Reprinted from THE JOURNAL OF PARASITOLOGY, June, 1959,
Vol. 45, No. 3, pages 337–346.

STUDIES ON HELMINTH PARASITES FROM THE COAST OF FLORIDA. III.

DIGENETIC TREMATODES OF MARINE FISHES FROM TAMPA AND BOCA CIEGA BAYS.*

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The trematodes reported herein were collected from marine fishes or invertebrate intermediate hosts. The trematodes collected from intermediate hosts live in marine fishes as adults. This publication is a continuation of a series of studies on the diseases and parasites of marine animals which is currently being sponsored by the Florida State Board of Conservation.

Acknowledgements are extended to Dr. V. G. Springer, of this Laboratory, for identification of some fish hosts.

Unless otherwise cited, all measurements are in millimeters.

FAMILY BUCEPHALIDAE Poche, 1907

1. *Prosorhynchus* sp.

Host: Chilomycterus schoepfi (Walbaum), spiny boxfish, family Diodontidae.
Incidence of infection: In 1 of 3 hosts.
Location: Interradial membranes of all fins.
Locality: Cabbage Key, Boca Ciega Bay, Florida.

Immature *Prosorhynchus* sp. from the spiny boxfish were not saved. Caballero, Bravo and Grocott (1953) have reported taking immature *Prosorhynchus* from the kidney of *Polydactylus opercularis* (= *Polynemus opercularis*), a threadfin, from the Gulf of Panama. To our knowledge, this record of Caballero et al (1953) is the only published report of a natural infection of fishes by *Prosorhynchus* metacercariae in this continent. According to Hopkins (1954) other records of larval *Prosorhynchus* from fishes may have actually referred to species of other bucephalid genera.

FAMILY LEPOCREADIIDAE Nicoll, 1935

2. *Diploproctodaeum plicitum* (Linton, 1928) Sogandares and Hutton, (in press). (Fig. 1)

Hosts: Chilomycterus schoepfi (Walbaum), spiny boxfish, new host record, family Diodontidae; and *Lagocephalus laevigatus* (Linn.), smooth swellfish, family Tetraodontidae.
Incidence of infection: In 1 of 3 *C. schoepfi,* and 1 of 1 *L. laevigatus.*
Location: Mid-intestine of *C. schoepfi;* exact location in intestine of *L. laevigatus* not observed.
Locality: C. schoepfi from Mullet Key, Boca Ciega Bay, and *L. laevigatus* from approximately ½ mile off Pinellas Point, Tampa Bay, Florida. New locality records.

A single specimen was collected from each *C. schoepfi* and *L. laevigatus. D. plicitum* has been reported from numerous hosts in the American Atlantic and Tropical American Pacific.

Received for publication October 6, 1958.
* This investigation was supported in part by a research grant (E-2008) from the National Institutes of Health, U. S. Public Health Service.
** Contribution Number 19.

3. *Diploproctodaeum vitellosum* n. sp.
(Fig. 2)

Host: Lagocephalus laevigatus (Linn.), smooth puffer, family Tetraodontidae.
Incidence of infection: In 1 of 1 host examined.
Location: Exact position in intestine not observed.
Locality: ½ mile offshore from Pinellas Point, Tampa Bay, Florida.
Holotype: U. S. National Museum Helminthological Coll. No. 38385.
Diagnosis (based on a single specimen): Body oblong in shape; anterior lateral folds of body extend a short distance posterior to acetabulum; 2.132 long by 1.482 wide. Cuticle apparently unspined; spines may have been lost during fixation. Oral sucker subterminal, 0.13 to 0.26 wide. Prepharynx approximately ⅞ length of pharynx. Pharynx with 6 ventral lobes, the bases of which are surrounded by circular muscles which extend the width of anterior end of pharynx; 0.13 long by 0.156 wide. Esophagus approximately ½ length of pharynx. Ceca extend to posterior end of body opening separately to outside. Acetabulum immediately preequatorial; 0.13 long by 0.286 wide. Transverse sucker ratio 1:1.1. Genital pore sinistral at anterior border of acetabulum, cirrus sac from genital pore to almost in contact with anterior border of ovary; containing unarmed cirrus and internal seminal vesicle approximately in posterior ¼ sac. External seminal vesicle ⅔ length of cirrus sac; from posterior end of cirrus sac curving sinistrally and dorsal to ovary. Ovary sinistral to midline, in contact with testes; multilobed; 0.286 long by 0.286 wide. Uterus ascending intercecally on dextral side of body to anterior level of acetabulum, descending dorsal to acetabulum transversing body sinistrally to enter a muscular metraterm which is to the left and about ⅝ length of cirrus sac. Vitellaria not intruding into anterior body folds; covering dorsal portion of body from level of oral sucker to fill hindbody dorsally and ventrally. Eggs thin-shelled; collapsed eggs measure 73 to 76 microns long by 46 microns wide. Excretory vesicle not observed.
The name *vitellosum* is to indicate the extensive vitelline glands.

There are 6 species in the genus *Diploproctodaeum* La Rue, 1926. These species are: *D. haustrum* (McCallum, 1918) La Rue, 1926, genotype; *D. plicitum* (Linton, 1928) Sogandares & Hutton, (*in press*); *D. cryptostoma* (Ozaki, 1928) Sogandares & Hutton, (*in press*); *D. holocentri* (Yamaguti, 1942) Sogandares & Hutton, (*in press*); *D. tetraodontis* (Nagaty, 1957) Sogandares & Hutton, (*in press*); *D. hemistoma* (Ozaki, 1928) Sogandares & Hutton, (*in press*).

Sogandares & Hutton (*in press*) have discussed the status of the genus *Diploproctodaeum* La Rue, 1926. Caballero, Bravo and Grocott (1952) considered *D. holocentri* a synonym of *D. hemistomum.* Caballero *et al* (1952) apparently confused the anterior parenchymal gland cells figured by Ozaki (1928) with vitellaria, and stated that they could find no differential character in the anterior extent of the vitellaria of the two species and that since egg size is very variable in other species of the genus, the two species were synonyms. We know through Yamaguti (1934) and Manter (1947) that Yamaguti had specimens of *D. hemistomum* in his possession at the time he described *B. holocentri.* We have not seen Yamaguti's specimens of *B. holocentri,* but assume that if he had specimens of *B. hemistomum,* he compared the two taxons before describing *D. holocentri.* So far as the descriptions of *B. holocentri* and *B. hemistoma* are concerned, the two taxons appear to be distinct.

There are 2 species of *Diploproctodaeum* in which the vitellaria extend anteriorly to the level of the pharynx. These species are: *D. holocentri* and *D. tetraodontis.*

D. vitellosum differs from *D. holocentri* as follows: (1) The genital pore is at sinistral anterior border of acetabulum rather than at sinistral posterior border of acetabulum; (2) external seminal vesicle overlaps the ovary; (3) vitellaria extend dorsal to posterior border of oral sucker as compared with vitellaria extending only to pharynx; (4) the pharynx has 6 ventral anterior lobes; and (5) the posterior tip of the cirrus sac is almost in contact with ovary rather than halfway between acetabulum and ovary in *D. holocentri.*

D. vitellosum differs from *D. tetraodontis* as follows: (1) The pharynx is smaller than oral sucker; (2) the acetabulum is pre-equatorial; (3) the prepharynx is approximately ½ length of the pharynx as compared with prepharynx lacking; (4) the esophagus is approximately ½ length of the pharynx as compared with esophagus lacking; (5) the ovary is sinistral to midline and separated from acetabulum by about a distance equivalent to length of acetabulum as compared with ovary median and overlapping or immediately behind posterior border of acetabulum; and (7) the genital pore is sinistral and level with anterior border of acetabulum rather than near posterior border of pharynx.

D. vitellosum differs from *D. haustrum, D. cryptostoma, D. hemistomum* and *D. plicitum* by possessing vitellaria which extend anterior to level of the oral sucker or a short distance beyond. *D. vitellosum* further differs from *B. cryptostoma* as follows: (1) The pharynx with 6 ventral lobes; (2) the posterior tip of the cirrus sac extends posterior to acetabulum, coming almost in contact with ovary, as compared with posterior border of cirrus sac less than ⅓ distance between acetabulum and ovary. *B. vitellosum* further differs from *D. hemistoma* by (1) possessing a shorter post-testicular space; (2) ovary separated from the acetabulum by less than one acetabular length as compared with ovary separated from acetabulum by two acetabular lengths; (3) genital pore level with anterior edge of acetabulum as compared with genital pore immediately behind acetabulum, close to it on the left side; and (4) internal seminal vesicle in posterior ¼ cirrus sac as compared with internal seminal vesicle in posterior 1/7 cirrus sac. *D. vitellosum* differs from *D. plicitum* as follows: (1) cirrus sac almost in contact with ovary as compared with cirrus sac from ⅓ to ½ distance from acetabulum to ovary; (2) external seminal vesicle overlapping ovary dorsally; (4) ovary level with sinistral side of body as compared with ovary anterior to foretestis almost in the midline of body (the most constant character which we have been able to observe in *D. plicitum*), and vitellaria coalescing anterior to acetabulum as compared with vitellaria never coalescing anterior to acetabulum. *D. vitellosum* differs from *D. haustrum* as follows: (1) in all above mentioned details in which *D. vitellosum* differs from *D. plicitum;* (2) the anterior part of the body is broadly rounded as compared with sagittate in *D. haustrum;* (3) the esophagus is about the length of pharynx as compared with esophagus longer than pharynx in *D. haustrum.*

4. *Multitestis rotundus* Sparks, 1954
(Figs. 3 to 5)

Host: Archosargus probatocephalus (Walbaum), sheepshead, family Sparidae.
Incidence of infection: In 1 of 3.
Number: In excess of 150.
Location: Pyloric ceca.
Locality: Bayboro Harbor, Tampa Bay, Florida; new locality record.

Our specimens of *M. rotundus* differ from those described by Sparks (1954) in possessing a more elongate body and a variable number of testes. The right side and left side of the body, respectively, may have the following combinations of testes: 4–4, 4–5, 5–4, 5–6, 6–5 and 6–6. *M. rotundus* is known from Port Aransas, Texas (Sparks, 1954), from Grande Isle, Louisiana (Sparks, 1958) and now from Tampa Bay, Florida.

FAMILY ACANTHOCOLPIDAE Lühe, 1909

5. *Stephanostomum ditrematis* (Yamaguti, 1939) Manter, 1947
(Figs. 6 to 7)

Host: Caranx hippos (Linn.); common jack; family Carangidae.
Incidence of infection: In 1 of 1 host examined.
Location: Rectum.
Locality: Bayboro Harbor, Tampa Bay, Florida; new locality record.

The only other record of *S. ditrematis* from *C. hippos* is by Linton (1940) who named and described *Stephanostomum filiforme* from this host in Woods Hole, Massachusetts. Manter (1947) has indicated that *S. filiforme* Linton, 1940, is a synonym of *S. ditrematis* and we agree with this synonymy. *S. ditrematis* is a parasite of carangids in Woods Hole, Massachusetts, Tortugas, Florida, Bimini, B.W.I., and the Tropical American Pacific.

Contraction of the posterior end of the body has caused a rather short post-testicular space in the specimen pictured in Figure 6. Other specimens in the same collection are as pictured by Yamaguti (1939).

6. *Stephanostomum* sp.
(Figs. 8 to 9)

Host: Acanthostracion tricornis (Linn.); cowfish; family Ostraciidae.
Incidence of infection: In 1 of 1 host.
Location: Encysted on pericardial membrane.
Locality: Bayboro Harbor, Tampa Bay, Florida.

The immature worm from *A. tricornis* possesses 36 peribuccal spines and a sucker ratio of 1 : 0.94. Immature *Stephanostomum* spp. have been reported from the flesh, fins and liver of some marine fishes. This is the first record of a *Stephanostomum* immature from the pericardial membrane of a fish.

Ten species of *Stephanostomum* with 36 peribuccal spines have been named. These species are: *S. carangium* (Yamaguti, 1951) Caballero, 1952; *S. casum* (Linton, 1910) MacFarlane, 1934; *S. cesticillum* (Molin, 1858) Looss, 1899; *S. ceylonicum* (Lühe, 1906) Caballero, 1952; *S. coryphaenae* Manter, 1947; *S. ditrematis* (Yamaguti, 1939) Manter, 1947; *S. minutum* (Looss, 1901) Manter, 1940; *S. nipponicum* Yamaguti, 1953; *S. pristis* (Deslongchamps, 1824) Looss, 1901; and *S. sentum* (Linton, 1910) Manter, 1947. Of these, *S. casum, S. coryphanenae, S. ditrematis* and *S. sentum* are the only species of the genus known from this continent. With the exception of *S. ditrematis,* our immature *Stephanostomum* specimen from *A. tricornis* differs from all of these species by possessing an acetabulum which is smaller than the oral sucker. *S. casum, S. coryphaenae,* and *S. sentum* may perhaps be further eliminated by the arrangement and size of the peribuccal spines. The shape, size and arrangement of the peribuccal spines suggest *S. ditrematis* which is a parasite of carangids in the Tampa Bay area. In addition, the specimens of *S. ditrematis* collected from this area possess a sucker ratio of from 1 : 0.098 to 1 :1.2, almost within the ratio given above for our immature *Stephanostomum* sp. This report may represent an accidental larval infection, as it would be difficult to conceive of carangids feeding on trunkfishes. It may also be that our larval specimen is a species different from *S. ditrematis.* For this reason, it is listed as *Stephanostomum* sp.

7. *Stephanostomum promicropsi* Manter, 1947
(Figs. 10 to 11)

Host: Promicrops itiara (Leichenstein); jewfish; family Serranidae.
Incidence of infection: In 1 of 1 host examined.
Location: Rectum.
Locality: Tampa Bay, Florida, new locality record.

S. promicropsi is also known from Tortugas, Florida. This record is the

northernmost for the species. An outstanding feature of *S. promicropsi* is that the vitellaria ventral to the ceca are interrupted at the level of the testes.

FAMILY OPECOELIDAE Ozaki, 1925

8. *Opecoeloides fimbriatus* (Linton, 1934) n. comb.
(Figs. 12 to 16)

Host: Penaeus duorarum Burkenroad; pink shrimp; family Penaeidae.
Location: Encysted in various sites or organs within cephalothorax.
Locality: Gandy flats, Tampa Bay, Florida.

This trematode was originally reported from the pink shrimp by Woodburn *et al* (1957). They correctly identified the species to familial level and furnished a photomicrograph. This study presents a more detailed account of the metacercaria from the pink shrimp.

Manter (1934) described *Cymbephallus fimbriatus,* ascribing the name to Linton *in press.* Later (1941) Hopkins reported the flame cell pattern of *Cymbephallus fimbriatus* Linton, 1934 collected from *Bairdiella chrysura* in Beaufort, North Carolina. Von Wicklen (1947) named the genus *Fimbriatus* with *Cymbephallus fimbriatus* Linton, 1934 (in Manter, 1934) as type species. Von Wicklen (1947) did not actually observe the type specimen of *Fimbriatus fimbriatus* (Linton, 1934), (USNM No. 8266), but instead had one of her colleagues, Mrs. Marjorie Jean Raecke Prince make the observations. Mrs. Prince observed 2 ani in Linton's type material. On the basis of the presence of two ani in *Cymbephallus fimbriatus,* Von Wicklen erected the genus *Fimbriatus.* The genus was, in addition, characterized by possessing an accessory sucker, and a protrusible acetabulum with fimbriated lobes. Our metacercarial specimens from the shrimp possess all of the characteristics of *Fimbriatus fimbriatus* (Linton, 1934) Von Wicklen, 1946 except eggs are lacking in the uterus and vitellaria are undeveloped. The presence of 2 ani or of a uroproct is dependent upon the contraction of the posterior end of the body in our specimens. When live metacercariae were placed under slight coverglass pressure and a small amount of neutral red stain added, the intestinal contents as well as the wall of the excretory vesicle were colored red. The presence of a uroproct was quite obvious in the first specimen observed. A second specimen possessed what appeared to be ani. At first it was believed that these two specimens represented 2 different genera. Close observation of the latter specimen showed that the two ani and the excretory vesicle formed a uroproct by involution of the posterior end of the body (Figs. 14 to 16). Observations of additional specimens under purposely varied coverslip pressure showed that the intestinal contents could be forced into the excretory bladder when the uroproct was formed, (Figs. 14 and 15). When the posterior end of the worm was dilated in the same specimen (Fig. 16), the intestinal contents would extrude from each cecum directly to the outside. We believe that when the uroproct is formed very close to the posterior end of the body it does not serve as a good generic character. Perhaps the presence of ani or of a uroproct may be of generic value when there is a distinct separation of the ani from the excretory pore. Since *Fimbriatus* is monotypic, and the presence of ani or of a uroproct is dependent upon contraction of the posterior end of the body, *Fimbriatus* Von Wicklen, 1946 is here considered a synonym of *Opecoeloides* Odhner, 1928. *Fibriatus fimbriatus* (Linton, 1934), Von Wicklen, 1946, becomes *Opecoeloides fimbriatus* (Linton, 1934) n. comb. Hopkins (1941) has indicated that *O. vitellosus* (Linton, 1934) Von Wicklen, 1946 may be distinguished from *O. fimbriatus* by the presence of minute rodlets

in the parenchyma of the former species. Our metacercarial specimens of *Opecoeloides fimbriatus* lacked these minute parenchymal rodlets. For this and the other above mentioned reasons, our specimens have been considered to be *Opecoeloides fimbriatus.*

FAMILY MONORCHIIDAE Odhner, 1911

9. *Lasiotocus minutum* (Manter, 1931) n. comb.
(Figs. 17 to 19)

Host: *Fundulus similis* Baird & Girard; family Poecoeliidae.
Incidence of infection: In 3 of 3 hosts.
Location: Anterior ⅓ intestine.
Locality: S. E. Beach Drive, St. Petersburg, Florida.

Specimens of a trematode which we believe to be *Proctotrema minuta* (Manter, 1931), Manter, 1942 were collected from *Fundulus similis* in St. Petersburg, Florida. Our specimens differed slightly from Manter's (1931) description of *P. minuta* from *Menidia menidia* and *Fundulus majalis,* in Beaufort, North Carolina. The egg size of our material is 16 to 20 microns long by 12 to 16 microns wide as compared with 16 to 17 microns long by 7 to 8 microns wide as given by Manter (1931). The specimen pictured in Figure 7 shows the eggs extending only a slight distance behind the testis. In other specimens in our collection, the eggs extend to the posterior end of the body. The genital atrium of most of our specimens is everted due to cirrus and metraterm protrusion. Careful examination reveals no spines to be present other than on the metraterm (Fig. 18), cirrus (Fig. 19), and cuticle.

According to Manter's (1942) interpretation, *Genolopa minuta* Manter, 1931 shares the unspined genital atrium in common with species of *Proctotrema* Odhner, 1911. Accordingly Manter (1942) transferred *G. minuta* to the genus *Proctotrema.* Yamaguti (1953) synonymized *Proctotrema* Odhner, 1911, with *Lasiotocus* Looss, 1907. We agree with this synonymy, but do not agree with Yamaguti (1953) in leaving *Proctotrema minuta* (Manter, 1931) Manter, 1942 in the genus *Genolopa* Linton, 1910. *Proctotrema minuta* (Manter, 1931) Manter, 1942 (Synonym: *Genolopa minuta* Manter, 1931) becomes *Lasiotocus minutum* (Manter, 1931) n. comb.

FAMILY ZOOGONIDAE Ohdner, 1911

10. *Diphterostomum americanum* Manter, 1947
(Figs. 20 to 21)

Hosts: *Gobiosoma robustum* Ginsburg, goby, family Gobiidae; *Lagodon rhomboides* (Linn.), pinfish, family Sparidae; and *Opsanus beta* (Goode & Bean), toadfish, family Batrachoidiidae; all new host records.
Incidence of infection: In 2 of 2 *G. robustum,* 1 of 4 *L. rhomboides,* and 1 of 10 *O. beta.*
Location: Rectum of all hosts.
Locality: *G. robustum* from Mullet Key, Boca Ciega Bay, Florida; *L. rhomboides* from Bayboro Harbor, and *O. beta* from Snell Isle, Tampa Bay, Florida; new locality records.

Manter (1947) originally described *D. americanum* from 1 of 6 *Brachygenys chrysagerus* (Günther) in Tortugas, Florida. Manter (1947) differentiated *D. americanus* from *D. brusinae* (Stossich, 1899) Stossich, 1904; *D. sargus ansularis* Wlassenko, 1931; *D. magnacetabulum* Yamaguti, 1938; and *D. spari* Yamaguti, 1938; mainly by the fact that the genital pore is posterior to the intestinal bifurcation in *D. americanum.*

The measurements and proportions of our trematode specimens agree rather closely with Manter's description of *D. americanum.* The sucker ratios of our

specimens range from 1:1.75 to 2.0. The ovary and testes are variable in position, depending upon contraction or method of fixation. Sometimes the ovary may be entirely dorsal to acetabulum along the median line of body or displaced to one side, and at other times the ovary may be posterior to and slightly overlapping acetabulum between the testes (Fig. 20). The testes may lie side by side, posterior to or overlapping acetabulum on each side of body. These observations agree with Looss' (1901) findings on *D. brusinae* as cited by Yamaguti (1934). Figure 21 shows one of our specimens with a contracted forebody. The genital pore and cirrus sac remain posterior to cecal bifurcation regardless of contraction or extension (Fig. 20) of forebody. This report of *D. americanum* from Tampa and Boca Ciega Bays, Florida, represent new host and locality records. The species was formerly known only from Tortugas, Florida.

SUMMARY

1. The following trematodes all new locality records for Tampa and/or Boca Ciega Bays, Florida, are reported: *Prosorhynchus* sp. (Family Bucephalidae); *Diploproctodaeum plicitum* (Linton, 1928) Sogandares & Hutton (*in press*); *Diploproctodaeum vitellosum* (this paper); *Multitestis rotundus* Sparks, 1954; (Family Lepocreadiidae); *Stephanostomum ditrematis* (Yamaguti, 1939) Manter, 1947; *Stephanostomum* sp.; *Stephanostomum promicropsi* Manter, 1947; (Family Acanthocolpidae); *Opecoeloides fimbriatus* (Linton, 1934) (this paper); (Family Opecoelidae); *Lasiotocus minutum* (Manter, 1931) (this paper); (Family Monorchiidae); and *Diphterostomum americanum* Manter, 1947 (Family Zoogonidae).

2. New host records are as follows: *Prosorhynchus sp.* (Metacercaria) in *Chilomycterus schoepfi* (Walbaum); *Diploproctodaeum plicitum* in *Chilomycterus schoepfi* (Walbaum); *Stephanostomum* sp. in *Acanthostracion tricornis* (Linn.); *Lasiotocus minutum* in *Fundulus similis* Baird & Girard; and *Diphterostomum americanus* in *Gobiosoma robustum* Ginsberg; *Lagodon rhomboides* (Linn.); and *Opsanus beta* (Goode & Bean).

3. A new species, *Diploproctodaeum vitellosum,* is described from *Lagocephalus laevigatus* (Linn.)

4. New combinations are as follows: *Fimbriatus fimbriatus* (Linton, 1934) Von Wicklen, 1946 becomes *Opecoeloides fimbriatus* n. comb.; *Proctotrema minuta* (Manter, 1931) Manter, 1942, becomes *Lasiotocus minutum* (Manter, 1931) n. comb.

5. Information pertaining to the exact location of each trematode species within its respective host(s) is given when possible.

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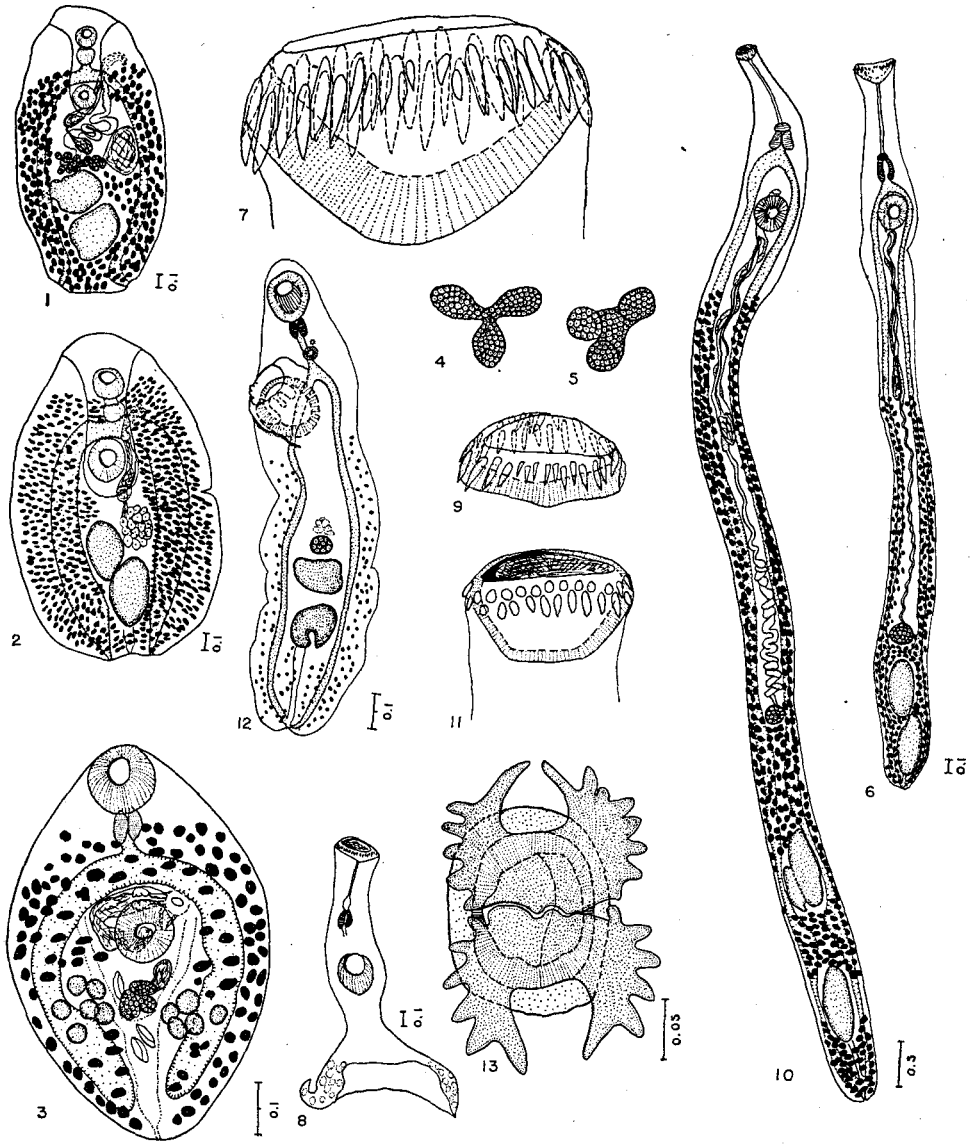
EXPLANATION OF FIGURES

Unless otherwise stated, all figures were drawn with the aid of a camera lucida. Scale has value indicated in millimeters.

FIGURE 1. *Diploproctodaeum plicitum,* ventral view of whole mount.
FIGURE 2. *Diploproctodaeum vitellosum,* ventral view of whole mount.
FIGURE 3. *Multitestis rotundus,* ventral view of whole mount.
FIGURE 4. Same, sketch of ovary to show variation.
FIGURE 5. Same, sketch of ovary to show variation.
FIGURE 6. *Stephanostomum ditrematis,* ventral view of whole mount.
FIGURE 7. Same, sketch of oral sucker and peribuccal spines, ventral view.
FIGURE 8. *Stephanostomum* sp., ventral view.
FIGURE 9. Same, sketch of oral sucker and peribuccal spines, ventral view.
FIGURE 10. *Stephanostomum promicropsi,* ventral view of whole mount.
FIGURE 11. Same, sketch of oral sucker and peribuccal spines, ventral view.
FIGURE 12. *Opecoeloides fimbriatus,* ventral view of whole mount.
FIGURE 13. Same, *en face* view of acetabulum to show fimbriations.
FIGURE 14. Same, sketch showing fully formed uroproct.
FIGURE 15. Same, sketch showing a slight uroproct formation.
FIGURE 16. Same sketch showing ani opening separately from excretory vesicle.
FIGURE 17. *Lasiotocus minutum,* lateral view of whole mount.
FIGURE 18. Same, metraterm spines.
FIGURE 19. Same, cirrus spines.
FIGURE 20. *Diphterostomum americanum,* dorsal view of whole mount.
FIGURE 21. Same, dorsal view of anterior end of body of a different specimen from that pictured in figure 20.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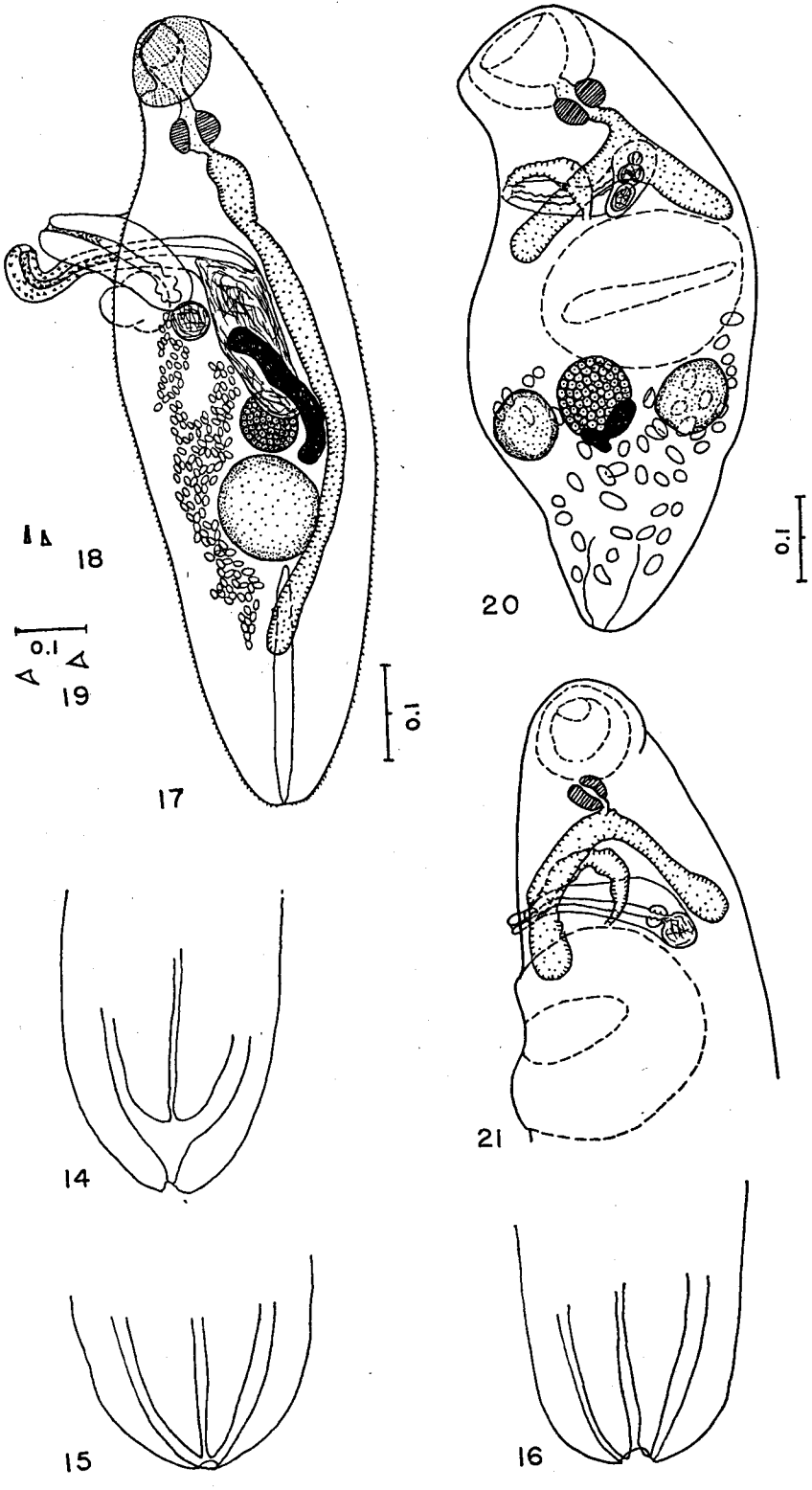
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20
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21
14
15
16