

## DIGENEA FROM BIRDS OF CHANDIGARH

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## ABSTRACT

This paper deals with the description of seven digenetic flukes collected from different birds of Chandigarh. One form, viz. *Patagifer* sp., has been kept as sp. inq. and its identification up to specific level has been kept pending till availability of further material. *Apharyngostrigea ramai* (Verma, 1936) Vidyarthi, 1937; *Strigea orientalis* Vidyarthi, 1937; *Neodiplostomum* (*Neodiplostomum*) *rufeni* Chatterji, 1942; *Echinochasmus bagulai* Verma, 1934; *Prosthogonimus cuneatus* (Rud., 1809) Braun, 1901 and *Notocotylus attenuatus* (Rud., 1809) Kossack, 1911 have been redescribed with minor variations. The position of *Apharyngostrigea ramai* has been discussed in relation to Ukoli's work based on the 'Numerical Taxonomy' of the genus *Apharyngostrigea* Ciurea, 1927.

## OBSERVATIONS

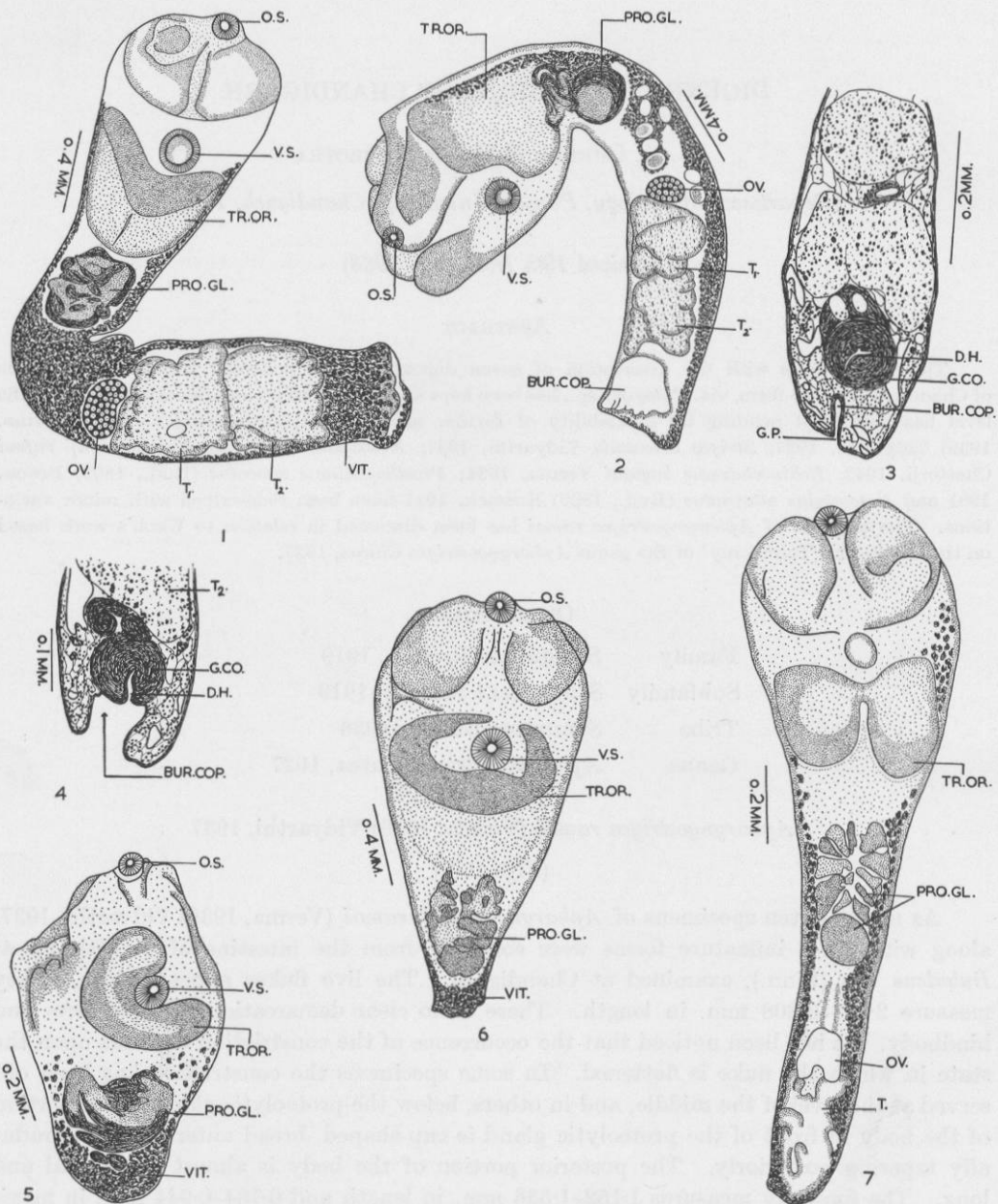
Family	<b>Strigeidae</b> Railliet, 1919
Subfamily	STRIGEINAE Railliet, 1919
Tribe	STRIGEINI Dubois, 1936
Genus	<i>Apharyngostrigea</i> Ciurea, 1927

*Apharyngostrigea ramai* (Verma, 1936) Vidyarthi, 1937

(Figs. 1-7)

As many as ten specimens of *Apharyngostrigea ramai* (Verma, 1936) Vidyarthi, 1937, along with three immature forms were collected from the intestine of a cattle egret, *Bubulcus ibis* (Linn.), examined at Chandigarh. The live flukes appear white. They measure 2.828-3.808 mm. in length. There is no clear demarcation between fore- and hindbody. It has been noticed that the occurrence of the constriction depends upon the state in which the fluke is flattened. In some specimens the constriction has been observed at the level of the middle, and in others, below the proteolytic gland. The portion of the body in front of the proteolytic gland is cup-shaped, broad anteriorly and gradually tapering posteriorly. The posterior portion of the body is almost cylindrical and long. The forebody measures 1.152-1.536 mm. in length and 0.784-0.944 mm. in maximum breadth which occurs at its anterior end. The hindbody is 1.552-2.368 mm. in length and 0.448-0.576 mm. in maximum breadth which occurs at its testicular region. The ratio between the length of the forebody and that of the hindbody is 1:1.19-1.64.

The subterminal oral sucker measures 0.112-0.128 × 0.112-0.114 mm. The ventral sucker, 0.144-0.224 × 0.16-0.244 mm. in size, lies 0.484-0.608 mm. behind the anterior end. The ratio between the lengths of the oral and the ventral suckers is 1:1.2-1.85. The tribocytic organ is quite muscular and large cup-like structure, provided with a



FIGS. 1 to 7. 1, *Apharyngostrigea ramai* (Verma, 1936) Vidyarthi, 1937; 2, *Apharyngostrigea ramai*—another specimen showing variation in shape of the body, its organ and position of the latter; 3, *A. ramai*—a longitudinal section of its posterior segment showing the formation of ductus hermaphroditicus by the genital ducts, and the genital cone; 4, *A. ramai*—a longitudinal section of its posterior region showing the opening of the ductus hermaphroditicus into the bursa copulatrix; 5, 6 and 7, *A. ramai*—immature forms showing successive stages of development.

thick muscular lappet on its margins. It measures 0.272–0.432 mm. in longitudinal axis and 0.448–0.592 mm. in transversal. In laterally flattened specimens, this adhesive organ is not distinctly stained.

The proteolytic gland is large, 0.352–0.464 × 0.224–0.40 mm. in size, composed of a number of small lobes. The posteriormost lobe is the largest of all.

The pharynx is absent. The course of the oesophagus and the intestinal caeca could not be followed in whole mount preparations due to the profuse distribution of vitellaria and large size of the tribocytic organ. However, the longitudinal sections reveal that the intestinal caeca terminate at the posterior extremity of the body.

The ovary, situated 0.288–0.544 mm. behind the proteolytic gland, is somewhat reniform measuring 0.08–0.224 × 0.16–0.288 mm. The Mehlis' gland complex is as usual inter-testicular. The uterus at its distal end unites with the male duct to form the ductus hermaphroditicus. The eggs, measuring 0.08–0.096 × 0.048–0.08 mm., are not numerous. The vitellaria are extensively developed, being very densely distributed in the hindbody, whereas in the forebody they are sparse. Only a few follicles extend in front of the ventral sucker. In one specimen the vitellaria have been seen extending up to the oral sucker.

The testes are two in number, tandem, multilobed and occupy almost the entire width of the hindbody behind the ovary. The anterior testis measures 0.384–0.56 × 0.368–0.496 mm., whereas the posterior testis, 0.416–0.576 × 0.32–0.512 mm. The vesicula seminalis is a coiled tube, lying behind the posterior testis and is followed by the common genital duct which opens into the bursa copulatrix. The latter is a spacious chamber with a wide terminal opening.

Besides the mature specimens of *Apharyngostrigea ramai*, the author also recorded from the same habitat and the same host, three immature forms of the same species which showed graded development of tribocytic organ, proteolytic gland and the hindbody.

Host: *Bubulcus ibis* (Linn.)

Habitat: Intestine

Locality: Chandigarh

#### Comments on the Genus *Apharyngostrigea* Ciurea, 1927

This genus comprises 13 already known species, namely *Apharyngostrigea cornu* (Zeder, 1800) Ciurea, 1927 (Syn. *A. bilobata* Olsen, 1940; Dubois et Rausch, 1950); *A. braziliiana* (Szidat, 1928) Szidat, 1929; *A. egretii* Verma, 1936; *A. garciai* Tubanguui, 1933;

#### Key to abbreviations:

*BUR.COP.*—bursa copulatrix; *CI.SA.*—cirrus sac; *D.H.*—ductus hermaphroditicus; *EG.*—egg; *EX.P.*—excretory pore; *G.CO.*—genital cone; *G.P.*—genital pore; *INT.*—intestine; *INT.C.*—intestinal caecum; *M.GL.COM.*—Mehliss' gland complex; *MT.*—metraterm; *O.S.*—oral sucker; *OV.*—ovary; *PH.*—pharynx; *PR.PH.*—prepharynx; *PRO.GL.*—proteolytic gland; *R.SE.*—receptaculum seminis; *T.*—testis; *T<sub>1</sub>*—anterior testis; *T<sub>2</sub>*—posterior testis; *TR.OR.*—tribocytic organ; *UT.*—uterus; *V.GL.*—ventral glands; *V.S.*—ventral sucker; *VES.SEM.*—vesicula seminalis; *VES.SEM.EXT.*—vesicula seminalis externa; *VES.SEM.IN.*—vesicula seminalis interna; *VIT.*—vitellaria.

*A. ibis* Azim, 1935; *A. intermedia* Bykhovskaia-Pavlovskaja, 1952; *A. joanae* Gupta, 1963; *A. multiovata* (Vigueras, 1944) Dubois et Vigueras, 1949 (Syn. *A. insulae* Vigueras, 1944; *A. cornu* Cable, Conner et Balling, 1960 nec Zeder, 1800); *A. pipientis* (Faust, 1918) Olivier, 1940 (Syn. *A. duboisi* Vigueras, 1944; *A. gundlachi* Vigueras, 1944; *A. tenuis* Dubois et Rausch, 1950; *A. ibis* Caballero et Hidalgo, 1955 nec Azim, 1935); *A. ramai* (Verma, 1936) Vidyarthi, 1937 (Syn. *Ridgeworthia ramai* Verma, 1936; *A. ardeolina* Vidyarthi, 1937; *A. indiana* Vidyarthi, 1937; *A. simplex* Bhalerao, 1942 nec S. J. Johnston, 1904; *Strigea egretta* Yang Fu-Hsi, 1962; *Apatemon* (Pseudostrigea) *parapandubi* Odening, 1962); *A. repens* (Chase, 1921) Dubois, 1937 (Syn. *Holostomum repens* Chase, 1921); *A. serpentia* Ukoli, 1967 and *A. simplex* (Johnston, 1904) Szidat, 1929 (Syn. *Holostomum simplex* Johnston, 1904).

Ukoli in 1967 reviewed the genus *Apharyngostrigea* Ciurea, 1927 by using the method of Numerical Taxonomy (Sneath and Sokal, 1962) in relation to certain characters such as length, width and shape of the body and its organs. He split up the original genus *Apharyngostrigea* Ciurea, 1927 into two genera, namely *Apharyngostrigea* (Ciurea, 1927 restricted) and *Chaseostrigea* Ukoli, 1967. He further divided the genus *Apharyngostrigea* into two new subgenera, viz. *Apharyngostrigea* (*Apharyngostrigea*) and *A. (Brasiliana)*. According to Ukoli the subgenus *A. (Apharyngostrigea)* comprises three species groups, namely *A. (A.) simplex*, *A. (A.) cornu* and *A. (A.) serpentia*. *A. (A.) simplex* comprises *A. bilobata*, *A. ibis*, *A. simplex*, *A. tenuis* and *A. simplex* (Johnston, 1904) Ukoli, 1967; *A. (A.) cornu* consists of *A. ardeolina*, *A. cornu*, *A. garciai*, *A. indiana* and *A. ramai* and the species group *A. (A.) serpentia* includes only one species, *A. serpentia*. The second subgenus *Apharyngostrigea (Brasiliana)* comprises three species groups, viz. *A. (Brasiliana) brasiliiana* including only species *A. brasiliiana*; *A. (Brasiliana) flexis* consisting of *A. flexis* and *A. (Brasiliana) egretii* comprising *A. egretii*. The seventh species group *Chaseostrigea repens* consists of only *A. repens*.

*A. pipientis*, *A. duboisi*, *A. gundlachi*, *A. insulae* and *A. multiovata* were not included in the study.

#### Key to the species of the genus *Apharyngostrigea* by Ukoli, 1967

- |   |                                      |
|---|--------------------------------------|
| 1. Testes multilobed .. .. .  | 2                                    |
| Testes rounded with entire margins .. .. .  | 4                                    |
| 2. Body not more than 3.5 mm. in length .. .. .   | <i>A. (Apharyngostrigea) simplex</i> |
| Body over 4 mm. in length .. .. .   | 4                                    |
| 3. Definite constriction between fore- and hindbody. Posterior half of forebody not markedly reduced in diameter. Anterior two-thirds of hindbody not greatly attenuated. Proteolytic gland relatively small, centrally placed at base of forebody .. .. .  | <i>A. (A.) cornu</i>                 |
| No constriction between fore- and hindbody. Posterior half of forebody conspicuously reduced in diameter. Anterior two-thirds of hindbody strongly attenuated thus forming a long narrow neck region with the posterior region of the forebody which is flexible, giving the body a snake-like appearance. Proteolytic gland relatively large, filling almost the entire diameter of the posterior half of the forebody .. .. . | <i>A. (A.) serpentia</i>             |
| 4. Body not more than 4 mm. in length .. .. .   | <i>A. (Brasiliana) flexis</i>        |
| Body not less than 7 mm. in length .. .. .  | 5                                    |

5. Length of body, 7 mm.  
 Body slender. Width of fore- and hindbody, 0.09 mm.  
 Suckers small, oral sucker,  $0.07 \times 0.07$  mm.  
 Ventral sucker,  $0.07 \times 0.17$  mm.  
 Testes large,  $0.8 \times 0.8$  mm. . . . . *A. (B.) brasiliiana*  
 Length of body, 7.1–7.6 mm.  
 Width of fore- and hindbody, 2.5 mm.  
 Suckers relatively large, oral sucker,  $0.18 \times 0.18$  mm.  
 Ventral sucker,  $0.26 \times 0.26$  mm.  
 Testes small, anterior testis,  $0.34 \times 0.4$  mm.  
 Posterior testis,  $0.33 \times 0.34$  mm. . . . . *A. (B.) egretii*

If we follow the key to the species given by Ukoli, 1967, *Apharyngostrigea ramai* (described by the author), being 2.92–3.808 mm. in length, falls in between the species groups *Apharyngostrigea (Apharyngostrigea) simplex* and *A. (A.) cornu*. The former group comprises those species whose body length does not exceed 3.5 mm. and the latter group includes such forms which are not less than 4 mm. However, the species *Apharyngostrigea (Brasiliana) flexis* comprises forms in which the body length is not more than 4 mm., but at the same time the testes are rounded. It appears that the species does not fit in any of the species groups of Ukoli.

If this species is compared on the whole with the already known forms of the genus *Apharyngostrigea*, it comes very close to *A. ramai* except for the size of the body. It will be inadvisable to consider the form as new on the basis of its size only. Therefore, this form has been regarded as *Apharyngostrigea ramai* (Verma, 1936) Vidyarthi 1937.

Family        **Strigeidae** Railliet, 1919  
 Subfamily    STRIGEINAE Railliet, 1919  
 Tribe         STRIGEINI Dubois, 1936  
 Genus         *Strigea* Abildgaard, 1790

*Strigea orientalis* Vidyarthi, 1937

(Fig. 8)

Two specimens of *Strigea orientalis* Vidyarthi, 1937 were recovered from the intestine of a black-winged kite, *Elanus caeruleus* (Desfontaines), examined at Chandigarh. The body, distinctly divided into fore- and hindbody, measures 3.264–4.64 mm. in length. The forebody,  $1.008-1.28 \times 0.784-1.12$  mm. in size, is cup-shaped. The hindbody measures 2.256–3.36 mm. in length and 0.96–1.104 mm. in maximum breadth at the testicular region. The posterior end of the hindbody is slightly tapering. The ratio between the length of the anterior and that of the posterior segments is 1:2.239–2.62.

The subterminal oral sucker measures  $0.12-0.128 \times 0.12-0.128$  mm. The ventral sucker,  $0.208-0.24 \times 0.144-0.24$  mm. in size, lies 0.448–0.528 mm. behind the anterior edge of the body, i.e. the situation of the anterior edge of the ventral sucker is 42.5–44.4/100 of the length of the anterior segment. The tribocytic organ is a massive structure. The proteolytic gland lies in the posterior region of the anterior segment and measures  $0.272 \times 0.432$  mm.

The gonads occupy more than the last three quarters of the body. The testes are large, tandem and slightly lobed. The anterior testis measures  $0.40-0.528 \times 0.752-0.784$  mm., whereas the posterior testis,  $0.608 \times 0.656-0.832$  mm. The post-testicular area is  $0.528-0.608$  mm. in length. The vesicula seminalis is 'S'-shaped. The genital cone and the bursa copulatrix are well developed.

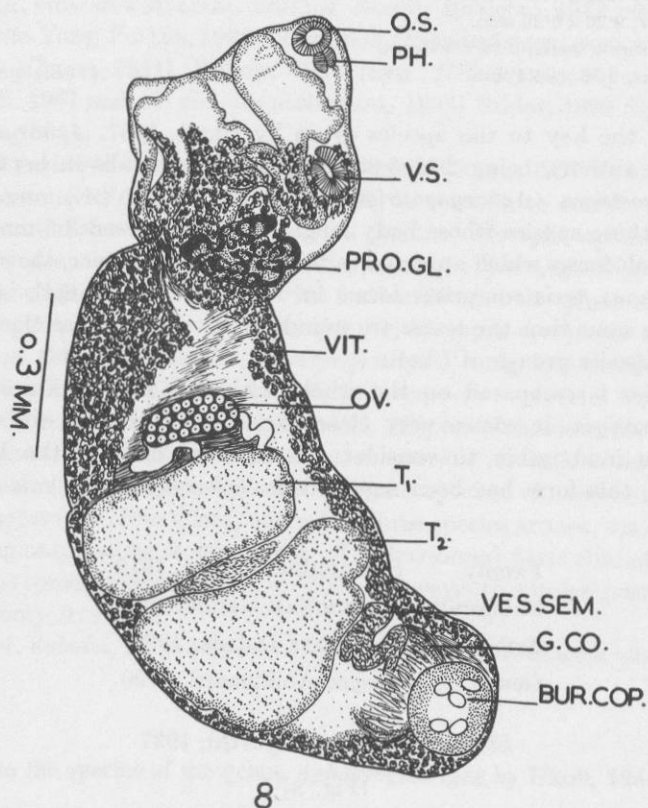


FIG. 8. *Strigea orientalis* Vidyarthi, 1936.

The ovary, transversely oval, pre-testicular in position, lies  $0.368$  mm. behind the anterior edge of the posterior segment, i.e. the situation of the anterior edge of the ovary is  $16.3/100$  of the length of the posterior segment. The vitellaria are profusely developed in both the segments; they extend from the region of the ventral sucker up to the posterior extremity of the body.

The eggs measure  $0.08 \times 0.048-0.056$  mm. One of the specimens harboured more than 40 eggs.

Host: *Elanus caeruleus* (Desfontaines)

Habitat: Intestine

Locality: Chandigarh

*Remarks*

The above described form differs from the original description given by Vidyarthi, 1937, in the gonads which do not occupy the whole of the posterior segment but only the last third quarter of the latter and in the maximum breadth of the posterior segment which occurs in the region of the testes instead of being in the anterior region of the posterior segment. The observations of *Strigea orientalis* taken by the author tally those described by Gupta, 1965, who reported it from another host, *Astur badius*.

Family	<b>Diplostomidae</b> Poirier, 1886
Subfamily	DIPLOSTOMINAE Monticelli, 1892
Tribe	DIPLOSTOMINI Dubois, 1936

*Neodiplostomum (Neodiplostomum) rufeni* Chatterji, 1942

(Figs. 9-10)

As many as 15 specimens of *Neodiplostomum (Neodiplostomum) rufeni* Chatterji, 1942 were recovered from the intestine of *Milvus migrans govinda* dissected in the Department of Zoology, Panjab University, Chandigarh. These flukes measure 1.498-2.478 mm. in length. The body is divided by a constriction into two unequal segments, the anterior small and the posterior long. The anterior segment, 0.61-1.218 × 0.756-1.148 mm. in size, is spatulate, whereas the posterior segment, 0.868-1.296 mm. in length and 0.518-0.79 mm. in maximum breadth, is cylindrical in shape. The ratio between the lengths of the anterior and the posterior segments is 1:1.03-1.59 (average ratio being 1.29). The ventral sucker, 0.07-0.14 × 0.084-0.112 mm., is situated a little in front of the tribocytic organ. The situation of its anterior edge is 23.7-28.57/100 of the length of the anterior segment (i.e. 0.154-0.28 mm. away from the anterior end). The tribocytic organ, 0.392-0.614 × 0.308-0.574 mm. in size, is oval or somewhat circular in shape and the situation of its anterior edge is 32.2-46.2/100 of the length of the anterior segment. The oral sucker, 0.07-0.14 × 0.056-0.098 mm., is either equal to or smaller than the ventral sucker. The ratio between the lengths of the oral and the ventral suckers is 1:1-1.5.

The pharynx is almost spherical and measures 0.28-0.77 × 0.056-0.077 mm. The oesophagus is very short and it divides into two intestinal caeca which extend up to the posterior extremity of the fluke.

The testes, two in number, lie tandem in the posterior segment. The anterior testis, 0.196-0.28 × 0.238-0.532 mm. in size, is somewhat asymmetrically developed and lies more towards the right side of the posterior segment. The posterior testis, 0.196-0.350 × 0.154-0.686 mm. in size, is transversely elongated and may spread in the entire breadth of the posterior segment. However, in some of the preparations it has been noticed that the posterior testis is almost degenerate or reduced to form two lobes, one on either side of the median axis of the posterior segment and connected by means of a thin isthmus. In one specimen the posterior testis seems to have degenerated completely.

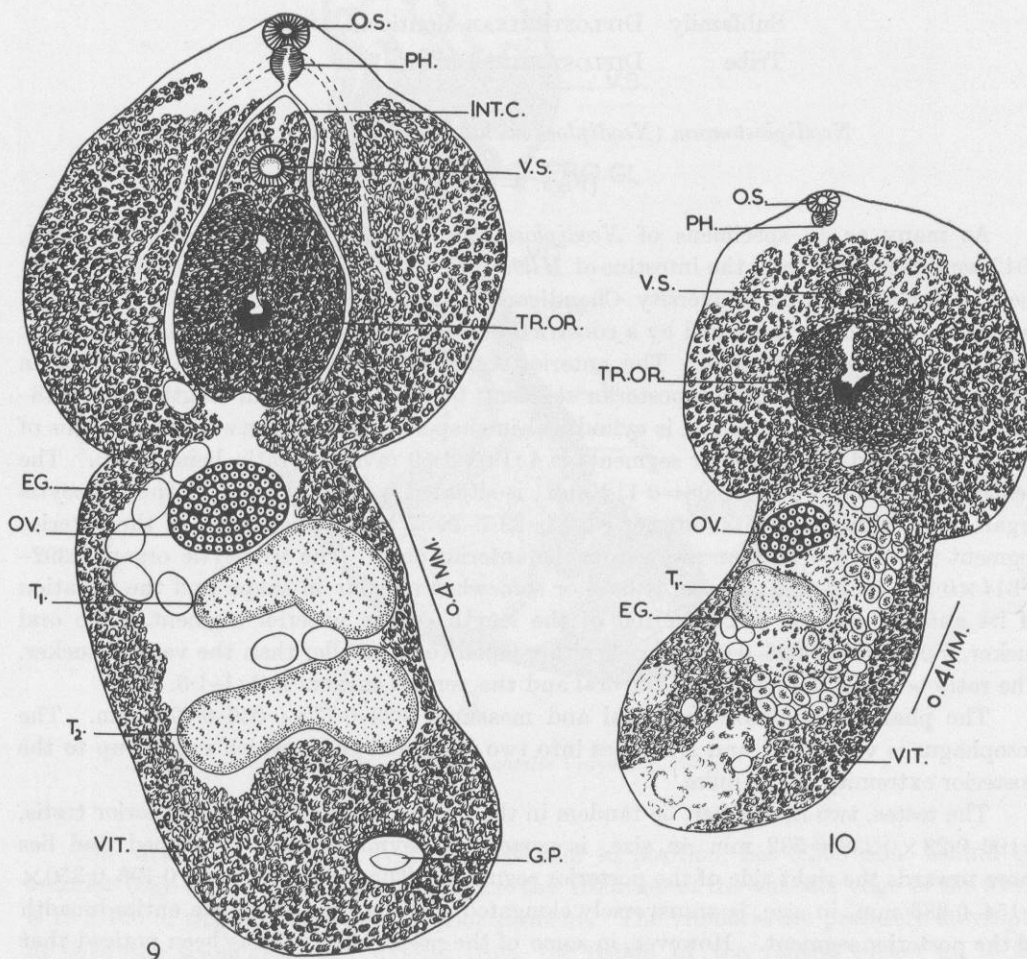
The ovary is pre-testicular and the situation of its anterior edge is either just at the beginning of the posterior segment or slightly behind it (i.e., from just at the anterior edge of the posterior segment to 5.4/100 of the length of the posterior segment). The ovary measures 0.112-0.224 mm. in length and 0.182-0.406 mm. in breadth. The

Mehlis' gland complex lies in between the two testes. The vitellaria are densely distributed in both the segments. The anterior extent of vitellaria in the anterior segment is 8.3-28/100 of the length of the anterior segment. The eggs are large, not numerous and measure 0.07-0.098 x 0.042-0.063 mm. The genital pore lies near the posterior extremity of the body.

Host: *Milvus migrans govinda*

Habitat: Intestine

Locality: Chandigarh



FIGS. 9 and 10. 9, *N. (N.) rufeni* Chatterji, 1942; 10, *N. (N.) rufeni*—another specimen showing the complete degeneration of the posterior testis.

#### Remarks

The observations recorded by the author differ slightly from the original description with respect to size of the body and its organs. The same are given in Table I.

A new host, *Milvus migrans govinda*, has been found for *Neodiplostomum* (*Neodiplostomum*) *rufeni* Chatterji, 1942.

TABLE I

	Chatterji's observations	Authors' observations
Body length ..	1.428-2.125 mm.	1.498-2.478 mm.
Anterior segment ..	0.527-0.85 × 0.663-0.986 mm.	0.61-0.218 × 0.756-1.148 mm.
Posterior segment ..	0.629-1.275 × 0.6-0.75 mm.	0.868-1.296 × 0.518-0.79 mm.
Oral sucker ..	-	0.07-0.14 × 0.056-0.098 mm.
Ventral suker ..	0.063 × 0.0675-0.0925 mm.	0.07-0.14 × 0.084-0.112 mm.
Situation of its anterior edge	0.195-0.35 mm. away from anterior extremity of the body	0.154-0.28 mm. away from anterior extremity of body
Tribocytic organ ..	0.1125-0.15 × 0.045-0.07 mm.	0.392-0.614 × 0.308-0.574 mm.
Anterior testis ..	0.15-0.306 × 0.493-0.668 mm.	0.196-0.28 × 0.238-0.532 mm.
Posterior testis ..	0.204-0.374 × 0.408-0.714 mm.	0.196-0.28 × 0.238-0.532 mm.
Ovary ..	0.085-0.17 × 0.34-0.391 mm.	0.112-0.224 × 0.182-0.406 mm.
Eggs ..	0.0875-0.095 × 0.045-0.0525 mm.	0.07-0.098 × 0.042-0.063 mm.

Family Echinostomatidae Looss, 1902  
 Subfamily ECHINOCHASMINAE Odhner, 1910  
 Genus *Echinochasmus* Dietz, 1909

*Echinochasmus bagulai* Verma, 1934

(Fig. 11)

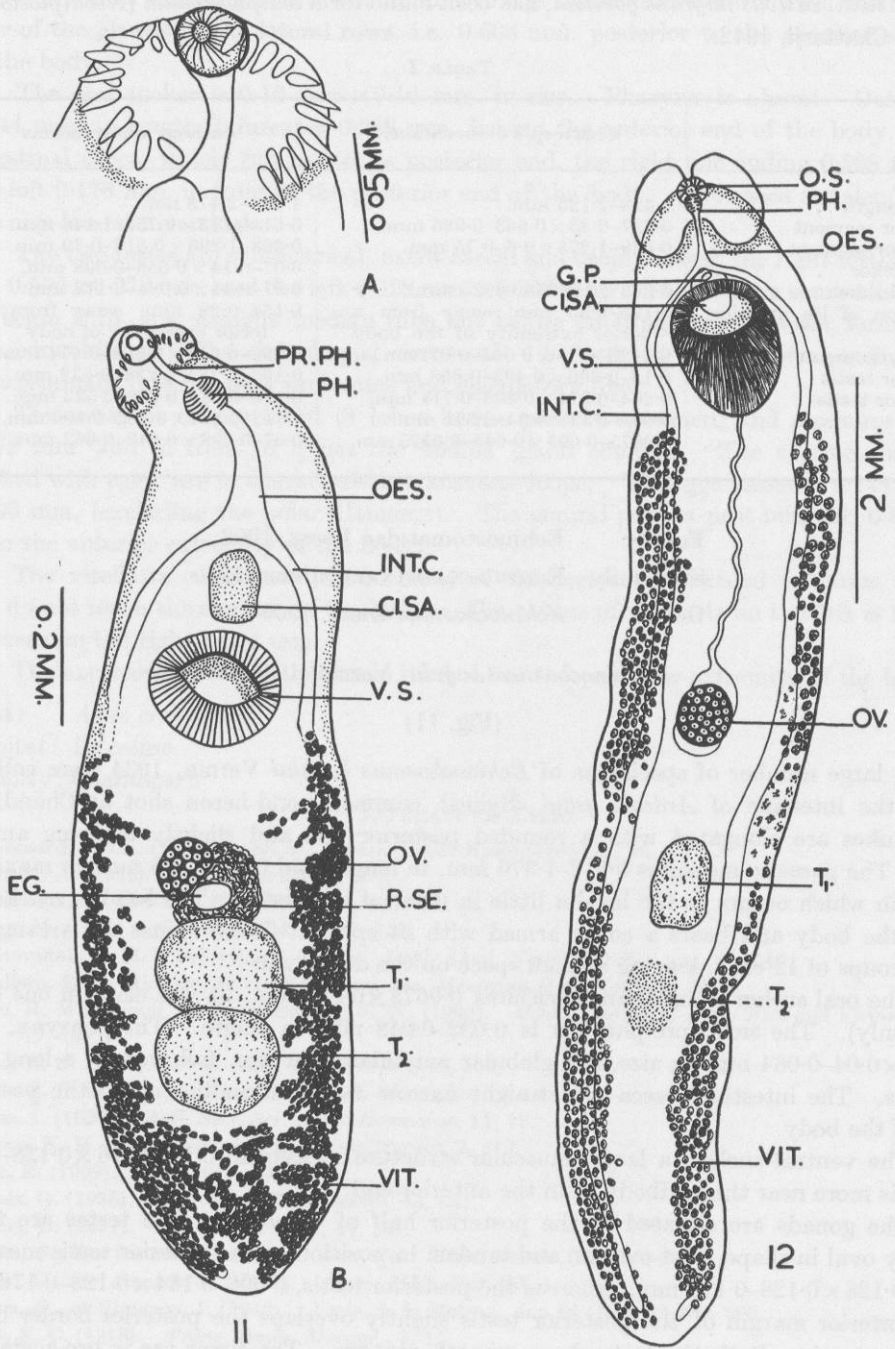
A large number of specimens of *Echinochasmus bagulai* Verma, 1934 were collected from the intestine of *Ardeola grayi* (Sykes), common pond-heron shot at Chandigarh. The flukes are elongated with a rounded posterior end and slightly tapering anterior end. The parasite measures 0.912-1.376 mm. in length and 0.18-0.376 mm. in maximum breadth which occurs at the level a little in front of the testes. The head is marked off from the body and bears a collar armed with 24 spines. These spines are arranged in two groups of 12 each, leaving a small space on the dorsal side.

The oral sucker is small and measures 0.0672 × 0.096 mm. (it was clear in one specimen only). The small pre-pharynx is 0.032-0.048 mm. in length. The pharynx, 0.04-0.064 × 0.04-0.064 mm. in size, is a globular muscular structure, followed by a long oesophagus. The intestinal caeca are straight narrow tubes extending up to the posterior end of the body.

The ventral sucker, a large, muscular structure measuring 0.112-0.16 × 0.128-0.176 mm., is more near the midbody than the anterior end.

The gonads are situated in the posterior half of the body. The testes are transversely oval in shape, post-ovarian and tandem in position. The anterior testis measures 0.08-0.128 × 0.128-0.176 mm., whereas the posterior testis, 0.096-0.144 × 0.128-0.176 mm. The anterior margin of the posterior testis slightly overlaps the posterior border of the anterior testis. Both the testes have smooth contour. The cirrus sac is pre-acetabular but behind the intestinal fork.

The ovary, 0.056-0.08 × 0.04-0.064 mm. in size, is situated a little in front of the anterior testis, slightly right to the median axis of the body. The vitellaria are confined



FIGS. 11 and 12. 11, *Echinochasmus bagulai* Verma 1934. (A) head collar magnified, (B) whole mount. 12, *Patagifer* sp.

laterally, extending from the level of the posterior border of the ventral sucker up to the posterior extremity of the body. In the post-testicular region, the vitellaria of both the sides are confluent. The eggs are few in number and large in size, measuring  $0.064 \times 0.04$  mm.

Host: *Ardeola grayi* (Sykes)

Habitat: Intestine

Locality: Chandigarh

#### Remarks

The species, *Echinochasmus bagulai* Verma, 1934, described by the author resembles the original description in all respects except for some minor differences in size of the body and its organs as given in Table II.

TABLE II

	Observations by Verma, 1935	Authors' observations
Length of the body ..	1-1.75 mm.	0.912-1.376 mm.
Breadth (maximum) ..	0.25-0.5 mm.	0.18-0.376 mm.
Collar spines ..	24	24
Oral sucker ..	0.07 mm. in diameter	0.0672 $\times$ 0.096 mm.
Ventral sucker ..	0.2 mm. in diameter	0.112-0.16 $\times$ 0.128-0.176 mm.
Prepharynx ..	0.05 mm. long	0.032-0.048 mm. long
Pharynx ..	0.042-0.059 mm. in diameter	0.04-0.064 $\times$ 0.04-0.064 mm.
Testes:		
Anterior testis ..	-	0.08-0.128 $\times$ 0.128-0.176 mm.
Posterior testis ..	-	0.096-0.144 $\times$ 0.128-0.176 mm.
Ovary ..	0.05 mm. in diameter	0.056-0.08 $\times$ 0.04-0.064 mm.
Eggs ..	0.067-0.0756 $\times$ 0.050-0.0588 mm.	0.064 $\times$ 0.04 mm.

Family **Echinostomatidae** Poche, 1926

Subfamily **ECHINOCHASMINAE** Odhner, 1910

Genus *Patagifer* Dietz, 1909

*Patagifer* sp. inq.

(Fig. 12)

A single, immature specimen of *Patagifer* sp. was recovered from the intestine of a coot, *Fulica atra* (Linn.). The fluke, creamish-white in living condition, is elongate, measuring 10.92 mm. in length and 1.956 mm. in maximum breadth which occurs in the region of the ventral sucker. The ratio between the length and the breadth of the body is 1:5.58. The head collar is well developed with distinct dorsal and ventral incisions and armed with a dorsally interrupted row of spines. The maximum number of spines which could be counted in each lobe of the head collar is 23. For want of more material the exact number of collar spines could not be ascertained.

The subterminal oral sucker measures 0.273 mm. in diameter. The ventral sucker is cup-shaped, measuring  $1.319 \times 0.095$  mm. and lying 0.890 mm. behind the collar notch.

The ratio between the oral and the ventral suckers is 1:4.83. The ratio of the length of the oesophagus to that of the body is 1:8.27.

The prepharynx is absent. The muscular pharynx,  $0.182 \times 0.1365$  mm., is followed by 0.45 mm. long oesophagus. The intestinal caeca extend up to the posterior extremity of the body. The intestinal bifurcation is 0.768 mm. behind the collar notch.

The testes are tandem in the posterior half of the body. The anterior testis measures  $0.864 \times 0.591$  mm. and is situated at a distance of 6.16 mm. from the collar notch and 0.912 mm. from the ovary. The posterior testis is not very clear, perhaps due to the immaturity of the specimen. Still its position is marked by slightly darker stain in that very region. The cirrus sac lies between the intestinal bifurcation and the ventral sucker and is mostly overlapped by the latter. It measures 0.432 mm. in length and 0.288 mm. in breadth. The genital pore is situated mesially just behind the intestinal bifurcation.

The ovary is situated in the posterior region of the anterior half of the body and measures  $0.546 \times 0.546$  mm. The Mehlis' gland complex lies posterior to it. The uterus is very feebly developed and there are no eggs in it. The vitelline follicles are confined to the lateral regions behind the ventral sucker up to the posterior end of the body covering the intestinal caeca.

The excretory pore is subterminal at the posterior extremity of the body.

Host: *Fulica atra* (Linn.)

Habitat: Intestine

Locality: Chandigarh

#### Remarks

Dorsally interrupted row of spines and dorsal and ventral incisions on the head collar are the characters which confirm the identification of the specimen as belonging to the genus *Patagifer* Dietz, 1909. For want of correct number of spines on the head collar and the detailed account of the reproductive system, its identification up to species level is not possible. Therefore it is retained as *Patagifer* sp. till the availability of more material.

Family **Prosthogonimidae** Nicoll, 1924

Genus *Prosthogonimus* Lühe, 1899

*Prosthogonimus (Macrogenotrema) cuneatus* (Rud., 1809) Braun, 1901

(Fig. 13)

A single specimen of *Prosthogonimus (M.) cuneatus* (Rud., 1809) Braun, 1901 was found floating in the albumen of hen's egg when the latter was cut open. The parasite is pyriform in shape, having broadly rounded posterior end and the narrow anterior. The body measures 8.981 mm. in length and 4.368 mm. in maximum breadth which occurs across the testicular region.

The subterminal oral sucker measures  $0.609 \times 0.637$  mm. The ventral sucker,  $0.846 \times 0.91$  mm. in size, lies 2.366 mm. behind the anterior end of the body. The ratio between the lengths of the two suckers is 1:1.43 and the ratio between the length of the ventral sucker and that of the body is 1:10.6.

The pharynx is globular,  $0.182 \times 0.273$  mm. in size. The oesophagus is a short tube measuring  $0.455$  mm. in length. It divides into two intestinal caeca which extend up to a little behind the testes, i.e. they terminate far in front of the posterior extremity of the body.

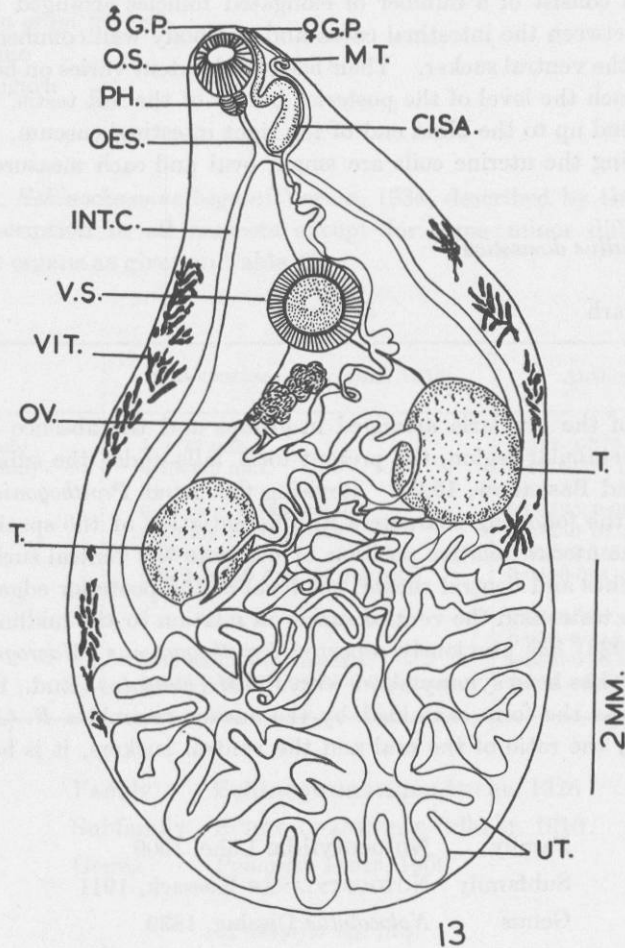


FIG. 13. *Prosthogonimus cuneatus* (Rud., 1809) Braun, 1901.

The gonads are post-acetabular. The testes, two in number, are diagonally situated in the middle third of the body. The left testis,  $1.365 \times 1.183$  mm. in size, is slightly cephalad to the right testis which measures  $1.275 \times 1.001$  mm.

The cirrus sac is a somewhat sinuous, tubular sac lying to the left of the oesophagus and extends from the level of the intestinal fork up to the genital atrium into which open both the male and the female genital ducts. The genital pores of both the ducts lie to the left of the median axis at the anterior end of the body at the level of the outer edge of the oral sucker.

The ovarian mass consists of a number of lobes and is pre-equatorial in position. The uterus, having both descending and ascending coils, fills up almost the whole of the

post-testicular region of the body. In the pre-acetabular region it runs as an ascending, slightly coiled tube but in front of the intestinal fork it continues along with and left to the cirrus sac, opening ultimately into the genital atrium, independent of the male genital pore.

The vitellaria consist of a number of elongated follicles arranged in groups. They extend laterally between the intestinal caeca and the body wall commencing at the level a little in front of the ventral sucker. Their backward extent varies on both sides. Those on the left side reach the level of the posterior border of the left testis, whereas those on the right side extend up to the blind end of the right intestinal caecum.

The eggs, filling the uterine coils are small, oval and each measures 0.024-0.0275 × 0.0143-0.0165 mm.

Host: *Gallus gallus domesticus*

Habitat: Oviduct

Locality: Chandigarh

#### Remarks

On account of the vitellaria arranged in groups and the absence of heavy uterine coils in the pre-acetabular region, the present form falls under the subgenus *Macrogenotrema* (Skrjabin and Baskakow, 1925). Revising the genus *Prosthogonimum* Lühe, 1899, Panin, 1957 used the following characters in differentiation of the species: the degree of development of the uterus, relative position of ovary to the ventral sucker and of uterus to intestinal branches and ventral sucker, the level of the posterior edge of vitellaria and the position of the testes and the ventral sucker in relation to the midline of the body.

Srivastava (1938) has previously reported *Prosthogonimum* (*Macrogenotrema*) *indicus* (from India) which has been synonymized with *P. (M.) cuneatus* (Rud., 1809) Braun, 1901 by Panin, 1957. As the form examined by the author resembles *P. (M.) indicus* in all respects except for the ratio of the oral and the ventral suckers, it is being described as *P. (M.) cuneatus*.

Family      **Notocotylidæ** Lühe, 1909  
 Subfamily   **NOTOCOTYLINÆ** Kossack, 1911  
 Genus        *Notocotylus* Diesing, 1839

*Notocotylus attenuatus* (Rud., 1809) Kossack, 1911

(Fig. 14)

A single specimen of *Notocotylus attenuatus* was collected from the intestine of a wild duck, *Anas creaca*. The fluke measures 4.704 mm. in length and 1.104 mm. in maximum breadth which occurs in the 2nd half of the body. The ventral glands are in three longitudinal rows, i.e. two lateral and one median. Each lateral row contains 17 glands. In the middle row 13 glands have been clearly seen. Taking into consideration the pattern of distribution of the glands, it seems that there may be one more gland in the middle row, thus raising its total number up to 14 but not exceeding 15 in any case. The first pair of ventral glands in the lateral rows is situated 0.528 mm. behind the anterior

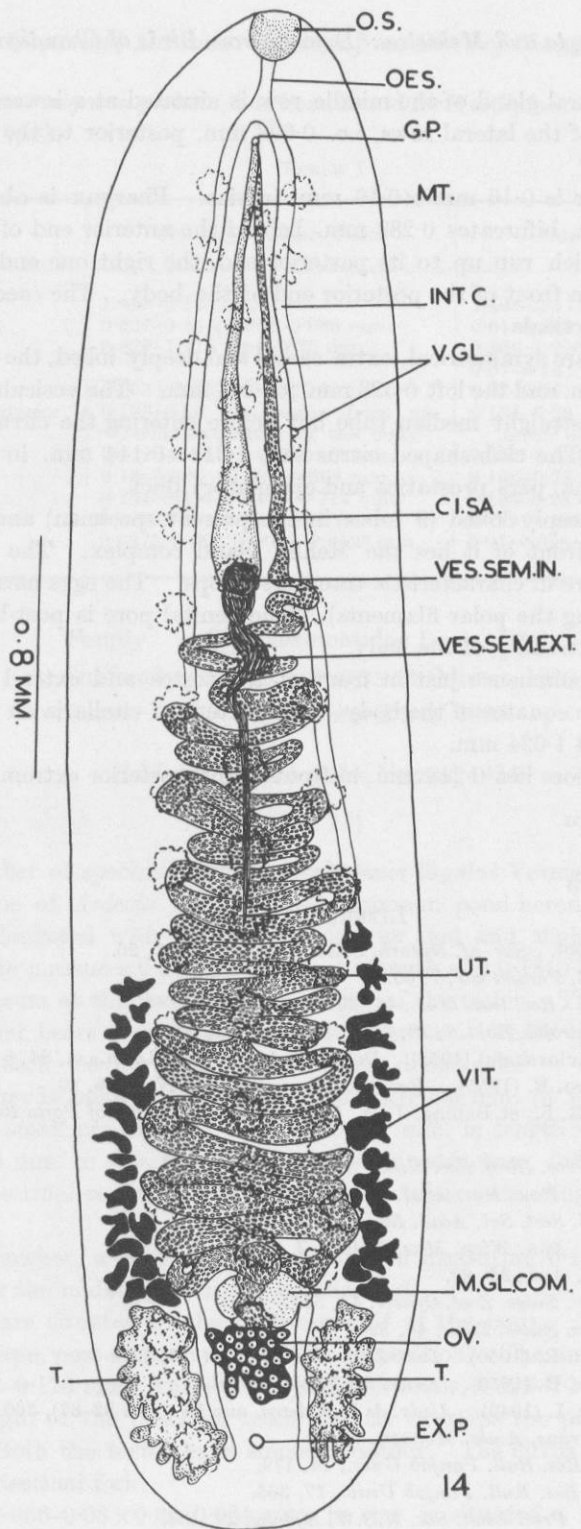


FIG. 14. *Notocotylus attenuatus* (Rud., 1809) Kossack, 1911.

end. The first ventral gland of the middle row is situated at a lower level than the first pair of the glands of the lateral rows, i.e. 0.608 mm. posterior to the anterior extremity of the body.

The oral sucker is 0.16 mm.  $\times$  0.16 mm. in size. Pharynx is absent. Oesophagus, 0.144 mm. in length, bifurcates 0.288 mm. behind the anterior end of the body into two intestinal caeca which run up to its posterior end, the right one ending 0.208 mm. and the left 0.176 mm. in front of the posterior end of the body. The caeca are slender without any lateral diverticula.

The two testes are symmetrical, extra caecal and deeply lobed, the right testis measuring 0.592  $\times$  0.272 mm. and the left 0.528 mm.  $\times$  0.204 mm. The vesicula seminalis externa, to begin with, is a straight median tube but before entering the cirrus sac, forms one or two convolutions. The club-shaped cirrus sac, 1.312  $\times$  0.144 mm. in size, encloses vesicula seminalis interna, pars prostatica and ejaculatory duct.

The ovary is deeply lobed (9 lobes in the present specimen) and measures 0.248  $\times$  0.272 mm. and in front of it lies the Mehlis' gland complex. The uterine coils, fully packed with eggs, are in characteristic transverse loops. The eggs measure 0.144–0.168  $\times$  0.096 mm. (excluding the polar filaments). The genital pore is post-bifurcal, 0.608 mm. from the anterior extremity of the body.

The vitellaria commence just in front of the testes and extend for some distance but do not reach the equator of the body. The extent of vitellaria on the left is 1.2 mm., whereas on the right 1.024 mm.

The excretory pore lies 0.248 mm. in front of the posterior extremity of the body.

Host: *Anas creaca*

Habitat: Intestine

Locality: Chandigarh

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