NOTES ON A VIVIPAROUS DISTOME.

By Edwin Linton,
Of Washington and Jefferson College, Washington, Pennsylvania.

During the summer of 1912, while engaged in work for the United States Bureau of Fisheries, in attempting to get some phases of the life history of certain trematode parasites of fishes, I examined a number of birds. Of the many interesting forms which were thus secured, one is, in a measure, unique in that not only are ciliated larvæ (miracidia) found in the uterus, but each miracidium was found to contain a well developed redia.

PARORCHIS AVITUS, new species.

Plate 43.

Miracidia in the ova of distomes have been recorded and larvæ containing rediæ have been noted in certain of the Monostomidæ, but so far as I am acquainted with the literature of the subject, this is the first record of such occurrence in a distome.

The distomes here described were obtained from the cloaca of a herring gull (*Larus argentatus*) at Woods Hole, Massachusetts, July 22, 1912. Ten specimens were found in one gull. Search was made for this interesting form by me during the remainder of the season of 1912 and again in the summer of 1913, also by Mr. Vinal N. Edwards in the interval between the two summers, but no more of these worms were found. In life they were leaf-like with outlines varying with the state of contraction, very different shapes being assumed by the same worm at short intervals (figs. 1 and 2). The color in general was white with a faint reddish-brown area toward the posterior end. This reddish-brown area is the region occupied by the posterior folds of the uterus in which the eggs are sufficiently colored to impart a color to the body at that point. The space in front of the brown ova, as far forward as the ventral sucker, is filled with large, thin-walled ova, each with a distinct spot of black pigment showing through the transparent shell of the ovum and the body wall. This is a conspicuous feature of the living worms when they

are flattened under a cover glass. The head is surrounded with a collar on which is a row of spines which vary but little in size from those which thickly beset the neck as far back as the ventral sucker.

Dimensions of a living specimen, in millimeters: Length, 6.2; breadth, 4; diameter of head 1.20, of oral sucker 0.42, of pharynx 0.22, of ventral sucker 1.18; small ova, i. e., those in posterior folds of uterus and not containing ciliated larvæ, 0.08 by 0.04; large ova, i. e., those in anterior folds of uterus, each containing a ciliated larva with a black pigment spot, 0.12 by 0.07.

Measurements of ova in another specimen yielded nearly similar dimensions, thus: Ovum not containing larva 0.085 by 0.041; ovum containing larva 0.136 by 0.071.

The following description is based, for the most part, on specimens stained with carmine and mounted in balsam.

General outline oval or pyriform, but more or less distinctly divided into head, neck, and body. Head differentiated from the neck by a muscular collar which projects distinctly laterally and apparently ends abruptly on the ventral side at the margins of the oral sucker, but really passes by a very indistinct fold across the ventral surface of the oral sucker (fig. 3).

A single row of small spines was seen on the collar of living specimens; spines of similar shape and slightly smaller are numerous on the neck but occur sparingly on the body back of the ventral sucker. The spines are short, round-pointed, and scalelike (fig. 6). They are not at all conspicuous in the mounted specimens. The neck extends to about the level of the ventral sucker. The body proper, that is the portion lying posterior to the middle of the ventral sucker, is round-oval and leaf-like. It is flattened or concave on the ventral surface and convex on the dorsal surface. The neck has a tendency to curve ventrally. Suckers nearly circular or a little broader than long with nearly circular apertures, oral sucker subterminal. Ventral sucker rather more than twice the diameter of the oral and situated at about the anterior third, the distance between the two suckers being approximately one-fifth of the entire length. Pharynx adjacent to the oral sucker oval, its length about half the diameter of the oral sucker. Pre-pharynx very short. Esophagus approximately twice the length of the pharynx, its walls more or less crumpled and irregular in outline (fig. 4). Intestinal rami beginning a short distance in front of the ventral sucker, slender and without diverticula, extending to near the posterior end of the body, where they lie close to the lateral borders of the testes. The reproductive aperture lies immediately in front of the ventral sucker, the space between the anterior border of the ventral sucker and the rami of the intestines being nearly filled by the prostate which surrounds the genital aperture. Testes two, deeply lobed, near the posterior end of the body, close together and

opposite, each lying between the median line and a ramus of the intestine. Cirrus short and spinous, surrounded by compact prostate. There is a small seminal vesicle on the postero-dorsal border of the ventral sucker from which a duct leads along the dorsal side of the sucker to the genital aperture. Ovary median, situated in front of testes and separated from them about as far as the diameter of a single testis, or a little less, oval, the transverse diameter greater than the axial diameter in my specimens. The vitellaria consist of two rather narrow rows of subglobular masses which extend from near the postero-lateral border of the ventral sucker nearly to the testes. Along the margins of the neck and body of living specimens which had been flattened under the cover glass numerous long-pyriform cells were seen (fig. 8). These are probably yolk-forming cells. The uterus is very voluminous, its folds occupying practically all the space between the testes and the ventral sucker and reaching nearly to the lateral margins of the body. It passes along the dorsal side of the ventral sucker to the right of the prostate and enters the ejaculatory duct from the antero-lateral side. In some cases ciliated larvæ (miracidia) and eggs were clustered on the right side of the genital aperture in the uterus (metraterm) (fig. 4*m*). The ova in the anterior half of the uterus have transparent walls and contain ciliated larvæ. These are readily recognized both in living and mounted specimens by the conspicuous spot of black pigment which is easily seen through the body wall. The posterior folds of the uterus are filled with reddish-brown ova in which larvæ have not yet developed. These ova are smaller than those in the anterior folds and the shells are thicker. Along with ova containing larvæ in the anterior folds of the uterus are miracidia which have escaped from their shells. In the living specimens they can be seen through the body wall moving about slowly in the uterus by means of their cilia. When they are removed from the uterus they retain their activity for but a short time in sea water, the cilia soon taking on a bristle-like appearance. The cilia cover the entire surface, being a little longer at the posterior end than elsewhere and most dense at the anterior end. The ciliated cells are relatively large and have rather large nuclei. Miracidia lying free in sea water measured from 0.12 to 0.16 millimeter in length and 0.08 millimeter in breadth. These measurements do not include the cilia, which are about 0.02 millimeter in length.

My attention was called to an interesting feature of these miracidia by my friend Doctor Coe, who chanced to be at the laboratory at the time that I was examining these distomes. Each of the ciliated larvæ was found to contain a single redia. These can also be made out not only in sections but in whole mounts stained with carmine. In all the living specimens observed the anterior end of the redia was

directed towards the anterior end of the miracidium. A redia in life measured 0.14 millimeter in length and 0.04 in breadth.

The excretory system of this distome was but imperfectly made out. What appear to be two rather ample vessels uniting near the posterior end at a terminal pore may be distinguished in the mounted specimens. In sections these appear only as irregular spaces whose connections are not clear. In a living specimen flattened under a cover glass freely moving fluid containing refractile globules was observed in branching vessels along the margins.

The musculature of the head and neck is peculiar in that there are strong muscle fibers connected with the spines. Thus in a tangential section of the neck the most conspicuous muscle fibers are those which run in a dorso-ventral direction. These fibers in the neck are straight while the corresponding fibers in the collar become more or less curved.

There can be no doubt but that these distomes belong to the same genus as the distomes from the herring gull described by Nicoll and placed by him in the genus *Parorchis*. It would be a satisfaction to me if I could refer them to Nicoll's species *P. acanthus*, but this seems to be inadvisable on account of certain constant differences. Furthermore the ova break open by a transverse fissure near the larger end instead of by a longitudinal fissure.

The differences between the adult specimens of the two species, being only in minor details, might possibly be ignored. On the other hand the miracidia of *P. avitus* appear to represent a different type from that figured by Nicoll.

In the internal anatomy my specimens resemble Braun's *Distomum pittacium* from *Tringa interpres* as closely as they do Nicoll's species, but there is the same objection to referring them to that species that Nicoll finds with respect to his *Z. acanthus*, namely, the absence of spines and of the characteristic collar in *D. pittacium*. The absence of spines, it is true, is of little importance since spines are easily lost, but the absence of the collar is significant inasmuch as that structure in both Nicoll's specimens and mine is conspicuous and contains characteristic muscle fibers, so that it is difficult to see how it could become so inconspicuous as to escape observation.

Dimensions of mounted specimens, in millimeters.

Length	4.69	3.96	3.98	5.88
Breadth at oral sucker	.88	.70	.72	.81
Breadth at ventral sucker	1.33	1.21	1.23	1.68
Greatest breadth	2.10	2.10	2.10	2.66
Length of oral sucker	.36	.35	.30	.44
Breadth of oral sucker	.42	.36	.39	.49
Length of pharynx	.18	.18	.22	.24
Breadth of pharynx	.22	.15	.14	.24
Length of esophagus	.42	.36	.42	.52
Length of ventral sucker	.84	.78	.71	1.35
Breadth of ventral sucker	.87	.78	.81	1.26
Distance from anterior end to ventral sucker	1.23	1.02	1.13	1.54

The length of ova in the posterior folds of the uterus varied from 0.066 to 0.079; the breadth of each one measured was 0.040. The length of ova in the anterior folds of the uterus varied from 0.082 to to 0.10 and the breadth from 0.046 to 0.060. Length of a miracidium 0.08, breadth 0.05. Length of a redia 0.06, breadth 0.03.

Type-specimen.—Cat. No. 7377, Helminthological Collections, U.S.N.M.

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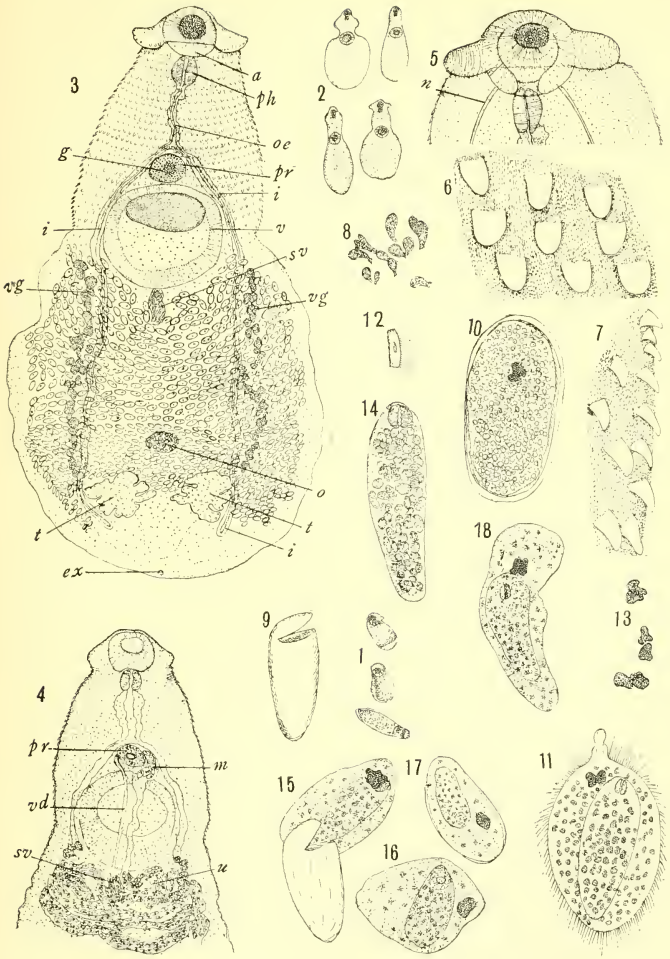
EXPLANATION OF PLATE 43.

a. oral sucker.
ex. excretory pore.
g. genital pore.
i. intestine.
m. metraterm.
n. nerve.
o. ovary.
oe. esophagus.
ph. pharynx.
pr. prostate.
sv. seminal vesicle.
t. testis.
u. uterus.
v. ventral sucker.
vd. vas deferens.
vg. vitellaria.

FIG. 1. Three specimens lying in sea water, ventral view.
2. Outlines of four mounted specimens.
3. Ventral view of specimen mounted in balsam. Length 3.75 mm.
4. Dorsal view of anterior portion of another specimen. Diameter of head 0.7 mm.
5. Ventral view of anterior end of specimen, optical section; *n*. nerve. Breadth of head 0.7 mm.
6. Spines of neck, surface view, life; length 0.022 mm.
7. Same, marginal view.
8. Yolk-forming cells, along margins of neck and body, life.
9. Egg shell with transverse fissure at larger end from which the miracidium has escaped.
10. Egg containing a ciliated larva, life.
11. Ciliated larva with single redia, liberated from egg.
12. Ciliated cell from crushed miracidium, life.
13. Pigment spots of miracidia, sketched from living specimens.
14. Redia removed from miracidium, life; length 0.14, breadth 0.04; length of pharynx 0.017, breadth 0.020 mm.
15. Miracidium with contained redia just escaped from egg; sketched from mounted specimen.
16, 17, 18. Miracidia with rediæ from specimens mounted in balsam.



PARORCHIS AVITUS, NEW SPECIES.

FOR EXPLANATION OF PLATE SEE PAGE 555.