

**DIGENETIC TREMATODES OF MARINE FISHES OF INDIA
(SUPERFAMILY HEMIUROIDEA : FAMILIES LECITHASTERIDAE
AND BUNOCOTYLIDAE)**

M. HAFEEZULLAH

*Zoological Survey of India,
234/4-Acharya J. C. Bose Road, Calcutta - 700020*

INTRODUCTION

This paper is based on 135 specimens on 47 slides. They belong to 9 species from 8 genera and 2 families of the superfamily Hemiuroidea Looss, 1899. The material was collected from the marine fishes of the Bay of Bengal (Bay of Bengal proper including Coromandel coast, Palk Bay and Gulf of Mannar) and Arabian Sea. It includes the description of a new species; two known species are reported for the first time from India; some important synonymies have been suggested; *Neotheleterum* Gibson and Bray, 1979 is accepted; and some known species are reported with interesting remarks. The classification of Hemiuroidea as given by Gibson and Bray (1979) has been adopted here.

MATERIALS AND METHODS

The specimens were recovered alive from hosts and were studied in that condition first. Later on, they were allowed to relaxe in normal saline. When completely relaxed, they were killed and fixed in AFA keeping them between glass slide and cover glass and applying a bit more pressure with the tip of a needle. After complete fixation, they were removed in AFA, washed in 70% alcohol to remove excess of AFA, and then stored in small glass vials in 70% alcohol. In the laboratory, these specimens were processed for staining, dehydration and final mounting. They were overstained with alcoholic Borax carmine. The overstained material was then differentiated in acid alcohol to the desired shade of staining. They were then treated with ammonia alcohol to neutralise the traces of acid in the material. The specimens were then dehydrated with various grades of alcohol. After giving a slight touch in xylol, these specimens were submerged in a small pool of clove oil in cavity blocks for attaining transparency. They were then mounted on clean slides in Canada balsam and dried.

The specimens will be deposited with the National Collections of the Zoological Survey of India, Calcutta for registration. All measurements are in micrometres (μm) except otherwise stated. The diagrams have been made with the aid of a camera lucida.

SYSTEMATIC ACCOUNT

Superfamily	HEMIUROIDEA Looss, 1899
Family	LECITHASTERIDAE Odhner, 1905
Subfamily	LECITHASTERINAE Odhner, 1905

Genus 1. *Lecithaster* Lühe, 19011. *Lecithaster indicus* Srivastava, 1935
(Fig. 1)

Host : A clupeid fish, (Family Clupeidae).

Location : Stomach.

Locality : Machhilipatnam (Bay of Bengal).

No. of Specimens : 1, on slide; collected on 24.1.1975.

Discussion : Srivastava (1935) described this species from Allahabad (River Ganges) in the intestine of *Clupea ilisha*, a clupeid migratory fish. The present single specimen collected at Machhilipatnam (Bay of Bengal) from the stomach of an unidentified clupeid fish broadly agrees with Srivastava's description.

Genus 2. *Aponurus* Looss, 19072. *Aponurus drepani* n. sp.
(Fig. 2)

Host : *Drepane punctatus* (L.), spotted drepane, (Family Drepanidae).

Location : Stomach.

Locality : Tuticorin (Gulf of Mannar).

No. of Specimens : 4, on 4 slides; collected on 22.1.1965.

Description : Body 1.14 - 1.61 mm long, 0.29 - 0.42 mm wide at acetabular level, with almost round ends, sometimes slightly tapering posteriorly. Tegument moderately thick, smooth. Acetabulum 192 - 225 long, 203 - 225 wide, spherical, at 359 - 548 from anterior end of body. Oral sucker 87 - 115 long, 91 - 115 wide, spherical, subterminal. Sucker width ratio about 1 : 2.1. Prepharynx absent; pharynx 27-38 in diameter (distinct in holotype and one paratype only), spherical, slightly overlapped by posterior portion of oral sucker; oesophagus wide; caeca simple, reaching almost to posterior end of body.

Tests 2, 77-91 in diameter (measurements on holotype and one paratype only, obscured in others by coils of uterus), globular, entire, oblique with dextral anterior most, equatorial. Seminal vesicle 122 long, 70 wide (in holotype only, in others not clearly seen), pyriform or bulb-shaped, anterodorsal to acetabulum, placed obliquely; pars prostatica long, curved, surrounded by well-developed prostate cells. Sinus sac 80 long, 52 wide (distinctly seen in holotype only), oval, muscular, extending posteriorly to slightly beyond caecal bifurcation, opening at base of oral sucker, enclosing hermaphroditic duct.

Ovary 66-105 long, 70-157 wide, globular, in one specimen transversely elongate, entire, medium, immediately posterior to hind testis. Seminal receptacle blind, 91 in diameter, dorsal to posterior testis. Vitellarium comprising of 7 rounded lobes, usually in

groups of 4 and 3 in one paratype 6 lobes, arranged around a central one in stellate fashion, all lobes separate, posterior to ovary. Uterus voluminous, extending to posterior end; metraterm present. Eggs $21-25 \times 7-14 \mu\text{m}$, numerous, dark.

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

Discussion : Three species in the genus have been reported from India. They are *A. breviformis* Srivastava, 1939, *A. bengalensis* Srivastava, 1939 (synonym of *A. intermedius* Manter, 1934) and *A. orientalis* Ahmad, 1981. *Aponurus drepani* n. sp. resembles *A. breviformis* in sucker width ratio and egg size, but differs from it in having a more anterior genital pore, a pars prostation curved and longer than the seminal vesicle and in the position and size of the seminal receptacle. From *A. orientalis* it differs in the prebifurcal position of the genital pore, in having a pars prostatica curved and longer than the seminal vesicle and in having much smaller eggs (in *A. orientalis* the eggs are $30-35 \times 17-19 \mu\text{m}$). From all other species of the genus, the present form differs in one or more of the following characters: the sucker width ratio, egg size, the position of the genital pore, the posterior extent of the uterus and the disposition of the testes.

Subfamily HYSTEROLECITHINAE Yamaguti, 1958

Genus 3. *Hysterolecitha* Linton, 1910

3. *Hysterolecitha sigani* Manter, 1969
(Fig. 3)

Hosts : *Platax tiera* Forskal, Rounded batfish, (Family Ephippidae); *Siganus oramin* (Schneider), Whitespotted spinefoot, (Family Siganidae); and *Scatophagus argus* (Linnaeus), Spotted butterflyfish, (Family Scatophagidae).

Location : Stomach.

Localities : Tuticorin (Gulf of Mannar); Tuticorin (Gulf of Mannar) and Karwar (Arabian Sea) respectively.

Number of specimens : 6 + 14 + 20 respectively, total 40, on 19 slides.

Specimens deposited : Z. S. I. Reg. Nos. W 7568/1 to W 7586/1.

Description (measurements on 5 specimens only) Body 1.764-4.2 mm long, 0.42-0.876 mm wide, elongate with both ends rounded. Tegument smooth. Acetabulum 274-516 long, 271-492 wide, spherical, situated at 0.480-0.948 mm from anterior end of body. Oral sucker 119-216 long, 137-271 wide, spherical or subspherical, subterminal. Preoral lobe 13-15 wide. Sucker width ratio 1: 1.83-2.28. Prepharynx indistinct; pharynx 30-104 long, 60-125 wide, globular, muscular, slightly overlapped by oral sucker; oesophagus short; 'Drusenmagen' present near bifurcation; caeca reaching almost posterior end of body.

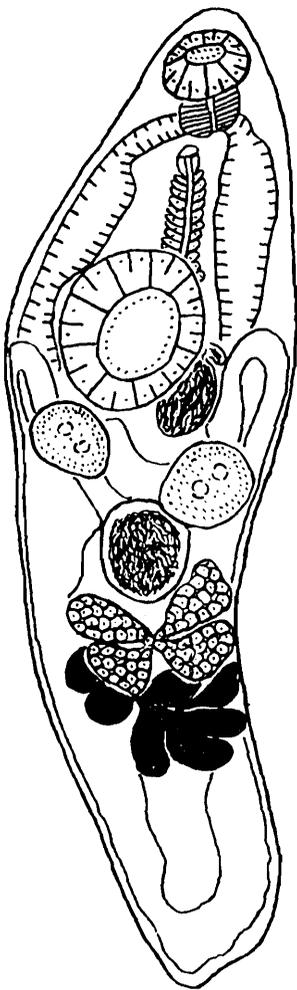


Fig.1

0.5mm

1.0mm

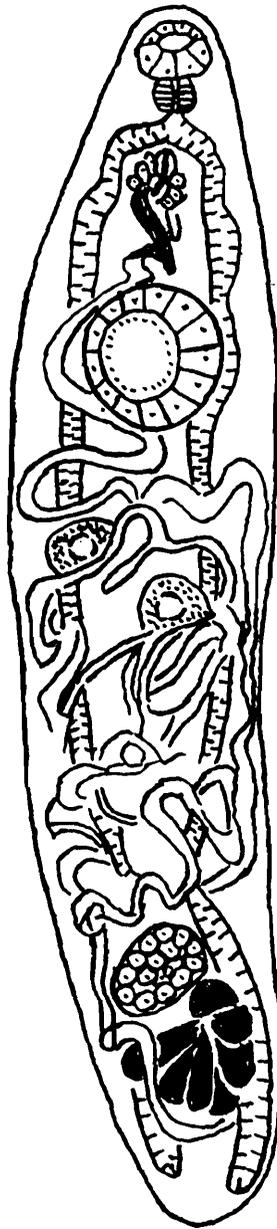


Fig 3

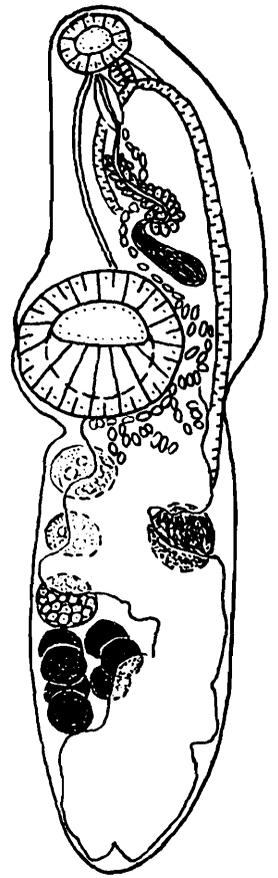


Fig.2

0.5mm

Fig. 1. *Lecithaster indicus* Srivastava, 1935. Entire worm; Fig. 2. *Aponurus drepani* n. sp. Entire worm. Fig. 3 *Hysterolecitha sigani* manter, 1969. Entire worm.

Testes 125-274 long, 135-272 wide, subglobular or transversely elongate, entire or slightly indented, diagonal, postacetabular, separated by uterine coils. Seminal vesicle sac-like or tubular, preacetabular or slightly overlapped by anterior border of acetabulum; pars prostatica short, surrounded by well-developed prostatic gland cells; sinus sac wide, globular, large immediately postbifurcal; hermaphroditic duct wide, appearing to be divided into 3 regions, protrusible, opening into genital atrium. Genital pore wide, immediately postbifurcal.

Ovary 164-360 long, 143-297 wide, median, subglobular, near posterior end of body. True seminal receptacle absent but uterine seminal receptacle present. Vitellarium digitate, in two masses, right one with 3 lobes and left with 4; lobes club-shaped immediately postovarian. Uterus voluminous, extending short of posterior end of body. Eggs 21-24 × 9-12 µm.

Excretory vesicle bifurcating posterior to acetabulum, branches reuniting dorsally to pharynx.

Discussion : Manter (1969) described this species from New Caledonia from *Siganus* sp., from Green Island and Moreton Bay, Queensland, Australia from *Siganus rivulatus*, from Green Island, Queensland, Australia from *Abudefduf palmeri*, and Green Island, Queensland, Australia from *Micracanthus strigosus*. As the species is reported for the first time from India, its full details have been provided above.

Subfamily TRIFOLIOVARIINAE Yamaguti, 1958

Genus 4. *Trifoliovarium* Yamaguti, 1940

4. *Trifoliovarium triacanthi* Bilqees, 1973

Syn. *T. triacanthusi* Gupta, V. and Ahmad, 1976

Host : *Triacanthus brevirostris*, Short nose tripod, (Family Triacanthidae).

Location : Stomach.

Localities : Puri, Machhilpanam, Kakinada (Bay of Bengal), Turicorin (Gulf of Mannar) and Calicut (Arabian Sea).

No. of Specimens : 3+5+10+3+3 respectively, total 24 on 7 slides

Specimens deposited : Z. S. I. Reg. Nos. W 7598/1 to W 7604/1.

Discussion : Yamaguti (1940) proposed the genus *Trifoliovarium* for specimens from the fish *Acanthocephala limbata* from Maisaki, Japan with *T. acanthocephalae* as the type species. Its ovary was described as possessing three lobes, but later on the same author (1971) emended this in a foot note (p. 322) stating that the ovary actually has four lobes.

Gibson and Bray (1979) confirmed this after examining the type material of *T. acanthocephalae*. Bilqees (1973) described a second species *T. triacanthi*, from the fish *Triacanthus brevirostris* from Karachi (Arabian Sea), differentiating it from the type

species mainly by the presence of a relatively larger ventral sucker (Sucker width ratio 1: 1.4), a shorter posterior extent of the seminal vesicle with respect to the ventral sucker, and a smaller egg size (32-39 x 17-20 μm) in the Japanese species and 20-25 x 11-13 μm in the Pakistani species).

Gupta, V. and Ahmad (1976), obviously unaware of Bilquees' work, described *T triacanthusi* from the fish *Triacanthus strigilifer* from Puri (Bay of Bengal). The description of this species fully agrees with that of *T triacanthi*. Therefore, *T triacanthusi* is conspecific with *T triacanthi*. This synonymy has also been indicated by Gibson and Bray (1979).

Gupta, A. N. and Sharma (1975) proposed that *Cladolecithotrema* Ichihara, 1970 is synonymous with *Trifoliovarium* Yamaguti, 1940, but Gibson and Bray (1979) do not agree with this synonymy and showed that the two genera are distinct. The author concurs with them.

Subfamily PROLECITHINAE Yamaguti, 1971

Syn. *Follicovitellotrematinae* Gupta, A. N. and Sharma, 1972

Genus 5. *Prolecitha* Manter, 1961

Syn. *Lobatovitelliovarium* Yamaguti, 1965

Follicovitellosum Gupta, A. N. and Sharma, 1972

Cryptodiscus Srivastava and Sahai, 1978 (New Syn.)

5. *Prolecitha obesa* Manter, 1961

Syn. *P. beloni* Nagaty and Abdel Aal, 1962

P. fusiforme (Yamaguti, 1965) Gibson and Bray, 1979

P. indicum (Gupta, A. N. and Sharma, 1972) Gibson and Bray, 1979

Cryptodiscus indicus Srivastava and Sahai, 1978 n.syn.

Host : *Belone strogylura*, Needlefish, (Family Belonidae) and *B. crocodila*, Giant Needlefish, (Family Belonidae).

Location : Stomach.

Localities : Rameswaram (Palk Bay) and Tuticorin (Gulf of Mannar) respectively.

No. of Specimens : 8 + 1 respectively, total 9 on 3 slides; collected on 2.3.75 & 14.3.75 by Dr. T. D. Soota.

The material was studied by Hafeezullah (1980) without Accession Numbers.

The synonymies of *Follicovitellosum* Gupta, A. N. and Sharma, 1972 and *P. indicum* Gupta, A. N. and Sharma, 1972 with *Prolecitha* Manter, 1961 and *P. obesa* Manter, 1961 respectively, following Gibson and Bray (1979), have already been discussed by Hafeezullah (1980) in the light of the Indian material.

All the above 9 specimens are mounted in lateral, ventrolateral or dorsolateral views due to the peduncle on which the ventral sucker is borne. This protuberance is retractile. In partially or fully retraced condition, the edges of the ventral sucker are likely to be covered by portions of body parenchyma of the protuberance itself. This situation may be encountered in various conditions depending upon the state of contraction of the peduncle. This explains the situation probably encountered by Yamaguti (1965) in *Lobatovitelliovarium fusiforme* and Srivastava and Sahai (1978) in *Cryptodiscus indicus*, and as such there is no special musculature associated with the ventral sucker.

As regards the male duct, the ovoid seminal vesicle is continued as a short aglandular duct which then widens as it proceeds almost dorsoventrally. This wide pars prostatica is surrounded by a dense, compact layer of prostate cells and opens into a large sucker-like genital atrium. It is very difficult to make out if an ejaculatory duct is differentiated at all. This difficulty arises due to the thick and compact layer of prostate cells. Most probably, neither is differentiated. A short metraterm is formed and opens into the sucker - like genital atrium separately, and thus no hermaphroditic duct is formed. This contradicts the opinion given by Gibson and Bray (1979) in parentheses on page 107. It is believed that materials of Manter (1961), Yamaguti (1965), Gupta A. N. and Sharma (1972) and Srivastava and Sahai (1978) are similar to those reported here.

Srivastava and Sahai (1978: p. 50), while giving the generic diagnosis of *Cryptodiscus*, state that they are 'intestinal parasites of marine teleosts', whereas they have reported their genus from a cartilaginous fish *Dasyatis urnak*. While such cases are not uncommon, it seems to be an accidental host or the latter might have fed upon the teleost fish which serves as the normal host for this fluke under consideration. Furthermore, they (1978: p. 48, 50) have described *Cryptodiscus indicus* as the type species of their genus *Cryptodiscus*, whereas in the abstract (p. 39) they have mentioned *Cryptodiscus madrasensis* as the type species.

Family BUNOCOTYLIDAE Dollfus, 1950

Subfamily OPISTHADENINAE Yamaguti, 1970

Genus 6. *Neotheletrum* Gibson and Bray, 1979

6. *Neotheletrum frontilatum* (Manter, 1969) Gibson and Bray, 1979.

Hosts : *Siganus oramin* (Schneider), Whitespotted spinefoot, and *Siganus Javus* (Linnaeus), Streaky spinefoot, (Family: Siganidae).

Location : Stomach.

Localities : Tuticorin (Gulf of Mannar), Keelakkarai (Palk Bay) and Karaikal (Coromandel coast, Bay of Bengal).

No. of Specimens : 44, on 11 slides.

Specimens deposited : Z. S. I. Reg. Nos. W 7587/1 to W 7597/1.

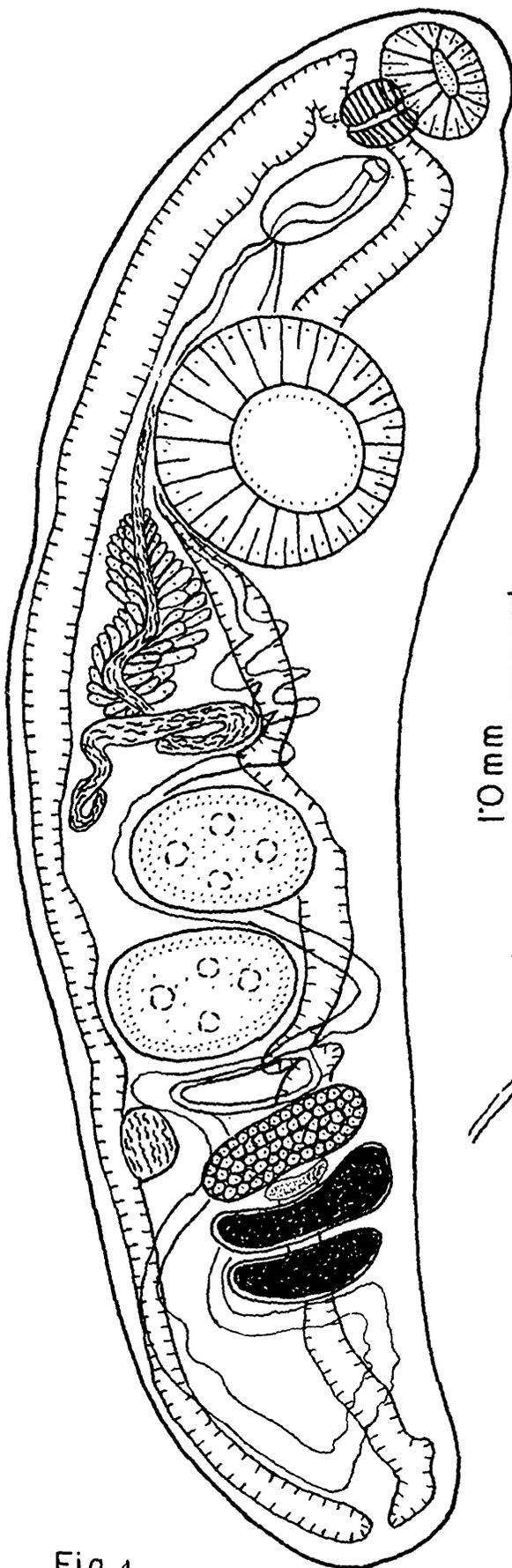


Fig. 4

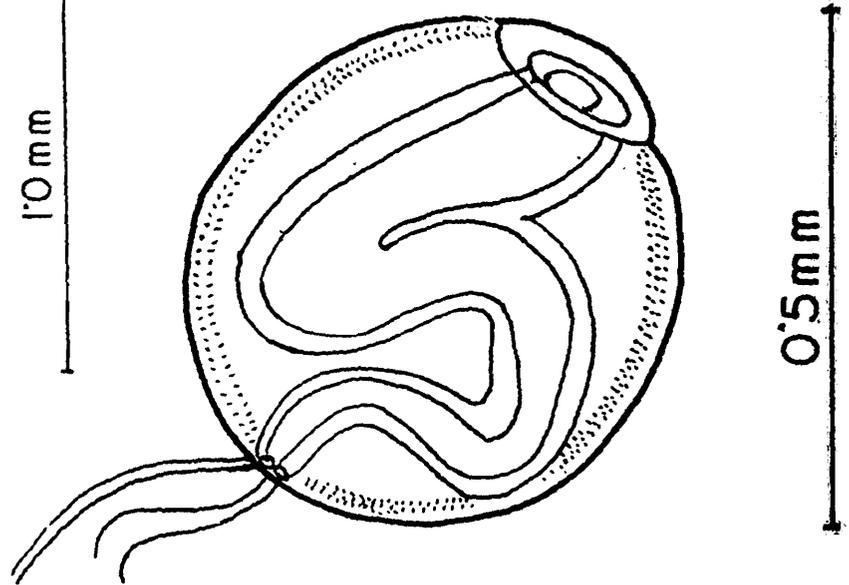


Fig. 5

Fig. 4. *Neopisthadena habei* Machida, 1980. Entire worm; Fig. 5. *Neopisthadena habei* Machida, 1980. Hermaphroditic pouch enlarged.

Discussion : Full details of this species were reported by Hafeezullah and Dutta (1980) on the basis of specimens from Chiria Tapu, Andamans (vide Z. S. I. Reg. Nos. W 7272/1 to W 7274/1) in the genus *Hysterolecithoides* Yamaguti, 1934. Gibson and Bray (1979) have given good reasons for considering it as the type species of a new genus *Neotheletrum*. The author is convinced by their reasoning and therefore concurs with them.

Genus 7. *Neopisthodena* Machida, 1980

7. *Neopisthadens habei* Machida, 1980

(Figs. 4 & 5)

Host : *Kyphosus cinerascens* Forskal, Ashen drummer, (Family Kyphosidae).

Location : Stomach.

Locality : Tuticorin (Gulf of Mannar).

No. of specimens : 12, on 2 slides; collected on 19.11.75.

The details of the above specimens agree fairly well with the description of the species as given by Machida (1980) from the same species of host from Ki Peninsula, Japan. However, as this is the first record from India and the second from the world, full details are provided here.

Description : Body 5.0-9.75 mm long, 1.2-1.96 mm wide at acetabular level. Tegument thick, unspined. Sides almost parallel, ends rounded. Acetabulum 692-1075 long, 708-1108 wide, globular, situated at 0.966-1.608 mm from anterior end of body, opening circular. Oral sucker 250-383 long, 350-550 wide, subterminal, withdrawn in anterior part of body. Sucker width ratio about 1:1.6. Prepharynx absent. Pharynx 167-242 long, 184-309 wide, wider than long, may be slightly overlapped by hind portion of oral sucker. Oesophagus short (contracted in all specimens) followed by caecal bifurcation. Proximal parts of caeca form shoulder, then turning posteriorly, extending to posterior end of body.

Testes two, 358-500 long, 508-875 wide, transversely oval, tandem, posterior to acetabulum, in middle-third of body, separated by coils of uterus. Seminal vesicle long, narrow, tubular and coiled anterior to testes. Pars prostatica long, narrow and curved posterior to ventral sucker, surrounded by well-developed prostatic gland cells. Aglandular part of pars prostatic straight entering into sinus-sac in preacetabular region. Sinus-sac oval, muscular, containing muscular and coiled hermaphroditic duct, opening just behind caecal bifurcation into shallow genital atrium. Genital cone or sinus organ absent.

Ovary 508-1016 long, 192-383 wide, kidney-shaped or transversely elongate, situated in anterior part of posterior-third of body, post-testicular. Blind seminal vesicle present, antero-dorsal to and shorter than ovary. Vitellaria compact, two separate masses, transversely elongate, parallel to each other, postovarian. Mehlis' gland well developed,

situated between ovary and anterior viteline mass. Post-vitelline region of body filled with coils of uterus, anteriorly forming metraterm entering sinus-sac along with aglandular pars prostatica to form hermaphroditic duct, whose anterior part is funnel-shaped. Eggs $30-43 \times 10-14 \mu\text{m}$.

Excretory vesicle I-shaped, bifurcating behind acetabulum, branches uniting dorsally to oral sucker; excretory pore terminal.

Discussion : Although the present specimens agree well with the description of *Neopisthadena habei* Machida, 1980, they do not agree to have papillae along the border of the oval opening. Similarly, the semicircular fold behind acetabulum in Machida's species is not present in the present material. As such, these two structures do not seem to form important parts of generic diagnosis of *Neopisthadens* Machida, 1980.

SUMMARY

Seven species of digenetic trematodes of marine fishes of the Bay of Bengal and Arabian Sea are reported here. They belong to the families Lecithasteridae Odhner, 1905 and Bunocotylidae Dollfus, 1950 in the superfamily Hemiuroidea Looss, 1899. Of these species, *Aponurus drepani* is new to science. *Hysterolecithoides sigani* Manter, 1969 and *Neopisthadena habei* Machida, 1980 are reported for the first time from India. *Lecithaster indicus* Srivastava, 1935, *Trifoliovarium triacanthi* Bilqees, 1973, *Prolecitha obesa* Manter, 1961 and *Neotheleterum frontilatum* (Manter, 1969) are reported and commented upon. *Cryptodiscus* Srivastava and Sahai, 1978 and *Trifoliovarium triacanthusi* Gupta, V and Ahmad, 1976 are considered new synonyms of *Prolecitha* Manter, 1961 and *Trifoliovarium triacanthi* Bilqees, 1973 respectively. *Neotheleterum* Gibson and Bray, 1979 is recognised.

ACKNOWLEDGEMENTS

Thanks are due to Dr. B. K. Tikader, Director, Zoological Survey of India, Calcutta, for providing library and laboratory facilities. Thanks are also due to Dr. A. K. Ghosh, Scientist 'D' for showing interest in the present study.

REFERENCES

- Bilqees, F. M. 1973. Marine fish trematodes of Pakistan. XIII. Three new species (Allocreadiidae and Hemiuridae), including a new genus *Karachitrema* gen. n. *Acta parasit. pol.*, XXI (23): 327-334.
- Chauhan, B. S. 1954. Studies on the trematode fauna of India. Part IV. Subclass Digenea (Prosostomata). (A revision of Hemiuroidea from the Indian region) *Rec. Indian. Mus.*, 51: 289-393.

- Gibson, D. I. & Bray, R. A. 1979. The Hemiuroidea: terminology, systematics and evolution. *Bull.Br.Mus. (nat.Hist.) (Zoology)*, 136 (2) : 36-146.
- Gupta, A. N. & Sharma, P. N. 1972. *Follicovitellosum indicum*, a new trematode found in the fish *Belone belone*. *Mar. Biol.*, Berlin, 12 (1):99-102.
- Gupta, A. N. & Sharma, P. N. 1975. Proposed synonymy of *Cladolecithotrema* Ichihara, 1970 with *Trifoliovarium* Yamaguti, 1940 (Hemiuridae: Trematoda). *A. Numb. Natn. Acad. Sci.India*, (1974), 61 : 127.
- Gupta; V & Ahmad, J. 1976. On a new species *Trifoliovarium triacanthusi* n.sp.of a marine fish, *Triacanthus strigilifer* (Day) from Puri, Orissa. *Indian J. Zool.*, 15 (1) : 1-3.
- 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.
- Hafeezullah. M. & Dutta, I. B. 1980. Digenetic trematodes of marine fishes of Andaman. *Rec. zool. Surv. India*. 77 (1-4) : 75-82.
- Machida, M. 1980. Hemiurid trematodes of *Kyphosus* collected around Cape Shionomisaki, Kii Peninsula. *Mem.Nat. Sci.Mus.*, Tokyo, (13): 113-120.
- Manter, H. W. 1947. The digenetic trematodes of marine fishes of Tortugas, Florida. *Amer. Midl. Natr.*, 38 : 257-416.
- Manter, H. W. 1969. Some digenetic trematodes of marine fishes of New Caledonia. Part IV Hemiuridae and Summary. *Proc. helminth. Soc., Wash.*, 36 (2): 194-204.
- Srivastava, H. D. 1935. New hemiurids (Trematoda) from Indian freshwater fishes. Pt. I. New distomes of the genus *Lecithaster* Luhe, 1901, from *Clupea ilisha*. *Proc. Acad. Sci.*, U. P., 4 (4): 381-387.
- Srivastava, H. D. 1939. Two new parasites of the genus *Aponurus* Looss, 1907 (Subfamily Lecithasterinae). *Indian J. vet. Sci.*, 9 (1): 31-35.
- Srivastava, H. D. 1941. New hemiurids (Trematoda) from Indian marine food fishes. Part VIII. - The morphology and Systematic position of a new parasite-*Indoderogenes purii* gen. et sp. nov. (Subfamily Derogenitinae). *Indian J. vet. Sci.*, 11 : 49-51.
- Srivastava, H. D. & Sahai, D. 1978. Trematodes of Indian fishes, part 4. Four new genera, one new subfamily and one new species, with a review of the species *Ophiocorchis* Srivastava, 1939 (family Hemiuridae LUHE, 1901). *Proc. Nat. Acad. Sci.*, India, 48 (B), 1: 40-52.

- Yamaguti, S. 1940. Studies on the helminth fauna of Japan. Part 21. Trematodes of fishes. VII. *Japanese J. Zool.*, **9** : 35-108.
- Yamaguti, S. 1965. New digenetic trematodes from Hawaiian fishes. Part I. *Pacific Sci.*, **9** : 458-481.
- Yamaguti, S. 1971. *Synopsis of digenetic trematodes of vertebrates*. Keigaku Publishing Co., Tokyo, Vol. 1: 1074 pp. Vol.II : 349 plates.
- Zhukov, E. V. 1977. (A study of trematodes of Indian marine fishes). *Parazitologicheskii sbornik*, Leningrad, No. 27: 51-79. (In Russian).