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Binder 110, Hirudinellidae A-Z [Trematoda Taxon Notebooks]

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HIRUDINELLIDAE Dollfus, 1932

Family diagnosis. — Large, robust, strongly muscular distomes with prominent acetabulum. Oral sucker subterminal, pharynx present, esophagus short. Ceca terminating at posterior extremity, may or may not communicate with excretory vesicle. Testes postacetabular. Cirrus pouch postbifurcal, enclosing ductus ejaculatorius and metraterm, latter two opening into genital atrium, which in turn opens outside in the median line near the anterior extremity. Ovary median, posttesticular. Receptaculum seminis absent. Laurer's canal present. Uterus postovarian. Vitellaria tubular, lateral. Excretory vesicle with two strongly winding arms united together at anterior extremity. Parasites of fishes. Including only one genus, *Hirudinella* (Garsin, 1730).

Hirudinella (Garsin, 1930)

Generic diagnosis. — Hirudinellidae: Body large, elongate, swollen posteriorly, covered with very thick, transversely corrugated cuticle. Oral sucker surmounted by fleshy lip; esophagus of moderate length; ceca forming "stomach" portion at commencement, often distended posteriorly with dark ingesta probably due to blood of host. Acetabulum large, prominent, in anterior part of body. Testes tandem, in ventral postacetabular intercecal field. Vesicula seminalis and pars prostatica dorsal, pre-acetabular. Cirrus pouch strongly muscular, containing ejaculatory duct and metraterm. Genital pore ventral or posterior to pharynx. Ovary just behind posterior testis. Shell gland compact, enclosed in capsule, postovarian. Uterine coils descending in postovarian intercecal field and ascending on dorsal side of ovary and testes; eggs small, embryonated. Vitellaria branched, extending back of ovary along outer side of ceca. Excretory vesicle receiving two strongly winding lateral collecting vessels. Parasitic in stomach of marine fishes.

Genotype: *H. marina* (Garsin, 1930) in *Scomber pelamys*; locality unknown. Cf. Nigrelli and Stunkard (1947).

Other species:

H. beebel Chandler, 1937, in *Acanthocybium ferox*; Bermuda. Also in *A. solandri*; Galapagos Isl., Panama Bay.

H. ingens Moniez, 1886, Type host unknown. Syn. of *H. clavata* — Nigrelli (1938).

H. phalloidea Guiart, 1938, in *Coryphaena hippurus*; Atlantic.

H. pourieri (Moniez, 1891) Dollfus, 1935, in *Thynnus alalunga*; Atlantic.

H. spinulosa Yamaguti, 1938 (Pl. 20, Fig. 253), in *Thynnus alalunga*; Pacific coast of Japan.

H. ventricosa (Pallas, 1774) Baird, 1853, syn. *Fasciola ventricosa* Pallas, *F. fusca* Bosc 1902; *F. coryphaenae hippuridis* Telesius in Litt. Rud., 1809; in *Coryphaena hippurus* (host not given by Pallas); Amboyna, Europe and Florida. For hosts of *H. fusca* (Bosc) see Linton (1940). Nigrelli (1938) listed *Xiphias gladius* as host.

H. clavata (Menzies, 1791) Blainv., 1828, is heterogeneous, as it includes, according to Baird (1853), *H. marina* Garsin, *Fasciola clavata* Menzies, *F. scomberi pelamidis* Telesius, *F. coryphaenae* Bosc and *Distoma clavatum* Rud. — Nigrelli (1938). In *Gymnosarda alleuterata*, Pacific; *Coryphaena hippurus*, *Pelamys sarda*, *Xiphias gladius*, *Thynnus thynnus*, *T. vulgaris*, Atlantic — Mantel (1940).

Key to species of *Hirudinella* from Hawaiian fishes

1. Cloaca present; testes diagonal; vitellaria commencing at level of testes; eggs 28-35 X 20-24 μ *H. marina*
- Cloaca absent 2
2. Testes diagonal; vitellaria commencing at level of ovary; eggs 35-42 X 18-24 μ *H. ahi*
- Testes symmetrical; vitellaria commencing at level between testes and ovary; eggs 39-42 X 23-26 μ *H. beebel*

From Yamaguti, 1930

HIRUDINELLA de Blainville 1824

(Diagnosis from Darr 1902)

Very large forms with cylindrical bodies very muscular and strongly swollen at the hind end. Suckers near each other, the ventral sucker strongly developed and not rarely more or less elevated from the body surface. Skin without spines usually thrown into ring-like folds. Digestive system with pharynx, medium long esophagus and long, sac-like swollen ceca without blind sacs in the anterior part. Content of ceca black. Excretory bladder simple; into it lead two longitudinal vessels with much wound course. Genital pore ventral under or behind the pharynx. Copulatory organs present; the very muscular cirrus sac encloses the end part of the male and female ducts. Seminal vesicle dorsal in the middle of the forebody and united to the ejaculatory duct by the strongly developed pars prostatica. Two globular testes caudal to the ventral sucker but usually near it. Globular ovary close behind the testes, about median, slightly larger than testes. Sem. rec. lacking, Lauer's canal present. Vitellaria tubular, well developed, in the sides of the body outside the ceca. Coils of uterus numerous, limited to the space behind the gonads. Eggs 30-48 μ by 14-24 μ . Inhabitants of the stomach and intestine of Scomberidae.

(Distomum ampullaceum was reported from a Cetacean but V. Buttel considers this an error. Same for Distomum pallasii)

Type species: Hirudinella clavata (Menzies, 1791)

Blainville, 1824

Host: Scomber pelamys

Syn.: Hirudinella marina

D. scomberi pelamidis Tilesius

D. coryphaenae (Bosc)

Fasciola coryphaenae

Other species: H. ventricosa (Pallas, 1774)

(= H. fusca (Poirier, 1885) of Mante

Syn. D. coryphaenae hippuridis

D. coryphaenae of Rudolphi

D. clavatum of Owen

H. spinulosa Yamaguti, 1938

Hirudinella clavata (Menzies, 1791)

Blainville, 1828

Host.—*Sarda velox* Meek & Hildebrand,
bonino [new host record].

Location.—Stomach.

Locality.—Morro Sentinela, Piñas Bay,
Panama Pacific.

Hirudinella marina (Garcin, 1930)
 Host.—*Acanthocybium solandri* (Cuv. & Val.), wahoo.
 Location.—Stomach.
 Locality.—15 miles S.E. Taboguilla Island, Gulf of Panama.

Stegandrus, 1939

221. *Hirudinella marina* (Garcin, 1930)

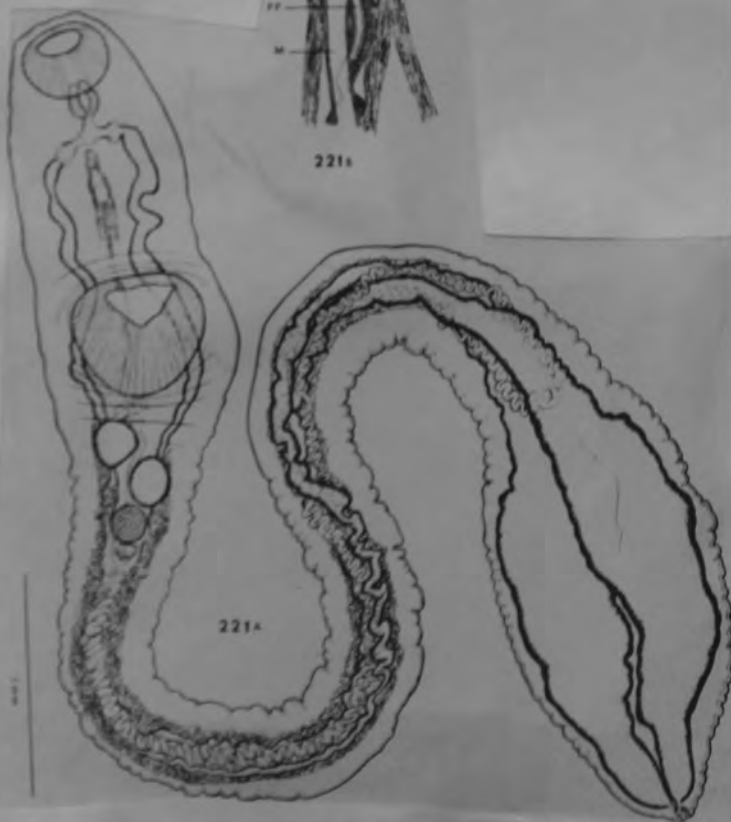
(Fig. 221)

HABITAT: Stomach of *Katsuwonus pelamis*, Hawaii.

DESCRIPTION (based on one immature and four mature specimens subjected to strong cover glass pressure): Body robust, 45-55 mm long, 3-4 mm wide at acetabular level, 5-7 mm wide near posterior extremity, slightly narrowed some distance back of acetabulum. Cuticle unspined, coarsely wrinkled transversely. Oral sucker subterminal, 1.3-1.7 X 1.4-2.0 mm; pharynx strongly muscular, longer than wide, 0.7-0.85 X 0.55-0.75 mm; esophagus constricted immediately behind pharynx, may be expanded before bifurcating. So-called stomach portion lined with cuticle, constricted off from ensuing ceca; ceca inflated with ingesta posteriorly, each connected with excretory vesicle by a narrow passage which is probably non-functional. Acetabulum 2.5-3.0 X 2.8-3.0 mm, situated just in front of middle of anterior third of body.

Testes subglobular, 0.5-1.0 X 0.4-0.85 mm, situated obliquely tandem behind middle of anterior third of body. Seminal vesicle tubular, winding in pre-acetabular median field dorsal to metraterm; pars prostatica straight or sigmoid, well differentiated between seminal vesicle and genital cone; ejaculatory duct penetrating genital cone longitudinally and opening at tip of genital cone. Genital atrium muscular, pyriform, 0.9 mm long by 0.38 mm wide at base in a specimen 47 mm long, opening midventrally a little behind intestinal bifurcation.

Ovary ovoid, 0.5-0.9 X 0.5-0.75 mm, immediately posttesticular, with oval, compact shell gland complex behind. Uterus descending some distance (3.9 mm in the specimen 47 mm long) back of ovary and then ascending in median field; metraterm straight anterior to acetabulum, opening on ventral surface of genital cone posterior to male pore. Eggs oval, numerous, 28-35 X 20-24 μ in life, 23-33 X 18-23 μ in balsam mounts. Vitellaria consisting of very fine, branched tubules, extending in cecal fields from level of testes into anterior part of caudal third of body. Excretory vesicle wide, moderately long, provided posteriorly with sphincter-like muscle bulb, through which the anal passages mentioned above empty into the vesicle from both sides; excretory pore opening at tip of papilliform terminal protuberance; lateral collecting vessels strongly winding, extending in both lateral fields throughout body length, apparently united dorsal to oral sucker, where two transverse vessels are seen crossing the median line.



over

DISCUSSION: As no accurate morphological information of this species is available so far, we are unable to identify our specimens from Hawaiian *Katsuwonus pelamis* definitely as *Hirudinella marina* (Garcin, 1730), but in view of the fact that the type host of this species is widely distributed in warm waters of the world, it seems very likely that they belong to this species.

Skrjabin and Guschanskaja (1956) proposed a new genus *Uoproctinella* for *Hirudinella spinulosa* Yamaguti, 1938 and distinguished it from *Hirudinella* Garcin by the postbifurcal genital pore and the presence of a cloaca and body spines. Except for the body spines, these characters are found in *Hirudinella marina*, the type species of the genus, so that the morphological differences on which the Russian authors separated *Uoproctinella* from *Hirudinella* are no longer tenable. Therefore, *Uoproctinella* must be suppressed in favor of *Hirudinella*.

Nigrelli and Stunkard (1947) synonymized *H. spinulosa* Yamaguti, 1938 with *H. marina*, but the two species differ distinctly one from the other in the body spination and in the anterior extent of the vitellaria as well as in the length of the eggs (39-47 μ vs. 28-35 μ).

From Yamaguti, 1970

Incidence of *H. marina* in skipjack tuna, *Euthynnus pelamis* (L.) from Marquesas and Hawaiian waters. See reprint by Nakamura and Yuen (1961), Trans. Amer. Fish. Soc. 90: 419-423

219. *Hirudinella abei* n. sp. Yam., 1970
(Fig. 219)

HABITAT: Stomach of *Neothunnus macropterus* (local name "ahi" or "ahihi"); Hawaii.

HOLOTYPE: U. S. Nat. Mus. Helm. Coll., No. 63799.

DESCRIPTION (based on a single whole mount): Body

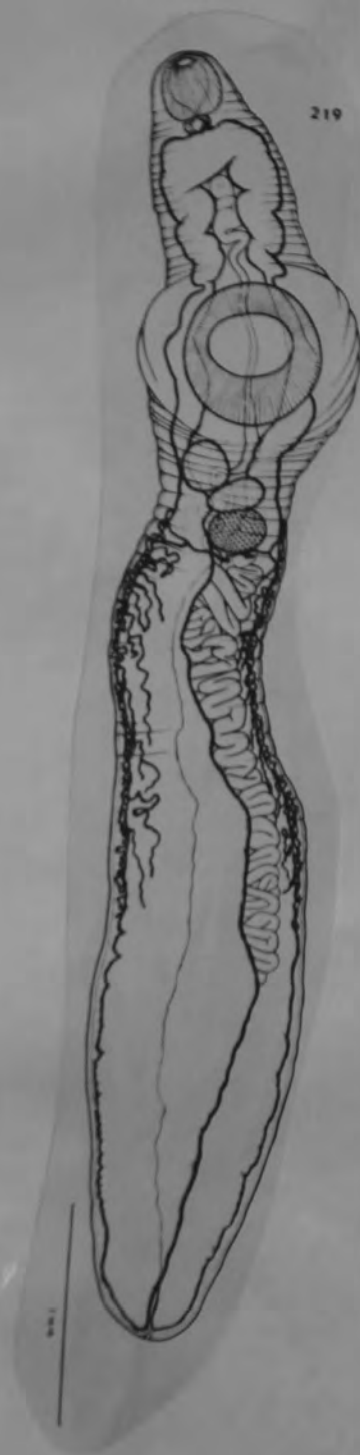
stout, 28 mm long, 4 mm wide at beginning of posterior third, somewhat attenuated behind acetabulum. Cuticle very thick, smooth, coarsely corrugated transversely. Oral sucker 1.15×1.7 mm, opening almost terminally. Pharynx 0.6 mm in diameter. Ceca in direct contact medially between ovary and posterior extremity where they appear to terminate blindly. Whether or not the two ceca actually open into the excretory vesicle could not be determined on the single specimen available. Acetabulum 3.7 mm in diameter, situated in posterior half of anterior third of body.

Testes rounded, diagonal, a little behind acetabulum; anterior testis 0.56×1.1 mm, posterior testis 0.8×0.8 mm. Seminal vesicle and pars prostatica hidden by uterus. Genital cone containing metraterm and ejaculatory duct, enclosed in a spherical muscular genital atrium 0.6 mm long by 0.5 mm wide, with slit-like free space in between. Genital pore 0.25 mm behind intestinal bifurcation.

Ovary subglobular, 0.75×0.95 mm, almost median, immediately posttesticular. Vitellaria tubular, winding, extending backward along outer side of ceca for about one-third of body length; their number unknown. Uterus spirally coiled, descending for a distance of 1.6 mm between two ceca and then ascending in the same intercecal field dorsal to ovary, testes, and acetabulum, strongly distended with eggs behind genital cone; metraterm penetrating genital cone ventral to ejaculatory duct. Eggs elliptical, $35-42 \times 18-24 \mu$ in balsam mount. Excretory pore terminal, further details not made out.

DISCUSSION: This species could be *Hirudinella clavata* (Menzies, 1791), but if Manter (1940) is correct in his identification of the species from the stomach of *Gymnosarda alleuterata* of Galapagos as *Hirudinella clavata* (Menzies), the present species differs from it distinctly in egg length. In Manter's specimens the eggs are $31 \times 23 \mu$, whereas in the Hawaiian specimen from *Neothunnus macropterus* they are $35-42 \times 18-24 \mu$. In internal anatomy the Hawaiian species from *Neothunnus macropterus* resembles *Hirudinella spinulosa* Yamaguti, 1938 from *Thynnus alalunga* of Japan, but the latter species is characterized by body spines.

Yam., 1970.



Uroprosthinella attenuata ~~new~~ Haffner et al., 1971
Figs. 5, 6

Host: *Naohunnus macropterus* (Schlegel), yellow
fin tuna; Thunnidae

Site: Stomach

Number of specimens: One

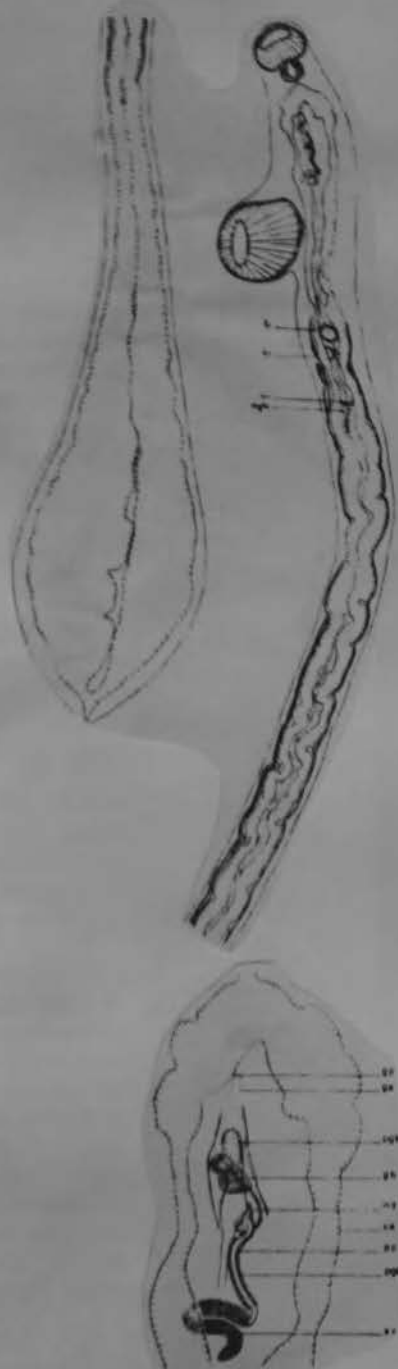
Locality: Veraval, Arabian Sea

Description (based on a single specimen): Body about 43 mm long, 5 mm wide at posterior part of body, elongate, attenuated behind acetabulum, posterior part club shaped. Cuticle very thick (about 75) somewhat corrugated in posterior part of body; spines very sparse (might have been lost during processing); subcuticular muscular layer quite thick. Acetabulum 2.02 mm by 2.446 mm, sub-spherical, prominent, near anterior end of body. Oral sucker 1.411 mm by 1.176 mm, sub-spherical, subterminal. Suckers' width ratio about 1:2. Prepharynx absent; pharynx 647-659 in diameter, pear shaped, partly overlapped by oral sucker; oesophagus short; just after caecal bifurcation each caecum having two dilations, then extending posteriorly in a sinuous fashion, dilated in posterior swollen part of body, joining near posterior end and forming a uroproct with excretory vesicle.

Testes 530 by 400-494, oval, slightly diagonal, postacetabular. Seminal vesicle about 131 wide, preacetabular, tubular, winding; pars prostatica long, winding, wide, surrounded by thin layer of prostatic gland cells; ejaculatory duct entering genital bulb or cone at base and opening at top of an anterior pocket of latter. Genital bulb or cone elongate, surrounded by muscle fibres, postbifurcal, containing terminal parts of male and female ducts, both of them opening ventrally into genital atrium. Genital atrium tubular; genital pore postbifurcal.

Ovary 165-200, subglobular, median, well removed posteriorly from testes. Seminal receptacle absent. Shell gland complex quite large, immediately posterior to ovary. Vitellaria branched, narrow, very long, highly convoluted tubules, extending from anterior level of anterior testis almost to end of attenuated part of body. Uterus extending posteriorly up to attenuated part of body, mostly in intercaecal field, proximal part lying posterodorsal to shell gland complex filled with sperm cells to form uterine seminal receptacle; metraterm expanded before entering genital bulb and opening on ventral wall of latter behind male opening. Eggs 15-24 x 12-17, thick-shelled. Excretory vesicle Y-shaped; stem short; collecting canals thin, thrown into complicated coils, meeting dorsal to oral sucker; excretory pore terminal.

Uroprosthinella attenuata resembles the type and only other species, *U. spinulosa* (Yamaguti, 1938) Skrjabin and Guschanskaja, 1957, but can be distinguished from the latter by more attenuated body, winding seminal vesicle (strongly twisted in *U. spinulosa*), greater space between ovary and testes, smaller sucker ratio (1:2.65 by average of diameters in *U. spinulosa*) and smaller egg size.



*Hirudinella beebei*. Ventral view. $\times 14$.

Description. (Based on serial sections of a single specimen.) Body somewhat pear-shaped, 32 mm. in length with maximum diameter, in posterior half of body, of 19 to 20 mm. Anterior half of body cone-shaped with bluntly rounded end; posterior end expanded and almost spherical (fig. 1). Entire body corrugated by circular rings, fine and close together on anterior cone, coarser and larger on hind-body. In fore-body rugae about 15μ to 300μ high and 80μ to 250μ broad. Oral sucker invisible externally except for its narrowed opening, reduced to a diameter of 400μ and rendered inconspicuous by overhanging of thickened cuticular lips (fig. 2, L. O. S.). Ventral sucker also overhung by thickened cuticular lips (fig. 2, L. V. S.), marked by radial rugae, and reducing opening to diameter of 770μ . Genital pore not visible externally. A slight depression around the opening of the excretory pore near posterior end. Cuticle about 40μ thick all over body, with thick subcuticular layer, underlaid by a very heavy layer of powerful longitudinal muscles which on transverse section are seen to be arranged in contiguous or nearly contiguous bundles 250μ to 300μ in diameter. Circular muscles missing except in the region of two suckers and between them, and particularly in lips surrounding the suckers (fig. 2, C. M.). A strong band of muscles (fig. 2, D. M.) traverses body diagonally from origin on anterior and medial wall of ventral sucker to join layer of longitudinal muscles somewhat more posteriorly on dorsal side.

Oral sucker a very thick-walled pocket with cavity directed postero-dorsally from antero-ventral opening. Pocket only about 150μ in diameter, but walls more than 1 mm. thick, giving total of about 2.35 mm. from dorsal to ventral side. From dorsal edge of upper rim of sucker to its bottom is 2.6 mm. Distance from opening into oral sucker to upper edge of opening into ventral sucker only about 4 mm. Ventral sucker, like oral one, with cavity directed postero-dorsally from antero-ventrally directed opening. Opening only 770μ in diameter due to overhanging lips. Cavity

just under lips about 1.4 mm. in diameter, maintaining this diameter for about 1.7 mm. and then being narrowed by the inward-bulging medial wall of sucker; depth of sucker about 4 mm. Walls of varying thickness, with maximum of about 1.5 mm., giving sucker an outside diameter of about 4 mm. Lip-like rim surrounding sucker about 3 mm. in outside diameter.

Pharynx nearly spherical and about 1.35 mm. in diameter, in my specimen fitting into groove in bottom of oral sucker. Esophagus, lined by thick cuticular walls, turns in antero-dorsal direction, resting against dorsal surface of pharynx, and reaching a level shortly behind junction of pharynx and oral sucker. Here the two branches spread laterally like the head of a "T" and widen into crop-like enlargements on either side; these measure about 620μ in antero-posterior direction and 540μ in dorso-ventral direction. Both esophagus and its lateral "crops" have heavy cuticular lining. At each lateral extremity, about 1 mm. from median line on either side, these "crops" open by narrow passageways into glandular pouches without cuticular walls, but lined by columnar cells provided with long filamentous processes which practically fill their lumina. These

pouches, of irregular lobulated shape, measuring roughly about 850μ in diameter, lie at level of pharynx on either side of it. Pouches open into intestinal ceca which have very narrow lumina, intricately branched in feather-like manner. Ceca first loop forward to level of bottom of oral sucker, then back to position lateral to glandular pouches, then medially and ventrally, with enlargements not far from latero-medial wall of ventral sucker near anterior extremity, then dorsally again, then ventrally,

Host: *Acanthocybium petus*

Locality: Bermuda

Collected by Beebe



FIG. 2. Median section of anterior part of body of *Hirudinella beebei*, partially reconstructed by additions from a few adjoining sections. C. M., circular muscles; D. M., diagonal muscle band; E. D., ejaculatory duct; E. P., ejaculatory pouch; Ex. C., expulsion canal; G. A., genital atrium; G. C., genital canal; G. M., genital musculature; G. P., genital pore; L. M., longitudinal muscles; L. O. S., lips of oral sucker; L. V. S., lips of ventral sucker; M., metraterm; M. G., Mehlis' gland; O., oesophagus; Ov., ovary; P. D., prostatic duct; Ph., pharynx; S. V., seminal vesicle; U. T., uterus.

etc., gradually swinging laterally. Near point where conical anterior part of body joins expanded posterior part, ceca begin branching in extremely complicated manner, with veritable maze of pockets and anastomosing, interlacing branches, which in cross-section give appearance of a reticulum. Near middle of hind-body a rather large expanded central lumen on each side, without much branching on medial sides, but with very complicated lateral and outer walls. As ceca proceed posteriorly they throw

off laterally a series of backward-directed divisions, each with its complicated pockets and anastomosing branches. Longest divisions of ceca terminate at extreme posterior end of body.

Excretory pore opens into short canal with rugose walls lined by thick cuticle, about 0.5 to 0.6 mm. long. This opens into rather spacious excretory bladder extending forward between the posterior extremities of longest branches of intestinal ceca. A few millimeters from posterior end, bladder very broad, and flattened between the ceca; posteriorly bladder split by some of posteriorly-directed divisions of ceca so that in a section about 3 mm. from posterior end it appears as several transversely flattened slits between the several cecal branches. More anteriorly, at about 7 mm. from posterior end, bladder ceases to be continuous from right to left side, but continues forward as one or more lateral horns on either side, which soon become further subdivided.

Genital pore (fig. 2, G. P.) situated very closely behind oral sucker, almost under its ventral lip, and about 1 mm. from its opening. Region surrounding male and female genital openings, as in *H. ampullaceum*, *H. zeimensi*, and *H. ingens*, surrounded by well-defined musculature which Mühlischlag designated "genital musculature" (fig. 2, G. M.). Genital musculature bounded anteriorly by walls of oral sucker and pharynx, and separated from ventral sucker posteriorly by metraterm and loops of prostatic duct. It lies about 700 μ beneath ventral surface of body, being entered by narrow genital canal (fig. 2, G. C.). Muscular area a little over 2 mm. in depth; just under ventral body wall it is about 1 mm. in diameter, but it widens to about 1.4 mm. in diameter at inner end. Middle portion occupied by cavity about 550 μ long and 140 μ wide, representing genital

atrium (fig. 2, G. A.). At distal end a narrow ejaculatory duct about 550μ long (fig. 2, E. D.) connects atrium with a broad cavity which Mühlischlag designated "protrusion pocket," but which I prefer to call ejaculatory pouch (fig. 2, E. P.). This pouch about 750μ broad and about 175μ deep; it is entered by another very narrow duct passing through musculature from prostatic duct outside. Metraterm (fig. 2, M.) enters atrium at inner posterior angle, behind male opening, by narrow passageway which may be termed "expulsion canal" (fig. 2, Ex. C.).

Testes parallel with each other at level of ventral sucker and in contact with its dorso-lateral walls,—separated from each other medially by distance of about 2.4 mm.; they are approximately equal in size and shaped like discs with rather irregular outlines, flattened antero-posteriorly; size about 3 to 3.5 mm. in diameter and about 1.7 mm. in antero-posterior thickness. Seminal vesicle (fig. 2, S. V.) a coarse, S-shaped, thin-walled tube 600μ in diameter distally where the vasa efferentia enter it, but diminishing to about 500μ in diameter; it enters prostatic duct by a very narrow muscular tube. Prostatic duct (fig. 2, P. D.) a thick-walled tube about 350μ in

diameter surrounded by prostate cells to thickness of about 75μ ; this passes in an antero-ventral direction anterior to metraterm, then loops back on itself to point just anterior to seminal vesicle in dorsal part of body, and then forward again, passing through musculature of genital atrium and entering ejaculatory pouch by a very narrow duct.

Ovary (fig. 2, Ov.) lies on median line between testes and in contact with dorsal wall of ventral sucker; its median portion lies at level of testes but its lateral portions lie slightly more posterior. Like testes, ovary has form of disc with irregular outline and of irregular thickness; it measures about 2.5 to 3 mm. in diameter and about 1.5 mm. in maximum antero-posterior thickness. Abutting against ovary ventrally and lying against posterior extremity of wall of ventral sucker, and following its contour, is Mehlis' gland (fig. 2, M. G.) which, like the gonads, is disc-shaped, measuring about 1.7 mm. in diameter dorso-ventrally, 2.3 mm. from left to right, and about 420μ in antero-posterior thickness dorsally, thinning out somewhat ventrally. Vitelline ducts enter it near median line dorso-anteriorly, near where it abuts against ovary. These ducts pass in ventro-lateral direction anterior to gland, in narrow space between it and posterior wall of ventral sucker; they are about 70μ in diameter. Near ventral wall of fluke they begin branching into very much convoluted and branched vitelline tubules varying in diameter from about 50 to 120μ . These tubules interlace with loops of uterus, but are densest on lateral portions of body. They also interlace between branches of intestinal ceca, being densest medial to ceca and external to central mass of uterine coils in anterior part of hind-body. They extend posteriorly to area 6 to 7 mm. behind posterior extremity of ventral sucker.

Oviduct makes loop posterior to Mehlis' gland before entering it, and receives Laurer's canal. The latter can be traced for some distance along posterior contour of ovary, but its penetration, if present, through thick dorsal layer of longitudinal muscles and through dorsal cuticle could not be found. Uterus emerges from midposterior surface of Mehlis' gland and passes ventrally just posterior to ventral sucker and then forms almost solid mass of loops and coils occupying central part of body bounded anteriorly by gonads and ventral sucker, and laterally by intestinal ceca. Posteriorly the mass of coils ends, encroached upon by expanding intestinal ceca, about 9 or 10 mm. from posterior end. Anteriorly uterus breaks through the strong diagonal band of muscle fibres which extend in a postero-dorsal direction from ventral sucker, and passes antero-ventrally along anterior face of this muscle. Finally, its wall gradually thickening and its lumen narrowing, it passes forward along inner wall of ventral sucker to position between ventral sucker and genital atrium. Here, after two short kinks, it enters genital atrium by narrow muscular "expulsion canal" posterior to entrance of sperm duct. Uterine eggs about 35 to 37μ by 24 to 26μ .

DISCUSSION

Although the large flukes which were long known as the "*Distomum clavatum* group," and later as the genus *Hirudinella*, have long been known, a detailed study of the internal anatomy of one of the group, *H. clavata* (Menzies), was first made by Poirier in 1885. In the same paper this author attempted to differentiate a number of other species on the basis of body form and external anatomy.

In 1903 Buttel-Reepen carefully described and differentiated two other species, which he designated *Distomum ampullaceum* and *D. siemersi*. In 1914 Mühlischlag added detailed descriptions of two more species, *D. fuscum* and *D. ingens*. The essential differences between some of these species are still far from clear. Satisfactory studies can be made only on serial sections which, on account of the size of the worms and the toughness of the body wall, are by no means easy to make. Most authors have, therefore, based their descriptions on sections of a single specimen. The extent of the variations due to states of contraction, age, method of preparation, etc., have not been sufficiently investigated. The strikingly different appearance of the genital sinus in *D. ampullaceum* and *D. siemersi* as pictured by Buttel-Reepen (1903), for instance, might, in the writer's opinion, be brought about entirely by muscular contraction in this region. Shape of the body, position of internal organs, corrugation of cuticle, arrangement of parts in the region of the genital openings, minor differences in histological appearance—all these, which have been used in distinguishing species, could undoubtedly be influenced very markedly by contraction, preservation and preparation. Until, however, longer series of specimens can be studied in serial sections, the validity of some of the various species hitherto described cannot be determined.

The form here described, although closely resembling *H. ampullaceum* and *H. ingens* in size and general appearance, differs markedly from both these species in the extremely complicated form of the digestive system, and in the distribution of the tubular vitellaria inside as well as outside of the intestinal ceca.

H. clavatum (Menzies) is described by Poirier (1885) as having intestinal ceca of complicated structure, but from this form the worm here described differs in many important respects, including shape and proportions of body, structure of genital sinus region, transverse arrangement and large size of gonads, absence of vitelline reservoir and common vitelline duct, exclusion of uterus from posterior portion of hind-body, size of eggs, and in other respects.

Locality: Bermuda

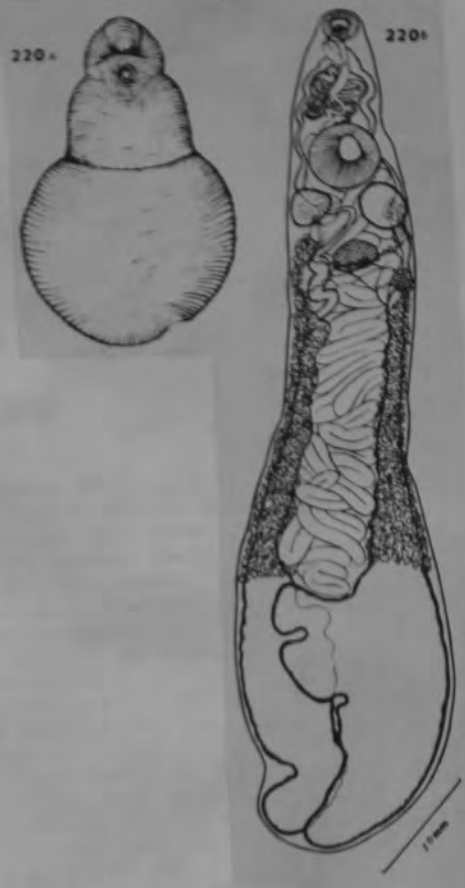
220. *Hirudinella beebei* Chandler, 1937

(Fig. 220)

HABITAT: Stomach of *Acanthocybium solandri*; Hawaii.
DESCRIPTION (based on two immature specimens subjected to strong cover glass pressure and transverse serial sections of a fully gravid specimen): Body robust, slightly tapered posterior to testiculovarian region 22 mm and 16 mm in respective length, 5-6 mm in maximum width at anterior part of posterior third of body. Cuticle smooth, coarsely corrugated transversely. Oral sucker subterminal, 1.0-1.2 X 1.3-1.6 mm; pharynx about 0.6 mm in diameter; ceca with sinuous walls, enlarged and septate posteriorly, but never branched, terminating at posterior extremity. Acetabulum 2.3-2.4 X 2.4-2.8 mm, in posterior half of anterior third of body.

Testes round, 0.33-0.41 X 0.3-0.54 mm, situated symmetrically posterolateral to acetabulum; vasa efferentia joining together dorsal to anterior part of acetabulum. Seminal vesicle tubular, 120 μ wide, winding in median field in front of acetabulum. Pars prostatica 0.12-0.14 mm wide, convoluted between seminal vesicle and genital atrium; ejaculatory duct short, penetrating genital papilla at its base and opening into hermaphroditic duct. Latter opening into genital atrium at tip of genital papilla. Genital atrium spherical, with thick muscular walls, 0.35-0.36 mm in diameter, enclosing genital papilla, with slit-like free space between. No ejaculatory pouch as described by Chandler for this species. Genital atrium opening midventrally immediately behind pharynx.

Ovary transversely elongated, 0.13 X 0.25 mm in larger specimen, nearly median, shortly postacetabular. Germiduct arising from ventral side of ovary, giving off Laurer's canal just before it joins the common vitelline duct. Shell gland complex compact, posteroventral to ovary. Laurer's canal running dorsad just beneath ovary; its distal end surrounded by accompanying cells and reaching to subcuticular layer at level of ovary, appears to terminate blindly, its cuticular lumen too much reduced to be functional. Vitellaria consisting, on each side, of very narrow branching tubules, the number of which could not be determined. They extend from the level of the ovary backward for some distance, mostly ventral and lateral to the ceca, but not so far backward as described by Chandler. In Chandler's specimens they extend posteriorly to area 6-7 mm behind the posterior end of the acetabulum. This difference is obviously due to the age of the parasite or the state of contraction of the body. Vitelline reservoir round, 0.2 mm in diameter, posteroventral to ovary. Uterus first descending some distance, then ascending windingly dorsal to ovary and acetabulum; metraterm entering genital papilla ventral to ejaculatory duct and opening into hermaphroditic duct at its base. Eggs elongate oval, thick-shelled, embryonated, 39-42 X 23-26 μ in sections. Excretory pore terminal; arms united dorsal to oral sucker.



DISCUSSION: Our material agrees with *Hirudinella beebei* Chandler, 1937 in internal anatomy, only differing in the ceca not being reticulate posteriorly, in the absence of Chandler's ejaculatory pouch, and in the extent of the vitellaria. It should be pointed out that this giant trematode was reported by Nigrelli and Stunkard (1937) from *Acanthocybium solandri* from Bermuda and Yucatan and by Manter (1940) from the same host species of Panama Bay. In 1947 Nigrelli and Stunkard synonymized *H. beebei* with *H. ventricosa* (Pallas, 1774), but this synonymy, not being based on internal anatomy, appears doubtful, as long as the type host for *H. ventricosa* is known to be *Coryphaena hippurus*. I believe that the host relationship, in addition to the internal anatomy, is very important in identifying *Hirudinella* species. It is to be noted that in the present species the ejaculatory duct and the metraterm join the hermaphroditic duct at different levels, the former a little anterior to the latter.

From YAMAGUTI, 1970



The photograph shows specimens of *Hirudinella marina* shortly after removal from the stomach of *Acanthocybium solandri* (Wahoo). The specimens measure approximately 3.5 centimeters in length, 2 centimeters in width and 1 centimeter in depth.

Some Notes on the Giant Trematode *Hirudinella marina*

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Washington 7, D. C.

Nigrelli and Stunkard in 1947 state that the first of the giant trematodes was described by Garcin in 1730 from the stomach of Scombriform fishes namely *Scomber pelamys*. Garcin named the parasite *Hirudinella marina*. Pallas in 1774 described a similar but larger specimen from an unnamed host in the Malay Archipelago, and designated it *Fasciola ventricosa*. Following this it was renamed several times by subsequent authors. Blainville in 1824 formally validated the generic name *Hirudinella* and *H. marina* therefore becomes the type species. *H. marina* has

been recorded by Chandler 1937 and Nigrelli and Stunkard 1947 from Black Fin Tuna (*Thunnus sp.*), Ocean Bónito (*Gymnosarda pelamis*), Pacific Swordfish (*Xiphias sp.*), Spanish Mackerel (*Scomberomorus maculatus*), Bluefin Tuna (*Thunnus thynnus*), Dolphin (*Coryphaena hippurus*), and Wahoo (*Acanthocybium solandri*).

In December 1961 ten specimens of *H. marina* were collected by Jean Jacques Beaujon from the stomach of the Wahoo (*Acanthocybium solandri*) off the Coast of Curacao Netherlands Antilles.—The specimens ranged in size from 4 cm. to 2.5 cm. the average being 3.2 cm. The accompanying plate illustrates the general external appearance of the parasites.

Beaujon states (personal communication) that he has intensively surveyed the pelagic fish of the Netherlands Antilles over a number of years. He found that

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the parasite occurs only in the Wahoo, and in no other fish common to the Netherlands Antilles. Beaujon further states that in every case of a parasitized Wahoo, the fish was found to contain two and only two parasites. This is in contrast to Nigrelli and Stunkard 1947.

A possible conclusion stemming from the findings of Beaujon might be that the waters of Curacao do not constitute the main habitat of the parasite and that the Wahoo becomes parasitized at some point in its range outside the waters of the Netherlands Antilles and returns with them. As far as can be ascertained the life history of these parasites has not been worked out.

References cited

- Blainville, 1824, *Notice Zoology and Physiology*, Appendix A.
Chandler, 1937, *American Microscopical Society*, 36, (3): 248-254.
Garcin, 1730, *Philosophical Transactions Royal Society of London*, (415), 36: 337-344.
Nigrelli and Stunkard, 1947, *Zoologica* 11, (4): 183-195.
Pallas, 1774, *Latentischen über Wizen*, Johann Christian Polakopf, 4, S. 200, 74, Berlin, Stralmond.

Hiradinella sp.

Host: *Scorpaena planifrons* (C).

Site: stomach.

A single immature specimen was taken
from the stomach of a scorpion fish.

Cuango; Fern Naves + Cabel, 1964

185. *Hirudinella ventricosa* (Pallas, 1774) Baird, 1853
Figs. 142-144

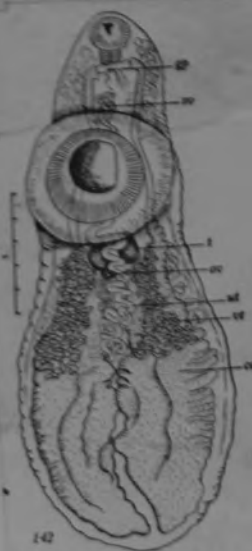
Host: *Coryphaena hippurus* Linn., "dolphin"; in 2 of 4 hosts examined; 1 mature and 3 immature specimens.

Location: Location of the immature specimens was not recorded; the mature specimens seemed to come from the body cavity.

Discussion: The type species of *Hirudinella* is *H. clavata* (Menzies, 1791), found in the stomach of *Scomber pelamys*. Various names given to this or closely related species have resulted in a confusing synonymy and the actual number of species in the genus is very uncertain. They are giant distomes known from early times and have been classified according to external form and other characters which are clearly subject to great individual variations in such muscular worms. Their descriptions date back to a time when the worms were referred to as "insects". They have been reported as being found several times free in the sea! As the unreliability of external features became realized, students (such as Poirier, 1885; Darr, 1902; Buttel-Reepen, 1903; and Mühlischlag, 1914) stressed in great detail the histology of these trematodes which were studied chiefly from serial sections. It seems somewhat strange that the common specific characters such as sucker ratio; position of gonads; extent and character of vitellaria; and egg size have been given little consideration or are buried within pages of histological detail. Published figures are either of externals only, or of sections.

Material to aid in clearing this confusion is not available to me. The problem is a complex one. Probably too many species are still recognized although there may well be several valid ones. My material of *H. clavata* from the Pacific (Manter, 1940) shows a very elongate cylindrical body with swollen posterior end, but young specimens of *H. berbei* have the same shape as these specimens from *Coryphaena*. The identification of my specimens as *Hirudinella ventricosa* is tentative. The host record is not new.

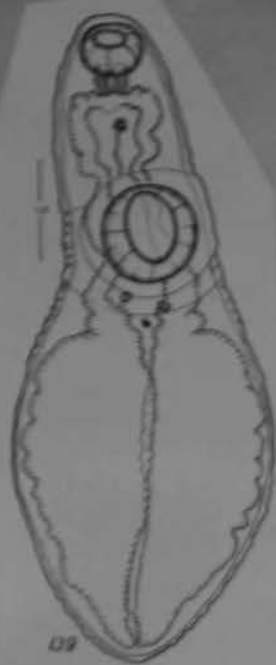
The following observations might be noted. The mature specimen measured 22.5 by 8.5 mm. The oral sucker was 1.738 mm in diameter; the acetabulum, with rounded aperture, was 3.879 mm; the sucker ratio thus being 1:2.2. The genital pore is opposite the base of the pharynx. The esophagus extends to each side leading to the inflated, lobed swellings representing the beginnings of the ceca. The ceca are rather narrow in the forebody but posterior to the acetabulum become huge in size filling most of the body. They show transverse foldings or pleats and apparently each has a longitudinal fold or pleat extending along the middle third of the hindbody. The three gonads are close together just posterior to the acetabulum, the small ovary being directly posterior to the right testis. The vitellaria anastomose to form a network (Fig. 144) chiefly ventral and dorsal to the ceca and extend from midtestis level to about 1/3 body length from the posterior end. The uterine coils are crowded between the ceca; they extend posteriorly to about the same limit as the vitellaria. Whether the male and female ducts open together or separately



could not be observed from the serial sections made of one immature specimen. However, as Chandler suggested, this point perhaps varies with contraction of the genital pore. Eggs, so far as they could be measured from a totemount, were about 33 by 19 μ , and had fairly thin shells.

Generic characters are, I believe, proximity of ovary to testes; the inflated ceca; the vitellaria anastomosing to form a network; and the failure of both the uterus and the vitellaria to reach by some distance the posterior end of the body.

over



FAMILY HIRUDINELLIDAE DOLLFUS, 1932

Hirudinella ventricosa (Pallas, 1774) Baird, 1853 (FIGURE 139)

Synonym:

Fasciola ventricosa Pallas, 1774.

Host: *Coryphaena hippurus*.

Site: stomach.

Locality: off Mayagüez, P. R.

Deposited specimen: No. 39408.

Our material is tentatively assigned to *H. ventricosa* as it appears very similar to that species as described by Manter (1947). In immature specimens, the excretory vesicle was observed as an elongate sac without the median tubular prolongation that receives the main excretory tubes in hemiurids. Instead, the vesicle receives those tubes independently at its anterolateral margins. The system is complex and apparently has 2 commissures anterior to the oral sucker.

from Siddiqui + Cable, 1960

Family Hirudinellidae

Hirudinella ventricosa (Pallas, 1774)
Baird, 1853

Host: *Acanthocybium sordidum* (Cuvier and Valenciennes), wahoo (Scombridae).

Habitat: Stomach.

Locality: Tema, Ghana.

Date: 31 December 1964.

Specimens: USNM Helm. Coll. No. 63183.

Discussion: We are identifying our three specimens from one host as *H. ventricosa* as a result of the analysis of the genus by Nigrelli and Stunkard (1947). One flattened worm measured about 47 mm long. The testes are extracecal and symmetrical, one on each side of the acetabulum; the ovary is postacetabular; and the genital pore is submedian to the left at the level of the cecal bifurcation.

From Fischthal & Kuntz, 1968

Hirudinella speciesFamily Hirudinellidae
Hirudinella sp.*Host:* *Synaphobranchus oryzi*.*Site:* body cavity.*Incidence and locality:* 1 of 14 at lat 19°00.3' N, long 95°11.1' W (Gulf of Mexico).

DISCUSSION

A single specimen 16.4 mm long by 2.28 mm at the acetabular, or widest, level and not developed sufficiently to identify possibly penetrated into the body cavity as an accidental infection. It had a few poorly formed eggs up to 29 μ long by 23 μ wide, and the ceca were distended posteriorly with hematin-like ingesta.

HIREUDINELLA

Allotomachicola n.g. YAMAGUTI, 1958

Syn. *Pseudotomachicola* Skrjabin et Guschanskaja,
1954, partim

Generic diagnosis. — Hemiuridae, Stomachicolinae: Body long, subcylindrical, muscular, with tail much longer than body proper. Oral sucker subterminal, surmounted by distinct preoral lobe. Prepharynx very short, pharynx ovoid, esophagus short, ceca prominently shouldered at pharyngeal level, terminating at posterior extremity. Acetabulum twice as large as oral sucker, near anterior extremity. Testes oblique, postacetabular. Seminal vesicle elongate saccular, largely preacetabular; pars prostatica bulbous, surrounded by well developed prostate cells; hermaphroditic duct enclosed in oval, muscular pouch, continued into long muscular tumbler-shaped genital atrium. Genital pore posterior or ventral to pharynx. Ovary coarsely lobed, situated medianly close behind posterior testis. Receptaculum seminis inconspicuous (not observed by Srivastava, but later found by Chauhan). Vitellaria composed of seven slender winding tubular lobes, extending laterally, overlapping ceca, but not intruding into uterine coils. Uterus winding largely in intercecal field and occupying most of tail; eggs small, without filament. Excretory arms presumably united in front. Stomach parasites of marine fishes.

Genotype: *A. secundus* (Srivastava, 1939) (Pl. 34, Fig. 444), in *Hemirhamphus limbatus*; Puri, India.

The generic diagnosis and figure are based on the emended description and the original drawings by Chauhan (1954), who kindly sent me the galley proofs of his paper on Trematode Fauna of India. As is evident from the descriptions and figures given by Srivastava and Chauhan, the present species differs fundamentally from any of the members of *Stomachicola* Yamaguti, 1934 and also from *Pseudotomachicola rubea* (Linton, 1910) Skrj. et Gusch., 1954, (vide *Stomachicola rubeus*) in the characters of the genitalia, especially the preacetabular position of the seminal vesicle, the bulbous pars prostatica, the lobed ovary, and the inconspicuous seminal receptacle. *Pseudotomachicola* Skrj. et Gusch. should be suppressed because *P. rubea* (Linton, 1910) (genotype) and *P. magna* (Manter, 1931) undoubtedly belong to *Stomachicola*, and *P. secunda* (Srivastava) is generically different from these two species.



The first representative, *Clupenurus piscicola*, of the subfamily Dinurinae in an Indian host was described by the author in 1935. In this paper is described the second representative of the subfamily in Indian hosts. The new parasite belongs to the genus *Stomachicola* Yamaguti, 1934. *S. secundus*, n. sp. is the largest trematode met with in Indian fishes up to the present time. It is a rare parasite and was found in the stomach of two out of a dozen specimens of the host *Hemirhamphus limbatus* Cub. & Val. examined at Puri in July 1935. The trematode has an elongated, muscular, subcylindrical body, 23–35* in length and a nearly uniform breadth of 2.5–3.4. It is sharply constricted into two parts—body proper and the tail. The latter is equal to twice the length of the body proper. The oral sucker is cup-shaped and subterminal, measuring 0.72–0.95 in diameter. The acetabulum is twice the size of the oral sucker and is situated at the junction of the first two-thirds of the body proper. The prepharynx is extremely small and opens posteriorly into an ovoid pharynx, 0.46–0.52 $\times$ 0.38–0.5 in size. The oesophagus is a small, spherical structure of 0.24 $\times$ 0.18 size and bifurcates into two straight caeca which extend along the sides of the body up to the hinder end of the tail. The caeca have prominent shoulders.

The testes, two in number, are situated asymmetrically in the intercaecal space, one on either side of the median line, close behind the acetabulum. The left testis measures 0.76–1.5 $\times$ 0.54–1.0 in size and is situated anterior to the right testis which is 0.8–1.48 $\times$ 0.7–0.9 in size. The elongated, oval vesicula seminalis, 0.8–1.45 $\times$ 0.4–0.6 in size, extends posteriorly up to the middle of the acetabulum. Anteriorly it opens through a narrow duct into a bulb-shaped pars prostatica, 0.4–0.6 $\times$ 0.2–0.3 in size, surrounded by prostate gland cells. The pars prostatica unites with the terminal part of the uterus into a small oval and muscular hermaphroditic pouch. The genital sinus is a long, muscular, tumbler-shaped structure opening to the outside just behind the pharynx.

The ovary is dome-shaped, with its base directed posteriorly and measures 0.8–0.9 $\times$ 0.88–1.2 in size. It is divided into three lobes, all joined at the ap., and is situated in the median line close behind the posterior testis. The yolk gland mass lies immediately behind the ovary and is of 0.34–0.65 $\times$ 0.56–0.85 size. A receptaculum seminis is absent but the initial part of the uterus is filled with sperms forming receptaculum seminis uterinum. The vitellaria are composed of two long, coiled tubes, extending laterally overlapping the caeca from the level of the middle of the anterior testis to just a little distance into the tail. They do not overlap the uterine coils. The uterus is thrown into intricately coiled loops extending into the tail for about three-fifths to two-thirds of its length. The eggs are numerous, operculate and 0.015–0.023 $\times$ 0.0076–0.01 in size.

The genus *Stomachicola* contains only the type species, *S. muraenesocis*, besides the form described in this paper. The Indian form resembles the type species in its general features and in the topography of the gonads; but it can be easily distinguished from the latter by the relative positions and the size ratio of the suckers, the initial course of the intestinal caeca, the position and shape of the vesicula seminalis, the shape of pars prostatica and the position of the genital pore. Further it differs from the type species in the character of its ovary, absence of receptaculum seminis, nature and extent of vitellaria and the posterior extent of the uterus.

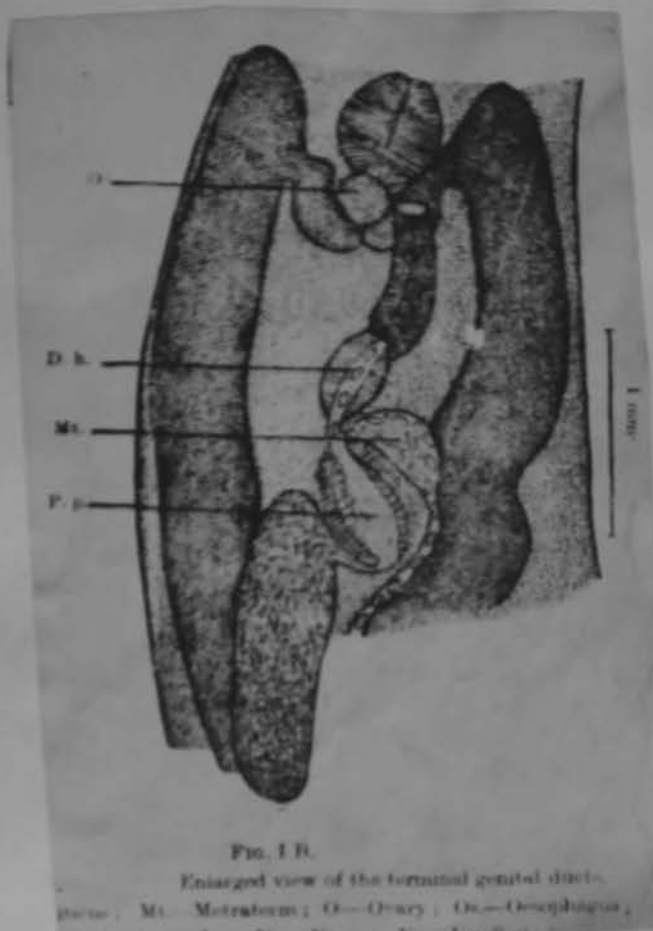


FIG. 1 B.

Enlarged view of the terminal genital ducts.

M. = Metatrachea; O = Ovary; D. h. = Dorsal horn;

Stomachicola secundus Srivastava, 1939

Length: 23-35
 Width: 2.5 to 3.4 Tail equal to 2X body length
 Oral sucker: 0.72 to 0.95
 Acetabulum (size): twice oral
 (location): $1/3$ from ant. end of body proper

Esophagus: small spherical

Pharynx: 0.46 to 0.52 by 0.38 to 0.5

Genital pore: just behind pharynx

Testes (shape): ovoid
 (location): diagonal close behind acetabulum

Cirrus sac:

Ovary (shape): dome-shaped; 3 lobes joined at top
 (location): close behind testes

Vitellaria: two long coiled tubes

Eggs: 15 to 23 by 7.6 to 10 μ

Other features:

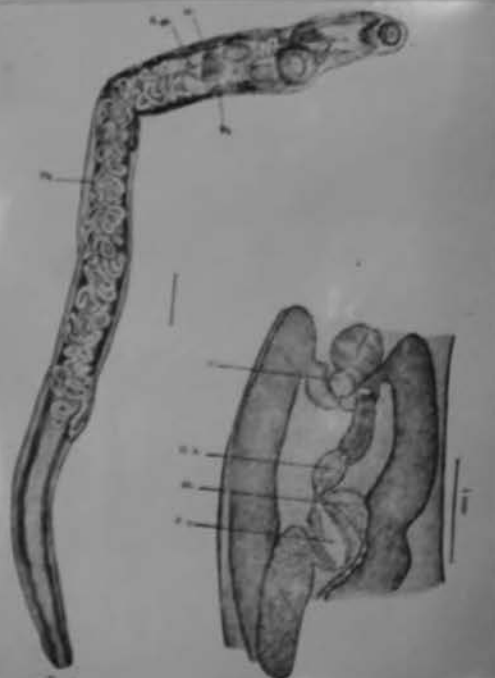
Host: Hemirhamphus limbatus Cuv. & Val.

Locality: Puri, India

Comparisons:

Reference: Indian Jour. Vet. Sci., 9:77-79

Life cycle:



ALLOSTOMACHICOLA

BATHYCOITYLIDAE Dollfus, 1932

Family diagnosis. — Medium-sized to large, elongate distomes. Oral and ventral suckers strongly developed, latter very prominent, encircled by fold of body wall, well apart from former. Pharynx present. Esophagus short, ceca terminating at or near posterior extremity. Testes postacetabular, tandem, in posterior half of body, separated one from the other by intervening ovary. Ductus ejaculatorius opening with metraterm by common genital pore near anterior extremity. Neither cirrus nor cirrus pouch. Ovary intertesticular. Vitellaria tubular, branched, ventral and lateral. Uterus coiled in hindbody as well as in forebody. Excretory vesicle Y-shaped; arms united anteriorly. Parasites of fishes. Including only one genus, *Bathycotyle* Darr, 1902.

Bathycotyle Darr, 1902

Generic diagnosis. — Bathycotylidae: Body robust, covered with thick

DIGESTA OF FISHES

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smooth cuticle. Forebody more or less arched. Oral sucker subterminal, surmounted by preoral lobe. Pharynx moderately developed. Ceca terminating at posterior extremity. Acetabulum large, strongly muscular, about one-third of body length or more from anterior extremity. Testes intercoelal, tandem, with ovary between. Vesicula seminalis tubular, winding. No distinct pars prostatica. Genital pore ventral to pharynx or oral sucker. Ovary median at about middle of hindbody. Receptaculum seminis lacking or represented by circumscribed dilatation of Laurer's canal. Shell gland compact. Vitellaria consisting of 10 or more slender tubules extending in ventral and lateral area near body surface. Uterine coils descending to posterior extremity, then ascending in dorsal area, may or may not reach oral sucker or pharynx. Eggs small, numerous, embryonated. Excretory arms united together dorsal to oral sucker. Parasitic on gills of marine fishes.

Genotype: *B. branchialis* Darr, 1902 in mackerel, German East Africa.

Other species: *B. coryphaenae* Yamaguti, 1938 (Pl. 20, Fig. 257), on gills of *Coryphaena hippurus*, Pacific coast of Japan.

BATHYCOTYLE Darr 1902

Medium-sized distomes with powerful body separated by a deep ventral sucker into a very muscular fore body and a weaker, narrowed hindbody. Suckers powerful. Ventral sucker surrounded by well-developed lips. Skin unarmed, ringed (wrinkled) Pharynx rather powerful, esophagus short, ceca to hind end. Large excretory vesicle, excretory pore terminal, branches uniting over the oral sucker. Genital pore close behind mouth opening. Copulatory organs lacking. Testes in hind body, behind one another, separated by ovary. Ovary between testes, partly over the anterior testis. Sem. res. lacking Laurer's canal present. Vitellaria well developed, tubular. Uterus with numerous coils, first caudalward, then dorsal to the oral sucker, then backward again before leading to genital atrium. Eggs very numerous with well developed opercula. On gills of mackerels.

Type species: Bathycotyle branchialis Darr 1902

From a marine fish (mackerel) near German East Africa

Bathycotyle = deep sucker

Bathycotyle branchialis Darr 1902

Length 9.10 mm., width 1.8 mm. anteriorly; 2.2 at ventral sucker, 2.1 mm. hind body.
 Rounded anteriorly, more pointed posteriorly.
 Oral sucker 1 mm.
 Ventral sucker 1.95 mm., at end of first body third.
 Ventral sucker very deep, nearly reaching dorsal surface.
 Genital pore median under pharynx. Genital atrium 0.12 mm. wide, 0.24 mm. long. The genital pores are located near each other in a small Erhöhung at the base of the atrium.
 Testes median, in hind body, separated by ovary.
 Seminal vesicle in about the middle of fore body, tubular.
 No cirrus. Sperm cells in genital atrium. Darr assumes self-fertilization.
 Ovary large, egg shaped, between testes. L. canal present.
 Uterine sem. rec.
 Vitellaria are paired glands of 5 to 6 long tubes on each side., extending from posterior end to level of anterior testis.
 Eggs 28 by 13 μ . Narrow metraterm 0.3 mm. long.

References: Darr, Adolf, 1902
 Über zwei Fasciolidengattungen
 Zeit. für Wiss. Zool. 71; 644-701

Dollfus, Robert Ph. 1932
 Trematodes in:
 Resultats Scientifiques du Voyage
 aux Indes Orientales Néerlandaises
 de LL. AA RR le Prince et la Princesse Léopold de Belgique. Vol II
 Fasc. 10



Bathycotyle branchialis Dollfus

BATHYCOTYPE

BOTULIDAE Guiart, 1938

Family diagnosis. — Large elongate distomes. Acetabulum ventral, near anterior extremity. Oral sucker terminal, pharynx present. Intestine without anterior limbs. Testes postacetabular; seminal vesicle tubular, winding dorsal to acetabulum. No cirrus pouch. Genital atrium long, tubular, opening ventral to oral sucker. Ovary posttesticular. Uterus surrounding ovary and testes. Vitellaria tubular, reticular, occupying posterior half of body. Excretory vesicle tubular. Parasites of marine fishes.

Type genus: *Botulus* Guiart, 1938.

Botulus Guiart, 1938

Generic diagnosis. — Botulidae Guiart, 1938: Body large, sausage-shaped, slightly pointed at anterior extremity, rounded behind. Oral sucker terminal; its anterior half eversible; pharynx of moderate size, intestinal bifurcation immediately pre-acetabular. Acetabulum with transverse aperture, near anterior extremity. Testes postacetabular. Seminal vesicle long, tubular, folded back on itself two times, mostly dorsal to acetabulum; ductus ejaculatorius opening with metraterm at base of long genital atrium, which opens ventral to oral sucker. Ovary posttesticular. Uterus enclosing testes and ovary dorsally and laterally. Vitellaria tubular, forming network, occupying posterior half of body. Excretory vesicle long, bifurcating behind vitellaria. Parasitic in intestine of marine fishes.

Genotype: *B. alepidosauri* Guiart, 1938 (Pl. 36, Fig. 466), in *Alepidosaurus ferax*; Mediterranean.

Section des **HIRUDINELLIDEA** R. Dollfus 1932Famille des **BOTULIDAE** n. f. **Guiart, 1938**

Famille composée de Distomes ayant l'extérieur d'un *Axygiidae* et la structure interne d'un *Hirudinellidae* et intermédiaire par conséquent entre ces deux familles. Elle ne comprend jusqu'ici qu'un seul genre et une seule espèce.

Genre **Botulus** n. g. **Guiart, 1938**

(du latin *botulus*, saucisson)

10. **Botulus alepidosauri** n. g., n. sp. **Guiart, 1938**

(Pl. A, fig. 5; Pl. n, fig. 24-27)

Campagne de 1897: Stn. 795. Le 1^{er} juillet un *Alepidosaurus ferox* est capturé à palancre, à 2480 mètres de profondeur, par 32° 32' 10" N. et 17° 04' 25" W., dans l'Atlantique au sud de l'île Madère.

Dans l'intestin on trouve deux énormes Trématodes, dont l'un est conservé dans l'alcool formolé et l'autre dans l'alcool à 70°.

Le premier est en excellent état. Il a la forme d'un saucisson (d'où son nom de *botulus*) de coloration blanchâtre avec un orifice béant vers l'extrémité antérieure, la ventouse buccale, et un autre un peu plus bas, la ventouse ventrale; cette dernière est un simple orifice allongé transversalement n'ayant nullement l'aspect d'une ventouse. De profil l'extrémité antérieure est légèrement pointue et l'extrémité postérieure arrondie. Dans l'ensemble le parasite ressemble à un gros asticot. Il mesure 27 millimètres de longueur sur 7 millimètres de largeur et 6 millimètres d'épaisseur. Il a été photographié en cet état, ventralement et de profil (Pl. n, fig. 24 et 25).

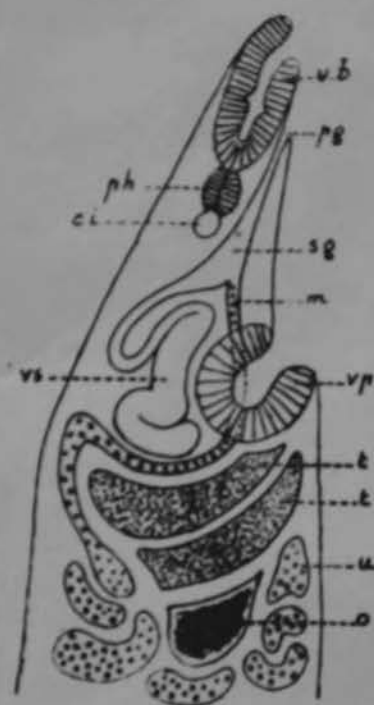
Ces photographies furent très heureuses, car durant les vacances suivantes le tube, enfermé dans une armoire, tomba et se brisa, sans doute à la suite des vibrations provoquées par les cars et camions passant sous les fenêtres du laboratoire. Cet important parasite fut donc retrouvé desséché et malgré nos tentatives il ne put être ramené à son état primitif. Actuellement il ne mesure plus que 18 millimètres de longueur sur 5 millimètres de largeur et 4 millimètres d'épaisseur. Il est vrai que la dessiccation a mis en relief des caractères qui n'étaient pas visibles sur l'exemplaire bien conservé: la rétraction a mis particulièrement en évidence les circonvolutions utérines serrées les unes contre les autres et occupant toute la région moyenne du corps.

Quant au deuxième exemplaire, conservé dans l'alcool à 70°, il était en assez mauvais état de conservation et avait été détérioré, sans doute lors de l'ouverture du tube digestif de l'hôte. En conséquence il fut utilisé pour l'examen histologique.

La ventouse buccale présente une forme très allongée et sa moitié antérieure peut se renverser au-dehors, ce qui agrandit singulièrement la dimension de la ventouse; elle se continue par un pharynx de dimension moyenne, en arrière duquel se trouve la bifurcation intestinale. En arrière de cette bifurcation se voit la ventouse ventrale. Le pore génital, situé sur la face ventrale de la ventouse buccale, communique avec un long atrium génital au fond duquel s'ouvrent isolément les conduits mâle et femelle. Le canal éjaculateur se continue par une longue vésicule séminale repliée deux fois sur elle-même et au fond de laquelle s'ouvre le canal déférent; celui-ci est en rapport avec les deux testicules situés en arrière de la ventouse ventrale; en arrière des testicules se trouve l'ovaire.

Le métraterme, qui s'ouvre au fond de l'atrium communique avec un vaste utérus formé par un long tube, dont les circonvolutions sont étroitement enchevêtrées les unes dans les autres en entourant dorsalement et sur les côtés le champ médian renfermant les testicules et l'ovaire. La moitié postérieure du corps est occupée par les glandes vitellogènes tubuleuses dont les ramifications se fusionnent en formant une sorte de réseau. La vésicule excrétrice assez longue paraît se bifurquer en arrière des vitellogènes.

TRÉMATODES PL. A.



Botulus cablei Stunkard, 1965Host: ALBATROSS BORRERIS GILLLocation: STOMACHLocality: NEAR EASTER ISLAND IN SOUTH PACIFIC depth not statedNo.: 13 SPECIMENS, ALL MALES

The worms (Fig. 1) are ovate to pyriform to fusiform; either end may be bluntly rounded or attenuated to a pointed tip. The body is only slightly flattened dorsoventrally and is broadly oval (Figs. 2, 3) in cross-section. The largest worm is 33.5 mm. long and 12 mm. in greatest width. It is spindle-shaped, attenuated at both anterior and posterior ends. The next largest specimen is 23 mm. long and 11 mm. wide. The sides are almost parallel; it is rounded posteriorly and tapers sharply at the anterior end. The smallest specimen is 11 mm. long and 6.5 mm. wide, broadly ovate with a pointed anterior tip.

The acetabulum is situated about one-fifth of the body length from the anterior end; it measures 1.44 to 2.25 mm. in diameter and the wall is 0.35 to 0.40 mm. in thickness. The cuticle is heavy, 0.15 to 0.25 mm. in thickness; it is unarmed, although rows of fine, often imbricated, transverse ridges may simulate spination. The surface often presents a granular or pebbled-leather appearance, with refringent dots, but these points are apparently the openings of subcuticular glands. The excretory pore is terminal and the tip of the vesicle may protrude as a papilla. The vesicle extends anteriorly, but the exceedingly vacuolated parenchyma makes it impossible to work out the excretory pattern.

The body wall is strongly muscular, especially in the anterior portion of the worm; it is composed of external circular, medial longitudinal, and internal diagonal layers. The longitudinal layer is especially developed, sometimes measuring as much as 0.094 mm. in thickness and composed of six to eight superimposed bundles of fibers. The parenchyma is highly vacuolate, with large fluid-filled cavities.

The mouth is subterminal, the oral sucker is 0.09 to 1.5 mm. in diameter with strong muscular walls (Fig. 2). The lumen is triangular with the ventral apex directed toward the mouth. The sucker is partially overlapped and partially continuous dorsally and posteriorly with the pharynx, which is almost as large as the oral sucker. The lumen of the pharynx is rhomboid to cruciform and the esophagus arises from the dorsal median crus. The esophagus is short and divides into two limbs that diverge laterally, expand to form the two heavy-walled "crops" or "stomachs," and continue laterad and posteriorly to open into the digestive ceca (Fig. 3). The esophagus is lined with cuticle and the ceca by a high columnar epithelium whose free edges are filamentous. Posterior to the gonads, the ceca become columnar, often with folded walls, but they are constricted posteriorly, where their tips communicate with the excretory vesicle (Figs. 1, 4).

The genital pore is located anteriorly and ventrally, a short distance behind the mouth (Fig. 2). A long genital atrium extends to the level of the posterior end of the pharynx and terminates in a dorsally located protrusible and retractile papilla which bears the openings of the male and female genital ducts. The testes are somewhat ventral, opposite or somewhat oblique with the left one slightly anterior and dorsal to the right, overlapping medially, and situated immediately posterior to the acetabulum. Sperm ducts arise from the dorsal, anterior, medial faces of the testes; they pass forward and medial and join above the posterior border of the acetabulum, to form the seminal vesicle, an expanded, thin-walled tube, filled with spermatozoa, which coils about above the acetabulum. It loops posteriorly and turns forward where it is enclosed by a layer, 0.11 to 0.15 mm. in thickness, of deeply staining secretory cells, and surrounded by a fibrous covering. This prostatic section of the male duct coils anteriorly and dorsad, then loses its glandular covering and as a coiled ejaculatory duct, together with the metraterm, enters a muscular-walled sac (Fig. 3), which extends forward and terminates in the papilla which protrudes into the genital atrium.

The ovary is oval, 1.00 to 1.60 mm. long; 1.50 to 1.75 mm. wide; and 1.4 to 1.6 mm. deep, situated slightly left of the median plane. The oviduct arises at the median, posterior face of the ovary and winds ventrad where it receives a duct from the vitelline receptacle and then anteriorly and dorsad to expand into the ootype, surrounded by the cells of Mehlis' gland, which measures about 0.50 mm. in lateral and 1.00 mm. in anteroposterior and dorsoventral dimensions. As the duct reaches



the dorsal portion of the gland. Laurer's canal diverges and coils dorsally, opening to the surface of the body in the midline above the posterior border of the ovary. The uterus begins at the emergence from Mehlis' gland and the initial coils are filled with masses of spermatozoa. The uterus winds posteriad and laterad, the loops become longer to extend from one side of the body to the other, dorsally and ventrally, occupying the middle third of the body and extending forward on either side of the gonads to the level of the acetabulum. Here the wall of the uterus, which previously was very thin and flexible, becomes thick and muscular, and as the metraterm passes forward to enter the muscular sac which encloses it and the ejaculatory duct (Fig. 3). The vitellaria are exceedingly numerous and filamentous, extending in a tangled mass on the ventral side of the body, posteriad in the central or median field at least four-fifths of the distance from the ovary to the posterior end of the body. Anteriorly the vitellaria converge and form a vitelline receptacle from which a short and narrow duct opens into the oviduct. The eggs are oval, thick shelled, operculate and without filaments. They are embryonated when passed and measure 0.030 to 0.034 by 0.023 to 0.025 mm.

The description of *Botulus alepidosauri* by Guiart is so incomplete that it is difficult to recognize the species. The textual account deals with generic characters and the specific features must be derived from the figures. Figure 5 portrays a sagittal section of the anterior region of the body and is highly schematic; Figures 26 and 27 give little precise information. According to Figure 5, the pharynx is much smaller than the oral sucker and quite distinct from it, and the testes are represented as one behind the other. Figure 26 suggests that the vitellaria are dorsal in position, but it is probable that the ventral side of the section is uppermost in the plate. Since the present specimens do not conform to the description of *B. alepidosauri*, they cannot be assigned to that species. The worms are clearly members of the genus *Botulus* and are described as a new species, *Botulus cablei*. Type, cotype, and other specimens are deposited in the U. S. National Museum, Helminthological Collection, No. 60934.

DISCUSSION

Guiart reported the specimens of *B. alepidosauri* were from the intestine of the host, but noted resemblance between them and members of the Azygiidae and the Hirudinellidae. The finding of the worms in the intestine, both dead and one partially disintegrated, indicates that the fish had been dead for some time and that the worms had migrated from the stomach. The members of both the Azygiidae and Hirudinellidae are stomach parasites of fishes, but they are only distantly related and their similarity is clearly a result of convergence. Accordingly, the allocation of the family Botulidae to a position intermediate between the two families is irrelevant. Actually, the morphology of *Botulus* agrees completely with the characters of the family Hirudinellidae Dollfus, 1932, as given by Yamaguti (1958), and permits the inclusion of *Botulus* in that family. Meanwhile the family Botulidae is reduced to a subfamily, Botulinae.

According to a report in Helminthological Abstracts, 30: 355 (1961), A. S. Skrjabin (1958) described a dinurid trematode from *Alepisaurus aesculapius* taken in the Pacific Ocean as a new genus and species, *Profundiella skrjabini*. The specimens differed from members of the Protorchiinae Yamaguti, 1934, family Hemuridae, in the position of the testes and the ovary and in the presence of so-called "stomachs" in the digestive system. These features were predicated as the basis for a new subfamily, Profundiellinae. But where these specimens differed from the Protorchiinae, they agree with the genus *Botulus* and there is a possibility that the two generic concepts are identical. In that event *Profundiella* will disappear as a synonym. Morphological agreement appears sufficient to warrant inclusion of *Profundiella* in the subfamily Botulinae, with suppression of the subfamily Profundiellinae.

LOOSE LEAF ORGANIZER

SCHEDULE

PERIOD OR TIME								
COURSE MON. INSTRUCTOR								
COURSE TUE. INSTRUCTOR								
COURSE WED. INSTRUCTOR								
COURSE THU. INSTRUCTOR								
COURSE FRI. INSTRUCTOR								
COURSE SAT. INSTRUCTOR								

NAME _____

ADDRESS _____

SCHOOL _____

TELEPHONE _____

CAMERONIA n. gen. SILQEE, 1971

Generic diagnosis: Hemiuridae: Stomachicolinae. Very long trematodes, with segmented tail many times longer than body proper and separated from it by a deep fold of cuticle. Invaginable oral sucker and pharynx well developed. Oesophagus very short or absent. Ceca long, usually irregularly dilated throughout its length. Acetabulum many times larger than oral sucker, close to anterior extremity. Testes post-acetabular, partly or entirely extra-caecal and symmetrical. Seminal vesicle pretesticular, elongated or saccular, constricted in the middle. Pars prostatica tubular, may or may not be surrounded by prostate cells. Male and female ducts may open separately or by a common genital pore posteroventral to pharynx or oral sucker. Hermaphroditic duct if present is very short enclosed in a prominent thin walled hermaphroditic sac.

Ovary median, transversely elongated, larger than testes, post-testicular. Receptaculum seminis larger and posterior to ovary. Laurer's canal absent. Vitellaria composed of eight winding tubules meeting between the ovary and receptaculum seminis, extending into tail for some distance. Uterine coils occupy most of the intercaecal and extra-caecal field extending further back of vitellaria in the tail region. Excretory vesicle tubular, arms united anteriorly. Eggs numerous, small, without filament.

TREMATODES OF MURAENESOX CINEREUS (Forsk.)

MANY trematodes are described from the fish *Muraenesox cinereus* by now. Among them *Stomachicola muraenesocis* Yamaguti, 1934 and *Lecithocladium longicaudum* Tseng, 1935, are peculiar in having distinctly annulated hind body or tail (Yamaguti, 1934), and the hind body being capable of splitting into pieces (Tseng, 1935), although Tseng did not mention the process of splitting or any details about it. The author has found from the same fish host of Karachi coast a variety of trematodes which grossly appear similar to the above-mentioned two species. But a detailed study revealed that there are great many differences between the present specimens and *Stomachicola muraenesocis* Yamaguti, 1934 and *Lecithocladium longicaudum* Tseng, 1935. Therefore, two new genera, *Cameronia* and *Segmentatum* (Hemiuridae: Stomachicolinae) are proposed for six different trematodes recovered from the fish *Muraenesox cinereus* of Karachi coast. I take pleasure in naming the former genus in honour of Dr. T. W. M. Cameron, an eminent parasitologist of the world, the latter refers to the segmentation of the hind body confirmed by the histological studies. Six species, *Cameronia octovitellarii*, *C. pakistani*, *Segmentatum karachiensis*, *S. cinereus*, *S. magnaesophagus*, and *S. qadrii*, are described under the two new genera. The last named species is in the honour of Dr. M. A. H. Qadri, Head of this department, Dean of Faculty of Science, University of Karachi, whose help throughout this work is unassessable.

Asexual multiplication also occurs in these trematodes by three different methods reported here. The regeneration of the lost parts in the asexually dividing pieces of the hind body is also studied and described.

SEGMENTATION, ASEXUAL MULTIPLICATION, AND REGENERATION.

The histological studies of the specimens belonging to the above mentioned two genera *Cameronia* and *Segmentatum* revealed that their hind body or tail consisted of numerous segments. The author is using the term segments for the small compartments of the hind body which are separated from each other by two distinct layers of the cuticle continuous with the outer body surface. (Fig. 8). These segments are separable as in the strobila of a cestode (Fig. 10).

In some specimens segmentation was distinct only in the posterior region of the hind body behind the uterine coils, while in others whole tail or hind body was segmented. In addition to segmentation the cuticular annulations were also present (Fig. 9). It should be quite clear that cuticular annulations are not mistaken with the segmentation of the hind body as some people might think. The description is based on the study of serial sections and there is no possibility of misinterpreting the cross bands of cuticula which were cut close to the surface and these deep convolutions give the appearance of segments. The segmentation was obvious even in the whole mount preparations (Fig. 12, 13, 21). The segmentation is also supported by the fact discussed below that the hind body splits into pieces at the point where the segmentation is marked (Fig. 13), and even the segments separate singly (Fig. 10).

Yamaguti (1934) described *Stomachicola muraenesocis* from the same fish host and mentioned about the prominent cuticular annulations on the posterior tail region but he did not make any histological study. Tseng (1935) has shown in his Fig. 3a, the constricted hind body and also mentioned in the legend that the hind body splits into two at the point of constriction but did not describe it in the text. He also made

some histological studies but omitted to mention whether the hind body was segmented in his specimens or not. Probably there was no segmentation otherwise it would have not been ignored as this is something quite peculiar for trematodes to have segmented body. Presumably the trematodes described by Manter (1969) which have internal muscular partitions, represent a connecting link between the unsegmented and the present segmented trematodes.

During the present investigations the asexual multiplication was first noticed by finding small individuals among the large trematodes, the relative size being 1 : 70. The size differences were so marked that a careful examination was desirable. It was realized that most of the small individuals had no other structures except a portion of the hind body with the ceca (Figs. 23, 24, 25, 26, 27), and even a few single segments were recovered (Figs. 10, 11). All were moving actively when alive. Small structures of different sizes were selected and mounted permanently for detail study. Different stages of organ formation were noticed among them. There were some pieces which had both ends equally thick (Fig. 23), while in others one end was thicker. The thicker end becomes the anterior end where the oral sucker develops. Fig. 25 shows a regenerate in which the outer layer is invaginated in the center of the thick end. In the regenerates the intestinal ceca also dilates anteriorly (Figs. 25, 27), some also show abrupt swellings posteriorly (Fig. 24). Actually any change in the intestinal ceca in the hind body is indicative of division or multiplication. It is observed repeatedly that division of hind body is predominated by changes in the intestinal ceca (Figs. 16-21). This may become irregularly dilated (Fig. 16), greatly folded (Figs. 16, 17, 20) or deeply constricted (Figs. 18, 20), ultimately dividing into small pieces (Fig. 19).

Little advanced stages are shown in Figs. 26, 27. As already mentioned the oral sucker makes its appearance by the invagination of cuticle with its underlying cells at the thicker end of the regenerate. The organs developing next to oral sucker are pharynx and acetabulum. Then the testes appear as groups of cells on either side of the acetabulum posteriorly (Figs. 28-33). Little later appears the ovary (Figs. 34-36), soon after or simultaneously develop the vitellaria and uterus. Some very small mature specimens (Fig. 37) probably represent the newly regenerated individuals.

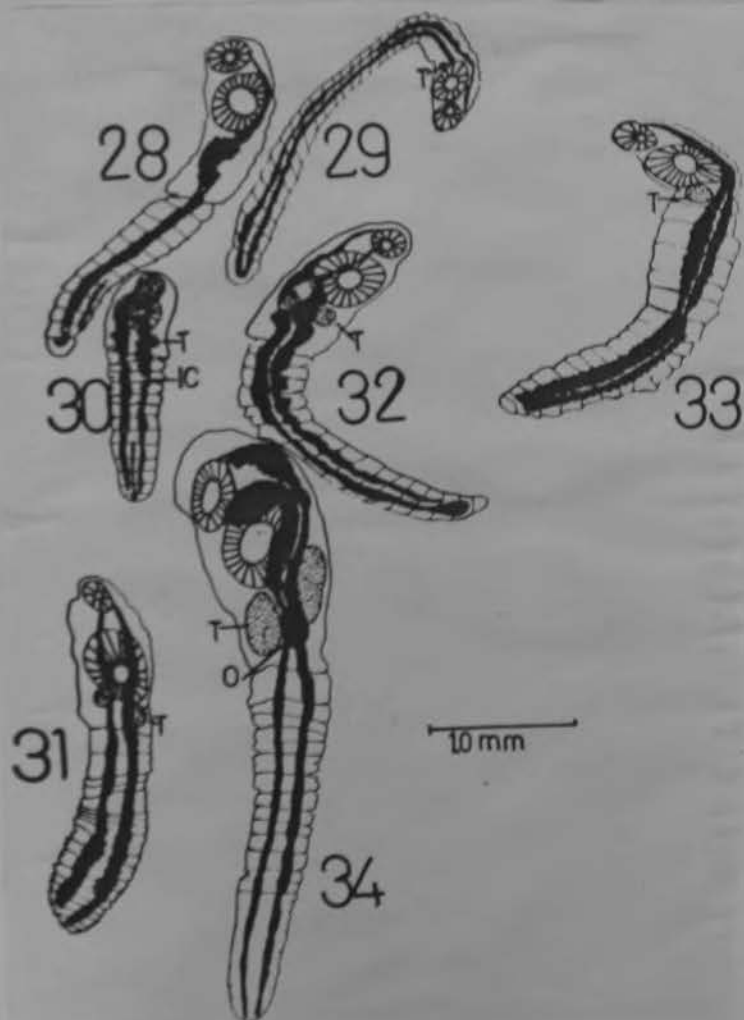
The regenerates were recovered from mixed infections in which all the above mentioned six species were present therefore, it is not definite which regenerate belongs to which species. Although some appear to be that of *Segmentotum kurachensis* (Fig. 35) because of the posteriorly fused ceca and ventrally curved body, while other that of *S. qadrii* (Fig. 36) in which ceca united in the hind body and again separate near the posterior extremity. The regenerates in which ceca remain separate throughout probably represent the other two species *Cameronia octotellarii* and *C. pakistani*.

In the light of present observations one can presume that in these trematodes each segment of the hind body is separable and can regenerate into a new individual.

Three methods of asexual multiplication are noticed namely: (1). Multiplication of hind body into large pieces separating at the point where the segment is marked (Fig. 13). (2) Formation of a constriction at the region where segment is not marked, constriction becomes deeper and deeper resulting into two pieces (Fig. 14, 15). In Fig. 22 is a newly divided specimen at the end of which degenerating tissues are present. (3) Separation of segments singly (Figs. 10, 11) similar to that of cestodes. It is worth noting that in all the cases ceca separate prior to the division of the body region. Other methods of asexual production probably occur as a tendency of budding was also present in some specimens.

The present observations by no means are complete and a further histological study of process of multiplication and regeneration is desirable.

FROM BILQUEES, 1971



CAMERONIA OCTOVITELLARII, ~~n. sp.~~ S. L. QEEF, 1971

(Fig. 1)

Habitat—stomach, Locality—Karachi, W. Pakistan, Number—2 specimens in 1 and 1 in the other, 50 hosts examined.

Description: (Measurements on the holotype only). Body smooth with a segmented tail, most of which was separated in the type specimen, length with a few tail segments being 7.98. While in the other two specimens the tail was 10.7 and 11.8. Body proper flattened anteriorly measuring 6.0 in length and 2.43 in width. Tail segments attenuated posteriorly. Oral sucker subterminal 0.48 long, 0.45 wide. Pharynx prominent 0.24 long, 0.27 wide. Oesophagus apparently lacking. Acetabulum strongly developed, much larger than oral sucker, 1.38 long, 1.41 wide.

Testes smooth, small, postacetabular and ventrolateral to ceca, almost symmetrical, 0.39×0.42 and 0.42×0.45 in size. Seminal vesicle elongated constricted into two parts 0.69×0.24 in size. Pars prostatica tubular connected with the seminal vesicle with a short tubular duct. Male genital opening just posterior to pharynx and anterior to uterine pore.

Ovary median, much larger than testes, and posterior to it transversely elongated 0.48 long, 1.08 wide. Receptaculum seminis larger and posterior to ovary measuring 0.84×1.26 in size. The eight long vitelline tubes four on each side of the receptaculum seminis meet below the ovary. Uterus intercaecal anteriorly but posterior to testes extends into the extracaecal field. Uterine pore preacetabular. Both the uterus and vitellaria extend into tail. Eggs small measuring 0.14×0.09 in size. Excretory arms united anterior to oral sucker.

First described species = Type Species



CAMERONIA PAKISTANI, n. sp. BILQUEES, 1971

(Fig. 2)

Habitat—stomach, Locality—Karachi, W. Pakistan, 2 specimens in 1, 50 hosts examined.

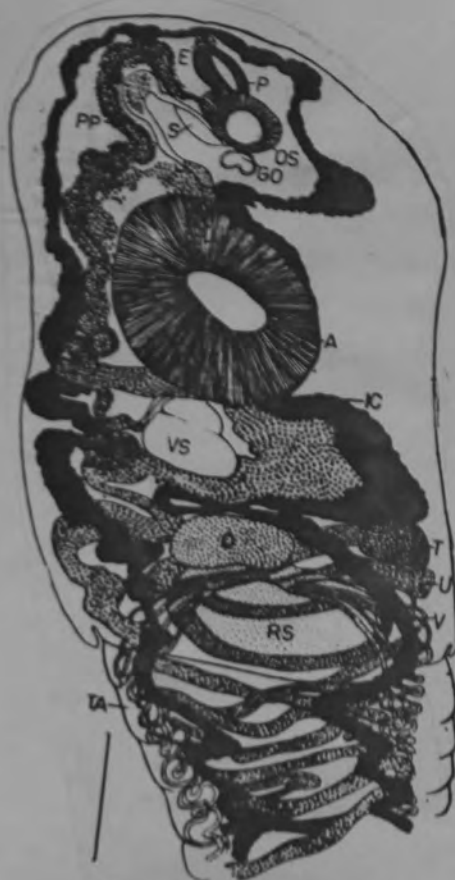
Description: Long trematodes with a segmented tail longer than body proper. In the type specimen body proper length 4.0, width 2.3. Tail 16.8 long, attenuated posteriorly. Oral sucker subterminal 0.36×0.42 in size. Pharynx elongated 0.27×0.24 in size. Oesophagus short and globular. Ceca irregularly dilated throughout its length terminating blindly near the posterior extremity. Acetabulum much larger than oral sucker 1.3 long, 1.2 wide.

Testes postacetabular, almost symmetrical 0.42×0.36 and 0.30×0.36 in size. Seminal vesicle pretesticular, median, saccular, consisting of an anterior smaller portion 0.24×0.21 and posterior larger portion 0.36×0.48 in size. Pars prostatica tubular, enormously developed and surrounded by prostate cells. Hermaphroditic duct very short enclosed in a thin walled sac measuring 0.4×0.16 in size. Genital opening wide, irregular in outline and situated a little anterior to acetabulum.

Ovary median, posttesticular, much larger than testes 0.36×1.05 in size. Seminal receptacle large 0.42×1.20 in size, postovarian. Vitellaria composed of eight long winding tubules meeting at the base of the ovary and extending into tail for some distance. Uterine coils intercaecal, but extend laterally at some places. It extends further back of vitellaria. Eggs small measuring 0.014×0.011 in size. Excretory arms united at the level of pharynx.

REMARKS: *Cameronia pakistani* is differentiated from the above-mentioned species *C. octovitellarii*, mainly by having an oesophagus, a common genital opening, a well developed hermaphroditic sac enclosing the short hermaphroditic duct and excretory arms united at the level of pharynx instead of anterior to oral sucker. The general shape and size of the body proper is also different in the two species.

C. pakistani also differs from *C. octovitellarii*, in having a saccular seminal vesicle while in the latter it is elongated, the ceca also form a more prominent loop in the postacetabular region in the former. The egg size also differs in the two species.



CAMEROONIA

CESTODERA, n. gen. BILQUEES, 1971

Generic diagnosis: Hemiuridae, stomachicolinae—body long, with tail apparently segmented and many times longer than body proper. Oral sucker, and pharynx well developed. Esophagus usually absent. Stomach portions usually very prominent. Ceca long extending to proterior extremity, may or may not be united anteriorly. Acetabulum much larger than oral sucker, near anterior extremity. Testes symmetrical, small, postacetabular. Seminal vesicle also postacetabular, anterior to testes, large and saccular. Pars prostatica long, strongly differentiated, surrounded by numerous prostate gland cells. Hermaphroditic duct if present very short. Genital pore posterior to pharynx. Ovary median or submedian, posttesticular, large. Vitellaria composed of two main tubules uniting immediately anterior to shell gland or receptaculum seminis. The vitelline tubules may or may not divide further extending into tail for some distance. Receptaculum seminis postovarian, large. Shell gland between ovary and receptaculum seminis. Uterine coils occupy the intercaecal field and also extend laterally at some places, descending into tail behind vitellaria. Eggs numerous, small without filaments. Excretory vesicle tubular, arms remain separate or united anterior to oral sucker.

KEY TO THE SPECIES OF CESTODERA

Stomach portions prominent, ceca not united, excretory arms remain separate anterior to oral sucker *C. gastrocecus*.

Stomach portions prominent, ceca united behind the acetabulum excretory arms united anteriorly *C. unicecus*.

TREMATODES OF *ARIUS SERRATUS* Day.

THE cat fish *Arius serratus* locally known as singhara is very common at Karachi coast and is a popular edible fish. Like many other fishes of this coast it also appears to be a favourable host for many helminth parasites including the trematodes. At present three new trematodes are described from this cat fish. Two of them for which a new genus *Cestodera* is proposed appear to be close relatives of the above mentioned trematodes belonging to the genus *Cameronia* and *Segmentatum*, from the fish *Muraenesox cinereus*, as well as with *Stomachicola muraenesocis* Yamaguti, 1934 and *Lecithocladium longicaudum* Tseng, 1935 from same fish host as far as the general shapes of the body is concerned, although differ from them in many important details. Under the new genus two species *Cestodera gastrocecus* and *C. unicecus* are described. The generic name refers to the long cestode like apparently segmented hind body or tail, and the species to the prominent stomach portions and anteriorly united ceca respectively. Histological studies of *C. gastrocecus* are also made and the observations are reported here. The third trematode from *Arius serratus* is identified belonging to the genus *Magnacetabulum* Yamaguti, 1934 and a new species, *M. glandocaudum* is assigned to it due to the presence of some structures differentiating it from the three known species of the genus. A metacercaria of *Magnacetabulum* sp. is also described from a smaller marine fish host *Otolithus argenteus*.

CESTODERA GASTROCECUS, ~~n. sp.~~ *BILQUEES*, 1971

(Figs. 38—47)

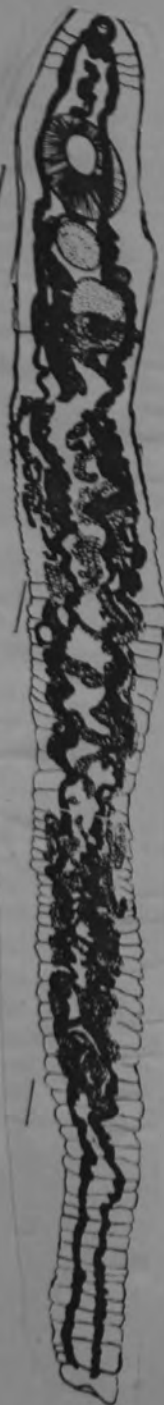
Habitat—stomach; Locality—Karachi, W. Pakistan, Number—4 specimens in 2; 2 in another; 50 host examined.

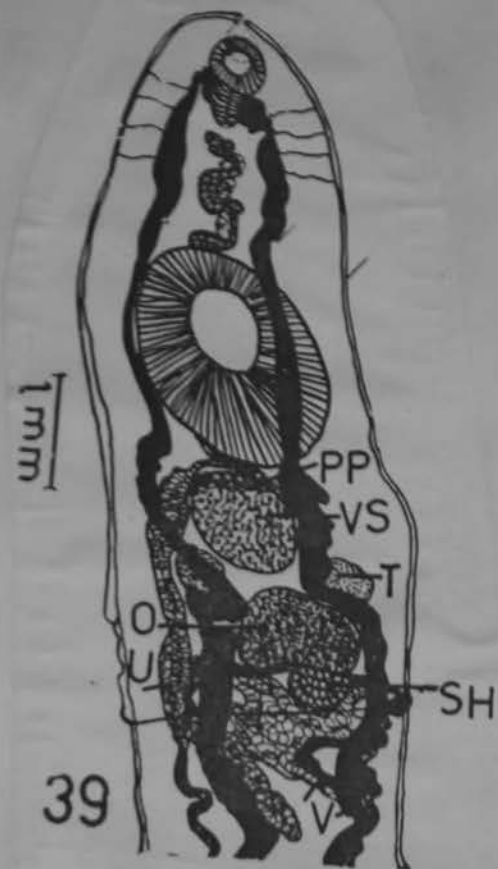
Description: Long, elongated, with a very long segmented tail. Fore-body rounded anteriorly, tail tapering posteriorly. Length 31.0, width at the union of body proper and tail 2.6. Oral sucker 0.5 wide; acetabulum 2.1 wide. Body proper 6.0 long, or about 1/5 body length. Pharynx 0.4 long, 0.3 wide; esophagus indistinct; stomach portions very prominent 0.3×0.4 in size (Figs. 41, 42). Ceca extending to posterior end of body, internally consisting of three distinct layers. An outer homogenous layer probably fibrous; a middle cellular layer the walls of which are not distinctly separated from each other, and contain large vacuoles; an inner irregular layer of black granules (Fig. 45). Tail divided into more than 70 distinct segments. Complete segmentation is noticeable posterior to uterine coils where each segment is separated from other by a thick layer of cuticle continuous with the outer surface cuticle (Figs. 43A—43D).

Testes smooth, subspherical, small, 0.4×0.5 and 0.45×0.56 in size, one on each side posterior to seminal vesicle. Seminal vesicle large 0.81×0.9 , rounded, immediately postacetabular. Numerous prostate cells present surrounding the long well differentiated pars prostatica. Each prostate cell has a dark blue staining nucleus and cytoplasm which is distinguishable into an outer granular region and a central light pink staining area (Fig. 46). Hermaphroditic duct indistinct. The male and female ducts remain separate and unite just before entering the circular genital atrium which is distinctly fibrous (Fig. 44). Genital opening posterior to pharynx.

Ovary slightly irregular in outline posteriorly, transversely elongated measuring 0.45×0.9 , situated immediately behind the tests. Shell gland spherical, closed to posterior border of ovary, small 0.32×0.40 . Seminal receptacle postovarian, large but not prominent in the diagram due to the uterine mass. Vitellaria consisting of two long winding tubules extending into tail and meeting above the shell gland. Each vitelline tubule has a central lumen surrounded by vitelline cells. These cells contain a large bluish brown nucleus and many chromatin particles arranged in different ways (Fig. 47). A black material is noticeable in some parts of the tubules accumulated between the cells. Uterine coils extend back of vitellaria in the tail region. Eggs very small measuring 0.014×0.01 in size. Excretory arms open separately anterior to oral sucker in a depression.

First described species = Type Species





CESTODERA UNICECUS, ~~n. sp.~~ BILGEE, 1971

(Figs. 48, 49)

Habitat—stomach, Locality—Karachi, W. Pakistan, Number—2 specimens in one; 50 host examined.

Description: Long with a very long segmented tail. Fore body rounded, tail attenuated posteriorly. Length about 65, width at the union of body proper and tail 2.5. Oral sucker 1.2 wide; acetabulum 2.2 wide. Body proper about 5.5 long, or 1/12 body length. Pharynx 0.4×0.4 in size, esophagus absent; stomach portions prominent 0.2×0.4 in size. Ceca terminate near posterior extremity and united by a transversely branch just above the ovary.

Testes smooth and symmetrical one on each side posterior to seminal vesicle, and almost covered by the large uterine mass in that region therefore exact size could not be determined but appeared much smaller than seminal vesicle and ovary. Seminal vesicle postacetabular, saccular, large 0.45×0.81 . Pars prostatica long and well differentiated surrounded by numerous prostate gland cells. Male and female ducts unite just before entering into a small genital atrium. Therefore hermaphroditic duct is apparently absent. Genital opening posterior to pharynx.

Ovary transversely elongated, concave anteriorly and convex posteriorly, 0.51×1.27 in size. Shell gland indistinct, probably very small and represented at the point where the vitelline ducts unite. Seminal receptacle postovarian, large 1.05×1.10 , spherical in shape. Vitellaria two long winding tubules entering into tail for some distance. Vitelline ducts united above seminal receptacle. Uterus forms a large mass anteriorly at the union of ceca then extends back into the tail as a coiled tube occupying the intercecal and most of the extracecal field. Uterine coils extend back of vitellaria. Eggs small, numerous measuring 0.018×0.010 in size. Excretory arms united anteriorly.

REMARKS: The large size of the body, smaller body proper, anterior union of ceca, anteriorly united excretory arms and larger eggs serve to differentiate *C. unicecus* from *C. gastrocecus* in which the eggs are smaller, excretory arms open separately anterior to oral sucker, and the ceca remain separate throughout its length. The shell gland in *C. unicecus* is poorly developed while it is well developed in *C. gastrocecus*.

A tendency of budding was also noticed in the tail region of *C. unicecus*, similar to that in hydra, in which a small bulb formed by the budding out of the tegument together with the ceca was prominent. Whether these budlike structures separate or remain attach was not determined. No budlike outgrowths were observed in *C. gastrocecus*.

Discussion

Trematodes of the new genus *Cestodera* appear to be closely related with *Stomachicola muraenesocis* Yamaguti, 1934; *Lecithocladium longicaudum* Tseng, 1935; as well as with the two new genera *Cameronia* and *Segmentatum* described in this communication in the previous pages. This is interesting to note that the two genera and Yamaguti's and Tseng's specimens all are from the fish *Muraenesox cinereus* of different localities. The trematodes of the genus *Cestodera* from the fish *Arius serratus* differ from the above-mentioned specimens by not having a distinct seminal vesicle and seminal receptacle and by having a well differentiated metratrem, separate openings of the excretory arms anteriorly as in the case of *C. gastrocecus*. It also differs from them in having only two vitelline tubes which do not divide even in the posterior region of the body. While in the trematodes from *Muraenesox cinereus* the number of vitelline tubes vary from 2 to 8. These usually have ventrally curved posterior or both ends while the specimens belonging to



Cestodera are dorsoventrally flattened as far as the present observations indicate. *Cestodera* is more closely related to *Cameronia* and *segmentatum* than to *Stomachicola*, as the first named three genera show an internal segmentation of the hind body; while in *Stomachicola muraenesocis* Yamaguti, 1934 and *Lecithocladium longicaudum* Tseng, 1935 no internal division is reported in the hind body, although Tseng has also made some histological studies. Yamaguti (1934) described deep annular constrictions in the posterior region of hind body. It is worth noting that the present specimens also have internal partitions in the hind body as well as the external division. Usually each external marking represents an internal partition but in some cases the cuticular annulations are also present throughout the length of the hind body in addition to the actual segments. One can differentiate the two even in the whole mount preparations. In *Cestodera* segmentation is only distinct in the more posterior part of the hind body which only contains the ceca, and anteriorly the segments are not completely separated unlike in *Cameronia* and *Segmentatum*. A bud like outgrowth as observed in the hind body of *C. unicecus* was also observed by Tseng (1935). But the difference is in the former the bud also contains an outfolding of the cecum while in the latter the bud has no ceca in it. Therefore, one can suggest that in *C. unicecus* the bud may separate. This assumption is actually based on the observations on the segmented trematodes from *Muraenesox cinereus* of Karachi coast, in which asexual multiplication occurs.

CESTODERA

Mediolecithus pacificus nov. fam., gen. et sp. Oshmarin, 1968

Рисунок

Хозяин: сельдь — *Lampla cornubica*.

Локализация: не установлена.

Место обнаружения: северо-западная часть Тихого океана.

Строение. Плоская, листовидной формы трематода, длиной 27 мм, шириной 10 мм. Ротовая присоска открывается субтерминально, она равна $2,222 \times 2,340$ мм. Глотка непосредственно примыкает к ротовой присоске, ее длина 1,62 мм, ширина 1,98 мм. Брюшная присоска, размером $2,31-2,61$ мм, находится в конце первой трети длины трематоды. Задний конец кишечника несколько впереди брюшной присоски. Начальные участки кишечных каналов имеют вадуты, более или менее глубокие перетяжки и изгибы; на всем протяжении в сторону заднего конца тела каналы широкие, стенки их неровные.

Два семенника расположены точно позади брюшной присоски на одной поперечной линии. Правый семенник $1,2 \times 3,4$ мм, левый — $1,76 \times 2,2$ мм. Семяпровод образует большой семенной пузырь в виде широкой извитой трубки с перетяжками и утолщениями. Пузырек расположен непосредственно справа от медиальной линии между центром брюшной присоски и половым отверстием. Мужское половое отверстие, так же как и женское, располагается на вершине гермафродитного полового сосочка,

который выступает из атриальной полости. Вершина полового сосочка находится на уровне заднего края глотки.

Овальный яичник, размером $1,6 \times 2,2$ мм, расположен на уровне семенников вентрально от правой кишечной ветви. Желточники имеют характерное строение и расположение. Они представляют собой шишуровидное образование, многочисленные мелкие и плотные петли которого располагаются интеркально, от уровня кишечника до уровня слепых концов кишечника. Против середины длины тела трематоды петли желточного шнурка особенно плотны, переполнены секретом и образуют крупное шаровидное скопление. Петли матки расположены позади семенников и яичника по всей ширине трематоды, несколько не достигая позади границ средней и задней трети длины тела.

Многочисленные яйца $0,030-0,038 \times 0,019-0,028$ мм.

Систематическое положение. Чрезвычайно своеобразное строение и расположение желточников, а также строение конечных участков мужских и женских половых путей не позволяют отнести описанную трематоду к какому-либо из известных семейств этих животных, поэтому мы обосновываем для нее самостоятельное семейство *Mediolecithidae* nov. fam. с единственным пока родом *Mediolecithus* nov. gen. и видом *M. pacificus* sp. nov.

Приводим характеристику нового семейства.

Рисунок *Mediolecithus pacificus* nov. fam., gen. et sp.



MEDIOLECITHUS

Skryabin, A. S., 1958. The helminth fauna of Alepisaurus aesculapius.

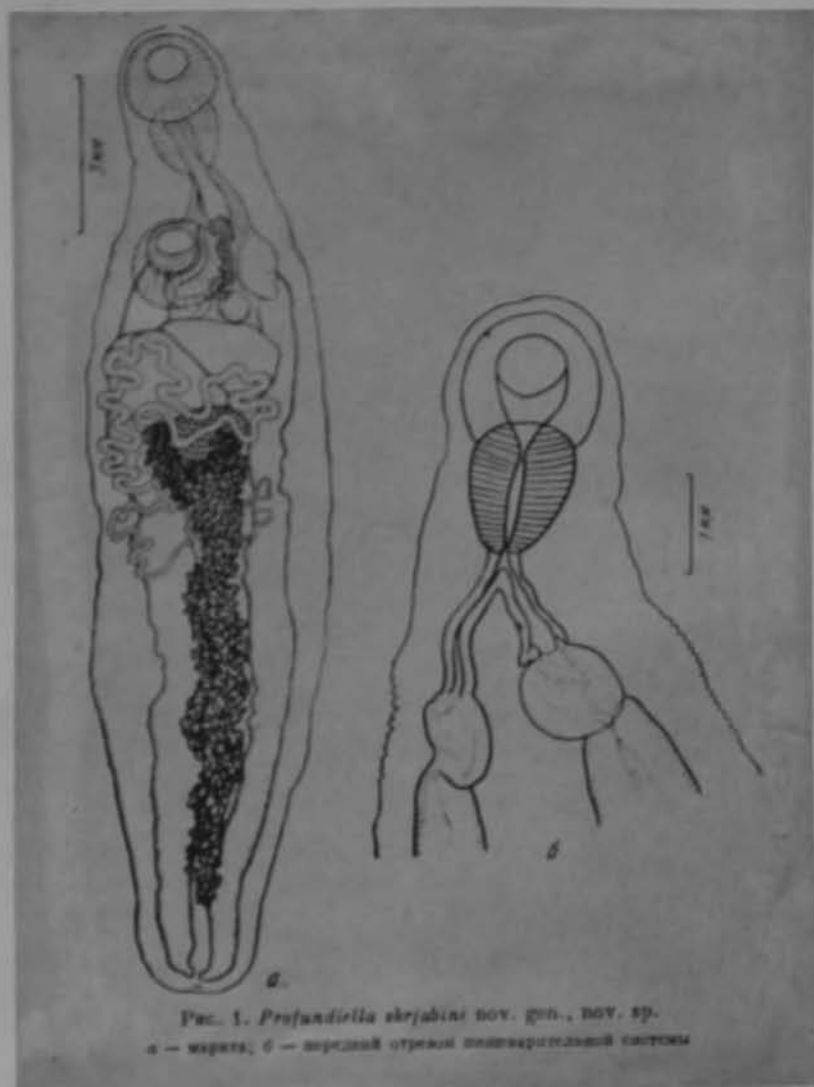
This is the first record of helminths from the deep-water fish Alepisaurus aesculapius. In four specimens from the Pacific were found unidentified Tetrarhynchidae, an unidentified species of Phyllobothrium, larvae of Contracaecum (which are described) and a dinurid trematode, Profundiella skryabini ng., n.sp. In the absence of a tail appendage the new form is nearest to Prosorchinae but differs in the position of the testes behind the ventral sucker and of the ovary at the hind end of the anterior half of the body. These and a characteristic digestive system (prepharynx absent, pharynx and short oesophagus present, caeca dilating at a point one-third along the body into so-called "stomachs") allow a new subfamily, Profundiellinae n. subf., to be erected for the new form. A description of the new species and diagnoses of the genus and subfamily are given.

Papers on Helminthology presented to Academician K. I. Skryabin on his 80th Birthday. Moscow: Izdatelstvo Akademii Nauk SSSR (In Russian).

Profundiella skryabini G. I. Skryabin, 1958

Hemiuridae
Dinurinae

SKRYABIN, A. S., 1958. [Krimski paraziticheski imunit, U.S.S.R.] [The helminth fauna of *Aliposaurus aequalipes*.] Papers on Helminthology presented to Academician K. I. Skryabin on his 80th Birthday. Moscow: Izdatel'stvo Akademii Nauk SSSR, pp. 343-344. [In Russian.] This is a first record of helminths from the deep-water fish *Aliposaurus aequalipes*. In four specimens from the Pacific were found unidentified Tetrathyrididae, an unidentified species of *Phyllobothrium*, larvae of *Conocaulum* (which are described) and a dinurid trematode, *Profundiella skryabini* n.g., n.sp. In the absence of a tail appendage the new form is nearest to *Proserchus* but differs in the position of the testes behind the ventral sucker and of the ovary at the hind end of the anterior half of the body. These and a characteristic digestive system (prepharynx absent, pharynx and short oesophagus present, caeca dilating at a point one-third along the body into so-called "stomachs") allow a new subfamily, *Profundiellinae* n.subf., to be erected for the new form. A description of the new species and diagnoses of the genus and subfamily are given. G. I. Pozniak



PROFUNDIETÀ

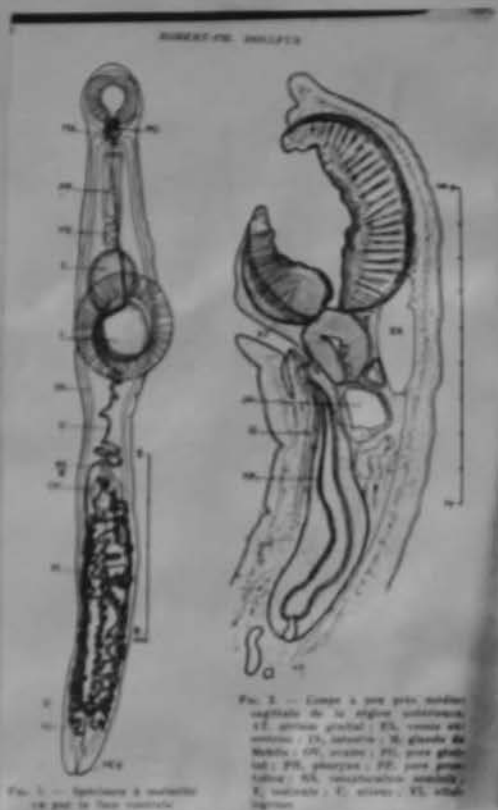
Prosorchiopsis (Prosorchiopsis) legendrei Dollfus, 1947

Host: Centrolophus niger Gmel

Location: body cavity

Locality: Concarneau, N.W. Coast of France.

raised to genus
by Borg & Busch (1954)



DESCRIPTION. — Hémiuride dépourvu de postabdomen. Corps subcylindrique, long de 2 mm. 5 à 9 mm. 5 environ, 7 à 10 fois plus long que large, devenant plus large en avant de l'acetabulum, et moins large en arrière de l'acetabulum. Cuticule lisse et inermes. Ventouse orale subterminale surmontée d'une lèvre préorale. Prépharynx absent; pharynx cylindrique; œsophage absent, partie transversale de l'intestin avec une petite dilatation à chaque extrémité; caeca simples atteignant presque tout à fait l'extrémité postérieure du corps. Acetabulum très proéminent, avec un diamètre presque deux fois celui de la ventouse orale et situé vers la fin du premier tiers de la longueur totale.

Testicule antérieur complètement ou partiellement préacétabulaire; testicule postérieur en contact avec l'antérieur, acétabulaire ou en partie préacétabulaire; la forme des testicules est variable; ils sont tantôt subsphériques, tantôt plus ou moins ellipsoïdaux ou même de forme un peu irrégulière, l'un quelquefois plus gros que l'autre. *Vésicule séminale* plutôt courte, un peu contournée. *Pars prostatica* cylindrique, tubuleuse.

médiane, occupant environ la moitié de la distance entre les ventouses. Les cellules pseudotubulaires sont relativement très petites. Canal hermaphrodite court s'ouvrant au sommet d'une papille conique dans l'atrium génital, celui-ci débouche à l'extérieur vers le niveau du bord antérieur du pharynx.

Ovaire globuleux vers la fin du second tiers de la longueur du corps. *Receptaculum seminis* et glande de Mehlis médians ; immédiatement contre le bord antérieur de l'ovaire. Canal de Laurer mal distinct, vraisemblablement pas long ni dilaté distalement. Uterus décrivant des sinuosités descendantes presque jusqu'à l'extrémité postérieure du corps, puis des sinuosités ascendantes jusque vers le milieu de l'acetabulum, ayant ensuite un trajet direct, médian, ventralement à la *pars prostatica* jusqu'à sa réunion avec le *ductus ejaculatorius* pour former le canal hermaphrodite. Vitellogènes constitués par plusieurs longs tubes contournés et grêles, s'anastomosant et s'étendant entre le bord antérieur de l'ovaire et presque l'extrémité postérieure du corps, c'est-à-dire dans près d'un tiers de la longueur du corps. La *ressie excrétrice* est en Y, elle se bifurque en arrière de l'acetabulum, et ses deux branches, larges, s'unissent dorsalement au pharynx. Œufs ovales : $28,5-31 \times 17-20 \mu$.

12 individus dont plusieurs immatures ont été récoltés à Concarneau (Finistère) dans la cavité générale d'un *Centrolophus niger* Guér. (1), par mon ami René Legendre (20-4-1946), à qui je dédie l'espèce avec mes meilleurs remerciements.

La présence d'un hémichordé adulte dans la cavité générale d'un poisson est évidemment inhabituelle.

DISCUSSION. — Chez les deux espèces actuellement décrites dans le genre *Prosorchiopsis* S. Yamaguti 1934, à l'opposé de l'entrée de l'œsophage dans l'intestin, il y a un petit diverticule ; les deux testicules sont entièrement précétabulaires ; la vésicule séminale est à peu près aussi longue que la *pars prostatica* ; le *receptaculum seminis* et la glande de Mehlis sont soit immédiatement en arrière de l'ovaire (chez *proenopsis*), soit immédiatement en avant (chez *brevisformis*) ; le canal de Laurer, très long, se termine par une dilatation vésiculeuse à une certaine distance en avant de l'ovaire. Chez mes spécimens de *Centrolophus*, qui n'ont pas d'œsophage, il n'y a pas de diverticule opposé à la suture du pharynx avec la partie transversale de l'intestin ; les deux testicules ne sont pas entièrement précétabulaires, le testicule postérieur est dorsal à l'acetabulum et le testicule antérieur n'est pas toujours complètement précétabulaire, il peut ne l'être que partiellement ; la vésicule séminale, contournée, est beaucoup plus courte que la *pars prostatica* ; le *receptaculum seminis* et la glande de Mehlis sont contre le bord antérieur de l'ovaire (comme chez *brevisformis*) ; le canal de Laurer ne s'étend pas loin en avant de l'ovaire et ne se termine pas par une vésicule.

L'ensemble de ces caractères distinctifs me paraît avoir moins d'importance que l'ensemble des caractères concordants ; dans ces conditions, je ne propose pas un nouveau genre, mais seulement un sous-genre : *Prosorchiopsis* n. s. g., qui sera défini ainsi :

Proterochinus sans œsophage, sans diverticule de la partie transversale de l'intestin à l'opposé de l'entrée du pharynx. Testicules jamais postacetabulaires ; le postérieur en partie précétabulaire ou acetabulaire, l'antérieur précétabulaire complètement ou en plus grande partie. Vésicule séminale contournée, courte, beaucoup plus courte que la *pars prostatica*. Longue *pars prostatica* médiane, tubuleuse. *Receptaculum seminis* et glande de Mehlis contre le bord antérieur de l'ovaire. Canal de Laurer relativement court, ne se terminant pas par une vésicule ; autres caractères conformes à la définition du genre par S. Yamaguti.

Cette définition du sous-genre est appelée à être modifiée pour y admettre d'autres espèces. Actuellement, l'espèce-type et seule espèce est *Prosorchiopsis (Prosorchiopsis) legendrei* n. sub. gen., n. sp.

216. *Prosorchiopsis aluterae* n. sp. Yam., 1970
(Fig. 216)

HABITAT: Stomach and intestine of *Alutera scripta*, Hawaii.

HOLOTYPE: U. S. Nat. Mus. Helm. Coll., No. 63797.

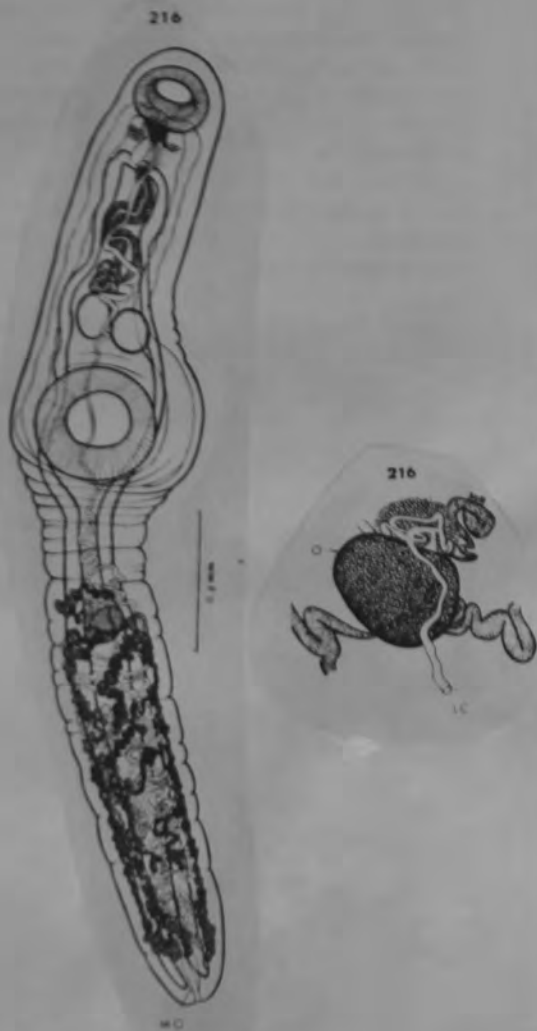
DESCRIPTION (based on two flattened whole mounts):

Body 5.5-8.5 mm long by 1.0-1.1 mm wide at forebody which is wider than the hindbody and occupies more than one-third of body length; hindbody cylindrical, slightly attenuated behind acetabulum. Cuticle smooth. Oral sucker subterminal, 0.32-0.5 X 0.43-0.6 mm, surmounted by conspicuous preoral lobe. Pharynx spherical, 0.12-0.18 X 0.13-0.21 mm, with a mass of postpharyngeal gland cells at its posterior end; esophagus curved back on itself with convex side directed backward; ceca bent at nearly right angles on each side at level of esophagus, terminating at posterior extremity. Acetabulum prominent, 0.6-0.95 X 0.65-0.97 mm, closer to midbody than to head end.

Testes subglobular, 0.25-0.38 X 0.18-0.43 mm, directly tandem or diagonal, immediately pre-acetabular. Seminal vesicle tubular, convoluted, 0.22-0.57 X 0.16-0.2 mm as a whole, contiguous to anterior testis. Pars prostatica long, winding, provided with a dense coat of prostatic cells; its anterior end abruptly tapered as it leads into the ejaculatory duct; the latter joins the likewise attenuated anterior end of metraterm to form a comparatively short hermaphroditic duct which in turn opens into the muscular genital atrium. Genital pore transversely elongated, ventral to pharynx.

Ovary subglobular, 0.2-0.32 X 0.18-0.33 mm, post-equatorial; shell gland compact, immediately anterodorsal to ovary. Vitellaria consisting of four main branches and several terminal branches, one of which lies in front of the ovary, whole organ extending from preovarian region to posterior extremity, encircling intestinal limbs. Common vitelline duct bifurcating two times near ovary. No seminal receptacle. Laurer's canal arising from germiduct near its origin, running backward dorsal to ovary and opening dorsally a little posterior to ovary. Uterus descending to near posterior extremity, then recurring at a distance of about 1.0 mm from posterior extremity, winding ventral to male duct in forebody; metraterm tapered before it joins the ejaculatory duct. Eggs oval, thick-shelled, 25-28 X 16-21 μ . Excretory arms united dorsal to pharynx.

DISCUSSION: This species resembles *Prosorchiopsis legendrei* (Dollfus, 1947) in general anatomy but differs markedly in the location of the testes. Dollfus illustrates in his figure (No. 2) that the distal portion of the seminal vesicle, pars prostatica, and ejaculatory duct are enclosed in an elongate sac, but in my transverse sections as well as in my whole mounts of *Prosorchiopsis nasonis* n. sp. and also in the whole mounts of the present species, I was unable to detect such a sac. If such structure is really present in *P. legendrei*, it should be the most



outstanding feature. Dollfus claims to have observed a seminal receptacle just in front of the ovary, but from my observation of the two Hawaiian representatives, it is certain that there is no true seminal receptacle, in strong contrast with *Prosorchiopsis* Yamaguti, 1934. From the course and structure of the Laurer's canal and presence or absence of a true seminal receptacle, there is no doubt that *Prosorchiopsis* and *Prosorchiopsis* are not congeneric, and as a matter of fact, Skrjabin and Guschan-skaja (1954) correctly raised Dollfus' subgenus *Prosorchiopsis* to generic rank.

As for the presence of a caudal cavity *sui generis* in the present species, it will be discussed in the account of the next species, in which it was clearly seen. Dollfus obviously missed this peculiar structure in his species *P. legendrei*.

217. *Prosorchiopsis nasoni* n. sp. Yam, 1970
(Fig. 217)

HABITAT: Stomach of *Naso hexacanthus*, Hawaii.

HOLOTYPE: U. S. Nat. Mus. Helm. Coll. No. 63798.

DESCRIPTION (based on nine gravid specimens): Body reddish in life, cylindrical, 17-31 mm long, up to 2.5 mm wide at level of acetabulum; hindbody rather slender, widely notched at its tip. Cuticle thick, smooth. Inner longitudinal muscle bundles very strongly developed. Oral sucker subterminal, 1.0-1.8 mm in diameter, surmounted by preoral lobe. Prepharynx very short. Pharynx globular, 0.25-0.4 X 0.34-0.5 mm; esophagus 0.1-0.5 mm long; ceca simple, terminating at posterior extremity. Acetabulum very prominent, 1.8-2.5 mm in diameter, situated at about one-fourth of body length from head end.

Testes subglobular, oval or elliptical, tandem, a short distance anterior to acetabulum, 0.3-0.7 X 0.18-0.33 mm; seminal vesicle tubular, convoluted immediately in front of anterior testis between two ceca, pars prostatica narrow but well developed, more or less winding, 0.8-1.8 mm long lineally, with dense coat of prostatic cells; ejaculatory duct narrower than pars prostatica, comparatively short, joining metraterm to form a short hermaphroditic duct which opens at base of genital atrium. Genital atrium (Fig. 217 B) funnel-shaped, widely opening ventrally to right of median line posterodextral to pharynx.

Ovary oval, reniform or bean-shaped, longitudinally elongated, 0.27-0.6 X 0.13-0.35 mm, pre-equatorial, shell gland compact, immediately anterodorsal to ovary. Vitellaria consisting of two stems, each of which bifurcates several times at irregular intervals, making a total of 10-12 or more, very narrow, winding, terminal branches extending longitudinally in subcuticular peripheral area all around body from preovarian region to near posterior extremity. No seminal receptacle. Laurer's canal not traceable. In the type one vitellarian branch arising from the right stem describes an X-shaped loop in front of the ovary and terminates a little anterodextral to the ovary. This preovarian vitelline branch is present in most gravid specimens, though absent in immature specimens. Uterus descending to a distance of 1.0-3.6 mm from posterior extremity, where it turns forward. Anteriorly it passes dorsal to acetabulum and alongside testes; metraterm well differentiated, joining ejaculatory duct to form a short hermaphroditic duct as mentioned above. Eggs oval, thick-shelled, embryonated, 23-28 X 14-19 μ . Excretory vesicle middorsal, tubular, long, bifurcating immediately behind acetabulum; arms wide, running just lateral to ceca, united anteriorly dorsal to pharynx.

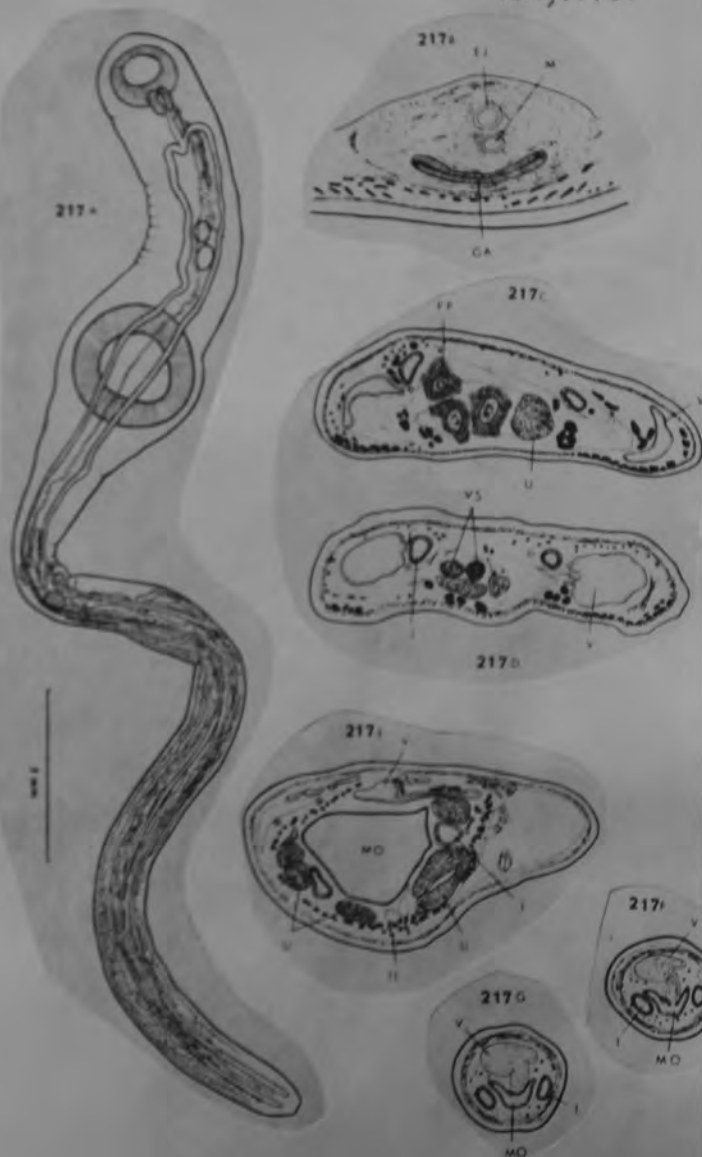
DISCUSSION: This species differs from *Prosorchiopsis sluteri* in the body and organs being much larger and in the acetabulum being situated more anteriorly.

As in *Prosorchiopsis sluteri* there is a long cylindrical cavity between the two ceca ventral to the excretory vesicle. This cavity* is lined with a layer of cuboidal

epithelia and extends in the median intercecal field from just behind the ovary straight down to the posterior extremity, where it joins the excretory canal lined with a thick corrugated cuticle. Since this canal communicates with the excretory vesicle dorsally and opens outside terminally (Fig. 217 F & G), there is an indirect communication between the Manter's organ and the exterior. This cavity contains a small number of desquamating epithelia and detritus. Although its function is unknown, there is no doubt that it is a cylindrical cavity *sui generis*. It certainly constitutes one of the most outstanding features of the genus *Prosorchiopsis*, although it is not mentioned by Dollfus.

* I propose to call this cavity "Manter's organ" in honor of Prof. Emeritus Harold W. Manter, University of Nebraska. In his personal communication Dr. Manter informed me that he also found a similar organ in *Progonotremma*. The function of this organ is unknown, but it seems certain that it serves as an accessory excretory organ as suggested by Manter (1969).

Yam, 1970.



GU CHANG-DONG AND SHEN, JI-WEI, 1979

(7) *Prosorchiopsis plataxonis*, sp. nov. (fig. 7)

Two specimens were secured from the intestine of one out of two *Platax teira* (Forsk.) from Sanya, Hainan Island, Guangdong Province, on April 23, 1964.

This species differs from *Prosorchiopsis aluterae* Yamaguti, 1970 chiefly in the larger size of body and from *P. nasonis* Yamaguti, 1970 in the position of the acetabulum, the distribution of vitellaria, the size of eggs.



图7 燕鱼似前康吸虫 *Prosorchiopsis plataxonis*, 新种的整体腹面

PROS ORCH 10 PSIS

Proserchiinae Yamaguti, 1934

Subfamily diagnosis. — Hemiuridae: Body long, slender, without tail. Acetabulum near anterior extremity. Testes tandem or diagonal, entirely or largely preacetabular. Seminal vesicle pretesticular. Ductus hermaproditicus projecting into genital atrium. Ovary postequatorial. Receptaculum seminis and Laurer's canal present. Vitellaria tubular, long, convoluted, extending between ovary and posterior extremity. Uterus reaching to posterior extremity. Excretory arms united dorsal to pharynx.

Prosorchi Yamaguti, 1934

Generic diagnosis. — Hemiridae, Prosorchiinae. Body long, slender, attenuated for a considerable distance in postacetabular region, without tail. Oral sucker subterminal, surmounted by preoral lobe. Esophagus very short, with posterior outgrowth; ceca terminating at posterior extremity. Acetabulum prominent, larger than oral sucker, near anterior extremity. Testes tandem or diagonal, intercecal, entirely or largely pre-acetabular. Vesicula seminalis elongate, pretesticular. Pars prostatica tubular. Ductus hermaphroditicus projecting into genital atrium. Genital pore ventral to oral sucker or pharynx. Ovary median, ventral, post-equatorial. Receptaculum seminis present. Laurer's canal originating from seminal receptacle, opening some distance in front of ovary into a dorsal vesicular sac which appears to have no external aperture. Vitellaria of seven very long convoluted tubes extending between ovary and posterior extremity. Uterus turning forward at or near posterior extremity; eggs small, numerous, thick-shelled. Excretory arms uniting dorsal to pharynx. Parasitic in digestive tract of marine fishes.

Genotype: *P. paenopus* Yamaguti, 1934 (Pl. 23, Fig. 293), in esophagus of *Paenopus anomala*, Inland Sea of Japan.

Other species:

P. breviformis Srivastava, 1936, in intestine of *Seriolichthys bipinnulatus*; India.

P. legendrei Dollfus, 1947, in *Centrolophus nigra*; Finistère. Djillfus (1947) proposed for this species a new subgenus *Prosorchiopsis*, which was raised to generic rank by Skrjabin and Guschanskaja (1954).

Prosorchi Yamaguti, 1934

GENUS DIAGNOSIS. Hemiuridae Lühe, 1901; *Prosorchi* n. subfam. Body long, slender, annulated in postantabular region. Cuticle thick, unarmed. Inner longitudinal musculature well developed. Oral sucker subterminal. Preoral lip present. Esophagus very short, with posterior diverticle. Ceca simple, terminating at posterior extremity of body. Acetabulum prominent, large, near oral sucker. Testes dorsal, directly tandem, partly overlapping, just in front of acetabulum. Vesicula seminalis elongate. Pars genitalis well differentiated. Ductus hermaphroditicus present. Genital atrium opening ventrally near anterior border of oral sucker. Ovary ventral, a little behind middle of body. Receptaculum seminale small, immediately behind ovary. Laurer's canal opening into dorsal terminal vesicle in front of ovary. Uterine duct convoluted behind ovary. Receptaculum seminale uterinum present. Uterus extending to near posterior end of body. Vitellaria tubular, long, convoluted, extending from ovary to posterior end of body. Eggs numerous, thick-shelled. Excretory system Y-shaped, uniting in front. Parasitic in marine fishes.

Genotype. *Prosorchi puenopsis*. Iceland Sea.

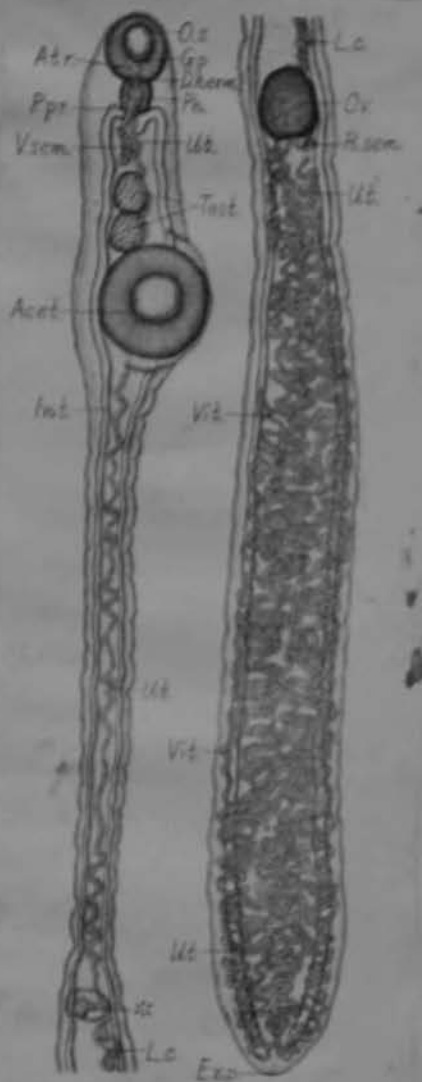


Fig. 121. *Prosorchi puenopsis*; ventral view. Type 12.7 x 0.81 mm.
* Terminal vesicle of Laurer's canal

others: *P. breviformis* Srivastava, 1936
Bay of Bengal

P. (Prosorchiopsis) legendrei Dollfus, 1947

N.W. Coast of France

DESCRIPTION. This worm was frequently found in the esophagus of *Ptenopsis anomala* (Temm. et Schl.) from the Inland Sea. The body is long and slender and particularly attenuated for some distance behind the acetabulum, with the maximum breadth in the caudal third of the body; its anterior end is obliquely truncate in dorsoventral direction, but the posterior is broadly pointed. The cuticle is thick and unarmed and its inner surface is transversely striated by the strongly developed transverse underlying muscular bundles. The subcuticular cells form a very thick compact layer for the whole body. In the forebody there are strong inner longitudinal muscular bundles arising from the oral sucker, and in the hindbody they are joined by more powerful bundles originating from the acetabulum and form a sheath around the internal organs, such as the genitalia, digestive tract, excretory vesicle, etc. The type, 12.7×0.81 mm, was carefully examined in the fresh state and then fixed in alcohol, stained with hematoxylin-eosin and mounted in balsam. The subterminal oral sucker, about 0.37 mm in diameter, is overlapped by the preoral lip about 0.05 mm long. The very short esophagus bifurcates into wide simple ceca extending to the posterior end of the body. Opposite the esophageal insertion there is a conspicuous diverticle, into which the cecal content is seen to enter in the living condition. The prominent acetabulum, 0.63 mm in diameter, lies at the posterior end of the first sixth of the body.

The oval testes, 0.24×0.2 mm, lie dorsally and directly tandem, overlapping each other in front of the acetabulum. There is no cirrus pouch. The elongate vesicula seminalis, 0.26×0.08 mm, is situated longitudinally a little in front of the testes. The tubular pars prostatica is surrounded by prostatic cells. The short ductus ejaculatorius joins the uterus to form a short ductus hermaproditicus projecting into the genital atrium in the form of a papilla. The genital atrium is relatively spacious posteriorly and opens outside on the ventral side of the oral sucker near its anterior border.

The approximately oval ovary, 0.41×0.36 mm, is situated in the median line near the ventral cuticle a little behind the middle of the body. The germiduct arising from the posterior end of the ovary passes obliquely to the left to unite with the receptaculum seminis at its posterior end, where it turns abruptly to the right and then is thrown into close convolutions, one of which extends to near the receptaculum seminis to receive the common vitelline duct. The proximal portion of the uterus functions as receptaculum seminis

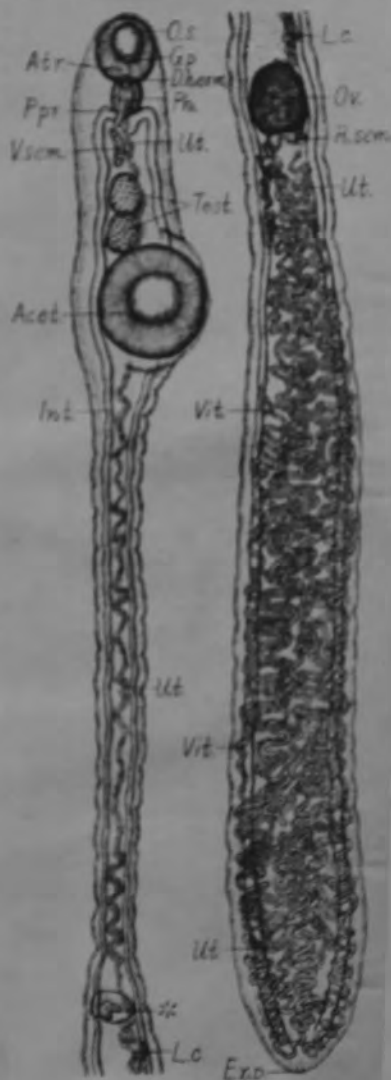


Fig. 131. *Protorchis ptenopsis*; ventral view. Type 12.7×0.81 mm.

* Terminal vesicle of Lauter's canal

uterinum. The small spherical receptaculum seminis lies directly behind the ovary and gives off the Laurer's canal at its anterior end (fig. 132). The canal passes forwards on the left dorsal side of the ovary and after running a sinuous course enters a large dorsal cavity lying about 0.53 mm in front of

the ovary. This cavity, about 0.25×0.2 mm, is very irregular in outline with a trabecular mass of parenchyma; it has no external opening and contains spermatozoa and granular detritus (fig. 131*).

The vitellarium is composed of several long convoluted tubes extending ventrally for the most part from the ovary to the extreme posterior end of the body. The uterus at first coils down on the left side to near the posterior end of the body, where it turns to the right and forwards to pass dorsally to the ovary and then ventrally to the terminal vesicle of the Laurer's canal mentioned above; in the fore-body it passes on the ventral side



Fig. 132. Ovarian complex of *Proserchia jenningsi*, ventral view.

of the testes and vesicula seminalis. The uterine eggs are very numerous, oval, thick-shelled and measure $0.027-0.033 \times 0.018-0.02$ mm.

The excretory system is Y-shaped; the wide tubular vesicle bifurcating just behind the acetabulum is connected with the terminal pore by a narrow passage arising from the dorso-terminal part of the vesicle; the lateral arms unite with each other on the dorsal side of the pharynx.

DISCUSSION. This worm is apparently a hemiurid, but unique in the preacetabular position of the testes and in the presence of a terminal vesicle of the Laurer's canal. It represents not only a new genus but also a new subfamily.

Host—*Seriolithys bipinnulatus* Bleeker.

Habitat—Intestine.

Locality—Puri, Bay of Bengal.

Seven specimens of this interesting trematode were obtained from the intestine of two hosts examined in July, 1935. The worms when alive are light brown in colour and show marked power of contraction and expansion. They can live in normal salt solution for more than six hours. The body is sub-cylindrical, elongated, with a nearly uniform breadth. In permanent mounts it measures 4.5-5.4 mm. in length and 0.75-0.96 mm. a maximum breadth across the acetabular region. It is completely devoid of scales or spines, though unicellular, deeply staining cutaneous gland cells occur in large numbers all over the body.

The oral sucker is situated on the ventral surface behind a roughly triangular, 0.07-0.1 mm. long pre-oral lip. It is a transversely oval structure measuring 0.28-0.32 x 0.3-0.35 mm. in size. The acetabulum is spherical, 0.5-0.58 mm. in diameter, about twice the size of oral sucker and is situated at the junction of the first and second thirds of body length. The oral sucker opens posteriorly into a rudimentary prepharynx visible in extended condition only. The pharynx is well developed and oval, measuring 0.12-0.14 mm. across. The extremely small oesophagus bifurcates into two long, sinuous and uniformly broad caeca extending upto the posterior end. At the intestinal bifurcation is given off a small oesophageal diverticulum similar to that present in *Ophiocorchiis lobatum* and *O. singularis* Srivastava, 1933.

The excretory bladder is Y-shaped. The main stem is a fairly wide sinuous tube extending from the posterior end to the acetabulum. The stem bifurcates into two lateral cornua just behind the acetabulum which anastomose with each other dorsal to the pharynx. The genital atrium is situated in the median line on the ventral surface in level with the posterior thirds of the oral sucker. It encloses a very small genital papilla on which the ductus hermaphroditicus opens.

The testes, two in number, are small, spherical bodies of 0.2-0.28 mm. diameter, occupying an obliquely tandem position in the intercaecal space about half-way between the intestinal bifurcation and acetabulum. The vesicula seminalis is a small, elongated swollen tube of 0.26-0.35 x 0.1-0.14 mm. size and lying between the testes and intestinal bifurcation. It opens anteriorly into a short, tubular pars prostatica, 0.08-0.09 x 0.015-0.04 mm., surrounded by numerous prostatic gland cells. The pars prostatica continues anteriorly into the ductus ejaculatorius which joins the terminal part of the uterus to form the ductus hermaphroditicus.

The ovary is transversely ovoid measuring 0.16-0.28 x 0.2-0.27 mm. in size and situated in the intercaecal space in the first fifth part of the posterior half of body. From its anterior margin is given off a short oviduct which soon receives the ducts from the receptaculum seminis and yolk reservoir before entering the ootype. The receptaculum seminis is a small, spherical structure lying dorso-lateral to the shell gland complex. The Laurer's canal which arises from the receptaculum seminis is a prominent, fairly long and coiled tube ending in a terminal vesicle. The shell gland complex lies immediately in front and partly overlapping the ovary and is nearly two thirds the size of the latter.

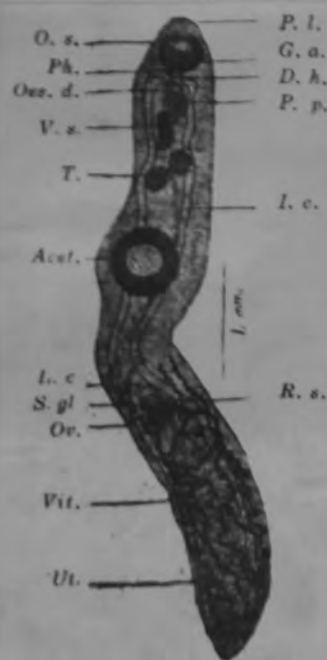


Fig. 1

Prosorchiis breviformis n. sp.

The vitellaria consist of two to four longitudinal, highly convoluted tubes extending from the ovary to the hinder end. The main tubes give off intricately convoluted secondary branches which anastomose with one another. In a few specimens two or three small secondary branches extend to short distances in front of the ovary. The yolk reservoir is very small and lies dorsal to the ovary.

The uterus in the post-ovarian part extends in short transversely arranged descending and ascending coils which overlap each other. In front of the ovary the ascending part runs in short transverse coils upto the pharynx where it receives the ductus ejaculatorius to form the ductus hermaphroditicus. The eggs are small, numerous, light yellow in colour and measure $0.033-0.038 \times 0.018-0.025$ mm. in size.

Paramphis breviformis, n. sp., differs from the type species of the genus *P. yocampus* Yamaguti, 1944, in the shape and much smaller size of body which is uniformly broad with its maximum breadth occurring across the acetabular region, comparatively caudad position of the acetabulum, position of the testes, shell gland complex and receptaculum seminis and the character and disposition of the vitellaria.

Proserchia breviformis Srivastava, 1936

Body subcylindrical, elongated, 4.5 to 5.4 by 0.75 to 0.96. Oral sucker 0.07 to 0.1; acetabulum 0.5 to 0.58; prepharynx rudimentary; pharynx 0.12 to 0.14 across. A small esophageal diverticulation given off at the intestinal bifurcation. Excretory vesicle T-shaped, branches, uniting dorsal to pharynx. Genital atrium median, opposite posterior 1/3 of oral sucker, containing a small genital papilla. Testes spherical, obliquely tandem midway between acetabulum and intestinal bifurcation. Ovary intercecal in first 5th of posterior half of body. Seminal receptacle dorso-lateral to ovary. Shell gland in front of ovary, 2/3 size of ovary. Vitellaria of 2 to 4 highly convoluted tubes from ovary to hind end. Main tubes give off branches which anastomose with one another. Eggs 33 to 38 by 18 to 25 μ .

Host: Seriolichthys bipinnulatus Bleeker (Gray et Gaimard)

Differs from F. paenopsis in shape and smaller size of body more caudad position of the acetabulum, position of testes, character of the vitellaria.

Ref. Proc. Nat. Acad. Sci., India, vol. 6 : 175-178, 1936

Host is Agave bispinulata (Chavez et
Gould, 1924)



Protorchis breviformis Srivastava, 1936

Syn. *Protorchis legendrei* Dollfus, 1947

(Fig. 34)

Host: *Harpodon nehereus*

Location: Intestine

Locality: Fish Harbour, Karachi (Arabian Sea)

The following description is based on six specimens collected from the intestine of a marine fish, *Harpodon nehereus*. A single specimen of this fish was examined at Fish Harbour Karachi in January, 1968.

DESCRIPTION

The body of the worm is elongated and dorsoventrally flattened, with maximum width in the acetabular region. The tail is absent. The oral sucker is subterminal and surrounds a circular mouth opening, provided with a preoral lobe. The pharynx is well developed and is as long as broad. The oesophagus is extremely short. The caeca are narrow and extend to the posterior end of the body. The acetabulum is rounded, very large and pre-equatorial in position. In the region of acetabulum, the body bulges out laterally.

The testes are one behind the other, close together and immediately preacetabular with the posterior margin of the posterior testis overlapping the anterior border of the acetabulum. Both testes are nearly rounded, with entire margins but the posterior testis is larger than the anterior. The ovary is median postequatorial and larger than the testes. It is nearly rounded with entire margins. The vitellaria are in the form of seven very long convoluted tubes, spread in the area between the ovary and posterior end of the body. The uterus extends from posterior extremity of the body to the genital atrium which is in the region of pharynx. Uterine coils are comparatively much more extensive in the postovarian region of the body. The eggs are numerous, small, oval in shape and pale yellow in colour.

MEASUREMENTS (IN MM.)

Body length 2.726-2.826, Body width 0.580-0.589, Oral sucker 0.226-0.228 × 0.226-0.228, Pharynx 0.128-0.129 × 0.098-0.099, Ventral sucker 0.581-0.591 × 0.493-0.513, Ovary 0.158-0.168 × 0.158-0.168, Anterior testis 0.108-0.112 × 0.138-0.142, Posterior testis 0.128-0.132 × 0.168-0.172, Eggs 0.00-0.031 × 0.020-0.021.

DISCUSSION

Protorchis legendrei Dollfus, 1947 has been separated from *P. breviformis* Srivastava, 1936 on the absence of oesophagus, the position of the testes, seminal vesicle and seminal receptacle. The oesophagus in all the species of this genus is very short and in contracted specimens can easily be obliterated from the view. The difference in position of certain organs mentioned above is only slight and can be well within the range to be expected in a species. It is therefore, suggested that the *P. legendrei* Dollfus, 1947 be regarded as a synonym of *P. breviformis* Srivastava, 1936.

The species under study resemble *P. breviformis* Srivastava, 1936 in all the essential characters and is identified as such.

From ZAIDI AND KHAN, 1977



Хозяин: *Rampus argenteus*¹.

Локализация: желудок.

Экстенсивность инвазии 7,5%, интенсивность—1—2 экз. у одной рыбы.

Голотип: препарат № СВ-5025.

Строение. Длина тела 4,94 мм при наибольшей ширине 0,49 мм. Ротовая присоска субтерминальная, $0,38 \times 0,36$ мм, фаринкс $0,20 \times 0,18$ мм, за ним следует пищевод длиной 0,23 мм, образующий дивертикула диаметром 0,15 мм. Брюшная присоска $0,75 \times 0,49$ мм.

Семенники $0,39 \times 0,29$ и $0,36 \times 0,28$ мм, расположены впереди брюшной присоски. Семенной пузырек лежит в передней части тела, его длина 0,35 мм, ширина—0,14 мм. Впереди семенного пузырька располагается группа простатических клеток, занимающих пространство длиной до 0,10 мм; простатический проток впадает в половой сосочек, имеющий размер $0,163 \times 0,100$ мм. С другой стороны, в сосочек впадает маточный проток. Половое отверстие вентро-медианное, открывается у заднего края брюшной присоски.

Яичник $0,29 \times 0,24$ мм, располагается в задней трети тела, семеприемник диаметром 0,12 мм, тельце Мелиса—0,09 мм. Желточные фолликулы

¹ Ю. Л. Мамоевым найден у *Forcipia niger* (см. настоящий сборник).

нителовидные, несколько извитые, расположены между яичником и задним концом тела. Петли матки немногочисленные; яйца размерами $0,025—0,031 \times 0,017—0,020$ мм. Кишечные ветви тянутся до заднего конца тела. Кутикула тела слабо кольчатая.

SOUTH CHINA SEA

"tentacles lightly rumped"
but this may be "strongly"
developed to "strongly rumped"
functioned by "strongly rumped"



а — общий вид гельминта;

Изменчивость признаков. Длина тела исследованных trematод колеблется в пределах 2,10—4,94 мм, наибольшая ширина 0,32—0,49 мм. Ротовая присоска $0,20—0,38 \times 0,20—0,36$ мм, брюшная— $0,35—0,75 \times 0,35—0,49$ мм. Семенники $0,15—0,36 \times 0,13—0,28$ мм и $0,15—0,39 \times 0,11—0,29$ мм; семенной пузырек $0,138—0,350 \times 0,138$ мм; яичник $0,08—0,29 \times 0,08—0,24$ мм; яйца $0,025—0,031 \times 0,014—0,020$ мм.

Систематическое положение. В роде *Protorchis* Yam., 1934 насчитывается два вида *P. psenopsis* Yam., 1934 и *P. breviformis* Srivastava, 1936, описанные, соответственно, от строматеевой рыбы из Японии и от ставриды побережья Индии. Кроме того, в печати находится описанный А. М. Парухиным *P. palinurichthi* из южной Атлантики (личное сообщение). Естественно, что наибольший интерес представляет сравнение наших экземпляров с трематодами, описанными от *Psenopsis* sp. (сем. *Stromateidae*), с которыми они наиболее сходны. Наши трематоды отличаются от *P. psenopsis* следующими признаками: кольчатой кутикулой, экваториальным расположением брюшной присоски, менее развитой задней частью тела, расположением тельца Мелиса и маточного семеприемника впереди, а не позади яичника, как это наблюдается у *P. psenopsis*.

От *P. breviformis* описанные трематоды отличаются более вытянутым телом, удлиненной задней частью его, более короткими и менее извитыми желточными фолликулами, а также расположением заднего семенника на большем расстоянии от переднего края брюшной присоски. От *P. palinurichthi* Paruchin (in lit.) наши трематоды отличаются значительно меньшими размерами тела и других органов.



б — кольчатый отдел половой системы;

if this is a genital cone, then see *Prosegonotrema*.

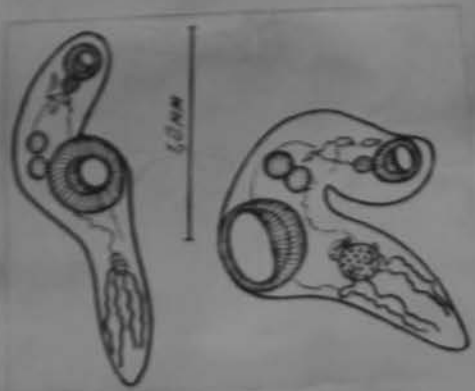
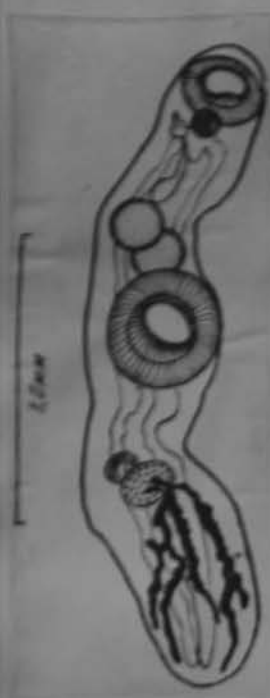


Figure 1. *Strongyloides stenocephali* (Baker, 1924)

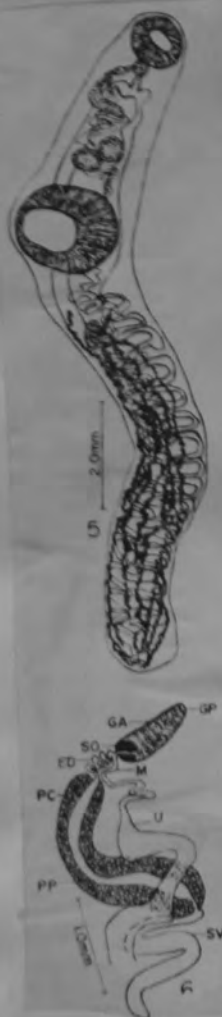
Host: *Amphiprion aeneum* (FERNANDEZ), surgeon-fish (Acanthopomidae).
 Habitat: Shomvi.
 Locality: Tanga, Ghana.
 Date: 5 April 1965.
 Specimens deposited: USNM Helms Coll. No. 71736 (holotype); No. 71737 (paratype).

DIAGNOSIS (based on four adult specimens from one host):
 Body very large, elongate, without exosoma, widest preacetabular at testicular level, anterior extremity round, posterior truncate or nearly so, tegument smooth, 20,150-23,345 long by 3,700-4,365 wide; forebody 5,010-6,820 long, hindbody 11,895-13,255 long, forebody-hindbody length ratio 1 : 1.94-2.62. Oral sucker subterminal ventral, 1,740-1,840 by 1,950-2,055, aperture transversely oval, in anterior half of oral sucker; preoral space 160-

315 long. Acetabulum 2,960-3,270 by 3,215-3,730, aperture round to transversely oval. Sucker length ratio 1 : 1.65-1.88, width ratio 1 : 1.06-1.91. Propharynx absent; pharynx overlapping oral sucker dorsally, 890-920 by 615-645; oesophagus thick walled, muscular, 560-775 long; oesophageal diverticulum large, thick walled, muscular; caecal bifurcation postpharyngeal, pretesticular, near level of anterior part of pars prostatica; caeca extending to near posterior extremity. Excretory bladder Y-shaped, stem bifurcating just postovarian, arms uniting at anterior margin of oral sucker.

Testes two, preacetabular, diagonal to tandem, smooth, contiguous, levels usually overlapping, anterior testis sinistral to posterior one when diagonal; anterior testis 845-1,185 by 765-980, lying 920-1,330 preacetabular; posterior testis 845-1,120 by 790-1,350, lying 390-695 preacetabular. Seminal vesicle long, tubular, serpentine, commencing anterior to one or the other testis. Duct connecting seminal vesicle to pars prostatica thick walled, muscular, 180 by 50 in two worms. Pars prostatica comma, S, or C-shaped, 1,800-2,220 by 185-190, surrounded by dense, compact layer of prostate cells up to 130-170 thick. Ejaculatory duct thick walled, muscular, serpentine, joined by metraterm to form hermaphroditic duct. Latter thick walled, muscular, entirely within sinus organ or short part preceding it. Sinus organ large, papilla-like, projecting into genital atrium, consisting of wide longitudinal muscle layer immediately surrounding hermaphroditic duct and narrower outer circular muscle layer, 145-345 by 170-245. Genital atrium dextral in three worms, sinistral in one, very large, pyriform or club shaped, with thick bands of longitudinal muscles internally and circular muscles external to it, thin layer of longitudinal muscles on outside, 730-810 by 315-360. Genital pore large, transversely oval, lateral to approximate midlength of pharynx or at its lateral margin, dextral in three worms, sinistral in one.

Ovary postacetabular, median, smooth, bean shaped with concavity sinistral in three worms, dextral in one, with papillalike projection on concave side from which oviduct arises, 1,070-1,105 by 585-600, lying 660-1,950 postacetabular. Ootype complex lying in concavity of ovary, overlapping latter sinistro- or dextro-dorsally. Mehlis' gland well developed. Vitellaria consisting of very long, serpentine tubes extending from ovarian level or short distance prev ovarian to near posterior extremity, number difficult to ascertain as tubes branch, overlap one another and are concealed by eggs. Vitelline reservoir overlapping ovary dorsally in two worms, ventrally in two, in ovarian concavity, containing few vitelline cells, 190-235 by 105-155. Uterus sinistral in three worms, dextral in one, extending in short transversely arranged descending (to near posterior extremity) and ascending loops overlapping each other, continuing ascent with short transverse loops between



ovary and acetabulum, with few loops and straight to undulating dorsal and anterior to latter, proximal coils filled with sperm. Metraterm thick walled, muscular, serpentine, entirely anterior to level of pars prostatica or overlapping its anterior level slightly. Eggs numerous, thick shelled, yellow-brown, 15 measuring 26-32 by 17-20.

DISCUSSION : Two species have been described in the genus *Proasorchis* YAMAGUTI, 1934: *P. psenopsis* YAMAGUTI, 1934, from a stromateid fish from Japan; *P. breviformis* SRIVASTAVA, 1936, from a carangid fish from India. PARUKHIN (1966, 1968) and PARUKHIN and KOVALEVA (1967) reported, without description or illustration, *Proasorchis palinurichti* (nom. nud.) from a stromateid fish from South-West Africa. The two described species differ from ours in being considerably smaller, in having a relatively short and straight seminal vesicle and a very short and weakly muscular (?) genital atrium, in the genital pore being ventral to the oral sucker, in the Mehlis' gland lying either posterior (*P. psenopsis*) or anterior (*P. breviformis*) to the ovary, and in the excretory stem bifurcating just postacetabular. *P. psenopsis* differs further in body shape.

Fatima Mujib Bilquees, 1971

Prasurichis hexavitellatus, sp. n., USNM No. 71941.

The description is based on two specimens from one host. Body long and slender, fore-body narrower than hind-body. Holotype length 4.95, maximum width 0.21. Oral sucker subterminal, surmounted by small preoral lobe 0.12 in length. Pharynx prominent, 0.086×0.12 , ceca long reaching to near posterior end of body. Acetabulum larger than oral sucker 0.5×0.61 in size. Testes tandem, preacetabular, oval, anterior 0.29×0.29 , posterior 0.32×0.29 . Seminal vesicle oval in shape 0.18×0.15 , pretesticular. Pars prostatica long and narrow, surrounded by prostate gland cells. Hermaphroditic duct enclosed in a thin-walled sinus sac, genital atrium indistinct, genital pore ventral to posterior border of pharynx.

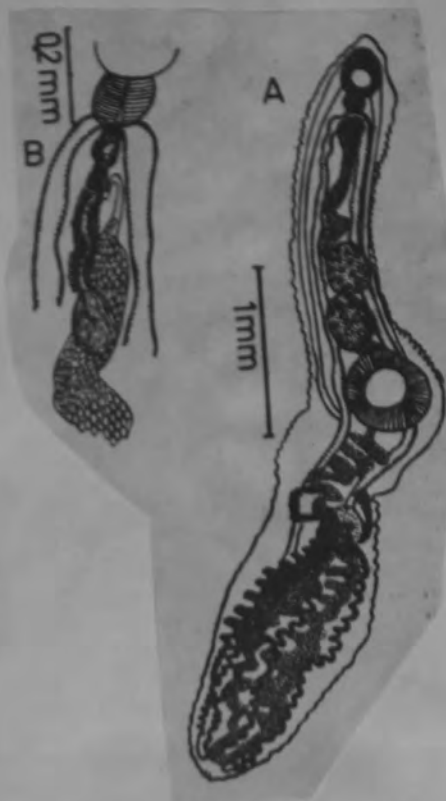
Ovary smooth, small 0.25×0.29 , situated behind acetabulum in posterior half of body. Receptaculum seminis 0.28×0.299 in size, larger than ovary. Vitellaria of six long, convoluted tubules, two extending anteriorly for a short distance and four longer tubules reaching to posterior extremity. The two anteriorly directed tubules are dilated at the distal end. Uterus coiling to posterior end of body and then forward, dorsal to acetabulum and gonads, joining the sinus sac

behind the cecal bifurcation. Eggs elongated, small $0.024-0.025 \times 0.0180-0.0184$ in size. Excretory vesicle bifurcating immediately posterior to acetabulum, arms dilated anteriorly and uniting dorsal to oral sucker.

Remarks.—*Prasurichis hexavitellatus*, differs from *P. stromatei*, by having only two testes, more prominent preoral lobe, difference in sucker ratio, differences in general shape and size, genital pore ventral to pharynx instead of ventral to oral sucker, a well-differentiated sinus sac, and much smaller seminal vesicle. The two anteriorly directed vitelline tubes in *P. hexavitellatus* are also much smaller than in *P. stromatei*.

Discussion

An interesting host-parasite relationship is noticeable in the genus *Prasurichis* Yamaguti. Hosts represent the fish families Stromateidae, Pampidae,¹ Centrolophidae⁴ and Carangidae.² Jordan⁶ states that "Pampidae and Centrolophidae are closely allied to Stromateidae" and that "Carangidae has the general aspect of Stromateus". *Serialichthys bipinnulatus*, the host of *Prasurichis breviformis*³ is a synonym of *Elagatis bipinnulatus* (Quoy et Gaimard, 1824), and *Serialichthys* Bleeker, 1854, is a synonym of *Elagatis* Bennett, 1840 (Carangidae).⁶



(A) *Prasurichis hexavitellatus*, sp. n., holotype, ventral view
(B) Anterior region of the same, ventral view showing the terminal genitalia.

The new species *Prorochis strumati*, from *Stomatopus sinensis* of the Karachi coast, is smaller than the type species *P. pumops*¹ and proportionately wider. Ratio of width to length in the former is 1:5, and in the latter it is 1:15.5. *Prorochis strumati* is also relatively wider than *P. breviformis*, *Prorochiopsis legendrei*⁴ and *P. chainanensis*.⁵ The new species has a third extracanal testes which is absent in the known species. The position of two larger testes is similar to *P. pumops*, *P. breviformis* and *P. chainanensis*, but differs from *Prorochiopsis legendrei*, in which even the anterior testes is not entirely anterior to acetabulum. *Prorochis strumati* can also be differentiated by its broader anterior end with small preoral lobe, large ovary, wider seminal vesicle and six vitelline tubes; two of which extend anteriorly from the level of ovary while four longer extend posteriorly reaching to posterior extremity. In *Prorochis pumops*, there are seven vitelline tubes, in *P. breviformis* there are two to four tubes extending from the ovary to the posterior end; the main tubes giving off convoluted, anastomosing secondary branches. *Prorochiopsis legendrei* has four convoluted vitelline tubes extending from the anterior border of ovary, reaching to little above the posterior end of body. *P. chainanensis* also has four but relatively small convoluted tubes arising almost from the middle of ovary, reaching to posterior extremity. Eggs of *P. strumati* are the smallest among the known species.

Prorochis hexavitellatus, is somewhat similar to *P. breviformis*,² in size relationship but can be differentiated from the latter by having no esophageal diverticulum, narrow fore-body, broad and rounded posterior end, six convoluted vitelline tubules; two smaller of which extend anterior to the ovary while four longer extend from the ovary to the posterior extremity, anterior excretory arm dilation, and smaller eggs. Eggs of *P. hexavitellatus* are also much smaller than *P. pumops*,¹ *Prorochiopsis legendrei*⁴ and *P. chainanensis*.⁵ A sinus sac enclosing the hermaphroditic duct is also present in *P. hexavitellatus* which is absent in the known species and in *P. strumati*.

Proserchia galimerichthi Paruchin (in press) [1970]

referred to by Lokicer in discussion of
Proserchia chainanensis

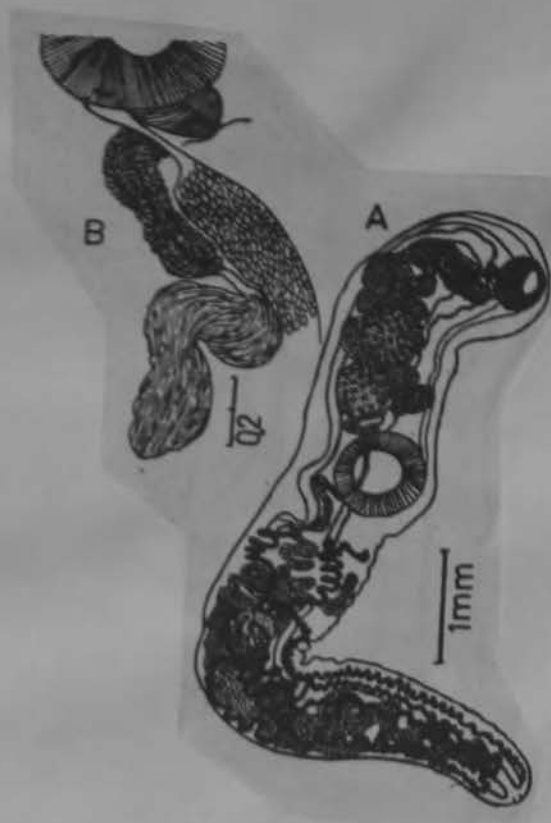
P. chainanensis differs from P. galimerichthi
(which is from Pomops sp. taken on the South
Atlantic) by: rumped cuticle, equatorial location
of acetabulum, less development of posterior part
of body, location of nephridial gland and ovary...
significantly smaller body

Description

Presorcheis stromati, sp. n., holotype, Dorsolateral view
 Fatima Majid Bilal, 1971
 CSNM No. 71940

Body long and slender, broader anteriorly, narrow posteriorly. Length 7.9, width 1.6. Oral sucker subterminal 0.47×0.51 . Preoral lobe small, 0.05 long. Pharynx small, 0.122×0.177 , esophagus lacking, ceca reaching to posterior extremity. Acetabulum large 0.87×0.94 , pre-equatorial. Testes three, spherical, preacetabular; two large intercaecal, equal in size 0.58×0.61 ; third smaller, extracaecal, 0.32×0.36 in size and connected with the posterior intra-caecal testes by a small duct. Seminal vesicle elongated, twisted to form roughly a 'S' shape, 0.56×0.14 , situated anterior to testes. Prostatic complex well differentiated, long, surrounded by numerous prostatic cells. Hermaphroditic duct small, genital atrium funnel shaped, genital pore wide, ventral and near the posterior border of oral sucker.

Ovary postacetabular, in posterior half of the body, smooth, 0.43×0.44 . Receptaculum seminis small 0.182×0.327 , prev ovarian. Laurer's canal present, arising at the posterior end of receptaculum seminis and passing down on the dorsal side of the ovary. Vitellaria composed of six long, convoluted tubules, four extending from level of ovary to posterior extremity, two extending anteriorly between ovary and acetabulum. Descending uterus reaches posterior end of worm, ascending dorsal to ovary, passing dorsal to testes and seminal vesicle, joining the hermaphroditic duct at the level of cecal bifurcation and in turn to the genital atrium posterior to pharynx. Eggs numerous, small $0.026-0.07 \times 0.014-0.015$ in size. Excretory vesicle 'Y' shaped, lateral arms dilating anteriorly and uniting at level of oral sucker.



Presorcheis stromati, sp. n., holotype, Dorsolateral view
 (B) Anterior region of the same showing the genital atrium

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GENUS: PROSORCHIS



- P. psenopsis
- P. breviformis
- ⊖ P. (P.) legendrei

● P. chrysomelae
 ⊖ P. palmarum

PROSOPICHTIS

Sclerodistomoides n. g. Kamegai, 1971

Generic diagnosis. Sclerodistomidae: Body large, unarmed. Oral sucker terminal; pharynx globular; esophagus short; no stomach portion at proximal end of caeca; undulating caeca terminating blindly at posterior extremity. Acetabulum larger than oral sucker in first one-third of body. Testes lobate, post-acetabular, diagonal. Vesicula seminalis preacetabular, convoluted; pars prostatica short; genital cone present; genital atrium well developed, opening ventral to pharynx in median line. Ovary oval, equatorial, in submedian line. Laurer's canal present. No receptaculum seminis. Shell gland compact. Vitellaria dendritic, distributed more than one half of the hindbody ventrally, vitelline reservoir absent. Uterus intercaecal, reaching near posterior extremity of body, metraterm preacetabular. Eggs small with thick shell. Excretory vesicle Y-shaped, arms with many short tubules, united dorsal to oral sucker; pore terminal. Parasitic in gall bladder of marine teleosts.

Type and only species: *Sclerodistomoides pacificus* n. g., n. sp.

Sclerodistomoides pacificus n. g., n. sp. Kamegai, 1971

(Figs. 1-3)

Host: *Cypselurus pinnatifidus japonicus*.

Location: Gall bladder.

Locality: Hachijo Island, Pacific coast of Japan.

Date: May 11, 1970.

Specimens: Holotype and paratypes deposited in Meguro Parasitological Museum, Coll. No. 16709, 16721.

Frequency: Eight worms in thirty five hosts examined.

Description. Based on eight specimens. Body stout, 21-30 mm long by 6-7 mm wide near middle of hindbody; cuticle unarmed; forebody attenuating anteriorly; hindbody more or less cylindrical. Oral sucker terminal, $0.5-0.76 \times 0.63-0.89$ mm; pharynx $0.33-0.49 \times 0.3-0.4$ mm; esophagus shorter than pharynx; undulating caeca distended with dark granular ingesta, terminating blindly at posterior extremity of body. Acetabulum larger than oral sucker, $1.6-2.5 \times 2.1-3.1$ mm, situated at middle of first one third of the body. Sucker ratio 1:2.3-4.

Testes slightly lobate, $0.8-1.8 \times 1.1-2.3$ mm, situated diagonally in posterior part of the first one-third of the body, ventral to caeca. Seminal vesicle tubular, 80-190 μ wide, convoluted, immediately preacetabular; pars prostatica tubular, short, surrounded by thick layer of prostate cells; ejaculatory duct short, joining metraterm about in the middle of genital cone to form hermaphroditic duct; genital cone 200 μ long by 175 μ wide at base in paratype. Genital atrium well differentiated at level of esophagus, opening ventral to pharynx in median line.

Ovary oval, $0.76-1.1 \times 0.9-1.2$ mm, situated in submedian line at equatorial level of the body. Laurer's canal opening dorsally in median line, 1.5 mm long posterior to ovary in holotype. No receptaculum seminis. Shell gland compact, posterodextral to ovary. Vitellaria dendritic, main vitelline duct in median line; many short subdivided side branches in extracaecal fields, extending ventrad from posterior border of testes to near mid-level of the lower third of body, without forming vitelline reservoir. Uterus intercaecal, reaching near caudal end of body, metraterm preacetabular, muscular. Receptaculum seminis uterum conspicuous in proximal uterine coils. Eggs oval, $30-45 \times 22-30 \mu$ in life, with a small knob at anti-opercular pole. Egg shell very thick, 2.5-4 μ thick. Excretory vesicle Y-shaped, bifurcated into two arms some distance from posterior extremity of body, united dorsal to oral sucker; pore terminal. Excretory arms possessing numerous short anastomosing tubules in hind body and fewer tubules in forebody; further details of system not made out.

Discussion. The present genus differs distinctly from the most closely related genus *Sclerodistomum* Looss, 1912 in that the vitellaria are dendritic rather than being undivided, slender, very long, twisted tubular lobes; and also in having no stomach portion at the proximal end of the caeca.



SCALE RODISTOMOPDES

SCLERODISTOMIDAE Dollfus, 1932

Family diagnosis. — Body stout, with thick cuticle and vesicular parenchyma. Oral sucker subterminal, directly followed by pharynx.

Esophagus very short. Ceca with stomach portion at commencement, terminating blindly at posterior extremity. Acetabulum large, prominent, situated toward midbody. Testes postacetabular. Vesicula seminalis tubular, winding, dorsal or anterior to acetabulum. Pars prostatica winding, with dense coat of prostatic cells. Genital cone enclosing hermaphroditic duct, opening into well developed genital atrium. Genital pore midventral, between two suckers. Ovary posttesticular. No receptaculum seminis. Laurer's canal present. Uterus strongly winding, occupying all available space of intercecal field of hindbody. Vitellaria divided on each side of hindbody posterior to testes into several long slender winding tubules. Excretory vesicle V-shaped. Parasites of marine fishes. Including only one genus, *Sclerodistomum* Loos, 1912.

HEMIURIDAE

Sclerodistominae Odhner, 1927

(Distomum clavatum group)

Large, powerfully built forms, some truly giant distomes, without tail appendage, with a powerful, cone-shaped copulatory organ which can be by protrusion elevated in a very wide genital atrium or sinus (the inner part of this sinus is often embedded with the opening -portion of the genital passages in a mass of much intertwined muscles; vitellaria consisting of numerous, branched, fine tubes. (from Odhner, 1927)

Genera: Sclerodistomum Looss

Eurycoelum Brock 1886 Nachr. Ges. 18: 543

Hirudinella Garsin

Isoparorchis Southwell

(Syn.: Leptolecithurus Kobayshi)

Considered a family by Dollfus

1932 Mem. Mus. R. Hist. Nat. Belg. 11(10) p. 2

Sclerodistomum Loosa, 1912

Generic diagnosis. — Sclerodistomidae: Cuticle transversely folded. Acetabulum equatorial or pre-equatorial, larger than oral sucker. Testes situated symmetrically or diagonally in postacetabular intercecal field. Genital cone and genital atrium very large, postbifurcal; genital pore immediately postbifurcal or pre-acetabular. Ovary more or less out of median line, a little nearer to acetabulum than to posterior extremity. Vitellaria mostly ventral, partly dorsal to ceca, extending between level of testes and posterior extremity. Uterus reaching to near posterior extremity; eggs small, numerous. Excretory vesicle V-shaped, with terminal pore. Stomach parasites of marine fishes.

Genotype: *S. italicum* (Stossich, 1893) (Pl. 23, Fig. 304), in *Lichia amia*; Triest.

Other species:

- S. diodontis* Yamaguti, 1942 (Pl. 23, Fig. 303), in *Diodon holocanthus*; Naha and Pacific coast of Mexico.
- S. sphaeroides* Manter, 1947, in body cavity of *Sphaeroides spengleri*; Florida.

SCLERODISTOMUM Looss, 1912

This genus was named for Distomum italicum Stossich, 1893 which is therefore the type species. Its host was Lichia amia.

This trematode has the following characteristics:

Length 13 to 15 mm., thickness 5 mm., width 5-6 mm. Body thick, flattened, acetabulum about in the middle. Underside hollowed out, wrinkled by many cross-folds of the smooth skin. Oral sucker 2 mm. in diameter, acetabulum 4 mm. Genital pore at anterior edge of acetabulum, surrounded by strong out-foldings of the skin. (variation: oral sucker 1.8 to 2; acetabulum 3. to 3.6 ?) Body very muscular. Skin with folds and also numerous conical points as described for Hirudinella by Poirer (1885: pl.28, fig.2).

No prepharynx. Pharynx 0.04 long, 0.045 wide. Esophagus 0.7 long, muscular, bending back dorsal to oral sucker where lies the bifurcation. Cecae also muscular, first bowing outward then backward over the sides of the acetabulum. Posterior to acetabulum they present outpocketings not unlike those of a leech's intestine; whether these are caused by deep indentations of the wall or only as a result of a passive folding of the intestine with the body contraction remains a question.

Excretory system well developed and complicated, analyzed with difficulty and with doubt. Pore at posterior end; in front of it a rather wide tubular space which runs from one side to the other in a bow parallel to the body sides to disappear anteriorly among the other organs. Between this cavity and the body wall a rather crowded row of large, usually round, clear lacunae which can be followed forward along the sides of the body until the thickness of the body prevents their observation. Between lacunae and body wall appear, especially in the body ends, here and there, clear, much branching canals. The canal leading from the pore to the above-mentioned bow-shaped space widens (before its entrance) into a funnel-shaped space- ? The arms of the bow-shaped space extend forward not entirely to the middle of the hindbody where they end blindly. Looss could not detect their connection to the rest of the system. He says: "Thus, the posterior part of the excretory vesicle is U-shaped or V-shaped. Its only connection with the rest of the system is median just opposite the pore. Here a rather thick-walled canal leads into a second larger space which has an irregular but in general antero-posteriorly flattened form and gives off a short blind tube on the dorsal side running forward and out, on the ventral side running backward and out. The only opening of the entire vesicular part lies about median and opposite the opening into the first vesicle. In front of the small connecting canal lies the third section (Ex³). This ends off numerous tubes toward the dorsal and the ventral running obliquely outward and fork again. The main space zigzags in the hindbody and at the acetabulum forks into two branches which surround the sucker and extend into the forebody. The vesicular swelling are apparently branches of this third section. Vitellaria tubular, branched. Other organs as in Hirudinella. Reference: ZoolJahrb.Supl.15:323-366.

SCLERODISTOMUM Looss, 1912

Diagnosis (original, after Looss' long description of the species)

Large, thick-bodied, smooth-skinned, tailless hemiurids. Fore-body hollowed. Excretory system Y-shaped but very complicated with many bulbous branches, with three regions in the stem, the posterior of which sends out two lateral processes. Genital pore median, between the suckers, nearer the ventral sucker. Large muscular genital cone in genital atrium. Short ductus hermaphroditicus which forks near the tip of the cone into two sex ducts. Pars prostatica long but closely coiled in region of genital cone, partly joined to cone by fibrous parenchyma. Seminal vesicle a coiled tube near the pars prostatica, not extending posterior to ventral sucker. Testes two slightly irregular in shape, symmetrical, right and left, not far posterior to ventral sucker. Ovary to the left, posttesticular. Laurer's canal present. Seminal receptacle absent. Vitellaria tubular, long, closely coiled, somewhat branched, chiefly ventral, occupying much of the space behind the testes. Uterus coils ventrally to near the posterior end, then dorsally to near the genital cone. Eggs thick-shelled, yellow-brown, unsegmented.

Type species: S. italicum (Stoss)

from the stomach of *Lichia amia*, at Triest

Zool. Jahrb. ~~Suppl.~~ Suppl. 15: 323-366 3 tables

Sclerodistomum bravoae — **PERCIVAL, 1963**
(Syn. "*S. diodontis* Yam., 1942" of
Bravo-Hollis, 1954)
(Figs. 9 and 10)

Host: *Diodon hystrix* L., 'o'opu-kawa (Diodontidae) type host; one specimen from one of four hosts.

Location: Uncertain; attached to piece of tissue recovered from coelom washing.

Holotype: No. 50892.

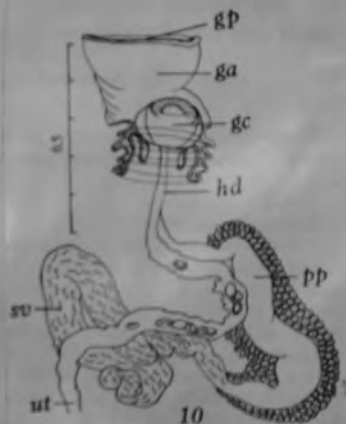
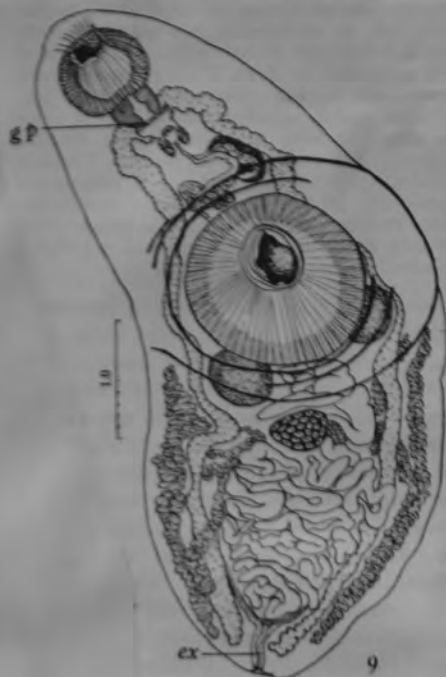
Description of Hawaiian specimen: Body contracted, 6.327 long by 2.226 wide; cuticula 0.020 to 0.035 thick; forebody about one-third body length, slightly tapered; hindbody less tapered, bluntly rounded. Oral sucker subterminal, 0.704 wide by 0.657 long; acetabulum prominent, 1.258 wide by 1.368 long, aperture longitudinal; sucker ratio 1:1.8. Pharynx immediately following oral sucker, 0.335 long by 0.322 wide; esophagus short, extending dorsally; cecal bifurcation dorsal to posterior part of pharynx; ceca muscular, extending to posterior end of body.

Testes symmetrical, just median to ceca and slightly overlapping posterior edge of acetabulum, separated by uterus, ovoid, 0.463 to 0.500 long by 0.352 to 0.407 wide; seminal vesicle tubular, immediately preacetabular, coiled on right side of

intercecal space; pars penitica sinuous, antero-sinistral to seminal vesicle, with thick layer of prostatic cells; ejaculatory duct short, joining metraterm at base of genital cone to form hermaphroditic duct; genital cone (contracted) 0.181 long by 0.161 wide; genital atrium 0.362 long by 0.302 wide at genital pore. Genital pore median, ventral to cecal bifurcation.

Ovary posttesticular, submedian, ovoid, 0.315 long by 0.369 wide; Laurer's canal not observed; Mehlis' gland median to ovary; vitellaria tubular and coiled, originating as seven tubes (four on one side, three on the other) but subdividing laterally, extending from level of testes to near tips of ceca in extracecal space. Uterus intercecal, much coiled in hindbody, extending forward between testes; metraterm slightly sinuous dorsal and anterior to acetabulum, joining ejaculatory duct at base of genital cone. Eggs ovoid, 32 by 22 to 24; shell 3 to 4 thick. Primary excretory vesicle Y-shaped with cellular wall; stem 0.396 long, arms extending forward median to ceca; tubules lateral to ceca in forebody but system otherwise obscured by internal organs.

Discussion: *Sclerodistomum diodontis* Yam., 1942, from the stomach of *Diodon holacanthus* L., has an elongate body, diagonal testes that are close together, and vitellaria that reach the testicular level but stop considerably posterior to the acetabulum. Bravo-Hollis (1954) reported *S. diodontis* from the body cavity of *D. holacanthus* in the Mexican Pacific, but her specimen, like the Hawaiian one, has symmetrical testes situated at the posterior edge of the acetabulum and vitelline tubules extending almost to the acetabulum. The Mexican specimen appears to be less contracted than the Hawaiian specimen, and differs chiefly in longer hindbody, sinistral rather than submedian ovary, and vitellaria that do not reach the tips of the ceca. I believe the two are conspecific, and propose the name *S. bravoae*



in honor of Margarita Bravo-Hollis who reported the Mexican specimen. *S. bravoae* is very similar to *S. diodontis*, but differs chiefly in the position of the testes. Gosline and Brock (1960) note that the fish *D. hystrix* may be the adult of *D. holacanthus*, in which case the hosts in Mexico and Hawaii would be the same species.

S. bravoae resembles *S. italicum* (Stossich, 1893) Looss, 1912, in the position of the testes, but differs in smaller body size, more anterior genital pore, and entirely preacetabular seminal vesicle.

HABITAT: Stomach of *Diodon* sp. (*Aystris*?); Hawaii.
DESCRIPTION (based on two whole mounts): Body massive, 5.4-7.5 X 2.2-2.7 mm as fixed under strong cover glass pressure. Cuticle very thick (up to 50 μ), wrinkled. Oral sucker subterminal, 0.53-0.6 X 0.66-0.8 mm; pharynx 0.21-0.25 X 0.28-0.34 mm; esophagus practically absent; ceca terminating at posterior extremity. Acetabulum very prominent, 1.1-1.55 X 1.18-1.7 mm, situated largely in anterior part of middle third of body.

Testes rounded, 0.46-0.62 X 0.35-0.46 mm, subsymmetrical, overlapping posterolateral edge of acetabulum. Seminal vesicle tubular, convoluted, overlapping anterodistal edge of acetabulum. Pars prostatica curved or convoluted, well differentiated, with thick layer of prostate cells, joining metraterm in genital cone; genital cone projecting into genital atrium, which in turn opens ventrally by a large transverse slit at level of posterior end of pharynx.

Ovary oval, 0.35 X 0.45-0.5 mm, nearly median or slightly to left, postequatorial. Vitellaria composed of strongly winding, narrow tubules extending from behind acetabulum to near cecal ends. Uterus first descending from behind ovary to near posterior extremity, and then ascending, thus occupying whole postovarian intercecal area, metraterm sinuous, pre-acetabular. Eggs oval, thick-shelled, 32-42 X 21-28 μ . Excretory vesicle Y-shaped; arms apparently united dorsal to oral sucker.
DISCUSSION. Our specimens agree very well with Pritchard's description and figure.

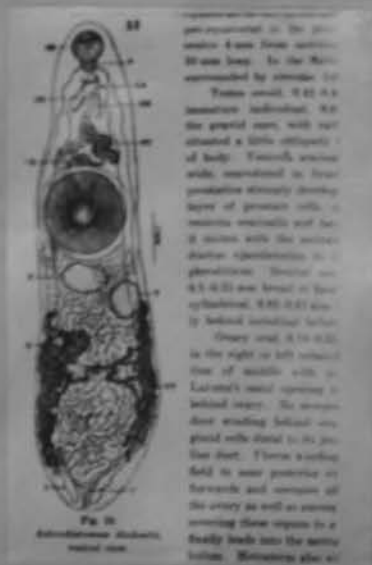
Ham, 1970



Sclerodistomus diodontis Yamaguti, 1942

Body robust, 6.2 to 10. by 1.5 to 2.7 mm; cuticula unarmed.
Very muscular.
Oral sucker 0.55 to 0.68 wide.
Acetabulum prominent 1.15 to 1.65 in diameter.
Testes ovoid with uneven surface, obliquely tandem, at about middle of body.
Seminal vesicle tubular, convoluted in front of acetabulum.
Para prostatica strongly developed, surrounded by dense layer of cells, spirally twisted between sem. ves and base of genital cone where it unites with the metraterm.
Genital cone 0.25 to 0.5 mm. long; genital atrium nearly cylindrical, opening immediately behind bifurcation.
Ovary oval, in right or left submedian line near junction of middle with posterior third.
No seminal receptacle. L. canal present.
Uterus winding backward to near posterior end; metraterm begins dorsal to acetabulum.
Vitellaria divided into very long, slender, strongly twisted tubular lobes, number undetermined. In an immature specimen there were 9 on the right and 8 on the left. In gravid specimens they extend from level of posterior testis to posterior end of uterus.
Excretory vesicle V-shaped.
Eggs 30 to 45 by 21 to 27 μ .
Host: Diodon holacanthus; stomach
Japan; Naha

Compared with S. italicum, differs in size, position of genital pore, posterior extent of vitellaria.



4. *Sclerodistomum diadema* Yamaguti, 1942 (Fig. 2)

Host: *Dioses holomastix* Linnaeus.

Location: intestine.

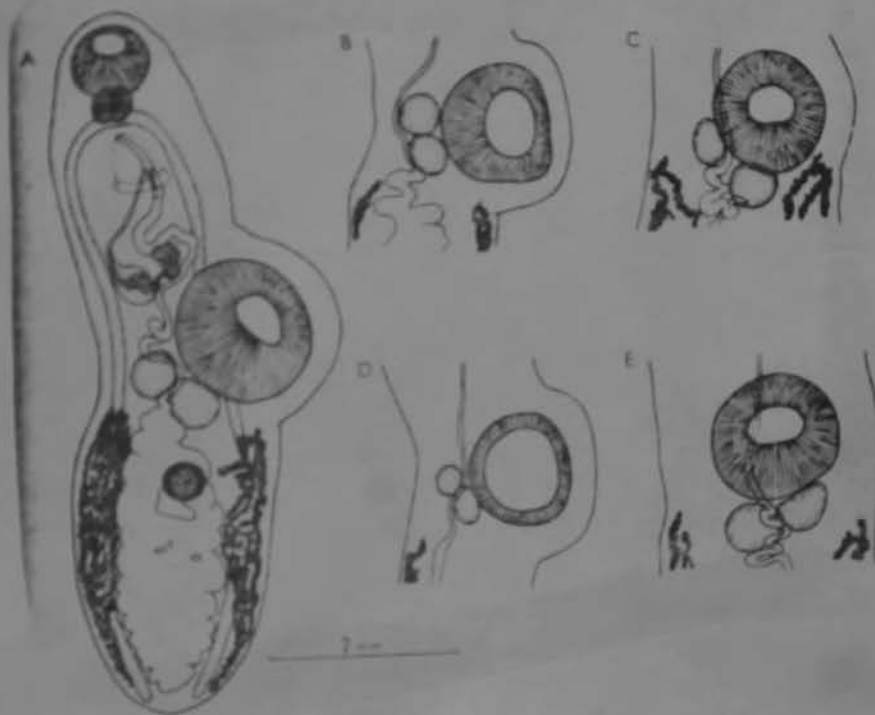
Locality: Litoral Santa Fe (provincia Bahama).

In the only host examined five specimens were found.

Description: Length of body 6.25–8.59 mm, maximum width 1.985 to 2.584 mm. Oral sucker 0.633–0.885 $\times$ 0.639–0.748 mm, acetabulum situated approximately in middle of body length, size 1.197–1.523 $\times$ 1.129 to

1.387 mm. Pharynx rounded (0.313–0.476 $\times$ 0.272–0.381 mm), caeca slender, reaching to posterior end of body. Testes oval (0.340–0.639 $\times$ 0.299–0.544 mm), diagonal or almost symmetrical, posterior to acetabulum or at its level. Large seminal vesicle present, provided with very developed prostatic part; genital pore immediately behind intestinal bifurcation. Oviduct (0.258–0.558 $\times$ 0.163–0.367 mm) submedially behind testes. Uterus with many upward and downward branches in space between caeca. Eggs measuring 0.033–0.042 $\times$ 0.027–0.030 mm. Vitellaria consist

of many tubular lobes situated dorsally and laterally to caeca in space from testes almost to posterior end of body.



The species *S. diadema* was described from *Dioses holomastix* from Japan (Yamaguti, 1942); later it was found in the same host from the Mexican Pacific (Bray-Holmes, 1954).

In 1963 Pritchard, on the basis of the only specimen, described a new species, *Sclerodistomum leucom*, from the host *Dioses luteus* (probably identical with *D. holomastix* — see Gosline and Bruck, 1960) from the Hawaiian Islands, differentiating it from *S. diadema* essentially by the symmetrical position of testes only. To this new species Pritchard (1963) also attributed the specimens recorded by Bray-Holmes (1954) as *S. diadema* from the coast of Mexico. As we observed in specimens from our material, the position of testes is rather variable (see Fig. 2) so that this feature has no taxonomical value. Since there are no metrical differences as well between *S. leucom* and *S. diadema*, we consider the entire *S. leucom* Pritchard, 1963 a synonym of *S. diadema* Yamaguti, 1942.

Sclerodistomus italicus

Hirudinellidae

Sclerodistomum italicum (Stossich, 1893) Looss, 1912.

SYNONYM: *Distomum italicum* Stossich, 1893.

HOSTS: **Tremnodon saltator* VALENCIENNES (Pomatoidae); **Dentex canariensis* FRIEDRICHSEN (Sparidae); **Seriola dumerili* (Risso) (Carangidae).

SITE: Stomach, small intestine.

LOCALITIES: 11° 30' N, 17° 30' W (*S. dumerili*); Gorda (others); Scorgal.

DATES: 1954 (*T. saltator*); 9 November 1955 (*D. canariensis*); 13 February 1956 (*S. dumerili*).

SECTIMENS DEPOSITED: USNM Helms, Coll. No. 71902 (from *T. saltator*); No. 71903 (*D. canariensis*); No. 71904 (*S. dumerili*).

DISCUSSION: This species has been described from *Lichia amia* (L.) (Carangidae) from the Adriatic Sea. Our collection consists of two adult and one immature worms from the first host listed, two adults from the second, and one adult from the third.

From Flachérol and Thomas, 1972.

1973

54. *Sclerodistomum rachycentri* Paruchin, sp. nov. (рис. 3).Хозяин: нигрита *Rachycentron canadus* (Kaup) (Rachycentridae).

Локализация: желудок.

Место и время обнаружения: Индийский океан, Аравийское море, июнь 1967 г. (экспедиция № 13).

Описание. Крупная трематода, кутикула не несет вооружения, но покрыта по всему телу мелкими складками. Длина тела 21 мм при максимальной ширине 5 мм. Крупная ротовая присоска расположена терминально, ее диаметр $1,45 \times 1,54$ мм. Префаринкс очень короткий, фаринкс диаметром $0,65 \times 0,45$ мм. Пищевод отсутствует. Развилка кишечника начинается непосредственно за фаринксом и ветви кишечника, располагаясь по краям тела, тянутся до хвостового конца. Брюшная присоска значительно крупнее ротовой и расположена в средней части тела. Ее диаметр $2,63 \times 2,43$ мм. Семенники лежат за брюшной присоской и находятся между ветвями кишечника, располагаясь параллельно друг другу. Диаметр левого семенника $0,62 \times 0,80$ мм, правого — $0,62 \times 0,88$ мм. Яичник лежит позади одного из семенников и отделен от него ветвями матки. Его диаметр $0,42 \times 0,68$ мм. Матка образует множество петель и простирается от брюшной присоски до задней части тела, не заходя на ветви кишечника. Желточники лежат в задней части тела, начинаясь за семенниками, и тянутся в виде длинных узких трубок, переплетающихся между собой, до конца тела располагаясь в боковых полях и заходя с внутренней стороны на ветви кишечника. Яйца многочисленные, размером $0,040 \times 0,026-0,033$ мм, толстостенные. Толщина скорлупы яиц $0,005$ мм. Крупное половое отверстие, лежащее впереди брюшной присоски, ведет в половой атриум. Он содержит конический выступ, на вершине которого открывается узкий гермафродитный канал.

Изменчивость признаков (по 3 экз.). Длина тела 21—23 мм при ширине 5—6 мм. Диаметр ротовой присоски варьировал у разных особей в пределах $1,45-1,63 \times 1,54-1,77$ мм, диаметр брюшной присоски составлял соответственно $2,63-3,28 \times 2,43-2,71$ мм. Размер фаринкса $0,65-0,71 \times 0,57$ мм. Диаметр левого семенника $0,62-0,97 \times 0,80$ мм, правого $0,62-0,80 \times 0,88$ мм. Диаметр яичника $0,42-0,48 \times 0,68-0,88$ мм.

Дифференциальный диагноз. По сочетанию признаков и взаиморасположению органов описываемая трематода должна быть отнесена к семейству Sclerodistomatidae Dollfus, 1932, а в этом семействе к роду *Sclerodistomum* Looss, 1912. В настоящее время этот род [14, 20, 23, 24] включает 5 видов: *S. italicum* (Stossich, 1893); *S. bravoae* Pritchard, 1963; *S. diodontis* Yamaguti, 1942; *S. sphaeroides* Manter, 1947; *S. psellodi* Paruchin, 1976.

От *S. italicum* изучаемый вид отличается большими размерами тела, фаринкса, яиц, иным соотношением размеров ротовой и брюшной присосок. От *S. bravoae* описываемые трематоды отличаются втрое большими размерами тела, в два с лишним раза большими размерами ротовой и брюшной

присосок, при ином их расположении, а также иным расположением желточников. От *S. diodontis* наша форма отличается вдвое большими размерами тела, ротовой и брюшной присосок, иным расположением брюшной присоски, семенников и желточников. От *S. sphaeroides* описываемая в качестве нового вида трематода отличается втрое большими размерами тела, ротовой и брюшной присосок, иным расположением брюшной присоски, семенников и желточников. От *S. psellodi* описываемая трематода отличается значительно меньшими размерами тела, соотношением размеров ротовой и брюшной присосок, строением матки и желточников.

На основании изложенного выше мы считаем необходимым выделить нашу форму в качестве самостоятельного вида *Sclerodistomum rachycentri*.

Видовое название дается по хозяину.

Голотип (Т 58) и паратипы (Т 58 а, б) хранятся в лаборатории паразитологии Института биологии южных морей, г. Севастополь.

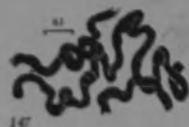


Host: *Sphaeroides spongiari* (Blanch), puffer; in 6 of 36 hosts examined; 1 specimen in each of 5 hosts; 3 specimens, 2 immature, in another.

Location: Body cavity.

Description: Body thick and muscular but forebody rather slender; color deep red in life; length 5.536 to 7.411 mm; greatest width 1.592 to 3.294 mm, near middle of hindbody; posterior end broadly rounded; forebody tapering. A specimen 4.117 mm long was immature. Oral sucker longer than wide, 0.387 to 0.667 mm in width by 0.438 to 0.740 mm in width; acetabulum sub-spherical, with small, longitudinal aperture, 0.752 to 1.372 mm in diameter. Ratio of transverse diameter of oral sucker to that of acetabulum about 1:2. Forebody about 1/4 to 1/3 body length. Pharynx 0.204 to 0.225 mm long by 0.182 to 0.262 mm wide; esophagus very short, with folded inner wall; small enlargement at beginning of each cecum; ceca fairly large but not voluminous as in *Hirudinella*, slightly sinuous, with finely corrugated wall, extending to posterior end of body, often containing a black material.

Genital pore midway between suckers, median or submedian, immediately posterior to intestinal bifurcation. Two testes, wider than long, in contact, side by side or diagonal, very closely posterior to acetabulum, often slightly overlapping posterior edge of acetabulum. Seminal vesicle a coiled tube with muscular wall and embedded in a finely fibrous stroma of the parenchyma. Anterior to the acetabulum the stroma becomes glandular but the male duct, now the pars prostatica, remains very muscular. The male duct joins the metraterm about in the middle of the genital cone (Fig. 146). Genital cone and atrium large. Ovary ovoidal or subspherical, distant from testes, about in middle of hindbody, median or to the right. Mehlis' gland compact, well developed, at the right or the left posterior edge of the ovary. Laurer's canal present, somewhat coiled, leading to a spherical enlargement within Mehlis' gland and containing sperm cells. True seminal receptacle absent. Uterus with wide, intercoiled transverse coils reaching to near the posterior end of the body then forward becoming a muscular metraterm near posterior border of acetabulum. The metraterm leads through the compact stroma surrounding the seminal vesicle and joins the male duct in the genital cone. The vitellaria originate as coiled tubes, 3 on one side, 4 on the other. These tubes almost immediately fork and some of them may fork again as they extend laterally from the region of Mehlis' gland. Near the ceca the tubes begin to diverge and lateral to the ceca they spread anteriorly and posteriorly as much coiled



1947] MANTER: DIGENETIC TREMATODES OF MARINE FISHES 367

but not anastomosing tubes. They seem to number from 7 to 10 with 8 as the most common number. Anteriorly they reach almost to testicular level, posteriorly almost to the end of the body. Only a few coils occur median to the ceca. Eggs are 32 to 36 by 19 to 24 μ and possess extremely thick shells (about 4 μ , as in *S. italicum*).

The excretory system is rather unusual but similar to that described by Looss (1912) for *S. italicum*. From the terminal excretory pore a short, narrow, cellular tube leads forward, enlarges to form a wider tube, then divides into two short, narrow, still cellular branches (Fig. 148). Usually one of these branches is much shorter than the other. The longer branch ends blindly just median to one of the intestinal ceca. Cross-sections show clearly that the shorter branch opens into the inflated, thin-walled, vesicular portion of the system. The junction is surrounded by a sphincter muscle. The vesicular portion of the system is lined with flat epithelium and sends out bulbous branches some of which may extend posteriorly along the side of the median excretory tube. About midway between the ovary and testes this highly irregularly shaped vesicle forks into two crura which extend into the region of the oral sucker. In the forebody they are less branched but still possess irregular bulbous outpocketings. They unite dorsal to the oral sucker.

Discussion: Only one other species, *S. italicum*, has been described in this genus. *S. sphaeroidis* differs from it in its smaller size, more slender forebody; more anterior genital pore, testes close together rather than far apart, and smaller eggs. Similarities include such details as the very thick shells of the eggs, and the peculiar excretory system although in *S. sphaeroidis* the "differentiated paired tube" labeled Ex¹ in Looss's figure has at least one long arm. *S. sphaeroidis* is from the body cavity rather than from the stomach of the host.

Dollfus (1932) proposed that the Sclerodistomatinae be raised to family rank and separated from *Hirudinella*, largely on the basis of the excretory system. Considering the terminal genital ducts, the tubular vitellaria, the shell gland complex, and the similarity in body form, I am inclined to retain *Sclerodistomum* and *Hirudinella* in the Sclerodistomatinae. In both genera the excretory vesicle is voluminous either as much coiled tubes or as a bulbous inflated tube.



NAHHAS AND SHORT (1965) REPORT THIS SPECIES FROM *CHILOMYTERUS SCHREFFELI* (STOMACH) AT ALLIGATOR HARBOR, APALACHEE BAY, GULF OF MEXICO.

FAMILY SCLERODISTOMIDAE
Dollfus, 1932

Sclerodistomum sphaeroides Manter, 1947
Host: **Diodon hystrix* (C. J.).
Site: stomach.

Cuba: *Cuba*; *San Juan* -
Cuba, 1964

FAMILY SCLERODISTOMATIDAE
Dollfus, 1932

Sclerodistomum sphaeroides Manter, 1947
Hosts: *Chilomycterus schoepfi* (2 of 6);
Sphaeroides testudineus (1 of 5)*.
Site: Stomach.

Discussion: Three specimens are 4.6 to 6.4 long and have eggs 24 to 31 by 19 to 24 microns. The genital pore is at the pharyngeal level in two specimens and $\frac{1}{2}$ the distance from the oral sucker to the acetabulum in the other. Sogandares-Bernal and Hutton (1959b:66) discussed the prob-

able error in some records of sites for species in this genus.

Overstreet, 1969

SCLETRODISTOMUM

SEGMENTATUM, n. gen. *BILGEES, 1971*

Generic diagnosis: Hemiuridae, Stomachicolinae. Very long trematodes with a segmented tail 5—10 times longer than body proper. Both ends curved ventrally. Oral sucker subterminal, invaginable. Ceca long, usually united posteriorly, and greatly folded in the postacetabular region. Pharynx prominent. Oesophagus absent. Acetabulum strongly developed, near anterior extremity, larger than oral sucker.

Testes usually unequal, postacetabular, may or may not be symmetrical. Seminal vesicle small or large, saccular, postacetabular and pretesticular in position. Pars prostatica well differentiated, tubular or massive. Hermaphroditic duct usually short, tubular. Genital opening preacetabular, posteroventral to pharynx.

Ovary submedian, posttesticular. Receptaculum seminis very large and posterior to ovary, median in position. Vitellaria consisting of four to eight long winding tubules extending into tail for some distance. Uterine coils also extend into tail further back of vitellaria. Excretory vesicle saccular or tubular arms united anteriorly. Eggs numerous small.

See discussion of "Segmentation,
Asexual Multiplication, and Regenera-
tion" filed with CAMERONIA
Bilgees, 1971. But don't believe it.

SEGMENTATUM KARACHIENSIS, ~~n. sp.~~ *BILGEES*, 1974

(Figs. 3, 4)

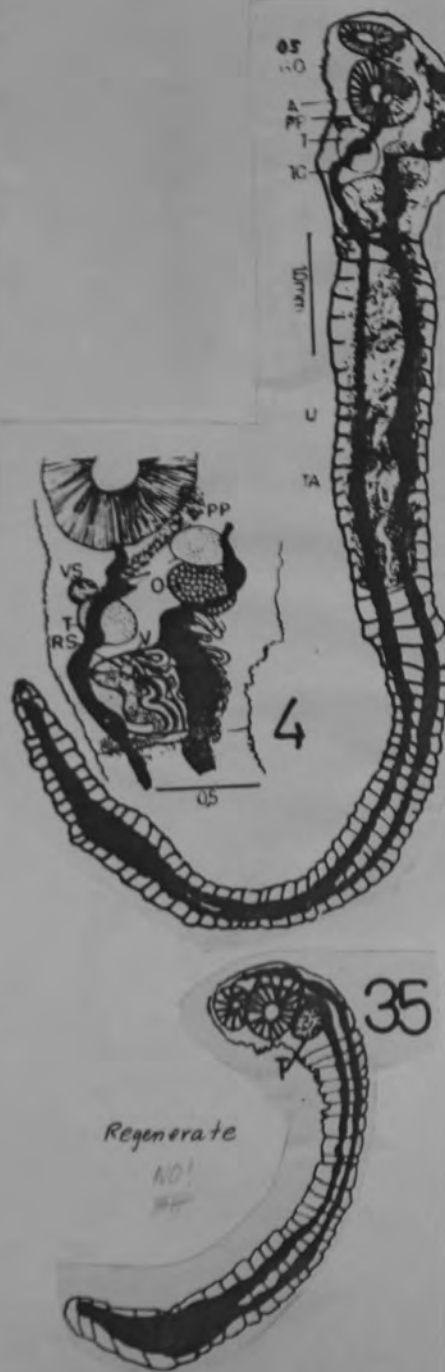
Habitat—stomach, Locality—Karachi, W. Pakistan, Number—6 specimens from three hosts, 50 hosts examined.

Description: Body curved ventrally, tapering at both ends, posterior end almost pointed, tail segmented 5–7 times longer than body proper. Body proper 1.79–2 long, tail 10.1–12.9 long. Subterminal oral sucker comparatively small 0.16–0.18 long, 0.3–0.32 wide. Pharynx small, elongated 0.08–0.085 long, 0.03–0.4 wide. "Stomach" portions poorly developed. Ceca long, fused together posteriorly. Anteriorly placed acetabulum larger than oral sucker 0.56×0.76 – 0.58×0.8 in size.

Testes postacetabular, equal in size and almost symmetrical measuring 0.17×0.20 – 0.18×0.21 . Seminal vesicle small 0.11×0.14 – 0.12×0.16 in size, saccular, unlobed. Pars prostatica well differentiated, immediately postacetabular to extending anterodorsal to it. Hermaphroditic duct short. Hermaphroditic sac absent. Genital pore posterior to pharynx.

Ovary submedian, almost equal to testes 0.19×0.17 – 0.2×0.18 . Receptaculum seminis postovarian, median, oval in shape and larger than ovary 0.45×0.46 – 0.51×0.52 in size. There are 8 vitelline tubes meeting at the base of the ovary and extending into tail for some distance. Uterine coils extend laterally and down into the tail beyond the vitellaria. More than half of the posterior tail region has no vitellaria or uterus except the intestinal ceca. Excretory vesicle is saccular, arms probably unite near the pharynx. Eggs are numerous small measuring 0.08×0.05 in size.

First described species = Type Species



SEGMENTATUM CINEREUSIS, n. sp. BILQUEES, 1971

(Fig. 6)

Habitat—stomach. Locality—Karachi. Numerous specimens from 4 host; 50 host examined.

Description: Type specimens and paratypes all long and delicate, with a segmented tail, anterior segments usually smaller and posterior long. Body proper slightly convex dorsally and concave ventrally and is distinctly marked off from the tail. Body proper length in the type 4.07, maximum width at the junction with the tail 2.03. Tail gradually narrows posteriorly measuring 37.0 in length. Oral sucker subterminal, invaginable, measuring 0.5×0.4 in size. Pharynx elongated 0.2×0.1 in size. "Stomach" portions prominent. Ceca long and fused together a little above the posterior extremity. Anteriorly ceca form prominent loops in the postacetabular region. The loops from both side come close together just above the ovary, and in some appear to be almost connected. Acetabulum large, oval, near the anterior extremity measuring 0.98×1.0 in size.

Testes unequal 0.6×0.5 and 0.7×0.4 in size. Seminal vesicle saccular immediately anterior to the left testes measuring 0.20×0.14 in size. Pars prostatica tubular. Hermaphroditic duct short opening posteroventral to pharynx.

Ovary median posttesticular, transversely elongated lying ventrally just at the junction of body proper and tail, measuring 0.3×0.7 in size. Receptaculum seminis also median, postovarian and large 0.8×0.9 in size. Vitellaria consist of 6 long tubules meeting at the base of ovary. Uterus extends into tail for some distance further back of vitellaria. In the anterior region of the tail uterine coils occupy the whole intercecal and extracecal field becoming almost straight in the body proper. Eggs small measuring 0.014×0.011 in size. Excretory vesicle tubular, arms united anteriorly.

REMARKS: *Segmentatum cinereusis* can be differentiated from *S. karachiensis* and *S. gadrii*, by having body proper distinctly expanded at the base, long posterior segments, the postacetabular loops of ceca closed together just above the ovary, 6 vitelline tubes and the seminal receptacle which is not located in the body proper but behind it in the tail region.



SEGMENTATUM MAGNAESOPHAGUSTUM, n. sp. BALQUEES, 1971

(Fig. 7)

Habitat-stomach, Locality-Karachi, Number-1 specimen in 1; 50 host examined.

Description: Long trematode with strongly ventrally curved body proper. Anterior extremity bluntly pointed, immediate postacetabular region deeply notched. Body proper length 3.86, maximum width at the base 1.27, acetabular region distinctly convex dorsally, concave ventrally. In the preacetabular region on the ventral side the cuticle is produced into four pairs of expansions. Oral sucker subterminal 0.18×0.29 in size, and is provided with three pairs of stout spine like structures. Pharynx prominent elongated 0.3 long, 0.14 wide. Esophagus unusually long and wide followed by prominent stomach portion. Intestinal bifurcation occurs on the acetabulum. The postacetabular loops of ceca are connected by a small transverse branch almost at the middle of ovary, then run posteriorly fusing again near the middle of the tail region, separating and fusing again near the posterior extremity. Acetabulum much larger than oral sucker 1.12×1.09 in size, the ventral margins of which are provided with numerous cuticular folds or expansions. The ventral cuticular expansions in the preacetabular region, the cuticular spines at the oral sucker, and the cuticular expansions at the acetabulum probably serve as additional adhesive structures.

Testes slightly unequal 0.10×0.25 and 0.10×0.21 in size, situated below the postacetabular notch of the body. Seminal vesicle indistinct probably because of the intestinal loops and pars prostatica in that region. Pars prostatica well differentiated surrounded by numerous prostate cells. Genital opening ventral to pharynx.

Ovary posttesticular, transversely elongated, larger than testes 0.36×0.7 in size. Vitelline tubes two meeting at the base of ovary and extending into tail for a short distance. Receptaculum seminis smaller and posterior to ovary 0.29×0.36 in size. Uterus occupy almost anterior 1/3 of the tail. Eggs small 0.018×0.011 in size. Excretory arms united anteriorly.

REMARK: The shape of body proper, ventral preacetabular cuticular expansions, the oral cuticular spines, cuticular modification at the ventral margins of acetabulum, large esophagus, postacetabular union of ceca, and its union in the middle of tail in addition to the posterior union and the egg size serve to distinguish *S. magnaesophagustum* from *S. karachiensis*, *S. quadrii*, and *S. cinereus*.

Discussion:

The two new genera *Cameronia* and *Segmentatum* including the segmented tailed trematodes resemble to some extent with *Stomachicola muraenosocis* (Yamaguti, 1934) and *Lecithocladium longicaudum* (Tseng, 1935). The latter is supposed to be the synonym of the former. Although the author is of the opinion that Tseng's specimen is different from that of Yamaguti's *S. muraenosocis*. No doubt that specimen from Chinese fish is more close to the *Stomachicola* Yamaguti, 1934, than to *Lecithocladium* Lube, 1901, and *Stomachicola longicaudum* appears to be a more appropriate name for Tseng's specimen. The six new trematodes described here are therefore placed under the sub-family Stomachicolinae. It is interesting to note that the present specimens as well as Yamaguti's and Tseng's specimens are from the same fish host *Muraenosox cinereus* of different localities.

The genus *segmentatum* is more closely related to *Stomachicola* than *Cameronia*. The irregularly dilated ceca forming loop at one side in the postacetabular region, constricted seminal vesicle, separate openings of male and female ducts, eight vitelline tubes and separable hind body serve to distinguish the genus *Cameronia* from *Stomachicola*. The genus *Segmentatum* is also distinguishable from the latter due to the ventrally curved extremities, convex dorsal and concave ventral surfaces of the body proper, posteriorly united ceca, massive pars prostatica, absence of hermaphroditic sac, four vitelline tubes, and saccular excretory vesicle.



7

SEGMENTATUM QADRII, n. sp. SILLAGEE, 1971

(Figs. 5, 5A)

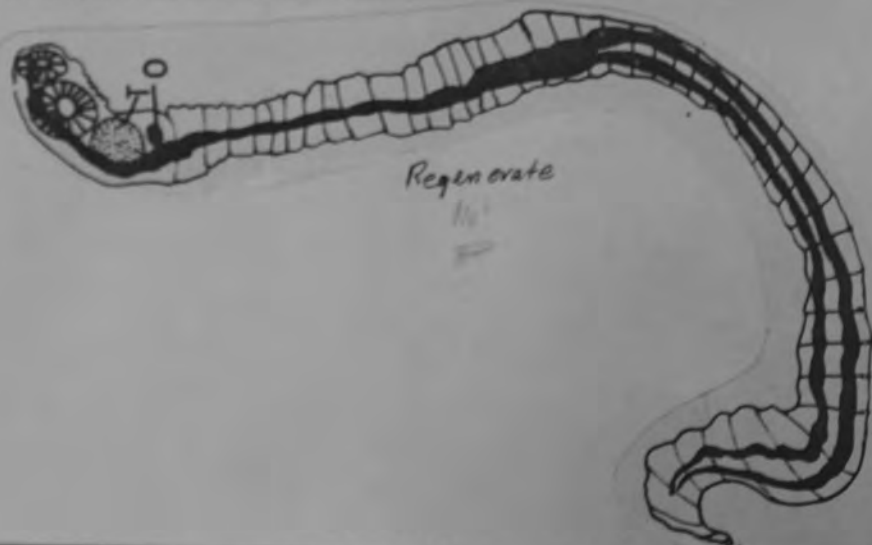
Habitat—stomach, Locality—Karachi, 17 specimens from 6 hosts, 50 hosts examined.

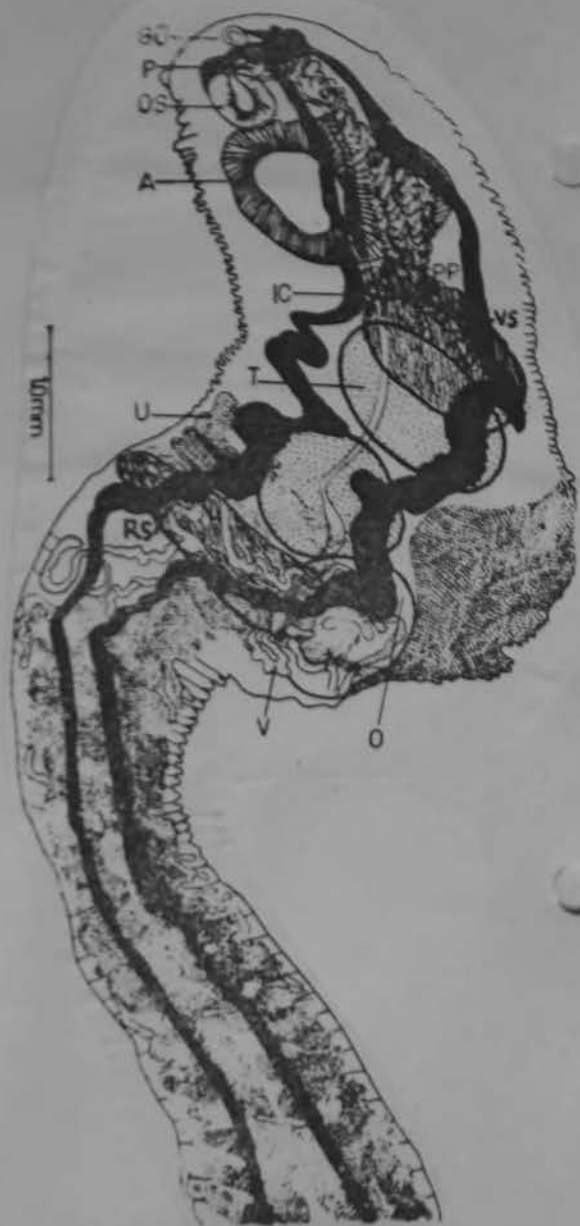
Description: Long trematodes with a long segmented tail 6–10 times longer than body proper. The body proper is convex dorsally and concave ventrally. Body proper length in the type specimen 4.4, greatest width at the testicular region is 2.6, becoming narrow at the junction with the tail. Both the extremities are curved ventrally. Tail gradually tapers posteriorly measuring 31.6 in length. The invaginable subterminal oral sucker 0.4×0.5 in size. Pharynx slightly elongated 0.18×0.14 in size. Ceca long, much folded in the postacetabular region then almost run straight down in the tail region meeting near the posterior extremity, separating again more posteriorly but in some specimens the ceca remain fused at the posterior tip. Oesophagus indistinct. "Stomach" portion of only one side is visible. Strongly developed muscular acetabulum larger than oral sucker 1.16×1.20 in size.

Testes unequal, postacetabular 0.6×0.65 and 0.6×0.58 in size. Seminal vesicle large, pretesticular, transversely elongated 0.40 long, 0.76 wide. Pars prostatica well developed occupying the posterior, dorsal, and anterodorsal region of the acetabulum. Hermaphroditic duct short opening ventral to pharynx by a circular genital opening.

Ovary posttesticular, almost as large as the posterior testes 0.6×0.5 in size. Receptaculum seminis elongated and ventral to ovary 0.5×1.1 in size. Vitellaria composed of four long winding tubules most prominent at the level of the ovary, extending into tail for some distance. Anteriorly uterus forms a compact mass dorsal to ovary then extends posteriorly as a coiled tube occupying most of the intercaecal field of the tail region beyond the vitelline tubes and also extends laterally. Excretory vesicle saccular, arms united near the oral sucker. Eggs 0.017×0.011 in size.

REMARKS: The prominent convexity of the dorsal surface of body proper, unequal testes, large seminal vesicle, elongated receptaculum seminis, four vitelline tubes, and excretory arms which unite near the oral sucker serve to distinguish *Segmentatum qadrii* from *S. karachiensis* in which the seminal vesicle is small, vitelline tubes are eight, receptaculum seminis is saccular, and the dorsal surface of the body proper is not distinctly convex, the excretory arms unite near the pharynx. The eggs are also much larger than in *S. karachiensis*.





SEGMENTATUM

Stomachicolinae ~~n. subfam.~~ Yamaguti, 1953

Subfamily diagnosis. — Hemiruridae: Body very long, subcylindrical; tail much longer than body proper. Acetabulum large, near anterior extremity. Testes postacetabular. Seminal vesicle saccular, postacetabular or largely preacetabular. Pars prostatica narrow or bulbous; hermaphroditic duct enclosed in muscular pouch, opening into genital atrium. Ovary posttesticular, lobed or not. Receptaculum seminis present. Vitellaria consisting of seven, slender, winding tubules. Uterus extending into tail. Excretory arms apparently united anteriorly.

Key to genera of *Stomachicolinae*

- Seminal vesicle preacetabular; pars prostatica bulbous; ovary lobed; seminal receptacle inconspicuous *Allostomachicola*
 Seminal vesicle postacetabular, pars prostatica narrow; ovary unlobed; seminal receptacle very large *Stomachicola*

Stomachicola Yamaguti, 1934

Syn. *Pseudostomachicola* Skrjabin et
Guschanskaja, 1934, partim

Generic diagnosis. — Hemiridae, Stomachicolinae: Body very long and contractile, with tail much longer than body proper; anterior extremity curved ventrad. Body parenchyma strongly refractive throughout. Oral sucker surmounted by prominent preoral lobe, followed by pharynx posterodorsally. Esophagus very short, ceca extending to posterior extremity. Acetabulum large, close to anterior extremity. Testes situated one on each side behind acetabulum. Seminal vesicle large, saccular, postacetabular, anterior or ventral to testes. Pars prostatica winding dorsal to acetabulum. Hermaphroditic duct enclosed in muscular pouch, opening into wide genital atrium. Genital pore behind oral sucker. Ovary ventral, posttesticular. Receptaculum seminis large. No Laurer's canal. Vitellaria consisting of seven slender tubules partly running through uterine coils. Uterine coils not only occupying intercecal field but also turning round ceca, extending into tail for some distance. Eggs small, numerous. Excretory arms apparently united in front. Stomach parasites of marine fishes.

Genotype: *S. muraenesocis* Yamaguti, 1934 (syn. *Loxotholium longicaudum* Shen Tseng, 1935) (Pl. 23, Fig. 301), in *Muraenesox cinereus*, Inland Sea of Japan and South China Sea.

Other species:

S. magnus (Manter, 1931) Manter, 1947, in *Synodus foetens* and *Cynoscion nebulosus*; Beaufort, N. Carolina.

S. rubens (Linton, 1910) Manter, 1947,¹⁾ in *Lycodontis moringa* and *L. funebris*; Florida.

¹⁾ Examination of Linton's type specimen deposited in Zoological Division of Agricultural Research Center, Beltsville, revealed that Manter (1947) is justified in assigning this species to *Stomachicola* n. gen. I can see no reason, contrary to Skrjabin and Guschanskaja (1934), to separate this species as representing a distinct genus. *Stomachicola* and *Allostomachicola* are masculine in gender.

STOMACHICOLA Yamaguti, 1934

Stomachicola n. g.

GENERIC DIAGNOSIS. Hemisididae Lühe, 1901; Dinurinae Loomis, 1907; with subfamily characters. Body exceedingly long, very contractile, demarcated behind receptaculum seminis

into short stout body proper and excessively long tail. Cuticle and subcuticular musculature of body proper well developed. Powerful tail retractor present. Cortical parenchymatous cells massed together into numerous groups lying in interstices filled with refractive substance. Anterior extremity rounded, strongly beaded ventrad; posterior more or less pointed. Oral sucker subterminal. Pharynx posterodorsal and contiguous to oral sucker. Esophagus short. Ceca sinuous, extending to posterior extremity of body. Acetabulum large, near oral sucker. Testes ventral, closely behind acetabulum, a little obliquely juxtaposed. Vesicula seminalis large. Pars prostatica long, sinuous. Hermaphroditic duct enclosed in muscular pouch, opening into shallow genital atrium. Genital pore behind oral sucker. Ovary ventral, posttesticular. Receptaculum seminis voluminous. No Laurer's canal. Vitelline gland consisting of seven long filiform tubes, extending into tail through uterine coils. Uterus coiled transversely, encircling ceca and extending into tail. Uterine eggs numerous, small. Parasitic in marine fishes.

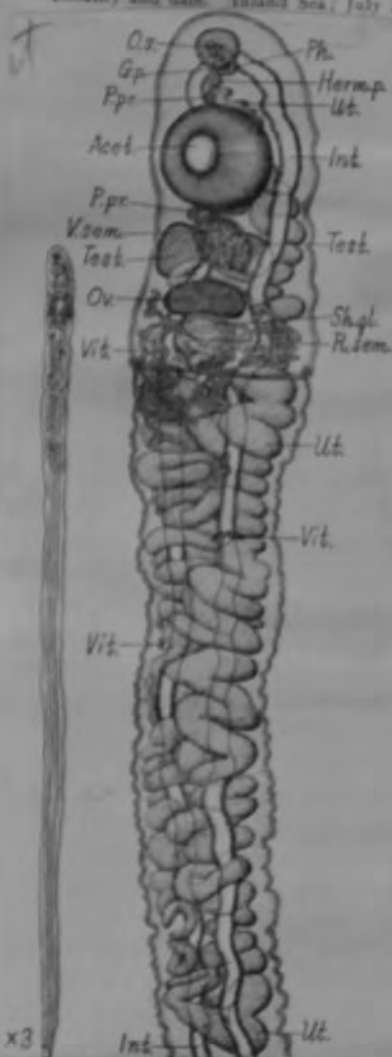
Genotype. *Stomachicola muraenesocis*.

Stomachicola muraenesocis n. sp.

SPECIFIC DIAGNOSIS. *Stomachicola*, with generic characters. Maximum length 55 mm or more. Maximum breadth about 2.5 mm. Oral sucker $0.23-0.42 \times 0.32-0.58$ mm. Pharynx $0.17-0.28$ mm in transverse diameter. Acetabulum $0.7-1.36$ mm in diameter. Testes dissimilar in shape; right $0.45-0.84 \times 0.33-0.64$ mm, left $0.28-0.46 \times 0.52-0.74$ mm. Ovary approximately kidney-shaped, $0.31-0.46 \times 0.35-0.85$ mm. Vesicula seminalis and receptaculum seminis very large. Eggs oval, $0.017-0.022 \times 0.0137-0.0143$ mm.

Habitat. Stomach of *Muraenesox cinereus* (Forsk.).

Locality and date. Inland Sea; July 23, 1929; August 29, 1929 (type date); August



mm, is directly posterodorsal to the oral sucker. The esophagus is short. The sinuous ceca with dark amorphous contents extend through the uterine coils to the posterior extremity of the body. The circular acetabulum, 1.1 mm in diameter, lies near the oral sucker.

The testes are situated symmetrically behind the acetabulum, the right being approximately triangular and 0.44×0.48 mm and the left oval and 0.45×0.37 mm. The oval vesicula seminalis, 0.63×0.5 mm, lies immediately behind the acetabulum and ventral to the testes. The long sinuous pars prostatica unites with the uterus to form the ductus hermaphroditicus which is enclosed in a small hermaphroditic pouch and opens into a wide genital atrium with its aperture just behind the oral sucker.

The ovary, 0.26×0.77 mm, is approximately kidney-shaped with its concavity directed posteriorly and



Syn. *Lecithocladium*
Ding, caudum
Bang, 1935

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Reported by Chauhan (1945) from *Muraenesox telabonoides* from Bombay coast. Chauhan considers *Lecithocladium longicaudum* Shen 1935 a member of *Stomachicola* but does not write the combination.

Subfamily Stomachicolinae Yamaguti, 1958

Stomachicola muranenocis Yamaguti, 1954Host: *Stenopus chirocarus* (Forsk.) (crustacean)

Site of infection: Mouth.

Locality: Formosan waters.

Specimens deposited: USNM Helms Coll. No. 61064 (four whole mounts on one slide) and 61064 (sectioned material).

Discussion

Thirty-three specimens of this species of *Stomachicola* were obtained. They are similar in most respects with the specimens described in the original diagnosis by Yamaguti (1954), who recovered the parasite from the same marine eel host. The genus is characterized by the extreme length of the esoma (relative to the soma); the long, filiform vitellaria; a large seminal receptacle; and a long, sinuous pars prostatica, surrounded by cells for most or all of its length. The most striking characteristic of *S. muranenocis* is the presence of an esoma that may reach a length 10 times the length of the soma.

S. muranenocis has been reported from the same host, *Muraenocis cinereus*, at several Oriental localities: Japan (Yamaguti, 1954); China (Loeng, 1935); and India (Bhalerao, 1943). Chauhan (1945) also reported it from

India in *M. tuberosoides*. Bhalerao (1943) cited a number of variations existing in the species. The other two species in the genus, *S. magnum* (Manter, 1931) Manter, 1947, and *S. ruber* (Linton, 1910) Manter, 1947, have been reported only from Atlantic fishes, the former from Beaufort, North Carolina, in *Synodus foetens* and *Cynoscion nebulosus* by Manter (1931) and the latter from Fort Myers, Florida, in *Gymnothorax funebris* and *G. merrilli* by Linton (1910).

Lecithocladium longicaudum Shen Tseng, 1935, was transferred to *Stomachicola* by Chauhan (1945). Yamaguti (1954) has synonymized this species with *S. muranenocis*.

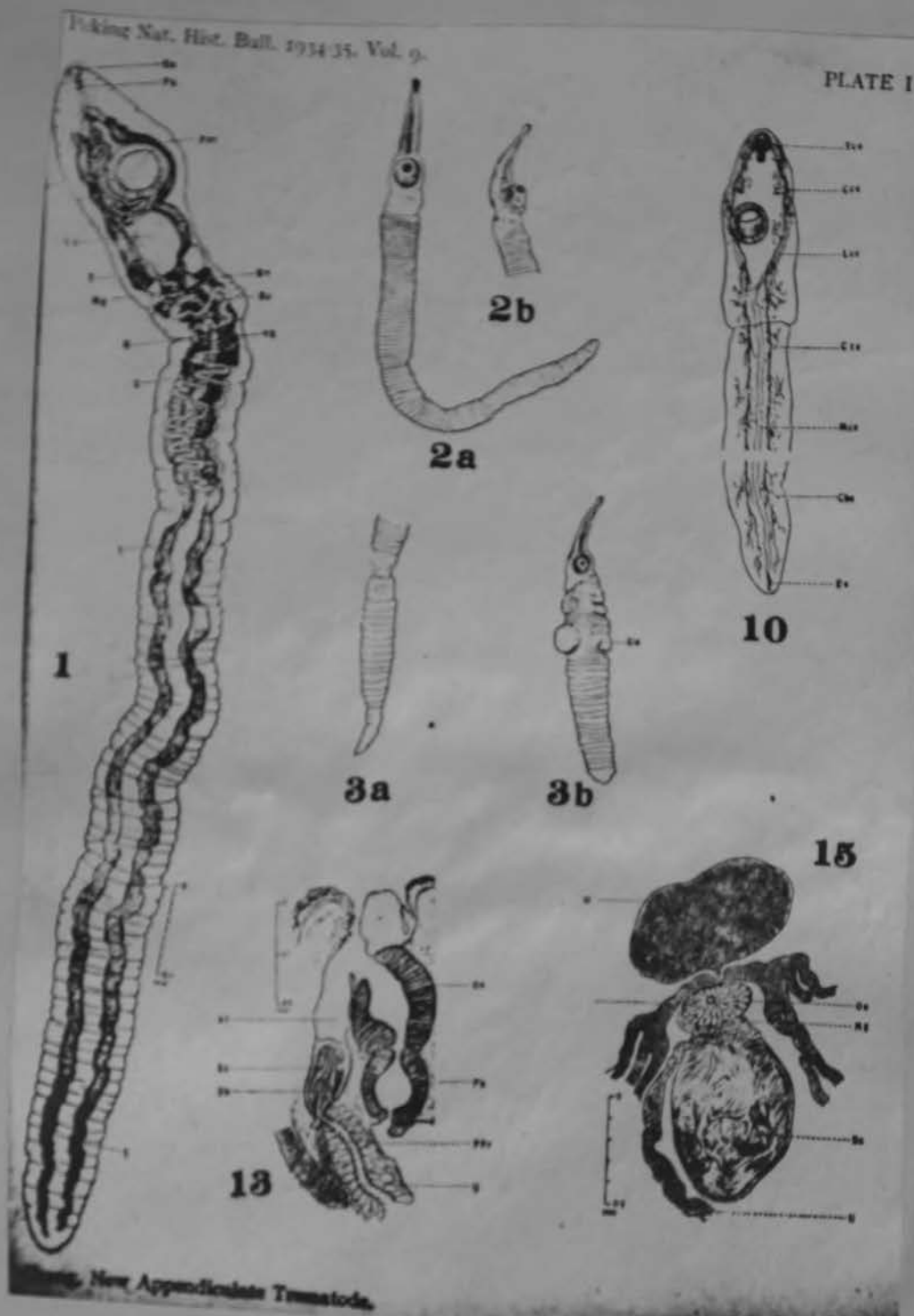
Pertinent measurements from 10 favorable specimens of *S. muranenocis* in the Formosan collection are: soma length, 1.97 to 3.91 mm; esoma length, 14.9 to 27.8 mm; total length, 18.1 to 31.7 mm; soma width, 505 to 782; oral sucker diameter, 140 to 287; acetabulum diameter, 574 to 853; pharynx diameter, 95 to 174; seminal vesicle, 565 to 783 by 304 to 435; ovary, 261 to 400 by 452 to 496; testes, 287 to 438 by 252 to 377; eggs, 14 to 18 by 8 to 10.

The subfamily Stomachicolinae is not recognized by Manter and Pritchard (1960a), but rather they place the two genera (*Stomachicola* and *Allotomachicola* Yamaguti, 1958) in the Lecithochirinae. The vitellaria of these genera are more than simply "compact, lobed, or digitate" (one of the characters they list for Lecithochirinae); they are long, intertwining, filiform tubules, more characteristic of the Dinomidae than the Lecithochirinae.

Stomachicola suraenesocis Yamaguti, 1934
 Synonym: *Lecithocladium longicaudum* Tseng, 1935

Peking Nat. Hist. Bull. 1934-35, Vol. 9.

PLATE I



New Appendiculate Trematode.

Stomachicola muraenesocis Yamaguti, 1934

(Fig. 36)

Host: *Muraena* sp.

Location: Intestine

Locality: Fish Harbour, Karachi, (Arabian Sea)

The description is based on fifteen worms extracted from intestine of *Muraena* sp. In January, 1968. Three fishes were examined, out of these only one fish yielded fifteen worms.

DESCRIPTION

The worm is very long. Its tail is comparatively much longer than its body proper. The tegument is smooth. The maximum width is at acetabular level. The preacetabular

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ZAIDI AND KHAN: TREMATODES OF FISHES

region tapers anteriorly and is always smaller than the postacetabular region of the body proper. The anterior extremity is curved ventrally.

The oral sucker is surmounted anteriorly by a short preoral lobe. It is subterminal, almost spherical. The ventral sucker is almost spherical and highly muscular. It is placed at 0.660-1.030 mm from anterior extremity and is much larger than the oral sucker. The prepharynx is absent. The pharynx is nearly spherical. The oesophagus is very short. The caeca are long and terminate at the posterior extremity of tail. They are filled with dark granular material. The gonads are placed in second half of body proper in the postacetabular region. The testes lie obliquely, a little behind the acetabulum. They are roundish and with entire margins. The ovary is just posttesticular in position, on right of median line. It is larger than the testes. The vitellaria are placed in posterior third of the body in form of seven tubules, extending in the posterior third of the body proper. The uterus is very extensive, anteriorly it extends upto acetabular level and posteriorly well into the tail. The eggs are numerous, small in size, oval in shape and embryonated.

MEASUREMENTS (IN MM.)

Total length (tail inclusive) 15.298-36.250, Body width 0.550-0.957, Tail length 13.038-32.730, Tail width 0.295-0.500, Preacetabular region of body proper 1.040-1.450, Oral sucker 0.157-0.295 $\times$ 0.167-0.344, Ventral sucker 0.550-1.040 $\times$ 0.550-0.957, Pharynx 0.083-0.206 $\times$ 0.118-0.187, Ovary 0.140-0.344 $\times$ 0.017-0.413, Anterior testis 0.110-0.394 $\times$ 0.140-0.295, Posterior testis 0.110-0.394 $\times$ 0.140-0.295, Eggs 0.007-0.010 $\times$ 0.015-0.017.

DISCUSSION

The material under study resembles with *Stomachicola muraenesocis* Yamaguti, 1934 in all the essential features and is, therefore, identified as such.

ACKNOWLEDGEMENT

Thanks are due to Drs. Muzaffar Ahmad, M. S. Bhutta and Fazl-e-Majid Khan of Department of Zoology University of the Punjab, Lahore. We are also thankful to Mr. Muhammad Farooq Ahmad Zoologist, Zoological Survey of Pakistan, Mr. Z. B. Mirza, Administrator World Wild Life Fund Pakistan, Dr. Nazir Ahmad and Dr. Rahimullah Qureshi for helping us in collection of material and in identification of host fishes.

Thanks are also due to Mr. Mahmood Janjua who helped us in photography.

From ZAIDI AND KHAN, 1977



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The following account is based upon 8 specimens recovered from the stomach of one out of three specimens of *Muraenesox cinereus* examined at fish harbour, Karachi.

The worm is very long, contractile, with its tail comparatively much longer than the body proper. The tegument is thick and devoid of any armature but it shows annular constrictions throughout the length of the body. Maximum breadth of the worm obtains at about the acetabular level. The pre-acetabular region of the worm which tapers anteriorly is always shorter than the post-acetabular region. The anterior extremity is curved ventrad. The oral sucker is surmounted anteriorly by a short pre-oral lobe. It is subterminal in position and almost spherical in outline. The ventral sucker is situated at a distance of 0.424–0.848 mm from the anterior extremity. It is a spherical and highly muscular structure, much larger than the oral sucker. The prepharynx is absent. The pharynx is spherical. The oesophagus is very short. The caeca are long and extend throughout the body proper and the tail, terminating a short distance in front of the posterior extremity of the tail. They are full of dark granular concretions.

The gonads are disposed in the second half of the body proper, in the post-acetabular region. The testes lie obliquely a short distance behind the acetabulum. They occupy almost whole of the testicular region of the worm. The anterior testis is slightly bigger than the posterior. There is a large saccular vesicula seminalis which lies immediately in front of the testes and anteriorly it terminates at the level of the posterior margin of the ventral sucker. The pars prostatica is well-developed and much convoluted, starting from the level of the posterior margin of the ventral sucker and extending far in front of it. Throughout its extent it is surrounded by numerous prostate gland cells. The ductus ejaculatorius anteriorly joins the metraterm and both collectively constitute the ductus hermaphroditicus, enclosed within a hermaphroditic bursa which anteriorly open into a wide genital opening, lying a short distance behind the oral sucker. The ovary is just post-testicular in position, on the median line. It is smaller than the testes, transversely elongated and situated at a distance of 0.166 mm from the posterior end of the body proper. The vitellaria are situated in the proximal part of the tail and are in the form of seven slender winding tubules, partly running through the uterine coils. The receptaculum seminis is large. The uterus is very extensive. Anteriorly it extends upto the acetabular level; while posteriorly it extends well into the tail. It is thrown into a descending and an ascending limb each comprising numerous irregular coils, very closely packed together, occupying for the most part the intercaecal space but at places over-reaching the caeca and extending into the extracaecal fields. The eggs are enormous in number, small in size, oval to almost rounded in shape, light brown in tinge, operculate and embryonated, containing fully formed miracidia inside. The excretory vesicle is Y-shaped.

(All measurements in millimetres)

Body length (tail inclusive)	9.635–34.178
Body breadth	0.363–1.050
Tail length	8.181–30.815
Pre-acetabular region of body proper	0.424–0.848
Post-acetabular region of body proper	0.666–1.515
Oral sucker	0.112–0.382 ×
	0.112–0.362
Ventral sucker	0.392–1.050 ×
	0.294–1.050
Pharynx	0.071–0.196 ×
	0.084–0.176
Ovary	0.066 × 0.107
Anterior testis	0.196 × 0.147
Posterior testis	0.166 × 0.147
Eggs	0.017–0.020 ×
	0.010–0.012

Host: *Muraenesox cinereus*

Location: Stomach

Locality: Arabian Sea (Karachi)



DISCUSSION

The worm under study resembles *Stomachicola muraenesocis* Yamaguti, 1934 in all essential features and measurements and has been identified as such. However, this species is being reported for the first time from Pakistan.

From BHUTTA AND KHAN, 1975

Stomachicola

Tubovesicula?

Hemiuridae
Dinurinae

Stomachicola magna (Manter, 1931) Manter, 1947

Dinurus magnus Manter, 1928

25. *Dinurus magnus* Manter (Figs. 24 and 25). Manter, 1931

Synonymy: *Dist. toratum* of Linton 1905, n.p.

Hosts: *Synodus foetens*, lizard fish; *Cynoscion nebulosus*, spotted trout.

Position: stomach. Frequency: two in one of two lizard fishes. Several specimens from *Cynoscion* were immature and occurred in the stomach and air bladder.

Body elongate, very muscular, 11-22 x 1.75-2.27 mm. The tail appendage about two-thirds total length. One of the immature forms from *Cynoscion* was 6.5 mm. in length. This large size is also attained by *Dinurus rubens* which may become 25 mm. in length. The ventral sucker is slightly more than twice the size of the oral sucker. The genital pore is at the level of the posterior edge of the pharynx. Pre-pharynx absent, oesophagus present, caeca reaching to the end of the tail. Testes oblique, close together, a short distance posterior to the ventral sucker. The seminal vesicle is large, not clearly divided into three parts, extending between the two testes. The pars prostatica is an exceedingly long, coiled tube, extending from the seminal vesicle to the sinus sac. Its coils extend appreciably both posterior and anterior to the ventral sucker. It becomes a straight tube with very few gland cells in that portion dorsal to the ventral sucker. Even in the immature specimens, it extends appreciably posterior and anterior to the ventral sucker. The sinus sac is muscular, cylindrical, about 0.14 mm. in length in the 11 mm. specimen. There is a genital atrium about one-third as long as the sinus sac. Ovary bean-shaped, median, a short distance posterior to the testes; seminal receptacle, large, posterior to ovary. Vitelline glands lateral, consisting of coiled tubes (four on left, three on right). Uterus coils posteriorly about half the length of the long tail, then anteriorly to the sinus sac. Eggs 9-11 x 6-8 μ .

This species is very similar to *D. rubens* in which, however, the pars prostatica is limited to the region dorsal to the ventral sucker. The intrusion of the seminal vesicle between the testes in *D. magnus* may be another less significant difference.



Stomachicola magna (Manter, 1931)

Host: *Paralichthys lethostigma*.

Location: Stomach and small intestine.

Batardaria Bay, La

A single mature specimen of *S. magna* was collected from the flounder, but like the other hemiurids, there were a great many immature specimens also present. Prior to this study, *S. magna* was unknown from the southern flounder, although Sparks (1958) did find it in the lizardfish from Grand Isle. Manter (1931) first described the species from *Cynoscion nebulosus* (Cuvier) of North Carolina.

The paucity of mature hemiurids in the flounder, as compared to the large number of immature forms, suggests that this fish does not represent a true definitive host but rather one in which a few worms reach maturity while the majority remain in an immature condition. This explanation seems even more plausible when the progenetic capabilities of this group of worms is considered.

During the examination of the tonguefish, *Symphurus plagiata*, 65 of the 96 specimens were noted to have hemiurid metacercariae encysted in the body musculature. The number of metacercariae per fish varied from one to seven and were located in every region of the body. The presence of the encysted larvae could be detected by the appearance of a large, dark brown spot associated with the cyst. A series of these larvae was studied both in the living state and in fixed preparations. A comparison of these forms with *S. magna* from the flounder and with several collected from the lizardfish clearly indicated that they were merely immature specimens of *S. magna*. It seems doubtful that these fishes are true intermediate hosts since Crustacea are the usual hosts for larval hemiurids.

From Corkum, 1966

Stomachicola rubeus (Linton, 1910) Manter, 1947

Stomachicola rubra (Linnaeus, 1910)

Münster, 1947

Synonyms: *Dinurus rubra* Linnaeus, 1910;
Pseudostomachicola rubra (Linnaeus) Skryabin
& Guschanskaja, 1954.

Host: *Gymnastoea moringa* (J); **G.*
rubra (J).

Site: stomach.

Jamaica, San Antonio & Case, 1964

Stomachicola mastacembeli S.L. Verma, 1973Host: Mastacembelus armatus (Linnaeus)

Location: Intestine

Locality: Bikaner, India

Ten specimens were collected from
Mastacembelus armatus from river DiamoderDescription in Zool. Anz. 190(3/4):
167-170.Considers Pseudostomachicola and
Allostomachicola synonyms of
Stomachicola.Key to Indian species of Stomachicola1. Sn present ——— S. murarensis
Sn absent ——— 22. Sv to ant. end of post. testis; 7 ut. tubes
———— S. mastacembeliSv to mid. testis; 3 ut. tubes — S. secundus

From Verma (1973)

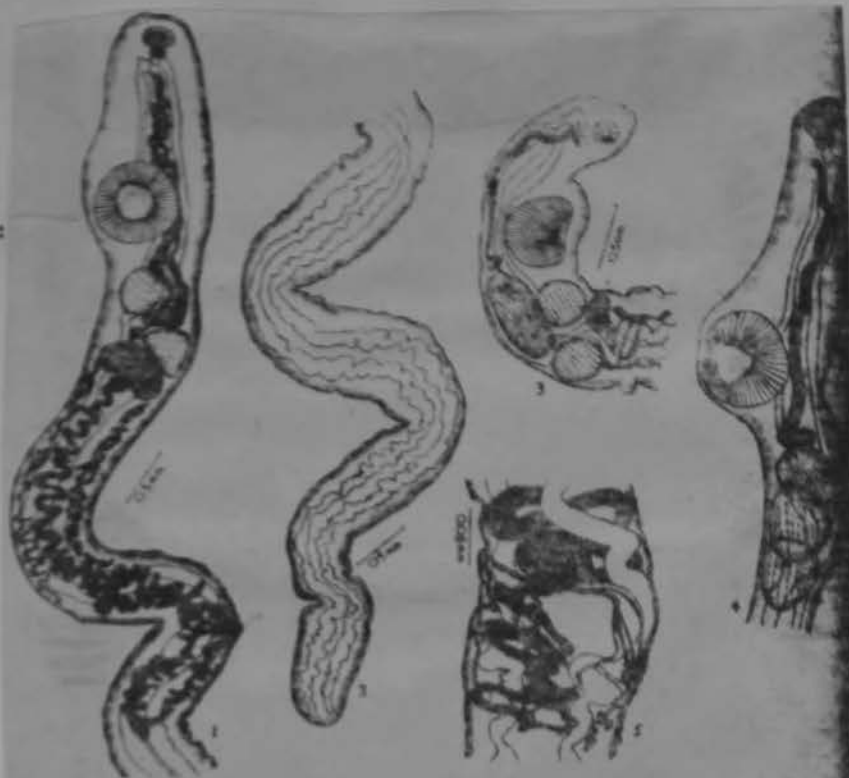


Plate I

FIG. 1 to 5. Stomachicola mastacembeli n. sp.

1. Anterior extremity, Dorsal view
 2. Posterior extremity, Dorsal view
 3. Anterior and posterior large testis (testis) and ovary (ovary), Ventral view
 4. Anterior end showing testis and ovary, Dorsal view
 5. Arrangement of uterine tubes

STOMACHICOLA