Cestode Parasites of Hawaiian Fishes

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THE CESTODE PARASITES of Hawaiian fishes have never been investigated by previous workers. The specimens on which the present report is based have been collected along with parasites of other groups during our survey of Hawaiian fish trematodes. In this collection are represented four new genera, two of which belong to the Amphicotylidae, and the others to the Parabothriocephalidae and Ptychobothriidae, respectively; the other already-known species are redescribed and figured in order to supplement earlier inadequate descriptions. All the larval forms, the identification of which is not easy, are reserved for a future study. The species described herein are listed below:

Amphicotylidae Ariola, 1899
1. *Pseudeubothrium xiphiados* n. g., n. sp.
2. *Pseudeubothrioides lepidocybii* n. g., n. sp.

Bothriocephalidae Blanchard, 1849
3. *Bothriocephalus carangis* n. sp.
4. *Bothriocephalus manubriformis* Linton, 1889

Parabothriocephalidae Yamaguti, 1959
5. *Metabothriocephalus menpachi* n. g., n. sp.

Ptychobothriidae Lühe, 1902
6. *Alloptychobothrium spilonotopteri* n. g., n. sp.

Lecanicephalidae Braun, 1900
7. *Cephalobothrium aetobatidis* Shipley et Hornell, 1906

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AMPHICOTYLIDAE Ariola, 1899

1. ***Pseudeubothrium xiphiados*** n. g., n. sp.

Fig. 1*A–H*

HABITAT: Intestine of *Xiphias gladius;* Hawaii.

HOLOTYPE: U. S. Nat. Mus. Helm. Coll., S. Y. No. 372.

DESCRIPTION (based on two immature and two gravid specimens; one of the latter was cut into serial sections): Unless otherwise indicated, the following description is based on the gravid whole mount and serial sections. The largest specimen preserved in formol-alcohol is about 320 mm long by 6 mm wide. The type (which was fixed under cover glass pressure in Schaudinn's solution, stained with Heidenhain's hematoxylin, and mounted in balsam) is 40 mm in length, with maximum width of 4 mm in the greater posterior part, with the tapering posterior extremity appreciably truncated. In the immature paratypes the scolex is of the *Eubothrium* type in general appearance, 1.5–2.5 mm long by 2.1–3.0 mm wide, with a distinct apical disc notched on the median margin both dorsally and ventrally; each surficial bothrium is elongate oval to elliptical, 1.8 × 1.1 mm, widest at the posterior half, with a wide longitudinal median furrow tending to deepen posteriorly; its lateral margins may be distinctly crenulated. In the type the strongly flattened scolex is 3.8 mm long by 1.5 mm wide, its apical disc is about 1.0 mm in transverse diameter, and its median marginal notch is hardly recognizable. The neck is distinct, about 7 mm long by 1.5 mm wide in the type, more or less irregularly corrugated transversely. Proglottides are short, craspedote, with most of the cortex expanded transversely in the form of lamellae, 226 in number in the type, at the posterior extremity of which the last segment is only 0.28 mm long by 1.0 mm wide and contains paired, excretory vesicles 0.1 mm wide. In an immature paratype this last segment is 0.45 mm long by 0.7 mm wide, and is oc-

ABBREVIATIONS USED IN FIGURES

b	bothrium	ex	excretory stem	s	sucker
c	cirrus	ga	genital atrium	sph	sphincter of vagina
cf	collarlike fold	gp	genital pore	t	testis
cp	cirrus pouch	il	inner longitudinal muscle	u	uterus
ds	ductus seminalis	mp	muscular pad	ud	uterine duct
cvp	cirrovaginal pore	n	nerve trunk	up	uterine pore
ds	dorsal vessel	o	ovary	vd	vas deferens
ej	ejaculatory duct	oc	oocapt	vg	vagina
ev	excretory vesicle	rs	receptaculum seminis	vt	vitellarium
				vv	ventral vessel

cupied by wide, paired, sigmoid, excretory vesicles up to 0.2 mm wide; the latter vesicles unite in the median line and open outside 0.1 mm from the posteriormost margin. Dorsal and ventral longitudinal excretory vessels running at junction of lateral with middle third of proglottis or just medial to it near lateral end of medulla, ventral to genital ducts and lateral to nerve trunk in gravid proglottides. Nerve trunk dorsal to vas deferens and vagina. Inner longitudinal muscle bundles strongly developed throughout strobila, forming a distinct boundary between medulla and cortex.

Testes rounded or elongate, numerous, rather small, arranged in one layer or two in dorsal medulla, continuously from end to end, leaving part of medulla free where the ovary and uterus are situated. In the gravid proglottides the testes are atrophied as they approach the senile segments. In some sections one testis or two may lie exceptionally in the dorsal cortex immediately outside the inner longitudinal muscle bundles or among these bundles. Cirrus pouch pyriform, with thick muscular wall, 0.15–0.2 mm wide in the type, situated oblique-transversely, mostly in lateral marginal cortex, with its base extending into outer end of medulla or not, containing narrow convoluted ejaculatory duct and a bulbous cirrus, which opens at the tip of the pouch into the genital atrium. The cuticular lining of the bulbous cirrus forms a reticular basket-like structure (Fig. 1H), which is continued onto the ejaculatory duct, where the network is reduced and becomes so fine that it appears like cilia in cross section. Genital pore lateral, irregularly alternating.

Ovary transversely elongated along anterior median ventral margin of medulla, just inside inner longitudinal muscle bundles, up to 0.45 mm transversely in the type. Shell gland complex posterodorsolateral to oocapt, at median dorsal prominence of ovary. Uterus winding transversely dorsal to ovary, extending laterad into space between lateral ends of ovary and lateral testes; it may reach to the nerve trunk passing ventral to the outermost testes. Finally the uterus empties into the uterine sac, which lies in the ventral cortex in about the same sagittal plane as the dorsal collecting excretory vessel. Uterine pore wide, about one-third of proglottis width from lateral margin or a little more laterally. Eggs elliptical, comparatively thick-shelled, embryonated, 76–100μ × 46–54μ in sections. Vitelline follicles small, round, extending profusely in almost entire cortical parenchyma of marginal laminae. Vitelline reservoir inconspicuous, just ventral to shell gland complex. Vagina opening into genital atrium ventral to cirrus pouch; it is enlarged at its terminal portion, lined with smooth cuticle, the remaining portion is narrow, tubular, and lined with cilia.

DISCUSSION: This genus differs from the most closely related *Eubothrium* Nybelin, 1922, as shown in Table 1.

These morphological differences, combined with difference in host, are sufficient to justify

FIGS. 1*A–H*. *Pseudeubothrium xiphiados* n. g., n. sp. *A,* scolex of paratype, dorsoventral view; *B,* posterior extremity of holotype, ventral view; *C,* transverse section of anterior part of paratype; *D,* transverse section of immature proglottis of paratype; *E,* transverse section of mature proglottis of paratype; *F,* transverse section of gravid proglottis through ovary; *G,* transverse section of lateral portion of gravid proglottis through genital and uterine pores; *H,* same showing basketlike structure of lining of cirrus.

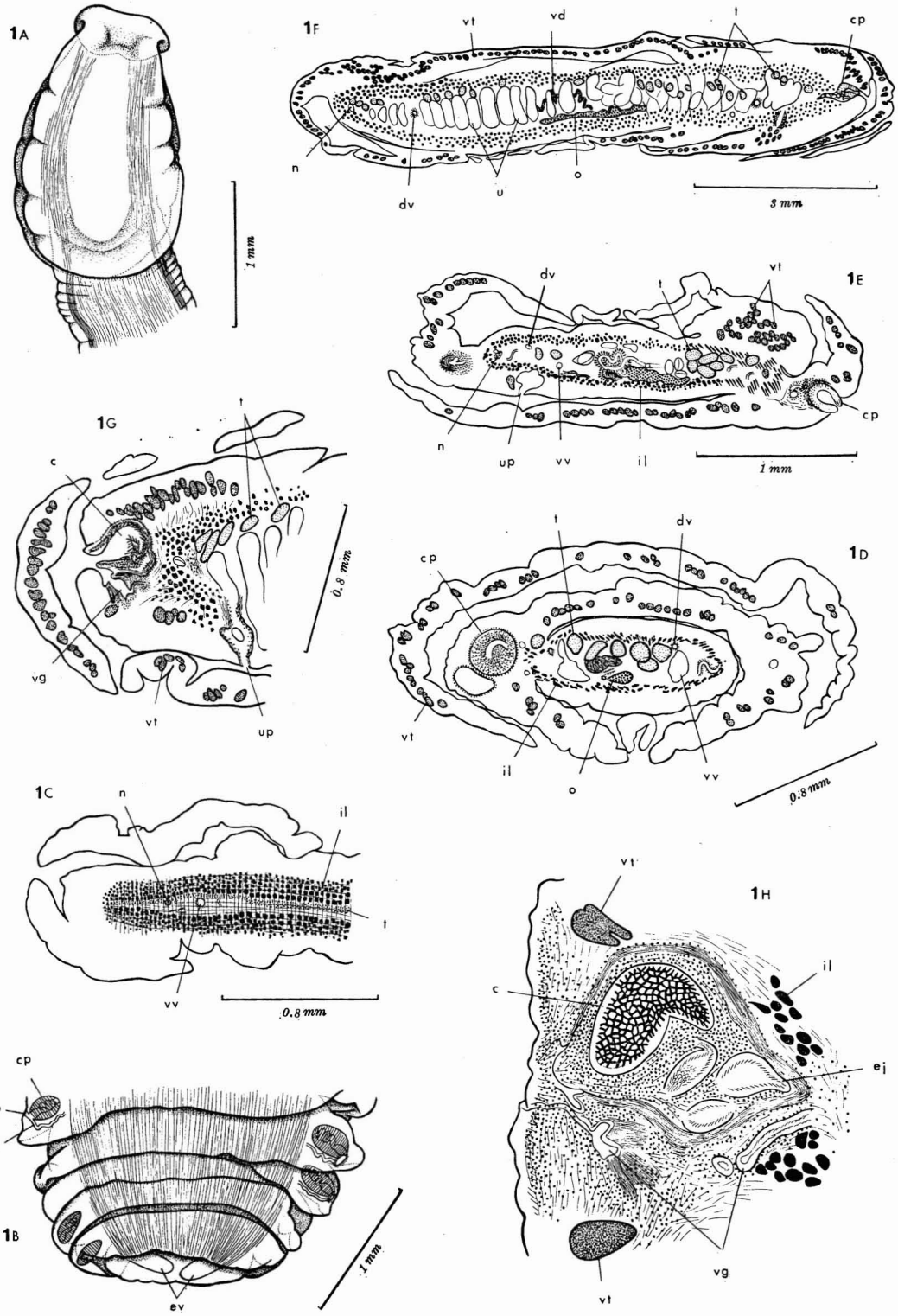
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TABLE 1
DIFFERENTIATION OF *Pseudeubothrium* FROM *Eubothrium*

CHARACTER	*Eubothrium*	*Pseudeubothrium*
Neck	absent	present
Median surficial furrow of strobila	present	absent
Vitellaria	may extend into inner longitudinal muscle layer or even into peripheral medulla	never extending into medulla
Uterine pore	midventral	submedian or sublateral, ventral
Vaginal pore	anterior to cirrus pouch	ventral to cirrus pouch

the separation of the present genus from *Eubothrium* Nybelin, 1922.

Pseudeubothrium n. g.

GENERIC DIAGNOSIS: Amphicotylidae, Amphicotylinae Lühe, 1902. Scolex with an apical disc and elongate simple bothria. Strobila with distinct neck and very short, transversely extended, laminate, imbricated proglottides. No median furrow on each flat surface of strobila. Testes in dorsal medulla, continuous in median field except in ovarian region. Vas deferens convoluted in dorsal medulla. Cirrus pouch with thick muscular wall. Ejaculatory duct winding in cirrus pouch; cirrus swollen bulbously and lined with reticular basket-like cuticle which is continued onto the ejaculatory duct, where the network becomes reduced and appears like spinelets or cilia in cross sections. In cross sections of the cirrus the lining may appear like spines. Genital pore lateral, alternating irregularly. Ovary transversely elongated in ventral median medulla. Vitellaria confined to laminate cortex all around proglottis, never extending into medulla. Vaginal duct ciliated; vagina proper enlarged, with smooth cuticle, opening into genital atrium ventral to cirrus pouch. Uterine sac present, muscular; uterine pore ventral, submedian or sublateral. Eggs comparatively thick-shelled, embryonated. Paired excretory vesicles very conspicuous in posteriormost segment. Parasitic in marine teleosts.

TYPE SPECIES: *P. xiphiados* n. sp., in *Xiphias gladius;* Hawaii.

2. ***Pseudeubothrioides lepidocybii*** n. g., n. sp. Fig. 2*A–C*

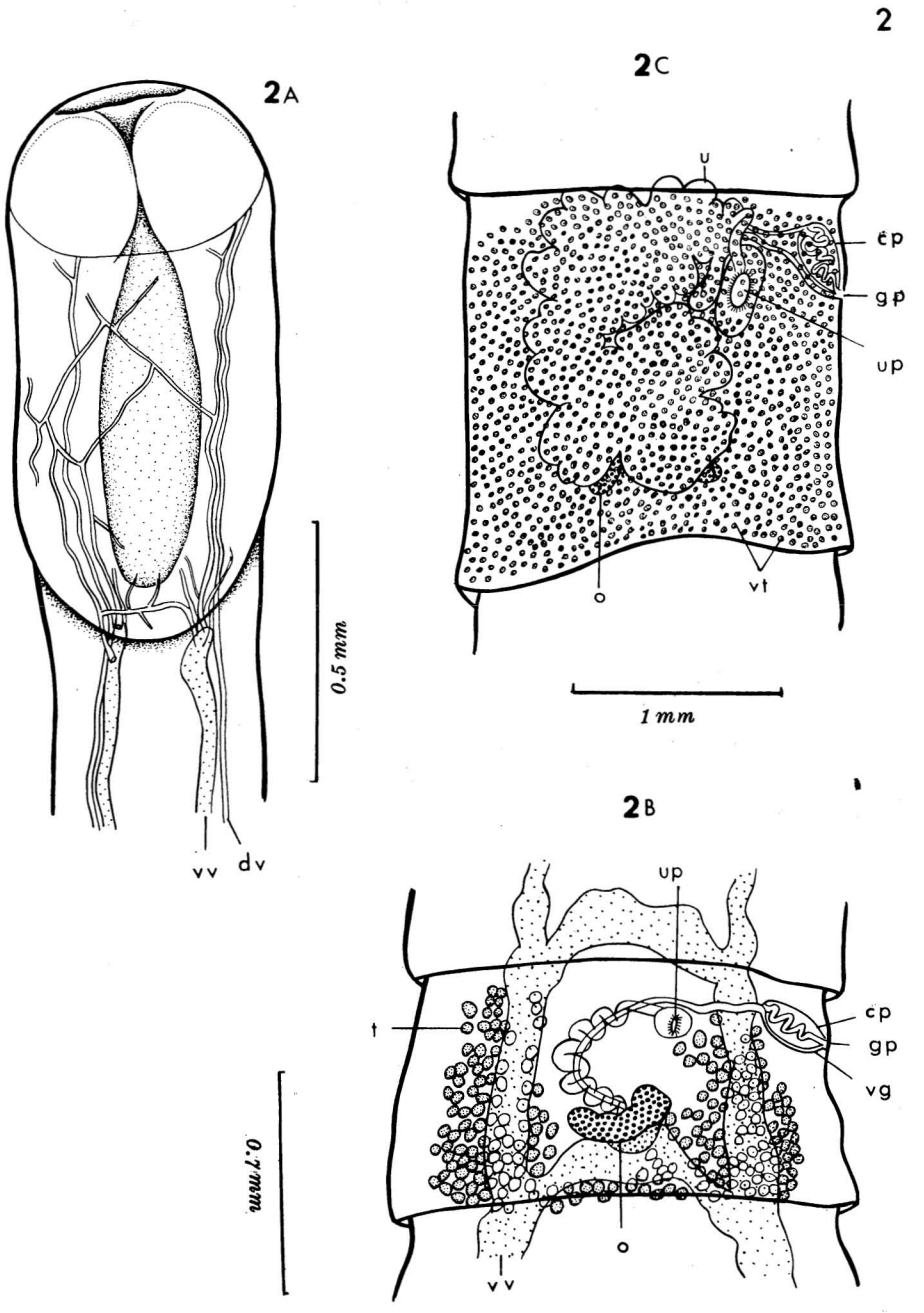
HABITAT: Intestine of *Lepidocybium flavobrunneum;* Hawaii.

HOLOTYPE: U. S. Nat. Mus. Helm. Coll., S. Y. No. 373.

DESCRIPTION (based on a gravid type and two immature paratypes): Scolex elongate, 1.05 mm long by 0.47 mm wide in the type, with apical disc 0.47 mm wide and incised dorsally and ventrally, and an elongate, elliptical, simple bothrium on each flat surface; unsegmented neck portion about 1.0 mm long. Proglottides with salient posterior border; young proglottides wider than long; gravid ones wider than long, or as wide as long, 1.1–1.8 mm × 1.6–1.9 mm, nearly parallel-sided. Ventral excretory stem very wide throughout strobila, ventral to vas deferens and vagina, with transverse commissure at posterior end of each proglottis.

Testes small, round, distributed in medulla alongside excretory stem, confluent at posterior end of proglottis, very few, if any, in preovarian median field. Vas deferens describing an arcuate curve along vagina, passing transversely immediately in front of uterine sac and then running toward cirrus pouch. Cirrus pouch elliptical, up to 0.35 × 0.2 mm, lying obliquely between excretory stem and lateral margin; ejaculatory duct winding in cirrus pouch; no bulbous cirrus in strong contrast with *Pseudeubothrium xiphiados* n. sp. Genital atrium opening marginally near anterior end of proglottis on the same side as uterine pore, alternating irregularly from side to side.

Ovary bipartite, median, immediately in front of transverse excretory commissure. Uterine sac comparatively small, on pore side of median line near anterior border of proglottis, with inconspicuous ventral pore in immature proglottides. In gravid proglottides the uterus filled with eggs takes an arcuate course like the vas deferens and vagina, and finally opens into the uterine sac which is now an elliptical muscular



FIGS. 2*A–C*. *Pseudeubothrioides lepidocybii* n. g., n. sp. from *Lepidocybium flavobrunneum*. *A,* scolex of holotype showing excretory system, dorsoventral view; *B,* mature proglottis of holotype, ventral view; *C,* gravid proglottis of holotype, dorsal view.

structure up to 0.45 mm long by 0.2 mm wide. Ventral uterine pore at or just behind level of genital pore. The gravid uterus as a whole presents many more indentations than that of *Pseudeubothrium xiphiados,* which forms a rather compact mass. Eggs elliptical, large, 70–81μ × 35–42μ. Vitelline follicles small, distributed extensively in entire cortex. Vagina running alongside vas deferens, then along posterior margin of cirrus pouch, opening together with male pore at base of genital atrium.

DISCUSSION: This species differs from the most closely related *Pseudeubothrium xiphiados* n. sp. in the structure of the scolex and proglottides, in the absence of a bulbous armed cirrus, and in egg size. Of these differences the most outstanding is the difference in the structure of the proglottides. In the type species of *Pseudeubothrium* the laminate cortex of the proglottides is so conspicuous that it can easily be distinguished from the usual cortex of the present species. This difference appears to be of generic importance, so I prefer to assign the species in question provisionally to a new genus, *Pseudeubothrioides,* which is defined as follows:

Pseudeubothrioides n. g.

GENERIC DIAGNOSIS: Amphicotylidae, Amphicotylinae. Scolex with apical disc and elongate simple bothria. Strobila serrate, with distinct neck and nearly parallel-sided proglottides, without median furrow on each flat surface. Ventral excretory stems parallel, very wide, with transverse anastomosis at posterior end of each proglottis. Testes extending mostly along longitudinal excretory stems, continuous across median line immediately in front of posterior border of proglottis. Cirrus pouch with muscular wall containing convoluted ejaculatory duct; cirrus not forming a bulbous swelling. Genital atrium marginal, irregularly alternating from side to side, near anterior corner of proglottis. Ovary transversely elongated, bipartite, in median ventral medulla. Vitellaria confined to cortical parenchyma. Vagina opening immediately behind cirrus into genital atrium. Uterine sac present, muscular when fully gravid. Uterine pore submedian, ventral, on pore side. Eggs large, thick-shelled, not embryonated. Parasitic in intestine of marine teleosts.

TYPE SPECIES: *P. lepidocybii* n. sp., in *Lepidocybium flavobrunneum;* Hawaii.

BOTHRIOCEPHALIDAE Blanchard, 1849

3. *Bothriocephalus carangis* n. sp.

Fig. 3*A–E*

HABITAT: Intestine of *Caranx helvolus* (type host, local name "black ulua") and *Carangoides ferdau* (local name "ulua"); Hawaii.

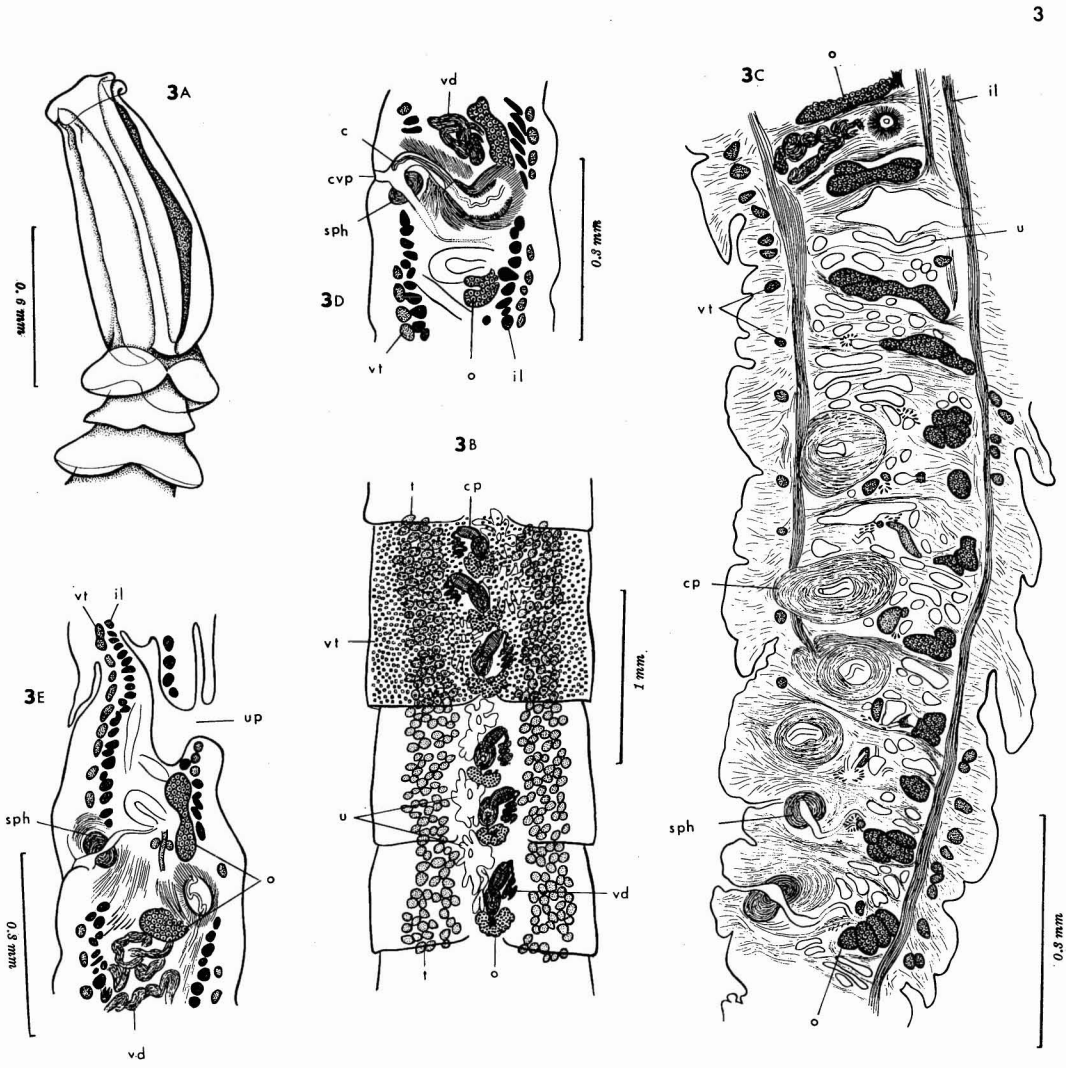
HOLOTYPE: U. S. Nat. Mus. Helm. Coll., S. Y. No. 374.

DESCRIPTION (based on eight, mostly gravid, mature specimens): Strobila 70–120 mm long, up to 2–5 mm wide when strongly flattened under cover glass, usually 1.0–1.5 mm wide, consisting of 170–230 primary segments and 15–30 or more secondary segments. Scolex longitudinally elongated, 1.0–1.6 mm long, with apical disc 0.25–0.45 mm in diameter, deeply incised laterally; bothria elongate oval in outline, up to 0.5–0.8 mm wide near posterior end, with thin smooth margin. Neck absent. Proglottides bell-shaped anteriorly, nearly parallel-sided posteriorly, with posterior margin slightly imbricated, or lateral margins slightly divergent. On each flat surface there is a distinct posterior median notch. Mature and gravid proglottides as long as wide, or longer than wide; the fused proglottides containing three sets of reproductive organs are longer than wide; proglottides with one set of reproductive organs are usually wider than long; senile end proglottis smaller than penultimate proglottis, longer than wide, convex on each side. Inner longitudinal muscle fibers rather weak in mature and gravid proglottides. Excretory system reticulate.

Testes round, divided into two medullary sublateral fields, apparently continuous from proglottis to proglottis, and interrupted in median field, 30–110 in number in each lateral field; this variation in number depends on the inadequate segmentation or fusion of proglottides, or on the degree of their maturity; generally speaking, the smallest number occurs in an immature, completely segmented, single proglottis; vas deferens convoluted close to base of cirrus pouch. Cirrus pouch elongate pyriform or claviform, provided with thick layer of inner circular and outer longitudinal muscle fibers,

0.2–0.35 mm × 0.08–0.11 mm, oblique to median axis of strobila, with its base alternating irregularly from one side of median line to the other, containing very narrow ejaculatory duct. Ejaculatory duct joining vagina just distal to vaginal sphincter to form a short cirrovaginal duct, which opens middorsally.

Ovary consisting of several lobes, rosette-shaped or bipartite, 0.15–0.35 mm wide, up to 0.45–0.55 mm wide in strongly flattened specimens, situated in median field immediately posteroventral to cirrus pouch. Vagina provided with a conspicuous bulbous sphincter just before uniting with ejaculatory duct, curved posteroventrad to join germiduct anterior to isthmus of ovary. Vitelline follicles diffuse in whole cortical parenchyma except marginal areas. Gravid uterus forming a few spiral turns and opening ventrally in median field anterolateral to base of cirrus pouch or level with it. Eggs oval, operculate, 60–68μ × 32–40μ in life; contained ovum unsegmented.



FIGS. 3*A–E*. *Bothriocephalus carangis* n. sp. *A,* scolex of paratype from *Caranx ferdau,* ventral view; *B,* mature proglottis of holotype from *Caranx helvolus,* dorsal view; *C,* longitudinal section of paratype from *Caranx ferdau; D,* longitudinal section of mature proglottis of paratype from *Caranx ferdau* through genital pore; *E,* longitudinal section of mature proglottis of paratype from *Caranx ferdau* through uterine pore.

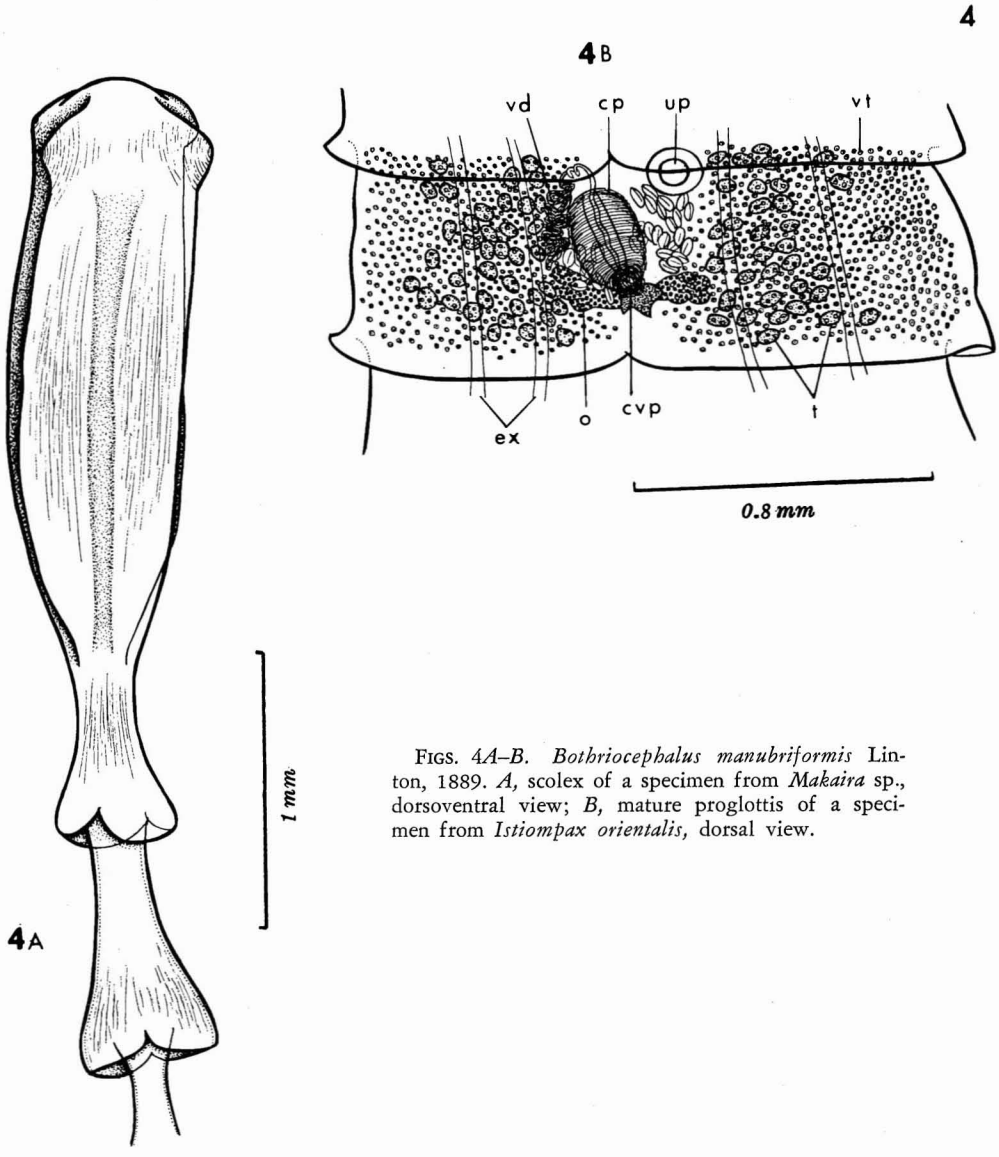
DISCUSSION: This species differs from the most closely related *Bothriocephalus scorpii* (Müller, 1776), from *Cottus scorpius* and other marine fishes, in that the cirrus pouch is large and muscular and tilting so conspicuously to one side or the other from the median axis of the strobila that discrimination between the two species is not difficult. I have some doubt about the alleged occurrence of *B. scorpii* in *Caranx* or other pelagic carangids, because the type host is *Cottus scorpius,* which is definitely a benthonic fish.

4. *Bothriocephalus manubriformis* Linton, 1889

Fig. 4*A–B*

HABITAT: Intestine of *Makaira audax, Istiophorus orientalis, Istiompax orientalis, Tetrapterus angustirostris,* and *Xiphias gladius;* Hawaii.

DESCRIPTION (based on several immature specimens and five gravid specimens): Strobila serrate, 25–334 mm × 0.35–3.8 mm; one specimen 130 mm long, comprising 420 primary



FIGS. 4*A–B*. *Bothriocephalus manubriformis* Linton, 1889. *A,* scolex of a specimen from *Makaira* sp., dorsoventral view; *B,* mature proglottis of a specimen from *Istiompax orientalis,* dorsal view.

segments and a large number of secondary segments. Scolex 1.7–2.8 mm long, with lateral bothria opening at anterior and posterior ends; apical disc, often prominent at center, 0.5–0.7 mm in transverse diameter, incised laterally. Proglottides campanulate, especially in anterior ones, which are medianly notched both dorsally and ventrally; gravid proglottides wider than long, medianly notched, 0.2–0.8 mm × 0.5–2.3 mm, with very prominent posterior border, always containing one set of reproductive organs unless pseudosegmented.

Testes arranged in one layer in two sublateral medullary fields, 25–50 or more in number on each side, not confluent in median field. Cirrus pouch elongate pyriform, 0.07–0.2 mm in diameter, usually slightly oblique, with strong circular muscles; vas deferens coiled around anterior end of cirrus pouch. Cirrovaginal pore dorsomedian, near posterior end of proglottis.

Ovary bipartite, divided laterally into several lobules, up to 0.3–0.5 mm in transverse diameter, at median posterior end of proglottis. Uterus sigmoid; uterine sac opening ventrally, rounded, up to 0.12–0.28 mm in diameter when distended with eggs, situated near anterior end of proglottis, usually only slightly to either side of median line. Eggs elliptical, operculate, 54–68μ × 33–38μ in balsam mounts. Vitelline follicles small, profusely distributed in entire cortical parenchyma except for median field, not continuous from one proglottis to the next; vitelline reservoir ovoid, situated behind ovary on the same side of the median line as the uterine pore. Vagina provided with sphincter just before joining ejaculatory duct.

DISCUSSION: This species is characterized by the lateral bothria being open anteriorly and posteriorly, and in the proglottides being campanulate. It occurs commonly in istiophorid fishes widely distributed in the Atlantic, Pacific, and Indian oceans.

PARABOTHRIOCEPHALIDAE Yamaguti, 1959

5. ***Metabothriocephalus menpachi*** n. g., n. sp.
Fig. 5*A–E*

HABITAT: Intestine of *Myripristis argyromus* (type host, local name "u'u" or "menpachi"), *M. chryseres* (local name "pau'u'u") and *M. berndti* (local name same as that of type host); Hawaii.

HOLOTYPE: U. S. Nat. Mus. Helm. Coll., S. Y. No. 375.

DESCRIPTION (based on a fragmented type 120 mm long by 2.4 mm wide and two paratypes, each of which is broken into several fragments; the following description is based mainly on the type): Scolex discoid at apex, which is depressed in the center, with an oval subapical bothrium 0.15 mm long by 0.13 mm wide on dorsal and ventral surface. Unsegmented neck uniform in width (about 0.1 mm in the type, in which the segmentation commences 2.65 mm behind the head end). Proglottides nearly parallel-sided, wider than long throughout strobila, with salient posterior border, which often may be constricted at pre-equatorial level. Inner longitudinal muscle bundles comparatively wide apart one from another (Fig. 5B). Dorsal and ventral excretory vessels running in lateral end of medulla, lateral to nerve trunk, ventral to terminal genital ducts.

Testes extending longitudinally medial to nerve trunk and longitudinal excretory vessels, 10–15 in number on each side. Vas deferens twisted, running outward immediately behind vagina. Cirrus pouch pyriform, small, 74–77μ × 56–65μ in immature proglottides; ejaculatory duct narrow, but swollen at base of cirrus pouch, opening with vagina on dorsolateral margin of proglottis at about pre-equatorial level, alternating irregularly from side to side.

Ovary transversely elongated near posterior margin of proglottis on pore side of median line, with compact mass of shell gland immediately behind. Uterine duct winding forward from behind ovary to uterine sac. Uterine sac rounded, almost median near anterior border of proglottis, opening midventrally. In fully gravid proglottides the uterus distended with eggs occupies the whole medulla with uneven outline. Eggs oval, operculate, rather thick-shelled, 77–90μ × 49–63μ in life; contained ova unsegmented. Vitelline follicles small, round, extending profusely in entire cortical parenchyma, continuous from proglottis to proglottis. Vagina running straight, obliquely anterolaterad from behind ovary toward com-

mon genital pore, lined with thick cuticle just before uniting with ejaculatory duct.

DISCUSSION: This genus bears a certain resemblance to *Parabothriocephaloides* Yamaguti, 1934 in gross anatomy, but differs from it in that the scolex is provided on each flat surface with an oval bothrium, and in the distribution of testes, etc. From these differences it seems certain that the present genus, obviously parabothriocephalid in structure, represents a distinct genus, for which the name *Metabothriocephalus* is proposed, with the following diagnosis:

Metabothriocephalus n. g.

GENERIC DIAGNOSIS: Parabothriocephalidae. Scolex not marked off from neck, with an indistinct apical disc followed on each flat surface by a small oval subapical bothrium surrounded by condensed tissue. Neck present. Strobila comparatively fleshy, with complete segmentation; proglottides wider than long throughout strobila, with salient posterior border and nearly parallel lateral margins. Inner longitudinal muscle bundles strongly developed anteriorly, though individual bundles are rather wide apart one from another. Testes medullary, in small number medial to excretory stems. Cirrus pouch reduced. Ejaculatory duct opening with vagina by a small common pore dorsomarginally at a pre-equatorial level, alternating irregularly from side to side. Ovary transversely elongated, not two-winged, slightly submedian (on pore side) near posterior end of proglottis. Uterine duct winding in median and submedian fields; uterine sac practically median, opening midventrally near anterior end of proglottis. Vagina straight, joining ejaculatory duct at genital pore. Vitellaria entirely cortical, diffuse, continuous from proglottis to proglottis. Eggs rather thick-shelled, operculate, with unsegmented ova. Parasitic in intestine of marine teleosts.

TYPE SPECIES: *M. menpachi* n. sp., in *Myripristis* spp.; Hawaii.

PTYCHOBOTHRIIDAE Lühe, 1902

6. ***Alloptychobothrium spilonotopteri*** n. g., n. sp.

Fig. 6*A–D*

HABITAT: Small intestine of *Cypselurus spilonotopterus;* Hawaii.

HOLOTYPE: U. S. Nat. Mus. Helm. Coll., S. Y. No. 376.

DESCRIPTION (based on four immature and three gravid specimens; unless otherwise indicated the following description is based on whole gravid mounts and serial sections of gravid proglottides): Strobilas over 30 mm long are all gravid. Scolex arrowhead-shaped in lateral view, with edges markedly crenulated and enclosing deep longitudinal groove, 2.8 mm long, 1.7 mm wide dorsoventrally in the type; its apex blunt-pointed, two posterior ends widely divergent or hanging down, one on each side of strobila. Neck absent. Proglottides transversely elongated, 0.1 × 0.5 mm at anterior end directly following scolex, with posterior border somewhat craspedote or not; gravid proglottides very variable in length and width, ranging from 0.18 to 0.9 mm in length and from 0.9 to 2.2 mm in width, depending on the degree of pressure applied on cover glass. Transverse sections of unflattened gravid specimens fusiform, 0.4–1.7 mm wide, 0.1–0.5 mm thick, showing notches in dorsal and ventral midlines, corresponding to genital atrium and uterine pore, respectively. Cuticle thick, with striations at right angles to the surface. Inner longitudinal muscle bundles isolated in lateral fields, but forming a conspicuous layer outside as well as inside of layer of vitellaria in median and submedian fields, with distinct median break corresponding to genital and uterine pores. Dorsal longitudinal excretory stem with thicker walls than ventral stem, lying lateral to ventral stem, latter stems separated one from the other by uterine coils; two or more, narrower, ventral vessels are seen forming anastomoses.

Testes confined to submedian medulla im-

FIGS. 5*A–E*. *Metabothriocephalus menpachi* n. g., n. sp. *A,* scolex of holotype from *Myripristis argyromus,* ventral view; *B,* immature proglottis of holotype, ventral view; *C,* mature proglottis of paratype from *Myripristis argyromus,* dorsal view; *D,* fully gravid proglottis of holotype, ventral view; *E,* transverse section of gravid proglottis of paratype from *Myripristis argyromus.*

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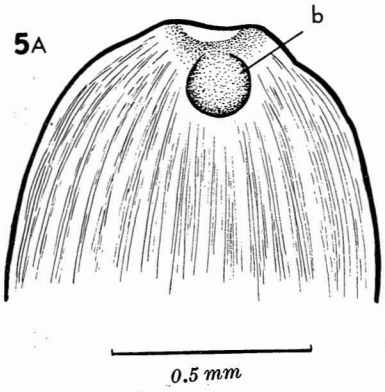
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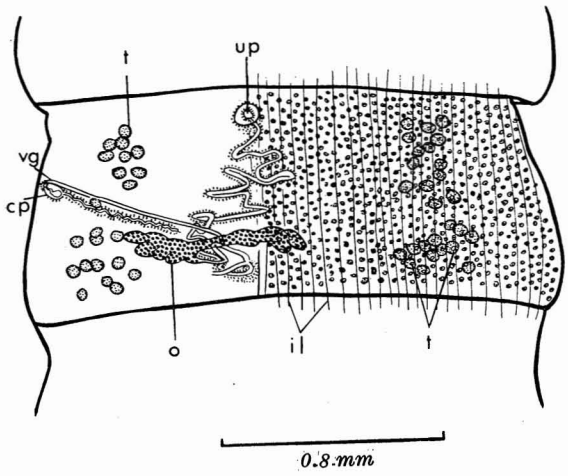
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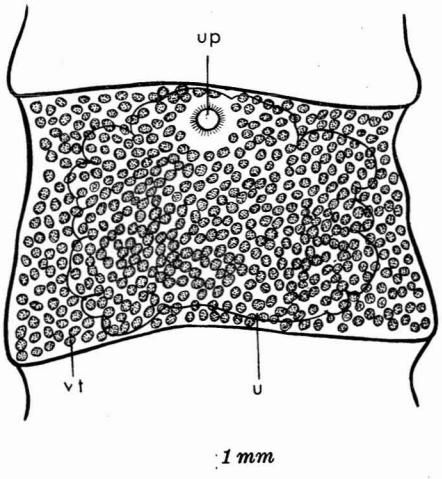
5D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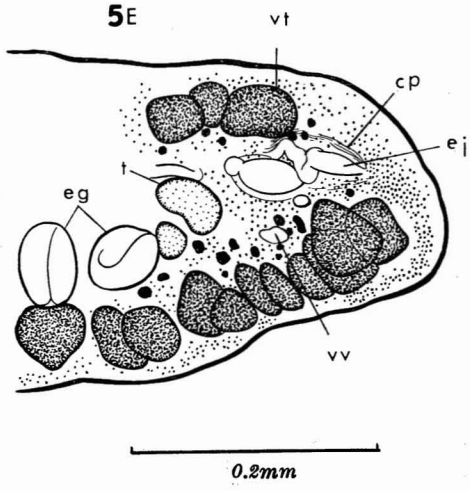
5E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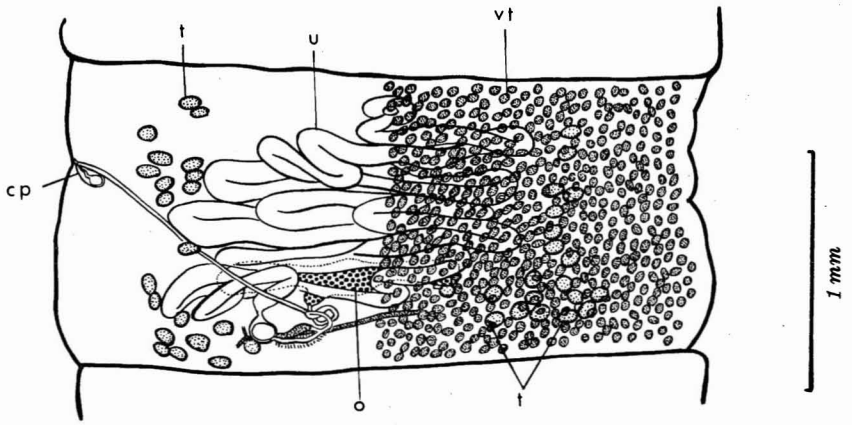
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mediately dorsal to ventral medullary excretory anastomoses, in one layer or two; although their total number could not be determined, they are not numerous. Thin-walled vas deferens convoluted around base of cirrus pouch. Cirrus pouch subglobular, 0.16–0.2 mm × 0.13–0.2 mm, not very muscular, situated in median field, with its long axis nearly at right angles to body surface, containing somewhat muscular pars prostatica surrounded by prostate cells at its base and an axial cirrus, which is lined with corrugated cuticle and supported by numerous transverse muscle fibers. The distal end of the cirrus joins the vagina to form cirrovaginal pore which opens at the bottom of the middorsal notch by a comparatively wide aperture.

Ovary arcuate, multilobulated, median, elongated transversely at base of proglottis, with its lateral ends curved posteriad or dorsad, 0.25–0.35 mm wide, up to 0.8 mm wide when extended; in cross sections a short lobe or two may be seen in the dorsal concavity of the ovary, where the vagina joins the germiduct arising from the dorsoposterior concave margin of the ovary. Vagina lined with thick cuticle and surrounded by dense layer of gland cells, running dorsad and backward windingly, opening into cirrovaginal pore alongside cirrus pouch. Vitelline follicles arranged in one layer all around between cortex and medulla, interrupted at notches where the uterus and cirrovaginal pore open, but continuous from proglottis to proglottis. Uterus winding a few times in median medulla from right to left and vice versa, not reaching to lateral medulla, distended with eggs when gravid, opening at small midventral notch at about level of cirrovaginal pore (Fig. 6C). No uterine sac. Eggs subglobular to ovoid, not operculate, 34–51μ × 23–37μ in lactophenolglycerine jelly, relatively thick-shelled, each containing oncosphere.

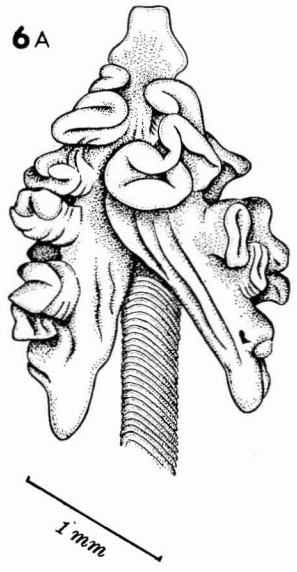
DISCUSSION: This genus differs from the most closely related *Ptychobothrium* Loennberg, 1889, as follows: (1) bothrial edges are markedly crenulated; (2) the inner longitudinal muscle layer is divided by the vitellarian layer into two (outer and inner) layers; in *Ptychobothrium* the longitudinal muscle bundles are seen among or between the vitelline follicles, but not divided into two layers; (3) the vagina is very strongly developed and so long that it forms transverse windings; (4) the multilobulated ovary is curved dorsoposteriad at its lateral ends to form a conspicuous dorsal concavity; (5) the uterus does not extend as far laterad as in *Ptychobothrium* and does not form a uterine sac; (6) the uterine pore is midventral instead of submedian.

Recently, Cable and Michaelis described in the Proceedings of the Helminthological Society of Washington 34(1):15–17, 1967, a new cestode, *Plicatobothrium cypseluri* n. g., n. sp., from the Caribbean flying fish, *Cypselurus bahiensis*. This worm resembles *Alloptychobothrium spilonotypteri* very closely, especially in the general shape of the scolex, the structure of the terminal genitalia, and the position of the vitellaria between the outer and inner layers of the longitudinal muscle bundles, but differs distinctly from the latter in that the ovary is V-shaped in dorsoventral view and the gravid uterine sac is conspicuously Y-shaped. The two species might be referred to the same genus, but until a detailed comparison of them is made on the whole mounts and sections, I prefer to regard them for the present as distinct not only specifically but also generically.

Alloptychobothrium n. g.

GENERIC DIAGNOSIS: Ptychobothriidae. Scolex arrowhead-shaped in lateral view, compressed from side to side, with dorsal and ventral bothrial edges markedly crenulated. Neck absent. Strobila may be completely or incompletely segmented; proglottides wider than long, craspedote or not. Inner longitudinal muscle bundles divided by vitellarian layer into two (outer and inner) layers. Testes not numerous, in one layer or two, in submedian medulla immediately dorsal to ventral medullary excretory anastomoses. Cirrovaginal pore opening at bottom of middorsal notch. Ovary multilobulated, arcuate, transversely elongated, median, at posterior end

FIGS. 6A–D. *Alloptychobothrium spilonotopteri* n. g., n. sp. *A,* scolex of holotype, lateral view; *B,* mature proglottis of paratype, dorsal view; *C,* transverse section of gravid proglottis of paratype through cirrus; *D,* transverse section of gravid proglottis of paratype through ovary.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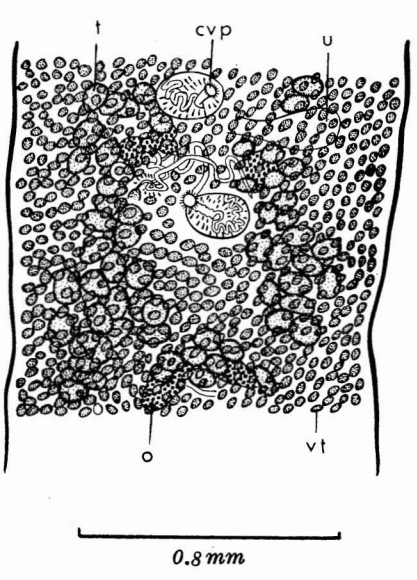
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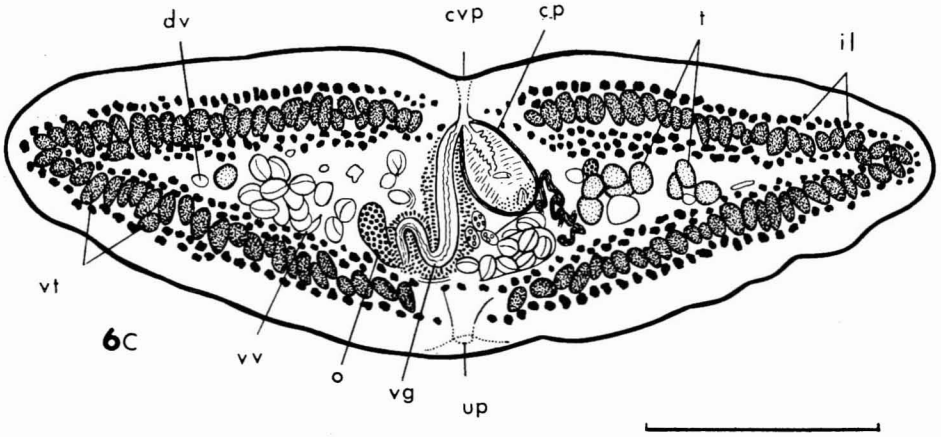
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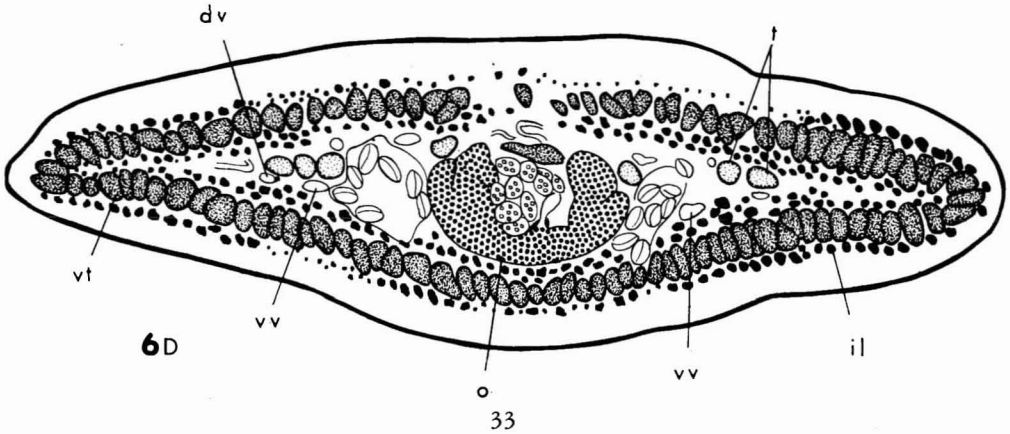
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of proglottis. Vitellaria continuous laterally and from proglottis to proglottis, but interrupted at notches, where the uterus and cirrovaginal pore open outside. Uterine coils confined to median field dorsal and anterior to ovary, not forming uterine sac before opening midventrally; eggs not operculate, containing subglobular oncosphere. Ventral longitudinal excretory stems anastomosing with narrower ventral vessels running longitudinally lateral to them. Parasitic in marine teleosts.

TYPE SPECIES: *A. spilonotopteri* n. sp., in *Cypselurus spilonotopterus;* Hawaii.

LECANOCEPHALIDAE Braun, 1900

7. *Cephalobothrium aetobatidis* Shipley et Hornell, 1906

Fig. 7*A–D*

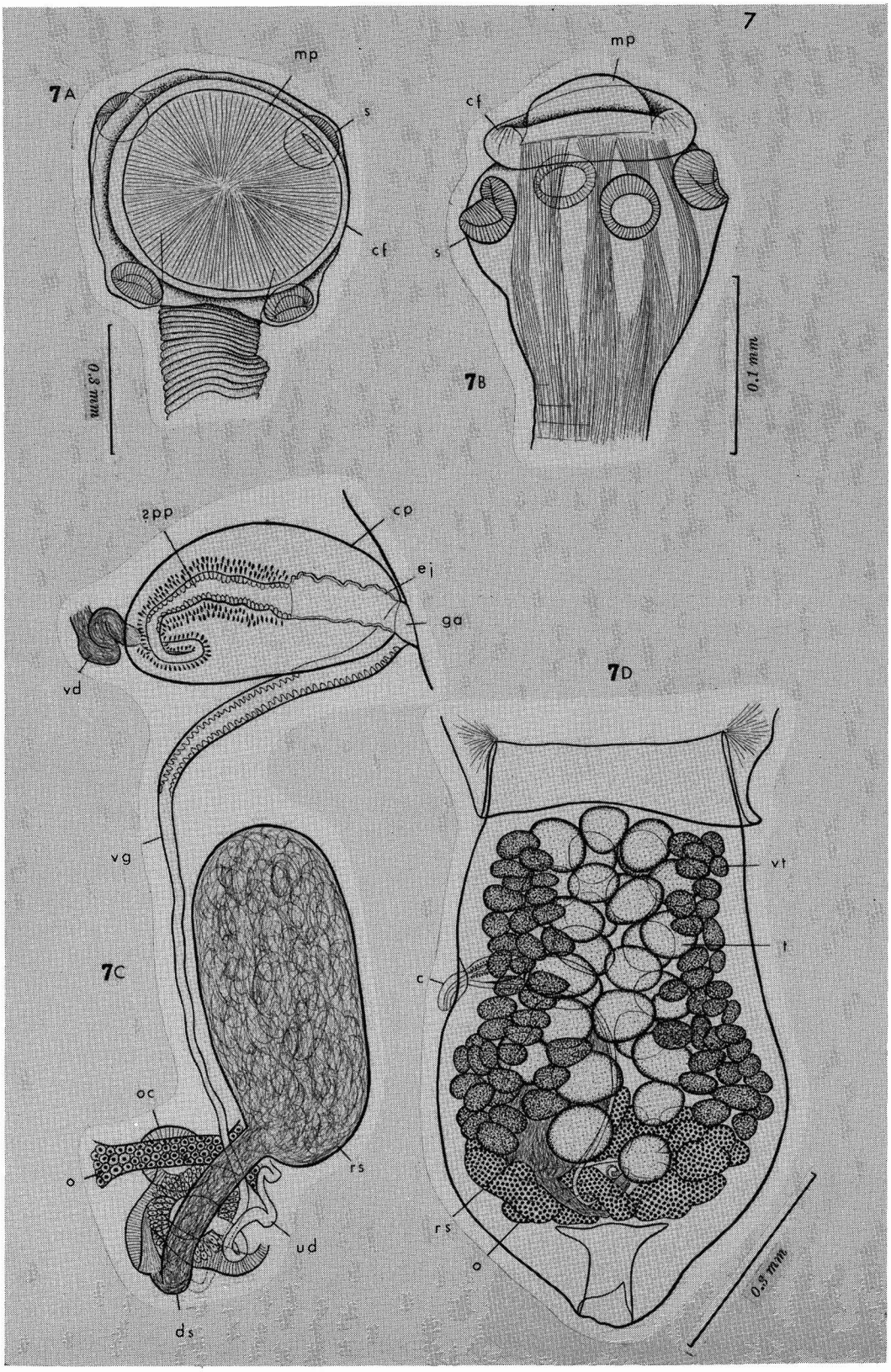
HABITAT: Spiral valve of *Aetobatis narinari;* Hawaii.

DESCRIPTION (based on five immature specimens and a single mature specimen): Strobila 18.7 mm long in the mature specimen, comprising 144 craspedote segments; some of the posterior segments were detached during preparation of the whole mount. Scolex rounded quadrangular, 0.5 × 0.67 mm, occupied at its apex by a circular muscle pad 0.45 × 0.5 mm and dome-shaped in profile. The strong muscle bundles of the pad are converged toward the center, without forming a suctorial depression or lumen; these muscle bundles are continued backwards into the ensuing proglottides in form of inner longitudinal bundles delimiting the medulla from the cortex. Around the apical pad is a circular collar-like fold which is conspicuous in much younger individuals. The four suckers situated at the corners of the scolex are 0.13 mm in diameter and present typical suctorial structure. Neck absent. Immature and anterior mature proglottides wider than long, but posterior mature ones longer than wide, constricted at both extremities. The easily detachable posterior proglottides are elliptical, 0.5–0.8 mm × 0.4–0.55 mm, with the posterior end produced backward in form of an abruptly tapering truncate cone. The inner longitudinal muscle bundles are strongly developed in the anterior immature proglottides but, as they proceed backward, they become gradually thinner and wider apart one from another, and in the posterior mature proglottides they are reduced to a layer of very fine individual fibers. Excretory stems not seen.

Testes globular to oval, comparatively large (50–100μ in diameter), 15–25 in number in mature proglottides, massed together, partly overlapping one another, in greater part of medulla between two lateral vitelline fields, leaving anteriormost and posterior parts of proglottis free. Vas deferens convoluted close to medial end of cirrus pouch. Cirrus pouch elongate pyriform or short claviform, 0.19 × 0.06 mm in the mature proglottis figured, lying transversely in pre-equatorial zone, nearly reaching median line, containing convoluted ejaculatory duct surrounded by gland cells (Fig. 7C) at base and eversible tubular ejaculatory duct distally. Cirrus, when everted, cylindrical, smooth, 60μ × 20μ in the proglottis figured (Fig. 7D), projecting backward along lateral margin of proglottis. Genital atrium is clearly seen, when the cirrus is not everted, as a cuticular ring, into which the cirrus opens immediately in front of the vagina. The genital pore pre-equatorial, may be slightly depressed occasionally, alternating irregularly from side to side.

Ovary two-winged, 0.1 × 0.3 mm in the mature proglottis figured (Fig. 7D), situated near posterior end of proglottis, with shell gland complex immediately behind its isthmus. Vitellaria follicular, extending in lateral medulla between testes and lateral edge of inner muscle sheath from a little behind level of anterior extent of testes to ovarian wings, where the transverse vitelline duct passes inward on each side. The winding uterine duct running forward dorsal to the ovarian isthmus appears to open into the incipient uterus proper from

FIGS. 7*A–D*. *Cephalobothrium aetobatidis* Shipley et Hornell, 1906. *A,* scolex, apical view; *B,* same, lateral view; *C,* male terminalia, ovariovaginal complex, and seminal receptacle, dorsal view; *D,* end proglottis, dorsal view.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the dorsal side a little anterior to the ovarian isthmus; the incipient uterus proper is seen as a wide, laterally crenulated lumen reaching to the base of the cirrus pouch. No eggs observed. The presence of a large elliptical seminal receptacle connected with the germiduct by a wide seminal duct, as shown in Fig. 7C and Fig. 7D, is one of the most important characteristics of this species.

DISCUSSION: Because the original description of this species by Shipley and Hornell is inadequate, no detailed comparison is possible between *Cephalobothrium aetobatidis* from Ceylon and the Hawaiian representative from the same host species, but from agreement in external anatomy there is no doubt that both are identical. The statement by Shipley and Hornell that the terminal "sucker" is round, with thickened edges, and their figure of the scolex appear misleading, because the apical muscle pad lacking a suctorial lumen is by no means a true sucker, and the collar-like circular fold encircling the apical pad is not shown in their figure.

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