

## TWO NEW INTESTINAL TREMATODES FROM THE DOG IN CHINA.

By MARCOS A. TUBANGUI,  
*Of Los Baños, Philippine Islands.*

Among some trematodes in the Helminthological Collections of the United States National Museum collected in China by Dr. R. T. Shields are two forms, one of which represents a species of *Prohemistomum* hitherto undescribed, and the other a variety of *Echinochasmus perfoliatus* differing somewhat from the European specimens of this species as described by various writers. Through the courtesy of the Bureau of Animal Industry, United States Department of Agriculture, I have had the opportunity of making a study of these specimens, and I am indebted to Dr. B. H. Ransom for his friendly interest as well as for the privilege of utilizing the facilities of the laboratory of the Zoological Division in my studies.

ECHINOCHASMUS PERFOLIATUS SHIELDSI, new variety.

Plate 1.

The genus *Echinochasmus* was proposed by Dietz (1909) in order to separate from the old genus *Echinostoma* Rudolphi, 1809, a group of trematodes characterized principally by the presence of a single, dorsally-interrupted row of spines arranged around a kidney-shaped collar, a small cirrus sac which lies anterior to the center of the acetabulum, and vitellaria which extend from the level of the acetabulum to the posterior extremity of the body. In 1911, Odhner raised it to the rank of a subfamily (Echinochasminae), and of its representatives only one, *Echinochasmus perfoliatus*, has thus far been known to infest the dog. It was first recorded by von Ratz (1908), but only a short time afterwards it was again reported by Railliet and Henry (1909) under the name *Echinostoma gregale*. Since then several authors have found it in Europe in the dog, cat, and hog, and, according to Railliet and Henry (1909), the *Distoma echinatum* reported by Generali (1881) might have been the same species.<sup>1</sup>

<sup>1</sup> Dr. W. W. Cort, in a note on January 29, 1921, before the Helminthological Society of Washington, reported an experiment in which Tanabe, as a result of swallowing trematode cysts found in a fish, afterwards recovered from his feces mature flukes that he designated by the name *Echinostomum perfoliatum japonicum*. At the same meeting I called attention to the presence of *Echinochasmus perfoliatus* in China, based upon the specimens described in the present paper. I have also been advised by Dr. R. T. Leiper that he has found *Echinochasmus perfoliatus* to be very common in dogs in Shanghai.

Table of comparison between *Echinochasmus perfoliatus* von Ratz and *Echinochasmus perfoliatus shieldsi*.

Designation...	<i>Echinostomum perfoliatum</i> = <i>Echinochasmus perfoliatus</i> .	<i>Echinostoma gregale</i> = <i>Echinochasmus perfoliatus</i> . Railliet and	<i>Echinochasmus perfoliatus</i> .	<i>Echinochasmus perfoliatus shieldsi</i> .
Investigator...	von Ratz, 1908, from Braun, 1911.	Henry, 1919....	Ciurea, 1915....	Tubangui, 1921.
Length.....	3-4 mm.....	2-3 mm.....	2.11-3.26 mm..	1.6-2.05 mm.
Maximum width.	0.6-1.0 mm....	0.4-0.7 mm....	0.39-0.75 mm..	0.39-0.52 mm.
Diameter of collar.	(?)	0.17-0.30 mm..	0.22-0.297 mm .	0.29-0.34 mm.
Number of collar spines.	12 each side (24).	12 on each side (24).	12 on each side (24).	12 on each side (24).
Arrangement of collar spines.	(?)	1st and 2d behind row.	1st and 2d behind row.	2d in front or 1st and 2d behind row.
Width of ventral space between collar spines.	(?)	0.11-0.125 mm..	(?)	0.11-0.12 mm.
Width of dorsal space between collar spines.	(?)	0.057-0.66 mm.	0.063-0.077 mm.	0.08-0.10 mm.
Diameter of oral sucker.	Smaller than acetabulum.	0.085-0.10 mm..	0.096-0.136 mm.	0.11-0.13 mm.
Length of prepharynx.	(?)	0.055-0.075 mm.	(?)	0.09-0.13 mm.
Diameter of pharynx.	(?)	0.09-0.095 mm..	0.066-0.098 mm.	0.06-0.07 mm.
Length of esophagus.	Long.....	0.225-0.40 mm..	(?)	0.17-0.31 mm.
Diameter of acetabulum.	Larger than oral sucker.	0.175-0.215 mm.	0.167-0.215 mm.	0.21-0.25 mm.
Position of acetabulum.	Between 1st and 2d third.	Anterior third..	Anterior third (?) (picture).	Behind anterior third.
Margin and shape of testes.	Big round (smooth?).	Globular, flattened at point of contact.	Ovoidal, smooth or crenated.	Crenated, oval, flattened at point of contact.
Position of testes.	Behind middle of body.	Point of contact behind middle of body.	Nearly in middle of body.	Behind middle of body.
Eggs, length...	0.103-0.135 mm.	0.100-0.110 mm.	0.092-0.110.....	0.097-0.105 mm.
Eggs, width...	0.066-0.094 mm.	0.065-0.074 mm.	0.057-0.070 mm.	0.065-0.074 mm.
Habitat.....	Intestine, dog, cat.	Intestine, dog..	Intestine, hog..	Small intestine, dog.
Distribution..	Hungary.....	Bucharest.....	Rumania.....	China.

The present form, while it closely resembles *Echinochasmus perfoliatus* von Ratz, presents several differential details which, if one could be sure of their constancy, would permit its recognition as a distinct species. But as it is impossible to decide this without examining other lots of specimens from the same locality and, if possible, making an actual comparison with the European form, it has been thought proper to consider this parasite only as a variety of the European species. The accompanying table shows concisely not

only the points of disagreement between the Chinese and European forms, but also the variations that occur in the European form itself according to the descriptions of different writers. These need not be discussed in detail, but on the whole they seem to indicate the existence of varieties in the species. The Chinese variety is shorter and comparatively wider than the European specimens originally described; the prepharynx is longer, the acetabulum larger and placed more posteriorly; the testes are transversely elongated and very noticeably crenated around their margins.

*Description.*—Length, 1.6 to 2.05 mm.; maximum width, 0.39 to 0.52 mm., measured in the neighborhood of the posterior testis. Lateral margins of the body, from the collar to the acetabulum, rolled ventrally, thus forming a shallow groove on the ventral surface of this region of the body (fig. 1B). Cuticle provided with strong spines which become sparser posteriad and may disappear entirely behind the posterior testis.

Oral sucker, 0.081 to 0.114 mm. long, 0.11 to 0.13 mm. wide, terminal, with the opening toward the ventral surface. Prepharynx 0.09 to 0.13 mm. long; pharynx 0.09 to 0.11 mm. long by 0.06 to 0.07 mm. wide; esophagus 0.17 to 0.31 mm. long, bifurcating in front of the acetabulum into two simple intestinal branches which reach nearly to the posterior extremity of the body. The acetabulum is large, measuring 0.22 to 0.27 mm. long by 0.21 to 0.25 mm. wide, and situated a little more than one-third of the body length from the anterior end. The oral collar, 0.29 to 0.34 mm. wide, is kidney-shaped, its ventral notch measuring 0.11 to 0.12 mm. in width and its dorsal space 0.08 to 0.10 mm. The collar spines number 12 on each side (total 24) and are 0.046 to 0.054 mm. long and 0.011 to 0.015 mm. wide at their bases. The innermost ventral and innermost dorsal of these spines are usually a little shorter than the others. The second ventral spine on one or both sides (numbered from the median line) is often found in front of the row (fig. 1A), but sometimes it is in line with the rest, in which case the first and third may be placed somewhat behind.

The testes possess crenated margins, are oval in shape, elongated transversely, one placed in front of the other with their neighboring surfaces in close contact. The anterior testis measures 0.09 to 0.16 mm. long by 0.19 to 0.24 mm. wide; the posterior 0.13 to 0.18 mm. by 0.16 to 0.23 mm. The two vasa efferentia are given off from their antero-external borders, pass anteriorly on the dorsal side of the acetabulum and empty into a bent, pyriform vesicula seminalis. A thin cirrus sac, which lies anterior to the center of the acetabulum, surrounds the seminal vesicle and short ejaculatory duct. A wide genital sinus, into which the male and female canals open, is located

in the median line between the acetabulum and intestinal bifurcation. The ovary is small, globular in shape, lying toward the right side in front of the anterior testis. The uterus is short and contains only a few eggs. Neither receptaculum seminis nor Laurer's canal were seen. The shell gland is diffuse. The vitellaria extend from the level of the middle of the acetabulum to the posterior extremity of the body. Occasionally they are found as far forward as the level of the genital sinus. In the posterior region of the body behind the second testis the vitellaria from both sides extend across the median line, while in front of the post-testicular region they occur only laterally and mostly on the external sides of the intestinal branches. The transverse vitelline ducts unite in front of the anterior testis, forming a transversely-elongated vitelline reservoir. The oval, thin-shelled eggs are 0.097 to 0.105 mm. long and 0.065 to 0.074 mm. wide, light-yellow in color, and provided with an operculum.

The excretory system follows the general arrangement in Echinostomes. A single stem leads from the terminal excretory pore anteriorly, giving off lateral branches and behind the posterior testis dividing into two main branches, each passing between the testes and the corresponding intestinal branch.

*Host.*—Dog.

*Location.*—Small intestine.

*Locality collected.*—China.

*Type specimens.*—United States National Museum Helminthological Collections No. 18678, collected by Dr. R. T. Shields.

**PROHEMISTOMUM INDUSTRIUM, new species.**

Plates 2 and 3.

This parasite represents the second species of the genus *Prohemistomum* Odhner, 1913, to be reported from the dog, the first, *P. appendiculatum*, having been described by Ciurea (1916). The placing of the new species in the genus is based on the general appearance of the body and the arrangement of the internal structures, especially the genital organs. It differs from *P. appendiculatum*, as well as from *P. spinulosum* Odhner, in the presence on its ventral surface, between the folds of the body, of a well-developed clinging plug which resembles that found in the genus *Braunina* Heider, 1900. Like *Braunina cordiformis* Wolfe, 1903, it probably maintains its position inside the intestine of its host by grasping the intestinal mucosa between the folds of the body and the clinging plug.

*Description.*—Body more or less oval, somewhat pyriform in shape, broad and round anteriorly, narrowing posteriorly. Stout spines cover the entire surface of the body except the clinging plug and the region posterior to the second testis. Length, 1.5 to 1.9 mm.; maximum width, 1.0 to 1.2 mm. and maximum thickness about 0.74 mm.,

both measured at the anterior third of the body. The ventral folds (figs. 2 B and 4 C), which originate on either side of the oral sucker, meet at about the level of the beginning of the posterior third of the body and form the borders of a large cavity occupied by the extensively-developed clinging plug (figs. 2 A, B). The clinging plug ("Haftapparat," "Zapfenapparat") is smooth and dome-shaped externally and provided with a broad base reaching from the acetabulum to a point slightly behind the posterior limit of the ventral folds. In some specimens it is confined within the cavity formed by the folds, but often it bulges out anteriorly in such a manner as to force back and overlies in ventral view both the pharynx and oral sucker (fig. 2 A). In its anterior end, in front of the vitellaria, are found numerous unicellular glands, probably representing the so called "Haftapparatdrüsen."

The oral sucker, 0.10 to 0.13 mm. long and 0.18 to 0.19 mm. wide, is terminal or antero-dorsal, depending upon the position of the clinging plug. It is immediately followed by a globular pharynx 0.10 to 0.13 mm. long and 0.13 to 0.14 mm. wide. The acetabulum (fig. 4 B), 0.10 to 0.11 mm. in diameter, is weakly developed and hidden by the clinging plug. It is located in the anterior third of the body, a short distance behind the pharynx, at the angle formed by the base of the clinging plug with the anterior region of the body. Its position suggests that it may serve with the ventral folds and clinging plug as an attaching organ. No esophagus being present, the simple intestinal branches arise directly from the pharynx; at first very narrow, they are much wider posteriorly. Their terminations, which are near the posterior end of the body, are visible, but the greater parts of the intestinal branches are hidden between the testes and vitellaria.

The testes are large, smooth, oval in shape, elongated antero-posteriorly and placed one behind the other; their point of contact with each other is about half-way between the anterior and posterior ends of the body. The anterior testis is somewhat smaller and is more inclined ventrally, its anterior extremity extending into the substance of the clinging plug (figs. 4 A, B). It measures 0.49 to 0.52 mm. long and 0.33 to 0.45 mm. wide and, like the posterior testis, it varies in thickness from 0.30 to 0.40 mm. The posterior testis is 0.65 to 0.81 mm. long by 0.36 to 0.38 mm. wide; approximately one-half of its length lies anterior of the posterior limits of the ventral folds and the other half posterior. The vasa efferentia (fig. 4 A) originate from the mid-ventral borders of the testes; the common duct arising from their union, or the vas deferens, enters the cirrus sac and is enlarged to form the vesicula seminalis. The cirrus sac is comparatively very much elongated, lying ventral to the two testes toward the right or left side (amphitypy) and measuring 0.70

to 0.90 mm. long and 0.08 to 0.13 mm. wide at its widest (anterior) portion. It encloses a vesicula seminalis which is not coiled, but is constricted at its middle portion, a pars prostatica and a protrusible cirrus (fig. 3). Cells are present between the wall of the cirrus sac and the vesicula seminalis and pars prostatica. In the unprotruded state the cirrus lies coiled within the sac, and a muscular ring which surrounds its distal portion can be distinctly seen.

The ovary is spherical in shape with a diameter of 0.15 to 0.19 mm. It lies in the substance of the clinging plug, on the ventral side of the posterior surface of the anterior testis, toward the left or right side and opposite the cirrus sac. It gives off from its postero-ventral surface a short oviduct with a distant ootype surrounded by a diffuse shell gland. Laurer's canal is present, but very difficult to find, even in sections, due to its small size and to the fact that it is crowded out by the vitelline glands and reservoir. It opens on the dorsal surface, toward the left or right side, opposite the anterior end of the second testis. The relations of the canal, the oviduct, the unpaired vitelline duct and the shell gland, and the course of the uterus are shown in figure 4 B. The receptaculum seminis is lacking. The vitellaria are very well developed and are composed of large acini measuring 0.13 to 0.15 mm. long and 0.07 to 0.09 mm. wide. They occupy the greater part of the substance of the clinging plug. The transverse vitelline ducts, which could only be made out in sections, are short and the vitelline reservoir is found between the two testes on the same side as Laurer's canal. The terminal portion of the uterus, the vagina, or metraterm, joins the male duct on the ventral side of the latter to form a common passage leading to the genital opening which is situated somewhat dorsally in the posterior end of the body. Surrounding the opening are muscular fibers arranged in circular fashion, but no well-developed genital sinus was seen. The large, thin-shelled eggs are 0.130 to 0.146 mm. long by 0.089 to 0.097 mm. wide. They are oval in shape, light-yellow in color and provided with an operculum.

The excretory system, as in other members of the Holostomata, is in the form of a subcutaneous network of vessels and capillaries. The excretory pore is small, located ventrally with respect to the genital opening.

*Host.*—Dog.

*Location.*—Intestine.

*Locality collected.*—China.

*Type specimens.*—United States National Museum Helminthological Collections No. 18683, collected by Dr. R. T. Shields.

Besides the type specimens of *Prohemistomum industrium*, the United States National Museum Helminthological Collections (No.

17807) contain a second lot of specimens also collected by Dr. R. T. Shields from the intestine of a dog in Nanking, China, in 1913.

Odhner (1913) considered his genus *Prohemistomum* an intermediate group between the typical Holostomes and the genus *Cyathocotyle* Muehling, 1897, partly because of the incomplete division of the body, externally, into an anterior and a posterior region. With *Cyathocotyle* it has been placed in the subfamily Cyathocotylinae by Railliet (1919), but so far no generic diagnosis has been given.<sup>2</sup> The inclusion of *P. industrium* in *Prohemistomum* brings together species exhibiting two types of clinging plugs as in the genus *Alaria* (= *Hemistomum*). *P. spinulosum* and *P. appendiculatum* have clinging plugs of one type, their clinging plugs being of small size, round to oval in shape and with or without a central depression. *P. industrium* has a clinging plug of another type, its clinging plug being very extensively developed and dome-shaped and occupying at least two-thirds of the body length.

#### Genus PROHEMISTOMUM Odhner, 1919.

*Generic diagnosis.*—Alariidae: Small trematodes, not over 2 mm. in length, more or less oval in shape, with the body not distinctly divided into an anterior and a posterior region. The cuticle is provided with spines or with fine scales. The anterior lateral margins of the body are foliaceous and rolled meso-ventrally to form ventral folds which unite posteriorly. Between the ventral folds and behind the acetabulum is a clinging apparatus which takes the appearance of a round or oval, knob-like process, which may or may not present a central depression; or that of an extensively developed plug which reaches anteriorly so as to hide in ventral view the acetabulum, pharynx and even the oral sucker. The simple intestinal branches extend almost to the posterior extremity of the body. The smooth or slightly indented testes lie one behind the other in the posterior half of the body or they may occupy the greater part of the body length between the acetabulum and the posterior end of the body. An elongated cirrus sac enclosing the vesicula seminalis and cirrus lies ventral to the testes. The small, globular ovary is found ventral to the anterior testis, opposite the cirrus sac. The diffuse shell gland, vitelline reservoir and the junction of the ootype and Laurer's canal

<sup>2</sup> Railliet (1919) subdivided the Holostomata into five subfamilies, namely, Strigeinae, Alariinae, Cyathocotylinae, Polyotyliinae (Polycotyliinae), and Brauniniinae. The family Strigeidae was proposed to include these subfamilies, so that at present there exist the following terms which refer to the same group of trematodes: Holostomidae, Diplostomidae, Hemistomidae, and Strigeidae. To avoid confusion which is apt to arise by the use of many synonymous names, I would favor the adoption of Hemistomidae against the rest for two reasons: the species represented by *Hemistomum* are better known and they appear to occupy a central position among the Holostomata. It has been pointed out, however, by Krause (1914) and by Hall and Wigdor (1918) that the name *Alaria* has priority over *Hemistomum*, so that the family name Alariidae should be used in place of Hemistomidae.

are located between the two testes. A receptaculum seminis is absent. The vitellaria are in the form of large acini extending from a level posterior to the acetabulum to the second testis or they may occupy the greater part of the substance of the clinging plug. The uterus is short and contains only a few but large eggs, which measure from 0.100 to 0.146 mm. long and 0.06 to 0.097 mm. wide. The vaginal opening is ventral to that of the male in the posterior extremity of the body. A genital sinus may be present or absent, but a bursa copulatrix is lacking. The excretory system is in the form of a subcutaneous network of vessels and capillaries. The excretory pore is ventral with respect to the genital opening.

Parasitic in birds and carnivores.

*Type species.*—*Prohemistomum spinulosum* Odhner, 1913.

*Key to species of Prohemistomum.*

- 1 Clinging plug extensively developed and dome-shaped, occupying at least two-thirds of the body length; acetabulum in anterior third of body, hidden in ventral view by clinging plug; cirrus protrusible ----- *Prohemistomum industrium*
- Clinging plug small, oval in shape; acetabulum midway of body length; cirrus not protrusible ----- 2
2. Body not over 1.0 mm. in length; oval in shape ----- *Prohemistomum spinulosum*
- Length, 0.90 to 1.75 mm.; posterior extremity of body tapering into a cylindrical appendix ----- *Prohemistomum appendiculatum.*

Following are brief descriptions of the two previously known species of *Prohemistomum*:

**PROHEMISTOMUM SPINULOSUM** Odhner, 1913.

Plate 4, fig. 5.

*Specific diagnosis.*—*Prohemistomum*: The body is broadly oval in form; length, 0.75 to 1.0 mm.; maximum width, 0.45 to 0.65 mm. The anterior two-thirds to four-fifths of the body length is flattened with the margins rolled ventro-posteriorly, producing a spoon-shaped cavity which contains the clinging plug. The posterior body region is not sharply separated from the anterior. The body is thinnest anterior to the clinging plug, but posterior to this level the thickness increases and near the posterior end of the body the proportion of the width to the thickness is 4:3. The cuticle is covered with fine scales except on the clinging plug, the posterior end of the body and the dorsal surface posterior to the anterior testis. The oral sucker, 0.07 to 0.085 mm. in diameter, is small and weakly



developed. The acetabulum is 0.06 mm. long by 0.085 mm. wide and lies in extended specimens midway of the body length. Behind the acetabulum is found the clinging plug which is elliptical in shape, measuring 0.14 to 0.16 mm. long by 0.12 mm. wide and presenting a deep central depression. The pharynx is 0.06 to 0.075 mm. long and 0.045 to 0.055 mm. wide. The esophagus is very short and the intestinal branches extend to near the posterior extremity of the body. The excretory system is in the form of a network. The testes are placed one in front of the other. The posterior testis occupies a median position in the boundary between the anterior and posterior body regions. The anterior testis may be pushed toward the left side of the median line. The margins of both testes are often slightly indented. Ventral to the testes, extending from the level of the anterior testis to the posterior extremity of the body, lies the elongated cirrus sac which encloses the vesicula seminalis, pars prostatica and cirrus. The globular ovary is found ventral to the anterior testis, toward the right side of the median line. The vitellaria are composed of large follicles which hide the posterior portions of the intestinal branches in ventral view. They extend from a level behind the acetabulum to the posterior end of the second testis. A receptaculum seminis is lacking; Laurer's canal is long and the vitelline reservoir lies between the two testes. The uterus is short and contains large eggs (4 to 5 in number) which are 0.10 mm. long by 0.06 mm. wide. The genital sinus is deep and relatively roomy.

*Host.*—*Milvus parasiticus*.

*Location.*—Intestine.

*Locality collected.*—Cairo, Egypt.

PROHEMISTOMUM APPENDICULATUM Ciurea, 1916.

Plate 4, fig. 6.

*Specific diagnosis.*—*Prohemistomum*: Length, 0.90 to 1.75 mm.; width, 0.40 to 0.60 mm., measured at the level of the clinging plug. The anterior region of the body or that region between the oral sucker and the point of meeting of the ventral folds, measures 0.66 to 1.20 mm. long and 0.070 to 0.099 mm. thick in front of the acetabulum. It is not sharply separated from the posterior body region which is 0.33 to 0.53 mm. long and which tapers posteriorly into a cylindrical appendix. The cuticle of the entire anterior body region is provided with fine scales except on the clinging plug. The oral sucker, 0.055 to 0.090 mm. in diameter, is terminal with the opening toward the ventral surface. The acetabulum, 0.050 to 0.085 mm. long by 0.065 to 0.095 mm. wide, lies almost midway of the body length. The simple intestinal branches, from the level of the clinging plug to

their terminations near the posterior extremity of the body, are hidden in ventral view by the vitellaria. Behind the acetabulum is the clinging plug which is 0.150 to 0.245 mm. long and 0.125 to 0.200 mm. wide and which may be provided with a central depression and padded margins. In some specimens the clinging plug is fungiform in appearance and with a smooth surface. The transversely elongated testes lie one behind the other and show slight indentations around their margins. The anterior testis, 0.110 to 0.176 mm. long by 0.154 to 0.240 mm. wide, lies on the median line or slightly toward the left side, ventral to the posterior half of the clinging plug. The posterior testis measures 0.116 to 0.176 mm. long and 0.165 to 0.275 mm. wide. The cirrus sac, 0.154 to 0.176 mm. wide (measured at its middle portion), extends obliquely from the right to the left side of the median line, ventral to the testes. The cirrus opens dorsally into the genital sinus. The small, globular ovary, 0.088 to 0.099 mm. in diameter, lies ventral to the anterior testis toward the left side. The shell gland is found posterior to the ovary and the vitelline reservoir is between the two testes. Between the vitelline reservoir and the left intestinal branch the ootype is situated. Laurer's canal is present. The vitellaria, in the form of large acini, extend from a level posterior to the acetabulum to the second testis. Anteriorly, between the acetabulum and anterior margin of the clinging plug, the vitellaria from both sides of the body unite. The uterus is short and contains only a few eggs (4 to 5 in number) which are 0.100 to 0.117 mm. long and 0.063 to 0.068 mm. wide and are brownish in color. The vagina is provided with a muscular sphincter at its opening on the ventral portion of the genital sinus. The excretory system is in the form of a network.

*Hosts.*—Primary: experimental dogs and cats; secondary: fresh-water fish (*Tinca tinca*, *Aspius aspius*, *Carassius carassius*, *Blicca bjorkna*, etc.).

*Location.*—Adult in intestine of experimental dogs and cats. Immature form in fresh-water fishes, presumably in the muscles.

*Locality collected.*—Roumania.

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EXPLANATION OF PLATES.

Index to lettering.

<i>ac</i> .....	acetabulum.	<i>os</i> .....	oral sucker.
<i>cir</i> .....	cirrus.	<i>Ov</i> .....	ovary.
<i>col</i> .....	collar.	<i>P</i> .....	pharynx.
<i>cp</i> .....	clinging plug.	<i>Pp</i> .....	prepharynx.
<i>cs</i> .....	cirrus sac.	<i>sg</i> .....	shell gland.
<i>csp</i> .....	collar spines.	<i>T<sub>1</sub></i> .....	anterior testis.
<i>E</i> .....	egg.	<i>T<sub>2</sub></i> .....	posterior testis.
<i>ep</i> .....	excretory pore.	<i>tud</i> .....	transverse vitelline duct.
<i>ev</i> .....	excretory vessels.	<i>ut</i> .....	uterus.
<i>gen. s.</i> .....	genital sinus.	<i>vag</i> .....	vagina.
<i>go</i> .....	genital opening.	<i>vag. sp.</i> .....	vaginal sphincter.
<i>int</i> .....	intestine.	<i>vd</i> .....	vas deferens.
<i>Lc</i> .....	Laurer's canal.	<i>ve</i> .....	vas efferens.
<i>od</i> .....	oviduct.	<i>vf</i> .....	ventral fold.
<i>Oc</i> .....	esophagus.	<i>vit</i> .....	vitellaria.
<i>ogs</i> .....	opening of genital sinus.	<i>V. r.</i> .....	vitelline reservoir.
<i>Oo</i> .....	ootype.	<i>V. s.</i> .....	vesicula seminalis.

PLATE 1.

FIG. 1.—*Echinochasmus perfoliatus shieldsi*, ventral view; A, same, with collar and spines enlarged; B, same, cross section through pharynx.

PLATE 2.

FIG. 2.—A, B, C, *Prohemistomum industrium*, showing general external appearance.

3.—*Prohemistomum industrium*, ventral view.

PLATE 3.

FIG. 4.—*Prohemistomum industrium*; A, reconstruction of male genital organs; B, reconstruction of female genital organs; C, cross section through anterior end of posterior testis.

PLATE 4.

FIG. 5.—*Prohemistomum spinulosum*, ventral view. Adapted from Odhner, 1913.

6.—*Prohemistomum appendiculatum*, ventral view. Adapted from Ciurea, 1916.

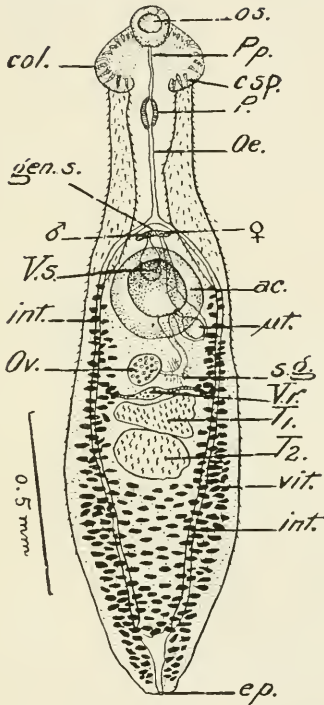


Fig. 1.

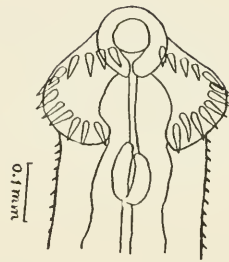
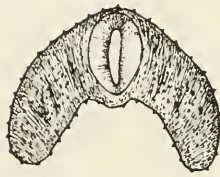


Fig. 1A.



0.1 mm.

Fig. 1B.

ECHINOCHASMUS PERFOLIATUS SHIELDSI.

FOR EXPLANATION OF PLATE SEE PAGE 12

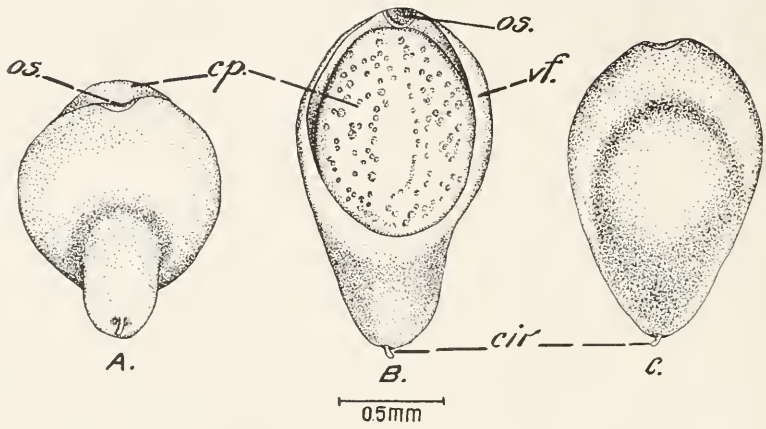


Fig. 2.

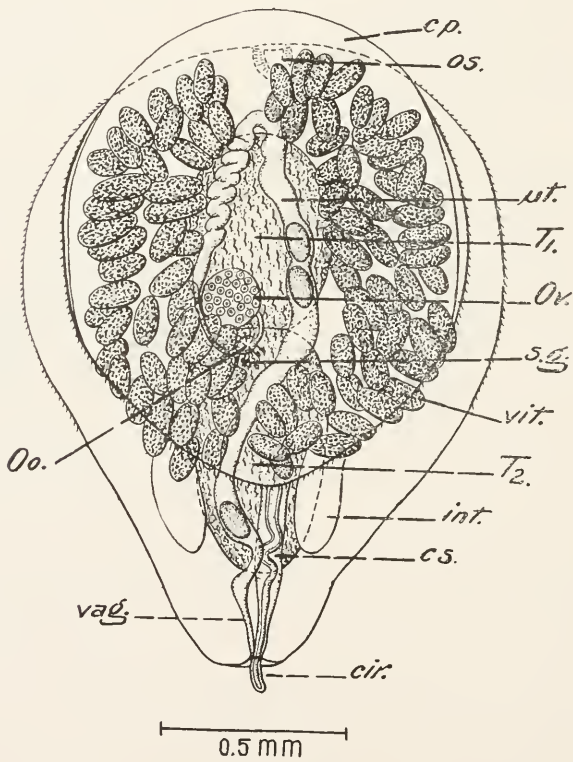
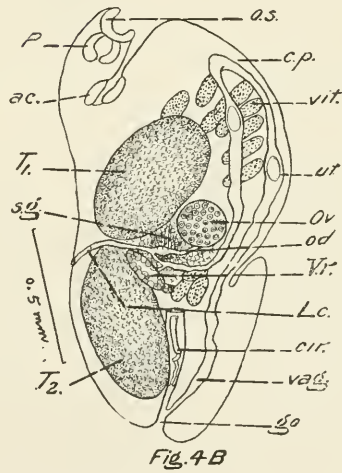
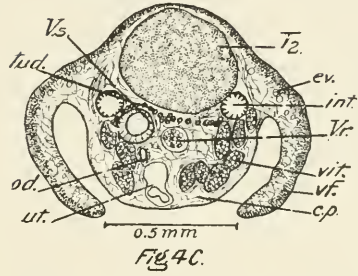
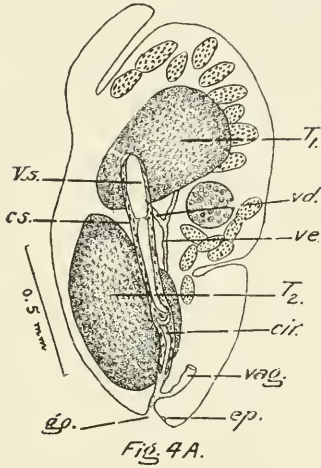


Fig. 3.

PROHEMISTOMUM INDUSTRIUM.

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PROHEMISTOMUM INDUSTRIUM.

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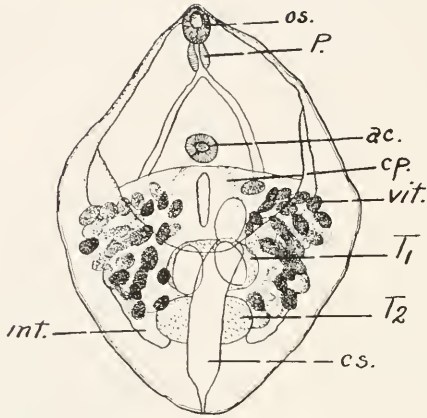


Fig. 5.

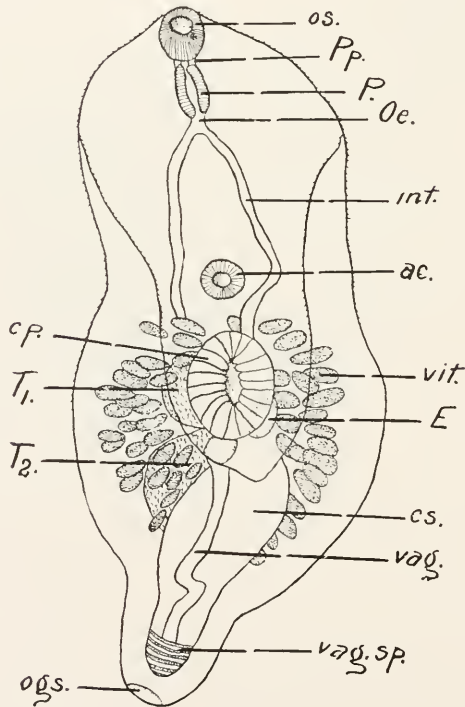


Fig. 6.

PROHEMISTOMUM SPINULOSUM AND PROHEMISTOMUM APPENDICULATUM.

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