

A PARTIAL SURVEY OF THE TREMATODES OF MANITOBA
WATER AND SHORE BIRDS

A THESIS

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ABSTRACT

Thirty seven trematode species are described from twenty six separate bird hosts. Six new species as well as six undetermined species are included. A new genus, *Xenisma*, is proposed for a new species belonging to the isolated genera of the family Echinostomatidae. The six new species are:

Parastrigea *neorobusta*, *Cotylurus* *mcleodi*, *Stephanoprora* *lari*, *Xenisma* *wardlei*, *Echinostoma* *platyrhynchi*, and *Echinostoma* *manitobensis*. The undetermined species are: *Mesostephanus* sp., *Plagiorchis* sp. 1, *Plagiorchis* sp. 2, *Astiotrema* sp., *Hindia* sp., and *Haematotrephus* sp.

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CHAPTER I

INTRODUCTION

This project was undertaken with a view to increasing our knowledge of the trematodes in the Province of Manitoba. Of necessity it was restricted to surveying a small segment of the animal life in the Province. Investigation of the water and shore birds was decided upon, as much material had already been collected from this group during a survey carried out to determine the varieties of cestodes in the Province by Neufeld (616).

The material examined was mainly that which was kindly given to the author by Mr. N. Neufeld, which had been collected by him along the Nelson and Hays Rivers in northern Manitoba, and at Whitewater Lake in southern Manitoba. Additional material was obtained by the author from the Netley marshes, south of Lake Winnipeg, and from Professor R. A. Wardle and Dr. J. A. McLeod from whom I was kindly loaned material which was already mounted. Birds brought in by hunters were examined for trematodes, and the trematode collection in the Zoology Department at the University of Manitoba was also employed in this survey.

Intensive work on schistosome dermatitis had been carried out in the Province by Wardle (475, 476), McLeod (306, 307,

309), McLeod and Little (310), and Swales (426), and much information, including life cycles on the schistosomes, was recorded. This information has been integrated into this work.

A resume on the helminthological work done in Manitoba has been included, as well as a summary of the research done across Canada on trematodes. It is hoped that this project will in some small way help to consolidate the work that has been done in Canada on the study of trematodes.

Twenty ~~six~~ bird hosts have been included in this survey, however due to the small number of birds examined, no definite conclusions can be made as to the host specificity of the parasites described.

CHAPTER II

HISTORICAL

The investigation of trematodes in Canada has been channeled towards the domesticated birds and animals, mainly from an economic point of view. However it has been realized for some time now, that to maintain our herds and flocks free of parasites, or to minimize them, we must know the life cycles of these parasites. Once this knowledge is gained, the weak link in the cycle can be determined, and we are then enabled to apply measures which can eliminate or reduce these parasites. Since these cycles include diverse types of life, we cannot limit our investigation to the domesticated animals, but must include the wild life as well.

In Canada, Allen (8, 9), Kennedy (251), Kingscote (254, 255), Knight (260), Law (282), Law and Kennedy (283) and Duff (153) have investigated the fur-bearing animals, however most of the investigation has centred on the parasitism of fishes. Lyster (292, 293, 294, 295), Bangham (25, 26, 539), Bangham and Venard (27, 540), Cameron (98, 99, 100, 101, 102, 103), Choquette (117, 118, 553), MacLulich (602), and Miller (609, 612) have covered the eastern portions of Canada quite intensively. In the west, Bangham and Adams (541) have checked the fresh water fish in British Columbia. Cooper (126) Heller (577), and McFarlane (298, 299) have checked the trem-

atode parasites of Canadian marine fishes, while Lyster (296), has done some investigating of Canadian sea mammals. One of the earliest workers in the field of Canadian parasitology was Stafford (649) who had investigated amphibians (412), fishes (413), marine vertebrates (415), and vertebrates in general (414). Cameron (550), Kingscote (256), Miller (611), and Parnel (369) also checked Canadian animals, the latter concentrating his study in the north eastern part of Canada. Miller (613) made a critical study of Stafford's early report on the parasites of Canadian animals. Ruminants have been investigated by Griffiths (673), Hadwen (184), Kingscote (256, 258) and Swales (424, 425), who reviewed the literature of Canadian helminthology up to 1933, restricting his study to the helminth parasites of domesticated and semi-domesticated mammals and economically important birds, (422, 423). Cannon (104, 105), investigated ducks, geese and starlings, Miller (610), pigeons, and Rayner (634) wild birds, in eastern Canada. In general, very little work has been done on the birds of Canada. In the Arctic areas, Brown et al (76) did some work at Igloolik in the North West Territories, while Cooper (127) investigated the trematodes and cestodes of the Canadian north as early as 1913. Cameron (97) looked into parasitism and public health in Canada. Hogarth (200) and Ross (391) reported bilharziasis in Canada, while Conklin and Baker (125) discovered the presence of the lancet fluke in 1930.

A break down of the helminthological investigations in Manitoba is as follows: (a)-Trematoda; Allen and Wardle (10) on a serious outbreak of infection of the dogs of northern Manitoba, McLeod (306, 307, 308, 309), McLeod and Little (310), Swales (426), and Wardle (475, 476), all of whom did quite extensive work on the schistosomes, with particular detail on schistosome dermatitis in the Province. *Prosthogonimus* was reported by Savage (395) in chickens. (b)-Cestoda; McLeod (305) investigated the genus *Citellus*, Kuitunen-Ekbaum (701), Nicholson (339, 340, 341, 342), Little (595), Newton (618), and Wardle (474) the fish, Boughton (545), the snowshoe rabbit, Riddle (637), the cats of Winnipeg, and Neufeld (616) the birds of Manitoba. (c)-Nematoda; Marchant (605) on the nemas of Manitoba soils, Smedley (699) marine and fresh water fish, and Rempel (635) who investigated the importance, overwinter survival, and geographic distribution of the internal parasites in sheep. (d)-Physiological and Technique; Green (572), Stewart-Hay (650), Harvey (576), and Wardle (671, 672, 673), all of whom confined their investigations to the cestoda. Hurst (584) investigated histological and toto-mount technique, using *Dibothriocephalus latus* and *Triaenophorus nodulosus* in his work as the availability of this material was extremely good.

Other trends in helminthological studies are as follows:

Histology; Ciordia (122), Monnig (333) and Willey (483). Germ cell cycles and embryology; Brook (72), Cort (134), Cort, Aneel, and Van der Woude (130, 131, 132, 561), Dingler (143), Dollfus (144), Hussey (226), and Linton (287), as well as Willey and Godman (486). Britt (69), Ciordia (555), Short (697), and Short and Menzel (698) have done very interesting and important work on the chromosomes of the digenetic trematodes. Physiology; Goodchild (571), Senger (640), Ferguson (165, 166), and Wilmoth and Goldfischer (487, 488).

Relatively little is known of the role that insects may have in the life cycles of the trematodes. One of the earliest reports of trematodes parasitizing insects was reported by Soparkar in 1918. Since then occasional articles appear of other cases. Crawford (137), and Peters (693) reported water beetles of the family Dytiscidae as being parasitized by Allocaeadium sp. of trematodes. Ono (361) discovered a plagi-orchid which used dragon flies in their life cycle. Soparkar (409), Brumpt (79), and van Thiel (663) investigated the role that mosquitoes play in the life cycles of trematodes, and Lakela (688) discussed the role of dragon fly nymphs in this.

The taxonomy of the digenetic trematodes is in a state of constant change. It is very difficult to assign many trematodes to their proper niches, as their life cycles have not as yet been determined. It is hoped that as the mysteries of these life cycles are solved, that a workable scheme for classific-

ation will evolve. In the field of taxonomy, the following have contributed valuable work; Byrd (87), Cort and Brackett (129), Faust (159, 162, 163), Lal (273), La Rue (281), Manter (324), McMullen and Beaver (542), Nicoll (344), Neiland (615), Skrjabin (405, 406), Stunkard (417), Ulmer (661), Ward (670), Willey (481, 483), Chandler (552), Cort (128), Dubois (564, 568), Barker (20), Hunter (582), and Kuntz (590).

Recently, Manter has published important studies on the zoogeography of the trematodes (603). His study was restricted to the marine fishes, as this group is the only one in which a sufficient amount of literature has been published of the trematodes which parasitize them. He discussed the following regions; European North Atlantic, Mediterranean, Red Sea, Woods Hole area, Tortugas area, New Zealand and Japan, as well as the Indian coasts. The Japanese area has been extensively studied by Yamaguti (498-512), and many of the specimens he discovered have not been found elsewhere.

Of extreme importance is the compiling of Index Catalogues by Stiles and Hassall (651) and more recently Hassall et al (652). This catalogue covers all articles which have been written on any form of parasitism whether it be protozoan or helminth. The author here makes the suggestion that a similar catalogue restricted to trematodes, and arranged by families

would greatly facilitate all phases of research on the study of trematodes.

CHAPTER III

MATERIALS AND METHODS

A good portion of the material used in this study had been collected in 1949 and 1950, and had been preserved in 5% formalin. Portions of this material were then immersed in M.A.S. (Mercuric-Acetic-Sulfate) fixative and A.F.A. (Alcohol-Formol-Acetic) fixative to determine the benefits, if any, of the use or non use of these fixatives on this material. The material was repeatedly washed in distilled water over a period of 24 hours to remove all traces of the formalin and other fixatives before staining. It was found that this procedure was sufficient for most of the material, however difficulties were encountered with the larger and more muscular trematodes. It was found that staining of these muscular trematodes was uneven and that the stained portions did not agree with the internal organs of the trematode in question. It was assumed that this was due to insufficient washing of the material to remove the last traces of the formalin.

In the case of fresh material, the intestinal tract of the bird was cut up into convenient sections in order to keep track of the locality from which the parasite was recovered. The small intestine itself was divided into three portions being designated 'upper', 'middle', and 'lower' small intestine. The contents of each portion was scraped into individual

containers, and continually washed in lukewarm water to remove as much of the suspended and dissolved material as was possible. After a suitable elapse of time, this to allow the heavier trematodes to settle to the bottom, the major portion of the water in the container was poured out. The container was filled with lukewarm water again, and the process was repeated. Finally, when the supernatant liquid was clear enough to see through, portions of the residue on the bottom of the container containing the trematodes, were poured into shallow glass dishes. By the use of a binocular microscope, the trematodes were removed from this residue, and placed into vials containing various fixatives. The majority of the specimens were stained with carmine which appeared to give the most satisfactory results. Good results were also obtained in staining small specimens with haematin.

Several hundred small echinostomes and strigeids were recovered from a Lesser Scaup duck, and the major portion of this material was used to experiment with several varieties of stains. The stains were employed either singly, or in various combinations with one another. It was from this investigation that the carmine stains appeared to be superior to all others with this material. However, a startling and possibly useful stain revealed itself in the case of using Wright's Triple Stain. Several strigeids and echinostomes were immersed

in this stain, and it was found that the vitelline follicles in the strigeid absorbed a brilliant green, leaving the rest of the specimen a light shade of pink. In the case of the echinostomes, they all assumed an overall lighter pink shade than the strigeids, and without the vitelline follicles absorbing any of the green as was noted in the case of the strigeids.

An unusual effect was noted in the case of removing a mounted specimen of Hypoderaeum conoideum from the slide. The specimen was immersed in xylol to remove the mounting medium and then put into fresh xylol. Accidentally the xylol evaporated completely leaving the specimen dry. On putting the specimen into beechwood creosote to clear it, the excretory system of the specimen appeared to be brought out. The clearing agent did not perfuse the specimen completely but left dendritic shapes which were laterally symmetrical in appearance. On standing further, it was seen that the clearing agent was slowly beginning to fill into the dendritic tubules. Photomicrographs were taken before the clearing agent obliterated all signs of the excretory system. Fig.1, page 12 shows this.

A method was discovered whereby the ventral glands on the notocotylids could be observed and counted. By removing the specimen under the binocular microscope, and applying a

PLATE I

Fig. 1. Excretory system of Hypoderaeum
conoideum x48



Fig. 1.

corner of some absorbent substance, such as a blotter, to remove the excess clearing agent, the glands were then seen to stand out in relief, and could very easily be observed.

The formulae and procedures of the fixatives and stains used to best advantage in this study were as follows:

Mercuric-Acetic-Sulfate (M.A.S.) fixative.

Mercuric chloride (saturated aqueous soln.)--98 ml.
 Glacial acetic acid----- 2 ml.
 Sodium sulfate----- 1 gm.

- (1)-Fix 1-2 $\frac{1}{2}$ hrs. depending upon size of specimen.
- (2)-Before staining, wash specimen in .5% iodine in 70% alcohol until iodine begins to remain in the wash solution.
- (3)-Specimen is ready for staining .

Alcohol-Formol-Acetic (A.F.A.) fixative.

Alcohol (50%)-----100 ml.
 Formalin (100%)----- 6.5 ml.
 Glacial acetic acid----- 2.5 ml.

- (1)-Leave specimen in fixative until it is opaque.
- (2)-No washing of specimen required prior to staining.
- (3)-Fixative is replaced with two changes of 50% alcohol, allowing 20 min. to 1 hour each time.
- (4)-Remove specimens to 70% alcohol, and they may remain here until ready to be stained.

Grenacher's Borax Carmine stain.

Carmine----- 3 gms.
 Borax (4% aqueous solution)-----100 ml.

- (1)-Boil carmine for half an hour in borax solution.
- (2)-Let stand at room temperature for 2 days, with occasional shaking.
- (3)-Filter.
- (4)-Mix filtrate with equal volume 70% alcohol.
- (5)-Filter next day.

To stain

- (a)-Leave specimen in stain from a few hours to a day depending upon size of the specimen.
- (b)-Pass into acidified 70% alcohol (1 ml. acetic acid per 100 ml. of alcohol).
- (c)-Leave specimen in for a day, or until tissue becomes translucent.
- (d)-Pass up the alcohol series (30%-50%-70%-80%-90%-95%-absolute alcohols) and mount specimen.

Ehrlich's Haematoxylin stain (original)

Glacial acetic acid-----	10 ml.
Haematoxylin-----	2 gms.
Potassium alum-----	in excess.
Distilled water-----	100 ml.
Absoluté alcohol-----	100 ml.
Glycerol-----	100 ml.

- (1)-Dissolve haematoxylin in acetic acid with 25 cc. of alcohol.
- (2)-Add glycerol and remaining alcohol.
- (3)-Dissolve alum in water with aid of heat.
- (4)-Slowly pour warm solution into haematoxylin.

- (5)-Expose solution to light and air for at least three weeks in order to ripen solution. When deep red color is acquired, stain is ready for use.

To stain

- (a)-Leave specimen in stain for 20 min.
 (b)-Wash in tap water until specimen appears blue.
 (c)-If overstained, redden for few seconds in acid water (10 drops concentrated H Cl per 100 ml. water), then blue again in tap water.
 (d)-Counterstain for 30-60 sec. in eosin (yellow)
 (e)-Rinse with distilled water.
 (f)-Pass rapidly up the alcohol series.

Haematin stain

(Potassium alum----- 50 gms) dissolve
 A(Distilled water-----1000 cc) first.

(Haematin----- 1 gm.) mix in
 B(95% alcohol----- 10 cc.) mortar.

- (1)-Add B to A slowly stirring.
 (2)-Add one small crystal of thymol as a preservative.
 (3)-Filter stain before using, each time.

To stain

- (a)-Bring specimen to be stained down to water stage of the alcohol series.
 (b)-Wash in distilled water, add stain, leave 1 hr.
 (c)-Wash in 3 changes tap water, 5 min. each time.
 (d)-Destain in 35% acid alcohol until blue changes to pink.

- (e)-Intensify in NH_4OH (2 drops per 500 ml. water) for 20 min.
- (f)-Wash several times in tap water.
- (g)-Take specimen back up alcohol series .
- (h)-Clear and mount.

Coelestin Blue B stain

Coelestin blue B-----	.5 gm.
Iron alum-----	5.0 gm.
Glycerol-----	14.0 ml.
Sulfuric acid (concentrated)-----	2.0 ml.
Distilled water-----	100.0 ml.

- (1)-Boil water, coelestin blue B, and iron alum 20 min.
- (2)-Allow to cool.
- (3)-Add glycerol and sulfuric acid.

To stain

- (a)-Stain specimen about 3 min.
- (b)-Rinse in water several times.
- (c)-Pass up the alcohol series, clear and mount.

Xylol based permount was the mounting medium used, while beechwood creosote was the clearing agent.

Literature consulted for this chapter was: (84), (173), (176), (179), (188), (311), (546), (638), (645, 646, 647, 648) and (6674).

CHAPTER IV

TAXONOMY AND DESCRIPTION

Classification of hosts

The classification used here is that of Wetmore (677). Identification of hosts was made by the use of Peterson's guides, (631, 632).

Class Aves-Birds

Subclass Neornithes-True birds

Superorder Neognathae-Typical birds

Order Gaviiformes-Loons

Family Gaviidae-Loons

Gavia immer-Common loon

Order Colymbiformes-Grebes

Family Colymbidae-Grebes

Colymbus holboelli-Holboell's grebe

Order Pelecaniformes-Tropic birds, Pelicans, allies

Suborder Pelecani-Pelecans, boobies, cormorants

Superfamily Suloidea-Boobies, cormorants & allies

Family Phalacrocoracidae-Cormorants

Phalacrocorax auritus-Double-crested cormorant

Order Anseriformes-Screamers, ducks, geese, swan

Suborder Anseres-Ducks, geese, and swans

Family Anatidae-Ducks, geese, and swans

Subfamily Anatinae-Surface feeding ducks

Anas platyrhynchos platyrhynchos-Mallard

Anas strepera-Gadwall

Anas acuta tzitzihoa-Pintail

Anas discors-Blue-winged teal

Spatula clypeata-Shoveller

Subfamily Aythyinae-Diving ducks

Aythya valisineria-Canvas-back duck

Aythya affinis-Lesser scaup duck

A. marila nearctica-Greater scaup duck

Glaucionetta albeola-Bufflehead

G. clangula americana-American golden-eye

Subfamily Merginae-Mergansers

Mergus serrator-Red-breasted merganser

Order Gruiformes-Cranes, rails and allies

Suborder Grues-Cranes, limpkins, trumpeter, rails

Superfamily Ralloidea-Rails

Family Rallidae-Rails, gallinules, coots

Fulica americana-Coot

Order Charadriiformes-Shorebirds, gulls, auks

Suborder Charadrii-Shorebirds

Superfamily Charadrioidae-Plovers, sandpipers

Family Scolopacidae-Woodcock, snipe & allies

Erolea melanotos-Pectoral sandpiper

Micropalma himantopus-Stilt sandpiper

Totanus flavipes-Lesser yellow-legs

Limnodromus griseus-Dowitcher

Limosa fedoa-Marbled godwit

Bartramia longicauda-Upland plover

Suborder Lari-Gulls, terns, skimmers

Family Laridae-Gulls, terns, skimmers

Subfamily Larinae-Gulls

Larus argentatus-Herring gull

Larus pipixcan-Franklin's gull

Larus delawarensis-Ring-billed gull

Subfamily Sterninae-Terns

Sterna hirundo hirundo-Common tern

Chlidonias nigra surinamensis-Black tern

Classification of trematodes

Phylum Platyhelminthes Claus, 1880

Class Trematoda Rudolphi, 1808

Subclass Digenea Van Beneden, 1858

Order Fasciolata Nicoll, 1936

Superfamily Paramphistomoidea Stiles & Goldberger,
1910

Family Paramphistomidae Fiscoeder, 1901

Subfamily Zygotylineae Stunkard, 1916

Genus Zygotytle Stunkard, 1916

Z. lunata (Diesing, 1836) Stunkard, 1916

Superfamily Notocotyloidea Nicoll, 1935

Family Notocotylidae Lühe, 1909

Subfamily Notocotylinae Kossack, 1911

Genus Notocotylus Diesing, 1839

Subgenus Notocotylus Dubois, 1951

N. t. triserialis Diesing, 1839

Subgenus Hindia Lal, 1935

Hindia species

Superfamily Cyclocoeloidea Henry, 1923

Family Cyclocoelidae Kossack, 1911

Subfamily Cyclocoelinae Stossich, 1902

Tribe Haematotrephea Witenberg, 1926

Genus Haematotrepheus Stossich, 1902

Haematotrepheus species

Superfamily Echinostomatoidea Faust, 1929

Family Echinostomatidae Poche, 1926

Subfamily Echinostomatinae (Looss, 1899)

Genus Echinostoma Rudolphi, 1809

E. revolutum (Frölich, 1802) Looss, 1899

E. platyrhynchi n. sp.

Genus Echinoparyphium Dietz, 1910

E. elegans (Looss, 1899)

Subfamily Echinochasminae Odhner, 1910

Genus Echinochasmus Dietz, 1909

E. manitobensis n. sp.

Subfamily Echinochasminae (cont'd)

Genus Stephanoprora Odhner, 1902

Stephanoprora lari n. sp.

Isolated genera

Genus Hypoderaeum Dietz, 1909

Hypoderaeum conoideum (Block, 1782) Dietz,
1909

Genus Petasiger Dietz, 1909

Petasiger chandleri Abdel-Malek, 1952

Genus Drepanocephalus Dietz, 1909

Drepanocephalus spathans

Genus Xenisma nom. nov.

Xenisma wardlei n. sp.

Family Cathaemasiidae (Fuhrmann, 1928)

Subfamily Cathaemasiinae Dollfus, 1950

Genus Cathaemasia Looss, 1899

Cathaemasia nycticoracis Olsen, 1940

Superfamily Plagiorchioidea Dollfus, 1930

Family Plagiorchidae Lühe, 1901

Subfamily Plagiorchinae Pratt, 1902

Genus Plagiorchis Lühe, 1899

Plagiorchis sp. 1.Plagiorchis sp. 2.

Genus Astiotrema Looss, 1900

Astiotrema sp.

*Family Brachylaemidae Joyeux and Foley, 1930

Subfamily Leucochloridiinae Poche, 1907

Genus Leucochloridium Carus, 1835

L. cyanocittae McIntosh, 1932

Order Strigeata La Rue, 1926

Supersuperfamily Strigeida Poche, 1925

Superfamily Strigeides Dubois, 1936

Subsuperfamily Strigeines Dubois, 1936

Family Strigeidae Railliet, 1919

Subfamily Strigeinae Railliet, 1919

Subsubfamily Strigeini Dubois, 1936

Genus Parastrigea Szidat, 1928

Parastrigea neorobusta n. sp.

Subsubfamily Cotylurini Dubois, 1936

Genus Cotylurus Szidat, 1928

Cotylurus communis Hughes, 1928) La Rue,
1932

C. cornutus (Rudolphi, 1808) Szidat, 1928

C. brevis Dubois and Rausch, 1950

C. Erraticus (Rudolphi, 1809) Szidat, 1928

C. mcleodi n. sp.

Subsuperfamily Diplostomines Dubois, 1936

Family Diplostomidae Poirier, 1886

Subfamily Diplostominae Monticelli, 1888

Subsubfamily Diplostomini Dubois, 1936

Genus Diplostomum v. Nordmann, 1832

D. huronense (La Rue, 1927) Hughes, 1929

D. spathaceum (Rudolphi, 1819) Braun, 1893

D. pelmatoides Dubois, 1932

D. baeri Dubois, 1937

D. gavium (Guberlet, 1922) Hughes, 1929

Genus Posthodiplostomum Dubois, 1936

P. prosostomum Dubois and Rausch, 1948

Superfamily Cyathocotylides Dubois, 1936

Family Cyathocotylidae Poche, 1925

Supersubfamily Prohemistomidi Dubois, 1938

Subfamily Prohemistominae Lutz, 1935

Subsubfamily Prohemistomini Dubois, 1938

Genus Mesostephanus Lutz, 1935

Mesostephanus sp.

*Family Schistosomatidae Looss, 1899, emend. Poche,
1907

Subfamily Schistosomatinae Stiles & Hassall, 1898

Genus Ornithobilharzia Odhner, 1912

O. filamenta McLeod, 1940

O. aviani McLeod, 1940

Genus Austrobilharzia Johnston, 1917

A. lari (McLeod, 1937) Penner, 1953

A. canadensis (McLeod, 1936) Penner, 1953

A. manitobensis (McLeod, 1936) Penner, 1953

Subfamily Bilharziellinae Price, 1929

Genus *Trichobilharzia* Skrjabin & Zakharow, 1920T. querguedulae (McLeod, 1937) Wu, 1953

Families marked with an asterisk (*), are not meant to be included in the superfamilies appearing above them.

Detailed description

Family Paramphistomidae

Zygocotyle lunata (Diesing, 1836) Stunkard, 1916

Several specimens of Z. lunata were obtained from the lower small intestine of the Lesser scaup duck Aythya affinis, the intestinal caecae and small intestine of the Pintail Anas acuta, and the intestinal caecae of the Mallard Anas p. platyrhynchos. As far as can be ascertained, this is the first report of Z. lunata from the Lesser scaup and Pintail. It has been reported previously from the following hosts:

Baldpate-Mareca americana (149)
 Blue-wing teal-Anas discors (532)
 Domestic duck-A. platyrhynchos (139), (6655), (149)
 Black duck-A. rubripes (104), (1149)
 Green-wing teal-A. carolinensis (374)
A. boschas (617)
A. melanotus (680), (374)
A. ipecuteri (680), (374) (104)
 Domestic goose-Anser a. domesticus (374), (617), (139),
 Domestic chicken-Gallus gallus (90), (617)
 Red-head duck-Aythya americana (149), (374)
 Wild turkey-Meleagris gallopavo intermedia (641)
 Curlew-Namenius a. arcuata (139)
 Wilsons snipe-Capella gallenago gallenago (374)
Himantopus wilsonii (374), (680)
 Ox-Bos taurus (139), (374), (387), (617)
 Elk-Cervus dichotomus (374), (563), (617)

Many of the specimens recovered from the intestinal tract were still alive. This was very interesting due to the hosts having been dead for two days prior to the recovery of the worms. Unfortunately time did not permit the investigation of how long the worms could have survived under these abnormal conditions of temperature.

Figs. 10 and 11, page 44, show the aspects of two specimens varying greatly in size. Comparisons of the dimensions of these two specimens with those of specimens from various sources are shown in Table I, page 26. Fig. 15, page 45, shows the convolutions of the caecae in an immature specimen. Figs. 16 and 17, page 45, are photomicrographs of a specimen obtained from Pintail duck.

Willey (485) in his study of the life cycle and bionomics of Z. lunata, discovered that flukes of the same age vary in size according to the number within the host. They apparently continue growing long after attaining sexual maturity. Range in size is from 3.1 by 1.4-9.2 by 4.7 mm.

One other species of this genus has been reported by Dollfus (146) from the dugong, Dugong dugong. Hilmy (578) described four new Paramphistomes from the dugong under the names Solenorchis travassosi, S. gohari, S. naguilmahfouzi and S. baeri. However Dollfus, stating that the pharyngeal pouches are difficult to see, and may have atrophied, trans-

TABLE I

COMPARISON OF MEASUREMENTS OF ZYGOCOTYLE LUNATA FROM VARIOUS SOURCES

	*	**		***	****
	Freedman Mallard Manitoba	Freedman Mallard Manitoba	Caballero Chicken Mexico	Price Ox Panama	Price W. snipe Texas
Length	3.870	7.304	9.000	6.000	3.000
Width	1.260	2.573	2.900	3.000	1.500
Or. sucker	0.158 d.	0.225 d.	0.253 d.	0.650	0.286 d.
Ph. pouches	0.113 x 0.072	0.338 x 0.199	0.351 x 0.234	0.250 x 0.130	0.130 x 0.065
Esophagus	0.360	0.498	1.170	0.455	0.260
Esophageal bulb	0.144 x 0.135	0.485 x 0.291	0.390 x 0.292	0.416 x 0.260	0.169 x 0.156
Anterior testis	0.270 x 0.270	0.415 x 0.664	0.975 x 1.404	0.650 x 0.390	0.364 x 0.221
Posterior testis	0.265 x 0.270	0.341 x 0.747	0.994 x 1.267	0.650 x 0.520	0.390 x 0.234
Ovary	0.090 x 0.180	-----	0.409 x 0.624	0.156 x 0.260	0.143 x 0.091
Acetabulum	1.035 x 0.630	1.743 x 1.079	1.925 x 1.500	1.100 x 1.200	0.550 x 0.520
Gen. pore to anterior	0.793	1.700	2.200	-----	-----
Eggs	0.045 x 0.090	1.088 x 0.083	0.151 x 0.098	0.143 x 0.090	0.125 x 0.075

All measurements in mm.

- * Specimen shown in Fig. 10, page 44.
- ** Specimen shown in Fig. 11, page 44.
- *** Maximum dimensions given, Price (374).
- **** Same as preceding line. (Wilson's snipe).

ferred the four new species to the genus *Zygocotyle*, claiming that they were the same as the specimens which he obtained from the dugong, with slight individual differences. Hilmy had erected the new subfamily Solenorchinae, and new genus Solenorchis to contain the apparent new species. These are now invalidated by Dollfus naming the five supposed varieties *Z. travassosi* (Hilmy, 1949) Dollfus, 1950.

Other literature consulted was: (89), (142), (171), (264), (286), (337), (406), (410), (451, 452), (469), (482), (484, 486), (500), (604), (679), (680), (682), (687).

Family Notocotylidae Lühe, 1909

Notocotylus triserialis triserialis Diesing, 1839

Specimens were obtained from the small intestine, caeca, and rectum of the Mallard, Pintail, Shoveller, and Lesser scaup. Many species of *Notocotylus* have been reported, however it appears to the writer, after examining the literature, that many are synonymous. Dubois (149) has made a detailed study of this group, reducing *N. intestinalis*, *N. stagnicolae*, and *N. urbanensis* to synonymy with *N. t. triserialis*. This species has been reported from the Blue goose (*Chen caerulescens*) (104), Wood duck (*Aix sponsa*) (189), Muskrat (*Fiber zibethicus*) (189), (260), (636).

Table II, page 28, compares a typical specimen collected

TABLE II

COMPARISON OF MEASUREMENTS OF NOTOCOTYLUS TRISERIALIS
TRISERIALIS FROM VARIOUS SOURCES

	Freedman* Shoveller Manitoba	Wu** Experimental Ottawa	Dubois*** Mallard & Shov. Wisconsin
Length	4.750	4.32	2.64
Width	1.140	1.10	0.070
Esophagus	0.40	0.18	0.145
Oral sucker	0.19 x 0.19	0.15 x 0.19	0.115 x 0.140
Cirrus	0.75 x 0.03	-----	-----
Testes	0.60 x 0.28	0.69 x 0.33	0.360 x 0.210
Ovary	0.28 x 0.28	0.25 x 0.20	0.180 x 0.180
Ventral glands	14 15 14	16-19, 14-16, 16-19	14-16, 14-15, 14-16
Metraterm	0.180	0.125	0.566
Cirrus pouch	1.70	-----	0.850 x 0.085
Egg	-----	0.023 x 0.013	0.021 x 0.013

All measurements in mm.

* Specimen shown in Fig. 3, page 31.

** Wu (497)

***Dubois (149)

by the writer, with several others reported in the literature. A typical specimen, Fig. 3, is pictured on page 31, while Figs. 6 and 7 on page 32 show the anterior and posterior aspects respectively.

Literature consulted was: (30, 31), (45), (65), (139), (149), (19), (46, 48), (104), (175), (189), (192), (195), (196), (197), (134), (268), (270, 271), (283), (289), (291), (325), (331), (334), (345), (427), (434), (436, 437), (461), (497), (498), (500, 502, 508, 509), (513), (555), (418), (617), (655), (642), (644), (669, 670), (679), (681), (695), (649), (684).

Hindia species

Two specimens were recovered from the intestinal caeca of the Coot (Fulica americana). Due to the size and opacity of the specimens, it was extremely difficult to differentiate most of the internal organs. However, sufficient details were observed to place this species in the genus Hindia by the use of Dubois' key (149). The dimensions are as follows: Length-2.40, Width-1.40, Esophagus-0.25, Oral sucker-0.22 by 0.16, Cirrus-0.60 by 0.03, Bifurcation of caecae to first of the median glands-0.28, Distance of vitellaria from extreme anterior-1.30, Testes (not distinct)-0.30 by 0.20, Ovary-0.26 by 0.21, Ventral glands-lateral 11, median 8 or 9?. Distance of vitellaria to lateral border-0.25, Metraterm-

0.55, Distance between genital pore and bifurcation of the caecae-0.07, Cirrus pouch-0.55. The uterus appeared to be intracecal, while the vitellaria extended from the lower borders of the testes to about the middle of the length of the body of the specimen. No spines were seen on the cuticle.

Literature consulted was: (12), (33), (82), (272), (427), (548), and (348). These specimens are shown in Figs. 4 & 5, page 31.

Family Cyclocoelidae

Haematotrephus species

Three specimens were found in the body cavity of the Upland plover (Bartramia longicauda). Witenberg's classification (490) is followed here. Dimensions in mm. of one specimen are as follows: Length-8.231, Width at oral sucker-0.660, Width at widest part-1.485, Oral sucker-0.165 by 0.221, Length of esophagus-about 0.945, Ovary-0.429 by 0.264, Anterior testis-round 0.363 diam., Posterior testis-ovoid 0.495 by 0.363, Eggs-0.099 by 0.050. Vitellaria extend extracecally from about the level of the bifurcation almost to the excretory cavity at the extreme posterior.

Fig. 2 on page 31 shows the complete specimen, while Figs. 8 and 9 on page 33 show details of the anterior and posterior portions respectively.

Literature consulted here was: (19), (78, 80), (71), (93), (145), (168), (172), (180), (189), (244, 245), (253), (266),

PLATE II

Fig. 2. Haematotrephus species from the
body cavity of the Upland plover
Bartramia longicauda. Ventral view.

Fig. 3. Notocotylus triserialis triserialis
from the Shoveller duck. Ventral view.

Fig. 4. Hindia species. Ventral view.

Fig. 5. Hindia species. Lateral view.



FIG. 2

1.0
mm.

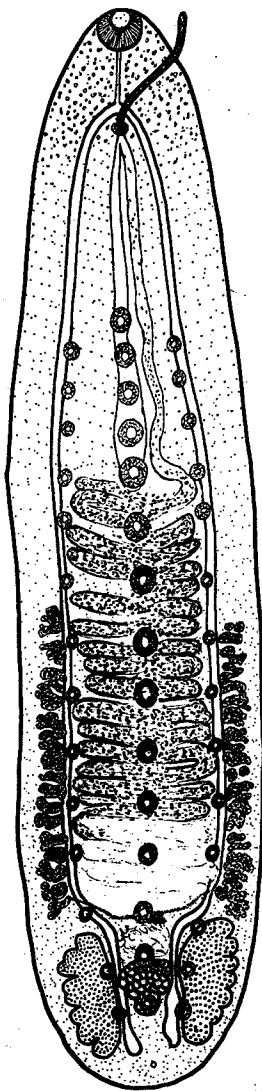


FIG. 3

1.0
mm.

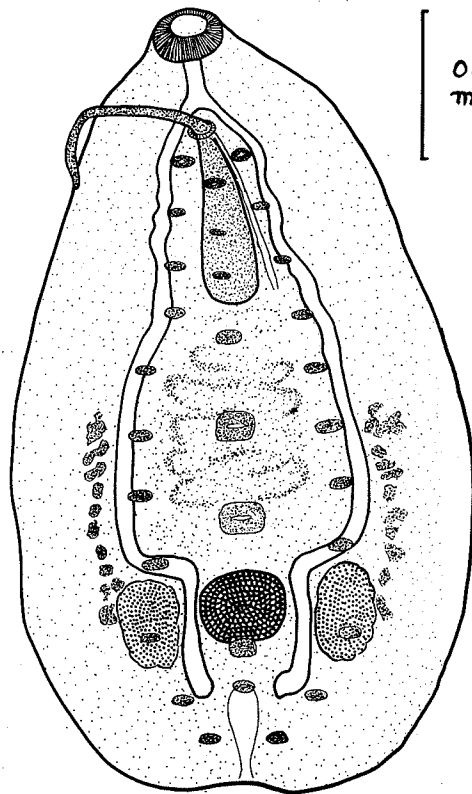


FIG. 4

0.5
mm.

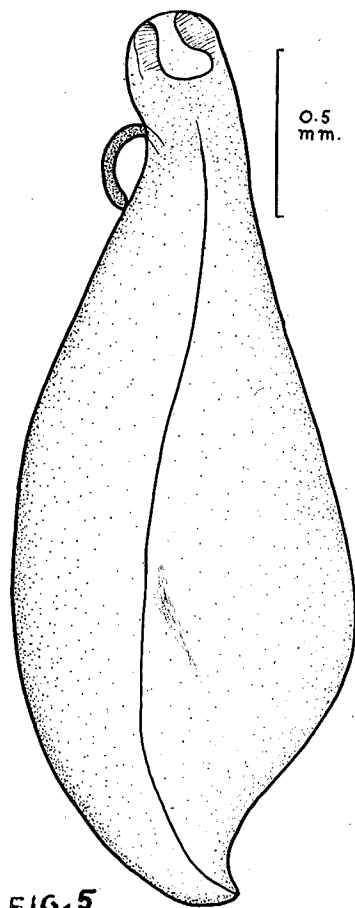


FIG. 5

0.5
mm.

PLATE III

Fig. 6. Photomicrograph anterior portion of
Notocotylus t. triserialis.

Ventral view. x35.

Fig. 7. Photomicrograph posterior portion of
Notocotylus t. triserialis.

Ventral view. x35.



Fig. 6



Fig. 7

PLATE IV

Fig. 8. Photomicrograph anterior portion of
Haematotrephus species.

Ventral view. $\times 45$

Fig. 9. Photomicrograph posterior portion of
Haematotrephus species.

Ventral view. $\times 53$.



Fig. 8

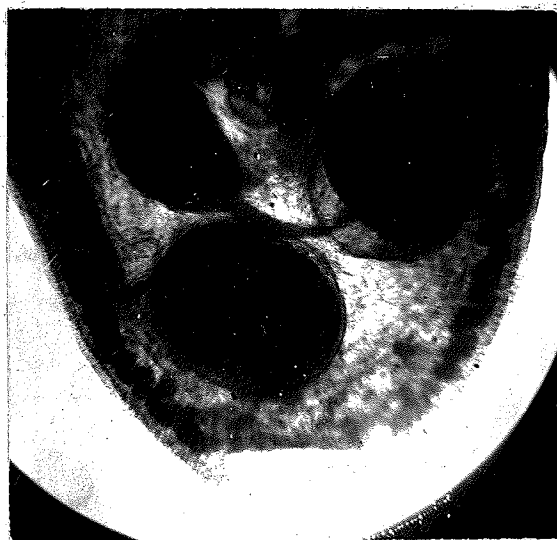


Fig. 9

(236), (325), (348), (443, 444), (447, 446, 450), (456),
 (491), (492), (498), (407), (461), (500), (509), (530),
 (617), (644), (654), (679), (687).

Family Echinostomatidae

Echinostoma revolutum (Fröhlich, 1802) Looss, 1899

Several specimens were recovered from the large intestine of the Canvas-back duck, and were found to agree quite closely to the descriptions given by various authors. Following are the dimensions in mm. of a typical specimen: Length-13.308, Width at level of ovary-1.578, Oral sucker-0.421 diam., Pharynx-0.526 by 0.316, Esophagus-0.894 by 0.263, Acetabulum-0.947 diam, Cirrus pouch-0.631 by 0.263, Cirrus-0.526 by 0.105, Ovary-0.421 diam., Shell gland complex-0.579 diam., Anterior testis-0.868 by 0.631 ovoid, Posterior testis-0.857 by 0.631 ovoid, Distance between Shell gland complex and anterior testis-0.158, Distance between testes-0.211, Eggs-numerous 0.079 by 0.052. Vitellaria extend from the level of the posterior margin of the acetabulum to within 0.316 of the posterior end of the worm. Two worms are shown on page 46, Figs. 18 and 19.

Literature consulted: (14), (34), (36), (51), (94),
 (113), (120), (121), (131), (140), (157), (234), (235), (240),
 (278), (332), (389), (394), (405), (457), (460), (461), (470),

(498), (500), (520), (521), (524), (607), (636), (640).

Echinostoma platyrhynchi n. sp.

A single specimen was recovered from the intestinal ceca of a Mallard. It has very close affinities to E. robustum as pictured by Yamaguti (502). The main differences are to be noted in the greater lobulation of the testes, and the lower situation of the genital organs in E. robustum. The eggs in E. platyrhynchi are only about half as large as those in E. robustum. The dimensions in mm. of E. platyrhynchi are as follows: Length-6.656, Width at acetabulum-0.845, Width at ovary-1.152, Collar-0.410, Oral sucker-0.166 diam. subterminal, Pharynx-0.205 by 0.128, Esophagus-0.435, Genital pore-0.094 by 0.128, Cirrus pouch-0.358 by 0.230, Acetabulum-0.538 diam., Distance between acetabulum and anterior end-1.024, Distance between acetabulum and ovary-1.536, Ovary-0.256 diam., Shell gland complex-0.128 by 0.358, Anterior testis-0.358 by 0.259, Posterior testis-0.512 by 0.256, Distance between testes-0.044, Distance between testes and posterior end-2.202, Spines-0.651 by 0.248 approximately 36, 2 rows, with 6 corner spines, Vitelline follicles-0.065 diam, Vitellaria extend from about 0.15 below acetabulum to within 0.205 of the posterior end. Eggs-0.054 by 0.031 numerous. Fig. 21, page 46.

Literature consulted here:(502), (534).

Echinoparyphium elegans (Looss, 1899)

Over 460 specimens were recovered from the upper third portion of the small intestine of a Lesser scaup. At the same time over 193 specimens of Cotylurus brevis were obtained from the same location, as well as 4 specimens of Xenisma wardlei n.g., n.sp. Several views are depicted on page 47, Figs. 23 to 25. Figs. 39 to 43 page 66, show the crown spines in greater detail, while Fig. 95, page 88, shows 6 specimens arranged according to the maturity of the specimen. They were picked at random, and after arranging them it became apparent that the distance between the oral sucker and the anterior border of the acetabulum remained virtually constant. It was thought that this was an indication that growth in the species took place posterior to the acetabulum. Thirty eight specimens were then projected and enlarged by means of a photographic micro enlarger, and the following dimensions were scaled off in centimeters for convenience: Length, width, distance between posterior border of posterior testis to posterior end of worm, and distance between the oral sucker and the anterior border of the acetabulum. The specimens ranged in length from 1.65 mm. to 3.16 mm. The graph on page 37 shows a scatter diagram of all the above mentioned dimensions plotted against the length of the specimen. In studying this scatter diagram it is seen at once that the relationship is

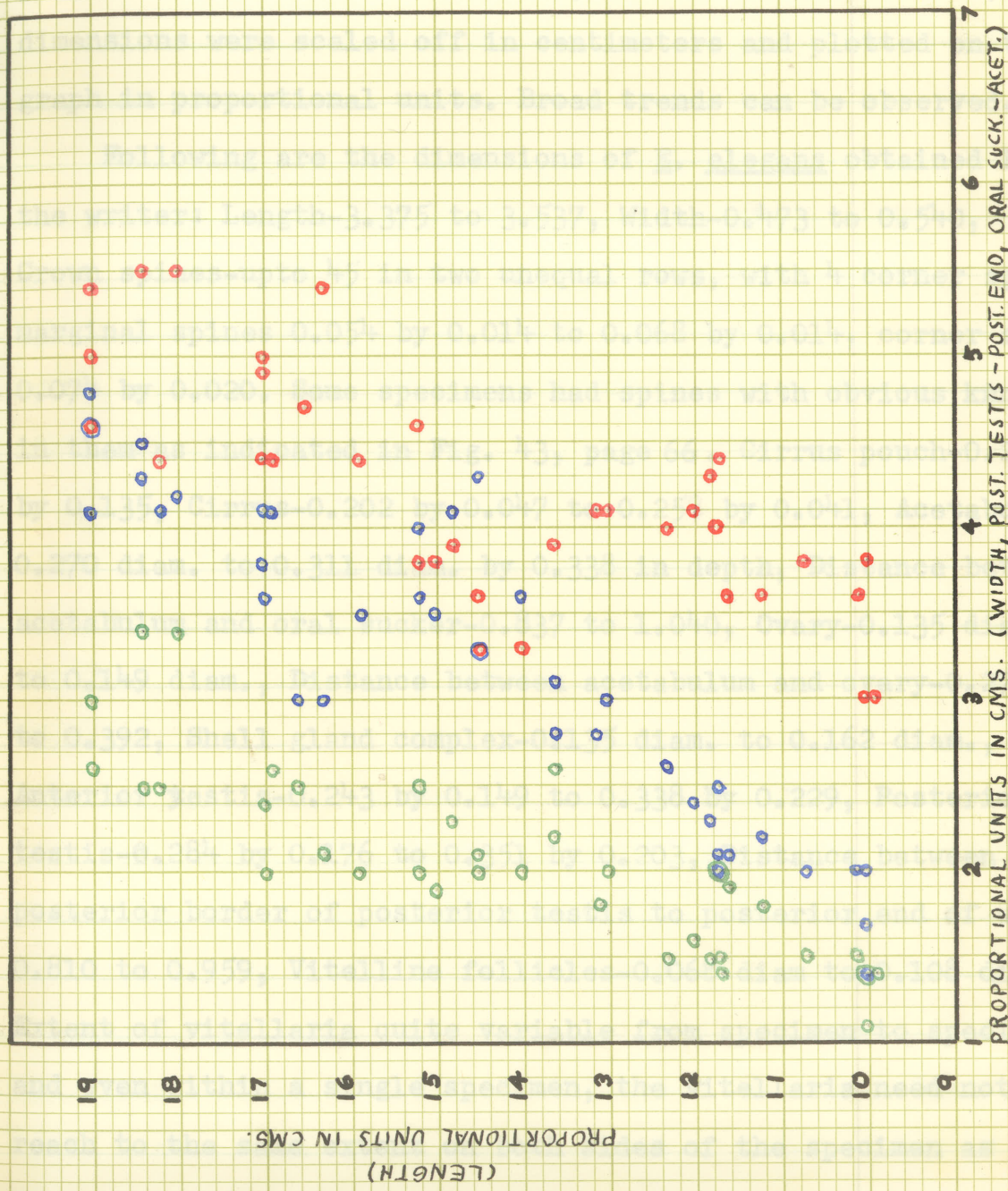


Fig. 14

not simple as was supposed originally when studying the specimens arranged in Fig. 95, page 88. Magnification of the projected specimens was 60 times, and as mentioned above, the dimensions were scaled off in centimeters and plotted on the graph in proportional units. Broad trends can be observed.

Following are the dimensions of E. elegans obtained by the writer: Length-3.375 to 3.537, Width-0.473 to 0.540, Crown spines-upto 45 in two unequal rows, with 4 corner spines, marginal spines 0.054 by 0.014 to 0.068 by 0.014, corner sp. 0.074 by 0.020. Some specimens had spines with obvious kinks in them as indicated in Fig. 43, page 66. Cirrus pouch-0.243 by 0.135, Cirrus-0.202 by 0.047 to 0.258 by 0.041, Acetabulum-0.270 diam. to 0.311 diam. by 0.338 in depth, Distance between acetabulum and oral sucker-0.837 to 1.040, Ovary-0.135 diam. to 0.149 diam., Distance between acetabulum and ovary-0.270 to 0.392, Shell gland complex-0.135 diam. to 0.162 diam., Anterior testis-0.243 by 0.149 to 0.338 by 0.229, Posterior testis-0.284 by 0.176 to 0.351 by 0.203, Distance between posterior border of posterior testis to posterior end of worm-0.810 to 0.959, Vitelline follicles-0.068 diam to 0.108 diam., Extent of vitellaria quite variable from specimen to specimen, and even within a single specimen, the vitellaria need not reach to the same extent on both sides of the specimen as Fig. 23 page 47, indicated. Oral sucker-0.041 diam. to 0.068

diam., Prepharynx-0.057 by 0.016 to 0.095 by 0.014, Pharynx-0.068 by 0.054 to 0.096 by 0.054, Esophagus-0.675 by 0.673 by 0.054, Eggs-0.068 by 0.057 to 0.081 by 0.047 (15-20 eggs).

All measurements are in mm., and all specimens measured were adults.

Literature consulted: (1), (15), (21), (38, 42), (50), (52), (142), (198), (202), (201), (217), (236), (249), (250), (139), (260), (263), (276), (330), (352, 353), (389), (393), (394), (420), (441), (463), (461), (465), (480), (498), (500), (509), (515), (522), (523), (525, 526), (614), (633), (657), (641), (679), (687).

Echinochasmus manitobensis n. sp.

This was obtained from the intestinal ceca of the Pintail duck, and is depicted in Figs. 20, and 38 pages 46 and 65, respectively. The dimensions in mm. are as follows: Length-1.951, Width at level of acetabulum-0.405, Width at level of ovary-0.474, Width at level of posterior testis-0.405, Width near posterior end of worm-0.284, Collar-0.221, Oral sucker-0.079 by 0.075, Prepharynx-absent, Pharynx-0.095, Esophagus, 0.237 by 0.008, Crown spines-0.039 by 0.016 (19), Body spines-0.015 by 0.010, Acetabulum-0.269 diam., Ovary-0.095 diam., Shell gland complex-0.032 by 0.071, Anterior testis-0.158 by 0.229, Posterior testis-0.219 by 0.198,

Distance between posterior border of acetabulum and anterior border of ovary-0.024, Distance between testes-0.008, Eggs-approximately 10, 0.074 by 0.050. This species shows very close affinities to E. perfiolatus the chief differences being no prepharynx, and eggs about $\frac{3}{4}$ the size found in E. perfiolatus, in E. manitobensis.

Literature consulted: (22, 23, 24), (41), (199), (252), (139), (246), (263), (323), (232), (277), (232), (335), (377), (338), (265), (321), (404), (407), (461), (439), (440), (445), (458), (461), (465), (468), (493), (498), (509), (514), (633), (679) and (687).

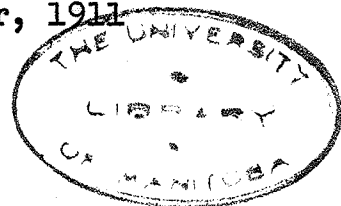
Stéphanoprora lari n. sp.

Twenty three specimens were obtained from the intestinal tract of several Herring gulls. Fig. 22, page 47, shows the morphology of this species. Dimensions in mm. are as follow: Length-6.327, Width-0.444, Oral sucker-0.088 by 0.085, Prepharynx-0.133 by 0.022, Pharynx-0.088 diam., Esophagus-0.488 by 0.067, Genital pore-0.065 diam. and 0.065 from acetabulum, Cirrus pouch-0.155 by 0.089, Acetabulum- 0.266 diam. and 0.599 from anterior border of ovary, Ovary-0.167 diam. and 0.266 from shell gland complex, Shell gland complex-0.155 diam., and 0.044 from anterior testis, Anterior testis-0.466 by 0.222, Posterior testis-0.511 by 0.225, Distance

between testes-0.178, Distance between posterior border of posterior testis to posterior end of worm-2.442, Vitellaria extend to within 0.222 of posterior end, Vitelline follicles-0.18 by 0.062, Crown spines-at least 16 (most of the specimens were deficient in spines) 0.044 by 0.020, Eggs-6 to 8, 0.067 by 0.040.

Following, is a key to the genus *Stephanoprora* Odhner, 1910, modified after the key given by Beaver (35) to contain the new species *S. lari*:

1. (2) Cephalic spines 26 in number-ornata Odhner, 1902
2. (3) Cephalic spines 24 in number-ozakii (Asada, 1926)
3. (1,2) Cephalic spines 22 or less in number-----4
4. (11) Vitellaria distinctly post. to junct. of testes-5
5. (6) Acetabulum wider than body-singularis (Lutz, 1924)
6. (5) Acetabulum not wider than body proper-----7
7. (10) Angle spines distinct from border spines-----8
8. (9) Vitellaria extend to middle of
posterior testis---denticulatus (Rud., 1802)
9. (7) Vitellaria confined to post-
testicular region-microcestius (Kurova, 1927)
10. (4) Angle spines not distinct from
border spines-----pendula (Looss, 1899)
11. (3) Vitellaria at junction of testes or more ant.---12
12. (15) Uterus very short, being less than length of region
of body anterior to genital pore-----13
13. (14) Body stout; testes large occupying 1/4 to 1/2
of hind-body-----spinosa Odhner, 1911



14. (12) Body slender; testes occupying less than 1/4 of hind body---conciliata (Dietz, 1909)
15. (11) Uterus of medium length, being greater in length than the region of body anterior to genital pore-----16
16. (17) Eggs greater than 0.080 mm.-magniovata Yamag., 1933
17. (16) Eggs less than 0.080 mm. in length-----18
18. (17) Ovary in close proximity to shell gland complex-----polycestus (Dietz, 1909)
19. (18) Ovary relatively far removed from shell gland complex-----lari n. sp.

Literature consulted: (29), (35), (7), (104), (170), (140, 142), (139), (230), (236), (288), (289), (269), (360), (366), (457), (453), (498), (509), (549), (607), (670), (679), (687).

Hypoderaeum conoideum (Block, 1782) Dietz, 1909

Several specimens were recovered from the small intestine of four Pintail ducks. The dimensions are compared in mm., with those from various sources, in Table III, page 43. Figs. 12 and 13, page 44, show the variations found in the species. The crown spines and cirrus extruding are shown in Figs. (34, 35) and 36 respectively, on page 64.

Literature consulted: (104), (139), (140, 141, 142), (146), (178), (328), (334), (350), (385), (418), (421), (438), (469), (470), (498), (500), (617), (679), (687).

TABLE III

COMPARISON OF MEASUREMENTS OF HYPODERAEUM CONOIDEUM FROM VARIOUS SOURCES

	Freedman* Pintail Manitoba	** Zerecero Bl.w.teal Mexico	*** Freedman Pintail Freedman	Rees Experim. England	Singh **** Pintail India
Length	8.866	8.399	6.575	10.200	7.84
Width	1.117	1.350	1.284	1.570	0.87
Collar	0.377	-----	-----	0.600	0.390
Marginal spines	0.014 x 0.003	0.019 x 0.006	-----	-----	0.021
No. spines	upto 33 double	-----	-----	(43 to 45)	(47) single row
Corner spines	-----	-----	-----	-----	0.025
Or. sucker	0.180 x 0.131	0.148 x 0.230	0.184 x 0.184	0.28 x 0.210	0.185 x 0.185
Pharynx	0.131 x 0.129	0.185 x 0.157	0.104 x 0.131	-----	0.15 x 0.105
Acetabulum	0.873 dm. x.698 dp.	0.897 x 1.036	0.710 x 0.710	-----	0.703
Ovary	0.349 x 0.349	-----	0.342 x 0.342	0.41 x 0.26	0.26 x 0.26
Shell gland complex	0.384 x 0.384	-----	0.316 x 0.316	----- x 0.45	0.15 x 0.15
Anterior testis	0.803 x 0.349	0.777 x 0.388	0.710 x 0.263	0.98 x -----	0.722 x 0.333
Posterior	0.942 x 0.316	0.898 x 0.324	0.684 x 0.316	0.90 x -----	0.796 x 0.32
Eggs	0.052 x 0.031	0.101 x 0.065	0.068 x 0.042	0.11 x 0.06	0.022x 0.053

All measurements in mm.

* Specimen shown in Fig. 13, page 44.

** All measurements maximum values given (532)

*** Specimen shown in Fig. 12, page 44.

**** Echinostoma microspina n. sp. It is the writer's opinion that this is synonymous with H. conoideum.

PLATE V

Fig. 10. Zygocotyle lunata from the intestinal ceca of the Mallard. Ventral view.

Fig. 11. Zygocotyle lunata from the intestinal ceca of the Mallard. Ventral view.

Fig. 12. Hypoderaeum conoideum from the small intestine of the Pintail. Ventral view.

Fig. 13. Hypoderaeum conoideum from the small intestine of the Pintail. Ventral view.

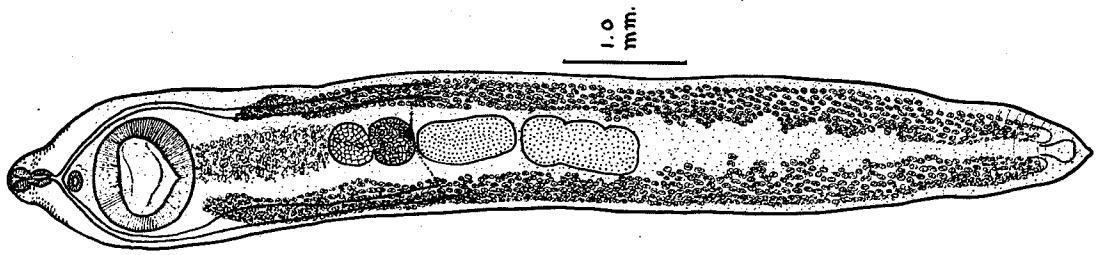


FIG. 13

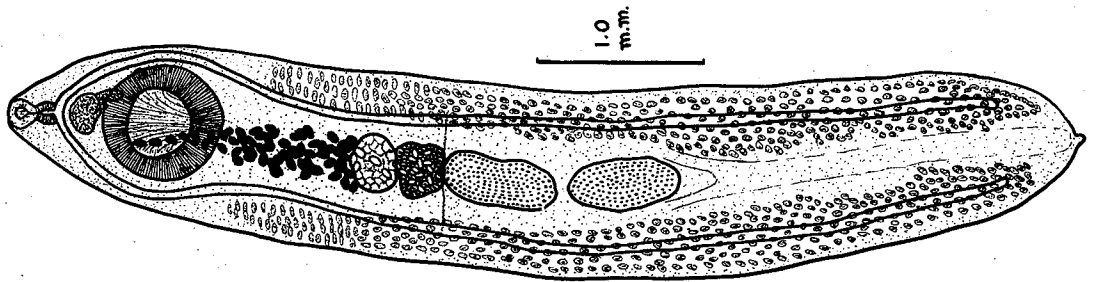


FIG. 12

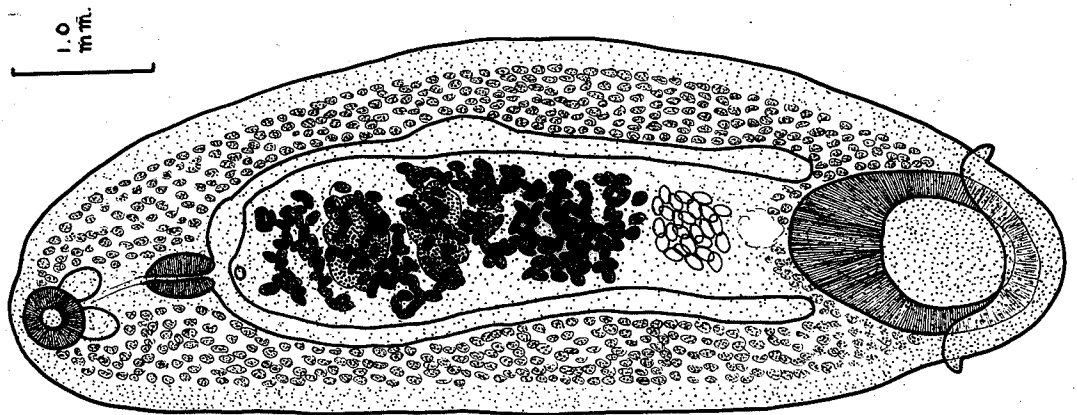


FIG. 11

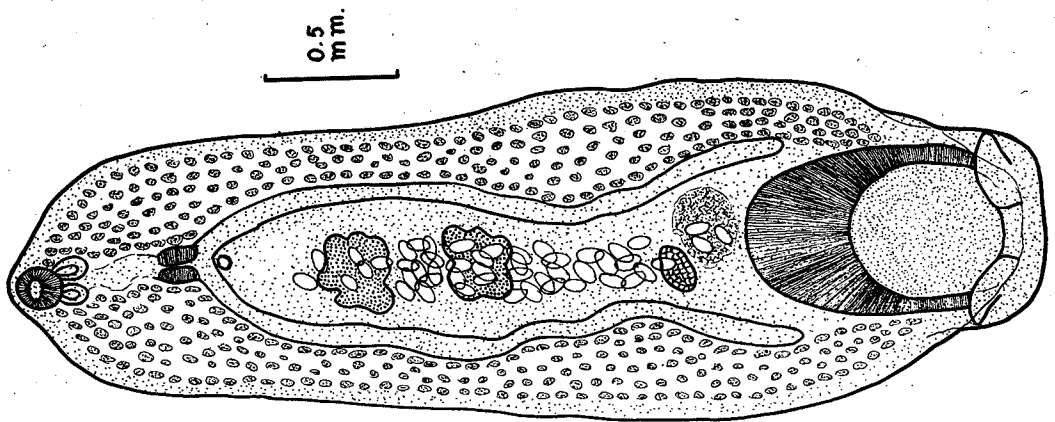


FIG. 10

inal ceca

inal ceca

11

11

PLATE VI

Fig. 15. Zygocotyle lunata from caeca Lesser
scaup duck. Immature specimen with
convolutions of caecae.

Fig. 16. Z. lunata from Pintail. x12

Fig. 17. Same specimen showing anterior portion.
x44

a Lesser
en with
ior portion.

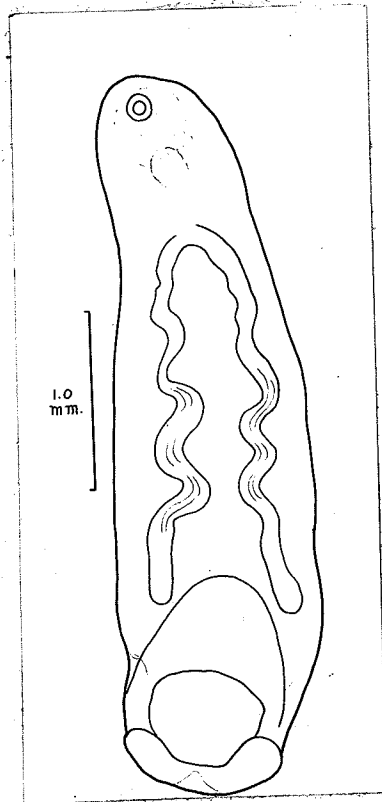


Fig. 15



Fig. 16



Fig. 17

PLATE VII

Fig. 18. Echinostoma revolutum. Ventral view.

Fig. 19. Echinostoma revolutum. Ventral view.

Fig. 20. Echinochasmus manitobensis n. sp.

Ventral view. From intestinal ceca of
the Pintail.

Fig. 21. Echinostoma platyrhynchi n. sp.

Ventral view. From the intestinal ceca
of the Mallard.

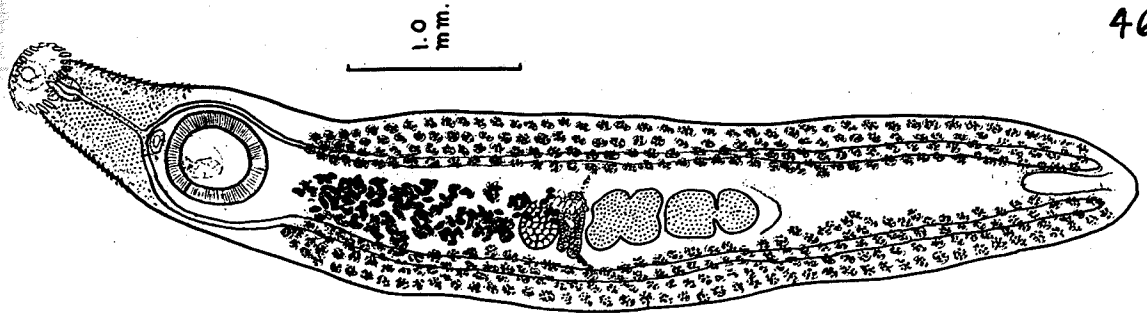


FIG. 21

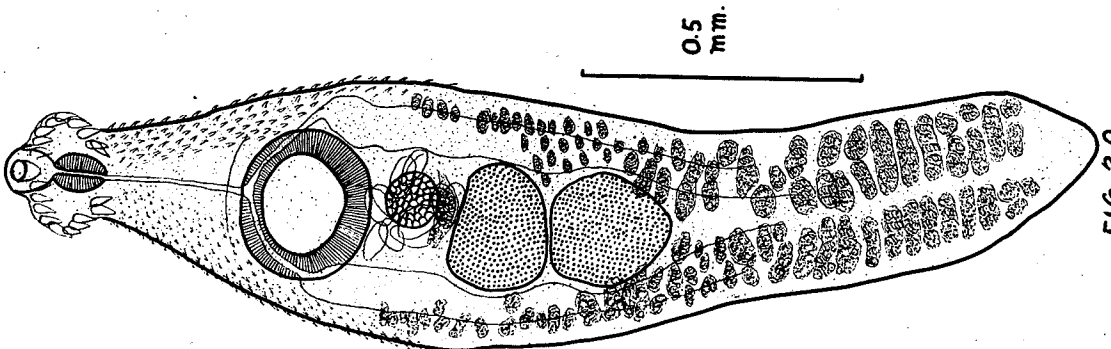


FIG. 20

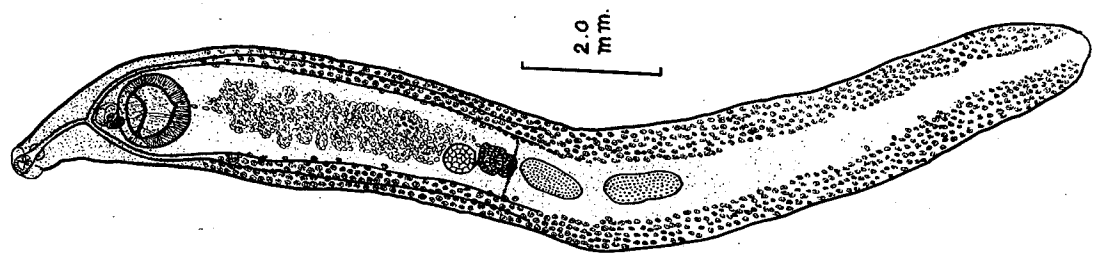


FIG. 19

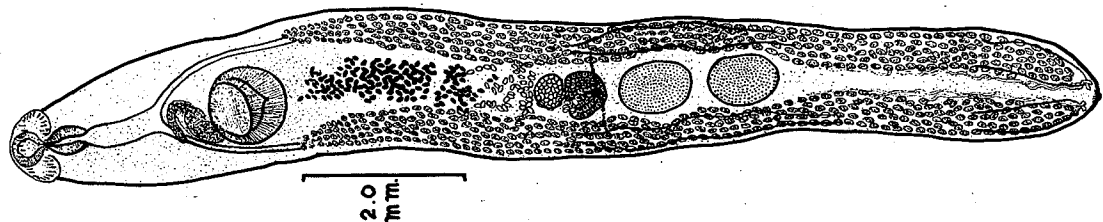


FIG. 18

l view.
 l view.
 sp.
 ceca of
 .
 nal ceca

PLATE VIII

Fig. 22. Stephanoprora lari n. sp. from
Herring gull. Ventral view.

Fig. 23. Echinoparyphium elegans from the
small intestine of the Lesser scaup.
Ventral view.

Fig. 24. Echinoparyphium elegans from the
Lesser scaup. Ventral view.

Fig. 25. Echinoparyphium elegans from the
Lesser scaup. Semi lateral view.

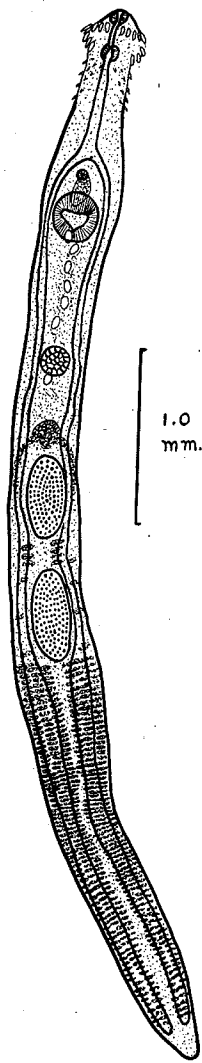


FIG. 22

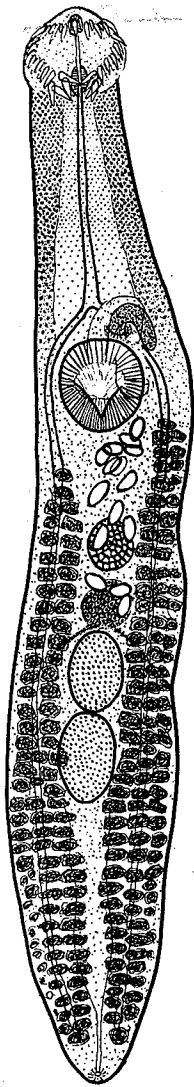


FIG. 23

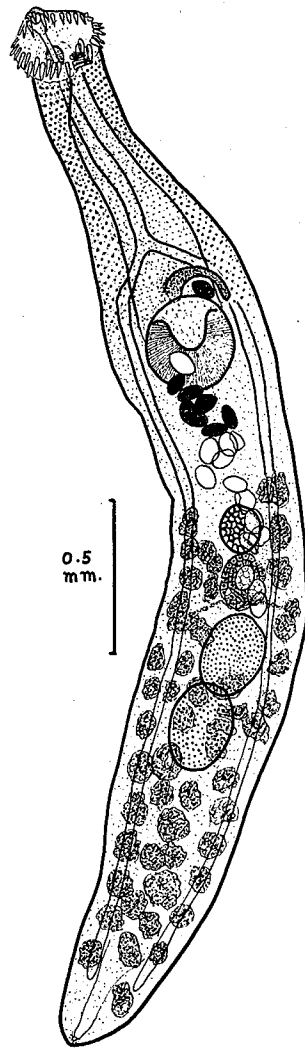


FIG. 24

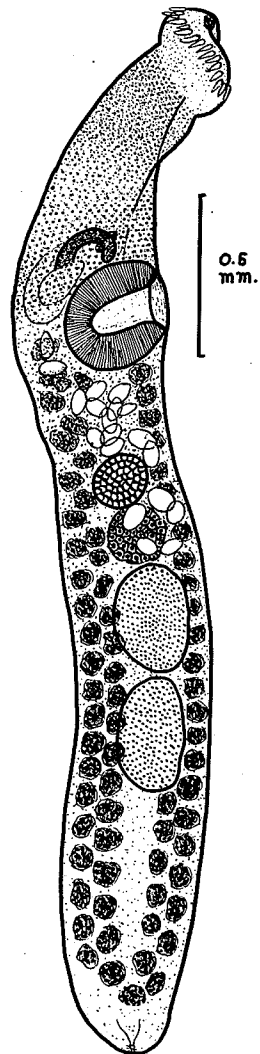


FIG. 25

Petasiger chandleri Abdel-Malek, 1952

Twenty three specimens were recovered from the duodenum of Hoelboel's grebe. They agree quite closely to the specimens that Abdel-Malek recovered from the pied-billed grebe. A comparison of the two is shown in Table IV, page 49. Figs. 26 and 27, page 55, show two views of P. chandleri. One of the specimens in the material collected had several spines in the crown missing. The unusual aspect was in the symmetrical manner in which they were missing. There was no sign that the spines had ever been in place, and it was assumed that this may have been a genetic defect.

Literature consulted: (2, 3, 4), (37), (39), (134), (138), (139), (141, 142), (169), (181), (232), (241), (288), (345), (382), (498), (509), (522), (607), (679), (687).

Drepanocephalus spathans Dietz, 1909

Several specimens were recovered from the ~~Double-crested~~ ~~cormorant~~. It has previously been reported by Dietz (140, 141, 142) from Phalacrocorax brasiliensis and P. carbo from South America. Fig. 28, page 55, shows a typical specimen from the Canadian material. As far as can be ascertained, this is the first report of D. spathans from the Northern Hemisphere. Table V, page 50 compares the material obtained here with that collected by Dietz in South America.

TABLE IV

COMPARISON OF MEASUREMENTS OF PETASIGER CHANDLERI WITH THAT COLLECTED BY ABDEL-MALEK

	Freedman Holboell's grebe	Abdel-Malek Pied-billed G.
Length	1.400	1.382
Pre-acetabular dist.	0.600	0.651
Post-acetabular dist.	0.428	0.496
Width at crown	0.228	0.222
Width at neck	0.210	0.185
Width at acetabulum	0.485	0.414
Oral sucker	0.056 diam.	0.071 x 0.077
Acetabulum	0.245 x 0.280	0.235 x 0.252
Pharynx	0.051 x 0.070	0.041 x 0.050
Esophagus	0.266	0.311
Anterior testis	0.195 x 0.150	0.222 x 0.126
Posterior testis	0.198 x 0.144	0.244 x 0.118
Cirrus sac	-----	0.192 x 0.089
Ovary	0.078 x 0.087	0.125 x 0.103
Vitelline reservoir	-----	0.052 x 0.096
Prepharynx	0.104	-----
Marginal spines (crown)	0.051 x 0.017	0.051 x 0.007
Corner spines (crown)	0.070 x 0.019	0.074 x 0.011
Body spines (dorsal)	0.013 x 0.004	-----
Eggs	0.080 x 0.056	0.074 x 0.059

All measurements in mm.

TABLE V

COMPARISON OF MEASUREMENTS OF DREPANOCEPHALUS SPATHANS WITH
THAT COLLECTED BY DIETZ

	Freedman Cormorant Manitoba	Dietz Cormorant South America
Length	8.954	7.250
Width at neck	1.147	1.400
Width at testes	0.962	
Oral sucker	0.222 diam.	0.350 diam.
Prepharynx	0.074	0.046
Pharynx	0.444 x 0.212	0.354 x 0.261
Esophagus	0.925 x 0.029	0.430 x -----
Acetabulum	1.036 x 0.740	0.950 x 0.770
Cirrus	1.480 x 0.074	-----
Cirrus pouch	0.555 x 0.333	-----
Acetabulum to anterior end	1.776	-----
Ceca	0.074 to 0.22	-----
Ovary	0.259 x 0.222	-----
Shell gland complex	0.333 x 0.185	-----
Anterior testis	0.703 x 0.555	0.740 x 0.690
Posterior testis	0.777 x 0.555	
Marginal spines (19)	0.148 x 0.037	0.242 x 0.054
Corner spines (2 x 4)	0.296 x 0.055	0.279 x 0.061
Eggs	0.111 x 0.074	0.062 x 0.050

All measurements in mm.

Fig. 37, page 65, shows the spines of the crown in a typical specimen.

Xenisma wardlei n.g., n. sp.

Four specimens were recovered from the small intestine of the Lesser scaup duck. In following the key in Dawes' (139), it appeared that this species belonged to the family Psilostomidae. It also had certain characteristics which seemed to ally it with the family Opecoelidae. However, the species seemed to fit in easier with the isolated genera in the family Echinostomatidae. The generic name Xenisma was decided upon due to the surprise which the author received when he first noticed these specimens mixed in with over 400 specimens of Echinoparyphium elegans. They were very nearly overlooked. This genus has very close affinities to the genus Aequistoma as proposed by Beaver (678), also in the unclassified genera of the family Echinostomatidae. The main differences being in the larger size of the vitelline follicles in X. wardlei, and also their arrangement in an antero-posterior linear way. Aequistoma parasitizes seals in the Caspian Sea, and this is another reason for differentiation of the two.

Figs. 30 and 31, page 59, show two full length views of X. wardlei. A lateral view of a third specimen, of the ant-

erior portion is shown in Fig. 44, page 67. Photomicrographs of various views are shown in Figs. 45 to 48, page 67.

The dimensions in mm. are as follows: Length-1.225 to 1.692, Width at testis-0.255 to 0.396, Oral sucker-0.085 by 0.070 to 0.123 by 0.097 by 0.089 in depth, ~~Esopharynx~~pharynx, not visible, Pharynx-0.060 by 0.057 to 0.072 by 0.058, No esophagus, Ceca-0.025 in width, Distance between acetabulum and anterior end of worm-0.240 to 0.259, Acetabulum-0.20 diam. to 0.223 diam. by 0.346 in depth, Distance between acetabulum and anterior testis-0.030 to 0.072, Distance between testes is variable, overlapping in some cases, Ovary-0.090 by 0.075 to 0.122 by 0.072, Anterior testis-0.115 diam. to 0.144 diam., Posterior testis-0.090 by 0.110 to 0.137 diam., Distance between posterior testis and posterior end of the worm-0.545 to 0.720, Vitelline follicles-0.060 to 0.101 diam., Shell gland complex-0.066 to 0.086 diam., Cirrus pouch-0.137 by 0.079, Eggs-0.064 by 0.040 to 0.100 by 0.068 (5 to 14 eggs).

Literature consulted: (28), (32), (37), (40), (43), (66), (74), (68), (71), (136), (144), (139), (164), (134), (191), (218), (229), (259), (262), (275), (284), (283), (329), (363), (378), (489), (499), (498), (512), (594), (629), (679), (668), (659), (687), (608).

Family Cathaemasiidae

Cathaemasia nycticoracis Olsen, 1940

One specimen was recovered from the Common loon (Gavia immer). In appearance and dimensions it most closely resembles C. nycticoracis as reported by Olsen (359) from the Black-crowned night heron (N. nycticorax hoactli). The two are compared in Table VI, page 54, and the specimen from the loon is shown in Fig. 29, page 55. The other species of the genus Cathaemasia are: C. hians (Rudolphi, 1809) Looss, 1899-(139), (146), (66, 67), (359), (432), (527), (529), (575), (653), (676). C. spectabilis Odhner, 1926--(139), (146), (359), (432), (527), (529), (575).

C. famelica Odhner, 1926--(139), (146), (359), (432), (527), (529), (575).

C. dollfusi Travassos, 1951--(455).

Other literature consulted: (92), (95), (108), (146), (155), (231), (233), (373), (449), (607), (679), (659), (683), (687), (690), (692).

Family Plagiorchidae

Plagiorchis sp. 1.

Several specimens were obtained from the Herring gull, and the dimensions in mm. are as follows: Length-2.236, Width at testes-0.430, Oral sucker-0.172 by 0.163, Prepharynx-

TABLE VI

COMPARISON OF MEASUREMENTS OF CATHAEMASIA NYCTICORACIS WITH
THAT COLLECTED BY OLSEN

	Freedman Common loon Manitoba	Olsen Blk. Cr.N.heron Minnesota
Length	6.250	5.4
Width at pharynx	0.675	1.05
Width at ovary	1.500	
Oral sucker	0.450 x 0.600	0.440 x 0.416
Prepharynx	0.688 x 0.087	none
Pharynx	0.300 x 0.350	0.280 x 0.212
Esophagus	0.875 x 0.300	0.466
Cirrus pouch	0.250 x 0.125	-----
Acetabulum	0.625 diam.	0.644 x 0.700
Ovary	0.250 x 0.200	to.200 x to.433
Shell gland complex	0.300 x 0.125	-----
Anterior testis	0.225 x 0.300	0.433 x 0.450
Posterior testis	0.500 x 0.308	0.483 x 0.450
Acetabulum to ovary (distance)	0.575	0.666
Post. testis to posterior end	1.950	1.500
Acetabulum to anterior end	1.750	1.450
Eggs	0.075 x 0.028	0.095 x 0.053

All measurements in mm.

PLATE IX

Fig. 26. Petasiger chandleri from
Holboel's grebe. Ventral view.

Fig. 27. Petasiger chandleri.
Lateral view.

Fig. 28. Drepanocephalus spathans
from the Red-breasted merganser.
Ventral view.

Fig. 29. Cathaemasia nycticoracis
from the Common loon.
Ventral view.

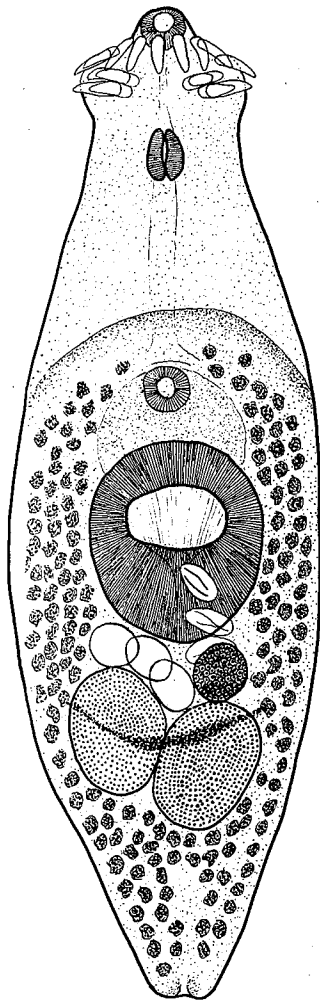


FIG. 26

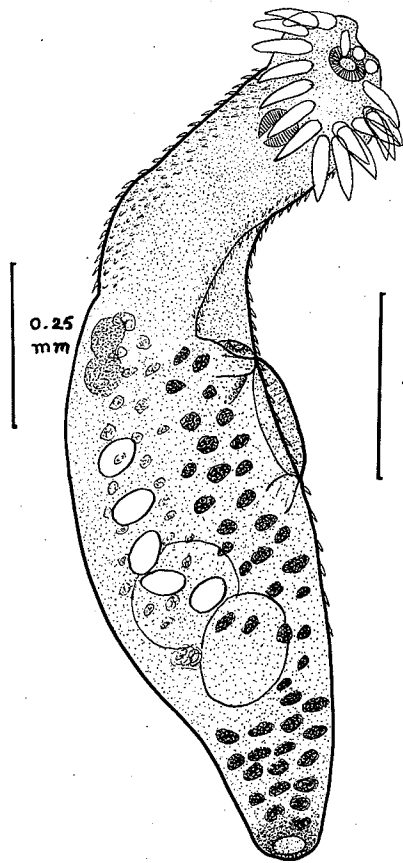


FIG. 27

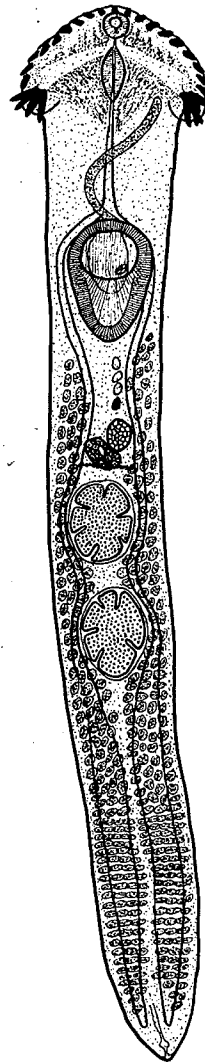


FIG. 28

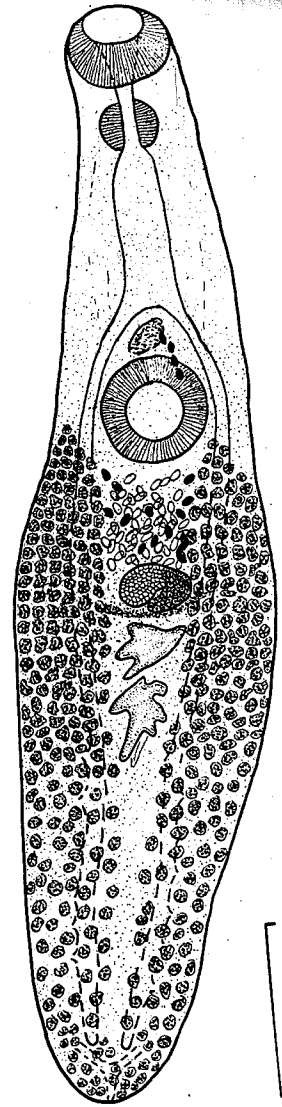


FIG. 29

0.013 by 0.012, Pharynx-0.056 by 0.071, No esophagus, Distance between acetabulum and anterior end of worm-0.559, Acetabulum-0.116 diam, Ovary-0.112 diam., Shell gland complex not discernible, Anterior testis-0.198 by 0.172, Posterior testis-0.215 by 0.189, Distance between testes-0.047, Post. testis to posterior end of worm-0.722, Vitelline follicles-about 0.034 diam., Cirrus-0.344 by 0.022, Cirrus pouch-0.559 by 0.060, Eggs-0.043 by 0.021. Fig. 97, page 93, shows a specimen.

Plagiorchis sp. 2.

One specimen was recovered from the small intestine of the common tern, and the dimensions in mm. are as follows: Length-1.138, Width at anterior testis-0.480, Oral sucker-0.221 by 0.204, No prepharynx, Pharynx-0.091 by 0.106, Esophagus-not discernible, Distance between acetabulum and anterior end of worm-0.293, Acetabulum-0.125 diam., Ovary-0.120 diam., Shell gland complex not discernible, Anterior testis-0.118 by 0.158, Posterior testis-0.120 by 0.163, Distance between testes-0.024, Distance between posterior testis and posterior end of worm-0.355, Vitelline follicles-about 0.043 by 0.014, Eggs-0.024 by 0.012. Specimen depicted in Fig. 98, page 93.

Astiotrema sp.

Several specimens were obtained from the small intestine of the Marbled godwit, and Franklin's gull, and a typical

specimen is shown in Fig. 96, page 93. Fig. 94, page 88, shows the variation in shape and size of 12 specimens. The dimensions in mm. of the specimen shown in Fig. 96, is as follows: 1.441, Width at ovary-0.363, Oral sucker-0.215 by 0.192, Pharynx-0.066 by 0.083, Esophagus-0.014 by 0.025, Cecum-0.017 wide, Distance between acetabulum and anterior end of worm-0.451, Acetabulum-0.110 diam., Ovary-0.083 diam., Shell gland complex-0.033 diam., Anterior testis-0.143 diam., Posterior testis-0.171 by 0.128, Distance between testes-0.008, Distance between posterior testis and posterior end of worm-0.358, Cecae extend to within 0.128 of the posterior end, Vitelline follicles-0.022 diam. approx., Cirrus-0.099 by 0.017, Cirrus pouch-0.347 by 0.028, Seminal receptacle-0.143 by 0.025, Eggs-0.035 by 0.022.

Literature consulted for the three specimens described above: (6), (47), (66, 67), (83), (227), (228), (139), (236), (261), (267), (247), (283), (260), (297), (312), (313), (314), (326), (336), (344), (357), (358), (361), (364), (365), (367), (368), (372), (392), (398), (399), (400), (402), (403), (408), (416), (429), (442), (448), (450), (498), (501), (509), (519), (533), (547), (606), (644), (649), (679), (687).

Family Brachylaemidae

Leucochloridium cyanocittae McIntosh, 1932

One specimen was found in the small intestine of a Lesser yellow-legs, and is shown in Fig. 32, page 59. The bird was shot at Whitewater Lake in south western Manitoba in August, 1950, and the worm specimen was preserved in 4% formalin. The specimen was stained with carmine and haematin, but due to the gravid condition of the worm, very little of the internal organs was discernible. The extent of the vitellaria and the uterus (as indicated by the presence of eggs) was sufficient to place the specimen into the genus Leucochloridium with the aid of Kagan's diagrams (588).

In appearance, it most closely resembles L. beauforti (225) from the Bursa of Fabricius and the rectum of Ammospiza maritima macgillivraii, and L. melospizae from the cloaca of Melospiza melodia.beata. Only one other species of the genus, L. cyanocittae, has been found in the Lesser yellow-legs, making this the second report from this host. The specimen is compared with several others in Table VII, page 60, measurement being in mm.

Other species in the genus are: beauforti (225), variae (303), (538), (588), cyanocittae (248), (304), (588), perisorisae (615), melospizae (303), (588), muscularae (588), paradoxum (5), (106), (107), (156), (186), (193), (290), (333), (390), (397), passeri (495), (588), australiense (242), (243),

PLATE X

Fig. 30. Xenisma wardlei n. sp. from
the small intestine of the Lesser
scaup duck. Ventral view.

Fig. 31. Xenisma wardlei. Three quarters
ventral view.

Fig. 32. Leucochloridium cyanocittae
from the small intestine of the
Lesser yellow-legs. Ventral view.

Fig. 33. Mesostephanus sp. from the
Red-breasted merganser.
Ventral view.



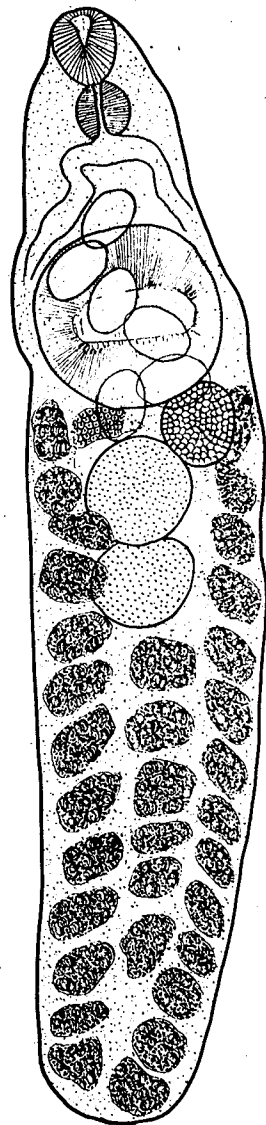


FIG. 30

0.25
mm.

0.25
mm.

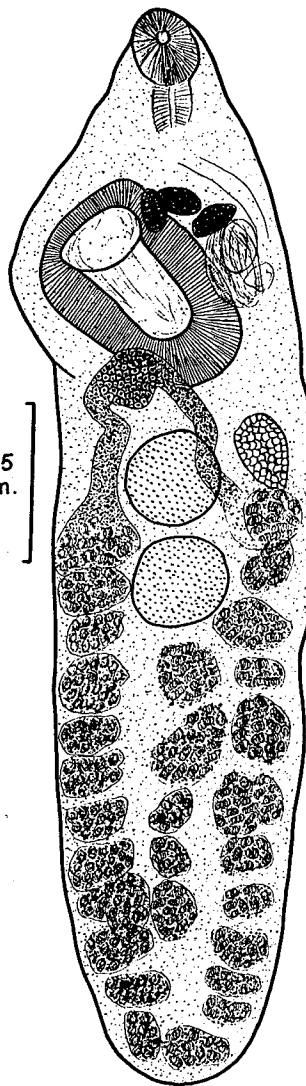


FIG. 31

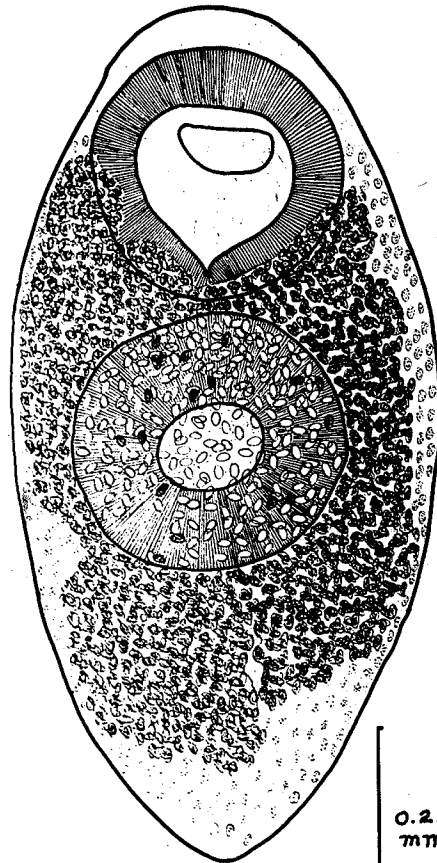


FIG. 32

0.25
mm.

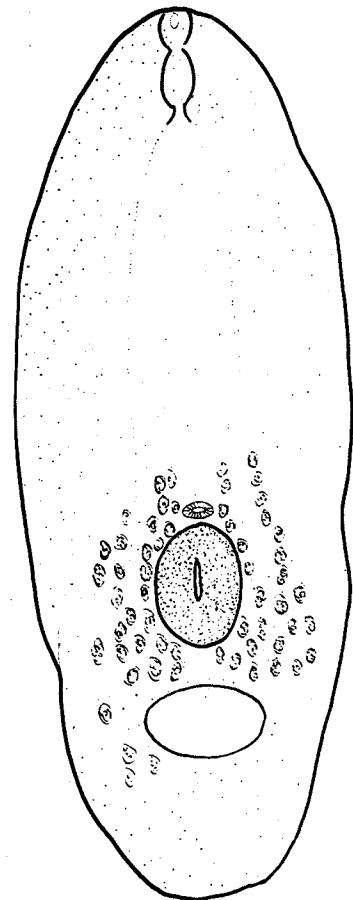


FIG. 33

0.16
mm.

TABLE VII

COMPARISON OF MEASUREMENTS OF LEUCOCHLORIDIUM CYANOCITTAE
FROM VARIOUS SOURCES

	* Freedman L.y.-legs Manitoba	** McIntosh Bluejay Michigan	*** Kagan Starling Experim.	*** Kagan Sparrow Experim.	*** Kagan Canary Experim.
Length	0.955	2.100	1.357	1.200	1.456
Width	0.473	1.33	0.739	0.584	0.776
Or. sucker	0.291 x 0.291	0.560 x 0.630	0.380 x 0.408	0.312 x 0.360	0.335 0.382
Acetabulum	0.290 x 0.290	0.540 x 0.575	0.312 x 0.334	0.295 x 0.277	0.338 x 0.338
Pharynx	-----	0.140 x 0.210	0.123 x 0.182	0.100 x 0.140	0.112 x 0.151
Ovary	-----	0.130 x 0.250	0.123 x 0.132	0.118 x 0.125	0.151 x 0.173
Anterior testis	-----	0.130 x 0.200	0.148 x 0.142	0.140 x 0.129	0.151 x 0.166
Posterior testis	-----	0.140 x 0.180	0.134 x 0.147	0.115 x 0.118	0.155 x 0.176
Cirrus sac	-----	0.150 x 0.180	-----	-----	-----
Eggs	0.013 x 0.009	0.024 x 0.018	-----	-----	-----

All measurements in mm.

* Specimen shown in Fig. 32, page 59. L.y.-legs = Lesser yellow-legs.

** McIntosh (303)

*** Kagan (248)

(588), fuscostriatus (588), heckerti (193), (430), (588), (700), sime (502), (588), sp. dubiae (700).

Other literature consulted: (11), (44), (70), (85), (86), (139), (168), (174), (177), (230), (301), (302), (322), (346), (388), (401), (449), (461), (466), (473), (478), (430), (494), (509), (531), (543), (586), (587), (588), (639), (643), (658), (666), (679), (686), (687).

Family Strigeidae

Parastrigea neorobusta n. sp.

One specimen was recovered from the small intestine of the Lesser scaup duck. Two views are shown in Figs. 59 and 60, page 76. Dimensions in mm. are as follows: Length-1.920, Anterior segment-0.768 by 0.064 by 0.775, Posterior segment-1.152 by 0.608 by 0.800, Ovary-0.096 diam., Anterior testis-0.205 by 0.320, Posterior testis-0.256 by 0.224, Distance of ovary to anterior end- 0.832, Distance of posterior testis to posterior end-0.288, Eggs-0.109 by 0.064. Has very close affinities to P. robusta as described by Dubois (147). It differs from robusta in that there is no sign of vitellaria in the anterior segment, and the addition of a peculiar looking lip protruding from the anterior of neorobusta.

Other literature consulted: (139), (564), (568), (687).

Cotylurus communis (Hughes, 1928), La Rue, 1932

Four specimens were recovered from the Bursa of Fabricius of an immature Herring gull. A specimen is shown in Figs. 72 and 73, page 81, and the dimensions in mm. are as follows: Length-6.094, Anterior segment-1.801 by 1.856 in depth, Posterior segment-4.709 by 1.884 in depth, Ovary-0.360 by 0.222 in depth, Anterior testis-0.416 by 0.904 in depth, Posterior testis-1.773 by 0.831 in depth, Eggs-0.097 by 0.055.

Literature consulted: (139), (147), (280), (285), (343), (356), (564), (679), (687).

Cotylurus cornutus (Rudolphi, 1808) Szidat, 1928

One specimen was recovered from the small intestine of the Marbled godwit (Limosa fedoa), and is pictured in Fig. 52, page 69. The dimensions in mm. are as follows: Length-2.040, Anterior segment-0.520 by 0.576 in depth, Posterior segment-1.520 by 0.612 in depth, Oral sucker-0.088 by 0.085, Acetabulum-0.112 by 0.132, Ovary-0.184 by 0.172, Anterior testis-0.264 by 0.280 in depth, Posterior testis-0.360 by 0.400 in depth, Distance of ovary from anterior end-0.800, Distance of posterior testis from posterior end-0.416, Eggs-0.120 by 0.056.

Literature consulted: (49), (123), (147), (148), (150), (152), (386), (477), (544), (564), (568), (667), (679), (687).

Cotylurus brevis Dubois and Rausch, 1950

Over 100 specimens were recovered from the small intestine of a single Lesser scaup duck. Many were also recovered from the duodenum of the Pintail, and the small intestines of the Mallard, and Greater scaup ducks. Typical specimens are shown in Figs. 53 and 54, page 70 and one of four abnormal specimens recovered from the Lesser scaup is shown in Fig. 51, page 69, and Fig. 90, page 86. Other views are shown in Figs. 83 to 85, page 84, Figs. 88, and 89 page 86, and Figs. 91 to 93 page 87. The dimensions in mm. are as follows: Length-2.228 to 2.650, Anterior segment-0.818 to 1.027 by 0.763 by 0.489 in depth, Posterior segment-0.141 to 1.622 by 0.742 by 0.517 in depth, Oral sucker-0.103 diam. to 0.138 by 0.143, Acetabulum-0.094 to 0.254 by 0.281 by 0.132 in depth, Distance between acetabulum and oral sucker-0.233 to 0.470, Ovary-0.122 to 0.223 by 0.180 by 0.207 in depth, Anterior testis-0.282 to 0.318 by 0.424 by 0.376, Posterior testis, 0.312 to 0.371 by 0.384 by 0.395 in depth, Distance between testes-about 0.053, Distance from posterior testis to posterior end-0.318 to 0.423, Distance from ovary to anterior end-1.034 to 1.272, Eggs-0.108 by 0.053 to 0.117 by 0.069.

Literature consulted: (104), (147), (151), (380), (419), (498), (568), (564), (679), (687).

PLATE XI

Fig. 34. Photomicrograph of anterior portion of Hypoderaeum conoideum, ventral view. x79

Fig. 35. Camera lucida drawing of anterior portion of H. conoideum.

Fig. 36. Photomicrograph of anterior portion of Hypoderaeum conoideum showing cirrus extruding. x55



Fig. 34

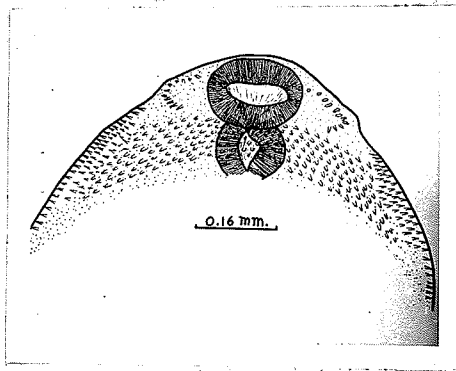


Fig. 35



Fig. 36

PLATE XII

Fig. 37. Anterior portion of
Drepanocephalus spathans
showing detail of crown
spines. x48

Fig. 38. Photomicrograph of
anterior portion of
Echinochasmus manitobensis n.sp.
x55

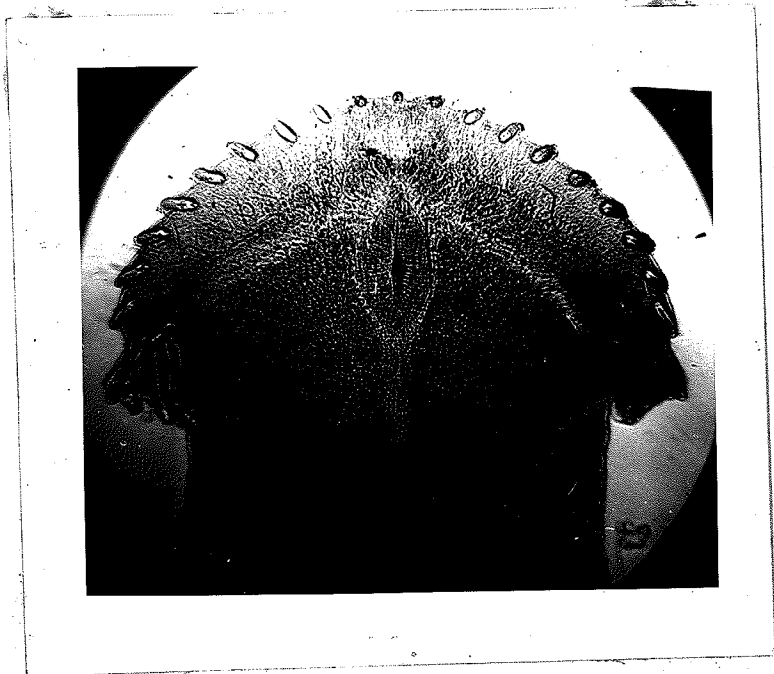


Fig. 37



Fig. 38

PLATE XIII

Fig. 39. Photomicrograph of anterior portion of Echinoparyphium elegans, ventral view. x62

Fig. 40. Photomicrograph of anterior portion of E. elegans, ventral view. x62

Fig. 41. Photomicrograph of anterior portion of E. elegans, ventral view. x62

Fig. 42. Camera lucida drawing to show the crown spines more clearly, of E. elegans.

Fig. 43. a-lateral view of corner spine.

b-frontal view of corner spine.

c-frontal view of border spine.

d-lateral view of border spine.

Scale drawn is equal to 0.025 mm.



Fig. 39.



Fig. 40.

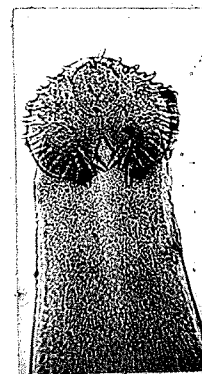


Fig. 41.

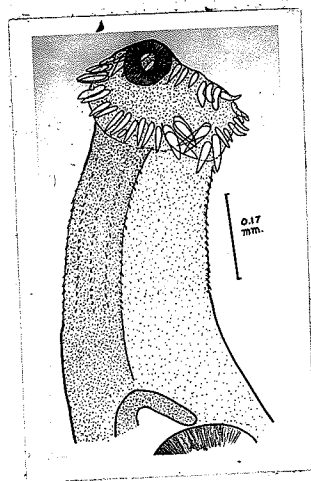


Fig. 42.

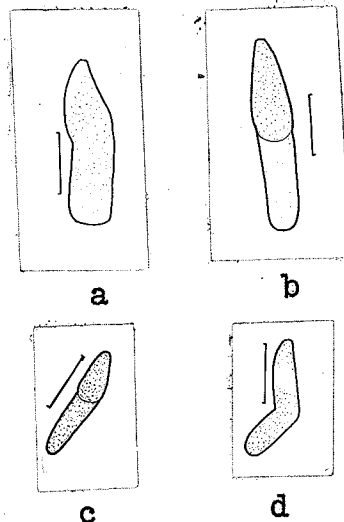


Fig. 43.

x62

x62

e
gans.

PLATE XIV

- Fig. 44. Camera lucida drawing of lateral anterior view of Xenisma wardlei n. sp.
- Fig. 45. Photomicrograph of drawing shown in Fig. 44. x61
- Fig. 46. Photomicrograph of lateral anterior view of Xenisma wardlei n. sp. x61
- Fig. 47. Ventral view, photomicrograph of Xenisma wardlei n. sp. shown in Fig. 30. x61
- Fig. 48. Ventral view, partly lateral, photomicrograph of Xenisma wardlei n. sp. shown in Fig. 31. x61



Fi

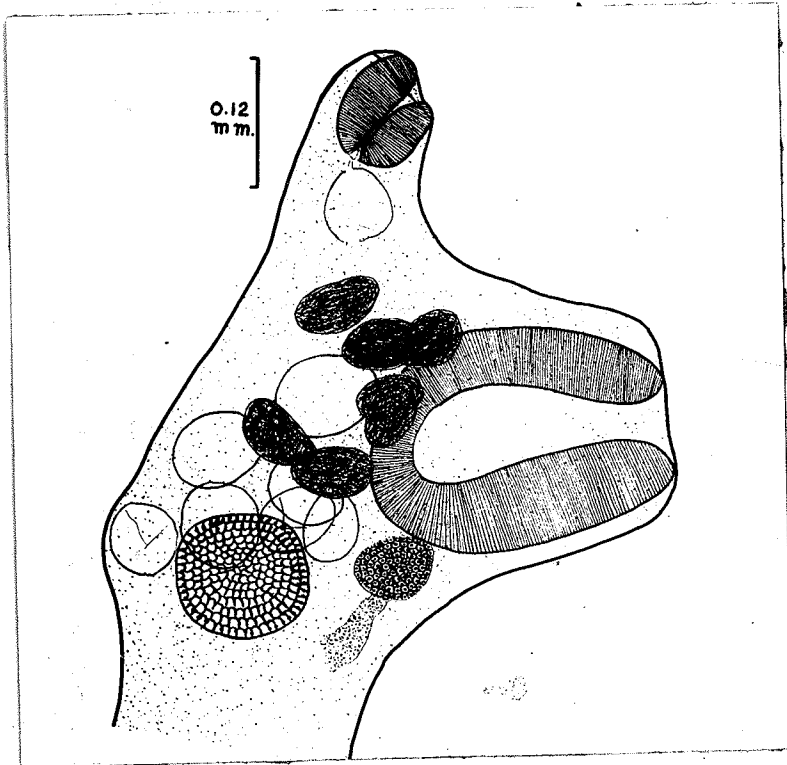


Fig. 44.

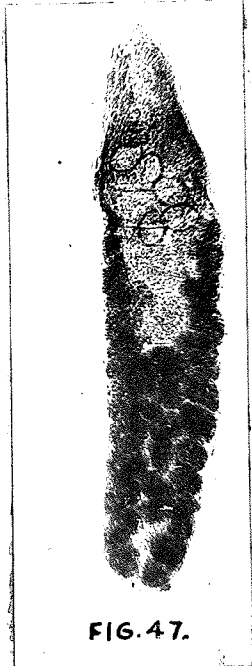


FIG. 47.

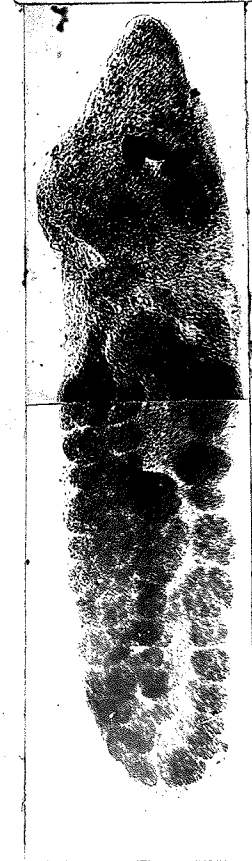


Fig. 48.

sp. x61

sp.

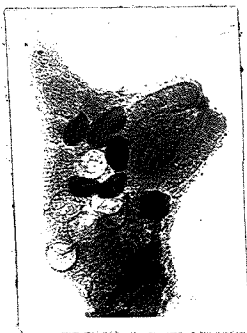


Fig. 45.



Fig. 46.

Cotylurus erraticus (Rudolphi, 1809) Szidat, 1928

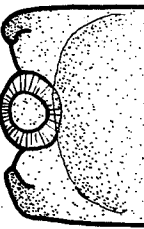
Several specimens were recovered from the intestinal caecae of the Red-breasted merganser, and the American golden-eye duck, and a typical specimen is shown in Figs. 49 and 50 page 69. All specimens were immature. The dimensions in mm. are as follows: Length-1.86, Anterior segment-0.630 by 0.380 by 0.40 in depth, Posterior segment-1.250 by 0.34 by 0.27 in depth, Oral sucker-0.12 diam., Acetabulum-0.15 by 0.16 diam., Ovary-0.09 by 0.12 by .09 in depth, Adhesive gland-2 distinct masses, 0.09 by 0.12 by 0.09, Posterior testis-0.36 by 0.18 by 0.33 in depth, Anterior testis-0.18 by 0.24 by 0.33 in depth. Literature consulted: (147), (152), (380), (498), (239), (564), (568), (667), (679), (687),

Cotylurus mcleodi n. sp.

Several specimens were recovered from the small intestine of the Herring gull, and a typical specimen is shown in Figs. 55 and 56, page 70. The most unusual feature of this species is the extreme length of the posterior segment. In this respect it is similar to Strigea elongatus as figured by Dubois (147), however, the vitellaria did not extend into the anterior segment, therefore a new species was created. The dimensions in mm. are as follows: Length-4.426, Anterior segment-0.797 by 0.840 by 0.938 in depth, Posterior segment-3.629 by 0.630 by 0.708 in depth, Acetabulum-0.212 by 0.248, Ovary-0.177 diam.,

PLATE XV

- Fig. 49. Cotylurus erraticus. Lateral view.
Fig. 50. C. erraticus. Ventral view.
Fig. 51. Aberrant form of C. brevis from the
small intestine of a Lesser scaup duck.
Fig. 52. C. cornutus from the small intestine
of the Marbled godwit.



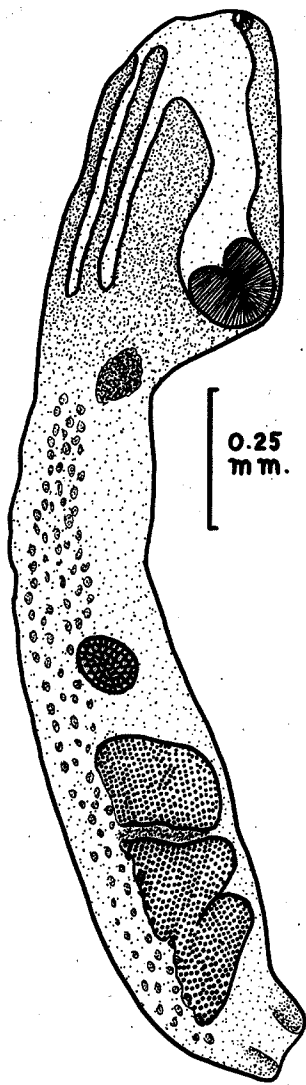


FIG. 49

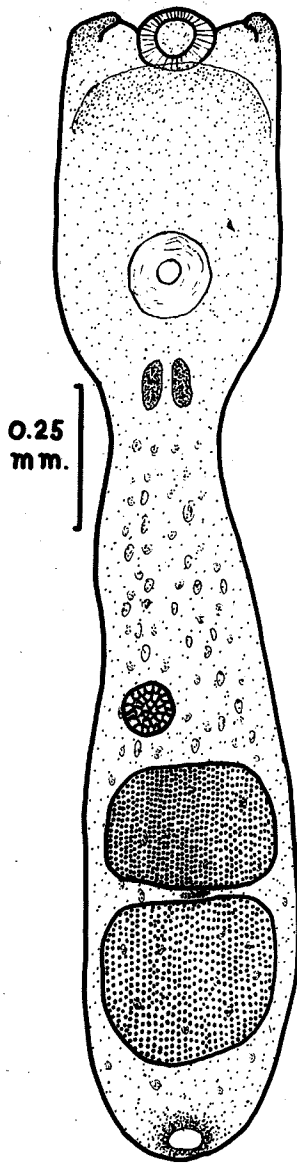


FIG. 50

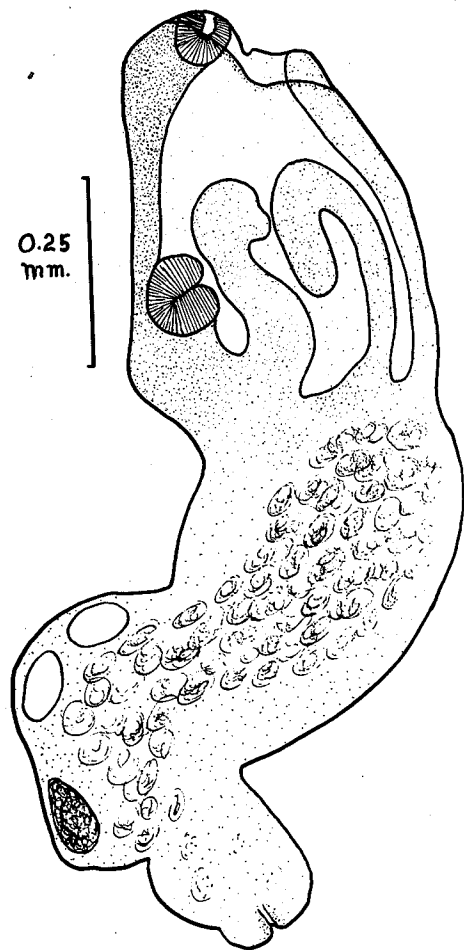


FIG. 51

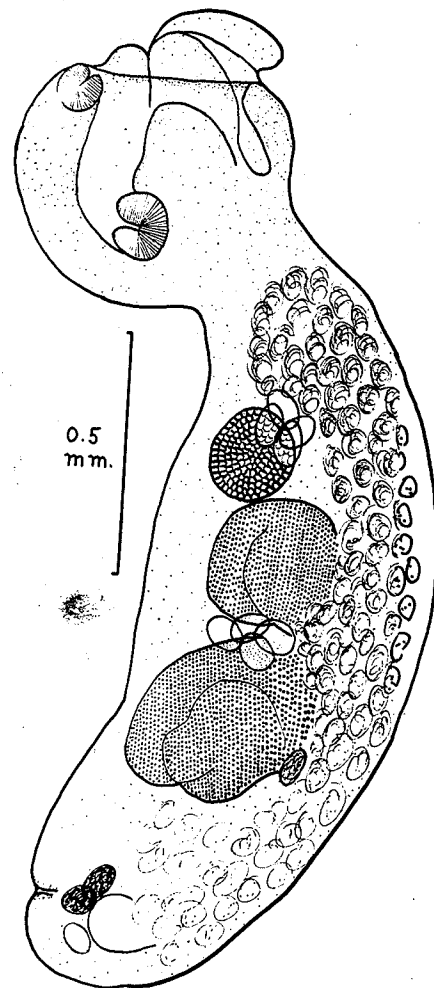


FIG. 52

PLATE XVI

Fig. 53. Lateral view of Cotylurus
brevis.

Fig. 54. Ventral view of C. brevis
showing bursa copulatrix
protruding from the genital atrium.

Fig. 55. Lateral view of C. mcleodi n. sp.
from the small intestine of the
Herring gull.

Fig. 56. Ventral view of C. mcleodi n. sp.



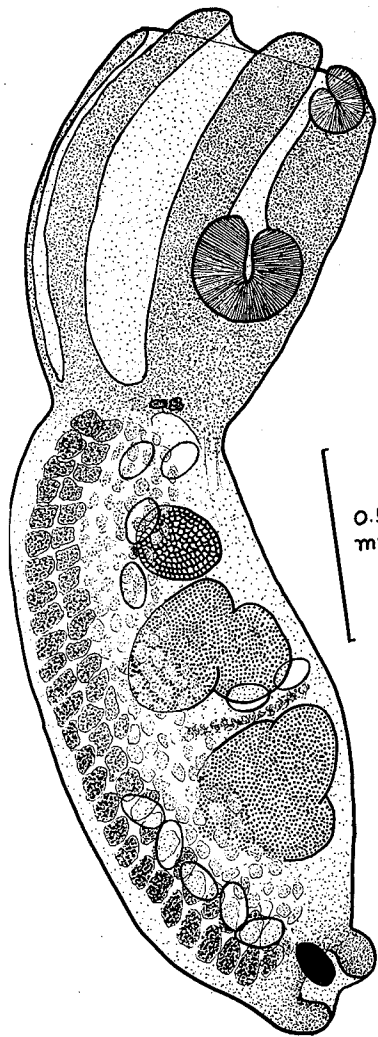


FIG. 53

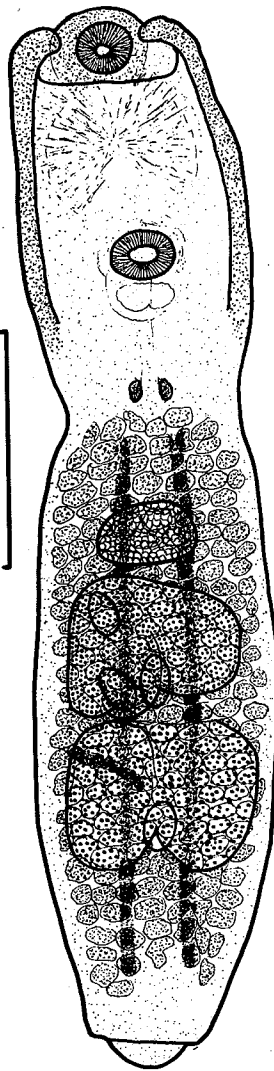


FIG. 54

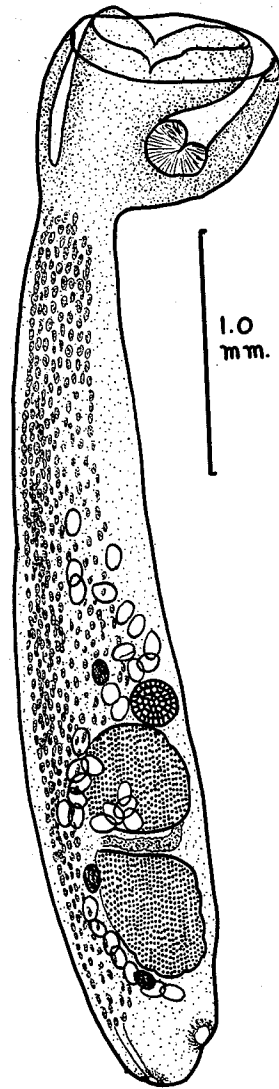


FIG. 55

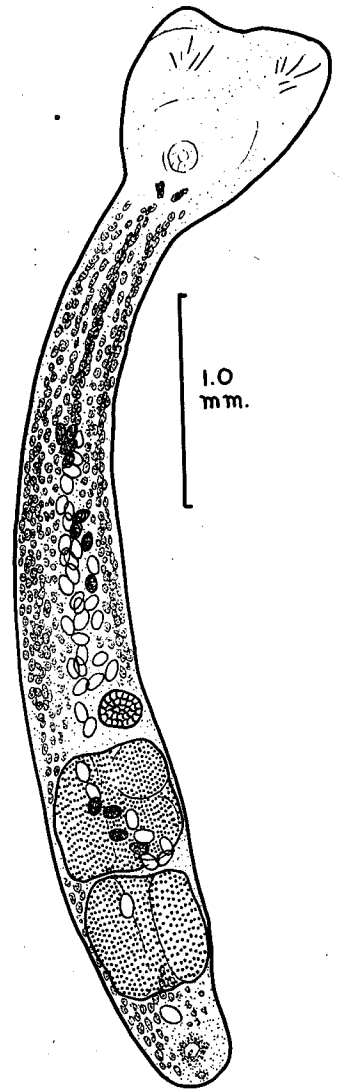


FIG. 56

Distance between ovary and anterior end-2.744, Anterior testis-0.442 by 0.600 by 0.460 in depth, Posterior testis-0.531 by 0.540 by 0.407 in depth, Distance between posterior testis and posterior end-0.442, Eggs-(35 to 52) 0.106 by 0.057. Literature consulted: (17), (88), (147), (238), (396), (469), (509), (564), (568), (667), (679), (687), (139).

Family Diplostomidae

Diplostomum huronense (La Rue, 1927) Hughes, 1929

One specimen was recovered from the small intestine of an immature Herring gull, and is shown in Figs. 61 and 62, page 77. The dimensions in mm. are as follows: Length-3.050, Anterior segment-1.586 by 0.793 by 0.305 in depth, Posterior testis-1.464 by 0.525 by 0.525 in depth, Oral sucker-0.085 by 0.110, Prepharynx-0.024, Pharynx-0.085 by 0.061, Esophagus-0.085 by 0.012, Distance between acetabulum and anterior end-0.817, Distance between tribocytic organ and anterior end-1.159, Acetabulum-0.092 by 0.110, Distance between tribocytic organ and acetabulum-0.244, Tribocytic organ-0.488 diam., Ovary-0.122 diam., Anterior testis-0.305 by 0.451, Posterior testis-0.305 by 0.427, Distance between posterior testis and posterior end-0.305, Genital atrium-0.183 by 0.085, Eggs-0.110 by 0.061. Literature consulted: (124), (139), (147), (209), (354), (384), (411), (462), (471), (472), (509), (517), (522), (537), (564), (566), (568), (591), (619), (628), (6679).

Diplostomum spathaceum (Rudolphi, 1819) Braun, 1893

Several specimens were recovered from the small intestine of a Herring gull, and a typical specimen is shown in Figs. 64 and 63, page 77, and a photomicrograph of the anterior segment is shown in Fig. 75, page 82. The dimensions in mm are as follows: Length-6.218, Anterior segment-2.668 by 1.508 by 0.290 in depth, Posterior segment-3.550 by 0.951 by 0.835, Oral sucker-0.139 by 0.209, No prepharynx, Pharynx-0.116 by 0.112, Esophagus-0.162, Acetabulum-0.151 by 0.186, Distance from acetabulum to anterior end-1.199, Distance between tribocytic organ and acetabulum-0.231, Tribocytic organ-0.626 by 0.325, Distance between ovary and anterior end-3.851, Ovary-0.311 diam., Anterior testis-0.626 by 0.835, Posterior testis-0.673 by 0.766, Distance between posterior testis and posterior end-0.603, Genital atrium-0.116 by 0.162, Pseudosuckers-0.070 by 0.162, Eggs-0.174 by 0.116.

Literature consulted: (73), (139), (147), (183), (232), (209), (346), (370), (411), (464), (502), (518), (563), (564), (568), (679), (687).

Diplostomum pelmatoides Dubois, 1932

Several specimens were recovered from the duodenum and small intestine of the Red-breasted merganser, and the small intestine of the Lesser scaup. Views are shown in Figs. 70, page 80, and Figs. 86 and 87 page 85. The dimensions of a

typical specimen are as follows: Anterior segment-0.522 by 0.363, Posterior segment-0.247 by 0.212, Oral sucker-0.073 by 0.061, Pharynx-0.044 by 0.026, Acetabulum-0.038 by 0.073, Tribocytic organ-0.110 by 0.125, Bursa copulatrix-0.064 by 0.087 by 0.060 deep, Eggs-0.070 by 0.035. This is the first report, as far as can be ascertained, of this species in North America.

Literature consulted:(54), (91), (112), (139), (147), (158), (204), (208), (209), (210), (211), (212), (213), (214), (225), (216), (219), (223), (224), (347), (509), (551), (564), (568), (574), (580), (581), (664), (679), (687).

Diplostomum baeri Dubois, 1937

Several specimens were recovered from the intestinal ceca and small intestine of the Red-breasted merganser, and a typical specimen is shown in Figs. 67 and 68, page 78. The dimensions in mm. are as follows: Length-0.666, Anterior segment-0.426 by 0.241 by 0.109 in depth, Posterior segment-0.240 by 0.192 by 0.176 in depth, Pseudosuckers-0.048 by 0.026, Acetabulum-0.032 diam., Tribocytic organ-0.106 by 0.090, Genital atrium-0.021 by 0.040, Eggs-(one) 0.043 by 0.032.

Literature consulted: (139), (147), (559), (568), (564), (679), (687), (685).

Diplostomum gavium (Guberlet, 1922), Hughes, 1929

One specimen was recovered from the small intestine of a Red-breasted merganser, and is shown in Figs. 66 and 78, pages 78, and 83 respectively. The dimensions in mm. are as follows: Length-0.636, Width at widest part-0.295, Width at level of tribocytic organ-0.257, Oral sucker-0.043 by 0.037, Pharynx-0.034 by 0.023, Pseudosuckers-0.053 by 0.028, Distance between acetabulum and anterior end-0.226, Acetabulum-0.023 diam., Tribocytic organ-0.109 diam., Distance between tribocytic organ and posterior end-0.279.

Literature consulted: (110), (139), (147), (182), (183), (203), (205), (206), (207), (209), (346), (564), (568), (687).

Posthodiplostomum prosostomum Dubois and Rausch, 1948

One specimen was recovered from a Herring gull, and is shown in Figs. 57 and 58, page 76, and a photomicrograph of the anterior segment is shown in Fig. 74, page 82. The dimensions in mm. are as follows: Length-2.256, Anterior segment-1.1440 by 0.461 by 0.230 in depth, Posterior segment-0.816 by 0.336 by 0.307 in depth, Oral sucker-0.038 diam., Pharynx-0.067 by 0.038, Acetabulum-0.077 diam., Distance of acetabulum from anterior end-0.850, Distance between tribocytic organ and acetabulum-0.163, Tribocytic organ-0.221 by 0.125, Ovary-0.067 by 0.144 by 0.154 in depth, Anterior testis-0.163 by

0.163 by 0.115 in depth, Posterior testis-0.230 by 0.154 by 0.106 in depth, Bursa copulatrix-0.221 diam., Eggs-0.106 by 0.058. Literature consulted: (111), (114), (115), (139), (147), (165), (166), (232), (349), (564), (567), (570), (568).

Family Cyathocotylidae

Mesostephanus sp.

Thirty specimens were recovered from the duodenum, intestinal ceca, and small intestine of three Red-breasted mergansers. Various specimens are shown in Figs. 33, page 59, 65 page 78, 69 page 79, and photomicrographs are shown on page 83, Figs. 76, 77, and 79 to 82. The dimensions in mm. are as follows: Length-0.631 to 1.079, Width- 0.151 to 0.358, Thickness-0.111, Distance of acetabulum to anterior end-0.260 to 0.663, Acetabulum-0.011 by 0.024 to 0.020 to 0.023, Oral sucker-0.028 by 0.023, Pharynx-0.042 by 0.025, Tribocytic organ-0.084 by 0.055 to 0.091 by 0.065, Distance of tribocytic organ to posterior end-0.169 to 0.293, Eggs-not more than 3 seen in any specimen-0.058 by 0.046 to 0.104 by 0.059.

Literature consulted: (7), (64), (109), (139), (147), (294), (500), (509), (536), (549), (556), (564), (565), (568), (579), (580), (581), (630), (660), (665), (679), (687).

PLATE XVII

- Fig. 57. Posthodiplostomum prosostomum
from Herring gull. Ventral view.
- Fig. 58. P. prosostomum. Lateral view.
- Fig. 59. Parastrigea neorobusta n. sp.
from the small intestine of Lesser
scaup. Ventral view.
- Fig. 60. P. neorobusta n. sp.
Lateral view.



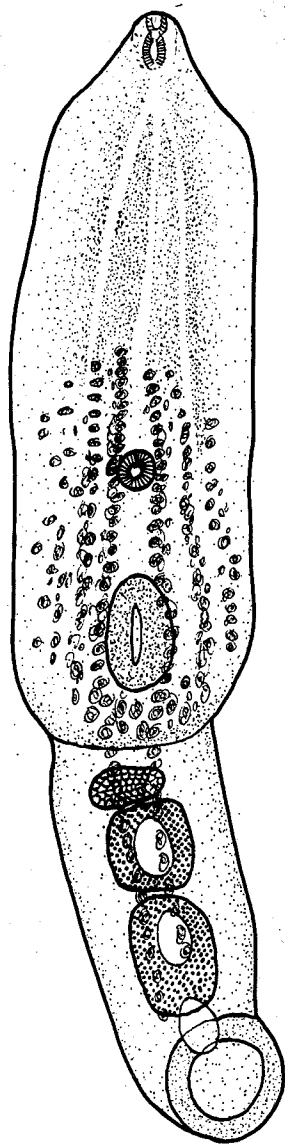


FIG. 57

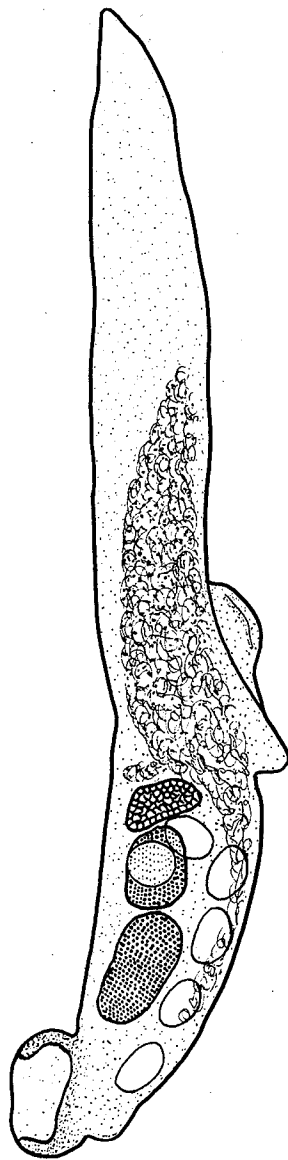


FIG. 58

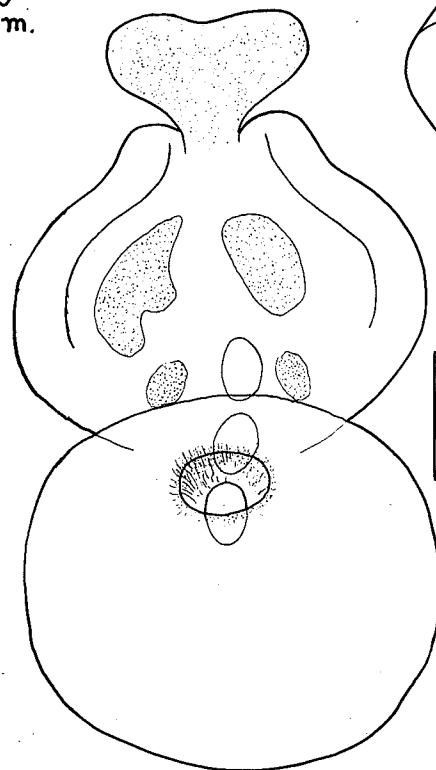


FIG. 59

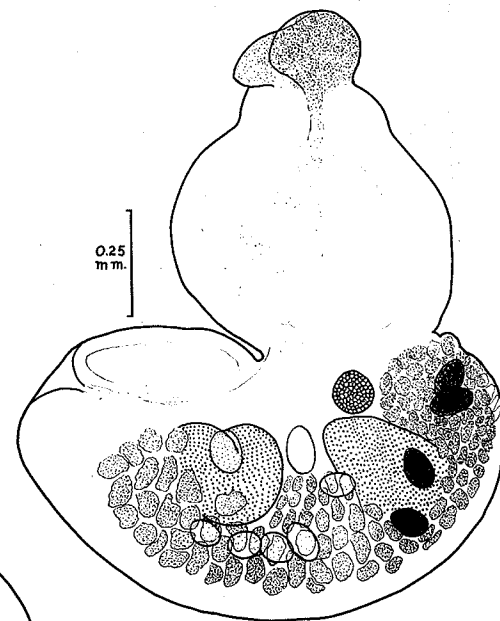
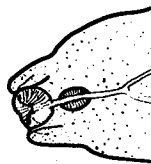
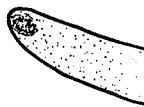
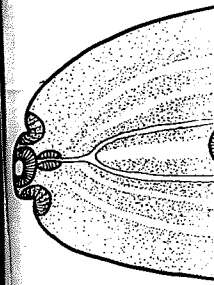


FIG. 60

PLATE XVIII

- Fig. 61. Diplostomum huronense
from the small intestine of an
immature Herring gull. Lateral view.
- Fig. 62. D. huronense. Ventral view.
- Fig. 63. D. spathaceum from the intestine
of Herring gull. Lateral view.
- Fig. 64. D. spathaceum. Dorsal view.



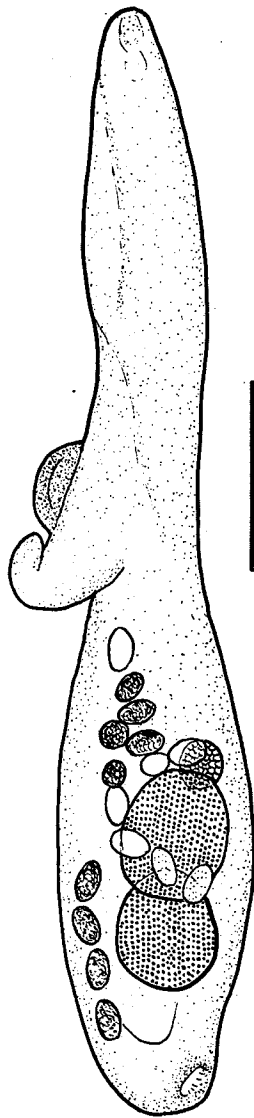


FIG. 61

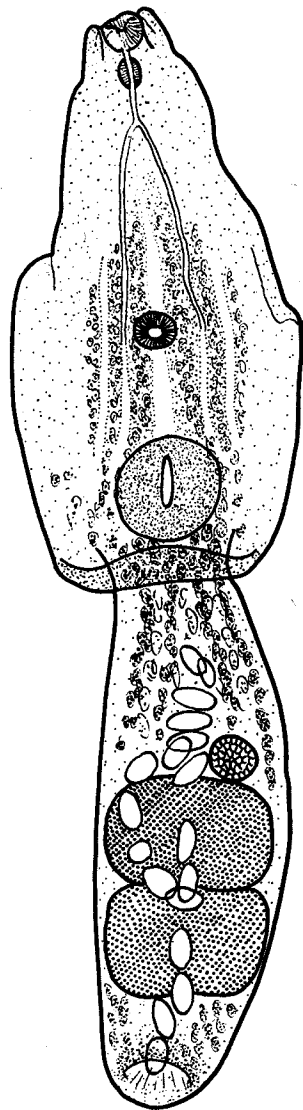


FIG. 62

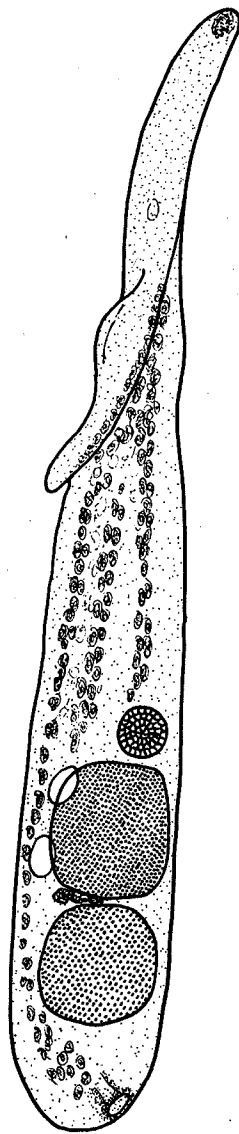


FIG. 63

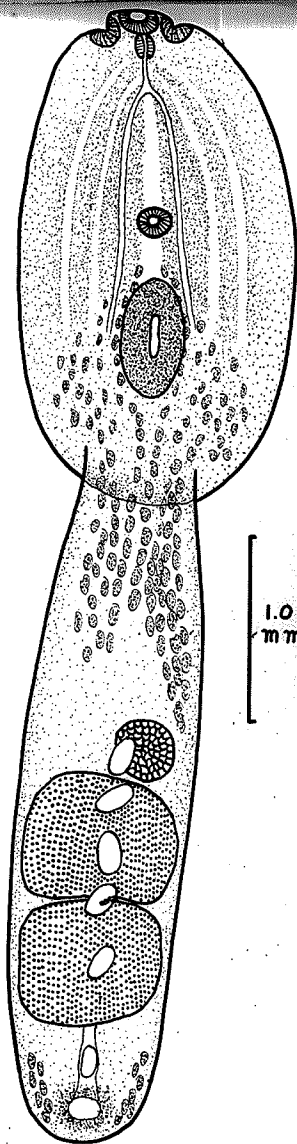


FIG. 64

PLATE XIX

Fig. 65. Mesostephanus sp. from the Red-breasted
merganser. Ventral view.

Fig. 66. Diplostomum gavium from the small
intestine of the Red-breasted merganser.
Ventral view.

Fig. 67. D. baeri from the intestinal ceca of
the Red-breasted merganser. Ventral view.

Fig. 68. D. baeri. Lateral view.

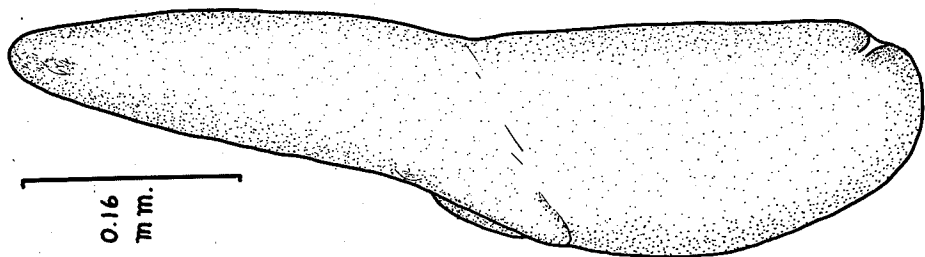


FIG. 68

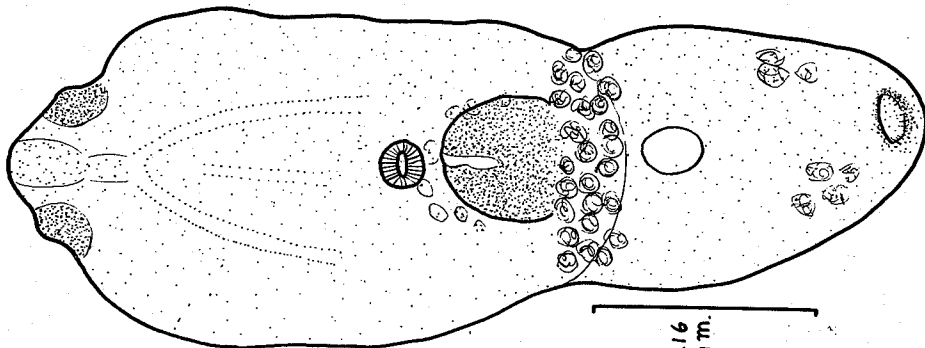


FIG. 67

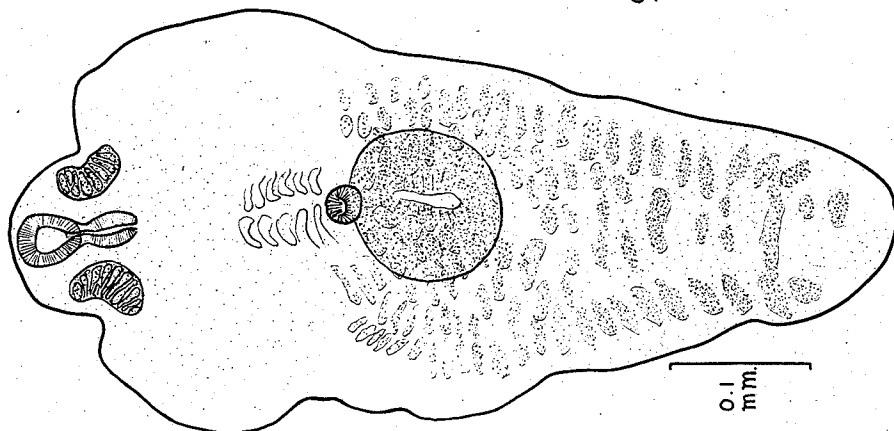


FIG. 66

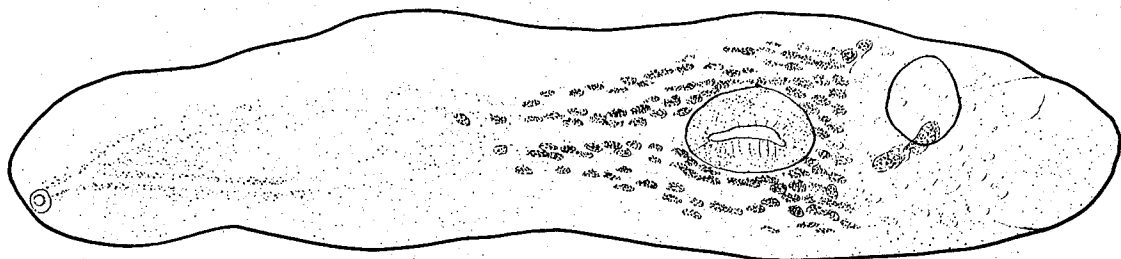


FIG. 65

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PLATE XX

Fig. 69. Various specimens of Mesostephanus
sp. from the duodenum, small intestine
and intestinal ceca of Red-breasted
mergansers.

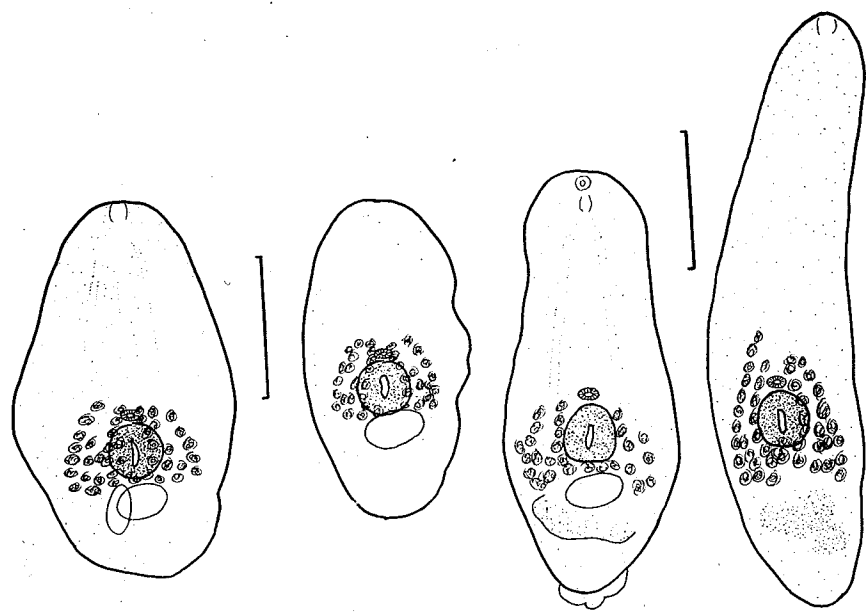


FIG. 69.



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PLATE XXI

Fig. 70. a-Diplostomum pelmatoides from
Red-breasted merganser.

Lateral view.

b-D. pelmatoides. Ventral view,
specimen mounted.

c-D. pelmatoides. Lateral view
of posterior segment.

d-D. pelmatoides. Dorsal view.

Fig. 71. ~~Acetabularia~~ Acetabularia lari, male and
female in copuli. From intestinal
vein of Herring gull.

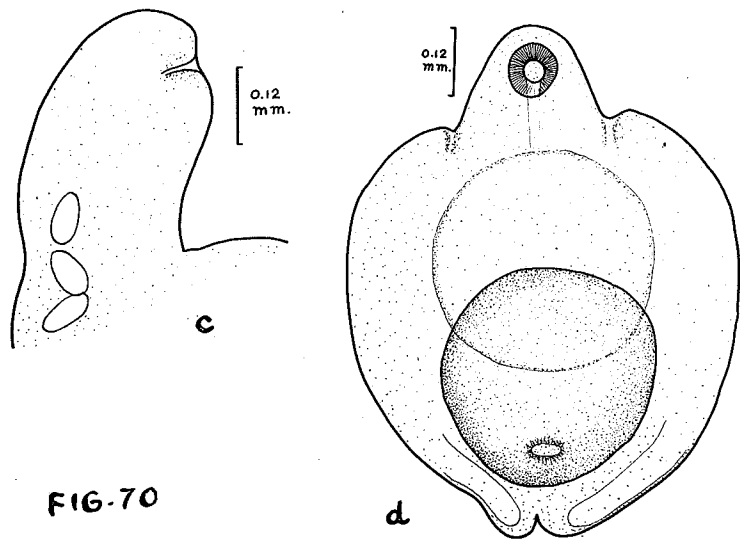
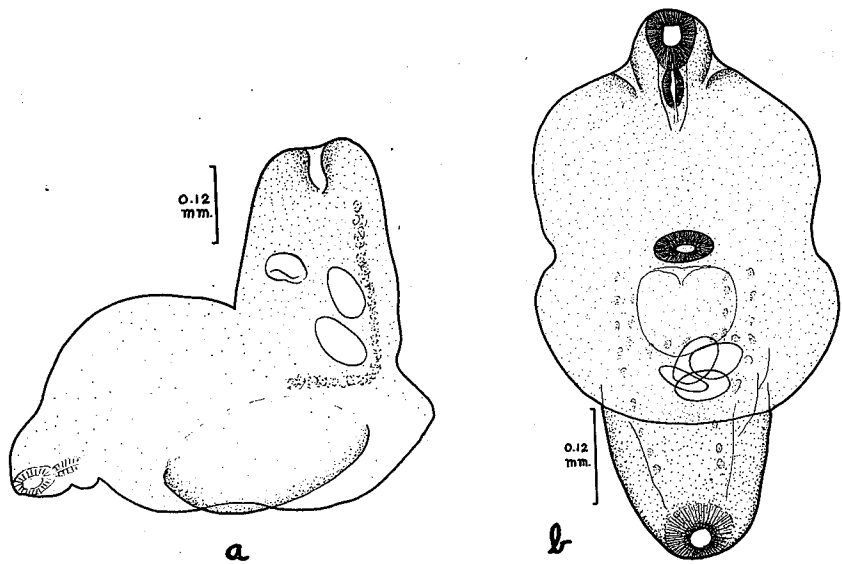


FIG. 70

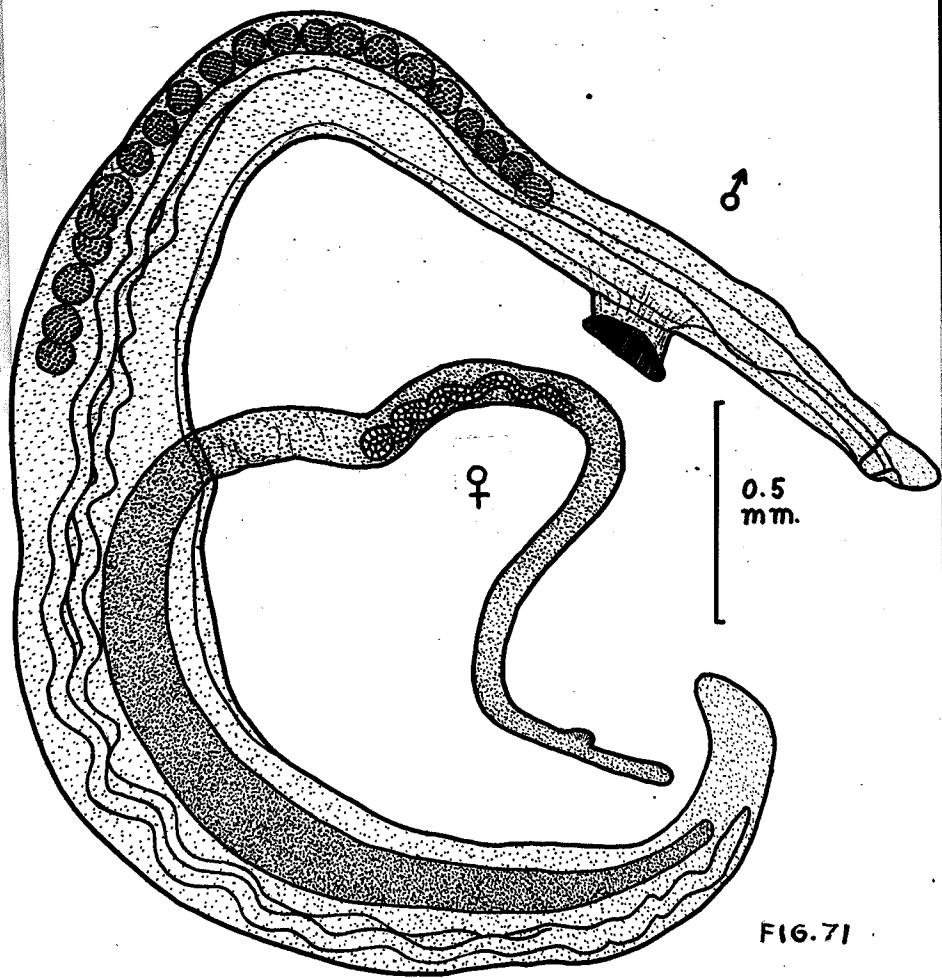


FIG. 71

PLATE XXII

Fig. 72. Cotylurus communis from the
Bursa of Fabricius of an
immature Herring gull.
Lateral view, cross section.

Fig. 73. C. communis specimen
before processing.

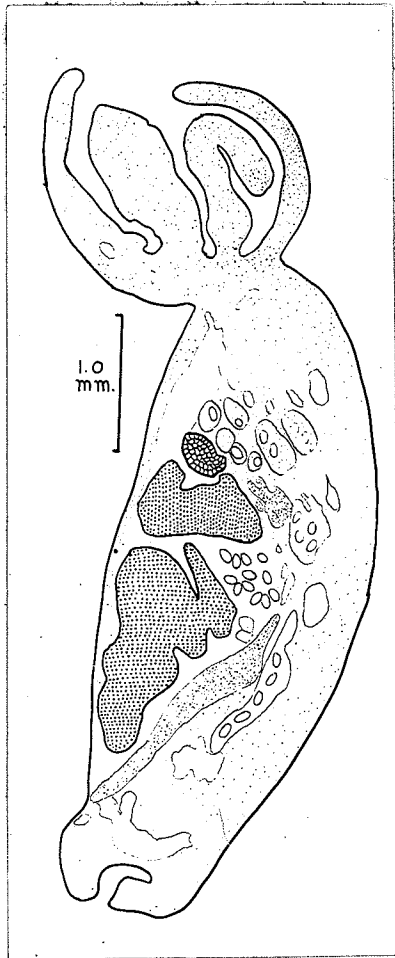


Fig. 72.

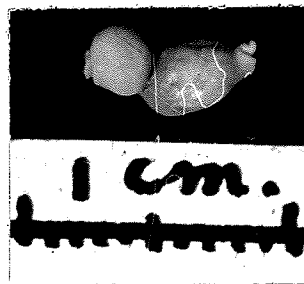


Fig. 73.

PLATE XXIII

Fig. 74. Photomicrograph of
anterior segment of
Posthodiplostomum prosostomum,
ventral view, x54

Fig. 75. Photomicrograph of anterior
segment of Diplostomum
saathaceum shown in Fig. 64.
x28



Fig. 74.



Fig. 75.

PLATE XXIV

Fig. 76. Mesostephanus sp. from Red-breasted
merganser. x75 Photomicrograph.

Fig. 77. Mesostephanus sp. x75 Photomicrograph.

Fig. 78. Diplostomum gavius x67 Photomicrograph

Fig. 79. Mesostephanus sp. x75 Photomicrograph

Fig. 80. Mesostephanus sp. x75 Photomicrograph

Fig. 81. Mesostephanus sp. x75 Photomicrograph

Fig. 82. Mesostephanus sp. x75 Photomicrograph

lateral view.

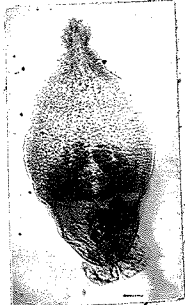


Fig. 76.



Fig. 77.



Fig. 78.



Fig. 79.



Fig. 80.



Fig. 81.



Fig. 82

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graph
graph
graph
graph

PLATE XXV

Fig. 83. Photomicrograph. Posterior
end of Cotylurus brevis. x68

Fig. 84. Photomicrograph. Posterior
end of C. brevis. x68

Fig. 85. Photomicrograph. Posterior
end of C. brevis. x68

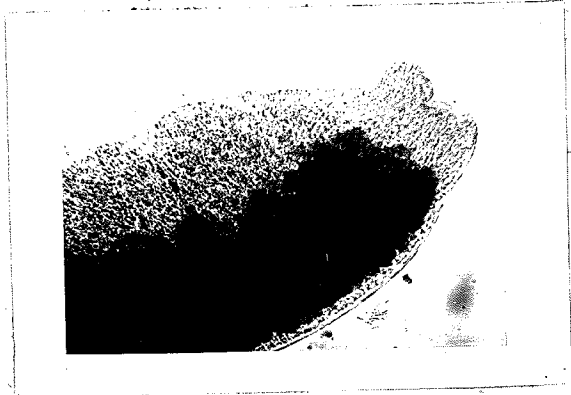


Fig. 83.

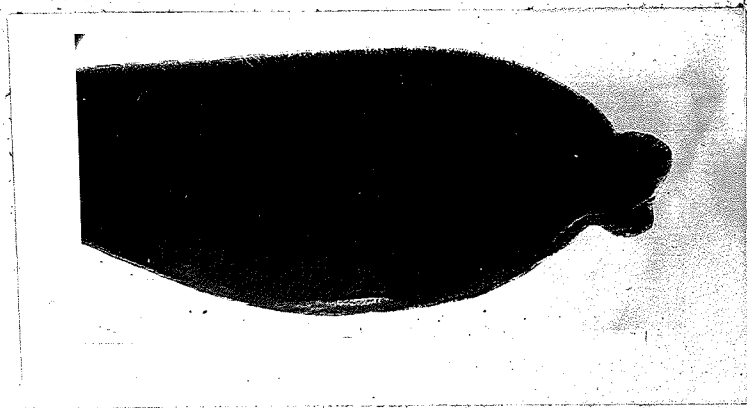


Fig. 84.

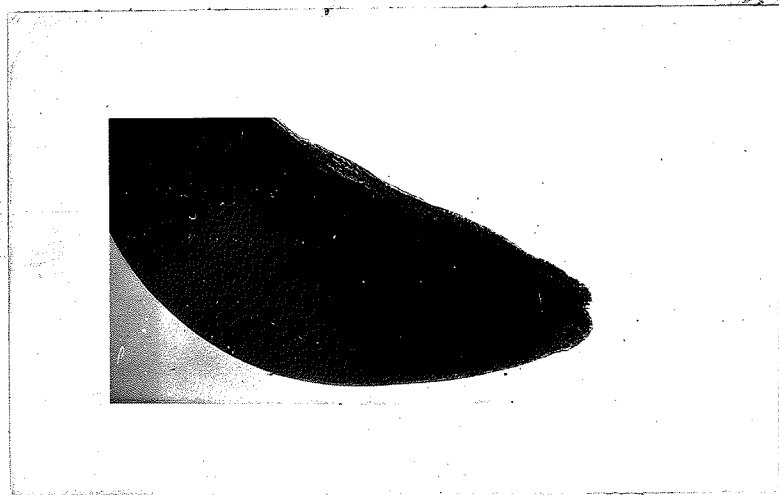


Fig. 85.

PLATE XXVI

Fig. 86. Photomicrograph of Diplostomum
pelmatoides shown in Fig. 70.b.

Dorsal view. x74

Fig. 87. Photomicrograph of unmounted
D. pelmatoides. Lateral view.

x74

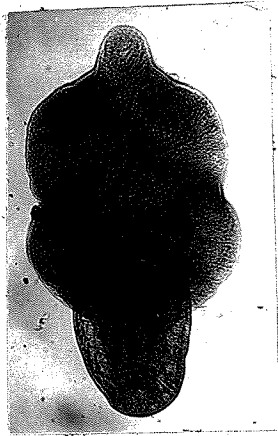


Fig. 86.

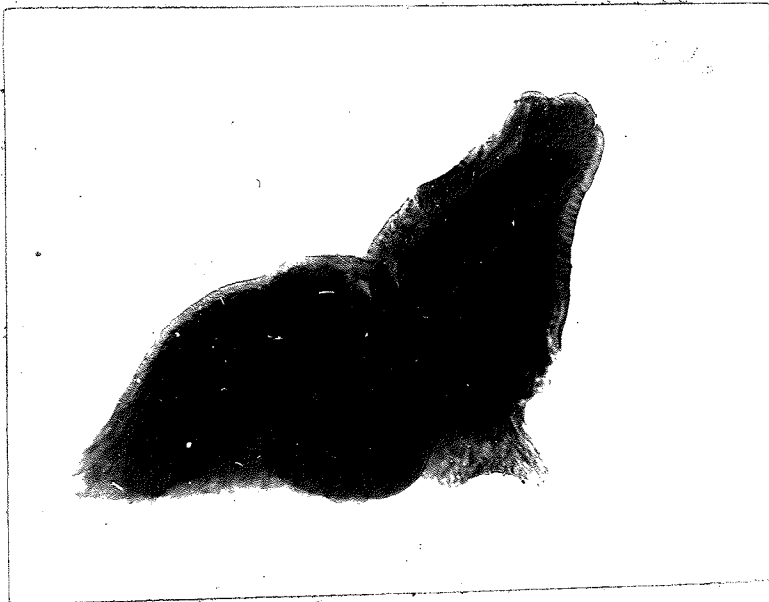


Fig. 87.

PLATE XXVII

- Fig. 88. Photomicrograph of posterior end of Cotylurus brevis shown in Fig. 54. x68
- Fig. 89. Photomicrograph of portion of anterior segment of C. brevis showing vitelline reservoir extending perpendicularly from the vitelline glands towards the ventral surface. Lateral view. x68
- Fig. 90. Photomicrograph of aberrant form of C. brevis shown in Fig. 51. x68



Fig. 88.



Fig. 89.



Fig. 90.

PLATE XXVIII

Fig. 91. Photomicrograph of anterior, lateral, segment of Cotylurus brevis. x68

Fig. 92. Photomicrograph of anterior segment of C. brevis. Ventral view. x68

Fig. 93. Photomicrograph of anterior segment of C. brevis shown in Fig. 54. x68

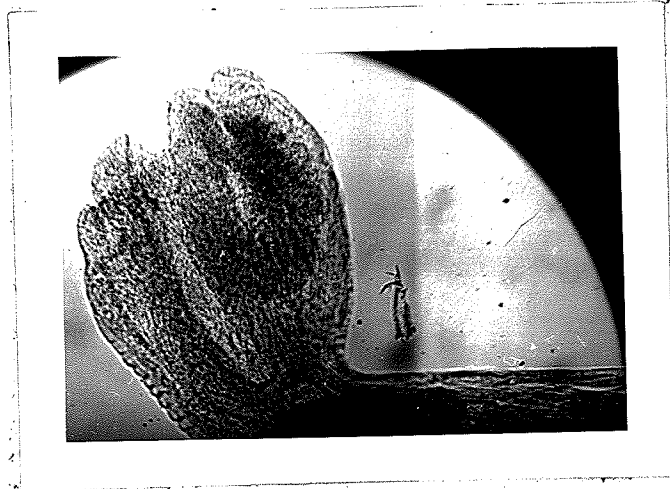


Fig. 91.

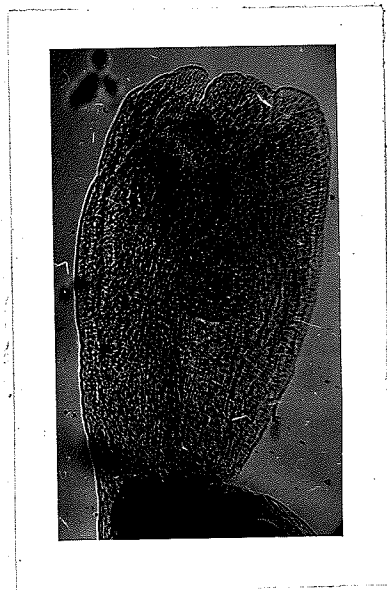


Fig. 92.

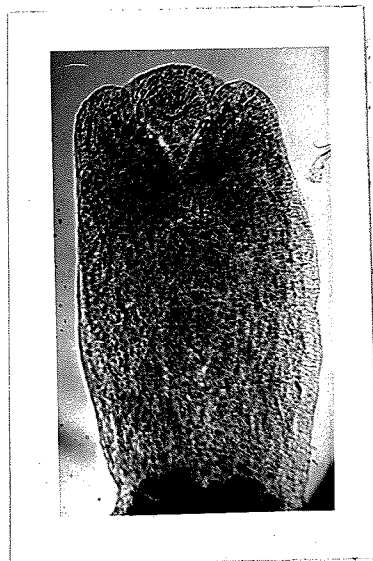


Fig. 93.

PLATE XXIX

Fig. 94. Astiotrema sp. Variations in
size and features.

Fig. 95. Echinoparyphium elegans.
Aspects of growth in the species.

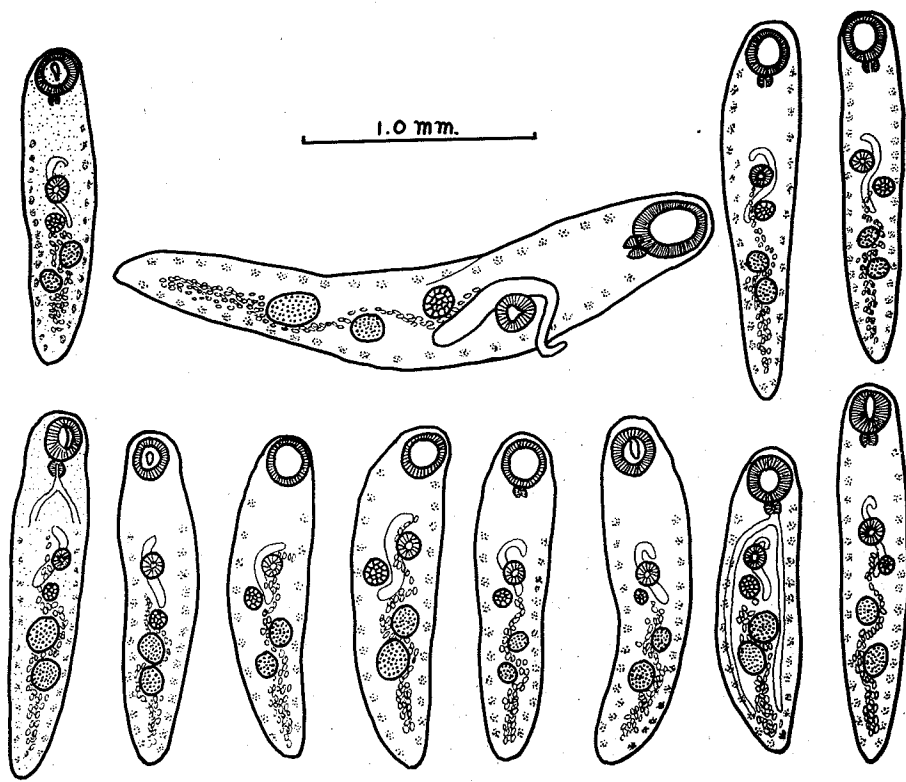


FIG. 94

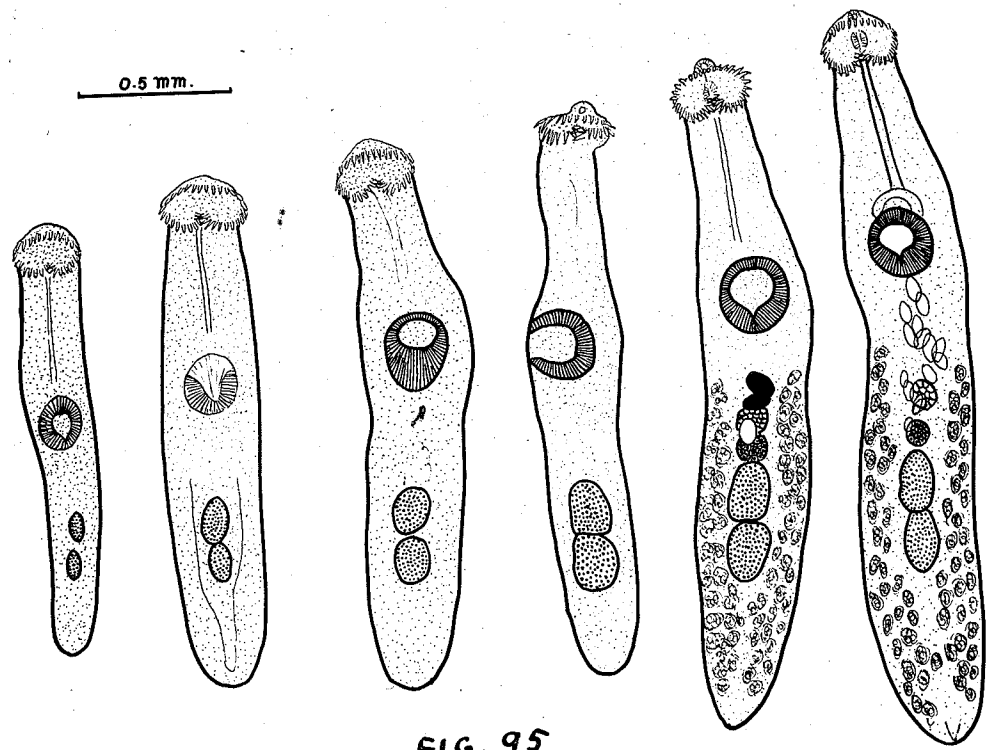


FIG. 95

Family Schistosomatidae

Six adult species of the Family Schistosomatidae have been discovered and reported by McLeod from Manitoba, and these are included in this work. They are as follows:

Ornithobilharzia filamenta McLeod, 1940---From the ceco-geomesenteric and mesenteric veins and lymphatics of the Herring gull and Ring-billed gull, (309). Fig. 103, page 95.

O. aviani McLeod, 1940---From the portal and hepatic veins of the Herring gull, (309). Fig. 104 (a to c), page 95.

Austrobilharzia lari (McLeod, 1937) Penner, 1953---This was originally reported by McLeod as Microbilharzia lari (308), (309), from the portal and intestinal veins of a Herring gull. Penner suppressed the genus Microbilharzia, allocating all the species to the genus Austrobilharzia, (625). Fig. 100, page 94.

A. canadensis (McLeod, 1936) Penner, 1953---Originally M. canadensis from the portal and hepatic veins of the Canvas-back, (307), (309), (625). Fig. 105 (a to b), page 95.

A. manitobensis (McLeod, 1936) Penner, 1953---Originally M. manitobensis from the hepatic portal veins of the Canvas-back, (307), (309), (625), Fig. 106 a, page 95.

Trichobilharzia querquedulae (McLeod, 1937) Wu, 1953---Originally Pseudobilharziella querquedulae (308), (309), (310), from the portal and intestinal veins of the Blue-wing teal. McMullen and Beaver (318) reduced the genus Pseudobilharziella

to synonymy with the genus *Trichobilharzia* and stated that *T. guerquedulae* was synonymous with *T. physellae*. Wu (496) does not agree that the two species are synonymous as there were a number of differences, and accordingly left the species described by McLeod, separately under the name *T. guerquedulae*.

McLeod mentions twelve species of cercariae as being found in Manitoba, only three of them (*Cercaria elvae* (Miller, 1923) Talbot, 1936 (309), *C. stagnicolae* Talbot, 1936 (309), and *C. dermolestes* McLeod, 1940 (309), the latter being the cercarial stage of "*Pseudobilharziella* sp." found in the Lesser yellow-legs and Pectoral sandpiper⁽³¹⁰⁾ being linked with schistosome dermatitis in the Province of Manitoba. The other nine species were: *Cercaria* of *Diplostomum flexicaudum* Van Haitsma, 1931 (309), *Cercaria* of *Cotylurus flabelliformis* Van Haitsma, 1931 (309), (467), *C. yogena* Cort and Brackett, 1937 (309), *C. dohema* Cort and Brackett, 1937 (129), (309), *C. bessiae* Cort and Brooks, 1928, the cercaria of *Crassiphiala amblop-litis* Hunter, 1937 (219), (309), *C. burti* Miller, 1923 (309), *C. wardlei* McLeod, 1934 (306), (309), *C. multicellulata* Miller (possibly) (309), and *C. physellae* (309) }

Schistosome Dermatitis.

Schistosome dermatitis is world wide in extent, and has been encountered by the writer as far north as the 55 th parallel of latitude in the marshes in the vicinity of Snow Lake, Manitoba. Extensive work has been carried out by Wardle

and McLeod on schistosome dermatitis in the Province, as mentioned previously in Chapter II. (306), (307), (309), (310), (426), (476), Alberta (185). Other fresh water dermatitis outbreaks have been reported from the following localities: Seattle-(221), (596), (600), (601). Cultus Lake, B.C.-(569). Eastern Massachusetts-(371). Wisconsin-(57), (59), (315), (319). Michigan-(316), (319), (320), (558). Wales-(327). Europe-(433). New Zealand-(300), (597), (598). Australia-(237), (599). South Africa-694). Burma-(letter to Cort by Meggitt). Japan-(220). Malaya-(81). Marine reports:Florida-(592), (593), (627). Mexico & California-(624). Rhode Island-(656). Other literature consulted: (53), (55), (58), (61), (62), (75), (77), (135), (194), (317), (318), (355), (475), (557), (559), (583), (585), (621), (622), (623), (625), (626), (119).

Other literature consulted on the schistosomes: (13), (56), (59), (60), (63), (116), (139), (154), (159), (160), (161), (274), (350), (362), (375), (376), (379), (381), (428), (431), (435), (454), (479), (518), (529), (542), (554), (590), (593), (620), (621), (623), (669), (679), (687), (689), (626), (513), (656).

CHAPTER V

SUMMARY AND CONCLUSIONS

Summary

Thirty seven trematode species are described from twenty six separate hosts. Six new species as well as six undetermined species are included. A new genus, *Xenisma*, is proposed for a new species that belongs to the isolated genera of the Echinostomatidae. The six new species are: *Parastrigea neorobusta*, *Cotylurus mcleodi*, *Stephanoprora lari*, *Xenisma wardlei*, *Echinostoma platyrhynchi*, and *Echinostoma manitobensis*. The undetermined species are: *Mesostephanus* sp., *Plagiorchis* sp. 1, *Plagiorchis* sp. 2, *Astiotrema* sp., *Hindia* sp., and *Haematotrephus* sp.

Conclusions

The provinces of Manitoba and Saskatchewan are in unique positions with respect to the four main waterfowl flyways in North America (562). It can readily be seen that the researcher in helminthology would have very fertile fields of exploration in these areas, where intermingling of the birds would occur.

ADDENDA

To the families Strigeidae and Diplostomidae may be added the following specimens collected by Dubois & Rausch in Manitoba. *Cotylurus erraticus* from the Ring-billed gull, and *C. cornutus* from the Silt sandpiper and Dowitcher. *Diplostomum spathaceum* from the Franklin's gull, and *D. repandum* from the Black tern. (152).

PLATE XXX

Fig. 96. Astiotrema sp. from the small intestine of Franklin's gull.

Ventral view.

Fig. 97. Plagiorchis sp. 1 from Herring gull. Ventral view.

Fig. 98. Plagiorchis sp. 2 from the small intestine of a Common tern.

Ventral view.

Fig. 99.-a-Trichobilharzia guerquedulae posterior segment of female, from the portal veins of Blue-wing teal. (After McLeod).

b-T. guerquedulae. Anterior segment of female. (After McLeod).

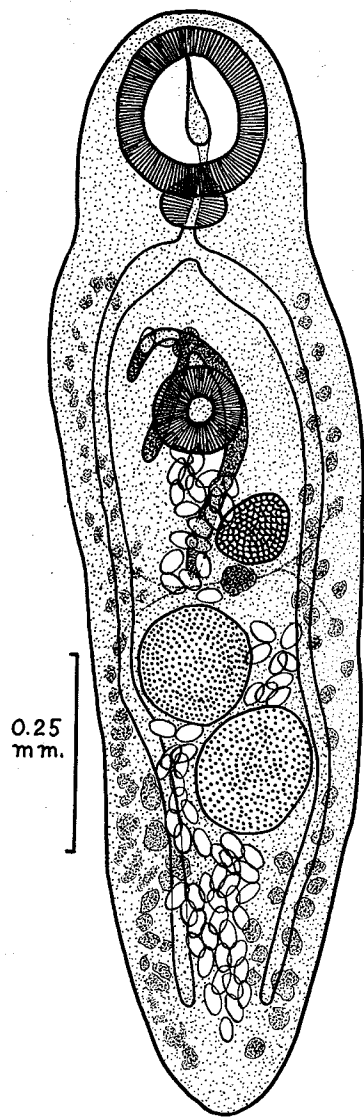


FIG. 96

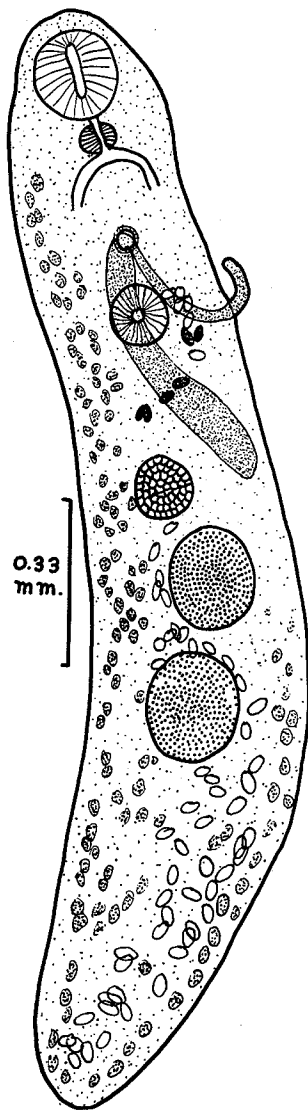


FIG. 97

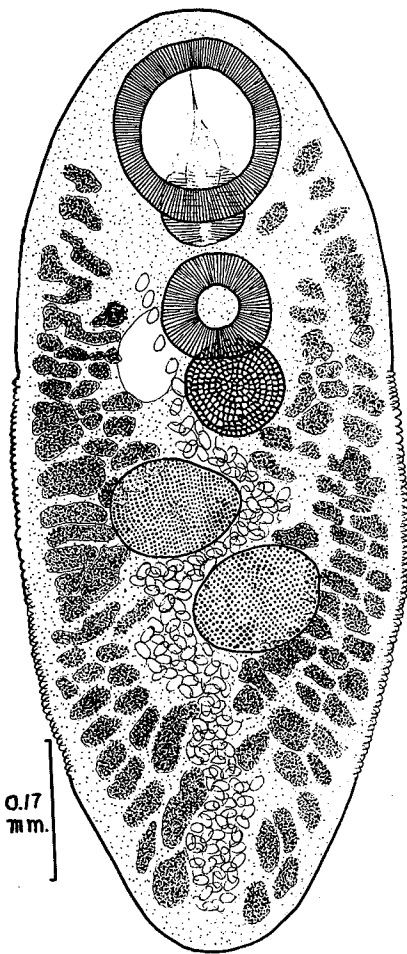


FIG. 98

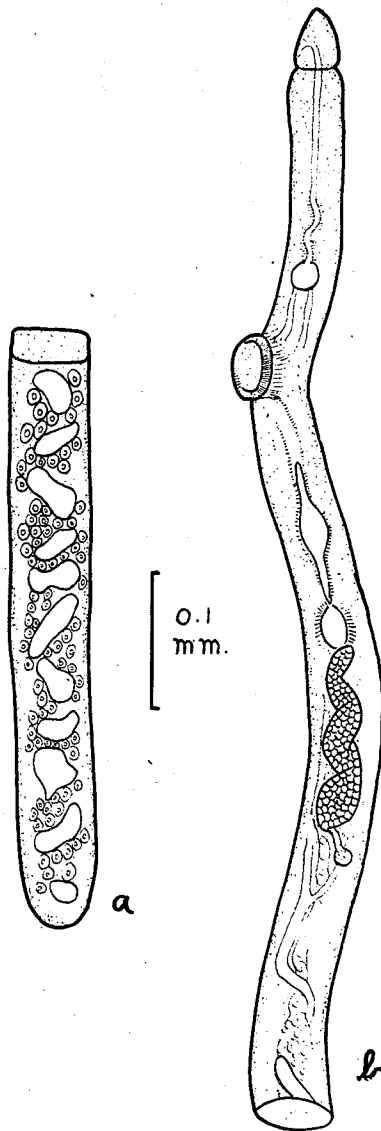


FIG. 99

PLATE XXXI

- Fig. 100. Austrobilharzia lari, from the intestinal veins of a Herring gull. Lateral view. (After McLeod). (male).
- Fig. 101. A. lari, female, from the portal veins of a Herring gull. Ventral view. (After McLeod).
- Fig. 102. a-Trichobilharzia querquedulae, posterior segment of male, ventral view, from the intestinal veins of a Blue-wing teal. (After McLeod).
- b-T. querquedulae, anterior segment of male. (After McLeod).
- c-T. querquedulae, anterior segment of immature male. (After McLeod).

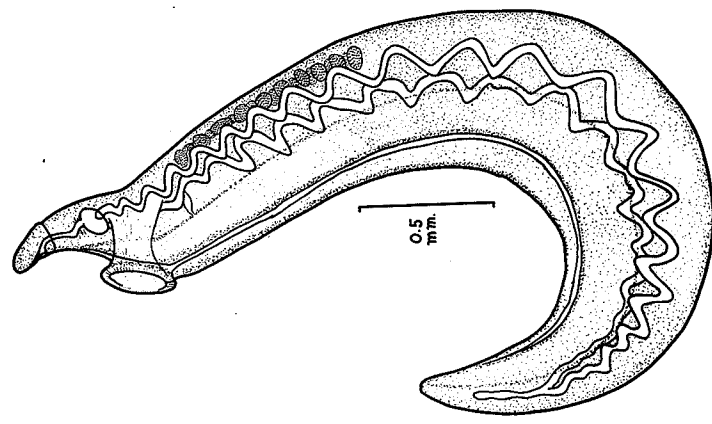


FIG. 100

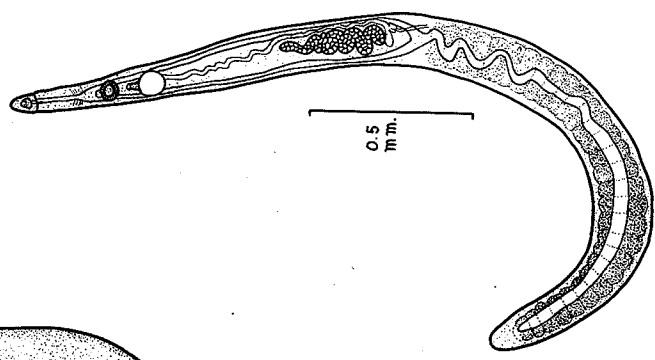
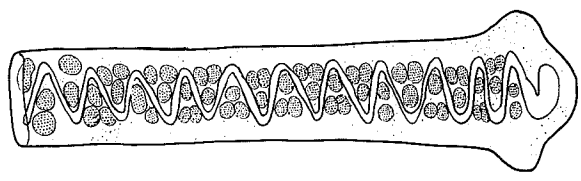
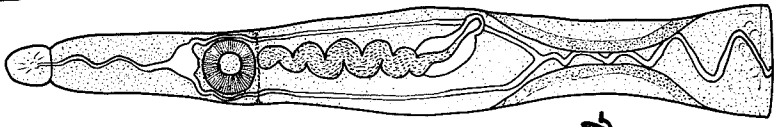


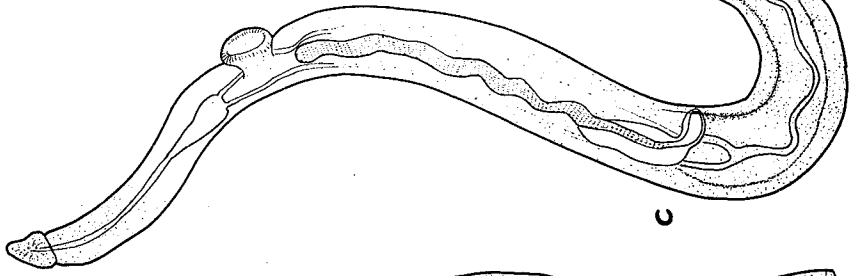
FIG. 101.



a



b



c

FIG. 102.

PLATE XXXII

Fig. 103. Ornithobilharzia filamenta.

a-Anterior segment of female,
ventral view, from the mesenteric
veins of a Herring gull. (After McLeod).

b-O. filamenta, female, entire specimen
from the lymphatics of a Ring-billed gull.
(After McLeod).

Fig. 104. O. aviani from the portal and
hepatic veins of the Herring gull.

a-Posterior segment of male. (After McLeod).

b-Anterior segment of male. (After McLeod).

c-Anterior segment of female. (After McLeod).

Fig. 105. Austrobilharzia canadensis, male, & female.

a-Male, from the portal veins of the
Canvasback duck. (Modified after McLeod).

b-Female, from the hepatic and portal veins.
(Modified after McLeod).

Fig. 106. Austrobilharzia manitobensis, male,
from the hepatic portal veins of the
Canvasback duck. (Modified after McLeod).

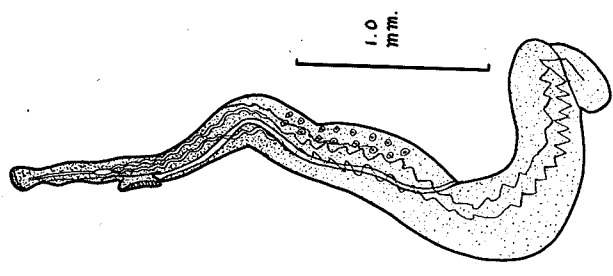


FIG. 106.

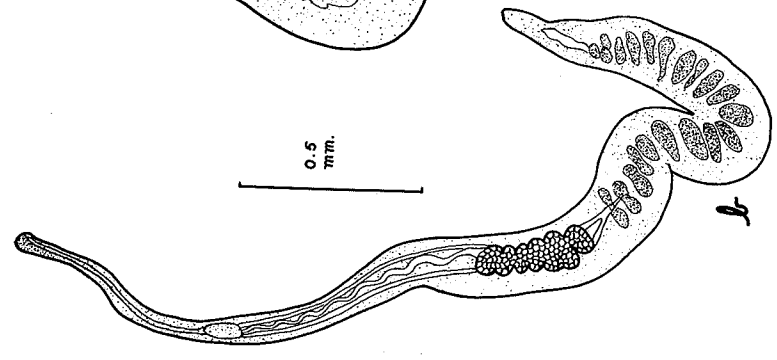


FIG. 105

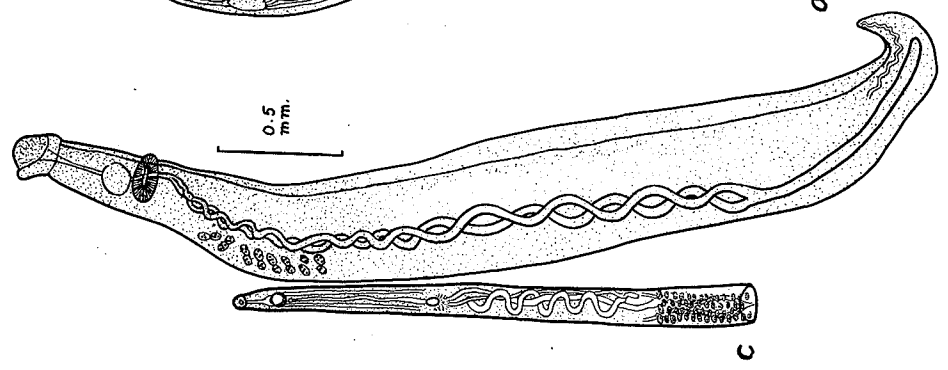


FIG. 104

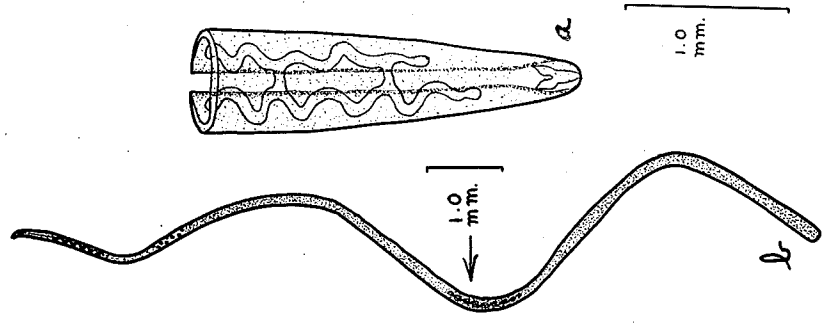
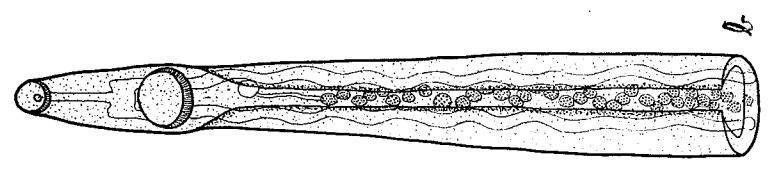
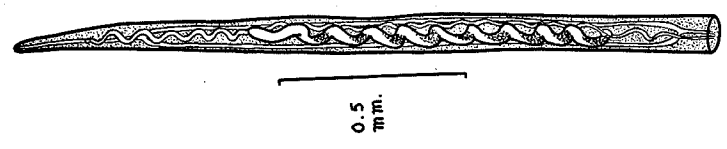


FIG. 103



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 female.
 d).
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BIBLIOGRAPHY

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