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TREMATODES FROM FISHES MAINLY FROM THE WOODS HOLE REGION, MASSACHUSETTS

By Edwin Linton [1]

INTRODUCTION

It has been my privilege, during a long series of years, to spend the summer months at the laboratory of the United States Bureau of Fisheries, at Woods Hole, Mass. During that time considerable attention was given to a study of the distribution of the helminth parasites of fishes. Through the cooperation of the late Vinal N. Edwards, collections and observations were made so as to cover all the months of the year. All collections in the months of October to May, inclusive, and the greater number of those in June and September, were made by Mr. Edwards. The majority of the collections in July and August, and a few of those in June and September, were made by the author.

Reports on a few trematodes from fishes not of the Woods Hole region are herein included. When not stated otherwise it is to be understood that digenetic forms came from the intestine and monogenetic forms from the gills. In many cases in which the same species of trematode is accredited to more than one species of fish, measurements are given of examples from different hosts, and record made of differences noted.

[1] Dr. Linton died on June 3, 1939, a few days before this paper was sent to the printer.—Ed.

Much difficulty is experienced when one attempts to identify alcoholic or formalin specimens of these soft-bodied forms, which not only assume diverse contraction shapes but may vary considerably in the size and relative proportions and positions of parts with the age of the individuals. No special search was made for monogenetic forms. Such as were found had usually been washed off the gills while preparing the viscera for examination. In the summers of 1912 to 1927 such helminths from the gills and skin of fishes as were met with were turned over to Dr. G. A. MacCallum, who was giving especial consideration to the monogenetic trematodes.

The author is under obligations to Drs. H. W. Manter and H. W. Stunkard for information that has prevented some duplication of names as a result of work carried on by them on forms noted in this report.

The invaluable index catalog of Stiles and Hassall [2] renders it unnecessary, in most cases, to cite literature prior to 1908. For the convenience of future investigators, however, frequent references have been given to earlier papers of the author, on trematodes from the Woods Hole region.

The names of fishes used in this report are those given in the check list of Jordan, Evermann, and Clark.[3]

Order MONOGENEA van Beneden, 1858

Suborder MONOPISTHOCOTYLEA Odhner, 1912

Family GYRODACTYLIDAE van Beneden and Hesse, 1863

Subfamily GYRODACTYLINAE Monticelli, 1892

Genus GYRODACTYLUS Nordmann, 1832

GYRODACTYLUS species

PLATE 14, FIGURE 158

On August 6, 1911, Dr. R. A. Spaeth called my attention to certain small monogenetic trematodes (U.S.N.M. No. 8142) on the scales of the common killifish (*Fundulus heteroclitus*). Later, on August 18, Dr. C. W. Hahn, who was examining killifishes for sporidia, reported these worms abundant on fishes he had been examining.

Measurements, life: Length, 0.5 mm.; breadth, anterior, 0.05 mm.; maximum, a little back of middle, 0.12 mm.; length of large hooks,

[2] Index-catalogue of medical and veterinary zoology. Subjects: Trematodes and trematode diseases. U. S. Hyg. Lab. Bull. 37, 401 pp., 1908.

[3] Check list of the fishes and fishlike vertebrates of North and Middle America north of the northern boundary of Venezuela and Colombia. Rep. U. S. Comm. Fish. 1928, pt. 2, 670 pp., 1930.

0.07 mm. The anterior end is bilobed, each lobe bearing a small contractile papilla. The posterior sucker bears two larger hooks symmetrically placed, one on each side of the median line, and about 18 small hooks and 2 spines on the margins.

These worms perform active looping movements, attaching themselves by the anterior end; then, releasing the posterior sucker, they rapidly loop themselves forward.

Subfamily TETRAONCHINAE Monticelli, 1903

Genus ANCYROCEPHALUS Creplin, 1838

ANCYROCEPHALUS PARVUS, new species

PLATE 14, FIGURES 159, 160

Body elliptical, narrowed abruptly at anterior end, which bears four blunt projections, and two pairs of eye spots; pharynx longer than broad; posterior disk with 18 hooks, 4 median pairs, 5 hooks on each lateral margin, and 2 transverse bars. The two median hooks are somewhat larger than the others. The cirrus pouch is pyriform, the cirrus long and filiform; seminal vesicle long-pyriform, beside cirrus pouch, ventral and posterior to the pharynx. Ovary median, longer than broad; seminal receptacle on left side at anterior border of vitellaria; follicles of vitellaria dense, filling all but a small portion of the anterior end of the body from the margins to the ovary and testis on the median line, and extending to the posterior end. One testis, longer than broad, on median line behind the ovary. Measurements in balsam: Length, 0.73 mm.; breadth, anterior end 0.1 mm., middle 0.5 mm.; pharynx, length 0.07 mm., breadth, 0.05 mm.; length of longest hooks 0.024 mm.

Average of 5: Length, 0.82 mm.; breadth, 0.38 mm. Longest, length 1.08 mm., breadth 0.34 mm.; shortest, length 0.67, breadth 0.39 mm.

Measurements, life (U.S.N.M. No. 8143): Length, 0.84 mm.; breadth, anterior (head) 0.1 mm., middle, maximum, 0.42 mm., posterior (caudal disk) 0.14 mm.

The middle of the body was traversed by strong, longitudinal muscle fibers, and by less strong longitudinal fibers along the lateral margins. The head carried four club-shaped projections, which, in a specimen fixed over the flame, broke up into longitudinal striae.

Type specimens.—U.S.N.M. No. 8143 (holotype and paratypes).

Host.—Garfish (*Strongylura marina*).

Record of collection.—Ten, collected on August 30, 1911, from gills of host.

Genus AMPHIBDELLA Chatin, 1874

AMPHIBDELLA FLAVOLINEATA MacCallum

Amphibdella flavolineata MacCallum, Zoopathologica, vol. 1, No. 1, p. 29, 1916.

On August 3, 1910, 16 trematodes were collected from the gills of a torpedo (*Tetranarce occidentalis*) that had been taken in a fish trap at Menemsha Bight.

Color, white. Measurements, life: Length, 3.78 mm.; breadth, maximum, about middle, 0.64 mm., in front of caudal disk 0.29 mm.; breadth of caudal disk, 0.42 mm. On July 17, 1911, we found U.S.N.M. No. 8144, and again, on July 7, 1914, several were collected from the gills of torpedoes.

As Dr. MacCallum had taken up the study of the monogenetic trematodes at Woods Hole in the summer of 1912, I made no further collections from the gills of the torpedo, but on August 3, 1920, I noted that they were numerous on the gills of one that was examined on that date for parasites. The specimens collected correspond to *A. flavolineata* MacCallum.

Family MONOCOTYLIDAE Taschenberg, 1879

Subfamily Dionchinae Johnston and Tiegs, 1922

Genus DIONCHUS Goto, 1899

DIONCHUS AGASSIZI Goto

Plate 14, Figures 162, 163

Dionchus agassizi Goto, Journ. Coll. Sci. Imp. Univ. Tokyo, vol. 12, pp. 286–291, figs. 19–21, 1899.

I have record of the finding of this trematode on the gills of remora on three occasions. The anterior end is broadly sagittate, with mouth at base of triangular head. In the living worm toothlike processes are very indistinct. The body is of nearly uniform breadth until near the posterior end, where it tapers to the posterior sucker. The posterior sucking disk in this species is characterized by being divided into 10 areas by as many radial ridges, which do not quite reach the center of the disk. On account of the contracted condition of the disk, and its position, showing only in lateral view in all but one of the mounted specimens, its structure cannot be made out satisfactorily. In the one specimen in which a ventral view of the disk is shown, no radial ridges can be distinguished. The distal ends of the two hooks on the disk of each of the mounted specimens are broken off. They are described by Goto as being clawlike. He

also states that they usually are broken off in the process of removing them from their host.

Measurements in balsam: Length, 2.31 mm.; maximum breadth, at level of mouth, 0.48 mm.; breadth at middle, 0.45 mm.; in front of posterior sucker 0.14 mm.; distance of mouth from anterior end 0.35 mm.

Host.—Remora (*Remora remora*).

Record of collections.—Three, collected on July 28, 1910, from gills of host. Small, white; two short, stout hooks on posterior sucking disk; four eye spots dorsal to mouth. Dimensions, life: Length, 1.72 mm.; breadth, at mouth 0.7 mm., middle 0.56 mm.; posterior disk, length 0.42 mm., breadth 0.35 mm.

One, collected July 21, 1911, from gills of host.

One (U.S.N.M. No. 8147), collected August 3, 1911, from gills of host.

Family UDONELLIDAE Taschenberg, 1879

Genus LINTONIA Monticelli, 1904

LINTONIA PAPILLOSA (Linton)

Nitzschia papillosa Linton, Proc. U. S. Nat. Mus., vol. 20, pp. 508, 509, pl. 40, figs. 1–7, 1898.

Lintonia papillosa (Linton), Monticelli, Arch. Zool. Napoli, vol. 2, pp. 117–124, pl. 7, figs. 1–7, 1904.

Seventeen examples of this species (U.S.N.M. No. 8146) were collected by Vinal N. Edwards, April 10, 1913, from the common codfish (*Gadus morrhua*), taken on Georges Bank.

Measurements in formalin: Smallest, length, 1.12 mm.; diameter, lateral view, 0.28 mm. Largest, length, 2.1 mm.; diameter, lateral view, 0.53 mm.

Family CAPSALIDAE Baird, 1853

Subfamily Benedeniinae Johnston, 1931

Genus ENTOBDELLA Blainville, 1818

ENTOBDELLA BUMPUSII (Linton)

Epibdella bumpusii Linton, Bull. U. S. Fish Comm. for 1899, pp. 286, 287, figs. 11–15, 1900.

Since the publication of the original description of this species I find among my notes record of this trematode on two occasions, both from the skin of the stingray (*Pastinachus centrourus*).

Record of collections.—One, collected June 24, 1921; length, about 11 mm.

One (U.S.N.M. No. 8148), collected July 1, 1924, from skin of host, ventral side; length, 14 mm.; breadth, 8 mm.

ENTOBDELLA HIPPOGLOSSI (O. F. Müller)

PLATE 14, FIGURES 164–169

See STILES AND HASSALL, U. S. Hyg. Lab. Bull. 37, p. 252, 1908, for references.

I have records of this trematode from the skin of the halibut (*Hippoglossus hippoglossus*) as follows:

Record of collections.—Four (U.S.N.M. No. 8149), collected by Vinal N. Edwards, June 15, 1906. In formalin specimens the suckers, narrow margins of the body, testes, and genitalia in front of the testes are white, elsewhere the color is purplish.

Received from the U. S. National Museum two specimens on December 7. Label: On halibut, Ward's Natural Science Establishment; acc. 11828. These agree closely with van Beneden's description of this species.

TABLE 1.—*Measurements of two specimens of* Entobdella hippoglossi *in glycerin and in balsam*

Measurement	Specimen 1		Specimen 2	
	Glycerin	Balsam	Glycerin	Balsam
	Mm.	*Mm.*	*Mm.*	*Mm.*
Length	17.00	13.50	10.00	8.50
Breadth	9.00	7.00	7.00	7.50
Anterior suckers, length	1.53	.77	1.20	1.33
Anterior suckers, breadth	.56	.51	.70	.63
Posterior sucker, length	4.75	4.00	4.50	4.50
Posterior sucker, breadth	5.25	3.50	4.50	4.50
Length of anterior hook	.42	.42	.56	.74
Length of middle hook	.84	.70	.98	1.40
Length of posterior hook	.16	.16	----------	.12

Subfamily CAPSALINAE Johnston, 1929

Genus TRISTOMA Cuvier, 1817

TRISTOMA PAPILLOSUM Diesing

PLATE 14, FIGURES 170–174

Tristomum coccineum Cuvier, LINTON, Proc. U. S. Nat. Mus., vol. 20, pp. 509, 510, pl. 40, fig. 9, 1898; Bull. U. S. Fish Comm. for 1899, p. 278, 1900; *ibid*, p. 448, 1901; Bull. U. S. Bur. Fish., vol. 31, pt. 2, p. 585, 1911.

Beginning with the season of 1912, Dr. G. A. MacCallum undertook investigations on the monogenetic trematodes of the Woods Hole region, and thereafter such gill and skin parasites as I came

across in my study of the food and internal parasites of fishes were turned over to him. Following are notes on tristomes from the gills of the swordfish (*Xiphias gladius*), collected on July 15, 1904, and July 13, 1911 (U.S.N.M. No. 8150). On the former date three tristomes were collected from the gills of one swordfish; on the latter date two swordfish were examined and 75 tristomes obtained from the gills of one; none was found on the other. Those of the first lot were yellowish, transparent, leaflike, and from 7 to 12 mm. or more in diameter. In the second lot they were pinkish to blood-red, becoming pale when much extended. Some of them, which soon became inactive, were blood-red with a white border. This marginal border bore clusters of small spines of various shapes (pl. 14, fig. 172). After lying overnight in sea water most of the worms, which had been active on the evening before, were still active. When the table was slightly jarred, the more active worms would contract quickly. The largest, when expanded, were 20 mm. or more in length and 15 mm. or more in breadth. They were then very thin, leaflike, transparent, yellowish white. When touched they contracted quickly, the length being much lessened, but the breadth remaining about the same. Upon repeated irritation they would become nearly circular in outline, the color in the contracted state being deep pink. Eggs dark brown, tetragonal, with a filament at each of the four trihedral angles, one filament being longer than the others; diameter, excluding filaments, 0.1 mm.

In a lot of 93 tristomes, all but two belong to this species. These vary greatly in size and shape. Of 31 specimens mounted in balsam, 25 are longer than broad, 4 are broader than long, and 2 have the length and breadth equal. Smallest, length, 4 mm., breadth, 2 mm.; largest, length, 13 mm., breadth, 9 mm. In 20 specimens, average length, 8.6 mm., breadth, 7.2 mm., the average number of groups of spines on one lateral margin was 45.6; maximum 51, minimum 40. There are two small, slender, slightly arcuate spines on the posterior sucker. These spines were 0.12 mm. in length and 0.02 mm. in breadth, on a specimen 5 mm. in length and 6 mm. in breadth, and on another 12 mm. in length and 10 mm. in breadth. In most cases these spines were situated in front of the posterior central loculus, but in four cases they were observed to be in front of the left posterior loculus, and in one at the central end of the right lateral loculus. The posterior dorsal surface of these worms is papillate; also, in strongly contracted specimens, the posterior margin is more or less incised behind the pedicel of the posterior sucker. Specimens which have been flattened under pressure during fixation have the posterior margin entire, or but slightly emarginate. The pharynx is usually broader than long. In 24 specimens examined, 3 were found in

which the length and breadth of the pharynx were about the same. In the others the breadth was greater than the length, the average for 2 specimens being: Length, 0.79 mm.; breadth, 1.03 mm.

The diameter of the posterior sucker is exclusive of the frilled border, which is somewhat evanescent. The anterior suckers are more or less crumpled, and the breadth could not be measured satisfactorily. The posterior sucker is usually nearly circular.

I have a record in my notes of the finding of what was thought to be this species on two occasions on the gills of the spearfish (*Istiophorus americanus*):

Several specimens collected on August 17, 1913, by Dr. MacCallum.

Three collected on July 23, 1924. The largest measured 10 mm. in length and 6.5 mm. in breadth; the smallest, length 8 mm., breadth 6.5 mm.; diameter of posterior sucker, 3.5 mm.; margins crenulate, dorsal surface with numerous small papillae; color translucent white. These specimens were turned over to Dr. MacCallum.

TABLE 2.—*Measurements of six specimens of* Tristoma papillosum *in balsam*

Measurement	1	2	3	4	5	6
	Mm.	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*
Length	4.00	6.00	7.00	10.00	11.00	13.00
Breadth	2.00	7.00	4.00	7.00	8.00	9.00
Anterior sucker, length	.80	1.20	.91	1.20	1.20	-------
Diameter of posterior sucker	.91	1.61	1.12	1.75	1.96	2.24
Pharynx, length	.63	.77	.56	.77	1.12	1.40
Pharynx, breadth	.56	1.00	.67	1.20	1.33	1.54

TRISTOMA COCCINEUM Cuvier

PLATE 14, FIGURES 175–179

Associated with the tristomes from the gills of the swordfish (*Xiphias gladius*) in the collection, referred to *T. papillosum*, there are two specimens that differ from the others, particularly in the absence of papillae and in the number and character of the spines on the lateral margins.

The marginal spines are arranged in linear groups at right angles to the margins, each group containing about four spines, and there are approximately 300 groups of spines on one lateral margin (pl. 14, fig. 175). Each spine is flattened, longer than broad, its free end bearing about five short, slender teeth. The length and breadth of the pharynx are about equal. In one of the specimens there was a slight constriction at about the middle of the length of the pharynx. The anterior suckers and the anterior border are crumpled so that exact outlines cannot be made out. There is a shallow emargination at the posterior end. Measurements in balsam: Length, 12.5 mm.;

breadth, 10.2 mm.; longer diameter of anterior suckers about 1.82 mm.; diameter of posterior sucker, exclusive of marginal border, 2.66 mm.; diameter of pharynx, 0.91 mm.; length of spines on posterior sucker, 0.13 and 0.15 mm.; breadth, 0.02 mm. (U.S.N.M. No. 8151).

On the right margin of one of the specimens, near the middle of the length, there is a spinelike structure, bearing on its ventral surface, near the tip, four stout, sharp-pointed, chitinous hooks (pl. 14, figs. 175, 176). There are two similar hooks on the dorsal side, not shown in the figures. Length of spine about 9.42 mm.; diameter at inner end about 0.11 mm., near tip 0.04 mm. This structure cannot be made out on the other specimen, which is much crumpled.

Genus CAPSALA Bosc, 1811

CAPSALA MOLAE (Blanchard)

PLATE 15, FIGURES 180–183

Tristomum rudolphianum Diesing, LINTON, Proc. U. S. Nat. Mus., vol. 20, p. 510, 1898; Bull. U. S. Fish Comm. for 1899, p. 281, 1900.

Tristomum molae Blanchard, LINTON, Bull. U. S. Fish Comm. for 1899, p. 466, 1901.

Host.—Sunfish (*Mola mola*).

Record of collections.—One, collected by Vinal N. Edwards, August 1, 1894. Dimensions in alcohol: Length 23 mm., breadth 24 mm., diameter of posterior sucker 16 mm. Location on host not noted on label.

Six (U.S.N.M. No. 8152), collected July 20, 1914, from skin of host; largest 25 mm. in diameter.

One, collected by Robert Goffin, September 3, 1925, from skin.

Eleven (U.S.N.M. No. 8153), collected July 19, 1926, from skin. These were turned over to Dr. MacCallum.

TABLE 3.—*Measurements of three specimens of* Capsala molae *in balsam*

Measurement	1	2	3
	Mm.	*Mm.*	*Mm.*
Length	5.00	10.00	15.00
Breadth	4.50	9.50	14.50
Anterior sucker, length	.80	1.12	1.54
Anterior sucker, breadth	.74	.84	1.12
Posterior sucker, length	1.64	4.00	5.00
Posterior sucker, breadth	1.24	5.00	6.00
Pharynx, length	.77	1.26	2.03
Pharynx, breadth	.70	1.12	1.75
Pharynx, anterior division, length	.49	.77	1.12
Pharynx, anterior division, breadth	.70	1.12	1.75
Pharynx, posterior division, length	.28	.49	.91
Pharynx, posterior division, breadth	.56	.92	1.56

CAPSALA LAEVIS (Verrill)

PLATE 15, FIGURES 184–188

Tristoma laeve VERRILL, Amer. Journ. Sci. and Arts, ser. 3, vol. 10, p. 40, 1875.

While a lot of alcoholic material from the gills of swordfish (*Xiphias gladius*) were being examined, a single specimen (U.S.N.M. No. 8154) of the genus *Capsala* was found. The date of collecting is not certain. It was probably in the lot collected on July 13, 1911, when about 75 tristomes were taken from the gills of a swordfish.

Measurements in balsam: Length, 11.25 mm.; breadth, 8.5 mm.; anterior suckers, length 2.1 mm., breadth 1.65 mm.; posterior sucker, length 3.78 mm., breadth 3.42 mm.; hooks on posterior sucker, length 0.45 mm., breadth 0.17 mm.; pharynx, length 1.4 mm., breadth 1.45 mm.

There are two stout, blunt hooks on the posterior sucker. The length given above is a little less than the actual length, since the hooks were slightly inclined to the plane of the slide, and consequently foreshortened in the camera lucida sketch. The pharynx is divided into an anterior and a posterior portion by a constriction a little back of the middle. Length of anterior portion, 0.84 mm.; breadth, 1.45 mm.; length of posterior portion, 0.56 mm.; breadth 0.91 mm.

The posterior sucker has five rays on its anterior half. The intestines are profoundly branched, the ultimate branches reaching nearly to the margins of the body and extending into the anterior suckers and into the anterior lobe between the suckers, in all of which branches of the intestines reach nearly to the margin. The cirrus pouch, enclosing the seminal vesicle at its base, reaches quite to the median line immediately behind the pharynx. The two testes lie side by side a short distance back of the cirrus pouch to the left of the median line. They are somewhat obscured by the branches of the intestine. The vas deferens makes a loop from the testes to a point a short distance to the right of the median line, returning in front of the testes, whence it becomes crumpled into short folds, then proceeds to the cirrus pouch, which it enters at about the middle of the length. The ovary is a rosettelike cluster of 12 or more lobed bodies on the median line, its left anterior border being contiguous with the right testis. The vitellaria have about the same distribution as the intestines, extending nearly to the margins, including the anterior suckers and the anterior lobe between the suckers. Two nerve trunks on each side lateral to the main intestinal rami, and connected at the level of the cirrus pouch by broad commissures, are clearly shown.

There are about 38 small tubercular spines on each lateral margin, beginning a short distance from the anterior suckers and extending to the posterior sucker. They are short, tending to pyramidal in shape, and are surmounted by three short tines. No eye spots were seen. There is a membranous border to both anterior and posterior suckers.

Suborder POLYOPISTHOCOTYLEA Odhner, 1912

Family ONCHOCOTYLIDAE Monticelli, 1903

Genus ONCHOCOTYLE Diesing, 1850

ONCHOCOTYLE MAVORI, new species

PLATE 15, FIGURES 189–196

The specimens here described were given to me by Dr. James W. Mavor, who had found them on the bottom of an aquarium in which were a number of white perch (*Morone americana*), from Tashmoo Pond, Marthas Vineyard, Mass.

Since these trematodes were not found on the gills of the perch, and since the genus *Onchocotyle* has been recorded only from the gills of selachians, there is naturally some doubt as to the perch being their host.

The following description is based mainly on a study of whole mounts in balsam:

The body proper is somewhat lanceolate, tapering more anteriorly than posteriorly. Anterior sucker nearly terminal, sharply marked off from the body by a constriction. The posterior sucker-bearing portion is approximately half the length of the body proper, and usually nearly at right angles to it. At the anterior ventral half of the sucker-bearing portion there are three pairs of relatively large circular suckers, equal in size and sessile. Each of these suckers is supported by a strong, sickle-shaped chitinous hook, the posterior end of which is blunt while the anterior end terminates in a slender, recurved claw. The hook agrees closely with Olsson's figure of the corresponding hook in *O. emarginata*.[4] The posterior half of the sucker-bearing portion tapers gently to a blunt, bifid termination, consisting of two small terminal suckers, longer than broad, and opening posteriorly. On the median line between the bases of these terminal suckers there is a pair of small hooks, which appear narrow in dorsoventral view but in lateral view are seen to have relatively broad bases, from which they taper to sharp-pointed and recurved ends. The genital pore is on the median line a short distance back

[4] Kongl. Svenska Vetensk. Akad. Handl., ser. 2, vol. 14, No. 1, pl. 2, fig. 26, 1876.

of the anterior sucker and close behind the bifurcation of the intestine. The pharynx is relatively small, about as broad as long. It was not clearly shown in the whole mounts; in sections the length was 0.075 mm., breadth, 0.06 mm. There appears to be a short esophagus in some of the mounted specimens, while in others it is indistinguishable. The intestines could not be traced in whole mounts, but in sections the two rami are seen to unite at the end of the body proper, and to continue as a single tube in the posterior sucker-bearing portion. The cirrus is dorsal to the anterior end of the uterus and enters the genital cloaca in front of the uterus. The testes are numerous and occupy the midregion of the posterior third of the body proper behind the ovary. The vas deferens is dorsal to the uterus. The ovary, at the center of the body, is longer than broad on right of median line and appears to be slightly lobed on its lateral margin. It was not clearly outlined in any of the mounted specimens. The vitelline reservoir is conspicuous. It is ventrally placed and is somewhat triangular in outline. It receives a duct from each side at its anterior angles and sends a short duct to the shell gland from its posterior angle. The vitellaria are diffuse and fill the lateral regions of the body from a little way back of the level of the genital pore and in large degree conceal the other genitalia. They extend into the sucker-bearing portion nearly to the terminal suckers. The uterus passes forward on the ventral side of the vas deferens to the genital pore. Ova were present in the uterus of each of the six mounted specimens, from 4 to 37, with an average of about 18. They are more or less oval-elliptical in outline with an elongated filament at each end; about 0.13 by 0.53 mm., exclusive of filaments. The division between the right and left vitellaria is narrow in front of the space occupied by the ovary, shell gland, and vitelline reservoir. The vitellaria overlap the testes and part of the ovary.

TABLE 4.—*Measurements of six specimens of* Onchocotyle mavori *in balsam*

Measurement	1	2	3	4	5	6
	Mm.	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*
Length of body proper	4.83	4.69	4.55	4.42	4.34	3.78
Length of sucker-bearing portion	2.10	2.10	2.17	2.31	2.45	2.10
Diameter anterior sucker	.35	.35	.38	.38	.36	.35
Maximum diameter of body	1.12	1.08	1.06	.92	.84	.68
Diameter larger posterior suckers	.45	.42	.42	.42	.49	.35
Posterior terminal sucker, length	.21	.21	.22	.21	.21	.21
Posterior terminal sucker, breadth	.14	.14	.14	.10	.14	.14

A specimen in glycerin measured 5 mm. in length, 1.14 mm. in maximum breadth; breadth of anterior sucker, 0.42 mm.; diameter of pharynx, 0.09 mm. Measurements of specimen in alcohol: Length,

10 mm.; length of sucker-bearing portion, 3 mm.; diameter of anterior sucker, 0.38 mm.; maximum diameter of body, 0.81 mm.; diameter of one of the larger pair of suckers, 0.42 mm.; one of posterior terminal suckers, length 0.25 mm., breadth 0.14 mm.

Type specimens.—Holotype, U.S.N.M. No. 8155; paratypes, No. 8412.

Family DICLIDOPHORIDAE Fuhrmann, 1928

Genus DICLIDOPHORA Diesing, 1850

DICLIDOPHORA AFFINIS (Linton)

Octoplectanum affine Linton, Proc. U. S. Nat. Mus., vol. 20, pp. 511, 512, pl. 51, figs. 1–5, 1898.
Diclidophora affinis (Linton), Bull. U. S. Fish Comm. for 1899, p. 482, 1901.

Three specimens of this species (U.S.N.M. No. 8156) were collected in the summer of 1905 from the mouth of the summer flounder (*Paralichthys dentatus*) by Dr. J. F. McClendon.

DICLIDOPHORA PINGUIS, new species

Plate 15, Figures 197–199

The trematodes here described were taken from the mouth of *Albatrossia pectoralis* in the northwest Pacific, June 7, 1906; U. S. Bureau of Fisheries steamer *Albatross*, station 4781, depth 482 fathoms.

Ten specimens were given to me by Willis H. Rich at the Bureau of Fisheries Laboratory, Woods Hole, Mass., in the summer of 1925. Measurements in alcohol: Length of body, 4 mm.; of sucker-bearing portion, about 3 mm.; breadth at level of anterior suckers, 0.56 mm., maximum, middle of body, 2.1 mm.; anterior suckers, length, 0.35 mm., breadth, 0.25 mm.; pharynx, length, 0.46 mm., breadth, 0.42 mm. In another specimen the breadth at level of anterior suckers was 0.45 mm.; anterior suckers, length, 0.28 mm., breadth, 0.21 mm.; pharynx, length, 0.42 mm., breadth, 0.35 mm. Dimensions of a posterior sucker in glycerin: Length of pedicel, 0.42 mm., diameter, 0.46 mm.; maximum diameter of sucker, 1.4 mm.

The alcoholic specimens agree in having a short, narrow anterior portion, which is sharply marked off from the body, necklike, nearly cylindrical, tapering but slightly to the anterior end. The body proper is stout and oblong-elliptical in outline. Sections show it to be very muscular. It is doubtless capable of much elongation. The mouth appears to be terminal; anterior suckers oval-elliptical; pharynx relatively large, its anterior edge lying at the posterior edges of the anterior suckers, its posterior end about on a level with the con-

striction, which marks off the anterior portion from the body proper. The esophagus is short. The intestinal rami appear to continue to near the posterior end of the sucker-bearing portion. The genital atrium is close behind the forking of the intestine, and appears to lie a little to one side of the median line. It is surrounded by strong muscles, but no hooks were seen either in whole mounts or in sections. The breadth of the muscular atrium in cross sections is 0.15 mm., its vertical diameter, 0.08 mm. The ovary, with its spacious portion containing large nucleated germ cells, lies a short distance behind the genital atrium. The shell gland is dorsally placed. The vitellaria begin at the level of the posterior end of the pharynx and extend to the posterior end of the body proper. The testes are numerous and fill a wide median space between the ovary and a point near the posterior end of the body. The sucker-bearing portion bears eight relatively large, pedicelled suckers, arranged symmetrically, four on each side. The suckers are supported by a chitinous frame work which forms a cross, characteristic of the genus *Diclidophora*.

Type specimens.—Holotype, U.S.N.M. No. 8157; paratypes, No. 8158.

Family DISCOCOTYLIDAE Price, 1936

Genus ANTHOCOTYLE van Beneden and Hesse, 1863

ANTHOCOTYLE MERLUCCII AMERICANUS MacCallum

PLATE 16, FIGURES 200, 201

Anthocotyle merluccii americanus MACCALLUM, Zoopathologica, vol. 1, pp. 25–27, figs. 10, 10A, 1916.

I find one specimen of this species in my collection, from gills of the whiting (*Merluccius bilinearis*), collected July 2, 1924. Length, life, 8 mm. (U.S.N.M. No. 8191).

Measurements in balsam: Length, 7.5 mm.; maximum breadth, at level of ovary, 1.26 mm.; diameter anterior suckers, 0.07 mm.; pharynx, length 0.08 mm., breadth 0.07 mm.; larger posterior suckers, left, length 0.52 mm., breadth 0.63 mm.; right, length 0.45 mm., breadth 0.52 mm.; smaller posterior suckers, length 0.06 mm., breadth 0.08 mm.; length of terminal spines 0.06 mm.

Some points of difference between this specimen and those studied by Dr. MacCallum were noted. Thus, the left of the larger posterior suckers are the larger instead of the right. The terminal hooklets are not of uniform size and shape. There are also paired vaginae (pl. 16, fig. 200).

Family HEXASTOMATIDAE Price, 1936

Genus HEXOSTOMA Rafinesque, 1815

HEXOSTOMA THYNNI (De la Roche)

Hexacotyle thynni (De la Roche), Linton, Bull. U. S. Fish Comm. for 1899, p. 446, figs. 296–298, 1901.

Record is here made of one specimen of this species, collected August 21, 1900, by Dr. C. B. Wilson from the mouth of the bonito (*Sarda sarda*).

Dimensions in life: Length 5 mm., breadth 1.5 mm. Color faint red. When compressed under cover glass a mass of globular bodies of different sizes was extruded from the excretory pore.

Family MAZOCRAEIDAE Price, 1936

Genus MAZOCRAEOIDES Price, 1936

MAZOCRAEOIDES GEORGEI Price, 1936

Plate 16, Figures 202–209

Mazocraeoides georgei Price, George Washington Univ. Bull. (Summaries of Doctoral Theses, 1934–36), p. 13, 1936.

Body, at rest and in preserved material, lanceolate; in life, capable of great alterations of length and breadth, usually slightly pointed in front of anterior suckers. Posterior third of body, more or less, with four suckers on each side; suckers with chitinous frames, and pedicels, which are very flexible in life, extending to a length nearly equal to half the breadth of the body and contracting until the chitinous portion is immersed in the substance of the body. In preserved material the pedicels of the posterior suckers are short. There is a cluster of six hooks at the posterior end, one larger pair, and two smaller pairs between the larger. Pharynx elliptical, longer than broad, near anterior suckers; esophagus as long as or longer than pharynx; rami of intestine much branched, but concealed by the vitellaria; genital sucker armed with short, recurved spines, a short distance back of forking of intestine. The single testis is in the posterior third, on the left side of the median line, and is deeply lobed on the lateral margin. The ovary, including germ-containing portion, lies on the right side of the median line parallel with the testis, extending a little farther anteriorly than the testis, but not quite so far posteriorly. The anterior portion, the ovary proper, is compact, the posterior, more elongated portion contains large, nucleated germ cells. The vitellaria are very voluminous and extend in broad lateral masses from a short distance behind the genital

sucker to the posterior end, where the lateral masses meet behind the testis. There is a vitelline reservoir on the median line in front of the level of the ovary. It is somewhat variable in shape and position, depending on the quantity of yolk. What was interpreted to be a seminal receptacle was seen in a few cases in front of the ovary. The shell gland and ootype are about on the median line on a level with the anterior portion of the ovary. The ova are elongate, with a filament at each end.

Measurements in balsam: Length, 2 mm.; breadth, at level of anterior suckers, 0.07 mm., in front of sucker-bearing portion, about 0.75 mm.; diameter of anterior sucker, 0.027 mm.; pharynx, length 0.045 mm., breadth, 0.027 mm.; ova diameter, 0.06 mm.; length, exclusive of filaments, about 0.26 mm.

Hosts.—Alewife (*Pomolobus pseudoharengus*) and hickory shad (*P. mediocris*).

Record of collections.—Five (U.S.N.M. No. 8159), collected August 11, 1908, from gills of alewife. Rami of intestines of most of them bright red; numerous minute black pigment spots in lateral areas. These worms were very active, contracting to a length of 0.6 mm. and stretching to a length of 1.8 mm.; posterior suckers, four on each side on very flexible and contractile pedicels, extending to more than half the breadth of the posterior half of the body, and contracting until no pedicel could be seen, the sucker even becoming immersed in the substance of the body; six slender hooks at the posterior end of the body, the part where they are implanted being very contractile, the hooks being so arranged as to have a grasping motion; worms fragile.

Number not recorded, collected July 8, 1910, on gills of alewife. Color by reflected light white, with numerous small brown pigment granules; margins and anterior end translucent, by transmitted light the axial region also translucent and somewhat yellowish. In a few cases the intestines were red. Body crossed by fine, crinkly lines with short, twiglike branchings.

Many, collected on August 17, 1910, on gills of a 22-cm. alewife. This worm has extraordinary powers of extension and contraction, especially of the part anterior to the sucker-bearing portion. The anterior end may be extended into a fine, threadlike neck, or it may be contracted so that the whole worm is as broad as it is long. These changes take place very rapidly.

One, collected August 20, 1910, from gills of hickory shad.

One, collected July 6, 1912. After this date no special search was made for gill parasites, since about this time the study of the monogenetic trematodes was taken up by Dr. MacCallum.

Genus PLEUROCOTYLE Gervais and van Beneden, 1859

PLEUROCOTYLE SCOMBRI (Gervais and van Beneden)

PLATE 16, FIGURES 210–214

See STILES and HASSALL, U. S. Hyg. Lab. Bull. 37, p. 346, 1908, for references.

A trematode from the gills of the chub mackerel (*Pneumatophorus grex*), collected August 9, 1908, is referred to this species (U.S.N.M. No. 8160).

The worm is divided by a constriction into two parts, an anterior lanceolate and a posterior clavate portion. The posterior portion carries four conspicuous suckers, from 0.2 to 0.4 mm. in diameter, in a longitudinal row. The first three suckers are longer than broad, the fourth is broader than long. Behind the fourth sucker there is a fifth minute sucker, about 0.04 mm. in diameter. It lies 0.15 mm. behind the fourth sucker, and about 0.03 mm. from the posterior margin of the sucker-bearing portion. The two suckers at the anterior end are longer than broad, the pharynx is at their posterior edges, and there is a relatively long esophagus. The intestine is profusely branched, the branches beginning in front of the point of forking. The intestines continue into the posterior, sucker-bearing portion. The genital cloaca is about halfway between the pharynx and the forking of the intestine. It is armed with a cluster of hooks, which were somewhat broken and disturbed. These hooks appear to have a large basal portion terminating at the anterior end in a small, recurved claw. The basal portions together form an oval-elliptical structure about 0.08 mm. in length and 0.05 mm. in diameter. The ovary lies near the right side of the median line, 1.26 mm. in front of the constriction; testes confined to narrow median space, about 1 mm. in length, behind the ovary. The vitellaria begin a short distance back of the forking of the intestine and extend into the sucker-bearing portion, filling the body and obscuring the other genitalia. The follicles are somewhat interrupted in the vicinity of the suckers but they continue on both sides to the posterior end.

Dimensions in balsam: Length, 7.84 mm.; breadth, anterior 0.16 mm., middle 1.47 mm., near posterior end 1.26 mm.; anterior suckers, length 0.09 mm., breadth 0.05 mm.; pharynx, length 0.09 mm., breadth 0.084 mm.; length of sucker-bearing portion, 2.38 mm.; breadth, at constriction, 0.7 mm., middle, and to near posterior end, 1.26 mm.; first three posterior suckers, each, length 0.42 mm., breadth 0.23 mm.; fourth posterior sucker, length 0.21 mm., breadth 0.3 mm.; minute terminal sucker, diameter about 0.04 mm.

155599—40——2

Family MICROCOTYLIDAE Taschenberg, 1879

Genus MICROCOTYLE van Beneden and Hesse, 1863

MICROCOTYLE CARANGIS MacCallum

Microcotyle carangis MacCallum, Zool. Jahrb., vol. 35, pp. 394–396, fig. B, 1913.

Six trematodes, collected on July 19, 1912, from the gills of the hardtail (*Paratractus crysos*), agree with the description of this species.

MICROCOTYLE PORONOTI MacCallum

Plate 16, Figure 215

Microcotyle poronoti MacCallum, Zool. Jahrb., vol. 38, pp. 72, 73, 75, fig. B, 1915.

Host.—Dollarfish (*Poronotus triacanthus*).

Record of collections.—One, collected July 2, 1907, from gills of host. One (U.S.N.M. No. 8161), collected July 11, 1910, length 4 mm., from gills. One, collected July 19, 1910, from gills.

These trematodes agree closely with the descriptions of this species. In these specimens, however, the anterior suckers are biloculate, a character not noted in *M. poronoti.* In the two specimens mounted in balsam, one has a distinct costa in each of the anterior suckers; in the other the costae are indistinct.

Dimensions in balsam: Length 5 mm.; breadth, at level of anterior suckers, 0.22 mm., maximum 0.63 mm.; anterior sucker, length 0.07 mm., breadth 0.1 mm.; pharynx, length 0.045 mm.; breadth 0.045 mm.; posterior sucker about 0.054 by 0.09 mm. The length of the sucker-bearing portion is approximately 1.6 mm.

MICROCOTYLE POMATOMI Goto

Plate 16, Figures 216–218

Microcotyle pomatomi Goto, Journ. Coll. Sci. Imp. Univ. Tokyo, vol. 12, pp. 278, 279, fig. 27, 1899.

Microcotyle sp. Linton, Bull. U. S. Fish Comm. for 1899, p. 451, figs. 299–306, 1901.

Linear-lanceolate; posterior sucker-bearing portion, and middle region of anterior portion colorless or translucent white; margins, including vitellaria, with numerous small black pigment spots. The number of posterior suckers appears to be 90 to 100 on each side. Goto gives the number as about 70. Genital atrium spacious, armed with numerous small recurved hooks. The ovary consists of two portions: a small, compact, many-lobed portion, situated ventrally, on the median line, and a larger and much convoluted portion, containing large germ cells, which, beginning at the right dorsal border of

the compact portion, pursues a somewhat tortuous course, crossing to the left side of the median line, then passing forward and crossing to the right side, and returning on the right side of the median line to the shell gland, which lies in front of the ovary. There it is joined by the vitelline duct and the duct from the seminal receptacle. There appears to be some variation in the course of the later folds of the ovary, but, in general, it is much as in the one shown in the sketch (pl. 16, fig. 217). There is also some variation in the outlines of the compact portion of the ovary, but in all it is lobed and broader than long.

Testes about 50, many of them irregularly lobed.

The suckers near the tip of the sucker-bearing portion are distinctly in two rows, but near the body proper they do not appear to be distinctly in two rows, even in some cases appearing to be in four or more irregular rows. This irregularity is more or less the result of compression.

TABLE 5.—*Measurements of three specimens of* Microtyle pomatomi *in balsam*

Measurement	1	2	3
	Mm.	*Mm.*	*Mm.*
Length	8.00	7.14	5.63
Length of sucker-bearing portion	3.00	2.80	2.53
Breadth, at level of anterior suckers	.20	.19	.18
Breadth, maximum	1.33	1.47	1.36
Anterior sucker, length	.06	.06	.06
Anterior sucker, breadth	.07	.07	.07
Pharynx, length	.05	.05	.05
Pharynx, breadth	.04	.05	.04

Ova, exclusive of filaments, 0.17 by 0.05 mm., to 0.24 by 0.08 mm. Posterior suckers about 0.06 by 0.07 mm.

Host.—Bluefish (*Pomatomus saltatrix*).

Record of collections.—Fifteen (U.S.N.M. No. 8162), collected August 11, 1904, from gills of host.

Twenty-six, collected July 1, 1910, from gills of host. Measurements, life: Length, 7.5 mm.; length of sucker-bearing portion, 2.5 mm.; maximum breadth, 2 mm.

MICROCOTYLE STENOTOMI Goto

PLATE 16, FIGURE 219

Microcotyle stenotomi GOTO, Journ. Coll. Sci. Imp. Univ. Tokyo, vol. 12, pp. 279–281, pl. 21, fig. 28, 1899.—G. A. and W. G. MACCALLUM, Zool. Jahrb., vol. 34, pp. 230, 231, 1913.

This species is probably of frequent occurrence. I have the following records for it:

Host.—Southern porgy (*Stenotomus chrysops*).

Record of collections.—Two (U.S.N.M. No. 8163), collected August 24, 1910, from gills of host; 6 fishes examined. Two, collected August 27, 1910, from gills; 3 fishes examined. Three, collected August 29, 1910, from gills; 16 fishes examined. One, collected August 30, 1910, from gills; 3 fishes examined.

Measurements in balsam: Length of body proper, 2.94 mm., of sucker-bearing portion, 0.98 mm.; breadth, at anterior end, 0.17 mm., middle, 0.45 mm.; anterior sucker, length, 0.09 mm., breadth, 0.06 mm.; posterior sucker, 0.036 by 0.045 mm.; pharynx, length, 0.036 mm., breadth, 0.03 mm.; egg, exclusive of filaments, 0.21 by 0.56 mm. Number of testes 12; number of posterior suckers about 48.

MICROCOTYLE FURCATA, new species

PLATE 16, FIGURE 220; PLATE 17, FIGURES 221–223

Body lanceolate, tapering to a blunt point at anterior end; sucker-bearing portion approximately half the length of the body proper, and bearing from 20 to 28 suckers on each side; pharynx nearly circular in outline; esophagus short. The intestines were hidden in large part by the vitellaria. So far as could be seen the main intestinal branches do not extend posterior to the vitellaria. The genital atrium is spacious and armed with numerous short, somewhat conical spines, the greater number of them about 0.006 mm. in length, but a few at the posterior border of the atrium are about 0.009 mm. in length. Ovary, as noted in other species of the genus, of two distinct portions: (1) The ovary proper, consisting of small, closely packed cells, on the right side of the median line at the anterior edges of the first testes; broader than long, and in some cases slightly lobed. Its inner end is about on the median line, whence it extends to the inner border of the right vitellaria. (2) An elongated and more or less convoluted portion, containing large nucleated germ cells. It is somewhat variable, but in general it may be described as a tubular, greatly enlarged germ duct (pl. 17, fig. 222). It leaves the anterior dorsal side of the ovary proper, passes forward dorsal to the shell gland near the median line, turns, and crosses the median line. It may then turn and run back for a short distance, turn again, and return on itself, and run parallel to its former course, thus forming a more or less horseshoe-shaped structure, with the closed end pointing forward. It ends in front of the ovary proper where it narrows to form the germ duct, which is joined, first, by the short duct from the seminal receptacle, which lies near the anterior border of the ovary proper, and then a little farther by the vitelline duct. It then enters the region of the shell gland, from

which it emerges as the uterus to pass along the median line ventral to the vas deferens to the genital atrium. Testes from 14 to 24. In the seven specimens mounted in balsam one has 14 testes, four have 15 each, one 16, and one about 24. They extend from the posterior edge of the ovary to a point a little in front of the posterior end of the vitellaria. The vitellaria begin a short distance back of the level of the genital atrium and continue in a broad band on each lateral margin to unite behind the testes. A few follicles continue into the sucker-bearing portion. Y-shaped yolk ducts are a conspicuous feature in most cases. In some of them these ducts expand into capacious yolk reservoirs. They originate, one on each side a little in front of the middle, and unite in a common duct on the median line a short distance in front of the ovary proper.

Measurements in balsam: Length of body proper 2.1 mm., of sucker-bearing portion 1.7 mm., breadth at level of anterior suckers 0.14 mm., at level of genital atrium 0.35 mm., at level of ovary 0.81 mm.; anterior sucker, length 0.045 mm., breadth 0.06 mm.; pharynx, length 0.045 mm., breadth 0.039 mm. (in another specimen length, 0.045 mm., breadth, 0.045 mm.); posterior sucker, 0.075 by 0.045 mm. Smallest number of suckers counted on one side 20, largest number noted 28; one was noted that had 28 suckers on one side and 24 on the other.

Type specimen.—Holotype, U.S.N.M. No. 8164.

Host.—Tautog (*Tautoga onitis*).

Record of collections.—One, collected August 15, 1908, from gills of host; length, 3 mm., breadth, 0.5 mm.; 42 suckers on sucker-bearing portion.

Many, collected July 9, 1910, from gills; color white, except in vicinity of vitellaria. In some cases the intestine was red by reflected, yellowish by transmitted, light. Length, 4 mm., more or less.

Three, collected August 3, 1910, on gills.

Few, collected August 10, 1910, on gills.

One (U.S.N.M. No. 8164), collected by Vinal N. Edwards, May 4, 1914, from gills; length, 4.25 mm.

MICROCOTYLE SPINICIRRUS MacCallum

Microcotyle spinicirrus MacCallum, Zoopathologica, vol. 1, No. 3, p. 95, fig. 50, 1918.

Host.—Fresh-water drum (*Aplodinotus grunniens*).

Record of collection.—A small number of these trematodes (U.S.N.M. No. 8165), collected by T. Serbes, Fairport, Iowa, and sent to me by Dr. R. E. Coker, were received on July 23, 1913. They agree in general with Dr. MacCallum's description of the species.

Measurements in balsam: Length, 2.8 mm.; maximum breadth, 0.5 mm.; length of sucker-bearing portion, 1.3 mm.; anterior suckers, length, 0.07 mm., breadth, 0.033 mm.; pharynx, length, 0.075 mm., breadth, 0.048 mm.; diameter of circle of hooks at genital pore, 0.1 mm.; length of hooks, about 0.04 mm.; diameter of cluster of cirrus hooks, 0.05 mm.; length of hooks, 0.036 mm.; length of a posterior sucker about 0.06 mm., breadth about 0.08 mm.; length of ovum, exclusive of filaments, 0.24 mm., diameter, 0.07 mm. The number of posterior suckers was about 50 on each side.

MICROCOTYLE species

PLATE 17, FIGURES 224–227

Two specimens from the gills of the squeteague (*Cynoscion regalis*) are here noted. The species differs from *M. longicauda* Goto, from the same host, in the number of caudal suckers, the number of testes, and in the character of the genital atrium.

The collection consists of a single mounted specimen.

Record of collections.—One, collected August 9, 1903. It was accidentally crushed while it was under examination. Hooks of the genital atrium of three kinds. Plate 17, figure 226, was sketched from the crushed specimen. Ova fusiform, with filament at one end.

One (U.S.N.M. No. 8166), collected August 22, 1914. This specimen, slightly damaged, is mounted in balsam. The number of testes is about 20. The ovary is lobed. The portion containing ripe germ cells forms a horseshoe-shaped loop with the open end toward the posterior end. The vitellaria extend into the sucker-bearing portion.

Measurements in balsam: Length, 4.5 mm.; breadth, at level of anterior suckers, 0.2 mm., at level of ovary 0.9 mm.; length of sucker-bearing portion about 2.3 mm.; anterior sucker, length, 0.09 mm., breadth, 0.06 mm.; pharynx, length, 0.08 mm., breadth, 0.05 mm.; posterior suckers, 0.07 by 0.05 mm.; about 70 suckers on each side.

Genus AXINE Abilgaard, 1794

AXINE GRACILIS, new species

PLATE 17, FIGURES 228–230

The collection contains three specimens, mounted in balsam: two adults, one of which lacks the greater part of the region back of the ovary, and one young specimen.

These worms are slender and of nearly uniform breadth throughout the greater part of the length, tapering slightly near the anterior

end, which is characterized by having a shallow notch with irregularly scalloped outline at the extreme anterior tip in front of the somewhat diagonally placed anterior suckers. The posterior end is expanded into a trumpet-shaped, sucker-bearing portion asymmetrically placed. There are about 60 posterior suckers in the adult specimen and about 50 in the young specimen. The pharynx is small and the esophagus short. The intestines, except near the anterior end, are concealed by the vitellaria. Genital atrium, behind forking of intestine, unarmed. Ovary at about the anterior third of the body, folded upon itself, the two ends pointing forward. In the adult specimen the right and shorter portion of the ovary contains small and much crowded germ cells; the left portion is about twice the length of the right, and contains large germ cells, with thick walls. The seminal receptacle and yolk reservoir lie in front of the left division of the ovary, and the shell gland and ootype at its anteromedian border. The follicles of the vitellaria are rather coarse, and fill the body from near the anterior, to near the posterior end, and from side to side except a narrow region along the median line, in front of and behind the ovary, and the space occupied by the ovary. The testes lie in a linear series, and are confined to a narrow median region reaching from the ovary to within a short distance of the posterior end of the vitellaria. In the adult specimen 20 testes were counted, and in the young specimen 14.

Measurements of adult in balsam: Length, 5.2 mm.; breadth, 0.45 mm.; anterior suckers, length, 0.03 mm.; breadth, 0.04 mm.; anterior end to intestinal rami, 0.18 mm., to vitellaria, 0.7 mm.; posterior end to vitellaria, 0.4 mm.

Type specimens.—Holotype, U.S.N.M. No. 8168; paratypes, No. 8167.

Host.—Garfish (*Strongylura marina*).

Record of collections.—One, collected September 9, 1907, from gills of a 9.5-inch garfish. The process of egg-making was in progress in this specimen. So far as it could be seen it proceeded in the same order as has been observed in *Entobdella bumpusii.*[5]

One, collected August 27, 1910.

One young (U.S.N.M. No. 8167), collected August 30, 1911. Dimensions, balsam: Length, 2 mm., breadth, 0.21 mm., anterior end to vitellaria, 0.4 mm.; anterior suckers, length, 0.03 mm., breadth, 0.036 mm.

One (U.S.N.M. No. 8168), collected September 10, 1912.

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[5] Bull. U. S. Fish Comm. for 1898, pp. 286, 287, 1900; and Biol. Bull., vol. 14, pp. 19–26, 1908.

HETERAXINE, new genus

This trematode agrees with the genus *Microcotyle* in having numerous suckers in two longitudinal rows on the posterior sucker-bearing portion, but differs from that genus in having the suckers of one of the rows fewer and much larger than those in the other row.

Type species.—*Heteraxine cokeri*, new species.

HETERAXINE COKERI, new species

PLATE 17, FIGURES 231–233

Body stoutish, tapering slightly to a rounded point at the anterior end; posterior sucker-bearing portion with two parallel rows of suckers, the one on the right side containing about 10 large suckers, the one on the left side with 30 or more small suckers. All the suckers are supported by a chitinous framework. Length in balsam, about 5 mm.; breadth, 1 mm. One of the large suckers measured 0.23 mm. in length and 0.35 mm. in breadth; one of the small suckers, length, 0.08 mm., breadth, 0.14 mm. Length of anterior suckers, 0.1 mm., breadth, 0.06; pharynx, length, 0.09 mm., breadth, 0.07 mm.; esophagus very short; genital aperture a short distance back of pharynx, at forking of intestine; retracted cirrus with a fascicle of slender spinelike hooks. These hooks are arranged in two circles, an outer with hooks 0.045 mm. in length and an inner with hooks 0.12 mm. in length. The ovary, as much of it as could be made out, which is the part that contains large, nucleated cells, begins on the left side of the median line, goes forward a short distance, crosses to the outer side, then turns posteriorly, and immediately returns to the median line, or a little to the left of it. Two main vitelline ducts unite in a single short vessel on the ventral side of the ovary. It was not possible to determine the exact number of testes, on account of the irregular shape and lobed character of some of them. The number appeared to be about 30. The vitellaria extend from about the level of the genital opening to near the posterior end of the sucker-bearing portion. An ovum in the uterus measured 0.3 mm. in length, exclusive of the long filament at the anterior end, and 0.08 mm. in diameter; another measured 0.4 by 0.11 mm., exclusive of the anterior filament.

Type specimens.—U.S.N.M. No. 8169 (holotype and paratypes)

Host.—Fresh-water drum (*Aplodinotus grunniens*).

Record of collection.—Two (U.S.N.M. No. 8169) received from Dr. R. E. Coker, Fairport, Iowa, No. 360 Meek Collection, May 2, 1913.

Order DIGENEA van Beneden, 1858

Suborder GASTEROSTOMATA Odhner, 1905

Family GASTEROSTOMIDAE Braun, 1883

Subfamily GASTEROSTOMINAE Monticelli, 1892

Genus GASTEROSTOMUM Siebold, 1848

GASTEROSTOMUM ARCUATUM Linton

PLATE 18, FIGURES 234, 235

Gasterostomum arcuatum LINTON, Bull. U. S. Fish Comm. for 1899, pp. 277, 278, 297, 298, figs. 85–90, 1900; *ibid.*, p. 446, 1901; Bull. U. S. Bur. Fish., vol. 24, pp. 363, 365, fig. 235, 1905.

As in other species of the Gasterostomidae, when any considerable number of individuals are examined, much variation in the relative positions of the genitalia is seen. This is due, in large part, to the ova, which often accumulate in enormous numbers. Thus, in the specimen figured it will be noted that the cirrus pouch extends only about halfway from the posterior end to the second testis, whereas it was represented in the original description of the species as extending to the second testis. Also, instead of only about three vitelline follicles on each side behind the level of the ventral sucker, there are in this specimen about twice that number. The number of follicles is, as a rule, 16 on each side. In the specimen figured the number appeared to be 16 on the left side and 15 on the right. The saccular intestine, in uncompressed specimens, seems to extend back to the ventral sucker, but in flattened specimens it may extend both anteriorly and posteriorly, as shown in the figure.

Measurements in balsam: Length, 2.38 mm., breadth, 0.28 mm.; anterior sucker, length, 0.075 mm., breadth, 0.081 mm.; ventral sucker, length, 0.06 mm., breadth, 0.066 mm.; ova, rather thick-shelled, about 0.018 by 0.01 mm.

Hosts.—This species appears to be of frequent occurrence in the bonito (*Sarda sarda*), where it has been found free in the stomach and intestine, also encysted in the pyloric caeca and liver. Other hosts: Common mackerel (*Scomber scombrus*), cutlassfish (*Trichiurus lepturus*), common codfish (*Gadus morrhua*).

Record of collections.—Recorded from the bonito on 19 dates in July and August, in 9 different years, from 1903 to 1928; approximately 1,100 from 15 fishes in July and 500 from 15 fishes in August (U.S.N.M. No. 8170).

On August 20, 1903, yellowish cysts 3 mm. in diameter, more or less, were found on the serous coat of the pyloric ceca of a bonito. Some of the deeper cysts were covered with a silvery coat. Most of the ova from these cysts were about 0.018 by 0.011 mm. There was some variation in size. Thus one ovum measured 0.021 by 0.014 mm. On July 22, 1926, the liver of a bonito, thickly beset with cysts, was brought to me by Dr. Rudolph Bennett. The older cysts were dark brown and filled with waxy, degenerate tissue; others yellow. While examining a piece of the liver two gasterostomes were noted. Later, after teasing portions of the liver, 250 gasterostomes were secured. A cyst, 3 mm. in diameter, was opened and found to be filled with eggs of this gasterostome. It would appear that the worms make their way from the stomach into the liver by way of the bile duct, in the branches of which they remain free for some time. Ultimately they become centers of irritation which are closed off by walls of connective tissue.

Five, collected July 26, 1928, from mackerel; viscera of 12 fishes examined. Measurements in balsam: Length, 1.26 mm.; breadth, 0.18 mm.; diameter of anterior sucker, 0.07 mm., of ventral sucker, 0.04 mm.; anterior end to vitellaria, 0.28 mm., to ventral sucker, 0.38 mm.; ova with thickish shells, 0.015 by 0.009 mm.

Two, collected by Vinal N. Edwards, June 18, 1913, from cutlassfish. Lengths in formalin, 1.92 and 2.1 mm. The neck is relatively shorter and thicker than it is in specimens from the bonito. In balsam the vitellaria are seen in lateral view and it is difficult to determine their number; 32 were counted in one and 28 in the other. Measurements of larger specimen in balsam: Length, 1.68 mm.; breadth, 0.39 mm.; anterior end to ventral sucker, 0.39 mm.; diameter of anterior sucker, 0.1 mm., of ventral sucker, 0.07 mm.; ova with thickish shells, 0.018 by 0.012 mm.

One (U.S.N.M. No. 8170), collected December 18, 1912, from codfish; 10 fishes examined. This specimen, somewhat macerated, is filled with ova, which obscure the anatomy. The cirrus pouch extends to the level of the middle of the second testis. The testes are relatively large, close together, one following the other; the ovary is separated by a short space from the first testis; vitellaria largely concealed by the ova, but appear to extend to the first testis, being represented by granules not aggregated into follicles. Dimensions in balsam: Length, 2.33 mm., breadth, 0.24 mm.; diameter of anterior sucker about 0.08 mm.; ventral sucker, length, 0.07 mm., breadth, 0.06 mm.; anterior end to first folds of uterus, 0.48 mm., to vitellaria, 0.81 mm.; ova somewhat variable in size and outline, about 0.21 by 0.012 mm., shells thickish.

GASTEROSTOMUM CAPITATUM, new species

PLATE 18, FIGURES 236–239

Fusiform, tapering rather more toward anterior than posterior end; densely covered with minute, blunt spines; anterior sucker ventral, preceded by a capitate hoodlike structure, which when fully expanded is much broader than the diameter of the neck at the level of the anterior sucker. Vitellaria 16 or more on each side, separated from the anterior sucker by a space equal to one-fifth or more of the length and extending little, if any, back of the level of the ventral sucker. Ventral sucker a little in front of the middle of the body; intestinal caecum, in uncompressed specimens, posterior to ventral sucker; ovary on right side of intestine; testes on right side, close together, one following the other, the first testis near the ovary. The cirrus pouch extends forward to the level of the second testis. The uterus may fill the greater part of the body back of the vitellaria, but was not observed to extend in front of the vitellaria.

Type specimens.—U.S.N.M. No. 8172 (holotype and paratypes).

TABLE 6.—*Measurements of five specimens of* Gasterstomum capitatum *in balsam*

Measurement	1	2	3	4	5
	Mm.	*Mm.*	*Mm.*	*Mm.*	*Mm.*
Length	1.82	1.96	1.82	1.68	1.05
Breadth, of capitate head	.17	.20	.22	.22	.21
Breadth, level of anterior sucker	.14	.17	.17	.14	.15
Breadth, near middle, maximum	.57	.50	.63	.43	.42
Anterior sucker, length	.10	.11	.11	.11	.12
Anterior sucker, breadth	.10	.11	.11	.11	.12
Diameter ventral sucker	.06	.07	.07	.07	.07
Anterior end to vitellaria	.55	.59	.42	.38	.35
Anterior end to ventral sucker	.76	.90	.73	.62	.52

Host.—Frigate mackerel (*Auxis rochei*).

Record of collection.—Seventeen (U.S.N.M. No. 8172), collected July 12, 1912. Dimensions, life, compressed: Length, 2.21 mm.; breadth, of capitate anterior end, 0.24 mm., maximum of body, 0.66 mm.; diameter of anterior sucker, 0.21 mm., of ventral sucker, 0.1 mm.; ova, 0.015 by 0.01 mm., shells not thick.

Subfamily PROSORHYNCHINAE Nicoll, 1914

Genus PROSORHYNCHUS Odhner, 1905

PROSORHYNCHUS CRUCIBULUM (Rudolphi)

PLATE 18, FIGURES 240–242

Prosorhynchus crucibulum (Rudolphi), NICOLL, Parasitology, vol. 3, pp. 352–354, fig. 7, 1910.

Two gasterostomes from the conger eel, mounted in balsam, although showing the anatomy incompletely on account of the masses of ova which fill the greater part of the body back of the vitellaria, agree closely with this species as it is described by Nicoll. The body is covered with minute spines and does not vary much in breadth; the breadth at the widest part approximately one-third the length. The anterior sucker is a comparatively large muscular structure, to which Nicoll gives the appropriate name "rhynchus." It tapers to a wedge shape posteriorly and reaches about to the anterior follicles of the vitellaria. The follicles of the vitellaria are irregular in shape, and form an arcuate, transverse cluster in front of the intestinal caecum and anterior folds of the uterus. The ventral sucker is a little back of the middle, and the intestinal caecum is directed forward. In one of the specimens the testes are opposite, the ovary lies at the dorsal border of the right testis, and the cirrus pouch impinges on the posterior edge of the right testis. In the other specimen the testes are crowded to the right side and the cirrus pouch is on the left side, its anterior end about on a level with the left testis, which is at the anteromedian border of the right testis. The ovary is at the anterior border of the right testis, its posterior border also touching the left testis, and its anterior edge on a level with the ventral sucker. The ova have thickish shells, but are somewhat distorted when closely packed together; average size about 0.036 by 0.024 mm.

Host.—Conger eel (*Conger conger*).

TABLE 7.—*Measurements of two specimens of* Prosorhynchus crucibulum *in balsam*

Measurement	1	2
	Mm.	*Mm.*
Length	1.96	2.24
Breadth	.70	.70
Anterior sucker, length	.39	.67
Anterior sucker, breadth	.28	.52
Diameter of ventral sucker	.18	.19
Anterior end to vitellaria	.38	.63
Anterior end to ventral sucker	1.12	1.12

Record of collection.—Two (U.S.N.M. No. 8173), collected September 20, 1912; length in formalin, 3 mm.; breadth, 1 mm.

PROSORHYNCHUS OVATUS (Linton)

PLATE 18, FIGURES 243, 244

Monostomum orbiculare Rudolphi, LINTON, Proc. U. S. Nat. Mus., vol. 20, pp. 541, 542, pl. 54, figs. 2–5, 1899.

Gasterostomum ovatum LINTON, Bull. U. S. Fish Comm. for 1899, p. 297, 1900; *ibid.*, p. 457, 1901.

Prosorhynchus ovatus (Linton), DOLLFUS, Fauna des Colonies Françaises, Helmintha, vol. 1, pp. 100–105, figs. 14–17, 1929.

Since earlier descriptions of this species have been lacking in some particulars, the following emended description is given:

Body ovate, depressed, flattened ventrally, convex dorsally, covered with minute spines; broadest as a rule about at the level of the ventral sucker, which is not far from the anterior third; broadly rounded at the anterior end and usually tapering posteriorly to a bluntly rounded point. Anterior sucker subterminal, nearly circular; ventral sucker approximately one-half the diameter of the anterior sucker. The sacculate intestine extends forward from the ventral sucker and gives off a slender cecum from its dorsal side, which extends back about to, or a little beyond, the posterior end of the second testis, its posterior end lying between the second testis and the anterior half of the cirrus-pouch. Testes two, on the right side, somewhat variable in shape, in some cases being longer than broad, in others broader than long, and in yet others circular in outline, close together, usually somewhat diagonally placed. The cirrus pouch lies on the left side of the median line, its anterior end, which encloses the seminal vesicle, extending forward about to the level of the anterior edge of the

TABLE 8.—*Measurements of five specimens of* Prosorhynchus ovatus *in balsam. (1 to 4, whole mounts; 5, frontal sections)*

Measurement	1	2	3	4	5
	Mm.	*Mm.*	*Mm.*	*Mm.*	*Mm.*
Length	3.15	2.84	2.52	2.24	1.68
Breadth, level of anterior sucker	.63	.70	.63	.70	.35
Breadth, level of ventral sucker	1.22	1.28	1.26	1.26	.63
Breadth, near posterior end	.56	.56	.49	.49	.28
Anterior end to ventral sucker	.98	1.07	.95	.71	.63
Anterior sucker, length	.25	.25	.28	.25	.16
Anterior sucker, breadth	.26	.24	.32	.28	.20
Diameter of ventral sucker	.15	.15	.15	.15	.12
Ovary, length	.24	.30	.30	.21	.18
Ovary, breadth	.21	.22	.22	.16	.14
First testis, length	.49	.52	.36	.28	.22
First testis, breadth	.31	.42	.32	.29	.18
Second testis, length	.60	.52	.35	.32	.24
Second testis, breadth	.28	.35	.36	.32	.17

second testis. Ovary on right side in front of first testis, from which it is separated usually by a space approximately equal to its own diameter, and usually a little in front of the level of the ventral sucker; shell gland at posteromedian border of ovary. The vitellaria are arranged in a somewhat arcuate cluster of follicles on each side from about the level of the ventral sucker to the level of the posterior border of the anterior sucker. The lateral clusters of follicles may or may not meet in the midventral region behind the anterior sucker. The folds of the uterus are widely distributed, and may extend from the posterior end as far forward as the level of the anterior border of the sacculate intestine, or farther. The ova are very numerous; they measure about 0.018 by 0.015 mm. in balsam, and have thickish shells.

Host.—Flasher (*Lobotes surinamensis*).

Record of collections.—Nine (U.S.N.M. No. 8174), collected August 1, 1918.

PROSORHYNCHUS GRACILESCENS (Rudolphi)

PLATE 18, FIGURES 245–249

Gasterostomum sp. LINTON, Bull. U. S. Fish Comm. for 1899, pp. 277, 298, fig. 91, 1900; *ibid.* p. 442, 1901.

Gasterostomum gracilescens Rudolphi, LINTON, Bull. U. S. Bur. Fish., vol. 24, p. 335, figs. 230–232, 1905.—Wagner, TENNENT, Quart. Journ. Micr. Sci., vol. 49, pp. 635–690, pls. 39–42, 1906.

I refer to this species certain gasterostomes of very diverse shape, frequently occurring in the garfish (*Strongylura marina*) and similar forms and found less frequently in the silversides (*Menidia notata*) and other Woods Hole fishes.

These forms vary in size, shape, and relative positions of the genitalia. The body, densely covered with small, scalelike spines, is usually more or less fusiform. The anterior sucker is relatively large and ventrally placed. The anterior end varies from capitate to bluntly and evenly rounded. The ventral sucker is usually a little in front of the middle, but, in strongly contracted specimens, it may be about the middle; it is subglobular and joined to the oval-elliptical, or pyriform, intestinal cecum by a short esophagus. The intestinal cecum is directed toward the anterior end. The cirrus pouch is relatively large, on the left side, its posterior portion thin-walled and more or less coiled in contracted specimens; the anterior portion is thick-walled, and encloses the seminal vesicle at its anterior end. The testes are usually diagonally placed, the second near the right side with the first at its anteromedian edge. They are not far from the middle of the length. They may, however, be crowded into various positions by the accumulating ova. In some cases they may lie, one

behind the other, close to the right side, or nearly opposite each other near the median line. Usually the first testis is behind the level of the ventral sucker, but in some cases it is crowded forward until its posterior edge is on a level with the ventral sucker. The ovary lies in front of the testes, and is usually near or in contact with one or both of the testes. It may be larger or smaller than a testis, or it may be about the same dimensions. Usually the testes are about the same size, circular, oval, subtriangular, to oval-elliptical in outline. The vitellaria, consisting of about 32 follicles, extend across the body from side to side, in some cases a short distance back of the anterior sucker, in others crowded forward so as to overlap the anterior sucker. The follicles extend but a short ways, if at all, along the sides. The uterus is very voluminous and may fill the body from the posterior end to the anterior sucker, thus more or less obscuring the anatomy. The eggs are small, about 0.015 by 0.009 mm. in balsam; shells thin, and usually more or less collapsed. No satisfactory formula can be given to describe the relative positions of the genitalia. For example, the anterior end of the cirrus pouch is, in some cases, about at the level of the posterior edge of the second testis, and therefore far back of the ventral sucker. In other cases the anterior end of the cirrus pouch may be in front of the first testis and in front of the ventral sucker.

In some there is a distinct cap overhanging the anterior sucker (pl. 18, fig. 246). In others the cap is reduced to a buttonlike process, and in still others there is no trace of it. In some, also, the anterior sucker appears to be retracted (pl. 18, fig. 247).

TABLE 9.—*Measurements of six specimens of* Prosorhynchus gracilescens, *in balsam*

Measurement	1	2	3	4	5	6[1]
	Mm.	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*
Length	1.33	1.36	1.04	1.05	0.76	0.54
Breadth, anterior end	.20	.35	.32	.25	.18	----
Breadth, middle	.46	.67	.60	.46	.35	.45
Breadth, near posterior end	.20	.28	.28	.15	.11	----
Anterior sucker, length	.18	.18	.20	.16	.16	.21
Anterior sucker, breadth	.16	.24	.24	.20	.18	.20
Diameter of ventral sucker	.06	.07	.07	.07	.06	----

[1] No. 6, shown in pl. 18, fig. 247, represents an extreme case of contraction.

The above account is based on material from the garfish (*Strongylura marina*).

Hosts.—Silversides (*Menidia notata*), kingfish (*Menticirrhus*), gar (*Strongylura marina*), goggler (*Trachurops crumenophthalma*).

Record of collections.—One, immature, collected August 26, 1904, from silversides. Dimensions, life: Length 1.4 mm.; breadth 0.55

mm.; diameter of anterior sucker 0.21 mm., of posterior sucker 0.09 mm.

Twenty-four (U.S.N.M. No. 8175), collected by Dr. C. W. Hahn, August 8, 1910, from silversides; cysts in flesh behind dorsal fin. Dimensions, life: Length 1.08 mm.; breadth 0.51 mm.; diameter of anterior sucker 0.25 mm., of ventral sucker 0.1 mm. Dimensions in balsam: Length 0.87 mm.; breadth 0.46 mm.; length of anterior sucker 0.15 mm., breadth 0.22 mm.; length of ventral sucker 0.08 mm., breadth 0.09 mm.

Eighteen (U.S.N.M. No. 8176), collected August 27, 1928, from kingfish. These are small, minutely spinose gasterostomes of very diverse shapes. In general they are more or less pyriform, tapering more posteriorly than anteriorly. Anterior suckers relatively large, opening ventrally. In some there is a small buttonlike projection in front of the anterior sucker, as in some of the forms from the gar. The shape depends in part on the condition of the cirrus; when it is everted the posterior third of the body is more or less cylindrical; when the cirrus is retracted the body may be ovate or pyriform. The relative positions of the testes and ovary are subject to some differences depending on the state of contraction, and particularly on their adjustment to the relatively large cirrus pouch. The vitellaria are in front of the other genitalia, except that they may be overlapped by folds of the voluminous uterus. In a typical example there appeared to be about 16 follicles of the vitellaria on each side of the median line forming a continuous band of follicles across the body just behind the anterior sucker. The ova were packed so closely that it was difficult to make satisfactory measurements. They are thin-shelled and about 0.012 by 0.008 mm. to 0.015 by 0.009 mm. in size.

TABLE 10.—*Measurements of four specimens of* Prosorhynchus gracilescens *in balsam*

Measurement	1	2	3	4
	Mm.	*Mm.*	*Mm.*	*Mm.*
Length	0.57	0.66	0.78	0.81
Breadth	.31	.22	.29	.30
Anterior sucker, length	.17	.14	.15	.13
Anterior sucker, breadth	.17	.14	.15	.17
Diameter of ventral sucker	----------	.08	----------	.06

Specimens collected from garfish on one date in July, three dates in August, eight dates in September, and one date in October, over a period of seven years during 1907 to 1928. In July, 8 from 1 fish, in August, 45 from 15 fishes, in September, 767 from 11 fishes, in October, 7 from 1 fish. The greatest number obtained from a single fish was 229, on September 9, 1923 (U.S.N.M. Nos. 8177–8178).

One (U.S.N.M. No. 8179), collected September 4, 1911, from goggler; 7 fishes examined. Measurements in balsam, compressed: Length, 1.4 mm.; breadth, 0.56 mm.; ova, 0.015 by 0.009 mm. The anatomy is concealed by the enormous number of ova.

Genus NANNOENTERUM Ozaki, 1924

NANNOENTERUM BACULUM (Linton)

PLATE 18, FIGURES 250, 251; PLATE 19, FIGURES 252, 253

Gasterostomum sp. LINTON, Bull. U. S. Fish Comm. for 1899, p. 447, figs. 369–372, 1901.

Gasterostomum baculum LINTON, Bull. U. S. Bur. Fish., vol. 24, p. 362, figs. 233, 234, 1905.

Bucephalus baculum (Linton), NICOLL, Journ. Marine Biol. Assoc. United Kingdom, vol. 10, p. 401, 1914.

Nannoenterum baculum (Linton), MANTER, Parasitology, vol. 23, p. 397, 1931.

The material available when the original description of this species was written, like much of the material hitherto referred by me to the genus *Gasterostomum*, was in poor condition, being more or less macerated. It was not until subsequent examination of material was made that the circle of tentacles surrounding the anterior sucker was noted.

Body nearly linear, covered with dense spines, which are minute, flat, and scalelike in front view, but appear to be slender and bristlelike in edge view, as along the margins of the body. Anterior sucker relatively large, bluntly wedge-shaped; in dorsoventral view anterior end truncate, posterior end rounded; opening of sucker anterior and ventral, surrounded by about 20 short tentacles. Relative positions of the genitalia subject to some variation, owing to greater or lesser accumulation of ova in the uterus. Usually the ventral sucker is about the middle of the length. The intestinal cecum extends posteriorly, its walls made up of large cells. Testes near together, one following the other, more or less oval-elliptical, longer than broad, near middle of postacetabular region. Cirrus pouch extending to about the middle of the second testis. Ovary in front of testes, on a level with the posterior half of the intestinal cecum, smaller than testes, subspherical. Ovary and testes on right side. Vitellaria lateral, about 16 follicles on each side, in some cases nearly symmetrical, in others extending farther anteriorly or posteriorly than the other. Usually they extend from the level of the first testis to about the middle of the preacetabular region. In some of the mounted specimens there appear to be about 12 follicles on one side and 16 on the other; in others about 15 follicles on each side; as many as 18 on a side were noted. The folds of the uterus may extend from the

posterior end to within a short distance of the anterior end. The dark brown ova are usually massed in the midregions of the body obscuring the other genitalia. The ova have thickish, noncollapsed shells, bluntly rounded at one end, pointed at the other.

Measurements, formalin specimens in glycerin: Length, 2.8 mm., breadth, 0.35 mm.; diameter circle of tentacles, 0.17 mm.; diameter of neck behind tentacles, 0.14 mm.; anterior sucker, length, 0.11 mm., breadth, 0.1 mm.; ventral sucker, length, 0.072 mm., breadth, 0.075 mm.; ova, 0.024 by 0.013 mm., 0.024 by 0.018 mm.

In a specimen 2.22 mm. long the ventral sucker was 1.22 mm. from the anterior end.

The above description is based on material from the northern barracuda (*Sphyraena borealis*).

Hosts.—Northern barracuda (*Sphyraena borealis*), American smelt (*Osmerus mordax*), Spanish mackerel (*Scomberomorus maculatus*), mackerel scad (*Decapterus macarellus*), kingfish (*Menticirrhus saxatilis*), clear ray (*Raja diaphanes*), barndoor skate (*R. laevis*).

Record of collections.—All collections made by Vinal N. Edwards in the months of April, September, October, and November, on 13 dates, in 5 different years, from 1908 to 1913. (U.S.N.M. No. 8180.)

From barracuda: One hundred, more or less, collected April 24, 1908. Many, collected September 27, 1910; 10 fishes examined. Eight, collected September 11, 1911, from one fish. Four hundred and sixty, more or less, collected October 10, 1911. Twenty-five, collected October 11, 1911. Two thousand two hundred and fifty, estimated, collected October 23, 1911; 40 fishes examined. Twenty-one, collected October 22, 1912; 100 fishes examined. Many, collected October 29, 1912; 150 fishes examined. Many, collected November 18, 1912; 18 fishes examined. One, collected September 18, 1913; 4 fishes examined.

Two hundred and twenty-three, collected October 25, 1913; length, 4.27 mm., more or less, in formalin; 120 fishes examined. One hundred and sixteen, more or less, collected October 29, 1913; 100 fishes examined.

From smelt: Five, collected by Vinal N. Edwards, October 23, 1911, 8 fishes examined. These specimens, in formalin, were in poor condition, being more or less macerated. Length in formalin, 2.24 mm., breadth, 0.22 mm. In a balsam specimen the diameter of the ventral sucker is 0.06 mm.; anterior sucker, length, 0.12 mm., breadth, 0.09 mm. Ova, pointed at one end, 0.022 by 0.014 mm., in formalin.

From Spanish mackerel: One, collected August 10, 1904, specimen imperfect. A reexamination of *Gasterostoma* collected from the Spanish mackerel at Beaufort, N. C., and at Woods Hole, Mass.,

showed that while anterior tentacles were indistinct, their presence was indicated; also some specimens show folds of the uterus extending in front of the ventral sucker.

From mackerel scad: One (U.S.N.M. No. 8181), collected October 25, 1913; 20 fishes examined. Length, in formalin, 3.25 mm.; diameter of circle of tentacles, 0.28 mm., of body, 0.33 mm. Ova very numerous, from posterior end to a point 0.47 mm. back of the anterior end. Body minutely spinous. The cirrus pouch extends forward to level of anterior end of second testis; testes separated from each other by an interval less than the diameter of a single testis, and the ovary is separated from the first testis by an interval a little less than the diameter of the ovary. The vitelline follicles are partly concealed by ova. About 14 follicles can be counted on one side, extending from about the level of the anterior end of the second testis to a point 0.08 mm. from the anterior end. Dimensions in balsam: Length, 2.87 mm.; breadth, anterior, 0.17 mm., middle, 0.29 mm., near posterior end 0.18 mm.; anterior sucker, length, 0.14 mm., breadth, 0.14 mm.; diameter ventral sucker, 0.06 mm.; distance anterior end to vitellaria, 0.81 mm., to uterus, 0.49 mm.; ova pointed at one end, 0.024 by 0.012 mm.

From kingfish: Five (U.S.N.M. No. 8182), collected October 26, 1912. Length in formalin, 3.22 mm.; breadth, 0.24 mm.; about eight of the circle of papillae visible in dorsal view. Measurements in balsam: Length, 1.61 mm., breadth, 0.25 mm.; anterior sucker, length, 0.1 mm., breadth, 0.09 mm.; diameter ventral sucker, 0.05 mm.; ova, 0.024 by 0.015 mm. One specimen showed about 14 vitelline follicles on each side.

The collection contains examples of this *Nannoenterum* from two species of ray. Since the occurrence of this parasite in a ray is exceptional it is probably to be regarded as a case of introduction along with fish in which it was a common parasite. This is probably also the explanation of the frequent macerated condition in which this parasite was found in certain hosts.

Four (U.S.N.M. No. 8183), collected September 27, 1910, from stomach of clear ray. Length in formalin, 2.76 mm.; breadth, 0.35 mm.; anterior end surrounded by small, spinelike papillae; body nearly cylindrical, bluntly rounded at posterior end, tapering to anterior end; anterior, 0.25 mm. of length necklike. Measurements in balsam: Length, 2 mm.; breadth, 0.32 mm.; anterior sucker, length, 0.12 mm., breadth, 0.13 mm.; length of tentacles, 0.015 to 0.021 mm.; diameter of testis, 0.18 mm., of ovary, 0.13 mm.; ova, 0.021 by 0.013 mm. Two of the four mounted specimens have very few spines. The uterus extends from near the posterior end to a point about halfway between the vitellaria and the anterior end. In each of the specimens the ova

were massed in front of the ventral sucker, thus hiding much of the vitellaria. The follicles of the vitellaria are rounded masses about 0.03 mm. in diameter, about 10 counted on the right side and 16 on the left. On the right side they extend in a single row for a distance of about 0.5 mm.; on the left side they extend from the anterior edge of the first testis forward in an irregular double row, partly concealed by ova, for a distance of about 0.06 mm. The ovary lay a little way in front of the first testis to the right of the median line. The testes were nearly circular in outline, one following the other and about 0.4 mm. from the posterior end.

Six (U.S.N.M. No. 8184), collected November 20, 1912, from barndoor skate.

Measurements in formalin: Length, 2.66 mm.; diameter of circle of papillae, 0.15 mm.; maximum diameter of body, 0.28 mm.; about 20 short, conical papillae in anterior circle; ova, pointed at one end, 0.023 by 0.013 mm. The specimens in balsam are not in good condition. It was found that unless especial precautions were taken these gasterostomes, which had been preserved in formalin, shriveled badly when transferred from absolute alcohol to the clearing fluid.

NANNOENTERUM GORGON (Linton)

PLATE 19, FIGURES 254–256

Gasterostomum gorgon LINTON, Bull. U. S. Bur. Fish., vol. 24, p. 364, figs. 240–242, 1905.

The shape of the body is somewhat variable, but in most of the specimens of the collection there is not much difference in the breadth for the greater part of the length; covered anteriorly with dense, low, flat, rounded spines. Anterior sucker relatively large, surrounded by about 20 tentacles, which, when extended are slender-pointed. Ventral sucker behind middle of length. In one specimen, 2.66 mm. long, the ventral sucker was 1.68 mm. from the anterior end; in another, 2.9 mm. long, the ventral sucker was 1.57 mm. from the anterior end. The intestinal cecum extends anteriorly from the ventral sucker. The cirrus pouch may extend forward so as to overlap the second testis. The testes lie on the right side, one following the other, usually with a short interval between them. The ovary usually lies on a level with the ventral sucker, and a short distance in front of the first testis. The vitellaria are laterally placed, about 32 follicles in all, the anteriors of which are at about the anterior fourth, or fifth, of the body length, and the posteriors but little if any back of the ventral sucker. In one specimen four follicles on one side lay back of the ventral sucker, the most posterior of them on a level with the posterior edge of the ovary. There were 17 follicles on that side,

and but 13 could be made out on the other. The folds of the uterus may extend from the posterior end to the anterior sucker. The ova have thickish shells, tend to be more or less bluntly pointed at one end, and measure 0.018 by 0.01 mm. to 0.021 by 0.012 mm.

TABLE 11.—*Measurements of five specimens of* Nannoenterum gorgon *in balsam*

Measurement	1	2	3	4	5
	Mm.	*Mm.*	*Mm.*	*Mm.*	*Mm.*
Length	3.13	3.08	2.82	2.38	3.08
Breadth, anterior	.25	.25	.35	.22	.22
Breadth, middle	.35	.42	.39	.29	.33
Breadth, near posterior end	.17	.31	.20	.14	.22
Anterior sucker, length	.24	.24	.28	.21	.21
Anterior sucker, breadth	.19	.21	.22	.18	.22
Anterior sucker to vitellaria	.63	.74	.91	.56	.87
Anterior sucker to uterus	.01	.53	.56	.35	.40
Diameter ventral sucker	.06	.06	.06	.06	.06

Host.—Great amberfish (*Seriola lalandi*).

Record of collections.—Nine, collected August 14, 1906, 6 from intestine of host, 1 from pyloric ceca, 2 from stomach; all macerated.

Ninety-eight (U.S.N.M. No. 8185), collected by Vinal N. Edwards, September 20, 1910; three fishes examined. Dimensions in formalin: Length, 3.29 mm.; breadth, anterior 0.21 mm., middle 0.35 mm., posterior 0.21 mm.; length of tentacle 0.15 mm.; ova 0.02 by 0.01 mm.

Suborder PROSOSTOMATA Odhner, 1905

Family ASPIDOGASTRIDAE Poche, 1907

Genus STICHOCOTYLE Cunningham, 1884

STICHOCOTYLE NEPHROPIS Cunningham

PLATE 19, FIGURES 257–259

See STILES and HASSALL, U. S. Hyg. Lab. Bull. 37, p. 364, 1908, for earlier literature.

Stichocotyle nephropis ODHNER, Kongl. Svenska Vetensk.-Akad. Handl., vol. 45, No. 3, pp. 1–16 (reprint), 5 figs., 1 pl., 1910.

A single specimen of this trematode (U.S.N.M. No. 8186) was collected by Vinal N. Edwards from a barndoor skate (*Raja laevis*), taken off Nantucket, June 4, 1906.

The exact location of the worm in its host was not noted. The immature, encysted stage of this trematode has been found in the Norway and the American lobsters; the sexually mature stage has been found in Europe in the liver and gall bladder of species of *Raja*.

The specimen was stained and mounted in balsam. So far as the anatomy can be made out it is in agreement with Odhner's descrip-

tion of *S. nephropis*. There are about 22 ventral suckers. The genital pore lies near the anterior border of the first ventral sucker, a little to the right of the median line. The ovary is ventral and lies just behind the fifth ventral sucker. The shell gland is at the posterior median border of the ovary. The two testes are dorsal, separated from each other by a distance less than the diameter of a single testis and both lying between the sixth and seventh suckers. The early folds of the uterus are filled with sperm and scattered ova. A few follicles of the vitellaria were noted, lying along the dorsal side, a little in front of the first testis; thence they extend to within 1.5 mm. of the posterior end, as a single mass of more or less pyriform follicles. Throughout the posterior half or more of their course they occupy from one-third to one-half the diameter of the body. The folds of the uterus are very voluminous, and fill most of the body, from a point about 2.3 mm. from the anterior end to a point about 4.3 mm. from the posterior end. The ova are very numerous, oval-elliptical in outline, and have thick shells, about 0.1 by 0.06 mm. in the two principal diameters. None of the ova were observed to have a lid at one end, as figured by Odhner. The intestine and excretory vessels extend to very near the posterior end, where the excretory vessels unite in a short muscular sinus.

Measurements in balsam: Length, 42 mm.; breadth, 1 mm. from the anterior end, 1.4 mm., maximum, about the middle, 1.75 mm.; 1 mm. from the posterior end 0.36 mm.; pharynx, nearly circular in outline, diameter, 0.28 mm.; ovary, length, 0.35 mm., breadth, 0.49 mm.; first testis, length, 0.63 mm., breadth, 0.84 mm.; second testis, length, 0.75 mm., breadth, 0.77 mm.; distance between testes, 0.35 mm.; ova, 0.1 by 0.06 mm., thickness of shell, 0.01 mm. The ovary is 0.21 mm. in front of the first testis, and about 14 mm. from the anterior end of the body.

On August 2, 1926, Dr. Rudolph Bennett brought to my laboratory several specimens of the immature stage of this trematode collected from the rectum of a lobster (*Homarus americanus*). These agree with W. S. Nickerson's description of *S. nephropis* from the American lobster.[6] The suckers range in diameter from 13 to 17 mm. Rudiments on the testes, ovary, and vitellaria are present (U.S.N.M. No. 8187).

On May 23, 1930, Miss Carol Moore brought to my laboratory at the University of Pennsylvania 15 specimens of the immature stage of *S. nephropis*, which she had found encysted in the serous coat of the rectum of a lobster.

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[6] Zool. Jahrb., Abt. Anat. und Ont., vol. 8, pp. 447–480, pls. 29–31, 1895.

Family STERINGOPHORIDAE Odhner, 1911

Subfamily STERINGOPHORINAE Odhner, 1911

Genus STERINGOPHORUS Odhner, 1905

STERINGOPHORUS FURCIGER (Olsson)

PLATE 19, FIGURES 260–265; PLATE 20, FIGURES 266, 267

Leioderma furcigerum Olsson, STAFFORD, Zool. Anz., vol. 27, p. 486, 1904.
Steringophorus furciger (Olsson), ODHNER, Die Trematoden des arktischen Gebietes, pp. 305–310, pl. 2, figs. 6, 7, 1905.
Steringophorus furciger (Olsson), NICOLL, Parasitology, vol. 6, pp. 190, 192, 1913.
Steringophorus furciger (Olsson), FUHRMANN, Kükenthal-Krumbach's Handbuch der Zoologie, vol. 2, p. 33, fig. 39, 1928.

Distomes collected by Vinal N. Edwards from the four-spotted flounder and the winter flounder are here recorded.

Note made after preliminary examination of formalin material: Outline oval, tapering to blunt extremities, varying from short oval with breadth nearly half the length, to linear oval with breadth but little more than one third the length; translucent, with cirrus pouch and vitellaria showing as white opaque spots; uterus with smoky-brown ova; aperture of ventral sucker in most cases transverse.

The following description is based on whole mounts in balsam and on series of sections:

Body long-ovate, smooth, tapering to each end; posterior end a little more pointed than anterior. Oral sucker circular, ventrally placed; no prepharynx; pharynx much smaller than oral sucker; esophagus as long as or longer than pharynx; intestinal rami begin about halfway between oral and ventral suckers and extend to a point not far from halfway between the ventral sucker and the posterior end; ventral sucker broader than long, much larger than oral sucker. Cirrus pouch large, between intestinal rami and ventral sucker, its thick walls abundantly supplied with prostatic cells. Ovary morula-like, mainly on right side of median line between the right testis and the ventral sucker; vitelline glands two, lateral to testes and extending forward to about the level of the posterior edge of the ventral sucker. The uterus proceeds from the shell gland, just behind the ovary, forward to the ventral sucker, then turns and passes back between the testes and fills the greater part of the posttesticular space; returning, the uterus, or metraterm, passes on the dorsal side of the ventral sucker, on the left side of the cirrus pouch to the genital pore. The excretory vessel is a single dorsal tube from the posterior end to a point between the testes, where it divides into a right and a left branch, which extends to the anterior end. Laurer's canal

originates near the median line a very little ways in front of the forking of the excretory vessel, near the anterior ends of the testes and the posterior border of the ovary. In serial sections it could be traced to the shell gland. There is no seminal receptacle, but the early folds of the uterus are filled with sperm mingled with ova. The sperm-containing portion of the uterus extends anteriorly to the posterior edge of the ventral sucker. Vitelline ducts lead to a small yolk reservoir ventral to the shell gland. The ova are numerous and measure about 0.04 by 0.02 mm.

TABLE 12.—*Measurements of eight specimens of* Steringophorus furciger *in balsam*

Measurement	1	2	3	4	5	6	7	8
	Mm.	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*
Length	2.73	2.62	2.56	2.45	2.23	2.10	2.03	2.00
Anterior end to ventral sucker	.84	.70	.67	.70	.59	.70	.63	.53
Ventral sucker to posterior end	1.47	1.51	1.54	1.40	1.26	1.05	1.05	1.12
Maximum breadth	.91	.84	.84	.84	.77	.91	.84	.77
Oral sucker, length	.28	.24	.26	.25	.26	.28	.25	.24
Oral sucker, breadth	.28	.30	.29	.30	.30	.30	.28	.28
Pharynx, length	.11	.16	.16	.13	.14	.14	.14	.14
Pharynx, breadth	.10	.15	.14	.14	.14	.14	.14	.14
Ventral sucker, length	.35	.35	.35	.35	.38	.35	.35	.35
Ventral sucker, breadth	.36	.52	.46	.49	.43	.52	.49	.42

Measurements of No. 1 were made on a series of frontal sections. It will be noted that No. 6 and No. 7 differ from the others in being relatively shorter from the ventral sucker to the posterior end.

Hosts.—Four-spotted flounder (*Paralichthys oblongus*) and common flatfish (*Pseudopleuronectes americanus*).

Record of collections.—Many, collected June 1, 1907, from four-spotted flounder.

Many (U.S.N.M. No. 8188), collected June 1, 1907, from flatfish; eight fishes examined.

Mr. Edwards' notes state that many distomes were found in both the four-spotted flounder and the flatfish. The vial of this date of material from the four-spotted flounder contains but one distome, while that with material from the flatfish contains 340 distomes of this species.

Genus LINTONIUM Stunkard and Nigrelli, 1930

LINTONIUM VIBEX (Linton)

PLATE 20, FIGURES 268–271

Distomum vibex LINTON, Bull. U. S. Fish Comm. for 1899, pp. 281, 291, 292, figs. 48–51, 1900; *ibid.* p. 464, 1901; Bull. U. S. Bur. Fish., vol. 24, p. 402, fig. 188, 1905 (an error appears in the description and figure; the anterior

ends of the excretory vessels were mistaken for diverticula of the intestine); Bull. U. S. Bur. Fish., vol. 31, pt. 2, p. 584, 1911.

Lintonium vibex (Linton), Stunkard and Nigrelli, Biol. Bull., vol. 58, pp. 336–343, 1 fig., 1930.

On account of the close resemblance of this distome to *Steringophorus cluthensis* Nicoll, later referred by Odhner to a new genus, I was inclined to refer *D. vibex* to that genus. Since Prof. Stunkard, however, has evidently gone over the ground with great care, I shall accept his conclusions.

As supplementary to Prof. Stunkard's contribution a few observations on this interesting distome, together with a record of collections made by Vinal N. Edwards and myself in the Woods Hole region since 1901, are given.

Body smooth, longer than broad, flattened in life, or more or less fusiform, plump in preserved material, greatest diameter at about middle of postacetabular region, tapering to anterior end, posterior end bluntly pointed; ventral sucker much larger than oral; no prepharynx; esophagus short or lacking; pharynx much smaller than oral sucker; intestinal rami simple, extending nearly to posterior end. The genital pore is on the median line, behind the pharynx; cirrus spinose; cirrus pouch oval-elliptical, enclosing the seminal vesicle and prostate, and lying in front of the ventral sucker. Testes oval, opposite, usually a little in front of the middle of the postacetabular region. The testes are, with few exceptions, longer than broad. Out of 20 specimens mounted in balsam there is only one in which the testes are broader than long, and in it there is some indication that the testes are distorted; an average of the testes of 20 specimens in balsam gave a length of 0.36 mm. and a breadth of 0.22 mm. The ovary is trilobed and usually lies about on the median line behind the ventral sucker, its posterior half between the anterior thirds of the testes. In some cases it is near the posterior border of the ventral sucker and in front of the testes. The shell gland, in whole mounts, appears to lie on the left side of the ovary and to extend anteriorly a little in front of the ovary, where it is joined by the yolk ducts. On account of the thickness of these distomes the relative positions of these organs are not easily seen. An examination of sections shows that the ovary is dorsally placed; in strongly contracted specimens it can be seen to be dorsal to the posterior border of the ventral sucker. The shell gland is ventral to the ovary, and the testes are also ventrally placed. Laurer's canal was traced in a somewhat sinuous course in a series of cross sections from the dorsal surface to the shell gland. It was also noted in a series of sagittal sections (pl. 20, fig. 270). The early folds of the uterus are filled with sperm in which ova are intermingled. The voluminous folds

of the uterus extend from the space between the testes to the posterior end, passing dorsal to the left border of the ventral sucker and beside the cirrus pouch to the genital pore. The vitelline glands lie between the intestinal rami and the lateral margins of the body and extend from the level of the testes, or a little ways in front of them, nearly to the posterior end. In some cases they are continuous; in others they are broken up into follicles. In most cases that were observed there were six follicles on the right side and seven on the left. The excretory vessels under some conditions are conspicuous, appearing as rather large lateral vessels, which begin at the level of the oral sucker, or in some cases at the level of the pharynx, and extend to the posterior end, where they unite in a short excretory vessel with thick, muscular walls. The ova have rather thick shells, and are about 0.04 by 0.02 mm. in size.

Longitudinal and diagonal muscle fibers are strongly developed in the neck. A conspicuous feature of sections of this distome is a layer of deeply-staining subcuticular cells.

Found very commonly, but in small numbers in each host, in the puffers of the Woods Hole region, usually in the pharyngeal cavity.

Hosts.—Oldwife (*Balistes vetula*), puffer (*Sphoeroides maculatus*).

Record of collections.—From oldwife: Five, collected by Vinal N. Edwards, September 8, 1903. Ground color in formalin greenish, reddish chocolate where intestines showed through the body wall; plump, neck folded ventrally. Measurements, made on a series of cross sections of a strongly contracted specimen: Length, 2.5 mm.; breadth, 1.35 mm.; vertical diameter, 1.12 mm.; oral sucker, length, 0.23 mm., breadth, 0.42 mm.; pharynx, length, 0.14 mm., breadth, 0.21 mm.; ventral sucker, length, 0.77 mm., breadth, 0.84 mm.; ova 0.045 by 0.024 mm., with thickish shells, not collapsed.

From puffer: Collection of June 26, 1903, consisted of four vials containing 69 distomes from puffer, many of them in clusters adhering to each other by the ventral suckers. One hundred fishes examined by Vinal N. Edwards.

Eleven, collected by Vinal N. Edwards, July 11, 1903, "from throat" of puffer. Twenty, collected July 9, 1904, from pharynx of one puffer; very active, necks very extensible, becoming linear; tendency to adhere to each other by the ventral suckers; prevailing color blood-red in larger specimens, pale yellow in smaller worms, when flattened and viewed with transmitted light. One, collected by Vinal N. Edwards, September 12, 1904, "from gills" of puffer. Two, collected by Dr. Irving I. Field, July 8, 1905, "from body cavity" of puffer.

Two, collected August 6, 1906, from near opening of pharyngeal sack of puffer. General ground color in life pale red or flesh-color;

intestines dark brown; ova in distal portions of uterus dark amber, those in middle folds lemon-yellow, those in newer folds, near the shell gland, nearly colorless. Excretory vessels voluminous, the two lateral branches extending from the level of the oral sucker to the posterior end where they unite in a short muscular excretory vessel, which opens at the terminal excretory pore. These branches may be in position to simulate intestinal diverticula, especially when constricted at the anterior end, and filled with granular material resembling the contents of the intestine, and were so wrongly interpreted in the Beaufort report. Necks very flexible, becoming at times slender and linear. The worms have a tendency to coil ventrally, with suckers adhering to the post ventral region.

Seventy-one distomes, two of them immature, collected on eight dates, August 7 to 23, 1906, from 16 puffers. Thirty-eight, collected from 6 puffers on three dates, August 1 to 10, 1907. Fifty, collected from 16 puffers on four dates, June 27 to 30, 1910. On June 28 and subsequent dates circular ciliate Protozoa, identified by Dr. C. W. Hahn as *Cyclochaeta domerguei* Moroff, were found moving about on the surface of these distomes.

Fifty-one, collected from 27 puffers on seven dates in July, one in August, and one in September, 1910, from July 5 to September 6. All from pharynx of host, usually near the point where it merges into the distensible sack. Nine of the fishes examined had no distomes of this species, the others had from one to three. They ranged from immature forms, 2 to 3 mm. in length, to adults 10 mm. in length and 3 mm. to 4 mm. in breadth when moderately extended.

One, collected by Vinal N. Edwards on June 9, 1914, from puffer; six fishes examined. Three (U.S.N.M. No. 8189), collected July 2, 1915, one fish examined.

From Mr. Edwards' notes of collections in 1915, I find that he examined 149 puffers on 13 dates in May, June, and September, when no distomes of this species were recorded.

Subfamily HAPLOCLADINAE Odhner, 1911

Genus TERGESTIA Stossich, 1899

TERGESTIA PECTINATA (Linton)

Distomum pectinatum LINTON, Bull. U. S. Bur. Fish., vol. 24, pp. 366, 389, figs. 200–203, 1905.

Theledera pectinata (LINTON), Carnegie Inst. Washington, Publ. 133, pp. 40, 41, 1910.

Six distomes (U.S.N.M. No. 8190), belonging to this species were collected from the intestine of a frigate mackerel (*Auxis rochei*), July 12, 1912, taken in a fish trap in Buzzards Bay, Woods Hole.

Measurements, life, flattened: Length, 3.71 mm.; breadth, anterior, 0.34 mm., maximum, 0.6 mm.; breadth of oral sucker, 0.28 mm.; pharynx, length, 0.24 mm., breadth, 0.14 mm.; diameter of ventral sucker, 0.32 mm.; ova 0.024 by 0.018 mm.

The intestine contained orange-colored material in granular masses at some part of their course, in most cases near the posterior end of the rami.

Ova in balsam mounts measure 0.024 by 0.018 mm. to 0.027 by 0.018 mm.

Family ZOOGONIDAE Odhner, 1911

Subfamily LECITHOSTAPHYLINAE Odhner, 1911

Genus LECITHOSTAPHYLUS Odhner, 1911

LECITHOSTAPHYLUS NITENS (Linton)

PLATE 21, FIGURES 272–274

Distomum nitens LINTON, Proc. U. S. Nat. Mus., vol. 20, pp. 534, 535, pl. 51, figs. 5, 6; pl. 52, fig. 1, 1898; Bull. U. S. Fish Comm. for 1899, p. 443, 1901.—PRATT, Amer. Nat., vol. 36, p. 958, 1902.

Distoma nitens Linton, Looss, Zool. Jahrb., vol. 12, p. 710, 1899.

No record of this distome has been made since the description of the species was published. An examination of a series of frontal sections (U.S.N.M. No. 8192) makes it desirable to make a few additions to the original description.

There is a short prepharynx, and the intestinal rami extend back of the testes but do not reach to the posterior end. The left ramus is about 0.9 mm. and the right 0.8 mm. from the posterior end. There appear to be at least 10 vitelline follicles on the left side and 8 on the right. Seminal receptacles small, at posterolateral border of ovary; shell gland at posteroventral border of ovary. The cirrus pouch is on the left side of the median line. Measurements, of nearly frontal sections: Length, 4.5 mm.; breadth, at level of cirrus pouch, 1.18 mm., at level of ovary, 1.08 mm.; anterior end to ventral sucker, 1.26 mm.; diameter of oral sucker, 0.38 mm.; pharynx, length, 0.28 mm., breadth, 0.22 mm.; diameter of ventral sucker, 0.57 mm.; cirrus pouch is on the left side of the median line. Measurements, of nearly to 0.036 by 0.018 mm.; distance of testes from posterior end, left 2.1 mm., right 1.68 mm.

Looss[7] points out the resemblance of this species to *Enodia megachondros* Looss; Pratt places it in the subfamily Plagiorchiinae.

[7] Zool. Jahrb., Abt. Anat. und Ont., vol. 12, p. 709, pl. 26, fig. 30, 1899.

Subfamily ZOOGONINAE Odhner, 1902

Genus ZOOGONOIDES Odhner, 1902

ZOOGONOIDES LAEVIS, new species

PLATE 21, FIGURES 275–277

Small distomes found on different occasions in the intestine of the tautog were at first thought to belong to the species *Z. viviparus* (Olsson) from *Pleuronectes microcephalus*, and reported by Odhner and Nicoll from a number of hosts mainly belonging to the Pleuronectidae.

The principal points of difference between these distomes from the tautog and *Z. viviparus* are the comparative absence of spines, an unimportant feature, and the greater length of the intestinal rami. There is a difference, also, in the position of the genital pore from that assigned to it by some authors. In this, however, there is some disagreement. Thus, Olsson's figure of his *Distoma vivipara*[8] places the genital pore near the right side of the neck. Odhner[9] describes and figures *Zoogonoides viviparus* (Olsson) as having the genital pore near the left margin at the level of the forking of the intestine. Nicoll[10] gives its position as near the left margin somewhat back of the forking of the intestine. Fuhrmann[11] describes and figures the genital pore on the left side. In his characterization of the Zoogonidae he states that the genital pore is not far from the left border of the body.

While the resemblance of these distomes to *Z. viviparus* is close, they differ consistently in the length of the intestines, which extend beyond the ventral sucker about to the level of the seminal receptacle. Also, they appear to be practically devoid of spines. I do not find any mention of spines in my notes made on fresh material, or on formalin material collected by Mr. Edwards. Careful search on 50 or more specimens mounted in balsam resulted in the finding of two in which a few exceedingly minute spines were faintly visible at the extreme anterior end dorsal to the oral sucker.

These distomes are small, fusiform, and smooth, or with but few minute spines; yellowish, tinged with red; ventral sucker much larger than oral, near the middle or a little in front of the middle, its aperture transverse. Average of 10 specimens in balsam: Transverse diameter of oral sucker 0.14 mm., of ventral sucker 0.24 mm. There is no prepharynx; pharynx small, broader than long; esophagus short; intestinal rami extend back of the ventral sucker, approx-

[8] Lunds Univ. Års-skrift, vol. 4, pt. 2, No. 8, pp. 28, 29, pl. 4, fig. 73, 1867–68.
[9] Centralbl. Bakt. und Parasit., vol. 31, pp. 62, 63, fig. 2, 1902.
[10] Ann. Mag. Nat. Hist., ser. 7, vol. 19, pp. 83, 84, figs. 8, 9, 1907.
[11] Kükenthal and Krumback's Handbuch der Zoologie, vol. 2, p. 103, fig. 122, 1928.

imately to the middle of the postacetabular region; genital aperture on right side of neck, near margin, about on a level with the forking of the intestine; cirrus pouch in front of ventral sucker, oval-elliptical with thick walls, containing prostatic cells; seminal vesicle in two divisions, inclosed in cirrus pouch; testes opposite, at level of ventral sucker. The position of the testes is somewhat variable. In some cases they extend in front of the ventral sucker; in others they lie at the level of the posterior border of the ventral sucker, even extending for a short distance back of it. The ovary lies behind the ventral sucker, on or near the median line, either to the right or to the left of it; shell gland at posterior border of ovary; seminal vesicle and vitelline gland behind the ovary, their relative positions somewhat variable. Thus, in one the ovary was at the posterior edge of the ventral sucker, the seminal receptacle on the median line, with the vitelline gland on the left side. In another the seminal receptacle lay behind the vitelline gland. The folds of the uterus occupy the greater part of the postacetabular region. The ova, which in the older portion of the uterus may contain ciliated miracidia, are about 0.07 by 0.03 mm. in size in balsam. The metraterm passes on the right side of the ventral sucker to the genital pore. There is a large excretory vessel at the posterior end, the excretory pore being surrounded by rosettelike musculature.

As a rule these distomes do not much exceed 1 mm. in length. Measurements, life, flattened under cover-glass: Length, 0.8 mm.; breadth, anterior, 0.15 mm., at level of ventral sucker, maximum, 0.42 mm., at posterior end 0.1 mm.; oral sucker, length, 0.14 mm., breadth, 0.11 mm.; pharynx, length, 0.03 mm., breadth, 0.05 mm.; ventral sucker, length, 0.21 mm., breadth, 0.23 mm.; ova 0.068 by 0.028 mm.; an ovum containing a ciliated embryo measured 0.072 by 0.028 mm.

Type specimens.—U.S.N.M. No. 8193 (holotype and paratypes).

Hosts.—Tautog (*Tautoga onitis*), round herring (*Etrumens sadina*).

Record of collections.—Twenty-six (U.S.N.M. No. 8193), collected July 27, 1904, from one tautog; small, fusiform, reddish yellow; ventral sucker showing a tinge of red. At first the worms were contracted and somewhat concave ventrally. When flattened the outline is almost rhomboidal. Two, lying free in sea water, measured 0.41 by 0.23 mm. and 0.38 by 0.26 mm., respectively. When flattened the length increased to 0.8 mm.

Eighteen, collected August 9, 1904, from one tautog. One of these, rather larger than the others, was noted in which ova had not yet appeared. The uterus, in many folds, filled the posterior end of the body.

One, collected August 11, 1908, from tautog; length, 0.91 mm., breadth, 0.42 mm.; diameter of oral sucker 0.14 mm., of pharynx 0.03 mm., of ventral sucker 0.22 mm.

Three, collected August 6, 1910, from tautog; small, brownish yellow, fusiform. Measurements, life: Length, 1.12 mm.; breadth, 0.54 mm.; diameter of oral sucker 0.15 mm., of pharynx 0.05 mm., of ventral sucker 0.3 mm.

One, collected August 10, 1910, from tautog; length, 0.87 mm.; breadth, 0.42 mm.; uterus voluminous, but without ova.

Three, collected April 21, 1913, from tautog. Measurements in formalin: Lengths, 1, 0.96, 0.94 mm.; breadths, 0.43, 0.42, 0.42 mm.; diameters of oral suckers, 0.16, 0.14, 0.15 mm., of ventral suckers, 0.26, 0.28, 0.26 mm.

Six (U.S.N.M. No. 8194), collected October 23, 1913, from tautog. Dimensions of largest in formalin: Length, 1.8 mm., breadth, 0.51 mm.; diameter of oral sucker, 0.18 mm., of ventral sucker, 0.28 mm.

An immature distome which appears to belong to this species is here recorded: One, immature, collected July 17, 1908, from round herring. Measurements, life: Length, 0.48 mm.; breadth, 0.26 mm.; diameter of oral sucker, 0.06 mm., of pharynx, 0.04 mm., of ventral sucker, 0.08 mm. Fusiform, broadest at level of ventral sucker, the posterior edge of which is at about the middle of the length. Testes opposite and about on a level with the posterior half of the ventral sucker; ovary behind testes; intestines extend nearly to posterior end of body. The excretory vessels contained exceedingly small globular bodies.

Genus STEGANODERMA Stafford, 1904

STEGANODERMA FORMOSUM Stafford

PLATE 21, FIGURES 278–282

Steganoderma formosum STAFFORD, Zool. Anz., vol. 27, pp. 486, 487, 1904.—MANTER, Illinois Biol. Mon., vol. 10, No. 2, pp. 88–90, figs. 58–60, 1926.

A single distome (U.S.N.M. No. 8195), found by Vinal N. Edwards in a four-spotted flounder (*Paralichthys oblongus*), June 1, 1914, agrees, so far as the anatomy is shown, with Manter's excellent description of this species.

The specimen, mounted in balsam, is oblong-elliptical, rounded at the ends, minutely and densely spinose, spines flat and scalelike; oral and ventral suckers about equal; pharynx small and rather indistinct; esophagus much longer than pharynx. The intestinal rami begin at a point about 0.28 mm. from the anterior end and 0.24 in front of the ventral sucker. They could be traced as far back as the level of the posterior edge of the ventral sucker, where they were

hidden by the vitellaria. The genital pore is on the left of the median line about on a level with the forking of the intestine. The cirrus pouch is relatively large and long, its base dorsal to the ventral sucker, whence it curves forward and to the left to the genital pore. The testes are rounded lateral, opposite, at about the middle of the postacetabular space. The specimen was slightly damaged and the left testis was not clearly defined. Ovary somewhat subtriangular in outline, at right lateral border of ventral sucker. The vitellaria consist of a cluster of compact follicles on each lateral margin, from about the anterior border of the ventral sucker to about the anterior edge of the testes. The uterus lies between the testes and fills the middle space between the vitellaria and behind the ovary, and occupies a considerable portion of the posttesticular space. The excretory pore is surrounded by deeply staining cells, but the excretory vessels are not distinguishable. The granular appearance of the parenchyma, especially conspicuous in the neck, is a characteristic of this species. The dimensions of these bodies in this specimen are rather smaller than those given by Manter, very few of them measuring as much as 0.015 mm. in diameter.

Measurements in balsam: Length, 1.75 mm.; breadth, at level of ventral sucker, 0.62 mm., maximum about 0.7 mm.; distance of ventral sucker from anterior end 0.62 mm.; diameter of oral sucker 0.14 mm., of pharynx 0.05 mm., of ventral sucker 0.14 mm.; length of esophagus 0.3 mm.; ova about 0.039 by 0.024 mm.

There is also in Mr. Edwards' collection an example of this species (U.S.N.M. No. 3196) from *Acanthocottus octodecimspinosus;* date of collecting not given. Measurements in balsam: Length, 2.35 mm.; maximum breadth, at middle of length, 1 mm.; diameter of oral sucker, 0.19 mm., of pharynx, 0.06 mm., of ventral sucker, 0.021 mm.; length of esophagus about 0.4 mm.; cirrus pouch, length, 0.45 mm., breadth, 0.18 mm.; ova 0.03 by 0.015 mm. to 0.034 by 0.018 mm.

The ventral sucker is weak and was at first overlooked. In ventral view the posterior end of the cirrus pouch with the enclosed seminal vesicle can be seen plainly through its walls. The uterus is voluminous, its folds lying between the testes and filling the greater part of the posttesticular region; ova numerous. The body in front of the vitellaria is filled with round, oval, and pyriform granular bodies from 0.01 to 0.03 mm. in diameter; also the excretory vessel, near the terminal excretory pore, is surrounded by pyriform cells.

This species has been recorded by both Stafford and Manter from the halibut (*Hippoglossus hippoglossus*).

Family ACANTHOCOLPIDAE Lühe, 1909

Genus DEROPRISTIS Odhner, 1902

DEROPRISTIS INFLATA (Molin)

PLATE 21, FIGURE 283

Deropristis inflata (Molin), MANTER, Illinois Biol. Mon., vol. 10, No. 2, p. 110, 1926.

Body densely covered with spines on anterior half, becoming sparsely scattered on the posterior half. In dorsal view the spines at the anterior end are in regular transverse rows, length, 0.009 mm.; breadth at base, 0.004 mm. On the median line at the level of the inflated portion of the neck there is a patch of larger spines, as much as 0.024 mm. in length and 0.007 mm. in breadth. The spines on the lateral margins of the inflated portion are stout, length 0.021 mm.; breadth, 0.009 mm. On the ventral side the margin of the inflated portion is armed with stout spines, elsewhere the spines are small. Oral and ventral suckers nearly equal; distance from anterior end to ventral sucker about one sixth of the entire length. The pharynx is a little longer than broad. There is a short prepharynx, and an esophagus about as long as the pharynx. The cirrus was retracted in all the specimens observed. It is armed with relatively long and slender spines. The spinous retracted cirrus is followed by the seminal vesicle, which has a longer anterior and shorter posterior division. The metraterm appeared to lie close to the dorsal side of that portion of the invaginated cirrus which lay in front of the spinous portion. Back of the point of coincidence of position with the cirrus, the metraterm is lined with spines which resemble those of the cirrus. The proportions and relative positions of these parts differ in various individuals. In a typical specimen, 4.69 mm. in length, the anterior ends of the spinous portions of cirrus and metraterm were 0.21 mm. back of the ventral sucker; the metraterm, on the right side of the cirrus, measured 0.56 mm. in length and 0.14 mm. in greatest breadth. The spinous portion of the cirrus was about 0.50 mm. in length and 0.21 mm. in breadth. The ovary in this specimen lay 0.7 mm. in front of the first testis, and the anterior end of the first testis was 0.87 mm. from the posterior end of the body. First testis, length, 0.33 mm.; breadth, 0.19 mm.; second testis, length, 0.42 mm., breadth 0.41 mm.; posterior end of second testis, 0.28 mm. from posterior end of body; one testis overlaps the other by 0.14 mm. The vitellaria are diffuse and extend from about the level of the middle of the seminal vesicle to within a short distance of the first testis. Folds of the uterus, containing many eggs, fill the body from the seminal vesicle to the first testis. There is a large seminal recep-

tacle dorsal and posterior to the ovary. Ova in balsam about 0.045 by 0.021 mm. to 0.048 by 0.024 mm.

TABLE 13.—*Measurements of five mounted specimens of* Deropristis inflata, *Nos. 1–3 in balsam; Nos. 4, 5 in glycerin*

Measurement	1	2	3	4	5
	Mm.	*Mm.*	*Mm.*	*Mm.*	*Mm.*
Length	2.10	2.80	4.27	4.97	4.09
Breadth of neck	.24	.39	.36	.43	.43
Breadth of body	.21	.52	.39	.47	.49
Oral sucker, length	.04	.09	.10	.13	.13
Oral sucker, breadth	.09	.12	.13	.14	.14
Pharynx, length	.05	.08	.07	.11	.11
Pharynx, breadth	.05	.08	.10	.08	.08
Ventral sucker, length	.07	.14	.11	.17	.15
Ventral sucker, breadth	.08	.17	.11	.15	.15

Host.—American eel (*Anguilla rostrata*).

Record of collections.—Two, collected August 14, 1905, slender, yellowish, with expanded neck; ova 0.047 by 0.023 mm. Thirty-three, collected December 6, 1909, small, slender, neck inflated, spinose.

Sixteen (U.S.N.M. No. 8197), collected November 18, 1911; length in formalin 4 mm. One, collected July 31, 1912, macerated, spines shed.

One, collected August 19, 1912, orange color by reflected light, rusty yellow by transmitted light; neck inflated, armed with strong spines; 6 low nodules on head. Dimensions, life: Length, 2.86 mm.; breadth, anterior 0.15 mm., neck 0.32 mm., body, maximum, 0.57 mm.; breadth of oral sucker 0.13 mm., of pharynx 0.07 mm., of ventral sucker 0.16 mm.; ova somewhat irregular, about 0.043 by 0.024 mm.

Nine, collected March 29, 1913. Forty, collected April 8, 1913. Two, collected April 21, 1913. Three, collected April 30, 1914; length 3.5 mm. in formalin. Six, collected May 1, 1914. Fifty-five, collected June 13, 1914, 1.42 to 5 mm. in formalin. A few, collected July 10, 1914.

DEROPRISTIS HISPIDA (Abilgaard)

PLATE 21, FIGURE 284; PLATE 22, FIGURES 285–287

Deropristis hispida (Rudolphi) LÜHE, in Brauer's Die Süsswasserfauna Deutschlands, vol. 17, Trematodes, p. 85, fig. 69, 1909.

The collection contains two of these distomes, collected May 13, 1913, by Vinal N. Edwards from the intestine of a small sturgeon (*Acipenser sturio*) taken at Menemsha Bight.

The expanded neck of this species is made up largely of strong muscle fibers and evidently acts as an organ of adhesion. There is a cluster of stout spines on each lateral margin of the neck and another on the dorsal surface about on a level with the pharynx.

In older worms the anterior surface of the body is covered with spines, but in younger specimens the surface is nearly devoid of spines. The ventral sucker is a little larger than the oral, and the pharynx is longer than the oral sucker.

Measurements in formalin: Length, 7.8 mm.; breadth of expanded portion of the neck, exclusive of spines, 0.57 mm., in front of ventral sucker, 0.21 mm., at middle of length, 0.29 mm., near posterior end, 0.35 mm.; oral sucker, length, 0.11 mm., breadth, 0.15 mm.; diameter of ventral sucker, 0.19 mm.; distance from anterior end of ventral sucker about 0.9 mm.

In another specimen: Oral sucker, length, 0.11 mm., breadth, 0.15 mm.; pharynx, length, 0.15 mm., breadth, 0.12 mm.; ventral sucker, length, 0.16 mm., breadth, 0.18 mm.; ova about 0.042 by 0.024 mm. in balsam.

In the older specimens the ova fill the space between the testes, which are at the posterior end of the body, and the seminal vesicle. The cirrus is long and spinous, the cirrus pouch extending far back of the ventral sucker, with the seminal vesicle at its posterior end. The metraterm lies beside the cirrus pouch and is lined with spines.

On July 20, 1924, two of these distomes, 4 and 6 mm. in length, were collected from a small sturgeon measuring 85 cm. in length (U.S.N.M. No. 8198).

Genus STEPHANOSTOMUM Looss, 1899

STEPHANOSTOMUM DENTATUM (Linton)

PLATE 3, FIGURE 25

Distomum dentatum LINTON, Bull. U. S. Fish Comm. for 1899, pp. 283, 294, figs. 64–67, 1900; *ibid.*, p. 483, 1901; Bull. U. S. Bur. Fish., vol. 31, pt. 2, p. 582, 1913.

This species is smaller and relatively broader than *S. tenuis;* also the ova are smaller, and the pharynx is relatively smaller.

In strongly contracted specimens the pharynx is contiguous with the oral sucker, but in individuals with the neck not greatly contracted a prepharynx can be seen. There does not appear to be an esophagus. The number of oral spines is 54; length of oral spines about 0.05 mm. The entire body may be covered with closely placed spines, most abundant on the neck, less numerous toward the posterior end. Specimens were seen which had lost some of or all the oral spines and most of the spines from the body. The body spines, seen in front view, are somewhat scalelike with bluntly rounded ends; in edge view, as seen on the margins of the neck, they are slender, tapering, and slightly recurved. The oral spines are of nearly uniform diameter for the basal half of the length, then taper gradu-

ally to the tip, which is sharp pointed. In most cases the oral sucker is ventrally placed; when the neck is extended it tends to become terminal.

The genital pore is on the median line at the anterior margin of the ventral sucker. The cirrus pouch passes on, or above, the right margin of the ventral sucker, and encloses the seminal vesicle; when not disturbed by compression it lies dorsal to the ventral sucker. It may be concealed, or more or less displaced by ova massed behind the ventral sucker. The testes lie on the median line, one following the other closely. There is considerable variation in their shape, some being nearly circular in outline, some longer than broad, some broader than long and some subtriangular. The anterior border of the first testis is usually not far from the middle of the length, and the distance of the second testis from the posterior end is greater than the length of a testis. The ovary is near the right anterior border of the first testis, usually nearly circular in outline, but in some cases broader than long. A seminal receptacle was not seen, the appearance being that of sperm in the early folds of the uterus. The uterus lies between the ovary and the ventral sucker, the metraterm passing along the left border of the ventral sucker to the genital pore. The vitellaria are diffuse, filling the posttesticular space and extending to about the level of the middle of the ventral sucker. They fill the marginal regions, and in many instances follicles lie both dorsal and ventral to the testes and ovary.

Host.—Summer flounder (*Paralichthys dentatus*).

Record of collections.—Three, collected July 27, 1904, not in good condition, macerated. One, collected August 9, 1904. Three, collected August 15, 1906. One, collected August 16, 1906. Ten, collected August 20, 1906; small, partly macerated, no spines around mouth, indistinct on body. One, collected August 16, 1929, macerated, spines evanescent; length, 1.85 mm.; breadth 0.6 mm.; ova 0.06 by 0.042 mm.

TABLE 14.—*Measurements of four specimens of* Stephanostomum dentatum *in balsam*

Measurement	1	2	3	4
	Mm.	*Mm.*	*Mm.*	*Mm.*
Length	1.40	2.10	2.80	2.91
Maximum breadth	.77	.70	1.00	.77
Oral sucker, length	.17	.15	.25	.14
Oral sucker, breadth	.18	.14	.18	.19
Pharynx, length	----------	.10	.12	.16
Pharynx, breadth	----------	.10	.11	.11
Ventral sucker, length	.18	.17	.25	.22
Ventral sucker, breadth	.24	.18	.21	.23
Ova	.057 by .03	.045 by .03	.06 by .04	.057 by .03

Collected by Vinal N. Edwards on four dates in September, two in October, and one in November; eight fishes were examined and 62 distomes obtained. The greatest number on any one date was 47 from two fishes, collected on October 6. For the other dates the numbers recorded are 7, 2, 1, 3, 1, 1; one fish having been examined on each date (U.S.N.M. Nos. 8199–8200).

STEPHANOSTOMUM FILIFORME, new species

PLATE 3, FIGURES 26–28

Variable in length, slender, and nearly linear; oral spines about 44 to 48, number not exactly determined; coarse spines on neck, few and scattered toward posterior end; length of oral spines about 0.06 mm., of neck spines 0.03 mm.; neck variable, but relatively short; prepharynx long; esophagus short or lacking; intestines reach to posterior end; ventral sucker larger than oral; genital pore in front of ventral suckers; cirrus pouch and seminal vesicle long, equal in some cases to one third the length of the postacetabular region; testes near the posterior end, one following the other with but little interval between; ovary separated from the first testis by a greater or less interval; early folds of the uterus in front of ovary contain sperm; vitellaria diffuse, filling the posterior two thirds or more of the postacetabular space, but not reaching as far forward as the ventral sucker; uterus with many but not numerous ova in front of ovary.

Measurements of one of longer specimens in formalin: Length, 15 mm., breadth, of oral circle of spines, 0.28 mm., behind circle of spines, 0.21 mm.; maximum breadth, 0.44 mm.; distance of ventral sucker from anterior end, 2.1 mm.

Measurements of one of shorter specimens in balsam: Length, 8.22 mm.; breadth, oral circle of spines, 0.22 mm., behind circle of spines, 0.14 mm., at level of ventral sucker, 0.38 mm., at level of testes, 0.49 mm.; distance of ventral sucker from anterior end, 1.12 mm., from ventral sucker to vitellaria, 2.12 mm., from second testis to posterior end, 0.35 mm.; ovary, length, 0.19 mm., breadth, 0.18 mm.; first testis, length, 0.7 mm., breadth, 0.25 mm.; second testis, length, 0.74 mm., breadth, 0.28 mm.

Type specimens.—U.S.N.M. No. 8202 (holotype and paratypes).

Hosts.—Great amberfish (*Seriola lalandi*), crevallé (*Caranx hippos*), cocinero (*Paratractus caballus*).

Record of collections.—Five, collected August 14, 1906, from amberfish; 10 to 12 mm. long, much macerated. Twenty-eight (U.S.N.M. No. 8202), collected September 20, 1910, from amberfish; three fishes examined.

One (U.S.N.M. No. 8203), collected September 22, 1913, from crevallé; length 8 mm., breadth 0.6 mm., in formalin. Measurements in balsam: Length, 7 mm.; breadth, 0.46 mm.; diameter oral circle of spines, 0.22 mm.; oral sucker, length 0.11 mm., breadth 0.15 mm.; pharynx (indistinct), length 0.15 mm., breadth 0.12 mm.; ventral sucker, length 0.21 mm., breadth 0.24 mm.; ova, 0.051 by 0.036 mm.; length of oral spines about 0.07 mm., of neck spines 0.015 to 0.03 mm. This distome agrees rather closely with the distomes from *S. lalandi*. The number of oral spines could not be determined exactly, but there are at least 44 in the two circles. The neck is contracted, breadth behind circle of spines, 0.14 mm., then expanding to a breadth of 0.45 mm.; length of neck, that is, from anterior end to ventral sucker, 0.6 mm. Prepharynx longer than pharynx; cirrus pouch and seminal vesicle long, extending 1.5 mm. back of ventral sucker; distance of ovary from first testis 0.5 mm., from first to second testis 0.15 mm., from second testis to posterior end 0.5 mm.; uterus median, from ovary to genital pore; vitellaria dense, from posterior end to a point 1.4 mm. back of ventral sucker.

TABLE 15.—*Measurements of three specimens of* Stephanostomum filiforme *in balsam*

Measurement	1	2	3
	Mm.	*Mm.*	*Mm.*
Length	13.30	9.94	7.63
Maximum breadth	.42	.42	.28
Oral sucker, length	.14	.14	.14
Oral sucker, breadth	.21	.17	.17
Pharynx, length	.15	.21	.14
Pharynx, breadth	.12	.10	.09
Ventral sucker, length	.29	.22	.25
Ventral sucker, breadth	.25	.18	.19
Length of prepharynx	.84	.56	.77
Anterior end to ventral sucker	1.40	.98	1.12
Ovary to first testis	1.12	.35	.45
Ova	0.06 by .04	0.06 by .04	0.06 by .04

One and a fragment (U.S.N.M. No. 8204), collected October 13, 1911, from the cocinero; 15 fishes examined: Length, 9 mm.; breadth, 1 mm., in formalin. Measurements in balsam: Length, 7.14 mm.; breadth, 0.35 mm.; oral sucker, length, 0.13 mm., breadth, 0.15 mm.; pharynx, length, 0.18 mm., breadth, 0.19 mm.; ventral sucker, length, 0.28 mm., breadth, 0.28 mm. (lateral view); length of oral spines about 0.06 mm., of neck spines about 0.03 mm.; ovary, length, 0.21 mm., breadth, 0.14 mm.; first testis, length, 0.63 mm., breadth, 0.25 mm.; second testis, length, 0.48 mm., breadth, 0.21 mm.; distance from ovary to first testis, 0.28 mm., from first to second testis, 0.14 mm., from second testis to posterior end, 0.35 mm.; ova, 0.06 by 0.04 mm.

Vitellaria dense, filling posterior part of body to within 1.9 mm. of ventral sucker. Distance from anterior end to ventral sucker 0.84 mm. Length of prepharynx about 0.32 mm.

STEPHANOSTOMUM TENUE (Linton)

PLATE 4, FIGURES 32–34

Distomum tenue LINTON, Proc. U. S. Nat. Mus., vol. 20, pp. 535, 536, pl. 52, figs. 2–8, 1898; Bull. U. S. Fish Comm. for 1899, pp. 455, 456, 468, 469, 1901.

Distomum tenue tenuissime LINTON, Proc. U. S. Nat. Mus., vol. 20, pp. 536, 537, pl. 52, figs. 9–12, 1898.

Distomes referred to this species from 10 species of fishes in the Beaufort, N. C., region, Bull. U. S. Bur. Fish., vol. 24, 1905.

Many of the distomes here recorded are imperfect in that the oral spines are either missing or in such condition that their exact number can not be determined; in many cases also the dermal spines are evanescent. About 42 oral spines were counted in distomes from *Roccus saxatilis* and *Morone americana* and about 48 in distomes from *Hemitripterus americanus.*

In general the ova of the distomes recorded under *S. tenue* measure 0.08 by 0.04 mm. or more, while those under *S. dentatum* are 0.06 by 0.03 mm. or less; all measurements were made on material mounted in balsam. The average diameters of oral sucker, pharynx, and ventral sucker of distomes from different hosts are as follows:

Species	Oral sucker	Pharynx	Ventral sucker
	Mm.	*Mm.*	*Mm.*
S. tenue	0.18	0.225	0.32
S. dentatum	.14	.140	.23

Hosts.—Sand launce (*Ammodytes americanus*), sea raven (*Hemitripterus americanus*), kingfish (*Menticirrhus saxatilis*), white perch (*Morone americana*), striped bass (*Roccus saxatilis*), toadfish (*Opsanus tau*).

Record of collections.—One (U.S.N.M. No. 8205), collected October 20, 1914, from sand launce. Measurements in balsam: Length, 3 mm.; breadth, 0.75 mm.; oral sucker, length, 0.17 mm., breadth, 0.22 mm.; pharynx, length, 0.32 mm., breadth, 0.28 mm.; ventral sucker, length, 0.35 mm., breadth, 0.35 mm.; ova, 0.096 by 0.054 mm. Most of the oral spines are missing, coarse spines on neck; prepharynx at least as long as pharynx; esophagus very short; seminal vesicle extends for three-fourths the distance from ventral sucker to ovary. There is a short interval between the testes in which a few vitelline follicles lie; ovary at anterior edge of testis; shell gland at anterior

median border of ovary; ova few; vitellaria from posterior end nearly to ventral sucker, not dense; intestines extend to posterior end of body.

Seventy-two (U.S.N.M. No. 8206), collected January 10, 1914, from sea raven; maximum length, in formalin, 5.5 mm. Body nearly linear; neck tapering, variable, average about 5.5 times in entire length; about 48 oral spines; length of oral spine about 0.05 mm.; spines on neck dense, length about 0.04 mm.; spines on body smaller, but continue to posterior end; prepharynx, when neck is not contracted, longer than pharynx; esophagus lacking; cirrus pouch dorsal to ventral sucker; seminal vesicle extends back of ventral sucker, but not halfway to ovary, more or less crumpled, as if crowded forward by ova; testes longer than broad, contiguous, or with short interval between; ovary nearly circular in outline, a little to right of median line, near anterior border of first testis. In some there is a short interval between ovary and testis in which follicles of the vitallaria lie. Vitellaria extend from posterior end to ventral sucker, follicles coarse. Testes near posterior end. In one distome, length, 4 mm., the second testis was 0.25 mm. from the posterior end; in another, length, 4.62 mm., the second testis was 0.35 mm. from the posterior end. Measurements in balsam: Length, 3.15 mm.; breadth, 0.7 mm.; oral sucker, length, 0.18 mm., breadth, 0.19 mm.; pharynx, length, 0.25 mm., breadth, 0.14 mm.; ventral sucker, length, 0.28 mm., breadth, 0.32 mm.; ova, average of eight, 0.08 by 0.04 mm.

One (U.S.N.M. No. 8207), collected September 8, 1910, from kingfish. Spines evanescent; oral spines missing; a few scattering spines on neck and dorsal side of body. Dimensions in balsam, lateral view: Length, 2.73 mm.; breadth, 0.56 mm.; oral sucker, length, 0.14 mm., breadth, 0.11 mm.; pharynx, length, 0.21 mm., breadth, 0.15 mm.; ventral sucker, length, 0.21 mm., breadth, 0.24 mm.; ova, 0.08 by 0.04 mm. Greatest breadth near posterior end at level of posterior testis, tapering to anterior end, posterior end bluntly rounded; prepharynx shorter than pharynx; esophagus very short or none; cirrus pouch long, slender, dorsal to ventral sucker; seminal vesicle long, pyriform, behind ventral sucker about halfway to ovary; testes about as broad as long, separated by a short interval which is filled with vitellaria; posterior testis 0.28 mm. from posterior end; ovary nearly circular in outline, at anterior border of first testis, on right side of median line; vitellaria extend to within about 0.1 mm. of ventral sucker; vitelline follicles rather coarse; ova in front of ovary, few.

Recorded from white perch: Proc. U. S. Nat. Mus., vol. 20, pp. 536, 537, 1898; Bull. U. S. Fish Comm. for 1899, p. 456, 1901. One (U.S.N.M. No. 8208), collected May 31, 1907, from white perch;

length, 7 mm. in formalin. Densely spinous on neck, spines continue to level of posterior testis. This specimen, mounted in balsam, shows only a lateral view of oral spines. There are about 42 spines in the two oral circles. Length of oral spines about 0.06 mm., of neck spines about 0.036 mm.; seminal vesicle extends more than halfway from ventral sucker to ovary; vitellaria extend from posterior end to level of anterior border of ventral sucker; a few follicles between testes; prepharynx as long as pharynx; esophagus short, or none; ova, 0.084 by 0.045 mm.

Recorded from striped bass: Proc. U. S. Nat. Mus., vol. 20, pp. 535, 536, 1898; Bull. U. S. Fish Comm. for 1899, p. 455, 1901. One (U.S.N.M. No. 8209), collected July 13, 1925, from striped bass. This distome was somewhat macerated, oral and cuticular spines missing. The seminal vesicle extends 1 mm. back of ventral sucker, to a point 0.7 mm. in front of ovary. The vitellaria extend to within 0.2 mm. of the ventral sucker, its follicles filling the intervals between the testes and between the ovary and first testis. The ovary is separated from the first testis by a space equal to its diameter, and the testes are separated from each other by a somewhat longer interval. Shell gland in front of ovary; no seminal receptacle could be distinguished, but the early folds of the uterus appeared to contain sperm. Dimensions in balsam: Length, 4.62 mm.; breadth, 0.56 mm. (maximum, at anterior border of ventral sucker); breadth behind ventral sucker, 0.45 mm.; oral sucker, length, 0.14 mm., breadth, 0.21 mm.; pharynx, length, 0.14 mm., breadth, 0.21 mm.; ventral sucker, length, 0.3 mm., breadth, 0.33 mm.; ova, 0.084 by 0.04 mm., 0.09 by 0.045 mm.; length of prepharynx, 0.35 mm.; esophagus lacking or very short. A reexamination of old material from this host was made and the number of oral spines found to be 42, as stated in the original description of the species.

Recorded from toadfish: Bull. U. S. Fish Comm. for 1899, pp. 468, 469, 1901.

STEPHANOSTOMUM VALDE-INFLATUM (Stossich)

Distomum valde-inflatum Stossich, LINTON, Proc. U. S. Nat. Mus., vol. 20, pp. 527, 528, pl. 47, figs. 1, 2, 1898; Bull. U. S. Fish Comm. for 1899, pp. 444, 464, 1901.

Since these immature, encysted distomes have not yet been allied with any adult stage it seems best to record them under this specific designation.

Hosts.—Filefish (*Ceratacanthus schoepfi*), silversides (*Menidia notata*), toadfish (*Opsanus tau*), sunfish (*Mola mola*).

Record of collections.—Recorded from filefish: Proc. U. S. Nat. Mus., vol. 20, pp. 527, 528, 1898; Bull. U. S. Fish Comm. for 1899;

pp. 444, 464, 1901. One, collected August 17, 1909, in cyst from filefish. Specimens collected July 13, 1911, in cysts on intestine of filefish; length, 1.12 mm., breadth, 0.8 mm. Large numbers of spherical cysts, collected August 21, 1915, from filefish, widely distributed in the muscles from tail to head, and between the vertebral spines, both haemal and dorsal; also in the peritoneal cavity, on the viscera and on the ventricle. In the flesh the spherical cysts, from 0.06 to 2 mm. in diameter, are enclosed in larger cysts 4.5 by 2.5 mm. Cysts on the ventrical and viscera are globular, without any of the white, granular, or cheesy material which is associated with the cysts in the flesh.

Many spherical cysts, collected September 6, 1927, from filefish in peritoneal cavity, on auricles and on mucous membrane of pharynx; a double circle of hooks around the mouth, about 32 in each circle.

Recorded from silversides: Bull. U. S. Fish Comm. for 1899, p. 444, 1901. Many globular cysts on viscera of silversides, collected by Dr. Irving A. Field on August 25, 1904. Few small cysts, collected August 30, 1910, from silversides; transparent, amber colored, and containing opaque distomes; cysts 0.8 mm. to 1 mm. in diameter; 24 fishes examined.

One, collected July 6, 1901, from toadfish; small, yellow, globular cyst, containing a distome with double circle of spines around mouth; about 24 spines in each circle. Few cysts on mesentery of toadfish, collected August 22, 1903. Four cysts on mesentery of toadfish collected August 25, 1903. Two cysts in stomach wall of toadfish, collected August 4, 1908.

A distome (U.S.N.M. No. 8210), collected from a sunfish, July 19, 1926, is here recorded. The specimen is not in good condition, having lost all the oral, and the greater part of the cuticular, spines. The neck is relatively longer and slenderer than in *S. dentatum;* also there is a seminal receptacle, which has not been observed in the distomes from the flounder. Measurements in balsam: Length, 1.82 mm.; breadth, 0.4 mm.; oral sucker, length, 0.12 mm., breadth, 0.14 mm.; pharynx, length, 0.12 mm., breadth, 0.06 mm.; ventral sucker, length, 0.18 mm., breadth, 0.25 mm.; ova, 0.054 by 0.027 mm., 0.06 by 0.036 mm.

Another small distome was noted that had spines around the mouth, but unfortunately it was lost before measurements had been made.

STEPHANOSTOMUM species

PLATE 4, FIGURES 29–31

Host.—Great amberfish (*Seriola lalandi*).

Three of the distomes (U.S.N.M. No. 8211), collected from this host, September 20, 1910, differ from the others obtained on this

date. They are much smaller and are sagittate, or long-oval, in outline instead of linear. They are somewhat macerated, all spines missing, except a few of the oral spines on one specimen. The greatest breadth is at about the middle of the postacetabular region, whence they taper rather uniformly to the anterior end, and are bluntly rounded posteriorly. The ventral sucker is much larger than the oral; pharynx longer than broad, and longer than the oral sucker; prepharynx as long as or longer than pharynx; esophagus short or lacking. The seminal vesicle extends far back of the ventral sucker; testes near the posterior end, one following and touching the other; ovary relatively small, at right anterior border of first testis; uterus between ovary and ventral sucker; vitellaria diffuse, follicles small, extending, in a specimen 2.28 mm. in length, to within 0.35 mm. of the ventral sucker. In optical section the neck shows a deeper layer of strong, transverse fibers, which are somewhat sinuous, and produce the effect of a lattice with lozenge-shaped openings, and an outer layer of fine, longitudinal fibers (pl. 4, fig. 31).

Measurements in balsam: Length, 3.22 mm., maximum breadth, 0.59 mm.; oral sucker, length, 0.14 mm., breadth, 0.15 mm.; pharynx, length, 0.28 mm., breadth, 0.14 mm.; ventral sucker, length, 0.27 mm., breadth, 0.28 mm.; oral spines, length, 0.021 mm., breadth, 0.012 mm.; ova, 0.06 by 0.03 mm.

These distomes bear some resemblance to *Lechradena edentula* Linton [12], which should be regarded as a species of *Stephanostomum*.

STEPHANOSTOMUM species

Host.—Leatherjack (*Oligoplites saurus*).

Two fragments of a distome (U.S.N.M. No. 8212), collected July 24, 1924, are here noted.

Measurements in balsam: Anterior fragment: Length, 2.8 mm.; breadth, 0.85 mm.; length of seminal vesicle, 1.26 mm., breadth, 0.18 mm.; ova, 0.069 by 0.036 mm. The anterior end of the seminal vesicle is about at the same level as the anterior follicles of the vitellaria, which are 0.49 mm. from the anterior end of the fragment on one side, and 0.63 mm. on the other. Posterior fragment: Length, 4.62 mm.; breadth, 0.7 mm.; first testis, length, 0.8 mm., breadth, 0.46 mm.; second testis, length, 0.87 mm., breadth, 0.46 mm.; ovary, length, 0.26 mm., breadth, 0.28 mm.; distance between ovary and first testis, 0.15 mm., between testes, 0.22 mm.; from second testis to posterior end, 1.3 mm. Vitellaria, composed of rather coarse follicles, fill the posttesticular space, the spaces between testes and those between ovary and testis. They are interrupted at

[12] Carnegie Inst. Washington Publ. 133, pp. 46, 47, fig. 87, 1910.

the levels of testes and ovary, begin again on front of the ovary, and continue in the anterior fragment along each lateral margin in a band about one third the breadth of the body. The anterior fragment is very densely spinose, the spines continuing to the level of the first testis, where they are sparse; length of spines about 0.01 mm.; testes long-oval, ovary nearly circular in outline; shell gland in front of ovary; no seminal receptacle seen; some indication that the supply of sperm had been exhausted, numerous nucleated cells, apparently unfertilized germ cells, lying in the uterus associated with the ova.

Family ECHINOSTOMIDAE Looss, 1902

Subfamily ECHINOSTOMINAE Looss, 1899

Genus ECHINOSTOMUM Rudolphi, 1809

ECHINOSTOMUM species

In June, 1915, twelve trout perch (*Percopsis omiscomaycus*) from Constantia, N. Y. (Oneida Lake), collected June 6, were sent to me for examination. Dr. Tarleton H. Bean in an accompanying letter stated that the collector reported that about 5 percent of the fish had "something wrong with the eyes." The fish had been taken from a small stream into which they had come to spawn. No distomes were found in any of the abnormal eyes. Tissues from diseased and from normal eyes were examined for bacteria by E. S. Linton. Numerous short bacilli were found in the abnormal eyes, none were found in the normal eyes. Two encysted distomes were found in an apparently normal eye, one in the connective tissue outside the eyeball, the other in one of the eye muscles; diameters of cysts 0.4 by 0.3 mm. and 0.3 by 0.22 mm.; distomes with a single circle of about 24 spines around the mouth, length of spines 0.04 mm.; neck spinose. In one of the fishes an eye which seemed to be more prominent than the other was opened and an encysted distome found in the teased material, apparently from the connective tissue surrounding the eyeball; body of distome minutely spinose; single circle of spines, 20 or more, around the mouth; length of spines, 0.035 mm. Length of distome, 0.34 mm. Another slightly bulging eye was examined and two encysted distomes found. The larger cyst measured 0.56 by 0.5 mm. What appears to be this specimen, compressed and mounted in balsam, is 0.8 mm. in length; diameter of crown of spines, 0.17 mm.; length of spines, 0.04 mm.; number of spines about 30; diameter of ventral sucker, 0.07 mm. The smaller cyst, 0.33 by 0.22 mm.; number of oral spines 20 or more; length of spines 0.035 mm. Another cyst adhering to the outside of an eyeball measured 0.37 by 0.34 mm.; distome with about 18 oral spines. (U.S.N.M. No. 8213.)

Subfamily HIMASTHLINAE Odhner, 1911

Genus HIMASTHLA Dietz, 1909

HIMASTHLA TENSA, new species

PLATE 4, FIGURE 35

Body nearly linear; neck short, covered with minute spines, about 0.02 mm. in length and continuing for a short distance back of the ventral sucker; pharynx small, close to oral sucker; esophagus long; intestines begin at anterior border of ventral sucker, indistinct in balsam mounts, but appear to extend to posterior end. Genital pore at anterior edge of ventral sucker on median line; cirrus pouch and seminal vesicle long, extending back of ventral sucker, the seminal vesicle more or less spirally curved; testes longer than broad, near posterior end, one following the other closely. In one of the specimens the testes are slightly irregular, the first having a deep notch on one side and the second being constricted about the middle of its length, the posterior half being distinctly narrower than the anterior. Ovary subglobular, a short distance in front of the first testis and a little to the right of the median line. An ample shell gland and vitelline reservoir lie between the ovary and first testis. The early folds of the uterus contain sperm. The vitellaria extend from the posterior end about to the posterior end of the seminal vesicle. The body is considerably elongated between the ovary and ventral sucker; numerous ova lie along the median line, between the marginal vitellaria, from the ovary to the anterior end of the vitellaria.

The ventral sucker is larger than the oral, and the mouth is surrounded by a single circle of spines, with two extra spines at the angles at each side. These extra spines are posterior to the others, and if continued would form an outer circle. The oral spines are about 0.02 mm. in length and 0.015 mm. in breadth; as near as could be determined the number of oral spines is about 32.

Measurements in balsam: Length, 5.32 mm.; maximum breadth, 0.59 mm.; breadth of circle of oral spines, 0.26 mm., of oral sucker, 0.11 mm.; pharynx, length, 0.11 mm., breadth, 0.07 mm.; ventral sucker, length, 0.31 mm., breadth, 0.31 mm.; ova somewhat variable, average of four 0.075 by 0.038 mm.; first testis, length, 0.5 mm., breadth, 0.32 mm.; second testis, length, 0.7 mm., breadth, 0.28 mm.; distance of second testis from posterior end, 0.7 mm.; length of esophagus, 0.35 mm.

Host.—Common codfish (*Gadus morrhua*).

Record of collections.—Three (U.S.N.M. No. 8214), collected January 22, 1915; 12 fishes examined.

Family ALLOCREADIIDAE Stossich, 1904

Subfamily ALLOCREADIINAE Looss, 1902

Genus LEBOURIA Nicoll, 1909

LEBOURIA TRUNCATA, new species

PLATE 3, FIGURES 21, 22

Small distomes, smooth, generally broadest near posterior end, tapering to anterior end; often subtriangular in outline; ventral sucker larger than oral; pharynx about half diameter of oral sucker; esophagus short, but in flattened specimens as long as or longer than pharynx; intestines reach to posterior end; genital pore near posterior end of pharynx, on median line, or near it. Cirrus and cirrus pouch not seen; seminal vesicle dorsal to ventral sucker, seen at the anterior border of the ventral sucker in one, where it appeared to have been crowded forward by the mass of ova; in another it lay at the right posterior border of the ventral sucker, length, 0.09 mm., breadth, 0.045 mm., and extending for about half its length back of the ventral sucker. It would appear that the cirrus is represented only by an ejaculatory duct. Testes two, diagonal, contiguous. Ovary in front of right testis, on right side of median line, lobed. Uterus between testes and ventral sucker, many ova lying along the left side and in front of the ventral sucker, as far as the pharynx, and in one case to the left side of the oral sucker. While not certainly made out, the early folds of the uterus appeared to contain sperm. Shell gland on left of ovary; vitellaria diffuse, from posterior end along the margins to the level of the pharynx. Ova in balsam about 0.06 by 0.03 mm.

Type specimens.—U.S.N.M. No. 8216 (holotype and paratypes).

Hosts.—Common weakfish (*Cynoscion regalis*), kingfish (*Menticirrhus saxatilis*), white perch (*Morone americana*), lizardfish (*Synodus foetens*).

Record of collections.—Collections of July 7, 1899, and August 6, 1900, from weakfish, on slides containing specimens of *Cymbephallus vitellosus*. Dimensions in balsam: Length, 1.57 mm., breadth, 0.75 mm.; breadth of oral sucker, 0.16 mm., of pharynx, 0.08 mm., of ventral sucker, 0.31 mm.; ova, 0.061 by 0.034 mm.

Twelve (U.S.N.M. No. 8215), collected September 10, 1928, from 8 young weakfish, from 68 to 112 mm. in length. These fish were seined on the same date and at the same locality as the examples of *Menticirrhus saxatilis* and *Synodus foetens*, from which this distome was also obtained.

One (U.S.N.M. No. 8216), collected September 11, 1907, from kingfish. Measurements, life: Length, 1.28 mm., breadth, 0.6 mm.; breadth of oral sucker, 0.12 mm., of pharynx, 0.07 mm., of ventral sucker, 0.28 mm.; ova, 0.061 by 0.034 mm. The specimen, in balsam, is much flattened, slightly broader at the level of the posterior edge of the ventral sucker than toward the posterior end; esophagus a little longer than pharynx.

One, collected September 23, 1913, from kingfish; 8 fishes examined. Length in balsam, 1.12 mm., breadth, 0.53 mm.

Twenty-four small distomes, collected September 10, 1928, from kingfish; 34 young fishes, 81 to 137 mm. in length, examined; same species found in young *Cynoscion regalis* and lizardfish (*Synodus foetens*), seined at the same locality on the same date. Dimensions of larger specimens in close agreement with those given above. Dimensions of the smaller distomes in balsam: Length, 0.67 mm.; breadth, 0.25 mm.; breadth of oral sucker, 0.08 mm., of pharynx, 0.045 mm., of ventral sucker, 0.13 mm.; ova 0.06 by 0.03 mm.

One (U.S.N.M. No. 8217), collected May 31, 1907, from white perch. Dimensions, balsam: Length, 0.70 mm., breadth, 0.38 mm.; diameter of oral sucker, 0.15 mm., of pharynx, 0.08 mm., of ventral sucker, 0.24 mm.; ova, 0.075 by 0.036 mm. Found adhering to a specimen of *Stephanostomum tenue*. Vitellaria dense, extending in front of ventral sucker; testes diagonal; ovary lobed, and adjacent to testis, to right of median line; only two ova in uterus.

One, collected September 11, 1928, from lizardfish; 15 fishes examined; same locality and date as specimens of species from *Cynoscion regalis* and *Menticirrhus saxatilis*.

LEBOURIA species

PLATE 3, FIGURE 23

A distome, near *Lebouria truncata*, is here recorded.

Body widest at ventral sucker, tapering rapidly to anterior, and more gradually to posterior end. Genital pore to left of median line, at level of posterior end of pharynx; prepharynx short, esophagus about as long as pharynx; seminal vesicle extends a little way beyond the posterior edge of the ventral sucker on the left side; intestines concealed by the vitellaria; testes diagonal, close together, at about middle of postacetabular space; ovary lobed, at right anterior border of first testis; uterus between ovary and ventral sucker; vitellaria diffuse, from posterior end along margins nearly to pharynx.

Measurements in balsam: Length, 1.12 mm.; breadth, 0.36 mm.; oral sucker, length, 0.10 mm., breadth, 0.08 mm.; pharynx, length, 0.07 mm., breadth, 0.06 mm.; ventral sucker, length, 0.18 mm., breadth, 0.25 mm.; ova, 0.075 by 0.033 mm.

Host.—Northern barracuda (*Sphyraena borealis*).

Record of collection.—One (U.S.N.M. No. 8218), collected October 29, 1926; 163 fishes examined.

LEBOURIA species

PLATE 3, FIGURE 24

Host.—Common flatfish (*Pseudopleuronectes americanus*).

Record of collection.—One specimen, collected May 16, 1916. Dimensions in balsam: Length 1.26 mm.; breadth 0.98 mm.; diameter of oral sucker 0.21 mm., of pharynx 0.09 mm., of ventral sucker 0.35 mm.; ova 0.072 by 0.034 mm. (U.S.N.M. No. 8219.) A small distome, near *L. truncata*, somewhat damaged and distorted, being broken on the left side near the posterior end, where a mass of eggs protrudes, and having the posterior end folded under ventrally. The testes appear to be nearly transverse, but the left testis has probably been crowded back by the mass of ova between it and the ventral sucker. Body smooth, ovate, broadest at level of testes, which are nearly transverse and near the posterior end; testes nearly circular in outline; ovary lobed, near anterior border of right testis; shell gland to left of ovary, median; vitellaria extend forward to level of oral sucker, follicles coarse, concealing intestines. So far as the anatomy can be made out there is a rather close agreement with the distomes from *Cynoscion regalis*.

Genus PODOCOTYLE Dujardin, 1845

PODOCOTYLE ATOMON (Rudolphi)

PLATE 1, FIGURES 1–7

Distomum simplex Rudolphi, LINTON, Bull. U. S. Fish Comm. for 1899, p. 485, 1901.

Sinistropus simplex (Rudolphi), STAFFORD, Zool. Anz., vol. 27, pp. 484, 485, 1904.—COOPER, Trans. Roy. Soc. Canada, ser. 3, vol. 9, sect. 4, pp. 185, 186, fig. 6–8, 1915.

Podocotyle atomon (Rudolphi), MANTER, Illinois Biol. Mon., vol. 10, No. 2, pp. 207, 208, fig. 49, 1926.

Body smooth, usually of nearly same breadth throughout; ventral sucker larger than oral; prepharynx short, esophagus as long as or longer than pharynx; intestines extend to posterior end; genital pore to left of median line, approximately near level of posterior end of pharynx; cirrus pouch anterior and dorsal to ventral sucker; seminal vesicle extending but a short distance back of ventral sucker; testes 2, relatively small, one following the other, in some cases with little or no interval between them, in others with an interval into which follicles of the vitellaria are inserted; ovary in front of first testis,

lobed, usually its posterior end three lobed; yolk reservoir dorsal to anterior border of ovary; seminal receptacle in front of and ventral to yolk reservoir, not clearly defined in mounted material, the sperm may be in the early folds of the uterus; shell gland ventral, in front of ovary; uterus between ovary and ventral sucker; ova, in balsam mounts, about 0.07 by 0.03 mm.; vitellaria diffuse, from posterior end along margins without interruption to the ventral sucker.

Hosts.—Long-spined sculpin (*Acanthocottus octodecimspinosus*), common eastern stickleback (*Gladiunculus bispinosus*), sea raven (*Hemitripterus americanus*), rusty dab (*Limanda ferruginea*), tomcod (*Microgadus tomcod*), grubby (*Acanthocottus aeneus*), common gurnard (*Merulinus carolinus*), common flatfish (*Pseudopleuronectes americanus*), tautog (*Tautoga onitis*).

Record of collections.—All collections from *Acanthocottus octodecimspinosus* made by Vinal N. Edwards. Three, collected April 20, 1914, from sculpin; three, May 14, 1914; one, October 20, 1914; five, October 24, 1914, 80 fishes examined; two, October 30, 1914, 50 fishes examined.

Nine, collected April 5, 1915, from sculpin; 34, collected April 12, 1915; 22, collected April 26, 1915.

One, collected April 21, 1916, from sculpin, five fishes examined; 37 (U.S.N.M. No. 8220), collected April 24, 1916.

Many shapes and sizes among formalin material. The length varies from 2.2 mm., with a breadth of 0.52 mm., to 6 mm., breadth, 2.5 mm.; ova, 0.08 by 0.05 mm.

Measurements in balsam: Length, 5.88 mm.; breadth, 1.54 mm.; oral sucker, length, 0.32 mm., breadth, 0.36 mm.; pharynx, length, 0.21 mm., breadth, 0.21 mm.; ventral sucker, length, 0.46 mm., breadth, 0.57 mm.; length of esophagus, 0.49 mm.; breadth of first testis, 0.56 mm., of second testis, 0.6 mm.; ova 0.075 by 0.032 mm.

One (U.S.N.M. No. 8221), collected by Vinal N. Edwards, May 8, 1914, from eastern stickleback. Measurements in balsam: Length, 2.6 mm.; maximum breadth, 0.7 mm.; breadth of oral sucker, 0.2 mm., of pharynx, 0.14 mm., of ventral sucker, 0.32 mm., of first testis, 0.21 mm.; ova, 0.07 by 0.033 mm.

All collections from *Hemitripterus americanus* made by Vinal N. Edwards. Two, collected November 20, 1911.

Five of the 43 distomes collected on April 26, 1915, and May 26, 1915 (U.S.N.M. No. 8222), from sea raven belong to this species.

Following are average measurements of seven specimens in balsam, of which the smallest had a length of 2 mm., and breadth of 0.68 mm., and the largest a length of 4.54 mm. and breadth of 1.54 mm.; Length, 3.34 mm.; breadth, 1.03 mm.; breadth of oral sucker, 0.23 mm., of pharynx, 0.14 mm.; ventral sucker, 0.37 mm.; length of esophagus,

0.18 mm.; breadth of first testis, 0.33 mm., of second testis, 0.3 mm.; ova about 0.075 by 0.036 mm.

Recorded from rusty dab: Linton, Bull. U. S. Fish Comm. for 1899, p. 485, 1901. A reexamination of balsam mounts shows that these distomes belong here. Dimensions in balsam: Length, 2.71 mm., breadth, 0.84 mm.; oral sucker, length, 0.14 mm., breadth, 0.17 mm.; pharynx, length, 0.07 mm., breadth, 0.1 mm.; ventral sucker, length, 0.24 mm., breadth, 0.3 mm.; breadth of first testis, 0.29 mm., second testis, 0.28 mm.; ova, 0.084 by 0.048 mm. In the lateral view of another specimen the length of the pharynx is 0.07 mm., of the esophagus, 0.14 mm. (U.S.N.M. No. 8223).

One (U.S.N.M. No. 8224), collected March 31, 1913, from tomcod, in a lot of 75 or more distomes, all of which, except this, belong to the species *P. ollsoni*. Dimensions in balsam: Length, 3.20 mm., breadth, 1.18 mm.; length of esophagus, 0.17 mm.; first testis, length, 0.18 mm., breadth, 0.30 mm.

Two (U.S.N.M. No. 8225), collected February 17, 1913, from grubby.

Five, collected February 3, 1915, from grubby; 8 fishes examined. Two of these are immature, length, 1.85 and 1.96 mm.; lengths of others, mature, 2.94 to 3.29 mm. Length of one in balsam, 3.1 mm.; breadth, 0.96 mm.; length of esophagus, 0.24 mm.; first testis, length, 0.25 mm., breadth, 0.25 mm.

One (U.S.N.M. No. 8226), collected July 21, 1924, from common gurnard. Yellowish, and minutely rugose before compression; cirrus short, seminal vesicle enclosed in cirrus bulb; posterior end of seminal vesicle at anterior border of ventral sucker. Measurements in balsam: Length, 2.66 mm., breadth, 0.67 mm.; diameter of oral sucker, 0.22 mm.; pharynx, length, 0.1 mm.; breadth, 0.13 mm.; ventral sucker, length, 0.24 mm., breadth, 0.32 mm.; length of prepharynx, 0.04 mm., of esophagus, 0.13 mm.; ova, 0.075 by 0.036 mm.

Distomes referred to this species were collected by Vinal N. Edwards from the winter flounder on 19 dates in six different years in the months of February, April, May, October, and December. The infestation in all cases was light. Thus, the record shows that on 12 dates 131 fishes were examined and a total of 97 distomes found. The highest average per host on any date was less than five, when 19 distomes were obtained from four fishes. On four dates the record for each date was one distome, although on those dates 66 fishes were examined. The smallest adult with ova measures, in balsam, 1.22 mm., in length, the largest, 5.18 mm. An average of six gave the breadth, 0.95 mm., and breadth of first testis 0.31 mm. (U.S.N.M. Nos. 8227, 8228.)

Six (U.S.N.M. No. 8229), collected May 4, 1914, from the tautog. Largest, in formalin: Length, 5 mm.; breadth, 1.5 mm. In balsam, largest, length, 3.92 mm.; breadth, 1.12 mm.; smallest, length, 2.8 mm., breadth, 1 mm. Measurements in balsam: Length, 3.82 mm.; breadth, 1.06 mm.; breadth of oral sucker, 0.21 mm., of ventral sucker, 0.39 mm.; pharynx, length, 0.11 mm., breadth, 0.14 mm.; length of esophagus, 0.14 mm.; breadth of first testis, 0.14 mm.; ova, 0.075 by 0.039 mm. Average of six: Breadth, 0.95 mm; breadth of first testis, 0.32 mm. Vitellaria extend to ventral sucker, uninterrupted at level of testes.

PODOCOTYLE OLSSONI Odhner

PLATE 1, FIGURES 8–12

Distomum simplex Rudolphi, LINTON, Proc. U. S. Nat. Mus., vol. 20, pp. 525, 526, pl. 47, figs. 3–7, 1989; Bull. U. S. Fish Comm. for 1899, pp. 436, 468, 475, 485, figs. 331, 332, 1901.

Distomum vitellosum LINTON, Bull. U. S. Fish Comm. for 1899, p. 464, 1901.

Podocotyle olssoni ODHNER, Trematoden des arktischen Gebietes, Fauna Arctica, vol. 4, p. 327, 1905.—MANTER, Illinois Biol. Mon., vol. 10, No. 2, pp. 208, 209, fig. 50, 1926.

The principal points in which this species differs from *P. atomon* are its relatively shorter esophagus, the much longer cirrus pouch and seminal vesicle, and the greater breadth of the testes as compared with the breadth of the body. The vitellaria are usually interrupted at the level of the testes in *P. olssoni*, while they are, as a rule, continuous in *P. atomon*.

Thus, in *P. olssoni* the length of the esophagus seldom equals that of the pharynx, the seminal vesicle may extend back of the ventral sucker as much as halfway to the ovary, and the testes are relatively much larger than they are in *P. atomon*.

An average of 13 of each species showed for *P. atomon*: Breadth of body, 1 mm., of first testis, 0.31 mm.; for *P. olssoni*: Breadth of body, 0.6 mm., of first testis, 0.3 mm. That is, for these specimens the breadth of the tests was one-third the breadth of the body in *P. atomon*, and one-half in *P. olssoni*.

TABLE 16.—*Comparison of average measurements in* Podocotyle atomon *and* P. olssoni

Species	Number of specimens	Oral sucker in ventral sucker	Pharynx in ventral sucker	Breadth of testis in breadth of body
P. atomon	4	1.57	2.48	3.30
P. olssoni	6	1.85	3.08	1.54

P. olssoni has a tendency, especially if placed in fresh water or weak formalin, to become turgid, in which case the neck is reflected, often until it stands at right angles with the body. The ovary in both species is lobed, usually somewhat pestlelike with three lobes at the posterior end.

Distomes from a large number of Woods Hole fishes are here recorded. While showing much variation in shape and proportions, and in minor details of structure they agree in essential particulars with Odhner's description of the species.

Hosts.—Long-spined sculpin (*Acanthocottus octodecimspinosus*), American sole (*Achirus fasciatus*), sand launce (*Ammodytes americanus*), American eel (*Anguilla rostrata*), lumpfish (*Cyclopterus lumpus*), common codfish (*Gadus morrhua*), common eastern stickleback (*Gladiunculus bispinosus*), sea raven (*Hemitripterus americanus*), conger eel (*Conger conger*), tomcod (*Microgadus tomcod*), white perch (*Morone americana*), grubby (*Acanthocottus aeneus*), American smelt (*Osmerus mordax*), summer flounder (*Paralichthys dentatus*), yellow perch (*Perca flavescens*), codling (*Urophycis chuss*), pollack (*Pollachius virens*), common gurnard (*Merulinus carolinus*), puffer (*Sphoeroides maculatus*), goggler (*Trachurops crumenophthalma*), garfish (*Strongylura marina*).

Record of collections.—Collected by Vinal N. Edwards from the sculpin on 17 dates in 6 different years in the months of February, March, April, May, October, November, and December. (U.S.N.M. No. 8230.) The largest number recorded on any date was 19, when 8 fishes were examined; lengths, in formalin from 1.4 to 6 mm. The vitellaria in these distomes from the sculpin are, as a rule, interrupted at the level of the testes. Two were noted in which the vitellaria were continuous. On a slide containing 10 distomes, 5 were noted with vitelline follicles in front of the ventral sucker. Of some 30 other mounted specimens only 2 had the vitellaria as far forward as the anterior border of the ventral sucker. In a small proportion of the mounted specimens the testes are slightly lobed. Measurements in balsam: Length, 4.83 mm., breadth, 0.77 mm.; oral sucker, length, 0.18 mm., breadth, 0.23 mm.; pharynx, length, 0.11 mm., breadth, 0.11 mm.; ventral sucker, length, 0.34 mm., breadth, 0.38 mm.; first testis, length, 0.42 mm., breadth, 0.35 mm.; second testis, length, 0.42 mm., breadth, 0.42 mm.; ova, 0.072 by 0.042 mm.

From American sole: One, immature, collected October 14, 1915. Measurements in balsam: Length, 1.09 mm., breadth, 0.29 mm.; oral sucker, length, 0.08 mm., breadth, 0.11 mm.; pharynx, length, 0.045 mm., breadth, 0.03 mm.; diameter of ventral sucker, 0.18 mm.; breadth of first testis, 0.14 mm.

From sand launce: Two (U.S.N.M. No. 8231), collected October 14, 1914. Length, in formalin, 4 mm. Twelve fish examined.

Lengths in balsam, 3.08 and 1.96 mm. They agree with this species in all essentials.

From American eel: One, collected September 2, 1903; length, 2.32 mm., breadth, 0.38 mm. One, collected August 16, 1912. One, collected April 18, 1913; length in formalin, 4 mm.; measurements in balsam: Length, 3.15 mm., breadth, 0.56 mm.; oral sucker, length, 0.16 mm., breadth, 0.22 mm.; pharynx, length, 0.14 mm., breadth, 0.14 mm.; ventral sucker, lateral view, length, 0.37 mm., breadth, 0.33 mm.; first testis, length, 0.35 mm., breadth, 0.36 mm.

From lumpfish: One (U.S.N.M. No. 8232), collected May 9, 1916, from fish that had been preserved in formalin: Length, 5.5 mm., breadth, 1.5 mm. Measurements in balsam: Length, 3.71 mm., breadth, 0.77 mm.; oral sucker, length, 0.2 mm., breadth, 0.21 mm.; pharynx, length, 0.11 mm., breadth, 0.14 mm.; ventral sucker, length, 0.36 mm., breadth, 0.4 mm.; length of esophagus, 0.07 mm.; breadth of first testis, 0.38 mm.; ova, 0.084 by 0.042 mm. All the lumpfish examined in 1924 and 1926 had been taken in May. Some had been put at once in formalin, others were kept in aquaria. The dates given are those on which the fish were examined:

Two, June 23, 1924; length, life, 4.5 mm.

Four, June 24, 1926. Three fishes, which had been preserved in formalin examined; 2 distomes found in each of the two larger; lengths in formalin, 2.5 to 4 mm.

One, July 6, 1926. Measurements, life: Length, 2.94 mm.; breadth, 0.77 mm.; oral sucker, length, 0.14 mm., breadth, 0.16 mm.; pharynx, length, 0.13 mm., breadth, 0.1 mm.; ventral sucker, length, 0.28 mm., breadth, 0.38 mm.; ova, 0.085 by 0.044 mm.

Three, July 8, 1926; slender, white, flaccid; length of largest, 9 mm.; breadth, 0.67 mm. In balsam these distomes are slender and linear, the breadth of the body at the level of the testes being little more than the breadth of a testis. In the largest of the three the ova few and imperfect and confined to the metraterm. In the others the ova are many and of normal size.

One, July 10, 1926; slender and, before compression, irregular in outline: Length, 3.78 mm.; breadth, 0.63 mm.; breadth of oral sucker, 0.19 mm., of pharynx, 0.11 mm., of ventral sucker, 0.45 mm.; ova, 0.07 by 0.04 mm.

One, July 13, 1926, length, 3.45 mm.

An average of four of these distomes from the lumpfish gives the diameter of the ventral sucker twice that of the oral sucker, and a little less than three times that of the pharynx.

From common codfish: One, collected December 10, 1914; 25 fishes examined; length in formalin, 5.5 mm.

Twelve (U.S.N.M. No. 8233), collected January 16, 1915; 80 fishes examined; length in formalin, 2 to 7 mm.

These distomes from the cod are elongated, slender, with prominent ventral suckers. Average of four: Breadth, 0.49 mm.; breadth of first testis, 0.31 mm.

From common eastern stickleback: This distome was collected from the stickleback on 10 dates in 6 different years, in the months of April, May, June, and July. On all but one date the collections were made by Vinal N. Edwards. Distomes not numerous, 114 in all. Over 200 fishes were examined. The largest number recorded for any date is 25, when 40 fishes were examined. They range in length from 3 to 7 mm. in formalin. Many of them are turgid, with conical necks reflected dorsally at right angles to the body. In some cases the vitellaria are not interrupted at the level of the testes. Ventral sucker approximately twice the diameter of the oral sucker, and three times that of the pharynx. Measurements, life: Length, 3 mm., breadth, 0.42 mm.; breadth of oral sucker, 0.15 mm., of pharynx, 0.09 mm., of ventral sucker, 0.36 mm. (U.S.N.M. No. 8234.)

From the sea raven: Collected from this host by Vinal N. Edwards on 9 dates in 6 different years, in the months of January, April, May, October, and December. The record shows that 16 fishes were examined, from which 198 distomes were obtained. The greatest number recorded from one fish is 117, collected on May 15, 1916; the smallest for any one date is one on December 24, 1912, when three fishes were examined. A distome, one of a lot of 16 collected on April 26, 1915, is exceptional in that, in spite of its size (length, 9 mm., maximum diameter, 1.12 mm.) no ova are present. It would appear that something had gone wrong with its egg-making mechanism. In front of the ovary there is a great deal of granular material associated with the follicles of the vitellaria. Masses of this material lie in front of the vitellaria, extending on the left side to the middle of the ventral sucker, and on the right side to its anterior border. (U.S.N.M. No. 8235.)

While most of these distomes from the sea raven maintain a breadth that does not vary greatly, the point at which the greatest breadth occurs varies. Thus, the greatest breadth in some is at the level of the testes, in others behind the testes, and in yet others between the ovary and ventral sucker. There is great variation also in the ratio of length to breadth. This is due to the fact that living specimens, in which the breadth may be as great as half the length, if placed in fresh water, or weak formalin, may become elongated, slender, and cylindrical, often with neck reflected and ventral sucker projecting. The cirrus is smooth, and when exserted is seen to have a bulbous base. The vitellaria, in extended specimens, are interrupted at the level of the testes; in contracted specimens they may be con-

tinuous. Average of four in balsam: Testes in breadth, 2; oral sucker in ventral sucker, 1.63; pharynx in ventral sucker, 3.

On July 11, 1927, five distomes were collected from a sea raven measuring 20 cm. in length. These, mounted in balsam, are seen to taper rather uniformly from about the level of the ovary to the posterior end. In one the seminal receptacle is situated at the left anterior border of the ovary; in the other it is greatly enlarged, the ovary being compressed between it and the first testis. It measures 0.16 mm. in length and 0.23 mm. in breadth. In another the ovary is crowded to the right side of the body by a mass of yolk, the yolk reservoir being greatly distended. The greatly reduced seminal vesicle in this specimen lies along the left side of the yolk reservoir. The latter is pyriform, length, 0.28 mm., greatest breadth, 0.17 mm. The ovary, length, 0.18 mm., breadth, 0.14 mm., is crowded into a triangular space at the anterior left border of the first testis. In three of these specimens the esophagus about equals the pharynx in length, in the other it is a little longer than the pharynx.

Recorded from the conger eel: Linton, Bull. U. S. Fish Comm. for 1899, p. 436, 1901.

Recorded from the tomcod: Linton, Proc. U. S. Nat. Mus., vol. 20, p. 526, 1898; Bull. U. S. Fish Comm. for 1899, p. 475, figs. 331, 332, 1901. Collected from this host on 116 dates in 13 different years; 21 dates in January, 10 in February, 2 in March, 36 in April, 6 in May, 2 in June, 4 in July, 1 in August, 5 in September, 12 in October, 5 in November, and 12 in December (U.S.N.M. No. 8236). All collections with the exception of those in July and August made by Vinal N. Edwards. These distomes vary greatly in length and shape. Most of those preserved in formalin vary in length from less than 1 to 6 or 7 mm., but slender, elongate forms occur that measure as much as 12 mm. Most of them are linear with prominent ventral suckers and with vitellaria interrupted opposite the testes. It should be noted, however, that living forms which are thickish, with closely appressed testes and unbroken vitellaria, may change, under pressure of the cover glass, to slender, elongate forms with vitellaria interrupted at the level of the testes. Also, when placed in fresh water, they become turgid, lengthened, and cylindrical, the acetabulum prominent and the neck reflected dorsally. The same changes follow immersion in weak formalin. Only one case was noted in which the ovary was not distinctly lobed; usually the ovary is 3-lobed at the posterior end, with a single anterior lobe, like the handle of a pestle. The testes in a few cases were slightly lobed. But one case was noted in which the body wall formed a raised margin around the ventral sucker. The number of fishes examined was not recorded in every instance. Following is a summary of collections in which the number of fishes examined was recorded:

TABLE 17.—*Record of specimens of* Podocotyle olssoni *collected from tomcod*

Month	Fishes examined	Distomes found	Average number per host
January	327	1,000	3.06
February	178	1,760	10.55
March	42	120	2.85
April	541	2,411	4.45
May	96	115	1.20
June	5	57	11.42
July	12	15	1.25
August	13	1	.08
September	17	35	2.06
October	93	145	1.55
November	40	59	1.47
December	136	151	4.78

Measurements of one in balsam: Length, 4.66 mm., breadth, 0.7 mm.; oral sucker, length, 0.2 mm., breadth, 0.22 mm.; pharynx, length, 0.11 mm., breadth, 0.13 mm.; ventral sucker, length, 0.34 mm., breadth, 0.39 mm.; length of esophagus, 0.08 mm.; breadth of testis, 0.42 mm.: ova, 0.072 by 0.039 mm. Measurements in formalin: Length, 6.15 mm., breadth, 0.65 mm.; diameter of oral sucker, 0.25 mm., of pharynx, 0.1 mm., of ventral sucker, 0.4 mm.; ova, 0.084 by 0.056 mm.

From the white perch: As in distomes from other hosts there is here a considerable variation in size and in details of structure. The smallest, in balsam, is 1 mm. in length and 0.11 mm. in diameter; the largest, 4.9 mm. in length and 0.56 mm. in breadth. The esophagus is as long as the pharynx. In many cases the vitellaria are not interrupted at the level of the testes. In some the vitellaria are interrupted on one side and not on the other. Cirrus smooth with basal bulb. Breadth of testis one-half or more the breadth of the body.

One, collected August 8, 1906. Fifteen, collected July 20, 1910. Collected by Vinal N. Edwards on six dates in four years, in April, May, and October, one to six on each date; 16 in all; lengths 2 to 4 mm. in formalin. (U.S.N.M. No. 8237.)

From the grubby: Collected from this host by Vinal N. Edwards on three dates: Three, December 23, 1905; length, 5.5 mm. in formalin. Two, April 14, 1910; 10 fishes examined; length, 3.5 mm. in formalin. Thirteen (U.S.N.M. No. 8238), February 3, 1915; 8 fishes examined. The smallest specimens, about 2 mm. in length and 0.5 mm. in breadth, are immature. Others with ova from 2.8 to 4.13 mm. in length. Measurements in balsam: Length, 3.71 mm., breadth, 0.66 mm.; oral sucker, length, 0.18 mm., breadth, 0.22 mm.; pharynx, length, 0.13 mm., breadth, 0.14 mm.; ventral sucker, length, 0.18 mm., breadth, 0.22 mm.; breadth of first testis, 0.35 mm.; ova, 0.075 by 0.045 mm.

From the American smelt: Collected by Vinal N. Edwards on two dates: Five, January 25, 1910. Thirty-six (U.S.N.M. No. 8239), June 20, 1914. In formalin, length of body, 5.8 mm., of neck, 0.7 mm.; diameter of body, 0.6 mm. Elongated, in most cases arcuate; necks short, arcuate, some reflected dorsally. Measurements, balsam: Length, 4.41 mm., breadth, 0.42 mm.; oral sucker, 0.14 mm., breadth, 0.15 mm.; pharynx, length, 0.13 mm., breadth, 0.08 mm.; ventral sucker, length, 0.28 mm., breadth, 0.29 mm.; ova, 0.08 by 0.04 mm.

From the summer flounder: Collected by Vinal N. Edwards on two dates: Two (U.S.N.M. No. 8240), September 20, 1915. Measurements in balsam: Length, 4.06 mm., breadth, 0.35 mm.; oral sucker, length, 0.14 mm., breadth, 0.15 mm.; pharynx, length, 0.08 mm., breadth, 0.1 mm.; ventral sucker, length, 0.25 mm., breadth, 0.21 mm.; first testis, length, 0.28 mm., breadth, 0.2 mm.; ova, 0.075 by 0.045 mm. Lateral view: Seventeen, October 3, 1915, 3 mm. to 6 mm. in length; slender, turgid.

From the yellow perch: One (U.S.N.M. No. 8241), collected April 23, 1914; length in formalin, 7 mm. Measurements in balsam: Length, 6.16 mm., breadth, 0.59 mm.; oral sucker, length, 0.21 mm., breadth, 0.12 mm.; pharynx, length, 0.12 mm., breadth, 0.11 mm.; ventral sucker, length, 0.31 mm., breadth, 0.33 mm.; length of esophagus, 0.15 mm.; first testis, length, 0.49 mm., breadth, 0.5 mm.; ova, 0.078 by 0.042 mm. There is a distinct seminal receptacle dorsal to the ovary and extending forward dorsal to the yolk reservoir.

From the codling: One, collected November 17, 1913; 30 fishes examined; length, 4.5 mm. in formalin. One (U.S.N.M. No. 8242), collected May 28, 1914; 10 fishes examined; length, 2.5 mm. in formalin. One, small, collected by Dr. G. A. MacCallum, August 20, 1915. Measurements, balsam: Length, 1.85 mm., breadth, 0.56 mm.; oral sucker, length, 0.13 mm., breadth, 0.17 mm.; pharynx, length, 0.07 mm., breadth, 0.1 mm.; ventral sucker, length, 0.28 mm., breadth, 0.38 mm.; breadth of first testis, 0.31 mm.; ova, 0.072 by 0.036 mm.

From the pollack: Twenty-four, collected August 19, 1908. Four (U.S.N.M. No. 8243), collected April 20, 1914. One, collected April 8, 1915. One, collected August 30, 1920. Length in balsam, 1.72 mm. to 4 mm. Measurements of one in balsam: Length, 1.92 mm., breadth, 0.53 mm.; oral sucker, length, 0.14 mm., breadth, 0.13 mm.; pharynx, length, 0.08 mm., breadth, 0.08 mm.; ventral sucker, length, 0.25 mm., breadth, 0.3 mm.; length of esophagus, 0.11 mm.; ova, 0.072 by 0.036 mm. A prepharynx could be distinguished in a few specimens which had been flattened.

From the common gurnard: Two (U.S.N.M. No. 8244), collected April 16, 1915; lengths in formalin, 2 mm. and 3.5 mm. Measurements in balsam: Length, 2.32 mm., breadth, 0.77 mm.; oral sucker,

length, 0.17 mm., breadth, 0.22 mm.; pharynx, length, 0.1 mm., breadth, 0.11 mm.; ventral sucker, length, 0.31 mm., breadth, 0.42 mm.; length of esophagus, 0.07 mm.; ova, 0.08 by 0.04 mm.

From the puffer: Recorded by Linton (*Distomum vitellosum*), Bull. U. S. Fish Comm. for 1899, p. 464, 1901. One, partly macerated, collected August 2, 1907. One, small, collected August 10, 1907. Three, collected June 8, 1914; largest, in formalin, 4.5 mm. One, collected June 8, 1916. These specimens in balsam are somewhat shriveled, but are in sufficiently good condition to identify. The ovary is lobed and pestle-shaped, and the vitellaria are interrupted opposite the testes.

From the goggler: One (U.S.N.M. No. 8245), collected September 13, 1915; length, in formalin, 5 mm. Measurements in balsam: Length, 4.76 mm., breadth, 0.56 mm.; diameter of oral sucker, 0.2 mm., of pharynx, 0.11 mm., of ventral sucker, 0.35 mm., of first testis, 0.35 mm.; ova, 0.078 by 0.045 mm. Cirrus exserted, smooth, length, 0.23 mm.; diameter at tip, 0.04 mm., at base, 0.06 mm.; ovary trilobed; vitellaria interrupted at level of testes.

From the garfish (*Strongylura marina*): Two, collected October 9, 1915; length in formalin, 3.82 mm. One, collected July 12, 1926. Measurements in balsam: Length, 3.15 mm., breadth, 0.52 mm.; breadth of oral sucker, 0.17 mm., of pharynx, 0.13 mm., of ventral sucker, 0.27 mm.; ova, 0.08 by 0.045 mm.

PODOCOTYLE species

PLATE 22, FIGURE 288

Body slender, greatest breadth at about level of ventral sucker; diameter of ventral sucker about twice that of oral sucker; diameter of pharynx about half that of oral sucker; prepharynx short; esophagus as long as or longer than pharynx; intestines extend nearly to posterior end. Genital pore in front of ventral sucker, a little to right of median line; cirrus pouch extends back of ventral sucker, on the left side; seminal vesicle at base of cirrus pouch; testes relatively large, the first rounded and slightly lobed, the second somewhat rhomboidal; ovary in front of first testis, short pestle-shaped, the posterior end 3-lobed; seminal receptacle on right side of ovary; shell gland in front of ovary; uterus between shell gland and ventral sucker; no ova in uterus; one ovum noted in shell gland, about 0.024 by 0.015 mm., probably not to be regarded as a fully formed egg; vitellaria extend from about the level of the posterior edge of the ventral sucker to the posterior end, interrupted at level of testes, but follicles lying between the testes and between the first testis and ovary.

Measurements in balsam: Length, 1.56 mm.; breadth, anterior, 0.09 mm.; at level of ventral sucker, 0.4 mm., at level of ovary, 0.21 mm., at level of second testis, 0.17 mm., near posterior end, 0.11 mm.; oral sucker, length, 0.07 mm., breadth, 0.08 mm.; pharynx, length, 0.05 mm., breadth, 0.04 mm.; ventral sucker, length, 0.14 mm., breadth, 0.15 mm.; first testis, length, 0.15 mm., breadth, 0.12 mm.; second testis, length, 0.17 mm., breadth, 0.14 mm.; ventral sucker to ovary, 0.24 mm.; second testis to posterior end, 0.26 mm.

Host.—Chinook salmon (*Oncorhynchus tschawytscha*).

One (U.S.N.M. No. 8246), found on slide with specimens of *Genarches infirmus*, from young salmon, Sacramento Basin, Calif., May 1900.

Genus CYMBEPHALLUS Linton, 1934

The genus *Cymbephallus* differs from *Podocotyle* in having a muscular sucker at the opening of the ejaculatory duct and a raised border surrounding the ventral sucker, this border being more or less scalloped, papillate, or fimbriate.

CYMBEPHALLUS VITELLOSUS (Linton)

PLATE 2, FIGURES 18–20

Distomum vitellosum LINTON, Bull. U. S. Fish Comm. for 1899, p. 290, figs. 38, 39, 1900; *ibid.*, p. 416 (page references to hosts in Woods Hole, Mass., region), figs. 333–340, 1901; Bull. U. S. Bur. Fish., vol. 24, p. 335 (page references to hosts in Beaufort, N. C., region), figs. 176–178, 1905; Proc. U. S. Nat. Mus., vol. 33, p. 105, figs. 63, 64 (notes on parasites of Bermuda fishes), 1907.—SUMNER, OSBURN, and COLE, Bull. Bur. Fish., vol. 31, pt. 2, p. 584 (list of hosts in Woods Hole region), 1911.

Cymbephallus vitellosus (LINTON), Journ. Washington Acad. Sci., vol. 24, p. 81, 1934.

Body smooth, of various shapes, often in living specimens with breadth one-third the length; under pressure, or when placed in fresh water, they tend to become turgid and may elongate until the length is six or more times the breadth; frequently tapering to a blunt point posteriorly; neck tapering, short-conical, often reflected dorsally in turgid specimens. Ventral sucker larger than oral, average ratio about 8:5, surrounded by a raised border, which may appear to be sinuous, or may be seen to bear four or five lobes on the posterior border and about four on the anterior border, often inconspicuous in mounted material. In turgid specimens the ventral sucker may be more or less prominent, or even pedicellate. Pharynx usually a little longer than broad, and a little less than the oral sucker, average ratio about 4:5. Prepharynx very short or none; esophagus as long as or longer than pharynx. The intestines reach nearly to the posterior end, usually hidden by the dense vitellaria. Genital pores

in front of ventral sucker, to the left of the midline, the male aperture surrounded by a strong, muscular, suckerlike structure. The ejaculatory duct passes dorsal to the ventral sucker, and the seminal vesicle may extend for one-third or more of the distance between the ventral sucker and ovary. Testes, two, one following the other, and touching, or separated by a short interval filled with follicles of the vitellaria, usually rounded, circular or oval, or occasionally subtriangular in outline. Ovary at or near anterior border of first testis, not lobed, circular to elliptical in outline. Vitelline reservoir and shell gland in front of ovary; seminal receptacle not seen, probably represented by early folds of uterus. Uterus between ovary and ventral sucker; the metraterm lies beside the ejaculatory duct, dorsal to the ventral sucker, and opens at the anterior border of the genital sucker in which the ejaculatory duct opens. Vitellaria diffuse and continuous from the posterior end to the posterior border of the ventral sucker, or near it. The excretory vessel extends from the posterior end to the ovary; ova about 0.05 by 0.03 mm. The average dimensions of 24 ova, of distomes from 16 species of fishes, mostly balsam mounts, were 0.053 by 0.029 mm.; maximum 0.063 by 0.033 mm., minimum 0.045 by 0.027 mm. Twenty-one of these distomes, mounted in balsam, from 13 species of fishes, had an average length of 1.88 mm., and an average breadth of 0.37 mm.; maximum length, 3.38 mm., minimum, 0.94 mm. A living specimen slightly compressed, measured 1.57 mm. in length and 0.85 mm. in breadth; another, turgid, length, 2.1 mm., breadth, 0.35 mm.

Hosts.—Common shad (*Alosa sapidissima*), sand launce (*Ammodytes americanus*), common herring (*Clupea harengus*), squeteague (*Cynoscion regalis*), mackerel scad (*Decapterus macarellus*), pinfish (*Lagodon rhomboides*), conger eel (*Conger conger*), rusty dab (*Limanda ferruginea*), spot (*Leiostomus xanthurus*), windowpane (*Lophopsetta maculata*), kingfish (*Menticirrhus saxatilis*), silver hake (*Merluccius bilinearis*), goatfish (*Mullus auratus*), toadfish (*Opsanus tau*), rudderfish (*Palinurichthys perciformis*), summer flounder (*Paralichthys dentatus*), four-spotted flounder (*P. oblongus*), spotted codling (*Urophycis regius*), codling (*U. tenuis*), bluefish (*Pomatomus saltatrix*), alewife (*Pomolobus pseudoharengus*), dollarfish (*Poronotus triacanthus*), common gurnard (*Merulinus carolinus*), winter flounder (*Pseudopleuronectes americanus*), bonito (*Sarda sarda*), common mackerel (*Scomber scombrus*), common pipefish (*Syrictes fuscus*), puffer (*Sphoeroides maculatus*), southern porgy (*Stenotomus chrysops*), tautog (*Tautoga onitis*), cunner (*Tautogolabrus adspersus*), round pampano (*Trachinotus falcatus*), goggler (*Trachurops crumenophthalma*).

Record of collections.—From shad: One, collected July 13, 1910. Measurements, life: Length, 1.75 mm., breadth, 0.52 mm.; diameter of oral sucker, 0.14 mm.; pharynx, length, 0.13 mm., breadth, 0.09 mm.; ventral sucker, length, 0.21 mm., breadth, 0.26 mm.; ova, 0.058 by 0.034 mm. One, collected July 5, 1923, by Dr. G. A. MacCallum.

From sand launce: Three, collected July 5, 1912; small, turgid, with prominent ventral suckers. Measurements, life, compressed: Length, 2.1 mm., breadth, 0.35 mm.; diameter oral sucker, 0.14 mm., of pharynx, 0.14 mm., of central sucker, 0.22 mm.; ova, 0.045 by 0.027 mm.

Recorded from common herring: Bull. U. S. Fish Comm. for 1899, p. 437, 1901.

Recorded from squeteague: Bull. U. S. Fish Comm. for 1899, p. 460, 1901.

Recorded from mackerel scad: Bull. U. S. Fish Comm. for 1899, p. 449, 1901. Nine (U.S.N.M. No. 8247), collected September and October, 1913; length, in balsam, 2.52 mm., breadth, 0.35 mm.

From pinfish: One (U.S.N.M. No. 8248) collected June 4, 1914; length, 3.6 mm., breadth, 0.67, in formalin.

Recorded from conger eel: Bull. U. S. Fish Comm. for 1899, p. 436, 1901. One, collected July 22, 1904; length, 2.5 mm., breadth, 0.65 mm., in fresh water, turgid.

Recorded from rusty dab: Bull. U. S. Fish Comm. for 1899, p. 485, 1901. Measurements in balsam: Length, 1.12 mm., breadth, 0.22 mm.; oral sucker, length, 0.11 mm., breadth, 0.1 mm.; Pharynx, length, 0.1 mm., breadth, 0.09 mm.; ventral sucker, length, 0.18 mm., breadth, 0.17 mm.; ova, 0.051 by 0.036 mm.

From spot: Collected by Vinal N. Edwards on five dates in September, nine in October, and two in November, 1912, 1913, and 1914; 225 fishes were examined and 59 distomes found. The greatest number secured on any date was ten, when 42 fishes were examined. Length, 2 to 3.5 mm. in formalin. Twenty-five or more distomes from this lot are mounted in balsam. Measurements of a typical form: Length, 2.14 mm., breadth, 0.42 mm.; oral sucker, length, 0.13 mm., breadth, 0.14 mm.; pharynx, length, 0.11 mm., breadth, 0.11 mm.; ventral sucker, length, 0.19 mm., breadth, 0.21 mm.; ova, 0.051 by 0.027 mm. (U.S.N.M. No. 8249).

From windowpane: Four, collected July 27, 1904; small, turgid, with prominent ventral suckers. Numerous (U.S.N.M. No. 8250), collected August 8 and 11, 1905; small, about 0.9 mm. in length; very various shapes; some short and broad, some flattened, others cylindrical; some with sessile, others with pedicelled ventral suckers; some with distinct papillate border surrounding the ventral sucker, in others papillae indistinct. Same variations in balsam mounts as noted in fresh material. Nine, collected July 18, 1923, found by Dr.

MacCallum on gills. They had evidently come from the stomach. Two, collected July 6, 1925, found adhering to an echinorhynchus, not noticed until after it had been in fresh water; turgid, with prominent ventral sucker and reflected neck. Measurements of distomes from this host agree with those from other hosts. Measurements of one in balsam: Length, 1.08 mm., breadth, 0.22 mm.; oral sucker, length, 0.08 mm., breadth, 0.1 mm.; pharynx, length, 0.08 mm., breadth, 0.07 mm.; ventral sucker, length, 0.2 mm., breadth, 0.15 mm.; ova, 0.051 by 0.033 mm.

From kingfish: Bull. U. S. Fish Comm. for 1899, p. 462, 1901. One (U.S.N.M. No. 8251), collected September 3, 1908. Measurements, balsam: Length, 1.86 mm.; breadth, 0.38 mm.; oral sucker, length, 0.12 mm., breadth, 0.12 mm.; pharynx, length, 0.11 mm., breadth, 0.08 mm.; ventral sucker, length, 0.18 mm., breadth, 0.18 mm.; ova, 0.051 by 0.03 mm. Two, collected September 23, 1913; length, in balsam, 1.5 mm.

From silver hake: Bull. U. S. Fish Comm. for 1899, pp. 282, 290, figs. 38, 39, 1900, p. 474, fig. 335, 1901. Three, collected August 29, 1903; small, one with ova. Three, collected August 15, 1907. Six (U.S.N.M. No. 8252), collected August 13, 1928; 1 to 1.75 mm. in length, in balsam. Two, collected August 16, 1928; length, 2 mm.; breadth, 0.46 mm., life.

From goatfish: Five, collected September 2, 1908, from an 8-cm. fish, seined in Great Harbor; lengths, 1.19 to 1.4 mm. in balsam; papillary fringe around ventral sucker distinct. Six, collected August 24, 1918, from an 11-cm. fish. Lengths in balsam, 1.4 to 3.12 mm. In one of the larger specimens it was noted that there was much variation in the size of the ova in the vicinity of the shell gland. Thus, while most of the ova in the specimen were of the usual size, a maximum of about 0.054 by 0.042 mm., the following variants were noted: 0.048 by 0.033; 0.045 by 0.033; 0.039 by 0.034; 0.033 by 0.024; 0.03 by 0.021; 0.033 by 0.018; 0.021 by 0.009 mm. Two (U.S.N.M. No. 8253), collected September 4, 1918, from a 12-cm. fish; slender; one, length, 2.59 mm., breadth, 0.4 mm.; the other, length, 4.41 mm., breadth, 0.36 mm.; ova, 0.048 by 0.027 mm.

From toadfish: One, collected September 9, 1913.

From rudderfish: One (U.S.N.M. No. 8254), collected August 19, 1929; measurements in balsam, lateral view: Length, 2.38 mm., breadth, 0.42 mm.; oral sucker, length, 0.17 mm., breadth, 0.17 mm.; pharynx, length, 0.14 mm., breadth, 0.15 mm.; ventral sucker, length, 0.27 mm., breadth, 0.24 mm.; ova, 0.51 by 0.57 mm.

From summer flounder: Bull. U. S. Fish Comm. for 1899, p. 482, fig. 336, 1901. One, collected October 19, 1903. One, collected August 9, 1904; taper-pointed posteriorly, length, 1.45 mm. One,

collected August 15, 1906; measurements, life: Length, 1.54 mm.; breadth 0.63 mm.; diameter oral sucker, 0.15 mm., of pharynx, 0.15 mm., of ventral sucker, 0.27 mm.; ova, 0.037 by 0.023 mm. Short papillae were noted behind the posterior edge of the ventral sucker.

From four-spotted flounder: One, collected August 4, 1905.

From spotted codling: Seven, collected October 19, 1908; 1.5 to 3.5 mm. in formalin. Eleven, collected October 23, 1913. Ten (U.S.N.M. No. 8255), collected November 12, 1915. Dimensions in balsam: Length 1.26 mm., breadth 0.32 mm.; oral sucker, length 0.09 mm., breadth 0.1 mm.; pharynx, length 0.08 mm., breadth 0.08 mm.; ventral sucker, length 0.15 mm., breadth 0.16 mm.; ova 0.54 by 0.27 mm.

From codling: Six, collected August 4, 1911; 3 fishes examined. Dimensions in balsam: Length 1.93 mm., breadth 0.56 mm.; oral sucker, length 0.11 mm., breadth 0.1 mm.; pharynx, length 0.1 mm., breadth 0.08 mm.; ventral sucker, length 0.21 mm., breadth 0.18 mm.; ova 0.048 by 0.027 mm. One (U.S.N.M. No. 8256), collected November 3, 1913; length in formalin 2.25 mm.; 4 fishes examined. One, collected July 30, 1929; length in balsam 1.68 mm.; 3 fishes (15–20 cm.) examined.

From bluefish: Bull. U. S. Fish Comm. for 1899, p. 451, figs. 337–339, 1901. A few, collected July 15, 1904. One, collected August 11, 1904, from intestine. One (U.S.N.M. No. 8257), collected July 1, 1910. Dimensions in balsam, lateral view: Length 3.38 mm., breadth 0.56 mm.; oral sucker, length 0.2 mm., breadth 0.15 mm.; pharynx, length 0.17 mm., breadth 0.12 mm.; ventral sucker, length 0.29 mm., breadth 0.31 mm.; ova 0.048 by 0.024 mm.; ventral sucker pedicillate, with 5 digitate lobes at its posterior border; ovary ellipitical; testes triangular in outline. One, collected August 27, 1910. A few, collected July 17, 1911; one of these in balsam shows distinct lobes on anterior border of ventral sucker and less distinct lobes on posterior border. In specimens flattened, and viewed either from the dorsal or the ventral side, these lobes are difficult to distinguish.

From alewife: Bull. U. S. Fish Comm. for 1899, p. 439, 1901. One, collected July 26, 1910; length, 1.6 mm.; breadth, 0.53 mm., life, compressed. One, collected August 17, 1910; length, 1.85 mm. Eleven, collected October 19, 1914. In one specimen, mounted in balsam, lateral view, blunt papillae around the ventral sucker are plainly shown; in the others, ventral view, they are not visible. Measurements in balsam: Length, 1.46 mm., breadth, 0.43 mm.; oral sucker, length, 0.11 mm., breadth, 0.10 mm.; pharynx, length, 0.08 mm., breadth, 0.08 mm.; ventral sucker, length, 0.18 mm., breadth, 0.14 mm.; length of esophagus, 0.11 mm.; ova, 0.051 by 0.027 mm.

From dollarfish: 20 (U.S.N.M. No. 8258), collected July 18, 1923; small, slender distomes, tapering anteriorly and posteriorly, with four short papillae on both anterior and posterior borders of the ventral sucker; length, free in sea water, 1.5 mm.; diameter, lateral view, maximum, 0.11 mm., near posterior end, 0.07 mm.; diameter of oral sucker, 0.09 mm., of ventral sucker, 0.15 mm.; ova, 0.042 by 0.024 mm. The testes vary from subtriangular to oval-elliptical in outline.

Measurements in balsam (lateral view): Length, 1.54 mm., breadth, 0.18 mm.; oral sucker, length, 0.11 mm., breadth, 0.08 mm.; pharynx, length, 0.1 mm., breadth, 0.06; ventral sucker, length, 0.17 mm., breadth, 0.18 mm.; ova, 0.048 by 0.024 mm.

TABLE 18.—*Measurements of the testes in five specimens of* Cymbephallus vitellosus

Testis	1		2		3		4		5	
	Length	Breadth	Length	Breadth	Length	Breadth	Length	Breadth	Length	Breadth
	Mm.	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*
First	0.08	0.08	0.07	0.13	0.10	0.13	0.14	0.07	0.14	0.11
Second	.13	.08	.08	.13	.13	.10	.17	.07	.15	.13

From common gurnard: One (U.S.N.M. No. 8259), collected August 28, 1907. Measurements in balsam: Length, 1.54 mm., breadth, 0.31 mm.; oral sucker, length, 0.13 mm., breadth, 0.11 mm.; pharynx, length, 0.11 mm., breadth, 0.08 mm.; ventral sucker, length, 0.21 mm., breadth, 0.18 mm.; ova, 0.05 by 0.03; length of esophagus, 0.13 mm. About four short papillae on anterior border of ventral sucker.

From winter flounder: Bull. U. S. Fish Comm. for 1899, p. 486, fig. 340, 1901.

From bonito: Bull. U. S. Fish Comm. for 1899, p. 446, 1901. One, collected July 25, 1904.

From common mackerel: Bull. U. S. Fish Comm. for 1899, p. 445, 1901. Two, collected July 20, 1918; from stomach of a mackerel about 25 cm. in length. Slender, tapering from level of testes to each end; esophagus a little longer than pharynx; characteristic lobes around ventral sucker well shown in one. Measurements in balsam: Length, 1.54 mm.; breadth, 0.4 mm.; oral sucker, length, 0.13 mm., breadth, 0.13 mm.; pharynx, length, 0.11 mm., breadth, 0.1 mm.; ventral sucker, length, 0.24 mm., breadth, 0.24 mm.; ova, 0.051 by 0.03.

Certain small distomes, most of them less than 1 mm. in length, but containing ova, from young mackerel, 18 to 27 mm. in length, collected in July and August, 1918, 1919, and agreeing closely with this species, are here recorded. Measurements in balsam: Length, 1.34 mm., breadth, 0.46 mm.; oral sucker, length, 0.14 mm., breadth,

0.17 mm.; pharynx, length, 0.12 mm., breadth, 0.11 mm.; ventral sucker, length, 0.18 mm., breadth, 0.22 mm.; ova, 0.045 by 0.024 mm.

From common pipefish: Ten, collected July 29, 1913; three fish examined; collected by Dr. G. A. MacCallum. One (U.S.N.M. No. 8260), collected June 13, 1914. Measurements in balsam: Length, 2.10 mm., breadth, 0.38 mm.; diameter oral sucker, 0.13 mm., of ventral sucker, 0.25 mm.; pharynx, length, 0.13 mm., breadth, 0.10 mm.; ova, 0.054 by 0.027 mm. Posterior end bluntly rounded; the seminal vesicle extends nearly half-way from ventral sucker to ovary.

From puffer: Bull. U. S. Fish Comm. for 1899, p. 464, 1901. One, collected August 16, 1906. Length in balsam, 1.4 mm.; breadth, 0.49 mm. Three small distomes (U.S.N.M. No. 8261), collected August 21, 1918, from a 20 mm. fish. Length, life, 0.70 mm. (Fig. 20). Measurements in balsam: Length, 0.52 mm.; breadth, 0.31 mm.; oral sucker, length, 0.08 mm., breadth, 0.11 mm.; pharynx, length, 0.09 mm., breadth, 0.09 mm.; ventral sucker, length, 0.17 mm., breadth, 0.18 mm.; ova, 0.042 by 0.021 mm. Resemble small distomes from mackerel; elliptical, strongly contracted; anatomy much obscured by vitellaria, which extend from posterior end to middle of ventral sucker; muscular genital pore at left of pharynx. These distomes resemble *Distomum* sp., from *Opsanus tau* (Bull. U. S. Fish Comm. for 1899, p. 469, fig. 328, 1901).

From southern porgy: Bull. U. S. Fish Comm. for 1899, p. 458, figs. 333, 334, 1901. One, collected August 1, 1904. One, collected August 22, 1910. Ventral sucker prominent, with characteristic undulate or papillate border; genital sucker seen distinctly, with metraterm opening in front of it.

From tautog: One, collected August 12, 1904; under slight pressure, length, 1 mm.; breadth, 0.45 mm.; after killing over flame, under pressure, length, 1.54 mm., breadth, 0.41 mm.

A few, collected August 15, 1908; three mounted in balsam. These taper to a blunt point posteriorly. Measurements, lateral view: Length, 1.26 mm., breadth, 0.20 mm.; diameter of oral sucker, 0.10 mm.; pharynx, length, 0.08 mm., breadth, 0.05 mm.; ventral sucker, length, 0.16 mm., breadth, 0.15 mm.; ova, 0.051 by 0.030 mm. Nine, collected July 5, 1910; variety of shapes. It was noted that two of these distomes differed from the others in having subtriangular testes, the juxtaposed edges of which were diagonal instead of horizontal. The posttesticular region of one was short and bluntly rounded, the other tapered to a blunt point. Length of one, 1.26 mm.; breadth, 0.49 mm.; the other, length, 1.05 mm., breadth, 0.31 mm. The others in this lot measured from 1.12 to 2.66 mm. in length. Two, collected August 2, 1911; before flattening one of these was elongated and fili-

form, the other rather slender and pointed posteriorly, each with characteristic ventral sucker. Seventeen (U.S.N.M. No. 8262), collected October 23, 1913; length, 1.5 mm., to 2.75 mm. in formalin. One, collected May 4, 1914; length, 3 mm. Fifteen, collected October 10, 1916; longest about 2.5 mm. in formalin.

TABLE 19.—*Measurements of three distomes of* Cymbephallus vitellosus *from the tautog, showing diversity of proportions*

Measurement	1	2	3
	Mm.	*Mm.*	*Mm.*
Length	0.87	1.15	2.87
Diameter at anterior end	.07	.11	.18
Diameter at middle	.22	.43	.56
Diameter near posterior end	.08	.34	.30

From cunner: Bull. U. S. Fish Comm. for 1899, p. 462, 1901. Three, collected August 15, 1905, small. One, collected August 22, 1905, length, 1.23 mm. in balsam. Seven (U.S.N.M. No. 8263), collected July 17, 1919; length, 1.5 mm. to 2.8 mm. in balsam. The vitellaria in the distomes of this lot are less dense than usual for this species, and the intestines could be traced to the posterior end. The metraterm could be seen opening in front of the genital sucker. Measurements in balsam: Length, 2.80 mm., breadth, 0.52 mm.; oral sucker, length, 0.16 mm., breadth, 0.15 mm.; pharynx, length, 0.15 mm., breadth, 0.12 mm.; ventral sucker, length, 0.28 mm., breadth, 0.25 mm.; ova, 0.048 by 0.027 mm.

From round pampano: Three (U.S.N.M. No. 8264), collected September 2, 1903, from a 20-mm. fish. Small, less than 1 mm. in length, strongly contracted; average length, 0.92 mm., breadth, 0.44 mm.; vitellaria to middle of ventral sucker; prominent border around ventral sucker. Measurements in balsam: Length, 0.91 mm., breadth, 0.50 mm.; oral sucker, length, 0.13 mm., breadth, 0.15 mm.; pharynx, length, 0.12 mm., breadth, 0.15 mm.; ventral sucker, length, 0.17 mm., breadth, 0.24 mm.; ova, 0.048 by 0.030 mm.

From goggler: Five (U.S.N.M. No. 8265), collected August 29, 1913; length, 3.38 mm., breadth, 0.30 mm., life. Measurements in balsam: Length, 2.66 mm., breadth, 0.42 mm.; diameter oral sucker, 0.15 mm., of pharynx, 0.10 mm., of ventral sucker, 0.18 mm.; ova, 0.054 by 0.027 mm. One, collected September 17, 1914; length, 2.17 mm. in formalin. Metraterm seen opening about on level of posterior end of pharynx and in front of the genital sucker; seminal vesicle to about one third the distance from ventral sucker to ovary; papillae around ventral sucker.

CYMBEPHALLUS FIMBRIATUS Linton

PLATE 2, FIGURES 13–17

Distomum vitellosum LINTON, Bull. U. S. Fish Comm. for 1899, p. 426, 1901; Bull. Bur. Fisheries, vol. 24, pp. 388, 390, figs. 176–178, 1905.

Cymbephallus fimbriatus LINTON, Journ. Washington Acad. Sci., vol. 24, p. 82, 1934.

Body elongate, not varying much in diameter; neck short, more or less conical; ventral sucker larger than oral, prominent, sometimes pedicelled, surrounded by a raised border, with many short papillae; pharynx longer than broad; esophagus longer than pharynx; intestines extend to posterior end; genital pore in front of ventral sucker, to left of median line, the opening of the ejaculatory duct a muscular genital sucker; opening of metraterm, with sphincter, on a blunt papilla at anterior border of genital sucker; seminal vesicle elongate, curved, extending to from one third to more than one half the distance between the ventral sucker and the ovary; testes two, one following the other, with but a short interval between, in some cases lobed. Ovary at or near interior border of first testis, usually not lobed, although a tendency toward a lobed condition was observed in a few cases; shell-gland at anterior border of ovary. No seminal receptacle seen; in one specimen sperm was seen in front of the shell gland, where it appeared to be lying in the early folds of the uterus. Vitelline reservoir at the dorsal, anterior border of the ovary; vitellaria diffuse, filling the body back of the testes, and along the margins, not usually interrupted opposite the testes, and extending to a point about half-way between the ovary and ventral sucker; uterus between ovary and ventral sucker; ova about 0.06 by 0.03, in balsam.

TABLE 20.—*Measurements of five specimens of* Cymbephallus fimbriatus *in balsam*

Measurement	1	2	3	4	5
	Mm.	*Mm.*	*Mm.*	*Mm.*	*Mm.*
Length	3.78	3.92	4.34	4.62	3.70
Maximum breadth	.53	.67	.49	.56	.56
Oral sucker, length	.26	.26	.17	.26	.19
Oral sucker, breadth	.25	.22	.14	.21	.15
Pharynx, length	.14	.15	.13	.15	.14
Pharynx, breadth	.07	.08	.08	.09	.07
Ventral sucker, length	.28	.32	.21	.35	.28
Ventral sucker, breadth	.28	.32	.28	.35	.28
Ova, 0.06 by 0.03.					

This species differs from *C. vitellosus* in its larger size, and in having longer and more numerous papillae around the ventral sucker, in the more or less lobed testes, and the larger ova, and in the relatively longer seminal vesicle. Also, while *C. vitellosus* in many

instances tends to taper from the middle toward the posterior end, *C. fimbriatus* as a rule maintains a uniform breadth back of the ventral sucker and is bluntly rounded at the posterior end. There are, however, many contraction shapes in both species, so that it is difficult to fit descriptions to them.

The ova are rather thin-shelled, and are much collapsed in all the balsam mounts. In six distomes, averaging 3.49 mm. in length, the average distance of the posterior end of the seminal vesicle from the ventral sucker was 0.78 mm. and from the ovary 0.074 mm.

Host.—Kingfish (*Menticirrhus saxatilis*).

Record of collections.—One (U.S.N.M. No. 8266), collected September 11, 1907. Measurements, life: Length, 1.28 mm.; breadth, 0.60 mm.; diameter of oral sucker, 0.12 mm., of pharynx, 0.07 mm., of ventral sucker, 0.028 mm.; ova, 0.061 by 0.034 mm.

One, collected September 8, 1909; length, 4 mm.

Three, collected June 29, 1910; one, collected July 7, 1910; seven, collected July 27, 1910. When first examined these distomes had been lying in sea water for several hours. They were, with one exception, turgid, longest 7 mm. One, still active, was yellowish green by transmitted light, crossed by fine, transverse wrinkles; length, 1.9 mm., breadth, 0.70 mm. After flattening under coverglass, length, 3.7 mm.; breadth, 0.84 mm.

Two, collected August 10, 1910. One, collected October 31, 1912; turgid, neck reflected at right angles to body; length, 3.5 mm. in formalin. Two, collected September 23, 1914; length, 2.5 mm. and 3 mm. Three, collected July 21, 1926, macerated.

Genus LEPOCREADIUM Stossich, 1906

LEPOCREADIUM PYRIFORME (Linton)

PLATE 5, FIGURES 47–49

Distomum pyriforme LINTON, Bull. U. S. Fish Comm. for 1899, pp. 292, 293, figs. 52–59, 1900 (from *Palinurichthys perciformis*); *ibid.*, pp. 453, 458, fig. 346 (*Distomum* sp.), 1901.

To this species are referred certain small distomes which, although differing in many details of structure, resemble each other sufficiently to warrant their inclusion in the same specific grouping when allowance is made for such differences as may be accounted for by varying conditions of contraction and age. In general they are small, spinose distomes, with suckers about the same size, pharynx small, prepharynx and esophagus present; genital pore in front of ventral sucker to left of median line; prostate and first seminal vesicle enclosed in cirrus pouch; a second seminal vesicle connected with the cirrus pouch by a short vas deferens, often masked by the ova; testes, one following the other; ovary in front of first testis, not

lobed. The diffuse vitellaria extend to, and often in front of the ventral sucker.

Hosts.—Sand launce (*Ammodytes americanus*), squeteague (*Cynoscion regalis*), kingfish (*Menticirrhus saxatilis*), rudderfish (*Palinurichthys perciformis*), harvestfish (*Peprilus paru*), bluefish (*Pomatomus saltatrix*), dollarfish (*Poronotus triacanthus*), southern porgy (*Stenotomus chrysops*), cutlassfish (*Trichiurus lepturus*).

Record of collections.—From sand launce: Two, collected July 5, 1912. Measurements in balsam: Length, 0.91 mm., breadth, 0.29 mm.; diameter of oral sucker, 0.07 mm., of pharynx, 0.04 mm., of ventral sucker, 0.05 mm.; length of prepharynx, 0.02 mm., of esophagus, 0.03 mm.; ova, 0.060 by 0.036 mm. In one of these the oral sucker was retracted. Metraterm with relatively thick walls; genital pore at anterior border of ventral sucker nearly median; globular concentric bodies in excretory vessels; vitellaria from posterior end along margins to a level halfway between ventral sucker and pharynx. Two (U.S.N.M. No. 8267), collected November 1, 1913. Thirty fishes examined. Length in balsam, 2.24 mm.; breadth, 0.66 mm. Seven, collected October 20, 1914. One hundred fishes examined.

From squeteague: Bull. U. S. Fish Comm. for 1899, p. 460, 1901.

From kingfish: Bull. U. S. Fish Comm. for 1899, p. 462, 1901.

From rudderfish: Distomes from this host were first described under the name *Distomum pyriforme*, see above. Fifteen, collected August 18, 1903; three fishes examined; largest specimens, life, length 1.12 mm., smallest 0.24 mm. Forty (U.S.N.M. No. 8268), collected August 7, 1928. Small, densely and finely spinose, spines, more or less evanescent. Ovate to elliptical-oblong; suckers nearly equal; prepharynx and esophagus each as long or longer than pharynx; intestines reach nearly to posterior end; genital pore in front of ventral sucker, a little to left of median line; cirrus-bulb dorsal to ventral sucker, its posterior end, enclosing a seminal vesicle, extending back of the ventral sucker; behind the cirrus pouch a second seminal vesicle connected with it by a short vas deferens; testes two, one following the other with little or no interval between, in posterior third of body; ovary in front of first testis, a little to the right of the median line, not lobed; uterus in front of ovary, ova few and relatively large; metraterm on left side of cirrus bulb; vitellaria from posterior end to, and in some cases in front of, ventral sucker; shell gland on left of ovary; yolk reservoir along anterior border of first testis; seminal receptacle between first testis and ovary, dorsal to yolk reservoir. Measurements in balsam: Length, 0.84 mm.; breadth, 0.22 mm.; oral sucker, length, 0.42 mm., breadth, 0.59 mm.; pharynx, length, 0.36 mm., breadth, 0.39 mm.;

ventral sucker, length, 0.57 mm., breadth, 0.57 mm.; length of prepharynx, 0.45 mm., of esophagus, 0.51 mm.; ova, 0.054 by 0.030 mm.

From bluefish: *Distomum* sp., Bull. U. S. Fish Comm. for 1899, p. 451, figs. 341–344, 1901.

From dollarfish: Small, spinose distomes from the dollarfish, agreeing in most particulars with this species are here recorded. See also Bull. U. S. Fish Comm. for 1899, pp. 454, 455, fig. 353, 1901. One, collected August 13, 1904; length, life, 1.28 mm., breadth, 0.28 mm.; prepharynx and esophagus but little longer than pharynx; concentric bodies in excretory vessels, 0.02 mm. in diameter. One, collected July 2, 1907. Measurements in balsam: Length, 0.96 mm.; breadth, 0.31 mm.; diameter of oral sucker, 0.06 mm., of pharynx, 0.04 mm., of ventral sucker, 0.06 mm.; ova, 0.054 by 0.027 mm. Concentric bodies in excretory vessels of living worm; prepharynx and esophagus short.

An immature distome, found in a mass of appendicularia in the stomach of this dollarfish, probably belongs here. It was minutely spinose and very changeable in shape. Measurements, life: Length, 0.18 mm.; maximum breadth at about the posterior third, 0.18 mm.; diameter of oral sucker, 0.04 mm., of ventral sucker, 0.03 mm., of concentric bodies in excretory vessels, 0.01 mm.

Forty-two, collected August 30, 1917, from a 72-mm. dollarfish. Two in life measured, the one 0.7 mm. in length and 0.45 mm. in breadth, the other 0.35 mm. in length and 0.18 mm. in breadth. Measurements in balsam: Length, 0.60 mm., breadth, 0.21 mm.; diameter of oral sucker, 0.05 mm., of ventral sucker, 0.05 mm.; pharynx, length, 0.04 mm., breadth, 0.03 mm.; ova, 0.051 by 0.033 mm.

Five, collected July 8, 1918, from an 85-mm. dollarfish.

One, collected July 25, 1918, from a 12-mm. dollarfish. The prepharynx and esophagus are short; in other respects it is in close agreement with distomes from the rudderfish.

Two, collected August 21, 1918, from a 12-mm. dollarfish. The prepharynx and esophagus are short; in other respects it is in close agreement with distomes from the rudderfish.

Two, collected August 21, 1918, from a 125-mm. dollarfish. On account of the retraction of the oral sucker no prepharynx could be seen, but there was a distinct esophagus. A second seminal vesicle could be made out.

From bonito: One (U.S.N.M. No. 8270), collected August 11, 1906. Measurements in balsam: Length, 1.22 mm.; breadth, 0.44 mm.; oral sucker, length, 0.75 mm., breadth, 0.57 mm.; pharynx, length, 0.05 mm., breadth, 0.06 mm.; diameter of ventral sucker, 0.75 mm.; ova, 0.056 by 0.027 mm. Prepharynx short, esophagus about as long as pharynx. The vitellaria extend in front of the ventral sucker. This distome is in close agreement with those from the rudderfish.

From southern porgy: *Distomum* sp., Bull. U. S. Fish Comm. for 1899, p. 296, fig. 72; p. 458, fig. 376, 1901. One, collected August 19, 1903. Measurements in balsam: Length, 0.65 mm.; breadth, 0.31 mm.; diameter of oral sucker, 0.07 mm., of ventral sucker, 0.07 mm.; pharynx, length, 0.05 mm., breadth, 0.04 mm.; ova, 0.068 by 0.032 mm. This distome agrees with the foregoing closely, but the esophagus is very short, and no prepharynx could be seen. The neck was strongly contracted.

Ten (U.S.N.M. No. 8271) collected August 24, 1910; six porgies examined. One, active in sea water, varied in length from 0.42 to 0.84 mm. An average of six gave the diameter of the oral sucker, 0.065, ventral sucker, 0.059 mm. In a lot of ten, mounted in balsam, there were noted cases with distinct prepharynx, and very short, or no esophagus; others with very short, or no prepharynx and distinct esophagus; others with both prepharynx and esophagus distinct. The vitellaria extend to level of posterior end of pharynx. In details of the anatomy these distomes are in close agreement with those from the rudderfish.

From cutlassfish: Thirty (U.S.N.M. No. 8272), collected June 18, 1913, from one fish. Length of longest, in formalin, 2.15 mm.; breadth, 0.6 mm. Eleven mounted in balsam vary from length, 0.6 mm. and breadth, 0.27 mm., to length, 1.26 mm., and breadth, 0.4 mm. Measurements of one of largest in balsam: Length, 1.20 mm., breadth, 0.42 mm.; diameter of oral sucker, 0.075 mm., of pharynx, 0.033 mm., of ventral sucker, 0.072 mm.; length of prepharynx, 0.015 mm., of esophagus, 0.18 mm.; ova, collapsed, about 0.06 by 0.024 mm.

The prepharynx is shorter than the pharynx and the esophagus varies from less than the length of the pharynx to twice its length or more. The vitellaria in all cases extend as far forward as the level of the ventral sucker. A second seminal vesicle was distinguished in one. So far as can be made out the anatomy of these distomes agrees closely with those from the rudderfish.

LEPOCREADIUM RETRUSUM, new species

PLATE 6, FIGURES 50–52

Body spinose, of nearly same breadth throughout, tapering slightly to anterior end, which is bluntly rounded; posterior end broadly rounded; oral sucker more or less retracted in all cases seen, smaller than ventral sucker; pharynx small, prepharynx longer than pharynx; esophagus about as long as pharynx; genital pore in front of ventral sucker, a little to left of median line; cirrus pouch large, extending back of ventral sucker and enclosing prostatic cells and a seminal vesicle; a second seminal vesicle connected with the cirrus bulb by a

short vas deferens, as in other species of this genus; testes two, one following the other, nearly contiguous, at about the posterior fourth of the length; ovary lobed, in front of first testis, a little to right of median line; seminal receptacle between ovary and first testis; uterus in front of ovary; metraterm thick-walled, on left side of cirrus pouch; vitellaria diffuse, from posterior end nearly to ventral sucker.

Type specimens.—Holotype, U.S.N.M. No. 8273; paratypes, No. 8274.

Host.—Chub mackerel (*Pneumatophorus grex*).

Record of collections.—One (U.S.N.M. No. 8273), collected July 31, 1928. Measurements in balsam: Length, 2.38 mm., breadth, 0.59 mm.; diameter of oral sucker, about 0.08 mm., of pharynx, 0.06 mm., of ventral sucker, 0.15 mm.; length of prepharynx, 0.17 mm., of esophagus, 0.06 mm.; ova, 0.06 by 0.03 mm.

Four (U.S.N.M. No. 8274), collected August 29, 1928. Measurements in balsam: Length, 1.12 mm., breadth, 0.35 mm.; diameter of oral sucker, about 0.09 mm., of pharynx, 0.03 mm., of ventral sucker, 0.12 mm.; ova, 0.054 by 0.030 mm.

LEPOCREADIUM TRULLAFORME, new species

PLATE 6, FIGURES 53–56

Distomum arcolatum Rudolphi, LINTON, Bull. U. S. Fish Comm. for 1899, pp. 279, 293, 294, figs. 60–63, 1900; *ibid.*, pp. 456, 462, 486, 487, fig. 351, 1901.

Small distomes, more or less oval in outline, densely spinose anteriorly; oral and ventral suckers about equal; prepharynx and esophagus present, but, so far as observed, not exceeding the pharynx in length; intestines extend nearly to posterior end; genital pore in front of ventral sucker a little to left of median line; cirrus pouch extending back of ventral sucker, enclosing the prostate and a seminal vesicle, followed by a second seminal vesicle; testes two, near together, at about posterior third, obliquely placed. Ovary, in some cases slightly lobed, to right of median line in front of second testis; seminal receptacle in front of first testis and on the left of the ovary; uterus between testes and ventral sucker, ova few and large; metraterm to left of cirrus pouch; vitellaria diffuse, extending in front of ventral sucker.

Type specimens.—U. S. N. M. No. 8276 (holotype and paratypes).

Hosts.—American sole (*Achirus fasciatus*), long-spined sculpin (*Acanthocottus octodecimspinosus*), kingfish (*Menticirrhus saxatilis*), white perch (*Morone americana*), winter flounder (*Pseudopleuronectes americanus*), cunner (*Tautogolabrus adspersus*).

Record of collections.—Distomum sp., Bull. U. S. Fish Comm. for 1899, p. 487, fig. 351, 1901. Two (U.S.N.M. No. 8275) from American sole, collected October 14, 1915. While the anatomy is rather

indistinctly shown in the balsam material, so far as it can be made out it is in close agreement with distomes from *Morone americana.* The prepharynx is short, the esophagus about as long as the pharynx; genital pore in front of ventral sucker and a little to the left of the median line; cirrus smooth; testes obliquely placed. Ovary circular in outline; ova two in each, large; vitellaria extend forward to level of pharynx. Measurements of larger specimen in balsam: Length, 0.87 mm., breadth, 0.39 mm.; diameter of oral sucker, 0.1 mm., of pharynx, 0.045 mm., of ventral sucker, 0.06 mm.; ova, 0.096 by 0.066 mm.

From long-spined sculpin: Five, collected December 22, 1906. Two, collected May 12, 1913; 20 fishes examined. Fourteen, collected April 20, 1914; 2 fishes examined. Four (U.S.N.M. No. 8276), collected April 26, 1915; 12 fishes examined.

The anatomy of these distomes is imperfectly shown mainly on account of the diffuse vitellaria which mask the other genitalia; so far as the anatomy can be made out it is in agreement with that of the distomes from *M. americana.* They differ in their consistent fusiform shape. The neck was much contracted so that the pharynx and adjacent structures were much obscured. In one a prepharynx could be seen which was about equal in length to the pharynx. Testes oblique; ovary in front of testes to right of median line. A seminal receptacle was noted in front of the first testis to the left of the ovary; ova few, large, posterior and dorsal to ventral sucker; vitelline follicles coarse, extending in front of ventral sucker. Measurements in balsam: Length, 1.4 mm.; breadth, 0.56 mm.; diameter of oral sucker, 0.14 mm., of pharynx, 0.07 mm., of ventral sucker, 0.14 mm.; ova, 0.10 by 0.05 mm.

From kingfish: One (U.S.N.M. No. 8277), collected September 11, 1907. Length, life, 1.12 mm.; breadth, 0.77 mm. Measurements, balsam: Length, 1 mm.; breadth, 0.5 mm.; oral sucker, length, 0.12 mm., breadth, 0.13 mm.; pharynx, length, 0.06 mm., breadth, 0.05 mm.; ventral sucker, length, 0.09 mm., breadth, 0.11 mm.; ova, 0.12 by 0.06 mm. This is a small, pyriform distome, densely spinose anteriorly, the spines continuing to near the posterior end. The anatomy is in close agreement with distomes from *M. americana;* prepharynx and esophagus short; genital pore near median line; ova few; what was interpreted to be the second seminal vesicle lay on the left side of the ovary, in front of the seminal receptacle, apparently crowded to the right by the ova.

Small distomes from young kingfish, collected August 21, 1918, are here recorded.

One (U.S.N.M. No. 8278) from a 55-mm. fish; 3 from a 100-mm. fish; 16 from a 105-mm. fish; 20 from a 110-mm. fish. These are

small, oval-elliptical distomes, varying from a length of 0.22 mm. with a breadth of 0.15 mm., to length 0.45 mm., with a breadth of 0.28 mm.; minutely and densely spinose at anterior end, spines becoming sparse toward posterior end; oral sucker larger and more muscular than ventral; pharynx about as broad as long, much smaller than oral sucker; prepharynx and esophagus very short; intestines reach to posterior end; cirrus and cirrus-pouch dorsal to ventral sucker, seminal vesicle extending back of ventral sucker; genital pore at anterior edge of ventral sucker, a little to left of median line; testes diagonal, nearly transverse in one, about midway between ventral sucker and posterior end; ovary to right of median line in front of right testis; yolk reservoir between ovary and right testis, best seen in dorsal view; shell gland ventral to left side of yolk reservoir, extending to median line; seminal receptacle dorsal to anterior border of left testis; a second seminal vesicle was faintly indicated dorsal to the shell gland; ova very few, one or two, between testes and ventral sucker; vitellaria diffuse, from posterior end to oral sucker; posterior excretory vessel large. A characteristic feature of these distomes is the large size and small number of the ova. No more than two ova were seen in any one of them. Some of the smallest were immature, and contained no ova, but ova were present in quite small specimens. Thus, one, length, 0.28 mm., breadth, 0.27 mm., contained one ovum 0.10 by 0.06 mm.; another, length, 0.28 mm., breadth, 0.25 mm., contained two ova, 0.10 by 0.05 mm. and 0.10 by 0.06 mm. Measurements of one in balsam: Length, 0.42 mm.; breadth, 0.36 mm.; oral sucker, length, 0.09 mm., breadth, 0.10 mm.; pharynx, length, 0.05 mm., breadth, 0.05 mm.; ventral sucker, length, 0.06 mm., breadth, 0.06 mm.; ova, 0.10 by 0.06 mm.

From white perch: Eight (U.S.N.M. No. 8279), collected August 8, 1910. Six fishes examined. Measurements, life, moderately compressed: Length, 1.04 mm.; breadth, 0.05 mm.; oral sucker, length, 0.1 mm., breadth, 0.11 mm.; pharynx, length, 0.06 mm., breadth, 0.04 mm.; ventral sucker, length, 0.10 mm., breadth, 0.09 mm.; ova, 0.11 by 0.07 mm.; ova 5 in number. Prepharynx and esophagus each shorter than pharynx; genital pore to left of median line; a second seminal vesicle noted; testes oblique; yoke reservoir between testes and ovary; seminal receptacle near median line in front of testes; shell gland in front of seminal receptacle; ovary in one appeared to be slightly lobed; vitellaria extend about to level of pharynx.

From winter flounder: *Distomum areolatum* Rudolphi, Bull. U. S. Fish Comm. for 1899, 1901.

From cunner: *Distomum areolatum* Rudolphi, Bull. U. S. Fish Comm. for 1899, 1901. A reexamination of these distomes shows that they belong here. They are densely spinose, broadest about the

middle of the length, tapering rather uniformly to bluntly rounded ends; prepharynx short, esophagus about as long as pharynx; testes oblique; ova few; vitellaria extend nearly to pharynx; genital pore about halfway between ventral sucker and pharynx, a little to left of median line; cirrus pouch extending back of ventral sucker. Measurements, balsam: Length, 1.06 mm., breadth, 0.49 mm.; breadth of oral sucker, 0.15 mm., of pharynx, 0.06 mm., of ventral sucker, 0.13 mm.; ova, 0.126 by 0.078. (U.S.N.M. No. 8280.)

Genus LEPIDAPEDON Stafford, 1904

LEPIDAPEDON CLAVATUM, new species

PLATE 4, FIGURES 36, 37

Body thickish, body more or less terete; neck and anterior part of body covered with dense, minute spines; tapering gradually to anterior end, and more or less abruptly to posterior end; oral sucker subterminal, pharynx relatively large, ventral sucker larger than oral; prepharynx approximately as long as pharynx, varying with state of contraction of neck; esophagus short, if any, intestines extend to posterior end; genital pore in front of ventral sucker, median or nearly so; cirrus pouch short, muscular, at anterior edge of ventral sucker; testes two, relatively large, more or less rounded, close together, one following the other, at about the posterior third, the second testis a little more than its length from the posterior end; ovary at anterior border of first testis; uterus between ovary and ventral sucker; ova not numerous, relatively large, for the most part clustered behind the ventral sucker; vitellaria diffuse, follicles coarse, from the posterior end to within a short distance of the ventral sucker.

One specimen from *Lophopsetta maculata* and four from *Ceratacanthus schoepfi* suggest *L. rachion*, but in each of them the ventral sucker is distinctly larger than the oral.

Type specimens.—Holotype, U.S.N.M. No. 8281; paratypes, No. 8282.

Hosts.—Filefish (*Ceratacanthus schoepfi*) and windowpane (*Lophopsetta maculata*).

Record of collections.—From filefish: One, collected August 7, 1905. Measurements, lateral view, in glycerin: Length, 3.5 mm.; maximum breadth, 0.84 mm.; oral sucker, length, 0.22 mm., breadth, 0.28 mm.; pharynx, length, 0.22 mm., breadth, 0.29 mm.; ventral sucker, 0.37 mm., breadth, 0.35 mm.; ova, 0.08 by 0.04 mm.

One (U.S.N.M. No. 8281), collected July 29, 1908.

Two (U.S.N.M. No. 8282), collected August 21, 1915. Body terete, nearly linear, greatest breadth at level of testes, tapering gradually

to anterior, and more abruptly to posterior end. While the seminal vesicle, so far as it is shown in the mounted specimens, is in front of the ventral sucker, in one specimen it appears to be somewhat crumpled, elongated, in front and on the right dorsal side of the ventral sucker, narrowing slightly until near the level of the anterior border of the sucker, where it expands from a diameter of 0.03 mm. into an enlarged portion 0.28 mm. in length and 0.13 mm. in diameter, the anterior half of which is contiguous with the cirrus pouch. The ovary appeared to be slightly lobed in one specimen, circular in outline in at least one, and oval-elliptical, with the longer diameter transverse, in one.

TABLE 21.—*Measurements of four specimens of* Lepidapedon clavatum *in balsam*

Measurement	1	2	3	4
	Mm.	*Mm.*	*Mm.*	*Mm.*
Length	3.50	3.25	3.50	3.78
Maximum breadth	.81	.62	.84	.84
Oral sucker, length	.17	.17	.28	.31
Oral sucker, breadth	.28	.28	.27	.28
Pharynx, length	.21	.21	.28	.28
Pharynx, breadth	.21	.21	.28	.29
Ventral sucker, length	.35	.38	.39	.37
Ventral sucker, breadth	.35	.38	.42	.35
Ova				.078 by 0.045

From windowpane: One (U.S.N.M. No. 8283), collected August 17, 1908. Measurements in balsam: Length, 3.64 mm., breadth, 0.70 mm.; oral sucker, length, 0.28 mm., breadth, 0.35 mm.; pharynx, length, 0.29 mm., breadth, 0.29 mm.; ventral sucker, length, 0.47 mm., breadth, 0.5 mm.; length of prepharynx, 0.28 mm.; ova, 0.075 by 0.045 mm. This specimen agrees closely with the distomes from *Ceratacanthus schoepfi*. The body is nearly linear, tapering to a moderately blunt point at the posterior end; neck nearly linear. Length of spines on neck about 0.015 mm. Seminal vesicle with a few prostate cells at right margin of cirrus pouch; ovary slightly lobed; shell gland in front of ovary; no seminal receptacle seen, but some indication of sperm in early folds of uterus.

LEPIDAPEDON ELONGATUM (Lebour)

PLATE 5, FIGURES 38–45

Lepodora elongata LEBOUR, Rep. (1907) Northumberland Sea Fisheries, pp. 20–21, 1908.

Lepidapedon elongatum (Lebour), MANTER, Illinois Biol. Mon., vol. 10, No. 2, pp. 85, 86, figs. 47, 48, 1926.

Distomes from seven species of Woods Hole fishes, while presenting many differences in minor details of structure, are referred to

this species. They are elongated forms differing from *L. rachion* in having a relatively smaller pharynx, and in having both the prepharynx and esophagus as long, or longer, than the pharynx. The testes are usually separated from each other by a longer or shorter interval in which follicles of the vitellaria appear.

Details of structure are given in the records of collections.

Hosts.—Four-bearded rockling (*Enchelyopus cimbrius*), common codfish (*Gadus morrhua*), pollack (*Pollachius virens*), summer flounder (*Paralichthus dentatus*), codling (*Urophycis chuss*), goggler (*Trachurops crumenophthalma*).

Record of collections.—From four-bearded rockling. *Distomum* sp., Bull. U. S. Fish Comm. for 1899, p. 479, fig. 330, 1901.

From common codfish: Eight, collected December 21, 1903; 24 fishes examined.

Thirteen, collected December 13, 1905; 50 fishes examined. Measurements in formalin: Length 1.6 mm., breadth 0.28 mm., nearly linear. One, collected November 12, 1912; 5 fishes examined. One, collected November 15, 1912; 3 fishes examined. Fourteen, collected December 28, 1912; 25 fishes examined. Two, collected December 30, 1912; 15 fishes examined. Measurements of one in formalin: Length 2.8 mm., breadth 0.42 mm.; diameter of oral sucker 0.10, of pharynx 0.06, of ventral sucker 0.10; ova, 0.066 by 0.040. Two hundred and thirty-four, collected January 22, 1915; 12 fishes examined. Thirty-seven (U.S.N.M. No. 8284), collected February 16, 1915, from one fish.

Two, collected July 15, 1926; 4 fishes examined. Distomes slightly macerated. These distomes from the cod are slender, neck densely spinose, spines less dense on anterior part of the body, sparse toward the middle of the length, disappearing near the posterior end. Neck when flattened slightly spatulate, broader and thinner than the subcylindrical body. The neck is supplied with numerous pyriform glands. Oral sucker a little larger than the ventral sucker, its opening directed forward; pharynx small, longer than broad; prepharynx, in uncontracted specimens, longer than the pharynx; esophagus much longer than the pharynx, depending on the degree of contraction, in some cases from twice to more than four times the length of the pharynx. Intestinal rami begin from about the middle to the posterior third of the neck and extend to the posterior end of the body. Genital aperture in front of ventral sucker; cirrus bulb oval-elliptical, about twice as long as broad, anterior and dorsal to ventral sucker; cirrus spinose; seminal vesicle moderately voluminous, extending back of ventral sucker; testes two, one following the other, the interval between them approximately equal to the length of a testis, and filled with follicles of the vitellaria. Ovary subglobular, a short distance

in front of the first testis, and at about the middle of the post-acetabular region; seminal receptacle at posterior border of ovary; vitellaria diffuse, extending from posterior end to the seminal vesicle, in most cases interrupted at the levels of the testes and ovary. The uterus lies between the ovary and the ventral sucker, passing ventral to the seminal vesicle, then to the left of the cirrus bulb to the genital pore.

TABLE 22.—*Measurements of four specimens of* Lepidapedon elongatum, *Nos. 1 and 2 in glycerin, Nos. 3 and 4 in balsam*

Measurement	1	2	3	4
	Mm.	*Mm.*	*Mm.*	*Mm.*
Length	4.62	4.62	3.78	2.03
Breadth of neck	.40	.42	.27	.27
Breadth of body	.35	.38	.25	.29
Diameter of oral sucker	.14	.14	.11	.10
Pharynx, length	.08	.11	.08	.08
Pharynx, breadth	.08	.08	.04	.04
Diameter of ventral sucker	.11	.13	.10	.10
Length of prepharynx	.20	.21	.17	.13
Ova	.07 by .04	.07 by .04	.06 by .03	.07 by .04

From pollack: One (U.S.N.M. No. 8285) collected May 28, 1913. Length, in formalin, 2.03 mm.; breadth, 0.35 mm. Measurements in balsam: Length, 1.68 mm.; breadth, 0.35 mm.; diameter of oral sucker, 0.08 mm.; pharynx, length, 0.08 mm., breadth, 0.04 mm., ventral sucker, length, 0.07 mm., breadth, 0.08 mm.; length of esophagus, 0.19 mm.; ova, 0.06 by 0.03 mm. Slender, of nearly same breadth throughout, neck slightly attenuate, and posterior end slightly tapering to blunt point. Details of anatomy in close agreement with distomes from cod.

From summer flounder: *Distoma* sp., Bull. U. S. Fish Comm. for 1899, pp. 482, 483, figs. 345, 352, 1901.

From codling: One (U.S.N.M. No. 8286), collected October 28, 1914; 10 fishes examined. Length, in formalin, 5.25 mm., breadth, 0.67 mm.; diameter of oral sucker, 0.18 mm., of ventral sucker, 0.18 mm.

One, collected August 20, 1915. Measurements in balsam: Length, 2.66 mm.; breadth, 0.49 mm.; diameter of oral sucker, 0.09 mm., of ventral sucker, 0.09 mm.; pharynx, length, 0.07 mm., breadth, 0.054 mm.; length of prepharynx, 0.12 mm., of esophagus, 0.10 mm.; ova, 0.060 by 0.045 mm.

The neck in each of these distomes from the hake was slightly tapering anteriorly, there being no indication of the spatulate condition noted in distomes from the cod.

From goggler: One, collected August 29, 1913. Small, spinose, immature. Measurements, life: Length, 0.7 mm.; breadth, 0.16 mm.

In balsam, length, 0.54 mm.; breadth, 0.12 mm.; diameter of oral sucker, 0.03 mm., of pharynx, 0.02 mm., of ventral sucker, 0.03 mm.; length of prepharynx, 0.03 mm., of esophagus, 0.04 mm. Rudiments of genitalia agree in relative positions with this species.

LEPIDAPEDON RACHION (Cobbold)

PLATE 5, FIGURE 46

Lepidapedon rachion (Cobbold), STAFFORD, Zool. Anz., vol. 27, p. 487, 1904.—MANTER, Illinois Biol. Mon., vol. 10, No. 2, pp. 84, 85, figs. 45, 46.

Lepodora rachiaea (Cobbold), ODHNER, Die Trematoden des arktischen Gebietes, Fauna Arctica, vol. 4, p. 332, pl. 2, figs. 12–15, 1905.

Distomes referred to this species were found in the sea bass, cod, haddock, and silversides. Differences in details of structure, which are many, may generally be accounted for by differing states of contraction, and differences in age. In general the outline is long oval, usually tapering more anteriorly than posteriorly, the neck and anterior part of the body bearing short, scalelike spines, which are evanescent; ventral sucker smaller than oral; pharynx relatively large; prepharynx as long, or longer, than pharynx; esophagus very short, often indistinguishable; genital pore in front of ventral sucker, on median line; cirrus-pouch in front of, and dorsal to ventral sucker; the seminal vesicle, often large, and extending back of the ventral sucker; testes two, one following the other; ovary in front of first testis and near it; testes and ovary relatively small and rounded; vitellaria diffuse, extending from the posterior end to the level of the ventral sucker. Other details, including measurements, given under the several hosts.

Hosts.—Black sea bass (*Centropristes striatus*), common codfish (*Gadus morrhua*), haddock (*Melanogrammus aegelfinus*), silversides (*Menidia notata*).

Record of collections.—One, from black sea bass, collected July 9, 1904. Measurements, life: Length, 3.23 mm.; breadth, anterior 0.37, at level of ventral sucker, 0.67 mm., near posterior end, 0.22 mm.; diameter of oral sucker, 0.35 mm., of pharynx, 0.26 mm., of ventral sucker, 0.24 mm.; ova, 0.05 by 0.04 mm. Measurements in balsam: Length, 2.1 mm.; maximum breadth, 0.4 mm.; diameter of oral sucker, 0.21 mm.; pharynx, length, 0.14 mm., breadth, 0.15 mm.; diameter of ventral sucker, 0.15 mm.; length of prepharynx, 0.21 mm., of esophagus, 0.03 mm.; ova, 0.054 by 0.030 mm. In this distome from the sea bass the vitellaria extended forward about to the level of the anterior border of the ventral sucker and the ovary was a little more to the left than to the right of the median line.

From common codfish. See *Distomum rachion* Cobbold, Proc. U. S. Nat. Mus., vol. 20, pp. 538, 539, 1898.

From haddock: One (U.S.N.M. No. 8287), collected October 31, 1895, Vinal N. Edwards collection. Measurements in formalin: Length, 3.43 mm.; breadth, 0.5 mm.; diameter of oral sucker, 0.42 mm., of ventral sucker, 0.3 mm.; pharynx, length, 0.3 mm., breadth, 0.27 mm.; ova, 0.07 by 0.04 mm.

Three, collected September 3, 1904.

Six, collected October 21, 1904. Length of largest, in formalin, 3.25 mm., breadth, 1 mm.; thickish, appressed, armed with low, flat, rounded spines. Measurements of one in balsam: Length, 1.6 mm.; breadth, 0.63 mm.; oral sucker, length, 0.21 mm., breadth, 0.22 mm.; pharynx, length, 0.18 mm., breadth, 0.15 mm.; ventral sucker, length, 0.15 mm., breadth, 0.17 mm.; ova, 0.06 by 0.03 mm.

The vitellaria in these distomes from the haddock do not extend as far forward as the ventral sucker, and the ovary in some of them is rather more to the right than to the left of the median line.

One, collected August 12, 1909. This is the only distome found in 16 haddock taken on Crab Ledge, off Nantucket. Length, life, 4 mm. Measurements in balsam: Length, 3.5 mm.; breadth, 0.64 mm.; diameter of oral sucker, 0.22 mm., of pharynx, 0.18 mm., of ventral sucker, 0.17 mm.; ova, 0.06 by 0.04 mm. Cirrus pouch elliptical, length, 0.18 mm., breadth, 0.14 mm.; seminal vesicle, relatively large, at posterior border of ventral sucker dorsal to the uterus (fig. 46).

From silversides: A few cysts, collected August 29, 1908, surrounded by black pigment on the skin of a silversides, contained immature distomes which agree with this species. Measurements, life: Length, 0.66 mm.; breadth, 0.29 mm.; diameter of oral sucker, 0.12 mm., of ventral sucker, 0.08 mm.; pharynx, length, 0.08 mm., breadth, 0.05 mm. Rudiments of the seminal vesicle, ovary, shell-gland, testes, and vitellaria were present, the latter extend forward to the level of the ventral sucker. The prepharynx was as long as the pharynx, and the intestinal rami extended to the posterior end.

Genus HOMALOMETRON Stafford, 1904

HOMALOMETRON PALLIDUM Stafford

PLATE 7, FIGURES 65–67

Distomum sp., LINTON, Bull. U. S. Fish Comm. for 1899, p. 442, fig. 354, 1901.
Homalometron pallidum STAFFORD, Zool. Anz., vol. 27, p. 487, 1904.—MANTER, Illinois Biol. Mon., vol. 10, No. 2, pp. 212, 213, figs. 54–56, 1926.

Distomes from various species of Woods Hole fishes while differing more or less among themselves, agree in so many essential char-

acters that it is not advisable to recognize their differences as of specific value.

Body more or less linear, although the proportions vary greatly with different stages of contraction, neck more or less tapering. Neck and anterior portion of body covered with short, blunt spines, becoming sparse posteriorly, more or less evanescent; oral and ventral suckers not differing much in size; pharynx much smaller than oral sucker, usually a little longer than broad; prepharynx and esophagus both present, their relative lengths variable, depending on contraction conditions; intestines extend nearly to posterior end of body, often hidden by the vitellaria; genital pore in front of ventral sucker, median; cirrus pouch lacking; ejaculatory duct and seminal vesicle dorsal to the ventral sucker, usually to the right of the median line, the seminal vesicle extending back of the ventral sucker as far as the ovary, the anterior border of which it often overlaps. The two testes are situated about midway between the ventral sucker and the posterior end, in many cases more or less lobed; ovary in front of first testis to the right of the median line, not lobed; shell gland and yolk reservoir between the ovary and first testis; seminal receptacle in front, and dorsal to the ovary on the right side of the seminal vesicle; vitellaria diffuse, from posterior end to, or nearly to, the level of the posterior margin of the ventral sucker; ova few, in front of testes, 0.09 or 0.1 mm. in longer, by 0.07 mm. or more in shorter diameter.

Further details given in record of collections.

Hosts.—Mademoiselle (*Bairdiella chrysura*), common killifish (*Fundulus heteroclitus*), spot (*Leiostomus xanthurus*), kingfish (*Menticirrhus saxatilis*), white perch (*Morone americana*), winter flounder (*Pseudopleuronectes americanus*), tautog (*Tautoga onitis*).

Record of collections.—Three (U.S.N.M. No. 8288), from mademoiselle, collected September 10, 1928; 4 fishes, 62 to 68 mm. in length, examined, seined at Wareham. Measurements, balsam: Length, 2.87 mm.; breadth, 0.59 mm.; diameter of oral sucker, 0.21 mm., of pharynx, 0.11 mm., of ventral sucker, 0.21 mm.; ova, 0.096 by 0.069 mm. These distomes resemble those from *M. saxatilis*, collected on the same date and from the same locality. Spines evanescent; prepharynx a little longer than pharynx, esophagus about same length as pharynx.

From common killifish: Seven (U.S.N.M. No. 8289), collected January 10, 1917, from one fish, eight fishes examined.

From spot: Collected by Vinal N. Edwards on 16 dates in the months of September and October in the years 1912, 1913, and 1914. His record shows a total of 40 distomes from 231 fishes. The largest

number on any date was 6, from 42 fishes on one occasion, from 23 on another. On seven dates but one distome was recorded; on one of these dates 50 fishes were examined.

Five (U.S.N.M. No. 8240), collected September 16, 1912; 10 fishes examined.

TABLE 23.—*Measurements of four specimens of* Homalometron pallidum *in balsam*

Measurement	1	2	3	4
	Mm.	*Mm.*	*Mm.*	*Mm.*
Length	4.62	3.51	2.32	1.54
Maximum breadth	1.02	.78	.56	.45
Oral sucker, length	.35	.26	.28	.18
Oral sucker, breadth	.37	.24	.28	.19
Length of prepharynx	.28	.14	.08	.07
Pharynx, length	.15	.14	.11	.10
Pharynx, breadth	.16	.13	.11	.10
Length of esophagus	.07	.07	.07	.09
Ventral sucker, length	.36	.28	.25	.20
Ventral sucker, breadth	.36	.28	.25	.19
Ova (collapsed) 0.096 by 0.051.				

From kingfish: Three (U.S.N.M. No. 8291), collected September 11, 1907. Measurements, life, compressed: Length, 4.5 mm.; breadth, anterior, 0.36 mm., middle, 0.32 mm., behind testes, 0.78 mm.; oral sucker, length, 0.26 mm., breadth, 0.25 mm.; pharynx, length, 0.14 mm., breadth, 0.08 mm.; ventral sucker, length, 0.26 mm., breadth, 0.26 mm.; ova, 0.10 by 0.06 mm. Prepharynx longer than pharynx; esophagus short. The seminal vesicle at its anterior end dorsal to the posterior edge of the ventral sucker, extending back to ovary; seminal receptacle somewhat elongated, at right side of seminal vesicle, and extending back dorsal to ovary.

Five (U.S.N.M. No. 8292), collected October 24, 1912; two fishes, length, 150 mm., examined.

Eight, collected October 31, 1912; ten fishes, length 125 mm., examined. Length, 1.98 mm.; breadth, 0.5 mm., in formalin. Most of these distomes, mounted in balsam, are strongly contracted. In one the vitellaria were reduced so that the intestines could be seen. They reached to within 0.18 mm. of the posterior end.

Forty (U.S.N.M. No. 8293), collected August 28, 1928; 34 fishes, 81 mm. to 137 mm. in length, examined.

These distomes, in balsam, vary from 1.3 to nearly 5 mm. in length, and are of great variety of shapes and proportions, as shown in the following table:

TABLE 24.—*Measurements of five specimens of* Homalometron pallidum *in balsam*

Measurement	1	2	3	4	5
	Mm.	*Mm.*	*Mm.*	*Mm.*	*Mm.*
Length	4.48	3.15	3.08	2.68	1.79
Length of neck	1.02	.75	.77	.77	.42
Maximum breadth	.98	1.14	.74	.63	1.19
Oral sucker, length	.29	.26	.24	.25	.22
Oral sucker, breadth	.29	.22	.28	.25	.24
Length of prepharynx	.21	.05	.17	.14	.00
Pharynx, length	.11	.08	.10	.10	.05
Pharynx, breadth	.12	.08	.07	.11	.05
Length of esophagus	.07	.04	.05	.07	.00
Ventral sucker, length	.30	.24	.25	.19	.28
Ventral sucker, breadth	.28	.24	.25	.15	.28
Ovary, length	.23	.17	.14	.14	.17
Ovary, breadth	.21	.25	.17	.12	.24
First testis, length	.23	.31	.33	.24	.14
First testis, breadth	.22	.45	.32	.24	.39
Second testis, length	.56	.77	.39	.18	.21
Second testis, breadth	.35	.70	.35	.26	.43
Ova	.10 by .09	.10 by .06	.10 by .05	.10 by .07	.10 by .06

From white perch: Five (U.S.N.M. No. 8294), collected April 28, 1914; two fishes examined. Largest, in formalin, length, 4 mm.; breadth, 1.35 mm. Measurements in balsam: Length, 2.94 mm.; breadth, 1.05 mm.; oral sucker, length, 0.35 mm., breadth, 0.39 mm.; pharynx, length, 0.15 mm., breadth, 0.13 mm.; ventral sucker, length, 0.39 mm., breadth, 0.42 mm.; no ova. Seminal vesicle dorsal to right border of ventral sucker, extending back of ventral sucker and overlapping the ovary, seminal receptacle dorsal to posterolateral border of ovary; yolk reservoir between ovary and first testis.

From winter flounder: The distome recorded from this host under the name *D. globiphorum* Rudolphi (Bull. U. S. Fish Comm. for 1899, p. 486, fig. 347, 1901), probably belongs here. Nine (U.S.N.M. No. 8295), collected July 28, 1905; length, 4 mm. One, collected February 10, 1913; 30 fishes examined; length, 3 mm., in formalin. Five, collected October 16, 1914; one fish examined. Sixteen, collected February 16, 1915; four fishes examined.

TABLE 25.—*Record of distomes of* Homalometron pallidum *from young* Pseudopleuronectes americanus

Fishes examined	Date collected	Length of fishes	Fishes parasitized	Degree of parasitization	Total distomes	Appendiculate distomes found
		Mm.				
65	10 dates, June 30 to Sept. 10	100 to 190	23	1–40	173	None.
264	28 dates, June 27 to Sept. 18	21 to 98	187	1–484	5,516	On 4 dates.
[1] 14	July 27, 1915		10	3–317	1,195	
[2] 12	June 27, 1916				1	
[1] 14	July 28		12	2–75	268	
[3] 12	Aug. 1		2	3–5	8	

[1] Seined in Katama Bay. [2] Seined in Great Harbor. [3] Seined at Monument Beach.

While the food of young winter flatfish was being studied in the summers of 1915 and 1916, a record was kept of the distomes found. With few exceptions these distomes were referred to the species *Homalometron pallidum* (U.S.N.M. No. 8296) and *Hemiurus appendiculatus*. The appendiculates, for the most part, came from the stomachs, the others from the intestines of their hosts.

Twenty-three, collected August 9, 1923; eight fishes examined.

Twelve, collected July 29, 1929. Smallest, length, 1.60 mm.; breadth, 0.53 mm.; largest, length, 3.20 mm., breadth, 0.77 mm.; ova, 0.096 by 0.042 mm.

These distomes from the winter flatfish, representing as they do a great variety of forms, agree in all essential particulars with this species as defined in the foregoing descriptions. Such differences as exist may be accounted for by differences in age and in contraction conditions. Thus, in distomes of the same lot there are some in which the seminal vesicle and seminal receptacle are clearly defined, some in which the seminal vesicle cannot be made out, some in which the seminal receptacle cannot be seen, and some in which neither of the seminal vessels can be distinguished. Evidently conditions varying from plethora to emptiness account for the apparent variation in these organs. In like manner differences in states of contraction, especially of the neck, explain many apparently radical differences in relative proportions. Differences harder to reconcile are seen in a tendency of the testes to be more or less lobed. Also, the ventral sucker tends in some to be a little larger than the oral sucker. (U.S.N.M. No. 8297.)

TABLE 26.—*Measurements of six specimens of* Homalometron pallidum *in balsam*

Measurement	1	2	3	4	5	6
	Mm.	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*
Length	3.74	3.39	3.57	2.31	3.50	3.75
Maximum breadth	.66	.48	.49	.95	.42	.52
Oral sucker, length	.28	.25	.28	.24	.25	.32
Oral sucker, breadth	.34	.19	.24	.24	.20	.22
Length of prepharynx	.07	.25	.25	.08	.21	.28
Pharynx, length	.19	.14	.17	.17	.14	.21
Pharynx, breadth	.15	.11	.14	.11	.10	.14
Length of esophagus	.07	.14	.08	.07	.10	.16
Ventral sucker, length	.31	.25	.36	.28	.30	.36
Ventral sucker, breadth	.31	.14	.25	.34	.21	.22
Ova, 0.09 by 0.06.						

From tautog: One, collected April 26, 1915. Measurements in balsam: Length, 0.81 mm.; breadth, 0.35 mm.; diameter of oral sucker, 0.15 mm., of pharynx, 0.08 mm., of ventral sucker, 0.15 mm.

Subfamily STEPHANOPHIALINAE Nicoll, 1909

Genus CREPIDOSTOMUM Braun, 1900

CREPIDOSTOMUM FARONIS (O. F. Müller)

PLATE 22, FIGURE 289

Crepidostomum laureatum (Zeder, 1800), BRAUN, 1900, STILES and HASSALL, U. S. Hyg. Lab. Bull. 37, p. 140, 1908.
Crepidostomum faronis (O. F. Müller), LÜHE, *in* Brauer's Süsswasserfauna Deutschlands, vol. 17, Trematodes, p. 63, fig. 54, 1909.

Body smooth, tapering slightly to each end; six short, blunt papillae around oral sucker, four dorsal and two ventral; ventral sucker larger than oral; prepharynx very short; pharynx much smaller than oral sucker; esophagus about as long as pharynx; intestinal rami extend nearly to posterior end. Genital pore on median line, in front of working of intestine, near posterior end of pharynx; cirrus smooth, cirrus pouch extends back of ventral sucker along its left border and encloses the seminal vesicle at its posterior end. Testes about middle of postacetabular region, one following the other, outlines more or less irregular. Ovary subglobular, a short distance back of ventral sucker, to left of median line; shell gland on posteromedian border of ovary. A yolk reservoir was noted in one specimen between the left anterior border of the first testis and the ovary; vitellaria diffuse, with coarse lobules filling the post-testicular space and extending forward to the level of the posterior end of the pharynx. Uterus between first testis and ventral sucker. The metraterm lies on the dorsal side of the ventral sucker, to the right of the cirrus-pouch. Ova not numerous, average in balsam 0.08 by 0.04 mm. The number in three specimens in balsam was 32, 42, and 90, more or less, respectively.

Host.—Brook trout (*Salvelinus fontinalis*).

Record of collections.—About 25 trout were examined for internal parasites on July 4, 1905, at Alder Lake in the Catskills, New York; 2 distomes found, 1 from each of two fish. (U.S.N.M. No. 8298.) Measurements of one, life: Length, 2.45 mm., breadth, 1.26 mm.; diameter of oral sucker, 0.32 mm., of pharynx, 0.23 mm., of ventral sucker, 0.43 mm.; ova, 0.06 by 0.045 mm. When compressed the greatest breadth was at about the anterior third at the level of the ventral sucker, thence tapering to the buntly rounded anterior end, and more gradually, to the posterior end. A slide contains three specimens collected June 26, 1911, not in good condition. My notes made during my second visit to Alder Lake are missing.

TABLE 26.—*Measurements of three specimens of* Crepidostomum faronis *in balsam*

Measurement	1[1]	2[1]	3[1]
	Mm.	*Mm.*	*Mm.*
Length	2.97	2.55	2.53
Breadth, level of oral sucker	.46	.42	.24
Breadth, level of ventral sucker	1.15	1.08	.66
Breadth, level of testes	1.06	.87	.62
Anterior edge of ventral sucker to anterior end	.77	.62	.63
Posterior edge of ventral sucker to ovary	.06	.13	.07
Posterior edge of ventral sucker to first testis	.46	.52	.56
Posterior edge of second testis to posterior end	.84	.70	.56
Oral sucker, length	.29	.24	.17
Oral sucker, breadth	.35	.32	.24
Pharynx, length	.21	.15	.11
Ventral sucker, length	.43	.38	.28
Ventral sucker, breadth	.49	.39	.31
Ovary, length	.25	.21	.24
Ovary, breadth	.21	.21	.20
First testis, length	.22	.18	.22
First testis, breadth	.25	.35	.28
Second testis, length	.24	.21	.28
Second testis, breadth	.28	.28	.29

[1] Ventral view. [2] Lateral view.

Family DIPLOPROCTODAEIDAE Ozaki, 1928

Genus BIANIUM Stunkard, 1930

BIANIUM PLICITUM (Linton)

PLATE 6, FIGURE 57; PLATE 7, FIGURES 58–64

Distomum sp. LINTON, Proc. U. S. Nat. Mus., vol. 20, pp. 537, 538, figs. 1, 2, 1898; Bull. U. S. Fish Comm. for 1899, vol. 19, p. 464, 1901; Bull. Bur. U. S. Fish Comm. for 1904, vol. 24, pp. 359, 385, 402, fig. 165, 1905.

Psilostomum plicitum LINTON, Proc. U. S. Nat. Mus., vol. 73, art. 1, p. 5, fig. 7, 1928.

Bianium concavum STUNKARD, Anat. Rec., vol. 47, p. 362, 1930.

Bianium plicitum (LINTON), STUNKARD, Zeitschr. für Parasitenk., vol. 3, pp. 715–719, figs. 3–7, 1931.

Body oblong, anterior end, when flattened, with margins of neck slightly expanded and more or less undulate; neck and anterior part of body densely covered with minute spines; oral sucker a little larger than ventral sucker, its opening ventral, its anterior border a short distance back of the anterior end of the body; pharynx variable, usually broader than long, its anterior border in some cases scalloped; prepharynx and esophagus short; intestinal rami extend to posterior end of body, where they open by distinct ani at the posterolateral margins.[13] Genital pore at left anterior edge of ventral

[13] Dr. Stunkard has called my attention to the presence of two distinct anal openings in this distome. I had overlooked this unique character, possibly because the specimens examined most closely had the intestinal rami hidden by the vitellaria, but probably because the attention that would be required to lead to such an unlooked-for characteristic was not given.

sucker; cirrus smooth; cirrus bulb near left dorsal margin of ventral sucker, and extending back of ventral sucker, enclosing the prostatic cells and a seminal vesicle at its posterior end. There is a second seminal vesicle connected with the base of the cirrus bulb by a short vas deferens. The second seminal vesicle is, in some cases, relatively large, in others it is small and obscured by the ova. Testes two, situated toward the posterior end, one following the other closely, and usually slightly diagonally placed, in some cases slightly lobed. Ovary profoundly lobed, as many as twenty lobes were counted in a few instances, situated ventrally at the anterior border of the first testis. Seminal receptacle elongated, at the left side of the ovary and first testis. Laurer's canal enters the seminal receptacle at its posterior end. The uterus lies between the ovary and the ventral sucker. The thick-walled metraterm lies on the left side of the cirrus pouch; ova from about 0.06 by 0.04 mm. to 0.07 by 0.05 mm. in balsam, the shells rather thin and usually collapsed in balsam mounts; vitellaria diffuse, from posterior end to ventral sucker, their breadth on the margins often from one-fourth to one-third the breadth of the body; yolk reservoir at posterior border of ovary. The excretory vessel at the posterior end of the body extends forward to about the anterior end of the first testis. Measurements in balsam: Length, 3.12 mm.; breadth, 1.24 mm.; oral sucker, length, 0.27 mm., breadth, 0.28 mm.; pharynx, length, 0.18 mm., breadth, 0.25 mm.; diameter of ventral sucker, 0.25 mm.; ova, 0.07 by 0.04 mm. An average of seven distomes, maximum length 3.12 mm., minimum 1.40 mm., gave the following results: Oral sucker, length, 0.19 mm., breadth, 0.22 mm.; pharynx, length, 0.14 mm., breadth, 0.18 mm.; ventral sucker, length, 0.19 mm., breadth, 0.21 mm.

Hosts.—Smooth puffer (*Lagocephalus laevigatus*), tomcod (*Microgadus tomcod*), puffer (*Sphoeroides maculatus*).

Record of collections.—From smooth puffer: Proc. U. S. Nat. Mus., vol. 20, pp. 537, 538, pl. 53, figs. 1, 2, 1898; Bull. U. S. Fish Comm. for 1899, p. 464, 1901. One, collected July 17, 1906.

From tomcod: One (U.S.N.M. No. 8299), collected June 8, 1914. Measurements in balsam: Length, 2.38 mm.; breadth, 0.98 mm.; diameter of oral sucker, 0.21 mm., of pharynx, 0.17 mm., of ventral sucker, 0.19 mm.; ova, 0.066 by 0.033 mm. Pharynx with sinuous anterior border.

From puffer: Bull. U. S. Fish Comm. for 1899, p. 464, 1901. Fifty-two (U.S.N.M. No. 8300), collected July 9, 1904, from intestines of two fishes. Nine, collected August 17, 1904. Twenty-eight, collected May 31, 1905. Most of these came from a piece of intestine of the host 40 mm. in length, preserved in formalin. Twelve, collected by Dr. Irving I. Field, July 8, 1905, from intestine of the host; white, squarish distomes. Thirty-four, collected August 6, 1906, from two

fishes; small, greenish or yellowish white, usually rather squarish in outline; that is, ends truncate and sides linear; lateral margins of neck expanded, in some cases folded under ventrally.

Two, collected August 9, 1906, from intestine of one fish. One, collected August 10, 1906, from intestine of one fish. Four, collected August 16, 1906, from intestine of one fish. Three, collected August 17, 1906, from intestine of one fish. Four, collected August 18, 1906, from intestine of one fish. Five, collected August 23, 1906, from intestine of one fish. One hundred and fourteen, collected August 1, 1907, from the intestines of two fishes. Thirty-four, collected August 2, from one fish. Many, collected August 10, from one fish. One hundred and fifty-one, collected June 28, 1910, from intestines of four fishes.

One hundred and ten, collected June 30, 1910, from two fishes; yellowish white, some rose color; shape irregular, many almost rectangular, others roughly triangular, tapering anteriorly and retuse at posterior end, a few arcuate; flattened under the cover-glass they become oblong with bluntly rounded anterior, and more or less truncated posterior ends. Measurements of largest, life: Length, 3.95 mm.; breadth, 1.57 mm.; diameter of oral sucker, 0.39 mm., of pharynx, 0.35 mm., of ventral sucker, 0.39 mm.

Ninety-three, collected July 5, 1910, from nine fishes. Twenty, collected July 27, from one fish; one of these, an adult with ova, from a cyst on the intestine of the host. Twenty-eight, collected July 5, 1910, from each of two fishes, number not recorded. One, collected September 6, 1910; two fishes examined. Fifty-two, collected June 1, 1914, from 15 fishes. Forty-five, collected June 8, 1914, from one fish. One hundred and thirty-nine, collected June 9, 1914, from one fish, six fish examined. Eighty-eight, collected June 8, 1915, from 16 fishes. One, collected July 2, 1915.

Family BUNODERIDAE Nicoll

Genus BUNODERA Railliet, 1896

BUNODERA NODULOSA (Froelich)

PLATE 22, FIGURES 290, 291

On April 23, 1914, Mr. Edwards examined 12 yellow perch (*Perca flavescens*) and found two distomes that appear to belong to this species (U.S.N.M. No. 8301).

Note on formalin material: Globular, or nearly so; dorsal region and neck white; ventral region swollen with ova, in which the eye spots of the contained miracidia can be seen; ventral sucker white with circular opening, slightly prominent, like an inverted saucer. The mouth is surrounded by six short, blunt papillae. Length,

2.25 mm.; breadth, 1.5 mm.; thickness, 1.6 mm.; ova, 0.077 by 0.042 mm.

Measurements in balsam: Length, 1.12 mm.; breadth, 0.84 mm.; diameter of oral sucker, 0.42 mm., of ventral sucker, 0.42 mm.; ova, 0.045 by 0.030 mm. to 0.069 by 0.045 mm.

Details of the anatomy are hidden by the mass of ova. This species has been found in Canada by Stafford (Zool. Anz., vol. 27, pp. 489, 490, 1904). So far as the anatomy can be made out these distomes are in agreement with Stafford's material, although they are somewhat smaller. The measurements of the ova are not given by Stafford. Looss (Zool. Jahrb., vol. 12, p. 598, 1899) gives the size of the ova 0.10 by 0.05 mm. He notes also the occurrence of miracidia with eye spots in the ova.

Family AZYGIIDAE Odhner, 1911

Genus AZYGIA Looss, 1899

AZYGIA LONGA (Leidy)

PLATE 22, FIGURES 292–297

Azygia longa (Leidy), MANTER, Illinois Biol. Mon., vol. 10, no. 2, pp. 63–72, figs. 19, 20, 30, 1926 (synonymy, p. 63).

Upon reviewing the distomes in my collection I find examples from three species of fishes, two fresh water and one marine, which, according to Manter's synopsis (loc. cit., p. 78) are to be referred to the species *Azygia longa* (Leidy). A brief description of this material is given as supplementary to Manter's careful diagnosis of this widely distributed and variable species.

Hosts.—Eastern pickerel (*Esox niger*), small-mouthed black bass (*Micropterus dolomieu*), cutlassfish (*Trichiurus lepturus*).

Record of collections.—From eastern pickerel, 12 distomes (U.S.N.M. No. 8302) attached to walls of stomach, collected May 5, 1898, by F. L. Harvey, Orono, Maine. Neck and anterior part of body nearly cylindrical; posterior part of body may be slightly compressed, smooth, but with fine transverse rugae; oral sucker larger than ventral; pharynx short, cylindrical; esophagus very short; intestinal rami reach to posterior end. Genital pore at anterior border of ventral sucker, on median line; cirrus-pouch, enclosing the prostate gland and coiled vas deferens, at anterior dorsal border of ventral sucker; cirrus and metraterm opening into a common atrium. Testes small, near together, one following the other, nearer to posterior end than to ventral sucker. The ovary is in front of the first testis, from which it was separated, from 0.08 to 0.15 mm. The shell gland and yolk reservoir are situated on the anterior and anterodorsal border of the ovary. Laurer's canal was noted, but no seminal receptacle

was seen. The uterus occupies the space between the shell gland and the ventral sucker. The vitelline glands are marginal and extend from a point a short distance back of the ventral sucker to a point about halfway between the second testis and the posterior end. Measurements of one of larger specimens in balsam: Length, 6.50 mm.; maximum diameter, 0.75 mm.; oral sucker, length, 0.67 mm., breadth, 0.60 mm.; pharynx, length, 0.28 mm., breadth, 0.21 mm.; ventral sucker, length, 0.36 mm., vertical diameter, 0.24 mm. An average of 36 of the larger ova, in a series of sections, was 0.042 by 0.025 mm.; the largest observed measured 0.054 by 0.033 mm.

From small-mouthed black bass: Collected by J. L. Robertson at Culver Lake, N. J., one specimen in June, 1905, seven specimens on November 15, 1907 (U.S.N.M. No. 8303). These distomes from the black bass differ from those found in the pickerel in the relative positions of testes and ovary. In the distomes from the pickerel the testes are separated from each other by a space equal to or greater than the diameter of a testis, and the ovary is separated from the first testis by a space about equal to its diameter, while in the distomes from the bass the testes and ovary are very close together, in most cases being actually in contact with each other. In four of the six mounted specimens the ovary lies directly in front of the first testis, in the others it lies beside the first testis, being crowded back by the uterus. In an immature specimen 2.17 mm. in length the ovary is separated from the first testis by a space nearly equal to its diameter. In another, immature, specimen, 2.10 mm. in length, the testes are in contact with each other, and the ovary is in contact with the anterior edge of the first testis. An average of 15 of the larger ova, in balsam mounts, was 0.056 by 0.029 mm.; the largest, 0.057 by 0.030 mm.; the smallest, 0.048 by 0.027.

From cutlassfish: This record is based on a series of sagittal sections of one distome, and a series of frontal sections of the anterior end of another. These sections occur in a lot which was prepared of the distome *Sterrhurus monticellii* from the cutlassfish. These sections are on a slide along with sections of a specimen of *S. monticellii*. Careful search was made for other examples of *Azygia* among the large number of *S. monticellii* in the collection but none were found.

The agreement between this material from the cutlassfish and that from the bass and pickerel is close. The testes and ovary are in contact with each other, as in the bass. The vitellaria are lateral, between the lateral margin and the intestinal rami, distributed more ventrally than dorsally, and extend from about 0.15 mm. back of the ventral sucker nearly to the posterior end. Ova numerous, maximum about 0.06 by 0.03 mm. Ova in the anterior folds of the uterus contain miracidia.

The following measurements are given for purposes of comparison with measurements tabulated in Manter's monograph:

TABLE 27.—*Measurements of nine specimens of* Azygia longa

Measurement	1[1]	2[1]	3[2]	4[2]	5[2]	6[2]	7[2]	8[3]	9[4]
	Mm.	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*
Length	6.65	5.46	7.00	5.74	5.39	4.90	2.10	4.00	3.00
Breadth	.70	.63	.91	.70	.60	.59	.42	.43	.63
Oral sucker, diameter	.56	.53	------	------	------	------	------	------	------
Oral sucker, length	------	------	.49	.60	.35	.35	.28	.42	.56
Oral sucker, breadth	------	------	.63	.46	.52	.49	.31	.42	.52
Pharynx, length	------	------	.21	.28	.21	.21	.14	.21	.25
Pharynx, breadth	------	------	.21	.25	.15	.17	.11	.16	.21
Ventral sucker, diameter	.46	.39	------	------	------	------	------	------	------
Ventral sucker, length	------	------	.43	.39	.32	.28	.25	.32	.45
Ventral sucker, breadth	------	------	.45	.45	.39	.38	.27	.25	.41
Posterior edge of ventral sucker to middle of ovary	2.33	2.10	2.24	2.03	2.06	2.10	.50	.47	------
Posterior edge of ventral sucker to anterior end	1.71	1.54	1.47	1.96	1.72	1.12	.98	1.51	1.92
Posterior edge of ventral sucker to anterior vitellaria	.42	.28	.24	.35	.35	.35	------	±.14	±.15
Posterior edge of testes to posterior end	1.71	1.33	1.89	1.33	1.12	1.15	.52	.80	------
Vitellaria on left beyond testes	.98	1.26	.78	±.90	±.34	.90	------	±.28	------
Vitellaria on right beyond testes	1.02	1.23	1.05	±.42	±.56	.60	------	±.21	------

[1] Balsam mounts from *Esox niger*.
[2] Balsam mounts from *Micropterus dolomieu*.
[3] Sagittal sections.
[4] Frontal sections from *Trichiurus lepturus*.

Genus OTODISTOMUM Stafford, 1904

OTODISTOMUM CESTOIDES (van Beneden)

Distomum cestoides VAN BENEDEN, Mem. Acad. Roy. Belgique, vol. 38, p. 17, pl. 4, fig. 9, 1870.

Distomum veliporum Creplin (?), LINTON, Proc. U. S. Nat. Mus., vol. 20, pp. 521, 522, 1898.

Otodistomum veliporum Creplin, STAFFORD, Zool. Anz., vol. 27, pp. 482, 483, 1904.

Xenodistomum melanocystis, ibid., p. 483.

Otodistomum cestoides (van Beneden), MANTER, Illinois Biol. Mon., vol. 10, No. 2, pp. 140–186, figs. 1–6, 8–10, 23–26, 28, 1926.

An intensive study of this distome has been made by Manter, loc. cit.

Hosts.—Clear ray (*Raja diaphanes*), barndoor skate (*Raja laevis*), filefish (*Ceratacanthus schoepfi*), fishingfrog (*Lophius piscatorius*), rudderfish (*Palinurichthys perciformis*).

Record of collections.—From clear ray: One, immature (U.S.N.M. No. 8304), collected May 18, 1914. Measurements in formalin: Length, 7.5 mm.; breadth, 1.5 mm.; thickness, 1 mm. Measurements in balsam: Length, 5.5 mm.; maximum breadth, at level of ventral sucker, 1.33 mm., breadth midway between ventral sucker and posterior end, 1.29 mm.; oral sucker, length, 0.66 mm., breadth, 0.70 mm.; pharynx, length, 0.38 mm., breadth, 0.21 mm.; ventral sucker, length,

0.97 mm., breadth, 1.04 mm. Ovary, 0.9 mm. back of ventral sucker, length, 0.14 mm., breadth, 0.25 mm.; testes about equal, length, 0.21 mm., breadth, 0.35 mm. The testes and ovary are close together, the group measuring about 0.46 mm. in length and 0.56 mm. in breadth. Aperture of oral sucker, length, 0.14 mm., breadth, 0.22 mm., of ventral sucker, length, 0.35 mm., breadth, 0.24 mm. (U.S.N.M. No. 8304.)

From barndoor skate: One, fragment (U.S.N.M. No. 8305), collected October 28, 1898. One, fragment; length in formalin, 10 mm. Two, collected November 4, 1898; lengths, 24 and 25 mm., respectively; breadth, 3.5 mm., nearly linear; neck reflected dorsally; color in formalin yellowish white to ashy gray, with dark blotches. Two, collected October 19, 1903; length of larger specimen, 54 mm.; of nearly uniform size from ventral sucker to middle of postacetabular region, thence tapering very slightly to posterior end; distance from anterior end to posterior edge of ventral sucker, 9 mm.; neck reflected dorsally, nearly at right angles to body. Fourteen, collected May 13, 1904; longest in formalin, 28 mm. Three, collected October 28, 1911; lengths in formalin, 11, 12, and 15 mm., respectively; breadth, 2 to 2.25 mm. Three, collected October 10, 1912; lengths in formalin, 22, 23, and 27 mm., respectively; maximum breadth, 4.5 mm. Sixteen, collected April 29, 1913; length of one in formalin, 47 mm., breadth, 4.5 mm. Five, collected April 30, 1913, 12 to 20 mm. in length in formalin. Five, collected May 6, 1913; 10 to 16 mm. in formalin. Four, collected May 9, 1913; largest in formalin, length 27 mm., maximum breadth, 4.5 mm., maximum thickness, 3 mm.; smallest, length, 23 mm., maximum breadth, 3 mm., tapering to posterior end; in each the neck was reflected dorsally nearly at right angles to the body.

The ova, as seen in a series of sections, are about 0.078 mm. by 0.051 mm.; thickness of shell, 0.003 mm.

From filefish: Immature trematodes encysted under the serous coat of the liver of the filefish are here recorded. One, collected July 11, 1910, from serous coat of liver near gall bladder of host; length, 13 mm., diameter, 3.5 mm.; nearly linear, moderately compressed, intestines voluminous; in balsam, diameter of oral sucker, 0.60 mm., of pharynx, 0.42 mm., of ventral sucker, 1.18 mm.

One, collected July 13, 1911, under serous coat of liver of host. Measurements in balsam: Length, 2.24 mm., maximum breadth, 0.73 mm.; oral sucker, length, 0.17 mm., breadth, 0.22 mm.; pharynx, length, 0.17 mm., breadth, 0.15 mm.; ventral sucker, length, 0.31 mm., breadth, 0.35 mm.

From fishingfrog: Immature distomes from the stomach wall of the goosefish are here recorded. The rudiment of the cirrus pouch lies at the posterior border of the pharynx. Rudiments of the ovary

and testes are present, the ovary being in front of the testes. The worms when compressed are usually rather slender and of nearly uniform breadth. The ratio of the suckers would point to *O. veliporum* rather than to *O. cestoides*. Since the studies of Manter show that differences in ratio of suckers are of little value, and other workers, as Mühlschlag and Odhner, rely mainly on the ova to distinguish between species, it seems best to record these immature distomes under the species *O. cestoides*.

Encysted distomes from the goosefish are recorded by Stafford (Zool. Anz., vol. 27, p. 483, 1904) and referred by him to a new genus and species, *Xenodistomum melanocystis*. Of these encysted distomes he says: "Resembles preceding species (*Otodistomum veliporum* Creplin) but is immature with rudiments of genital organs and ducts."

Five, collected November 11, 1904.

Four, collected July 31, 1905, in cysts on viscera of host. Measurements, life: Length, 4 mm.; breadth, 1.5 mm.; oral sucker, length, 0.35 mm., breadth, 0.49 mm.; pharynx, length, 0.30 mm., breadth, 0.20 mm.; ventral sucker, length, 0.50 mm., breadth, 0.64 mm.; intestines voluminous.

Two, immature, collected July 2, 1910; length, 4 and 5 mm., respectively; breadth, 1 mm. Single excretory vessel from posterior end to a point about halfway between the ventral sucker and the posterior end, there dividing into two lateral branches which were traced to the anterior sucker, but were not seen to unite.

Three, immature, collected July 29, 1910; length, 5 mm. A number of cysts, on and in the stomach wall, most of them containing larvae of the cestode *Rhynchobothrium imparispine*, had been removed from a goosefish. These distomes were found among this material.

Eight, collected May 22, 1911; lengths in formalin, 3 to 6.5 mm. Mr. Edwards' notes do not state where these distomes were found in the goosefish, but they resemble in every particular distomes from cysts on the viscera.

Thirty, immature, collected April 10, 1913; in dark-brown cysts in the stomach wall; cysts oval, 3.5 mm. in diameter, in formalin; brown color due to degenerate tissue; worms plump, from 3 to 5 mm. in length. Measurements in glycerin: Length, 3.12 mm., breadth, 0.87 mm.; breadth of oral sucker, 0.46 mm., of ventral sucker, 0.60 mm.

One, collected July 15, 1914, found by Dr. MacCallum on mesentery of host.

Three (U.S.N.M. No. 8306), collected August 17, 1923, in cysts associated with cestode cysts. Measurements in balsam: Length, 10.5 mm., breadth, 1.65 mm.; oral sucker, length, 0.66 mm., breadth, 0.74 mm.; pharynx, length, 0.28 mm., breadth, 0.25 mm.; diameter of

ventral sucker, 1.09 mm.; cirrus pouch, length, 0.23 mm., breadth, 0.21. mm.

Fourteen, immature, collected July 17, 1924, encysted in submucosa of stomach, surrounded by black, granular pigment; some of them rather active after liberation from cysts. Measurements, life, compressed: Length, 8 mm., breadth, 1.40 mm.; oral sucker, length, 0.67 mm., breadth, 0.53 mm.; pharynx, contracting and expanding, length and breadth at time of measuring, about 0.28 mm.; ventral sucker, length, 0.95 mm., breadth, 0.92 mm.

Two, immature, collected July 7, 1926, from cysts on viscera of host. Seven, collected August 12, 1926, in dark-brown cysts in stomach wall. Measurements in balsam: Length, 0.6 mm.; breadth, 1.61 mm.; oral sucker, length, 0.53 mm., breadth, 0.56 mm.; pharynx, length, 0.28 mm., breadth, 0.21 mm.; ventral sucker, length, 0.95 mm., breadth, 0.91 mm.; cirrus pouch, length, 0.21 mm., breadth, 0.14 mm.

Ratio of suckers, average of six in balsam: Oral sucker, length, 0.503 mm., breadth, 0.588 mm.; ventral sucker, length, 0.875 mm., breadth, 0.871 mm.

From rudderfish: One, immature, collected August 22, 1910; recorded here provisionally.

Note made at time of collecting: Length, 5 mm.; breadth, 1 mm.; thickish, white, smooth, nearly linear, bluntly tapering at each end; dark intestine showing through body wall; black contents of excretory vessel pressed out at excretory pore when cover glass was placed on specimen; genitalia not developed. Measurements in balsam: Length, 4.34 mm., breadth, 0.70 mm.; oral sucker, length, 0.30 mm., breadth, 0.38 mm.; pharynx, length, 0.25 mm., breadth, 0.22 mm.; ventral sucker, length, 0.46 mm., breadth, 0.53 mm. The intestines extend to the posterior end; no trace of genitalia.

Family HEMIURIDAE Looss, 1907

Subfamily SCLERODISTOMINAE Odhner, 1927

Genus HIRUDINELLA Blainville, 1824

HIRUDINELLA FUSCA (Bosc)

PLATE 12, FIGURES 134–144; PLATE 13, FIGURES 145–157

Distomum clavatum Rudolphi, LINTON, Proc. U. S. Nat. Mus., vol. 20, pp. 539, 540, pl. 53, figs. 8–11 (from *Xiphias gladius*), 1898; Bull. U. S. Fish Comm. for 1899, p. 445 (from *Thunnus thynnus*), p. 448 (from *Xiphias gladius*), 1901.

Distomum lageniforme LINTON, Proc. U. S. Nat. Mus., vol. 20, pp. 524, 525, pl. 47, figs. 1, 2, 1898; Bull. U. S. Fish Comm. for 1899, from *Remora remora*, probably belongs here.

Distomum fuscum Poirier (Bosc), MÜHLSCHLAG, Zool. Jahrb., vol. 37, pp. 217–232, pl. 9, figs. 4–7, 8 figs., 1914.

Hirudinella clavata (Menzies), Cooper, Trans. Roy. Soc., Canada, ser. 3, vol. 9, p. 186 (from *Thunnus thynnus*), 1915.

Hirudinella fusca (Poirier, 1885), Manter, Illinois Biol. Mon., vol. 10, no. 2, pp. 104–107, figs. 75–79 (from *Xiphias gladius*), 1926.

Large distomes belonging to the group represented by *Distomum clavatum* Rudolphi are here considered. The anatomy of these distomes, so far as it is shown by sectioned material from the swordfish, horse mackerel, and cutlassfish, is in general agreement with Manter's excellent description of *H. fusca* (Poirier) from the swordfish.

Externally the distomes from the swordfish exhibit some fairly constant differences from those of the horse mackerel. Thus, in distomes from the swordfish, the neck in alcoholic specimens is usually arched and slender, the body somewhat elongated, increasing in diameter from the ventral sucker toward the posterior end, then tapering quickly and rather coarsely wrinkled (fig. 134). In distomes from the horse mackerel the neck is very short, conical, and reflected dorsally; body, in most cases, cylindrical and crossed by fine wrinkles (fig. 135). Forms more or less intermediate, however, occur among the distomes from each host.

These distomes agree in having the opening of the metraterm behind the genital papilla. The latter is a very muscular structure and in some cases was found to be protruding from the genital pore (fig. 138). A large prostate accompanies the more or less coiled or folded ejaculatory duct, and is followed posteriorly by the seminal vesicle, which is also more or less coiled or folded. The two testes are close to the posterior border of the ventral sucker, close together, and diagonally placed. The ovary is immediately behind the testes, and the shell gland is posterior and ventral to the ovary. The tubular vitellaria and folds of the uterus extend from the ventral sucker about halfway to the posterior end of the body. An interpretation of the genital ducts, associated with the shell gland, as shown in serial sections of a distome from the swordfish, is given in figures 151–153. Laurer's canal approaches the shell gland at its anterodorsal border near the ovary. It enlarges to form a relatively small seminal receptacle, which has the appearance of being divided into five or six compartments. This may represent the more or less coiled portion of the empty canal observed in sections of the distome from the cutlassfish (fig. 150). This observation was made on a series of frontal sections of a distome which had been flattened at the time of fixation. Laurer's canal, in this series of sections, in its course to the dorsal surface, lies near the posterior border of the second testis.

Structures from the subcuticular layer penetrate the cuticle (fig. 155). In one series of sections the cuticle was partly macerated and presented the appearance of being finely papillate, or spinose.

Additional details given in notes under the several hosts.

Hosts.—*Histrio pictus*, rudderfish (*Seriola zonata*), horse mackerel (*Thunnus secundodorsalis*), goggler (*Trachurops crumenophthalma*), cutlassfish (*Trichiurus lepturus*), swordfish (*Xiphias gladius*).

Record of collections.—One, immature (U.S.N.M. No. 8307), collected September 5, 1919, from *Histrio pictus*. This specimen, when first noted, had been cut into three pieces, one cut passing just behind the genital pore, the other a short distance back of the ventral sucker. The body was minutely and transversely wrinkled, and pinkish in color. Aggregate length, before flattening under pressure, about 8 mm.; maximum breadth, 3.5 mm. Measurements in balsam: Length, 13.5 mm.; breadth at oral sucker, 1.54 mm., at ventral sucker, 2.31 mm., maximum breadth, at 3.5 mm. from the posterior end, 3.5 mm.; oral sucker, length, 1.12 mm., breadth, 1.26 mm.; pharynx, length, 0.84 mm., breadth, 0.91 mm.; diameter of ventral sucker, 1.47 mm.; distance between suckers, 2.5 mm. There is no prepharynx. The pharynx tapers from a breadth of 0.9 mm. at its anterior end to about 0.6 mm. at its posterior end. Esophagus short; the voluminous intestines reach to the posterior end. The genital pore is at the right posterior edge of the pharynx. The genital papilla is about 0.7 mm. in length and 0.5 mm. in breadth. The opening of the uterus is not clearly shown, but it appears to be behind the genital papilla. The testes lie near the posterior edge of the ventral sucker. The left testis is subtriangular in outline. Its anterior border is practically contiguous to the posterior edge of the ventral sucker, and its median end on the median line. The right testis is bluntly slipper shaped, its median end contiguous to the posterior median border of the left testis. It is broader than long, and at its lateral end is prolonged anteriorly until it is nearly on a level with the anterior edge of the left testis. The ovary is a short distance behind the testes on the median line. It is much smaller than the testes, subglobular, and is surrounded by a rather thick wall. It is made up of a relatively small number of large, nucleated cells. The rudiment of the shell gland lies at the median and posterior border of the ovary. The uterus, represented by a slender but well-defined tube, lies in a tangled coil on the right side of the ovary, and passes in a wide curve back to within 4 mm. of the posterior end, and forward between the testes, and dorsal to the ventral sucker, toward the genital pore. Certain slender, irregular, threadlike structures in the vicinity of the ovary were noted. They may be rudiments of the vitellaria.

From rudderfish: One, collected September 19, 1912. Measurements in formalin: Length, 12 mm.; breadth, 6 mm.; thickness, 5 mm. Neck and suckers pale, yellowish white; body darker and crossed by transverse rugae (fig. 137).

From horse mackerel: Sixteen (U.S.N.M. No. 8310), collected June 16, 1911. Note made on formalin material: Much variation in size. Measurements, largest: Length of body, 17 mm., of neck, 5 mm.; diameter of body, 6.7 mm. Smallest, length of body 5 mm., of neck, 2.5 mm.; diameter of body, 2.25 mm. In all of these distomes both the body and neck were cylindrical, or nearly so, and the neck was reflected nearly, and in some cases, quite at right angles to the body, in most cases arcuate, but in some straight.

Four, collected June 23, 1911. Measurements in formalin: Largest, length of body, 14 mm., of neck, 3 mm.; diameter of body, 3 mm.

Fourteen (U.S.N.M. No. 8310), collected August 8, 1913, from stomach of host. Pale, translucent pink to brick red, with dark brown intestines showing through the body wall; actively contracting. Smallest, at rest, length about 15 mm., largest, 30 mm. When placed in sea water they exhibited a tendency to adhere to each other by their ventral suckers.

Two, collected July 31, 1914, in stomach of host.

One (U.S.N.M. No. 8308), collected June 29, 1915. This specimen stretched to a length of 40 mm. in sea water, and contracted to 20 mm. when placed in killing fluid. Measurements of a specimen from the horse mackerel mounted in balsam: Length, 14 mm.; breadth, 3.25 mm.; oral sucker, length, 0.92 mm., breadth, 1.00 mm.; breadth of pharynx, 0.56 mm.; ventral sucker, length, 1.82 mm., breadth, 1.78 mm. The testes in this specimen, at the posterior edge of the ventral sucker, are nearly transverse, their median ends touching each other; right testis, length, 0.42 mm., breadth, 0.84 mm.; left testis, length, 0.56 mm., breadth, 0.84 mm.; each testis tapers laterally from its median end. Ovary close to posterior edge of testes, median, its anterior edge convex, posterior edge nearly straight; length, 0.14 mm., breadth, 0.43 mm. The intestines are voluminous, filled with dark-colored food material, and extend to the posterior end of the body. In a series of cross sections (thickness about 0.016 mm.) numbering about 776, the first trace of vitellaria is in the 237th section, and the last in the 538th. The voluminous uterus, filled with enormous numbers of eggs, extends from a point dorsal to the posterior edge of the ventral sucker, at about the 209th section, to about the 510th section. Ova, about 0.036 by 0.024 mm. The genital ducts associated with the shell gland agree closely with the interpretation of sectioned material from the swordfish. In these sections from the horse mackerel, however, the early folds of the uterus contain sperm. The genital papilla, ejaculatory duct, prostate, and metraterm in the distomes from the swordfish and horse mackerel agree. In each the prostate is voluminous (figs. 138, 154).

The genital pore, as shown in sections, is on a level with the pharynx. In a series of cross sections of a distome in which the genital papilla is retracted, the genital pore is ventral to the posterior end of the oral sucker. It is small and occupies only three sections (thickness of sections about 0.016 mm.). The genital atrium is represented by a duct, vertical diameter 0.11 mm., transverse diameter, 0.22 mm., which continues in 47 sections, when it expands at the genital papilla. At the thirteenth section back of the first appearance of the genital papilla, the metraterm, with its thick, muscular wall first appears.

From goggler: One, immature (U.S.N.M. No. 8309), collected August 17, 1913, from cyst on intestine. This distome, when removed from the cyst, was subspherical, translucent, with a faint tinge of pink; intestines dark brown.

Measurements in balsam: Length, 3.4 mm.; maximum breadth, 2.24 mm.; oral sucker, length, 0.46 mm., breadth, 0.49 mm.; diameter of pharynx, 0.28 mm.; ventral sucker, length, 0.74 mm., breadth, 0.88 mm. The body is strongly contracted, and the voluminous intestines, containing dark brown granular material, conceal whatever rudiments of genitalia may be present.

From cutlassfish: One, collected July 1, 1903, from stomach of host. Note on alcoholic specimen: Neck short, arched; body plump, crossed by fine wrinkles; length, 17 mm.; breadth, 8 mm.; thickness, 6.5 mm.; breadth of neck at base, 4 mm., at level of oral sucker, 2.5 mm. Mr. Edwards reported that the worm when living was elongated but contracted when placed in alcohol.

The anatomy, as revealed by a series of cross sections, agrees closely with Manter's description and figures of *H. fusca.* Details of the genital ducts in the vicinity of the shell gland, as interpreted from sections, are shown in figure 150. The ova are not of uniform size, and are somewhat smaller than those in the distome from the swordfish and horse mackerel. The largest noted measured 0.036 by 0.027 mm.; average dimensions of eight of the larger ova were 0.028 by 0.021 mm.

The prostatic portion of the ejaculatory duct is nearly straight, thus differing from the distomes of the swordfish and horse mackerel in which it is more or less coiled. The ejaculatory duct, surrounded by prostatic cells, enters the muscular genital papilla near the dorsal side of the neck, extends back for a short distance, about 35 sections of the series, along the dorsal region, then, at about section 130, turns abruptly ventrad to the seminal vesicle at about the middle of the length of the ventral sucker. The seminal vesicle, sections 115–158 of the series, is tubular and loosely coiled, as many as six divisions of it appearing in a single section. The first (left) testis begins dorsal to the posterior edge of the ventral sucker, and occupies sec-

tions 202–242. The right testis lies close beside the left in sections 215–231. The ovary is subglobular and lies close to the testes on their ventral border in sections 231–244. The tubular vitellaria appear in sections 197–304, which is from the posterior margin of the ventral sucker to a point a short distance back of the middle of the length of the body. The uterus, exclusive of the slender anterior portion, metraterm, begins anteriorly dorsal to the posterior border of the ventral sucker and extends back to about the middle of the length of the body. Its voluminous folds are filled with enormous numbers of small ova. The metraterm, opening behind the genital papilla, at about section 80, passes back for a short distance on the ventral side of the ejaculatory duct and prostate, as a muscular-walled duct surrounded by gland cells. At section 113 it turns abruptly ventrad in front of a similar ventral turn of the ejaculatory duct. At section 117 the metraterm, now near the dorsal border of the ventral sucker, and with still a rather thick muscular wall, but without gland cells, passes back as a straight duct ventral to the seminal vesicle, to about the 193rd section, where it becomes convoluted, and is filled with ova. Ova occur also in the straight portion, but not uninterruptedly.

This specimen was somewhat macerated, giving to the cuticle in some places the appearance of being finely papillate.

From swordfish: Two, collected July 15, 1904, from stomach. Length, 25 mm.; diameter of neck, 1.5 mm., of body at level of ventral sucker, 4.5 mm.; maximum diameter, 6.5 mm. Color pink to reddish, with dark blotches, due to contents of intestine; coarse transverse wrinkles on ventral side of posterior half of the body. While the specimen was under examination many elongated, cylindrical egg masses were ejected from the genital pore behind the oral sucker; largest ova, 0.036 by 0.025 mm.

One, collected July 20, 1904, from stomach. General color brick red, intestines showing as black lines. Neck very actively contractile, changing rapidly from 2 to 10 mm. in length. The body did not show much activity. Length, when fixed in alcohol, 8.5 mm.

Two, collected July 13, 1911, from stomach. Color of body magenta, black intestines showing through body wall; neck paler, oral sucker whitish. Specimen, after lying in sea water over night, measured 28 mm. in length; body nearly cylindrical, 5 mm. in diameter; neck actively extending and contracting, stretching to 9 mm. or more, when it became quite slender.

Twenty-five, collected July 20, 1912, from stomach; pink to brick red; length of largest in life over 30 mm. Largest in alcohol: Length, 24 mm.; breadth, 7 mm.; thickness, 5.3 mm.; smallest, length, 11 mm.; breadth, 2.5 mm.

Twenty-two (U.S.N.M. No. 8312) collected August 8, 1927, from stomach of host; 10 to 36 mm. in length; pale pink to brick red; necks in some translucent; intestine filled with black material.

Subfamily DEROGENETINAE Odhner, 1927

Genus DEROGENES Lühe, 1900

DEROGENES VARICUS (Müller)

PLATE 12, FIGURES 128–133

Derogenes varicus (Müller), NICOLL, Parasitology, vol. 3, p. 348, 1910.—MANTER, Journ. Parasit., vol. 13, p. 17, 1925; Illinois Biol. Mon., vol. 10, no. 2, p. 103, fig. 57, 1926.—FUHRMANN, Handb. Zool., vol. 2, p. 109, fig. 133, 1928.

This species was found by Manter in 6 species of marine fishes. Nicoll reports it from 19 species of British marine fishes. Although recorded from a large number of hosts it is reported to occur only in small numbers.

Three specimens, one from each of three species of fishes, in the collection from Woods Hole fishes appear to belong to this species. The anatomy is incompletely shown in each, but so far as it is shown the agreement with this species is close.

Hosts.—Common codfish (*Gadus morrhua*), flasher (*Lobotes surinamensis*), fishingfrog (*Lophius piscatorius*).

Record of collections.—One (U.S.N.M. No. 8313), from common codfish, collected December 13, 1894, associated with 52 specimens of *Hemiurus levinseni.* Measurements in balsam: Length, 1.56 mm.; breadth, 0.39 mm.; diameter of oral sucker, 0.19 mm., pharynx, 0.09 mm., ventral sucker, 0.33 mm.; ova, 0.054 by 0.033 mm., shells thick; distance from anterior end to ventral sucker, 0.77 mm., from posterior end to ventral sucker 0.63 mm.; many of ova capped at one end.

From flasher: One (U.S.N.M. No. 8314), collected September 1, 1910. Measurements in balsam: Length, 2.00 mm., breadth, at level of ventral sucker, 0.53 mm., elsewhere from 0.28 to 0.42 mm.; oral sucker, length, 0.18 mm., breadth, 0.21 mm.; pharynx, length, 0.11 mm., breadth, 0.10 mm.; ventral sucker, length, 0.36 mm., breadth, 0.39 mm.; ova, average of ten, 0.051 by 0.036 mm., largest about 0.054 mm. by 0.036 mm., shells thick; anterior end to ventral sucker, 0.98 mm. There appears to be but one vitelline gland, posterior to the ovary on the right side. The anterior end was very mobile in the living worm.

From fishingfrog: One (U.S.N.M. No. 8315), collected August 30, 1920. Measurements in balsam: Length, 1.19 mm.; breadth, 0.36 mm.; diameter oral sucker, 0.14 mm., pharynx, 0.06 mm., ventral sucker, 0.28 mm.; ova, average of six, 0.047 by 0.032 mm., largest 0.054 by 0.039, shells thick; distance from anterior end to the ventral sucker, 0.59 mm.; few ova capped.

Genus GENARCHES Looss, 1902

GENARCHES MÜLLERI (Levinsen)

PLATE 22, FIGURES 298, 299; PLATE 23, FIGURE 300

Distomum mulleri LEVINSEN, Overs. Danske Vidensk. Selks. Forh., 1881, p. 56, pl. 2, fig. 3.
Progonus mulleri (Levinsen), Looss, Zool. Jahrb., vol. 12, p. 642, 1899.
Genarches mülleri (Levinsen), Looss, Zool. Jahrb., vol. 16, p. 732, 1902.—ODHNER, Die Trematoden des arktischen Gebietes, Fauna Arctica, vol. 4, pp. 365, 366, pl. 4, figs. 8, 9, 1905.

Three, fusiform, rusty, yellowish-red distomes from the lumpfish are referred to this species. On account of the large number of eggs in each of them, but few details of the anatomy can be made out.

The body is smooth, ventral sucker much larger than oral and situated about the middle, or a little back of the middle; pharynx much smaller than the oral sucker; no prepharynx; esophagus very short, genital pore median, at posterior end of pharynx; cirrus short, smooth; cirrus pouch small, a little behind the pharynx; seminal vesicle posterior to the cirrus pouch; testes at posterior border of ventral sucker, nearly opposite; vitelline glands two, subglobular, opposite, near posterior end; ovary to right of median line at the anterior border of the right vitelline gland; seminal receptacle behind the ovary and between the vitellaria. The thick-shelled ova fill the greater part of the body from the posterior end to the genital pore. Ova, 0.048 to 0.054 mm. by 0.033 mm., in balsam.

TABLE 28.—*Measurements of two specimens of* Genarches mülleri *in balsam*

Measurement	1[1]	2[2]
	Mm.	*Mm.*
Length	2.34	2.52
Breadth	.70	.66
Anterior end to ventral sucker	.94	1.17
Oral sucker, length	.29	.24
Oral sucker, breadth	.29	.31
Pharynx, length	.07	.07
Pharynx, breadth	.11	.10
Ventral sucker, length	.49	.42
Ventral sucker, breadth	.49	.35

[1] Ventral view. [2] Lateral view.

GENARCHES INFIRMUS, new species

PLATE 23, FIGURES 301, 302

Smooth, fusiform, greatest diameter about at level of ventral sucker; neck somewhat elongated, ventral sucker, except when the neck is contracted, being but little in front of the middle; oral

sucker subterminal, with a tuberclelike prolongation of the body in front; no prepharynx; pharynx about half the diameter of the oral sucker, or less. In most cases the esophagus appeared to be shorter than the pharynx, on account of the very contractile neck, but in the specimen sketched, fig. 301, the esophagus is longer than the pharynx, and has rather thick walls. The genital pore is on the median line behind the forking of the intestine; cirrus smooth; cirrus pouch elongate, fusiform, enclosing cells of the prostate and, at its posterior end, the seminal vesicle. The posterior end of the cirrus pouch is at the anterior edge of the ventral sucker, or slightly overlapping it dorsally. Testes near posterior edge of ventral sucker, diagonally placed; ovary behind testes and in front of the two vitellaria, which are near the posterior end, and transverse, or, in some cases slightly diagonal. The uterus extends from the level of the vitellaria to the ventral sucker; ova about 0.04 by 0.02 mm.

TABLE 29.—*Measurements of five specimens of* Genarches infirmus *in balsam*

Measurements	1	2	3	4	5
	Mm.	*Mm.*	*Mm.*	*Mm.*	*Mm.*
Length	2.00	1.89	1.68	2.00	2.31
Breadth, level of oral sucker	.08	.12	.15	.14	.15
Breadth, level of ventral sucker	.35	.28	.42	.42	.35
Breadth, near posterior end	.08	.10	.13	.11	.08
Oral sucker, length	.15	.12	.14	.12	.15
Oral sucker, breadth	.14	.12	.14	.13	.14
Pharynx, length	.07	.06	.06	.06	.07
Pharynx, breadth	.07	.07	.07	.07	.08
Ventral sucker, length	.29	.21	.26	.24	.29
Ventral sucker, breadth	.27	.29	.29	.28	.28
Ova, 0.036 by 0.018 to 0.042 by 0.021 mm.					

Type specimens.—U.S.N.M. No. 8317 (holotype and paratypes).

Host.—Chinook salmon (*Oncorhynchus tschawytscha*).

Record of collections.—Eight (U.S.N.M. No. 8317), collected May 17, 1898, from stomach of young salmon. Pinole, San Pablo Bay, California.

Six, collected November 17, 1898, from stomach of young salmon. Battle Creek, California.

GENARCHES species

PLATE 23, FIGURES 303, 304

Body smooth, long oval-elliptical, not differing much in breadth throughout, bluntly rounded at each end; ventral sucker approximately twice the diameter of the oral sucker; pharynx about half the diameter of the oral sucker; no prepharynx; esophagus, if any,

very short; rami of intestine extend to posterior end of body. Genital pore behind oral sucker; cirrus pouch short, with thick walls, partly overlapping anterior edge of ventral sucker; testes obscured by the ova, but appear to be not far back of the ventral sucker, and nearly transverse; ovary behind testes, on right side of the median line; vitellaria two, opposite, behind the ovary and near the posterior end; ova scattered through the postacetabular region, from near the posterior end to the ventral sucker; shells of ova not much collapsed.

Measurements in balsam: Length, 1.05 mm.; breadth, at level of oral sucker, 0.21 mm., at level of ventral sucker, 0.38 mm., maximum 0.39 mm.; oral sucker, diameter, 0.17 mm.; pharynx, diameter about 0.07 mm.; ventral sucker, length, 0.28 mm., breadth, 0.34 mm.; ova, average of 10, 0.040 by 0.023 mm.

Host.—Chinook salmon (*Oncorhynchus tschawytscha*).

Two distomes (U.S.N.M. No. 8318) found on slide with specimens of *Genarches infirmus*.

Measurements of smaller specimen: Length, 0.84 mm.; breadth, at level of oral sucker, 0.15 mm., at level of ventral sucker, 0.28 mm.; diameter of oral sucker, 0.12 mm., of pharynx, 0.06 mm., of ventral sucker, 0.23 mm.; ova, 0.039 by 0.039 by 0.018 mm., to 0.042 by 0.021 mm.

Subfamily HEMIURINAE Looss, 1899

Genus HEMIURUS Rudolphi, 1809

HEMIURUS APPENDICULATUS (Rudolphi)

PLATE 8, FIGURES 68–74

Distomum appendiculatum Rudolphi, LINTON, Bull. U. S. Fish Comm., for 1899, p. 289, 1900; *ibid.*, p. 415, 1901 (list of hosts with page references).

The small appendiculate distomes referred to this species have been found in many species of fishes in the Woods Hole region.

Their frequent occurrence in young fishes which feed on the intermediate hosts of this distome (copepods, etc.), and which themselves in turn become the food of a variety of fishes, doubtless accounts for the wide distribution of the species.

The following description from notes made on material from the herring (*Clupea harengus*) applies in general to forms from other hosts. Additional data will be found in the record of collections.

Body more or less fusiform, crossed anteriorly by fine lines producing serrate margins. These annulations are rather faintly shown on many of the smaller specimens. So far as my material shows, the appendix, when fully extended, is about half the length of the body. The oral and ventral suckers are near together, and the diameter of

the ventral sucker is about twice that of the oral. The diameter of the pharynx is about half that of the oral sucker. There is no esophagus, and the intestinal rami extend to the posterior end of the appendix. The genital pore is at the posterior margin of the oral sucker. The seminal vesicle is behind the ventral sucker and in front of the testes, which are near together and diagonally placed. The ovary and vitellaria are situated toward the posterior end of the body and are separated from the testes by folds of the uterus. The ovary is more or less oval in outline, the longer diameter transverse. The two vitellaria lie at the posterior margin of the ovary, and, so far as observed in material from the herring, they appear to be but little lobed. The folds of the uterus were observed to enter the appendix for a short distance. The ova measure about 0.024 by 0.014 mm. in the two principal diameters. In balsam mounts the ova are usually collapsed and much crowded together.

Hosts.—Filefish (*Ceratacanthus schoepfi*), menhaden (*Brevoortia tyrannus*), common herring (*Clupea harengus*), round herring (*Etrumeus sadina*), common eastern stickleback (*Gladiunculus bispinosus*), rudderfish (*Palinurichthys perciformis*), summer flounder (*Paralichthys dentatus*), pollack (*Pollachias virens*), glut herring (*Pomolobus aestivalis*), hickory shad (*Pomolobus mediocris*), alewife (*Pomolobus pseudoharengus*), winter flounder (*Pseudopleuronectes americanus*), common mackerel (*Scomber scombrus*), rudderfish (*Seriola zonata*), common scup (*Stendtomus chrysops*), striped anchovy (*Anchoviella epsetus*), lizardfish (*Synodus foetens*), cunner (*Tautogolabrus adspersus*), codling (*Urophycis tenuis*).

Record of collections.—From filefish: One, collected August 7, 1905. Measurements in balsam: Length, 1.54 mm.; breadth, 0.35 mm.; diameter oral sucker, 0.06 mm., pharynx, 0.04 mm., ventral sucker, 0.15 mm.; ova, 0.021 by 0.012 mm.

From menhaden: One, collected August 26, 1903; immature, very active, length varying from 0.6 to 1.2 mm.; excretory vessel filled with spherical bodies; seminal vesicle filled with sperm. One, collected July 11, 1905; measurements in balsam: Length 1.18 mm., breadth 0.19 mm.; length of appendix, 0.45 mm.; diameter of oral sucker 0.06 mm., pharynx 0.04 mm., ventral sucker 0.11 mm.; ova about 0.024 by 0.012 mm.

From common herring: Two, collected August 14, 1905; length 0.8 mm.; ova 0.024 by 0.012 mm. One hundred and fifteen distomes (U.S.N.M. No. 8319) collected July 1 to August 29, 1919, from 20 small fish, measuring from 40 to 85 mm. in length; smallest number in one fish one, largest number in one fish 20; some adult with ova. Three, collected July 17, 1920, from a 75-mm. fish. One, collected July 17, 1920, from a 75-mm. fish. Two, collected August 17, from a 60-mm. fish.

From round herring: Small appendiculate distomes were found in young round herring in 1908 on two dates in July and on five dates in August. Ten distomes were obtained from 110 fishes. Six of these distomes, all immature, belong to the species *H. appendiculatus*. Measurements of one in balsam: Length, 0.58 mm.; breadth, 0.11 mm.; diameter of oral sucker, 0.03 mm., of pharynx, 0.015 mm., of ventral sucker, 0.06 mm. (U.S.N.M. No. 8320).

From common eastern stickleback: One, collected July 20, 1910. Measurements in life: Length, 1.68 mm.; breadth, 0.22 mm.; diameter of oral sucker, 0.07 mm., of pharynx, 0.05 mm., of ventral sucker, 0.18 mm.; ova, 0.027 by 0.012 mm.

From rudderfish (*Palinurichthys perciformis*): Several (U.S. N.M.) No. 8321), collected August 6, 1904. Measurements in balsam: Length, including appendix, 1 mm., breadth, 0.17 mm.; diameter of oral sucker, 0.05 mm., pharynx, 0.02 mm., ventral sucker, 0.09 mm.; ova, 0.02 by 0.01 mm.

Four, immature, collected August 19, 1929. (1) Measurements in balsam, including appendix, 1.96 mm., breadth, 0.28 mm.; diameter oral sucker, 0.04 mm., pharynx, 0.02 mm., ventral sucker, 0.07 mm. (2) Length, 1.75 mm.; breadth, 0.50 mm.; diameter oral sucker, 0.2 mm., pharynx, 0.01 mm., ventral sucker, 0.04 mm.

From common mackerel: One, collected August 3, 1905.

From rudderfish (*Seriola zonata*): Two (U.S.N.M. No. 8327), collected August 16, 1910. Measurements, balsam: Length, including appendix, 1.47 mm.; breadth, 0.25 mm.; diameter oral sucker, 0.06 mm., of pharynx, 0.03 mm., of ventral sucker, 0.12 mm.; ova, collapsed, about 0.024 by 0.012 mm. A note, made at the time of collecting these distomes, states that sperm was seen rotating rapidly in the seminal receptacle, in anticlockwise fashion. The specimen was presumably being observed from the ventral side.

Four, collected August 19, 1929. Measurements in agreement with the foregoing.

From summer flounder: One, collected July 20, 1904. One, collected August 15, 1906.

From pollack: One (U.S.N.M. No. 8322), collected August 19, 1908. Measurements, life: Length, not including appendix, 2.17 mm.; breadth, 0.42 mm.; diameter oral sucker, 0.07 mm., pharynx, 0.04 mm., ventral sucker, 0.17 mm.; ova, 0.027 by 0.010 mm. Length in balsam, 1.40 mm.

From glut herring: Fifty or more, collected September 6, 1910. Lengths from 0.5 mm. to 2.25 mm., all with ova. Measurements of one, life, compressed, appendix retracted, 1.68 mm., breadth, 0.53 mm.; diameter oral sucker, 0.08 mm., pharynx, 0.04 mm., ventral sucker, 0.19 mm., ova 0.027 by 0.010 mm., slightly reniform.

Forty (U.S.N.M. No. 8323), collected September 18, 1913.

From hickory shad: One hundred and fifty, collected August 15, 1906, from intestine of one fish.

Fifty-five (U.S.N.M. No. 8324), collected September 5, 1913, from one fish. Measurements, balsam: Length, including appendix, 1.43 mm.; breadth, 0.32 mm.; length of appendix, 0.53 mm.; diameter oral sucker, 0.08 mm., pharynx, 0.04 mm., ventral sucker, 0.19 mm.; ova, collapsed and crowded together, about 0.024 by 0.012 mm.

From alewife: One, collected July 26, 1906. One (U.S.N.M. No. 8325), collected August 30, 1910.

Eight distomes from this host in old collection, in balsam, have an average length of 1.88 mm.; average length of body, 1.25 mm.; of appendix, 0.63 mm.; maximum length, 2.59 mm., minimum, 1.24 mm. Measurements of one in balsam: Length, including appendix, 2.56 mm.; breadth, 0.36 mm.; diameter oral sucker, 0.07 mm., pharynx, 0.04 mm., ventral sucker, 0.14 mm.; ova, collapsed and crowded, about 0.024 by 0.012. At the time of collecting, sperm was noted in rapid rotary motion in the seminal receptacle, while quiescent sperm filled the early portion of the uterus at the posterior border of the ovary.

Note on distomes found in the food of young alewives, August 27, 1920: Thirty distomes were counted in a small bit of debris from the intestine of a 50-mm. fish; length of distomes about 0.33 mm. One hundred and fifty were counted in the bottom of a dish in which the contents of the stomach and intestine of a 57-mm. alewife had been washed; lengths of distomes from 0.35 to 0.70 mm. Others were noted in a 57, a 65, and a 72-mm. fish. Measurements of one in balsam: Length, 0.36 mm.; breadth, 0.14 mm.; diameter of oral sucker, 0.06 mm., ventral sucker, 0.09 mm.; ova, 0.021 by 0.012 mm.

From winter flounder: Following is a summary of appendiculate distomes referred to the species *H. appendiculatus*, noted while examining young winter flounders for their food:

TABLE 30.—*Record of distomes of* Hemiurus appendiculatus *from young* Pseudopleuronectes americanus

Fishes examined	Date collected	Length of fishes	Total distomes	Fishes seined
		Mm.		
10–14	July 27, 1915	28 to 58	[1] 1,193	Katama Bay.
8	September 9, 1915	72	[2] 1	Sheep-pen Cove.
8	September 14, 1915	62 to 128	[3] 1	Great Harbor.
12	October 19, 1915	82 to 124	[4] 1	Quisset Harbor.

[1] Worms mainly from stomachs; smallest number in a single host 3, in a 37-mm. fish; largest number in a single host 317, in a 30-mm. fish.

[2] From a 72-mm. fish.

[3] From a 62-mm. fish.

[4] From a 120-mm. fish.

Two hundred and sixty-eight collected July 28, 1916, from 12 of 14 fishes, 45 to 74 mm. in length, mainly from stomach; smallest number from one host 2, from a 62-mm. fish; largest number from one host 75, from a 54-mm. fish. Measurements of one in balsam: Length, appendix retracted, 0.87 mm.; breadth, 0.24 mm.; diameter of oral sucker, 0.08 mm., of pharynx, 0.05 mm., of ventral sucker, 0.16 mm.; ova, 0.022 by 0.010 mm.

From common scup: One, immature, collected August 19, 1919, from a 36-mm. fish. Measurements, in balsam: Length of body, 0.63 mm.; of appendix, 0.28 mm.; breadth, 0.14 mm.; diameter of oral sucker, 0.04 mm., of pharynx, 0.02 mm., of ventral sucker, 0.08 mm.

From striped anchovy: Numerous, collected August 15, 1906. These distomes agree with distomes found in the hickory shad (*Pomolobus mediocris*) on the same date, but were smaller. Specimens mounted in balsam are from 0.7 to 0.84 mm. in length, not including the appendix. Measurements in balsam, lateral view: Length, 0.84 mm.; breadth, 0.18 mm.; diameter of oral sucker, 0.045 mm., of pharynx, 0.027 mm., of ventral sucker, 0.09 mm.; ova about 0.024 by 0.012 mm.

From lizardfish: Three (U.S.N.M. No. 8328), collected September 11, 1928; 15 fishes, from 87 to 137 mm. in length, examined. Measurements in balsam: Length, including appendix, 1.17 mm.; length of appendix, 0.35 mm.; breadth, 0.24 mm.; diameter of oral sucker, 0.05 mm., of pharynx, 0.03 mm., of ventral sucker, 0.10 mm.; ova, 0.024 by 0.009 mm.

From cunner: One, immature, collected June 30, 1919, from a 12-millimeter cunner. The distome was actively contractile, varying in length from 0.37 to 0.90 mm.

From codling: One, collected October 29, 1914. Measurements in formalin: Length, 2.4 mm., breadth, 0.45 mm.; length of appendix, 1 mm.; diameter of oral sucker, 0.08 mm.; ventral sucker, 0.17 mm.; ova, 0.028 by 0.011 mm. Length in balsam, 1.76 mm.

Four, collected July 20, 1929; 3 fishes examined.

Twenty-two (U.S.N.M. No. 8329), collected August 7, 1929, from one fish.

HEMIURUS LEVINSENI Odhner

PLATE 8, FIGURES 75–77

Distomum ocreatum Molin (part), LINTON, Bull. U. S. Fish Comm. for 1899, p. 288, pl. 35, fig. 19, 1900.

Hemiurus levenseni ODHNER, Die Trematoden des arktischen Gebietes, Fauna Arctica, vol. 4, pp. 348–351, pl. 4, fig. 2, 1905.—MANTER, Illinois Biol. Mon., vol. 10, No. 2, pp. 92, 93, figs. 62, 63, 1926.

Hermiurus levinsenii Odhner, MANTER, Journ. Parasit., vol. 12, p. 13, 1925.

This species, which resembles *H. appendiculatus* in many of its characters, differs from that species markedly in the relative size of the suckers. Whereas the diameter of the ventral sucker in *H. appendiculatus* is about twice that of the oral sucker, in *H. levinseni* the suckers are nearly equal, the oral sucker often being slightly larger than the ventral.

Hosts.—Lumpfish (*Cyclopterus lumpus*), common codfish (*Gadus morrhua*), tilefish (*Lopholatilus chamaeleonticeps*), whiting (*Merluccius bilinearis*), pollack (*Pollachius virens*), codling (*Urophycis chuss*).

Record of collections.—One (U.S.N.M. No. 8330), collected July 10, 1926, from lumpfish. Measurements in balsam: Length, 1.26 mm., breadth, 0.53 mm.; diameter of oral sucker, 0.15 mm., of pharynx, 0.07 mm., of ventral sucker, 0.13 mm.; ova, much crowded and difficult to measure, about 0.018 by 0.012 mm.

From common codfish: Fifty-three (U.S.N.M. No. 8331), collected December 13, 1894, from one cod. Measurements in formalin: Length, 2.73 mm.; breadth, 0.41 mm.; diameter of oral sucker, 0.22 mm., of pharynx, 0.11 mm., of ventral sucker, 0.22 mm.; ova, 0.025 by 0.014 mm. Average of six in balsam, lengths from 1.26 to 2.03 mm.: Length, 1.71 mm.; breadth, 0.39 mm.; diameter of oral sucker, 0.20 mm., of pharynx, 0.10 mm., of ventral sucker, 0.19 mm.; length of appendage, 0.26 mm.; ova, 0.024 by 0.012 mm.

One, collected December 21, 1903; 30 fishes examined. Five, collected July 15, 1926; 4 fishes examined.

The eggs in most of these distomes from the cod are not collapsed and appear to be distinctly larger than those in the distomes from the pollack, etc. In one of the mounted specimens, however, some of the eggs are collapsed and resemble those in distomes from other hosts rather closely.

From tilefish: *Distomum ocreatum* Molin, Bull. U. S. Fish Comm. for 1899, p. 472, 1901. One of the larger specimens from this host (U.S.N.M. No. 8332) has the following dimensions, in balsam: Length, 2.38 mm., breadth, 0.42 mm.; diameter of oral sucker, 0.21 mm., pharynx, 0.10 mm., ventral sucker, 0.21 mm.; ova, 0.023 by 0.012. The seminal vesicle was not seen distinctly to be in two sections, and the prostate begins a little in front of the ventral sucker.

From whiting: One, collected July 23, 1923. Measurements, balsam: Length, 0.98 mm., breadth, 0.25 mm.; diameter of oral sucker, 0.12 mm., of pharynx, 0.06 mm., of ventral sucker, 0.10 mm.; ova crowded and collapsed, about 0.018 by 0.009 mm.

One (U.S.N.M. No. 8333), collected July 15, 1924. Measurements, balsam: Length, 1.40 mm. (posterior end missing); breadth, 0.30

mm.; diameter oral sucker, 0.18 mm., of pharynx, 0.08 mm., of ventral sucker, 0.15 mm.; ova, 0.021 by 0.012 mm.

From pollack: One (U.S.N.M. No. 8334), collected July 31, 1924. Measurements in balsam: Length, appendix retracted, 1.54 mm.; breadth, 0.57 mm.; diameter of oral sucker, 0.17 mm., of pharynx, 0.08 mm., of ventral sucker, 0.13 mm.; ova, much crowded and collapsed, about 0.018 by 0.012 mm. The prostate appears to begin slightly in front of the ventral sucker, but the neck of the specimen is strongly contracted. If the neck were straightened the anterior prostatic cells would be about on a level with the anterior border of the ventral sucker.

In the distomes from both the whiting and pollack the seminal vesicle was in two sections, characteristic of the species.

From codling: One, collected August 19, 1910.

HEMIURUS species

Host.—Mousefish (*Histrio pictus*).

Record of collections.—One (U.S.N.M. No. 8355), immature, collected September 5, 1919. Measurements, life: Length, 0.60 mm., breadth, 0.21 mm.; diameter of oral sucker, 0.10 mm., of ventral sucker, 0.14 mm. Cuticle smooth, intestinal rami voluminous, appendix short, retracted.

Measurements in balsam: Length, 0.84 mm.; breadth, 0.24 mm.; diameter of oral sucker, 0.10 mm., of pharynx, 0.05 mm., of ventral sucker, 0.14 mm.

Genus BRACHYPHALLUS Odhner, 1905

BRACHYPHALLUS CRENATUS (Rudolphi)

PLATE 11, FIGURES 109–120

Distomum ocreatum Molin, LINTON, Proc. U. S. Nat. Mus., vol. 20, pp. 514, 515 pl. 42, fig. 12 (from *Pomotomus saltatrix*), 1898; *in* Linton, Bull. U. S. Fish Comm. for 1899, p. 288, figs. 16, 17 (not fig. 19) (from *Pollachias virens*), 1900.

Hemiurus crenatus (Rudolphi), LANDER, Contr. Harvard College, No. 148, pp. 1–28, 4 pls., 1904.

Brachypallus crenatus (Rudolphi), ODHNER, Die Trematoden des arktischen Gebietes, Fauna Arctica, pp. 352, 353, pl. 4, figs. 3–5, 1905.—Looss, Zool. Jahrb., vol. 26, pp. 158, 159, figs. 64, 65, 1907.—MANTER, Journ. Parasit., vol. 12, p. 13, 1925; Illinois Biol. Mon., vol. 10, No. 2, pp. 94, 95, fig. 53, 1926.

Brachyphallus affinis (=*B. crenatus* C. H. Lander, 1904) Looss, Zool. Jahrb., vol. 26, pp. 158, 159, 1907.

The distomes referred to this species in this report are characterized by having a nearly linear body which is crossed by fine lines producing sharply serrate margins in robust specimens; in many cases

the serrations are faint, or have disappeared entirely. The oral and ventral suckers are nearly equal and are separated from each other by a space approximately equal to the diameter of one of them. The diameter of the pharynx is about half that of the oral sucker. Prepharynx and esophagus none, intestinal rami extend to end of appendix. The genital pore is on the midventral line about halfway between the oral and ventral suckers. The cirrus-pouch is short, and the seminal vesicle is dorsal to the anterior border of the ventral sucker. The two testes are close behind the ventral sucker, near together, and slightly diagonal; they vary from circular to oval-elliptical in outline. The ovary is situated toward the posterior end of the body proper, and is usually oval-elliptical in outline, with the longer diameter transverse. The vitellaria lie immediately behind the ovary. They are lobed, and while there is considerable variation in the lobation, the right one was usually three-lobed and the left two-lobed.

The seminal receptacle and shell gland lie behind the ovary between the vitellaria. The folds of the uterus are voluminous and fill the body between the ventral sucker and ovary; folds of the uterus extend back of the ovary and vitelline glands but were not observed to enter the appendix. Ova, in balsam, about 0.024 mm. by 0.012 mm.

The above description is based on specimens from the eel.

Hosts.—Sand launce (*Ammodytes americanus*), American eel (*Anguilla rostrata*), common herring (*Clupea harengus*), sea raven (*Hemitripterus americanus*), fishingfrog (*Lophius piscatorius*), silversides (*Menidia notata*), kingfish (*Menticirrhus saxatilis*), silver hake (*Merluccius bilinearis*), tomcod (*Microgadus tomcod*), white perch (*Morone americana*), American smelt (*Osmerus mordax*), pollack (*Pollachius virens*), hickory shad (*Pomolobus mediocris*), bluefish (*Pomatomus saltatrix*), remora (*Remora remora*), common mackerel (*Scomber scombrus*), codling (*Urophycis chuss*), codling (*Urophycis tenuis*).

Record of collections.—From sand launce, one and fragment collected July 5, 1912. Measurements, life: Length, appendix partly retracted, 0.84 mm.; breadth, 0.32 mm.; diameter of oral sucker, 0.13 mm., pharynx, 0.05 mm., ventral sucker, 0.17 mm.; ova, 0.024 by 0.012 mm. In the fragment the diameter of the oral sucker was 0.14 mm., ventral sucker, 0.15 mm.

One, collected October 29, 1913; length, 2 mm. in formalin. Six (U.S.N.M. No. 8336), collected November 1, 1913; 2 to 4 mm. in formalin, appendix everted. One, collected October 13, 1914; length in formalin, appendix retracted, 1.73 mm., breadth 0.54 mm.; diameter of oral sucker 0.22 mm., ventral sucker 0.23 mm., ova 0.028 by

0.14 mm. Three, collected October 20, 1914. Twenty-two, collected November 5, 1914.

From American eel: One, collected December 6, 1909. Seven (U.S.N.M. No. 8337), collected June 13, 1913; 1.40 mm. to 2.47 mm., excluding appendix, in formalin. Forty, collected July 10, 1914, in washings from intestines of 9 eels. Dr. G. A. MacCallum also found a number on the gills.

Average measurements of nine specimens mounted in balsam, and varying in length from 1.26 to 1.92 mm.: Length, 1.42 mm.; breadth, 0.36 mm.; diameter of oral sucker, 0.136 mm., pharynx, 0.06 mm., ventral sucker, 0.139 mm.; ova, 0.024 by 0.012 mm.

From common herring: One, collected November 11, 1904; length, 2.5 mm. in formalin. One, collected November 4, 1911; length, 3.7 mm. in formalin. Two, collected November 8; length, 3 mm. in formalin. Three, collected July 17, 1920. Three (U.S.N.M. No. 8338), collected August 17, 1920, from a 60-mm. fish. Measurements, life: Length, 2.10 mm., breadth, 0.49 mm.; diameter of oral sucker, 0.25 mm., of ventral sucker, 0.25 mm.

These distomes from the herring when compared with those from the eel agree in those characters which have been enumerated. Differences in outline of the vitellaria occur, but in general they resemble those of the eel distomes, varying from obscurely lobed to distinctly lobed examples.

Average measurements of eight in balsam varying in length from 1.05 to 2.10 mm.: Length, 1.66 mm.; breadth, 0.40 mm.; diameter of oral sucker, 0.15 mm., pharynx, 0.07 mm., ventral sucker, 0.15 mm.; ova, 0.024 by 0.012 mm.

From fishingfrog: One (U.S.N.M. No. 8340), collected August 3, 1910. Measurements, balsam: Length, ex. appendix, 1.40 mm.; breadth, 0.42 mm.; diameter oral sucker, 0.17 mm., pharynx, 0.08 mm., ventral sucker, 0.17 mm.; ova, collapsed and crowded, about 0.021 by 0.009 mm. One, collected December 6, 1912.

From silversides (*Menidia notata*): A small, immature, yellowish distome, collected August 11, 1919, from a 28-mm. fish, is here recorded. Length, life, 0.24 mm.; breadth, 0.04 mm.; diameter oral sucker, 0.03 mm., ventral sucker, 0.03 mm.

From kingfish: One (U.S.N.M. No. 8341), collected September 9, 1908, from intestine. Measurements in balsam, appendix retracted: Length, 1.76 mm.; breadth, 0.36 mm.; diameter oral sucker, 0.16 mm., pharynx, 0.08 mm., ventral sucker, 0.17 mm.; ova, 0.021 by 0.012 mm.

One, collected July 19, 1910. Measurements, life, appendix partly retracted: Length, 1.50 mm.; breadth, 0.28 mm.; ova, 0.028 by 0.016 mm. In balsam the diameter of the oral sucker is 0.126 mm., pharynx, 0.06 mm., ventral sucker, 0.135 mm.; ova, 0.021 by 0.012 mm.

From silver hake: One, collected August 15, 1907. One, collected July 29, 1910.

Two, collected August 16, 1910. Measurements, life: Length, including appendix, 2.6 mm.; breadth, 0.67 mm.; diameter oral sucker, 0.25 mm., pharynx, 0.14 mm., ventral sucker, 0.27 mm. Another and larger specimen (U.S.N.M. No. 8342): Length, 4.2 mm.; breadth, 0.70 mm.; diameter of oral sucker, 0.33 mm., pharynx, 0.14 mm., ventral sucker, 0.35 mm.; ova, 0.027 by 0.017 mm.

Five, collected August 19, 1910. Eight, collected May 25, 1911. One, collected July 15, 1924.

From tomcod: One, collected July 30, 1904.

From white perch: Three (U.S.N.M. No. 8343), collected April 21, 1913. Measurements in balsam: Length, appendix retracted, 1.26 mm.; breadth, 0.26 mm.; diameter oral sucker, 0.14 mm., pharynx, 0.07 mm., ventral sucker, 0.17 mm.; ova not developed.

From American smelt: One, collected January 25, 1911.

Two (U.S.N.M. No. 8344), collected February 3, 1911. Lengths in balsam, 1.33, 1.82, and 2.10 mm. Measurements of largest: Length, 2.10 mm.; breadth, 0.63 mm.; diameter oral sucker, 0.25 mm., pharynx, 0.12 mm., ventral sucker, 0.28 mm.; ova, 0.027 by 0.012 mm.

From pollack: Two, collected August 12, 1910: Length in alcohol, 2 mm. One, collected July 1, 1912; length, 3.57 mm.; eighteen fishes examined.

One (U.S.N.M. No. 8345), collected July 31, 1924. Measurements in balsam: Length, 3.80 mm.; breadth, 0.72 mm.; length of appendix, 1.33 mm.; diameter oral sucker, 0.27 mm., pharynx, 0.15 mm., ventral sucker, 0.28 mm.; ova about 0.024 by 0.012 mm.

From hickory shad: Two, collected August 20, 1910; two fishes examined. Six, collected June 17, 1911; five fishes examined. Eight, collected June 21, 1911; two fishes examined. Eighty (U.S.N.M. No. 8346), collected June 21, 1913; length of one in formalin, 1.91 mm.; length of appendix 1 mm.

TABLE 31.—*Measurements of two specimens of* Brachyphallus crenatus (*U.S.N.M. No. 8346*) *in balsam, appendices retracted*

Measurement	1	2
	Mm.	*Mm.*
Length	1.22	0.82
Breadth	.35	.21
Diameter oral sucker	.16	.12
Diameter pharynx	.08	.05
Diameter ventral sucker	.16	.12
Ova, 0.024 by 0.012 mm.		

From bluefish: Two (U. S. N. M. No. 8347), collected July 8, 1911. Measurements in balsam: Length, appendix retracted, 1.47 mm., breadth, 0.27 mm.; diameter oral sucker, 0.20 mm., pharynx, 0.09 mm., ventral sucker, 0.21 mm.; ova, 0.024 by 0.012 mm.

From remora: One, collected July 21, 1911. Measurements in balsam: Length, appendix retracted, 1.82 mm.; breadth, 0.49 mm.; diameter oral sucker, 0.20 mm., pharynx, 0.09 mm., ventral sucker, 0.21 mm.; ova crowded and collapsed, about 0.024 by 0.012 mm. This specimen was not noted at the time of collecting, but appears on a slide containing specimens of *Sterrhurus monticellii.*

From common mackerel: One (U.S.N.M. No. 8348), collected June 6, 1908. Measurements in balsam: Length, appendix retracted, 0.9 mm.; breadth, 0.28 mm.; diameter oral sucker, 0.10 mm., ventral sucker, 0.10 mm.; ova, collapsed, about 0.024 by 0.012 mm.

From codling (*Urophycis chuss*): Few, collected August 19, 1910. Measurements in balsam: Length, appendix retracted, 2.17 mm.; breadth, 0.38 mm.; diameter oral sucker, 0.18 mm., pharynx, 0.08 mm., ventral sucker, 0.18 mm.; ova, 0.024 by 0.012 mm.

From codling (*Urophycis tenuis*): One (U.S.N.M. No. 8349), collected November 3, 1913. Measurements in balsam: Length, appendix retracted, 1.54 mm.; breadth, 0.46 mm.; diameter oral sucker, 0.18 mm., pharynx, 0.07 mm., ventral sucker, 0.21 mm.; ova collapsed and crowded, about 0.024 by 0.012 mm.

Subfamily STERRHURINAE Looss, 1907

Genus STERRHURUS Looss, 1907

STERRHURUS MONTICELLII (Linton)

PLATE 10, FIGURES 101–107

Distomum monticellii LINTON, Proc. U. S. Nat. Mus., vol. 20, pp. 518–520, pl. 44, figs. 2–8, 1898; Bull. U. S. Fish Comm. for 1899, pp. 451, 473, 482, 1901; Bull. U. S. Bur. Fisheries, vol. 24, p. 334, etc., figs. 154–155, 1905.

Hemiurus monticellii (Linton), Looss, Zool. Jahrb., vol. 12, p. 641, 1899.

Sterrhurus monticellii (LINTON), Carnegie Inst. Washington Publ. 133, pp. 61, 62, figs. 139, 140, 1910.

Body smooth, ventral sucker much larger than oral; cirrus pouch small, in neck behind pharynx; seminal vesicle dorsal to anterior border of ventral sucker; testes not far back of ventral sucker, near together and somewhat diagonally placed; ovary separated from testes by folds of the uterus; vitellaria at posterior border of ovary, each deeply lobed; uterus voluminous, its folds extending back of the vitellaria, the early folds containing sperm; ova, 0.015 to 0.024 mm. by 0.009 to 0.012 mm.

Hosts.—*Caranx chrysos*, lumpfish (*Cyclopterus lumpus*), sharksucker (*Echeneis naucrates*), round herring (*Etrumeus sadina*), little tunny (*Euthynnus alletteratus*), leatherjacket (*Oligoplites saurus*), remora (*Remora remora*), rudderfish (*Palinurichthys perciformis*), bluefish (*Pomatomus saltatrix*), goggler (*Trachurops crumenophthalma*), cutlassfish (*Trichiurus lepturus*).

Record of collections.—From *Caranx chrysos:* One, collected August 8, 1904. Measurements, life: Length, 1.35 mm.; diameter of oral sucker, 0.10 mm.; ventral sucker, length, 0.22 mm., breadth, 0.26 mm.; ova, 0.014 by 0.009 mm.

One (U.S.N.M. No. 8350), collected October 15, 1915. Measurements in balsam: Length, appendix missing, 0.95 mm.; breadth, 0.36 mm.; diameter of oral sucker, 0.11 mm., of pharynx, 0.06 mm., of ventral sucker, 0.23 mm.; ova, 0.014 by 0.009 mm.

From lumpfish: One (U.S.N.M. No. 8351), collected July 10, 1926. Measurements in balsam: Length, appendix retracted, 2.10 mm.; diameter of oral sucker, 0.12 mm., of pharynx, 0.06 mm., of ventral sucker, 0.28 mm.; ova, 0.018 by 0.012 mm.

From sharksucker: Eighty-eight (U.S.N.M. No. 8352), collected August 19, 1903. Alcoholic specimens, much distorted: Length of longest about 3 mm. Average of eight in balsam: Diameter of oral sucker, 0.12 mm., of ventral sucker, 0.32 mm.; ova about 0.020 by 0.012 mm.

From round herring: One, collected July 28, 1908. Measurements in balsam, appendix retracted: Length, 1 mm.; breadth, 0.28 mm.; diameter of oral sucker, 0.10 mm., of pharynx, 0.04 mm., of ventral sucker, 0.22 mm.; ova few, not distinct, about 0.018 by 0.010 mm.

From little tunny: Nine (U.S.N.M. No. 8353), collected August 12, 1905; from 1.8 mm. to 2.6 mm. in length; variety of shapes; color of larger specimens pale pink, others translucent, almost colorless, except where the amber-colored eggs lie; active sperm noted at posterior border of the ovary. Average of four, life: Diameter of oral sucker, 0.14 mm., of ventral sucker, 0.41 mm.; average of seven in balsam, oral sucker, 0.12 mm., ventral sucker, 0.33 mm.

From leatherjacket: One (U.S.N.M. No. 8354), collected July 14, 1924. Measurements in balsam: Length, 2.10 mm.; breadth, 0.45 mm.; diameter of oral sucker, 0.12 mm., of pharynx, 0.06 mm., of ventral sucker, 0.28 mm.; ova collapsed and crowded, about 0.015 by 0.007 mm.

From remora: Nine (U.S.N.M. No. 8355), collected July 28, 1910, from stomach at pyloric opening; pale red, active, with tendency to cling together when placed in sea water; excretory vessels seen to unite above pharynx; right vitelline gland four-lobed, left three-

lobed; sperm seen in active rotary motion at posterior border of ovary.

Thirteen, collected July 21, 1911. Nineteen, collected August 3, 1911, from stomach of host. Five, collected September 9, 1912, from stomach of host. One, collected July 26, 1918.

One, collected July 21, 1919. Measurements, life: Length, appendix retracted, 1.35 mm.; breadth, 0.23 mm.; diameter oral sucker, 0.10 mm., pharynx, 0.06 mm., ventral sucker, 0.21 mm.; ova, 0.024 by 0.012 mm.

From rudderfish: One, collected August 20, 1910, immature, recorded here, but not enough of anatomy shown to admit of satisfactory determination. Length, including appendix, 1.89 mm., in balsam; length of appendix, 0.56 mm.; breadth at level of ventral sucker, 0.48 mm., behind ventral sucker, 0.38 mm.; diameter of oral sucker, 0.19 mm., of pharynx, 0.10 mm., of ventral sucker, 0.35 mm.

From bluefish: "Several," collected July 15, 1904. Two (U.S.N.M. No. 8356), collected July 8, 1911.

From goggler: A small distome and a fragment of another from this host were collected August 27, 1905. Measurements in balsam, appendix retracted: Length, 1.40 mm.; breadth, 0.36 mm.; diameter of oral sucker, 0.10 mm., pharynx, 0.06 mm., ventral sucker, 0.24 mm.; ova, 0.014 by 0.009 mm.

From cutlassfish: Two hundred and sixteen (U.S.N.M. No. 8357), collected June 9, 1903, from mouth of host. Measurements in glycerin: Length, including appendix, 3 mm.; breadth, 0.9 mm.; diameter of oral sucker, 0.16 mm., ventral sucker, 0.38 mm.

Forty-seven, collected June 15, 1903, from mouth of host. Two hundred and forty, collected July 26, 1903, from stomach of host. Two hundred and eighty-three, collected August 6, from stomach of host. Three hundred and thirteen, collected September 16, 1903.

Two fishes taken at Menemsha Bight were examined August 2, 1904. One of them had been in alcohol for several months, the other in formalin for about three days; 317 distomes were collected from the stomachs, most of them from the formalin specimen.

One hundred and forty-three, collected June 18, 1913. Largest, in formalin, 3.5 mm., plump, arcuate. More than 50 specimens of various sizes from this host were either mounted in balsam or cleared in acetic-glycerin. All clearly belong to the same species. Measurements in balsam, average of nine: Diameter of oral sucker, 0.17 mm., of ventral sucker, 0.43 mm.; smallest oral sucker, 0.14 mm., largest, 0.21 mm.; smallest ventral sucker, 0.35 mm., largest, 0.50 mm.; ova about 0.018 by 0.012 mm.

STERRHURUS species

Here is recorded a single distome from *Histrio pictus*, on which the following note was made at the time of collecting, August 9, 1904.

Body smooth, with a few irregular transverse wrinkles; genital aperture at posterior edge of oral sucker; cirrus, cirrus pouch and prostate indistinct; testes transverse at posterior edge of ventral sucker; ovary subglobular, on left side; vitellaria behind ovary, the left one slightly lobed, its anterior border reaching nearly to the middle of the ovary. The rami of the intestine extend to the appendix, but were not seen to enter it.

Measurements in glycerin: Length, 1.23 mm.; breadth, anterior, 0.15 mm., middle, 0.45 mm., posterior, 0.15 mm.; diameter of oral sucker, 0.15 mm., of ventral sucker, 0.28 mm.

Subfamily LEICITHASTERNAE Odhner, 1905

Genus LECITHASTER Lühe, 1901

LECITHASTER CONFUSUS Odhner

PLATE 11, FIGURES 121–124

Distomum bothryophoron Olsson, LINTON, Bull. U. S. Fish Comm. for 1899, p. 439, figs. 355, 356, 1901.

Lecithaster confusus ODHNER, Die Trematoden des arktischen Gebietes, Fauna Arctica, vol. 4, p. 359, 1905; Zool. Jahrb., vol. 26, p. 164, figs. 70–72, 1907.—LÜHE, *in* Brauer's Süsswasserfauna Deutschlands, vol. 17, Trematodes, pp. 140, 141, 1909.

Examples of small distomes have been found in a number of Woods Hole fishes which agree closely with forms that appear in the literature of the Trematoda under a variety of specific names, but which are included by Odhner and Lühe in the two species *Lecithaster gibbosus* (Rudolphi) and *L. confusus* Odhner.

Unfortunately many of the specimens in the collection show the anatomy imperfectly.

According to Lühe, following Odhner, the two species may be briefly characterized thus:

L. gibbosus: Lobes of ovary roundish, scarcely longer than broad; lobes of vitellaria slender, tending to pyriform; seminal vesicle dorsal to, and not extending beyond the ventral sucker; ova, 0.025 to 0.027 by 0.013 mm.

L. confusus: Lobes of ovary longish; lobes of vitellaria short, scarcely as long as broad; seminal vesicle extending back of ventral sucker; ova, 0.015 to 0.017 by 0.009 mm.

In those cases in which the seminal vesicle, ovary, and vitellaria are indistinct I have referred those with ova approximating 0.025 by 0.013 mm. to *L. gibbosus*, and those whose ova approximate 0.015 by 0.009 mm. to *L. confusus*.

The distomes referred to the species *L. confusus* are fusiform, anterior end rather bluntly rounded, posterior end tapering; greatest diameter at about level of ventral sucker, or a little behind it; ventral sucker much larger than oral; no prepharynx, esophagus none, or very short; intestinal rami extend to posterior end, in some cases inflated and conspicuous; genital pore about half-way between oral and ventral suckers; ejaculatory duct long, surrounded by prostatic cells; seminal vesicle dorsal to and extending back of the ventral sucker. Testes nearly transversely placed, a short distance behind ventral sucker. Ovary four-lobed, lobes blunt, behind testes; vitellaria behind ovary, seven-lobed, lobes more or less pyriform. The folds of the uterus fill the body from the level of the anterior border of the ventral sucker to the posterior end. The metraterm passes from the dorsal border of the ventral sucker to the genital pore. Ova very numerous and small, approximating 0.015 by 0.009 mm.

The above description is based on material from the hickory shad (*Pomolobus mediocris*).

Hosts.—Black sea bass (*Centropristes striatus*), common herring (*Clupea harengus*), round herring (*Etrumeus sadina*), hickory shad (*Pomolobus mediocris*), dollarfish (*Poronotus triacanthus*), common mackerel (*Scomber scombrus*), puffer (*Sphoeroides maculatus*), cunner (*Tautogolabrus adspersus*).

Record of collections.—From black sea bass: Immature distomes (U.S.N.M. No. 8358), from 0.23 to 0.35 mm. in length, were found on June 30, 1919, in young sea bass, one from a 7-mm. fish, one to four from each of five 9-mm. fish; one, with ova, from a 6-mm. fish. Measurements in formalin: Length, 0.30 mm.; breadth, 0.16 mm.; diameter oral sucker, 0.06 mm., pharynx, 0.03 mm., ventral sucker, 0.09 mm.; ova, 0.015 to 0.018 by 0.009 mm. Seminal vesicle extends back of ventral sucker.

From common herring: Three small distomes, collected August 29, 1919, largest 1 mm. in length, from a 56-mm. herring. Measurements in balsam: Length, 0.70 mm., breadth, 0.21 mm.; diameter oral sucker, 0.06 mm., pharynx, 0.036 mm., ventral sucker, 0.16 mm.; ova collapsed and crowded, about 0.015 by 0.009 mm.

From round herring: Immature distomes belonging to the genus *Lecithaster*. Three, collected August 7, 1908; length, 0.65 mm. Three, collected August 8, 1908; length, 0.50 mm.; breadth, 0.22 mm.; diameter oral sucker, 0.04 mm., pharynx, 0.03 mm., ventral sucker, 0.09 mm. One, collected August 10, 1908; length, 0.57 mm.; breadth, 0.14 mm.; diameter oral sucker, 0.045 mm.; pharynx, 0.03 by 0.04 mm., ventral sucker, 0.10 mm.

From hickory shad: Thirteen, collected June 10, 1907. One (U.S.N.M. No. 8359), collected June 21, 1913; four fishes examined:

Length, in formalin, 0.9 mm.; breadth, 0.42 mm.; diameter of oral sucker, 0.14 mm., ventral sucker, 0.28 mm.; ova, 0.020 by 0.013 mm. The ova in balsam are thin-shelled and difficult to measure, about 0.015 by 0.009 mm.

Seven (U.S.N.M. No. 8360), collected September 5, 1913. Measurements in formalin from length 0.91 mm. and breadth 0.44 mm. to length 1.75 and breadth 0.63 mm.; ova in balsam, about 0.015 by 0.009 mm.

The lobes of the ovary seemed to be at least as long as broad; lobes of vitellaria about as long as broad.

TABLE 32.—*Measurements of six specimens of* Lecithaster confusus *in balsam*

Measurement	1[1]	2	3	4	5	6
	Mm.	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*
Length	1.33	1.26	0.94	1.00	1.15	1.54
Breadth	.54	.58	.39	.43	.35	.65
Oral sucker, length	.15	.14	.08	.10	.10	.14
Oral sucker, breadth	.16	.13	.08	.11	.10	.13
Pharynx, length	.09	.10	.04	.04	.06	.08
Pharynx, breadth	.08	.10	.04	.04	.05	.07
Ventral sucker, length	.25	.26	.19	.24	.19	.25
Ventral sucker, breadth	.24	.21	.14	.17	.18	.22
Ova, 0.015 by 0.009 mm.						

[1] No. 1, ventral view, others lateral view.

From dollarfish: One, collected July 20, 1919, from a 12-mm. fish. Measurements in balsam: Length, 0.7 mm.; breadth at level of ventral sucker, 0.28 mm., behind ventral sucker, 0.22 mm.; diameter oral sucker, 0.06 mm., pharynx, 0.04 mm., ventral sucker, 0.15 mm.; ova, 0.012 by 0.007 mm.

From common mackerel: Eight (U.S.N.M. No. 8361), collected August 23, 1919, from a 16-mm. fish and ten from a 22-mm. fish. Measurements, life: Length, 0.52 mm.; breadth, 0.25 mm.; diameter oral sucker, 0.06 mm., pharynx, 0.04 mm., ventral sucker, 0.16 mm.; ova, 0.015 by 0.009 mm.

One, collected August 28, 1919, from an 11-mm. fish; length, 0.33 mm.

Three from a 10-mm. fish. Measurements of one, life: Length, 0.45 mm.; breadth, 0.18 mm.; diameter oral sucker, 0.06 mm., ventral sucker, 0.11 mm.; ova, 0.015 by 0.009 mm. Lobes of vitellaria slightly pyriform.

From puffer: Four, collected July 7, 1919, from a 10-mm. fish, two from each of two 9-mm. fish, and two from a 7-mm. fish. Measurements, life: Length, 0.98 mm., breadth, 0.40 mm.; diameter oral sucker, 0.98 mm., pharynx, 0.05 mm., ventral sucker, 0.18 mm.; ova 0.015 by 0.010 mm.

One (U.S.N.M. No. 8362), collected July 25, 1919, from a 7-mm. fish. Lobes of vitellaria short, about as broad as long.

From cunner: One to five immature distomes, collected June 30, 1919, 0.27 to 0.46 mm. in length, from each of nine young cunners from 9 to 15 mm. in length. One distome with ova from a 9-mm. fish.

Five, collected July 15, 1919, from a 10-mm. fish. Eight, collected July 21, 1919, from a 12-mm. fish.

Five (U.S.N.M. No. 8363), collected July 25, 1919, from a 10-mm. fish. Measurements in balsam: Length, 0.38 mm.; breadth, 0.24 mm.; diameter oral sucker, 0.07 mm., ventral sucker, 0.12 mm.; ova, 0.018 by 0.009 mm.

Twelve, collected August 21, 1919, from a 21-mm. fish, and one from a 20-mm. fish.

One distome from the stomach of a small cunner was still apparently in place in a copepod.

Average measurements of nine distomes from young cunners: Length, 0.33 mm.; breadth, 0.19 mm.; diameter of oral sucker, 0.06 mm., ventral sucker, 0.10 mm.

Note on a living specimen, July 15, 1919: Testes close behind ventral sucker; ovary behind testes; vitellaria posterior to ovary, lobed in manner characteristic of the genus *Lecithaster;* seminal receptacle a little way behind level of testes, dorsal; seminal vesicle dorsal to ventral sucker, ejaculatory duct surrounded by coarse prostatic cells; cirrus not evident; intestines reach to near posterior end; folds of uterus amid other organs, from posterior end to ventral sucker; metraterm passing dorsal to ventral sucker to genital pore.

LECITHASTER GIBBOSUS (Rudolphi)

PLATE 11, FIGURES 125, 126

Distomum bothryophoron Olsson, LINTON, Bull. U. S. Fish Comm. for 1899, p. 437 (from *Clupea harengus*), 1901.

Lecithaster gibbosus (Rudolphi), ODHNER, Die Trematoden des arktischen Gebietes, Fauna Arctica, vol. 4, pp. 356–359, 1905.—Looss, Zool. Jahrb., vol. 26, pp. 164, 165, 1907.—MANTER, Illinois Biol. Mon., vol. 10, No. 2, pp. 95, 96, fig. 61, 1926.

Small distomes belonging to the genus *Lecithaster*, which agree closely with this species, are recorded.

Hosts.—Silversides (*Menidia notata*), common scup (*Stenotomus chrysops*).

Record of collections.—From silversides: *Distomum* sp. recorded from this host (Bull. U. S. Fish Comm. for 1899, p. 444, figs. 357, 358, 1901) probably belong here. Small distomes, collected August 11, 1919, noted while examining young silversides for their food. One to nine found in each of six fishes, measuring 25 to 85 mm. in length.

Dimensions of one, life: Length 1.05 mm., breadth 0.3 mm.; diameter of oral sucker 0.09 mm., pharynx 0.045 mm., ventral sucker 0.18 mm.; ova 0.027 by 0.015 mm. One, collected August 19, 1919; dimensions in balsam: Length 1 mm., breadth 0.21 mm.; diameter of oral sucker 0.1 mm., pharynx 0.056 mm., ventral sucker 0.15 mm.; ova 0.027 by 0.015 mm. The anatomy is indistinctly shown on account of the uterus, which, crowded with ova, fills the greater part of the body; lobes of vitellaria pyriform.

From common scup: Two (U.S.N.M. No. 8364), collected July 27, 1920. Measurements in balsam: (1) Length 1.26 mm., breadth 0.51 mm.; oral sucker, length 0.1 mm., breadth 0.15 mm.; pharynx, length 0.05 mm., breadth 0.06 mm.; diameter of ventral sucker 0.28 mm. (2) Length 1.09 mm., breadth 0.47 mm.; oral sucker, length 0.1 mm., breadth 0.13 mm.; diameter of ventral sucker 0.22 mm.; ova 0.032 by 0.018 mm.

The genitalia are obscured and more or less displaced by the accumulation of ova. The intestinal rami extend to the posterior end, the cells in their walls distinct; genital aperture ventral to pharynx; genital sinus short; cirrus pouch in front of ventral sucker, inclosing prostate and seminal vesicle; testes a short distance behind ventral sucker, nearly transverse. Ovary not distinctly seen; in one specimen it appeared to be behind the right testis, in the other behind the left. The lobes of the vitellaria are long and fingerlike.

The largest ova noted were about 0.036 by 0.018 mm.; the smallest 0.024 by 0.015 mm.

Genus APONURUS Looss, 1907

APONURUS species

PLATE 12, FIGURE 127

Four small distomes from a specimen of *Lobotes surinamensis*, September 1, 1910, are here recorded.

The distomes were somewhat macerated, and the anatomy is imperfectly shown in the mounted specimens. So far as the anatomy can be made out these distomes appear to be near the species *Aponurus laguncula* Looss (Zool. Anz., vol. 31, p. 608; Zool. Jahrb., vol. 26, p. 169, figs. 53, 54, 77, 78, 1907).

Body smooth, not differing much in breadth, bluntly rounded posteriorly, slightly tapering anteriorly; ventral sucker much larger than oral; genital pore ventral to pharynx; cirrus pouch short; prostate and seminal vesicle at anterior margin of ventral sucker; testes a short distance back of ventral sucker; ovary behind testes, about middle of post-acetabular region; vitellaria of several distinct

lobes at posterior border of ovary. The lobes of the vitellaria appeared to be distinct from each other, but were closely crowded together. Their exact number could not be determined, but there appeared to be about six of them. The uterus, filled with small ova, occupies most of the postacetabular region. The ova in three of the mounted specimens agree in size, the maximum dimensions being about 0.024 by 0.012 mm. to 0.030 by 0.016 mm. In one of the specimens the ova are smaller and somewhat irregular in shape, as if defective, maximum about 0.015 by 0.010 mm.

Measurements, life: Length, 1.36 mm.; breadth, 0.40 mm.; diameter oral sucker, 0.10 mm., pharynx, 0.06 mm., ventral sucker, 0.20 mm.; ova, 0.034 by 0.017 mm.

Measurements in balsam: Length, 1.12 mm.; breadth, 0.25 mm.; diameter oral sucker, 0.09 mm., pharynx, 0.054 mm., ventral sucker, 0.16 mm.; ova, 0.030 by 0.016 mm. (U.S.N.M. No. 8365.)

Subfamily DINURINAE Looss, 1907

Genus DINURUS Looss, 1907

DINURUS PINGUIS, new species

PLATE 9; PLATE 10, FIGURES 97–100

Distomum grandiporum Rudolphi, LINTON, Proc. U. S. Nat. Mus., vol. 20, pp. 520, 521, pl. 44, fig. 9 (from *Anguilla rostrata*), 1898.

Distomum rufoviride Rudolphi, *ibid.*, pp. 512–517, pl. 42, fig. 14, pl. 43, figs. 1–4 (from *Roccus lineatus*), 1898.

Distomum tornatum Rudolphi, LINTON, Bull. U. S. Fish Comm. for 1899, p. 442 (from *Fundulus heteroclitus*), p. 444, fig. 310 (from *Menidia notata*), p. 455 (from *Roccus lineatus*), 1901; Bull. U. S. Bur. Fish., vol. 24, p. 355 (from *Synodus foetens*), p. 356 (from *Tylosurus marinus*), p. 399, fig. 156 (from *Menticirrhus americanus*), 1905.

The genus *Dinurus* was established by Looss in 1907 with *D. tornatus* (Rudolphi) as the type species (Zool. Jahrb., vol. 26, p. 112, 1907).

The following description of the species is based on material from *Menidia notata*. Further details are given under the record of collections.

Body smooth, plump, more or less fusiform; suckers near together, the ventral much larger than the oral; pharynx nearly spherical; prepharynx and esophagus none; intestinal rami extend to posterior end of appendix. Genital aperture median at posterior ventral margin of pharynx; cirrus and cirrus-pouch short; ejaculatory duct long, sinuous; surrounded by cells of prostate gland; seminal vesicle behind ventral sucker, capacious, extending between

the testes to a point a little in advance of the middle of the posterior testis. The two testes are placed a little diagonally a short distance behind the ventral sucker, round to subtriangular in outline, the right testis a little in advance of the left. The ovary lies behind the testes, is oval-elliptical in outline, its longer diameter transverse. At its posterior border is the seminal receptacle, which is usually spacious. The shell gland is situated behind the left ventral border of the ovary to the left of the seminal receptacle. The vitellaria tubular. There appear to be about three on each side. Anteriorly they extend to about the level of the left testis and the posterior border of the right testis, posteriorly they extend some distance back of the ovary. The folds of the uterus in adult individuals are voluminous, filling the dorsal region of the body from the ovary to the ventral sucker, and behind the ovary to the appendix into which they may press for a short distance. The accumulated ova may crowd the testes forward to the level of the ventral sucker. The excretory vessels are lateral from the ovary to the dorsal side of the pharynx, where they unite. The lateral vessels at their posterior ends unite on the dorsal side of the ovary and continue as a single vessel to the posterior end.

Measurements of a specimen from *Menidia notata*, in balsam: Length, 5 mm.; breadth at level of oral sucker, 0.35 mm., at ventral sucker, 0.80 mm.; maximum breadth, at about middle of length, 1.40 mm., near posterior end, 0.35 mm.; diameter of oral sucker, 0.21 mm., of pharynx, 0.14 mm., of ventral sucker, 0.46 mm.; right testis, length, 0.44 mm., breadth, 0.44 mm.; left testis, length, 0.52 mm., breadth, 0.39 mm.; ovary, length, 0.35 mm., breadth, 0.52 mm.; ova, about 0.018 by 0.012 mm.

Hosts.—American eel (*Anguilla rostrata*), squeteague (*Cynoscion regalis*), sea raven (*Hemitripterus americanus*), silver hake (*Merluccius bilinearis*), silversides (*Menidia notata*), kingfish (*Menticirrhus saxatilis*), toadfish (*Opsanus tau*), summer flounder (*Paralichthys dentatus*), common gurnard (*Merulinus carolinus*), northern barracuda (*Sphyraena borealis*), lizardfish (*Synodus foetens*).

Record of collections.—From American eel: One, collected August 30, 1910; length, 7 mm.; breadth, 2 mm.; fusiform. One (U.S.N.M. No. 8366), collected November 7, 1911; length, in formalin, 6 mm. Four, collected November 21, 1912; 2.5 to 6.5 mm.

Some of the following notes were made on a collection of nine distomes, measuring from 5 to 10 mm. in formalin, from the stomach of an eel taken in Chesapeake Bay, October 31, 1921.

The body in general is fusiform, although presenting a variety of shapes due to different degrees of contraction. Sagittal sections show

that the seminal vesicle extends diagonally between the testes from near the ventral to near the dorsal surface. It may be displaced in individuals which are gorged with ova so as to lie on the left side of the ventral sucker. The testes are nearly opposite each other on either side of the seminal vesicle. Sections show them to be slightly lobed. In younger specimens the testes may lie behind the ventral sucker at a distance equal to twice the diameter of the ventral sucker; in older specimens they may be crowded by the ova to either side of the ventral sucker. The ovary is relatively large, median, immediately behind the testes, extending farther ventrally than the testes. The shell gland is at the ventral edge of the ovary. Behind the ovary is the relatively large seminal receptacle. While the laterally placed vitellaria are tubular, in one series of frontal sections, in addition to the tubular vitellaria there is a vitelline mass on the left side 0.56 mm. in length and breadth and 0.65 mm. in dorsoventral diameter. In this specimen the ovary and testes are at the posterior border of the ventral sucker. The posterior end of the seminal vesicle is dorsal to the ovary and is crowded by the voluminous uterus to the left side of the ventral sucker. In a specimen with relatively few ova the distance from the ventral sucker to each testis and to the seminal vesicle is 0.77 mm., to the ovary, 0.91 mm., to the seminal receptacle, 1.18 mm. In a specimen with very many ova the distance from the ventral sucker to the left testis is 0.14 mm., to the seminal receptacle 0.42 mm.; the ovary, right testis, and seminal vesicle are contiguous to the posterior border of the ventral sucker. Estimates made from series of cross sections: (1) In a series, in which the ova had not become crowded in the postacetabular region, the distance from the ventral sucker to the seminal vesicle was 0.56 mm., and to the first testis 1 mm. (2) In a series in which the postacetabular region was crowded with ova the anterior border of the first testis was 0.05 mm., and the anterior end of the seminal vesicle was 0.18 mm. in front of the posterior edge of the ventral sucker. In a series of sagittal sections the ovary is 0.28 mm. in length and 0.42 mm. in dorsoventral diameter, the seminal vesicle 0.77 mm. in length, the seminal receptacle 0.28 mm. in length and 0.70 mm. in dorsoventral diameter.

Measurements in balsam: Length, 5.5 mm.; breadth, 1.75 mm.; diameter of oral sucker, 0.28 mm., of pharynx, 0.16 mm., of ventral sucker, 0.54 mm.; distance between oral and ventral suckers, 0.24 mm.; ova about 0.017 by 0.011 mm.

From squeteague: One, collected July 15, 1905, immature, encysted in stomach wall of host; plump, fusiform, pinkish in color, and surrounded by black pigment; only intestine, excretory vessels, and retracted appendix could be distinguished: Length, 4.5 mm.; probably belongs to this species.

From sea raven: One, collected October 11, 1911. Measurements in balsam: Oral sucker, length, 0.22 mm.; breadth, 0.25 mm.; pharynx, length, 0.14 mm., breadth, 0.18 mm.; ventral sucker, length, 0.63 mm., breadth, 0.70 mm. Specimen contracted, intestines in dense coils at posterior end; anatomy obscured by masses of ova.

From silver hake: One, collected October 31, 1911. In formalin, body plump, nearly cylindrical; neck short, subcylindrical, curved ventrad, concealing the ventral sucker; length, 4 mm.; diameter, 2 mm. Measurements in balsam, appendix retracted: Length, 3.36 mm.; breadth, 1.54 mm.; diameter of oral sucker, 0.28 mm., of pharynx, 0.22 mm., of ventral sucker, 0.70 mm.; ova, 0.015 by 0.012 mm.

From silversides: Few, collected August 25, 1906. Three, collected August 10, 1910. One, collected August 11, 1910. Measurements, life, compressed: Length, 5.36 mm.; breadth, 1.82 mm.; diameter of oral sucker, 0.25 mm., of pharynx, 0.18 mm., of ventral sucker, 0.61 mm.; ova, 0.018 by 0.012 mm.; folds of uterus voluminous. Two (U.S.N.M. No. 8367), collected July 30, 1929.

From kingfish: One (U.S.N.M. No. 8368), collected August 28, 1928. Thirty-four fishes, from 75 to 123 mm. in length, examined. Length, in balsam, 8 mm.; maximum breadth, 2 mm. from anterior end, 1.82 mm., tapering to about 0.28 mm. near each end; diameter of oral sucker, 0.18 mm., of pharynx, 0.14 mm., of ventral sucker, 0.49 mm; distance from anterior end to ventral sucker, 0.42 mm.; ova about 0.015 by 0.012 mm., much crowded and difficult to measure.

From toadfish: Three, collected August 15, 1899. Flesh color, except where the ova impart a yellowish tinge and the vitellaria a brownish color; plump, and of exceeding diversity of shape; posterior end with concentric wrinkles, often button-shaped. Body cylindrical, neck conical and very extensible. In some cases the neck and ventral sucker would be on a slender stalk, and the greater part of the body gathered into a globular mass at the posterior end. Then, in a few seconds, the worm would become nearly spherical. Length of one at rest, 5 mm., diameter, 1.7 mm. In a series of sagittal sections the length is about 5 mm. and the diameter 1.5 mm.; the largest cross sections measure 1.29 mm. in vertical and 1.23 mm. in transverse diameter; oral sucker, length, 0.24 mm., diameter, 0.19 mm.; diameter of pharynx, 0.15 mm., of ventral sucker, 0.49 mm.; ova, 0.018 by 0.012 mm.

From summer flounder: Three, collected October 1, 1903. Lengths in formalin, 2.5 mm., 3 mm., and 3.5 mm.; diameter of neck, 0.7 mm., of body, 1.5 mm.; ova, 0.018 by 0.012 mm.

One (U.S.N.M. No. 8369), collected September 23, 1912. Length, 6 mm. in formalin.

From common gurnard: A distome, collected August 21, 1911, by Dr. G. A. MacCallum, belongs here.

From northern barracuda: One (U.S.N.M. No. 8370), collected August 31, 1903; four fishes examined. Measurements in balsam, appendix retracted: Length, 3.36 mm.; breadth, 1 mm.; oral sucker, length, 0.18 mm., breadth, 0.23 mm.; pharynx, length, 0.13 mm., breadth, 0.14 mm.; diameter of ventral sucker, 0.48 mm.; ova, 0.018 by 0.012 mm. Testes about equal, diameter 0.54 mm.; ovary, length 0.35 mm., breadth 0.43 mm.; seminal vesicle, length 0.56 mm., breadth, 0.33 mm.

From lizardfish: Three (U.S.N.M. No. 8371), collected September 10, 1928; fifteen fish, 75 to 125 mm. in length, examined; fish seined at Wareham.

TABLE 33.—*Measurements of three specimens of* Dinurus pinguis *in balsam*

Measurement	1[1]	2	3
	Mm.	*Mm.*	*Mm.*
Length	3.15	5.43	6.86
Breadth	1.18	1.93	1.93
Oral sucker, length	.17	.21	.24
Oral sucker, breadth	.21	.21	.36
Pharynx, length	.13	.14	.21
Pharynx, breadth	.13	.14	.20
Ventral sucker, length	.42	.63	.70
Ventral sucker, breadth	.42	.56	.63

[1] No. 1, ventral view; Nos. 2 and 3, lateral view.

Ova crowded, collapsed, about 0.018 by 0.009 mm.

DINURUS TORNATUS (Rudolphi)

Distomum tornatum Rudolphi, LINTON, Proc. U. S. Nat. Mus., vol. 20, pp. 513, 514, pl. 42, figs. 6–12 (from *Coryphaena hippurus*), 1898; Bull. U. S. Fish Comm. for 1899, p. 452, 1901; Bull. U. S. Bur. Fisheries, vol. 24, p. 373 (from *C. hippurus*), p. 374 (from *C. equisetis*), 1905.

The posterior end of a distome (U.S.N.M. No. 8372) that had been broken just behind the ventral sucker was obtained from a harvestfish (*Peprilus paru*) on July 24, 1908. The fragment was active, anterior portion serrate; intestines and uterus extending nearly to posterior end of appendix. Seminal vesicle large, diagonal, its posterior end near anterior border of first testis; testes diagonal, touching each other, first testis triangular in outline, second elliptical, length of each 0.32 mm., breadth, 0.21 mm.; ovary a short distance behind testes, length, 0.25 mm., breadth, 0.32 mm.; body of nearly uniform diameter, 0.7 to 0.8 mm.; appendix, diameter at anterior end, 0.7 mm., tapering uniformly to posterior end. From anterior end of fragment to seminal vesicle 0.4 mm., to first testis, 0.7 mm., to ovary,

1.4 mm. One of the tubular vitellaria extends about 0.5 mm. into the appendix, and the folds of the uterus reach to within 0.6 mm. of the posterior end; ova, 0.013 by 0.009 mm. All measurements made on specimen mounted in balsam.

A fragment, from harvestfish, collected August 7, 1908: Posterior end, containing the ovary, vitellaria and folds of the uterus crowded with ova. Length, 2.10 mm.; diameter, 0.77 mm.; ova, 0.015 by 0.009 mm. Two larval dibothria had penetrated the fragment, length of each 1.20 mm., breadth, 0.19 mm.

Genus ECTENURUS Looss, 1907

ECTENURUS VIRGULA Linton

PLATE 8, FIGURE 78

Ectenurus virgula LINTON, Carnegie Inst. Washington Publ. 133, pp. 63, 64, fig. 148 (from *Clupanodon pseudohispanicus*, Tortugas, Fla.), 1910.

A distome (U.S.N.M. No. 8373), collected August 17, 1913, from *Trachurops crumenophthalma*, is in close agreement with distomes from the Spanish sardine, collected at the Dry Tortugas. The nuchal eminence, which characterizes Looss's genus *Ectenurus*, cannot be distinguished, but neither can it be seen in some of the Tortugas specimens.

The body is transversely striate with sharply and rather coarsely serrate margins. The diameter of the ventral sucker is about three times that of the oral; pharynx subglobular. The neck is much contracted, and the appendix is retracted. The genital aperture is at the ventral margin of the oral sucker; cirrus pouch slender; seminal vessicle divided into three compartments, one following the other, and increasing slightly in size posteriorly, dorsal and posterior to ventral sucker. The two testes lie near the posterior border of the ventral sucker and are diagonally placed. The right testis is close to the border of the sucker, and the left is contiguous to the posteroventral surface of the posterior division of the seminal vesicle. The ovary is larger than the testes and is contiguous to the posterior border of the left testis. Length of first testis, 0.08 mm., breadth, 0.12 mm.; length of second testis, 0.08 mm., breadth, 0.15 mm.; length of ovary, 0.15 mm., breadth, 0.19 mm. Vitellaria tubular, on right, left, and posterior sides of the ovary. The folds of the uterus are mainly behind the ovary and vitellaria, filling the space between the vitellaria and the base of the appendix. The ova are small, collapsed, and crowded, and difficult to measure; about 0.016 by 0. 008 mm.

Measurements in balsam: Length, 1.4 mm.; breadth, 0.43 mm.; diameter of oral sucker, 0.11 mm., of pharynx, 0.07 mm., of ventral sucker, 0.30 mm.

Genus LECITHOCLADIUM Lühe, 1901

LECITHOCLADIUM GULOSUM (Linton)

PLATE 8, FIGURES 79-82

Distomum gulosum LINTON, Bull. U. S. Fish Comm. for 1899, p. 454, figs. 315–317, 1901.—NICOLL, Ann. Mag. Nat. Hist., ser. 7, vol. 19, p. 69, 1907.
Lecithocladium gulosum (Linton), Looss, Zool. Jahrb., vol. 26, p. 135, 1907.

One specimen from the chub mackerel was observed to have a distinct hump on the neck, thus resembling *L. cristatum* (Rudolphi), but this nuchal hump may be due to contraction, since it is absent from others which are mounted in a position to show the neck in lateral view. There is no indication of the incised serrations characteristic of *L. excisum* (Rudolphi).

TABLE 34.—*Measurements of the seminal vesicle of* Lecithocladium gulosum *in two series of cross sections and four series of sagittal sections*

Measurements	Cross		Sagittal			
	Mm.	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*
Length	0.42	0.49	0.46	0.52	0.53	0.64
Maximum diameter	.32	.24	.29	.28	.17	.20
Maximum thickness of wall	.10	.08	.08	.06	.05	.02

TABLE 35.—*Measurements of specimens of* Lecithocladium gulosum *in balsam*

Measurements	From *Poronotus triacanthus*		From *Pneumatophorus grex*		From *Scomber scombrus*	
	Mm.	*Mm.*	*Mm.*	*Mm.*	*Mm.*	*Mm.*
Length	8.40	8.82	7.42	9.42	6.58	6.02
Breadth	1.14	1.16	.94	1.12	.70	.55
Oral sucker, length	.46	.51	.46	.56	.42	.45
Oral sucker, breadth	.42	.36	.39	.52	.25	.33
Pharynx, length	.42	.38	.45	.49	.42	.45
Pharynx, breadth	.18	.19	.25	.22	.17	.17
Ventral sucker, length	.40	.42	.39	.43	.35	.34
Ventral sucker, breadth	.38	.36	.39	.43	.35	.34
Seminal vesicle, length	.77	.77	.77	1.09	.56	.53
Seminal vesicle, breadth	.25	.25	.21	.31	.18	.17

The ova in all the balsam mounts are crowded and collapsed, about 0.018 by 0.009 mm. Average of 10 specimens from *P. triacanthus:* Length of oral sucker, 0.32 mm.; of pharynx, 0.29 mm.; of ventral sucker, 0.30 mm. Average of 10 from *P. grex:* Length of oral sucker, 0.28 mm.; of pharynx, 0.29 mm.; of ventral sucker, 0.23 mm.

Hosts.—Dollarfish (*Poronotus triacanthus*), chub mackerel (*Pneumatophorus grex*), common mackerel (*Scomber scombrus*).

Record of collections.—From dollarfish: Three, collected July 24, 1918. Two (U.S.N.M. No. 8374), collected July 25, 1918.

From chub mackerel: One, collected August 15, 1918, fragment, suckers missing. Excretory vessel, dark brown, slender, extends from posterior end to anterior edge of testes, where it divides into two lateral vessels; length, 5 mm.

Twelve, collected August 19, 1918. Some of these are fragments as on previous date. The suckers adhere to the mucous membrane of the host and the worms have a tendency to break behind the ventral sucker unless care is taken in removing them. Measurements, life: Length, 6 mm.; oral sucker, length, 0.48 mm., breadth, 0.38 mm.; pharynx, length, 0.42 mm., breadth, 0.20 mm.; diameter of ventral sucker, 0.42 mm. Length very variable, depending on the degree of contraction.

Fifteen and several fragments, collected August 31, ——; very extensible, some of them stretching to a length of 15 mm. or more.

Collection of August 22, 1910. Number not noted. Color of body reddish, neck translucent-white, entire. Length as much as 6 mm. Measurements, life: Length, 5.36 mm.; breadth, 0.87 mm.; oral sucker, length, 0.58 mm.; breadth, anterior, 0.56 mm., posterior, 0.21 mm.; pharynx, length 0.56 mm., breadth, anterior, 0.21 mm., posterior, 0.25 mm.; ventral sucker, length, 0.49 mm., breadth, 0.54 mm.; ova, 0.02 by 0.01 mm.

Seventeen, collected August 18, 1920; various contraction forms, with tendency to be somewhat swollen toward the posterior end when the appendix is retracted. Seven (U.S.N.M. No. 8375), collected July 21, 1928; actively contracting and extending, from 4 to 9 mm.

Five, collected August 6, 1928; 3 to 7 mm., translucent, reddish yellow in region of uterus. One (U.S.N.M. No. 8376), collected August 23, 1928. Six, collected July 6, 1929; 3 fishes examined. Thirty-two, collected July 11, 1929; 3 fishes examined. Four, collected July 29, 1929; 3 fishes examined. Twenty-eight, collected August 19, 1929; 3 fishes examined.

From common mackerel: Two (U.S.N.M. No. 8377), collected August 10, 1906. Measurements, life: Length, 7 mm.; diameter, anterior, 0.37 mm., middle, 0.84 mm., thence tapering to 0.28 mm. or less at the posterior end; oral sucker, length, 0.49 mm., breadth, 0.28 mm.; pharynx, length, 0.42 mm., breadth, 0.16 mm.; diameter of ventral sucker, 0.35 mm.; ova, 0.02 by 0.01 mm.

CYST CONTAINING TREMATODE OVA

PLATE 11, FIGURE 108

A cyst from the wall of the postbranchial chamber of a summer flounder (*Paralichthys dentatus*), collected by Dr. C. W. Hahn, July

25, 1910, contains coils of the uterus of a distome. The specimen in balsam measures: Length, 3.57 mm.; maximum breadth, about 1 mm.; ova, 0.024 by 0.012 mm. Portions of the uterus are filled with ova, while other portions contain yellow, granular material, presumably yolk granules. In some places this material is associated with ova. The size of this fragment suggests a distome of the dimensions of *Dinurus pinguis*, but the ova are distinctly larger than they are in that species. (U.S.N.M. No. 8378.)

Family ACCACOELIIDAE Odhner, 1928

Distomes from the pelagic sunfish, *Mola mola*, are here considered. These are medium to large distomes with elongated and strongly muscular bodies, in most cases smooth; neck short and often more or less reflected dorsally; ventral sucker larger than oral, often pedicelled, thus causing the anterior end of the worm to appear to be forked. Pharynx much smaller than oral sucker, usually long-pyriform; esophagus long, intestinal rami elongate with anterior diverticula, giving to the intestine the characteristic H-shape. Excretory vessel Y-form with short stem and short branches; genital pore ventral, median, behind oral sucker; copulatory organ muscular; ejaculatory duct surrounded by prostatic cells; seminal vesicle tubular, convoluted, usually entirely in front of ventral sucker, or dorsal to it. Testes behind ventral sucker, close together, one following the other. Ovary behind testes, median; shell gland at anterior edge of ovary; no seminal receptacle, the sperm being stored in the early folds of the uterus; vitellaria lateral variously distributed in the different species; uterus voluminous, mainly behind the ovary; metraterm with muscular walls, ventral to seminal vesicle and prostate; ova numerous, small. The relative positions of structures, especially at the anterior end, are subject to considerable alteration with varying contraction conditions.

The classification adopted by Odhner [14] has been followed:

Genus ACCACOELIUM Monticelli, 1893

ACCACOELIUM CONTORTUM (Rudolphi)

Distomum contortum (Rudolphi), Linton, Proc. U. S. Nat. Mus., vol. 20, pp. 528–530, pl. 48, figs. 3–7, 1898; Bull. U. S. Fish Comm. for 1899, p. 466, 1901.—Sumner, Osburn, and Cole, Bull. U. S. Bur. Fisheries, vol. 31, pt. 2, p. 582, 1911.

Accacoclium contortum (Rudolphi), Odhner, Zool. Anz., vol. 77, p. 172, 1928.

Anterior part of body covered with blunt, papillalike spines; prepharynx protrudes into oral sucker, forming a conical papilla; geni-

[14] *Rhynchopharynx paradoxa* n. g., n. sp. nebst Revision der Accacoeliden von *Orthogoriscus mola*. Zool. Anz., vol. 66, pp. 167–175, 1928.

tal pore at level of posterior edge of oral sucker; copulatory organ large; ejaculatory duct convoluted, surrounded by prostatic cells; convoluted seminal vesicle, dorsal to ventral sucker; first testis some distance behind ventral sucker; vitellaria mainly behind ovary.

Measurements made on a series of sagittal sections: Length, 10.00 mm.; maximum breadth, 1.60 mm.; oral sucker, length, 0.70 mm., breadth, 0.91 mm.; pharynx, length, 0.42 mm., breadth, 0.21 mm.; ventral sucker, length, 1.19 mm., breadth, 1.40 mm.; anterior end to posterior edge of ventral sucker, 3.78 mm.; anterior end to first testis, 5.18 mm.; second testis to ovary, 0.56 mm.; ova, maximum, about 0.033 by 0.021 mm.

TABLE 36.—*Measurements of four specimens of* Accacoelium contortum *in balsam.*

Measurement	1	2	3	4
	Mm.	*Mm.*	*Mm.*	*Mm.*
Length	14.00	15.00	14.00	15.00
Maximum breadth	1.00	2.00	1.50	1.00
Oral sucker, length	.50	.70	.56	.56
Oral sucker, breadth	.38	.62	.56	.50
Pharynx, length	.28	.42	.35	.28
Pharynx, breadth	.14	.16	.16	.14
Ventral sucker, length	.63	1.12	.70	.77
Ventral sucker, breadth	.70	.91	.84	.56
Length of ventral sucker and pedicel	1.68	1.05	1.33	2.10

Host.—Ocean sunfish (*Mola mola*).

Record of collections.—A collection (U.S.N.M. No. 8379), of July 20, 1914. Number not recorded in notes. Heads and necks inserted in mucous membrane of pharynx; body slender, cylindrical, tapering to posterior end, yellowish. These worms were still active after lying in sea water over night.

Twenty-five (U.S.N.M. No. 8380), collected September 3, 1925, in one mass in pharynx of host. These distomes were found by Dr. G. A. MacCallum while examining the gills of a sunfish.

Twenty-five, collected July 19, 1926, in anterior portion of alimentary canal, and on gills.

Genus ACCACLADOCOELIUM Odhner, 1928

ACCACLADOCOELIUM MACROCOTYLE (Diesing)

Distomum macrocotyle Diesing, LINTON, Proc. U. S. Nat. Mus., vol. 20, pp. 522, 523, pl. 45, figs. 8–10, pl. 46, figs. 1–5, 1898; Bull. U. S. Fish Comm. for 1899, p. 282, 1900; *ibid.*, p. 466, 1901.—SUMNER, OSBURN, and COLE, Bull. U. S. Bur. Fish., vol. 31, pt. 2, p. 583 1911.

Accacladococlium macrocotyle (Diesing), ODHNER, Zool. Anz., vol. 77, p. 172 1928.

Smooth; genital pore at posterior edge of oral sucker; copulatory organ short, ejaculatory duct not much convoluted; prostate large; convoluted seminal vesicle at anterior dorsal border of ventral sucker; first testis usually near ventral sucker; vitellaria extend from oral sucker to ovary; ova about 0.024 by 0.018 mm.

Measurements, balsam, lateral view: Length, 13.00 mm.; maximum breadth, 1.54 mm.; oral sucker, length, 0.61 mm., breadth, 0.56 mm.; ventral sucker, length, 1.33 mm., breadth, 1.30 mm.; anterior end to posterior border of ventral sucker, 3.24 mm.; anterior end to first testis, 3.15 mm.; second testis to ovary, 0.21 mm.; ovary to posterior end, 6.30 mm.

Measurements made on a series of sagittal sections: Length, 10.00 mm.; maximum breadth, 1.26 mm.; oral sucker, length, 0.50 mm., breadth, 0.50 mm.; pharynx, length, 0.30 mm., breadth, anterior, 0.08 mm., breadth, posterior, 0.15 mm.; ventral sucker, length, 1.20 mm., breadth, 1 mm.; anterior end to posterior border of ventral sucker, 3.85 mm.; anterior end to first testis 3.85 mm.; second testis to ovary, 0.40 mm.; ovary to posterior end, 4.12 mm.; copulatory organ, retracted, length, 0.24 mm., breadth, 0.07 mm.

Host.—Ocean sunfish (*Mola mola*).

Record of collections.—Eleven (U.S.N.M. No. 8381), collected July 20, 1914, from intestine of host; fusiform, elongate posteriorly; translucent; intestine dark brown; uterus greenish yellow. A number of these distomes were clinging to cestodes (*Ancystrocephalus microcephalus*); maximum length, compressed under cover-glass, about 18 mm.

Fourteen (U.S.N.M. No. 8382), collected September 3, 1925, from intestine of host; 20 mm. in length, in alcohol.

Genus ACCACLADIUM Odhner, 1928

ACCACLADIUM SERPENTULUS Odhner

Distomum nigroflavum Rudolphi, Linton, Proc. U. S. Nat. Mus., vol. 20, pp. 530, 531, pl. 48, figs. 8–11, pl. 49, figs. 1, 2, 1898; Bull. U. S. Fish Comm. for 1899, p. 282, 1900; *ibid.*, p. 406, 1901.—Sumner, Osburn, and Cole, Bull. U. S. Bur. Fisheries, p. 31; pt. 2, p. 583, 1911.

Accacladium serpentulus Odhner, Zool. Anz., vol. 77, pp. 173–174, fig. 3, 1928.

Nearly smooth, but with a few minute, scattering papillae at the anterior end. There is a blunt papilla in the oral sucker at the entrance of the prepharynx. Genital pore some distance back of posterior edge of oral sucker. In a series of sagittal sections, distance between oral and ventral suckers about 2 mm.; the genital pore is about 0.5 mm. back of the oral sucker. Copulatory organ rather large; in a series of sagittal sections, length, 0.70 mm., diameter, 0.14 mm., tapering to 0.07 mm. at its anterior end. The prostate is well

developed. In a specimen mounted in balsam, copulatory organ everted, the length of the prostate is 0.70 mm., its diameter 0.14 mm., ejaculatory duct somewhat convoluted. In a series of sagittal sections, copulatory organ retracted, the length of the prostate is 0.56 mm., diameter, 0.50 mm.; ejaculatory duct much convoluted. Seminal vesicle tubular, convoluted, dorsal to and behind ventral sucker; first testis some distance back of ventral sucker; folds of uterus behind ovary and also between ventral sucker and first testis; vitellaria behind ventral sucker, extending nearly to ovary. Ova, 0.027 by 0.019 mm. to 0.03 by 0.021 mm.

Measurements, balsam, lateral view: Length, 12.00 mm., maximum diameter, 1.12 mm.; oral sucker, length, 0.70 mm., breadth, 0.63 mm.; pharynx, length, 0.35 mm., breadth, 0.14 mm.; ventral sucker, 0.91 mm., breadth, 0.63 mm.; anterior end to posterior border of ventral sucker, 2.38 mm.; anterior end to first testis, 3.36 mm.; second testis to ovary, 0.28 mm.; ovary to posterior end, 4.42 mm.

Host.—Ocean sunfish (*Mola mola*).

Record of collections.—Eleven (U.S.N.M. No. 8383), collected July 20, 1914, from intestine of host.

One, collected September 3, 1925, from intestine of host. Length of neck, 4 mm., length of body back of ventral sucker, 40 mm.; length of ventral sucker and pedicel, 3 mm.

Several, collected July 19, 1926, found in intestine of host; number not recorded.

Thirteen, collected July 13, 1927, in intestine of host.

Genus OROPHOCOTYLE Looss, 1902

OROPHOCOTYLE FOLIATA (Linton)

Distomum foliatum Linton, Proc. U. S. Nat. Mus., vol. 20, pp. 532–534, pl. 50, figs. 1–3; pl. 51, figs. 1–4, 1898; Bull. U. S. Fish Comm. for 1899, p. 282, 1900; *ibid;* p. 466, 1901.—Sumner, Osburn, and Cole, Bull. U. S. Bur. Fish., vol. 31, pt. 2, p. 583, 1911.

Orophocotyle foliata (Linton), Looss, Centralbl Bakt., Parasit., vol. 31, p. 644, 1902.—Odhner, Zool. Anz., vol. 77, p. 175, 1928.

Odhner [15] is of the opinion that Monticelli's *Distomum calyptrocotyle* is the immature form of *D. foliatum.*

Smooth; ventral sucker with accessory lobes, often pedicelled, much larger than oral; genital pore a short distance behind oral sucker; copulatory organ short; ejaculatory duct rather short, convoluted; prostate not large; convoluted seminal vesicle in front of ventral sucker, some of its folds dorsal to prostatic portion of ejaculatory duct. First testis, in some cases near, even on a level

[15] Zool. Anz., vol. 38, p. 525, 1911; vol. 77, p. 175, 1928.

with the ventral sucker, in others at a considerable distance behind the ventral sucker, with numerous folds of the uterus between testis and ventral sucker; vitellaria in neck and extending from the oral sucker to the testes, vitelline ducts continuing to the shell gland. Ova, maximum in balsam, 0.030 by 0.018 mm. to 0.033 by 0.021 mm.

TABLE 37.—*Measurements of five specimens of* Orophocotyle foliata

Measurement	1[1]	2[1]	3[1]	4[2]	5[2]
	Mm.	*Mm.*	*Mm.*	*Mm.*	*Mm.*
Length	15.00	16.00	14.00	------	------
Maximum breadth	.84	1.12	.77	------	------
Oral sucker, length	.53	.67	.72	0.52	0.63
Oral sucker, breadth	.49	.74	.35	.21	.39
Pharynx, length	.28	.44	.42	.30	.42
Pharynx, breadth	.16	.21	.16	.15	.23
Ventral sucker, length	1.33	1.40	1.33	------	------
Ventral sucker, breadth	.70	.70	1.50	------	------
Length ventral sucker and pedicel	1.96	1.12	2.10	------	------

[1] In balsam. [2] Sagittal sections.

Host.—Ocean sunfish (*Mola mola*).

Record of collections.—Several (U.S.N.M. No. 8384), collected July 20, 1914, from intestine of host.

Eight (U.S.N.M. No. 8385), collected September 3, 1925, from intestine of host; lengths 8 to 22 mm.

Twenty-seven, collected July 19, 1926, from intestine of host.

Family DIDYMOZOONIDAE Monticelli, 1888

Genus DIDYMOZOON Taschenberg, 1878

DIDYMOZOON SCOMBRI Taschenberg

PLATE 23, FIGURES 305–309

Didymozoon scombri Taschenberg, ODHNER, Surtrych ur "Zoologische Studien" tillagnade T. Tullberg, pp. 311–323, text figs. 1, 2, pl. figs. 1–11, 1907.

A tangled mass of trematodes (U.S.N.M. No. 8386), found in the intestinal wall of a butterfish (*Poronotus triacanthus*), July 24, 1918, was straightened out on a slide and fixed under slight pressure. The entire lot consists of seven individuals, aggregate length in alcohol 264 mm. Length of one of the longest specimens in balsam, 40 mm.; breadth near oral sucker, 0.53 mm., elsewhere from 0.18 to 0.52 mm.; oral sucker, length, 0.23 mm., breadth, 0.21 mm. In another, diameter of oral sucker, 0.29 mm.; breadth near oral sucker, 0.63 mm., for the first 2 mm. of the length; elsewhere the breadth varies from 0.28 to 0.35 mm.; rami of the intestines could be traced for a short distance but were soon hidden by the uterus. In one specimen, approximately 40 mm. in length, the anterior end of the

first testis was about 1.6 mm. from the anterior end. The tubular ovary began near the testes and continued in the germ duct which ended at the shell gland, about 15 mm. from the anterior end. The tubular vitelline gland extended from the shell gland to the posterior end. The uterus, lying mainly in two longitudinal folds, fills the body in most cases from near the oral sucker to the posterior end. The uterus and ejaculatory duct appeared to open at the posterior margin of the oral sucker in one; while in another the uterus can be traced to the right anterior ventral margin of the oral sucker, thence it appears to cross over to the left anterior border. In another the uterus opens at the ventral edge of the oral sucker a little to the left of the median line. In another the uterus opens on the median line at the anterior ventral border of the oral sucker. Where best shown the opening of the uterus is slightly prominent, as a very low rounded papilla at the ventral border of the oral sucker.

There is much variation in the testes. In general the right testis is considerably in advance of the other. Thus, in one the left testis is much smaller than the right, and its anterior end is about on a level with the posterior end of the right testis. Each is elongated and more or less convolute-lobed. In another the relative positions are about the same but the second, or left, testis is larger than the first. In another the testes are nearly opposite, as figured by Odhner. In another they are opposite and very much reduced in size. In this specimen the uterus exhibits regional inflations as in Odhner's figure (l. c., fig. 8).

DIDYMOZOON SARDAE (G. A. and W. G. MacCallum)

PLATE 23, FIGURE 310

Koellikeria sardae G. A. and W. G. MACCALLUM, Zool. Jahrb., vol. 39, pp. 161–166, figs. 11–16, 1916.

Following is a record of collections of this trematode which were made by Mr. Edwards and myself. So far as details of the anatomy are shown in mounted material they agree with the description of the species given by the MacCallums. In one of the specimens mounted in balsam the intestine is seen to divide at about the middle of the length of the testes, or 2.8 mm. from the anterior end. The esophagus is conspicuous, being surrounded by a thick wall of cells, while the walls of the intestine are exceedingly thin.

Host.—Bonito (*Sarda sarda*).

Record of collections.—Four, collected July 7, 1903, by Vinal N. Edwards, from gills of one fish.

Measurements in formalin: Largest cyst, length, 12 mm., breadth, 3.5 mm.; smallest cyst, length, 7 mm.; breadth, 4.5 mm. Two worms from largest cyst measured 34 and 37 mm. in length, respectively;

maximum breadth, 0.9 mm.; necklike portion at anterior end, length, 6.5 mm.; breadth, 0.45 mm.; diameter at anterior end, 0.33 mm.; diameter of oral sucker, 0.26 mm.; pharynx, length, 0.21 mm., breadth, 0.15 mm.; ova, 0.014 by 0.011 mm. Worms from smallest cyst of practically the same dimensions as those from largest cyst.

Two cysts from one of three fishes examined August 18, 1903. One fish examined on August 19, two on August 20, and one on August 24; no cysts found. Length of cyst, 10 mm.; diameter, 3 mm. Two worms from each cyst, measuring 50 mm. in length in sea water. Walls of cyst transparent; color of worms yellow, due to ova in the voluminous folds of the uterus; neck translucent, bluish-white, traversed by a yellow line, the metraterm. Measurements, life: Oral sucker, length, 0.17 mm., breadth, 0.20 mm.; pharynx, length, 0.17 mm., breadth, 0.15 mm. Three cysts from gills, two worms in each cyst, collected by Vinal N. Edwards September 22, 1903.

Six cysts from gills, collected June 17, 1904, by Vinal N. Edwards; long oval-elliptical, length 10 mm., diameter, 3.5 mm.

Cysts from gills. Edwards examined the gills of 100 bonitos on August 31, 1904, and found about 10 out of every 12 infected, with 2 and 3 cysts on each infected fish.

One cyst collected July 8, 1905, from gills containing two worms, one 50 mm. in length, the other slightly less.

Gills of bonito were examined on six dates, August 10 to 27, 1906, no cysts found.

Three cysts from gills (U.S.N.M. No. 8387), two worms in each cyst, collected August 3, 1908. These were younger stages than any of those hitherto recorded. One of them was examined while it was still active. Length of esophagus about 2.5 mm.; intestinal rami extend to the posterior end, and in places contained orange-colored granular material. The anterior end of the uterus, metraterm, was nearly straight, lay beside the esophagus and opened at the junction between the oral sucker and pharynx; ova, 0.014 by 0.009 mm., yellowish, but with moderately high magnification, both by transmitted and reflected light, they appear to be faintly greenish. In another specimen, length, 18 mm., neck slender, length, 3.5 mm.; anterior end white, remainder of body lemon yellow, due to ova; rami of intestine convoluted; neck very contractile; oral sucker and pharynx each oval-elliptical in outline, and of about the same size, 0.015 to 0.016 mm. in diameter; neck very changeable, varying in diameter from 0.2 to 0.7 mm.; movements of body back of neck very slight; diameter of body from 0.8 to 1 mm., tapering to posterior end. In another specimen the pharynx was much smaller than the oral sucker and appeared to be rather thin-walled and collapsed. In this specimen the neck was contracted so as to throw the esophagus into a number of crowded

folds which would have been difficult to interpret if other specimens had not been at hand. The vas deferens was traced into the neck where it lay ventral to the esophagus and the right of the uterus.

Some small, yellowish masses, collected June 27, 1910, encysted on the viscera proved to contain trematode ova, 0.017 by 0.010 mm., associated with granular material. The ova resemble those of trematodes from the gills of the bonito.

Slender, filiform fragments collected by Dr. C. W. Hahn, July 21, 1911, under the mucous membrane of the inner wall of the gill chamber, also fragments from a cyst. These fragments are narrow and ribbonlike; ova, 0.015 by 0.009 mm.

DIDYMOZOON species

PLATE 23, FIGURES 311–314

Following are records of trematodes probably to be referred to this genus but which do not present sufficient characters to admit of specific determination.

Hosts.—Frigate mackerel (*Auxis rochei*), chub mackerel (*Pneumatophorus grex*), common mackerel (*Scomber scombrus*), rudderfish (*Seriola zonata*).

Record of collections.—Cyst on gills (U.S.N.M. No. 8388), collected July 12, 1912, from frigate mackerel; length, 4 mm.; diameter, 1.5 mm. The cyst contained portions of uterus and vitellaria; ova with rather thin shells, much crowded, about 0.018 by 0.009 mm. The specimen was doubled on itself and represented a length of about 6.65 mm., breadth, 0.63 mm.

From the chub mackerel (fig. 313): A small yellow cyst, collected August 15, 1908, in muscle tissue beside the anal aperture of the host. Three yellow cysts, collected in August, 1908, from gills of one fish, and one from another (U.S.N.M. No. 8389). These cysts contained slender trematode fragments filled with ova about 0.012 by 0.006 mm. Fragments mounted in balsam aggregate about 25 mm. in length, and vary in breadth from 0.05 to 0.26 mm. One specimen complete, length about 18 mm., breadth varying from 0.05 to 0.28 mm.; oral sucker, terminal, about 0.07 mm. in diameter; pharynx not distinct, being hidden by ova.

From common mackerel (figs. 311, 312): Two yellow, globular cysts on pyloric caeca (U.S.N.M. No. 8390), collected August 10, 1906. One cyst contained a threadlike trematode, broken into fragments which aggregated a length of about 180 mm., and, for the most part, 0.07 to 0.14 mm. in breadth; ova, 0.014 by 0.008 mm. Two heads were found. Diameter at anterior end, 0.14 mm., at 0.28 mm. from anterior end, 0.29 mm., at 1 mm. from anterior end, 0.15 mm. The second cyst contained a large number of eggs. These frag-

ments were mounted in balsam but the slide does not appear to have either of the heads.

From rudderfish (fig. 314): Twelve (U.S.N.M. No. 8391), collected September 12, 1928. Slender distomes firmly attached to the mucous membrane of the stomach; there was some inflammation at the point of attachment. Many fragments were obtained and mounted in balsam. Maximum diameter, 0.25 mm. In addition to folds of the uterus crowded with ova there are remnants of tubular vitellaria. The ova are rather elongate, more or less collapsed, from 0.024 by 0.010 to 0.027 by 0.012 mm.

Genus WEDLIA Cobbold, 1860

WEDLIA BIPARTITA (Wedl)

PLATE 23, FIGURES 315–317; PLATE 24, FIGURE 318

Wedlia bipartita (Wedl), ODHNER, "Zoologische Studien" tillagnade Prof. T. Tullberg, pp. 323–392, pl. figs. 12, 13; text figs. 3–6, 1907.—FUHRMANN, Handb. Zool., Kükenthal-Krumbach, vol. 2, pp. 64, 65, 73–75, figs. 85, 97, 1928.

Koellikeria (*Didymozoon*) *thynni* Taschenberg, G. A. and W. G. MACCALLUM, Zool. Jahrb., vol. 39, p. 144, 1916.

For the older literature see Stiles and Hassall, Hygienic Lab. Bull. No. 37, 1908: *Didymocystis wedlei* Ariola, p. 152; *Didymozoon thynni* Taschenberg, p. 153; *Monostomum bipartitum* Wedl, p. 310; *Wedlia bipartita* (Wedl, 1844), p. 383.

Following are brief notes on encysted trematodes from the horse mackerel (*Thunnus secundodorsalis*):

Record of collections.—Thirty or more (U.S.N.M. No. 8392), collected July 31, 1914. These were first noted as small yellow spots among the intestinal villi. Later three larger cysts were found among the pyloric caeca. The egg-filled portion of one of these trematodes which was removed from its cyst measured 1.45 mm. in length and 1.71 mm. in breadth. A protruding anterior end measured 0.45 mm. in length; breadth, anterior, 0.30 mm., posterior, 0.03 mm.; oral sucker, length, 0.15 mm., breadth, 0.12 mm.; no pharynx noted. Ova, 0.021 by 0.014 mm.

Another, an immature specimen, was somewhat dumbell shaped. Measurements: Length, 1.24 mm., breadth of anterior potrion, 0.30 mm., of middle portion 0.04 to 0.07 mm., posterior portion, 0.48 mm.; oral sucker, length, 0.10 mm., breadth, 0.09 mm.; pharynx, length, 0.04 mm., breadth, 0.02 mm.

Among the numerous specimens in the collection mounted in balsam is one in which the anterior ends of two trematodes protrude side by side from the oblong massive portion in which only folds of the uterus, crowded with ova, and a few portions of the tubular vitellaria can be made out. In one of these the uterus, and in the other the ejaculatory duct can be seen, each opening at the posterior

border of the oral sucker. In addition to the uterus and vitellaria, two small, deeply staining bodies, opposite each other and situated at the margin, a little in front of the middle of the length of a flattened specimen, were interpreted as the testes, and another on the median line, a little back of the middle, as the ovary. No pharynx can be made out satisfactorily in this specimen, although a faint indication of one appears in the head of the female. Another specimen with a reniform massive portion containing the uterus, etc., also has two protruding heads side by side. These differ considerably in size. Measurements of female: Breadth at level of oral sucker, 0.18 mm.; oral sucker, length, 0.075 mm., breadth, 0.090 mm. Measurements of male: Breadth at level of oral sucker, 0.06 mm.; oral sucker, length, 0.045 mm., breadth, 0.060 mm. Length of common egg-containing portion, 0.70 mm., breadth, 1.12 mm.

Eight cysts, collected by Vinal N. Edwards, September 22, 1914, from pyloric caeca. These were at first taken to be pedicelled cysts, but they proved to be pyloric caeca in the lumens of which the trematodes were lodged.

Four, collected June 29, 1915, encysted in the pyloric caeca, yellow; largest, length, 9 mm., breadth, 4.5 mm.; smallest, length, 3 mm., breadth, 1.5 mm.; ova, 0.028 by 0.014 mm.

WEDLIA XIPHIADOS (G. A. and W. G. MacCallum)

Koellikeria xiphiados (G. A. and W. G. MacCallum), Zool. Jahrb., vol. 39, pp. 148–153, figs. 1–5, 1916.

Cysts from flesh behind gill cavity collected July 21, 1913. These cysts came from a swordfish (*Xiphias gladius*), taken by Charles Grinnell. The specimens had been more or less mutilated, but it was possible to trace a slender tube containing blood vessels from each cyst toward the gill cavity. Before this material was turned over to Dr. MacCallum, who was giving special attention to trematodes on the gills of fishes, a few notes were made. Upon comparing my notes with the detailed description given by the MacCallums I find them in agreement, with the exception of the dimensions of the ova. These are stated in the description of the species to be 0.06 mm. in diameter. My notes give the dimensions as 0.021 by 0.016 mm. In some ivory white tubules the ova were slightly smaller than the yellow, older ova. They measured 0.020 by 0.016 mm., and, so far as observed, had developed to the two-celled stage.

A short papilla, 4 mm. long and 4 by 3 mm. in diameter, was observed on the side of one of the trematodes. It had a mouthlike opening at the end and along one side. Within the papilla there was a thin membrane, richly supplied with blood vessels, which appeared to be distributed generally among the tubular genitalia of the trematode.

One of these trematodes after removal from its cyst measured 40 by 28 by 24 mm.

Family HETEROPHYIDAE Odhner, 1914

Genus CRYPTOCOTYLE Lühe, 1899

CRYPTOCOTYLE LINGUA (Creplin)

Cryptocotyle lingua (Creplin), Ryder, Bull. U. S. Fish Comm. for 1884, pp. 37–42, 1884.—Linton, Bull. U. S. Fish Comm. for 1899, pp. 281, 296, pl. 40, figs. 76–81, 1900; *ibid.*, pp. 462, 463, fig. 318, 1901.—Ransom, Proc. U. S. Nat. Mus., vol. 57, pp. 544–548, 1920.—Linton, Proc. U. S. Nat. Mus., vol. 73, art. 1, pp. 19–20, 1928.—Stunkard and Willy, Amer. Journ. Trop. Med., vol. 9, pp. 117–128, 6 figs., 1929.—Stunkard, Journ. Morph. and Physiol., vol. 50, pp. 143–191, pls. 1–4, 1930.

Dermocystis ctenolabri Stafford, Zool. Anz., vol. 28, p. 682, 1905.

Toecotrema lingua (Creplin), Linton, Journ. Parasit., vol. 1, pp. 128–134, 3 figs., 1915.

The following record of distomes encysted in the skin of Woods Hole fishes is compiled from notes made on various occasions from 1903 to 1927. Many of the notes were made while small fishes were being examined for their food, and are, consequently, difficult to reduce to a tabular form. Also, since it was not always possible to give exact numbers, approximations are marked with a plus-or-minus sign in the tabular summary.

In some cases these cysts occur in great numbers. Thus, a window-pane (*Lophopsetta maculata*) 32 cm. in length and 24 cm. in breadth, was examined for cysts on July 14, 1924, and the following note made: The entire surface, including the fins, was densely and uniformly peppered with encysted distomes, with the usual accompanying pigmentation; several on corneas of eyes; mouth, pharynx, and gills thickly beset with them. Counts were made at different places on the surface and it was found that 50 per square centimeter would be a conservative estimate of the degree of infection. The number of cysts on the surface, not including the mouth, pharyngeal and gill regions, according to this estimate would be about 76,800.

These cysts are very common on the tautog (*Tautoga onitis*). Thus, in 1908, 97 tautogs, from 8.5 to 34 cm. in length, were examined on 16 dates, from July 23 to September 3. Only an occasional fish was noted on which cysts were not present on the fins, and in most cases on the sides. Occasionally one is recorded as having large numbers of cysts. Thus, one seined at the Weepeckets, August 4, length 27 centimeters, had approximately 75 cysts on each eye. Eleven scales taken at random from the sides had an average of 10.2 cysts per scale, ranging from 0 to 13 mm.

The cunner (*Tautogolabrus adspersus*) is probably more generally infested by this parasite (U.S.N.M. No. 8393) than any of the Woods Hole fishes, with the possible exception of the tautog.

The late Dr. Irving T. Field, who, in 1903, was studying the food of cunners, reported that large numbers of them had cysts in the skin. Vinal N. Edwards in 1905 reports that he examined over 200 cunners taken in the seine at Quisset Harbor and found all to be infected. He states that he looked them over carefully to see if he could find one that was free from skin parasites, but did not find any that was clear of cysts. He also reports that he examined 100 cunners at Menemsha Bight, taken in fish trap and by seine, but saw no skin parasites. The cunners of Menemsha, however, are not always free from these cysts. Thus, on July 29, 1908, 21 cunners, seined at Menemsha, were examined. The larger fish had numerous cysts on the fins and sides; the smaller fish were, most of them, lightly infested, although one of the smallest, 8 cm. in length, had numerous cysts. Cunners from the fish trap at Menemsha, however, were found to be practically free from skin parasites, while those from traps in Buzzards Bay, near Woods Hole, were frequently heavily parasitized. In more or less enclosed bodies of water the infection is often high. Thus, at Sheep-pen Cove, August 12, 1908, three cunners were taken, each of which was densely peppered with black pigment spots; 24 scales were taken at random from the side of the larger one, 18 cm. in length. The average number of cysts per scale was 7.25; largest number on one scale 19. Also, at Hadley Harbor on August 24, 60 cunners, chosen at random from a large number taken in the seine, were examined; 29 of them were densely covered with cysts. The body and fins were almost black, with some

TABLE 38.—*Cysts of* Cryptocotyle lingua *on skin and fins of Woods Hole fishes*

Host	Month	Number of days	Number of fishes examined	Cysts			
				None	Few	Many	Numerous
Acanthocottus aeneus	July, Aug.	2	6	2	4		
Gadus morrhua	Dec.	1	1				1
Lophopsetta maculata	May, July, Aug., Sept.	9	23	5	11	1	6
Menticirrhus saxatilis	Aug., Sept.	6	16	12	4		
Menidia notata	July, Aug., Sept.	10	121	81	20		
Microgadus tomcod	Apr., Aug., Dec.	5	27			14	13
Mullus auratus	Sept.	2	3	2	1		
Osmerus mordax	Aug.	2	21	15	6		
Pholis gunnellus	Aug.	1	1		1		
Pollachius virens	Apr., Aug.	2	3		3		
Pomatomus saltatriz	July, Aug., Sept.	1	70	67	3		
Poronotus triacanthus	July, Aug.	3	3				3
Pseudopleuronectes americanus	July, Aug., Sept.	12	67	±34	±30		3
Scomber scombrus	July, Aug.	10	78	54	20	4	
Tautoga onitis	July, Aug., Sept.	29	112	±7	±65	±30	±10
Tautogolabrus adspersus	July, Aug., Sept.	48	815	±173	±445	±48	±148
Trachinotus falcatus	Sept.	2	6	1	5		

blotches of red, and a ground color of dark blue. The mucous membrane of the mouth and the tongue was thickly covered with cysts.

In all cases but one the distomes which were removed from cysts and examined belonged to the species *C. lingua*. The exception was in cysts from two specimens of *Menidia notata* seined in Great Harbor, August 29, 1908, two cysts on the caudal fin of each, and three on each side of one.

The foregoing tabular summary is unsatisfactory in some particulars. For example these cysts are of rather frequent occurrence in *Microgadus tomcod* and *Poronotus triacanthus*, which could hardly be inferred from the table.

The life history of this distome has recently been worked out by Dr. H. W. Stunkard. An abstract of his paper appeared in the Collecting Net, vol. 5, p. 268.

Family CLINOSTOMIDAE Lühe, 1901

Genus CLINOSTOMUM Leidy, 1856

CLINOSTOMUM MARGINATUM (Rudolphi)

Clinostomum marginatum (Rudolphi) H. L. Osborn, Biol. Bull., vol. 20, pp. 350–356, pl. 1, 1911; Journ. Morph., vol. 23, pp. 189–228, pls. 1–3, 1912.

The following records of the encysted stage of this widely distributed parasite add some localities to those included in Osborn's publications.

Hosts.—Brook trout (*Salvelinus fontinalis*), large-mouthed black bass (*Huro floridana*), small-mouthed black bass (*Micropterus dolomieu*), yellow perch (*Perca flavescens*).

Record of collections.—Two distomes of this species, from the flesh of the brook trout from Alder Lake, Delaware County, N. Y., were sent to me by Dr. Tarleton H. Bean; date of sending November 27, 1910. Length of larger, 7 mm.; breadth, 0.8 mm.

A considerable number of trout (U.S.N.M. No. 8395) were examined for flesh parasites at Alder Lake from June 26 to June 28, 1911. Unfortunately the notes of this examination are missing. Distomes were found in the flesh of several trout, usually just beneath the skin. They were not numerous in any of the fishes. Specimens mounted in balsam measure from 3.6 to 8 mm. in length. Measurements of one of the larger specimens in balsam: Length, 8 mm.; maximum breadth, 1.9 mm.; oral sucker, length, 0.30 mm., breadth, 0.33 mm.; ventral sucker, length, 0.85 mm., breadth, 0.92 mm.

Alder Lake is about 40 acres in extent. No other fish than trout are in the lake.

Ten large-mouthed black bass (U.S.N.M. No. 8394), taken in Bass Lake, White Earth Reservation, Minn., and preserved in formalin,

were examined at the Laboratory of the Bureau of Fisheries, Woods Hole, Mass., August 6, 1919. The fish had been collected at the instance of Dr. Earl A. Danielson, of Litchfield, Minn. Letters accompanying the collection were dated June 18 and 23. The fish were sent on account of their infestation with the tapeworm *Proteocephalus ambloplites*. Immature distomes were found in the flesh of eight of the ten fishes, from 3 to 27 in each, 108 in all. Measurements in balsam: Length, 5 mm.; breadth, at level of oral sucker, 0.81 mm., at level of ventral sucker, 1 mm., maximum, 1.22 mm.; oral sucker, length, 0.25 mm., breadth, 0.26 mm.; diameter of ventral sucker, 0.64 mm.

Received on October 23, 1902, caudal and dorsal fins and pieces of the flesh of small-mouthed black bass, taken by the Rev. James H. Young, Troy, Ohio, in Lost Creek, Miami County, Ohio. Mr. Young stated that the bass taken during the summer were nearly all infested with parasites, on the fins and in the flesh, especially along the backbone. These parasites proved to be *C. marginatum*. One removed from its cyst measured 4.5 mm. in length and 2 mm. in breadth.

Three small-mouthed black bass (U.S.N.M. No. 8396), about 4 cm. in length, sent to the Laboratory of the Bureau of Fisheries, Woods Hole, Mass., by Deputy Fish and Game Warden Charles Meyers, Far Hills, N. J., were received on July 29, 1915. The fish were taken from Ravine Lake, Somerset Hills Country Club.

Five encysted distomes of *C. marginatum* were found, one cyst on the gills, one in the gill cavity, and three in the flesh. Those on the gills and in the gill cavity were bright yellow, the others pale yellow. The largest, from the flesh, in formalin measured 9 mm. in length. Measurements in balsam: Length, 8.5 mm.; breadth, at level of oral sucker, 1.12 mm., at level of ventral sucker, 1.54 mm., maximum, 2.03 mm.; diameter of oral sucker, 0.36 mm., ventral sucker, 0.70 mm., breadth, 0.83 mm.

Received from Dr. Tarleton H. Bean on June 8, 1915, distomes collected from yellow perch in Honeoge, and neighboring lakes, by Ward's Natural Science Establishment. There were seven distomes in the vial, all *C. marginatum*. Lengths, in formalin, 4 to 6 mm.; breadth, 1.5 mm. Some with fragments of cysts attached.

Family STRIGEIDAE Railliet, 1919

Genus TETRACOTYLE Filippi, 1854

TETRACOTYLE COMMUNIS Hughes

PLATE 24, FIGURE 319

Tetracotyle communis HUGHES, Trans. Amer. Micr. Soc., vol. 47, pp. 415–419, figs. 1, 5, 6, 8–11, 1928.

Encysted trematodes from a fresh-water fish, the wall-eyed pike (*Stizostedion vitreum*), are here recorded.

Cysts from fish from market, Washington, Pa. (U.S.N.M. No. 8397), presumably from Lake Erie, collected March 7, 1891. A slide in my collection contains sections of a cyst with enclosed larval trematode, and of a trematode which had been removed from its cyst.

The structure of cyst and larva, so far as shown in these sections, agrees with the detailed description given by Hughes, but there is no trace of spines, and the pharynx is not well shown.

Measurements of cyst, 0.80 by 0.60 mm.; of contained larva, length, 0.55 mm., breadth, 0.42 mm.; ventral sucker, breadth, 0.17 mm., vertical diameter, 0.17 mm.; oral sucker, length, 0.11 mm., breadth, 0.14 mm.

Genus NEASCUS Hughes, 1927

NEASCUS CUTICOLA (van Nordmann)

PLATE 24, FIGURES 320–323

Diplostomum cuticola Diesing, LINTON, Proc. U. S. Nat. Mus., vol. 20, p. 513, pl. 41, figs. 1–10, pl. 42, figs. 1–5, 1898.

Diplostomum cuticola (van Nordmann), LÜHE, Brauer's Süsswasserfauna Deutschlands, Trematodes, pp. 166, 167, 1909.

Neascus cuticola (van Nordmann), HUGHES, Trans. Amer. Micr. Soc., vol. 47, pp. 331, 332, figs. 3, 9–11, 1928.

The encysted trematodes from four species of fresh-water fishes here recorded, although differing somewhat in the relative proportions of the suckers, so far as the anatomy is shown, agree with descriptions of this species.

Hosts.—Large-mouthed black bass (*Huro floridana*), small-mouthed black bass (*Micropterus dolomieu*), brook trout (*Salvelinus fontinalis*), yellow perch (*Perca flavescens*).

Record of collections.—Specimens of large-mouthed black bass were received on July 8, 1915, from Dr. E. E. Smith. They were collected by T. C. H. Richardson, who stated that the fish came from a reserve pond where the fish were dying off. The location of the pond was not given, but it is in New Jersey, not far from New York City. Numerous cysts on fins and in the muscle tissue. The cysts were surrounded by black pigment. A cyst in glycerin measured 0.40 by 0.23 mm.; estimated length of larval trematode in cyst, 0.54 mm.

Ten large-mouthed black bass were received on July 31, 1919. The fishes had been taken in June from Bass Lake, White Earth Reservation, Minn., and had been collected and sent at the instance of Dr. Earl A. Danielson. The fishes had been sent on account of heavy cestode infection. Cysts surrounded by black pigment were found on each of the fish, from 2 to 35 on each, most of them on the

fins, but also under the skin and a few in the flesh. In all 95 cysts were noted, of which 61 were on the fins, 32 under the skin, and 2 in the flesh. Measurements of larva in glycerin: Length, 0.30 mm.; breadth, 0.15 mm.; oral sucker, length, 0.060 mm., breadth, 0.039 mm.; ventral sucker, not distinct, length about 0.042, breadth about 0.024 mm.

Pieces of the skin and fins of small-mouthed black bass, with many pigmented cysts, were received on October 3, 1902. The fishes were collected by the Rev. James H. Young at Troy, Ohio. A larva removed from its cyst measured 0.4 mm. in length and 0.2 mm. in breadth.

Received on September 25, 1903, pieces of skin with underlying muscle tissue of small-mouthed black bass with cysts surrounded by black pigment. The bass were taken from a fresh water pond near Portland, Maine. It was stated that the yellow perch and sunfish in the pond were similarly affected. Larvae removed from cysts measured 0.4 mm. in length and 0.2 mm. in breadth.

A small-mouthed black bass, taken on November 15, 1907, by James L. Robertson from Culver Lake, Branchville, N. J., was sent to me on account of the large number of cestodes in the body cavity. Pigmented cysts containing larval trematodes were found in the flesh.

Three small-mouthed black bass (U.S.N.M. No. 8398) were received on July 29, 1915, from Charles Meyers, Deputy Fish and Game Warden, Far Hills, N. J. The fishes had been taken in Ravine Lake, Somerest Hills Country Club. Mr. Meyers stated that the bass in the lake were heavily infested with these parasites, especially on the fins and in the mouth. There were numerous cysts with black pigment on these fishes; most abundant on the caudal and pectoral fins, on the cheeks and opercular region, also on inner side of opercle; a few in the mouth, and scattering cysts on the scales of the sides. Many cysts were found in the skin. They were not visible from the outside, but upon removing the skin they were found to be rather abundant along the sides. A piece of skin about 5 cm. square had about 25 cysts on the inner side. Most of these cysts were in the subdermal connective tissue, but one was noted just back of the head at a depth of 8 mm.; a few were found among the neural spines under the dorsal fin, as much as 20 mm. from the surface. The largest cyst noted was 2.5 mm. in diameter; usual size about 1 mm. in diameter. The pigmented area is much larger than the cyst. Fifty-three cysts were counted on an 18 mm. square on a pectoral fin, and 72 on a similar area on a caudal fin. Measurements of a formalin specimen removed from its cyst: Length, 0.8 mm.; breadth, neck, 0.28 mm., at level of ventral sucker, 0.26 mm.; posterior end to ventral sucker, 0.30 mm.; diameter of oral sucker, 0.07 mm.,

of pharynx, 0.04 mm., of ventral sucker, 0.04 mm.; middle and anterior regions with numerous subspherical bodies from 0.007 to 0.010 mm. in diameter. Measurements in balsam: Length, 0.90 mm. (fore and hind body about equal); maximum breadth, 0.30 mm.; breadth of oral sucker, about 0.07 mm., of pharynx (indistinct) about 0.024, of ventral sucker, 0.036 mm. In another balsam specimen: Breadth of oral sucker, 0.054 mm., of ventral sucker, 0.033 mm.; hold-fast organ, length, 0.069 mm., breadth, 0.048 mm.

On July 3 and 4, 1904, a number of brook trout, 60 more or less, were examined for skin parasites, at Alder Lake in the Catskills, near Turnwood, N. Y. Many of them had cysts surrounded by black pigment on the skin. None of the fish had large numbers of cysts. A few had as many as from 25 to 30 cysts on each side. Some had from one to five cysts on a side; others were free from cysts. The cysts lie just beneath the epidermis so that a considerable number of them produce an embossed surface which can be detected by passing the hand lightly over it. Many of these cysts were opened and found to contain larval trematodes, all apparently of the same species. The cysts were from 0.4 to 0.7 mm. in diameter. One cyst 0.56 mm. in diameter had walls 0.15 mm. thick. The liberated larva was 0.22 mm. in length and 0.14 mm. in breadth. A larva removed from its cyst and flattened under the cover glass had the following measurements: Length, 0.28 mm.; diameter of oral sucker, 0.044 mm., of pharynx, 0.020 mm., of ventral sucker, 0.054 mm. A transverse slit with deeply staining walls, marking the position of the hold-fast organ, is a conspicuous feature. A report of this investigation was published in "The diagnosis of a case of parasitism in the brook trout," Proc. Int. Zool. Cong., 1907, pp. 629, 632.

On May 25, 1908, I received from Dr. Tarleton H. Bean three yellow perch (U.S.N.M. No. 8399) which had been taken in Ampersand Pond, in the Adirondacks, by J. C. Hanchett, Superintendent of Knollwood Club. The fishes were thickly covered with encysted trematodes, surrounded by black pigment, similar in appearance to those of the brook trout. The cysts were distributed indiscriminately over the body, on the fins and eyes, each containing an immature trematode larva.

Seven yellow perch were seined in a fresh-water pond at Quisset, near Woods Hole, on July 1, 1913. A few trematode cysts in the skin, beneath the scales. Cyst, 0.48 by 0.40 mm.; larva liberated from the cyst, but still enveloped in a thin membrane, 0.30 by 0.20 mm. Another cyst, 0.49 mm. in diameter, contained a larval trematode, length, 0.25 mm., breadth, 0.17 mm.

155599—40——11

UNCLASSIFIED FORMS

Genus PLEORCHIS Railliet, 1896

PLEORCHIS AMERICANUS Lühe

PLATE 24, FIGURES 324–330

Distomum polyorchis Stossich, LINTON, Bull. U. S. Fish Comm. for 1899, pp. 460, 461, figs. 363–365, 1901.

Pleorchis americanus LÜHE, Rep. Pearl Oyster Fish. Gulf of Manaar, pt. 5, p. 103, 1906.

Revised description of species: Of nearly the same breadth throughout most of the length, tapering slightly from a point a little back of the ventral sucker to the anterior end; posterior end more or less truncate; body covered with flat, round-pointed spines. Oral and ventral suckers nearly equal; pharynx much smaller than oral, from which it is separated by a prepharynx; prepharynx and esophagus each longer than the oral sucker. The rami of the intestines extend to the posterior end of the body, each sending off numerous branches, which themselves may branch one or more times. In the vicinity of the testes this branching is only on the lateral sides, but behind the testes the branching is both lateral and medial; anteriorly each ramus is prolonged into a caecum which extends forward beyond the level of the anterior end of the pharynx. The genital pore is on the median line in front of the ventral sucker. The cirrus is smooth; the cirrus-pouch lies dorsal to the right side of the ventral sucker, encloses the seminal vesicle, which is in two divisions, and extends well back of the ventral sucker. Testes numerous, lying in two double rows, dorsal and ventral, on each side of the median line for a distance approximating half the length of the body. In the specimen of which the measurements are given the distance from the anterior end to the first testis is 2.6 mm., from the last testis to the posterior end, 1.1 mm., while the distance from the anterior to the posterior testis inclusive is 3.7 mm. The ovary is lobed, morulalike in horizontal section, and lies at the anterior borders of the first testes, more of it on the right than on the left side of the median line. The shell gland lies on the anterior border of the ovary. Laurer's canal enters about on the median line dorsal to the anterior border of the ovary. There is no seminal receptacle, the early folds of the uterus acting in that capacity. The folds of the uterus lie between the ovary and ventral sucker, passing on the dorsal side of the ventral sucker to the genital pore. The vitellaria fill the body behind the testes, and form broad lateral bands forward to about the level of the posterior edge of the ventral sucker. The main excretory vessel is single and on the median line. Ova rather

numerous, in balsam mounts, maximum, 0.078 by 0.048 mm. Measurements in balsam: Length, 7.4 mm.; maximum breadth, 2.2 mm.; breadth at ventral sucker, 1.9 mm.; length of prepharynx and esophagus each about 0.4 mm.; oral sucker, length, 0.32 mm., breadth, 0.36 mm.; pharynx, length, 0.19 mm., breadth, 0.22 mm.; ventral sucker, length, 0.31 mm., breadth, 0.32 mm.; ova, 0.069 by 0.045 mm. In a series of cross sections of a specimen 1.4 mm. in breadth, the breadth of the oral sucker is 0.31 mm., vertical diameter, 0.25 mm.; diameter of pharynx, 0.17 mm. in each direction; ventral sucker, breadth, 0.28 mm., vertical diameter, 0.25 mm.; ova, 0.078 by 0.045 mm.

In a series of sagittal sections there are 14 pairs of testes on one side of the median line and 15 on the other. In this series of sections Laurer's canal is on the dorsal side a little to the right of the median line and about on a level with the anterior third of the ovary. The canal was traced to the oviduct which is entered just before the oviduct expanded into the uterus which was there filled with sperm and ova intermingled.

Host.—Squeteague (*Cynoscion regalis*).

Record of collections.—Four (U.S.N.M. No. 8400), collected July 27, 1904 (two were white and two faint pink, more deeply colored anteriorly). One, collected July 11, 1905. One, collected July 17, 1905, from pyloric caeca of host. One, collected August 28, 1907; length, 6.5 mm.; breadth, 2 mm.; excretory vessel large, sacculate, along median line, toward posterior end.

GARGORCHIS[16] new genus

Characters of genus: Cuticle spinose; ventral sucker larger than oral; esophagus present; rami of intestine long; main excretory vessel a single median trunk from posterior end to ventral sucker; genital opening in front of ventral sucker; cirrus pouch extending back of ventral sucker and enclosing a seminal vesicle. A second seminal vesicle lies at the posterior end of the cirrus pouch. Testes many (11 in type species), median, behind ovary; ovary behind ventral sucker and in front of testes; seminal receptacle near ovary; vitellaria diffuse; uterus mainly in front of ovary.

GARGORCHIS VARIANS, new species

PLATE 24, FIGURE 331; PLATE 25, FIGURES 332–340

Body covered with minute spines, dense anteriorly, sparse posteriorly, rather plump, usually broadest at level of ventral sucker, with short neck and tapering postacetabular region, but may be

[16] γάργαρα, plenty + ὄρχις, testis.

either long or short oval-elliptical, or fusiform; neck very variable, usually strongly contracted in preserved specimens. Oral sucker subterminal, usually broader than long; prepharynx short; pharynx of good size, usually longer than broad, approximately as long as the oral sucker and about half as broad; esophagus as long as or longer than the pharynx, but often appearing shorter on account of the contracted condition of the neck; intestinal rami with thick walls and extending to the posterior end. The ventral sucker is much larger than the oral, its opening transverse. The genital pore is in front of the ventral sucker to the left of the median line, and about on a level with the posterior end of the pharynx. The cirrus is smooth, the cirrus-pouch long-pyriform, muscular, extending back of the ventral sucker on the left side and enclosing a seminal vesicle at its posterior end. A second seminal vesicle lies behind and beside the posterior end of the cirrus-pouch. The second seminal vesicle and the base of the cirrus-pouch are surrounded by cells of the prostate gland. Testes, eleven in number so far as observed, roundish or subtriangular in outline, median, in two more or less irregular longitudinal rows, in the posterior half of the postacetabular region. Ovary small, about 3-lobed, in front of testes, and usually a little to the right of the midventral line; in most cases behind the level of the seminal vesicles, but in some cases on a level with the base of the cirrus pouch, and near the ventral sucker. The shell gland and yolk reservoir are at the posterior border of the ovary. There is a seminal receptacle behind the ovary. It is dorsally placed with respect to the ovary, and in compressed specimens may appear to be to the right of the median line in some cases, to the left in others; often it appears to be to the right of the median line and on a level with the anterior testes. Laurer's canal was seen in a series of cross sections (fig. 339). The diffuse vitellaria fill the greater part of the space back of the testes and extend forward nearly or quite to the ventral sucker. The uterus lies between the testes and ventral sucker; the metraterm lying beside the cirrus pouch and lateral to it, joining the cirrus pouch very near the genital pore. The ova are thin-shelled; maximum in balsam about 0.060 by 0.036 mm.

The relative positions of ovary, seminal vesicles, seminal receptacle and first testes are subject to some variation with different degrees of contraction, and with varying amounts of sperm in the vesicles.

The main excretory vessel is conspicuous in living specimens, and was traced from the terminal excretory pore to a point dorsal to the ventral sucker. In series of cross sections the excretory vessel was traced to the level of the ventral sucker, but the arrangement of the excretory vessels in the neck was not satisfactorily shown.

Measurements, average of nine specimens, in balsam: Length, 2.28 mm.; breadth, 0.82 mm.; oral sucker, length, 0.20 mm., breadth, 0.23 mm.; pharynx, length, 0.20 mm., breadth, 0.13 mm.; ventral sucker, length, 0.32 mm., breadth, 0.35 mm.; ova about 0.06 by 0.03 mm. Longest of the nine specimens, length, 3.08 mm., breadth, 0.63 mm.; broadest of the nine specimens, length, 2.01 mm., breadth, 0.94 mm.

Average of nine specimens in balsam, more or less oval-elliptical in outline, post-acetabular region not tapering: Length, 1.31 mm.; breadth, 0.67 mm.; oral sucker, length, 0.16 mm., breadth, 0.20 mm.; pharynx, length, 0.15 mm., breadth, 0.10 mm.; ventral sucker, length, 0.27 mm., breadth, 0.32 mm.; ova, 0.054 by 0.033 mm. to 0.063 by 0.039 mm. Longest of the nine specimens, length, 2.10 mm.; breadth, 0.94 mm.; broadest of the nine specimens, length, 1.98 mm.; breadth, 1.08 mm.

Type specimens.—U.S.N.M. No. 8401 (holotype and paratypes).

Host.—Filefish (*Ceratacanthus schoepfi*).

Record of collections.—Thirty, collected August 7, 1905. At first pale pinkish, bleaching to translucent bluish white after lying in sea water for some time; very various shapes, becoming a little more uniform when placed in 70% alcohol. Measurements in glycerin, compressed: Length, 2.94 mm.; breadth, 1.05 mm.; oral sucker, length, 0.25 mm., breadth, 0.32 mm.; pharynx, length, 0.25 mm., breadth, 0.20 mm.; ventral sucker, length, 0.45 mm., breadth, 0.45 mm.

Five specimens, collected August 19, larger specimens turgid and translucent, smaller specimens yellowish or flesh colored; maximum length, 2.8 mm.

Four, collected July 29, 1908; turgid, necks very short.

Numerous, collected August 19, 1908, various shapes.

Twenty-four, collected July 11, 1910; the living and active worms were yellowish with a faint tinge of red; greatest diameter at level of ventral sucker; neck usually contracted; postacetabular region tapering; the conspicuous excretory vessel was traced from a point a little in advance of the dorsal border of the ventral sucker to the posterior end. The wall of the excretory vessel altered in appearance while the specimen was under observation. Longitudinal and transverse fibers in its walls, in certain stages of contraction, gave to the wall a checkered appearance. Inactive specimens were squarish-oblong in outline, but when flattened under the cover glass they assumed outlines similar to those of the active specimens. Still others were turgid, semitransparent, with their vitellaria much reduced. Two of the small, active distomes were placed in fresh water where they soon became turgid, and then resembled closely the distomes which were inactive when first removed from the intestine of the fish and

placed in sea water. The fish from which these distomes were obtained had been dead for several hours.

Fifty, more or less, collected July 13, 1911, from intestine of host.

Fifty, or more, collected August 21, 1915; some yellow, others white.

Fifteen, collected July 28, 1920, about 2 mm. in length.

Fifty-six, collected August 27, 1926; relatively shorter and broader than the usual forms.

Eighty-five more or less (U.S.N.M. No. 8401), collected by Dr. E. B. Krumbhaar, August 17, 1929. Two types, agreeing with foregoing descriptions; one white, obtuse, inactive; the other broadest at ventral sucker, postacetabular region more or less elongated, color yellowish tinged with red, active.

Genus STENOCOLLUM Stafford, 1904

STENOCOLLUM FRAGILE (Linton)

Distomum fragile LINTON, Bull. U. S. Fish Comm. for 1899, pp. 282, 295, figs. 68–70, 1900; *ibid.*, p. 466, 1901.

Stenocollum fragile (Linton), STAFFORD, Zool. Anz., vol. 27, p. 487, 1904.

One example of this distome (U.S.N.M. No. 8402), somewhat macerated, was collected from the intestine of a sunfish (*Mola mola*) July 19, 1926.

Genus DERETREMA Linton, 1910

DERETREMA FUSILLUS Linton

PLATE 25, FIGURES 341–344

Deretrema fusillus LINTON, Carnegie Inst. Washington Publ. 133, pp. 49, 50, figs. 102–104a, 1910.

Four distomes from a flyingfish, collected on three different dates at Woods Hole, are referred to this species, although, as was the case with the Tortugas material, showing considerable variation among themselves.

The body is smooth, fusiform, broadest at level of ventral sucker; no prepharynx, esophagus not longer than pharynx; intestinal rami extend back of ventral sucker, but not to the posterior end; genital pore at left side of neck; cirrus pouch large, in front of ventral sucker and enclosing the seminal vesicle and prostate; testes behind ventral sucker, opposite. Ovary in front of right testis, at right posterior border of the ventral sucker; seminal receptacle behind ovary. The vitellaria consist of a few follicles lateral to the ventral sucker and testes; shell gland and yolk reservoir between the testes. The uterus, beginning at the shell gland, fills with its voluminous folds all of the post-testicular region of the body and also a considerable portion of the region behind and dorsal to the ventral sucker. The metraterm,

seen in only one specimen, appears to lie in front and to the right of the cirrus-pouch, and to open at the genital pore. All of the specimens are more or less distorted by compression. The ova are numerous, elliptical, from 0.033 by 0.018 mm. to 0.037 by 0.021 mm.

The excretory pore and a small portion of the excretory vessel are visible in one of the mounted specimens, but little can be distinguished on account of the dense mass of ova with which the posterior end of the body is filled.

TABLE 39.—*Measurements of four specimens of* Deretrema fusillus *in balsam*

Measurement	1	2	3 [1]	4
	Mm.	*Mm.*	*Mm.*	*Mm.*
Length	1.15	1.36	2.10	2.87
Breadth	.68	.68	.84	1.12
Oral sucker, length	.12	.11	.28	.27
Oral sucker, breadth	.11	.17	.32	.32
Pharynx, length	.11	.11	.14	.22
Pharynx, breadth	.10	.11	.14	.22
Ventral sucker, length	.35	.35	.42	.42
Ventral sucker, breadth	.25	.28	.35	.35
Posterior edge of ventral sucker to anterior end	.63	.87	1.10	1.27

[1] No. 3 ventral view, others lateral view.

Host.—Sharp-finned flyingfish (*Exocoetus volitans*).

Record of collections.—One, collected July 16, 1910. Two, collected August 9, 1910. One (U.S.N.M. No. 8403), collected August 27, 1928.

Genus SIPHODERA Linton, 1910

SIPHODERA VINALEDWARDSII (Linton)

Monostomum vinaledwardsii LINTON, Bull. U. S. Fish Comm. for 1899, p. 470, figs. 373–376, 1901.

Monostomum vinal-edwardsii LINTON, Bull. U. S. Bur. Fish., vol. 24, pp. 379, 410, 1905; Proc. U. S. Nat. Mus., vol. 33, p. 118, fig. 97, 1907.

Siphodera vinaledwardsii (LINTON), Carnegie Inst. Washington Publ. 133, p. 74, figs. 208, 209a, 1910.—MANTER, Illinois Biol. Mon., vol. 10, pp. 107–110, figs. 80–83, 1926.

Hosts.—Toadfish (*Opsanus tau*) and alewife (*Pomolobus pseudoharengus*).

Record of collections.—No special search for this trematode has been made at Woods Hole since the first description of the species was published. I have record of collections from toadfish on four dates in August and one in October, in four different years, from 1903 to 1914; 17, from eight fishes; one to five worms in each. (U.S.N.M. No. 8404).

One, from alewife, collected July 26, 1906; length of living specimen, 2.52 mm., breadth, 1.12 mm.; ova, 0.021 by 0.010 mm.

Genus MONOSTOMA Zeder, 1800

MONOSTOMA species

PLATE 26, FIGURE 345

A trematode, collected by Vinal N. Edwards from a cod (*Gadus morrhua*), December 16, 1905 (U.S.N.M. No. 8405), is here noted.

The specimen was stained and mounted in balsam, but shows but little of the anatomy. The sketch shown in figure 345 was made of the specimen lying in formalin. In the mounted specimen the cirrus is not so clearly outlined as in the sketch. A cirrus pouch is faintly shown, and testes are indicated along the median line toward the posterior end, but the number and outlines cannot be determined.

Measurements in formalin: Length, 1.82 mm.; breadth, anterior, 0.47 mm., middle, 0.58 mm., posterior, 0.39 mm.; breadth of anterior sucker, 0.47 mm.; diameter of cirrus, 0.07 mm.; distance of cirrus from posterior end, 0.7 mm. The margins are folded under ventrally; if flattened the breadth would be increased about 0.14 mm.

Genus DISTOMA Retzius, 1782

DISTOMA FENESTRATUM Linton

PLATE 26, FIGURES 346–348

Distomum sp. LINTON, Bull. U. S. Bur. Fish., vol. 24, pp. 373, 374, figs. 213, 214 (from *Coryphaena equisetes* and *C. hippurus*), 1905.

Distomum fenestratum LINTON, Proc. U. S. Nat. Mus., vol. 33, pp. 111, 112, figs. 86–91 (from *Lycodontis moringa*), 1907; Carnegie Inst. Washington, Publ. 133, p. 51, figs. 105, 106 (from *Haemulon plumieri* and *H. sciurus*), 1910.—SUMNER, OSBURN, and COLE, Bull. U. S. Bur. Fish., vol. 31, pt. 2, p. 582 (from *Brevoortia tyrannus*), 1911.

Immature distomes, recorded from widely different hosts and localities, as indicated in the above references, are here reported.

Hosts.—Sand launce (*Ammodytes americanus*), menhaden (*Brevoortia tyrannus*), round herring (*Etrumeus sadina*), remora (*Remora remora*).

Record of collections.—Five (U.S.N.M. No. 8406), collected November 1, 1913; lengths in formalin, 2.4 to 3.5 mm.; breadths of three about 0.25 mm.; one measuring 2.85 mm. in length had a maximum breadth of 0.30 mm.; another, length, 3.23 mm.; breadth, 0.20 mm. Measurements in balsam: Length, 2.52 mm.; maximum breadth, about 0.45 mm. from posterior end, 0.24 mm.; anterior sucker, length, 0.051 mm., breadth, 0.036 mm.; diameter of ventral sucker, 0.11 mm.; distance from anterior end to posterior edge of ventral sucker, 0.28 mm.

From menhaden: One (U.S.N.M. No. 8407), collected July 4, 1905; fragment; posterior end showing characteristic constrictions

of the intestines, giving the appearance of distinct, nearly translucent bodies.

One, collected August 7, 1906, length, 2.38 mm. Measurements in balsam: Length, 1.54 mm.; breadth, near anterior end, 0.10 mm., at level of ventral sucker, 0.18 mm., maximum, 0.29 mm.; oral sucker, length, 0.054 mm., breadth, 0.051 mm.; ventral sucker, length, 0.09 mm., breadth, 0.10 mm.; length of neck, 0.16 mm.

From round herring: One, collected July 25, 1908; slender, white, very active, cylindrical before compression under the cover glass. The anterior part of the postacetabular region opaque, white by reflected light, yellowish brown by transmitted light. The posterior half of the postacetabular region contained eight pairs of transparent bodies, which are to be interpreted as being caused by somewhat regular constrictions of the walls of the voluminous intestinal rami. By reflected light they have the appearance of windowlike spaces occupied by a thin, transparent membrane; by transmitted light they have the appearance of thickish, bladderlike bodies with more or less lobed or crenulated outlines. The lobed character disappeared as the worm was kept under observation. The mouth is terminal. The anterior end was slightly invaginated. The surface was crossed by exceedingly fine wavy lines. Measurements, life: Length, 2.10 mm.; breadth, 0.24 mm.; diameter of ventral sucker, 0.09 mm.

Two (U.S.N.M. No. 8408), collected September 17, 1912. Measurements, life: Length, 2.24 mm.; maximum breadth, 0.36 mm.; oral sucker, length, 0.084 mm., breadth, 0.056 mm.; diameter of ventral sucker, 0.11 mm. The voluminous intestines were represented by five or six pairs of bladderlike structures at the posterior end of the body, anteriorly they continue as smaller, laterally placed bodies with finely granular contents. It was noted that at the posterior end beneath the cuticle there was a layer of nucleated cells. These specimens were stained and mounted in balsam but are not satisfactory. The 10 posterior divisions of the intestine are filled with a structureless material that does not take the stain. In the postacetabular region, which is more or less opaque in the living worm, cells, which appear to be arranged in rather squarish lateral masses were observed, beginning not far back of the ventral sucker. Behind these, and between the laterally placed smaller bodies, kinks in the intestinal rami, a lot of relatively large nucleated cells were observed.

In both of the mounted specimens the mouth is terminal, the oral sucker is longer than broad, and the ventral sucker is considerably larger than the oral. There is no pharynx; what was at first taken to be a pharynx in one proved to be a kink in the esophagus. The excretory pore is terminal.

From remora: Two (U.S.N.M. No. 8409), collected August 3, 1911; one of these was encysted in the stomach wall.

Measurements in balsam: Length, 3.78 mm.; breadth, at level of oral sucker, 0.07 mm., at level of ventral sucker, maximum, 0.30 mm., thence tapering to 0.14 mm. at posterior end; oral sucker, length, 0.08 mm., breadth, 0.06 mm.; ventral sucker, length, 0.11 mm., breadth, 0.10 mm. When one of these distomes was fixed under pressure the characteristic constrictions of the intestinal rami in large measure disappeared (figures 346, 347).

DISTOMA species

PLATE 26, FIGURES 349, 350

Record is here made of two trematodes from the kingfish. Both specimens are more or less macerated, and the very numerous ova obscure the genitalia in great degree.

Neck slender and tapering, body of about uniform breadth; prepharynx and esophagus both present, the latter relatively long; cirrus pouch large and elongated, enclosing the seminal vesicle; testes in the posterior third, their outlines obscured by ova; ovary median, in front of testes, and a short distance behind the posterior end of the cirrus pouch, apparently lobed. The vitellaria, consisting of six or eight follicles on each side, extends from the level of the ovary forward to the level of the posterior end of the cirrus pouch. The uterus, crowded with ova, fills the body from the cirrus pouch to the posterior end. The metraterm is much expanded and has thick, muscular walls. Musculature of ventral sucker weak.

These trematodes resemble unidentified forms from *Orthopristis chrysopterus* (Bull. U. S. Bur. Fish., vol. 24, pp. 379, 380, figs. 216, 218, 1905).

Host.—Kingfish (*Menticirrhus saxatilis*).

Record of collections: One (U.S.N.M. No. 8410), collected September 11, 1907. Anterior third, from level of genital pore, slender, tapering; posterior two thirds of length rather slender and of nearly uniform breadth. Measurements in balsam: Length, 2.21 mm.; breadth, anterior, 0.07 mm., at level of genital pore (0.5 mm. from anterior end) 0.28 mm.; diameter of oral sucker, 0.06 mm., of ventral sucker, 0.075 mm.; pharynx, length, 0.036 mm., breadth, 0.024 mm.: length of prepharynx, 0.09 mm., of esophagus, 0.42 mm.; ova, 0.021 by 0.012 mm.

One, collected July 21, 1926. Slender, fusiform, anterior end missing. Measurements in balsam: Length, 2.10 mm.; breadth, from level of genital pore to posterior end, 0.28 mm.; ova, 0.021 by 0.015 mm.

DISTOMA species

PLATE 26, FIGURE 351

Among the cysts containing larval distomes belonging to the genus *Echinostoma*, from *Percopsis omiscomaycus*, collected at Constantia, N. Y., Oneida Lake, June 6, 1915, two globular cysts, adhering to the eyeball, contained immature distomes which are generically different from the others. Measurements of one of the cysts, 0.66 by 0.57 mm.; the other, 0.45 mm. Measurements of distome, life: Length, 0.60 mm.; breadth, 0.60 mm.; diameter of oral sucker, 0.13 mm.; ventral sucker, length, 0.13 mm., breadth, 0.16 mm. These distomes, mounted in balsam, agree closely in their dimensions: Length, 0.53 mm.; breadth, 0.53 mm.; oral sucker, length, 0.10 mm., breadth, 0.10 mm.; ventral sucker, length, 0.14 mm., breadth, 0.18 mm. Measurements of distome from cyst in liver, life: Length, 0.66 mm.; breadth, 0.69 mm.; diameter of oral sucker, 0.14 mm.; ventral sucker, length, 0.18 mm., breadth, 0.22 mm. But few details are shown in the balsam mounts. They are smooth, nearly circular in outline, the cuticle very definitely limited and firm; ventral sucker larger than oral, broader than long, its anterior edge at about middle of the length of the body; oral sucker nearly circular. No pharynx or esophagus seen; intestinal rami appear to be short and to have rather thick walls. There is a deeply stained mass of cells between the ventral sucker and the posterior end, not yet differentiated into genitalia. The parenchyma throughout is finely and uniformly granular. (U.S.N.M. No. 8411.)

ABBREVIATIONS USED ON PLATES

a—— Acetabulum.	*oe*—— Esophagus.
c—— Cirrus.	*ph*—— Pharynx.
cp—— Cirrus pouch.	*pr*—— Prostate.
exp—— Excretory pore.	*sg*—— Shell gland.
exv—— Excretory vessel.	*sr*—— Seminal receptacle.
ej—— Ejaculatory duct.	*sv*—— Seminal vesicle.
g—— Germinal pore.	*sv'*—— Second seminal vesicle.
h—— Holdfast organ.	*t*—— Testis.
i—— Intestine.	*u*—— Uterus.
l—— Laurer's canal.	*vd*—— Vas deferens.
lm—— Longitudinal muscle.	*vg*—— Vitelline gland.
m—— Metraterm.	*y*—— Yolk reservoir.
o—— Ovary.	*yd*—— Yolk duct.
o'—— Portion of ovary with mature cells.	

Unless otherwise stated all sketches were made with the aid of the camera lucida from balsam mounts.

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(New genera and species printed in *italic.*)

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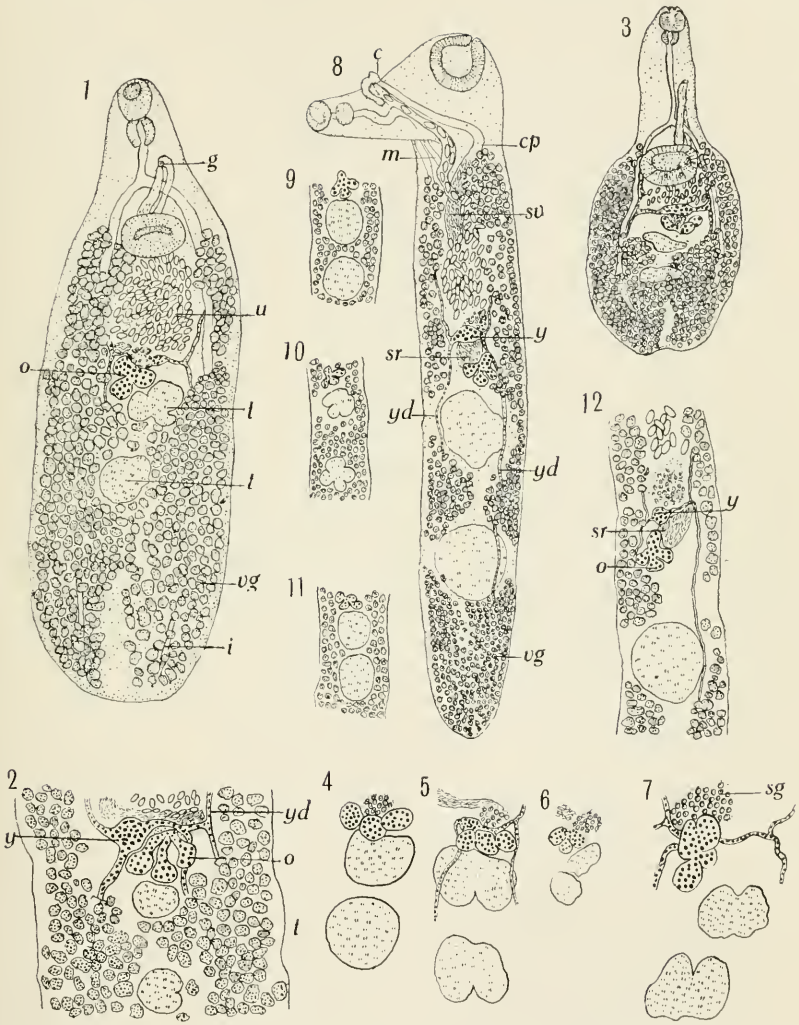

1–7. *Podocotyle atomon* (Rudolphi): 1, From *Hemitripterus americanus*, ventral view; 2, median region of another specimen from same host; 3, from *Pseudopleuronectes americanus*, ventral view; 4–7, ovary and testes of four specimens from same host.

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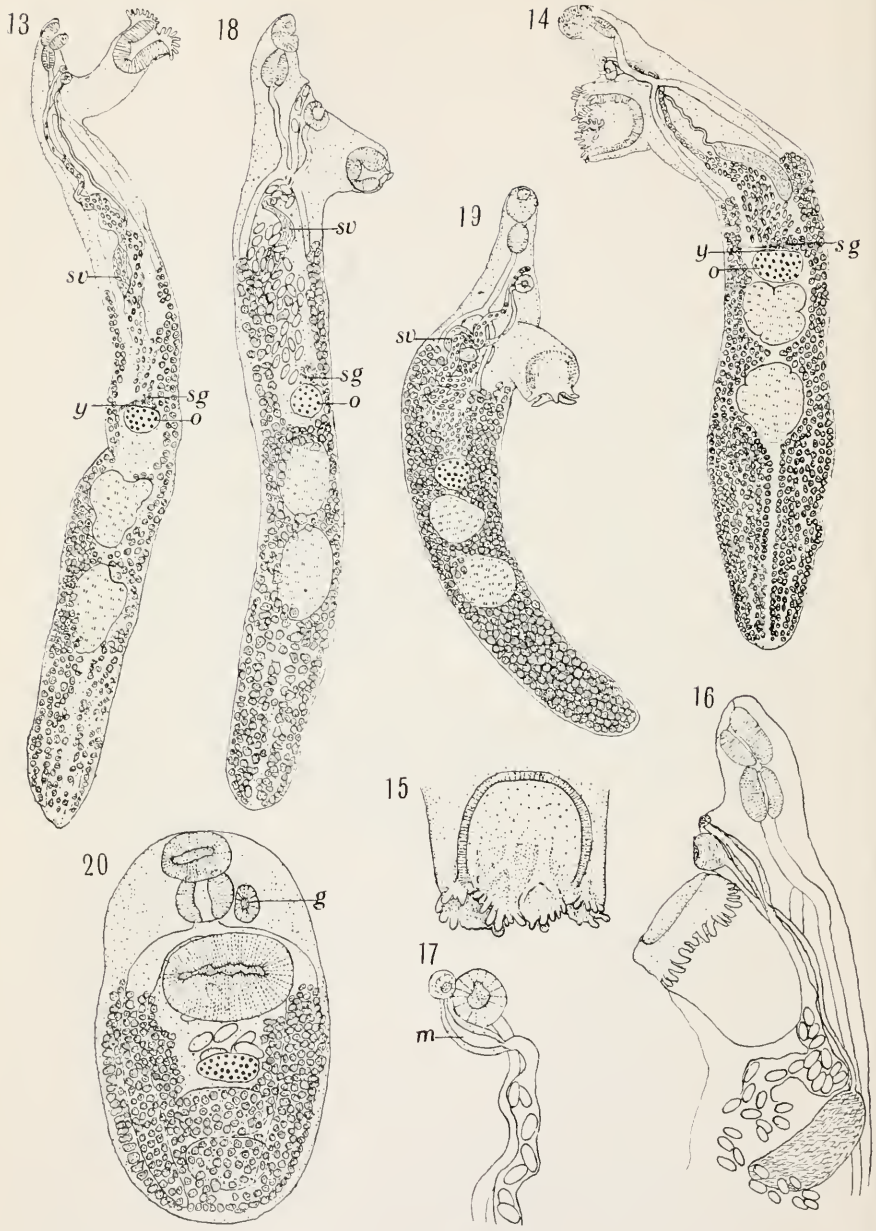

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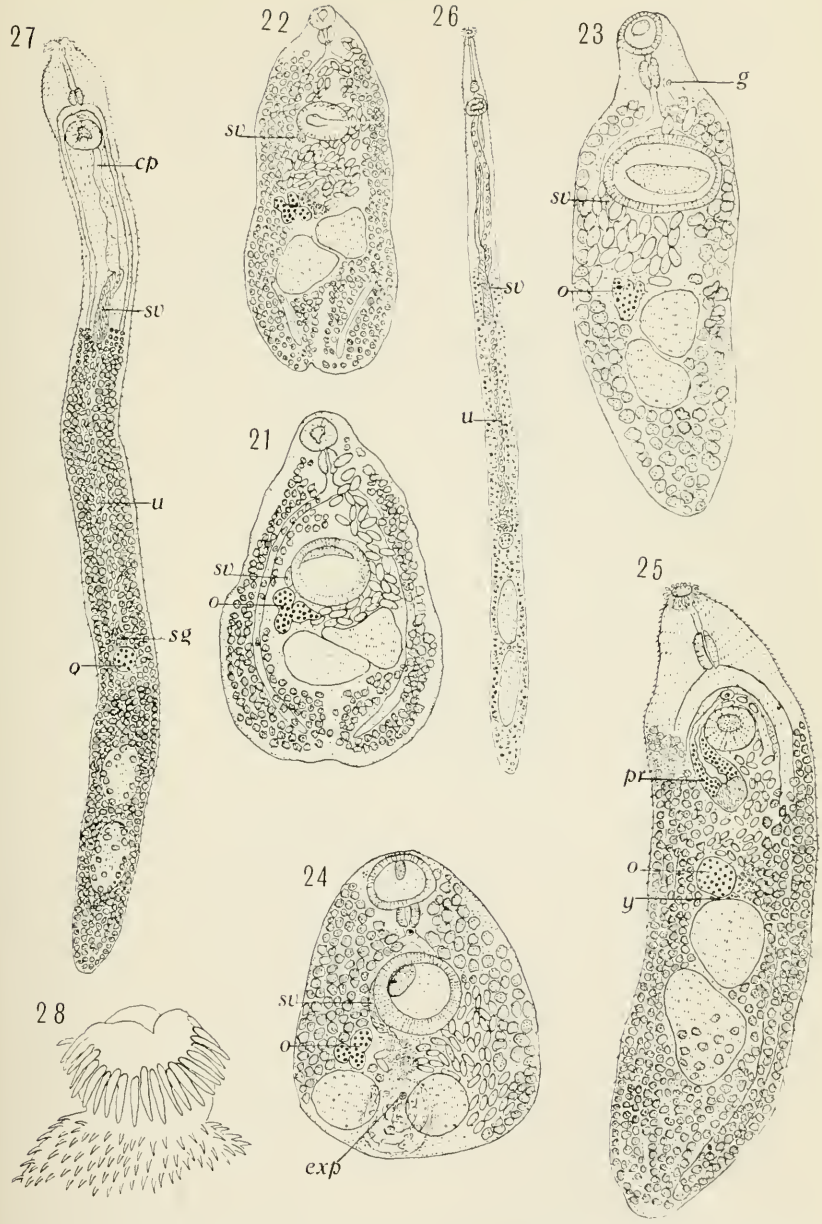

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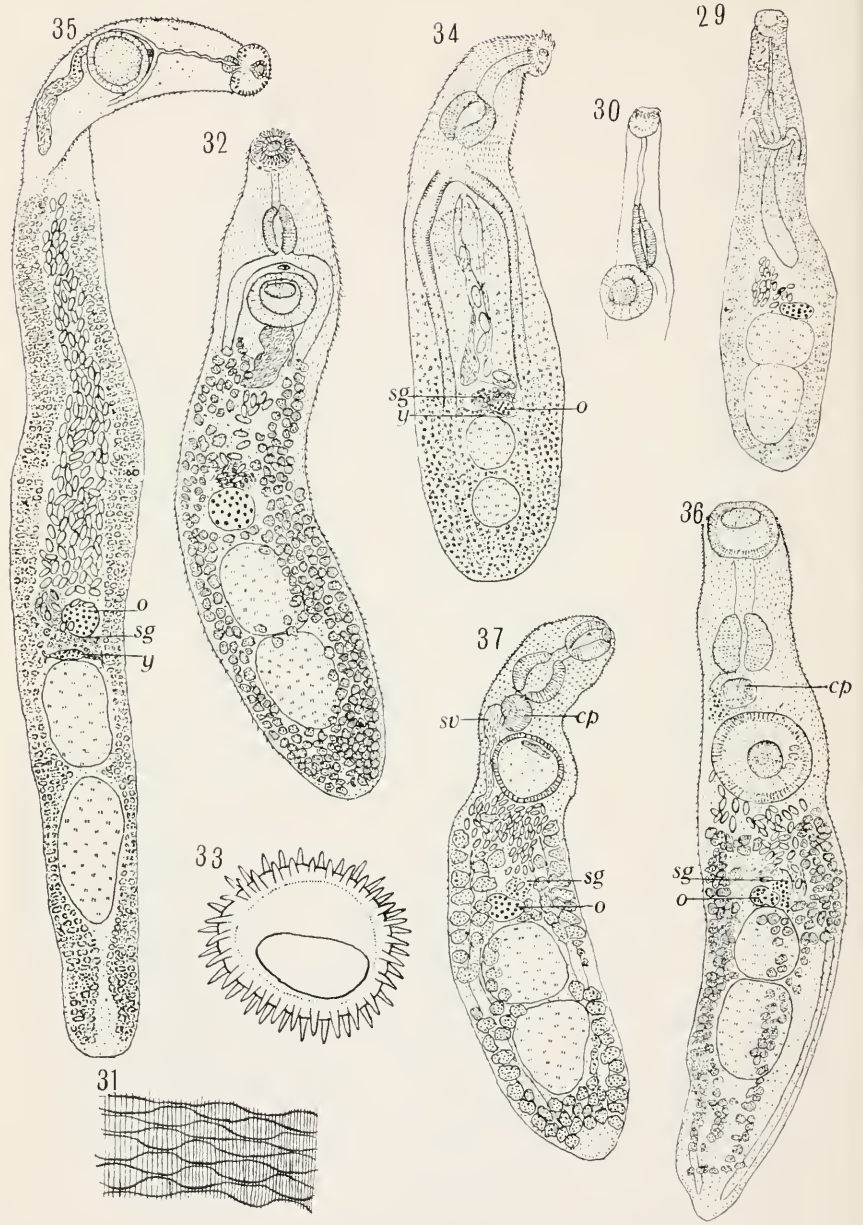
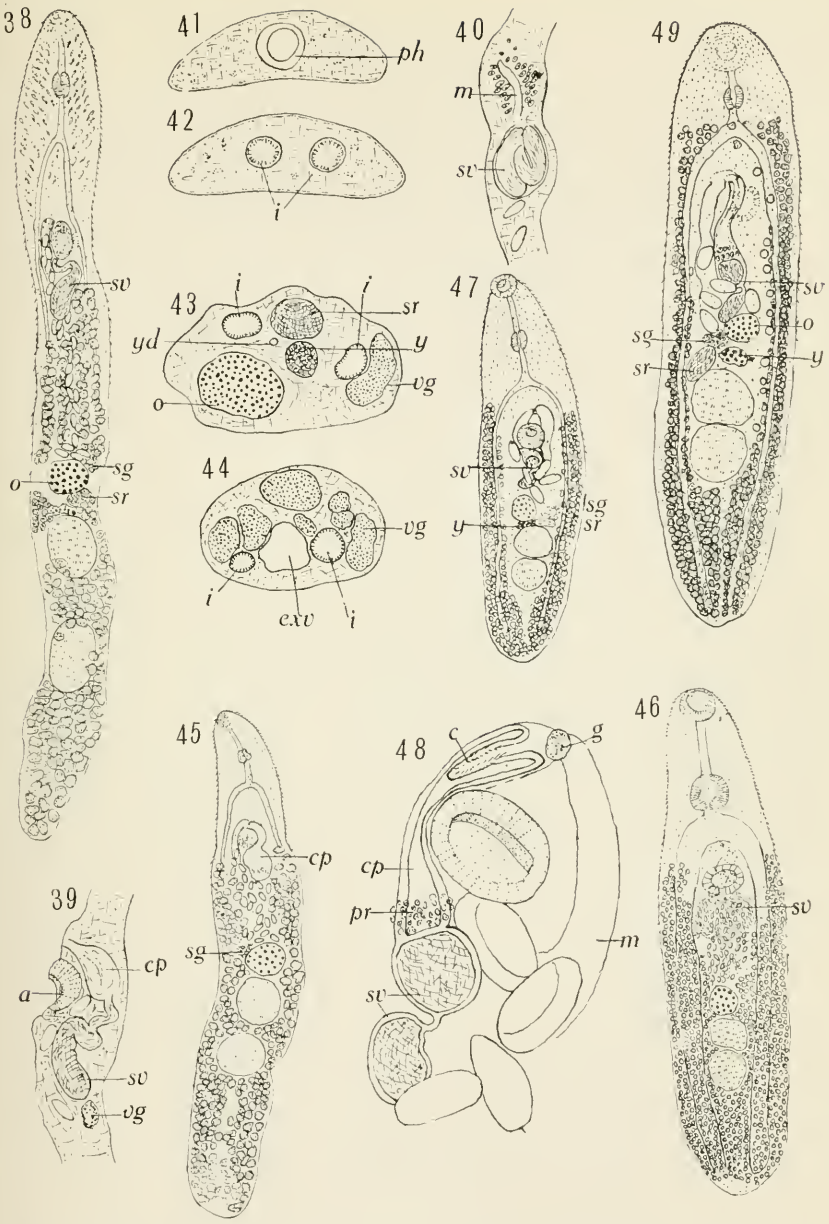


29–31. *Stephanostomum* sp. from *Seriola lalandi:* 29, Dorsal view, spines evanescent; 30, anterior end of another specimen, ventral view; 31, optical section of tissues of neck.

32–34. *Stephanostomum tenue* (Linton): 32, From *Hemitripterus americanus*, ventral view; 33, front view of oral spines; 34, from *Ammodytes americanus*, dorsal view.

35. *Himasthla tensa*, new species: From *Gadus morrhua.*

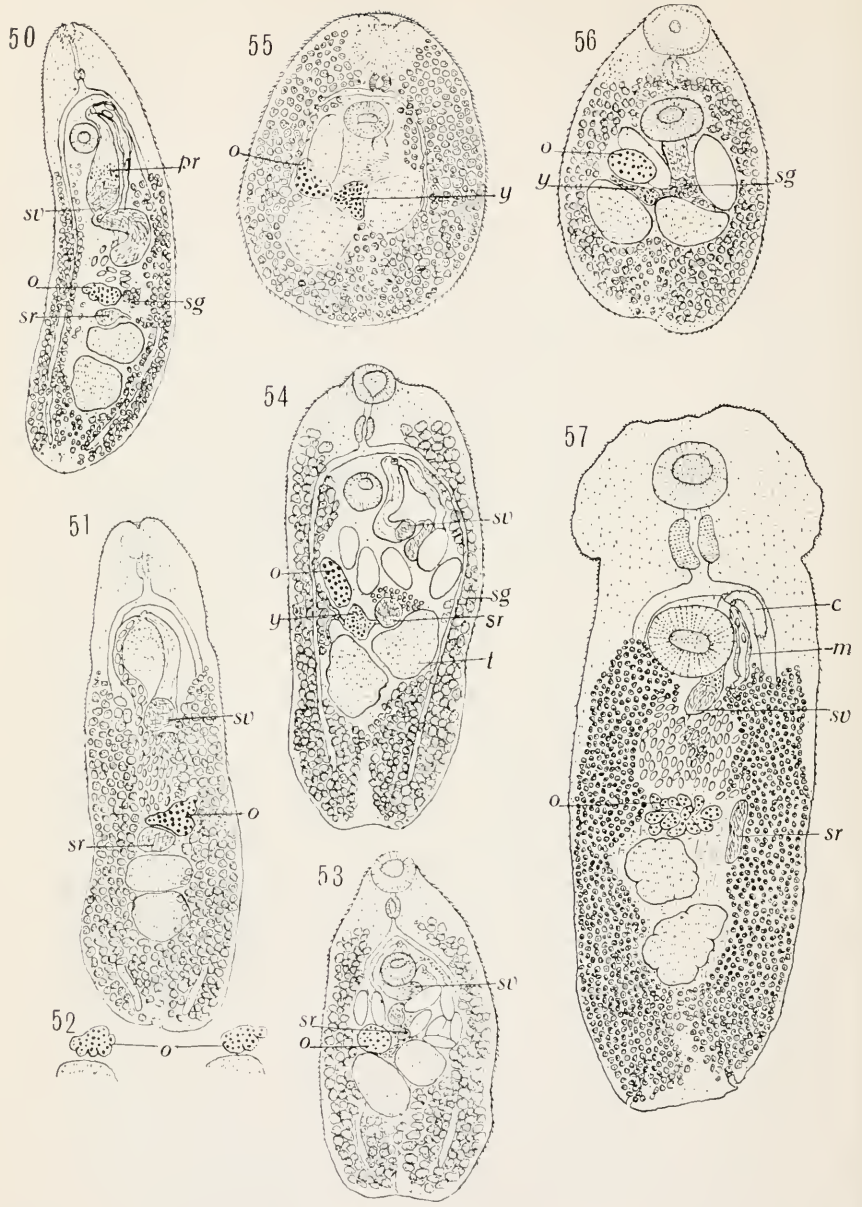
36, 37. *Lepidapedon clavatum*, new species: 36, From *Lophopsetta maculata;* 37, from *Ceratacanthus schoepfi.*



38–45. *Lepidapedon elongatum* (Lebour): 38, From *Gadus morrhua*, dorsal view, glycerin; 39, sagittal section at level of ventral sucker, about median; 40, sagittal section at level of ventral sucker, lateral; 41, transverse section through pharynx; 42, transverse section in front of ventral sucker; 43, transverse section in front of ovary; 44, transverse section near posterior end; 45, from *Urophycis chuss*, dorsal view.

46. *Lepidapedon rachion* (Cobbold): From *Melanogrammus aegelfinus*.

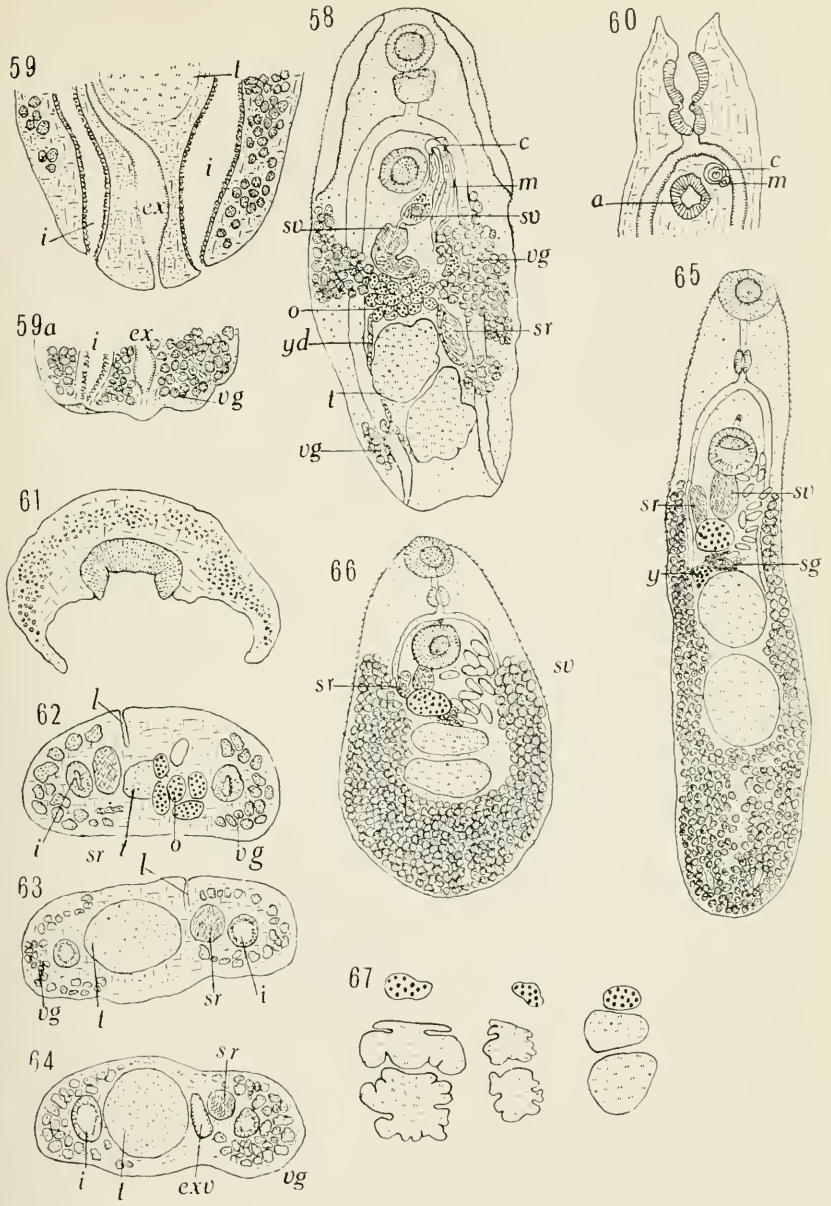
47–49. *Lepocreadium pyriforme* (Linton): 47, From *Palinurichthys perciformis;* 48, cirrus pouch and seminal vesicle; 49, from *Poronotus triacanthus*.



50–52. *Lepocreadium retrusum*, new species: 50, From *Pneumatophorus grex*, ventral view; 51, dorsal view; 52, ovaries of two showing varieties of lobation.

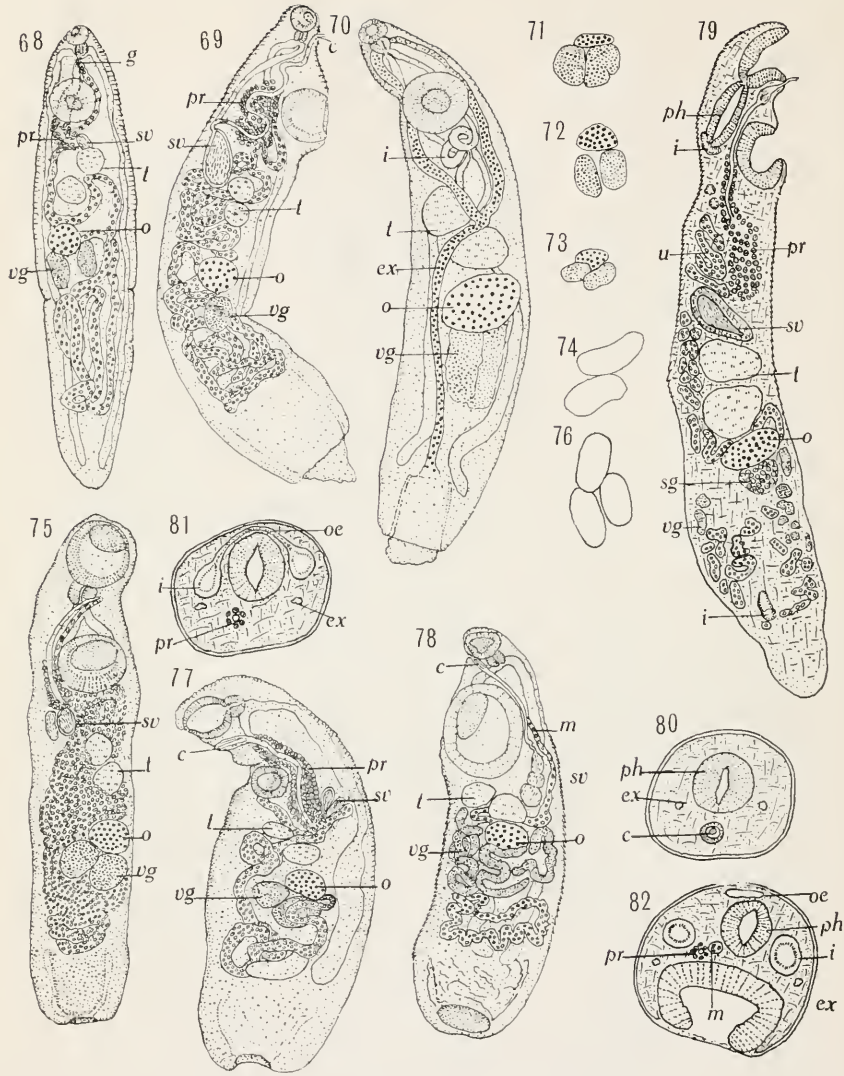
53–56. *Lepocreadium trullaforme*, new species: 53, From *Menticirrhus saxatilis;* 54, from *Morone americana*, somewhat distorted by compression; 55, small distome from young *M. saxatilis;* 56, another from same host.

57. *Bianium plicitum* (Linton): From *Sphoeroides maculatus*, ventral view, lateral margins of neck extended.



58-64. *Bianium plicitum* (Linton): From *Sphoeroides maculatus:* 58, Degenerate specimen, vitellaria much reduced, ova few and imperfect; 59, posterior end, frontal section, vitellaria sparse; 59a, posterior end, frontal section, slanting, vitellaria sparse; 60, horizontal section, anterior end; 61, transverse section, anterior end; 62, transverse section at level of posterior border of ovary, testis added from next posterior section; 63, transverse section near level of anterior end of first testis; 64, transverse section at level of first testis showing excretory vessel.

65-67. *Homalometron pallidum* Stafford: 65, From *Menticirrhus saxatilis;* 66, short variety from same host; 67, ovary and testes from three specimens from *Pseudopleuronectes americanus.*

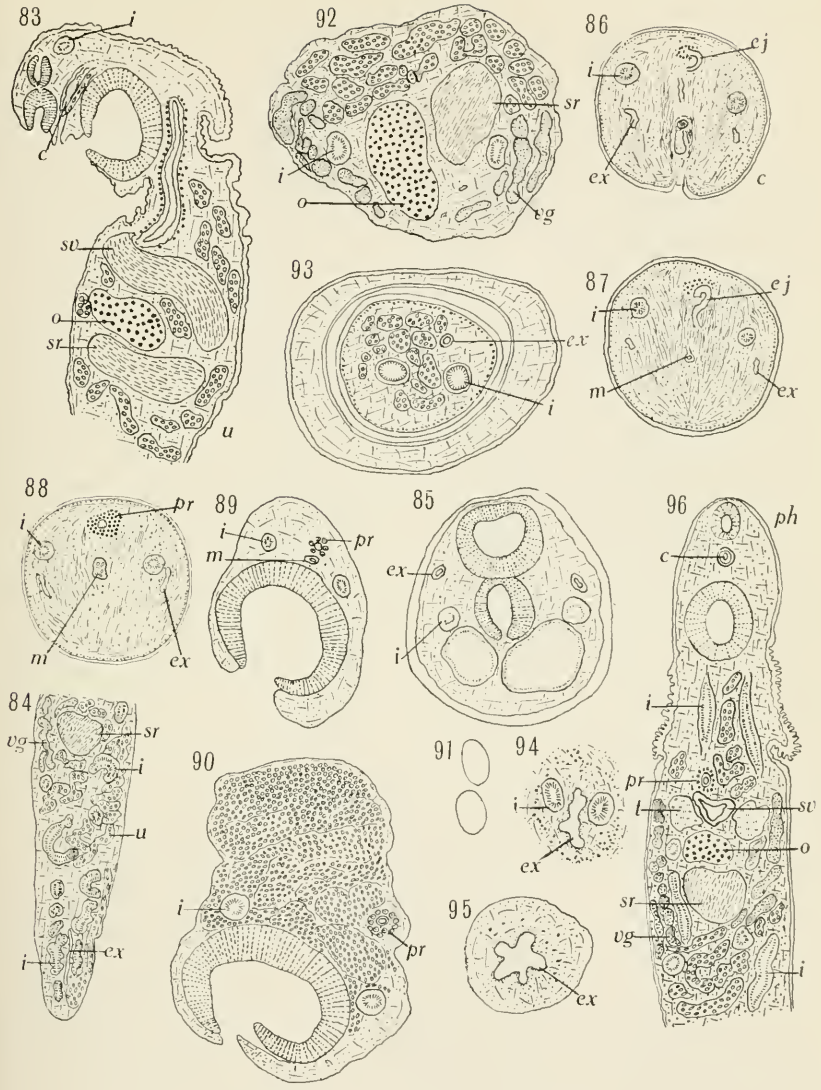


68–74. *Hemiurus appendiculatus* (Rudolphi): 68, From *Pomolobus mediocris*, ventral view; 69, same, lateral view; 70, from *Brevoortia tyrannus*, immature, ventral view; 71, from *Clupea harengus*, ovary and vitelline glands, dorsal view; 72, same, ventral view; 73, ovary and vitelline glands; 74, from *Pomolobus aestivalis*, ova.

75–77. *Hemiurus levinseni* Odhner: 75, From *Gadus morrhua*, ventral view; 76, same, ova; 77, from *Pollachius virens*, lateral view of neck, ventral of body.

78. *Ectenurus virgula* Linton: From *Trachurops crumenophthalma*, ventral view.

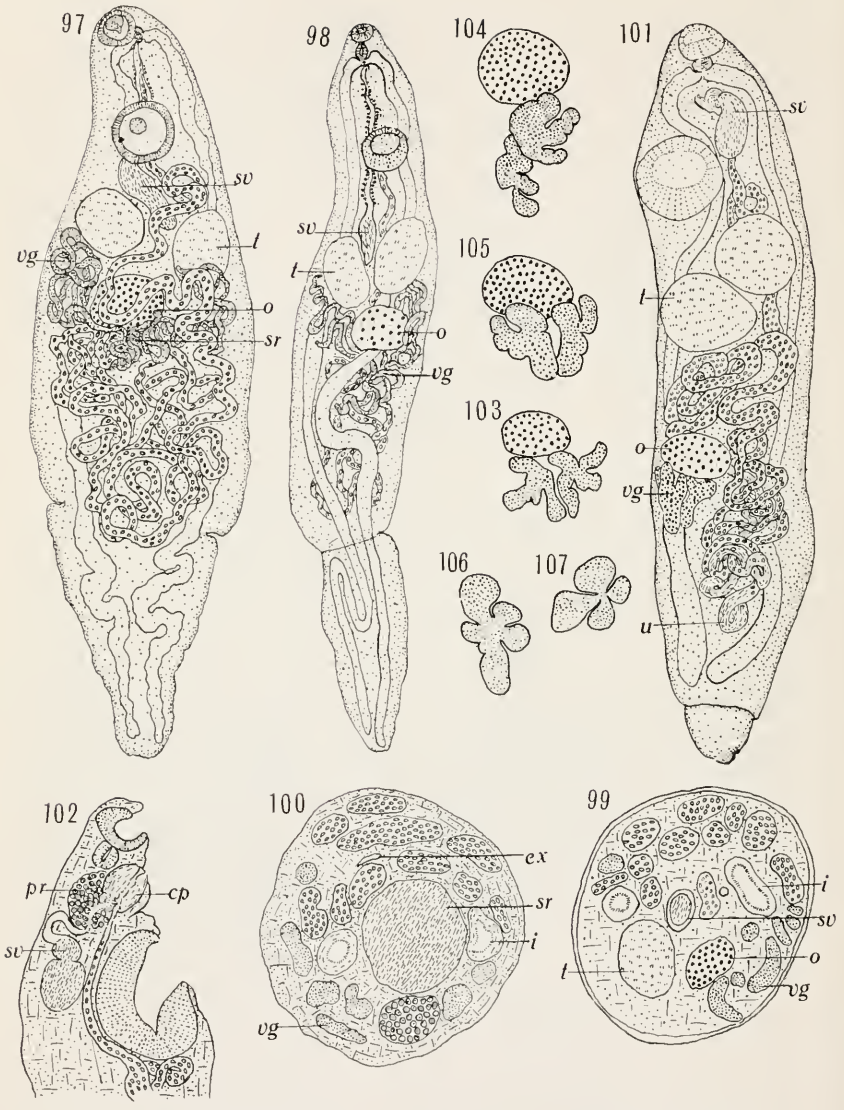
79–82. *Lecithocladium gulosum* (Linton): 79, From *Poronotus triacanthus*, sagittal section; 80, from *Pneumatophorus grex*, cross section, level of anterior fourth of pharynx; 81, cross section at middle of pharynx; 82, cross section near posterior end of pharynx.



DINURUS PINGUIS, NEW SPECIES.

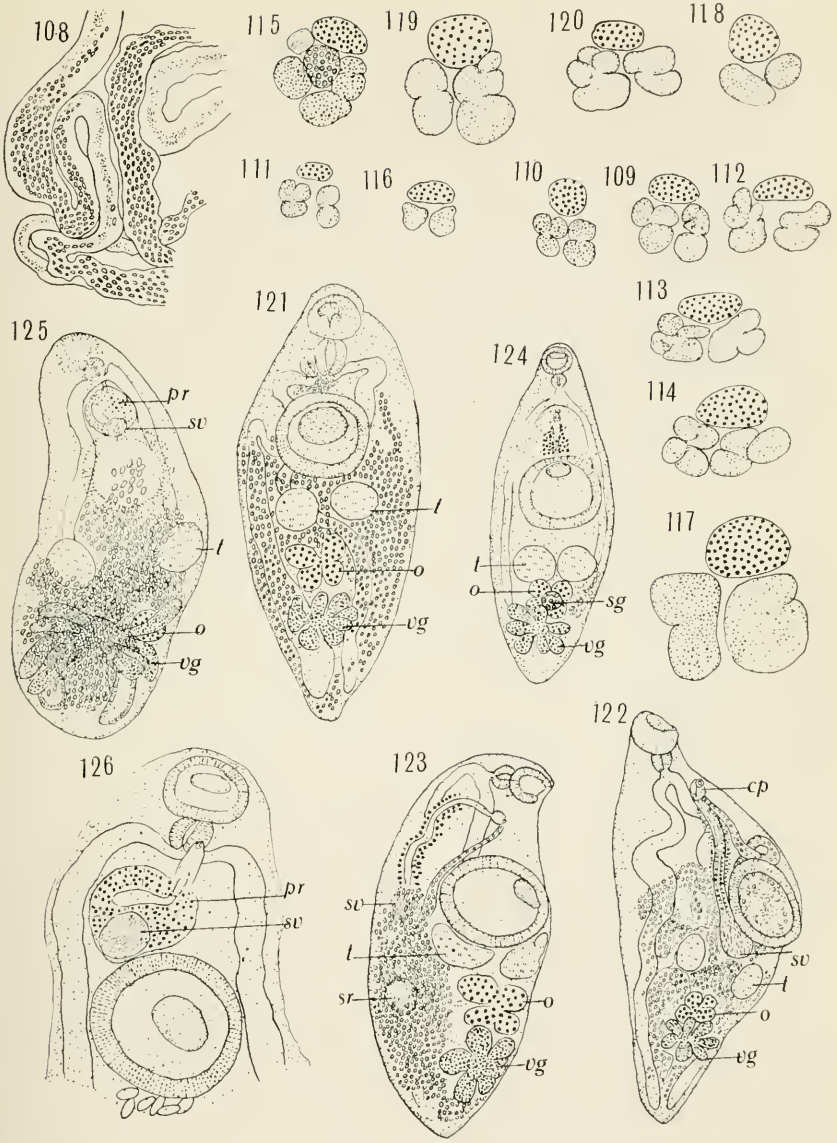
83–95. From *Anguilla rostrata:* 83, Sagittal section of anterior end; 84, frontal section of posterior end; 85, nearly frontal section of head; 86, cross section of neck at level of genital pore; 87, cross section of neck behind genital pore; 88, cross section of neck short distance back of section shown in fig. 87; 89, cross section of specimen in which ova for most part are confined to postacetabular region; 90, cross section of specimen in which ova are crowded forward dorsal to ventral sucker, section at about same level as fig. 89; 91, ova; 92, cross section behind testes; 93, cross section of retracted appendix; 94, excretory vessel and intestines, from cross section 0.1 mm. from posterior end; 95, cross section 0.06 mm. from posterior end.

96. From *Menidia notata:* Frontal section, anterior end.



97–100. *Dinurus pinguis,* new species, from *Menidia notata:* 97, Ventral view of plump specimen; 98, ventral view of slender specimen; 99, cross section at level of anterior edge of ovary; 100, cross section at level of ovary behind testes.

101–107. *Sterrhurus monticellii* (Linton): 101, From *Oligoplites saurus,* dorsal view; 102, from *Trichiurus lepturus,* sagittal section of neck; 103–105, same, ovary and vitelline glands from 3 specimens; 106, same, right vitelline gland, glycerin; 107, same, left vitelline gland, glycerin.

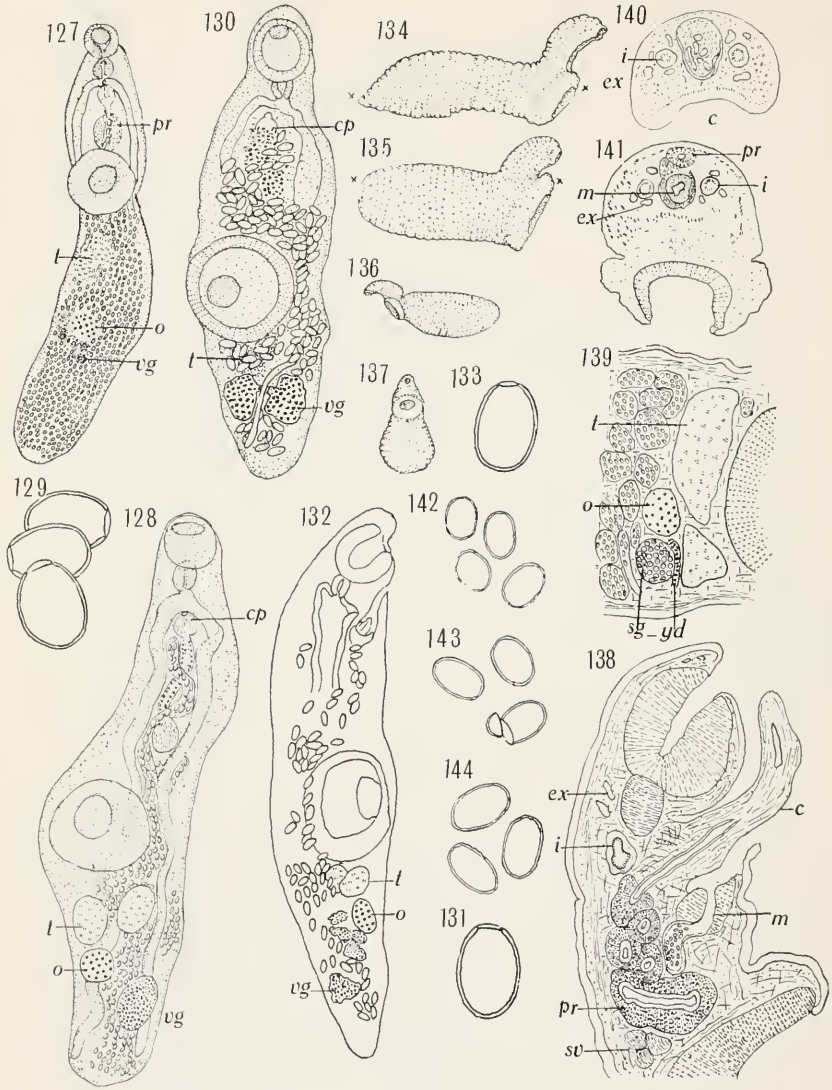


108. Trematode ova from cyst, postbranchial chamber of *Paralichthys dentatus;* coils of uterus containing ova and granules of yolk.

109–120. *Brachyphallus crenatus* (Rudolphi): Ovary and vitelline glands; shell gland and seminal receptacle shown in 115. (109–115 from *Anguilla rostrata*, 116 from *Pomolobus mediocris*, 117 from *Pollachias virens*, 118 and 119 from *Urophycis chuss*, 120 from *U. tenuis*.)

121–124. *Lecithaster confusus* Odhner: 121, 124, Ventral views; 122, 123, lateral views. (121 and 122 from *Pomolobus mediocris;* 123 and 124 from *Scomber scombrus*.)

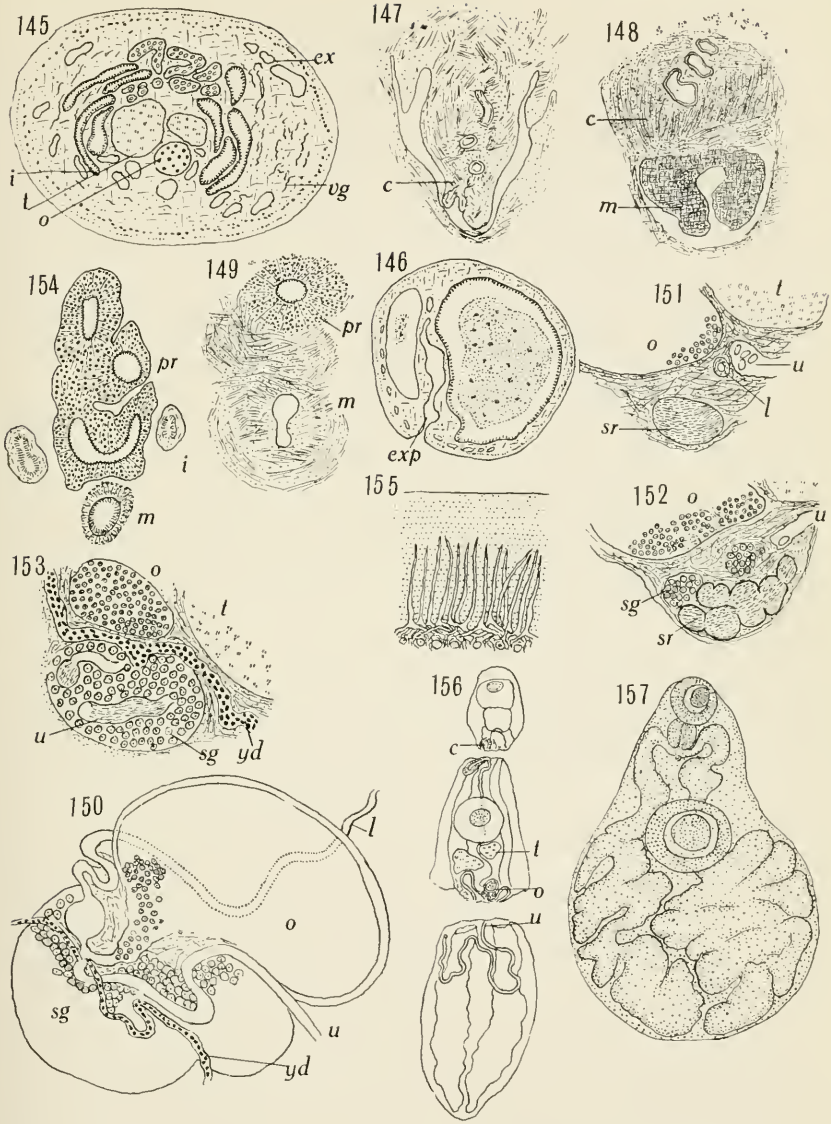
125, 126. *Lecithaster gibbosus* (Rudolphi) from *Stenotomus chrysops:* 125, Dorsal view; 126, ventral view, anterior end.



127. *Aponurus* sp. from *Lobotes surinamensis:* Ventral view.

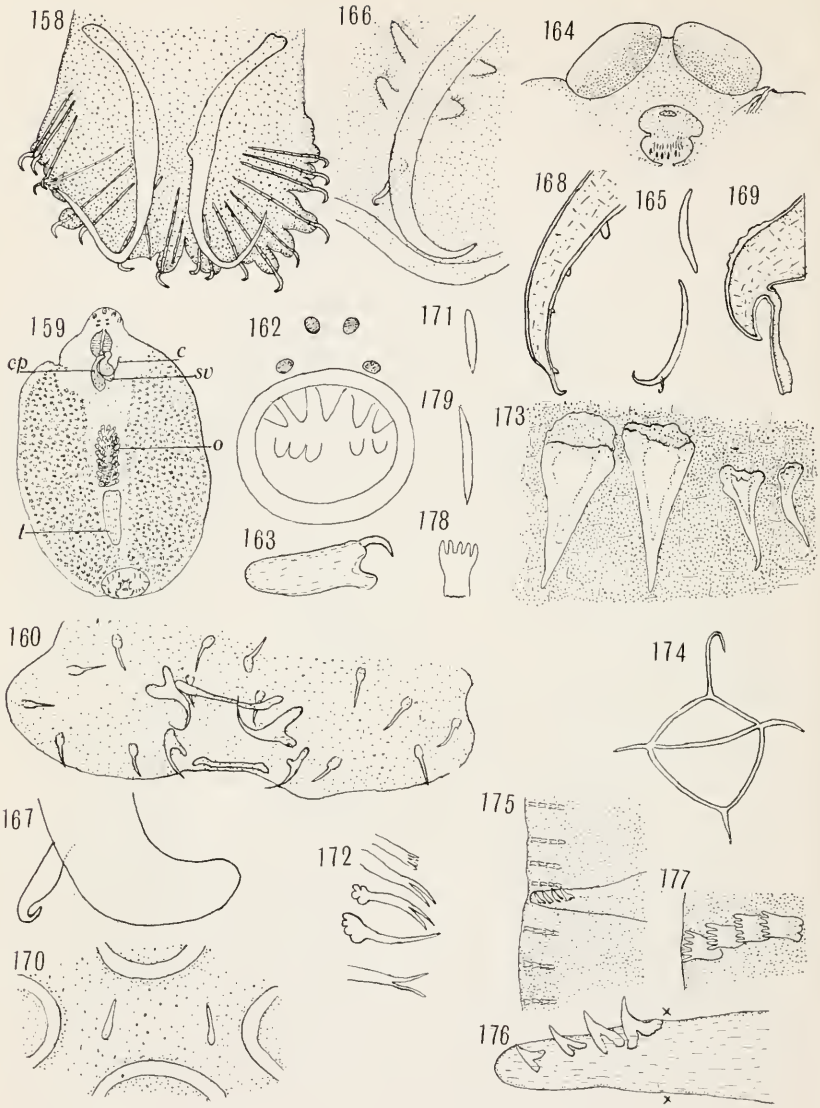
128–133. *Derogenes varicus* (Müller): 128, 130, Ventral views; 129, 131, 133, ova; 132, lateral view: (128 and 129 from *Lobotes surinamensis*, 130 and 131 from *Lophius piscatorius*, 132 and 133 from *Gadus morrhua.*)

134–144. *Hirudinella fusca* (Bosc): 134, From *Xiphias gladius*, alcoholic specimen; 135, from *Thunnus secundodorsalis*, alcoholic; 136, from *Trichiurus lepturus*, alcoholic; 137, from *Seriola zonata*, formalin; 138, from *Xiphias gladius*, sagittal section of neck; 139, from same, sagittal section of body behind ventral sucker; 140, from *Trichiurus lepturus*, cross section at level of genital papilla (cone, of Poirier); from same, 141, cross section at level of ventral sucker; 142, from same, ova; 143, from *Thunnus secundodorsalis*, ova; 144, from *Xiphias gladius*, ova.



145–155. *Hirudinella fusca* (Bosc): 145, Cross section at level of anterior border of ovary, 146, cross section near posterior end; 147, section of genital papilla, from cross section of neck; 148, section of base of genital papilla and anterior end of metraterm, from cross section of neck; 149, ejaculatory duct, prostate, and metraterm, from cross section of neck; 150, ovary and shell gland, partly diagrammatic, from cross sections; 151, ovary and dorsal wall of shell gland, from frontal section; 152, ovary and dorsal portion of shell gland, from frontal section; 153, ovary and shell gland, from frontal section; 154, ejaculatory duct, prostate, and metraterm, from cross section of neck; 155, cuticle, from cross section. (138, 139, and 151–153 from *Xiphias gladius*, 140, 141, and 145–150 from *Trichiurus lepturus*, 154 and 155 from *Thunnus secundodorsalis*.)

156, 157. Immature distomes referred provisionally to *H. fusca:* 156, Fragments from *Pterophryne histrio;* 157, from *Trachurops crumenophthalma.*



158. *Gyrodactylus* sp. from *Fundulus heteroclitus:* Posterior end, life.

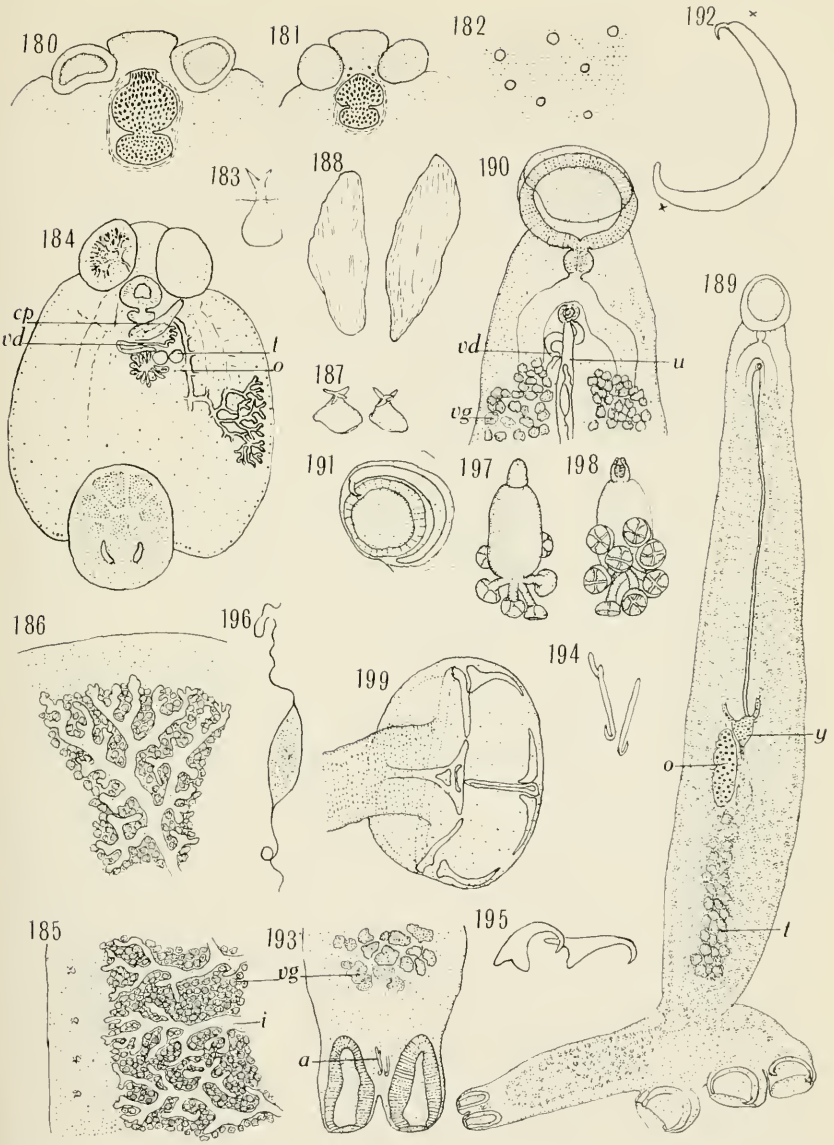
159, 160. *Ancyrocephalus parvus*, new species, from *Strongylura marina:* 159, Ventral view, eye spots showing through; 160, posterior disk.

162, 163. *Dionchus agassizi* Goto from *Remora remora:* 162, Ventral view of mouth, eye spots showing through; 163, side view of hook, claw restored.

164–169. *Entobdella hippoglossi* (Müller) from *Hippoglossus hippoglossus:* 164, Anterior end, ventral view; 165, set of hooks on left side; 166, third hook and posterior end of second; 167, third hook and posterior end of second from another specimen; 168, sagittal section of posterior edge of sucker; 169, sagittal section of anterior edge of sucker.

170–174. *Tristoma papillosum* Diesing from *Xiphias gladius:* 170, Portion of posterior sucker, ventral view; 171, spine from posterior sucker; 172, different types of marginal spines; 173, group of marginal spines; 174, ovum.

175–179. *Tristoma coccineum* Cuvier from *Xiphias gladius:* 175, Portion of right margin with accessory hook-bearing structure; 176, end of accessory hook-bearing structure; 177, group of marginal spines; 178, marginal spine; 179, spine from posterior sucker.

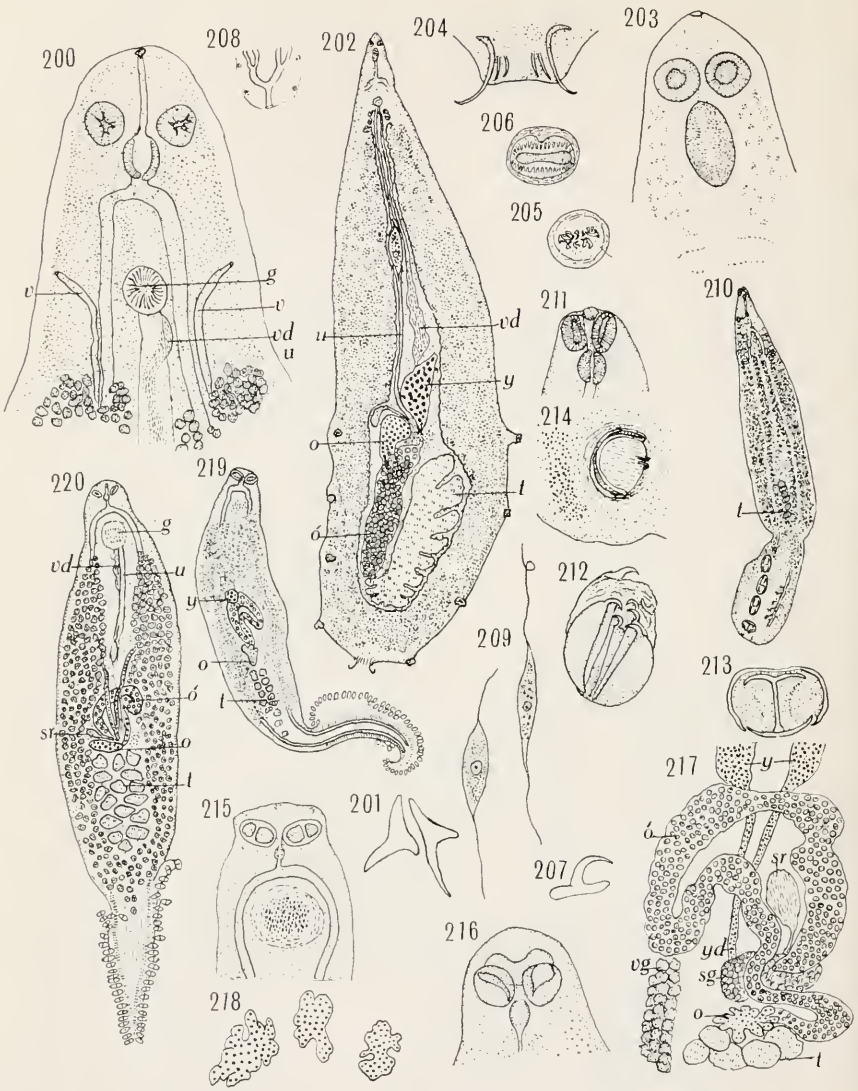


180–183. *Capsala molae* (Blanchard) from *Mola mola:* 180, Anterior end of large specimen, ventral view; 181, anterior end of young specimen, dorsal view showing eye spots; 182, portion of margin showing arrangement of spine; 183, lateral view of marginal spine.

184–188. *Capsala laevis* (Verrill) from *Xiphias gladius:* 184, Ventral view; 185, lateral margin at level of testes, showing branching intestine, vitellaria, and marginal spines; 186, portion of anterior lobe between suckers; 187, marginal spines; 188, spines from posterior sucker, slightly foreshortened.

189–196. *Onchocotyle mavori*, new species, from *Morone americana:* 189, Ventrolateral view; 190, anterior end, ventral view; 191, single sucker; 192, chitinous hook from sucker; 193, posterior end; 194, terminal hooklets, ventral view; 195, same, lateral view; 196, ovum.

197–199 *Diclidophora pinguis*, new species, from *Albatrossia pectoralis:* 197, Dorsal view, alcohol; 198, ventral view of same specimen; 199, dorsal view of one of the posterior suckers.



200, 201. *Anthocotyle merlucii americanus* MacCallum from *Merluccius bilinearis:* 200, Anterior end, ventral view; 201, terminal hooks.

202–209. *Mazocraeoides georgei* Price from *Pomolobus pseudoharengus:* 202, Ventral view; 203, anterior end, ventral view; 204, posterior end; 205, genital pore; 206, same, life; 207, hook from genital atrium; 208, excretory vessels at posterior end, life; 209, ova.

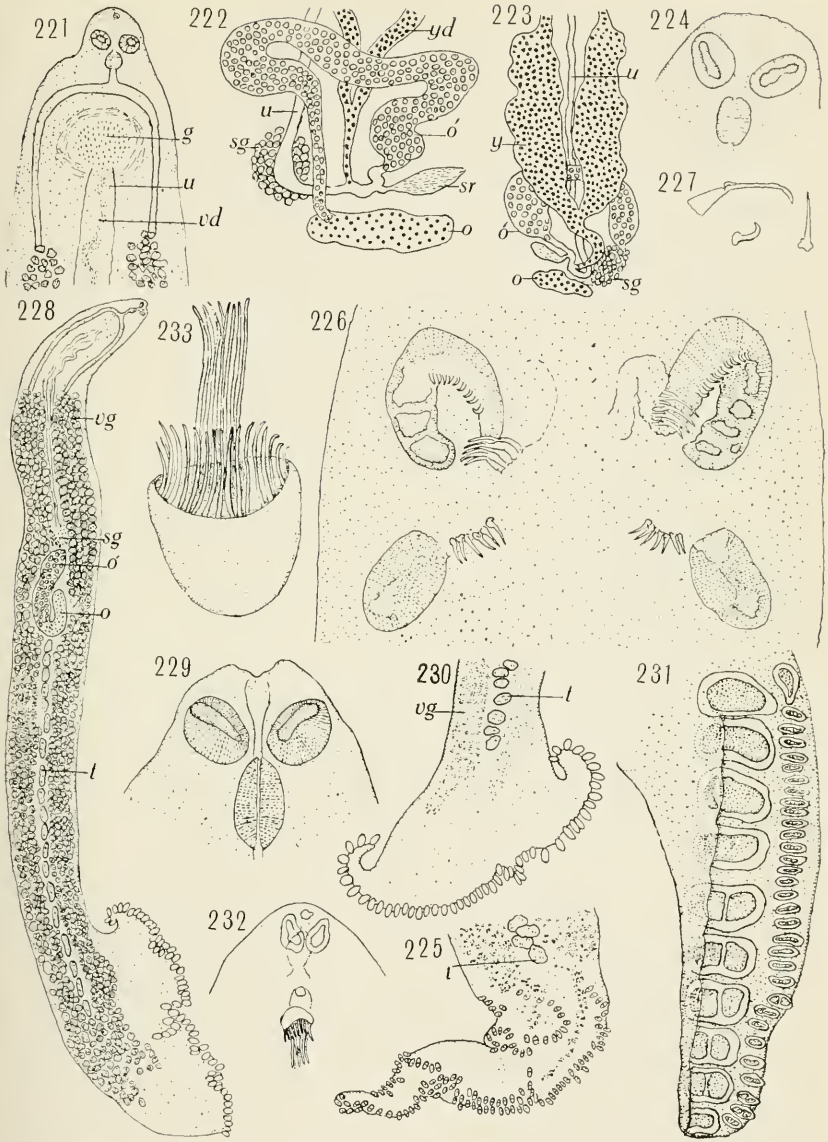
210–214. *Pleurocotyle scombri* (Gervais and van Beneden) from *Pneumatophorus grex:* 210, Ventral view; 211, anterior end; 212, hooks of genital atrium, somewhat broken and distorted; 213, posterior end of the four larger suckers; 214, minute terminal sucker.

215. *Microcotyle poronoti* MacCallum from *Poronotus triacanthus:* Anterior end, ventral view.

216–218. *Microcotyle pomatomi* Goto from *Pomatomus saltatrix:* 216, Anterior end, ventral view; 217, diagram of genitalia in vicinity of ovary; 218, ovaries from three specimens.

219. *Microcotyle stenotomi* Goto from *Stenotomus chrysops:* Ventrolateral view.

220. *Microcotyle furcata*, new species, from *Tautoga onitis:* Ventral view.

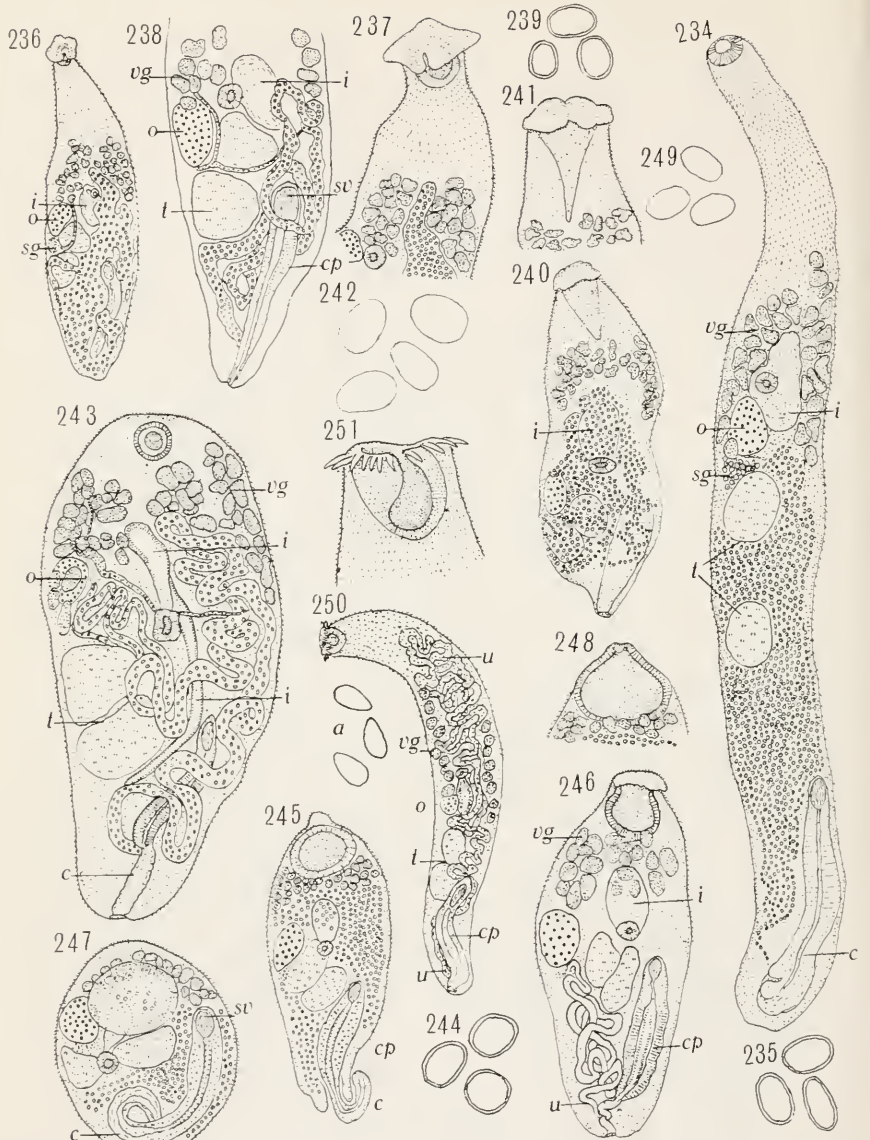


221–223. *Microcotyle furcata*, new species, from *Tautoga onitis:* 221, Anterior end, ventral view; 222, genitalia in region of ovary, dorsal view, diagrammatic; 223, same of another specimen, ventral view.

224–227. *Microcotyle* sp. from *Cynoscion regalis:* 224, Anterior end, ventral view; 225, posterior end; 226, genital atrium; 227, types of hooks from genital atrium.

228–230. *Axine gracilis*, new species, from *Strongylura marina:* 228, Dorsolateral view; 229, anterior end; 230, posterior end of young specimen.

231–233. *Heteraxine cokeri*, new genus and species, from *Aplodinotus grunniens:* 231, Posterior sucker-bearing portion; 232, anterior end; 233, genital atrium.



234, 235. *Gasterostomum arcuatum* Linton from *Sarda sarda:* 234, Ventral view; 235, ova.

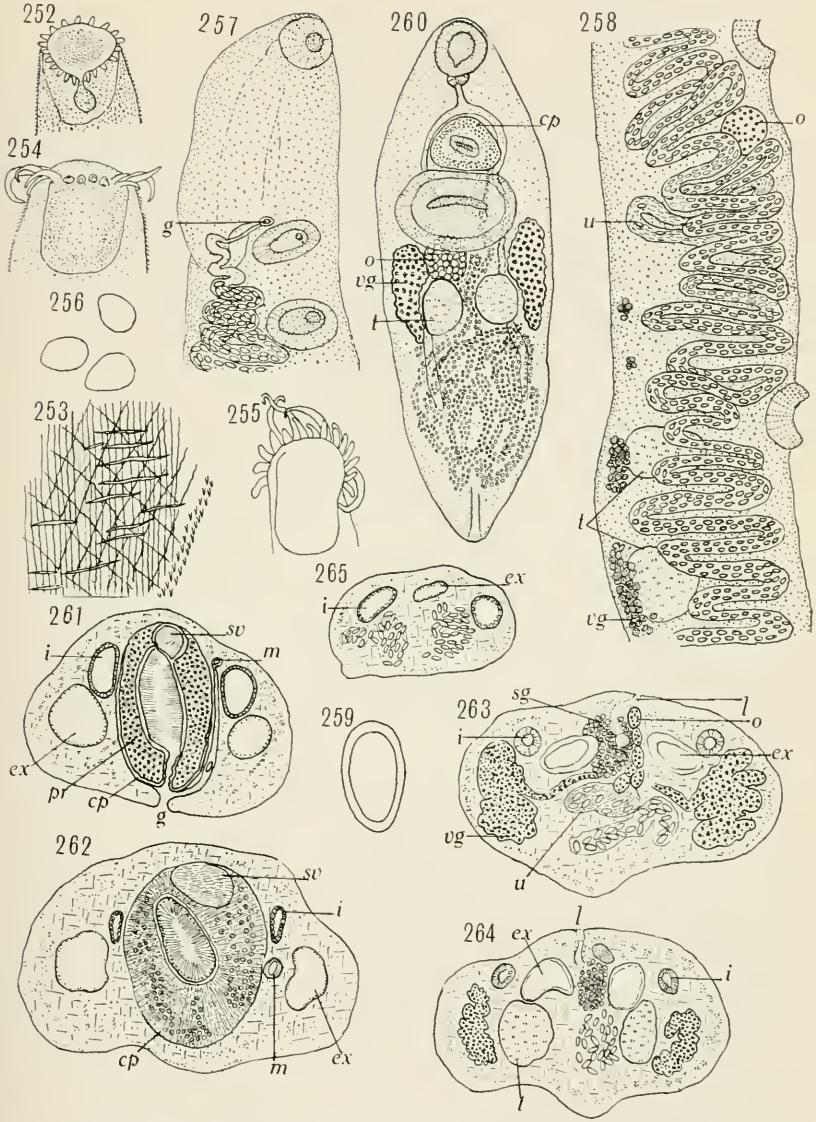
236–239. *Gasterostomum capitatum*, new species, from *Auxis rochei:* 236, Ventral view; 237, anterior end of another specimen; 238, posterior end of another specimen (uterus diagrammatic); 239, ova.

240–242. *Prosorhynchus crucibulum* (Rudolphi) from *Conger conger:* 240, Ventral view; 241, anterior end of another specimen; 242, ova.

243, 244. *Prosorhynchus ovatus* (Linton) from *Lobotes surinamensis:* 243, Ventral view; 244, ova.

245–249. *Prosorhynchus gracilescens* (Rudolphi): 245, Ventral view; 246, specimen in which no ova had developed; 247, strongly contracted specimen; 248, anterior end; 249, ova. (245 from *Menticirrhus saxatilis*, 246–249 from *Strongylura marina.*)

250, 251. *Nannoenterum baculum* (Linton) from *Sphyraena borealis:* 250, Ventral view; 251, anterior end.

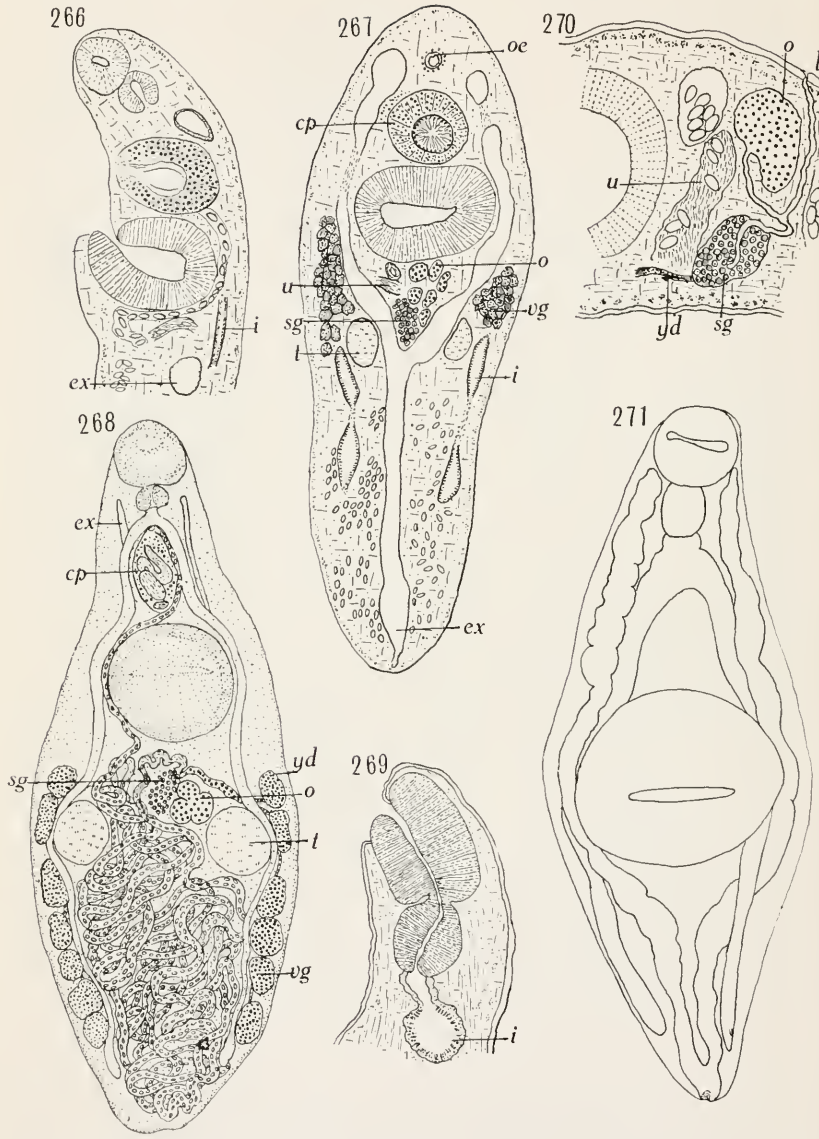


252, 253. *Nannoenterum baculum* (Linton) from *Sphyraena borealis:* 252, Anterior end, showing circle of 20 spines; 253, muscle fibers in body wall, glycerin.

254–256. *Nannoenterum gorgon* (Linton) from *Seriola lalandi:* 254, Dorsal view of anterior end; 255, dorsal view of another specimen; 256, ova.

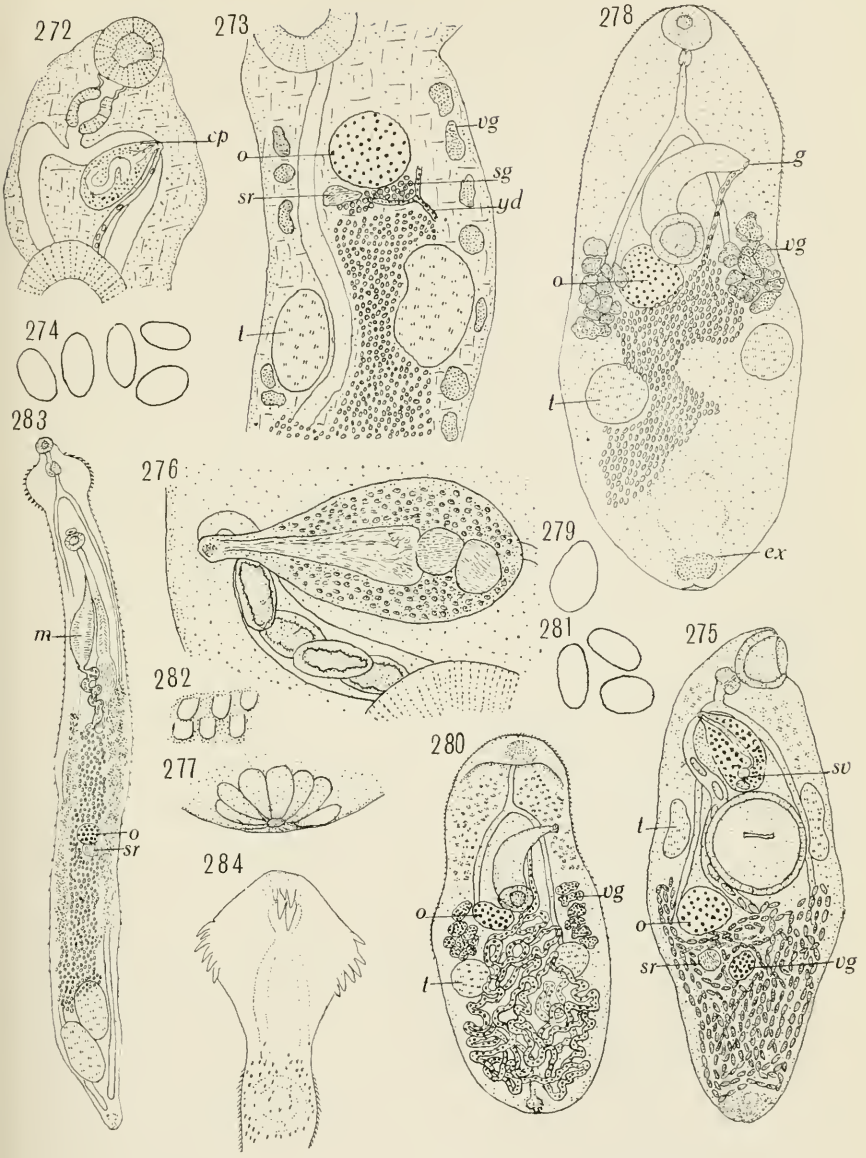
257–259. *Stichocotyle nephropis* Cunningham from *Raja laevis:* 257, Ventral view of anterior end; 258, region of fifth to some distance back of sixth ventral sucker; 259, ovum.

260–265. *Steringophorus furciger* (Olsson) from *Pseudopleuronectes americanus:* 260, Ventral view; 261, 262, cross sections at level of cirrus pouch; 263, 264, cross sections at level of Laurer's canal, from different series of sections; 265, cross section near end of intestine.



266, 267. *Steringophorus furciger* (Olsson) from *Pseudopleuronectes americanus:* 266, Sagittal section, anterior end; 267, frontal section.

268–271. *Lintonium vibex* (Linton) from *Sphoeroides maculatus:* 268, Dorsal view; 269, sagittal section, anterior end; 270, sagittal section showing Laurer's canal; 271, immature specimen, ventral view. (In some cases the intestines were entirely ventral to the excretory vessels.)



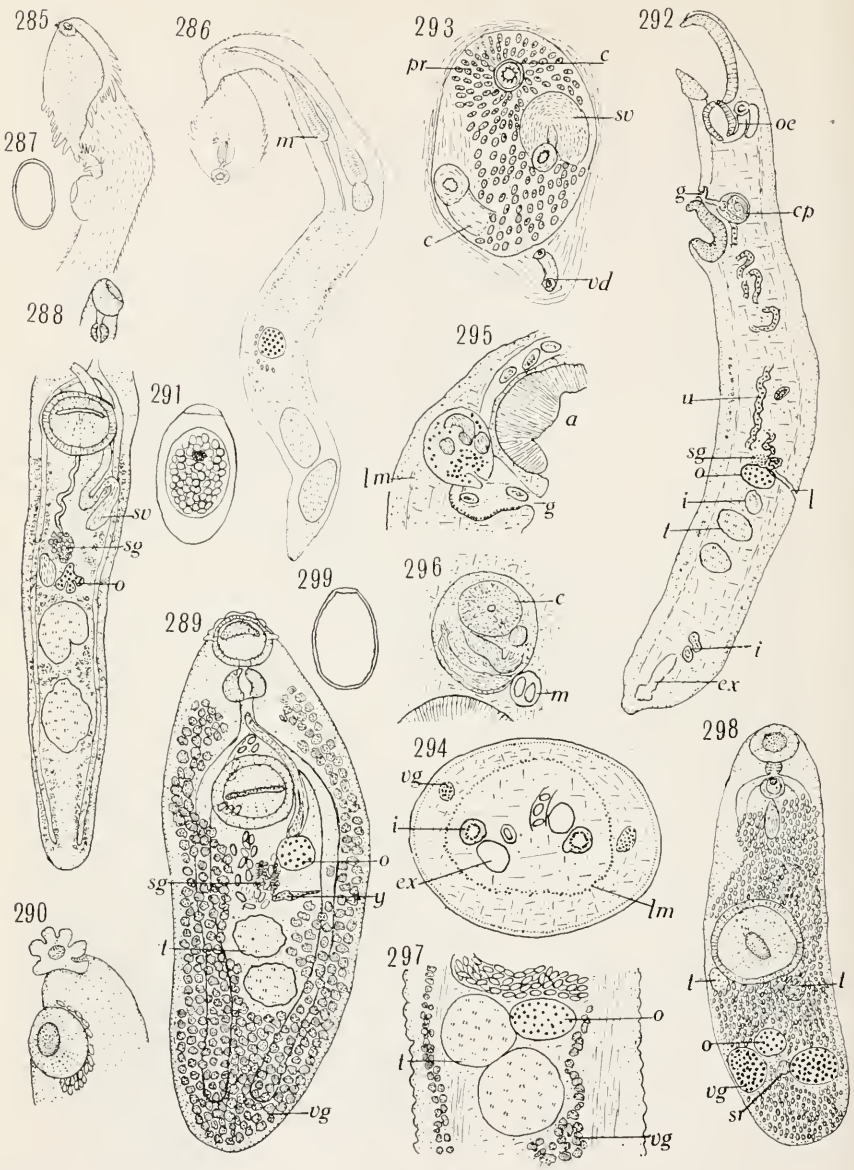
272–274. *Lecithostaphylus nitens* (Linton) from *Tylosurus acus:* 272, Frontal section, anterior end; 273, frontal section, region of ovary and testes; 274, ova.

275–277. *Zoogonoides laevis*, new species, from *Tautoga onitis:* 275, Ventral view; 276, cirrus pouch and metraterm, ventral view, life, ova with ciliated miracidia; 277, excretory pore, life.

278–282. *Steganoderma formosum* Stafford: 278, Ventral view; 279, ovum; 280, ventral view; 281, ova; 282, spines on ventral surface. (278 and 279 from *Paralichthys oblongus*, 280–282 from *Acanthocottus octodecimspinosus*.)

283. *Deropristis inflata* (Molin) from *Anguilla rostrata:* Ventral view.

284. *Deropristis hispida* (Abilgaard) from *Acipenser sturio:* Dorsal view of anterior end.



285–287. *Deropristis hispida* (Abilgaard) from *Acipenser sturio:* 285, Ventrolateral view of head; 286, another, distorted; 287, ovum.

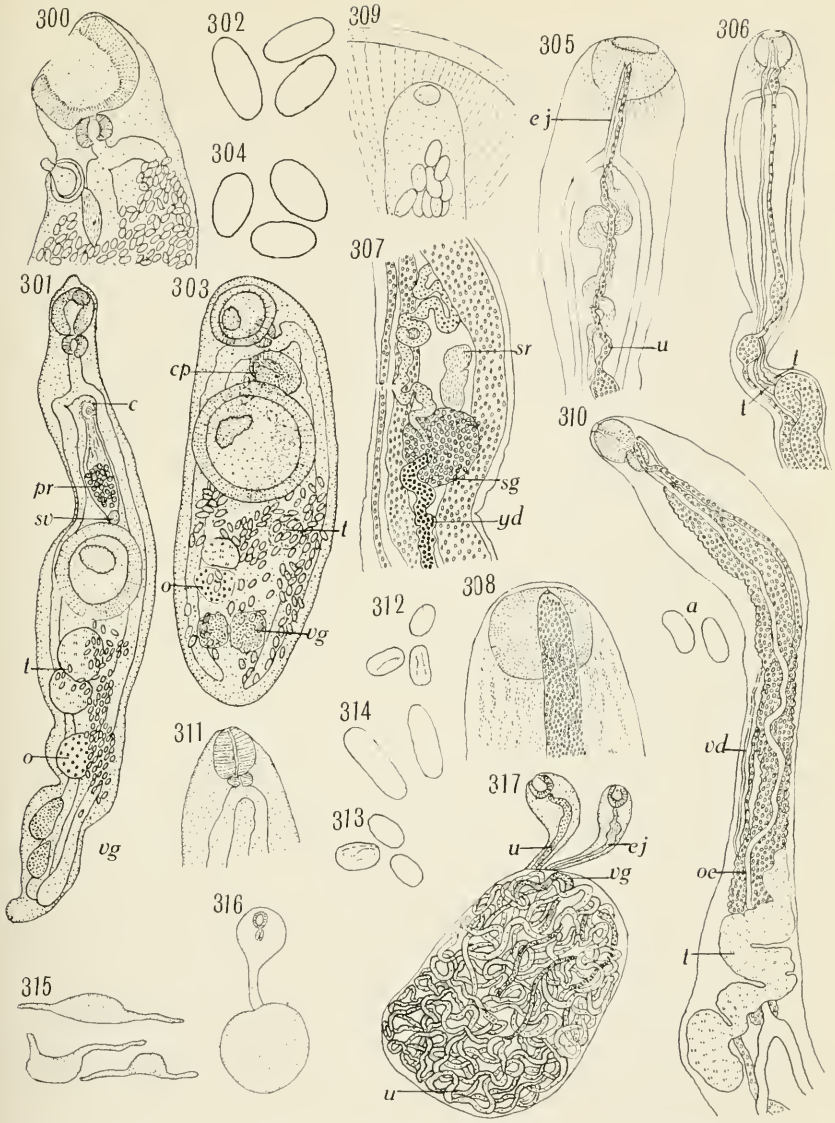
288. *Podocotyle* sp. from *Oncorhynchus tschawytscha:* Broken specimen.

289. *Crepidostomum faronis* (Müller) from *Salvelinus fontinalis:* Ventral view.

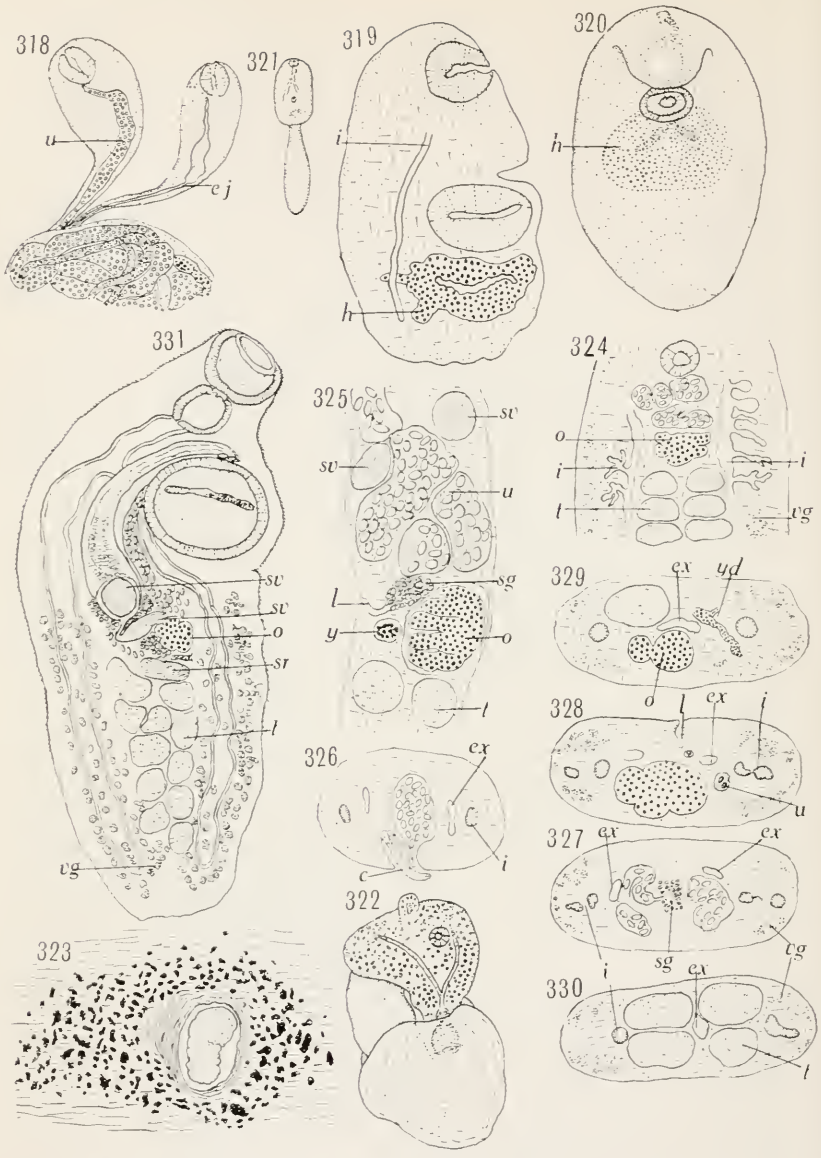
290, 291. *Bunodera nodulosa* (Froelich) from *Perca flavescens:* 290, Ventrolateral view of anterior end, formalin; 291, ovum.

292–297. *Azygia longa* (Leidy): 292, Sagittal section; 293, frontal section of cirrus pouch; 294, cross section, middle of length; 295, sagittal section, region of cirrus pouch; 296, frontal section, cirrus pouch and metraterm; 297, frontal section, region of testes. (292–294 from *Esox niger*, 295 and 296 from *Trichiurus lepturus*, 297 from *Micropterus dolomieu.*)

298, 299. *Genarches mülleri* (Levinsen) from *Cyclopterus lumpus:* 298, Ventral view; 299, ovum.



300. *Genarches mülleri* (Levinsen) from *Cyclopterus lumpus:* Lateral view, anterior end.
301, 302. *Genarches infirmus*, new species, from *Oncorhynchus tschawytscha:* 301, Ventral view; 302, ova.
303, 304. *Genarches* sp. from *Oncorhynchus tschawytscha:* 303, Ventral view; 304, ova.
305–309. *Didymozoon scombri* Taschenberg from *Poronotus triacanthus:* 305, Anterior end, ventral view; 306, same view of another, ejaculatory duct empty; 307, view of region of vicinity of shell gland; 308, anterior end of specimen with metraterm gorged with ova; 309, same, more highly magnified.
310. *Didymozoon sardae* (G. A. and W. G. MacCallum) from *Sarda sarda:* Anterior end.
311–314. *Didymozoon* sp.: 311, Anterior end, life; 312–314, ova. (311 and 312 from *Scomber scombrus*, 313 from *Pneumatophorus grex*, 314 from *Seriola zonata.*)
315–317. *Wedlia bipartita* (Wedl) from *Thunnus secundodorsalis:* 315, Trematodes encysted in pyloric caeca of host, life; 316, small specimen with single head protruding, life; 317, specimen compressed, heads of both male and female protruding.



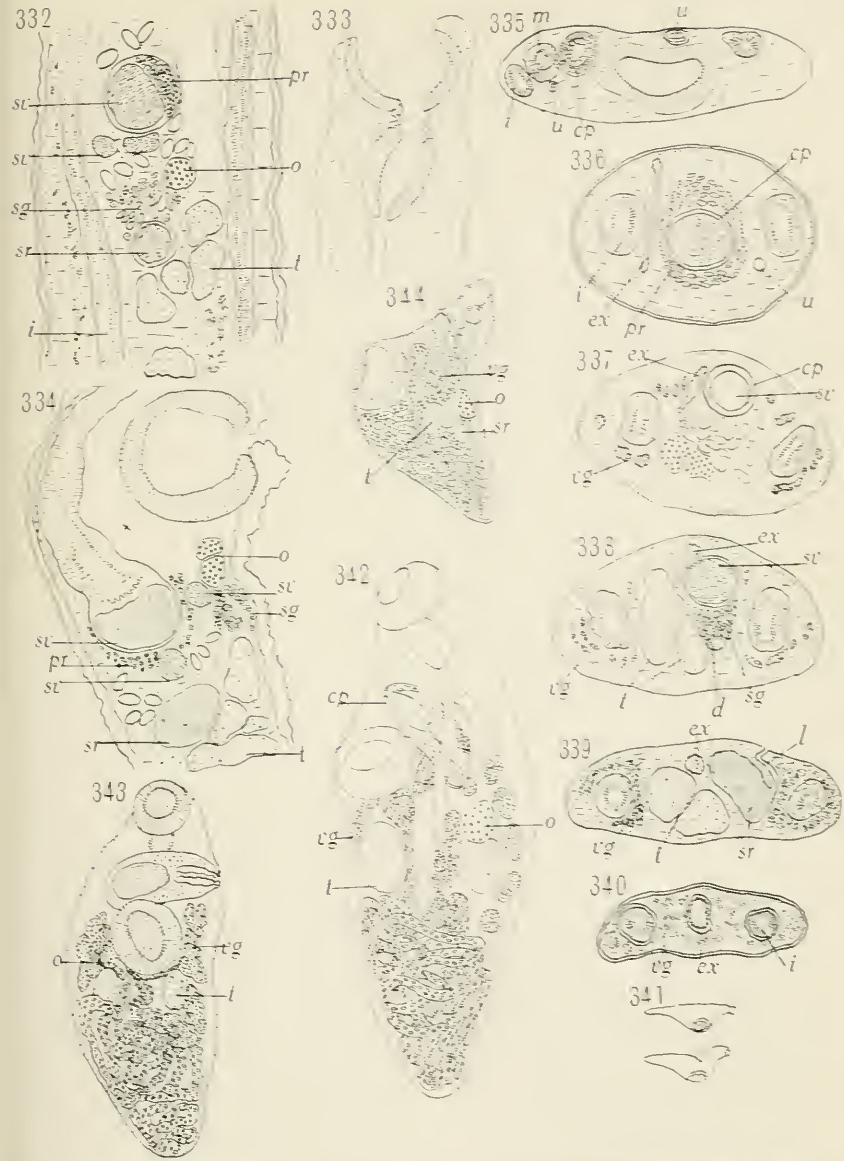
318. *Wedlia bipartita* (Wedl) from *Thunnus secundodorsalis:* Heads of specimens shown in fig. 317, enlarged.

319. *Tetracotyle communis* Hughes from *Stizostedion vitreum:* Longitudinal section.

320–323. *Neascus cuticola* (Nordmann): 320, Ventral view, life, posterior end reflected dorsad; 321, specimen removed from cyst and straightened, life; 322, larva escaping from cyst, life; 323, cyst surrounded by pigment, section. (320 from *Salvelinus fontinalis*, 321–323 from *Micropterus dolomieu.*)

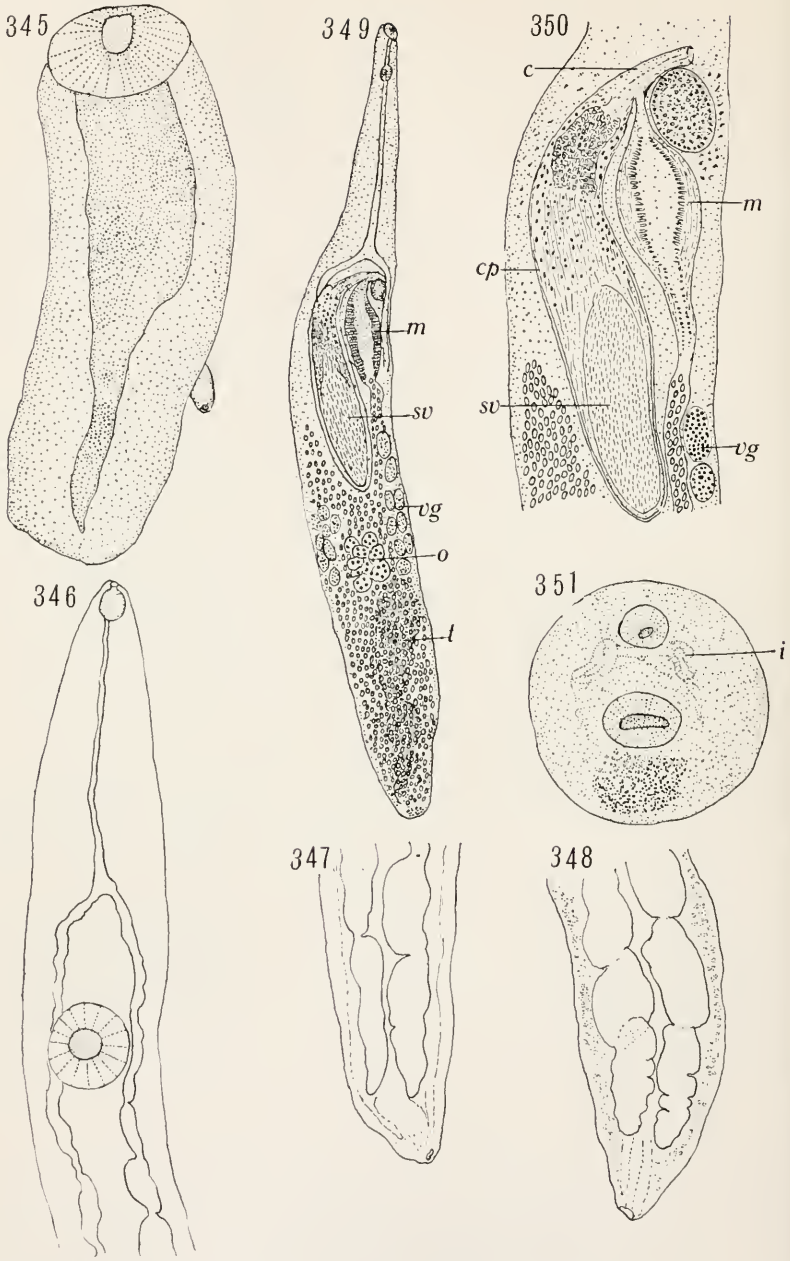
324–330. *Pleorchis americanus* Lühe from *Cynoscion regalis:* 324, Frontal section, region of ovary; 325, sagittal section, region of ovary; 326, cross section at level of genital pore; 327, cross section near level of anterior edge of ovary; 328, fifth section in series back of fig. 327; 329, fifth section in series back of fig. 328; 330, section from series a few sections back of fig. 329.

331. *Gargorchis varians*, new genus and species, from *Ceratacanthus schoepfi:* Ventral view.



332–340. *Gargorchis varians*, new genus and species, from *Chilomycterus schoepfi*: 332, Frontal section, region of ovary; 333, sagittal section, anterior end; 334, sagittal section, region of seminal receptacle; 335, cross section near anterior end of ventral sucker; 336, cross section, base of cirrus pouch; 337, cross section, level of ovary; 338, cross section, level of first testes; 339, cross section, level of seminal receptacle (tortuous course of Laurer's canal compiled from several sections); 340, cross section near posterior end.

341–344. *Deretrema fusillus* Linton from *Exocoetus volitans*: 341, Characteristic shapes, life; 342, ventrolateral view; 343, ventral view; 344, lateral view.



345. *Monostoma* sp. from *Gadus morrhua:* Ventral view.

346–348. *Distoma fenestratum* Linton: 346, Anterior end of specimen fixed under pressure; 347, posterior end of same specimen; 348, posterior end of specimen showing characteristic constricted intestine. (346 and 347 from *Remora remora,* 348 from *Ammodytes americanus.*)

349, 350. *Distoma* sp. from *Menticirrhus saxatilis:* 349, Ventral view; 350, region of cirrus pouch and metraterm.

351. *Distoma* sp. from *Percopsis omiscomaycus:* Ventral view.