# NOTES ON CESTODE PARASITES OF BIRDS

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The material upon which these notes are based was, for the most part, collected in the region about Woods Hole, Massachusetts, by the late Vinal N. Edwards. As a rule it was preserved either in formalin or alcohol without the employment of any special killing fluids. Consequently the whole mounts and sectioned material, while as satisfactory as could be expected, do not always reveal as many details of structure as could be desired.

It had been hoped that an examination of the fish-eating birds would supply some stages in the life histories of helminth parasites common to birds and fishes. This hope was not realized in the case of the cestode parasites.

Following is a list of the parasites considered in these notes with their hosts:

| PARASITE | HOST |
|---|---|
| *Ligula intestinalis* (Linnaeus) | *Colymbus holboelli.* |
| | *Podilymbus podiceps.* |
| *Schistocephalus solidus* (O. F. Müller) | *Podilymbus podiceps.* |
| *Tetrabothrius cylindraceus* (Rudolphi) | *Sterna dougalli.* |
| | *hirundo.* |
| | *Larus argentatus.* |
| | *atricilla.* |
| | *marinus.* |
| *Tetrabothrius heteroclitus* (Diesing) | *Nycticorax nycticorax naevius.* |
| | *Puffinus borealis.* |
| | *gravis.* |
| | *griseus.* |
| *Tetrabothrius macrocephalus* (Rudolphi) | *Colymbus auritus.* |
| | *holboelli.* |
| | *Gavia immer.* |
| *Tetrabothrius sulcatus*, new species | *Fregata magnificens.* |
| *Ophriocotyle proteus* Fries | *Larus argentatus.* |
| | *atricilla.* |

| | |
|---|---|
| *Dilepis unilateralis* (Rudolphi)_____ | *Butorides virescens.* |
| *Choanotaenia parina* (Dujardin)_____ | *Passer domesticus.* |
| *Choanotaenia ransomi*, new species___ | *Gavia immer.* |
| | *Larus argentatus.* |
| | *atricilla.* |
| | *delawarensis.* |
| | *philadelphia.* |
| *Choanotaenia*, species_____ | *Larus argentatus.* |
| *Hymenolepis anceps*, new species_____ | *Mergus serrator.* |
| *Hymenolepis ardeae* Fuhrmann_____ | *Butorides virescens.* |
| *Hymenolepis coronula* Fuhrmann_____ | *Glaucionetta clangula americana.* |
| | *Oidemia perspicillata.* |
| *Hymenolepis ductilis*, new species_____ | *Larus argentatus.* |
| | *marinus.* |
| *Hymenolepis fusus* (Krabb)_____ | *Larus argentatus.* |
| *Hymenolepis hamulacanthos* new species_____ | *Marila americana.* |
| *Hymenolepis macracanthos* (Linstow)_ | *Mergus serrator.* |
| *Hymenolepis pachycephala* (Linstow)_. | *Colymbus holboelli.* |
| *Hymenolepis podicipina* Szymanski___. | *Colymbus auritus.* |
| | *holboelli.* |
| *Hymenolepis rostellata* (Abilgaard)__ | *Colymbus holboelli.* |
| | *Gavia immer.* |
| *Hymenolepis tritesticulata* Fuhrmann_ | *Fulica americana.* |
| | *Marila marila.* |
| | *Mergus serrator.* |
| | *Oidemia deglandi.* |
| | *perspicillata.* |
| *Hymenolepis* (*Wcinlandia*), species__ | *Marila marila.* |
| | *Oidemia deglandi.* |
| *Hymenolepis*, species_____ | *Larus delawarensis.* |
| *Hymenolepis*, species_____ | *Fulica americana.* |
| *Rhabdometra similis* Ransom_____ | *Coccyzus americanus.* |
| *Diorchis acuminata* Clerc_____ | *Marila americana.* |
| *Valipora mutabilis*, new species_____ | *Nycticorax nycticorax naevius.* |
| *Valipora parvispine*, new species_____ | *Gavia immer.* |
| *Dioicocestus fuhrmanni* Linton_____ | *Colymbus auritus.* |
| | *holboelli.* |
| *Diploposthe laevis* (Bloch)_____ | *Marila americana.* |
| *Gyrocoelia milligani*, new species_____ | *Crocethia alba.* |
| *Fimbriaria fasciolaris* (Pallas)_____ | *Mergus serrator.* |
| | *Oidemia deglandi.* |
| *Fimbriaria falciformis*, new species____ | *Fulica americana.* |
| | *Clangula hyemalis.* |
| | *Oidemia deglandi.* |
| | *perspicillata.* |

## FOOD NOTES

On account of their possible service in suggesting lines of inquiry concerning life histories of the cestodes which are described in this paper the following brief summary of food notes is given:

*Butorides virescens:*

July, August, and September.—Small fish (*Fundulus*), on 5 dates; insects, 3 dates.

*Coccyzus americanus:*

June.—Stomach of one bird contained 20 caterpillars and fragments of beetles.

*Colymbus auritus:*

January, February, March, April, November, and December.—Fish (*Fundulus*, silversides, sculpins), 5 dates; Nereis, 2 dates; shrimp, 1 date.

*Colymbus holboelli:*

January, February, March, April, November, and December.—Fish (cunners, sculpins, silversides), 14 dates; Nereis, 3 dates; amphipods, crabs, and shrimp, 1 date.

*Fulica americana:*

November.—Mussels, 2 dates.

*Gavia immer:*

January, February, April, July, and December.—Fish (cunners, menhaden, sculpins, silversides), 11 dates.

*Larus argentatus:*

January, February, March, April, May, June, August, September, November, and December.—Fish (alewives, cunners, herring, sand eels, sculpins, silversides), 12 dates; crabs, 4 dates; starfish, 2 dates; mussels, 9 dates; garbage, 14 dates.

*Larus atricilla:*

April, May, July, August, and September.—Fish (pipe fish, pollock, silversides, young herring), 10 dates; insects, 3 dates; small mollusks, 1 date; small crustaceans, 1 date.

July 3.—One stomach contained 66 wasps, 1 beetle, and many fragments of insects.

July 30.—Approximately 300 isopods (*Idotea*) and small crabs 4 mm. in breadth, were found in the stomach of one gull.

*Larus delawarensis:*

January.—Crabs and gravel.

*Larus marinus:*

January.—Crabs, 1 date; mussels, 1 date.

April.—Fish (cunners), 1 date.

*Larus philadelphia:*

November.—Fish (sand eels, silversides), 6 dates; shrimp, 1 date; small crustaceans (*Mysis*), 1 date (number in vial, 1,670).

April.—Copepods, 1 date.

*Marila americana:*

February.—Mollusks, *Ulva*, and eel grass, 1 date.

*Marila marila:*

January and February.—Small mollusks, on 5 dates; eel grass and *Ulva*, 1 date.

*Mergus serrator:*

January, February, April, and November.—Fish (cunners, pholas, sculpins (eggs), silversides, stickleback, tautog), 18 dates; mussels, 1 date.

*Nycticorax nycticorax, naevius:*

May, July, and September.—Fish (*Fundulus*, silversides, whiting, from fish pound), 12 dates.

*Oidemia deglandi:*

February, June, July, August, September, October, and November.—Bivalve mollusks (*Mytilus*, *Venus*, *Yoldia*), 8 dates; gastropod mollusk shells, some containing hermit crabs, 2 dates.

October 18.—Two birds examined; one contained 736 (estimated) small clams (*Venus*), 3 to 7 mm. in length; the other contained 728 (estimated) of the same, 3 to 8 mm. in length.

*Oidemia perspicillata:*

February, May, and July.—Small bivalve mollusks, 3 dates; univalve mollusks, 1 date.

*Podilymbus podiceps:*

November.—Feathers and down, 2 dates.

*Puffinus borealis:*

August.—Fish and squid, 1 date.

*Sterna dougalli:*

August.—Fish, 1 date.

*Sterna hirundo:*

August and November.—Fish (*Fundulus*, silversides), 3 dates; squid, 1 date; insects (Hymenoptera), 1 date.

The greater part of the work of the preparation of this report was done at the medical department of the University of Georgia, Augusta, Georgia.

## LIGULA INTESTINALIS (Linnaeus)

Figures 1–4

There are considerable differences exhibited by the outlines of the anterior ends of strobiles. Two types of these are shown in figures 1, 2; the one elongated and sharp-pointed, the other bluntly rounded. There is a superficial segmentation of the strobile, but only at the anterior end. Thus in a mounted specimen measuring about 56 mm. in length segments occur only on the anterior 12 mm., where there are 38 distinct proglottides. They cease abruptly, the succeeding part of the strobile being transversely rugose, but without any indi-

cation of proglottides further than is shown by the successive sets of reproductive organs. Rudiments of these may be seen about 3.5 mm. from the anterior end; ova make their appearance 10 mm. or less from the anterior end. At the distance of about 20 mm. from the anterior end the sets of reproductive organs are about 0.15 mm. apart. Toward the posterior end four sets of reproductive organs occupied a length of strobile of only 0.63 mm.; near the posterior end three sets, now represented by egg-masses, took up 0.92 mm. of length. In another strobile three egg clusters occupied a length of 2.10 mm.

The anatomy, as revealed by several series of sections, agrees with that given by various authors. A diagrammatic representation of the genitalia reconstructed from a series of transverse sections is given in Figure 4.

In a transverse section made 1 mm. from the anterior end the thickness of the cuticle is 0.02 mm., subcuticula 0.14, longitudinal muscle layer 0.11, circular muscle layer 0.11, medulla 0.14. The subcuticula consists of a dense layer of radial fibers with numerous fine longitudinal fibers interspersed. At the edge of the subcuticula, next the layer of longitudinal muscles, there is a layer of nuclei deeply stained, which represents the rudiments of the vitellaria. The longitudinal fibers of the cuticula are in clusters and appear to be very small fascicles of fine longitudinal muscles. The bundles of longitudinal muscles in transverse section are much elongated radially, and the individual fibers are closely crowded and numerous. The layer of circular muscles is here strongly developed, being of about the same thickness as the longitudinal layer. The medulla is narrow, a little less than one-sixth the thickness of the strobile at this point. The structure of the adult strobile differs from the foregoing principally in the space occupied by the vitellaria, which lies between the subcuticula and the layer of longitudinal muscles. Thus in a transverse section 3.36 by 0.70, at a point where the thickness of the strobile was about 0.60, the thickness of the cuticle was 0.009, the subcuticula 0.07, the vitelline layer 0.07, the longitudinal muscle layer 0.08, the circular muscle layer 0.03, and the thickness of the medulla 0.10. The longer diameter of the testes is dorso-ventral and is about equal to the thickness of the medulla. At this level the fibers of both longitudinal and circular muscles are coarser than they are near the anterior end of the strobile. The medulla is crossed by numerous rather strong dorso-ventral fibers which can be traced across the circular muscles and between the bundles of the longitudinal layer.

The ova varied in greater diameter from 0.057 to 0.069, and in lesser diameter from 0.036 to 0.042; average of fourteen 0.061 by 0.039.

RECORD OF COLLETIONS

*Colymbus holboelli*, new host:

1910, April 17.—2, flat, thin, tapering to the posterior end, where the breadth was 2 mm.; length of one 72 mm., maximum breadth 6; length of the other 116, maximum breadth 7.

*Podilymbus podiceps:*

1903, November 13.—5, from 40 to 115 mm., in formalin. In all but one the maximum breadth was 4 mm., in one it was 6 mm.

(U.S.N.M., Helm. Coll. 7859.)

### SCHISTOCEPHALUS SOLIDUS (O. F. Müller)

Figure 5

A single strobile was found in a lot of cestodes collected by Mr. Edwards November 13, 1903, at Woods Hole from the pied-billed grebe (*Podilymbus podiceps*), new host. The specimen was associated with several strobiles of *Ligula intestinalis*, and was not recognized until after it had been mounted in balsam. It is 60 mm. in length, fusiform, tapering more posteriorly than anteriorly, the greatest breadth being at a point a little in front of the middle. Breadth of scolex and anterior segments, measured on their posterior margins, 1 mm., 1.12, 1.40, 1.96, 2.10, 2.21, 2.49; length from 0.42 to 0.56; number of proglottides in the strobile, 94. Lateral margins of strobile serrate. At the broadest part of the strobile the proglottides measured 0.60 mm. in length and 3.64 in breadth. Near the posterior end the proglottides were somewhat crumpled and measurements were not satisfactory, but the length and breadth are about equal, and about 1 mm.

Rudiments of a cirrus first appear in the eleventh proglottis; a few clusters of cells with somewhat irregular outlines appear in the ninth proglottis and continue for about five proglottides which may represent the testes. In the twelfth, thirteenth, and fourteenth proglottides the cirrus, cirrus-pouch, testes, ovary, vitellaria, and rudiments of the uterus could be seen. In the fifteenth proglottis the uterus was filled with a compact mass of ova, not differing materially in size nor in apparent number of ova from similar masses in the 79 proglottides which succeeded it. This mass of ova in the fifteenth proglottis measured 0.35 mm. in length and 0.56 in breadth. It should be remarked that although the full complement of ova had appeared in the fifteenth proglottis, none had yet been formed in the fourteenth. Ova seen in position to give the maximum section are 0.075 by 0.045; an average of 12 ova taken at random was 0.071 by 0.043. The diameter of the cirrus-pouch was about 0.12.

(U.S.N.M., Helm, Coll. 7860.)

## Genus TETRABOTHRIUS Rudolphi

For synonymy see Ransom's Taenioid Cestodes of North American Birds, Bull. 69, U. S. Nat. Mus., 1909.

Scolex provided with four prominent suckers in dorso-ventral pairs, and with a characteristic cap-like appendage at the anterior end. Proglottides begin near the scolex, and, as a rule, are much broader than long. The genital pores are unilateral, each consisting of a strong muscular cloaca into which the cirrus and vagina open. The cirrus-pouch is small, much smaller than the cloaca, on the inner border of which it lies. The vitelline gland lies in front of the ovary.

### TETRABOTHRIUS CYLINDRACEUS (Rudolphi)

Figures 6–13.

Cestodes in the collection from two species of tern and three species of gull, belonging to the genus *Tetrabothrius*, while exhibiting considerable difference in the appearance of the strobiles, agree in so many respects that the best disposal of them seems to be to place them in the same species. Further details are given under each specific host. Differences in the structure of the scoleces were slight, although there were considerable differences in size. The genital pore in adult proglottides was at about the middle of the length, or a little anterior to the middle, and nearly on the margin. The diameter of the cirrus-pouch was nearly the same in all, and the relation between the vagina and cirrus at the point of entry into the cloaca was the same in all. The number of testes, which surround the ovary, appeared to be about the same in all. The number of fibers in the bundles of longitudinal muscles did not furnish a reliable specific character, since the number of fibers differs in different regions of the strobile, and in different parts of the same section. In all of the sections there is close agreement in the nature of the longitudinal muscles. In all cases there are two quite distinct layers, an inner layer of relatively large bundles, with 25 fibers, more or less, in each, and an outer layer consisting of a greater number of bundles than are found in the inner layer, but with from 3 to 7 fibers in each. Mature ova were seen only in sections of material from the tern. They were surrounded by thin, membranous envelopes.

From *Sterna hirundo*, new host:

Appendage of scolex moderately developed; length of scolex, 0.24; breadth, anterior, 0.24; posterior, 0.32, in balsam.

Maximum length of strobile 55 mm.; posterior segments, length 1, breadth 2; margins of strobile rather sharply serrate, except in

middle portion, where the proglottides are very short with bluntly rounded margins; first distinct segments about 3 mm. back of scolex. The short cirrus opens beside the vagina on a papilla in the muscular genital cloaca. The cirrus-pouch varies slightly in size and shape in different sections. In a series of frontal sections it was about 0.05 mm. in length and 0.04 in diameter. The folds of the vas deferens lie on the dorsal side of the medullary space between the cirrus-pouch and the median line. The exact number of testes was not indicated in whole mounts, but, as seen in sections, appears to be 20 or more. The vagina passes, from its opening beside the cirrus, at first ventrad, then medio-dorsad, enlarging in its course into an elongated seminal receptacle. The ovary, as seen in frontal sections, consists of two lobulate masses symmetrically placed on each side of the median line, where they unite. The vitelline gland is small, lobed, and lies on the median line in front of the ovary and on the ventral side of the medullary space. In a mature but unripe proglottis the vitelline gland was 0.056 mm. in length and 0.056 in breadth; the ovary in the same proglottis measured 0.126 in length and 0.322 in breadth. Rudiments of the uterus were seen leading from the shell gland, and, in proglottides in which ova had begun to appear, the uterus lay on the dorsal side of the ovary; in mature proglottides it is profoundly lobed. Later the lobed condition gives way to a more or less even outline, when the uterus occupies practically all of the medullary space. Ova with six-hooked embryos were seen in the ripe proglottides. They have three membranous envelopes, and are about 0.045 mm. in diameter. In sections of adult, but unripe, proglottides the inner longitudinal muscle bundles contain from 12 to 27, or more, fibers; and the outer from 3 to 7, or more. The circular layer, next within the inner longitudinal layer and surrounding the medullary space, is rather distinct. The ventral excretory vessels are much larger than the dorsal.

This form from the tern has rather more distinct divisions of the strobile into proglottides than is the case with those from the gulls. Indeed there are some suggestions in the anatomy of Fuhrmann's species *T. sarisini*, from a tern of New Caledonia.

From *Larus atricilla:*

The bothria are long-oval, with rather strong muscular border, the capitate appendage is moderately developed. There is a short, unsegmented neck; the first proglottides are much broader than long, and the margins of the strobile are bluntly serrate. The proglottides increase rather uniformly in breadth but very slowly in length. The following dimensions are fairly typical: Length 52 mm.; maximum breadth 2.5; breadth of proglottis 5 mm. back

of scolex 0.16, length 0.07; 10 mm. back, breadth 0.35, length 0.14; 20 mm. back of scolex, breadth 0.72, length 0.12; 30 mm. back, breadth 1.54, length 0.17; 40 mm. back, breadth 1.90, length 0.17. The anatomy of the proglottides is in close agreement with that already given.

From *Larus marinus:*

Material not in good condition, but so far as the anatomy is shown it is in agreement with the foregoing; for example, the diameter of the cirrus-pouch is about 0.045 mm., and details of the structure of the genital cloaca, as shown in sections, agree with what was observed in sections of material from other gulls.

From *Larus argentatus:*

The scoleces differ more or less in shape, due to different contraction conditions, but not so much in size. Thus a considerable number of scoleces mounted in balsam do not vary much from 0.24 mm. in length and breadth. The capitate appendage is moderately well developed, although in some of the mounted scoleces it appears to be rather meager. Diameter of cirrus-pouch 0.045 mm.; number of testes about 22; details of structure of genital cloaca, ovary, vitelline gland, musculature, etc., agree with foregoing descriptions.

RECORD OF COLLECTIONS

*Sterna hirundo:*

1904, August 3.—Anterior end of strobile, length 7.5 mm.; scolex missing.

1912, August 2.—Three fragments, aggregating 35 mm.

1912, August 17.—One, length 135 mm.

1913, September 4.—Two, length 145 and 155 mm.

*Sterna dougalli:*

1904, August 3.—Six fragments of strobile, aggregating 18 mm.

*Larus atricilla:*

1911, September 9.—One scolex and fragments of strobile.

1913, August 4.—One, length 52 mm., and fragment. U.S.N.M., (Helm. Coll. 7861.)

3 mm.; 1, scolex somewhat macerated, length 38 mm.

1915, May 27.—Two, one with scolex; length 55 mm.

*Larus marinus:*

1904, January 19.—Four; dimensions of one: Length 130 mm.; diameter of scolex, anterior 0.45, posterior 0.40; length of scolex 0.40. One strobile in this lot, scolex missing, measured 250 mm. in length and 2.5 in greatest breadth.

1911, January 10.—Strobile and fragments aggregating a length of 220 mm.

1914, April 28.—One.

*Larus argentatus:*

This species was collected at Woods Hole on many dates in all except two months of the year.

January.—On seven dates in three different years; few found on any date; in most cases the scoleces were missing; maximum length 40 mm.

February.—On eight dates in four different years; largest number found on any date 30; maximum length 100 mm. On one date the record is "many, 15 with scoleces."

March.—On one date; 3 fragments; maximum length 85 mm.; no scoleces.

April.—On six dates in four different years; largest number with scoleces found on any date 7; maximum length 220 mm.

May.—On three dates in two different years; largest number found on any date 18; maximum length 150 mm., maximum breadth 3.

July.—One date; six strobiles with scoleces, and about 12 scoleces with only anterior portion of strobile attached; numerous strobiles without scoleces.

September.—One date; eight, four with scoleces; many fragments.

October.—One date; three strobiles, no scoleces.

November.—On four dates in three different years; one on each of three of the dates. On the other date the record is: "Many strobiles without scoleces; 2 scoleces; breadth of strobile 2 mm."; maximum length 160.

December.—On four dates in three different years; greatest number on any date 4; maximum length 70 mm., breadth 2.

### TETRABOTHRIUS HETEROCLITUS (Diesing)

Figures 14–22

Cestodes of this genus, collected from three species of shearwater, and the night heron, as was the case in cestodes of the same genus from gulls and divers, exhibit much variability in size of strobiles and in the shape of the proglottides. Some diversity also exists in the scoleces.

*Scolex.*—Bothria oval-elliptical, with relatively thick, muscular borders; appendage appearing rather weak, but in well-preserved specimens seen to be fairly well developed. The majority of the scoleces in balsam have a length and breadth of about 0.35 mm. Thus 22 scoleces averaged 0.37 in length and breadth; 12 of the 22 measured 0.35 by 0.35. A few scoleces were seen which were larger; length 0.75, breadth 0.72, and, one much smaller, length and breadth 0.21.

*Strobile.*—The larger strobiles are subcylindrical, with short proglottides, beginning near the scolex, and increasing in length and breadth gradually and uniformly, the posterior proglottides about one-fourth as long as broad; lateral margins of strobile bluntly serrate. In other and smaller strobiles there is great variety in the shape of the proglottides. For example, in some the proglottides begin near the scolex as closely set transverse striae, which continue for a short distance; first distinct proglottides closely crowded together, margins of the strobile bluntly serrate. Then the proglottides begin to lengthen rather rapidly, soon becoming as long as broad, with prominent, slightly thickened posterior borders; toward the posterior end they may again become shorter and crowded together. Other proglottides are slender and have distinct proglottides throughout the entire length. The largest specimen in the collection, from *P. stricklandi*, measures about 100 mm. in length, 2.5 in greatest breadth, and 1.5 in thickness; posterior, ripe proglottides, length 0.6, breadth 2.5. The cirrus is short, and opens on a papilla in the genital cloaca. The cirrus-pouch does not vary greatly from a diameter of 0.045; the largest diameter noted was 0.057, the smallest 0.028 by 0.037. The voluminous vas deferens lies on the dorsal side of the medullary space. The testes surround the ovary and vitelline gland, and rudimentary uterus. Their number was not satisfactorily shown, except in young, campanulate proglottides, where there appeared to be from 20 to 25, or more. The vagina opens into the gential cloaca on the ventral side of the cirrus papilla. It is sinuous at first, then expands slightly into an elongated seminal receptacle. The vitelline gland is anterior to the ovary on the dorsal side, and is slightly lobed. The ovary is profoundly lobed. The uterus, in ripening proglottides, is lobed, the lobes becoming less distinct as the proglottides grow older. The number of fibers in the muscular bundles is variable. Thus in the section of a ripe proglottis, breadth 1.33, thickness 0.91, the maximum number of fibers in the inner bundles was about 22, in the outer 12. In another, the number of fibers in the inner bundles varied from 6 to 22, in the outer from 3 to 8. In another the maximum number of fibers in the inner bundles was 16, more or less, in the outer 12, more or less. The outer layer becomes subcuticular for a short distance at the anterior end of the proglottis.

### RECORD OF COLLECTIONS

*Puffinus borealis*, new host:

1906, June 11.—Four birds examined by Mr. Edwards, who recorded: "Worms very numerous." There is a considerable variety in size in this lot. Some very small moniliform strobiles were noted, which subsequent examination showed to be

constricted rather uniformly near the scolex, several incipient proglottides being included in the bead-like portion included between two adjacent constrictions.

1913, August 5.—Five strobiles, 3 with scoleces, about 30 mm. in length and 1 mm. in breadth; also 3 very small scoleces and fragments of both larger and smaller strobiles.

U. S. N. M., Helm, Coll. 7862.

*Puffinus gravis*, new host:

1904, October 31.—Eight strobiles with scoleces, and about 25 without scoleces; maximum length, in alcohol, 70 mm.

*Puffinus griseus*, new host:

1906, June 8.—Six birds examined by Mr. Edwards; few cestodes; great difference in size, but most of them large. Dimensions of one, in formalin: Length 80 mm.; greatest breadth 2.5, thickness 1.5.

1906, June 11.—Six birds examined; cestodes of smaller size than those collected on June 8.

*Nycticorax nycticorax naevius*, new host:

1913, July 5.—One small strobile, macerated, and a few fragments, longest 16 mm.

1913, July 5.—One small strobile, macerated, and a few fragments, longest 16 mm.

Transverse sections were made of the largest fragments. In details of structure of the genital cloaca, cirrus, cirrus-pouch, and vagina, which are satisfactorily shown in the sections, likewise in the musculature, there appears to be exact agreement with corresponding features in the shearwater material. The walls of the excretory vessels are thick, as in the species from the shearwater, and contain conspicuous longitudinal fibers. The latter do not appear in sections of shearwater material. The difference in this respect may be due to the somewhat macerated condition of the material from the night heron.

An average of ten cirrus-pouches gives the dimensions: 0.045 by 0.055 mm.; the smallest 0.041 by 0.054, and the largest 0.054 by 0.054.

The maximum number of muscle fibers appears to be about 20 in the inner bundles and 7 in the outer. The uterus is lobed. The proglottides sectioned were about 0.08 mm. in length and 1.26 mm. in breadth.

1913, August 5.—Fragments of strobile, longest 40 mm., no scolex.

### TETRABOTHRIUS MACROCEPHALUS (Rudolphi)

Figures 23–31

*Scolex.*—There is a great variety of size and form; bothria oval-elliptical; anterior appendage prominent in larger scoleces, less prominent in smaller scoleces.

*Strobile.*—The larger strobiles are robust, thickish, neck subcylindrical; proglottides begin a short distance back of scolex, at first very short, increasing in length very slowly, much crowded, very much broader than long; ripe proglottides may become half as long as broad. Younger strobiles somewhat cylindrical, proglottides at first crowded, much broader than long, becoming nearly as long as broad. In all cases the margins of the strobiles are more or less serrate. In some of the longer strobiles the adult and ripe proglottides are somewhat campanulate. These are less robust than the majority of the longer strobiles, the proglottides are less crowded and of greater relative length. The scoleces in these two forms agree in details of structure. The muscular genital cloaca is situated near the margin at about the middle of the length of the proglottis. The cirrus opens on a small papilla, at the base of which is the opening of the vagina. The cirrus-pouch is at the median border of the genital cloaca. The cirrus is short and smooth; the rather voluminous vas deferens lies on the dorsal side of the medullary space, in some cases extending from the cirrus-pouch nearly to the median line; in one case it was observed to surround the dorsal excretory vessel. The exact number of testes is difficult to determine. They are rather numerous, as many as 20 appearing in the same transverse section, and representing from 35 to 40 or more in the proglottis. In a whole mount the number of testes, in a proglottis measuring 0.28 mm. in length and 0.56 in breadth, was estimated to be about 40. The diameter of the cirrus-pouch is about 0.075 mm. The vagina lies on the ventral side of the cirrus-pouch, is at first slender and more or less sinuous. It passes mediad near the ventral excretory vessel, enlarges, and continues mediad on the ventral side of the vas deferans to the border of the small, lobed vitelline gland, where it turns abruptly ventrad. The vitelline gland lies at the median line towards the anterior end of the proglottis, in front of the lobed ovary. The uterus, in ripening proglottides, is much lobed, the lobes tending to become obscure, or to disappear entirely in the older proglottides, which are filled with ova. Diameter of ova about 0.045 mm. The ventral excretory vessels are much larger than the dorsal, oval in section, the dorso-ventral diameter the greater, and, in a few series of sections, relatively large transverse vessels were shown at the posterior ends of the proglottides connecting the ventral vessels. In the scolex the vessels are abundantly distributed in the axial region, and at the lateral margins between

the two bothria, which, lying back to back, constitute a lateral pair. These lateral vessels form close spirals near the base of the scolex, where they are joined by the axial vessels to continue in the strobile as the dorsal and ventral lateral vessels.

There are two layers of longitudinal muscles, arranged in bundles, the outer layer consisting of many small bundles each containing few fibers, the inner layer consisting of fewer and larger bundles. In proglottides in which the uterus was rudimentary the outer bundles contained a maximum of about 30 fibers, the outer bundles about 7. In proglottides in which the uterus was well advanced, the inner bundles contained a maximum of about 20 fibers, the outer about 5. At the base of the scolex there is but a single layer of longitudinal muscles, which is separated from the cuticle by a granular layer containing many radial fibers. Near the scolex the layer of circular fibers, which encloses the medullary space, is conspicuous. It becomes less so in older portions of the strobile. Longitudinal sections give no indication of the formation of free proglottides. A tendency to separate from the strobile was observed only in the case of the slender variety.

RECORD OF COLLECTIONS

*Gavia immer:*

(U.S.N.M., Helm. Coll. 7863.)

1906, January 8.—Two loons examined; 12 tape worms in one, 30 in the other.

1911, July 1.—Fourteen large, with adult, loose proglottides, length 125 mm.; 6 small, also with loosening proglottides, length 10; 1, length 30.

1911, July 22.—Twenty-one large and small, with fragments; maximum length 100 mm., in alcohol.

1911, July 24.—One hundred and forty-seven scoleces and 77 strobiles and fragments without scoleces. There were two varieties, one relatively thick, much longer and larger than the other, which is slender and filiform. One of the larger measured 125 mm. when straightened in a dish and fixed in corrosive acetic. One of the smaller, slender strobiles measured 30, and another 45 mm. in length. There were intermediate forms, so that it would appear that these seemingly different forms simply represent different ages of strobiles of the same species. There is not a corresponding difference in the size of the scoleces.

1911, September 1.—About 20.

1913, January 1.—Twenty-three with scoleces; the largest strobile noted was 100 mm. in length, and 2.5 in greatest breadth, in formalin; scoleces large, length 1.12, breadth 0.84; ova with six-hooked embryos.

1913, February 13.—Sixteen with scoleces, all about the same size, length 68 mm., maximum breadth 2; ripe proglottides on practically all.

1913, February 15.—Thirty-one with scoleces, largest, length 80 mm., maximum breadth 2, smallest, length 30 mm., but with ripe proglottides.

1913, April 28.—Five with scoleces, longest 58 mm.

1913, December 31.—Fifty-six, largest, length 140 mm., maximum breadth 4; a small strobile, length 11, breadth 0.7.

1914, February 21.—Mass of strobiles, not disentangled and counted, but doubtless as many as noted on the label, 120. Two removed measured 178 and 200 mm. respectively; all appeared to be large, maximum breadth 4 mm.

1914, December 12.—Ten with scoleces, and a few fragments, longest 84 mm.

1914, December 26.—Seven strobiles, no scoleces; length 100 mm.

1915, July 7.—Thirty-one with scoleces.

1915, August 11.—Very numerous.

1917, January 26.—Seven with scoleces, and many fragments; longest about 55 mm.; 4 small, with apparently nearly mature proglottides.

1917, February 6.—Two with scoleces, and fragments aggregating a length of 1,200 mm.; 1 small strobile with scolex.

*Colymbus auritus:*

1904, March 3.—Two with scoleces, 12 and 54 mm. in length, respectively; maximum breadth 3.2.

1912, February 8.—Two strobiles with scoleces, 65 and 70 mm. in length, respectively, and fragments aggregating 315 mm.

1914, April 16—Four scoleces; longest strobile 40 mm., maximum breadth 2.

1917, February 20.—Three strobiles with scoleces, and one fragment.

*Colymbus holboelli*, New host:

1905, December 11.—One and fragments.

1909, January 30.—A few fragments and one scolex.

### TETRABOTHRIUS SULCATUS, new species

Figures 32–39

*Scolex.*—Squarish, with rather sharp and clear-cut outlines; the overhanging, shelf-like anterior appendage, characteristic of the genus, well developed on the margins, but less prominent in dorsoventral aspects; length and breadth each about 0.35 mm.

*Strobile.*—The unsegmented portion has a tendency to narrow a short distance back of the scolex. The strobiles are slender and

filiform, the longest about 45 mm. The segments, as a rule, are much broader than long with a tendency to lengthen towards the middle of the strobile, where the length may become greater than the breadth. The segments are more or less wedge-shape, and are traversed by a deep and apparently permanent groove. The genital pores are situated a little in front of the margin. The cirrus appears to be a little longer than it is in the other species of this genus noted in this paper. The diameter of the cirrus-pouch, in transverse sections of the strobile 0.041, in frontal sections 0.065, in sagittal sections 0.051. The number of testes appears to be about 20. The vagina, opening into the genital cloaca near the cirrus, lies in a gentle curve on the ventral side of the cirrus-pouch and vas deferens. The vitelline gland is slightly, and the ovary strongly, lobed. The uterus in ripe proglottides fills the greater part of the medullary space; immature ova were seen which were oval-elliptical, and 0.04 mm. in the longer diameter.

The walls of the excretory vessels are thick, and there is a transverse vessel at the posterior end of the proglottides connecting the ventral vessels.

The bundles of the inner layer of longitudinal muscles are elliptical in section, and are made up of a maximum of about 25 fibers. The outer bundles contain from 3 to 5 fibers each.

A specimen mounted in balsam has the following dimensions: Length, 45 mm.; breadth of scolex, 0.34, length, 0.35; breadth of bothrium, 0.14, length, 0.33; breadth of neck, 0.21; distance to first distinct segment, 1.12; length of first segment, 0.03, breadth, 0.14; length of segment at middle of strobile 0.07, breadth 0.24; posterior segment, length 0.14, breadth 0.34. The greatest breadth was 0.56, length of segments at that point 0.08. The longest segment was 0.28, its breadth, anterior 0.14, posterior 0.28.

RECORD OF COLLECTION

*Fregata magnificens:*

1907, July 8.—A number of small cestodes were given me on this date by Dr. John W. Watson, which he had collected a few days before at Bird Key, Tortugas, Florida, from a man-of-war bird.

(U.S.N.M., Helm. Coll. 7864 (type).)

### OPHRYOCOTYLE PROTEUS (Fries)

Figures 40–44

*Scolex.*—Short and broad; the so-called rostellum is a broad, terminal sucker with strong, muscular walls, and with a scalloped border which is armed with very numerous, minute spines. These

spines are nearly straight, with abruptly recurved tips, and with strong basal supports; length about 0.004 mm. They are very closely placed—about 20 counted in the space of 0.015 mm.—in a sinuous row following the scalloped border of the rostellum. The suckers are armed with sharp-pointed hooks, most strongly represented on the anterior border, but sparingly placed elsewhere on the sucker; length 0.008 mm. Diameter of scolex in balsam 0.28.

*Strobile.*—The segments begin very close to the scolex, at first much broader than long, with the posterior edge slightly projecting and rounded at the lateral margins. As the segments lengthen the posterior edges give to the lateral margins a serrate outline. Genital pores irregularly alternate, about the middle, or a little in front of the middle of the lateral margin; cirrus-pouch cylindrical, reaching nearly to the median line. The testes are at the posterior end of the proglottis behind the female genitalia. Their number was not satisfactorily made out, but there appear to be about nine. The vagina lies close behind the cirrus-pouch. It was traced to the median line where it was obscured by the ovary. The ovary is oval, transversely placed a little in front of the middle, and occupies about two-thirds of the breadth of the proglottis. Immediately behind it, at the median line, is the vitelline gland which appears in dorso-ventral view to be fusiform. In a proglottis 0.27 mm. in breadth the vitelline gland measured 0.054 by 0.018 mm. in the two principal diameters. Ripe proglottides are as long or longer than broad. The uterus occupies all the medullary space in the ripe proglottides. The ova are nearly circular in outline, with thin, membranous shells; diameter of onchosphere about 0.02 mm.

Dimensions of a strobile with ripe proglottides, in balsam: Length 10; breadth of scolex 0.25, length 0.21; diameter of sucker 0.08; breadth of rostellum 0.16; breadth of neck 0.12; length of segment 1 millimeter back of scolex 0.10, breadth 0.15; length of segment 5 millimeters back of scolex 0.32, breadth 0.32; length of segment near posterior end 0.58, breadth 0.35. Dimensions of small strobile: Length 3; breadth of scolex 0.29, length, 0.17; breadth of neck 0.11; length of segment 1 millimeter back of scolex 0.08, breadth 0.32; length of segment near posterior end 0.25, breadth 0.37.

### RECORD OF COLLECTIONS

*Larus atricilla*, new host:

1914, September 29.—One scolex, and fragments of 2 strobiles; longest 40 mm., in formalin.

1915, May 18.—Twenty-eight short strobiles, from 2 to 4.5 mm. in length, with scoleces.

(U.S.N.M., Helm. Coll. 7865.)

*Larus argentatus*, new host:

1912, September 4.—Three small, longest about 9 mm., in formalin.

### DILEPIS UNILATERALIS (Rudolphi)

Figures 45–51

*Scolex.*—Short and broad; suckers orbicular, directed forward; rostellum short and stout, armed with two circles of hooks, 10 in each circle; length of hooks in anterior circle about 0.033 mm., in posterior circle, about 0.018; hooks with long basal and short ventral roots, blade moderately curved. It is difficult to determine the number and arrangement of the hooks on the retracted rostellum. One scolex was found among the mounted specimens with everted rostellum (fig. 46), from which the above details were obtained.

*Strobile.*—In most cases this is much narrower than the scolex for a short distance. It then increases in breadth, usually rather quickly, in some cases almost abruptly; nearly linear throughout; breadth of the posterior end of a proglottis greater than the anterior, imparting a more or less serrate outline to the lateral margins; genital pores unilateral, near the anterior end of the proglottis. In many cases the genital pore is at the summit of a papillary projection. The cirrus was seen exerted in only a few instances. It is relatively long and slender, and is armed with minute spines. The cirrus-pouch is elongate, subcylindrical, and reaches to about the median line, its inner end acting as a seminal vesicle. At its base near the median line, and at the anterior end of the proglottis, there is a voluminous vas deferens. The testes are about 10 in number, although 12 were counted in a few proglottides. They are situated behind and along the lateral margins of the ovary. In some adolescent proglottides two or three of the testes lay nearly in front of the ovary on the antiporal side. The vagina opens on the ventral side of the cirrus and lies a little posterior to the cirrus-pouch, turning dorsad in the vicinity of the vas deferens. It has thick, muscular walls, and is surrounded by a layer of what appear to be glandular cells. No seminal receptacle was seen. The ovary is relatively large, is composed of two lateral divisions, deeply lobed and united by a transverse portion at the median line. The vitelline gland is compact, and situated at the median line dorsal to the ovary. The uterus in ripe proglottides is profoundly lobed, and ultimately occupies the greater part of the interior of the proglottis. The cirrus and vagina pass between the excretory vessels of the poral side. A unique condition was noted in the character of the excretory vessels. On the poral side the ventral vessel is the larger, while on the antiporal side the dorsal vessel is the larger. This character was noted in different

series of transverse sections. There are two layers of longitudinal muscles, the outer with the more numerous bundles. The inner circle, as seen in transverse sections, is not quite continuous, one or two bundles being lacking in the vicinity of the excretory vessels.

In a strobile 8 mm. in length rudiments of genitalia could be seen 0.05 mm. back of the scolex; the full complement of testes was attained at a distance of a little less than 2 mm. from the scolex; the adult ovary was noted at about 3 mm. from the scolex; and at about the middle of the strobile, that is about 4 mm. from the scolex, the uterus appeared. At first the uterus consisted of an axial mass of ova, whose contours could not be made out in the whole mounts. From the axial mass lateral diverticula appeared in succeeding proglottides, the uterus soon becoming profoundly lobed. In the last two millimeters of the strobile, comprising about 12 proglottides, the uterus was lobed as shown in figure 49.

The ova were rather too closely packed in the uterus of the whole mounts to admit of satisfactory measurement. They appear to have two membranous shells, the diameter of the outer being from 0.024 to 0.03 mm. The following note was made on living material collected July 9, 1913: Shells of ova thin and at first collapsed; when placed in fresh water the outer shell became turgid; diameter of outer shell 0.066 mm., of inner shell 0.033, of onchosphere, containing a six-hooked embryo, 0.019.

Most of the strobiles in my collection are small, about 8 mm. in length, although a few are longer (see below) and are in close agreement with Clerc's description of the species.[1]

Measurements of strobiles mounted in balsam are as follows:

| | *Mm.* | *Mm.* | *Mm.* |
|---|---|---|---|
| Length | 8. 00 | 15. 00 | 23. 00 |
| Diameter of scolex | . 12 | . 14 | . 14 |
| Length of scolex | . 06 | . 08 | . 07 |
| Diameter of suckers | . 05 | . 05 | . 06 |
| Diameter of rostellum | ------- | . 05 | ------- |
| Length of rostellum | ------- | . 024 | ------- |
| Length of larger hooks | ------- | . 033 | ------- |
| Length of smaller hooks | ------- | . 018 | ------- |
| Length of posterior segments | . 21 | . 30 | . 35 |
| Breadth of posterior segments | . 42 | . 46 | . 46 |

RECORD OF COLLECTIONS

From *Butorides virescens*:

1906, June 20.—Eighteen.

1912, August 14.—Nine from one of two herons, maximum length about 12 mm.

(U.S.N.M., Helm Coll. 7866.)

[1] Centralbl. Bakter, Parasit., vol. 32, pp. 714–715, figs. 3 and 4.

1913, July 9.—Five, no scoleces, maximum length about 12 mm.
1913, August 14.—A few fragments of strobiles, no scoleces.
1914, July 28.—Numerous, length of largest less than 10 mm.
1916, July 20.—Numerous, 100 or more, from three herons, most of them about 5 mm. in length scoleces present in a few.

#### CHOANOTAENIA PARINA (Dujardin)

Figures 52–53

Three scoleces, and fragments of strobiles aggregating about 200 mm. in length, agree with descriptions of this species. Since there appear to be four strobiles represented in the lot, an average length of 50 mm. is indicated, which is the length recorded by Clerc for this species. The maximum breadth is about 0.8, which is in agreement with Clerc's record. A scolex with rostellum retracted measures 0.24 in breadth; another with rostellum exserted, and somewhat distorted, measures 0.16 in breadth; the diameter of a sucker is about 0.10. There are 20 hooks in a single circle, about 0.015 in length. There is a distinct unsegmented, or neck, portion of the strobile. The proglottides, at first broader than long, lengthen gradually and ultimately are longer than broad. There is, however, considerable variety in the shape of the proglottides, and the different contraction shapes impart much variety in the apparent disposition of the genitalia. The genital pores are irregularly alternate, and open near the anterior third of the margin of the proglottis. The general plan of the genitalia is shown in figure 53. The ventral excretory vessels are conspicuous in most of the proglottides except those which are filled with ova. A typical ovum measured 0.045 by 0.033; diameter of onchosphere 0.03; length of onchosphere hooks 0.018.

From *Passer domesticus*, August 30, 1923.
(U.S.N.M., Helm. Coll. 7867.)

#### CHOANOTAENIA RANSOMI, new species

Figures 54–68

The taenioids referred to this species were collected from several species of gulls, on many widely separated dates, mainly by Vinal N. Edwards, and all from the Woods Hole region; also a few taenioids from the loon appear to belong here.

They present a great variety of contraction shapes, but there do not appear to be differences sufficient to justify their assignment to different species.

*Scolex.*—There is little difference in the size and shape of the scoleces; in general it is broader than long. Thus, an average of

eight scoleces from *Larus atricilla*, mounted in balsam, gave a length of 0.22 mm. and a breadth of 0.32. The average diameters of the suckers on these scoleces were, length 0.15, breadth 0.14. As a rule the suckers are nearly circular, the length often approximating that of the scolex, especially when the rostellum is retracted, and the breadth approximately one-half the breadth of the scolex. The rostellum is slender, cylindrical, and slightly enlarged at the apex, which is surmounted by a crown of about 20 hooks. These appear to be arranged in a single circle, but in specimens with the hooks in favorable position for showing the arrangement they may be seen to be in two circles, placed very near together, and with the hooks all practically of the same size. The hooks have long dorsal and short ventral roots and slender, slightly curved blades. Most of the hooks in my mounted material are characterized by having a central air space throughout the greater part of the length. The length of the hook is about 0.038 mm. The sheath of the rostellum is muscular, more or less fusiform, and, when the rostellum is retracted, reaches a little way back of the posterior edge of the suckers. Measurements and further details are given in descriptions of material from the several hosts.

*Strobile.*—The maximum length of formalin specimens is about 140 mm., and the maximum breadth about 2 mm.; a maximum length of 75, and breadth of 1.5 or less, is more usual.

The following description of the strobile is based on material from *L. atricilla*, and is in practical agreement with notes made on material from other gulls. Further details will be found in the records made of material from the several hosts. There is a short neck, which is usually a little narrower than the scolex; measurements of the eight strobiles in which the average breadth of the scolex was 0.32 gave the average breadth of the neck 0.29, distance from scolex to first distinct segments 0.56, length of first segments 0.014, breadth 0.23. In most cases near the scolex the segments are much broader than long. They then usually lengthen rather rapidly so that at a point 2 mm., or less, from the scolex they are as long as, or longer than broad. The proportions of the proglottides may vary considerably in different parts of the strobile. Thus, in a mounted specimen measuring 75 mm. in length, about 1 mm. from the scolex the length of the proglottides was about 0.028, the breadth 0.30; 2 mm. from the scolex, length 0.11, breadth 0.22; 5 mm. from the scolex, length 0.21, breadth, 0.13 at posterior end, 0.11 at anterior end of proglottis; at 30 mm. from the scolex, length 0.52, breadth, anterior 0.18, posterior 0.32; 40 mm. from scolex, length 0.45, breadth 0.50, 50 mm. from scolex, length 0.63, breadth 0.63 (variable, as for examples, the proglottis in front of this, length 0.67, breadth 0.56;

the proglottis following, length 0.62 on one margin, 0.35 on the other, breadth 0.74); posterior proglottis, length 0.63, breadth 0.80. In a lot of small strobiles, 5 to 7 mm. in length, one had the following dimensions: Length 7; 1 mm. back of scolex, length of proglottis 0.05, breadth 0.28; 2 mm. back of scolex, length 0.10, breadth 0.28; 5 mm. back of scolex, length 0.11, breadth 0.52; 1 mm. from posterior end, length 0.13, breadth 0.57; posterior proglottis, length 0.24, breadth 0.32. The genital apertures are irregularly alternate near the anterior end of the margin of the proglottis. The walls of the genital cloaca are thick and muscular; cirrus-pouch slender, cylindrical; cirrus not clearly shown in my preparations. What appear to be loops of the vas deferens occupy the inner two-thirds of the length of the cirrus-pouch. There is a voluminous vas deferens, its folds lying on the dorsal side of the cirrus-pouch, and between its inner end and the median line. There is no seminal vesicle. The testes lie posterior to the female genitalia. Their exact number was not determined. About 12 was the greatest number observed in transverse sections of about 0.015 mm. thickness. The number is probably about 20. The vagina opens into the genital cloaca posterior to the cirrus. It follows a sinuous course to the median line where it terminates in a subglobular seminal receptacle about on a level with the genital pore. The vitelline gland is bluntly lobed, situated at the median line a little posterior and ventral to the seminal vesicle. In a transverse section, 0.56 by 0.50 mm. in the two principal diameters, the vitelline gland measures 0.098 by 0.056. The ovary is profoundly lobed, its divisions being in general pyriform. It lies in front of the vitelline gland, and is nearly symmetrical with respect to the median line; its breadth approximately two-thirds the breadth of a mature proglottis. The uterus is at first sacculate. In ripe proglottides the entire medullary space is filled with ova. The ventral excretory vessels are much larger than the dorsal, and are connected by a transverse vessel at the posterior end of the proglottides. The cirrus-pouch and vagina pass between the poral pair of excretory vessels. There are two layers of strong longitudinal muscles, but circular muscles were not seen in any of the sections.

Following are notes on material referred to this species from other species of gulls:

From the herring gull (*Larus argentatus*):

The average breadth of 12 scoleces mounted in balsam, is 0.42, minimum 0.35, maximum 0.52; average diameter of sucker 0.18, minimum 0.17, maximum 0.22; length of hooks 0.036; number of hooks about 20. An everted rostellum measured 0.21 mm. in length, same as the length of the scolex, diameter at base 0.06, behind hooks 0.04,

at apex, including hooks, 0.09. In lateral view the scolex may appear decidedly broader than the neck, and bluntly sagittate. In dorso-ventral view the anterior end is bluntly rounded and the posterior end merges into the strobile, which is smooth for a short distance, often as broad as the scolex, in some cases a little broader, in others a little narrower, but almost invariably narrowing as proglottides make their appearance. Segments appear in specimens mounted in balsam about 0.28 mm. back of the scolex. As the proglottides develop they tend to produce serrate margins on the strobile. Usually they soon become squarish, then longer than broad, and more or less campanulate, again shortening until they are broader than long, and ultimately they may again become as long as broad. The cirrus-pouch, as it appeared in a series of transverse sections was slightly pyriform, measuring 0.08 mm. in length, and 0.04 in diameter in a section 0.38 by 0.28. In these sections the vagina was seen to be flexed in one or two sinuous folds. The cirrus-pouch and vagina lie between the dorsal and ventral excretory vessels, and dorsal to the lateral nerve. Diameters of section of ventral excretory vessel 0.024 by 0.033, of dorsal vessel 0.009 by 0.012. Diameter of ovum, outer shell 0.072 by 0.065, inner 0.043 by 0.036, onchosphere 0.032 by 0.02, length of embryonic hooks 0.015.

From the black-backed gull (*Larus marinus*):

The scoleces of the two specimens from this host agree in all essential characters with those from *L. atricilla*. The lateral margins of one of the strobiles are serrate, the usual condition, those of the other are somewhat crenulate. The latter strobile is stouter than the other, and the proglottides were not mature. A similar difference was noted in strobiles from the herring gull. A diagram of the female genitalia, as interpreted from a series of transverse sections, is shown in figure 63. Dimensions of the larger strobile in balsam: Length 40 mm.; diameter of scolex 0.33, of sucker 0.16; length of hooks 0.03; breadth of neck 0.35; distance to first segment approximately 0.28, length approximately 0.01, breadth 0.32; length of last proglottis 0.32; breadth 0.45. Length of smaller strobile 30; diameter of scolex 0.32, of sucker 0.15; breadth of neck 0.28; length of hooks 0.03; length of last proglottis 0.17, breadth 0.90.

From the Bonaparte gull (*Larus philadelphia*):

The average diameter of five scoleces, in balsam, is 0.35 mm., of suckers, 0.18; number of hooks about 20, length 0.038. As in the strobiles from the other gulls, there is much diversity of shape. In some the proglottides are closely crowded at first and much broader than long throughout. In others the proglottides begin to lengthen near the scolex, and have a tendency to become more or less campanulate. There are intermediate forms, both of larger

and smaller strobiles. In most cases the lateral margins are rather sharply serrate. In ripe proglottides the uterus occupies practically the entire interior.

From ring-billed gull (*Larus delawarensis*):

One strobile, scolex, and anterior end missing, agrees in all essentials with those from other gulls.

Among the strobiles from *Larus philadelphia* referred to this species are two, scoleces missing, which may belong to a different species. They are characterized by having the ripe proglottides longer than broad, and attached by a slender anterior pedicel, thus giving a moniliform aspect to the chain (fig. 68). The genital pores, which are irregularly alternate, instead of being near the anterior end of the strobile, are farther back, although still in front of the middle of the margin. The genitalia are but imperfectly shown. The vas deferens could be traced from a point near the median line to the cirrus-pouch. It lies in more or less tangled coils, of which the more median are the larger, tapering to a slender thread at the cirrus-pouch. The cirrus-pouch is oval-elliptical, thin walled, and contains a few loops of the vas deferens. The relative position of the ovary, vitelline gland, and testes, so far as could be made out, agrees with that of the other strobiles. Dimensions of larger strobile, in balsam: Length 25 mm.; breadth at anterior end 0.25; distance to first distinct segment about 0.42; length of first segment, approximately 0.02, breadth 0.31; ripe segments 20 mm. from anterior end, length 1, breadth 0.7; last segment, length 1.12, breadth 0.66.

RECORD OF COLLECTIONS

All from Woods Hole region; collections in all months, except July and August, made by Vinal N. Edwards.

*Larus argentatus:*

1903, November 16.—Two strobiles and six fragments.
1903, November 21.—Two with scoleces.
1904, December 3.—One, length, in formalin, 24.5.
1906, February 6.—One, scolex missing.
1906, February 12.—A few fragments, no scoleces.
1907, February 28.—Few, number not recorded; no scolex.
1912, February 19.—One.
1912, November 13.—Fragments, longest 34 mm., no scolex.
1913, January 8.—Many fragments, 14 scoleces.
1913, April 28.—Few fragments, 2 scoleces.
1913, November 17.—One, length 70 mm.
1913, December 31.—One strobile with scolex, length 130 mm.

1914, April 29.—Large number, 61 with scoleces; maximum length 34 mm., all immature.

1914, December 23.—Fragments representing about six strobiles, no scoleces.

1914, December 26.—Eleven strobiles, longest 135 mm., greatest breadth 1 mm., no scoleces.

1914, December 30.—Four fragments, no scoleces.

1915, September 1.—Three strobiles, and fragments, longest 90 mm., maximum breadth 1.12; one scolex; diameter of ovum 0.063, of onchosphere 0.039; length of embryonic hooks 0.014.

1915, October 5.—Twenty-six, longest with scolex 50 mm.

1915, November 1.—One, length 7 mm.

1916, March 9.—Three, lengths 7, 12, and 50 mm.

1916, December 19.—Three, short, rather plump, longest 15 mm.

1919, January 27.—Five, 10 to 72 mm. in length; no scoleces.

*Larus atricilla:*

1908, August 27.—Four with scoleces; ripe proglottides containing ova with six-hooked embryos.

1911, July 21.—Fragments representing four strobiles, longest about 100 mm.; one scolex.

U.S.N.M., Helm. Coll. 7869 (paratypes).

1913, April 23.—Five with scoleces, many fragments, longest about 50 mm.; breadth 1 mm.

1913, April 29.—One, scolex missing.

1913, July 3.—One, scolex missing.

1913, August 5.—Nine with, and four without scoleces; all short and somewhat clavate; maximum length 9 mm.

1914, July 30.—Four with scoleces and several fragments, maximum length 75 mm.

(U.S.N.M., Helm. Coll. 7868.) (Type.)

1915, August 13.—Two fragments 7 and 40 mm. in length; maximum breadth 2; no scolex.

1916, October 7.—Many fragments, longest 20 mm., maximum breadth 1; no scolex.

1916, October 28.—One, length 48 mm.; maximum breadth 0.6.

*Larus delawarensis:*

1914, January 24.—One, length 48 mm.; scolex missing.

*Larus marinus:*

1904, January 19.—About seven strobiles, not all with scoleces; maximum length 60 mm.

*Larus philadelphia:*

1906, November 16.—Two gulls examined, 15 worms found in older, none in younger.

1906, November 25.—One hundred and seventy strobiles from two gulls.

1912, November 15.—Seven gulls examined; 35 strobiles, and fragments from two birds; longest strobile noted 72 mm.

1912, November 20.—Four gulls examined; seven strobiles, two with scoleces, from one bird.

1912, December 21.—Eight gulls examined; four strobiles with scoleces, and a few fragments.

1913, April 3.—Eight gulls examined; nine strobiles with scoleces, and eight fragments from two birds; maximum length about 62 mm.

*Gavia immer:*

1915, August 11.—Few.

This species from the loon appears to be identical with that from the gulls, and is therefore recorded under *C. ransomi.* The diameter of scoleces in balsam is from 0.35 to 41 mm.; diameter of sucker about 0.18; length of hooks about 0.032. The arrangement of the hooks of the rostellum, as in those from gulls, is difficult to interpret. In most views there appears to be a single circle of hooks, but in favorable position they are seen to be as shown in figure 59; that is, in two very closely placed circles. The hooks are all of practically the same length.

### CHOANOTAENIA, species

Figures 69, 70

A scolex found on a slide along with several strobiles of *Hymenolepis ductilis* from *Larus argentatus* differs from other species in the collection. The size and shape of the hooks suggest *C. porosa*, although the number appears to be 12, instead of 14, the number given for that species.

(U.S.N.M., Helm. Coll. 7870.)

The scolex is broader than long, and the suckers have strong, muscular borders. The rostellum is retracted but is clearly shown. It is slender with thickish, muscular walls, and appears, as it lies in its sheath, as a rigid, pestle-shaped structure, with a bulbous enlargement at the anterior end, whose diameter is about equal to the length of the hooks. From this anterior hook-bearing end it tapers to a bluntly rounded posterior end. This slender, tapering portion, beginning at the level of the anterior borders of the suckers, extends for a distance equal to half of its length back of the posterior borders of the suckers. Breadth of scolex 0.40 mm.; diameter of sucker 0.18; length of hooks 0.105; length of rostellum 0.42; distance to first segments 0.28; length of first segments 0.01; breadth 0.28. The neck is of about the same breadth as the scolex. About 0.25 mm. behind the scolex the strobile narrows, and the last segments, which are 0.84 mm. back of the scolex, have a length of 0.07 and a breadth of 0.25.

HYMENOLEPIS ANCEPS, new species

Figures 71–78

*Scolex.*—Bluntly rounded or pyramidal, suckers directed forward; rostellum not seen exserted, but evidently short; hooks in a single circle, about 18, length about 0.012 mm., strongly recurved, dorsal root short, ventral root about as long as the recurved blade.

*Strobile.*—Segments begin a short distance back of the scolex, at first much crowded, breadth many times the length, increasing in length and breadth gradually, but remaining much broader than long. There are two types of strobiles. In one the anterior segments are exceedingly short, with rounded margins, imparting a finely crenulated margin to the strobile, breadth much greater than the length; for example, breadth 0.28 mm., length 0.014 (fig. 74). In the other type the segments soon become well defined with the breadth of the posterior end greater than the anterior, giving a sharply serrate lateral margin to the strobile; for example, breadth 0.21 mm., length 0.028 (fig. 73); maximum breadth about 3 mm. Genital pores unilateral, about middle of margin, or a little in front of middle; cirrus short, unarmed; cirrus-pouch long oval-elliptical, with rather thin wall. In an adult, unripe proglottis 0.24 mm. in length and 1.92 in breadth the cirrus-pouch measured 0.28 in length and 0.056 in diameter. The inner two-thirds, or more, of the cirrus-pouch functions as a seminal vesicle. The folds of the vas deferens at the base of the cirrus-pouch are voluminous but were not seen to expand into an inner seminal vesicle. Testes three, lobed, two of them close together on the antiporal side of the median line, one on the poral side (fig. 75). The vagina opens on the ventral side of the cirrus; at first a slender tube lying on the ventral side of the cirrus-pouch, it expands into a large seminal receptacle which persists after the uterus has developed (fig. 76). The ovary is small, lobed, situated on the median line. The vitelline gland is compact, three-lobed, when fully developed, on the median line dorsal to the ovary. The uterus is irregularly lobed and extends from margin to margin in the ripe proglottides (fig. 76). The dorsal and ventral vessels of each pair of lateral excretory vessels lie near together, the ventral being much larger than the dorsal, and the cirrus and vagina pass dorsad of the poral pair. The longitudinal muscles are strongly developed, and lie in two circles, an outer continuous and an inner discontinuous layer (fig. 77).

The following measurements were made of specimens mounted in balsam: Breadth of scolex from 0.13 to 0.16 mm.; diameter of suckers 0.075; length of hooks about 0.012. No complete strobile was mounted. In one measuring 54 mm. the length of the posterior proglottis was 0.24, the breadth 1.92.

RECORD OF COLLECTIONS

(U.S.N.M., Helm. Coll. 7871.) (Type.)

From *Mergus serrator:*

1913, April 1.—One, scolex missing, length 75 mm., maximum breadth 2.5.

1913, April 15.—Fragments of strobiles, aggregating 165 mm., longest 75, maximum breadth 3.75.

1914, February 24.—About 30, half of them with scoleces. In one strobile, measuring 130 mm. in length, the maximum breadth was 2.25, and the diameter of the scolex was 0.21; in another, measuring 295 mm. in length, the maximum breadth was 3, and the diameter of the scolex 0.22.

1914, February 28.—Twelve with scoleces, and an equal number of fragments; longest 153 mm., maximum breadth 4 mm.

### HYMENOLEPIS ARDEAE (Fuhrmann)

Figures 79–88

*Scolex.*—Short, broad, rounded in front; suckers circular, directed forward; rostellum with single circle of 10 hooks, long dorsal and short ventral roots, length about 0.033 mm. Diameter of scolex, in balsam, 0.35 mm., of sucker 0.08 to 0.09 mm.

*Strobile.*—Segments begin a short distance back of the scolex, much broader than long throughout, flaring at basal border forming a bluntly serrate outline on the lateral margins; genital pores unilateral, near anterior end of the proglottis; length 125 mm., breadth 3 mm. or more.

*Male genitalia.*—Cirrus short, cylindrical, bluntly tapering at apex, thickly beset with short, slender spines; length of cirrus about 0.090, diameter 0.045, length of spines 0.007 mm. The cirrus-pouch in unripe proglottides is subcylindrical, its inner end functioning as a seminal vesicle, length 0.28, diameter 0.07 mm.; in ripe proglottides only the outer portion, into which the cirrus can be retracted, remains, length 0.25, diameter 0.12 mm. A short vas deferens leads to an inner, oval-elliptical seminal vesicle. The testes are three in number, comparatively small, and lie side by side at the same level, a little to the poral side of the median line. The inner seminal vesicle is contiguous with the lateral margin of the lateral testis.

*Female genitalia.*—The vagina opens on the ventral side of the cirrus. It is a thin-walled, slender tube, except near the external opening, where the walls are somewhat thickened. Its course is parallel to the cirrus-pouch, near the ventral side of which it lies, on the dorsal side of the excretory vessels. On the dorsal side of the ovary and near the shell gland it ends in a small oval-elliptical semi-

nal receptacle. The ovary is small, lobed, and is symmetrically placed with respect to the median line, on the ventral side of the proglottis. The vitelline gland is small, situated at the median line, dorsal to the posterior border of the ovary, and ventral to the shell gland.

The uterus in ripe proglottides occupies practically all of the medullary space inside the layer of longitudinal muscles. In one series of transverse sections the ova were aggregated in the lateral regions (fig. 83).

The longitudinal muscles are represented by two layers, an outer of smaller, and an inner of larger bundles. These were not studied in detail, but in one section the larger bundles were found to contain from 20 to 40 fibers, and the smaller from 10 to 20. In transverse sections these bundles of fibers are usually oblong-elliptical in outline with the longer diameter radial.

The marginal excretory vessels lie close together, the ventral being much larger than the dorsal. The poral pair lie on the ventral side of the cirrus and vagina. In figure 83 it is seen that the ventral excretory vessel persists in the ripe proglottis, lying in the lumen of the uterus. Diameter of ova about 0.027 by 0.021 mm.

### RECORD OF COLLECTIONS

*From Butorides virescens:*

(U.S.N.M., Helm. Coll. 7872.)

1887, July 29.—One, length 102 mm., breadth 2.2.

1913, July 9.—Two, each about 100 mm., maximum breadth 5 mm.

1913, July 12.—One, length 125; three fragments.

1916, July 20.—One, length 85 mm., in intestine of one of three herons.

### HYMENOLEPIS CORONULA (Dujardin)

Figures 89–93

*Scolex.*—Short, bluntly rounded in front, with suckers directed forward (in scoleces with rostellum retracted); rostellum short; hooks about 20, in a single circle, strongly recurved, length about 0.01 mm. Diameter of scolex 0.15, of suckers 0.07, of circle of hooks 0.03.

*Strobile.*—Neck at first usually as broad, or broader than the scolex, narrowing slightly a short distance behind the scolex; first segments about 0.5 mm. from the scolex. The proglottides are very short and crowded even in the longer strobiles. The last proglottis in the smaller mounted strobiles is narrower and longer than the

preceding proglottides. The strobiles are throughout their length thick and robust. The genital pores are unilateral, the cirrus, so far as could be made out, is rather short and smooth; the inner two-thirds, or more, of the cirrus-pouch is cylindrical and acts as a seminal vesicle. It is connected by a slender vas deferens with an elongated and capacious inner seminal vesicle. The testes are three in number, relatively large and lie near together in the median region. In sections of younger portions of the strobile the two anti-poral testes touch each other, and the poral testis lies very close to its anti-poral neighbor. Sections made farther back, where the female genitalia are developing, show a greater space between the poral and the nearer anti-poral testis, but the testes remain comparatively close together. The ovary is relatively small and lobed; the vitelline gland still smaller, compact, and situated on the ventral side of the ovary. The vagina is seen in transverse sections to lie along the ventral side of the cirrus-pouch. For a short distance it is thick-walled then it becomes thin-walled and slender for a distance approximately equal to the length of the cirrus-pouch, when it expands into an elongated, more or less sinuous seminal receptacle. The cirrus-pouch and vagina pass dorsally to the excretory vessels. The excretory vessels lie close together, the ventral much larger than the dorsal, and both are thrown into close spirals. The uterus, as seen in transverse sections, appears to be tubular, and probably lobed. Portions of it appear in the mid dorsal region extending lateral to the excretory vessels nearly to the lateral limits of the medullary area, and in the medullary area on the anti-poral side of the ovary. The uterus in these sections does not contain ova, but is filled with germ cells intermixed with yolk granules. There are two layers of longitudinal muscle fascicles. The outer layer is continuous, the inner interrupted, and represented by about 8 dorsal and 8 ventral fascicles in the median region, and by one or two fascicles, dorsal and ventral, in the vicinity of the excretory vessels. The strobiles are too thick for satisfactory study as whole mounts. In thick frontal sections of adult proglottides the small, lobed ovaries, and compact vitelline glands along the median line, the capacious seminal vesicles and seminal receptacles on the poral side of the median line, and the close spirals of the ventral excretory vessels are the most conspicuous objects. Both the seminal vesicles and seminal receptacles were filled with spermatozoa. The testes, while plainly seen, are not so conspicuous as the ovary and seminal vessels. Maximum length of strobile 128 mm.; maximum breadth 2 mm.

The above description was based on material from *Oidemia perspicillata*. Following are notes on strobiles, scoleces missing, from *Glaucionetta clangula americana*.

This material comprises a number of fragments of strobiles, representing two individual chains, 33 and 52 mm. in length, respectively. A characteristic of these strobiles is the variety of shapes which the proglottides have assumed in different regions. Thus, in one strobile, the anterior portion for about 9 mm. consists of proglottides which are at first distinct and somewhat wedge-shape, length 0.25 mm., breadth 0.35. These are followed by proglottides 0.28 in length and 0.42 in breadth. At the posterior end of this 9 mm. portion the length of the proglottides has decreased to 0.18 and the breadth increased to 0.63. At this point the character of the proglottides changes abruptly. For a distance of 3 mm. the proglottides are closely crowded, the length being about 0.06 and the breadth 1.12. Beyond this thickened portion the proglottides again become wedge-shape, length 0.35, breadth at anterior end of proglottis 0.56, at posterior end 0.75. This condition is maintained for about 8 mm. The remainder of the strobile is made up of proglottides which become broader and shorter. At about the fourth proglottis from the posterior end the length is 0.28, the breadth 1.54. Genitalia begin near the anterior end. The cirrus-pouch and testes show distinctly in the proglottides, which immediately precede the thickened portion. The latter is rather opaque, the testes and rudiments of the female genitalia are crowded into a laterally elongated mass which occupies the middle third of the breadth of the proglottis. In the first distinct segments behind the thickened portion the testes are much larger than they are where last seen in front of the thickened portion. While in the last segment in front of the thickened portion the diameter of a testis is barely 0.07 mm., the diameter of a testis in the first distinct segment back of the thickened portion is 0.15 mm. Moreover, the ovary and vitelline gland, which were not distinguishable in front of the thickened portion, are clearly shown in the proglottides which succeed the thickened portion. The ovary increases in size and becomes more lobed in succeeding proglottides. The posterior proglottides are again much crowded, and the anatomy is difficult to interpret. Essentially the same characters are shown in the other strobile. In maturing proglottides the ovary increases in size and in number of lobes, while the testes decrease in mass, and what seems to be a relatively spacious seminal vesicle appears posterior to the median end of the cirrus-pouch. The genital pores are unilateral. The cirrus-pouch is long-pyriform, largest at its inner end. In younger segments its inner end is near the anterior border not far from the median line. Thence it passes posterio-laterad to the margin, where it opens at the genital cloaca, a little in front of the middle of the length of the segment. The testes are three in number and lie near together at the middle portion of the posterior end of the

segment. The length of the cirrus-pouch is about 0.35 mm. and its diameter, maximum, 0.07. The cirri were retracted. They appear to be smooth. The vas deferens is straight with rather rigid walls from a point a little mediad of the middle of the length of the cirrus-pouch to its lateral extremity, where it opens into the genital cloaca near the entrance of the vagina. The cirrus could not be made out, but it appears to be represented by a recess in the anterior wall of the genital cloaca (fig. 93) corresponding to Wolffhügel's figure.[2]

RECORD OF COLLECTIONS

*Oidemia perspicillata*, new host:

1913, May 8.—Six larger, length about 128 mm., breadth 2; 6 smaller, length from 15 to 25 mm.
(U.S.N.M., Helm. Coll. 7873.)

*Glaucionetta clangula americana*, new host:

1914, December 28.—Two strobiles, 33 and 52 mm. in length, no scoleces.

HYMENOLEPIS DUCTILIS, new species

Figures 94–101

Certain small, slender taenioids from the herring gull, suggesting *H. microsoma* (Creplin), but differing from that species in the smaller size and the shape of the hooks, in the smaller and less lobed ovary, and the more slender cirrus-pouch, are here referred to a new species.

*Scolex.*—Somewhat pyramidal, breadth, in balsam, about 0.2 mm.; suckers oval-elliptical, a little longer than broad, for example, length 0.12, breadth 0.10, average diameter in balsam 0.11; rostellum much longer than scolex, slender with single crown of hooks, 10 in number, length about 0.039, rather slender, ventral root short, dorsal root long and slightly curved at the tip, blade much shorter than ventral root.

*Strobile.*—Small, slender; neck short, segments at first very short, increasing in length and breadth slowly, but throughout much broader than long. Thus, the posterior, ripe proglottides in a strobile mounted in balsam, measured 0.07 in length and 0.35 in breadth; lateral margins usually sharply serrate. The genital pores are unilateral, and situated toward the anterior end of the margin. The cirrus-pouch is cylindrical, or long-fusiform, usually more or less curved or spiral, in earlier portions of the strobile extending to the median line, or beyond it; in a proglottis measuring 0.33 mm. in breadth, the cirrus-pouch measured 0.17 in length and 0.024 in

[2] Kenntniss der Vogel helminthen, fig. 103.

diameter; the inner portion of the cirrus-pouch functions as a seminal vesicle. The cirri are slender, slightly tapering, and smooth; maximum length of exserted cirri about 0.11, diameter 0.006. Figure 99 is a camera lucida sketch of a specimen mounted in balsam, in which the lateral margin of the strobile is grooved. This may be a contraction feature, although the same peculiarity was noted in more than one strobile. There is an inner seminal vesicle, which is circular in outline as seen in ventral view. It lies on the ventral side of the cirrus-pouch (fig. 97). The three testes are close together near the median line, one poral, the others antiporal. They are relatively large, as compared with the length of a proglottis in the anterior proglottides, but become less conspicuous as the female genitalia develop. The vagina is postero-ventral to the cirrus-pouch. There is a relatively spacious seminal receptacle in front of the ovary at the median line. The ovary was not satisfactorily shown in the mounted material. So far as it could be made out it is small, but little lobed, its two main divisions not quite symmetrical. The vitelline gland, so far as could be determined, is small, compact, and lies behind the ovary. In the posterior proglottides of strobiles measuring 18 mm. in length the uterus occupies the greater part of the medullary space. It appears as a rather compact mass with evenly rounded outlines. The ova, so far as could be seen, in whole mounts, measured about 0.036 in diameter of outer, and 0.018 of inner shell. The ova seen in transverse sections are without shells, and measure 0.015 in diameter. In two strobiles the uterus, in the posterior proglottides, is more strongly developed on the aporal than it is on the poral side. This asymmetrical development caused the strobile at this place to become arcuate. Although the segments in one of these strobiles with aporal development of the uterus are shorter, and more crowded together, and the strobile is more delicate and fragile than the others, there does not seem to be warrant for regarding it as specifically different from the others.

Three strobiles, mounted in balsam, and each measuring about 18 mm. in length, have the following average dimensions: Breadth of scolex 0.24, diameter of sucker 0.12, length of posterior proglottis 0.08, breadth 0.50.

The only sections made were of ripe proglottides. They show the dorsal and ventral excretory vessel of each marginal pair to be close together and not differing greatly in size. The genital canals pass on the dorsal side of the excretory vessels. The longitudinal muscles are arranged in two layers, an outer consisting of many small bundles, and an inner consisting of eight larger bundles, somewhat symmetrically placed (fig. 101). The foregoing account is based on material from the herring gull (*Larus argentatus*).

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From the black-backed gull (*Larus marinus*):

There is one slide in the collection. It contains 8 fragments of strobiles, three of them with soleces. They agree with the species from the herring gull in number, size and shape of hooks, in the dimensions and character of the scolex, and in the anatomy of the proglottides, so far as it is shown. Breadth of scolex 0.25 mm., diameter of sucker 0.14, length of hooks 0.036; length of maturest proglottides 0.07, breadth 0.50. Genital pores unilateral; cirrus-pouch cylindrical, more or less spirally curved, extending to, or beyond, the median line. All fragments small, and rather delicate.

RECORD OF COLLECTIONS

*Larus argentatus*s

(U.S.N.M., Helm Coll. 7874 (type).)

1905, May 4.—Several anterior ends of strobiles, 1 scolex.

1912, February 16.—Ten slender strobiles.

1912, February 17.—Five scoleces; small, slender strobiles.

1913, February 12.—One, length 13 mm., scolex missing.

1913, November 13.—Many fragments of strobiles, scoleces missing.

1913, November 17.—One scolex.

1913, November 18.—Three scoleces; several strobiles, scoleces missing.

1914, January 20.—Two scoleces, one with slender strobile.

1915, April 8.—One hundred strobiles, more or less, and a few scoleces; small, fragile, much broken, longest about 16 mm.

1915, October 5.—Three scoleces, diameter 0.22 mm.; length of strobile 15.

1916, February 17.—Two small fragments.

1916, April 18.—One hundred and forty-one scoleces from young herring gull; maximum length of strobile about 25 mm.; many fragments of strobiles, a few of them consisting of mature segments very loosely attached to each other.

1917, January 8.—Four very small, immature, with scoleces; maximum length 12 mm.

*Larus marinus:*

1914. April 28.—A few small strobiles, about 15 mm. in length.

HYMENOLEPIS FUSUS (Krabb)

Figures 102–104

*Scolex.*—Small, suckers nearly circular in outline, rostellum relatively stout, hooks strongly recurved, 10, about 0.02 mm. in length.

*Strobile.*—All the strobiles in the collection are immature. In all cases they are slender, the maximum breadth not exceeding 0.35 mm.,

and all having a tendency to become narrower toward the posterior end. In most cases the segments appear less than 1 mm. back of the scolex; in one strobile, which was about twice as long as the longest of the others, the neck was over 3 mm. in length. The first segments, at first much crowded, and little more than transverse rugae, remain much broader than long, until the posterior end, where, in most cases, they become, for a short distance, slightly narrower and somewhat lengthened. Thus, in the longest mounted specimen, measuring about 30 mm. in length, the breadth of segments 0.4 mm. from the posterior and is 0.33 and the length 0.05. The posterior segment is not perfect, but the penultimate segment measures 0.21 in breadth and 0.07 in length. The posterior segment in another strobile was 0.10 mm. in length and 0.15 in breadth; 05 mm. from the posterior end the segments were 0.02 in length and 0.28 in breadth (fig. 104). The cirrus and cirrus-pouch are rudimentary, but it can be seen that the reproductive pores are unilateral. Rudiments of a seminal vesicle appear in the posterior segments of some of the strobiles as a slightly sinuous mass which lies along the anterior border of the segment to a point about half way between the median line and the aporal margin. The three testes are small and placed near together in the postero-median part of the proglottides.

The agreement in number, size, and character of the hooks with *H. fusus* is close; the size of the strobile, however, is much less.

### RECORD OF COLLECTION

*Larus argentatus*, new host:

(U.S.N.M., Helm. Coll. 7875.)

1912, July 22.—Fifteen with scoleces.

1913, January 6.—One strobile, scolex missing, very slender; length 26 mm.

1913, November 21.—Two; anterior end of strobiles exceedingly attenuate.

1914, January 20.—Two, very slender.

1914, September 8.—Few scoleces, several fragments, maximum length 100 mm., greatest breadth 1.5 mm.; anterior ends extremely attenuate.

1914, September 18.—One with scolex, length 55 mm., and fragments of about five strobiles.

1914, December 23.—One strobile with scolex from small gull.

1915, January 29.—Many fragments representing about eight strobiles, maximum length 34 mm., one scolex.

1915, April 5.—One scolex, and fragments of about three strobiles, maximum length 20 mm.

1917, January 17.—Two, slender, one with scolex, maximum length 25 mm.

1917, January 27.—Many fragments, no scoleces; maximum length 25 mm.

1918, January 8.—Many fragments, two strobiles, longest about 24 mm.

### HYMENOLEPIS HAMULACANTHOS, new species

Figures 114–126

*Scolex.*—Somewhat pyramidal, when the rostellum is extruded; suckers relatively large; rostellum armed with a circle of 8 hooks, the basal ends of which are thin and claw-like; diameter of scolex, in balsam, 0.25, of sucker 0.13; length of hooks 0.108.

*Strobile.*—Anterior end slender; proglottides begin near the scolex, for the most part broader than long; at the anterior end, where the genitalia first appear, the length is 0.02, the breadth 0.14; near the posterior end, ripe proglottides, in a specimen mounted in balsam, are 0.56 long and 2.8 broad. At intervals there are regions where the breadth is only about three times the length. The proglottides, in the anterior fourth of a strobile measuring 112 mm. in length, are very short and crowded, the lateral margins of the strobile being crenulate. As the proglottides begin to lengthen their posterior diameter becomes greater than the anterior, and the lateral margins of the strobile are serrate. The genital pores are unilateral, near the anterior end of the proglottis, the cirrus and vagina opening near together in the genital cloaca. The cirrus is very long and slender, with a slight bulbous enlargement at the base which is spinose (fig. 121). The cirrus-pouch is elongate, somewhat clavate, and extends beyond the poral excretory vessels. Its inner half, or more, functions as a seminal vesicle; sagittal sections show that its walls are formed of longitudinal muscles. It communicates by a short vas deferens with an inner seminal vesicle which extends nearly to the median line, where it turns at nearly right angles and leads to near the posterior margin of the proglottis, where it receives vasa efferentia from the testes. There are three testes, one on the poral, two on the antiporal side. In maturing proglottides the testes are profoundly lobed (fig. 117). The vagina opens on the ventral side of the cirrus. For a short distance it has rather thick muscular walls, in a series of sagittal sections seen to be a sphincter muscle; it then narrows to a slender tube which lies on the ventral side of the cirrus-pouch for about half the length of the latter. It there expands into a capacious seminal receptacle, which sends a short, and rather broad duct to the vicinity of the shell-gland. The ovary is on the median line, and like the

testes, is in maturing proglottides profoundly lobed. The vitelline gland is a small, compact, bluntly-lobed gland lying on the median line dorsal to the posterior margin of the ovary, and ventral to the posterior margin of the shell-gland.

In whole mounts of strobiles with ripe proglottides the uterus is seen in earlier proglottides to be diffusely lobed. In regions of the strobile where the proglottides are closely crowded, and many times as broad as long, these lobes are more or less globular or pyriform (fig. 119). In longer proglottides, where the length may be as much as half the breath, the lobes of the uterus are elongated and lie in a direction parallel to the axis of the proglottis (fig. 118). The ova, so far as they could be made out in whole mounts, are oval-elliptical; immature ova appeared to have a maximum diameter of 0.018. A mature ovum measured 0.039 by 0.015 in the two principal diameters. The outer layer of longitudinal muscles is represented by about 100 bundles containing but few, 3 to 5, fibers. The inner layer consiste of 8 small bundles which are easily overlooked. No circular fibers were seen.

Dimensions of specimen mounted in balsam: Length 112 mm.; breadth of scolex 0.25, of sucker 0.136; length of hooks 0.108; breadth of neck 0.14; length of segments, 1 mm. from scolex, 0.02, breadth 0.15; length of posterior segments 0.51, breadth 2.38; maximum breadth 3.00, length 0.51.

RECORD OF COLLECTION

*Marila americana:*

1914, February 28.—Two strobiles and fragments. Dimensions of larger in formalin: Length 115 mm.; breadth of scolex 0.36, of neck 0.22; maximum diameter of strobile 3.25.
U. S. N. M., Helm. Coll. 7876.

### HYMENOLEPIS MACRACANTHOS (Linstow)

Figure 105–113

*Scolex.*—Broader than long, suckers relatively large, with thick muscular walls; rostellum cylindrical, its sheath extending into the neck; hooks eight in number, 0.09 mm. in length; diameter of scolex in balsam 0.26 mm., of suckers 0.075. The hooks agree in detail with figures of *H. macracanthos*, but are smaller, being about 0.09 mm. in length, instead of exceeding 0.10 mm.

*Strobile.*—Segments begin rather abruptly close to the scolex, increase in length and breadth slowly, but remain much broader than long throughout. The male genitalia are fully developed while the female genitalia are still rudimentary; genital pores unilateral, at

about the middle of the margin of a proglottis; cirrus long and filiform, rigid, from a clubshaped thin-walled base (fig. 111). Diameter of basal portion, at its outer end, 0.024 mm., of filiform portion 0.002.; cirrus-pouch cylindrical, extending beyond the median line of the proglottis, its inner portion acting as an outer seminal vesicle; an inner seminal vesicle lies along the dorsal side of the cirrus-pounch; testes three, one on the poral side of the median line, two on the antiporal side, oval, about 0.048 by 0.060 mm. in diameter. Ovary on median line, small, four-lobed when fully developed; vitelline gland small, compact, dorsal to the posterior border of the ovary, becoming two-lobed; uterus; at first lobed, later occupying nearly all the interior of the proglottis, and crowding the persistent cirrus to the anterior border of the proglottis; diameter of onchospheres, so far as they can be seen in whole mounts, about 0.018 mm.

In a strobile from which the scolex is missing, measuring 13 mm. in length, rudiments of male genitalia appear in the anterior proglottides, which are 0.04 mm. in length and 0.15 in breadth. The male genitalia are mature 4 mm. from the anterior end. Rudiments of the ovary can be seen about 3 mm. farther back. The vitelline gland persists in a few proglottides after the uterus has become prominent. In the last 3.5 mm., comprising 21 proglottides, the uterus fills practically all the interior of the proglottides except at the anterior border where the long, cylindrical cirrus-pouch lies. In the preceding eight proglottides the uterus is distinctly lobed, and occupies a large part of the interior of the proglottides. The uterus in the next 12 preceding proglottides is lobed, but less and less developed anteriorly. The ovaries become inconspicuous shortly after the uterus appears, while the vitelline glands persist for about 12 proglottides after the ovaries can no longer be recognized. In an examination of serial sections the vagina was seen to begin as a short, slender tube with a sphincter muscle at its inner end. A short distance from the sphincter the vagina expands into a seminal receptacle which lies along the ventral side of the cirrus-pouch. The inner seminal vesicle communicates with the cirrus-pouch, which in large part functions as a seminal vesicle, by a short vas deferens. A portion of this inner seminal vesicle projects beyond the inner end of the cirrus-pouch, but the greater portion of it lies on the dorsal side of the cirrus-pouch. The structure of the cirrus-pouch agrees with descriptions of *H. macracanthos*. The long and filiform cirrus was clearly demonstrated in serial sections.

RECORDS OF COLLECTIONS

From *Mergus serrator:*

(U.S.N.M., Helm. Coll. 7877.)

1887, July 1.—One, length 16.15 mm.

1913, January 1.—Twenty-five, small, maximum not much exceeding 12 mm. in length.

1913, April 11.—The vial with label of this date contains cestodes obtained from four birds, in the stomachs of which were found *Pholas*, cunners, and sticklebacks. There are very numerous small strobiles from most of which the scoleces are missing. Evidently the scoleces are rather firmly embedded in the mucous membrane, and are broken off in attempts to remove them. A piece of intestine, with worms attached, was in the vial. It was difficult to detach them without breaking them.

1913, April 17.—Numerous, small, scoleces missing.

1913, April 28.—Many, as above.

HYMENOLEPIS PACHYCEPHALA (Linstow)

Figures 127–130

*Scolex.*—Subpyramidal, suckers rather large; rostellum longer than scolex; hooks 10, slender, graceful, about 0.045 mm. in length.

Dimensions of scolex mounted in balsam: Diameter 0.24; breadth of sucker 0.09, length 0.10; length of rostellum 0.29. In one scolex, the rostellum of which is fully extended but with hooks missing, the rostellum tapers to a diameter of 0.03, then expands at the tip to a diameter of 0.06. The retracted rostellum lies in the elongate, vesicular sheath which extends as far, or a little farther, back than the posterior border of the suckers. In one scolex (fig. 128) the circle of hooks lay at the posterior end of the sheath with the hooks pointing forward; in other cases the retracted hooks pointed posteriorly.

*Strobile.*—Short; proglottides few and loosely attached. No proglottides in which the genitalia had begun to develop, were seen. The proglottides begin close to the scolex; they are rounded at the margins. About eight proglottides were as many as were seen distinctly in any strobile, and the posterior three or four of these were loosely attached. In those strobiles which contained as many as eight proglottides the last three or four were narrower than the first three or four.

Dimensions of formalin specimen: Length 8.68 mm.; breadth of scolex 0.17; length of rostellum 0.17, diameter 0.06; third segment, length 0.056, breadth 0.22; fourth segment, length 0.063, breadth 0.21; fifth segment, length 0.07, breadth 0.18; sixth segment, length 0.084,

breadth 0.15; seventh segment, length 0.12, breadth 0.14; eighth segment, length 0.15, breadth 0.12.

RECORD OF COLLECTIONS

*Colymbus holboelli*, new host:

(U.S.N.M., Helm. Coll. 7878.)

1909, January 27.—The vial contained many small scoleces, 78 counted.

1913, February 12.—Fourteen scoleces; strobiles very small and short.

### HYMENOLEPIS PODICIPINA (Szymanski)

Figures 131–138

*Scolex.*—Small, differing in outline in mounted specimens, but in most cases rather subangular, with the suckers directed forward; rostellum short and stout, length and breadth being about equal. Dimensions in glycerine, somewhat compressed: Breadth 0.21 mm.; diameter of suckers 0.08; diameter of rostellum 0.08; length of hooks about 0.03. The hooks are rather abruptly recurved and sharp-pointed, 10 in number.

*Strobile.*—All of the strobiles in the collection are immature. They are characterized by their linear, thread-like structure, and exceedingly short and closely crowded proglottides. In a strobile mounted in balsam, and approximately 36 mm. in length, the diameter of the scolex was 0.18, diameter of neck 0.12; length of segments, 2 mm. back of the scolex, approximately 0.003, breadth 0.18; at middle of strobile length of segments approximately 0.01, breadth 0.48; near posterior end length of segments approximately 0.02, breadth 0.40. At the posterior end the strobile narrows abruptly; the narrowed portion in this case is represented by a single proglottis, length 0.08, breadth 0.18. Rudiments of genitalia appear within 5 mm., or less, of the scolex. The genital pores are unilateral, near, but not quite on the margin, near the anterior end of the proglottis. Cirrus slender, filiform; cirrus-pouch thin-walled, cylindrical, straight, and at right angles to the margin. The three testes are small and near together at the median line. The outer layer of longitudinal muscles consists of a large number of very small bundles, the inner is composed of eight bundles, four of which are ventral and four dorsal, and all much larger than those in the outer layer. The ventral excretory vessels are much larger than the dorsal; the latter show rather indistinctly in the sections, and appear to be more sinuous than the ventral vessels. The above description is based on material from *Colymbus auritus.*

RECORD OF COLLECTIONS

*Colymbus auritus:*

1905, December 25.—Numerous scoleces with short strobiles, 1.5 mm., more or less, in length.

1906, December 8.—Three.

1914, April 16.—Numerous; most of them exceedingly filiform anteriorly, length about 40 mm.; others stouter, maximum 60 mm.

*Colymbus holboelli*, new host:

1904, February 25.—One, slender and thread-like. Length, in formalin, 22 mm.; diameter of scolex 0.22.

(U.S.N.M., Helm. Coll. 7879.)

### HYMENOLEPIS ROSTELLATA (Abildgaard)

Figures 139–142

*Scolex.*—Varying in shape, but in most cases bluntly rounded with subcircular suckers; rostellum as long, or longer than the scolex, when fully extended, more or less abruptly enlarged at the apex, which bears a single circle of 10 hooks, from 0.048 to 0.06 mm. in length. The sheath of the rostellum is conspicuous, muscular and extends into the neck. Diameter of a scolex in balsam about 0.30, of sucker about 0.14; length of everted rostellum 0.22, diameter, middle, 0.04, at apex 0.09.

*Strobile.*—There is a short neck, or unsegmented portion, which is usually narrower than the scolex. The proglottides, which begin near the scolex as fine transverse lines, remain short and closely crowded together for a greater or lesser distance. There is a great variety of forms exhibited in the strobiles. Some are rather thickish, with very closely crowded proglottides, the breadth many times the length; others are slender, filiform with proglottides becoming as long as, or longer than broad. It would appear to be impossible to regard these varying forms as belonging to the same species if it were not for the fact that similar and as great variations may occur in the same strobile. Genital pores unilateral. The walls of the genital cloaca are thick. The cirrus-pouch is large, subcylindrical, and when not curved extends nearly, if not quite, to the anti-poral excretory vessels. The three testes are relatively large, one on the poral and two on the anti-poral side of the ovary. The ovary is lobed, and may attain a breadth more than one-third that of the proglottis. The much smaller vitelline gland lies on the median line behind the ovary, is more compact than the ovary, but was seen to be distinctly lobed in some of the proglottides.

The following account of the anatomy of a proglottis is based on an examination of a series of transverse sections. The cirrus emerges

from a low papillary eminence on the inner wall of the genital cloaca. This eminence is densely covered with short spines (fig. 142). The cirrus is slender, filiform and smooth, about 0.25 mm. in length. Its diameter at base is about 0.012, whence it tapers slowly and uniformly to the tip. At a point 0.06 from the tip the diameter is about 0.007. The cirrus-pouch is subcylindrical, and extends nearly to the aporal excretory vessels. Its walls are thick and muscular, and for a considerable portion of its length it acts as a seminal vesicle. There is a capacious inner seminal vesicle, which, at least in short adolescent proglottides, lies very close to the cirrus-pouch, along the ventral side, and from a point near the anti-poral end as far as the middle of the length of the pouch. The testes are relatively large, 0.28 mm. in transverse section, one poral, and two anti-poral (fig. 141). The vagina is tubular and leads by a more or less meandering course, to a relatively capacious seminal receptacle. The ovary, situated at the median line, is small, lobulate, almost morula-like in its early stages of development. Coincident with the degeneration of the testes the ovary increases in size, and becomes broader than long. It is rather compact but lobulate, and is made up of large cells. The vitelline gland is a small but conspicuous organ, distinctly lobed in some proglottides, more compact in others.

The two longitudinal muscle layers, while well developed, are not very sharply marked off from each other. The outer layer is composed of a large number of small fascicles of irregular size and shape, which are confusedly placed as seen in transverse sections. In transverse sections through the anterior end of a proglottis this layer is close to the cuticle, but becomes separated from the cuticular region in succeeding sections. Along the inner border of the muscular layer at intervals there are larger fascicles, sub-circular in section. These fascicles represent the inner layer of longitudinal muscles. The ventral excretory vessels are relatively large, and appear somewhat triangular in cross section. The dorsal vessels are small and inconspicuous in the series of sections which was examined. They are rather variable in position, being more or less displaced by the large cirrus-pouch. The latter passes on the dorsal side of the excretory vessels.

Dimensions of different types of strobiles.

| | Millimeters | | | |
|---|---|---|---|---|
| Length | 33.00 | 44.00 | 64.00 | 40.00 |
| Diameter of scolex | .35 | | .28 | .21 |
| Diameter of sucker | .14 | | .14 | .11 |
| Length of rostellum | .28 | | .25 | |
| Length of hooks | .06 | | .05 | |
| Length of proglottis near posterior end | .08 | .32 | .10 | .22 |
| Breadth of proglottis near posterior end | 1.40 | .63 | .39 | .50 |

The breadth of the anterior end of the longer proglottides is less than that of the posterior end. Thus in a proglottis 0.14 mm. in length the breadth of the anterior end was 0.16, of the posterior end 0.22; in another, 0.32 in length, the breadth of the anterior end was 0.42, of the posterior end 0.63.

RECORD OF COLLECTIONS

*Gavia immer:*

1911, July 22.—Fifty-nine strobiles and numerous fragments; length 40 mm., more or less. 1911, July 24. 1. U.S.N.M., Helm. Coll. 7880.

1911, September 1.—One hundred and thirty.

1915, August 11.—Many.

1916, July 4.—Four with scoleces, 2 without.

*Colymbus holboelli*, new host:

1913, April 28.—One fragment of strobile, length 15 mm.

### HYMENOLEPIS TRITESTICULATA (Fuhrmann)

Figures 143–147

Small cestodes refered to this species were found in the following hosts: red-breasted merganser (*Mergus serrator*), surf duck (*Oidemia perspicillata*), white-winged scoter (*O. deglandi*), greater scaup duck (*Marila marila*), and the American coot (*Fulica americana*).

*Scolex.*—Varying in outline, but more or less triangular, suckers relatively large, with thick borders; rostellum when fully extended slender, cylindrical, much longer than scolex, sheath of rostellum with strong muscular walls, and extending into the neck behind the scolex; hooks 10, length 0.036 to 0.039 mm., with long dorsal and short ventral root and slightly curved blade.

*Strobile.*—Neck short, the segments in most cases beginning close to the scolex; in some cases, in which the anterior end of the strobile was more or less relaxed, as if slightly macerated, the segmentation is not distinct until 0.5 to 0.7 mm. back of the scolex. There is a tendency in some strobiles to contract and thus increase the breadth near the scolex, and rarely at other points. Thus, in one, the diameter of the scolex in balsam is 0.19 mm., while the strobile immediately behind the scolex for a distance of 0.9 mm. has a breadth of 0.26. The strobiles in general are linear, increasing slowly in breadth, the proglottides as a rule remaining much broader than long. The male genitalia make their appearance early, exserted cirri having been observed 1.5 mm. back of the scolex. The genital pores are unilateral and are situated a little in front of the middle of the lateral margin. The cirrus is armed with slender spicules. It is more or less club-shape, and, when fully everted, a slight bulbous enlargement may appear (fig. 147). The cirrus shown in this figure

measured 0.135 mm. in length, 0.015 in diameter at base, 0.018 at the bulbous enlargement and at the tip, and was 2.5 mm. back of the scolex. The cirrus-pouch is long, slender, cylindrical, at first reaching to or beyond the median line; later it may become somewhat curved, or spiral; its walls are thick, and appear to be made up of longitudinal muscles. Its inner portion functions as an outer seminal vesicle. An inner seminal vesicle was seen near the median end of the cirrus-pouch, and connected with it by a short vas deferens. In some of the younger proglottides this inner seminal vesicle was relatively large. Thus the diameter of an inner seminal vesicle was 0.054 mm., the diameter of the adjacent cirrus-pouch being 0.042. Only male genitalia appear in the anterior part of the strobile. The three testes are small with circular outlines and placed near together nearly in a straight line, the one nearest the antiporal margin of the proglottis being a little in advance of its neighbor. This observation was made on a proglottis 0.03 mm. in length and 0.24 in breadth; the diameter of a testis was 0.024. The vagina lies along the ventro-posterior border of the cirrus-pouch; a seminal receptacle was faintly shown near the median line. The ovary was not clearly shown in the mounted specimens. It appears to be small and rather compact, but where best seen somewhat unsymmetrical with reference to the median line, and more or less lobed (fig. 146). The vitelline gland was compact and not lobed. The uterus, beginning as a small tube on the ventral side of the ovary, develops rapidly in succeeding segments, and ultimately occupies practically all of the medullary space. In ripe portions of some strobiles the septa between the proglottides are indistinct, so that the relatively large ova appear to be continuous from one proglottis to another. Diameter of onchosphere 0.030 to 0.036 mm., length of embryonic hooks 0.012. Dimensions, life: Length 10; diameter of scolex 0.32, length 0.32; diameter of sucker 0.14; length of exserted rostellum 0.20, diameter at base 0.08, middle 0.03, tip 0.08; breadth of neck 0.20; distance to first segment 0.080, length of first segment 0.02, breadth 0.22; length of last segment 0.24, breadth 0.30. Length of longest strobile mounted in balsam 24 mm. Dimensions of mounted specimens: (1) Length 9; breadth of scolex 0.24, length 0.16; breadth of sucker 0.10, length 0.12; length of rostellum 0.18; length of sheath 0.18; length of posterior segment 0.14, breadth 0.24. (2) Length 24; breadth of scolex 0.19; breadth of sucker 0.11; length of posterior segment 0.14, breadth 0.49. Further details are given under records of collections.

The foregoing account is based on material from *Marila marila*, new host. Following are notes on material from the other hosts in which this species was found:

From *Fulica americana*, new host. The ripe proglottides, in all cases, were much broader than long. Thus, in a fragment of strobile, in which all the proglottides are filled with the relatively large ova, and the septa between the proglottides are not distinguishable, the length of a single proglottis was 0.07 mm. and the breadth 0.70. The cirri were nearly cylindrical, 0.09 to 0.10 in length, 0.012 in diameter at base, and 0.015 near the tip, whence they tapered to a short, acute to acuminate, point. They were spinous except at the tip. The largest fragment is about 12 mm. in length. There are a few immature strobiles which appear to belong to this species. One of these, about 3.5 mm. in length, is lanceolate; diameter of scolex 0.18; strobile increasing in breadth gradually from about 0.10 to a maximum of 0.28, which is at a point 0.4 from the posterior end. The segments are short, nowhere more than 0.015 in length, until near the posterior end; penultimate segment, length 0.045, breadth 0.126; posterior segment, length 0.06, breadth 0.105. The length of the hooks on all the scoleces but one was about 0.033; on one they were about 0.029 in length.

From *Mergus serrator*, new host. A few short fragments, the anterior ends of strobiles, maximum length 4 mm. Length of hooks 0.036 mm.; cirri spinose, somewhat clavate, bluntly rounded and smooth at the apex; breadth of scolex 0.15 to 0.20.

From *Oidemia deglandi*, new host. Length of hooks 0.033 mm. Cirri, when fully exserted and not collapsed, usually about 0.12 in length, with a diameter of from 0.012 to 0.018; but in one strobile the maximum length of a cirrus was 0.16 and the maximum diameter 0.033. Where best seen the cirrus is characterized by having a cylindrical base covered with minute spines which are less crowded distally where the cirrus becomes slightly swollen; beyond this point it is usually clavate, with slender spines which become shorter toward the tip, where they are very minute. The anatomy of a proglottis, as shown in sections, agrees with the foregoing. The ovary in some transverse sections was dumb-bell shape, and was composed of distinct, subangular cells. The dorsal and ventral excretory vessels lie close together, and the cirrus-pouch and vagina pass on the dorsal side of the poral pair. The musculature was not well shown in the sections. There appeared to be but a small number of longitudinal muscle bundles.

From *Oidemia perspicillata*, new host. Strobiles all small and immature, agreeing with immature strobiles from *O. deglandi*. There is a tendency to assume a slightly fusiform shape. At the posterior end there is usually a longer or shorter portion where the proglottides are moniliform. Length of hooks 0.036 mm.

RECORD OF COLLECTIONS

*Marila marila:*

(U.S.N.M., Helm. Coll. 7881.)

1887, August 23.—Two, length 10 to 10.5 mm.

1914, February 19.—Eight, longest 15 mm.

1914, February 26.—About 43 strobiles, few with scoleces, maximum length 45 mm.

1914, February 28.—About 20 strobiles, small.

*Fulica americana:*

1920, November 20.—Six scoleces and a few fragments of strobiles. Collected by Robert A. Goffin.

*Mergus serrator:*

1913, January 1 and April 11.—Few, associated with numerous examples of *H. macracanthos.*

*Oidemia deglandi:*

1887, August 29.—Both large and small taenioids collected on this date agree in the character of the scoleces, including the hooks, and in the anatomy of the proglottides. The maximum length was 150 mm. A small strobile measured 6 mm. in length; diameter of scolex 0.17.

1911, July 3.—Numerous, length of strobiles not exceeding 10 mm.; posterior ends of longest moniliform, with a few segments loosely attached.

1913, August 14.—Numerous, 2,000 (estimated); length 16 mm., more or less.

1913, September 4.—Very numerous, as above.

1913, November 4.—Many; length about 7 mm.; strobiles more or less arcuate; three birds examined, worms in two.

1916, October 18.—Approximately 500; length 7 mm.

*Oidemia perspicillata:*

1913, May 8.—Few, 5 to 12 mm. in length.

1913, July 12.—Large numbers with scoleces embedded in mucous membrane of intestine; 1,267 counted; all small, 4 mm., more or less.

HYMENOLEPIS (WEINLANDIA), species

Figures 148–152

A few taenioids from *Marila marila*, and *Oidemia deglandi*, while possibly not belonging to the same species, have many points of resemblance, especially in the shape and arrangement of the hooks which closely resemble those of *Hymenolepis anceps*, new species from *Mergus serrator.*

(1) Among the taenioid cestodes found in *Oidemia deglandi* (U.S.N.M., Helm. Coll. 7882), most of which have been referred to *H. tritesticulata*, there are a few fragments of strobiles, one strobile with the scolex missing, and one scolex with about 12 mm. of

strobile, immature, which belong to a different species. While it is not quite certain that these fragments belong to the same species as that represented by the one scolex, there appears as yet to be no reason for regarding them as specifically different.

*Scolex.*—The rostellum (fig. 150) is short, its diameter nearly equaling the length. It is surmounted by a single circle of about 18 hooks, which are short and strongly curved, about 0.010 mm. in length (fig. 151).

*Strobile.*—The neck, at first about the same breadth as the scolex, grows slightly narrower a short distance behind the scolex. Distinct segments do not appear until about 1.6 mm. back of the scolex. The proglottides are sharply outlined, and the lateral margins of the strobile are distinctly serrate. Rudiments of genitalia have made their appearance in the posterior proglottides. While rudiments of the cirrus have not yet appeared, the indications are that the genital pores are unilateral.

A strobile, scolex missing, agrees with the fragment above described. The segments at the anterior end are at the same stage of development as those at the posterior end of the fragment with scolex. The posterior segments are adult (fig. 152), but no ova have yet appeared. There are three relatively large testes, two antiporal and one poral. The antiporal testes are contiguous, one being situated at the antero-median border of the other. The ovary is lobed, the vitelline gland, small, subtriangular in outline, and compact. Genital pores unilateral; cirrus not seen extruded. It appears to be short, the principal part of the cirrus-pouch acting as a seminal vesicle. In dorso-ventral view the cirrus-pouch appears to be oblong-elliptical in outline. In other fragments of strobiles, apparently belonging to the same species, seen in marginal view, the cirrus-pouch as a whole is much curved, in some cases S-shaped.

Dimensions of fragment of strobile with scolex: Length 12 mm.; diameter of scolex 0.18, of sucker, 0.08; length of rostellum 0.06, length 0.054; length of hooks 0.010; length of last segment 0.08, breadth 0.36.

Dimensions of strobile, scolex missing: Length 54 mm.; length of anterior segments 0.08, breadth 0.28; length of median segments 0.11, breadth 1.15; length of posterior segments 0.16; breadth 1.22.

This material belongs to the lot collected by Vinal N. Edwards on November 4, 1913.

(2) A single specimen collected from *Marila marila*, August 23, 1887 (U.S.N.M., Helm. Coll. 7883) is here recorded. But little more than an outline of the somewhat compressed scolex can be made out in the mounted specimen; even the suckers are too faintly shown to permit measurement. They have been added to the camera lucida sketch (fig. 148) from a memorandum sketch made at the time of

collecting. The rostellum is short and broad; the hooks, 10 or 12 in number, are 0.015 mm. in length (fig. 149).

Measurements made at the time of collecting, specimen slightly compressed: Length 12 mm.; diameter of scolex 0.22, length 0.22; diameter of rostellum 0.08; diameter of neck 0.10; distance to first distinct segment 0.12; length of first distinct segment 0.02, breadth 0.16; length of last segment 0.12, breadth 0.60; length of fourth from last segment 0.09, breadth 0.90; number of segments 250.

### HYMENOLEPIS, species

Figures 153–156

Among the cestodes collected by Vinal Edwards is a small lot from *Larus delawarensis*, collected January 24, 1914, U.S.N.M., Helm. Coll. 7884. My note made at the time of a preliminary examination of the formalin material is: Slender cestodes with distinct segments; diameter of scolex 0.45 mm.; numerous short fragments from 10 to 15 mm. in length; longest strobile, scolex missing, 50 mm.

The mounted material comprises two scoleces and six fragments of strobiles which represent two strobiles 30 and 44 mm. in length respectively. The proglottides are all immature.

*Scolex.*—Somewhat pyramidal, rostellum longer than scolex, tapering to the middle of its length, enlarged at the apex, which bears a single crown of 10 hooks, 0.054 to 0.060 mm. in length. The hooks have long dorsal and short ventral roots, blade but slightly recurved, and are longer and less slender than those of *H. ductilis* from the herring gull.

*Strobile.*—There is a short neck, about as long as the scolex. For a short distance the segments are closely crowded, but soon become distinct, and, in places, as long, or even a little longer than broad. Throughout the greater part of the strobile the proglottides have abruptly flaring posterior borders. Near the posterior end of each strobile the proglottides are, for a short distance, crowded and much broader than long. Only rudiments of the genitalia have developed, but are sufficient to show that the genital pores are unilateral and near the anterior end of the proglottis.

Dimensions of larger specimen in balsam: Lenth 44.00 mm.; diameter of scolex 0.32, of sucker 0.14; length of rostellum 0.25, of hooks 0.054; breadth of neck 0.19; length of proglottides 0.5 mm. from scolex 0.015, breadth 0.18; length near middle of strobile 0.15, breadth 0.21; length 1 mm. from posterior end of strobile 0.08, breadth 0.42; length of last proglottis 0.15, breadth 0.26.

### HYMENOLEPIS, species

Figures 157–159

In a small lot of cestodes, collected by Robert A. Goffin, Nov. 20, 1920, from *Fulica americana* (U. S. N. M., Helm. Coll. 7885,) one small strobile differs from the others, which have been referred to *H. tritesticulata.*

*Scolex.*—Subtriangular in outline; suckers oval, a little longer than broad; sheath of rostellum pyriform, extending a little way back of posterior margin of the suckers; hooks (fig. 158) 10 in number and about 0.036 mm. in length, with conspicuous air spaces.

*Strobile.*—Neck very short, narrower than scolex; first segments very short; rudiments of genitalia appear as early as the segments; Mature cirrus-pouches appear about 1.25 mm. back of the scolex; cirrus-pouch short-fusiform, with thick muscular walls, more or less curved; in some the convex side is anterior, in some posterior, others are more or less curved dorso-ventrally. The genital pores are unilateral, and near the anterior border of the proglottis. The cirrus is smooth, slender, filiform, almost spiculate; when fully everted it is seen to issue from a short, subconical base (fig. 159). Length of cirrus-pouch 0.012, diameter 0.04. The genitalia are not very clearly shown in the mounted specimen. The three globular testes, about 0.021 mm. in diameter, are placed in a horizontal line near the posterior margin of the proglottis, two of them in contact with each other at the median line, the other slightly removed toward the antiporal margin. There is a seminal vesicle near the inner end of the cirrus-pouch. Vagina not satisfactorily shown; ovary not distinct, but appears to be relatively small, slightly lobed, the larger part of it on the antiporal side of the median line; uterus somewhat tubular in ventro-posterior part of proglottis, later it occupies the greater part of the medullary space.

Dimensions, in balsam: length 5.6 mm.; breadth of scolex 0.19; length of sucker 0.114, breadth 0.084; maximum diameter of sheath of rostellum 0.075; distance to first segment 0.09, length 0.006, breadth 0.11; length of cirrus-pouch 0.09 to 0.12, maximum diameter 0.03 to 0.04; cirrus, basal portion, length 0.012, breadth 0.012, slender portion, length 0.045, diameter 0.004; posterior segments, length 0.10, breadth 0.28.

### RHABDOMETRA SIMILIS (Ransom)

Figures 160–163

*Scolex.*—The shape of the scolex varies somewhat, due to different states of contraction when fixation took place. In most cases it is

rounded in outline, the suckers nearly circular and but little prominent. There is a short rostellum surmounted by a double circle of very short hooks. Their exact number was not satisfactorily made out, but there appear to be in the neighborhood of 40 (this from notes made on fresh material); in the mounted material the number of hooks appears to be less than this estimate, and they are so closely crowded that there appears to be but a single circle; the length is about 0.01 mm.

*Strobile.*—There is a neck which, as a rule, is considerably longer than the scolex. One case was observed in which the distance to the first segments was about equal to the length of the scolex, the short neck being of about the same diameter as the scolex. In the other strobiles the diameter of the neck was less than that of the scolex. The segmentation begins gradually, the first segments being much broader than long. The segments lengthen until, toward the posterior end of the strobile, they are longer than broad. The segments overlap but slightly, and the breadth of the anterior end is less than that of the posterior, except at the posterior end of the strobile, where they may be nearly linear, the extreme posterior segment being rounded and slightly narrowed at the posterior end. The genital pores are irregularly, alternate, and situated near the anterior fourth of the lateral margin. The cirrus is short and apparently smooth. The cirrus-pouch is small; in a transverse section of a ripe proglottis its diameter was 0.045 mm., in another 0.051. There are 12 or more testes. The exact number could not be made out in the mounted specimens, and my sections proved to be made through ripe proglottides, in which, although a few testes remained, no estimate could be made from them of the number in a mature, unripe proglottis. The diameter of a single testis in these sections was about 0.05 mm. The vas deferens, as seen in a ripe proglottis, extends from the cirrus-pouch antero-mediad to the median line, where there was a remnant of what appeared to be a coiled mass of the vas deferens, near the anterior end of the proglottis, immediately in front of the para-uterine organ.

The female genitalia were made out only in part. As seen in the whole mount of a ripe proglottis (fig. 162), the vagina, opening at the posterior side of the cirrus, in the genital cloaca, can be traced in a diagonal line postero-mediad, to a point near the wall of the uterus. Little is shown of its structure, but there is an indication of a slight enlargement into a seminal receptacle. The uterus in most of the ripe proglottides is an elongated sac lying on the median line, and preceded by the para-uterine organ. The latter is filled with dense fibrous tissue. The eggs are oval, with thin membranous shells. The longer diameter of the onchosphere is about 0.03 mm.

Transverse sections of ripe proglottides agree in detail with figure 24 of Ransom's description of *R. similis*.[3] Longitudinal muscles are but feebly developed, and no circular muscles were seen.

Although these worms are smaller than the type, and there is, moreover, a crown of hooks on the scolex, which has not been noted in this genus, I prefer, on account of the very close resemblance presented by the anatomy of adult and ripe proglottides, to refer them to *R. similis*.

RECORD OF COLLECTION

*Coccyzus americanus:*

1906, June 14.—The taenioids here described were collected from a male yellow-billed cuckoo, found dead on the college campus, Washington, Pa. The stomach contained 20 caterpillars, and jaws and legs of beetles. There were 30 strobiles with scoleces, and many fragments of strobiles, consisting of ripe segments. These fragments were of a brick-red color. The worms remained active for some time in normal salt solution. Maximum length, 20 mm. Other dimensions: Breadth of scolex 0.32, of sucker 0.10, of neck 0.20; distance to first segments about 0.30; length of posterior segments 1.12, breadth 0.80. Three ripe proglottides, still attached to each other, had the following dimensions: (1) length 2.72, breadth 0.56; (2) length 3.20, breadth 0.64; (3) length 1.60, breadth 1. These proportions were changing, due to the contraction and relaxation of the proglottides.

(U.S.N.M., Helm. Coll. 7886.)

### DIORCHIS ACUMINATA Clerc

Figures 164–173

*Scolex.*—Subject to some contraction variations, but in most cases abruptly truncate, with suckers directed forward; rostellum elongate, subcylindrical, enlarging at apex, which is surmounted by a crown of 10 hooks. The hooks are characterized by having the long dorsal root slightly curved; length about 0.05 mm. Hooks occur on the suckers, but on account of their small size are not easily seen.

*Strobile.*—Slender throughout; proglottides very closely crowded together, beginning as transverse striae a short distance back of the scolex. Rudiments of genitalia appear near the scolex, and develop slowly, although mature male genitalia may appear early; see figure 166, which was sketched from a point less than 1.5 mm. from the scolex. The cirri are slender, armed with straight, bristle-like

[3] Bulletin 69, U. S. National Museum, p. 32.

spines, rather sparsely set, and have a bulbous enlargement near the base (fig. 167). The cirrus-pouch is elongate, cylindrical, its walls largely composed of longitudinal muscles; the inner half, or more, of its length acting as a seminal vesicle. An inner seminal vesicle lies on the dorsal side of the inner end of the cirrus-pouch, which communicates with the two testes by what appear in my sections to be relatively large vasa efferentia. The vagina, ventral, parallel, and very similar in appearance to the cirrus-pouch, leads to a capacious seminal receptacle. The ovary, vitelline gland, testes, and inner seminal vesicle are massed together along the median line, and are difficult to interpret in whole mounts. The proglottides are very short, their length in some portions of the strobile being less than the axial diameter of ovaries and testes. Thus, in a portion of a strobile where the length of the proglottides was 0.15 mm., the antero-posterior diameter of testes and ovaries was from 0.16 to 0.21. The ovary is lobed, and is ventral to the small, compact vitelline gland. The uterus varies greatly in different parts of the strobile. In earlier proglottides it is more or less lobed; in ripe proglottides it occupies the greater part of the interior. The ova are fusiform (fig. 171). The central excretory vessel is much larger than the dorsal, and has thinner walls. The dorsal and ventral vessel of each pair lie close together, and the genital ducts pass on the dorsal side of the poral pair.

There are two layers of longitudinal muscles, an outer, consisting of a large number of small bundles, oval-elliptical in transverse section, and containing a maximum of about six fibers, and an inner, consisting of eight bundles, which are much larger than those in the outer layer. The number of fibers in the inner bundles is variable; as many as 30 were counted in one of them.

### RECORD OF COLLECTIONS

*Marila americana*, new host:

1914, February 19.—Four strobiles, two with scoleces; slender, segments indistinct in all but one, filiform, thickish; longest measured 176 mm.; maximum diameter 1.5; breadth of scolex 0.42, of neck 0.37; diameter of rostellum at apex, 0.09. Diameter of another scolex 0.27, of rostellum 0.07; number of hooks in each 10, length 0.05.
(U.S.N.M., Helm. Coll. 7887.)

1914, February 26.—Three strobiles, scoleces missing, slender, filiform, segments indistinct; lengths, 140, 143, 184.

1914, February 28.—Number not recorded; length of one 30 mm., breadth of scolex 0.33 mm.

### VALIPORA, new genus

*Dipylidiinae:*

Rostellum armed with a single crown of hooks, 0.01 to 0.03 mm. in length, with long dorsal and short ventral roots. Genital pores unilateral; genital cloaca with strong muscular walls. Genital ducts pass between the longitudinal excretory vessels. Testes 12 to 25, or more, posterior or lateral to ovary. Uterus saclike, lobed, but filling the medullary space in ripe segments.

The cestodes here placed have many characters which ally them to the genera *Lateriporus* Fuhrmann, and *Monopylidium* Fuhrmann.

*Type of genus.—Valipora mutabilis.*

### VALIPORA MUTABILIS, new species

Figures 174–181

The cestodes from the night heron, here considered, appear to belong to the same species. There is considerable variation, particularly in the form of the ovary and uterus in proglottides of different stages of development and in the shape of the proglottides themselves, but in some of the longer strobiles there is as great variation in these respects in a single strobile as was observed in different strobiles.

*Scolex.*—The mounted specimens exhibit a variety of contraction shapes, and there is considerable difference in dimensions. The following dimensions are averages of five scoleces: Length 0.11 mm., breadth 0.18; sucker, length 0.10, breadth 0.075. The rostellum was retracted in all cases, and the number of hooks was difficult to determine. There appear to be 10; length 0.03 mm. The hooks are slender, straight, and rather abruptly recurved at the tip.

*Strobile.*—Measurements of the living worm gave a maximum length of about 20 mm. A few strobiles which had been placed for a short time in fresh water extended to more than twice that length. The longest mounted specimen measures approximately 35 mm. in length. In normal strobiles the breadth of the neck is about 0.06. Segments begin near the scolex. At first much broader than long, the proglottides increase slowly in length and breadth, but remain much broader than long. The posterior edge overlaps the succeeding segment, so that the cirrus-pouch of the succeeding segment is nearly or quite covered by the overlapping border of the preceding segment. In a strobile measuring about 15 mm. in length, at a point 2 mm. back of the scolex, the segments are 0.06 in length and 0.14 in breadth; at the middle of the strobile they are 0.10 in length and 0.18 in breadth; near the posterior end the length is 0.11, and the breadth 0.56; the posterior two or three segments were 0.21 in length and 0.54 in breadth. These proglottides were adult but not ripe. Length

of ripe proglottides, in which the uterus occupies the greater part of the interior, 0.23, breadth, anterior 0.35, posterior 0.60. In strobiles which had been placed in fresh water before fixation, the proglottides presented a great variety of shapes, exhibiting a tendency to lengthen and become more or less campanulate. Thus, at one point a proglottis has the following dimensions: Length 0.29 mm., breadth, anterior 0.14, posterior 0.32; the third segment back of this, length 0.15, breadth, anterior 0.35, posterior 0.42; the sixth segment back of the latter, length 0.32, breadth, anterior 0.17, posterior 0.34; ripe segments, length 0.39, breadth, anterior 0.28, posterior 0.53.

The genital pores are unilateral and situated in front of the middle of the margin. The cirrus is long, slender, and smooth. The cirrus-pouch has thick muscular walls, and has a tendency to press against the marginal wall so as to make a protruding bulge in the outline of the lateral margin. The cirrus-pouch extends anteromediad, and coils of the vas deferens lie at the median line near the anterior border. The exact number of testes was not made out, but they appear to be at least 12 in number. They lie dorsal to the ovary and extend somewhat beyond its posterior and lateral borders. The ovary, while presenting a variety of appearances in proglottides of different stages of development, becomes more or less lobed (fig. 177). It lies ventral to the testes, and the relatively small and compact vitelline gland lies immediately posterior to it. The uterus differs markedly in appearance even in adjacent proglottides. As it matures it becomes profoundly lobed (fig. 180). Ultimately the lobes become indistinct and the uterus comes to occupy practically all the interior of the proglottis. So far as can be made out the eggs are oval, with thin, membranous shells, the diameter of which is at least as much as 0.036 mm.; diameter of onchosphere 0.018.

The longtitudinal muscles are not sharply set off into two layers, but the fascicles on the medullary side are fewer and larger than those on the cuticular side, as in *V. parvispine* (fig. 187).

The genital ducts pass between the longitudinal excretory vessels. The latter are indistinct in most of the sections. The dorsal vessel is minute, the ventral vessel much larger. In one series of sections the lumen of a ventral vessel, crowded by the gravid uterus and with collapsed walls, measured 0.018 by 0.003 mm. in the two principal diameters; the lumen of the dorsal vessel was about 0.002 mm. in diameter.

RECORD OF COLLECTIONS

*Nycticorax nycticorax naevius:*

1905, October 19.—Few, small, no scoleces.

1906, September 26.—Fragments of strobiles; no scoleces.

1906, September 28.—Several fragments, with at least one scolex.

1908, September 1.—Several fragments of strobiles, three scoleces.
1913, May 7.—A few fragments of strobiles.
1913, May 14.—Fifty-two; maximum length about 16 mm.
1913, May 15.—Sixteen strobiles, small; two with scoleces.
1913, May 16.—Five, maximum length 36 mm.
1913, May 20.—Three small strobiles, no scoleces.
1914, September 9.—Six, length about 12 mm., scoleces missing.
1914, September 23.—Small pieces of strobiles, no scoleces.
1922, July 17.—Three hundred, more or less; longest, in sea water, about 20 mm.

U.S.N.M., Helm. Coll. 7888 (type).

### VALIPORA PARVISPINE, new species

Figures 182–187

*Scolex.*—Subject to some variation due to different degrees of contraction, but usually broader than long with relatively large suckers; rostellum not seen fully everted, but evidently tapering and enlarging but little at the tip; hooks, about 20, appear to be in a single circle, and of the same size and shape, length 0.010 to 0.012 mm. Average breadth of 7 scoleces mounted in balsam was 0.50, length 0.29, diameter of sucker 0.28.

*Strobile.*—The neck is short and of varying breadths, depending on the conditions of contraction. In some cases it is as broad immediately behind the scolex as the scolex itself; in others there is a constriction behind the scolex followed by an abrupt enlargement, which may be as broad as the scolex and of about the same length; in some cases the region of first proglottides is as broad as the unsegmented portion, or neck; in others it is much narrower. In most cases the anterior end of the strobile is characterized by having the proglottides closely crowded. There is often considerable variation in the shape of the proglottides in different regions of the strobile. The most usual shapes, perhaps, are those shown in figure 184, but portions of the same strobile may have the proglottides more or less campanulate or cuneate. Thus, in the strobile of which figure 182 is a sketch of the scolex, the condition shown in the sketch is maintained for a distance of about 1 mm., the length of the segments about 0.04 mm. This is followed by a short portion in which the segments are closely crowded and under 0.03 mm. in length. Following this the segments lengthen and assume outlines like those in figure 184. Then come some half dozen segments that are wedge-shape; a typical segment measured 0.49 mm. in length, breadth at anterior end 0.14, at posterior end 0.30. This is succeeded by a succession of segments much like those shown in

the sketch, which continue for the remainder of the length, about two-thirds of the total length, except where interrupted at one place, where about four segments are elongated and wedge-shape. The genital pores are unilateral. They are surrounded by a strong muscular cloaca, and are situated toward the anterior end of the proglottis. Dimensions of a specimen mounted in balsam: Length 42 mm.; breadth of scolex 0.47, of sucker 0.28; length of posterior segment 0.10, breadth 0.63.

*Anatomy of proglottis.*—The genital cloaca has strong muscular walls; at the posterior side of the cloaca the cirrus and vagina open near together. The cirrus pouch is cylindrical and passes anteriomediad from the genital pore. The vas deferens is voluminous at the median end of the cirrus-pouch, and a part of it is enclosed in the cirrus-pouch. The number of testes was not determined, but there appeared to be as many as 25 in some transverse sections of immature proglottides. The vagina is nearly the same size and shape as the cirrus-pouch and lies nearly parallel to it on its ventral side. It extends a little nearer to the median line than the cirrus-pouch and appears to act, for the most part, as a seminal reservoir; the germ duct arising from its inner end is short and sinuous. It was traced in transverse sections of immature proglottides to the dorsal side of the ovary and the poral border of the vitelline gland. The ovary is situated in the antero-median region, and both it and the vitelline gland are lobed. The ovary appears to be a single but finely lobed gland, and the vitelline gland, a much smaller and more compact organ, lies just behind the ovary on the median line.

In one series of transverse sections the longitudinal muscle layer was poorly developed. Another series was made through a region of immature proglottides. In these the fascicles have a somewhat two-layered arrangement, and the inner fascicles are as a rule larger and contain coarser fibers than do the outer fascicles (fig. 187). Circular muscles were not seen.

The relatively small dorsal and ventral excretory vessels lie near together except when, on the poral side, they are separated by the cirrus-pouch and vagina.

Some of the sections contained large numbers of calcareous bodies.

### RECORD OF COLLECTIONS

*Gavia immer:*

(U.S.N.M., Helm. Coll. 7889 (type).)

1911, July 22.—Strobiles long and filiform; only two scoleces seen, but fragments of strobiles aggregating 70 centimeters found; all filiform and practically of the same diameter throughout.

1911, July 24.—Five.

1911, September 1.—Some of the slender strobiles noted but no scoleces seen.

1914, February 21.—Few; length of longest 60 mm.; maximum breadth 0.38; diameter of scoleces 0.31 to 0.53 (formalin).

1916, July 4.—Over 214 with scoleces, and at least as many strobiles from which the scoleces were missing. Most of the mature strobiles from 25 to 40 mm. in length; one, much attenuated, 85 mm. in length; diameter of scoleces 0.56, or more; maximum breadth of strobile 1 mm.

### DIOICOCESTUS FUHRMANNII Linton

Examples of this separate-sexed cestode were collected by Vinal N. Edwards in the Woods Hole region from two species of grebe.

Fuhrmann noted as a characteristic of the different species of this genus that a male and a female strobile are always to be found together.

As was noted in the original description of this species,[4] the same characteristic is indicated by most of the material in this collection. There are, however, two dates on which a single specimen is recorded. In the absence of detailed notes made at the time of the preliminary examination of the material these records should be regarded as incomplete. In all cases where two strobiles can be referred without doubt to the same host, the female is the larger.

### RECORD OF COLLECTIONS

From *Colymbus auritus:*

1913, April 28.—One female strobile; length 190 mm., maximum breadth 8.5 mm., maximum thickness 4.5 mm. Sections were made of the posterior end of this strobile. The seminal receptacles were found to be full of sperm cells, thus indicating that at least one male strobile had been present in this host contemporaneously with the female strobile which was collected.

*Colymbus holboelli:*

(U.S.N.M., Helm. Coll. 7890.)

1904, February 24.—Two birds examined; two strobiles; lengths 196 and 164 mm., respectively; maximum breadths 5 and 3 mm., respectively.

1904, February 25.—Two strobiles; length 264 and 140 mm., maximum breadths 6.5 mm.

1904, March 5.—Two birds examined; four strobiles; length 132, 45, 245, and 94 mm., maximum breadths 7.5, 7, 8, and 8 mm.

[4] Journal of Parasitology, vol. 11, pp. 163–169.

1904, December 13.—Two strobiles; lengths 60 and 108 mm., maximum breadths 10.5 and 7.5 mm.

1906, December 8.—Two strobiles, 120 and 135 mm. in length, and a fragment 50 mm. in length; maximum breadth 8 mm.

1910, January 12.—Two strobiles; length 167 and 113 mm.; maximum breadth in each 6 mm., and thickness 3 mm. The shorter specimen was in two pieces, one, with scolex, 28 mm. in length.

1910, January 13.—A vial with label of this date contained a fragment, lacking the scolex, length 120 mm., breadth 9 mm.

1913, February 12.—Two strobiles, 120 and 65 mm. in length; maximum breadth 7 and 6.5 mm., thickness 3 and 3.5 mm.

1913, February 18.—One strobile, length 110, maximum breadth 6, thickness 3 mm.

1913, April 28.—Two birds examined; lengths of strobiles recorded, 172, 130, 110, 95, and 40 mm. One of these was probably a fragment. These specimens were combined with others before the generic status had been recognized.

### DIPLOPOSTHE LAEVIS (Bloch, 1782), Jacobi, 1896

Figures 214–221

*Scolex.*—Missing.

Anterior mature proglottides from nearly as long as broad to about half as long as broad; ripe proglottides from four to five times as broad as long; lateral margins somewhat rounded, giving a crenulate outline to the strobile.

Genital pores on each lateral margin at about the middle of the length of the proglottis; cirri two to each segment, one on each side, stoutish and densely beset with minute spines, which are slender, and nearly straight, only slightly curved at the tip; cirrus-pouch thick-walled, somewhat fusiform. Testes three, relatively small, near together at the posterior end of the proglottis behind the female genitalia. They are limited to the earlier portion of the strobile. The two seminal vesicles are capacious, somewhat tubular, their inner ends near together at the median line at the dorsal border of the ovary. Each communicates with its cirrus-pouch by a short vas deferens. The cirrus-pouches extend antero-mediad from the genital pores.

The vaginae appear in the whole mounts as thin-walled tubes with somewhat irregular outlines, posterior to the cirrus-pouches. The ovary is profoundly lobed, differing in the number and shape of the lobes in the different proglottides. In general it is somewhat crescent shaped, inclosing the shell-gland, and, in some cases, partly inclosing the vitelline gland. In some of the proglottides the posterior lobes of the ovary are ventral to the vitelline gland. The

vitelline gland is also lobed but the lobes are shorter and blunter than those of the ovary. The uterus in ripe proglottides occupies the greater part of the interior of the proglottis, the ova lying in several rounded masses, showing that the uterus is more or less lobed.

The sections which were made proved to be all of ripe proglottides. In these the musculature appears to be comparatively weak. The longitudinal muscles were represented by an outer layer of very small fascicles which is continuous, except where broken by the genital ducts. There are also a few small fascicles of an inner layer of longitudinal muscles in the median region of the proglottis.

The two ventral longitudinal excretory vessels are relatively large; the dorsal vessels, while somewhat variable, are very much smaller than the ventral vessels. In some sections they are minute and difficult to recognize. Usually they lie near the ventral vessels on the median side.

#### RECORD OF COLLECTION

*Marila americana*, new host:

1914, February 26.—Six fragments of strobiles, maximum length about 30 mm. The broadest of these fragments measured in formalin, 4.5, the narrowest about 2.5 mm.
(U.S.N.M., Helm. Coll. 7891.)

### GYROCOELIA MILLIGANI, new species

Figures 188–193

The material upon which this description is based consists of one slide containing one scolex and fragments of strobile aggregating about 24 mm., one slide of frontal, one of sagittal, and two of transverse sections.

*Scolex.*—Broader than long, suckers a little longer than broad; rostellum enlarged at the tip, hooks missing; the extended rostellum and its sheath form a pestle-shaped structure. Diameter of scolex 0.22 mm., of sucker 0.11, of rostellum at middle 0.042, at apex 0.056; distance from base of sheath to apex of rostellum 0.22.

*Strobile.*—The neck is short and the proglottides begin abruptly; posterior breadth of proglottides greater than anterior, making the lateral margins of the strobile strongly serrate. Genital pores irregularly alternate at about the middle of the margin. There is a tendency in parts of the strobile for the genital pores to be at the summit of a papillary projection of the lateral wall of the proglottis. The cirrus-pouch is somewhat fusiform, with the median end tapering to a blunt point, producing in some cases a conical rather than a fusiform shape. In mature proglottides the length of the cirrus-

pouch was from 0.45 to 0.56 mm. and the maximum diameter 0.15. Its walls are strong, with spirally arranged muscles. The inner portion incloses portions of the vas deferens (fig. 191). In sections of ripe proglottides the cirri were missing, as if lost in the act of copulation. In sections of adult unripe proglottides the cirri were retracted. So far as they could be made out they seem to have rather collapsible walls and are densely covered with minute spines 0.012 to 0.015 mm. in length. In a proglottis 1.33 mm. in breadth, the length of the cirrus-pouch was 0.53, length of the cirrus 0.24. The cirrus-pouch passes between the two lateral excretory vessels. The vitelline gland lies on the median line near the posterior edge of the proglottis. In a frontal section of a proglottis 0.28 mm. in length and 0.84 in breadth, the vitelline gland was 0.045 in length and 0.12 in breadth. In a transverse section of a proglottis 1.08 in breadth the thickness of the vitelline gland was 0.075, the breadth 0.14. The gland is compact, with short, blunt lobes. The ovary lies anterior to the vitelline gland, and in adult proglottides its breadth is approximately one-third that of the proglottis. A small empty space dorsal to the vitelline gland was interpreted to be the seminal receptacle. No trace of vagina was seen in any of the sections. The number of testes was not determined. They are few and small and medially situated, dorsal to the ovary, and, together with the vas deferens, posterior to the inner end of the cirrus-pouch.

The excretory vessels in each lateral pair lie close together; the ventral is only a little larger than the dorsal, and there is a transverse vessel at the posterior end of the proglottis connecting the two ventral vessels.

There are two layers of longitudinal muscles, each layer containing a large number of muscle bundles, 80, more or less, in the outer layer, and a somewhat smaller number in the inner. The size of the bundles is variable in each layer, but there is not much difference between the average size of the bundles of the two layers. The bundles are subcircular in cross-section; individual fibers coarse. There is a layer of circular fibers between the outer layer and the subcuticla, and another on the inner side of the inner layer. The medullary space is crossed by numerous strong dorso-ventral fibers.

Record of collection.

*Crocethia alba:*

1902, August 15.—Two scoleces and one strobile 24 mm. in length; rostellum without hooks; breadth at posterior end 3.25 mm. The bird was obtained by Dr. John D. Milligan of the Bureau of Fisheries steamer, *Fish Hawk*, near Cape Lookout, N. C.

(U.S.N.M., Helm. Coll. 7892 (type).)

### Genus FIMBRIARIA Frölich [5]

Examples of this genus have been collected by Mr. Edwards in the Woods Hole region from *Mergus serrator*, *Oidemia deglandi*, *O. perspicillata*, *Fulica americana*, and *Harelda hyemalis*. There is great diversity of shape and form presented by the representatives of this genus in the collection, but, so far as I am able to determine, after a study of many whole mounts and series of sections, they are referable to two species only, namely, the widely distributed species *Fimbriaria fasciolaris* and the new species *F. falciformis*.

#### FIMBRIARIA FASCIOLARIS (Pallas)

Figures 194–199

*Scolex.*—Minute, at the extremity of a pennon-like pseudoscolex; rostellum with a circle of 10 hooks. The dimensions of the scolex agree with those given in the literature of the species. Thus, in one case, the breadth of the scolex was 0.10 mm.; breadth of sucker 0.036, length 0.045; diameter of circle of hooks 0.03; length of hooks 0.02.

The pseudoscolex is reflected until it is nearly or quite at right angles to the strobile. There is, moreover, a tendency to extend laterally, in a more or less rounded projection, at the base. This is best seen in young specimens. It is thus easy to distinguish this species from *F. falciformis*, which latter, especially in young specimens, has a sickle-shaped pseudoscolex. The length of the pseudoscolex, to which the scolex, whose dimensions have been given above, was attached, was 6 mm.; its greatest breadth 1.5.

*Strobile.*—Unsegmented, although the closely crowded transverse wrinkles give the appearance of segmentation. Genitalia, except in a very rudimentary state, rather remote from the scolex; genital pores unilateral, and very closely crowded together. In a series of transverse sections not exceeding 0.015 mm. in thickness, portions of as many as three cirrus-pouches may be seen in a single section. The cirrus is short, and is armed with numerous, minute spines; length of larger, basal spines about 0.006 mm. The cirrus-pouch is nearly cylindrical, its length approximately four or five times the diameter, as for instance, length 0.15; breadth 0.030; its inner portion acts as a seminal vesicle. The vas deferens connects with an inner seminal vesicle. There appear to be three testes, one situated at a distance equal to about one-fourth the breadth of the strobile from each lateral margin, and one near the median line; vasa efferentia convey sperm from these to the inner seminal vesicle.

[5] For synonymny see Taenioid Cestodes of North American Birds, Ransom. Bull. 69, U. S. National Museum.

The vagina opens on the ventral side of the cirrus. It communicates with a relatively spacious seminal receptacle, which lies on the median side of the inner seminal vesicle. The lining of minute spines, noted in the exterior portion of the vagina of *F. falciformis*, was not observed in any of the sections of this species. The ovary is tubular, in some cases slightly branching, and lies on the ventral side of the medullary space, near the median line. The vitelline gland is slender and lies ventral to the ovary. As is shown in figure 196 its length may be more than three times that of the ovary as seen in transverse sections of the strobile. Figure 198 is from a camera lucida sketch of the complex of female genital ducts as it appeared in a series of sections of an unripe portion of a strobile, the uterus, only, being diagrammatic. In ripe portions of the strobile ova fill practically all of the medullary space. Here and there, however, in the series of sections, there are indications of an earlier tubular stage of development of the uterus, as is shown in the diagram. The ova, as they appear in these sections, have thin shells, and have a maximum diameter of 0.036 mm.

The thickness of the cuticle as about 0.003, of the subcuticula, about 0.17. The latter is granular, crossed with fine, radial fibers, and contains large numbers of calcareous bodies; some of these bodies are circular in outline, but most of them are oval, and range from 0.007 to 0.014 in the major diameters. Next within the subcuticula there is a layer of longitudinal muscle fibers consisting of a single circle of fascicles. These fascicles are irregularly oval in cross section, the longer diameter radial, and the cross sections approximately 0.052 by 0.024 in the two prinicpal diameters. Within the layer of longitudinal muscles there is an inconspicuous layer of fine granules with a few circular fibers.

The water vascular system consists of three pairs of prinicpal vessels, which are more or less sinuous; a pair situated at a distance equal to about one-fourth the breadth of the strobile from each lateral margin, and a third pair not far from the median line. These vessels, with the exception of the enlarged median one, are small and of nearly uniform size, about 0.015 in diameter. The walls of these vessels are relatively rather thick. The difference in size between the large vessel of the median pair and that of the other longitudinal excretory vessels is striking. Thus, in a transverse section through a portion of the strobile where the reproductive organs were mature, but no ova had yet appeared, the diameter of the more marginally placed vessels, and the smaller of the median pair, was about 0.015, while that of the median large vessel was 0.08 by 0.15 (fig. 196). In a section made through a portion of the strobile where the medullary space was filled with ova, and no trace of the smaller

vessels remained, the large vessel persisted, the two principal diameters being 0.13 by 0.09 (fig. 197).

The above description is based on material from *Mergus serrator*. The agreement is close with *F. fasciolaris*, as described by Wolffhügel in his monograph.[6] None of the preparations reveal any spines at the outlet of the vagina. Furthermore, the dimensions of the hooks at the base of the cirrus are smaller than those recorded for this species.

RECORD OF COLLECTIONS

*Mergus serrator*.

(U.S.N.M., Helm. Coll. 7893.)

1903, November 5.—Ten fragments of strobiles, three with pseudoscolesces; longest strobile with pseudoscolex 52 mm.; length of pseudoscolex 4.8; breadth back of pseudoscolex 0.78, at posterior end 1.6; maximum breadth observed 3.

1912, February 6.—One, length 50 mm.

1913, November 7.—Nineteen with pseudoscoleces, and a few fragments. Two of the longest measured 123 and 136 mm., respectively, in length; maximum breadth 3.

1914, February 20.—Three, and two fragments; lengths of strobiles 21, 38, and 130 mm., of fragments 15 and 18; maximum breadth 4.

1914, February 21.—One, length 22 mm.

1914, February 24.—Three, and a number of fragments, macerated.

*Oidemia deglandi*, new host:

1909, February 2.—Twelve strobiles with pseudoscoleces and many fragments, all very irregularly contracted. These strobiles are linear and subcylindrical for the greater part of the length, then enlarge abruptly near the posterior end, where the greatest breadth observed was 5 mm. The pseudoscoleces were much crumpled; the largest from 4.5 to 5 mm.; maximum length of strobile 55.

1913, August 14.—One hundred and forty-five, from 3 to 10 mm. in length; relatively short and broad; some of this lot are *F. falciformis*.

1913, September 4.—Ninety-two; some very small, 2 mm., or less, in length. The longest strobile with pseudoscolex was 30 mm. in length; one, from which the pseudoscolex was missing, was 34 mm. in length; maximum breadth 2.5.

1913, November 4.—Ten; some very small, 5 mm.. or less; longest 40 mm.

[6] Arbeit aus dem Universitat Basel, 1900.

1914, June 2.—Five hundred, more or less; 100 of these larger, up to 34 mm. in length, maximum breadth 3.5; the others small, 2 to 10 mm. in length.

1916, October 18.—Forty-one; from 3 to 25 mm. in length in one vial. In another vial, with label of same date, there were 191 from 1 to 22 mm. in length.

1916, October 28.—Nine, from 5 to 15 mm. in length.

### FIMRIARIA FALCIFORMIS, new species

Figures 200–213

*Scolex.*—Minute as compared with the pseudoscolex, diameter about 0.10 mm.; suckers subcircular, diameter about 0.04; rostellum moderately elongate, with a circle of 10 hooks about 0.015 mm. in length.

Pseudoscolex tapering and more or less sickel-shaped, without any sharp constriction at its base, thus appearing as a curved and flattened continuation of the strobile into which rudiments of the reproductive organs extend for some distance.

*Strobile.*—Linear with reproductive organs less crowded than in *F. fasciolaris.* Testes laterally elongated and much lobed, three in number, although in some of the anterior portions of the strobile there appear to be but two. Hooks on base of cirrus 0.006 mm. in length, and a little coarser in appearance than in *F. fasciolaris.* The cirrus-pouch in a series of sections of a strobile from *Clangula hyemalis* measured about 0.30 in length and 0.036 in diameter. The base of the cirrus-pouch acts as a seminal vesicle; there is also an inner seminal vesicle. The vagina, at its entrance into the genital pore, is lined with fine hooks; it lies on the ventral side of the cirrus-pouch and leads to a seminal receptacle. Ovary and vitelline gland slender, with about the same proportions and position as in *F. fasciolaris.* The tubular uterus persists, and even in sections of maturing proglottides was seen to lie in closely packed irregular coils in the medullary space (fig. 211). There is a single layer of longitudinal muscles, and there are four pairs of longitudinal excretory vessels, of which the ventral have relatively thin, and the dorsal thick walls. In a transverse section of an adult proglottis the largest ventral vessel had the following dimensions: Diameters 0.045 by 0.033, of lumen 0.039 by 0.027; largest dorsal vessel, diameters 0.024 by 0.018, of lumen 0.015 by 0.011.

#### RECORD OF COLLECTIONS

*Oidemia deglandi:*

1913, August 14.—One hundred and forty-five, from 3 to 10 mm. in length; maximum breadth 1.8; all immature. Some of this lot belong to the species *F. fasciolaris.*

1914, June 2.—Forty-five, from 10 to 30 mm. in length (U.S.N.M., Helm. Coll. 7894 (type).)

See under *F. fasciolaris* for other dates. *F. falciformis* was found in considerable numbers associated with *F. fasciolaris* in material from *O. deglandi* which had been placed in the same bottle before it was noted that more than one species was represented. A slide prepared at the time of collecting on August 14, 1913, makes it clear that *F. falciformis* was present in the scoter which was examined on that date.

*Oidemia perspicillata:*

1914, February 18.—Three; 115, 120, and 130 mm. in length, respectively, with nearly uniform breadth of 2 mm.

*Clangula hyemalis:*

1914, February 16.—Eight; smallest, length 9 mm., maximum breadth 1 mm. My notes made while making a preliminary examination of formalin material record a specimen from this lot measuring 34 mm. in length and 4 mm. in maximum breadth, but the greatest length noted in the alcoholic material is 15, with a maximum breadth of 3. These forms from *C. hyemalis* are more corrugated than those from *Oidemia*, but the reproductive organs are of the same type as in the forms referred to *F. falciformis.*

*Fulica americana:*

1920, November 3.—Two strobiles, collected by Robert A. Goffin. The larger specimen in balsam measures 8 mm., exclusive of pseudoscolex; greatest breadth 1.4; length of pseudoscolex 4.2. The strobile tapers to a blunt point at the posterior end. There are about five sets of reproductive organs to the millimeter at the posterior end and about six to the millimeter in the median region; reproductive organs at the posterior end mature, but ova not yet developed.

## EXPLANATION OF PLATES

*c.* cirrus.
*cm.* circular muscle.
*cp.* cirrus-pouch.
*de.* dorsal excretory vessel.
*ex.* excretory vessel.
*gc.* genital cloaca.
*im.* inner longitudinal muscle.
*lm.* longitudinal muscle.
*n.* nerve.
*o.* ovary.
*om.* outer longitudinal muscle.
*ot.* ootype.
*sd.* sperm duct.
*sg.* shell gland.
*sr.* seminal receptacle.
*sv.* seminal vesicle.
*t.* testis.
*te.* transverse excretory vessel.
*u.* uterus.
*v.* vagina.
*vd.* vas deferens.
*ve.* ventral excretory vessel.
*vg.* vitelline gland.
*y.* yolk reservoir.
*yd.* vitelline duct.

PLATE 1

*Ligula intestinalis* (Linnaeus) from *Podilymbus podiceps*

FIG. 1. Anterior end of strobile, sharp-pointed type; breadth at x–x 0.4 mm.
2. Anterior end of strobile, bluntly rounded type; breadth at x–x 1 mm.
3. Transverse section, about 0.1 mm, from anterior end; longest diameter of section 1.36 mm.
4. Transverse section showing genitalia; camera lucida drawing, details added from adjoining sections; dorso-ventral diameter 0.7 mm.

*Schistocephalus solidus* (C. F. Müller), from *Podilymbus podiceps*

5. Anterior end of strobile; breadth at base of first segment 1 mm.

*Tetrabothrius cylindraceus* (Rudolphi)

6. Scolex; maximum breadth 0.35 mm., from *Larus argentatus.*
7. Adult proglottis, ventral view; breadth 0.93 mm.; from *Sterna hirundo.*
8. Dorsal view of same.
9. Frontal section of adult proglottis; breadth 0.98 mm.
10. Transverse section in vicinity of genital pore; diameter of cirrus-pouch 0.04 mm.

PLATE 2

*Tetrabothrius cylindraceus* (continued).

FIG. 11. Diagram of female genitalia.
12. Maturing proglottides; breadth 1.56 mm.
13. Mature proglottis; breadth 1.82 mm.

*Tetrabothrius heteroclitus* (Diesing).

14. Scolex; breadth 0.45 mm., from *Puffinus borealis.*
15. Transverse section of scolex; greater diameter 0.46 mm.
16. Transverse section of proglottis; longer diameter 0.44 mm.
17. Details of body wall of same; camera lucida drawing, Zeiss 2/D.
18. Transverse section of genital cloaca; diameter of cirrus-pouch 0.041 mm.; from *Nycticorax nycticorax naevius.*
19. Ripe proglottides, posterior to proglottis shown in figure 20; breadth 0.34 mm.; from *Puffinus griseus.*
20. Adult proglottis; maximum breadth 0.27 mm.

PLATE 3

*Tetrabothrius heteroclitus* (continued)

FIG. 21. Frontal section of ripe proglottides; breadth 1.33 mm.
22. Genital cloaca and cirrus-pouch from frontal section of adult proglottis; diameter of cirrus-pouch 0.045 mm.

*Tetrabothrius macrocephalus* (Rudolphi)

23. Scolex; greatest breadth 0.73 mm., from *Colymbus auritus.*
24. Transverse section of scolex; longer diameter 0.81 mm.
25. Transverse section of immature proglottis; longer diameter 0.98 mm.
26. Transverse section of adult proglottis; longer diameter 0.79 mm. (Pencil sketch of this figure misinterpreted; lateral diameter of vitelline gland too great.)

27. Mature proglottides; length 0.70 mm., from *Gavia immer*.
28. Mature proglott is; breadth 2.38 mm.
29. Transverse section through genital cloaca; dorso-ventral diameter 0.53 mm.
30. Transverse section of strobile near scolex; circular muscle layer to cuticle inclusive, 0.16 mm.
31. Longitudinal section of lateral margin of strobile showing varying position of outer longitudinal muscle layer with reference to the cuticle; length of proglottides about 0.45 mm.

PLATE 4

*Tetrabothrius sulcatus*, new species from *Fregata magnificens*

FIG. 32. Scolex and portion of strobile; diameter of scolex 0.48 mm.
33. Proglottides; breadth 0.40 mm.
34. Proglottides from posterior end of strobile; breadth 0.53 mm.
35. Adult proglottis; length 0.21 mm.
36. Sagittal section of proglottides near poral margin; dorso-ventral diameter 0.43 mm.
37. Transverse section of ripe proglottis; longer diameter 0.46 mm.
38. Transverse section of proglottis in vicinity of genital pore; diameter of cirrus-pouch 0.048 mm.
39. Frontal section through genital pore; diameter of cirrus-pouch 0.065 mm.

*Ophryocotyle proteus* (Fries), from *Larus atricilla*

40. Strobile; length 3 mm.
41. Scolex; breadth 0.28 mm.
42. Spines from rostellum; length 0.004 mm.
43. Spines from sucker; length 0.008 mm.
44. Proglottis; length 0.28 mm.

*Dilepis unilateralis* (Rudolphi) from *Butorides virescens*

45. Scolex; breadth 0.135 mm.
46. Rostellum; diameter, exclusive of hooks, 0.051 mm.
47. Immature proglottis; breadth 0.35 mm.
48. Adult proglottis; breadth 0.50 mm.

PLATE 5

*Dilepis unilateralis* (continued)

FIG. 49. Ripe proglottis; breadth 0.53 mm.
50. Transverse section of proglottis; 0.34 by 0.18 mm.
51. Dorsal view of genital pore, from whole mount; camera lucida drawing, Spencer 6/4 mm.

*Choanotaenia parina* (Dujardin) from *Passer domesticus*

52. Rostellum; diameter 0.04 mm.
53. Proglottis; length 0.77 mm.

*Choanotaenia ransomi*, new species

54. Scolex; diameter 0.39 mm., from *Larus atricilla*.
55. Optical section of retracted rostellum; length of hooks 0.39 mm.
56. Single hook; length 0.039 mm.
57. Adult proglottis; breadth 0.08 mm.
58. Scolex and portion of strobile; breadth of scolex 0.36., from *Gavia immer*.
59. Tip of rostellum; diameter, exclusive of hooks, 0.07 mm.
60. Scolex and portion of strobile; diameter of scolex 0.39 mm., from *Larus philadelphia*.
61. Proglottides; breadth 0.28 mm.

PLATE 6

*Choanotaenia ransomi* (continued)

FIG. 62. Proglottides; maximum breadth 0.28 mm., from *Gavia immer*.
63. Diagram of female genitalia; from series of sections of material from *Larus marinus*.
64. Transverse section of strobile; greater diameter 0.42 mm.; *a*, posterior edge of segment which separates from the inner core in the following section of the series. From *Larus argentatus*.
65. Sagittal section of ripe proglottis; dorso-ventral diameter 0.28 mm.
66. Ovum, sketched from formalin material; diameter 0.072 mm.
67. Proglottides, from strobile 2 mm. in front of moniliform segments shown in the next figure; breadth 0.74 mm. (see text); from *Larus philadelphia*.
68. Ripe proglottis; length 1 mm.

*Choanotaenia*, species, from *Larus argentatus*

69. Scolex and anterior part of strobile; diameter of scolex 0.40 mm.
70. Hooks; length 0.105 mm.

*Hymenolepis anceps*, new species from *Mergus serrator*

71. Scolex; diameter 0.15 mm.
72. Hooks from rostellum; length 0.012 mm.
73. Proglottides, about 1 mm. from scolex; type of strobile with serrate lateral margins, breadth 0.18 mm.
74. Proglottides about 1 mm., from scolex; type of strobile with closely crowded segments; breadth 0.26 mm.
75. Adult proglottis; breadth 1.77 mm.
76. Ripe proglottis; breadth 2.60 mm.
77. Transverse section of ripe proglottis; diameters 2.66 by 0.70 mm.
78. Abnormal proglottides; breadth 2.50 mm.

PLATE 7

*Hymenolepis ardeae* (Fuhrmann) from *Butorides virescens*

FIG. 79. Scolex and portion of strobile; diameter of sucker 0.084 mm.
80. Hooks from rostellum; length 0.035 mm.
81. Immature proglottides; breadth 0.86 mm.

82. Transverse section of proglottis: genitalia supplied from about five sections; diameters 1.26 by 0.77 mm.
83. Transverse section of ripe proglottis; diameters 1.05 by 0.28 mm.
84. Frontal section of ripe proglottis; breadth 1.09 mm.
85, 86, 87. Transverse sections of cirrus and cirrus-pouch, from sagittal sections of proglottis; diameters of cirrus, 0.056, 0.07, and 0.09 mm.
88. Longitudinal section of cirrus and cirrus-pouch, from frontal section of proglottis; diameter of cirrus-pouch 0.11 mm.

*Hymenolepis coronula* (Dujardin)

89. Scolex; diameter of sucker 0.06 mm.; from *Oidemia perspicillata*.
90. Front view of scolex; diameter of sucker 0.07 mm.
91. Transverse section of proglottis; longer diameter 1.61 mm.
92. Adult proglottis; length 0.50 mm.; from *Glaucionetta clangula americana*.

PLATE 8

*Hymenolepis coronula* (continued)

FIG. 93. Transverse section of genital cloaca; camera lucida drawing, Spencer 6/4 mm.

*Hymenolepis ductilis*, new species, from *Larus argentatus*

94. Scolex and portion of strobile; diameter of scolex 0.26 mm.
95. Tip of rostellum; length of hooks 0.039 mm.
96. Ventral view of young proglottis; breadth 0.33 mm.
97. Ventral view of proglottides; breadth 0.35 mm.
98. Dorsal view of young proglottis; breadth 0.30 mm.
99. Lateral margin of proglottides; length of proglottis 0.05 mm.
100. Ripe proglottides; breadth 0.35 mm.
101. Transverse section of ripe proglottis; diameters 0.39 by 0.15 mm.

*Hymenolepis fusus* (Krabb) from *Larus argentatus*

102. Scolex; diameter 0.10 mm.
103. Hooks from rostellum; length 0.02 mm.
104. Posterior end of strobile; maximum breadth 0.28 mm.

*Hymenolepis macracanthos* (Linstow) from *Mergus serrator*

105. Scolex; diameter 0.13 mm.
106. Hook from rostellum; length 0.09 mm.
107. Dorsal view of young proglottis; rudiment of ovary showing through from ventral side; breadth 0.50 mm.
108. Dorsal view of older proglottis, testes not seen; breadth 0.47 mm.
109. Ripe proglottis, with remnant of ovary; breadth 0.48 mm.
110. Ripe proglottis; breadth 0.53 mm.
111. Cirrus; diameter of bulbous base 0.036 mm.
112. Section of base of cirrus; diameter 0.030 mm.

PLATE 9

*Hymenolepis macracanthos* (continued)

FIG. 113. Section of cirrus-pouch and vagina, from transverse section of proglottis; camera lucida drawing, Spencer 6/4 mm. *s.* sphincter muscle of vagina.

*Hymenolepis hamulacanthos*, new species, from *Marila americana*

114. Scolex; diameter 0.26 mm.
115. Rostellum, hooks retracted; length of hook 0.108 mm.
116. Single hook; length 0.108 mm.
117. Mature proglottis, somewhat diagrammatic; from whole mount, but part of vas deferens, vasa efferentia, and vitelline gland supplied from sections; breadth 1.47 mm.
118. Ripe proglottis, about 20 mm. from posterior end of strobile; breadth 1.47 mm.
119. Ripe proglottis, near posterior end of strobile; breadth 2.80 mm.
120. Nearly transverse section of proglottis; longer diameter 1.62 mm.
121. Cirrus; camera lucida drawing, Spencer 6/4 mm.
122. Transverse section of cirrus and vagina, 0.05 mm. from lateral margin of proglottis; diameter of cirrus 0.016 mm.
123. Same, 0.09 mm. from lateral margin of proglottis; same magnification as Fig. 122.
124. Same, 0.21 mm. from lateral margin of proglottis; diameter of cirrus-pouch 0.09 mm.
125. Transverse section of cirrus-pouch and vagina, 0.30 mm. from the lateral margin of the proglottis; diameter of cirrus-pouch 0.09 mm.
126. Transverse section of longitudinal muscles; Spencer 10/4 mm.

PLATE 10

*Hymenolepis pachycephala* (*Linstow*)

FIGS. 127, 128, 129. Scoleces and portions of strobiles; diameters of scoleces 0.24, 0.22, and 0.24 mm.
130. Hooks from rostellum; length 0.045 mm.

*Hymenolepis podicipina* (Szymanski) from *Colymbus auritus*

131. Scolex; diameter 0.17 mm.
132. Front view of scolex; diameter 0.17 mm.
133. Front view of rostellum; diameter 0.07 mm.
134. Hooks; length 0.03 mm.
135. Immature proglottides; breadth 0.22 mm.
136. Posterior end of strobile; maximum breadth 0.28 mm.
137. Cirrus; length of proglottis 0.045 mm.
138. Transverse section of proglottis; longer diameter 0.50 mm.

*Hymenolepis rostellata* (Abilgaard) from *Gavia immer*

139. Scolex; diameter 0.34 mm.
140. Tip of rostellum; diameter, exclusive of hooks, 0.093 mm.
141. Adult proglottis; breadth 0.68 mm.
142. Genital cloaca and base of cirrus, from transverse section of proglottis; diameter of genital cloaca 0.066 mm.

*Hymenolepis tritesticulata* (Fuhrmann)

143. Scolex; diameter 0.18 mm., from *Fulica americana.*
144. Hook from rostellum; length 0.039 mm.
145. Ripe proglottides; breadth 0.50 mm.
146. Proglottides, ventral view; breadth 0.27 mm., from *Marila marila.*
147. Cirrus and cirrus-pouch; length of cirrus 0.135 mm.

*Hymenolepis*, species (Genus *Weinlandia*, Mayhew, 1925)

148. Scolex; diameter 0.19 mm., from *Marila marila.*
149. Hooks from rostellum; length 0.015 mm.
150. Rostellum; diameter at circle of hooks 0.054 mm., from *Oidemia deglandi.*
151. Hook from rostellum; length 0.010 mm.

PLATE 11

*Hymenolepis*, species (continued)

FIG. 152. Adult proglottis; breadth 1.22 mm.

*Hymenolepis*, species from *Larus delawarensis*

153. Scolex; diameter 0.14 mm.
154. Hooks from rostellum; length 0.054 mm.
155. Immature proglottides; breadth 0.22 mm.
156. Immature proglottides; breadth 0.28 mm.

*Hymenolepis*, species from *Fulica americana*

157. Scolex; diameter 0.19 mm.
158. Hook from rostellum; length 0.036 mm.
159. Cirrus and cirrus-pouch; diameter of cirrus-pouch 0.036 mm.

*Rhabdometra similis* (Ransom), from *Coccyzus americanus*

160. Scolex and portion of strobile; breadth of scolex 0.25, of neck 0.22 mm.
161. Scolex and portion of strobile, slender type; breadth of scolex 0.22, of neck 0.13 mm.
162. Ripe proglottis; length 0.98 mm.; *p*, parauterine organ.
163. Cirrus and cirrus-pouch, from transverse section of ripe proglottis; diameter of cirrus-pouch 0.05 mm.

*Diorchis acuminata* Clerc from *Marila americana*

164. Scolex; diameter 0.24 mm.
165. Hook from rostellum; length 0.048 mm.
166. Immature proglottides; breadth 0.40 mm.
167. Cirrus; length from base of tumid portion 0.10 mm.
168. Adult proglottis; breadth 0.63 mm.
169. Ripe proglottis, ova not yet mature; breadth 1.05 mm.
170. Ripe proglottis, ova mature; breadth 0.60 mm.
171. Ovum; 0.075 by 0.015 mm.

PLATE 12

*Diorchis acuminata* (continued)

FIG. 172. Ventral view of genitalia, whole mount; camera lucida drawing, Spencer 6/4 mm.
173. Transverse section, adult proglottis; 0.74 by 0.45 mm.

*Valipora mutabilis*, new species from *Nycticorax nycticorax naevius*

174. Scolex; diameter 0.20 mm.
175. Hooks from rostellum; length 0.030 mm.
176. Immature proglottides; breadth 0.48 mm.
177. Adult proglottis, breadth 0.39 mm.
178. Adult proglottis, dorsal view; breadth 0.43 mm.
(Figs. 176–178, somewhat diagrammatic. The testes were not clearly defined in the whole mounts.)
179. Ripe proglottis; breadth 0.46 mm.
180. Ripe proglottis, immediately preceding the segment sketched in Fig. 181; breadth 0.49 mm.
181. Posterior proglottis; breadth 0.49 mm.

*Valipora parvispine*, new species, from *Gavia immer*

182. Scolex; diameter 0.56 mm.
183. Rostellum, retracted; diameter circle of hooks 0.03, length of hooks about 0.010 mm.
184. Immature proglottides; breadth 0.30 mm.
185. Adult proglottis, partly diagrammatic; breadth 0.63 mm.
186. Transverse section of proglottis; longer diameter 0.56 mm.
187. Transverse section of longitudinal muscles; smaller fascicles on cuticular side; camera lucida sketch, Spencer, 6/4 mm.

PLATE 13

*Gyrocoelia milligani*, new species from *Crocethia alba*

FIG. 188. Scolex and portion of strobile; diameter of scolex 0.22 mm.
189. Scolex; diameter 0.22 mm.
190. Proglottides; breadth 1.40 mm.
191. Section of basal portion of cirrus-pouch; 0.21 by 0.17 mm.
192. Section of cirrus-pouch with retracted cirrus; 0.19 by 0.15 mm.
193. Spines from cirrus; length 0.015 mm.

*Fimbriaria fasciolaris* (Pallas) from *Mergus serrator*

194. Pseudoscolex and scolex; length of pseudoscolex 4.6 mm.
195. Scolex; diameter 0.10 mm.
196. Transverse section of proglottis; longer diameter 1.42 mm.
*a*. Calcareous bodies.
197. Transverse section of ripe proglottis; longer diameter about 3 mm.
198. Diagram of genitalia.
199. Cirrus; length of spines about 0.006 mm.

*Fimbriaria falciformis*, new species

200, 201, 202. Immature strobiles from *Oidemia deglandi;* lengths 4.2, 5.6, and 4.5 mm.

203. Scolex; enlarged view of scolex shown in Fig. 204, from *Clangula hyemalis;* diameter 0.12 mm.

PLATE 14

*Fimbriaria falciformis* (continued)

FIG. 204. Immature strobile from *Clangula hyemalis;* length, excluding pseudoscolex, 8 mm.

205. Transverse section of adult proglottis; longer diameter 1.32 mm.

206. Transverse section, diagrammatic; made up from about 5 sections; diameters 1.28 by 0.28 mm.

207. Section of cirrus and vagina, from transverse section of proglottis; diameter of cirrus at base 0.03 mm.

208. Transverse section of proglottis; from *Oidemia perspicillata;* longest diameter 1.26 mm.

209. Transverse section of proglottis; longer diameter 1.22 mm.

210. Dorsal view of proglottides, whole mount; breadth 1.20 mm.

211. Transverse section of ripe proglottis; longer diameter 1.05 mm.

212. Section of cirrus-bulb and vagina, from transverse section of proglottis; length of cirrus-pouch 0.17 mm.

213. Ova in uterus; camera lucida drawing, Zeiss 2/D.

PLATE 15

*Diploposthe laevis* (Bloch, 1782), Jacobi, 1896, from *Marila americana*

FIG. 214. Adult proglottides; breadth 1.68 mm.

215. Ripe proglottides; breadth 2.78 mm.

216. Adult proglottis; length 1 mm.

217. Adult proglottis, posterior to the one shown in fig. 216; breadth 1.68 mm.

218. Ripe proglottis; breadth 3.92 mm.

219. Transverse section of ripe proglottis; greater diameter 2.68 mm.

220. Cirrus, optical section, from whole mount; diameter of cirrus 0.066 mm.

221. Spines on cirrus; length 0.004 mm.

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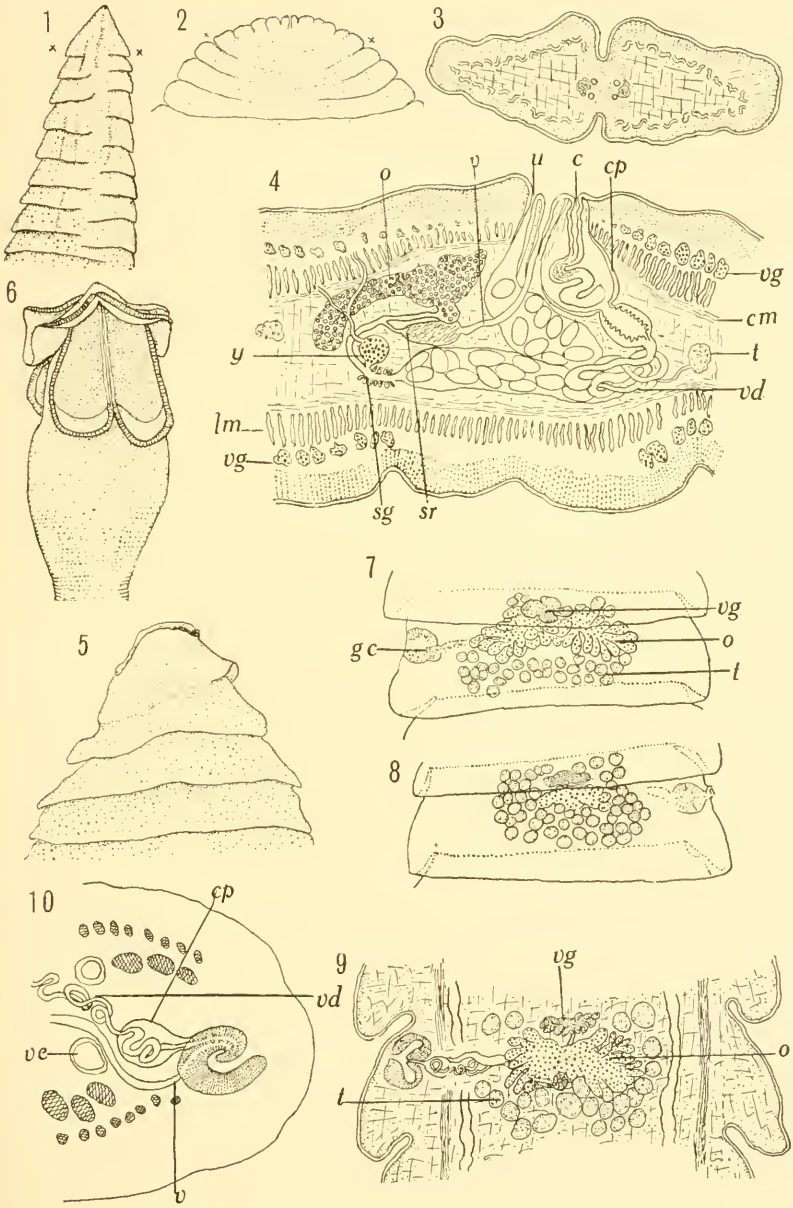
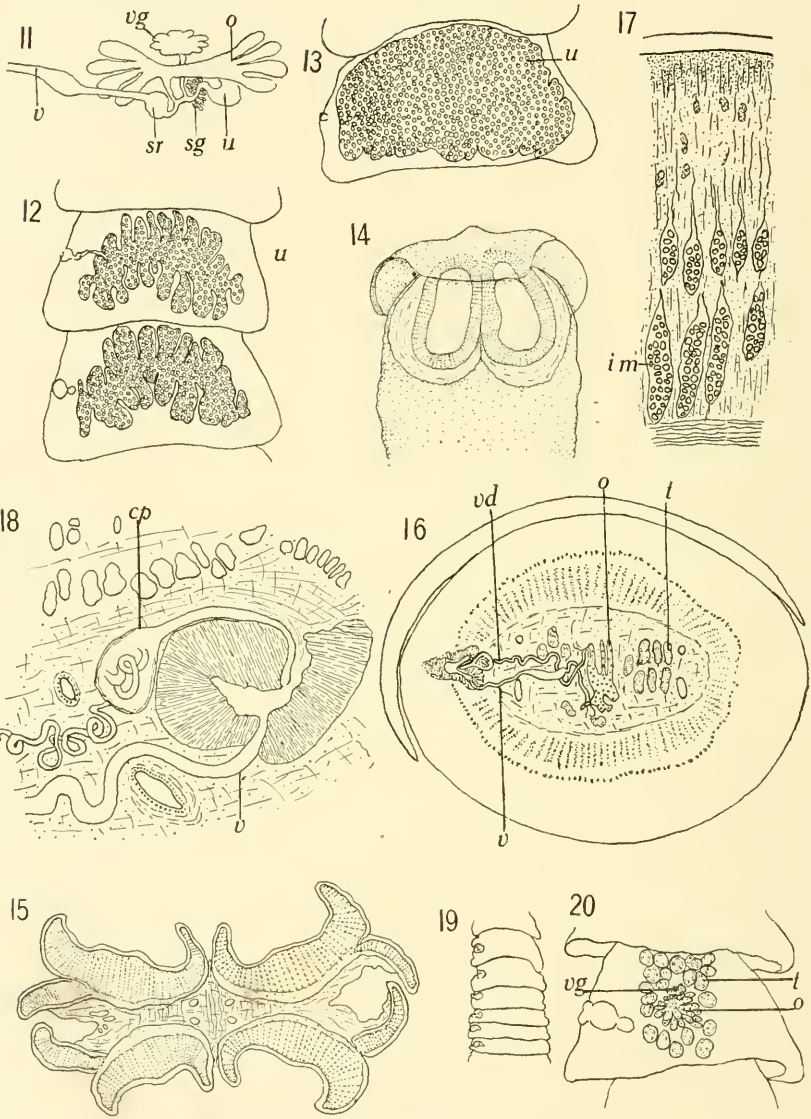


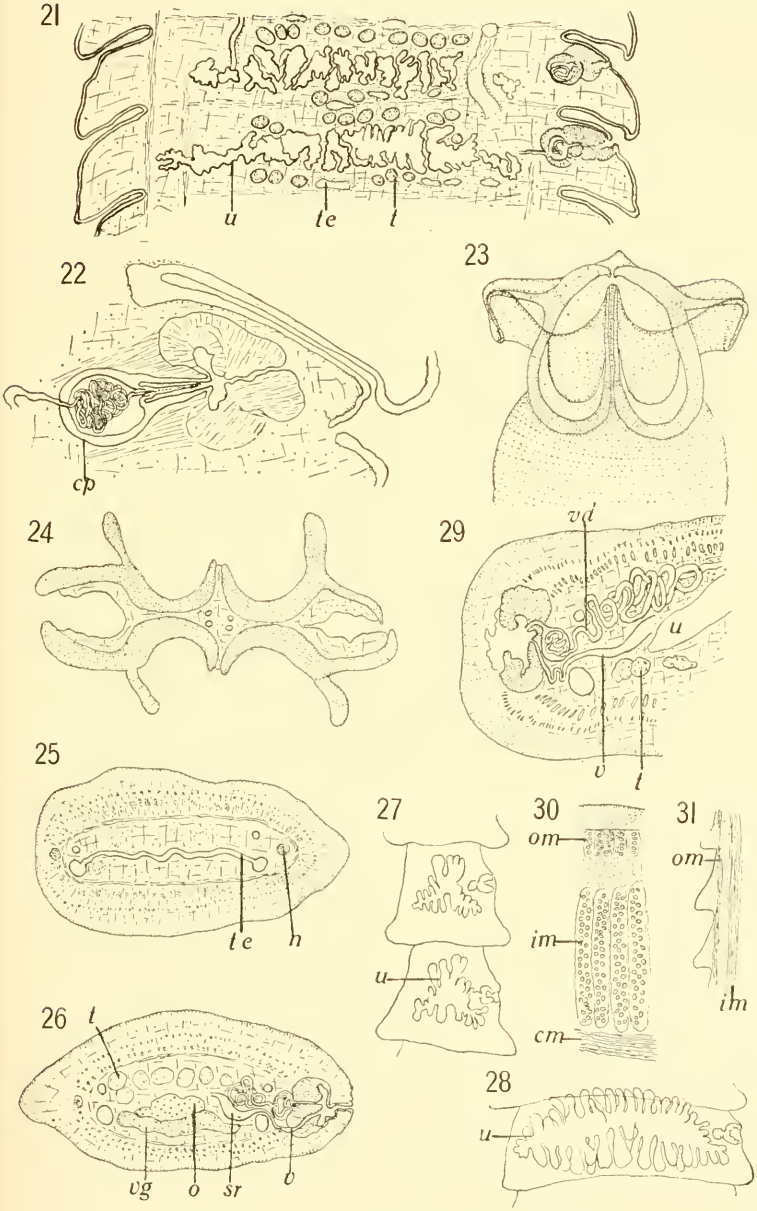

CESTODES OF GREBE, GULL, AND TERN

FOR EXPLANATION OF PLATE SEE PAGE 66



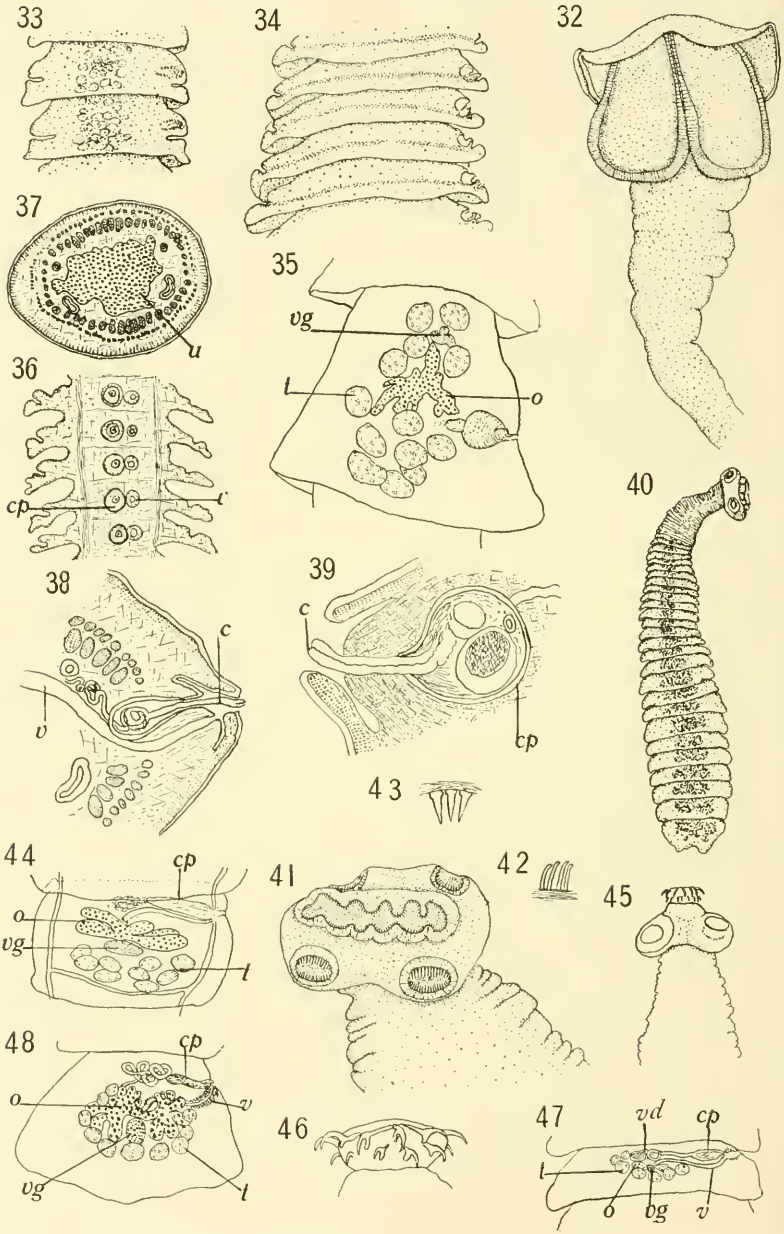

CESTODES OF SHEARWATERS AND NIGHT HERON

FOR EXPLANATION OF PLATE SEE PAGE 66



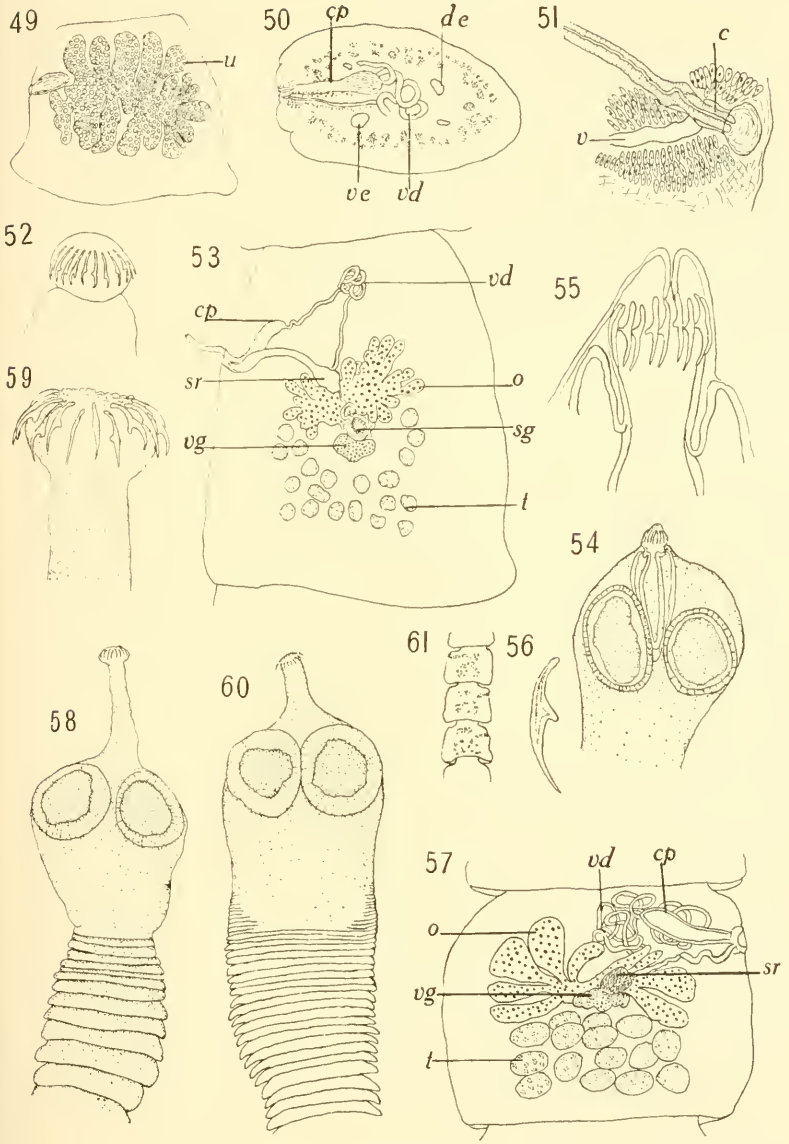

CESTODES OF SHEARWATER, GREBE, AND LOON

FOR EXPLANATION OF PLATE SEE PAGES 66 AND 67



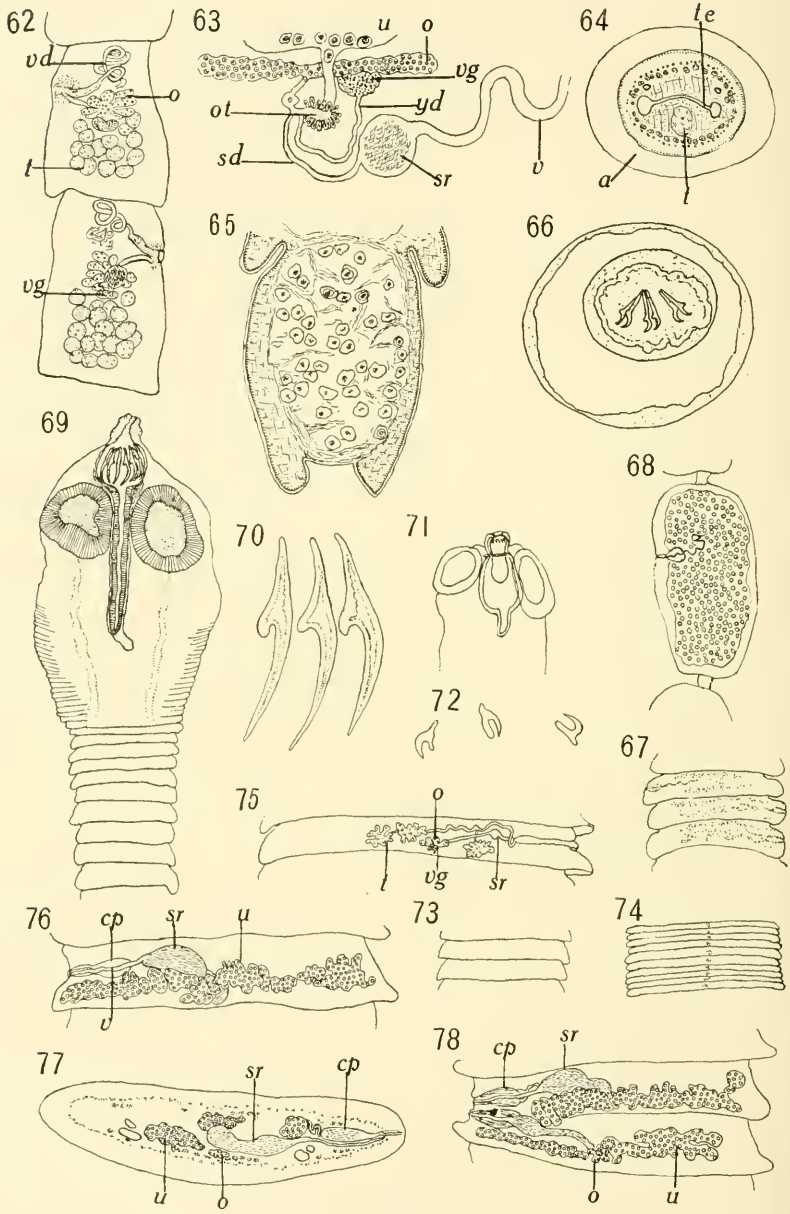

CESTODES OF FRIGATE-BIRD, GULL, AND GREEN HERON

FOR EXPLANATION OF PLATE SEE PAGE 67



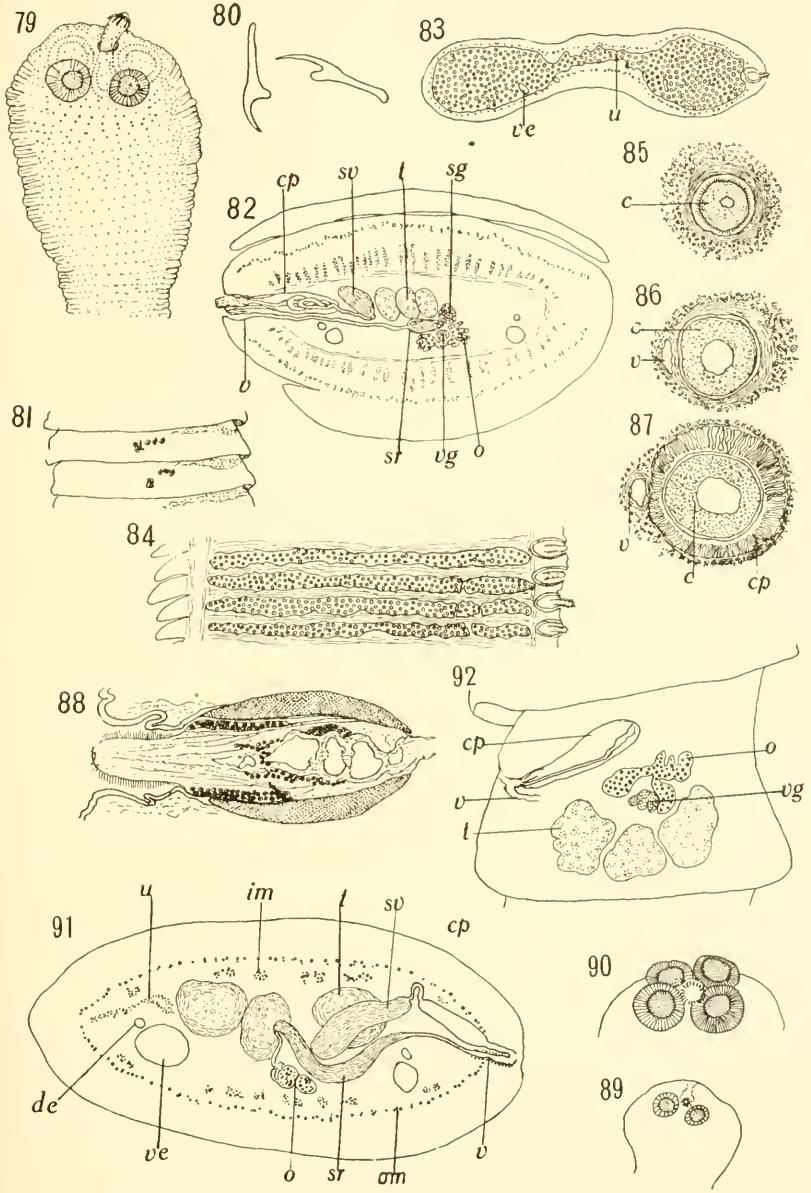

CESTODES OF GREEN HERON, ENGLISH SPARROW, GULLS, AND LOON

FOR EXPLANATION OF PLATE SEE PAGES 67 AND 68



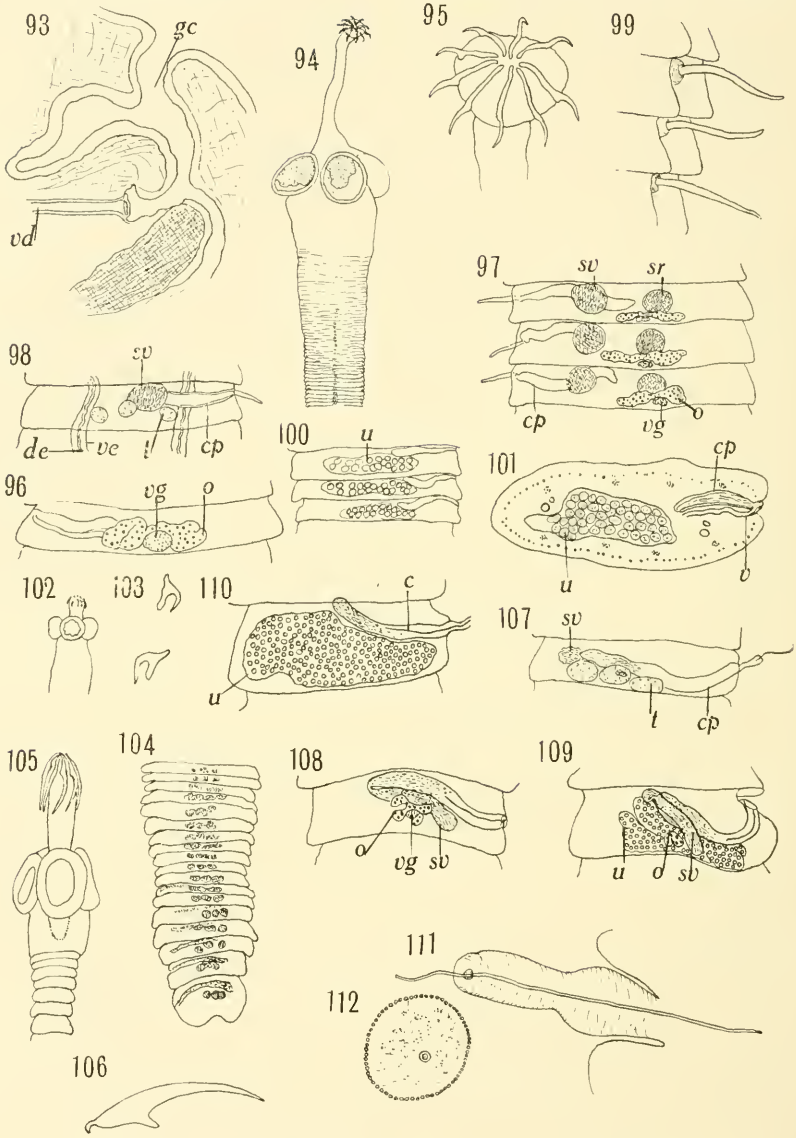

CESTODES OF LOON, GULLS, AND MERGANSER

FOR EXPLANATION OF PLATE SEE PAGE 68



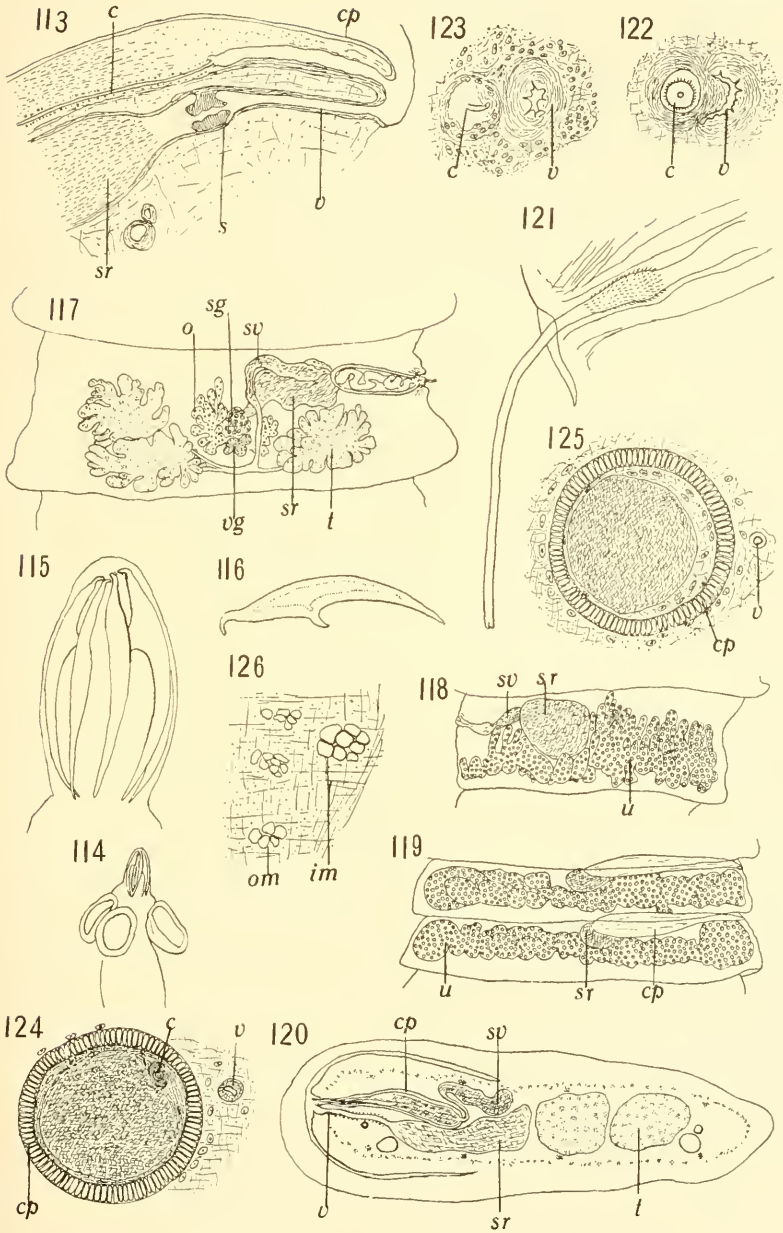

CESTODES OF GREEN HERON, SCOTER, AND WHISTLER DUCK

FOR EXPLANATION OF PLATE SEE PAGES 68 AND 69



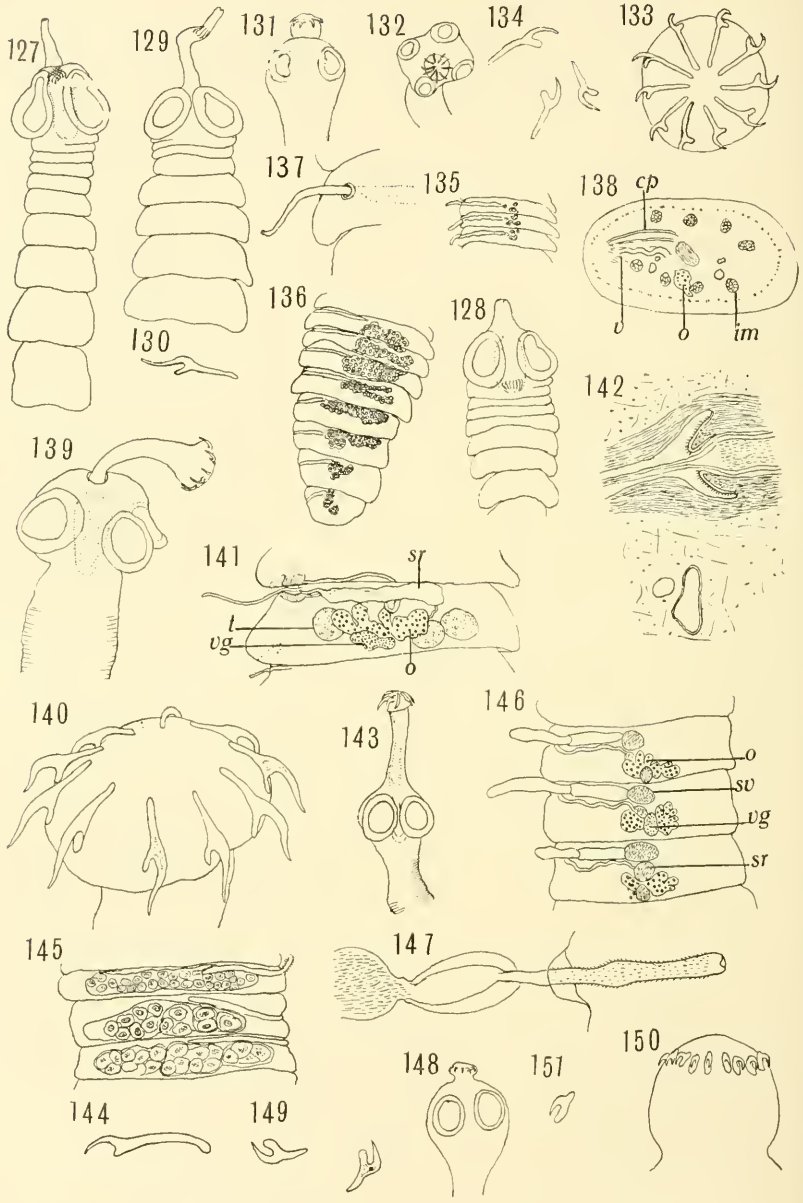

CESTODES OF WHISTLER DUCK, GULLS, AND MERGANSER

FOR EXPLANATION OF PLATE SEE PAGE 69



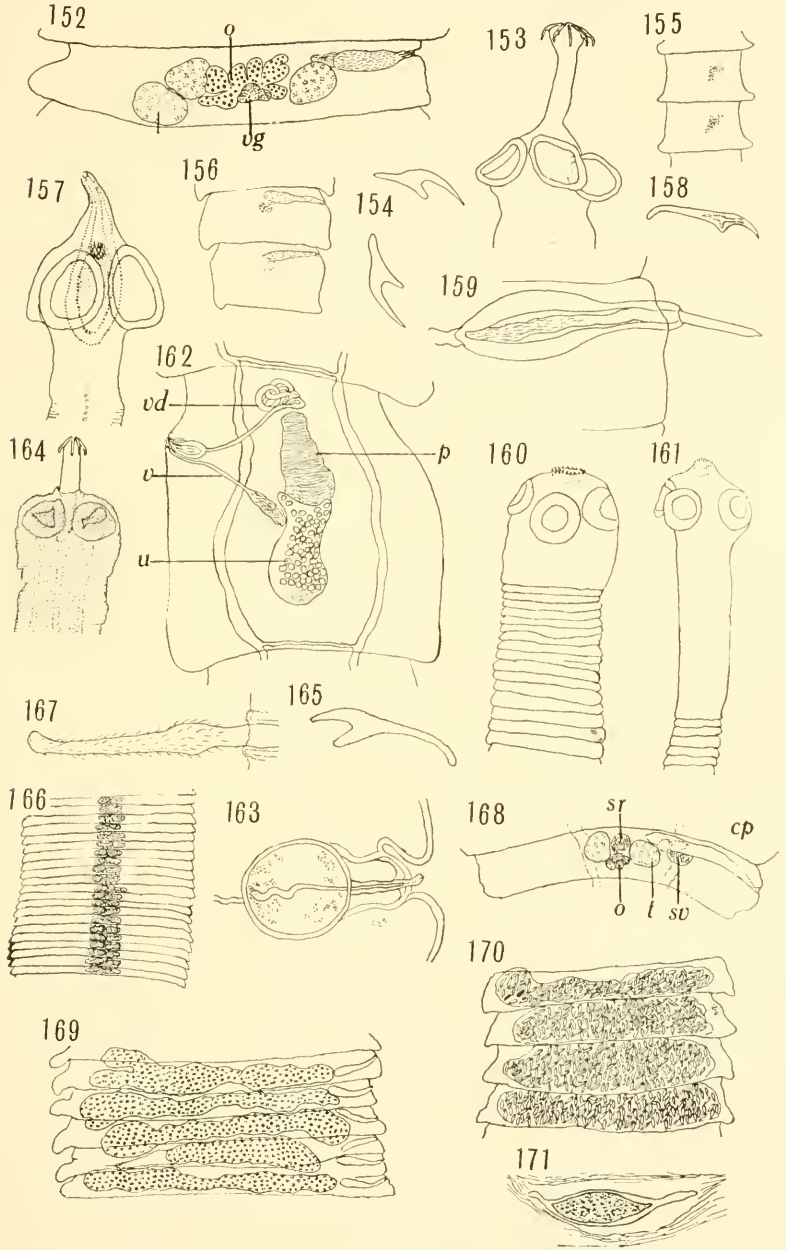

CESTODES OF MERGANSER AND AMERICAN POCHARD

FOR EXPLANATION OF PLATE SEE PAGE 70



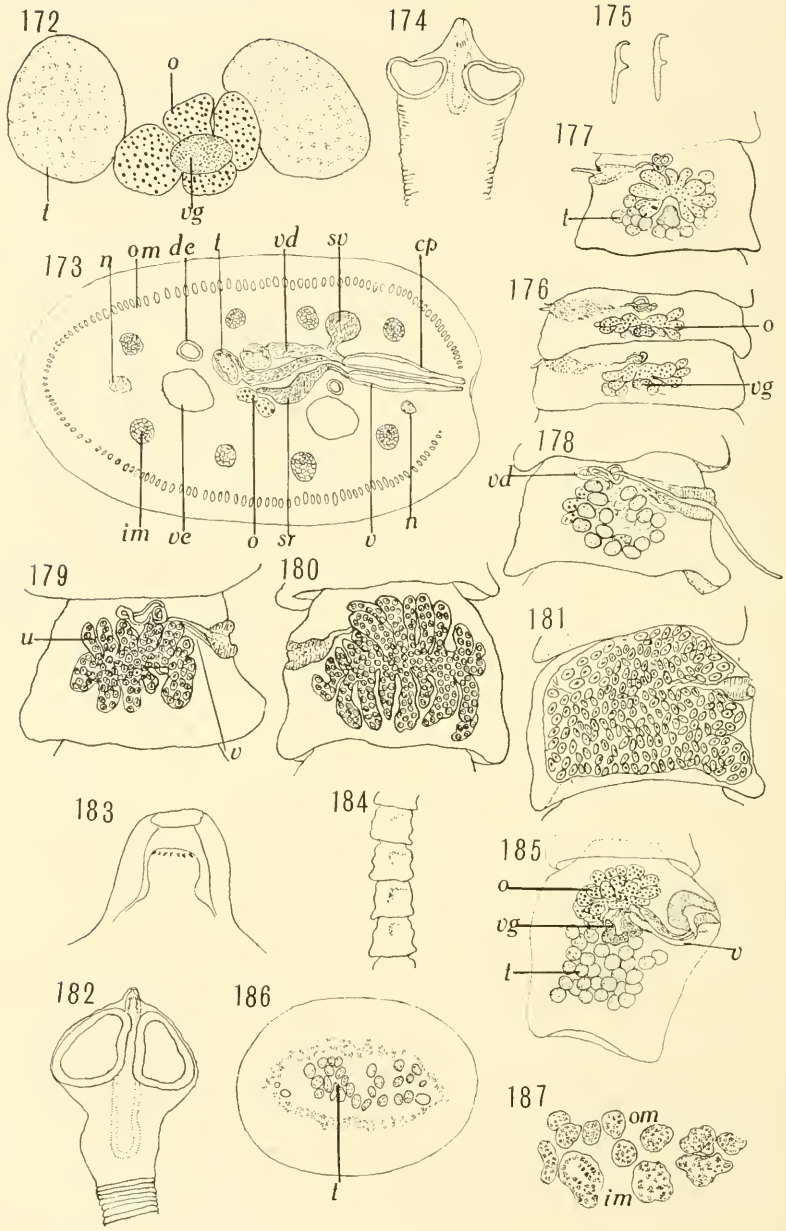

CESTODES OF AMERICAN POCHARD, GREBES, LOON, SCAUP DUCK, COOT, AND SCOTER

FOR EXPLANATION OF PLATE SEE PAGES 70 AND 71



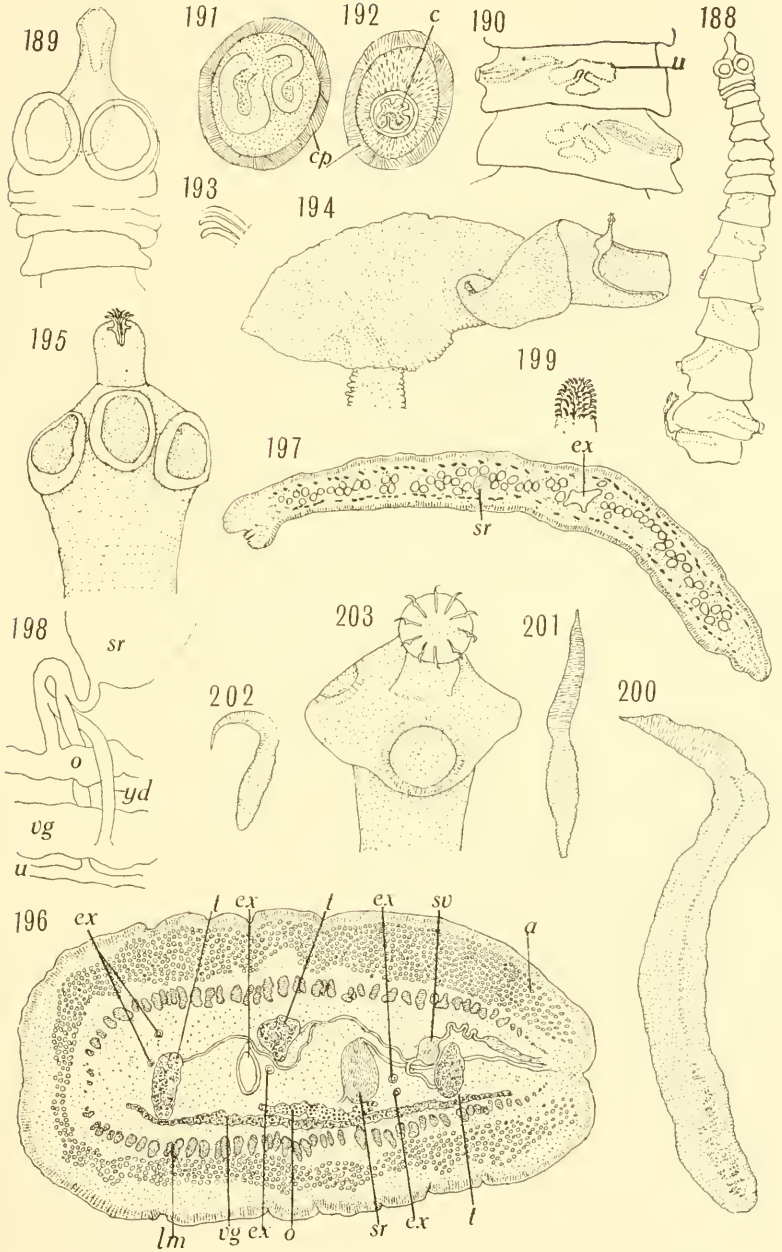

CESTODES OF SCOTER, GULL, COOT, YELLOW-BILLED CUCKOO, AND AMERICAN POCHARD

FOR EXPLANATION OF PLATE SEE PAGE 71



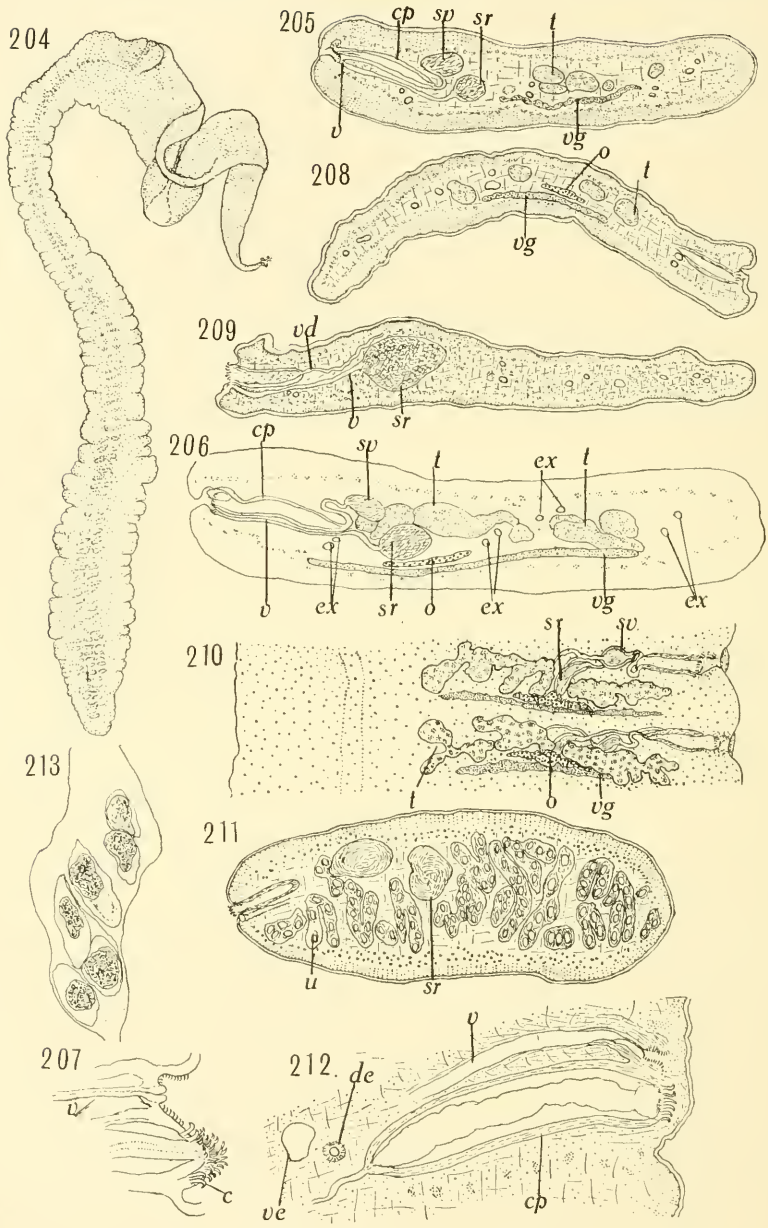

CESTODES OF AMERICAN POCHARD, NIGHT HERON, AND LOON

FOR EXPLANATION OF PLATE SEE PAGE 72



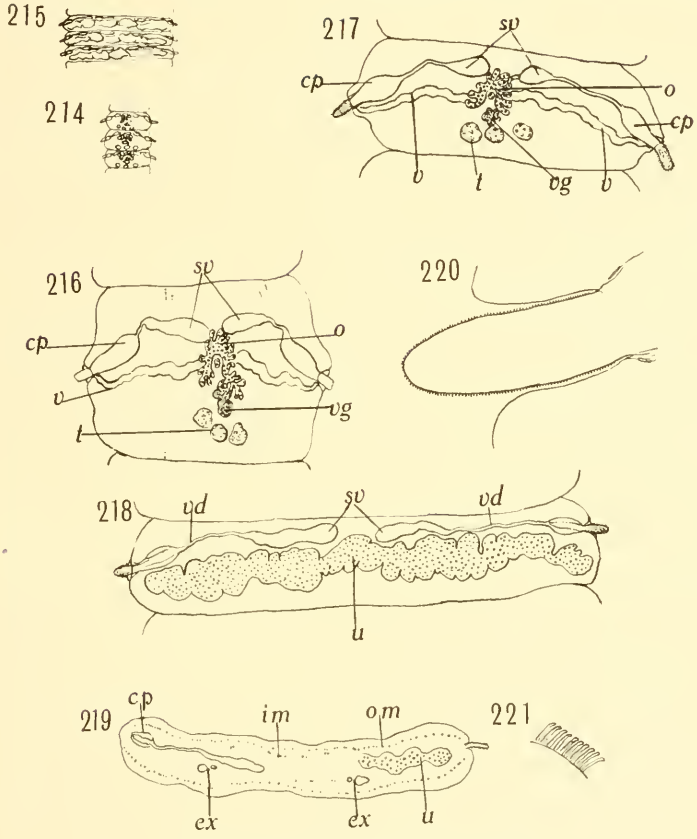

CESTODES OF SANDERLING, SHELDRAKE, SCOTER, AND OLD SQUAW

FOR EXPLANATION OF PLATE SEE PAGES 72 AND 73




CESTODES OF OLD SQUAW AND SCOTER

FOR EXPLANATION OF PLATE SEE PAGE 73




CESTODES OF AMERICAN POCHARD

FOR EXPLANATION OF PLATE SEE PAGE 73