1967. *Microphallus dicaecus* Mukherjee and Ghosh, *Zool. Anz.*, 178 : 342-347.

1969. *Megalotriotrema dicaecus* Rao, *Ann. Parasit. hum. cum.*, 44 : 125-130.

Material : Host : *Atretium schistosum*, *Rana tigrina*.

Diagnosis : Body length 1.23-1.85. Oesophagus 0.27-0.42 long, bifurcates much anterior to ventral sucker into stout and short caeca, which never surpass acetabular level. Testes entire, symmetrical, postacetabular. Seminal vesicle, large, preacetabular. Ejaculatory duct long, enters the male papilla. Genital atrium conspicuous. Genital opening posterolateral to acetabulum. Ovary round pretesticular on right side, larger than testes, uterus encircles the testes and vitellane follicles, almost cover the hind body, it extends anteriorly to blind end of caeca at anterior end metraterm is formed.

Vitellaria follicular, lobes distinct, confined to hind body, from postacetabular level to hinder end of body. Eggs 0.02×0.01 .

Distribution : India : West Bengal (South & North 24-Parganas, Barddhan); Andhra Pradesh.

Remarks : *M. indicus* (Mukherjee and Ghosh, 1967) Rao, 1969 was considered a synonym of *M. dicaecus* by Deblock, Mukherjee and Ghosh (1978).

X. Family Proterodiplostomidae, Dubai 1936

Subfamily Proalarioidinae Yamaguti, 1971

24. Genus *Proalariodes* Yamaguti, 1933

36. *Proalarioides tropidonotis* Vidyarthi, 1937

(Fig. 17)

1937. *Proalarioides tropidonotis* Vidyarthi, *Ann. Mag. nat. Hist.*, 5.10.20 : 549-553.

Material : Host : *Natrix stolata*, *Bufo viridis*, *Bufo melanostictus*, *Rana tigrina*.

Diagnosis : Body distinctly bipartite; forebody 6.11-7.34 and hind body cylindrical 6.0-6.11. Pseudosuckers present on either side of oral sucker. Tribocytic organ, large, about one third of forebody. Vitelline follicles intrude in it. Oesophagus short, caeca terminating short of posterior end, larger than oral sucker, in postbifurcal zone in front of tribocytic organ. Testes in hind body, tandem, juxtaposed. Ovary pretesticular, median, seminal vesicle behind posterior testis. Hermaphroditic duct formed by ejaculatory duct and distal portion of uterus, opens into the genital atrium. Genital atrium opens near posterior end, Uterus in hind body, intercaecal. Vitelline follicles mostly in forebody, surrounding tribocytic organ. Eggs $0.097-0.110 \times 0.05-0.072$.

Distribution : India : West Bengal (North & South 24-Parganas, Barddhan, Haora, Puruliya, Medinipur); Bihar, Uttar Pradesh, Madhya Pradesh, Andhra Pradesh.

XI. Family Cyathocotylidae Muehling, 1898

Key to subfamilies

1. Body elongate, divided into neck like constriction, tribocytic organ large Muehlingiinae
Body bipartite, linguiform 2
2. Tribocytic organ small; vitellaria lateral to tribocytic organ Szidatiinae

Subfamily Muehlingiinae Mehra, 1950

25. Genus *Muehlingina* Mehra, 1950

37. *Muehlingina lutrai* Mehra, 1950

1950. *Muehlingina lutrai* Mehra, *Presidential Address. Proc. Natn. Acad. Sci. India*, 1950 : 27-29.

Material : Host : *Lutra bulgaris*.

Diagnosis : Body divided into a small neck like cup shaped anterior portion and a large posterior region. Tribocytic organ with median slit, extend backward through some distance in hind body. Pharynx larger than oral sucker. No acetabulum. Testes obliquely tandem; cirrus pouch large,

reaching to midlevel of posterior region. Genital pore opening in genital atrium. Ovary intertesticular. Large vitelline follicles from anterior region to level of posterior testis. Uterus reaching to ventral side of posterior testis, containing large oval eggs. Metraterm opening into terminal genital atrium, alongside cirrus. No measurement given in original description.

Distribution : India : West Bengal (Zoo-garden, Calcutta).

Subfamily Szidatiinae Dubois, 1938

26. Genus *Gogatea* Lutz, 1935

38. *Gogatea serpentium* (Gogate, 1932) Lutz, 1935

(Fig. 18)

Syn. *Gogatea indicum* Chattopadhyay, 1970 n. syn.

G. kalri Farooqi, 1973 syn. nov

G. karachiensis Farooqi, 1973 syn. nov

1932. *Prohemistomum serpentium* Gogate, *Parasitology*, 24(3) : 218-220.

1935. *Gogatea serpentium* Lutz, *Mem. Inst. Osw. Cruz*, 30(22) : 157-168.

Material : *Xenochrophis piscator*, *Natrix stolata*.

Diagnosis : Distinctly bipartite body, total body length 1.66-1.73. Oesophagus bifurcates in anterior third of body, caeca extend upto posterior testis. Testes tandem; cirrus pouch 0.63-0.70 × .04-0.06. Genital pore terminal. Ovary intertesticular, variously placed, in some cases lateral to anterior testis. Large vitelline follicles from caecal bifurcation to anterior end of anterior testes intrude in intercaecal zone and tribocytic organ. Eggs few, one or two in number, measure 0.15-0.2 × .06-0.08.

Distribution : India : West Bengal (South 24-Parganas, Medinipur Haora); Uttar Pradesh, Andhra Pradesh, Madhya Pradesh.

Other records : Burma, Pakistan.

Remarks : Dubois (1969) opined that the genus *Gogatea* is monotypic. As such *G. incognitum* Baugh, 1958, *G. mehrai* Dwivedi and Chauhan, 1970, *G. indicum* Chattopadhyaya, 1970 fall synonym to type species. Farooqi (1973) added two more species *G. kalrii* and *G. karachiensis* from Pakistan on some characters such as extension of vitelline follicles, length of cirrus pouch, size of tribocytic organ, and position of ovary. These characters are extremely variable in this genus and not sufficient ground for proposing new species. They are considered synonym to type species.

XII. Family Echinostomatidae Poche, 1925

Key to subfamilies

1. Body bipartite, anterior region semicircular, posterior region cylindrical Chaunocephalinae
Body not bipartite 2
2. Head collar without any spines Pseudoechinostominae
Head collar spined 3

3. Head collar rudimentary, armed with very small spines, smaller than cuticular spines
Psilorchiinae
Head collar well developed 4
4. Head collar divided in two ridges on each side of oral sucker..... Microparyphiinae
Head collar not divided in two ridges..... 5
5. Collar spine single or double, dorsally uninterrupted row of spines along with end group of corner spines Echinostomatinae
Head collar otherwise 6
6. Head collar reniform or reduced to two lateral lobes. No distinct end group of spines present
Echinochasminae

Subfamily Echinostomatinae Poche. 1925

Key to genera

1. Testes longitudinally elongated, cirrus sac extend upto middle or slightly more of acetabulum
Vermatrema
Testes not elongated 2
2. Uterus long, much coiled with numerous eggs; cirrus sac preacetabular..... *Echinostoma*
Uterus not long..... 3
3. Uterus with few eggs *Echinoparyphium*

27. Genus *Echinostoma* Rudolphi, 1809

Key to species

1. Testes deeply lobed..... 2
Testes not deeply lobed..... 3
2. Cirrus pouch extends beyond acetabulum *A. malayanum*
Cirrus pouch does not extend beyond acetabulum 4
3. Cirrus pouch preacetabular, postcaecal; end group with five collar spines..... *E. revolutum*
End group with more than five collar spines *E. eduardoi*

39. *Echinostoma revolutum* (Froelich, 1802) Looss, 1899

1802. *Fasciola revolutum* Froelich, *Beitrag Naturg. Einge*, 29 : 58-60.

1899. *Echinostoma revolutum* Looss, *Zool. Jahrb. Syst.*, 12 : 521-784.,

Material : Host : Duck.

Diagnosis : Body length 9.4-22.8, collar spines 37, from 34-37 in double, partly double row. Five in each corner group. Acetabulum 0.7-1.7. Intestinal caeca extends upto hinder end. Testes tandem, in post equatorial zone, entire, oval or lobed; cirrus sac small, in between caecal bifurcation and acetabulum. Ovary equatorial, median; vitellaria follicular from a little behind acetabulum to posterior extremity, intruding in posttesticular region or not. Uterus intercaecal, between anterior testis and acetabulum. Eggs 0.097-0.126 × 0.059-0.71.

Distribution : India : West Bengal (Haora, Medinipur, Barddhan): Uttar Pradesh, Tamil Nadu, Orissa:

Other records : Cosmopolitan.

40. *Echinostoma eduardoi* Ghosh and Chauhan, 1977

(Fig. 19)

1977. *Echinostoma eduardoi* Ghosh and Chauhan, *Doctor Eduardo Caballero Caballero, memor vol Mexico, 165-168.*

Material : Host : *Bandicota bengalensis*.

Diagnosis : Body length 3.15-5.31. Sucker ratio 1 : 3. Ventral sucker larger. Collar with uninterrupted double row of 34-36 spines. Testes postequatorial, tandem. Cirrus sac not extending beyond anterior third of acetabulum, post bifurcal. Genital pore bifurcal or slightly below bifurcation. Ovary pretesticular, separated by uterus; uterus extending between ovary and acetabulum. Vitellaria follicular from ovarian level to some distance short of posterior extremity, lateral, contiguous or not in post testicular level. Eggs, operculate 0.08-0.09 × 0.03-0.04.

Distribution India : West Bengal (Salt Lake, Calcutta).

41. *Echinostoma malayanum* Leiper, 1911

1911. *Echinostoma malayanum* Leiper, *J. London Sci. Trop. Med.*, 1 : 27-28.

Material : Host : *Bandicota indica*.

Diagnosis : Body length 9.4-12.33, collar with 40-44 spines; cuticle spined. Ventral sucker larger than oral sucker; sucker ratio 1 : 4 in length. Intestinal caeca almost reaching to posterior end. Testes deeply lobed, tandem. Male and female genital duct open separately; cirrus sac elongated, varies in length, may or may not extend beyond ventral sucker. Ovary pretesticular. Vitellaria follicular, in lateral field, extend from the level of middle or a little posterior to ventral suckers to posterior end of body, uterus in between ventral sucker and testes. Eggs 0.11-0.13 × .05-1.06

Distribution : India : West Bengal (Calcutta, West Dinajpur); Assam, Uttar Pradesh, Andhra Pradesh.

Other records : Cosmopolitan.

Remarks : The position of this species is controversial as many authors considered it conspecific with *Artyfechinostomum sufrartyfex*. *Artyfechinostomum araoni* Bandopadhyay et al. 1989; *Paramphistomum suprartyfex* Lane, 1915 and *P. mehrai* Jain, 1960 recorded in tribal population of Bengal might be of *Echinostoma malayanum* Leiper, 1911 only.

28. Genus *Vermatrema* Srivastava, 1974

42. *Vermatrema longitestis* (Verma, 1936) Srivastava, 1972

(Fig. 20)

1936. *Euparyphium longitestis* Verma, *Allahabad Univ. Stud.*, 12 : 147-188.

1974. *Vermatrema longitestis* Srivastava, *J. zool. Soc. India*, 24(2) (1972) : 169-191.

Material : Host : Black Swan, *Cygnus atratus*.

Diagnosis : Body elongated 9.77-10.68 long, greatest breadth in preacetabular region, 1.37-2.02; cuticle spined anteriorly. Poorly developed collar 0.22-0.26 × 0.49-0.50. Collar spines arranged in single row, end group contain 4 spines each. Total number of spines not mentioned, oral sucker 0.22-0.23 × 0.25. Pharynx oval, oesophagus short, caeca upto posterior end. Acetabulum near anterior fourth of body 0.82-0.99 × 0.74-0.95. Testes median, tandem, longitudinally elongated with indented margin. Cirrus sac elongate, overlapping acetabulum, extending upto middle or more 0.84-0.88 × 0.19-0.35. Genital pore median, preacetabular, postbifurcal on a genital sucker. Ovary round, preequatorial, in position. Vitelline glands in lateral field, mostly extracaecal, from postacetabular level to caecal ends. Uterus short, between anterior testes and acetabulum, intercaecal. Eggs few, 0.07-0.11 × 0.04-0.08.

Distribution : India : West Bengal (Calcutta).

29. Genus *Echinoparyphium* Dietz, 1909

43. *Echinoparyphium gizzardai* Verma, 1936

1936. *Echinoparyphium gizzardai* Verma, *Allahabad Univ. Stud.*, 12 : 147-188.

Material : Host : Black Swan, *Cygnus atratus*.

Diagnosis : Body elongate 2.85-3.0 × 0.46-0.55; cuticle spined anteriorly. Collar with 22 spines. Oral sucker 0.084 × 0.1. Ventral sucker 0.34 × 0.29 with cavity; in first fourth of body. Testes oval, posttesticular space 0.67. Ovary pretesticular, Vitellaria follicular from acetabulum to posterior extremity; uterus between ovary and ventral sucker, intervitellarial. Eggs few 13-20 rounded 0.077-0.10 × 0.067-0.07.

Distribution : India : West Bengal (Calcutta).

Subfamily Psilorchiinae Mehra, 1980

30. Genus *Psilorchis* Thapar and Lal, 1935

44. *Psilorchis indicus* Thapar and Lal, 1935

1935. *Psilorchis indicus* Thapar and Lal, *Proc. Indian Acad. Sci.*, 2(1), : 88-94.

Material : Host : Domestic duck.

Diagnosis : Body length 5.76-8.57. Cuticle spined; collar small, 0.27-0.32 × 0.39-0.43 with minute irregularly arranged spines. Spines on the collar are even minute than cuticular spines. Acetabulum, very large 0.62-0.87 near anterior end, with opening at anterior end. Sphincter anteriorly with a deep cavity with spines present. Oral sucker very small 0.02-0.21 in diameter. Oesophagus very short. Testes tandem, postequatorial, with irregular margin or slightly lobed. Genital pore preacetabular, postbifurcal; cirrus sac anterior to acetabulum. Ovary pretesticular, oval. Eggs. 0.08-0.14 × 0.03-0.08.

Distribution : India : West Bengal (Medinipur); Uttar Pradesh, Orissa, Rajasthan.

Subfamily Pseudoechinostominae

31. Genus *Pseudoechinostomum* Odhner, 1911

45. *Pseudoechinostomum indicus* Mehra, R.K. 1944

1944. *Pseudoechinostomum indicus* Mehra, *Allahabad Univ. Stud.*, 28 : 13-26.

Material : Teal. *Netton crecca*.

Diagnosis : Body length 7.5-9.5, cuticle spined. Collar 0.52×0.32 , not having any spines. Acetabulum much larger than oral sucker, ratio 5 : 1. Oesophagus small. divides into two intestinal caeca extending upto hind end. Testes tandem, slightly lobed, postequatorial. Cirrus sac 1.35×0.32 extends upto posterior margin of acetabulum. Genital pore submedian, sucker like, close inside left caecum; vesicula seminals long. Ovary pretesticular, preequatorial; receptaculum seminis uterinum present. Uterus between ovary and acetabulum. Eggs $0.095-0.1 \times 0.056-0.06$.

Distribution : India : West Bengal (Medinipur, Hughli); Uttar Pradesh.

Subfamily Chaunocephalinae Travassos, 1922

32. Genus *Chaunocephalus* Dietz, 1909

Chaunocephalus similiferox Verma, 1936

1936. *Chaunocephalus similiferox* Verma, *Allahabad Univ. Stud.*, 12 : 146-185.

Material : Host : Black headed gull, *Larus ridibundus*, Black necked stork. *Xenorhynchus asiaticus*.

Diagnosis : Body divisible almost in two parts, dilated bulb like spiny anterior and nonspiny subcylindrical posterior portion. Body length 4.41-8.80, width of anterior body 3.0-4.01; posterior narrow portion 0.7-1.01. Head collar small with 27 spine in double uninterrupted row. End groups with four spines, dorsal two, being larger than ventral two. Oesophagus long, with a diverticula at acetabular region, divides in two caeca, extending upto posterior end, open into the terminal portion of excretory bladder, forming uroproct. Acetabulum between fore and hind body, $0.506-0.547$ in diameter. Testes symmetrical or obliquely symmetrical, in hind body. Cirrus sac small, conical in shape, postbifurcal, $0.154-0.021 \times .08-0.14$. Vesicula seminalis small, saccular. Genital pore surrounded by small sucker, portbifurcal. Ovary close to acetabulum. Vitelline follicles extensive, in whole of anterior body, extend upto testicular level in hind body. Uterus between testes and caecal bifurcation. Eggs many, $0.07-0.109 \times 0.042-0.059$.

Distribution : India : West Bengal (Calcutta); Uttar Pradesh, Madhya Pradesh.

Subfamily Microparyphiinae Mendheim, 1943

33. Genus *Microparyphium* Dietz, 1909

47. *Microparyphium montei* Verma, 1936

1936. *Microparyphium montei* Verma, *Allahabad Univ. Stud.*, 12 : 147-188.

Material : Host : common kingfisher, *Alcedo atthis*.

Diagnosis : Body elongate, posterior portion drawn into caudal process. Body length 7.61-9.38 and maximum breadth in the ovarian region 1.22-1.39; cuticle spined anteriorly. Head collar poorly developed, spines in single uninterrupted row. Number of spines not mentioned. Oral sucker $0.21-0.22 \times 0.22-0.23$. Pharynx well developed. Oesophagus 0.04; Caeca run upon posterior extremity. Acetabulum larger than oral sucker, close to it, $0.62-0.78 \times 0.63-0.78$. Testes elongate, tandem, lobed, postequatorial. Cirrus sac small, between caecal bifurcation and acetabulum. $0.28-0.32 \times 0.16-0.24$. Genital pore submedian immediately postbifurcal. Ovary postequatorial. Vitelline follicles

lateral, from postacetabular zone to posterior end. Uterus between testes and acetabulum. Metraterm distinguishable. Eggs embryonated, $0.126-0.154 \times 0.07-.09$.

Distribution : India : West Bengal (Calcutta).

Subfamily Echinochasminae Odhner, 1911

Key to genera

1. Vitellaria extending upto pharynx, confluent in preacetabular and postacetabular level
Episthmium
- Vitellaria not extending upto pharynx 2
2. Vitellaria not extending beyond acetabulum, not confluent anteriorly *Echinochasmus*

34. Genus *Episthmium* Luhe, 1909

48. *Episthmium caninum* (Verma, 1935) Yamaguti, 1958

(Fig. 21)

1935. *Episthochasmus caninum* Verma, *Proc. Indian Acad., Sc.* 1(12) : 837-856.

1958. *Episthmium caninum* Yamaguti, *Systema Helminthum* Vol. 1 Interscience Pub, Newyork, 1-1575.

Material : Host : Dog.

Diagnosis : Body length 0.85-3.26; cuticle with spines, collar with 24 spines 12 on each side. Four spines in two rows forms the corner group. Oral sucker almost half the size of acetabulum. Oesophagus 0.21-1.0 caeca upto posterior extremity Testes tandem close to each other, cirrus sac anterodorsal to acetabulum or overlapping it. Genital pore in between caecal bifurcation and acetabulum. Ovary pretesticular submedian, postacetabular uterus in between testes and acetabulum very short. Vitellaria quite extensive, from pharyngeal level to hind end, contiguous in oesophageal and posttesticular level. Eggs $0.07-0.91 \times .08-0.12$.

Distribution : India : West Bengal (Calcutta); Uttar Pradesh.

Other records : Japan. Burma.

Remarks : Chatterjee (1954), Gupta and Pande (1963) suggested synonymy of *Episthochasmus caninum* Verma, 1935 with *Echinochasmus corvus* Bhalerao, 1926. Yamaguti (1971), Mehra (1980) maintained the synonymy of the species. They held the genus *Episthmium* valid and transferred the species *E. corvus* Bhalerao, 1925 under it.

49. *Episthmium corvus* (Bhalerao, 1926) Mehra, 1980

1926. *Echinochasmus corvus* Bhalerao, *Parasitology*, 18, 387.

1980. *Episthmium corvus* Mehra, *Fauna of India, Platyhelminthes I* Calcutta : 1-409.

Material : Host : *Corvus splendens*.

Diagnosis : Body length 0.98-2.09, collar $0.9-0.12 \times 0.21$. Four peripheral large spines in two rows. Total spines 24, arranged in two groups of 12, interrupted dorsally. Testes postequatorial,

tandem, crescent shaped. Ovary pretesticular, submedian. Vitellaria confluent in precaecal and posttesticular level, very extensive. Cirrus sac 0.22×0.25 , extends almost to the base of posterior margin of testis, genital pore at anterolateral corner of acetabulum. Uterus limited between anterior testis and ventral sucker, passes dorsally to ventral sucker and opens at genital pore; eggs few, 4-15, $0.07-0.1 \times 0.04-0.06$.

Distribution : India : West Bengal (Calcutta); Uttar Pradesh.

35. Genus *Echinochasmus* Dietz, 1909

50. *Echinochasmus perfoliatus* (Ratz, 1908) Gedoelst, 1911

1908. *Echinostoma perfoliatus* Ratz, *Allat. Közlem.* 7(1) : 15-20.

1911. *Echinochasmus perfoliatus* Gedoelst, *Synopsis des Parasitologie de l'homme et des animaux domestiques*, 322 p.

Material : Host : Cat, Dog, Pig, Man.

Diagnosis : Body oval 3-5 long, cuticle spined. Collar spines 24 of equal size. Acetabulum larger than oral sucker. Oesophagus moderately long. Caeca lateral, reach almost upto hind end. Testes postequatorial, tandem. Cirrus sac overlapping acetabulum anteriorly. Genital pore postbifurcal, preacetabular, submedian. Ovary pretesticular submedian. Vitellaria lateral, from anterior margin of acetabulum to hind end, overlapping caeca, intrude in intercaccal field in posttesticular level, not contiguous. Uterus in between ovary and acetabulum. Eggs elliptical, $0.090-0.130 \times 0.055-0.095$.

Distribution : India : West Bengal (Calcutta); Maharashtra, Andhra Pradesh, Tamil Nadu, Orissa.

Other records : Indonesia, Japan, Korea, China.

Remarks : Maplestone and Bhaduri (1940) obtained this parasite 14 and 39 times out of 100 dogs examined in each case from Calcutta. Chandler (1925) also recorded this parasite from dogs in Calcutta.

XIII. Family Psilostomidae Looss, 1900

Subfamily Psilostominae Looss, 1900

36. Genus *Psilochasmus* Luhe, 1909

51. *Psilochasmus oxyurus* (Creplin, 1825) Luhe, 1909

(Fig. 22)

1825. *Distoma oxyurus* Creplin, *Observation de entozois* Gryphew., 86 pp.

1909. *Psilochasmus oxyurus* Luhe, *Parasitische plattourmer 1. Trematoden. Susswasserfauna Dentschi. Heft., 17* : 215.

Material : Host : Domestic duck.

Diagnosis : Body length 4.52-8.12. Cuticle smooth. Acetabulum almost double the size of oral sucker. Oesophagus of varying length. Testes tandem in posterior third of body. Ovary pretesticular, subequatorial or equatorial. Vitellaria mostly extracaccal, lateral, from postacetabular level to hind end, confluent anteriorly and posteriorly. Cirrus pouch very long, extending behind acetabulum upto ovary. Genital pore, variable, between acetabulum and caccal bifurcation. Eggs $0.08-0.11 \times .056-0.07$.

Distribution . India : West Bengal (Medinipur); Maharashtra, Uttar Pradesh, Andhra Pradesh..
Other records : Europe, America, Russia, China.

XIV. Family Fasciolidae Railliet, 1893

Key to subfamilies

1. Intestinal caeca dendritic, acetabulum small; cirrus sac anterodorsal to acetabulum.....Fasciolinae
Intestinal caeca simple..... 2
2. Acetabulum much larger than oral sucker; cirrus sac long, extending far behind acetabulum.....
Fasciolopsinae

Subfamily Fasciolinae Railliet, 1893 : Stiles and Hassal, 1898

37. Genus *Fasciola* Linnaeus, 1758

Key to species

1. Body round.....*F. jacksoni*
Body elongate..... 2
2. Shoulders not prominent. Intestinal diverticles having internal branching *F. gigantica*
Shoulder and intestine otherwise 3
3. Shoulders prominent. Intestinal diverticles not having internal branching *F. hepatica*

52. *Fasciola gigantica* Cobbold, 1855

1855. *Fasciola gigantica* Cobbold, *N. Phil. J. n.s.* 2(2) : 262-266.

Material : Cow, buffalo.

Diagnosis : Body length 2.5-7.5 cm. Cephalic cone short, caeca branched internally. Acetabulum larger than oral sucker, 1.5-2.00 in diameter. Testes very much branched, tandem. Cirrus sac anterodorsal to acetabulum. Ovary also branched, submedian, pretesticular. Vitellaria lateral; uterus between ovary and acetabulum. Eggs 0.125-0.19 × 0.06-0.112.

Distribution : India : West Bengal (Calcutta, Siliguri, Darjeeling, Bankura), Cosmopolitan.

Other records : Africa, America.

53. *Fasciola hepatica* Linnaeus, 1758

1758. *Distoma hepaticum* Linnaeus, *Systema natural persegmatia*, 227 pp.

Material : Cattle, Sheep.

Diagnosis : Body with cephalic cone and distinct shoulder, 1.8-4.7 cm. Cephalic cone 3-5 long. Caeca branches on anterior part only. Acetabulum larger than oral sucker 1 : 6. Genital pore, median between caecal bifurcation and acetabulum. Testes branched. Cirrus sac small thin walled. Ovary very much branched, preacetabular. Vitellaria occupying all available space within caecal branching, laterally. Uterus forming rosette like cluster of coils between ovary and acetabulum. Eggs 0.13-0.15 × 0.06-0.09.

Distribution : India : West Bengal (Calcutta, Birbhum, Darjeeling, Siliguri, Jalpaiguri) cosmopolitan.

54. *Fasciola jacksoni* Cobbold, 1869

(Fig. 23)

1869. *Fasciola jacksoni* Cobbold, *Qurt. J. Micr. Sc.*, n.s., 9 : 48-49.

Material : Host : Elephant.

Diagnosis : Body almost round. Anterior and posterior end folded ventrally, 10-14, cuticle spined. Intestinal caeca branched, with many diverticles. Cirrus sac preacetabular, large, 6-9. Ovary and testes branched, vitellaria extensive, occupying two third of available space. Uterus very small. Eggs 0.112-0.125 × 0.0625-0.075.

Distribution : India : West Bengal (Jalpaiguri); Bihar, Madras, Punjab.

Other records : Burma.

Subfamily Fasciolopsinae Odhner, 1910

38. Genus *Fasciolopsis* Looss, 1899

55. *Fasciolopsis buski* (Lankester, 1857) Stiles, 1901

1857. *Distoma buski* Lankester. Appendix B to *Kuchenmeister Gattlob Fieldricks Heimrich*, 1857 : 438-443.

1901. *Fasciolopsis buski* Stiles, *Veterinarian*, London, 74 : 190-200.

Material : Host : Pig.

Diagnosis : Body length 2.0-7.5 cm, cuticle spinose. Acetabulum larger than oral sucker, ratio 1 : 3.2-3.4. Oesophagus almost absent; caeca simple without branching, extends upto posterior end in zig zag course. Testes branched, tandem, in postequatorial zone. Cirrus sac sinuous, 0.8 in length. Ovary pretesticular, divided in three main branches which are further subdivided. Uterus between ovary and acetabulum. Eggs 0.12-0.16 × 0.08-0.95.

Distribution : India : West Bengal (Darjeeling, Maldah); Uttar Pradesh.

Other records : Burma, Japan.

XV. Family Schistosomatidae Stiles and Hassal, 1898 : Poche, 1907

Subfamily Schistosomatinae Stiles and Hassal, 1898

39. Genus *Schistosoma* Weinland, 1858

Key to species

1. Intestinal caeca unite near equator..... 2
- Intestinal caeca unite at equator..... 3
2. Testes four to five, ovary near junction of posterior and middle third of body. Eggs oval with terminal spine 0.120-0.150 × 0.040-0.080..... *S. haematobium*

3. Testes usually 2 to 7 4
 Testes more than 7 5
4. Eggs suboval with a symmetrical spine. $0.97-0.148 \times .045-0.082$*S. incognitum*
 Eggs elongated spindle shaped, symmetrical with both ends drawn out, one end provided with terminally bent spine, $0.336-0.42 \times 0.38-0.055$ *S. nasalis*
5. Testes 5-16. Eggs oval with terminal spine, $0.07-0.12 \times 0.027-0.072$*S. indicum*

56. *Schistosoma indicum* Montgomery, 1906

(Fig. 24)

1906. *Schistosoma indicum* Montgomery, *J. Trop. Vet. Sc.*, 1(2) : 138-174.

Material : Host : Cattle, Buffalo.

Diagnosis : Male body 'C' shaped, $4.1-19.45 \times 0.16-0.73$. Anterior body $0.54-0.45$, posterior body flattened, leaf like with gynaecophoric canal, $3.75-18.4 \times 0.3-0.5$. Cuticle tuberculate, spined. Acetabulum larger than oral sucker, spined, pedunculate. Oesophagus with oesophageal glands. Caeca unite to form common caecum, end blindly some distance before posterior end. Testes 5-16 in alternate double row, postacetabular. Vesicula seminalis kidney shaped, $0.04-0.086$ long. Ductus ejaculatorius near posterior extremity. Female body cylindrical, $4.9-26.4 \times 0.08-0.3$, spines in posterior extremity. Both suckers in anterior region. Oral sucker armed. Acetabulum $0.04-0.06$ in diameter. Oesophagus with oesophageal gland, bifurcates at preacetabular area, caeca reunite to form common caecum at postovarian zone. Common caecum may again bifurcate and reunite in its course to posterior end. Ovary immediately postequatorial. Oviduct arises from tapering end of ovary. Vitellaria coextensive with common caecum, end near caecal termination. Ootype lined with glandular cells. Genital pore midventral, postacetabular. Eggs oval with terminal spine, $0.07-0.12 \times 0.027-0.043$. Length of spine $0.005-0.013$.

Distribution : India : West Bengal (North & South 24-Parganas, Medinipur, Darjeeling, Bankura); Uttar Pradesh, Bihar, Andhra Pradesh.

57. *Schistosoma nasale* Rao, 1933

(Fig. 25)

1933. *Schistosoma nasale* Rao, *Indian J. Vet. Sci. Anim. Husb.*, 3 : 29-38.

Material : Cattle, Buffalo.

Diagnosis : Male body $6.30-11.0$ in length and $0.33-0.55$ broad. Anterior body spindle shaped, contains two suckers. Posterior body folded up forming gynaecophoric canal, covered with tubercles. Oral sucker $0.1-0.25 \times 0.19-0.23$. Ventral sucker pedunculate, fairly large $0.22-0.335$. Oesophagus $0.32-0.51$, bifurcates just anterior to ventral sucker. Testes 3-6, placed dorsally in one row, just behind ventral sucker. Vesicula seminalis pear shaped, pretesticular. Ductus ejaculatorius opens near gynaecophoric canal. Female body cylindrical, $7.0-11.0 \times 0.103-0.203$. Cuticle smooth except at posterior end which bears spines. Oral sucker $0.05-0.1 \times 0.032-0.048$. Ventral sucker spined $0.038-0.041$ in diameter. Oesophagus $0.11-0.18$, bifurcates just above ventral sucker. Caeca run parallel and unite at postovarian zone to form common caecum, extend to about $0.6-0.7$ from truncated posterior extremity. Ovary precaecal to union. Uterus in front of ovary, opens at genital pore

posterior to ventral sucker, with 4-5 eggs at a time. Vitelline follicle co-extensive with common caecum, terminate in front of posterior extremity. Eggs spindle shaped, asymmetrical, with one convex and other concave end. Eggs in uterus measure 0.3×0.043 ; those in nasal discharge $0.336-0.42 \times 0.038-0.043$.

Distribution : India : West Bengal (Medinipur, Bankura, Puruliya); Madras, Andhra Pradesh, Kerala, Madhya Pradesh, Bihar, Uttar Pradesh.

Other records : Burma.

58. *Schistosoma incognitum* Chandler, 1926

(Fig. 26)

1926. *Schistosoma incognitum* Chandler, *Indian J. Med. Res.*, 14 : 179-183.

Material : Host : Pig.

Diagnosis : Male body divided in two parts, a short cylindrical anterior portion with two suckers, a long flat posterior portion with incurved lateral margin to form gynaecophoric canal, $2.43-8.86 \times .01-0.457$. Cuticle of posterior body with scattered spined tubercles dorsally, minute spines ventrally. Oral sucker $0.1-0.2 \times 0.08-0.18$. Acetabulum 0.08×0.26 in diameter. Oesophagus $0.16-0.36$ in length, bifurcates at preacetabular level. Caeca unite to form common caecum at middle third of body, may bifurcate and reunite in its course to posterior extremity, or slightly short of it. Testes 2-7. Vesicula seminalis pretesticular, $0.026-0.49 \times 0.026-0.032$, opening ventrally by a canal of almost same length. Genital pore at beginning of gynaecophoric canal.

Female usually shorter, $2.57-7.6 \times 0.05-0.14$. Cuticle smooth, finely spined. Oral sucker $0.05-0.1 \times 0.028-0.07$. Ventral sucker pedunculate, $0.03-0.057$ in diameter. Oesophagus bifurcates at preacetabular level, unite to form common caecum, extend upto $0.028-0.186$ from posterior end, may bifurcate or reunite a few time. Ovary a solid mass, in front of caecal union, Vitelline follicles extend from caecal union to almost the end of common caecum, filling all available space. Uterus a tube $0.257-0.757$, between caeca, opens through genital pore. It contains a single ovum at one time. Eggs flattend on side with symmetrical spine at one end, $0.097-0.148 \times 0.045-.081$.

Distribution : India : West Bengal (Calcutta); Uttar Pradesh.

Other records : Thailand.

59. *Schistosoma haematobium* (Bilharz, 1852) Weinland, 1858

(Fig. 27)

1852. *Distomum haematobium* Bilharz, *Ztschr. Wissensch. Zool.*, 4 : 72-76.

1858. *Schistosoma haematobium* Weinland, *Human Cestoides*, Cambridge : 93 pp.

Material : Host : Cow.

Diagnosis : Body length of male 10-15. Posterior part of body with tubercles bearing spines, ventral sucker pedunculate. Both suckers with spines. Testes 4-5. Oesophagus with two dilations. Intestine fork closely anterior to ventral sucker. Caeca divided at intervals.

Female body length 15-25, maximum width 0.25. cuticle smooth. Suckers and posterior end with spines. Intestinal caeca commence anterior to ventral sucker and unite in posterior third near ovary;

vitellaria extend from ovary to posterior end. Eggs elongate, oval in shape, with characteristic terminal spine, $0.12-0.16 \times .04-0.06$.

Distribution : India West Bengal (Calcutta); Maharashtra.

Other records : Africa, Australia, Europe, America.

Remarks : Blanford (1886) recorded ova of this parasites from large intestine of a transport bullock from Calcutta. Bhalerao (1934) doubted the identification and opined that the ova might be of *S. indicum*. *S. hamatobium* does not occur in India. All the records are doubtful.

XVI. Family Cephalogonimidae Looss, 1899

Subfamily Cephalogoniminae Looss, 1899

Genus *Cephalogonimus* Poirier, 1886

60. *Cephalogonimus gangeticus* Pande, 1932

1932. *Cephalogonimus gangeticus* Pande, *Bull. Acad. Sc. Allahabad*, 2(2) : 85-100.

Material : Host : *Trionyx gangeticus*.

Diagnosis : Body length 4.00-15.0, cuticle spined. Acetabulum larger than oral sucker in anterior third of body. Oesophagus short. Testes tandem, intercaecal; cirrus pouch long, claviform, enclosing seminal vesicle, prostatic complex and large ejaculatory duct. Genital pore anterodorsal to oral sucker. Ovary pretesticular, posterolateral to acetabulum, vitelline glands follicular, lateral, may be symmetrical, from around the level of ventral sucker to the level of testicular zone. Uterus in posttesticular region. Eggs $0.024-0.028 \times 0.015-0.01$.

Distribution India : West Bengal (Calcutta, Hugli); Uttar Pradesh.

Remarks : This species has been considered synonym of *C. amphiumae* Chandler, 1923 by Bhalerao (1936) and synonym of *C. emydis* Moghe, 1932, by Rai (1961).

XVII. Family Acanthostomidae Nicoll, 1914 : Poche, 1926

Subfamily Acanthostominae Nicoll, 1914

41. Genus *Acanthostomum* Looss, 1899

61. *Acanthostomum burminis* (Bhalerao, 1926) Bhalerao, 1940

(Figs. 28, 29)

1926. *Acanthochasmus burminis* Bhalerao, *Parasitology*, 18 : 4-13.

1940. *Acanthostomum burminis* Bhalerao, *Indian J. Ver. Sc. Anim Husb.* 10(1) 96-97.

Material : Host : *Xenochrophis piscator*.

Diagnosis : Body length 2 to 4, cuticle spined. Oral sucker with a single row of 24-28 spines, arranged in circle. Spines are $0.028-0.04 \times 0.012-0.024$ in size. Acetabulum larger than oral sucker, ratio 2 : 1. Oesophagus short. Caeca extend upto 0.12-0.18 from posterior end; anal opening funnel shaped. Caccum of right side atrophied. Testes tandem, at posterior third, vesicula seminalis postacetabular. Genital pore preacetabular. Ovary pretesticular. receptaculum seminis $0.069-0.09 \times 0.06-0.117$. Uterus between ovary and acetabulum. Vitellaria restricted from equatorial level to preovarian zone. Eggs $0.027-0.042 \times 0.011-0.0182$.

Distribution : India : West Bengal (North & South 24-Parganas, Puruliya, Bankura); Uttar Pradesh, Madhya Pradesh, Andhra Pradesh.

Other records : Burma.

Remarks : Nasir (1974) revised the genus *Acanthostomum* and recognised only two species as valid. *A. scyphocephalum* (Braun, 1899) for the new world species and *A. imbatiforme* (Mol., 1859) for old world species. He suggested synonymy of the genera *Acanthochasmus*, *Atrophocaecum*, *Caimaricola*, *Haplocaecum* and *Proctocaecum* with the genus *Acanthostomum*. About nineteen species have so far been described under the genus *Acanthostomum* of which seven are from India.

XVIII. Family Strigeidae Railliet, 1919

Subfamily Strigeinae Railliet, 1919

42. Genus *Strigea* Abildgaard, 1790

62. *Strigea elongata* Yamaguti, 1935

1935. *Strigea elongata* Yamaguti, *Jap. J. Zool.*, 6 : 159-182.

Material : Host : *Oriolus xanthersous*.

Diagnosis : Body bipartite. fore body 0.67-0.83 × 0.45-0.6 hind body 1.70-4.0 × 0.5-0.6. Pseudosuckers present. Tribocytic organ divided into two lobes reaching upto anterior margin of forebody, vitellaria in forebody, intrude in tribocytic organ. Genital cone well differentiated, enclosing hermaphroditic duct, formed by union of uterus with ejaculatory duct. Eggs 0.084-0.09 × 0.036-0.069.

Distribution : India : West Bengal (Digha); Uttar Pradesh.

Other record : Japan, Poland.

Remarks : Dubois (1968) synonymised this species with *Strigea falconis mergregori* Tuhangui, 1932.

XIX. Family Diplostomidae Poirier, 1886

Subfamily Diplostominac Poirier, 1886 : Dubois, 1936

43. Genus *Diplostomum* Brandes, 1892

63. *Diplostomum (Delichorchis) splendens* Manna and Choudhury, 1973

1973. *Diplostomum (Delichorchis) splendens* Manna and Choudhury, *Zool. Anz.*, 190. 5/6 : 343-346.

Material : Host : *Corvus splendens*.

Diagnosis : Body divided in two regions. Total length 1.30-2.32. Forebody 0.44-1.16 × 0.76-0.87. Tribocytic organ elliptical situated close to acetabulum. Vitellaria extending from pseudosucker to genital cone; uterus in between ovary and isthmus. Eggs measures 0.060-0.069. The terminal ends of uterus and ejaculatory duct unite to form hermaphroditic canal opening at genital cone.

Distribution : India : West Bengal (Calcutta).

44. Genus *Neodiplostomum* Krause64. *Neodiplostomum cochleare* (Krause, 1914) La Rue, 1926

(Fig. 30)

1914. *Hemistomum cochleare* Krause, *Ztschr. Wiss. Zool.*, 112 : 93-238.1926. *Neodiplostomum cochleare* La Rue, *Tr. Am. Micr. Soc.*, 45 : 11-19.**Material** : Host : Hornbill.

Diagnosis : Body bipartite. Forebody 1.6-1.8 × 0.8-0.84; hind body 0.96-1.05 × 0.46-0.58. Oral sucker 0.084, smaller than acetabulum, 0.101. Tribocytic organ in posterior quarter of anterior body. Testes in hind body, median, tandem; ovary pretesticular round. Vitellaria extending forward beyond acetabulum, intruding in median field except in tribocytic organ, posteriorly in hind body vitelline follicles are lateral, extend only upto testicular level. Eggs large, few, distributed over testes also, 0.108 × 0.08.

Distribution : India : West Bengal, (Calcutta zoo), Uttar Pradesh.

Subfamily Alariinae Hall et Wigdor, 1918

45. Genus *Alaria* Schrank, 178865. *Alaria alata* (Goeze, 1782) Krause, 19141782. *Planaria alata* Goeze, *Versuch einer Naturgeschichte der Eingewidenermer thierischer Korper* : 471 pp1914. *Alaria alata* Krause, *Z. Wiss. Zool.* 112 : 93-228.**Material** : Host : Dog.

Diagnosis : Body bipartite. Forebody with pseudosuckers modified into auricular projections; hind body shorter. Body length 2.4-6. Tribocytic organ prominent. Pharynx well developed. Oesophagus short, bifurcates into two caeca, terminating at posterior end. Acetabulum near oral sucker, postbifurcal. Testes lobed, tandem, in hind body, posterior testis larger than anterior one. Seminal vesicle followed by muscular ejaculatory duct. Genital cone present. Bursa small, with subterminal genital pore. Ovary pretesticular, at the junction of body parts, uterus extending upto tribocytic organ. Vitellaria confined to forebody intruding in intercaecal zone. Eggs few 0.098-0.012 × 0.062-0.081.

Distribution : India : West Bengal (Jalpaiguri, Calcutta); Uttar Pradesh, Andhra Pradesh.

Other records : Europe, Siberia, Africa.

Remarks : Maplestone and Bhaduri (1940) recorded this parasite in eleven dogs out of 100 examined by them from Calcutta.

XX. Family Heterophyidae Odhner, 1914

Key to subfamilies

1. Testes single at posterior extremity..... Haplorchinae
- Testes double..... 2
2. Testes symmetrical or tandem..... Heterophyinae

Subfamily Haplorchinae Looss, 1899

46. Genus *Haplorchis* Looss, 1899

66. *Haplorchis taichui* (Nishigori, 1924) Pearson, 1964

1924. *Mohorchotrema taichui* Nishigori, *J. Ind. Ass. Formosa*, 237 : 569-610.

1964. *Haplorchis taichui* Pearson, *Parasitology*, 54 : 601-676.

Material : Host : Cat.

Diagnosis : Body length 0.055-1.3 right caecum may be slightly longer. Single testis gonotype with spines, numbering 14-15, fan shaped. Vitelline follicles large, from ovarian level to posterior end intrude in intercaecal zone at testicular level. Spines measures 0.0075-0.04. Eggs 0.013-0.027 × 0.012-0.026.

Distribution : India : West Bengal (Calcutta); Uttar Pradesh.

Other records : Egypt, Taiwan.

Subfamily Heterophyinae Odhner, 1914 : Ciurea, 1924

47. Genus *Heterophyes* Cobbold, 1866

67. *Heterophyes heterophyes* (Siebold, 1852) Stiles and Hassal, 1900

1852. *Distoma heterophyes* Siebold, *Institut. Paris* (974), 20(1) : 280-281.

1900. *Heterophyes heterophyes* Stiles and Hassal, *Ann. Rep. Bureau Animal Indust., U.S. Dept. Agri* (1899) : 563.

Material : Host : Dog.

Diagnosis : Body length 0.4-2.0 with scale like spines. Pharynx small, oesophagus of moderate length, divides into two caeca, extending upto hind end. Acetabulum larger than oral sucker, at middle third of body. Testes juxtaposed, slightly oblique, at caecal ends. Cirrus pouch absent. Genital pore sucker like with spines, posterolateral to acetabulum. Ovary pretesticular, vitellaria in hind body, anterior or anterolateral to testes. Uterus with loops, between testes and acetabulum. Eggs 0.02-0.03 × 0.01-0.017.

Distribution : India : West Bengal (Calcutta).

Other records : Ceylon, Africa, China, Japan.

XXI. Family Opisthorchiidae Braun, 1901

Key to subfamilies

1. Posterior end with sucker like depression..... Pseudamphistominae
- Posterior end smooth..... 2
2. Vitellaria in bunches, upto precovarian zone..... Opisthorchiinae

Subfamily Opisthorchiinae Looss, 1899.

Key to genera

1. Vitellaria continuous, extending upto ovary or anterior testis..... *Opisthorchis*
 Vitellaria otherwise 2
2. Vitellaria in bunches, extend upto posterior testicular level or further behind, divided into two regions around ovary..... *Amphimerus*

48. Genus *Opisthorchis* Blanchard, 189568. *Opisthorchis felineus* (Rivolta, 1834) Blanchard, 1895

1834. *Distoma felineus* Rivolta, *Gior. Anat. Fisiol & Patel. Animali.*, 16 : 20-28.

1895. *Opisthorchis felineus* Blanchard, *Bull. Soc. Zool. Francs.* 20 : 217.

Material : Host : Cat, Dog.

Diagnosis : Body elongate, 8-15, oral sucker larger than acetabulum, oesophagus short. Caeca terminate short of hind end, at posttesticular level. Testes at posterior third portion of body, lobed, obliquely tandem. Cirrus pouch absent. Genital pore just above acetabulum, median. Ovary, pretesticular, anterolateral to anterior testis. Seminal receptacle below ovary. Vitellaria in bunches, extracaecal. limited in extension from preacetabular level to preovarian zone. Uterine loops confined between ovary and acetabulum. Eggs 0.026-0.030 × 0.005-0.015.

Distribution : India : West Bengal (Calcutta); Uttar Pradesh.

Other records : Europe, Russia.

Remarks : Chander (1925) observed that 61% of 250 cats he had examined from Calcutta were infected with this parasite. But Maplestone and Bhaduri (1940) obtained this parasite only in 8 dogs out of 200 examined by them from Calcutta.

49. Genus *Amphimerus* Barkar, 191169. *Amphimerus noverca* (Braun, 1902) Barkar, 1911

1902. *Opisthorchis noverca* Braun, *Zool. Jahrb.*, 16 : 162.

1911. *Amphimerus noverca* Barkar, *Arch. Par.*, 14 : 513-561.

Material : Host : Pig, Wild dog (*Cuon dukhuensis*).

Diagnosis : Body length 4.8-5.6, breadth 1.85-2.1; protrucible pedicle without spines, bearing acetabulum and genital pore on the tip. Oral sucker 0.23-0.27, larger than acetabulum, 0.16-0.17. Oesophagus short, 0.04. Caeca lateral, upto posterior end. Testes in posterior third, round or lobate. Genital pore median, at anterior margin of acetabulum on pedicle, with acetabulum. Ovary irregularly lobed. Vitellaria in bunches having break in ovarian zone, consisting of 8 group of follicles. Uterus coiled anterior to ovary. Eggs .0125-0.13 × .07-0.08.

Distribution : India : West Bengal (Calcutta); Punjab, Bihar, Uttar Pradesh.

Other states : Phillipines.

Remarks : Mehra (1980) considered the genus *Amphimerus* as subgenus of *Opisthorchis*. Maplestone and Bhaduri (1940) recorded *Opisthorchis* var *lobata* and *O. v. oribiculata* from dogs of Calcutta. Yamaguti (1971) listed them as synonym of *A. noverca*.

Subfamily Pseudoamphistominae Yamaguti, 1958

50. Genus *Pseudamphistomum* Luhe, 1908

70. *Pseudamphistomum truncatum* (Rudolphi, 1819) Luhe, 1908

1819. *Amphistoma truncatum* Rudolphi, *Entozoarum synopsis in acca Mantissa duplex et indices locupitssini Benol.*, 811.

1908. *Pseudamphistomum truncatum* Luhe, *Ctbl. Bakt.*, 1, 48(4) : 426-436.

Material : Dog.

Diagnosis : Body length 1.64-2.5, cuticle spined. Posterior end with sucker like ventroterminal depression. Oral sucker and pharynx well developed. Oesophagus very short or absent. caeca sinuous, upto posterior extremity. Acetabulum in equatorial zone, almost of the same size as oral sucker. Testes diagonal, close together, overlapping. caeca posteriorly, near caecal end. Seminal vesicle convoluted. No cirrus pouch. Genital pore preacetabular. Ovary submedian. pretesticular Vitellaria with large follicles, extracaecal, from the genital pore to testicular level. Uterus with many loops, overlapping caeca, extending in preacetabular zone. Eggs 0.027-0.035 × 0.012-0.016.

Distribution : India : West Bengal (Calcutta); Punjab.

Other records : Europe, Russia.

XXII. Family Spirorchidae Stunkard, 1922

Subfamily Spirorchinae Stunkard, 1922

51. Genus *Hemiorchis* Mehra, 1939

71. *Hemiorchis bengalensis* Mehra, 1940

1940. *Hemiorchis bengalensis* Mehra, *Proc. nat. Acad. Sci. India*. 10(4) : 100-118.

Material : Host : *Hardella thurgi*.

Diagnosis : Elliptical in shape. Body length 6' and 'breadth 1.03-1.17' cuticle spined. Acetabulum one and half time larger than oral sucker. Oesoplagus slightly undulating with two bends. Intestinal caeca with forwardly directed loops lying parallel to oesophagus. Beyond acetabulum caeca with indented margins. Genital loops well developed. Testes twenty in number, arranged in linear series. Cirrus sac large, posttesticular, in front of ovary. Genital opening on left side, inside left caecum, within genital loop. Vitellaria intercaecal, from intestinal bifurcation to ovary, with numerous round follicles around acetabulum. Eggs 0.09 × 0.06.

Distribution : India : West Bengal (Ranaghat); Uttar Pradesh.

XXIII. Family Isparorchidae Poche, 1925

52. Genus *Isoparorchis* Southwell, 1913

72. *Isoparorchis hypselobagri* (Billet, 1898) Ejsmont, 1932

1898. *Distoma hypselobagri* Billet, *Bull. Sci., France Belgique*. 28 : 283.

1932. *Isoparorchis hypselobagri* Ejsmont, *Ann. Par.*, 10(5) : 453-547.

Material : Host : Man, Freshwater fishes.

Diagnosis : Body 10-30, cuticle smooth with crenulated margin. Oral sucker with preoral lobe. Pharynx and oesophagus very small. Caeca sharply sinuous, extend upto posterior extremity. Acetabulum within anterior third, larger than oral sucker. Testes symmetrical, within sinuous notch of caeca, posterior to acetabulum. Ovary at posterior zone. tubular. Seminal vesicle tubular, anterodorsal to acetabulum. Hermaphroditic sac preacetabular. Genital pore postbifurcal. Vitellaria dendritic with branch, overlaps caeca laterally; uterus with transverse loops across caeca. Metraterm distinguishable. Eggs $0.042-0.051 \times 0.022-0.027$.

Distribution : Widely distributed in fishes throughout India. Rarely in man.

Other records : China, Japan, Australia, Siberia.

Remarks : Common parasite in Swim bladder of freshwater siluroid fish. Occasionally recorded from human beings and other animals. Chandler (1926) recovered a specimen from a patient in Calcutta. He also discussed the pathogenic role of this species in Medinipur. Bhalerao (1932) recorded this parasite from a Crocodile in Assam. Srivastava (1977) discussed its hosts and distribution. Manna et al. (1986-92) are engaged in the studies of different aspect of this parasite in West Bengal.

XXIV. Family Balfouridae Travassos, 1951

53. Genus *Balfouria* Leiper, 1909

73. *Balfouria monogama* Leiper, 1909

(Fig. 31)

1909. *Balfouria monogama* Leiper, *Rep. Welcome Res. Lab.* : 187-199.

Material : Host : Open billed stork, *Anastomus oscitans*.

Diagnosis : Body length $6.21-8.5 \times 3.1-4.2$, cuticle spined. Head-collar with dorsally interrupted double row of spines. Body divided in three parts, anterior narrow, middle bulbus and conical posterior end. Caeca, reaching posterior extremity. Acetabulum larger than oral sucker 1 : 4.5 in ratio. Testes very small, one pressed against the other, diagonal or symmetrical. Cirrus sac 0.2. Genital pore preacetabular. Ovary preacetabular and pretesticular. Uterus strongly convoluted, occupying midbody, extending to hind body, when fully gravid. Eggs large 0.091×0.122 .

Distribution : India : West Bengal (Ranaghat, Hughli); Andhra Pradesh.

Other records : Sudan, Egypt.

XXV. Family Cyclocoelidae Stossich, 1902

Subfamily Cyclocoelinae Stossich, 1902

54. Genus *Cyclocoelum* Brandes, 1892

74. *Cyclocoelum (Cyclocoelum) mutabile* (Zeder, 1800) Brandes, 1892

(Fig. 32)

1800. *Monostoma mutabile* Zeder, *Erster Nachtrag Zur Naturgeschichte der Eingewide wurmer, mit Zufassen und Anmer Kungen herausgegeben.*, 320 pp.

1892. *Cyclocoelum mutabile* : Brandes, *Centralbl. Bakteriolog.*, 12 (15) : 504-511.

Material : Host : Stilt, *Himantopus himantopus*.

Diagnosis : Body length 7.5-18.7. Oesophagus short. Caeca without diverticles, united posteriorly. Testes oblique, separated from each other by uterine coils. Ovary in intertesticular zone, submedian, opposite to anterior testis. Uterus intercaecal. Vitellaria lateral to caeca, from caecal bifurcation to caecal end, not united. Eggs $1.05-1.32 \times .063-0.072$.

Distribution : India : West Bengal (Hughli, Puruliya); Uttar Pradesh, Rajasthan, Andhra Pradesh.

Other records Europe, America.

XXVI. Family Prosthogonimidae Luhe, 1909

55 Genus *Prosthogonimus* Luhe, 1899

Key to species

1. Vitellaria limited, in groups..... *P. putschkowskii*
 Vitellaria more extensive..... 2
2. Vitellaria not in groups, extends in postequatorial level..... *P. elongatus*

75. *Prosthogonimus putschkowskii* Skrjabin, 1912

1912. *Prosthogonimus putschkowskii* Skrjabin, *Arch. vet. Nauk. S. Petersburg*, 42(12) : 1270.

Material Host : Domestic fowl.

Diagnosis : Body length 4.69-7.93 greatest breadth 1.73-3.08 around postequatorial level. Cuticle spined. Oral sucker 0.24-0.36, globular. Pharynx 0.16-0.23, round. Oesophagus short. caeca terminate 1.35-1.37 short of posterior end. Ventral sucker larger than oral sucker 0.81-0.84. Testes pre-equatorial, symmetrical or slightly oblique. Genital pore at anterior end, on left side of oral sucker. Ovary pretesticular, postacetabular, lobed, 12-15 lobes. Vitelline follicles lateral, in groups, seven groups on left and 8-9 on right side, extend from middle third of body to some distance short of caecal extension. Uterine coils mostly intercaecal but at postcaecal end cover the whole breadth of the body. Eggs $0.019-0.047 \times 0.013-0.029$.

Distribution : India : West Bengal (Calcutta); Uttar Pradesh, Madhya Pradesh.

Other records : Europe, Africa, Russia, China, America.

Remarks : Present authors collected living specimen of this parasite, floating on a egg-pouch, served to a customer, in a Calcutta restaurant. This is a common parasite of bursa fabrii and oviduct of domestic fowl, which occasionally enters in the egg membrane also. This parasite is highly pathogenic, reduces egg production considerably, may also cause serious disease. Chatterjee (1938) also recorded *Prosthogonimus* sp. from an egg of hen.

76. *Prosthogonimus elongatus* Mukherjee, 1967

(Fig. 33)

1967. *Prosthogonimus elongatus* Mukherjee, *Indian J. Helminthol.*, 18(2) : 91-93.

Material : Host : Pigeon, *Columba livia*.

Diagnosis : Body length 2.91-4.43; 0.66-0.83 in maximum breadth, in region of gonads. Cuticle spined. Oral sucker 0.23-0.35 in diameter, larger than ventral sucker, which is 0.095-0.13, within anterior fourth of the body. Oesophagus is absent. Two broad intestinal caeca extend upto posterior level or a little further from the level of posterior testis. Testes symmetrical, postacetabular, overlapping caeca. Cirrus sac small, close to oral sucker, extend upto the level of caecal bifurcation. Genital pore near oral sucker. Ovary lobed, pretesticular, close to acetabulum. Vitellaria follicular, lateral, slightly asymmetrical from behind caecal bifurcation to a little postequatorial level of the body. Uterus massive, occupying all available space at posttesticular level. Eggs. 0.032-0.042 × 0.011-0.021.

Distribution : India, West Bengal (Calcutta).

Remarks : Yamaguti, 1971 remarked that due to its body shape and extensive vitellaria it can well be placed in a separate subgenus.

XXVII. Family Brachylaimidae Miller, 1936

Subfamily Brachylaiminae Miller, 1936

56. Genus *Glaphyrostomum* Braun, 1901

77. *Glaphyrostomum indicum* Mukherjee, 1964

(Fig. 34)

1964. *Glaphyrostomum indicum* Mukherjee, *India J. Helminth.*, 16 (1) : 52-55.

Material : Host : Pigeon, *Columba livia*.

Diagnosis : Body without spines, length 5.2-6.93; maximum breadth 0.64-0.79 at postacetabular zone; oral sucker 0.21-0.25 × 0.24-0.29; oesophagus very short, 0.04-0.06 in length; Caeca terminates almost at the posterior end. Acetabulum 1.06-1.29 in diameter, within anterior fourth of body. Testes in posterior region of body, tandem. Genital pore between anterior margin of ovary and posterior margin of anterior testis, about 1.06-1.08 from posterior end. Ovary intertesticular; vitellaria follicular, asymmetrical, extracaecal or overlapping caeca, extend from around caecal bifurcation to the middle of ovary; uterus intercaecal, may overlap caeca, extensive, occupies all available space, reaches upto bifurcal level, then descends backwards to the genital pore. Eggs 0.021 × 0.011.

Distribution : India : West Bengal (Calcutta).

XXVIII. Family Notocotylidae Diesing, 1839

Subfamily Notocotylinae Diesing, 1839 : Kossack, 1911

57. Genus *Notocotylus* Diesing, 1839

78. *Notocotylus attenuatus* (Rudolphi, 1809) Kossack, 1911

(Fig. 35)

1809. *Monostoma attenuatum* Rudolphi, *Entozoonem sive Vermium intestinalium historia naturalis*, 2(1), 457 pp.

1911. *Notocotylus attenuatus* Kossack, *Zool. Jahrb., Jena. Abt. Syst.*, 31(4), 491-590.

Material : Host : Duck.

Diagnosis : Body elongate, attenuated anteriorly. Body size 2.35-4.45 × 0.67-1.49. Ventral glands in three rows. Oesophagus short. Intestinal caeca extend upto hind end. Testes crenulated, at hind end, symmetrical, extracaecal. External seminal vesicle tubular, long, winding. Cirrus pouch pre-equatorial. Genital pore at postbifurcal zone. Ovary intercaecal, intertesticular. Vitellaria follicular, extracaecal, from equatorial zone to pretesticular level. Uterus forming loops, in between ovary and cirrus pouch. Metratrem conspicuous. Eggs 0.016-0.022 × 0.01-0.016.

Distribution : India : West Bengal (Medinipur); Uttar Pradesh, Rajasthan.

XXIX. Family Paragonimidae Dollfus, 1939

58. Genus *Paragonimus* Braun, 1889

79. *Paragonimus westermanii* (Kerbert, 1878) Braun, 1899

1878. *Distoma westermanii* Kerbert, *Zool. Anz. Leipzig*, 1 : 271-273.

1899. *Paragonimus westermanii* : Braun, *Bakterial*. 5(24) : 794

Material : Host : Tiger, Cat, Mongoose, Dog.

Diagnosis : Body length 7.5-13 and breadth 4-6; cuticle spined. Oral sucker slightly smaller than equatorial ventral sucker. Caeca undulating reach upto posterior end. Testes lobed, symmetrical, intercaecal, postequatorial in position. Cirrus pouch absent. Genital pore posterolateral to ventral sucker. Ovary lobed, submedian, pretesticular. Vitellaria extensive, extend on dorsal and lateral side from caecal bifurcation to posterior end. Uterus with many loops, pretesticular, opposite to ovary, overlaps caeca of one side. Eggs with indistinct operculum, 0.08 × 0.045.

Distribution : India : West Bengal (Calcutta); Uttar Pradesh, Kerala, Tamil Nadu.

Other records Japan, China, Thailand, Korea, Europe, America.

XXX. Family Paramphistomidae Fiscoeder, 1901

Key to subfamilies

1. Body divided in two portions Gastrodiscinae
Body not divided in two portions 2
2. Ventral pouch present..... Gastrothylacinae
Ventral pouch absent..... 3
3. Oral diverticula absent..... 4
Oral diverticula present 5
4. Cirrus pouch absent..... Paramphistominae
5. Pharynx with paired diverticula, vitellaria encroaching intercaecal field..... Diplodiscinae
Vitellaria not in intercaecal, zone 6
6. Acetabulum with caudal appendage. Oral sucker with small diverticula Zygocotylinae
Acetabulum without appendage 7
7. Preoral papillae present. Pharyngeal bulb elongate Orientodiscinae
No preoral papillae 8

8. Oesophagus long, 'J' shaped with anterior muscular and posterior glandular portions
 Cladorchiinae

Subfamily Paramphistominae Fiscoeder, 1901

59. Genus *Paramphistomum* Fiscoeder, 1900

Key to species

- 1 Intestinal caeca wavy; papillae on the mouth present *P. cervi*
 Intestinal caeca otherwise; no papillae on the mouth..... 2
 2. Intestinal caeca sinuous *P. explanatum*

80. *Paramphistomum cervi* (Zeder, 1790) Fiscoeder, 1901

(Fig. 36)

1790. *Fistularia cervi* Zeder. *Schrift, Gesellsch. Naturt. F. Berlin*. 10(1) : 65-74.

1901. *Paramphistomum cervi* Fiscoeder, *Zool. Anz.*, 24 : 367-375.

Material : Host : Cow, Buffalo.

Diagnosis Body conical, 5-12, concave ventrally and convex dorsally, surface wrinkled, papillae may be present in circumoral region. Caeca convoluted or straight ending dorsal to acetabulum. Testes lobed, tandem or oblique. Genital atrium present very near base of acetabulum. Vitellaria from oral sucker to caecal end. Eggs 0.148 × 0.077.

Distribution : India : West Bengal (Calcutta, Hughli, Medinipur, Haora, Barddhan, Puruliya, Darjeeling); widely distributed.

Other records : Cosmopolitan.

81. *Paramphistomum explanatum* (Creplin, 1847) Fiscoeder, 1904

(Fig. 37)

1847. *Amphistoma explanatum* Creplin, *Arch. Naturg., Berlin*. 135, 1 : 289-300.

1901. *Paramphistomum explanatum* : Fiscoeder, *Zool. Jahrb.*, 20 : 453-470.

Material : Host : Cattle.

Diagnosis : Body conical 6-12 in length. Ratio of acetabulum to body length 1 : 2.3; oral sucker with sphincter at anterior end, lumen of sucker spindle shaped with 12-17 conical papillae on each side. Testes diagonal, one overlapping the other, lobed, cauliflower like. Pars musculosa well developed. Genital atrium present. Ovary round, dextral. Uterus coiled dorsal to testes. Genital pore median, below intestinal bifurcation. Eggs 0.133 × .087.

Distribution : India : West Bengal (Haora, West Dinajpur, Calcutta, Siliguri, Jalpaiguri, Puruliya), widely distributed in India.

Other records : Africa, Australia, Philippines.

60. Genus *Cotylophoron* Stiles and Goldberger, 1910

Key to species

1. Oesophageal bulb present, testes diagonal, deeply lobed *C. cotylophorum*
 Oesophageal bulb absent, testes tandem or oblique 2
2. Testes oblique, irregularly lobed *C. orientalis*
 Testes tandem, deeply lobed
3. Testes with thread like ramification *C. indicum*

82. *Cotylophoron cotylophorum* (Fischöeder, 1901) Stiles and Goldberger, 1910

1901. *Paramphistomum cotylophorum* Fischöeder, *Zool. Anz.*, 24 : 367-375.

1910. *Cotylophoron cotylophorum* Stiles and Goldberger, *Hyg. Lab. Bull.*, No. 60 : 259.

Material : Host : Cattle, Goat.

Diagnosis : Length 5-8. Ratio of acetabulum to body length 1 : 2.7. Oesophagus with strongly developed oesophageal bulb. Caeca wavy terminate in acetabular level. Testes lobed, diagonal. Ovary posttesticular. Genital atrium present. Genital pore just postbifurcal. Eggs 0.125-0.140 × 0.055-0.068.

Distribution : India (widely distributed in ruminants) in all districts of West Bengal.

Other records : Africa, Congo, Indo-China, Phillipines.

83. *Cotylophoron indicum* Stiles and Goldberger, 1910

(Fig. 38)

1934. *Cotylophoron indicum* Stiles and Goldberger *Bull. 60. Hyg. Lab. U.S. Publ. Heal Mar. Hosp. Serv.*, 1-259.

Material : Host : Goat, Cattle, Deer

Diagnosis : Length 3.68-5.85, ratio of acetabulum in relation to body length 1 : 2.6-1 : 3.7. Testes deeply lobed with thread like ramification, tandem. Genital atrium present. Ovary dorsolateral to acetabulum. Enggs 0.148 × 0.078.

Distribution : India : West Bengal (Calcutta, Howrah, Hooghly, Darjeeling, Purulia, Birbhum), widely distributed in India.

84. *Cotylophoron orientalis* Harshey, 1934

1934. *Cotylophoron orientalis* Harshey, *Proc. Acad. Sc. U.P. Agra. and Oudh.*, 4(1) 95-106.

Material : Host : Sheep, Goat, Sable antelope (*Hippotragus niger*).

Diagnosis : Length 7.56-9.35, cuticle smooth. Caecal bifurcation acute angled. Testes tandem, irregularly lobed. Ovary median or submedian near acetabulum. Genital sucker 0.25-0.34 in diameter. Pars prostatica well developed. Shell gland just behind ovary. Eggs 0.136 × 0.085.

Distribution : India : West Bengal (Calcutta); Uttar Pradesh.

61. Genus *Ceylonocotyle* Nasmark, 1937

Key to species

1. Oesophageal bulb present 2
 Oesophageal bulb absent..... 3
2. Testes round, tandem, ovary preacetabular *C. scoliocoelium*
3. Oesophagus surrounded by glands, musculature of oesophagus immediately anterior to intestinal fork strongly developed..... *C. cuonum*
 Oesophagus not surrounded by glands 4
4. Testes tandem, lobed. vitellaria from middle of oral sucker to acetabulum, may intrude in intercaecal area.....*C. maplestoni*

85. *Ceylonocotyle scoliocoelium* (Fischöeder, 1904) Nasmark, 1937

(Fig. 39)

1904. *Paramphistomum scoliocoelium* Fischöeder, *Zool. Jahrb., Jena Abt. Syst.*, 20(5) : 453-470.1937. *Ceylonocotyle scoliocoelium* Nasmark, *Zool. Bid. Frol. Uppsala* 16 : 1-565*Material* : Host : Goat, Cattle, Buffalo, Deer

Diagnosis : Body length 4.08-6.95, cuticular papillae may be present anteriorly. Oesophagus 0.46-1.21, provided with oesophageal bulb. Caeca wide, undulating, extends upto acetabulum. Testes tandem. Genital pore postbifurcal. Ovary posttesticular. Vitellaria with large follicles from bifurcal zone to caecal end, extracaecal, asymmetrical or overlapping in some. Eggs 0.12-0.17 × .06-0.08.

Distribution : India : West Bengal (Calcutta, Birbhum, Bardhaman, Siliguri, Jalpaiguri, Puruliya), widely distributed.

Other records : Indo-China, Africa.

86. *Ceylonocotyle cuonum* (Bhalerao, 1937) Mukherjee and Chauhan, 19651937. *Paramphistomum cuonum* Bhalerao, *J. Helminth.*, 15 : 97-124.1965. *Ceylonocotyle cuonum* Mukherjee and Chauhan, *J. zool. Soc. India*, 17 : 150-225.*Material* : Host : *Cuon dukhunensis*

Diagnosis : Body length 3.35-5.7. Acetabulum larger than oral sucker. Testes lobed or not, tandem, equatorial. Genital pore 0.22, posterior to caecal bifurcation. Ovary posttesticular. Uterine coil dorsal to both the testes. Metraterm thick. Vitellaria follicular, extensive, from level of genital pore to acetabulum, mostly extracaecal. Eggs 0.012-0.013 × .05-.06.

Distribution : India : West Bengal (Calcutta Zoo).

Remarks : Bhalerao, (1937) described this species from wild dog and placed it in the genus *Paramphistomum*. Yamaguti (1978) placed it under a new genus *Pseudoparamphistoma* Mukherjee and Chauhan (1965) placed it under *Ceylonocotyle*.

87. *Ceylonocotyle maplestoni* (Bhalerao, 1937) Mukherjee and Chauhan, 1965

(Fig. 40)

1937. *Paramphistomum maplestoni* Bhalerao, *J. Helminth.*, 15 : 91-124.1965. *Ceylonocotyle maplestoni* Mukherjee and Chauhan, *J. zool. Soc. India*, 17 : 150-225.**Material** : Host : Hog deer, *Hyelaphus porchnus***Diagnosis** : Body length 4.05-5.02. Oesophagus 0.2-0.22. Caeca terminate a short distance 0.22 away from acetabulum. Testes lobed, tandem, equatorial. Parsmuculosa and parsprostatica well developed. Prostate gland present. Ovary posttesticular; vitellaria follicular, extensive, from middle of oral sucker to anterior border of acetabulum, extracaecal, some times intrude in intercaecal zone. Genital pore median, below intestinal bifurcation. Eggs 0.115-0.119 × 0.05-0.052.**Distribution** : India : West Bengal (Calcutta Zoo).

Subfamily Gastrodiscinae Monticelli, 1812

Key to genera

1. Ventral surface of posterior portion covered with papillae. Vitellaria occupying whole extracaecal field..... *Gastrodiscus*
Papillae and vitellaria otherwise 2
2. Ventral surface of posterior portions not covered with papillae. Vitellaria extending from level of posterior testis to acetabular zone..... *Gastrodiscoides*

62. Genus *Gastrodiscus* Laukart, 1877

Key to species

1. Genital pore immediately behind cephalic cone, prebifurcal; vitellaria only between intestinal caeca and free margin of discoidal portion of body *G. aegyptiacus*
Genital pore and vitellaria otherwise 2
2. Genital pore posterior from base of cephalic cone, postbifurcal. Vitellaria distributed throughout whole discoidal portions of body *G. secundus*

88. *Gastrodiscus secundus* Looss, 1907

(Fig. 41)

1907. *Gastrodiscus secundus* Looss, *Ann. Trop. Med. and Parasitol.*, 1(1) : 121-154.**Material** : Host : Elephant.**Diagnosis** : Body colour pink when fresh. Divided between two parts, anterior small, posterior large discoidal, cephalic portion 1.09-1.17 × 1.87-2.6. Papillae present. Oral sucker with two oral pouches laterally. Caeca terminate near acetabular level. Testes lobed, diagonal. Genital pore postbifurcal. Ovary near left side of acetabulum; vitellaria in discoidal part. Eggs 0.119-0.191 × 0.087.**Distribution** : India : West Bengal (Jalpaiguri), Tamilnadu, Assam, Andhra Pradesh.89. *Gastrodiscus aegyptiacus* (Cobbold, 1876) Railliet, 1892

(Fig. 42)

1876. *Diplostomum aegypticum* Cobbold, *Vetarinarian*, London, (587) 49, 4 5(263) 22: 755-758.1893. *Gastrodiscus aegyptiacus* Railliet, *C.R. Soc. Biol.*, (26): 633-634.

Material : Host : Horse.

Diagnosis : Body divided in two parts. Cylindrical anterior part and papillated, large discoidal posterior part. Acetabulum small with raised margins. Oral sucker with paired pouch. Caeca long, straight, extend upto acetabular zone. Testes lobed, diagonally tandem. Ovary posttesticular, may be lobed. Vitellaria between intestinal caeca and free margin of posterior portion of body. Genital pore behind cephalic cone, postbifurcal. Eggs $0.17-0.19 \times 0.41$.

Distribution : India : West Bengal (Darjeeling) ; Assam. Other records : Europe, Africa.

63. Genus *Gastrodiscoides* Leiper, 1913

90. *Gastrodiscoides hominis* (Lewis and Mc Connell, 1876) Leiper, 1913

(Fig. 43)

1876. *Amphistoma hominis* Lewis and Mc Connell, *Proc. Asiatic Soc. Bengal*, 8 : 182-186.

1913. *Gastrodiscoides hominis* Leiper, *Tr. Soc. Trop. Med. and Hyg.* (1912-1913), 6(8) : 265-297.

Material : Host : Pig, *Bandicota bengalensis*, Man

Diagnosis : Body divided in two portion. Anterior part small, posterior large flattened. Oral sucker with a pair of evagination. Caeca slightly undulating. Testes lobed, tandem. Ovary median, posttesticular. Vitellaria from level of posterior testis to acetabular zone. Genital pore postbifurcal. Eggs 0.15×0.07 .

Distribution : India : West Bengal (Siliguri, Calcutta, Jalpaiguri); Uttar Pradesh, Andhra Pradesh, Meghalaya, Assam, Bihar.

Other records Malay, Combodia, Russia.

Subfamily Cladorchinae Fiscoeder, 1901

64. Genus *Olveria* Thapar and Sinha, 1945

91. *Olveria indica* Thapar and Sinha, 1945

(Fig. 44)

1945. *Olveria indica* Thapar and Sinha, *Indian J. Vet Sc. Anim. husb.*, 15(3) : 219-221.

Material : Host : Cattle.

Diagnosis : Body length 6.14-7.07, cuticular papillae present in region of mouth and genital sucker. Denticles present upto oesophageal region, oesophagus 'J' shaped; caeca with two to three loops. Testes diagonally tandem, rounded or slightly lobed. Ovary submedian posttesticular round. Uterus 'S' shaped. Genital sucker present. Genital pore 1.42 from anterior end. Vitelline glands well developed with large follicles, lateral, on either side of body, extending upto acetabular zone. Eggs $0.060-0.085 \times 0.075-0.119$.

Distribution : India : West Bengal (Siliguri, Calcutta); Uttar Pradesh.

Subfamily Gastrothylacinae Stiles and Goldberger, 1910

Key to genera

- 1 Uterus crossing from one side to the other near middle level; tests symmetrical*Gastrothylax*
Uterus and testes otherwise..... 2
- 2 Uterus not crossing but confined to dorsal median field throughout its length. Testes tandem
..... *Fiscoederius*

65. Genus *Gastrothylax* Poirier, 188392. *Gastrothylax crumenifer* (Creplin, 1847) Otto, 1896

(Fig. 45)

1846. *Amphistoma crumenifer* Creplin, *Arch. Naturg. Berlin* 135 1 : 30-35.1896. *Gastrothylax crumenifer* : Poirier, *Bull. Soc. Philomat. Paris*, (1882-83), 7(2) : 73-80.**Material** : Host : Goat, Cattle

Diagnosis : Body length 9-18 with large ventral sac, opening anteriorly and extending over the ventral surface upto acetabulum. Anterior end papillated. Oesophagus 'S' shaped, caeca upto anterior border of testes. Testes deeply lobed, symmetrical, with median ovary in between; uterus and vasdeference on opposite side. Laurer's canal opens anterior to excretory pore. Genital pore opens in between pharynx and caecal bifurcation. Vitellaria extend from caecal bifurcation to acetabulum, along the length and breadth of the worm. Eggs 0.115-0.145 × .06-0.07.

Distribution : India : West Bengal (North & South 24 Parganas, Siliguri Calcutta, Medinipur, Hughli, Puruliya); Uttar Pradesh, Punjab, Andhra Pradesh, Assam.

Other records : China, Burma, Sri Lanka.

66. Genus *Fischoederius* Stiles and Goldberger, 1910

Key to species

1. Caeca short, terminate at equatorial, pretesticular level of body *F. elongatus*
Caeca long 2
2. Caeca extend upto posttesticular or preacetabular level *F. cobboldi*

93. *Fischoederius elongatus* (Poirier, 1883) Stiles and Goldberger, 19101883. *Gastrothylax elongatum* Poirier, *Bull. Soc. Philomat.*, 7 : 731910. *Fischoederius elongatus* : Stiles and Goldberger, *Hyg. Lab. Bull.* No. 60 : 259 p.**Material** : Host; Goat.

Diagnosis : Body length 6-20, papillae around mouth, ventral sac with narrow neck extending upto posterior margin of genital atrium. Caeca short not extending beyond third or four fifth of body. Testes indented, one dorsal to the other, just preacetabular; vesicula seminalis and pars muscosa coiled. Ovary ventrocaudal, smaller than testes. Vitellaria lateral to caeca extending from caudal end of parsprostatica to beyond equatorial level only. Eggs 0.125-0.135 × 0.665-0.075.

Distribution : India : West Bengal (Calcutta, Medinipur, Siliguri), Uttar Pradesh, Tamil Nadu.

Other records : Japan, Sri Lanka.

94. *Fischoederius cobboldi* (Poirier, 1883) Stiles and Goldberger, 19101883. *Gastrothylax cobboldi* Poirier, *Bull. Soc. Philamet.*, 7 : 73.1910. *Fischoederius cobboldi* : Stiles and Goldberger, 1910 *Hyg. Lab. Bull.* No. 60 : 259 p.**Material** : Host : Cattle.

Diagnosis : Body length 2.7-15.5 with or without constriction anteriorly; ventral pouch extending upto testicular level. Caeca wavy, upto acetabulum. Testes median, tandem, with irregular margin. Ovary posterolateral to anterior testis. Genital pore prebifurcal. Vitellaria follicular from caecal bifurcation to caecal end. Eggs $0.11-0.12 \times 0.06-.065$.

Distribution : India : West Bengal (Siliguri, North & South 24-Parganas, Calcutta, Medinipur), widely distribution.

Subfamily Orientodiscinae Yamaguti, 1971

67. Genus *Orientodiscus* Srivastava, 1938

95. *Orientodiscus lobatum* Srivastava, 1938

(Fig. 46)

1938. *Orientodiscus lobatum* Srivastava, *Indian J. Vet. Sc. Anim. husb.*, 8(8) : 367-374..

Material : Host : *Trinix gangeticus*.

Diagnosis : Body length 5-7. Oval sucker with posterior lateral pouches; oesophageal bulb spindle shaped. Caeca with crenulated margin, sinuous, extend upto posterior level of ovary. Testes tandem, lobed; cirrus sac egg shaped. Vesicula seminalis externa present. Ovary almost triangular with deep notch at its base directed towards right caecum. Genital pore at bifurcal zone. Uterus transversely coiled. preovarian. Vitellaria with irregular follicle from level of acetabulum to oesophageal bulb. Eggs $0.144-0.129 \times 0.064-0.075$.

Distribution : India : West Bengal (Hughli, North & South 24-Parganas, Calcutta), Uttar Pradesh.

Subfamily Diplodiscinae Cohn, 1904

68. Genus *Diplodiscus* Diesing, 1836

96. *Diplodiscus amphichrus* Tubangui, 1933

(Fig. 47)

1933. *Diplodiscus amphichrus* Tubangui, *Philippine J. Sci.*, 52 (2) : 167-197.

Material : Host : *Rana cyanophlyctis*, *Rana tigrina*.

Diagnosis : Body conical 1.6-3.3. Oesophagus with bulb 0.27-0.44. Caecal bifurcation upto acetabulum. Testes single, median, equatorial. Ovary posttesticular, submedian, Genital pore some distance from intestinal bifurcation, intracaecal. Vitellaria well developed from level of oesophageal bulb to acetabular zone, contiguous on both ends. Eggs $1.04-1.12 \times 0.062-0.70$.

Distribution : India : West Bengal (Calcutta, Haora, North & South 24-Parganas, Medinipur, Purulia, Siliguri); widely distributed in other parts of India.

Other records Burma, Ceylon, Manchuria, Korea, Phillipines.

Subfamily Zygotylinac Ward, 1917

69. Genus *Stunkardia* Bhalerao, 1931

97. *Stunkardia dilymphosa* Bhalerao, 1931

(Fig. 48)

1931. *Stunkardia dilymphosa* Bhalerao, *Rec. Ind. Mus.*, 33 : 475-482.

Material : Host : Pig, Turtle.

Diagnosis : Body length 20-22. Oral sucker funnel shaped with oral diverticles posteriorly on both sides. Acetabulum semicircular anteriorly and funnel shaped posteriorly with two muscular process. Oesophagus, zig zag with oesophageal bulb. Caeca wavy appearing continuous 'S' shaped. Testes deeply lobed, tandem, equatorial. Ovary posttesticular, median, with crenulated margin. Vitellaria small, follicular from level of oesophageal bulb to anterior border of acetabulum. Cirrus sac absent. Uterus much coiled, proovarian; vesicula seminalis and metraterm opening in the foremost bracket of caecal loop. Eggs 0.132×0.117 .

Distribution : India : West Bengal (Calcutta, Siliguri, West Dinajpur, Puruliya).

Other records : Burma.

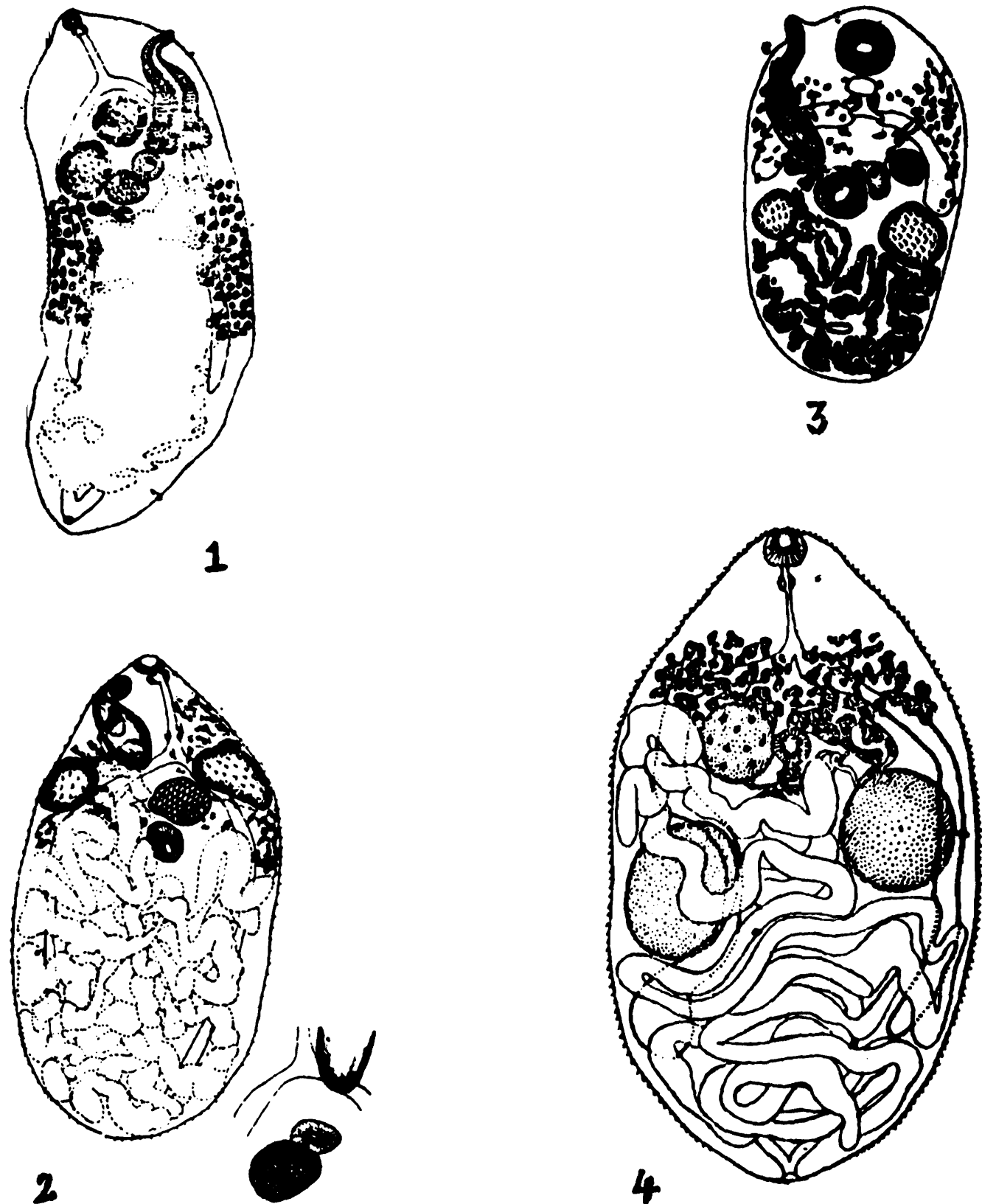


Fig. 1. *Ganeo tigrinum* Mehra et Negi, 1928; Fig. 2. *Mehraochis Yanarum* Srivastava, 1934; Fig. 3. *Pleurogenoides gastroporus* Luhe, 1901; Fig. 4. *Parabascus ovatus* (Tubangui, 1928).



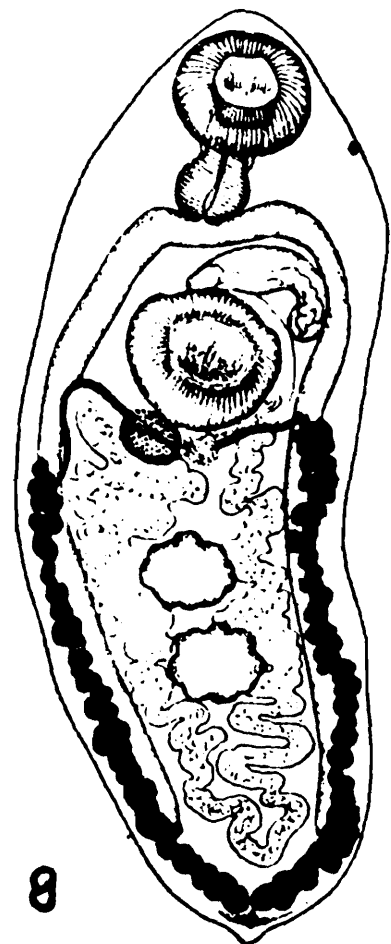
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Fig. 5. *Tremiorchis vanarum* Mehra et Negi, 1928; Fig. 6. *Mesocoelium burdwanensis* Mukherjee, 1968; Fig. 7. *Astioterma sudavshani*, Mukherjee et Ghosh, 1968; Fig. 8. *Encyclometra colubrimurorum* (Rudolphis, 1819).

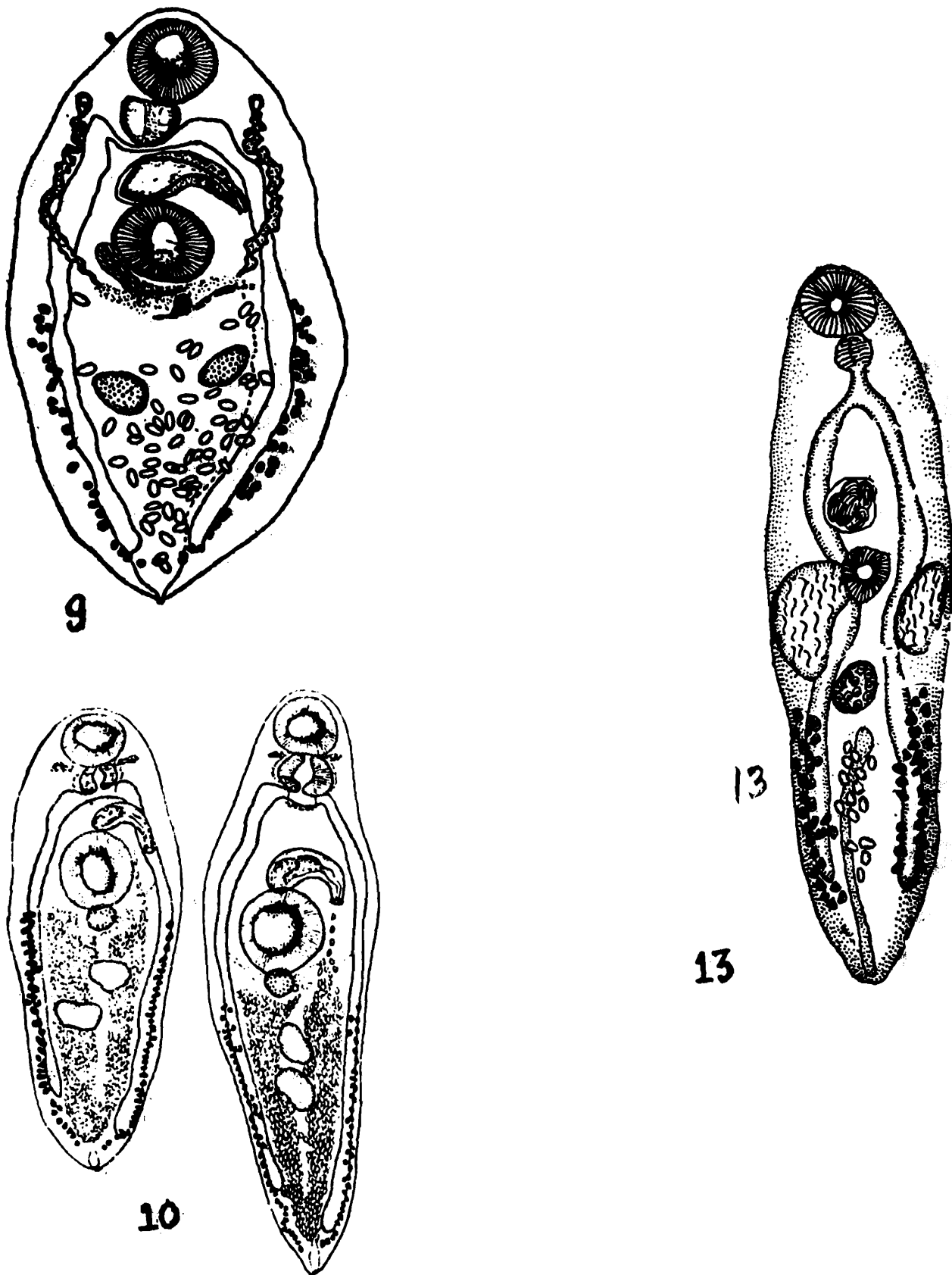


Fig. 9. *Encyclometra bungava* Srivastava et Ghosh, 1968. Fig. 10. *Encyclometra japonica* Yoshida et Ozaki, 1929; Fig. 13. *Anchitrema sanguineum* (Sonsino, 1894).

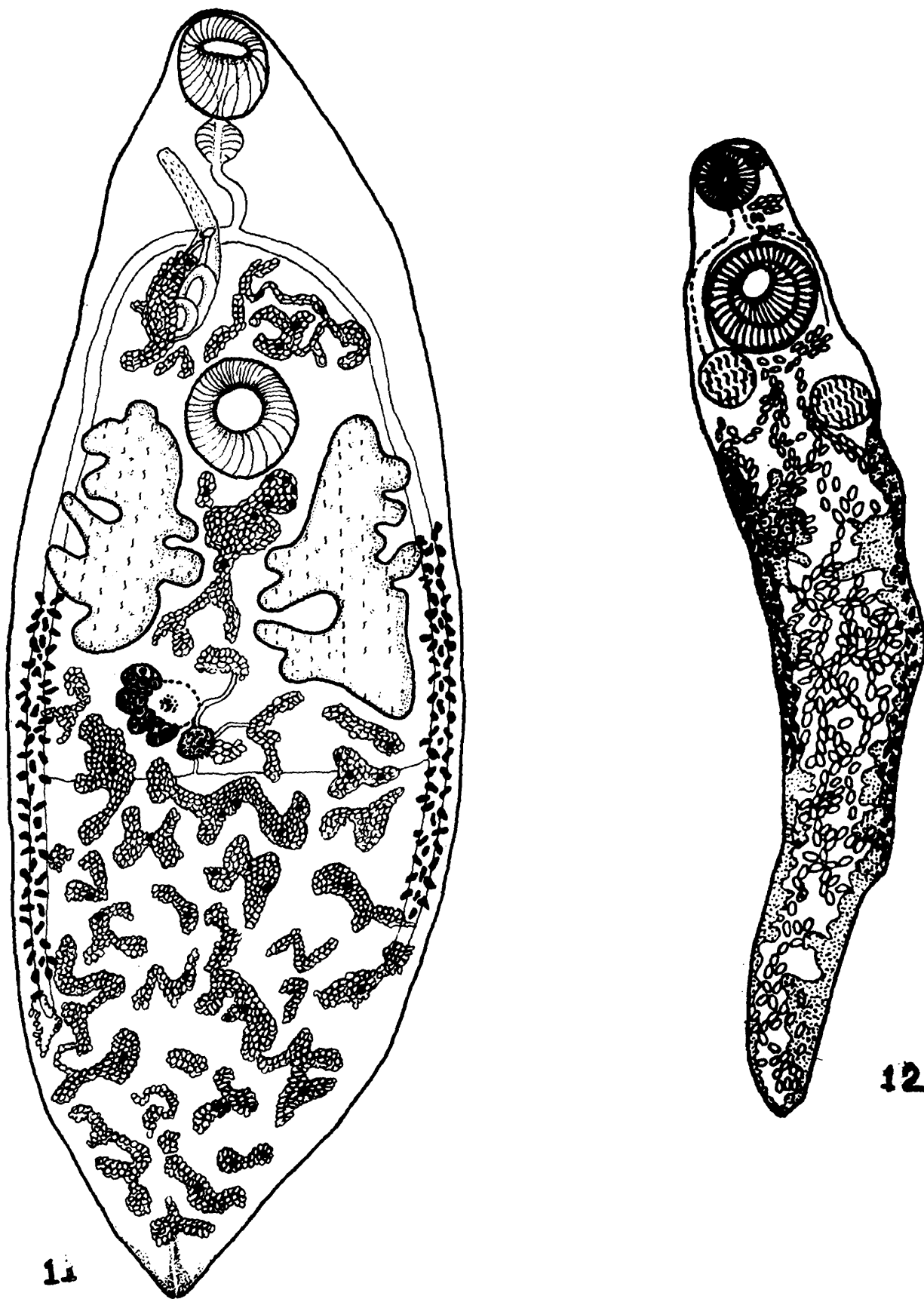
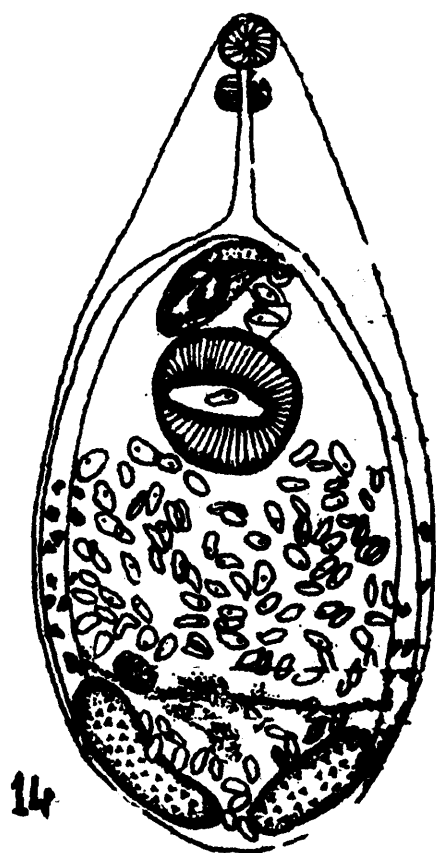


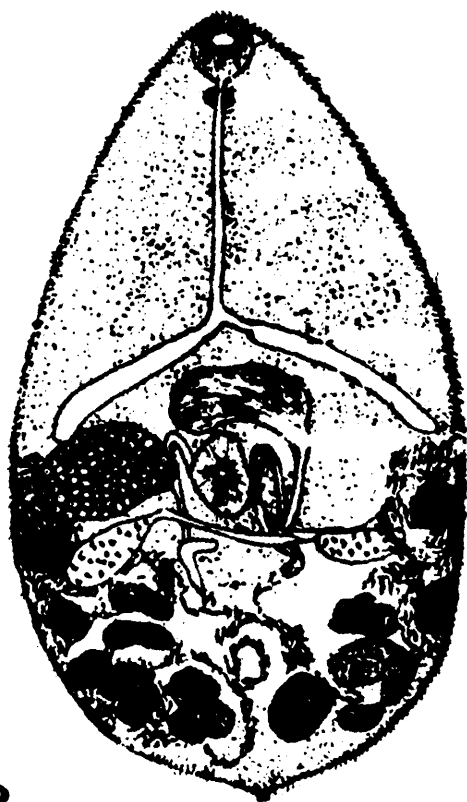
Fig. 11. *Eurytrema bhaleraoi* Mukherjee et Srivastava, 1992; Fig. 12. *Lyperosomum (Lyperosomum) yeangensis* Soota et Ghosh, 1977.



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Fig. 14. *Ommatobrephus bengalensis* Mukherjee et Ghosh, 1968; Fig. 15. *Ommatobrephus lobatum* Mehra, 1928; Fig. 16. *Megalotristrema dicaecus* (Mukherjee et Ghosh, 1969).

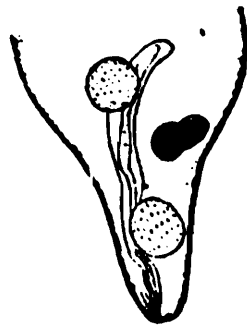
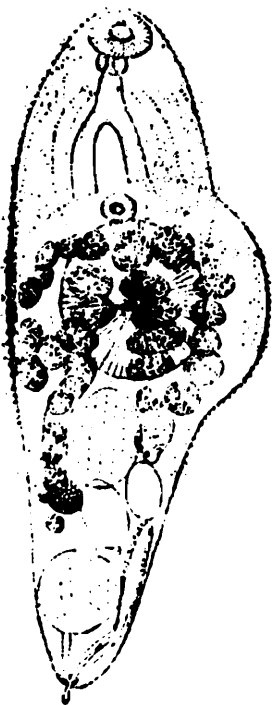
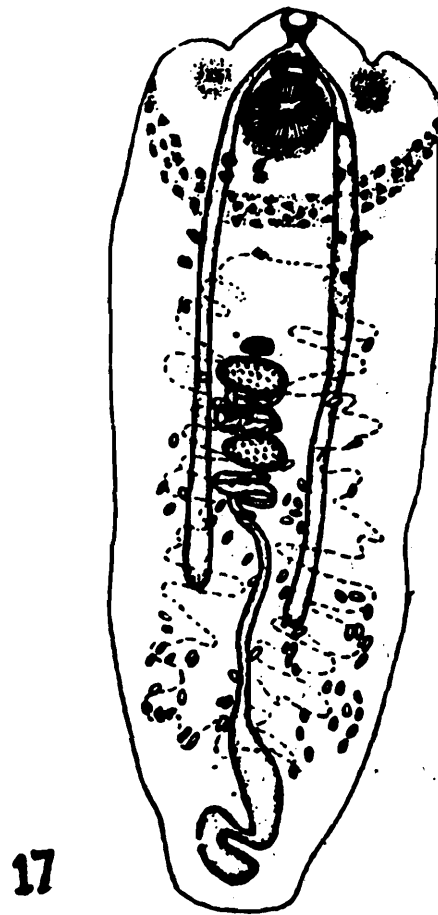


Fig. 17. *Proalaroides tropidonotis* Vidyarthi, 1937; Fig. 18. *Gogatea serpentium* (Gogate 1932) - Whole mount and pesterior end.

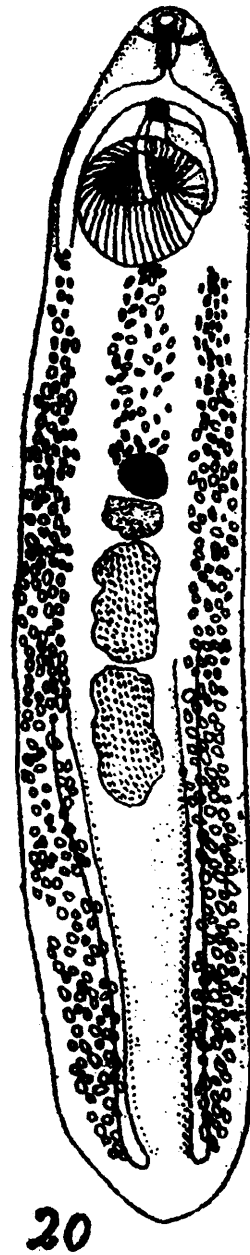
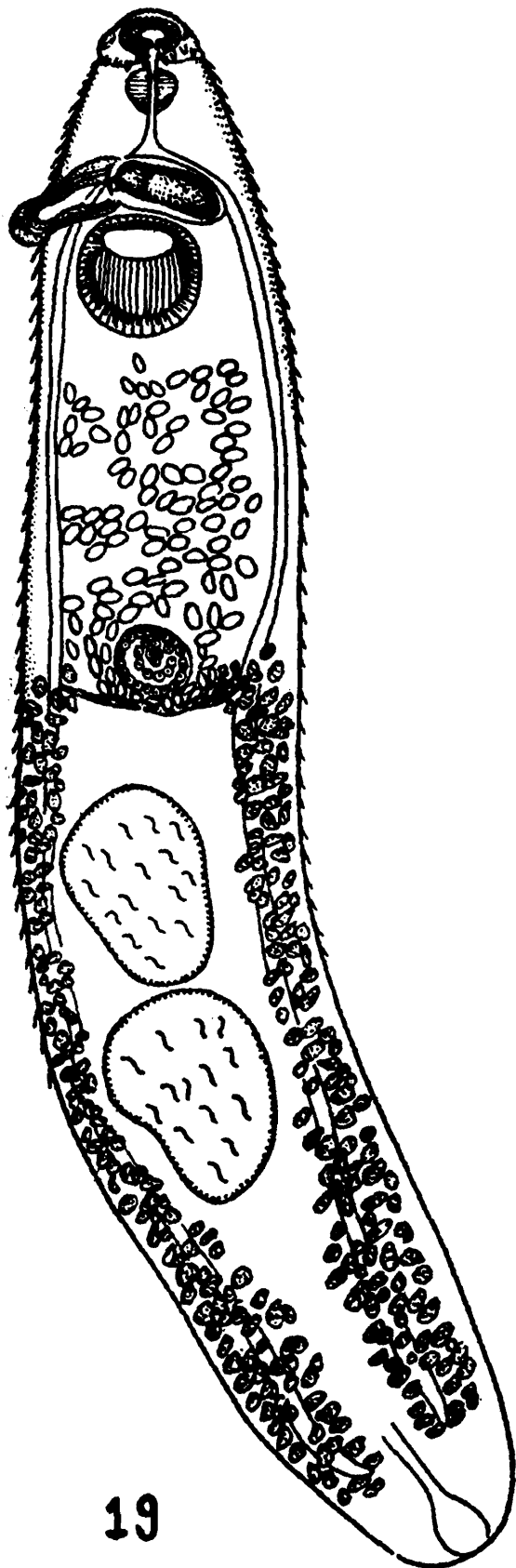


Fig. 19. *Echinostoma eduardoi* (Ghosh et Chauhan, 1977; Fig. 20. *Vermatrema longitestis* (Verma, 1936) Srivastava, 1974.

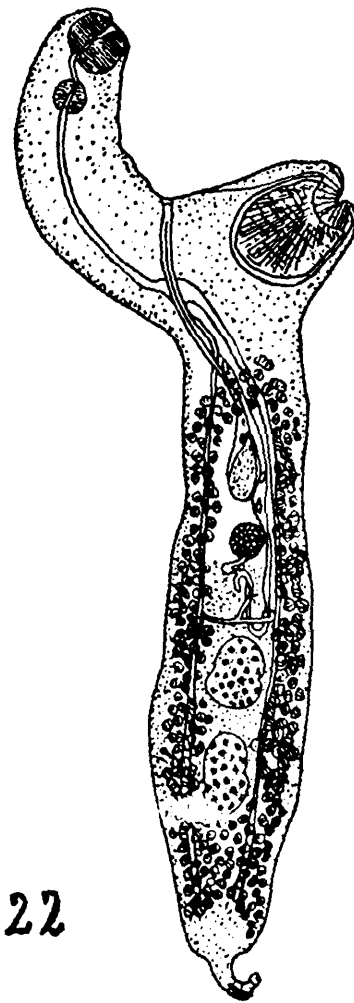
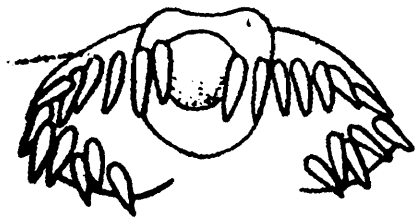


Fig. 21. *Episthemium caninum* (Verma, 1935) Whole mount and collar; Fig. 22. *Psilochasmus oxyuris* (Creplin, 1825) Luhe 1909.

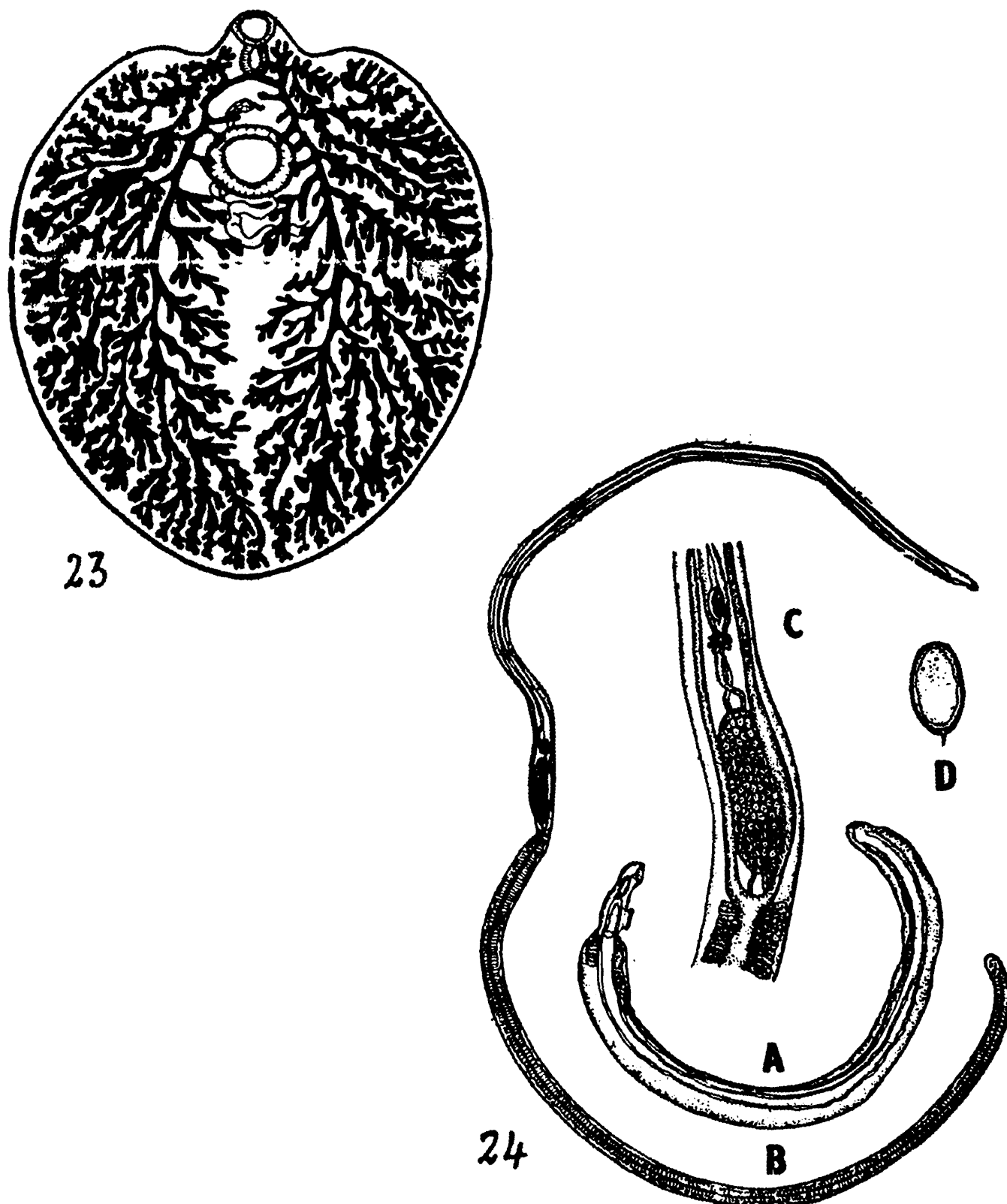


Fig. 23. *Fasciola jacksoni* (Cobbold, 1859); Fig. 24. *Schistoma indicum* Montgomery, 1906 - A. Male; B. Female; C. Female genitalia; D. Eggs.

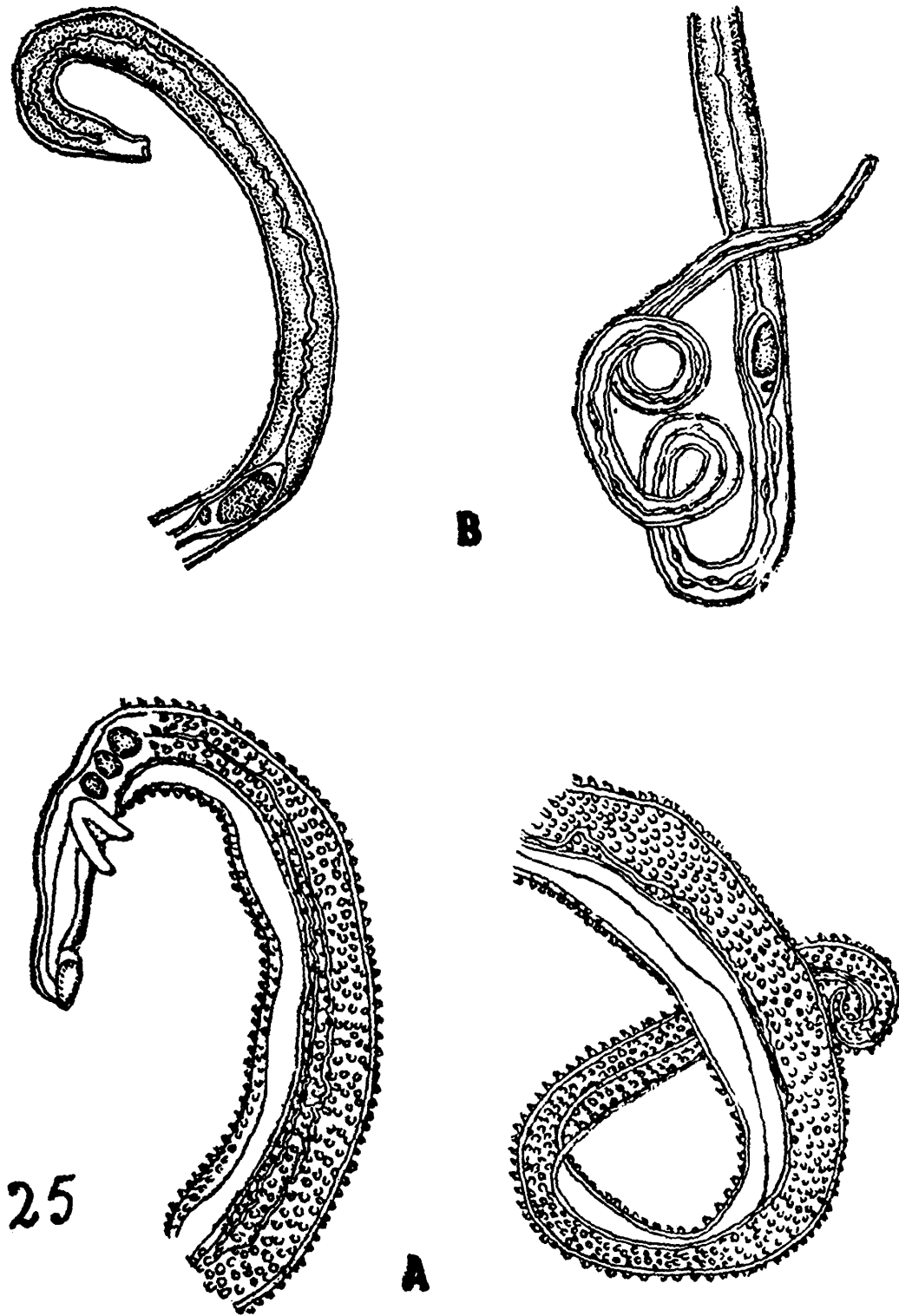


Fig. 25. *Schistosoma nasale* Rao, 1933 A. Male; B. Female.

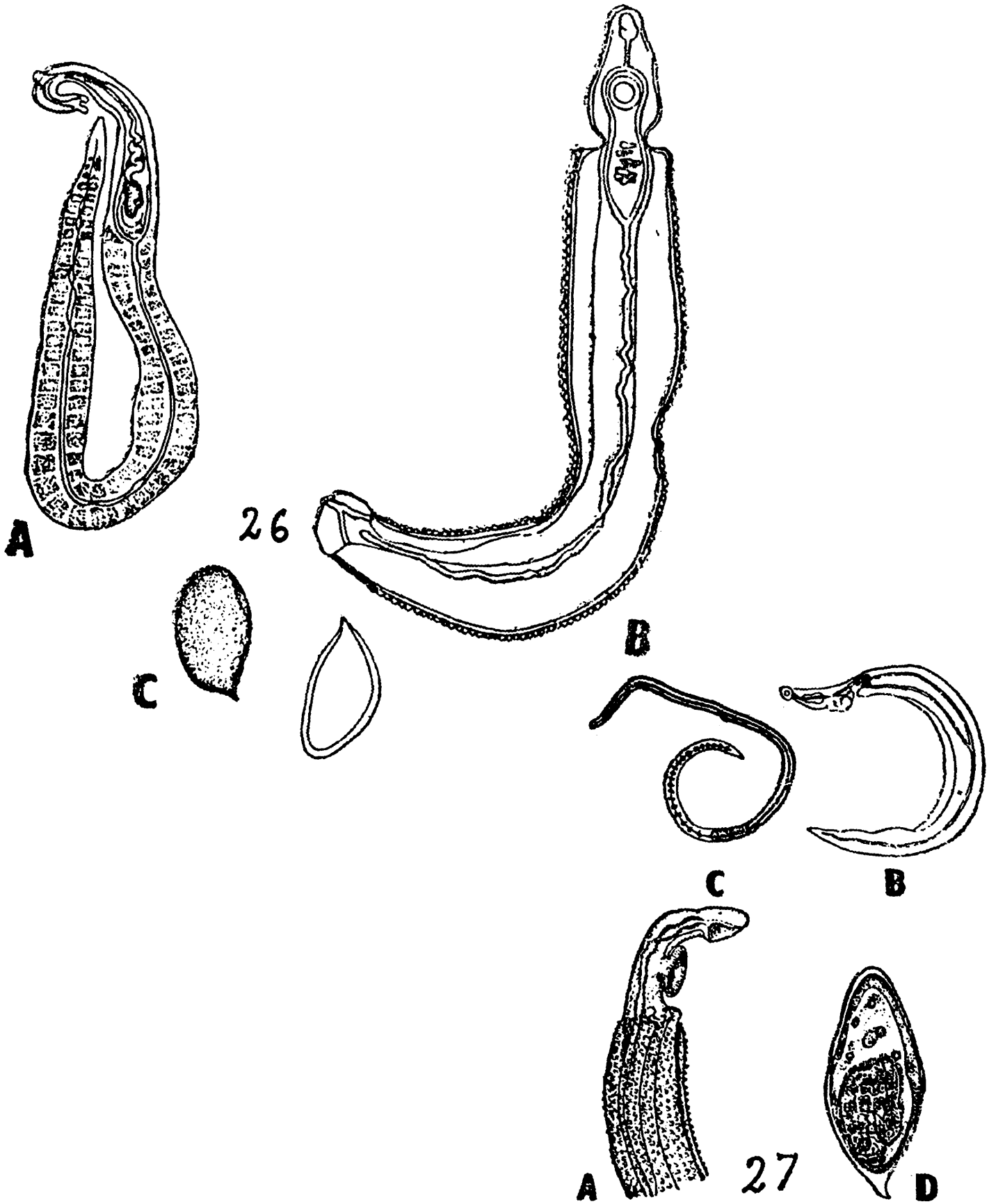


Fig. 26. *Schistosoma incognitum* chandler, 1926
Schistosoma haematobium (Bilhavz, 1852)

A. Female; B. Male; C. Eggs. Fig. 27.
 A. Entire body of male; B. Entire body of female; C. Egg.

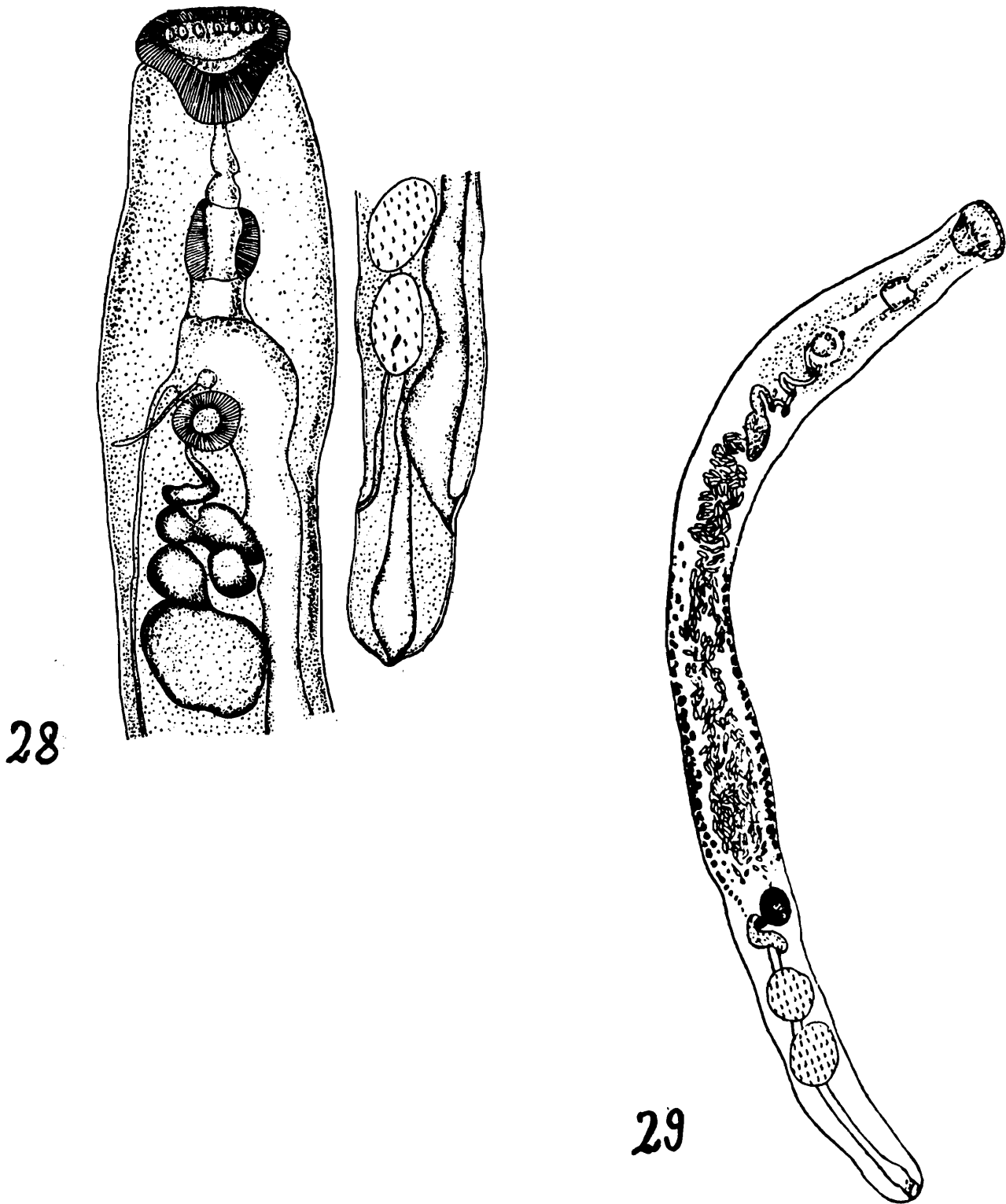


Fig. 28. *Acanthostomum burminis* (Bhalerao, 1936); Fig. 29. *Acanthostomum burminis* (Bhalerao, 1936).

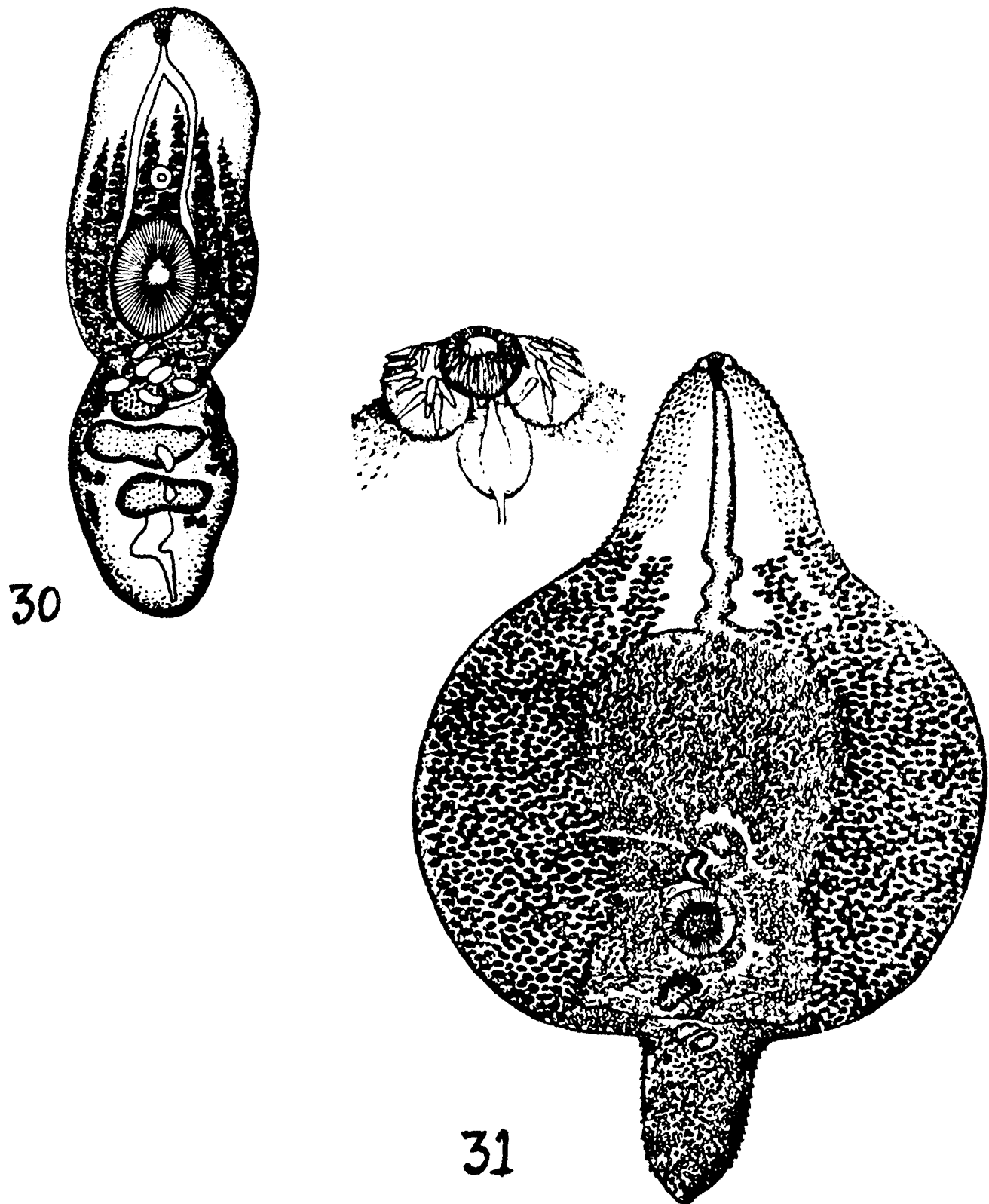


Fig. 30. *Neodiplostomum cochlerare* (Krause, 1915); Fig. 31. *Balfauria monogama* Leiper, 1908.

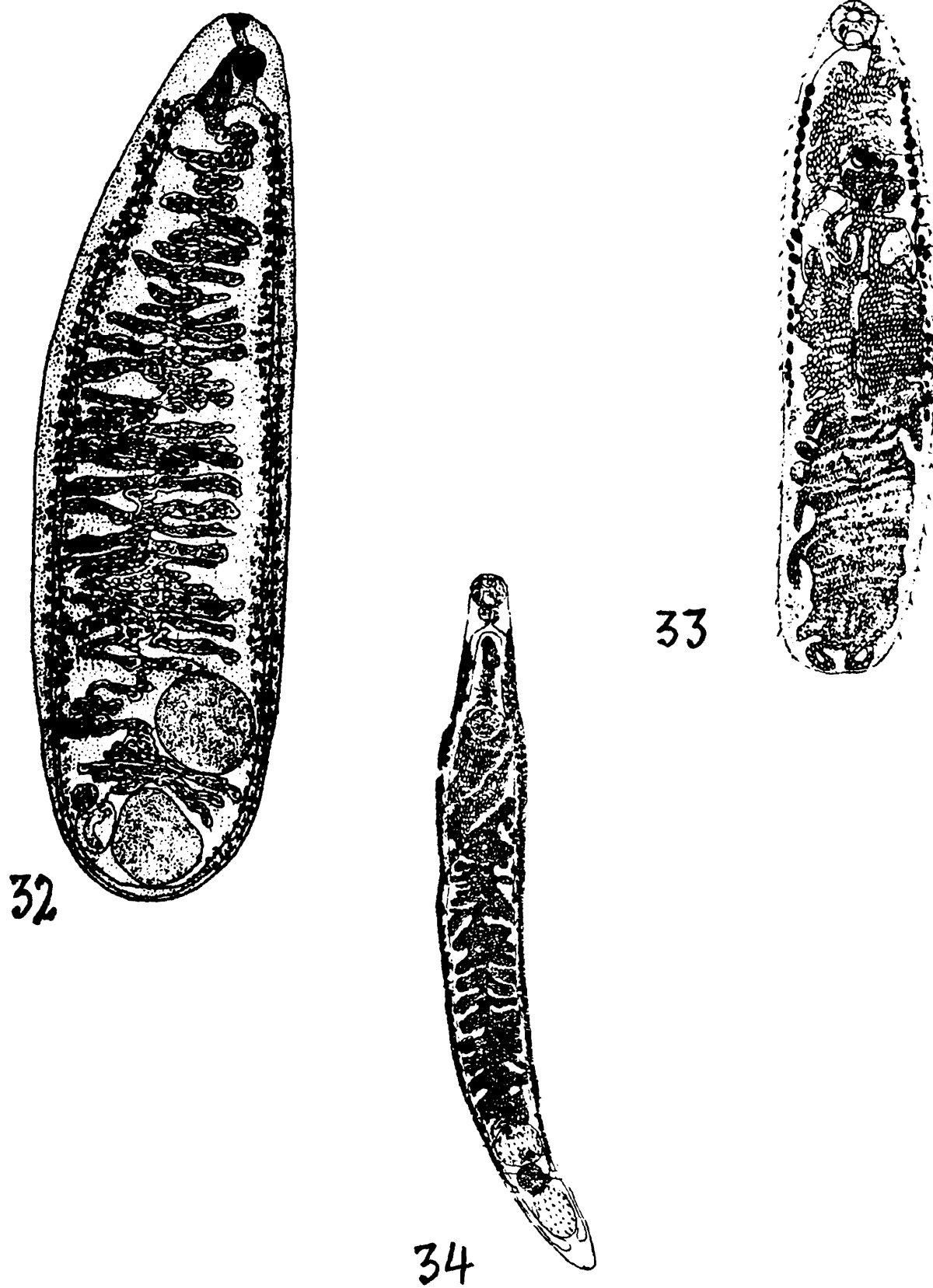


Fig. 32. *Cyclocoelum (C.) mutabile* (Zeder, 1800); Fig. 33. *Prosthogonimus elongatus* Mukherjee, 1966; Fig. 34. *Glaphyrostomum indicum* Mukherjee, 1964.

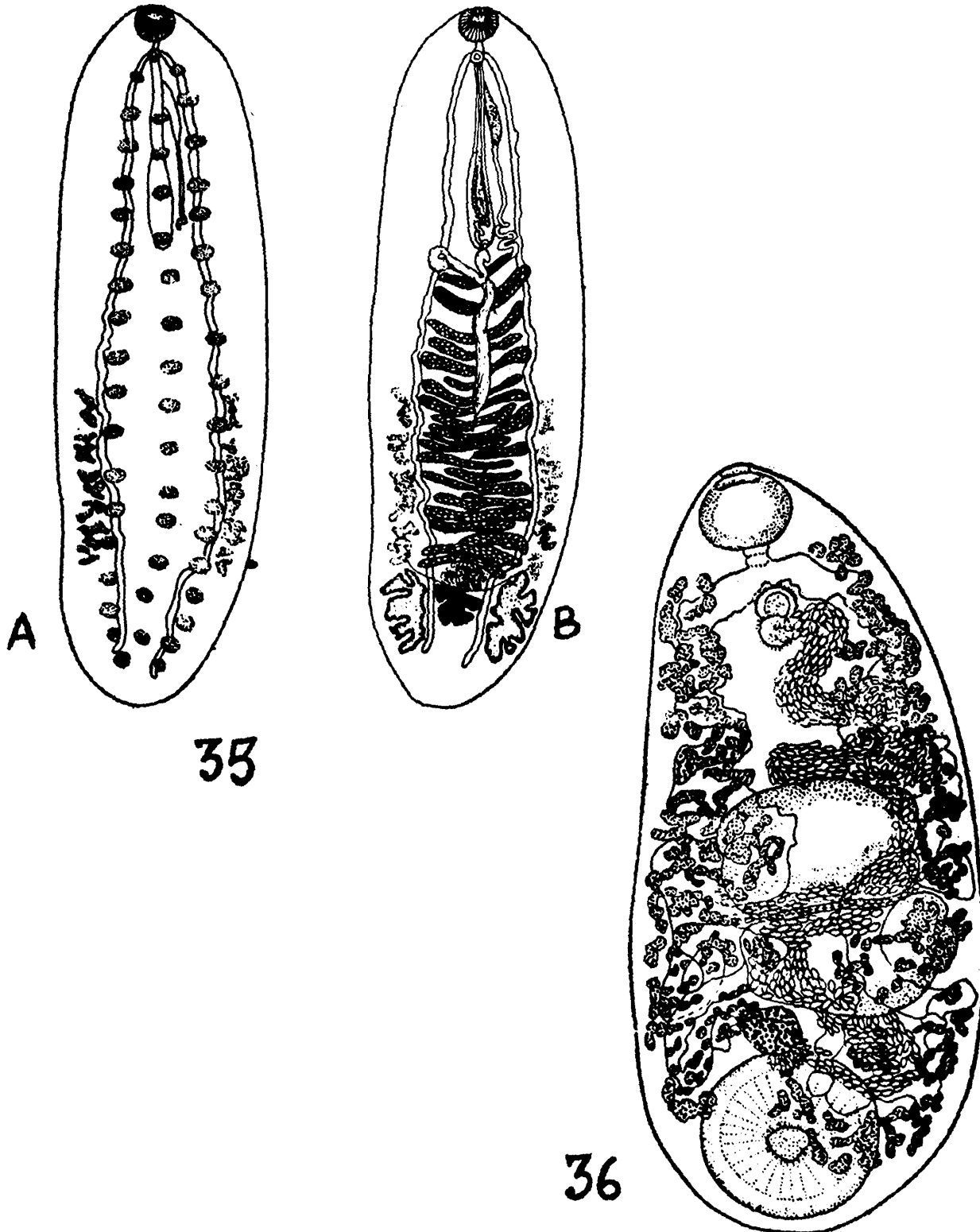


Fig. 35. *Notocotylus (N.) attenuatus* (Rudolphi, 1809) - A. Ventral glands; B. whole mount; Fig. 36. *Paramphistomum cervi* (Zeder, 1780).

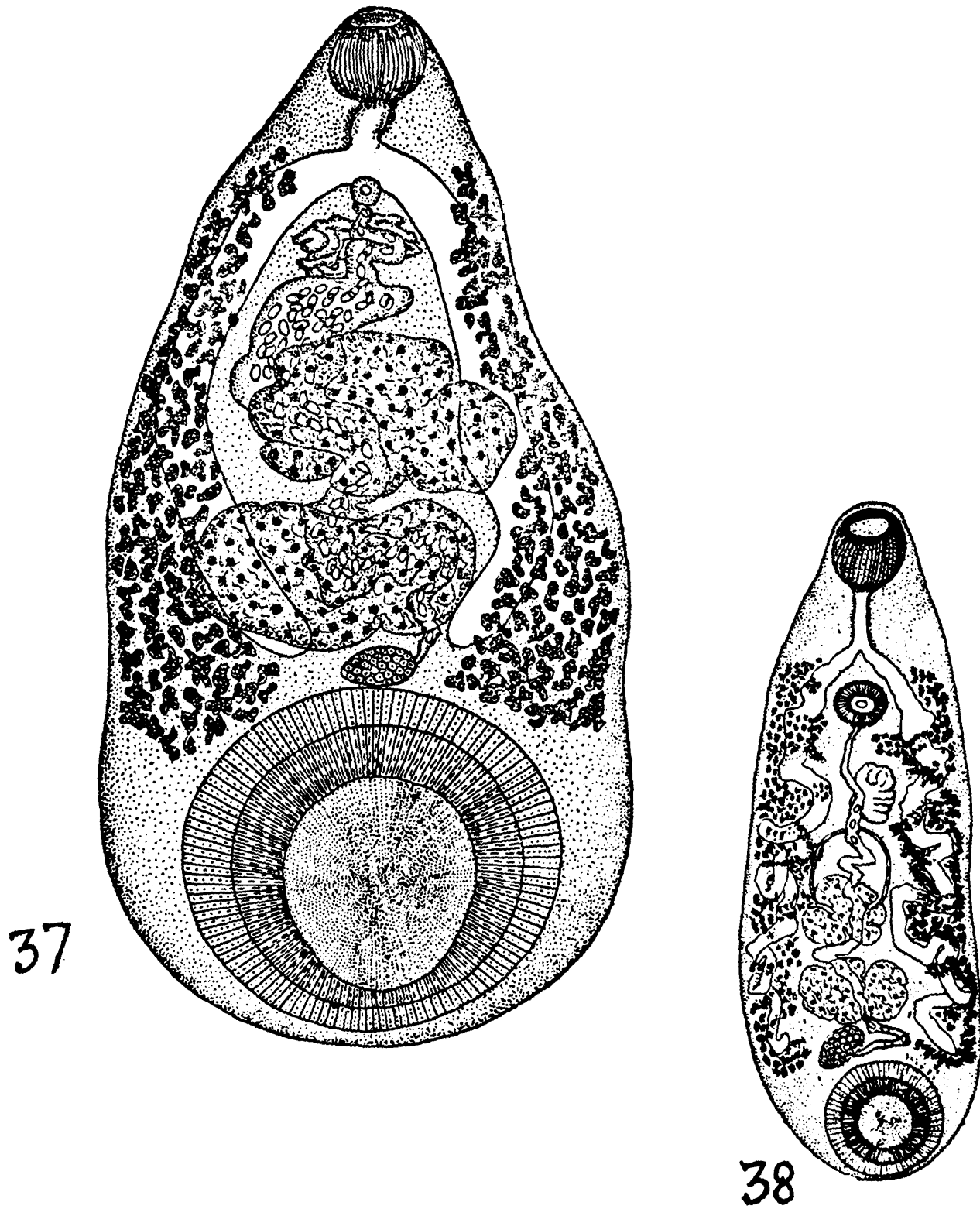


Fig. 37. *Paramphistomum explanatum* (Creplin, 1937.); Fig. 38. *Cotylophoron indicum* Steles et Gold borger, 1910.

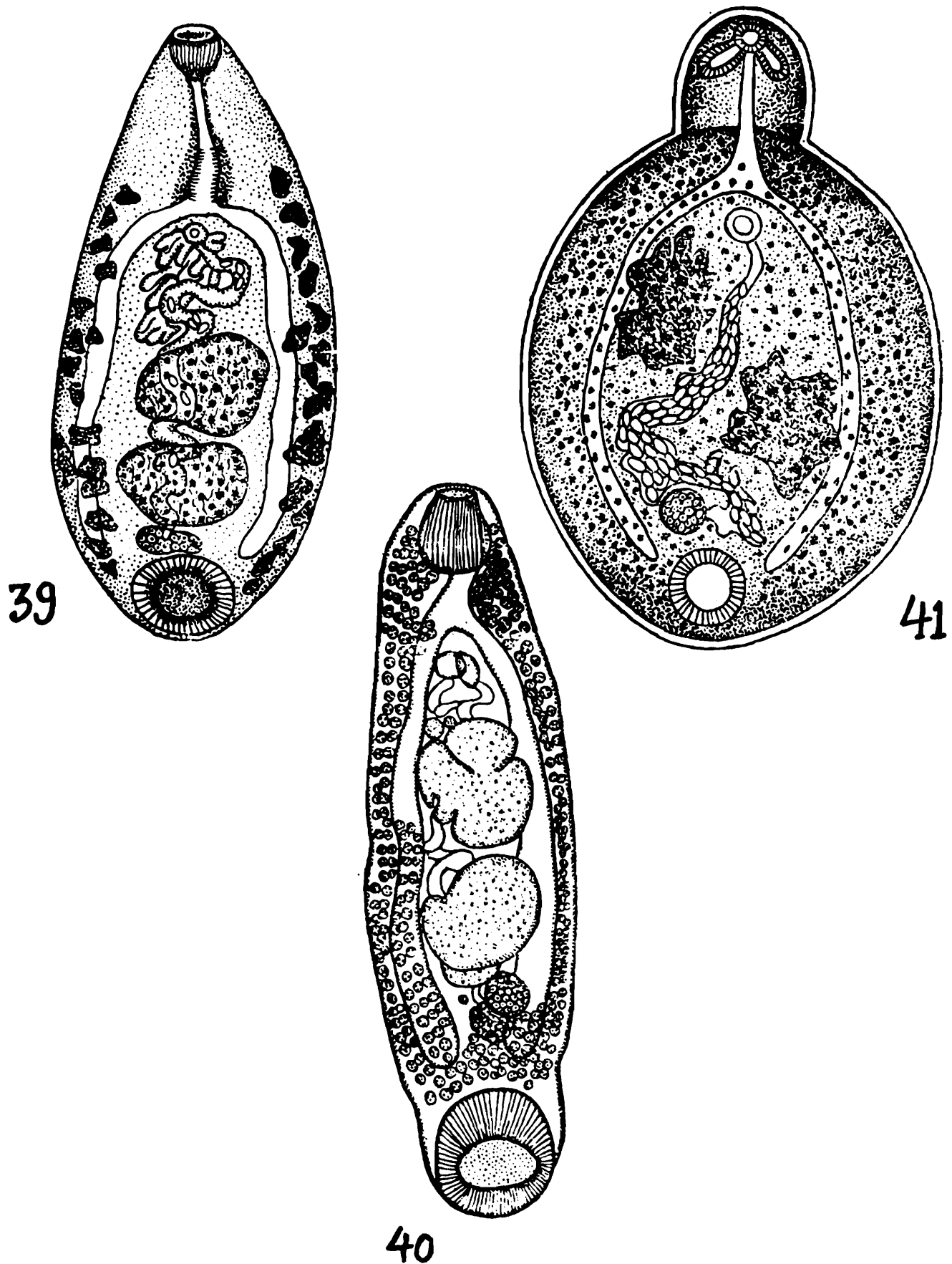


Fig. 39. *Celonocotyle scliocoelium* (Fischoeder, 1901); Fig. 40. *Celonocotyle maplestoni* (Bhalerao, 1937); Fig. 41. *Gastrodiscus secundus* Looss, 1907.

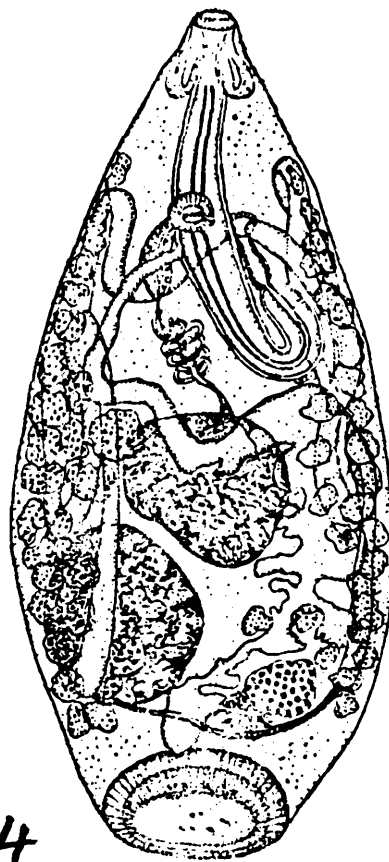
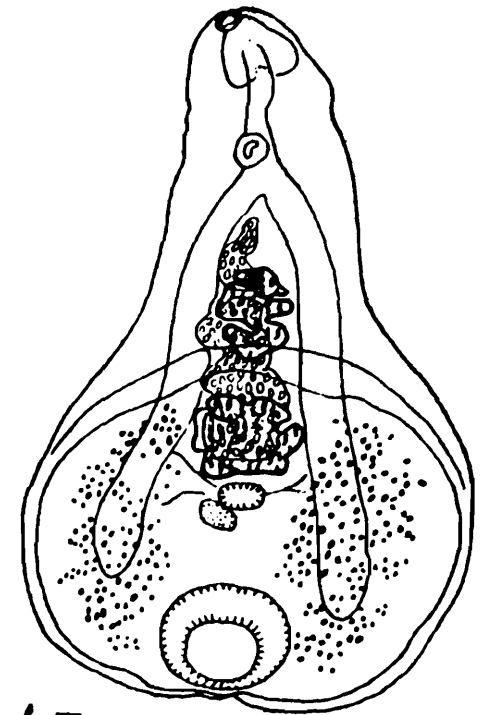
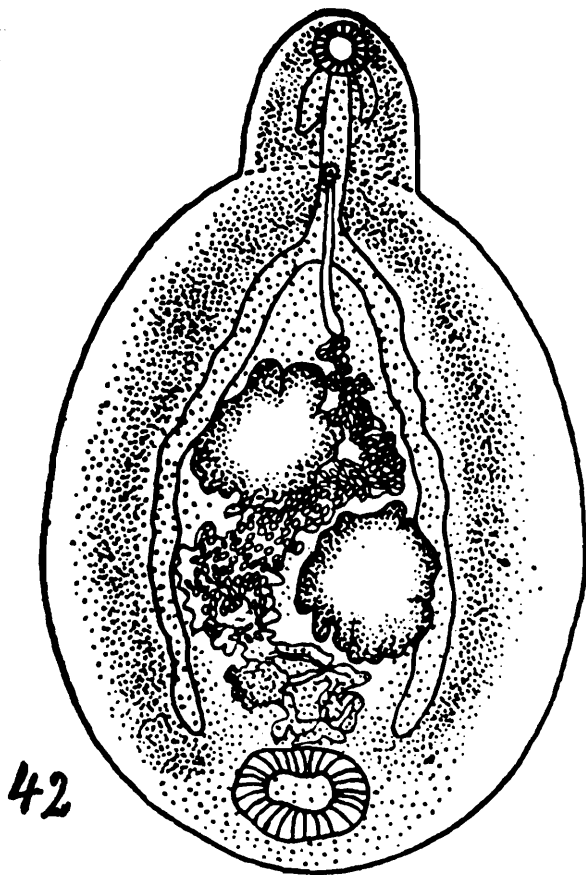


Fig. 42. *Gastrodiscus aegypticus* (Cobbold, 1874); Fig. 43. *Gastrodiscoides hominis* (Lewis et Mc Connel, 1876); Fig. 44. *Olveria indica* Thaper et Sinha, 1945.

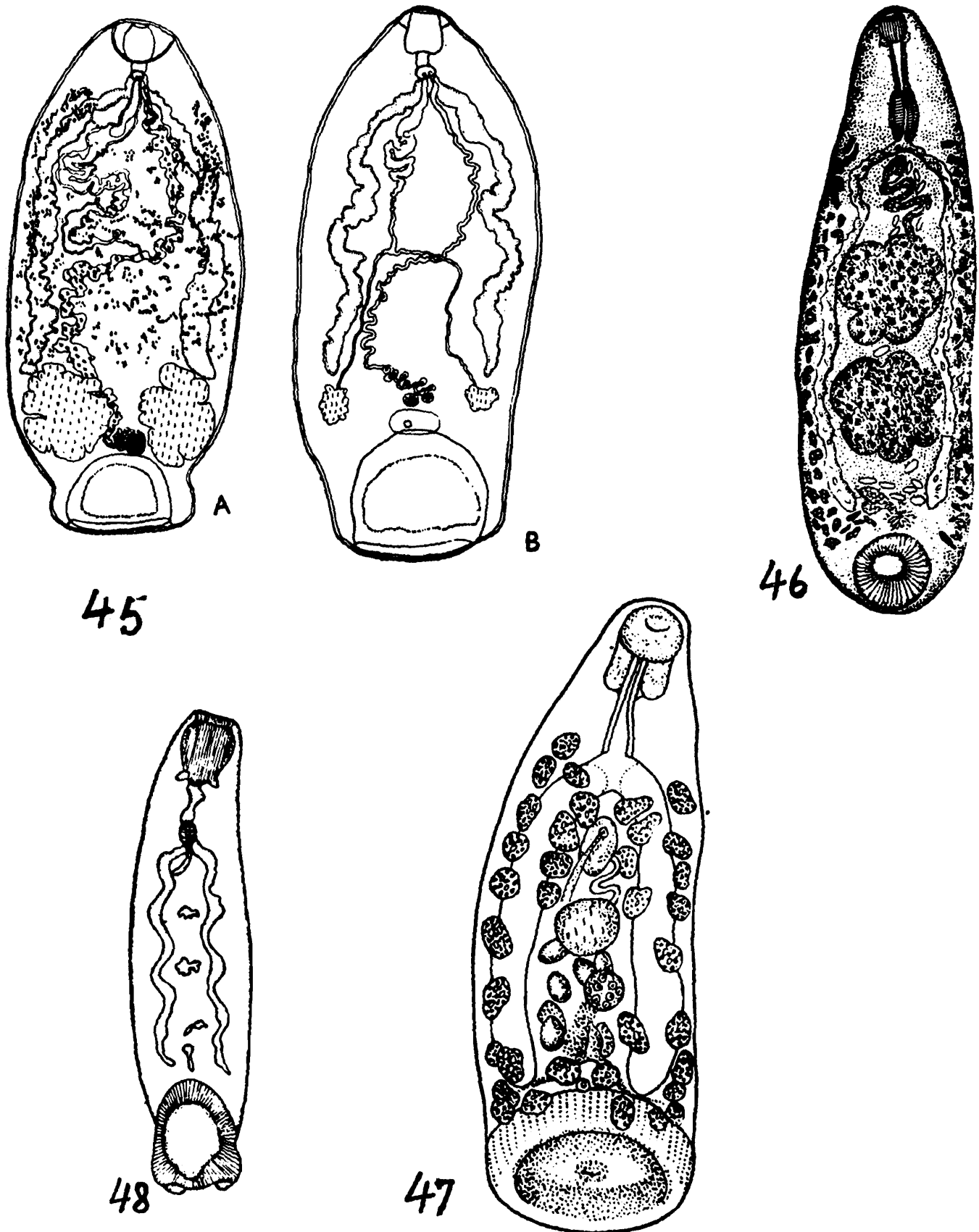


Fig. 45. *Gastrothylax crumenifer* (Creplin, 1887) A. Mature adult; B. Young adult; Fig. 46. *Orientodiscus lobatum* Srivastava, 1938; Fig. 47. *Diplodiscus amphicrus* Tubangui, 1933; Fig. 48. *Stumkardia dilumphosa* Bhalerao, 1931.

Host Parasite List

(* Recorded from Literature)

Amphibia

| Host | Parasite |
|---------------------------|--|
| <i>Rana cyanophlyctis</i> | <i>Ganeo srinagarensis</i> <i>G. ankholensis</i> <i>G. tigrinum</i> <i>Prosotocus bengalensis</i> <i>Mehraorchis ranarum</i> <i>Pleurogenoides gastroporus</i> <i>Halipegus mehransis</i> <i>Diplodiscus amphichrus</i> |
| <i>Rana tigerina</i> | <i>Ganeo tigrinum</i> <i>Pleurogenoides gastroporus</i> <i>Tremuorchis ranarum</i> <i>Halipegus mehransis</i> <i>Megalotriotrema dicaecus</i> <i>Proalarioides tropidonotis</i> <i>Diplodiscus amphichrus</i> |
| <i>Bufo melanostictus</i> | <i>Ganeo tigrinum</i> <i>Proalarioides tropidonotis</i> <i>Pleurogenoides gastroporus</i> <i>Mesocoelium sociale</i> <i>Astiotrema sudarshani</i> |
| <i>Bufo Viridis</i> | <i>Mesocoelium sociale</i> <i>Proalarioides tropidonotis</i> |

Reptile

| | |
|-----------------------------|--|
| <i>Chamaleon zeylanicus</i> | <i>Ganeo tigrinum</i> |
| <i>Enhydrina schistosa</i> | <i>Lecithochirium acutum</i> |
| <i>Calotes versicolor</i> | <i>Parabascus ovatus</i> <i>P. macrorchis</i> <i>Mesocoelium burdwanensis</i> <i>Paradistomoides orientalis</i> <i>Stomylotrema travassosi</i> |

| | |
|-----------------------------------|------------------------------------|
| <i>Uromastix sp.</i> | <i>Halipegus mehransis</i> |
| <i>Varanus bengalensis</i> | <i>Ommatobrephus lobatum</i> |
| <i>Hemidactylus flaviviridis</i> | <i>Parabasus macrorchis</i> |
| | <i>Paradistomoides orientalis</i> |
| <i>Kachuga kachuga</i> | <i>Astiotrema odhneri</i> |
| <i>Kachuga intermedia</i> | <i>Bilorchis indicus</i> |
| <i>Trionyx triangularis</i> | <i>Astiotrema odhneri</i> |
| <i>Trionyx gangeticus</i> | <i>Bilorchis indicus</i> |
| | <i>Cephalogonimus gangeticus</i> |
| | <i>Orientodiscus lobatus</i> |
| <i>Kachuga dhongoka</i> | <i>Astiotrema reniferum</i> |
| <i>Hardella thurgi</i> | <i>Heniorchis bengalensis</i> |
| <i>Trionyx nilotica</i> | <i>Astiotrema reniferum</i> |
| <i>Lissenys punctata</i> | <i>Bilorchis indicus</i> |
| <i>Turtle</i> | <i>*Stunkardia dilymphosa</i> |
| <i>Natrix piscator</i> | <i>Styphlodora horida</i> |
| (= <i>Tropidonotus piscator</i>) | <i>Xenopharynx solus</i> |
| | <i>Encyclometra japonica</i> |
| | <i>Ommatobrephus bengalensis</i> |
| | <i>Gogatea serpentium</i> |
| | <i>Acanthostomum burminis</i> |
| <i>Tropidonotus colubrimorum</i> | <i>Encyclometra colubrimurorum</i> |
| <i>Naja naja</i> | <i>Xenopharynx solus</i> |
| | <i>Encyclometra japonica</i> |
| <i>Python molurus</i> | <i>Styphlodora horida</i> |
| <i>Atretium schistosum</i> | <i>Encyclometra japonica</i> |
| | <i>Megalotriotrema dicaecus</i> |
| <i>Boa constrictor</i> | <i>Styplodora horida</i> |
| <i>Natrix stolata</i> | <i>Ommatobrephus bengalensis</i> |
| | <i>Proalarioides tropidonotis</i> |
| | <i>Gogatea serpentium</i> |
| <i>Zamenis mucosus</i> | <i>*Styphlodora nicolli</i> |
| | <i>Ommatobrephus lobatum</i> |
| <i>Bungarus fasciatus</i> | <i>Encyclometra hungara</i> |

Bird*Corvus splendens** *Lyperosomum kakea** *Episthimum corvus** *Diplostomum (D) splendens**Duck**Echinostoma revolutum**Psilorchis indicus**Notocotylus attenuatus**Fowl**Prosthogonimus putschkowskii**Pigeon**Prosthogonimus elongatus**(Columba livia)**Glaphyrostomum indicum**Picus flavimucha flavimucha**Lyperosomum reangensis**Metapodius indicus**Stomylotrema travassosi**Black swan**Vermatrema longitestis**(Cygnus atratus)** *Echinoparyphium gizzardii**Teal** *Pseudechinostoma indicum**(Netton creeca)**Black headed gull**Chauncephalus similiferox**(Larus ridibundus)**Black necked stork**Chaunocephalus similiferox**(Xenorhynchus asiaticus)**Kingfisher**Microparyphium montei**(Alcedo atthis)**Oriole**(Oriolus xanthorsous)**Hornbill**Neodiplostomum cochleare**Open bill stork**Balfouria monogama**(Anastomus oscitans)**Himantopus himantopus (Stilt)**Cyclocoelum (C) mutabile***Mammal***Bat**Prosthodendrium ovimagnosum**Pipistrellus minimus**Anchitrema sanguinum**Suncus murinus**Anchitrema sanguinum**Bandicota bengalensis**Echinostoma eduardoi**E. malayanum**Gastrodiscoides hominis*

*Dog & Wild dog **

** Amphimerus noverca*

** Pseudoamphistomum truncatum*

Prosthodendrium ovimagnosum

** Episthmium caninum*

** Ephinochasmus perfoliatus*

** Schistosoma incognitum*

** Alaria alata*

** Heterophyes heterophyes*

** Opithorchis felineus*

** Paragonimus westermanii*

Goat

Dicrocoelium dendriticum

Cotylophoron cotylophorum

Schistosoma indicum

** Cotylophoron orientalis*

Gastrothylax crumenifer

Fischoederius elongatus

Cat

** Echinochasmus perfoliatus*

** Haplorchis taichui*

** Opisthorchis felineus*

** Pasagonimus westermanii*

Pig

** Echinochasmus perfoliatus*

Fasciolopsis buski

** Schistosoma incognitum*

** Amphimerus noverca*

Gastrodiscoides hominis

Cattle (Cow, Buffalo)

Eurytrema pancreaticum

E. bhaleraoi

Fasciola gigantica

F. hepatica

Schistosoma indicum

S. nasale

Paramphistomum cervi

P. explanatum

| | |
|-----------------|-----------------------------------|
| | <i>Colylophoron colylophorum</i> |
| | * <i>C. indicum</i> |
| | * <i>C. orientalis</i> |
| | <i>Olveria indica</i> |
| | <i>Gastrothylax crumenifer</i> |
| | <i>Fischoderius cobboldi</i> |
| Horse | * <i>Gastrodiscus aegyptiacus</i> |
| Man | * <i>Echinostoma malayanum</i> |
| | <i>Echinochasmus perfoliatus</i> |
| | <i>Isoparchis hypselobagri</i> |
| | <i>Aryfechinostomum oraohi</i> |
| | * <i>Paragonimus westermanii</i> |
| | * <i>Gastrodiscoides hominius</i> |
| Buffalo | <i>Fasciola gigantica</i> |
| | <i>Schistosoma indicum</i> |
| | <i>S. nasale</i> |
| | <i>Paramphistomum cervi</i> |
| | <i>P. explanatum</i> |
| | <i>Colylophoron colylophorum</i> |
| | <i>C. indicum</i> |
| Sheep | <i>Fasciola hepatica</i> |
| | <i>Colylophoron colylophorum</i> |
| | <i>C. indicum</i> |
| Elephant | * <i>Fasciola jacksoni</i> |
| | * <i>Gastrodiscus secundus</i> |
| Tiger | * <i>Paragonimus westermanii</i> |
| Deer | <i>Colylophoron indicum</i> |
| Antelope | <i>Colylophoron orientalis</i> |
| Mongoose | * <i>Paragonimus westermanii</i> |

TABLE I
District-wise distribution of Trematodes

| Sl. No. | Districts Parasitic Species | Koch Bihar | Jalpaiguri | Darjiling | South 24 Parganas | North 24 Parganas | Calcutta | Haora | Hugli | Medinipur | Bankura | Puruliya | Bardhaman | Nadia | Murshidabad | Birbhum | Maldah | West Dinajpur | |
|---------|------------------------------------|------------|------------|-----------|-------------------|-------------------|----------|-------|-------|-----------|---------|----------|-----------|-------|-------------|---------|--------|---------------|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | |
| 1. | <i>Ganeo srinagarensis</i> | | | | | + | | | | | | | | | | | | | |
| 2. | <i>G. ankholaensis</i> | | | | | | + | | | | | | | | | | | | |
| 3. | <i>G. tigrinum</i> | | | | + | + | | + | | + | + | | | | | | | | |
| 4. | <i>Prostocus bengalensis</i> | | | | | | + | | | | | | | | | | | | |
| 5. | <i>Mehraorchis ranarum</i> | | | | + | + | + | | | | | + | | | | | | | |
| 6. | <i>Pleurogenoides gastroporus</i> | | | | + | + | | | + | + | | | | | | | | | |
| 7. | <i>Prosthodendrium ovimagnosum</i> | | | | | | | + | | | | | | | | | | | |
| 8. | <i>Parabascus macrorchis</i> | | | | | | + | | | | | | + | | | | | | |
| 9. | <i>P. ovatus</i> | | | | + | + | | | | | | + | + | | | | | | |
| 10. | <i>Tremiorchis ranarum</i> | | | | | | + | | | + | + | | + | | | | | | |
| 11. | <i>Mesocoelium sociale</i> | | | | | | + | | | + | | | | | | | | | |
| 12. | <i>M. burdwanensis</i> | | | | | | | | | | | | + | | | | | | |
| 13. | <i>Astiotrema odhneri</i> | | | | + | + | | | | | | | + | | | | | | + |
| 14. | <i>A. reniferum</i> | | | | + | + | + | + | | | | | | | | | | | |
| 15. | <i>A. sudarshani</i> | | | | + | | | | | | | | | | | | | | |
| 16. | <i>Stryphlodora horida</i> | | | | | + | | | | + | | | | | | | | | |
| 17. | <i>S. nicolli</i> | | | | | | + | | | | | | | | | | | | |
| 18. | <i>Bilorchis indicus</i> | | | | | | + | | | + | | | | | | | | | |
| 19. | <i>Xenopharynx solus</i> | | | | + | + | | | | | | + | | | | | | | |

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|--|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|
| 20. <i>Encyclometra colubrinurorum</i> | | | | + | | + | | + | + | | + | | | | | | |
| 21. <i>E. bungara</i> | | | | + | | | | | | | | | | | | | |
| 22. <i>E. japonica</i> | | | | + | + | | | + | | | + | | | | | | |
| 23. <i>Dicrocoelium dendriticum</i> | | | + | | | | | | | | | | | | | | |
| 24. <i>Paradistomoides orientalis</i> | | | | | | + | | + | | + | | | | | | | |
| 25. <i>Eurytrema pancreaticum</i> | | | + | | + | + | | | | | | | | | | | |
| 26. <i>E. bhaleraoi</i> | | | + | | | | | | | | | | | | | | |
| 27. <i>Lypersomum reangensis</i> | | | + | | | | | | | | | | | | | | |
| 28. <i>L. kakea</i> | | | | | | + | | | | | | | | | | | |
| 29. <i>Stomylotrema travassosi</i> | | | | | | | | | | | | + | | | | | |
| 30. <i>Halipegas meharansis</i> | | | | + | + | | | | + | | | | | | | | |
| 31. <i>Lecithochirium acutum</i> | | | | | | | | | + | | | | | | | | |
| 32. <i>Anchitrema sanguineum</i> | | | | + | | + | | | | + | | | | | | | |
| 33. <i>Ommatobrephus bengalensis</i> | | | | + | | | | | | | | | | | | | |
| 34. <i>O. lobatum</i> | | | | + | + | + | + | | + | | | | | | | + | |
| 35. <i>Megalotriotrema dicaeacus</i> | | | | + | + | | | | | | | | + | | | | |
| 36. <i>Proalaroides tropidonotis</i> | | | | + | + | | + | | + | | + | + | | | | | |
| 37. <i>Muehlingina lutrai</i> | | | | | | + | | | | | | | | | | | |
| 38. <i>Gogatea serpentium</i> | | | | + | | | + | | + | | | | | | | | |
| 39. <i>Echinostoma revolutum</i> | | | | | | | + | | + | | | + | | | | | |
| 40. <i>E. eduardoi</i> | | | | | | + | | | | | | | | | | | |
| 41. <i>E. malavanum</i> | | | | | | + | | | | | | | | | | | + |
| 42. <i>Vermatrema longitestis</i> | | | | | | + | | | | | | | | | | | |
| 43. <i>Echinoparyphium gizzardi</i> | | | | | | + | | | | | | | | | | | |
| 44. <i>Psilorchis indicus</i> | | | | | | | | | + | | | | | | | | |
| 45. <i>Pseudoechinostomum indicus</i> | | | | | | | | + | + | | | | | | | | |
| 46. <i>Chaunocephalus similiferox</i> | | | | | | + | | | | | | | | | | | |
| 47. <i>Microparyphium montei</i> | | | | | | + | | | | | | | | | | | |

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|--|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|
| 48. <i>Episthimum caninum</i> | | | | | | + | | | | | | | | | | | |
| 49. <i>E. corvus</i> | | | | | | + | | | | | | | | | | | |
| 50. <i>Echinochasmus perfoliatus</i> | | | | | | + | | | | | | | | | | | |
| 51. <i>Psilochasmus oxyurus</i> | | | | | | | | | + | | | | | | | | |
| 52. <i>Fasciola gigantica</i> | | | + | | | + | | | | + | | | | | | | |
| 53. <i>F. hepatica</i> | | + | + | | | + | | | | | | | | | + | | |
| 54. <i>F. jacksoni</i> | | + | | | | | | | | | | | | | | | |
| 55. <i>Fasciolopsis buski</i> | | | + | | | | | | | | | | | | | + | |
| 56. <i>Schistosoma indicum</i> | | | + | + | + | | | | + | + | | | | | | | |
| 57. <i>S. nasale</i> | | | | | | | | | + | + | + | | | | | | |
| 58. <i>S. incognitum</i> | | | | | | + | | | | | | | | | | | |
| 59. <i>S. haematobium</i> | | | | | | + | | | | | | | | | | | |
| 60. <i>Cephalogonimus gangeticus</i> | | | | | | + | | + | | | | | | | | | |
| 61. <i>Strigea elongata</i> | | | | | | | | | + | | | | | | | | |
| 62. <i>Diplostomum (D) splendens</i> | | | | | | + | | | | | | | | | | | |
| 63. <i>Acanthostomum burminis</i> | | | | + | + | | | | | + | + | | | | | | |
| 64. <i>Neodiplostomum cochleare</i> | | | | | | + | | | | | | | | | | | |
| 65. <i>Alaria alata</i> | | + | | | | + | | | | | | | | | | | |
| 66. <i>Haplorchis taichui</i> | | | | | | + | | | | | | | | | | | |
| 67. <i>Heterophyes heterophyes</i> | | | | | | + | | | | | | | | | | | |
| 68. <i>Opisthorchis felineus</i> | | | | | | + | | | | | | | | | | | |
| 69. <i>Amphimerus noverca</i> | | | | | | + | | | | | | | | | | | |
| 70. <i>Pseudamphistomum truncatum</i> | | | | | | + | | | | | | | | | | | |
| 71. <i>Hemiorchis bengalensis</i> | | | | | | | | | | | | | + | | | | |
| 72. <i>Isoparorchis hypselobagri</i> | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| 73. <i>Balfouria monogama</i> | | | | | | | | + | | | | | + | | | | |
| 74. <i>Cyclocoelum (C) mutabile</i> | | | | | | | | + | | | + | | | | | | |
| 75. <i>Prosthogonimus putschkowsii</i> | | | | | | + | | | | | | | | | | | |

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|--|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|
| 76. <i>P. elongatus</i> | | | | | | + | | | | | | | | | | | |
| 77. <i>Glaphyrostomum indicum</i> | | | | | | + | | | | | | | | | | | |
| 78. <i>Notocotylus attenuatus</i> | | | | | | | | | + | | | | | | | | |
| 79. <i>Paragonimus westermanii</i> | | | | | | + | | | | | | | | | | | |
| 80. <i>Paramphistomum cervi</i> | | | + | | | + | + | + | + | | + | + | | | | | |
| 81. <i>P. explanatum</i> | | + | + | | | | + | | | | + | | | | | | + |
| 82. <i>Cotylophoron cotylophorum</i> | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| 83. <i>C. indicum</i> | | | + | | | + | + | + | | | + | | | | + | | |
| 84. <i>C. orientalis</i> | | | | | | + | | | | | | | | | | | |
| 85. <i>Ceylonocotyle scoliocoelium</i> | | + | + | | | + | | | | | + | + | | | + | | |
| 86. <i>C. cuonum</i> | | | | | | + | | | | | | | | | | | |
| 87. <i>C. maplestoni</i> | | | | | | + | | | | | | | | | | | |
| 88. <i>Gastrodiscus secundus</i> | | + | | | | | | | | | | | | | | | |
| 89. <i>G. aegyptiacus</i> | | | + | | | | | | | | | | | | | | |
| 90. <i>Gastrodiscoides hominis</i> | | + | + | | | + | | | | | | | | | | | |
| 91. <i>Olveria indica</i> | | | + | | | + | | | | | | | | | | | |
| 92. <i>Gastrolhylax crumenifer</i> | | | + | + | + | + | | + | + | | + | | | | | | |
| 93. <i>Fischoederius elongatus</i> | | | + | | | + | | | + | | + | | | | | | |
| 94. <i>F. cobboldi</i> | | | + | + | + | + | | | + | | + | | | | | | |
| 95. <i>Orientodiscus lobatum</i> | | | | + | + | + | | + | | | | | | | | | |
| 96. <i>Diplodiscus amphichrus</i> | | | + | + | + | + | + | | + | | + | | | | | | |
| 97. <i>Stunkardia dilymphosa</i> | | | + | | | + | | | | | + | | | | | + | |

SUMMARY

A comprehensive account of all the species of the class Trematoda excluding those from fish hosts and monogeneans, recorded so far from West Bengal have been included in the present work. Larval forms have also been excluded. Key for the families, subfamilies, genera and species dealt in the present work have been provided. Diagnostic characters and distribution of all the species both from West Bengal and other localities of India and abroad have been included, as far as possible, from literature. Synonymies of some species have also been discussed or indicated omitting critical analysis, which is beyond the scope of the present work. History of taxonomic studies of trematodes from West Bengal have also been briefly discussed.

In all 97 species under 69 genera and 30 families have been recorded in the present volume. Host parasite list of trematodes from West Bengal has also been appended.

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DIGENETIC TREMATODES OF FISHES

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INTRODUCTION

Barring deep-sea fishes, the fishes of India, marine or freshwater, have been fairly much explored for digenetic trematodes during the last thirty years, but the eastern States including West Bengal always remained neglected in this regard. The digenetic trematodes of fishes of West Bengal are negligibly known to-day. No concerted efforts were ever made to know the State's fauna of digenetic trematodes of fishes. The Russian academician E.V. Zhukov (1972, 1977) reported some digeneans from marine fishes of India including Hugli estuary. Vasantha Kumari and Srivastava, C.B. (1976a) merely listed 12 species of digenetic trematodes from the marine fishes of Digha coast. They (1976b) further listed 9 species of digenetic trematodes of freshwater fishes of Calcutta and adjacent areas, but detailed descriptions or characteristics of the species involved were not furnished in these two publications. Some species from the fishes of Digha coast and Canning Town (Matla estuary) are included in the Ph.D. thesis of Shri I.B. Dutta of Zoological Survey of India, Calcutta which he has submitted for the award of Ph.D. degree to Calcutta University. These are the only published and unpublished worth mentioning works from West Bengal so far as the digenetic trematodes of marine, estuarine and freshwater fishes are concerned.

According to an estimate of the Fish Division of the Zoological Survey of India, Calcutta, there are about 2400 species of marine and freshwater fishes in the world, of which 2000 species (Approx. 600 spp. of freshwater and approx. 1400 spp. of marine) occur in India and its surrounding seas. Out of these 2000 species, a fairly large number of species of marine, estuarine and freshwater fishes must be occurring in the rivers, ponds, estuaries and coastal waters of West Bengal. It is the strong belief of the world trematodologists that each species of fish, whether pelagic, benthic, vegetarian, estuarine, riverine or pond fishes, must be harbouring at least one species of digenetic trematode. Thus, from West Bengal, which is very rich in fish fauna, a fairly large number of fish digenetic trematodes must have been known, which is regrettably not the position today. In the present work only 54 species (excluding the ones which have been included in Shri I.B. Dutta's Ph.D. thesis) are listed from three districts i.e. District Medinipur (Digha and Junput), District South 24-Parganas (Bakkhali, Kakdwip, Diamond Harbour, Matla estuary at Canning Town, Sagar Island and Hugli Estuary) and District Calcutta (Calcutta). It is based on the published work as well as some collection present in the Platyhelminthes Section. I was supposed to submit a report on the digenetic trematodes of marine and estuarine fishes of West Bengal coast involving only two districts. It was in January, 1992 when I was asked to include the digenean flukes of freshwater fishes of West Bengal also in my report.

Obviously, the digenetic trematode fauna of fishes of West Bengal is very little known as compared to the large number of species of fishes. Much remains to be known from the remaining 14

districts of West Bengal so far as freshwater fishes are concerned. Matla and Hugli estuaries and other rivulets in the Sunderbans are to be more thoroughly explored for the digenean flukes of their fishes. Marine fishes hauled at Bakkhali, Digha and Junput should be more exhaustively explored for flukes. The responsibility rests with the posterity. Of course, there are two major limitations for any exhaustive investigation. Firstly, deep-sea fishing is not carried out by the West Bengal Government which is difficult also due to very wide continental shelf. Secondly, big fishes cannot be purchased for examination due to acute paucity of funds.

MORPHOLOGY AND TERMINOLOGY

The digenean flukes or the digenetic trematodes are flat, elongated and leaf-like invertebrate animals ranging in size from less than a millimeter to several centimeters. They may also be ovoid, conical, cylindrical or broader than long. They are soft-bodied consisting of three layers (outer circular, middle oblique and inner longitudinal) of subcuticular muscles and dorso-ventral transverse bands of muscles, the intervening spaces between muscle bands and various system organs being filled with fluid and a spongy network of mesenchymal parenchyma. There is no body cavity in this group of animals.

The digenetic trematodes are endoparasites of various groups of vertebrates and have complicated life cycles involving alternation of generations and hosts. Adults reproduce sexually in a vertebrate whereas asexual multiplication takes place in larval stages usually in a molluscan intermediate host. Due to parasitic mode of life certain organs like male and female reproductive systems and the organs of attachment have greatly specialised whereas organs of locomotion, sensation and digestion have been reduced. There is no blood vascular system in these parasites but in some flukes a lymphatic system is very much present which seems to function as a primitive circulatory system.

As a rule, the digeneans are monoecious i.e. the male and female reproductive systems occur in the same individual but in the Didymozoidae there is a tendency towards sexual dimorphism. In this family the tendency of dimorphism is gradual and in varying degrees so much so that in certain genera it is complete. In the family Schistosomatidae the sexes are separate and the males live in the gynecophoric canal of females.

EXTERNAL MORPHOLOGY

The external features and internal anatomy of digenetic trematodes have been illustrated in Figs. A and B. They are flattened and elongated. The shape may be leaf-like, linguiform, ovoid, pyriform, fusiform, conical or cylindrical. The size may vary from less than a millimeter to a few millimeters. In some hemeurid digeneans the body is divided into an anterior and a posterior region. The posterior part can be retracted or withdraw partially or wholly into the anterior part. The two regions are known as 'soma' and 'ecsoma' 'body' and 'tail' or 'body proper' and 'appendage' (Fig. C). The tegument or cuticle may be smooth or covered with fine *spines*. Somewhere in the middle line on the ventral surface the main organ of attachment, the *ventral sucker* or *acetebulum*, is situated. It is usually sessile or may be borne on a peduncle as is the case in the genus *Psedopecoeloides* Yamaguti, 1940. In the genus *Opegaster* Ozaki, 1928, the anterior and posterior lips of ventral

sucker are provided with digitate *papillae*. However, a ventral sucker is absent in the Bucephalidae. The *oral sucker* surrounds the mouth at or near anterior end of body. In the genus *Karyakartia* Hafeezullah, 1979 the rim of the oral sucker is provided with anteriorly directed tentacles whereas in *Stephanostomum* Looss, 1899 it is beset with two rings of *circumoral spines*. In the Bucephalidae there is no oral sucker. Instead, there is a *rhynchus* at the anterior end of body. A *genital pore* is usually located in front of the ventral sucker. In some species a *Laurer's canal* opens on the posterodorsal surface, while in others it does not communicate to the exterior at all. The excretory pore usually opens at the posterior end of the body. In the Bucephalidae the genital pore opens near the posterior end of body.

INTERNAL ANATOMY

Mention has been made above about the Muscular System, Parenchyma and Lymphatic System. Nervous System is of primitive type, consisting of a pair of *lateral ganglia* in the pharyngeal region, three pairs of anterior and three pairs of posterior *longitudinal trunks*, and several *commissures*. These systems are of no taxonomical value in digenetic trematodes. However, the excretory, digestive and reproductive systems (Fig. B) and the general relative arrangement of internal organs are definitely important from taxonomical point of view.

Excretory System : The excretory system is of *protonephridial type* i.e. the unit is *flame cell*. The system consists of *flame cells* and their ducts, anterior and posterior *lateral excretory capillaries*, *collecting tubes* or *canals*, *excretory bladder* and *excretory pore*. The movements of the tuft of cilia of the flame cells causes excretion of the liquid waste products from the surrounding tissues into the excretory system. The excretory bladder may be *saccular*, *tubular*, *U-shaped* or *Y-shaped*. The shape of the excretory bladder and its anterior extent are important characters of taxonomic value.

Digestive System : The digestive tract is usually *triclad*. It consists of a terminal or subterminal mouth surrounded by *oral sucker* (except in Bucephalidae), a short or long tubular *prepharynx*, a narrow *oesophagus*, and *intestine* bifurcated into two *caeca*. The intestinal caeca may have outer branches in the postacetabular region as in *Euclinostomum*. Usually the caeca end *blindly* (Fig. D) near posterior end of body but they may form true *ani* (Fig. E) also by communicating with the exterior on either side of excretory pore as in *Bianium*; they may unite to form a *cyclocoel* (Fig. F) as in *Genarchopsis*; they may unite to form a small common duct called *anal canal* (Fig. G) which opens to the exterior on ventral side through a single *anus* in front of the excretory pore; and they may enter into the excretory vesicle from either side so that the excretory vesicle assumes the function of a true *cloaca* (Fig. H) as in *Pseudopecoeloides*. In the families Bucephalidae and Haplospalanchnidae only one caecum develops to the full size.

Reproductive System : The male reproductive organ is *testis* where sperms are produced. Usually there are two *testes*. In some genera the testis is single while in others there are several. The two testes may lie symmetrical, diagonal or tandem in formation. In shape they may be spherical, lobate, tubular or dendritic. From each testis arises a very narrow duct called *vasa efferentia* which unite to form a common duct, the *vas deferens*. It passes anteriorly into the muscular *cirrus sac* which

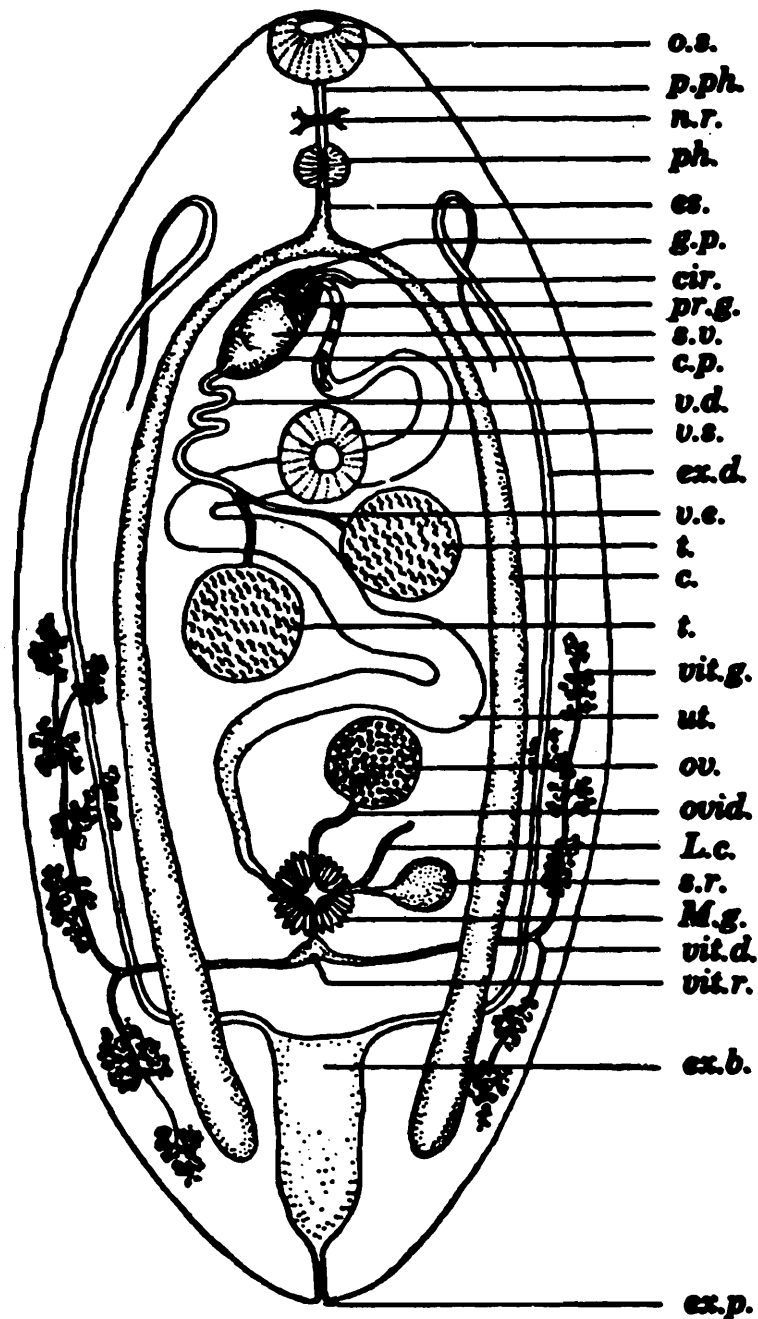


Fig. A Diagrammatic fluke to illustrate principal morphological characteristics. Abbreviations: *c.*, cecum; *cir.*, cirrus; *c.p.*, cirrus pouch; *es.*, esophagus; *ex.b.*, excretory bladder; *ex.d.*, excretory duct; *ex.p.*, excretory pore; *g.p.*, genital pore; *L.c.*, Laurer's canal; *M.g.*, Mehlis' gland; *n.r.*, nerve ring; *o.s.*, oral sucker; *ov.*, ovary; *ovid.*, oviduct; *ph.*, pharynx; *p.ph.*, prepharynx; *pr.g.*, prostate glands; *s.r.*, seminal receptacle; *s.v.*, seminal vesicle; *t.*, testis; *ut.*, uterus; *v.d.*, vas deferens; *v.e.*, vas efferens; *vit.d.*, vitelline duct; *vit.g.*, vitelline glands; *vit.r.*, vitelline reservoir; *v.s.*, ventral sucker.

THE TREMATODA

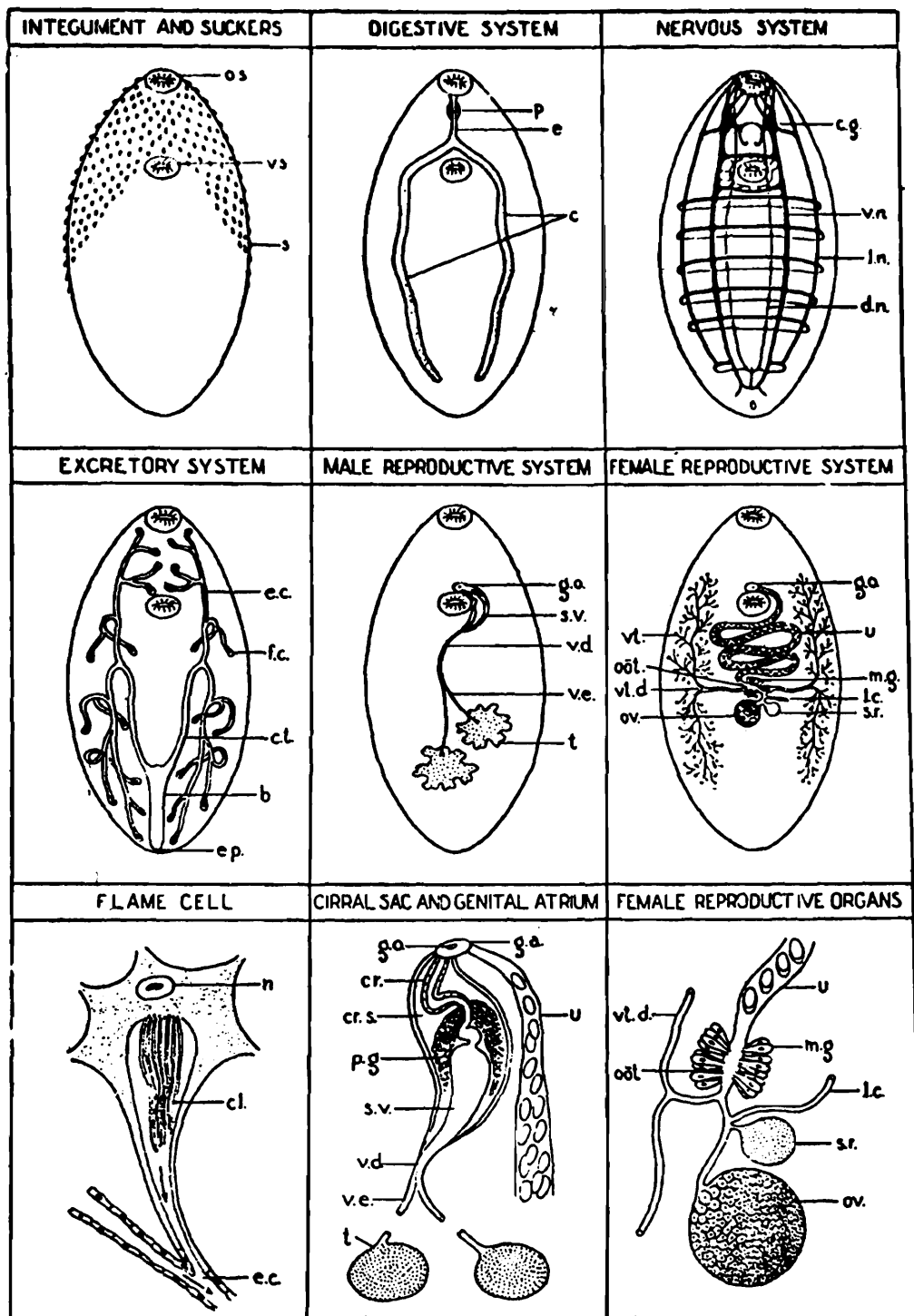


Fig. 1. Schematic representation of morphology of a typical trematode

b, bladder; c, caeca; c.g., cephalic ganglia; cl., cilia; cr., cirrus; c.r.s., cirral sac; c.t., collecting tube; d.n., dorsal nerve trunk; e, esophagus; e.c., excretory capillary; e.p., excretory pore; f.c., flame cell; g.a., genital atrium; g.o., genital opening; l.c., Laurer's canal; l.n., lateral nerve trunk; m.g., Mehlis' gland; n, nucleus; oot., ootype; o.s., oral sucker; ov., ovary; p, pharynx; p.g., prostatic gland; s, spines; s.r., seminal receptacle; s.v., seminal vesicle; t, testis; u, uterus; v.d., vas deferens; v.e., vas efferens; v.n., ventral nerve trunk; v.s., ventral sucker; vt., vitellaria; vt.d., vitelline duct.

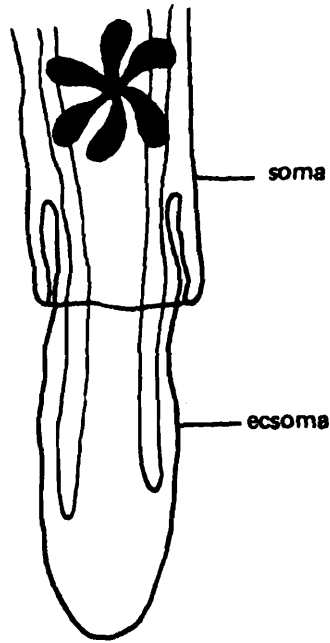


Fig. C

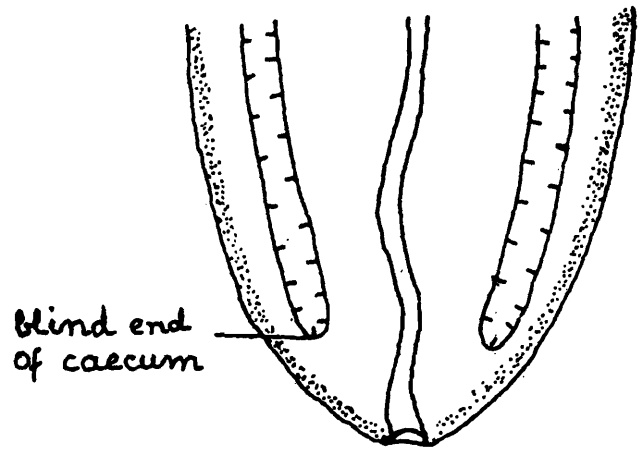


Fig. D

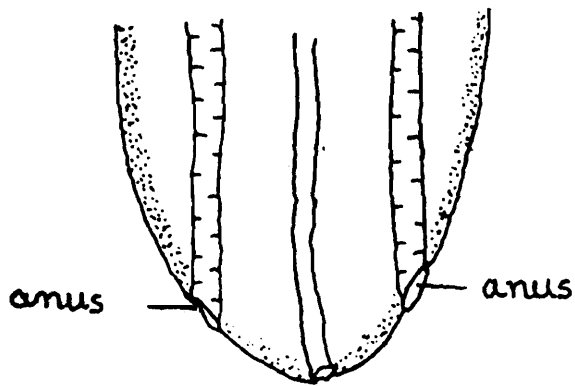


Fig. E

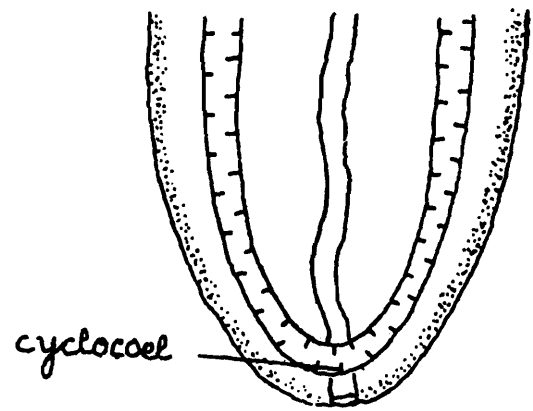


Fig. F

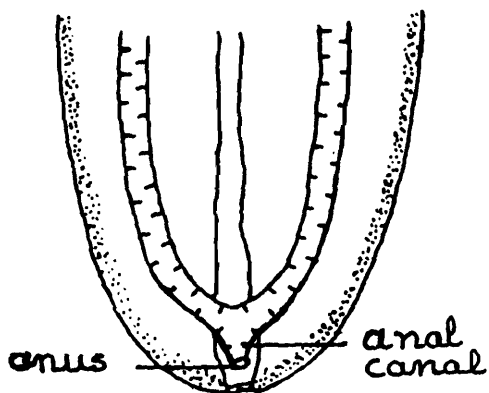


Fig. G

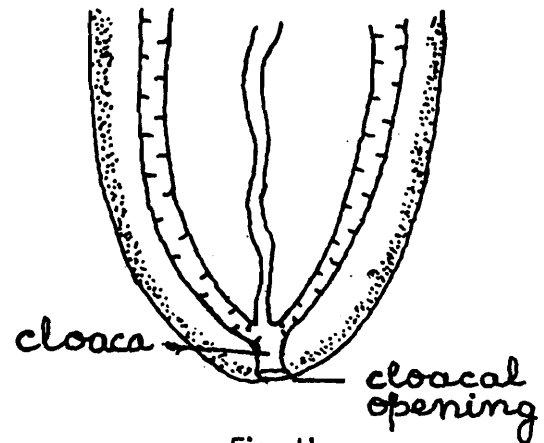


Fig. H

Fig. C. Soma and ecsoma of a hemiurid; Fig. D. Blind end of Caecum; Fig. E. Caeca forming anii; Fig. F. Caeca forming cyclocoel; Fig. G. Caeca forming anal canal and anus; Fig. H. Caeca forming cloaca with excretory vesicle.

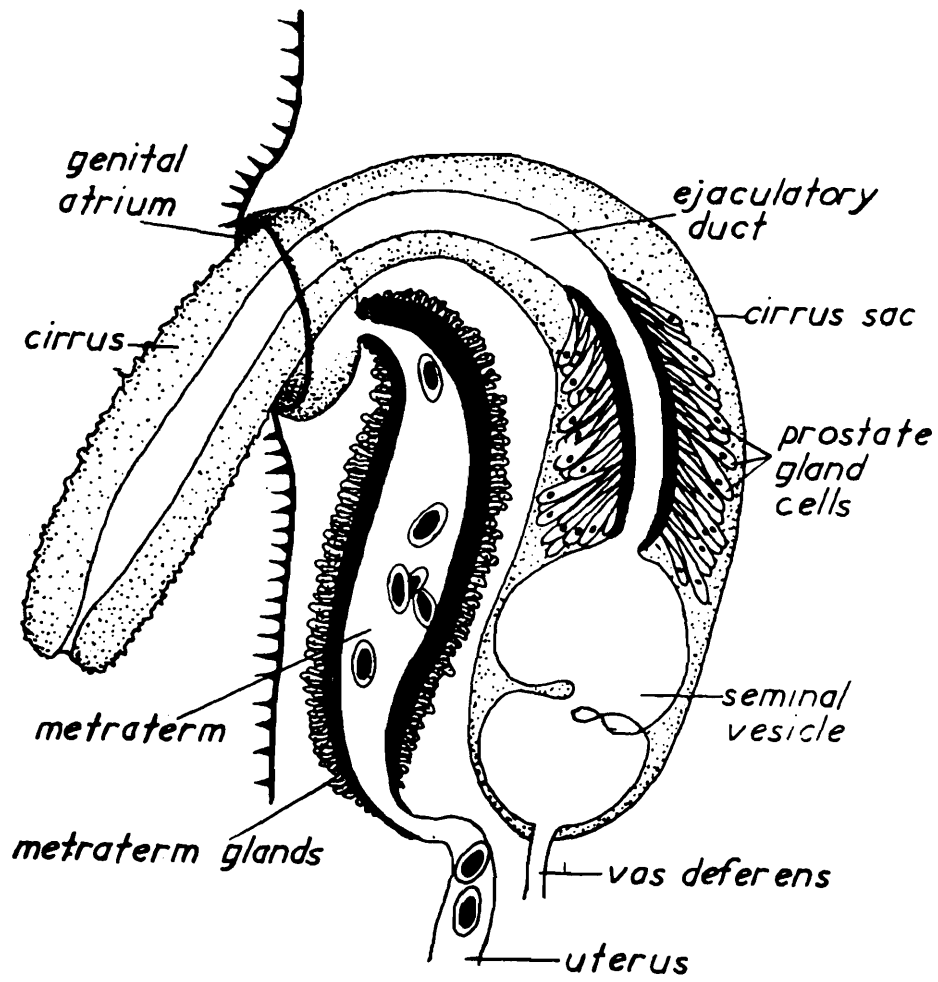


FIG. I

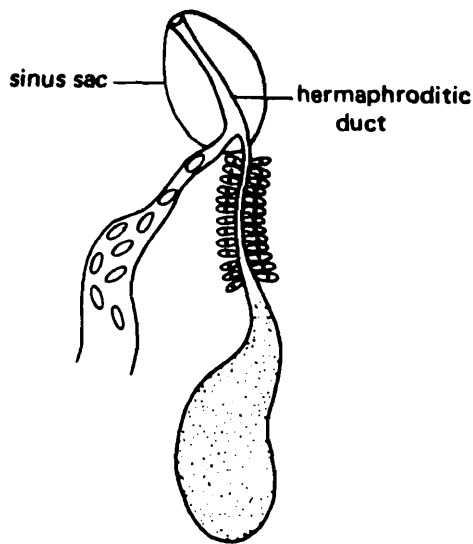


Fig. J

Fig. I. Anterior genital ducts with genital opening; Fig. J. Anterior genital ducts with sinus sac.

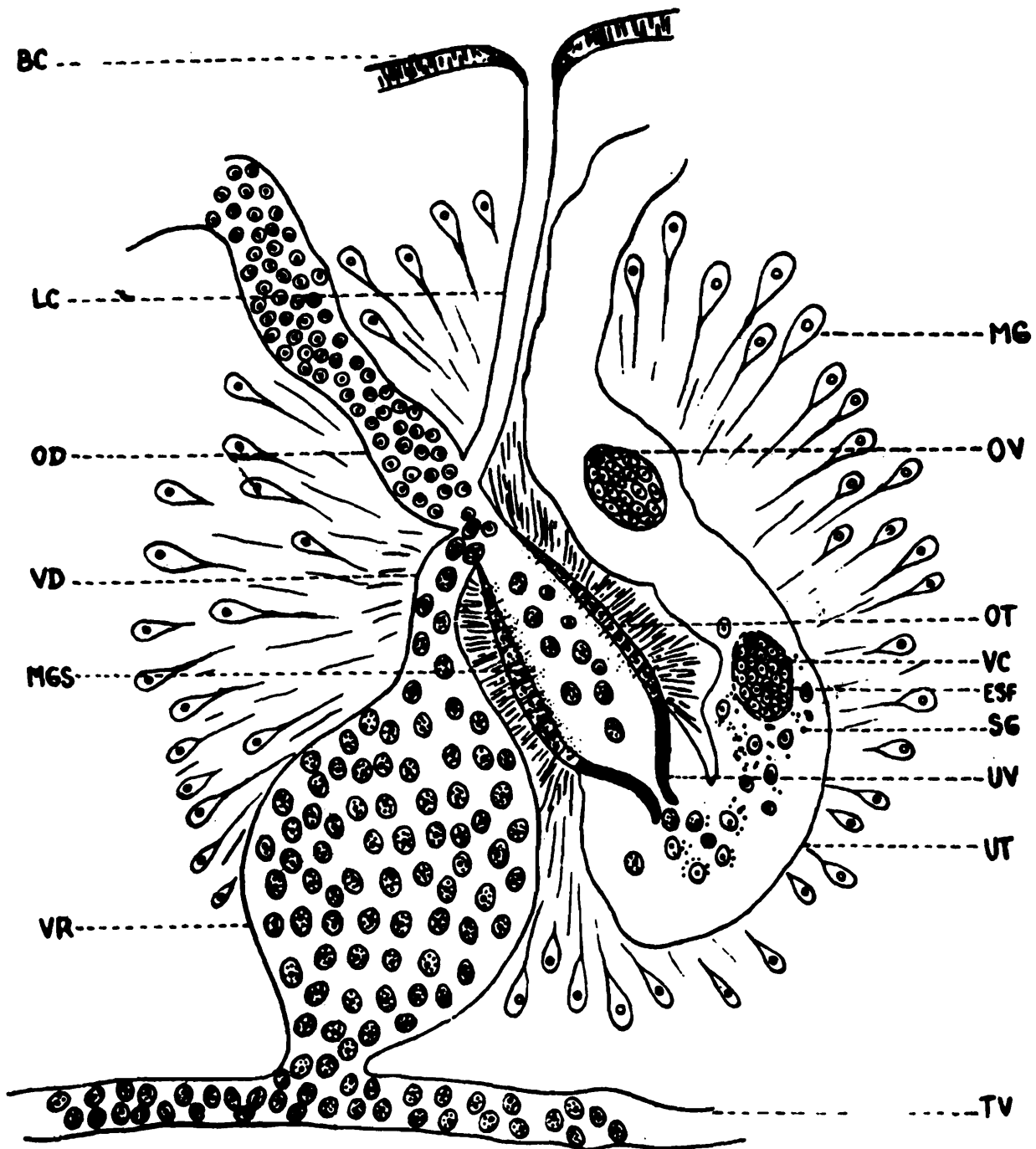


FIG. K Diagram of the Mehlis' gland complex in *Fasciola hepatica* showing the relationships of the ducts and the gland.

Key: *BC*, Body cuticle; *ESF*, Egg shell formation; *LC*, Laurer's canal; *MG*, Mehlis' gland; *MGR*, Mehlis' gland region; *MGS*, Mehlis' gland secretion; *OD*, Oviduct; *OT*, Ootype; *OV*, Ovum; *SG*, Shell granule; *TV*, Transverse vitelline duct; *UT*, Uterus; *UV*, Uterine valve; *VC*, Vitelline cells massed behind ovum; *VD*, Median vitelline duct; *VR*, Vitelline reservoir. (Rao, courtesy of Jour. Parasitology.)

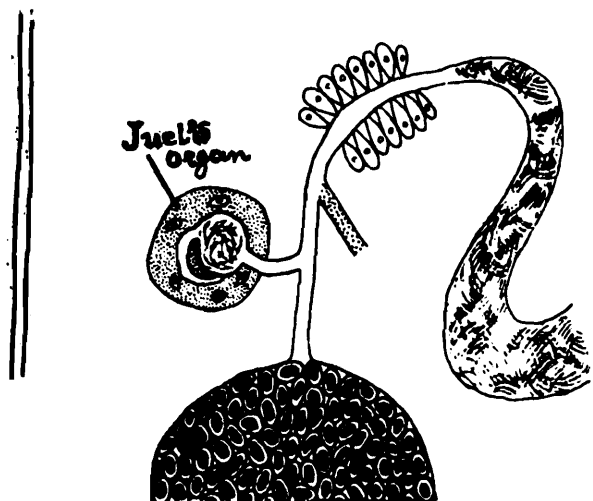


Fig. L

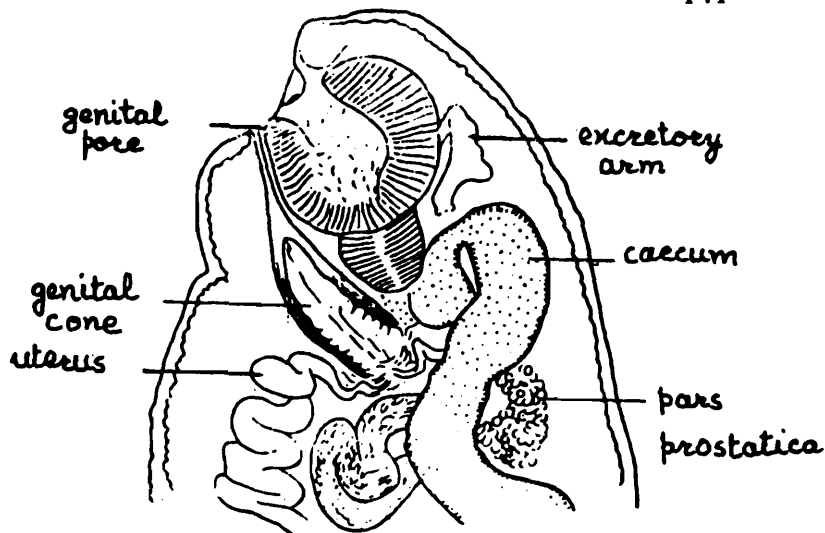


Fig. M

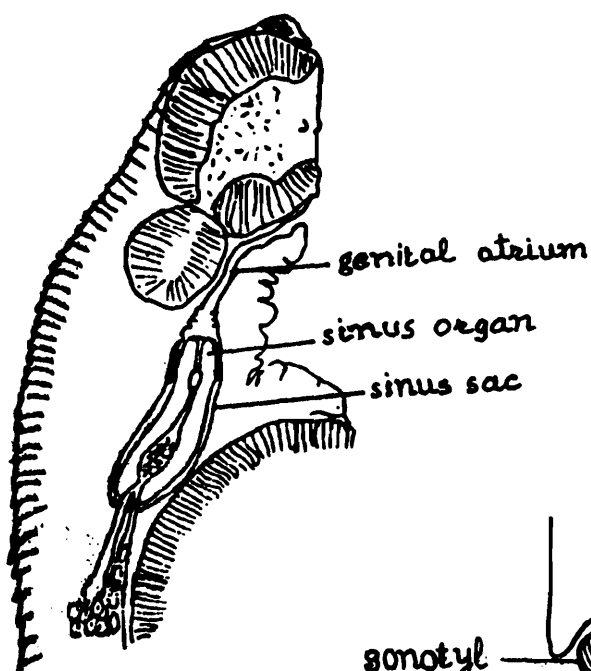


Fig. N

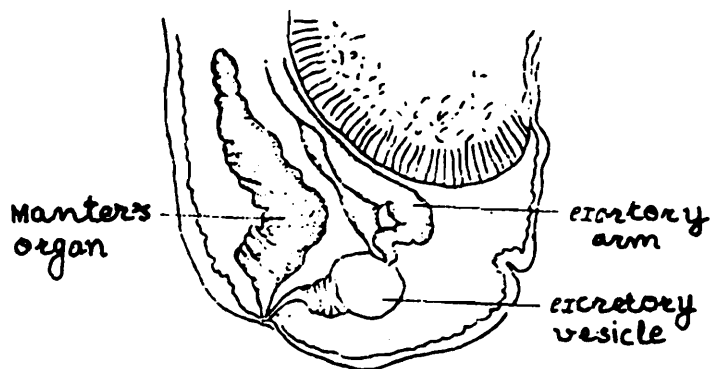


Fig. O

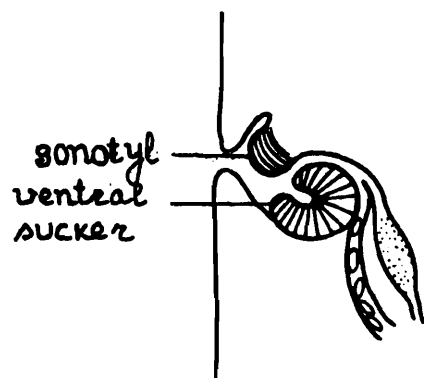


Fig. Q

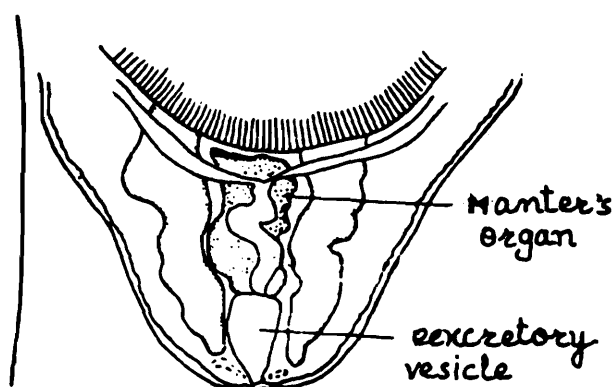


Fig. P

Fig. L. Formation of Juel's Organ instead of Laurer's Canal. M. Genital cone in *Prosogonotrema bilabiatum* (After Manter, 1969). Fig. N. Anterior part of *Hysterolecitha trilocalis* to show sinus organ and sinus sac. (After Manter, 1970). Fig. O. Posterior end of *Prosogonotrema bilabiatum* to show Manter's organ. Intestinal caeca omitted. Lateral view. (After Manter 1969). Fig. P. Posterior end of *Prosogonotrema subequilata* to show Manter's organ in relation to excretory vesicle and caeca. Ventral View. (After Manter, 1969). Fig. Q. Ventrogenital complex to show gonotyl in relation to ventral sucker and genital opening. Lateral View.

encloses a widened or swollen *seminal vesicle*, a small narrow duct, the *pars prostatica*, surrounded by a cluster of *prostatic gland cells*, a somewhat muscular portion called *ejaculatory duct*, and the terminal more muscular *cirrus* (Fig. I). The secretion of the prostatic gland cells nourishes the spermatozoa. Sometimes a part of the seminal vesicle remains outside the cirrus sac, which is then known as *vesicula seminalis externa*. The *cirrus* is the organ of copulation. It protrudes out into the *common genital atrium* at the time of copulation and enters into the nearby female genital pore. By the contraction of the cirrus sac, the sperms get deposited into the uterus. The deposited sperms travel down the uterus and get collected into *seminal receptacle*.

Sometimes, for example in the opcoelid genus *Opegaster* the cirrus sac is very small and remains restricted to enclosing a small cirrus only near the genital pore. As a result the seminal vesicle and *pars prostatica* remain suspended in the parenchyma outside. In others the cirrus sac may be absent at all. In some hemiurids particularly *hemiurids*, a true cirrus is absent and the terminal parts of male and female ducts fuse to form a muscular *hermaphroditic duct* enclosed in a sac similar to the cirrus sac. This sac enclosing the hermaphroditic duct is called *sinus-sac* (Fig. J).

The female gonad is *ovary* which produces ova proper. From the ovary a short *oviduct* arises which dilates to form a swollen muscular structure called *ootype*. The oviduct on the way receives the duct from *seminal receptacle* and in some species *Laurer's canal* also. The *ootype* receives fine ducts from a cluster of surrounding gland cells called *Mehlis' gland* which provides a lubricative secretion to the ripe ova. The oviduct also receives a *vitelline duct* from the *vitelline reservoir* which is formed in the middle at the junction of *transverse vitelline ducts* coming from the *vitellaria* of the two sides. The *vitellaria*, follicular or compact, provide shell material and food to the ripe ova. Fig. K gives a complete picture of the *ootype-Mehlis' gland complex*. In the *ootype* ripe ova come from ovary and receive sperms from seminal receptacle for fertilization and encapsulation of ripe ova takes place in *ootype* and thus finished eggs are produced in *ootype*. The *Laurer's canal*, seminal receptacle and vitelline reservoir are conveniently situated very close to the *ootype* and ovary for the purposes of nourishment, fertilization and shell formation of the ripe ova. In several cases the seminal receptacle is absent. In such cases sperms get collected in the proximal part of the uterus which is then known as *receptaculum seminis uterinum*. In many hemiurids and all hemiurids the *Laurer's canal* does not open on the dorsal surface. Instead it forms a capsule or receptacle (Fig. L). This structure is known as *Juel's organ* because it was first described by H.O. Juel in 1889. The uterus commences from the distal end of the *ootype*, takes a tortuous course describing loops and coils and finally opens into the *common genital atrium* besides the male pore. The terminal part of the uterus may be differentiated into a muscular structure called *metratrem* which acts as a *vagina* during self-fertilization which is the rule in digenetic trematodes. The function of the *Laurer's canal* is not known with certainty. It is believed that this canal may be functioning as a vestigial vagina during cross-fertilization with another worm or it may be acting for the exit of excess spermatozoa and yolk.

In some hemiurids like *Uterovesiculurus* and others a muscular cylindrical organ penetrated by the hermaphroditic duct is formed which is called *sinus organ* (Fig. M). It lies free in the *sinus sac* and projects into the *genital atrium*. In the genus *Prosogonotrema* a long conical and muscular structure enclosed in the genital atrium or projecting into it is formed at the base of or ventral to oral sucker. In its axis is contained a hermaphroditic duct. This conical muscular structure is called

genital cone (Fig. N). Again in the same genus *Prosogonotrema* there occurs a long and wide accessory excretory vesicle in the hindbody dorsal to the normal excretory vesicle. As this structure was discovered by Dr. H.W. Manter in 1969 it is called *Manter's organ* (Figs. O & P). In heterophyids like *Haplorchoides* an appendicular outgrowth within the acetabulogenital complex is formed, or it may be a lobe or pad or sucker-like prominence. It is considered to be a copulatory device in the acetabulogenital complex and is called *gonotyl* (Fig. Q).

MATERIAL AND METHOD

The present work is based on the compilation of the published work on digenetic trematodes of fishes of West Bengal as well as on the digenean material collected from the marine, estuarine and freshwater fishes of the State. The method of collection of the digenean material from the fish hosts as followed in the field is given in brief in the following lines.

The fish hosts were purchased from the commercial fishermen either at the landing places or from the fish markets. They were identified with the help of literature or experts of Zoological Survey of India. Efforts were made to examine as many specimens of a species of fish as possible to avoid negative results. It had always been the endeavour to examine fishes as fresh as possible in order to recover worms live and in good condition. As a matter of rule, the fishes were opened for examination in normal saline (0.78 gm of analytical NaCl dissolved in 100 c.c. of distilled water) and after removal from the host the trematodes were washed with and allowed to relaxe for some time in the same medium in cavity blocks. In as many cases as possible and in so far as time permitted in the field laboratory, the trematodes were first studied alive under traveller's binocular microscope particularly for features like the shape of the excretory bladder and their extent as well as the condition of the intestinal caeca near the posterior end of the body. The results of this study were noted in the field book with rough diagrams for future use. After complete relaxation, the worms were taken on a clean slide with the help of a long dropper, covered with a coverglass or a piece thereof depending up on the size and texture of the worm for flattening, taking care that the worm was not overpressed or overflattened. For stout and highly muscular trematodes like hemiurids particularly hemiurids which are unmanageable, additional pressure was applied gently with the tip of an entomological needle for proper flattening. The worm was then fixed by sending a few drops of fixative, preferably AFA for better results, under the coverglass with the help of a dropper. The slide with the worm in AFA fixative was covered with a big petridish to avoid dehydration of the specimen. Sufficient timer was allowed for proper and complete fixation of the worm. After fixation, the parasite was removed from the slide, kept it in the same fixative (AFA) separately for some time, washed in 70% alcohol repeatedly with the aid of a dropper in order to remove even traces of fixative from the material, and finally stored in 70% alcohol in air tight glass vials. A label bearing the names of the host and the organ from which the worm was recovered, name of the locality and the date of collection was also inserted in the vial for use in future.

In the laboratory trematodes were stained with alcoholic borax carmine (borax carmine prepared in 70% alcohol). As a matter of preference, the specimens were overstained first and then

differentiated with acid alcohol (one drop of concentrated HCl in 100 C.C. of 70% alcohol). The process of differentiation was kept on observing under a binocular till the desired result was achieved. The material was then treated with ammonia alcohol in a cavity block in order to remove traces of acid alcohol by neutralising it. The material was then washed with 70% alcohol 2- 3 times with the aid of a dropper in order to remove traces of ammonia from it. It is then dehydrated in various grades of alcohol (80%, 90%, 96% and 100%) according to the standard method. After complete dehydration, it was cleared in clove oil with a final rinse in xylol rendering it transparent and free from excess of clove all. It was then immediately mounted in Canada balsam and slowly dried on a regulated hot plate in low temperature. Thus the specimens were made ready for study. A label of collection data (name of the fish host, organ of the host from where the trematode was recovered, name of the place from where the fish host was collected and the date of collection) was pasted on the left side of the slide and another label with the identification of the trematode was pasted on the right side.

Short diagnosis of each species including the characteristic features and key characters have been furnished. All body measurements have been given in millimetres whereas those of organs and eggs are in microns. The illustrations of various species in this report have been borrowed from the literature. The distribution of species includes their occurrence in West Bengal and other States of India. In the text, the species have been arranged alphabetically where more than one species are reported under a genus. Only in such cases, keys to the species of genera have been provided for the convenience of the readers. Only genera and species have been serially numbered. All the material used in the present report will be deposited with the National Helminthological Collection of Zoological Survey of India, Calcutta. The material of the species reported by Dr. E.V. Zhukov from Hugli estuary could not be examined for obvious reasons. The egg measurements are in micron.

SYSTEMATIC ACCOUNT

Key to West Bengal Fish Digenean Families

[Modified after Ben Dawes (1947), Yamaguti (1971) and Gibson and Bray (1979) according to need of the present work. The useableness of keys is greatly prohibited by exceptions - Yamaguti (1971)].

1. Ovary tubular, band-like or coiled; parasitic in swim-bladder of freshwater fishes.....
 Isoparorchidae
- Ovary never tubular or band-like 2
2. Ovary pretesticular 3
- Ovary never pretesticular 17
3. Cirrus sac heavily spined 4
- Cirrus sac usually not heavily spined 6

4. Metraterm usually forming a special terminal organ; hermaphroditic duct absent; vitellarium not extensive, usually in symmetrical bunches of follicles; uterus usually occupying most of hindbody..... Monorchidae
 Metraterm not forming a special terminal organ 5
5. Hermaphroditic duct (genital sinus) long; vitellarium follicular, usually extensive, uterus preovarian or descending as far back as testes Acanthocolpidae
 Hermaphroditic duct (genital sinus) short; vitellarium follicular, usually not extensive, confined to middle region of body, follicles scanty and sparse; uterus between anterior or posterior testis and metraterm Deropristiidae
6. Cirrus sac absent; acetabulogenital complex formed, with or without gonotyl Heterophyidae
 Cirrus sac present; acetabulogenital complex not formed 7
7. Tests preacetabular; genital atrium provided with an accessory organ posteriorly Monodhelnthidae
 Tests postacetabular; genital atrium not provided with accessory organ posteriorly..... 8
8. *Prostatic sac present; parasitic in freshwater teleosts and elasmobranchs..... Azygiidae
 Prostatic sac absent; parasitic in freshwater and marine teleosts..... 9
9. Parasitic in freshwater fishes..... 10
 Parasitic mainly in marine fishes, exceptionally in freshwater fishes..... 13
10. Tests and ovary in or near acetabular zone, vitelline follicles in neck or shoulder region..... Lecithodendriidae
 Tests and ovary not in or near acetabular zone; vitelline follicles not in neck or shoulder region. 11
11. Vitellarium follicular, extending in fore-and hindbody, sometimes rather limited in extent, not confluent near posterior end of body; cirrus sac usually very long Plagiorchidae
 Vitellarium follicular, extensive, confluent near posterior end of body; cirrus sac not very long 12
12. Uterus extending into inter-and posttesticular region Macroderoididae
 Uterus usually pretesticular, exceptionally extending to posterior end of body..... Allocreadiidae
13. Acetabulum from near midlevel to posterior end of body; muscular postoral ring at posterior margin of oral sucker present or absent..... Opistholebetidae
 Acetabulum well in anterior half of body; muscular postoral ring entirely absent 14

* It is a muscular sac surrounding the pars prostatica and seminal vesicle. The term has been coined by Gibson (1976).

14. Oral sucker with papilliform anteriorly directed processes; one or more accessory suckers may or may not be present in front of acetabulum..... **Enenteridae**
- Oral sucker without papilliform appendages; accessory suckers in front of acetabulum entirely absent 15
15. Vitellarium follicular, usually limited in extent, often forming symmetrical bunches; uterus usually occupying all available space in posttesticular region**Felodistomatidae**
- Vitellarium extensively developed; uterus preovarian, exceptionally extending into posttesticular area 16
16. Body smooth; eyespot pigments absent; cirrus sac variable in development, usually weakly developed, greatly reduced or absent; acetabulum with or without papilliform or tentacular appendages **Opecoelidae**
- Body usually spined; eyespot pigments present; cirrus sac well developed; acetabulum usually without appendages**Lepocreadiidae**
17. Ovary posttesticular; vitellarium compact, single or paired; excretory vesicle Y-shaped 18
- Ovary intertesticular, in hindbody; caeca long, simple or with long lateral branches in hind body; vitellarium follicular; uterus ascending up to a certain level behind acetabulum and then descending to open into uterine sac; metacercaria encysting in liver, wall of body-cavity or kidney of fishes; adults in birds and reptiles.....**Clinostomidae**
18. Body divided into soma and ecsoma; vitellarium consisting of 7 winding tubules or digitate lobes in groups of 3 and 4**Hemiuridae**
- Body not divided into soma and ecsoma..... 19
19. Vitellarium filamentous; Manter's organ present**Prosogonotrematidae**
- Vitellarium oval or globular masses; Manter's organ absent 20
20. Acetabulum usually in or behind middle of body; seminal vesicle in forebody, enclosed in sinus sac; vitellarium consisting of 1 or 2 masses, entire or lobed; ovary and vitellarium pre- or posttesticular; parasitic mainly in freshwater and marine teleosts, occasionally in amphibians and reptiles **Derogenidae**
- Acetabulum in anterior half or middle of body; seminal vesicle never enclosed in sinus sac 21
21. Vitellarium 7 oval to digitiform lobes, often congregated behind ovary in rosette.....
.....**Lecithasteridae**
- Vitellarium 1, 2 or 3 ovoid masses behind ovary **Bunocotylidae**

A. Hosts – Marine and estuarine fishesFamily *Acanthocolpidae* Lühe, 1909Subfamily *Acanthocolpinae* Lühe, 1906**Genus 1. *Acanthocolpus* Lühe**1906. *Acanthocolpus* Lühe, *Ceylon pearl Oyster Fish. Rep.*, pt. 5 : 100.**Key to West Bengal species of *Acanthocolpus***

Body with acetabular peduncle; cirrus sac extending posteriorly upto anterior level of vitellaria; genital sinus short extending posteriorly up to base of acetabular peduncle only; anterior level of vitellaria preequatorial.....*Acanthocolpus liodorus* Lühe, 1906

Body with acetabular protuberance or peduncle; cirrus sac extending posteriorly beyond anterior level of vitellaria; genital sinus long, extending much behind base of acetabular protuberance; anterior level of vitellaria equatorial *Acanthocolpus caballeroi* Gupta, A.N. and Sharma, 1972

1. *Acanthocolpus caballeroi* Gupta, A.N. and Sharma

(Fig. 1)

1972. *Acanthocolpus caballeroi* Gupta, A.N. and Sharma, *An. -Inst. Biol. Univ. Nat. Auton. Mexico*, 43 (1) : 94.1981. *Acanthocolpus puriensis* Gupta, V. and Puri, *Indian J. Helminth.*, 32 (1) : 132.1981. *Acanthocolpus lucknowensis* Gupta, V. and Puri, *Indian J. Helminth.*, 32 (1) : 134.

Material examined : Host - *Anodontostoma chakunda* (Hamilton-Buchanan), Chakunda gizzard-shad, (Family Clupeidae), *Chirocentrus dorab*, dorab wolf herring, (Family Chirocentridae); location - intestine; locality Digha; number of specimens 1 + 14, on 1 + 2 slides, 14 specimens on two slides from *Chirochutrus dorab* are already deposited as ZSI. Reg. Nos. W 7545/1 7546/1.

Diagnosis : Body cylindrical, pedunculate near anterior end of body, 2.805 – 11.175 mm long, 0.285-0.615 mm wide, unspined. Acetabulum at tip of a large protuberance or peduncle. Oral sucker lacking circumoral spines, smaller than acetabulum. Intestinal caeca ending blindly near posterior end of body. Testes two ovate, directly tandem, postequatorial. Cirrus sac very long, extending much posterior to anterior level of vitellarium, enclosing bipartite seminal vesicle, pars prostatica and spined ejaculatory duct. Genital sinus (hermaphroditic duct) very long, spined. Genital opening at base of acetabular peduncle. Ovary globular, small, immediately in front of anterior testis. Uterus with few eggs, preovarian. Metraterm long, spined, entering genital sinus much behind base of acetabular protuberance. Eggs 60 X 30. Vitelline follicles extending anteriorly up to almost midbody covering an appreciable posterior part of cirrus sac. Excretory vesicle Y-shaped; pore terminal or subterminal.

Remarks : This species was originally described by Gupta, A.N. and Sharma (1972) from the fish *Chirocentrus dorab* from Ratnagiri (Arabian Sea). Hafeezullah (1978) considered it as a synonym of *Acanthocolpus luhei* Srivastava, 1939. Later on, he (in press) revalidated it as a distinct species on

the basis of material recovered from the fish *Chirocentrus dorab* from Chandipur, Konarak and Digha (Bay of Bengal). He (in press) further synonymised *A. puriensis* Gupta, V. and Puri, 1981 and *A. lucknowensis* Gupta, V. and Puri, 1981 with *A. caballeroi*. The fish *Chirocentrus dorab* is the favourite host of the genus *Acanthocolpus* Lühe, 1906 in Arabian Sea and Bay of Bengal. *Anodontostoma chakunda* seems to be an accidental host.

Distribution : West Bengal : Digha (District Medinipur); Orissa and Maharashtra coasts,

2. *Acanthocolpus liodorus* Lühe

(Fig. 2)

1906. *Acanthocolpus liodorus* Lühe, *Ceylon Pearl Oyster Fish. Rep. Pt. 5* : 100.

1977. *Acanthocolpus liodorus* : Zhukov. *Parazit. Sb.*, No. 27 : 64.

1980. *Acanthocolpus inglisi* Gupta, S.P. and Gupta, R.C. *Indian J. Helminth.*, 32 (1) : 61.

1981. *Acanthocolpus guptai* Gupta, V. and Puri, *Indian J. Helminth.*, 32 (2) : 129.

Material examined : Host - *Chirocentrus dorab* (Forskål), Dorab Wolf herring, (Family Chirocentridae); location - intestine; localities - Hugli estuary, Digha coast.

Diagnosis : Body cylindrical with acetabular peduncle near anterior end of body, 2.24-2.70 mm long. 0.41-0.45 mm wide, unspined. Acetabulum borne on a peduncle. Oral sucker subterminal, without circumoral spines. Prepharynx long; pharynx pearshaped; oesophagus shorter than prepharynx; Caeca ending blindly near posterior end of body. Testes two, elongate, directly tandem, postequatorial. Cirrus sac extending almost up to anterior level of vitellarium, posterior to acetabular peduncle, enclosing seminal vesicle, parsprostatica and spined ejaculatory duct. Genital sinus (or hermaphroditic duct) long. Genital pore near base of acetabular peduncle, Ovary spherical, immediately in front of anterior testis. Uterus between ovary and base of acetabular peduncle; metraterm spined. Eggs 62 x 33. Vitelline follicles from posterior level of cirrus pouch to posterior end of body.

Remarks : Zhukov (1977) reported it from Hugli estuary from the fish *Chirocentrus dorab*. Vasanta Kumar and Srivastava, C.B. (1976a) reported it from Digha coast from the same host. *Acanthocolpus inglisi* Gupta, S.P. and Gupta, R.C., 1980 and *Acanthocolpus guptai* Gupta, V. and Puri, M., 1981 have been considered as synonyms of *A. liodorus* Lühe, 1906 by Hafeezullah (in press) on the basis of the material collected from the same fish host from Veraval, Bombay and Kozhikode (ZSI. Reg. Nos. W 751/1 to W 7528/1).

Distribution : West Bengal : Hugli estuary (District South 24-Parganas), Digha (District Medinipur); coasts of Maharashtra, Gujarat, Orissa, Andhra Pradesh, Tamil Nadu, Kerala.

Subfamily Stephanostominae Yamaguti, 1958

Genus 2. *Stephanostomum* Looss

1899. *Stephanostomum* Looss, *Zool. Jahrb. Syst.*, 12 : 576.

1942. *Monorchistephanostomum* Pérez Vigueras, *Rev. Univ. Habana* 7 (40-42) : 193, 195.

1955. *Critovitellarium* Pérez Vigueras, *Rev. Iber. Parasitol., Libro homenaje Lopez-Neyra, Extraordinary Volume* : 440.

Key to West Bengal species of *Stephanostomum*

1. Both rings of circumoral spines complete 2
Both rings of circumoral spines interrupted midventrally..... 3
 2. Vitellaria extend from posterior level of cirrus sac to posterior end of body; circumoral spines 40..
..... *Stephanostomum triacanthi* Madhavi, 1976
 3. Vitellaria extend from posterior level of cirrus sac to posterior end of body; circumoral spines 32..
.....*Stephanostomum orientalis* (Srivastava, H.D., 1939)
- Vitellaria extend from level of middle of cirrus sac to posterior end of body; circumoral spines 30-33 *Stephanostomum bicoronatum* (Stossich, 1883)

3. *Stephanostomum bicoronatum* (Stossich) Fuhrmann
(Figs. 3, 4)

1883. *Distomum bicoronatum* Stossich, *Boll. Soc. Adriat. Sc. Nat.*, Trieste, 8 : 113.

1928. *Stephanostomum bicoronatum* : Fuhrmann, *Kukenthal's Handb. Zool.* : 104.

1977. *Stephanostomum bicoronatum* : Zhukov, *Parazit. Sb.*, No. 27 : 64.

Material examined : Nil.

Hosts – *Otolithoides biauratus* (Cantor) and *Otolithoides brunneus* (Day), Bronze-crocker, (Family Sciaenidae) : location - intestine; locality - Hugli estuary.

Diagnosis : Body elongate, 1.82-3.18 mm long, 0.33-0.47 mm wide, spined. Eye-spot pigments present. Acetabulum prominent, in posterior half of anterior third of body. Oral sucker terminal, smaller than acetabulum, provided with 30-33 circumoral spines in two alternating rings interrupted midventrally. Caeca simple, terminating at posterior end of body. Testes two ellipsoidal, directly tandem, near posterior end of body. Cirrus sac extending posteriorly half way to ovary. Genital pore immediately in front of acetabulum. Ovary ovoid, pretesticular, separated from anterior testis by vitelline follicles. Uterus between ovary and cirrus pouch. Metraterm well developed, not longer than cirrus sac entering genital sinus along with ejaculatory duct. Egg elongate oval, 62-73 x 33-37. Vitelline follicles extending from middle of cirrus sac to posterior end of body. Excretory vesicle tubular; pore ventroterminal.

Remarks : This species has been generally reported from the fish family Sciaenidae. Zhukov (1977) collected it from Cochin also from a sciaenid fish *Johnius soldado*. However, it is recorded by Zhukov (1977) for the first time from India (Hugli estuary).

Distribution : West Bengal : Hugli estuary (South 24-Parganas); Kerala Coast.

4. *Stephanostomum orientalis* (Srivastava, H.D.) Madhavi
(Figs. 5, 6)

1939. *Acanthocolpus orientalis* Srivastava, H.D., *Indian J. vet. Sci.*, 9 : 215.

1976. *Stephanostomum orientalis* : Madhavi, *Riv. Parassit.*, 37 (2-3) : 116.

1979. *Stephanostomum chauhani* Gupta, V. and Ahmad, *Helminthologia*, 16 : 162 (n. syn.).

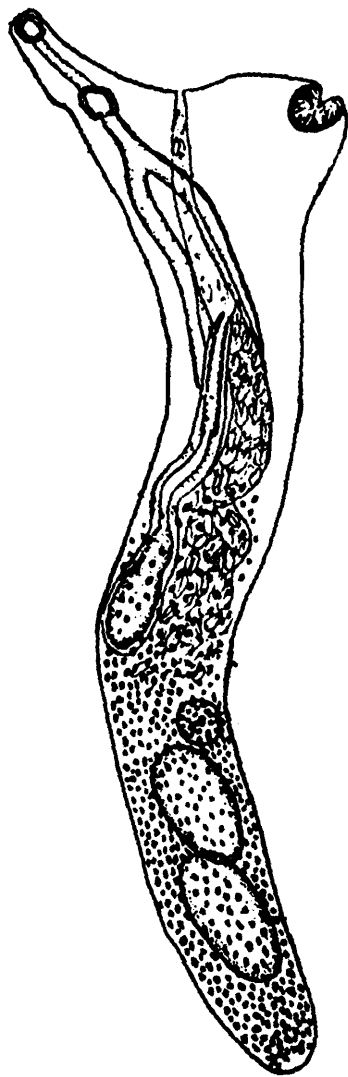


Fig. 1



Fig. 3



Fig. 4

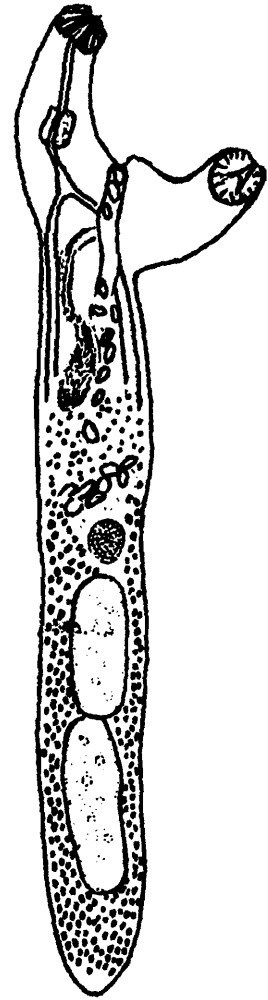


Fig. 2

Fig. 1. *Acanthocolpus caballeroi*. Lateral View (After Gupta, A.N. and Sharma, 1972).
 Fig. 2. *Acanthocolpus liodoras*. Lateral View. Fig. 3. *Stephanostomum bicoronatum*. Ventral View.
 Fig. 4. Enlarged anterior part of *Stephanostomum bicoronatum*.

Material examined : Host - *Megalaspis cordyla* (L.), Hardtail scad, (Family Carangidae) and *Lutjanus johni* (Bloch), John's snapper, (Family Lutjanidae); location intestine; locality Digha coast; no. of specimens 3, on two slides.

Diagnosis : Body elongate, slender, 4.35-6.09 mm long, 0.39-0.74 mm wide, spined. Acetabulum situated just behind caecal bifurcation. Oral sucker funnel-shaped, smaller than acetabulum. Circumoral spines present in two alternating rings with a gap on ventral side; spines 32, spindle-shaped, ventral spines measuring 38-50 while dorsal ones 55-72. Prepharynx very long, pharynx pyriform; oesophagus short. Caecal bifurcation in front of acetabulum; intestinal caeca extending up to posterior end of body. Testes two, ovate, tandem, may or may not be separated by vitelline follicles. Cirrus sac very long, tubular, sinuous, extending much posterior to acetabulum up to or a little posterior to anterior level of vitellarium, enclosing a bipartite seminal vesicle, a tubular pars prostatica surrounded by prostate gland cells and a long and spined cirrus joining terminally with metraterm to form a short hermaphroditic duct opening into genital atrium. Genital atrium unspined, situated between acetabulum and caecal bifurcation. Ovary globular or oval, pretesticular, separated from anterior testis. Seminal receptacle absent. Uterus preovarian, metraterm differentiated, spined, joining terminally with cirrus to form hermaphroditic duct. Eggs 57-82 x 47-55. Vitellarium follicular, circumcaecal, extending from near posterior end of cirrus sac to posterior end of body. Excretory vesicle Y-shaped; pore terminal.

Remarks : The only difference between *Acanthocolpus* Lühe, 1906 and *Stephanostomum* Looss, 1899 is that in the former genus the circumoral spines are lacking whereas in the latter genus they are present. Srivastava, H.D. (1939b) originally described his species as *Acanthocolpus orientalis* from the carangid fish *Caranx kalla* from Puri coast. Madhavi (1976) collected specimens from carangids *Caranx sexfasciatus*, *Carangoides malabaricus* and *C. chrysophrys* from adjoining Waltair coast. Her specimens are identical to Srivastava's species except that they have two alternating rings of circumoral spines. On the basis of this close similarity, she presumed that probably circumoral spines were lost in Srivastava's specimens due to maceration. Therefore she transferred *Acanthocolpus orientalis* to the genus *Stephanostomum*. In the present two specimens from *Megalaspis cordyla* also, one has the circumoral spines while in the other they have been shed off. In the single specimen from *Lutjanus johni* also the circumoral spines have been lost during processing. Except some differences in body and egg measurements, *Stephanostomum chauhani* Gupta, V. and Ahmad, 1979 from the fish *Lutianus rivulatus* is morphologically identical to *Stephanostomum orientalis*. Therefore, the former species is considered as a synonym of the latter.

Distribution : West Bengal : Digha coast (District Medinipur); coasts of Orissa and Andhra Pradesh.

5. *Stephanostomum triacanthi* Madhavi

(Figs. 7, 8)

1976. *Stephanostomum triacanthi* Madhavi, *Riv. Parassit.*, 37 (2-3) : 118.

Material examined : Host - *Triacanthus brevirostris*, short-nosed tripod, (Family Triacanthidae); location - intestine; locality - Digha coast; no. of specimen - one, on slide.

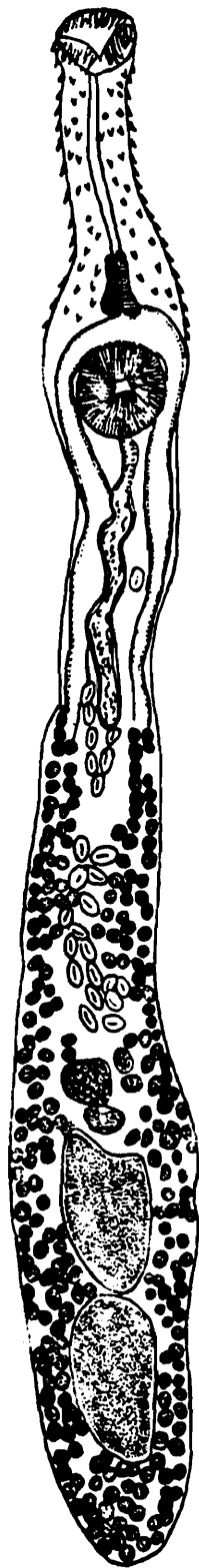


Fig. 5

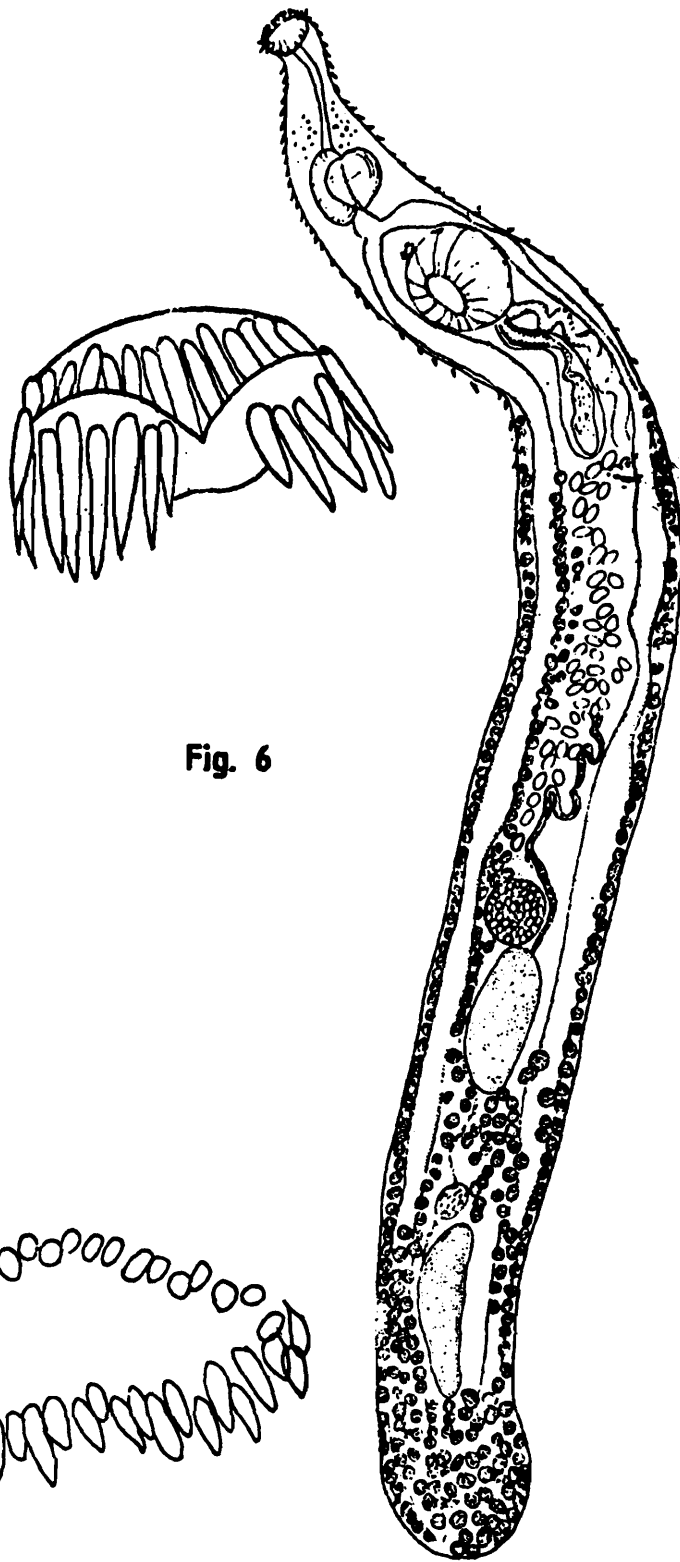


Fig. 6

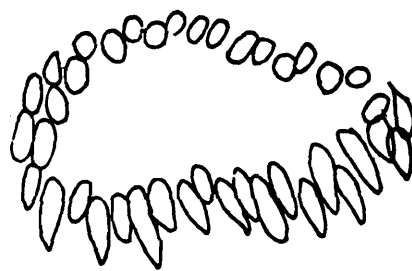


Fig. 8

Fig. 7

Fig. 5. *Stephanostomum orientalis*. Ventral View (After Madhavi, 1976). Fig. 6. Enlarged anterior end of *Stephanostomum orientalis*. Fig. 7. *Stephanostomum triacanthi*. Ventral View (After Madhavi, 1976). Fig. 8. Enlarged anterior end of *Stephanostomum triacanthi*.

Diagnosis : Body elongate, 5.690 mm long, 0.576 mm wide, spinose. Acetabulum globular, situated at about one fourth of body length from anterior end. Oral sucker terminal, surrounded by two alternating complete rings of circumoral spines, 40 in number, oral spines 39 long, aboral spines 54 long. Testes two, postequatorial, elliptical, tandem, separated by vitelline follicles. Cirrus sac claviform, short, not much extending posterior to acetabulum, enclosing undivided saccular seminal vesicle, pars prostatica and a long and spined cirrus, joining with metraterm near posterior margin of acetabulum to form a hermaphroditic duct. Genital atrium long opening near anterior margin of acetabulum. Ovary globular, pretesticular, separated from anterior testis. Seminal receptacle absent, uterine seminal receptacle present. Uterus preovarian, Metraterm long, tubular, spined, joining cirrus. Eggs 62 x 31-35. Vitellarium follicular, circumcaecal, extending from posterior level of cirrus sac to posterior end of body. Excretory vesicle Y-shaped; pore terminal.

Remarks : A sperm reservoir in the course of vas deferens is seldom formed in digenetic trematodes, but this structure is formed in *S. triacanthi* Madhavi, 1976 as happens in *S. sierraleonensis* Fischthal and Williams, 1971. Its absence or presence has no systematic value. However, it is not formed in the present single specimen.

Distribution : West Bengal : Digha (District Medinipur); Andhra Pradesh coast.

Family Deropristiidae Skrjabin, 1958

Syn. Deropristiidae Mehra, 1962

Subfamily Deropristiinae Cable and Hunninen, 1942

Genus 3. *Skrjabinopsolus* Ivanov, in Ivanov and Murygin

1937. *Skrjabinopsolus* Ivanov, in Ivanov and Murygin, *Skrjabin Comm.*, Vol. : 264.

1974. *Opisthodiplomonorchis* Madhavi, *Riv. Parassit.*, 35(2) : 91, 93.

6. *Skrjabinopsolus elongatus* (Madhavi) Hafeezullah
(Figs. 9, 10)

1974. *Opisthodiplomonorchis elongatus* Madhavi, *Riv. Parassit.*, 35(2) : 91.

1984. *Skrjabinopsolus elongatus* : Hafeezullah, *Bull. zool. Surv. India*, 6(1-3) : 213.

Material examined : Host - *Polynemus sextarius* (Bloch), black-spot threadfin, *Polydactylus* sp., (Polynemidae); location - intestine; locality - Digha coast; no. of specimens - 20, on 8 slides.

Diagnosis : Body elongate, 2.97-3.71 mm long, 0.32-0.33 mm wide, spinose (spines lost in present material during processing). Acetabulum in middle of anterior half of body. Oral sucker slightly smaller than acetabulum. Prepharynx present; pharynx small; oesophagus very long; followed by caecal bifurcation, caeca extending up to posterior end of body. Testes two, equal or subequal, near posterior end of body. Cirrus sac elongate claviform, enclosing bipartite seminal vesicle, pars prostatica and spined cirrus, extending much posterior to acetabulum. Genital atrium long, opening immediately anterior to acetabulum. Ovary irregularly multilobed, postequatorial. Receptaculum seminis posterior to ovary. Uterine coils extensive, median, between cirrus sac and anterior testis. Meterterm differentiated, well developed, long, spined, opening into genital atrium independently. Vitellaria follicular, intercaecal, extending from posterior end of cirrus sac to anterior to anterior testis, interrupted by ovary in middle. Eggs oval 16 x 8. Excretory vesicle Y-shaped, pore terminal.

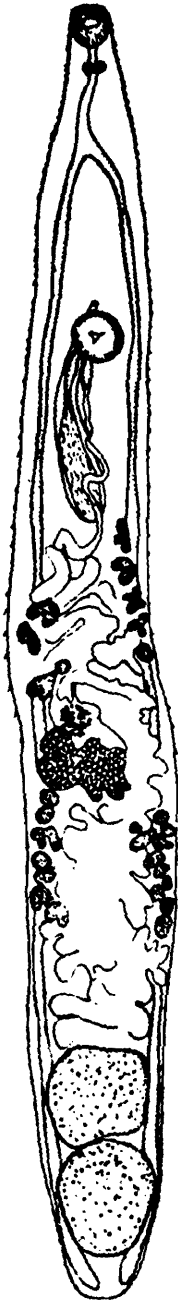


Fig. 9

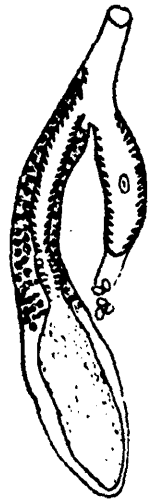


Fig. 10

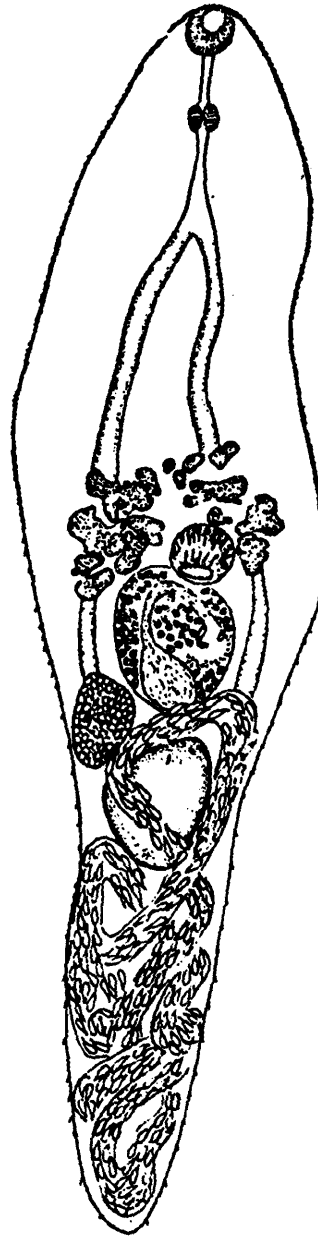


Fig. 11



Fig. 12

Fig. 9. *Skrjabinosolus elongatus*. Ventral View (After Madhavi, 1974). Fig. 10. Enlarged anterior genital ducts of *Skrjabinosolus elongatus*. Fig. 11. *Opisthomonorchis carangi*. Ventral View (After Madhavi, 1974). Fig. 12. Enlarged cirrus sac and genital atrium of *Opisthomonorchis carangi*.

Remarks : The genus *Skrjabinopsolus* has been largely reported from the cartilaginous fish family Acipenseridae from Russia and U.S.A., but in India (Bay of Bengal and Arabian Sea), it generally occurs in the bony fish families Polynemidae, Psettodidae (*Psettodes erumai*) and *Glyphidodon bengalensis* (Günther).

Distribution : West Bengal : Digha (District Medinipur); Andhra Pradesh (Waltair coast); Orissa (Chilka Lake) : Tamil Nadu (Porto Nove, Vellar estuary); Veraval coast (Gujarat State).

Family Monorchiidae Odhner, 1911

Subfamily Opisthomonorchiinae Yamaguti, 1952

Genus 4. *Opisthomonorchis* Yamaguti

1952. *Opisthomonorchis* Yamaguti, *Acta Med. Okayama*, 8(2) : 173.

1974. *Pseudopisthomonorchis* Madhavi, *Riv. Parassit.*, 35(2) : 96, 98.

7. *Opisthomonorchis carangi* (Madhavi) Hafeezullah
(Figs. 11, 12)

1974. *Pseudopisthomonorchis carangi* Madhavi, *Riv. Parassit.*, 35(2) : 96.

1984. *Opisthomonorchis carangi* : Hafeezullah, *Bull. zool. Surv. India*, 6(1-3) : 212.

Material examined : Host *Carangoides malabaricus* (Bloch), Malabar trevally, (Family Carangidae); location - intestine; locality Digha coast; no. of specimen one, on slide.

Diagnosis : Body elongate, 1.220-2.10 mm long, 0.256-0.384 mm wide, lanceolate, spined. Eye-spot pigment present in oesophageal region. Acetabulum slightly pre-or post-equatorial. Oral sucker smaller than acetabulum. Pre-pharynx present; pharynx 20-50 in diameter, oesophagus longer than prepharynx, followed by caecal bifurcation; caeca extending upto posterior end of body. Testes single, subspherical, postequatorial, situated in anterior part of posterior third of body. Cirrus sac globular or elliptical, thinwalled, postacetabular, partially overlapping acetabulum or not, separated from testis posteriorly by uterine coils, enclosing seminal vesicle, pars prostacica and spined cirrus. Genital atrium spined. Genital pore median or slightly submedian, postacetabular, some distance from acetabulum. Ovary submedian, entire, subspherical, at level of junction of cirrus sac and testis. Receptaculum seminis lacking. Uterus describing numerous loops and filling all postovarian region and partly overlapping testis. Metraterm unarmed, opening into genital atrium directly. Terminal organ absent. Eggs 15-27 x 9-12, with long unipolar filaments. Vitellarium follicular, follicles large and irregular in shape, circumcaecal, extending posteriorly from hind level of acetabulum to some distance anterior to it, coalescing anteriorly in middle line.

Remarks : Hafeezullah (1984) has discussed at length emphasising that *Pseudopisthomonorchis* Madhavi, 1974 should be considered as a synonym of *Opisthomonorchis* Yamaguti, 1952. He also synonymised *Opisthomonorchis thapari* Varma and Singh, 1979 with *Opisthomonorchis carangi* (Madhavi, 1974), there being no morphological difference between the two. Madhavi described her species from the carangid fish *Carangoides malabaricus* whereas Varma and Singh reported their species from *Caranx armatus*.

Distribution : West Bengal : Digha (District Medinipur); Andhra Pradesh, Kerala and Maharashtra coasts.

Subfamily Lasiotocinae Yamaguti, 1958

Genus 5. *Genolopa* Linton1910. *Genolopa* Linton, *Carnegie Inst. Washington Publ.* 133 : 77.8. *Genolopa bychowskii* Zhukov

(Fig. 13)

1977. *Genolopa bychowskii* Zhukov, *Parazit. Sb.*, No. 27 : 56.*Material examined* : Nil.

Host - *Apolectus niger* (Bloch) (= *Parastromateus niger*), Black pomfret, (Family Apolectidae); location - intestine; locality - Hugli estuary.

Diagnosis : Body 0.94-1.22 mm long, 0.16-0.23 mm wide, fusiform. Oral sucker smaller than acetabulum. Acetabulum preequatorial; prepharynx present; pharynx well developed; oesophagus very long; caecal bifurcation preacetabular; caeca extending up to posterior end of body. Testis single, ovate, in posterior part of body. Cirrus sac very long, extending much posterior to acetabulum. Genital pore immediately preacetabular. Genital atrium spined. Ovary immediately anterior to testis, trilobed. Uterus much coiled, largely between ovary and acetabulum, a few coils descending in posttesticular region. Eggs 14 x 9.

Remarks : The species is peculiar in the genus *Genolopa*. It differs from all the species of the genus in the position of the gonads in the posterior part of the body, very long oesophagus and very long cirrus sac extending much posterior to the acetabulum.

Distribution : West Bengal : Hugli estuary (District South 24-Parganas).

Family Opecoelidae Ozaki, 1925

Subfamily Opecoelinae Stunkard, 1931

Genus 6. *Pseudopecoeloides* Yamaguti1940. *Pseudopecoeloides* Yamaguti, *Japanese J. Zool.*, 9(1) : 75.Key to species of *Pseudopecoeloides* from West Bengal

Body elongate, constricted at levels of ovary and testes; testes spindle-shaped; ovary ovate; vesicula seminalis extending much posterior to base of acetabular peduncle :

Acetabular pad on ventral sucker absent; eggs larger (48-60 x 33-93)
*P. tenuis* Yamaguti, 1940

Acetabular pad on ventral sucker present; eggs smaller (40-50 x 25-37)
*P. tenuoides* Martin, 1960

9. *Pseudopecoeloides tenuis* Yamaguti

(Fig. 14)

1940. *Pseudopecoeloides tenuis* Yamaguti, *Japanese J. zool.*, 9(1) : 75.

Material examined : Host *Priacanthus hamrur* (Forskål) dusky-finned Bulleye, (Family Priacanthidae); location intestine, locality Digha coast; no. of specimens 2, on two slides.

Diagnosis : Body elongate, 12.376–12.565 mm long, 0.688–0.723 mm wide, slender, with a long delicate acetabular peduncle near anterior end of body, constricted at levels of testes and ovary. Acetabulum borne at tip of a long peduncle, without tentacles. Oral sucker larger than acetabulum. Prepharynx short; pharynx muscular; oesophagus short; intestinal caeca opening into excretory vesicle near posterior end of body forming cloaca. Testes two, sausage or spindle-shaped, almost equal, tandem, separated from each other and ovary by intervening vitelline follicles, situated in middle third of body. Seminal vesicle extending posteriorly upto in front of anterior level of vitellarium, posterior part saccular becoming tubular and coiled anteriorly. Cirrus sac thin-walled, short, enclosing only pars prostatica and short ejaculatory duct. Genital pore immediately behind pharynx, sinistral. Accessory genital sucker absent. Ovary ovate, pretesticular, separated from anterior testis. Seminal receptacle absent. Uterus preovarian, median, winding, extending from ovary to near caecal bifurcation, opening into genital pore probably by indistinct metraterm. Vitellarium follicular, extending from some distance behind seminal vesicle up to posterior end of body, confluent in posttesticular region, interrupted laterally at testicular and ovarian levels. Eggs ovate, 34–52 x 26–34. Excretory vesicle tubular; cloacal opening terminal.

Remarks : The present form is the type species of *Pseudopecoeloides* described from the fish *Pseudopriacanthus nipponicus* from Mia Prefecture, Japan. Later on, it was reported from New Zealand and Macassar also. Here it is reported from an allied fish host *Priacanthus hamrur* from West Bengal coast, India.

Distribution : West Bengal : Digha (District Medinipur).

10. *Pseudopecoeloides tenuoides* Martin (Figs. 15, 16)

1960. *Pseudopecoeloides tenuoides* Martin, *Pacific Science*, 14(4) : 414.

1976. *Pseudopecoeloides tenuoides* : Vasantha Kumari and Srivastava, C.B., *Newsl. zool. Surv. India*, 2(4) : 165.

Material examined : Host *Rastralliger kanagurta* (Cuvier), Indian mackerel, (Family Scombridae); location intestine; locality Digha coast.

Diagnosis : Body elongate, 2.555–5.04 mm long, 0.16–0.50 mm wide, slender, slightly constricted at testicular and ovarian levels, having peduncle near anterior end of body. Acetabulum borne at tip of peduncle, lacking tentacles, provided with thick pads. Oral sucker larger than acetabulum. Prepharynx short; pharynx muscular; oesophagus shorter than pharynx; intestinal caeca joining excretory vesicle to form cloaca near posterior end of body. Testes two, spindle-shaped, tandem, separated by intervening vitelline follicles. Cirrus sac not known. Seminal vesicle a narrow long coiled duct extending from in front of anterior level of vitellarium, continued as pars prostatica and short cirrus. Genital pore at level of pharynx, submedian to left. No accessory genital sucker. Ovary oval, entire, pretesticular. Mehlis' gland complex in front of ovary. Seminal receptacle absent. Uterine coils median, between ovary and seminal vesicle. Vitellarium follicular, extending from behind seminal vesicle to posterior end of body, interrupted at gonadal levels, confluent posterior to posterior testis. Eggs 40–50 x 25–37. Excretory vesicle tubular; cloacal opening terminal.

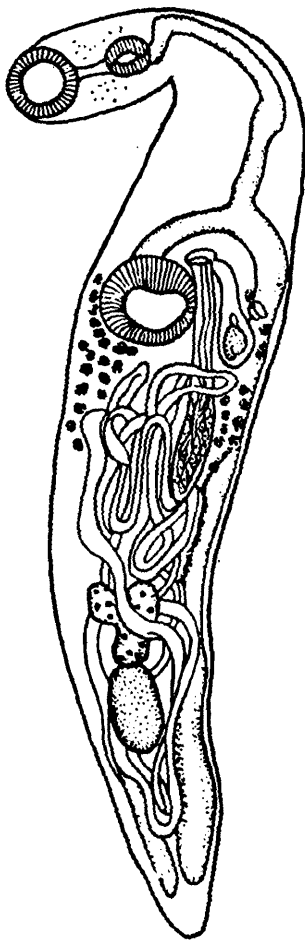


Fig. 13

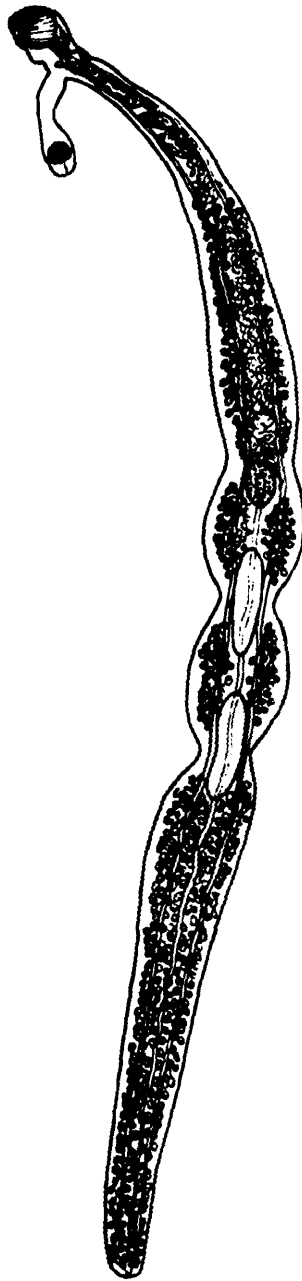


Fig. 14

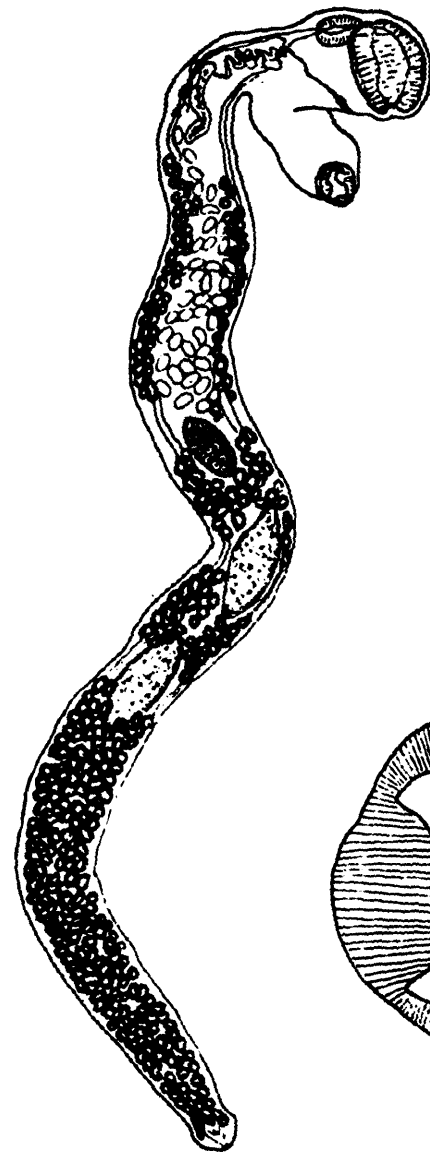


Fig. 15

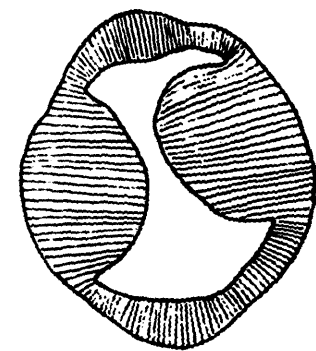


Fig. 16

Fig. 13. *Genolopa bychowskii*. Ventral View (After Zhukov, 1977). Fig. 14. *Pseudopecoeloides tenuis*. Lateral View (After Yamaguti, 1940). Fig. 15. *Pseudopecoeloides tenuoides*. Lateral View (After Martin, 1960). Fig. 16. *Pseudopecoeloides tenuoides*, acetabulum showing pads.

Remarks : The species was originally described from the fish *Priacanthus cruentatus* (Lacépède) from Hawaii, but Vasantha Kumari and Srivastava, C.B. (1976a) recovered it from the fish *Rastralliger kanagurta* from Digha coast.

Distribution : West Bengal : Digha (District Medinipur).

Genus 7. *Paradactylostomum* Zhukov

1972. *Paradactylostomum* Zhukov, *Parazitologiya*, 6(4) : 347.

11. *Paradactylostomum indicum* Zhukov

(Fig. 17)

1972. *Paradactylostomum indicum* Zhukov, *Parazitologiya*, 6(4) : 347.

Material examined : Nil.

Host *Engraulis telara* (Hamilton-Buchanan), Gangetic anchovy, (Family Engraulidae); location intestine; locality – Hugli estuary.

Diagnosis : Body pyriform, 1.12 – 1.45 mm long, 0.35-0.41 mm wide, broadly rounded posteriorly, unspined. Acetabulum deep cup-shaped, preequatorial, not stalked, without digitate processes. Oral sucker spherical, terminal, smaller than acetabulum. Prepharynx absent; pharynx longer than wide. Oesophagus very long; intestinal caeca forming cyclocoel near posterior end of body. testes two, tandem, transversely elongated, margin lobed, intercaecal, in posterior part of body. Seminal vesicle very long, sinuous, extending posteriorly upto ovary rather fairly overlapping it, only anterior part of male terminal genitalia is enclosed in cirrus sac. Genital opening midway between acetabulum and caecal bifurcation. Ovary 3-lobed, preacetabular, submedian, postequatorial. Uterus with few eggs, between ovary and acetabulum, metraterm formed. Eggs 46-50 x 25-29. Vitellarium follicular, extending from caecal bifurcation to posterior end of body even beyond cyclocael caeca.

Remarks : Zhukov (1972) erected the genus *Paradactylostomum* and described the species *P. indicum* from the material collected from the fish host *Engraulis telara* from Hugli estuary. He (1977) again recorded this species from the same host and from the same Hugli estuary.

Distribution : West Bengal : Hugli estuary (District South 24-Parganas).

Family Enenteridae Skrjabin and Koval, 1965

Subfamily Enenterinae Yamaguti, 1958

Genus 8. *Karyakartia* Hafeezullah

1979. *Karyakartia* Hafeezullah, *Riv. Parassit.*, 40(3) : 328.

12. *Karyakartia pambanense* (Karyakarte) Hafeezullah

(Fig. 18)

1968. *Acanthostomum* (*Gymnatrema*) *pambanense* Karyakarte, *Riv. Parassit.*, 29(3) : 186.

1979. *Karyakartia pambanense* : Hafeezullah, *Riv. parassit.*, 40(3) : 328.

Material examined : Host *Therapen jarbus* (Forskål), Jarbua terapon, (Family Theraponidae); location intestine; locality Canning Town; no. of specimen one, on slide.

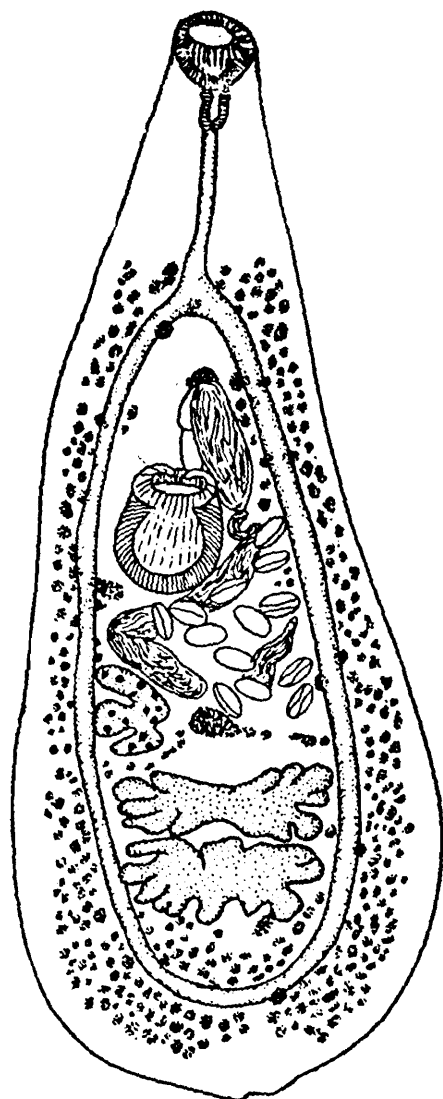


Fig. 17

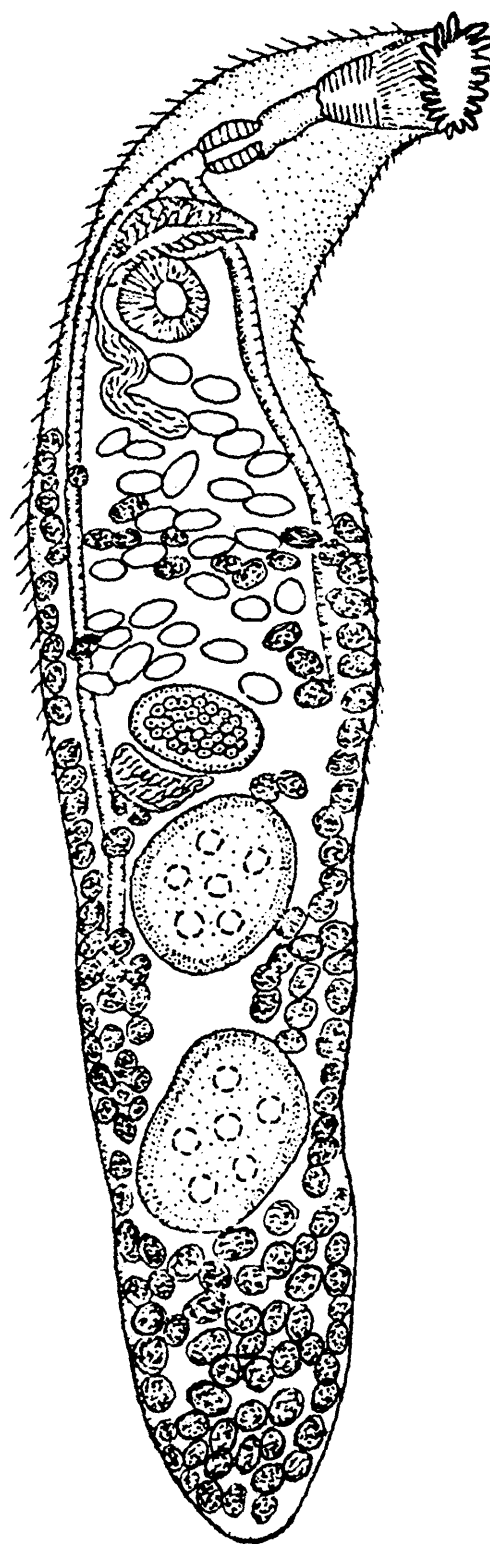


Fig. 18

Fig. 17. *Paradactylostomum indicum*. Ventral View (After Zhukov, 1972). Fig. 18. *Karyakartia pambanense*. Ventral View.

Diagnosis : Body elongate, flattened, 2.2-3.08 mm long, 1.01-0.536 mm wide, spined. Acetabulum 147-161 diameter, spherical, in middle of anterior half of body. Oral sucker 185-210 long, 161-168 wide, terminal, funnel or bell-shaped, 19-21 anteriorly directed oral tentacles arising from rim of large mouth. Prepharynx and short oesophagus present. Intestinal caeca forming cyclocoel near posterior end of body. testes two, postequatorial, tandem, separated by vitelline follicles. External seminal vesicle sacculate or tubular, winding, largely postacetabular, cirrus sac well developed, bulbous, anterodorsal to acetabulum, enclosing internal seminal vesicle, pars prostatica and cirrus. Genital pore near caecal bifurcation. Ovary globular or ovate, entire, pretesticular. Seminal receptacle present. Uterus scanty, preovarian. Metraterm formed. Eggs 70-73 x 45-52, thick-walled. Vitellarium follicular, extending from posterior extent of external vesicle to posterior end of body. Excretory vesicle tubular; pore terminal.

Remarks : Karyakarte (1968) described the present species in the genus *Acanthostomum* Looss, 1899 from the fish *Therapon puta*. Hafeezullah (1979) collected identical material from an allied fish host *Therapon jarbus*. Correcting the erroneous original description, he erected a new genus *Karyakartia* in the family Enenteridae to accommodate Karyakarte's species.

Distribution : West Bengal : Canning Town (District South 24-Parganas); coasts of Andhra and Tamil Nadu.

Family Lepocreadiidae (Odhner, 1905) Nicoll, 1935

Subfamily Lepocreadiinae Odhner, 1905

Genus 9. *Lepocreadioides* Yamaguti

1936. *Lepocreadioides* Yamaguti, *Helminth Fauna of Japan, 15. Trematodes of Fishes, II* : 1, 2.

1971. *Bicaudum* Bilqees, *Pakistan J. Sci.*, **14**(3) : 254 (n. syn.).

13. *Lepocreadioides indicum* Srivastava, H.D.
(Fig. 19)

1941. *Lepocreadioides indicum* Srivastava, H.D., *Indian J. vet. Sci.*, **11**(1) : 52.

1971. *Bicaudum otolithi* Bilqees, *Pakistan J. Sci.*, **14**(3) : 255 (n. syn.)

1973. *Bicaudum interruptum* Bilqees, *Acta Parasit. Pol.*, **21**(23) : 329 (n. syn.).

Material examined : Host *Cynoclossus macrolepidotus* (Bleeker), *C. lida* (Bloch). Tongue soles, (Family Cynoglossidae); location intestine; localities coasts of Junput and Bakkhali; number of specimens 10 + 11, on 2 + 2 slides.

Diagnosis : Body foliate or ovoid, bluntly pointed anteriorly and broadly rounded posteriorly; lateral and posterior margins smooth in young adult stage becoming crenated to various degrees and fashions in older specimens, in some gravid ones a single very deep crenation on each lateral margin dividing body in anterior and posterior portions distinctly; similarly, a narrow median incision or a broad notch appearing at posterior margin with age. Acetabulum preequatorial. Oral sucker smaller than acetabulum. Testes ovate, diagonal, in posterior third of body, in younger stage rounded and symmetrical or subsymmetrical also. External seminal vesicle present. Cirrus sac club-shaped, obliquely disposed with elongate neck, enclosing internal seminal vesicle, pars prostatica and cirrus. Genital pore marginal, very near and sinistral to oral sucker. Ovary postacetabular, pretesticular,

basically 3-lobed, lobes joining at a base, sublobation also occurring. Seminal receptacle present. Uterus pretesticular. Vitelline follicles laterals, extending upto caecal bifurcation or short of it. Excretory vesicle tubular, extending beyond acetabulum anteriorly; excretory pore at tip of posterior median incision.

Remarks : Bilqees (1971) erected the genus *Bicaudum* (type species *B. otolithi*) on the basis of a single specimen recovered from the fish *Otolithus argenteus* examined at Karachi coast. In this genus the body is foliate, divided into anterior and posterior regions by a deep crenation on each lateral margin and there is a deep incision in the middle of posterior end. To her genus she (1973) added one more species *B. interruptum* collected from the tongue sole *Cynoglossus sindensis*, also examined at Karachi. She did not compare her genus *Bicaudum* with *Lepocreadioides* Yamaguti, 1936 and her two species with *L. indicum* as described by Srivastava (1941) and later reported by Hafeezullah (1970). Obviously, *Bicaudum* has been erected on variable characters of *L. indicum*. As such, it is synonymised with *Lepocreadioides* and the two species *B. otolithi* and *B. interruptum* with *L. indicum*.

L. indicum has been reported from *Platycephalus insidiator* and *Otolithus argenteus* but various species of tongue soles (Cynoglossidae) are its favourite hosts. Zhukov (1977) reported it in *Cynoglossus dubius* Dey from Hugli estuary. Earlier, Vasantha Kumari and Srivastava, C.B. (1976b) also reported it from *Cynoglossus bilineatum* from Sagar Island, West Bengal.

Distribution : West Bengal : Junput (District Medinipur) and Bakkhali, Sagar Island and Hugli estuary (District South 24-Parganas); Orissa and Andhra Pradesh coasts.

Genus 10. *Opechona* Looss

1907. *Opechona* Looss, *Zool. Anz.*, **31**(19-20) : 616.

14. *Opechona* sp. of Zhukov (Fig. 20)

1977. *Opechona* sp. of Zhukov, *Parazit. Sb.*, No. 27 : 60.

Material examined : Nil.

Host *Pampus argenteus* (Euphrasen). Silver pomfret, (Family Stromateidae); *Apolectus niger* (Bloch) (= *Parastromateus niger*). Black pomfret, (Family Apolectidae); location intestine; locality Hugli estuary.

Diagnosis : Body elongated, flattened, 0.57-0.87 mm long, 0.17-0.21 mm wide, spined. Eye-spot pigments present on either side of pharynx. Acetabulum slightly preequatorial, much behind caecal bifurcation. Oral sucker subterminal, smaller than acetabulum. Oesophagus somewhat longer than prepharynx, posterior half lined with epithelia (pseudoesophagus); caecal bifurcation slightly anterior to middle of forebody; intestinal caeca ending near posterior end of body. testes ovate, tandem, smooth, in posterior third of body. Cirrus sac claviform, extending much posterior to acetabulum, enclosing internal seminal vesicle, prostatic vesicle, pars prostatica surrounded by prostate cells and cirrus. Genital pore immediately preacetabular. External seminal vesicle sinuous, extending almost to ovary. Ovary globular, immediately pretesticular, smooth. Seminal receptacle (?) not illustrated. Uterus with few eggs, between acetabulum and ovary. Eggs 50-56 x 27-29. Vitellarium follicular, from acetabular level to posterior end of body. Excretory bladder I-shaped.



Fig. 19

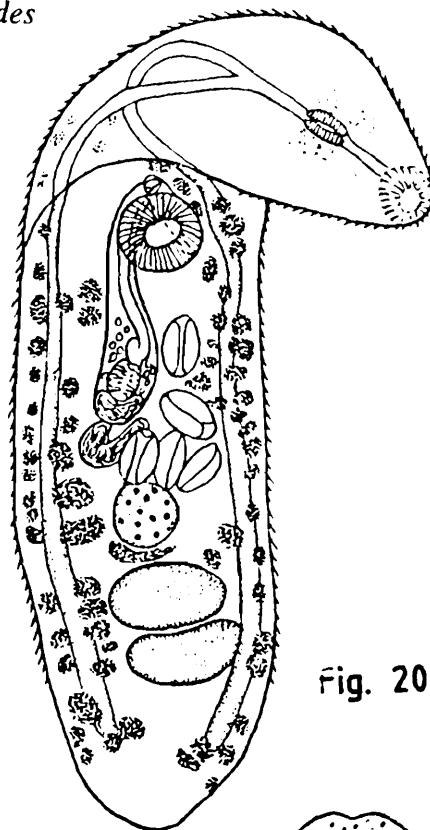


Fig. 20

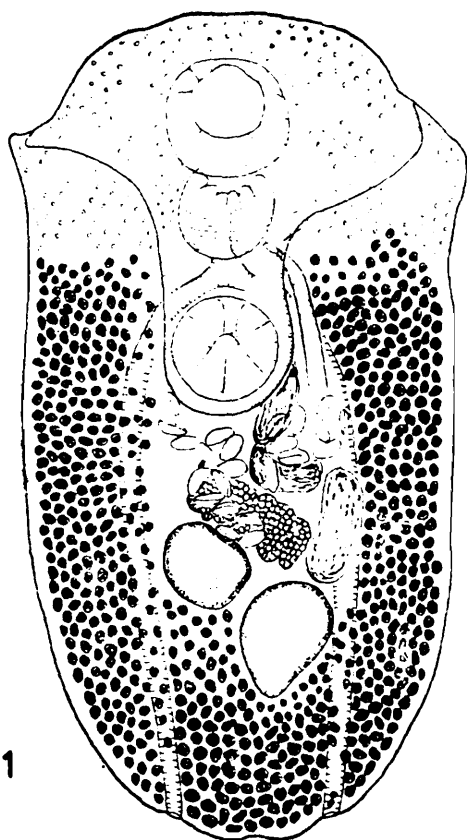


Fig. 21



Fig. 22

Fig. 19. *Leporcreadioides indicum*. Ventral View. Fig. 20. *Opechona* sp. Ventral View (After Zhukov, 1977). Fig. 21. *Bianium bombayense*. Ventral View. Fig. 22. *Bianium plicatum*. Ventral View.

Remarks : *Opechona formiae* Oshmarin, 1965 has also been described from the same fish host *Formio niger* (= *Parastromateus niger*) from Vietnam but zhukov (1977) did not compare his *Opechona* sp. with it. Hafeezullah (1970) described *Lepidapedon longivesiculum* from the fish *Pampus argenteus* from Bombay (Arabian Sea) and Gupta, N K and Mehrotra (1971) described *Lepidapedon nelsoni* from the same fish hosts *Pampus argenteus* and *Formio niger* (= *Parastromateus niger*) from Kerala (Arabian Sea). *Opechona* sp. bears so close resemblance with *Lepidapedon longivesiculum* and *L. nelsoni* that the generic diagnosis of the former appears doubtful, all the three forms having been described from the same fish hosts. However, there is no appreciable difference of taxonomic value between the latter two species. Therefore, we are inclined to consider *L. nelsoni* as a synonym of *L. longivesiculum*.

Distribution : West Bengal : Hugli estuary (District South 24- Parganas).

Subfamily Diploproctodaeinae Park, 1939

Genus 11. *Bianium* Stunkard

1930. *Bianium* Stunkard, *Anat. Rec.*, 47(3) : 363.

1965. *Amarcotyle* Travassos, Freitas and Buhrnheim, *Atas. Soc. Biol.*, Rio de Janeiro, 9(6) : 95-97.

Key to West Bengal species of *Bianium*

Oral sucker distinctly larger than acetabulum; vitelline follicles extend up to acetabular level; genital pore at level of anterior margin of acetabulum..... *B. plicatum* (Linton, 1928)

Oral sucker almost equal to acetabulum; vitelline follicles extend up to level of caecal bifurcation or base of pharynx; genital pore at base of pharynx
..... *B. bombayense* Gupta, A.N., 1968

15. *Bianium bombayense* Gupta, A.N.

(Fig. 21)

1968. *Bianium bombayense* Gupta, A.N., *Japanese J. Parasit.*, 17(2) : 138-148.

1970. *Bianium bombayense* : Hafeezullah, *Parasitology*, 61 : 436.

Material examined : Host *Torguigener oblongus* (Bleeker), oblong blowfish, (Family Tetodontidae); location intestine; locality Digha coast; number of specimens 7, on one slide.

Diagnosis : Body linguiform, 1.290 - 1.703 mm long, 0.705 - 0.808 mm wide, unspined. Body margins expanded laterally but not fusing with each other ventrally. Acetabulum 181-206 long, 163-198 wide, preequatorial. Oral sucker subterminal 198-232 long, 172- 224 wide, almost equal to acetabulum. Pharynx globular, well developed, anterior margin denticulated; oesophagus short; caeca opening to exterior at posterior end. Testes oblique, postequatorial. External seminal vesicle present. Cirrus sac club-shaped, extending posterior to acetabulum, enclosing internal seminal vesicle, pars prostatica surrounded by prostatic gland cells, and cirrus. Genital pore at base of pharynx, submedian, sinistral. Ovary multilobed, pretesticular, postequatorial. Receptaculum seminis present, submedian. Vitelline follicles extending from level of base of pharynx or caecal bifurcation to posterior end of body. Uterus short, between ovary and acetabulum. Metraterm distinctly formed. Eggs 52-69 x 26-43. Excretory vesicle tubular; excretory pore terminal.

Remarks : Nasir and Gomez (1977) synonymised *Bianium* Stunkard, 1930 and *Amarcotyle* Travassos *et al.*, 1965 with *Diploproctodaeum* La Rue, 1926, while Yamaguti (1971), synonymising *Amarcotyle* with *Bianium*, distinguished the latter genus from *Diploproctodaeum*. The authors agree with Yamaguti (1971).

Distribution : West Bengal : Digha (District Medinipur); coasts of Maharashtra and Tamil Nadu.

16. *Bianium plicatum* (Linton) Stunkard
(Fig. 22)

1928. *Psilostomum plicatum* Linton, *Proc. U.S. Nat. Mus.*, **73** : 5.

1930. *Bianium concavum* Stunkard, *Anat. Rec.* **47**(3) : 363.

1931. *Bianium plicatum* : Stunkard, *Z. Parasitenkd.*, **3** : 715.

Material examined : Host *Torquigener oblongus* (Bleeker), oblong blowfish; *Spheroides* spp. (Family Tetrodontidae); location intestine; localities Hugli estuary, Digha coast.

Diagnosis : Body elongate, foliate or linguiform, 1.68-1.83 mm long, 0.54-0.64 mm wide; lateral margins expanded, expansions not meeting ventrally. Tegument unspined. Acetabulum at about posterior end of anterior third of body. Oral sucker subterminal, larger than acetabulum. Prepharynx indistinct; pharynx well developed, anterior margin lobed; oesophagus short, bifurcating in front of acetabulum, intestinal caeca opening to exterior on either side of excretory pore at posterior end of body. Testes directly tandem or slightly oblique, postequatorial. External seminal vesicle saccular. Cirrus sac claviform, extending posterior to acetabulum, enclosing internal seminal vesicle, pars prostotica surrounded by prostate gland cells, and cirrus. Genital pore at level of anterior margin of acetabulum, submedian, sinistral. Ovary multilobed, pretesticular, median, almost equatorial. Seminal receptacle present. Uterus between ovary and cirrus sac. Metraterm well developed. Eggs 50-66 x 29-41. Vitelline follicles extending from acetabular level to posterior end of body. Excretory vesicle tubular; excretory pore terminal.

Remarks : Vasantha Kumari and Srivastava (1976a) recorded this species from *Spheroides* spp. from Digha coast and Zhukov (1977) reported this species from *Torquigener oblongus* from Hugli estuary. Manter (1947) has listed great variations in various structures of this species in the light of which Hafeezullah (1970) considered *Bianium madrasi* Gupta, A.N., 1968 as a synonym of *B. plicatum*. Bilqees (1974), describing further variations in this species, concurred with this synonymy.

Distribution : West Bengal : Digha (District Medinipur), Hugli estuary (District South 24-Parganas); coasts of Andhra Pradesh and Tamil Nadu.

Genus 12. *Cotylocreadium* Madhavi

1972. *Cotylocreadium* Madhavi, *Parasit.*, **58**(2) : 224.

17. *Cotylocreadium triacanthi* (Hafeezullah) Madhavi
(Figs. 23, 24)

1970. *Diplocreadium triacanthi* Hafeezullah, *Parasitology*, **61** : 438.

1972. *Cotylocreadium triacanthi* Madhavi, *J. Parasit.*, **58**(2) : 224.

Material examined : Host *Triacanthus brevirostris*, short-nosed tripod, (Family Triacanthidae); location intestine; locality Digha coast; number of specimens 14, on two slides.

Diagnosis : Body 1.19–1.36 mm long, 0.96–1.29 mm wide, flower vase or cup-shaped. Lateral expansions turning ventrally, fusing with each other completely in pre- and postacetabular regions both forming ventral body fold and thus assuming a cup-shaped structure. Tegument spined. Eye-spot pigments on either side of pharynx. Acetabulum 122–155 in diameter, feeble almost equatorial. Oral sucker subterminal, 81–155 in diameter, slightly smaller than acetabulum. Prepharynx short; pharynx small; oesophagus longer than pharynx. Intestinal caeca reaching body margin at ovarian or testicular level, entering body fold, running transversely inwards in it to some distance and then posteriorly to end blindly before posterior end. Testes symmetrical, near posterior end of body. Cirrus sac largely preacetabular. External seminal vesicle postacetabular. Genital pore median or slightly submedian at level of caecal bifurcation. Ovary unlobed, median pretesticular. Seminal receptacle present. Uterus between acetabulum and testes, sometimes extending between testes. Distinct metraterm formed. Vitelline follicles between intestinal bifurcation and posterior end, intruding into ventral body fold. Eggs 63 x 48–54. Excretory vesicle I-shaped; excretory pore terminal.

Remarks : Hafeezullah (1970) described the present species from the fish *Triacanthus brevisostris* whereas Madhavi (1972) reported it from the allied host species *Triacanthus strigilifer*. Nasir and Gomez (1977) considered *Cotylocreadium* Madhavi, 1972 as a synonym of *Diploproctodaeum* La Rue, 1926 but the present authors do not agree with this synonymy. *Cotylocreadium* is distinct from *Diploproctodaeum* in characters such as shape of body, peculiar course and blind ending of intestinal caeca, almost preacetabular cirrus sac, more anterior genital pore, symmetrical testes, unlobed ovary and uterus extending between testes posteriorly. As a matter of fact, *Cotylocreadium* should be raised to a new subfamily status.

Distribution : West Bengal : Digha (District Medinipur); coasts of Andhra Pradesh and Kerala.

Family Fellodistomatidae Nicoll, 1913

Subfamily Monascinae Dollfus, 1947

Genus 13. *Monascus* Looss

1907. *Monascus* Looss, *Zool. Anz.*, **31**(19-20) : 616.

Key to West Bengal species of *Monascus*

Vitelline follicles extend from posterior margin of acetabulum to testicular level; ovary spherical, unbranched.....*Monascus filiformis* (Rudolphi, 1819)

Vitelline follicles restricted, from middle of acetabulo-ovarian region to testicular level; ovary lobed.....*Monascus chauhani* Vasantha Kumari, 1975

18. *Monascus chauhani* Vasantha Kumari

(Fig. 25)

1975. *Monascus chauhani* Vasantha Kumari, *Dr. B.S. Chauhan Comm. Vol* : 247-250.

1976. *Monascus elongatus* Karyakarte and Yadav, *Marathwada Univ. J. Sci. (nat. sci.)*, **15**(8) : 169. (n. syn.)

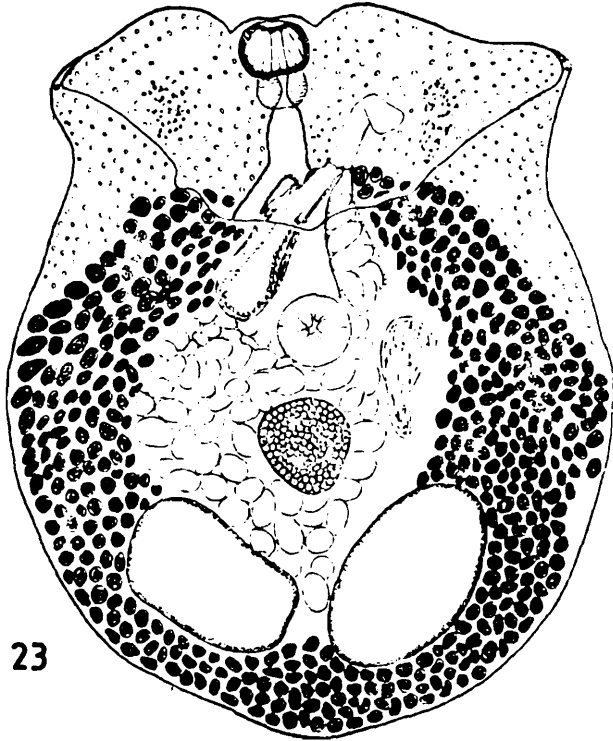


Fig. 23

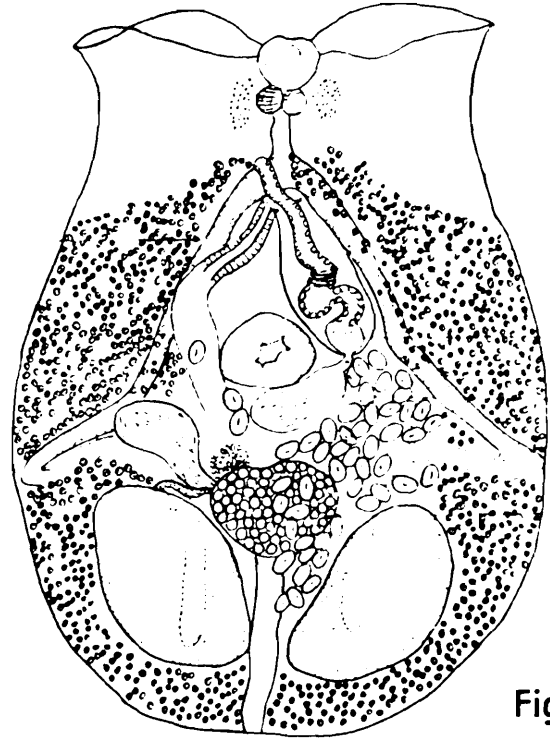


Fig. 24

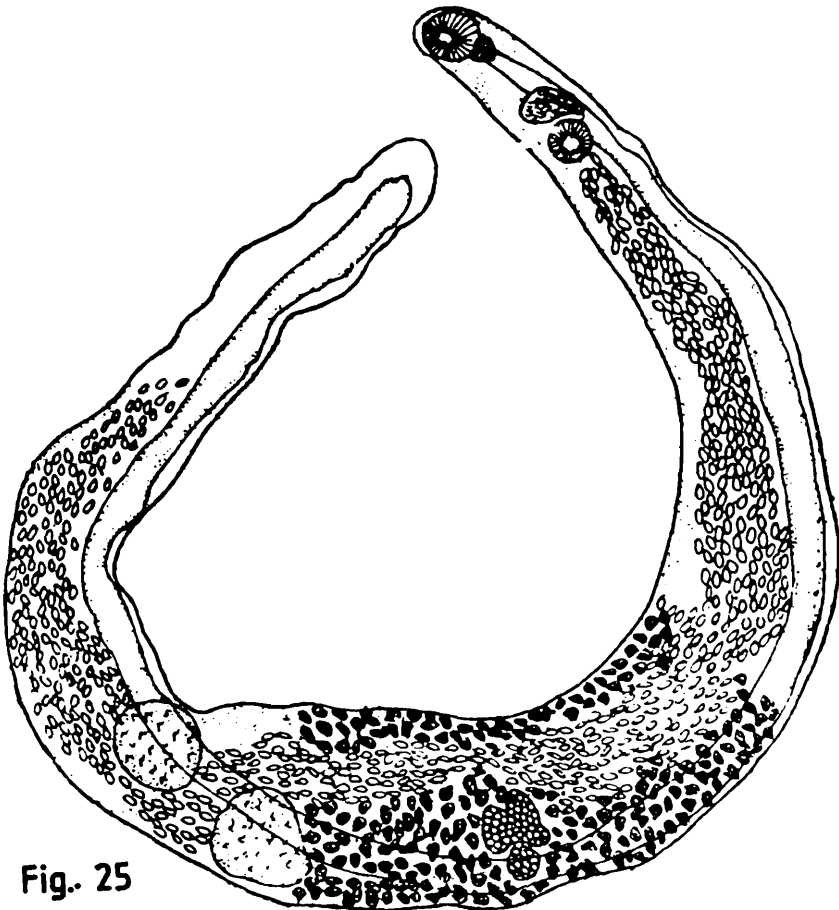


Fig. 25

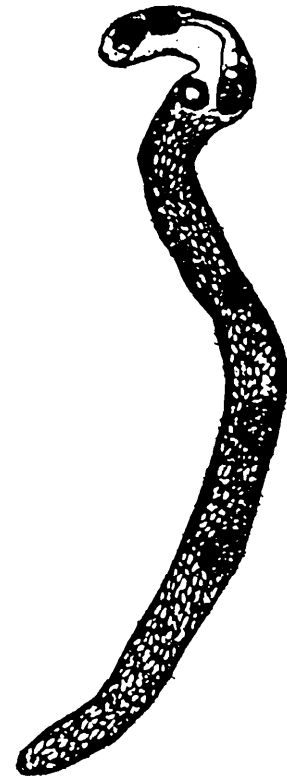


Fig. 26

Fig. 23. *Cotylocreadium triacanthi*. Ventral View (After Hafeezullah, 1970).
Fig. 24. *Cotylocreadium triacanthi*. Dorsal View (After Madhavi, 1972). Fig. 25. *Monascus chauhani*. Ventral View (After Vasantha Kumari, 1975). Fig. 26. *Monascus filiformis*. Ventral View (After Srivastava, H.D., 1941).

Material examined : Host *Pampus argenteus* (Euphrasen), Silver pomfret; *Pampus chinensis* (Euphrasen), Chinese pomfret, (Family Stromateidae); location intestine; locality Digha coast.

Diagnosis : Body elongated, cylindrical, 3.7–11.5 mm long, 0.4–0.67 wide, smooth. Acetabulum cephalad, 110–230 in diameter. Oral sucker 140–270 in diameter, bigger than acetabulum. Pharynx comparatively small. Only right intestinal caecum present. Testes two, tandem, postequatorial, separated by uterine coils. Cirrus sac preacetabular, enclosing bipartite seminal vesicle, short pars prostatica and short ejaculatory duct. Genital pore preacetabular. Ovary lobed, pretesticular, postequatorial, separated from anterior testis by uterine coil. No seminal receptacle. Vitelline follicles restricted, from middle of acetabulovarian zone to anterior margin of testis. Uterus voluminous, from posterior margin of acetabulum to some distance short of posterior end. Eggs 24–28 x 12–14. Excretory vesicle Y-shaped; pore terminal.

Remarks : Restricted extent of vitelline follicles appears to be a deviation from the generic characteristic. Lobation of ovary may prove a variation of smooth ovary in the genus *Monascus* in future investigations. Vasantha Kumari and Srivastava, C.B. (1976a) recorded it from fishes *Pampus argenteus* and *Pampus sinensis* from Digha coast.

Distribution : West Bengal : Digha (District Medinipur); Maharashtra State.

19. *Monascus filiformis* (Rudolphi) Looss (Fig. 26)

1819. *Distoma filiformis* Rudolphi, *Berolini* : 112.

1907. *Monascus filiformis* : Looss, *Zool. Anz.*, 31(19-20) : 616.

Material examined : Host *Caranx* sp., (Family Carangidae); location intestine; locality Junput; no. of specimens 5, on one slide (ZSI, Reg. No. W 7471/1).

Diagnosis : Body elongated, narrow, of nearly uniform breadth, 6.14–7.16 mm long, 0.52–0.64 mm wide, spined. Acetabulum 22–26 in diameter, cephalad in position. Oral sucker 28–34 wide, pharynx 280–400 long, oesophagus continuing as intestinal caecum on right side of body up to posterior end. Testes two, tandem, postequatorial, separated by coils of uterus. Cirrus sac ovoid, small, largely preacetabular, enclosing a bipartite seminal vesicle, a small pars prostatica with gland cells and a small ductus ejaculatories. Genital pore preacetabular. Ovary small, pretesticular, separated from anterior testis by coils of uterus, preequatorial. Receptaculum seminis absent. Vitelline follicles extending from level of posterior margin of acetabulum to anterior or posterior testis. Uterus voluminous, filling all available space from posterior margin of acetabulum to posterior end of body. Metraterm present. Eggs 34–38 x 19–23. Excretory vesicle Y-shaped; pore terminal.

Remarks : Kjøie (1979) studied the life-history of *M. filiformis* with the aid of SEM. She found that the caecum is not unbranched in its cercariae and adults, rather the right caecum is complete and the left caecum is short and reduced, the bifurcation of pseudo-oesophagus taking place somewhere between acetabulum and ovary. Kjøie (*loc. cit.*) also showed that the intestine apparently does not establish relationship with the excretory vesicle. These two findings are probably true for all the species of *Monascus*. Kjøie (1979) and Bray and Gibson (1980) considered *M. typicus* as a synonym of *M. filiformis*. Bray and Gibson (*loc. cit.*) further considered *M. orientalis* also as a synonym of *M. filiformis*. Vasantha Kumari and Srivastava (1976a) recorded *M. filiformis* from the

fish host *Rastralliger kanagurta* and *M. orientalis* (syn. of *M. filiformis*) from the fish *Arius jella* from Digha coast.

Distribution : West Bengal : Junput and Digha (District Medinipur); coasts of Orissa, Andhra Pradesh, Tamil Nadu, Kerala and Maharashtra.

Subfamily Antorchiinae Yamaguti, 1958

Genus 14. *Faustula* Poche

1918. *Eurema* MacCallum, *Zoopath*, **1**(3) : 86 (preoccupied).

1926. *Faustula* Poche, *Arch. Naturg.*, **91**(A) : 120.

1935. *Orientophorus* Srivastava, H.D., *Parasitology*, **27**(3) : 374.

Key to West Bengal species of *Faustula*

Genital pore beyond caecal bifurcation anteriorly; cirrus sac extending posteriorly up to middle or posterior margin of acetabulum; vitelline follicles in acetabular zone laterally
.....*Faustula brevichrus* (Srivastava, H.D., 1935)

Genital pore immediately or a little behind caecal bifurcation; cirrus sac extending much posterior to acetabulum; vitelline follicles extending from about middle of oesophagus to posterior margin of ovary.....*Faustula gangetica* (Srivastava, H.D., 1935).

20. *Faustula brevichrus* (Srivastava, H.D.) Yamaguti

(Fig. 27)

1935. *Orientophorus brevichrus* Srivastava, H.D., *Parasitology*, **27**(3) : 374.

1960. *Faustula chauhani* Gupta, P.D. and Srivastava, C.B., *Indian J. Helminth.*, **12**(2) : 114. (n. syn.).

Material examined : Host *Hilsa ilisha* (Hamilton), Hilsa shad (Family Clupeidae); location intestine; locality Digha coast.

Diagnosis : Body oval, 1.088-1.284 mm long, 0.448-0.608 mm wide at testicular level, spined. Acetabulum 128-160 in diameter, almost in middle of body. Oral sucker 80-112 long, 64-144 wide. Pharynx smaller than oral sucker; oesophagus long; intestinal caeca extending beyond testes posteriorly. Testes two, symmetrical, on either side of acetabulum. Cirrus sac flask-shaped, overlapping acetabulum partly or wholly, enclosing seminal vesicle, pars prostatica, ejaculatory duct and cirrus. Genital pore at about level of intestinal bifurcation, sinistral. Ovary lobed, postacetabular. Seminal receptacle absent. Vitellarium follicular, lateral in acetabular zone. Uterus voluminous, filling whole of hindbody, Eggs 15-16 x 9-10. Excretory vesicle Y-shaped; arms reaching oesophageal level; pore terminal.

Remarks : Vasantha Kumari and Srivastava, C.B. (1976a) recorded it from Digha coast from the type host *Hilsa ilisha*. Gupta, P.D. and Srivastava, C.B. (1960) described *Faustula chauhani*. Simha (1974) considered it as a synonym *Faustula brevichrus* (Srivastava, H.D., (1935). The authors agree with this action.

Distribution : West Bengal : Digha (District Medinipur); Uttar Pradesh.

21. *Faustula gangetica* (Srivastava, H.D.) Yamaguti
(Fig. 28)

1935. *Orientophorus gangeticus* Srivastava, H.D., *Parasitology*, **27** (3) : 377.

1958. *Faustula gangetica* : Yamaguti, *Systema Helminthum Vol. I. The Digenetic Trematodes of Vertebrates*. Interscience publishers, New York : 34.

1974. *Faustula mandapamensis* Simha, *Riv. Parassit.*, **35** (2) : 100 (n. syn.).

Material examined : Host *Hilsa ilisha* (Hamilton), Hilsa shad, *Hilsa toli* (Val.) [= *Hilsa sinensis* Misra]. Toli shad, (Family Clupeleidae); location intestine; locality Digha coast break

Diagnosis : Body oval, 2.170–3.050 mm long, 0.880–1.390 wide, spined. Acetabulum 200–350- μ m diameter, preequatorial. Oral sucker syphoid or subspherical, terminal, 124–190 long, 220–320 wide, equal or subequal to acetabulum. Pharynx muscular; oesophagus 320–460 long; intestinal caeca extending upto almost equatorial level. Testes two, symmetrical, acetabular or slightly postacetabular. Cirrus sac flask-shaped, extending beyond acetabulum posteriorly. Genital pore immediately behind intestinal bifurcation or a little posterior to it, median or submedian. Ovary lobed, postacetabular, post equatorial. Seminal receptacle absent. Vitellarium follicular, lateral, commencing from about midoesophageal level or slightly behind it to level of posterior margin of ovary. Uterus voluminous, occupying whole posttesticular space. Eggs 15–17 x 7–11. Excretory vesicle Y-shaped with short stem; arms reaching oesophageal level; pore terminal.

Remarks : Vasantha Kumar and Srivastava, C.B. (1976a) recorded it from the type host *Hilsa ilisha* and *Hilsa sinensis* from Digha. Hafeezullah and Siddiqi (1970) and Gupta, V. and Ahmad (1977) recorded it from the fish *Hilsa sinensis*. Simha (1974) described *Faustula mandapamensis* from the fish host *Stromateus cinereus*. The authors find no morphological difference of taxonomic value between this species and *Faustula gangetica*. Therefore *F. mandapamensis* is considered as a synonym of *F. gangetica*.

Distribution West Bengal Digha (District Medinipur); coasts of Orissa, Tamil Nadu, Maharashtra and Gujarat.

Family Monodhelminthidae Dollfus, 1937

Subfamily Monodhelminthinae Yamaguti, 1958

Genus 15. *Mehratrema* Srivastava, H.D.

1939. *Mehratrema* Srivastava, H.D., *Indian J. vet. Sci.*, **9** (1) : 97, 99.

22. *Mehratrema dollfusi* Srivastava, H.D.
(Fig. 29)

1939 *Mehratrema dollfusi* Srivastava, H.D., *Indian J. vet. Sci.*, **9** (1) : 97.

1976a. *Mehratrema dollfusi* : Vasantha Kumari and Srivastava, C.B., *Newsl. zool. Surv. India.*, **2** (4) : 165.

Material examined : Host *Arius jella* Day, small-eye catfish, (Family Ariidae); location intestine; locality Digha coast.

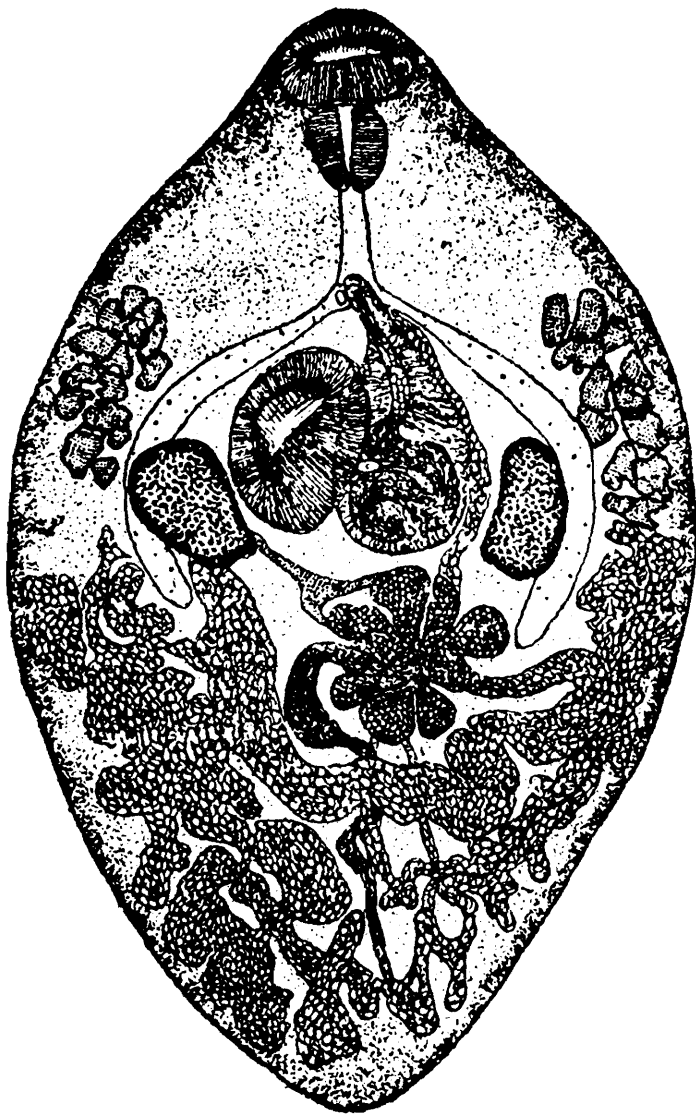


Fig. 27

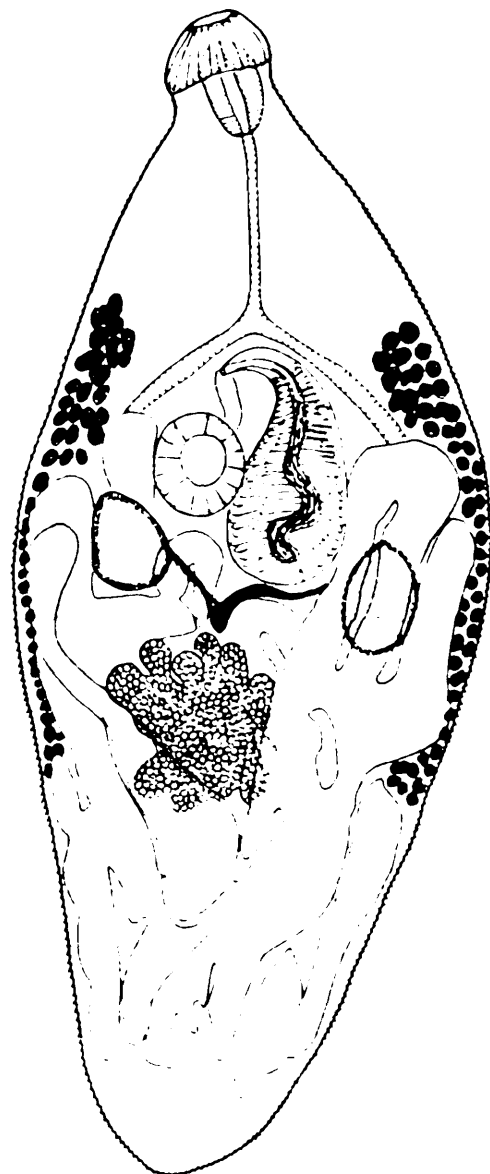


Fig. 28

Fig. 27. *Faustula brevichrus*. Ventral View (After Srivastava, H.D. 1935). Fig. 28. *Faustula gangetica*. Ventral View.

Diagnosis : Body elongated, flat, 1.46-3.52 mm in length, 0.4-0.78 mm wide, spined. Suckers nearly equal or oral sucker slightly larger than ventral sucker. Acetabulum a little behind equatorial plane. Oral sucker subterminal; short prepharynx present; pharynx muscular; oesophagus long; intestinal caeca ending a little in front of posterior end of body. Testes two, spherical, symmetrical, immediately, preacetabular, Cirrus sac tubular, containing seminal vesicle, pars prostatica, ejaculatory duct and cirrus. Genital pore at about posterior end of anterior third of body. Surrounded by a genital sucker. Ovary subspherical or slightly trilobed, anterior to left testis. Vitellarium follicular, extending from level of anterior margin of ovary to much anterior to caecal ends. Uterus descending to posterior end of body, ascending limb forming a highly developed metraterm on right side of cirrus sac. Eggs 30-53 x 22-26. Excretory vesicle U-or V-shaped; excretory pore terminal.

Remarks : Vasantha Kumar and Srivastava, C.B. (1976a) recorded this species from a sea catfish *Arius jella* from Digha coast.

Distribution : West Bengal : Digha (District Medinipur); Orissa and Karnataka coasts and Krusadai Island (Gulf of Mannar).

Family Bunocotylidae Dollfus, 1950

Subfamily Aphanurinae Skrjabin & Guschanskaja, 1954

Genus 16. *Aphanurus* Looss

1907. *Aphanurus* Looss, *Zool. Jahrb. (Syst)*, **26** (1) : 69, 107.
 1954. *Chauhanurus* Skrjabin & Guschanskaja, In : Skrjabin, K.I. (Ed) [*Trematodes of Animals and Man. Principles of Trematodology*] Moscow, **10** : 319. [In Russian].
 1957. *Helaphanurus* Slusarski, *Acta parasit. pol.*, **5** : 51-62.

23. *Aphanurus stossichi* (Monticelli) Looss

(Fig. 30)

1891. *Apoblema stossichi* Monticelli, *Atti. Acad. Sci. Torino.*, **26** : 501.
 1907. *Aphanurus stossichi* : Looss, *Zool. Anz.*, **31** (19-20) : 591.
 1977. *Aphanurus stossichi* : Zhukov, *Parasit. Sb.*, No. **27** : 69.

Material examined : Host *Clupea fimbriata* (Valenciennes). Fringescale sardinella, *Hilsa ilisha* (Hamilton Buchanan), *Hilsa shad*, *Hilsa toli* (Valenciennes), *Toli shad* (Family Clupeidae); locations Stomach and intestine; localities Digha coast and Canning Town (Matla estuary); no. of specimens - 9 + 10 + 14 on 8 + 3 + 3 slides respectively.

Diagnosis : Body small, elongated; ecsoma absent. Tegument with annular plications all over. Acetabulum well developed, near anterior end of body. Oral sucker subterminal, much smaller than acetabulum. Pharynx comparatively very small. Intestinal caeca narrow, ending blindly near posterior end of body. Testes asymmetrical, situated at about equatorial plane. Seminal vesicle large, pear-shaped, in hindbody, pretesticular, pars prostatica long, tubular, surrounded by prostate gland cells. Ejaculatory duct long. Sinus-sac present in front of acetabulum, enclosing hermaphroditic duct. Genital pore at intestinal bifurcation. Ovary small, postequatorial. Receptaculum seminis present. Vitellarium a single, large, ovoid mass, posterior to ovary. Uterus descending upto caecal ends. Excretory vesicle Y-shaped, bifurcating behind acetabulum, cornua meeting dorsal to oral sucker.

Remarks : Zhukov (1977) reported this species from fishes *Ilisha elongata*, *Engraulis telara* and *Coilia ramcrati* from Hugli estuary. He synonymised *Aphanurus microrchis* Chauhan, 1945 with *A. stossichi* (Monticelli, 1891), but the former species differs from the latter in the position of acetabulum being very near to oral sucker, position of ovary being immediately postequatorial, extracaecal position of sinus-sac its posterior extent at level with posterior margin of pharynx, and position of genital pore ventral to oral sucker.

Distribution : West Bengal : Digha (District Medinipur); Canning Town, Matla estuary (District South 24-Parganas), Hugli estuary (District South 24-Parganas); Orissa and Uttar Pradesh.

Family Hemiuridae Looss, 1899

Subfamily Ellytrophallinae Skrjabin and Guschanskaja, 1954

Genus 17. *Lecithocladium* Lühe

1901. *Lecithocladium* Lühe *Zool. Anz.*, **24** : 401.

1935. *Clupenurus* Srivastava, H.D., *Z. Parasitenkd.*, **8** : 135.

Key to West Bengal species of *Lecithocladium*

1. Oral sucker distinctly larger than acetabulum 2
 Oral sucker smaller than acetabulum 3
2. Ovary and vitelline tubules much removed anteriorly from posterior end of somatic body; vitelline tubules not entering ecsoma *L. harpodontis* Srivastava, H.D., 1942
 Ovary and vitelline tubules nearer to posterior end of somatic body; vitelline tubules entering ecsoma..... *L. excisum* (Rudolphi, 1891).
3. Pharynx small, slightly longer than broad..... *L. piscicola* (Srivastava, H.D., 1935)
 Pharynx large, cylindrical..... *L. glandulum* Chauhan, 1945

24. *Lecithocladium excisum* (Rudolphi) Lühe

(Fig. 31)

1819. *Distoma excisum* Rudolphi, *Berolini* : 411.

1901. *Lecithocladium excisum* : Lühe, *Zool, Anz.*, **24** : 395.

1977. *Lecithocladium excisum* : Zhukov, *Parasit. Sb.*, No. 27 : 68.

1980. *Lecithocladium stromatei* Farooq and Khanum, *Pakistan J. Zool.* **12** (2) : 221. (n. syn)

Material examined : Nil. Host *Apolectus niger* (Bloch) (= *Parastromateus niger*), Black pomfret, (Family Apolectidae) and *Pampus argenteus* (Euphrasen). Silver pomfret, (Family Stromateidae); location stomach; locality Hugli estuary.

Diagnosis : Body elongate, tubular, 4.88–8.41 mm long, 0.56–0.9 mm wide, with distinct annular body plications. Ecsoma protruding to varying degrees, sometimes becoming longer than somatic body. Acetabulum in first quarter of body. Oral sucker infundibuliform, ventrolateral margins of each side notched, larger than acetabulum. Prepharynx absent. Pharynx cylindrical, large, overlapping acetabulum in contracted specimens. Oesophagus short. Intestinal caeca forming 'shoulder' extending up to posterior end of body. Testes tandem, in middle of soma, position

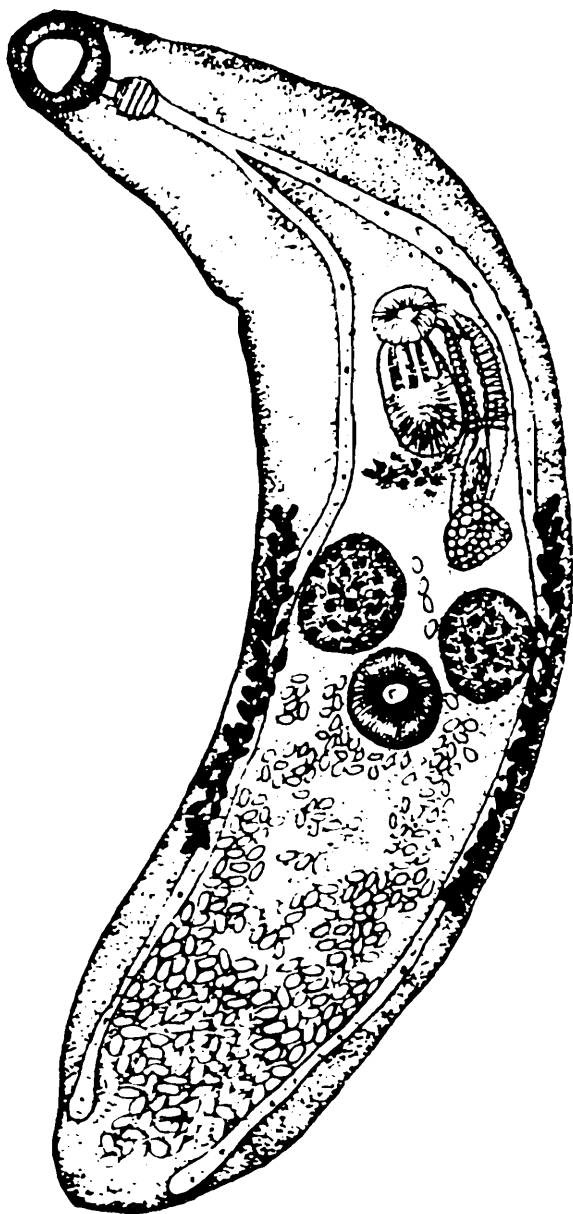


Fig. 29



Fig. 30



Fig. 31

Fig. 29. *Mehratrama dollfusi*. Ventral View (After Srivastava, H.D. 1939). Fig. 30. *Aphanurus stossichi*. Ventral View (After Srivastava, H.D., 1941). Fig. 31. *Lecithocladium excisum*. Ventral View (After Radhakrishnan and Nair, 1979).

changing with contraction and eversion of ecsoma. Seminal vesicle large, fusiform or elliptical, thick-walled, pretesticular, giving rise anteriorly to a short and curved glandular duct. Pars prostatica long, sinuous, surrounded by well developed prostatic gland cells upto middle of acetabulum, onwards becoming small joining metraterm dorsal to anterior part of acetabulum to form hermaphroditic duct. Sinus-sac tubular, enclosing hermaphroditic duct. Genital pore ventral to anterior part of oral sucker. Ovary in posterior half of somatic body, position changeable due to contraction and protrusion of ecsoma, resulting in some specimens to descend into ecsoma near junction of ecsoma and somatic body. Juel's organ present posterior to ovary. Vitellarium consisting of seven long tubular lobes, posterior to ovary, sometimes occurring in anterior part of ecsoma in fully extended worms. Uterine coils descending upto middle of ecsoma. Eggs 18-20 x 11-12. Excretory vesicle Y-shaped; arms uniting dorsal to oral sucker.

Remarks : It is a much discussed species in respect of its diagnosis, occurrence in host, synonymies and geographical distribution. Zhukov (1977) recorded it from Hugli estuary from black pomfret. Hafeezullah (in press) redescribed it from Veraval and Okha coasts from black pomfret.

Distribution : West Bengal : Hugli estuary (District South 24-Parganas); coasts of Kerala, Maharashtra and Gujarat.

25. *Lecithocladium glandulum* Chauhan

(Fig. 32)

1945. *Lecithocladium glandulum* Chauhan, *Proc. Indian Acad. Sci., B.*, **21** (3) : 168.

1976a. *Lecithocladium glandulum* : Vasantha Kumari and Srivastava, C.B., *Newsl. zool. Surv. India*, **2** (4) : 166.

Material examined : Host *Caranx melampygus* Cuvier, Bluefin Jack, (Family Carangidae); location stomach; localities Junput and Digha coasts; no. of specimens 12, on 5 slides.

Diagnosis : Body elongate, almost spindle-shaped, with distinct cuticular plications all over somatic body. Ecsoma smaller than soma. A dorsal oral lip present. Acetabulum preequatorial, slightly larger than oral sucker. Pharynx cylindrical. Intestinal caeca extending almost upto posterior end of body. Testes almost equatorial. Vesicula seminalis spindle-shaped, thick-walled, pretesticular. Pars prostatica long, sinuous, extending upto a little posterior to intestinal bifurcation, surrounded by prostate gland cells upto middle of acetabulum. Sinus-sac extending from behind intestinal bifurcation to genital pore at level of posterior margin of oral sucker, enclosing hermaphroditic duct. Ovary dome-shaped, post testicular, in front of junction of body proper and ecsoma. Receptaculum seminis present. Vitellarium consisting of 7 tubules, arranged in a particular fashion near junction of soma and esoma. Uterine coils extending into ecsoma upto appreciable distance. Eggs 24 x 10. Excretory vesicle Y-shaped; arms uniting dorsal to oral sucker.

Remarks : Vasantha Kumari and Srivastava, C.B. (1976a) recorded this species from the fish *Polynemus paradiseus* from Digha coast. Hafeezullah (in press) has recorded this species from *Caranx carangus* (Bloch) from Madras coast.

Distribution : West Bengal : Digha and Junput (District Medinipur); coasts of Tamil Nadu and Maharashtra.

26. *Lecithocladium harpodontis* Srivastava, H.D.

(Fig. 33)

1937. *Lecithocladium harpodontis* Srivastava, H.D., *Proc. 24th Indian Sci Congr.*, Hyderabad : 295-296.1942. *Lecithocladium harpodontis* Srivastava, H.D., *Parasitology*, **34** (1) : 124.1976a. *Lecithocladium harpodontis* : Vasantha Kumari and Srivastava, C.B.; *Newsl. zool. Surv. India*, **2** (4) : 164.

Material examined : Host *Pampus argenteus* (Euphrasen), Silver pomfret, (Family Stromateidae); location stomach; locality Digha coast.

Diagnosis : Body elongate, about 5.26 mm long, 0.7 mm wide, with faint denticulations. Ecsoma present, shorter than soma. Acetabulum prequatorial, larger than oral sucker. Intestinal caeca with 'shoulders' extending into ecsoma. Testes prequatorial. Vesicula seminalis bulb-shaped, extending posteriorly up to testicular level. Pars prostatica tubular, sinuous, surrounded by prostate gland cells. Sinus-sac tubular, long, enclosing tubular hermaphroditic duct. Genital pore ventral to oral sucker near anterior margin. Ovary spherical, a little larger than testes, post testicular, much anteriorly removed from junction of somatic body and ecsoma. Receptaculum seminis absent. Uterine seminal receptacle formed. Vitellarium consisting of 8 long coiled tubules. Uterine coils largely postovarian, extending into ecsoma for a short distance. Excretory bladder Y-shaped; arms uniting dorsal to oral sucker.

Remarks : Originally this species was described from the fish *Chrysophrys datina* Hamilton. It has been recorded in *Pampus argenteus* from Digha coast by Vasantha Kumar and Srivastava, C.B. (1976 a).

Distribution : West Bengal : Digha (District Medinipur); Orissa coast.

27. *Lecithocladium piscicola* (Srivastava, H.D.) Manter & Pritchard

(Fig. 34)

1935. *Clupenurus piscicola* Srivastava, H.D., *Z. Parasitenkd.*, **8** : 135.1960. *Lecithocladium piscicola* : Manter & Pritchard, *Proc. helminth. Soc. Wash.*, **27** (2) : 168.1963. *Lecithocladium piscicola* : Fischthal and Kuntz, *Proc. helminth. Soc. Wash.*, **30** (1) : 83.

Material examined : Host *Hilsa ilisha* (Hamilton Buchanan). Hilsa shad, (Family Clupeidae); location stomach; locality Digha coast, no. of specimens 24, on 2 slides.

Diagnosis : Body elongated, anterior end truncated, posterior end conical, 2.720-3.382 mm long, 0.362-0.52 mm wide, somatic body with plications, ecsoma smaller than somatic body. Acetabulum cephalad, larger than oral sucker. Pharynx slightly longer than wide or oval (not cylindrical). Intestinal caeca extending up to posterior end of body. Testes diagonal, contiguous, almost equatorial. Seminal vesicle sacciform or spindle-shaped, thick-walled, immediately pretesticular. A short, curved, aglandular duct arising from it anteriorly. Pars prostatica a long and sinuous tube surrounded by prostatic gland cells up to acetabulum only. Sinus sac small, narrow, tubular, enclosing tubular hermaphroditic duct. Genital pore at base of oral sucker. Ovary spherical, post equatorial. Seminal receptacle present behind ovary. Vitellarium seven winding tubular lobes in groups of three and four, not extending into ecsoma. Uterus sometimes extending into ecsoma. Eggs 13-15 x 5-7. Excretory vesicle Y-shaped, arms uniting dorsal to oral sucker; excretory pore terminal.



Fig. 32

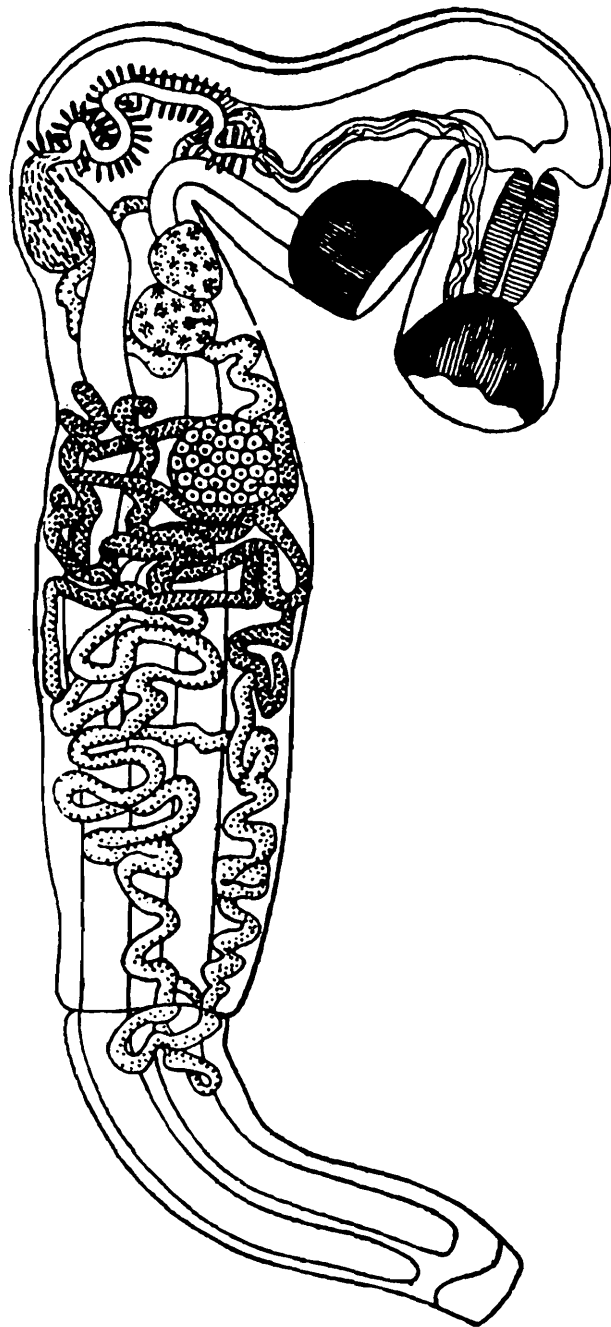


Fig. 33

Fig. 32. *Lecithocladium glandulum*. Ventral View (After Chaunan, 1945). Fig. 33. *Lecithocladium harpodontis*. Ventral View (After Srivastava H.D., 1937).

Remarks : It is almost certain that Srivastava, H.D. (1935) made error in studying the extent of glandular part of pars prostatica, tubular sinus-sac and tubular vitelline glands in *Clupenurus piscicola*. *Lecithocladium ilishae* of Mamaev, 1970, *L. illishae* of Bashirullah and D'silva, 1973, *L. chauhani* Hafeezullah, 1975 and *Lecithocladium* sp. of Soota and Ghosh, 1977 have been described from the same migratory fish host, *Hilsa ilisha*, and they are all synonyms of *Lecithocladium piscicola* (Srivastava, H.D., 1935).

Distribution : West Bengal : Digha (District. Medinipur; Orissa coast, Uttar Pradesh (river Ganges)

Subfamily Dinurinae Looss, 1907

Genus 18. *Uterovesiculurus* Skrjabin & Guschanskaja

1954. *Uterovesiculurus* Skrjabin & Guschanskaja, In : Skrjabin, K.I. (Ed.) [*Trematodes of animals and man. Principles of trematodology*]. Moscow, 9 : 344, 376. (In Russian).

1978. *Exoticotyle* Sahai and Srivastava, H.D., *Proc. natn. Acad. Sci. India*, B 48 (1) : 17. (n. syn.)

Key to West Bengal species of *Uterovesiculurus*

1. Body spindle-shaped, greatest width at acetabulo-ovarian zone, very prominent; ovary kidney-shaped 2
 Body elongate, greatest width at testiculo-ovarian zone, comparatively not so prominent; ovary spherical *U. lemeriensis* (Tubangui and Masilungan, 1935)
2. Testes contiguous or slightly separated; uterine coils not passing between them
 *U. hamati* (Yamaguti, 1934)
 Testes separate, uterine coils passing between them *U. paralichthydis* (Yamaguti, 1934)

28. *Uterovesiculurus hamati* (Yamaguti) Skrjabin & Guschanskaja (Fig. 35)

1934. *Ectenurus hamati* Yamaguti, *Japanese J. Zool.*, 5 (3) : 462.

1954. *Uterovesiculurus hamati* : Skrjabin & Guschanskaja, In : Skrjabin, K.I. (Ed.) [*Trematodes of animals and man. Principles of trematodology*]. Moscow, 9 : 481 (In Russian).

1977. *Uterovesiculurus hamati* : Zhukov, *Parasit Sb.*, No. 27 : 69.

Material examined : Host *Polynemus sextarius* Bloch, Blackspot-threadfin, *Eleutheronema tetradactylus* (Shaw), Four-finger-threadfin, (Family Polynemidae), *Otolithoides brunneus* (Day), Bronze-croaker, (Family Sciaenidae), *Sillago panajius*, (Family Sillaginidae); location stomach; localities coasts of Digha, Junput and Bakkhali; no. of specimens (7, on 2 slides) + (4, on 3 slides) + (10, on 2 slides) respectively.

Diagnosis : Body more or less spindle-shaped with maximum width at testiculo-ovarian region. Ecsoma much shorter than somatic body. A short dorsal preoral lip present. Acetabulum prominent in anterior part of middle-third of body, much larger than oral sucker. Intestinal caeca extending upto posterior end of ecsoma. Testes wedge-shaped or subspherical, contiguous or slightly separated, post-acetabular. Seminal vesicle oval or subpherical, posterodorsal to acetabulum. Pars prostatica short, surrounded by well developed prostatic gland cells distally at base of sinus-sac, connected to

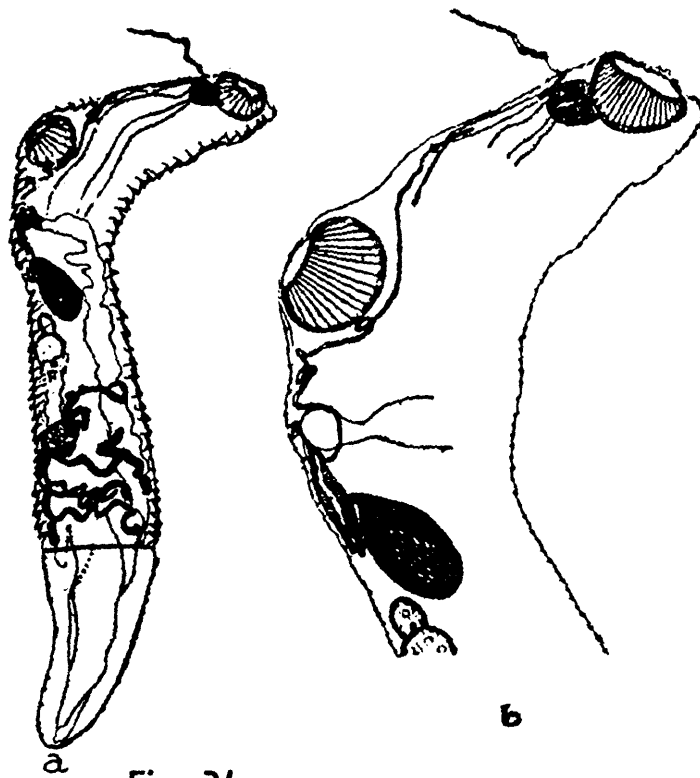


Fig. 34

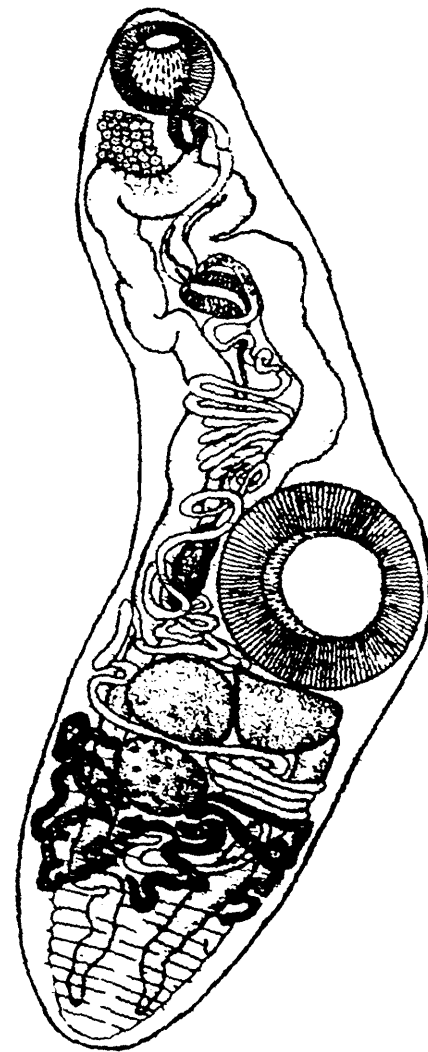


Fig. 35

Fig. 34a) *Lecitholadium piscicola*. Lateral View. Fig. 34b) Enlarged anterior part of *Lecithocladium piscicola*. Fig. 35. *Uterovesiculurus hamati*. Ventral View (After Zhukov, 1977).

seminal vesicle by a long aglandular duct, joining with a very short narrow duct arising from characteristic terminal uterine swelling to form permanent sinus-organ enclosed in sinus-sac. Sinus-organ projecting into genital atrium. Genital pore situated on ventral side of oral sucker. Ovary transversely elongated, kidney-shaped, posttesticular. Juel's organ present. Vitellarium consisting of seven tubular lobes, may be extending into ecsoma. Uterine coils not extending into ecsoma, terminally a characteristic uterine swelling formed before joining male duct at base of sinus-sac. Eggs 14-17 x 9-11. Excretory vesicle Y-shaped; arms uniting dorsal to pharynx; excretory pore at posterior end of ecsoma.

Remarks : Zhukov (1977) recorded this species in *Sillago panajius* (Forskål) and *Otolithoides brunneus* (Day) from Hugli estuary. The distal swelling of the uterus is considered as the characteristic of the genus *Uterovesiculurus*.

Distribution : West Bengal : Junput, Digha (District Medinipur), Bakkhali (District South 24-Parganas), Hugli estuary (District South 24-Parganas); coasts of Andhra Pradesh and Tamil Nadu.

29. *Uterovesiculurus lemeriensis* (Tubangui and Masilungan)

(Fig. 36)

1935. *Ectenurus lemeriensis* Tubangui and Masilungan, *Philipp. J. Sci.*, **58** (4) : 442.

1962. *Erilepturus lembriensis* : Velasquez. *J. Parasit.*, **48** : (4) : 541.

1976a *Erilepturus lemeriensis* : Vasantha Kumari & Srivastava, C.B., *Newsl. zool. Surv. India*. **2** (4) : 165.

1978. *Uterovesiculurus sinensis* Gu and Shen, *Acta zool. Sin.*, **24** (4) : 384. (n. syn.)

Material examined : Nil. Host *Otolithoides brunneus* (Day), Bronz-croaker, (Family Sciaenidae); location stomach; locality Digha coast.

Diagnosis : Body elongate, smooth. Ecsoma usually extended. Acetabulum almost at equatorial level. Intestinal caeca extending up to posterior end of ecsoma. Testes oblique or almost symmetrical, postacetabular. Seminal vesicle postero-dorsal to acetabulum, elongate sacciform. Pars prostatica short, surrounded by prostate gland cells at distal end of male duct, connected to seminal vesicle by a long aglandular duct. Sinus-sac present, enclosing sinus-organ. Genital pore ventral to anterior part of pharynx. Ovary globular. Juel's organ present. Vitellarium consisting of seven tubular lobes, entering into ecsoma. Uterine coils extending into ecsoma posteriorly, forming a uterine swelling at its distal end at base of sinus-sac. Eggs 11-15 x 6.5. Excretory vesicle Y-shaped.

Remarks : Vasantha Kumar and Srivastava, C.B. (1976a) recorded this species from the marine fish *Otolithoides brunneus* (Day) from Digha coast. This fish does not appear to be the normal host for the present worm. Its favourite host is *Scomberoides lysan* (Forskål). Velasquez (1962) redescribed this species from *S. lysan* from Philippines waters and mentioned the presence of uterine swelling at distal end of female duct in all her specimens. *Uterovesiculurus sinensis* Gu and Shen, 1978 described from fishes *Chorinemus lysan* (Forskål) and *Zonichthys nigrofasciata* (Rüppell) from China Sea appears to be nothing but *U. lemeriensis* originally described from adjoining waters. The illustrated specimen (Fig. 10) of Gu and Shen is a contracted one; the ecsoma is withdrawn pushing the vitelline tubules and the gonads far inside the somatic body. Hafeezullah (in press) recorded *U. lemeriensis* in *Scomberoides lysan* and *Curanx melampygus* from Visakhapatnam and Karwar coasts respectively.

Distribution : West Bengal : Digha (District Medinipur); coasts of Andhra Pradesh and Karnataka.



Fig. 36

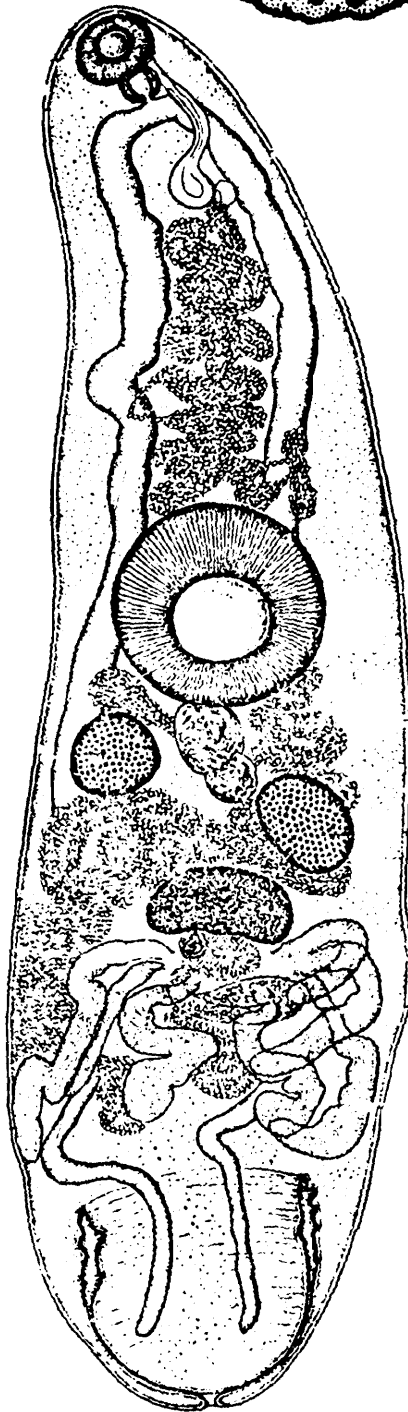


Fig. 37

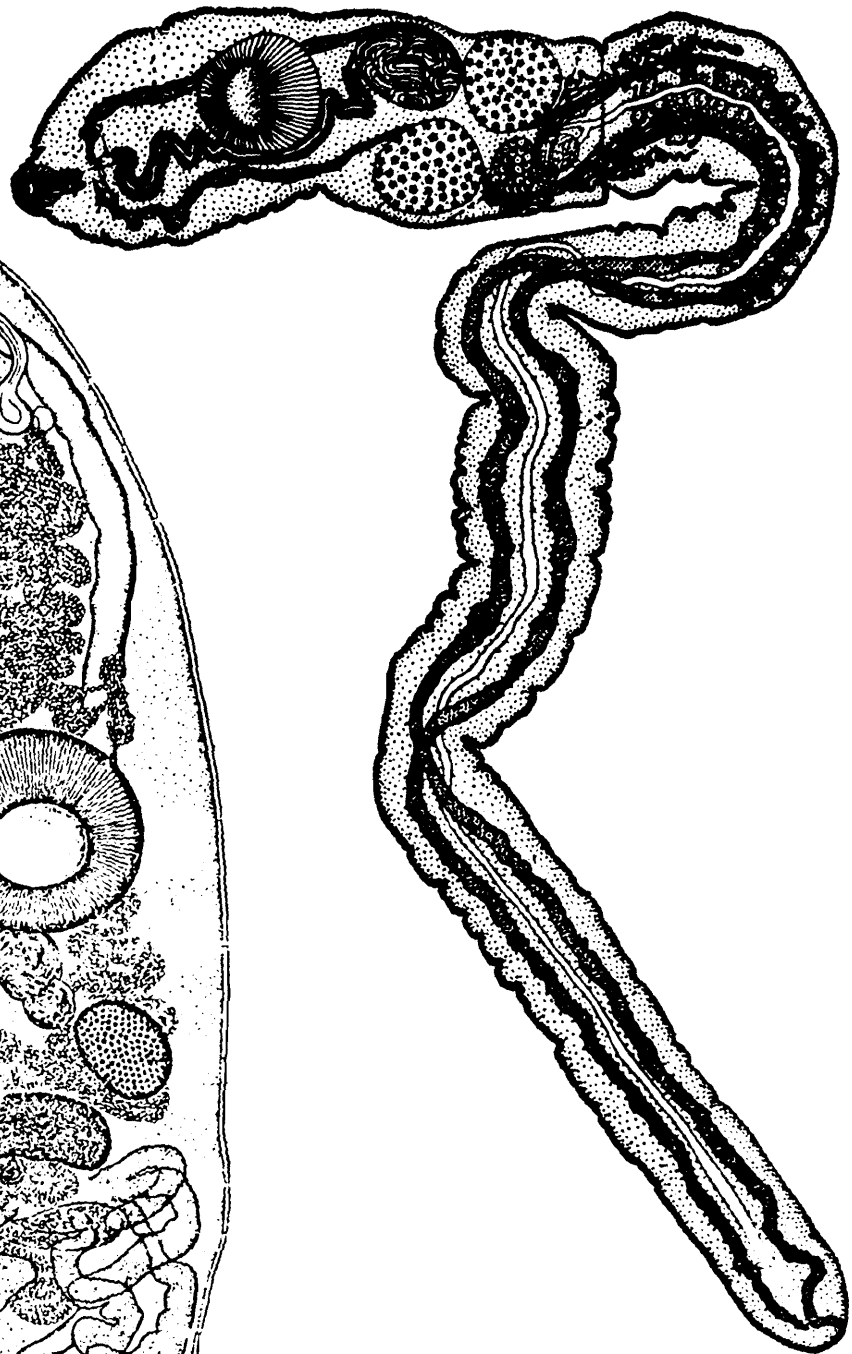


Fig. 38

Fig. 36. *Uterovesiculurus lemeriensis*. Ventral View (After Velasquez, 1979). Fig. 37. *Uterovesiculurus paralichthydis*. Ventral View. (After Yamaguti, 1934). Fig. 38. *Stomachicola muraenesocis*. Ventral View.

30. *Uterovesiculurus paralichthydis* (Yamaguti) Skrjabin & Guschanskaja
(Fig. 37)

1934. *Ectinurus paralichthydis* Yamaguti, *Japanese J. Zool.*, **5** (3) : 465.
 1934. *Ectenurus platycephali* Yamaguti, *Ibid.*, **5** (3) : 466.
 1954. *Uterovesiculurus paralichthydis* : Skrjabin and Guschanskaja, *In* : Skrjabin, K.I. (Ed.), [*Trematodes of animals and man. Principles of trematodology*] Moscow, **9** : 482.
 1978. *Uterovesiculurus paralichthydis* : Sahai and Srivastava, H.D. *Proc. natn. Acad. Sci. India*, **B, 48** (1) : 31.
 1978. *Uterovesiculurus indicus* Sahai and Srivastava, H.D., *Proc. natn. Acad. Sci. India*, **B, 48** (1) : 27 (n. syn.).

Material examined : Host *Platycephalus indicus* (Linnaeus), Indian flathead, (Family Platycephalidae); location stomach; locality Digha coast; no. of specimen 1, on slide.

Diagnosis : Body spindle-shaped, smooth; ecsoma generally entirely withdrawn into soma, may be protruding out also. Dorsal preoral lip present. Intestinal caeca extending into ecsoma. Acetabulum much larger than oral sucker, situated in anterior part of middle-third of body. Testes postacetabular, diagonal, separated by uterine coils. Seminal vesicle bipartite. Pars prostatica short, surrounded by prostatic gland cells at distal end, connected to seminal vesicle by a long aglandular duct. Sinus-sac enclosing sinus-organ, opening in genital atrium. Genital pore ventral to oral sucker. Ovary kidney-shaped, posttesticular. Juel's organ present. Vitellarium consisting of seven elongated tubules, not entering into ecsoma. Uterus forming uterine swelling at its distal end at base of sinus-sac. Eggs 18-24 x 13-14. Excretory vesicle Y-shaped.

Remarks : Sahai and Srivastava, H.D. (1978) synonymised *Uterovesiculurus platycephali* (Yamaguti, 1934) with *U. paralichthydis* (Yamaguti, 1934). We concur with this action. The species was recorded by Vasantha Kumari and Srivastava, C.B. (1976a) from Digha coast in the fish *Chorinemus lysan* as *Erilepturus platycephali* (Yamaguti, 1934).

Distribution : West Bengal : Digha (District Medinipur); coasts of Andhra Pradesh and Tamil Nadu.

Subfamily *Stomachicolinae* Yamaguti, 1958

Genus 19. *Stomachicola* Yamaguti

1934. *Stomachicola* Yamaguti, *Japanese J. Zool.*, **5** : 456, 458.
 1978. *Linguastomachicola* Srivastava, H.D. and Sahai, *Proc. natn. Acad. Sci. India*, **B, 48** : 44.

31. *Stomachicola muraenesocia* Yamaguti
(Fig. 38)

1934. *Stomachicola muraenesoci* Yamaguti, *Japanese J. Zool.*, **5** : 456.
 1934. *Stomachicola muraenesoci* : Zhukov, *Parazit. Sb.*, No. **27** : 72.

Material examined : Nil.

Host *Muraenesox talabonoides* (Bleeker) (Family Muraenidae); location Stomach; locality Hugli estuary.

Diagnosis : Body about 55 mm long, highly contractile due to well developed muscles, smooth, divided into a short somatic body (containing all system organs) an excessively long ecsoma (containing extensions of intestinal caeca, tubular vitelline gland and uterus). Acetabulum cephalad, much larger than oral sucker. Testes behind acetabulum. Seminal vesicle postacetabular, pretesticular. Pars prostatica very long, winding, connected to seminal vesicle by a short aglandular duct, surrounded by well developed prostatic gland cells. Sinus-sac very short, enclosing a short hermaphroditic duct. No sinus-organ. Genital pore behind oral sucker. Ovary reniform or oval, posttesticular. Long, winding vitelline tubules seven, descending into ecsoma. Coils of uterus also descending into ecsoma. Eggs 17-22 x 13-14. Excretory vesicle V-shaped; arms uniting dorsal to oral sucker.

Remarks : The present genus is monotypic so far. Hafeezullah (1980) has decisively shown that *Stomachicola* Yamaguti, 1934 is distinct from *Allostomachicola* Yamaguti, 1958. He (1985) has further discussed at length the large number of synonyms of *Stomachicola* and *Stomachicola muraenesocis*. While the species has been reported from other fish hosts also, but its favourite hosts are two marine eels, *Muraenesox talabonoides* (Bleeker) and *Muraenesox cinereus* (Forskål). Zhukov (1977) also recorded it in the marine eel *Muraenesox talabonoides* (Bleeker) from Hugli estuary.

Distribution : West Bengal : Hugli estuary (District South 24-Parganas); all along east and west coasts of India.

Subfamily Lecithochirunae Lühe, 1901

Genus 20. *Lecithochirium* Lühe

1901. *Lecithochirium* Lühe, *Zool. Anz.*, **24** : 395, 473.
 1965. *Magniscyphus* Reid, Coil and Kuntz, *Proc. helminth. Soc. Wash.*, **32** : 202.
 1977. *Neohysterolecitha* Ahmad, *Neth. J. Zool.*, **27** : 305-309.

32. *Lecithochirium polynemi* Chauhan

(Fig. 39)

1945. *Lecithochirium polynemi* Chauhan. *Proc. Indian Acad. Sci.*, B **21** (3) : 163.
 1945. *L. acutum* Chauhan, *Ibid.*, **21** (3) : 164.
 1976a. *Lecithochirium polynemi* : Vasantha Kumari and Srivastava, C.B., *Newsl. zool. Surv. India*, **2** (4) : 166.
 1977. *L. polynemi* : Zhukov, *Parazit. Sb.*, No. **27** : 70.

Material examined : Host *Harpodon nehereus* (Hamilton Buchanan), Bombay duck, (Family Harpodontidae); location stomach; locality Bakkhali; No. of specimens 17, on two slides.

Diagnosis : Body elongate, tapering anteriorly beyond acetabulum, about 4.15-4.80 long, 0.77-0.93 mm wide. Pre-oral lobe nipple-shaped or rounded. Ecsoma protruded or retracted; if protruded, shorter than soma. Tegument smooth. Presomatic pit present in front of acetabulum. Acetabulum larger than oral sucker, Intestinal caeca may or may not be extending into ecsoma. Testes oblique, postacetabular. Seminal vesicle tripartite, partly over-lapping acetabulum or not. Sinus-sac short,

enclosing short hermaphroditic duct. Sinus-organ absent. Genital pore just posterior to or slightly beyond intestinal bifurcation. Ovary spherical, postequatorial. Receptaculum seminis present. Vitellarium in two compact masses each having three and four digitate lobes, immediately postovarian. Uterine coils extending into ecsoma or not. Eggs 16-18 x 11. Excretory vesicle Y-shaped; pore terminal.

Remarks : Vasantha Kumari and Srivastava, C.B. (1976a) recorded this species in a marine fish *Trichurus savala* and *Harpodon natherius* from Digha coast. Zhukov (1977), while reporting digenetic trematodes of fishes from Hugli estuary, considered *Lecithochirium polynemi* Chauhan, 1945 as a synonym of *Lecithochirium acutum* Chauhan, 1945. This conclusion appears to be a slip of pen. The fact is that *L. acutum* is a synonym of *L. polynemi* because of page priority of the latter. He recorded this species from the fish *Harpodon nehereus*.

Distribution : West Bengal : Bakkhali, Hugli estuary (District South 24- Parganas), Digha (District Medinipur); Maharashtra coast.

Family Lecithasteridae Odhner, 1905

Subfamily Lecithasterinae Odhner, 1905

Genus 21. *Aponurus* Looss

1907. *Aponurus* Looss, *Zool. Anz.*, **31** (19-20) : 607.

33. *Aponurus breviformis* Srivastava, H.D.

(Fig. 40)

1930. *Aponurus breviformis* Srivastava, H.D., *Indian J. vet. Sci.*, **9** (1) : 31.

1977. *Aponurus breviformis* : Zhukov, *Parazit. Sb.*, No. **27** : 69.

Material examined : Host *Ilisha filigera* (Valenciennes), Jewelled ilisha, *Hilsa ilisha* (Hamilton Buchanan), Hilsa shad (Family Clupeidae) and *Apolectus niger* Bloch, Black pomfret, (Family Apolectidae); location intestine; locality Digha coast; no. of specimens 23 + 1 + 3, on 8 + 1 + 2 slides respectively.

Diagnosis : Body small, elongated, 0.83-1.06 mm long, 0.16-0.22 mm wide; ecsoma absent. Tegument smooth. Acetabulum preequatorial. Oral sucker subterminal, smaller than acetabulum. Intestinal caeca extending up to posterior end of body. Testes two, situated in middle third of body, tandem. Seminal vesicle saccular, in forebody. Pars prostatica long, tubular, surrounded by prostatic gland cells, anteriorly joining with uterus to form hermaphroditic duct enclosed in sinus-sac, Genital pore immediately posterior to intestinal bifurcation. Ovary globular, posttesticular. Seminal receptacle present. Vitellarium consisting of seven lobes posterior to ovary. Uterus posterior to seminal vesicle. Eggs 20-25 x 12. Excretory bladder Y-shaped; cornua uniting dorsal to oral sucker; pore terminal.

Remarks : Srivastava, H.D. (1939a) described it from the fish *Therapon puta* from Puri coast. Zhukov (1977) recorded it from the fish *Ilisha elongata* from Hugli estuary.

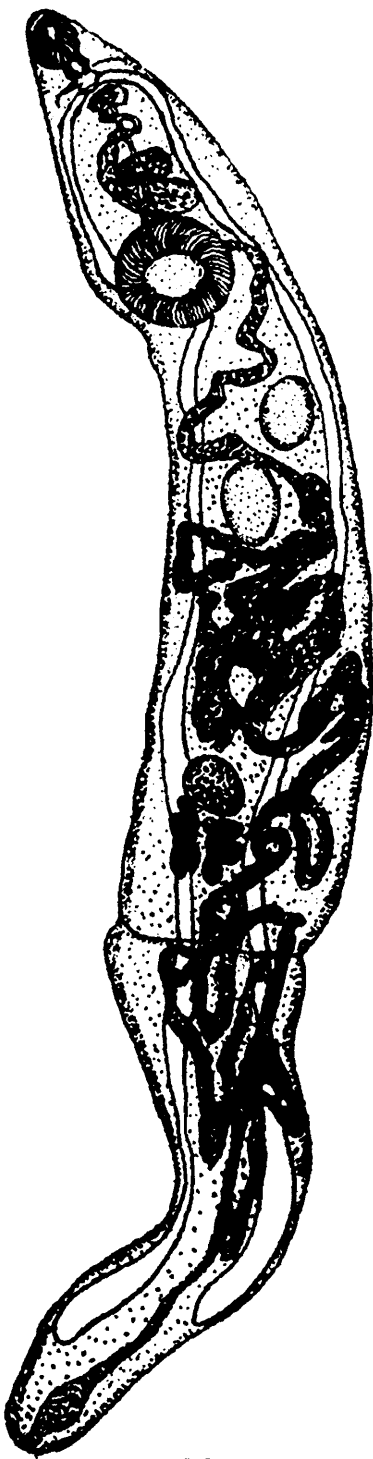


Fig. 39

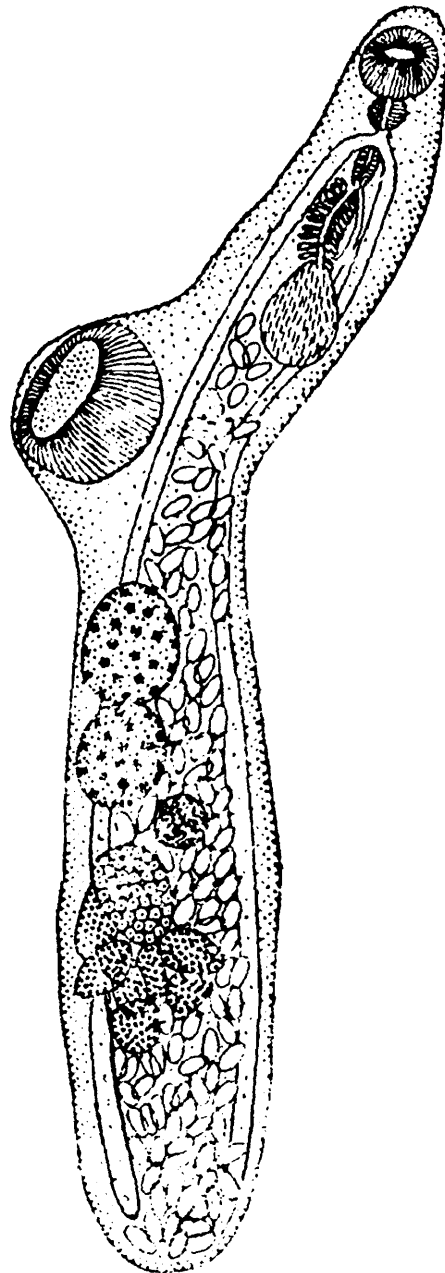


Fig. 40



Fig.41

Fig. 39. *Lecithochirium polynemi*. Ventral View. (After Chauhan, 1945). Fig. 40. *Aponurus breviformis*. Ventral View. (After Srivastava, H.D., 1939). Fig. 41. *Prosogonotrema bilabiatum*. Ventral View.

Distribution : West Bengal : Digha (District Medinipur) Hugli estuary (District South 24-Parganas); Orissa coast.

Family Prosogonotrematidae Perez Viguera, 1940

Subfamily Prosogonotrematinae Perez Viguera, 1940

Genus 22. *Prosogonotrema* Perez Viguera

1940. *Prosogonotrema* Perez Viguera, *Mem. Soc. Cubana Hist. Nat.*, **14** (3) : 249-252.
 1948. *Bhaleraoia* Srivastava, H.D., *Proc. Indian Sci. Congr.*, Delhi, **34** (Pt. III) : 174-175.
 1978. *Bhaleraoia* : Sahai and Srivastava, H.D., *Proc. natn. Acad. Sci. India*, B, **48** (2) : 69.

34. *Prosogonotrema bilabiatum* Perez Viguera

(Figs. 41, O, P)

1940. *Prosogonotrema bilabiatum* Perez Viguera, *Mem. Soc. Cubana Hist. Nat.*, **14** (3) : 249-252.
 1948. *Bhaleraoia* Srivastava, H.D., *Proc. Indian Sci. Congr.*, Delhi, **34** (pt. III) : 174-175.
 1978. *Bhaleraoia piscicola* : Sahai and Srivastava, H.D., *Proc. natn. Acad. Sci. India*, B, **48** (2) : 70.
 1980. *Prosogonotrema diacanthi* Bilquees and Durrani, *Pakistan J. Zool.*, **12** (2) : 205. (n. syn.).
 1980. *Prosogonotrema karachiensis* Bilquees and Durrani, *Pakistan, J. Zool.*, **12** (2) : 207. (n. syn.).

Material examined : Host *Platax orbicularis* Forskål, rounded batfish. (Family Platycidae); location intestine; locality Digha coast; no. of specimens one, on slide.

Diagnosis : Body elongated, muscular, thick, with both ends broadly rounded. Preoral lobe with a shallow depression, not markedly bilobed. Acetabulum highly muscular, postequatorial, much larger than subterminal oral sucker. Prepharynx and oesophagus absent. Male and female systems including narrow coils of uterus and convoluted vitelline tubules located in preacetabular region, and caecal ends, excretory vesicle and Manter's organ (accessory excretory vesicle) situated in postacetabular part of body. Seminal vesicle tubular, convoluted, pretesticular, may be extending posteriorly between symmetrical testes. Ovary near anterior margin of acetabulum. Seminal receptacle and uterine seminal receptacle present. Vitellarium consisting of seven convoluted tubules, preovarian. Genital cone cylindrical or slightly tapering anteriorly. Distal parts of male and female ducts entering genital cone separately, joining to form a short hermaphroditic duct. Genital pore at base of oral sucker. Excretory vesicle Y-shaped, stem divided into two parts joined by a narrow isthmus: arms uniting dorsal to pharynx. A long and wide accessory excretory vesicle dorsal to usual excretory vesicle, called Manter's organ, present.

Remarks : Altogether 13 species have been described in the genus *Prosogonotrema* Perez Viguera, 1940, 11 of which fall in synonymy with the type species, *P. bilabiatum* Perez Viguera, 1940. Only *P. carangi* Velasquez, 1961 stands apart from the type species. Only those synonymies are listed above which have been reported from Indian subcontinent including Pakistan. Two more species described by Yadav (1980) from the west coast of India are not included here into consideration because their literature is not available at the moment.

Manter (1969) and Nasir (1973) have found in their materials of *P. bilabiatum* from Australia and Venezuela respectively that bilobation of the preoral lip is present in varying degrees in different specimens of a single population. It may even be absent in some specimens. So this character is variable and untrustworthy for separating species in the genus *Prosogonatrema*.

Nasir (1973) pointed out that different structures in *P. bilabiatum* Perez Viguera, 1940, *P. clupeae* Yamaguti, 1952, *P. carangi* Velasquez, 1961, *P. subequilatum* Pritchard, 1963, *P. abalisti* Parukhin, 1964, *P. symmetricum* Oshmarin, 1965, and *P. pritchardae* Hafeezullah, 1971 have been distinguished from each other on the basis of "size difference, coupled with position and shape of various organs, and structural interpretation." He further observed that they have been separated from each other on variable characters and therefore he drastically synonymised the latter seven species with the type species *P. bilabiatum*. To this list of synonymy of Nasir (1973) may also be added *P. plataxum* Gu and Shen, 1979 and *P. caesionis* Gu and Shen, 1979.

Hussain and Rao (1980) redescribed *P. carangi* Velasquez, 1961 from the fish host *Monacanthus monoceros* (Day) from Waltair coast, and emphasised that at least this species should be considered valid and distinct from the type species on the basis of markedly subequal testes which character is also exhibited by a metacercaria of *Prosogonatrema* (Rao, 1973) present in "a plankton collection from the inshore waters of Waltair during a summer." It is, however, tentatively agreed that *P. carangi* Velasquez, 1962 is distinct from *P. bilabiatum* Perez Viguera in subequal testes and much larger body size (14 x 6 mm).

Distribution : West Bengal : Digha (District Medinipur); coasts of Karnataka and Maharashtra.

B. Hosts – Freshwater Fishes

Family Allocreadiidae (Looss, 1902) Stossich, 1903

Subfamily Allocreadiinae Looss, 1902

Genus 23 *Allocreadium* Looss

1900. *Allocreadium* Looss, *Zool. Anz.*, **23** : 602.

1962. *Rhynchocreadium* Srivastava, C.B., *Indian J. Helminth.*, **14** : 1.

1969. *Rhynchocreadium* : Kakaji, *Ann. Parasit.*, **44** (2) : 141.

Key to West Bengal species of *Allocreadium*

1. Cirrus sac extending posteriorly beyond acetabulum; vitellarium extending from level of middle of acetabulum to posterior end of body; acetabulum sessile (normal)
.....*Allocreadium kosia* Pande, 1938
- Cirrus sac never extending posteriorly beyond acetabulum..... 2
2. Cirrus sac dorsal or anterodorsal to acetabulum 3
- Cirrus sac preacetabular..... 4
3. Vitellarium extending from a level of anterior margin of ovary to posterior end of body; acetabulum sessile or borne on a very short peduncle*Allocreadium mehrai* Gupta, 1956

- Vitellarium extending from a level between ovary and acetabulum to posterior end of body; acetabulum sessile or not pedunculate.....*Allocreadium heteropneustusius* Agrawal, 1964
4. Vitellarium extending from level of caecal bifurcation to posterior end of body.....
.....*Allocreadium chilikai* (Chatterji, 1956)
- Vitellarium extending from level of posterior margin of acetabulum to posterior end of body.....
.....*Allocreadium handiai* Pande, 1937.

35. *Allocreadium chilikai* (Chatterji) Madhavi
(Fig. 42)

1956. *Psilostomum chilikai* Chatterji, *Indian J. Helminth.*, **8** : 96-99.

1969b. *Allocreadium fasciatusi* Kakaji, *Ann. Parasit.*, **44** (2) : 132.

1978. *Allocreadium chilikai* : Madhavi, *J. Helminth.*, **52** : 58.

Material examined : Host *Colisa fasciata* (Schneider) [= *Trichogaster fasciatus* (Bloch and Schneider)]. (Family Belontiidae); location intestine; locality Diamond Harbour; no. of specimen 18, on 3 slides.

Diagnosis : Body elongated, 3.33-6.50 mm long and 0.70-1.5 mm. wide, aspinose. Acetabulum spherical, preequatorial, equal to or slightly larger than oral sucker. Prepharynx absent; pharynx ovoid; oesophagus 100-200 long; intestinal caeca extending up to posterior end of body. Testes spherical, tandem, postequatorial. Cirrus sac flask-shaped, preacetabular, enclosing bipartite seminal vesicle, pars prostatica, ejaculatory duct and cirrus. Genital pore midway between acetabulum and caecal bifurcation. Ovary spherical, slightly preequatorial, submedian. Receptaculum seminis pear-shaped or retort-shaped, lateral to and larger than ovary. Vitellarium follicular, extending from level of caecal bifurcation to posterior end of body. Uterine coils mainly between anterior testis and acetabulum. Eggs 148-160 x 98-117. Excretory vesicle tubular.

Remarks : Chatterji (1956) described *Psilostomum chilikai* from the fish *Lates calcalifer* (Bleeker) (Family Centripomidae) from Chilka Lake, whereas the species of the digenean genus *Psilostomum* occur in birds. Kakaji (1969) described *Allocreadium fasciatusi* from the fish *Trichogaster fasciatus* (Bloch and Schneider) (Family Belontiidae) from the river Gomti at Lucknow. Madhavi (1978) recorded *Allocreadium fasciatusi* Kakaji, 1969 from the fish *Aplocheilus melastigma* McClelland (Family Cyprinodontidae) from a stream 5 km away from the campus of Andhra University. Additionally, she elucidated the life history of this fluke. She further observed that *Psilostomum chilikai* Chatterji, 1956 is identical to *Allocreadium fasciatusi* Kakaji, 1969. Therefore *A. fasciatusi* becomes a synonym of *P. chilikai* with the combination *Allocreadium chilikai* (Chatterji, 1956) Madhavi, 1978.

Distribution : West Bengal : Diamond Harbour (District South 24- Parganas); Orissa, Andhra Pradesh and Uttar Pradesh.

36. *Allocreadium handiai* Pande
(Fig. 43)

1937a. *Allocreadium handiai* Pande, *Ann. Mag. Nat. Hist.*, **20** (10) : 416.

1960. *Allocreadium ophiocephali* Srivastava, P.S., *Indian J. Helminth.*, **12** (2) : 108.

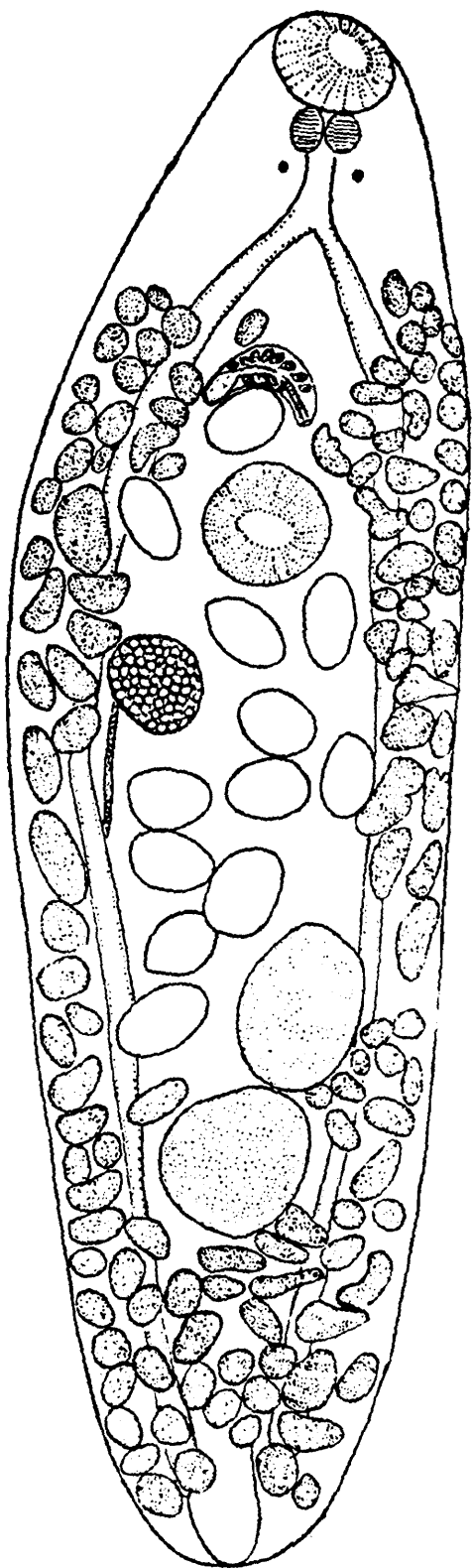


Fig. 42

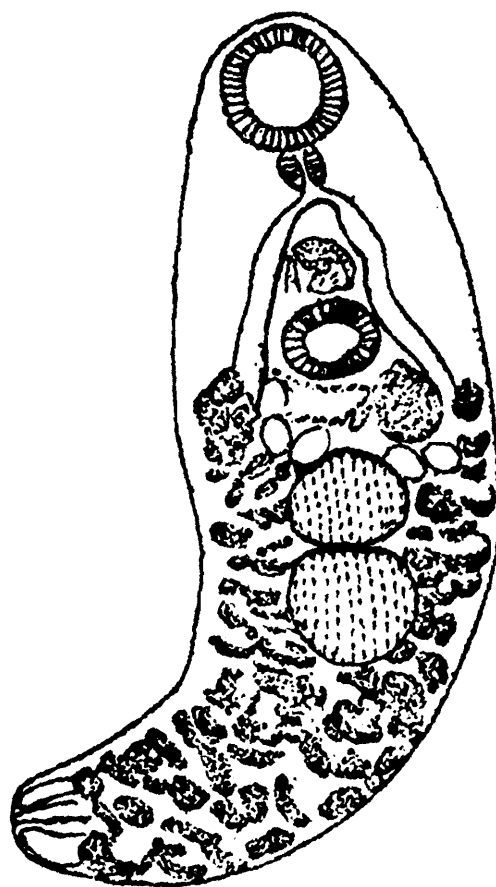


Fig. 43

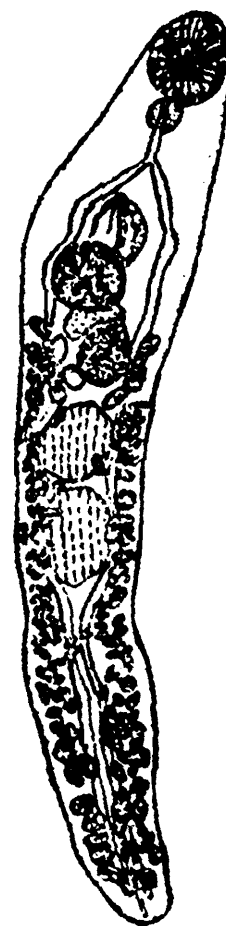


Fig. 44

Fig. 42. *Allocreadium chilikai*. Ventral View. Fig. 43. *Allocreadium handiai*. Ventral View (After Kakaji, 1969). Fig. 44. *Allocreadium heteropneustusius*. Ventral View. (After Agrawal, 1964).

1969b. *Allocreadium handiai* : Kakaji, *Ann. Parasit.*, **44** (2) : 136.

1976b. *Allocreadium handiai* : Vasantha Kumari and Srivastava, C.B., *Newsl. zool. Surv. India*, **2** (5) : 200.

Material examined : Host *Channa gachua* Hamilton, (Family Channidae); location intestine; locality Calcutta; no. of specimens 10, on 3 slides.

Diagnosis : Body elongated with both ends rounded, aspinose, 1.33-5.68 mm long and 0.41-1.13 mm wide at level of cirrus sac and acetabulum at about one-fourth of body length from anterior end. Oral sucker subterminal, larger than acetabulum. Prepharynx absent; pharynx muscular; oesophagus short; intestinal caeca extending up to posterior end of body. Testes spherical, tandem, near mid-body. Cirrus sac flask-shaped, obliquely placed between intestinal bifurcation and acetabulum, enclosing a bipartite seminal vesicle, a short pars prostatica, a long ejaculatory duct and muscular cirrus. Genital atrium present. Genital pore between acetabulum and caecal bifurcation or pharynx. Ovary spherical, pretesticular, just behind acetabulum. Seminal receptacle posterolateral to ovary and in front of anterior testes. Vitellarium follicular, follicles extending from behind acetabulum to posterior end of body. Uterine coils largely between anterior testis and acetabulum. Eggs 117-130 x 70-100. Excretory vesicle tubular.

Remarks : Pande (1937a) originally described it in *Ophiocephalus punctatus* from Handia, Allahabad and Haldwani (all cities in U.P.). Kakaji (1969b) redescribed it from the same host from Lucknow and synonymised *Allocreadium ophiocephali* Srivastava P.S., 1960 with it. Vasantha Kumari and Srivastava, C.B. (1976b) recorded it from *Channa gachua* and *Clarias batrachus* (= *Clarias magur*) from Calcutta.

Distribution : West Bengal : Calcutta; Uttar Pradesh and Madhya Pradesh.

37. *Allocreadium heteropneustusius* Agrawal

(Fig. 44)

1964. *Allocreadium heteropneustusius* Agrawal, *Indian J. Helminth.*, **16** : 82.

1969b. *Allocreadium heteropneustusius* : Kakaji, *Ann. Parasit.*, **44** (2) : 143.

Material examined : Host *Heteropneustes fossilis* (Bloch). Stinging catfish, (Family Heteropneustidae); location intestine; locality Diamond Harbour, no. of specimens 9, on 4 slides.

Diagnosis : Body elongate with both ends rounded, unarmed, 1.36-3.16 mm long and 0.34-0.80 mm wide, tapering posteriorly from acetabulum. Acetabulum preequatorial, in anterior part of body, smaller than oral sucker. Prepharynx absent; pharynx ovoid, oesophagus short, intestinal caeca extending up to posterior end of body. Testes tandem, in middle of body. Cirrus sac elongated or flask-shaped, overlapping anterior part of acetabulum or a little anterior to it, enclosing bipartite seminal vesicle, pars prostatica, ejaculatory duct and cirrus. Genital pore midway between acetabulum and caecal bifurcation, median or submedian. Ovary spherical or oval, between acetabulum and anterior testes, submedian. Receptaculum seminis near ovary. Vitellarium follicular, extending from ovarian level to posterior end of body. Uterine coils mainly between acetabulum and anterior testes. Eggs 80-100 x 40-55. Excretory vesicle tubular.

Remarks : The species was originally reported from the fish *Heteropneustes fossilis* from Lucknow by Agrawal (1964). Later on, it was redescribed from a different host *Mystus seenghala* (Sykes) from the same locality by Kakaji (1969b). It resemble *A. handiai* Pande, 1937 most in all details. However, its validity is accepted tentatively till more information on it becomes available in future.

Distribution : West Bengal : Diamond Harbour (District South 24- Parganas); Uttar Pradesh.

38. *Allocreadium kosia* Pande

(Fig. 45)

1938. *Allocreadium kosia* Pande, *Proc. Indian Acad. Sci.*, **7** (2) : 58.

1976b. *Allocreadium kosia* : Vasantha Kumari and Srivastava, C.B., *Newsl. zool. Surv. India.*, **2** (5) : 200.

Material examined : Host *Mystus cavasius* (Hamilton), Dwarf catfish, (Family Bagridae); location intestine; locality Calcutta.

Diagnosis : Body elongated, about 6 mm long and 1 mm wide, nearly uniform. Acetabulum 38-39 in diameter, in posterior part of first quarter of body. Oral sucker 43 long and 41 wide, slightly larger than acetabulum. Prepharynx present; pharynx muscular; oesophagus 28-33 long. Intestinal caeca extending up to posterior end of body. Testes tandem, postequatorial. Cirrus sac curved around left side of acetabulum extending beyond its posterior margin, enclosing coiled seminal vesicle, spherical pars prostatica and straight ejaculatory duct. Genital pore just behind intestinal bifurcation. Ovary spherical, postacetabular. Seminal receptacle postovarian. Vitellarium follicular, extending from level of middle of acetabulum to posterior end of body. Uterus extending between acetabulum and anterior testis. Eggs 72-75 x 54-57. Excretory bladder tubular.

Remarks : Originally the present species was described from the fish *Barbus chilinodes* from Almora, Kumaon Hills by Pande (1938). Vasantha Kumari and Srivastava, C.B., (1976b) recorded it from a catfish *Mystus cavasius* from Calcutta.

Distribution : West Bengal : Calcutta; Uttar Pradesh.

39. *Allocreadium mehrai* Gupta, S.P.

(Figs. 46, 47)

1956. *Allocreadium mehrai* Gupta, S.P., *Indian J. Helminth.*, **8** : 103.

1962. *Rhynchocreadium aculeata* Srivastava, C.B., *Indian J. Helminth.*, **14** : 1-4.

1965. *Rhynchocreadium singhia* Prasad, *Zool. Anz.*, **175** : 4-6.

1976b. *Rhynchocreadium aculeata* : Vasantha Kumari and Srivastava, C.B., *Newsl. zool. Surv. India.*, **2**(5) : 200.

Material examined : Host *Rhynchobdella aculeata* (Bloch), a freshwater spiny eel, (Family Mastacembelidae); location intestine; locality Diamond Harbour; no. of specimens 18, on 4 slides.

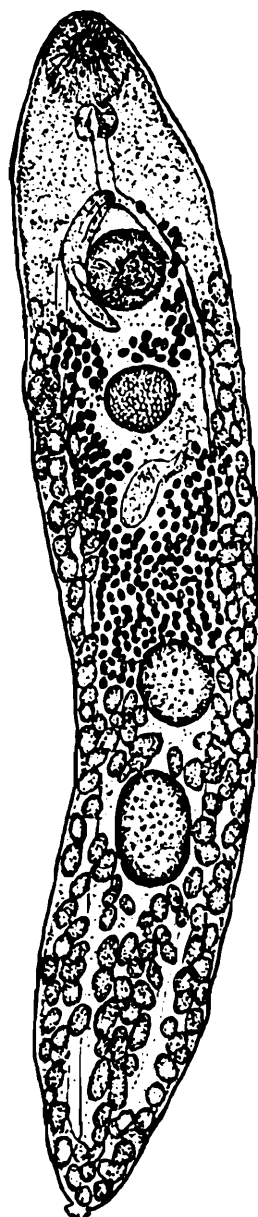


Fig. 45

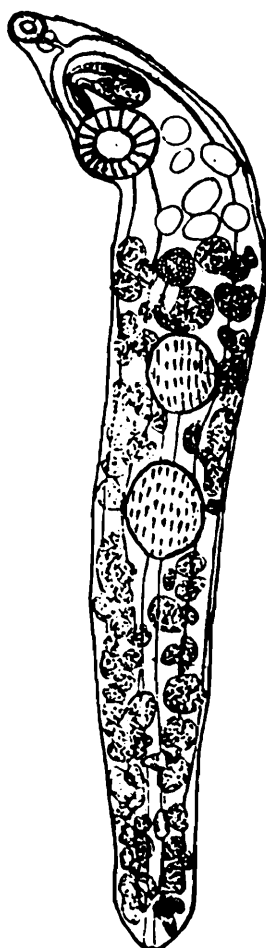


Fig. 46

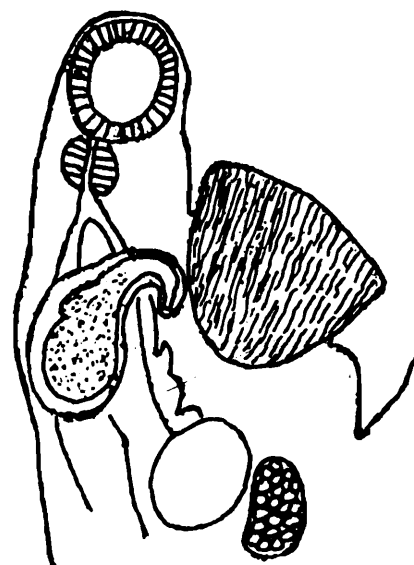


Fig. 47

Fig. 45. *Allocreadium kosia*. Ventral View. (After Pandey, 1938). Fig. 46. *Allocreadium mehrai*. Ventral View (After Gupta, S.P., 1956). Fig. 47. Enlarged anterior part of *Allocreadium mehrai*. (After Kakaji, 1969).

Diagnosis : Body elongated with both ends rounded, about 3-5 mm long and 0.55-0.90 mm wide, aspinose. Acetabulum subsessile, cup-shaped, near anterior end of body, larger than subterminal oral sucker. Prepharynx absent. Pharynx oval; oesophagus short. Intestinal caeca extending up to posterior end of body. Testes spherical, tandem, situated almost in middle of body. Cirrus sac flask-shaped, dorsal or anterodorsal to acetabulum, enclosing internal seminal vesicle, pars prostatica, ejaculatory duct. Genital pore in front of acetabulum. Ovary oval or spherical, preequatorial, pretesticular, much removed behind acetabulum. A pear-shaped seminal receptacle present near ovary. Vitellarium follicles extending from level of anterior margin of ovary or a little anterior to it to posterior end of body, may be discontinuous lateral to gonads. Uterine coils largely between ovary and acetabulum. Eggs few, 160-200 x 110-120. Excretory vesicle tubular; excretory pore terminal.

Remarks : The species usually parasitises freshwater eels like *Rhynchobdella aculeata* and *Mastacembelus armatus*, but Vasantha Kumari and Srivastava, C.B. (1976b) recorded it from *Glossogobius giuris* also from Calcutta.

Distribution : West Bengal : Calcutta, (District Calcutta), Diamond Harbour (South 24-Parganas); Uttar Pradesh and Madhya Pradesh.

Subfamily Orientocreadiinae Yamaguti, 1958

Genus 24. *Orientocreadium* Tubangui

1931. *Orientocreadium* Tubangui, Philipp. J. Sci., 44 (4) : 417.

Key to West Bengal species of *Orientocreadium*

Prepharynx short; vitelline follicles extend from level of posterior margin of acetabulum to posterior end of body *O. batrachoides* Tubangui, 1931

Prepharynx long; vitelline follicles extend from level of ovary to about halfway between posterior testis and posterior tip of body *O. pseudobagri* Yamaguti, 1934

40. *Orientocreadium batrachoides* Tubangui

(Fig. 48)

1931. *Orientocreadium batrachoides* Tubangui, Philipp. J. Sci., 44 (4) : 417.

Material examined : Host *Clarias batrachus* (L.). Walking catfish, (Family Clariidae); location intestine; locality Calcutta; no. of specimens 9, on 5 slides.

Diagnosis : Body elongate, small, about 2 mm long and 0.5 mm wide, armed with spines. Acetabulum at about one-third of body length from anterior end. Oral sucker nearly equal to acetabulum. Prepharynx and oesophagus short. Pharynx muscular. Intestinal caeca extending up to posterior end of body. testes tandem, unequal, postovarian, postequatorial. Cirrus sac elongated pyriform, enclosing internal seminal vesicle, pars prostatica and long cirrus. External seminal vesicle extending up to ovary. Genital pore immediately preacetabular. Ovary subspherical, pretesticular, almost equatorial. Seminal receptacle absent. Vitelline follicles often united, extending from level of

posterior margin of acetabulum to posterior end of body. Uterus extending from equatorial plane to posterior end of body. Eggs 25-31 x 18-20.

Remarks : Beverley-Burton (1962) considered *Orientocreadium indicum* Pande, 1934 as a synonym of *O. batrachoides*, but Fischthal and Kuntz (1963) distinguished it from the latter on the basis of cirrus and metraterm being spined in the former. Vasantha Kumari and Srivastava, C.B., (1976b), while reporting *O. indicum* in the fish *Heteropreustes fossilis* from Canning Town (West Bengal, India), concurred with Fischthal and Kuntz (1963). Agrawal (1964) does not agree with them in considering *O. indicum* distinct from *O. batrachoides*. She argues that "in the light of the descriptions of *O. raipurensis* and *O. dayali* (both forms from the fish *Clarias batrachus* and both having spiny cirrus), it is apparent that the presence of spined cirrus and metraterm are variable characters. Therefore, *O. indicum* is a synonym of *O. batrachoides*." Therefore, *O. indicum* is a synonym of *O. batrachoides*." Again, Fischthal and Thomas (1968), while recording *O. indicum* in the fish *Heterobranchus longifilis* Cuvier and Valenciennes (Clariidae) from Ghana, recognize it as a valid species. Kakaji (1969a) redescribed *O. batrachoides* from the intestine of *Rita rita* from river Ganges at Varanasi with spiny cirrus, but considered this character as a specific variation. In the present material also, out of a population of 9 specimens from *Clarias batrachus*, spines on the cirrus are seen in only two specimens while in the remaining 7 specimens the cirral spines are not seen. So, it is quite possible that spines on the cirrus and metraterm might have been escaped observation by the authors reporting *O. batrachoides*. So, on the basis of the present evidence, we are inclined to consider *O. indicum* Pande, 1934 as a synonym of *O. batrachoides* Tubanguui, 1931, till future investigations regarding validity of *O. indicum* Pande, 1934.

Distribution : West Bengal : Calcutta (District Calcutta), Canning Town (District South 24-Parganas); Uttar Pradesh, Madhya Pradesh.

41. *Orientocreadium pseudobagri* Yamaguti

(Fig. 49)

1934. *Orientocreadium pseudobagri* Yamaguti, *Japanese J. Zool.*, 5 (3) : 334.

1976b. *Orientocreadium pseudobagri* : Vasantha Kumari and Srivastava, C.B., *Newsl. zool. Surv. India*. 2 (5) : 202.

Material examined : Host *Clarias batrachus* (= *Clarias magur*, Walking catfish, (Family Clariidae); location intestine; locality Calcutta.

Diagnosis : Body elongate, anterior end broadly rounded, posterior end more or less pointed. Acetabulum pre-equatorial, at about one third of body length from anterior end, almost equal to oral sucker. Prepharynx longer than oesophagus. Pharynx muscular. Intestinal caeca extending upto near posterior end body. Testes subglobular, tandem, post-equatorial. Cirrus sac extending up to near ovary, enclosing internal seminal vesicle, pars prostatica and a long cirrus, opening into genital atrium. Genital pore in front of acetabulum. External seminal vesicle present. Ovary rounded, pre-testicular, equatorial. Vitellarium follicular, extending from ovarian level to halfway between posterior testis and posterior end of body. Uterus extending from acetabulum to posterior end of body. Eggs 27-33 x 18-21.

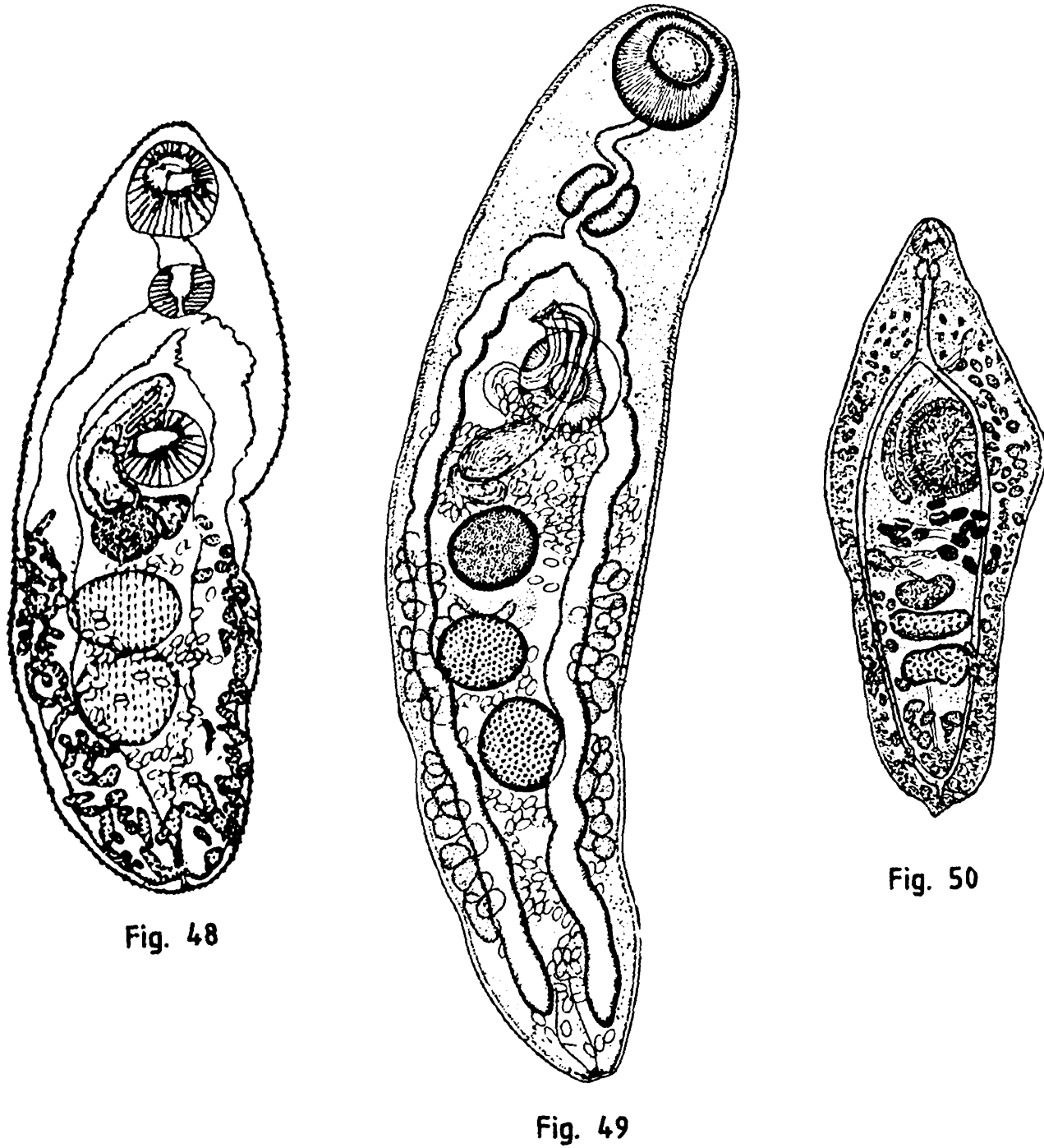


Fig. 48. *Orientocreadium batrachoides*. Ventral View (After Kakaji, 1969). Fig. 49. *Orientocreadium pseudobagri*. Ventral View (After Yamaguti, 1934). Fig. 50. *Opegaster heliyai*. Ventral View (After Pandey, 1937).

Remarks : Vasantha Kumari and Srivastava, C.B., (1976b) recorded this species from the fish *Clarias batrachus* (= *Clarias magur*) from Calcutta.

Distribution : West Bengal : Calcutta (District Calcutta).

Family Opecoelidae Ozaki, 1925

Subfamily Opecoelinae Stunkard, 1931

Genus 25. *Opegaster* Ozaki

1928. *Opegaster* Ozaki, Japanese *J. Zool.*, **2** (1) : 17, 24.

1976. *Godavaritrema* Karyakarte and Yadav, *Marathwada Univ. J. Nat. Sci.*, **15** (8) : 157, 164. (n. syn.)

1981. *Gangatrema* Agarwal, G.P. and Kumar, *Japanese J. Parasit.*, **30** (1) : 9. (n. syn.).

42. *Opegaster beliyai* Pande

(Fig. 50)

1937b. *Opegaster beliyai* Pande, *Proc. natn. Acad. Sci.*, **7** (2) : 113.

1976b. *Opegaster beliyai* : Vasantha Kumari and Srivastava, C.B. *Newsl. zool. Surv. India*, **2** (5) : 201.

Material examined : Host *Glossogobius giuris* (Hamilton), Bar-eyed Goby, (Family Gobiidae); *Chanda nama* (Hamilton), *Chand ranga* (Hamilton), Glassy Perchlets, (Family Chandidae); location intestine; locality Diamond Harbour; no. of specimens - 34, on 6 slides + 26, on 6 slides + 29, on 5 slides respectively.

Diagnosis : Body elongated oval, anterior end pointed, posterior end rounded, 1.32-3.24 mm long and 0.38-0.96 mm wide. Acetabulum located in second quarter of body on a short protuberance, 3 papillae on each lip, much larger than oral sucker. Prepharynx short; pharynx muscular; oesophagus long, intestinal caeca uniting to form an anal canal opening ventrally in front of posterior end of body. Gonads compact, almost in middle of posterior half of body. Testes transversely elongated, may be triangular or irregularly spherical also, directly or obliquely tandem. Cirrus sac very short, enclosing a very small part of anterior male duct before opening into genital atrium. External seminal vesicle very long, curving around right side of acetabulum or slightly dorsal to it and extending up to posterior margin of acetabulum or beyond. Genital pore situated on left side at level of middle of oesophagus submarginally. Ovary generally kidney-shaped, transversely elongated or spherical, directly pretesticular. Vitellarium follicular, extending from a level of middle of oesophagus to posterior end of body. Uterine coils transverse between ovary and acetabulum. Uterine seminal vesicle formed. Eggs 72-81 x 32-40. Excretory vesicle tubular; excretory pore terminal.

Remarks : Originally this species was described by Pande (1937b) from Allahabad in *Glossogobius giuris*. Later on, Vasantha Kumari and Srivastava, C.B. (1976b) recorded it from Calcutta in *Macrogathus aculeatus* and *Channa punctatus*. Here it is reported not only from the type host but also from two very closely related fishes *Chanda nama* and *Chanda ranga*. The papillae on the anterior and posterior lips of the mouth of acetabulum are retractile and therefore in most cases they are not seen in mounted specimens. Probably this was the condition in the specimens of *Godavaritrema indica* and *G. marina* described by Karyakarte and Yadav (1976). Also, they are in error in interpreting the thin membrane of external seminal vesicle as cirrus sac in their genus

Godavaritrema. They could not detect the very short cirrus sac enclosing a very small part of anterior male duct near genital atrium in their two species. Obviously and by all probabilities, *Godavaritrema* Karyakarte and Yadav, 1976 is a synonym of *Opegaster* Ozaki, 1928. Similarly, Agrawal, G.P. and Kumar (1981) are in error in studying the cirrus sac, condition of caeca near posterior end of body and not detecting the papillate lips of acetabulum in their genus *Gangatrema*. This genus is nothing but *Opegaster* Ozaki, 1928.

Opegaster beliyai exhibits variations in the shape and arrangement of gonads as well as in the posterior extension of external seminal vesicle.

Distribution : West Bengal : Diamond Harbour (District South 24-Parganas) and Calcutta (District Calcutta); Uttar Pradesh.

Family Opistholebitidae Fukui, 1929

Subfamily Pycnadeninae Yamaguti, 1971

Genus 26. *Birendralebes* Srivastava, C.B. and Ghosh

1972. *Birendralebes* Srivastava, C.B. and Ghosh, *J. zool. Soc. India*, **24** (1) : 53.

43. *Birendralebes krishnakantai* Srivastava, C.B. and Ghosh
(Fig. 51)

1972. *Birendralebes krishnakantai* Srivastava, C.B. and Ghosh *J. zool. Soc. India*, **24** (1) : 53.

Material examined : Host *Chanda nama* (Hamilton) (= *Ambassis nama*) and *Chanda ranga* (Hamilton) (= *Ambassis ranga*) Glassy perchlets, (Family Chandidae); location intestine; locality Dhakuria lake, Calcutta; no. of specimens 20, ZSI Holotype no. W 7210 and paratype nos. W 7211 to W 7212.

Diagnosis : Body foliate, narrow anteriorly and broader posteriorly, aspinose. Acetabulum in posterior fourth or fifth of body, larger than oral sucker. Post-oral ring behind oral sucker absent. Eye-spot pigments in prebifurcal zone present. Prepharynx absent; pharynx muscular; oesophagus very short; intestinal caeca extending up to posterior end of body. Testes postacetabular, tandem, oblique or symmetrical. Cirrus sac semilunar or horseshoe-shaped, immediately postequatorial, enclosing bipartite seminal vesicle, ejaculatory duct and cirrus. Genital pore preacetabular, postequatorial. Ovary round, preacetabular. Insemination chamber and seminal receptacle present. Vitellarium follicular, extending from level of caecal bifurcation to testicular level. Uterine loops between testes and cirrus sac. Metraterm formed. Eggs 117-162 x 63-100. Excretory vesicle saccular; pore terminal.

Remarks : Srivastava, C.B. and Ghosh (1972) erected the genus *Birendralebes* and described the species *B. krishnakantai* from two closely related species of fishes collected from Dhakuria lake, Calcutta.

Distribution : West Bengal : Dhakuria lake, Calcutta (District Calcutta).

Family Monorchiidae Odhner, 1911

Subfamily Asymphyloporinae Szidat, 1943

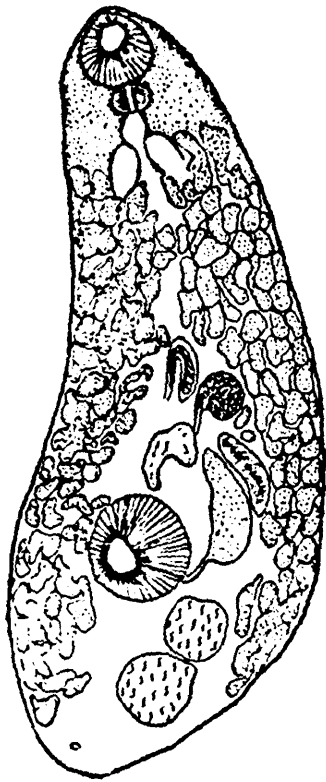


Fig. 51

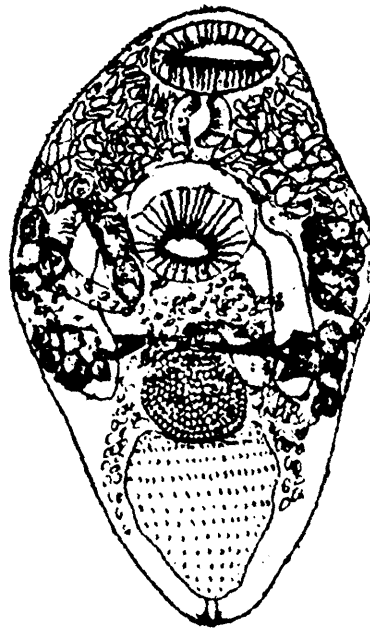


Fig. 52

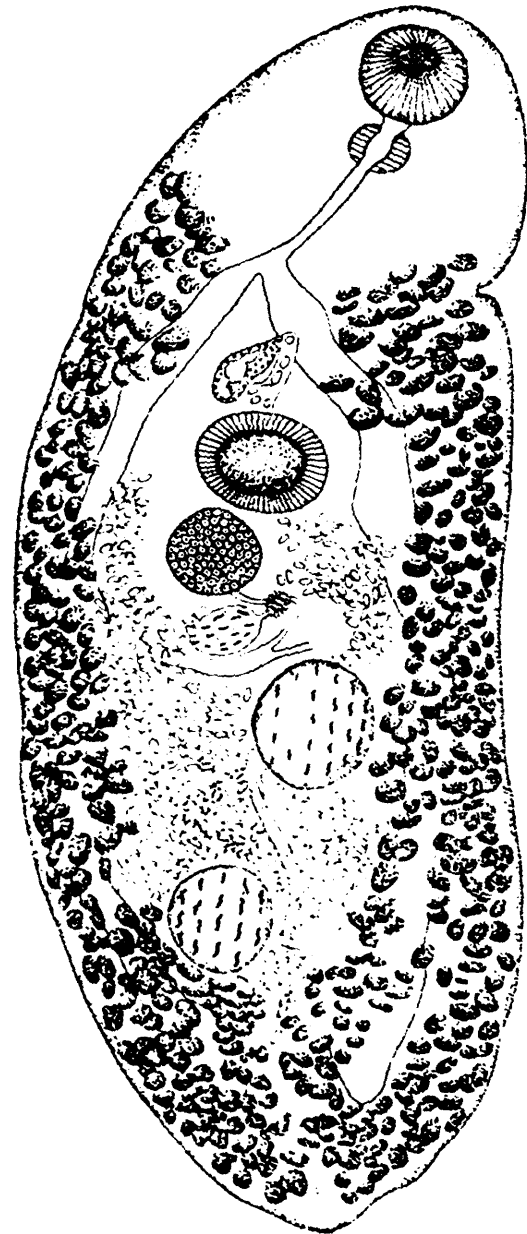


Fig. 53

Fig. 51. *Birendralebes krishnakantai*. Ventral View (After Srivastava, C.B. & Ghosh, 1972). Fig. 52. *Asymphylodora kedarai*. Ventral View (After Srivastava, N.N., 1951). Fig. 53. *Macrolecithus indicus*. Ventral View (After Gupta, S.P. & Agrawal, 1967).

Genus 27. *Asymphylogora* Looss1890. *Asymphylogora* Looss, *Zool. Jahrb. Abt. Syst.*, **12** (5-6) : 598.1943. *Parasymphylogora* Szidat, *Z. Parasitenkd.*, **13** (1) : 25-61.44. *Asymphylogora kedarai* Srivastava, N.N.

(Fig. 52)

1951. *Asymphylogora kedarai* Srivastava, N.N. *Indian J. Helminth*, **3** (1) : 7.

Material examined : Host *Puntius sophoreo* (Hamilton), Yellow Barb, (Family Cyprinidae); location intestine; locality Kakdwip; no. of specimens 25, on 6 slides.

Diagnosis : Body oval or spindle-shaped, broadest at acetabular region and tapering to rounded ends, spinose in preacetabular region. Acetabulum pre-equatorial, overlapping caecal bifurcation slightly larger than oral sucker. Prepharynx absent; pharynx well developed; oesophagus broad; caecal bifurcation dorsal to anterior border of acetabulum; intestinal caeca broad, extending up to level of anterior one-third of testis. Testis ovoid, large, smooth, situated in posterior third of body, usually contiguous with ovary anteriorly. Cirrus sac saccular, elongate, posterodorsal to acetabulum, may be obliquely placed on right side of body, enclosing bipartite seminal vesicle, pars prostatica surrounded by prostate gland cells, ejaculatory duct and unspined muscular cirrus. Genital pore dextral, submarginal, at level of caecal bifurcation in acetabular zone. ovary pyriform or spherical, median immediately pretesticular. Seminal receptacle practically absent or very small. Vitellarium follicular, largely extracaecal, extending from a level behind genital pore to level of posterior margin of ovary. Vitelline reservoir anterior to ovary. Uterus filling entire available space between acetabulum and posterior end of body extending even in posttesticular space. Metraterm or terminal organ unspined. Eggs 14-15 x 9-10. Excretory vesicle tubular; pore terminal.

Remarks : N. N. Srivastava (1951) probably described his species *Asymphylogora kedarai* from contracted specimens. In the present material the shape of body is more or less spindle-shaped, oesophagus is not short, testis is not triangular but ovoid, ovary is almost pyriform and the uterus extends in the posttesticular area also.

Distribution : West Bengal : Kakdwip (South 24-Parganas); Uttar Pradesh.

Family Macroderoididae McMullen, 1937

Subfamily Macroderoidinae Odening, 1964

Genus 28. *Macrolecithus* Hasegawa and Ozaki1926. *Macrolecithus* Hasegawa and Ozaki, *Zool. Mag.*, **38** : 225-228.1967. *Paramacrolecithus* Srivastava, C.B. and Ghosh, *Proc. Indian Acad. Sci., Sec. B*, **66** (5) : 179 (n. syn.).1971. *Macrolecithus* (*Paramacrolecithus*) : Yamaguti, *Synopsis of Digenetic Trematodes of Vertebrates*, Vol. I : 200.45. *Macrolecithus indicus* Gupta, S.P. and Agrawal

(Fig. 53)

1967. *Macrolecithus indicus* Gupta, S.P. and Agrawal, *Proc. helminth. Soc. Washington*, **34** (2) : 156.

Material examined : Host *Puntius sophore* (Ham.), Yellow barb, (Family Cyprinidae); location - intestine; locality Kakdwip; no. of specimen one, on slide.

Diagnosis : Body elongate, leaf-like, both ends rounded; aspinose. Acetabulum spherical, preequatorial, slightly larger than or equal to oral sucker. Prepharynx short; pharynx muscular; oesophagus long; intestinal caeca ending a little anterior to posterior end of body. Testes two, oblique, separated by uterine coils, postequatorial. Cirrus sac club-shaped, curved, preacetabular, enclosing bipartite seminal vesicle, pars prostatica, ejaculatory duct and cirrus, submedian. Genital pore submedian, intercaecal, near right caecum at level between acetabulum and caecal bifurcation. Ovary spherical, immediately posterior to acetabulum, smaller than testes. Receptaculum seminis large, posterior to ovary, vitellarium follicular, extending from level of caecal bifurcation or pharynx to posterior end of body, uterine coils passing between testes and extending upto posterior margin of posterior ovary or beyond. Metraterm formed. Eggs 40-100 x 30-50. Excretory vesicle tabular.

Remarks : Srivastava, C.B. and Ghosh (1967) distinguished their genus *Paramacrolecithus* from *Macrolecithus* Hasegawa and Ozaki, 1926 on the basis of characters like intertesticular disposition of uterine coils which extend behind the posterior testis, extension of tubular excretory vesicle up to the ovarian level, extension of vitelline follicles from pharynx to posterior end of body and their contiguous nature in the posttesticular area, shape and size of cirrus-sac and submedian genital pore. All these characters are present in *Macrolecithus indicus* Gupta, S.P. and Agrawal, 1967 also. Therefore, *Paramacrolecithus* falls in synonymy with *Macrolecithus*. *M. rasborai* n. comb. (Srivastava, C.B. and Ghosh, 1967) differs from *M. indicus* Gupta and Agrawal, 1967 in the submedian genital pore occurring between the right caecum and acetabulum and less space between caecal bifurcation and acetabulum. In Fig. 1 of *M. indicus*, the genital pore has been shown submedian whereas in Fig. 2 it has been shown to be median, but in both figures the genital pore lies (medianly or submedianly) at a level between acetabulum and caecal bifurcation.

Distribution : West Bengal : Kakdwip (District South 24-Parganas); Uttar Pradesh.

Family Azygiidae Odhner, 1911

Subfamily Azygiinae Lühe, 1909

Genus 29. *Azygia* Looss, 1899

1899. *Azygia* Looss, *Zool. Jahrb. Syst.*, **12** (5-6) : 569.

1971. *Azygia* (*Azygia*) : Yamaguti, *Synopsis of Digenetic Trematodes of Vertebrates*, Vol. I : 65.

46. *Azygia* (*Azygia*) *angusticauda* (Stafford) Manter

(Fig. 54)

1904. *Mimodistomum angusticaudum* Stafford, *Zool. Anz.*, **27** (16-17) : 488.

1926. *Azygia angusticauda* : Manter, *Illinois Biol. Monogr.*, **10** (2) : 186.

1971. *Azygia* (*Azygia*) *angusticauda* : Yamaguti, *Synopsis of Digenetic Trematodes of Vertebrates*, Vol. I : 66.

Material examined : Host *Channa punctatus* (Bloch), Spotted snakehead, (Family Channidae); *Chanda nama* Hamilton, Glassy perchlet. (Family Chandidae); location stomach; localities Calcutta and Diamond Harbour respectively; no. of specimens 1 + 1, on two slides.

Diagnosis : Body elongate with rounded ends, 3.33 - 6.0 mm long, 0.71- 1.25 mm wide. Tegument unspined. Acetabulum spherical, large, preequatorial. Oral sucker spherical, subterminal, slightly larger than or equal to acetabulum. Prepharynx absent; pharynx ovoid, small; oesophagus may or may not be distinct; shoulder formed after caecal bifurcation; intestinal caeca sinuous, indented terminating near posterior end of body. Testes subspherical or broader than long, obliquely tandem, situated in anterior region of posterior third of body. Cirrus sac subglobular, situated in front of acetabulum, enclosing internal seminal vesicle, pars prostatica and ejaculatory duct. Ovary subglobular or wider than long or kidney-shaped, pretesticular, usually submedian. Seminal receptacle may or may not be present. Vitellarium follicular; lateral extending from acetabular level to a little anterior to hind end of body. Uterus in lateral coils between ovary and acetabulum. Eggs oval, 28-48 x 30-59. Excretory vesicle Y-shaped, stem extending up to posterior testes; excretory pore terminal.

Remarks : Kakaji (1968) observes that this species exhibits some variations so much so that *Azygia asiatica* Simha and Pershad, 1964 and *Azygia stunkardi* Rai, 1964 become its synonyms, but this conclusion requires further studies on the species. Earlier Bhalerao (1942) reported this species from Fuleshwar (W. Bengal) from the liver of *Mastacembelus pancalus*.

Distribution : West Bengal : Calcutta (District Calcutta), Diamond Harbour (District South 24-Parganas), Fuleshwar (District Hugli); Uttar Pradesh.

Family Plagiorchiidae Lühe, 1901

Subfamily Astiotrematinae Baer, 1924

Genus 30. *Astiotrema* Looss

1899. *Astia* Looss, *Zool. Jahrb. Abt. Syst.*, **12**(5-6) : 590. (Preoccupied for an arachnid by Koch, 1879)
 1900. *Astiotrema* Looss, *Zool. Anz.*, **23** : 602.
 1955. *Gauhatiana* Gupta, S.P., *Indian J. Helminth.*, **5**(1) : 14.

47. *Astiotrema reniferum* (Looss) Looss
 (Fig. 55)

1896. *Distoma unicum* Looss, *Mem. Inst. egypt.* (Egypte), **3** : 44. (A homonym of one of Molin's distomes, 1859).
 1898. *Distoma reniferum* Looss, *Centralbl. Bakteriolog.*, **23**(11) : 461.
 1899. *Astia renifera* : Looss, *Zool. Jahrb. Abt. Syst.*, **12**(5-6) : 592.
 1900. *Astiotrema reniferum* : Looss, *Zool. Anz.*, **23** : 602.
 1955. *Gauhatiana batrachii* Gupta, S.P., *Indian J. Helminth.*, **5**(1) : 14.
 1976b. *Astiotrema reniferum* : Vasantha Kumari and Srivastava, C.B., *Newsl. zool. Surv. India*, **2**(5) : 202.

Material examined : Host *Clarias batrachus* (L.), Walking catfish. (Family Clariidae); location intestine, localities Kakdwip, Calcutta; no. of specimens 22, on 7 slides.

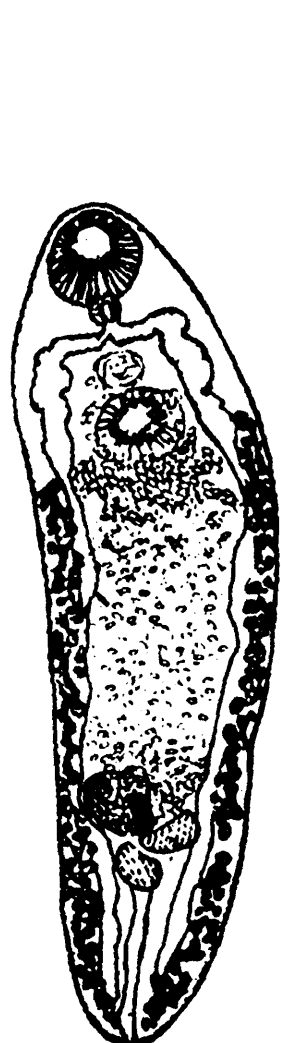


Fig. 54

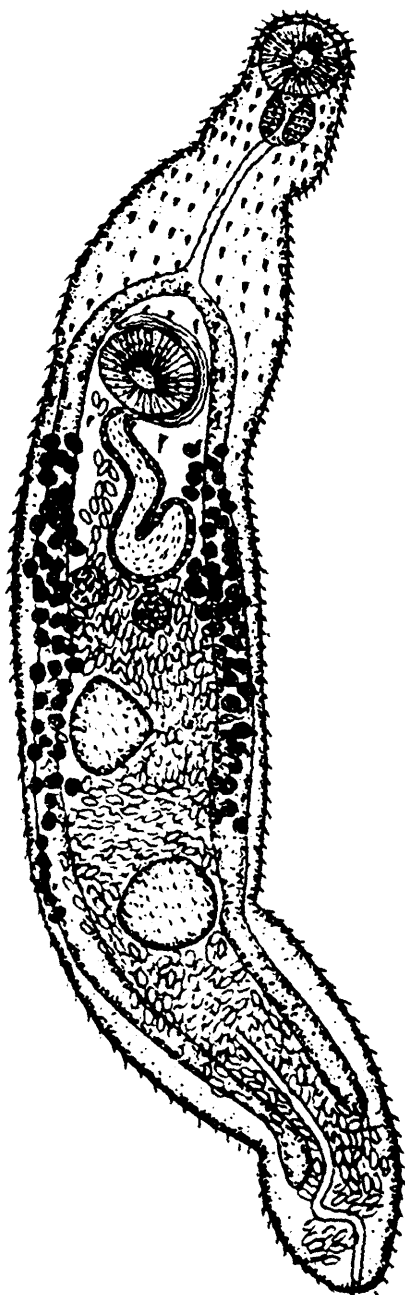


Fig. 55

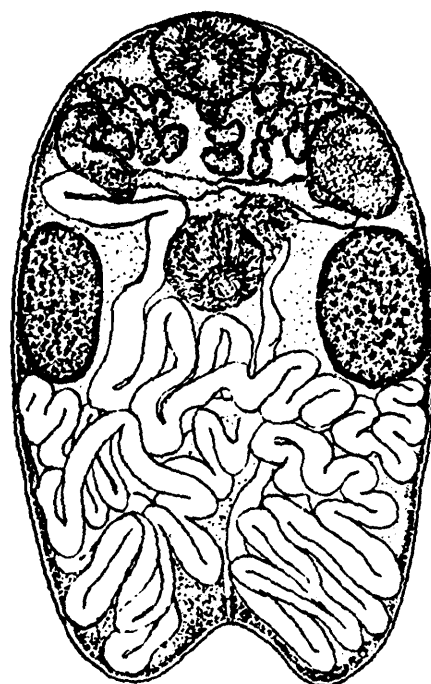


Fig. 56

Fig. 54. *Azygia (Azygia) angusticauda*. Ventral View (After Kakaji, 1968). Fig. 55. *Astiotrema reniferum*. Ventral View (After Agrawal, 1966). Fig. 56. *Pleurogenoides pabdai*. Ventral View (After Pandey, 1937).

Diagnosis : Body elongated, lanceolate, gradually tapering to rounded ends, spinose. Acetabulum situated at about end of first quarter of body, roughly equal to oral sucker. Prepharynx absent; pharynx moderately developed; oesophagus fairly long; caecal bifurcation in front of acetabulum; intestinal caeca reaching short of posterior end of body. Testes tandem or oblique, just behind equatorial plane, postovarian. Cirrus sac claviform, elongated, reaching to ovary, enclosing large seminal vesicle, tubular pars prostatica surrounded by prostate cells, and a small cirrus, opening into genital atrium. Genital pore immediately preacetabular, median or submedian. Ovary spherical or oval, preequatorial. Seminal receptacle present. Vitellarium follicular, lateral, covering intestinal caeca, extending from level of posterior margin of acetabulum to level of middle of posterior testes. Coils of uterus between acetabulum and posterior end of body. Eggs 24-35 x 11-19. Excretory vesicle Y-shaped with main long vesicle passing between two testes, and short arms; pore terminal.

Remarks : Yeh and Fotedar (1958), Khalil (1959) and Siddiqi (1965) have noted that this species exhibits great range of variations in almost all its system organs so much so that, out of 23 species of *Astiotrema*, only four remained valid. Yeh and Fotedar (1958) synonymised *Gauhatiana* with *Astiotrema*. Vasantha Kumari and Srivastava, C.B. (1972) described this species from fishes *Clarias batrachus* (L.) and *Mystus cavasius* (Hamilton) from Calcutta and noted great variations.

Distribution : West Bengal : Calcutta (District Calcutta), Kakdwip (District South 24-Parganas); Uttar Pradesh, Madhya Pradesh and Punjab.

Family Lacithodendriidae (Lühe, 1901) Odhner, 1910

Subfamily Pleurogeninae Travassos, 1920

Genus 31. *Pleurogenoides* Travassos

1921. *Pleurogenoides* Travassos, *Arch. Escola Super. Agric. e Med. Vet.*, Rio de Janeiro, 5(1-2) : 77.

48. *Pleurogenoides pabdai* (Pande) Kaw

(Fig. 56)

1937. *Pleurogenes pabdai* Pande, *Nat. Acad. Sci. India*, 7(2) : 111.

1944. *Pleurogenoides pabdai* : Kaw, *Proc. Indian Acad. Sci., Sec. B* 18 : 107.

1968. *Pleurogenes attui* Kakaji, *Indian J. Helminth.*, 20(2) : 137 (n. syn.)

Material examined : Host *Ompok bimaculatus* (Bloch), Butter catfish. (Family Siluridae); location intestine; locality Diamond Harbour; no. of specimens 13, on 4 slides.

Diagnosis : Body elliptical with bifid posterior end, 1.3-1.4 mm long, 0.86 mm wide at testicular level. Tegument spined. Acetabulum preequatorial. Oral sucker larger than acetabulum. Prepharynx present; pharynx globular; oesophagus short, bifurcating into two caeca; intestinal caeca simple, wide, short, extending rather transversely up to anterior or slightly inner margin of testes. Testes two, symmetrical, equatorial, on either side of acetabulum. Cirrus sac claviform, obliquely placed in front of left testes, posterior extent reaching acetabulum, enclosing seminal vesicle, pars prostatica, ejaculatory duct and a small cirrus. Genital pore at pharyngeal level, sinistral, submarginal. Ovary

spherical or oval, in front of right testis, smaller than testes. Receptaculum seminis and Mehlis' gland complex anterolateral to acetabulum, dextral. Vitellarium follicular, in two bunches of 9-11 follicles on either side of oesophagus between intestinal caeca to oral sucker. Uterus long, thrown into coils, occupying all available space posterior to testes and acetabulum. Metraterm absent. Eggs 26-29 x 11-14. Excretory vesicle Y-shaped.

Remarks : *Pleurogenoides attui* (Kakaji, 1966) Yamaguti, 1971 does not materially differ from *P. Pab dai*. Therefore, it is synonymised with *P. pab dai*.

Distribution : West Bengal : Diamond Harbour (South 24-Parganas); Uttar Pradesh.

Family Clinostomidae Lühe, 1901

Subfamily Euclinostominae Yamaguti, 1958

Genus 32. *Euclinostomum* Travassos

1928. *Euclinostomum* Travassos, *Compt. Rend. Soc. Biol. Paris*, **98**(8) : 644.

49. Metacercaria of *Euclinostomum heterostomum* (Rudolphi) Travassos

(Fig. 57)

1809. *Distoma heterostomum* Rudolphi, *Entozoorum sive vermium intestinalum historia naturalis*, **2**(1) : 381.

1899. *Clinostomum heterostomum* : Braun, *Zool. Anz.*, **22** : 489.

1928. *Euclinostomum heterostomum* : Travassos, *Mem. Inst. Oswaldo Cruz.*, **21**(2) : 334.

1966. *Euclinostomum indicum* Bhalerao, *Proc. Indian Acad. Sci.*, B, **16**(3) : 67.

1976b. *Euclinostomum heterostomum* : Vasantha Kumari and Srivastava, C.B., *Newsl. zool. Surv. India*, **2**(5) : 203.

Material examined : Host - *Channa punctatus* (Bloch), spotted snakehead. (Family Channidae); location - metacercaria encysted in liver; locality - Calcutta; no. of specimens - 2, on slide.

Diagnosis : Body liguiform with both ends bluntly rounded. Acetabulum well developed, situated in second fifth of body, much larger than oral sucker. Oral sucker very small, surrounded by collar-like fold of body wall; tubular prepharynx (termed as oesophagus) entering intestinal bifurcation; intestinal caeca extending up to some distance before posterior end of body, with 10 lateral branches externally in postacetabular part of body. Gonads situated in four fifths of body. testes two, postequatorial, tandem, anterior testis broad U-shaped, posterior testis more or less Y-shaped. Cirrus sac situated immediately before anterior testis between its two limbs, enclosing internal seminal vesicle and prostatic complex. Genital pore in front of cirrus-sac. Ovary globular, smooth, intertesticular, submedian to right of middle line. Oviduct arising from ovary and opening into ootype. Uterine duct curving around side of anterior testis and running forward upto a certain level behind acetabulum, opening into uterine sac there. Uterine sac running backward; metraterm receiving cirrus in front of cirrus sac. Distance between suckers more than that between acetabulum and uterine sac. Ovary smooth.

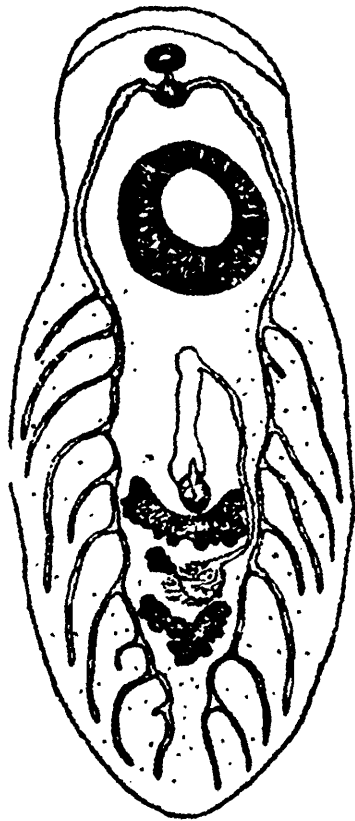


Fig. 57

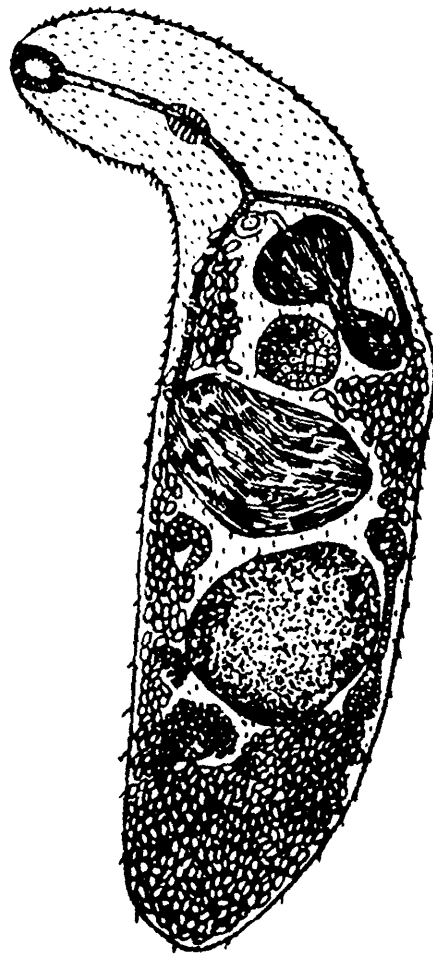


Fig. 58

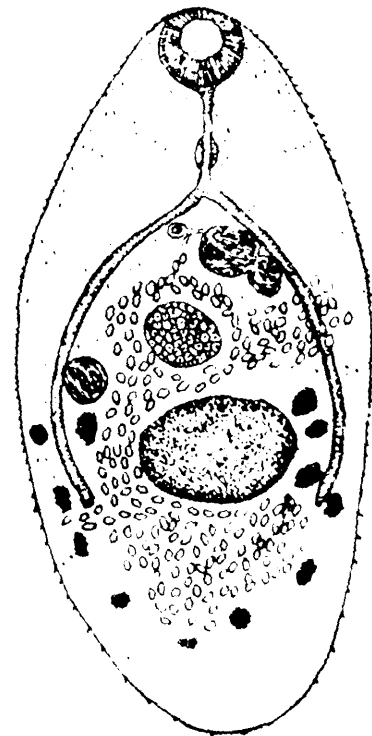


Fig. 59

Fig. 57. Metacercaria of *Euclinostomum heterostomum*. Ventral View (After Agarwal, 1959). Fig. 58. *Haplorchoides attenuatus*. Ventral View (After Srivastava, H.D., 1935). Fig. 59. *Haplorchoides piscicola*. Ventral View (After Srivastava, H.D. 1935).

Remarks : Agarwal (1959) giving a key to the metacercariae of the genus *Euclinostomum* (Travassos, 1928), distinguished *E. indicum* (Bhalerao, 1942) from the type species *E. heterostomum* (Rudolphi, 1809), but Ukoli (1966) considered Bhalerao's species as a synonym of the type species. Vasantha Kumari and Srivastava, C.B. (1976b) reported this species from Calcutta from *Channa punctatus*. The authors agree with Ukoli (1966) that *E. indicum* (Bhalerao 1942) is a synonym of *E. heterostomum*.

Distribution : West Bengal : Calcutta (District Calcutta); Madhya Pradesh.

Family Heterophyidae Leiper, 1909

Subfamily Haplorchiinae Looss, 1899

Genus 33. *Haplorchoides* Chen

1949. *Haplorchoides* Chen, *Ann. trop. Med. Parasit.*, **43**(3-4) : 305.

1949. *Pseudohaplorchis* Dayal, *Indian J. Helminth.*, **1**(2) : 106. (nec Yamaguti, 1954)

Key to West Bengal species of *Haplorchoides*

(After Mehra, 1980)

Body elongated or spindle-shaped, anterior region somewhat attenuated or attenuated both ways; ventrogenital sinus encloses acetabulum armed with a single circle of 40-80 rodlets.....
..... *Haplorchoides attenuatus* (Srivastava, 1935)

Body ovoid or elliptical, ventrogenital sinus encloses acetabulum armed with a single circle of 36-40 rodlets..... *Haplorchoides piscicolu* (Srivastava, 1935)

50. *Haplorchoides attenuatus* (Srivastava, H.D.) Chen (Fig. 58)

1935. *Haplorchis attenuatum* Srivastava, H.D., *Proc. natn. Acad. Sci. India*, **5**(1) : 76.

1945. *Haplorchoides attenuatus* : Chen, *Ann. trop. Med. Parasit.*, **43**(3-4) : 306.

1968. *Haplorchoides attenuatus* : Rai and Pande, *Agra Univ. J. Res.*, (Science), **16**(2) : 17-24. (May, 1967).

Material examined : Host *Mystus aor* (Hamilton), (Family Bagridae); location intestine; locality Kakdwip; no. of specimens 21, on 3 slides.

Diagnosis : Body spindle-shaped, 0.80-1.15 mm long and 0.2-0.4 mm wide, maximum width at ovarian level, attenuating both sides, spinose. A small acetabulum or gonotyl with a circlet of 40-48 rodlets or spines lying in a ventrogenital sinus situated immediately behind caecal bifurcation slightly displaced laterally. Oral sucker small, pharynx ovate; prepharynx very long, longer than oesophagus; intestinal caeca extending up to testis or posterior end of body. testes single, median, postequatorial, well removed anteriorly from posterior end of body. Seminal vesicle large, bipartite; extending posteriorly up to ovary, anteriorly continued as ejaculatory duct opening into ventrogenital sinus. Ovary spherical, equatorial or slightly preequatorial seminal receptacle behind ovary, larger than latter, in some specimens reduced to small size. Vitellarium follicular, overlapping caeca.

from posterior margin of seminal receptacle to a little in front of posterior end of body, a few follicles in posttesticular area. Uterine coils filling all available space between ventro-genital sinus to posterior end of body. Eggs 34-42 x 10-25. Excretory vesicle Y-shaped.

Remarks : Rai and Pandey (1968) studied various species of *Haplorchoides* Cheng, 1949 described from India. They concluded that most of the Indian species have been described on variable characters. So they synonymised all holding that only two species, viz. *Haplorchoides attenuatus* (Srivastava, H.D., 1935) and *Haplorchoides piscicola* (Srivastava, H.D., 1935) are valid. Therefore, *H. seenghali* Gupta, S.P., 1955 and *H. macronis* Agarwal, 1964 reported from *Macrones seenghala* (= *Mystus seenghala*) are synonyms of *H. attenuatus* (Srivastava, H.D., 1935) also from *Macrones seenghala*. Vasantha Kumari and Srivastava, C.B. (1976b) recorded this species from Calcutta from the fish *Mystus seenghala* as *Haplorchoides seenghali*.

Distribution : West Bengal : Kakdwip (District South 24-Parganas), Calcutta (District Calcutta); Assam, Uttar Pradesh, and Andhra Pradesh.

51. *Haplorchoides piscicola* (Srivastava, H.D.) Chen

(Fig. 59)

1935. *Haplorchis piscicola* Srivastava, H.D., *Proc. natn. Acad. Sci. India*, 5(1) : 78.

1949. *Haplorchoides piscicola* : Chen, *Ann. trop. Med. Parasit.*, 43(3-4) : 306.

1968. *Haplorchoides piscicola* : Rai and Pande, *Agra Univ. J. Res. (Science)*, 16(2) : 17-24. (May, 1967).

Material examined : Host *Mystus vittatus* (Bloch). Stripe Dwarf Catfish, (Family Bagridae); location - intestine; locality Kakdwip; no. of specimens 19, on 3 slides.

Diagnosis : Body ovoid, 0.8-2.3 mm long and 3.30-0.58 mm wide, spinose. A very small acetabulum or gonotyl embedded in a ventrogenital sinus with a circlet of 36-40 rodlets or spines situated in vicinity of caecal bifurcation, median or lateral. Oral sucker small; pharynx ovate; prepharynx longer than oesophagus; caeca extending up to testis. Testis single, large, spherical, median. Seminal vesicle bilobed, extending up to ovary, ejaculatory duct opening into ventro-genital sinus. Ovary spherical, much smaller than testis, equatorial or slightly preequatorial. Seminal receptacle usually reduced. Vitellarium follicular, lateral, from ovary to beyond caecal ends, a few follicles in posttesticular space. Uterine coils occupying all available space between ovary and posterior end of body. Eggs 20-40 x 12-17.

Remarks : Rai and Pande (1968) synonymised several Indian species with *Haplorchoides piscicola*. Srivastava, H.D. (1935) described this species from the fish *Eutropichthys vacha* from the rivers Ganges and Jamuna at Allahabad.

Distribution : West Bengal : Kakdwip (District South 24-Parganas); Assam and Uttar Pradesh.

Family Derogenidae Nicoll, 1910

Subfamily Halipeginae Poche, 1926

Genus 34. *Genarchopsis* Ozaki

1925. *Genarchopsis* Ozaki, *Japanese J. Zool.*, 1 : 101.

Key to West Bengal species of *Genarchopsis*

- Oesophageal pouch absent; uterine coils intercaecal; seminal receptacle absent
 *Genarchopsis dasus* Gupta, S.P., 1951
- Oesophageal pouch present; uterine coils intercaecal; uterine seminal receptacle present
 *Genarchopsis cuchiai* Kakaji, 1969

52. *Genarchopsis cuchiai* Kakaji

(Fig. 60)

1969. *Genarchopsis cuchiai* Kakaji, *Indian J. Helminth.*, **21**(1) : 74.

Material examined : Host *Amphipnous cuchia* (Hamilton), swamp eel, (Family Synbranchidae); location stomach; locality Canning Town; no. of specimens 6, one young adult and 5 immature, on 2 slides.

Diagnosis : Body fusiform with anterior end rounded and posterior pointed, 5.6.-5.75 mm wide and 1.72-2.2 mm wide at acetabular level. Acetabulum large, prominent, in posterior half of body. Oral sucker subterminal, smaller than acetabulum. Prepharynx absent; pharynx muscular; oesophagus absent; oesophageal pouch well developed; arising from base of pharynx; caeca sinuous, uniting near posterior end of body to form cyclocoel. Testes postacetabular, symmetrical or oblique, irregular in shape. Cirrus sac absent. Seminal vesicle tubular, coiled, free in parenchyma; pars prostatica swollen, surrounded by well developed prostatic gland cells; terminal part of male duct joining with the terminal part of uterus to form hermaphroditic duct enclosed probably in a weakly developed sinus-sac; sinus-organ muscular, cone-shaped. Genital pore immediately behind caecal bifurcation, median. Ovary irregular in shape, posttesticular. Juel's organ absent, instead uterine seminal vesicle formed in proximal part of uterus. Vitellarium two compact pyriform masses near posterior end of body, symmetrical, extra-caecal. Eggs 20-40 x 10-12, with unipolar filaments.

Remarks : *Genarchopsis cuchiai* Kakaji, 1969 does not possess a seminal receptacle or a Juel's organ. The present specimens from the same host also do not possess these organs, but instead uterine seminal receptacle is formed. This is the first report of this structure in the genus *Genarchopsis*. Moreover, genital pore is postbifurcal and median in the present material. Even then, the authors are inclined to refer these specimens to the species *G. cuchiai*.

Distribution : West Bengal : Canning Town (South 24-Parganas); Uttar Pradesh.

53. *Genarchopsis dasus* Gupta, S.P.

(Fig. 61)

1951. *Genarchopsis dasus* Gupta, S.P. *Indian J. Helminth.*, **3** (1) : 41.1966. *Genarchopsis dasus* : Agrawal, *Ann. Parasit. hum. comp.*, **41** : 230.

Material examined : Host *Channa punctatus* (Bloch). Spotted snakehead. (Family Channidae); location Stomach; locality Calcutta; no. of specimens 50, on 5 slides. *Diagnosis* : Boy spindle-shaped with rounded anterior end and pointed posterior end, 1.12-3.14 mm long and 0.68-1.22 mm wide at acetabular level. Acetabulum large, in posterior half of body. Oral sucker subterminal;

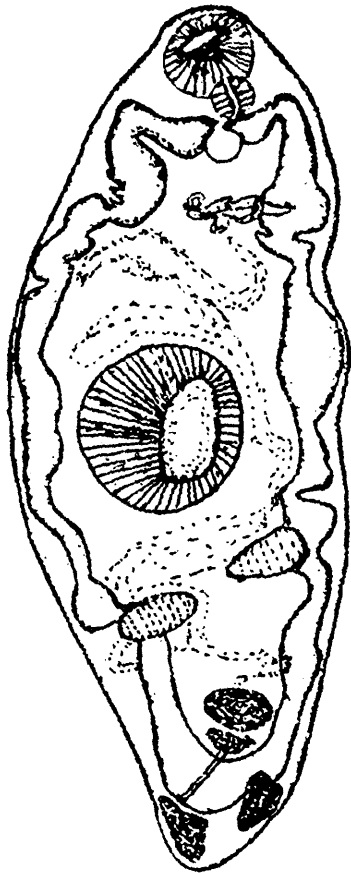


Fig. 60

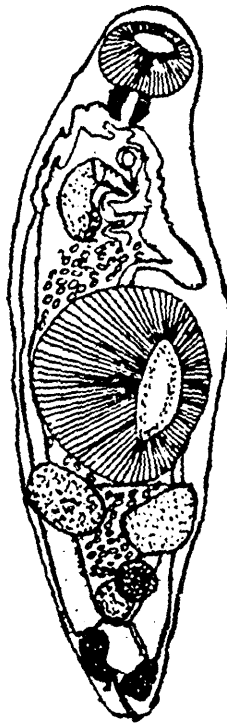


Fig. 61

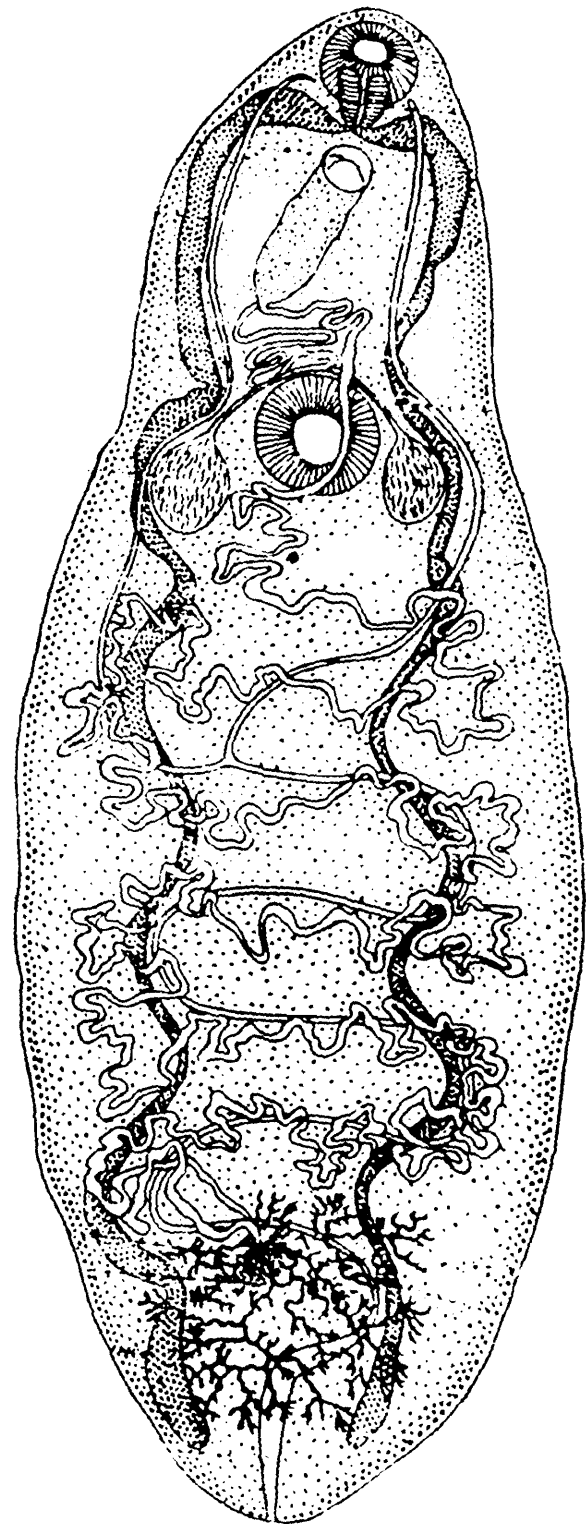


Fig. 62

Fig. 60. *Genarchopsis dasus*. Ventral View (After Gupta S.P., 1951). Fig. 61. *Genarchopsis cuchiai*. Ventral View (After Kakaji, 1969). Fig. 62. *Isoparorchis hypselobagri*. Dorsal View. (After Kuang, Wu, 1938).

smaller than acetabulum. Prepharynx and oesophagus absent. Pharynx muscular. Oesophageal pouch absent. Caecal bifurcation at posterior end of pharynx. Intestinal caeca broad, wavy, forming cyclocoel in region of vitellaria near posterior end of body. Testes postacetabular, oblique or symmetrical, oval or rounded. Cirrus sac absent. Seminal vesicle, behind caecal bifurcation, tubular, coiled; pars prostatica surrounded by prostatic gland cells; terminal part of male duct joining with terminal part of uterus to form hermaphroditic duct enclosed probably in a weak sinus-sac; cone-shaped sinus organ presents. Genital pore immediately behind caecal bifurcation. Ovary spherical, postacetabular, posttesticular to right testis. Seminal receptacle absent. Probably Juel's organ present posterodorsal to ovary. Vitellarium compact, entire or slightly indented, symmetrical or oblique, situated in hinder most part of body. Uterus thrown in lateral coils, largely intercaecal, preacetabular, descending into postacetabular region also. Eggs with unipolar filaments, 40-46 x 15-17. Excretory vesicle Y-shaped, dividing into arms near acetabulum, uniting dorsal to oral sucker.

Remarks : Anjaneyulu (1968) and Madhavi and Rao (1974) described that a Juel's organ is present in *Genarchopsis punctati* Agrawal, 1964 instead of a seminal receptacle. Therefore, it should be one of the generic characters of *Genarchopsis*. Rai (1972) believes that eight Indian species of *Genarchopsis* are *G. goppo* Ozaki, 1925 only.

Distribution : West Bengal : Calcutta (District Calcutta); Uttar Pradesh and Andhra Pradesh.

Family Isoparorchidae (Travassos, 1922) Poche, 1926

Subfamily Isoparorchinae Travassos, 1922

Genus 35. *Isoparorchis* Southwell

1913. *Isoparorchis* Southwell, *Rec. Indian Mus.*, **2** : 91.

1915. *Leptolecithum* Kobayashi, *Zool. Mag. Tokyo*, **27** : 50.

54. *Isoparorchis hypselobagri* (Billet) Ejsmont

(Fig. 62)

1898. *Distomum hypselobagri* Billet, *Bull. Scient. France et Belgique*, **28**(2) : 283.

1913. *Isoparorchis trisumilitubis* Southwell, *Rec. Indian Mus.*, **9** : 92.

1915. *Leptolecithum eurytremum* Kobayashi, *Zool. Mag., Tokyo*, **27** : 50.

1927. *Isoparorchis tandani* Johnston, *Trans. roy. Soc. S. Austr.*, **51** : 129.

1932. *Isoparorchis hypselobagri* : Ejsmont, *Ann. Parasit. hum. comp.*, **10** : 455.

Material examined : Host *Wallago attu* (Schl.), Freshwater shark. (Family Siluridae); *Mastacembelus armatus* (Lacepede). Spiny ell. (Family Mastacembelidae); location usually swim bladder; localities Calcutta and adjacent areas.

Diagnosis : Body large, elliptical or foliate, translucent. Tegument unspined. Acetabulum in anterior part of body. Oral sucker subterminal, a little smaller than acetabulum; preoral lobe may be present. Prepharynx absent; pharynx present; oesophagus indistinguishable being very short; "stomach" formed at beginning of each caecum; intestinal caeca running sinuously to posterior end of body. Testes two, spherical, symmetrical, located at posterolateral margins of acetabulum. Seminal vesicle tubular, convoluted, preacetabular. Sinus-sac or hermaphroditic sac very muscular. Genital

pore usually postbifurcal, median. Ovary tubular or hand-like or coiled into a rounded structure, in posterior part of body. Laurer's canal and seminal receptacle present. Uterus very long, thrown into transverse loops extending laterally beyond intestinal caeca. Metratrem formed, entering sinus-sac. Eggs small, numerous. Excretory vesicle Y-shaped; stem signoid; arms serpentine, united dorsal to pharynx; excretory pore terminal.

Remarks : This is a very common and widely distributed fluke both as adult and immature forms. Usually it inhabits the swim bladder of piscine hosts but it has been recorded from other parts of the host body also. In addition to fish hosts it has been recorded from man and crocodile also. Immature forms of this parasite have been recorded from a large number of fish hosts in India as well as elsewhere in the world. Vasanta Kumari and Srivastava C.B. (1976b) also recorded it from Calcutta from the fish *Mastacembelus armatus*.

Distribution : West Bengal : Calcutta (District Calcutta); Assam, Maharashtra and Andhra Pradesh. In fact, this parasite is widely distributed in India.

Districtwise Distribution of Species

| Medinipur | South 24-Parganas |
|--|--|
| 1. <i>Acanthocolpus caballeroi</i> | 1. <i>Acanthocolpus liodorus</i> |
| 2. <i>Acanthocolpus liodorus</i> | 2. <i>Allocreadium chilikai</i> |
| 3. <i>Aphanurus stossichi</i> | 3. <i>Allocreadium heteropneustusius</i> |
| 4. <i>Aponurus breviformis</i> | 4. <i>Allocreadium mehrai</i> |
| 5. <i>Bianium bombayense</i> | 5. <i>Aphanurus stossichi</i> |
| 6. <i>Bianium plicatum</i> | 6. <i>Aponurus breviformis</i> |
| 7. <i>Cotylocreadium triacanthi</i> | 7. <i>Astiotrema reniferum</i> |
| 8. <i>Faustula brevicehrus</i> | 8. <i>Asymphyllodora kedarai</i> |
| 9. <i>Faustula gangetica</i> | 9. <i>Azygia (Azygia) angusticauda</i> |
| 10. <i>Lecithocladium glandulum</i> | 10. <i>Bianium plicatum</i> |
| 11. <i>Lecithocladium harpodontis</i> | 11. <i>Genarchopsis cuchiai</i> |
| 12. <i>Lecithocladium piscicola</i> | 12. <i>Genolopa bychowskii</i> |
| 13. <i>Lepocreadioides indicum</i> | 13. <i>Haplorchoides attenuatus</i> |
| 14. <i>Mehratrema dollfusi</i> | 14. <i>Haplorchoides piscicola</i> |
| 15. <i>Monascus chauhani</i> | 15. <i>Karyakartia pambanense</i> |
| 16. <i>Monascus filiformis</i> | 16. <i>Lecithochirium polynemi</i> |
| 17. <i>Opisthomonorchis carangi</i> | 17. <i>Lecithocladium excisum</i> |
| 18. <i>Prosogonotrema bilabiatum</i> | 18. <i>Lepocreadioides indicum</i> |
| 19. <i>Pseudopecoeloides tenuis</i> | 19. <i>Macrolecithus indicus</i> |
| 20. <i>Pseudopecoeloides tenuoides</i> | 20. <i>Opechona</i> sp. |
| 21. <i>Skrjabinopsolus elongatus</i> | 21. <i>Opegaster beliyai</i> |
| 22. <i>Stephanostomum orientalis</i> | 22. <i>Orientocreadium batrachoides</i> |
| 23. <i>Stephanostomum triacanthi</i> | 23. <i>Paradactylostomum indicum</i> |
| 24. <i>Uterovesiculurus hamati</i> | 24. <i>Pleurogenoides pabdai</i> |

- | | |
|-------------------------------------|--------------------------------|
| 25. Uterovesiculurus lemeriensis | 25. Stephanostomum bicoronatum |
| 26. Uterovesiculurus paralichthydis | 26. Stomachicola muraenesocis |
| | 27. Uterovesiculurus hamati |

Calcutta

1. Allocreadium handiai
2. Allocreadium kosia
3. Allocreadium mehrai
4. Astiotrema reniferum
5. Azygia (Azygia) angusticauda
6. Birendralebes krishnakantai
7. Metacercaria of Euclinostomum heterostomum
8. Genarchopsis dasus
9. Haplorchoides attenuatus
10. Isoparorchis hypselobagri
11. Opegaster beliyai
12. Orientocreadium batrachoides
13. Orientocreadium pseudobagri

Host – Parasite List

A. Hosts – Marine and Estuarine Fishes of West Bengal :

| Fish Hosts | Digenean Parasites |
|----------------------------|------------------------------|
| Family Cynoglossidas | |
| Cynoglossus macrolepidotus | Lepocreadioides indicum |
| Cynoglossus lida | Lepocreadioides indicum |
| Cynoglossus dubius | Lepocreadioides indicum |
| Cynoglossus bilineatum | Lepocreadioides indicum |
| Family Stromateidae | |
| Pampus argenteus | Opechona sp. of Zhukov, 1977 |
| | Monascus chauhani |
| | Lecithocladium excisum |
| | Lecithocladium harpodontis |
| Pampus chinensis | Monascus chauhani |
| Family Apolectidae | |
| Apolectus niger | Opechona sp. of Zhukov, 1977 |

| | |
|--------------------------|---------------------------------|
| | Genolopa bychowskii |
| | Lecithocladium excisum |
| | Aponurus breviformis |
| Family Tetrodontidae | |
| Torguigener oblongus | Bianium plicatum |
| | Bianium bombayense |
| Spheroides spp. | Bianium plicatum |
| Family Triacanthidae | |
| Triacanthus brevirostris | Cotylocreadium triacanthi |
| | Stephanostomum triacanthi |
| Family Carangidae | |
| Carangoides malabaricus | Opisthomonorchis carangi |
| Megalaspis cordyla | Stephanostomum orientalis |
| Caranx melampygus | Lecithocladium glandulum |
| Caranx sp. | Monascus filiformis |
| Chorinemus lysen | Uterovesiculurus paralichthydis |
| Family Theraponidae | |
| Therapon jarbua | Karyakartia pambanense |
| Family Sciaenidae | |
| Otolithoides biauratus | Stephanostomum bicoronatum |
| Otolithoides brunneus | Stephanostomum bicoronatum |
| | Uterovesiculurus hamati |
| | Uterovesiculurus lemeriensis |
| Family Lutjanidae | |
| Lutjanus johni | Stephanostomum orientalis |
| Family Chirocentridae | |
| Chirocentrus dorab | Acanthocolpus liodorus |
| | Acanthocolpus caballeroi |
| Family Clupeidae | |
| Anodontostoma chakunda | Acanthocolpus caballeroi |
| Hilsa ilisa | Lecithocladium piscicola |
| | Aphanurus stossichi |
| | Aponurus breviformis |
| | Faustula brevicrus |

| | |
|------------------------|---------------------------------|
| Hilsa toli | Faustula gangetica |
| Ilisha filigera | Faustula gangetica |
| Ilisha elongata | Aphanurus stossichi |
| | Aponurus breviformis |
| | Aponurus breviformis |
| | Aphanurus stossichi |
| Clupea fimbriata | Aphanurus stossichi |
| Family Ariidae | |
| Arius jella | Mehratrema dollfusi |
| Family Priacanthidae | |
| Priacanthus hamrur | Pseudopecoeloides tenuis |
| Family Scombridae | |
| Rastraliger kanagurta | Pseudopecoeloides tenoides |
| Family Engraulidae | |
| Engraulis telara | Paradactylostomum indicum |
| | Aphanurus stossichi |
| | Aphanurus stossichi |
| Coilia ramcrati | |
| Family Polynemidae | |
| Polynemus sextarius | Skrjabinopsolus elongatus |
| | Uterovesiculurus hamati |
| | Lecithocladium glandulum |
| | Skrjabinopsolus elongatus |
| | Uterovesiculurus hamati |
| Family Sillaginidae | |
| Sillago panijius | Uterovesiculurus hamati |
| Family Platycephalidae | |
| Platycephalus indicus | Uterovesiculurus paralichthydis |
| Family Muraenidae | |
| Muraensox talabonoides | Stomachicola muraenesocis |
| Family Harpodontidae | |
| Harpodon nehereus | Lecithochirium polynemi |
| Family Platicidae | |
| Platax orbicularis | Prosogonotrema bilabiatum |

Family Trichuridae

Trichurus savala

Lecithochirium polymeni

B. Hosts – Freshwater Fishes

| Fish Hosts | Digenean Parasites |
|--|---|
| Family Bagridae | |
| Mystus cavasius | Allocreadium kosia Astiotrema reniferum |
| Mystus seenghala (= Macrones seenghala) | Haplorchoides attenuatus |
| Mystus aor | Haplorchoides attenuatus |
| Mystus vittatus | Haplorchoides piscicola |
| Family Channidae | |
| Channa gachua | Allocreadium handiai |
| Channa punctatus | Opegaster beliyai Euclinostomum heterostomum (Metacercaria) Azygia (Azygia) angusticauda Genarchopsis dasus |
| Family Clariidae | |
| Clarias batrachus (= Clarias magur) | Allocreadium handiai Astiotrema reniferum Orientocreadium batrachoides Orientocreadium pseudobagri |
| Family Mastacembelidae | |
| Rhynchobdella aculeata (= Macrognathus aculeatus) | Allocreadium mehrai Opegaster beliyai |
| Mastacembelus armatus | Azygia (Azygia) angusticauda Isoparorchis hypselobagri |
| Family Gobiidae | |
| Glossogobius giuris | Allocreadium mehrai Opegaster beliyai |
| Family Heteropneustidae | |
| Heteropneustes fossilis | Allocreadium heteropneustusius Orientocreadium batrachoides |

Family Belontiidae

Colisa fasciata

Allocreadium chilkai

Family Cyprinidae

Puntius sophore

Macrolecithus indicus

Asymphylogora kedara

Family Chandidae

Chanda nama

Opegaster beliyai

Birendralebes krishnakantai

Azygia (Azygia) angusticauda

Chanda ranga

Opegaster beliyai

Birendralabes krishnakantai

Family Siluridae

Ompok bimaculatus

Pleurogenoides pabda

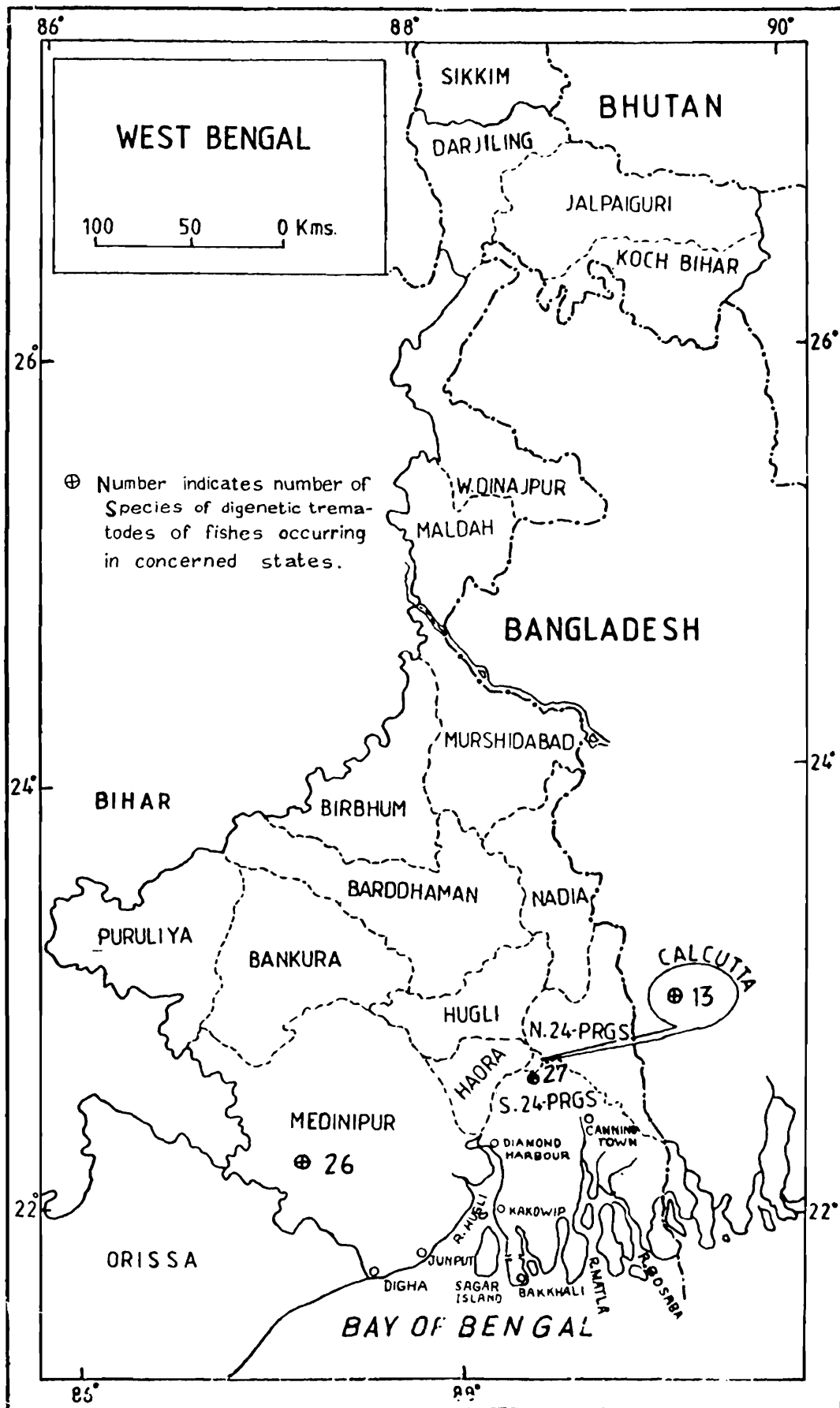
Wallago attu

Isoparorchis hypselobagri

Family Synbranchidae

Amphipnous cuchia

Genarchopsis cuchia



SUMMARY

The present work is a report on the fauna of digenetic trematodes of marine, estuarine and freshwater fishes of West Bengal. These parasitic helminths are being reported from Bakkhali, Kakdwip, Diamond Harbour, Canning Town, Hugli estuary (District South 24- Parganas), Digha, Junput (District Medinipur) and Calcutta (District Calcutta). This work is based on material collected from these places (except Hugli estuary) as well as some species already reported from Digha, Calcutta and Hugli estuary. After a brief history of the reporting of the digenetic trematodes of fishes of West Bengal, an account of external morphology and internal anatomy of these flukes have been given. The scientific terms have been attempted to explain with the help of suitable diagrams wherever necessary. The chapter Systematic Account embodies a key to the digenetic families involved, short description of characteristics of 54 species under 35 genera, their distribution in India keys to species of genera occurring in the fishes of West Bengal and synonymies of genera and species. These 54 species and 35 genera belong to 22 families. At the end of the report a Host - Parasite List and Districtwise Distribution of these parasitic worms are also provided in separate chapters.

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PLATYHELMINTHES : CESTODA

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INTRODUCTION

Cestodes or tapeworms are internal parasites, mostly found in vertebrate intestine, in adult stages; larval and cystic forms, of course, are found in different body organs of almost all vertebrates and invertebrates. Among all the helminth parasites, they have perfectly adapted to the parasitic mode of life having completely dispensed with digestive, respiratory and circulatory systems and having chosen the habitat of vertebrate intestine in their adult stage. In most cases, where they get predigested food in abundance. They have unique and well developed reproductive system, in each gravid and growing proglottids. They were known to occur from time immemorial, in domestic and wild animals including man as the causative agent, for disease and death. Some of these animals are found to have been recorded in Vedic literature also.

Gilchrist (1851-56) a surgeon posted in Madras can very well be credited to record helminth parasites from domestic animals for the first time from India, from modern systematic point of view. Most of the subsequent studies remained confined to the study of these parasites from man, livestock and poultry animals besides some studies on parasites of commercially important food fishes. Even the 'Fauna of British India on Cestoda' by Southwell (1930) contains very meagre record of cestode parasites from the then Indian region including Ceylon and Burma. Mention of few facts will clarify the point. There are about 1500 species of birds recorded from Indian sub-continent but in the 'Fauna volume' record from only mere 93 species of birds is available. Similarly from about 400 species of reptiles, record of cestode parasites is available only from about 60 species. Approximately 2000 species of freshwater and marine fishes have been described from India but studies have been made for cestode parasites in not more than 150 species. The position has not improved to any great extent till date. So a great lacuna exists in our knowledge about the faunal diversity of cestodes in India as a whole. Gap in our knowledge is more apparent, due to the fact that cestodes are very much host specific and a particular cestode species is capable of becoming parasite only in a particular species, or at most genus or family of bird, reptile fish etc. This phenomenon of host specificity in cestodes is being successfully utilised for the study of geographical distribution, migratory routes, taxonomic affinity, evolutionary significance of different species and genera of vertebrate host animals, having wide distribution range. Southwell, (1910) opined that pearl formation in oysters is due to the presence of a larval tapeworm of the genus *Tetrarhynchus*. He recommended that effort should be made to make the condition favourable for the growth of these parasites, for increasing the formation of pearls in oysters. Thus for the first time study of cestode parasites became all the more important and got a great impetus. Since the publication of cestode fauna volume in 1930 some notable contributions were made on cestode taxonomy in India, by Moghe (1925-34); Subhapradha (1957) Johri (1931-57); Mukherjee (1965-70),

Capoor (1980-90), Shinde 1970- 90); Raina (1986-90); Ghosh (1975-90); Pandey (1973-80) and some other workers. But no systematic survey report or consolidated account of any state, or host group is available. It can very well be summarised that only 20-30% of total cestode fauna has so far been discovered and described from India.

As the studies on cestode fauna are far from complete in Indian region, the information available from that of West Bengal is evidently more dismal, Southwell (1913-1930) initiated studies on cestode parasites and incidentally his studies were mostly from the parasites recovered from the animals died in Calcutta Zoo. These parasites are being recorded in the present work, as the cestode parasites from West Bengal. It is very difficult to verify whether all these parasites were endemic to West Bengal or some of them were carried from the original place from where the hosts were brought.

The present study is an attempt to bring together all the information available at the present time regarding cestode species, recorded from West Bengal. But it must be understood that the group is largely unexplored and needs thorough survey and study.

In the present work 94 species under 51 genera and 18 families are recorded from West Bengal. The cestodes are found only within host animals and not in the open space and as such locality of parasite is mostly that of the host only. Diagnostic keys for all the species dealt here, have been prepared in a manner so that their identification becomes easy. Classification proposed by Yamaguti (1959), Skrjabin (1951-65) and Wardle et.al (1974) have been followed broadly, in the present work. But it must be cleared that in nature arbitrary distinguishable criteria fixed by taxonomists for different order, family, genus etc., do not exist. So in true sense all system of classification is unnatural but most useful for grouping and to identify specimens on logical basis, out of hundreds of species available in nature.

HISTORICAL BACKGROUND

History of studies on the cestodes parasites of West Bengal can very well be regarded, as history of such studies in India as well. Southwell (1913-19) initiated the work as Director of Fisheries, Bengal. He (1913) wrote that "knowledge of parasites of fresh water fish in India is at present nil" He also noted that upto 1913 species of cestodes in the collection of Indian Museum did not exceed more than twenty only. He studied the cestode parasites of Bengal and these reports formed the first addition to the knowledge of cestode fauna of the then British India. Southwell (1913) recorded *Ophryocotyle bengalensis* (= *Gangesia bengalensis*) and *Bothriocephalus* (*Anchistrocephalus*) *polyptera* from teleostean fish *Ophiocephalus striatus* and *Labeo rohita* from West Bengal. In 1913 he also recovered a cestode parasite *Duthiersia fimbriata* (Diesing, 1850) from a reptile, *Varanus bengalensis* and in 1916 recorded *Cotugnia digonopora* (Pasquale, 1890) from *Corvus macrorhynchus*; *Davainea friedbergi* (von Linstow, 1877) from *Pavo nigripennis* and some other cestode from birds of West Bengal. Incidentally these form the first record of cestode parasites from any fish, reptile and bird from India also.

Dr. B. Prashad, the first Indian Director of Zoological Survey of India, did some work on cestode parasites of fishes of West Bengal. Southwell and Prashad (1918) studied the life history of *Rhynchobothrium ilisha* Southwell and Prashad 1918 (= *Tentacularia ilisha*) a parasite of *Carcharius gangeticus* from Bengal, whose larval form was reported to be found in *Clupea*

ilisha (= *Hilsa ilisha*). This forms the first authentic record on the life history studies of any cestode parasite in India. Southwell and Prashad (1918) described a new genus *Rhynchobothrium ilisha* from *Hilsa ilisha* from Bengal. Southwell (1923) later on found this parasite to be a pleurocercoid larva with parthenogenic reproduction and renamed it as *Ilisha parthenogenetica*.

Southwell continued his studies on cestode parasites and published a number of papers during (1916-1930) dealing with cestode parasites mostly from Zoo-animals dying in Calcutta Zoological Garden. The writing up of Fauna of British India including Ceylon and Burma on Cestoda was assigned to Southwell, in recognition of his pioneering work. The volume was published in the year 1930 which contains valuable information on cestode parasites, known till then. Some records of cestode parasites from West Bengal are also available there. Chandler (1926-30) reported *Hymenolepis nana*; *H. diminuta* and *Taenia solium* infections from some districts of Bengal while surveying the incidence of helminth diseases in Bengal. Chandler (1925) also studied the Zoonotic importance of some cestode parasites, collected from 250 cats of Calcutta. Maplestone and Bhaduri (1940) recorded helminth parasite from 200 dogs in Calcutta and in 1942 recorded some helminth from rats of Calcutta.

Very little work was done in West Bengal since the publication of fauna volume on cestodes except stray record by veterinary and medical personnel. During the year 1954-55 authorities of Damodar Valley Corporation requested Zoological Survey of India to undertake the investigation on the fish diseases in carps, causing heavy mortality and lowering the marketable value of dam fishes. Officials of Zoological Survey of India, investigated the matter and found that the larvae of the cestode parasite *Ligula intestinalis* (Linnaeus 1758) was responsible for the disease in carps. Remedial measures were suggested. A large number of parasites were also collected from fishes of the Dam. Srivastava and Ghosh, 1981 and Ghosh, 1987 surveyed fish parasites in some D.V.C. dams. Since then after several years Mooping Survey of various districts of West Bengal was undertaken by the survey during 1985-89 and quite a sizeable collection was made from domesticated as well as wild animals from some districts.

MATERIAL AND METHOD

Cestode parasites were collected for study, during routine survey work and also during the recent mopping survey of West Bengal, undertaken for this work. Hosts were either purchased from market or animal collectors or collected in the fields by means of shooting, trapping, netting etc. Freshly killed animals were dissected and the guts were carefully removed from the end of buccal cavity to the anus or cloaca. Various other body organs such as liver, heart, lung, kidney, urinary bladder etc., were separately cleaned and dissected in normal saline in different petri dishes. Larger cestodes were then picked up with naked eye and smaller ones collected under binocular. Every care was taken to collect complete specimens with head which very often remain embedded in the gut submucosa. Larger cestods, were thoroughly cleaned by shaking them and allowing them to stretch themselves to the fullest extent. The specimens were then flattened, on slide under cover glass, slide or glass plate pressure depending upon their size and thickness. Cestodes of smaller size were flattened without any distortion when the living specimens were fixed in hot water or 4% hot formalin and then transferred to fixative.

Cestodes are best preserved in 4-5% formalin rather than alcohol. A few drops of glycerine in the preservative gives good result. Best stain for preparing permanent slides are Acetic Acid Alum Carmine and Delafield's Haematoxylin. In some cases, particularly for smaller specimens, Borax Carmin gives very good result.

All the measurements used in this volume are in millimetre unless otherwise mentioned, in the text.

MORPHOLOGY AND TERMINOLOGY

(Fig. 1-8)

Cestodes are dorsoventrally flat, rarely cylindrical, tape-like; length variable from a millimetre to several meters. At the anterior end, an organ of attachment that is head (*Scolex*) armed with suckers, hooks or both are present. In monozoic cestode the head is said to be absent, except in some where a sucking organ or *pseudoscolex* develops. Structure of head is very important taxonomically. Order and in most cases family are easily distinguishable by head characters. The main six orders of polyzoic cestode have following characters. Cyclophyllidea bears four suckers, in Pseudophyllidea two sucking grooves or bothria are present. Trypanorhyncha head have four protrusible proboscides armed with spines. In Tetracyllidea four ear like lappets are present. Diphyllidea have two spoon shaped bothridia and Spathebothridea having scolex with no suckers, bothridia, tentacles etc. Several other variation and intermediate forms of head structure are also found in cestodes, necessitating erection of several other order, superfamily etc., by different authors.

Neck is the unsegmented portion of cestode between head and starting of segmentation. It is of various shape and size, present or absent; in some case dilated to form accessory holdfast organ.

Strobila or the body part is made of *proglottids* or segments which is one in the class cestodaria or monozoic cestode and two to many in the class Eucestoda or polyzoic cestodes. Outer segmentation usually correspond with that of internal segmentation. Segmentation may be parallel, convex or trapezoidal. The posterior border or proglottids normally covers the anterior border of posterior proglottids and they are called *craspedote*, in the opposite case they are called *acraspedote*. The proglottid increase in length and breadth progressively towards gravid ones but only the terminal ones decrease in breadth.

Digestive, respiratory and circulatory systems are absent in cestodes.

Muscular system usually consist of longitudinal, circular and diagonal muscle fibres. In different order of Cestodes, a great variety in their arrangement have been observed. Longitudinal muscle fibres may be in two to four layers, having circular muscle fibre, in between. Circular muscle fibre divides the connective tissues in body parenchyma in two zones, namely *medullary* and *cortical*. Genital organs remain normally confined in cortical layer and excretory vessels, nerves and longitudinal muscles are medullary in position. Diagonal fibres are not very conspicuous in most cases. Muscle fibre becomes weak gradually towards gravid proglottid, which makes it easy for their detachment from the body chain and ultimate rupture of body wall, for liberating eggs. Arrangement of muscle fibres and zonal distribution of body organs in medullary and cortical layers are of taxonomic importance.

Excretory system consist of flame cells in parenchyma. They anastomise and form four longitudinal vessels in each proglottid, two running on each lateral side, one dorsal and one ventral.

Dorsal almost as a rule, smaller than ventral, by which in most cases, dorsal and ventral side could be determined. The longitudinal vessels run upto the scolex dorsally then turn backwards and descend as ventral vessels upto the last proglottid where they open to the exterior. The longitudinal vessels are connected by transverse vessels, at the posterior end of each proglottid. Relative position of genital duct and excretory vessels is generally constant for a genus in cestodes and as such is very important taxonomically.

Nervous system consists of central ganglia in the scolex from which nerve trunks arise. Generally four nerve trunks are present in scolex and two longitudinal nerve trunks run along the border of proglottids. Nerve ganglions are also present scattered in each proglottid to monitor external stimuli.

Male reproductive system (Fig. 7) cestodes in general are *proterandrous* or *androgyny*, that is male organs develop earlier; though in some cases they are *protogynous* or *gynandry* in which female organs develop earlier. They are hermaphrodites in general, except in few cases where male and female genitalia develop in different proglottids of the same or different individuals. Male genital organs consist of many testes, though two or three testes are also present in some families and genera of cestodes. Normally they remain confined and scattered within the excretory vessels in medullary region, rarely extending to cortical region. Number of testes per segment and their arrangement is an important tool for differentiating genera and species in cestodes. Small duct known as *vasa efferentia* arises from each testis and all these ducts unite to form *vas difference* which runs as sperm duct, from about the middle of each mature proglottid, towards genital pore. The terminal muscular protrusible portion of the sperm duct is known as *cirrus* which is male copulatory organ. The non-protrusible portion is termed as *ejaculatory duct*. The sperm duct before entering into cirrus pouch may have dilation which is called the *external seminal vesicle*. If the dilation is inside the cirrus pouch it is termed as *internal seminal vesicle*. Dilation of ejaculatory duct is termed as *pars prostatica*. *Seminal vesicle* if present, along with *ejaculatory duct* and *pars prostatica* are very often enclosed within a sac called *cirrus sac*. This organ may be absent but if present, is variously shaped from a minute organ to a size extending across the breadth of the proglottids. *Ductus hermaphroditicus* is also present in certain cestodes, cirrus is armed with spines in some cases. It opens to the *genital atrium* or *direct to the outside through genital sinus, genital cloaca* or *cirro-vaginal aperture* as per the position of genital organs. The genital pore is usually on a small depression, on the various place on the lateral margin of one or both sides of every mature proglottid or on the ventral or dorsal superficial surface.. It may open along with female genital pore. The relative position of genital openings along with shape and size of cirrus pouch is important from taxonomic point of view.

Female reproductive system (Fig. 8) Ovary is single, two lobed, lies in the medullary region in most cases. Double ovary and partly or fully cortically placed position of ovaries are also reported in few cases. Ovary is H, X, fan shaped, lobed, branched or compact, normally lies ventrally and posterior to testes. In some cases it is pretesticular. The lobes of the ovary are joined by a hollow tube called *isthmus* from which fine tubular *oviduct* arises. The eggs pass from ovary to this oviduct which soon divides in two long tubes, namely *vagina* and *uterus*. Vagina proceeds upto genital pore. Uterus of varied characteristic shape and size in different genera, remain loaded with eggs. Vitelline gland is single, compact or branched and remains close to ovary. It may be divided in many follicles which are confined laterally, in medullary or cortical region or encircle the

proglottid. They are rarely absent in some cestodes where the germ cells in uterus is fertilised in situ. Vagina commonly opens to the exterior, through genital atrium along with male aperture. It may open directly on the lateral side, on the ventral flat side or near posterior extremity. The uterus is a straight or coiled tube with or without outgrowths. The uterus in some cases is replaced into eggs capsules containing one or more number of eggs. One or more *paruterine organ* may also develop on the uterus in some cases for storage of eggs. In the gravid proglottid uterus with eggs, occupies all the available space and practically rest of the organ degenerate, except genital pore, cirrus pouch, and genital atrium. Uterine pore is present or absent and open along with or separately from vaginal aperture on marginal or ventral surface. Eggs are discharged to the outside by disintegration or rupture of uterine wall where uterine pore is absent. The most gravid proglottid is detached from the body of cestode and passed out of the host to exterior. If it is one by one it is called *euapolysis*. when detached in groups of two or more proglottids they are called *anapolysis*. In some cases embryo matures only after detachment of the segment from the body, then it is termed as *hyperapolysis*. The eggs are globular or oval, in most cases the ovum is covered with two or three membrane. The embryo normally bears six hooklets, characteristic of polyzoic cestode eggs, though they are absent in some cases. Monozoic cestode egg have 10 hooks. In some cases, poles of the egg have two projection called *pyriform apparatus* which may cross each other when fully matured.

Life history Most of the tapeworm have indirect life cycle. Two or more hosts are required to complete the life history and one of which is usually an invertebrate. The most common hosts are insects, crustacea, ticks, mites, annelids, molluscs etc. Very few complete life history of cestode species are known. There are still several order of cestodes in which life history has not been studied, even on single species.

The larval forms in cestoda are subdivided in various ways. Hexacanth or Onchospheres is the larval forms of most Eucestoda, and is characterised with six small hooks. In cestodaria larval forms when comes out of egg normally bears ten hooks. Proceroid is an elongated larva with posterior bulb the cercomer bearing six hooks. Plerocercoid is next state of proceroid and could develop into adult only in definite host. The sparganum are plerocercoid larva whose identity is unknown. In pleurocercus a bladder called blastocyst, is present in the posterior end, whose upper portion or the body is protrusible with in this bladder. Solid hexacanth larva or cyclophyllids is known as cysticeroid and they are of varying shape and size. If the body or cysticeroid is having segmentation it is called Strobilocercoid. Cysticeroid with a hollow bladder is designated as Cysticercus. They are of different characteristic shape and size. Cysticercus with a single protoscolex is known as Coenurus. Single bladder with many protoscolices is strobilocercus. Unilocular hydatids are having many protoscolices formed by endogenous budding. Hydatid cysts having endogenous buddings are known as multilocular or alveolar hydatid, found in *Echinococcus multilocularis*. The *Echinococcus* genus are having largest cystic forms and have many protoscolices formed by exogenous budding which breaks free and settles within cyst as *hydatid sand*.

General life cycle pattern in some major cestode orders

Cyclophyllidea The larva with characteristic six hooks embryo or oncosphere within the egg cell, remain passive till it is infested by the intermediate vertebrate or invertebrate hosts. The oncosphere in case of vertebrate intermediate hosts comes out of the egg cell and penetrates the lining of the intestine and develops into *cysticercus*. Secretion of a gland in the oncosphere helps in penetrating the intestinal wall. The *cysticercus* also known as *bladder worm* have a thickened

portion of the wall which invaginates and develops into a scolex. In the species in which several such scolices are formed they are known as *coenurus*. In some other species scolices which develops as invaginations with in the wall of the intermediate host, further produces scolices by invagination on first generation of cysts. Like wise several other scolices are formed as invagination of second generation. This large cyst is known as *hydatid cyst*.

The *oncospheres* in case of invertebrate hosts, which are in most cases arthropods, develops into a solid larva known as cysticercoid which lack bladder but posses a inverted scolex at one end. These larva develop into adult after reaching the definitive host by invagination known as encystment which is influenced by several enzymatic and environmental factors.

Proteocephala The oncospheres from hosts are ingested by invertebrate hosts mostly copepods. The oncosphere after encystment penetrates the gut wall of the intermediate host and reach homocoel where it develops into *proceroid larvae*. The *proceroid larvae* sometime contain a caudal appendage or *cercomer*. Further development occurs only after the intermediate host is ingested by definitive host where the proceroid larva develops into Pterocercoid larvae with invaginated scolices in hepatic, muscular or intestinal epithelium. These larvae develops into adult through metamorphosis after migrating to host's intestine.

Pseudophyllidea The oncosphere is ciliated and after liberation from egg could swim freely and is known as *coracidium*. *Coracidia* is similar with eggs of digenetic trematode and have operculum. After ingested by the intermediate hosts, mostly copepods, they shed the cilia and penetrate upto homoçoel where they develop into elongated oval proceroid with six hooks in the caudal appendage, cercomer. Further development occurs when the intermediate host is ingested by second intermediate host. Proceroids develop into worm like solid form with an invaginated scolex. When the second intermediate host is ingested by final host, adult worm develops.

Key to larval forms

1. Larva hatching out of egg..... 2
 - Larva develops in vertebrate or invertebrate host 4
2. Larva with six small hooks mostly in eucestoda 3
 - Larva with ten hooks in cestodaria *Lycophore*
3. Larva ciliated *Coracidium*
 - Larva not ciliated *Hexacanth or Oncosphere*
4. Larva with bladder filled with fluid..... 5
 - Larva with solid structure..... 9
5. Parasitic in fishes, scolex with four armed tentacles *Pleurocercus*
 - Parasitic of mammals 6
6. Strobila with segmentation *Strobilocercus*
 - Strobila without segmentation 7
7. Single scolex present..... *Cysticercus*
 - Scolex more than one 8

8. Daughter cyst present mainly endogenous *Hydatid (Unilocular)*
 Budding mainly exogenous *Hydatid (Multilocular)*
9. Larva Parasitic in vertebrate *Pleurocercoid or Sparganum*
 Parasitic in invertebrate 10
10. Strobila with segmentation *Strobilocercoid*
 Strobila without segmentation 11
11. Scolex prominent with four suckers, occasionally with armed rostellum *Cysticercoid*
 Scolex inconspicuous 12.
12. Scolex not well defined, posterior bulb known as cercomer, may be present along with hexacanth hooks *Proceroid*

Explanation of letters used in Text figures

| | | | |
|---------|-----------------------------|---------|---------------------------|
| c., | cirrus | p.n.o., | paruterine organ |
| c.p., | cirrus pouch | r.s. | receptaculum seminis |
| d.e.v., | dorsal excretory vessels | s., | scolex |
| e., | eggs | s.g., | shell gland |
| e.c., | egg capsule | t., | testes |
| e.v., | excretory vessels | u., | uterus |
| e.v.s., | external vesicula seminalis | u.p., | uterine pore |
| f.p., | female genital pore | v., | vagina |
| g.a., | genital atrium | v.d. | vas deferens |
| g.p., | genital pore | v.e., | vas efferentia |
| g.s., | genital sucker | v.e.v., | ventral excretory vessels |
| i.g., | interproglottid gland | v.s., | vesicula seminalis |
| i.v.s., | internal vesicula seminalis | v.u.a., | vagino uterine aperture |
| o.v., | Ovary | v.t. | Vitelline duct |
| o.v.d., | oviduct | | |

List of Taxa

- Family Amphilinidae Claus, 1879
 Subfamily Gephyrolininae Poche, 1926
 Genus *Gephyrolina* Poche, 1926
 1. *Paragonopora* (Woodland, 1923)
- Family Caryophyllaeidae Leuckart, 1878
 Subfamily Lytocestinae Hunter, 1927
 Genus *Lytocestus* Cohn, 1908

2. *indicus* (Moghe, 1925)
3. *longicollis* Ramadevi, 1973
- Genus ***Djombangia*** Bovien, 1926
4. *penetrans* Bovien, 1926
- Genus ***Lytocestoides*** Baylis, 1928
5. *leptocephali* Kundu, 1985
- Family Pterobothriidae Pinter, 1931
- Genus ***Syndesmobothrium*** Diesing, 1854
6. *filicollis* Linton, 1889
- Family Dilepididae Railliet and Henry, 1909
- Subfamily Dipylidiinae Stiles, 1896
- Genus ***Dipylidium*** Leuckart, 1863
7. *Caninum* (Linnaeus, 1758)
- Genus ***Joyeuxiella*** Fuhrmann, 1935
8. *gervaisi* (Setti, 1895)
- Genus ***Southwellia*** Moghe, 1925
9. *gallinarum* (Southwell, 1921)
- Genus ***Prochoanotaenia*** Meggitt, 1924
10. *microsoma* (Southwell, 1922)
- Subfamily Dilepidinae Fuhrmann, 1907
- Genus ***Lateriporus*** Fuhrmann, 1907
11. *spinus* Fuhrmann, 1922
- Genus ***Choanotaenia*** Railliet, 1896
12. *decacantha* Fuhrmann, 1913
- Genus ***Amoebotaenia*** Cohn, 1890
13. *sphenoides* Railliet, 1892
- Genus ***Anomotaenia*** Cohn, 1900
14. *acollis* Fuhrmann, 1907
- Genus ***Dilepis*** Weinland, 1858
15. *campylancristrota* (Wedl, 1855)
16. *cypselina* Neslobinsky, 1911
- Genus ***Cyclorchida*** Fuhrmann, 1907
17. *omalancristrota* (Wedl, 1856)
18. *forteria* Meggitt, 1933
- Subfamily Paruterinae Ransom, 1909
- Genus ***Rhabdometra*** Cholodkovsky, 1906

19. *tomica* Cholodkovsky, 1906
20. *dendrocitta* Woodland, 1929
- Family Anoplocephalidae Cholodkovsky, 1902
- Subfamily Anoplocephalinae Blanchard, 1891
- Genus ***Anoplocephala*** Blanchard, 1848
21. *perfoliata* (Goeze, 1782)
22. *magna* (Abildgaard, 1789)
23. *manubriata* Railliet, Henry and Bouch, 1914
- Genus ***Aporina*** Fuhrmann, 1903
24. *delafondi* (Railliet, 1892)
- Genus ***Bertiella*** Stiles and Hassal, 1902
25. *studeri* (Blanchard, 1891)
- Genus ***Moniezia*** Blanchard, 1891
26. *expansa* (Rudolphi, 1810)
27. *benedeni* (Moniez, 1879)
- Genus ***Mesgovoyia*** Spassky, 1951
28. *pectinata* (Goeze, 1782)
- Genus ***Paronia*** Diamare, 1900
29. *columbae* (Fuhrmann, 1902)
- Genus ***Oochoristica*** Luhe, 1898
30. *tuberculata* (Rudolphi, 1819)
31. *sigmoides* Moghe, 1926
- Subfamily Avitellinae Gough, 1911
- Genus ***Avitellina*** Gough, 1911
32. *centripunctata* (Rivolta, 1879)
33. *goughi* Woodland, 1927
- Genus ***Stilesia*** Railliet, 1893
34. *globipunctata* (Rivolta, 1874)
35. *vittata* Railliet, 1896
- Family Dibothriocephalidae Luhe, 1902
- Subfamily Diphyllbothrinae Luhe, 1899
- Genus ***Duthiersia*** Perrier, 1873
36. *expansa* Perrier, 1873
- Genus ***Bothridium*** Blainville, 1824
37. *pithonis* Blainville, 1824

- Genus ***Ligula*** Bloch, 1782
 38. *intestinalis* Bloch, 1782
- Family Diploposthidae Poche, 1926
- Genus ***Diploposthe*** Jacobi, 1896
 39. *laevis* (Bloch, 1782)
- Family Onchobothriidae Braun, 1900
- Genus ***Acanthobothrium*** Van Ben, 1850
 40. *coronatum* (Rudolphi, 1819)
- Genus ***Pedibothrium*** Linton, 1909
 41. *hutseni* (Southwell, 1911)
- Family Dioecocestidae Southwell, 1930
- Subfamily Dioecocestinae Fuhrmann, 1936
- Genus ***Dioecocestus*** Fuhrmann, 1900
 42. *novae-guineae* Fuhrmann, 1914
- Family Mesocestoididae Perrier, 1897
- Genus ***Mesocestoides*** Vaillant, 1863
 43. *lineatus* (Goeze, 1782)
- Family Tetrarhynchidae Cobbold, 1864
- Genus ***Tetrarhynchus*** Rudolphi, 1809
 44. *tetrarhynchus* sp.
- Family Hymenolepididae Railliet and Henry, 1909
- Subfamily Hymenolepidinae Perrier, 1897
- Genus ***Hymenolepis*** Weinland, 1858
 45. *diminuta* (Rudolphi, 1819)
 46. *gracilis* (Zeder, 1803)
 47. *lanceolata* (Bloch, 1782)
 48. *farciminosa* (Goeze, 1782)
 49. *fusa* (Krabbe, 1869)
 50. *capillaroides* Fuhrmann, 1906
 51. *simplex* Fuhrmann, 1906
 52. *medici* (Stossich, 1890)
- Genus ***Flamingolepis*** Spassky et Spasskaja, 1954
 53. *liguloides* (Gervais, 1847)
 54. *megalorchis* (Luhe, 1898)

Genus ***Passerilepis*** Spassky et Spasskaja, 1954

55. *zosteropis* (Furhmann, 1918)

Genus ***Echinocotyle*** Blanchard, 1891

56. *rosseteri* Blanchard, 1891

57. *uralensis* Clerc, 1902

Family Taeniidae Ludwig, 1886

Subfamily Taeniinae Perrier, 1897

Genus ***Taeniarhynchus*** Weinland, 1858

58. *saginata* (Goeze, 1782)

Genus ***Taenia*** Linnaeus, 1758

59. *solium* Linnaeus, 1758

60. *hydatigera* Pallas, 1766

61. *pisiformis* (Bloch, 1780)

62. *crassiceps* (Zeder, 1800)

Genus ***Multiceps*** Hall, 1910

63. *gaigeri* Hall, 1916

64. *multiceps* (Leske, 1780)

65. *serialis* (Gervais, 1847)

Family Proteocephalidae La Rue, 1911

Subfamily Proteocephalinae Mola, 1929

Genus ***Gangesia*** Woodland, 1924

66. *bengalensis* (Southwell, 1913)

Genus ***Acanthotaenia*** Linstow, 1903

67. *biroi* Ratz, 1900

68. *nilotica* (Beddard, 1913)

69. *beddardi* (Woodland, 1925)

Genus ***Ophiotaenia*** La Rue, 1911

70. *calmetti* Barrois, 1898

71. *nainae* Beddard, 1913

Family Nematotaeniidae Luhe, 1910

Genus ***Nematotaenia*** Luhe, 1899

72. *dispar* (Goeze, 1782)

Family Triaenophoridae Loennberg, 1889

Genus ***Anchistrocephalus*** Monticelli, 1890

73. *anchistrocephalus* sp.
 Family Davaineidae Fuhrmann, 1907
 Subfamily Ophryocotylinae Fuhrmann, 1907
 Genus *Ophryocotyloides* Fuhrmann, 1920
74. *menacanthis* Moghe and Inamdar, 1934
 Subfamily Davaineinae Braun, 1900
 Genus *Davainea* Blanchard, 1891
75. *proglottina* Davaine, 1860
 Genus *Cotugnia* Diamare, 1893
76. *margareta* Beddard, 1916
 77. *digonopora* (Pasquale, 1890)
 78. *fastigata* Meggitt, 1920
 Genus *Railletina* Fuhrmann, 1920
 Subgenus *Railletina* (Railletina)
79. (*R.*) *spiralis* (Baczynaka, 1914)
 80. (*R.*) *polychalix* (Kotlan, 1921)
 81. (*R.*) *microscolecina* (Fuhrmann, 1909)
 82. (*R.*) *cohni* Baczynska, (1914)
 83. (*R.*) *friedbergeri* (Linstow, 1878)
 84. (*R.*) *ceylonica* (Baczynska, 1914)
 85. (*R.*) *tetragona* (Molin, 1858)
 86. (*R.*) *fuhrmanni* (Southwell), 1922
- Subgenus *Railletina* (*Fuhrmannetta*)
87. (*F.*) *echinobothrida* (Megnin, 1880)
 88. (*F.*) *korkei* Joyeux and Houdemer, 1928
- Subgenus *Railletina* (*Paroniella*)
89. (*P.*) *cruciata* (Rudolphi, 1819)
 90. (*P.*) *urogalli* (Modeer, 1790)
 91. (*P.*) *corvina* (Fuhrmann, 1905)
 92. (*P.*) *tragopani* Southwell, 1922
- Subgenus *Railletina* (*Skrjabinia*)
93. (*S.*) *cesticillus* (Molin, 1858)
 94. (*S.*) *centropi* (Southwell, 1922)

SYSTEMATIC ACCOUNT

Key to the families of cestodes recorded from West Bengal

1. Monozoic Cestode 2
Polyzoic Cestode 3
2. Testes in two post ovarian lateral fields. Genital pore in posterior extremity **Amphilinidae**
Testes in single preovarian median field. Genital pore preovaria **Caryophyllidae**
3. Scolex with two to four bothridia 4
Scolex without bothridia, with dorsal and ventral groove. Vitellaria compact
..... **Diphyllobothriidae**
4. Scolex with four bothridia, vitellaria medullary, follicular. Eggs with polar filament
..... **Pterobothriidae**
Scolex with two to four bothridia. Vitellaria encircle the proglottid. Eggs without filament
Vitellaria otherwise 5
5. Scolex with two to four bothridia armed with four pairs of hooks. Vitellaria lateral
..... **Onchobotheridae**
Bothridia shallow 6
6. Scolex with two shallow bothridia with disc like termination, vitellaria cortical or medullary
..... **Triachophoridae**
Scolex with four suckers 7
7. Vitellaria follicular **Proteocephalidae**
Vitellaria compact 8
8. Genital pore median, ventral **Mesocestoidae**
Genital pore marginal 9
9. Rostellum absent 10
Rostellum present 11
10. Strobila cylindrical. Testes one or two **Nematotaeniidae**
Strobila flat, testes many **Anoplocephalidae**
11. Strobila flat. Rostellum with single crown of hooks. Testes not more than three
..... **Hymenolepididae**
Rostellum armed, Testes many 12
12. Rosteller hooks T shaped; uterus without longitudinal stem and lateral branch **Davaineidae**
Rosteller hooks rose thorned shaped **Dilepididae**
Rosteller hooks of different shape 13
13. Uterus with longitudinal stem and laterals branch. Male and female genital opening single
..... **Taeniidae**
Uterus with no lateral branch 14

14. Double set of male genital opening and single female genitalia. Uterus with no lateral branch and longitudinal stem **Diploposthidae**
 Sexes separate 15
15. Sexes separate individually or in different proglottids of the same specimen **Dioecocestidae**

Family AMPHILINIDAE Claus, 1879

Subfamily GEPHYROLININAE Poche, 1926

Uterus very long, N-shaped with descending limb median, ovary elongate, vitellaria unbranched, vagina not crossing vasdeferens.

Genus *Gephyrolina* Poche, 1926

Testes in two longitudinal strips, lateral to ascending uterine limbs.

1. *Gephyrolina paragonopora* (Woodland, 1923) Poche, 1926

1923. *Amphilina paragonopora* Woodland, *Quart. J. Micr. Sci.* **67**: 47-84.

1926. *Gephyrolina paragonopora* Poche. *Rec. Indian Mus.*, **28** : 1-27

Material : Host *Macrones aor*, *Mystus seenghala*

Diagnosis : Ribbon like in appearance, Scolex absent. Anterior extremity bears papillae. Posterior extremity terminates in a depression. Testes in lateral zones. No hooks on the cirrus. Eggs with short polar process

Distribution : India : West Bengal (24-Parganas, Medinipur); River Jamuna, Ganges, Allahabad; Punjab.

Family CARYOPHYLLAEIDAE Leuckart, 1878

Subfamily LYTOCESTINAE Hunter, 1927

Key to the genera of the subfamily Lytocestinae

1. Scolex undifferentiated, vitellaria not post ovarian, uterus almost covered with thick coat, ductus ejaculatorius enclosed in parenchymatous bulb..... *Lytocestus*
 Scolex differentiated with terminal sucker..... 2
2. Vitellaria encircling testicular field *Djombangia*
 Scolex short with longitudinal groove, vitellaria through out, in cortical parenchyma.....
 *Lytocestoides*

Genus *Lytocestus* Cohn, 1908

Key to the species of the genus *Lytocestus*

1. Vitellaria in cortical parenchyma not extending beyond ovary.....
 *L. indicus*
 Vitellaria extending beyond ovary *L. longicollis*

2. *Lytocestus indicus* (Moghe, 1925) Moghe, 1931
(Fig. 9)

1925. *Caryophyllaeus indicus* Moghe, *Parasit*, **17**: 232-235

1931. *Lytocestus indicus* Moghe, *Parasit*, **23**: 84-87

Material : Host *Clarias batrachus*.

Diagnosis : Scolex rounded, separated from the body by a constriction. Testes lying scattered. Vitellaria occupy the portion between genital opening and head. Eggs. 0.08 x 0.04.

Distribution : India : West Bengal (Bardhaman, Birbhum, 24-Parganas, Medinipur). Throughout India.

3. *Lytocestus longicollis* Ramadevi, 1973.

1973. *Lytocestus longicollis* Ramadevi, *Jour. Helminth* **47**(4) : 415-420

Material : Host *Clarias batrachus*.

Diagnosis : Presence of conspicuous receptaculum seminis. Neck long and narrow. Testes numerous, ovary H-shaped. Genital aperture in last tenth. Eggs. 0.046-0.054 x 0.023. Unembryonated.

Distribution : India : West Bengal (24-Parganas); Andhra Pradesh

Genus *Djombangia* Bovien, 1926

Djombangia penetrans Bovien, 1926
(Fig. 10)

1926. *Djombangia penetrans* Bovien, *Medd. Dansk Natural Foren.* **82**: 157-181

Material : Host *Clarias batrachus*.

Diagnosis: Body of the worm broad, fleshy, head globular, connected with body by thick neck. Genital aperture near the hind end; uterus glandular, coils in medullary region. Uterus upto neck where it follow its course back to the female opening. Testes extending from ovaries to vicinity of neck, vitellaria do not extend so far forward as the testes but extend to hind border of ovary. Winged ovary in posterior extremity, medullary, eggs with small projection.

Distribution: India : West Bengal (Maldah, North 24-Parganas); Elsewhere : Java.

5. Genus *Lytocestoides* Baylis, 1928

Lytocestoides leptocephali Kundu, 1985
(Fig. 11)

1985. *Lytocestoides leptocephali* Kundu, *Bull. Zool. surv. India*, **7**(2-3) : 285-290

Material examined: Host *Lepidocephalichthys guntea*.

Diagnosis : Length of this cestode may be 4.7 or little more. Scolex usually globular. Neck present. Surface smooth. testes 16-20 larger than vitelline follicle, Cirrus sac large, globular or oval. Ovary in posterior part of body, distinctly H-shaped. Eggs, oval measuring 0.04.-0.05 x 0.03.

Distribution : India : West Bengal (North 24-Parganas).

Family PTEROBOTHRIDAE Pinter, 1931

Genus *Syndesmobothrium* Diesing 1855

Longitudinal band of small hooks on external surface; recurved hooks on internal surface and intermediate rows of hooks of different shape and size on the proboscis; adults in elasmobranch larvae in teleosts.

6. *Syndesmobothrium filicolle* Linton, 1889

1889. *Syndesmobothrium filicolle* Linton *Amer. J. Sc. Arts.*, **37**: 239-240

Material : Host *Ilisha ilisha*.

Diagnosis: The four-hooked proboscides coming out of the edges of head. Hooks are equal in size. Genital pore gives the appearance of an irregular and abnormal segmentation, appears in the fourth or fifth proglottis.

Distribution : India : West Bengal (Calcutta); Bihar; U.P; Elsewhere : Sri Lanka, America.

Family DILEPIDIDAE Railliet and Henry, 1909

Key to the subfamilies of the family Dilepididae

1. Uterus breaking down into egg capsules containing one or several eggs **Dipylidiinae**
 Uterus without separate egg capsule 2
2. Uterus sac like persistent **Dilepidinae**
 Uterus with one or more paruterine organs **Paruterininae**

Subfamily DIPYLIDIINAE Stiles, 1896

Key to the genera of the subfamily Dipylidiinae

1. Genitalia double 2
 Genitalia single 3
2. Rostellum with several row of hooks; Egg capsule contain several eggs *Dipylidium*
 Rostellum with several row of hooks; Egg capsule contain single egg *Joyeuxiella*
3. Rostellum with double row of hooks, genital pore unilateral..... *Southwellia*
 Rostellum with single crown of hooks. Genital pore irregularly alternate *Prochoanotaenia*

Genus *Dipylidium* Leuckart, 1863

7. *Dipylidium caninum* (Linnaeus, 1758) Leuckart 1863

(Fig. 12)

1758. *Taenia caninum* Linnaeus *Editio decima reformata* **1**: 823 Holmiae.

1863. *Dipylidium caninum* Linnaeus Leuckart *Arch. Sci. Phys. Nat. n. ser.* **16**: 243-245.

Material: Host Dog, *Paradoxurus grayi*, *Paradoxurus hermaphroditus*, *Felis viverrina*.

Diagnosis: Segments longer than broad, Rostellum club shaped; thorny hooks, anterior one larger, 0.01-0.015 and posterior one 0.006. Hooks in two to five rows. Egg capsule contain many eggs.

Distribution: India : West Bengal (Kalimpong, Darjiling). Cosmopolitan.

Remarks: This is a common parasite of dog and cat through out the globe, occasionally found in man.

Genus *Joyeuxiella* Fuhrmann, 1935.

8. *Joyeuxiella gervaisi* (Setti 1895) Fuhrmann, 1935

1895. *Dipylidium gervaisi* Atti Soc. Ligust. Sc. nat. geogr. Genova 6: 99-106.

1935. *Joyeuxiella gervaisi* Fuhrmann. Bull. Ornithologique de la Surv. romande., 1: 114-150.

Material: Host - Malayan Palm civet; *Paradoxurus hermaphroditus*; *Felis viverrina*.

Diagnosis: The worm upto 4 cm. Rostellum small with 8-12 rows of hooks numbering about 60. Testes 80, uterus breaking down in egg capsule containing single egg.

Distribution: India : West Bengal (Zoogarden, Calcutta). Elsewhere : Africa.

Genus *Southwellia* Moghe, 1925

9. *Southwellia gallinarum* (Southwell, 1921) Moghe, 1925
(Fig. 13)

1921. *Monopylidium gallinarum* Southwell Ann. Trop. Med. Parasit., 15: 161-166.

1925. *Southwellia gallinarum* Moghe, Parasitology, 17: 384-400.

Material: Host Fowl.

Diagnosis: Head prominent 3x5. rostellum retractile with 120 hooks. Suckers unarmed. Testes about 30. Genital pore in anterior corner of segment. Egg diameter 0.035. Five to nine eggs per capsule.

Distribution: India : West Bengal (Murshidabad, Baharampur).

Genus *Prochoanotaenia* Meggitt, 1924

10. *Prochoanotaenia microsoma* (Southwell, 1922) Meggitt, 1924.
(Fig. 14)

1922. *Choanotaenia microsoma* Southwell, Ann. Trop. Med. Parasitology, 16: 127-152.

1924. *Prochoanotaenia microsoma* Meggitt, Parasitology, 16: 303- 312.

Material: Host Crested bunting, *Melophus melanicterus* Eastern boya, *Ploceus artigula*.

Diagnosis: Rostellum with 16-20 hooks; size 0.035. Genital pore prominent, irregularly alternate. testes 16-20. Cirrus with spines at right angle to its length. Egg capsule contain one egg.

Distribution: India : West Bengal (Zoogarden, Calcutta).

Remarks: Fuhrmann, 1932; Wardle and McLeod (1952) did not recognise this genus. Yamaguti (1959) erected a new genus *Spiniglans* for this species which appear to be unnecessary as he relied on a single character such as spines on tips of cirrus, which should not be given generic importance.

Subfamily DILEPIDINAE Fuhrmann, 1907

Key to the genera of subfamily Dilepidinae

1. Rostellum armed with single row of hooks 2
- Rostellum armed with double row of hooks 4

2. Genital pore unilateral *Lateriporus*
 Genital pore other wise 3
3. Genital pore irregularly alternate, proglottids many *Choanotaenia*
 Genital pore regularly alternate segments less than thirty *Anomotaenia*
4. Genital pore irregularly alternate ovary symmetrical *Anomotaenia*
 Genital pore not as above 5
5. Genital pore unilateral, genital canal pass dorsally to excretory vessels *Dilepis*
 Genital canal pass between longitudinal excretory vessels *Cyclorchida*

Genus *Lateriporus* Fuhrmann, 1907

11. *Lateriporus spinosus* Fuhrmann, 1922
 (Fig. 15)

1922. *Lateriporus spinosus* Fuhrmann *Centrabl. Bakt. Parasitenk.* **87**: 438-451.

Material : Host - *Adrea purpurea*.

Diagnosis: Testes not surpassing ventral excretory vessel. Cirrus large, extending upto middle of the segment or even beyond. Eggs 0.016.

Distribution: India : West Bengal (Zoogarden, Calcutta). Elsewhere : Brazil.

Genus *Choanotaenia* Fuhrmann, 1907

12. *Choanotaenia decacantha* Fuhrmann, 1913.

1913. *Choanotaenia decacantha* Fuhrmann *Medd. Goteborgs Musei Zoologiska, Afdelning 1*: 41.

Material: Host - Snipe, *Capella* sp.

Diagnosis: Under 5 cm in length; Rostellum armed with 10 hooks. Testes 13-16 lies posterior to ovary, Eggs. 0.024.

Distribution: India : West Bengal (Murshidabad). Elsewhere : North Atlantic.

Genus *Amoebotaenia* Cohn, 1890.

13. *Amoebotaenia sphenoides* Railliet, 1892

1892. *Amoebotaenia sphenoides* Railliet, *Bull. soc. zool. France* **17** : 115-117.

Material: Host - Domestic fowl.

Diagnosis: The worm is wedge-shaped when young. The head is more or less square having four suckers and protrusible rostellum with 12-14 hooks, shape of which are typical to the species. Genital pore alternate, close to the anterior corner of the segment; uterus with finger like outgrowth, overlaps the excretory vessels. Eggs 0.03-0.031

Distribution: India : West Bengal (Baharampur) Other records : Cosmopolitan in distribution.

Genus *Anomotaenia* Cohn, 1900

(Fig. 16)

14. *Anomotaenia acollis* Fuhrmann, 1907.

1907. *Anomotaenia acollis* Fuhrmann, *zool. Anz.* **32** : 289-297.

Material : Host *Cuculus varius*.

Diagnosis : Cubical head, rostellum with 40 hooks arranged in a double row. The testes are behind the ovary and it occupy two-third of the segment. The genital pore are irregularly alternate and situated on lateral margin anteriorly. Recepticulum seminis enormous. Eggs many.

Distribution : India : West Bengal (Zoogarden, Calcutta)

Genus *Dilepis* Weinland, 1858.

Key to species

Rostellum with about 20 hooks in double row; Anterior row larger Cirrus armed with spines.....

..... *D. campylancristrota*

Rostellum armed with double crowns of hooks of the same size and rose thorned shape.....

..... *D. cypselina*

15. *Dilepis campylancristrota* (Wedl, 1855) Fuhrmann, 1908

(Fig. 17)

1855. *Taenia campylancristrota* Wedl, *Wien. math. natur wiss, Klasse Abt.*, **16**: 371-395.

1908. *Dilepis campylancristrota* Fuhrmann *Zool. Jahrb. Suppl.* **10**: 252.

Material: Host *Herodias garzetta*, *Ardeola grayi*

Diagnosis: Small in size 20 to 30 segments. The genital pore on anterior third of the lateral margin of the segment. Rostellum is armed with about 20 hooks, arranged in a double row. No neck. The cirrus is armed with minute spines. Testes 7 or 8. Uterus as two round sac.

Distribution: India : West Bengal (Murshidabad). Elsewhere : Europe.

16. *Dilepis cypselina* Neslobinsky, 1911

1911. *Dilepis cypselina* Neslobinsky, *Centrabl.* **50**(6) : 166

Material : Host Treepie, *Dendrocitta leucogaster*.

Diagnosis: The head with double crown of hooks 0.018 in size, rose thorn shaped. Genital pores unilateral, cirrus sac situated anteriorly.

Distribution: India : West Bengal (Zoogarden, Calcutta). Elsewhere : Russia.

Remarks: Southwell (1930) opined that the specimen recovered by him under this name might be a new species. But Yamaguti (1959) listed it as the above species.

Genus *Cyclorchida* Fuhrmann, 1907

Key to species

Rostellum with 20 spines in double row. Anterior row larger than posterior one.....

..... *C. omalancristrota*

Rostellum with more than 20 spines *C. forteria*

17. *Cyclorchida omalancristrota* (Wedl. 1856) Fuhrmann, 1907.1856. *Taenia omalancristrota* Wedl. *Akad L Wiss. Wien Math. naturwiss Klasse Abt.*, **18** : 5-27.1907. *Cyclorchida omalancristrota* Fuhrmann *Constrabl. Bakt. Parasitenk* **45** : 512-536.**Material:** Host - Spoonbill, *Platalea leucorodia***Diagnosis:** the worm upto 25 cm. Rostellum with 20 hooks, peculiar in shape, size of hooks in anterior rows 0.017 and that of posterior row is 0.06. Testes about 90 surrounded by female genitalia. Cirrus sac about 0.02, ovary bilobed. The gravid uterus with compartments by ingrowths from its wall. The eggs 0.024.**Distribution:** India : West Bengal (Zoogarden, Calcutta) Other records : Africa, Australia.18. *Cyclorchida forteria* Meggitt, 1933.1933. *Cyclorchida forteria* Meggitt *Rec. Indian Mus.*, **35** : 145-165.**Material:** Host - Orange headed ground Thrush, *Zoothera citrina*.**Diagnosis:** Rostellum with 20-40 hooks. Cirrus sac very long. Uterus a transverse tube extends between excretory vessels.**Distribution:** India : West Bengal (Zoogarden, Calcutta).

Subfamily PARUTERINAE Ransom, 1909.

Genus *Rhabdometra* Cholodkovsky, 1906Uterus looks like single median sac, paruterine organ present..... *Rhabdometra*

Key to the species

Testes 20-30; genital duct pass between longitudinal excretory vessels *R. tomica*Testes 10-12 *R. dendrocitta*19. *Rhabdometra tomica* Cholodkovsky, 19061906. *Rhabdometra tomica* Cholodkovsky *Arch. Parasitol.* **10**: 332-347**Material:** Host - Painted partridge, *Trancolium pictus*.**Diagnosis:** The worm upto 7 cm. Head unarmed, no rostellum. Suckers prominent. Absence of neck. Genital pore irregularly alternate. Posterior margin of segment bell like. Tests 20-30 in a group in posterior part of segment. Vasdeference much coiled, paruterine organ develop over uterus. Eggs oval 0.04 in length.**Distribution :** India : West Bengal (Calcutta Zoo garden). Elsewhere : Russia.20. *Rhabdometra dendrocitta*, Woodland, 19291929. *Rhabdometra dendrocitta* Woodland *Proc. zool. Soc. London* **1** : 25-29.**Material :** Host Indian Tree Pie, *Dendrocitta vagabunda***Diagnosis :** The worm upto 6 cm, No rostellum, Ventral excretory vessel larger than dorsal, Genital duct between dorsal and ventral vessel. Testes 10-12. Paruterine organ develop from poral extremity of uterus. Eggs. 0.05 x 0.09.

Distribution : India : West Bengal, (Puruliya). Allahabad.

Family ANOPELOCEPHALIDAE Cholodkovsky, 1902

Key to the subfamilies of Anoplocephalidae

1. Uterus tubular, sacular or reticulate **Anoplocephalinae**
 Uterus not as above 2
2. Uterus branching down in egg capsule. Each capsule containing one egg **Linstowiinae**
 Uterus develop in paruterine organ **Avitellinae**

Subfamily *Anoplocephalinae* Blanchard, 1891

Key to the genera of the subfamily Anoplocephalinae Blanchard, 1891

1. Genitalia single; uterus reticular or transversely elongate 2
 Genitalia double; uterus branching down in egg capsule 5
2. Genital pore unilateral; ovary extending whole width of medulla; eggs with pyriform apparatus **Anoplocephala**
 Genital pore irregularly alternate 3
3. Uterus extending beyond excretory vessels, Genital pore not traceable in mature and gravid proglottid **Aporina**
 Genital pore traceable throughout 4
4. Uterus situated in between the excretory vessels **Bertiella**
 Uterus extends beyond excretory vessels **Oochoristica**
5. Interproglottid glands usually present, eggs with pyriform apparatus horn of which end in a disk. Uterus over reaching excretory stems **Moniezia**
 Interproglottidal glands absent 6
6. Eggs with pyriform apparatus, horns of which long and cross each other. Pyriform apparatus may be absent. Uterus not surpassing excretory stem **Mesogovoyia**
 Uterus surpass excretory stem 7
7. Uterus horseshoe shaped, eventually occupies the entire segment. Eggs with or without rudimentary pyriform apparatus **Paronia**

Genus *Anoplocephala* Blanchard, 1848

Key to the species

1. Head with lappets **A. perfoliata**
 Head without lappets 2
2. Large worms upto 15 cm in length parasites of horse, donkey **A. magna**
 Head without lappets; small worm upto 3 cm only. Parasites of elephants **A. manubriata**

21. *Anoplocephala perfoliata* (Goeze, 1782) Blanchard, 1848

1782. *Taenia perfoliata* Goeze. *Versuch Ceiner naturgeschichte der Eingeweidewurmer thierischer Korper, Blankenburg* : 471.

1848. *Anoplocephala perfoliata*, Blanchard, *Ann. Sci. nat. zool.* 10, 321-364; 106-202.

Material : Host - Horse, Ass.

Diagnosis : Scolex tubular, with four small lappets posteriorly. Testes upto 200. Cirrus armed. Ovary lobed on poral side, size of the lobe on poral side twice that of aporal side. Vitellaria below the poral half of ovary. Uterus a transverse tube, lobed; later on fills the entire proglottid. Eggs with pyriform apparatus 0.08-0.09 in diameter.

Material : Host - Horse, Ass.

Distribution : India : West Bengal. Cosmopolitan.

22. *Anoplocephala magna* (Abildgaard, 1789), Spengel, 1905.

1789. *Taenia magna* Abildgaard in O.F. Muller, *Zoologicae Danicae. Havniae* : 50-51.

1905. *Anoplocephala magna* Spengel *Z. wiss. Zool.* 82 : 252-287.

Material : Host - Horse, Donkey.

Diagnosis : Specimens are quite large may be upto 25cm; vitelline glands and ovary are on poral half. Pyriform apparatus present. Gravid uterus fills the entire segment. Eggs 0.07-0.08.

Distribution : India : West Bengal (Calcutta). Cosmopolitan.

23. *Anoplocephala manubriata* Railliet, Henry and Bouch, 1914

1914. *Anoplocephala manubriata* Railliet, Henry and Bouch. *Bull. Soc. Path. Exot.* 7 : 78-83.

Material : Host - Elephant

Diagnosis : Length upto 26; Scolex cubical, excretory system with anastomosing branches. Vitellaria median, uterus lobed fills the entire proglottid. Eggs 0.07-0.08 in diameter.

Distribution : India : West Bengal (Zoogarden, Calcutta, North Bengal).

Genus *Aporina* Fuhrmann, 190324. *Aporina delafondi* (Railliet, 1892) Baer, 1927
(Fig. 18)

1892. *Taenia delafondi* Railliet *Compt. Rend. Soc. Biol.* 4: 49-53.

1927. *Aporina delafondi* Baer *Bull. Biol. France et de Belg. Suppl.* 10 : 241.

Material : Host - *Platyercus pennanti*, *Columba livia*.

Diagnosis : The worm upto 14 cm. Genital pore irregularly alternate, in anterior third of lateral margin. Uterus a transverse tube, on maturity become saccular and lobed. Testes one hundred; more on aporal side, cirrus does not reach the excretory vessels.

Distribution : India : West Bengal (Zoogarden, Calcutta) Elsewhere : Europe, Africa, Australia, America.

Remarks : Spassky (1951) and Yamaguti (1959) placed this species under *Killigrewa* Meggitt, 1927. The main difference between the two genus being testes divided by aporally placed ovary. Ghosh (1975) considered that the genus *Killigrewa* is synonymus with *Aporina*.

Genus *Bertiella* Stiles and Hassal, 190225. *Bertiella studeri* (Blanchard, 1891) Stiles and Hassal, 1902
(Fig. 19)1891. *Bertiella studeri* Blanchard Mem. Soc. Zool. France 4 : 186-196.1902. *Bertiella studeri* Stiles and Hassal Science, 16 : 434.**Material** : Host - *Simia satyrus*; *Hylobates hoolock*, Man.**Diagnosis** : The worm may be upto 80 cm. Tests 200-300. Ovary in poral half. Uterus initially a transverse tube, in gravid segments it fills the entire segment. Eggs 0.045-0.06 with pyriform apparatus, horns terminate in long filaments.**Distribution** : India : West Bengal (Zoogarden, Calcutta) Cosmopolitan in distribution among Primates and Man.Genus *Moniezia* Blanchard, 1891

Key to the species

Interproglottid gland are grouped as round, blind sacs like rosette *M. expansa*Interproglottid glands are arranged in short, transverse row in front of posterior border of segment *M. benedeni*26. *Moniezia expansa* (Rudolphi, 1810) Blanchard, 1891
(Fig. 20)1810. *Taenia expansa* Rudolphi *Entozoorum sive Rudolphi, Vermium intestinalium historia naturalis* 11 pans, 2, 386 p. amstel aldami.1891. *Moniezia expansa* Blanchard, Mem. Soc. Zool. France. 4 : 166-196.**Material** : Host - *Antilope cervicapra*; *Testicercus quadricornis*; *Bos indicus*; *capra* sp.**Diagnosis** : The worm upto 4 to 5 meter. 6-30 interproglottidal glands are present at the posterior margin of the segment, these may be absent in some cases. Excretory system composed of longitudinal vessels one each side. testes 300-400. Ovary is bilobed, fan shaped. Uterus single reticulate. Eggs 0.06 in diameter with pyriform apparatus.**Distribution** : India : West Bengal (Calcutta zoo), Puruliya, Murshidabad, Bardhaman. Cosmopolitan.27. *Moniezia benedeni* (Moniez, 1879) Blanchard, 1891
(Fig. 21)1879. *Taenia benedeni* Moniez Bull. *Scientifique department du Nord Lille*, 2 : 163-164.1891. *Moniezia benedeni* Blanchard Mem. Soc. Zool. France 4 : 186-196.**Material** : Host *Bos indicus*, *Capra* sp., OX.**Diagnosis** : The worm long upto 4 meter. Posterior segments fleshy thick about 2 mm. Testes about 500; 6 cm. in breadth, may be in the form of two triangle. The egg contain a well developed pyriform apparatus. The interproglottid glands is a narrow linear structure close to posterior margin.**Distribution** : India : West Bengal ((Birbhum, Puruliya, Calcutta), Cosmopolitan.

Genus *Mesogovoyia* Spassky, 195128. *Mesogovoyia pectinata* (Goeze, 1782) Spassky, 1951.

(Fig. 22)

1782. *Taenia pectinata* Goeze Versuch einer naturgeschichte der Eingeweidewurmer thierischer korper. XI-471 pp. Blankenburg.

1951. *Mesogoveyia pectinata* spassaky *Anoplocephalata Tapeworms of domesticated and wild animals*, Israel ... programme of Scientific translation Jerusalem, 1970.

Material : Host - Hare, *Lepus hispidus*.

Diagnosis : size variable upto 18 cm. Testes 60-150 between and posterior to two ovaries. Cirrus sac very long; uterus a single transverse tube, extending upto excretory vessels. Eggs 0.05-0.06 in diameters.

Distribution : India : West Bengal (Murshidabad, Baharampur). Elsewhere : Europe, Africa, North America.

Genus *Paronia* diamare, 190029. *Paronia columbae* (Fuhrmann), 1918.

(Fig. 23)

1902. *Moniezia columbae* Fuhrmann *Centralbl. Bakt. Parasitenk*, 32 : 122-147.

1918. *Paronia columbae* Fuhrmann *Nova caledonia F. sarasin et j. Roux* 2 : 399-440.

Material : Host *Columba livia*

Diagnosis : The worm about 5 cm. posterior segments little longer than broad. Genital pore double, situated in middle of lateral margin of a segment. Ovary fan shaped. Uterus at first double in each segment, arises as semicircular tube from which many tubular outgrowth arises, gradually they fuse and uterus occupies the entire segment. Eggs 0.075 in diameter with pyriform apparatus.

Distribution : India : West Bengal (Baharampur, Murshidabad). Elsewhere : Sumatra.

Genus *Oochoristica* Luhe, 1898Key to species of *Oochoristica*

Number of testes 30-35. Cirrus sac crosses longitudinal excretory vessels *O. tuberculata*

Number of testes 22-28. Cirrus sac do not cross longitudinal excretory vessels..... *O. sigmoides*

30. *Oochoristica tuberculata* (Rudolphi, 1819) Southwell, 1930

1819. *Taenia tuberculata* Rudolphi *Entzoorum synopsis cui accedunt mantissa duplex et indices locupletissimi*, Berolini 10 : 811.

1930. *Oochoristica tuberculata* Southwell *Fauna Brit. India, Cestoda*. London, 2 : 61-62

Material : Host - *Varanus bengalensis*

Diagnosis : Testes confined in post vitelline zone. Vas deferences curved around testes, runs anterior to vagina. Eggs scattered throughout strobila.

Distribution : India : West Bengal (Medinipur, Bardhaman, 24-Parganas); Rajasthan, Uttarpradesh.. Elsewhere : Europe : Africa.

31. *Oochoristica sigmoides* Moghe, 19261926. *Oochoristica sigmoides* Moghe *Rec. Indian Mus.*, **28** : 53-54.*Material* : Host *Calotes versicolor**Diagnosis* : Testes arranged in two groups. Vasdeferens not coiled. Genital pore in anterior lateral margin. Eggs 0.25-0.026 in diameter.*Distribution* : India : West Bengal (Calcutta, Bardhaman); Madhya Pradesh.

Subfamily AVITELLINAE GOUGH, 1911

Key to genera of the subfamily Avitellinae

Single set of genitalia, one paruterine organ in each segment..... *Avitellina*
 Two paruterine organ in each segment..... *Stilesia*

Genus *Avitellina* Gough, 1911

Key to species

Testes in four rows; paruterine organ with a fibrous cap *A. centripunctata*
 Paruterine organ like a bunch of banana *A. goughi*

32. *Avitellina centripunctata* (Rivolta, 1874) Woodland, 19271878. *Taenia centripunctata* Rivolta *Giorn anat. Fis Pat Anim Pisa*, **10** : 302-3081927. *Avitellina centripunctata* Woodland *Ann. Trop. Med. Parasitol* **21** : 385-414*Material* : Host Cattle, buffalo.*Diagnosis* : Length upto 4 m. Segmentation external and indistinct. Genital pores irregularly alternate, in lateral margin of segment. Testes 10-20 in four groups each with 2-4 tubes. Ovary on poral half. Uterus replaced by paruterine organ. Eggs 0.02-0.04 with conical out growth of 0.01-0.016.*Distribution* : India : West Bengal (Bardhaman, Jalpaiguri, Siliguri, Birbhum). Cosmopolitan.*Remarks* : Southwell (1930) and Wardle and McLeod (1952) doubted the distribution of this species from India. However most of the other worker recorded this species from India, Thapar, (1939); Raina (1975).33. *Avitellina goughi* Woodland, 19271927. *Avitellina goughi* Woodland *Ann. Trop. Med. Par.* **21** : 385-414.*Material* : Host Cattle, Sheep, goat.*Diagnosis* : Upto 3 meter Testes in four rows, one on the right and one to the left of ventral longitudinal canal. Dorsal vessel minute. Ovary on poral side. Paruterine organ develops early; look like bunch of banana in the middle of segment. Eggs 0.04 in diameter.*Distribution* : India : West Bengal; North India. Elsewhere : Burma, South Africa.Genus *Stilesia* Railliet, 1893

Key to species

Head almost square. Testes external to ventral vessel. Vas deferens not closely coiled.....
*S. globipunctata*
 Testes lateral to ventral canal. Vas deference closely convoluted *S. vittata*

34. *Stilesia globipunctata* (Rivolta, 1874) Railliet, 1893.1874. *Taenia globipunctata* Rivolta *Sopra alcuni specie del Taenia della Pecora*, Pisa.1893. *Stilesia globipunctata* Railliet *Traite de zoo-logie medicate et agricote* 2nd ed. 730 Paris**Material** : Host - Cattle.**Diagnosis** : The worm may be about 60 cm. Segmentation distinct. The genital pore in anterior angles of the proglottid, irregularly alternate. Testes 4-7 on each side between ventral excretory canal and nerve vessel. Ovary between dorsal and ventral excretory vessel. On uterine outgrowth paruterine organs develops. Eggs. 0.05 x 0.02.**Distribution** : India : West Bengal (Siliguri, Calcutta) Elsewhere : Africa, Europe.35. *Stilesia vittata* Railliet, 1896
(Fig. 24)1896. *Stilesia vittata* Railliet *Societe de Biologic Paris*. 48 : 489-492**Material** : Host-Sheep, goat.**Diagnosis** : Upto 3 meter. Testes external to excretory vessel. Sperm duct dorsal in between excretory vessel. Paruterine organ develops. Vas deferens closely convoluted. Eggs 0.04 x 0.02.**Distribution** : India : West Bengal (Bardhaman, Medinipur, Darjiling). Elsewhere : Africa, Europe.

Family DIBOTHRIOCEPHALIDAE Luhe, 1902

Scolex compressed from side to side, bothria shallow. Genital pore and uterine pore surficial and ventral, opening through cirrovaginal pore [Diphyllobothrinae Luhe, 1899]

Key to the genera of the subfamily Diphyllobothrinae

1. Scolex with fan shaped bothridia, testes and vitellaria confluent in anterior and posterior median field **Duthiersia**
Scolex shaped difluently, blunty pointed or with two bothridia..... 2
2. Scolex with two tubular bothridia. Testes and vitellaria not confluent in anterior and posterior median field **Bothridium**
Scolex blunty pointed, body unsegmented. testes in single dorsal sheet, intercepted by the uterus **Ligula**

Genus *Duthiersia* Perrier, 187336. *Duthiersia expansa* Perrier, 18731873. *Duthiersia expansa* Perrier *Arch. Zool. Expetr. et. gen 2* : 349-362.**Material** : Host *Varanus bengalensis*.**Diagnosis** : Posterior pore opening of bothrial groove present. Scolex fan shaped. Uterus tubular rose thorn like.**Distribution** : Cosmopolitan.

Genus *Bothridium* Blainville, 1824.37. *Bothridium pithonis* Blainville, 1824

1824. *Bothridium pithonis* Blainville *Traite zoologique et physiologique sur les vers intestinaux de l'homme*, 52 pp. Paris

Material : Host - *Python reticulate*, *Naja hannah*

Diagnosis : The worm upto 500mm. Bothria tubular; Testes in two lateral bands behind the cirrus pouch. Ovary V-shaped. Aperture of cirro-vaginal atrium at the junction of the first and middle third of ventral surface of the segment.

Distribution : India : West Bengal (Darjiling, Zoogarden Calcutta). Elsewhere : Nepal, Africa, Phillipines.

Genus *Ligula* Bloch, 178238. *Ligula intestinalis*, Bloch, 1782

1782. *Ligula intestinalis* Bloch *Abhandlung von der Erzeugung der Eingeweidewurmer nnd den Mitteln wider dieselben*. 54 pp. Berlin.

Material : Host *Labeo calbasu*, *Labeo rohita*, *Catla catla*, *Barbus sp.* *Danio sp.* *Amblypharyngodon mola*, *Nemacheilus rupicola*

Diagnosis : Length variable; 10-90 cm even upto 1 meter. Breadth 5 mm to 1.5 cm. Scolex triangular, pointed. Segmentation indistinct transversely wrinkled. Dorsoventral grooves present on flat surface. Plecercoid stage in cyprinid fishes. Adult in birds, not recorded from India.

Distribution : India : West Bengal, D.V.C. Dams, Calcutta. Elsewhere : Cosmopolitan

Remarks : Only larval form have been recovered from fishes of India.

Family DIPLOPOSTHIDAE Poche, 1926

Genus *Diploposthe* Jacobi, 1896

Key to the genera under family Diploposthidae

Rostellum armed, genital pore double, cirrus armed, strongly developed; uterus a tranverse sinuous sac *Diploposthe*

Genus *Diploposthe* Jacobi, 1896

(Fig. 25)

39. *Diploposthe laevis* (Blochs 1782) Jacobi

1782. *Taenia laevis* Bloch, *Abhandlung von der Erzeugung der Eingeweidewurmer und den Mitteln wider dieselben*. 54 pp. Berlin.

1896. *Diploposthe laevis* Jacobi *Zool. Anz.* 19 : 268-269.

Material : Host The eastern white eyed duck, *Nyroca baeri*

Diagnosis : Worm upto 50 cm. Vaginal aperture present. Testes in median field, not divided in two groups. Double male genital pore. Testes large 3-7 in each segment. Cirrus strongly developed. Uterus with diverticula.

Distribution : India : West Bengal (Zoogarden, Calcutta.) Cosmopolitan.

Family ONCHOBOTHRIIDAE Braun, 1900

Key to the genera of Onchobothriidae

- Two pairs of three compartmental bothridia, each armed with a pair of forked hooks *Acanthobothrium*
- Two pairs of leaf like bothridia, each armed with rose thorn or two pronged hooks *Pedibothrium*

Genus *Acanthobothrium* Van Ben 185040. *Acanthobothrium coronatum* (Rudolphi, 1819) Van Ben, 1850

1819. *Bothriocephalus coronatus* Rudolphi *Entozoorum synopsis cui. accedunt mantissa duplex et indices locupletissimi* 811 p. Berolini.

1850. *Acanthobothrium coronatus* Van Ben Mem. Acad. Moy. Sci Belg. 25.

Material : Host - *Rhyncobatis olyddensis*

Diagnosis : Prongs of hooks equal. Each bothrium with single accessory sucker. Genital pore irregularly alternate. Testes 80-120, more on the aporal side. Pyriform cirrus pouch extends almost one fourth the distance across the segment. The uterine pore opens to the ventral surface.

Distribution : India : West Bengal (Sand head, mouth of river Hooghly). Elsewhere : Sri Lanka, America.

Genus *Pedibothrium* Linton, 190941. *Pedibothrium hutsoni* (Southwell, 1911) Southwell, 1914.

1911. *Phyllobothroides hutsoni* southwell *Ceylon Marine Biological Reports* 1 : 168-174.

1924. *Pedibothrium hutsoni* southwell *Ann. Trop. Med. Parasit.* 18 : 451-491.

Material : Host *Ginglymostoma concolor*.

Diagnosis : The worm may be upto 6.7 cm. Number of proglottides 100. Four simple leaf like bothridia with a pair of rose thorn shaped hooks. Genital pore irregularly alternate, in the middle of lateral margin. Testes 80-130. Ovary bilobed.

Distribution : India : West Bengal (Zoograden, Calcutta). Elsewhere : Sri Lanka.

Family DIOECOCESTIDAE Southwell, 1930

Subfamily DIOECOCESTINAE Fuhrmann. 1936

Male with double set of reproductive organ; uterus a transverse tube

Genus *Dioecocestus* Fuhrmann, 1900

Rostellum with single crown of hooks; Male with double set of reproductive organ per segment *Dioecocest*

42. *Dioecocestus novae - guineae* Fuhrmann, 1914.

1914. *Dioecocestus navae - guineae* Fuhrmann *Zool. Anz.* 44 : 611-620.

Material : Host Little grebe, *pediceps albipennis*

Diagnosis : These are the cestodes where sexes are separate. length of male worm upto 10 cm. female worm 17 cm. segments are much broader than length. 12 hooks on female head. Uterus arises as transverse tube behind ovary. Uterus appears to be divided into loculi by ingrowths from uterine wall. Two set of reproductive organs in male and one set in female. Eggs 0.042 – 0.044 in diameter

Distribution : India : West Bengal (Zoogarden, Calcutta). Elsewhere : New Guinea.

Family MESOCESTOIDIDAE Perrier, 1897

Genus *Mesocestoides* Vaillant, 1863

Scolex with rostellum and spines. Eggs enclosed in a single thick uterine capsule

43. *Mesocestoides lineatus* (Goeze, 1782) Railliet, 1893
(Fig. 26)

1782. *Taenia lineata* Goeze *Versuch einer Naturgeschichte der Eingeweidewurmer thierischer korper*, 471 p. Blankenburg.

1893. *Mesocestoides lineatus* Railliet *Traite de Zoologie medicale et agricole*, 763 p. Paris.

Material : Host-*Felis tigris*.

Diagnosis : The worm upto 2.5 meter in length. The genital pore on the ventral surface near the middle. Testes 50; extending laterally to excretory vessels. Ovary bilobed. The uterus consists of an elongated cylindrical sac in median longitudinal axis of the segment. In posterior part, uterus develops egg capsule. Eggs 0.04 – 0.06 × .03 ÷ 0.040.

Distribution : India : West Bengal. Elsewhere : Europe, Africa.

Family TETRARHYNCHIDAE Cobbold, 1864

Genus *Tetrarhynchus* Rudolphi, 1809

Head with four bothridia, lying parallel with the body having sucking surfaces externally.

44. *Tetrarhynchus* sp.

Material : Host *Cybium guttatum*

Distribution : India : West Bengal (South 24-Parganas dist.).

Family HYMENOLEPIDIDAE Railliet and Henry, 1909

Subfamily HYMENOLEPIDINAE Perrier, 1897

Testes three, uterus sac like *Hymenolepidinae*

Key to the genera of the subfamily Hymenolepidinae Perrier, 1897

1. Rostellum absent, rudimentary and unarmed *Hymenolepis*
Rostellum present 2
2. Rostellum with single crown of eight (8) hooks *Flamingolepis*
Rostellum with more than 8 hooks 3

3. Rostellum with single crown of 10-12 hooks, cirrus pouch reaching to or beyond median line ...
 *Echinocotyle*
 Rostellum with 10 hooks; cirrus pouch not reaching median line..... *Passerilepis*

Genus *Hymenolepis* Weinland, 1858

Key to the species

1. Scolex unarmed.....*H. diminuta*
 Scolex armed..... 2
 2. Rostellum armed with 8 hooks..... 3
 Rostellum armed with 10 hooks or more..... 4
 Rostellum armed with 20 hooks or more..... 5
 3. Rostellum hooks 0.07 to 0.082..... *H. gracilis*
 Rostellum hooks 0.03-0.035 *H. lanceolata*
 4. Rostellum hooks 0.018-0.023 *H. farciminosa*
 Rostellum hooks 0.016 *H. fusa*
 Rostellum hooks 0.035 *H. capillaroides*
 5. With 20 hooks, 0.012 to 0.017..... *H. simplex*
 With 22 hooks 0.030 0.034..... *H. medici*

Genus *Hymenolepis* Weinland, 1858

45. *Hymenolepis diminuta* (Rudolphi, 1819) Blanchard, 1891
 (Fig. 27)

1819. *Taenia diminuta* Rudolphi *Entozoorum synopsis cui accedunt mantissa duplex et indices locupeltissimi* 811 p. Berolini

1891. *Hymenolepis diminuta* Blanchard *mem. Soc. zool. France* 4: 420-489.

Material : Host - Rat.

Diagnosis : The worm upto 60 cm in length. Scolex unarmed. Genital pore at anterior third of lateral margin. Testes in straight line. Poral testes separated from other two by ovary. Eggs. 0.054-0.066 in diameter.

Distribution : India : West Bengal (South 24-Parganas, Calcutta, Jalpaiguri).

46. *Hymenolepis gracilis* (Zeder, 1803) Cohn, 1901

1803. *Hymenolepis gracilis* Zeder *Anleitung Zur Naturgeschichte der Eingeweidewurmer* 432 Bamberg.

1901. *Hymenolepis gracilis* Cohn *Zur Anatomie und Systematik der Vogelcestoden. Nova Acta Leop. Carol. Akad.* 79 : 269-450.

Material : Host *Phoenicopterus roseus*.

Diagnosis : The worm upto 27 cm in length. Rostellum with 8 hooks each of 0.07 x 0.08. The posterior segment may be square. Genital pore in the margin of proglottis may be hidden by overlap of preceding segments. Testes 3, ovary mostly bilobed. Recepticulum seminis conspicuous.

Distribution : India : West Bengal (Zoogarden, Calcutta) Elsewhere : Europe, America, Russia.

47. *Hymenolepis lanceolata* (Bloch, 1782) Weinland, 1858

1782. *Taenia lanceolata* Bloch Abhandlung von der Erzeugung der Eingeweidewurmer und den Mitteln Wider dieselben, 54 Berlin.

1858. *Hymenolepis lanceolata* Weinland *An essay on the tapeworms of man* 93. Cambridge, Massachusetts.

Material : Host Black Australian swan, *Chenopsis atrata*.

Diagnosis : Total length of the worm is extremely variable, it may be upto 13 cm. Head small globular. Long cylindrical rostellum with 8 hooks in single row. Genital pore unilateral, at anterior corner of lateral margin of segment. All the three testes in a line in posterior part of segment. Cirrus sac very small, cirrus armed. Ovary aporal. Eggs 0.05 x 0.035 oval.

Distribution : India : West Bengal. Cosmopolitan.

48. *Hymenolepis farciminosa* (Goeze, 1782) Fuhrmann, 1906

(Fig. 28)

1782. *Taenia farciminosa* Goeze Versuch einer naturgeschichte der *Eingeweidewurmer thierischer* Korper, 471 Blankenburg.

1906. *Hymenolepis farciminosa* Fuhrmann, *Centralbl Bakt, Parasitenk*, 41 : 440-442.

Material : Host *Corvus macrorhynchus*

Diagnosis : Length upto 72 cm. Rostellum with 10 hooks. Testes two aporal, one anterior to other. Cirrus sac long, external seminal vesicle upto middle of the segment, it varies in size in different part of strobila. Ovary deeply lobed. Uterus partly septet.

Distribution : India : West Bengal (Zoogarden Calcutta). Elsewhere : Rangoon, Europe.

49. *Hymenolepis fusa* (Krabbe, 1869) Fuhrmann, 1906.

(Fig. 29)

1869. *Taenia fusa* Krabbe *Kgl. Danske Videnska Selskab. Skrifter, Naturvidenskab, Math. Afdel*, 8 : 249-263.

1906. *Hymenolepis fusa* Fuhrmann *Centralbl Bakt. Parsitenk*. 42 : 352-358.

Material : Host *Larus brunneicephalus*.

Distribution : India : West Bengal (Zoogarden Calcutta).

50. *Hymenolepis capillaroides* Fuhrmann, 1906

1906. *Hymenolepis capillaroides* Fuhrmann *Centralbl. Bakt. Parasitenk*, 41 : 440-452.

Material : Host Snipe

Diagnosis : The worm upto 3 cm. Blade of hooks more or less equal to base. length of hooks below 0.03, cirrus pouch 0.08 0.01 Ratio of segment width 1:4.5

Distribution : India : West Bengal (Murshidabad). Elsewhere : Brazil.

51. *Hymenolepis simplex* Fuhrmann, 1906

1906. *Hymenolepis simplex* Fuhrmann *Centralbl. Bakt. Parasitenk* 41 : 440-452.

Material : Host *Todorna cornuta*

Diagnosis : The worm upto 5 cm in length. Head with 20 hooks of 0.12 in length. Testes large two aporal and other in front of one. Cirrus sac very large, extending upto excretory vessel of aporal half. Uterus sacular.

Distribution : India : West Bengal. Elsewhere : Europe, China, America.

52. *Hymenolepis Medici* (Stossich, 1890) Fuhrmann, 1906

1890. *Taenia medici* Stossich *Boll. Soc. Adriat. Sci. Nat. Trieste* 12 : 49-56.

1906. *Hymenolepis medici* Fuhrmann, *Centralbl. Bakt. Parasitenk* 41 : 440-452.

Material : Host *Pelicanus philippensis*.

Diagnosis : The worm upto 1.5 cm Posterior segment is square. Rostellum with 22 hooks of 0.03 0.34 in length. Two testes aporal while one in front of other. Cirrus sac very long extends more than middle half or in some cases even more upto aporal corner.

Distribution : India : West Bengal. Elsewhere : Europe, Africa, Malaya.

Genus *Flamingolepis* Spassky et Spasskaja, 1954.

Key to the species

8 hooks each 0.11-0.13 in size *F. liguloides*

8 hooks each of 0.9 in size.. *F. megalorchis*

53. *Flamingolepis liguloides* (Gervais 1847) Spassky et Spasskaja, 1954

1847. *Halysis liguloides* Gervais *mem. Acad. Sc. Lettr. Montpellier* 1 : 85-103.

1954. *Flamingolepis liguloides* Spassky et Spasskaja *Trudy Gelm. Lab. Akad. Nauk SSSR* 7 : 55-119.

Material : Host Flamingo, *Phoenicopterus roseus*.

Diagnosis : The worm upto 7.5 cm in length. Scolex triangular diameter 0.5. Ventral excretory vessel larger than dorsal. Testes one poral, two aporal. Cirrus sac extend upto aporal testes. External seminal vesicle prominent, extends upto vitelline gland. Recepticulum seminis large dorsal to ovary.

Distribution : India : West Bengal (Zoogarden, Calcutta). Elsewhere : France.

54. *Flamingolepis megalorchis* (Luhe, 1898) Spassky et Spasskaja 1954.

1898. *Taenia megalorchis* Luhe, *Sitz-ber. kgl. Preuss. Akad. Wiss.* 40 : 619-628

1954. *Flamingolepis megalorchis* Spassky et Spasskaja *Trudy Gelm Lab. Akad. Nauk SSSR.* 3 : 55-119.

Material : Host Flamingo.

Diagnosis : Worm upto 8 cm. Rostellum with 8 hooks of 0.9. Testes two aporal. Cirrus very long upto even aporal excretory vessel. Genital pore unilateral. Ovary and vitalline gland in between two aporal testes and other testes on poral side. Uterus a simple sac covers the space within segment.

Distribution : India : West Bengal (Calcutta Zoo garden). Elsewhere : Europe, Africa, Cuba.

Genus *Passerilepis* Spassky et Spasskaja, 1954

55. *Passerilepis zosteropis* (Fuhrmann, 1918) Spassky et Spasskaja, 1954

1918. *Weinlandia zosteropis* Fuhrmann *Nova Caledonia* 2 : 399-449

1954. *Passerilepis zosteropis* Spassky et Spasskaja, *Trudy Gelm Lab. Akad. Nauk SSSR*, 7 : 55-119.

Material : Host white checked bulbul, *Criniger flaveollus* : Green magpie, *Cissa chinensis*; Eastern boya *Ploceus passerinus*; Crested bunting *melophus melanicterus* : Treepie *Dendrocitta sp*; Golden backed wood packer *Brachypterus aurantius*; Laughing thrush *Trochalopteron, meridionale*; Magpie *Pica rustica*; *Ploceus atrigula*.

Diagnosis : Worm upto 2.2 cm. Rostellum with 10 peculiarly shaped hooks in single row. Two testes aporal, one in front of other. Cirrus sac extends beyond excretory vessel. External seminal vesicle conspicuous 0.6 in length. Genital pore unilateral. Vagina opens ventral to cirrus sac. Uterus a lobed sac, fills all the open space in a proglottid. Egg size 0.06.

Distribution : India : West Bengal (Zoogarden, Calcutta), Darjiling. Elsewhere : Burma, Loyalti island.

Genus *Echinocotyle* Blanchard, 1891

Key to the species of the genus *Echinocotyle*

Rosteller hooks not more than 0.04 in length..... *E. rosseteri*

Rosteller hooks more than 0.06 in length..... *E. uralensis*

56. *Echinocotyle rosseteri* Blanchard, 1891

1891. *Echinocotyle rosseteri* Blanchard, *Mem. Soc. Zool. France* 4 : 186-196.

Material : Host Domestic duck.

Diagnosis : Worm upto 1.5 Head subspherical. Suckers with spines rostellum armed with single crown of hooks. Testes three. Cirrus sac long extend upto middle of the segment, Genital pore unilateral.

Distribution : India : West Bengal. Elsewhere : Europe.

Remarks : This species was recorded in Europe from a bird imported from West Bengal.

57. *Echinocotyle uralensis* Clerc, 1902

1902. *Echinocotyle uralensis* Clerc, *zool. Anz.* 25 : 569-575.

Material : Host Snipe, *Capella sp.*

Diagnosis : Worm upto 4 cm. Head with rostellum having 10 hooks. Testes three, V shaped. Seminal vesicle prominent. Cirrus sac small. Genital pore unilateral. Vagina with large seminal vesicle dorsal to cirrus sac. The uterus with irregular walls.

Family TAENIIDAE Ludwig, 1886

Subfamily TAENIINAE Perrier, 1897

Key to the genera of the subfamily Taeniinae Perrier, 1897

1. Rostellum rudimentary without hooks *Taeniarhynchus*
 Rostellum armed with double crown of hooks numbering less than thirty 2
 Rostellar hooks more than thirty 3
2. Rostellum with less than thirty hooks large one. 0.16-.018 ovary bilobed. Aporal larger than poral *Taenia*
 Ovary bilobed, two halves widely separated, fan shaped and of equal size *Multiceps*
3. Rostellum with upto 50 hooks, larger one 0.03-0.09 mm *Hydatigera*

Genus *Taeniarhynchus* Weinland, 1858

58. *Taeniarhynchus saginatus* (Goeze, 1782) Weinland, 1858

1782. *Taenia saginata* Goeze versuch einer Naturgeschichte der Eingeweidewurmer thierischer Korper 471 p. ... Blankenburg.

1858. *Taeniarhynchus saginatus* Weinland. An essay on the tape worm of man. 93. Cambridge. Massachusetts.

Material : Host Man.

Diagnosis : Calciferous bodies are present. Uterus with 18-35 branches. Ovarian lobes circular.

Distribution : India : West Bengal (Calcutta). Cosmopolitan.

Genus *Taenia* Linnaeus, 1758.

Key to the species

1. Number of hooks 30-50 2
 Number of hooks less than 30 4
2. Uterine branches 20-25 *T. solium*
 Uterine coils less than 20 3
3. Number of hooks 35-45 size 0.02-0.3; uterine coils 8-14 *T. pisciformes*
 Number of hooks 32-34 size 0.1-0.12; uterine coils 7-10 *T. crassiceps*
4. Number of hooks 22-24 *T. hydatigera*

59. *Taenia solium* Linnaeus, 1758.

(Fig. 30)

1758. *Taenia solium* Linnaeus *Editio decime reformata* vol. 1, 823 p. Holmiae.

Material : Host Man.

Diagnosis : Length of the worm 2 to 4 meter. Number of segment 800-900. Rostellum with 25-50 hooks of 0.01-0.18 in size. Genital pore irregularly alternate, in the middle of lateral margin of proglottid. Head globular 0.06 to 1 mm in diameter. Testes are numerous. Ovary bilobed; situated posteriorly. Uterus with a medium stem with 7-10 laterals compound branches; on each side. Eggs 0.031-0.036 in diameter.

Distribution : India : West Bengal (Calcutta). Cosmopolitan.

60. *Taenia hydatigera* Pallas, 1766

1766. *Taenia hydatigera* pallas. *Miscellanea Zoologiae*, 224.

Material : Host Four horned antelope, *Tetracercus quadricornis*.

Diagnosis : Length may be 75 cm to 5 m. Segments 650-700 fleshy, gravid one 10-15 mm. in length 4-5 mm. in breadth. Rostellum with 22-44 hooks. Genital pore irregularly alternate, near the middle of lateral margin of the segment. Number of testes 600-700, small in size. Ovary bilobed, each lobe almost circular. Vitelline glands lies transversely behind the ovary. Uterus with central stem.

Distribution : India : West Bengal (Zoogarden, Calcutta). Cosmopolitan.

61. *Taenia pisiformis* (Bloch, 1780) Gmelin, 1790

1779. *Vermis vesicularis pisiformis* Bloch *Beschafft Berl. Ges Naturf. Fr.* 4, 534-561.

1790. *Taenia pisciformes* Gmelin *Systema Naturae* Tom para 6 (Vermes) Leipzig.

Material : Host *Felis tigris*, *Felis viverrina*, *Felis leo*.

Diagnosis : Length of the worm 60 cm to 2 m. Number of segment 400. Rostellum with 34-48 hooks. Testes 400 500 spread over in each segment. Ovary bilobed, each lobe being reniform. Uterus having 8-14 lateral branches. Eggs 0.037 10.038 in diameter.

62. *Taenia crassiceps* (Zeder, 1800) Rudolphi, 1810.

1800. *Alyseloninthus crassiceps* Zeder. *Erster Nachtrag zur Naturgeschichte der Eingeweidewurmer, mit Zufassen und Anmerkungen herausgegeben*, p. 320, Leipzig.

1810. *Taenia crassiceps* Rudolphi *Entozoorum sive vermium intestinalium historia naturalis*, vol. 2. Amstelaedami.

Material : Host *Felis viverrina*.

Diagnosis : Length of the worm 120-220. Rostellum with 32-34 hooks. Largest one of 0.186 in length; smaller one 0.0135. Uterus branched, 8 lateral branches. Eggs 0.025 in diameter.

Distribution : India : West Bengal (Zoogarden, Calcutta). Elsewhere : Europe, America.

Genus *Multiceps* Hall, 1910

Key to species

1. Testes extend beyond ovary, Uterine Branches 5-10 Maximum size of hooks 0.017-0.022
*M. gaigeri*
- Testes does not extend beyond ovary 2

2. Uterine branches 9-26, Maximum size of hooks 0.015-0.017 *M. multiceps*
 Proglottids serrated, uterine branches 20-25, maximum size of hooks 0.013-0.017 *M. serialis*

63. *Multiceps gaigeri* Hall, 1916

1916. *Multiceps gaigeri* Hall. *J. Am. Vet Med Ass.* **50** : 214-223.

Material : Host Dog.

Diagnosis : Length of the worm 25 to 182 cm. Genital pore irregularly alternate, slightly behind the middle of lateral margin of segment. Rostellum about 0.036 in breadth. testes 200-225 confined to lateral field. Vagina bilobed. Uterus with 12-15 compound branches.

Distribution : India : West Bengal, Calcutta. Elsewhere : Pakistan, Sri Lanka, South Africa, Russia.

Remarks : This species is very important from Veterinary point of view as the larval form (*Coenurus gaigeri*) of this species is found in brain and nervous system of sheep, goat etc. and cause the disease.

64. *Multiceps multiceps* (Leske, 1780) Hall, 1910

1780. *Taenia multiceps* Leske von dem drehen. *Lpzg.* 1780 : 52.

1910. *Multiceps multiceps* Hall, *U.S. Bur. Anim Indust Bull* 125-1 68 p.

Material : Host Jackal, *Canis aureus*.

Diagnosis : Length 40-100 cm. Number of segment 200-250. Rostellum hooks 22-32 larger ones 0.15-0.17 length. Genital pore irregularly alternate in the lateral margin of the segment. testes 200. Ovary bilobed. Uterus with 9 to 26 lateral compound branches on each side. Eggs 0.029-0.037.

Remarks : Larval forms cause the disease known as gid in ruminants.

65. *Multiceps serialis* (Gervais, 1847) Stiles and Stevenson, 1905

1947. *Coenurus serialis* Gervais *Mem. Acad. Sc. lettr. Montpellier* 1 : 85-103.

1905. *Multiceps serialis* stiles and stevenson, *U.S. Bur. Animal Cnd. Bull.* **80** : 1-14.

Material : Host Dog.

Diagnosis : The worm measure 20 to 72 cm. in length. Rosteller hooks 26-32 larger ones of 0.013-0.017. Genital pore in various position. Gravid segment longer than broad 6 to 12 mm. Testes numerous, also occur posteriorly to ovary. Ovary bilobed. Uterus with 20 to 25 lateral branches on each side. Eggs 0.031 0.034 in diameter.

Distribution : India : West Bengal (Calcutta). Cosmopolitan.

Family PROTEOCEPHALIDAE La Rue, 1911

Subfamily PROTEOCEPHALINAE Mola, 1929

Key to the genera of Proteocephalinae

1. Hold fast with rostellum 2
 Hold fast without rostellum 3

2. Testes in two separate bonds. Holdfast with rostellum bearing spines..... ***Gangesia***
 3. Holdfast having small spines ***Acanthotaenia***
 Holdfast without spines. Suckers oval or circular..... ***Ophiotaenia***

Genus ***Gangesia*** Woodland, 1924

66. ***Gangesia bengalensis*** (Southwell, 1913) Woodland, 1924
 (Fig. 31)

1913. *Ophriocotyle bengalensis* Southwell *Rec. Ind. Mus.*, 9 : 79-103.

1924. *Gangesia bengalensis* Allahabad Univ. *Stud.*, 4 : 119-176.

Material : Host *Ophiocephalus striatus*, *Wallago attu*, *Labeo rohita*.

Diagnosis : Length upto 7 cm. Segments 100-200, holdfast conical; rostellum with 32-37 curved hooks. Genital pore irregularly alternate, in the lateral margin of segment. Testes 100. Ovary bilobed, posterior. Egg measure 0.092 to 0.099.

Distribution : India : West Bengal (Medinipur, Berhampur, Birbhum); North India. Elsewhere : Japan.

Genus ***Acanthotaenia*** Linstow, 1903

Key to the species

1. Testes below 50 in number 2
 2. External segmentation indistinct, testes 40-45 per segment..... ***A. biroi***
 Testes usually more than 50 3
 3. External segmentation distinct, testes 60-80 ***A. nilotica***
 Testes 50-60 in two groups ***A. beddardi***

67. ***Acanthotaenia biroi*** Ratz, 1900

1900. *Acanthotaenia biroi* Ratz *Parasitologica Jegyzetek. Veterinarius, Budapest* 23 : 525-535.

Material : Host *Varanus nebulosus*.

Distribution : External segmentation indistinct; holdfast with four suckers. Rostellum conical without hook. Spines present on holdfast. Genital pore irregularly alternate. Testes 40-45.

Distribution : India West Bengal (24-Parganas, Calcutta). Elsewhere : Australia.

Remarks : Several worker consider this species synonym of *A. nilotica*.

68. ***Acanthotaenia nilotica*** (Beddard, 1913) Baylis, 1929

1913. *Ichthyotaenia nilotica* Beddard *Bull. Soc. Path. exot.* 6 : 343-346.

1929. *Acanthotaenia nilotica* Baylis *Ann. Mag. Nat. Hist. (Ser 10)* 10.

Material : Host Unknown.

Diagnosis : Length 4 to 8 cm. Scolex measure 0.21 in length 0.25 in breadth covered with cuticular spines. testes 60-80. Cirrus armed with spines. Ovary posterior bilobed.

Distribution : India : West Bengal (Calcutta). Elsewhere : Africa.

69. *Acanthotaenia beddardi* (Woodland, 1925) Baylis, 1929

1925. *Proteocephalus beddardi* Woodland *parasitology* 17 : 370 - 394.

1929. *Acanthotaenia beddardi* Baylis *Ann. Mag. Nat. Hist.* (Ser 10) 10.

Material : Host *Varanus bengalensis*.

Diagnosis : Length upto 6 cm. Testes 50-60.

Distribution : India : West Bengal (24 Parganas); U.P. (Allahabad).

Genus *Ophiotaenia* La Rue, 1911

Key to the species

Cirrus pouch 1/3 or less of the segment width; uterine branches more than 25 on each side.....
.....*O. calmetti*

Cirrus pouch 1/4 or less of the segment width, uterine coils with 16-25 lateral diverticula *O. naie*

70. *Ophiotaenia calmetti* Barrois, 1898

1898. *Ichtiotaenia calmetti* Barrois, *Bull. Soc. Sci, agr. arts., Lille.* 2.

Material : Host - *Bungurus caeruleus*.

Diagnosis : Testes 150-160 in two groups. Cirrus pouch about 1/3 or less than the segment. Uterine branches more than 25 on each side.

Distribution : India : West Bengal. Elsewhere : Brazil.

71. *Ophiotaenia naie* Beddard, 1913

1913. *Ophiotaenia naie* Beddard *Proc. zool. Soc. London* 8 : 153 -168.

Material : Host *Naja tripudians*.

Diagnosis : Holdfast without spines. Testes 120 -170 in two groups. Uterine branches 18-25 on each side. Vagina dilated near opening anterior or posterior to cirrus sac. Eggs 0.026 in diameter.

Distribution : India : West Bengal (Museum compound Calcutta); U.P.; Tamil Nadu; Rajasthan.

Family NEMATOTAENIIDAE Luhe, 1910

Genus *Nematotaenia* Luhe, 1899

72. *Nematotaenia dispar* (Goeze, 1782) Luhe 1899

1782. *Taenia dispar* Goeze, *Versuch einer Naturgeschichte der Eingeweidewurmer thierischer korper Blankenburg*, 471.

1899. *Nematotaenia dispar* Luhe *Zool. Anz.* 22 : 524-539

Material : Host - *Bufo melanostictus*.

Diagnosis : Body almost unsegmented. Cylindrical Genital apertures alternating irregularly from one margin to other. Testes two, paruterine organ each having several uterine capsules, arranged in two parallel rows, separated from one another.

Distribution : India : West Bengal (Calcutta, Malda). Elsewhere : Europe, Africa, North America.

Family TRIAENOPHORIDAE Loennberg, 1889

Genus *Anchistrocephalus* Monticelli 1890

73. *Anchistrocephalus* sp.

Material : Host *Ophiocephalus striatus*, *Labeo rohita*.

Diagnosis : Length upto 1.7. Segmentations distinct and complete. Scolex rectangular having two fleshy bothria, with about fifty six spines.

Family DAVINEIDAE Fuhrmann, 1907

Key to the subfamily of the family Davaineidae

Uterus persistent **Ophriocotylinae**

Uterus breaks up into egg capsules **Davaineinae**

Subfamily OPHRIOCOTYLINAE Fuhrmann, 1907

Genus *Ophryocotyloides* Fuhrmann, 1920

74. *Ophryocotyloides monacanthis* Moghe and Inamdar, 1934

1934. *Ophryocotyloides monacanthis* Moghe and Inamdar, *Rec. Indian Mus.*, 36 : 7-16.

Material : Host *Dendrocitta rufa*.

Diagnosis : Hooks on the rostellum in two circle. spines on sucker margin in several rows. Genital pore unilateral. Testes 18-20. Cirrus extending beyond excretory vessel. Ovary in front of testes. Uterus persistent, forms lobed sac in mature segments.

Distribution : India : West Bengal; Madhya Pradesh, Nagpur.

Subfamily DAVINEINAE Braun, 1900

Key to the genera of the subfamily Davaineinae

1. Genitalia single 2
Genitalia double 3
2. Proglottid small below 15 only. Genitalia single, genital pore regularly alternate **Davainea**
Proglottid many, genital pore unilateral and irregularly alternate **Railletina**
3. Proglottid many **Cotugnia**

Genus *Davainea* Blanchard, 1891

75. *Davainea proglottina* Davainé, 1860

(Fig. 32)

1860. *Davainea proglottina* Davaine *Traite des Entozoaires et des maladies vermineuses de g'homme et des animaux domestiques* 838 Pairs.

Material : Host Domestic fowl.

Diagnosis : The worm upto 4 mm. in length. Number of segment 4-6. Scolex with 80-95 hooks. Suckers with minute rose-thorn shaped hooks. Number of testes 19-22. Cirrus sac large extends almost upto middle of the segment. Cirrus with silky hairs. Ovary bilobed anterior to testes. Eggs free in capsules, each containing single egg in gravid segments.

Distribution : Cosmopolitan.

Genus *Cotugnia* Diamare, 1893

Key to the species

1. Rostellum smaller than sucker *C. margareta*
Rostellum almost of the same size 2
2. Suckers armed *C. digonophora*
Suckers unarmed *C. fastigata*

76. *Cotugnia margareta* Beddard, 1916

1916. *Cotugnia margareta* Beddard *Proc. zool. Soc. London* **22** : 695-706.

Material : Host Crow *Crocyus macrorhynchus*; *Lophophorus refulgens*.

Diagnosis : Rostellum smaller than sucker. Two set of genital organ; testes confined within excretory vessels arranged almost in two groups. Vagina short. Ovary lobulated. Uterus breaks down in egg capsules, each containing one egg.

Distribution : India : West Bengal : (Zoogarden, Calcutta) Birbhum.

77. *Cotugnia digonophora* (Pasquale, 1890) Blanchard, 1891 (Fig. 33)

1890. *Taenia digonophora* Pasquale *Giorn. intern. sci. med. Napoli* **12** : 905-910.

1891. *Cotugnia digonophora* Blanchard *Mem. Soc. Zool. France* **4** : 420-429.

Material : Host - Duck, domestic fowl.

Diagnosis : Length upto 8 cm. Thickness 1 mm. Rostellum hooks in single row, each measuring about 0.08. Diameter of suckers 0.045 Neck may be absent. Genital pore double in each segment. Testes about 100. Ovaries 2 in each segment. Egg measure 0.06.

Distribution : India : West Bengal : Zoogarden Calcutta, Berhampore. Elsewhere : Rangoon.

78. *Cotugnia fastigata* Meggitt, 1920

1920. *Cotugnia fastigata* Meggitt *Parasitology* **12** : 390-410

Material : Host - Parrot.

Diagnosis : Length upto 3 cm. Strobila triangular. Head 0.05-0.06 in diameter with four unarmed suckers and single armed rostellum with 200 hooks of 0.02 in length. Genital pores lateral in the anterior quarter. Testes forming narrow bands of two or three rows. Cirrus sac long. Ovary lobulated asymmetrical. Dorsal longitudinal excretory vessel absent in mature segments.

Distribution : India : West Bengal : Zoogarden Calcutta; Bardhaman, Murshidabad.

Genus *Raillietina* Fuhrmann, 1920Key to the subgenera of the genus *Raillietina*

1. Egg pouch with several eggs..... 2
Egg. pouch with single egg..... 3
2. Genital pore unilateral *Raillietina* (*Raillietina*)
Genital pore alternating irregularly *Raillietina* (*Fuhrmannetta*)
3. Genital pore unilateral *Raillietina* (*Paroniella*)
Genital pore alternating irregularly *Raillietina* (*skrjabinia*)

Key to the species of *Raillietina* (*Raillietina*)

1. Number of rostellor hooks more than 200 2
Number of rostellor hooks less than 200 but more than 100 3
Number of rostellor hooks less than 100 4
2. Rosteller hooks 300, size of hooks 0.152; many eggs per pouch *R. spiralis*
Rosteller hooks 324, size 0.001-0.004; Eggs per pouch 6 or more..... *R. polychalix*
Rosteller hooks 180, size 0.009-0.01 *R. microscolecina*
Rosteller hooks 160, size 0.08 *R. cohni*
Rosteller hooks 150, size 0.012-0.014..... *R. friedbergeri*
Rosteller hooks 120, size 0.01 *R. ceylonica*
Rosteller hooks 100, size .006-.008 *R. tetragona*
4. Rosteller hooks 25-30, size .02-.03 *R. fuhrmanni*

79. *Raillietina* (*Raillietina*) *spiralis* (Baczynska, 1914) Fuhrmann, 1920

1914. *Davainea spiralis* Baczynska Bull. Soc. sc. Nat. Neuchatel 40 : 187-239.

1920. *Raillietina* (*Raillietina*) *spiralis* Fuhrmann, Festschrift fur zschokke, Bale, 19.

Material : Host Green Pigeon, *Crocopus phoenicopterus*.

Diagnosis : Length 3-4 cm. Genital pores unilateral in anterior corner of lateral margin of the segment. Diameter of head 0.02. sucker armed with 7 rows of hooks. Diameter of rostellium 0.015 armed with 300 hooks each 0.016 in length. Testes few in number. Ovary flat. Eggs in capsules having diameter 0.01 contain 4-6 eggs.

Distribution : India : West Bengal : Zoogarden Calcutta, Bardhaman, Nadia, Malda. Elsewhere : New Guinea.

80. *Raillietina* (*R.*) *polychalix* (Kotlan, 1921) Southwell, 1930.

(Fig. 34)

1921. *Davainea polychalix* Kotlan Ann. Hist. Nat. Musee. Nat. Hungarici 18 : 1-27.

1930. *Raillietina polychalyx* Southwell *Fauna of British India. Cestodae* Vol. II Taylor and Francis, London, 262.

Material : Host - *Lorius garrulus*.

Diagnosis : Length upto 5.5 cm Suckers armed; Rostellum armed with 240-250 hooks. Genital pore unilateral at extreme anterior corner of lateral margin of segment. testes 4 being poral, 6 being aporal. Ovary in the middle of the segment, not bilobed. Egg capsule 24-26, each with 2-5 eggs.

Distribution : India : West Bengal : Zoogarden, Calcutta. Elsewhere : New Guinea.

81. *Raillietina (R.) microscolecina* (Fuhrmann, 1920) Fuhrmann.

1909. *Davainea microscolecina* Fuhrmann *Centralbl Bakt. Parasitenk*, 1 Abt. **49** : 94-124.

1920. *Raillietina (R.) microscolecina* Fuhrmann *Festschrift fur Zschokke, Bale*, 19.

Material : Host Parrot, *Lorius rosatus*.

Diagnosis : Length upto 10 cm. Genital pore unilateral in the lateral margin of segment. Calcareous corpuscles each measuring 0.01 present in parenchyma. Testes 16 to 20. Each gravid segment contain about 45 egg capsules, with one egg in the beginning, later on may contain 1-7 eggs.

Distribution : India : West Bengal : Zoogarden, Calcutta, Murshidabad, Malda. Elsewhere : Brazil.

82. *Raillietina (R.) cohni* (Baczynska, 1914) Fuhrmann, 1920

1914. *Davainea cohni* Baczynska, *Bull. soc. sc. Nat. Neuchatel*, **40** : 187-239.

1920. *Raillietina (R.) cohni* Fuhrmann *Festschrift fur Zschokke, Bale*, 1920.

Material : Host *Pterocles exustus*; *P. arenarius*.

Diagnosis : Length upto 3 cm. scolex 0.0192 in length and 0.024 in breadth. testes 10 to 15. A single row of testes, lies posteriorly to the female genital organs. Cirrus sac pyriform 0.078 in length and 0.028 in breadth. Ovary in the anterior part of segment, much lobed, breadth 0.06. Eggs grouped in capsules, each contains 2 to 3 eggs.

Distribution : India : West Bengal : Zoogarden, Calcutta. Elsewhere : East Africa, Nepal.

Remarks : Lopez Neyra (1944) considered this species as a variety of *R. tetragona*.

83. *Raillietina (R) friedbergeri* (Linstow, 1878) Fuhrmann, 1920
(Fig. 35)

1878. *Taenia friedbergeri* Linstow 1878 *Arch. Naturg.* **44** : 218-245.

1920. *Raillietina friedbergeri* Fuhrmann, *Festschrift fur zschokke, Bale*, 1920, pp. 19.

Material : Host Black shouldered peacock, *Pavo nigripennis*.

Diagnosis : Worm measures upto 20 cm. Head pyriform 0.03 in length 0.04 in breadth. Suckers are armed with 4 to 5 rows of small hooks. testes 25 to 32. Ovary conspicuous lobed organ. Each segment contains about 100 eggs capsules. 2 to 3 eggs in each capsule.

Distribution : India : West Bengal : Zoogarden, Calcutta. Elsewhere : Europe.

84. *Raillietina (R.) ceylonica* (Baczynska, 1914) Fuhrmann, 19201914. *Davainea ceylonica* Baczynska Bull. Soc. Sc. Nat. Neuchatel. 40 : 187-239.1920. *Raillietina (R.) ceylonica* Fuhrmann, Festschrift fur zschokke, Bale, 1920.*Material* : Host *Crocopus phoenicopterus*, white bellied pigeon, *Columba leuconata*.*Diagnosis* : Worm upto 3-4 cm. Rostellum armed with 120 hooks in double row. Hook size 0.01. Suckers armed. Testes few, genital pore in anterior third of lateral margin. Ovary deeply lobed. Egg capsule contain 6-10 eggs. Eggs 0.028 in diameter.*Distribution* : India : West Bengal. Elsewhere : Sri Lanka.85. *Raillietina (R.) tetragona* (Molin, 1858) Fuhrmann, 19201858. *Taenia tetragona* Molin Akad. wiss, wien Math Naturw classe Abt. 1 .30 : 127-158.1920. *Raillietina (R.) tetragona* Festschrift fur zschokke, Bale 1920, 19.*Material* : Host Tragopan phesant, *Muska domestica*.*Diagnosis* : Length of the worm upto 25 cm. Unilateral genital pore near the centre of the lateral margin of the segments. Scolex large, suckers with 8 to 10 rows of hooks. Testes 20 to 30. Egg capsules 50 to 100 in each segment. 6 to 12 eggs in each capsules. Size of egg 0.025 to 0.05.*Distribution* : India : West Bengal. Cosmopolitan.86. *Raillietina (R.) fuhrmanni* (Southwell, 1922) Fuhrmann and Baer, 1944.

(Fig. 36)

1922. *Davainea fuhrmanni* Southwell Ann. Trop. Med. Par. 16 : 127-152.1944. *Raillietina (R.) fuhrmanni* Fuhrmann and Baer Bull. soc. Sc. Nat. Neuchatel 68 : 113-140.*Material* : Host *Crocopus phoenicopterus*, *C. phayrei*.*Diagnosis* : Length of worm upto 8 cm. Shape of segments are variable. Length of head 0.033. Diameter of suckers 0.07 with few rows of minute hooks. Testes 12. Cirrus sac 0.017 in length and 0.08 in breadth. Cirrus armed with spine measuring 0.017. Egg capsules contain normally 6-7 eggs sometime upto 11 eggs. Black pigment occasionally found. Eggs about 0.036.*Distribution* : India : West Bengal : Calcutta. Elsewhere : Burma, Tanganyika, Egypt.Key to the species of *Raillietina* (Fuhrmannetta) from West Bengal

Rostellum with collar spine numbering 200 to more measure 0.01 to 0.013.....

..... *R. (F) echinobothrida*Collar spine 150-160 measures 0.18 to 0.20..... *R. (F) Korkei*87. *Raillietina (F.) echinobothrida* (Megnin, 1880) Stiles and Orleman 1926

(Fig. 37)

1880. *Taenia echinobothrida* Megnin Bull. Soc. Zool. France 5 : 117-129.1926. *Raillietina (F) echinobothrida* Stiles and Orleman. Ann. Parasit, 4 : 65-67.

Material : Host - domestic fowl, jungle fowl, *Gallus ferrugineus*.

Diagnosis : Length of the worm upto 25 cm. Suckers with 8 to 10 rows of hooks size of which 0.06 to 0.015. Rostellum with 200 hooks in two rows. Size 0.01-0.013. Testes 20 to 30. Each egg capsule contain 6 to 12 eggs of 0.025 to 0.05 size.

Distribution : India : West Bengal : Berhampur. Cosmopolitan

88. *Raillietina (F) korkei* Joyeux and Houdemer, 1928

1928. *Raillietina korkei* Joyeux and Houdemer, *Ann. Par.* 5(4) : 289-309.

Material : Host - domestic pigeons.

Diagnosis : Length upto 164 mm. scolex 0.017 in length 0.02 in breadth. Genital pore irregularly alternate. Rostellum dome-shaped with 150-160 hooks of 0.018-0.02, in double row. Aporal testes 17, poral 7, each measure 0.035 in diameter. Egg capsules 50 to 60 in each segment. Each capsule measure 0.017 and contain 6 to 9 eggs of 0.018 × 0.014 in diameter.

Distribution : India : West Bengal : Calcutta; Punjab.

Key to the species of *Raillietina (Paroniella)* from West Bengal

- | | | |
|----|--|---------------------|
| 1. | Rostellum hooks 200 or more | 2 |
| | Rostellum hooks below 200..... | 3 |
| 2. | Rosteller hooks 200, size 0.014 0.016..... | <i>R. cruciata</i> |
| 3. | Rosteller hooks 100, size 0.01-0.011 | <i>R. urogalli</i> |
| | Rosteller hooks 80, size 0.016-0.018 | <i>R. corvina</i> |
| | Rosteller hooks 46, size 0.01 | <i>R. tragopani</i> |

89. *Raillietina (P.) cruciata* (Rudolphi, 1819) Fuhrmann, 1920

1819. *Davainea cruciata* Rudolphi *Entozoorum synopsis cui accedunt mantissa duplex et indices locupletissimi*, 811 Berolini

1920. *Raillietina (P.) cruciata* Fuhrmann *Festschrift fur zschokke Bale*, 1920, 19 pp.

Material : Host *Corvus macrorhynchus*, *Pica rustica*; *Brachypterus aurantiacus*.

Diagnosis : Rostellum armed with about 200 hooks, measuring 0.015 in double row, Suckers armed. Testes 27-30. Ovary median; uterus breaks down in egg capsule containing single oncosphere.

Distribution : India : West Bengal. Elsewhere : Brazil.

90. *Raillietina (P.) urogalli* (Modeer, 1790) Fuhrmann, 1920

(Fig. 38)

1790. *Taenia urogalli* Modeer *Zusatze* 11-8-122

1920. *Raillietina urogalli* Fuhrmann *Festschrift fur Zschokke, Bale* 1920, 19.

Diagnosis : Upto 35 cm. Rostellum with about 160 hooks each 0.014-0.016. Suckers armed. One longitudinal vessel on each side. Testes 130 being most distinguishing features of this species. Vas deference much coiled. Bilobed ovary slightly on poral half. Uterus at first consist of a central cavity with radiating lobes and ultimately breaks down in egg capsule containing one egg. Eggs 0.024-0.03 in diameter.

Material : Host Partridge pheasant, *Alectoris groecachukar*.

Distribution : India : West Bengal : Zoogarden, Calcutta. Elsewhere : Europe, West Siberia.

91. *Raillietina (P.) corvina* (Fuhrmann, 1905) Fuhrmann, 1920

1905. *Davainea corvina* Fuhrmann *Zool. Jahrb. Syst.* **22**(3) : 303-320

1920. *Raillietina (P.) corvina* Fuhrmann, *Festschrift fur Zschokke Bale*, 1920, 19.

Material : Host *Felis pardus*; *Corvus splendens*.

Diagnosis : upto 12 cm. Rostellum armed with 80 hooks each 0.016-0.018 in length. suckers armed with 5-6 rows of hooks. testes about 25 arranged in two groups one on each side of ovary. Ovary median; with tubule like follicles. Uterus breaks down in egg capsule.

Distribution : India : West Bengal : Calcutta, Bardhaman; U.P. Elsewhere : Africa, Thailand, Ceylon.

92. *Raillietina (P.) tragopani* southwell, 1922

1920. *Raillietina tragopani* Southwell, *Ann. Trop. Med. Parasit.* **16** : 127-152.

Material : Host *Tragopan Pheasant*.

Diagnosis : Worm upto 8.5 mm. Rostellum hooks 46 in single row each 0.01 in length. Suckers armed with 4-6 rows of hooks. Testes 6-7; four situated aporaly, one or two posterior to ovary and one on poral side. Ovary bilobed, composed of many acini. Uterus first appear as small cavity, pre ovarian and within two lobes ultimately break down in egg capsule, containing one egg. Eggs 0.054 in diameter.

Distribution : India : West Bengal, Zoogarden Calcutta. Other record : Burma.

Remarks : Fuhrmann (1932) considered this species as synonym of *R. (P) facilis* Meggitt, 1926.

Key to species of *Raillietina* (Skrjabinia)

Suckers unarmed, rostellum with 400-500 hooks; size 0.01-0.12*R.(S.) cesticillus*
Sucker armed..... *R.(S.) centropi*

93. *Raillietina (S.) cesticillus* (Molin, 1858) Fuhrmann, 1920

(Fig. 39)

1858. *Taenia cesticillus* Molin Sitz-ber *Akad. Wiss. Wien Math-Naturw. Classe Abt. I.* **30** : 127-158.

1920. *Raillietina (S.) cesticillus* Fuhrmann *Festschrift fur Zschokke, Bale*, 1920. 10 pp.

Material : Host domestic fowl.

Diagnosis : Worm upto 13 cm. Rostellum with 400-500 hooks, in two rows, each 0.07-0.018 in length. Testes 20-30. Cirrus sac extends median to excretory vessels. Uterus breaks down in egg capsule, each with one egg.

Distribution : India : West Bengal; Calcutta, Berhampore, Bardhaman U.P. Cosmopolitan.

94. *Raillietina (S.) centropi* (Southwell, 1922) Southwell, 1930.

1922. *Davainea centropi* Southwell *Ann. Trop. Med. Parasit.* **18** : 459-491.

1930. *Raillietina (S.) centropi* Southwell *Cestoda Vol. II, Fauna of British India* : 262 Taylor and Francis, London.

Material : Host *Centropus rufipennis*.

Diagnosis : Upto 2.5 cm. Rostellum small, with 300 hooks each 0.09-0.011 in length arranged in double rows. Suckers armed with about 15 rows of hooks. Testes 40 preovarian on each side of ovary. Uterus extends laterally upto excretory vessels consist of many parenchymatous capsules, containing single egg. Eggs 0.05 in diameter.

Distribution : India : West Bengal, Berhampore.

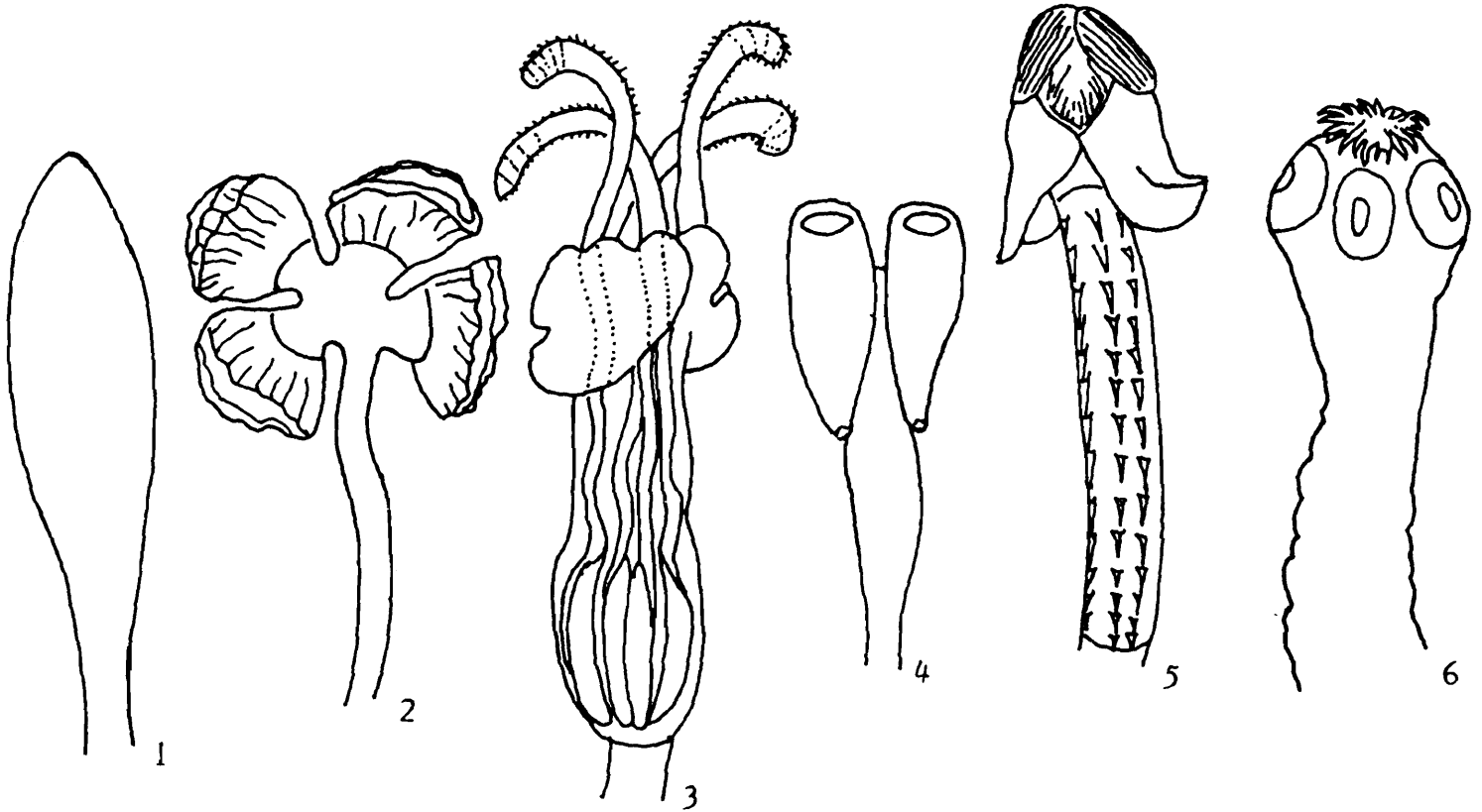


Fig. 1
 Fig. 2
 Fig. 3
 Fig. 4
 Fig. 5
 Fig. 6

Fig. 1. Order Spathebothridea; Fig. 2. Order Tetraphyllidea; Fig. 3. Order Trypanorhyncha; Fig. 4. Order Pseudophyllidea; Fig. 5 Order Diphyllidea; Fig. 6. Order Cyclophyllidea'.

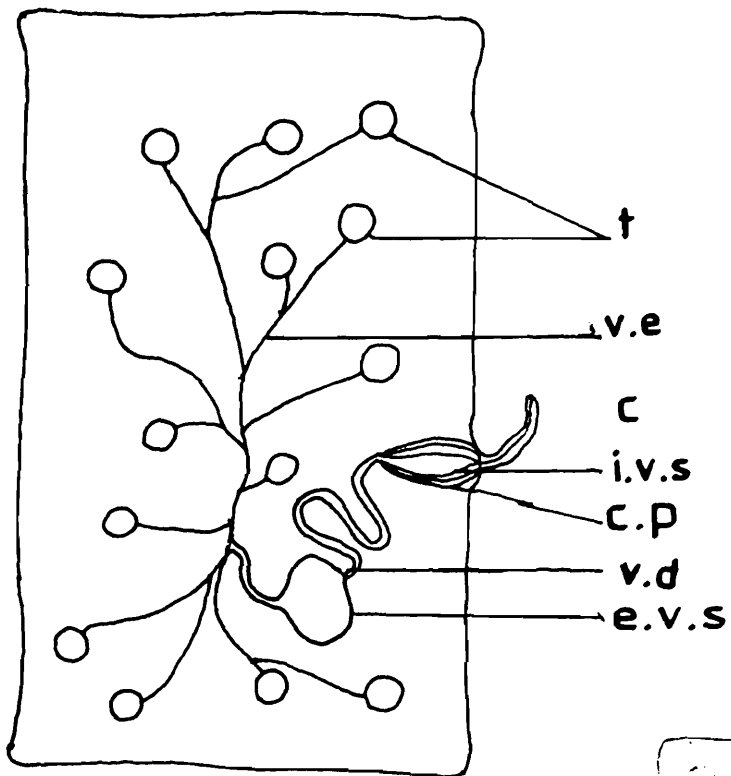


Fig. 7.

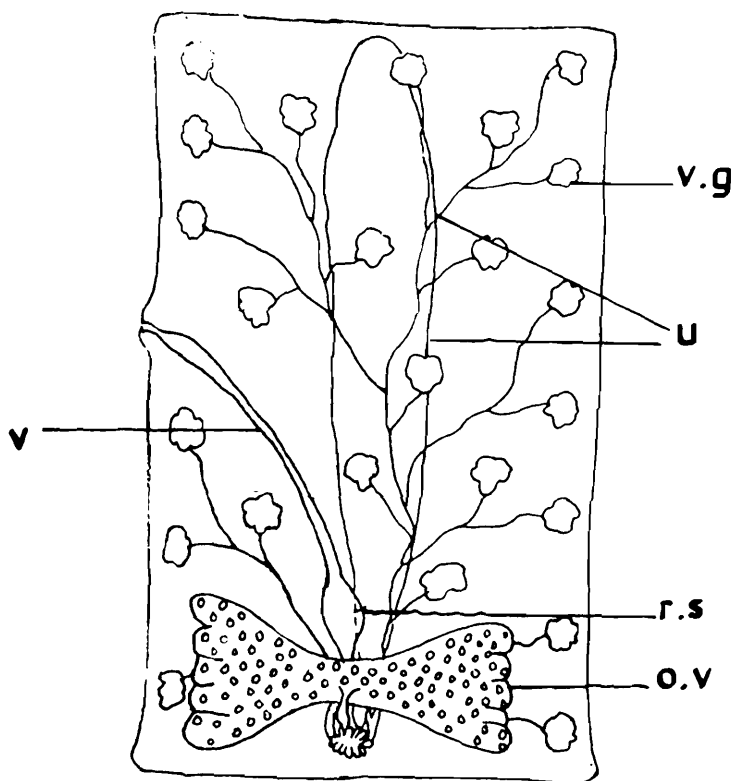


Fig. 8

Fig. 7. Male genitalia; Fig. 8. Female genitalia.

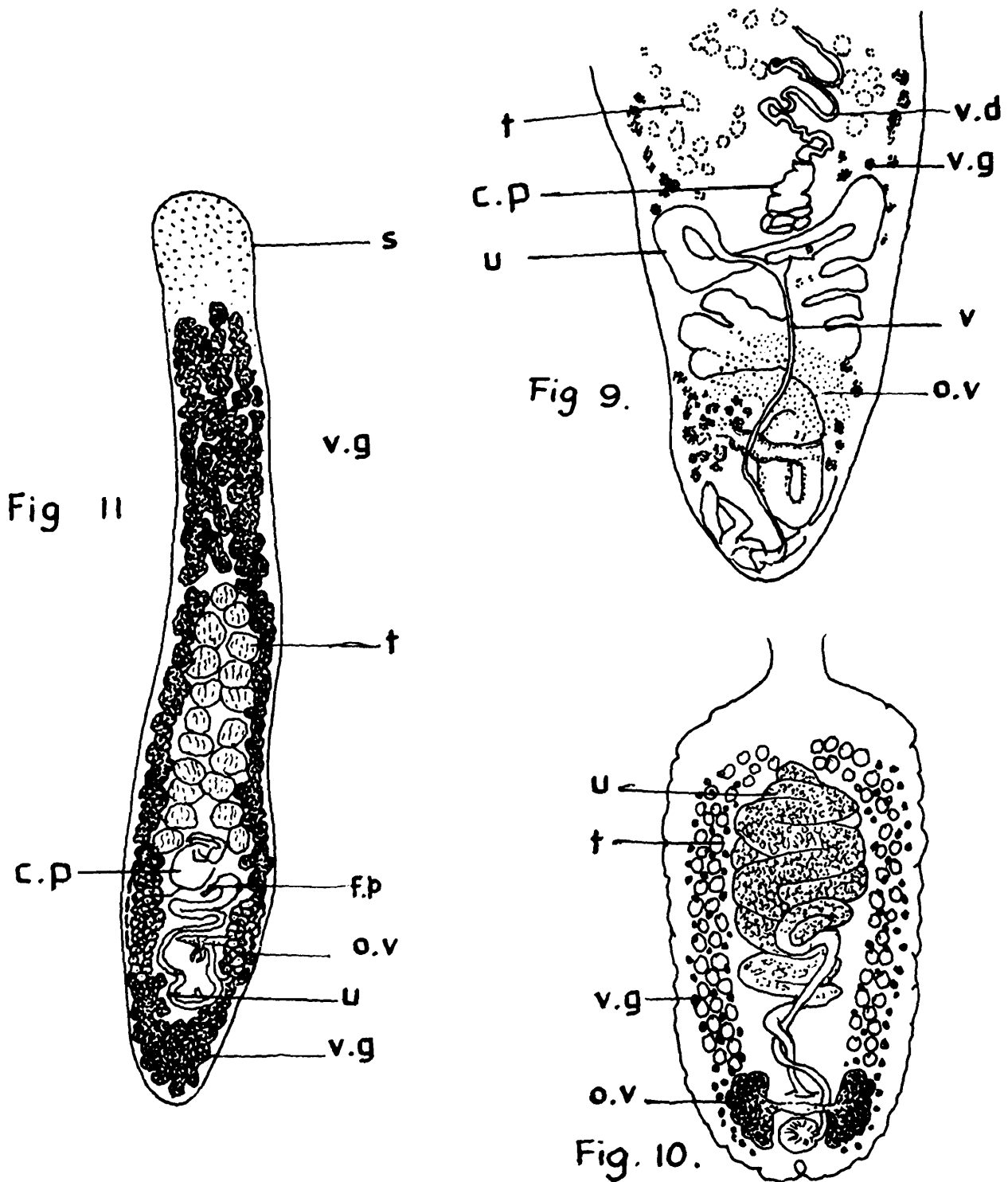


Fig. 9. *Lytocestus indicus*; Fig. 10. *Djombangia penetrans*. Fig. 11. *Lytocestoides leptocephali*.

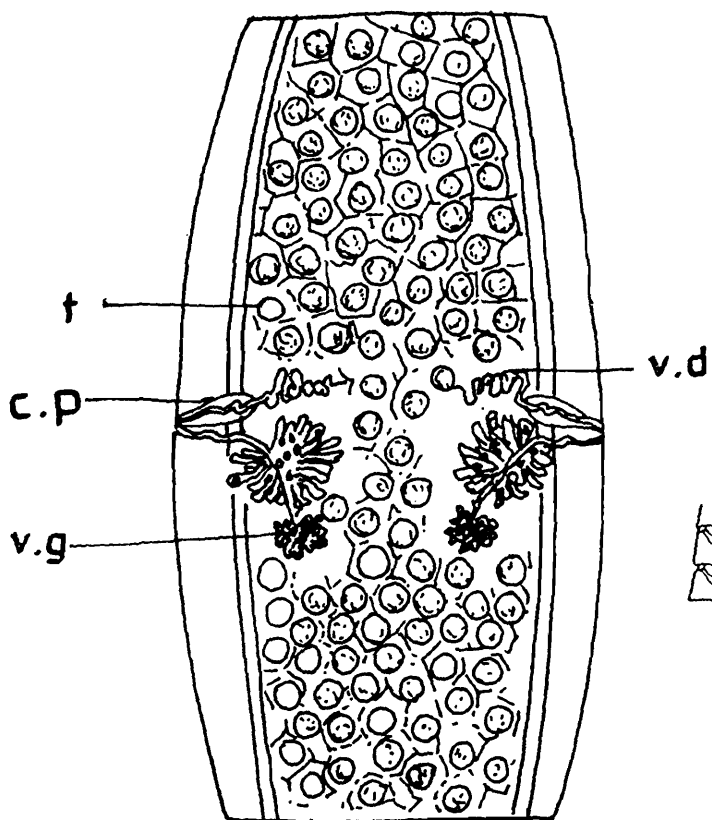


Fig 12

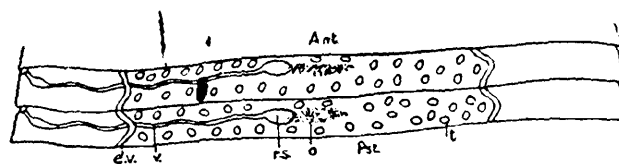


Fig.13

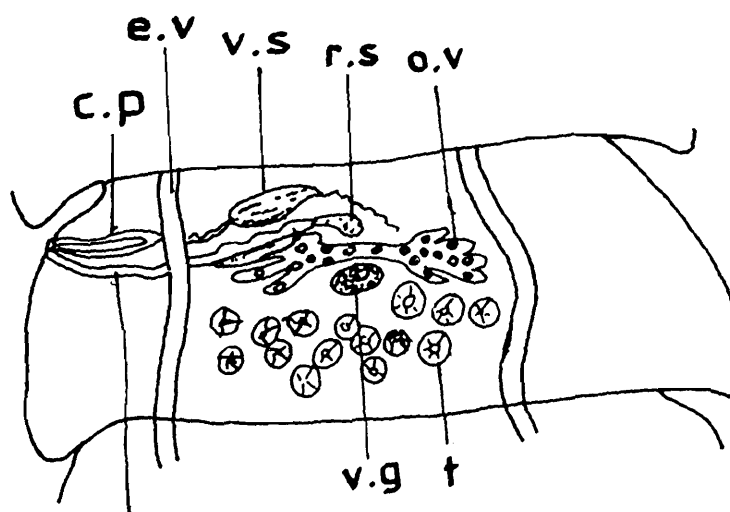


Fig. 14

Fig. 12. *Dipylidium caninum* (Matured segment $\times 31$). Fig. 13. *Southwellia gallinarum* (Matured segment $\times 33$). Fig. 14. *Prochoanotaenia microsoma* (Matured segment $\times 214$).

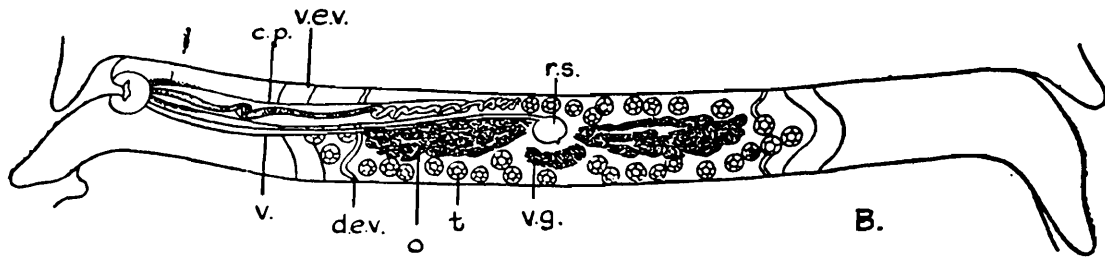


Fig. 15

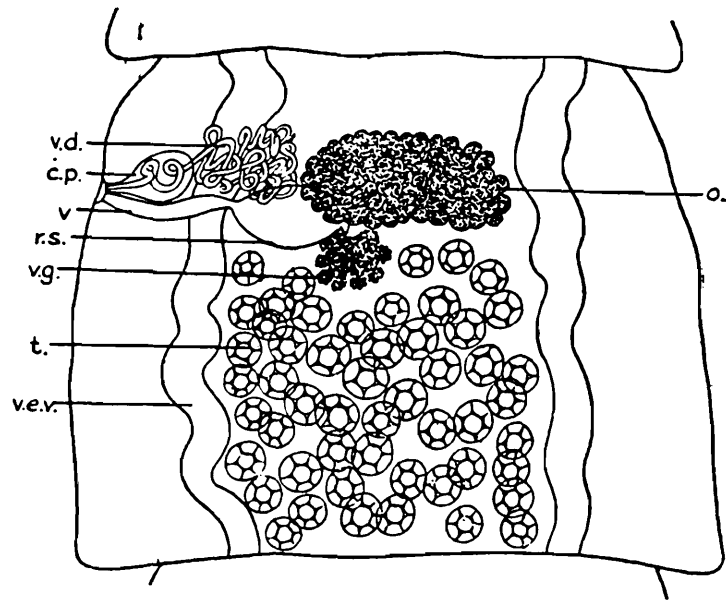


Fig. 16 .

Fig. 15. *Lateriporus spinosus* (Matured segment $\times 60$). Fig. 16. *Anomotaenia acollis* (Matured segment $\times 90$).

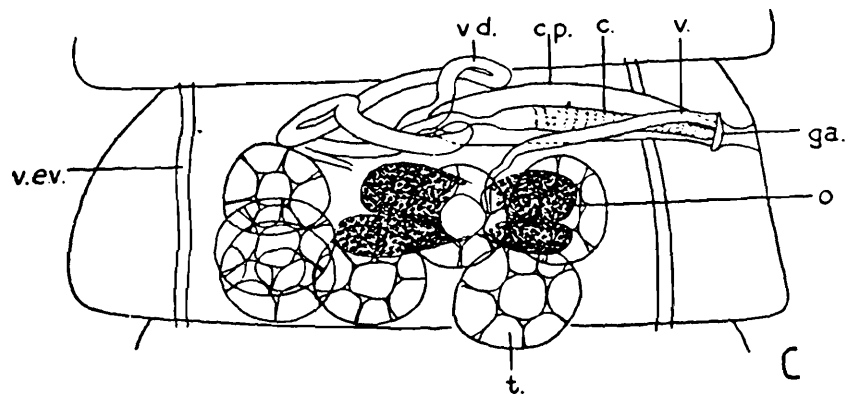
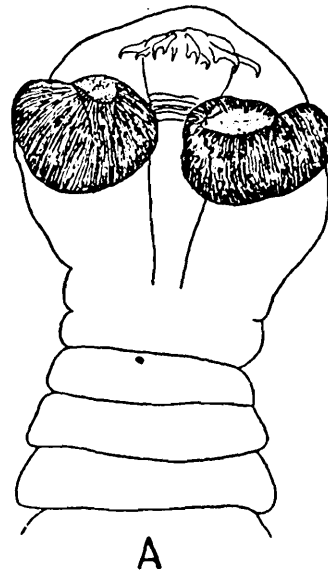


Fig. 17

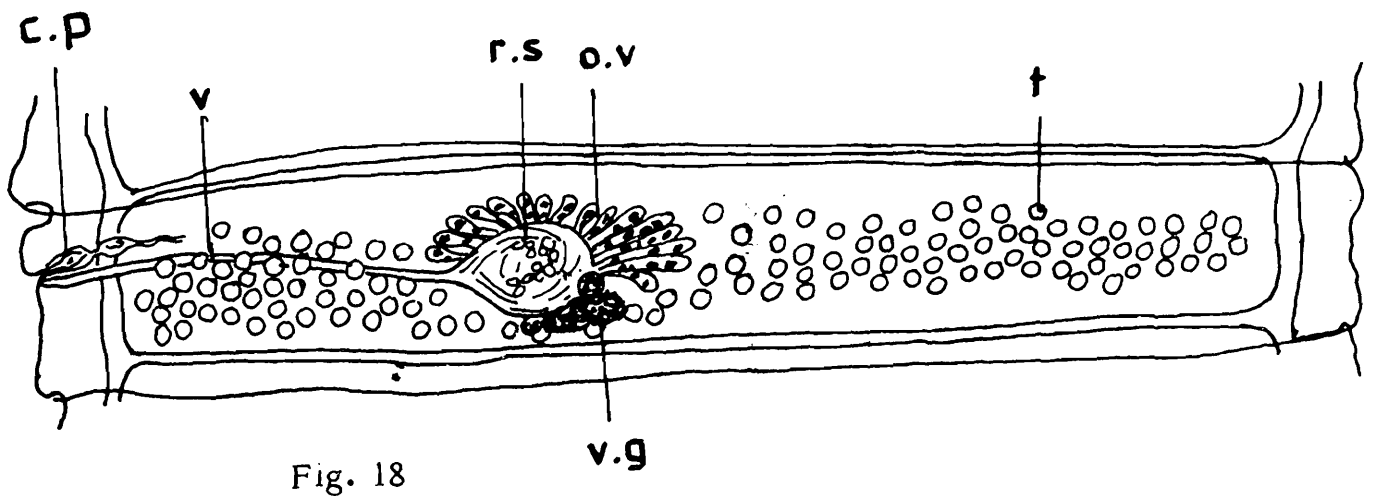


Fig. 18

Fig. 17. *Dilepis campylancristrota*, A-Head $\times 240$; B- resteller hook $\times 530$; C- Mature segment $\times 200$. Fig. 18. *Aporina delafondi*.

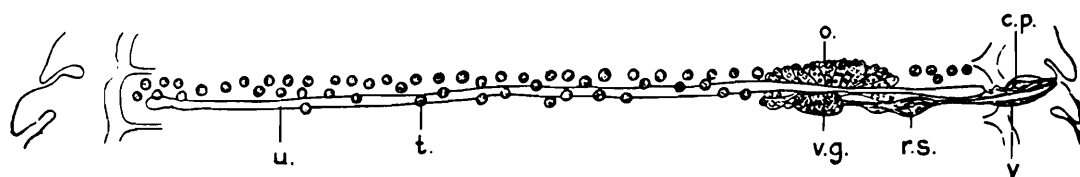


Fig. 19

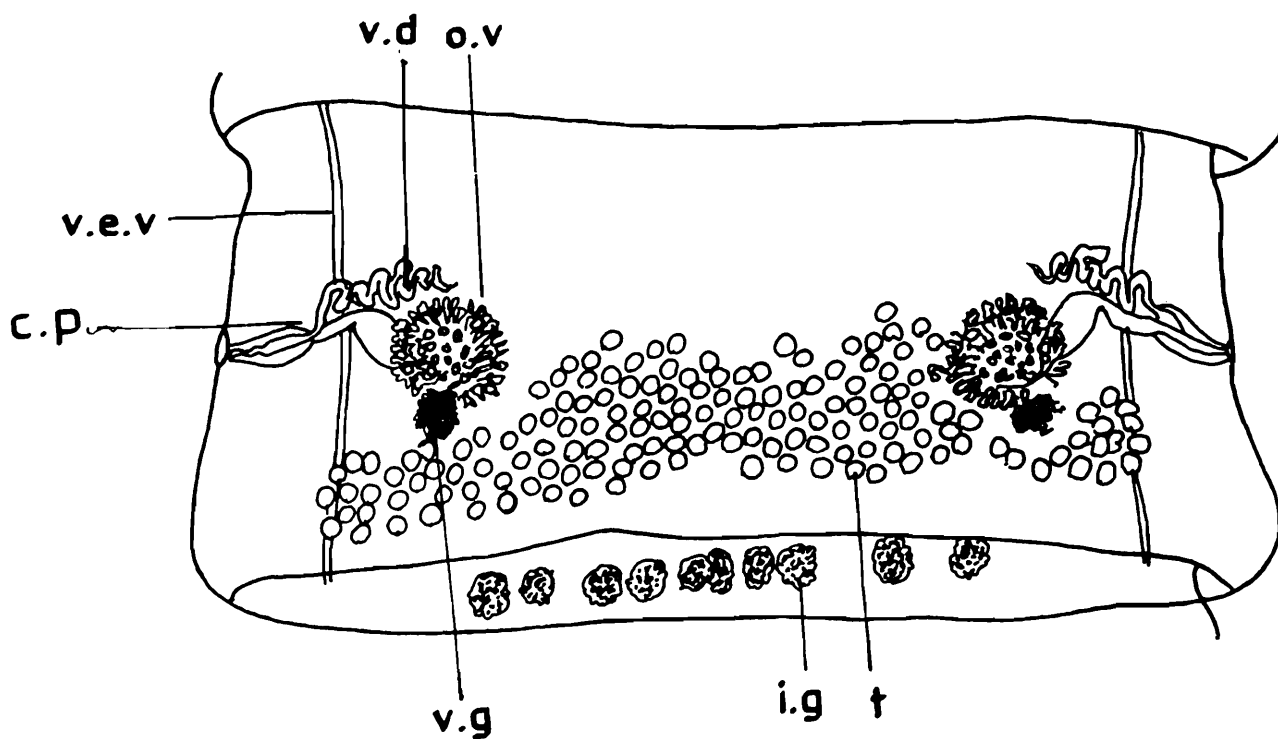


Fig. 20

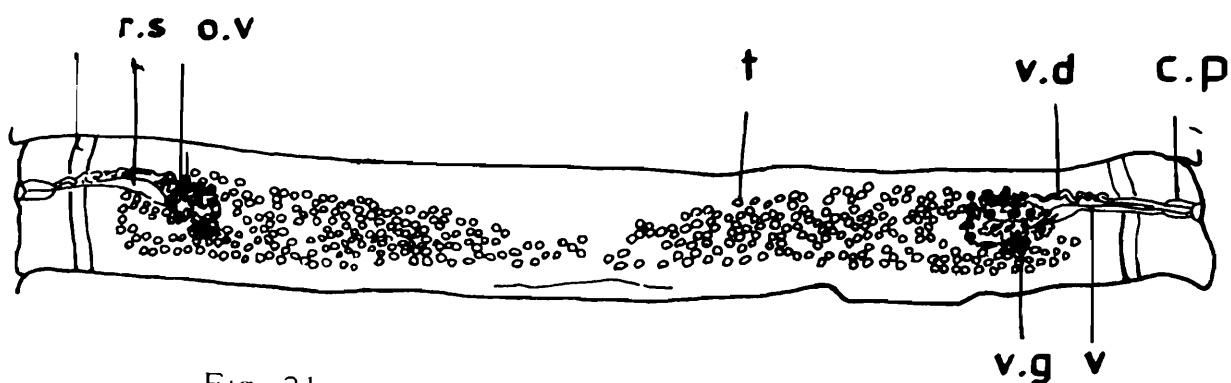


Fig. 21

Fig. 19. *Bertiella studeri*; Fig. 20. *Moniezia expansa* (Matured segment $\times 37$); Fig. 21. *Moniezia benedani* (Matured segment $\times 17$).

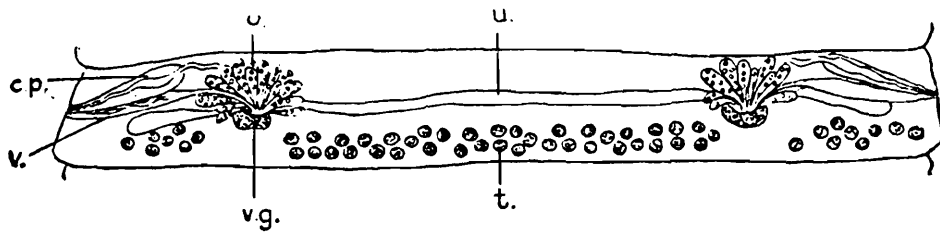


Fig. 22

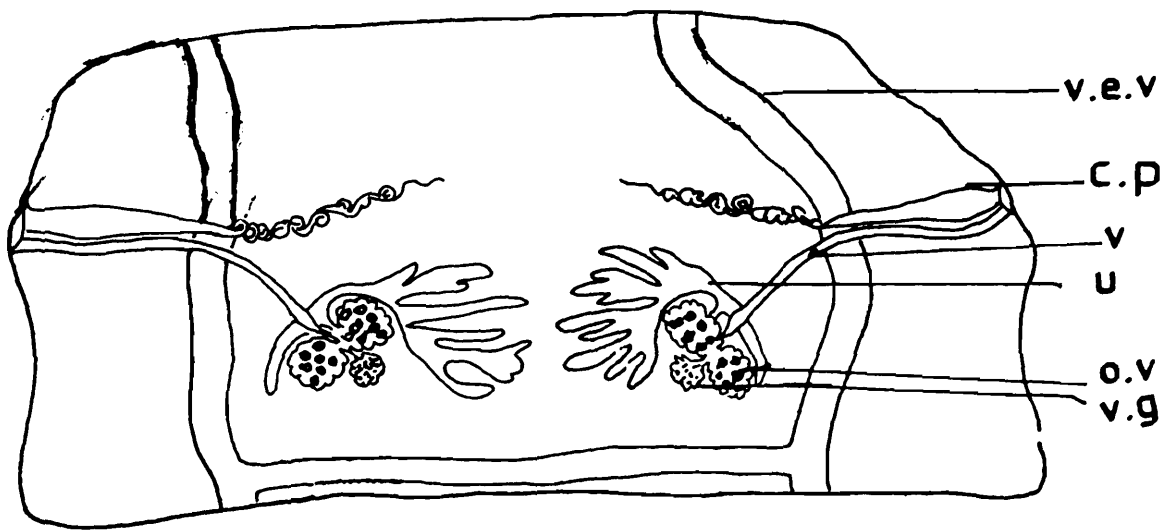


Fig. 23

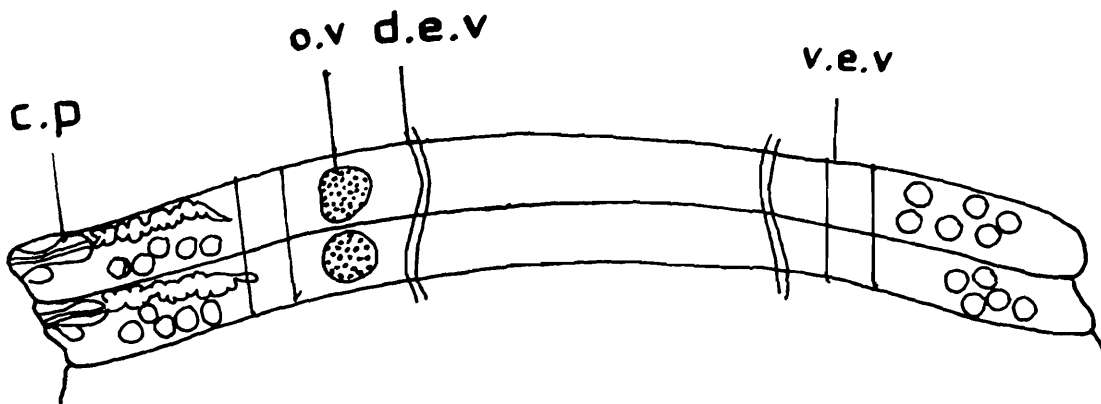


Fig. 24

Fig. 22. *Mesgovoyia pectinata*; Fig. 23. *Peronia columbae* (Matured segment $\times 33$); Fig. 24. *Stilesia vittata* (Matured segment $\times 74$).

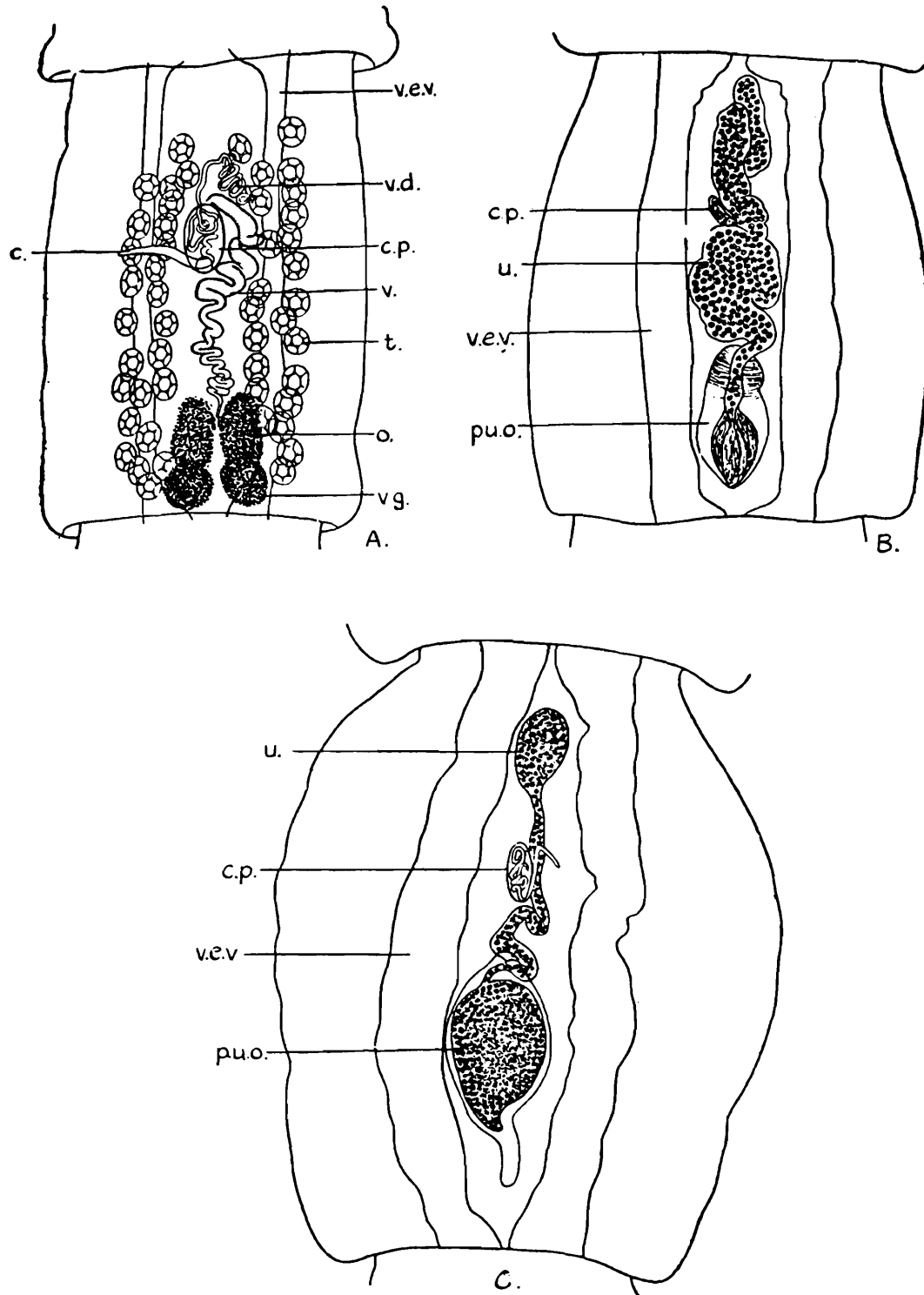


Fig. 26

Fig. 26. *Mesocestoides lineatus*, A-Matured segment $\times 53$; B- Gravid segment; C. Gravid segment.

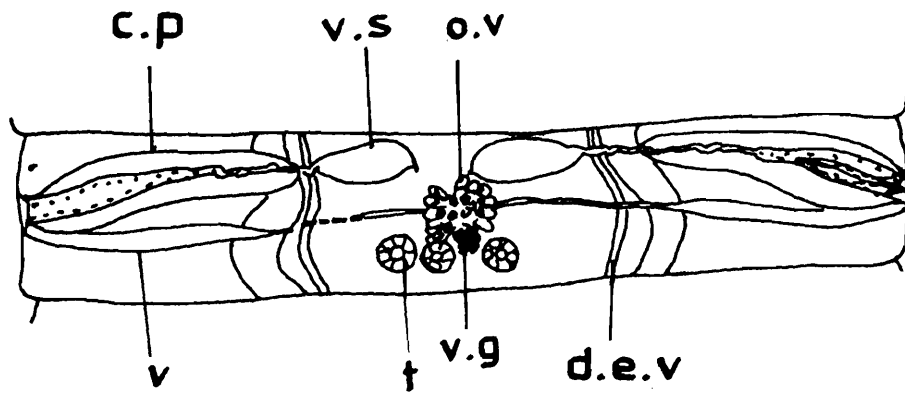


Fig. 25

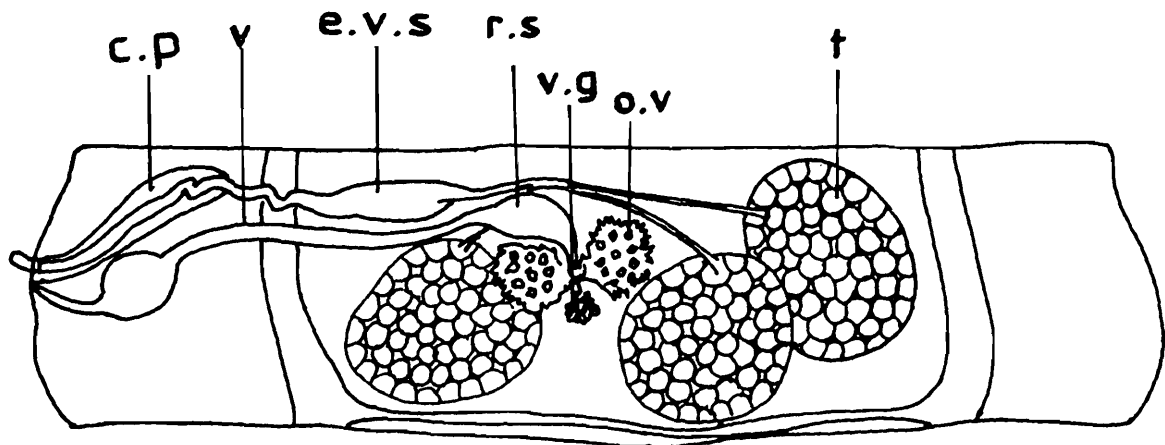


Fig. 27

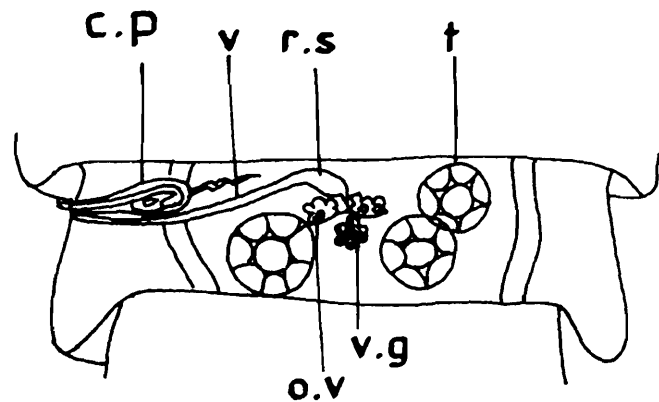


Fig. 28

Fig. 25. *Diploposthe laeris* (Matured segment $\times 74$). Fig. 27. *Hymenolepis diminuta* (Matured segment $\times 128$). Fig. 28. *Hymenolepis farciminoso* (Matured segment $\times 74$).

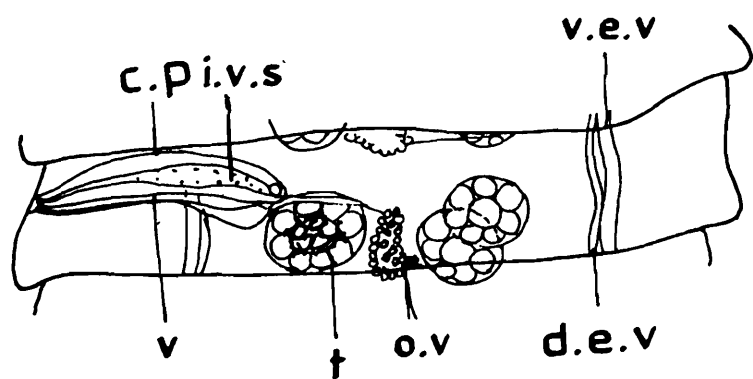


Fig. 29

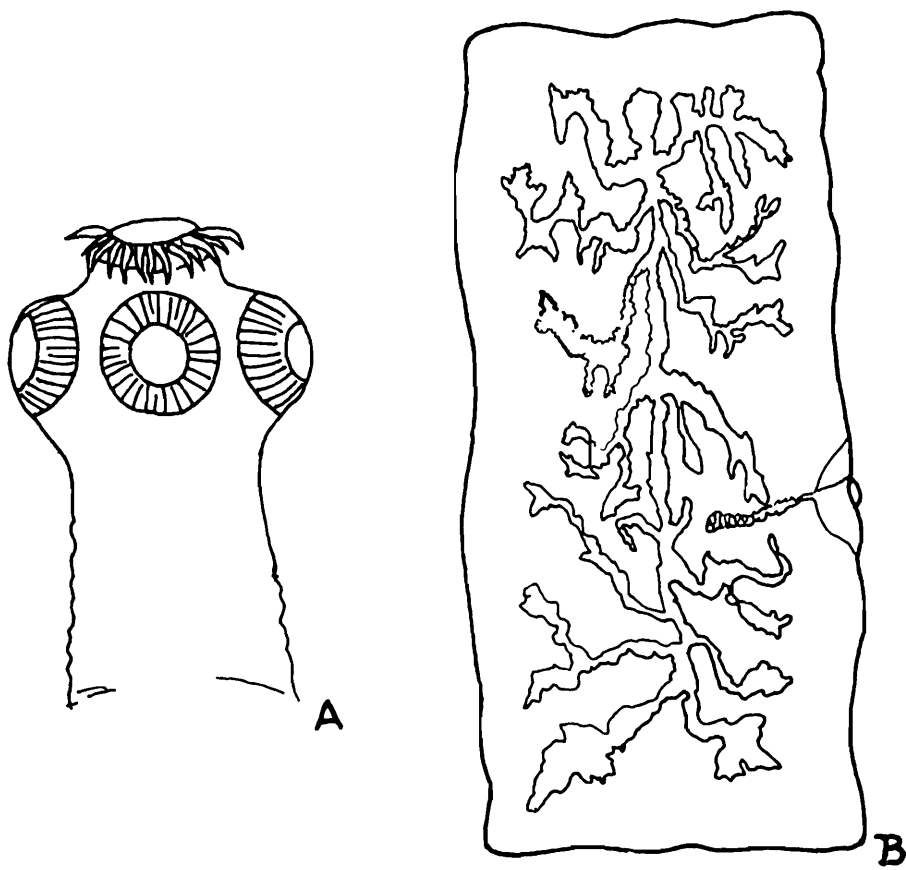


Fig. 30

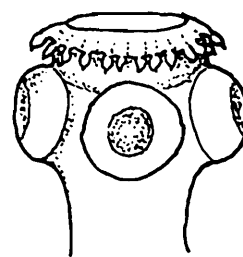


Fig. 31

Fig. 29. *Hymenolepis fusa* (Matured segment $\times 136$). Fig. 30. *Taenia solium*. A-Head (Matured segment $\times 42$); B-gravid segment $\times 8$. Fig. 31. *Gangesia bengalensis*.

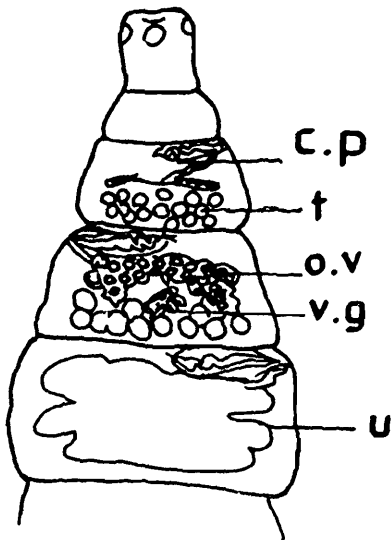


Fig. 32

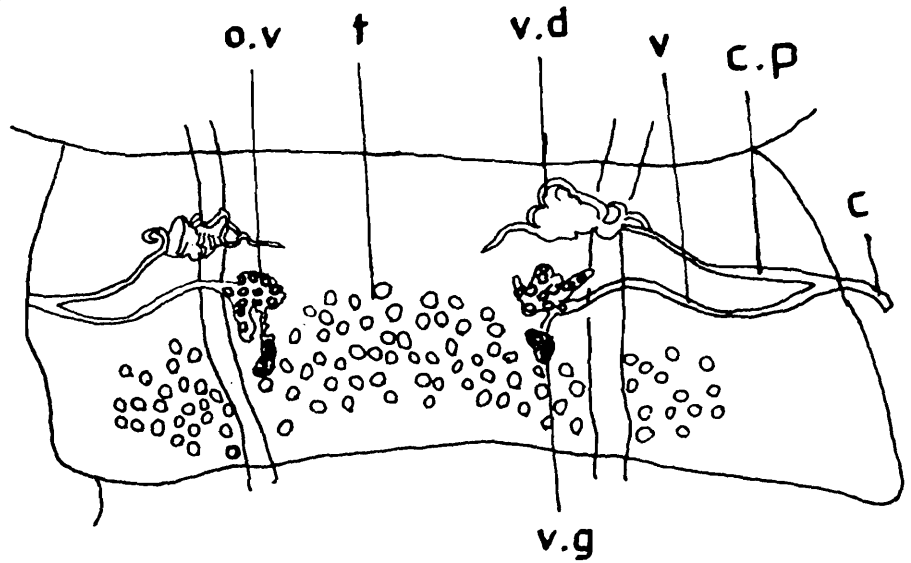


Fig. 33

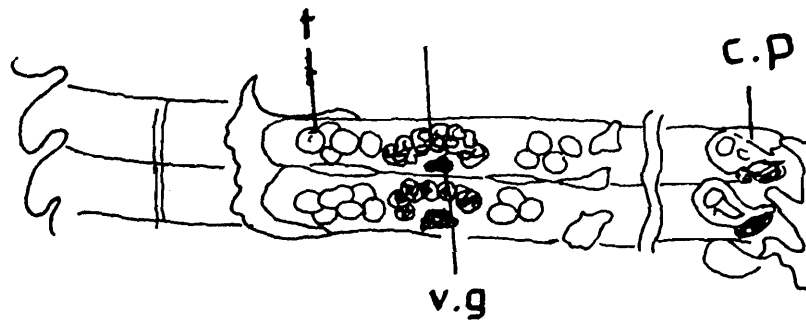


Fig. 34

Fig. 32. *Davainea proglottina* (Matured segment $\times 67$). Fig. 33. *Cotugnia digonophora* (Matured segment $\times 268$). Fig. 34. *Raillietina (R.) polychalix* (Matured segment $\times 142$).

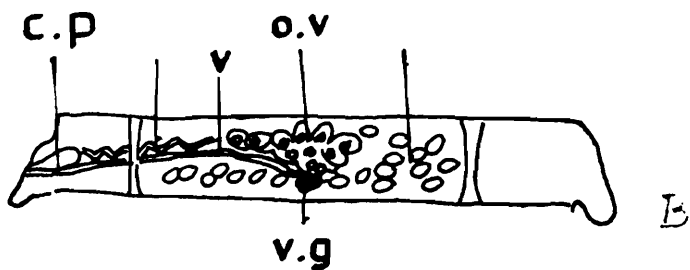
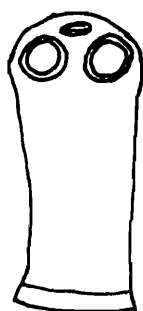


Fig. 35



A

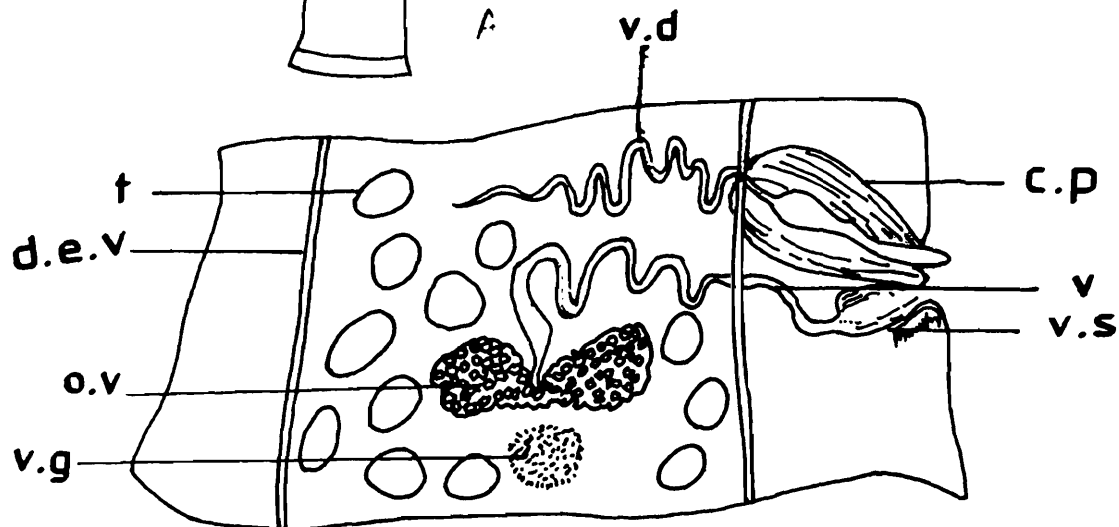


Fig. 36

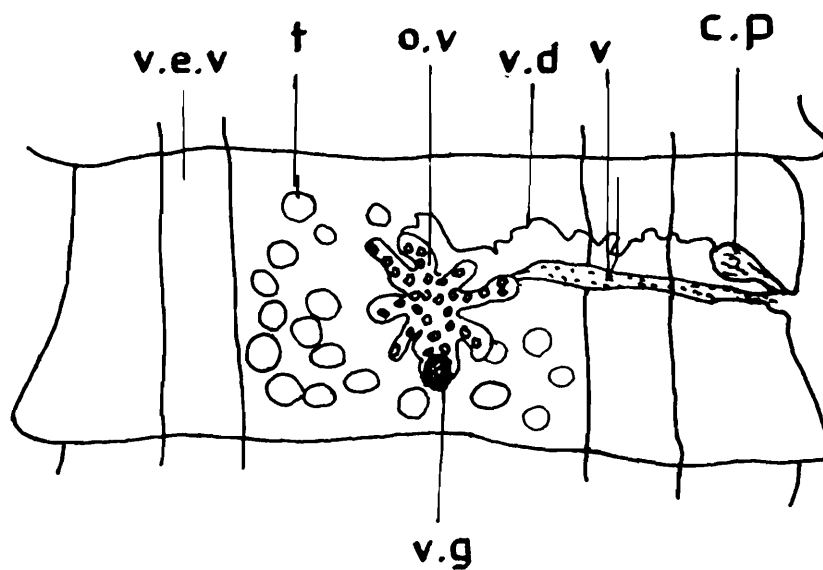


Fig. 37

Fig. 35. *Raillietina (R.) friedbergerei*. A Head; B- Mature segment. Fig. 36. *Raillietina (R.) fuhrmanni* (Mature segment $\times 215$). Fig. 37. *Faillietina (Fuhrmannetta) echinobothrida* (Mature segment $\times 75$).

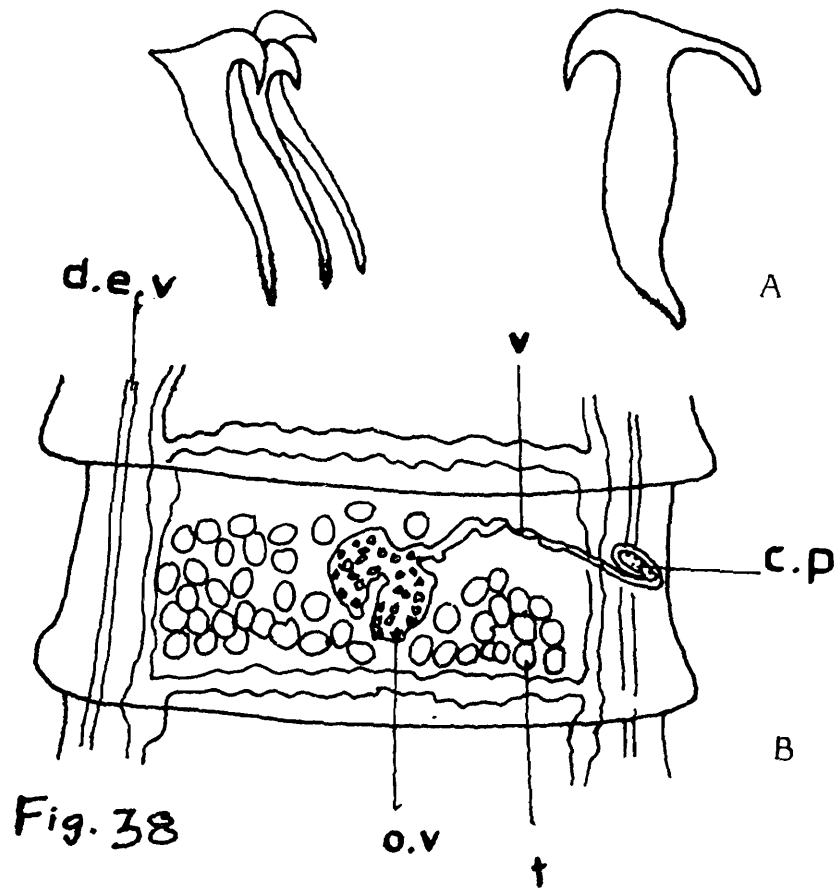


Fig. 38

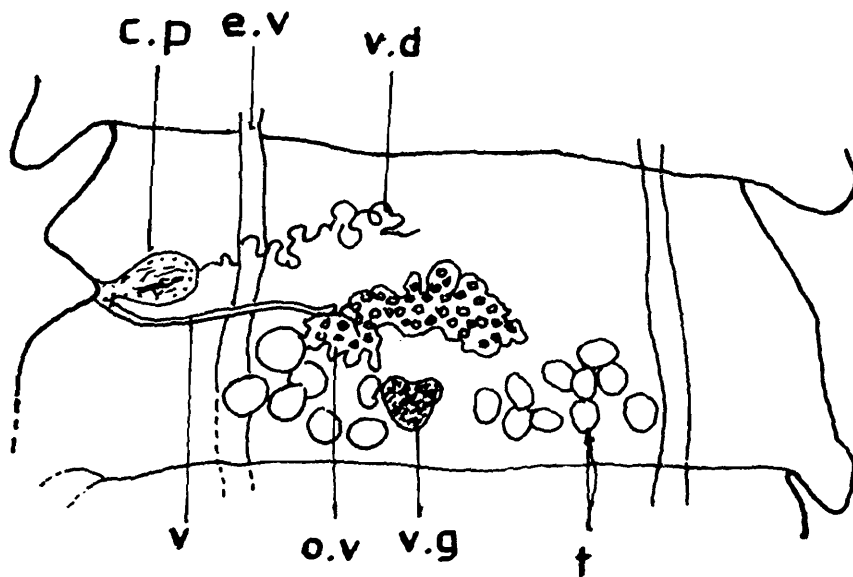


Fig. 39

Fig. 38. *Raillietina (Paroniella) urogalli*. A-rostellar hooks; B Matured segment. Fig. 39. *Raillietina (Skrjabinia) cesticillus* (Matured segment $\times 61$).

Classified list of Cestode hosts from West Bengal

| Host | Parasite |
|------------------------------------|---|
| <i>MAMMALIA</i> | |
| Order PRIMATES | |
| Family PONGIDAE | |
| ** <i>Simia satyrus</i> | |
| = <i>Pongo pygmaeus</i> (Linnaeus) | : <i>Bertiella studeri</i> Blanchard, 1891 |
| Orang-Utang | : <i>Bertiella studeri</i> Blanchard, 1891 |
| Family HYLOBATIDAE | |
| <i>Hylobates hoolock</i> (Harlan) | |
| (Hoolock Gibbon) | |
| Family HOMINIDAE | |
| <i>Homo sapiens</i> Linnaeus | : <i>Taeniarhynchus saginatus</i> (Goeze, 1782) <i>Taenia solium</i> (Linnaeus, 1758) |
| Order CARNIVORA | |
| Family CANIDAE | |
| <i>Canis</i> Sp. | |
| (Dog) | : <i>Taenia hydatigena</i> (Pallas, 1766) <i>Taenia pisiformis</i> (Bloch, 1780) <i>Echinococcus granulosus</i> (Zeder, 1803) <i>Multiceps serialis</i> (Gervais, 1847) <i>Multiceps gaigeri</i> Hall 1916 <i>Dipylidium caninum</i> (Linn., 1758) |
| * <i>Canis aureus</i> Linnaeus | : <i>Multiceps multiceps</i> (Leske, 1780) |
| (Asiatic jackal) | |
| Family FELIDAE | |
| <i>Felis viverrina</i> Bennett | : <i>Joyeuxiella gervaisi</i> (Setti, 1895) |
| (fishing Cat) | |
| <i>Felis</i> sp. | : <i>Dipyllobothrium decipiens</i> (diesing, 1850) |
| (Cat) | : <i>Dipylidium caninum</i> (linnaeus, 1758) <i>Taenia pisiformis</i> (Bloch, 1780) <i>Taenia crassiceps</i> Zeder, 1800 |
| <i>Felis leo</i> | : |
| * = <i>Panthera leo</i> Linnaeus | : <i>Taenia pisiformis</i> (Bloch, 1780) |
| (Lion) | |

| Host | Parasite |
|---|---|
| <i>Felis pardus</i> | |
| * = <i>Panthera pardus</i> Linnaeus (Leopard) | : <i>Raillietina corvina</i> (Fuhrmann, 1905) |
| <i>Felis tigris</i> | |
| = <i>Panthera tigris</i> Linnaeus (Tiger) | : <i>Mesocestoides lineatus</i> (Goeze, 1782) |
| | <i>Taenia pisiformis</i> (Bloch, 1780) |
| Family VIVERRIDAE | |
| <i>Paradoxurus grayi</i> | |
| * = <i>Paguma larvata grayi</i> (Bennett) (Masked Palm civet) | : <i>Dipylidium caninum</i> (Linnaeus, 1758) |
| * Not recorded from West Bengal. Parasite recorded from zoo-animals | |
| ** Not recorded from India. Parasite recorded from zoo-animals | |
| * <i>Paradoxurus hermaphroditus</i> (Pallas) (Common Palm civet/Toddy cat) | : <i>Dipylidium caninum</i> (Linnaeus, 1758) <i>Joyeuxiella gervaisi</i> (Setti, 1895) |
| Order PERIASSODACTYLA | |
| Family EQUIDAE | |
| Horse and Dunkey | : <i>Anoplocephala magna</i> (Abildgaard, 1789) Sprengel, 1905 |
| Order ARTIODACTYLA | |
| Family BOVIDAE | |
| <i>Antelope cervicapra</i> (Linnaeus) (Black buck) | : <i>Moniezia expansa</i> (Rudolphi, 1810) |
| <i>Bos sp.</i> (Cow) | : <i>Moniezia expansa</i> (Rudolphi, 1810) <i>Moniezia benedeni</i> (Moniez, 1879) |
| <i>Capra sp.</i> (Goat) | : <i>Moniezia expansa</i> (Rudolphi, 1810) <i>Moniezia benedeni</i> (Moniez, 1879) |
| <i>Bubalus sp.</i> | : <i>Avitellina centripunctata</i> (Rivolta, 1874) |
| <i>Bos sp.</i> (ox) | : <i>Moniezia benedeni</i> (Moniez, 1879) |
| <i>Cattle</i> | : <i>Avitellina centripunctata</i> (Rivolta, 1874) <i>Stilesia globipunctata</i> (Rivolta, 1874) |

| Host | Parasite |
|---|---|
| * <i>Tetracerous quadricornis</i> (Blainville) (Four horned antelope, Chousingha) <i>Tetracerus</i> sp. | : <i>Moniezia expansa</i> (Rudolphi, 1810) : <i>Taenia hydatigena</i> Pallas, 1766 |
| Order LAGOMORPHA Family LEPORIDAE <i>Lepus hispidus</i> | : <i>Mosgovoyia pectinata</i> (Goeze, 1782) |
| = <i>Caprolagus hispidus</i> (Pearson) (Assam rabbit/Hispid hare) Order RODENTIA Family MURIDAE <i>Mus decumanus</i> = <i>Rattus norvegicus</i> (Rat) | : <i>Cysticercus fasciolaris</i> <i>Oochoristica symmetrica</i> <i>Railliatina celebensis</i> |
| AVES | : <i>Hymenolepis diminuta</i> (Rudolphi, 1819) <i>H. nana</i> (Siebold, 1852) |
| Order PODICIPEDIFORMES Family PODICIPEDIDAE <i>Podiceps albipennis</i> = <i>Podiceps ruficollis</i> (Pallas) (Little grebe) | : <i>Dioecocestus novae-guineae</i> Fuhrmann, 1914 |
| Order PELECANIFORMES Family PELECANIDAE <i>Pelicanus Philippensis</i> Gmelin (Spottedbilled Pelican) | : <i>Hymenolepis medici</i> (Stossich, 1890) |
| Order CICONIIFORMES Family ARDEIDAE <i>Herodias garzetta</i> = <i>Egretta garzetta</i> (Linnaeus) (Little Egret) | : <i>Dilepis campylancristrota</i> Fuhrmann, 1908 |
| <i>Ardeola grayii</i> (Sykes) (Pond heron) | : <i>Dilepis campylancristrota</i> Fuhrmann, |
| <i>Ardea purpurea</i> Linnaeus (Purple heron) | : <i>Lateriporus spinosus</i> Fuhrmann, 1922 |

| Host | Parasite |
|--|--|
| Order ANSERIFORMES | |
| Family THRESKIORNITHIDAE | |
| * <i>Platalea Leucorodia</i> Linnaeus (Spoonbill) | : <i>Cyclorchida omalancristrota</i> (Wedl, 1856) |
| Family ANATIDAE | |
| <i>Nyroca baeri</i> = <i>Aythya baeri</i> (Radde) (Bear's Pochard) | : <i>Diploposthe laevis</i> (Bloch, 1782) |
| <i>Tadorna cornuta</i> = <i>Tadorna tadorna</i> (Linnaeus) (Common Shelduck) | : <i>Hymenolepis simplex</i> Fuhrmann, 1906 |
| Family ANATIDAE | |
| <i>Anas sp.</i> (Domestic duck) | : <i>Echinocotyle rosseteri</i> Blanchard, 1891 |
| Order CYCONIIFORMES | |
| Family PHOENICOPTERIDAE | |
| * <i>Phoenicopterus roseus</i> Pallas (Flamingo) | : <i>Hymenolepis gracilis</i> (Zeder, 1803) : <i>Flamingolepis liguloides</i> (Gervais, 1847) : <i>F. megalorchis</i> (Luhe, 1898) |
| Order GALLIFORMES | |
| Family PHASIANIDAE | |
| <i>Gallus gallus murgii</i> Robinson and Kloss (Red Jungle fowl) | : <i>Raillietina</i> (F) <i>echinobothrida</i> (Megnin, 1880) |
| <i>Mask domestica</i> (Trogopan pheasant) | : <i>Raillietina</i> (<i>Raillietina</i>) <i>tetragona</i> Molin, 1858 <i>Raillietina tragopani</i> southwell, 1922 |
| Order CHARADRIIFORMES | |
| Family LARIDAE | |
| <i>Larus brunneicephalus</i> Jerdon (Brown headed Gull) | : <i>Hymenolepis fusa</i> (Krabbe, 1869) |
| Family CHARADRIIDAE | |
| <i>Gallinago minima</i> (Brunnich) (Snipe) | : <i>Hymenolepis capinaroides</i> (Fuhrmann, 1906) |

| Host | Parasite |
|---|---|
| <i>Gallinago solitaria</i> Hodgson | : <i>Echinocotyle rosseteri</i> Blanchard, 1891 <i>Choanotaenia decacantha</i> Fuhrmann, 1913 |
| = <i>Capella</i> sp. (Solitary Snipe) | |
| Order COLUMBIFORMES | |
| Family COLUMBIDAE | |
| <i>Columba livia intermedia</i> Strickland (Blue Rock Pigeon) | : <i>Aporina delafondi</i> Railliet, 1892 <i>Paronia columbae</i> Fuhrmann, 1902 <i>Raillietina</i> (F) <i>Korkei</i> Joyeux and Houdemer, 1928 |
| <i>Crocopus Phoenicopterus</i> | : <i>Raillietina</i> (R.) <i>fuhrmanni</i> (Southwell, 1922) |
| = <i>Treron phoenicopterus</i> (Green Pigeon) | : <i>Raillietina</i> (R.) <i>spiralis</i> (Baczynska, 1914) <i>Raillietina</i> (R.) <i>ceylonica</i> (Baczynska, 1914) |
| <i>Crocopus phayrei</i> | : <i>Raillietina</i> (R.) <i>fuhrmanni</i> (Southwell, 1922) |
| <i>Alectoris graea chukar</i> (J.E. Gray) (Partridge Pheasant) | : <i>Raillietina urogalli</i> (Modeer, 1790) |
| <i>Columba leuconota</i> Vigars (White bellied Pigeon) | : <i>Raillietina</i> (R.) <i>ceylonica</i> (Baczynska, 1914) |
| Family PTEROCLIDIDAE | |
| * <i>Pterocles exustus</i> = <i>Psittalula raseata</i> (Indian Sandgrouse) | : <i>Raillietina</i> (R.) <i>Cohni</i> (Baczynska, 1914) Fuhrmann, 1920 |
| Order PSITTACIFORMES | |
| Family PSITTACIDAE | |
| <i>Lurius rosatus</i> (Parrot) | : <i>Raillietina</i> (R.) <i>macroscolecina</i> Fuhrmann, 1908 : <i>Cotugnia fastigata</i> Meggitt, 1920 |
| Order CUCULIFORMES | |
| Family CUCULIDAE | |
| <i>Cuculus varius</i> Vahl (Common Hawk cuckoo, Brain fever Bird) | : <i>Anomotaenia acollis</i> Fuhrmann, 1907 |
| <i>Centropus rubipensis</i> | : <i>Raillietina</i> (S) <i>centropi</i> (Southwell, 1922) |
| Order PASSERIFORMES | |
| Family EMBERIZIDAE | |
| <i>Melophus melanicterus</i> (Crested bunting) | : <i>Choanotaenia microsoma</i> Southwell, 1922 |

| Host | Parasite |
|---|--|
| Order PICIFORMES | |
| Family PICIDAE | |
| <i>Brachypterns aurantius</i> = <i>Dinopium benghalense benghalense</i> (Linnaeus) (golden backed woodpecker) | : <i>Raillietina cruciata</i> (Rudolphi, 1819) |
| Order PASSERIFORMES | |
| Family PLOCEIDAE | |
| <i>Ploceus atrigula</i> = <i>Ploceus philippinus</i> (Linn.) (Baya) | : <i>Choanotaenia microsoma</i> southwell, 1922 : <i>Passerilepis zosteropis</i> (Fuhrmann, 1918) |
| <i>Ploceus passerinus</i> | : <i>Passerilepis zosteropis</i> (Fuhrmann, 1918) |
| Family MUSCICAPIDAE | |
| <i>Geocichla citrina</i> = <i>Zoothera citrina</i> (Latham) (Orange header Ground Thrush) | : <i>Cyclorchida foteria</i> Meggitt, 1933 |
| Family CORVIDAE | |
| <i>Dendrocitta leucogastra</i> Gould (southern Tree Pie) | : <i>Dilepis cypselina</i> Neslobinsky, 1911 |
| <i>Dendrocitta rufa</i> = <i>Dendrocitta vagabunda</i> (Latham) (Indian Tree Pie) | : <i>Rhabdometra dendrocitta</i> Woodland, 1929 |
| <i>Corvus macrorhynchus</i> Wagler (Jungle Crow) | : <i>Hymenolepis farciminosa</i> (Goeze, 1782) |
| <i>Corvus splendens</i> Vieillot (House Crow) | : <i>Raillietina corvina</i> (Fuhrmann, 1905) |
| <i>Cissa chinensis</i> (Boddaert) | : <i>Passerilepis zosteropis</i> Fuhrmann, 1918 |
| * <i>Pica rustica</i> | : <i>Raillietina cruciata</i> (Rudolphi, 1819) |
| Family PYCNONOTIDAE | |
| * <i>Criniger flaveolus</i> (White throated Bulbul) | : <i>Passerilepis zosteropis</i> Fuhrmann, 1918 |
| Family EMBERIZIDAE | |
| ** <i>Melophus melanicterus</i> Gmelin | : <i>Passerilepis zosteropis</i> Fuhrmann, 1918 |
| REPTALIA | |
| Order SQUAMATA | |
| Suborder SAURIA | |
| Family VARANIDAE | |

| Host | Parasite |
|--|---|
| <i>Varanus bengalensis</i> (Daudin) (Common Indian Monitor) | : <i>Duthiersia expansa</i> Perrier : <i>Acanthotaenia beddardi</i> Woodland, 1925 |
| * <i>Varanus nebulosus</i> (Gray) (Clouded Moitor) | : <i>Acanthotaenia biroi</i> Ratz, 1960 |
| Suborder SERPENTES | |
| Family BOIDAE | |
| <i>Python reticulatus</i> (Schneider) (Reticulated Python) | : <i>Bothridium pithonis</i> Blainville, 1824 |
| Family ELAPIDAE | |
| <i>Bangurus caeruleus</i> (Schneider) (Common Indian Krait) | : <i>Ophiotaenia calmetti</i> Borros, 1898 |
| <i>Naja tripudians</i> = <i>Naja naja</i> (Linnaeus) (India Cobra) | : <i>Ophiotaenia naie</i> Beddard, 1913 |
| AMPHIBIA | |
| Order ANURA | |
| Family BUFONIDAE | |
| <i>Bufo melanostictus</i> Schneider (Common Indian Toad) | : <i>Nematotaenia dispar</i> (Goeze, 1782) |
| Fishes | |
| Order CLUPEIFORMES | |
| Family CLUPEIDAE | |
| <i>Hilsa ilisha</i> (Hamilton) (River Shad) | : <i>Pterobothrium filicolle</i> (Linton, 1889) |
| Order CYPRINIFORMES | |
| Family CYPRINIDAE | |
| <i>Danio aequipinnatus</i> Mc Clelland (Danio) | : <i>Ligula intestinalis</i> (Linnaeus, 1758) (Larvae) |
| <i>Labeo calbasu</i> (Hamilton) (Kalbasu) | : <i>Ligula intestinalis</i> (Linnaeus, 1758) (Larvae) |
| <i>Labeo rohita</i> (Hamilton) (Rohu) | : <i>Ligula intestinalis</i> (Linnaeus, 1758) (Larvae) |
| | : <i>Gangesia bengalensis</i> (Southwell, 1913) |
| | : <i>Senga ophiocephalina</i> (Tseng, 1933) |
| | : <i>Anchistrocephalus</i> sp. |

| Host | Parasite |
|---|--|
| Family COBITIDAE (Loaches) | |
| <i>Lepidocephalichthys guntea</i> (Hamilton) | : <i>Lytocestoides lepidoccephali</i> Kundu, 1985 |
| <i>Nemacheilus rupicola</i> (Mc Clelland) | : <i>Ligula intestinalis</i> (Linnaeus, 1758) (Larvae) |
| Order SILURIFORMES | |
| Family CLARIIDAE (Air breathing Catfishes) | |
| <i>Clarias batrachus</i> (Linnaeus) | : <i>Djombangia penetrans</i> Bovien, 1926 : <i>Djombangia indica</i> Kundu, Bhattacharya and Dutta, 1986 : <i>Lytocestus indicus</i> (Moghe, 1925) : <i>Lytocestus longicollis</i> Ramadevi, 1973 |
| Family HETEROPNEUSTIDAE | |
| <i>Heteropneustes fossilis</i> (Bloch) (Stinging Catfish) | : |
| Family SILURIDAE | |
| <i>Wallago attu</i> (Schneider) (Freshwater Shark) | : <i>Gangesia bengalensis</i> (Southwell, 1913) |
| Family BAGRIDAE | |
| <i>Mystus aor</i> (Hamilton) (= <i>Macrones aor</i>) | : <i>Gephyrolina paragonopora</i> Woodland, 1923 |
| <i>Mystus seenghala</i> (Sykes) (giant River Catfish) | : <i>Gephyrolina paragonopora</i> Woodland, 1923 |
| Order CHANNIFORMES | |
| Family CHANNIDAE (Snake head fishes) | |
| <i>Ophiocephalus striatus</i> = <i>Channa striatus</i> (Bloch) | : <i>Gangesia bengalensis</i> southwell, 1913 : <i>Senga ophiocephalina</i> (Tseng, 1933) |
| Order LAMNIFORMES | |
| Suborder LAMNOIDEI | |
| Family ORECTOLOBIDAE | |

| Host | Parasite |
|--|---|
| <i>Ginglymostoma concolor</i> = <i>Nebrius ferrugineus</i> (Lesson) (Giant sleepy-shark) | : <i>Pedibothrium hutsoni</i> (Southwell, 1911) |
| Order PERCIFORMES | |
| Suborder SCOMBROIDEI | |
| Family SCOMBRIDAE | |
| <i>Cybium guttatum</i> = <i>Scomberomorus guttatus</i> (Bloch & Schneider) (Mackerel) | : <i>Tetrarhynchus sp.</i> |
| <i>Rhyncobatis olyddensis</i> | : <i>Acanthobothrium coronatum</i> (Rudolphi, 1819) |

SUMMARY

A comprehensive account of a cestodes so far recorded from West Bengal is incorporated in the present work. Key for the identification of families, genera and species have been included along with salient diagnostic character of each species, distribution range of the species have been indicated. In all, 93 species under 50 genera and 18 families have been recorded. Host parasite list of cestodes so far recorded from different group of vertebrates has also been appended.

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**PLANT PARASITIC NEMATODES
(TYLENCHIDA : NEMATODA)**

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INTRODUCTION

Tylenchid nematodes affect human society and economy in so many ways, particularly by inflicting heavy losses on our commercial food crops, fibre, fodder, timber and forest resources. Any single crop can hardly escape their attack. The problems of these nematodes pose enormous, but the realisation of their real importance, as a vast and potential limiting factor in agricultural field, has only recently received world wide attention, after a good number of publications on tylenchida were published in last three decades.

Tylenchids occurs in all possible habitats in soil, water and plants. Their greatest diversity of form occurs amongst parasites of roots. A handful of moist soil from the rhizosphere of any plant should normally yield more than two or three species. A grain of galled wheat might contain upto 30,000 nematodes. One gram of coconut roots may yield more than 4000 *Radopholus* (Koshy *et.al.*, 1976).

Tylenchid nematodes move very slow in soil, plant tissue or water and the movement may be random, or oriented towards the source of stimuli. There are evidences that several highly adapted root parasites (e.g. Heteroderidae) have co-evolved with their hosts (Krall & Krall, 1970). Some tylenchids show great ability to withstand desiccation and extreme adverse environment condition, like, extreme minus degree temperatures; on the opposite, maximum hot temperatures as in hot springs.

In India, there had never been a trial to assess the crop losses due to these pests, in terms of gross national productivity. But how minimum this can be ? Say if it is 2-5 %, even then, a developing country like our India, can ill afford to lose that staggering total of millions of rupees.

According to Thorne (1961) the modern research on nematology (other than animal parasitic helminths), really began with the publication of a monograph on Anguithelidae by Bastian (1965). Then after through a series of excellent and monumental works & publications of a great number of pioneer workers like N.A. Cobb (1890-1933). Thorne (1936-1975). Orley (1881), Goodey, Jones, Coomans, Oostenbrink, Raski, Tarjan, Krall, Siddiqi, Jairajpuri, Luc, Loof, Fortuner and many others; in the last three decades, we have got about 230 papers, only on the taxonomy of tylenchids, beside other papers on Bio-ecology, pathogenecity, morphology, bionomics, biochemistry and control work etc. The contribution made by De man needs special mention, and this is his formula for giving body dimentions of nematodes (plant and soil) is still universally used in taxonomic studies. The work of an Indian scientist (now in International Institute of Parasitology, London) Prof. M.R. Siddiqi, particularly his comprehensive publication on Tylenchida (1986) should be taken as landmark in the history of Tylenchid taxonomy.

In India first plant parasitic nematode (root-knot) were reported by Barber (1901) from tea gardens, and Butler (1906) from black pepper plants in Kerala. Butler again reported 'Ufra' disease in rice caused by *Tylenchus angustus* (= *Ditylenchus angustus*) from Bengal (now Bangladesh).

Goodey (1951) described two new species from India. Starting from 1959-60 in the last three decades, different institutes and scientists have worked on plant parasitic nematodes. Of them two prominent schools almost parallaly started, one at Aligarh Muslim University (in the department of Zoology and botany both) (with Prof. Basir, Siddiqi, S.H. Khan, Jairajpuri, Azmi, Ahmad, A.M. Khan, W. Khan, Alam, Saxena, Haseeb, Husain and many others) and the other in Indian Agricultural Research Institute, (N. Delhi) (with Seshadri, Prasad, Swarup, Sethi, Khan, Dasgupta, Sanwal, Chawla and many others). Many other University and research institutes now have initiated research on plant nematodes.

Now when the world fauna of Tylenchids consists about 216 valid genera and 2200 species, in India we have records of about 85 genera and 560 species belonging to 17 families (Baqri, 1991). This present paper on Tylenchid fauna of West Bengal consists only 52 species belonging to 26 genera and 10 families.

A list of survey conducted in West Bengal and the areas covered is given below :

| <i>Year & Month</i> | <i>Areas covered</i> | <i>Conducted by</i> |
|-----------------------------|--|-----------------------------|
| (1) 1977 November | 3 blocks of Burdwan district | Dr. Q.H. Baqri & party |
| (2) 1979 March | 3 blocks of Birbhum district | Dr. Q.H. Baqri & party |
| (3) 1981 May | Darjeeling district | Dr. Q.H. Baqri & party |
| (4) 1982 May | 4 blocks of West Dinajpur district and 1 block of Murshidabad district | Dr. Q.H. Baqri & party |
| (5) 1983 October & November | Malda, Jalpaiguri and Darjeeling districts | Dr. Q.H. Baqri & party |
| (6) 1984 March | Burdwan, Hooghly, Bankura, Birbhum & Murshidabad districts | Dr. A. Chatterjee and party |
| (7) 1985 February & March | Bankura, Burdwan, Birbhum & Murshidabad districts | Dr. A. Chatterjee and party |
| (8) 1986 March | Bankura, Burdwan and Birbhum districts | Dr. A. Chatterjee and party |
| (9) 1986 September | Malda and Nadia districts | Dr. A. Chatterjee and party |
| (10) 1988 January | 24-Parganas and Midnapore districts | Dr. A. Chatterjee and party |

In West Bengal, when we have records of more than 250 Dorylaimids, (mainly due to the contribution of Baqri and his associates (1974 till date) the works of plant parasitic nematodes particularly on Tylenchida are relatively little, and that too were done mainly by two group of experts. First under the leadership of Khera (1970-77), who was associated with Chaturvedi (1970 till the date) and Singh. They have done a monographic work on nematodes associated with jute cultivation (Chaturvedi and Khera, 1979). Beside that they have also published, on some nematodes

associated with vegetable cultivation. After them, Baqri (1974 till date) associated with Jana, Ahamad and Sinha, had done and published good lot of work on tylenchids [the work under the leadership of Baqri were mainly done under an ICAR co-ordinated project on nematodes]. Beside the above two groups there were some sporadic reports like Banerjee (1966) Mukherjee (?) Sukul (?).

Survey tours for collection in West Bengal were conducted mainly by two group of scientists. First under the leadership of Dr. Q.H. Baqri and 2nd under the leadership of Dr. A. Chatterjee. During collection of soil samples, special emphasis were given, to collect the samples from rhizospheres of different crop like, paddy, citrus, mulberry, vegetable and other fruit trees and plants.

MATERIAL AND METHODS

During survey tours, collections were procured and processed through a series of procedures, a short account of which are given below :

Sampling – Samples of soils about 500 cc (in volume) each time, were collected from rhizosphere of different plants and crop, usually upto a depth of about 20 cm. from surface. The samples were taken in polythene bags, tied and labelled with name of collector, date of collection, name of the locality and record of host plants.

Processing – In the process of extraction and isolation of nematodes from soils, only one sample was taken in a plastic bucket, then the soil was mixed with water (about 7 litres) to prepare an uniform suspension. The soil-water suspension was thoroughly shaken and was put to rest (undisturbed) for about 20 seconds to allow the bigger stones, sands, other heavier material to settle down as sediment. The upper suspension was quickly passed through a coarse sieve to remove the floating debris etc. The filtrate then again was passed through a set of sieves of 100, 200, 300 mesh-size. The residue from each of the three sieves were taken into a beaker in fresh water.

The aliquot collected in the above manner was subjected to modified Bearmann's funnel floatation method (modified by Whitehead and Hemming, 1965) [That is aliquot of each sample was put on tissue paper on an aluminium net suspended in fresh and clear water in a petridish]. Each sample was allowed to be suspended for 48 hours. Then the debris and sediments on the tissue paper were rejected, and the clear water together with nematodes were taken in watch glass, and were examined under a low power binocular microscope and all the nematodes were picked up one by one with the help of a very fine needle, and were transferred to a second watch glass.

Killing fixation and dehydration – The nematodes thus collected, were killed by pouring hot water on them. Excess of water was again drawn out with the help of a fine dropper, and the nematodes were fixed in FAA solution. (Formalin (4%) 30 ml, glacial acetic acid 5 ml, absolute alcohol 100 ml, and distilled water 200 ml). The fixed nematodes (at least after 24 hours) were processed by slow glycerine method of dehydration (Thorne, 1961). The nematodes were transferred to 1% glycerine (ethanol 20 parts glycerine 1 part distilled water 79 parts). For quicker dehydration the watch glass with 1% glycerine were placed in a BOD incubator, where temperature were kept at 40°C. After about 7 days these were passed through 5% glycerine (ethanol 95 parts glycerine 5 parts). The nematodes were

kept in the glycerine solution till the other component evaporated, and only the glycerine was left. The nematodes were finally taken into pure and dehydrated glycerine.

Mounting, Sealing – Nematodes four to eight were mounted in a drop of pure and dehydrated glycerine on glass slides. Glass-wool supports of the same size as that of nematodes were always used under the cover slips to prevent any pressure on the specimens. The cover slips were sealed with glycerine adhesive.

Measurements and Drawings – The measurements were taken under stereoscopic microscope with the help of stage and oculo-micrometer. De Man's formula were used for denoting the dimensions of nematodes. The indices viz. L, a, b, b' etc. were adopted from standard works, on different group of nematodes. Drawings were done with the help of camera lucida.

MORPHOLOGY & TERMINOLOGY

Tylenchida are bilaterally symmetrical, elongate cylindroid, unsegmented pseudocoelomate animals, covered with a cuticular exo-skeleton secreted by the hypodermis (= epidermis). They have longitudinal muscles for locomotion, a terminal oral opening surrounded by bilaterally or radially arranged sensilla, protrusible stomatal stylet, a substylet orifice of the dorsal oesophageal gland, a circum-oesophageal or circum intestinal nerve ring, an excretory system with a single duct and renette cell, a pore-like anus directed outward, a true tail (post anal body portion) and they lack a circulatory system and motile cilia. They are phasmidian but also may not have phasmids.

Body wall and cuticle – The body wall consists of external cuticle, hypodermis and somatic muscle layer. The cuticle is the exoskeleton of nematodes. It is non cellular proteinaceous secretion of the hypodermis, covers the entire body, intrudes to line, stoma, oesophagus, excretory duct, vagina, rectum and cloaca. Fig. – 1.

Striae and body annules – In most of the nematodes, the body is transversely striated. The striations may be prominent or faint. The portion between two consecutive striae called body annule. The size shape and number of body annules has great significance in nematode taxonomy. (Fig – 1).

Lateral fields – Laterally the body cuticle is marked by longitudinal incisures (Lines, involutions) and may or may not be raised into longitudinal ridges or bands, often interrupting the transverse body striations or annules. The lines originate as a narrow area and gradually enlarges in mid body and at the tail end the number and size of the incisures may reduce.

Excretory system – In tylenchids, there is a single excretory cell or renette situated laterally or lateroventrally, usually in the post-oesophageal region, from which an excretory duct leads to the medioventral excretory pore. (Fig. – 1).

Nerve ring and other sense organs – The nerve ring encircles the isthmus of the oesophagus. Different nerve connections are named to use in taxonomic description. The 'hemizonid' is the major latero-ventral commissure near the excretory pore. The 'cephalids' are the anterior ones just behind the cephalic region. The 'hemizonion' occurring a little behind the hemizonid and 'caudalids' in the tail region.

Amphids – There are a pair of lateral chemoreceptors located in the cephalic region, usually close to the oral aperture. The amphid apertures may be slit-like, transversely, longitudinally or obliquely placed on the head.

Derides – In Tylenchidae and Merliniinae, derides are located in the centre of the lateral fields in the form of protuberances (Cervical papillae) without any opening outside. In Tylenchoidea and Hexatyliina derides are common, at or near the level of excretory pore.

Phasmids – Phasmids are chemoreceptors on the tail of the tylenchida but may also be located in the preanal region or erratically placed in the body. (Fig. 3E, F)

Cephalic region Cephalization or possession of head is suggested by presence of cuticular cephalic frame work and the juxtaposition of the oral opening, sensilla and amphid apertures. The Cephalic region (= lipregion) may or may not be marked off from the body by a depression, constriction or expansion. The base of cephalic region is the transverse line passing through the basal plate. Most of the Tylenchida and Hexatyliina have a small six lobed cephalic region but may also be four lobed or bilobed or un-lobed. There may be two subdorsal and two subventral, or with two dorsal, two ventral, two latero-dorsal and two latero ventral lobes.

There is a basal plate from which a tubular or inverted funnel-shaped vestibulum extension (= stylet guiding apparatus) extends into body cavity. The frame work may be low or high arched. (Plate 3/1, 3/2).

Stoma – The stoma or stomatal cavity is lined with an external cuticle extending upto base of stylet conus. The anterior most region is called prestoma.

Pseudolips or Lip areas – There are no lips in Tylenchida except for two lateral liplet-like structures in some forms. The areas surrounding the oral opening, bearing the sensilla are true lips, usually modified into a oral or labial disc. 'Pseudolips' term are used in criconematidae.

Stylet – The stylet or spear of Tylenchida is stomatostylet (that of dorylaimida is an odontostylet). The stylet is composed of two parts; anterior is 'conus' and posterior is 'shaft' The latter bears three (one dorsal, two subventral) basal knobs; rarely the knobs may be absent. The stylet length varies from 5 μm to 180 μm . The protractor muscles arise from non-contractile oesophageal tissue and lined by the same basal lamina, that covers the oesophagus, are called stylet muscles.

Oesophagus (Pharynx) – In most Tylenchida the corpus is divided into precorpus and postcorpus (the equivalent term precorpus and metacarpus). The oesophageal glands form a diverticulum overlapping the anterior intestine. The subventral and dorsal oesophageal glands open into oesophageal lumen, anterior to the oesophago-intestinal and at the base of the stylet. The precorpus has six cells, enclosed by a basement membrane, running longitudinally from median bulb to the base of the stylet. The lumen of precorpus is circular. The postcorpus or median oesophageal bulb is muscular in most cases. The lumen of isthmus is triradiate.

The Tylenchida have three uninucleate oesophageal glands (Salivary), one dorsal and two subventrals. The glands may be enclosed in a basal (terminal) bulb or lie free in body cavity. The oesophago-intestinal valve or caudia is also lined internally with the cuticle. (Plate – 1).

Intestine – The intestine may be cellular or syncytial and oligocytous. The intestine in Criconematina and most adult Tylenchina is syncytial, means show no lumen. The intestine is divided into two parts, anteriorly short anterior part and next very long mid intestine extends upto rectum.

Tail – The nematodes have true tails, *i.e.* postanal elongation of body. The tail may be elongate filiform or prehensile (in Halenchidae). Its shape may differ between juveniles and adults, or between two sexes. In many genera, in adults the tail is short or absent but well developed in juveniles. The mail tail in several genera may be enveloped with a bursa (a flap like structure).

Female reproductive system – The females in the suborder Tylenchina is didelphic (double uterus), occasionally the posterior branch is reduced in size or represented by a postvulval uterine sac. The females in the suborders Hexatylinea and Criconematina is monodelphic. In didelphic forms, the two branches of the system are out-stretched in opposite directions, from the vulva, being amphidelphic, and the monodelphic forms are usually prodelphic. (Fig. – 2).

Vulva – The female gonopore or vulva is a transverse slit like aperture which may be transversely oval or rarely round. In didelphic forms it is usually median or submedian, but in monodelphic forms the vulva usually located near the anus. The presence of lateral vulval membrane and epiptygma are important diagnostic characters. (Fig. – 2).

Vagina – may be a flattened tube provided with dilators and constrictor muscles. The female genital tract comprises of uterus, spermatheca, oviduct and ovary. In bisexual species of Tylenchinae the spermatheca is usually round and axial, may or may not contain spermatozoa.

Male reproductive system – Tylenchids with few exceptions are monorchic (with single testis). The testis are outstretched or may be reflexed at terminal part. Spermatocytes are arranged in one, two or multiple rows. The male accessory genital structures include a pair of cuticularized spicules, (chitinous structure) a gubernaculum with or without telamon or titillae, a non-papillary (non ribbed) bursa and genital papillae. The male tail is devoid of caudal papillae. The genera, where bursa are present, may have amphids shifted to bursa zone.

A list of abbreviations, used universally to express the dimentions and measurements of nematode body and organs are given below :

L = total body length in mm. from end to end.

a = $\frac{\text{body length}}{\text{maximum body width}}$

b = $\frac{\text{body length}}{\text{oesophageal length}}$

b' = $\frac{\text{body length}}{\text{distance from head end to posterior end of oesophageal glands}}$

c = $\frac{\text{body length}}{\text{tail length}}$

c' = $\frac{\text{tail length}}{\text{body width at anus}}$

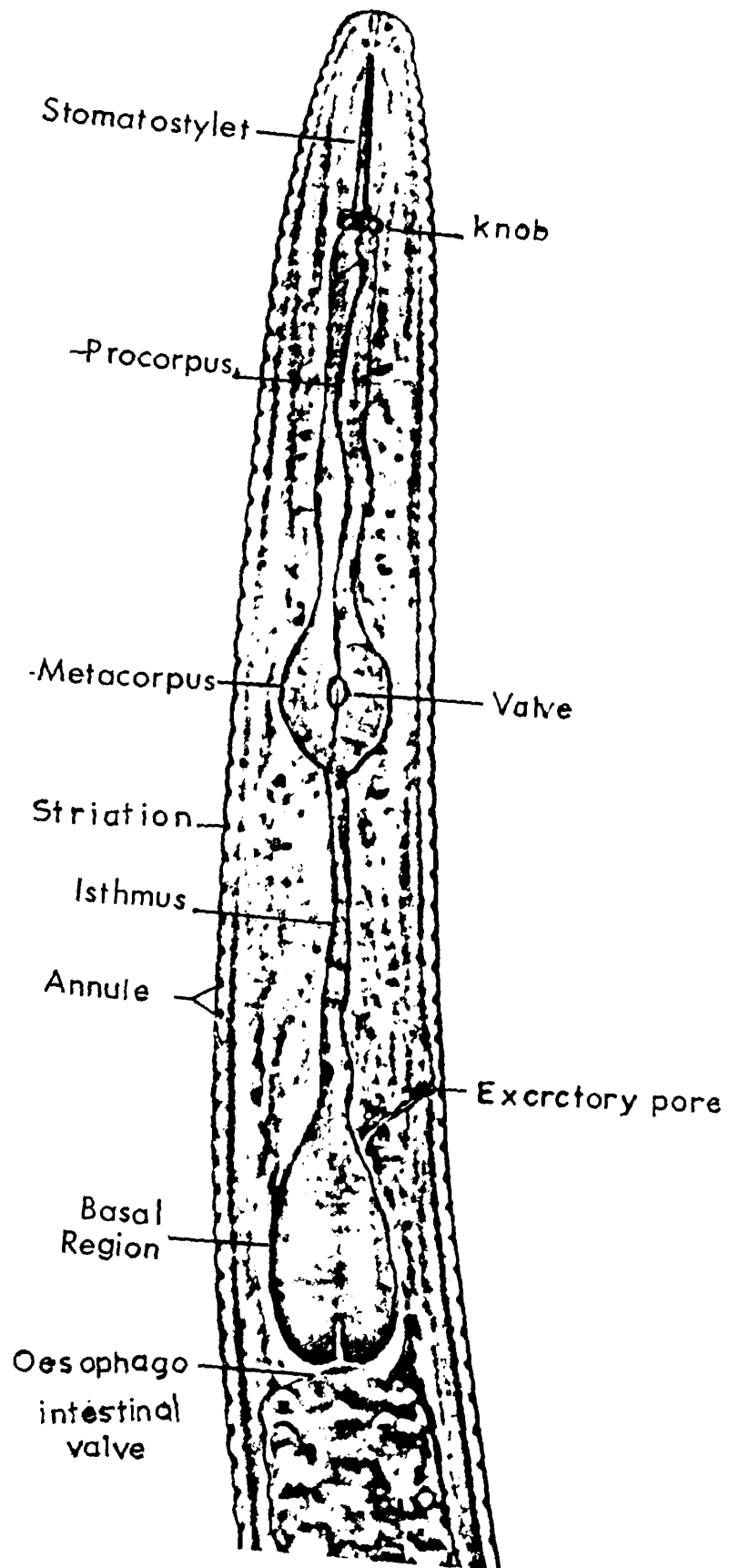


Fig. 1. Anterior part of Tylenchid nematode showing different parts and organs.

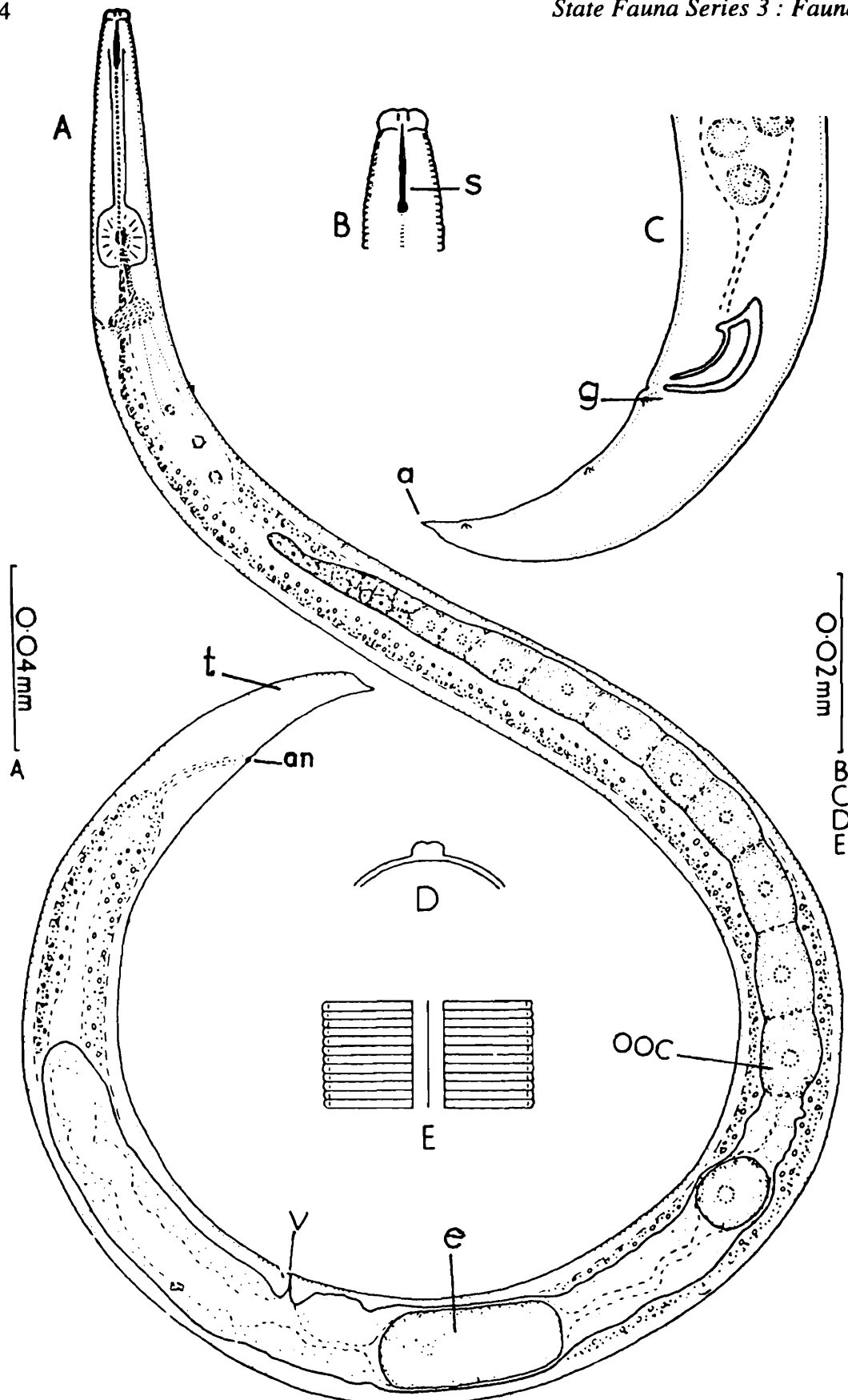


Fig. 2. A - Female nematode, B - Lateral view of head, C - Mail tail, D - Section in midbody showing lateral field.

a = mucro, an = anus, e = egg, g = gubernaculum, ooc = oocyte, s = stylet, t = tail, v = vulva (After - Hooper, 1958)

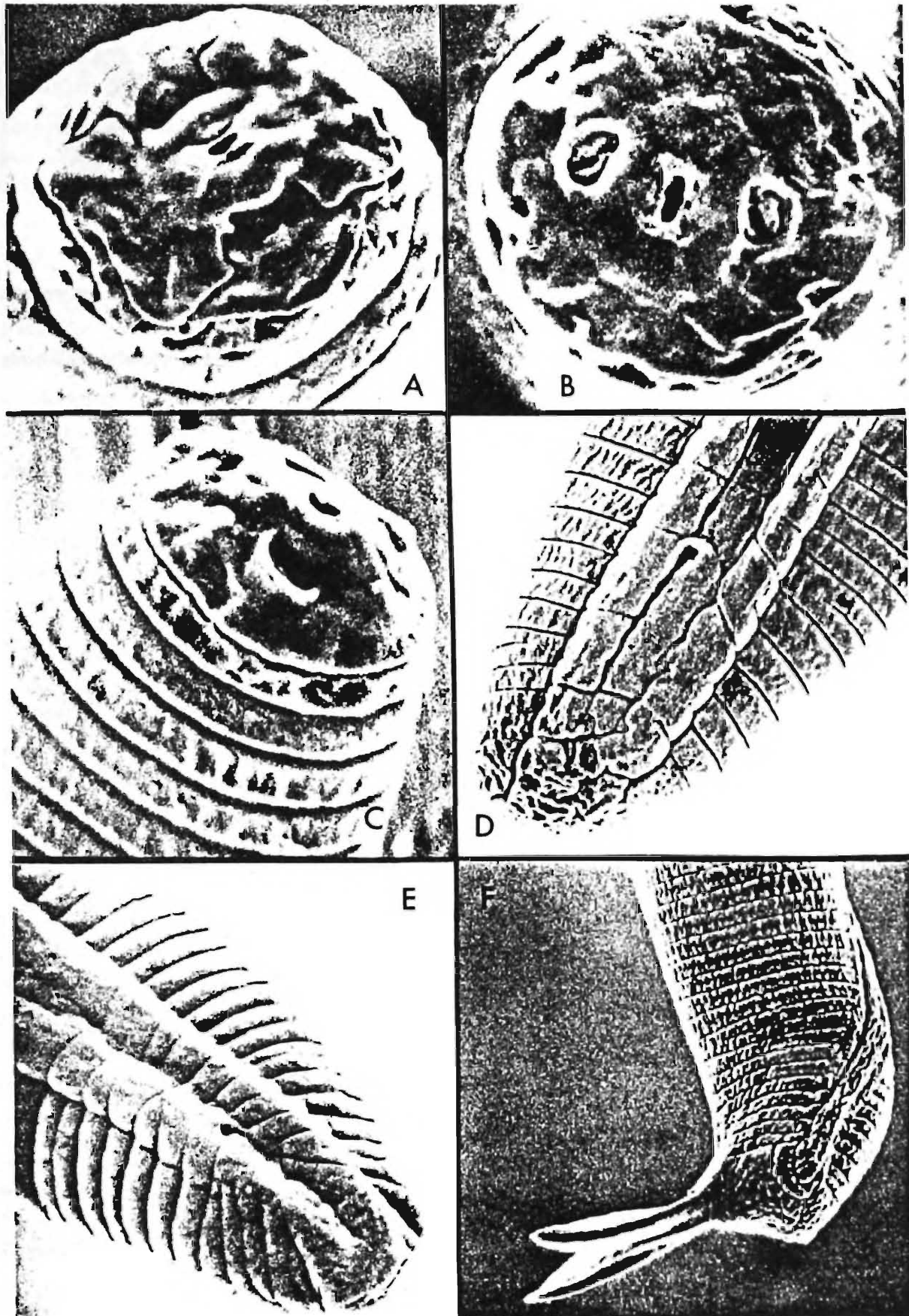


Fig. 3. Scanning electron micrograph. A & B Face view of two *Pratylenchus* spp. C = near profile view of Head of the same species, as in B, D & E = Tail tip with phasmids of two different *Pratylenchus* sp., F = Everted spicules of *Heterodera* sp. (After Mai & Lyon - 1975)

| | | |
|-------|---|---|
| V | = | $\frac{\text{distance from head end to vulva}}{\text{body length}} \times 100$ |
| V' | = | $\frac{\text{distance from head end to vulva}}{\text{distance from head end to anus}} \times 100$ |
| T | = | $\frac{\text{distance from cloacal aperture to anterior of testis}}{\text{body length}} \times 100$ |
| m | = | length of conus as percentage of total stylet length |
| o | = | distance between stylet base and orifice of dorsal oesophageal gland as percentage of stylet length |
| MB | = | distance between anterior end of body and centre of median oesophageal bulb as percentage of oesophageal length |
| R | = | total number of body annules |
| Roes | = | number of annules in oesophageal region |
| Rex | = | number of annules between anterior end of body and excretory pore |
| RV | = | number of annules between posterior end of body and vulva |
| RVan | = | number of annules between vulva and anus |
| Ran | = | number of annules on tail |
| VL/VB | = | distance between and posterior end of body, divided by body width at vulva |

Systematic position of the Order *Tylenchida*

| | | |
|----------|---|-------------------------------------|
| Phylum | – | Nematoda Rudolphi (Lankester, 1977) |
| Class | – | Secernentea von Linstow, 1905 |
| Syn. | – | Phasmida Chitwood & Chitwood, 1973 |
| Subclass | – | Tylenchia Inglis, 1983 |
| Order | – | Tylenchida Thorne, 1949 |

Key to suborders of Order *Tylenchida*

- Parasite of coelome or coelomic tinues of Annelida amphibia; terminal excretory duct and pore suckerlike..... ***Myenchina***
Free living or parasites of plants and arthropods, terminal excretory duct and pore not sucker lik
..... 2
- Mycetophagus or non root phytoparasitic, Arthropod parasitic cycle present; oesophagus intestinal junction at or anterior to nerve ring; if posterior to it, then either oesophageal base with a prominent stem like extension or two anterior most cells of intestine modified to act as valve; phasmids absent ***Hexatylinea***
Fungus feeding absent, arthropod-parasitic cycle absent, single generation cycle, non mycetophagus or root parasitic forms; oesophago intestinal junction well behind nerve ring phasmid may be present or absent 3

3. Female oral aperture generally 'T' shaped usually overhung by lateral liplets, postcorpus massive, and amalgamated with precorpus. Spermatheca ventral or ventrolateral to uterine axis, phasmids absent *Criconematina*
 Female oral aperture round or oval, postcorpus not massive, and not amalgamated. Spermatheca not ventral or ventro-lateral to uterine axis. Phasmids or phasmid like structures present
 *Tylenchina*

Suborder *Tylenchina* Chitwood & Chitwood, 1950

Key to Superfamilies of *Tylenchina*

1. Phasmids not detectable on tail; phasmid-like structures present much anterior to tail region, dorsal to lateral fields, in female near vulva, tails generally filiform *Tylenchoidea*
 Phasmids present in or near tail region (except for migratory scutella of Hoplolaiminae) in lateral fields not near vulva, tails generally not filiform, if filiform then with distinct phasmids..... 2
2. Subventral oesophageal glands enlarged, usually extending past the dorsal gland; sexual dimorphism in anterior region manifest.....*Hoplolaimoidea*
 Subventral oesophageal glands not enlarged not extending past the dorsal gland. Sexual dimorphism in anterior region not manifest.....*Dolichodoroidea*

Superfamily *Tylenchoidea* Orley, 1800

Key to the families of *Tylenchoidea*

1. Cephalic setae present *Atylenchidae* (No representation)
 Cephalic setae absent 2
2. Stylet over 24 µm long, if shorter, then about, as long as precorpus with tubular protractors
 *Tylodoridae* (No representation)
 Stylet under 24 µm (generally 8-16 µm) long, not as long as precorpus, generally with divergent protractors..... 3
3. Body extremely attenuated (a = 60-181) appearing glass fibrelike; bursa lobed.....
 *Ecphyadophoridae*
 Body not extremely attenuated, not appearing glass fibre-like, bursa not lobed *Tylenchidae*

Family *Tylenchidae* Orley, 1880

Key to the subfamilies of *Tylenchidae*

1. Amphidial apertures prominent, posterior to level of cephalic papillae, partially covered by a cuticular flap.....*Boleodorinae*
 Amphidial apertures rarely prominent, anterior to cephalic papillae, not covered by a cuticular flap..... 2
2. Lateral field with 2 incisures (single ridge) *Duosulciinae*
 Lateral field with 3 or 4 incisures (2 or 3 ridge)..... 3

3. Crustaformeria generally tricolomellate; spermatheca offset, tails elongate filiform..... *Tylenchinae*

 Crustaformeria quadricolumellate; spermatheca axial; tails short conoid.....
 (not recorded in West Bengal)

Subfamily *Tylenchinae* Orley, 1880

Key to the genera of *Tylenchinae*

- Post vulval uterine sac present, male cloacal lips not tubular; cuticle annulated tails ventrally arcuate or hook like..... *Tylenchus*
 Post vulval uterine sac present, male cloacal lips not tubular, cuticle annulated, but tails not ventrally arcuate or hook like..... *Filenchus*

Genus *Tylenchus* Bastian, 1865

Key to the species of *Tylenchus*

1. Body arcuate, terminus hooked, cephalic frame work absent..... *T. davainei*

Tylenchus davainei Bastian, 1865

1865. *Tylenchus davainei* Bastian *Trans. Linn. Soc. London*, **25** : 73-184.
 1932. *Anguillulina davainei* (Bastian, 1865) Goodey, *J. Helminth* **10** : 75-180.
 1986. *Tylenchus davainei* Bastian, Siddiqi, M.R., *Tylenchida Parasites of Plants and Insects*, Commonwealth Agric. Bureaux : 644 pp.

Materials : Nil.

Diagnosis : Ventrally curved upon relaxation; cuticle 1-2 μm ., marked with distinct transverse striae, lateral field with four incisures cephalic region continuous, annulated, with no sclerotization, stylet 8-21 μm ; with posteriorly sloping basal knobs. Median oesophageal bulb oval; basal bulb pyriform, cardia distinct. Spermatheca round, offset. Tail ventrally arcuate often hooked, tapering to a pointed terminus. Spicules cephalated, 13-25 μm long. Gubernaculum simple, fixed.

Distribution : India, W. Bengal (Burdwan, Birbhum and Hooghly).

Remarks : Material from Baqri (1975) collection.

Tylenchus arcuatus Siddiqi, 1963

1963. Siddiqi, M. R.; *Z. Parasitenkunde*, **23** : 170-180.

Remarks : The measurements and descriptions were not available.

Materials : Nil.

Distribution : India, W. Bengal, Birbhum.

Filenchus filiformis (Butschili, 1873) Meyl, 1961

1873. *Tylenchus filiformis* Butschili *Nova. Acta. Acad. Caesar. Carol.*, **36(5)** : 1-144.
 1986. *Filenchus filiformis* (Butschili, 1872) Meyl, 1961 Siddiqi, M.R. *Tylenchida Parasites of plants and Insects*, Commonwealth Agric. Bureaux : 644 pp.

Materials : ♀ 10 Nilganj, Barrackpore, 1972; S. Khera & party. Male (2) Ghatal, Midnapore, (3) Arambag, Hooghly. ♀ (2) Arambag, Hooghly, W.B. all from Rhizosphere of vegetables.

Diagnosis : Female – Body slender, tapering towards the terminus; finely striated cuticle; marked with four incisures on the lateral field, Head continuous stylet fine; weakly developed and with sloping knobs, ovary single, anterior, outstretched; oocytes in a single row, post vulvar sac one body width long.

L = 0.46-0.64 mm.; a = 25-33, b = 4.4-5.3, c = 5.8-6.8, V = 63-70, stylet 8-12 µm.

Male spicula tylenchoid; gubernaculum small. Bursa adanal and 3 anal body width long.

L = 0.43-0.51 mm.; a = 33-36, b = 5.2-6.1, c = 5-6 stylet 8-11 µm. spicula = 14-15 µm. gubernaculum 4-6 µm.

Distribution : India, W. Bengal (Hooghly, Midnapore, 24-Parganas).

Remarks : Siddiqi (1986) has placed the species under 'species inquirendae et incertae' Reported from rhinosphere of Jute crop. (Chaturvedi & Khera 1979).

Subfamily **Boleodorinae** Khan, 1964

Genus **Boleodorus** Thorne, 1941

Boleodorus (Boleodorus) acutus Thorne & Malek, 1968

1968. *Boleodorus (Boleodorus) acutus* Thorne & Malek *Nematods of northern great planes*. South Dakota Univ., pp. 1-111.

Materials : ♀ 5 Birbhum, March, 1979, Baqri & party.

Diagnosis : Female From middle of the body both end tapering, coarsest striae about 1 µ apart. Lateral field with 4 minute incisures. Phasmids and deirids not seen. Lip region conical with slightly elevated perioral papillae. Spear 13 µ long with strong, tapering knobs. Basal bulb and anterior end of intestine crowded by a large glandular body 1-2 times as long as body width. Vulva with elevated labia. Spermatheca present but without sperms. Ovary outstretched with oocytes in single line. Body narrow behind vulva. Hyaline intestinal cells adjacent to rectum, similar to those Siddiqi, 1963 refers to as a prerectum.

L = 0.5 mm; a = 22; b = 4.4; c = 8.0; V = 67.

Distribution : India, W. Bengal (Birbhum).

Remarks : *Boleodorus acutus* is immediately distinguished by uniformly conoid tail and large gland, crowding base of oesophagus and intestine.

The present description is from Thorne & Malek, 1986.

Subfamily **Duosulciinae** Siddiqi, 1979

Genus **Ottolenchus** (Hussain & Khan, 1967) Wu 1970

Ottolenchus equisetus (Husain & Khan, 1967) Wu 1970

1967. *Tylenchus (Ottolenchus) equisetus* Husain & Khan, *Proc. Helminth Soc. Wash.*, **34** 175-186,

1979. *Ottolenchus parvus* (Siddiqi) *Nematologica*, **25** : 215-236.

Materials : ♀ 5 Bolpur, March, 1979; Baquri and party.

Diagnosis : Duosulcinae, Cuticle with course annules lateral ridge showing two incisures. Amphids with longitudinal curved slips. Cephalic region low, less than three adjacent body annules high, circular in cross section. Stylet slender 11 µm; conus shorter than shaft, knobs minute rounded. Post corpus a muscular bulb with valve plates. Terminal bulb pyriform; vagina leading inward not sclerotised. Post vulval uterine sac present. Tail elongate-filiform. Bursa adanal. Spicules tylenchoid. Gubernaculum slender linear.

Distribution : India, W. Bengal (Birbhum).

Remarks : Reported in the final report of All India Co-ordinated Project on Nematodes (I.C.A.R.) by Baqri *et. al.* 1984.

Super family **Dolichodoroidea** Chitwood in Chitwood & Chitwood, 1950

Family **Dolichodoridae** Chitwood in Chitwood & Chitwood, 1950

Key to the subfamilies of *Dolichodoridae*

Lateral field with 6 incisures; male with hypopygma (paired papillae on posterior anal tip).....

..... *Merliniinae*

Lateral field with 3-5 incisures, male without hypopygma *Tylenchorhynchinae*

Sub family **Tylenchorhynchinae** Eliava, 1964

Key to the genera of *Tylenchorhynchinae*

Lateral fields with 5 incisures..... *Quinisulcius*

Lateral fields with 3 or 4 incisures..... *Tylenchorhynchus*

Genus *Tylenchorhynchus* Cobb, 1913

Key to species of *Tylenchorhynchus*

Tail 14-24 annules long, with a large, unstriated terminal annule *T. mashhoodi*

Tail 32-43 annules long, with smooth rounded terminus..... *T. goffarti*

Genus *Tylenchorhynchus* Cobb, 1913

Tylenchorhynchus mashhoodi Siddqi and Basir, 1959

1959. *Tylenchorhynchus mashhoodi* Siddqi & Basir, *Proc. 46th Indian Science Congr.*, 35; Siddiqi, 1961 *Z. Parasitkde* **21** : 46-64.

1968. *T. zae* Sethi & Swarup *Nemotologica*, **14** : 77-88.

Materials : Male (3) and female (2) from Jangipur, Murshidabad, Male 1, female 1. Susunia, Bankura, Male 3 female 1 from Shaktigarh, Burdwan.

Diagnosis : Body curved ventrally, distinct cuticular striations. Lateral field 1/3 of body width, with four incisures; outer incisures crenate. In some cases outer anterior margin of stylet knobs pointed. Tail cylindrical, 14-24 annules, tip rounded with large unstriated terminal annules. Phasmid in anterior half of tail.

Male : L = 0.51-0.68 mm., a = 28-33, b = 3.7-5.4, c = 12-14, T = 46-48, stylet = 15-18 μm ., spicula = 12-22 μm ., gubernaculum 11-12 μm .

Female : L = 0.43-0.68 mm., a = 24-31, b = 38-56, c = 12.0-17.8, V = 52.57, stylet 14-21 μm .

Distribution : India, W. Bengal (Burdwan, Bankura, Hooghly, Howrah, Murshidabad, Nadia, W. Dinajpur, Malda, Jalpaiguri, Darjeeling and Birbhum).

Remarks : The species was first recorded by Chaturvedi and Khera, 1979 in West Bengal. Baqri 1984 also recorded the species from a number of districts from North Bengal.

Tylenchorhynchus goffarti Sturhan, 1966

1966. *Tylenchorhynchus goffarti*. Sturhan 1966

1970. *Tylenchorhynchus goffarti* Baqri & Jairajpuri, *Rev. Brasil. Biol.*, **30** : 64-65.

1978. *Tylenchorhynchus swarupi* Singh & Khera, *Bull. zool. Surv. India*, **1** : 25-28.

Materials : Nil.

Diagnosis : Female Cuticle transversely striated 1-2 μ apart; longitudinal striations absent. Lateral field with 4 incisures, 1/5 to 1/4th of body width. Lip region set off from body 6-8 μm wide and 3-4 μm high. Head frame work slightly sclerotised. Stylet 16-23 μm , head-width long; metenchium 50-57 % of stylet length; knobs sloping downward 3-5 μm wide. Orifice of dorsal oesophageal gland about 2 μm . from base of stylet; median bulb ovate 46-54 % of oesophageal length. Vulva, a transverse slit; vagina about 1/2 of body width. Spermatheca ovate or spherical and functional. Tail with a smooth rounded terminus marked with 32-43 annules ventrally.

Male Spicules 18-24 μm long. Gubernaculum trough shaped, 7-10 μm long. Tail conoid with acute terminus.

Distribution : India : West Bengal (24-Parganas; Birbhum).

Remarks : Actually Singh and Khera (1978) proposed *T. swarupi* as a new species but when the types were reviewed by Ahmad and Baqri (1987) they recognised *T. swarupi* – a synonym of *T. goffarti*.

Tylenchorhynchus brassicae Siddiqi, 1961

1961. Siddiqi, M. R. *Tylenchorhynchus brassicae* *Z. Parasitkde* **21** : 46-64.

[The species was reported by Baqri *et. al.* (1984) but the description and measurements were not available].

Distribution : India, W. Bengal (Birbhum and Darjeeling).

Genus *Quinisulcius* Siddiqi, 1971

Quinisulcius capitatus

1961. *Tylenchorhynchus capitatus* Siddiqi, *Z. Parasitenkunde* **21** : 62-63.

1975. *Quinisulcius capitatus* Coomans & Saltakoglu *Meded. Fac. Landbwel. Gent* **40** : 497-500.

Materials : ♀ 5 Kalimpong, from rhizosphere of Citrus plants. May, 81. Baqri & party.

Diagnosis : Female – Transversely striated cuticle 1-2 μm apart longitudinal lines absent. Lateral field with 5 incisures 1/5th to 1/4th of the body width. Lip region set off from the body with 5-6 annules, 4-5 μm high and about 8 μm wide. Head frame work slightly sclerotised. Stylet 2.1-2.3

times the head-width; metenchium 50-53 % of the stylet length. Stylet knobs indented anteriorly; 3-3.5 μm wide. Tail cylindrical with acute smooth terminus, marked with 37-44 annules ventrally.

Male – Not found.

♀ 0.67-0.76 mm., a = 20-33, b = 4.9-5.5, c = 14-16, c' = 2.6-2.9, V = 52-59, G₁ = 25-29, G₂ = 22-25, stylet = 17-18 μm .

Distribution : India : West Bengal (Darjeeling).

Remarks : The species is recorded by Ahmad & Baqri, 1987, from rhizosphere of Citrus, Dalap Chand Basti, Kalimpong.

Subfamily **Merliniinae** Siddiqi, 1971

Genus **Merlinius** Siddiqi, 1970

Merlinius affinis (Allen, 1955) Siddiqi, 1970

1970. *M. affinis* Siddiqi, M.R., *Proc. Helminth Soc. Wash.*, **37** : 68-77.

Materials : Nil.

Diagnosis : Female Transversely striated cuticle, lateral field 1/5 1/4 of the body, flat at apex, bearing 6 annules; 3-4 μm high and 6.5 8.0 μm wide. Head frame-work heavily sclerotised. Stylet 2.6-2.8 times the head width, its anterior part (metenchium) about half of the stylet length, stylet knob slightly indented anteriorly. Gonads typical to genus. Tail broadly rounded with 28-34 annules ventrally.

Male Similar to females in general morphology except in genital system. Spicules 24 μm medially. Gubernaculum stout 6 μm long. Tail elongate conoid with acute terminus.

Distribution : India : West Bengal (Darjeeling).

Remarks : Reported in the final report of All India Co-ordinated Project on Nematodes (I.C.A.R.) by Dr. Baqri *et. al.* 1984, from soil around roots of tea.

Super family **Hoplolaimoidea** Filipjev, 1934

Key to families of **Hoplolaimoidea**

1. Mature female round or lemon-shaped behind neck; anus terminal; stylet in male larger than that of females, tail non bursate..... 2
 Mature female not round or pearshaped; anus not terminal, male with stylet equal or smaller than that of females, tail bursate 3
2. Excretory pore in mature female opposite or anterior to median bulb; male with large lip cap and large transverse shit-like amphidial structures gall-inciting **Meloidogynidae**
 Excretory pores in mature female, behind median bulb; male with small lip cap, with small oval to round amphidial apertures, not gall-inciting **Heteroderidae**
3. Juveniles and females with low arched cephalic frame work; endoparasites of roots
 **Pratylenchidae**
 Juvenile and females with high arched cephalic frame work; ectoparasites of roots..... 4

4. Mature female swollen, sedentary *Rotylenchulidae*
 Mature female not swollen, migratory *Hoplolaimidae*

Family **Hoplolimidae** Filipjev, 1934

Key to the subfamilies of *Hoplolimidae* Filipjev, 1934

- Phasmids scutellum-like *Hoplolaiminae*
 Phasmids pore like *Rotylenchoidinae*

Subfamily **Hoplolaiminae** Filipjev, 1934

Key to the genera of *Hoplolaiminae*

- Stylet knobs tulip-shaped, each with 1-3 anteriorly directed tooth like projections ... *Hoplolaimus*
 Stylet knobs not tulip-shaped, without tooth like projections *Scutellonema*

Genus *Hoplolaimus* Daday, 1905

Key to species of *Hoplolaimus*

1. Length of stylet 33 to 40 μm *H. indicus*
 Length of stylet 45 to 50 μm 2
 2. Basal ring of lip region with 6-8 longitudinal striations *H. dubius*
 Basal ring of lip region with 10 to 15 longitudinal striations *H. columbus*

Genus *Hoplolaimus* Daday, 1905

Hoplolaimus dubius Chaturvedi, Singh and Khera, 1979

1979. *Hoplolaimus dubius* Chaturvedi, Singh & Khera, Studies on Taxonomy, Biology and Ecology of nematodes associated with jute crop. Z.S.I. Tech. Monograph No. 2.

Materials : ♀ 5 Rang sagar, District — Murshidabad 1972, Chaturvedi and Khera.

Diagnosis : Body stout and uniformly cylindrical, on thermal death assumes curved shape, cuticle thick, striated transversely. Head distinctly set off, head shape shows sexual dimorphisms. Female head truncate, cone shaped, marked with three annules, cephalic frame work well developed. Basal plates strongly cuticularised. Stylet massive, basal knobs strong rounded 5-6 μm across. Dorsal oesophageal gland orifice 4 μm from the base of stylet knobs. Median bulb 20 μm in diameter, subspherical in shape, with crescentic valves. Oesophageal gland with 6 nuclei, dorsally overlapping the intestine. Tail short rounded, marked with 10-15 annules ventrally. Lateral field with one incisure. Didelphic amphidelphic gonads. Anterior ovary 182 μm and posterior 196 μm long. Oocytes in a single row. Spermatheca round. For males, Head hemispherical, marked with three annules. Spicules paired, strong, alate, telamon present; gubernaculum small.

Female – (Holotype) L = 1.14 mm., a = 31, b = 8.5, b = 5.8, c = 54, V = 58, stylet = 36 μm .

Male (Paratype) L = 0.99-1.12 mm., a = 26-28, b = 7.0-8.5 c = 32-35, T = 51-52, stylet = 35-38 μm , spicula = 38-39 μm . gubernaculum = 18-20 μm .

Distribution : The description is based on the description of type species by Chaturvedi, Singh and Khera, 1979.

Hoplolaimus columbus Sher, 1963

1963. *Hoplolaimus columbus* Sher, S.a. *Nematologica* 9 (2) : 267-295.

Materials : ♀ 5 ♂ 5, Burdwan, Nov., 77, Baqri and party.

Diagnosis : Female – Lip region with three cuticular rings and 10-15 longitudinal striations, visible on basal ring. Stylet knobs anteriorly with 6 nuclei. Hemizonion and caudalid not detected, spermatheca absent lateral field reduced and with one poorly developed incisure. Intestine blind pouch extending up to caudal part of body. Tail rounded terminally with 17 cuticular rings on ventral side.

Male – general structures are more or less similar with female. Stylet knobs with two anteriorly directed protrusions. Stylet opening subterminal, gubernaculum trough-shaped with distinct titillae. Spicules slightly curved with very slender parus. Bursa commences at level of anterior end of spicules and terminates at end of tail.

♀ L = 1.26-1.8 mm; a = 30-38, b = 9.1-12.4; b' = 6.3-9.7, c = 39-57; V = 51-60, stylet = 40-48 μm .

♂ L = 1.15-1.4 mm; a = 25.9-39.2; b = 9.6-12.2, c = 26.8-33.1, stylet = 40.2-43.7 μm , spicules 36.6-52.5 μm .

Distribution : India, W. Bengal, Burdwan

Remarks : The species is reported by Baqri et. al. (1984) but the present description is from Krall (1985).

Hoplolaimus indicus Sher, 1963

1979. *Basirolaimus indicus* (Sher, 1963) Shamsi M.A. *Nematol. Medit.*, 7 : 15-19.

1982. *Hoplolaimus arachidis* Maharaju & Das c.f. Siddiqi, M.R., *Tylenchida*, : 1-644, publ. by Commonwealth Institute of Parasitology.

Materials : Nil.

Diagnosis : Female – Body ventrally curved upon fixation, cuticle coarsely annulated, lateral field with one incisure or 2-3 incomplete broken incisures. Lip region hemispheroid marked by 3-4 annules, basal annule with 6-12 longitudinal striations. Cephalic frame work strong. Stylet robust 30-34 μm long, basal knobs with 1-3 forwardly directed processes. Median oesophageal bulb spheroid, with well developed valvular apparatus, oesophageal glands overies amphidelphic. Spermatheca filled with sperm. Tail round, with 8-13 annules.

Male – Generally similar to female. Spicules arcuate and cephalated, 37-48 μm long. Bursa terminal.

♀ L = 1.02-1.04 mm; a = 22-36; b = 8.4-9.1, b' = 7.0-8.1, c = 45-74; c' = 0.66-0.68, V = 50-59.

♂ L = 0.94-1.3 mm, a = 26-36; b = 8.9-12.0, b' = 6.2-9.0 c = 31-38.

Distribution : India : West Bengal, Burdwan; West Dinajpur, Murshidabad, Birbhum, Darjeeling.

Remarks : reported by Baqri *et.al.* 1984 (Final report of All India Co-ordinated Research Project on Nematodes. ICAR). This is a potential pest of rice.

***Hoplolaimus sagarensis* Sinha, 1987**

Remarks : Sinha, 1987 had reported the species but it's reference and descriptions were not available.

Distribution : India : W. Bengal (24-Parganas).

Genus ***Scutellonema*** Andrassy, 1958

***Scutellonema brachyurum* (Steiner, 1978) Andrassy, 1958**

1938. *Rotylenchus brachyurum* Steiner, *J. Agric. Rec.* **56**(1) : 1-8.

1958. *Scutellonema brachyurum* Andrassy, *Acta Zool. Acad. Sci. Hungaricae*, Budapest, **4**(1-2) : 1-87.

Materials : Nil.

Diagnosis : Female Body becomes spiral upon fixation. Lip region semispherical, slightly demarcated with 3-5 cuticular rings. 6 longitudinal striations present on basal ring of lip region. Stylet knob rounded. Intestine overlaps rectum for short distance. Scutella usually situated immediately behind anus. Lateral field with 4 incisures; areolation observed in anterior part, and in scutellar region (Scutella 3.0-4.0 μ m) tail with 7-13 cuticular rings and tip rounded.

Male – Length of tail equal to width in cloacal region, spicules rigid, slightly arcuate. Gubernaculum straight. Bursa annulate, wide, slightly rounded.

♀ L = 0.72-0.88 mm.; a = 24-34, b = 6.3-8.2; b' = 45-66; c = 45-58; stylet = 24-27 μ m, spicules 27 μ m gubernaculum 12-14 μ m.

Distribution : India : W. Bengal (Darjeeling).

Remarks : The species was recorded by Baqri *et.al.* (1984), (I.C.A.R. Project Report) but the description is from Krall, 1985.

Sub family ***Rotylenchoidinae*** Whitehead, 1958

Genus ***Helicotylenchus*** Steiner, 1945

1. Tail semispherical, almost cylindrical or almost conical with rounded terminus, devoid of growth..... 2
Tail conically convex on dorsal side, terminally not rounded, often with ventral out growth 6
2. Spermathecae functional (with spermatazoa)..... ***H. multinctus***
Spermathecae not functional 3
3. Anterior margin of stylet knobs directed backward..... ***H. indicus***
Stylet knobs anteriorly flattened or concave 4

4. Stylet knobs indented anteriorly *H. paraplatyurus*
 Stylet knobs not indented anteriorly 5
5. Tail widely rounded off, phasmids anterior to anus *H. goodeyi*
 Tail narrowly rounded off; phasmids posterior to anus *H. retusus*
6. Ventral outgrowth of tail absent or poorly defined..... *H. dihystra*
 Ventral (terminal) out growth of tail well developed its length equal or more than 2 annules ... 7
7. Spermathecae functional (with spermatozoa) *H. erythrinae*
 Spermathecae nonfunctional (without spermatozoa)..... 8
8. Lip region without cuticular annulations or latter indistinct..... *H. microcephalus*
 Lip region with distinct cuticular annulations 9
9. Terminus of tail concave in front of ventral out growth..... *H. crenacauda*
 Terminus of tail not concave in front of ventral out growth 10
10. Ventral out growth of tail elongated, rounded off *H. egyptiensis*
 Ventral outgrowth of tail-short & obtuse; inner incisures of lateral field fuse to form a 'Y' shape *H. abunaamai*

***Helicotylenchus abunaamai* Siddiqi, 1972**

1972. *Helicotylenchus abunaamai*, Siddiqi, M.R., *Nematologica* **18** : 74-91.

Materials : ♀ 5 Kharbani, Birbhum, March, 79, Baqri and party.

Diagnosis : Lip region continuous with 4 annules, broadly rounded. Anterior and posterior cephalids not found. Stylet knob less indented anteriorly. Hemizonid 0-1 annules anterior to excretory pore, 2 annules long. Spermatheca without sperms. Tail ventrally concave and dorsally convex with an unstriated ventral projection; inner incisures of lateral field fusing, forming a 'Y' shape.

L = 0.51 mm; a = 23, b = 5.2, b' = 4.4; c = 41, c' = 1.06; V = 62, stylet = 21.6 µm, m = 48.4, o = 40.

Distribution : India : W. Bengal (Birbhum).

Remarks : The species is reported by Baqri and Ahmad, 1983.

***Helicotylenchus paraplatyurus* Siddiqi, 1972**

1972. *Helicotylenchus paraplatyurus* Siddiqi, M. R., *Nematologica* **18** : 74-91.

1980. *H. seshadrii* Singh, R.V. and Khera, S. *Indian J. Nematol.* **9** (1979) : 95-1000.

Materials : ♀ 7 Belur, Howrah, 1971 S. Khera and party.

Diagnosis : Lip region continuous, broadly rounded, with 4-5 annules. Anterior and posterior cephalids indistinct Lateral field with smooth incisures. Stylet knobs indented anteriorly, Hemizonid 2-4 annules anterior to excretory pore. Spermatheca offset, without sperm. Tail subcylindrical, with broadly rounded terminus, marked by 11-16 annules.

♀ L = 0.65 mm., a = 30; b = 5.7, b' = 48, c = 43, c' = 1.24, V = 64, stylet = 23 µm, m = 47, o = 41.

Distribution : India, W. Bengal (Howrah).

Remarks : The species was first recorded by Singh and Khera, 1980 and was subsequently reviewed by Baqri and Ahmad, 1983. Species from rhizosphere of Okra.

***Helicotylenchus retusus* Siddiqi and Brown, 1964**

1964. *Helicotylenchus retusus* Siddiqi and Brown, *Proc. Helminth. Soc. Wash.*, **31** : 209-211.

Materials : ♀ 3 Krishnapur and Majherpara, district – Burdwan, Nov. 77; Baqri and party.

Diagnosis : Body curved ventrally, cuticle with striae, interrupted by lateral field. Lateral field occupies 1/4 of the body width, four incisures, which continue upto tail end. Tail 9-12 annules, terminus semicircular.

L = 0.59-0.63 mm., a = 28-23, b = 6.2-7.0, c = 53-64. V = 61-64, o = 61-64, stylet = 23-24 μ m.

Distribution : India : W. Bengal, Burdwan, Birbhum.

Remarks : From rice and jute fields.

***Helicotylenchus crenacauda* Sher, 1966**

1966. *Helicotylenchus crenacauda* Sher, *S. A. Nematologica*, **12** : 1-56.

1979. *H. indentatus* Chaturvedi and Khera, *ZSI. Technical Monograph No. 2* : 1-105.

Materials : ♀ 96 Burdwan sadar Nov., 77; Baqri & party.

Diagnosis : Body spirally curved, cuticle 1.5-2.0 μ thick with distinct transverse striae. Lip region continuous, marked by 4-5 annules. Lateral fields 1/7th to 1/4th of body width near middle of body. Hemizonid 0-2 annules from excretory pore, 1.5-2.5 annules long. Stylet 3.6-4.3 times the head width. Stylet knob flattened (30%) or indented (70%) anteriorly, vulva a transverse slit. Vagina about 1/2 of the corresponding body width, oocytes arranged in one or two rows. Spermatheca well developed, without sperm, tail with well developed ventral projection and the characteristic indentation at dorsal terminal part of the tail, marked by 6-12 annules ventrally.

L = 500-700 μ m; a = 20-29, b = 4.7-6.3, c = 30-44.

V = 60-66, stylet = 24-27.5 μ m. conus 11-13 μ m; Tail = 13-19 μ m.

Distribution : India : W. Bengal, Burdwan.

Remarks : Chaturvedi and Khera, 1979 proposed *H. indentatus* a new species but Baqri and Ahmad, 1983 proposed this as new synonym of *H. crenacauda*. The description of the species is based on the description given by Baqri and Ahmad, 1983. The collection is from rhizosphere of paddy and jute.

***Helicotylenchus microcephalus* Sher, 1966**

1966. *Helicotylenchus microcephalus* Sher, *S. A. Nematologica* **12** : 1-56.

1980. *H. belurensis* Singh, R. V. and Khera, *S. Indian J. Nematol.* **9** (1979) : 95-100.

Materials : ♀ 5 Belur, dist. Howrah, 1971, S. Khera and party.

Diagnosis : Lip region continuous, truncated, marked by indistinct annules. Anterior and posterior cephalids not found. Incisures smooth. Stylet knobs anteriorly indented. Hemizonid 1-2

annules, anterior to excretory pore, 2 annules long. Spermatheca offset, without sperm. Tail curved dorsally, tapering to form a projection, marked by 11-14 annules ventrally.

♀ L = 0.63 mm; a = 30, b = 5.8, b' = 4.7; c = 40, c' = 1.16

V = 62; stylet = 24 µm; m = 48, o = 43

Distribution : India : W. Bengal (Howrah, W. Dinajpur).

Remarks : Singh and Khera, 1980, proposed the species as new, *H. belurensis*. But Baqri and Ahmad, 1983 had put the species as a synonym of *H. microcephalus*.

Helicotylenchus indicus Siddiqi, 1963

1963. *Helicotylenchus indicus* Siddiqi, *Z. Parasitkde.*, **23** : 239-244.

1964. *H. plumariae* Khan & Basir, *Proc. helminth. Soc. Wash.*, **31** : 199-202.

Materials : ♀ 10 Mourigram, Sankrail, Andul, dist. Howrah, 1972; S. Khera and party.

Diagnosis : Body curved in a form of spiral, Lip region rounded with 5 indistinct annules. Lateral field 1/6 of the body width, with four incisures, continued upto tail tip, tail 11-12 annules, tip semicircle, centrally projected.

L = 0.41-0.61 mm; a = 23-29, b = 4.4-5.8, c = 20-47, V = 61-67, stylet = 19-22 µm.

Distribution : India : W. Bengal, 24-Parganas; Nadia; W. Dinajpur, Darjeeling.

Remarks : The species was first reported by Chaturvedi and Khera, 1979.

Helicotylenchus multicinctus (Cobb, 1893) Golden, 1956

1893. *Hopholaimus multicinctus* Cobb, *Macleay Mem. vol. Linn. Soc. N.S.W.* 252-308.

1956. *Helicotylenchus multicinctus* Golden, A. M., *Maryland Ag. Exp. Stn. Bull.*, 44-85 : 28 pp.

Materials : ♀ 11, Darjeeling, Oct., Nov., Baqri and party.

Diagnosis : Lip hemispherical, continuous with body, with 4-5 annules. Stylet knobs indented anteriorly. Excretory pore anterior to oesophago-intestinal junction. Spermatheca offset, filled with sperm. Tail more curved dorsally, terminus hemispherical, with 10-14 annules ventrally.

♀ L = 0.54 mm, a = 27, b = 5.3, b' = 4.4, c = 45, c' = 1.02, V = 68, stylet = 24 µm.

Distribution : India : W. Bengal (Darjeeling).

Remarks : The species was reported by Baqri & Ahmad, 1983; from the rhizosphere of *Zea mays*.

Helicotylenchus erythrinae (Zimmerman, 1904) Golden, 1956

1956: *Helicotylenchus enythrinae* Golden, A. M. *Maryland Ag. Exp. Stn. Bull.* A-85, 28 pp.

Materials : ♀ 8 Darjeeling proper, May, 81 Baqri and party.

Diagnosis : Lip region hemispherical, marked by 4-5 annules. Anterior cephalids indistinct, posterior cephalids 7-8 annules below lip region, Stylet knobs indented anteriorly. Hemizonid 0-2 annules form excretory pore, 2 annules long. Spermatheca offset, filled with sperm. Tail dorsally curved, tapering gradually to a conspicuous ventral projection with a pointed tip.

♀ L = 0.49 mm; a = 23, b = 5.2; b' = 4.3; c = 29, c' = 1.35, V = 62; stylet = 22.3 µm; m = 48, o = 39.

Distribution : India : W. Bengal (Darjeeling).

Remarks : The species was reported by Baqri and Ahmad, 1983, from rhizosphere of Tea plants.

Helicotylenchus dihystra (Cobb, 1893) Sher, 1961

1893. *H. dihystra* Cobb, N. A. *macleay Mem. Vol. Linn. Soc. N.S.W.* 252-308.

1961. *H. dihystra* Cobb, N. A. *Nematologica* 6 : 155-169.

Materials : ♀ 26 from Darjeeling, Lebong, Phoolsering Kurseong, Dagapur Tea Estate, Darjeeling, May, 81, Baqri and party.

Diagnosis : Lip region continuous, hemispherical, marked by 4-5 annules. Anterior cephalids not seen, posterior cephalids 6-7 annules, below the lip region. Lateral field not aerolated. Stylet knob flattened or indented anteriorly. Hemizonid 0-2 annules anterior to excretory pore. Spermatheca rounded, offset, without sperm. Tail dorsally curved, with slight ventral projection, fusion of the inner incisures at the tail tip is noted with U or V shape.

♀ L = 0.55-0.66 mm., a = 21-26, b = 4.8-5.3, c = 38-44, V = 63-65, o = 37-45, stylet = 24.7-26.0 µm. tail length = 14.5-16.0 µm.

Distribution : India : W. Bengal (Darjeeling, Birbhum).

Remarks : The species was reported by Baqri and Ahmad, 1983 and the description is on the basis of their description. This was reported from various Host Plants like Tea, Banana, Maize, Mango etc.

Family **Rotylenchulidae** Husain & Khan, 1967

Subfamily **Rotylenchulinae** Husain & Khan, 1967

Genus **Rotylenchulus** Linford & Oliveira, 1940

Rotylenchulus Linford & Oliveira, 1940

1940. *Rotylenchulus reniformis* Linford and Oliveira *Pro. helminth. Soc. Wash.*, 7(1) : 35-42; Dasgupta, Raski and Sher, 1969, *J. Nematol.*, 1(2) : 126-145.

1960. *Leiperotylenchus leiperi* Das, *Z. Parasitkde* 19 : 553-605.

1965. *R. stakmani* Husain & Khan, *Proc. helminth. Soc. Wash.*, 32(1) : 21-23.

Materials : Nil.

Diagnosis : ♀ (immature) Body ventrally curved, Head continuous, lip region conoid, rounded, with five indistinct annules. Lateral field with four incisures, more than 1/5th body width. Tail 24 µm length, with rounded tip. Striae coarse towards tip. Two opposed ovaries with two flexures; rows of oocytes not clear.

L = 0.35 mm., a = 24, b = 3.8, b' = 2.6, c = 14, c' = 2.8, V = 69, stylet = 18 µm, o = 76.

♀ (immature) Generally similar to females, pore slender, Stylet and knobs poorly developed than in females. Oesophagus reduced. Bursa adanal, vestigial. Testis single.

L = 0.38 mm., a = 27, b' = 3.9, c = 21, c' = 1.4, stylet = 11 µm., o = 62, spicula = 17 µm., gubnaculum = 7 µm.

Distribution : India : W. Bengal (Hooghly, Burdwan, Birbhum).

Remarks : The species was reported by Chaturvedi and Khera, 1979 and the present description is on that basis.

Family **Pratylenchidae** Thorne, 1949

Key to the subfamilies of *Pratylenchidae*

Tails similar between sexes; phasmids near terminus *Hirschmanniellinae*

Tails dissimilar between sexes, phasmids not near terminus *Pratylenchinae*

Family **Pratylenchidae** Thorne, 1949

Subfamily *Hirschmanniellinae* Fotedar and Handoo, 1978

Genus *Hirschmanniella* Luc & Goodey, 1963

Key to the species of *Hirschmanniella*

Stylet 21 – 24 μm long

Tail elongate conoid, terminus with a pointed ventral projection *H. gracilis*

Stylet 16 – 21 μm long

Tail not so elongate, terminus with a mucro *H. oryzae*

Genus *Hirschmanniella* Luc and Goodey, 1963

Hirschmanniella oryzae (Soltwedel, 1889) Luc and Goodey, 1963

1889. *Tylenchus oryzae* Soltwedel, *Verlag van de Director vijfde Fversl. Proefstn. Midden Fava over 1888/89*, pp.15-16.

1921. *Rotylenchus oryzae* Filipjev and Schuuzmans Stekhoven, *A manual of agricultural helminthology*, 878 pp.

1962. *Hirschmannia oryzae* Luc and Goodey, *Nematologica* **7** : 192-202.

1963. *Hirschmanniella oryzae* Luc and Goodey *Nematologica* **9** : 471.

Materials : ♂ 3 Memari, Burdwan

♂ 2 Monteswar, Burdwan

Materials : ♂ 3 Bolpur, Birbhum

♀ 2 Arambag, Hooghly, ♀ 3 Memari, Burdwan

All from rhizosphere of paddy crop by Chaturvedi & Khera, 1972.

Diagnosis : Cylindrical, linear body, narrowing behind anus, continuous head, slightly flattened lip region. Tail elongate, annulated upto terminus, terminus round with a ventral mucro. Distinctly striated cuticle, lateral field 1/4 of body width, with four incisures, the posterior most is aerolated. Spear 4 times body diameter at basal plate, oesophageal gland overlaps intestine ventrally. Tail 3 times body width at the anus, terminating in a mucro.

Female – L = 0.96 – 1.60 mm., a = 48-51, b = 8.3-11.1, b' = 4.1-5.6, c = 15-22, c' = 3.4-4.0, V = 51-54, stylet = 16-21 μm .

Male – L = 0.82-1.1 mm; a = 48-52, b = 8.7-9.0, c = 15-17, stylet = 15-17 μ m, spicula 20-21 μ m, gubernaculum 6-8 μ m.

Distribution : India : W. Bengal, Burdwan, Birbhum, Hooghly, Bankura, Murshidabad.

Remarks : The study made by Baqri *et. al.* (1984) records that *H. orizae* is dominant pest species of paddy in most of the southern West Bengal districts.

This was also reported from rhizosphere of jute, Chaturvedi and Khera, 1979.

***Hirschmanniella gracilis* (De Man, 1880) Luc & Goodey, 1963**

1880. *Tylenchus gracilis* de Man.

1932. *Angnillulina gracilis* (de Man) T. Goodey, *J. Helminth* **10** : 75-180.

1962. *Hirschmannia gracilis* (de Man) Luc C.M. & Goodey, *J. B. Nematologica* **7** : 197-202.

Materials : Nil.

Diagnosis : Female body slightly ventrally curved, cuticle with transverse striae 1.2-2.0 μ m apart. Lateral field with 4 incisures, incomplete areolation may occur in tail region. Lip region continuous with body, marked by 3-5 annules. Stylet robust 21-24 μ m with rounded basal knobs oesophagus typical of the genus. Ovary amphidelphic. Spermatheca filled with sperm. Tail elongate conoid, 3.5 to 6.0 anal body width long, terminus with a pointed ventral projection.

Males – generally similar except reproductive system and tail shape. Spicules 28-38 μ m long. Gubernaculum 9-14 μ m. Bursa subterminal. Tail slightly ventrally curved.

♀ L = 1.43-1.96 mm, a = 42-62, b = 11.6-17, b' = 4.5-8.7, c = 16-21, c' = 3.4-5.9, V = 48-54.

♂ L = 1.22-1.82 mm, a = 42-64, b = 10.4-13.7, b' = 4.1-7.2, c = 15.5-22.5, c' = 3.4-6.0, o = 13-21.

Distribution : India : West Bengal, Burdwan, West Dinajpur, Murshidabad, Malda, Jalpaiguri, Darjeeling, Birbhum.

Remarks : Reported by Baqri, 1983, Dey & Baqri, 1985. This is most important pest of rice in almost all the districts of W. Bengal.

Subfamily **Pratylenchinae** Thorne, 1949

Genus ***Pratylenchus*** Filipjev, 1936

Key to the species of ***Pratylenchus***

1. Tail tip broadly rounded and unstriated 2
 Tail tip crenate seems to be bifid..... ***P. coffeae***
2. Labial sclerotization extending backwards upto three annules. Tail tip truncate ***P. thornei***
 Labial sclerotization not extending upto 3 backward annules. Tail cylindroid ***P. minyus***

Pratylenchus minyus Sher & Allen, 1953

1953. *Pratylenchus minyus* Sher & Allen, *Univ. Calif. Publ. zool.* **54**(6) : 441-470.

cf. Thorne, 1961 *Principles of nematology*, 553.

Materials : Nil.

Diagnosis : Female body curved dorsally, Head not set off, with two annules, transversely striated cuticle, lateral field about 1/4 of body width marked with four crenate incisures. Tail short, cylindroid, more than two anal body diameter long, tip unstriated, cephalic framework well developed. Stylet massive, basal knobs rounded. Oesophageal gland orifice about 3 μm behind the base of knobs; procorpus 22 μm long, median bulb subspherical 14 \times 10 μm , oesophageal gland 56 μm long.

Female – L = 0.39 mm, a = 20, b = 5.7, b' = 3.6, c = 17, V = 82, stylet = 17 μm .

Distribution : India : W. Bengal (Hooghly).

Remarks : The only specimen (female) was recorded by Chaturvedi and Khera, 1979 and the description is also based upon their description. Species from rhizosphere of jute.

***Pratylenchus coffeae* (Zimmermann, 1898) Goodey, 1951**

1898. *Tylenchus coffeae* Zimmermann, 1898, *Meded. Landb. Voor. Dienst. Buitenz*, **27** : 1-64.

1920. *T. mahogani* Cobb, 1920. *J. Parasit*, **6**(4) : 188-191.

1936. *Pratylenchus mahogani* (Cobb, 1920) Filipjev, *Trudy Zool. Inst. Akad. Nauk SSSR* **3** : 537-550.

1951. *P. coffeae* (Zimmermann, 1898) Goodey, *Soil & Freshwater Nematodes*, 399 pp.

Materials : Nil.

Diagnosis : Female – Ventrally curved body; anteriorly head not set off consists of two annules. Lightly striated cuticle, lateral field about 1/5 of the body width marked with 4 incisures, phasmid about the middle of the tail. Cylindroid tail, terminus crenate, seems to be bifid about three anal body width long.

L = 0.38 mm, a = 27, b = 5.4, b' = 3.3, c = 13, V = 72, stylet = 17 μm .

Distribution : India, W. Bengal, North 24-Parganas.

Remarks : The species was recorded by Chaturvedi and Khera, 1979 and the description is based upon their description based on an immature specimen.

***Pratylenchus thornei* Sher & Allen, 1953**

Materials : Nil.

Diagnosis : Female Body open 'C' shaped, tapering posterior to vulva. Finely striated cuticle. Lateral field with 4 incisures, the outer ones are slightly crenate. Lip region continuous, marked by 3 annules; labial sclerotization extending backwards on 2-3 body annules, stylet 15-19 μm long. Female reproductive system prodelphic. Spermatheca without sperm. Tail tip broadly rounded to truncate, smooth.

Male – Generally similar to females, Spicules slender 21 μm long.

♀ = 0.4-0.7 mm, a = 25-36, b = 5.4-8.3, c = 18.6-25.1, V = 73-80, stylet – 17 μm .

♂ = L = 0.49 mm, a = 29, b = 6.2, c = 20.3, T = ?

Distribution : India : W. Bengal (Darjeeling).

Remarks : Reported by Baqri *et. al.* – All India Co-ordinated Research Project on nematodes (I.C.A.R.).

Family **Meloidogynidae** Skarbilovich, 1959

Subfamily **Meloidogyninae** Skarbilovich, 1959

Genus **Meloidogyne** Goeldi, 1892

Key to the species of **Meloidogyne**

1. Lateral line absent in perineal pattern. Interphasmidal distance 19-21 μm vulvar width 20-22 μm
 Lateral field with 2 incisures fairly wide in perineal pattern, Inter phasmidal distance 25-27 μm
 vulvar width 24-26 μm ***M. javanica***
2. Perineal pattern with dorsal arch very high, with irregular striae***M. incognita***
 Perineal pattern with low dorsal arch and with smooth striae.....***M. graminicola***

Meloidogyne incognita (Kofoid and White, 1919) Chitwood, 1949

1919. *Oxyuris incognita* Kofoid and White, *J. Am. med. Ass.* **72**(8) : 567-569.

1923. *Heterodera incognita* (Kofoid and White, 1919) Sanground, *Parasitology*, **10**(2) : 92-94.

1949. *Meloidogyne incognita* (Kofoid and White, 1919) Chitwood, *Proc. helminth. Soc. Wash.*, **16** : 90-104.

Materials : ♀ 15 – Bolpur, Birbhum, ♀ 9 Arambag, Tarakeswar, Hooghly., ♂ 12 – Bolpur, ♂ 10 Santiniketan, ♂ 4 Nanur, Birbhum, March, 86; A. Chatterjee & party.

Diagnosis : Male – Long, cylindroid body tapering slightly anteriorly. Cuticle distinctly striated, Lateral field about 1/3 of body width, with four incisures. Perineal pattern – Striae closely spaced, dorsal arch round and high, lateral line absent. Inter phasmidal distance 19-21 μm ; vulval width 20-22 μm , anus to tail tip 11-15 μm .

♀ L = 0.51 mm., width = 0.42 mm, stylet = 15 μm . knobs 3-5 μm across, median bulb 50 × 35 μm .

♂ L = 1.1 mm, a = 35, b' = 13, c = 92, stylet = 25 μm , knobs = 5 μm ., across; median bulb = 17 × 10 μm . spicula = 29 μm , gubernaculum – 9 μm .

Distribution : India : W. Bengal, Burdwan, Birbhum, Bankura, Hooghly, Murshidabad.

Remarks : This is a potential pest of more than 200 host plants.

Meloidogyne javanica (Treub, 1885) Chitwood, 1949

1885. *Heterodera javanica* Treub, *Meded. Land, Voor. Dienst. Buitenz.*, **2** : 1-39.

1890. *Tylenchus (Heterodora) javanica* (Treub, 1885) Cobb, *Agric. Gaz. N.S.N.* **1**(2) : 155-184.

1949. *Meloidogyne javanica* (Treub, 1885) Chitwood, *Proc. helminth. Soc. Wash.*, **16** : 90-104.

Materials : ♀ 3 Chatna, Bankura, March, 84, ♀ 7 Memari, Burdwan, ♂ 6 Bainchi, Hooghly, March, 86. ♂ 4 Kotulpur, Bankura, ♂ 5 Chatna, Bankura, March, 84, ♂ 4 Memari, Burdwan March, 85; A. Chatterjee and party.

Diagnosis : Cylindroid body, anteriorly tapering. Head continuous, stylet knobs round to sloping backwards. Lateral field with 4 incisures. Tail bluntly rounded. Spicula slightly curved with ventral and lateral flanges. Gubenaculum crescentic. Perineal pattern – fine striae, closely spaced

and round, lateral field with two incisures. Anal fold present. Short striae extending towards angle of vulva, vulvae width 25 μm ., anus to tail tip 10 μm .

♀ L = 0.63 mm., width 0.45 mm, stylet = 16 μm , knobs 4 μm , across, median bulb = 39 \times 15 μm , spicula = 29 μm . gubernaculum = 7 μm .

♂ L = 0.83 mm. a = 25, b' = 11, c = 50, stylet = 20 μm , knobs = 4 μm , across; median bulb = 19 \times 14 μm ; spicula = 29 μm , gubernaculum = 7 μm .

Distribution : India : W. Bengal, Burdwan, Birbhum, Bankura, Hooghly.

***Meloidogyne graminicola* Golden and Birchfield, 1965**

1965. *Meloidogyne graminicola* Golden and Birchfield, W. *Proc. Helminth Soc. Wash.*, 32(2) : 228-231.

Materials : ♀ 20, ♂ 10, Burdwan, Hooghly, Baqri & party.

Diagnosis : Female – Pearly white, globular or pear shaped with small neck. Cuticle distinctly annulated but often with irregular punctations. Lip region smooth, anteriorly flattened not distinctly set off from neck. Spear slender and delicate; Knobs rounded with posteriorly sloping anterior margins. Orifice of dorsal oesophageal gland 3.2 μ behind spear base. Excretory pore anterior to median oesophageal bulb, 7-16 annules behind lip region; median oesophageal bulb, highly muscular and large 20-23 μ long 10-12 μ wide, with strongly cuticularised valve; ovaries two, filling body cavity and overlying intestine. Perineal pattern dorsoventral, oval to circular, dorsal arch low with smooth striae. Tail tip with distinct but disorganized striae. Lateral field obscure or absent. Phasmids minute. Distance from anus to vulva about 2.5-3.0 times the distance between anus and level of phasmids.

♀ L = 0.57 mm, width = 0.41; a = 1.3, spear = 11.08 μm .

Distribution : India : W. Bengal, Burdwan, Birbhum, Hooghly, Malda, Murshidabad.

Remarks : Baqri *et. al.* (1984) had established it a major pest of rice beside *Hirschmanniella oryzae*.

Suborder **Criconematina** Siddiqi, 1980

Key to super families of **Criconematina**

Females and juveniles with thick cuticle bearing coarse, round or retrose annules; oesophagus with isthmus broad and amalgamated with basal bulb **Criconematoidea**

Females and juveniles with thin cuticle bearing fine round annules, oesophagus with isthmus not amalgamated with basal bulb **Tylenchuloidea**

Superfamily **Criconematoidea** Taylor, 1936

Family **Criconematidae** Taylor, 1936

Key to the subfamilies of **Criconematidae**

1. Female with a cuticular body sheath, juveniles with scales or spines usually arranged in alternating rows or irregularly **Hemicriconemoidinae**

Female without a cuticular body sheath; scales or spines is present in longitudinal rows 2

2. Juveniles and females with scales or spines (except females of *criconema*)..... ***Criconematinae***
 Juveniles and females without scales or spines ***Macroposthoniinae***

Subfamily ***Criconematinae*** Taylor, 1936

Genus ***Criconema*** Hofmanner & Menzel, 1914

Key to the species of ***Criconema***

Body annules 60-88 in number stylet 65-68 μm long..... ***Criconema degrissei***

Body annules 105-112 in number stylet 94-115 μm long..... ***Criconema bengalensis***

Criconema degrissei (Baqri, 1978) New Comb.

1978. *Nothocriconema degrissei* Baqri, *Indian J. Nematol.*, 8(1978) : 116-121.

Materials : Nil.

Diagnosis : Female Body slightly curved ventrally; Lip region low, with rounded lips. First labial annule not very prominent, 10-12 μm wide 2nd labial annule 14-18 μm ; 3rd annule 18-22 μm wide. Body annules 60-68 in number, posterior margin serrated except at tail. Stylet slender 65-68 μm or 15-18% of body length, basal knobs 8-9 μm wide. Orifice of dorsal oesophageal gland 9-10 annules from terminus; its anterior margin is larger and over hanging. Spermatheca non-functional, Tail conspicuously conoid.

φ L = 0.93; a = 12, b = 4.1, c = ?, V = 89.

Distribution : India, W. Bengal (Darjeeling).

Remarks : From original holotype description Baqri, 1978. Siddiqi, 1986 had synonymized *Nothocriconema* with the genus *Criconema* and in the present publication the species is placed under *Criconema*. The collection is from tea garden, Lebong, Darjeeling.

Criconema bengalensis (Sinha, 1989) New Comb.

1989. *Nothociconoma bengalensis* Sinha, Baqri & Choudhury, *Indian J. Nematol.*, 19(2) : 100-104.

Materials : Nil.

Diagnosis : Female Body almost straight upon fixation, tapering regularly towards both extremities. Body annules 105-112. Presence of some sclerotised structures in 8-10 longitudinal rows appearing, as cuticular punctation.

Two head annules; 1st pointing up word 13-14 μm wide, separated from the 2nd annules by a short and distinct neck 2nd annule 14-14 μm wide. Stylet slender 94-115 μm long, knobs anchor-shaped 8-10 μm wide. Vulva open 55-60 μm from tail terminus. Vagina 20-22 μm long. Spermatheca distinct with rounded sperms. Anus 10 annule from tail terminus. Tail conoid with pointed terminus.

φ (from holotype) L = 0.49 mm, a = 109, b = 3.6, c = 13, V = 87, V' = 57, R = 111; Rex = 36, Rv = 16, Ran = 9; R van = 6, Rst = 25, stylet = 102 μm .

Male – Not found.

Distribution : India : W. Bengal (24 Parganas).

Remarks : The species was described new by Sinha *et. al.* 1989 and the present description follows that description. Siddiqi (1986) had synonymized the genus *Nothocriconema* with that of *Criconema* and in the present work the species is placed under *Criconema*.

Collection is from mid-littoral swamp of Harinbari Mangrove.

Subfamily **Macroposthoniinae** Skarbilovich, 1959

Key to genera of **Macroposthoniinae**

Vulva open; submedian lobes usually present, separate **Macroposthonia**

Vulva closed; submedian lobes if present not separate..... **Criconemoides**

Genus **Macroposthonia** de Man, 1880

Macroposthonia ornata (Raski, 1985) De Grisse & Loof, 1965

1965. *Macroposthonia ornata* De Grisse & Loof, *Proc. helminth. Soc. Wash.*, **25** : 139-142.

Materials : Nil.

Description : was not available.

♀ L = 0.42-0.51 mm, a = 10-14, b = 35-4.3, c ?; V = 91-95; R = 79-91, RSt = 12-14, RV = 57, stylet = 51-54 µm.

Distribution : India : W. Bengal, Jalpaiguri, Burdwan, W. Dinajpur, Darjeeling. Reported by Baqri *et. al.* 1984.

Macroposthonia crenata (Loof, 1964) De Grisse & Loof, 1965

1965. *Macroposthonia crenata* De Grisse and Loof, *Verst. Pl. Zick. Dienst.*, **141** : 160-168.

1965. *M. crenata* Revision of the genus *criconemoides* *Meded Land Hoogeschool Opzock-Stns Gent.* **30** : 577-603.

Distribution : India : W. Bengal (West Dinajpur).

Remarks : Description and measurements were not available. The species was recorded by Baqri, 1984.

Genus **Criconemoides** Taylor, 1936

Criconemoides ornatus Raski 1985

1952. *Criconemoides cylindricum* Raski *Proc. Helminth. Soc. Wash.*, **19**(2) : 85-99.

1985. *C. ornatus* Raski *Proc. helminth. Soc. Wash.*, **25**(2) : 139-142.

Materials : ♀ 5 Tarakeswar, dist. Hooghly.

Diagnosis : ♀ body curved or straight. Head and tail terminus hemispherical to truncated shape. Head not set off, consisting of two annules, sublateral lobes present. Tail conoid, tip button shaped.

Distribution : India : W. Bengal, Hooghly, Burdwan.

Remarks : The species was first reported by Chaturvedi and Khera, 1979.

***Criconemella onoensis* (Luc, 1959) Luc & Raski, 1981**

1965. *Macroposthonia onoensis* (Luc, 1959) de Grisse & Loof, *Meded. Land Hoogesch. Opzoek-Stns.* **30** : 577-603.

1981. *Criconemella onoensis* (Luc, 1959) Luc & Raski, *Rev. Nematol.*, **4** : 3-21.

Materials : 10 ♀♀, Sukna, May, 81; Q. H. Baqri & party.

Diagnosis : Female Body cylindrical, cuticle marked by 111-135 annules. Lateral fields and phasmids absent. Lip region continuous with body pseudolips, greatly reduced; submedian lobes, present, projecting separately. Stylet 40-51 μm long with a very long conus and well developed basal knobs. Female reproductive system prodelphic; oesophagus with precorpus and a muscular post corpus, amalgamated, forming, enlarged cylindrical corpus, isthmus short and terminal bulb small. Vulva with open lips. Tail with a cup-shaped end.

♀ L = 0.41 mm; a = 13, b = 3.9; c = ?, V = 93; R = 131; RSt = 16; RV = 8; stylet = 50 μm .

Distribution : India : W. Bengal. (Darjeeling).

Remarks : Reported by Baqri, 1978 and description follows that.

Subfamily **Hemicriconemoidinae** Andrassy, 1979Genus ***Hemicriconemoides*** Chitwood & Birchfield, 1957Key to the species of ***Hemicriconemoides***

Stylet length 45-60 μm Vulvar sheath well developed..... ***H. cocophillus***

Stylet length 60-75 μm Vulvar sheath lacking..... ***H. mangiferae***

Hemicriconemoides mangiferae Siddiqi, 1961

1961. *Hemicriconemoides mangiferae* Siddiqi, M.R. *Proc. Helminthol. Soc. Wash.*, **28** : 19-35.

Materials : 10 ♀♀ Coochbihar, Oct., Nov., 83.

Diagnosis : Cuticular sheath attached to body at anterior end, vulva and some times on tail. Lip region slightly set off with 2 annules, 1st angular and directed outward. Body annules 3-4 μ wide in mid-body. Stylet knobs 5-7 μ across. Vulvar sheath lacking. Tail convex conoid or rounded. In convex- conoid tail, the last 3-4 annules narrow abruptly.

♀ L = 0.52 mm; a = 16; b = 4.7, c = ?, V = 93, R = 133; RSt = 21; RV = 14; stylet = 71 μm .

Distribution : India : W. Bengal, Coochbehar.

Remarks : Reported by Baqri, 1978 and the description follows that. Collection from rhizosphere of pine, apple, mango, banana.

Hemicriconemoides cocophillus (Loos, 1949) Chitwood and Birchfield, 1957

1957. *H. cocophillus* (Loos, 1949) Chitwood & Birchfield, *Proc. helminth. Soc. Wash.*, **24** : 80-86.

Materials : Nil.

Diagnosis : Female – Body robust, straight upon fixation, cuticular sheath attached to the inner cuticle at the anterior end. Cuticle distinctly annulated, 3-5 μm wide, at mid-body. No lateral field.

Lip region with 2 annules, slightly demarcated from body. Stylet 50-54 μm long, with well developed basal knobs, which are 5-7 μm wide. Orifice of the dorsal oesophageal gland 5-7 μm from basal knobs; oesophagous typical circonematid type. Ovary prodelphic. Vulvar sheath well developed. Tail convex conoid to attenuated.

♀ L = 0.42-54 mm.; a = 13-18, b = 4.9-5.1; c = ?, V = 90-94, R = 109-120, RSt = 14-15; RV = 8-12, stylet = 50-54 μm .

Distribution : India : W. Bengal, Darjeeling, Burdwan, Birbhum.

Remarks : Description following Baqri, 1978. Collection from Dagapur Tea Estate, Darjeeling.

***Hemicriconemoides sundarbanensis* Ganguly & Khan, 1982**

1982. Ganguly & Khan, *Indian Journal of Nematology*. **11** : 241-243.

Remarks : The species was recorded by Baqri, 1984 but the measurement were not available.

Superfamily Tylenchuloidea

Family Tylenchulidae Skarbilovich, 1947

Subfamily Tylenchulinae Skarbilovich, 1947

Genus *Tylenchulus* Cobb, 1915

***Tylenchulus semipenetrans* Cobb, 1913**

1913. *Tylenchulus semipenetrans* Cobb, N. A., *J. Wash. Acad. Sci.* **3** : 287-288.

Materials : Nil.

Diagnosis : Female : (mature) Body behind neck, swollen irregularly 68-100 μ at its widest, ventrally arcuate; neck region distorted, body behind vulva digitate, 36 μ long, diameter at vulva 23 μ (20-27). Body cuticle 4 μ . (2.5-5.5) thick near middle, not annulated, ovary coiled; Spermatheca with sperms, Intestine syncytial, lacking a lumen, rectum and anus absent. Excretory pore 17 μ (12-19) in front of vulva.

♀ L = 0.37 mm; a = 4.5; b = 2.97, excretory pore 82.5%, Spear = 13.5 μ .

Distribution : India : W. Bengal (Darjeeling).

Remarks : This has been established a dominant pest of Citrus in Darjeeling and Sikkim by Baqri *et.al.* (1984).

Family Paratylenchidae Thorne, 1949

Subfamily Paratylenchinae Thorne, 1949

Key to genera of *Paratylenchinae*

Stylet 43-119 μm long, excretory pore usually opposite to median bulb or more anterior. Mature females, with a tendency to swell abnormally in prevulval region ***Gracilacus***

Stylet under 40 μm ; excretory pore usually near base of isthmus or opposite to basal bulb, mature females not swelling abnormally ***Paratylenchus***

Genus *Paratylenchus* Micoletzky, 1922*Paratylenchus dianthus* Jenkins & Taylor, 1956

1956. *Paratylenchus dianthus* Jenkins & Taylor, *Proceedings Helminth. Soc. Wash.*, vol. 23 : 124-127.

Materials : Nil.

Diagnosis : Cuticle with transverse striae, about 2.0 microns apart lateral field 1/3 of the body diameter with 4 incisures, lip region is truncate, continuous with body contour and with 6 lips. No amphids. The conspicuous excretory pore opens ventrally near the base of isthmus. No phasmids. Spear with heavy knob. Dorsal oesophageal gland opens into the lumen of oesophagus about 4.6 μm behind the base of the spear; middle bulb is typical criconematoid. No cardia. Anus is obscure. Single ovary is very long, reach up to the base of the oesophagus. Oogonia in double row. Spermatheca with sperms. Vulva is transverse slit, immediately after vulva the body narrows down.

♀ L = 0.34-0.41 mm; a = 22-33; b = 4.0-4.9, c = 11-13; V = 82-85; stylet = 23-26 μm .

Distribution : India : W. Bengal (Darjeeling, Burdwan).

Remarks : The species was reported by Baqri, 1978 and the present description follows the original description of Jenkins and Taylors, 1956. Collection from tea garden, Dagapur.

Genus *Gracilacus* Raski, 1962*Gracilacus janai* Baqri, 1978

1978. *Gracilacus janai* Baqri, *Indian J. Nematol.*, 8 : 116-121.

Materials : Nil.

Diagnosis : Female Body ventrally arcuate, tapering towards both ends, cuticle marked with transverse striae. Lateral fields with two smooth incisures, about 1/6 - 1/7th body width near middle. Head narrow and flat, sclerotization light. Stylet 54-59 μm (19-22% of body length), basal knobs rounded, about 3 μm wide. Orifice of dorsal oesophageal gland 5-6 μm behind base of stylet. Median bulb 7-8 μm wide, 8-10 μm crescentic valves. Vulvae lips slightly protrude. Spermatheca filled with sperms. Tail cylindrical with bluntly rounded tips, marked with 16-20 annules ventrally.

♀ L = 0.27 mm, a = 18; b = 2.8, c = 12, V = 77.

Distribution : India : W. Bengal (Burdwan).

Remarks : From original description of Baqri, 1978.

Suborder *Hexatylna* Siddiqi, 1980Superfamily *Anguinoidea* Nicoll, 1935Family *Anguinidae* Nicoll, 1935Key to the subfamilies of *Anguinidae*

Postcorpus bulboid, muscular, valvate..... *Anguininae*

Postcorpus not bulboid, muscular or valvate..... *Nothotylenchinae*

Subfamily *Anguininae* Nicoll, 1935Key to the genera of *Anguininae*

1. Dorsal oesophageal gland forming a long lobe extending over intestine, with nucleus lying posterior to oesophago-intestinal junction *Pseudhalenchus*
 Dorsal oesophageal gland not forming a long lobe, extending over intestine, with nucleus anterior to oesophago-intestinal junction 2
2. Annulations prominent, lateral field with incisures, excretory pore posterior to median oesophageal bulb *Ditylenchus*
 Annulations absent or faint, lateral field without incisures, excretory pore anterior to median oesophageal bulb *Indoditylenchus*

Genus *Ditylenchus* Filipjev, 1936Key to the species of *Ditylenchus*

- Tail is of usual length of the genus. Bursa is extended, a little behind the tail tip, lateral field with four incisures *D. dipsaci*
- Tail is larger than usual *Ditylenchus*. Bursa is 1/3 of the tail length lateral field with six incisures *D. caudatus*

Ditylenchus dipsaci (Kuhn, 1857) Filipjev, 1936

1857. *Anguillula dipsaci* Kuhn, *Z. Wiss. Zool.*, (1) : 129-137.

1936. *Ditylenchus dipsaci* (Kuhn, 1857) Filipjev, *Trudy zool. Inst. Akad.*

Materials : Nil.

Diagnosis : Male Body curved ventrally, fine cuticular transverse striations, lateral field 1/6 body width, with four incisures. Head continuous, lip $3 \times 6 \mu\text{m}$, low and rounded. Stylet short and fine, knobs minute and fine. Procorpus $25 \mu\text{m}$., median bulb $14 \times 9 \mu\text{m}$. oval vulvular; isthmus and posterior bulb jointly measuring $49 \mu\text{m}$ in length. Spicula and gubernaculum tylenchoid, burrow is extended a little behind the tail tip.

Male L = 0.63 mm, a = 50, b = 6.4, c = 11, stylet = $10 \mu\text{m}$. spicula = $20 \mu\text{m}$., gubernaculum = $6 \mu\text{m}$.

Distribution : India : W. Bengal, Murshidabad.

Remarks : The only male was reported by Chaturvedi and Khera, 1979, and the present description in accordance of that report (No pathogenic symptom was reported). Collection from rhizosphere of jute.

Ditylenchus mirus Siddiqi, 1963

1963. Siddiqi, *X. Parasitekde* Vol. 23 : 390-396.

Distribution : India : W. Bengal, Burdwan.

Remarks : The description and measurements were not available.

***Ditylenchus caudatus* Thorne & Malek, 1961**

1961. *D. caudatus* Thorne & Malek, *Nematodes of the Northern great plains* : 1-111 publ. by South Dakota State Univ.

Materials : ♀ 5 Bolpur March, 1979; Baqri and party.

Diagnosis : Striae of mid body only, 1.5 μ apart. Lateral fields about 1/3 body width, with 6 incisures. Lip region rounded, not set off. Spear about 10 μ long, with strong basal knob, median bulb oval, with valve slightly anterior to centre. Basal bulb cylindroid. Intestine joined to bulb by an obscure valve, touched with oocytes arranged in single file except for a short region of multiplication. Vulva anus distance about equal to tail length.

Male more slender than female with well developed bursa extending about 1/3 tail length, the tail being larger than usual in *Ditylenchus* (Hence the name *caudatus*).

L = 1.0 mm; a = 28, b = 5.7; c = 10; V = 75.

Distribution : India, W. Bengal (Bhutan).

Remarks : The description of the species is given as per the original description of Thorne & Malek, 1961, author of the species.

Genus *Pseudhalenchus* Tarjan, 1958***Pseudhalenchus anchilisposomus* Tarjan, 1958**

1958. *Pseudhalenchus anchilisposomus* Tarjan, *Proc. Helminth. Soc. Wash.* 25(1) : 20-25.

Materials : ♀ 10 Jangipara, dist. Hooghly, Burdwan, 1972; Chaturvedi and Khera.

Diagnosis : Female : Body straight, fine cuticular striations, lateral field 1/3 of body width, marked with 6 incisures. Tail short conoid, 4-5 times anal body width long. Post vulvar sac 1/3 of the vulva anus distance. L = 0.59-0.75 mm; a = 36-41, b = 4.6-6.5, c = 11-16, V = 75-84, stylet = 7-8 μ m.

Distribution : India, W. Bengal. Burdwan, Hooghly, Midnapur, also reported from Rajasthan.

Remarks : The species was reported by Chaturvedi and Khera, 1979 were associated with jute crop.

Genus *Indoditylenchus* Sinha et. al. 1985***Indoditylenchus sundarbanensis* Sinha et. al. 1985.**

1985. *Indoditylenchus sundarbanensis* Sinha et. al. *Indian J. Helminth (NS)* 2 (1 & 2) Dec., 1985, 31-35.

Materials : ♀ 3; Prentice island, 1989, Mrs. B. Sinha

Diagnosis : Body almost straight upon fixation and tapering slightly towards both ends. Cuticle non annulated but with fine striae like dorylaimids. Longitudinal lines absent. Lateral field without incisures. Lip region smooth and continuous with body, 6.0-6.5 μ m wide and 2.0-2.5 μ m high. Head framework weakly sclerotised. Stylet 12-12.5 μ m long, about 2 times the head width, its anterior part (metenchium) 6-6.5 μ m long 50-52% of stylet length; basal knob, rounded about 2 μ m wide. Orifice of the dorsal oesophageal gland 2-2.5 μ m from stylet base. Median bulb 42-45% of the

oesophageal length. Posterior bulb does not overlap intestine, Hemizonid not seen. Vulva a transverse slit Vagina 9-10 μm about 1/3rd of the body width. Female reproductive system monodelphic. Spermatheca filled with sperms, ovary very long extending upto the anterior end of basal oesophageal bulb, oocytes in a single row. Tail elongate conoid with rounded terminus.

(From Holotype) L = 1.00 a = 36, b = 6.7, c = 8.4; V = 82.

Remarks : The genus *Indotylenchus* was proposed new. It was close to *Ditylechnus* but without incisures and annulations and excretory pore anterior to median oesophageal bulb.

Distribution : India, W. Bengal (24-Parganas).

Subfamily *Nothotylenchinae* Thorne, 1941

Key to the genera of *Nothotylenchinae*

- Spear, less than 10 μm long..... *Nothotylenchus*
 Spear, more than 10 μm long *Chitinotylenchus*

Key to the species of *Chitinotylenchus*

- Stylet 10-15 μm long..... *C. annulatus*
 Stylet 14-22 μm long..... *C. paragracilis*

Chitinotylenchus annulatus (Cassidy, 1930) Filipjev, 1936

1936. *Chitinotylenchus annulatus* Filipjev, I.N., *Proc. Helm. Soc. Wash.*, **3** : 80-102.

Materials : Nil.

Diagnosis : Female – Cuticle coarsely striated, lateral fields with 4 incisures. Head very shallow, flat, not offset. Spear 20 μ long, the posterior part trifurcate, its limbs bearing rather horizontally flattened knobs. Median bulb of oesophagus ovate, with central valve plates; isthmus swelling to a pyriform, second bulb. Vulva a depressed slit. Ovary prodelphic, out stretched.

♀ L = 0.65 mm, a = 27, b = 5.7, c = 84, V = ?

Male – unknown

Distribution : India, W. Bengal (Murshidabad)

Remarks : The species was reported in the final report of All India Co-ordinated Research Project on Nematodes by Baqri *et. al.* (1984).

Genus *Chitinotylenchus* (Micoletzky, 1922) Filipjev, 1936

Chitinotylenchus paragracilis (Micoletzky, 1922) Filipjev, 1936

1922. *Tylenchus (Chitinotylenchus) paragracilis* Micoletzky *Naturgesch.*, **87** (8) : 1-320.

1936. *C. paragracilis* (Micoletzky, 1922) Filipjev, 1936, *Trudy zool. Inst. Nauk. SSSR* **3** : 537-550.

Materials : Male – 1, Collection from Habra, 24-Parganas.

Diagnosis : Body curved ventrally; cuticle finely striated; lateral field 1/3 of body width marked with four incisures. Head not set off, 3 μm . high and 5 μm wide cephalic frame work very

weak. Tail cylindrical, tip rounded, about 4 anal body diameter long. Stylet slender, knobs minute and separate from each other; procorpus cylindrical 30 μm long, median bulb oval 10 X 6.5 μm , valve inconspicuous, posterior bulb pyriform. Posterior bulb and isthmus 33 μm long one nucleus seen in posterior bulb. Nerve ring 70 μm from anterior end. Testis single, outstretched; spermatocytes, arranged in a single row. Spicula tylenchoid. Bursa – adanal, 20 μm . long. Gubernaculum thick in the middle.

L = 0.46 mm, a = 38, b = 5.8, c = 13, T = 58, stylet = 13 μm spicula = 14 μm . gubernaculum = 7 μm .

Distribution : India, W. Bengal (24-Parganas).

Remarks : Chaturvedi and Khera (1977) recorded this genus first in India.

Genus *Nothotylenchus* Thorne, 1941

Nothotylenchus acutus Khan, 1965

1965. *Nothotylenchus acutus* Khan, S.H. *Proceedings of the Helminthological Society Wash.*, **32** (1) : 90-93.

Materials : Nil.

Diagnosis : Female – Slender body, tapering at both ends appearing ventrally a little curved. Cuticle with transverse striae 1-5 μ about in mid-body. Lateral field with 4 incisures, about 1/4 of the body width. Lip region, low, rounded smooth. Spear 7 μ long; knobs rounded 2 μ wide. Outlet of dorsal oesophageal gland 1.5 μ behind spear base. Corpus slender, with a valveless spindle-shaped median swelling. Basal bulb well set off having 3 oesophageal glands. Basal oesophageal bulb joined to the intestine by a small rounded cardia. Vulva a transverse slit. Vagina with thick walls about 1/4 vulval body width long. Spermatheca present, with sperms, ovary single prodelphic. Vulva-anus distance about 1.17 times that of tail length. Anus distinct. Tail ventrally arcuate, cylindroid, with pointed terminus.

♀ L = 0.5 mm, a = 28, b = 6, c = 11, V = 76.3% spear 8 μ ♂ L = 0.39 mm, a = 31, b = 4.9, c = 8.5, spear = 7 μ spicula 14 μ , gubernaculum = 4.5 μ

Distribution : India, W. Bengal (West Dinajpur).

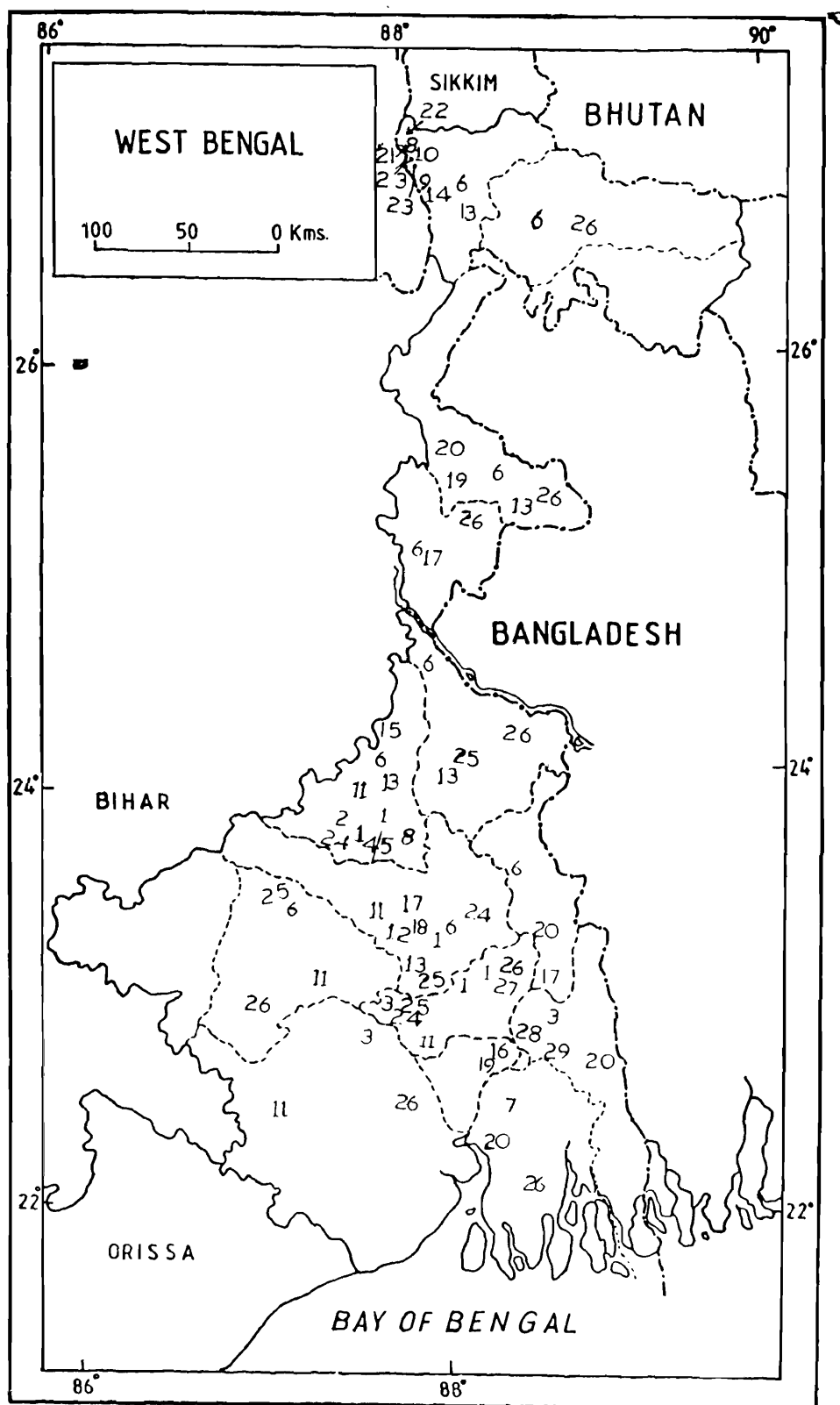
District Wise Distribution Chart of the Species

| Name of the Family | Name of the species | Locality |
|--------------------|---------------------------------------|--|
| 1 | 2 | 3 |
| Tylenchidae | (1) ** <i>Tylenchus davaini</i> | District Burdwan Birbhum and Hooghly |
| | (2) <i>T. arcuatus</i> | District Birbhum |
| | (3) <i>Filenchus filiformis</i> | Districts Hooghly, Midnapore, 24-Parganas, and Burdwan |
| | (4) <i>Boleodorus acutus</i> | District Birbhum |
| | (5) <i>Ottolenchus equisetus</i> | District Birbhum |
| Dolichodoridae | (6) <i>Tylenchorhynchus mashhoodi</i> | Districts Burdwan, Birbhum, Bankura, Hooghly, Howrah, Murshidabad, Nadia, West Dinajpur, Malda, Jalpaiguri & Darjeeling |
| | (7) <i>T. goffarti</i> | Districts 24-Parganas & Birbhum (Narendrapur) |
| | (8) <i>T. brassicae</i> | Districts Birbhum and Darjeeling |
| Dolichodoridae | (9) <i>Quinisulcius capitatus</i> | District Darjeeling (Kalimpong) |
| Dolichodoridae | (10) <i>Merlinius affinis</i> | Districts Darjeeling (Lebong) |
| Hoplolaimidae | (11) <i>Hoplolaimus dubius</i> | District Murshidabad, (Rangsagar), District ✓ Bankura, Burdwan, Hooghly, Midnapore, Nadia and 24-Parganas. |
| | (12) <i>H. columbus</i> | District Burdwan |
| | (13) <i>H. indicus</i> | Districts Burdwan, Murshidabad, West Dijnajpur, Birbhum and Darjeeling |
| | (14) <i>Scutellonema brachyurum</i> | District Darjeeling (Kalimpong) |
| | (15) <i>Helicotylenchus abunaamai</i> | District Birbhum (Kharbani) |
| | (16) <i>H. paraplatyurus</i> | District Howrah (Belur) |
| | (17) <i>H. retusus</i> | District Malda (Gazal), Birbhum, Nadia (Santipur, Krishnagar), Burdwan (Krishnapur) |
| | (18) <i>H. crenacauda</i> | District Burdwan |
| | (19) <i>H. microcephalus</i> | District West Dinajpur and Howrah (Belur) |
| | (20) <i>H. indicus</i> | Districts 24-Parganas(Bongaon, Barasat, Diamond Harbour) Nadia (Ranaghat), West Dinajpur and Darjeeling. |

** Index number shown against each species are again shown in the map of West Bengal to demonstrate the distribution patters.

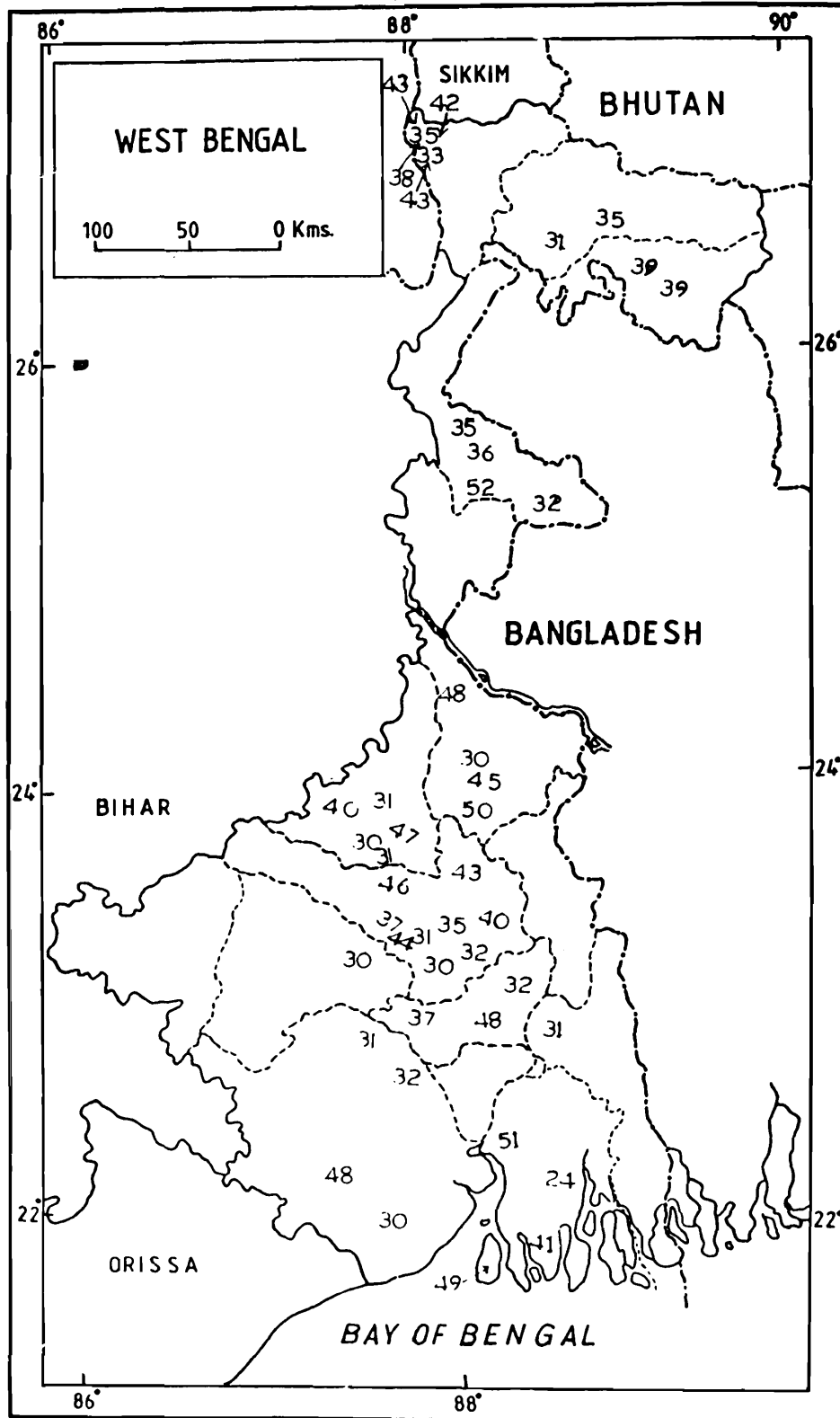
| 1 | 2 | 3 |
|-----------------|--|---|
| Hoplolaimidae | (21) <i>Helicotylenchus multicinctus</i> | District Darjeeling |
| | (22) <i>H. erythrinae</i> | District Darjeeling |
| | (23) <i>H. dihystra</i> | Districts Darjeeling (Kurseong, Lebong, Phoolsering) and Birbhum |
| Rotylenchulidae | (24) <i>Rotylenchulus reniformis</i> | Districts Hooghly (Tarakeswar, Duttapur), Burdwan and Birbhum |
| Pratylenchidae | (25) <i>Hirschmanniella oryzae</i> | Districts Burdwan (Memari, Monteswar) Birbhum (Bolpur), Hooghly (Arambag & Uttarpara), Bankura (Susunia), Murshidabad (Rangsagar) |
| | (26) <i>H. gracilis</i> | Districts Burdwan, West Dinajpur, Murshidabad, Malda, Jalpaiguri, Darjeeling and Birbhum |
| | (27) <i>Pratylenchus minyus</i> | District Hooghly (Jangipara) |
| | (28) <i>P. coffeae</i> | District 24-Parganas (Barrackpore) |
| | (29) <i>P. thornei</i> | ? |
| Meloidogynidae | (30) <i>Meloidogyne incognita</i> | Districts Birbhum, Bankura, Hooghly, Burdwan and Murshidabad. |
| Meloidogynidae | (31) <i>Meloidogyne javanica</i> | District Burdwan (Memari, Monteswar), Birbhum (Bolpur, Ahmadpur) Bankura and Hooghly. |
| | (32) <i>M. graminicola</i> | District Burdwan (Memari, Monteswar), Birbhum (Bolpur, Ahmadpur), Bankura and Hooghly. |
| Criconematidae | (33) <i>Nothociconema degrissei</i> | District Darjeeling (Lebong) |
| | (34) <i>N. bengalensis</i> | District 24-Parganas (Haribari) |
| | (35) <i>Macroposthonia ornata</i> | District Jalpaiguri (Shakigarh), Burdwan, West Dinajpur and Darjeeling |
| | (36) <i>M. crenata</i> | District West Dinajpur |
| | (37) <i>Criconemoides ornatus</i> | Districts Hooghly (Tarakeswar) Burdwan (Memari and Galsi) |
| | (38) <i>Criconemella onoensis</i> | District Darjeeling (Sukna) |
| | (39) <i>Hemicrionemoides mangiferae</i> | District Coochbehar (Phulbari, Chakchaka) |
| | (40) <i>H. cocophillus</i> | Districts Darjeeling, Birbhum, Burdwan |
| Tylenchulidae | (41) <i>Tylenchulus semipenetrans</i> | District Darjeeling |
| Paratylenchidae | (43) <i>Paratylenchus dianthus</i> | Districts Darjeeling (Dagapur), Burdwan |
| | (44) <i>Gracilacus janai</i> | District Burdwan (Sealdah) |
| Anguinidae | (45) <i>Ditylenchus dipsaci</i> | District Murshidabad (Rangsagar) |

| 1 | 2 | 3 |
|------|---------------------------------------|---|
| (46) | <i>D. mirus</i> | District Burwan |
| (47) | <i>D. caudatus</i> | District Birbhum |
| (48) | <i>Pseudhalenchus anchilisposomus</i> | Districts Burdwan, Hooghly, Midnapore and Murshdabad |
| (49) | <i>Indoditylenchus sundarbanesis</i> | (Sundarban) |
| (50) | <i>Chitinotylenchus annulatus</i> | District Murshidabad |
| (51) | <i>C. paragracilis</i> | District 24-Parganas (Falta) |
| (52) | <i>Nothotylenchus acutus</i> | District West Dinajpur |



Distribution Map

The index number of each species in accordance with the index number of the preceding chart are shown in the map.



Distribution Map

The index number of each species in accordance with the index number of the preceding chart are shown in the map.

SUMMARY

The present paper includes fifty two, so far recorded species of plant parasitic nematodes, all belong to order Tylenchida under Phylum Nematoda. These fifty two species belong to twenty six genera and ten families. Beside that, two chapters on general morphology (in short) and method of collection are added at the beginning.

ACKNOWLEDGEMENTS

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FRESHWATER ROTIFERS
(Rotifera : Eurotatoria)

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INTRODUCTION

The rotifers are pseudocoelomate and usually microscopic organisms (size generally ranging between 40 μm – 250 μm) which comprise a very old group of invertebrates. These are invariably treated as a class of the phylum Aschelminthes or even as a distinct phylum. They exhibit world-wide distribution and possess remarkable ability to colonise diversified aquatic and semi-aquatic biotopes. They constitute an important component of lentic freshwater zooplanktonic communities, form an integral link in aquatic food-chain and contribute significantly to secondary production in freshwater ecosystems. The rotifers are also regarded as valuable indicators of trophic status of their environs.

The rotifers have attracted the attention of the microscopists from different parts of the globe since they were first described by Leeuwenhoek (1703). The systematic studies on Indian Rotifera were, however, initiated by Anderson (1889) and so far resulted in about 105 publications from widely scattered localities in this country but still reflected lack of comprehensive regional or state-wise faunistic investigations (Sharma, 1991).

The first contribution to the rotifer fauna of West Bengal was made by Anderson (1889) based on the collections from Calcutta and its environs. This was followed by the report of some species from Canning (Sewell, 1934) while Sewell (1935) gave an account of the rotifers present in the Indian Museum Tank, Calcutta (during 1929-32). Tiwari and Sharma (1977) remarked on the changes in their species composition in the stated pond after a period of about four decades. Further, various papers by this author (Sharma 1978a, 78b, 78c, 79a, 79b, 79c, 79d, 79e and 80) provided important information based on the samples collected from Lower Bengal. This study was subsequently extended to include material from other parts of this state. The present communication, therefore, attempts to present a comprehensive account of the rotifer fauna of West Bengal based on the author's collections from different parts of this state and also on re-examination of the earlier reports. All the presently documented taxa are briefly described and illustrated and taxonomic keys are provided. Comments are made on the nature and composition of the rotifer fauna of West Bengal and distribution and ecology of various taxa.

MATERIAL AND METHODS

This study is based on the samples collected by this author from wide range of ephemeral and perennial habitats from 57 localities and their environs, spread over thirteen districts of West Bengal (Fig. 1). A detailed list of the sampled localities is given separately. The collections have been obtained between July, 1974 – September, 1978 and on various occasions between the years 1984-87. In all, over 600 samples are examined for the present observations.

Individual collections were made with a plankton net of bolting silk (No. 25) and were preserved in the field in 5% formalin. Macrophyte associated aquatic biotopes were disturbed before sampling to dislodge various inhabitant species. Different collections were screened with a Wild stereoscopic binocular microscope. Permanent mounts of the studied taxa were made in Polyvinyl alcohol lectophenol mixture. Some soft-bodied forms were also mounted temporarily in glycerol. Various taxa were identified by observing morphological characters suggested by Voigt (1957), Edmondson (1959), Kutikova (1970), Ruttner-Kolisko (1974), Koste (1978) and Pontin (1978). Detailed structure of trophi, wherever necessary, was examined for specific differentiation.

All the drawings are made using a Leitz-Dialux phase contrast microscope with a drawing tube attachment. The measurements are given in micrometers (μm). The reference collections and slides are deposited in Freshwater Biology Laboratory, Department of Zoology, North-Eastern Hill University, Shillong.

The classification followed in this text is after Koste (1978). Various species are arranged alphabetically under their respective genera. The material examined from West Bengal is indicated by the abbreviations of the localities. The distribution of various taxa in West Bengal is indicated by different districts, in India is shown by the states from where these have so far been reported while that from elsewhere referred to their global distribution.

LIST OF LOCALITIES

The examined samples were collected from the following localities and their adjacent areas :

| District | Localities | Abbreviation |
|----------|------------------------------|--------------|
| Calcutta | 1. Indian Museum tank | IMT |
| | 2. Tank opposite Lindsay st. | TOL |
| | 3. Tank in Maidan | TIM |
| | 4. Tank opposite Park street | TOP |
| | 5. Victorial memorial lake | VML |
| | 6. Dhakuria lake | DL |
| | 7. Bhawanipore | BP |
| | 8. Ballygunge | BG |
| | 9. Tollygunge | TG |
| | 10. New Alipore | NAP |
| | 11. Mominpur | MNP |
| | 12. Behala | BL |

| District | Localities | Abbreviation |
|-------------------|-------------------------------|---------------------|
| North 24 Parganas | 13. Baranagar | BN |
| | 14. Bon-Hugli | BH |
| | 15. Dum Dum | DD |
| | 16. Titagarh | TG |
| | 17. Barrackpore | BRP |
| South 24 Parganas | 18. Barisha | BR |
| | 19. Thakurpukur | THK |
| | 20. Amtala | AMT |
| | 21. Alampur | ALP |
| | 22. Raipur | RP |
| | 23. Sarisha | SR |
| | 24. Nayabasti | NB |
| | 25. Gopalpur | GP |
| | 26. Jinjrahat | JH |
| | 27. Memanpur | MNP |
| | 28. Maheshtala | MST |
| | 29. Budge Budge | BB |
| | 30. Achipur | APR |
| | 31. Garia | GR |
| | 32. Manikpur | MNK |
| 33. Baripur | BPR | |
| Haora | 34. Haora | HWH |
| | 35. Sibpur (Botanical Garden) | BG |
| | 36. Bali | BA |
| Hugli | 37. Liluah | LH |
| | 38. Serampur | SRP |
| | 39. Hind Motors | HM |
| | 40. Tarakeshwar | TKR |
| | 41. Natungram | NGM |
| Barddhaman | 42. Amgram | AMG |
| | 43. Barddhaman | BDN |
| Nadia | 44. Asansol | ASN |
| | 45. Kalyani | KLN |
| | 46. Naihati | NH |
| | 47. Krishnanagar | KNG |

| District | Localities | Abbreviation |
|------------|--------------------|--------------|
| Medinipur | 48. Medinipur | MDP |
| | 49. Kharagpur | KRP |
| Bankura | 50. Bankura | BNK |
| Malda | 51. Malda City | MLD |
| Jalpaiguri | 52. Jalpaiguri | JPG |
| | 53. New Jalpaiguri | NJP |
| Koch Behar | 54. Alipurduar | APD |
| | 55. Koch Behar | CB |
| | 56. New Koch Behar | NCB |
| Darjiling | 57. Siliguri | SLG |

SYSTEMATIC LIST OF THE EXAMINED TAXA

Class ROTIFERA

Subclass EUROTATORIA Bartos, 1959

Superorder MONOGONONTA Wesenberg-Lund, 1889

Order PLOIMIDA Delage, 1897

Family BRACHIONIDAE Wesenberg-Lund, 1899

Brachionus angularis Gosse, 1851

B. bidentata bidentata Anderson, 1889

B. bidentata crassispineus (Hauer, 1963)

B. bidentata jirovci (Bartos, 1946)

B. budapestinensis Daday, 1885

B. calyciflorus f. dorcas (Gosse, 1851)

B. calyciflorus f. anuraeiformis (Brehm, 1909)

B. calyciflorus f. borgerti (Apstein, 1907)

B. caudatus personatus (Ahlstrom, 1940)

B. caudatus aculeatus (Hauer, 1937)

B. caudatus aculeatus f. lateralis (Hauer, 1937)

B. caudatus vulgatus (Ahlstrom, 1940)

B. diversicornis (Daday, 1883)

B. donneri Brehm, 1951

B. forficula forficula Wierzejski, 1891

B. forficula minor (Voronkov, 1913)

B. falcatus Zacharias, 1893
B. mirabilis (Daday, 1897)
B. patulus patulus Müller, 1776
B. patulus macracanthus (Daday, 1905)
B. plicatilis Müller, 1786
B. pterodinooides Rousselet, 1913
B. quadridentatus quadridentatus Hermann, 1783
B. quadridentatus cluniorbicularis (Skorikov, 1894)
B. quadridentatus rhenanus (Lauterborn, 1893)
B. quadridentatus brevispinus (Ehrenberg, 1832)
B. rubens Ehrenberg, 1838
B. sessilis Varga, 1951
B. urceolaris (Müller, 1773)
Keratella cochlearis (Gosse, 1851)
K. lenzi Hauer, 1938
K. procurva (Thorpe, 1891)
K. quadrata (Müller, 1786)
K. tropica (Apstein, 1907)
Platytias quadricornis (Ehrenberg, 1838)
Anuraeopsis coelata (De Beauchamp, 1932)
A. fissa (Gosse, 1851)

Family EUCHLANIDAE Bartos, 1959

Beauchampiella eudactylota (Gosse, 1886)
Euchlanis dilatata Ehrenberg, 1832
E. oropha Gosse, 1887
E. triquetra Ehrenberg, 1838
Dipleuchlanis propatula (Gosse, 1887)
Tripleuchlanis plicata (Levander, 1884)

Family MYTILINIDAE Bartos, 1959

Mytilina ventralis ventralis (Ehrenberg, 1832)
M. ventralis longidactyla (Wulfert, 1965)
M. acanthophora Hauer, 1938
M. bisulcata (Lucks, 1912)

Family TRICHOTRIDAE Bartos, 1959

Trichotria tetractis (Ehrenberg, 1830)*Macrochaetus sericus* (Thorpe, 1893)*M. collinsi* (Gosse, 1867)

Family COLURELLIDAE Bartos, 1959

Colurella obtusa (Gosse, 1886)*C. uncinata* (Müller, 1773)*C. sulcata* (Sternroos, 1898)*Lepadella (Lepadella) acuminata* (Ehrenberg, 1834)*L. (L.) aspida* Harring, 1916*L. (L.) cristata* (Rousselet, 1893)*L. (L.) imbricata* Harring, 1914*L. (L.) ovalis ovalis* (Müller, 1786)*L. (L.) ovalis larga* (Sharma, 1978) new comb.*L. (L.) patella* (Müller, 1773)*L. (L.) quadricarinata* (Sternroos, 1898)*L. (L.) rhomboides* (Gosse, 1886)*L. (L.) rhomboidula* (Bryce, 1890)*L. (L.) triptera* Ehrenberg, 1830*L. (L.) triprojectus* Sharma, 1978*Lepadella (Heterolepadella) aspicora* Myers, 1934*L. (L.) ehrenbergi* (Perty, 1850)*L. (L.) heterostyla* (Murray, 1913)*Squatinella mutica* (Ehrenberg, 1832)

Family LECANIDAE Bartos, 1959

Lecane (Lcane) aculeata (Jakubski, 1912)*L. (L.) arcuata* Harring, 1914*L. (L.) bifastigata* Hauer, 1938*L. (L.) crepida crepida* Harring, 1914*L. (L.) crepida bengalensis* (Sharma, 1978) new comb.*L. (L.) curvicornis curvicornis* (Murray, 1913)*L. (L.) curvicornis nitida* (Murray, 1913)*L. (L.) flexilis* (Gosse, 1886)*L. (L.) hastata* (Murray, 1913)*L. (L.) hornemanni* (Ehrenberg, 1834)

- L. (L.) inermis* (Bryce, 1892)
L. (L.) lateralis Sharma, 1978
L. (L.) leontina (Turner, 1892)
L. (L.) ligona (Dunlop, 1901)
L. (L.) ludwigi (Eckstein, 1883)
L. (L.) luna luna (Müller, 1773)
L. (L.) luna dorsicalis (Arora, 1965) new comb.
L. (L.) nana (Murray, 1913)
L. (L.) ohioensis (Herrick, 1885)
L. (L.) papuana (Murray, 1913)
L. (L.) pertica Haring & Myers, 1926
L. (L.) signifera signifera (Jennings, 1896)
L. (L.) signifera ploenensis (Voigt, 1902)
L. (L.) stokesii (Pell, 1890)
L. (L.) ungulata (Gosse, 1887)
L. (L.) vasishti Sharma, 1980
Lecane (Hemimonostyla) inopinata (Haring & Myers, 1926)
L. (Hm.) sympoda (Hauer, 1929)
L. (Hm.) syngenes (Hauer, 1938)
Lecane (Monostyla) bulla (Gosse, 1851)
L. (M.) closterocerca (Schmarda, 1859)
L. (M.) decipiens (Murray, 1913)
L. (M.) furcata (Murray, 1913)
L. (M.) hamata (Stokes, 1896)
L. (M.) lunaris lunaris (Ehrenberg, 1832)
L. (M.) lunaris crenata (Haring, 1913)
L. (M.) obtusa (Murray, 1913)
L. (M.) pawlowskii Wulfert, 1966
L. (M.) pyriformis (Daday, 1905)
L. (M.) quadridentata (Ehrenberg, 1832)
L. (M.) scutata (Haring & Myers, 1926)
L. (M.) sinuata (Hauer, 1938)
L. (M.) stenroosi (Meissner, 1908)
L. (M.) thalera (Haring & Myers, 1926)
L. (M.) thienemanni (Hauer, 1938)
L. (M.) unguitata (Fadeev, 1925)

Family NOTOMMATIDAE Remane, 1933 (partim)

Cephalodella auriculata (Müller, 1773)

C. catellina (Müller, 1776)

C. forficula (Ehrenberg, 1832)

C. gibba (Ehrenberg, 1832)

C. mucronata Haring & Myers, 1924

Scaridium longicaudum (Müller, 1786)

Family TRICHOCERCIDAE Remane, 1933

Trichocerca (Trichocerca) rattus (Müller, 1776)

T. (T.) elongata braziliensis (Murray, 1913)

T. (T.) pusilla (Lauterborn, 1898)

T. (T.) cylindrica (Imhof, 1891)

T. (Diurella) similis (Wierzejski, 1893)

T. (D.) weberi (Jennings, 1903)

Family ASPLANCHNIDAE Haring & Myers, 1926

Asplanchna brightwelli Gosse, 1850

A. priodonta Gosse, 1850

Family SYNCHAETIDAE Remane, 1933

Polyarthra vulgaris Carlin, 1943

Family DICRANOPHORIDAE Remane, 1933

Dicranophorus forcipatus (Müller, 1773)

D. lutkeni (Bergendal, 1892)

Family GASTROPODIDAE Remane, 1933

Gastropus stylifer Imhof, 1891

Ascomorpha saltans Bartsch, 1870

A. ovalis (Bergendal, 1892)

Order GNESIOTROCHA De Beauchamp, 1965

Suborder FLOSCULARIACEA Remane, 1933

Family CONOCHILIDAE Bartos, 1959
Conochilus natans (Seligo, 1900)
Conochilus unicornis Rousselet, 1892

Family HEXARTHRIDAE Bartos, 1959
Hexarthra mira (Hudson, 1871)

Family TESTUDINELLIDAE Bartos, 1959
Pompholyx sulcata Hudson, 1885
T. emarginula (Stenroos, 1898)
T. parva (Terne. ., 1892)

Family FILINIDAE Bartos, 1959
Filinia longiseta (Ehrenberg, 1834)
F. terminalis (Plate, 1886)
F. opoliensis Zacharias, 1898
F. pejleri (Hutchinson, 1964)

Family TROCHOSPHAERIDAE Bartos, 1959
Horaëlla brehmi Donner, 1949

Superorder DIGONONTA Bartos, 1959

Order BDELLOIDEA Remane, 1933

Family PHILODINIDAE Remane, 1933
Rotaria neptunia (Ehrenberg, 1832)

SYSTEMATIC ACCOUNT

Class ROTIFERA

Subclass EUROTATORIA Bartos, 1959

Ovary with vitellarium. Reproduction parthenogenetic, bisexual or asexual (Bdelloidea).

This subclass includes freshwater or brackishwater rotifers. It is divisible into two superorders i.e., Monogononta and Digononta, both of which are represented in this account.

Key to superorders of subclass Eurotatoria

Ovary Single..... Monogononta Wesenberg-Lund, 1889
Ovaries paired Digononta Bartos, 1959

Superorder Monogononta Wesenberg-Lund, 1889

Ovary unpaired. Reproduction by parthenogenesis, at times bisexual. Forms usually free swimming.

The monogononts belong to two orders and these are also included in the present study.

Key to orders of Superorder Monogononta

- Corona of diverse types. Trophi varied. Foot without ciliaries.....
 Order Ploimida Delage, 1897
- Corona varied. Trophi malleoramate. Ciliated foot present in free swimming larvae.....
 Order Gnesiotrocha De Beauchamp, 1965

Order PLOIMIDA Delage, 1897

Loricata or illoricata forms; body shape variable. Corona of diverse types; never of *Hexarthra*-, *Conochilus*- or *Collotheca*- type. Trophi malleate, cardate, forcipate, virgate or incaudate. Foot, if present, with paired or unpaired toes. Forms creeping, free-swimming, free-living, epibionts or ectoparasites; not forming colonies.

Order Ploimida is represented by twelve families in this account.

Key to recorded families of order PLOIMIDA

1. Corona of *Brachionus*- or *Euchlanis*- type..... 2
 Corona of *Notommata*-, *Dicranophorus*- or *Asplanchna*- type 7
2. Trophi malleate, not modified for suction..... 3
 Trophi malleate, modified for suction Family Lecanidae Bartos, 1959
3. Head without hood. Corona without lateral lamellae
 Family Colurellidae Bartos, 1959
 Head with hood. Corona with lateral lamellae 4
4. Dorsal surface of lorica without any longitudinal sulcus..... 5
 Dorsal surface of lorica with a longitudinal sulcus..... Family Mytilinidae Bartos, 1959
5. Only trunk covered with lorica..... 6
 Head, trunk and foot loricate and clearly defined Family Trichotridae Bartos, 1959
6. Dorsal and ventral plates of lorica fused laterally
 Family Brachionidae Wesenberg-Lund, 1899
 Dorsal and ventral plates of lorica joined laterally by a thin membrane.....
 Family Euchlanidae Bartos, 1959
7. Corona of *Notommata*-type. Trophi virgate
 Family Notommatidae Remane, 1933 (*partim*)
 Corona *Asplanchna*- or *Dicranophorus*- type. Trophi modified virgate, incaudate or forcipate. 8

8. Corona of *Dicranophorus*-type. Trophi forcipate.....
 Family Dicranophoridae Remane, 1933
 Corona of *Asplanchna*- type. Trophi modified virgate or incaudate 9
9. Trophi modified virgate 10
 Trophi incaudate Family Asplanchnidae Haring & Myers, 1926
10. Corona symmetrical. Foot present or absent 11
 Corona asymmetrical. Foot present, with equal or unequal bristle-like toes.....
 Family Trichocercidae Remane, 1933
11. Corona as a small ring. Stomach with blind extensions
 Family Gastropodidae Remane, 1933
 Corona reduced to small zone around mouth, and on anterior lobes or auricles, if present.
 Stomach without blind extensions Family Synchaetidae Remane, 1933

Family BRACHIONIDAE Wesenberg-Lund, 1899

Only trunk covered with lorica; dorsal and ventral plates of lorica closely fused laterally. Foot present or absent. Trophi malleate. Corona of *Brachionus*- or *Euchlanis*- type. Funnel shaped mouth in buccal area.

Brachionidae was previously considered to be a very large family but was split up (Bartos, 1959) into six families. Amongst seven genera presently included in this family (Koste, 1978), only four i.e., *Brachionus*, *Keratella*, *Platytias* and *Anuraeopsis* are noticed in the collections from West Bengal.

Key to recorded genera of family BRACHIONIDAE

1. Foot present 2
 Foot absent..... 3
2. Foot annulated and retractile within lorica..... Genus *Brachionus* Pallas, 1766
 Foot segmented, not retractile Genus *Platytias* Haring, 1913
3. Lorica with distinct occipital spines. Dorsum with characteristic pattern.....
 Genus *Keratella* Bory de St. Vincent, 1822
 Lorica without occipital spines. Dorsum with or without any pattern.....
 Genus *Anuraeopsis* Lauterborn, 1900

Genus 1. *Brachionus* Pallas, 1766

Brachionus Pallas, 1766, p. 89

Noteus Ehrenberg, 1830, p. 48

Schizocerca Daday, 1883, p. 291

Characters : Body oval, more or less flattened dorsoventrally and distinctly loricate. Head illoricate and retractile. Lorica usually separated into a dorsal and a ventral plate; basal plate lorica developed in some species. Anterior occipital margin with two, four or six spines. With or without postero-lateral spines. Posteromedian spines present in some species. Foot-opening at the posterior end of lorica between the basis of posterior spines, if present. Foot long, flexible, annulated and retractile; toes two.

Type species : *Brachionus urceus* (Linnaeus, 1758).

The examined material included seventeen species of *Brachionus*. Some of the documented species also exhibited infraspecific variations as mentioned in this text.

Key to recorded species of genus *Brachionus*

1. Anterior ventral margin with conspicuous spines 2
 Anterior ventral margin without conspicuous spines..... 3
2. Lateral antennae on conical protuberance.....*Brachionus donneri* Brehm
 Lateral antennae not on conical protuberance.....*Brachionus patulus* Müller
3. With six occipitals spines 4
 With 2-4 occipitals spines 13
4. Lateral occipitals longest..... 5
 Lateral occipitals not longest 6
5. Basal plate developed. Posterior spines wide apart at base*Brachionus bidentata* Anderson
 Basal plate wanting. Posterior spines close together at base..... *Brachiu*
6. Intermediate occipital spines longest *Brachionus falcatus* Zacharias
 Median occipital spines longest 7
7. Posterior spines developed 8
 Posterior spines wanting..... 9
8. Foot-sheath prolonged into long spines.....*Brachionus mirabilis* (Daday)
 Foot-sheath not prolonged into long spines.....*Brachionus quadridentatus* (Daday)
9. Sheath surrounding foot-opening present *Brachionus pterodinoides* Rousselet
 No definite foot-sheath present..... 10
10. Lorica globular..... *Brachionus plicatilis* Müller
 Lorica oval, dorsoventrally compressed..... 11
11. Foot-opening ventral; occipital spines rudimentary *Brachionus sessilis* Varga
 Foot-opening terminal; occipital spines distinct..... 12

FIG. 1

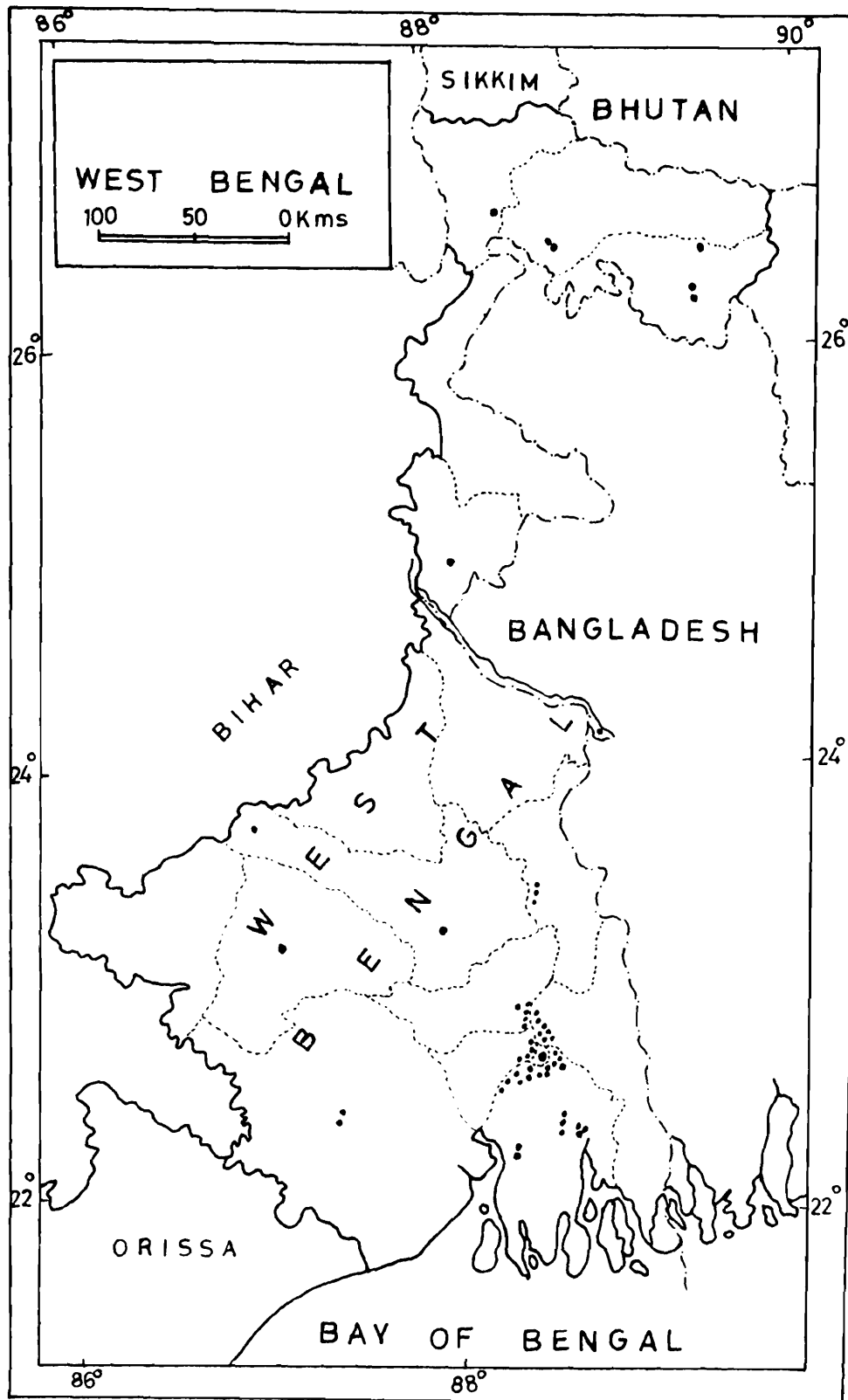


Fig. 1. Map of West Bengal indicating sampled localities.

12. Occipital spines saw-toothed *Brachionus rubens* Ehrenberg
 Occipital spines thin, not saw-toothed *Brachionus urceolaris* (Müller)
13. With two occipital spines *Brachionus angularis* Gosse
 With four occipital spines 14
14. Lorica globular, not separated into dorsal and ventral plates *Brachionus calyciflorus* Pallas
 Lorica compressed, separated into distinct dorsal and ventral plates 15
15. Dorsum with plaques. Caudal spines lacking *Brachionus budapestinensis* Daday
 Dorsum without plaques. Caudal spines distinctly developed 16
16. Posterior spines wide apart at base and with knee-like swellings on inner side
 *Brachionus forficula* Wierzejski
 Posterior spines close together at base and without any swelling on inner side
 *Brachionus diversicornis* (Daday)

1. *Brachionus angularis* Gosse, 1851
 (Figs. 2-5)

Brachionus angularis Gosse, 1851, p. 203; Ahlstrom, 1940, p. 154, Pl. 5, figs. 10-19.

Brachionus angularis angularis Gosse : Koste, 1978, p. 92, T.13 : 1-6, a-b.

Material examined : IMT, TOL, DL, BG, TG, BL, BN, BH, DD, TG, BRP, BR, THK, SR, NB, GP, MST, MNK, HWH, BG, SRP, HM, NGM, NH, BDN, ASN, KLN, KNG, MDP, KRP, BNK, MLD, NJP, CB, SLG.

Characters : Lorica usually stippled, compressed dorsoventrally and with a pattern of cuticular plates in some specimens. Anterior margin with two median occipital spines. Foot-opening large and flanked laterally by cuticular protuberances. Posterior spines lacking.

Measurements : Total length : 85-105; maximum width 65-90.

Distribution : India : West Bengal (Calcutta, North & South 24-Parganas, Haora, Hugli, Bardhaman, Nadia, Medinipur, Bankura, Malda, Jalpaiguri, Koch Behar and Darjiling); Andhra Pradesh, Assam, Orissa, Maharashtra, Madhya Pradesh, Delhi, Kashmir, Punjab, Haryana and Chandigarh (U.T.). Elsewhere : Cosmopolitan.

2a. *Brachionus bidentata bidentata* Anderson, 1889
 (Fig. 6)

Brachionus bidentata Anderson, 1889, p. 352, pl. 21, fig.13; Ahlstrom, 1940, p. 167, pl. 12, figs. 1-2, 4-7.

Brachionus furculatus Thorpe, 1891, p. 302, pl. 6, fig. 3; Edmondson and Hutchinson, 1934, p. 158.

Brachionus bidentata bidentata Anderson : Kutikova, 1970, p.588, fig. 934; Koste, 1978, p.75, T.10 : 1. a-s.

Material examined : APR, BPR, BNK, SRK, HWH, HM, TKR, PG, APD, BDN, SLG.

Characters : Lorica firm, stippled and elongated. Dorsal and ventral plates joined together for about 3/4 of length of lorica and then diverge to unite with basal plate. Anterior margin with six

occipital spines; laterals and medians longer than intermediate occipital spines. Postero-lateral spines almost parallel-sided and variable in length. Foot-opening with a symmetrically projecting sheath.

Measurements : Total length : 170-210; maximum width : 100-115.

Distribution : India : West Bengal (South 24-Parganas, Haora, Hugli, Barddhaman, Jalpaiguri, Koch Behar and Darjiling); Andhra Pradesh, Orissa, Punjab and Haryana. Elsewhere : Tropics and Subtropics.

2b. *Brachionus bidentata crassispineus* (Hauer, 1963)
(Fig. 7)

Brachionus bidentata Anderson : Ahlstrom, 1940, pl.1 3, fig. 8.

Brachionus bidentata var. *crassispineus* Hauer, 1963, p. 173, abb. 4.

Brachionus bidentata f. *crassispineus* (Hauer) : Koste, 1978, p.76, T.10 : 1, g and i; Sharma, 1983, p.32, figs. 21-23.

Material examined : THK, SR, BDN.

Characters : Lorica stippled, almost rectangular in outline. Postero-lateral spines divergent and with strong basis.

Measurements : Total length : 165-200; maximum width 150-190; postero-lateral spines : 60-72.

Distribution : India : West Bengal (South 24-Parganas and Barddhaman); Punjab and Orissa. Elsewhere : Africa, India and Australia.

2c. *Brachionus bidentata jirovci* (Bartos, 1946)
(Fig. 8)

Brachionus bidentata Anderson : Ahlstrom, 1940, pl.13, fig.9.

Brachionus bidentata var. *jirovci* Bartos, 1946, p.146, abb.1-4.

Brachionus bidentata f. *adorna* Wulfert, 1966, p.59, abb. 4, a-d.

Brachionus bidentata jirovci (Bartos) : Kutikova, 1970, p.589, fig.933.

Brachionus bidentata f. *jirovci* (Bartos): Koste, 1978, p.76, T.10: 1, j-q.

Material examined : BN, SR, MLD.

Characters : Lorica variable in outline and without posterior spines. Dorsal plate of lorica often with distinct cuticular pattern.

Forma *adorna* described by Wulfert (1966) from Baroda (Gujarat) was subsequently reported from West Bengal (Sharma, 1979b) and Punjab (Sharma, 1981). These are proposed to be treated as synonyms of *B. bidentata* f. *jirovci* following Koste(1978). The previous specimens from West Bengal also did not show any distinct pattern on the dorsal plate of lorica.

Measurements : Total length 150-185; maximum width : 110-122.

Distribution : India : West Bengal (North & South 24-Parganas and Malda); Punjab. Elsewhere : Europe, Africa and Australia.

3. *Brachionus budapestinensis* Daday, 1885

(Fig. 9)

Brachionus budapestinensis Daday, 1885, p.113, 211, pl.XI, figs. 1-4, 8, 10; Ahlstrom, 1940, p.152, pl.4, figs. 6-9.

Brachionus lineatus Skorikov, 1896, p.356, pl.VIII, fig. 26.

Brachionus budapestinensis budapestinensis Daday : Kutikova, 1970, p.589, fig.931; Koste, 1978, p.91, T.12 : 4, a-d.

Material examined : BH, BN, GR, THK, TOL, BNK, CB, TKR, JPG.

Characters : Lorica firm, oval and covered with minute tubercles. Anterior occipital margin with six spines. Median occipital spines longer than laterals. Dorsal plate with cuticular ridges, with a central pentagonal field. Caudal spines lacking. Foot-opening small v-shaped dorsally and a large oval opening ventrally.

Measurements : Total length : 115-136; maximum width : 80-90; lateral occipital spines : 18-22; median occipital spines : 30-35.

Distribution : India : West Bengal (South 24-Parganas, Hugli, Bankura, Jalpaiguri and Koch Behar); Madhya Pradesh and Punjab. Elsewhere : Cosmopolitan.

4. *Brachionus calyciflorus* Pallas, 1766

Brachionus calyciflorus Pallas, 1766, p.93.

Characters : Lorica flexible and oval; with four broad-based occipital spines of variable length. Posterior and postero-lateral spines present or absent, usually of variable length.

B. calyciflorus is a variable and polymorphic species (Ahlstrom, 1940; Kutikova, 1970; Koste, 1978). It is also represented by the following forms in the collections examined from West Bengal.

4a. *Brachionus calyciflorus* f. *dorcas* (Gosse, 1851)

(Fig. 10)

Brachionus dorcas Gosse, 1851, p.202; Hudson and Gosse, 1886, p. 118, pl.28, fig.4.

Brachionus calyciflorus f. *dorcas* (Gosse) : Ahlstrom, 1940, p. 179, pl..III, fig. 5.

Material examined : AMT, BB, BH, BPR, IMT, SR, SRK, TOL, MST, BDN, KLN, NH, NCB, MLD, SLG.

Characters : Lorica flexible and oval in outline. Anterior occipital margin with four broad based spines; median occipital spines distinctly longer than laterals. Postero-lateral spines present or absent.

Measurements : Total length : 400-460; maximum width 250-280; lateral occipital spines : 60-72; median occipital spines : 95-120.

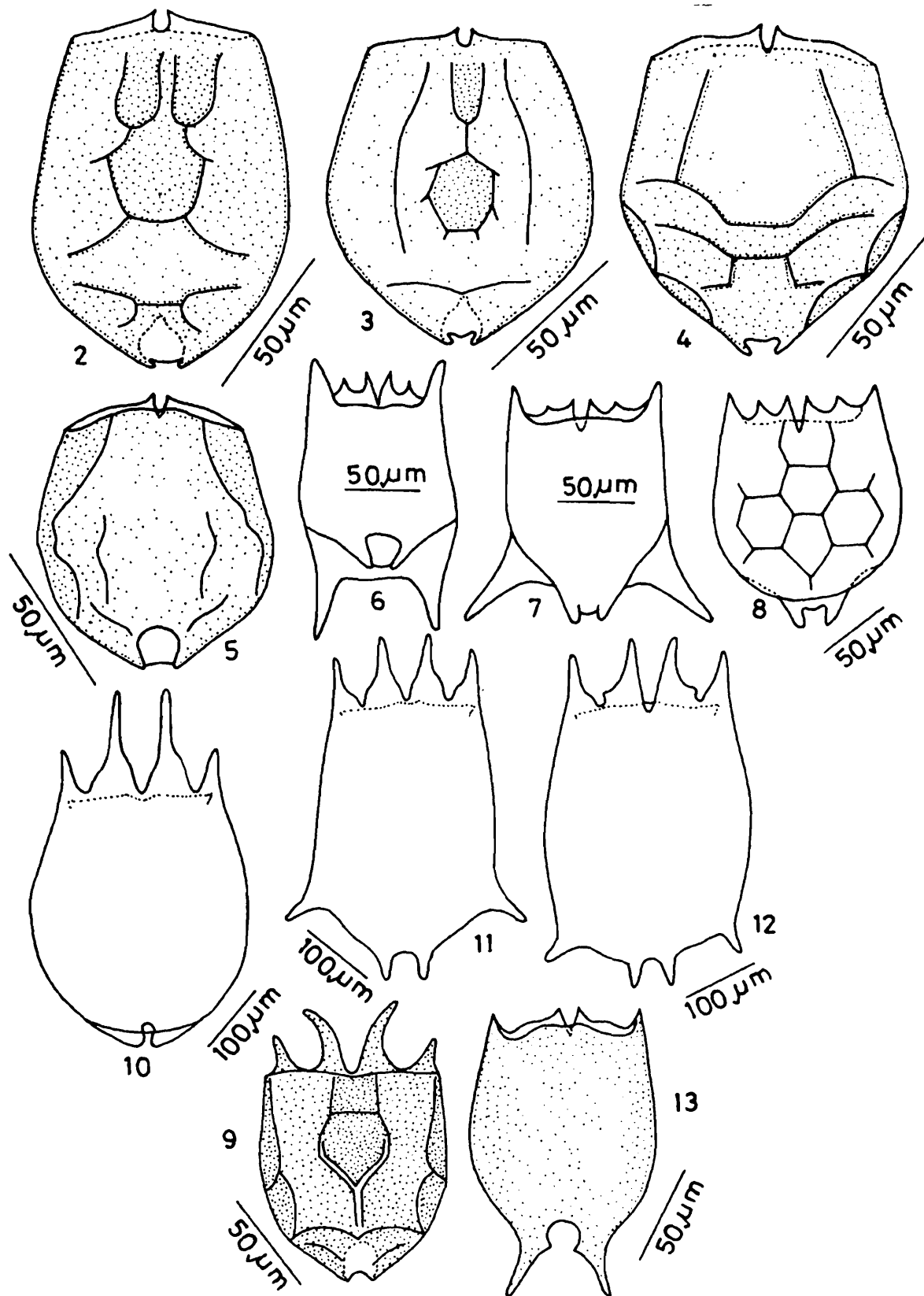
Distribution : India : West Bengal (Calcutta, North & South 24-Parganas, Hugli, Bardhaman, Nadia, Malda, Koch Behar and Darjiling); Orissa, Andhra Pradesh, Madhya Pradesh and Punjab. Elsewhere : Cosmopolitan.

4b. *Brachionus calyciflorus* f. *anuraeiformis* (Brehm, 1909)

(Fig. 11)

Brachionus pala anuraeiformis Brehm, 1909, p.210, text-fig.

Brachionus calyciflorus Pallas : Ahlstrom, 1940, p.150, pl.3, fig.3.



Figs. 2-4, *Brachionus angularis* Gosse : dorsal views; Fig. 5. ventral view; Fig. 6. *B. bidentata* *bidentata* Anderson : Ventral view; Fig. 7. *B. bidentata* *crassispineus* (Hauer) : ventral view; Fig. 8. *B. bidentata* *jirovci* (Bartos) : dorsal view; Fig. 9. *B. budapestinensis* Daday : dorsal view; Fig. 10. *B. calyciflorus* f. *dorcis* (Gosse) : dorsal view; Fig. 11. *B. calyciflorus* f. *anuraeiformis* (Brehm) : dorsal view; Fig. 12. *B. calyciflorus* f. *borgerti* (Apstein) : dorsal view; Fig. 13. *B. caudatus* *aculeatus* (Hauer) : ventral view.

Brachionus calyciflorus f. *anuraeiformis* (Brehm) : Arora, 1966, p.4, text-fig. 10; Koste, 1978, p.8, T.12 : 1, b; Sharma, 1979b, p.242, pl.I, fig.3.

Material examined : APR, IMT, THK, KLN, APD, NH.

Characters : Occipital margin with four spines; median occipital spines slightly longer than laterals. Posterior spines present. Postero-lateral spines moderately small.

Measurements : Total length : 290-310; maximum width 175-180; postero-lateral spines 35-55.

Distribution : India : West Bengal (Calcutta and South 24-Parganas); Orissa Madhya Pradesh and Punjab. Elsewhere : Cosmopolitan.

4c. *Brachionus calyciflorus* f. *borgerti* (Apstein, 1907)
(Fig. 12)

Brachionus amphiceros borgerti Apstein, 1907, p.211, figs. G, H.

Brachionus calyciflorus f. *borgerti* (Apstein) : Ahlstrom, 1940, p.170, pl.20, figs. 7, 8.

Brachionus calyciflorus var. *hymani* Dhanapathi, 1974, p.364, pl. II, figs. 3, 4.

Material examined : AMT, APR, TOL, BN, TG.

Characters : Median occipital spines slightly longer than laterals and with saw-tooth like basis. Postero-lateral spines present or absent; if present, small.

Measurements : Total length : 280-300; maximum width: 170-180; postero-lateral spines : 25-32.

Distribution : India : West Bengal (Calcutta, North & South 24-Parganas); Orissa, Andhra Pradesh and Punjab. Elsewhere : Sri Lanka, Formosa.

5. *Brachionus caudatus* Barrois & Daday, 1894

Brachionus caudatus Barrois & Daday, 1894 a, p.232, pl.VII, figs. 9, 10, 13.

Characters : Lorica usually stippled and often with a pattern of cuticular plates or ridges. Occipital margin with two median spines separated by a U-shaped sinus; lateral spines developed in some forms and intermediates rarely developed. Posterior spines stout, usually divergent and flexed ventrally.

It is another variable species of genus *Brachionus* and is presently represented by three subspecies and one form.

5a. *Brachionus caudatus aculeatus* (Hauer, 1937)
(Figs. 13 & 14)

Brachionus angularis v. *aculeatus* Hauer, 1937, p. 18, fig. 1a.

Brachionus caudatus v. *aculeatus* (Hauer) : Ahlstrom, 1940, p. 159, 3, e-h, T. 13 : 23, f.

Brachionus angularis var. *aculeatus* f. *laterals* Hauer, 1937, p.19, fig. 16.

Material examined : AMT, BB, TIM, THK, APR, IMT, MNK, MNP, MST, BDN, APD.

Characters : Lorica rigid, stippled, moderately compressed dorso-ventrally and with six occipital spines. Lateral and median occipital spines almost equally developed. Posterior spines bent ventrally and outwardly, each posterior spine bearing a dorsally extended spur-like process on its inner side.

Some specimens with lateral prominences on postero-lateral corners of lorica (Fig. 14) are designated as *B. caudatus aculeatus* f. *lateralis* (Hauer).

Measurements : Total length : 140-158; maximum width : 85-112.

Distribution : India : Madhya Pradesh, Rajasthan, Panjab, West Bengal and Orissa. Elsewhere : Tropics and Subtropics.

5b. *Brachionus caudatus personatus* (Ahlstrom, 1940)
(Fig. 15)

Brachionus caudatus var. *personatus* Ahlstrom, 1940, p.158, pl. 7, figs. 1, 2, 5-7; Koste, 1978, p.95, T.13 : 23, a-e, 24, T.14: 3, a-d.

Brachionus caudatus f. *personatus* (Ahlstrom) : Sharma, 1983, p.36, fig.31.

Material examined : BH, BN, BPR, GR, NJP, SLG.

Characters : Lorica rigid, heavily stippled and with six occipital spines; lateral occipital spines longer than medians. Posterior spines strong, divergent and in the plane of axis of the body.

Measurements : Total length : 190-200; maximum width : 105-115; posterior spines: 62-75.

Distribution : India : West Bengal (North & South 24-Parganas, Jalpaiguri and Darjiling); Orissa and Punjab. Elsewhere : Pantropical.

5c. *Brachionus caudatus vulgatus* (Ahlstrom, 1940)
(Fig. 16)

Brachionus caudatus f. *vulgatus* Ahlstrom, 1940, p.156, pl.6, figs. 6, 8-11; Koste, 1978, p.95, T.13 : 19-22.

Material examined : APR, BPR, GR. SR.

Characters : Lorica with a pattern of cuticular ridges on dorsal plate; occipital margin with two small median spines. Posterior spines divergent and arising at an angle ventrally.

Measurements : Total length : 165-170; maximum width : 95-100; posterior spines : 50-60.

Distribution : India : West Bengal (South 24-Parganas) and Punjab. Elsewhere : Subtropics.

6. *Brachionus diversicornis* (Daday, 1883)
(Fig. 17)

Schizocerca diversicornis Daday, 1883, p.291; Daday, 1885, p. 132, pl.XI, figs. 5-7.

Brachionus diversicornis (Daday) : Ahlstrom, 1940, p.161, pl.9 fig.7.

Brachionus diversicornis diversicornis (Daday) : Koste, 1978, p.86, T.15 : 5, a-d.

Material examined : AMT, BB, BL, BN, BPR, BRP, SR, THK, MLD, BH, HWH, NH, CB, NJP.

Characters : Lorica elongated, rigid and compressed dorsoventrally. Anterior margin with four occipital spines; median occipital spines short and laterals longer. Posterior spines two, unequal and divergent; the right posterior spine usually long.

Measurements : Total length : 250-465; maximum width : 120-200.

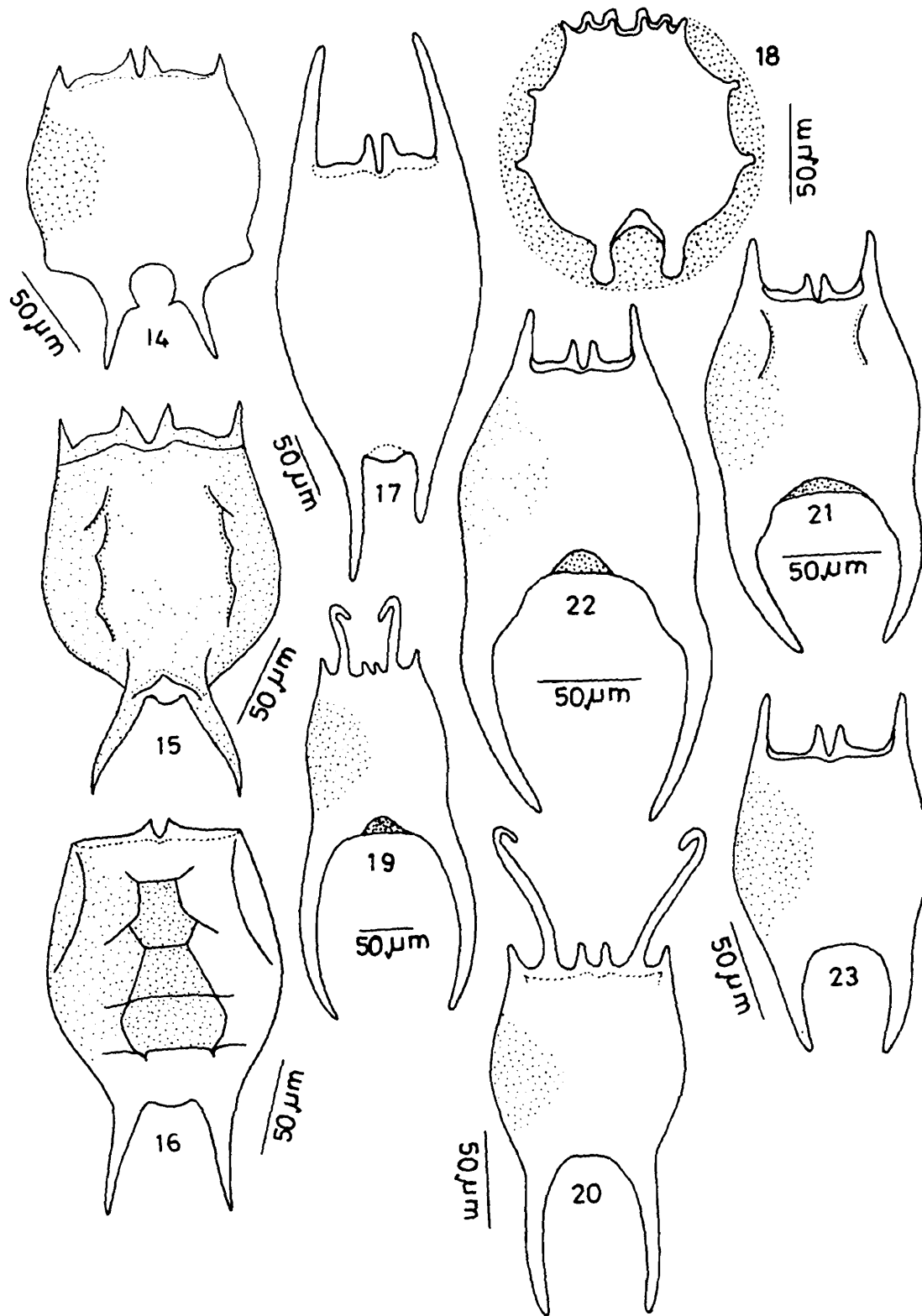


Fig. 14. *Brachionus caudatus aculeatus* f. *lateralis* (Hauer) : ventral view; Fig. 15. *B. caudatus personatus* (Ahlstrom) : ventral view; Fig. 16. *B. caudatus vulgatus* (Ahlstrom) : dorsal view; Fig. 17. *B. diversicornis* (Daday) : dorsal view; Fig. 18. *B. donneri* Brehm : dorsal view (with gelatinous covering); Fig. 19 and 20. *B. falcatus* Zacharias : dorsal views; Figs. 21 and 22. *B. forficula* Wierzejski : dorsal views; Fig. 23. *B. forficula minor* (Voronkov) : ventral view.

Characters : India : West Bengal (North & South 24-Parganas, Haora, Malda, Jalpaiguri and Koch Behar); Orissa, Assam and Punjab. Elsewhere : widespread but not so far recorded from America.

7. *Brachionus donneri* Brehm, 1951
(Fig. 18)

Brachionus donneri Brehm, 1951, p.54, abb. 1; Berzins, 1973, p.458, figs.12-14; Sharma, 1983, p.32, figs. 1 & 2.

Measurements : APD, SLG.

Characters : Lorica oval, strongly flattened dorsoventrally and with a gelatinous cover. Occipital margin with six blunt spines and ventral anterior margin with four short blunt spines. Lateral antennae located on conical lateral protuberances. Foot-opening flanked with club-shaped spines.

Measurements : Total length : 128-135.

Distribution : This species comprises a new report from West Bengal. India : West Bengal (Jalpaiguri and Koch Behar); Tamil Nadu and Assam. Elsewhere : Tropical central America, South and South-Eastern Asia and Tropical Australia.

8. *Brachionus falcatus* Zacharias, 1898
(Figs. 19 & 20)

Brachionus falcatus Zacharias, 1898, p.45, taf. IV, fig.4; Ahlstrom, 1940, p.164, pl.10, figs. 1-3.
Brachionus falcatus falcatus Zacharias : Koste, 1978, p.83, T.14 : 2, a-b.

Material examined : AMT, APR, BL, BN, THK, BPR, DL, VML, TOL, NH, MLD, BH, TKR, APD, CB, NJP, BNK, BDN.

Characters : Lorica rigid and compressed dorsoventrally. Occipital margin with six spines : intermediate occipital spines longest and curved ventrally, laterals and medians short and of almost equal length. Posterior spines long, incurved and widely separated at their bases.

Measurements : Total length : 200-360; maximum width : 118-140.

Distribution : India : West Bengal (Calcutta, North & South 24-Parganas, Hugli, Bankura, Bardhaman, Malda, Jalpaiguri and Koch Behar); widely distributed in this country, so far reported from Assam, Orissa, Bihar, Andhra Pradesh, Madhya Pradesh, Gujarat, Rajasthan, Kerala, Punjab and Haryana. Elsewhere : Pantropical and Subpantropical.

9a. *Brachionus forficula forficula* Wierzejski, 1891
(Figs. 21 & 22)

Brachionus forficula Wierzejski, 1891, p.51, fig.3; Ahlstrom, 1940, p.162, pl.3, fig.8, pl.20, figs.1, 2.
Brachionus forficula forficula Wierzejski : Koste, 1978, p.96, T.14 : 7, c, e.

Material examined : AMT, BB, BL, MST, BPR, SR, GR, SRK, MNP, THK, KRP, HWH, KLN, BDN, TG, CB, SLG.

Characters : Lorica rigid, finely stippled and compressed dorso-ventrally. Anterior margin with four occipital spines, laterals longer than medians. Posterior spines stout, inwardly directed and

widely separated at their bases; each with a knee-like swelling on inner side near the base. Polymorphic species.

Measurements : Total length : 210-260; maximum width : 112-120.

Distribution : India : West Bengal (North & South 24-Parganas, Howrah, Hugli, Burdwan, Nadia, Cooch Behar and Darjeeling); Orissa, Andhra Pradesh, Gujarat and Punjab. Elsewhere : Subtropicopolitan.

9b. *Brachionus forcifula minor* (Voronkov, 1913)
(Fig. 23)

Brachionus forcifula var. *minor* Voronkov, 1913, p.103, fig.9.

Brachionus forcifula f. *minor* (Voronkov) : Fadeev, 1925, p.288, fig.A, 8-9; Koste, 1978, p.96, T.14 : &, b.

Material examined : MNK, SR, MLD, SLG, THK.

Characters : Forms small, lorica rigid and finely stippled. Posterior spines short, of almost equal length and without any swelling. Ratio of length of posterior spines to total body length less than half.

Measurements : Total length : 130-150; lorica length: 78-94; posterior spines : 40-50.

Distribution : India : West Bengal (South 24-Parganas, Malda and Darjiling); Orissa and Punjab. Elsewhere : Subtropics.

10a. *Brachionus patulus patulus* (O. F. Müller, 1786)
(Fig. 24)

Brachionus patulus Müller, 1786, p.361, Taf. XLVII, figs. 14, 15; Koste, 1978, p.69, T. 8 : 1, 2a, 3, 6.

Platylas patulus (Müller) : Ahlstrom, 1940, p. 175, pl. 19, figs. 1-4.

Material examined : BH, BL, BN, IMT, MNP, MNK, TOL, TOP, VML, SRP, ASN, KNG, KRP, JPG, APD.

Characters : Lorica subrectangular and dorsum with a pattern of cuticular ridges. Both occipital and mental margins with short, blunt spines. Posterior spines short and stout. Foot-opening flanked by two short spines.

Measurements : Total length : 220-260; maximum width : 160-180.

Distribution : India : West Bengal (Calcutta, North & South 24-Parganas, Hugli, Barddhaman, Nadia, Jalpaiguri and Koch Behar); widely distributed in this country, reported so far from Orissa, Andhra Pradesh, Gujarat, Tamil Nadu, Kerala, Rajasthan, Punjab and Kashmir. Elsewhere : Cosmopolitan.

10b. *Brachionus patulus macracanthus* (Daday, 1905)
(Fig. 25)

Noteus militaris var. *macracanthus* Daday, 1905, p.119, pl. VII, figs. 3,4.

Platylas patulus macracanthus (Daday) : Harring, 1914, p.530, pl.XVII, fig. 1.

Platylas patulus var. *macracanthus* (Daday) : Ahlstrom, 1940, p.176, pl. XIX, figs.5, 8.

Brachionus patulus var. *macracanthus* (Daday) : Wulfert, 1965, p.49, Abb. 4c; Koste, 1978, p.69, T.16 : 2, b.

Brachionus patulus macracanthus (Daday) : Sharma, 1983, p.269, 2. Fig.2.

Material examined : NCB, NJP.

Characters : Differentiated by its distinctly elongated posterior spines; lateral antennae situated on postero-lateral spines.

Measurements : Total length : 220-240; maximum width : 125-140; postero-lateral spines : 115-128.

Distribution : Represents a new record from West Bengal. India : West Bengal (Jalpaiguri and Koch Behar) and Meghalaya. Elsewhere : Neotropics.

11. *Brachionus plicatilis* O. F. Müller, 1786

(Fig. 26)

Brachionus plicatilis Müller, 1786, p.344, pl.L, figs.1-8; Ahlstrom, 1940, p.149, pl.2, figs. 1-9.

Brachionus plicatilis plicatilis Müller : Koste, 1978, p.77, T.9 : 1, a-e, T.12 : 7.

Material examined : BN, THK, APR.

Characters : Lorica oval and flexible. Anterior margin with six occipital spines; occipital spines almost equally long, broad-based, acutely pointed and saw-toothed.

Measurements : Total length : 170-190; maximum width : 130-140.

Distribution : India : West Bengal (North & South 24-Parganas); Assam, Rajasthan, Punjab and Ladak. Elsewhere : Cosmopolitan.

12. *Brachionus pterodinoides* Rousselet, 1913

(Fig. 27)

Brachionus pterodinoides Rousselet, 1913, p. 59, pl.VI, fig.1, a-e; Ahlstrom, 1940, p.169, pl.XIV, figs. 9-11.

Material examined : BN, THK.

Characters : Lorica oval and strongly compressed dorsoventrally. Anterior margin with six occipital spines of almost equal length. Foot-opening pear-shaped and located ventrally. Foot sheath weakly developed.

Measurements : Total length : 266-280; maximum width : 185-200.

Distribution : India : West Bengal (North & South 24-Parganas) and Assam. Elsewhere : Europe, North and South America.

13. *Brachionus mirabilis* Daday, 1897

(Fig. 28)

Brachionus mirabilis Daday, 1897, p.140, fig. 8; Ahlstrom, 1940, p.167, pl.11, figs.5-8.

Brachionus quadridentatus mirabilis (Daday) : Koste, 1978, p.75, T. 5 : 5, a-d.

Material examined : APR, BB, APD.

Characters : Lorica firm and stippled. Anterior occipital margin with six spines; medians longest and curved outwards. Ventral plate of lorica terminating into two long posterior spines extending backwards from lorica at an angle of 45°. Foot-opening situated between the bases of ventral spines and surrounded by a sheath.

Measurements : Total length : 250-260; maximum width: 120-125; caudal spines : 120-130; foot-opening spines : 70-100.

Distribution : India : West Bengal (South 24-Parganas and Koch Behar); Assam and Orissa. Elsewhere : Tropics.

14a. *Brachionus quadridentatus quadridentatus* Hermann, 1783
(Figs. 29 & 30)

Brachionus quadridentatus Hermann, 1783, p.47, pl. II, fig.9; Ahlstrom, 1940, p.165, pl.10, fig.9.

Brachionus quadridentatus quadridentatus Hermann : Kutikova, 1970, p.581, fig.907; Koste, 1978, p.73, T.11 : 4, a-b, abb.32a.

Material examined : APR, AMT, BL, DL, TOL, VML, GR, BA, HM, AMG, BDN, KNG, MLD, CB, SLG.

Characters : Lorica rigid, stippled and moderately compressed dorsoventrally. Anterior margin with six occipital spines; median spines longest and ventrally curved, laterals longer than intermediates. Postero-lateral spines well developed. Ventro-posterior spines prolonged to form a foot-sheath around the retractile foot.

Measurements : Total length : 280-300; maximum width : 175-185.

Distribution : India : widely distributed, reported so far from West Bengal (Calcutta, South 24-Parganas, Haora, Hugli, Barddhaman, Nadia, Malda, Koch Behar and Darjiling; Assam, Orissa, Andhra Pradesh, Madhya Pradesh, Kerala, Rajasthan, Punjab and Kashmir. Elsewhere Cosmopolitan.

14b. *Brachionus quadridentatus cluniorbicularis* (Skorikov, 1894)
(Fig. 31)

Brachionus cluniorbicularis Skorikov, 1894, p.33; Skorikov, 1896, p.240, pl. VIII, fig. 24.

Brachionus quadridentatus f. cluniorbicularis (Skorikov): Ahlstrom, 1940, p.179, pl.12, fig.24.

Brachionus quadridentatus var. cluniorbicularis (Skorikov) : Koste, 1978, p.74, T.11: 4.e.

Brachionus quadridentatus cluniorbicularis (Skorikov) : Kutikova, 1970, p.583, fig.913.

Material examined : MNK, SR, THK, VML, KRP, APR, NCB.

Characters : Lorica rigid, with relatively small median occipital spines. Postero-lateral spines lacking; postero-lateral angles of lorica rounded.

Measurements : Total length : 195-200; maximum width : 165-185.

Distribution : India : West Bengal (Calcutta, South 24-Parganas, Medinipur and Koch Behar); Orissa, Madhya Pradesh and Ladak. Elsewhere : Cosmopolitan.

14c. *Brachionus quadridentatus rhenanus* (Lauterborn, 1893)
(Fig. 32)

Brachionus rhenanus Lauterborn, 1893, p.269, pl.XI, fig.3.

Brachionus quadridentatus rhenanus (Lauterborn) : Kutikova, 1970, p.582, fig. 912.

Brachionus quadridentatus f. *rhenanus* (Lauterborn) : Koste, 1978, p.74, T.11: 4, c.

Material examined : BN, BL, BRP, THK, NH.

Characters : Median occipital spines relatively small. Postero-lateral angles of lorica produced into pointed edges or small spines.

Measurements : Total length : 200-220; maximum width : 185-190.

Distribution : India : West Bengal (Calcutta, North & South 24-Parganas); Andhra Pradesh and Punjab. Elsewhere : Cosmopolitan.

14d. *Brachionus quadridentatus brevispinus* (Ehrenberg, 1832)

(Fig. 33)

Brachionus brevispinus Ehrenberg, 1832, p.146; Ehrenberg, 1838, p.513, pl. LXIII, fig. 6.

Brachionus quadridentatus brevispinus (Ehrenberg) : Kutikova, 1970, p. 581, fig. 910.

Brachionus quadridentatus f. *brevispinus* (Ehrenberg) : Koste, 1978, p. 74, T.11 : 4, c.

Material examined : TG, BA, ALP, BB.

Characters : Median occipital spines short. Postero-lateral spines less than 1/3 of the length of lorica, sometimes even smaller.

Measurements : Total length: 220-240; maximum width: 190-200; postero-lateral spines: 30-58.

Distribution : India : West Bengal (Calcutta, North & South 24-Parganas and Haora); Assam, Orissa and Andhra Pradesh. Elsewhere : Cosmopolitan.

15. *Brachionus rubens* Ehrenberg, 1838

(Fig. 34)

Brachionus rubens Ehrenberg, 1838, p.513, pl.LXIII, fig.4; Ahlstrom, 1940, p.170, pl. 15, figs. 1-9; Kutikova, 1970, p.586, fig. 921.

Brachionus urceolaris var *rubens* (Ehrenberg) : Koste, 1978,p.79, T.9 : 2, a-e.

Material examined : AMT, BH, BL, BN, IMT, MNK, SRK, THK, TOL, JH, GP, RP, SRP, BG, TG, ALP.

Characters : Lorica oval, firm and compressed dorsoventrally. Anterior margin with six occipital spines; median and intermediate occipital spines with peculiar unsymmetrical shape each spine showing a narrow anterior part, then rounding outwards and forming a broad base; median occipitals somewhat longer than others. Four inner occipital spines with short strengthening ridges.

Measurements : Total length : 185-250; maximum width : 130-170.

Distribution : India : West Bengal (Calcutta, North & South 24-Parganas); Assam, Orissa, Punjab, Haryana and Rajasthan. Elsewhere : Cosmopolitan.

16. *Brachionus sessilis* Varga, 1951

(Fig. 35)

Brachionus sessilis Varga, 1951, p.217-220, abb. 1-7; Thomasson, 1963, p.31, abb.9-10.

Brachionus urceolaris sessilis (Varga) : Koste, 1978, p.79, T.9 : 6, a-c.

Material examined : MNP.

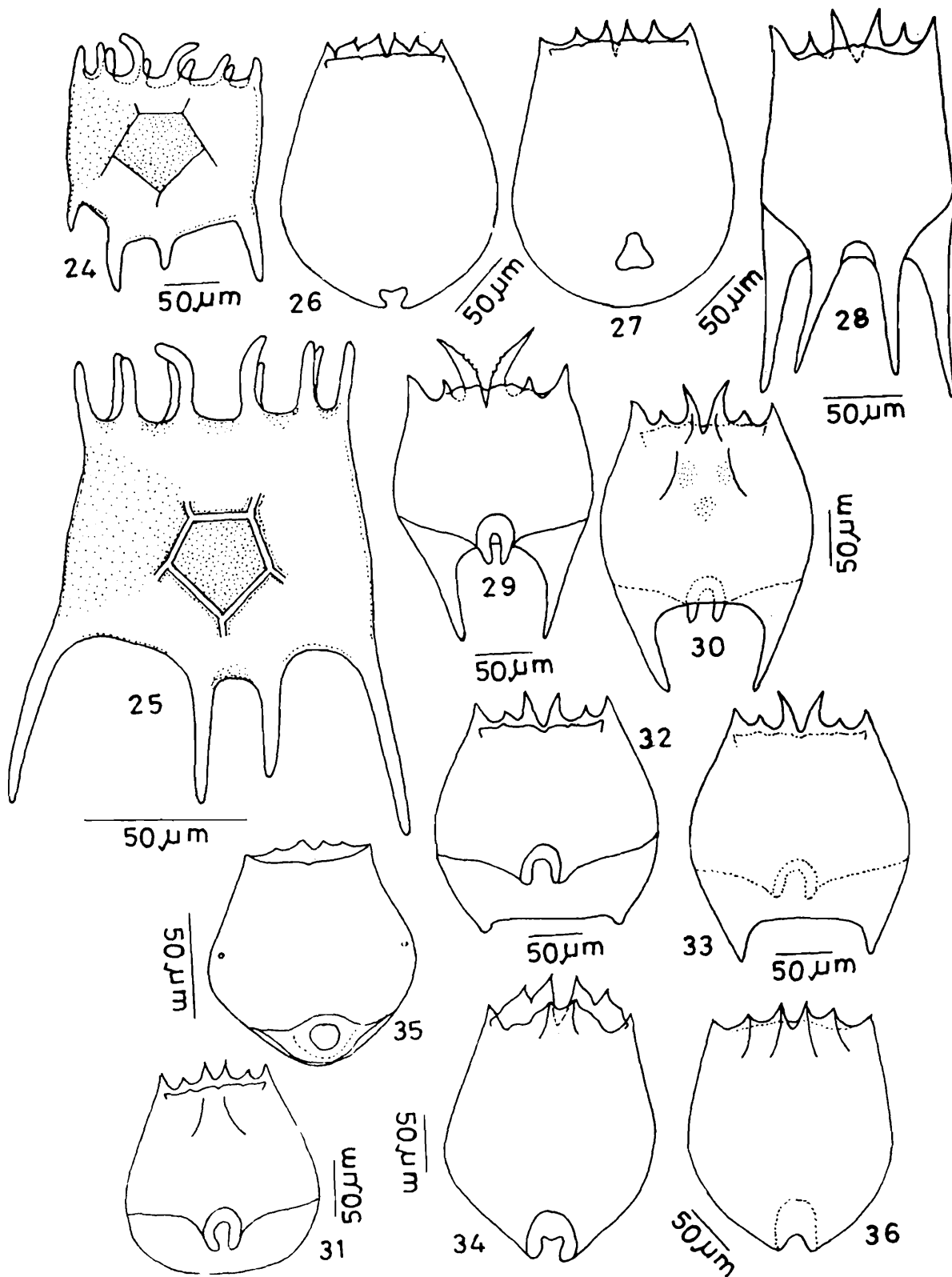


Fig. 24. *Brachionus patulus* (Müller) : dorsal view; Fig. 25. *B. patulus macracanthus* (Daday) : dorsal view; Fig. 26. *B. plicatilis* Müller: ventral view; Fig. 27. *B. pterodinoides* Rousselet : ventral view; Fig. 28. *B. mirabilis* Daday : ventral view; Fig. 29. *B. quadridentatus quadridentatus* Hermann : ventral view; Fig. 30. dorsal view; Fig. 31. *B. quadridentatus cluniorbicularis* (Skorikov) : ventral view; Fig. 32. *B. quadridentatus rhenanus* (Lauterborn) : ventral view; Fig. 33. *B. quadridentatus brevispinus* (Ehrenberg) : ventral view; Fig. 34. *B. rubens* Ehrenberg : ventral view; Fig. 35. *B. sessilis* Varga : ventral view; Fig. 36. *B. urceolaris* (Müller) : dorsal view.

Characters : Lorica almost circular in outline and strongly bulged dorsally. Anterior occipital margin relatively broad and with small occipital spines; submedian spines rudimentary. Foot-opening located ventrally.

Characters : Total length : 100-105; maximum width : 90-95.

Distribution : India : West Bengal. (South 24-Parganas). Elsewhere : Hungary, Africa, Ceylon, Malaysia and Australia.

17. *Brachionus urceolaris* O.F. Müller, 1773
(Fig. 36)

Brachionus urceolaris Müller, 1773, p.131; Ahlstrom, 1940, p.171, pl.16, figs. 1-11.

Brachionus urceolaris urceolaris Müller : Koste, 1978, p.78, T.9: 3, a-e, abb. 30a and abb. 3.

Material examined : APR, BB, GR, LH.

Characters : Lorica oval, firm and moderately compressed dorso-ventrally. Anterior margin with six occipital spines; medians longest, laterals and intermediates of almost equal length; four inner occipital spines with strengthening ridges. Foot-opening almost rectangular dorsally but semicircular ventrally.

Measurements : Total length : 170-220; maximum width : 160-180.

Distribution : India : West Bengal (South 24-Parganas and Howrah), Madhya Pradesh and Punjab. Elsewhere : Cosmopolitan.

Genus *Keratella* Bory de St.Vincent, 1822

Keratella Bory de St.Vincent, 1822, p.470

Anurea Ehrenberg, 1832, p.144.

Characters : Lorica divided into a dorsal and a ventral plate; dorsal plate with characteristic facets and more or less distinctly granulated. Occipital margin with four or six spines. Mental margin rigid, with a median sinus. Posterior spines often present, one or two; single posterior spines usually median.

Type species : *Keratella quadrata* (O.F. Müller, 1786)

This genus is represented by only five species in the material examined from West Bengal.

Key to recorded species of genus *Keratella*

1. Lorica without any posterior spine *Keratella lenzi* Hauer
Lorica with one or two posterior spines 2
2. With single median posterior spine Dorsal plate with a median ridge
..... *Keratella cochlearis* (Gosse)
- With two equal or unequal postero-lateral spines. Dorsal plate with a row of median plaques 3
3. Posterior median plaque pentagonal and terminating in a median line
..... *Keratella procurva* (Thorpe)

- Posterior median plaque hexagonal and not terminating in a median line 4
4. Median raminant present under posteriormost plaque. Posterior spines distinctly unequal
 *Keratella tropica* (Apstein)
- Posterior most median raminant absent. Posterior spines almost equal in length.....
 *Keratella quadrata* (Müller)

18. *Keratella cochlearis* (Gosse, 1851)

(Fig. 37)

Anurea cochlearis Gosse, 1851, p.202; Lauterborn, 1900, p.421, pl. 10, figs. 2-4, text-figs. 1, 2.

Keratella cochlearis (Gosse) : Harring, 1913 b, p.56; Ahlstrom, 1943, p.420, pl.35, figs. 1-4.

Keratella cochlearis cochlearis (Gosse) : Kutikova, 1970, p.603, y fig.903; Koste, 1978, p.112, T.24 : 1, a-d, T.23 : 11, a-b, 12, a.

Material examined : TIM, APD, CB, JPG, SLG.

Characters : Lorica elongated-oval and with a median posterior spine of variable length. Anterior margin with six occipital spines; medians longest and ventrally curved, intermediates usually divergent and shorter than laterals. Dorsal plate with a median longitudinal line extending from behind median frontal area; two enclosed plaques on either side of the median line, with two enclosed lateral polygons.

Measurements : Total length : 130-220; maximum width : 62-82; posterior spine : 30-60.

Distribution : India : West Bengal (Calcutta, Jalpaiguri, Koch Behar and Darjiling); Assam, Kerala, Kashmir, Ladak, Punjab and Rajasthan. Elsewhere : Cosmopolitan.

19. *Keratella lenzi* Hauer, 1953

(Fig. 38)

Keratella lenzi Hauer, 1953, p.167, fig. 9; Berzins, 1955, p.555, fig. 7.

Keratella lenzi lenzi Hauer : Koste, 1978, p.108, T.22 : 2, a-g.

Material examined : SRK, MLD, NCB.

Characters : Lorica elongate-oval, with maximum width behind its middle region, rounded posteriorly and without any posterior spine. Anterior margin with six occipital spines; medians longest and ventrally curved. Dorsal plate with three median plaques, the ultimate plaque elongated and its arms running towards the posterior margin in form of a divergent crest.

Measurements : Total length : 145-158; maximum width : 62-66.

Distribution : India : Punjab, West Bengal (South 24-Parganas, Malda and Koch Behar); Assam and Punjab. Elsewhere : Pantropical and pansubtropical.

20. *Keratella quadrata* (O. F. Müller, 1786)

(Fig. 39)

Brachionus quadratus Müller, 1786, p.354, pl.49, figs. 12,13.

Anurea quadrata Ehrenberg, 1832, p.145; Ehrenberg, 1838, p.508, pl.LXII, fig. 14.

Keratella quadrata (Müller) : Harring, 1913 b, p.57; Ahlstrom, 1943, p.439, pl. LXXX, figs. 1-7.

Material examined : SR, GR.

Characters : Lorica almost rectangular in outline and with six anterior occipital spines; median spines longest and curved. Dorsal plate with three median hexagonal plaques behind anterior median area; lateral plaques arranged symmetrically on either side of median plaques. Posterior spines long, subequal, widely separated at their bases and parallel or divergent.

Measurements : Total length : 198-225; maximum width : 82-96; posterior spines : 62-75.

Distribution : India : West Bengal (South 24-Parganas); Assam, Tamil Nadu, Kerala, Kashmir and Ladak. Elsewhere : Cosmopolitan.

21. *Keratella procurva* (Thorpe, 1891)
(Fig. 40)

Anurea procurva Thorpe, 1891, p.305, pl.17, fig. 7.

Keratella valga var. *procurva* (Thorpe) : Ahlstrom, 1943, p.452, pl. 39, fig.8.

Keratella procurva (Thorpe) : Berzins, 1953, p. 7, fig. 6.

Keratella procurva procurva (Thorpe) : Koste, 1978, p.106, T.17: 5, T. 21 : 9.

Material examined : BH, BN, MNK, SR, DH, RP, NB, BA.

Characters : Lorica elongated and with six anterior occipital spines; median spines longest and curved. Dorsal plate with three median plaques; posteriormost plaque pentagonal and terminating in a short median line extending upto posterior margin of lorica. Posterior spines small and subequal.

Measurements : Total length : 140-150; maximum width: 60-70.

Distribution : India : West Bengal (Calcutta, North & South 24-Parganas); Orissa Kerala, Kashmir and Ladak. Elsewhere : Pantropical and pansubtropical.

22. *Keratella tropica* (Apstein, 1907)
(Figs. 41-43)

Anurea valga f. *tropica* Apstein, 1907, p, 210, fig. F.

Keratella valga f. *tropica* (Apstein) : Edmondson and Hutchinson, 1934, p.170, figs. 4,C-E; Hauer, 1938, p. 382, fig. 30, a; Wulfert, 1966, p.67, figs.12, a-f.

Keratella tropica (Apstein) : Berzins, 1955, p.554, figs.2-3.

Material examined : AMT, APR, BL, APR, IMT, SR, SRK, TOL, BG, TG, BA, JH, ALP, LH, TKR, AMG, ASN, KNG, KRP, MDP, NJP, CB.

Characters : Lorica elongate-oval and with six anterior occipital spines; median occipitals longest, pointed and out curved. Dorsal plate with three median hexagonal plaques and a small (suarish) area between the last median plaque and the posterior margin of lorica. Posterior spines unequal and variable in length; the right spine generally longer than the left, the left posterior spine much reduced in some specimens.

Measurements : Total length : 180-240; maximum width : 70-88; right posterior spine : upto 120; left posterior spine : upto 40.

Distribution : India : widely distributed in this country, reported so far from West Bengal (Calcutta, North & South 24-Parganas, Haora, Barddhaman, Nadia, Medinipur, Jalpaiguri and Koch

Behar); Assam, Bihar, Orissa, Andhra Pradesh, Madhya Pradesh, Kerala, Gujarat, Rajasthan, Punjab, Haryana, Kashmir and Ladak. Elsewhere : Tropics and Subtropics.

Genus *Anuraeopsis* Lauterborn, 1900

Anuraeopsis Lauterborn, 1900, p.441.

Characters : Lorica thin, flexible, ovate or navicular and rounded or obtusely truncate posteriorly. Dorsal and ventral plates of lorica joined laterally by a soft membrane. Foot absent.

Type species : *Anuraeopsis fissa* (Gosse, 1851).

Only two species belonging to this genus are known from this country and these are also observed in the presently examined material.

Key to recorded species of genus *Anuraeopsis*

Lorica oval, usually stippled; without any surface pattern *Anuraeopsis fissa* (Gosse)

Lorica boat-shaped, granulated; with distinct pattern on dorsum
..... *Anuraeopsis coelata* (De Beauchamp)

23. *Anuraeopsis coelata* (De Beauchamp, 1932)
(Fig. 44)

Anuraeopsis navicula var. *coelata* De Beauchamp, 1932, p.238, *Anuraeopsis coelata* (De Beauchamp) : Wulfert, 1966, p.57, abb.1.

Anuraeopsis coelata coelata (De Beauchamp) : Koste, 1978, p.137, p.137, T.34 : 8, T.33: 6, a-d, 7.

Material examined : AMT, BB, BN, BPR, IMT, MNK, SR, BNK, NB, KRP.

Characters : Lorica boat-shaped and granulated. Dorsal plate with two longitudinal ridges running parallel to each other and then united at the hinder end to form a single ridge. Anterior occipital margin without any spines or serrations.

Measurements : Total length : 90-100; maximum width : 45-48.

Distribution : India : West Bengal (Calcutta, South 24-Parganas, Medinipur and Barddhaman); Orissa, Assam and Gujarat. Elsewhere : Pantropical.

24. *Anuraeopsis fissa* (Gosse, 1851)
(Figs. 45 & 46)

Anurea fissa Gosse, 1851, p.202.

Anuraeopsis fissa (Gosse) : Harring, 1913 b, p.13.

Anuraeopsis fissa fissa (Gosse) : Berzins, 1962, p.35, figs. 1-10; Kutikova, 1970, p.633, figs. 1037 A; Koste, 1978, p.131, T.33: 3, a-e, h-j.

Material examined : APR, BH, BL, BN, BRP, MNK, MST, BR, MLD, NCB, SLG.

Characters : Lorica ovate and obtusely pointed posteriorly ; anterior dorsal margin of lorica with a shallow sinus. Ventral plate projecting a little laterally beyond the dorsal plate in the anterior region.

Measurements : Total length : 80-90; maximum width : 45-48.

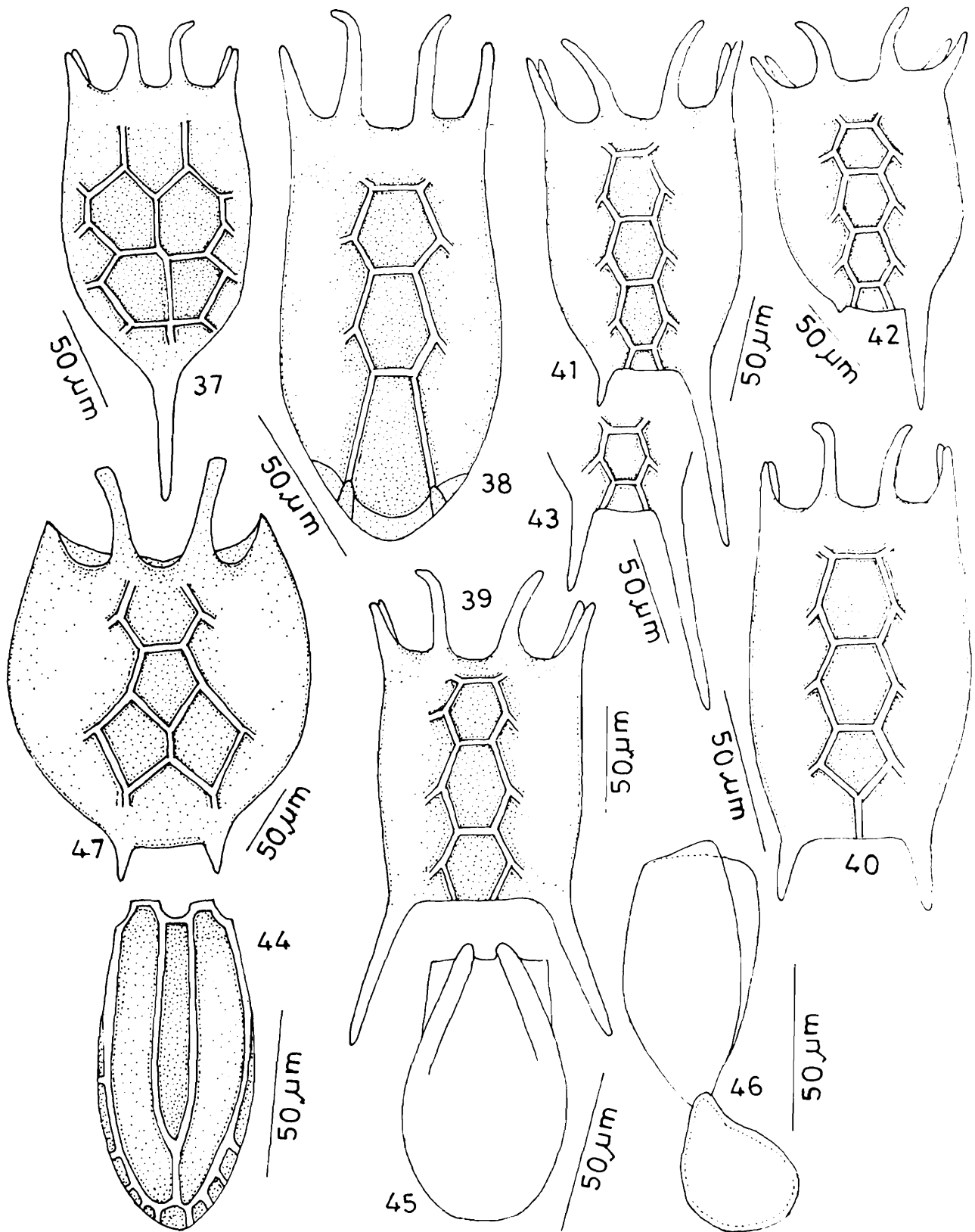


Fig. 37. *Keratella cochlearis* (Gosse) : dorsal view; Fig. 38. *K. lenzi* Hauer; dorsal view; Fig. 39. *K. quadrata* (Müller) : dorsal view; Fig. 40. *K. procurva* (Thorpe) : dorsal view; Fig. 41 and 42. *K. tropica* (Apstein) : dorsal views, Fig. 43. posterior end (dorsal view); Fig. 44. *Anuraeopsis coelata* (de Beauchamp) : dorsal view; Fig. 45. *A. fissa* : dorsal view; Fig. 46. lateral view; Fig. 47. *Platyias quadricornis* (Ehrenberg) : dorsal view.

Distribution : India : West Bengal (Calcutta, North & South 24-Parganas, Malda, Koch Behar and Darjiling); Assam, Orissa, Kerala, Rajasthan, Gujarat, Punjab, Chandigarh (U.T.) and Haryana. Elsewhere : Cosmopolitan.

Genus *Platyias* Haring, 1913

Platyias Haring, 1913 b, p.84.

Noteus Ehrenberg, 1832, p.143.

Characters : Lorica somewhat compressed dorsoventrally, separated into a dorsal and a ventral plate. Anterior and posterior margins of lorica with two spines each. Mental margin variable. Foot jointed and retractile, foot-opening located in ventral plate; toes two.

Type species : *Platyias quadricornis* (Ehrenberg, 1832)

This genus is represented by only one species in the present account.

25. *Platyias quadricornis* (Ehrenberg, 1832)

(Fig. 47)

Noteus quadricornis Ehrenberg, 1832, p.143, pl.IV, fig.5.

Platyias quadricornis (Ehrenberg) : Haring, 1913 b, p.84; Ahlstrom, 1940, p.174, pl. 18, figs. 6-9.

Material examined : APR, BB BN, IMT, MNP, SR, BNK, DD, RP, ALP, NGM, KNG, KLN, JPG.

Characters : Lorica almost circular, tuberculated and with a dorsal pattern of pentagonal facets. Occipital margin with two stout median spines, with bluntly rounded to nearly truncate tips. Posterior spines short and parallel.

Measurements : Total length : 180-290; maximum width : 140-190.

Distribution : India : widely distributed, reported so far from West Bengal (Calcutta, North & South 24-Parganas, Nadia and Jalpaiguri); Assam, Orissa, Andhra Pradesh, Kerala, Rajasthan, Punjab, Haryana, Kashmir and Ladak. Elsewhere : Cosmopolitan.

Family EUCHLANIDAE Bartos, 1959

Lorica thin or strong, dorsal and ventral plates bounded together a thin membrane; with or without lateral sulci. Dorsal plate with or without longitudinal groove. Toes very long and baton-shaped or small blade-shaped. Trophi malleate.

This family includes five genera and amongst these four genera are documented in this account.

Key to recorded genera of family EUCHLANIDAE

1. Lorica thin, without lateral sulcus Genus *Beauchampiella* Remane, 1929
Lorica strong, with lateral sulcus..... 2
2. With single lateral sulcus 3
With double lateral sulci Genus *Tripleuchlanis* Myers, 1930
3. Dorsal plate usually arched and wider than ventral plate Genus *Euchlanis* Ehrenberg, 1832
Dorsal plate concave and narrower than ventral plate.....
..... Genus *Dipleuchlanis* De Beauchamp, 1910

Genus *Beauchampiella* Remane, 1929*Eudactylota* Manfredi, 1927, p.8, 29.*Beauchampiella* Remane, 1929, p.107

Characters : Lorica thin, pear-shaped, dorsally bulged and without any lateral sulcus. Toes very long and baton-shaped.

Type species : *Beauchampiella eudactylota* (Gosse, 1886)

This genus is presently represented by only one species.

26. *Beauchampiella eudactylota* (Gosse, 1886)

(Fig. 48)

Scaridium eudactylota Gosse, 1886 (In : Hudson and Gosse, 1886), p. 74, pl. XXI, fig.4.*Beauchampiella eudactylota* (Gosse) : Remane, 1933, p.107.*Eudactylota eudactylota* (Gosse) : Voigt, 1957, p.158, taf.31, fig.1, taf.92, fig.2; Kutikova, 1970, p.578, fig. 906.*Beauchampiella eudactylota eudactylota* (Gosse) : Koste, 1978, p.134, Abb.11 : a-f, T.35 : 1, a-b.*Material examined* : JH, BA, AMG, HM.

Characters : Body transparent, pear-shaped, thin, flexible and with a distinct dorsal bulge. Muscle bands supporting body and foot distinct. Foot two-segmented; toes very long and baton-shaped.

Measurements : Total length : 500-550; foot length : 80-90; toes : 280-290.

Distribution : This species represents a new report from West Bengal. India : West Bengal (South 24-Parganas, Haora and Hugli); Madhya Pradesh and Andhra Pradesh. Elsewhere : Cosmopolitan.

Genus *Euchlanis* Ehrenberg, 1832*Euchlanis* Ehrenberg, 1832, p.131.*Dapidia* Gosse, 1887b, p.364.

Characters : Body oval, more or less domed dorsally. Dorsal and ventral plates of lorica bounded laterally by a thin membrane. Dorsal plate usually indented at its posterior margin and elongated into a median keel or lateral wings in some species. Ventral plate usually flat. Foot short, two-segmented; toes sword-shaped and with pointed tips. Trophi modified malleate.

Type species : *Euchlanis dilatata* Ehrenberg, 1832.Only three species of *Euchlanis* are noticed in the samples examined from West Bengal.Key to recorded species of genus *Euchlanis*

1. Dorsal plate of lorica with a strong median keel. Ventral plate slightly convex
..... *Euchlanis triquetra* Ehrenberg
- Dorsal plate without any strong median keel. Ventral plate nearly flat 2

2. Dorsal plate with a small hump. Toes paralld-sided*Euchlanis dilatata* Ehrenberg
Dorsal plate arched. Toesy slightly dilated in middle *Euchlanis oropha* Gosse

27. *Euchlanis dilatata* Ehrenberg, 1832

(Figs. 49 & 50)

Euchlanis dilatata Ehrenberg, 1832, p.131, pl.4, fig.3; Voigt, 1957, p.172, Taf. 28 : figs.2, 7, Abb.16, g.

Euchlanis hipposideros Gosse, 1851, p.201.

Euchlanis dilatata dilatata Ehrenberg : Kutikova, 1970, p.569, fig.887; Koste, 1978, p.138, T.36 : 1, a-c.

Material examined : BH, BN, DL, IMT, MNP, SR, KLN, NH, MLD, BNK, BDN, CB, NJP.

Characters : Lorica oval and flexible. Dorsal plate slightly bulged and with a shallow notch at its posterior end. Ventral flat, smaller and narrower than dorsal plate. Toes parallel-sided and with acutely pointed tips.

Measurements : Length dorsal plate : 170-200; length ventral plate: 150-180; width dorsal plate : 132-150; width ventral plate : 108-130; toes : 54-75.

Distribution : India : widely distributed and reported so far from West Bengal (Calcutta, North & South 24-Parganas, Barddhaman, Nadia, Bankura, Jalpaiguri and Koch Behar); Assam, Meghalaya, Orissa, Gujarat, Punjab, Ladak and Kashmir. Elsewhere : Cosmopolitan.

28. *Euchlanis oropha* Gosse, 1887

(Figs. 51 & 52)

Euchlanis oropha Gosse, 1887 a, p.5, pl.2, fig. 16; Koste, 1978, p. 137, T.36 : 6, a-g.

Material examined : SR, THK.

Characters : Lorica ovoid; dorsal plate uniformly arched, longer than ventral plate and with a deep notch at its posterior end. Ventral plate flat and narrower than dorsal plate. Toes short, stout and spindle-shaped.

Measurements : Length dorsal plate: 190-220; length ventral plate: 178-192; width dorsal plate: 125-140; width ventral plate: 110-128; toes : 50-62.

Distribution : India : West Bengal (South 24-Parganas); and Andhra Pradesh. Elsewhere : apparently Cosmopolitan.

29. *Euchlanis triquetra* Ehrenberg, 1838

(Figs. 53 & 54)

Euchlanis triquetra Ehrenberg, 1838, p. 461, taf. LVII, fig.8; Kutikova, 1970, p.574, fig.903; Koste, 1978, p.142, T.39 : 5, a-k, 8, a-e.

Material examined : APD, SLG.

Characters : Lorica elliptical, truncate posteriorly and with lateral flanges; with a strong dorsal keel extending from anterior posterior end of lorica. Dorsal plate longer than ventral plate. Toes slender, rod-shaped and with pointed tips.

Measurements : Length dorsal plate : 178-190; length ventral plate : 125-130; height of lorica : 80-95; toes : 60-70.

Distribution : Represents a new report from West Bengal, India : West Bengal (Koch Behar and Darjiling) and Meghalaya. Elsewhere-Cosmopolitan.

Genus *Dipleuchlanis* De Beauchamp, 1910

Dipleuchlanis De Beauchamp, 1910, p.122.

Characters : Ventral plate narrower than dorsal plate. Lateral sulci forming a deep groove. Foot three-segmented, with setae; toes long and parallel-sided. Unci with 7-10 teeth each.

Type species : *Dipleuchlanis propatula* (Gosse, 1886).

This genus is presently represented by only one species.

30. *Dipleuchlanis propatula* (Gosse, 1886)
(Figs. 55 & 56)

Diplois propatula Gosse, 1886 (In : Hudson and Gosse, 1886), p.87 pl. XXIV, fig. 2.

Dipleuchlanis propatula (Gosse) : De Beauchamp, 1910, p.122; Voigt, 1957, p.173, Taf.29 fig.12, abb.16, t.

Material examined : APR, SR, BB, HWH, ASN, BDN, BNK, SLG.

Characters : Lorica oval or ovoid and compressed dorsoventrally. Dorsal plate concave and smaller than ventral plate. Toes long and cylindrical.

Measurements : Length dorsal plate : 140-150; length ventral plate : 160-180; width dorsal plate : 68-78; width ventral plate: 240-250; toes : 80-90.

Distribution : India : West Bengal (South 24-Parganas, Haora, Barddhaman, Bankura and Darjiling); Assam, Orissa and Kerala. Elsewhere : Cosmopolitan.

Genus *Tripleuchlanis* Myers, 1930

Tripleuchlanis Myers, 1930, p.357.

Characters : Lorica ovoid and with double cuticular folds between dorsal and ventral plates. Foot three-segmented. Uncus with six teeth.

Type species : *Tripleuchlanis plicata* (Levander, 1894).

This genus is represented by only one species in the samples examined from West Bengal.

31. *Tripleuchlanis plicata* (Levander, 1894)
(Figs. 57-59)

Euchlanis plicata Levander, 1894, p.48, Taf. II, figs. 26-28.

Tripleuchlanis plicata (Levander) : Myers, 1930, p.379, pl.22, figs. 1-4.

Tripleuchlanis plicata plicata (Levander) : Kutikova, 1970, p. 563, fig. 877; Koste, 1978, p.144, T.40 : 3, a-d, 5, a-c.

Material examined : IMT, DH.

Characters : Lorica rigid and ovoid; dorsal and ventral plates connected by bellow-like folds in cross-section. Foot robust, three-segmented; toes short and parallel-sided.

Measurements : Length dorsal plate : 120-130; length ventral plate : 100-120; toes : 28-30.

Distribution : India : West Bengal (Calcutta and North 24-Parganas) and Andhra Pradesh. Elsewhere : Cosmopolitan.

Family MYTILINIDAE Bartos, 1959

Lorica with or without anterior and posterior spines; dorsal surface of lorica with a median longitudinal sulcus. Trophi malleate.

Only one genus belonging to this family is included in the present account.

Genus *Mytilina* Bory de St. Vincent, 1826

Mytilina Bory de St. Vincent, 1826, p.87.

Salpina Ehrenberg, 1830, p. 46.

Diplax Gosse, 1851, p.201.

Characters : Body cylindrical, heavily loricate and laterally flattened. Lorica with double dorsal keel and with spines on all four corners; spines, at times, completely or partly reduced. Foot with indistinct three-segments; toes thin and slender. Corona similar to *Euchlanis* type.

Type species : *Mytilina mucronata* (O.F. Müller, 1773).

Three species and one subspecies of *Mytilina* are documented in this account.

Key to recorded species and subspecies of *Mytilina*

1. Lorica without spines. Toes terminating into distinct spines *Mytilina bisulcata* (Lucks)
Lorica with or without anterior and posterior spines. Toes without spines 2
2. Posterior end of lorica without spines *Mytilina acanthophora* Hauer
Posterior end of lorica with spines 3
3. Postero-median and postero-ventral spines short *Mytilina ventralis ventralis* (Ehrenberg)
Postero-median and postero-ventral spines long *Mytilina ventralis longidactyla* (Wulfert)

32a. *Mytilina ventralis ventralis* (Ehrenberg, 1832)

(Fig. 60)

Salpina ventralis Ehrenberg, 1832, p.133, pl.4, fig.7.

Mytilina ventralis (Ehrenberg) : Harring, 1913 b, p.75.

Mytilina ventralis ventralis (Ehrenberg) : Kutikova, 1970, p.519, fig. 759; Koste, 1978, p.147, T.42 : 6, e.

Material examined : AMT, DL, IMT, MNP, VML, HM, NB, DD, BG, BPR, LH, ASN, MDP, APD.

Characters : Lorica heavily stippled anteriorly; antero-ventral corners with a spine on each side. Postero-dorsal and postero-ventral spines short and variable; toes two and moderately long.

Measurements : Lorica length : 210-232; toes : 78-90.

Distribution : India : widely distributed reported so far from West Bengal (Calcutta, North & South 24-Parganas, Haora, Barddhaman, Medinipur and Koch Behar); Assam, Orissa, Madhya Pradesh, Gujarat, Madhya Pradesh, Andhra Pradesh, Kerala, Punjab,, Kashmir, Ladak and Rajasthan. Elsewhere : Cosmopolitan.

32b. *Mytilina ventralis longidactyla* (Wulfert, 1965)
(Fig. 61)

Mytilina ventralis f. *longidactyla* Wulfert, 1965, p.354, Abb. 2g; Koste, 1978, p.147, T.41 : 12.

Material examined : AMT, APR, MST.

Characters : Lorica strong and elongated and heavily stippled anteriorly. Postero-median and postero-ventral spines distinctly elongated. Toes longer, parallel-sided and with pointed tips.

Measurements : Total length : 258-264; Postero-median spines: 80-86; postero-ventral spines : 50-60; toes : 75-85.

Distribution : India : West Bengal (South 24-Parganas) and Gujarat. Elsewhere : Africa.

33. *Mytilina acanthophora* Hauer, 1938
(Fig. 62)

Mytilina acanthophora Hauer, 1938, p.550, abb.73, a-c; Kutikova, 1970, p.517, fig. 768; Koste, 1978, p.149, T. 41 : 5, a-c, abb. 37, a-b.

Material examined : IMT.

Characters : Lorica strong, granulated, dorsally arched and laterally compressed. Antero-ventral corners of lorica with distinct triangular cusps; posterior end with a deep invagination. Toes long, slender and terminating into acute points.

Measurements : Total length : 240-245; lorica length : 150-152; height of lorica : 90-95; toes : 80-90.

Distribution : India : West Bengal (Calcutta) and Punjab. Elsewhere : Indonesia, Sri Lanka, Wolga Delta and Amazon.

34. *Mytilina bisulcata* (Lucks, 1912)
(Fig. 63)

Diplax bisulcata Lucks, 1912, p. 95, figs. 28, a-e.

Mytilina bisulcata (Lucks) : Hauer, 1936, p.144, taf.II, abb.17, a-c; Kutikova, 1970, p.521, fig. 770; Koste, 1978, p.150, T.41 : 1, a-c.

Material examined : CB, JPG.

Characters : Lorica transparent and its anterior end with two folds; almost rounded in cross-section and dorsal keel with three stumps. Dorsal sulcus indistinct. Toes long and slender; produced into distinct slender spines.

Measurements : Lorica length 152-160; toes : 55-60; spines : 8-12.

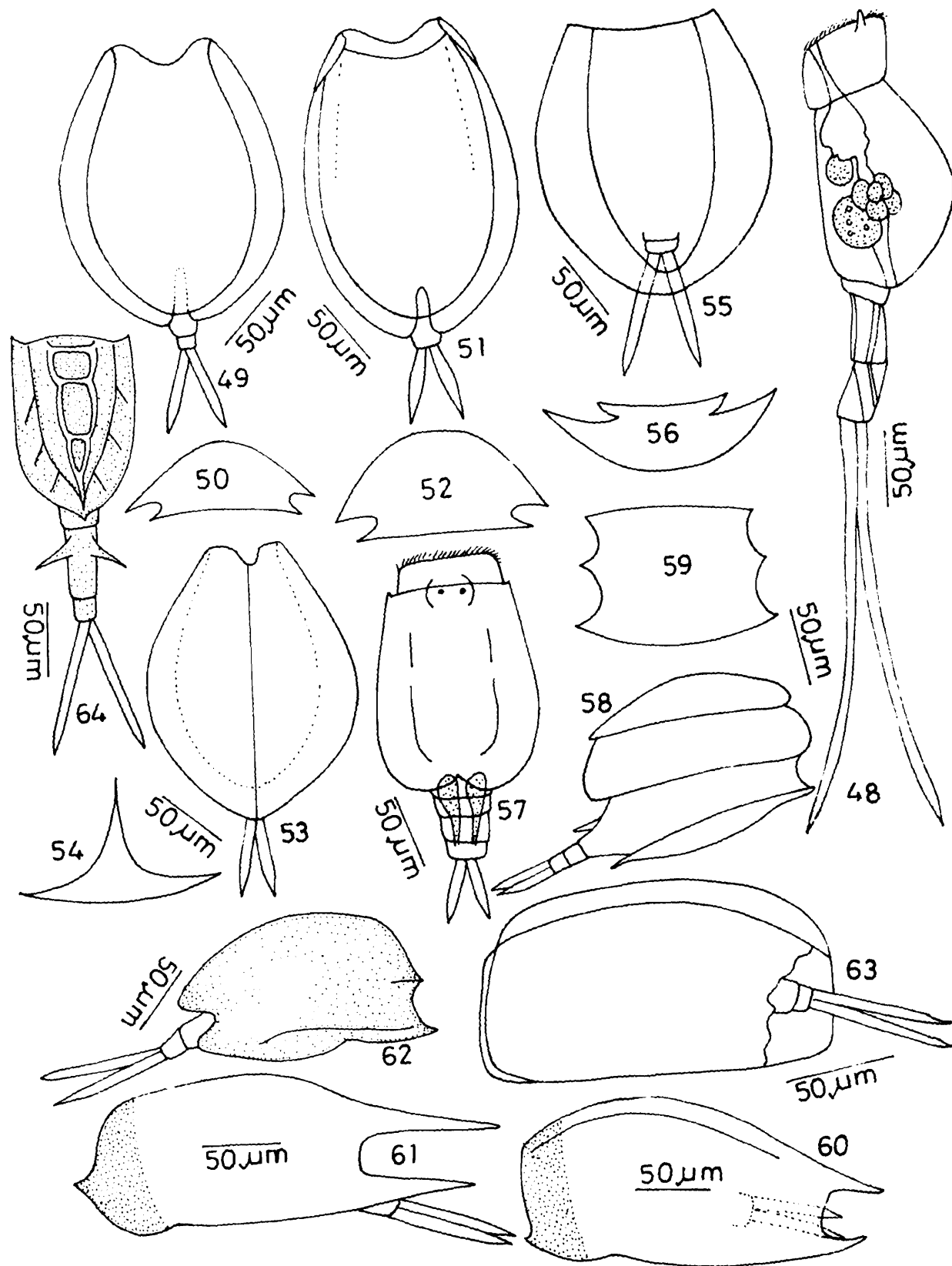


Fig. 48. *Beauchampiella eudactylota* (Gosse) : lateral view; Fig. 49. *Euchlanis dilatata* Ehrenberg : ventral view; Fig. 50. Cross-section; Fig. 51. *E. oropha* Gosse : ventral view; Fig. 52. Cross-section; Fig. 53. *E. triquetra* Ehrenberg : dorsal view; Fig. 54. Cross-section; Fig. 55. *Dipleuchlanis propatula* (Gosse) : ventral view; Fig. 56. Cross-section; Fig. 57. *Tripleuchlanis plicata* (Levander) : dorsal view; Fig. 58. Lateral view; Fig. 59. Cross-section; Fig. 60. *Mytilina ventral ventralis* (Ehrenberg) : lateral view; Fig. 61. *M. ventralis longidactyla* (Wulfert) : lateral view; Fig. 62. *M. acanthophora* Hauer : lateral view; Fig. 63. *M. bisulcata* (Lucks) : lateral view; Fig. 64. *Trichotria tetractis* (Ehrenberg) : dorsal view.

Distribution : Represents a new record from West Bengal. India : West Bengal (Jalpaiguri and Koch Behar) and Orissa. Elsewhere apparently Cosmopolitan.

Family TRICHOTRDAE Bartos, 1959

Head, trunk and foot clearly defined and with lorica. Trunk laterally broad, slightly granulated, often with spines on the dorsum. Trophi malleate.

This family is presently represented by two genera.

Key to recorded genera of family TRICHOTRIDAE

Lorica with dorsal spines and with anal segment Genus *Macrochaetus* Perty, 1850

Lorica without dorsal spines and anal segment Genus *Trichotria* Bory de St. Vincent, 1827

Genus *Trichotria* Bory de St. Vincent, 1827

Trichotria Bory de St. Vincent, 1827, p.752.

Dinocharis Ehrenberg, 1830, p.47.

Characters : Head, trunk and foot strongly loricate. Foot mobile, three- segmented; second foot-segment with spines of variable length. Toes long, slender and ending into pointed tips. Corona simple, similar to *Euchlanis* type.

Type species : *Trichotria pocillum* (O.F. Müller, 1776)

Only one species belonging to this genus is documented in this account.

35. *Trichotria tetractis* (Ehrenberg, 1830)

(Fig. 64)

Dinocharis tetractis Ehrenberg, 1830, p.47.

Dinocharis pauper Ehrenberg, 1830, p.47.

Trichotria tetractis (Ehrenberg) : Harring, 1913 b, p.106; Wulfert, 1966, p.90. Abb. 47, a-e.

Trichotria tetractis tetractis (Ehrenberg) : Kutikova, 1970, p.513, fig.748; Koste, 1978, p.157, abb.10 : 2, T. 45 : 5a, T.46 : 1, T.47 : 4, a-d.

Material examined : APR, GR, MNP, SR, THK, BN, MLD, NJP, CB, SLG, NCB. HM. AMG. BDN, HWH, BB, BPR.

Characters : Lorica heavily stippled and longer than its width; antero-dorsal corners produced into small spines. Dorsum with distinct pattern of carinal plates and ridges. Second foot-segment longest. Toes long, cylindrical and terminating into acute points.

Measurements : Lorica length : 112-130; maximum width : 70-80; foot : 68-85; toes : 90-105.

Distribution : India : widely distributed, reported so far from West Bengal (North & South 24-Parganas, Haora, Hugli, Bardhaman, Malda, Jalpaiguri, Koch Behar and Darjiling); Assam, Orissa, Andhra Pradesh, Madhya Pradesh, Tamil Nadu, Kerala, Gujarat, Punjab and Kashmir. Elsewhere : Cosmopolitan.

Genus *Macrochaetus* Perty, 1850

Macrochaetus Perty, 1850, p.22.

Characters : Lorica broad, scutellate, strongly loricate and granulate; its margins serrate or with spines. Dorsum with several pairs of mobile spines; spines also present on posterior margin of lorica and on anal segment. Foot two-segmented; toes two and thin. Corona simple, with buccal field.

Type species : *Macrochaetus subquadratus* Perty, 1850.

Two species belonging to this genus are examined in the studied collections.

Key to recorded species of genus *Macrochaetus*

Body with eight spines. Anal spines lacking.....*Macrochaetus sericus* (Thorpe)

Body with ten spines. A pair of anal spines present *Macrochaetus collinsi* (Gosse)

36. *Macrochaetus sericus* (Thorpe, 1893)

(Fig. 65)

Dinoharis sericus Thorpe, 1893, p.152, fig.4.

Macrochaetus serica (Thorpe) : Haring, 1913 b, p. 67.

Macrochaetus sericus (Thorpe) : Wulfert, 1964, p.288-292, Abb. 7-9; Kutikova, 1970, p.516, fig.755; Koste, 1978, p.159, T.49 : 1, a-e, 2, T.48 : 42, b.

Material examined : APR, MST, MNP, BA, JH, BG.

Characters : Lorica granulated, horse-shoe shaped and with small spines at its external angles; without any anal segment. With eight dorsal spines ; median caudal spines deeply inserted. Foot two-segmented. Toes short and spindle shaped.

Measurements : Lorica length : 94-102; maximum width : 88-100; second-foot segment : 18-20; toes : 16-20.

Distribution : India : West Bengal (Calcutta, South 24-Parganas and Haora); Andhra Pradesh and Madhya Pradesh. Elsewhere Tropics and Subtropics.

37. *Macrochaetus collinsi* (Gosse, 1867)

(Fig. 66)

Dinocharis collinsi Gosse, 1867, p.269, figs.1-4.

Macrochaetus collinsi (Gosse) : Haring, 1913b, p.67; Wulfert, 1964, p. 292, Abb. 10-13; Kutikova, 1970, p.516, fig. 752.

Material examined : LH, NCB, APD.

Characters : Lorica often variable, sub-rectangular or horse-shoe shaped and with serrate external edges. Anal segment present. With four dorsal, four posterior and two anal spines.

Measurements : Lorica length : 68-72; maximum width 72-80; second foot-segment : 20-22; toes : 16-20.

Distribution : Represents a new record from West Bengal. India : West Bengal (Haora and Koch Behar) and Rajasthan. Elsewhere : Tropics and Subtropics.

Family COLURELLIDAE Bartos, 1959

Corona with broad lateral lamellae and with hood. Eyes lateral. Lorica comprised of one or two plates, dorsoventrally or laterally compressed; with or without ventral and dorsal furrows. Trophi modified malleate.

Three genera of this family are included in this account.

Key to recorded genera of family COLURELLIDAE

1. Lorica laterally compressed, consists of a single plate.....
..... Genus *Colurella* Bory de St. Vincent, 1824
Lorica dorsoventrally compressed, with dorsal and ventral plates..... 2
2. Head-shield large, not retractile..... Genus *Squatinella* Bory de St. Vincent, 1826
Head-shield small, retractile Genus *Lepadella* Bory de St. Vincent, 1826

Genus *Colurella* Bory de St. Vincent, 1824

Colurella Bory de St. Vincent, 1824, p.203.

Colurus Ehrenberg, 1830, p.44.

Monura Ehrenberg, 1830, p.44.

Characters : Lorica oval or ovate, laterally compressed and consists of a single plate; with a ventral median longitudinal cleft. Head plate small and retractile. Foot three- segmented; toes sharply pointed. Corona similar to *Euchlanis* type. With or without eye.

Type species : *Colurella uncinata* (O.F. Müller, 1773).

Only three species belonging to this genus are examined in the collections from West Bengal.

Key to recorded species of genus *Colurella*

1. With a longitudinal cleft. Foot forwardly directed..... *Colurella sulcata* (Stenroos)
Without a longitudinal cleft. Foot not forwardly directed 2
2. Lorica plumpy, obtuse posteriorly. Posterior angles relatively apart *Colurella obtusa* Gosse)
Lorica ovate. Posterior angles produced, downwardly directed and drawn closely.....
..... *Colurella uncinata* (Müller)

38. *Colurella obtusa* (Gosse, 1886)

(Figs. 67 & 68)

Colurus obtusus Gosse, 1886 (In : Hudson and Gosse, 1886), p.103, pl. XXVI, fig. 3.

Colurella obtusa (Gosse) : Haring, 1913b, p.30.

Colurella obtusa obtusa (Gosse) : Kutikova, 1970, p.529, figs. 784, 786 : Koste, 1978, p.166, T.51: 6. a-c, 8, a-c, T.52 : 1-3.

Material examined : DD, ASN, ALP, KRP, BNK.

Characters : Lorica small and plumpy: with obtuse posterior angles. Foot-opening relatively broad. Toes small, slender and pointed.

Measurements : Lorica length : 55-60; maximum width : 28-30; toes : 14-16.

Distribution : Represents a new record from West Bengal. India : West Bengal (North & South 24-Parganas, Bardhaman, Medinipur and Bankura) and Punjab. Elsewhere : Cosmopolitan.

39. *Colurella uncinata* (O.F. Müller, 1773)

(Figs. 69 & 70)

Brachionus uncinatus Müller, 1773, p.134.

Brachionus uncinatus (Müller) : Bory de St. Vincent, 1824, p.203; Voigt, 1957, p.209, Taf. 36, fig.7.

Colurus uncinatus Ehrenberg, 1830, p. 44.

Colurella uncinata uncinata (Müller) : Kutikova, 1970, p. 532, y fig.797; Koste, 1978, p.170, T.54 : 6, a-c. Abb.41.

Material examined : BB, BH, IMT, MNK, MNP, MDP, HWH, BR, NGM.

Characters : Lorica broadly ovate; posterior angles of lorica produced and downwardly directed, edges drawn closer. Toes two, slender and pointed.

Measurements : Lorica length : 82-100; height of lorica : 52-60; toes : 18-22.

Distribution : India : West Bengal (Calcutta, North & South 24-Parganas, Haora, Hugli and Medinipur). Elsewhere : Cosmopolitan.

40. *Colurella sulcata* (Stenroos, 1898)

(Fig. 71)

Metopidia sulcata Stenroos, 1898, p.166, Taf. II, figs. 27-29.

Colurella sulcata (Stenroos) : Harring, 1913 b, p.30; Wulfert, 1966, p.63, Abb.89; Kutikova, 1970, p.534, fig 801; Koste, 1978, p.172, T.55 : 5, a-b.

Material examined : CB, SLG.

Characters : Lorica slender, elongated and with a longitudinal cleft. Foot and toes forwardly directed; toes long, slender and pointed.

Measurements : Lorica length : 75-90; height of lorica : 28-32; toes : 18-20.

Distribution : Represents a new report from West Bengal. India : West Bengal (Koch Behar and Darjiling); Orissa and Gujarat. Elsewhere Cosmopolitan.

Genus *Lepadella* Bory de St. Vincent, 1826

Lepadella Bory de St.Vincent, 1826, p. 86.

Metopidia Ehrenberg, 1832, p.72.

Notogonia Perty, 1850, p. 20.

Hexastemma Schmarida, 1859, p. 60.

Characters : Lorica oval, ovate, pear-shaped or circular and moderately to strongly compressed dorsoventrally; with characteristic head and foot openings. Anterior end often with a stippled collar. Dorsal plate flat, arched or with a keel. Foot three-segmented; toes long and pointed. Corona consists of a single line of cilia, with lateral tufts on buccal field. Trophi malleate.

This genus is divisible into three subgenera. Of these, only two are represented in the examined collections.

Key to recorded subgenera of Genera *Lepadella*

- Toes two equal *Lepadella (Lepadella)* Bory de. St. Vincent, 1826
 Toes two, unequal *Lepadella (Heterolepadella)* Bartos, 1955

Subgenus *Lepadella (Lepadella)* Bory de St. Vincent, 1826

Lepadella Bory de St. Vincent, 1826, p.86.

Eulepadella Hauer, 1926, p. 459.

Characters : Species differentiated by two equal toes.

Type species : *Lepadella (Lepadella) patella* (Müller, 1786).

This subgenus is presently represented by eleven species and one subspecies.

Key to recorded species of subgenus *Lepadella*

1. Lorica with three tubular projections *Lepadella triprojectus* Sharma
 Lorica without any such projections 2
2. Posterior end of lorica produced into a spine of variable length.....
 *Lepadella acuminata* (Ehrenberg)
 Posterior end of lorica not produced into any spine 3
3. Lorica with a distinct dorsal keel..... 4
 Lorica without a dorsal keel 8
4. With anterior backwardly directed dorsal crest..... *Lepadella cristata* (Rousselet)
 Without any dorsal crest..... 5
5. Dorsal keel sharp and thin 6
 Dorsal keel broad 7
6. Lorica rhomboidal..... *Lepadella rhomboidula* (Bryce)
 Lorica small, pear-shaped..... *Lepadella triptera* Ehrenberg
7. Lorica ovate and compressed in cross-section *Lepadella rhomboides* (Gosse)
 Lorica oval, not compressed in cross-section..... *Lepadella imbricata* Harring
8. Ventral flat in central region and concave on sides..... *Lepadella quadricarinata* (Stenroos)
 Ventral plate nearly uniformly flat 9
9. Lorica sphaerical, without dorsal sinus *Lepadella aspida* Harring
 Lorica oval or ovate, with dorsal and ventral sinus 10
10. Lorica compressed in cross-section *Lepadella ovalis* (Müller)
 Lorica not compressed in cross-section *Lepadella patella* (Müller)

41. *Lepadella (Lepadella) acuminata* (Ehrenberg, 1834)

(Fig. 72)

Metopidia acuminata Ehrenberg, 1834, p.210; Ehrenberg, 1838, p.477, pl.59, fig. 10.*Lepadella acuminata* (Ehrenberg) : Haring, 1913b, p.63.*Lepadella acuminata acuminata* (Ehrenberg) : Kutikova, 1970, p.544, figs.822, 823.*Lepadella acuminata* f. *typica* (Ehrenberg) : Koste, 1978, p.189, T. 63 : 5, a-h.*Material examined* : APR, BNK, APD, CB, NJP, AMG.*Characters* : Lorica almost oval in outline, moderately compressed dorsoventrally; with anterior dorsal and ventral sinus. Posterior end of lorica produced into a pointed spine of variable length. Foot-groove oval; toes pointed.*Measurements* : Lorica length : 88-100; maximum width : 58-70; toes : 20-25.*Distribution* : India : West Bengal (South 24-Parganas, Hugli, Bankura and Koch Behar); Arunachal Pradesh, Assam and Meghalaya. Elsewhere : Cosmopolitan.42. *Lepadella (Lepadella) aspida* Haring, 1916

(Figs. 73 & 74)

Lepadella aspida Haring, 1916, p.536, pl.89, figs. 1-3; Kutikova, 1970, p.548, fig. 837; Koste, 1978, p.187, T.61 : 3, a-b.*Material examined* : MNP, MST.*Characters* : Lorica almost circular in outline; dorsal sinus lacking, ventral sinus circular and without any stippled collar. Dorsal plate arched, ventral plate nearly flat. Foot-groove rounded U-shaped; toes short and pointed.*Measurements* : Lorica length 60-62; maximum width 48-50; toes : 12.*Distribution* : India : West Bengal (South 24-Parganas) and Punjab. Elsewhere : China, America, Central and Eastern Asia, India.43. *Lepadella (Lepadella) cristata* (Rousselet, 1893)

(Figs. 75-77)

Colurus cristata Rousselet, 1893, p.446, pl.7, fig.2*Metopidia cristata* Voronkov, 1907, p.112, pl. VIII, figs.40-42.*Lepadella cristata* (Rousselet) : Haring, 1913 b, p.63; Kutikova, 1970, p.539, fig. 811; Koste, 1978, p.193, T. 62 : 1, a-k.*Material examined* : NCB.*Characters* : Lorica oval, with a dorsal median keel and a distinct anterior backwardly dorsal crest. Anterior dorsal margin nearly straight; anterior ventral margin with a V-shaped sinus. Foot-groove pear-shaped; last foot-joint projecting beyond lorica. Toes long and pointed.*Measurements* : Lorica length : 100-105; maximum width : 80-90; height of lorica : 75-80; toes : 28-32.

Distribution : Represents a new record from West Bengal. India : West Bengal (Koch Behar) and Meghalaya. Elsewhere : Cosmopolitan.

44. *Lepadella (Lepadella) imbricata* Harring, 1914
(Figs. 78 & 79)

Lepadella imbricata Harring, 1914, p. 549, pl.16, figs. 3-5; Harring, 1916, p.556, pl.95, figs. 9-11; Kutikova, 1970, p.544, fig. 830.

Material examined : BR.

Characters : Lorica broadly oval, slightly constricted at anterior end. Dorsal plate with inconspicuous median ridge and its anterior margin straight. Ventral plate with a V-shaped anterior sinus. Last foot-segment longest. Toes long and pointed; often twisted.

It is presently retained as a distinct species following the account of Kutikova (1970).

Measurements : Lorica length : 78-80; maximum width : 50-52; toes : 18-20.

Distribution : India : West Bengal (South 24-Parganas). Elsewhere : USSR, America, Malaya and Neotropics.

45a. *Lepadella (Lepadella) ovalis ovalis* (O.F. Müller, 1786)
(Figs. 80 & 81)

Brachionus ovalis Müller, 1786, p.345, pl.41, figs. 1-3.

Mytilina lepidura Bory de St. Vincent, 1826, p.87.

Lepadella ovalis (Müller) : Ehrenberg, 1830, p.45, Taf.7, fig.4; Harring, 1916, p.537, p.84, figs.4-10; Kutikova, 1970, p.549, fig.840; Koste, 1978, p.182, T.60: 1, a-c, Abb.45.

Material examined : APR, BB, BH, BN, BG, BL, MST, THK, ASN, BNK, AMG, NH, NCB, SLG.

Characters : Lorica oval to circular in outline and compressed dorsoventrally in cross-section. Dorsal plate convex and ventral plate nearly flat. Dorsal and ventral sinus with stippled collars. Toes relatively short and pointed.

Measurements : Lorica length : 90-138; maximum width : 70-118; toes : 22-30.

Distribution : India : West Bengal (Calcutta, North & South 24-Parganas, Bardhaman, Bankura, Koch Behar and Darjiling); all states in North-Eastern India, Orissa, Punjab, Ladak and Kashmir. Elsewhere : Cosmopolitan.

45b. *Lepadella (Lepadella) ovalis larga* (Sharma, 1978) *new comb.*
(Figs. 82-84)

Lepadella ovalis f. *larga* Sharma, 1978a, p.85, figs.19-21; Sharma and Sharma, 1987, p.20, figs. 38-40.

Material examined : MST.

Characters : Differed from typical *L. ovalis* in (i) lorica broader than its length; (ii) dorsal plate more arched; (iii) shape of posterior margin of lorica; (iv) shape of foot-groove.

This was earlier described by this author as a new form but is now proposed to be treated as a subspecies in view of its distinct differences from the typical specimens.

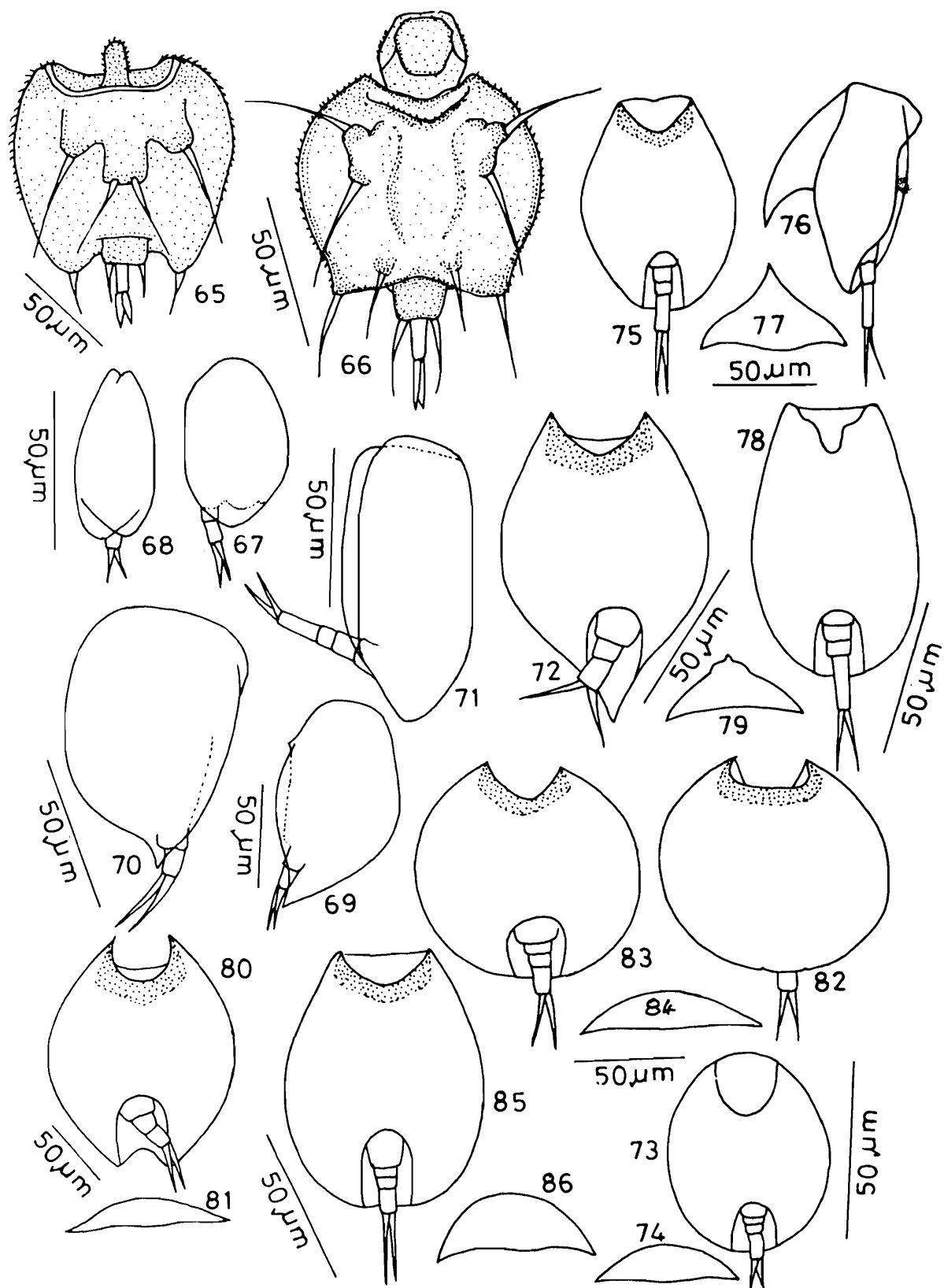


Fig. 65. *Macrochetus sericus* (Thorpe) : ventral view; Fig. 66. *M. collinsi* (Gosse) : ventral view; Fig. 67. *Colurella obtusa* (Gosse) : dorsal view, Fig. 68. lateral view; Fig. 69 and 70. *C. uncinata* (Müller) : lateral views; Fig. 71. *C. sulcata* (Stenroos) : lateral view; Fig. 72. *Lepadella (Lepadella) acuminata* (Ehrenberg) : ventral view; Fig. 73. *L. (L.) aspida* Haring : ventral view; Fig. 74. Cross-section; Fig. 75. *L. (L.) cristata* (Rousselet) : ventral view; Fig. 76. lateral view; Fig. 77. Cross-section; Fig. 78. *L. (L.) imbricata* Haring : ventral view; Fig. 79. Cross-section; Fig. 80. *L. (L.) ovalis ovalis* (Müller) : ventral view; Fig. 81. Cross-section; Fig. 82. *L. (L.) ovalis larga* (Sharma) new comb. : dorsal view; Fig. 83. Ventral view, Fig. 84. Cross-section; Fig. 85. *L. (L.) patella* (Müller) : ventral view, Fig. 86. Cross-section.

Measurements : Lorica length : 94; maximum width : 100; anterior width : 32; length of foot-groove : 26; foot : 32; toes : 25.

Distribution : India : Endemic, reported so far only from its original locality in South 24-Parganas district in West Bengal.

46. *Lepadella (Lepadella) patella* (O.F. Müller, 1773)
(Figs. 85 & 86)

Brachionus patella Müller, 1786, p.341, pl.8, figs. 15-19.

Lepadella patella (Müller) : Bory de St. Vincent, 1826, p.86; Voigt, 1957, p.199, Taf.34, fig.5, Taf. 91, Fig. 9.

Lepadella similis Lucks : Naidu, 1967, p.386, pl. II, fig.7.

Lepadella patella patella (Müller) : Kutikova, 1970, p.550, fig. 841; Koste, 1978, p.183, T.59: 2, a-p, 4, a-1.

Material examined : AMT, APR, BB, IMT, GR, MNK, SR, TG, BG, BH, KRP, BNK, MLD, APD.

Characters : Lorica oval in outline and dorsal plate strongly arched; anterior dorsal and ventral sinus with stippled collars. Foot-groove U-shaped; toes pointed.

Differed from *L. ovalis* in its small size and strongly arched dorsal plate.

Measurements : Lorica length : 72-80; maximum width : 50-62; toes : 18-22.

Distribution : India : widely distributed and reported from West-Bengal (Calcutta, North & South 24-Parganas, Medinipur, Bankura, Malda and Koch Behar); North-Eastern India, Orissa, Rajasthan, Gujarat, Punjab, Ladak and Kashmir. Elsewhere : Cosmopolitan.

47. *Lepadella (Lepadella) quadricarinata* (Stenroos, 1898)
(Figs. 87-89)

Metopidia quadricarinata Stenroos, 1898, p.165, Taf. III, fig.2.

Lepadella quadricarinata (Stenroos) : Haring, 1913 b, p.64; Voigt, 1957, p.197, Taf.30, fig.14, Taf.35, figs. 10, a-c.

Material examined : APR, MNK, MST.

Characters : Lorica broadly ovate, with four small folds over the foot-groove; posterior end of lorica slightly emarginate. Dorsal plate convex, ventral plate nearly flat in its median region and slightly concave along its sides. Foot-groove variable; toes pointed.

Measurements : Lorica length: 80-95; maximum width : 65-70; toes : 20-22.

Distribution : India : reported so far only from West Bengal (South 24-Parganas). Elsewhere : apparently Cosmopolitan.

48. *Lepadella (Lepadella) rhomboides* (Gosse, 1886)
(Figs. 90 & 91)

Metopidia rhomboides Gosse, 1886 (In : Hudson and Gosse, 1886), p. 108, pl. 25, fig. 10.

Lepadella rhomboides (Gosse) : Haring, 1913 b, p.65.

Lepadella rhomboides rhomboides (Gosse) : Kutikova, 1970, p.540, fig.817; Koste, 1978, p.194, T. 64 : 1-3, 7c, 5 a-c.

Material examined : APR, BB, BH, BN, GR, IMT, THK, NGM, AMG, NH, KNG, BND, KRP, MLD, SLG.

Characters : Lorica rhomboid-ovate; dorsal plate with a wide and moderately high median keel, sides of keel strongly convex and meet centrally at an obtuse angle forming a faint ridge. Dorsal sinus shallow. Foot-groove variable; toes pointed.

Measurements : Lorica length : 80-108; maximum width : 42-65; toes : 24-30.

Distribution : India : West Bengal (Calcutta, North & South 24-Parganas, Barddhaman, Nadia, Medinipur, Malda and Darjiling) ; various states in Eastern and North-Eastern India, Tamil Nadu and Gujarat. Elsewhere : Cosmopolitan.

49. *Lepadella (Lepadella) rhomboidula* (Bryce, 1890)
(Figs. 92-94)

Metopidia rhomboidula Bryce, 1890, p.76, text-fig.

Lepadella rhomboidula (Bryce) : Haring, 1913 b, p.65; Haring, 1916, p.559, pl. 96, figs. 1-4; Kutikova, 1970, p. 539, fig. 810; Sharma and Sharma, 1987, p.21, figs. 43-45.

Lepadella triptera f. *rhomboidula* (Bryce) : Koste, 1978, p.192, T. 62 : 5, a-d.

Material examined : AMT.

Characters : Lorica rhomboidal in outline, with a moderately high median dorsal keel; sides of keel strongly concave. Posterior margin of lorica slightly concave. Dorsal sinus lacking, ventral sinus semicircular. Foot-groove inverted U-shaped; toes two and with pointed tips.

Koste (1978) proposed to treat this species as a form of *Lepadella triptera*. *L. rhomboidula*, however, differed from the former in relatively large body size, shape of lorica and in having a moderately high dorsal keel. Hence, it is presently retained as a distinct species following Kutikova (1970) and Sharma and Sharma (1987).

Measurements : Lorica length : 72-78; maximum width : 74-82; toes : 20-22.

Distribution : India : reported so far only from West Bengal (South 24-Parganas). Elsewhere : apparently Cosmopolitan.

50. *Lepadella (Lepadella) triptera* Ehrenberg, 1830
(Figs. 95-97)

Lepadella triptera Ehrenberg, 1830, p.74, 83; Haring, 1916, p.500, pl.95, figs. 1-4; Kutikova, 1970, 542, fig. 812; Sharma and Sharma, 1987, p.18, figs. 17-19.

Lepadella triptera triptera Ehrenberg : Koste, 1978, p.192, T. 62 : 2, a-h, 4, 10.

Material examined : IMT, BN, BNK, ASN, MDP, NH, NJP.

Characters : Lorica small and circular or pear-shaped in outline. Dorsal plate with a high and thin median keel. Anterior end of dorsal plate with a shallow notch, ventral sinus broadly U-shaped. Posterior end of lorica obtusely pointed. Toes short and pointed.

Measurements : Lorica length: 48-65; maximum width: 40-50; toes: 14-16.

Distribution : India : West Bengal (Calcutta, North & South 24-Parganas, Barddhaman, Bankura, Medinipur and Koch Behar); Assam, Meghalaya, Tamil Nadu, Punjab and Ladak. Elsewhere : Cosmopolitan.

51. *Lepadella (Lepadella) triprojectus* Sharma, 1978
(Figs. 98 & 99)

Lepadella triprojectus Sharma, 1978b, p.87, figs. 34-35; Sharma and Sharma, 1987, p.20, figs. 41-42.

Material examined : IMT.

Characters : Lorica broadly oval and with three characteristic tube-like projections. Dorsal sinus broad, shallow, concave and with a stippled collar. Ventral sinus V-shaped. Foot-groove U-shaped; toes moderately long and pointed.

Measurements : Lorica length : 75; maximum width: 55; anterior width : 38; anterior projection : 15; postero-lateral projections : 9-9; foot : 26; toes : 20.

Distribution : India : Endemic species, collected so far from its type locality in Calcutta, West Bengal.

Subgenus *Heterolepadella* Bartos, 1955

Heterolepadella Bartos, 1955, p.27, 184.

Characters : Differentiated by two unequal and separate toes.

Type species : *Lepadella (Heterolepadella) ehrenbergi* (Perty, 1850).

This subgenus is represented by only three species in the examined collections from West Bengal.

Key to recorded species of subgenus *Heterolepadella*

1. Lorica oval in shape *Lepadella (Heterolepadella) aspicora* Myers
Lorica rhomboidal in shape 2
2. Lateral angles of lorica with distinct cusps. Posterior angles pointed.....
..... *Lepadella (Heterolepadella) ehrenbergi* (Perty)
Lateral and posterior angles bluntly rounded ... *Lepadella (Heterolepadella) heterostyla* (Murray)

52. *Lepadella (Heterolepadella) aspicora* Myers, 1934
(Fig. 100)

Lepadella aspicora Myers, 1934, p.5, figs. 16-18; Hauer, 1938, p. 527, figs. 50, a-c.

Lepadella (Heterolepadella) aspicora Myers : Koste, 1978, T. 67 : 2, a-c; Sharma and Sharma, 1987, p. 20, fig. 33.

Material examined : MNP, MST.

Characters : Lorica broadly oval in outline; dorsal sinus shallow and ventral sinus V-shaped, both with stippled collars. Dorsal plate moderately arched, ventral plate nearly flat. Last foot-segment longest. Toes two, unequal; right toe longer than the left and toes often twisted.

Measurements : Lorica length : 63-72; maximum width : 58-65; right toe : 23-25; left toe : 16-18.

Distribution : India : Known only from West Bengal (South 24-Parganas). Elsewhere : Mount Desert Island (USA) and Indonesia.

53. *Lepadella (Heterolepadella) ehrenbergi* (Perty, 1850)

(Figs. 101 & 102)

Notogonia ehrenbergi Perty, 1850, p. 20.

Metopidia ehrenbergi : Jennings, 1894, p.24.

Metopidia angulata Anderson, 1889, p.356, pl.21, fig. 10.

Lepadella ehrenbergi (Perty) : Harring, 1913b, p.63; Voigt, 1957, p.203, Taf.34, Fig.3, Taf.35, Fig.12.

Lepadella ehrenbergi (Perty) : Kutikova, 1970, p.554, fig.853; Koste, 1978, p.197, T. 66 : 1, a-g; Sharma and Sharma, 1987, p.20, figs. 22-23.

Material examined : APR, BB, GP, MDP, ASN, CB, SLG.

Characters : Lorica broadly rhomboidal in outline. Dorsal plate moderately convex in central region and relatively flat laterally. Lateral angles with median spurs curving outwards and forwards. Posterior angles pointed and posterior margin of lorica slightly concave. Foot-groove broader posteriorly; toes unequal and pointed.

Measurements : Lorica length : 68-75; maximum width : 72-80 : right toe : 20-24; left toe : 14-16.

Distribution : India : West Bengal (South 24-Parganas, Bardhaman, Medinipur, Koch Behar and Darjiling); Nagaland, Assam, Meghalaya and Orissa. Elsewhere : Cosmopolitan.

54. *Lepadella (Heterolepadella) heterostyla* (Murray, 1913)

(Figs. 103 & 104)

Metopidia heterostyla Murray, 1913 b, p.459, pl. XIX, figs. 6, a-c.

Lepadella heterostyla (Murray) : Harring, 1916, p. 552, pl. 94, figs. 9-13; Voigt, 1957, p.204, Taf. 35, Fig.15.

Lepadella (Heterolepadella) heterostyla (Murray) : Kutikova, 1970, p.553, fig. 851; Koste, 1978, p. 197, T. 65 : 12, a-e.

Material examined : MNK, NB, ALP, THK, SRP, JPG, APD, NCB.

Characters : Lorica rhomboidal and with its edges curving upwards from the blunt lateral angles. Dorsal plate strongly convex in its median region. Posterior angles of lorica with semicircular emarginations. Toes unequal and pointed.

Measurements : Lorica length: 68-75; maximum width: 72-78; right toe: 22-26; left toe: 16-20.

Distribution : India : West Bengal (South 24-Parganas, Hugli, Jalpaiguri and Koch Behar); Mizoram, Assam, Meghalaya and Orissa. Elsewhere : Cosmopolitan.

Genus *Squatinella* Bory de St. Vincent, 1826

Squatinella Bory de St. Vincent, 1826, p.87.

Stephanops Ehrenberg, 1830, p. 64.

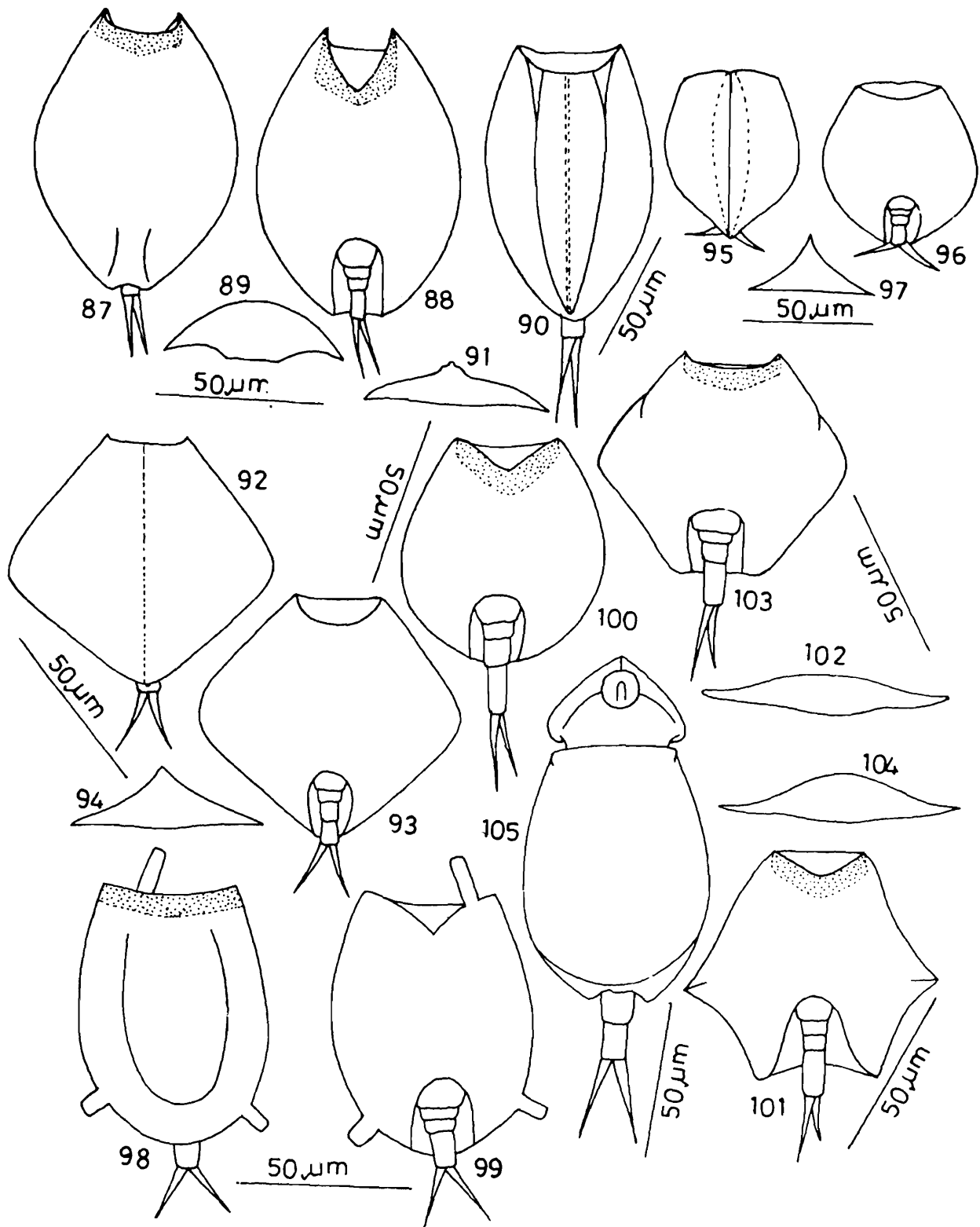


Fig. 87. *Lepadella (Lepadella) quadricarinata* (Stenroos) : dorsal view; Fig. 88. ventral view; Fig. 89. cross-section; Fig. 90. *L. (L.) rhomboides* (Gosse) : dorsal view; Fig. 91. cross-section; Fig. 92. *L. (L.) rhomboidula* (Bryce) : dorsal view, Fig. 93. ventral view, Fig. 94. cross-section; Fig. 95. *L. (L.) triptera* Ehrenberg : dorsal view; Fig. 96. ventral view; Fig. 97. cross-section; Fig. 98. *L. (L.) triprojectus* Sharma : dorsal view; Fig. 99. ventral view; Fig. 100. *L. (Heterolepadella) aspicora* Myers : ventral view; Fig. 101. *L. (H.) ehrenbergi* (Perty) : ventral view; Fig. 102. cross-section; Fig. 103. *L. (H.) heterostyla* (Murray) : ventral view; Fig. 104. cross-section; Fig. 105. *Squatinella mutica* (Ehrenberg) : dorsal view.

Listrion Schmarda, 1864, p. 20.

Characters : Body spindle-shaped or cylindrical, transparent and with thin lorica. Head and corona enclosed by a characteristic transparent and semicircular head shield. Lorica smooth, ribbed or spiny. Foot long and three-segmented; toes equal, slender and with pointed tips. Corona with a ciliated buccal field. Two distinct eye spots present. Trophi weak and malleate.

Type species : *Squatinella cirrata* (O.F. Müller, 1773).

Only one species belonging to this genus is included in the present account.

55. *Squatinella mutica* (Ehrenberg, 1832)
(Fig. 105)

Stephanops muticus Ehrenberg, 1832, p.138.

Squatinella mutica (Ehrenberg) : Haring, 1913b, p. 97; Kutikova, 1970, p. 561, fig. 873.

Squatinella tridentata var. *mutica* (Ehrenberg) : Voigt, 1957, p. 194, Taf. 33, Fig. 4.

Squatinella mutica mutica (Ehrenberg) : Koste, 1978, p. 175, T. 56 : 1, a-f, 5, a-b.

Material examined : APD.

Characters : Trunk with oblong-ovate lorica; posterior end of lorica semicircular or with a notch. First foot-segment covered by shield-like projection of dorsal plate. Toes long, slender and acutely pointed.

Measurements : Total length : 150-155; maximum width : 60-65; toes : 28-30.

Distribution : Represents a new record from West Bengal. India : West Bengal (Koch Behar) and Ladak. Elsewhere : apparently Cosmopolitan.

Family LECANIDAE Bartos, 1959

Body loricate and consists of dorsal and ventral plates. Trophi malleate, modified for suction. Buccal area very simple. Foot one or two jointed; toes one or two.

The members of this family comprise an important fraction of the documented species and these belong to only one genus.

Genus *Lecane* Nitzsch, 1827

Lecane Nitzsch, 1827, p.68.

Cathypna Hudson and Gosse, 1886, p.94.

Diarthra Daday, 1897, p.143.

Characters : Body cylindrical in the extended form, ovate when contracted and usually dorsoventrally compressed. Lorica oval, pear-shaped or shield-shaped; with dorsal and ventral plates. Antero-lateral edges of lorica prolonged into angles or short spines in some species; posterior and rounded or extended into a process. Foot short, two-segmented; only second foot-joint mobile. Toes one or two, in the latter case completely or partially fused; often with short and pointed claws. Corona with circumapical band and buccal field. Single cerebral eye present.

This genus is divisible into three subgenera i.e., *Lecane* (*s. str.*) Nitzsch, *Hemimonstyla* Bartos and *Monostyla* Ehrenberg. All the stated subgenera are observed in the examined material.

Key to recorded subgenera of genus *Lecane*

1. Toe single *Lecane (Monostyla)* Bartos, 1959
 Toes two 2
2. Toes always separate *Lecane (Lecane)* Nitzsch, 1827
 Toes partially fused *Lecane (Hemimonostyla)* Bartos, 1959

Subgenus *Lecane (Lecane)* Nitzsch, 1927

Lecane Nitzsch, 1827, p. 68.

Cathypna Hudson and Gosse, 1886, p. 94.

Distyla Eckstein, 1883, p. 343.

Diarthra Daday, 1897, p. 143.

Characters : Characterized by two completely separate toes.

Type species : *Lecane luna* (O. F. Müller, 1776).

Twenty-two species belonging to this subgenus are documented in the present account.

Key to recorded species and subspecies of *Lecane (Lecane)*

1. Lorica with antero-lateral spines 2
 Lorica without antero-lateral spines 24
2. Toes with claws 9
 Toes without claws 3
3. Ventral plate rounded posteriorly 4
 Ventral plate not rounded posteriorly 6
4. Lorica narrower and second foot-joint projecting beyond lorica
 *Lecane pertica* Haring & Myers
 Lorica relatively broader and second foot-joint not projecting 5
5. Lorica cylindrical, dorsal plate rounded posteriorly and with rounded markings
 *Lecane signifera signifera* (Jennings)
 Lorica oval, dorsal plate truncate posteriorly and with distinct pattern
 *L. signifera ploenensis* (Voigt)
6. Ventral plate with rectangular posterior projection and with small lateral spines
 *Lecane ligona* (Dunlop)
 Ventral plate not rectangular posteriorly 7
7. Ventral plate with spade-shaped posterior projection *Lecane ohioensis* (Herrick)
 Ventral plate with different posterior projection 8

8. Posterior end of ventral plate produced into a triangular spine.....*Lecane ludwigi* (Eckstein)
 Posterior end of ventral plate with bifurcate triangular process.....*Lecane stokesii* (Pell)
9. Claws slightly swollen at base.....*Lecane hastata* (Murray)
 Claws not swollen at base..... 10
10. Ventral plate with posterior projection 11
 Ventral plate rounded posteriorly 12
11. Distal projection of ventral plate with small lateral spines. Anterior margins straight. Toes small *Lecane bifastigata* Hauer
 Distal projection of ventral plate without lateral spines. Anterior ventral margin with deep sinus. Toes long *Lecane leontina* (Turner)
12. Antero-lateral angles with distinct corners..... 13
 Antero-lateral angles with spines..... 16
13. Ventral plate with postero-lateral projections *Lecane lateralis* Sharma
 Ventral plate without any such projections 14
14. Anterior ventral margin undulating and with a shallow median sinus
*Lecane papuana* (Murray)
 Anterior ventral margin not undulating..... 15
15. Anterior margins slightly concave. Lorica broader *Lecane luna luna* (Müller)
 Anterior dorsal margin nearly straight and ventral margin concave. Lorica relatively narrow....
*Lecane luna dorsicalis* (Arora)
16. Lorica bigger in size. Claws long*Lecane unguolata* (Gosse)
 Lorica relatively smaller. Claws small..... 17
17. Lorica oblong and parallel-sided 18
 Lorica not elongated nor parallel-sided 20
18. Dorsal and ventral plates equally broad.....*Lecane vasishti* Sharma
 Dorsal and ventral plates not equally broad 19
19. Dorsal plate narrower than ventral plate*Lecane crepida crepida* Haring
 Dorsal plate as broad as ventral plate anteriorly but narrow posteriorly
 *Lecane crepida bengalensis* Sharma
20. Anterior margins straight and coincident 21
 Anterior margins not straight or coincident 23
21. Lorica compressed. Second foot-joint projecting beyond lorica..... 22
 Lorica gibbous posteriorly. Second foot-joint not projecting*Lecane flexilis* (Gosse)

22. Anterior lateral spines long. Ventral plate projecting beyond dorsal plate posteriorly
 *Lecane aculeata* (Jakubski)
 Anterior lateral spines small. Ventral plate not projecting beyond dorsal plate
 *Lecane arcula* Haring
23. Anterior dorsal margin with folds. Dorsal and ventral plates with distinct markings
 *Lecane curvicornis nitida* (Murray)
 Anterior dorsal margin without folds. Ventral plate with some markings
 *Lecane curvicornis curvicornis* (Murray)
24. Dorsal and ventral plates equally broad. Toes with claws *Lecane inermis* (Bryce)
 Ventral plate narrow than dorsal plate. Toes without claws 25
25. Lorica gibbous. Posterior segment large. Toes outcurved *Lecane hornemanni* (Ehrenberg)
 Lorica relatively compressed. Posterior segment small. Toes straight *Lecane nana* (Murray)

56. *Lecane (Lecane) aculeata* (Jakubski, 1912)
 (Figs. 106 & 107)

Distyla aculeata Jakubski, 1912, p. 543, figs. 3, 4.

Lecane aculeata (Jakubski) : Wiszniewski, 1932, p.48, Taf.1, figs.1, 2; Kutikova, 1970, p.442, fig.586.

Lecane aculeata aculeata (Jakubski) : Koste, 1978, p. 231, T.76 : 2, a-d, 15.

Material examined : IMT, APR, HM, AMG, NB, SRP, KNG, NH, BNK, MLD, NCB.

Characters : Lorica elongate-oval, with straight and coincident anterior margins. Dorsal plate with distinct surface markings. Ventral plate narrower than dorsal plate and produced into large outcurving spines at its external edges. Posterior segment broader and semicircular. Toes parallel-sided and with distinct claws.

Measurements : Length dorsal plate : 54-68; length ventral plate : 60-74; width dorsal plate : 47-58; width ventral plate : 44-54; toes : 20-24; claws : 6-8.

Distribution : India : West Bengal (Calcutta, South 24-Parganas, Hugli, Nadia, Bankura, Malda and Koch Behar) and Meghalaya. Elsewhere : Tropics and Subtropics.

57. *Lecane (Lecane) arcula* Haring, 1914
 (Figs. 108 & 109)

Cathypna aculeata Murray, 1913 a, p.350, pl. XIV, figs. 28 a,c (not *Distyla aculeata* Jakubski).

Lecane arcula Haring, 1914, p. 539, pl.19, figs. 1-4; Hauer, 1938, p.509, Abb. 33 a, b; Kutikova, 1970, p. 422, fig. 584.

Lecane aculeata var. *arcula* (Haring) : Koste, 1978, p. 231, T.76 : 1, a-b.

Material examined : BPR, BB, APR.

Characters : Lorica slightly longer than its width; external angles of ventral plate produced anteriorly into two small spines. Dorsal plate with few indistinct surface markings. Ventral plate

ovate and slightly narrower than dorsal plate. Posterior segment small and rounded. Toes parallel-sided; claws small and curved outwards.

L. arcula is presently retained as a distinct species following Hauer (1938) and Kutikova (1970).

Measurements : Length dorsal plate : 49-66; length ventral plate : 54-72; width dorsal plate : 44-54; width ventral plate : 40-52; toes : 18-20; claws : 4-6.

Distribution : India : West Bengal (South 24-Parganas) and Mizoram. Elsewhere : Cosmopolitan.

58. *Lecane (Lecane) bifastigata* Hauer, 1938

(Figs. 110 & 111)

Lecane bifastigata Hauer, 1938, p. 511, Abb. 35 a, b; Kutikova, 1970, p.438, fig. 575; Koste, 1978, p.234, T. 77 : 2, a-c.

Material examined : BG.

Characters : Lorica cup-shaped; ventral plate broader than dorsal plate and with distinct forwardly directed spines at its anterior external angles. Anterior ventral margin slightly concave. Posterior segment dorsally curved, trapezoidal and with very small lateral spines. Toes moderately long and with pointed claws.

Measurements : Length dorsal plate : 70-72; length ventral plate : 80-82; width dorsal plate : 50-54; width ventral plate : 60-65; toes : 25-28; claws : 8-10.

Distribution : India : reported so far from Calcutta in West Bengal. Elsewhere : Indonesia, Russia, Sri Lanka.

59a. *Lecane (Lecane) crepida* Harring, 1914

(Figs. 112 & 113)

Distyla gissensis Jennings, 1900, p. 91, pl.20, figs. 33-34 (not *Distyla gissensis* Eckstein)

Lecane crepida Harring, 1914, p. 533, pl. XXII, figs. 4-7; Hauer, 1938, p. 512, Abb. 36, a-b; Kutikova, 1970, p. 442, fig. 585.

Lecane crepida crepida Harring : Koste, 1978, p.232. T. 76 : 6, a-b.

Material examined : MST, BPR, MDP, BNK, ASN.

Characters : Lorica elongated, parallel-sided in the upper half and then tapering; ventral margin with two stout anterior spines at its external angles. Dorsal plate strongly convex and its surface markings limited to three pairs of divergent ridges. Ventral plate broader than dorsal plate and with a transverse fold in front of foot. Toes long and slender; terminating into pointed claws.

Measurements : Length dorsal plate : 70-75; length ventral plate : 80-86; width dorsal plate : 40-45; width ventral plate : 50-56; toes : 28-32; claws : 8-10.

Distribution : India : West Bengal (South 24-Parganas, Bardhaman, Medinipur and Bankura); Assam, Meghalaya, Tamil Nadu, Gujarat and Punjab. Elsewhere : Tropics and Subtropics.

59b. *Lecane (Lecane) crepida bengalensis* (Sharma, 1978) *new comb.*
(Figs. 114 & 115)

Lecane crepida f. *bengalensis* Sharma, 1978a, p.192, figs. 3 & 4.

Material examined : IMT.

Characters : Dorsal plate nearly as broad as ventral plate in its anterior region, truncate posteriorly and without any surface markings. Ventral plate with broad-based spines at external edges. Toes parallel-sided; claws short and pointed.

It is presently proposed to be treated as a subspecies as its differences from typical *L. crepida* are distinct to warrant this new status.

Measurements : Length dorsal plate : 75; length ventral plate : 86; width dorsal plate : 42; width ventral plate : 46; anterior width : 42; toes : 24; claws : 6.

Distribution : India : reported so far from West Bengal (Calcutta). Elsewhere : Endemic to India.

60a. *Lecane (Lecane) curvicornis curvicornis* (Murray, 1913)
(Figs. 116 & 117)

Cathypna curvicornis Murray, 1913a, p. 346, pl. XIV, fig. 22.

Lecane curvicornis (Murray) : Harring, 1914, p.537, pl. XVII, fig.3; Harring and Myers, 1926, p. 321, pl. VIII, figs.1, 2; Kutikova, 1970, p. 440, fig. 582.

Lecane curvicornis curvicornis (Murray) : Koste, 1978, p.224, T. 74: 2, e.

Lecane curvicornis f. *miamensis* (Myers) : Chengalath and Fernando, 1973, p.16, figs. 7 & 8; Sharma, 1978a, p. 145, figs. 9 & 10.

Material examined : IMT, BR, SR, MST, MNK, MLD, MDP, KRP, LA, AMG, NH, SR.

Characters : Lorica pyriform, anterior margins coincident and with broad V-shaped sinus; external angles with prominent spines. Dorsal plate narrower than ventral plate and without any surface markings. Ventral plate with a transverse fold in its posterior region. Posterior segment small; often rounded or tricuspidate. Toes long and straight and, at times, slightly curved near base in some preserved specimens (refer: Koste,1978). Claws small and each claw with a basal spicule.

Sharma (1978a) designated some specimens with tricuspidate posterior segment as var. *miamensis* (Myers) following Chengalath and Fernando (1973). Koste (1978) mentioned such variations in the ape of posterior segment in typical form and, therefore the mentioned specimens are now allocated to *L. curvicornis curvicornis* (Murray).

Measurements : Length dorsal plate : 110-120; length ventral plate : 128-135; width dorsal plate : 95-100; width ventral plate : 105-110; toes : 42-50; claws : 9-15.

Distribution : India : West Bengal (Calcutta, North & South 24-Parganas, Hugli, Haora, Medinipur and Malda); Andhra Pradesh and Madhya Pradesh. Elsewhere : Tropics and Subtropics.

60b. *Lecane (Lecane) curvicornis nitida* (Murray, 1913)
(Fig. 118)

Cathypna nitida Murray, 1913a, p.347, pl. XIV, fig. 24 a, b.

Lecane curvicornis f. *nitida* (Murray) : Hauer, 1938, p. 513, Abb. 37 a,b; Sharma, 1987a, p. 102, fig. 2.

Lecane curvicornis nitida (Murray) : Koste, 1978, p.224, T.74 : 2a.

Material examined : CB.

Characters : Dorsal and ventral plates with a strong pattern of surface markings. Antero-dorsal margin with a number of folds. Antero-ventral margin with a broad U-shaped sinus flanked with inwardly directed distinct spines at external angles.

Measurements : Length dorsal plate : 160-168; length ventral plate : 185-190; width dorsal plate : 130-135; width ventral plate: 142-148; toes: 65-70; claws: 20-22.

Distribution : Represents a new report from West Bengal. India : West Bengal (Koch Behar) and Meghalaya. Elsewhere : South America, West Africa and Indonesia.

61. *Lecane (Lecane) flexilis* (Gosse, 1886)

(Fig. 119)

Distyla flexilis Gosse, 1886 (In : Hudson and Gosse, 1886), p. 97, pl. XXIV, fig. 7.

Cathypna flexilis (Gosse) : Stenroos, 1898, p.159, Taf.2, fig. 19.

Lecane flexilis (Gosse) : Harring, 1913 b, p.61; Harring and Myers, 1926, p. 355, pl. XXIV, figs. 3, 4; Kutikova, 1970, p. 439, fig. 578; Koste, 1978, p. 227, T. 75 : 3, a-i, T.76 : 11, a-d, 12, a-b.

Material examined : APR, BPR, CB, APD.

Characters : Lorica strongly gibbous and with straight anterior margins; with small triangular spines at external angles of anterior ventral margin. Dorsal plate strongly arched in posterior region.. Ventral plate flexible, narrower than dorsal plate and with a few folds and markings. Toes short, tapering to small and dorsally curved claws.

Measurements : Length dorsal plate: 68-74; length ventral plate: 74-82; width dorsal plate: 62-65; width ventral plate: 48-54; toes: 20-22; claws: 4-5.

Distribution : India : West Bengal (South 24-Parganas and Koch Behar), Meghalaya, Tamil Nadu and Gujarat. Elsewhere : Cosmopolitan.

62. *Lecane (Lecane) hastata* (Murray, 1913)

(Fig. 120)

Cathypna hastata Murray, 1913a, p.348, Taf.14, fig.25.

Lecane hastata (Murray) : Harring and Myers, 1926, p.363, pl. XXVIII, figs. 5, 6; Wulfert, 1966, p. 73, Abb. 22, a-c; Kutikova, 1970, p. 445, fig. 595; Koste, 1978, p. 233, T. 76 : 10, a-c.

Material examined : HWH, NCB.

Characters : Lorica almost oval in outline, with coincident anterior margins. Dorsal plate smaller than ventral plate and obtuse posteriorly. Anterior external angles of ventral plate with small spines. Posterior segment broad and semicircular. Toes almost parallel-sided and slightly swollen at their free ends; claws distinct, pointed and with swollen bases.

Measurements : Length dorsal plate : 80-87; length ventral plate : 96-105; width dorsal plate : 60-65; width ventral plate : 78-85; toes : 35-40; claws : 14-16.

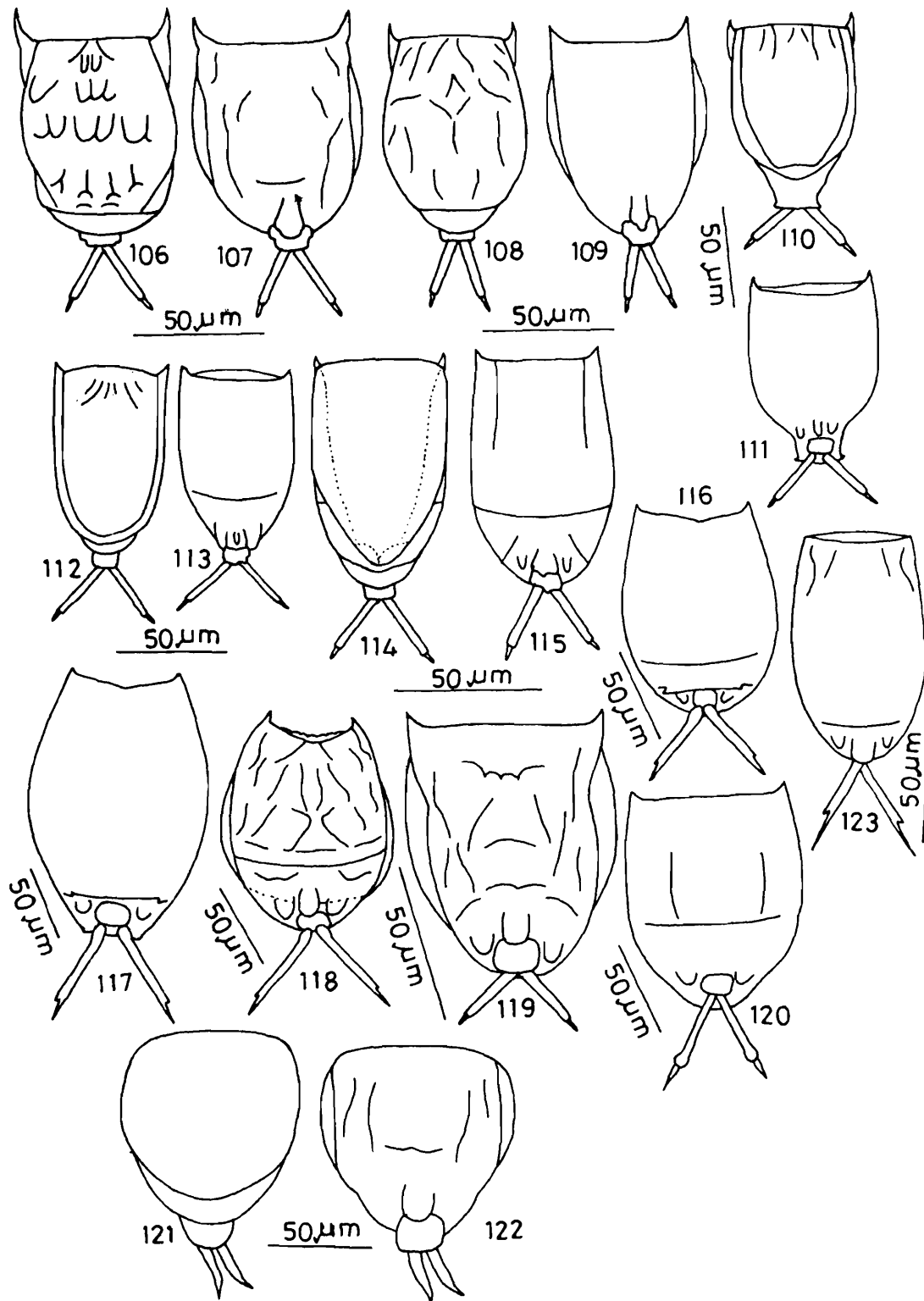


Fig. 106. *Lecane (Lecane) aculeata* (Jakubski) : dorsal view, Fig. 107. ventral view; Fig. 108. *L. (L.) arcula* Haring : dorsal view, Fig. 109. ventral view; Fig. 110. *L. (L.) bifastigata* Hauer : dorsal view, Fig. 111. ventral view; Fig. 112. *L. (L.) crepida crepida* Haring : dorsal view, Fig. 113. ventral view; Fig. 114. *L. (L.) crepida bengalensis* (Sharma) new comb. : dorsal view, Fig. 115. ventral view; Fig. 116 and 117. *L. (L.) curvicornis curvicornis* (Murray) : ventral views; Fig. 118. *L. (L.) curvicornis nitida* (Murray) : ventral view; Fig. 119. *L. (L.) flexilis* (Gosse) : ventral view; Fig. 120. *L. (L.) hastata* (Murray) : ventral view; Fig. 121. *L. (L.) hornemanni* (Ehrenberg) : dorsal view, Fig. 122. ventral view; Fig. 123. *L. (L.) inermis* (Bryce) : ventral view.

Distribution : India : reported so far from West Bengal (Haora and Koch Behar). Elsewhere : Europe, Eastern Asia and South America.

63. *Lecane (Lecane) hornemanni* (Ehrenberg, 1834)
(Figs. 121 & 122)

Euchlanis hornemanni Ehrenberg, 1834, p. 206, 220.

Distyla hornemanni: Hudson and Gosse, 1889, p. 42, pl. XXXIII, fig. 37.

Cathypna hornemanni (Ehrenberg) : Murray, 1913a, p. 349, pl. XIV, fig. 26.

Lecane hornemanni (Ehrenberg) : Harring, 1914, p. 543; Kutikova, 1970, p. 458, fig. 629; Koste, 1978, p.204, T. 68 : 5, a-b, 6, a-b. 9, a-c.

Material examined : TG, HWH, LH, MLD, BNK, APD.

Characters : Lorica broadly ovate; anterior margins coincident, slightly convex and without any spines at external angles. Dorsal plate semicircular and broader than ventral plate. Toes stout and tapering gradually to acute and slightly curved points.

Measurements : Length dorsal plate : 74-82; length ventral plate : 86-95; width dorsal plate : 85-92; width ventral plate : 72-80; toes : 30-32.

Distribution : India : West Bengal (Calcutta, Haora Bankura, Malda and Koch Behar); Meghalaya, Andhra Pradesh, Tamil Nadu, Gujarat and Kashmir. Elsewhere : Tropics and Subtropics.

64. *Lecane (Lecane) inermis* (Bryce, 1892)
(Fig. 123)

Distyla inermis Bryce, 1892, p. 274, text-fig.

Cathypna inermis (Bryce) : Murray, 1913c, p. 556, pl. XXII, fig.7, a-b.

Lecane inermis (Bryce) : Harring, 1913 a; p. 556; Harring and Myers, 1926, p. 379, pl. XXXIII, figs.1, 2; Kutikova, 1970, p.451. fig.606; Koste, 1978, p.219, T.72 : 14, a-c, T.73 : 1, a-h.

Material examined : SLG.

Characters : Lorica elongated and flexible; with nearly straight anterior margins, without any spines at anterior external angles. Toes small and terminating into long and pointed claws.

Measurements : Lorica length : 68-80; maximum width : 45-50; toes : 25-30; claws : 10-12.

Distribution : Represents a new report from West Bengal. India : West Bengal (Darjiling) and Meghalaya. Elsewhere : Cosmopolitan.

65. *Lecane (Lecane) lateralis* Sharma, 1978
(Figs. 124 & 125)

Lecane lateralis Sharma, 1978c, p. 191, figs 1 & 2.

Material examined : Lorica broadly ovate; anterior dorsal margin concave, anterior ventral margin undulating and with a shallow median sinus. Dorsal plate almost circular and smaller than ventral plate. Ventral plate with a transverse fold in its posterior region; its ventro-lateral angles produced into small extensions. Toes long, parallel-sided about 3/4 of the length and with stout claws; each claw with a distinct basal spicule.

Measurements : Length dorsal plate : 110; length ventral plate : 120; width dorsal plate : 112; width ventral plate : 115; toes : 42; claw : 10.

Distribution : India : West Bengal (South 24-Parganas) and Orissa. Elsewhere : Endemic to India.

66. *Lecane (Lecane) leontina* (Turner, 1892)

(Fig. 126)

Cathypna leontina Turner, 1892, p.61, pl. I, fig. 12.

Lecane leontina (Turner) : Haring, 1913 b, p.61 : Haring and Myers, 1926, p. 326, pl. X, figs. 3-5; Kutikova, 1970, p. 436, fig. 571.

Lecane leontina leontina (Turner) : Koste, 1978, p. 234, T. 77 : 7, a-h.

Material examined : IMT, BR, AMT, APR, BB, MST, BL, BNK, BDN, ASN, NH, MLD, THK, NCB, SLG.

Characters : Lorica oblong-ovate; anterior dorsal and ventral sinus broadly V-shaped. Ventral plate broader than dorsal plate and with triangular spines at anterior external angles. Posterior segment extending over foot as a tail-like projection. Toes long, parallel-sided and terminating into pointed claws; each claw with a basal spicule.

Measurements : Length dorsal plate : 150-170; length ventral plate : 190-215; width dorsal plate : 125-140; width ventral plate : 130-150; toes : 120-130; claws : 12-15.

Distribution : India : widely distributed and reported from West Bengal (Calcutta, North & South 24-Parganas, Bardhaman, Malda, Koch Behar and Darjiling); all the states in North-Eastern India, Orissa, Andhra Pradesh, Madhya Pradesh and Punjab. Elsewhere : Tropics and Subtropics.

67. *Lecane (Lecane) ligona* (Dunlop, 1901)

(Figs. 127 & 128)

Cathypna ligona Dunlop, 1901, p. 29, pl. 2, figs. 4-6.

Lecane ligona (Dunlop) : Haring, 1913b, p.61; Haring and Myers, 1926, p.339, pl. XVI, figs. 3-6.

Lecane ligona ligona (Dunlop) : Kutikova, 1970, p. 456, fig. 622; Koste, 1978, p. 211, T. 70 : 8, a-b.

Material examined : BA.

Characters : Lorica barrel-shaped and with broader anterior end; anterior dorsal margin convex, anterior ventral margin broadly U-shaped and with inwardly directed small spines at its external angles. Dorsal plate smaller than ventral plate. Posterior segment almost rectangular; its posterior margin undulating and produced into two lateral spines. Toes short, stout and terminating into pointed tips.

Measurements : Length dorsal plate : 86-90; length ventral plate : 105-110; width dorsal plate : 74-85; width ventral plate : 85-95; toes : 25-30.

Distribution : India : reported so far from West Bengal (Haora). Elsewhere : apparently Cosmopolitan.

68. *Lecane (Lecane) ludwigi* (Eckstein, 1883)

(Figs. 129-134)

Distyla ludwigii Eckstein, 1883, p. 383, Taf. 26, fig. 37.

Cathypna ludwigi (Eckstein) : Murray, 1913c, p. 352, pl. XIV, fig.23.

Lecane ludwigi (Eckstein) : Haring, 1913b, p.61; Haring and Myers, 1926, p. 350, pl. XXII, figs. 5, 6; Kutikova, 1970, p. 458, fig. 630.

Lecane ludwigi ludwigi (Eckstein) : Koste, 1978, p. 212, T. 71 : 1a, h-j (including various forms).

Material examined : APR, MST, MNP, BPR, MST, NGM, NCB, MLD.

Characters : Lorica oval; anterior margins coincident, slightly concave and with prominent spines at external angles of ventral margin. Ventral plate narrower than dorsal plate. Posterior segment usually produced into a long triangular spines. Toes long, parallel-sided and ending into distinct conical points.

Besides typical specimens (Figs. 129-130), this species indicated variations in the shape of its posterior segment and such individuals are assigned to *f. brevicauda* (Eckstein) (Fig. 131), *f. laniculata* Hauer (Fig. 132) and *f. laticaudata* Hauer (Fig.133). In addition, *L. ludwigi ercodes* (Fig. 134) reported earlier by this author from West Bengal (Sharma, 1979a) is now assigned to *f. marshi* (Haring) following Koste (1978).

Measurements : Length dorsal plate : 105-120; length ventral plate : 150-160; width dorsal plate : 78-80; width ventral plate : 68-76; toes : 40-44.

Distribution : India : West Bengal (South 24-Parganas, Hugli, Malda and Koch Behar); Orissa, Andhra Pradesh and Punjab. Elsewhere : Cosmopolitan.

69a. *Lecane (Lecane) luna luna* (O.F. Müller, 1776)

(Fig. 135)

Cercaria luna Müller, 1776, p.280.

Lecane luna (Müller) : Haring, 1913 b p.61 ; Haring and Myers, 1926, p. 334, pl. XIV, figs. 5,6.

Lecane luna luna (Müller) : Kutikova, 1970, p.438, fig. 572; Koste, 1978, p. 223, T.74 : 1, a-h, T.85 : 8-11.

Material examined : SR, IMT, BN, BG, BA, BB, BPR, BNK, GR, MST, DD, MNK, BL, KLN, AMG, APD, CB, SLG.

Characters : Lorica ovate to subcircular in outline. Dorsal plate broader than ventral plate. Anterior ventral sinus V-shaped and with cuspidate external angles. Toes stout, parallel-sided,swollen at their bases and ending into distinct claws; each claw with a distinct basal spicule.

Measurements : Length dorsal plate : 115-125; length ventral plate : 135-145; width dorsal plate: 117-125; width ventral plate : 105-110; toes : 40-42; claws : 8-10.

Distribution : India : widely distributed reported so far from West Bengal (Calcutta, North & South 24-Parganas, Haora, Hugli, Bankura, Nadia, Koch Behar and Darjiling); all states in North-Eastern India, Orissa, Gujarat, Rajasthan, Punjab, Kashmir and Ladak. Elsewhere : Cosmopolitan.

69b. *Lecane (Lecane) luna dorsicalis* (Arora, 1965)

(Fig. 136)

Lecane dorsicalis Arora, 1965, p. 449, fig. 2.

Lecane luna (Müller) : Nayar, 1968, p. 176, fig. 17.

Lecane luna f. dorsicalis (Arora) : Sharma, 1978a, p.147, figs. Figs. 22 & 23.

Material examined : IMT.

Characters : Differentiated from typical specimens in having straight anterior dorsal margin and narrower lorica.

The examined specimens are sufficiently distinct from typical forms and, hence, the same are presently assigned subspecies status.

Measurements : Length dorsal plate : 110-120; length ventral plate : 120-135; width dorsal plate : 98-110; width ventral plate : 91-98; toes : 35-40; claws : 8-10.

Distribution : India : Endemic to this country and reported so far only from West Bengal (Calcutta).

70. *Lecane (Lecane) nana* (Murray, 1913)

(Figs. 137 & 138)

Cathypna nana Murray, 1913 a, p.353, pl. XIV, figs, 29, a-c.

Lecane nana (Murray) : Haring, 1914, p. 536; Haring and Myers, 1926, pl. XXXIV, figs.1, 2; Koste, 1978, p. 204, T. 68 : 10, a-d, T.48 : 4 and 9.

Material examined : IMT, SR, APR, AMG, KRP, BDN, NCB.

Characters : Lorica small and almost subcircular; anterior margins coincident, slightly convex and external angles produced into distinct edges. Ventral plate narrower than dorsal plate, almost parallel-sided anteriorly and then tapering. Toes slender and produced into curved, pointed tips.

Measurements : Length dorsal plate : 50-54; length ventral plate : 58-62; width dorsal plate : 48-52; width ventral plate : 40-45; toes: 20-22.

Distribution : India : West Bengal (Calcutta, South 24-Parganas, Hugli, Barddhaman, Medinipur and Koch Behar); Rajasthan and Gujarat. Elsewhere : Cosmopolitan.

71. *Lecane (Lecane) ohioensis* (Herrick, 1885)

(Figs. 139 & 140)

Distyla ohioensis Herrick, 1885, p. 54, fig. 1.

Cathypna ohioensis (Herrick) : Turner, 1892, p. 61.

Lecane ohioensis (Herrick) : Haring, 1913b, p.62; Haring and Myers, 1926, p. 354, pl. XXIII, figs.4, 5.

Lecane ohioensis ohioensis (Herrick) : Kutikova, 1970, p. 458, fig.625; Koste, 1979, p.213, T. 71 : 9, a-b.

Material examined : MST.

Characters : Lorica broadly oval; anterior margins concave, external angles with inwardly directed distinct and stout spines. Dorsal plate truncate posteriorly and with four transverse rows of tessellations. Ventral plate narrower than dorsal plate and with a few folds. Posterior segment broad and with a spade-shaped posterior process. Toes long, parallel-sided and terminating into short and pointed tips.

Measurements : Length dorsal plate : 100-110; length ventral plate : 125-132; width dorsal plate : 75-80; width ventral plate : 64-68; toes: 34-36.

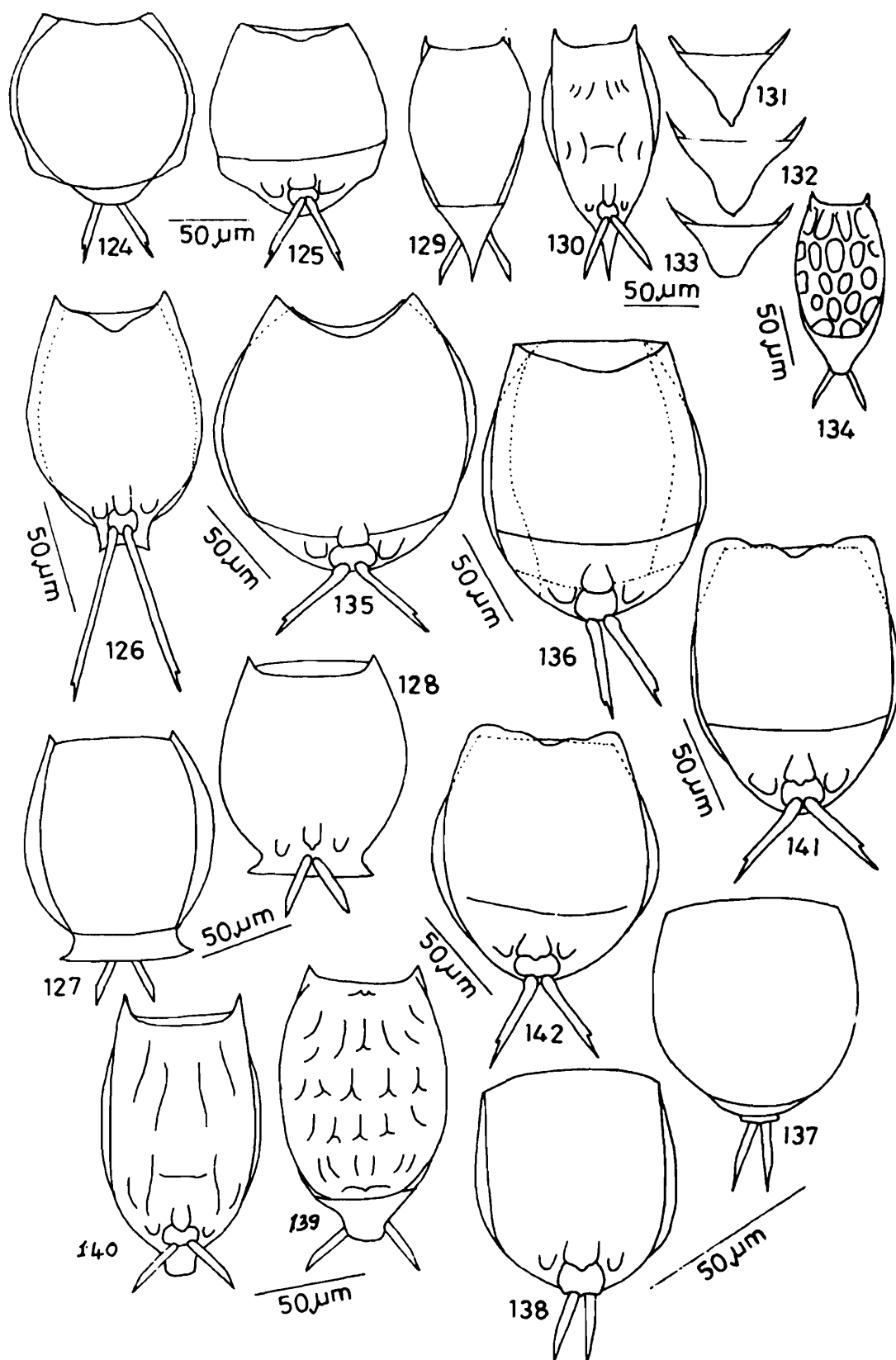


Fig. 124. *Lecane (Lecane) lateralis* Sarma : dorsal view, Fig. 125. ventral view; Fig. 126. *L. (L.) leontina* (Turner) : ventral view; Fig. 127. *L. (L.) ligona* (Dunlop) : dorsal view, Fig. 128. ventral view; Fig. 129. *L. (L.) ludwigi* (Eckstein) : f. *typica* : dorsal view; Fig. 130. ventral view; Fig. 131. f. *brevicauda* Hauer; Fig. 132. Posterior segment, f. *laniculata* Hauer; Fig. 133. Posterior segment, f. *laticaudata* Hauer; Fig. 134. f. *marshi* (Harring); dorsal view; Fig. 135. *L. (L.) luna luna* (Muller) : ventral view; Fig. 136. *L. (L.) luna dorsicalis* (Arora) new comb. : ventral view; Fig. 137. *L. (L.) nana* (Murray) : dorsal view; Fig. 138. ventral view; Fig. 139. *L. (L.) ohioensis* (Herrick) : dorsal view; Fig. 140. ventral view; Fig. 141 and 142. *L. (L.) papuana* (Murray) : ventral views.

Distribution : India : West Bengal (South 24-Parganas). The previous report by Edmondson and Hutchinson (1934) from Punjab referred to localities now in Pakistan. Elsewhere : Cosmopolitan.

72. *Lecane (Lecane) papuana* (Murray, 1913)
(Figs. 141 & 142)

Cathypna papuana Murray, 1913 c, p. 551, pl. XXII, figs. 2, a-d.

Lecane papuana (Murray) : Haring, 1914, p. 534; Haring and Myers, 1926, p. 336, pl. XIV, figs. 3, 4; Koste, 1978, p.225, T. 74 : 4, a-c.

Material examined : MNK, BR, THK, APR, MNP, MST, BB, BNK, BDN, ASN, KRP, MLD, HWH, APR, NCB, SLG.

Characters : Lorica broadly oval to circular; anterior dorsal margin straight, anterior ventral margin with a V-shaped sinus flanked with undulating sides. Ventral plate slightly narrower than dorsal plate. Posterior segment small and rounded. Toes moderately long, parallel-sided and terminating into small claws; each claw with a distinct basal spicule.

Measurements : Length dorsal plate : 95-115; length ventral plate : 115-140; width dorsal plate : 94-102; width ventral plate : 90-95; toes : 35-45; claws : 8-12.

Distribution : India : West Bengal (South 24-Parganas, Haora Barddhaman, Bankura, Medinipur, Malda, Koch Behar and Darjiling); Mizoram, Tamil Nadu, Kashmir and Ladak. Elsewhere: Tropics and Subtropics.

73. *Lecane (Lecane) pertica* Haring & Myers, 1926
(Fig. 143)

Lecane pertica Haring and Myers, 1926, p. 340, pl. XII, figs. 1-2; Hauer, 1938, p. 521, Abb. 43, a-b; Koste, 1978, p. 208, T. 69 : 10, a-b, 14, a-c.

Material examined : CB.

Characters : Lorica elongate oval; anterior margins coincident and with small spines at external angles. Dorsal plate oval, broader than ventral plate and with surface markings. Ventral plate elongated and with a few markings. Toes long, parallel-sided initially and then tapering into long pointed tips.

Measurements : Length dorsal plate : 115-120; length ventral plate : 125-132; width dorsal plate: 68-72; width ventral plate : 62-65; toes : 70-75.

Distribution : Represents a new record from West Bengal. India : West Bengal (Koch Behar); Meghalaya and Assam. Elsewhere : North and South America and Indonesia.

74a. *Lecane (Lecane) signifera signifera* (Jennings, 1896)
(Fig. 144)

Distyla signifera Jennings, 1896, p. 92, figs. 1, 2.

Cathypna signifera (Jennings) : Murray, 1913 c, p. 552, pl. 23, fig. 13.

Lecane signifera (Jennings) : Haring, 1913b, p.62; Haring and Myers, 1926, p.333, pl XIII, figs. 3, 4

Lecane signifera signifera (Jennings) : Kutikova, 1970, p. 454, fig.619; Koste, 1978, p. 209, T.69 : 1, a-b, 2, c.

Material examined : SLG.

Characters : Lorica oblong in outline; anterior margins straight, coincident and with small, anteriorly directed spines at external angles. Dorsal plate rounded posteriorly and with rounded surface markings. Ventral plate narrower than dorsal plate. Toes long, parallel-sided and with pointed tips.

Measurements : Length dorsal plate : 120-136; length ventral plate : 135-142; width dorsal plate : 90-94; width ventral plate : 84-88; toes : 52-60.

Distribution : Represents a new report from West Bengal. India : West Bengal (Darjiling) and Meghalaya. Elsewhere : Cosmopolitan.

74b. *Lecane (Lecane) signifera ploenensis* (Voigt, 1902)

(Fig. 145)

Distyla ploenensis Voigt, 1902, p. 679.

Cathypna ploenensis (Voigt) : Murray, 1913 c, p. 552, pl. 22, fig. 4.

Lecane ploenensis (Voigt) : Haring, 1913 b, p.62; Haring and Myers, 1926, p. 332, pl. 13, figs. 5, 6.

Lecane signifera ploenensis (Voigt): Kutikova, 1970, p.209, fig. 613.

Material examined : APD.

Characters : Lorica elongate-oval; spines at anterior external angles relatively longer. Dorsal plate truncate posteriorly and with strong surface markings. Toes longer than typical specimens.

Measurements : Length dorsal plate : 105-135; length ventral plate : 110-145; width dorsal plate : 90-98; width ventral plate : 78-85; toes : 45-70.

Distribution : India : West Bengal (Koch Behar); Mizoram, Meghalaya, Gujarat and Punjab. Elsewhere : Cosmopolitan.

75. *Lecane (Lecane) stokesii* (Pell, 1890)

(Figs. 146 & 147)

Cathypna stokesii Pell, 1890, p. 140, text-fig.

Distyla stokesii (Pell) : Jennings, 1894, p. 24.

Lecane stokesii (Pell) : Haring, 1913 b, p. 62; Haring and Myers, 1926, p. 353, pl. XXIII, figs.1-3; Kutikova, 1970, p.458, fig. 628.

Lecane stokesi (Pell) : Koste, 1978, p. 214, T.71 : 7, a-c.

Material examined : BG.

Characters : Lorica elongate-oval; anterior margins concave, coincident and with distinct spines at external angles. Dorsal plate truncate posteriorly and with distinct surface markings. Ventral plate narrower than dorsal plate, elongated and with a few surface markings. Posterior segment produced into a bifurcate process. Toes long, parallel-sided and with pointed tips.

Measurements : Length dorsal plate: 100-105; length ventral plate: 148-152; width dorsal plate: 78-82; width ventral plate: 62-68; toes: 40-45.

Distribution : India : reported so far from West Bengal (Haora). Elsewhere : West and Central Europe, North America.

76. *Lecane (Lecane) ungulata* (Gosse, 1887)
(Fig. 148)

Cathypna ungulata Gosse, 1887 b, p. 361, pl. VIII, fig. 1.

Lecane ungulata (Gosse) : Harring, 1913 b, p. 62; Harring and Myers, 1926, p.323, pl. IX, figs. 3, 4; Kutikova, 1970, p. 439, fig. 580.

Lecane ungulata ungulata (Gosse) : Koste, 1978, p. 225, T.74 : 6, a-g.

Material examined : BR, BN, BH, BB, MST, APR, KNG, NH, MLD, JH, NB, APD, SLG.

Characters : Lorica large, broadly ovate; anterior margins almost straight and with distinct triangular cuspidate spines at external angles. Dorsal plate narrower than ventral plate. Toes parallel-sided and with long stout claws; each claw with a prominent basal spicule.

Measurements : Length dorsal plate : 190-220; length ventral plate : 220-260; width dorsal plate : 158-170; width ventral plate : 165-190; toes : 80-85; claws : 40-45.

Distribution : India : widely distributed reported so far from West Bengal (North and South 24-Parganas, Nadia, Malda, Koch Behar and Darjiling); Mizoram, Nagaland, Assam, Meghalaya, Orissa, Andhra Pradesh, Gujarat and Punjab. Elsewhere : Cosmopolitan.

77. *Lecane (Lecane) vasishti* Sharma, 1980
(Figs. 149 & 150)

Lecane vasishti Sharma, 1980, p. 131-132, figs. 1, A & B.

Material examined : IMT.

Characters : Lorica oblong, almost cylindrical; external angles produced into small spines. Dorsal and ventral plates equally broad, maximum width at the anterior end. Posterior segment small and semicircular. Toes long, parallel-sided; claws small and pointed.

Measurements : Length dorsal plate : 75; length ventral plate : 79; width dorsal and ventral plates : 31; anterior width : 33; toes : 22; claws : 7.

Distribution : India : known only from its type-locality in Calcutta, West Bengal. (Endemic species).

Subgenus *Lecane (Hemimonstyla)* Bartos, 1959

Hemimonostyla Bartos, 1959, p.497.

Characters : Species of this subgenus differentiated by two, partly fused toes.

Type species. : *Lecane (Hemimonostyla) agilis* (Bryce, 1892)

This subgenus is represented by only three species in the collections examined from West Bengal.

Key to recorded species of subgenus *Lecane (Hemimonostyla)*

1. Toes fused for 3/4 of the length and swollen near base *Lecane (Hm.) syngenes* (Hauer)
- Toes fused for 1/3 of the length and parallel-sided 2
2. Anterior dorsal margin straight. Dorsal plate without surface markings.....
-*Lecane (Hm.) inopinata* Harring & Myers

Anterior dorsal margin wavy. Dorsal plate with distinct surface markings.....
 *Lecane (Hm.) sympoda* Hauer

**78. *Lecane (Hemimonstyla) inopinata* (Harring & Myers, 1926)
 (Figs. 151 & 152)**

Lecane inopinata Harring & Myers, 1926, p. 374, pl. XXXII, figs. 5,6.

Lecane (Hemimonostyla) inopinata (Harring & Myers) : Kutikova, 1970, p.462, fig. 460.

Material examined : IMT, MNK, SR, MDP, BNK, KRP, NCB.

Characters : Lorica broadly ovate, width about 2/3 of the length and anterior margins straight. Dorsal plate oval, truncate posteriorly and without any surface markings. Ventral plate narrower than dorsal plate and with a few longitudinal ridges. Posterior segment small. Toes fused for about 1/3 of their length and tapering into distinct, curved claws.

Measurements : Length dorsal plate : 65-75; length ventral plate : 76-80; width dorsal plate : 58-60; width ventral plate : 52-56; toes : 20-25; claws: 4-5

Distribution : India : West Bengal (Calcutta South 24-Parganas, Bankura, Medinipur and Koch Behar); Assam, Meghalaya and Andhra Pradesh. Elsewhere : Tropics and Subtropics.

**79. *Lecane (Hemimonstyla) sympoda* (Hauer, 1929)
 (Figs. 153 & 154)**

Lecane sympoda Hauer, 1929, p. 152, Abb. 10; Hauer, 1938, p. 524, Abb. 48, a-b.

Lecane (Hemimonostyla) sympoda (Hauer) : Kutikova, 1970, p. 410, fig. 639.

Material examined : SR, APR, MST, MNP, BDN, ASN.

Characters : Lorica width about 4/5 of its length. Anterior dorsal margin often wavy; anterior ventral margin straight and drawn out into sharp corners or small spines at its external angles. Dorsal and ventral plates with surface markings. Ventral plate narrower than dorsal plate, often parallel-sided. Toes fused for about 1/4 of their length; claws acutely pointed.

Measurements : Length dorsal plate : 55-58; length ventral plate : 60-54; width dorsal plate: 48-56; width ventral plate : 44-46; toes : 18-20; claws : 8-9.

Distribution : India : West Bengal (South 24-Parganas and Barddhaman) and Gujarat. Elsewhere : Cosmopolitan.

**80. *Lecane (Hemimonostyla) syngenes* (Hauer, 1938)
 (Figs. 155 & 156)**

Monostyla syngenes Hauer, 1938, p. 547, Abb. 69, a-b.

Lecane (Monostyla) syngenes (Hauer) : Koste, 1972, p.399, T.27 : 1.

Lecane (Hemimonostyla) syngenes (Hauer) : Chengalath *et. al.* 1974, p. 89, figs. 23 & 24.

Lecane (Hemimonostyla) kluchor var. *syngenes* (Hauer) : Koste, 1978, p. 238, T. 78 : 10, a-e.

Material examined : NH.

Characters : Lorica broadly elliptical, anterior margins straight and external angles rounded. Dorsal and ventral plates without any surface markings; ventral plate narrower than dorsal plate. Toes fused for more than 3/4 of their length, fused part broad in its anterior half; claws short and parallel.

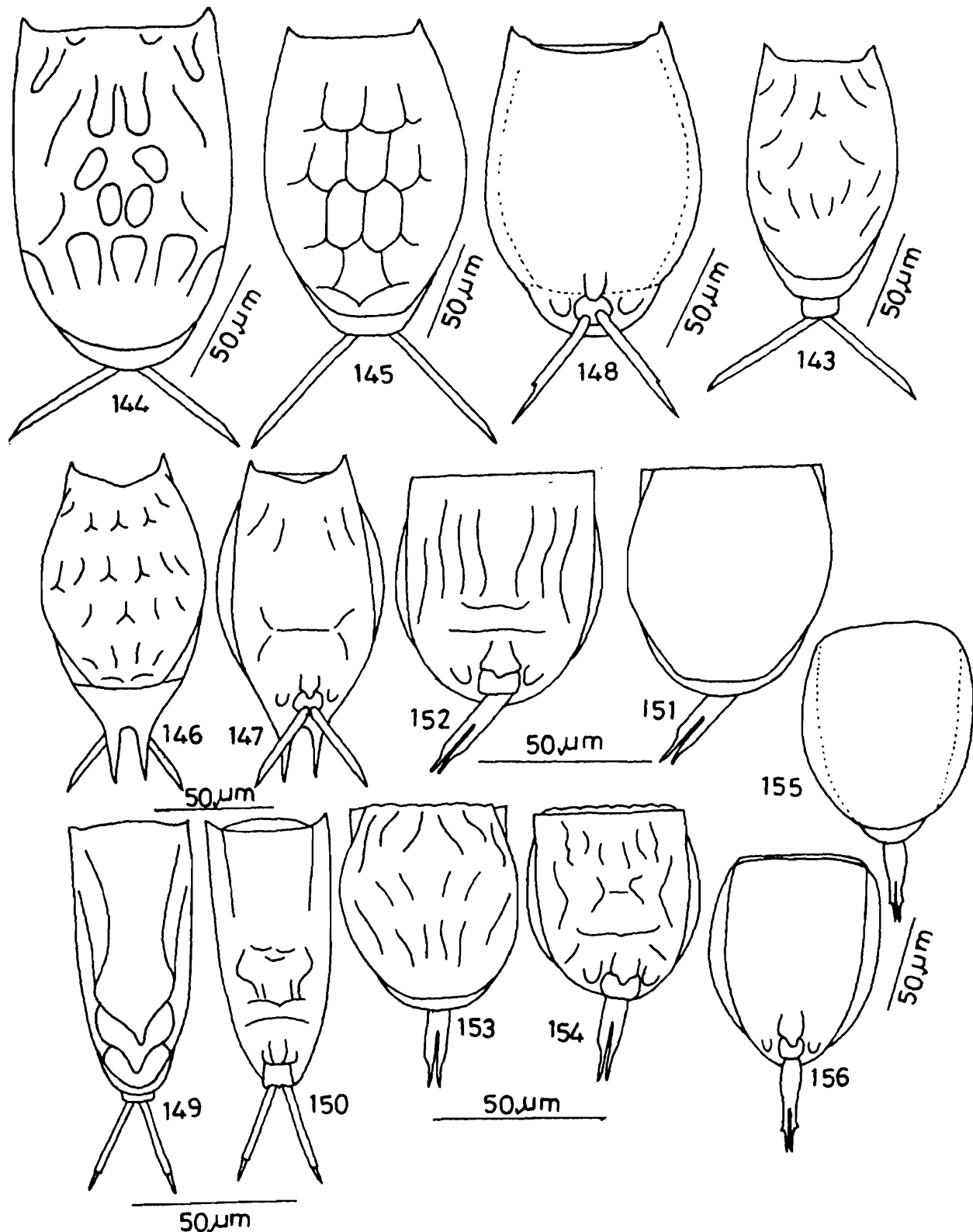


Fig. 143. *Lecane (Lecane) pertica* Harring & Myers : ventral view; Fig. 144. *L. (L.) signifera signifera* (Jennings) : dorsal view; Fig. 145. *L. (L.) signifera ploenensis* (Voigt) : dorsal view; Fig. 146. *L. (L.) stokesii* (Pell) : dorsal view; Fig. 147. ventral view; Fig. 148. *L. (L.) ungulata* (Gosse) : ventral view; Fig. 149. *L. (L.) vasishti* Sharma : dorsal view; Fig. 150. ventral view; Fig. 151. *L. (Hemimonostyla) inopinata* Harring & Myers : dorsal view; Fig. 152. ventral view; Fig. 153. *L. (Hm.) sympoda* Hauer : dorsal view; Fig. 154. ventral view; Fig. 155. *L. (Hm.) syngenes* (Hauer) : dorsal view; Fig. 156. ventral view.

Measurements : Length dorsal plate : 90-94; length ventral plate : 95-98; width dorsal plate : 72-76; width ventral plate : 64-68; toes : 40-42; claws : 4-5.

Distribution : India : reported so far from West Bengal (North 24-Parganas). Elsewhere : Indonesia, Sri Lanka and Brazil.

Subgenus *Lecane (Monostyla)* Ehrenberg, 1830

Monostyla Ehrenberg, 1830, p. 46.

Characters : Species of this subgenus distinguished by the presence of a single toe.

Type species : *Lecane (Monostyla) cornuta* (O.F. Müller, 1786)

This subgenus is represented by sixteen species in the samples examined from West Bengal.

Key to recorded species of subgenus *Lecane (Monostyla)*

1. Anterior dorsal margin with median curved spines *Lecane (M.) quadridentata* (Ehrenberg)
Anterior dorsal margin without median spines..... 2
2. Toe with one or two claws..... 3
Toe without any claw 11
3. Claw(s) with basal spicules 4
Claw(s) without basal spicules 10
4. Anterior margins straight and coincident *Lecane (M.) obtusa* (Murray)
Anterior margins not straight or coincident 5
5. Dorsal plate smaller than ventral plate and with straight anterior margin..... 6
Dorsal plate not smaller than ventral plate and its anterior margin not straight 7
6. Anterior ventral sinus flanked with inwardly directed peg-like spines. Toe swollen at its base ..
..... *Lecane (M.) stenroosi* (Meissner)
Anterior ventral sinus flanked with undulating margin. Toe parallel-sided
..... *Lecane (M.) unguitata* (Fadjev)
7. Antero-lateral corners with broad-based cuspidate spines
..... *Lecane (M.) thalera* (Harring & Myers)
Antero-lateral corners without any such spines..... 8
8. Anterior margins slightly concave 9
Anterior dorsal margin with shallow sinus and ventral margin with deep U-shaped sinus
..... *Lecane (M.) bulla* (Gosse)
9. Anterior dorsal and ventral margins slightly concave. Lorica broader.....
..... *Lecane (M.) lunaris lunaris* (Ehrenberg)

- Anterior dorsal margin straight and ventral margin concave. Lorica less broader
 *Lecane (M.) lunaris crenata* (Harring)
10. Toe with two claws *Lecane (M.) furcata* (Murray)
 Toe with one claw *Lecane (M.) scutata* (Harring & Myers)
11. Antero-lateral angles rounded..... 12
 Antero-lateral angles with distinct corners or spines 13
12. Anterior margins straight and coincident..... *Lecane (M.) pyriformis* (Daday)
 Anterior dorsal margin concave, ventral margin with deep U-shaped sinus with collar.....
 *Lecane (M.) pawlowskii* Wulfert
13. Antero-lateral angles with distinct corners and anterior margins slightly concave.....
 *Lecane (M.) closterocerca* (Schmarda)
 Antero-lateral angles with distinct spines and anterior margins variable in shape 14
14. Anterior dorsal margin straight and antero-lateral angles with prominent spines.....
 *Lecane (M.) thienemanni* (Hauer)
 Anterior dorsal margin not straight. Antero-lateral spines small 15
15. Anterior dorsal and ventral sinus shallow *Lecane (M.) hamata* (Stokes)
 Anterior dorsal and ventral sinus deep..... 16
16. Anterior margins equally broad *Lecane (M.) sinuata* (Hauer)
 Anterior dorsal margin smaller than ventral margin..... *Lecane (M.) decipiens* (Murray)

81. *Lecane (Monostyla) bulla* (Gosse, 1851)

(Figs. 157 & 158)

Monostyla bulla Gosse, 1851, p. 200.

Lecane (Monostyla) bulla (Gosse) : Wulfert, 1966, p.70, Abb.15, a-c.

Lecane (Monostyla) bulla bulla (Gosse) : Kutikova, 1970, p. 478, fig. 679; Koste, 1978, p. 252, T. 83 : 2, a-b, T. 85 : 1, a-c.

Material examined : IMT, SR, THK, DD, BH, BN, BL, APR, DL, GR, APR, MNP, MST, BB, LH, KLN, AMG, ASN, BDN, MLD, APD, SLG.

Characters : Lorica oblong-ovate; anterior dorsal margin with a shallow sinus, anterior ventral margin with a deep sinus flanked with small cusps at external angles. Ventral plate equally broad or slightly narrower than dorsal plate. Toe long and terminating into a long and pointed claw with distinct basal spicules; claw with a distinct median line but not divided.

Measurements : Length dorsal plate : 112-120; length ventral plate : 118-130; width dorsal plate : 84-90; width ventral plate : 80-90; toe : 48-55; claw : 12-18.

Distribution : India : widely distributed, reported so far from West Bengal (Calcutta, North & South 24-Parganas, Hugli, Haora Nadia, Barddhaman, Malda, Koch Behar and Darjiling); all states in North-Eastern region, Orissa, Andhra Pradesh, Tamil Nadu, Rajasthan, Gujarat, Punjab and Kashmir. Elsewhere : Cosmopolitan.

82. *Lecane (Monostyla) closterocerca* (Schmarda, 1859)
(Figs. 159 & 160)

Monostyla closterocerca Schmarda, 1859, p. 59, Taf. XIV, fig. 125.

Lecane (Monostyla) closterocerca (Schmarda) : Voigt, 1957, p. 230, Taf. 42, fig. 2, Taf. 45, fig. 1; Kutikova, 1970, p. 466, fig. 650.

Lecane (Monostyla) closterocerca closterocerca (Schmarda) : Koste, 1978, p. 256, T. 84 : 2, a-f, 5, a-c, T. 85 : 2, a-d.

Material examined : IMT, MNK, AMT, SR, SRK, BRP, TOL, GR, THK, VML, MST, BB, MNP, APR, NH, BND, KRP, NCB, CB, APD.

Characters : Lorica broadly oval; anterior margins slightly concave, external angles rounded or produced into small corners. Ventral plate narrower than dorsal plate. Toe parallel-sided for about 1/2 of its length and then tapering to an acute point.

Measurements : Length dorsal plate : 54-62; length ventral plate : 65-70; width dorsal plate : 55-58; width ventral plate : 44-50; toe : 22-28.

Distribution : India : showing wider distribution and reported so far from West Bengal (Calcutta, North & South 24-Parganas, Bardhaman, Medinipur and Koch Behar); all states in N. E. India, Orissa, Tamil Nadu, Gujarat, Rajasthan, Punjab, Kashmir and Ladak. Elsewhere : Cosmopolitan.

83. *Lecane (Monostyla) decipiens* (Murray, 1913)
(Fig. 161)

Monostyla decipiens Murray, 1913 a, p. 360, pl. XV, figs, 43, a-c.

Lecane (Monostyla) decipiens (Murray) : Voigt, 1957, p. 230, Taf. 43, fig. 24; Koste, 1978, p. 260, T.84 : 9, a-b.

Material examined : MST, ALP, BB, MNP, NGM, BA, LH, TG, BDN.

Characters : Lorica elongate-oval; anterior margins coincident and with a deep U-shaped sinus flanked by two acute triangular cusps at the external angles. Toe parallel-sided for about half of its length and then tapering to an acute point.

Measurements : Length dorsal plate : 78-82; length ventral plate : 90-95; width dorsal plate : 70-80; width ventral plate : 54-60; toe : 38-42.

Distribution : India : West Bengal (Calcutta, South 24-Parganas, Haora, Hugli and Bardhaman); Mizoram, Assam, Meghalaya, Orissa and Punjab. Elsewhere : apparently Cosmopolitan.

84. *Lecane (Monostyla) furcata* (Murray, 1913)
(Fig. 162)

Monostyla furcata Murray, 1913 a, p. 358, pl. XV, figs, 40, a-b; Haring and Myers, 1926, p. 407, pl. XLIII, figs.5, 6.

Lecane (Monostyla) furcata (Murray) : Voigt, 1957, p. 237, Taf.42, fig.6, Taf.43, fig.2; Kutikova, 1970, p. 480, fig. 685.

Lecane (Monostyla) furcata (Murray) : Koste, 1978, p.242, T:80 : 2, a-b.

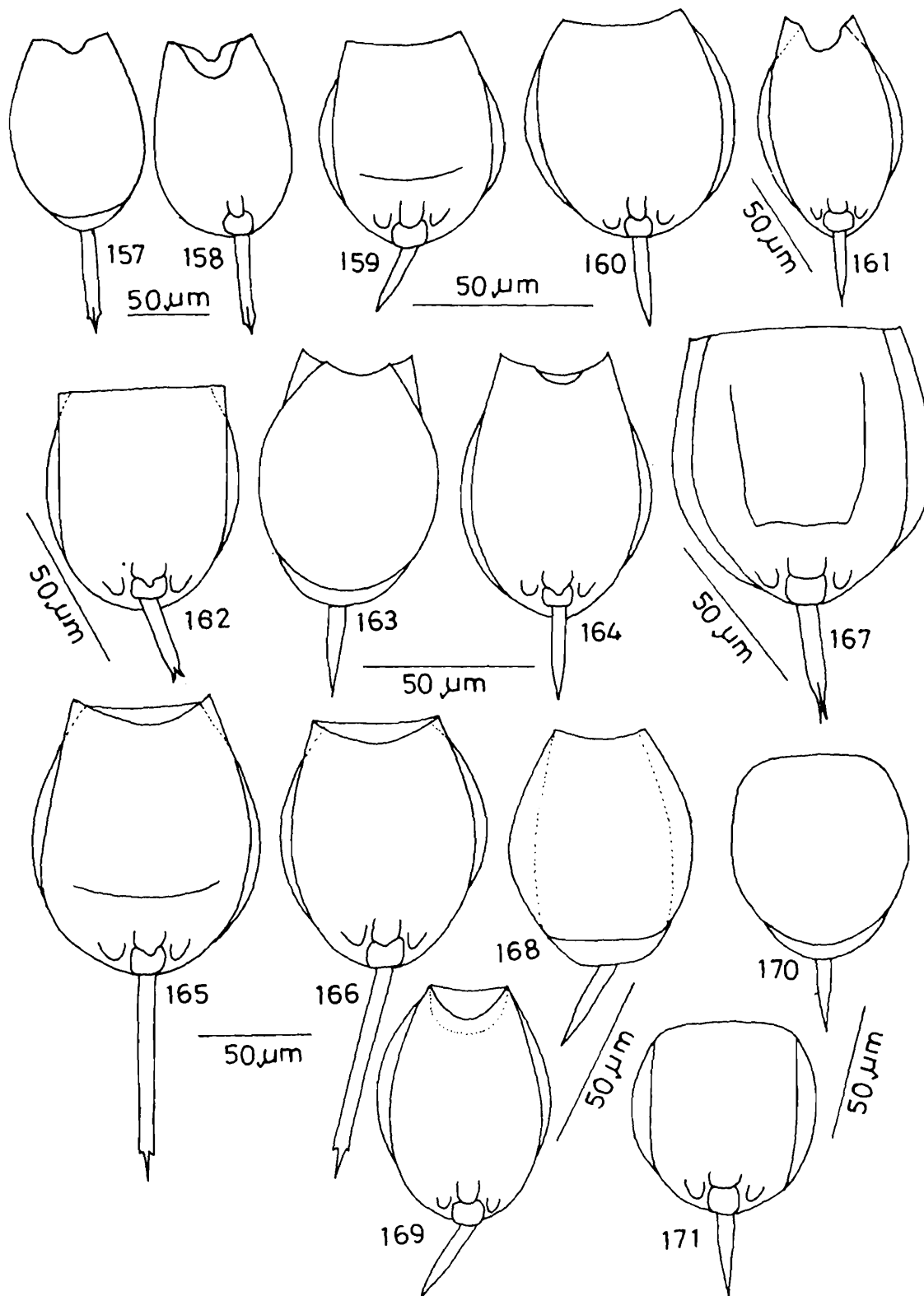


Fig. 157. *Lecane (Monostyla) bulla* (Gosse) : dorsal view, Fig. 158. ventral view; Figs. 159 and 160. *L. (M.) closterocerca* (Schmarda) : ventral views; Fig. 161. *L. (M.) decipiens* (Murray) : ventral view; Fig. 162. *L. (M.) furcata* (Murray) : ventral view; Fig. 163. *L. (M.) hamata* (Stokes) : dorsal view, Fig. 164. ventral view; Fig. 165. *L. (M.) lunaris lunaris* (Ehrenberg) : ventral view; Fig. 166. *L. (M.) lunaris crenata* (Harring) : ventral view; Fig. 167. *L. (M.) obtusa* (Murray) : ventral view; Fig. 168. *L. (M.) pawlowskii* Wulfert : dorsal view, Fig. 169. ventral view; Fig. 170. *L. (M.) pyriformis* (Daday) : dorsal view, Fig. 171. ventral view.

Material examined : IMT, SR, APR, BB, MST, APD, MNP, GR, BL.

Characters : Lorica broadly oval, with straight anterior margins and without any surface markings. Ventral plate almost parallel-sided and narrower than dorsal plate. Toe short and stout; terminating into two divergent and pointed claws.

Measurements : Length dorsal plate : 54-60; length ventral plate : 60-64; width dorsal plate : 52-58; width ventral plate : 44-50; toe : 22-24; claws : 4-6

Distribution : India : West Bengal (Calcutta and South 24-Parganas); Assam, Meghalaya and Mizoram. Elsewhere : Cosmopolitan.

85. *Lecane (Monostyla) hamata* (Stokes, 1896)

(Figs. 163-164)

Monostyla hamata Stokes, 1896, p. 21, pl. VII, figs. 6-8; Haring and Myers, 1926, p.414, pl. XLVII, figs. 1, 2.

Lecane (Monostyla) hamata (Stokes) : Voigt, 1957, p.23, Taf. 41, fig. 2, Taf. 43, fig. 22; Kutikova, 1970, p.1970, p.466, fig. 647.

Lecane (Monostyla) hamata hamata (Stokes) : Koste, 1978, p. 258, T.84 : 10, a-c, T.85 : 5, a-c.

Material examined : IMT, SR, TOL, TOP, MST, BB, APR.

Characters : Lorica elongate-oval. Anterior dorsal margin with a shallow lunate sinus; anterior ventral margin with a deep V-shaped sinus and with acute angled distinct cusps at its external angles. Toe parallel-sided for about half of its length and then tapering to an acute point.

Measurements : Length dorsal plate : 62-68; length ventral plate : 71-77; width dorsal plate : 52-55; width ventral plate : 40-46; toe : 24-28.

Distribution : India : West Bengal (Calcutta and South 24-Parganas); Mizoram, Assam, Meghalaya, Orissa, Tamil Nadu, Gujarat, Rajasthan, Punjab and Kashmir. Elsewhere : Cosmopolitan.

86a. *Lecane (Monostyla) lunaris lunaris* (Ehrenberg, 1832)

(Fig. 165)

Lepadella lunaris Ehrenberg, 1832, p. 127.

Monostyla lunaris (Ehrenberg) : Haring and Myers, 1926, p. 384, pl. XXXV, figs. 1-6.

Lecane (Monostyla) lunaris (Ehrenberg) : Voigt, 1957, p. 235, Taf. 42, fig. 9, Taf. 43, fig.30, Taf. 45, fig.12; Kutikova, 1970, p. 478, fig. 677.

Lecane (Monostyla) lunaris (Ehrenberg) : Koste, 1978, p. 248, T. 82 1, a-j, T. 85: 3.

Material examined : ALP, BPR, BNK, MLD, KRP, APD, SLG.

Characters : Lorica broadly ovate; anterior margins not coincident, each with a shallow lunate sinus. Dorsal plate semicircular to pear-shaped, ventral plate broadly oval and narrower than dorsal plate. Toe long, parallel-sided; claw pointed, with a median furrow and two basal spicules.

Measurements : Length dorsal plate : 90-100; length ventral plate : 105-120; width dorsal plate : 85-95; width ventral plate : 78-88; toe : 60-75; claw : 10-12.

Distribution : India : West Bengal (South 24-Parganas, Bankura, Medinipur, Malda, Koch Behar and Darjiling; all states in North-eastern region, Gujarat and Kashmir. Elsewhere : Cosmopolitan.

86b. *Lecane (Monostyla) lunaris crenata* (Harring, 1913)
(Fig. 166)

Monostyla crenata Harring, 1913 a, p.349, pl. XXXVI, figs. 4-6; Harring and Myers, 1926, p. 386, pl. XXXVI, figs. 5, 6.

Lecane (Monostyla) crenata (Harring) : Voigt, 1957, p. 232, taf.42, fig.7, Taf.45, fig.9; Sharma, 1978a, p.149, Figs. 46 & 47.

Lecane (Monostyla) lunaris crenata (Harring) : Koste, 1978, p. 249, T.82 : 4, a-b.

Material examined : IMT, TIM, NB.

Characters : Differentiated from the nominate subspecies in having straight anterior dorsal margin, smaller size of lorica, shape of ventral plate and relatively longer toe.

Measurements : Length dorsal plate : 88-92; length ventral plate : 98-104; width dorsal plate : 80-84; width ventral plate : 75-78; toe : 80-88; claw : 10-14.

Distribution : India : West Bengal (Calcutta and South 24-Parganas); Tamil Nadu and Kashmir. Elsewhere : Tropics and Subtropics.

87. *Lecane (Monostyla) obtusa* (Murray, 1913)
(Fig. 167)

Monostyla obtusa Murray, 1913 a, p. 357, pl. XV, fig. 37; Harring and Myers, 1926, p. 403, pl. XLII, figs. 5, 6.

Lecane (Monostyla) obtusa (Murray) : Voigt, 1957, p. 235, Taf.43, fig.47, d; Kutikova, 1970, p.473, fig.668.

Lecane (Monostyla) obtusa obtusa (Murray) : Koste, 1978, p. 243, T 81 : 3, a-b.

Material examined : NCB.

Characters : Lorica almost oval and without any surface markings; anterior margins straight, coincident and with minute spines at external angles. Ventral plate narrower than dorsal plate. Toe cylindrical, slightly swollen in its middle region; claw pointed and with basal spicules.

Measurements : Length dorsal plate : 60-68; length ventral plate : 66-74; width dorsal plate 62-68; width ventral plate : 50-56; toe : 22-26; claw : 8-10.

Distribution : Represents a new report from West Bengal. India : West Bengal (Koch Behar) and Andhra Pradesh. Elsewhere : Cosmopolitan.

88. *Lecane (Monostyla) pawlowskii* Wulfert, 1966
(Figs. 168 & 169)

Lecane pawlowskii Wulfert, 1966, p.77, Abb.29, a-c.

Lecane (Monostyla) pawlowskii Wulfert : Koste, 1978, p. 258, T.84 : 7, a-c; Sharma, 1978a, p.151, figs. 55 & 56.

Material examined : MNP.

Characters : Lorica oval; anterior dorsal margin nearly flat, anterior ventral margin with a deep sinus and its external angles produced into rounded corners. Ventral plate narrower than posteriorly truncate dorsal plate; both plates with a few surface markings. Toe parallel-sided for about half of its length and then tapering to an acute point.

Measurements : Length dorsal plate : 60-62; length ventral plate : 70-74; width dorsal plate : 52-55; width ventral plate : 44-48; toe : 24-26.

Distribution : Endemic to India, reported so far only from West Bengal (South 24-Parganas) and Gujarat.

89. *Lecane (Monostyla) pyriformis* (Daday, 1905)
(Figs. 170 & 171)

Monostyla pyriformis Daday, 1905, p. 330; Harring and Myers, 1926, p. 409, pl. XLV, figs. 1, 2.

Lecane (Monostyla) pyriformis (Daday) : Kutikova, 1970, p. 465, fig. 648; Koste, 1978, p. 256, T. 84 : 1, a-b.

Material examined : SR, APR, MST, KLN, NH, JH, MLD, CB.

Characters : Lorica oval; anterior margins coincident, straight or slightly convex and with rounded external angles. Ventral plate narrower than dorsal plate. Second foot-joint subsquare. Toe parallel-sided for some distance and then tapering into a slender tip.

Measurements : Length dorsal plate : 56-60; length ventral plate : 60-65; width dorsal plate : 58-62; width ventral plate : 44-48; toe: 20-30.

Distribution : India : West Bengal (North & South 24-Parganas, Nadia, Malda and Koch Behar); Meghalaya and Punjab. Elsewhere : Cosmopolitan.

90. *Lecane (Monostyla) quadridentata* (Ehrenberg, 1832)
(Fig. 172)

Monostyla quadridentata Ehrenberg, 1832, p. 130; Harring and Myers, 1926, p. 391, pl. XXXVIII, figs. 3-5.

Lecane (Monostyla) quadridentata (Ehrenberg) : Voigt, 1957, p.229, Taf.43, fig.19; Kutikova, 1970, p.472, p.666; Koste, 1978, p.255, T.83: 8, a-c.

Material examined : IMT, SR, APR, MST, BNK, ASN, KNG, SLG.

Characters : Lorica ovate to pyriform. Anterior dorsal margin with two outcurved spines, ventral margin with a V-shaped sinus and its external angles produced into minute frontal spines. Dorsal plate narrower than ventral plate. Toe long and parallel-sided; claw pointed and with two distinct basal spicules.

Measurements : Length dorsal plate : 108-125; length ventral plate : 120-142; width dorsal plate : 80-92; width ventral plate : 82-102; toe : 50-60; claw : 16-18.

Distribution : India : widely distributed reported so far from West Bengal (Calcutta, South 24-Parganas, Bardhaman, Bankura, Nadia and Darjiling); Manipur, Mizoram, Nagaland, Assam, Meghalaya, Orissa, Madhya Pradesh, Andhra Pradesh, Rajasthan, Punjab, Haryana and Kashmir. Elsewhere : Cosmopolitan.

91. *Lecane (Monostyla) scutata* (Harring & Myers, 1926)
(Fig. 173)

Monostyla scutata Harring and Myers, 1926, p. 401, pl. XL, figs. 1, 2.

Lecane (Monostyla) scutata (Harring and Myers) : Voigt, 1957, p. 231, Taf.43, fig.11; Kutikova, 1970, p. 471, fig. 664; Koste, 1978, p. 245, T.81 : 8 & 12.

Material examined : NCB.

Characters : Lorica oval, anterior margins coincident and slightly concave ; anterior ventral margin broader and produced into sharp corners at its external angles. Ventral plate narrower than dorsal plate and almost parallel-sided. Toe parallel-sided; claw short and pointed

Measurements : Length dorsal plate : 62-65; length ventral plate : 68-72; width dorsal plate : 58-64; width ventral plate : 48--55; toe : 16-22; claw : 6-8.

Distribution : Represents a new report from West Bengal. India : West Bengal (Koch Behar) and Meghalaya. Elsewhere : Cosmopolitan.

92. *Lecane (Monostyla) sinuata* (Hauer, 1938)
(Fig. 174)

Monostyla sinuata Hauer, 1938, p. 545, Abb. 67, a-b.

Lecane (Monostyla) sinuata (Hauer) : Wulfert, 1966, p. 79, Abb. 53; Sharma, 1978 a, p. 151, Fig. 59.

Lecane (Monostyla) hamata var. *sinuata* (Hauer) : Koste, 1978, p.259, T.84 : 11.

Material examined : BPR, BNK.

Characters : Lorica almost oval, with small anterior opening. Anterior ventral margin with a deep sinus bounded by curving margins and its external angles with small spines. Ventral plate narrower than dorsal plate and with a few surface markings. Second foot-joint rectangular. Toe stout, almost parallel-sided for about half of its length and then terminating into an acute point.

Measurements : Length dorsal plate : 74-76; length ventral plate : 80-82; width dorsal plate : 52-56; width ventral plate : 42-46; toe : 24-30.

Distribution : India : Gujarat and West Bengal (South 24-Parganas and Bankura). Elsewhere : Sumatra.

93. *Lecane (Monostyla) stenroosi* (Meissner, 1908)
(Figs. 175 & 176)

Monostyla stenroosi Meissner, 1908, p.22, pl.2, fig.8; Harring and Myers, 1926, p. 394, pl. XXXIX, figs. 1, 2.

Lecane (Monostyla) (Meissner) : Voigt, 1957, p.233, T.43, fig.6, T.44, fig. 8; Kutikova, 1970, p. 474, fig. 669; Koste, 1978, p. 247, T. 80 : 7, a-b, d-e.

Material examined : MNK, BR, AMT, THK, BDN, BH, CB.

Characters : Lorica broadly ovate to circular and with straight anterior dorsal margin; ventral margin with a shallow sinus flanked with two incurved hook-like frontal spines. Dorsal plate oval and smaller than ventral plate. Toe stout, spindle-shaped; claw pointed and with two distinct basal spicules.

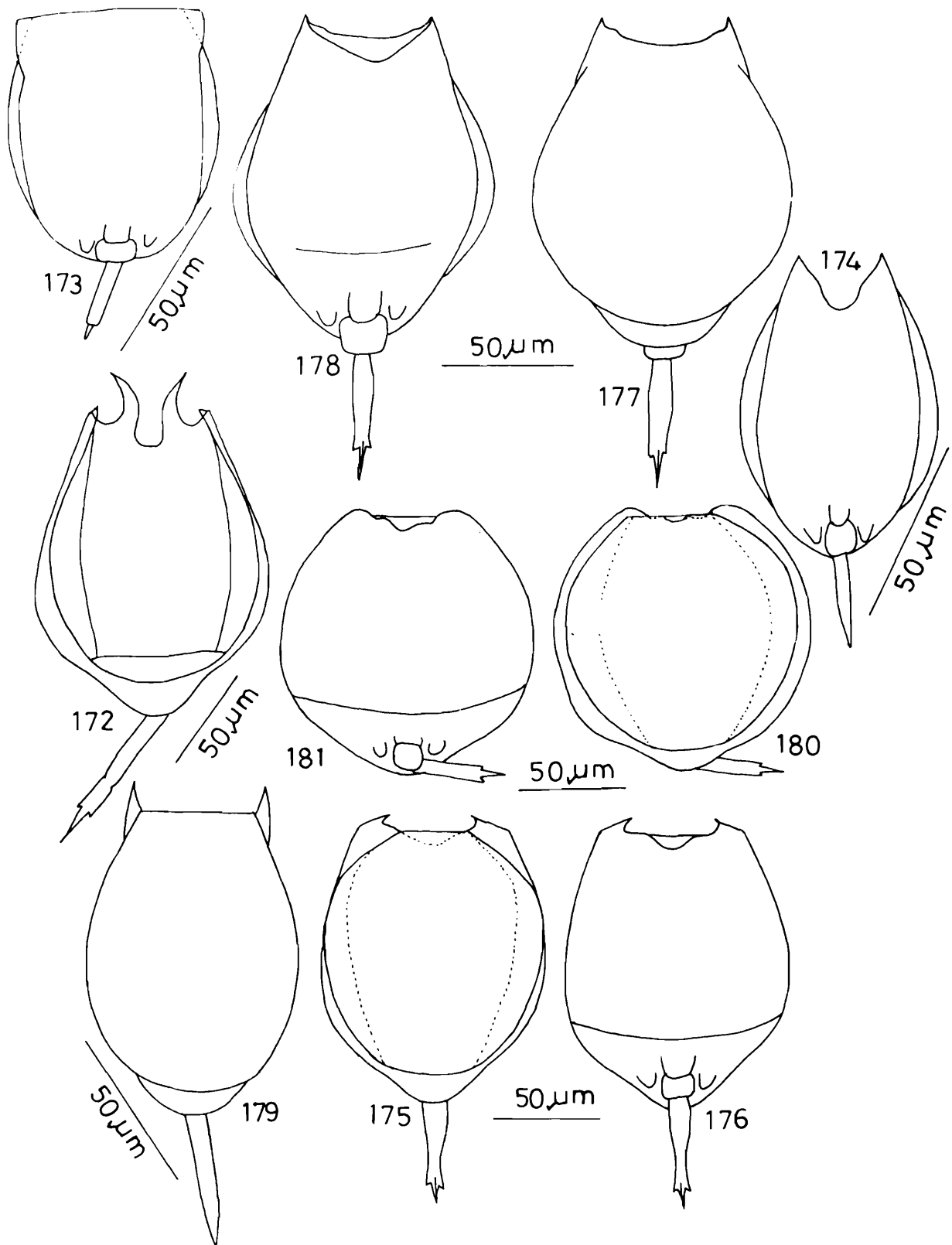


Fig. 172. *Lecane (Monostyla) quadridentata* (Ehrenberg) : dorsal view; Fig. 173. *L. (M.) scutata* (Harring & Myers) : ventral view; Fig. 174. *L. (M.) sinuata* (Harring & Myers) : ventral view; Fig. 175. *L. (M.) stenroosi* (Meissner) : dorsal view; Fig. 176. ventral view; Fig. 177. *L. (M.) thalera* (Harring & Myers) : dorsal view; Fig. 178. ventral view; Fig. 179. *L. (M.) thienemanni* (Hauer) : dorsal view; Fig. 180. *L. (M.) unguitata* (Fadееv) : dorsal view; Fig. 181. ventral view.

Measurements : Length dorsal plate : 105-112; length ventral plate : 110-126; width dorsal plate : 90-96; width ventral plate : 92-100; toe : 40-42; claw : 8-10.

Distribution : India : West Bengal (North & South 24-Parganas, Bardhaman and Koch Behar); Assam, Andhra Pradesh and Gujarat. Elsewhere : apparently Cosmopolitan.

94. *Lecane (Monostyla) thalera* (Harring & Myers, 1926)

(Figs. 177 & 178)

Monostyla thalera Harring and Myers, 1926, p. 394, pl. XXXIX, figs. 3, 4.

Lecane (Monostyla) thalera (Harring and Myers) : Voigt, 1957, p. 236, Taf.43, fig. 28; Hauer, 1963, p. 188, Abb. 21; Kutikova, 1970, p. 747, fig.670; Sharma, 1978 a, p.151, Figs. 62 & 63.

Lecane (Monostyla) lamellata thalera (Harring and Myers) : Koste, 1978, p. 254, T. 83 : 5, a-b, 7, a-b.

Material examined : IMT, APD.

Characters : Lorica ovate. Anterior dorsal margin concave; anterior ventral margin with a relatively deep sinus and with curved sides, external angles with small, incurved spines. Ventral plate narrower than dorsal plate. Toe long, spindle-shaped; claw pointed and with small basal spicules.

Measurements : Length dorsal plate : 120-132; length ventral plate : 128-144; width dorsal plate : 94-100; width ventral plate : 88-92; toe : 42-50; claw : 14-16.

Distribution : India : West Bengal (Calcutta and Koch Behar) and Gujarat. Elsewhere : apparently Cosmopolitan.

95. *Lecane (Monostyla) thienemanni* (Hauer, 1938)

(Fig. 179)

Monostyla thienemanni Hauer, 1938, p. 548, Abb.70, a-b.

Lecane (Monostyla) thienemanni (Hauer) : Wulfert, 1966, p. 81, Abb. 37, a-d; Sharma, 1979 a, p. 58, figs.17, 18.

Lecane (Monostyla) hamata var. *thienemanni* (Hauer) : Koste, 1978, p. 259, T. 84 : 14, a-d.

Material examined : BA, HWH, NCB.

Characters : Lorica elongate oval, anterior dorsal margin straight and narrower; anterior ventral margin with a shallow sinus and its external angles produced into two strongly built triangular spines. Dorsal plate slightly truncate posteriorly and broader than ventral plate. Toe parallel-sided for about half of its length and the tapering to an acute point.

Measurements : Length dorsal plate : 65-74; length ventral plate : 76-82; width dorsal plate : 60-62; width ventral plate : 50-55; toe : 32-36.

Distribution : India : West Bengal (Haora and Koch Behar); Meghalaya and Gujarat. Elsewhere : Indonesia, Sri Lanka.

96. *Lecane (Monostyla) unguitata* (Fadeev, 1925)

(Figs. 180 & 181)

Monostyla unguitata Fadeev, 1925, p. 21, pl. 1, fig. 7; Hauer, 1938, p. 548, Abb. 71, a-b.

Lecane (Monostyla) unguitata (Fadeev) : Wulfert, 1966, p.82, Abb.38, a-e; Kutikova, 1970, p.481, fig.687.

Lecane (Monostyla) unguitata unguitata (Fadeev) : Koste, 1978, p.246, T.80 : 6, a-f.

Material examined : IMT, MNK, SR, KRP, BDN, MLD, CB, JH, AMG, NH.

Characters : Lorica broadly circular and anterior opening relatively smaller. Anterior dorsal margin straight; anterior ventral margin undulating, with a fairly deep median sinus and with distinctly rounded external angles. Dorsal plate pyriform, truncate posteriorly and smaller than ventral plate. Toe almost parallel-sided; claw pointed, with an indistinct furrow and with two distinct basal spicules.

Measurements : Length dorsal plate : 90-95; length ventral plate : 100-110; width dorsal plate : 82-88; width ventral plate : 90-95; toe : 26-30; claw : 12-14.

Distribution : India : West Bengal (Calcutta, North & South 24-Parganas, Hugli, Bardhaman, Medinipur, Malda and Koch Behar); Assam, Meghalaya and Gujarat. Elsewhere : Eastern Europe, North America, Indonesia and Sri Lanka.

Family NOTOMMATIDAE Remane, 1933 (*partim*)

Trophi virgate and modified for suction. Corona ventral (*Notommata* type), often with ciliated auricles. Trunk usually spindle-shaped. Foot generally not clearly set off from the body. Toes present.

Two genera belonging to the family Notommatidae are recorded in this account.

Key to recorded genera of family *Notommatidae*

- Foot and toes longer than body..... Genus *Scaridium* Ehrenberg, 1830
 Foot and toes not longer than body..... Genus *Cephalodella* Bory de St. Vincent, 1826

Genus *Cephalodella* Bory de St. Vincent, 1826

Cephalodella Bory de St. Vincent, 1826, p. 43.

Diglena Ehrenberg, 1830, p.18

Diaschiza Hudson and Gosse, 1886, p. 77.

Characters : Body cylindrical, slightly curved; with thin dorsal and ventral plates. Foot short, toes slightly bent and pointed. Corona consists of a simple circumapical band of cilia and with ventral buccal field. Trophi virgate, variously shaped in different species.

Type species : *Cephalodella catellina* (O.F. Müller, 1786).

Five species of this genus are documented in this account.

Key to recorded species of *Cephalodella*

1. Body short and stout..... 2
 Body elongated 3
2. Posterior end of abdomen gibbous and projecting over foot. Foot ventrally directed
 *Cephalodella catellina* (Müller)
 Posterior end of abdomen not gibbous. Foot terminal *Cephalodella auriculata* (Müller)
3. Lorica with distinct posterior projection..... *Cephalodella mucronata* Haring & Myers

- Lorica without any posterior projection..... 4
4. Toes short, curved and with few basal spines on inner side.....*Cephalodella forficula* (Ehrenberg)
- Toes long, gradually tapering and with conical tips *Cephalodella gibba* (Ehrenberg)

97. *Cephalodella auriculata* (O.F. Müller, 1773)
(Fig. 182)

Vorticella auriculata Müller, 1773, p. 111.

Diaschiza auriculata (Müller) : Harring, 1913 b, p. 33.

Cephalodella auriculata (Müller) : Harring and Myers, 1924, p. 479, pl. XXVIII, fig. 6; Kutikova, 1970, p.240, figs.110, 142; Koste, 1978, p. 366, T.113 : a, T.117 : 5, a-f, T 232 : 3, d.

Material examined : APR.

Characters : Body short and stout; head wider than trunk and with a small rostrum. Lorica fairly rigid, stippled and plates distinct; lateral clefts narrow anteriorly and widening gradually towards the posterior end. Foot short and stout; toes short, pointed and ventrally curved.

Measurements : Total length : 120-130; toes : 22-24.

Distribution : India : reported so far from West Bengal (South 24-Parganas). Elsewhere : Cosmopolitan.

98. *Cephalodella catellina* (O.F. Müller, 1786)
(Figs. 183 & 184)

Cercaria catellina Müller, 1786, p. 130, Taf.20, figs. 12, 13.

Diglena catellina Ehrenberg, 1830, p. 8.

Cephalodella catellina (Müller) : Harring and Myers, 1924, p. 465, pl. XXVII, figs. 3-5; Kutikova, 1970, p. 232, figs. 114, 125.

Cephalodella catellina catellina (Müller) : Koste, 1978, p. 371, T. 128: 1, a-e.

Material examined : THK.

Characters : Body short, stout and gibbous dorsally. Lorica flexible, plates indistinct; lateral clefts parallel-sided. Head distinct and with two red eye spots. Foot, small and ventrally directed because of projecting posterior portion of body. Toes small, spindle-shaped, with pointed tips and often curved. Rami with asymmetrical alulae. Fulcrum without any distinct apophysis.

Measurements : Total length : 98-100; toes : 16-18.

Characters : India : West Bengal (South 24-Parganas). Elsewhere : Cosmopolitan.

99. *Cephalodella forficula* (Ehrenberg, 1831)
(Figs. 185 & 186)

Distemma forficula Ehrenberg, 1831, p. 139.

Furcularia forficula Ehrenberg, 1838, p. 421, Taf. XXXIV, figs. 1-3.

Cephalodella forficula (Ehrenberg) : Harring, 1913b, p.25; Harring and Myers, 1924, p.45, pl. XXXIV, figs.1-3; Kutikova, 1970, p.251, fig.176; Koste, 1978 p.358, T.129 : 6, a-i, 7, a-b.

Material examined : AMT, MNP, SR, KNG.

Characters : Body fairly long, slender and spindle-shaped; cuticle thin and flexible. Head distinct and slightly oblique anteriorly. Trunk cylindrical. Foot distinct and almost rhomboidal. Toes short, curved forwards and acutely pointed; with characteristic knob-like basal spine and another small spine. Sub-unci fan shaped. Mastax with two distinct salivary glads. Anterior eyes paired.

Measurements : Total length : 145-152; toes : 30-35.

Distribution : India : West Bengal (South 24-Parganas and Nadia) and Andhra Pradesh. Elsewhere : Cosmopolitan.

100. *Cephalodella gibba* (Ehrenberg, 1832)

(Fig. 187)

Furcularia gibba Ehrenberg, 1832, p. 130, Taf.IV, Fig. 16.

Cephalodella gibba (Ehrenberg) : Harring and Myers, 1924, p. 472, pl. XXX, figs. 4-6; Voigt, 1957, p.282, taf. 52, fig. 10, Taf. 53, Fig. 10.

Cephalodella gibba gibba (Ehrenberg) : Kutikova, 1970, p.271, fig. 220; Koste, 1978, p. 353, T. 116 : 1, a-d, T. 112 : 3, T. 115 : 2.

Material examined : BPR, SRK, ALP.

Characters : Body elongated, gibbous dorsally and laterally compressed. Lorica firm, plates distinct; lateral clefts narrow anteriorly and widening distally to the posterior end. Foot small. Toes long, curved, gradually tapering and with conical tips. Rami symmetrical, free ends of manubria curved.

Measurements : Total length : 240-250; toes : 78-85.

Distribution : India : West Bengal (South 24-Parganas and Hugli); Gujarat, Kashmir and Ladak. Elsewhere : Cosmopolitan.

101. *Cephalodella mucronata* Harring & Myers, 1924

(Figs. 188 & 189)

Cephalodella mucronata Harring and Myers, 1924, p. 510, pl. XXXVI, figs. 2-4; Kutikova, 1970, p. 266, fig.212; Koste, 1978, p.346, T.112 : 4, c-d, T.114 : 3, a-c.

Material examined : MST, BNK, ASN, APD.

Characters : Body long, cylindrical, dorsally arched and laterally compressed. Lorica rigid, extending over foot and projecting beyond it; posterior projection of lorica variable in length. Toes elongated, slender, curved and tapering gradually to pointed tips. Trophi symmetrical. Small retrocerebral sac present.

Measurements : Total length : 220-230; toes : 105-110.

Distribution : India : West Bengal (South 24-Parganas, Barddhaman, Bankura and Koch Behar). Elsewhere : Cosmopolitan.

Genus *Scaridium* Ehrenberg, 1830

Scaridium Ehrenberg, 1830, p. 47.

Characters : Body cylindrical or spindle-shaped; lorica thin. Foot three-segmented; terminal foot-segment longest. Corona simple, with ventral ciliated zone. Trophi virgate. Digestive tract straight and with large gastric glands.

Type species : *Scaridium longicaudum* (O.F. Müller, 1786).

Only one species belonging to this genus is documented presently.

102. *Scaridium longicaudum* (O.F. Müller, 1786)
(Fig. 190)

Trichoda longicaudum Müller, 1786, p.216, taf.31, figs. 8-10.

Scaridium longicaudum (Müller) : Ehrenberg, 1830, p. 47; Voigt, 1957, p. 259, Taf.46, fig. 1; Koste, 1978, p. 298, T. 97 : 4-5, Abb. 11a : 2.

Material examined : APR, MST, MNP, NH, HWH, MLD, NCB.

Characters : Lorica thin, more or less cylindrical. Foot three-segmented, distal segment longest; foot-segments with striated muscles. Toes long, almost parallel-sided and with blunt tips. Trophi symmetrical; unci broad.

Measurements : Total length: 360-395; foot: 110-120; toes: 128-145.

Distribution : India : West Bengal (North & South 24-Parganas, Haora Malda and Koch Behar); Gujarat and Punjab. Elsewhere : Cosmopolitan.

Family TRICHOCERCIDAE Remane, 1933

Body often arched, cylindrical, asymmetrical and spindle-shaped or sacciform; often with a keel or striated area. Foot present, reduced or absent; with equal or unequal bristle-like toes. Corona of *Asplanchna* or *Notommata* type. Trophi virgate and asymmetrical. Eyes on brain. Lateral antennae usually placed asymmetrically.

This family is represented by genus *Trichocerca* in the examined material.

Genus *Trichocerca* (Lamarck, 1801)

Rattulus Lamarck, 1801, p. 394.

Vaginaria (partim) Schrank, 1802, p. 383.

Monocera Bory de St. Vincent, 1826, p. 69.

Mastigocerca Ehrenberg, 1830, p. 46.

Acanthodactylus Tessin, 1890, p. 152.

Characters : Body more or less elongated, cylindrical, always asymmetrical and sometimes twisted; lorica thin to rigid and with one or two keels or striated areas. Foot short; with equal or unequal toes, substyles sometimes present. Corona simple, one or two palps on the apical buccal field. Lateral antennae often very symmetrical. Trophi virgate, more or less asymmetrical. Digestive tract straight, gastric glands small, pedal glands large.

This genus includes two subgenera and the same are also represented in this account.

Key to recorded subgenera of the genus *Trichocerca*

Toes equally long or right toe at least 1/3 the length of the left toe.....
.....*Trichocerca* (*Diurella*) Bory de St. Vincent, 1824

Toes always unequal, right toe often strongly reduced or less than 1/3 the length of the left toe ...
 *Trichocerca (Trichocerca)* Lamarck, 1801

Subgenus *Trichocerca (Diurella)* Bory de St.Vincent, 1824

Diurella Bory de. St.Vincent, 1824, p. 568.

Characters : Both toes equally long or the right toe at least 1/3 the length of the left toe.

Type species : *Trichocerca (Diurella) tigris* (O.F. Müller, 1786).

Key to recorded species of *Trichocerca (Diurella)*

Lorica elongated. Anterior end with two spines flanked by a dorsal hump.....
 *Trichocerca (Diurella) similis* (Wierzejski)

Lorica short and stout. Anterior end with lateral plates and a dorsal spine.....
 *Trichocerca (Diurella) weberi* (Jennings)

103. *Trichocerca (Diurella) similis* (Wierzejski, 1893)
 (Figs. 191 & 192)

Coelopus similis Wierzejski, 1893, p. 406.

Diurella stylata Jennings, 1903, p. 313, pl. III, figs. 27-31.

Trichocerca (Diurella) similis (Wierzejski) : Voigt, 1957, p. 323, Taf. 68, fig. 5, Taf. 6, 9, fig. 2, Taf. 72, figs. 8, 12; Kutikova, 1970, p. 315, fig. 307.

Trichocerca (Diurella) similis similis (Wierzejski) : Koste, 1978, p. 393, T. 136: 1, a-m.

Material examined : APR, IMT, MNK, SR, NH, MDP, KRP, BNK, NB, KNG, APD, SLG.

Characters : Body elongated and broad anteriorly; anterior end with two long spines dorsally separated by a small hump. Dorsal keel extending upto about 1/3 the body length. Foot two segmented; first foot-segment overlapped by the projecting posterior end of lorica. Toes short and unequal, spines present at the base of the toes. Trophi asymmetrical; left uncus with two distinct parallel combs.

Measurements : Body length : 160-220; left toe : 70-80; right toe : 40-50.

Distribution : India : West Bengal (Calcutta, North & South 24-Parganas, Nadia, Medinipur, Koch Behar and Darjiling) and Gujarat. Elsewhere : Cosmopolitan.

104. *Trichocerca (Diurella) weberi* (Jennings, 1903)
 (Figs. 193-195)

Diurella weberi Jennings, 1903, p. 309, pl. I, figs. 11-14.

Trichocerca (Diurella) weberi (Jennings) : Kutikova, 1970, p. 308, fig. 293; Koste, 1978, p. 387, T. 134 : 3, a-h.

Material examined : GR, THK, TOL.

Characters : Body short, stout and almost cylindrical; anterior end with two lateral plates and with a distinct spine on the right side. Striated keel extending dorsally upto 2/3 of the body length. Rami strong, with wide alulae. Fulcrum expanded at its free end. Left manubrium large and incurved, right manubrium reduced. Toes almost equally long and with broad stylets at their bases.

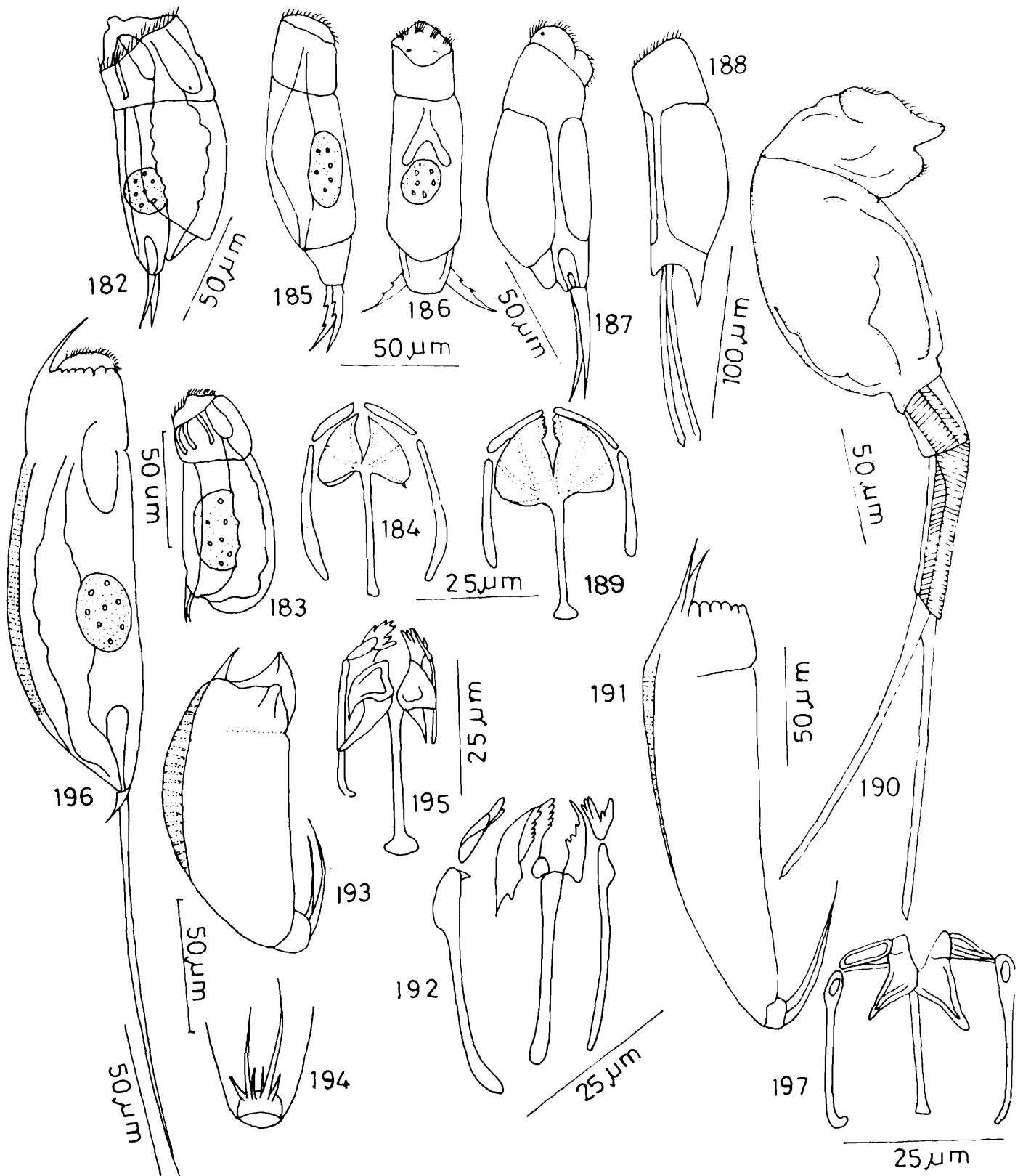


Fig. 182. *Cephalodella auriculata* (Müller) : lateral view; Fig. 183. *C. catellina* (Müller) : lateral view; Fig. 184. Trophi; Fig. 185. *C. forcifcula* (Ehrenberg) : lateral view; Fig. 186. ventral view; Fig. 187. *C. gibba* (Ehrenberg) : lateral view; Fig. 188. *C. mucronata* Harring & Myers : lateral view; Fig. 189. Trophi; Fig. 190. *Scaridium longicaudum* (Müller) : lateral view; Fig. 191. *Trichocerca* (*Diurella*) *similis* (Wierzejski) : lateral view; Fig. 192. Trophi; Fig. 193. *T. (D.) weberi* Jennings : lateral view; Fig. 194. posterior end (ventral view); Fig. 195. trophi; Fig. 196. *T. (Trichocerca) cylindrica* (Imhof) : lateral view; Fig. 197. Trophi.

Measurements : Body length : 95-105; left toe : 40-45; right toe : 35-38; trophi : 45.

Distribution : India : West Bengal (Calcutta and South 24-Parganas); Punjab, Kashmir and Ladak. Elsewhere : Cosmopolitan.

Subgenus *Trichocerca (Trichocerca)* Lamarck, 1801

Trichocerca Lamarck, 1801, p. 394.

Rattulus Lamarck, 1801, p. 24.

Characters The right toe always less than 1/3 the length of the left toe or right toe even rudimentary.

Type species : *Trichocerca (Trichocerca) rattus* (O.F. Müller, 1776)

Four species of this subgenus are documented in this account.

Key to recorded taxa of *Trichocerca (Trichocerca)*

1. Anterior end of lorica with a distinct spine *Trichocerca (Trichocerca) cylindrica* (Imhof)
Anterior end of lorica without any spine..... 2
2. Body short and without any keel or striated area *Trichocerca (Trichocerca) pusilla* (Lauterborn)
Body elongated, with distinct keel and striated area 3
3. With double keel extending about 1/3 the body length. Left toe longer than body
..... *Trichocerca (Trichocerca) elongata braziliensis* (Murray)
With a broad keel extending upto 1/2 the body length. Left toe shorter than body
..... *Trichocerca (Trichocerca) rattus* (Müller)

105. *Trichocerca (Trichocerca) cylindrica* (Imhof, 1891)
(Figs. 196 & 197)

Mastigocerca cylindrica Imhof, 1891, p. 37.

Rattulus cylindricus Jennings, 1903, p. 325, pl. VII, figs. 62-64.

Trichocerca cylindrica (Imhof) : Haring, 1913b, p. 102; Kutikova, 1970, p. 324, fig. 326.

Trichocerca cylindrica cylindrica (Imhof) : Koste, 1978, p. 403, T. 131 : 2, a-d, T. 139 : 6, a-i, Abb. 24 : 1.

Material examined : SLG, MLD.

Characters : Body long, cylindrical and often with a gelatinous case. Anterior end with a median dorsal spine and a number of longitudinal folds. Lorica thin, with a striated area and a single dorsal keel. Left toe almost as long as lorica; right toe reduced to a small scaly spine. Lateral antennae located in the middle of the dorsal crest. Trophi asymmetrical, manubria with curved free ends, unci moderately broad and rami curved.

Measurements : Body length : 210-230; left toe : 190-200; right toe : 16-18.

Distribution : Represents a new record from West Bengal. India : West Bengal (Koch Behar and Darjiling); Meghalaya and Kashmir. Elsewhere : Palaearctic and Nearctic regions.

106. *Trichocerca (Trichocerca) pusilla* (Lauterborn, 1898)
(Figs. 198 & 199)

Mastigocerca pusilla Lauterborn, 1898, p. 175.

Rattulus pusillus Jennings, 1903, p. 339, pl. IX, figs. 81-85.

Trichocerca pusilla (Lauterborn) : Harring, 1913 b, p. 104; Kutikova, 1970, p.323, fig.329; Koste, 1978, p. 401, T. 139: 8, a-b.

Material examined : MDP, BNK, APD, CB.

Characters : Body short and slender, with distinct head; without any crest for striated area. Anterior end straight but with longitudinal folds in contracted specimens. Corona with a distinct palp. Toes unequal; left toe long and ventrally directed, right toe very small. Trophi asymmetrical; left manubrium long and curved and right manubrium small.

Measurements : Body length : 90-115; left toe : 55-65; right toe : 10-12.

Distribution : Represents a new record from West Bengal. India : West Bengal (Medinipur, Bankura and Koch Behar) and Orissa. Elsewhere : Cosmopolitan.

107. *Trichocerca (Trichocerca) rattus* (O.F. Müller, 1776)
(Figs. 200 & 201)

Trichoda rattus Müller, 1776, p. 281.

Trichocerca rattus (Müller) : Harring, 1913b, p. 101; Wulfert, 1939, p. 615, Abb. 35, a-g.

Trichocera rattus rattus (Müller) : Kutikova, 1970, p. 321, fig. 323; Koste, 1978, p. 318, T. 139: 3, a-c.

Material examined : IMT, SR, MDP, AMG.

Characters : Body spindle-shaped and with a broad striated keel extending upto 1/2 the body length. Lateral antennae situated in the anterior portion of the body. Left toe smaller than body; right toe reduced. Right manubrium slightly reduced than left. Right ramus obtuse, left ramus strong, plank-shaped and with broad free end.

Measurements : Body length : 150-165; left toe : 130-135; trophi : 45-50.

Distribution : India : West Bengal (Calcutta, South 24-Parganas, Hugli and Medinipur); Gujarat, Punjab, Kashmir and Ladak. Elsewhere : Cosmopolitan.

108. *Trichocerca (Trichocerca) elongata braziliensis* (Murray, 1913)
(Figs. 202 & 203)

Rattulus braziliensis Murray, 1913 a, p. 244, pl. 10, figs. 16, a-b.

Trichocerca braziliensis (Murray) : Hauer, 1965, p. 375, Abb. 32, a-e; Sharma, 1978 c, p. 41, pl. II, Figs. 1 & 2.

Trichocerca elongata braziliensis (Murray) : Koste, 1978, p.397, T.137a : 1, a-g.

Material examined : IMT.

Characters : Body cylindrical, with two small keels extending upto 1/3 of the body length. Left toe longer than body, right toe reduced. Trophi asymmetrical; fulcrum expanded at the distal end, right manubrium large and inwardly directed at its free end and left manubrium reduced.

Measurements : Body length : 130-145; left toe : 155-165; trophi : 50-55.

Distribution : India : reported so far from West Bengal (Calcutta). Elsewhere : South America and Sri Lanka.

Family ASPLANCHNIDAE Haring & Myers, 1926

Body relatively large, lorica absent; cuticle thin and transparent. Foot absent or present. Corona consists of a simple girdle of arcs and tufts of cirri around head and a very small area around mouth. Intestine, cloaca and anus present or absent. Trophi incaudate. Often viviparous.

This family is represented by only single genus in this text.

Genus *Asplanchna* Gosse, 1850

Asplanchna Gosse, 1850, p. 18.

Characters : Body illoricate, transparent, polymorphic and with thin cuticle; body shape sacciform, bell-shaped or with humps or projections. Foot absent; pedal glands sometimes present. Corona comprised of a broken single ring of cilia; apical field bulged to varying degree and with scattered tufts of cilia. Vitellarium horse-shoe shaped or globose. Often viviparous, with one or several embryos.

Type species : *Asplanchna priodonta* Gosse, 1850.

Two species belonging to this genus are documented presently.

Key to recorded species of genus *Asplanchna*

Vitellarium spherical, with eight nuclei. Protonephredia with four flame bulbs each.....
*Asplanchna priodonta* Gosse
 Vitellarium horse-shoe shaped, with 20-32 nuclei. Protonephredia with 10-20 flame bulbs each..
*Asplanchna brightwelli* Gosse

109. *Asplanchna brightwelli* Gosse, 1850
 (Fig. 204)

Asplanchna brightwelli Gosse, 1850, p.23; Voigt, 1957, p. 386, Taf. 84, Fig. 10; Kutikova, 1970, p. 429; fig. 557; Koste, 1978, p. 454, T. 163 : 10, a-d, Abb. 24, b, Abb. 63 : 2, a-b.

Material examined : APR, DL, IMT, THK, TOL, NH, KRP, MDP, BNK, KNG.

Characters : Body transparent, thin, sacciform or with humps but rarely bell-shaped. Contractile vesicle irregular in shape. Protonephredia long, each with 10-20 flame cells. Vitellarium horse-shoe shaped and with 20-32 nuclei. Inner margin of each ramus with a small tooth.

Measurements : Total length : 530-810.

Distribution : India : West Bengal (Calcutta, North & South 24-Parganas, Bankura, Medinipur and Nadia); Assam, Orissa, Andhra Pradesh, Punjab, Kashmir and Ladak. Elsewhere : Cosmopolitan.

110. *Asplanchna priodonta* Gosse, 1850
 (Fig. 205)

Asplanchna priodonta Gosse, 1850, p. 18, pls. 1, 2; Voigt, 1957, p. 385, Taf. 84, Fig. 7.

Asplanchna priodonta priodonta Gosse : Kutikova, 1970, p. 429, fig.558; Koste, 1978, p. 450, T. 163 : 7, a-c, T. 164 : 2, a-c.

Material examined : BPR, MNK, SR, NCB, MLD, SLG.

Distribution : Body thin, transparent and rounded to sacciform in its shape. Contractile vesicle small and rounded. Protonephredia with four flame bulbs each. Gastric glands rounded. Vitellarium rounded and with eight nuclei. Rami serrate on inner side, broad at free ends and each with lateral prolongation at the base.

Measurements : Total length : 480-750.

Distribution : India : West Bengal (South 24-Parganas, Malda, Koch Behar and Darjiling); Meghalaya, Gujarat and Kashmir. Elsewhere : Cosmopolitan.

Family SYNCHAETIDAE Remane, 1933

Body sacciform, bell-shaped or conical; lorica absent or present. Foot and toes present, sometimes strongly reduced or absent. Corona of *Asplanchna* type, reduced to small zone around the mouth and on anterior lobes or auricles, if present. Trophi virgate, with or without hypopharynx.

Family Synchaetidae is represented by only one genus in the collections examined from West Bengal.

Genus *Polyarthra* Ehrenberg, 1834

Polyarthra Ehrenberg, 1834, p. 226.

Anarthra Hood, 1895, p. 672.

Characters : Body illoricate, slightly flattened dorsoventrally and with four groups of three feathered sword-shaped serrate blades or paddles each; two groups dorsolateral and two groups ventrolateral. Corona with a circumapical band of cilia and two cylindrical ciliated antennae. Trophi large and virgate. Vitellarium with 4, 8 or 12 nuclei. Foot absent.

Type species : *Polyarthra vulgaris* Carlin, 1943.

Only one species of this genus is documented in this account.

111. *Polyarthra vulgaris* Carlin, 1943

(Fig. 206)

Polyarthra vulgaris Carlin, 1943, p. 82, Taf. I, Abb. 1, Taf. 3, Abb. 1; Voigt, 1957, p. 392, Abb. 23 : 3, 18; Kutikova, 1970, p. 35, fig. 383.

Polyarthra vulgaris vulgaris Carlin : Koste, 1978, p. 434, T. 135 : 1, 5-6, 10a, T. 156 : 3d, 4, T. 157 : 2, a-f.

Material examined : APR, AMT, DL, IMT, MST, SR, MDP, JH, AMG, KRP, MLD, CB.

Characters : Body broadly cylindrical and with paired ventral appendages. Apical field with two ciliated antennae. lateral antennae located in the posterior third part of the body. Vitellarium with eight nuclei. Blades pinnate to feather-shaped and slightly longer than body; each blade with a distinct mid-rib and lateral ribs.

Measurements : Body length : 105-135; length of blades : 120-145; ventral appendages : 30-40.

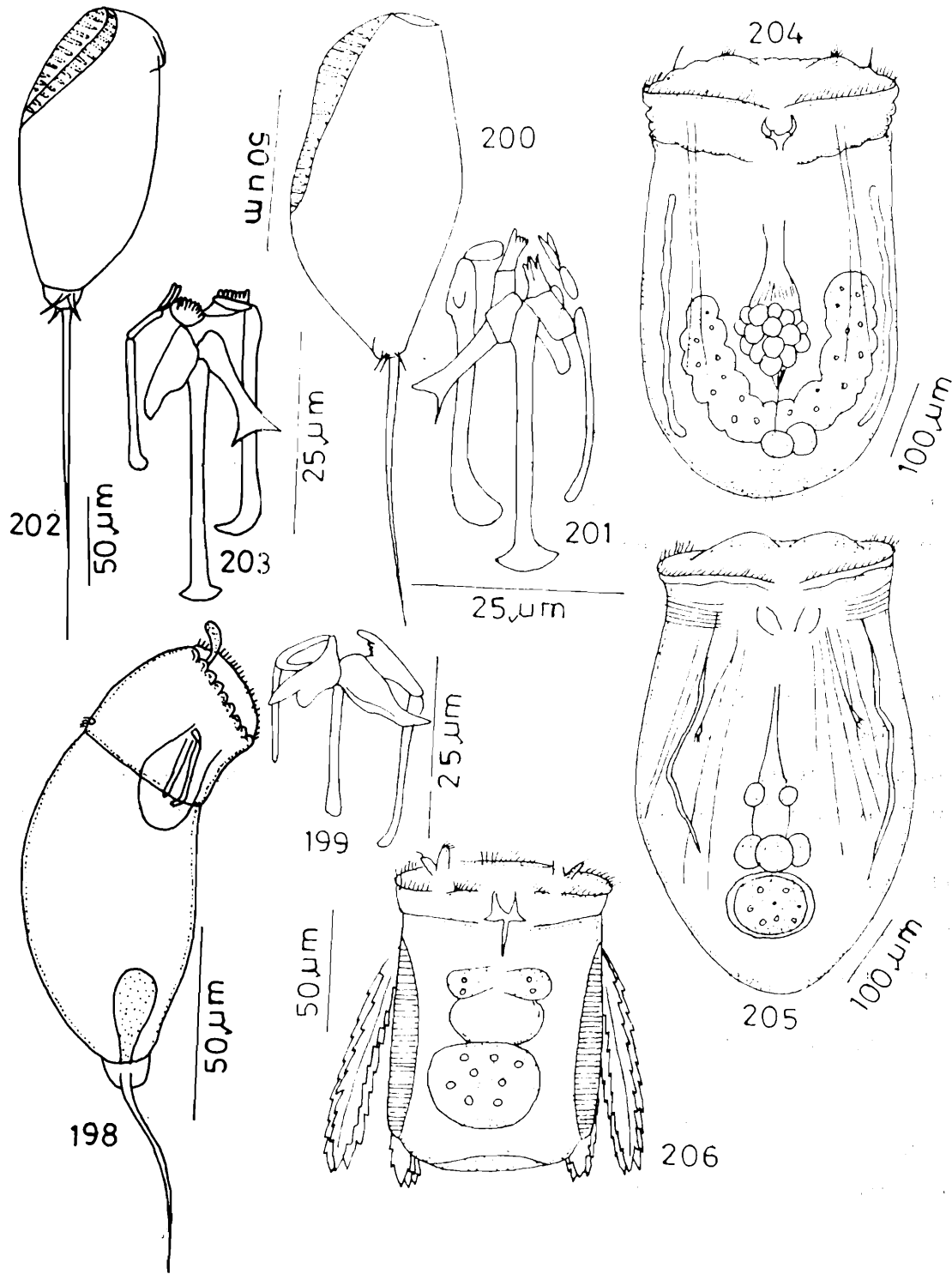


Fig. 198. *Trichocerca (Trichocerca) pusilla* (Lauterborn) : lateral view. Fig. 199. Trophi Fig. 200. *T. (T.) rattus* (Müller) : lateral view, Fig. 201. Trophi; Fig. 202. *T. (T.) elongata braziliensis* (Murray) : lateral view, Fig. 203. Trophi; Fig. 204. *Asplanchna brightwelli* Gosse : dorsal view; Fig. 205. *A. priodonta* Gosse : dorsal view; Fig. 206. *Polyarthra vulgaris* Carlin : dorsal view.

Distribution : India : West Bengal (Calcutta, South 24-Parganas, Hugli, Medinipur, Malda and Koch Behar); Assam, Orissa and Punjab. Elsewhere : Cosmopolitan.

Family DICRANOPHORIDAE Remane, 1933

Forms illoricate or partly loricate. Corona similar to *Notommata*- type, under a hook-like rostrum; mouth almost in centre of corona; lateral tufts like auricles. Trophi forcipate and protrusible. One genus of the family Dicranophoridae is included in this account.

Genus *Dicranophorus* Nitzsch, 1827

Dicranophorus Nitzsch, 1827, p. 68.

Distemma Ehrenberg, 1830, p. 47.

Arthroglena Bergendal, 1892, p. 96.

Characters : Body mostly slender and spindle-shaped; with cuticular plates and longitudinal folds. Foot mostly small; toes long or moderately long, ventrally directed and terminating into claws in some species. Corona with ventral broad field; rostrum mostly well developed.

Type species : *Dicranophorus forcipatus* (O.F. Müller, 1773).

The collections examined from West Bengal indicated only two species of this genus.

Key to recorded species of genus *Dicranophorus*

- Rostrum large, with two small ventral pegs. Toes with claws
 *Dicranophorus lutkeni* Bergendal
- Rostrum small, without any projections. Toes without claws.....
 *Dicranophorus forcipatus* (Müller)

112. *Dicranophorus forcipatus* (O.F. Müller, 1773)
 (Figs. 207 & 208)

Cercaria forcipatus Müller, 1773, p. 34, pl. 20, figs. 21-23.

Diglena forcipata Ehrenberg, 1832, p. 154, pl. 4, fig. 10.

Dicranophorus forcipatus (Müller) Harring, 1913 b, p. 35; Koste, 1978, p. 46, T. 169 : 10, 13, a-t, T. 170 : 6, 12, a-b, 11, Abb. 52 : a-h.

Material examined : SR, THK, BNK, MDP, NCB.

Characters : Body elongated and with straight ventral margin. Head and neck distinct. Rostrum short, broader, rounded anteriorly and with two small, red eye spots. Corona ventral and nearly as long as head. Abdomen short and cylindrical. Foot short and two-segmented; toes moderately long, with folds and terminating into pointed tips. Retrocerebral organ but narrow anteriorly. Rami with two spines, unci with row of teeth.

Measurements : Total length : 300-315; toes : 50-60.

Distribution : India : reported so far from West Bengal (South 24-Parganas, Hugli, Bankura, Malda and Koch Behar). Elsewhere : Cosmopolitan.

113. *Dicranophorus lutkeni* (Bergendal, 1892)
(Figs. 209 & 210)

Arthroglena lutkeni Bergendal, 1892, p.96, pl.5, fig. 6 : 30.

Dicranophorus lutkeni (Bergendal) : Harring and Myers, 1928, p. 718, figs. 1-2; Kutikova, 1970, p.376, fig.429.

Dicranophorus lutkeni lutkeni (Bergendal) : Koste, 1978, p. 465, T.169 : 15, a-e, T.170 : 28, a-c.

Material examined : APR.

Characters : Body slender, elongate and with straight ventral surface. Rostrum long, rounded and with two ventrally curved small pegs. Corona ventral and a little longer than head. Abdomen elongated, parallel-sided for 3/4 of its length and then tapering rapidly. Foot concave and moderately large. Toes long, straight, broad at the bases and terminating into long and slender claws. Rami with long alulae and with unpaired teeth on inner end.

Measurements : Body length : 180-190; toes : 42-50.

Distribution : India : reported only from West Bengal (South 24-Parganas). Elsewhere : Arctic, Palaearctic and Nearctic regions.

Family GASTROPODIDAE Remane, 1933

Forms small, pelagic or sometimes semi-planktonic. Body oval, sac-shaped or bottle-shaped; foot present or absent. Apical field with or without tentacle. Trophi virgate. Gastric glands with blind sacs.

This family is presently represented by two genera.

Key to recorded genera of family GASTROPODIDAE

Foot present, with one or two toes..... Genus *Gastropus* Imhof, 1888

Foot absent.....Genus *Ascomorpha* Perty, 1850

Genus *Gastropus* Imhof, 1888

Gastropus Imhof, 1888, p. 171.

Hudsonia Hood, 1893, p. 231.

Hudsonella Zacharias, 1893, p. 25.

Characters : Body laterally compressed and with stiff cuticle. Anterior end of lorica little or greatly wavy. Corona with or without palp. Foot attached near middle of ventral surface and typically at right angles to longitudinal axis of the body; with one or two toes.

Type species : *Gastropus stylifer* Imhof, 1891.

Only one species belonging to this genus is reported in this account.

114. *Gastropus stylifer* Imhof, 1891
(Fig. 211)

Gastropus stylifer Imhof, 1891, p.37; Voigt, 1957, p. 338, Taf. 73, figs. 1, 3; Kutikova, 1970, p. 332, fig. 340; Koste, 1978, p. 414, T. 144: 1, a-g.

Material examined : NCB.

Characters : Body nearly spherical and with a gelatinous covering. Lorica thin, brightly colored and laterally compressed; anterior end with longitudinal folds and palps. Foot-opening surrounded by a distinct rim and foot inserted ventrally nearly at right angles to the longitudinal axis of the body. Foot annulated; toe single, small and pointed.

Measurements : Body length : 78-85; maximum width : 68-74; foot : 38-40.

Distribution : Represents a new record India. India : West Bengal (Koch Behar). Elsewhere : Europe, Asia, North and South America.

Genus *Ascomorpha* Perty, 1850

Ascomorpha Perty, 1850, p. 18.

Sacculus Gosse, 1851, p. 198.

Chromogaster Sudzuki, 1964, p. 63.

Characters : Body sacciform to oval; lorica thin. Corona consists of a single circumapical ring of cilia; apical field with a finger or sickle-shaped stiff tentacle and tufts of cilia. Mastax modified for suction; trophi virgate. Stomach large, bilobed or with sacculations; intestine obliterated.

Type species : *Ascomorpha ecaudis* (Perty, 1850).

This genus is represented by two species in the samples examined from West Bengal.

Key to recorded species of genus *Ascomorpha*

Body compressed. Cuticle stiffened too form thin lorica. Palp sickle-shaped. Accretion bodies numerous *Ascomorpha ovalis* (Bergendal)

Body not compressed. Cuticle slightly stiffened. Palp finger-like. Only one irregular accretion body *Ascomorpha saltans* Bartsch

115. *Ascomorpha saltans* Bartsch, 1870

(Figs. 212 & 213)

Ascomorpha saltans Bartsch, 1870, p. 364; Rudescu, 1960, p. 915, fig. 728; Kutikova, 1970, p. 336, fig. 344.

Ascomorpha saltans saltans Bartsch: Koste, 1978, p. 415, T. 145 : 6, a-i.

Material examined : APD.

Characters : Body oval, elevated in cross-section and with four longitudinal folds ; cuticle slightly stiffened. Styli on apical field long, palp finger-like and generally dorsally bent. Retrocerebral sac long. Protonephredia with three flame bulbs each. Only one irregular accretion body present.

Measurements : Total length : 110-128; body width : 62-70.

Distribution : Represents a new report from West Bengal. India : West Bengal (Koch Behar) and Ladak. Elsewhere : Cosmopolitan.

116. *Ascomorpha ovalis* (Bergendal, 1892)

(Fig. 214)

Anapus ovalis Bergendal, 1892, p. 1.

Chromogaster ovalis (Bergendal) : Voigt, 1957, p.34, Taf.62, figs.1-4, Taf.73, figs. 6, 8; Kutikova, 1970, p. 337, fig. 347.

Ascomorpha ovalis (Bergendal) : Carlin, 1943, p. 34; Koste, 1978, p. 416, T. 145 : 6, a-i.

Material examined : MDP, SLG.

Characters : Body oval or elliptical and compressed moderately dorsoventrally; cuticle stiffened to form thin lorica. Dorsal and ventral plates of lorica joined laterally by a thin membrane; dorsal plate smaller than central plate. Styli on apical filed in rows of twos or fours. Apical palp sickle-shaped. Accretion bodies numerous.

Measurements : Total length : 118-125; maximum width; 90-98.

Distribution : Represents a new record from this country. India : West Bengal (Medinipur and Darjiling). Elsewhere : Europe, North and South America, Indonesia and Japan.

Order GNESIOTRCHA De Beauchamp, 1965

Larvae free-swimming, with ciliated foot. Adults creeping, sessile or pelagic. Only members of the family Testudinellidae with lorica.

It includes two suborders and only one of them i.e., Suborder : Flosculariacea is dealt with in this account.

Suborder FLOSCULARIACEA Remane, 1933

Body loricate or illoricate. Trophi malleoramate. Corona of *Hexarthra* or *Conochilus*- type. Foot, if present, without toes; in the living forms or in juvenile stages, it terminates into a ciliated cap. Numerous foot glands present. Includes solitary, free-swimming colonies or sessile forms; sessile forms often with a gelatinous sheath or tube made up of detritus.

Five families belonging to this suborder are documented in this account.

Key to recorded families of Suborder FLOSCULARIACEA

1. Body illoricate 2
 Body loricate; lorica with foot-openingFamily Testudinellidae Bartos, 1959
2. Corona of *Hexarthra*- type. Body with six arm-like appendages.....
 Family Hexarthridae Bartos, 1959
 Corona of *Conochilus*- type. Body with or without movable appendages..... 3
3. Forms pelagic, colonial or solitary. Foot present Family Conochilidae Remane, 1933
 Forms solitary. Foot absent 4
4. Body conical or bell-shaped, with 3-4 movable cuticular setae.....
 Family Filiniidae Bartos, 1959
 Body sacciform or spherical, without any spines and with broad apical field.....
 Family Trochosphaeridae Bartos, 1959

Family CONOCHILIDAE Remane, 1933

Forms free-swimming, usually in colonies and often with a gelatinous case. Lorica absent; foot stout and without holdfast; toes absent. Corona unlobed, horse-shoe shaped, with mouth in middle or near dorsal edge. Trophi malleoramate.

This family is presently represented by only one genus.

Genus *Conochilus* Ehrenberg, 1834

Conochilus Ehrenberg, 1834, p. 224

Characters : Body conical or vase-shaped and with long, contractile and unsegmented foot. Forms usually colonial but sometimes solitary and with transparent gelatinous case. Corona consists of a horse-shoe shaped double band of cilia; mouth near dorsal edge of corona. Digestive tract U-shaped, anus situated dorsally. Excretion by protonephredial tubes.

Type species : *Conochilus hippocrepis* (Schrank, 1803)

Two species belonging to this genus are presently examined in the collections from West Bengal.

Key to recorded species of genus *Conochilus*

Forms colonial. Lateral antennae fused *Conochilus unicornis* Rousselet

Forms solitary. Lateral antennae free and ventrally located *Conochilus natans* (Seligo)

117. *Conochilus natans* (Seligo, 1900)

(Fig. 215)

Tubicolaria natans Seligo, 1900, p. 60, T. 9 : 7.

Conochilus natans (Seligo) : Voigt, 1902, p.680; Koste, 1978, p.560, T.210 : 5, a-b, 7c, 10a, 14a.

Conochiloides natans Hlava, 1904, p.253; Sharma, 1978 c, p. 45, Pl. III, fig. 5.

Material examined : TIM.

Characters : Forms solitary. Body vase-shaped; foot stalk-like and surrounded by a gelatinous sheath. Corona horizontal and with flat apical field. Lateral antennae free at the proximal ends and located ventral to corona.

Measurements : Total length : 320-330; maximum width : 120-130.

Distribution : India : West Bengal (Calcutta). Elsewhere : apparently Cosmopolitan.

118. *Conochilus unicornis* Rousselet, 1892

(Figs. 216 217)

Conochilus unicornis Rousselet, 1892, p. 367, pl. XXIV, fig. 11, a-c; Kutikova, 1970, p.653, fig. 1073;

Koste, 1978, p.559, T.210 : 6, a-c, 1a, 9, 10b, 11a.

Material examined : APD, SLG.

Characters : Forms colonial, with 5-25 individuals in each colony bounded by a gelatinous case. Body vase-shaped; foot contractile and almost as long as the body in extended form. Apical field conically domed and mouth located in its centre. Lateral antennae fused and located on apical field.

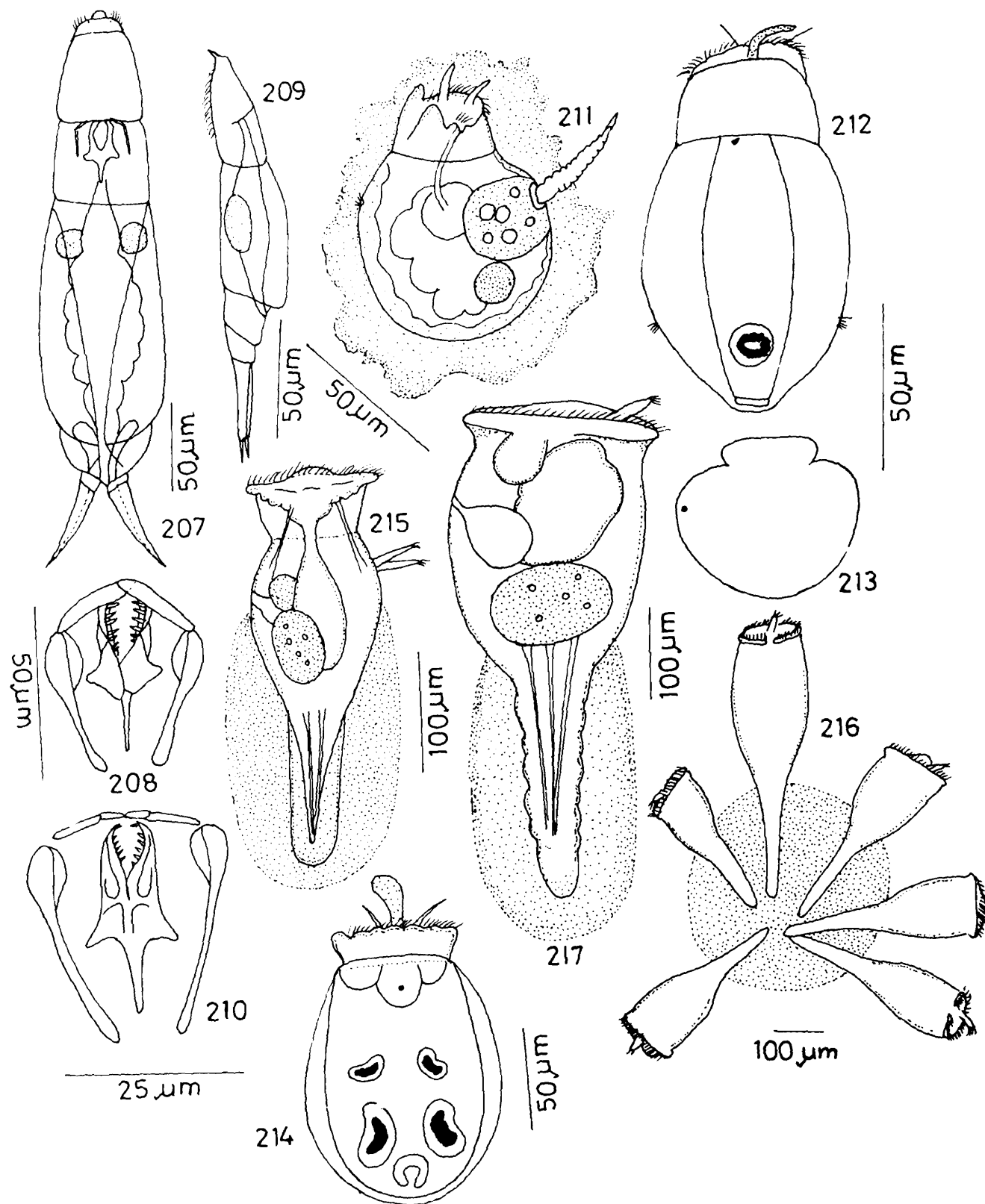


Fig. 207. *Dicranophorus forcipatus* (Müller) : dorsal view; Fig. 208. Trophi; Fig. 209. *D. lutkeni* (Bergendal) : lateral view; Fig. 210. Trophi; Fig. 211. *Gastropus stylifer* Imhof : lateral view; Fig. 212. *Ascomorpha saltans* Bartsch : dorsal view; Fig. 213. Cross-section; Fig. 214. *A. ovalis* (Bergendal) : dorsal view; Fig. 215. *Conochilus natans* (Seligo) : dorsal view; Fig. 216. *C. unicornis* Rousselet : colony; Fig. 217. Single individual (dorsal view).

Measurements : Total length : 500-750.

Distribution : India : new record ; West Bengal (Koch Behar and Darjiling). Elsewhere : cosmopolitan.

Family HEXARTHRIDAE Bartos, 1959

Includes pelagic forms. Body illoricate and with six arm-like mobile appendages; appendages with bristles and spines. Foot absent. Corona of *Hexarthra* type. Trophi malleoramate.

This family is represented by only one genus in this account.

Genus *Hexarthra* Schmarda, 1854

Hexarthra Schmarda, 1854, p. 15.

Pedalion Hudson, 1871, p. 121.

Pedalia Barrois, 1878, p. 661.

Characters : Body conical; six arm-like appendages with pinnate bristles at their tips. Corona wavy, with double band of cilia and with or without ventral lip. Two eyes situated ventrally on apical field. Some species with two club-shaped dorsal appendages located at the posterior end of the body. Unci with variable number of teeth. Intestine straight, anus terminal. Subitaneous eggs attached to anal opening.

Type species : *Hexarthra mira* (Hudson, 1871).

Only one species of this genus is documented in this account.

119. *Hexarthra mira* (Hudson, 1871)
(Fig. 218)

Pedalion mira Hudson, 1871, p. 121, pl. 94, figs. 1-4.

Pedalia mira (Hudson) : Harring, 1913 b, p. 81; Voigt, 1957, p. 415, Taf. 90, fig. 8, Abb. 24.1.

Hexarthra mira (Hudson) : Kutikova, 1970, p.672, fig.1123; Koste, 1978, p.563, T.211 : a-m, Abb. 58 : 1.

Material examined : BB, BH, MNP, BNK, BRP, KLN, MLD.

Characters : Body conical or bell-shaped. With six arm-like appendages (one dorsal, one ventral, two latero-dorsal and two latero-ventral) and each ending with pinnate bristles. Ventral arm with three pairs of spines and eight bristles. Two ciliated club-shaped appendages located at posterior end of the body. Each ramus with six teeth.

Measurements : Body length : 220-340.

Distribution : India : West Bengal (North & South 24-Parganas, Bankura, Malda and Nadia); Assam, Tamil Nadu, Rajasthan, Punjab and Kashmir. Elsewhere : Cosmopolitan.

Family TESTUDINELLIDAE Bartos, 1959

Creeping or semi-pelagial forms; not in tubes or in colonies. Body loricate, without any appendages; with a distinct foot-opening. Foot, is present, tubiform or terminal ciliated.

Two genera belonging to this family are reported presently.

Key to recorded genera of family TESTUDINELLIDAE

Foot present. Lorica strongly built. Benthic forms.....
 Genus *Testudinella* Bory de St.Vincent, 1826
 Foot lacking. Lorica moderately strong. Pelagic forms.....Genus *Pompholyx* Gosse, 1851

Genus *Pompholyx* Gosse, 1851

Pompholyx Gosse, 1851, p. 203

Characters : Body with thin lorica, oval or elliptical or shield-shaped; without foot. Cloacal opening located at posterior end of lorica; eggs attached to posterior end with retractile threads of secretions. Corona consists of a simple circumapical band of cilia. Trophi malleoramate; unci with numerous teeth. Vitellarium with 12 nuclei.

Type species : *Pompholyx complanata* Gosse, 1851.

120. *Pompholyx sulcata* Hudson, 1885

(Fig. 219)

Pompholyx sulcata Hudson, 1885, p. 613, pl. XII, figs. 7, 8; Kutikova, 1970, p. 665, fig. 1107; Koste, 1978, p. 536, T.197 : 5, a-d.

Material examined : AMT, DL, BB, DH, SR, IMT, THK, BNK, MDP, KRP, KNG, NH, NB, AMG, HM, MLD, SLG.

Characters : Lorica broadly oval and tapering posteriorly behind its middle region; with four longitudinal furrows and divided into dorsal and ventral bulges in cross-section. Anterior end raised into a lobe-like projection dorsally; ventral margin with two lateral elevations flanking a shallow median sinus. Cloacal aperture terminal.

Measurements : Lorica length : 110-120; maximum width : 80-90.

Distribution : India : West Bengal (Calcutta, North & South 24-Parganas, Hugli, Bankura, Medinipur, Nadia, Malda and Darjiling); Assam, Orissa, Punjab, Kashmir and Ladak. Elsewhere : Cosmopolitan.

Genus *Testudinella* Bory de St. Vincent, 1826

Testudinella Bory de St.Vincent, 1826, p.85.

Pterodina Ehrenberg, 1830, p.48.

Characters : Body loricate, circular, elliptical, oval or vase-shaped and more or less compressed. Foot-opening ventral, located near middle or in the posterior half or posterior end of lorica. Foot annulated and terminating with a band of cilia. Corona with a circumapical band of cilia. Position of lateral antennae diagnostic. Digestive tract with large and lobed gastric gland. Vitellarium horse-shoe shaped.

Type species : *Testudinella clypeata* (O.F. Müller, 1786).

Three species belonging to this genus are reported in the collections examined from West Bengal.

Key to recorded species of genus *Testudinella*

1. Lorica circular, foot-opening located nearly in the middle of ventral side
 *Testudinella patina* (O.F. Müller)
 Lorica of other shapes, foot not located in the middle 2
2. Lorica pear-shaped. Foot elliptical *Testudinella parva* (Ternetz)
 Lorica vase-shaped. Foot slit-shaped *Testudinella emarginula* (Stenroos)

121. *Testudinella patina* (Hermann, 1783)
 (Fig. 220)

Brachionus patina Hermann, 1783, p. 48, Taf. 2, Fig. 10.

Pterodina patina Hermann, 1830, p. 48.

Testudinella patina (Hermann) : Haring, 1913b, p. 100; Voigt, 1957, p. 409, Taf. Fig. 5, Taf. 89, Fig. 22.

Testudinella patina patina (Hermann) : Kutikova, 1970, p.656, fig. 1078; Koste, 1978, p.526, T.194, T.195 : 1-5; Sharma, 1990, p.29, Fig.1.

Material examined : AMT, DL, IMT, MNP, SR, THK, AMG, BB, HWH, BA, BG, BNK, MDP, MLD, SLG.

Characters : Lorica transparent, circular and dorsoventrally flattened. Dorsal plate slightly convex and anterior dorsal margin rounded. Lateral antennae situated anterior to middle region of lorica. Foot-opening circular and located in the middle part one ventral side; foot annulated, retractile, ventrally projecting and with a terminal ciliated cap.

Measurements : Lorica length : 175-190; maximum width : 162-180.

Distribution : India : West Bengal (Calcutta, North & South 24-Parganas, Haora Hugli, Bankura, Medinipur, Malda and Darjiling); Assam, Orissa, Andhra Pradesh, Gujarat, Punjab and Kashmir. Elsewhere : Cosmopolitan.

122. *Testudinella emarginula* (Stenroos, 1898)
 (Fig. 221)

Pterodina emarginula Stenroos, 1898, p.168, Taf.II, figs. 31, 32.

Testudinella incisa : Haring, 1913b, p.100 (partim).

Testudinella emarginula (Stenroos) : Kutikova, 1970, p.661, fig. 1102; Sharma, 1990, p.33, Figs. 11 & 12.

Testudinella incisa var. *emarginula* (Stenroos) : Koste, 1978, p.532, T.119 : 11, a-b, 16f, Abb. 9 : 16.

Material examined : APD, MLD.

Characters : Lorica vase-shaped and with maximum width slightly behind its anterior end; biconcave in cross-section. Anterior dorsal margin with a plate-like process and ventral margin with a shallow notch. Foot-opening slit-shaped and located near posterior end of lorica.

Measurements : Lorica length : 90-100; maximum width : 70-75.

Distribution : New report from West Bengal. India : West Bengal (Koch Behar and Malda); Assam, Meghalaya and Tripura. Elsewhere : apparently Cosmopolitan.

123. *Testudinella parva* (Ternetz, 1892)
(Fig. 222)

Pterodina parva Ternetz, 1892, p.42, Taf. III, figs. 21, 22.

Testudinella parva (Ternetz) : Haring, 1913b, p. 100; Kutikova, 1970, p.658, fig. 1081.

Testudinella parva parva (Ternetz) : Koste, 1978, p. 529, T. 196 : 11-12; Sharma, 1990, p.31, Fig. 4.

Material examined : SLG.

Characters : Lorica pear shaped, transparent and with maximum width in the posterior region; convex in cross-section. Anterior dorsal margin slightly elevated and with shallow depression; anterior ventral margin with median notch. Lateral antennae located behind the middle region of lorica. Foot-opening elliptical and located at a short distance from posterior margin of lorica.

Measurements : Lorica length : 115-125; maximum width : 98-108.

Distribution : Represents a new report from West Bengal. India : West Bengal (Darjiling); Meghalaya and Assam. Elsewhere : Cosmopolitan.

Family FILINIIDAE Bartos, 1959

Body without lorica and with three or four cuticular setae. Circumapical band with a single ring of cilia. Trophi malleoramate.

Only one genus belonging to this family is reported in this account.

Genus *Filinia* Bory de St. Vincent, 1824

Filinia Bory de St. Vincent, 1824, p. 507.

Triarthra Ehrenberg, 1832, p. 138.

Tetramastix Zacharias, 1898, p. 132.

Characters : Body illoricate, cylindrical or sacciform; with two movable antero-lateral spines and one or two terminal or subterminal setae. Anus terminal; foot absent. Corona consists of a single circumapical ring of cilia. Dorsal antenna at level with anterior setae; lateral antennae behind the middle region of the body. Eyes two and situated on apical field. Digestive tract simple.

Type species : *Filinia passa* (O.F. Müller, 1786).

Four species of this genus are documented in this account.

Key to recorded species of genus *Filinia*

1. Body elongated and spindle-shaped..... 2
 Body sacciform or cylindrical 3
2. Body elongated, with two long broad-based anterior setae, along caudal setae and another small caudal setae..... *Filinia opoliensis* (Zacharias)
 Body width 1/3 or 1/4 of its length. With three setae, posterior setae oblique based and terminally inserted *Filinia pejleri* Hutchinson

3. Posterior setae inserted usually 25 μm away from caudal end..... *Filinia longiseta* (Ehrenberg)
 Posterior setae inserted terminally or near to caudal end *Filinia terminalis* (Plate)

124. *Filinia longiseta* (Ehrenberg, 1834)
 (Fig. 223)

Triarthra longiseta Ehrenberg, 1834, p. 222, pl. 8, fig. 1.

Filinia longiseta (Ehrenberg) : Harring, 1913b, p. 48; Sharma, 1979 c, p.45, Pl. III, Fig. 8.

Filinia longiseta longiseta (Ehrenberg) : Kutikova, 1970, p.669, fig. 1116; Koste, 1978, p.572, T.215 : 2, a-c, 13, a-b, T. 216 : 2, a-b, 6, 10, a-c.

Material examined : APR, BB, APR, IMT, GR, THK, TOL, KRP, NH, KLN, MDP, BNK, MLD, CB.

Characters : Body thin, barrel-shaped and with two long movable antero-lateral seta and one long immobile posterior setae. Anterior setae usually folded ventrally. Posterior seta inserted usually 25 μm away from caudal end of body.

Measurements : Body length : 142-170; antero-lateral seta : 330-360; posterior setae : 130-160.

Distribution : India : West Bengal (Calcutta, North & South 24-Parganas, Bankura, Nadia, Medinipur, Malda and Koch Behar); Assam, Orissa, Madhya Pradesh, Gujarat, Rajasthan, Punjab and Haryana. Elsewhere : Cosmopolitan.

125. *Filinia terminalis* (Plate, 1886)
 (Fig. 224)

Triarthra terminalis Plate, 1886, p. 19.

Filinia terminalis (Plate) : Voigt, 1957, p. 421, Taf. 89, fig. 3; Kutikova, 1970, p.668, fig. 1114; Koste, 1978, p. 575, T. 215 : 11, T.216 : 5, T. 217 : 1, a-f, li.

Material examined : AMG, HWH, APD.

Measurements : Body thin, cylindrical and relatively shorter than the preceding species; with two movable antero-lateral setae and one immobile posterior seta. Posterior seta inserted terminally or slightly away (0-15 μm) from caudal end.

Characters : Body length : 100-132; antero-lateral setae : 300-350; posterior seta : 220-250.

Distribution : Represents a new report from West Bengal. India : West Bengal (Haora Hugli and Koch Behar); Tamil Nadu and Gujarat. Elsewhere : Cosmopolitan.

126. *Filinia opoliensis* (Zacharias, 1898)
 (Fig. 225)

Tetramastix opoliensis Zacharias, 1898, p. 132, Taf. 1, figs. 6,7; Hauer, 1938, p. 560, fig. 84; Voigt, 1957, p.422, Taf.89, figs.6,7, Taf.10, fig.7.

Filinia opoliensis (Zacharias) : Ruttner-Kolisko, 1974, p. 118, fig. 50.1.b; Sharma, 1979c, p. 46, Pl. III, Fig. 9.

Tetramastix opoliensis Zacharias : Kutikova, 1970, p.670, fig. 1120.

Filinia opoliensis opoliensis (Zacharias) : Koste, 1978, p. 576, T. 215 : 3, T. 217 : 5, a-g, Abb. 8 : 3.

Material examined : AMT, BH, BL, GR, THK, TOP, TG, KLN, HWH, JH, HM, BNK, BDN, KRP, NCB.

Characters : Body long and cylindrical. Anterior setae long and broad-based; posterior seta long and inserted terminally and with an additional small seta or spine located at its base.

Measurements : Body length: 140-180; anterior setae: 240-280; posterior long seta: 220-230; posterior small seta: 45-55.

Distribution : India : West Bengal (Calcutta, North & South 24-Parganas, Haora Hugli, Bankura, Bardhaman, Medinipur and Koch Behar); Assam, Orissa, Madhya Pradesh, Gujarat, Rajasthan and Punjab. Elsewhere : Cosmopolitan.

127. *Filinia pejleri* Hutchinson, 1964

(Fig. 226)

Filinia pejleri Hutchinson, 1964, p. 1-8, Fig. 1, a; Koste, 1978, p. 575, T. 217 : 3; Sharma, 1979c, p. 46, Pl. III, fig.10.

Material examined : BB, SR, TOP.

Characters : Body relatively small, transparent fusiform and with three setae; width 1/3 or 1/4 of body length. Posterior seta with a broad oblique base and inserted terminally at posterior end of the body.

Measurements : Body length : 138-160; maximum width : 40-50; posterior seta : 250-280; left anterior seta : 300-340; right anterior seta : 340-355.

Distribution : India : West Bengal (Calcutta and South 24-Parganas); Assam, Tamil Nadu, Rajasthan and Punjab. Elsewhere : Tropics and Subtropics.

Family **TROCHOSPHAERIDAE** Bartos, 1959

Body spherical or sacciform; without lorica, foot or any body appendage. Corona consists of a single band of cilia encircling the body (*Trochosphaera*) or borne apically on a short neck (*Horaëlla*). Trophi malleoramate. Anus terminal or subterminal. Vitellarium rounded or sickle-shaped. Species pelagic; ovo-viviparous or viviparous.

This family is presently represented by only single genus.

Genus *Horaëlla* Donner, 1949

Horaëlla Donner, 1949, p. 134.

Characters : Body thin, transparent, vesicular and without lorica. Corona borne on a short neck. Vitellarium spherical and with eight nuclei. Ovo-viviparous.

Type species : *Horaëlla brehmi* Donner, 1949.

Only one species belonging to this genus is reported from the collections examined from West Bengal.

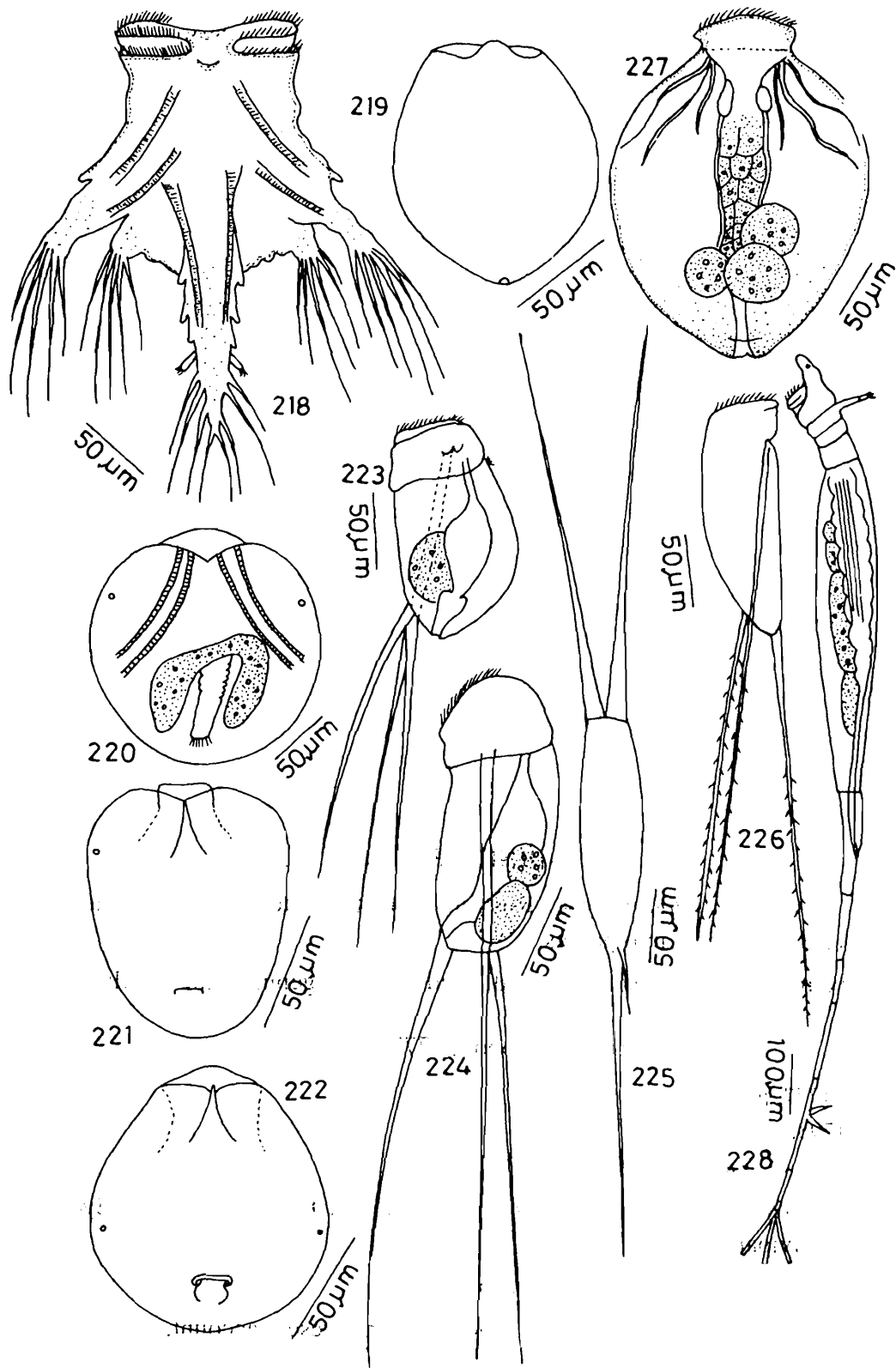


Fig. 218. *Hexarthra mira* (Hudson) : ventral view; Fig. 219. *Pompholyx sulcata* Hudson : dorsal view; Fig. 220. *Testudinella patina* (Hermann) : ventral view; Fig. 221. *T. emarginula* (Stenroos) : ventral view; Fig. 222. *T. parva* (Ternetz) : ventral view; Fig. 223. *Filinia longiseta* (Ehrenberg) : lateral view; Fig. 224. *F. terminalis* (Plate) : lateral view; Fig. 225. *F. opoliensis* Zacharias : dorsal view; Fig. 226. *F. pejeri* Hutchinson : lateral view; Fig. 227. *Horaëlla brehmi* Donner : dorsal view; Fig. 228. *Rotaria neptunia* (Ehrenberg) : Fig. 228, lateral view.

128. *Horaëlla brehmi* Donner, 1949

(Fig. 227)

Horaëlla brehmi Donner, 1949, p.130-140, Abb.1, a-b, 2, b-c, 3, a-c; Chengalath *et al.* 1973, p.53, figs.104-105; Sharma, 1979c, p. 46, Pl. III, Fig. 11.

Material examined : TIM, SR.

Characters : Body transparent, vesicular and broadly elliptical. Corona simple, with a single band of cilia raised on a short neck and apical field without any sense organ. Lateral antennae located in posterior region of the body. Mouth located behind coronal ring, with two eyes on its sides. Cloacal aperture terminal and appears to be slightly elevated. Ovo-viviparous.

Measurements : Total length : 275-280; maximum width : 200-205.

Distribution : India : West Bengal (Calcutta and South 24-Parganas); Bihar and Orissa. Elsewhere : Cosmotropical.

Superorder DIGONONTA Bartos, 1959

Ovaries paired, with vitellarium. Reproduction asexual. This superorder is represented by only one order in this account.

Order BDELLOIDEA Remane, 1933

Mostly benthic, sometimes free-swimming; body elongated, fusiform and transversely wrinkled into telescopically retractile segments. Ciliated rostrum located on head and with a dorsal antenna. Trophi ramate. Corona with two ciliated discs on pedicles (*Philodina* type) or on a ventral ciliated area (*Adineta*-type).

Only one family of this order is reported presently.

Family PHILODINIDAE Remane, 1933

Characters : Corona *Philodina*-type. Rostrum retractile. Stomach lumen tube-shaped and ciliated. Food excrete not formed into pallets.

The material examined from West Bengal indicated only one genus of the family Philodinidae.

Genus *Rotaria* Scopoli, 1777

Rotaria Scopoli, 1777, p.375

Rotifer Cuvier, 1798, p. 659

Esechielina Bory de. St. Vincent, 1826, p. 76.

Characters : Body fusiform and usually elongated; foot three-segmented. Eyes, if present, located on rostrum. Viviparous.

Type species : *Rotaria rotatoria* (Pallas, 1766).

Only one species belonging to this genus is reported in the present account.

129. *Rotaria neptunia* (Ehrenberg, 1832)

(Fig. 228)

Actinurus neptunia Ehrenberg, 1832, p.145, pl.4, fig.23.

Rotaria neptunia (Ehrenberg) : Harring, 1914, p. 556; Koste, 1978, p. 215, pl. 28, fig. 5, a-c; Sharma, 1979c, p.46, Pl. III, Fig.12.

Material examined : SR, APR, TOL, SRP, BN.

Characters : Body long, slender and fusiform. Rostrum with two eyes and with an arched rostral papilla. Palp-like antennae on first neck segment. Trunk long, narrowing gradually. Foot long, slender and telescopic, with a pair of pointed spurs; last foot-segment with three slender and equal toes.

Measurements : Total length : 1350-1400; trunk : 520-540; foot : 600-650; toes : 75-80.

Distribution : India : West Bengal (Calcutta, North & South 24-Parganas and Darjiling); Assam and Andhra Pradesh. Elsewhere : Cosmopolitan.

ADDITIONAL TAXA

The following taxa, reported earlier by Anderson (1889) from Calcutta and its environs, are not observed in the collections examined by the author :

- Family EUCHLANIDAE
Euchlanis dilatata macrura (Ehrenberg, 1832)
- Family MYTILINIDAE
Mytilina ventralis brevispina (Ehrenberg, 1832)
- Family COLURELLIDAE
Colurella adriatica Ehrenberg, 1831
Squatinella mutica tridentata (Fresenius, 1858)
- Family LECANIDAE
Lecane (Monostyla) cornuta (Müller, 1786)
- Family NOTOMMATIDAE
Notommata tripus Ehrenberg, 1832
Monommata longiseta (Müller, 1786)
- Family FLOSCULRIDAE
Flosculria ringens (Linne, 1758)
Limnias ceratophylli Schrank, 1803
L. melicerta Weisie, 1848
Beauchampia crucigera (Dutrochet, 1812)
Ptygura stephanion (Anderson, 1889)
Sinantherina socialis (Linne, 1758)
- Family TESTUDINELLIDAE
Testudinela patina intermedia (Anderson, 1889)
- Family COLLOTHECIDAE
Collotheca ornata (Ehrenberg, 1832)

C. companulata (Dobie, 1849)

C. ambigua Hudson, 1883

C. tenuilobata (Anderson, 1889)

Family PHILODINIDAE

Rotaria rotatoria (Pallas, 1766)

R. mento (Anderson, 1889)

R. ovata (Anderson, 1889)

R. macroceros (Gosse, 1851)

Philodina citrina (Ehrenberg, 1832)

DISCUSSION

The author's collections from various localities of West Bengal revealed 129 species (152 taxa) of freshwater rotifers belonging to 18 eurotatorien families and 30 genera. Among these, 27 species (28 taxa) represented new records from this state while three species comprised new additions to Indian Rotifera. Further, three new combinations were also proposed in this account. However, 19 species (23 taxa) spread over nine genera and two families documented previously (Anderson, 1889) from Calcutta and its environs were not observed in the presently examined samples. These, combined together with this author's list, raised the total number of the rotifers reported from West Bengal to 148 species (175 taxa). The stated figure comprised the maximum qualitative diversity of this group of micro-invertebrates from any particular state or region of India.

Dumont (1983) commented on overall paucity of endemic rotifers in the Indian subcontinent and considered this situation to be secondary which resulted from the invasion of the Oriental faunal elements to the Near East especially during the Pleistocene. This aspect was also stressed by Sharma (1991) and endemic elements of this group from India were so far represented by only 26 species (32 taxa). However, interestingly 1/4 of these taxa were described from West Bengal and these included *Lecane lateralis*, *L. vasishti*, *L. crepida bengalensis*, *Lepadella triprojectus*, *L. ovalis larga*, *Ptygura stephanion*, *Rotaria menta* and *R. ovata*. Of these, the distribution range of *Lecane lateralis* was recently extended (Sharma, 1987b) to Orissa State. In addition, another endemic species i.e., *Lecane (Monostyla) pawlowskii*, described from Gujarat (Wulfert, 1966), was reported from West Bengal (Sharma, 1978a).

The comparison of the Rotifer fauna of West Bengal with that of Indian rotifera (Sharma and Michael, 1980; Sharma, 1991) indicated its fairly well diversified species composition. The taxa reported from West Bengal comprised 49.3% of the rotifer fauna of this country and about 30% of those so far documented from the Oriental region (Sudzuki, 1989). Further, out of total 24 families of this group reported from India (Table 1), 20 families were represented in the material examined from West Bengal. On the other hand, the generic diversity remained low (39 genera) in contrast with the report of 60 genera reported from this country.

Table 1 : Comparison of the rotifer fauna of West Bengal with Indian Rotifera

| | Recorded Species | | Recorded Genera | |
|---------------------------|------------------|-------|-----------------|-------|
| | West Bengal | India | West Bengal | India |
| Order PLOIMIDA | | | | |
| Family Epiphanidae | — | 7 | — | 4 |
| Family Brachionidae | 25 | 37 | 4 | 5 |
| Family Euchlanidae | 6 | 13 | 4 | 5 |
| Family Mytilinidae | 3 | 7 | 1 | 2 |
| Family Trichotridae | 3 | 6 | 2 | 3 |
| Family Colurellidae | 19 | 25 | 3 | 3 |
| Family Lecanidae | 42 | 70 | 1 | 1 |
| Family Proalidae | — | 4 | — | 2 |
| Family Notommatidae | 8 | 26 | 4 | 7 |
| Family Gastropodidae | 3 | 3 | 2 | 2 |
| Family Trichocercidae | 6 | 19 | 1 | 1 |
| Family Asplanchnidae | 2 | 7 | 1 | 2 |
| Family Synchaetidae | 1 | 8 | 1 | 2 |
| Family Dicranophoridae | 2 | 7 | 1 | 2 |
| Order GNESIOTROCHA | | | | |
| Family Floscularidae | 6 | 13 | 5 | 6 |
| Family Conochilidae | 2 | 4 | 1 | 1 |
| Family Hexarthridae | 1 | 4 | 1 | 1 |
| Family Filiniidae | 4 | 5 | 1 | 1 |
| Family Testudinellidae | 4 | 10 | 2 | 2 |
| Family Trochosphaeridae | 1 | 1 | 1 | 1 |
| Family Collothecidae | 4 | 4 | 1 | 1 |
| Family Atrochidae | — | 1 | — | 1 |
| Order BDELLOIDEA | | | | |
| Family Philodinidae | 6 | 22 | 2 | 4 |
| Family Habrotrochidae | — | 7 | — | 1 |
| | 148 | 310 | 39 | 60 |

Note : The recorded genera and species from West Bengal included those documented presently and reported earlier by Anderson (1889). The detailed composition of Indian Rotifera was given by Sharma (1991).

Family-wise break up of the rotifer fauna of West Bengal (Table 1) indicated that Lecanidae, Brachionidae and Colurellidae, in the stated order, formed a dominant fraction of the examined species. This pattern corresponded with the qualitative abundance of the mentioned families in many South-East Asian rotifer faunas in general and to that of Indian Rotifera in particular. However, two other important families i.e., Notommatidae and Trichocercidae were not well represented in the samples collected from West Bengal. Further, confirming to the general composition of the Oriental fauna (Sudzuki, 1989) and Indian Rotifera (Sharma, 1991), the monogononts comprised a bulk of the documented taxa from this state. On the other hand, amongst about 365 species (21 genera) of the digonont rotifers (Order Bdelloidea) known from the world, 29 species were so far reported from India while only six species of this order were recorded from West Bengal. Of these, five species were examined earlier by Anderson (1889). In addition, sessile and colonial members of the family Floscularidae and various species of the genus *Collotheca* (Family Collothecidae), listed previously by Anderson (*loc cit.*), were not noticed in the presently studied samples.

Green (1972), Chenagalath *et al.*, (1974), Pejler (1977) and Fernando (1980) highlighted the importance of genus *Brachionus* (Family: Brachionidae) in tropical rotifer communities. Pejler (*loc cit.*) stated that this genus was entirely missing in arctic areas but gained increased significance towards the equatorial region. It was interesting to note that out of 21 species of the mentioned genus documented from India (Sharma, 1983), seventeen species occurred in West Bengal. Further, Dussart *et al.*, (1984) stressed the presence of many species of *Lecane* to be a characteristic feature of the rotifer communities of tropical Asia and Australia. This important feature was also evident in this account wherein *Lecane* complex exhibited highest diversity (42 species). The qualitative predominance of species of *Lecane* and *Brachionus*, therefore, imparted a broadly tropical character to the rotifer fauna of West Bengal.

Besides various endemic elements, the rotifer fauna of West Bengal also reflected a notable fraction of biogeographically interesting taxa which could be broadly assigned to two groups. The first group included taxa of global distributional significance and these were represented by *Brachionus donneri*, *B. bidentata jirovci*, *B. patulus macracanthus*, *B. sessilis*, *Mytilina acanthophora*, *M. ventralis longidactyla*, *Lecane bifastigata*, *L. curvicornis nitida*, *L. pertica*, *L. hastata*, *L. ligona*, *L. stokesii*, *L. (Hemimonostyla) syngenes*, *L. (Monostyla) thalera*, *L. (M.) sinuata*, *L. (M.) thienemanni*, *Trichocerca elongata braziliensis*, *Dicranophorus lutkeni*, *Collotheca tenuilobata* and *Horaëlla brehmi*. The second group was comprised of species indicating regional distributional importance in India or in the Indian subcontinent and these were represented by *Brachionus mirabilis*, *Keratella lenzi*, *Tripleuchlanis plicata*, *Euchlanis triquetra*, *Mytilina bisulcata*, *Colurella sulcata*, *Colurella adriatica*, *Lepadella aspida*, *L. cristata*, *L. imbricata*, *L. quadricarinata*, *L. rhomboidula*, *L. aspicora*, *Squatinella mutica*, *Lecane arcula*, *L. inermis*, *L. (Monostyla) furcata*, *L. (M.) scutata*, *Cephalodella auriculata*, *C. catellina*, *Notommata tripus*, *Monommata longiseta*, *Trichocerca cylindrica*, *Gastropus stylifer*, *Ascomorpha saltans*, *A. ovalis*, *Floscularia ringens*, *Limnias ceratophylli*, *L. melicerta*, *Conochilus natans*, *Collotheca ornata*, *C. companulata*, *C. ambigua*, *Filinia pejleri*, *Testudinella emarginula*, *T. parva*, *Rotaria vulgaris*, *R. macroceros* and *Philodina citrina*.

A detailed analysis of the documented taxa reflected that cosmopolitan elements comprised a significant component (67.2%) of the rotifer fauna of this state. On the other hand, various

pan-tropical, tropical and sub-tropical elements were represented by *Brachionus bidentata* (including various subspecies), *B. caudatus personatus*, *B. caudatus aculeatus*, *B. caudatus vulgatus*, *B. falcatus*, *B. forficula*, *B. forficula minor*, *B. diversicornis*, *Keratella lenzi*, *K. procurva*, *Anuraeopsis coelata*, *Macrochaetus collinsi*, *M. sericus*, *Lecane aculeata*, *L. crepida*, *L. curvicornis*, *L. papuana*, *L. signifera ploenensis*, *L. hornemanni*, *L. pertica*, *L. (Hemimonostyla) inopinata*, *Cephalodella mucronata* and *Filinia pejleri*.

The present observations indicated that the rotifer communities of West Bengal included an important fraction of periphytic elements (59.7%) while planktonic and occasionally planktonic forms comprised 26.4% and 13.8% respectively. The stated grouping of the recorded taxa was done following the works of Edmondson (1959), Ruttner-Kolisko (1974) and Koste (1978). Interesting differences were noticed in the composition of planktonic rotifer communities in lower Bengal and upper (North) Bengal. The samples examined from alkaline water bodies in lower Bengal invariably contained *Brachionus angularis*, *B. calyciflorus*, *B. bidentata*, *B. caudatus*, *B. budapestinensis*, *B. falcatus*, *B. forficula*, *B. diversicornis*, *B. rubens*, *B. urceolaris*, *Anuraeopsis fissa*, *Keratella tropica*, *K. procurva*, *Pompholyx sulcata*, *Polyarthra vulgaris*, *Asplanchna brightwelli*, *Filinia longiseta* and *F. opoliensis*. On the other hand, *Keratella cochlearis* was the most common and dominant limnetic rotifer in acidic waters especially in upper (North) Bengal while it was very rare in the gangetic region of this state. The plankton samples from upper Bengal also included *Keratella lenzi*, *Asplanchna priodonta* and *Brachionus donneri*. In addition, these samples contained some eurytopic brachionids which were known to tolerate (Koste, 1978) wide range of pH variations. Such species included *Brachionus angularis*, *B. falcatus*, *B. forficula*, *B. diversicornis* and *B. calyciflorus* and as mentioned above these species also occurred in alkaline biotopes in lower Bengal. Relatively lower diversity of the Brachionids in general and *Brachionus* species in particular in North Bengal region of this state could be attributed to general acidic nature of water bodies or presence of relatively fewer permanent lentic habitats. Such a situation, under identical ecological conditions, was also reported previously by Fernando and Zankai (1981) and Dussart *et al.*, (1984).

Based on the present study, a number of recorded taxa could be regarded as typical acidophilic elements *i.e.*, *Brachionus donneri*, *B. patulus macracanthus*, *Keratella lenzi*, *K. cochlearis*, *Colurella sulcata*, *Lepadella cristata*, *Squatinella mutica*, *Mytilina bisulcata*, *Beauchampiella eudactylota*, *Euchlanis triquetra*, *Dipleuchlanis propatula*, *Lecane curvicornis*, *L. ligona*, *L. pertica*, *L. inermis*, *L. pertica* and *L. (M.) scutata*. In addition, *Collotheca ornata*, *C. companulata* and *C. tenuilobata* reported previously by Anderson (1889) could also be assigned to this category following the work of Koste (1978). On the other hand, *Brachionus budapestinensis*, *B. bidentata*, *B. rubens*, *B. urceolaris*, *B. sessilis*, *B. plicatilis*, *Keratella procurva*, *Mytilina acanthophora*, *Lecane lunaris crenata*, *L. thienemanni*, *Asplanchna brightwelli*, *Filinia pejleri* and *Horaella brehmi* were regarded as alkalophilic elements.

Various warm-stenothermal forms were represented by *Anuraeopsis fissa*, *Brachionus bidentata*, *B. caudatus*, *B. forficula*, *B. mirabilis*, *Keratella lenzi*, *Dipleuchlanis propatula*, *Beauchampiella eudactylota*, *Macrochaetus collinsi*, *Colurella sulcata*, *Lepadella cristata*, *Lecane aculeata*, *L. crepida*, *L. ludwigi*, *L. (Hemimonostyla) inopinata*, *L. (Monostyla) quadridentata*, *L. (M.) stenroosi*, *Cephalodella mucronata* and *Scaridium longicaudum*. A number of eurythermal elements included *Brachionus angularis*, *B. calyciflorus*, *B. rubens*, *Keratella cochlearis*, *K. tropica*, *Lepadella ovalis*, *L. patella*, *Lecane inermis*, *L. (Monostyla) hamata*, *Polyarthra vulgaris* and *Testudinella patina*.

while a few cold-stenothermal forms were represented by *Conochilus natans*, *Monommata longiseta*, *Dicranophorus lutkeni* and *Sinantherina socialis*. The stated categories were recognized following the account of Koste (1978).

Some remarks were made earlier by this author (Sharma, 1979 e) on epizoic rotifers from West Bengal. The present study also confirmed the previous observations regarding epizoic associations of *Brachionus rubens* on *Daphnia carinata*, *Moina micrura*, *Diaphanosoma sarsi*, and *D. excisum*; the affinity of attachment was relatively more on the first two species of the cladocerans. Interestingly, *Brachionus sessilis* exhibited epizoic associations only with *Diaphanosoma excisum* and *D. sarsi* and thus confirmed the remarks of Varga (1951) and Fernando and Zankai (1981) that this brachionid could be regarded as exclusively epizoic on the cladoceran genus *Diaphanosoma*. The present study, however, did not indicate any example of epizoic nature of other two species i.e., *Brachionus caudatus* and *Lepadella ovalis* which were noticed to be attached earlier (Sharma, 1979 e), in fewer instances, on the odonate nymphs.

The present study registered notable variations regarding overall species composition of the rotifer communities in different aquatic habitats in this state. The maximum total number of species (68-72 species) were recorded from water bodies with aquatic macrophytes and these were primarily comprised of periphytic and littoral elements. This was followed by the report of total 37-40 species from paddy-fields and total rotifer diversity of 28-33 species from domestic ponds/fish ponds. However, the number of species occurring in individual plankton samples in domestic ponds or fish-ponds usually ranged between 6-14 species. Further, a maximum number of 18-20 rotifer species/sample were observed in some paddy-fields in contrast to the earlier report of 28-33 species/sample (Sharma, 1987a; Sharma and Sharma, 1987) from these ecosystems in Meghalaya State in North-Eastern India but inspite of the recorded variations, the samples examined from paddy-fields of West Bengal were also dominated by the species belonging to *Lecane* and *Lepadella*.

SUMMARY

The present account dealt with 129 species (152 taxa) of freshwater rotifers belonging to 18 families and 30 genera and also included three new combinations. Of these, 27 species (28 taxa) were new to West Bengal while three species comprised new reports from India. This study raised overall rotifer diversity from West Bengal to 148 species (175 taxa), spread over 20 families and 39 genera, which represented the maximum qualitative occurrence of these organisms till now recorded from any particular state or region of this country. Further, about 25% of the Indian endemic rotifers were documented from this state.

The rotifer taxa so far known from West Bengal comprised 49.3% of Indian Rotifera and about 30% of the rotifer fauna of the Oriental region. The monogonots constituted a major component of the taxa documented from this state and their significant fraction was formed by the members of the families Lecanidae, Brachionidae and Colurellidae. The qualitative predominance and common occurrence of species of *Lecane* and *Brachionus* imparted a broadly tropical character to the rotifer fauna of West Bengal.

The periphytic, planktonic and facultative planktonic elements comprised 59.7%, 26.4% and 13.8% respectively of the reported taxa. The planktonic rotifer communities from generally alkaline aquatic ecosystems in lower Bengal and acidic water bodies from various localities in upper (North) Bengal reflected interesting variations in their species composition. The samples examined from upper Bengal region of this state also indicated various acidophilic species.

The rotifer fauna of West Bengal included a notable number of biogeographically interesting elements. Of these, *Brachionus donneri*, *B. bidentata jirovci*, *B. patulus macracanthus*, *B. sessilis*, *Mytilina acanthophora*, *M. ventralis longidactyla*, *Lecane bifastigata*, *L. pertica*, *L. hastata*, *L. curvicornis nitida*, *L. ligona*, *L. stokesii*, *L. (Hemimonostyla) syngenes*, *L. (Monostyla) thalera*, *L. (M.) sinuata*, *L. (M.) thienemanni*, *Trichocerca elongata braziliensis*, *Dicranophorus lutkeni*, *Collotheca tenuilobata* and *Horaëlla brehmi* reflected global distributional significance while a number of other documented species indicated regional distributional importance in this country or in the Indian subcontinent. In addition, various pantropical, tropical and sub-tropical elements were also well represented in the samples from West Bengal.

Some observations were made on epizoic associations of *Brachionus rubens* and *B. sessilis*.

The maximum overall rotifer diversity (68-72 species) was noticed in water bodies with aquatic macrophytes while a total of 37-40 species were observed in the samples collected from paddy-fields while domestic ponds or fish-ponds reflected overall qualitative diversity ranging between 28-33 species.

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NEMATODE PARASITES OF VERTEBRATES

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INTRODUCTION

Nematodes are one of the most important group of animals. They play an important role in the economy of man and domesticated animals, Livestock, Poultry, Fisheries as well as the wild life. Nematodes have successfully adapted to a variety of habitats. Their representative are not only found as parasites in almost all group of animals but are also as free living stage in sweet, brackish or marine waters in soil and as plant parasite in all sort of plants.

Greatest diversity of adaptability is shown by those found in vertebrates. Their presence in this higher forms is not only restricted to alimentary canal, but also found in the body cavity, lung, heart, blood vessels, urinogenital system, connective tissue, serous membrane, oral, orbital and nasal cavities etc.

Parasitic forms are highly pathogenic, in some cases and they are capable of causing serious damage to the health of the host. Ascarids, strongyloids and filariids are included among the most pathogenic helminths of man and animals. Many cause diseases with a sharply defined clinical symptom which may lead to death in certain cases. The disease *delafondiosis*, or "Colic" of horses, which often terminates in the death of the animal is caused by the nematodes. Other destructive diseases as *alfortiosis*, *strongylosis* and *trichonematinoses* of horses, *bunostomatosis* and *chabertiosis* of ruminants, *ancylostomidoses* of carnivores, *syngamoses* and *amidostomatoses* of birds etc. are caused by strongyloids. *Ancylostomidoses* of man are widely distributed among the populations of tropical countries. *Filariasis*, *onchocerciasis* and *tropical eosinophilia* or *pulmonary eosinophilia* of man are caused by Filariids.

Dracaunculiasis is caused by the infection of Guinea worm. These are responsible to a reduction of the physical and internal powers of the patient and in severe cases ending fatally.

Therefore, study of helminth parasites of vertebrates have great practical as well as scientific value directly related to the welfare of human beings.

In connection with the knowledge on nematode parasites in India, studies on this group in West Bengal is rather satisfactory. Valuable contributions have been made from west Bengal by Boulenger (1914-1928), Chandler (1925-1928), Gaiger (1910-1915), Lane (1913-1921), Linstow (1904-1908), Maplestone (1903-1932) and Ware (1924) who studied the nematodes of animals dying in the Zoological Gardens, Calcutta. These parasites are being recorded in the present work as the nematode parasite of West Bengal. It is very difficult to verify whether all these parasites were endemic to West Bengal or some of them were carried from the native place of the hosts. The specimens collected during the recent Mopping Survey of West Bengal, are also included in this report. The species represented in the National Zoological Collections are referred in the present work with their Registration numbers, and 'T' is marked against primary types.

Recent workers on this group are Chakravarty, Biswas, Majumder, De, Manna and Soota etc. who initiated the work on different aspects of animal nematodes in West Bengal.

Since the publication of nematode fauna by Baylis (1936 and 1939) a good number of literatures have accumulated on this group. But no systematic survey report on consolidated account of any state or host group is available.

The object of this work is to bring together all the nematode species recorded so far from West Bengal.

This comprises 230 species contained in 111 genera 38 families and 4 orders of which 4 species are new to science. Diagnostic keys for all the species dealt here have been provided in such a manner so that their identification become easy. The classification followed for higher taxa is more or less based on CIH keys, unless otherwise stated.

From relevant literatures it appears that some genera like *Neoprotozoophaga* Biswas and Chakravarty, 1963, *Paraicosiella* Majumdar and Chakravarty, 1963, *Propharyngodon* Biswas and Chakravarty, 1963, *Amphinisakis* Chakravarty and Majumdar, 1959 and species like *Aproctoides lissum* Chandler, 1929 and *Paraprocta brevicaudata* (Chandler, 1924) Maplestone, 1931, lacking adequate descriptions. These records, therefore, need confirmation by examination of more materials from host species or the types. So all the above taxa are *incertae sedis* and have been dealt at the end with appropriate remarks.

HISTORICAL BACKGROUND

Nematode parasites of man and animals are well known to us from time immemorial.

In India studies of nematodes have been taken up by the British Officers of medical and veterinary sciences. Boulenger (1914-1928), Chandler (1925-1929), Gaiger (1910-1915), Lane (1913-1921), Linstow (1904-1908), Maplestone (1926-1940), Ware (1924) studied the nematodes of animals dying at the Zoological Gardens, Calcutta. The Zoological Survey of India has also made a valuable contribution by collecting animal parasitic nematodes from the animal dying at Calcutta Zoo and also from other places. Dr. N. Annandale, the first Director of this Survey have handed over these materials to Dr. H.A. Baylis of the British Museum (Natural History), London. Baylis and Daubney (1922) published their findings it included fourteen new species and five new genera, besides proposing a few new subfamilies and higher taxa. Many new species were described by Chandler and Maplestone working at the School of Tropical Medicine, Calcutta. The European Helminthologists have thus played a vital role in increasing the knowledge on nematode in this country as well as in West Bengal.

Thus, it can be concluded that the studies on parasitic nematodes in India began from West Bengal.

Among the Indian Helminthologist during pre-independence period Chakravarty (1936) and during post-independence period Chakravarty and Majumdar, G. (1959), Biswas and Chakravarty (1963) from Calcutta University, and more recently De from Burdwan University, Manna from Calcutta University; Majumdar, N. (1965), Mukherjee (1967), Soota (1965-1983), Chaturvedi

(1967- 1973) and Dey Sarkar (1980) from the Zoological Survey of India studied the different aspects of animal nematodes in West Bengal. Recently Mopping survey of West Bengal districts was under taken during 1985-89 by Zoological Survey of India and a good number of collection was made from domesticated and wild animals from some district, studies on which have been also incorporated in the present work.

MATERIAL AND METHOD

Nematodes from vertebrate hosts were collected for the present study during routine survey work and also during the recent Mopping survey of West Bengal, undertaken for this work. Hosts were either purchased from the market or animal collectors or collected in the fields by shooting, trapping, netting etc.

For the collection of nematode parasites from a freshly killed hosts, viscera is to be opened from different parts, search for nematodes parasites are to be made. Nematodes from a host should be collected as soon as possible after the death of the host, so as to avoid the effects on the parasite due to decomposition of the body of host. The same urgency is to be followed in case of nodules or tumours parasites in the walls of intestine or embaded in tissue or body cavity. In case of a large animal entire gut is to be carefully dissected lengthwise and then the available parasites along with gross contents were removed. After this the mucous membrane is to be washed in normal saline, then both the liquid and the washed surface of the membrane have to be examined throughly for collecting less conspicuous forms which might get escaped in the first examination. In the case of a small host the entire gut should be opened in normal saline. Some small worms not easily detected, as in the case of some bird nematodes, it is necessary to scrap out the parts of the membranal surface and the scraping should be shaken well in normal saline. Worms are to be allowed to settle in the bottom and the liquid is carefully poured off. Fresh liquid is to be added repeatedly, then the parasites should be collected by decantation. Various other body organs like liver, heart, lung, kidney, urinary bladder, eye etc., should be separately dissected in normal saline in different petri dishes. Every care should be taken to collect the worms are again washed throughly to remove whatever residual extraneous material may still adhering to the specimens. They are fixed by putting the specimens straight in a clean petri dish and 70% steaming alcohol is to be poured over them. But in the case of filariids, for better result, the following process should be applied. They should be fixed immediately after collection by immersing them directly in 70% steaming alcohol, instead of washing them in normal saline as otherwise the specimens will burst. Specimens thus fixed should be preserved in 70% alcohol with a few drops of glycerine and a proper label with name of host, locality, location of parasite, date of collection and name of collector should be given. Whenever the specimens are to be examined they should be cleared either in Creasote (Beechwood) or Lactophenal. Before restoring them in to the 70% glycerine-alcohol, they should be washed a few minutes in 70% acid alcohol, to prevent their darkening. In the case of delicate and small specimens glycerine may be used as clearing agent.

All measurements used in this volume are in milimeter unless otherwise stated.

MORPHOLOGY AND TERMINOLOGY

Nematodes or round worms are unsegmented, bilaterally symmetrical, cylindrical, vermiform animals, tapering towards each end, length variable from less than a millimeter to 150 mm. *Dracunculus medinensis* measures more than a metre. The body is curved externally, with a tough resistant cuticle, which is elastic and flexible. Body surface is mostly smooth in parasitic nematodes. Transverse or longitudinal striations are present in some nematodes. But cuticle in some cases is variously modified as bristles, spines, papillae, warts etc. The papillae in the anterior region are called cephalic papillae and those in the posterior region are referred as caudal or anal papillae. These characters are having taxonomic importance. The cuticle may be expanded longitudinally in the form of cephalic, cervical and lateral alae. The alae at the lateral part of the body are termed as lateral alae. Those on the cephalic region are called cephalic alae and on the 'neck' region cervical alae. In males of many nematodes special lateral expansions occur on the cuticle near the posterior end of the body termed as caudal alae. In strongyloides, cuticle in males is expanded at the posterior end in the form of bell-shaped structure known as bursa, which is further supported by muscular rays. Musculature is of taxonomic importance it consist of longitudinal muscle fibers arranged variously and according to their arrangement, they are known as holomyarian, meromyarian and polymayarian etc.

The mouth lies at the anterior end of the body, terminally or subterminally, and may or may not be surrounded by lip-like structures. In stronghloides lips are modified into few or many leaf-like structures known as leaf-crown in two sets the outer leaf-crown and inner leaf-crown.

Digestive system consists of mouth, buccal cavity, pharynx or oesophagus of varied types, intestine and anus. Oesophagus contains oesophageal gland. The posterior opening of the alimentary canal is usually referred to as the anus in the female and as the cloacal aperture in the male. In most nematodes there is a postanal or postcloacal prolongation of the body, commonly called the tail.

In stronglyloides, bursa projects beyond the posterior end of the body and there is no tail. In some other forms the anus or cloacal aperture is terminal, so that in these again tail is absent.

Nervous system consists of a nerve ring encircling oesophagus. From it nerve trunks are given out anteriorly and posteriorly. In male there is a special development of the nervous system at the posterior end of body, in connection with the copulatory apparatus and its associated sense organs. Sense organs occure in the form of papillae and amphid. Amphid are very characteristic of nematodes and are of taxonomic value, of the free living nematodes where they are best developed. In many species, the tail in both sexes, usually bears a pair of lateral sense organs, which are rather pore-like than papillae like, and is known as phasmids or canal pores.

Excretory system consists of canals of gland like organs. There is no definite proof that these glands are doing excretory functions.

Sexes are separate and gonads are tubular and coiled. Usually there is a single testis. The sperm duct opens into the cloaca, and is associated with accessory structures such as cuticular spicules and gubarnaculum acting as guide. In females with few exceptions, there are usually two ovaries and oviducts. Each oviduct may have a small dilation called the seminal receptacle, which receives and retains the spermetazoa. The eggs are fertulised in it. The genital tube is then continued as the

- Cephalic ala : Ala confined to cephalic region.
- Cervical ala : Ala confined to 'neck' region.
- Caudal ala : Ala restricted to posterior-end of male.
- Circumoral : Any structure encircling the mouth.
- Claviform : Club shaped.
- Cloaca : In the case of males the cloacal opening is the common aperture for digestive and genital tubes. Sometimes the spicules are noticed coming out from cloacal aperture.
- Cordon : Longitudinal cuticular festoon-like or cord-like thickening extending posteriorly in or on the cervical region and may be straight, spiral, recurved or form loops, present in the spiruroid family Acuariidae.
- Corona radiata : In strongyloides the border of the labial region are divided into a series of leaf like structures, in two circles, termed as internal and external corona (= internal and external leaf-crowns of some authors).
- Corpus : It is the anterior end of oesophagus often separated from the posterior bulb by the isthmus.
- Deirids : A pair of sensory organs found in the cervical region (= cervical papillae of some authors).
- Dentigerous ridges : Rows of denticles situated on the inner surface of the lips.
- Didelphic : Female with two set of female reproductive organs.
- Diorchie : Male with two testis.
- Genital Cone : It is a terminal or subterminal, postanal ventral process in male of strongyloids, which may have on its ventral surface a granular and thick cuticle, designated by some authors as a 'dermal collar'
- Gubernaculum : An accessory male copulatory piece, more or less strongly chitinized structure, frequently serving as a guide for the copulatory spicules, variable in shape and developed in connection with the dorsal wall of the cloaca of male (= Accessory piece of some authors).
- Interlabia : Cuticular outgrowth arising at the base of the lips or Pseudolabia and extending between them.
- Isthmus : It is the middle part of muscular oesophagus.
- Lateral ala (Pl. alae) : The ala or alae confined to the lateral part of the body.

- Monodelphic** : Species with one set of female reproductive organs.
- Monorchic** : Species with one testis.
- Mouth collar** : A ring like cuticular swelling some times surrounding the anterior end.
- Oesophageal Funnel** : A funnel shaped expansion of the lumen of the oesophagus at its anterior end, behind its junction with the buccal capsule or pharynx.
- Ovijector** : It is a spialized part of the female genital system between the end of the uterus and the vulva, serving to control the deposition of ova.
- Oviparous** : Females lay eggs which normally hatch outside.
- Ovoviviparus** : Eggs embryonated when passed out of body.
- Pedunculated Papillae** : Stalked genetal papillae in the anal region of male.
- Pharynx** : Narrow posterior part of the body buccal cavity with thick sclerotized walls.
- Plectanes** : Cross striated cuticular plates functioning as support for some genital papillae in some male.
- Polydelphic** : With more then two sets of female reproductive organs.
- Preanal sucker** : A thickened cuticular border in the pre-cloacal region.
In the absence of thickened cuticular border, such structures are referred to as sucker like organ.
- Pseudolabia** : Cuticular outgrowth arise around the oral opening.
- Rays** : Genital papillae and their accompanying muscles found embedded in the bursa of strongyloid males.
- Rosettes** : Punctuation pattern of cuticle surrounding the genital papillae.
- Spicule** : Sclerotized copulatory organ of male nematodes, in pair or single.
- Striations** : Species with fine transverse groove occuring at regular intervals.
- Synlophe** : Enlarged longitudinal or oblique cuticular ridges which serve to hold the nematodes in place inside the gut wall found in some trichostrongylids.
- Ventriculus** : It is glandular modification of the distal portion of the oesophagus of some species of nematodes may have a solid appendage of varying length extending posteriorly dorsal to the intestine (Ventricular appendix).
- Viviparous** : Producing eggs which hatch in the uterus itself.
- Vulva** : It is the female reproductive aperture (gonopare), opens outside the body by an annular depression.

SYSTEMATIC ACCOUNT

| | |
|------------------|---|
| Class | NEMATODA |
| I Subclass | ADENOPHOREA |
| 1. Order | ENOPLIDA |
| Super family (1) | TRICHINELLOIDEA |
| 1. Family | TRICHURIDAE (Ransom, 1911) Railliet, 1915 |

Key to subfamilies

1. Cloaca with thin muscular wall anterior and posterior to point of entry of spicule. Body usually filiform, but oesophageal region expanded markedly. Cirrus usually present.

Parasites of skin, spleen, intestine, respiratory and excretory system of vertebrates
Capillariinae Railliet, 1915

Cloaca with thick muscular wall anterior to point of entry of spicule; wall thinner posterior to point of entry.

Post oesophageal region of the body markedly thicker. Cirrus with spines or tubercles.

Parasites of large intestine of mammals.....Trichurinae Ransom, 1911

Subfamily Capillariinae Railliet, 1915

Genus *Capillaria* Zeder, 1800

Key to species

Parasitic in the intestine of pigeons and other birds*C. columbae*

Parasite in the intestine of rat*C. prashadi*

1. *Capillaria columbae* (Rudolphi, 1918) Travassos, 1915

1819. *Trichosoma columbae* Rudolphi, *Entozoorum Synopsis*. Berlin, 15.

1915. *Capillaria columbae* Travassos, *Mem. Inst. Osw. Cr.* 7(2) : 159.

Material : 2 examples, Z.S.I. Reg. No. W907/1, host-Pigeon (*Columba livia domestica*); location-intestine; locality Zoological Gardens, Calcutta, W. Bengal; 19.vii.1915. Coll. A.C. Chandler.

Diagnosis : Male : Body 8.4-11.8 long, 0.025-0.064 wide; caudal end provided with a rounded brusa-like membrane, supported by a pair of L-shaped processes, each with a terminal papilla; spicule bluntly rounded tip, 1.2-1.57 long; spicule sheath transversely wrinkled, but without spines.

Female : Body 10.5-19 long, 0.03-0.99 wide; posterior end bluntly rounded; vulva 0.06-0.17 from anterior end; eggs with polar plugs, 0.041-0.056 X 0.022-0.036 in diameter.

Distribution : India : West Bengal, (Calcutta). Elsewhere : Cosmopolitan in distribution.

2. *Capillaria prashadi* Maplestone and Bhaduri, 1942

1942. *Capillaria prashadi* Maplestone and Bhaduri, *Rec. Indian Mts.*, Calcutta, 44 : 201.

Material : Host *Rattus norvegicus* (= *Mus decumanus*); location intestine ; locality Calcutta, West Bengal.

Diagnosis : Male : Body 7.0 (Length of fragment) long, 0.49 wide, anus subterminal; the spicule slightly chitinized, 0.95 long, proximal end with a bulbous dilation; spicule sheath muscular with transverse striation.

Female : Body 10.2-13 long, 0.16-0.67 wide; vulva without lip, 0.1-0.2 behind the posterior end of the oesophagus; eggs with plugs, 0.058-0.064 X 0.024-0.029 in diameter.

Distribution : India : West Bengal, (Calcutta).

Subfamily Trichurinae Ransom, 1911

Genus *Trichuris* Roederer, 1761

Key to the species

- Parasites of dog and fox *T. vulpis*
- Parasites of Primates and Swine *T. trichiura*
- Parasites of ruminants 1
- 1. Spicules of male less than 3 mm long..... *T. discolor*
- Spicules more than 3 mm long 2
- 2. Spines on distal expansion of everted spicule sheath shorter than rest. Vagina long, slender and sinuous, its lumen widening gradually..... *T. ovis*
- Spines on distal expansion of everted spicule sheath longer than the rest. Vagina short and stout, its lumen forming angular bends expanding suddenly into an egg chamber. *T. globulosa*

1. *Trichuris trichiura* (Linnaeus, 1771)

1771. *Ascaris trichiura* Linnaeus, *Genera animalium* ox editione duodecima systematis naturae. In usus academicos, 543 Edinburgi.

Material : Several examples, Z.S.I. Reg. No. W905/1; host Hylobatis sp; location intestine, locality Zoological Gardens, Calcutta, West Bengal; 19.ix.1914. 4 examples, Z.S.I. Reg. No. WN 271; host Rhesus Macaque (*Macca mulata*); location-intestine; locality Ghoombhanjang, Darjeeling district, West Bengal; 23.vi.1974; Coll. T.D. Soota.

Diagnosis : Male : Body 30-45 long, 0.45-0.65 wide; Slender oesophageal portion about two-thirds to three-fifths of the total body length; spicule tip rounded or pointed, 2.0-3.35 long.

Female : Body 35-50 long, 0.5-0.85 wide; vulva not prominent; eggs 0.05-0.56 X 0.021-0.025 in diameter.

Distribution : India : West Bengal (Calcutta, Darjeeling). Elsewhere : Cosmopolitan in distribution.

2. *Trichuris ovis* (Abildgaard, 1795) Smith, 1908

1795. *Trichocephalus ovis* Abildgaard. [nv]

1908. *Trichuris ovis* Smith, *Univ. Penn. Med. Bull* 20(12) : 269.

Material : Hosts Sheep, goat, ox, camel and many other ruminants.

Location : Intestine; locality Calcutta, West Bengal.

Distribution : Male : Body about 50-80 long, 0.5 wide; slender oesophageal portion about three quarters of the total length; spicule 4.9-7.2 long; thickened distally before tapering to a point, the spicule sheath, when fully everted glabular expansion at its distal end.

Female : Body 50-80 long, 1.0 wide; vulva prominent, eggs with polar plugs.

Distribution : India : West Bengal (Calcutta). Elsewhere : Cosmopolitan.

3. *Trichuris globulosa* (V. Linstow, 1901), Ransom 1911

1901. *Trichocephalus globulosus* V. Linstow, *Arch. Mikr. Anat.*, **58**(1) : 182-183.

1911. *Trichuris globulosa* Ransom, *U.S. Dept. Agric. Bureau Animal Industry*, Bull. **127** : 15.

Material : Several examples, Z.S.I. Reg. No. W6963/1 W6965/1; host-goat; location-Caecum and rectum; locality Calcutta, Slaughter house; 6-1-1962. Several examples, Z.S.I. Reg. No. WN 190; host-domestic goat; location intestine; locality Karsiyang, Darjeeling district, West Bengal; 13.v.1975, Coll. T.D. Soota.

Diagnosis : Male. Body 40-70 long, 0.71 wide; Slender oesophageal portion about two-thirds of the total body length; Spicule pointed 3.8-5.7 long; the spicule-sheath when fully everted, globular expansion at the distal end.

Female : Body 40-70 long, 0.87 wide; vulva prominent; eggs with Polar plugs.

Distribution : India : West Bengal (Calcutta, Darjeeling). Elsewhere : Cosmopolitan in distribution.

4. *Trichuris discolor* (V. Linstow 1906) Ransom, 1911

1906. *Trichocephalus discolor* V. Linstow. *Spolia Zeylanica*, Colombo, **3** : 173.

1911. *Trichuris discolor*, Ransom, *U. S. Dept. Agric. Bureau Animal Industry*, Bull. **127** : 15.

Material : Hosts : Zebu (*Bos indicus*), Cattle, buffalo & okapi etc. Location : Intestine; locality Zoological Gardens, Calcutta, West Bengal.

Diagnosis : Male. Body 45-59 long, 0.55-0.75 wide; slender oesophageal portion about two-thirds of the total body length; spicule tip rounded. 1.76-2.3 long; spicule sheath covered with spines.

Female : Body 43-52 long, 0.67-0.83 wide; vulva not prominent.

Distribution : India : West Bengal, (Calcutta). Elsewhere : Europe, U.S.A. and Japan.

5. *Trichuris vulpis* (Froelich. 1789) smith, 1908

1789. *Trichocephalus vulpis* Froelich, *Naturforscher*, Halle, **24** : 142-145.

1908. *Trichuris vulpis* Smith, *Univ. Penn. Med. Bull.* **20**(12) : 269-292.

Material : Several examples, Z.S.I. Reg. No. WN 648; host – domestic dog; location caecum and intestine; locality Baharampur, Murshidabad district, West Bengal; 15.viii.1975. coll. R.K. Ghosh.

Diagnosis : Male : Body 45-75 long; thick portion 18-20.5 long; spicule 8.5-11 long, spicule sheath covered with dense spines basally but smooth distally.

Female : Vulva prominent.

Remarks : The species is recorded for the first time from India.

Distribution : India : West Bengal (Murshidabad).

6. *Trichuris* sp.

Material : One ♀ Z.S.I. Reg. No. W 6984/1, host *Bandicota indica*, location intestine, locality Howrah, West Bengal, 7.xii. 1967 Coll. Y Chaturvedi.

Diagnosis : Female : Body 18.7 long, 0.28 wide at the maximum; Vulva 7.5 from posterior end and not everted; vagina 0.73 long, straight; eggs 0.066 X 0.0444 in diameter.

- II Subclass SECERNENTEA
- 2. Order ASCARIDIDA
- Super family (1) ASCARIDOIDEA
- 1. Family ASCARIDIDAE Baird, 1853

Key to Subfamilies

- 1. Oesophagus with globular to ellipsoidal posterior ventriculus 2
- Oesophagus without ventriculus 3
- 2. Ventriculus without appendices. Gubernaculum absent.
- Parasites of mammals and birds..... Toxocarinae (Hartwich, 1954) Osche, 1958
- Ventriculus without appendices or with two anterior and three posterior appendices.
- Parasites of crocodilians and rarely of fishes Muticaecinae (Hartwich, 1954) Compana-Rouget, 1960
- 3. Lips generally rounded hexagonal. Interlabia absent. Intestinal caecum absent. Gubarnaculum absent.
- Parasites of mammals..... Ascaridinae (Baird, 1853) Hartwich, 1974
- Lips nearly quadangular. Interlabia present or absent. Intestinal caecum present or absent. Gubarnaculum present or absent.
- Parasites of reptiles and amphibians rarely of birds .. Angusticaecinae Skrjabin & Karokhin, 1945

Subfamily Ascaridinae (Baird, 1853) Hatwich, 1974

Key to genera

- 1. Cervical alae absent 2
- Cervical alae present 3
- 2. Lips subdivided into anterior and posterior regions by internal transverse groove.
- Interlabia present Parasites of equines *Parascaris* Yorke & Maplestone, 1926
- Lips subdivided into anterior and posterior regions by slight lateral indentations.
- Interlabia absent.
- Parasites of primates, artiodactyles and rodents..... *Ascaris* Linn., 1758
- 3. Anterior margin of lips not deeply indented.
- Roughened patches absent in perianal region of male. Egg shell smooth.
- Parasites of carnivores..... *Toxascaris* Leiper, 1907

1. Genus *Ascaris* Linnaeus, 17581. *Ascaris lumbricoides* Linnaeus, 1758

1758. *Ascaris lumbricoides* Linnaeus *Systema naturae per regnaria naturae secundum classes, ordines, genera, species cum characteribus differentitis synonymis, locis. Editio decima, reformata*, Vol. 1, 648 Holmiae.

Material : 2♀♀ Z.S.I. Reg. No. W708/1, host a boy of 11 years; locality Calcutta, West Bengal; June, 1923.

Several examples, Z.S.I. Reg. Nos. W709/1-W711/1; host *Simia satyras*; location stomach and intestine; locality Zoological Gardens, Calcutta, West Bengal; 16.viii.1914, 5.iv.1916 and 19.ix.1917.

Several examples, Z.S.I. Reg. Nos. W712/1-W714/1, host *Sciurus indicus*; location - intestine; locality as above; 2.i.1914, 20.vi.1914 and 10.i.1916.

One example, Z.S.I. Reg. No. W715/1; host *Sciurus pygerythrus*; location and locality as above; 16.iv.1913.

Diagnosis ; Head with three semicircular lips, dorsal lip with a pair of large double papillae on its outer surface; ventro lateral lips with one double papillae. Male : body 150-250 long, 3-5 wide; tail conical, curved ventrally; caudal papillae 70-75 pairs, arranged irregularly, of these 5 pairs postanal, two anterior most pair of postanal papillae having double terminations, and a large median papilla on the anterior lip of cloaca; Spicules non-alate, tubular, short and stout about 2 long. Female : Body 200-400 or even more long; tail short and conical; vulva about anterior third of the body; eggs oval, thick shelled.

Distribution : India : West Bengal (Calcutta). Elsewhere : Cosmopolitan.

2. *Ascaris* sp.

Material : 2♀♀ Z.S.I. Reg. No. WN 649; host Rat (*Rattus rattus*); location Stomach; locality Purulia district, Purulia, West Bengal, 12.v.1977, Coll. R.K. Ghosh.

2. Genus *Parascaris* Yorke & Maplestone, 19261. *Parascaris equorum* (Goeze, 1782) Yorke and Maplestone, 1926

1782. *Ascaris equorum* Goeze, *Versuch einer Naturgeschichte der Eingeweidewürmer thierischer Körper*, 63-65 Blankenburg.

1926. *Parascaris equorum* Yorke and Maplestone, *Nematode parasites of vertebrates*. 261 London.

Material : One♀ Z.S.I. Reg. No. ZEV3934/7; host Horse, location-Stomach, locality Calcutta, West Bengal.

Diagnosis : Male : Body 150-280 long; tail flattened ventrally, with slight alae; caudal papillae 79-105 pairs, irregularly arranged, of these 5 postanal, two anterior pairs of postanal papillae having double terminations; a small median papilla on the anterior lip of the cloaca.

Female : Body 180-370 long, 8 wide; vulva at about the anterior quarter of the body; eggs 0.09-0.1 in diameter, shells finely pitted.

Distribution : India : West Bengal, (Calcutta). Elsewhere : Cosmopolitan.

3. Genus *Toxascaris* Leiper, 1907

Key to species

1. Pulp of dorsal lip forms two anterior appendages, 25 pairs of preanal papillae. Spicules 0.9-1.5 mm..... *T. leonina*
 Pulp of dorsal lip forms three anterior processes. 30 pairs of preanal papillae. Spicules 0.65 mm.
 *T. transfuga*

1. *Toxascaris leonina* (V. Linstow, 1902) Railliet and Henry, 1911

1902. *Ascaris leonina* V. Linstow, *Arch. Mikr. Anot.*, **60** : 218.

1911. *Toxascaris leonina* Railliet and Henry, *C.R. Soc. Biol.*, **70**(1) : 15.

Material : Several examples, Z.S.I. Reg. Nos. W732/1; host Lion (*Panthera leo*); W733/1-W735/1; host Tiger (*Panthera tigris*); W736/1-W737/1; host Leopard (*Panthera pardus*); W738/1 and W739/1; host Fishing cat (*Felis viverrina*); W740/1; host Leopard cat (*Felis bengalensis*); W741/1; host Hunting leopard (*Acinomyx jubatus*); W742/1; Indian fox (*Vulpes bengalensis*); location Stomach and intestine; locality Zoological Gardens, Calcutta, West Bengal; 3.i. 1916, 15.ii. 1910, 21.ii. 1916, 23.ii. 1918, 21.ii. 1916, 22.xii. 1919, 2.vii. 1913, 31.i. 1920, 6.v. 1919, 22.viii. 1919, 22.viii. 1919, and 12.ix. 1916 respectively.

Diagnosis : Body slender; cervical alae long and narrow. Male : Body 20-70 long; caudal end without cone-shaped appendage; caudal papillae about 30 pairs, about 25 preanal and 5 postanal, of the postanal papillae one pair double papillae; spicules equal or subequal, 0.7-1.5 long; gubernaculum absent.

Female : Body 30-100 long; tail sharply pointed; vulva in anterior third of the body; eggs almost round, covered by flat smooth shell.

Distribution : India : West Bengal, (Calcutta). Elsewhere : Cosmopolitan.

2. *Toxascaris transfuga* (Rud. 1819) Baylis and Daubney, 1922

1819. *Ascaris transfuga* Rudolphi, *Entozoorum synopsis cui accedunt mantissa duplex et indices locupletissimi*. Berolini. 273-274.

1922. *Toxascaris transfuga* Baylis and Daubney, *Mem. Indian Mus.*, Calcutta, **7**(4) : 270-272.

Material : Several examples, Z.S.I. Reg. Nos. W748/1-W754/1; host Panda (*Aelurus fulgens*); Several examples Z.S.I. Reg. Nos. W743/1-W747/1 and W755/1; host Sloth-bear (*Melursus ursinus*); location intestine; locality Zoological Gardens, Calcutta, West Bengal; 4.iv.1914, 1.iv.1916, 22.vii. 1914, 1.ii. 1913, 11.v. 1913, 8.vi. 1914, 5.viii. 1918, 24.iii. 1916, 19.v. 1914, 12.iv. 1916, 20.vii. 1914 and 4.viii. 1915 respectively.

Diagnosis : Anterior end curved dorsally; cervical alae well developed.

Male : Body 92 long, 1.8. wide; tail 0.45-0.5 long, bluntly conical, ending in a short spine; 6 pairs of postanal papillae, one pair of them large double papillae; preanal papillae more than 30 pairs; spicules very short and stout, 0.53-0.65 long, dotted with small granulations.

Female : Body 115-240 long, 2.8-4.5 wide; tail 1.4 long, bluntly conical, almost round posteriorly with small papilliform terminal tip, vulva in anterior third of the body; eggs oval, with thick smooth shell.

Distribution : India : West Bengal, (Calcutta). Elsewhere : Widely distributed in India; North America, Malaya, Borneo, Sumatra, Syria, Arctic region, Tibet (China), USSR.

Subfamily Angusticaecinae Skrjabin and Karokhin, 1945

Key to tribes

1. Intestinal caecum present, occasionally paired.
 - Female with two uterine branches *Angusticaecinea* Chabaud, 1965
 - Intestinal caecum generally absent.
 - Female with four or six uterine branches
 - *Ophidascaridinea* (Hartwich, 1954 Subfam.) Chabaud, 1965
1. Tribe *Angusticaecinea* Chabaud, 1965
 1. Genus *Amplificaecum* Baylis, 1920

Key to species

1. Male less than 15 long..... 3
 - Male more than 15 long 2
2. Gubernaculum present..... *A. phalacrocoraxi*
 - Gubernaculum absent..... *A. varani*
3. Male tail without papillae..... *A. capellae*
 - Male tail with papillae..... *A. ixobrychusi*

(T) 1. *Amplificaecum varani* Baylis and Daubney, 1922

1922. *Amplificaecum varani* Baylis and Daubney, *Mem. Indian Mus.*, Calcutta, 7 : 287-288.

Material : 2 examples, Z.S.I. Reg. No. W792/1; host common water monitor (*Varanus salvator*); location intestine; locality Zoological Gardens, Calcutta, West Bengal, 6.xi. 1913.

Diagnosis : Male : Body 22.2-24.9 long, 0.73 wide, tapering; Cuticular striations fine; interlabial grooves present; intestinal caecum wide, 0.9-1 long; tail conical, 0.16 long; preanal papillae about 32 pairs, postanal 5 pairs and a small median papillae on the anterior lip of the cloaca; spicules equal, short (0.5) and simple cylindrical, slightly tapering rods.

Female : Body 24.75 long, 0.8 wide; tail conically pointed, 0.32 long, with a pair of papillae; vulva 6.5 from anterior end; eggs oval and thin shelled.

Distribution : India : West Bengal, (Calcutta).

2. *Amplificaecum phalacrocoraxi* Chakravarty and Majumdar, 1964

(Fig. 1. A.B.C.)

1960. *Amplificaecum phalacrocoraxi* Chakravarty and Majumdar, *Proc. Zool. Soc. Calcutta*, 12 : 115-120.

Material : Host *Phalacrocorax* sp. location Stomach; locality Calcutta, West Bengal.

Diagnosis : Male 34.6 long, 0.65 wide; Female : 31.6 long, 0.67 wide; cervical papillae present.

Distribution : India : West Bengal, (Calcutta).

3. *Amplichaecum capellae* Majumdar, 1964
(Fig. 2, A.B.C.)

1964. *Amplichaecum capellae* Majumdar, *Proc. Zool. Soc., Calcutta*, **17**(1) : 113.

Material : Host *Gallinago gallinago* (= *Capella galinago*); location Stomach; locality Calcutta, West Bengal.

Diagnosis : Male : Body 8.68-14.04 long, 0.31-0.39 wide; tail conical; caudal alae absent; spicules subequal, left 1.36-2.43 and right 1.27-2.35 long.

Female : Body 15.43 long, 0.42 wide; tail as in male; vulva in the anterior half of the body (8.32 from posterior end).

Distribution : India : West Bengal, (Calcutta).

4. *Amplichaecum ixobrychusi* Majumdar and Chakravarty, 1963
(Fig. 3, A.B.C.)

1963. *Amplichaecum ixobrychusi* Majumdar and Chakravarty, *Z. Parasitenk.*, **23** : 405.

Material : Host *Ixobrychus cinamomeus*; location Stomach; locality Dum Dum, 24-Parganas (North), West Bengal.

Diagnosis : Male : 10.62 long, 0.52 wide; three lips each with a papillae; dentigerous ridges absent; interlabia present; intestinal caecum two, anteriorly directed 1.5 long, and posteriorly directed 0.36 long; tail conical 0.15 long; spicules unequal, longer 1.58 long, smaller 1.30 long; caudal papillae 3 pairs, one pair preanal, 2 pairs postanal.

Female : Body 15.43 long, 0.42 wide; tail conical 0.24 long, vulva at 5.91 from anterior end.

Distribution : India : West Bengal, (24-Parganas (North)).

2. Tribe Ophidascaridinea (Hatwich, 1954 Subfam.) Chabaud, 1965

2. Genus *Ophidascaris* Baylis, 1921

Key to species

- Parasites of pythons.....*O. filaria*
- Parasites of cobra and krait.....*O. naiae*
- Parasites of water snake 1
- 1. Vulva in anterior third of body.
 - Postanal papillae in male 2 pairs*O. gestri*
 - Vulva postequatorial.
 - Postanal papillae in male 6 pairs*O. piscatori*

1. *Ophidascaris filaria* (Dujardin, 1845) Baylis, 1921

1845. *Ascaris filaria* Dujardin, *Histoire naturelle des Helminthes on verse intestinaux*. Paris, 653-654.

1921. *Ophidascaris filaria* Baylis, *Parasitology*, Cambridge, **12**(4) : 413-414.

Material : Several examples, Z.S.I. Reg. Nos. W756/1-W768/1 and W6803/1; host *Python molurus*; location intestine; locality Zoological Gardens, Calcutta, West Bengal.

Several examples, Z.S.I. Reg. No. W769/1, host *Python molurus*; location intestine; locality Haridebpur, Tollygung, Calcutta, West Bengal.

Diagnosis : Male : Body upto 110 long, 1 wide; interlabia short and bluntly conical, interlabial grooves well developed; tail bluntly conical; Postanal papillae 6 pairs, most anterior pair with double terminations; spicules slightly unequal, rounded tips, alate, 4-4.8 long.

Female : Body upto 170 long, 1.5 wide; tail bluntly conical; vulva behind the middle of the body; eggs nearly spherical.

Distribution : India : West Bengal, (Calcutta). Elsewhere : Asia, Malaya, Vietnam, Sri Lanka, Chira, Java; Australia, Africa, Egypt.

2. *Ophidascaris gestri* (Parona, 1889) Baylis, 1921

1889. *Ascaris gestri* Parona, *Ann. Mus. Civico Genova*, Ser. II, 7 : 768.

1921. *Ophidascaris gestri* Baylis, *Parasitology*, Cambridge, 12(4) : 417.

Material : 3 examples, Z.S.I. Reg. No. W6804/1; host *Natrix piscator*; location intestine, locality Salt Lake, Calcutta, West Bengal; 4.iii.1968, Coll. Y Chaturvedi.

Diagnosis : Male 55-67 long, 1 wide; tail with a terminal spike; caudal papillae 12 pairs, 10 pairs preanal and 2 pairs postanal; spicules long, equal, and rounded tips.

Female : Body 55-78 long, 1 wide; tail short, with a terminal spike; vulva in the anterior third of body, inconspicuous.

Distribution : India : West Bengal, (Calcutta, Shibpur, Howrah); Dibrugarh, Assam.

Elsewhere : Burma, North Tenasserim.

(T) 3. *Ophidascaris piscatori* Soota and Chaturvedi, 1970 (Fig. 4. A, B)

1970. *Ophidascaris piscatori* Soota and Chaturvedi, *Proc. Indian Acad. Sci. Bangalore*, B, 71(3) : 103-104.

Material : One ♂ Z.S.I. Reg. No. W6825/1; host the checkered keel-back Snake (*Natrix piscator*); location Stomach; locality Birati, 24 Parganas (North), West Bengal; Coll. S.C. Roy, 19.vii.1968.

4 examples, Z.S.I. Reg. No. W6826/1, other particulars as above.

Diagnosis : Male : Body 85.17-86.54 long, 1.38-1.4 wide; spicules equal, 2.97-3.03 long, alate with rounded tips; caudal papillae, postanal 6 pairs, preanal clearly discernible about 40.

Female : Body 86.16-95.3 long, 1.51-1.54 wide; vulva post equatorial, 57.23-64.5 from anterior end.

Distribution : India : West Bengal, (24 Parganas (North)).

4. *Ophidascaris naiae* (Geddoelst, 1916) Baylis, 1921

1916. *Ascaris naiae* Geddoelst, *Extraits de la Revue Zool. Africaine*. Bruxelles. 1 : 3.
 1921. *Ophidascaris naiae* Baylis, *Parasitol.*, Cambridge, 12(4) : 418.

Material : Several examples, Z.S.I. Reg. No. W160/1; host Indian Cobra (*Naja tripudians*); location intestine; locality Calcutta, West Bengal; 10.xi.1917; Coll. B. Prashad.

Diagnosis : Male : Body 52.0 long; tail 0.2 long; Caudal papillae 41 pairs, about 35 pairs preanal, 6 pairs postanal; spicules slightly unequal and blunt tips, upto 5.04 and 4.64 long.

Female : Body 56.7 long; tail conical, 0.24 long; vulva behind the middle of the body; eggs elliptical, thick, finely punctate shells.

Distribution : India : West Bengal, (Calcutta). Elsewhere : Africa, Belgian Congo.

Subfamily Toxocarinae (Hartwich, 1954, fam.) Osche, 1958

Key to Genera

1. Interlabia absent. Intestinal caecum absent. Cervical alae present. Lips without dentigerous ridges. Parasites of mammals (carnivora and elephants) *Toxocara* Stiles, 1905
 Interlabia present. Intestinal caecum present. Cervical alae absent. Lips with dentigerous ridges. Parasites of birds *Porrocaecum* Railliet and Henry, 1912

1. Genus *Toxocara* Stiles, 1905

Key to species

- Parasite of dog tribe *Toxocara canis*
 Parasite of cat tribe..... *T. mystax*

1. *Toxocara canis* (Werner, 1782) Stiles, 1905

1782. *Lumbricus canis* Werner, *Vermium intestinalium brevis expositionis continuatio*. 11-13. Lipsiae.
 1905. *Toxocara canis* Stiles, *U.S. Deptt. Agric., Bur. Anim. Ind. Bull.* (79) : 150.

Material : Several examples Z.S.I. Reg. No. W730/1; host Indian fox (*Vulpes benglensis*); and Reg. No. W731/1; host Indian wolf (*Canis pallipes*); location intestine; locality Zoological Gardens, Calcutta, West Bengal; 17.xii. 1913 and 24.iv. 1913. 2 exs. Z.S.I. Reg. WN 650; host domestic dog; location intestine; Loc Baharampur, Murshidabad District; West Bengal, 15.viii. 1975; Coll. R.K. Ghosh.

Diagnosis : Male : body 50-100 long; anterior lobes of the pulp of the lips digitiform, tapering and convergent; cervical alae long and narrow, spicules about 0.75-1.0 long.

Female : Body 50-180 long; egg 0.075 0.08 in diameter.

Distribution : India : West Bengal, (Calcutta, Murshidabad). Elsewhere : Cosmopolitan in distribution.

2. *Toxocara mystax* (Zeder 1800) Baylis, 1936

1800. *Fusaria mystax* Zeder, *Erster Nachtrag Zur Naturgeschichte der Eingeweidewürmer*, 45-47 Leipzig.

1936. *Toxocara mystax* Baylis, *F.B.I., Nematoda*, Vol. I; 60.

Material : Several examples, Z.S.I. Reg. Nos. W719/1-721/1; host domestic cat; location intestine; locality Indian Museum Building, Calcutta, West Bengal; 24.iv. 1915 and 22.iii. 1915; Coll. N. Anandale.

Several example, Z.S.I. Reg. No. W722/-W725/1; host *Panthera pardus*; location intestine; locality Zoological Gardens, Calcutta; 28.ii. 1920, 13.i. 1920, 22.xii. 1919 and 19.i. 1920.

Several example, Z.S.I. Reg. No. W726/1; host *Felis chaus*; location intestine; locality same as above; 1.iv. 1914. Several example, Z.S.I. Reg. Nos. W727/1 and W728/1; host *Felis viverrina*; location intestine; locality same as above; 11.xi. 1914 and 2.vii. 1913.

Several examples Z.S.I. Reg. No. W729/1; host *Felis viverrina*; location intestine; locality Tollygang, Calcutta, West Bengal, 9.iv. 1920.

Diagnosis : Male : Body 30-70 long; pulp of the lips with two long, digitiform anterior lobes; cervical alae broad; spicules slightly unequal, 1.6-2 long.

Female : Body 40-108 long; eggs 0.065-0.075 in diameter.

Distribution : India : West Bengal, (Calcutta). Elsewhere : Cosmopolitan.

2. Genus *Porrocaecum* Railliet and Henry, 1912

Key to species

- Parasite of birds of prey..... 1
 Parasite of herons, egrets, crane etc..... 2
 1. Pulp of dorsal lip with two bifurcated anterior lobes..... *P. depressum*
 Pulp of dorsal lip with two rounded anterior lobes, each bearing a flattened and expanded process..... *P. angusticolle*
 2. Male with about fifteen pairs of preanal papillae. Spicules about 1.25 mm long..... *P. ardeae*
 Male with five pairs of preanal papillae. Spicules about 0.5 mm long. *P. reticulatum*
 Male with 18 pairs of preanal papillae, gubernaculum present..... *P. ibidis*

1. *Porrocaecum depressum* (Zeder, 1800) Baylis, 1920

1800. *Fusaria depressa* Zeder, *Erster Nachtrag Zur Naturgeschichte der Eingeweidewürmer*, 37-38 Leipzig.

1920. *Porrocaecum depressum* Baylis, *Parasitology*, Cambridge [Eng.], 12 : 261.

Material : Several examples, Z.S.I. Reg. No. W775/1; host vulture (*Aegyptius monachus*); location intestine; locality Zoological Gardens, Calcutta, West Bengal; 10.i.1913.

Diagnosis : Male . Body slender, 24-100 long; interlabia small; tail with terminal prolongation bearing 5 pairs of small papillae and a large pair of double papillae; preanal papillae 17 pairs.

Female : Body 30-112 long; vulva in anterior third of the body; eggs with double shells, thickened at the poles and with fine dots.

Distribution : India : West Bengal, (Calcutta). Elsewhere : Europe, Asia (Russian Turkestan), South America (Brazil and British Guiana) and Africa (Transval).

2. *Porrocaecum angusticolle* (Molin, 1860) Baylis and Daubney, 1922

1860. *Ascaris angusticollis* Molin, *Sitz. K. Akad. wiss., Wein.*, **40** : 336-337.

1922. *Porrocaecum angusticolle* Baylis and Daubney, *Mem. Ind. Mus.*, Calcutta, **7** : 275-277.

Material : 8 examples, Z.S.I. Reg. No. W3996/1, and 4 examples Z.S.I. Reg. No. W6815/1; host Kite (*Milvus migrans govinda*); location intestine; locality Calcutta, West Bengal. 8.iii. 1960 and 2.vii. 1959.

Diagnosis : Male : Body upto 55 long; tail conical, 0.39 long; a distinct constriction halfway from cloacal aperture to tip of tail; postanal papillae 5 pairs, one pair double papillae; spicules equal, non alate, 0.95 long.

Female : Body 40-90 long; tail blunt, 0.7 long; a pair of caudal papillae 0.2 from the tip; vulva dividing the body length in ratio of 3 : 5; eggs 0.085-0.093 X 0.058-0.074 in diameter.

Distribution : India : West Bengal, (Calcutta). Elsewhere : Europe (Austria), Africa (Egypt).

3. *Porrocaecum ardeae* (Frolich, 1802) Baylis, 1936

1802. *Ascaris ardeae* Frolich, *Beitrag Zur Naturgeschichte der Eingewidewiirmer. Naturf. Halle*, **29** : 44-45.

1936. *Porrocaecum ardeae* Baylis, *Fauna of British India, Nematoda*, **1** : 73.

Material : Several examples, Z.S.I. Reg. No. W777/1; host common crane (*Grus grus*); location intestine; locality Zoological Gardens, Calcutta, West Bengal; 20.iii. 1915.

Several examples, Z.S.I. Reg. Nos. W778/1 and 779/1; host demoiselle crane (*Anthropoides virgo*); location intestine; locality same as above; 23.vii. 1915 and 9.i. 1913.

Diagnosis : Male : Body 40-55 long, 1.0 wide; a pair of lateral alae extending throughout the length of the body; tail with digitiform prolongation; 5 pairs papillae on it; in addition 15 pairs of preanal and one pair of double postanal papillae; spicules equal 1.25 long, with wide alae.

Female : Body upto 160 long, 2-4 wide; eggs 0.1X0.078 in diameter, the outer surface reticulate.

Distribution : India : West Bengal, (Calcutta). Elsewhere : Europe, South America (Brazil), North America and Africa (Transval).

4. *Porrocaecum reticulatum* (V. Linstow, 1899) Baylis and Daubney, 1922

1899. *Ascaris reticulata* V. Linstow, *Mitt. Zool. Mus. Berlin*, **1** : 7.

1922. *Porrocaecum reticulatum* Baylis and Daubney, *Mem. Ind. Mus.*, Calcutta, **7** : 278-280.

Material : Several examples, Z.S.I. Reg. No. W780/1; host purple heron (*Ardea purpurea*), location-intestine; locality Zoological Gardens, Calcutta, West Bengal; 11.xi. 1915.

Several examples, Z.S.I. Reg. Nos. W781/1 and W782/1; host night heron (*Nycticorax nycticorax*); location intestine; locality as above; 9.iv. 1916, 20.ix. 1915.

Diagnosis : Male : Body upto 56 long, 0.81 wide; tail 0.27-0.36 long, with finger like appendage, with 2 very small pairs papillae; an additional postanal pair of large papillae just anterior to the constriction; preanal papillae 5 pairs; spicules tubular, non-alate 0.35-0.57 long; gubernaculum present (Baylis and Daubney 1922), 0.3 long.

Female : Body upto 87 long, 1.6 wide; eggs 0.107-0.112 X 0.086-0.092 in diameter; shell reticulate.

Distribution : India : West Bengal, (Calcutta). Elsewhere : Africa (Porto Alegre), Asia (China, Japan and Astrakhan) and Australia (Queensland).

5. *Porrocaecum ibidis* (Mapleston 1932)

1932. *Belanisakis ibidis* Mapleston, *Rec. Ind. Mus.*, Calcutta, **34** : 229-261.

Material : 5 examples, Z.S.I. Reg. No. WN270; host Tawny wood owl (*Strix aluco nivicola*); location intestine; locality Ghoombhanjang, Darjeeling District, West Bengal; 20.vi. 1974; coll. T.D. Soota, also from *Ibis melanocephalus*; locality Zoological Gardens, Calcutta.

Diagnosis : Male : Body 18.7-24 long, 0.38-0.54 wide; interlabia and cervical alae present; tail bluntly conical, 0.22-0.33 long; caudal papillae 10 pairs discernible, 7 preanal and 3 postanal; spicules stout, equal, bluntly pointed, 0.38-0.5 long; gubernaculum 0.066-0.088 long.

Female : Body 34.6 long, 0.73 wide; vulva 17.7 from anterior end.

Distribution : India, West Bengal, (Calcutta, Darjeeling).

Subfamily Multicaecinae (Hartwich, 1954 fam.) Campana Rouget, 1960

Key to tribes

1. Ventriculus with two anteriorly and three posteriorly directed appendices of different sizes.....
..... Multicaecinae Campana-Rouget, 1960
- Ventriculus without appendices..... Dujardinascaridinea Campana-Rouget, 1960

Tribe Multicaecinae Campana-Rouget, 1960

Key to genera

1. Lips without dentigerous ridges. Interlabia absent. Behind the lips, cuticular thickening consisting of about sixteen transversely striated ribs. Parasites of crocodilians.....
..... *Typhlophorus* V. Linstow, 1906
- Lips with dentigerous ridges. Interlabia present. Cuticular thickening behind the lips absent. Parasites of crocodilians..... *Multicaecum* Baylis, 1923

1. Genus *Typhlophorus* V. Linstow, 1906.

1. *Typhlophorus lamellaris* V. Linstow, 1906

1906. *Typhlophorus lamellaris* V. Linstow, *Journ. and Proc. Asiatic Soc., Bengal*, n.s., **2(7)** : 269-271.

Material : Host Gharial (*Gavialis gangeticus*); location Stomach; locality Zoological Gardens, Calcutta, West Bengal.

Diagnosis : Male : body 11 long, 0.31 wide; cephalic collar 0.12 long; ventriculus and intestinal caecum present; tail conical, 1/141 of the body length; spicules equal, 0.6 long; 4 pairs of preanal papillae.

Female : Body 16 long 0.32 wide; tail tip bent dorsally; two rounded projections in front of anus; vulva pre-equatorial; uterine branches opposed; oviparous, eggs 0.073 X 0.062 in diameter thick-shelled.

Distribution : India : West Bengal, (Calcutta).

2. Genus *Multicaecum* Baylis, 1923

1. *Multicaecum agile* (Weld. 1862) Baylis, 1923

1862. *Ascaris agilis* Wedle, *Sitzungsb. K. Akad. Wiss. Math. Naturw. classe. Wien.*, **44** : 467-468.

1923. *Multicaecum agile* Baylis, *parasital*, **15** : 222-232.

Material : Several examples, Z.S.I. Reg. No. W1604/1; host-Gharial (*Gavialis gangeticus*); location Stomach; locality Zoological Gardens, Calcutta, West Bengal.

Diagnosis : Male : Caudal alae absent; caudal papillae 10 pairs, 5 pairs postanal and five pairs preanal; spicules equal; gubernaculum present.

Female : Vulva near middle of body; tail straight, with a pair of papillae near the tip.

Distribution : India : West Bengal, (Calcutta). Elsewhere : Africa.

(T) 2. *Multicaecum gangeticum* (Maplestone, 1930) Hartwich, 1974

1930 *Polycaecum gangeticum* Maplestone, *Rec. Indian Mus.*, Calcutta, **32** : 388-391.

1974. *Multicaecum gangeticum* Hartwich, *CIH key to nematode Parasites of vertebrates*, No. 2 : 12.

Material : 1 ex. immature female; Z.S.I. Reg. No. W1605/1; host Gharial (*Gavialis gangeticus*); location intestine; locality Zoological Gardens, Calcutta, West Bengal.

Diagnosis : (Based on a single immature female) Body 11.5 long, 0.226 wide; mouth surrounded by three lips; lips not marked off by a groove from the body; interlabia absent; ventriculus giving off five caeca; two anterior caeca very unequal of the three posterior caeca the middle one much shorter than the other two; vulva in the middle of the body; 5.75 from anterior end; tail straight, 0.176 long, blunt tipped surrounded by a fine cuticular point.

Distribution : India : West Bengal, (Calcutta).

2. Tribe Dujardinascaridinea Compans-Rouget, 1960

1. Genus *Dujardinascaris* Baylis, 1947

* 1. *Dujardinascaris dujardini* (Travassos, 1920) Baylis, 19471920. *Dujardinia dujardini* Travassos, *Arch. Esc. Sup. Agric. Med. Vet.*, 4(1) : 15.1947. *Dujardinascaris dujardini*, Baylis, *Ann. Mag. nat. Hist.* London, (VI), 14 : 123-124.

Material : Several examples, Z.S.I. Reg. No. W793/1; host - *Crocodilus porosus*; location - intestine; locality Port Canning, 24-parganas district (South), West Bengal.

Diagnosis : Male : Body about 18 long, 0.6 wide; tail conical, 0.11 long; preanal papillae 5 pairs, postanal papillae 4 pairs; spicules equal, 8 long; gubernaculum 0.3-0.32 long.

Female : Body 35-40 long, 2.2 wide; tail 0.3 long; vulva 16 from anterior end; eggs subglobular 0.075 in diameter.

Distribution : India : West Bengal, (24-Parganas (South)). Elsewhere : Africa.

2. Family ANISAKIDAE (Railliet & Henry, 1912, Subfam.) Skrjabin and Karokhin, 1945

Key to Subfamilies

1. Cuticle with spines 2
Cuticle without spines 3
2. Lips flattened and expanded out wards. Interlabia absent. Intestinal caecum present. Spicules subequal. Parasites of fishes, rarely in reptiles Goeziinae Travassos, 1919
3. Excretory system ribbon like. Intestinal caecum absent. parasites of mammals, birds reptiles and fishes Anisakinae Railliet & Henry 1912
Excretory system not ribbon like. Intestinal caecum present. Parasite of fishes Rapidascariidinae Hartwich, 1954

Subfamily Anisakinae Railliet & Henry, 1912

Key to tribes

1. Oesophagus with oblong to cylindrical ventriculus. Appendix absent. Intestinal caecum present or absent. Lips with dentigerous ridges Anisakinea Chabaud, 1965
Oesophagus with reduced globular ventriculus giving off one or two elongated appendices. Intestinal caecum present. Lips with or without dentigerous ridges Contracaecinea Mozgovi & Shakhmatova, 1971

1. Tribe Anisakinea Chabaud, 1965

1. Genus *Terranova* Leiper and Atkinson, 1914(T) 1. *Terranova pristis* (Baylis and Daubney, 1922) Johnston and Mawson, 19451922. *Porrocaecum pristis* Baylis and Daubney, *Mem. Indian Mus.*, 7 : 280.1945. *Terranova pristis* Johnston and Mawson, *Rep. B.A.N.Z. Antarctic Res. Exped.* 5 : 111.

* *Dujardinia helicina*, recorded by Baylis (1923, 1936) was Synonymised with *Dujardinascaris dujardini* by Yamagute (1961).

Material : One example, Z.S.I. Reg. No. W784/1; host Saw fish (*Pristis perrotteti*); location intestine; locality Hooghly River, at Uluberia, Howrah district, West Bengal, 18.viii.1913.

Diagnosis : Male : Body upto 26.6 long; 0.74 wide; lips small with dentigerous ridges, narrow, bilobed; interlabia absent; ventriculus and intestinal caecum present; tail 0.38 long, conical with slight caudal alae; spicules non-alate, equal, 0.9 long; caudal papillae 47 pairs, 40 preanal. 7 postanal and a medium papillae on anterior lip of cloaca.

Female : Body 34.2 long, 1.06 wide; tail bluntly conical, 0.44 long, with a pair of caudal papillae, 0.162 from tip, vulva 12.3 from anterior end.

Distribution : India : West Bengal, (Howrah).

2. Tribe *Contracaecina* Mozgovoi and Shakhmatova, 1971

Key to genera

1. Caudal papillae only one pair.

Spicules equal.

Parasites of birds *Duplicaecum* Majumdar & Chakravarty 1963

Caudal papillae many. Spicules equal or subequal. Parasites of fish-eating birds and marine mammals..... *Contracaecum* Railliet and Henry, 1912.

1. Genus *Duplicaecum* Majumdar & Chakravarty, 1963

1. *Duplicaecum ibisi* Majumdar & Chakravarty, 1963

(Fig. 5, A,B,C)

1963. *Duplicaecum ibisi* Majumdar & Chakravarty, *Z. Parasitenkunde*, Berlin, 23 : 405-410.

Material : Host Cattle Egret (*Bubulcus ibis coromandus*); location-Stomach; locality Dum Dum, 24-Parganas (North), West Bengal.

Diagnosis : Body with striae; interlabia present; dentigerous ridges absent, head separated from body by a groove; oesophagus with short ventriculus; two oesophageal appendices; intestinal caecum present.

Male : Body 34.48 long, 0.78 wide; oesophagus 3.49 long; tail curved ventrally, conical, 0.19 long; spicules stout, simple, equal, tip blunt, 2.1 long; only one pair of postanal papillae; gubernaculum absent.

Female : Unknown.

Distribution : India : West Bengal, (24-Parganas (North)).

2. Genus *Contracaecum* Railliet and Henry 1912

Key to species

1. Parasite of Ganges dolphin..... *C. lobulatum*

Parasite of birds..... 2

2. Parasites of cormorants *C. spiculigerum*
 Parasites of herons, egrates, stork etc. 3
3. Interlabia without transverse processes 4
 Interlabia with transverse processes *C. tricuspe*
4. Male with nine pairs of postanal papillae. Spicules 3.28 mm *C. rosarium*
 Male with ten pairs postanal papillae. Spicules 1.8 mm *C. engonium*

1. *Contracaecum spiculigerum* (Rud. 1809) Ralliet & Henry, 1912

1809. *Ascaris spiculigerum* Rudolphi, *Entozoorum Sire vermium intestinalium historia naturatis*, 2 : 290
 Amstelaedami.

1912. *Contracaecum spiculigerum* Railliet & Henry, *Bull. Soc. Path. Exot.*, 5 : 256.

Material : 2 examples, Z.S.I. Reg. No. W787/1; host : Indian shag (*Phalacrocorax fuscicollis*);
 location intestine; locality Calcutta, West Bengal, India; 25.viii.1913.

Diagnosis Male : Body 30-45 long, 0.9 wide; tail conically pointed; caudal papillae 38-56
 preanal and 7 pairs postanal; spicules alate, upto 8 long.

Female : Tail conical; vulva at about the anterior third of the body.

Distribution : India : West Bengal, (Calcutta). Elsewhere : Cosmopolitan.

2. *Contracaecum rosarium* (Connal, 1912) Baylis, 1920

1912. *Ascaris rosarius* Connal, *J. Lond. School. Trop. Med.*, 1(3) : 233-234.

1920. *Contracaecum rosarium* Baylis, *Ann. and Mag. Nat. Hist. London*, Ser 9, vol 6 : 233-294.

Material Several examples, Z.S.I. Reg. No. W788/1; host : Indian Shag (*Phalacrocorax fuscicollis*);
 location intestine; locality Calcutta, West Bengal; 25.viii.1913.

Diagnosis : Preanal papillae numerous; Postanal papillae 9 pairs, the 5th from the posterior end
 being double; spicules alated.

Female : Vulva at 1.59 from anterior end. vagina 0.17 long.

Distribution : India : West Bengal, (Calcutta). Elsewhere West Africa.

3. *Contracaecum haliaeti* Baylis & Daubney, 1923

1923. *Contracaecum haliaeti* Baylis and Daubney, *Rec. Indian Mus.*, Calcutta, 25(6) : 556.

Material : 5 examples, Z.S.I. Reg. No. W 6807/1; host Kite (*Milvus migrans*); location
 Gizzard; locality Chandni Chowk, Calcutta; 2.vii. 1959, coll. B.S. Chauhan.

Diagnosis : Male : Body 50 long, 1.5 wide; dorsal tip 0.11 long, 0.15 wide.

Female : Vulva in front of the middle of the body.

Distribution : India : West Bengal, (Calcutta). Elsewhere : Philadelphia, North America.

4. *Contracaecum tricuspe* (Gedoelst, 1916) Baylis, 1920

1916. *Kathleena tricuspis* Gedoelst, *Rev. Zool. Africana* (Bruxelles), 5(1) : 1-90.

1920. *Contracaecum tricuspe* Baylis, *Parasitol*, 12 : 262.

Material : Several examples, Z.S.I. Reg. No. W790/1; host Indian darter (*Anhinga melanogaster*); location-Proventriculus; locality Calcutta, West Bengal. 25.viii. 1913.

Diagnosis : Male 13.8 long, 0.785 wide; at least 56 pairs of caudal papillae; Spicules 4.6 long.

Female : Body 21.1-17.5 long, 0.96-1.28 wide; tail with a pair of papillae; vulva at anterior 2/5 of body.

Distribution : India : West Bengal, (Calcutta). Elsewhere : Africa (Belgian Congo).

(T) 5. *Contracaecum engonium* Baylis and Daubney, 1922

1922. *Contracaecum engonium* Baylis and Daubney, *Mem. Indian Mus.*, Calcutta, 7 : 284-285.

Material : One ♂ Z.S.I. Reg. No. W1006/1; host – Black stork (*Ciconia nigra*); location ?; locality Zoological Gardens, Calcutta West Bengal.

Diagnosis : Male : Body 13 long, 0.57 wide postanal papillae 10 pairs, spicules equal, 1.8 long.

Distribution : India : West Bengal, (Calcutta).

6. *Contracaecum lobulatum* (Schneider, 1866) Baylis and Daubney, 1923

1866. *Ascaris lobulata* Schneider, *Monographic der Nematoden*, Berlin. 193.

1923. *Contracaecum lobulatum* Baylis and Daubney, *Rec. Indian Mus*, Calcutta; 25(6) : 557.

Material : Host *Platanista gangetica* location mouth, stomach, small and large intestines; locality Ganges and Hooghly River, West Bengal.

Diagnosis : Male : Body 30-40 long, 1.1 wide; lips longer than broad; dorsal lip about 0.2 long, 0.17 wide; interlabia nearly as long as the lips; oesophageal appendix very short, and intestinal caecum very long; preanal papillae about 7 pairs, postanal papillae 12 pairs arranged very irregularly; spicules 2.37 long.

Female : Tail 0.5 long, vulva at about the anterior quarter of the body.

Distribution : India : West Bengal, (Hooghly River).

Subfamily Goeziinae Travassos, 1919

Genus *Goezia* Zeder, 1800

(T) 1. *Goezia gavialidis* Maplestone, 1930

1930. *Goezia gavialidis* Maplestone, *Rec. Indian Mus*. Calcutta, 32 : 391-394.

Material : One example, Z.S.I. Reg. W1606/1; host – Gharial (*Gavialis gangeticus*); location Stomach; locality Zoological Gardens, Calcutta, Coll. P.A. Maplestone.

Diagnosis : Male unknown.

Female : Body 6.6 long, 0.6 wide; vulva 2.8 from anterior end; oesophagus 0.75 long, with posterior bulb; oesophageal appendix thin, 1.5 long; tail 0.2 long.

Distribution India : West Bengal, (Calcutta).

Subfamily Raphidascaridinae Hartwich, 1954

Tribe Lappetascaridinea (Rasheed, 1965, subfam.) Hartwich, 1974

Genus *Lappetascaris* Rasheed, 1965

1. *Lappetascaris lutjani* Rasheed, 1965

(Fig. 6 A, B, C)

1965. *Lappetascaris lutjani* Rasheed, *J. Helminth.*, **39**(4) : 313.

Material : Several examples, Z.S.I. Reg. No. WN 350; host *Ilisha feligera*; location intestine; locality Calcutta fish market; 21.ii. 1977; coll. T.D. Soota.

Diagnosis : Male : Body 8.0-32.5 long, 0.1-0.66 wide; lips 3, somewhat rectangular; dorsal lip with two double papillae, venterolaterals each with one double, one single papilla and a lateral amphid; cuticular collar or ring present behind the lips; tail 0.05-0.11 long, with papilla like process at tip; spicules similar, alate, equal or subequal 1.77-3.2 long, distally with blunt, conical, bifid tip caudal papillae 17-20 pairs, 14-17 preanal, 3-4 postanal.

Female : Body 11.17-35.0 long, 0.25-1.1 wide; vulva pre-equatorial, 4.23-7.80 from anterior end; eggs 0.03-0.047 X 0.036-0.045 oval.

Distribution : India : West Bengal (Calcutta, 24-Parganas (South)); Bombay, Maharashtra; Karaikal, Pondicherry. Elsewhere : Pakistan, Karachi.

Superfamily (2) COSMOCERCOIDEA

1. Family COSMOCERCIDAE (Railliet 1916 Subfam.) Travassos, 1925

Subfamily COSMOCERCINAE Railliet, 1916

Key to genera

- 1 Caudal papillae two types, rosette and simple*Cosmocercoides* Wilkie, 1930
Caudal papillae one type, simple*Oxysomatium* Railliet & Henry, 1916

1 Genus *Cosmocercoides* Wilkie, 1930

1. *Cosmocercoides dukae* (Holl, 1928) Travassos, 1931

(Fig.- 7)

1928. *Cosmocerca dukae* Holl, *J. E. Michell Scient. Soc.* **43** : 184-186

1931. *Cosmocercoides dukae* Travassos, *Mems. Inst. Oswaldo Cruz.* **25** : 237-298.

Material : Several examples, Z.S.I. Reg. No. WN195-197; hosts Himalayan toad (*Bufo himalayanus*) and Pelobatid toad (*Megophrys* sp.); location intestine; locality Karsiyang and Manibhanjan, Darjeeling District, West Bengal; 9.v. 1975 & 18.v. 1975; coll. T.D. Soota.

Diagnosis : Male : Body 6.2-6.4 long; lateral alae present; spicules equal, 0.16-0.18 long; gubernaculum 0.13-0.15 long; caudal papillae 41 and of two types, 10 simple and small postanal and in pairs; and 31 rosettes, of which 23 preanal in two rows with uneven numbers, 10 in one and 13 in the other and 8 adanal grouped together; tail 0.2-0.24 long and pointed.

Female : Body 6.9-7.1 long; vulva 4.0-4.2 from anterior end; eggs 0.066 X 0.044 in diameter; tail 0.27-0.33 long and pointed.

Distribution : India : West Bengal, (Darjeeling); U.P., Mukteswar, Nainital, Western Himalayas. Elsewhere : U.S.A., North Carolina and Texas.

2. Genus *Oxysomatium* Railliet & Henry, 1916

Key to species

- 1. Gubernaculum present..... *O. macintoshii*
 Gubernaculum absent..... 2
- 2. Caudal papillae 16 pairs; spicules 0.21 long.....*O. anurae*
 Caudal papillae 13 pairs; spicules 0.16 long..... *O. stomatici*

1. *Oxysomatium anurae* Biswas & Chakravarty, 1963

(Fig. 8. A, B)

1963. *Oxysomatium anurae* Biswas & Chakravarty, *Z. Parasitenkunde*, Berlin, 23 : 420.

Material : Host - *Bufo melanostictus*; location rectum; locality Barasat, 24-parganas (North), West Bengal.

Diagnosis : Male : Body 2.37 long, 0.2 wide; lateral alae large; tail tapering, 0.23 long, spicules equal, slender, 0.21 long; caudal papillae 16 pairs, 4 pairs preanal, one adanal and 11 pairs postanal and an unpaired anterior to cloaca; gubernaculum absent.

Female : Body 4.23-5.0 long, 0.33-0.36 wide; tail filamentous, 0.42-0.5 long; vulva 2.18-2.40 from anterior end; viviparous.

Distribution : India : West Bengal, (24-Parganas (North)).

2. *Oxysomatium macintoshii* (Stewart, 1914) Karve, 1927

1914. *Oxysoma macintoshii* Stewart, *Rec. Ind. Mus.*, Calcutta, 10 : 165-193.

1927. *Oxysomatium macintoshii* Karve, *Ann. and Mag. Nat. Hist.*, (9) : 20 : 620-628.

Material : Several examples; Z.S.I. Reg. Nos. W6860/1-6876/1, WN269, WN651 WN658: hosts - Toad (*Bufo melanostictus*), Frog (*Rana tigrina* and *Rana cyanoflictis*); location intestine and rectum; locality - Birati, 24-Parganas District (North); Bhasna, 24-Parganas District (South); Bardhaman, Bardhaman District; Seuri, Bankura District; Gonpur, Sainthia and Tarapith, Birbhoom District; Bhaharampur, Murshidabad District; Amta, Howrah district; Atiamochar, Coochbehar District; Purulia, Purulia District; Kulik, West Dinajpur District; Sukna, Darjeeling District, West Bengal, India. 22.iv.1968, 26.vii. 1968, 26.iv. 1967, 12.vii. 1967, 26.vii. 1967, 12.xi. 1968, 26.vi. 1967, 12.vii. 1967, 26.iv. 1967, 14.1. 1966, 22.ii. 1968; 16.iv. 1974, 23.v. 1977, 4.iv. 1984, 30.iii. 1984, 21.xii. 1985, 30.viii. 1983, 12.v. 1977, 27.xi. 1988. Collectors : S.C. Roy, T.D. Soota, R.K. Ghosh, A.K. Mondal, D.K. Kundu and S.R. Dey Sarkar.

Diagnosis : Male : Body 2-2.5 long; lateral alae extend throughout greater part of the body, spicules equal relatively long about 0.24 long; gubernaculum 0.0224 - 0.032 long; caudal papillae 27 pairs, 18 pairs postanal and 9 pairs preanal.

Female : Body 3-6 long; vulva at about middle of the body; tail narrow 0.35-0.41 long; eggs 0.3-0.338 X 0.186-0.226 in diameter; viviparous.

Distribution : India : West Bengal, (Calcutta, Coochbihar, Bardhaman, Bankura, Birbhoom, Darjeeling, Murshidabad, Purulia, 24-Parganas (North & South)). Elsewhere : Burma; Africa; Tanganika Niger valley.

3. *Oxysomatium stomatici* Biswas & Chakravarty, 1963 (Fig. 9-A, B)

1963. *Oxysomatium stomatici* Biswas & Chakravarty, *Z. Parasitenkunde*, Berlin, **23** : 422.

Material : Host *Bufo stomaticus*; location rectum; locality - Calcutta, West Bengal.

Diagnosis : Male : Body 1.37 long, 0.17 wide; lateral alae present; tail tapering 0.12 long; spicules equal, slender, 0.16 long; caudal papillae 13 pairs, 4 preanal and 9 postanal; gubernaculum absent.

Female : Body 2.7-2.9 long, 0.17-0.18 wide; tail 0.18-0.21 long; vulva 1.40-1.45 from anterior end; viviparous.

Distribution : India : West Bengal, (Calcutta).

2. Family KATHLANIIDAE (Lane, 1914 Subfam.) Travassos, 1918

Key to subfamilies

1. Pharyngeal part of oesophagus without longitudinal rows of denticles.

Intestinal diverticulum absent..... Kathlaniinae Lane, 1914

Pharyngeal part of oesophagus with three longitudinal rows of denticles.

Intestinal diverticulum present Cruzeiinae (Travassos, 1917) Ortlepp, 1924

Subfamily Kathlaniinae Lane, 1914

1. Genus *Falcaustra* Lane, 1915

Key to species

1. Preanal sucker and gubernaculum present 2

Preanal sucker and gubernaculum absent..... 3

2. Spicules 1.13 long..... *F. barbi*

Spicules 2.9 long.....*F. kempi*

3. Caudal papillae 10 pairs and an unpaired median*F. leptcephala*

Caudal papillae 23 pairs*F. bengalensis*

4. Preanal sucker absent; gubernaculum present*F. brevispiculata*

(T) 1. *Falcaustra barbi* Baylis and Daubney, 1922

1922. *Falcaustra barbi* Baylis and Daubney, *Mem. Indian Mus.*, Calcutta, 7 : 305-306.

Material : Several examples. Z.S.I. Reg. No. W848/1-849/1; host *Tor tor*; location intestine; locality Torsa River, Falakata, Jalpaiguri district, West Bengal; 23.i. 1914, coll. T. Southwell.

Diagnosis : Male : Body 15.2-16.5 long, 0.65-0.7 wide; head almost globular, followed by a neck; buccal cavity, Pharynx and prebulbular swelling present; tail 0.6 long; sucker 3.7 from caudal end; spicules equal, 1.13 long; gubernaculum 0.2 long, caudal papillae 10 pairs, and a median unpaired preanal papillae.

Female : Body 15.5-19.6 long, 0.65-1.0 wide; tail 0.65-0.8 long, with a pair of very small inconspicuous papillae; vulva 6.25-7.3 from posterior end; eggs 0.075 X 0.05 in diameter.

Distribution : India : West Bengal, (Jalpaiguri). Elsewhere : Africa, Sudan.

2. *Falcaustra brevispiculata* (Baylis, 1935) Petter, 1979

1935. *Spironoura brevispiculata* Baylis, *Ann. & Mag. Nat. Hist* (10) 16 : 187-192.

1979. *Falcaustra brevispiculata* Petter, *Bull. Mus. natn. Hist.*, Paris, 4th Ser., 1(4) p. 1012.

Material : Twelve ♂♂ and ♀♀, Z.S.I. Reg. No. W6767/1; host *Rana hexadactyla*; location intestine; locality Sujapur and Falta, 24-Parganas (South); 5.xi. 1965. Several ♂♂ and ♀♀; Z.S.I. Reg. No. W6768-69/1; host and location same as above; locality Salt Lake, Calcutta; 7.viii. 1967, coll. Sujit Chakraborty.

Diagnosis : Male : Body 10.5-13.5 long, 0.5 to 0.7 wide; head wider than neck, 0.12-0.15 wide; buccal cavity with pharynx 0.15-0.18 long; tail 0.43-0.5 long, conical and tapering, distally forming a terminal spike about 0.13-0.15 long; preanal sucker absent; spicules equal 0.28-0.35 long gubernaculum present; caudal papillae 10 pairs, an unpaired preanal median.

Female : Body 13.5-14.7 long; 0.5 to 0.7 wide; oesophagus including bulb about 1.9 long; tail as in male 0.5-0.6 long, with a pair of lateral papillae; vulva about 5.5-6.0 from posterior end; eggs 0.12-0.46 X 0.068 0.08 in diameter.

Distribution : India : West Bengal, (Jalpaiguri). Elsewhere : Sri Lanka. Colombo.

(T) 3. *Falcaustra kempi* (Baylis and Daubney 1922) Chabaud, 1978

1922. *Zanclophorus kempi* Baylis and Daubney, *Mem. Indian Mus.*, Calcutta I : 312-313.

1978. *Falcaustra kempi* Chabaud, *CIH Key No. 6*. p. 12

Material : Five examples, ZSI. Reg. N. W856/1; host *Testudo elongata*; location intestine; locality Baradighi, Jalpaiguri, Jalpaiguri District, West Bengal; 9.viii. 1916; coll. W.L. Travers.

Diagnosis : Male : Body 10.9 12.8 in length, 1.0-1.1 wide; preanal sucker deep and muscular about 1.1 from the cloaca; tail 0.45 to 0.55 long; spicules 2.9 long, 0.1 wide; gubernaculum deeply cleft in front; caudal papillae 9 pairs, an unpaired preanal median.

Female : Body 13.4-15.8 long, 1.2-1.4 wide; tail bluntly conical 0.55-0.8 long; with a pair of papillae 0.27 from the tip; vulva 4.0-4.8 from the posterior end, eggs 0.125-0.137 X 0.075 0.085 in diameter.

Distribution : India : West Bengal, (Jalpaiguri).

(T) 4. *Falcaustra leptocephala* Baylis & Daubney, 1922

1927. *Falcaustra leptocephala* Baylis and Daubney, *Mem. Indian Mus.*, Calcutta, **7** : 306-307.

Material : 4 examples, Z.S.I. Reg. No. W850/1; host *Tor tor*; location intestine; locality Torsa River, Falacata, Jalpaiguri District, West Bengal; 23.i. 1914; coll. T. Southwell.

Diagnosis : Male : Body upto 19.0 long, 1.3 wide; head very narrow, "neck" absent; preanal sucker absent; spicules equal 1.0 long; gubernaculum absent, caudal papillae 10 pairs, an unpaired preanal median.

Female : Body upto 27.0 long, 1.4-1.8 wide; anterior end as in male; tail 1.1-1.3 long, with a pair of papillae 0.6 from the tip; vulva 11.0 from posterior end.

Distribution : India : West Bengal, (Jalpaiguri).

5. *Falcaustra bengalensis* Manna & Mahapatra, 1989

1989. *Falcaustra bengalensis* Manna & Mahapatra, *Indian Journal of Animal Health*, **28**(2) : 133-137.

Material : Host A turtle (*Geoclemys hamiltoni*), location-intestine, locality Baruipur, 24-Parganas (South), West Bengal.

Diagnosis : Male : 12.7-13.5 long, 0.61-0.66 wide; pharynx 0.7-0.12, oesophagus 2.53-2.89 long; oesophageal bulb 0.57-0.61 long, 0.33-0.57 wide; tail pointed; spicules equal, 0.45-0.51 long; caudal papillae 23 pairs, 4 preanal and 19 postanal.

Female : Body 13.5-15 long, 0.66-0.70 wide; pharynx 0.07-0.16 long; oesophagus 2.80-2.88 long; tail pointed; vulva at the posterior two third of the body; eggs thick shelled, 0.10-0.13 X 0.09 in diameter.

Distribution : India, West Bengal, (24-Parganas (South)).

Subfamily *Cruziinae* (Travassos, 1917 fam.) Ortlepp, 1924

1. Genus *Pseudocruzia* Wolfgang, 1953

(T) 1. *Pseudocruzia orientalis* (Maplestone, 1930) Wolfgang, 1953

1930. *Cruzia orientalis* Maplestone, *Rec. Indian Mus.*, Calcutta, **32** : 78-80.

1953. *Pseudocruzia orientalis* Wolfgang, *Can. J. Zool.*, **31** : 16-19.

Material : 9 examples, Z.S.I. Reg. No. W1541/1, host domestic pig; location Caecum and intestine; locality Calcutta, West Bengal, coll. P.A. Maplestone.

Diagnosis : Dorsal lip very prominent, ventrolateral lips marked off from the body by a deep groove; pharynx with 19-23 rows of teeth; intestinal caecum present. Male Body 13 17.9 long; tail about 0.25 long; spicules subequal, alate, 0.86-1.03 long; gubernaculum 0.18-0.1 long.

Female : Tail tapering; 0.69-0.71 long; vulva about the middle of the body, not prominent; eggs thick shelled, 0.12 X 0.056-0.06 in diameter.

Distribution : India : West Bengal, (Calcutta).

3. Family ATRACTIDAE (Railliet, 1917 subfam.) Travassos, 1919

Key to genera

1. Lips distinct 2
 Lips not very distinct..... 3
2. Tail of male terminated by long filament. Parasites of Equidae and primates
 *Probstmayria* Ransom, 1917
 Tail long and attenuated in both sexes. Parasites of fishes and reptiles
 *Monhysterides* Baylis & Daubney, 1922
3. Vulva separated from rectum and anus. Parasites of reptiles and amphibians
 *Atractis* Dujardin, 1845

Genus *Atractis* Dujardin, 1845

Key to species

- Parasite of tortoises *A. granulosa*
 Parasite of iguanas *A. opeatura*

1. *Atractis granulosa* (Railliet and Henry, 1912) Thapar, 1925

1912. *Atractis dactyluris* (Rudolphi, 1819) var. *granulosa*, Railliet & Henry Bull. Soc. Path. Exot. Paris 5 : 259.

1925. *Atractis granulosa* Thapar, J. Helm. London, 3(3-4) : 135.

Material : Several examples, Z.S.I. Reg. No. W845/1; host *Testudo elongata*; location intestine; locality Baradighi, Jalpaiguri, Jalpaiguri District, West Bengal, 9.viii. 1918.

Diagnosis : Mouth with six lips, not very distinct. Male : Body 4.7-5.25 long; posterior half curved; in the posterior region of the body, a yellowish longitudinal band present on each side of mid ventral line; caudal papillae 10 pairs, 4 preanal and 6 postanal; spicules unequal longer 0.415-0.5 long, shorter 0.106-0.118 long; gubernaculum, conical and hollow, 0.126-0.13 long.

Female : Body 5-5.7 long; vulva about 0.09 from the anus; eggs ellipsoidal, 0.48-0.5 X 0.2-0.225 in diameter.

Distribution : India : West Bengal, (Jalpaiguri).

2. *Atractis opeatura* Leidy, 1891

1891. *Atractis (Ascaris) opeatura* Leidy, Proc. Acad. Nat. Sc. Phila., 42(3) s.v. 20, 411-412.

Material : Several examples, Z.S.I. Reg. No. W846/1; host an Iguana; location intestine; * locality Zoological Gardens, Calcutta, West Bengal; 26.xii. 1912.

Diagnosis : Male : Body spirally coiled, 4-5 long; caudal papillae 8 pairs, 4 postanal, one adanal and 3 preanal; spicules transversely striated, longer 0.42-0.44 long, shorter 0.19-0.29 long; gubernaculum tubular 0.1-0.176 long.

Female : Body 5-6.22 long, not coiled; vulva about 0.3 from the anus; eggs shell membranous 0.18-0.19 X 0.062-0.079 in diameter.

Distribution : India : West Bengal, (Calcutta). Elsewhere : New Providence Isl.

**Remarks* : The host *Iguana* is not a native of India. Baylis and Daubney (1922) recorded this species from an *Iguana* in captivity in the Zoological Gardens, Calcutta.

2. Genus *Monhysterides* Baylis & Daubney, 1922

(T) 1. *Monhysterides piscicola* Baylis and Daubney, 1922

1922. *Monhysterides piscicola* Baylis and Daubney, *Mem. Indian Mus.*, Calcutta, 7 : 78-80.

Material : One example, Z.S.I. Reg. No. W941/1; host Mahseer, (*Tor tor*); location intestine; locality Torssa River, Falakata, Jalpaiguri District, West Bengal; 23.i. 1914, coll. T. Southwell.

Diagnosis : Male : Body 3.5-4 long, 0.15-0.2 wide; cuticular striations fine; oesophagus divided into two parts, anterior short, muscular, 0.2 long, posterior long, granular but also muscular, 0.32 long; tail 0.34 long, tapering to a point; spicules unequal, left 0.21 long, right 0.08 long; caudal papillae 9 pairs, 4 preanal, 5 postanal.

Female : Body 3.7-4.4 long, 0.15-0.2 wide; anterior end as in male; tail 0.55-0.65 long tapering; vulva 0.45 from anus.

Distribution : India : West Bengal, (Jalpaiguri).

3. Genus *Probstmayria* Ransom, 1917

(T) 1. *Probstmayria simiae* Maptestone, 1931

1931. *Probstmayria simiae* Maptestone, *Rec. Indian Mus.*, Calcutta, 33 : 141-144.

Material : Several examples, Z.S.I. Reg. No. W1594/1; host *Hyalobates hoolock*; location intestine; locality Zoological Gardens, Calcutta; coll. P.A. Maptestone.

Diagnosis : Oesophagus divided into two parts; anterior cylindrical and the posterior flask shaped. Male : Body 1.5-1.6 long; tail 0.36 long, with 4 pairs of papillae; spicules unequal and dissimilar, 0.04 and 0.08 long.

Female : Body 1.6-1.8 long; vulva at about the middle of the body; with prominent lips; viviparous.

Distribution : India : West Bengal, (Calcutta).

Superfamily (3) HETERAKOIDEA

1. Family ASCARIDIIDAE Travassos, 1919

Genus *Ascaridia* Dujardin, 1845

Key to species

1. Parasites of columbiformes. spicules 1.2 to 1.9 long..... *Ascaridia columbae*
 Parasites of Galliformes birds..... 2
 Parasites of cranes..... 3
2. Third pair of caudal papillae of male from anterior end subventral..... *A. galli*
 Third pair of caudal papillae of male from anterior end lateral *A. compar*
3. Male with six pairs of preanal papillae *A. cristata*
 Male with three pairs of preanal papillae..... *A. stroma*

1. *Ascaridia galli* (Schrank, 1788) Freeborn, 1923

1788. *Ascaris galli* Schrank, *München*, 116 p.

1923. *Ascaridia galli* Freeborn, *Science*, N.Y. [new ser.], **57** : 692-693.

Hosts : Common fowl, turkey, guinea fowl and domestic duck, blood pheasant (*Ithaginis cruentus*); **location** intestine, oesophagus, gizzard and oviduct; **locality** : Zoological Gardens, Calcutta, West Bengal.

Diagnosis : Male : Body 30-80 long; 0.49-1.21 wide; tail 0.48-0.85 long; preanal sucker 0.2-0.24 from cloaca, 0.2-0.28 in diameter : caudal alae narrow; caudal papillae 10 pairs, variable in number and position; spicules equal, rarely slightly unequal, 1-2.5 long.

Female : Body 60-123 long, 0.9-1.86 wide; tail 1-1.88 long; vulva usually in the middle of the body; eggs 0.065-0.088 X 0.04-0.05 in diameter.

Distribution : India : West Bengal, (Calcutta). Elsewhere : Cosmopolitan in distribution.

2. *Ascaridia compar* (Schrank, 1790) Travassos, 1913

1790. *Ascaris compar* Schrank, *Acad. n. Handl.*, Stockholm [ners. ser.] 11 : 118.

1913. *Ascaridia compar* Travassos, *Mem. Inst. Oswaldo cruz, Rio de Janeiro Mamguinhos*, **5** : 289.

Material : Host Chakor (*Alectoris graeca chukar*); **location** Stomach, small intestine; **locality** Zoological Gardens, Calcutta, West Bengal.

Diagnosis : Male : Body 36-54 long, 1.2 wide; tail 1/66 of total body length; caudal alae present; preanal sucker oval, 0.34 X 0.3 in diameter; caudal papillae 10 pairs, 4 preanal and 6 postanal, spicules 1.78 long.

Female : Body 65-96 long, 1.6 wide; tail about 1 long; eggs 0.08 X 0.091 in diameter.

Distribution : India : West Bengal, (Calcutta). Elsewhere : North America (U.S.A.), Asia (Philippines, Taiwan), Europe (England, Germany, Italy), Finland, Australia & USSR.

3. *Ascaridia columbae* (Gmelin, 1790) Travassos, 1913

1790. *Ascaris columbae* Gmelin, *Systema naturae & C. Edito decima tertia*. Pt 6 : 3034.

1913. *Ascaridia columbae* Travassos, *Mem. Inst. Oswaldo Cruz, Riode Janeiro Manguinhos*, 5 : 291-292.

Material : Host *Columbia livia*, *Crocopus phoenicopterus* and other pigeons; location small intestine; locality – Zoological Gardens, Calcutta, West Bengal.

Diagnosis : Male : Body 16-70 long, 0.7-1.1 wide; lateral alae present in the cervical region; tail about 0.48 long; caudal alae narrow; preanal sucker 0.15-0.2 in diameter; caudal papillae typically 14 pairs, 9 preanal and 5 postanal; spicules, equal 1.2-1.9 long.

Female : Body 20-95 long, 1.2-2.5 wide; tail conical, with a terminal spike, 1.1-1.2 long; vulva near midbody; eggs 0.06-0.09 X 0.04-0.05 in diameter.

Distribution : India : West Bengal, (Calcutta). Elsewhere : Cosmopolitan.

4. *Ascaridia cristata* (V. Linstow, 1901) Railliet and Henry, 1914

1901. *Heterakis cristata* V. Linstow, *Jena. Zeitschr. f. Naturw.* 35 (n. F. 28) : 409-428.

1914. *Ascaridia cristata* Railliet & Henry, *9 Cong. internat. de Zool, Rennes (Monaco, 113)* : 678.

Material : Host Sarus crane (*Grus antigone*); location : intestine; locality Zoological Gardens, Calcutta, West Bengal.

Diagnosis : Male : Body 35-38 long, 1.1-1.34 wide; cervical alae present; tail conical 0.62 long; caudal papillae 13 pairs, 6 preanal and 7 postanal in position; spicules slender and alate, 0.95 long.

Female : Body 38-57 long, 1.1-1.76 wide; tail 0.7 long; vulva 20 from anterior end; eggs 0.085-0.091 X 0.058-0.062 in diameter.

Distribution : India : West Bengal, (Calcutta).

Elsewhere : Africa, Congo.

5. *Ascaridia stroma* (V. Linstow, 1899) Railliet and Henry, 1914

1899. *Heterakis stroma* V. Linstow, *Mitt. Zool. Mus., Berlin*, 1(2) : 11.

1914. *Ascaridia stroma* Railliet and Henry, *Ext. IXe. Congress Internat. Zool., Monaco, 1913* : 678.

Material : Host : *Grus grus*, *Grus antigone*, *Grus paradisea*; location - intestine; locality - Zoological Gardens, Calcutta, West Bengal.

Diagnosis : Male : Body 25 long, 0.8 wide; broad cervical alae present; oesophagus 1/16, tail 1/47 of total length; caudal papillae 10 pairs, 3 preanal, 1 adenal and 6 postanal in position; spicules equal.

Female : Body 56 long, 1.70 wide; tail 1/117 of total body length; with digitiform prolongation; eggs 0.172 X 0.146 in diameter.

Distribution : India : West Bengal, (Calcutta). Elsewhere : Africa and Germany.

2. Family HETERAKIDAE Railliet & Henry, 1912

Key to subfamilies

- 1. Caudal alae present 2
- Caudal alae present or absent 3
- 2. Interlabia present. Caudal alae well developed, supported by long, narrow papillae. Few sessile papillae on tail. Parasites of birds, rarely mammals *Heterakinae* Railliet & Henry, 1912
- Interlabia absent. Caudal alae supported by few pairs of large fleshy papillae. Many sessile papillae on tail. Parasites of amphibians, reptiles and mammals. *Meteterakinae* Inglis, 1967
- 3. Caudal papillae numerous, sessile. Spicules equal or subequal. Parasites of amphibians and reptiles *Spinicaudinae* Travassos, 1920

Subfamily Heterakinae Railliet & Henry, 1912

Key to genera

Cordons or labial grooves absent. Spicules unequal or equal. Preanal sucker present. Parasites mainly of Galliformes birds, one species in mammals. *Heterakis* Dujardin 1845

Cordons or labial grooves present. Spicules very unequal and dissimilar. Preanal sucker present. Parasites of phasianid birds in India, Burma etc. *Pseudaspidodera* Baylis & Daubney 1922

1. Genus *Heterakis* Dujardin, 1845

Key to species

- Parasites of birds 1
- Parasite of mamal (rats)..... *H. spumosa*
- 1. Spicules of male unequal..... 2
- Spicules of male equal or subequal..... 7
- 2. Longer spicule about 2 long 3
- Longer spicule about 1.0 long or less 5
- 3. Shorter spicule with a double curve near the tip *H. gallinae*
- Shorter spicule with a barb near the tip..... 4
- 4. Longer spicule with simple point; barb of shorter spicule small..... *H. pavonis*
- Tip of longer spicule spear-shaped; barb of shorter spicule large and massive *H. bosia*
- 5. Longer spicule about 1.0 long; shorter spicule about 0.3-0.4 long *H. indica*
- Longer spicule less than 1.0 long..... 6
- 6. Longer spicule little over 0.3 in length *H. parva*
- Longer spicule 0.5 or more in length..... *H. vulvolabiata*

7. Spicules about 2.0 long *H. isolonche*
 Spicules much less than 2 long 8
8. Spicules about 0.4-0.6 long; preanal sucker 0.1 in diameter *H. papillosa*
 Spicules less than 0.4 long; preanal sucker less than 0.1 in diameter *H. beramporia*

1. *Heterakis gallinae* (Gmelin, 1790) Freeborn, 1923

1790. *Ascaris gallinae* Gmelin, *Caroli a Linne. Systema naturae & C. Editio decima tertia pt. 6*, 3034.

1923. *Heterakis gallinae* Freeborn, *Nicotine as a poultry vermifuge. Science, N.Y., new ser.*, **57** : 692-693.

Material : Several examples, Z.S.I. Reg. Nos. W801/1-W810/1; hosts *Lophophorus impejanus*, *Tragopan satyra*, *Tragopan* sp., *Francolinus gularis*, and *Galloperdix spadicea*; location intestine and caecum; locality Zoological Gardens, Calcutta.

Male : Body 7-13 long, 0.24-0.4 wide; oesophagus including bulb about 1.0-1.1 long; caudal alae broad; tail about 0.3-0.5 long; Sucker well developed, 0.1-0.2 from the cloaca; caudal papillae 12 pairs; 4 pairs between the cloaca and tail tip, 4 pairs pedunculated papillae, 2 pairs sessile papillae near the cloaca and 2 pairs pedunculated papillae in the vicinity of the sucker; spicules, unequal, dissimilar, right 1.6-2.6 long with narrow alae, and a simple, conical tip, left 0.6-1.3 long with broad alae and double curve.

Female : Body 8.0-15.0 long; tail tapering, and pointed 1-1.2 long, with a pair of papillae; vulva 3.7-4.75 from posterior end; eggs oblong 0.063-0.075 X 0.036-0.048 in diameter.

Distribution : India : West Bengal, (Calcutta). Elsewhere : Cosmopolitan in distribution.

2. *Heterakis indica* Maplestone, 1932

1932. *Heterakis indica* Maplestone, *Rec. Ind. Mus.*, Calcutta, **34** : 229-261.

Material : Host domestic fowl; location intestine; locality Calcutta market. coll. P.A. Maplestone.

Diagnosis : Male : Body 5.6-7.2 long, 0.22-0.28 wide; caudal papillae as in *H. gallinae*, longer spicule approximately 1-1.2 long, shorter about 0.3-0.4 long and bifid tip.

Female : Body 7.2-7.38 long, 0.25-0.32 wide; eggs 0.062-0.068 X 0.032-0.036 in diameter.

Distribution : India : West Bengal, (Calcutta).

3. *Heterakis pavonis* Maplestone, 1932

1932. *Heterakis pavonis* Maplestone, *Rec. Ind. Mus.*, Calcutta, **34** : 229-261.

Material : Host Silver pheasant (*Gennaues nycthemerus*); location intestine; locality Zoological Gardens, Calcutta; Coll P.A. Maptestone.

Diagnosis : Male : Body 6.8-7.2 long, 0.25-0.27 wide; tail 0.44-0.475 long; Sucker 0.068-0.072 in diameter and 0.11-0.12 from the cloaca; longer spicule 1.68-1.89 long, shorter with a brab, about 0.6-0.7 long.

Female : Body 8.8-10.1 long, 0.36-0.44 wide; tail 0.91-1.07 long; eggs 0.068-0.076 x 0.038-0.044 in diameter.

Distribution : India : West Bengal, (Calcutta).

(T) 4. *Heterakis bosia* Lane 1914

1914. *Heterakis bosia* Lane, *Indian J. Med. Res.*, Calcutta, **2** : 657-58.

Material : One ♂ and one ♀, Z.S.I. Reg. No. ZEV 6860/7; host- Crimson horned pheasant, *Tragopan satyra* (= *Ceriornis satyra*); location Caecum ? locality Zoological Gardens, Calcutta; coll. M.N. Bose. Several examples, ZSI Reg. No. 811-816/1; host *Tragopan satyra*; location caeca and intestine; locality Zoological Gardens, Calcutta.

Diagnosis : Male : Body 8-9.8 long, 0.26-0.47 wide; lateral alae present, beginning at about 0.2 from anterior end and extending about the level of the sucker; tail about 0.55-0.69 long; sucker about 0.15 from the cloaca; caudal papillae 12 pairs, 4 preanal, 2 adanal, and 6 postanal; spicules unequal, longer about 1.5-1.85 long, its proximal end wide like a spear head, distal end sharply pointed; shorter spicule about 0.9-1 long, with a one sided massive barb.

Female : Body 9.5-11.1 long, 0.26-0.4 wide; tail 1.2-1.5 long, and caudal papillae 0.8 from the tip; vulva slightly posterior to middle of the body; eggs 0.068-0.08 X 0.035-0.04 in diameter.

Distribution : India : West Bengal, (Calcutta).

(T) 5. *Heterakis parva* Maplestone 1931

1931. *Heterakis parva* Maplestone, *Rec. Indian Mus.*, Calcutta, **33** : 128-29.

Material : One ♂ and one ♀, Z.S.I. Reg. No. W1588/1; host *Euplocamus nyctemerus*; location intestine; locality Zoological Gardens, Calcutta; coll. P.A. Maplestone.

Diagnosis : Body 4.68 long, 0.247 wide; lips not separated from the body by a groove; lateral alae absent; tail 0.356 long; caudal papillae 14 pairs, 7 pairs "paracloacal" group (4 lateral and 3 subventral) a small subventral pair near the isolated lateral pair between this group and the posterior group; spicules similar and unequal, longer 0.317 long, shorter 0.277 long.

Female : Body 6.03 long, 0.376 wide; tail 0.549 long; vulva at 2.65 from posterior end, with slightly prominent lips.

Distribution : India : West Bengal, (Calcutta).

(T) 6. *Heterakis vulvolabiata* Chandler, 1926

1926. *Heterakis vulvolabiata* Chandler, *Indian J. Med. Res.*, Calcutta, **13** : 620-21.

Material : One ♂ Z.S.I. Reg. No. W1360/1; host-*Arboricola torqueola*; location caeca and intestine; locality Zoological Gardens, Calcutta; coll. A.C. Chandler.

Diagnosis : Male : Body 6-7 long, 0.25 wide; lips semi-globular; lateral alae narrow, tail 0.23-0.32 long; preanal sucker small 0.05 in diameter; caudal papillae 13 pairs; spicules very unequal and dissimilar, left 0.29-0.32 long, right slender and bristle like 0.535-0.6 long.

Female : Body 7-8 long, 0.265 wide; tail tapering and sharp pointed 0.54 long; vulva posterior to middle of the body, with prominent lips; eggs 0.550-0.06 X 0.035 in diameter.

Distribution : India : West Bengal, (Calcutta).

7. *Heterakis isolenche*. V Linstow, 1906.

1906. *Heterakis isolenche* V. Linstow, *Soplia Zeylanica*, **1**, (3) : 252.

Material : Several examples, Z.S.I. Reg. Nos. W796-99/1, host-*Tragopan satyra*; location intestine and caeca; locality Zoological Gardens, Calcutta; 20.iv. 1914; 23.iii. 1914; 12.iv. 1917 and 22.i. 1920. 2 examples, Z.S.I. Reg. No. W800/1; host *Lophophorus ? impejanus*; location intestine; locality Zoological Gardens, Calcutta; 1.iii.1914; 4 examples, Z.S.I. Reg. No. W1357-58/1; host *Lophura rufa*; location intestine and caeca; locality Zoological Gardens, Calcutta, 8.i. 1926. coll. A.C. Chandler; 2 examples, Z.S.I. Reg. No. 1359/1, host *Polyplectron bicalcaratum*, location caecum; locality Zoological Gardens, Calcutta, coll. A.C. Chandler.

Diagnosis : Male : body 7-15 long, 0.25-0.55 wide; tail 0.4-0.8 long; sucker about 0.6-1.06 from posterior end; caudal papillae 12 pairs, arranged as in *H. gallinae*; the spicules broadly alated, subequal, longer about 1-2.23 and shorter about 0.72-1.9 long.

Female : Body 7.3-17 long; 0.35-0.6 wide; tail 0.83-1.75 long slender and pointed; vulva a little anterior to middle of body; eggs 0.065-0.08 X 0.035 0.046 in diameter.

Distribution : India : West Bengal, (Calcutta, Murshidabad). Elsewhere Europe; Germany, France and England; North America U.S.A. and Canada.

8. *Heterakis papillosa* (Bloch, 1782) Railliet, 1885

1782. *Ascaris papillosa* Bloch, *Abhandlung von der Erzeugung der Eingeweiderwürmer und den Mitteln wider diesselben*. Berlin. pp.32.

1885. *Heterakis papillosa* Railliet, *Elements de Zoologie medicale et agriole*, Paris 324p.

Material : 2 examples, Z.S.I. Reg. No. W794/1; host *Phasianus torquatus*; location intestine; locality Zoological Gardens, Calcutta, 13.v. 1919. 2 examples, Z.S.I. Reg. No. W795/1; host ? *Arboricola torquella*; location intestine; locality Zoological Gardens, Calcutta; West Bengal, 12.iv. 1913.

Diagnosis : Male : Body 7.3-13 long, 0.22-0.63 wide; lateral alae narrow broader in the oesophageal region, extending almost throughout the body; caudal alae broad; tail with a long terminal filament; preanal sucker very prominent, 0.11-0.22 in diameter; spicules equal 0.39-0.61 long.

Female : Body 8.9-20 long; vulva posterior to middle of body; eggs 0.068-0.075 X 0.042-0.048 in diameter.

Distribution : India : West Bengal, (Calcutta). Elsewhere : Europe : Germany, Leipzig; Asia, Russian Turkestan.

(T) 9. *Heterakis berhamporia* Lane, 1914

1914. *Heterakis berhamporia* Lane. *Indian J. Med. Res.*, Calcutta, 2 : 658-60.

Material : 3 examples, Z.S.I. Reg. No. ZEV 6861/7; host-domestic fowl; location Caeca; locality Baharampur, Murshidabad District, West Bengal; coll. C. Lane.

Diagnosis : Male : Body 5-6 long; 0.26 wide; lateral alae present; tail 0.37 long; preanal sucker 0.12 from the cloaca, and 0.055 in diameter; spicules nearly equal, 0.35 and 0.3 long, the longer with a tapering curved point, the shorter expending in the terminal third and with a prominent angle on the ventral surface near the point; caudal papillae 12 pairs, arranged as in *H. gallinae*.

Female : Body 6-8 long, 0.3 wide; curved ventrally somewhat abruptly at about the level of the vulva; tail 0.66 long, with a pair of papillae at 0.33 from the tip; vulva at the middle of the body; eggs 0.05-0.66 X 0.03-0.038 in diameter.

Distribution : India : West Bengal, (Murshidabad). Elsewhere : Malaya and Philippines.

10. *Heterakis spumosa* Schneider, 1866

1866. *Heterakis spumosa* Schneider, Monographie der Nematoden. Berlin 77.

Material : Eleven examples, Z.S.I. Reg. No. ZEV 6863/7; host-*Rattus norvegicus*; location lumen of caecum; locality Baharampur, Murshidabad district, West Bengal, coll. T. Southwell; Donor C. Lane. Several ♂♂ and ♀♀, ZSI Reg. Nos. W6840-41/1; host-*Rattus rattus*; location intestine; locality Calcutta, West Bengal; 28.i. 1963, coll. R.P. Mukherjee. Several ♂♂ and ♀♀, Z.S.I. Reg. Nos. W6842-43/1; host *Bandicoota indica*; location intestine and caecum; locality Calcutta, W. Bengal, 20.xi. 1965; Several examples, Z.S.I. Reg. No. WN 659; host *Rattus rattus*; location-intestine; locality-Malda, Malda Dist., West Bengal, 22.xii.1983; coll. S.R. Dey Sarkar.

Diagnosis : Male : Body 6.4-9.85 long, 0.26-0.33 wide; lateral alae beginning at about 0.2 from anterior end and extended upto preanal sucker; tail 0.25-0.3 long; caudal alae wide anteriorly; sucker about 0.2 from cloaca; caudal papillae 10 pairs, paracloacal group 5 pairs, 2 near preanal sucker, and 3 posterior group; spicules subequal, flattened, tapering and longitudinally striated, 0.2-0.37 long.

Female : Body 7-13 long, 0.3-0.52 wide; lateral alae beginning at about 0.2 and extending to the tip of the tail; tail 0.68-0.9 long, with a pair of papillae at about 0.45 from the tip; vulva posterior to middle of body, with prominent lips, eggs 0.055-0.065 X 0.04-0.055 in diameter.

Distribution : India : West Bengal, (Calcutta, Murshidabad, Malda). Elsewhere : Cosmopolitan.

2. Genus *Pseudaspido*~~*dera*~~ Baylis and Daubney, 1922

Key to species

1. Longer spicule of male more than 2 long.....*P. voluptuosa*
 Longer spicule less than 1 long 2
 Longer spicule more than 1 long 3
2. Longer spicule about 0.8 long; shorter spicule 0.45.....*P. pavonis*
 Longer spicule less than 0.7; shorter spicule 0.45 long *P. spinosa*
3. Longer spicule 1.4 to 1.8 long; shorter spicule ventrally curved, about 0.6 long *P. jnanendrae*

(T) 1. *Pseudaspido*~~*dera*~~ *pavonis* Baylis & Daubney, 1922

1922. *Pseudaspido*~~*dera*~~ *pavonis* Baylis & Daubney, *Mem. Indian Mus.*, Calcutta 7 : 297-300.

Material : Several examples, Z.S.I. Reg. Nos. W840/1-W84/1; host : *Pavo muticus*, *Pavo cristatus*, *Argusianus argus*; location caeca; locality Zoological Gardens, Calcutta, West Bengal.

Diagnosis : Male : Body 6 long, 0.25 wide; cuticle finely striated; lateral alae narrow extended from a little anterior to nerve ring almost to tail; posterior part of tail simple, slender and finely pointed; caudal alae wide; circular preanal sucker 0.12-0.13 in diameter and 0.15-0.17 from cloaca;

caudal papillae 12 pairs; of these 3 pairs just anterior to filamentous portion of tail, the middle pair the more ventral and larger; a solitary forth pair projecting into alae, adanal group of 4 more or less lateral pairs pedunculated and 2 small sessile, ventral pairs, one of them preanal and the other postanal, 2 pairs pedunculated on either side of the sucker; spicules very unequal and dissimilar, longer slender and simple 0.78 long, shorter with broad alae and a barbed tip, 0.45 long.

Female : Body 7 long, 0.3 wide; tail about 1 long, straight, and tapering to a slender point; with a very minute pair of papillae; vulva posterior to middle of the body, about 3 from the tail end; two opposed uteri; eggs 0.70 X 0.04 in diameter, usually slightly thickened internally at one pole.

Distribution : India : West Bengal, (Calcutta).

(T) 2. *Pseudaspidodera voluptuosa* Chandler, 1926

1926. *Pseudaspidodera voluptuosus* Chandler, *Indian J. Med. Res.*, Calcutta, **13** : 621-622.

Material : 2 examples. Z.S.I. Reg. No. W1361/1; host *Argusianus argus* and *Rollulus rouloul*; location intestine and caeca; locality Zoological Gardens, Calcutta, West Bengal. 12 examples, Z.S.I. Reg. No. W1587/1; host-*Rollulus rouloul*; location-intestine; locality as above; coll. P.A. Maplestone.

Diagnosis : Male : Body 6.25-9.25 long, 0.325-0.38 wide; cuticle finely striated; lateral alae begin at about 0.15 from anterior end and extended upto 3/4 of body length; tail 0.36-0.39 long; caudal alae and caudal papillae similar to those of *P. pavonis*; preanal sucker 0.1 in diameter and 0.125-0.16 from cloaca; spicules very long and unequal, longer with narrow alae, tapering 2.7-3.45 long, smaller with broad alae and with a simple pointed tip 1.44-1.7 long.

Female : Body 9.35-10.15 long, 0.46 wide; tail slender and tapering, 1.05-1.25 long; vulva posterior to middle of the body, dividing the total length in the 6 : 4 ratio; eggs 0.06 X 0.068 X 0.035 0.038 in diameter.

Distribution : India : West Bengal, (Calcutta).

3. *Pseudospidodera spinosa* Maplestone, 1932

1932. *Pseudospidodera spinosa* Maplestone, *Indian J. Med. Res.*, Calcutta, **20** : 419-420.

Material : Host *Argusianus argus*; location intestine; locality-Zoological Gardens, Calcutta.

Diagnosis : Male : Body 7.8-8.5 long, 0.45-0.49 wide; cordons well developed anastomosing with a single row of spines; lateral alae absent; oesophagus including bulb 0.65-0.71 long; tail 0.39-0.45 long; "The caudal alae appear to be divided into three portions by one transverse groove between the sucker and cloaca and a second one just behind the posterior group of caudal papillae" caudal papillae similar to those of *P. pavonis*; preanal sucker 0.24-0.25 in diameter and 0.14-0.18 from cloaca; spicules similar and unequal, longer 0.614-0.673 long, and smaller 0.277-0.317 long.

Female : Body 9.3-9.5 long; tail 1.09 long; vulva 3.745-4.058 from posterior end; eggs 0.06 X 0.036 in diameter.

Distribution : India : West Bengal, (Calcutta).

(T) 4. *Pseudaspidodera jnanendrae* Chakravarty, 1938

(Fig. 10. A.B.C)

1938. *Pseudaspidodera jnanendrae* Chakravarty, *Parasitology*, Cambridge, **30** : 167-170.

Material : 16 examples, Z.S.I. Reg. No. W3332/1; host *Papo cristatus*; location intestine; locality Calcutta, West Bengal.

Diagnosis : Male : Body 5-7.1 long; cuticular striation fine lateral alae absent, recurrent branches of the cephalic cordons anastomosing; oesophagus 0.82-0.9 long; bulb 0.18-0.25 long; tail 0.35-0.43 long; caudal alae divided into three separate pieces, caudal papillae typically twelve pairs; second pair of the pedunculated paraoccal group of papillae the largest, and the third the smallest; spicules dissimilar and unequal, longer simple 1.4-1.8 long, smaller alated, tip slightly ventrally curved, 0.53-0.63 long.

Female : Body 6.2-7.5 long; tail pointed 1-1.2 long; vulva 2.7-3.6 from posterior end; vagina first directed posteriorly and then anteriorly; eggs 0.05 X 0.03 X 0.07-0.03 in diameter.

Distribution : India : West Bengal, (Calcutta).

Subfamily Meteterakinae Inglis, 1967

Key to genera

1. Cordons absent. Spicules simple. Parasites of alimentary canal of oriental amphibians and reptiles. *Meteterakis* Karve, 1930
- Cordons present. Spicules equal, similar and complex. Parasite of *Hystrix* in India
..... *Gireterakis* Lanc, 1917

Genus *Meteterakis* Karve, 1930

Key to species

1. Caudal alae well developed *M. govindi*
- Caudal alae narrow *M. mabuyae*

1. *Meteterakis govindi* Karve, 1930

1930. *Meteterakis govindi* Karve, *Ann. Trop. Med. & Parasitol*, Liverpool, **24** : 481-485.

Material : Several examples, Z.S.I. Reg. Nos. W6848/1-W6853/1; host-Toad (*Bufo melanostictus*); location intestine and rectum; locality Bhasna, 24-Parganas (South) and Birati, 24-Parganas (North), West Bengal; 7.vi. 1965, 14.i. 1966; 15.i. 1966; 16.v. 1968, coll. S.C. Roy. 6 examples, Z.S.I. Reg. No. WN660; host *Bufo melanostictus*; location rectum; locality Bhaluka, Malda District; 4.iii. 1988; coll. S.R. Dey Sarkar. 5 exs. Z.S.I. Reg. No. WN661; host *Bufo melanostictus*; location intestine; locality Baharampur, Murshidabad, District; 27.iii. 1984; coll. D.K. Kundu. 1 example, Z.S.I. Reg. No. WN 662 host *Calotes versicolor*; location intestine; locality Atiamochar, Coochbehar District; 2.ix. 1983; coll. A.K. Mondal. 10 exs. Z.S.I. Reg. No. WN 663; host *Bufo melanostictus*; location rectum; locality Kulik, West Dinajpur District; 27.ii. 1988; coll. S.R. Dey Sarkar. 3 exs. Z.S.I. Reg. No. WN 664; host *Bufo melanostictus*; location intestine; locality Amta, Howrah District; West Bengal; coll. D.K. Kundu.

Diagnosis : Male : body 5-5.4 long, 0.23 wide; lateral alae present; tail 0.17-0.2 long; caudal alae well developed; preanal sucker present, 0.07 from cloaca; caudal papillae at least 17 pairs; spicules equal and similar, tapering and very delicate distally, about 0.27 long.

Female : Body 4.6-6 long, 0.25-0.3 wide; tail with a pair of papillae, 0.26-0.34 long, tapering and pointed; vulva 2.2-2.8 from anterior end, eggs 0.075 X 0.043 in diameter.

Distribution : India : West Bengal, (24-Parganas, North and South, Darjeeling, Howrah, Malda, Murshidabad, Coochbihar and West Dinajpur). Elsewhere : Burma, Rangoon; Dacca, Bangladesh.

2. *Meteterakis mabuyae* (Chakravarty, 1944) Inglis, 1958

1944. *Africana mabuyae* Chakravarty, *J. Dept. Sc. Univ. Calcutta*, n.s.; **1(4)** : 70.

1958. *Meteterakis mabuyae* Inglis, *Parasit.*, Cambridge, **48(1-2)** : 9-31.

Material : 2 exs. Z.S.I. Reg. No. W3503/1, host *Mabuya carinata*; location intestine; coll. G.K. Chakravarty.

Diagnosis : Male : Body 4.7 long, 0.25 wide; lateral alae absent; tail curved ventrally. 0.15 long; caudal alae narrow; preanal sucker present; caudal papillae 20 pairs, 9 preanal, 3 paracloacal and 8 postanal; spicules equal, pointed, 0.3 long.

Female : Body 7.025 long, 0.35 wide; tail 0.25 long, tapering to a fine point; vulva prominent. 2.6 from anterior end.

Distribution : India : West Bengal, (Calcutta).

2. Genus *Gireterakis* Lane, 1917

1. *Gireterakis girardi* Lane, 1917

1917. *Gireterakis girardi* Lane, *Indian J. med. Res.*, Calcutta, **4** : p. 414.

Material Host *Hystrix bengalensis*; location intestine; locality Zoological Gardens, Calcutta, West Bengal.

Diagnosis : Male : Body 18-21 long, 0.9 wide; anterior end curved ventrally; lateral alae from anterior end to beginning of caudal alae; cervical papillae 0.25 from anterior end; tail 0.60 long. Caudal alae well developed; preanal sucker 0.175 from cloaca; caudal papillae 15 pairs, 4 lateral, 10 subventral and one subdorsal in position; spicules equal, similar and complex, 1.5 long.

Female : Body 24-26 long, 0.9 wide tail tapering, curved dorsally, 1.9 long; papillae 0.8 from the tip; vulva from 7-8 from anterior end; vagina directed posteriorly, uterine branches opposed; eggs 0.05 X 0.037 in diameter.

Distribution : India : West Bengal, (Calcutta).

Subfamily Spinicaudinae Travassos, 1920

Key to genera

1. Caudal alae of male not supported by papillae. Spicules equal. Parasites of amphibians and reptiles of Africa and India.....*Africana* Travassos, 1920

Caudal alae of male supported by stout papillae. Spicules, equal or subequal. Parasites mainly of reptiles, rarely amphibians. *Strongyluris* Mueller, 1894

1. Genus *Africana* Travassos, 1920

Key to species

1. Lateral alae absent. Spicules alate *A. bufonis*
 Lateral alae present. Spicules nonalate *A. varani*

1. *Africana bufonis* Biswas and Chakravarty, 1963
 (Fig. 11. A, B)

1963. *Africana bufonis* Biswas and Chakravarty, *Z. Parasitenkunde*, Berlin, **23** : 425.

Material : Host *Bufo melanostictus*; location rectum; locality Calcutta, West Bengal.

Diagnosis : Male : Body 4.29-4.96 long; 0.33-0.36 wide; lateral alae and cervical papillae absent; caudal papillae 15 pairs, 8 preanal, 7 postanal; narrow caudal alae beginning in front of the preanal sucker, and ending near the tip of tail; spicules stout, equal, similar, alate, finely pointed, 0.45-0.48 long; tail conical and sharply pointed, 0.18-0.22 long.

Female : Unknown.

Distribution : India : West Bengal; (Calcutta).

(T) 2. *Africana varani* Maplestone, 1931

1931. *Africana varai* Maplestone, *Rec. Indian Mus. Calcutta*, **33** : 139-141.

Material : Three examples and three broken pcs., Z.S.I. Reg. No. W1593/1; host *Varanus bengalensis*; location intestine; locality Zoological Gardens, Calcutta; coll. P.A. Maplestone.

Diagnosis Male : Body about 4.0-4.9 long, 0.192 wide. 0.29; lateral alae and cervical papillae present; caudal papillae 13-16 pairs and a small median papilla in front of the sucker; spicules slender, equal 0.34 long.

Female : Body about 6.0-6.11 long; 0.27-0.35 wide; tail sharply pointed 0.376 long; vulva 2.7 from the anterior end; eggs 0.068-0.072 X 0.036-0.041 in diameter.

Distribution : India : West Bengal, (Calcutta).

2. Genus *Strongyluris* Mueller, 1894

Key to species

1. Parasite of chameleon *S. chamaeleonis*
 Parasite of calotes *S. calotis*

(T) 1. *Strongyluris chamaeleonis* Baylis & Daubney, 1922

1922. *Strongyluris chamaeleonis* Baylis & Daubney, *Mem. Indian Mus.*, Calcutta, **7** : 294-297.

Material : 3 examples, Z.S.I. Reg. No. W39/1; host *Chamaeleon vulgaris*; location intestine; locality Zoological Gardens, Calcutta, West Bengal.

Diagnosis : Male : Body 6.3 long, 0.5 wide; tail including terminal spike 0.13 long; caudal alae almost circular; preanal sucker 0.9 in diameter; caudal papillae 9 pairs; spicules 1.1 long.

Female : Body 8.4-8.75 long; 0.5-0.7 wide, tail conical 0.3 long, with a pair of papillae; vulva 3.0-3.3 from posterior end.

Distribution : India : West Bengal, (Calcutta).

(T) 2. *Strongyluris calotis* Baylis & Daubney, 1923

1923. *Strongyluris calotis* Baylis & Daubney, *Ann. Mag. Nat. Hist. Ser.* : (9), 11 : 334.

Material : Several examples, Z.S.I. Reg. Nos. W6775/1-W6782/1; hosts *Calotes versicolor*, and *Calotes* sp.; location intestine; localities Krishna Sagar, Bardhaman, Bardhaman District; Calcutta; Dum Dum, 24-Parganas (North); 4.xii.1965, 19.ii. 1963 and 12.ii. 1963; coll. R.K. Ghosh.

Diagnosis : Male : Body 8.4-11.1 long, 0.4-0.5 wide; neck wider than head forming a 'shoulder' behind the base of lips; tail 0.1-0.12 long, terminal spike minute, caudal end abruptly truncate; sucker deep 0.12-0.16 in diameter; caudal papillae 10 pairs; spicules subequal 0.72-0.8 long.

Female : Body 10.0-13.65 long, 0.52-0.75 wide; tail very short, bluntly rounded with a minute terminal spike and a pair of papillae; vulva prominent 4.5-5.65 from posterior end; eggs 0.0875-0.0975 X 0.05-0.0525 in diameter.

Distribution : India : West Bengal, (Bardhaman, Calcutta, 24-Parganas (North)); Tikarpara, Orissa. Elsewhere : Pattipola, Sri Lanka; Java and South China.

Super family (4) SEURATOIDEA

1. Family CUCULLANIDAE Cobbold, 1864

Subfamily CUCULLANINAE Yorke & Maplestone, 1926

Key to genera

1. Intestinal caecum absent. Species generally of medium or large size, with thin cuticle.....
 *Cucullanus* Mueller, 1777
 Intestinal caecum present. Species generally of small size, with thick cuticle.....
 *Dichelyne* Jigerskiold, 1902

Genus *Cucullanus* Mueller, 1777

Key to species

- Precloacal sucker present 1
 Precloacal sucker absent..... 2
 1. Body with spherical cuticular thickenings *C. ritai*
 Body without spherical cuticular thickenings *C. pangasius*
 2. Spicules unequal and weavey *C. panijaseus* n. sp.

1. *Cucullanus pangasius* Soota & Chaturvedi, 1971

1971. *Cucullanus pangasius* Soota & Chaturvedi, *Zool. Anz.*, **187**, p. 310.

Material : Two examples, Z.S.I. Reg. No. WN 665; host *Pangasius pangasius*; location intestine; locality Chandkhali Block, Sundarban, 24-Parganas (South), West Bengal, 11.ix. 1983, coll. S.R. Dey Sarkar.

Diagnosis : Male : Body 30.0-32.0 long, 0.9-0.99 wide; head with two lateral lips, each bordered with narrow denticulate cuticle with three small papillae on outer surface; preanal sucker 0.044-0.055 from cloaca; tail conical, 0.26-0.31 long; spicules equal, 1.5-1.8 long; gubernaculum 0.14-0.16 long; caudal papillae 11 pairs, 1 anterior and 2 behind sucker, 4 near and 4 posterior to cloaca.

Female : Body 34.4-35.2 long, 1.27-1.32 wide; tail 0.44-0.5 long; vulva 23.4-24.2 from anterior end; eggs round, 0.044 X 0.044.

Distribution India : West Bengal, (24-Parganas (South)).

2. *Cucullanus ritai* Karve, 1952

1952. *Cucullanus ritai* Karve, *J. Univ. Bombay*, **21**(3), p. 9.

Material Host *Rita buchanani*; location intestine : locality Calcutta, West Bengal.

Diagnosis : Male : Body 7.9 long, 0.5 wide; with spherical cuticular thickening of varying size; sucker 1.02 from posterior end; tail 0.15 long, bluntly rounded, with roughly triangular spike; spicules equal, sickle-shaped, alate, 0.73 long; gubernaculum 0.095 long; caudal papillae 11 pairs, 5 preanal, 6 postanal; single median papilla just anterior to cloacal opening.

Female Body 10.9 long, 0.6 wide; tail 0.13 long bluntly round, ending in a spike; vulva 4.2 from posterior end; eggs 0.045 X 0.03 0.035.

Distribution : India : West Bengal, (Calcutta).

3. *Cucullanus panijuseus* n. sp.

(Fig. 12. A, B)

Material : Holotype ♂; Z.S.I. Reg. No. WN 666 host *Sillagionoperis panijus*, location intestine; locality Diamond Harbour, 24-Parganas (South), West Bengal; 13.ii. 1977; coll. M. Hafuzullah. Paratypes 2 ♂♂ 3 ♀♀, Z.S.I. Reg. No. WN 667; other particulars as for holotype.

Description : Cuticle thin, ala of any kind absent, oesophagus well developed; intestinal caecum absent; spicules unequal, similar, nonalate, pointed, and weavy; gubernaculum 'V' shaped; preanal sucker absent.

Male : Body 3.04-3.92 long, 0.192-0.240 wide; oesophagus 0.416-0.48 long; tail 0.096-0.176 long pointed with a terminal spike; spicules similar, unequal, non alate, pointed, longer 1.44 long, shorter 1.20 long; both the spicules weavy; gubernaculum 'V' shaped 0.084-0.008 long; caudal papillae 9 pairs, 3 preanal two adanal and 4 postanal; preanal sucker absent; caudal muscles well developed.

Female : Body 2.56-3.2 long; 0.192-0.208 wide; oesophagus 0.40-0.41 long; tail tapering to a fine point, 0.08 long, papillae or phasmid absent; vulva 1.12-1.20 from anterior end; eggs 0.032 X 0.016 in diameter.

Discussion : The present specimens come closer to *Cucullanus jalnaensis* (Kalyankar, 1971) Petter 1974, and *Cucullanus rivulatus* Soota and Dey Sarkar, 1980 in the absence of cephalic alae and in the number of caudal papillae, but differ markedly in body size being 3.04-3.92 (13.03 in *C. jalnaensis* and 4.5-7.5 in *C. rivulatus*), in having unequal weavey spicules 1.2 and 1.44 (subequal 0.55 and 0.5 in *C. jalnaensis*; equal 0.7-0.9 in *C. rivulatus*). The most distinguishing character of the present specimens is the presence of weavey spicules, not present in any other species under the genus *Cucullanus* Muellor, 1777, described sofar. Therefore, a new specific name *Cucullanus panijaseus* n. sp. is proposed for the species.

2. Genus *Dichelyne* Jigerskiold, 1902

1. *Dichelyne Wallagoni* Chakravarty & Majumdar, 1961

1961. *Dichelyne wallagoni* Chakraborty & Majumdar, *Parasitology*, **51** p. 404.

Material : Host *Walago attu*; location intestine, locality Calcutta, West Bengal.

Diagnosis : Male : Body 15.48 long, 0.5 wide; pseudo-buccal capsule 0.45 long; oesophagus 1.37 long; intestinal caecum 0.32 long; sucker 0.4 from cloaca; tail 0.35 long, ending in a spike; spicules left 2.4 long right 2.17 long; gubernaculum 0.065 long; caudal papillae 15 pairs, 6 preanal, 9 postanal.

Female : Body 13.0-15.83 long, 0.39-0.52 wide; tail 0.28-0.32 long; vulva 4.8-6.2 from posterior end.

Distribution : India : West Bengal, (Calcutta).

2. *Dichelyne trionyx* Chakravarty & Majumdar, 1961

1961. *Dichelyne trionyx* Chakravarty & Majumdar, *Parasitology*, **51** : 401-407.

Material : Host *Trionyx gangeticus*; location intestine; locality Calcutta, West Bengal.

Diagnosis : Male : Body 8.85-13.71 long, 0.31-0.46 wide; cuticle finely striated; oesophagus including pseudo-buccal capsule 1.0-1.3 long; intestinal caecum 0.19-0.28 long; nerve ring 0.41-0.53 from anterior end; preanal sucker 0.35-0.55 from cloaca; tail 0.27-0.32 long with slight cauda alae; spicules subequal, left 1.9-2.3 long, right 1.8-2.2 long; gubernaculum 0.026 long; caudal papillae 11 pairs, 5 preanal, 6 postanal.

Female : Unknown.

Distribution : India : West Bengal, (Calcutta).

Superfamily (5) SUBULUROIDEA

1. Family SUBULURIDAE (Travassos, 1914) Yorke & Maplestone, 1926

Key to subfamilies

1. Pharyngeal portions of buccal cavity not lobed or twisted but with elaborate ridges. Parasites of birds and mammals Allodapinae Inglis, 1958

Pharyngeal portions of buccal cavity more or less twisted. Parasites of mammals
Labiobulurinae Quentin, 1969

2. Peripheral and radial lobes separated. Chordal lobes helix in form. Parasites of birds and MammalsSubulurinae Travassos, 1914

Subfamily ALLODAPINAE Inglis, 1958

1. Genus *Allodapa* Diesing, 1861

Subgenus *Allodapa* Diesing, 1861

(T) 1. *Allodapa (Allodapa) turnicis* (Maplestone, 1931), Inglis, 1958

1931. *Subulura turnicis* Maplestone, *Rec. Indian Mus.*, Calcutta, **33** : 135-138.

1958. *Allodapa turnicis* Inglis, *Proc. Zool. Soc. Lond.*, **130** : 597.

Material : 2 exs. Z.S.I. Reg. No. W1592/1, host *Turnix dussumieri*; location-intestine; locality Zoological Gardens, Calcutta, West Bengal.

Diagnosis : Male : Body 11.5-13 long, 0.42 wide; mouth wide six lips, each with a papilla, caudal alae narrow; caudal papillae 12 pairs, 5 preanal and 7 postanal; spicules equal, 0.84 long; gubernaculum 0.14 long.

Female : Body 17.5 long, 0.42 wide; tail 0.5 long, with a terminal spike; and a pair of papillae about 0.13 from the tip; vulva about 7.8 from anterior end; eggs 0.068-0.074 X 0.056 in diameter.

Distribution : India : West Bengal, (Calcutta). Elsewhere : Afghanistan (Kabul).

Subfamily LABIOBULURINAE Quentin, 1969

1. Genus *Tarsubulura* Inglis, 1958

1. *Tarsubulura peramata* (Ratzel, 1868) Inglis, 1958

1868. *Subulura peramata* Ratzel, *Arch. Naturgesch.*, **34** : 150-156.

1958. *Tarsubulura peramata* Inglis, *Proc. Zool. Soc. Lond.*, **130** : 599.

Material : Host Slender loris (*Loris lydekkerianus*, *Loris gracilis*); location Intestine; locality Zoological Gardens, Calcutta, West Bengal.

Diagnosis : Male : Body 7.5-8.5 long, 0.45-0.52 wide; cervical alae extended to the posterior end of the oesophagus; tail straight, tapering and finely pointed, 0.25 long; caudal papillae 10 pairs, 4 preanal, 6 postanal; spicules equal, 2.5 long.

Female : Body 10-11.25 long, 0.57-0.7 wide; tail tapering and finely pointed, 0.75 long; vulva at about the middle of the body; eggs 0.081 X 0.065 in diameter.

Distribution : India : West Bengal, (Calcutta). Elsewhere : Sri Lanka.

Subfamily SUBULURINAE, Travassos, 1914

1. Genus *Subulura* Molin, 1860

Subgenus *Subulura* Molin, 1860

Key to species

1. Spicule equal..... 2
 Spicule subequal *S. (S.) perdicularia* n. sp.
2. Caudal papillae 11 pairs 3
 Caudal papillae 15 pairs *S. (S.) multipapillata*
3. Spicules about 0.8 long, gubernaculum with a spur *S.(S.) galloperdicis*
 Spicule about 0.9 long, gubernaculum without spur..... *S. (S.) olympioi*
4. Spicules equal or subequal caudal papillae 10 pairs..... *S. (S.) andersoni*

1. *Subulura (Subulura) andersoni* (Cobbold, 1876) Railliet and Henry, 1914

1876. *Ascaris andersoni* Cobbold, Notes Entozoa pt. 4. *Proc. Zool. Soc. Lond.* pp. 296-297.

1914. *Subulura andersoni* Reilliet and Henry, *Ext. IXC Congress Internat. Zool. Monaco*, 1913, 680.

Material : Host : *Sciurus* sp., Squirrel, (*Faunambulus pennanti*), *Rattus norvigicus*; location Intestine and Caecum; locality Zoological Gardens, Calcutta, West Bengal.

Diagnosis : Male : Body 13.5-14.9 long, 0.36-0.43 wide; cervical alae extended 0.9 from anterior end; oesophagus including bulb 1.68-2.4 long; tail curled, 0.25-0.3 long, with a terminal spike; sucker 0.115 long, 0.5-0.62 from cloaca; caudal papillae 10 pairs; spicules alated equal or subequal, 0.85-1.0 long.

Female : Body : 15.9-23.1 long, 0.4-0.53 wide; tail with a terminal spike, 1.13 long; vulva 6.5-8 from anterior end; eggs, 0.078 X 0.06 in diameter.

Distribution : India : West Bengal, (Calcutta); Madras; Nagpur (Maharashtra), North eastern India and Kanthalia.

(T) 2. *Subulura (Subulura) galloperdicis* Baylis and Daubney, 1922

1922. *Subulura galloperdicis* Baylis & Daubney, *Mem. Indian Mus., Calcutta*, 7 : 300-302.

Material : 8 examples, Z.S.I. Reg. No. W843/1; host : Red spur fowl (*Galloperdix spadicea*); Gray partridge, (*Francolinus pondichianus*); Night jar (*Caprimulgus* sp.).

Diagnosis : Male : Body 9.5-10 long, 0.3 wide; cervical alae narrow, extended about 1.0 from anterior end; tail 0.21 long with a slender terminal spike; sucker spindle-shaped 0.65 from cloaca; caudal papillae 11 pairs, 4 preanal 2 adanal and 5 postanal; spicules equal 0.76-0.8 long, 0.02 wide; gubernaculum with a spur, about 0.18 long.

Female : Body 11.5-12.5 long, 0.4 wide; tail 1.1 long; vulva in the anterior half, dividing the total length in the ratio 3 : 4; eggs 0.065 X 0.035 in diameter.

Distribution : India : West Bengal (Calcutta, Medinipur); Madhya Pradesh, Jabalpur; Rajasthan, Ajmer. Elsewhere : Arizona.

(T) 3. *Subulura (Subulura) multipapillata* (Chandler, 1926) Cram, 1927

1926. *Allodapa multipapillata* Chandler, *Indian J. Med. Res.*, Calcutta, **13** : 622-623.

1927. *Subulura multipapillata* Cram, *Bull. U.S. Nat. Mus.* (140) : 388.

Material : 2 exs. Z.S.I. Reg. No. W1363/1; host Red crested wood-quail (*Rollulus rouloul*); location - Caeca and intestine; locality-Zoological Gardens, Calcutta; gubernaculum in two parts, a narrow stout piece 0.145 long, dorsal to the spicules, and a flat piece 0.17 long, ventral to the spicules.

Diagnosis : Male : Body 6-7 long, 0.26-0.28 wide; cervical alae short and narrow; tail 0.23 long; caudal alae divided into two portion; caudal papillae 14 pairs, 8 preanal and 7 postanal; spicules equal and tubular, 0.78 long, 0.022 wide; gubernaculum in two parts, a narrow stout piece 0.145 long, dorsal to the spicules, and a flat piece 0.17 long, ventral to the spicules.

Female : Body 8-10 long, 0.35 wide; tail 2 long; vulva divided the total body length in the ratio of about 3 : 5; eggs 0.056-0.063-0.034-0.042 in diameter.

Distribution : India : West Bengal, (Calcutta).

1. *Subulura (Subulura) olympioi* Barreto, 1919

1919. *Subulura olympioi* Barreto, *Mem. Inst. Oswaldo Cruz.*, **11**(11) : 10-70.

Material : Host *Pavo cristatus*; location intestine; locality Calcutta, West Bengal.

Diagnosis : Male : Body 5-8.4 long 0.41 wide; caudal alae poorly developed; tail 0.228 long; caudal papillae 11 pairs, 3 preanal, 2 adanal, and 6 postanal; spicules equal 0.899 long; gubernaculum 0.127 long.

Female : Body 7.7-15.6 long, 0.462 wide; tail 0.976 long; vulva small, not salient, a little anterior to middle of body; eggs 0.067 X 0.050 in diameter.

Distribution : India : West Bengal, (Calcutta). Elsewhere : South America, Brazil.

5. *Subulura (Subulura) perdicularia* n. sp.

(Fig. 13. A, B)

Material : Holotype 1 ♂ Z.S.I. Reg. No. WN 668; host Jungle Bush quail (*Perdicula asiatica*); location - intestine; locality-Jhargram, Medinipur District, West Bengal, 9.ix. 1984; coll. S.R. Dey Sarkar. Paratypes 2 ♀♀, Z.S.I. Reg. No. WN 669; other particular same as for the holotype.

Description : Body slender, anterior end curved in form of a hook and posterior end attenuated, cervical alae present. Buccal cavity thick walled.

Male : Body 8.72 long, 0.32 wide; cervical alae 1.2 long; oesophagus including bulb 0.92 long, bulb 0.176 long, nerve ring 0.24 from anterior end; excretory pore 0.24 from anterior end; sucker fan shaped, without rim; tail curved, blunt, 0.144 long; caudal alae wide 0.72 long from posterior end; spicules subequal alate, longer 0.64 long, shorter 0.56 long; gubernaculum 0.08 long; caudal papillae 11 pairs, 3 preanal, 2 adanal and 6 postanal in position, the most anterior pair just in front of the sucker.

Female : Body 12.0-14.3 long, 0.54-0.56 wide; oesophagus including bulb 1.04-1.8 long, bulb about 0.24-0.3 long; tail straight, ended with a terminal spike, 0.4-0.56 long; vulva pre-equatorial, prominent, 4.4-4.64 from anterior end, eggs 0.048 X 0.032 in diameter.

Discussion : The present series comes closest to *Subulura (Subulura) bentocruzi* Barreto, 1917, in having caudal alae, subequal spicules, gubernaculum and pre-equatorial vulva, number and arrangement of caudal papillae. But differs from it in various body measurements size and shape of spicules. In the present worm the spicules are 0.64 and 0.56 long, while the same are 1.52 and 1.05 long in *Subulura (Subulura) bentocruzi*. Vulva in *S. (S.) bentocruzi* is salient, but the same is prominent in the present worm. Hence, the present worm is regarded as new to science and a new specific name *Subulura (Subulura) perdicularia* is proposed to accommodate it.

3. Order OXYURIDA

Superfamily (1) OXYUROIDEA

1. Family PHARYNGODONIDAE Travassos, 1919

Key to genera

1. Mouth with three simple lips, pharynx short or absent, vulva equatorial or pre-equatorial
.....*Pharyngodon* Diesing, 1861
- Mouth with three bilobed lips, pharynx present, vulva postequatorial.....*Thelandros* Wedl. 1862

Genus *Pharyngodon* Diesing, 1861

1. *Pharyngodon gekko* (Chakravarty and Bhaduri, 1948), Petter & Quentin, 1976 (Fig. 14. A-F)

1948. *Neopharyngodon gekko* Chakraborty and Bhaduri, *Proc. Zool. Soc. Bengal*, Calcutta, **1**(2) : 103-107.

1976. *Pharyngodon gekko* Petter & Quentin, *C.I.H. Keys to the Nematode Parasites of vertebrates*, No. 4 : 6.

Material : Host *gekko gekko*; location rectum; locality Calcutta, West Bengal.

Male : Body : 2.0-2.5 long, 0.14-0.18 wide; oesophagus 0.4 long, bulb 0.094 long; nerve ring 0.17 from anterior end; caudal end ventrally and obliquely truncated; tail with-bursa-like membrane, 0.2 long; spicules equal, fine, 0.06 long; gubernaculum comma-shaped, 0.014 long; caudal papillae 3 pairs, one lateral on sub-dorsal and one subventral in position.

Female : Body 4.7-6.0 long, 0.35-0.36 wide; vulva 0.81-0.85 from anterior end; tail straight, with spines 0.85-0.87 long; eggs elongately oval, slightly asymmetrical and operculated at one or both ends.

Distribution India : West Bengal, (Calcutta).

2. Genus *Thelandros* Wedl, 1862

Subgenus *Thelandros* Petter & Quentin, 1976

1. *Thelandros (Thelandros) maplestoni* (Chatterjee, 1933) Baylis, 1936

1933. *Parapharyngodon maplestoni* Chatterjee, *Ann. Trop. Med. & Parasitol*; Liverpool, **27** : 131-134.

1936. *Thelandros maplestoni* Baylis, *Fauna of British India, Nematoda, Vol. I.*, p. 195.

Material : 10 examples, Z.S.I. Reg. Nos. W6855/1 and 6856/1; host *Hemidactylus flaviviridis*; location intestine and rectum; locality Calcutta, West Bengal, 14.xi. 1962, 17.xi. 1962; coll. R. P. Mukherjee; 2 ex. Z.S.I. Reg. No. W6857/1; host *Calotes versicolor*; location intestine; locality Bardhaman, Bardhaman District, West Bengal; 8.ix. 1948; coll. S.C. Baugh; 3 ex. Z.S.I. Reg. No. W6858/1, host *Calotes versicolor*; location intestine; locality New Alipore, Calcutta, West Bengal, 19.xii. 1967, coll. R. K. Ghosh.

Diagnosis : Male : Body 1.98-3.0 long, 0.22 wide; cuticle coarsely and deeply ringed; caudal end curved ventrally; cloacal aperture situated on a conical prominence; caudal papillae 3 pairs; spicule 0.076-0.09 long; caudal alae absent.

Female : Body 3-5.2 long; tail 0.3-0.4 long, tip curved dorsally; vulva with slight prominent lips, approximately in the middle of body, variable in position.

Distribution : India : West Bengal, (Bardhaman, Calcutta). Karnataka; Bangalore, Maharashtra, Nagpur and Pune. Elsewhere : Colombo. Sri Lanka; Rangoon; Burma.

2. Family HETEROXYNEMATIDAE

Subfamily HETEROXYNEMATINAE (Skrjabin & Schikhobalova 1948 fam.) Petter and Quentin, 1976

1. Genus *Syphaciella* Mønning, 1924

(T) 1. *Syphaciella indica* Maplestone, 1931

1931. *Syphaciella indica* Maplestone, *Rec. Indian Mus.*, Calcutta, **33** : 132-135.

Material : 14 examples, Z.S.I. Reg. No. W1591/1; host Sandgrouse (*Pterocels excustus*); location intestine, locality Zoological Gardens, Calcutta, West Bengal, coll. P.A. Maplestone.

Diagnosis : Male : Body 3.4 long, 0.29 wide; cephalic inflation present; lateral alae present throughout the body, extending beyond the tip of the tail; caudal papillae 4 pairs, very small; spicules straight, delicate, proximal end round, tapering to end in fine points; gubernaculum 0.037 long.

Female : Body 5.5-6.5 long; 0.38-0.4 wide; tail about 1 long, ended in a long fine point; vulva at about 1.4 from anterior end; eggs oval and thick shelled.

Distribution : India : West Bengal, (Calcutta); Andhra Pradesh, Hyderabad. Elsewhere Afganistan.

3. Family OXYURIDAE Cobbold, 1864

Key to genera

1. Gubernaculum present..... *Syphacta* Seurat, 1916
 Gubernaculum absent..... 2
2. Lateral alae present. Parasite of mammals..... *Enterobius* Leach, 1853
 Lateral alae absent. Parasites of birds..... *Avilandros* Skrjabin & Schikhobalova, 1951

1. Genus *Avilandros* Skrjabin & Schikhobalova, 1951(T) 1. *Avilandros avis* (Maplestone, 1940) Skrjabin and Schikhobalova, 1951

1940. *Thelandros avis* Maplestone. *Rec. Indian Mus.*, Calcutta, 42(3) : 426-429.

1951. *Avilandros avis* Skrjabin & Schikhobalova. (nv)

Material : 6 pcs., Z.S.I. Reg. No. W3441/1; host *Tringa hypoleucos*; location - intestine; locality Zoological Gardens, Calcutta, West Bengal; coll. P.A. Maplestone.

Diagnosis : Male : Body 3.65-9.16 long, 0.35-0.38 wide; cuticle coarsely striated transversely; lateral alae absent; cuticle swollen on posterior part of the body; caudal papillae 2 pairs, large; spicules single, straight, pointed, 0.84-0.096 long; tail 0.072-0.08 long; gubernaculum absent.

Female : Body 5.88-6.4 long, 0.59-0.63 wide; tail short, conical, 0.35-0.36 long; vulva posterior to middle of body, with prominent lip, 2.39-2.48 from posterior end.

Distribution India : West Bengal, (Calcutta).

2. Genus *Enterobius* Leach, 18531 *Enterobius vermicularis* (Linnaeus, 1758) Leach, 1853

1758. *Ascaris vermicularis* Linnaeus, *Systema naturae per regnatria naturae Secundum classes, ordines, genera, species, cum characteribus, differentitis, synonymis, locis, Edito decima, reformata*, Vol. 1. 648 Holmaao.

1853. *Enterobius vermicularis* Leach, *Cat. Entozoa Brit. Mus.*, 108.

Material : Several examples, Z.S.I. Reg. No. ZEV 6133/1; host Man; location - intestine; locality Baharampur, Murshidabad District, West Bengal.

Diagnosis Male Body 2.0-5.0 long, 0.1-0.2 wide; narrow lateral alae present near the head and extended almost to the posterior end; cephalic cuticular swelling about 0.1-0.15 long, 0.1-0.11 wide; posterior end curved ventrally; spicule single, relatively stout, slightly recurved tip, 0.125-0.13 long; caudal papillae 5 pairs.

Female : Body 2.5-13.0 long, 0.3-0.6 wide; tail long and tapering; vulva at junction of anterior and middle third of the body.

Distribution : India : West Bengal, (Murshidabad). Elsewhere : Cosmopolitan.

2. *Enterobius anthropitheci* (Gedoelst, 1916) Baylis, 1936

1916. *Oxyuris anthropitheci* Gedoelst, *Rev. zool. Africana (Bruxelles)*, 5(1) : 1-90.

1936. *Enterobius anthropitheci* Baylis, *F.B.I. Nematoda*, vol. I : 191 p.

Material : Host Black headed lemur (Probably *Lemur brunneus*); location - intestine; locality Zoological Gardens, Calcutta, West Bengal, recorded by Baylis and Daubney (1922).

Diagnosis : Male : Unknown.

Female : Body 4.0-5.5 long, 0.325-0.36 wide; cephalic cuticular swelling 0.12 long, 0.08-0.95 wide and clearly marked off behind by a groove; tail 1.4-1.5 long; vulva divided the body in the proportion of 1:2.35 or 1:2.85.

Distribution : India : West Bengal, (Calcutta). Elsewhere : Africa, Belgian Congo.

3. Genus *Syphacia* Seurat, 1916

1. *Syphacia muris* (Yamaguti, 1935) Yamaguti, 1941

1935. *Oxyuris muris* Yamaguti, *Japan. J. Zool.*, **6**(2) : 433-457.

1941. *Syphacia muris* Yamaguti, *Jap. Jr. Zool.*, **9**(3) : 409-439.

Material : One ♀; Z.S.I. Reg. No. WN336/1; host *Rattus* sp.; location intestine; locality Calcutta, West Bengal; 29.xi. 1962; Coll. R.P. Mukherjee and B.N. Das.

Diagnosis : Male : Body small, thin; posterior end bent ventrally; narrowing abruptly behind the cloaca and ending in a fine processes; spicule single, gubernaculum absent.

Female : Body 2.75 long, tail 0.5 long, vulva very conspicuous, 0.6 from anterior end.

Remarks : Maplestone and Bhaduri (1942) described *Syphacica baylisi* from some female specimens from Rats (*Rattus norvegicus* (= *Mus decumanus*)) in Calcutta. but Quentin (1971) and Soota (1981), considered it as a synonym of *S. muris* (Yamaguti, 1935) Yamaguti, 1941.

Distribution : India : West Bengal, (Calcutta). Elsewhere : Japan.

4. Order SRIRURIDA

Suborder CAMALLANINA

Superfamily (1) CAMALLANOIDEA

1. Family CAMALLANIDAE Railliet & Henry, 1915

Key to genera

1. Buccal capsule not divided into two valves *Spirocamallanus* Olsen, 1952
 Buccal capsule divided into two lateral valves 2
2. Buccal cavity large behind valves *Paracamallanus* Yorke & Maplestone, 1926
 Buccal cavity reduced or absent behind valves *Camallanides* Baylis & Daubney, 1922
3. Longitudinal band supporting buccal valves not separated into ventral and dorsal groups
 *Camallanus* Railliet & Henry, 1915

1. Genus *Camallanus* Railliet & Henry, 1915

Key to species

- Spicule single. Caudal papillae 11-13 pairs, caudal alae well developed *C. mastacembeli*
 Spicule double. Spicules unequal and similar; Precaudal ala short *C. anabantis*

1. *Camallanus anabantis* Pearse, 1933

1933. *Camallanus anabantis* Pearse, *J. Siam. Soc. Nat. Hist. Supplement*, 9(2) p. 179.

Material : 2 examples Z.S.I. Reg. No. WN670; host *Anabas testudineus*; location intestine; locality Sainthia, Birbhum District, West Bengal; 9.iv. 1984; Coll. D.K. Kundu.

Diagnosis : Male : Body 2.90-16.77 long; 0.10-0.45 wide; buccal capsule of two valves, each with nine longitudinal rows of teeth; tail with two spines and a short precaudal alae; spicules two, unequal, similar, smaller 0.07-0.32 long, larger 0.35-0.65; caudal papillae 10-13 pairs, 4-7 preanal, 0-2 adanal, 5-6 postanal; a pair of phasmids.

Female : Body 7.2-20.0 long, 0.15-0.55 wide; tridents 0.022 long; cephalic papillae present; a pair of cervical papillae occasionally observable; tail tip bifid; vulva preequatorial.

Distribution : India : West Bengal, (Calcutta, Birbhum); Aurangabad, Maharashtra; Patna, Bihar; Jullundur, Panjab.

Elsewhere : Bangkok, Thailand; North Borneo, Sabah; Kuala Lumpur, Malaysia; Sri Lanka.

2. *Camallanus mastacembeli* (Sahay and Sinha, 1966) Agrawal, 1967

1966. *Zeylanema mastacembeli* Sahay and Sinha, *Jap. J. med. Sci. Biol.*, 19(5) : 247.

1967. *Camallanus mastacembeli* Agrawal, *Annls Parasit. hum. comp.*, 42(3) : 330.

Material : Several examples, Z.S.I. Reg. No. WN 671; host *Nandus nandus*; location intestine; locality Amta, Howrah District, West Bengal; 21.xii. 1985; coll. D.K. Kundu.

Diagnosis : Male : body 8.54-13.16 long; buccal ridges armed; tridents with subequal prongs, middle 0.03-0.05 long, laterals 0.058-0.09 oesophagus divided into two parts; anterior muscular, posterior glandular; spicule single, 0.336-0.76 long; caudal papillae 11-13 pairs, 7-9 preanal, 1-2 adanal, 2-4 postanal, cuticular swelling 0.384 from posterior end.

Female : Body 16.25-26.28 long, 0.224-0.30 wide; tail 0.16-0.22 long; vulva preequatorial.

Distribution : India : West Bengal, (24 Parganas (South), Howrah).

Elsewhere : India : U.P., Lucknow, Varanasi; Bihar, Patna.

2. Genus *Camallanides* Baylis and Daubney, 19221. *Camallanides prashadi* Baylis and Daubney, 1922

1922. *Camallanides prashadi* Baylis and Daubney, *Mem. Indian Mus.*, Calcutta, 7 : 325-328.

Material : One example, Z.S.I. Reg. No. W877/1; host Banded Krait (*Bungarus fasciatus*); location intestine; locality Zoological Gardens, Calcutta, West Bengal, 19.vii. 1915. Z.S.I. Reg. No. W876/1; host King Cobra (*Naja hannah*); other details same as above; 14.vii. 1907. Several examples, Z.S.I. Reg. Nos. W6952-61/1; hosts *Natrix piscator*, *N. stolatus*, *Enhydris* sp., *Ptyas mucosus*; location oesophagus and intestine; locality Bhasna & Sujapur, 24-Parganas (South) District, West Bengal; 26.iv. 1967, 26.x. 1965, 6.xi. 1965, 10.xi. 1965, 11.xi. 1965, 27.i. 1965, 31.vii. 1967; coll. C.B. Srivastava, S.S. Saha.

Diagnosis : Male : Body 3.7-6.6 long, 0.088-0.18 wide; cuticular striations very fine; sclerotized rods irregular shape and of yellow colour; tail pointed, small with caudal alae; caudal papillae 12 pairs, 7 preanal, 5 postanal; spicules unequal and dissimilar, right broad, alate, 0.16-0.24 long, left slender, 0.11-0.16 long; gubernaculum triangular.

Female : Body 5.0-18.3 long, 0.19-0.5 wide; tail tapering 0.3-0.6 long; vulva 2.3-7 from anterior end, very prominent modified into a tubular appendage.

Distribution : India : West Bengal, (Calcutta, 24-Parganas (South)).

3. Genus *Paracamallanus* Yorke and Maplestone, 1926

1. *Paracamallanus singhi* (Ali, 1957) Campana Rouget, 1961

1957. *Neocamallanus singhi* Ali, *Indian J. Helminth.*, 8(1956) : 19.

1961. *Paracamallanus singhi* Campana-Rouget, *Publ. Inst. r. Sci. nat. Belgique*, 3(4) : 27.

Material : One ♂ Z.S.I. Reg. No. W6669/1; host *Channa striatus*; location-intestine; locality Fish Market, Calcutta, West Bengal; 5.ii. 1964, coll. N. Majumdar. 4 examples, Z.S.I. Reg. Nos. W6670/1 and W6671/1; other details same as above. One ♂ Z.S.I. Reg. No. W7037/1; host *Channa orientalis*; location Caecum; locality Salt lake, Calcutta, West Bengal; 11.ii. 1970; coll. S.R. Dey Sarkar. Several examples; Z.S.I. Reg. No. W7038/1; other details same as above. 3 examples, Z.S.I. Reg. No. WN672; host *Channa punctatus*, location Caecum; locality Raigang, West Dinajpur District, West Bengal; 26.ii. 1988, coll. S.R. Dey Sarkar.

Diagnosis : Male : Body 3.96-6.62 long, 0.13-0.18 wide; oesophagus divided into two parts, anterior muscular posterior glandular; tail 0.077-0.14 long; caudal alae present; spicules unequal, right longer, 0.11-0.178 long, left shorter, 0.055-0.094; caudal papillae pedunculate, 9-12 pairs, 4-5 preanal, 2 adanal, 3-5 postanal.

Female : Body 5.77-14.0 long, and sometimes with a pair of phasmids, 0.026 from tip; vulva with prominent lips, equatorial or pre-equatorial, 2.86-9.32 from anterior end.

Distribution : India : West Bengal, (Calcutta and West Dinajpur).

4. Genus *Spirocamallanus* Olsen, 1952

1. *Spirocamallanus gubernaculus* (Khera, 1955), Soota, 1983

1955. *Procamallanus gubernaculus* Khera, *An. Esc. nac. Cienc. biol. Mex.* 8 : 245.

1983. *Spirocamallanus gubernaculus* Soota, *Rec. zool. Surv. India*, Occasional Paper No. 54, p. 182.

Material : Host *Rita rita*; location intestine; locality Hooghly River, West Bengal.

Diagnosis : mouth supported by six papillae, four submedian, two lateral; buccal capsule elongated, barrel-shaped, with 16-18 spiral thickenings and a pair of lateral finger-shaped thickenings parallel to longitudinal axis; oesophagus divided into two parts cervical papillae present.

Male : Body 3.75-10.79 long, 0.09-0.14 wide; spicules unequal, dissimilar, right 0.17-0.301 long; left 0.0585-0.07; caudal papillae 11-12 pairs, 5-7 preanal, 5-6 postanal.

Female : Body 6.67-18.25 long; 0.08-0.19 wide; vulva 1.3-8.45 from anterior end.

Distribution : India : West Bengal, (Hooghly River). U.P. (Lucknow); Bihar (Patna).

Superfamily (2) DRACUNCULOIDEA

1. Family MICROPLEURIDAE (Baylis & Daubney, 1926 subfam.) Travassos, 1960.

1. Genus *Micropleura* Linstow, 19061. *Micropleura vivipara* V. Linstow, 19061906. *Micropleura vivipara* V. Linstow, *J. and Proc. Asiatic Soc. Bengal; Calcutta*, 2 (7) : 269.

Material : One example; Z.S.I. Reg. No. W868/1; host Gharial (*Gavialis gangeticus*); location body cavity; locality Zoological Gardens, Calcutta, West Bengal; 7.vi. 1913.

Diagnosis : Cuticle without striations, but with irregularly distributed series of minute tubercles.

Male : Body 9.9-10.6 long, 0.36-0.4 wide; mouth surrounded by ten papillae; oesophagus divided into two parts, anterior muscular and narrow, posterior glandular and wide; caudal end spirally coiled; tail conically tapering, 0.5 long; caudal ala single, caudal papillae 7 pairs, 3 preanal, 4 postanal; spicules equal, very slender, tapering to fine point, 0.3-0.33 long; gubernaculum 0.07 long.

Female : Body 37-43 long, 0.79-1.0 wide; tail with a pair of subventral papillae, 0.2-0.35 long; vulva near middle of body.

Distribution India : West Bengal. (Calcutta).

Superfamily (3) GNATHOSTOMATOIDEA

1. Family GNATHOSTOMATIDAE Railliet, 1895

Key to subfamilies

1. Cephalic bulb and cervical sacs absent. Pseudolabia without posterior appendages Spiroxyinae Baylis & Lane 1920

 Cephalic bulb and cervical sacs present. Pseudolabia absent
 Gnathostomatinae (Railliet 1895) Baylis & Lane, 1920

Subfamily GNATHOSTOMATINAE (Railliet, 1895, fam.) Baylis and Lane, 1920

Key to genera

1. Head bulb unarmed without hooks *Tanqua* Blanchard, 1904
 Head bulb armed with rows of hooks or spines 2
2. Body unarmed. Parasite of fishes *Echinocephalus* Molin, 1958
 Body partially or wholly armed with posteriorly directed spines. Parasite of mammals.
 *Gnathostoma* Owen, 1836

1. Genus *Gnathostoma* Owen, 1836*Gnathostoma doloresi* Tubangui, 1925

1925. *Gnathostoma doloresi* Tubangui, *Philipp. F. Sc.*, Manila, **28**(1) : 11-37.

Material : Several examples, Z.S.I. Reg. Nos. W1539 and 1544/1; host domestic Pig; location - intestine; locality Calcutta, West Bengal.

Diagnosis : Male : Body 19.7-38 long, 1.1-2.6 wide; spicules unequal, stout and curved, left 1.85-2.08 long, right 0.6-0.7.

Female : Body 27-52 long, 1.46-4.9 wide; vulva 10.4-19 from posterior end.

Distribution : India : West Bengal, (Calcutta). Elsewhere : Japan; Malaya; Philippines.

2. Genus *Echinocephalus* Molin, 18581. *Echinocephalus uncinatus* Molin, 1858

1858. *Echinocephalus uncinatus* Molin, *Sber. Akad. Wiss. Wisen.*, **30** : p. 154.

Material : Host - *Trygon* sp.; location-intestine; locality-Hooghly, River, West Bengal.

Diagnosis : Head with 30-40 rows of hooks. Male : Body 13.0-33.4 long, 0.55-0.8 wide; spicules two, right 1.52-1.875 long, left 1.55-1.9; caudal papillae 8 pairs, 2 preanal, 1 adanal, 5 postanal.

Female : Body upto 31.0 long, 0.86 wide; tail with a pair of papillae; vulva 1.25-1.35 from posterior end.

Distribution : India : West Bengal, Hooghly River; Gulf of Mannar, Portonovo, Tamil Nadu.

Elsewhere : Off Sri Lanka; Karachi coast, Pakistan.

3. Genus *Tanqua* Blanchard, 1904

Key to species

1. Head bulb with four swellings; uterus with four branches.....*T. tiara*
 Head bulb with two swellings; uterus with two branches.....*T. anomala*

1. *Tanqua tiara* (V. Linstow, 1879) Blanchard, 1904

1879. *Ascaris tiara* V. Linstow, *Wurttemb. Naturw. Jahresh.*, Jaheg, **35** : 320.

1904. *Tanqua tiara* Blanchard, *Arch Parasitol*, Paris, **8** : 478.

Material : Several examples, Z.S.I. Reg. Nos. ZEV 6090 and 6131/7; W 879-898/1 and W1067/1; hosts *Varanus bengalensis* (= *V. monitor*), *V. salvalor*, *V. flavescens*, *V. nebulosus*; location - stomach; locality - Zoological Gardens, Calcutta, West Bengal : 23.i 1913, 13.i. 1912, 3.x. 1917, 3.vii. 1916, 18.v. 1915, 29.iv. 1915, 26.vii. 1915, 7.ix. 1915, 20.iv. 1918, 26.viii. 1915, 21.vi. 1916, 14.v. 1915, 18.vii. 1915, 20.ix. 1919, 2.vii. 1915, 12.xi. 1915, 20.xii. 1917, 19.iv. 1913, 6.xi. 1913, 23.i. 1914, 16.vii. 1924. Several examples, Z.S.I. Reg. W6943/1; host *Varanus* sp.; location Stomach; locality Bhasna, 24-Parganas (South) District, West Bengal; 22.vii. 1968; coll. Y Chaturvedi.

Diagnosis Male Body 15-39 long, 0.44-1.1 wide; cuticular striations present; head bulb 0.27-0.52 in diameter; spicules 0.77-1.72 long; caudal alae well-developed; caudal papillae 8 pairs, 3 preanal, 5 postanal.

Female : Body 20-44 long; 0.88-1.4 wide; tail conical; vulva 4.5-7.8 from posterior end.

Distribution : India : West Bengal, (Calcutta, 24-Parganas (South)). Elsewhere : Africa.

2. *Tanqua anomala* (V. Linstow, 1904) Baylis, 1916

1904. *Heterakis anomala* V. Linstow, *Spolia zeylan.* 1(4) : 7.

1916. *Tanqua anomala* Baylis, *Ann. Mag. Nat. Hist.*, Ser 8, 17 : 229-230.

Material : Several examples, Z.S.I. Reg. Nos. W899 and 900/1; host-Snake; location Stomach, locality zoological Gardens, Calcutta, West Bengal; 17.i.v 1914, 21.iii. 1918; several examples, Z.S.I. Reg. Nos. W6944-51/1; hosts *Natrix piscator*, *N. stolatus*, *Enhydria* sp., *Dryophis* sp., location Stomach; locality-Birati; 24-Parganas (North), Bhasna, 24-Parganas (South) Districts, West Bengal; 26.vi. 1967, 16.v. 1965, 21.vi. 1966, 10.xi. 1965, 11.xi.1965, 18.iv. 1968, 24.x. 1968, 27.v. 1967; coll. Sudarsan Roy; 6 exs. Z.S.I. Reg. No. WN 352/1; host *Natrix piscator*; location issued from the mouth when the snake was struck with a stick; locality Sagar Island, 24-Parganas (South); 10.vii. 1972; coll. T.P. Bhattacharya. 3 examples, Z.S.I., Reg. No. WN673; host *Natrix piscator*; location intestine; locality Ulbaria, Howrah District, West Bengal; 1.i. 1986 coll. D.K. Kundu.

Diagnosis : Male : Body 25-50 long, 0.66-2 wide; anterior part tapering; head bulb 0.23-0.42 in diameter; spicules 1.3-1.7 long, caudal alae well developed, papillae 8 pairs, 3 preanal, 5 postanal.

Female : Body 29-56 long, 0.95-2 wide; vulva 8.8-18.7 from posterior end.

Distribution : India : West Bengal, (Calcutta, Howrah, 24-Parganas (North & South)). Elsewhere : Sri Lanka, Colombo; Saim and China.

Subfamily SPIROXYINAE Baylis and Lane, 1920

1. Genus *Spiroxys* Schneider, 1866

Key to species

1. Gubernaculum absent; median tooth present*S. gangetica*
 Gubernaculum present; median tooth absent*S. gubernae*

1. *Spiroxys gangetica* Baylis and Lane, 1920

1920. *Spiroxys gangetica*, Baylis and Lane, *Proc. zool. Soc.* London, pp. 245-310.

Material : Host *Trionyx gangeticus*, locality Ganges delta, West Bengal.

Diagnosis Anterior end tapering end bent at an angle; each lip with six teeth in addition to a median tooth; a cuticular collar present behind the bases of the lips.

Male Body : 34-43 long, 0.75 wide; caudal alae well developed; spicules subequal, blunt tipped with hyaline cap, left 2.25 long, and right, 2.1; caudal papillae 11 pairs, 4 preanal, 7 postanal.

Female : Body 48-50.3 long, 0.85-0.95 wide; tail conical, slightly curved ventrally 0.65 long, terminal end forming a small hook, and a pair of caudal papillae at 0.32 from the tip; vulva 20.0-27.0 from posterior end.

Distribution : India : West Bengal, Gangetic delta.

2. *Spiroxys gubernae* Chakravarty & Majumdar, 1959

(Fig. 15. A-C)

1959. *Spiroxys gubernae* Chakravarty & Majumdar, *Proc. Zool. Soc.*, Calcutta, **12** : 121-124.

Material : Host *Chitra indica*; location rectum; locality Baranagar, near Calcutta, West Bengal.

Diagnosis : Body elongated and striated, lip tri-lobed; each lobe with two teeth; a cuticular collar present behind the base of lips.

Male Body 22.4-39.9 long, 0.54-0.64 wide; caudal alae well developed and striated; caudal papillae 11 pairs, 4 preanal and 7 postanal. of the 11 pairs 1 pair preanal and 1 postanal sessile; spicules subequal, bluntly pointed ending in hyaline caps, left 1.8-2.0 long, right 1.4-1.8 long; gubernaculum 0.15 long.

Female : Body : 30.2-46.9 long, 0.50-0.84 wide; tail bluntly conical, without papilla, 0.23-0.45 long; vulva slightly prominent, 13.1-20.5 from posterior end.

Distribution : India : West Bengal, (Calcutta).

Superfamily (4) PHYSALOPTEROIDEA

1. Family Physalopteridae (Railliet, 1893 subfam.) Leiper, 1908

Key to subfamilies

1 Caudal alae of male fading into lateral borders of body. Cuticular ornamentation limited to the medioventral zone anterior to anus. Parasite of fishes..... Proleptinae Schulz, 1927

Caudal alae of male ornamented and united on ventral surface of body Parasites of vertebrates except fishes..... Physalopterinae Railliet, 1893

Subfamily PHYSALOPTERINAE Railliet, 1893

Key to genera

1. Each lip with a single external tooth and two double paired internal tooth. Spicules very unequal. Uteri four. Parasite of reptiles, rarely of amphibians, rodents and primates.....

..... *Abbreviata* Travassos, 1920

Each lip with a single external tooth and three internal teeth. Spicules well developed, equal, subequal or unequal. Uteri two to four. Parasites mainly of birds, carnivora, occasionally of snakes and mammals which ingest flesh or insects *Physaloptera* Rudolphi 1819

1. Genus *Abbreviata* Travassos, 1920*Abbreviata varani* (Parona, 1889) Schulz, 19271889. *Physaloptera varani* Parona, *Ann. Mus. Civ. di Storia nat. di Genova*, 2/1 : p. 776.1927. *Abbreviata (Abbreviata) varani* Schulz, *Soborn. Rabot. Gelm. Posv. K.I. Skrjabinae*, pp. 287-312.

Material : Several examples, Z.S.I. Reg. No. WN 674; host - Indian monitor (*Varanus bengalensis*); location intestine; locality Bhasna, 24-Parganas (South), West Bengal.

Diagnosis : Body with fine traverse cuticular striations; body tapering towards both extremity; lips large.

Male : Body 10-24 long, upto 0.8 wide; caudal "bursa" nearly twice as long as broad; small cuticular elevations on ventral surface in the cloacal region; spicules unequal, sharply pointed, left filiform about 2.1 long, right 'broad' upto 0.342 long; caudal papillae 10 pairs, 3 pairs (2 pedunculate) preanal, 7 pairs (2 pedunculate) postanal and a single preanal median papilla.

Female : Body upto 35 long, 1 wide; anus subterminal; tail blunt; vulva at anterior quarter of body, uterine branches four.

Distribution : India : West Bengal, (24-Parganas (South)); Barkuda Island, Satpara, Chilka Lagoon, Orissa. Elsewhere : Burma; Sri Lanka; China; North America.

2. Genus *Physaloptera* Rudolphi, 1819

Key to species

1. Parasite of birds of prey.....*P. alata*
- Parasite of carnivora..... 2
2. Ventral surface of caudal region in male with longitudinal rows of tubercles in its middle portion
..... *P. praeputialis*
- Ventral surface of caudal region in male continuous longitudinal ridges only..... *P. brevispiculum*

1. *Physaloptera praeputialis* V. Linstow, 18891819. *Physaloptera praeputialis* V. Linstow, *Arch. f. Naturg.*, 44(1) : 238-239.

Material : Several examples, Z.S.I. Reg. No. W1065/1; host-domestic cat; location - intestine; locality Indian Museum Compound, Calcutta.

Diagnosis : Male : Body 13-45 long, 0.7-2 wide; cuticle with fine transverse striations. Caudal alae well developed. Caudal papillae 10 pairs, 4 pairs usual pedunculate lateral papillae, one pair and a median preanal, 5 pairs postanal; spicules unequal, left longer, 1-2, right shorter, 0.43-0.9.

Female : Body 15-55 long, 1-2.5 wide; tail conical, blunt tip, with a pair of papillae; vulva equatorial, not prominent.

Distribution : India : West Bengal, (Calcutta). Elsewhere : Burma; Sri Lanka; Africa; Brazil; British Guiana; Cuba; China; Korea; Hawaii; Malaya; Puerto Rico; South America; Mexico; Russia.

2. *Physaloptera brevispiculum* V. Linstow, 1906

1906. *Physaloptera brevispiculum* V. Linstow, *Spolia Zeylanica*, Colombo, 3 : 166.

Material : Host-Golden Cat (*Felis temmincki*); locality Zoological Gardens, Calcutta, West Bengal.

Diagnosis : A prepuce like sheath of cuticle present at posterior end in both sexes. Male : Body 11.1-30 long, 0.9-1.2 wide; 4 pairs usual pedunculate lateral papillae and 13 sessile ventral and subventral papillae; spicules unequal.

Distribution : India : West Bengal, (Calcutta). Elsewhere : Sri Lanka, Malaya; Nigeria, Africa.

3. *Physaloptera alata* Rudolphi, 1819

1819. *Physaloptera alata* Rudolphi, *Entozoorum Synopsis cuiaccedung mautissa duplex et indices locupletissimi*, Berolini 29-30.

Material : 2 exs. Z.S.I. Reg. No. WN189; host-Sparrow Hawk (*Accipter nisus melaschistos*); location intestine; locality Sandakphu, Darjeeling District, West Bengal; 15.iii. 1975; coll. R.K. Ghosh.

Diagnosis : Male : Body 17-23 long, 0.6-0.65 wide; caudal alae well developed; 5 pairs lateral pedunculate papillae, 11 sessile ventral and subventral papillae; spicules slender, equal or subequal.

Female : Body 19-34 long, 0.8-0.9 wide; tail relatively long and tapering; vulva varies in position.

Distribution : India : West Bengal, (Darjeeling); Andhra Pradesh, Hyderabad. Elsewhere Africa; Australia; Brazil; China; Europe; Japan; North America.

4. *Physaloptera* sp.

Material : One female : Z.S.I. Reg. No. W952/1; host *Vulpes bengalensis*; location intestine; locality Zoological Gardens, Calcutta, West Bengal.

Subfamily PROLEPTINAE Schulz, 1927

1. Genus *Heliconema* Travassos, 1919

1. *Heliconema longissima* (Ortlepp, 1922) Chabaud and Campana Rouget, 1956

1922. *Physaloptera longissima* Ortlepp, *Proc. Zool. Soc. London*, 2 p. 1041.

1956. *Heliconema longissima* Chabaud and Campana Rouget, *Anns. Parasit hum. Comp.*, 31 p. 308.

Material : Host : *Mastacembalus armatus*; location Stomach and intestine; locality Sonarpur, 24-Parganas (South), West Bengal.

Diagnosis : Cuticle with prominent transverse cuticular striations and well developed inflation at anterior end; lips two large, lateral, each having on inner surface an anteriorly directed conical tooth; oesophagus divided into two parts.

Male : Body 14.8-31.68 long, 0.31-0.62 wide; tail ventrally bent, with broad, continuous caudal alae and having longitudinal rows of elongate, quadrangular, cuticular elevations ventrally for some distance above cloacal level; spicules dissimilar, unequal, left longer, tapering, gutter like distally, 0.49-0.83 long, right 0.19-0.23, shorter, with broad base rounded distal tip with hyaline cap; caudal papillae 11 pairs, 4 pedunculate preanal, 7 postanal.

Female : 14.0-34.50 long, 0.38-0.79 wide; tail with bluntly rounded tip; a pair of small subterminal papillae (Phasmids); vulva equatorial 9.2718.16 from posterior end.

Distribution : India : West Bengal, (24-Parganas (South)). Elsewhere : Australia; China; Japan; South Africa.

Superfamily (5) THELAZIOIDEA

Family THELAZIIDAE Skrjabin, 1915

Key to subfamilies

1. Inner surface of buccal capsule often armed with teeth. Oesophagus divided. Vulva near anus. Posterior end pointed in both sexes.....*Oxyspirurinae* (Skrjabin, 1916) Yamagute, 1961
- Inner surface of buccal capsule without teeth. Oesophagus undivided. Vulva in anterior half of body. Posterior end rounded in both sexes...*Thelaziinae* (Skrjabin 1915) Baylis & Daubney 1926

Subfamily OXYSPIRURINAE (Skrjabin, 1916 fam.) Yamaguti, 1961

1. Genus *Oxyspinura* Drasche in Stossich, 1897

Key to subgenera

1. Buccal capsule not divided. Lateral alae present. Gubernaculum absent.....
.....*Oxyspirara (Barusispirura)* Chabaud, 1975
- Buccal capsule not divided. Lateral alae absent. Gubernaculum present or absent.....
.....*Oxyspirura (Hamulofilaria)* Chandler, 1924 gen.

1. Genus *Oxyspirura* Drasche in Stossich, 1897

1. Subgenus *Barusispirura* Chabaud, 1975

Key to species

1. Caudal papillae 5 pairs preanal, 2-3 pairs postanal *O. (B.) longistriata* n. sp.
- Caudal papillae 4 pairs postanal only *O. (B.) montana*

1. *Oxyspirura (Barusispirura) longistriata* n.sp.

(Fig. 16. A-C)

Material : Holotype ♂ Z.S.I. Reg. No. WN675; host Jungle Babbler (*Turdoides striatus*); location from under nictitating membrane; locality Gonpur, Birbhoom District, West Bengal; 10.iii. 1988, coll. S.R. Dey Sarkar.

Paratypes 4 ♂♂ 5 ♀♀, Z.S.I. Reg. No. WN676; other particulars as for holotype.

Description : The body finely striated in longitudinal direction. Buccal capsule undivided. Head provided with narrow cephalic alae. Lateral alae present.

Male : Spicules unequal and dissimilar. Gubernaculum absent. Tail bluntly conical.

Female : Vulva in posterior end. Tail pointed.

Measurements : Male : Body 9.44-9.68 long, 0.288-0.272 wide; buccal capsule 0.032-0.048 long; nerve ring 0.24 from anterior end; oesophagus 0.496-0.576 long; spicules, right smaller, broad, stout and navicular in shape, 0.192 long, left larger, slender 0.48-0.51 long; spicule ratio approximately 1:2.5-2.56; caudal papillae 7-8 pairs, 5 preanal, 2-3 postanal; tail 0.176 long.

Female : Body 10.5-13.84 long, 0.34-0.352 wide; buccal capsule 0.024-0.032 long; nerve ring 0.24-0.32 from posterior end; oesophagus 0.57-0.72 long; vulva 0.448-0.576 from posterior end; eggs 0.032-0.04 X 0.024; tail 0.192-0.24 long.

Remarks The present species comes close to *Oxyspirura (Borusispirura) fulica* Sultana, 1964, in the presence of cephalic alae, dissimilar spicules and in the absence of gubernaculum, but differs from it in body size, size of spicules and in the number and arrangement of caudal papillae. It also differs from all other species known under the genus and from different hosts in the number and arrangement of caudal papillae, shape and size of body and in the presence of longitudinal striations.

(T) 2. *Oxyspirura (Barusispirura) montana* Soota and Dey Sarkar, 1980
(Fig. 17. A-C)

1980. *Oxyspirura montana* Soota and Dey Sarkar, *Proc. Zool. Soc. Calcutta*, **31** : 39-46.

Material : One ♂ Z.S.I. Reg. No. WB 184; host Brown crested Tit (*Parus dichrous dichrous*); location eye, under nictitating membrane; locality Tonglu, Darjeeling District, West Bengal; 2.iii. 1975; coll. R.K. Ghose. 5 examples, Z.S.I. Reg. No. WN 185; other particulars as for the above.

Diagnosis : Male : Body 5.6-6.0 long; 0.22-0.27 wide; buccal capsule undivided; spicules dissimilar and unequal, smaller 0.26-0.27 and larger 0.46 long; gubernaculum absent; caudal papillae four postanal pairs only; tail pointed.

Female : Body 6.8-10.2 long, 0.3-0.44 wide; buccal capsule similar to male; vulva 0.5-0.55 from posterior end; tail pointed.

Distribution : India : West Bengal, (Darjeeling).

2. Subgenus *Hamulofilaria* (Chandler, 1924 Gen.) Chabaud, 1975

(T) 1. *Oxyspirura (Hamulofilaria) indica* (Chandler, 1924) Chabaud, 1975

1924. *Hamulofilaria indica* Chandler, *Parasitology*, Cambridge, **16** : 398-399.

1975. *Oxyspirura (Hamulofilaria) indica* Chabaud, *CIH keys to Nematode Parasites*, No. 3, 23 p

Material : 1 ex. Z.S.I. Reg. No. W1366/1; host *Cissa chinensis*; location mesentry in the vicinity of liver; locality Zoological Gardens, Calcutta, coll. A.C. Chandler.

Diagnosis : Male : Body 5.6-7.5 long, 0.19-0.28 wide; buccal capsule small, undivided; cuticle almost smooth; spicules unequal, dissimilar, longer 0.33-0.36, smaller 0.13-0.17 long; tail tapering, bent and with a callosity near the lip.

Female : Body 8.8-9 long, 0.33-0.5 wide; tail narrow, 0.16-0.17 long; vulva 0.49-0.5 from posterior end; uteri two, prodelphys.

Distribution : India : West Bengal, (Calcutta). Elsewhere : Nepal, Thankot.

***Oxyspirura* sp.**

Material : 2 ♀♀, Z.S.I. Reg. No. WN 677; host a thrush; location from under nictitating membrane; locality Gonpur, Birbhum District, West Bengal; 8.iii. 1988, coll. S.R. Dey Sarkar.

Subfamily THELAZIINAE (Skrjabin, 1915, fam.) Baylis and Daubney 1926

Genus *Thelazia* Bosc, 1819

Key to subgenera

1. Female tail relatively long. Gubernaculum usually present. Eggs thick shelled. Parasite of birds
 *Thelazia (Thelaziella)* Travassos, 1918
 Female tail short. Gubernaculum absent. Egg thin shelled. Parasite of mammals.
 *Thelazia (Thelazia)* Bosc, 1819

1. Subgenus *Thelaziella* Travass 1918

1. *Thelazia (Thelaziella) campanulata* (Molin, 1858) Railliet and Henry, 1910

1858. *Filaria campanulata* Molin, *Akad. Wiss., Wien*, **28** : 365-461.

1910. *Thelazia campanulata* Railliet and Henry *Compt. rend. Soc. Biol., Paris*, **68** : 216.

Material : Several examples, Z.S.I. Reg. No. WN 267; host Whistling thrush (*Myiophonus caeruleus temminckii*); location from under the nictitating membrane; locality Reang, Darjeeling District, West Bengal, 28-29.vi. 1974, coll. T.D. Soota. 3 exs. Z.S.I. Reg. No. WN 678; host Jungle crow (*Corvus macrorhynchos*); location Eye (nictitating membrane); locality Khuntimari, Jalpaiguri District, West Bengal, 23.iii. 1979, coll. S.R. Dey Sarkar.

3 examples, Z.S.I. Reg. No. WN 679; host Jungle Crow; location eye (nictitating membrane); locality Kulik, West Dinajpur District, West Bengal, 29.ii. 1988, coll. S.R. Dey Sarkar.

Diagnosis : Male : Body 9.5-12.0 long, 0.27-0.47 wide; tail round; spicules unequal, dissimilar, smaller 0.13-0.2 and longer 1.5-2.0 long; gubernaculum 0.044-0.055 long; caudal papillae 12-13 pairs, 8-9 preanal, 4 postanal.

Female : Body 9.5-12.4 long, 0.25-0.46 wide; tail blunt; vulva 0.44-0.72 from anterior end.

Distribution : India : West Bengal, (Darjeeling, Jalpaiguri and West Dinajpur). Elsewhere : South America, Brazil.

2. Subgenus *Thelazia* Bosc, 18191. *Thelazia (Thelazia) rhodesii* (Desmarest, 1828) Blainville, 18281828. *Thelazius rhodesii* Desmarest, *Veterinarian*, London, 1(3) : 79-81.1828. *Thelazia rhodesii* Blainville, *Vers. Diet. Sc. Nat* 57 : 547.

Material : Several examples Z.S.I. Reg. No. WN 680; host domestic cow; location eye, locality Jalpaiguri, Jalpaiguri District, West Bengal; 1.iv. 1989, coll. S.R. Dey Sarkar.

Diagnosis : Male : Body 7.3-14 long, 0.4-0.46 wide; cuticular annulations prominent; tail blunt 0.078-0.092 long; caudal papillae 12-14 pairs preanal, 2-3 pairs postanal; spicules unequal, dissimilar, right smaller, stout, 0.1-0.15, left longer, filiform, 0.62-0.93 long.

Female : Body 12-21 long 0.47-0.5 wide; tail bluntly conical, 0.08-0.083 long; vulva 0.9-1.2 from anterior end.

Distribution : India, West Bengal, (Jalpaiguri). Elsewhere : Africa; China; Cyprus; Europe; Formosa; Japan; Java; Korea; Sumatra; U.S.A.

2. Family RHABDOCHONIDAE (Travassos, Artigas & Pereira, 1928 subfam) Skrjabin 1946

Genus *Rhabdochona* Railliet, 1916Subgenus *Globochona* Moravec, 1972*Rhabdochona (Globochona)* sp.

Material : One ♀, Z.S.I. Reg. No. WN 681; host *Silonia silondia*; and 2 ♀♀, Z.S.I. Reg. No. WN 682; host *Eutropiichthys vacha*; location intestine; locality Bhaluka, Maldah Dist., West Bengal, 1.iii. 1988, coll. S.R. Dey Sarkar.

Superfamily (6) SPIRUROIDEA

1. Family GONGYLONEMATIDAE (Hall, 1916 subfam.) Sobolev, 1949

Genus *Gongylonema* Molin, 1857Subgenus *Gongylonema* Chabaud, 1975(T) 1. *Gongylonema (Gongylonema) capucini* Maplestone, 19391939. *Gongylonema capucini* Maplestone, *Rec. Indian Mus.*, Calcutta, 41 (4) : 419-421.

Material : 2 exs., Z.S.I. Reg. No. W3427/1; host *Cebus capucinus*; locality Zoological Gardens, Calcutta, West Bengal; coll. P.A. Maplestone.

Diagnosis : Cuticular bosses present on the anterior end; Pharynx present; oesophagus divided into two parts.

Male : Body 5.4-6.3 long, 0.13-0.19 wide; caudal alae well developed, 0.26-0.28 long; 9 pairs pedunculate papillae, 5 pairs preanal and 4 pairs postanal, in addition 5-6 sessile papillae on the ventral surface of tail near its tip; tail pointed, 0.13-0.14 long; spicules unequal, dissimilar, longer delicate, tip slightly spatulated, and surrounded by a delicate membranous expansion, about 0.52 long; shorter spicule relatively stout, slightly curved at proximal end and marked by thickening with transverse grooves, 0.08-0.088 long; gubernaculum absent.

Female : Body 15.3 long, 0.19 wide; vulva about 2.06 from posterior end; tail 0.16 long, narrow rapidly immediately behind the anus; eggs oval thick-shelled.

Distribution : India : West Bengal, (Calcutta).

2. Family SPIROCERCIDAE (Chitwood & Wehr, 1932 subfam) Chabaud, 1975

Key to subfamilies

1. Pharynx without rugous or annular thickenings Spirocercinae Chitwood & Wehr, 1932
- Pharynx with rugous or annular thickenings Ascaropsinae Alicata & McIntosh, 1933

Subfamily ASCAROPSINAE Alicata & McIntosh, 1933

Key to genera

1. Lips not prominent 2
- Lips prominent *Streptopharagus* Blanc, 1912
2. Buccal cavity with tooth 3
- Buccal cavity without tooth 4
3. Pharynx straight, wall with spiral thickenings *Ascarops* Van Beneden, 1873
4. 6 lips joined to form 2 lateral masses. Pharynx elongated *Physocephalus* Diesing, 1861

1. Genus *Ascarops* Van Beneden, 1873

1. *Ascarops strongylina* (Rud. 1819) Alicata & McIntosh, 1933

1819. *Spiroptera strongylina* Rudolphi, *Entozoorum synopsis Cri accedunt mantissa duplex et indices locupletissimi* Berolini 237-238.

1933. *Ascarops strongylina*, Alicata and McIntosh, *J. par.* 20(1) : 62.

Material : Several examples, Z.S.I. Reg. No. W1540/1; host-domestic pig; location-intestine; locality Calcutta, West Bengal. 8 examples, Z.S.I. Reg. No. WN 187; host domestic pig; location intestine; locality Karsiyang, Darjeeling District, West Bengal; 12.v. 1975; coll. T.D. Soota.

Diagnosis : Male : Body 10-15 long, 0.3-0.39 wide; lateral alae present cervical papillae asymmetrical; caudal alae well developed, right side of the alae about twice as wide as that of left; 4 pairs of pedunculate preanal papillae, one pair of similar postanal papillae; spicule very unequal, left slender, finely pointed 2.24-2.9 long, right stouter and blunter 0.45-0.62 long.

Female : Body 15-22 long, 0.26-0.54 wide; body slightly constricted in the region of vulva; tail bluntly conical; vulva 7-8 from anterior end.

Distribution : India : West Bengal, (Darjeeling, Calcutta). Elsewhere : Africa; Australia; Argentina; Brazil; China; Siam; Formosa; Sri Lanka; Celebes; Manchuria; Phillipines; Puerto Rico, U.S.A.

2. Genus *Streptopharagus* Blanc, 1912

1. *Streptopharagus pigmentus* (V. Linstow, 1897) Railliet & Henry, 1918

1897. *Spiroptera pigmenta* V. Linstow, *Arch. Mikr. Anat.*, **49**(3) : 608-610.

1918. *Streptopharagus pigmentus* Railliet & Henry, *Bull. Soc. Path. Exot.*, **11**(2) : 82-86.

Material : 2 exs. Z.S.I. Reg. No. W14981; host-Hoolock gibbon (*Hylobates hoolock*); location Stomach and intestine; locality Zoological Gardens, Calcutta, West Bengal.

Diagnosis : Male : body 28-55 long; 0.6-1 wide; lateral ala present in the oesophageal region on the left side only; caudal alae transversely striated; 4 pairs of preanal and one pair of postanal pedunculate papillae and a group of 5 pairs of Small sessile papillae near the tail tip. Cloacal aperture partly surrounded by clawlike cuticular processes; spicules unequal, dissimilar, alate, left slender 4-6.7 long; right stouter 0.5-0.76 long, gubernaculum small asymmetrical shape.

Female : Body 46-95 long, 0.85-1.5 wide; tail conical; vulva 9.5-20 from anterior end.

Distribution : India : West Bengal, (Calcutta).

3. Genus *Physocephalus* Diesing, 1861

Key to species

1. Parasites of Hoolock gibbon; lateral flanges one pair *P. primus*
 Parasites of pigs. Lateral flanges 3 pairs..... *P. sexalatus*

1. *Physocephalus sexalatus* (Molin, 1860) Diesing, 1861

1860. *Siproptera sexalata* Molin, *Sitz. K. Akad. Wiss., Wien*, **38**(28) : 957-958.

1861. *Physocephalus sexalatus* Diesing, *Sitzungsb. Akad. Wiss. Math. Naturw. Cl.* **42**(28) : 686-687.

Material : Several examples, Z.S.I. Reg. No. W1647/1; host domestic pig; location intestine; locality Calcutta, West Bengal; 5 exs. Z.S.I. Reg. No. WN 188; host domestic pig; location intestine; locality Karsiyang, Darjeeling District, West Bengal; 12.v. 1975; coll. T.D. Soota.

Diagnosis : Male : Body 6.0-15 long; 0.26-0.32 wide; 3 parallel lateral alae on each side of the body; apparently a single cervical papilla on the left side; caudal end spirally coiled, caudal alae slightly asymmetrical; 4 pairs sublateral pedunculate preanal papillae; 4 pairs small subventral papillae near the tip; spicules unequal, alate, pointed, left slender, grooved ventrally 1.23-2.5 long, right stouter, 0.2-0.4 long.

Female : Body 9-22.5 long, 0.33-0.48 wide; tail tip bent ventrally, constricted at about 0.04 from anus; vulva behind the middle of the body.

Distribution : India : West Bengal, (Calcutta, Darjeeling). Elsewhere Cosmopolitan in distribution.

2. *Physocephalus primus* (Maplestone, 1932) Yamaguti, 1961

1932. *Physocephaloides primus* Maplestone, *Rec. Indian Mus.*, Calcutta, **34**(3) : 229-231.

1961. *Physocephalus (Physocephaloides) primus*, Yamaguti, *Systema Helminthum*, Vol. 3 : 608.

Material : Host : Hoolock gibbon (*Hylobates hoolock*); location-intestine; locality Zoological Gardens, Calcutta, West Bengal.

Diagnosis : Male : Body 11.5-15 long, 0.37-0.39 wide; cervical papillae asymmetrical; caudal alae broad, symmetrical; spicules unequal, left longer 1.8-2.5 long, right 0.45-0.5.

Female : Body 18-21 long, 0.4-0.42 wide; tail bluntly rounded, curved ventrally; vulva 5.2 from posterior end (in a specimen of 21 long).

Distribution : India : West Bengal, (Calcutta).

Subfamily SPIROCERCINAE Chitwood and Wehr, 1932

1. Genus *Cylicospirura* Ververs, 1922

Key to subgenera

1. Caudal end of male without spine. Four pairs of preanal caudal papillae. Parasites of carnivores.

.....*Cylicospirura* (*Cylicospirura*) Ververs, 1922

Caudal end of male with one pair of spines. Six pairs of preanal caudal papillae. Parasites of insectivores.....*Cylicospirura* (*Gastronodus*) (Singh, 1934 gen.) Chabaud, 1975

Genus *Cylicospirura* Ververs, 1922

1. Subgenus *Cylicospirura* Ververs, 1922

(T) 1. *Cylicospirura* (*Cylicospirura*) *felinea* (Chandler, 1925) Sandground, 1933

1925. *Spirocerca felineus* Chandler, *Indian J. Med. Res.*, **13** : 221-222.

1933. *Cylicospirura felinea* Sandground, *Z. Parasitenkde*, **5** (3-4) : 542-588.

Material : 2 exs. Z.S.I. Reg. No. W1355/1; host domestic cat; location in tumours in the stomach wall; locality Calcutta, West Bengal; coll. A.C. Chandler.

Diagnosis : Male : Body 18-22.5 long; 0.48-0.54 wide; blood red in colour during life; tail spirally coiled, ended in blunt point; well developed; 4 pairs preanal, 2 pairs postanal pedunculated papillae, and a group of 8 minute papillae at the tail tip; spicules unequal, longer 2.25-2.5 long, smaller 0.47-0.5; gubernaculum small.

Female : Body 19-30 long, about 0.9 wide; vulva 3-5 from anterior end; tail bluntly rounded.

Distribution : India : West Bengal, (Calcutta). Elsewhere : Algeria; Saim.

2. Subgenus *Gastronodus* (Singh, 1934 gen.) Chabaud, 1975

Cylicospirura (*Gastronodus*) *strassenii* (Singh, 1934.) Chabaud, 1975

(Fig. 18, A & B)

1934. *Gastronodus strassenii* Singh, *Curr. Sci.*, Bangalore, 2(8) : 287.

1975. *Cylicospirura* (*Gastronodus*) *strassenii* Chabaud, *CIH keys to Nematode Parasites of vertebrates*, No. 3, p. 33.

Material : Several examples, Z.S.I. Reg. No. WN 683; host Shrew (*Suncus murinus*); location in nodules in the stomach wall; locality Kanaisole, Medinipur District, West Bengal, 8.ix. 1984, coll. S.R. Dey Sarkar.

Several examples Z.S.I. Reg. No. 684; host and location as above; locality-Kulik, West Dinajpur District, West Bengal, 25.ii.1988, coll. S.R. Dey Sarkar.

Diagnosis : Male : Body 14-26 long; 0.3-0.56 wide; cervical papillae present; tail short, rounded tip, 0.24 long, with well developed caudal alae; caudal papillae 12 pairs, 6 preanal and 6 postanal, of the postanal papillae 2 pair sessile and a large median papilla anterior to the cloaca; spicules unequal, dissimilar, longer 2.56-2.7 long pointed, shorter 0.45-0.62 long; enclosed by a broad and rounded ala; gubernaculum 'V' shaped, 0.064 long.

Female : Body 25.0-40.0 long; anus subterminal, tail rounded, with a pair of lateral papillae; vulva at about 0.82-1.5 from anterior end; eggs thick shelled.

Distribution : India : West Bengal, (Medinipur; West Dinajpur) (first report); Andhra Pradesh, Hyderabad. Elsewhere : Bangladesh.

Superfamily (7) HABRONEMATOIDEA

1. Family HABRONEMATIDAE (Chitwood and Wehr, 1932) Invaschkin, 1961

Key to subfamilies

- 1. Posterior border of lips and pseudolabia without ornamentation
..... Habronematinae Chitwood & Wehr, 1932
- Posterior border of lips and pseudolabia with ornamentations; parasites of birds
..... Histocephalinae Gendre, 1922

1. Genus *Habronema* Diesing, 1861

Key to species

- 1. Longer spicule of male less than 2 long..... 2
Longer spicule of male more than 2 long..... 7
- 2. Longer spicule 1 or more in length..... 3
Longer spicule less than 1 long 6
- 3. Shorter spicule 0.4 or more in length..... 4
Shorter spicule less than 0.4 long 5
- 4. Vulva in front of middle of body *H. magnilabiatum*
Vulva near posterior end of body.....*H. emplocami*
- 5. Vulva slightly behind middle of body.....*H. imbricatum*
Vulva near posterior end of body..... *H. diesingi*
- 6. Vulva in front of middle of body *H. asymmetricum*
Vulva near posterior end of body..... *H. indicum*
- 7. Caudal papillae 10-11 pairs pedunculated*H. bulbosum*
Caudal papillae 6 pairs pedunculated, 3 pairs sessile*H. avicedae*
- 8. Longer spicule about 3.9 long*H. casuaru*

1 *Habronema bulbosum* (V. Linstow, 1906) Baylis, 1939

1906. *Physaloptera bulbosa* V. Linstow, *Arch. f. Naturg.*, **72** : 250.

1939. *Habronema bulbosum* Baylis, *The Fauna of British India, including Ceylon and Burma*. Nematoda II : 78. London.

Material : Host : Peafowl (*Pavo cristatus*) location-under lining of gizzard; locality Zoological Gardens, Calcutta, West Bengal.

Diagnosis : Male : Body 10.4-18.4 long; caudal end bent ventrally; caudal alae broad, oval; 5-7 pairs large pedunculate papillae in the cloacal region, 3-4 preanal, 2 postanal and 4-5 pairs small lateral papillae near the tail tip; spicules, tubular, left 2.17-2.45 long, right 0.88-0.945; gubernaculum with lateral wings.

Female : Body 24-27.8 long; tail conical; vulva about 1.25 from posterior end.

Distribution : India : West Bengal, (Calcutta).

(T) 2. *Habronema indicum* Maplestone, 1929

1929. *Habronema indica* Maplestone, *Rec. Indian Mus.*, Calcutta, **31** : 90-92.

Material : 3 exs. Z.S.I. Reg. No. W1611/1; host Indian Roller (*Coracias benghalensis indica*); location-gizzard; locality Zoological Gardens, Calcutta, West Bengal; Coll. P.A. Maplestone.

Diagnosis : Male : Body 7.1 long; caudal end straight; caudal alae broad, slightly asymmetrical; caudal papillae 9 pairs, 4 pairs preanal, 5 pairs postanal; spicules unequal, 0.694 and 0.357 long; gubernaculum boat shaped.

Female : Body 10.75 long; tail blunt tipped; vulva 0.59 from posterior end.

Distribution : India : West Bengal, (Calcutta).

(T) 3. *Habronema euplocami* Maplestone, 1930

1930. *Habronema euplocami* Maplestone, *Rec. Indian Mus.*, Calcutta; **32** : 406-407.

Material : 3 examples, Z.S.I. Reg. No. W1610/1; host-Kalij Pheasant (*Gennaeus [= Euplocamus] leucomelanus*); location gizzard; locality Zoological Gardens, Calcutta; West Bengal; coll. P.A. Maplestone.

Diagnosis : Male : Body 10.4 long; caudal alae broad; caudal papillae pedunculated 9 pairs, 2 pairs preanal, 1 pair adanal and 6 postanal; spicules thin and tapering, longer 1.0 long, smaller 0.436; gubernaculum well developed.

Female : Body 18.5-19.5 long; tail tip blunt, with a pair of papillae; vulva 1.45-1.6 from posterior end.

Distribution : India : West Bengal, (Calcutta).

(T) 4. *Habronema imbricatum* Maplestone, 1930

1930. *Habronema imbricata* Maplestone, *Rec. Indian Mus.*, Calcutta, **32**(4) : 408-411.

Material : 2 examples, Z.S.I. Reg. No. W1612/1, host Scops owl (*Otus scops sunia [= Scops pennatus]*); location gizzard; locality-Zoological Gardens, Calcutta, coll. P.A. Maplestone.

Diagnosis Male : Body 8.3 long; caudal alae broad; caudal papillae 6 pairs; 4 preanal and 2 postanal; anterior pair of postanal papillae sessile; all the other papillae pedunculate; spicules longer 1.38 long, shorter 0.38.

Female : Body 10.6 long; tail sharply pointed with a pair of subventral papillae near the tip; vulva behind the middle of the body, 5.7 from anterior end.

Distribution : India : West Bengal, (Calcutta).

5. *Habronema diesingi* Maplestone, 1932

1932. *Habronema diesingi* Maplestone, *Rec. Indian Mus.*, Calcutta, **34**(3) : 238-240.

Material : Host Vulturine guinea fowl (*Acryllium vulturinum*); location gizzard; locality Zoological Gardens, Calcutta, West Bengal, coll. P.A. Maplestone.

Diagnosis : Male : Body 8.8 long; caudal alae well developed; caudal papillae 10 pairs, one pair sessile adanal, the rest pedunculate, 2 pairs preanal, 7 pairs postanal, spicules 1.7 and 0.297 long; gubernaculum broad.

Female : Body 14.5 long; tail with a pair of papillae, tapering and pointed; vulva 1.74 from posterior end.

Distribution : India : West Bengal, (Calcutta).

6. *Habronema magnilabiatum* Maplestone, 1932

1932. *Habronema magnilabiata* Maplestone, *Rec. Indian Mus.*, Calcutta, **34**(3) : 241-242.

Material : Host Himalayan Greyheaded Fishing Eagle (= *Ichthyophaga nana plumbeus*) [= *Polioaetus plumbeus*]; location gizzard; locality Zoological Gardens, Calcutta, West Bengal; coll. P.A. Maplestone.

Diagnosis : Male : Body 9.1 long; caudal end curved ventrally, caudal alae narrow; caudal papillae 6 pairs, 4 pairs pedunculate preanal and 2 pairs postanal sessile; spicules longer 1.78 and shorter 0.554 long; gubernaculum 'rugged' asymmetrical.

Female : Body 15.6 long; tail tapering to a point; vulva 8.1-8.5 from posterior end.

Distribution : India : West Bengal, (Calcutta).

7. *Habronema asymmetricum* Maplestone, 1932

1932. *Habronema asymmetrica* Maplestone, *Rec. Indian Mus.*, Calcutta, **34**(3) : 241-244.

Material : Host : Pale Harrier (*Circus macrourus*); location gizzard; locality Zoological Gardens, Calcutta, West Bengal; coll. P.A. Maplestone.

Diagnosis : Male : Body 7.5 long; caudal alae asymmetrical; caudal papillae irregularly placed, some big double, their arrangement differ in different specimens; spicules 0.65 and 0.24 long; gubernaculum absent.

Female : Body 11.0 long; vulva 5.9 from posterior end.

Distribution : India : West Bengal, (Calcutta).

8. *Habronema casuarii* Maplestone, 1932

1932. *Habronema casuarii* Maplestone, *Rec. Indian Mus.*, Calcutta, **34**(3) : 244-245.

Material Host Double wattled cassowary (*Casuarius bicarunculatus*); location gizzard; locality Zoological Gardens, Calcutta, West Bengal, coll. P.A. Maplestone.

Diagnosis : Male : Body 26.5 long; caudal alae broad and symmetrical; 5 pairs large pedunculate lateral caudal papillae, 3 preanal, one adanal and one postanal; spicules unequal, longer slender with a barb near the tip, 3.1-3.9 long, shorter alate, simple, rounded tip, 1.0-1.3 long.

Female : Body 53.0 long; vulva 8.3-9.2 from posterior end.

Distribution : India : West Bengal, (Calcutta).

9. *Habronema avicedae* Soota and Dey Sarkar, 1981

(Fig. 19 A-C)

1981. *Habronema avicedae* Soota and Dey Sarkar, *Rec. Zool. Surv. India*, **79** : 35-36.

Material : One ♂ Z.S.I. Reg. No. WN 265; host Indian Black Crested Baza (*Aviceda leuphotes leuphotes*); location-intestine; locality-Sukna, Darjeeling District, West Bengal; 13.vii. 1974; coll. T.D. Soota.

One ♂ Z.S.I. Reg. No. WN 266, other particulars as for above.

Diagnosis : Male : Body 9.8 long; spicules unequal, longer 2.5 and smaller 0.5 long; gubernaculum 0.055 long; caudal papillae pedunculate 6 pairs, sessile 3 pairs discernible.

Female Body 33.0 long; vulva 17.4 from anterior end.

Distribution : India : West Bengal, (Darjeeling).

Subfamily HISTOCEPHALINAE Gendre, 1922

1. Genus *Viguiera* Seurat, 19131 *Viguiera majumdari* De, 1979

(Fig. 20. A-D)

1979. *Viguiera majumdari* De, *Folia Parasitologica (Praha)* **26** : 73-76.

Material : 14 examples, Z.S.I. Reg. No. WN 685; host : Black Drongo (*Dicrurus adsimilis macrocercus*); location under the horny layer of gizzard; locality Kulik, West Dinajpur district, West Bengal, 26.ii. 1988, coll. S.R. Dey Sarkar.

Diagnosis : Male : Body 5.12-7 long; vestibule short, cylindrical, thickwalled; oesophagus very long; tail tapering spirally coiled, with bluntly pointed tip; caudal alae well developed with striations; caudal papillae pedunculated, preanal 5-9 pairs, 2 pairs postanal and a single papilla on right side; spicules very unequal and dissimilar, left longer 1.15-1.18 long rounded tip, right smaller 0.12-0.2 long.

Female : Body 7.98-11.02 long; tail short, conical, blunt; vulva very close to anus; vagina anteriorly directed.

Distribution : India : West Bengal, (Bardhaman; West Dinajpur).

2. Family TETRAMERIDAE Travassos, 1914

Subfamily TETRAMERINAE (Travassos, 1904, fam.) Chabaud, 1975

Key to genus and subgenera

Female body globular or in the form of an almost closed spiral; body markedly swollen between head and tail region. Pharynx smooth. Anal papillae atrophied. Parasites of proventriculus of birds, females in proventricular glands and male on mucosal surface ..*Tetrameres* Creplin, 1846

Female body globular or subglobular. Male with spines on lateral fields

.....*Tetrameres (Tetrameres)* Creplin, 1846

Female body spirally coiled. Male without spines on lateral fields

.....*Tetrameres (Microtetrameres)* Travassos, 1915

1. Genus *Tetrameres* Creplin 1846

1. Subgenus *Tetrameres* Creplin, 1846

(T) 1. *Tetrameres (Tetrameres) spinosa* (Maplestone, 1931) Baylis, 1939

1931. *Echinuria spinosa* Maplestone, *Rec. Indian Mus.*, Calcutta, **33**(2) : 83-852.

1939. *Tetrameres spinosa* Baylis, *F.B.I. Nematoda*, Voll. II : 142, London.

Material : 2 exs. Z.S.I. Reg. No. W1570/1, host-common pochard *Aythya ferina* [= *Nyroca ferina*] and an unidentified duck.

location gizzard; locality Zoological Gardens, Calcutta, West Bengal; coll. P.A. Maplestone.

Diagnosis : Male : Body 4.7 long; body with spines irregularly arranged at anterior end; tail straight with rounded tip; caudal ala or papilla absent, spicules unequal, longer 0.4 long; shorter 0.044.

Female : Unknown.

Distribution : India : West Bengal, (Calcutta).

2. Subgenus *Microtetrameres* Travassos, 1915

1. *Tetrameres (Microtetrameres) spiralis* (Seurat, 1915), Travassos, 1915.

1915. *Tropidocerca spiralis* Seurat, *Compl. rend.Soc. Biol., Paris*, **78**(10) :280-282.

1915. *Tetrameres (Microtetrameres) spiralis* Travassos, *Brazil-med.*, Rio-de Janeiro, **29** : 297.

Material : One example, Z.S.I. Reg. No. W1572/1; host cattle Egret (*Bubulcus ibis coromandus*); location-outer wall of proventriculus; locality Zoological Gardens, Calcutta, West Bengal, coll. P.A. Maplestone.

Diagnosis : Male : Body 4.75 long 0.13 wide; tail conical, with pointed tip; caudal papillae 4 pairs, 2 pairs preanal, 2 postanal; spicules very unequal, left slender, longer, 2.3 long, right shorter, 0.145 long.

Female : Body 2.5 long, 2 wide; blood-red in colour; body coiled in a spiral of three and a half turns; cuticle transversely striated; tail tapering, rounded tip with terminal spike; 0.225 long; vulva 0.13 from anus.

Distribution : India : West Bengal, (Calcutta).

3. Family CYSTIDICOLIDAE (Skrjabin, 1946 subfam.) Chabaud, 1975

Key to genera

1. Pharynx generally short. Anterior region of body with rows of spines, cephalic cuticle without collarete. Parasites of intestine of fish *Spinitectus* Fourment, 1883
- Pharynx of usual shape, often very long. Body without spine. Cephalic cuticle forming collarete. Parasites of intestine of fish..... *Pseudoproleptus* Khera, 1953

1. Genus *Spinitectus* Fourment, 1883

Key to species

1. Caudal alae present; caudal papillae 7-12 pairs *S. minor*
- Caudal alae absent; caudal papillae 8 pairs..... *S. caballeroi*

1. *Spinitectus caballeroi* Datta and Majumder, 1972

(Fig. 21.)

1972. *Spinitectus caballeroi* Datta and Majumder, *An. Inst. Biol. Univ. Mex.*, 43 Ser. Cienc. Del. Mar. Y Linol. (1). p. 85.

Material Host *Bagarius bagarius*; location Stomach; locality Medinipur, West Bengal.

Diagnosis : Male : Body 5.40 long; with 102 spinous circlets, beyond which spines absent; first 16 compact, and closely set, remaining sparsely distributed; caudal alae absent; spicules unequal, dissimilar, right smaller, narrow gradually tapering 0.22 long; left longer wide, with knob proximally, 0.89; caudal papillae 8 pairs, 5 preanal, 1 adanal, 2 postanal.

Female Body 22.34 long; with 208 spinous circlets and sparsely distributed spines upto tail tip; first 21 compact and closely set; tail conical; vulva 0.36 from posterior end.

Distribution : India : West Bengal, (Medinipore).

2. *Spinitectus minor* (Stewart, 1914) Baylis, 1939

1914. *Spiroptera denticulata* var. *minor* Stewart, *Rec. Indian Mus.*, 10 p. 175.

1939. *Spinitectus minor* Baylis, *F.B.I.*, 2 p. 171.

Material : Host *Notopterus notopterus*; location-stomach; locality Calcutta, West Bengal.

Diagnosis Male Body 1.87-6.7 long; cuticle with series of transverse rings having backwardly directed spines diminishing posteriorly in size and number; caudal alae present; spicules dissimilar, unequal, right shorter 0.05-0.1 long, left longer 0.38-0.77 with 'foot shaped' distal end; caudal papillae 7-12 pairs, 3-4 preanal, 0-1 adanal, 3-8 postanal.

Female : Body 4.08-11.1 long; anterior end similar to male; vulva 0.25-0.4 from posterior end.

Distribution : India : West Bengal, (Calcutta).

2. Genus *Pseudoproleptus* Khera, 1955

1. *Pseudoproleptus vestibulus* Khera, 1955

1955. *Pseudoproleptus vestibulus* Khera, *Indian J. Helminth.*, 5(1953), p. 115.

Material : Several examples : Z.S.I. Reg. No. WN 186; host *Mastacembelus armatus*; location-intestine; locality Siliguri, Darjeeling, District, West Bengal; 17.vi. 1975, 18-19.ix. 1975, coll. T. D. Soota and Q.H. Baqri.

Diagnosis : Male : Body 5.9-29.7 long; oesophagus divided into two parts, anterior muscular, posterior glandular; tail with caudal alae, spicules dissimilar, unequal, smaller 0.168-0.234 long, larger 0.4-0.6; caudal papillae 10 pairs, 4 preanal, 6 postanal.

Female : Body 6.09-34.2 long; vulva postequatorial, 2.75-15.0 from posterior end.

Distribution : India : West Bengal, (Calcutta, Darjeeling) U.P., Lucknow.

Superfamily (8) ACUARIOIDEA

1. Family ACUARIIDAE (Railliet, Henry & Sisoff, 1912 Subfam.) Chabaud, 1975

Key to subfamilies

1. Cephalic ornamentation with cordons on cuticle which often form cuticular collarette..... 2
 Cephalic ornamentation with cylindrical horns, blades, sheilds or a hood, apex of these structures always clearly detached from the cuticle Schistorophinae
2. Cordons extending mainly longitudinally and extending largely on the cervical region.....
 Acuariinae Railliet, Henry & Sisoff, 1912
 Cordons extending transversely from near point of origin, and expand only on the cephalic region, to form a collaretteSeuratiinae

Subfamily ACUARIINAE Railliet, Henry and Sisoff, 1912

Key to genera

1. Cordons not recurrent and not anastomosing *Acuaria* Bremser, 1861
 Cordons recurrent, anastomosing or not anastomosing. Cordons not enlarged posteriorly. Body spines on lateral fields absent *Synhimantus* Railliet, Henry and Sisoff, 1912
 Cordons not recurrent but anastomosing in pairs. Body spines on lateral field present.....
 *Echinuria* Soloviev, 1912.

1. Genus *Acuaria* Bremser, 1811

Key to species

1. Male known 2
 Male unknown 4

2. Longer spicule 0.2 or more in length.....*A. anthuris*
 Longer spicule less than 0.2 in length..... 3
3. Longer spicule about 0.17 long *A. conica*
 Longer spicule 0.09 long.....*A. brevispicula*
4. Female upto 26 long; vulva prominent *A. indica*
 Female upto 28 long; vulva not prominent*A. lata*

1. *Acuaria anthuris* (Rudolphi, 1819) Railliet, Henry and Sisoff, 1912

1819. *Spiroptera anthuris* Rudolphi, *Entozoorum synopsis cri accedunt mantissa duplex et indices locupletissimi* 243., Beroline.

1912. *Acuaria (Acuaria) anthuris* Railliet, Henry and Sisoff. *Compt. rend. Soc. Biol., Paris*, 73(36) : 622-624.

Material : 2 examples : Z.S.I. Reg. Nos. W869/1 and W1564/1; host Red billed blue magpie (*Cissa erythrorhyncha occipitalis* [= *Urocissa e. occipitalis*]) and Redbilled Blue Chough (*Pyrrhocorax pyrrhocorax* [= *Graculus eremita*]); location gizzard; locality Zoological Gardens, Calcutta, West Bengal; 7.v. 1915. 1 example; Z.S.I. Reg. No. W1567/1; host-Indian Tree pie (*Dendrocitta rufa*); locality as above, coll. P.A. Maplestone.

Diagnosis : Male : Body 9.2-13 long; cordons extended posteriorly at about 2-3; caudal alae long and broad; tail straight, rounded tip; caudal papillae 11 pairs, 4 preanal and 7 postanal; spicules subequal; short and broad; bigger 0.22-0.287 and smaller 0.18-0.234 long.

Female : Body 13-31.5 long; cordons extended at about 7.5-9.0; tail rounded tip with a pair of subterminal papillae; vulva at 10-10.6 from anterior end.

Distribution : India : West Bengal, (Calcutta). Elsewhere : Afganistan, Kabul; Canada; Europe; Japan; U.S.A.

(T) 2. *Acuaria conica* Maplestone, 1931

1931. *Acuaria conica* Maplestone, *Rec. Indian Mus. Calcutta*, 33 : 77-79.

Material : 1 example : Z.S.I. Reg. No. W1566/1; host-Magpie Robin (*Capsychus saularis*); location gizzard; locality Zoological Gardens, Calcutta, West Bengal; coll. P.A. Maplestone.

Diagnosis : Male : Body 6.0-6.7 long; cordons 0.28-0.3 from anterior end; caudal alae broad; caudal papillae 4 pairs preanal, 6-7 postanal; spicules unequal dissimilar, longer 0.168 and shorter 0.112 long.

Female : Body 12.6-16.2 long; cordons 0.45-0.49 long; tail straight, 0.23 long; vulva behind the middle of the body; at 2/5 to 10/21 of the total length from posterior end.

Distribution : India : West Bengal, (Calcutta).

3. *Acuaria indica* Maplestone, 1932

1932. *Acuaria indica* Maplestone, *Rec. Indian Mus., Calcutta*, 34(3) : 248-249.

Material : Host Shikra (*Accipiter badius*); location - gizzard; locality Zoological Gardens, Calcutta, West Bengal.

Diagnosis : Male : Unknown.

Female : Body 22-26 long; cordons 0.44 long; cervical papillae short and stout, 0.25 from anterior end; tail tip blunt, 0.24-0.25 long; vulva behind the middle of body, at 9.8-12.6 from posterior end.

Distribution : India : West Bengal, (Calcutta).

4. *Acuaria brevispicula* Maplestone, 1932

1932. *Acuaria brevispicula* Maplestone, *Rec. Indian Mus.*, Calcutta, **34**(3) : 249-251.

Material : Host Magpie Robin (*Copsychus saularis*); location gizzard; locality Zoological Gardens Calcutta, West Bengal.

Diagnosis : Male : Body 4.4 long; cordons extended upto posterior end of oesophagus; caudal alae long, broad, divided into inner and outer areas' caudal papillae 9 pairs, 3 preanal, 6 postanal; spicules, 0.09 and 0.075 long.

Female : Unknown.

Distribution : India : West Bengal, (Calcutta).

(T) 5. *Acuaria lata* Maplestone, 1931

1931. *Acuaria lata* Maplestone, *Rec. Indian Mus.* Calcutta, **33** : 79-80.

Material : 1 example, Z.S.I. Reg. No. W 1565/1; host Red crested wood-quail (*Rollulus rouloul*); location : gizzard, locality-Zoological Gardens, Calcutta, West Bengal. coll. P.A. Maplestone.

Diagnosis : Male unknown.

Female Body 28.5-29 long; four coarse double cordons 20-21 long; tail curved ventrally; blunt tipped; vulva inconspicuous, 15-16 from anterior end.

Distribution : India : West Bengal, (Calcutta).

2. Genus *Echinuria* Solobviev, 1912

(T) k. *Echinuria hargilae* (Baylis and Daubney, 1923) Cram, 1927

1923. *Acuaria (Echinuria) hargilae*. Baylis and Daubney, *Ann. Mag. Nat. Hist. Ser. 9*, **11** : 333-335.

1927. *Echinuria hargilae* Cram, *United States National Museum, Bulletin* **140** : p 253.

Material : Several examples : Z.S.I. Reg. No. W870/1; host-Adjutant stork (*Leptoptilos dubius*); location-gizzard; locality-Zoological Gardens, Calcutta, West Bengal.

Diagnosis : Male : Body 11-11.5 long; cuticular spines absent; cordons extended back for a distance of 0.95-1.1 from anterior end; their transverse connections bend forward slightly as they cross the lateral lines; derids dorsal to cordons; oesophagus divided into three parts tail spirally coiled; caudal alae present; Caudal papillae 9 pairs, 4 preanal, 5 postanal; spicules unequal, dissimilar, right spicule slender, 0.65-0.675 long, left curved, irregularly twisted and flanged, with an expended root, 0.19-0.21 long.

Female : Body 13-15 long; vulva at about 0.17 from posterior end, anterior lip with prominent swelling; tail 0.05 long.

Distribution : India : West Bengal, (Calcutta).

3. Genus *Synhimantus* Railliet, Henry & Sisoff, 1912

Key to subgenera

1. Cordons not anastomosing.....*Dispharynx* Railliet Henry and Sisoff, (1912 gen.) Chabaud, 1975
2. Cordons anastomosing.....*Synhimantus* Railliet, Henry & Sisoff, 1912

1. Subgenus *Dispharynx* Railliet, Henry & Sisoff, 19121. *Synhimantus (Dispharynx) nasuta* (Rudolphi, 1819) Chabaud, 1975

1819. *Spiroptera nasuta* Rudolphi, *Entozoorum Synopsis Cri accedunt mantissa duplex et indices locupletissimi*, 238. Beralini.

1975. *Synhimantus (Dispharynx) nasuta* Chabaud, CIH keys to the Nematode Parasites of Vertebrates. No. 3, pt 2 : 54.

Material : Host Bronze winged jacana (*Metopidius indicus*); location oesophagus and gizzard; locality Zoological Gardens, Calcutta, West Bengal.

Diagnosis : Male : Body 4.5-8.3 long; cordons wavey, 0.42-0.52 long; deirids a little in front of posterior limit of cordons; caudal end spirally coiled; caudal alae long, narrow; caudal papillae pedunculated, 9 pairs, 4 preanal, 5 postanal; spicules unequal, dissimilar, left longer, slender 0.4-0.52 long; right broad, boat shaped, 0.15-0.2 long.

Female : Body 5.5-10.2 long; cordons 0.54-1 long; tail conica, with a button like termination, a median ventral papilla and a pair of small subventral papillae near the lip; vulva at about 2.0-2.5 from posterior end.

Distribution : India : West Bengal, (Calcutta). Elsewhere : Cosmopolitan.

2. Subgenus *Synhimantus* Railliet, Henry and Sisoff, 1912

Key to species

1. Vulva very close to anus*S. (S.) invaginatus*
Vulva away from anus..... 2
2. Female 3.3 long; tail suddenly narrowed 0.1 long.....*S. (S.) nanus*
Female 11.9-13.01 long; tail conical, 0.24-0.27 long.....*S. (A.) hydrabadensis*

1. *Syntimantus (Synhimantus) invaginatus* (V Linstow 1901) Railliet, Henry and Sisoff, 1912

1901. *Dispharagus invaginatus* Linstow, *Jena. Ztschr. Naturw.*, **28** : 414.

1912. *Synhimantus (Synhimantus) invaginatus* Railliet, Henry and Sisoff, *Compt. rend. Soc. Biol.*, Paris, **73** : 622-624.

Material : Several examples, Z.S.I. Reg. No. W1568/1; host-cattle Egret (*Bubulcus ibis coromandus*); location gizzard; locality-Zoological Gardens, Calcutta, West Bengal.

Diagnosis : Male : Body 8.5-11.1 long; cordons broad posteriorly, extended backward 0.44-0.61 from anterior end; the recurrent branches anastomosing at 0.24-0.33 from anterior end; tricuspid cervical papillae at 0.63-0.77 from head end; caudal alae thick and vascular; caudal papillae pedunculated, 9 pairs, 4 preanal and 5 postanal, spicules unequal, dissimilar, left shorter, slender, tapering 0.47 long, right stout, 0.9 long.

Female : Body 9.5-12.5 long; cordons similar to male; tail invaginated within a prepuce-like sheath of cuticle; anus and vulva very close together; tail very short and bluntly conical.

Distribution : India : West Bengal, (Calcutta). Elsewhere : Africa, Algeria; Corsica; Europe.

2. *Synhimantus (Synhimantus) hydrabadensis*, Ali, 1968

(Fig. 22. A & B)

1968. *Synhimentus hydrabadensis* Ali, *J. Helminth.* **42** : 221-242.

Material : Host Crow Pheasant (*Centropus sinensis*); location Proventriculus; locality Burdhaman, West Bengal; Recorded by A.P. Nandi and Krishna Kundu (1985).

Diagnosis : Male : Body 6.00-9.60 long, 0.21-0.30 wide; cuticle with transverse striations; cordons anastomosing, extended 0.36-0.55 from anterior end; pharynx 0.17-0.21 long; muscular oesophagus 0.43-0.73 long, and glandular 2.06-2.67 long; cervical papillae present; tail 0.32 long, with round tip; caudal alae thin; caudal papillae 13 pairs, pedunculated; 4 preanal and 9 postanal; spicules, unequal, dissimilar and alate: left longer, 0.57-0.69 long, right 0.18-0.25 long, broad, ended in a hook-like structure; longitudinal pre-cloacal ridges present.

Female : Body 11.90-13.01 long, 0.67--0.72 wide; tail conical 0.24-0.27 long; vulva 3.72-4.31 from posterior end; amphidelphic; eggs thin-shelled.

Distribution : India : West Bengal, (Bardhaman); Andhra Pradesh, Hyderabad.

(T) 3. *Synhimantus (Synhimantus) nanus* Maplestone, 1931

1931. *Acuaria (Synhimantus) nana* Maplestone, *Rec. Indian Mus.*, Calcutta, **33** : 81-82.

1961. *Synhimantus nanus* Yamaguti, *Systema Helminthum* Vol. **3** : 278, New York.

Material : 1 ex., Z.S.I. Reg. No. W1569/1, host-Golden backed woodpecker (*Brachypternus bengalensis* [= *B. aurantius*]); location gizzard; locality-Zoological Gardens, Calcutta West Bengal; coll. P.A. Maplestone.

Diagnosis : Male unknown.

Female : Body 3.3 long; subventral pair of cordons 0.26 long, dorsal pair about 0.3; tail suddenly narrowed, 0.1 long; vulva at about 11 from posterior end.

Distribution : India : West Bengal, (Calcutta).

Subfamily SEURATIINAE Chitwood & Wehr, 1932

1. Genus *Aviculariella* Wehr, 1913

1. *Aviculariella alcyona* Wehr, 1931

1931. *Aviculariella alcyona* Wehr, *Proc. U.S. natn. Mus.*, Washington, **79**(5) : 4.

Material : 1 ex. Z.S.I. Reg. No. W1571/1, host-Kingfisher (*Ceryle alcyon*); location gizzard; locality Zoological Gardens, Calcutta, West Bengal; * coll. P.A. Maplestone.

Remarks : * Maplestone (1931) described this species as *Rusguniella brevis*

Diagnosis : Male : Body 4.75 long; cordons extended about 0.044 from anterior end; a transverse groove present immediately behind the cordons; tail curved ventrally; caudal alae present; caudal papillae 7 pairs, pedunculated, 2 preanal 5 postanal; spicules unequal, dissimilar, longer slender, pointed tip, expanded root, 0.5 long; shorter 0.14 long, stout and curved.

Female Body 7.3 long; cordon 0.15 long, tail straight, bluntly pointed with a cap; caudal papillae present at the middle of tail; vulva about 0.15 from posterior end.

Distribution India : West Bengal, (Calcutta). Elsewhere . Canada; U.S.A.

Subfamily SCHISTOROPHINAE Travassos, 1918

1. Genus *Schistorophus* Railliet, 1916

1. *Schistorophus tenuis* (Maplestone, 1932) Singh, 1949 (Fig. 22. A & B)

1932. *Quasithelazia tenuis* Maplestone, *Rec. Indian Mus.*, **34**(3) : 233-235.

1949. *Schistorophus tenuis* Singh, *J. Helminth*, **23**(1-2) : 29-32.

Material : Host White breasted Kingfisher (*Halcyon [= Ceryle] smyrnensis*); location gizzard; locality Zoological Gardens, Calcutta, West Bengal.

Diagnosis : Male : Body 7.2-8.48 long; tail tip round; spicules unequal, dissimilar, left longer, slender, tubular 0.32 long, right short, stout, traugh like, 0.08 long; caudal papillae pedunculated 16 pairs; 12 pairs preanal, 4 pairs postanal.

Female : Body 14.6-15.3 long; tail bluntly conica; vulva 7.2-7.7 from posterior end.

Distribution : India : West Bengal, (Calcutta), Orissa, Chilka; Andhra Pradesh, Hydrabad.

Superfamily (9) DIPLOTRIAENOIDEA

1. Family DIPLOTRIAENIDAE (Skrjabin, 1916 subfam.) Anderson, 1958

Key to subfamilies

1 Mouth simple without peribuccal chitinous ring or epaulettes, with trident-like structures on each side of anterior end of oesophagus. Anus subterminal.

Vulva in oesophageal region. Parasites of cavities of birds..... Diplotriaeninae Skrjabin, 1916

Trident like structures absent. Oral opening bordered by cuticularized elevations or cuticular thickening in form of epaulettes.

Tail moderately long with lateral alae and elongate pedunculate papillae, less commonly subterminal without alae and with sessile papillae. Vulva in oesophageal region. Parasites of cavities of reptiles and birds.....

.....Dicheilonematinae Wehr, 1935

Subfamily DIPLOTRIAENINAE Skrjabin, 1916

Key to genus

Cephalic extremity with one pair of lateral pores on each opening of tridents. First-stage larva with circles of spines around cephalic end and on caudal end. Parasite of insectivorous birds

.....*Diplotriaena* Railliet and Henry, 1909

Genus *Diplotriaena* Railliet & Henry, 1909

Key to species

- Left spicule of male at least 1.0 long 1
 Left spicule of male less than 1.0 long 3
 1. Male with several pairs of preanal and postanal papillae 2
 Male apparently with 5 pairs of postanal papillae *D. nepalensis*
 2. Preanal papillae 3 or 4 pairs *D. tricuspis*
 Preanal papillae 2 pairs *D. graculi*
 3. Right spicule of male more than 0.5 long *D. dubia*
 Right spicule of male less than 0.5 long *D. urocissae*

1. *Diplotriaena tricuspis* (Fedchenko, 1874) Seurat, 1915

1874. *Filaria tricuspis* Fedchenko. *Izv. Imp. obsh. Lyub. Estestv. Antrop., & C.*, Moscow 10 : 60-61.

1915. *Diplotriaena tricuspis* Seurat, *Bull. Soc. Hist. Nat. Afr. Nord.*, 7(2) : 17-21.

Material : 1 example, Z.S.I. Reg. No. W867/1; host Blandford's laughing thrush (*Torchalopteron jerdoni meridionale*); location Body Cavity; locality Zoological Gardens, Calcutta, West Bengal.

Diagnosis : Male : Body 36-75 long; tridents 0.09-0.24 long; oesophagus divided into two parts, anterior narrow muscular, posterior wide, glandular; tail with truncate termination, 0.13 long; caudal papillae 9-11 pairs; spicules unequal, dissimilar, left straight, 1-2.5 long, right spirally twisted about 1½ turns, 0.55-0.92 long.

Female : Body 40-200.0 long; vulva in oesophageal region, 0.43-0.8 from anterior end; anus subterminal.

Distribution : India : West Bengal, (Calcutta, 24-Parganas (North)). Elsewhere : Africa, Asia, Europe, U.S.A.

(T) 2. *Diplotriaena graculi* (Maplestone, 1931) Baylis, 1939

1931. *Diplotriaena graculi* Maplestone, *Rec. Indian Mus.*, Calcutta, 33 : 97-100.

1939. *Diplotriaena graculi* Baylis, *Fauna of British India, Nematoda*, Vol. 2 : 39 p.

Material : 1 ex., Z.S.I. Reg. No. W1577/1; host Red-billed Chough (*Pyrhocorax pyrrhocorax* [= *Graculus eremita*]); location : body cavity; locality Zoological Gardens, Calcutta, West Bengal, coll. P.A. Maplestone.

Diagnosis : Male : Body 27.5-32 long; tridents irregular in shape, variable in the length of their branches, 0.18-0.208 long; caudal end bluntly rounded; caudal papillae 3 pairs, 2 pairs preanal, 1 postanal; spicules unequal, dissimilar, longer 1.565 long, shorter 0.634 long, spirally twisted in 5 or 6 turns.

Female : Body 70-108 long; vulva slightly prominent; 0.49-0.59 from anterior end.

Distribution India : West Bengal, (Calcutta). Elsewhere : Russia.

(T) 3. *Diplotriaeana dubia* (Mapleston, 1931) Baylis, 1939

1931. *Diplotriaeana dubia* Maplestone, *Rec. Indian Mus.*, **33** : 100-101.

1939. *Diplotriaeana dubia* Baylis, *Fauna of British India, Nematoda*, Vol. **2** : 40 p.

Material : 2 Psc. Z.S.I. Reg. No. W1578/1; host Red-billed Chough (*Pyrrhocorax pyrrhocorax* [= *Graculus eremita*]); location-body Cavity; locality Zoological Gardens, Calcutta, West Bengal; coll. P.A. Maplestone.

Diagnosis : Male : Body 8.55 long; caudal end rounded in lateral view; post cloacal portion of ventral surface covered with pointed papillae like prominences, caudal papillae 4 pairs preanal only; spicules, long straight 0.812 long, shorter 0.594 long, with a "broad double curve"

Female Unknown.

Distribution : India : West Bengal, (Calcutta).

(T) 4. *Diplotraena urocissae* (Maplestone 1931) Baylis, 1939

1931. *Diplotriaeana urocissae* Maplestone, *Rec. Indian Mus.*, Calcutta, **33** : 102-104.

1939. *Diplotriaeana urocissae* Baylis, *Fauna of British India, Nematoda*, Vol. **2** 41 p.

Material : 2 Pcs., Z.S.I. Reg. No. W1579/1, host Yellow billed blue Magpie (*Urocissa flavirostris*); location-body cavity; locality Zoological gardens, Calcutta, West Bengal; coll. P.A. Maplestone.

Diagnosis : Male only : Body 18.2 long; tridents 0.148 long; caudal end truncate; spicules, longer, 0.713 long, shorter 0.495 long, the whole forming an open S-shaped curve; only 2 pairs preanal caudal papillae.

Distribution : India : West Bengal, (Calcutta).

5. *Diplotriaeana nepalensis* Soota and Chaturvedi, 1967

(Fig. 23. A & B)

1967. *Diplotriaeana nepalensis* Soota and Chaturvedi, *J. Zool. Soc. India*, **19**(1 & 2) : 133-136.

Material : 5 examples, Z.S.I. Reg. No. WN686; host-Himalayan whistling thrush (*Myiophoneus caeruleus temmincki*); location-body cavity; locality Reang, Darjeeling District, West Bengal; 30-vi-1974; coll. T.D. Soota.

Diagnosis : Male : Body 19.8-32.2 long; tridents with transverse ridges and pointed tips and 0.18-0.198 long; tail 0.143-0.165 long; caudal papillae 5 pairs, all appear postanal; spicules unequal, dissimilar, left more or less straight, 1.0 long, right spirally twisted, 0.8 long the curves and 0.64 in straight line.

Female : Body 69-81.0 long; tridents as in male, 0.16-0.69 long; tail 0.28-0.38 long.

Distribution : India : West Bengal, (Darjeeling). Elsewhere : Burhanilkanth, Nepal.

6. *Diplotriana molpastisi* Majumdar & Chakravarty 1963

1963. *Diplotriana molpastisi* Majumdar & Chakravarty, *Z. Parasitenkunde* Berlin, 23 : 1-10.

Material : Host Red-vented bulbul (*Molpastes cafer benglensis*); location body cavity; locality - purchased from markets in Calcutta, West Bengal.

Diagnosis : Male : Body 22.0 long, 0.42 wide, without Striae; tridents with equal and corrugated prongs, 0.15 long; caudal end rounded; tail 0.078 long; caudal papillae 10 pairs, 4 pairs preanal and 6 pairs postanal; spicules, un-equal, dissimilar, left longer, straight and broadly curved distally, 0.65 long, right shorter, stouter twisted and alate, 0.45 long.

Female : Body 45.7-52.3 long, 0.55-0.58 wide; vulva 0.67-0.91 from anterior end; anus subterminal.

Distribution : India : West Bengal, (Calcutta).

Subfamily DICHEILONEMATINAE Wehr, 1935

1. Genus *Hastospiculum* Skrjabin, 19231. *Hastospiculum macrophallos* (Parona, 1889) Baylis, 1930

1889. *Filaria macrophallos* Parona, *Ann. Mus. Civ. Stir. Nat. Genova* (2), 7(37) : 778.

1930. *Hastospiculum macrophallos* Baylis, *Ann. & Mag. Nat. Hist.* (10), 6 : 672-677.

Material : 1 ex. Z.S.I. Reg. No. W1576/1; host-*Varanus salvator*, *V. flavescens* and *V. nebulosus*; location-abdominal cavity; locality-Zoological gardens, Calcutta, West Bengal.

Diagnosis : Male : Body 80-100 long, complete specimens seldom obtained; male comparatively rare; cuticle transversely striated; caudal end bluntly rounded with alae, which started only a short distance near the cloaca and continuous round the posterior end, thus forming a bursa-like structure; caudal papillae with long peduncle 8-9 pairs, variable in number and position; spicules unequal alate, pointed and slightly hooked tips, left longer 2-4.45, long right shorter 0.42-0.51 long.

Female : Body upto about 250 long; longitudinal striations prominent; tail bluntly rounded with a pair of papillae at its extremity; anus subterminal; vulva at 0.85-1.15 from anterior end. Eggs barrel shaped.

Distribution : India : West Bengal, (Calcutta); Car-Nicobar. Elsewhere : Burma, Annam; Equatorial, Africa.

Superfamily 10. APROCTOIDEA

1. Family APROCTIDAE (Yorke & Maplestone, 1926 subfam.) Skrjabin & Schikhobalova, 1945

Subfamily APROCTINAE Yorke & Maplestone, 1926

Genus *Pseudaprocta* Schikhobalova, 1930*Pseudaprocta vagabunda* n. sp.

(Fig. 24 A-C)

Material : Holotype 1 ♂ Z.S.I. Reg. No. WN 687; host Tree pie (*Dendrocitta vagabunda*); location Orbital muscle; locality Gonpur, Birbhoom District, West Bengal, 10.iii.1988, coll. S. R. Dey Sarkar.

Paratypes 1 ♂ 2 ♀♀, Z.S.I. Reg. No. 688; other details as for the holotype.

Diagnosis : Body delicate, yellowish when alive. Cuticle unstriated. Anterior and posterior end bluntly rounded in both sexes. Buccal cavity minute. With delicate lobed cordons between cephalic papillae and amphids. Oesophagus short and undivided. Spicule similar and subequal. Gubernaculum absent.

Female : Tail short with a pair of small subterminal papilla ventrally. Vulva in oesophageal region.

Male : Body 17.12-21.6 long, 0.27-0.34 wide; nerve ring 0.176-0.24 from anterior end; oesophagus 0.8-0.96 long; tail short curved ventrally, 0.16-0.128 long; spicules subequal, stout, pointed tips, longer 0.288-0.256 and shorter 0.24-0.272 long; caudal papillae 4 pairs, 2 pairs preanal and 2 postanal.

Female : Body 35-38 long; 0.624-0.72 wide; nerve ring 0.192-0.208 from anterior end; oesophagus 0.96-1.04 long; vulva prominent, 0.48-0.528 from anterior end; tail 0.128-0.16 long with a pair of subterminal papillae, eggs 0.016 X 0.048 in diameter.

Discussion : The present species differs markedly from all other species described so far under the genus *Pseudaprocta* Schikhobalova, 1930, in size of spicules, number and arrangement of caudal papillae and various body measurements. However, it is nearer to *Pseudaprocta gubernacularia* Schikhobalova 1930, in the presence of a pair of subterminal caudal papillae in the female. But, differs from it in various body measurements, size of spicules, number and arrangement of caudal papillae, and in absent of gubernaculum. The present species (male = 17.12-21.6, female = 35-38) is much longer than *P. gubernacularia* (male = 16.0, female = 16-17). The spicules are 0.359 and 0.398 in *P. gubernacularia* while the same are 0.256 and 0.288 in the present species.

Hence, the present species is regarded as different from all the known forms and is named *Pseudaprocta vagabunda* n.sp.

Superfamily (11) FILARIOIDEA

1. Family FILARIIDAE (Weinland, 1858) Cobbold, 1879

Subfamily FILARIINAE Weinland, 1858

1. Genus *Filaria* Mueller, 1787

1. *Filaria haje* Wedl, 1862

1862. *Filaria haje* Wedl, Sitz, K. Akad. Wiss Math. Naturw. Classe Wien., 44 : 463-482.

Material : Hosts Cobra (*Naja tripudians*) and Banded Krait (*Bungarus fasciatus*); location - intestine; locality Zoological Gardens, Calcutta.

Diagnosis : According to Wedl's description Body 20-25 long; cuticle thick and transversely wide and muscular; tail ended in a conical spike; curved dorsally. Specimens recorded by Baylis and Daubney (1922), about 6-8 long.

Distribution : India : West Bengal, (Calcutta). Elsewhere : Africa, Egypt.

2. *Filaria abbreviata* Rudolphi, 1819

1819. *Filaria abbreviata* Rudolphi, *Entozoorum synopsis Cri accedunt mantissa duplex et indices locupletissimi*, 555. Berolini.

Material : Host *Saxicola* sp.; location Orbit; locality ? Zoological Gardens, Calcutta, West Bengal, recorded by Baylis & Daubney (1922).

Diagnosis : Female : Body 24 long. 0.57 wide; anterior end attenuated and truncated; cuticle smooth, buccal capsule small; oesophagus divided into two parts; anus subterminal, vulva at 0.45 from anterior end.

Distribution : India : West Bengal, (Calcutta). Elsewhere : Viena.

2. Family ONCHOCERCIDAE (Leiper, 1911) Anderson, and Bain, 1976

Key to subfamilies

- 1. Buccal capsule present 2
- Buccal capsule absent 3
- 2. Buccal capsule well developed. Caudal alae absent. Development in Diptera. Infective stage with large glandular oesophagus and long tail with minute subterminal processes. Parasites of mammals..... Setariinae Yorke & Maplestone, 1926
- Buccal capsule clearly defined or inconspicuous. Caudal alae absent or weakly developed. Development in various haematophagous arthropods. Infective stage with long tail. Parasites of reptiles, birds and mammals. Onchocercinae Leiper, 1911
- 3. Buccal capsule reduced or absent. Oesophagus short. Caudal papillae reduced in size and number. Tail long. Development in Diptera. Parasites of reptiles, birds and mammals Splendidofilariinae Chabaud & Choquet, 1953
- Buccal capsule absent. Oesophagus long. Caudal papillae few in number. Anus subterminal in both sexes. Parasites mainly of birds, rarely of reptiles and mammals Lemdaninae Lapez-Neyra, 1956

Subfamily SETARIINAE Yorke & Maplestone, 1926

1. Genus *Setaria* Viborg, 1759

Key to species

- 1. Lateral processes of tail of female round *C. equina*
- Lateral processes of tail of female conical *C. cervi*

1. *Setaria equina* (Abildgaard, 1789) Railliet & Henry, 1911

1789. *Gordius equinus* Abildgaard, in Muller, *Zool. Dan.*, 3 : 49-50.

1911. *Setaria equina* Railliet & Henry, *Bull. Soc. Path. Exot.*, 4(6) : 387.

Material : Host Equines Donkey, Horse, Mule; location-intestine, liver, lungs, peritoneal cavity, stomach, thoracic cavity.

Locality : Calcutta, West Bengal.

Diagnosis : Male : Body 48-80 long; circumoral ring with four prominences; four of the submedian cephalic papillae very prominent; tail tip rounded 0.1-0.15 long with a pair of papilla-like lateral appendages; caudal papillae 8 pairs, 4 preanal, and 4 postanal; spicules markedly dissimilar, left spicule longer about 0.63-0.66 long, and its proximal and distal portions nearly equal in length, right shorter about 0.14-0.23 long, and oblong in lateral view.

Female : Body 70-120 long; tail 0.38-0.6 long; ended in a knob, smooth or spiny, a pair of rounded, papilla-like sublateral appendages, 0.045-0.07 from the tail tip; vulva at 0.41-0.7 from anterior end.

The microfilaria, in the blood of the host, 0.28 long, 0.007 wide.

Distribution : India : West Bengal, (Calcutta), Assam; Mukteswar, U.P.; Tamil Nadu. Elsewhere : Cosmopolitan.

2. *Setaria cervi* (Rudolphi, 1819) Baylis, 1936

1819. *Filaria cervi* Rudolphi, *Entozoorum synopsis cri accedunt mantissa duplex et indices locupletissimi*, 8 p. Berolini.

1936. *Setaria cervi* Baylis, *Ann. Trop. Med. and Parasitol.*, **30** : 297.

Material : 1 ex. (damaged), Z.S.I. Reg. No. W1517/1, host *Cervus axis*; location abdominal cavity; locality Zoological Gardens, Calcutta, West Bengal; coll. P.A. Maplestone.

Diagnosis : Male : Body 30-60 long; dorsal and ventral processes of the circumoral ring prominent but variable in shape; cephalic papillae less prominent; tail tip rounded, 0.2-0.24 long; papilla-like appendages well-developed; caudal papillae variable in number, 3-5 pairs of preanal or adanal, and 3-5 pairs of postanal; spicules unequal, dissimilar, left longer 0.26-0.4 long, proximal portion tubular, relatively long, distal portion twisted and complex form; right shorter, broad, membranous, boat shaped, 0.1-0.16 long.

Female : Body 40-120 long; anterior end as in male; tail 0.26-0.65 long, ended in a knob, smooth or spiny; lateral processes well developed and conical; vulva at 0.43-0.83 from anterior end.

Distribution : India : West Bengal, (Calcutta); Bombay, Maharashtra; Hyderabad, A.P.; Izatnagar and Mukteswar, U.P. Elsewhere : Cosmopolitan.

2. Genus *Papillosetaria* Vevers, 1922

(T) 1. *Papillosetaria veversi* Maplestone, 1931

1931. *Papillosetaria veversi* Maplestone, *Rec. Indian Mus.*, Calcutta, **33** : 94-97.

Material : 4 pcs., Z.S.I. Reg. No. W1575/1; host *Tragulus javanicus*; location - extra peritoneal surface of abdominal wall; locality Zoological Gardens, Calcutta, West Bengal, Coll. P.A. Maplestone.

Diagnosis : Male : Body 70 long; circumoral ring absent; cuticle with irregularly placed papilli-form structures extending from about the middle of the oesophagus to about 3 from posterior

end; caudal end spirally coiled; tail pointed 0.09 long; caudal papillae 10 pairs 7 preanal and 3 postanal; spicules unequal dissimilar, longer 0.275 long, its proximal part stout curved tube, distal end with two or more lash-like portions coiled round one another; shorter 0.09 long, broad and boat shaped.

Female : Body 142.0 long; cuticular papilliform structures extended from about the middle of oesophagus to the anus; tail pointed, curved dorsally, 0.26 long, with "a pair of large prominent papillae on each side of it a short distance anterior to the tip"; vulva at 0.535 from anterior end.

Distribution : India : West Bengal, (Calcutta). Elsewhere : Java.

Subfamily ONCHOCERCINAE Leiper, 1911

1. Genus *Dipetalonema* Diesing, 1861

1. *Dipetalonema digitatum* (Chandler, 1929) Baylis, 1939

1929. *Dirofilaria digitata* Chandler, *Proc. U.S. Nat. Mus.* Washington 75, Art. 6 : 1-10.

1939. *Dipetalonema digitatum* Baylis, *F.B.I. Nematoda*, Vol.2 : 10 p.

Material : Host Hoolock gibbon (*Hylobates hoolock*); location-abdominal cavity; locality Zoological Gardens, Calcutta, West Bengal, Coll. A.C. Chandler.

Diagnosis : Female : Body 170-210 long; both ends very slender and tapering; cuticular striation absent; tail 0.33 long, cylindrical, with blunt tip bearing two pairs of digitiform papillae; vulva slightly prominent, 1.1-1.3 from anterior end.

Distribution : India : West Bengal, (Calcutta). Elsewhere : Burma; Annam; Thailand.

Subfamily SPLENDIDOFILARIINAE Chabaud and Choquet, 1953

Key to genera

1. Tail of male blunt. Spicules equal, vulva in oesophageal region. Female tail blunt.....
.....*Chandlerella* Yorke & Maplestone, 1926
Tail short, bluntly conical spicules unequal. Vulva behind the posterior end of oesophagus.
Female tail with dorsoventral cleft*Protofilaria* Chandler, 1929

1. Genus *Chandlerella* Yorke & Maplestone, 1926

(T) 1. *Chandlerella bosei* (Chandler, 1924) Yorke & Maplestone, 1926

1924. *Filaria bosei* Chandler, *Parasitology*, Cambridge, 16 : 399-400.

1926. *Chandlerella bosei* Yorke & Maplestone, *The nematode parasites of vertebrates* : 411.

Material : 1 ex. Z.S.I. Reg. No. W1364/1, host Racket tailed Drongo (*Dissemurus paradiseus*); location peritoneal covering of axillary air sac; locality Zoological Gardens, Calcutta, West Bengal, Coll. A. C. Chandler.

Diagnosis : Male : Body 9-11.5 long; cuticle smooth; oesophagus undivided short, stout, club-shaped; caudal end coiled; tail 0.14-0.16 long with 3 pairs of subventral papillae; spicules equal, short, stout, trough like, 0.07-0.084 long.

Female : Body 24.5 long; cuticle as in male; tail short, blunt, 0.4 long; vulva at 0.31 from anterior end.

Distribution : India : West Bengal, (Calcutta).

2. Genus *Protofilaria* Chandler, 1929

1. *Protofilaria furcata* Chandler, 1929

1929. *Protofilaria furcata* Chandler, *Proc. U.S. Nat. Mus.*, **75** Art 6. P: 1-10.

Material : Host Ruffed lemur (*Lemur ruber*); location thoracic cavity; locality-Zoological Gardens, Calcutta, West Bengal. [host from Madagascar]; coll. A.C. Chandler.

Diagnosis : Male : Body 13-15 long; cuticle smooth; body tapering at each end; tail 0.085-0.09 long; left spicule 0.115 long, spoon shaped, right spicule blunt about 0.07 long, caudal papillae absent.

Female : Body 29-30 long; vulva at about 1.4 from anterior end.

Distribution : India : West Bengal, (Calcutta).

4. Subfamily LEMDANINAE Lapez-Neyra, 1956

1. Genus *Lemdana* Seurat, 1917

1. *Lemdana bengalensis* Soota & Chaturvedi, 1971

(Fig. 25. A-C)

1971. *Lemdana bengalensis* Soota & Chaturvedi, *Zool. Anz. Leipzig*, **186** (5-6) : 362-364.

Material : 1 ex., Z.S.I. Reg. No. W6934/1, host-Brown shrike (*Lanius cristatus*); location - Subcutaneous tissue near neck; locality Salt Lake, Calcutta, West Bengal; 18.ix. 1969. coll. S. S. Saha.

Diagnosis : Male : Body 20.0-24.8 long; cuticle smooth; lateral fields narrow; oesophagus divided; tail short and rounded, 0.064-0.084 long; spicules very unequal, left tubular, longer 2.8-2.88 long, with a sheath 1.12 long, right smaller 0.3-0.37 long; 3 circumanal papillae only are taceable.

Female : Body 66.0-89.5 long; tail 0.11-0.13 in length, short round and bearing two small terminal subventral papillae; vulva in oesophageal region and 1.44 from anterior end.

Distribution : India : West Bengal, (Calcutta); Monghyr, Bihar; Satpara, Orissa. Elsewhere : Nepal, Thankat.

5. Order STRONGYLIDA

Superfamily (1) ANCYLOSTOMATOIDEA

1. Family ANCEYLOSTOMATIDAE (Looss, 1905) Lichtenfels 1980

Key to subfamilies

1. Duct of dorsal oesophageal gland generally in dorsal gutter on inner surface of buccal capsule. Gubernaculum Present. Dorsal ray of bursa with two short stems. Vulva in the posterior half of the body. Female tail with terminal spike Ancylostomatinae Looss, 1905

Duct of dorsal oesophageal gland in tooth like dorsal cone. Gubernaculum absent. Dorsal ray of bursa with two long stems. Vulva in the anterior half of the body. Female tail blunt or pointed, but without terminal spike..... Bunostominac (Railliet & Henry, 1909) Looss, 1911.

1. Subfamily ANCYLOSTOMATINAE Looss, 1905

Key to tribes

1. Teeth or cutting plates absent.....
Globocephalina (Travassos & Vogelsang, 1932 subfam.) Lichtenfels, 1980
 Teeth or cutting plates present or weakly developed..... 2
2. Oral opening armed with teeth. Parasites of carnivora, Primates, Edentata and Suidae.....
 Ancylostomatinae (Looss, 1905 subfam.) Lichtenfels, 1980.
 Cutting plates in oral opening, poorly developed. Buccal capsule formed by five to ten articulating plates.....Arthrocephalina (Schmidt & Kuntz, 1968, subfam.) Lichtenfels, 1980.

1. Tribe Ancylostomatinae (Looss, 1905 Subfam.) Lichtenfels, 1980

Key to genera

- Buccal capsule small and cup-shaped. Cuticle thin and serrated. Externo-dorsal rays arise from the main stem of the dorsal ray. Parasites of submucosal cysts of intestine of Felidae
 *Galonchus* Railliet 1918
- Buccal capsule deep and infundibular. Cuticle thick and unserrated. Externo-dorsal rays arise high up on the median stem of the dorsal ray.
 Parasites of intestine of carnivora. Primates, Edentata, Rodentia and suidae.....
 *Ancylostoma* (Dubini, 1843) Creplin, 1845

1. Genus *Galoncus* Railliet, 1918

1. *Galoncus perniciosus* (V. Linstow, 1885) Railliet, 1918

1885: *Ankylostomum perniciosum* Linstow, *Arch. f. Naturg.*, 51 J. 1(3) : 238-239.

1918. *Galoncus perniciosus* Railliet, *Bull. Soc. Path. exot.*, Paris, 11 : 86-93.

Material : Several examples, Z.S.I. Reg. No. W943/1; host-*Panthera pardus* [= *Felis pardus*]; location-intestine; locality Zoological Gardens, Calcutta, West Bengal, 4.iv. 1919.

Diagnosis : Male : Body 8-14 long; anterior of body retractile; buccal capsule 0.07-0.08 long; spicules 1.7-2.0 long; gubernaculum 0.045 long.

Female : Body 11.6-17.4 long, tail 0.15-0.225 long, ended in a small spike; vulva at 2.8-3.6 from posterior end.

Distribution : India : West Bengal, (Calcutta). Elsewhere : Africa; Europe.

2. Genus *Ancylostoma* (Dubini, 1843) Creplin, 1845

Key to Subgenera

1. Oral opening with three pairs of ventrolateral teeth.

Bursa with short lateral lobe and divergent rays.

Parasites of carnivora, Primates, Edentata, Suidae; cosmopolitan.....

..... *Ancylostoma (Ancylostoma)* Lane, 1916

Oral opening with two pairs of ventrolateral teeth.

Externolateral ray divergent from mediolateral and posterolateral rays parallel.

Externodorsal ray originating near middle of dorsal ray.

Parasites of carnivora, Primates, Rodentia, of Indo-Malayan region.....

..... *Ancylostoma (Ceylancylostoma)* Lane, 19161. Subgenus *Ancylostoma* Lane, 1916

Key to species

1. Inner most pair of ventral teeth almost as large as the others; spicules about 0.9 long

..... *A. (A.) caninum*Inner most pair of ventral teeth rudimentary; spicules about 2 long.....*A. (A.) duodenale*1. *Ancylostoma (Ancylostoma) duodenale* (Dubini, 1843) Creplin, 18451843. *Agchylostoma duodenale* Dubini, *Ann. Univ. Med. Milano*, **106** : 5-13.1845. *Ancylostoma duodenale* Creplin, *Arch. f. Naturg.*, Beng., 11th year, vol. 1 p. 325; and 12th year, vol. 1. p. 129.1916. *Ancylostoma (Ancylostoma) duodenale* Lane, *Ind. J. Med. Res. Calcutta*, **4** : 74-92.

Material : Several examples, Z.S.I. Reg. No. W864/1; host-Man; Location ? locality - Baharampur, Murshidabad District, West Bengal, 5.i. 1910, coll. C.J.R. Milne.

Several examples, Z.S.I. Reg. Nos. W911/1, and W1071/1; host Tiger (*Panthera tigris*); location intestine; locality Zoological Gardens, Calcutta, West Bengal; 21.ii. 1916 & 17.vii. 1924.

Diagnosis : Male : Body 8-11 long; buccal capsule 0.185-0.25 long; ventral teeth consist of two large pairs and a rudimentary inner pair; medio-lateral and postero-lateral rays of bursa widely separated; spicules about 2.0 long; gubernaculum 0.1-0.15 long.

Female : Body 10-13 long; vulva at about posterior third of body.

Distribution : India : West Bengal, (Calcutta, Darjeeling, Murshidabad); Delhi, Hardoi, Lucknow, Narela, Thamarwa, U.P. Elsewhere : Cosmopolitan in distribution.

2. *Ancylostoma (Ancylostoma) caninum* (Ercolani 1859) V. Linstow, 1889

1859. *Strongylus caninus* Ercolani, *Noewi Elementi tearicoparactici di Medicina Veterinaria Bologna* 530.

1889. *Ankylostomum Caninum* V. Linstow, *Helminthologisches, Arch. f. Naturg.*, Berlin, 1 : 235.

1916. *Ancylostoma (Ancylostoma) caninum* Lane, *Ind. J. Med. Res.* Calcutta, 4 : 74.

Material : Several examples, Z.S.I. Reg. Nos. W912/1-W924/1; hosts wild dog (*Cyon dukhunensis*), Indian wolf (*Canis pallipes*), Indian Jacal (*Canis aureus*), Indian fox (*Vulpes bengalensis*), Indian desert fox (*Vulpes pusilla* (= *Vulpes leucopus*), leopard (*Panthera pardus* (= *Felis pardus*), Fishing Cat (*Felis viverrina*) and domestic cat. locality Zoological Gardens, Calcutta, recorded by Baylis and Daubney (1922, 1923); several ex.; Z.S.I. Reg. No. WN192/1; host Indian fox (*Vulpes bengalensis*); location intestine; locality Manibhanjan, Darjeeling District, West Bengal; 16.v. 1975 coll. T.D. Soota.

Several ex., Z.S.I. Reg. No. WN 689; host-domestic dog; location intestine; locality Kalimpong, Darjeeling District, West Bengal; 8.ix. 1975; coll. R. K. Ghosh.

Diagnosis : Male : Body about 10.0 long; buccal capsule 0.25 long; with 3 pairs of large ventral teeth; medio-lateral and postero-lateral rays widely separated; spicules about 0.9 long; gubernaculum 0.16 long.

Female : Body about 14.0 long; tail about 0.2 long; vulva at about posterior third of the body.

Distribution : India : West Bengal, (Calcutta, Darjeeling); Aligarh, Mukteswar, U.P.; Bombay, Maharashtra; Punjab. Elsewhere : Cosmopolitan in distribution.

2. Subgenus *Ceylancylostoma* Lane, 1916

Key to species

1. Inner pair of ventral teeth well developed; spicule about 3.0 long *A. (C.) malayanum*
- Inner pair of ventral teeth rudimentary; spicule about 0.8 long; *A. (C.) ceylanicum*

1. *Ancylostoma (Ceylancylostoma) ceylanicum* Leiper, 1915

1915. *Ancylostoma ceylanicum* Leiper, *J. Roy. Army. Med. Corps*, 24(6) : 569.

1916. *Ancylostoma (Ceylancylostoma) ceylanicum* Lane, *Ind. J. Med. Res.*, Calcutta, 4 : 74-91.

Material : Several ex. Z.S.I. Reg. Nos. W931/1-W937/1; hosts *Canis aureus*, *Canis pallipes*, *Cyon dukhunensis*, *Vulpes bengalensis*, *Vulpes pusilla* (= *Vulpes leucopus*), *Melursus ursinus*, *Panthera tigris* (= *Felis tigris*), *Panthera pardus* (= *Felis pardus*), *Felis viverrina*; domestic Cat. location intestine; locality Zoological Gardens, Calcutta, and India Museum Compound (from domestic Cat, Reg. No. W933 & W934/1 24.iv. 1915 & 15.i. 1915).

Diagnosis : Male : body about 7.7-8.5 long; buccal capsule 0.175 long, ventral teeth consist of one large pair and a rudimentary inner pair; medio-lateral and postero-lateral rays close together; spicules about 0.8 long; gubernaculum 0.075 long.

Female : Body about 9-10.5 long; tail 0.16 long; vulva about 3.5 from posterior end.

Distribution : India : West Bengal, (Calcutta, Darjeeling, Murshidabad). Elsewhere : China, Japan, Formosa, Korea, Saim, Philippines.

2. *Ancylostoma (Ceylancylostoma) malayanum* (Alessandrini, 1905) Lane, 1916

1905. *Uncinaria malayana* Alessandrini, *Su di alcuni Uncinariæ parasite dell' uomoe di altri vertebrati*, T.C. pts. 1-3, 31-33.

1916. *Ancylostoma (Ceylancylostoma) malayanum*, Lane, *Ind. J. med. Res.*, Calcutta, 4 : 74-91.

Material : Several ex. Z.S.I. Reg. No. W940/1-W941/1; hosts-Sloth bear (*Melursus ursinus*); Malay bear (*Helactos malaynus (= Ursus malayanus)*) and *Selenarctos thibetanus thibetanus (= Ursus torquatus)*; location intestine; locality Zoological Gardens, Calcutta, West Bengal; 1.v. 1916 & 6.vii. 1914.

Diagnosis : Male : Body 11.5-16 long; buccal capsule 0.185 long; ventral teeth two pairs, the inner pair well developed; though considerably smaller than the outer; medio lateral and posterolateral rays close together; spicules 3.0 long; gubernaculum 0.1 long.

Female : Body 15-19 long; tail 0.125 long; vulva at about 7.0 from posterior end.

Distribution India West Bengal, (Calcutta, Darjeeling); Angul, Orissa. Elsewhere : Malaya.

2. Tribe Arthrocephalina (Schmidt & Kuntz, 1968, Subfam.) Lichtenfels, 1980

Genus *Arthrostoma* Cameron, 1927

(T) 1. *Arthrostoma longespiculum* (Maplestone, 1931) Lichtenfels, 1980

1931. *Uncinaria longe spiculum* Maplestone, *Rec. Indian Mus.* Calcutta, 33 : 169-171.

1980. *Arthrostoma longespiculum* Lichtenfel., *CIH Keys to Nematode Parasite of vertebrates*, No. 8. p. 11.

Material : 7 exs. Z.S.I. Reg. No. W1602/1; host Civet Cat (*Viverricula malaccensis*); location small intestine; locality Zoological Gardens, Calcutta, West Bengal, coll. P.A. Maplestone.

Diagnosis : Male : Body about 3.8 long; buccal capsule about 0.08-0.1 long, 0.06-0.09 wide; formed by "three articulated plates, and articulations are also visible in the laterals walls of the capsule" (Maplestone); subventral lancets triangular and prominent; terminations of the branches of dorsal ray of bursa tridigitate, outer most digitation being longest; spicules equal, slender, 1.19-1.25 long; gubernaculum about 0.07-0.09 long.

Female : Body 3.3-4 long; tail blunt at the tip, 0.1-0.25 long; Vulva a little behind mid body; near the vulva an asymmetrical papilla present.

Distribution : India : West Bengal, (Calcutta). Elsewhere : Philippines, Tonkin; U.S.A. Washington Zoo.

3. Tribe Globocephalina (Travassos & Vogelsang, 1932, Subfam.) Lichtenfels, 1980.

Genus *Globocephalus* Molin, 1861

Key to species

1. Teeth in buccal capsule bicuspid *G. samoensis*
Teeth in buccal capsule simple and triangular or ridge like 2
2. Buccal capsule subglobular. Bases of teeth extend to its extreme posterior end ... *G. urosubulatus*
Buccal capsule funnel shaped. Bases of teeth do not reach its posterior end *G. connorfilii*

1. *Globocephalus urosubulatus* (Alessandrini, 1909) Baylis, 1936

1909. *Crassisoma urosubulatus* Alessandrini, *Arch. Par.*, **13** : 459-474.

1936. *Globocephalus Urosubulatus* *The Fauna of British India* Nematoda, Vol. **1** : 328p.

Material : Several examples, Z.S.I. Reg. NW1546/1; host - Pig; location small intestine. locality Slaughter house in Calcutta, West Bengal; Recorded by P.A. Maplestone.

Diagnosis : Male : Body 3.99-4.69 long; buccal capsule subglobular, 0.14-0.2 in depth, and 0.084-0.14 in internal diameter; a pair of teeth, triangular and variable size present to the extreme posterior edge of the capsule; spicules 0.852-0.931 long.

Female : Body 4.74-6.87 long; tail 0.12-0.196 long.

Distribution : India : West Bengal, (Calcutta); Hardoi, U.P. Elsewhere : Canton; Europe: Italy; Luzon, Puerto Rico; U.S.A. Vergin Island.

2. *Globocephalus connorfilli* Lane, 1922

1922. *Globocephalus connorfilis* Lane, *Ann. Mag. nat. Hist.*, London, (9) **9** : 683-685.

Material : Several examples; Z.S.I. Reg. No. W155/1; host-domestic Pig; location small intestine; locality - Slaughter house in Calcutta, West Bengal; Recorded by P.A. Mapiestone (1930).

Diagnosis : Male : Body 4-5 long; buccal capsule funnel shaped, 0.12-0.212 long, and 0.068-0.108 in internal diameter; teeth originate somewhat further forward on the ventral wall of the capsule; spicules 0.455-0.594 long.

Female : Body 4.1-6.5 long; tail 0.13-0.21 long, caudal papillae 0.04 from the tip; Vulva 2-2.4 from posterior end.

Distribution : India : West Bengal, (Calcutta).

3. *Globocephalus samoensis* Lane, 1922

1922. *Globocephalus samoensis* Lane, *Ann. Mag. nat. Hist.*, London, (9) **9** : 683-685.

Material : Several example, Z.S.I. Reg. No. W1548/1; host domestic pig; location small intestine locality Slaughter house in Calcutta, West Bengal; Recorded by P.A. Maplestone (1930).

Diagnosis : Male : Body 4.2-5.7 long; buccal capsule "nearly circular guarded by most rudimentary ventral semilunes, and bearing posteriorly a pair of large, stout, bicuspid teeth"; spicules about 0.4, (according to Maplestone 0.376-0.495), gubernaculum diamond shaped in dorsal view. 0.055 long.

Female : Body 5.3-6.7 long; tail 0.084-0.124 long, without terminal spike, caudal papillae at 0.015 from the tip; vulva at about 2.0 from posterior end.

Distribution : India : West Bengal, (Calcutta). Elsewhere : Samoa.

Subfamily BUNOSTOMINAE (Railliet & Henry, 1909, Tribe) Looss, 1911

Key to tribes

1. Anterior end anterodorsally directed. Oral opening without cutting plates or with small inconspicuous ventral cutting plates. Buccal collar present Oesophagus 1/20th of body length.....
..... *Acheilostominea* Lichtenfels, 1980

Anterior end bent dorsally. Oral opening with well-developed cutting plates. Buccal collar absent. Oesophagus about 1/10th of body length. *Bunostominae* Railliet & Henry, 1909

1. Tribe *Acheilostominae* Lichtenfels, 1980

1. Genus *Tetragomphius* Baylis and Daubney, 1923

1. *Tetragomphius procyonis* Baylis & Daubney, 1923

1923. *Tetragomphius procyonis* Baylis & Daubney, *Ann. Mag. nat. Hist. Soc. Sr.*, (9) 11 : 334.

Material : 8 exs. Z.S.I. Reg. No. ZEV 6077/7; host *Raccon* (*Procyon* sp.); location ? pyloric end of the stomach; locality Zoological Gardens, Calcutta, West Bengal; 28.iii. 1892; donor Zoological Gardens, Calcutta.

Diagnosis : Male : Body 13-15 long; head small, bent dorsally; cusps of subdorsal teeth stout and conical, subventral teeth more slender; cervical papillae present; dorsal ray stout, giving off the externodorsal rays a little in front of its bifurcation; terminations of its branches bidigitate; spiculs slender, pointed 7-8 long.

Female : Body 16-20 long, anterior extremity as in male; tail bluntly pointed; 0.34 long; vulva with prominent lips. 3.6-4 from posterior end.

Distribution : India : West Bengal, (Calcutta); Musoori, U.P.

2. Tribe *Bunostominae* Railliet & Henry, 1909

Key to genera

1. Male copulatory bursa symmetrical..... *Necator* Stiles, 1903.

Male copulatory bursa asymmetrical..... *Bunostomum* Railliet, 1902.

1. Genus *Necator* Stiles, 1903

1. *Necator americanus* (Stiles, 1902) Stiles, 1903

1902. *Uncinaria americana* Stiles, *Am. Med.*, 3(19) : 777-778.

1903. *Necator americanus* Stiles, *Journ. Amer. Med. Ass.*, Chicago, 41 : 312-313.

Material : Host-African Rhinoceros, *Didermocerus sumatrensis* [= *Rhinoceros bicornis*], Indian Rhinoceros, *Rhinoceros unicornis* [= *R. indicus*]; locality Zoological Gardens Calcutta, West Bengal; recorded by Baylis and Daubney (1922 and 1923).

Diagnosis : Male : Body 5.2-10 long; buccal capsule 0.08-0.14 long, 0.07-0.12 wide; bursa with two large lateral lobes and a small dorsal lobe; externo-dorsal rays relatively long and slender, arising high up on the stem of the dorsal ray, and cleft for almost the whole of its length. terminations bidigitate; spicules 0.92 long.

Female : Body 7-13.5 long; tail 0.17 long; vulva at the middle of the body.

Distribution : India : West Bengal, (Calcutta). Elsewhere : Cosmopolitan in distribution.

2. Genus *Bunostomum* Railliet, 1902

Key to species

1. Subventral lancets in buccal capsule one or two pairs.....*B. trigonocephalum*
 Subventral lancets in buccal capsule one.....*B. cobi*

1. *Bunostomum trigonocephalum* (Rud. 1808) Railliet, 1902

1808. *Strongylus trigonocephalus* Rudolphi, *Entozoorum Sive vermium intestinalium historia naturalis*, Vol. 1. Amstelaedami.36

1902. *Bunostomum trigonocephalum* Railliet, *C. R. Soc. Biol.*, **54** : 108.

Material : Host - Sheep; location - small intestine; locality - Darjeeling District, West Bengal. Recorded by Lane, 1917.

Diagnosis : Male : Body 11-17 long; buccal capsule 0.17-0.225 long; dorsal tooth relatively long, its dorsal border longer than the distance from its tip to the mouth opening; usually one pair of subventral lancets, occasionally a smaller second pair may present; spicules slightly twisted, 0.6-0.75 long, with striated alae.

Female : Body 14-26 long; tail 0.25-0.4 long, with a pair of papillae at about 0.08-0.12 from the tip; vulva usually not prominent, at 5.5-8.0 from anterior end.

Distribution : India : West Bengal, (Darjeeling); U.P., Haridwar, Mukteswar, Jackol, Tehri.

Elsewhere : Cosmopolitan.

(T) 2. *Bunostomum cobi* Maplestone, 1931

1931. *Bunostomum cobi* Maplestone, *Rec. Indian Mus.*, Calcutta, **33** : 165-168.

Material : 5 exs. Z.S.I. Reg. No. W1601/1; host-water buck (*Antelope kobus ellipsiprymnus* [= *Cobus ellipsiprymnus*]; locality - Zoological Gardens, Calcutta, West Bengal, coll. P.A. Maplestone.

Diagnosis : Male : Body 8.8-11.4 long; buccal capsule funnel shaped, 0.164-0.176 long; dorsal tooth truncate at tip; its dorsal border about half as long as the distance from its tip to the mouth opening; subventral lancets broad, rounded, one pair; spicules slightly twisted, striated, 0.55-0.66 long.

Female : Body 15-16 long; tail, straight, blunted tip, 0.37-0.46 long, with a pair of papillae at about 0.15 from the tip; vulva slightly prominent, at 4.2-5.7 from anterior end.

Distribution : India : West Bengal, Calcutta. Elsewhere : N. Rhodesia, S. Africa.

Super family (2) DIAPHANOCEPHALOIDEA

1. Family DIAPHANOCEPHALDAE Travassos, 1920

Key to genus

Peri-oral groove delimited only by anterior ridge.

Buccal cavity lacking membranous cuticular processes at base.

Spicules alate.

Male bursa trilobed.

Peribursal budge absent.

Parasites of snakes, rarely of lizards. Cosmopolitan.....*Kalicephalus* Molin 1861

Genus *Kalicephalus* Molin, 1861

Key to subgenera

1. Rudimentary corona radiata present 3
Corona radiata absent or rudimentary 2
2. Vulva closer to anus. Prodelphic. Spicule equal.
Parasite of snakes, rarely lizards; cosmopolitan. *Kalicephalus (Schadius)* Lichtenfels, 1980
Vulva closer to mid body. Amphidelphic. Spicules unequal. Parasites of oriental snakes.
..... *Kalicephalus (Kalicephaloides)* (Yeh, 1956 gen.) Lichtenfels, 1980
3. Buccal capsule with prominent projections of posterior dorsal and ventral plates.
Rudimentary corona radiata present. Spicules equal.
Parasites of stomach and intestine of snakes
..... *Kalicephalus (occipitodontus)* (Ortlepp, 1923 genus) Lichtenfels, 1980.

1. Subgenus *Schadius* Lichtenfels, 1980

Key to species

1. Spicule alate (2)
Spicule nonalate *K. (S.) willeyi*
2. Spicules less than 0.5 long (4)
Spicules more than 0.4 long (3)
3. Vulva more prominent *K. (S.) elongatus*
Vulva less prominent *K. (S.) brachycephalus*
4. Female tail with a terminal spike *K. (S.) indicus*
Female tail without a terminal spike *K. (S.) longior*

1. *Kalicephalus (Schadius) willeyi* V. Linstow, 1904

1904. *Kalicephalus willeyi* V. Linstow, *Spolia Zeylan.*, 1 : 99.

Material : 3 exs., Z.S.I. Reg. Nos. W908/1 and W909/1, host - *Bungarus fasciatus* and *Naja tripudians*; location - intestine; locality - Zoological Gardens, Calcutta, West Bengal; coll. A.C. Chandler, 1 example, Z.S.I. Reg. No. W6989/1; host - *Ptyas mucosus*; location - intestine; locality - Birati, 24 Parganas (North), West Bengal, 4.x. 1967, coll. R. K. Ghosh.

Diagnosis : Male : Body 8.4-10; caudal bursa typical; spicules equal, very slender, except near their roots, nonalate 0.32 long; gubernaculum long slender.

Female : Body 6.9-19.7 long; tail conical, variable in length 0.33-0.85 long; vulva prominent, with papilliform process, 2.3-7.7 from posterior end.

Distribution : India : West Bengal, (Calcutta); Assam. Elsewhere : Sri Lanka, Colombo, Horana and Weligatta.

2. *Kalicephalus (Schadius) indicus* Ortleep, 1923

1923. *Kalicephalus indicus* Ortleep, *J. Helminth*, 1 : 180.

Material : 3 examples, Z.S.I. Reg. No. W6900/1; host *Ptyas mucosus*; location intestine; locality - Bhasna, 24 Parganas (south) West Bengal; 10.xi. 1965; coll. R. K. Ghosh. 2 examples Z.S.I. Reg. No. W6991/1, host *Bungarus fasciatus*; location intestine; locality Salt Lake, Calcutta, West Bengal, 31.vii. 1967, coll. R. K. Ghosh; 1 example, Z.S.I. Reg. No. 6995/1; host *Natrix piscator*; location - intestine; locality Bhasna, 24 Parganas (South), West Bengal, 5.viii. 1968, coll. R. K. Ghosh.

Diagnosis : Male : Body 4.2-6.4 long; spicules equal, alate, 0.32-0.47 long; gubernaculum 0.12-0.14 long; bursal rays same as described for the species.

Female : Body 6.2-9.2 long; vulva prominent, 0.99-1.9 from posterior end; tail with a terminal spike, 0.138-0.198 long.

Distribution : India : West Bengal, (Calcutta, 24-Parganas (South)). Elsewhere : China; London; South Africa.

(T) 3. *Kalicephalus (Schadius) longior* Maplestone, 1931

1931. *Kalicephalus longior* Maplestone, *Rec. Indian Mus.*, Calcutta, 33 : 113-115.

Material : 5 examples, Z.S.I. Reg. No. W1583/1; hosts *Naja tripudians* and *Bungarus fasciatus*; location - intestine; locality Zoological Gardens, Calcutta, West Bengal, Calcutta, coll. P.A. Maplestone; 2 exs. Z.S.I. Reg. No. W1584/1 host *Gongylophis conicus*; location - intestine; locality - Zoological Gardens, Calcutta, coll. P.A. Maplestone.

Diagnosis : Male : Body 6.67-7.32 long; spicules equal upto 0.31 long; gubernaculum 0.111-0.125 long; bursal rays same as described for the species.

Female : Body 7.48-12 long; tail tapering blunted tip 0.34-0.49 long; vulva prominent, 2.65-4.7 from posterior end.

Distribution : India : West Bengal, (Calcutta); Aligarh, Muketswar, U.P. Elsewhere : China ; Malaya.

(T) 4. *Kalicephalus (Schadius) elongatus* Maplestone, 1931

1931. *Kalicephalus elongatus* Maplestone, *Rec. Indian Mus.*, Calcutta, 33 : 105-107.

Material : 12 exs. Z.S.I. Reg. No. W1580/1; hosts Rat snake (*Ptyas [= Zamenis] mucosus*) and cobra (*Naja tripudians*); location intestine; locality Zoological Gardens, Calcutta, West Bengal, coll. P. A. Maplestone.

Diagnosis : Male : Body 7.8-8 long; spicules 0.42-0.44 long; gubernaculum 0.14-0.15 long; bursal rays same as described for the species.

Female : Body 10.9-12.7 long; tail sharply pointed 0.61-0.67 long; vulva on a very prominent papilla, 2.0-2.65 from posterior end.

Distribution : India : West Bengal, (Calcutta).

5. *Kalicephalus (Schadius) brachycephalus* Maplestone, 1931

1931. *Kalicephalus brachycephalus* Maplestone, *Rec. Indian Mus.*, Calcutta, **33** : 107-109.

Material : Host Rat Snake (*Ptyas mucosus* [= *Zamenis mucosus*]); location - intestine; locality Zoological Gardens, Calcutta, West Bengal, Coll. P.A. Maplestone.

Diagnosis : Male : Body 7.2 long; head wider than neck; dorsal ray of bursa stout, but with slender branches, ventral rays separated for nearly the whole of their length; spicules 0.4 long; gubernaculum 0.16 long.

Female Body 9.2-10.4 long, head similar to male; tail conical, 0.32 long; vulva slightly prominent, 3-3.4 from posterior end.

Distribution : India : West Bengal, (Calcutta).

2. Subgenus *Occipitodontus* (Ortlepp, 1923 gen) Lichtenfels, 1980

6. *Kalicephalus (Occipitodontus) fimbriatus* (Ortlepp, 1923), Baylis, 1936

1923. *Occipitodontus fimbriatus* Ortlepp, *J. Helminth*, **1** : 165.

1936. *Kalicephalus fimbriatus* Baylis, *F.B.I., Nematoda*, vol., **I** : 354-355.

Material : One example, Z.S.I. Reg. No. W1581/1; host Banded Krait (*Bungarus fasciatus*); location Stomach; locality Zoological Gardens, Calcutta, West Bengal; coll. P.A. Maplestone; 2 exs. Z.S.I. Reg. No. 6994/1, host *Bungarus fasciatus*; location-intestine; locality - Birati, 24-Parganas (North), West Bengal, 6.iv. 1968.

Diagnosis : Male : Body 9.7-12.2 long; head in lateral view broad and abruptly truncate rudimentary leaf-crown present; spicules slender, tapering, slightly alate and spirally twisted at their tips, 0.43-0.49 long; dorsal wall of spicular canal partly chitinized, gubernaculum not distinct.

Female : Body 12.3-17.3 long; head as in male; tail acutely conical, 0.37-0.42 long; vulva about posterior third of body, dividing the body in the ratio of about 1.7 : 1 or 1.1 : 1.

Distribution : India : West Bengal, (Calcutta, 24-Parganas (North)); Assam, Dibrugarh.

Elsewhere : South Africa; Java.

3. Subgenus *Kalicephaloides* (Yeh, 1956 Gen.) Lichtenfels, 1980

(T) 1. *Kalicephalus (Kalicephaloides) minutus* (Baylis and Daubney, 1922), Ortlepp, 1923

1922. *Diaphanocephalus minutus* Baylis and Daubney, *Mem. Indian Mus.*, **7** : 332.

1923. *Kalicephalus minutus* Ortlepp, *J. Helminth.*, **1** : 165

1956. *Kalicephaloides minutus* Yeh, *J. Helminth.*, **30** : 211-216.

Material : One example, Z.S.I. Reg. No. W909/1; host - *Naja tripudiens*; location - intestine; locality Zoological Gardens, Calcutta; 26. Viii. 1915; coll. A.C. Chandler. Several examples, Z.S.I. Reg. No. W1582/1; host-Cobra (*Naja tripudiens*); and Banded Krait (*Bungarus fasciatus*); location intestine; locality Zoological Gardens, Calcutta, West Bengal, coll. P.A. Maplestone. 2 exs. Z.S.I. Reg. No. W6992/1, host *Bungarus fasciatus*; location - intestine; locality - Birati, 24-Parganas (North) West Bengal, 11.x. 1965, coll. S. C. Roy.

Diagnosis : Male : Body 4.5-5.4 long; head relatively wide, followed by a constriction; dorsal ray of bursa stout at its base; externodorsal rays originate near its base, behind them a pair of long, stout and curved accessory branches; terminal branches of the dorsal ray, short and digitate; ventral rays long, slender, closely opposed and fused about two third of their length; spicules, unequal, longer about 0.4-0.5 long, shorter about 0.32-0.33 long; gubernaculum 0.12 long.

Female : Body 4.5-6.2 long; tail tip blunt, 0.22-0.3 long; vulva very prominent, about 1.3-1.8 from posterior end, dividing the body length the ratio about 2.2 : 1 or 2.5 : 1.

Distribution : India : West Bengal, (Calcutta). Elsewhere : Africa.

Kalicephalus sp.

Material : 1 ex. Z.S.I. Reg. No. 6996/1; host *Enhydris* sp. location Stomach; locality Salt Lake, Calcutta, West Bengal; 21.vi. 1966; coll. S. S. Saha. 1 ex., Z.S.I. Reg. No. W6997/1, host *Enhydris* sp. location - intestine; locality Sujapur, 24-Parganas (South), West Bengal, 27.v. 1967; C. B. Srivastava.

1 ex., Z.S.I. Reg. No. W6998/1; host - *Natrix piscator*; location stomach; locality Biraty 24-Parganas (North), West Bengal; 19.vii. 1968, coll. Sundarsan Roy.

1 ex. Z.S.I. Reg. No. W6999/1; host *Naja naja*, location intestine, locality Bhasna, 24-Parganas (South), West Bengal, 11.vii. 1969, coll. S. C. Roy.

Superfamily (3) STRONGYLOIDEA

1. Family STRONGYLIDAE Baird, 1853

Key to subfamilies

1. Buccal capsule large and globular, subglalar or infundibular. Parasites of mammals.....

..... Strongylinae Railliet, 1885

Buccal capsule usually short, sometimes long, may be divided into anterior and posterior portion. Parasites mainly of Perissodactyla.....Cyathostominae Nicoll, 1927

Subfamily STRONGYLINAE Railliet, 1885

1. Genus *Choniangium* Henry and Bauche 1914

1. *Choniangium epistomum* (Piana, 1900) Railliet, Henry and Bauche, 1914

1900. *Sclerostoma epistomum* Piana, *Arch. Parasit.*, 3 : 511-529.

1914. *Choniagnium epistomum* Railliet, Henry and Bauche, *Bull. Soc. Path. exot.*, Paris, 7(2) : 207.

Material : 4 exs. Z.S.I. Reg. No. ZEV6796/7; host Indian elephant (*Elephas maximus indicus*); location Caccum; locality Baharampur, Murshidabad District, West Bengal; Recorded by - C. Lane.

Diagnosis : Male : 14 long; 0.75 wide near the head; buccal capsule about 0.75 long and 0.35 in diameter; external leaf crown with 53 converging rays; spicules 2.0 long, widest about their middle, double 'S' curve at peripheral part and gradually tapering to a fine point; gubernaculum present.

Female : Body 19 long, 1.0 wide near the head; tail about 0.5 long, with a pair of papillae at about 0.15 from the tip; vulva at 0.8 from posterior end.

Distribution : India : West Bengal, (Murshidabad); Orissa.

Subfamily CYATHOSTOMINAE Nicoll, 1927

Tribe Murshidiinea Lichtenfels, 1980

Key to genera

Buccal capsule roughly cylindrical. Elements of external leaf crown longer laterally than dorsally or ventrally*Murshidia* Lane, 1914

Buccal capsule shallow. Elements of external leaf crown of uniform length.....*Khalilia* Neveu-Lemaire, 1924

1. Genus *Murshidia* Lane, 1914

Subgenus *Murshidia* (Lane, 1914) Chabaud, 1957

Key to species

1. Each spicule with a small, posterior directed spur near the tip; oesophagus about 0.5-0.6 long.....
.....*M. (M.) murshidia*
Each spicule with golf-club shaped tip, without posterior spur; oesophagus about 0.9-1.0 long
.....*M. (M.) falcifera*

(T) 1. *Murshidia (Murshidia) murshidia* Lane, 1914

1914. *Murshidia murshidia* Lane, *Indian J. med. Res.*, Calcutta, 2(1) : 388-389.

Material Several exs. Z.S.I. Reg. No. ZEV6795/7, host Indian elephant (*Elephas maximus indicus*); location Caccum; locality Jalpaiguri, Jalpaiguri District, West Bengal.

Diagnosis : Male : Body 18-0 long; buccal capsule 0.075-0.12 in diameter; external leaf crown with 60 elements; lateral rays of bursa with swollen bases; spicules equal, slender about 1.3 long, tips bent dorsally.

Female : Body about 22-28 long; tail tapering to a slender point 1.6-2.2 long; vulva with prominent lips, 2.3-2.9 from posterior end.

Distribution : India : West Bengal, (Jalpaiguri); Malabar, Kerala, Orissa. Elsewhere : Burma; Sri Lanka; China.

2. *Murshidia (Murshidia) falcifera* (Cobbold, 1882) Lane, 1915

1882. *Strongylus falcifer* Cobbold, *Trans. Linn. Soc.*, London; Zool Ser. 2, 2 : 224-236.

1915. *Murshidia falcifera* Lane, *Indian J. Mud. Res.*, 3(1) : 106.

Material : Several exs. Z.S.I. Reg. No. ZEV6799/7, host Indian elephant (*Elephas maximus indicus*); location Caccum; locality- Jalpaiguri, Jalpaiguri District, West Bengal.

Diagnosis : Male : Body 22-27 long; buccal capsule 0.1-0.13 in diameter; external leaf crown (according to Lane) 80 elements; bases of lateral rays of bursa not swollen; spicules, equal, slender, upto 1.79 long; gubernaculum 'S' shaped curved, 0.05 long.

Female : Body 24-32 long; tail 1.59-2.2 long, and with a pair papillae at 1.5 from the tip; vulva with slightly thickened lips, about 3.0 from posterior end.

Distribution : India : West Bengal, (Jalpaiguri); Andamans; Malabar; Kerala, Orissa. Elsewhere : Burma; Sri Lanka; Sumatra.

2. Genus *Khalilia* Neveu-Lemaire, 1924

1. *Khalilia pileata* (Railliet, Henry and Bauche, 1914) Baylis, 1936

1914. *Cylostomum pielatum* Railliet, Henry, and Bauche, *Bull. Soc. Path. exot.*, Paris 7(2) : 208-209,
1936. *Khalilia pileata* Baylis, *F.B.I. Nematoda*, 1 : 282-284.

Material : Host Indian elephant (*Elephus maximus indicus*); location Caccum; locality Murshidabad, Murshidabad District, West Bengal.

Diagnosis : Male : 9.5-10 long; buccal capsule 0.025-0.04 long, upto 0.128 wide, leaf crown with 32-36 elements, external leaf crown stout; cuticle swollen ventrally near the bursa into a large boss; dorsal lobe of bursa and dorsal ray very long; dorsal ray about 1.7 long, and bifurcated at about 0.25 from its base; spicules very long and filiform, (according to Lane) 3.5 in length; gubernaculum 0.165 long.

Female : Body 11.5-14 long; tail blunt, 0.45 long, with pair of papillae at 0.25 from the tip; vulva at 0.7-0.75 from posterior end.

Distribution : India : West Bengal, (Murshidabad); Orissa; Malabar, Travancore, Kerala.

2. Family CHABERTIIDAE (Popova, 1952 Subfam.) Lichtenfels, 1980

Key to subfamilies

1. Buccal capsule large, thick-walled, globular or subglobular. Parasites of intestine of ruminants, Primates, rodents and marsupials..... Chabertiinae Popova, 1952.
- Buccal capsule relatively small, cylindrical and subglobular. Parasites of intestine or stomach of ruminants, primates, lemurs, pigs and rodents..... Oesophagostominae Railliet, 1916.

Subfamily CHABERTIINAE Popova, 1952

1. Genus *Agriostomum* Railliet, 1902

1. *Agriostomum vryburgi* Railliet, 1902

1902. *Agriostomum vrylurgi* Railliet, *Compt. rend. Soc. Biol.*, Paris, 54 : 107-110.

Material : Host - Zebu (*Bos indicus*); location - duodenum; locality Darjiling, West Bengal; recorded by Lane (1923).

Diagnosis : External corona radiata absent; oral opening circular, directed anterodorsally; buccal capsule shallow in both sexes. Male : Body 9.2-11.0 long, a ventral cervical groove present; oesophagus 1-1.1 long; spicules equal, alate, transversely striated, 0.83-0.87 long; gubernaculum 0.09 long.

Female : Body 13-15.5 long, tail tapering to a fine point, 0.15-0.26 long; vulva at 0.47-0.6 from posterior end.

Distribution : India : West Bengal, (Darjiling); Nilgiri, Madras. Elsewhere : Java; Sumatra.

Subfamily OESOPHAGOSTOMINAE Railliet, 1916

Key to Tribes

1. Cervical inflation with transverse cervical groove present..... 2
Cervical groove absent, cervical inflation if present greatly reduced Bourgelatiinea
2. Transverse cervical groove completely encircling the body..... Bourgelatioidinea
Transverse cervical groove always confined to ventral side..... Oesophagostominea

1. Tribe Bourgelatioidinea Lichtenfels, 1980

Key to genera

- Corona radiata single, with 6 lip like internal elements. Spicules with simple points.....
..... *Rhabditostomum* Chabaud and Krishnaswamy, 1976
- Corona radiata double. Spicules terminated by long coiled filaments
..... *Bourgelatioides* Chandler, 1931

1. Genus *Rhabditostomum* Chabaud and Krishnaswamy, 1976

1. *Rhabdiostomum traguli* (Maplestone, 1932) Chaband & Krishnaswamy, 1976

1932. *Oesophagostomoides traguli* Maplestone, *Rec. Indian Mus.*, Calcutta, **34**(3) : 254-256.

1976. *Rhabdiostomum traguli* Chaband & Krishnaswamy, *Bull. Mus. natn. Hist. nat.*, Paris, 3e, Ser., No. 388, *Zoologie* **270** : 721-727.

Material : Host - Javan mouse - deer (*Tragulus javanicus*); location-intestine; locality - Zoological Gardens, Calcutta, West Bengal; recorded by P.A. Maplestone (1932).

Male : Body 2.9 long; cephalic inflation marked posteriorly by a projecting ridge, followed by a groove in the cuticle which completely encircled the body; buccal capsule small, cylindrical; spicules tapering, pointed and alate, 0.872 long.

Female : Body 3.0 long; tail 0.084 long, ended in a sharp point; vulva 0.04 from anus.

Distribution : India : West Bengal, (Calcutta). Elsewhere : Pakistan, Sealkot and Peshawar.

2. Genus *Bourgelatioides* Chandler, 1931

1. *Bourgelatioides traguli* Chandler, 1931

1931. *Bourgelatioides traguli* Chandler, *Proc. U.S. natn. Mus.*, Washington **78** : 1-11.

Material : Host - Javan mouse-deer (*Tragulus javanicus*) : location-Small intestine, locality - Zoological Gardens, Calcutta, West Bengal; recorded by Chandler (1931).

Diagnosis : Male : Body 11.3 long; buccal capsule shallow, and cylindrical; internal leaf crown with 20-25 elements; spicules tapering, to fine points, each bearing a long, convoluted terminal filament; 0.655 in length, excluding the filaments.

Female : Body 11.5 long; tail sharply pointed 0.2 long, vulva at about 0.25 from the anus, with prominent lips.

Distribution : India : West Bengal, (Calcutta).

2. Tribe *Oesophagostomina* Lichtenfels, 1980

Key to genus

External corona radiata more than 8 elements. Internal corona radiata present
 *Oesophagostomum* Molin, 1861

Genus *Oesophagostomum* Molin, 1861

Key to subgenera

1. Corona radiata single.....*Oesophagostomum* (*Bosicola*) Sandground 1929
 Corona radiata double 2
2. Cervical papillae at the level of oesophageal expansion. Parasites of Suidae
*Oesophagostomum* (*O.*) Molin, 1861
 Cervical papillae anterior to oesophageal expansion..... 3
 Cervical papillae posterior to oesophageal expansion. Parasite of ruminants
 *Oesophagostomum* (*Hysteracrum*) Railliet and Henry, 1913
3. Spicules less than 1 long; vagina short *Oesophagostomum* (*Proteracrum*) Railliet & Henry, 1913
 Spicules more than 1 long; vagina long *Oesophagostomum* (*Conoweberia*) Ihle, 1922

1. Subgenus *Oesophagostomum* Molin, 1861

Key to the species

1. Spicules of male less than 1.0 long..... 2
 Spicules of male more than 1.0 long..... 3
2. External leaf crown contains 9 elements..... *O. (O). quadrispinulatum*
 External leaf crown contains 30 elements.....*O. (O). maplestonei*
3. External leaf crown contains 9 elements.....*O. (O). dentatum*
 External leaf crown contains 14-16 elements..... *O. (O). brevicaudam*

1. *Oesophagostomum (Oesophagostomum) dentatum* (Rudolphi, 1803) Molin, 1861

1803. *Strongylus dentatus* Rudolphi, *Arch. Zool.u. Zool.*, 3 (2) : 12-13.

1861. *Oesophagostomum (Oesophagostomum) dentatum* Molin, *Mem. R. Ist. Veneto*. 9 (1860) : 443.

Material : Several examples, Z.S.I. Reg. No. W1554/1, host Pig (domestic); location intestine; locality Slaughter house in Calcutta, West Bengal, 22.vii.1930. coll. P.A. Maplestone.

Several exs. Z.S.I. Reg. No. WN 193/1; host Pig (domestic); location - intestine; locality - Karsiyang, Darjeeling district, West Bengal, 12-13.v.1975, coll. T. D. Soota.

Diagnosis : Male : Body 8-10 long; cervical groove extended to some distance on to the lateral surface; lateral alae absent; external leaf crown with 9 elements and internal leaf-crown with 18 small elements; oesophagus not swollen at the anterior end, 0.5 long; cervical papillae at the posterior end of oesophagus, spicules alate, tapering to a blunt point, 1.5-1.32 long, gubernaculum trowel-shaped, 0.116-0.14 long.

Female : Body 9.7-14.5 long; tail tapering, 0.25-0.43 long; vulva at 0.28-0.39 from the anus.

Distribution : India : West Bengal, (Calcutta, Darjeeling). Elsewhere : Cosmopolitan in distribution.

2. *Oesophagostomum (Oesophagostomum) quadrispinulatum* (Marccone, 1901) Alicata, 1935

1901. *Oesophagostomum dentatum* var. *quadrispinulatum* Marccone.nv

1935. *Oesophagostomum quadrispinulatum* Alicata, *J. Parasitol*, **21** : 215-216.

Material : Several exs., Z.S.I. Reg. No. W1553/1, host Pig (domestic); location large intestine, locality slaughter house in Calcutta, West Bengal; 22.vii.1930, coll. P. A. Maplestone.

Diagnosis : Male : Body 6.58-8.85 long; cervical papillae behind the middle of oesophagus; oesophagus 0.32-0.42 long, with small distinct swelling at its anterior end; spicules 0.78-0.95 long; gubernaculum trowel-shaped. 0.104-0.144 long.

Female : Body 8.53-10.36 long; tail upto 0.47 long; vulva at 0.38-0.99 from the anus.

Distribution : India : West Bengal, (Calcutta). Elsewhere : Cosmopolitan in distribution.

3. *Oesophagostomum (Oesophagostomum) brevicaudum* Schwartz and Alicata, 1930

1930. *Oesophagostomum brevicaudum* Schwartz & Alicata, *J. Agric. Res. U.S. Dept. Agric.*, **40** (1) : 11-23.

Material : 2 exs., Z.S.I. Reg. No. W1549/1; host Pig (domestic); location-Caecum and large intestine; locality slaughter house in Calcutta, 22.vii.1930 collected and recorded by P.A. Maplestone (1930) under the name *Oesophagostomum suis*.

Diagnosis : Male : Body 6.2-8.75 long, internal leaf-crow with 28-32 elements, cephalic inflation well marked; cervical groove extended on to the sides, about 0.17-0.24 from anterior end; oesophagus with slightly swelling anteriorly; cervical papillae at about 0.33-0.38 from anterior end; spicules 1.0-1.3 long; gubernaculum trowel-shaped, 0.098-0.12 long.

Female : Body 6.4-11.4 long; tail bent dorsally; 0.356-0.515 long; vulva at 0.614-0.792 from the anus.

Distribution : India : West Bengal, (Calcutta). Elsewhere : Cosmopolitan in distribution.

4. *Oesophagostomum (Oesophagostomum) maplestonei* (Schwartz 1931)
emend, Schwartz, 1932

1931. *Oesophagostomum maplestonei* Schwartz, *vet. Med.*, Chicago, **26** : 11.

Material : 2 exs., Z.S.I. Reg. No. W1552/1; host Pig (domestic); location Caccum and large intestine; locality Calcutta, West Bengal; 22.vii.1931; coll. P. A. Maplestone.

Diagnosis : Male : Body 6.87-7.91 long; ventral cervical groove deep, at about 0.16-0.18 from anterior end; cephalic inflation not well marked; external leaf crown with 30 elements; oesophagus relatively broad with a distinct oesophageal funnel; spicules 0.832 long; gubernaculum trowel shaped.

Female : Body 8.2-9.1 long; tail straight, tapering, 0.237-0.257 long; vulva at 0.317-0.356 from the anus.

Distribution : India : West Bengal, (Calcutta).

2. Subgenus *Hysteracrum* Railliet & Henry, 1913

Key to the species

1. External leaf crown contains 12 elements.....*O. (H). asperum*
External leaf crown contains 10 elements.....*O. (H). indicum*

1. *Oesophagostomum (Hysteracrum) asperum* Railliet & Henry, 1913

1913. *Oesophagostomum (Hysteracrum) asperum* Railliet & Henry, 1913 *Bull. Soc. Path exot.*, Paris, **6** (7) : 506-511.

Material : 5 ♂♂ 16 ♀♀, Z.S.I. Reg. No WN 194/1; host goat (domestic); location intestine; locality Karsiyang, Darjeeling District, West Bengal, 13.v.1975, coll. T. D. Soota.

Diagnosis : Male : Body 11-13 long, mouth collar in the form of a truncate cone, marked off by a well-defined groove posteriorly; Cephalic inflation of cuticle well developed; cervical groove well marked ventrally about 0.32-0.36 from anterior end; external leaf crown bluntly rounded. 12 in number; internal leaf crown of 24 small elements; spicules 1.35-1.7 long; gubernaculum shovel shaped, 0.1 long.

Female : Body 14.0-17.5 long; tail 0.14-0.17 long, with a pair of papillae at 0.055-0.066 from the tip; vulva prominent, about 0.32-0.39 from posterior end.

Distribution : India : West Bengal, (Darjiling); U.P., Mukteswar. Elsewhere : China; Indo-China; Malaya; Pakistan; Murree; Kaghan Valley; Panama Canal Zone.

(T.) 2. *Oesophagostomum (Hysteracrum) indicum* Maplestone, 1931

1931. *Oesophagostomum indicum* Maplestone, *Rec. Indian Mus.*, Calcutta, **33** : 145-148.

Material : 2 exs., Z.S.I. Reg. No. W 1595/1, host-spotted deer, *Axis axis* (= *Cervus axis*); and Red deer (*Cervus elaphus*); location large intestine, locality Zoological Gardens, Calcutta, West Bengal.

Diagnosis : Male : Body 7.6-9.1 long; mouth collar deep and marked off by a groove; cephalic inflation as in *O. (H). dentatum*; cervical groove at 0.26-0.28 from anterior end; "the external leaf crown arises from the base of the capsule, from which it sweeps inwards and forwards. The internal leaf crown consists of very short coarse elements, which in optical section appear as a double-contoured wavy line running across the capsule at its anterior end" Cervical papillae behind the posterior end of oesophagus; spicules 1.3-1.36 long.

Female : Body 9.9-12.2 long; tail straight and sharply pointed, 0.13-0.14 long; vulva 0.18 from the anus.

Distribution : India : West Bengal, (Calcutta).

3. Subgenus *Proteracrum* Railliet & Henry, 1913

1. *Oesophagosomum (Proteracrum) columbianum* (Curtice, 1890) Stossich, 1899

1890. *Oesophagostoma columbianum* Curtice, *U.S. Dept. Agric.*, Washington, **220** : 26.

1899. *Oesophagostomum columbianum* Stossich, *Bull. Soc. Adriat. Sc. Nat.*, Trieste, **19** : 94-96.

Material : Several examples, Z.S.I. Reg. Nos. W 7017/1 to 7053/1; host goat (domestic); location intestine; locality Slaughter house, in Calcutta, West Bengal, 27.xii.1962, 3.i.1963, 25.i.1963, 2.i.1963, 15.xi.1963, 19.xii.1963, 27.xii.1963, 8.xi.1962, 2.xi.1962 and 6.i.1962; coll.? 2 exs., Z.S.I. Reg. No. WN 274/1, host goat (domestic); location intestine; locality Ghoom, Darjiling District, West Bengal; 21.vi.1974, coll. T. D. Soota.

Diagnosis : Male : Body 12-16 long; anterior end curved into a hook; mouth collar in the form of truncate cone; cephalic inflation absent; lateral alae present; external leaf crown with 20-24 elements and internal 40-48; cervical papillae just behind the cervical groove; spicules 0.75-0.85 long; gubernaculum about 0.1 long; prebursal papillae, occasionally present.

Female : Body 14-18 long, tail tapering, 0.3-0.6 long; vulva less prominent, at about 1-1.4 from posterior end.

Distribution : India : West Bengal, (Calcutta, Darjiling). Elsewhere : Cosmopolitan in distribution.

4. Subgenus *Bosicola* Sandground, 1929

Key to the species

1. Internal leaf crown contains about 40 elements; oesophagus about 1.0 long *O. (B.) radiatum*
- Internal leaf crown contains at least 50 elements; oesophagus about 0.6-0.8 long.....
..... *O. (B.) curvatum*

1. *Oesophagostomum (Bosicola) radiatum* (Rud. 1803), Railliet, 1898

1803. *Strongylus radiatus* Rudolphi, *Arch. Zool. u. Zoot.*, **3** (2) : 13-15.

1898. *Oesophagostomum radiatum* Railliet. *Rec. Med. Veter.*, t. **75** : 254.

Material : Several examples, Z.S.I. Reg. No. W 1597/1, host a "hybrid bison" (*Bos frontalis* x *B. taurus*); location large intestine, locality Zoological Gardens, Calcutta, West Bengal, coll. P. A. Maplestone. Also from *Bos bubalus*, location large intestine, locality Darjiling, Darjiling District, West Bengal; recorded by Lane and Baylis and Daubney.

Diagnosis : Male : Body 14-17 long, buccal capsule wider in front than behind, internal leaf crown with 38-40 elements; oesophageal funnel well developed about 0.075 long; cervical papillae at about the middle of oesophagus, a little behind the posterior limit of cephalic inflation; spicules 0.7-0.8 long; gubernaculum about 0.1-0.115 long.

Female : Body 16-22 long; posterior end slightly curved ventrally; tail 0.3-0.4 long; vulva prominent, about 1.0 from posterior end.

Distribution : India West Bengal, (Calcutta, Darjiling); Punjab. Elsewhere Pakistan Lahore.

(T) 2. *Oesophagostomum (Bosicola) curvatum* Maplestone, 1931

1931. *Oesophagostomum curvatum* Maplestone, *Rec. Indian Mus.*, Calcutta, **33** 145-148.

Material : 2 examples, Z.S.I. Reg. No. W1595/1, host spotted deer, *Axis axis* (= *Cervus axis*) location-large intestine; locality-Zoological Gardens, Calcutta, West Bengal, coll. P. A. Maplestone.

Diagnosis : Male : Body 8.4-9.6 long, anterior end bent into a hook; "mouth collar well-marked in the form of a ring with rounded edges, which curves forwards laterally; cephalic inflation similar to that of *O. (B). radiatum*; cervical groove at 0.21-0.22 from anterior end; buccal capsule cylindrical, 0.028-0.032 in diameter, internal leaf crown at least with 50 elements, spicules 0.49-0.59 long; gubernaculum through like.

Female : Body 12.5-14.8 long; tail straight, and slender, 0.22-0.26 long; vulva at 0.57-0.75 from the anus.

Distribution : India : West Bengal, (Calcutta).

5. Subgenus *Conoweberia* Ihle, 1922

Key to species

1. Teeth in oesophageal funnel large and arising near its base *O. (C). tridentatum*
Teeth in oesophageal funnel small and arising from its anterior end 2
2. Spicules of male upto 1.6 long *O. (C). blanchardi*
Spicules of male upto 2.0 long *O. (C.) ovatum*

1. *Oesophagostomum (conoweberia) blanchardi* Railliet & Henry, 1912

1912. *Oesophagostomum blanchardi* Railliet & Henry, *Arch. Parasit.*, **14** (4) : 572.

Material : 2 examples, Z.S.I. Reg. No. W 1598/1; host *Hylobates hoolock*; location stomach, locality Zoological Gardens, Calcutta, West Bengal, collected and recorded by Maplestone (1931) under the name (*Oesophagostomum apiostomum*, Willach, 1891)

Diagnosis : Male Body 15-17 long; cephalic inflation well developed; cervical groove at 0.22-0.3 from anterior end; external leaf crown with 10-13 elements, internal with numerous small elements; oesophageal funnel wide, with three teeth anteriorly; spicules 1.3-1.4 long; gubernaculum 0.158-0.16 long.

Female : Body 17-20 long; tail conically pointed, 0.18-0.24 long; vulva at 0.37-0.48 from posterior end.

Distribution India . West Bengal, (Calcutta). Elsewhere Borneo; Indochina; Java; London Zoo.

2. *Oesophagostomum (conoweberia) ovatum* (V Linstow, 1906) Railliet & Henry, 1912

1906. *Strongylus ovatus* V. Linstow, *Spolia Zeylanica*, Colombo, 3 : 163-188.

1912. *Oesophagostomum ovatum* Railliet & Henry, *Arch. Parasit.*, **14** (4) : 572.

Material 2 examples, Z.S.I. Reg. No. W. 1599/1, host Hoolock Gibbon (*Hylobates hoolock*); location Stomach; locality Zoological Gardens, Calcutta, West Bengal; collected and recorded by Maplestone (1931) under the name *Oesophagostomum blanchardi* Railliet & Henry, 1912.

Diagnosis : Male : Body 11.1-17.0 long; external leaf crown with 14 elements; cervical groove at 0.356-0.45 from anterior end; cervical papillae at 0.536 from anterior end; spicules about 1.98--2.0 long; gubernaculum about 0.2 long.

Female Body 17-20 long; tail about 0.277 long; vulva at 0.297 from anus.

Distribution India West Bengal, (Calcutta). Elsewhere Africa; Borneo; Indochina; Sumatra.

3. *Oesophagostomum (conoweberia) tridentatum* Maplestone, 1932

1932. *Oesophagostomum tridentatum* Maplestone, *Rec. Indian Mus.*, Calcutta, **34** (3) : 257-259.

Material Host Dusky langur (*Presbytis obscurus* (= *Semnopithecus obscurus*)); location stomach, locality Zoological Gardens, Calcutta, Coll P. A. Maplestone.

Diagnosis Male Body 12-14 long; mouth-collar conical; cervical groove at about, 0.36-0.49 from anterior end, external leaf crown with 20 broad, pointed elements; internal leaf crown absent; oesophageal funnel wide and cup-shape; three large anteriorly directed teeth arising near the base of the oesophageal funnel; cervical papillae at about 0.54-0.61 from anterior end; spicules 1.6 long; gubernaculum 0.175-0.18 long.

Female Body 14-17 long; tail about 0.16-0.2 long; vulva at about 0.16-0.2 from anus.

Distribution India : West Bengal, (Calcutta). Elsewhere : Borneo.

Superfamily (4) TRICHOSTRONGYLOIDEA

1. Family AMIDOSTOMATIDAE (Travassos, 1919, Subfam.) Baylis & Daubney, 1926

Key to subfamilies

- 1 Buccal capsule long and well developed cephalic sensorial papillae located at extremity of long pedunclesAmidostomatinae Travassos, 1919
 Buccal capsule short and poorly developed. Lips with simple or denticular appendices.....
Epomidistomatinae Skrjabin & Schulg, 1937

Subfamily AMIDOSTOMATINAE Travassos, 1919

Genus *Amidostomum* Railliet & Henry, 1909

1. *Amidostomum skrjabini* Boulenger, 1926

1926. *Amidostomum skrjabini* Boulenger, *Parasit.*, Cambridge, **18** (1) : 86-100.

Material 2 exs., Z.S.I. Reg. No. W 1607/1; host Golden eyed Pochard (*Fuligula cristata*); *Nyroca* (= *Aythya*) *ferina* and some other unidentified ducks; location intestine; locality Zoological Gardens, Calcutta, West Bengal; collected and recorded by Maplestone (1930) under the name *A. fuligulae* Maplestone, 1930.

Diagnosis : Male : Body 7.5-9 long, 0.1-0.13 wide; cuticle transversely striated; buccal capsule thin walled; with three teeth, dorsal tooth long and pointed, and two very small and inconspicuous subventral teeth, antero-lateral ray of bursa turned slightly forward, away from the medio-lateral ray; externo-dorsal rays being independent of the dorsal ray and terminate at a considerable distance from the edge of the bursa; spicules about 0.12-0.16 long, and each ended in two unequal processes, the inner shorter and more pointed than the outer; gubernaculum elongated, 0.06-0.08 long; pre-bursal papillae present.

Female : Body 9-13.5 long; 0.1-0.14 wide; tail about 0.19-0.27 long; tapering, with a rounded tip and bearing a papillae behind the middle; vulva at about 1 7-2.6 from posterior end.

Distribution : India : West Bengal, (Calcutta). Elsewhere : Africa, Asia Europe, North and South America.

Subfamily Epomidiostomatinae Skrjabin & Schulz, 1937

Key to genera

1. Anterior extremity armed posteriorly with four protruding formations directed away from oral opening *Epomidiostomum* Skrjabin, 1915
- Anterior extremity without such formations *Pseudamidostomum* Boulenger, 1926

1. Genus *Epomidiostomum* Skrjabin, 1916

1. *Epomidiostomum uncinatum* (Lundhal, 1848) Seurat, 1918

1848. *Strongylus uncinatus* Lundhal, *Fauna et Flora Fenn. Forch.*, **1**, Haft., 283-284.

1918. *Epomidiostomum uncinatum* Seurat, *Bull. du mus d'hist. nat.*, No. 5 : 345-351.

Material : 2 examples, Z.S.I. Reg. No. W 1608/1, hosts Pintail (*Anas acuta* (= *Dafila acuta*)); location ? gizzard, locality Zoological Gardens, Calcutta, West Bengal, coll. P. A. Maplestone.

Diagnosis : Male : Body 6.3-7.13 long, 0.15 wide; head with a pair of subdorsal and a pair of subventral, backwardly-directed spines; mouth surrounded by four prominent, forwardly-directed papillae and a pair of less conspicuous lateral papillae also present, bursa with two large lateral lobes and small dorsal lobe; ventral rays divergent; externo-lateral ray divergent from the latero-ventral ray, and almost parallel to the main trunk which bifurcated to form the medio-lateral and postero-lateral rays; the externo-dorsal rays originate at the base of the dorsal ray; dorsal ray bifurcated; spicules short trifurcate distally, 0.12-0.13 long; gubernaculum absent; prebursal papillae present.

Female : Body 10-11.5 long; 0.25 wide; tail forming a conical appendix, 0.14-0.17 long; with a button like at its apex; vulva at about 2.2 from posterior end.

Distribution : India West Bengal, (Calcutta). Elsewhere : Africa; Central Asia; Europe.

2. Genus *Pseudamidostomum* Boulenger, 1926

(T) 1. *Pseudamidostomum boulengeri* Maplestone, 1930

1930. *Pseudamidostomum boulengeri* Maplestone, *Rec. Indian Mus.*, Calcutta, **32** : 399-403.

Material 3 examples, Z.S.I. Reg. No. W 1609/1; host cotton Teal (*Nettapus coromandolianus*); location ? under horny lining of gizzard; locality Zoological Gardens, Calcutta, West Bengal. coll. P. A. Maplestone.

Diagnosis : Male : Body 8.3-8.6 long, 0.18-0.21 wide; buccal capsule wide, short, without teeth; ventral lip of the cloacal aperture with a pair of papillae; prebursal papillae asymmetrical; ventral rays of bursa divergent; lateral rays parallel, antero-lateral ray short and stout, medio-lateral and postero-lateral rays longer and more slender and nearly reaching the edge of the bursa; dorsal ray stout at its base, near to which externo-dorsal rays originate; spicules 0.12-0.124 long, stout, slightly curved and with broad alae; gubernaculum absent.

Female : Body 11-11.5 long, 0.22-0.24 wide; tail with a pair of papillae at the middle, 0.28 long; vulva at about 2.7-2.8 from posterior.

Dist. ibution : India : West Bengal, (Calcutta).

2. Family ORNITHOSTRONGYLIDAE (Travassos, 1937 Subfam.) Durette-Desset and Chabaud, 1981

Subfamily ORNITHOSTRONGYLINAE Travassos, 1937

Genus *Ornithostromylus* Travassos, 1914

Key to species

1. Spicule of male 0.144 long; female tail with a pair of papillae *O. travassosi*
- Spicule of male 0.168 long; female tail without papillae *O. nicobaricus*

1 *Ornithostromylus nicobaricus* Maplestone, 1940

1940. *Ornithostromylus nicobarica* Maplestone, *Rec. Indian Mus.*, Calcutta, **42** (3) : 425-429.

Material : 3 examples, Z.S.I. Reg. No. W 3440/1; host Nicobar Pigeon (*Coloenas nicobarica*); location intestine; locality Zoological Gardens, Calcutta, West Bengal, coll. P. A. Maplestone.

Diagnosis Male : Body 6.5-7.75 long; cephalic inflation prominent and slightly asymmetrical, with distinct transverse striations; bursal rays typical, except for two small lateral branches arising asymmetrically from the lateral borders of the dorsal ray; prebursal papillae present; spicules equal, 0.164-0.168 long, and ended in usual three points; gubernaculum 'Y' shaped, 0.038 long.

Female : Body 9.9-10.8 long, 0.118 wide; tail tapering, ended in a spike, 0.20-0.21 long; vulva at 2.0-2.36 from anus.

Distribution : India : West Bengal, (Calcutta).

2. *Ornithostrongylus travassosi* Maplestone, 1932

1932. *Ornithostrongylus travassosi* Maplestone, *Rec. Indian Mus.*, Calcutta, **34** (3) : 259-261.

Material : Host Coral-billed pigeon (*Chalcophaps indica*); location gizzard; locality Zoological Gardens, Calcutta, West Bengal.

Diagnosis : Male : Body 5.7 long; 0.88 wide; buccal capsule slight, cuticle of anterior end inflated; externo-dorsal rays almost reaching the edge of the bursa; spicules 0.144 long, inner borders with membranous alae; gubernaculum 'Y' shaped 0.048 long.

Female : Body 7.8 long, 0.116 wide; tail 0.12 long, ended in a spike and a pair of papilla present at about 0.024 from the tip; vulva at 1.87 from the anus (1.99 from posterior end).

Distribution : India : West Bengal, (Calcutta).

3. Family TRICHOSTRONGYLIDAE (Leiper, 1908 Subfam.) Leiper, 1912

Subfamily HAEMONCHINAE (Skrjabin & Schulz, 1937, Tribe) Skrjabin & Schulz, 1952

Key to genera

1. Dorsal lobe of bursa of male asymmetrical..... *Haemonchus* Cobb, 1898
 Dorsal lobe of bursa of male symmetrical *Mecistocirrus* Railliet & Henry 1912

1. Genus *Haemonchus* Cobb, 1898

Haemonchus contortus (Rud. 1803) Cobb, 1898

1803. *Strongylus contortus* Rudolphi, *Arch. Zool. u. Zool.*, **3** (2) 15.

1898. *Haemonchus contortus* Cobb. *Agric. Gaz. N.S.W.*, **9** : 47.

Material : 3 examples, Z.S.I. Reg. No. W 7008/1, host Sheep; location abomesum; locality Slaughter house in Calcutta, 26.ii.1962.

Diagnosis : Male : Body about 10-20 long, 0.23-0.4 wide; buccal cavity small, a dorsal tooth present at its base; a pair of well developed spine like cervical papillae present at about 0.3-0.44 from anterior end; stem of dorsal ray slightly longer than its branches; prebursal papillae present; spicules relatively short, each with a small barb near its tip, dark brown in colour, 0.3-0.5 long; gubernaculum fusiform about 0.2 long.

Female : Body 18-30 long; 0.4-0.5 wide; tail slender, sharply pointed, 0.3-0.63 long, with a pair of papillae at about 0.1 from the tip; vulva at 3-5 from the posterior end and usually covered by a backwardly directed, tongue shaped flap.

Distribution : India : West Bengal, (Calcutta). Elsewhere : cosmopolitan in distribution.

2. Genus *Mecistocirrus* Railliet & Henry, 1912

1. *Mecistocirrus digitatus* (V. Linstow, 1906) Railliet & Henry 1912

1906. *Strongylus digitatus* V. Linstow, *Spolia Zeylanica*, Colombo, **3** : 168.

1912. *Mecistocirrus digitatus* Railliet & Henry, *Bull. Soc. Path. Exot.*, **4** : 37.

Material : 8 examples, Z.S.I. Reg. No. WN 2775/1, host domestic Cow; location Stomach; locality Ghoom, Darjiling district; 21.vi.1974, coll. T.D. Soota.

Diagnosis : Male Body about 16-31 long, 0.36-0.4 wide; cuticle with transverse striations, anterior end with a slight vesicular swelling; mouth subterminal and slightly dorsal, with a large buccal tooth cervical papillae at about 0.5 from anterior end; bursa with two large lateral lobes, and a small but distinct dorsal lobe; ventro-ventral ray short, slender and divergent from the latero-ventral ray; lateroventral and antero-lateral rays very stout, close together and parallel; dorsal ray short and bifurcated; prebursal papillae present, spicules very long, slender, 3.8-7 long; gubernaculum absent.

Female : Body 19-43 long; 0.47 wide, cuticle and mouth as in male; tail pointed about 0.14-0.2 long; vulva at about 0.26-0.6 from posterior end.

Distribution : India West Bengal, (Calcutta, Darjiling). Elsewhere Cosmopolitan in distribution.

4. Family MOLINEIDAE (Skrjabin & Schulz, 1937 Subfam.) Durette-Desset & Chabaud, 1977

Subfamily MOLINEINAE Skrjabin & Schulz, 1937

1. Genus *Oswaldocruzia* Travassos, 1917

1. *Oswaldocruzia filiformis* (Goeze, 1782) Travassos, 1917

1782. *Ascaris filiformis* Goeze *Versuch einer Naturgeschichte der Eingeweidewürmer thierischer Körper*, Blankenburg : 39.

1917. *Oswaldocruzia filiformis* Travassos, *Brazil Medica*, 31 : 73.

Material : Several examples, Z.S.I. Reg. Nos. W 6972-6979/1 and WN 690-696; hosts *Bufo melanostictus*, *Rana tigrina*, *Rana cyanoflictis*, *Calotes versicolor*; location Stomach, intestine & rectum; localities Calcutta; Birati, Dum Dum, 24 Parganas (North), Bhasna, 24 Parganas (South); Bardhaman, Bardhaman district; Sainthia and Tarapith, Birbhoom District; Atiamochar, Coochbehar District, Bhatiar Bill, Maldah, Maldah District; Eaharpur, Murshidabad District, Amta, Howrah District. West Bengal: 24.iv.1964; 27.iv.1965, 7.vi.1965, 8.vii.1965, 28.x.1965, 2.vii.1967, 26.viii.1968, 30.iii.1984, 4.iv.1984, 2.ix.1984, 21.xii.1985, 4 & 16.iii.1988, collector S. C. Roy, C. B. Srivastava, R. K. Ghosh, S. R. Dey Sarkar & D. K. Kundu.

Diagnosis : Male : Body 5.0-9.5 long, 0.13-0.15 wide; head including vesicle 0.033-0.044 wide; oesophagus club-shaped, 0.38-0.5 long; spicules 0.19-0.2 long splitted into 3-5 separate branches; gubernaculum absent.

Female : Body 10.0-18.5 long, 0.13-0.26 wide; tail 0.22-0.5 long; vulva prominent, 3.3-5.5 from posterior end.

Distribution : India : West Bengal, (Calcutta, Bardhaman, Birbhoom, Coochbehar, Malda, Murshidabad, Howrah and 24-Parganas (North & South)). Elsewhere : Europe, Asia.

Superfamily (5) METASTRONGYLOIDEA

1. Family ANGIOSTRONGYLIDAE (Boehm & Gebauer, 1934 Subfam.)
Anderson, 1978

Genus *Pulmostrongylus* Hsu, 1935

(T.) 1. *Pulmostrongylus palustris* (Soota & Chaturvedi, 1970) Anderson, 1978
(Fig. 26)

1970. *Herpestostrongylus palustris* Soota & Chaturvedi, *Proc. Indian Acad. Sci. Bangalore B.* 71 (3) : 105-107.

1978. *Pulmostrongylus, palustris* Anderson, *CIH Keyes to the nematode Parasites of vertebrates*, No.5 : 20.

Material One example, Z.S.I. Reg. No. W 6830/1 and one example, Z.S.I. Reg. No. W 6831/1; host Indian marsh mongoose (*Herpestes palustris*); location lungs; locality Bhasna, 24-Parganas (South), West Bengal; 28.ix.1967, coll. Y Chaturvedi.

Description : Male : Body 20.4-20.95 long, filiform, without cuticular striations, 0.23-0.25 wide, spicules equal, short, 0.11-0.12 long; gubernaculum minute, inverted 'Y' shaped; bursa short; venteroventral and lateroventral rays fused together except for a very short distance near the distal end, anterolateral separated from the rest of the lateral system, mediolateral and posterolateral also fused together excepting for a short distance near the terminal end and appear very stout, externodorsal separated with a blunt rounded tip and a nodular swelling little above the tip, dorsal ray in two branches each split at apices; two unequal chitinous rings surround by a large third ring or sheath near cloaca.

Female : Unknown.

Distribution : India : West Bengal, 24 Parganas (South).

THE TAXONOMIC STATUS OF THE TAXA DEALT WITH BELOW IS UNCERTAIN THEY
ARE TREATED AS GENERA/SPECIES INQUIRENDAE

1. Genus *Neoprotozoophaga* Biswas & Chakravarty, 1963
(Fig. 27. A, B)

Biswas and Chakravarty established the genus *Neoprotozoophaga* for their species *N. bufonis* from *Bufo melanostictus* collected at Barasat 24 Parganas District (North) West Bengal; and placed it under the family Oxyuridae. Petter & Quentin (1976) placed *Neoprotozoophaga* Biswas & Chakravarty 1963 in the cosmocercidae and remarked, "The single spicule described by the authors is apparently the gubernaculum" Further, in his recent classification of the group, Chabaud (1978) opined, "*Neoprotozoophaga* Biswas & Chakravarty 1963, is a member of the cosmocercidae and not an oxyuroid. The description of the type species is not sufficient to determine the exact synonymy but it may be a species of *Maxavchonia* Chabaud and Brygoo, 1960" Hence, the taxonomic position of this genus remains uncertain.

1. *Neoprotozoophaga bufonis* Biswas & Chakravarty, 1963
(Fig. 27. A, B)

1963. *Neoprotozoophaga bufonis* Biswas & Chakravarty, *Z. Parasitenkunde*, **23** : 416-418.

Material host *Bufo melanostictus*; location rectum; locality Barasat, 24 Parganas (North), West Bengal.

Diagnosis Male : Body 1.75 long; 0.19 wide, narrow lateral alae present; oesophagus with bulb 0.37 long; tail acutely conical, with a terminal spike, 0.14 long; spicule single, boat shaped, 0.10 long; caudal papillae 12 pairs, 5 preanal, 7 postanal; gubernaculum absent.

Female : Body 1.93 long, 0.18 wide; lateral alae absent; tail filiform and abruptly narrows behind the anus, 0.52 long; vulva at the base of oesophageal bulb, 0.27 from anterior end.

Remarks : Uncertain taxonomic position of the genus *Neoprotozoophaga* has already been noted.

2. *Neoprotozoophaga natrixi* Biswas and Chakravarty, 1963

(Fig. 28. A, B)

1963. *Neoprotozoophaga natrixi* Biswas & Chakravarty, *Z. Parasitenkunde*, **23** : 418-419.

Material : Host *Natrix stolata*; location rectum; locality Dum Dum, 24 Parganas (North), West Bengal.

Diagnosis Male Body 1.02 long, 0.14 wide, oesophagus with bulb 0.24 long, bulb 0.05 long; tail with a terminal spike 0.09 long, spicule single, boat-shaped, finely pointed, 0.08 long; caudal papillae 9 pairs, 4 preanal 5 postanal.

Female : Body 4.94 long; 0.23 wide; tail short, tapering behind the anus, 0.33 long; vulva at 2.47 from anterior end.

Remarks : The taxonomic status of this species is same for the *Neoprotozoophaga bufomis*.

2. Genus *Propharyngodon* Biswas & Chakravarty, 1963

Biswas and Chakravarty (1963) erected the genus *Propharyngodon* for their species *P. ranae* from *Rana tigrina* collected at Dum Dum, 24 Parganas District (North), West Bengal. But Chaband (1978) in his recent classification of the group excluded the genus from the key for its inadequate description and opined, "If one ignores the difference in hosts, there is nothing in the description of the type species of *P. ranae* to differentiated it from *Skrjabinodon* Inglis, 1968. If further study confirms this *Skrjabinodon* would be placed in the synonymy of *Propharyngodon*" As such the taxonomic status of the genus remains uncertain.

1. *Propharyngodon ranae* Biswas & Chakravarty, 1963

(Fig. 29. A, B)

1963. *Propharyngodon ranae* Biswas & Chakravarty, *Z. Parasitenkunde*, **23** : 419-420.

Material Host *Rana tigrina*, location -rectum; locality Dum Dum, 24 Parganas (North) West Bengal.

Diagnosis : Male : Body 1.0-1.46 long, 0.22-0.23 wide; body finely striated; lateral alae well developed; and extended upto cloaca; oesophagus with bulb 0.16-0.18 long; bulb 0.05-0.06 long; tail filiform, 0.29-0.31 long; spicule and gubernaculum absent; caudal papillae 3 pairs, one preanal, 2 postanal.

Female Body 2.7-4.9 long, 0.27-0.37 wide; tail filiform 0.31-0.53 long; vulva 0.53-0.57 from anterior end; eggs canoe-shaped, with caps at both the poles, 0.15-0.16 x 0.003 in diameter.

Remarks The difficulty regarding the taxonomic status to the genus *Propharyngodon* Biswas and Chakravarty, 1963, has already been stated above. The same difficulty also arises for the species.

3. Genus *Paraicosiella* Majumdar and Chakravarty, 1963

This genus was established by Majumdar and Chakravarty (1963) for their specimens from a bird, *Coturnyx coturnyx* from Calcutta, West Bengal, with *P. coturnyx* as its type species, and placed it under filariid. It may be noted that the genus itself is based on inadequate description (e.g. Oesophagus with bulb). Anderson and Bain (1976) in their recent classification of the group. Opined, "Paraicosiella Majumdar and Chakravarty, 1963 belongs with the oxyuroids" and with which the present author agrees subject to confirmation

1. *Paraicosiella coturnyx* Majumdar and Chakravarty 1963

(Fig. 30. A, B)

1963. *Paraicosiella coturnyx* Majumdar & Chakravarty, *Z. Parasitenkunde*, **23** : 8-9.

Material : Host *Coturnyx coturnyx* : location intestine; locality Calcutta (Purchased from markets), West Bengal.

Diagnosis : Male : Body 7.7-7.8 long 0.28-0.29 wide; cuticle smooth with striae; oesophagus with bulb 0.88-0.91; bulb 0.13-0.14 long; cervical alae present; caudal alae absent; tail 0.13-0.16 long; spicules similar, slender and subequal, left 0.61-0.72 long, right 0.65-0.75; caudal papillae 7 pairs, 3 preanal and 4 postanal; gubernaculum 0.039 long.

Female : Body 11.3 long, 0.29 wide; tail long, conical 0.81 long; vulva 4.52 from anterior end; vagina anteriorly directed, uteri opposed; eggs elliptical, and thick-shelled.

Remarks : Uncertain systematic position of the genus *Paraicosiella* has already been dealt with. The same difficulty also arise for the species. Hence, re-examination of the type as well as examination of more material is desirable to remove this difficulty.

4. Genus *Amphisakis* Chakravarty & Majumdar, 1959

On the basis of some female specimens from a fish, *Eutropiichthys vacha* from Calcutta, West Bengal, Chakravarty and Majumdar established the genus *Amphisakis* and placed it under the family Cucullanidae. But, in his recent classification of the group, Chabaud (1978) opined. "Amphisakis Chakravarty and Majumdar 1960, is not a member of the Cucullanidae. It may be a larval ascaridoid" to which the present author agrees.

1. *Amphisakis bengalensis* Chakravarty and Majumdar, 1959

1959. *Amphisakis bengalensis* Chakravarty & Majumdar, *Proc. Zool. Soc.*, Calcutta, 12(2), p. 117.

Material : Host *Eutropiichthys bengalensis*; location intestine; locality Calcutta, West Bengal.

Diagnosis : Female : Body 17.21-24.34 long, 0.338-0.65 wide; finely striated, excepting anteriorly which coarse; lips two, each with 3 papillae, oesophagus muscular, with one pseudo-capsule or posterior dilation, 2.3-3.15 long; oesophageal appendix 0.416-0.455, and intestinal caecum 1.70-2.38 long; eggs 0.065-0.09 x 0.039-0.065 in diameter.

Male : Unknown.

Remarks : Chabaud (1978) considers this genus to be a larval stage of an ascaridoid, hence its taxonomic status is uncertain.

1. *Paraprocta brevicaudata* (Chandler, 1924) Maplestone, 1931

1924. *Filaria brevicaudata* Chandler, *Parasitology*, Cambridge, 16(4) : 398-404.

1931. *Paraprocta brevicaudata* Maplestone, *Rec. Indian Mus.*, Calcutta, 33(2) : 89-92.

Material : 1 ex., Z.S.I. Reg. No. W1365/1; host-Racket-tailed Drongo (*Dissemurus paradiseus* = *Dicrurus paradiseus*); Locality - Zoological Gardens, Calcutta, West Bengal.

Diagnosis : Male : Body 7.5-10.5 long; cephalic papillae absent; oesophagus undivided; caudal alae absent; tail curved, bluntly rounded, short, 0.06-0.065 long; caudal papillae absent or very inconspicuous; spicules unequal, both broad and trough like, longer 0.18-0.2, shorter 0.06-0.07 long (after Maplestone, 1931).

Female . Body 16-18 long; vulva inconspicuous 1.0-1.2 from anterior end; tail short, bluntly rounded, 0.16 long.

Remarks : Chandler (1924) on the basis of two males and one female from *Dissemurus* (= *Dicrurus*) *paradiseus* and *Cissa chinensis*, from the Zoological Gardens, Calcutta, West Bengal described this species as *Filaria brevicaudata*. But Maplestone (1931) examined a large number of material from *Oriolus ? indicus*, *Coracias benghalensis indica*, *Arborophila atrogularis*, *Dendrocitta rufa*, *Copsychus saularis* and *Polyplectron bicalcaratum* died in the Zoo Gardens, Calcutta, established the genus *Paraprocta* and assigned *Filaria brevicandata* to it. But in their recent classification of the group Anderson and Bain (1976) opined, "*Paraprocta bravicaudata* was most inadequately described by Chandler (1924) and additional specimens described and assigned to the genus by Maplestone (1931) were probably not conspecific with Chandler's material. We believe this species should be regarded as a *species inquirenda* and the genus removed from the Filarioidea" and with which the present author also concurs. Hence pending re-examination of more material the taxonomic status of the species is uncertain.

2. *Aproctooides lissum* Chandler, 1929

1929. *Aproctooides lissum* Chandler, *Proc. U.S. nat. Mus.*, Washington 75 Art. 6 : 1-10.

Material . Host - Mag pie Robin (*Copsychus saularis*); location-Orbital cavity; locality - Zoological Gardens, Calcutta, West Bengal.

Diagnosis : Male : Body 12.00 long; cuticle unstriated; oesophagus short, divided, anterior 0.155 long, posterior 0.575 long; caudal end spirally coiled; tail short, rounded, 0.145 long; spicules unequal, similar, much broader proximally than distally, left spicule about 0.3 long, right 0.13 long; caudal papillae absent.

Female : Unknown.

Remarks : Due to its inadequate description it has already been treated as *species inquirendae* by Anderson and Bain (1976). In their recent classification of the group, they opined, "The female of *Aproctooides lissum* is unknown and the male tail inadequately described (e.g. papillae absent). We believe this species, not rediscovered and redescribed after almost half a century, should also be regarded as a *species inquirenda* and the genus removed from the Filarioidea".

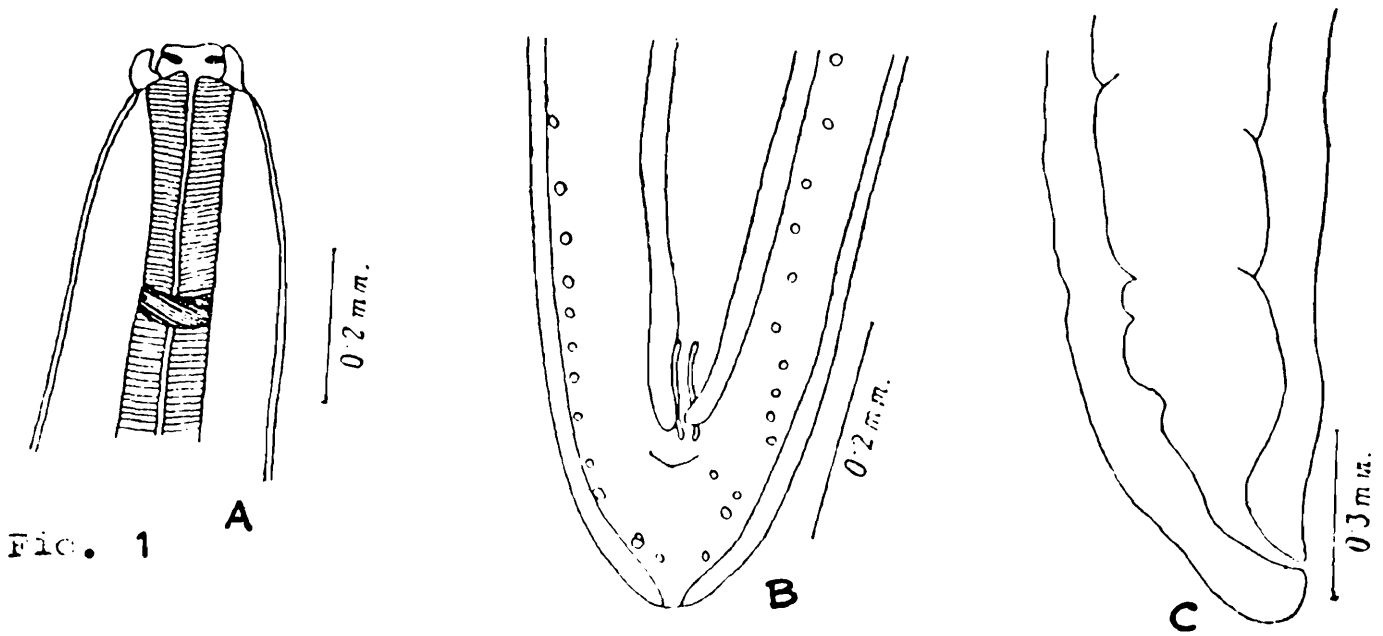


FIG. 1

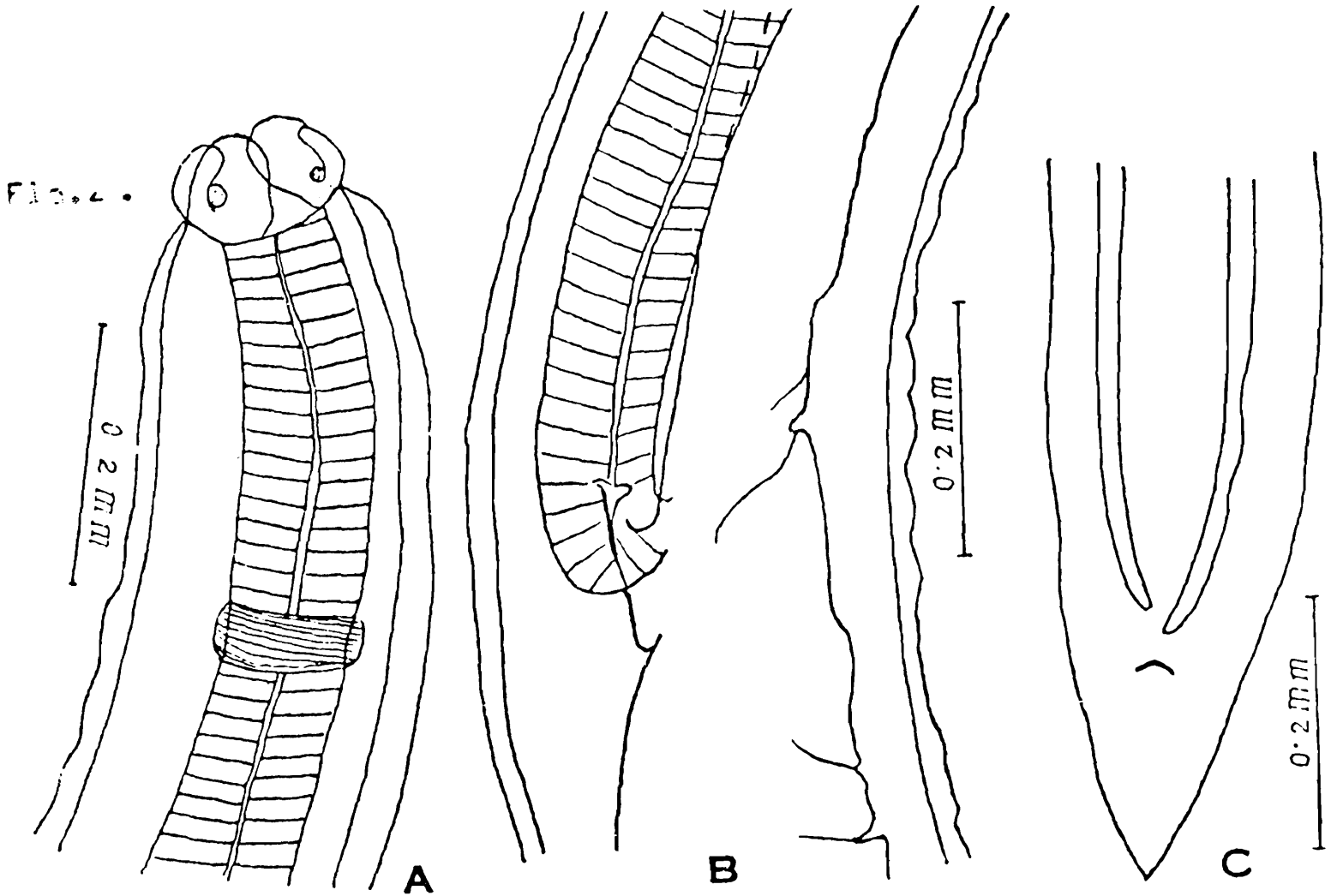


FIG. 2

Fig. 1. *Amplichaecum phalacrocoraxi* (After Chakravarty & Majumdar, 1964) A. male anterior end; B. male posterior end, all preanal papillae not shown; C. female posterior end.

Fig. 2. *Amplichaecum capellae* (After Majumdar, 1964) A. male anterior end; B. oesophageal junction with intestine and intestinal caecum; C. male posterior end.

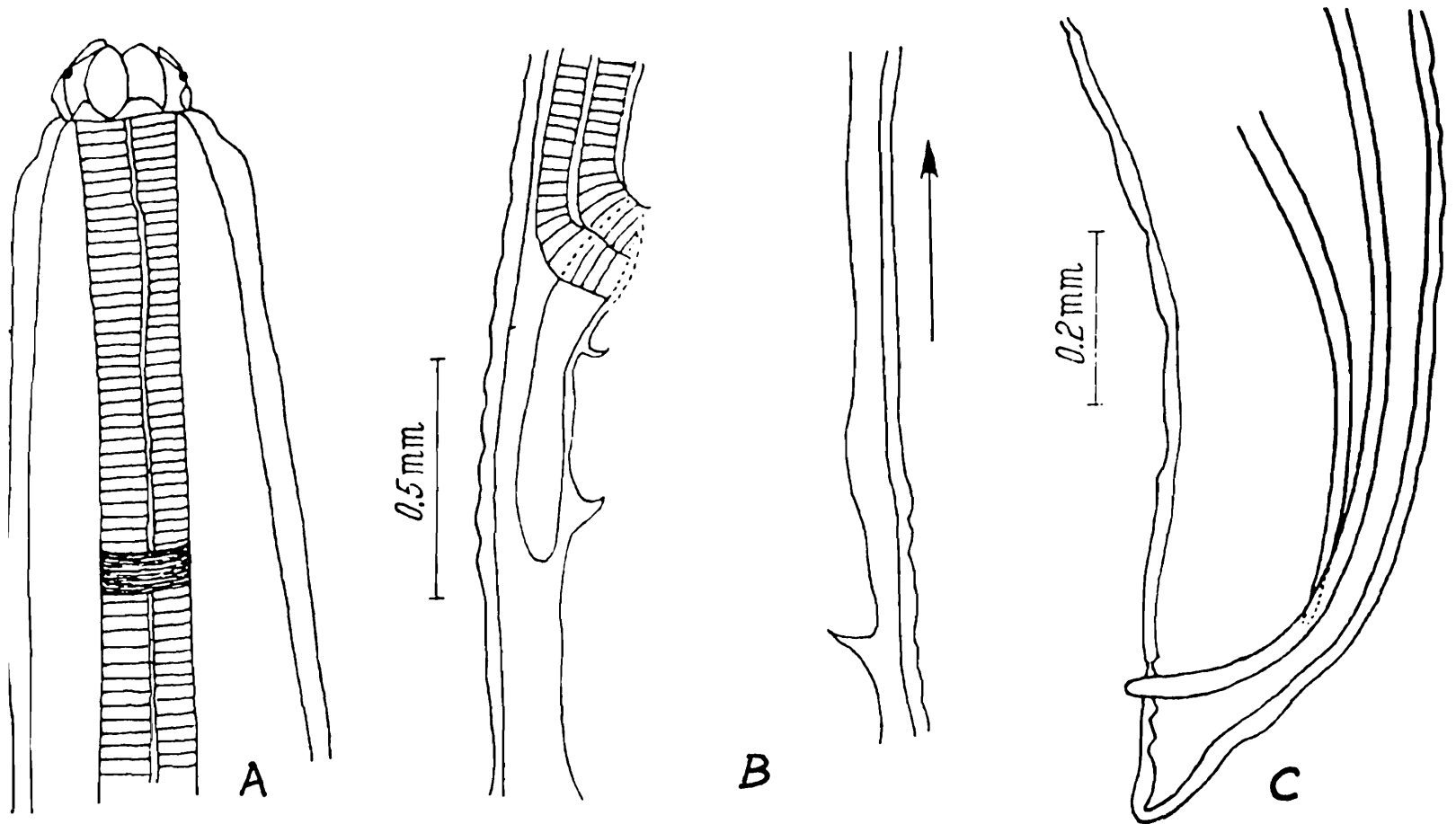


Fig. 3 .

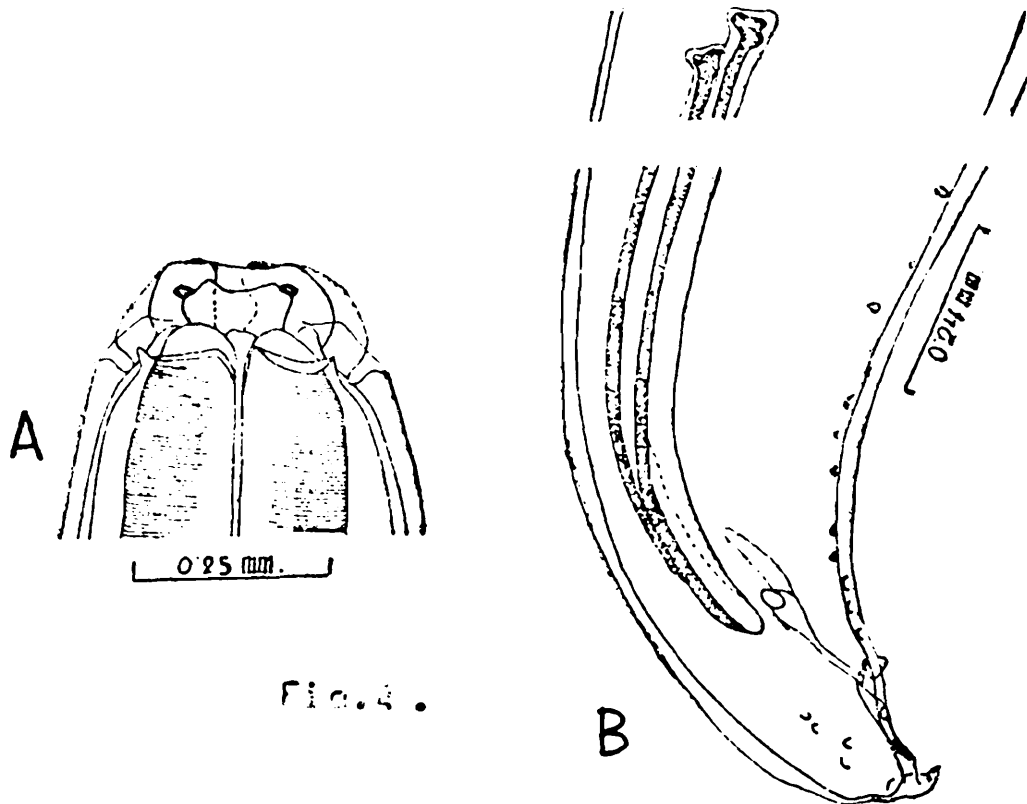


Fig. 4 .

Fig. 3. *Amplicaeum ixobrychusi* (After Majumdar and Chakravarty, 1963), A. female anterior end; B. male intestinal caecal region; C. male posterior end.

Fig. 4. *Ophidascaris piscatori* (After Soota and Chaturvedi, 1970), A. anterior end, B. male posterior end.

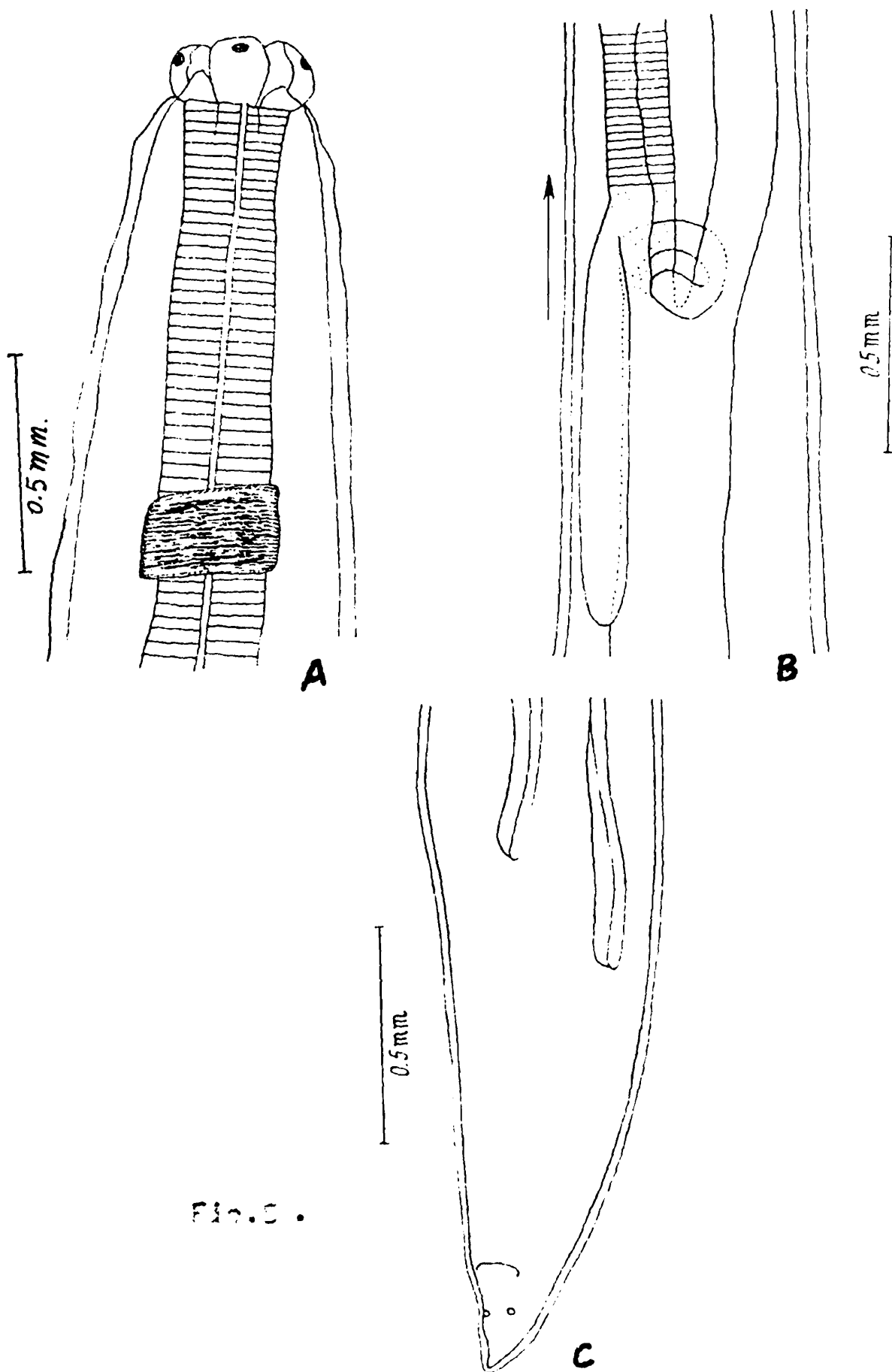


Fig. 5 .

Fig. 5. *Duplichaecum ibisi* (After Majumdar and Chakravarty, 1963) A. male anterior end; B. male ventricular region; C. male posterior end.

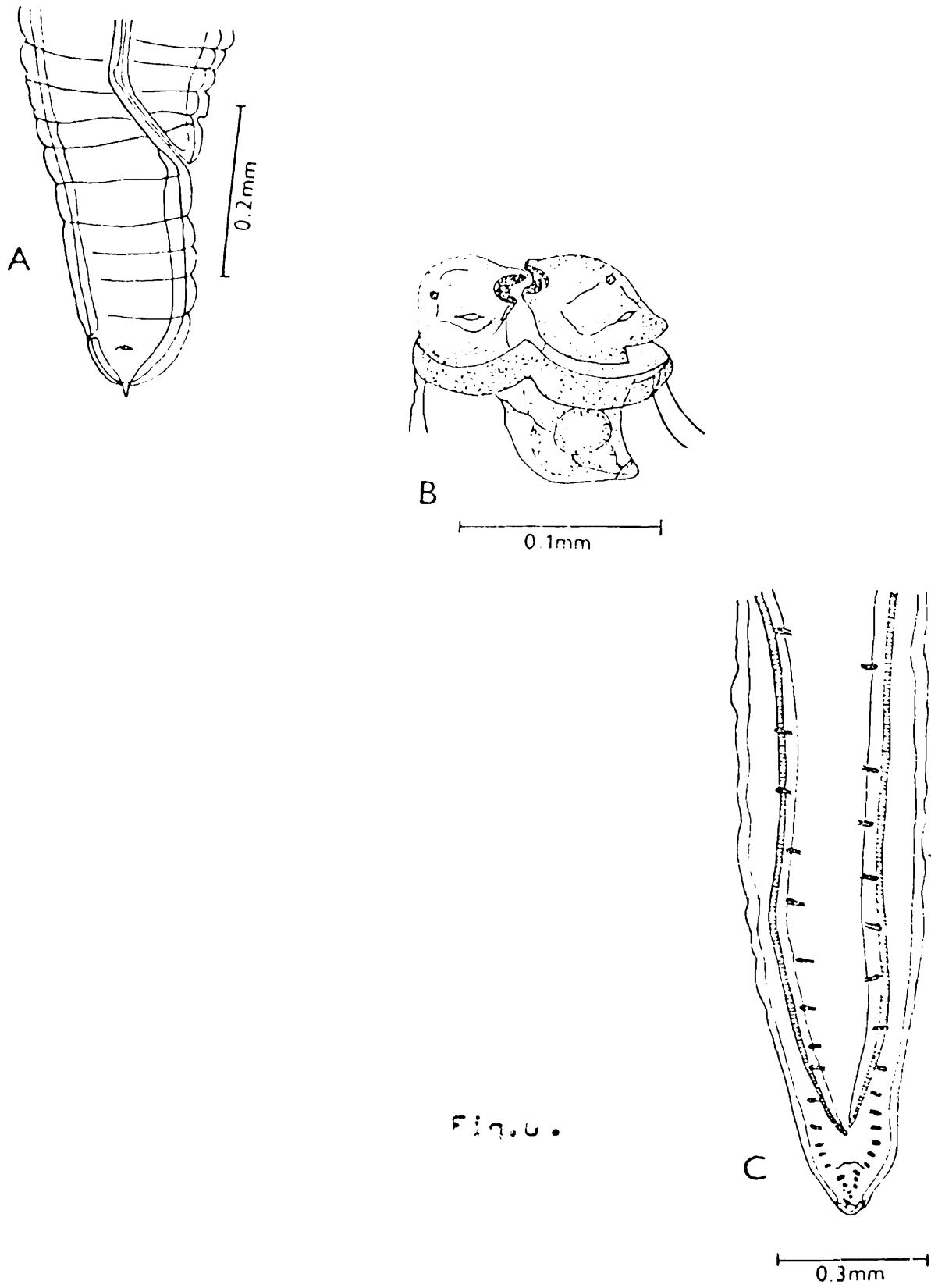


Fig. 6.

Fig. 6. *Lappetascaris lutjani* (After De, Ghosh and Majumdar, 1978) A. female posterior end; B. anterior end lateral view; C. male posterior end.

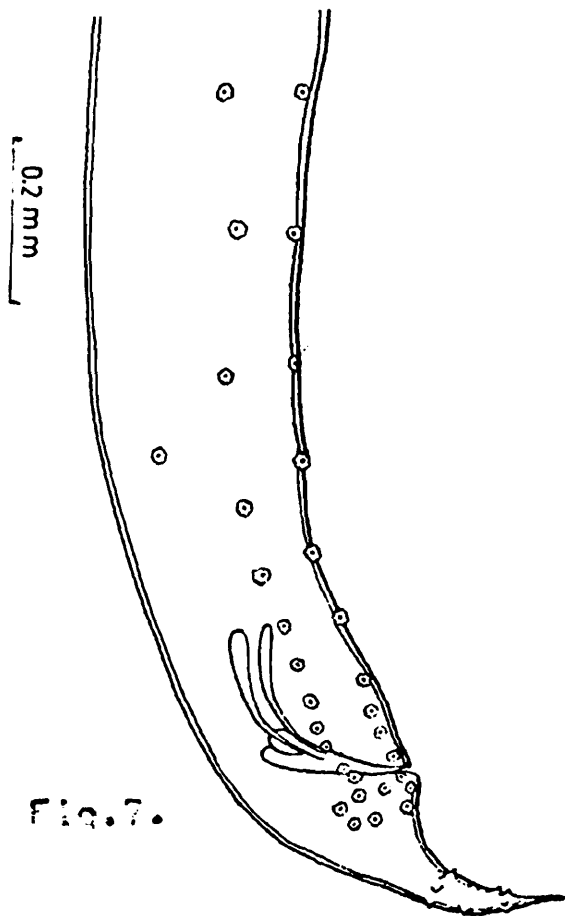


Fig. 7.

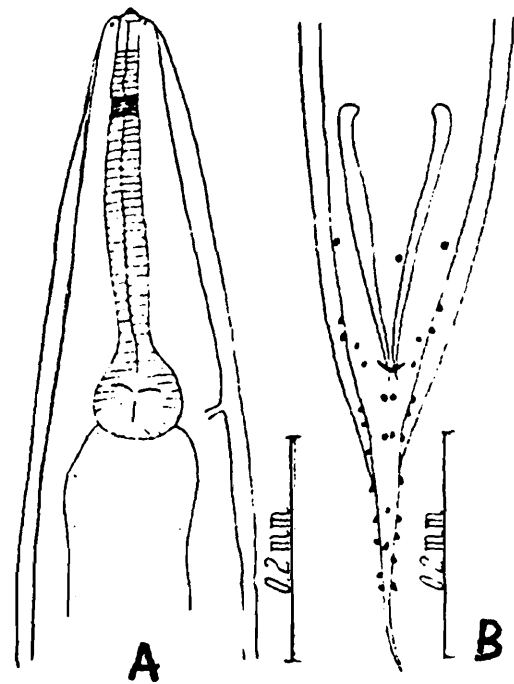


Fig. 8.

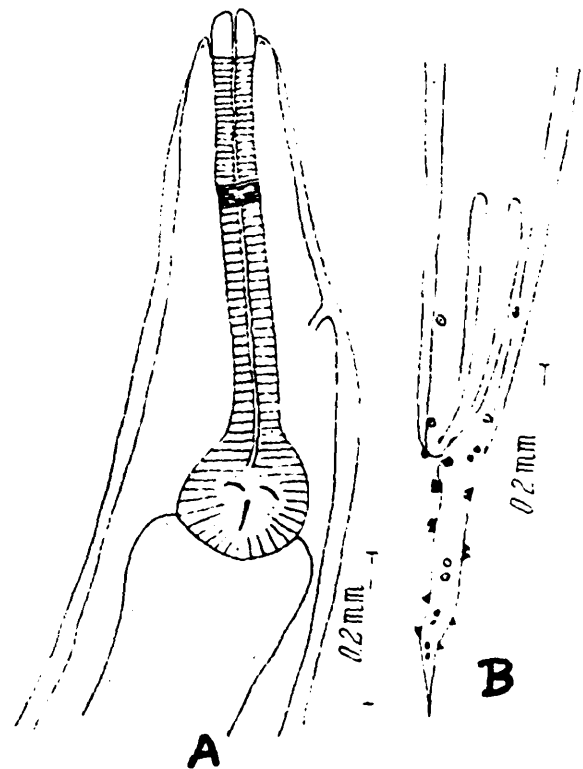


Fig. 9.

Fig. 7. *Cosmocercoides duke* (After Soota and Dey Sarkar, 1980) male posterior end.

Fig. 8. *Oxysomatium anurae* (After Biswas and Chakravarty, 1963) A. female anterior end; B. male posterior end.

Fig. 9. *Oxysomatium somatici* (After Biswas and Chakravarty, 1963) A. male anterior end; B. male posterior end.

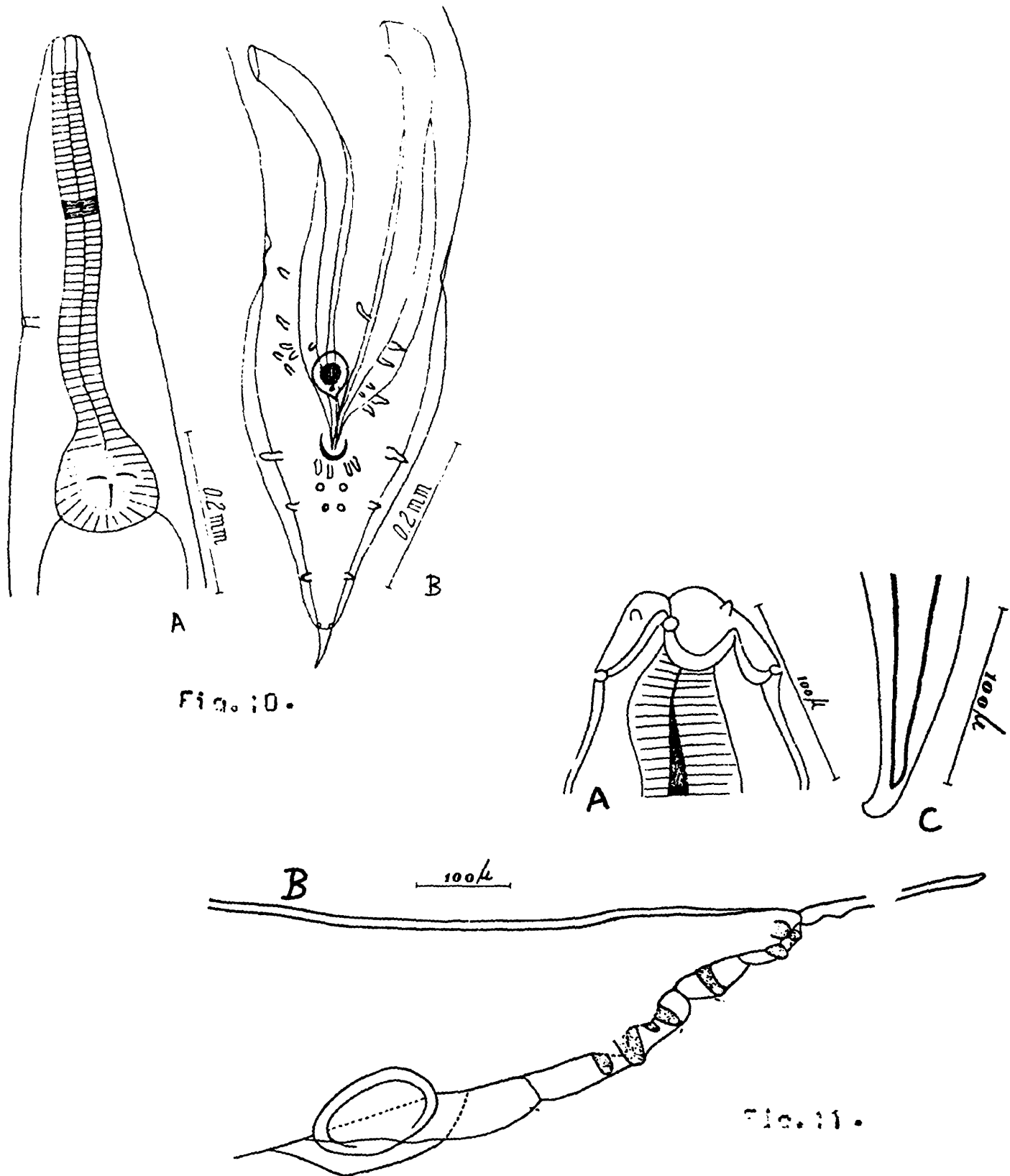


Fig. 10. *Pseudaspodera inanendrae* (After Chakravorty) A. female anterior end; B. male posterior end; C. female posterior end.

Fig. 11. *Africana bufonis* (After Biswas and Chakravarty, 1963) A. male anterior end; B. male posterior end.

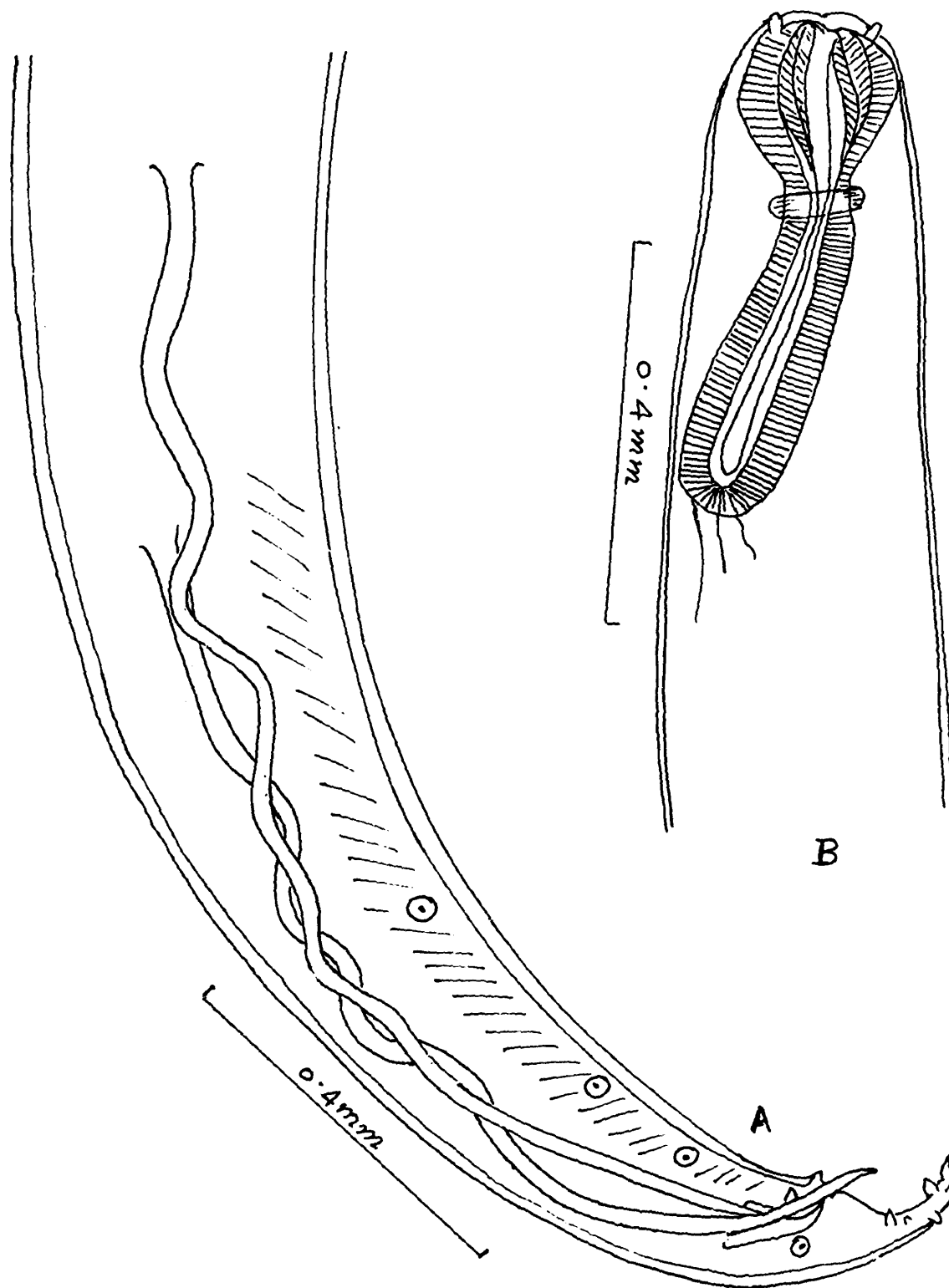


Fig. 12 .

Fig. 12. *Cucullanus panijuseus* n.sp. A. male anterior end; B. male posterior end.

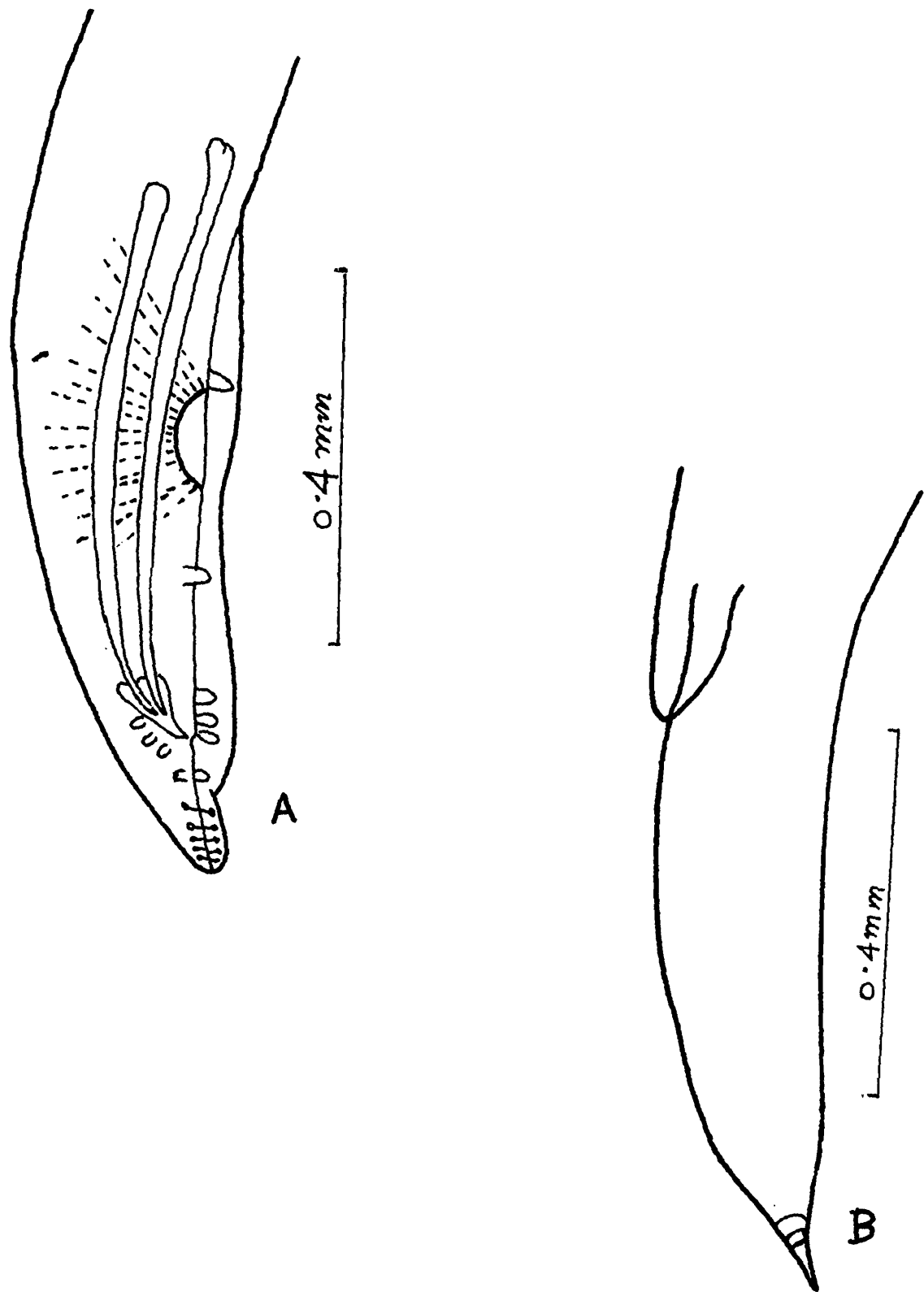


Fig. 13.

Fig. 13. *Subulura (Subulura) perdicularia*, n.sp. A. male posterior end; B. female posterior end.

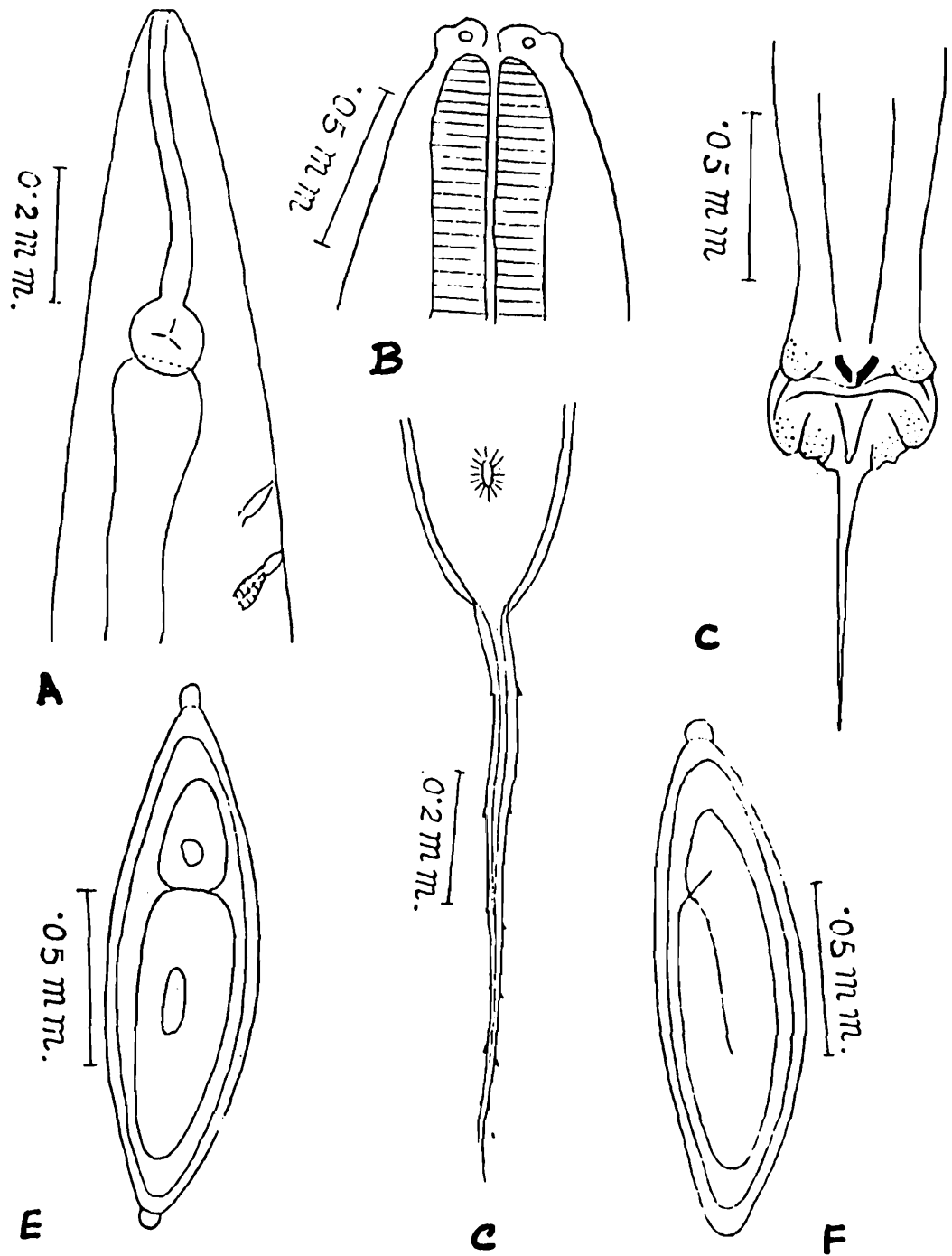


Fig. 14.

Fig. 14. *Pharyngodon gekko* (After Chakravarty and Bhaduri) A. female anterior end; B. female head, lateral view; C. male posterior end, D. female posterior end; E. egg showing two opercula; F. egg showing one operculum.

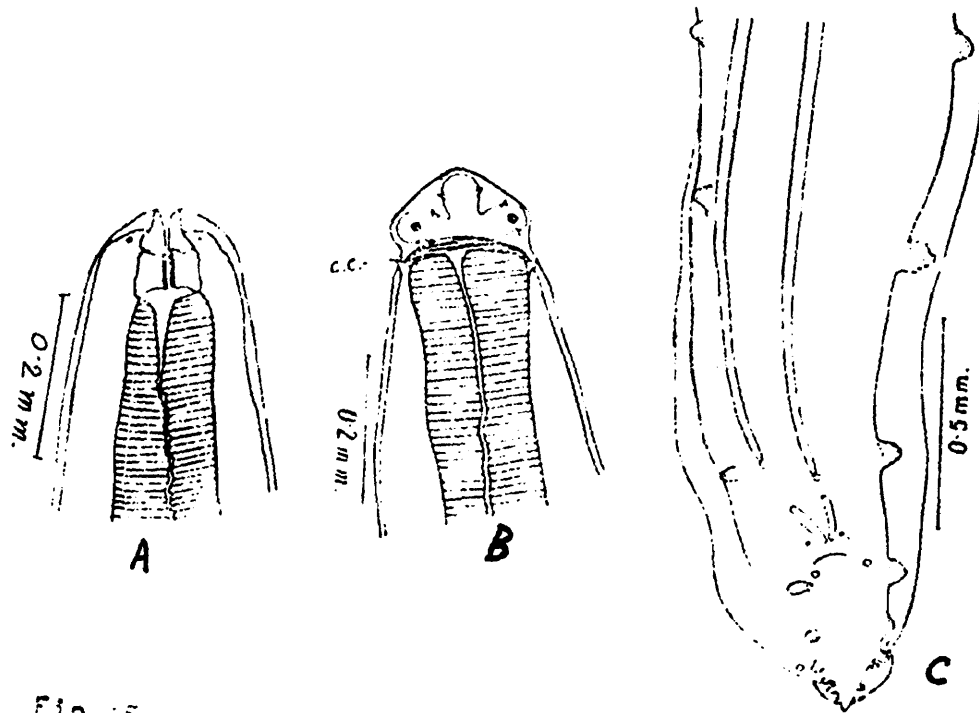


Fig. 15.

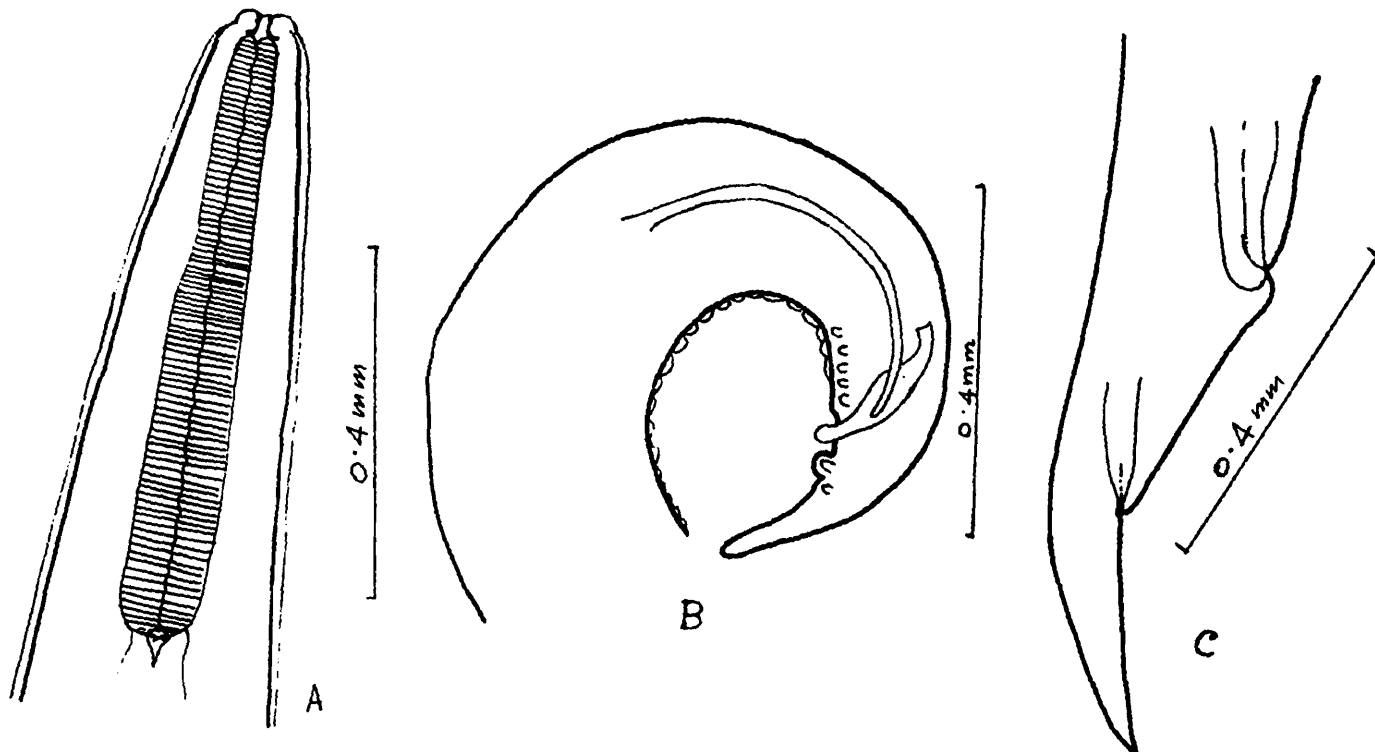


Fig. 16.

Fig. 15. *Sproxys gubernae* (After Chakravarty and Majumdar) A. male anterior end, dorsal view; B. male anterior end, lateral view; c.c. cuticular collar. C. male posterior end.

Fig. 16. *Oxyspirura (Barusispirura) longistriata*, n.sp. A. male posterior end; B. male posterior end; C. female posterior end.

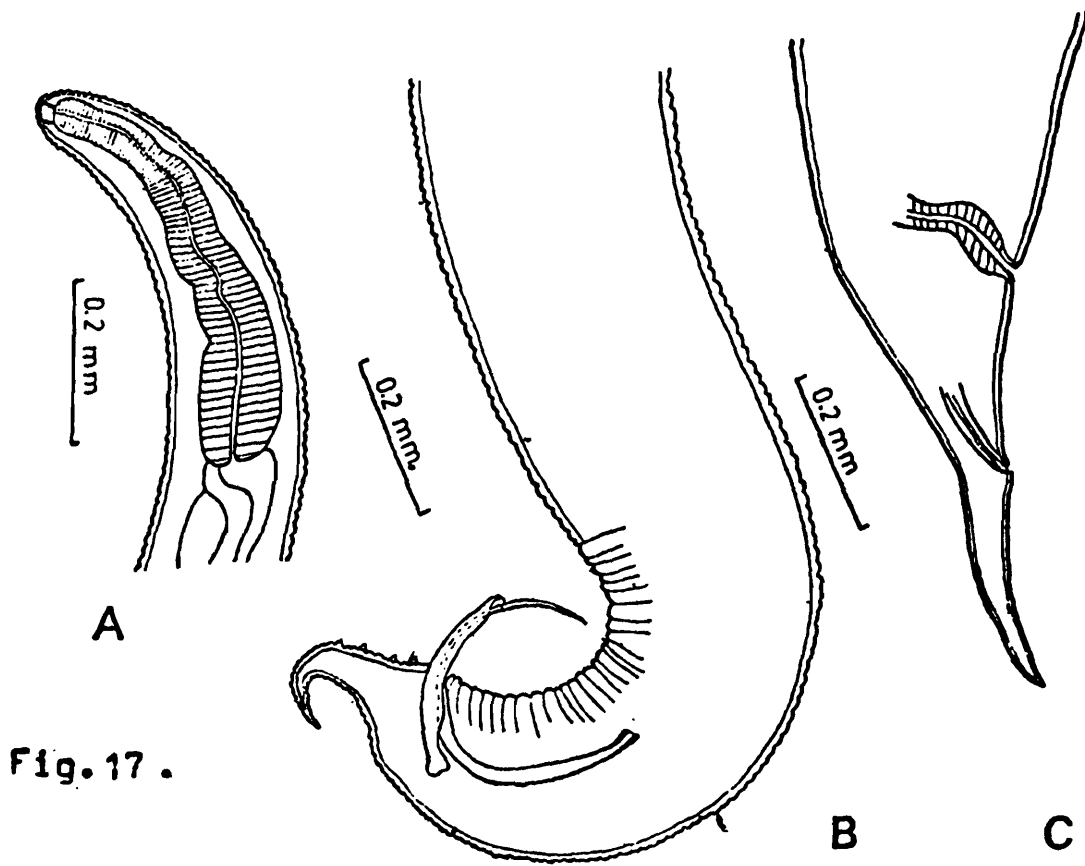


Fig. 17 .

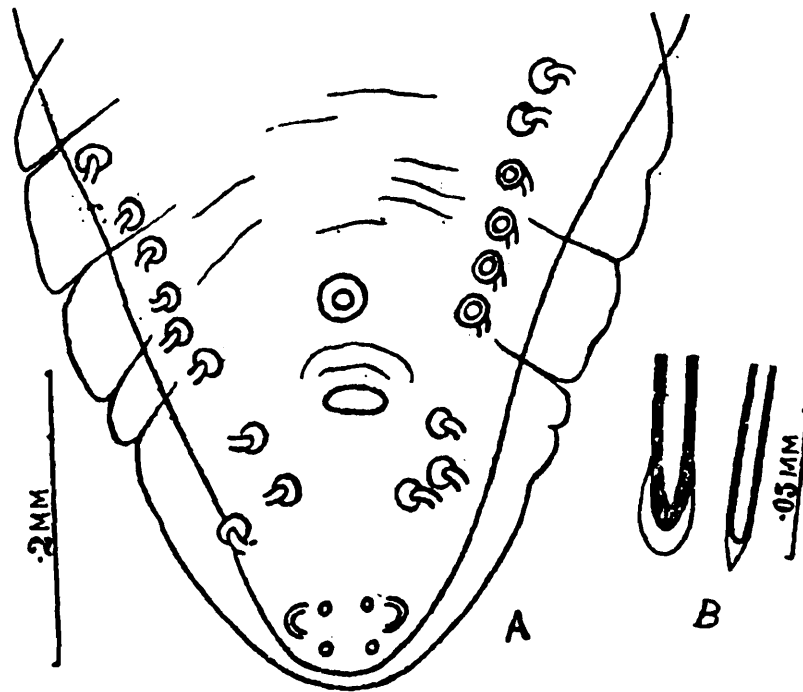


Fig. 18 .

Fig. 17. *Oxyspirura (Barusispirura) montana* (After Soota and Dey Sarkar, 1980) A. male anterior end, B. male posterior end, C female posterior end.

Fig. 18. *Cyclospirura (Gastronodus) strassenii* (After Singh, 1934) A. male posterior end; B. Tips of spicules.

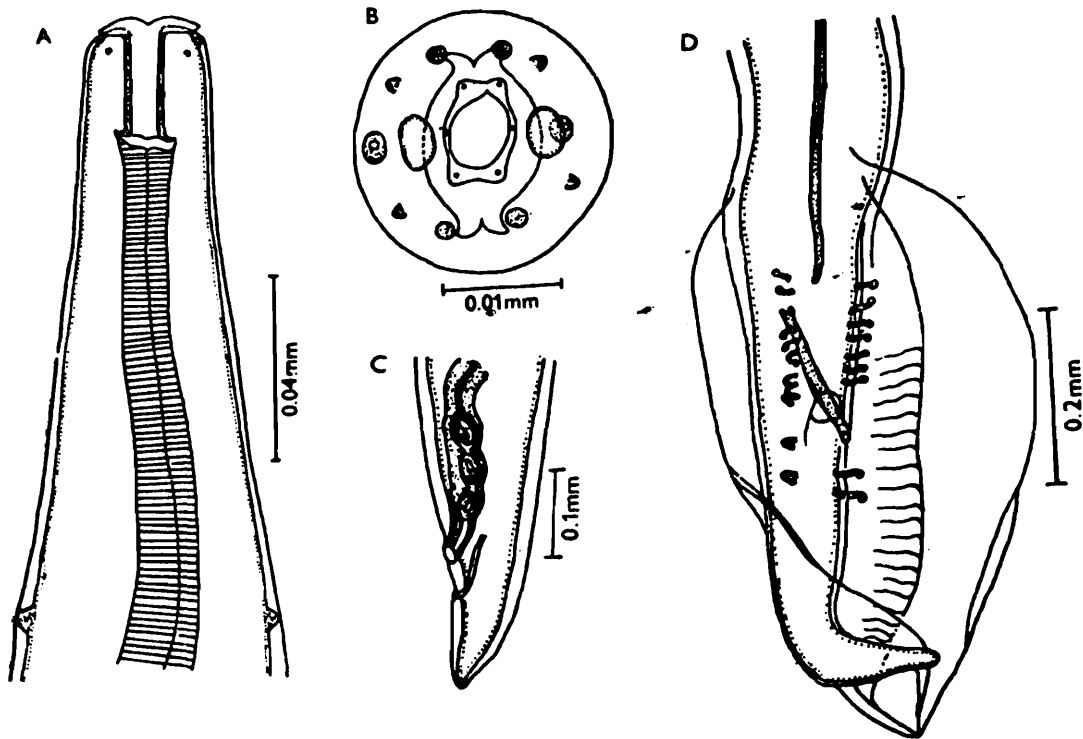


Fig. 20.

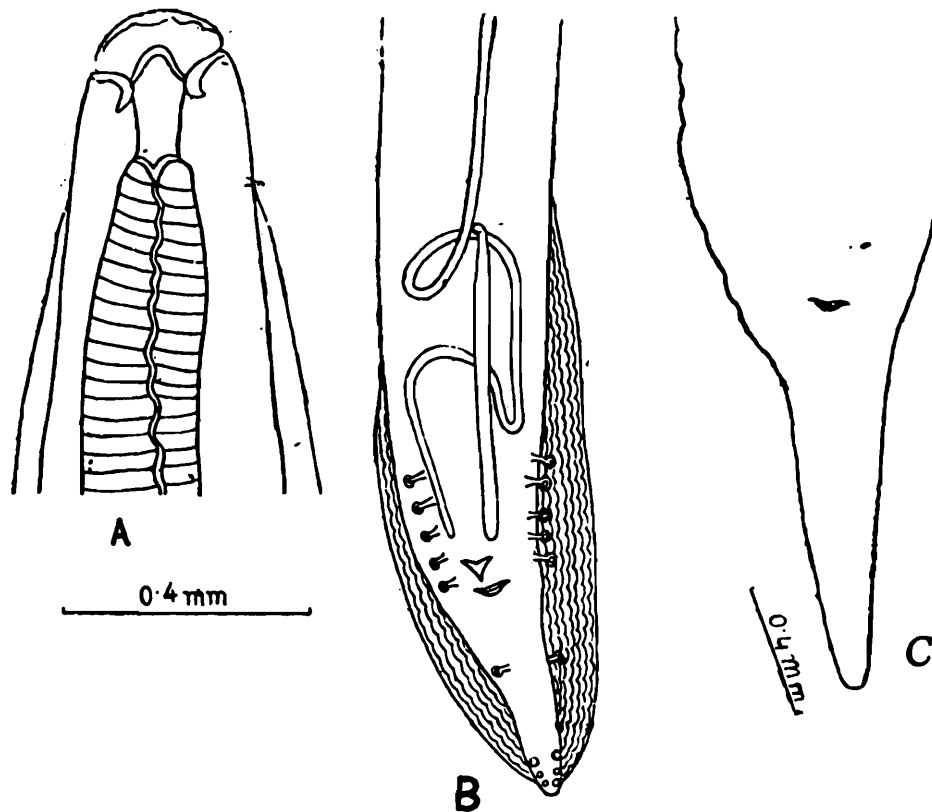


Fig. 19.

Fig. 19. *Habronema avicedae* (After Soota and Dey Sarkar, 1981) A. male anterior end; B. male posterior end; C. female posterior end.

Fig. 20. *Viguiera majumdari* (After De, 1979) A. female anterior end; B. female anterior end, apical view; C. female posterior end; D. male posterior end.

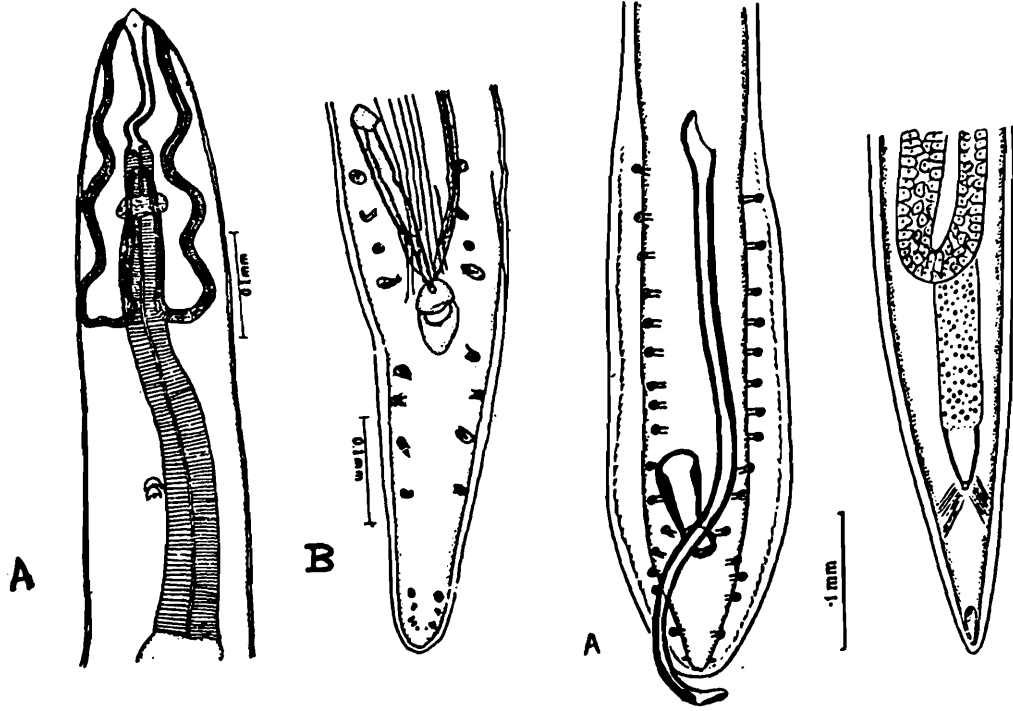


Fig. 21.

Fig. 22.

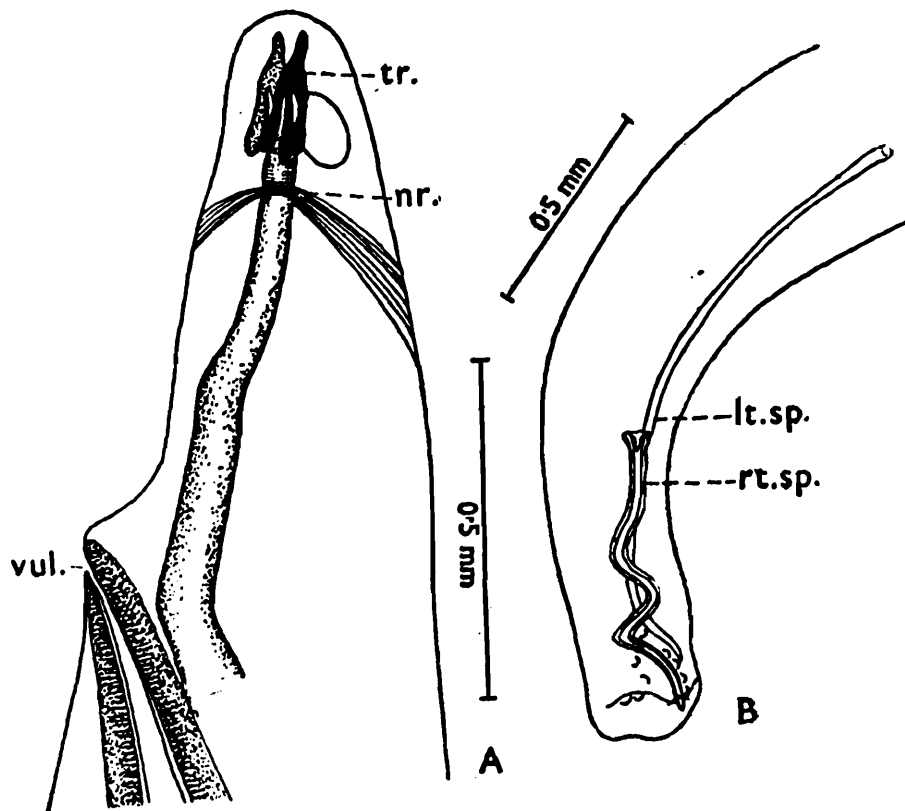


Fig. 23.

Fig. 21. *Synhimantus (Synhimantus) hydrabadensis* (After Nandi and Kundu, 1985) A. female anterior end, B. male posterior end.

Fig. 22. *Schistorophus tenuis* (After Singh, 1949) A. male posterior end; B. female posterior end.

Fig. 23. *Diplotriaena nepalensis* (After Soota and Chaturvedi, 1967) A. female anterior end; tr., trident; nr., nerve ring; vul., vulva; B. male posterior end; lt. sp., left spicule; rt. sp., right spicule.

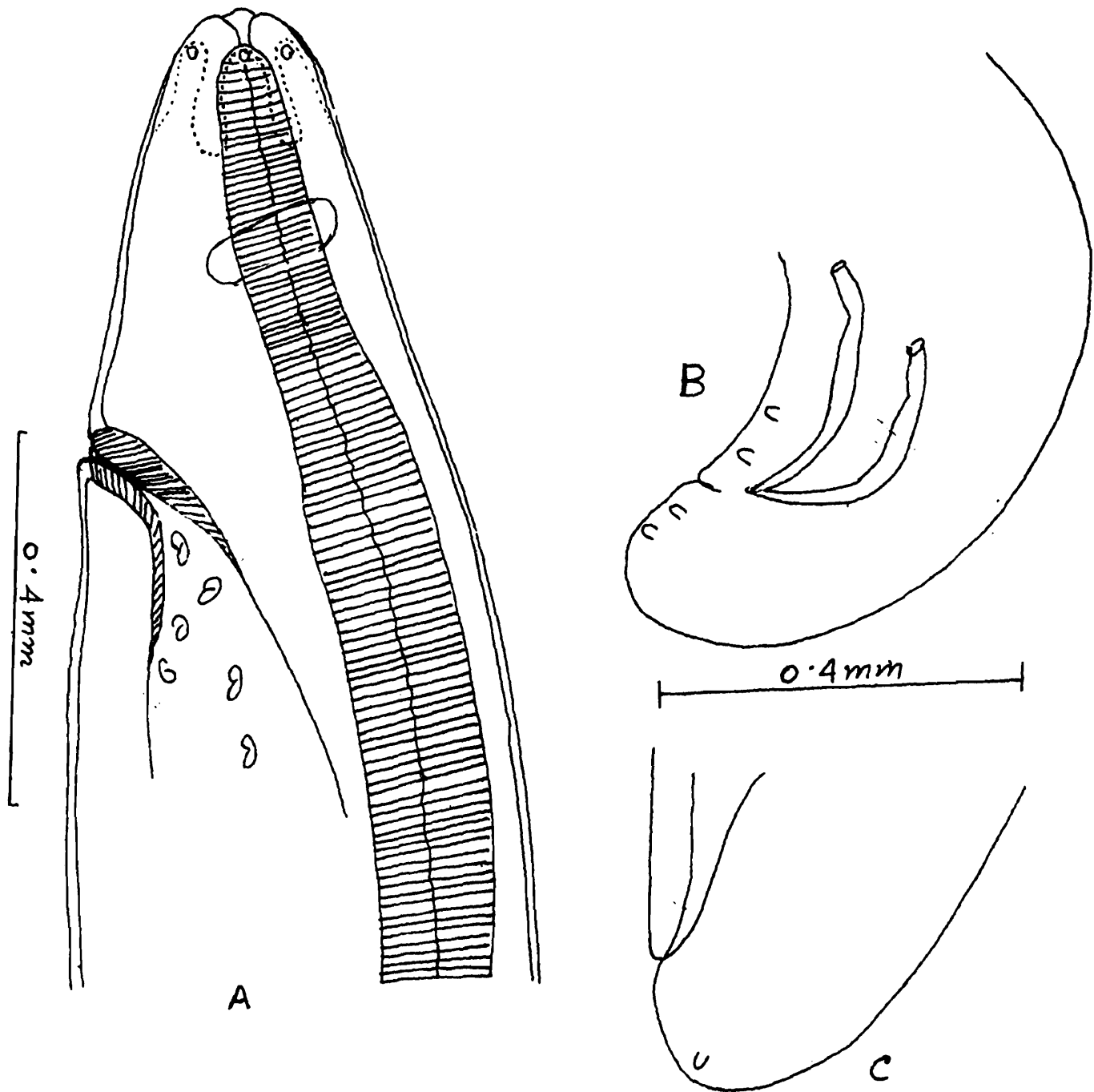


Fig. 24. *Pseudaprocta vagabunda* n. sp. A. female anterior end; B. male posterior end; C. female posterior end.

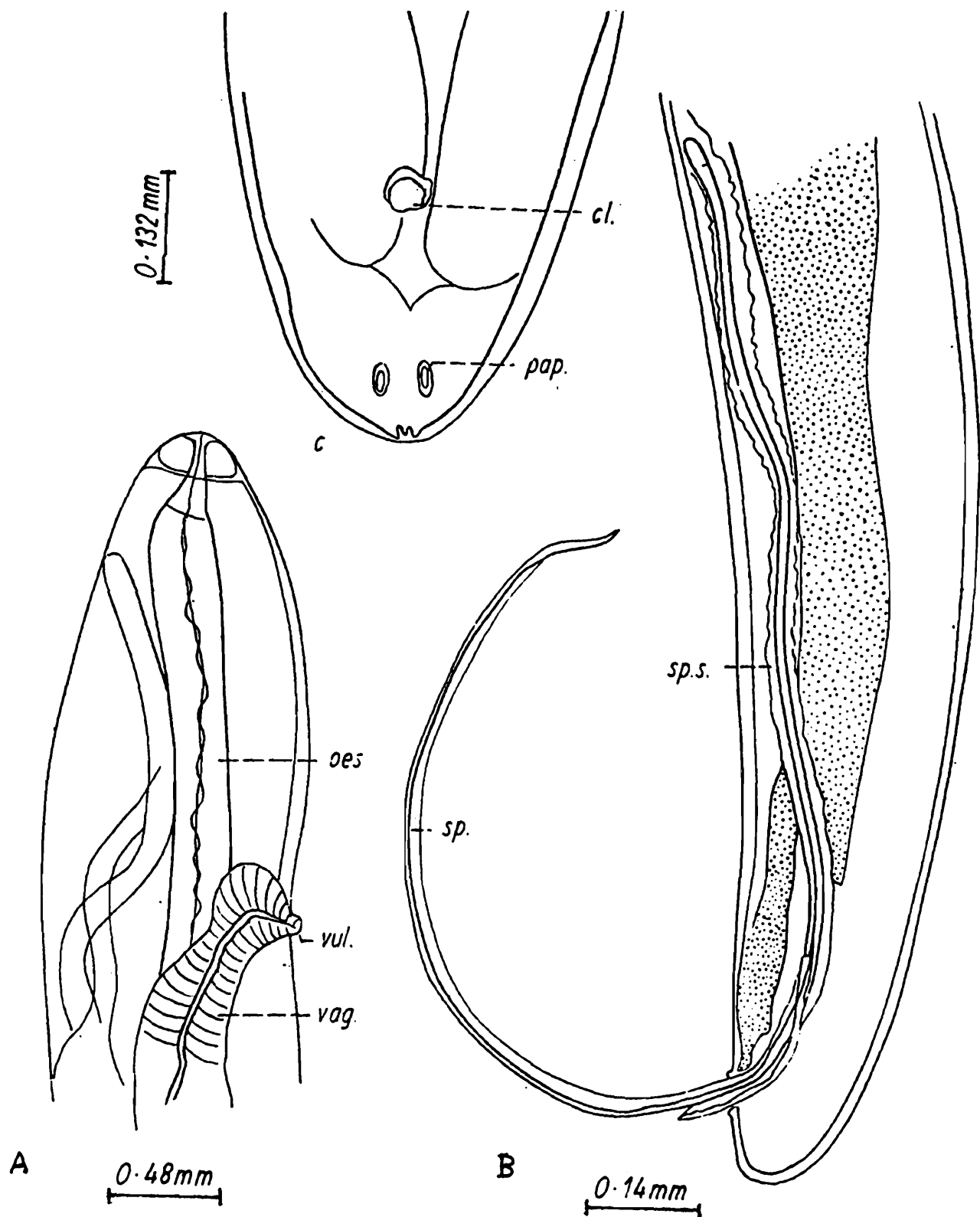


Fig. 25.

Fig. 25. *Lemdana bengalensis* (After Soota and Chaturvedi, 1971) A. female anterior end, B. male posterior end; C. female posterior end.

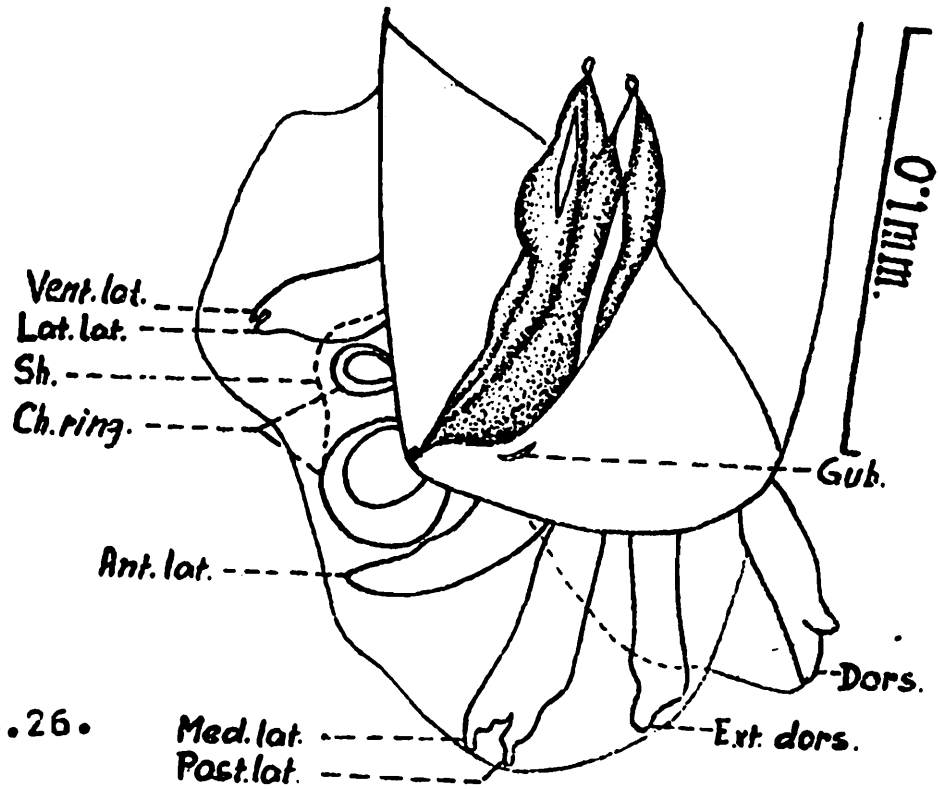


Fig. 26.

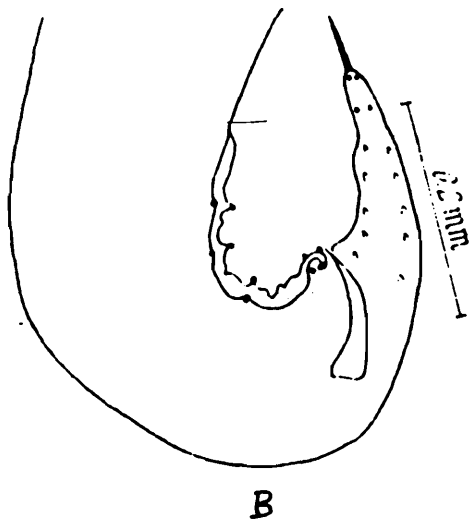
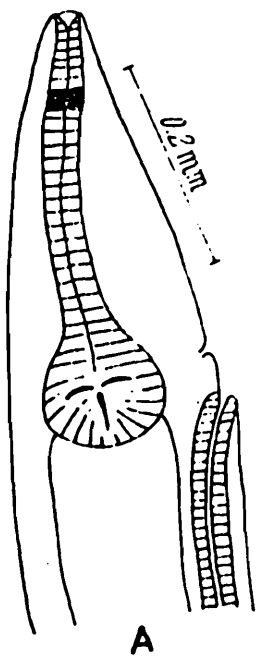
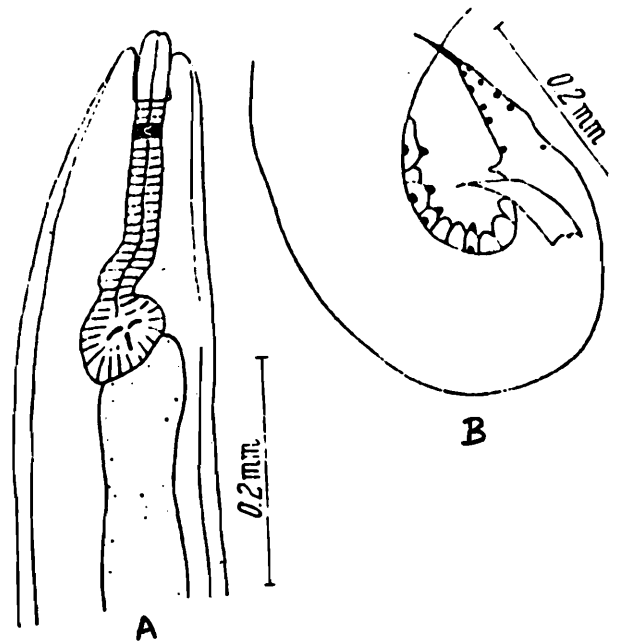


Fig. 27.



0.2 mm.



Fig. 28.

Fig. 26. *Pulmostrongylus palustris* (After Soota and Chaturvedi, 1970) Male posterior end.

Fig. 27. *Neoprotozoophaga bufonis* (After Biswas and Chakravarty, 1963) A. female anterior end; B. male posterior end.

Fig. 28. *Neoprotozoophaga natrixi* (After Biswas and Chakravarty, 1963) A. male anterior end; B. male posterior end.

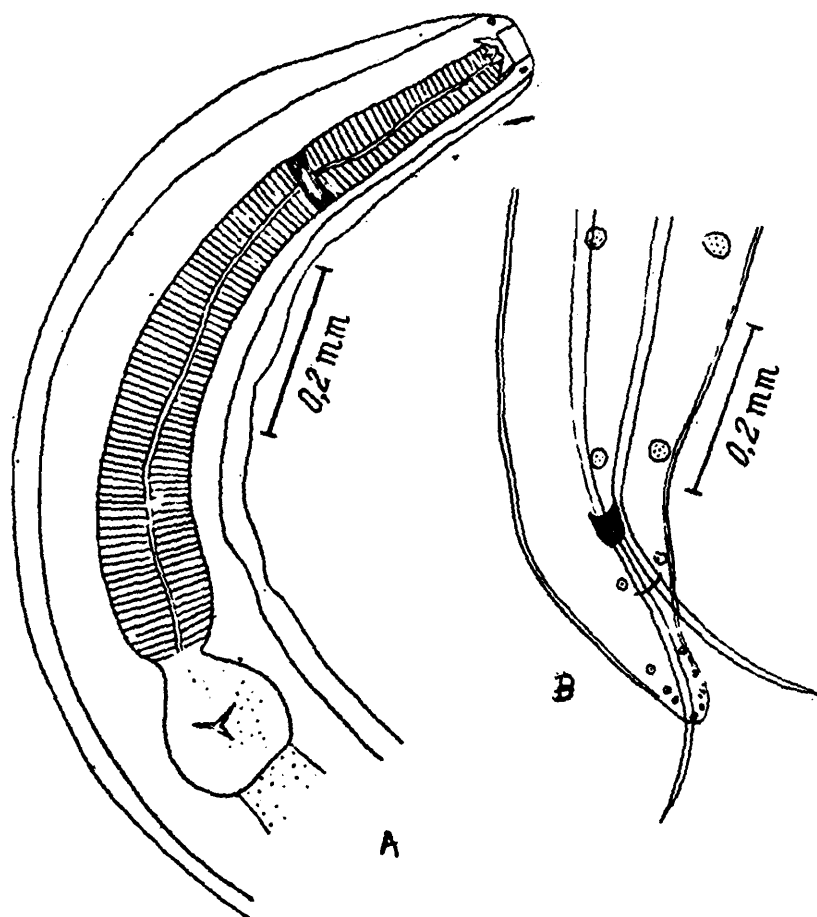


Fig.30.

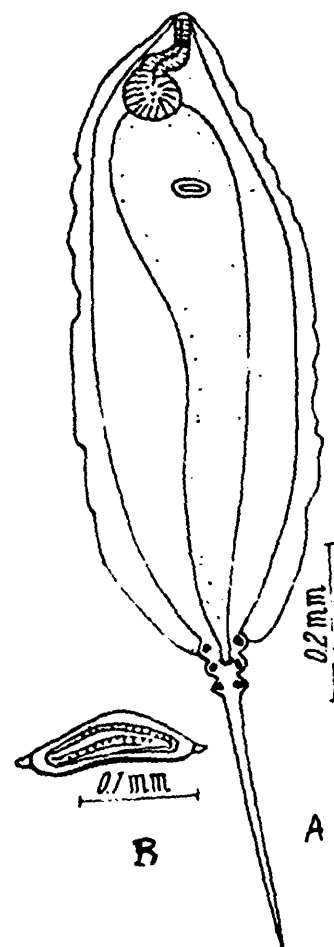


Fig.29.

Fig. 29. *Propharyngodon ranae* (After Biswas and Chakravarty, 1963) A. entire male; B. egg.

Fig. 30. *Paraicosiella coturnyx* (After Majumdar and Chakravarty, 1963) A. male anterior end. B. male posterior end.

Classified list of Nematode hosts from West Bengal

* Not recorded from West Bengal

** Not recorded from India

| <i>Host</i> | <i>Parasite</i> |
|---|--|
| Mammalia | |
| Order I PRIMATES | |
| 1. Family Hominidae | |
| <i>Homo sapiens</i> (Man) | <i>Ascaris lumbricoides</i> , <i>Ancylostoma</i> (<i>Ancylostoma</i>) <i>doudenale</i> , <i>Enterobius vermicularis</i> |
| 2. Family Pongidae | |
| ** <i>Pongo pygmaeus</i> (= <i>Simia satyrus</i>) | <i>Ascaris lumbricoides</i> , <i>Streptopharagus pigmentus</i> |
| <i>Hylobates hoolock</i> | <i>Dipetalonema digitatum</i> , <i>Probstmayria simiae</i> , <i>Physocephalus primus</i> , <i>Oesophagostomum</i> (<i>Conoweberia</i>) <i>blanchardi</i> , <i>O. (C.) ovatum</i> |
| <i>Hylobates</i> sp. | <i>Trichuris trichiura</i> |
| 3. Family Cercopithecidae | |
| <i>Presbytis obscurus</i> (= <i>Semnopithecus obscurus</i>) | <i>Oesophagostomum</i> (<i>Conoweberia</i>) <i>tridentatum</i> |
| <i>Macaca mulata</i> (= <i>Macacus rhesus</i>) | <i>Trichuris trichiura</i> |
| 4. Family Lorisidae | |
| * <i>Loris lydekkerianus</i> (= <i>Loris gracelis</i>) | <i>Tarsubulura peramata</i> |
| 5. Family Lemuridae | |
| ** <i>Lemur brunneus</i> | <i>Enterobius anthropopithecii</i> |
| 6. Family Cebidae | |
| ** <i>Cebus capucinus</i> | <i>Gongylonema</i> (<i>Gongylonema</i>) <i>capucini</i> |
| Order II CARNIVORA | |
| 7. Family Canidae | |
| <i>Canis lupus pallipes</i> | <i>Ancylostoma</i> (<i>Ancylostoma</i>) <i>caninum</i> , <i>Ancylostoma</i> (<i>Ceylancylostoma</i>) <i>ceylanicum</i> |
| * <i>Canis aureus</i> | <i>Ancyllostoma</i> (<i>Ancylostoma</i>) <i>caninum</i> , <i>Ancylostoma</i> (<i>Ceylancylostoma</i>) <i>ceylanicum</i> |
| Domestic dog | <i>Trichuris vulpis</i> , <i>Toxocara canis</i> |
| <i>Cyan alpinus dukhunensis</i> | <i>Ancylostoma</i> (<i>Ancylostoma</i>) <i>caninum</i> , <i>Ancylostoma</i> (<i>Ceylancylostoma</i>) <i>ceylanicum</i> |

| <i>Host</i> | <i>Parasite</i> |
|--|---|
| <i>Vulpes bengalensis</i> | <i>Physaloptera</i> sp., <i>Ancylostoma</i> (<i>Ancylostoma</i>) <i>caninum</i> , <i>Ancylostoma</i> (<i>Ceylancylostoma</i>) <i>ceylanicum</i> , <i>Toxascaris leonina</i> |
| <i>Vulpes pusilla</i> (= <i>vulpes leucopus</i>) | <i>Ancylostoma</i> (<i>Ceylancylostoma</i>) <i>ceylanicum</i> , <i>Ancylostoma</i> (<i>Ancylostostoma</i>) <i>caninum</i> |
| 8. Family Felidae | |
| <i>Panthera tigris</i> (= <i>Felis tigris</i>) | <i>Ancylostoma</i> (<i>ceylancylostoma</i>) <i>ceylanicum</i> , <i>Ancylostoma</i> (<i>Ancylostoma</i>) <i>duodenale</i> , <i>Toxascaris leonina</i> |
| <i>Panthera leo</i> (= <i>Felis leo</i>) | <i>Toxascaris leonina</i> |
| <i>Panthera pardus</i> (= <i>Felis pardus</i>) | <i>Galoncus pernicious</i> , <i>Toxocara mystax</i> , <i>Toxascaris leonina</i> , <i>Ancylostoma</i> (<i>Ceylancylostoma</i>) <i>ceylanicum</i> |
| <i>Felis chaus</i> | <i>Toxocara mystax</i> |
| <i>Felis bengalensis</i> | <i>Toxocara leonina</i> |
| <i>Felis temmincki</i> | <i>Physaloptera brevispiculum</i> |
| <i>Felis viverrina</i> | <i>Ancylostoma</i> (<i>Ceylancylostoma</i>) <i>Ceylanicum</i> , <i>Ancylostoma</i> (<i>Ancylostoma</i>) <i>caminum</i> , <i>Toxocara mystax</i> , <i>Toxascaris leonina</i> |
| 9. Family Procyonidae | |
| ** <i>Procyon</i> sp. | <i>Tetragomphius procyonis</i> |
| <i>Aelurus fulgeus</i> | <i>Toxascaris transfuga</i> |
| 10. Family Ursidae | |
| <i>Melursus ursinus</i> | <i>Toxascaris transfuga</i> , <i>Ancylostoma</i> (<i>Ceylancylostoma</i>) <i>ceylanicum</i> , <i>A. (C.) malyanum</i> |
| <i>Helactos malayanus</i> (= <i>Ursus malayanus</i>) | <i>Ancylostoma</i> (<i>Ceylancylostoma</i>) <i>ceylanicum</i> |
| <i>Selenarctos thibetanus</i> (= <i>Ursus torquatus</i>) | <i>Ancylostoma</i> (<i>Ceylancylostoma</i>) <i>malayanum</i> |
| 11. Family Viverridae | |
| ** <i>Viverricula malaccensis</i> | <i>Arthostoma longespiculum</i> |
| <i>Herpestes palustris</i> | <i>Pulmostrongylus palustris</i> |
| Order III INSECTIVORA | |
| 12. Family Soricidae | |
| <i>Suncus murinus</i> | <i>Cylicospirura</i> (<i>Gastronodus</i>) <i>strassenii</i> |
| Order IV Rodentia | |
| 13. Family Muridae | |
| <i>Rattus rattus</i> | <i>Heterakis spumosa</i> |

| <i>Host</i> | <i>Parasite</i> |
|--|---|
| <i>Mus musculus</i> , | |
| <i>Rattus</i> sp. | <i>Syphacia muris</i> |
| <i>Rattus norvegicus</i> (= <i>Mus decumanus</i>) | <i>Capillaria prashadi</i> |
| <i>Rattus norvigicus</i> , | <i>Heterakis spumosa</i> , <i>Sublura (Subulura) andersoni</i> |
| <i>Bandicoota indica</i> | <i>Heterakis spumosa</i> , <i>Trichuris</i> sp. |
| 14. Family Sciuridae | |
| <i>Sciurus indicus</i> | <i>Ascaris lumbricoides</i> |
| <i>Sciurus pygerythrus</i> , | |
| <i>Funambulus pennanti</i> , | |
| <i>Sciurus</i> sp. | <i>Subulura (Subulura) andersoni</i> |
| 15. Family Hystricidae | |
| <i>Hystrix bengalensis</i> | <i>Gireterakis girardi</i> |
| Order V PROBOSCIDEA | |
| 16. Family Elephantidae | |
| <i>Elephas maximus indicus</i> | <i>Choniangium epistomum</i> , <i>Murshidia (Murshidia)</i> <i>murshidia</i> , <i>M. (M.) falcifera</i> , <i>Khalilia pileata</i> |
| Order VI PERRISODACTYLA | |
| 17. Family Equidae | |
| Horse, Dunkey & Mule | <i>Parascaris equorum</i> , <i>Setaria equina</i> |
| 18. Family Camelidae | |
| Camel | <i>Trichuris ovis</i> |
| 19. Family Rhinocerotidae | |
| <i>Rhinoceros unicornes</i> | <i>Necator americanus</i> |
| ** <i>Rhinoceros bicornis</i> | <i>Necator americanus</i> |
| Order VII ARTIODACTYLA | |
| 20. Family Bovidae | |
| Sheep (Domestic) | <i>Bunostomum trigonocephalum</i> , <i>Trichuris ovis</i> |
| Goat (Domestic) | <i>Trichuris globulosa</i> , <i>T. ovis</i> , <i>Oesophagostomum</i> (<i>Hysteracrum</i>) <i>asperum</i> , <i>Oesophagostomum</i> (<i>Proteracrum</i>) <i>columbianum</i> |
| <i>Capra falconeri</i> | <i>Haemonchus contortus</i> |
| Cow (Domestic) | <i>Trichuris ovis</i> , <i>T. discolor</i> , <i>Thelazia (Thelazia)</i> <i>rhodesii</i> , <i>Agriostomum vryburgi</i> , <i>Mecistocirrus</i> <i>digitatus</i> |
| Buffalo (Domestic), | <i>Trichuris discolor</i> |
| <i>Bubalus bubalis</i> (= <i>Bos Bubalis</i>) | |
| "Hybrid Bison" (<i>Bos frontalis</i> × <i>Bos taurus</i>) | <i>Oesophagostomum (Bosicola) radiatum</i> |

| <i>Host</i> | <i>Parasite</i> |
|--|--|
| ** Okapi | <i>Trichuris discolor</i> |
| 21. Family Cervidae <i>Axis axis</i> (= <i>Cervus axis</i>) | <i>Seteria cervi</i> , <i>Oesophagostomum</i> (<i>Hysteracrum</i>) <i>indicum</i> , <i>O. (Bosicola) curvatum</i> |
| 22. Family Tragulidae ** <i>Tragulus javonicus</i> | <i>Papillosetaria verversi</i> , <i>Bourgelatioides traguli</i> , <i>Rhabdostomum traguli</i> |
| 23. Family Suidae Pig (Domestic) | <i>Ascarops strongylina</i> , <i>Gnathostoma doloresi</i> , <i>Globocephalus urosubulatus</i> , <i>G. connorfilli</i> , <i>G. samoensis</i> , <i>Physocephalus sexalatus</i> , <i>Pseudocruzia orientalis</i> , <i>Oesophagostomum (oesophagostom) dentatum</i> , <i>Oesophagostomum (O.) quadrispinulatum</i> , <i>O. (O.) brevicaudum</i> , <i>O. (O.) maplestonei</i> |
| Order VII CETACEA | |
| 24. Family Platanistidae <i>Platanista gangetria</i> | <i>Contraecaecum lobulatum</i> |
| AVES | |
| Order I. PELECANIFORMES | |
| 1. Family Phalacrocorccidae <i>Phalacrocorax fuscicollis</i> <i>Anhinga rufa melanogaster</i> | <i>Contraecaecum spiculigerum</i> , <i>C. rosarium</i> <i>Contraecaecum tricuspe</i> |
| Order II CICONIIDORMES | |
| 2. Family Ardeidae <i>Bubulcus ibis coromandus</i> <i>Ardea purpurea</i> | <i>Tetrameres (Microtetrameres) spiralis</i> , <i>Synhimentus (Synhimentus) inveginatus</i> , <i>Duplicaecum ibisi</i> <i>Porrocaecum reticulatum</i> |
| 3. Family Ciconiidae <i>Ciconia nigra</i> | <i>Contraecaecum engonium</i> |
| 4. Family Threskiornithidae <i>Threskiornis aethiopica melanocephala</i> (= <i>Ibis melanocephalus</i>) | <i>Porrocaecum ibidis</i> |
| 5. Family Ciconiidae <i>Leptoptilos dubius</i> | <i>Echinuria hargilae</i> |
| Order III. ANSERIFORMES | |
| 6. Family Anatidae <i>Anas acuta</i> (= <i>Dafila acuta</i>) | <i>Epomidostomum uncinatum</i> |

| <i>Host</i> | <i>Parasite</i> |
|---|---|
| <i>Anthya ferina</i> (= <i>Nyroca ferina</i>) | <i>Tetrameres</i> (<i>Tetrameres</i>) <i>spinosa</i> <i>Amidostomum skrjabini</i> |
| * <i>Aythya cristata</i> (= <i>Fuligula cristata</i>) | <i>Amidostomum skrjabini</i> |
| <i>Nettapus coromandelianus</i> | <i>Pseudamidostomum boulengeri</i> |
| Domestic duck | <i>Ascaridia galli</i> , <i>Heterakis gallinae</i> |
| Order IV. FALCONIFORMES | |
| 7. Family Accipitridae | |
| <i>Aviceda leuphotes leuphotes</i> | <i>Habronema avicedae</i> |
| <i>Milvus migrans</i> | <i>Contracecum haliaeti</i> , <i>Porrocaecum angusticolle</i> |
| <i>Accipiter badius</i> (= <i>Astur badius</i>) | <i>Acuaria indica</i> |
| <i>Accipiter nisus melaschistos</i> | <i>Physaloptera alata</i> |
| <i>Icthyophaga nana plumbea</i> (= <i>Polioaetus plumbeus</i>) | <i>Habronema magnilabiatum</i> |
| <i>Aegyptius monachus</i> | <i>Porrocaecum depressum</i> |
| <i>Circus macrourus</i> | <i>Habronema asymmetricum</i> |
| Order V. GALLIFORMES | |
| 8. Family Phasianidae | |
| Common fowl | |
| Turkey, Guinea fowl | <i>Ascaridia galli</i> |
| Common fowl | <i>Heterakis gallinae</i> <i>H. indica</i> , <i>H. berhamporia</i> |
| <i>Alectoris chukor chukor</i> (= <i>Alectoris graeca chukor</i>) | <i>Ascaridia campar</i> , <i>Heterakis gallinae</i> |
| <i>Francolinus gularis</i> | <i>Heterakis gallinae</i> |
| <i>Francolinus pondicherianus</i> | <i>Subulura</i> (<i>Subulura</i>) <i>galloperdicis</i> |
| <i>Perdicula asiatica</i> | <i>Subulura</i> (<i>Subulura</i>) <i>pedicularia</i> n. sp. |
| <i>Arborophila torqueola</i> | <i>Heterakis gallinae</i> , <i>H. papillosa</i> |
| <i>Lophophorus impejanus</i> | <i>Heterakis gallinae</i> , <i>H. isolonche</i> |
| <i>Lophura leucomelana</i> (= <i>Gennacus leucomelana</i>) | |
| ** <i>Lophura necthemerus</i> (= <i>Gennaeus nythemerus</i>). | <i>Heterakis gallinae</i> |
| ** <i>Lophur nychemerus</i> (= <i>Gennacus nythemerus</i>) | <i>Heterakis pavonis</i> <i>Heterakis parva</i> |
| <i>Lophura leucomelana</i> (= <i>Euplocomus leucomelanus</i>) | <i>Habronema euplocami</i> |
| ** <i>Lophura rufa</i> | <i>Heterakis isolonche</i> , <i>H. gallinae</i> |
| <i>Tragopan satyra</i> | <i>Heterakis isolonche</i> , <i>H. gallinae</i> , <i>H. bosia</i> |
| <i>Polyplectron bicalcaratum</i> | <i>Heterakis isoionche</i> , <i>Paraprocta brevicauda</i> |

| <i>Host</i> | <i>Parasite</i> |
|--|---|
| <i>Ithaginis cruentus</i> | <i>Ascaridia galli</i> |
| <i>Galloperdix spadicea</i> | <i>Heterakis gallinae, Subulura (Subulura) galloperdicis</i> |
| <i>Acryblium vulturium</i> (= Turkey) | <i>Heterakis gallinae, Habronema diesingi</i> |
| <i>Pavo cristatus</i> | <i>Pseudaspidodera pavonis, P. jnanendrae, Subulura (Subulura) olympioi, Physaloptera bulbosa</i> |
| ** <i>Pavo muticus</i> | <i>Pseudaspidodera pavonis</i> |
| ** <i>Phasianus torquatus</i> | <i>Heterakis gallinae, H. papillosa</i> |
| <i>Argusianus argus</i> (= Argus pheasant) | <i>Pseudaspidodera pavonis, P. voluptuosa, P. spinosa</i> |
| <i>Rollulus roulroul</i> | <i>Acuaris lata, Subulura (Subulura) multipapilata, Pseudaspidodera spinosa</i> |

Order VI GRUIFORMES

9. Family Turnicidae

Turnix sylvatica dussumier, Turnix sp. Allodapa (Allodapa) turnicis

10. Family Gruidae

Grus grus Porrocaecum ardeae, Ascaridia stroma

Grus antigone Ascaridia cristata, A. stroma

* *Grus paradisia Ascaridia stroma*

11. Family Otididae

Chlamydotis undulata macqueenii Heterakis gallinae

Order VII CHARADRIIFORMES

12. Family Jacanidae

Metopidius indicus Synhimentus (Dispharynx) nasuta

13. Family Charadriidae

Tringa hypoleucos Avilandros avis

Order VIII COLUMBIFORMES

14. Family Pteroclididae

Pterocles exustus Syphaciella indica

15. Family Columbidae

Coluba livia Ascaridia columbae

Treron phoenicoptera (= Crocopus phoenicopterus)

Columba livia Capilaria columbae

Caloenas nicobarica Ornithostrongylus nicobaricus

Chalcophans indica Ornithostrongylus travassose

* *Chila purpow Capillaria columbae*

Order IX STRIGIFORMES

| <i>Host</i> | <i>Parasite</i> |
|--|--|
| 16. Family Strigidae ** <i>Otus scops sunia</i> (= <i>Scops pennatus</i>) Order X CORACIIFORMES | <i>Habronema imbricatum</i> |
| 17. Family Alcedinidae ** <i>Ceyla alcyon</i> <i>Halcyon symrenensis</i> | <i>Aveiculariclla alcyona</i> <i>Schistorophus tenuis</i> |
| 18. Family Coraciidae <i>Coracias benghalensis india</i> Order XI PICIFORMES | <i>Habronema indicum, Paraprocta brevicauda</i> |
| 19. Family Picidae <i>Dinopium benghalense</i> (= <i>Brachypternus benghalensis</i>) Order XII CASUARIIFORMES | <i>Synhimentus (Synhimentus) nanus.</i> |
| 20. Family Casuariidae ** <i>Casuarus bicarrunculatus</i> Order XIII PASSERIFORMES | <i>Habronema casuarii</i> |
| 21. Family Lanidae <i>Lanius cristatus</i> | <i>Lemdana bengalensis</i> |
| 22. Family Oriiidae <i>Oriolus chinensis diffusus</i> (<i>Oriolus indicus</i>) | <i>Paraprocta brevicauda</i> |
| 23. Family Dicruridae <i>Dicrurus adsimilis macrocercus</i> <i>Dicrurus paradiseus</i> (= <i>Dissemurus paradiseus</i>) | <i>Viguiera majumdari</i> <i>Splendidofilaria bosei, Paraprocta brevicauda</i> |
| 24. Family Corvidae <i>Dendrocitta vagabunda</i> (= <i>Dendrocitta rufa</i>) <i>Pyrrhocorax pyrrhocorax</i> (= <i>Graculus eremita</i>) <i>Cissa chinensis</i> <i>Cissa flavirostris</i> (= <i>Urocissa flavirostris</i>) <i>Cissa (= Urocissa) erythrorhyncha</i> <i>Corvus macrorhynchos</i> | <i>Acuria anthuris, Paraprocta brevicauda,</i> <i>Pseudaprocta vagabunda n. sp.</i> <i>Diplotriaena graculi, D. budia, Acuria anthuris</i> <i>Oxyspirura (Hamulofilaria) indica, Paraprocta brevicanda</i> <i>Diplotriaena urocissae</i> <i>Acuaria anthuris</i> <i>Thelazia (Thelaziella) companulata</i> |
| 25. Family Muscicapidae <i>Turdoides striatus</i> | <i>Oxyspirua (Barusispirura) longistriata n. sp.</i> |

| <i>Host</i> | <i>Parasite</i> |
|---|---|
| <i>Garrulax jerdoni meridionale</i> (= <i>Torchalopteron jerdoni meridionale</i>) | <i>Diplotrienea tricuspis</i> |
| <i>Myiophonus caeruleus temmenckii</i> | <i>Thelazia (Thelaziella) companulata, Diplotriaena nepalensis</i> |
| <i>Copsychus saularis</i> | <i>Acuaria conica, A. brevispicula, Paraprocta brevicanda, Aproctoides lissum</i> |

26. Family Paridae

| | |
|---------------------------------|---|
| <i>Parus dichorous dichrous</i> | <i>Oxyspirura (Barusispirura) montana</i> |
|---------------------------------|---|

REPTILIA

Order I SQUAMATA

Suborder I SURIA

1. Family Agamidae

| | |
|---------------------------|--|
| <i>Calotes</i> sp. | <i>Strongyluris calotes</i> |
| <i>Calotes versicolor</i> | <i>Oswaldocruzia filiformis, Thelandros (Thelandros) maplestonei</i> |

2. Family Scineidae

| | |
|------------------------|----------------------------|
| <i>Mabuya carinata</i> | <i>Meteterakis mabuyae</i> |
|------------------------|----------------------------|

3. Family Chamaeleonidae

| | |
|---|----------------------------------|
| <i>Chamaeleo zeylanicus</i> (= <i>Chamaeleo vulgaris</i>) | <i>Strongyluris chamaeleonis</i> |
|---|----------------------------------|

4. Family Varanidae

| | |
|---|---|
| <i>Varanus sulvator</i> | <i>Amplicaecum varani, Hastospiculum macrophallos</i> |
| <i>Varanus bengalensis</i> (= <i>Varanus monitor</i>) | <i>Abbreviata varani, Africana varani, Tanqua tiara</i> |
| <i>Varanus flavescens</i> | <i>Tanqua tiara, Hastospiculum macrophallos</i> |
| <i>Varanus nebulosus</i> | <i>Tanqua tiara, Hastospiculum macrophallos</i> |
| <i>Varanus ? indicus</i> | <i>Physaloptera varani</i> |

5. Family Gekkomidae

| | |
|--------------------|--------------------------|
| <i>Gekko gekko</i> | <i>Pharyngodon gekko</i> |
| ** <i>Iguana</i> | <i>Atractis opeatura</i> |

Suborder II SURPENTES

6. Family Boidae

| | |
|--|--|
| <i>Python molurus</i> | <i>Ophidascaris filaria</i> |
| <i>Eryx conicus</i> (= <i>Gongylophis conicus</i>) | <i>Kalicephalus (Schadius) longior</i> |

7. Family Colubridae

| | |
|---------------------|-----------------------|
| <i>Dryophis</i> sp. | <i>Tanqua anamola</i> |
|---------------------|-----------------------|

| <i>Host</i> | <i>Parasite</i> |
|---|---|
| <i>Enhydryis</i> sp. | <i>Tanqua anamola</i> |
| <i>Xenochrophis piscator</i> (= <i>Natrix piscator</i>) | <i>Ophidascaris gestri</i> , <i>O. piscatori</i> , <i>Tanqua anamola</i> , <i>Kalicephalus (Schadius) indicus</i> |
| <i>Xenochrophis stolatus</i> (= <i>Natrix stolatus</i>) | <i>Neopratozoophaga natrixi</i> |
| <i>Ptyas mucosus</i> | <i>Kalicephalus (Schadius) willeyi</i> , <i>K. (S.) indicus</i> , <i>K. (S.) elongatus</i> , <i>K. (S.) brachycephalus</i> |
| 8. Family Elapidae | |
| <i>Naja naja</i> (= <i>Naja tripudians</i>) | <i>Ophidascaris naiae</i> , <i>Falaria haji</i> , <i>Kalicephalus (Schadius) willeyi</i> , <i>Kalicephalus (S.) longior</i> , <i>Kalicephalus (S.) elongatus</i> , <i>Kalicephalus (Kalicephaloides) minutus</i> |
| <i>Bungarus fasciatus</i> | <i>Camallanides prasadi</i> , <i>Filaria haji</i> , <i>Kalicephalus (Schadius) willeyi</i> , <i>Kalicephalus (S.) indicus</i> , <i>Kalicephalus (S.) longior</i> , <i>Kalicephalus (Occipitodontus) fimbriatus</i> , <i>Kalicephalus (Kalicephaloides) minutus</i> |
| Order II CROCODYLIA | |
| 9. Family Gavialidae | |
| <i>Gavialis gangeticus</i> | <i>Goezia gavialidis</i> , <i>Typhlophorus lamellaris</i> , <i>Multicaecum agile</i> , <i>Micropleura vivipara</i> |
| 10. Family Crocodyliadae | |
| <i>Crocodylus porosus</i> | <i>Dujardinascaris dujardini</i> |
| Order III TESTUDINES | |
| 11. Family Trionychidae | |
| <i>Trionyx gangeticus</i> | <i>Spiroxys gangetica</i> , <i>Dichelyne trionyx</i> |
| <i>Chitra indica</i> | <i>Spiroxys gubernae</i> |
| 12. Family Testudinidae | |
| <i>Indotestudo elongata</i> (= <i>Testudo elongata</i>) | <i>Falcaustra kempi</i> , <i>Atractis granulosa</i> |
| AMPHIBIA | |
| Order I ANURA | |
| 1. Family Ranidae | |
| <i>Rana hexadactyla</i> | <i>Falcaustra brevispiculata</i> |
| <i>Rana tigerina</i> | <i>Propharyngodon ranae</i> , <i>Meteterakis govindi</i> |
| <i>Rana hexadactyla</i> | <i>Meteterakis govindi</i> |
| <i>Rana cyanophlyctis</i> , <i>Rana</i> sp. | <i>Oxwaldocruzia filiformis</i> |

| <i>Host</i> | <i>Parasite</i> |
|--|---|
| 2. Family Pelobatidae <i>Megophrys</i> sp. | <i>Cosmocercoides dukae</i> |
| 3. Family Bufonidae <i>Bufo melanostictus</i> | <i>Oxysomatium anurae</i> , <i>Oxysomatium macintoshii</i> <i>Oswaldocruzia filiformis</i> |
| <i>Bufo himalayanus</i> | <i>Africana bufonis</i> , <i>Metaterakis govindi</i> , <i>Neoprotozoophaga bufonis</i> |
| <i>Bufo stomaticus</i> | <i>Cosmocercoides dukae</i> <i>Oxysomatium stomatici</i> |

FISHES

| | |
|---|--|
| Order I. LAMNIFORMES | |
| 1. Family Pristidae <i>Pristis perrotteti</i> | <i>Terranova pristis</i> |
| Order II. CLUPEIFORMES | |
| 2. Family Clupeidae <i>Ilisha filigera</i> | <i>Lappetascaris lutjani</i> |
| Order III. OSTEOGLOSSIFORMES | |
| 3. Family Notopteride <i>Notopterus notopterus</i> | <i>Spinitectus minor</i> |
| Order IV. SILURIFORMES | |
| 4. Family Bagridae <i>Rita rita</i> <i>Rita bucharani</i> | <i>Spirocamallanus gubernaculus</i> <i>Cucullanus ritai</i> |
| 5. Family Schilbeidae <i>Silonia silondia</i> <i>Eutropiichthys vacha</i> | <i>Rhabdochona (Globochona) sp.</i> <i>Rhabdochona (Globochona) sp.</i> |
| 6. Family Pangasiidae <i>Pangasius pangasius</i> | <i>Cucullanus pangasius</i> |
| 7. Family Siluridae <i>Wallago attu</i> | <i>Dichelyne wallagoni</i> |
| 8. Family Sisoridae <i>Bagarius bagarius</i> | <i>Spinitectus caballeroi</i> |
| Order V. CHANNIFORMES | |
| 9. Family Channidae <i>Channa striatus</i> | <i>Camallanides hemidentata</i> , <i>Paracamallanus singhi</i> |

| <i>Host</i> | <i>Parasite</i> |
|---------------------------------|--|
| <i>Channa orientalis</i> | <i>Paracamallanus singhi</i> |
| Order VI. PERCIFORMES | |
| 10. Family Anabantidae | |
| <i>Anabus testudineus</i> | <i>Camallanus anabantis</i> |
| 11. Family Nandidae | |
| <i>Nandus nandus</i> | <i>Camallanus mastacembeli</i> |
| 12. Family Sillaginidae | |
| <i>Sillaginopsis panijus</i> | <i>Cucullanus panijuseus</i> n. sp. |
| 13. Family Mastacembalidae | |
| <i>Mastacembalus armatus</i> | <i>Pseudoproleptus vestibulus</i> |
| Order VII. CYRINIFORMES | |
| 14. Family Cyprinidae | |
| <i>Tor tor</i> | <i>Falcaustra leptcephala</i> , <i>F. barbi</i> , <i>Monhysterides piscicola</i> |
| Order VIII. RAJIFORMES | |
| 15. Family Dasyatidae | |
| <i>Drasyatis (= Trygon) sp.</i> | <i>Echinocephalus uncinatus</i> |

SUMMARY

The paper deals with the parasitic nematodes so far recorded from West Bengal. This comprises 230 species, contained in 111 genera, 38 families and 4 orders of which four species are new to science. The classification followed is practically up to date being based on C.I.H. keys. Diagnostic keys for all the species dealt here have been provided, and a host parasite list is also presented.

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