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DIGENETIC TREMATODES OF MARINE FISHES OF INDIA (SUPERFAMILY HEMIUROIDEA : FAMILY HEMIURIDAE)

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INTRODUCTION

The present study is based on 60 specimens mounted on 43 slides of digenetic trematodes of marine fishes of the bay of Bengal and Arabian Sea. The material will be deposited with the National Collections of the Zoological survey of India, Calcutta. The references marked with an asterisk (*) have not been seen by the author. The classification of Hemiuroidea Looss, 1899 as given by Gibson and Bray (1979) has been adopted here.

MATERIAL AND METHODS

The specimens were first studied alive after they were recovered from the fish hosts. They were allowed to relax in normal saline in cavity blocks. After the muscular body movement was slowed down, they were kept on clean slide one by one and covered with a cover glass and flattened gently with the tip of a needle under a binocular. They were then killed and fixed in A.F.A. using gentle pressure with the tip of the needle in order to avoid contraction of the body. They were allowed to remain in this condition covered with a petridish in order to avoid chances of drying. When fully fixed, they were removed in 70% alcohol and preserved in the same in air-tight small glass vials.

In the laboratory, they were overstained with alcoholoic borax carmine, treated with acid alcohol to remove excess of the stain, placed in ammonia alcohol to remove traces of acid and then washed thrice with 70% alcohol to remove any trace of the alkali. The specimens were then dehydrated in higher grades of alcohol, given a touch in xylol, cleared in clove oil and finally mounted in Canada balsam and dried.

All measurements in descriptions are in micrometres unless otherwise stated. Diagrams have been made with the aid of a camera lucida.

SYSTEMATIC ACCOUNT

Superfamily HEMIUROIDEA Looss, 1899

Family HEMIURIDAE Looss, 1899

Subfamily ELLYTROPHALLINAE Skrjabin and Guschanskaja, 1954

Genus 1. ***Lecithocladium*** Lühe, 1901

Syn. *Clupenurus* Srivastava, 1935

Magnapharyngium Bilqees, 1971

Colletostomum Sahai and Srivastava, 1978

Cleftocolleta Sahai and Srivastava, 1978

The genus *Clupenurus* Srivastava, 1935 has always been disputed one in the family Hemiuridae and has not been reported since it was erected. Its validity *vis-a-vis Lecithcladium* has always been doubted. Manter (1940) indicated that *Clupenurus* may be a synonym of *Tubulovesicula* Yamaguti, 1934. Later on, he (1947) revised his opinion and differentiated the two genera in the extent of glandular part of pars prostatica and in the absence or presence of cuticular plications on the body proper. He further suggested that *Clupenurus* should stand as a genus closely related to *Lecithocladium*, and Manter and Pritchard (1960) considered the former as a synonym of the latter. Fischthal and Kuntz (1963) also considered *Clupenurus* a synonym of *Lecithocladium* and emended the diagnosis of the latter genus. But Yamaguti (1971) considered it as a distinct genus. Gibson and Bray (1979) accept the validity of *Clupenurus* with a question mark. Probably they doubt that it has been adequately and correctly studied and described. They differentiated it from *Lecithocladium* on the basis of a glandular region of the pars prostatica largely in the forebody and a bulbous sinus-sac. In *Lecithocladium* the glandular region of pars prostatica is largely in the hindbody and the sinus sac is mainly tubular, narrow and usually situated in the forebody. But Gibson and Bray (1986) seem to have revised their opinion by considering *Clupenurus piscicola* Srivastava, 1935 as a synonym of *Lecithocladium harpodontis* Srivastava, 1937 with a question mark. However, they did not list *Clupenurus* as a synonym of *Lecithocladium.*

Clupenurus was described to have a plicated soma, a pharnyx which is longer thatn wide (if not cylindrical), a spindle-shaped or pyriform seminal vesicle with a muscular wall, a sinuous pars prostatica with a recurved proximal part surrounded by gland cells and a tubular vitellarium. These vital characters are also present in *Lecithocladium.* Therefore the synonymy of *Clupenurus* with *Lecithocladium* may be taken beyond doubt. Srivastava's *Clupenurus* must possibly be the result of erroneous study from badly processed specimens. I have examined hundreds of specimens of the fish *Hilsa ilisha* from various places along the Indian sea coasts and have found the trematode specimens recovered from them to be the same as *Lecithocladium ilishae* Mamaev, 1970, *L. ilishae* Bashirullh and D'Silva, 1973, *L. chauhani* Hafeezullah, 1975 and *Lecithocladium* sp. of Soota and Ghosh, 1977.

1. ***Lecithocladium piscicola*** (Srivastava, 1935)

Syn. *Clupinurus piscicola* Srivastava, 1935

Lecithocladium ilishae of Mamaev, 1970

L. ilishae of Bashirullah and D'Silva, 1973

L. chuhani Hafeezullah, 1975

Lecithocladium sp. Soota and Ghosh, 1977 (n.syn.)

Discussion : Gibson and Bray (1979) have doubted the validity of some other species (listed above) reported in *Lecithocladium* from *Hilss ilisha*. They (1986), however, finally considered them as synonyms.

The specimens of *Lecithoclaium* sp. of Soota and Ghsoh, 1977 mounted on two slides (Z.S.I. Reg. Nos.W 7249/1 and W 7250/1) were examined by the author, and they were found to be identical to *L.chauhani*. While sending the paper containing the description of *L. chauhani* to press, the descriptions of *L. ilishae* of Mamaev, 1970 and *L.ilishae* of Bashirullah and D'Silva, 1973 had not become available to the author. Presuming that the original description of *Clupenurus piscicola* is inaccurate, the author concurs with Gibson and Bray (1986) that the other four species of *Lecithocladium* reported from *Hilsa ilisha* are synonymous with it, but it is hard to share their (1986) opinion that all these species are in their turn synonyms of *L. harpodontis* Srivastava, 1937.

Colletostomum Sahai and Srivastava, 1978 has been described from the fish host *Pseudosciaena diacanthus* from Bombay coast. It comes well within the concept of *Lecithocladium*. The reported presence of "an everted, circular, appreciably broad collar around the oral sucker" may be a fixation artifact and needs corroboration after rechecking *Colletostomum muthiai* Sahai and Srivastava, 1978, the type species of the genus.

Cletftocolleta Sahai and Srivastava, 1978 (type species *C.magnum*) from the stomach of *Scomberoides tala* from the Madras coast is nothing but a *Lecithocladium*. The reported presence of a muscular collar around the oral sucker of the type species may also be a fixation artifact and requires confirmation.

2. ***Lecithocladium apolecti*** Velasquez, 1962

Syn. *L. exisiforme* of Gupta and Sehgal (1971)

L. annulatum of Gupta and Sehgal (1971)

L. annulatum of Gupta and Sehgal (1971)

L. hexavitellarii (Bilqees, 1971)

L. excisiforme of Radhakrishnan and Nair (1979) (n. syn)

L. stromatei Farooq and Khanum, 1980

(Figs. 1-7)

Host : *Formio niger* (Bloch), black pomfret. (Family Formionidae)

Syn. *Parastromateus niger* (Bloch)

Apolectus niger (Bloch)

Location : Stomach.

Localities : Veraval, Okha (Arabian Sea).

Number of Specimens : 6, on 6 slides (from Veraval); collected on 16.11.1965; 2, on 1 slide (from Okha); collected on 8.11.1978

Description : Body 10.09 - 15.37 mm long, 0.89 - 1.19 mm wide at junction of soma and ecsoma, elongate, attenuated posterior to acetabulum; ecsoma 3.82-6.91 mm long, 0.73-1.04 mm wide, tapering to a rounded posterior end. Tegument thin, feeble rings at places discernible in some specimens, otherwise smooth, 'Kraüselung' absent. Acetabulum 364-418 long, 378-459 wide, spherical, at 0.76-1.12 mm from anterior end. Oral sucker 397-451 wide, funnel-shaped, terminal, ventral lip having two notches. Muscular protrusion ('Nacken-buckel') dorsal to oral sucker not sen. Preoral lobe absent. Sucker width ratio 1 : 0.91-0.99. Pharynx 378-391 long, 195-243 wide, muscular, cylindrical; oesophagus short, oval, followed by intestinal bifurcation; 'Drüsenmagen' formed, then turning back and reaching almost posterior end of body.

Tests two, 378-999 long, 270-378 wide, entire, globular or oval, tandem, in middle or hind region of soma, preovarian. Seminal vesicle 715-970 long, saccular or elliptical, elongate, with thick muscular walls, in hind body; pars prostatica long, slightly convoluted,weekly developed, with prostate gland cells (which are also weakly developed) surrounding it along its full length but becoming faint anteriorly, joining metraterm postero-dorsal or antero-dorsal to acetabulum (Figs. 6-7) to form hermaphroditic duct, in one specimen even joining posterior to pharynx. Hermaphroditic duct very long, slender, enclosed in long tubular sinus-sac, occasionally projecting out of genital pore. Genital atrium probably shallow.

Ovary 222-378 long, 289-357 wide, subglobular, entire, median, situated in middle of hind region of body near junction of body proper and ecsoma or descending into tail near junction (Fig. 5). Juel's organ present attached to ovary posteriorly. Shell gland present. Vitellarium 7 long winding tubules, extending or not into ecsoma depending upon position of ovary, or entirely into ecsoma in cases where ovary descends into it (Fig. 5). Uterus voluminous, descending up to middle of ecsoma; metraterm differentiated, very long, winding. Eggs small, 14 × 7 µm, very numerous, dark.

Excretory vesicle Y-shaped, arms uniting dorsal to oral sucker; excretory pore terminal.

Discussion : The chief characteristics of these specimens are: tegument feebly ringed and discernible with difficulty in a few places only, otherwise it is smooth. The gonas are situated normally in the middle third of the soma but the ovarian complex may also be found to occur in various positions in its posterior third, or it may even descend into the ecsoma near the junction (Figs. 2-5). With the gradual posterior displacement of the ovary, the testes also move posteriorly. The vitelline tubules are distributed in a particular fashion posterior to ovary, a few of them entering ecsoma. In some specimens a few tubules extended anteriorly to the ovary (Figs. 2-3). The pars

prostatica is not very tortuous and is surrounded by feebly developed prostatic gland cells. The eggs are very minute measuring 14 × 7 μm.

L. stromatei Farooq and Khanum, 1980 and *L. hexavitellarii* (Bilqees, 1971) do look identidal to *L. apolecti*, but, contrary to Bray and Gibson (1986), *L. anteroporus* (Bilqees, 1971), *L. tetravitellarii* (Bilqees, 1971), *L. microductus* (Bilqees, 1971), *L. arabiana* (Bilquees, 1971), *L. octovitellarii* (Bilquees, 1971) and *L. microcaudum* (Bilqees, 1971) differ from *L. apolecti* in certain respects.

3. ***Lecithocladium megalaspis*** Yamaguti, 1953
(Fig. 8)

Host : *Megalaspis cordyla* (Linn.), torpedo (Family Carangidae).

Location : Stomach.

Locality : Bombay (Arabian Sea).

Number of Specimens : 5, on 5 slides; collected on in May 1964.

Discussion : The posterior limit of the hermaphroditic duct, as studied in five specimens, extends to various distances between the pharynx and the anterior border of the acetabulum. It seems to be a variable character, at least in *Lecithocladium*, and care should be exercised in using it as a diagnostic character.

4. ***Lecithocladium glandulum*** Chauhan, 1945
(Fig. 9)

Host : *Caranx carangus* (Bloch), black tailed trevally, (Family Carangidae).

Location : Stomach.

Locality : Madras (Bay of Bengal).

No. of Specimens : 3, on 3 slides; collected on 9.11.1964.

Discussion : Originally, Chaunan (1945) described this species from *Lutianus johnii* (type host) and *Mugil speigleri* from the Bombay coast. *Caranx carangus* is a new host record for this species.

Subfamily DINURINAE Looss, 1905

Genus 2. ***Tubulovesicula*** Yamaguti, 1934

Syn. *Transversolecitha* Sahai and Srivastava, 1978 (n. syn.)

5. ***Tubulovesicula angusticauda*** (Nicoll, 1915)

Transversolecitha scaberi Sahai and Srivastava, 1978 (n. syn.)
(Figs. 10, 11)

Host : *Platycephalus scaber* (Linn.), Rough flathead, (Family Platyecphalidae).

Location Stomach.

Locality : Karwar (Arabian Sea).

No. of Specimens : 2, on 2 slides; collected on 20.5.1965.

Discussion : The two specimens agree well with the description as provided by Manter and Pritchard (1960) except for the sucker ratio (1: 2.39 in the present material, as against 1 : 1.7-1.8). Only in one of them does the seminal vesicle not extend posterior to the acetabulum.

Transversolecitha scaberi Sahai and Srivastava, 1978, described from the same species of host from Madras (Bay of Bengal) is considered a synonym of *Tubulovesicula angusticauda*. Sahai and Srivastava (1978) have reported their genus and species from improperly preserved specimens in which the tubular seminal vesicle is coiled and the tubules of vitellarium could have been extended.

Tubulovesicula angusticauda has also been reported from Australia, New Zealand, the Celebes and Hawaii.

Genus 3. ***Uterovesiculurus*** Skrjabin and Gushanskaja, 1954

Syn. *Exoticotyle* Sahai and Srivastava, 1978 (n. syn.)

6. ***Uterovesiculurus lemiriensis*** (Tubangui and Masilungan, 1935) (Fig. 12)

Host : *Scomberoides lysan* (Forskal), doubledotted queenfish, (Family Carangidae), and *Caranx melampyqus* Cuvier, Bluefin jack, (Family Carangidae).

Location : Stomach.

Localities : Viskhapatnam (Bay of Bengal) and Karwar (Arabina Sea).

No.of Specimens : 3 + 7, total 10 on 3 + 7 slides; collected on 17.10.1964 and in 1965 respectively.

Discussion : Hafeezullah (1975) commented at length on this species. Velasquez (1962) redescribed it from the same species of fish from the Philippine. The redescription agrees fairly well with the original in general morphology except for slight differences in certain body measurements and egg size. *Exotycotyle* Sahai and Srivastava, 1978 (type species *E. labiatus*) is beyond any shadow of doubt a synonym of *Uterovesiculurus*.

7. ***Uterovesiculurus paralichthydis*** (Yamaguti, 1934)

Syn. *U. platycephali* (Yamaguti, 1934)

U. indicus Sahai and Srivastava, 1978 (n.syn.) (Fig. 13)

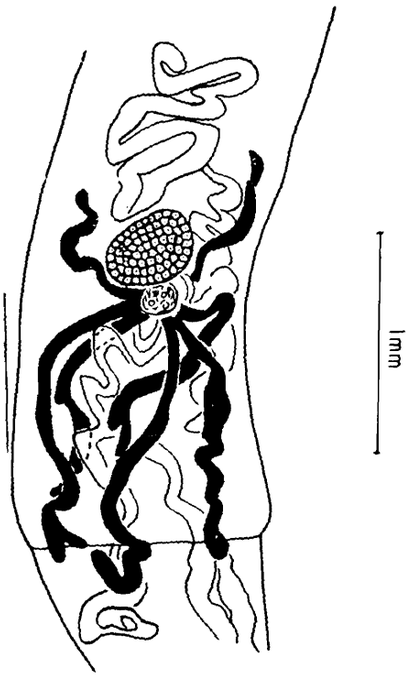
Host : *Platycephalus indicus* (Linn), Indian flathead, (Family Platycephalidae).

Location : Stomach.

Locality : Tuticorin (Gulf of Mannar); Madras.

No. of Specimens : 5 + 2, on 7 slides; collected on 8.1.1965 and 27.11.1964 respectively.

Fig.1



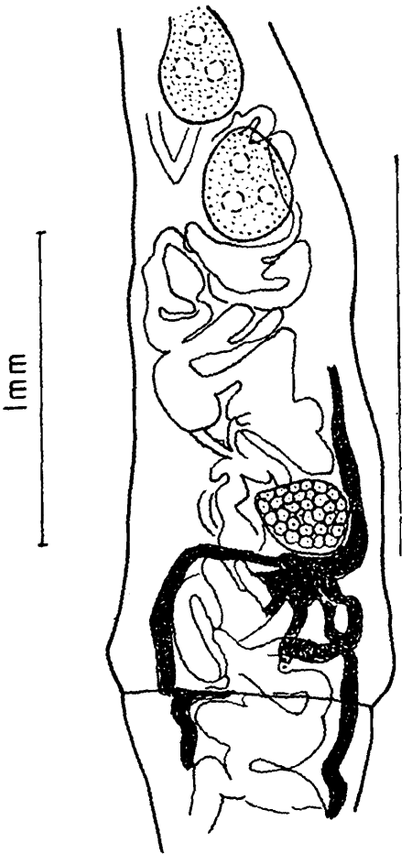


Fig.3

Fig. 1. *Lecithocladium apolecti*. Entire worm. Fig. 2. Part of body as in normal position of gonads. Fig. 3. Part of body of another specimen. Ovarian complex and vitellariam removed posteriorly.

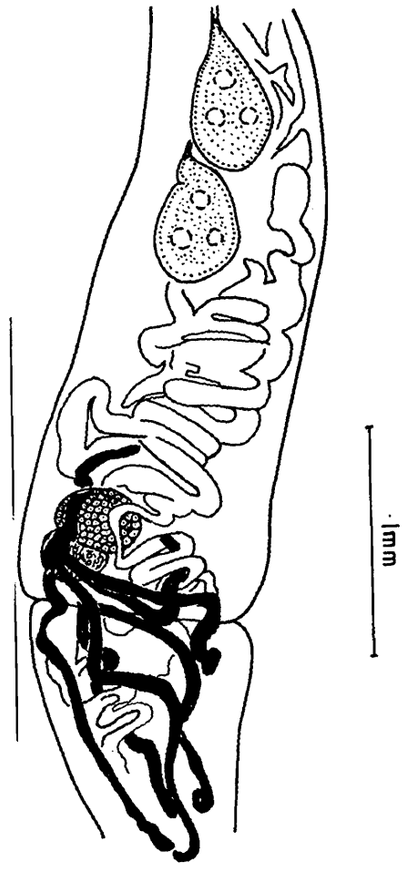


Fig.4

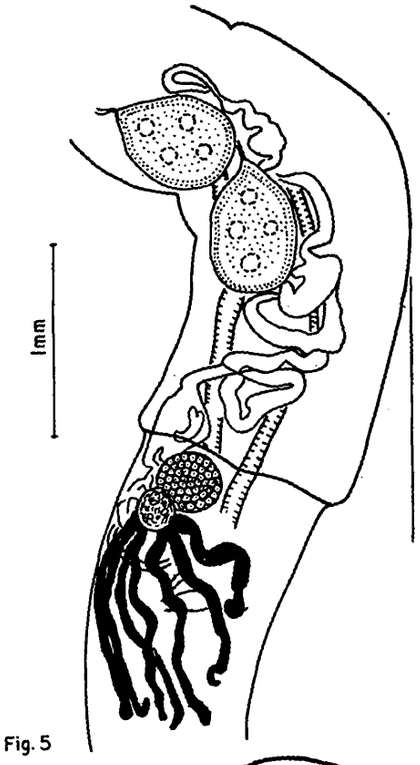


Fig. 5

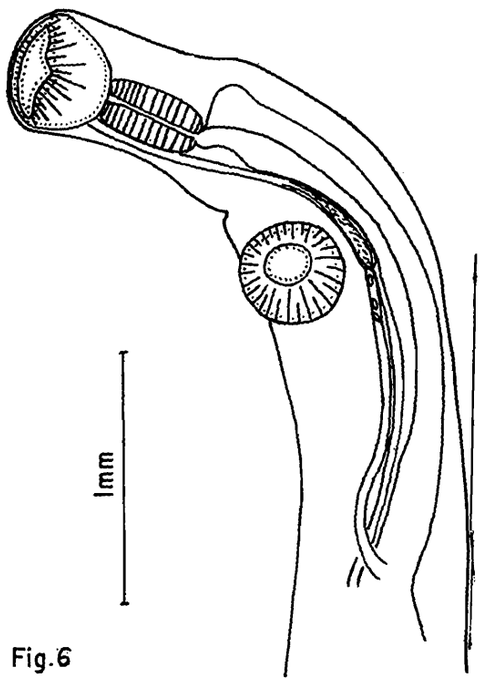


Fig.6

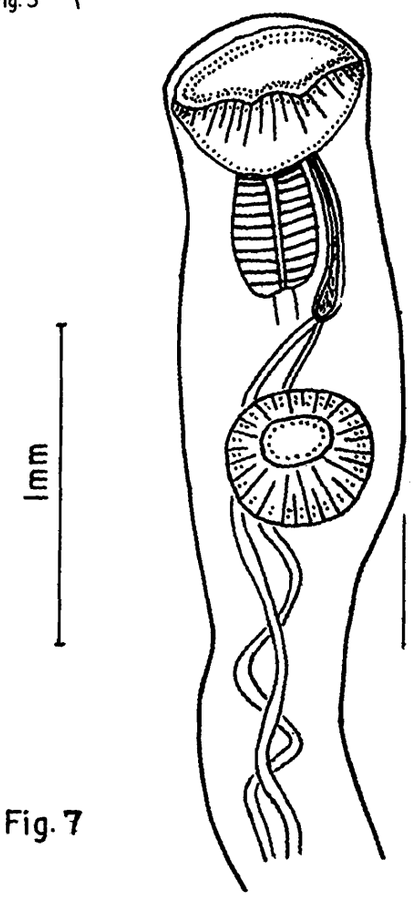


Fig. 7

Fig. 4. Part of body of still another specimen. Ovarian complex and vitelleriam come near junction of body proper and ecsoma. Fig. 5. Part of body of the specimen in which ovarian complex and vitellariam descended into ecsoma. Fig. 6. Anterior part of body. Sinus-sac reaching acetabulum posteriorly. Fig. 7. Anterior part of another specimen. Sinus- scc not reaching acetabulum posteriorly.

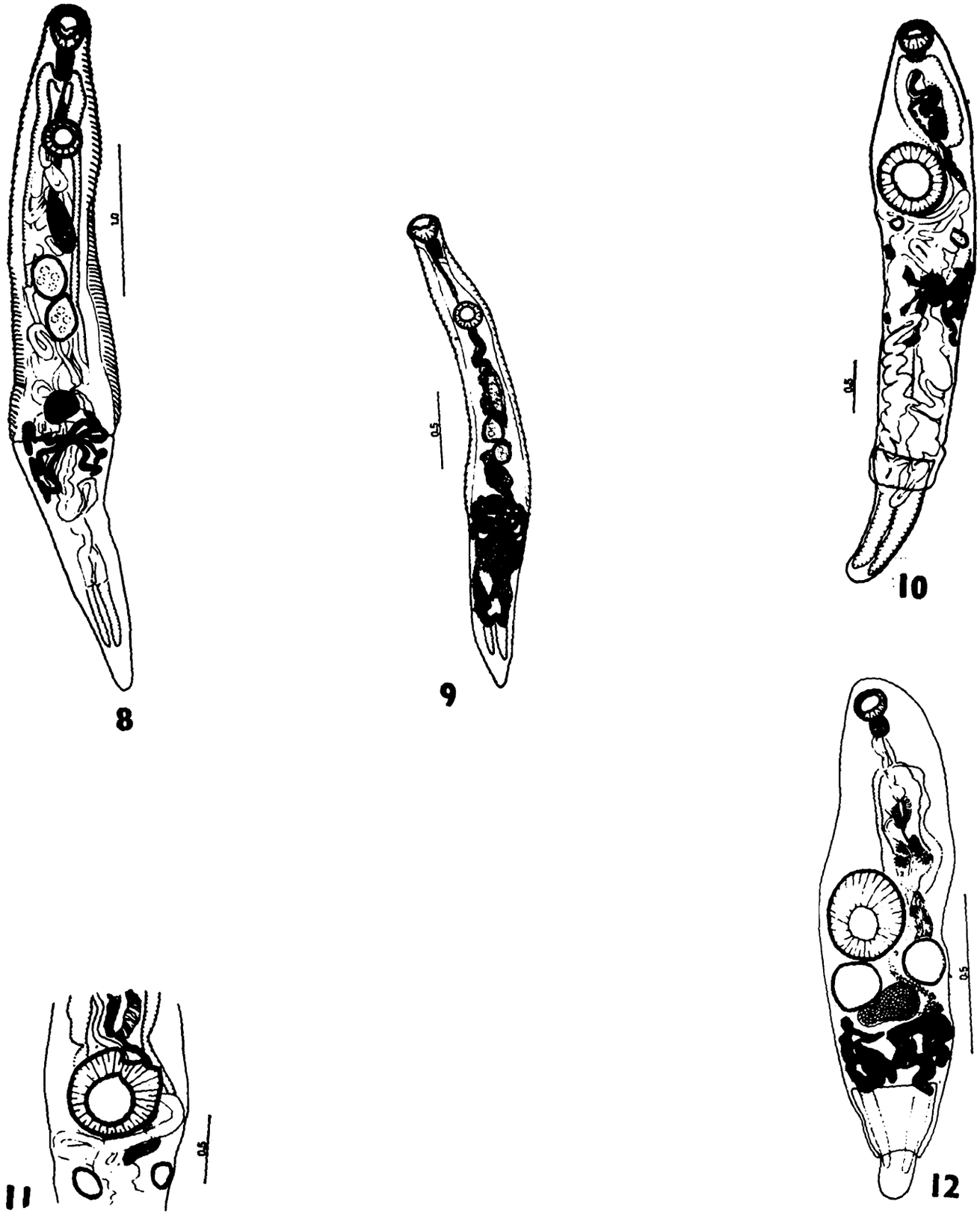


Fig. 8. *Lecithocladium megalaspis*. Entire worm. Fig. 9. *Lecithocladium glandulum*. Entire worm. Fig. 10. *Tubulovesicula angusticauda*. Entire worm. Fig. 11. *Tubulovesicula angusticauda*. Acetabular region. Fig. 12.*Uterovesiculurus lemiriensis*. Entire worm.

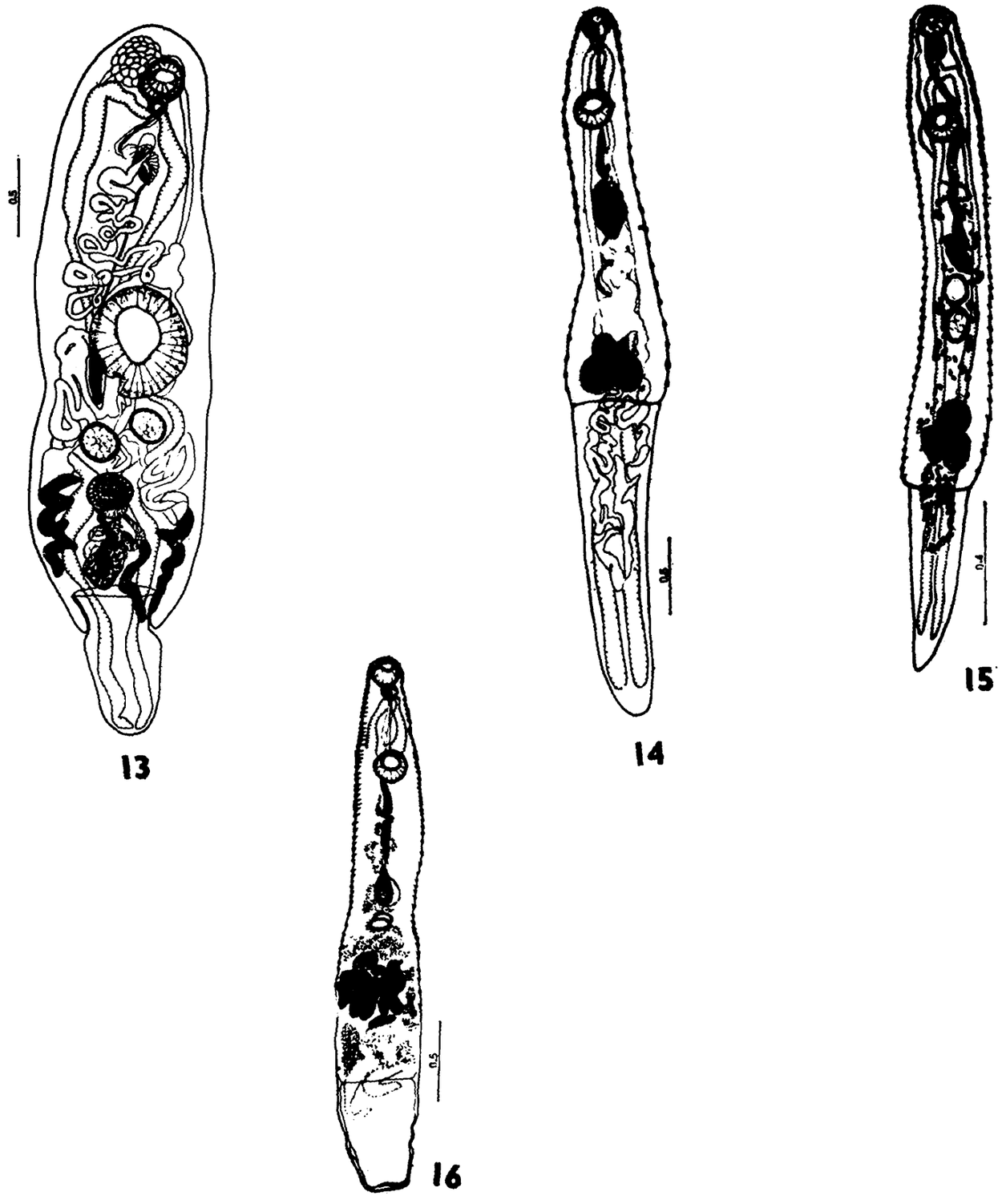


Fig. 13. *Uterovesiculurus paralichthydis*. Entire worm. Fig. 14. *Parahemiurus gastricus*. Entire worm. Fig. 15. *Parahemiurus dussumieri*. Entire worm. Fig. 16. *Parahemiurus engraulisi*. Entire worm.

Discussion : The differences between *U. paralichthydis* and *U. platycephali* seem to be meagre and therefore, I agree with Sahai and Srivastava (1978) in considering the latter a synonym of the former. By the same reasoning *U. indicus* reported from the fish *Platycephalus indicus* should also be taken as a synonym of *U. paralichthydis.*

Subfamily HEMIURINAE Looss, 1899

Genus 4. ***Parahemiurus*** Vaz and Pereira, 1930

Syn. *Dentiacetabulum* Sahai and Srivastava, 1977 (n.syn.)

Daniella Sahai and Srivastava, 1977 (n.syn.)

8. ***Parahemiurus gastricus*** (Sahai and Srivastava, 1977) n.comb. (Fig. 14)

Host : *Sardinella sirm* (Walbaum), spotted Sardinella, (Family Clupeidae).

Location : Stomach.

Locality : Tuticorin (Gulf of Mannar).

No. of Specimens : 2, on 2 slides; collected on 1.2.1965.

Discussion : Sahai and Srivastava (1977) described their species *Dentacetabulum gastricus* in the fish *Dussumieria acuta* from Madras (Bay of Bengal). The present material is similar to the description for *D. gastricus*, and I consider it a species of the genus *Parahemiurus* Vaz and Pereira, 1930. Consequently, *Dentacetabulum* is considered here as a synonym of *Parahemiurus.*

In having a short and saccular sinus-sac close to the pharynx, it comes close to *Parahemiurus yanamense* Hafeezullah, 1980, but the latter has a small ecsoma in comparison with the size of the soma, whereas in the former the ecsoma is only slightly shorter than the body proper, Secondly, the sides of the body in the latter are almost parallel whereas in the forme this is not the casee, being widest at the junction of the body proper and the ecsoma.

9. ***Parahemiurus dussumieri*** Hafeezullah, 1981

Syn. *Parahemiurus indicus* Ahmad, 1981 (n. syn.)
(Fig. 15)

Host : *Dussumieria acuta* Valenciennes, Rainbow sardine, (Family Clupeidae).

Location : Stomach.

Locality : Madras (Bay of Bengal).

No. of Specimens : 8, of two slides; Collected on 28.11.1964.

Discussion : *Parahemiurus dussumieri* Hafeezullah, 1981 (Published: October 31, 1981) and *Parahemiurus indicus* Ahmad, 1981 were separately described from the same species of fish host and from the same stretch of water. The descriptions broadly agree with each other, except that the tegument in the latter has been described to be smooth,

and the pars prostatica only partly glandular. According to the present material, the tegument has ventral plications all over body proper and the extent of dorsal plications is not constant. Moreover, pars prostatica is completely glandular. *P. indicus* Ahmad, 1981 becomes a junior synonym to *P. dussumieri*, as the former has been published in December, 1981.

10. ***Parahemiurus engraulisi*** Gupta and Jahan, 1977

Syn. *P. cameroni* Gupta and Ahmad, 1979 (n.syn.)

P. simhai Gupta and Gupta, 1978 (n.syn.)

P. puriensis Ahmad, 1981 (n.syn.)

(Fig. 16)

Host : *Ilisha filigera* (Valenciennes) Jwelled shad, (Family Clupeidae), *Thrissocles hamiltoni* (Gray), Hamilton's anchovy, Englaulidae), and *Thrissocles mystax* (Schneider) Moustached anchovy, (Family Engraulidae).

Location : Stomach.

Localities : Visakhapatnam (Bay of Bengal), Tuticorin (Gulf of Mannar), and Madras (Bay of Bengal) respectively.

No. of Specimens : 3+1+1, on 5 slides; collected on 30.9.1964, 3.1.1965 & 10.11.1964 respectively.

Discussion : The details of the above specimens overlap with the descriptions of *P. engraulisi, P. simhai, P. cameroni* and *P. puriensis*. Hence the identification of the present material and synonymy of *P. simhai, P. cameroni* and *P. puriensis* with *P. engraulisi.*

SUMMARY

Ten hemiurid species from marine fishes of the Bay of Bengal and Arabian Sea belonging to four genera under three subfamilies are reported with comments and additional information including synonymies. Four species, *viz., Lecithocladium piscicola* (Srivastava, 1935), *L. apolecti* Velasquez, 1962, *L. megalaspis* Yamaguti, 1953 and *L. glandulum* Chauhan, 1945 in the subfamily Elytrophallinae Skrjabin and Guschanskaja, 1954; three species, *viz., Tubulovesicula angusticauda* (Nicoll, 1915), *Utervesiculurus lemeriensis* (Tubangui and Masilungan, 1935) and *U. paralichthydis* (Yamaguti, 1934) in the subfamily Dinurinae Looss, 1905; and three species, *viz., Parahemiurus gastricus* (Sahai and Srivastava, 1977), *P. dussumieri* Hafeezullah, 1981 and *P. engraulisi* Gupta and Jahan, 1977 in the subfamily Hemiurinae Looss, 1899 are reported. The new synonymies suggested are: *Colletostomum* Sahai and Srivastava, 1978 and *Cleftocolleta* Sahai and Srivastava, 1978 with *Lecithocladium* Lühe, 1901; *Lecithocladium* sp. of Soota and Ghosh, 1977 with *Lecithocladium piscicola*

(Srivastava, 1935); *Lecithocladium excisiforme* of Radhakrishnan and Nair (1979) with *L. apolecti* Velasquez, 1962; *Transversolecitha* Sahai and Srivastava, 1978 with *Tubulovesicula* Yamaguti, 1934 and *Transversolecitha scaberi* Sahai and Srivastava, 1978 with *Tubulovesicula angusticauda* (Nicoll, 1915); *Exoticotyle* Sahai and Srivastava, 1978 with *Uterovesiculurus* Skrijabin and Guschanskaja, 1954 and *Uterovisiculurus indicus* Sahai and Srivastava, 1978 with *U. paralichthydis; Dentiacetabulum* Sahai and Srivastava, 1977 and *Daniella* Sahai and Srivastava, 1977 with *Parahemiurus* Vaz and Pereira, 1930; *Parahemiurus dussumieri* Hafeezullah, 1981; and *P. simhai* Gupta and Gupta, 1978, *P cameroni* Gupta and Ahmad, 1979 and *P puriensis* Ahmad, 1981 with *P. engraulisi* Gupta and Jahan, 1977.

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REFERENCES

Ahmad, J. 1981. Studies on digenetic trematodes from marine fishes from the bay of Bengal. Part XVI. *Riv. Parassit.*, **XLII** (3): 403-413.

Bilqees, F.M. 1971. Marine fish trematodes of West Pakistan. II & III. Descriptions of four new genera and sixteen species (Hemiuridae) with notes on the histology, segmentation, asexual multiplication and regeneration of some of them. *The Agricultural Research Council, Karachi, Pakistan.* pp. 1-55.

Chauhan, B.S. 1945. Trematodes from Indian marine fishes. Part IV On some trematodes of the family Hemiuridae Lühe, 1901, with descriptions of six new forms. *Proc. Indian Acad. Sci.*, **21**: 10-173.

Chauhan, B.S. 1954. Studies on the trematode fauna of India. Part VI. Subclass Digenea (Prosostomata). (A revision of Hemiuroidea from Indian region.). *Rec. Indian. Mus.*, **51**: 289-393.

Dawes, B. 1947. *The trematoda of British Fishes.* The Ray Society, London, 364 pp.

Fischthal, J.H. & Kuntz, R.E. 1963. Trematode parasites of fishes from Egypt. Part III. Six new hemiuridae. *Proc. helminth. Soc. Wash.*, **30** : 78-91.

Gibson, D.I. & Bray, R.A. 1979. The Hemiuroidea: terminology, systematics and evelution. *Bull. Br. Mus. nat. Hist.* (Zool.), **36** (2) : 35-146.

Gibson, D.I. & Bray, R.A. 1986. The Hemiuridae (Digenea) of fishes from the North-east Atlantic. *Bull. Br. Mus. nat. Hist.* (Zool.), **51** (1) : 1-125.

Gupta, N.K. & Sehgal, K.H. 1970. Studies onsome hemiurid trematodes from marine food fishes in India. *Res. Bull. Sci. Punjab Univ.*, (1970), **21** : 227-239.

Hafeezullah, M. 1975. Two new trematodes (Digenea : Hemiuridae) of marine fishes from east coast of India. *Dr B S Chauhan* Comm. Vol., pp. 203-210.

Hafeezullah, M. 1980. On the status of some genera of the subfamilies Stomachicolinae Yamaguti, 1958, Dinurinae Looss, 1907 and Prolecithinae Yamaguti, 1971 (Digenea : Hemiuridae). *Bull. zool. Surv. India*, **3** (1 & 2): 69-76.

Looss, A. 1908. Beitrage zur Gystematic der Distomen. Zur Kunntnis der familie Hemiuridae. *Zool.Jb.Syst.*, **26**: 64-180.

Manter, H.W. 1940. Digenetic trematodes of fishes from the Galapagos Islands and the neighbouring Pacific. *Rep. Allen Hancock Pacific Exped.*, **2**(14):329-497.

Manter, M.W. 1947. The digenetic trematodes of marine fishes of Tortugas, Florida. *Amer.Midl.Natl.*, **28** : 257-416.

Manter, H.W. & Pritchard, M.H. (1960). Additional hemiurid trematodes from Hawaiian fishes. *Proc helminth. Soc. Wash.*, **27** : 165-180.

Nahhas, F.M. & Short, R.B. 1965. Digenetic trematodes of fishes from Apalachy Bay, Gulf of Mexico. *Tulane Stud. Zool.*, **12**: 39-50.

Radhakrishnan, S. & Nair, N.B. 1979. Digenetic trematodes from the fishes of the Southwest coast of India. *Aquatic Biology*, **4** : 95-107.

Srivastava, H.D. 1942. New hemiurids (Trematoda) from Indian marine food fishes. Part III. Two new parasites of te genus *Lecithocladium* Lühe, 1901 (Subfamily Dinurinae Looss, 1907). *Parasitology*, **34** : 124-127.

Sahai, D. & Srivastava, H.D. 1977. Trematodes of Indian fishes. Part I. Two new genera of hemiurids (Subfamily Hemiurinae Looss, 1899). *Proc. Nat. Acad. Sci. India.* **47** (B), I: 7-12.

Sahai, D. & Sriastava, H. D. 1978. Trematode parasites of Indian fishes. Part 3. Five new genera of Hemiurids and two new species of *Uterovesiculurus* Skrjabin and Guschanskaja, 1954 (Subfamily Dinurinae Looss, 1907). *Proc. Nat. Acad. Sci. India.* **48** (B), I : 17-32.

Velasquez, C. C. 1962. Some hemiruid trrematodes from Philippine fishes. *J. Parasit.*, **48** : 539-544.

Yamaguti, S. 1971. *Synopsis of digenatic trematodes of vertebrates.* Vol. I. Keigaku Publishing Co., Tokyo, Japan, pp. 1074.