SOME TREMATODE PARASITES
OF
DUCKS AND GEESE
IN
EASTERN CANADA

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OF DUCKS AND GEESE IN EASTERN CANADA

by

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A C K N O W L E D G E M E N T S

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I. INTRODUCTION

The recent inauguration of conservation of wild life in North America has focussed the attention of zoologists on the breeding grounds of ducks and geese on this continent. In most instances these areas are situated in Canada and it is here that the problems concerning the health of these birds are important. It is fairly safe to say that the major infestations by internal parasites are contracted in the breeding grounds due to the tremendous numbers of birds congregated in a comparatively small area. This is undoubtedly the case when infestations are present in young birds.

Although our knowledge of the trematode parasites of these birds has been considerably increased during late years, by many publications in the United States, there is still a lack of knowledge concerning the distribution of species. In order to make a contribution towards a further knowledge of the internal parasites encountered in these birds a study of the parasites collected in eastern Canada during the general survey work of the Institute of Parasitology was made. The species described in this paper were unidentified specimens present in the collection of the above mentioned Institute during the winter of 1937-38.

II. DESCRIPTION OF PARASITES

ECHINOSTOMA REVOLUTUM (Frölich, 1802)

(Plate I., Figs. 1, 2)

Synonyms: Distomum revolutum Frölich, 1802
D. echinatum Zeder, 1803
Echinostoma echinatum Rudolphi, 1809

Generic Diagnosis (From Baylis (1)).

"The genus Echinostoma Rudolphi, 1809, consists of medium-sized or rather large forms with a double row of spines in the 'head crown,' not interrupted dorsally. The cuticle is spiny on the ventral surface of the anterior region. The suckers are close together. The cirrus sac is small and lies almost entirely in front of the ventral sucker. The testes are usually rounded or oval with their long axis arranged longitudinally, and may or may not be lobed. They lie in the middle line, one immediately behind the other, in the posterior half of the body. The ovary is round or transversely oval, and situated in the middle or a little to one side. The vitelline glands do not extend forward beyond the posterior border of the ventral sucker. The adults occur in the intestine of birds."

Description

Five specimens from the small intestine of the domestic goose, Anser domesticus, several specimens from the Black duck, Anas rubripes rubripes, and three immature worms from the Canada goose, Branta canadensis, were examined.

Those from the domestic goose were used as typical forms as they adhered more closely to the specific description as given by Lal (9) and Yamaguti (24). These specimens were all from the Institute of Parasitology collection and were preserved in ethyl-glyco-formol solution. The worms were stained in Delafield's acid haematoxylin, cleared in Beech-wood creosote and mounted in Canada balsam.

Typical Form (Plate I., Fig. 1.)

This worm is flattened and elongate-oval, measuring 15.9 mm. in length and 2.57 mm. at its point of greatest width in the uterine region. The cuticle is spinose, the spines being thickest anteriorly and disappearing completely in the post-testicular region. The reniform head-collar is 0.96 mm. broad and bears 37 rod-shaped and bluntly pointed spines. There are five spines in each end group, six in each lateral group, and 15 in the dorsal group; those in the latter group are arranged in two alternating rows. In each end, or corner group, there are three oral spines and two aboral spines, the latter being continuous with the six lateral spines. These spines are symmetrical in arrangement. There does not appear to be a great deal of difference in comparative sizes of oral and aboral spines except that the orals, in the corner groups, appear to be only slightly smaller than the aborals. The largest cephalic spine, measuring 150μ by 32μ, appears to be the outermost aboral spine in the corner group, and the smallest, measuring 70μ by 30μ is either of the two end spines in the dorsal group. The cuticular spines are much smaller,

varying from 29-45μ by 15-17μ, the smallest being anterior in position. Many of the cuticular spines were missing, due, in all probability, to partial digestion of the cuticle and its subsequent scaling off. The sub-terminal oral sucker is 0.40 mm. by 0.25 mm. The short prepharynx is 0.12 mm. long. The muscular pharynx measures 0.29 mm. by 0.34 mm. The long, slender oesophagus is 1.06 mm. in length. The intestinal caeca are long, slender and tubular and reach to within approximately 0.24 mm. from the posterior end of the body. The muscular acetabulum occurs in the posterior part of the anterior quarter of the body, its anterior margin being about 2.60 mm. from the anterior end of the worm. It is cup-shaped and slightly deeper than it is broad, measuring 1.31 by 1.36 mm.

The testes lie one directly behind the other in the median longitudinal line and occupy the anterior portion of the post-equatorial region of the body. They are oval in shape and have an entire margin. The anterior testis, measuring 1.26 mm. by 0.84 mm. is slightly smaller than the posterior testis, which is 1.42 mm. by 0.87 mm. The cirrus-sac is anterior to the acetabulum and it contains the cirrus, a pars prostatica and a large prostate gland. The male and female genital glands open to the exterior through a common genital pore which is situated in the mid-line directly posterior to the caecal bifurcation.

The ovary has an entire margin and in these specimens is more or less pear-shaped with its long axis lying crosswise to the longitudinal axis of the body. It measures 0.54 mm. by

0.37 mm. and lies close in front of the anterior testis. Directly posterior to and slightly to one side of the ovary lies a large, diffuse shell gland. A Laurer's canal is present. A comparatively large uterine seminal receptacle is present. The vitellaria occupy the lateral fields of the body and extend from a point a short distance posterior to the acetabulum to almost the posterior end of the body. They consist of distinct and fairly large follicles. The vitelline ducts lead into a small vitelline reservoir. For the most part the vitellaria cover the intestinal caeca on all sides. From the oviduct the uterus extends anteriorly in fairly loose, transverse coils which are bounded laterally by the intestinal caeca and the vitelline follicles. The eggs are small, measuring 100-110μ by 52-60μ.

The specimens from the Black duck were much smaller than those taken from the domestic goose. The average worm measures 6.65 mm. in length and 1.94 mm. in width. The shape of the worm differs from that of the typical form in that it has a narrow anterior portion which extends posteriorly as far as the acetabulum where it widens considerably, forming shoulders and gradually narrowing after the uterine region, finally ending in a bluntly rounded posterior extremity. The cuticle, as in that of the typical form, is thickly spined anteriorly with no spines in the post-testicular region. The collar spines are slightly smaller than those in the typical form, but resemble them in number and position. A table comparing the organs of the typical form with those of the specimens from the duck is given below.

COMPARISON OF E. REVOLUTUM FROM THE GOOSE WITH THAT FROM THE DUCK

	Body	Collar Spines	Cuticular Spines	Oral Sucker	Pharynx	Oesoph-agus	Acetab-ulum	Testes	Vitell-aria	Ovary	Egg
Type Species from Goose	Elon-gate	No. = 37	Numerous anterior-ly. None posterior-testicular region	Sub-term-inal	Muscul-ar	Long, Slender	2.6 mm. from anterior end. Sub-globul-ar.	Oval, entire margin. Length-wise of body.	From post-erior of acetabul-um to posterior extremity	Equatorial in position. Margin entire. Pear-shaped.	Oval
	15.9 x 2.57 mm.	70-150µ x 30-32µ		0.40x 0.25 mm.	0.29 x 0.34 mm.	1.06 mm. long	1.31 x 1.36 mm.	Ant. 1.26 x 0.84 mm. Post. 1.42 x 0.87 mm.		0.54 x 0.37 mm.	100-110µ x 52-60µ
Species from Duck	More or less flask-shaped	No. = 37	Numerous anterior-ly. None in post-testicul-ar reg-ion.	Sub-term-inal	Muscul-ar	Long Slender	1.46 mm. from anterior end. Sub-globul-ar.	Oval, lobul-ated. Cross-wise of body.	From post-erior of acetabulum to poster-ior extrem-ity. Distinct follicles.	Equatorial in position. Lobulated Oval.	Oval
	6.65 x 1.94 mm.	70-80µ x 17-18µ		0.24x 0.22 mm.	0.17 x 0.22 mm.	0.49 mm. long	0.69 x 0.64 mm.	Ant. 0.63 x 0.25 mm Post. 0.65 x 0.29 mm.		0.47 x 0.22 mm.	93-110µ x 50-54µ

The worms from the intestine of the Canada goose were immature (Plate 1. Fig. 2.). The largest of these is only 3.65 mm. long and 0.73 mm. in breadth at its widest portion in the acetabulum region. In none of these specimens are eggs present. The vitelline follicles could not be distinguished. It is quite possible that the follicles are present, but in their immaturity have not yet taken on their pigment, or there is the possibility that, contrary to the condition found in most flukes, the vitellaria do not develop until later on in life. The 37 collar spines are present and also the internal organs of reproduction are situated in the same relative positions as in the typical forms from the domestic goose.

Discussion

Echinostoma revolutum is perhaps the commonest form of Echinostome parasitic in domestic as well as wild ducks and geese. It is very cosmopolitan in distribution and I would hesitate to state that any one of the hosts which I have mentioned is a new carrier of this parasite.

ECHINOPARYPHIUM ELEGANS (Lss., 1899)

(Plate I., Fig. 3).

Generic Diagnosis (From Lühe (14)).

"Kleine Echinostomatiden mit schlankem Körper. Bauchsaugnapf ungefähr an der Grenze vom I. und 2. Viertel der Körperlänge. Kopfkragen sehr klein, nierenförmig, mit doppelter, dorsal nicht unterbrochener Stachelreihe; die Stacheln der aboralen Reihe etwas grösser als die der oralen. Haut bestachelt. Cirrusbeutel länglich, den Bauchsaugnapf noch zum Teil dorsal überlagernd. Hoden länglichoval bis elliptisch, in der Mitte des Hinterkörpers, median dicht hintereinander, sich mitunter noch gegenseitig abplattend. Keimstock kugelig, median oder etwas seitlich, dicht vor dem vorderen Hoden. Dotterstöcke in den Seiten des Körpers, nach vorn den Hinterrand des Bauchsaugnapfes nicht ganz erreichend. Uterus kurz, wenig gewunden. Eier wenig zahlreich, verhältnismässig gross, 0,084 bis 0,110:0,052-0,084 mm.

Im Darm Vogëln."

Description

Only two specimens were found in the small intestine of a Black Duck, Anas rubripes, from St. Genevieve, P.Q. The worms were fixed in 5% formol-saline, stained in Delafield's acid haematoxylin, cleared in Beechwood creosote and mounted in Canada balsam.

These are small, slender Echinostomes, which taper slightly towards the posterior end, with a bluntly rounded termination. The anterior part of the worm has a roundish cross-section whereas the posterior portion is flattened. The ventral sucker appears to be borne on a thick, short stalk so that it protrudes from the ventral surface of the worm. The anterior portion of the worm is bent ventrally. A reniform head-crown is present, bearing a double row of spines which is unbroken dorsally. A full complement of spines could be made out on only one of the specimens and it bore a total of 42 spines. The original example described by Looss in 1899 (14) bore only 42 spines, whereas Dietz in 1908 (4) describes it as having 43 spines. There is the possibility that one of the spines in the dorsal row of my specimen is missing and if such were the case then a full complement of 43 spines would be present. On each ventral corner lobe of the head-crown is borne four spines, one pair being superimposed upon the other pair. The spines of the aboral row are somewhat larger than those of the oral row: The oral spines measure 40-44.6μ by 11.9-13.5μ whereas those of the aboral row measure 50.7-62.93μ by 12-16μ. The largest spine of the corner groups measures 52.1 by 13.5μ. No cuticular spines could be distinguished but it is quite possible, due to the roughened and scaly condition of the anterior cuticle, that the spines have been lost as a result of partial digestion of the cuticle by the intestinal juices of the host. The cuticle of the posterior part of the body did not show this sloughed appearance. The

terminal oral sucker measures 0.07-0.08 mm. by 0.087-0.092 mm. with an opening of 0.025-0.036 mm. in diameter. There is a short prepharynx, 0.026-0.031 mm. in length. The muscular pharynx is 0.09-0.096 mm. in length by 0.061-0.069 mm. in width. The oesophagus is long and comparatively broad, measuring 0.31-0.36 mm. by 0.061-0.072 mm. The intestine bifurcates a short distance in front of the ventral sucker and the gut branches, 0.06 mm. at their widest points, terminate blindly 0.115 mm. from the posterior end of the body. The powerful acetabulum, situated about 0.64 mm. from the anterior end of the worm, measures 0.223-0.269 mm. with an opening 0.05-0.058 mm. in diameter.

The testes are elongate-oval in shape and lie median, one behind the other, in the posterior half of the body. The margins are smooth. The anterior testis measures 0.19-0.213 by 0.12-0.14 mm. and the posterior testis, 0.035 mm. behind the anterior testis, measures 0.217-0.23 by 0.137-0.16 mm. The thin-walled cirrus-sac, 0.2-0.21 by 0.12-0.122 mm. enclosing a powerful cirrus and an internal seminal vesicle, lies dorsal to the acetabulum and extends from a short distance anterior to the anterior margin of the acetabulum, posteriorly to approximately the centre of it. The common genital pore opens ventrally at a point about mid-way between the caecal bifurcation and the anterior margin of the ventral sucker.

The roundish ovary, 0.09-0.11 mm. in diameter, lies a short distance in front of the anterior testis and slightly to the left of the mid-line. It is separated from the anterior testis by a

diffuse shell gland and a vitelline receptacle. The uterus extends from the oviduct to the genital opening making few transverse loops and containing few eggs. The eggs are comparatively large, measuring 87-91 by 45-49μ. The vitellaria occupy the lateral fields of the body and surround the intestinal caeca on all sides except the inner side. The vitellaria consist of separate groups of small follicles. The follicles do not meet in the mid-line behind the posterior testis. They extend from a short distance caudad of the posterior border of the ventral sucker backwards to almost the posterior end of the worm.

Discussion

To the best of my knowledge this is the first time that Echinoparyphium elegans has been reported from the Black duck and I have been unable to find any record of E. elegans having ever been found on the North American continent before this date.

STEPHANOPRORA MERGI

(Plate I. Fig.4.)

Generic Diagnosis (From Odhner (17)).

"Gattung Stephanoprora Odhner.

(= Mesorchis Dietz plus Monilifer Dietz).

"Cirrusbrutel wohl entwickelt. Ein ganz kurzer, aber kräftiger Cirrus vorhanden. 22 oder 26 Kragenstacheln. Arten: St. denticulata (Rud.), St. pendula (Lss.), St. spinosa Odhn., St. ornata Odhn. und nach Dietz, St. conciliata (Dietz)."

Description

Three small flukes were found in the caeca of an American Merganser duck, Mergus merganser americanus. The worms were preserved in ethyl-glyco-formol mixture, stained in alum-carmine, cleared in oil of wintergreen and mounted in Canada balsam.

The worm is elongate-oval in shape with an almost circular cross section. The "neck" region, extending from the head collar to the point of bifurcation of the intestine, is only slightly narrower than the posterior portion of the worm. The average specimen measures 1.16 mm. long with a maximum width, in the anterior testicular region, of 0.277 mm. A well differentiated, reniform head-collar is present, measuring 0.17 by 0.19 mm. The collar bears one row of spines which is discontinuous dorsally. In each end group of spines there are two "Echstacheln" and there are nine "Randstacheln" in each lateral group making a complement of 22 collar spines. The spines vary

in size from 25-37μ by 5-6μ. From the head collar to approximately the anterior border of the anterior testis the cuticle is provided with fine, closely set, backwardly directed spines which are very numerous anteriorly becoming more sparse posteriorly.

The oral sucker, measuring 0.053-0.058 by 0.043-0.047 mm. is slightly sub-terminal and appears somewhat drawn out posteriorly. A comparatively long prepharynx is present measuring 0.061 mm. in one specimen to 0.08 mm. in another. The pharynx varies from 0.072-0.078 mm. in length by 0.04-0.06 mm. in width. It is followed by a long oesophagus which is from 0.18-0.2 mm. in length. The intestinal caeca pass postero-laterally and reach to almost the posterior end of the fluke. The ventral sucker, 0.072-0.130 by 0.04-0.146 mm., is situated with its anterior border about 0.46 mm. from the anterior end of the worm. It is almost equatorial in position.

The two testis are transversely elongate, with entire margins. The anterior testis, 0.072-0.083 by 0.1-0.15 mm., is slightly smaller than the posterior testis, 0.084-0.1 by 0.114-0.13 mm. The testes lie one directly behind the other in the mid-line in the third quarter of the worm. The vasa efferentia and vas deferens could not be distinguished in these specimens. The cirrus-sac is dorsal to the acetabulum and lies somewhat diagonally with its anterior end slightly to the left of the mid-line. It extends posteriorly to the level of the centre of the ventral sucker. The cirrus-sac contains a large vesicula seminalis, a small pars prostatica and a small cirrus. Both male and female ducts open through a

common genital pore which is situated a short distance posterior to the intestinal bifurcation.

The ovary, measuring 0.05 by 0.32 mm., is oval with an entire margin. It lies a short distance anterior to the anterior testis and slightly to the right of the mid-line with almost the whole of its anterior half covered ventrally by the posterior portion of the acetabulum. A uterine seminal receptacle is situated slightly to the left of the mid-line and somewhat posterior to the ovary. A large, diffuse shell-gland is present in the mid-line lying very close to the anterior testis. A Laurer's canal could not be distinguished. The uterus is quite short and forms one loop which extends slightly posterior to the ovary and then bends anteriorly to the genital opening. The ova vary from 87-90μ in length by 40-50μ in width. They are very few in number, five being the most present in one worm, and are very large compared with the size of the worm. The vitellaria are composed of large follicles, the individual follicles being situated very close to each other. They extend from the anterior level of the anterior testis to almost the posterior end of the worm. Caudad of the posterior testis the follicles converge towards the mid-line forming a single mass in the posterior quarter of the worm. The vitelline ducts cross in front of the anterior testis to join and form a vitelline reservoir which occupies a position directly ventral to the shell-gland.

Discussion

S. merulae Yamaguti (24), is much larger than the specimen I have described. The testes are elongate-oval with their long axis in the mid-line of the worm. The prepharynx is very short and the ventral sucker is more anteriorly placed than is the case in S. mergi whose acetabulum is almost equatorial in position. The cirrus-sac is diagonal but does not extend posterior to the anterior border of the acetabulum.

S. reynoldi Bhalerao (3), is also a much larger worm. Its anterior testis is in the anterior half of the body and its posterior testis is in the posterior half unlike the condition existing in S. mergi in which both testes occupy the posterior half of the worm. The vitellaria do not converge until they reach the posterior end of the worm. The ova are somewhat smaller and more numerous than those in S. mergi. The ventral sucker is more anteriorly placed.

Linton, in a monograph entitled "Trematode Parasites of Birds" (13), describes a fluke which he names Mesorchis pseudoechinatus. The genus Mesorchis has now been included in the genus Stephanoprora (17), as has also the genus Monilifer. In M. pseudoechinatus the position and shape of the testes is unlike the condition as found in S. mergi. The ova are approximately the same size but are much more numerous. The vitellaria form two dense, lateral masses of follicles in the posterior portion of the body. The

individual follicle is fairly small.

Several other species of Stephanoprora have been described but S. mergi appears to differ from them in its small body size, the shape, size and position of the testes, the more or less equatorial position of the acetabulum, the comparatively long prepharynx and oesophagus and the extent of the vitellaria.

Hypoderaeum conoideum (Bloch, 1782)

(Plate II. Fig. 1).

Synonyms: Distomum convideum (Bloch 1782)
Echinostoma conoideum Rudolphi 1809,
Psilochasmus lecithosus Otte, 1926.

Dietz, in 1909, placed it in the genus Hypoderaeum.

Generic Diagnosis (From Neveu-Lemaire (15)).

"Echinostominae à corps cylindrique, allongé et aplati en arrière. Ventouse ventrale relativement grande et située près de l'extrémité antérieure. Partie du corps située en avant de cette ventouse recourbée ventralement et beaucoup plus mince que la partie postérieure. Tégument épineuse; disque adoral peu développé. Oesophage trés court. Poche du cirre allongée, atteignant en arrière le bord postérieur de la ventouse ventrale. Testicules allongés et placés l'un derrière l'autre sur la ligne médiane. Parasites des oiseaux."

Description

Ten specimens were found in the small intestines of four Black ducks, Anas rubripes rubripes, from Lake St. Peter district, Province of Quebec. The worms were stained in alum carmine, cleared in oil of wintergreen and mounted in Canada balsam.

The fluke is elongate-oval in shape and quite flat, slightly tapering towards the ends where it is bluntly rounded. The

average specimen measures 13.3 mm. in length by 2.1 mm. in width at the widest portion in the testicular region. The head collars, in my specimens, are very rudimentary and in the specimen illustrated measures 0.64 mm. in width. Most of the collar spines were lost and those present did not afford the opportunity of making correct measurements of them.

The sub-terminal oral sucker appears slightly drawn out posteriorly and is 0.4 mm. wide by 0.3 mm. in length. The oesophagus is very short measuring 0.2 mm. in length. The intestinal caeca are narrow and tubular and reach to within 0.46 mm. from the posterior end of the worm. The pharynx measures 0.24 by 0.2 mm. The large acetabulum, 1.42 mm. in length by 1.3 mm. in width, is placed with its anterior margin 1.1 mm. from the anterior end of the worm. The acetabular opening is quite large, measuring 0.8 x 0.74 mm.

The testes lie one directly behind the other in the median line. The greater part of the anterior testis lies in the posterior portion of the anterior half of the worm while the posterior testis lies wholly within the posterior half of the worm. The anterior testis measures 1.47 by 0.74 mm. and the posterior 1.51 by 0.62 mm. The testes are elongate-oval in shape and have entire margins. The cirrus pouch is large and elongate extending slightly farther backwards than the middle level of the acetabulum. The cirrus sac contains a cirrus, a twisted <u>vesicula seminalis</u> and a well developed

pars prostatica. Both cirrus and metraterm open through a common genital pore of fairly wide aperture, directly posterior to the level of the caecal bifurcation.

The ovary, 0.5 by 0.48 mm., forms an almost perfect sphere with entire margin. It lies a little to the left side of the median line with its posterior margin about 0.4 mm. anterior to the anterior margin of the anterior testis. A large and diffuse shell-gland occupies the greater part of the space between the ovary and testis. Ventral to the shell-gland there is a large vitelline reservoir. A uterine seminal receptacle lies close to the shell-gland and partly surrounded by it. The uterus lies in irregular coils extending from the ovary to the genital pore and bounded on either side by the intestinal caeca and vitellaria. The eggs are oval in shape and measure 82-102 by 60-70μ. The vitelline follicles occupy the lateral fields and extend from about the level of the posterior margin of the acetabulum to within 0.5 mm. from the posterior end of the body.

In several of the specimens examined there was a papilla-like extension of the cuticle at the posterior end of the worm.

Discussion

Dietz in 1909 (19) reported Hypoderaeum conoideum in the intestine of Anas boschas; Yamaguti, in 1932 (25), found it in the small intestine of Anas platyrhyncha platyrhyncha. I have seen no report of H. conoideum from Anas rubripes rubripes before this time.

Zygocotyle ceratosa Stunkard, 1917

Synonyms: Amphistoma lunatum Diesing, 1836

Zygocotyle lunata Price, 1928.

Generic diagnosis (From Neveu-Lemaire (15))

"Zygocotylinae à ventouse postérieure grande, fortement musculeuse et s'ouvrant ventralement; sa partie postérieure est cupuliforme; sa partie antérieure est conique, à sommet dirigé en avant et dorsalement; en arrière de la ventouse se trouve un épaississement caractéristique qui se prolonge de chaque côté. Caecums intestinaux à parois épaisses se terminant au niveau de l'ouverture de la ventouse postérieure. Testicules allongés dans le sens transversal, lobulés ou à contours irréguliers, à bords parfois lisses chez les petits exemplaires et placés l'un derrière l'autre. Ovaire ovale, situé en arrière des testicules. Parasites des bovidés, des cervidés, et des oiseaux aquatiques."

Description

Several specimens were taken from the caeca of the Black duck, Anas rubripes rubripes and from the caeca of the domestic goose, Anser domesticus. The material was collected on the Island of Montreal. The worms were preserved in ethyl-glyco-formol mixture, stained in Delafield's acid haematoxylin and were finally cleared in Beechwood creosote and mounted in Canada balsam.

The worms are oval, flat, thickened at either end with the acetabulum protruding slightly from the posterior end of the body. The body cuticle is spineless and comparatively smooth. The dorsal surface is underlaid with numerous large, deeply-staining glands. The flukes vary from 3.5-8.7 mm. in length and from 1.0-2.5 mm. in width. The acetabulum consists of an anteriorly projecting part and a posterior part having two laterally projecting horns. The oval acetabular opening measures approximately 0.95 mm. in length by 0.80 mm. in width.

The sub-terminal oral sucker is typically oval in shape being slightly drawn out anteriorly and measures 0.5-0.58 mm. in diameter in a fully mature specimen. From the posterior margin of the sucker two oval, oral evaginations extend backwards. These are slightly longer than they are broad and measure about 0.25 by 0.20 mm. The oesophagus is somewhat convoluted and is about 0.35 mm. in length. It terminates in an oesophageal bulb measuring 0.48-0.55 mm. by 0.24-0.32 mm. The caeca are narrow at their point of bifurcation, becoming broader centrally, and then narrowing towards their posterior termination. They are about 4.45 mm. in length by 0.37 mm. in width at their broadest point. They terminate a short distance in front of the anterior portion of the acetabulum.

The two testes, about 0.62-0.67 mm. in length by 0.41-0.45 mm. in width, lie one behind the other in the median line. They are lobulated ovals and lie with their long axes crosswise of the body. The caudal testis occupies an almost

equatorial position with the anterior testis lying a short distance in front of it. On either side the testes are bounded by the inner margins of the intestinal caeca. Due to the poor condition of the specimens examined the vasa efferentia could not be made out and only a portion of the coiled seminal vesicle could be distinguished. There is no cirrus sac. The male and female genital tubes open through a common genital pore which is situated slightly caudad of the caecal bifurcation.

The ovary is oval and lobed and measures approximately 0.43 by 0.32 mm. Its long axis lies crosswise of the body at a position 0.7-0.81 mm. caudad to the posterior testis. Directly posterior to the ovary lies a small Mehlis' gland which receives, on its ventral surface, the common vitelline duct. The two vitelline ducts pass transversely across the body, ventral to the intestinal caeca, and unite to form the common vitelline duct ventral of the Mehlis' gland. From the Mehlis' gland the uterus passes posteriorly in several convolutions and then passes in irregular loops anteriorly to the metraterm and genital pore. The uterine coils do not extend laterally beyond the inner sides of the intestinal caeca. In the specimens examined neither the oviduct nor the Laurer's canal could be distinguished. The vitellaria are numerous and irregular in shape and extend over the lateral fields of the worm from a point just posterior to the oral evaginations to a point just opposite the caecal terminations. With the exception of a few follicles the

vitellaria are bounded medially by the outer sides of the intestinal caeca and they extend outwards almost to the lateral margins of the worm. The eggs are fairly large, oval, non-operculate and measure 110-150μ by 70-95μ.

Discussion

Zygocotyle ceratosa has been recorded many times from the caeca and intestines of many different species of wild and domestic ducks and geese. It has also been described as a parasite of the caeca and intestine of the ox. According to Neveu-Lemaire it is confined in its distribution to the new world. I have not been able to find any former record of the Black duck, Anas rubripes rubripes, being a carrier of this parasite, but it is quite possible that such a record has been made.

APATEMON GRACILIS (RUD., 1819) Szidat, 1929

(Plate II. Fig. 3.)

Synonyms: Amphistoma gracile Rudolphi, 1819.
Holostomum gracile Dujardin, 1845.
Strigea gracilis Lühe, 1909.
Apatemon gracilis Szidat, 1928

Generic diagnosis (From Neveu-Lemaire (15)).

"Strigeinae à partie antérieure occupant un tiers de la longueur, totale du corps. Une partie du cou manque. Cône génital proéminent. Bourse représentée par une simple excavation sans bulbe musculeux. Glandes vitellogènes confinées à la partie postérieure du corps et situées ventralement. Parasites des oiseaux."

Description

A considerable infestation by these Strigeids occurred in the small intestine of the American Golden-eye duck, Glaucionetta clangula americana. The worms were preserved in an ethyl-glyco-formol mixture, stained in Delafield's acid haematoxylin, cleared in Beechwood creosote and mounted in Canada balsam.

The specimens ranged from 1.38-2.72 mm. in length, the fore-body being 0.57-0.9 by 0.45-0.62 mm. and the hind-body 0.78-1.82 by 0.47-0.58 mm. The entire cuticle is apparently aspinose. The fore-body is cup-shaped and about one half

the length of the cylindrical hind-body. The constriction between fore- and hind-body is quite well marked. The anterior opening of the fore-body is narrower than the constriction between fore- and hind-body. The dorso-lateral muscle fibres are easily distinguishable, originating in the pharyngeal region and, as they extend posteriorly, give off numerous lateral branches. With different specimens the hind-body is recurved dorsally to varying degrees depending on the state of contraction of the dorso-lateral muscles.

The oral sucker, measuring 0.14 mm. in diameter, is terminal and is followed directly by the smaller pharynx which is 0.1 by 0.08 mm. The intestine bifurcates a short distance behind the pharynx and the gut-branches extend backwards to a point a little behind the posterior testis. The acetabulum is somewhat larger than the oral sucker and measures 0.16 by 0.21 mm. The holdfast organ is composed of an outer and an inner lobe which join posteriorly at their bases. The outer lobe is considerably larger than the inner lobe. In the majority of specimens examined both outer and inner lobes were retracted within the cup-like fore-body. At a position near the junction of the two lobes of the hold-fast organ there is an adhesive gland which is apparently made up of a number of deeply-staining lobules.

The testes are large and lobed. The more anterior one lies in the posterior part of the anterior half of the hind-body, while the other lies in the anterior part of the posterior

half of the hind-body. The posterior testis, measuring 0.40-0.56 by 0.38-0.41 mm. and placed 0.46 mm. from the posterior end of the body, was, in the majority of cases, larger than the anterior testis which measures 0.35-0.54 by 0.31-0.36 mm. The testes lie one behind the other and so close, in some cases, that they appear to be touching each other or even overlapping. The vesicula seminalis is quite a large structure and lies sigmoid-fashion directly posterior to the posterior testis and close to the dorsal body-wall. The ejaculatory duct opens at the end of a bulbous swelling called the "genital-cone."

Close to the anterior border of the anterior testis lies a sub-globular ovary, measuring 0.18 by 0.17 mm. From its antero-dorsal surface a convoluted oviduct arises. A short distance from the ovary a Laurer's canal is given off which runs postero-dorsally and opens on the dorsal surface of the body. A diffuse shell-gland lies dorsally between the two testes. The vitellaria do not extend into the forebody but are confined to the ventral field of the hind-body. The vitelline follicles are separate and very numerous. They extend from the constriction between fore- and hind-body to a point opposite the genital cone. A rather large vitelline reservoir occurs near the anterior border of the posterior testis, its duct passing postero-ventrally to the group of vitelline follicles. The uterus extends for a short distance anteriorly and then bends back passing dorsally through the mass of vitellaria to join the ejaculatory duct prior to its entry into the genital cone. The

genital atrium in these specimens is not very spacious and is somewhat hour-glass shaped. The ova are quite large, measuring 90-100 by 60-67μ.

Discussion

I have identified these specimens as Apatemon gracilis mainly because of the egg size and the disposition of the testes and ovary. My specimens adhere closely to the description as given by Yamaguti (24), of some worms he found in the small intestine of Mergus merganser merganser. I believe that this is the first time that Glaucionetta clangula americana has been reported as a host to Apatemon gracilis.

PSILOCHASMUS LONGICIRRATUS Skrjabin, 1913

(Plate II., Fig. 4.).

Generic Diagnosis Lühe (n.g.). (From Lühe (14)).

"Psilostominen mit schlankem, lanzettformigen, in eine züruckziehbare Spitze auslaufendem Hinterkörper und konisch verjüngtem Vorderende. Bauchsaugnapf sehr tief und stark vorspringend, an der Grenze vom 1. und 2. Viertel der Körperlänge. Haut unbestachelt. Oesophagus vorhanden, Darmgabelung dicht vor dem Bauchsaugnopf. Hoden gross, längsgestreckt, an ihren Seitenrändern mehrfach tief eingekerbt. Keimstock kugelig, von den Hoden durch die Schalendrüse getrennt. Dotterstöcke mit zahlreichen Follikeln vom Hinterende des Bauchsaugnapfes bis nicht ganz ins Körperende reichend."

Description

Worms of this species were removed from the small intestines of the Black duck, Anas rubripes rubripes and the Canada Goose, Branta canadensis. The specimens were preserved in a mixture of ethyl-glyco-formol, stained in Delafield's Acid Haematoxylin, cleared in Beechwood creosote and mounted in Canada balsam.

These are flat, fairly thick-set and more or less lancet-shaped worms. The anterior portion, as far backwards as the acetabulum, is conical in shape. The posterior portion is more flattened becoming round again at the posterior end. From the posterior end of the worm a cylindrical, tail-like

process is given off. This process is both protrusible and retractile being activated by numerous circular muscles which are plainly visible at the posterior end of the worm. It measures anywhere from 0.29-0.75 mm. in length by 0.08-0.30 mm. in width at its widest point. Several miniature specimens having an average measurement of 3.05 mm. in length by 0.7 mm. in width, were found. A typically mature form is 5.73-6.30 mm. in length by 1.42 mm. - 1.44 mm. in width at its point of greatest breadth in the anterior testicular region. The cuticle is unarmed and fairly smooth.

The subterminal oral sucker is 0.36-0.47 by 0.31-0.33 mm. in size. A pharynx, measuring 0.26-0.29 by 0.20-0.22 mm. is separated from the oral sucker by a very short pre-pharynx. The pharynx is followed by a fairly wide oesophagus which is 0.55-0.63 mm. in length by 0.07-0.14 mm. in width. At a point about 0.16 mm. in front of the acetabulum the oesophagus bifurcates into the two lateral intestinal caeca which extend posteriorly to within 0.62-0.71 mm. from the posterior end of the worm. The caeca are tubular and are fairly narrow, measuring 0.05-0.11 mm. in width. The acetabulum occupies a position in the anterior part of the second quarter of the worm. It is borne on a thick stalk which protrudes 0.80-0.92 mm. from the ventral surface of the worm. It is 0.59-0.61 x 0.52-0.62 mm. in size.

The testes occupy a postequatorial position. They are situated one directly behind the other in the mid-line of the worm. The margins, in all the worms examined,

were distinctly lobed. The anterior testis measures 0.82-0.85 mm. in length and 0.49-0.56 mm. in width while the posterior one is 0.67-1.00 by 0.46-0.52 mm. in size. The cirrus sac is very long and more or less club-shaped with the large end of the club occupying the more posterior position. It is 1.56-1.65 mm. in length and 0.20-0.23 mm. at its widest posterior point. It encloses a seminal vesicle of fairly large size and a very long, convoluted cirrus. The posterior margin of the cirrus sac extends to varying distances behind the anterior margin of the ovary. Both male and female organs open through a common genital pore which is situated at approximately the same level as the intestinal bifurcation and is somewhat sinistral in position.

The ovary is globular to sub-globular in shape and median in position. It measures 0.17-0.23 mm. in diameter. Directly posterior to the ovary is a diffuse shell-gland which separates the ovary from the anterior testis. A Laurer's canal is present opening on the ventral side of the worm, with its pore to the left side of the median line. The uterus is fairly short with a few coils extending posterior to the ovary and a few anterior to it. The uterine coils are bounded laterally by the intestinal crura and the vitelline follicles. The vitellaria occupy the lateral fields of the body and extend from shortly behind the ventral sucker to almost the posterior end of the body and inwards just to the intestinal caeca, with some follicles covering the caeca and a few extending inwards past the caeca. Caudad of the posterior testis the two

vitelline patches unite to form one. The vitelline follicles are comparatively small and densely packed. The eggs are relatively few in number and measure. 82-97 by 70-76μ.

All of the excretory system could not be made out. A few sinuses could be distinguished anterior to the acetabulum. The excretory system opens to the exterior through a pore situated at the tip of the posterior, tail-like process.

Discussion

I have been able to find only two other records of P. longicirratus, both being from the old world. Skrjabin (19) found specimens in the small intestine of Fuligula nyroka from the Russian Turkestan. Tubangui (23) describes specimens of P. longicirratus from the intestine of the domestic duck from the Philippine Islands. My specimens compare quite closely with those described by Skrjabin and Tubangui except that their specimens were slightly smaller in body size.

NOTOCOTYLUS ATTENUATUS (Rud. 1809) Diesing, 1839

(Plate III. Figs. 1, 2 and 3)

Synonym: Monostomum attenuatum Rudolphi, 1809

Generic Diagnosis (From Lal (9))

"Trematoda with 2-5 rows of protrusible ventral glands, cirrus-sac never extending beyond half of the body length, vagina about one-third to as long as the cirrus-sac, genital pore situated behind the intestinal bifurcation, vitellaria extend up to the middle of the body, eggs 0.018-0.022 mm. long with filaments at either end."

Description

A fairly heavy infestation by these specimens, occurred in the caeca and rectum of a "Lesser" Snow Goose, Chen hyperborea hyperborea from the Eastern Arctic. The worms were fixed in 5% formol-saline, stained in Delafield's Acid Haematoxylin, cleared in oil of wintergreen and mounted in Canada balsam.

These trematodes are flat, narrowed anteriorly and broadly rounded posteriorly with the greatest width in the pre-ovarian region. The cuticle is densely covered with very small spines; the greatest number of spines occurs on the antero-ventral surface. The average specimen measures 2.76 by 0.75 mm. On the ventral surface there are three rows of gland-like structures which open into protrusible

pits. In the median row there are 14 such glands and in either sub-median row there are 15 (Plate III. Fig. 2.).

As yet the exact function of these glands is unknown. The terminal oral sucker is cup-shaped and measures 0.13 by 0.15 mm. A pharynx is absent and the oesophagus is short, slender and approximately 0.15 mm. in length. The intestinal crura are long and slender and terminate blindly about 0.07 mm. from the posterior end of the body.

The testes, 0.45 by 0.16 mm., are elongate, lobed and lie one on either side of the ovary and separated from it by the terminal portions of the gut branches. The external seminal vesicle is tubular and lies in transverse coils at the base of the cirrus-sac. The cirrus-sac is long, club-shaped and with the thicker end of the club placed proximal to the anterior coils of the uterus. The external surface of the cirrus-sac appears to be thrown into lance-shaped evaginations which produces a pine-cone effect. The sac measures about 0.9 mm. in length and partially extends into the middle third of the body. The internal seminal vesicle is sacciform and occupies the base of the cirrus sac. Continuous with the internal seminal vesicle is the pars prostatica which is more or less club-shaped and slightly convoluted (Plate III. Fig. 3.). The common genital pore opens directly behind the caecal bifurcation.

The lobed ovary, 0.21 by 0.20 mm. lies median to the testes. Anterior to the ovary and also in the median line lies an oval oötype and directly anterior to this lies the diffuse shell gland. The vitellaria are placed lateral

to the intestinal caeca and extend from a point just posterior to the middle of the body to a point just anterior to the testis. The vitelline ducts cross the body and unite medially, ventral of the oötype, in a slightly expanded bulb. The uterus lies in close, transverse coils which extend from the base of the cirrus sac to the region of the shell gland and are bounded on either side by the intestinal caeca. Anteriorly the uterus leads into the vagina which in turn opens into the genital pore. The vagina is about half the length of the cirrus sac and opens in the form of a slightly expanded funnel into the genital atrium. Surrounding the vagina are numerous irregularly shaped glands of unknown function and, so far as I am aware, hitherto undescribed by any students of this species. The uterine coils are distended by the countless numbers of oval eggs which measure 24-27 by 10-12μ. Each egg is provided with a single filament at either pole.

Discussion

N. attenuatus is very cosmopolitan in distribution and not very particular as regards host specificity. It has been reported from many different species of ducks and geese both of domestic and wild variety. Prior to this record I have not seen it described from Chen hyperborea hyperborea but it is possible that such a record has been made.

III. SUMMARY AND CONCLUSIONS

Trematode parasites were collected from various species of ducks and geese of both wild and domestic habitat.

The Black duck, Anas rubripes rubripes, was parasitized by five of the eight species described in this paper. Of these five, two, namely, Echinoparyphium elegans and Psilochasmus longicirratus, have been described for the first time on the North American continent and the Black duck is a new host to both these parasites. The other three species from the Black duck were Echinostomum revolutum, Hypoderaeum conoideum and Zygocotyle ceratosa. The latter two species have been described as possibly new parasites to the Black duck.

A new species, Stephanoprora mergi, from the American Merganser duck, Mergus merganser americanus, was described and illustrated and the reasons given for considering it as a new species. The characters differing from other species, were given as the small body size, the shape, size and disposition of the testes, the more or less equatorial position of the acetabulum, the comparatively long prepharynx and oesophagus and the extent of the vitellaria.

From the small intestine and caeca of the Domestic goose were taken two species of trematode parasites. These were described as Echinostoma revolutum and Zygocotyle ceratosa. Both species were described from this host by former authors.

A table was made comparing E. revolutum from the Domestic goose with those specimens taken from the Black duck and reasons were given for including both groups of parasites in the same species.

The American Golden-Eye duck, Glaucionetta clangula americana, was recorded as a new host for Apotemon gracilis.

From the Canada goose two species of trematode parasites were recorded. Three miniature forms of Echinostoma revolutum were taken from the Canada goose and several specimens of Psilochasmus longicirratus were described as new parasites to this host.

In the caeca of the Lesser Snow goose, Chen hyperborea hyperborea, was found a tremendous infestation of Notocotylus attenuatus. The author expresses his doubt as to whether the Lesser Snow goose is a new host for this very common and cosmopolitan parasite.

From a perusal of this paper it is shown that both ducks and geese very often are parasitized by the same species of internal parasite. Echinostoma revolutum is common to two species of goose and a species of duck. Zygocotyle ceratosa is described from the Domestic goose and the Black duck. Psilochasmus longicirratus was extracted from the small intestines of both the Black Duck and the Canada goose. It would seem then, even after such a small survey as has been carried out and described in this paper, that there is very little host specificity exhibited by the internal parasites of ducks and geese.

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ILLUSTRATIONS

PLATE I.

Fig. 1. Echinostoma revolutum Frölich, 1802, specimen from Anser domesticus, entire worm, ventral view. x4.

" 2. Echinostoma revolutum Frölich, 1802, specimen from Branta canadensis, entire worm, ventral view, also magnified anterior end. x17 and x45 respectively.

" 3. Echinoparyphium elegans Looss, 1899, entire worm, ventral view, also magnified anterior end. x26.5 and x103 respectively.

" 4. Stephanoprora mergi sp. nov. entire worm, ventral view. x45.

PLATE 2.

Fig. 1. Hypoderaeum conoideum Bloch, 1782 non Railliet 1805, entire worm, ventral view. x6.

" 2. Zygocotyle ceratosa Diesing, 1836, entire worm, ventral view. x9.

" 3. Apatemon gracilis (Rud., 1819) Szidat, 1929, entire worm, lateral view. x25.

" 4. Psilochasmus longicirratus Skrjabin, 1913, entire worm, dorsal view. x11.

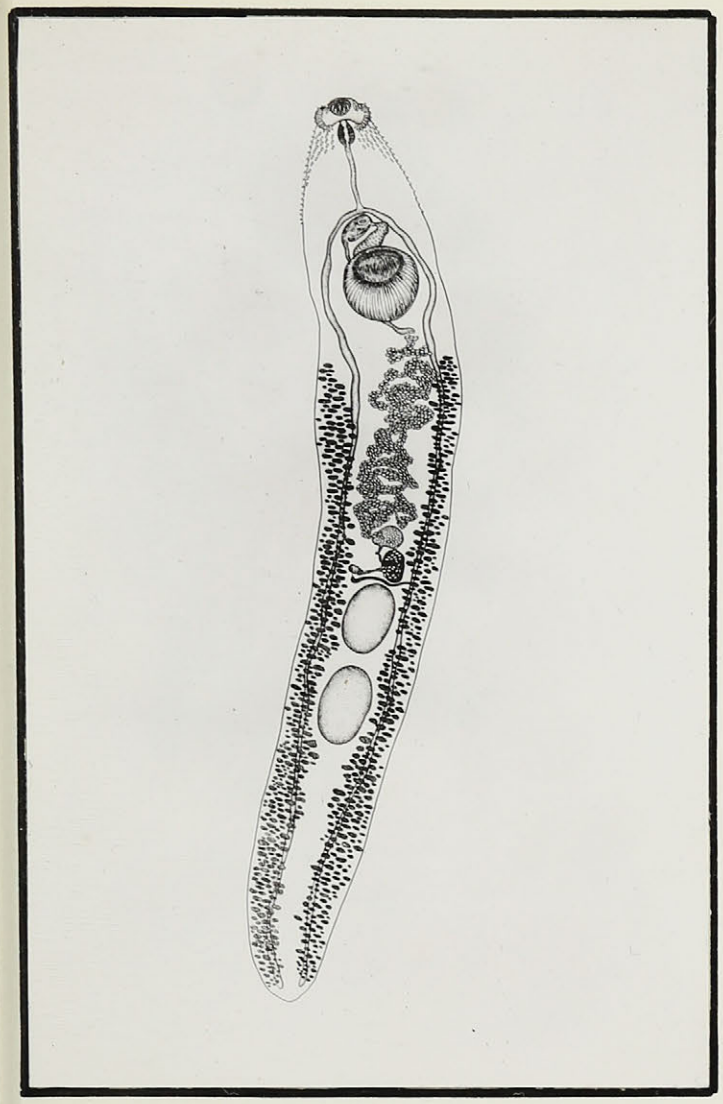
PLATE 3.

Fig. 1. Notocotylus attenuatus Rudolphi, 1809, entire worm, ventral view. x16.

" 2. Notocotylus attenuatus Rudolphi, 1809, number and arrangement of ventral glands. x16.

" 3. Notocotylus attenuatus Rudolphi, 1809, showing anterior portions of male and female genital organs. x43.5.

PLATE.I



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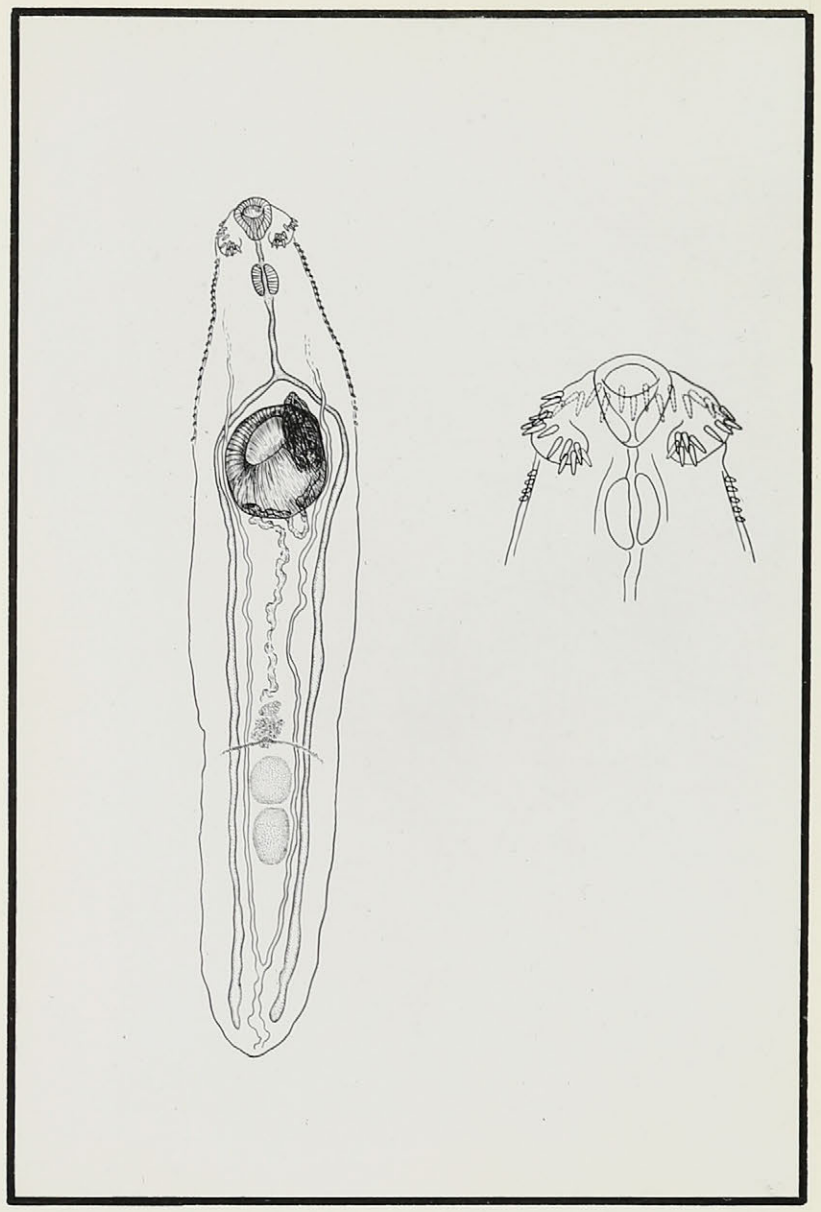

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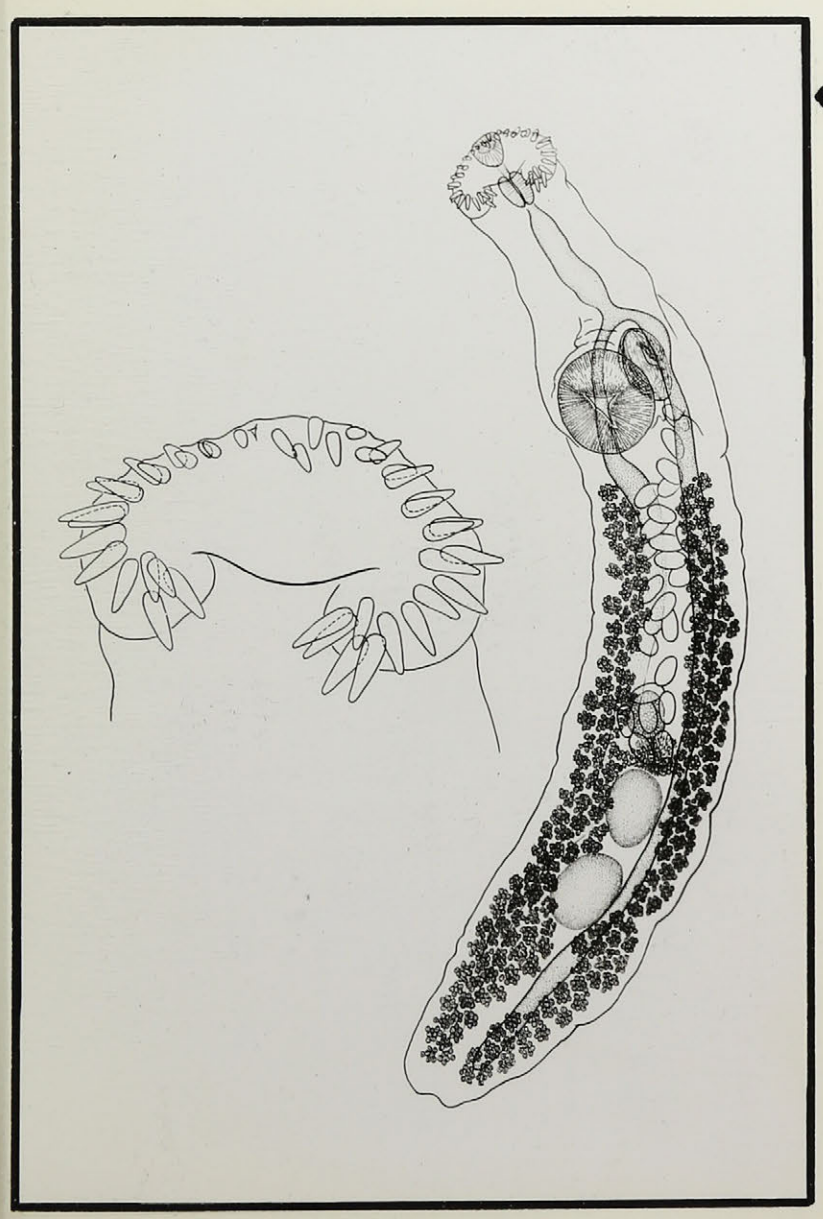

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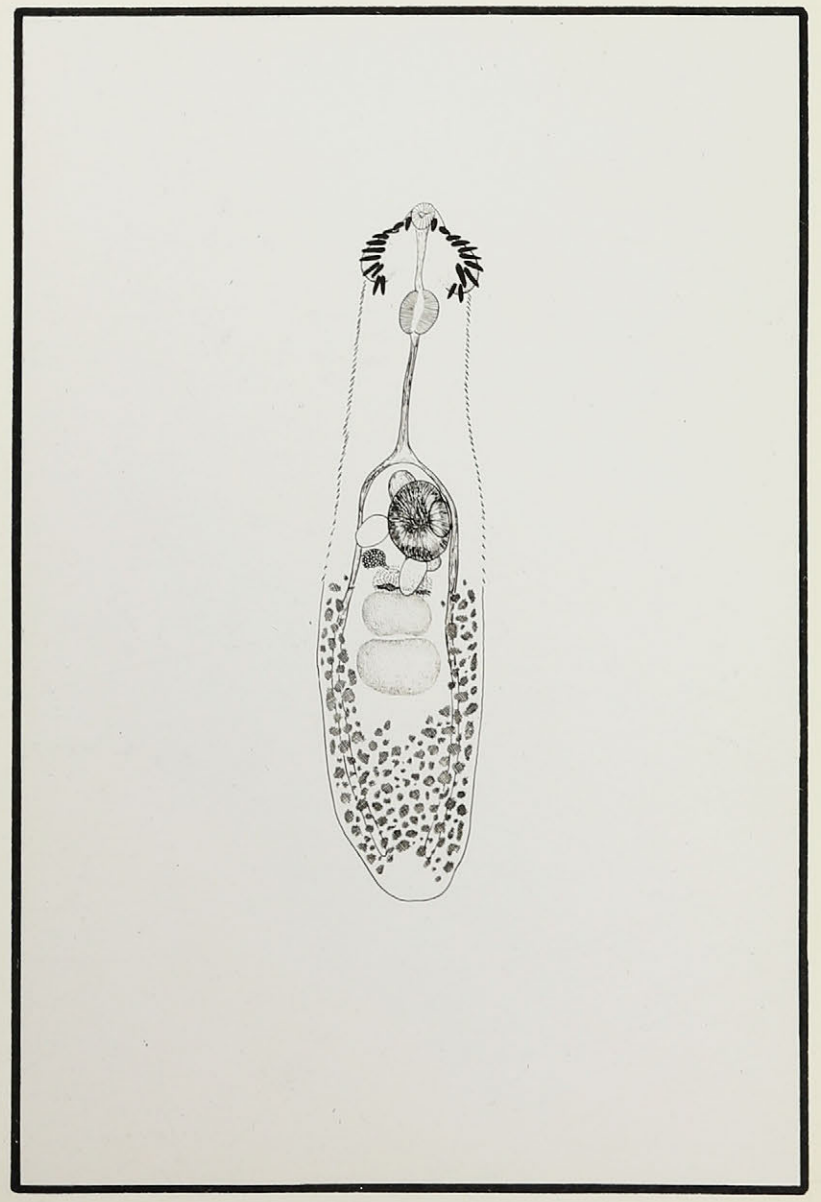

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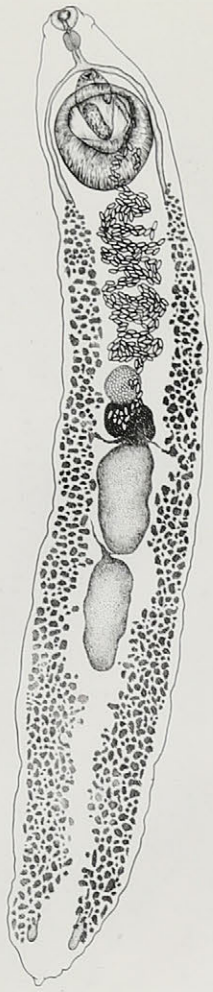

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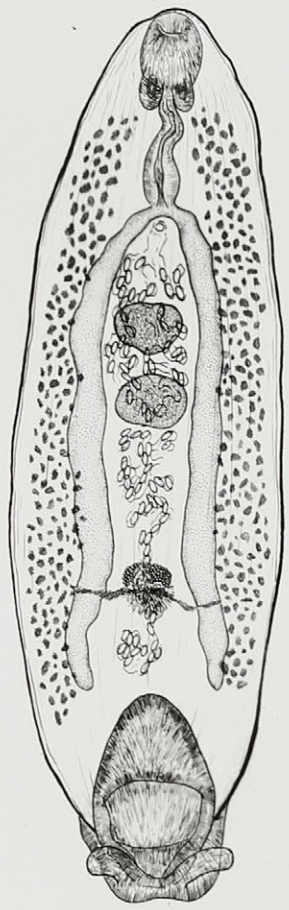

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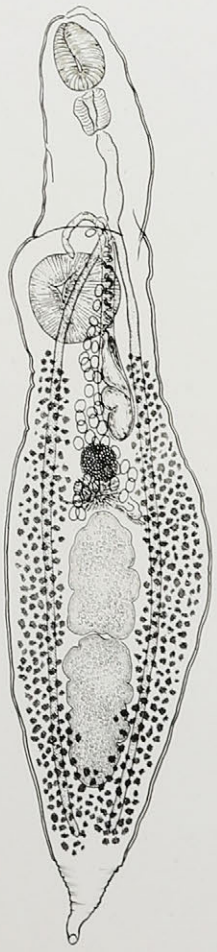
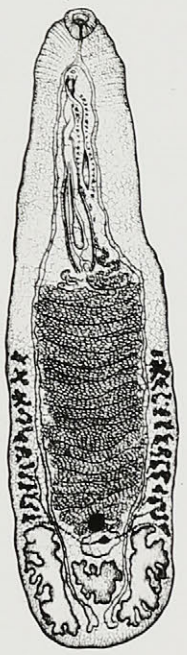


PLATE. III

1.



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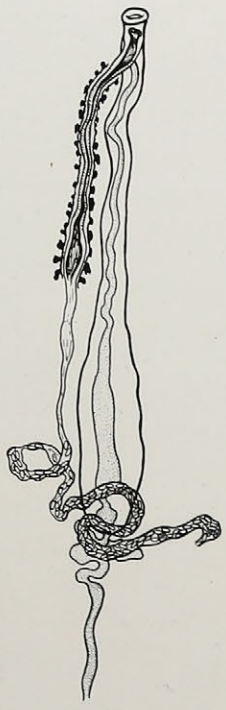

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