

NOTES ON AVIAN ENTOZOA.

BY

EDWIN LINTON, PH. D.

(With Plates IV-VIII.)

The greater part of the material which is described in this paper was collected by the author in the summer of 1890 in the Yellowstone National Park, Wyoming.

A scientific expedition was sent out in July and August of that year by the Hon. Marshall McDonald, U. S. Commissioner of Fish and Fisheries, for the purpose of making a natural-history survey of the lakes and streams of the National Park. The author was instructed by the Commissioner to investigate specially the question of the excessive parasitism in the trout of Yellowstone Lake, and to ascertain if possible the source of infection.

The results of the study of that problem have been published in the Bulletin of the U. S. Fish Commission, Vol. IX, pp. 337-358, Pls. CXVII-CXIX, "A contribution to the Life History of *Dibothrium Cordiceps*, a Parasite infesting the Trout of Yellowstone Lake." In the search for the final host of the trout parasite several entozoa were found incidentally which were preserved for study.

The following birds were examined, with the results appended :

1. *Ardea herodias*, ♂, one bird examined. The stomach contained insect larvæ (*Hydrophyllus*, *Gomphus* and *Chironomus*), with a little vegetable material. No parasites.

2. *Clangula albeola*, ♀, one bird examined. The undigested food consisted mainly of *Ephemerid* larvæ. No parasites.

3. *Larus californicus*, three birds examined. The stomachs contained a few ribs and vertebrae of small fish. The entozoa were: *Dibothrium cordiceps*, three immature specimens, *D. exile* sp. nov., one specimen; *Tenia porosa*, one specimen, *T. filum*, several specimens; *Distomum* (?) *verrucosum* sp. nov., two specimens.

4. *Fuligula vallisneria*, ♀, one bird examined. The entozoa consisted of numerous specimens of *Tenia compressa* sp. nov.

5. *Oedemia americana*, four birds examined, one large and three smaller specimens; the entozoa found in the large bird consisted of two specimens of *Echinorhynchus striatus*; the three smaller birds yielded the following entozoa: *Distomum flexum* sp. nov., one specimen; *Episium*

plicatus gen. et. sp. nov., four specimens; *Tenia macrocantha* sp. nov., three specimens; *T. compressa* sp. nov., several specimens.

6. *Pelecanus erythrorhynchus*, four birds examined. The stomachs contained good-sized fish in different stages of digestion. All of them contained very numerous specimens of *Ascaris spiculigera* in the œsophagus and stomach. In the intestine of two of them the adult stage of *Dibothrium cordiceps* was found, thus furnishing proof that the pelican is a final host of the trout parasite.

The above specimens were collected from the 1st to the 10th of August, on the shores of Yellowstone Lake.

The description of a few specimens collected by Mr. P. L. Jouy at Guaymas, Mexico, in February, 1891, is also included in this paper. These consist of specimens of *Ascaris spiculigera*, numerous, from stomach and œsophagus of *Pelecanus fuscus*; *Echinorhynchus rectus* sp. nov., from a species of *Larus*; fragments of *Tenia*, probably *T. capitella*, from *Colymbus* sp.; fragments of *Tenia*, probably *T. fusus*, from *Larus*, sp.; fragments of *Tenia*, probably *T. larina*, from another species of *Larus*.

I have not included in this paper any account of the adult stage of *D. cordiceps* of the pelican, having already described it in the article cited above. Attention may be called here, however, to the occurrence of what I take to be immature specimens of *D. cordiceps*, in good condition, in the intestine of the California Gull. It is probable, therefore, that this bird may occasionally become the final host of the trout parasite.

One new genus was met with among the parasites of the duck, *Oedemia americana*. This genus, which I have named *Epision*, is characterized by a singular modification of the anterior part of the body into an organ for absorption and adhesion.

NEMATODA.

Filaria serrata sp. nov.

(Pl. iv, Figs. 1-4.)

The following description is based on a single specimen, a male, from the intestine of the hawk, *Circus cyaneus hudsonius*, Yellowstone Lake, Wyoming, August, 1890. It appears to be near *F. leptoptera* R.,* but differs from that species in some important particulars, especially in the character of the spicules. I, therefore, for the present, record it as a new species.

The length of the specimen is about 8 millimeters, the diameter, 0.2 millimeter. It tapers gradually and uniformly toward the anterior end. The posterior end is coiled into a helix and is provided with broad, lateral and muscular alæ. The spicules are two and very unequal; the longer one is about .3 millimeter in length, the shorter only about one-

* See Schneider, Monogr. der Nem. P. 97, Pl. v, fig. 8, and Von Linstow, Trosch. Archiv., 1877, p. 10.

tenth as long; the extremity of each is bent around into a short hook (Fig. 4). Lips, two, lateral, with three tooth-like processes on inner side of each. Pharynx short, and with what appears to be a chitinous ring at the base. The body is crossed by transverse striae, which give the cuticle a segmented appearance, being sharply serrate on the margins in optical section. The transverse striae are 0.008 millimeter apart.

The anal papillae were not as satisfactorily made out as could be desired, but appear to have the arrangement shown in the diagram (Fig. 3). The papillae on the left side are fungiform, with comparatively broad disks. Those on the left side and the four small post-anal papillae near the caudal extremity were plainly seen, while those on the right side were made out by focussing down through the overlapping ala, and were not so satisfactorily seen.

Ascaris spiculigera Rudolphi.

(Pl. IV, Figs. 5-12.)

Diesing, Syst. Helm., II, 157, Revis. der Nem., 658.

Leidy, Proceed. Acad. Phila., 1853, p. 102; 1890, p. 411.

Schneider, Monogr. der Nem., p. 45; Pl. I, Fig. 14.

v. Linstow, Zoöl. of the Voyage of H. M. S. Challenger, Part LXXI, pp. 3, 4, Pl. I, figs. 5-7.

This nematode was found in immense numbers in the White Pelican (*Pelecanus erythrorhynchus*), Yellowstone Lake, Wyoming, August, 1890. Two birds yielded 820 specimens.

Two lots of this parasite from *P. fuscus* collected by Mr. P. L. Jouy, at Guaymas, Mexico, February, 1891, (National Museum acc. 24137, Nos. 971,974), have also been submitted to me for examination. These lots contain 45 and 102 specimens respectively, being in each case the number found in a single bird. I make the following extract from Mr. Jouy's letter:

The gular pouch and stomach were infested with worms. They were found sparingly in the throat and pouch of the birds, becoming more abundant in the stomach, at the bottom of which they were a mass with the partially digested fish. A few of them were slightly attached to the skin of the pouch or stomach and required a slight pull to release them. No parasites of any kind were found in the intestines of this bird.

The largest females among the Guaymas specimens measured 34 millimeters in length and 1.5 millimeters in diameter; the largest males 28 millimeters in length and 1.5 millimeters in diameter. The smallest specimens measured 7.5 millimeters in length and 0.35 millimeter in diameter.

Following are the dimensions of two of the largest specimens:

	♀	♂
	mm.	mm.
Length.....	32.00	20.50
Greatest diameter.....	2.10	1.50
Diameter of body, anterior end.....	.55	.40
Diameter of head.....	.30	.25

In the adult worm the body is rather stout and dark colored, due to the contents of the intestine. Those found in the œsophagus were smaller and lighter colored than those found in the stomach. Moreover, they were attached to the mucous membrane of their host, leaving a small round pit when removed. The body is of nearly uniform size throughout, tapering a little more at the anterior than at the posterior end. The head is characterized by having a triangular spine-like interlobe in the intervals between the three proper lobes of the head (Fig. 6). Papillæ were observed near the anterior end of some (Fig. 6). They appeared to be more common on the females than on the males, but are variable in number and frequently altogether absent.

The œsophagus is slender and rather short. There is a short diverticulum beyond its union with the intestine; the latter also extends forward of the union with the œsophagus for a short distance as a blind sac.

In both the Guaymas and the Yellowstone specimens the females considerably outnumbered the males. The sexes are readily distinguished. The posterior end of the males is usually curved sharply and is provided with two long filiform spicules which, when fully extended, may curve almost into a circle. The spicules are of unequal length. When the spicules are not visible for any reason the males may still usually be recognized by the flattened surface near the posterior end, which ordinarily presents a grooved appearance between the retractor muscles of the spicules.

Bodies of the females frequently swollen in the region of the reproductive aperture, which is placed about the anterior third. This aperture in one of the adult specimens measured 0.75 millimeter in length and 1.25 millimeters in a direction transverse to the axis of the body. The posterior end of the female is cylindrical, pointed, and not recurved, as in the male. The ova measured 0.06 millimeter in diameter, the shell of the same being 0.005 millimeter thick. Some were observed in which segmentation had begun; both morulae and gastrulae were noticed. This was in the eggs from a Guaymas specimen.

My observations on the anal papillæ were made on a single adult male. Their disposition is shown in the diagram, in which the precise relative distances from each other are perhaps not exactly shown. There are, as is shown in the sketch (Fig. 10) six pairs of post-anal papillæ, symmetrically arranged. The four anterior of these pairs are distinguished by having a common disk. The two posterior pairs are without disks and the papillæ in each pair slightly removed from each other. The latter are smaller than the other pairs, and of the others the anterior pairs are the larger. The pre-anal papillæ begin opposite the anal aperture and extend in symmetrical rows along each side. They are a little closer together near the posterior end of the rows for about eight papillæ. In the specimen examined there were about twenty-six pre-anal papillæ in each row.

ACANTHOCEPHALA.

Echinorhynchus rectus sp. nov.

(Pl. IV, Figs. 13-17.)

Two specimens of *Echinorhynchus*, ♂ and ♀, were found among some fragments of *Tenia* collected by Mr. P. S. Joly, at Guaymas, Mexico, February, 1891. The specimens were obtained from the intestines of *Larus* (*Chroicocephalus*) sp.

The body is smooth, fusiform, with its greatest diameter near the anterior end whence it tapers very gradually in both directions; proboscis nearly cylindrical, implanted obliquely or at right angles, armed with about twenty-four spiral series of hooks, about ten visible on one side in a single spiral, those on basal half straighter and more slender than those on distal half, base of proboscis for a short distance without hooks; sheath slender, a little longer than the proboscis; lemnisci slender, a little longer than the sheath.

Male, length 8.5 millimeters; testes two, oval, approximate, median; prostatic glands represented by a broad tubular organ into which ducts from the testes empty and which continues posteriorly in a large ejaculatory bulb, the genitalia ending posteriorly in an eversible copulatory bursa.

Female, length 9 millimeters, immature, no ova.

Following are the dimensions of the male:

	Millimeters.
Length.....	8.80
Anterior diameter.....	.45
Greatest diameter.....	.80
Posterior diameter.....	.45
Length of proboscis, (estimated).....	1.80
Diameter of proboscis, anterior.....	.25
Diameter of proboscis, base.....	.22
Length of sheath.....	1.80
Length of lemnisci.....	2.00
Diameter of lemnisci.....	.10
Length of hooks.....	.09
Length of testis.....	.60
Breadth of testis.....	.35

The length of the proboscis was estimated; 1.4 millimeters was the length of the extended portion and 0.4 millimeter the length of the part still invaginated at the apex. In the female the length of the proboscis was 1.5 millimeters with 0.4 millimeter of apex invaginated; length of sheath, 2.2 millimeters; diameter of sheath, 0.3 millimeter at its widest part, near anterior, and 0.12 millimeter at its posterior end.

Several nucleated cells were observed in the bursa of the male; these were 0.04 millimeter in diameter and each contained a conspicuous nucleus 0.01 millimeter in diameter.

These specimens possess several points of agreement with *E. transversus* Rudolphi.

According to Dujardin the male of *E. transversus* has only one globular testis, while the testes of *E. rectus* are two in number.

Echinorhynchus striatus Goeze.

(Pl. v, Figs. 18-25.)

Diesing, Syst. Helm. II, 45, Molin. Sitzungsab. d. k. Akad. xxx, 143; Denkschr. d. k. Akad. XIX, 266, tab. VIII, Fig. 7.

Two small echinorhynchi (Figs. 22-25) from the Black Scoter (*Ede-mia americana*) have been referred to the species *E. striatus*, although they are considerably smaller than the recorded specimens of this species. The specimens are both females, one with embryos and the other with large ovarian masses with no embryos. They were found in the intestine near the cæca, one cream-colored, the other orange yellow.

The bodies are conical, spherical in front with a constriction near the anterior end, echinate in front of constriction, behind the constriction the body is smooth, longitudinally striated and terminating in a blunt point. The proboscis is larger at the base than at the apex and is armed with hooks of nearly uniform size, so disposed that about eight may be counted in a transverse spiral on one side and twelve in a longitudinal row. The proboscis is partly withdrawn in each of these specimens, so that the neck can not be plainly seen. It appears, however, to be conical and unarmed.

The length of these specimens was about 3.3 millimeters. Other dimensions as follows:

	Millimeters.
Length of proboscis.....	0.60
Diameter of proboscis, apex.....	.12
Diameter of proboscis, base.....	.20
Length of sheath.....	.60
Diameter of body, anterior.....	.80
Length of hooks.....	.05

At a distance of 0.4 millimeter from the posterior end the diameter was 0.3 millimeter; 1 millimeter from the posterior end the diameter was 0.6 millimeter. One of the eight specimens contained embryos 0.14 millimeter in length and 0.03 millimeter in diameter; the other contained ovarian masses, ellipsoidal in shape and 0.14 by 0.06 millimeter in their two principal diameters.

These specimens agree with the following-described specimens in the shape and armature of the proboscis and in the spines on the anterior part of the body, but differ in their smaller size, conical shape, and the absence of spines at the posterior end.

HABITAT: *Ede-mia americana*, intestines. Yellowstone Lake, Wyoming, August, 1891.

A small lot of Echinorhynchi consisting of six specimens, all males (Figs. 18-21), from another duck which appears to be *Ede-mia americana*, not fully grown, agree in several important particulars with the foregoing and have been referred to the same species. These specimens vary in length from 2.5 to 5.5 millimeters. The smaller ones have cylindrical bodies with one and in one case two constrictions. The larger

specimens are somewhat fusiform. The anterior region of the body is rounded and echinate. The proboscis, especially of the larger specimens, the spines of the anterior part of the body, and the shape, number, and arrangement of the proboscis hooks agree closely with those of the first lot. There is, however, a slight difference between the larger and the smaller specimens in the shape of the proboscis and the number of hooks. In the smaller specimens the proboscis is less conical than it is in the larger and there appears to be a less number of vertical rows of hooks. The hooks toward the base of the proboscis are stouter than those near the apex.

The testes are oval, and, when not displaced by constrictions in the body, lie close together, even slightly overlapping at their contiguous ends, near the base of the proboscis sheath. In some cases the anterior constriction of the body forced the anterior testis forward beside the sheath.

The prostatic glands appear to be about four in number and are elongated and parallel.

The most characteristic feature of these specimens is the echinate posterior end. This, indeed, appears to be an echinate armature of the bursa. These spines are numerous, forty or more having been counted in two of the specimens. They are terminal, and, like those on the anterior part of the body, appear to be sagittate in some aspects.

Two specimens from this lot yielded the following measurements :

	mm.	mm.
Length	5.50	2.50
Diameter, anterior .....	.40	.35
Diameter, median .....	.85	.50
Diameter, posterior .....	.20	.20
Length of proboscis .....	.60	.60
Diameter of proboscis at base .....	.24	.15
Diameter of proboscis at apex .....	.18	.15
Length of proboscis sheath .....	.70	.60

The anterior testis in one specimen was 0.3 millimeter in length and 0.17 millimeter in breadth; the posterior testis was 0.28 millimeter in length and 0.15 millimeter in breadth.

TREMATODA.

Holostomum variabile Nitzsch.

(Pls. v, vi, Figs. 26-29, 30-32.)

Amphistoma macrocephalum Rudolphi, Entoz., II, 340; Synopsis, 88, 354.

Holostomum variabile Nitzsch., Diesing, Syst. Helm., I, pp. 312-313, Revis. d. Myzhelm., p. 320; Von Linstow, Troesch. Archiv., p. 187, Compend. Helm., p. 103; Wedl, Sitzungsber., XXVI, p. 252-253, Pl. I, 18; Molin, Denkschrift. d. Kais. Akad., XIX, pp. 194-195, Pl. I, 6, 7; Brandes, Monograph d. Holostomidae Zoöl. Jahrb., 1890, p. 590, Pl. XLI, figs. 1, 8, 9.

Holostoma macrocephalum Creplin, Dujardin, Helm., pp. 368-369.

Holostoma macrocephalum (Rud.), Olsson, Bitrag till Skand. Helm., p. 31.

Body divided into a shorter anterior and a longer posterior part by a profound constriction. Anterior part of body subglobose, variable, aperture transverse; posterior cylindrical, curved, slightly attenuate. Reproductive aperture terminal, circular, surrounded by an ample muscular border and with a central, obconical, protractile part.

Length, 3.7 millimeters.

The foregoing is a brief synopsis of the superficial characters of my specimens and differs in some particulars from the descriptions of *H. variable* given by Diesing and others. For example, the species is usually described as being bilabiate and gaping at the apex. My specimens are so much contracted that this character, while not contradicted, is not manifest.

This peculiar entozoan has been found infesting a number of species of raptorial birds. Von Linstow has noted its occurrence in twenty-four species distributed among the following genera: *Nyctale*, *Ulula*, *Egolius*, *Surnia*, *Bubo*, *Strix*, *Circus*, *Pernis*, *Buteo*, *Aquila*, *Circætos*, *Pandion*, and *Falco*. (Compend. Helminth.)

The following account is based on four specimens from the intestines of *Circus cyaneus* var. *hudsonius* collected near Yellowstone Lake, Wyoming, August, 1890. The specimens when studied were all alcoholic, no observations having been made on the living worms.

Two of the specimens furnished the following measurements:

	mm.	mm.
Length.....	3.70	3.60
Length of anterior, subglobular part.....	.60	.80
Diameter of anterior part.....	.90	.80
Diameter of posterior part, median.....	.70	.80
Diameter of posterior end.....	.40	.45
Diameter of posterior aperture.....	.15	.12

The ova measure 0.09 millimeter in length and 0.065 millimeter in breadth.

The bodies of all the specimens are bent abruptly at the constriction and the posterior portion is also more or less curved. From the examination of a series of sections it was ascertained that the anterior portion is bent abruptly backwards so that its dorsal region approximates the dorsal region of the posterior part. This is effected by some strong fascicles of longitudinal muscles which have their principal development in the dorsal and dorso-lateral regions of the body.

Anatomy.—The following observations on the anatomy of this species are based on a series of longitudinal sections made parallel to a dorso-ventral plane, and stained with borax carmine.

In the anterior, subglobular division of the body there are three muscular organs placed near together (Fig. 29, *m. ph. s.*) which represent the mouth, pharynx, and ventral sucker. The first and third of these appear, in the sections, to open into the interior of the mass, since that part of the body is much folded together and contracted. This part of the body appears to be capable of expanding into a comparatively large suctorial or, more properly, absorbing surface.

The anterior or oral sucker is 0.15 millimeter in its antero-posterior diameter and 0.12 millimeter in its dorso-ventral diameter; the diameter of the passage between its muscular walls 0.02 millimeter. The walls of the pharynx are almost contiguous with those of the oral sucker. Its length is 0.12 and its depth 0.09 millimeter. The length of the ventral sucker is 0.12, and its depth 0.21, and the thickness of its walls 0.06 millimeter. The œsophagus is short, at first deflected, ventrally, then divides in front of the ventral sucker. The two branches at first diverge, then turn back towards the constriction. In these sections they could not be traced into the posterior region of the body. The walls of the pharynx, and particularly of the intestinal crura, are ciliated.

The greater part of the anterior division of the body is filled with what I interpret to be the vitelline glands. The latter also occupy the anterior and ventral region of the posterior division of the body. A folded portion which occupies a central position (Fig. 29, *y*) appears to answer to Molin's "*lembo roversato*." It contains many nucleated cells and would appear from its position and structure to be an organ for absorption. A lobed body (Fig. 28, *x*) is situated in the anterior division near the constriction and towards the dorsal side. This is evidently the "*kugliger korper*" of Von Linstow, mentioned in his anatomy of *Holostomum gracile*. The lobes of this body are composed of minute cells which are about 0.004 millimeter in diameter. The irregular cleft which in these sections marks the limits of the lateral borders extends almost to the constriction (Figs. 28-29).

The reproductive organs, with the exception of a part of the vitellaria, lie in the posterior division of the body. The extreme posterior end of the body consists of a muscular suctorial organ with thick walls. In the middle of the base of this organ the uterus terminates in a prominent papilla (Fig. 28, *p*). On the dorsal side of the body, immediately in front of the bursa, is the pyriform cirrus pouch, with a duct leading therefrom and emptying into the uterus about the base of the papilla (Fig. 28, *c*). There does not appear to be any cirrus and the pouch probably functions as an ejaculatory organ. In front of the cirrus pouch, and occupying a position about on the median line, is the posterior seminal receptacle. The testes are large, extending from near the base of the bursa to near the middle of the posterior division of the body, and taking up three-fourths of the dorso-ventral diameter. They reach the body-wall dorsally and laterally, but not ventrally. A vas deferens lies along the ventral side of the testes, between them and the uterus. The shell gland, together with a portion of the germ duct and the main vitelline duct and the beginning of the uterus, lies between the two testicular lobes (Fig. 28).

The ovary is single, lenticular, and lies in front of the testes, at about the middle point of the body. (Fig. 28 *o*.) It is inclined forward at its ventral end and backward at its dorsal end. Laterally it reaches

almost to the walls of the body, being separated from them by a thin layer of the vitellaria, and some strong muscle-fascicles from the anterior division of the body. The cells of the ovary measure 0.02 millimeter in diameter. The nuclei measure 0.007 millimeter in diameter, and in some a nucleolus was observed. Between the ovary and the anterior testis is a space which contains what I have called in the explanation of Fig. 28, the anterior seminal receptacle, the vagina and the beginning of the oviduct. The sections showed the presence of a duct here which appears to communicate with the exterior dorsally and which I have interpreted as the vagina, or canal of Laurer. (Fig. 28 *v.*) The oviduct originates at the dorsal end of the ovary, passes along the dorsal region between the anterior testis and the body-wall, enters the space between the testes where, after receiving the main vitelline duct, it enters the shell-gland and emerges in the ventral region as the uterus. The uterus, from its origin about the ventral side of the anterior testis, proceeds anteriorly where, in the space in front of the ovary the ovules are for the most part collected. The uterus here appears to consist of several voluminous folds, but the walls are thin and the ova appear in the section to lie in an illy-defined cavity. The posterior prolongation of the uterus was proved by tracing ova along the ventral region, where they were found in the posterior portion of the uterus near where it terminates in the posterior bursa. The walls of the uterus near its posterior end are thick and muscular and lined with cilia.

The vitelline glands are voluminous organs, occupying the anterior part of the body proper, where they fill the peripheral regions, having a further development in the anterior division of the body. A broad ventral branch extends backward almost to the posterior end. Two vitelline ducts extend along the ventral side of the body above the ventral vitellaria. Opposite the space between the two testicular lobes each gives off a duct which unite in a common duct between the two testes. This latter duct joins the oviduct behind the shell-gland. (Fig. 28 *yd.*) A cross section of the common vitelline duct presents a curious reticulated appearance, due to aggregation of the food yolk into elongated spheroidal masses of minute fat globules.

Distomum (?) *verrucosum* sp. nov.

(Pl. VI, Figs. 33-35.)

Two singular specimens from the intestines of the California Gull (*Larus californicus*) possess so many characters peculiar to themselves that I do not hesitate to regard them as representatives of a hitherto undescribed species, although on account of the paucity of material I am able to give but few points in their anatomy.

One of these specimens was coiled in a spiral as shown in Fig. 33, the other, Fig. 35, had lost a part of the body. That the two belong to the same species admits of no doubt.

The length of the fragment was 5.5 and of the entire specimen about 8 millimeters.

The body, behind the ventral sucker, appears to be subcylindrical, but is characterized by a profound groove on the ventral side, the edges of which consist of ventro-marginal flaps, which separate anteriorly on either side of the ventral sucker, in front of which they disappear. Neck flat on ventral side; mouth subterminal, large; ventral sucker near anterior end, short-pedicelled, circular, with thickish, prominent or reflected border; reproductive aperture in front of ventral sucker. Surface of body, from and including ventral sucker, smooth; remainder of body on back and sides more or less tuberculous; tubercles specially abundant on dorsal region just back of ventral sucker. The ventral surface is crossed by transverse rugæ, which, together with the disk of the ventral sucker, are minutely tuberculated. It is probable that the ventral surface in life does not appear to be grooved, but rather flat.

The fragmental specimen had the following dimensions in millimeters: Length, 5.5; diameter of neck, 0.4; diameter behind ventral sucker, 0.7; ventral sucker, 1.4 back of head; diameter of mouth, 0.4; diameter of ventral sucker, 0.6. A central tubular organ containing a coiled duct, presumably the uterus, extended back from the posterior end of the fragment 1.4 millimeters. This tube was 0.27 millimeter in diameter and the contained duct 0.06 millimeter in diameter. The thin walls of this tube were minutely roughened. The tubercles on the surface of the body are short and blunt and measure 0.025 millimeter in length. In most cases their breadth equals their length.

The imperfect specimen was stained and cut into longitudinal sections. The specimen is immature and the sections do not show much that can be made out definitely. The alimentary canal is bifurcate, but otherwise there is little resemblance to any Distomum or even Trematode with which I am familiar. The reproductive aperture lies in a groove on the ventral side of the neck in front of the ventral sucker, and a little forward of the bifurcation of the intestine. A series of oval masses, which lie along the dorsal region are probably the vitellaria. The exact nature of the cylindrical tube with its contained, convoluted duct, which protrudes from the center of the posterior end of the fragment was not determined.

The neck of the entire specimen was much flatter than the body proper, which was subcylindrical, *i. e.*, compressed so that its dorso-ventral diameter was less than its lateral diameter. The diameter, lateral, of the head was 0.3 millimeter; the breadth of the neck midway between the mouth and ventral sucker was 0.7 millimeter; greatest diameter of the body, 0.8 millimeter; diameter of the posterior end, 0.3 millimeter; length of the spiral, 2.3 millimeters; entire length of specimen, 8 millimeters. Two sinuous dark-colored lines traverse the back along the posterior two-thirds of the body. These are probably the genitalia showing through the dermis.

HABITAT: *Larus californicus*, intestines, Yellowstone Lake, August, 1890.

Distomum flexum sp. nov.

(Pl. vi, Figs. 36-44.)

It has been found necessary to make a new specific name to accommodate a small *Distomum* from the black scoter (*Oedemia americana*), although its near relationship to at least two described forms is quite evident. It agrees very closely with Diesing's *D. baculus*; indeed, if Diesing's description alone were employed it could be readily referred to that species. Von Linstow, however, in his account of *D. baculus* (Trosh. Archiv. 1877, p. 183, Pl. XIII, Fig. 15), neither mentions nor figures any cervical spines. It is not at all probable that such a careful observer as he would neglect to mention such an important character, especially as in his figure of *D. spinulosum* (l. c. Fig. 14), the cervical spines are shown. The latter species must be excluded on account of the smaller number (twenty-two) of the oral spines.

A *Distomum* discovered and described by Olsson from *Larus marinus*, and called by him *D. pseudocchinatum* (Bitrag till Skandinavien Helminthfauna, p. 21, Pl. IV, Figs. 45-49) resembles my specimen in the spinous margins of the neck and in the general appearance of the head. It is much larger, however, being 8 millimeters in length, and has, moreover, only about twenty oral spines.

The body of this specimen is subcylindrical and linear; the neck is attenuate anteriorly, concave on the ventral side, just back of the head, and armed with spines along the margins; the head is transversely reniform and provided with a crown of about forty-five spines; the mouth is terminal and prominent, its aperture circular; the ventral sucker is about twice the diameter of the mouth and sessile; pharynx elongated; genital aperture in front of ventral sucker; testes two, oval, midway between ventral sucker and posterior end; ova few and large.

Length, 2.5 millimeters.

Other dimensions are :

	Millimeters.
Diameter of head .....	.30
Diameter of neck .....	.19
Diameter of the body at the ventral sucker .....	.40
Diameter of body near posterior end .....	.26
Diameter of ventral sucker, internal .....	.16
Diameter of ventral sucker, external .....	.28
Diameter of oral sucker, internal .....	.09
Diameter of oral sucker, external .....	.13
Length of testes .....	.30

The oral hooks are flat and broad, and the larger ones 0.055 millimeter in length, and 0.01 to 0.015 millimeter in breadth.

The cervical spines are triangular and 0.015 to 0.02 millimeter in length. These spines appeared to be only in the margins of the neck, although possibly they may extend dorsally for a short distance.

The front edge of the ventral sucker was 0.5 millimeter from the an-

terior end. The pharynx was 0.1 millimeter in length, and 0.06 millimeter in breadth, its anterior end 0.03 millimeter back of the oral aperture.

The ova were few, about nine were counted, and were relatively large, 0.09 millimeter in length. Several of them were observed to be undergoing segmentation (Figs. 39 and 40).

The ovary is situated in front of the testes, and near the anterior one; the vitellaria are voluminous, occupying the posterior part of the body behind the testes and the margins of the body nearly as far forward as the ventral sucker.

HABITAT : *Oedemia americana*, intestines, Yellowstone Lake, August, 1890.

CESTODA.

Dibothrium cordiceps Leidy.

(Pl. VI, Fig. 45.)

Larval (encysted) stage in *Salmo mykiss*.

Leidy, Hayden's Report on Geol. of Montana and Adjacent Territory, 1871, p. 351, 382.

Linton, Bulletin U. S. Fish Commission, 1889, Vol. IX, pp. 65-79. Pl. XXIII-XXVII.

Adult stage, in *Pelecanus erythr orhynchus*.

Linton, Bulletin U. S. Fish Commission, 1889, Vol. IX, pp. 337-358. Pl. CXVII-CXIX.

I have referred to this species a small lot of immature specimens, belonging to the genus *Dibothrium*, obtained from the intestine of the California Gull (*Larus californicus*), Yellowstone Lake, August, 1890. Five specimens were found in one gull and one in another.

The specimens have the following characters: Bothria lateral; body rather thick, subcylindrical in front, compressed elsewhere, tapering posteriorly, crossed by exceedingly fine striae.

The dimensions of an average specimen are as follows :

	Millimeters.
Length	7.00
Diameter of head.....	.32
Diameter of body, anterior lateral.....	.65
Diameter of body, anterior marginal.....	.40
Diameter near posterior end.....	.20

There is no indication of reproductive organs.

The species *D. cordiceps* is not excluded by any characters yet developed in these specimens. Satisfactory identification, however, is always difficult in forms like these, which may assume such diverse shapes with different degrees of contraction.

On account of the small size and immature condition of these specimens it may be inferred that they had not been in the intestine of the gull very long. It does not follow, therefore, that they would reach maturity in this host. So that even if the specimens have been correctly identified in this case it can not be said positively that the gull is a proper final host of *D. cordiceps*.

The adult stage of *D. cordiceps* was found in the intestine of *Pelecanus erythrorhynchus*, Yellowstone Lake, August, 1890, an account of which was published by the author in a paper entitled "A Contribution to the Life-history of *Dibothrium cordiceps* Leidy." Bulletin of the U. S. Fish Commission, 1890, Vol. IX, pp. 337-358, Pl. CXVII-CXIX.

Dibothrium exile sp. nov.

(Pl. VI, Figs. 46-48.)

Head oblong, tapering both anteriorly and posteriorly; bothria elongated, lateral with rather thin lips; neck long and slender; the first segments twice as broad as long, this proportion continuing without much change, except that the breadth increases rather faster than the length, until the median region is reached where the segments are squarish and even a little longer than broad; the posterior segments are rectangular, the length being a little in excess of the breadth. The segments throughout are characterized by considerable regularity and distinctness and the strobile by its nearly linear form throughout.

The single specimen obtained had the following dimensions in alcohol.

	Millimeters.
Length	153.00
Length of head	1.50
Greatest breadth of head .....	.60
Thickness of head .....	.20
Distance from head to first segment	10.00
Breadth of neck .....	.30
Thickness of neck .....	.16
Length of first segments .....	.28
Breadth of first segments .....	.50
Length of posterior segments .....	.85
Breadth of posterior segments .....	.80

The length of the living specimen was 160 millimeters.

The genitalia have not yet developed. Careful search was made in several of the posterior segments which had been stained with borax carmine and made transparent in oil of cloves, without revealing any genitalia whatever. The interior of the segments is filled for the greater part with granular protoplasm. These granules were beginning to gather into denser masses along the median line rather towards the posterior part of the segments. It may be inferred therefore that the genital apertures are median in this species, although it can not be proved from this specimen.

HABITAT: *Larus Californicus*, intestines, Yellowstone Lake Wyoming, August, 1891.

EPISION gen. nov.

(Ἐπίσιον, a pennant).

Anterior end of body (head) lamellate, more or less crispate, deflected. Body proper, tæniæform, segmented, segments not distinct. Reproductive apertures lateral (?).

Epision plicatus sp. nov.

(Pl. VI, Figs. 49-53.)

Anterior part of body (head) a lamellate unsymmetrical organ, which consists of an elongated auricular pointed flap, deflected marginally and forming an angle with the body proper, and a shorter rounded lobe at the opposite margin. This leaf-like organ is more or less crimped or folded, especially near the shorter lobe, and on the anterior edge; it is crossed by fine transverse lines, which upon enlargement appear due to a segmented condition of the organ; two pairs of vessels rise near its extreme tip and are continuous with the longitudinal vessels of the body proper. Body nearly linear, flattened; segments beginning immediately behind the head, not distinct. Reproductive organs rudimentary in specimens examined, but from their position along the median line of the strobile, and their resemblance to similar stages of development in the *Dibothriidae*, it is probable that the reproductive apertures are median.

Longest specimen, 23 millimeters in length and 1.5 millimeters in breadth.

HABITAT: *Oedemia Americana*, intestines, Yellowstone Lake, Wyoming, August, 1890.

The foregoing description is based on four specimens from the Black Scoter, the largest 23 and the smallest 6 millimeters in length. The breadth of the head of the larger specimen was about 3.2 millimeters, breadth of the body near the head 1 millimeter, and the length of the rather indistinct segments near the head 0.2 millimeter; greatest breadth of the body 1.5 millimeters; near the posterior end the breadth decreased to about 0.8 millimeter.

Following are the dimensions in millimeters of the smallest specimen: Length, 6; breadth of head, 1.8; length of head, 0.7; breadth of body near head, 0.35; breadth of body, posterior, 0.55.

The segments, which are rather indistinct, appear as if in pairs, or rather each is divided into two nearly equal parts by a faint transverse line.

The head is finely serrate on its margins, and presents a minutely segmented appearance when magnified. It is therefore not to be regarded as homologous with a scolex, but rather as the anterior portion of the strobile modified into an absorbing and adherent organ.

None of the specimens had reproductive organs developed sufficiently to fix the systematic position of these singular forms. Sections made from a series of posterior segments of a medium sized specimen show that there is no distinct segmentation in the inner portions of the strobile. The genitalia are represented by small, oblong clusters of granules lying transverse to the axis of the body and crowded together along the median region of the body. There are no external apertures, but the arrangement of the incipient genitalia, and of the longitudinal muscle fibers and the longitudinal vessels, as seen in these sections, indicates relationship with the *Dibothriidae*.

Tænia sp. *Fragments not certainly identified.*

(Pl. VII, Figs. 54-58.)

Several fragments of *Tænia* from *Larus* sp. and *Colymbus* sp., collected at Guaymas, Mexico, by Mr. P. L. Jouy, February, 1891, have been referred to me for examination by the U. S. National Museum.

The fragments are without scolices, which makes the matter of identification uncertain.

I append, however, the following descriptive notes on these fragments.

I. Fragments of *Tænia* from *Colymbus* sp., Museum No. 4930 collector's No. 972 (Figs. 54, 55).

Mr. Jouy's notes on this lot are: "972. Parasitic worms from intestines of *Colymbus* sp. ♂ juv. The throat and stomach of this bird were empty and these specimens, apparently of a tapeworm, were found in the lower intestine."

The fragments appear to belong to the same strobile; the longest measures 115 millimeters, and the next longest 65 millimeters. The aggregate length of the fragments is about 200 millimeters. The largest proglottides are about 2 millimeters broad and 1 millimeter in length. The youngest segments are 0.75 millimeter in length, 1.2 millimeters in breadth, and 0.7 millimeter in thickness. Color of the alcoholic specimens, pinkish yellow, or faint rose. The segments are rounded on their anterior corners, posterior corners blunt and slightly projecting. Reproductive apertures all on one margin about the middle of the segments. Cirri, not seen projecting, but appear to have rather large diameter. Sometimes one margin of a segment projects about its middle point. This projection is on the margin opposite the one bearing the genital form.

The ripe segments contained ova which were inclosed in an outer pellucid envelope measuring from 0.09 to 0.12 millimeter in diameter, and containing an embryo 0.06 to 0.07 millimeter in diameter, the spines of which were about 0.02 millimeter in length.

These fragments very probably belong to the species *T. capitellata* Rudolphi or to an undescribed closely related species.

II. Fragments of *Tænia* from *Larus* sp. Museum No. 4931. Collector's No. 973 (Fig. 56).

Upon these Mr. Jouy makes the following note: "973. Parasitic worms from intestines of black-backed gull, *Larus* sp. There are apparently two kinds of worms from this specimen, but they are all taken from the intestines, the throat and stomach of the bird being clean and empty."

The longest fragment measures 155 millimeters in length. The other fragments are 80, 30, and 18 millimeters, respectively. The 80 and 30-millimeter fragments belong to the same strobile, and the 18-millimeter piece belongs to the 155-millimeter strobile.

In the longest specimen the last segments were 0.5 millimeter in length and 1.5 millimeters in breadth. The length of the first distinct segments was 0.5 and the breadth 0.2 millimeter. The anterior end for about 8 millimeters was attenuate and without evident segments. The first evident segments were a little more than twice as long as wide. The reproductive apertures are all on one margin, about the middle of the segments, somewhat prominent with thickened, protruding borders. The color of the alcoholic specimens is yellowish white. Segments somewhat like those from *Colymbus* in outline but not so thick, and rather more regular; strobile in general more delicate.

T. fusus Krabbe is suggested by these fragments.

III. Fragments of *Tænia* from *Larus* sp. Museum No. 4932. Collector's No. 975 (Figs. 57, 58). Mr. Jouy's note on this lot is as follows: "975. Parasitic worms (tapeworms) from the intestines of gull *Larus* (*Chroicocephalus*) sp. ♂. The throat and stomach of this specimen also clean and empty."

This lot consists of several fragments belonging to about three strobiles. The longest fragment measures 18 millimeters in length. The aggregate length of the fragments is about 140 millimeters. Anterior segments funnel shape, succeeding segments much crowded, and much broader than long; posterior segments squarish or rounded, separating easily from the strobile, about 1 millimeter in length and 0.6 millimeter in breadth. Reproductive apertures alternate and apparently regularly so; apertures near anterior end of segment. Ova spherical with thin walls, containing embryos. Diameter of external shell, 0.05 millimeter; diameter of embryo, 0.03 millimeter; length of spines, 0.01 millimeter. Some of the ova have thin, somewhat wrinkled shells; some also have what appear to be small curved hooks over the surface (Fig. 58). The specific determination of these fragments is not certain. In some particulars it agrees closely with *T. larina* Krabbe. All of these Guaymas fragments contained numerous small granular bodies, the largest of which measured 0.025 millimeter in greatest diameter, although usually smaller than that. In oil of cloves these particles frequently showed a concentric structure. They dissolve in acetic acid, but with difficulty. Brisk effervescence was not obtained even with heated hydrochloric acid. This character is in marked contrast with the behavior of the calcareous particles in the Yellowstone Lake specimens, where brisk effervescence followed treatment with acetic acid.

Tænia porosa Rudolphi.

(Pl. VII, Figs. 59-71.)

Rudolphi, Entoz. Hist. III, 190, Pl. x, 1; Synopsis 168 and 529, Pl. III, 7, 8. Dujardin, Hist. Nat. des Helm., 561. Diesing, Syst. Helm., I, 546; Sitzb. XIII, 610; Sitzb. XLIX, 415; Krabbe, Beitrag til Kund. om Fugl. Bænd., 260, 261, Pl. I, 10-13.

Head subglobose, bothria somewhat circular with a thick border; proboscis cylindrical, armed with from twelve to fifteen hooks, which are

0.12 millimeter in length and straightish; neck short; first segments very short, subsequently variously longer and narrower, often infundibuliform; posterior segments on longest strobiles, squarish and transversely wrinkled; genital apertures irregularly alternate, cirrus short, opening near anterior edge of margin and directed forward; ova with a double envelope; length of embryonic hooks, 0.35 millimeter. Largest specimen measured while living, 120 millimeters in length and 2.5 millimeters in greatest breadth. Greatest recorded length hitherto, 100 millimeters.

HABITAT: *Larus californicus*, intestine, Yellowstone Lake, on different dates in August, 1890.

I refer to this species several *Tænia*, which, while presenting some differences among themselves that are difficult to reconcile with each other, do not, at least with the material at hand, appear to me to justify their separation into distinct species.

But one specimen with ripe proglottides was found. This was associated with several specimens of *T. filum* collected on August 2, 1890, and had the following dimensions and characteristics:

	Millimeters.
Length	110.00
Diameter of head.....	.46
Length of head.....	.30
Length of proboscis.....	.38
Diameter of proboscis.....	.11
Diameter of crown of hooks.....	.19
Length of hooks.....	.12
Diameter of neck.....	.35
Length of anterior segments.....	.20
Breadth of anterior segments.....	.25
Length of posterior segments.....	2.00
Breadth of posterior segments.....	2.50

The above dimensions are from measurements of an alcoholic specimen. The living worm measured 120 millimeters in length. The diameter of the proboscis immediately behind the hooks and at base was 0.09 millimeter; at apex and in middle, 0.11 millimeter. The posterior segments became dilated in alcohol. They were subglobose, being swollen with the contained embryos. The hooks on the proboscis were in a single circle and were fourteen in number. The complete set is probably fifteen. These hooks are uniform in size and shape, and are exactly 0.12 millimeter in length. The anterior segments are somewhat funnel shape, preceded, however, by very short beginning segments like transverse wrinkles; the median segments are somewhat rectangular, broader than long, and increasing in breadth toward the posterior end. Toward the posterior end of the strobile the segments have one or two wrinkles at the margin. The reproductive apertures are marginal near the anterior end of the segments and irregularly alternate, although often for a series of a dozen or more segments irregularly alternate. The cirri are short, smooth, and directed

forward. The embryos are well developed in the ripe segments, are enclosed in a double envelope, and their hooks are of three sorts (Fig. 66). Two of the hooks are broader than the other four, and two of the remaining four are more curved than the others. There is no material difference in length, however, each measuring about 0.035 millimeter.

Two specimens, 25 and 10 millimeters in length, respectively, and two fragments 6 and 8 millimeters in length, were obtained from another gull. The number of hooks in the larger was about fifteen, in the smaller twelve. The hooks agree in shape and size with those of the first specimen.

No reproductive apertures were seen in the smaller specimen. In the other they appeared at first to be situated along one margin, but upon closer examination were found to be irregularly alternate, with a tendency for several successive segments to have the reproductive apertures on the same margin. Cirrus short, conical, as seen, 0.17 millimeter in length, 0.05 millimeter in diameter at base, and 0.02 millimeter in diameter at apex.

In all of the foregoing there were numerous minute calcareous bodies, showing under proper optical conditions a concentric structure, and evolving carbon dioxide briskly when treated with acetic acid. These were particularly abundant in the two smaller specimens. They are more abundant in the median and posterior segments, few appearing in the anterior portion of the strobile.

Variety a. (Figs. 67-71).—Three specimens from a gull captured August 10, 1890, are referred to this species, but on account of certain constant characters of difference they are given a special place.

The specimens measured 15, 17, and 21 millimeters in length respectively; breadth near posterior end 1 millimeter. Head broad, compressed, 0.55 millimeter broad and 0.3 millimeter thick; diameter of neck 0.3 millimeter, in one the diameter immediately behind the head was 0.4 millimeter, and one millimeter back of head 0.32 millimeter. The hooks are exactly twelve in number and measure 0.12 millimeter in length. They agree in shape and size with those of the other specimens. The strobiles are all young and complete—that is, they have not lost any segments. They are rather plump, increasing in breadth uniformly from the neck to near the posterior end. The strobile thus has somewhat the shape of a club, nearly cylindrical in middle portion, but compressed elsewhere. The reproductive apertures are irregularly alternate, with a tendency to be regularly alternate for several successive segments. The apertures are near the anterior edge of the segments at the margins. A series of sections was made of several of the posterior segments, from which it was ascertained that the cirri, which are all retracted, are smooth and agree with those of the others in shape. Calcareous bodies are not so numerous as in the other specimens. The male reproductive organs were well developed, consisting of a voluminous vas deferens, large testicular lobes, containing sperm-

atozoa already developed and developing. Ova had not yet made their appearance. Sinuous marginal aquiferous vessels, as well as very strong fascicles of longitudinal muscles were continuous from segment to segment.

Naturally Krabbe's *Tænia dodecacantha* from *Larus minutus* is suggested by this variety, but that species must be excluded from consideration on account of the character of the spines, which in Krabbe's species are from 0.72 to 0.74 millimeter in length instead of 0.12 millimeter.

Tænia filum Goetze.

(Pl. VIII, Figs. 72-78.)

Diesing, Syst. Helm., p. 530; Sitzb., XIII, p. 607, and XLIX, p. 411.

Dujardin, Hist. des Helm., p. 605. Krabbe, Bitrag til Kunds. om Fugl. Bænd., p. 312, 313, Pl. VIII, Figs. 198-201.

Head subglobose, broader than long; bothria nearly circular; proboscis cylindrical, enlarging at the extremity, with a circle of small abruptly recurved and sharp-pointed hooks, the slender pointed part of the hook parallel with the basal portion and a little longer; neck long and slender; ripe segments subcuneate, posterior marginal edges usually prominent and acute; genital apertures near one of the margins, cirrus slender, tapering, smooth from a swollen spinous basal portion.

Longest specimens observed 52 millimeters in length. Length of hooks 0.025 millimeter.

HABITAT: *Larus californicus*, intestines, Yellowstone Lake; obtained on two different occasions, August 2 and 10, 1890.

The following dimensions are in millimeters. In one specimen, measuring 52 in length, the diameter of the head was 0.2, of the neck 0.1; length of the last segment 0.12, breadth 0.44. In another specimen the diameter of the proboscis at the apex was 0.08, at the base 0.06; diameter of head 0.27, length 0.22; diameter of neck 0.13; length of first segments 0.02, breadth 0.12; diameter of bothrium 0.11.

The diameter of the spinous basal portion of the cirrus was in one instance found to be from 0.012 to 0.015; diameter of filiform terminal portion, near the base, 0.006, tapering to 0.004 at the extremity; length of filiform portion 0.05, of spinous basal portion 0.08.

The segments in some specimens were rather crowded with margins somewhat rounded making convex serrations on the margins. The reproductive apertures were in these cases not immediately at the margins, but at a distance from the nearest margins equal to one-third the entire breadth of the strobile (Fig. 78). In the posterior segments the reproductive apertures are near the margin. One of the specimens with segments thus characterized had the following dimensions: Length 33 millimeters; greatest breadth 0.7 millimeter, at which point the length of segments was 0.1 millimeter; length of posterior segments

0.08 millimeter, breadth 0.4 millimeter. In this specimen the first segments began about three millimeters back of the head.

Some specimens with ripe segments contained ova which were 0.025 to 0.03 millimeter in diameter, and which inclosed typical six-hooked embryos.

Tænia macrocantha sp. nov.

(Pl. VIII, Figs. 79-82.)

Head subglobose, somewhat pyramidal; bothria in lateral pairs and little prominent; proboscis subcylindrical, expanded at apex, contracted at base; hooks in a single circle, large, nine (?) to thirteen; body subcylindrical, segments very short and crowded together anteriorly, lengthening and narrowing posteriorly; strobile, in alcoholic specimens, slightly arcuate with crenate margins; reproductive apertures marginal, all on one margin; cirrus long, filiform, and armed with exceedingly minute spines; largest specimen 15 millimeters long and 1 millimeter broad.

HABITAT: *Edemia americana*, Yellowstone Lake, Wyoming, August, 1890.

Following are detailed measurements of the largest specimen in the lot, dimensions given in millimeters: Length 15, diameter of head 0.75, diameter of neck 0.60, length of head 0.50, length of proboscis 0.42, diameter of proboscis at base 0.10, diameter of proboscis at apex exclusive of hooks 0.22, diameter of crown of hooks 0.35, length of hooks 0.21, length of first distinct segment 0.025, breadth of first segment 0.65, length of last segment 0.28, breadth of last segment 0.50, greatest diameter of body 1, diameter of cirrus 0.015 to 0.019, length of spines on cirrus not exceeding 0.001.

The number of hooks in this specimen was made out to be nine. In order to ascertain the number of hooks accurately, a specimen in which the proboscis was retracted, and which had presumably not lost any of the hooks after it had been put in alcohol, was taken and the set of hooks carefully dissected out. The number in this case was found to be exactly thirteen, and they were 0.22 millimeter in length.

The hooks, when isolated, are seen to be of two sorts, as shown in Fig. 80. In the set of hooks examined, nine of the thirteen were like Fig. 80, *a*, the other four being like those of Fig. 80, *b*. This difference would probably be overlooked except where the hooks are isolated.

The hooks resemble those of *T. megacantha* Rndolphi, as figured by Krabbe (Bitrag til Kunds. om Fugl. Bænd., 80, Pl. IX, Fig. 251). There are, moreover, no characters which are absolutely contradicted in the published descriptions of that species. The descriptions of *T. megacantha* are, however, deficient in detail, and since the hosts are widely different, *T. megacantha* being a parasite of species of *Caprimulgus* and *Nyctibius*, it has appeared to me best to refer my specimens to a new species.

Tænia compressa sp. nov.

(Pl. VIII, Figs. 83-92.)

A large lot of *Tæniæ* from *Fuligula vallisneria* consists of a variety of forms which, however, upon examination do not afford differences that can be regarded safely as specific. I have therefore referred them to a single species.

This species resembles *T. sinuosa* in the number, size, and shape of the hooks, but differs from it in the absence of the globular spinose sack near the genital orifice, described and figured by Dujardin and others.

Tænia compressa, as represented by the individuals in this lot, may be briefly characterized thus: Head variable, usually broader than long, often pyramidal, compressed laterally, bothria prominent; proboscis ob-conical with a simple crown of rather straight hocks, ten in number and usually about 0.055 millimeter in length; reproductive apertures along one margin, cirrus 0.008 to 0.01 millimeter in diameter, spinose with a smooth conical tip; neck short; first segments usually crowded, much broader than long; median segments in longer strobiles also crowded, very short, ripe segments funnel-form with salient posterior margins.

The specimens in this lot varied from 5 to 27 millimeters in length.

In the preliminary examination of these specimens they were separated into three groups.

The first group contained small club-shaped strobiles from 5 to 10 millimeters in length.

The second group contained longer specimens, 20 to 30 millimeters in length.

The third group was much like the second, but with thicker and broader strobiles.

Two or three fragments were found that appeared to belong to a different species. In them the segments were exceedingly short and crowded and the breadth was about 2 millimeters, considerably greater than that of any of the complete strobiles.

In the first group the neck, *i. e.*, unjointed part of the body, is short, the segments soon become distinct, at first sometimes funnel-form, then much crowded together, becoming funnel-form again towards the posterior end. The segments increase in breadth to near the posterior end, so that the whole strobile becomes somewhat club-shaped. The reproductive apertures are all on one margin of the strobile, each a little in front of the middle of its segment. The elongated bulb of the cirrus (Figs. 89, 91) lies on an elliptical body, which is yellowish and opaque. The bulb is at first nearly transverse to the longitudinal axis, becoming inclined posteriorly at the marginal end in the posterior segments. The cirrus is about 0.01 millimeter in diameter, thickly beset

with minute bristle-like spines, and when fully everted with a short conical tip devoid of spines.

In one specimen measuring 8 millimeters in length the posterior segments contained ova, with embryos, measuring about 0.025 millimeter in diameter.

The proboscis when fully extended is at least as long as the head, expands at the apex, where it bears a circle of ten hooks. These are bent somewhat abruptly near the end, but on the whole are rather straight.

One specimen was observed which agreed with the others in the number and shape of the hooks, but the hooks measured only 0.04 millimeter instead of from 0.05 to 0.055 in the others. The proboscis in this specimen was elongated, cylindrical and 0.4 millimeter in length, or over two and a half times the length of the head. An average specimen 7 millimeters in length had the following dimensions, in millimeters: Diameter of head, 0.18; length of bothrium, 0.15; length of proboscis, 0.16; diameter of proboscis at apex, not including hooks, 0.08; diameter of crown of hooks, 0.12; diameter of proboscis at base, 0.04; diameter of neck, 0.08; length of first distinct segments, 0.025; breadth of first segments, 0.14; length of last segments, 0.37; breadth of last segments, 0.7. In another specimen the diameter of the head was 0.24 millimeter and the diameter of the proboscis at base 0.025 millimeter, while the other dimensions were nearly as in the detailed measurements given.

The specimens of the second group do not present any constant differences, other than size, of sufficient importance to justify their reference to a distinct species or even variety. The head appears to be broader, in some cases at least, in proportion to the length, and the middle segments are much more closely crowded together; the cirrus is also possibly a little more slender. Embryos were observed, 0.04 by 0.03 millimeter in the two principal diameters, with spines measuring 0.01 millimeter in length.

Detailed measurements of a specimen 27 millimeters in length yielded the same results for hooks, proboscis, and segments as were obtained from small specimens of the first group.

Those referred to the third group were characterized by having thick strobiles in which the segments were relatively short and crowded together. In one specimen 15 millimeters in length the last segments were much crowded, measuring 1.1 millimeters in breadth, and 0.13 millimeter in length, otherwise as in the first two groups. The cirrus pouches in some of these larger specimens are inclined at an angle of nearly 45 degrees with the margin; the elliptical body beside the cirrus pouch is not distinct as it is in the smaller specimens.

Several specimens of this species were found in the intestines of *Edeia americana*. In these the head was compressed laterally, appearing rectangular in outline when viewed from the front. In cases

where the proboscis was completely retracted the bothria were directed forward. The average breadth of the head of three specimens was 0.26 millimeter; length of hooks, 0.055 millimeter; length of the proboscis, 0.14; diameter at base, 0.04; diameter at apex, 0.08; and diameter of crown of hooks, 0.13 millimeter. The specimens were for the most part small, measuring from 8 to 13 millimeters in length. One fragment (Figs. 91, 92) was 20 millimeters in length, its posterior segments 0.4 millimeter long and 1.4 millimeters broad.

In these specimens calcareous bodies were exceedingly numerous. Reproductive organs as in those from *Fuligula vallisneria*.

HABITAT: *Fuligula vallisneria* and *Ædemia americana*, intestine, Yellowstone Lake, Wyoming, August, 1890.

WASHINGTON and JEFFERSON COLLEGE,
Washington, Pa., August 1, 1891.

EXPLANATION OF FIGURES.

[Figs. 64 and 65 from life; all others from alcoholic specimens and drawings by the author.]

PLATE IV.

Filaria serrata, sp. nov., from *Circus cyaneus* var. *hudsonius*.

- Fig. 1. Optical section of head, lateral view, $\times 350$.
 Fig. 2. Superficial view of same.
 Fig. 3. Diagram of posterior end, ventral view, showing arrangement of anal papillæ of male. The small post-anal pair on the right side were not clearly shown in the specimen.
 Fig. 4. Copulatory spines, lateral view, $\times 225$.

Ascaris spiculigera Rudolphi, from *Pelecanus erythrorhynchus* and *P. fuscus*.

- Fig. 5. Adult female from stomach of host, $\times 10$. v, reproductive aperture.
 Fig. 6. Head of male, $\times 36$.
 Fig. 7. Another view of same, $\times 36$.
 Fig. 8. Posterior end of female, $\times 36$.
 Fig. 9. Ova in which segmentation has begun, $\times 225$. a, morula; b, gastrula stage.
 Fig. 10. Diagram of posterior end, ventral view, showing arrangement of anal papillæ in male.
 Fig. 11. Lateral view showing copulatory spines, $\times 36$.
 Fig. 12. Anterior portion of alimentary canal, $\times 14$. m, mouth; o, œsophagus; i, intestine.

Echinorhynchus rectus, sp. nov., from *Larus* sp.

- Fig. 13. Male, slightly compressed, $\times 6$. This and the three following sketched from specimen in oil of cloves.
 Fig. 14. Female, slightly compressed, $\times 6$.
 Fig. 15. Hooks near base of proboscis, $\times 225$.
 Fig. 16. Hooks near apex of proboscis, $\times 225$.
 Fig. 17. Bursa of male, showing nucleated cells in walls, $\times 27$.

PLATE V.

Echinorhynchus striatus Goetze, from *Cedemia americana*.

- Fig. 18. Optical outline of male, $\times 45$.
 Fig. 19. Outline of another from same lot, $\times 24$.
 Fig. 20. Caudal spines, $\times 225$.
 Fig. 21. Hooks of proboscis, $\times 225$. *a*, apical and *b*, basal of one specimen; *c*, apical and *d*, basal of another.
 Fig. 22. Female with embryos, $\times 15$.
 Fig. 23. Apex of proboscis of same, $\times 225$.
 Fig. 24. Dermal spines of same, $\times 225$.
 Fig. 25. Marginal view of dermal spines, $\times 225$.

Holostomum variabile Nitzsch, from *Circus cyaneus* var. *hudsonius*.

- Fig. 26. Lateral view, $\times 21$. *a*, anterior aperture, *b*, posterior aperture. The specimen is concave on the dorsal side.
 Fig. 27. View of anterior end, $\times 27$. The dorsal side is uppermost in the sketch.
 Fig. 28. Longitudinal vertical section, $\times 42$. *a*, anterior aperture; *b*, posterior aperture, into a muscular, suctorial organ; *c*, ejaculatory duct; there does not appear to be a true cirrus; *p*, papilla at the summit of which the ejaculatory duct and the uterus lie as a common duct. The papilla and muscular sucker probably constitute a copulatory organ. *cp*, seminal vesicle, corresponding to a bursa penis; *vsa* and *vsp*, anterior and posterior seminal receptacle; *t*, testes; *v*, aperture of vagina; *o*, germ gland or ovary; *gd*, germ duct; *cd*, common duct, which passes around the anterior testis, and between the two testes receives the vitelline duct *yd'*; *sg*, shell gland; *u*, origin of uterus; *u'*, uterus near posterior end; *yd*, one of the two longitudinal vitelline ducts; *vg*, vitelline or yolk gland; *ov*, ova in anterior uterine spaces; *o'*, ova in posterior portion of uterus; *s*, ventral sucker, see Fig. 29; *x*, glandular organ, the *kügliger Körper* of Von Linstow.

Sketch from a single section, but the ducts represented by *v*, *cd*, and *yd'* somewhat diagrammatic. Transverse sections of the convoluted common germ duct are shown between the testes.

- Fig. 29. Longitudinal vertical section of the anterior division of the body, several sections removed from that shown in Fig. 28, $\times 52$. *m*, mouth surrounded by a muscular suctorial organ and communicating by a short passage with the muscular pharynx *ph*; *i*, intestine which is bifurcate in front of the ventral sucker *s*, a lateral branch passing on either side of that organ; *dm*, dorsal longitudinal muscles; *lm*, lateral longitudinal muscles; *vm*, ventral longitudinal muscles; *vg*, vitelline glands; *y*, section of invaginated fold, apparently an organ of absorption; *a*, anterior aperture.

PLATE VI.

Holostomum variabile Nitzsch.

- Fig. 30. Cells of germ gland or ovary, $\times 360$.
 Fig. 31. Section of segmenting ovum, $\times 375$.
 Fig. 32. Transverse section of vitelline duct near its union with the common germ duct, showing the peculiar arrangement of yolk globules, $\times 360$.

Distomum (?) *verrucosum*, sp. nov., from *Larus californicus*.

- Fig. 33. Specimen coiled in a spiral, $\times 15$.
 Fig. 34. Anterior end of same specimen, $\times 24$.
 Fig. 35. Fragment, $\times 15$. The tubercles are somewhat more enlarged.

Distomum flexum, sp. nov., from *Edemia americana*.

- Fig. 36. Lateral view, $\times 15$.
 Fig. 37. Ventral view of head of same, $\times 38$.
 Fig. 38. Dorsal view of body, ventral of head, compressed, $\times 30$.
 Fig. 38a. Oral hooks, $\times 225$.
 Fig. 39. Segmenting ovum, $\times 225$.
 Fig. 40. Another showing more advanced stage of segmentation, $\times 225$.
 Fig. 41. Oral hooks, dorsal view, $\times 180$.
 Fig. 42. Cirrus and bursa, $\times 60$.
 Fig. 43. Pharynx, $\times 180$.
 Fig. 44. Cervical spines, $\times 225$.

Dibothrium cordiceps Leidy., from *Larus californicus*.

- Fig. 45. Lateral view of head of immature specimen, $\times 27$.

Dibothrium exile, sp. nov., from *Larus californicus*.

- Fig. 46. Marginal view of head, $\times 30$.
 Fig. 47. Anterior segments, lateral view, $\times 14$.
 Fig. 48. Posterior segments, lateral view, $\times 14$.

Epision plicatus gen. et sp. nov., from *Edemia americana*.

- Fig. 49. Lateral view of head and anterior part of body of smallest specimen, $\times 12$.
 Fig. 50. Lateral view of head of largest specimen, $\times 15$.
 Fig. 51. Portion of head near apex, $\times 54$.
 Fig. 52. Lateral view of margin of head, $\times 225$.
 Fig. 53. Posterior end of largest specimen, lateral view, $\times 12$.

PLATE VII.

Fragments of *Tœnia* from *Colymbus* sp. and *Larus* sp., *T. capitella* Rud. (?) *Colymbus* sp.

- Fig. 54. Posterior segments, lateral view, $\times 12$.
 Fig. 55. Marginal view of same, $\times 12$.

T. fusus Krabbe (?) from *Larus* sp.

- Fig. 56. Posterior segments, lateral view, $\times 12$

T. larina Krabbe ? from *Larus* sp.

- Fig. 57. Fragments, $\times 12$: *a*, anterior; *b*, postmedian, and *c*, posterior segments.
 Fig. 58. Ovum of same, $\times 345$.

Tœnia porosa Rudolphi, from *Larus californicus*.

- Fig. 59. Head with proboscis extended, lateral view, $\times 56$.
 Fig. 60. Anterior segments of same, $\times 12$.
 Fig. 61. Antero-median segments, $\times 12$. The genital apertures are not quite uniformly alternate.
 Fig. 62. Posterior segments, $\times 12$.
 Fig. 63. Hooks, $\times 360$.
 Fig. 64. Ovum with embryo, from life, $\times 180$: *a*, external pellicle; *b*, finely granular food-stuff with a few globular masses of varying size; *d*, finely granular and homogeneous material assuming a flowing appearance at *e*; *f*, granulo-nuclear patch; *g*, vacuolar granular area; *h*, granular area with large vacuolar spaces; *c*, embryo with four of the six hooks showing.
 Fig. 65. External pellicle of ovum, highly magnified, from life.
 Fig. 66. Hooks of a single embryo, in position, $\times 345$.

Var. α .

- Fig. 67. Head with rostellum retracted, $\times 60$.
Fig. 68. Rostellum of same, $\times 225$.
Fig. 69. Hooks of same, $\times 360$.
Fig. 70. Anterior segments, $\times 22$.
Fig. 71. Posterior segments, $\times 12$.

PLATE VIII.

Tænia filum Goetze, from *Larus californicus*.

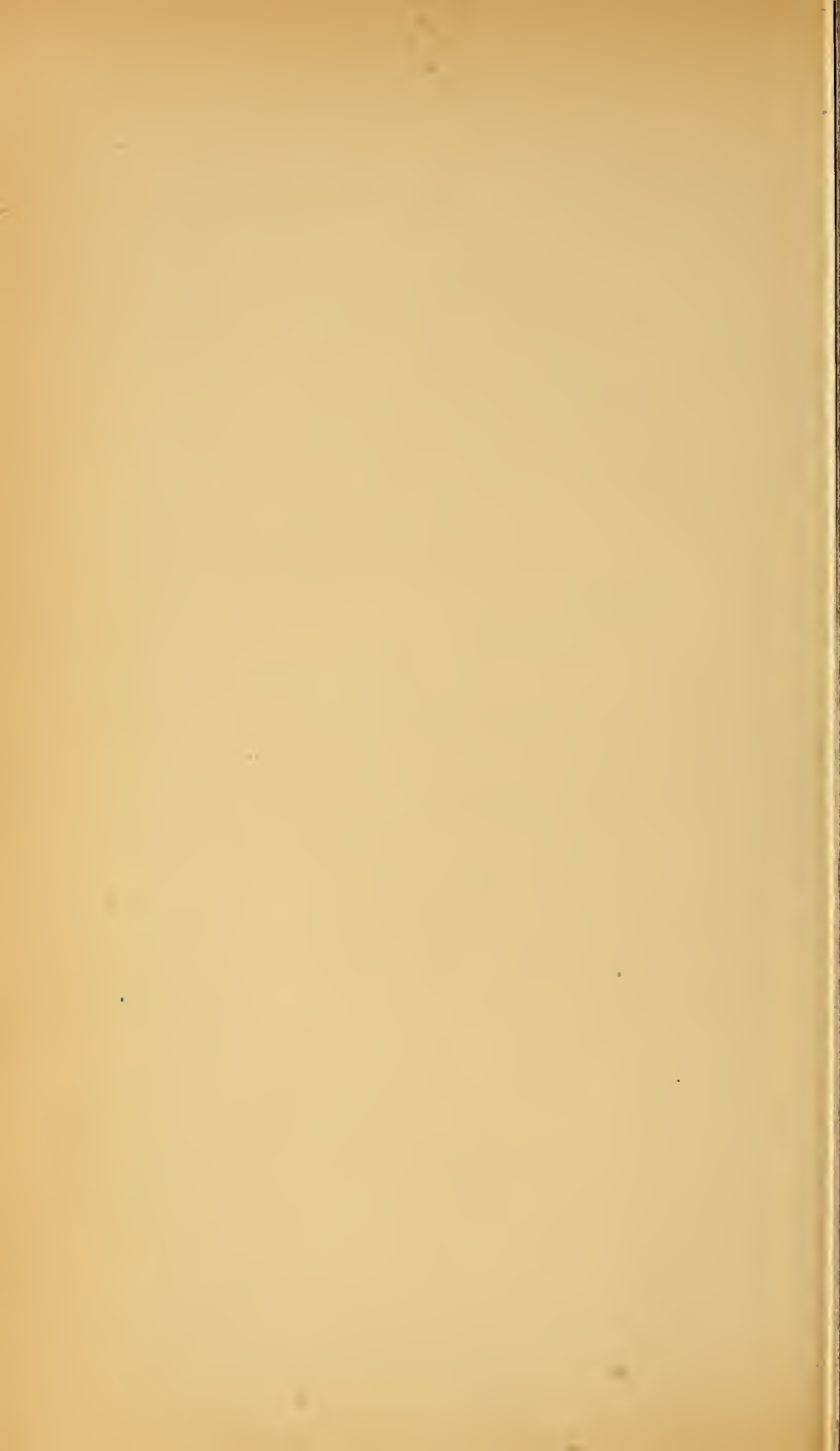
- Fig. 72. Head with rostellum retracted, $\times 225$.
Fig. 73. Head and neck, proboscis exerted, $\times 52$.
Fig. 74. Proboscis and hooks of same, $\times 360$.
Fig. 75. Hooks of No. 72, $\times 345$.
Fig. 76. Posterior segments of No. 73, $\times 52$.
Fig. 77. Cirrus of same, $\times 345$.
Fig. 78. Postero-median segments of No. 72, $\times 56$.

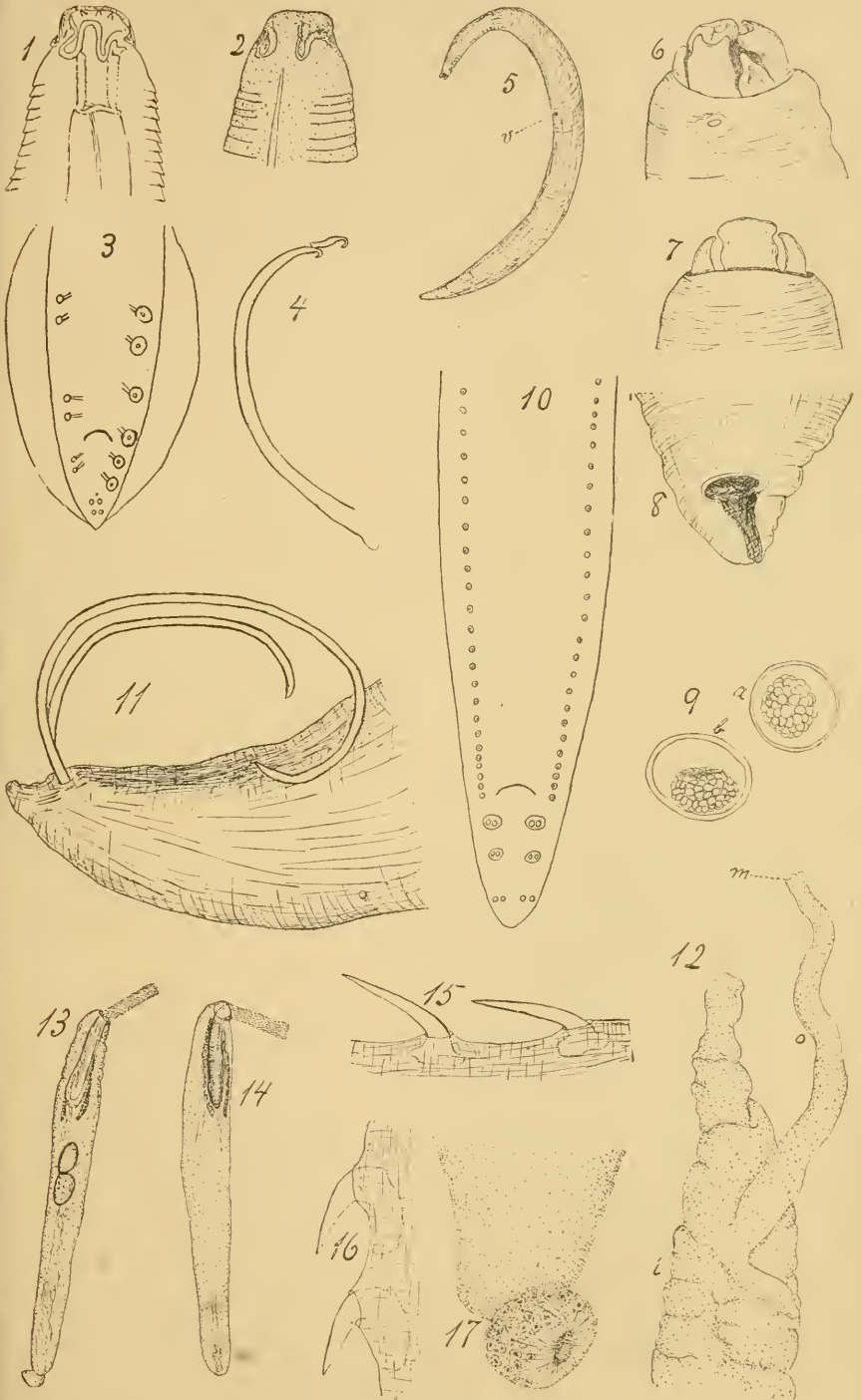
Tænia macrocantha, sp. nov., from *Cedemia americanus*.

- Fig. 79. Head with proboscis exerted, $\times 30$.
Fig. 80. Hooks of same, $\times 360$.
Fig. 81. Posterior segments of same, $\times 16$.
Fig. 82. Last two segments of same, $\times 45$.

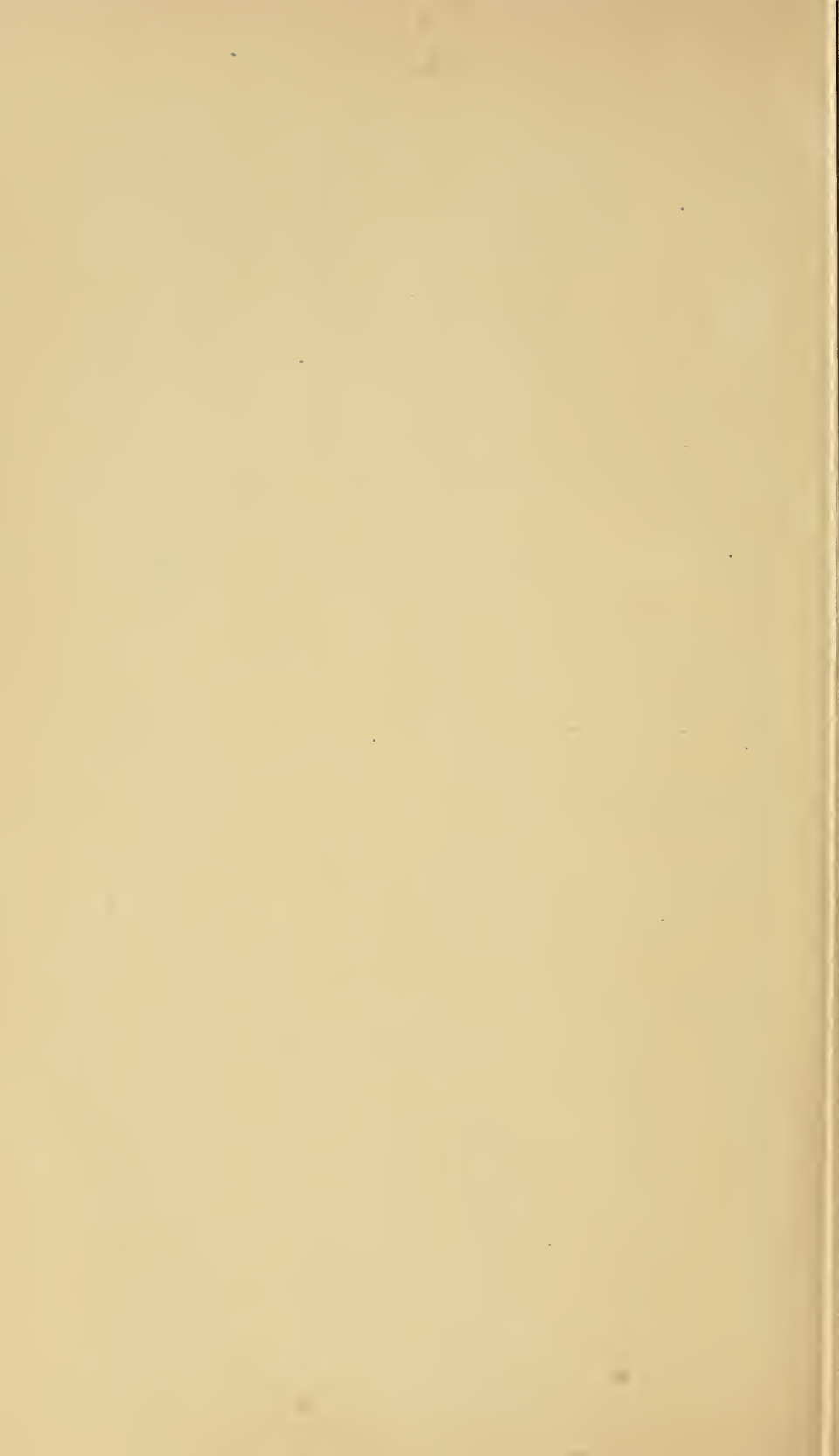
Tænia compressa, sp. nov., from *Fuligula vallisneria* and *Cedemia americana*.

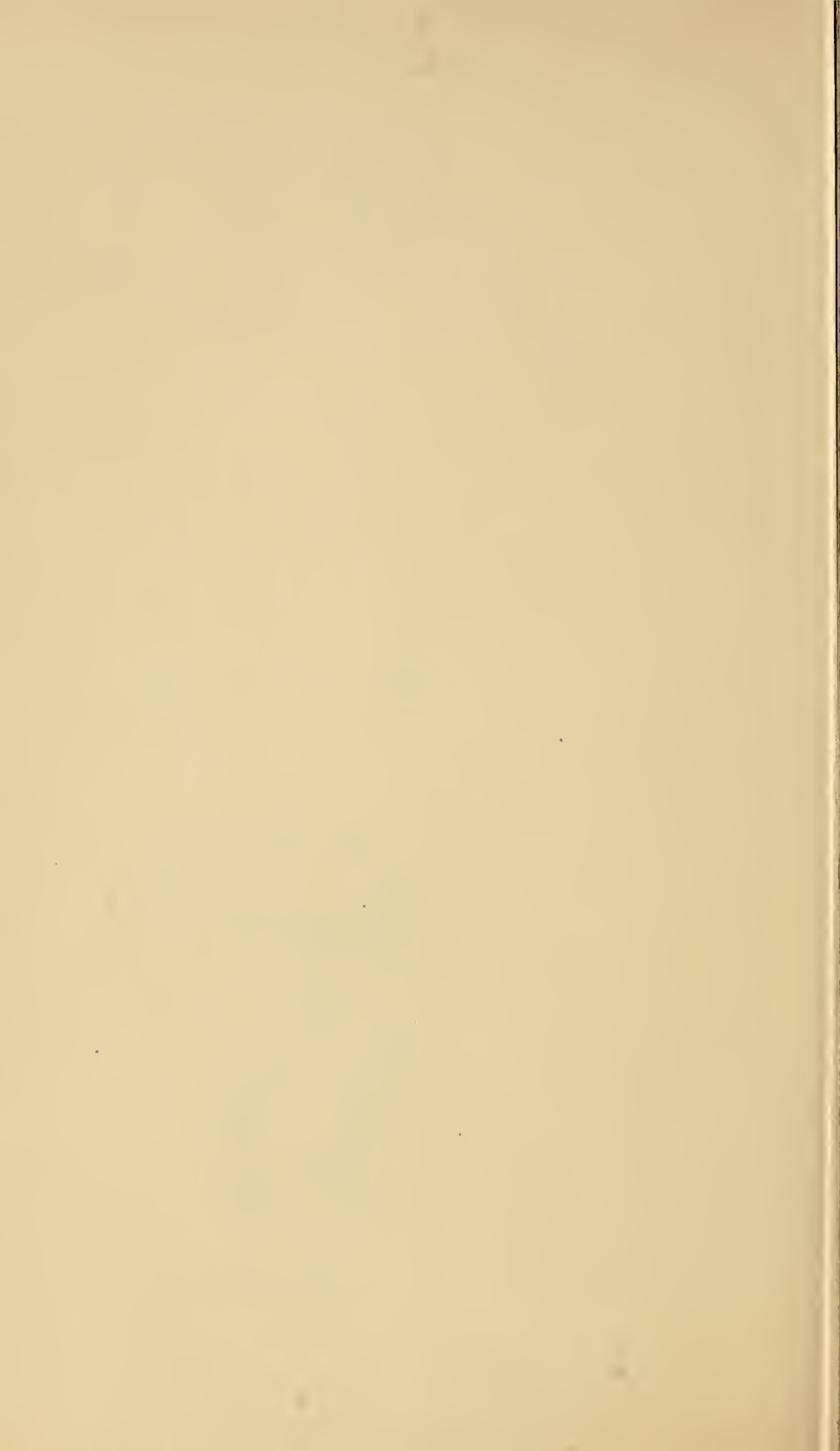
- Fig. 83. Head and neck of specimen from *Fuligula*, $\times 54$.
Fig. 84. Proboscis and rostellum of another from same host, $\times 225$.
Fig. 85. Hooks of same, $\times 345$.
Fig. 86. Hooks from another specimen, same host, $\times 345$.
Fig. 87. Postero-median segments, same host, $\times 27$.
Fig. 88. Posterior segments, same, $\times 27$.
Fig. 89. Posterior segments of another, different individual host, $\times 30$.
Fig. 90. Cirrus of No. 88, $\times 360$.
Fig. 91. Postero-median segments, from *Cedemia*, $\times 15$.
Fig. 92. Hooks of same, $\times 360$.





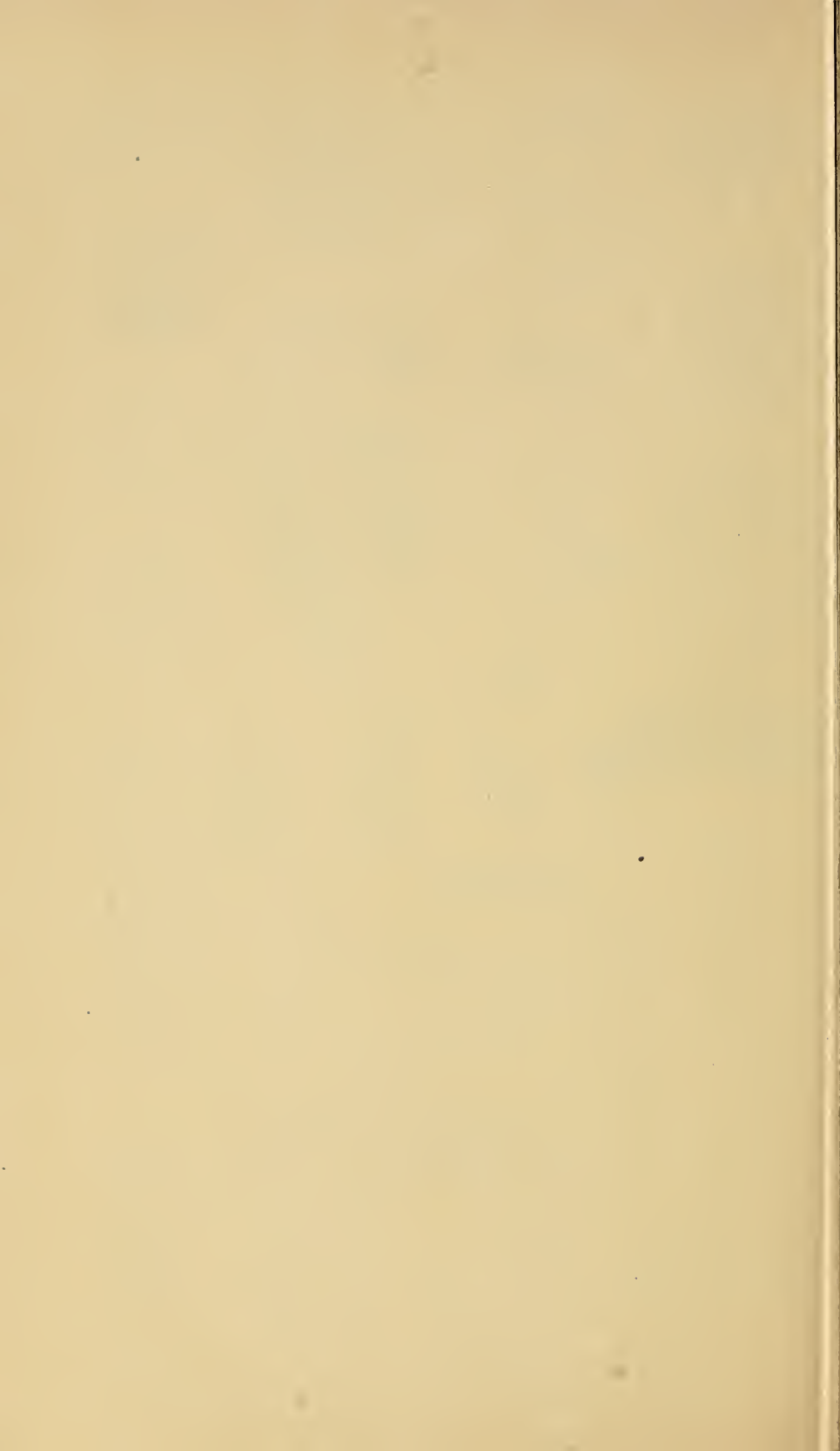
AVIAN ENTOZOA.

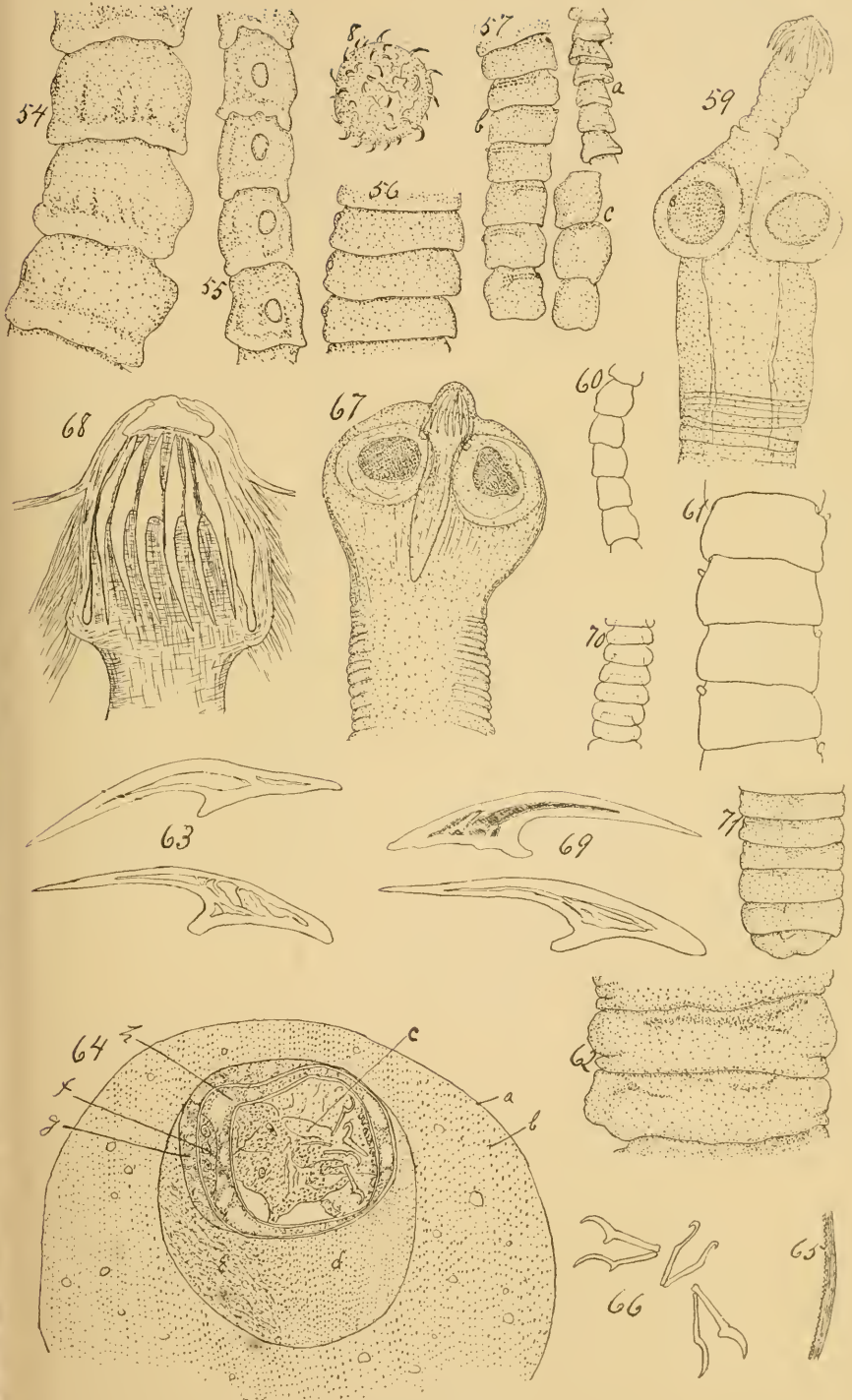




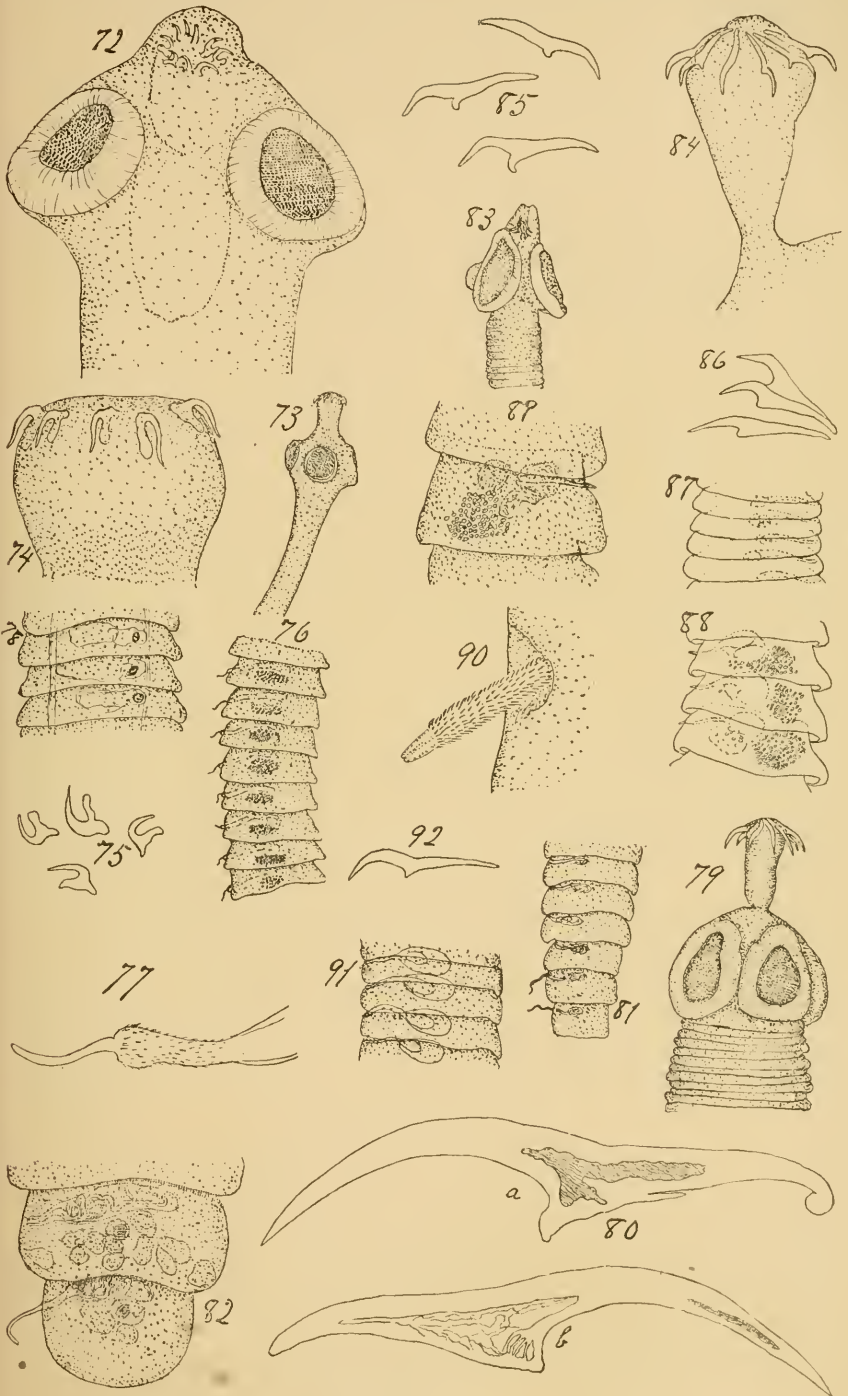


AVIAN ENTOZOA.









AVIAN ENTOZOA.

