STUDIES ON THE TREMATODE FAUNA OF INDIA.

Part III. Subclass DIGENEA (*Gasterostomata*)

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CONTENTS.

I. General.

Trematode parasites form an important group in the study of helminth fauna of India but unfortunately, so far, there is no compact publication dealing with them in a comprehensive way. An attempt has, therefore, been made in this series to fill up that void. This paper is the first publication in the series and deals with Indian gasterostome trematode parasites. Parts dealing with other groups, *e.g.* Monogenea, Aspidogastrea, Prosostomata, etc., are under preparation and will come out in due course.

The Class *Trematoda* is divided into three Subclasses : A. *Monogenea* B. *Aspidogastrea*, C. *Digenea*. They represent generally three, different ecological habitats of the Orders. The representatives of the Subclass Monogenea are mostly minute forms, usually found as external parasites, clinging to the skin, gills of fishes, lining of buccal cavity, pharynx, urinary bladder of amphibians, etc. and as the name indicates are believed to have direct life-history. The forms belonging to Subclass Aspidogastrea penetrate more deeply into the body of the host than do most Monogenea and their adhesive apparatus is characteristic. It occupies almost the entire ventral surface of the body, consisting of numerous suckerlets or *alveoli* arranged in one or three to four rows, somewhat like the 'foot' of a gastropod mollusc. Most of the other trematodes belong to the Subclass Digenea, which are found as internal

parasites, have well defined oral and or ventral suckers and indirect life-history. The main characters, defining the three Subclasses are more or less as follows :—

Key to Subclasses of Class TREMATODA—

A. Main adhesive apparatus a postero-ventral disc, or one or a number of suckers set upon a disc or upon surface of body, sometimes supplemented by hooks and hooklets. Other adhesive organs, when present, various types of suckers situated near anterior extremity. Excretory pores paired, situated in anterior region. Genital pore or pores also anterior. Parasites living on skin or in other superficial locations of vertebrates, specially on the gills of fishes	MONOGENEA.
B. Main adhesive apparatus a single row of suckerlets or alveoli set upon the ventral surface of the body, or three or four longitudinal rows of alveoli set upon an enormous posterior (ventral) disc, which lacks hooks or hooklets. Other adhesive organs weakly developed or unpresented. Excretory and genital pores as in C ; endoparasites of vertebrates, specially fishes and chelonians, but also of mollusca and crustacea	ASPIDOGASTREA.
C. Main adhesive apparatus, when present, a solitary cup-shaped sucker, situated somewhere on the ventral surface, of the body. Other adhesive organ, when present, a weak oral sucker encircling the mouth. Excretory pore single and posterior. Genital pore or pores ventral, generally in the anterior region, between the suckers. Vaginal pore or pores absent. Opening of Laurer's canal dorsal, near the posterior extremity ; endoparasites of every class of vertebrates, and of some invertebrates	DIGENEA.

II. GENERAL ACCOUNT OF THE ORDER GASTEROSTOMA.

The general morphology and anatomy of Gasterostomes, family Bucephalidae, is peculiar in many and various ways from that of Prosostomate distomes. Therefore, their study is of significance specially from the phylogenetic point of view. Their general pattern is very peculiar though simple, in comparison to that of the monogenetic and other digenetic trematodes, in as much as they show certain resemblances in anatomy to Rhabdocoelid Turbellarians. The following brief, general description of the group will therefore be found of interest.

The representatives of this group are very small, almost transparent forms, usually with the anterior end flattened and the posterior cylindrical. Their oral or mouth opening is placed on the ventral surface of the body instead of the usual anterior terminal position of other trematodes. It is

not guarded by any oral sucker and is a simple, usually crescent shaped, insignificant slit. This is immediately followed by a well developed more or less spherical, muscular pharynx, which leads into a simple, sac-shaped intestinal caecum, the group resembling in this respect most of the Rhabdocœlid Turbellarians. The position of oral opening and muscular pharynx is very much variable even in the same species. It is, however, situated mostly in antero-posterior direction and is never terminal. It may be anterior, posterior or at the level of the gonads, testes and ovary. The intestinal caecum is usually median in disposition and has its blind end usually directed anteriorly but in a few cases it may be directed posteriorly, even in the specimens of the same species. This is also not a constant character.

The cuticle in the group is very thin, and densely covered with backwardly directed minute spines specially towards the anterior end. Their size and density of distribution decreases towards the posterior end.

The head or anterior end of these parasites is furnished with fixation organs, a character used as basis for classification in systematic studies in the group. They are in the form of retractile tentacles on an anterior sucker, as in the case of the genus *Bucephalus* Baer, 1827 ; an anterior sucker alone in *Bucephalopsis* (Diesing, 1855) ; a sucker with a hoodlike process in the genus *Rhipidocotyle* Diesing, 1858, and *Dolichoenterum* Ozaki, 1924 ; a rhynchus or anterior rostellum as in the genus *Prosorhynchus* Odhner, 1905 and *Neidhartia* Nagaty, 1937 and a rhynchus and tentacles as in the genus *Alcicornis* MacCallum, 1917.

The male genital organs are composed of two, compact, spherical, testes typically placed towards the right side, in tandem position or sometimes obliquely situated. The two vas deferens join to form the vasa efferentia, which enters the cirrus sac. Cirrus sac is a well developed elongated organ, situated at the posterior end, towards the left side. It contains anteriorly a comparatively large, usually ovoid vesicula seminalis interna, leading into a spindle shaped, pars prostatica, followed posteriorly by cirrus proper. Prostate gland cells are distributed in the space between the wall of cirrus sac and pars prostatica. Cirrus sac opens subterminally on the ventral side at the posterior end, together with the terminal part of the uterus in a common genital atrium.

The female genital organs are composed of a spherical ovary, usually slightly smaller than the testes, situated anterior to the anterior testes, towards the right side except in the genus *Dolichoenterum* Ozaki, 1924, in which it is situated in between the two testes and in the genus *Neidhartia* Nagaty, 1937, in which it is situated on left side of the testes. Oviduct, arising from the ovary, receives two common vitelline ducts, a very fine Laurer's canal and continues as uterus. Uterine coils generally extend anteriorly upto the anterior limit of vitellaria and its posterior end opens into the common genital atrium. Eggs are small, numerous, golden yellow in colour, oval in shape, thin shelled, with an operculum on the narrow pole but with no lateral spines or filaments. Receptaculum seminis is generally absent. The vitelline glands are composed of spherical follicles, distributed generally in the anterior region, in two lateral bands or groups or in the form of an anterior arch. This combination

may be found in the specimens of the same species and is not considered to be a reliable character for taxonomic studies. The number of vitelline follicles varies slightly on two sides and in different species, the left set opposite the ovary—usually extending further posterior than the right set. The two lateral vitelline ducts meet the oviduct posterior to the ovary.

The excretory vesicle is generally a simple, elongated, sac-shaped vessel; Y shaped in some forms, opening at the posterior end, except perhaps in *Prosorhynchus uniporus* Ozaki, 1924, in which it probably opens in the common genital sinus.

III. SYSTEMATIC ACCOUNT.

Subclass DIGENEA.

This Order is further sub-divided to two Orders, which can be differentiated as follows :—

A. Mouth situated near the middle of the body	Order *Gasterostomata.*
B. Mouth situated near the anterior extremity	Order *Prosostomata.*

Order GASTEROSTOMATA Odhner, 1905.

Syns. *Alcicornida* Poche, 1926 (Superfamily)
Bucephalata La Rue, 1926 (Suborder)
Bucephaloidea Dollfus, 1929 (Superfamily)

The Gasterostomes are digenetic trematode parasites which depart from the usual concepts of trematode structure in that the anterior sucker is unrelated to the mouth opening. The simple rhabdocoelic gut opens on the ventral surface of the body. This unique location of the mouth led Odhner (1905) to apply the descriptive name Gasterostomata to the Order.

Diagnosis : Mouth ventral, near the middle of the body. Haptor a muscular sucker with or without tentacles, or a rhynchus, at the anterior extremity. Intestine sac-like. Genital pore ventral, near the posterior extremity. Gonads globular, generally near the mid-body or posterior Vitellaria located in the anterior region. Uterus having 2 or 3 folded limbs. Cercaria furcocercous. Development with exchange of hosts.

This group occurs mainly in fishes and contains a solitary family, *Bucephalidae.*

Family BUCEPHALIDAE Poche, 1907

Gasterostomidae Braun, *1883.*

Syns. Alcicornidae Poche, 1926.

Diagnosis. : with the characters of the Order.

The oldest recorded species of this group, dates back to Rudolphi who described *Monostomum crucibulum, M. galeatum* and *Distoma gracilescens,* in 1819. Baer (1827) introduced the first generic name *Bucephalus* to accommodate certain encysted cercariae under the name *Bucephalus polymorphus.* Siebold (1848) proposed the genus *Gasterostomum* for an adult trematode, which he named as *G. fimbriatum* and observed the similarity between his species and *Bucephalus polymorphus.* Wagner (1858) regards *B. polymorphus* Baer, 1827 as the larval form of *Gasterostomum fimbriatum* Siebold, 1848 and thus the generic name

Gasterostomum fell into synonymy to *Bucephalus* Baer, 1827. Consequently Poche (1907) changed the family name *Gasterostomidae* to *Bucephalidae*. On this ground some authors regard even the Order *Gasterostomata* as Order *Bucephalata* or *Bucephalida* or superfamily *Bucephaloidea*, etc.

Members of this family are mostly found as adult parasites in the guts of marine and freshwater fishes and larval stages encysted in the nerves.

Representatives of this family were recorded for the first time in India by Verma (1936).

Nicoll (1914) on the basis of the nature of the anterior sucker divided the family into two subfamilies, which can be distinguished as follows:—

Key to Subfamilies of Family BUCEPHALIDAE.

A. Anterior adhesive organ a sucker	*BUCEPHALINAE*, Nicoll, 1914
B. Anterior adhesive organ a rhynchus	*PROSORHYNCHINAE*, Nicoll, 1914.

Eckmann (1932) did not recognize subfamilies but some others like Nagaty (1937), Manter (1940a), Chauhan (1943), Dawes (1946), and Dayal (1948) have followed the classification.

A. Subfamily *BUCEPHALINAE* Nicoll, 1914.

Syn. *Gasterostominae* Bräun, 1883.

The subfamily contains, at present, five genera : *Bucephalus* Baer, 1827 ; *Bucephalopsis* (Diesing, 1855), Nicoll, 1914 ; *Rhipidocotyle* Diesing, 1858 ; *Dolichoenterum* Ozaki, 1924 and *Neobucephalopsis* Dayal, 1948. They can be differentiated by the following key :—

Key to Genera of Subfamily BUCEPHALINAE.

A. Ovary situated in between the two testes	*Dolichoenterum.*
Ovary situated anterior to anterior testis	B.
B. I. Anterior end provided with a muscular sucker, having a circlet of six or seven muscular, retractile tentacles or fimbriae	*Bucephalus.*
II. Anterior end provided with a weak shallow sucker surmounted by a fan shaped hood	*Rhipidocotyle.*
III. Anterior end provided with a simple, globular, muscular sucker only	IV.
IV. Receptaculum seminis absent	*Bucephalopsis.*
Receptaculum seminis present	*Neobucephalopsis.*

(i) Genus **Bucephalus** Baer, 1827

Syns. *Gasterostomum* Siebold, *1848.*

Eubucephalus Diesing, 1855.

The genus was created by Baer (1827) for a new furcocercous cercaria, *Bucephalus polymorphus*, the name denoting a likeness to the head of an ox and the extended tentacles being comparable to horns. The tentacles show specific differences in shape and number. They are conspicuous when extended but are invariably very inconspicuous in retracted condition, when they appear only as small papillae.

Generic diagnosis : *Bucephalinae* Nicoll, 1914, with Subfamily characters.

Body elongate or ovate. Cuticle covered with spines. Anterior end possesses tentacles as well as a sucker on the ventral surface. Oral aperture on the ventral surface, removed from the anterior or the posterior extremities. Oral sucker absent. A well developed muscular pharynx present. Intestinal caecum simple, sac-shaped. Testes two, smooth contoured. Cirrus-sac at the posterior half, towards the left side of the body. Ovary smooth contoured, anterior to the testes. Vitelline glands in two groups, in the anterior half of the body and are either separate or may meet together forming an arch. Excretory vesicle simple, a tubular sac—

Type species : *Bucephalus polymorphus* Baer, 1827.
syns. *Distoma campanula* Dujardin, 1845.
Gasterostomum fimbriatum Siebold, 1848.
Gasterostomum laciniatum Molin, 1859.
Bucephalus elegans Woodhead, 1930.
Bucephalus varicus Manter, 1940.

The following species of the genus have been recorded, so far, from the Indian region :—

(1) *Bucephalus tridenticularia* Verma, 1936.
(2) *B. aoria* Verma, 1936.
(3) *B. jagannathai*, Verma, 1936.
(4) *B. indicus* Srivastava, 1938.
(5) *B. gangeticus* Srivastava, 1938.
(6) *B. barina* Srivastava, 1938.

They can be distinguished by the following key :—

Key to India Species, of Genus Bucephalus.—

(1)	Tentacles four in number	*B. gangeticus.*
	Tentacles more than four in number .	2.
(2)	Tentacles five in number	*B. barina.*
	Tentacles more than five in number	3.
(3)	Tentacles six in number	4.
	Tentacles more than six in number	5.
(4)	Tentacles with two lateral processes .	*B. indicus.*
	Tentacles with a single inwardly directed process	*B. jagannathai.*
(5)	Tentacles eight in number	*B. tridenticularia.*
	Tentacles more than eight in number .	*B. aoria.*

1. **Buchephalus tridenticularia** Verma, 1936.

Dawes, B. (1946). The Trematoda. Cam. Univ. Press., Lond : 192.

(TEXT-FIG. 1.)

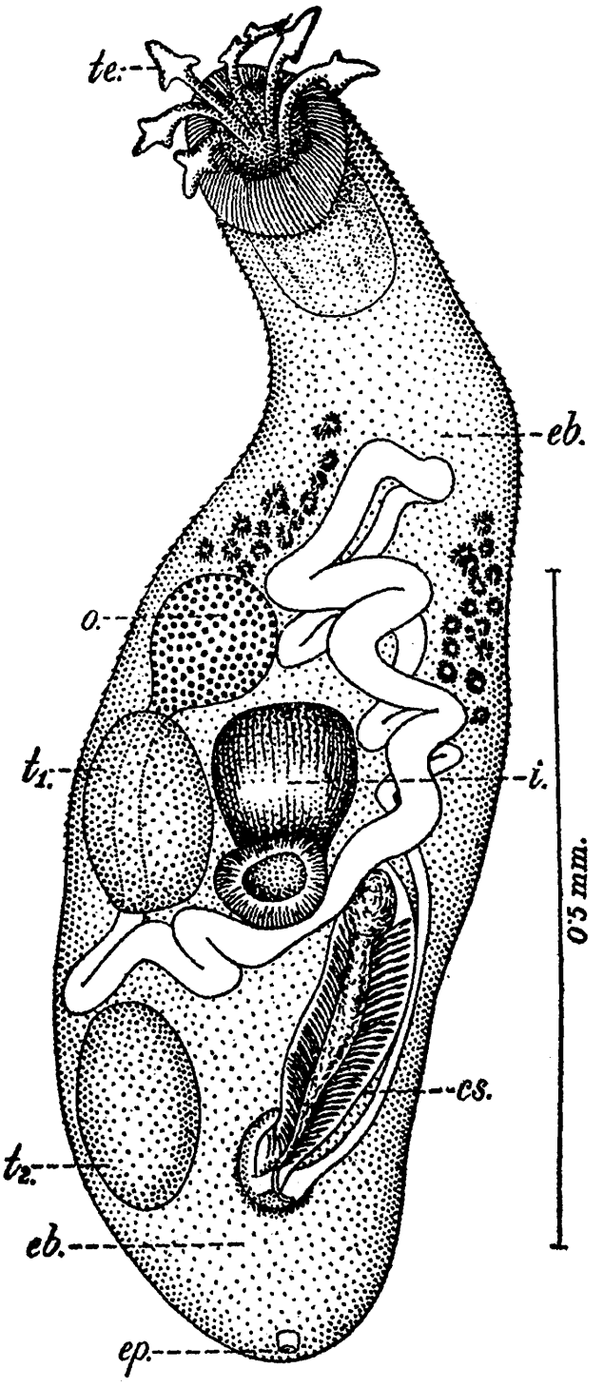
Srivastava, H.D. (1938) *Indian J. vet. Sci.* 8(4) : 321.

Specific diagnosis : *Bucephalus* Baer, 1827 ; with Generic characters.

Body elongate, anteriorly narrower ; length 1·07-1·75 ;* greatest width, in the region of pharynx, 0·38—0·46. Anterior sucker prominent,

*All measurements in this paper are given in millimetres unless otherwise stated.

0·125 in diameter, subterminal, with eight, arrow, head-like tentacles, having 2 lateral processes on opposite sides of the main stem ; 0·026 long 0·013—0·016 broad. Pharynx 0·08—0·11 in diameter, at one-third length of body from hinder end. Intestinal sac anteriorly directed, 0·16—0·38 long, reaching middle of body. Ovary 0·15 in diameter



Text-fig. 1.—*Bucephalus tridenticularia* : entire specimen; ventral view (after Verma).

cs, Cirrus sac; *eb*, Excretory bladder; *ep*, Excretory pore; *i*, Intestine; *o*, Ovary; t_1, Anterior testis; t_2, Posterior testis; *te*, Tentacle.

globular, right sided, situated just ahead of equatorial line or beside intestinal sac. Uterine coils in mid-vitellarial field, between posterior-testis and anterior level of vitellaria. Vitelline follicles minute, 0·018-0·02 in diameter, extending from front margin of intestine or ovary to midway between intestine and anterior sucker, numbering 14-20 on each side. Testes oval, larger than ovary, anterior one behind ovary,

0·14—0·2×0·12—0·16 ; posterior far behind to right of cirrus sac, 0·13-0·19×0·15—0·18. Cirrus pouch large, on left side, 0·29—0·53 long, 0·07—0·12 broad. Genital pore ventral, 0·05—0·15 from posterior end. Eggs light yellow, 0·0189—0·020×0·013—0·015. Excretory bladder elongated, broadly tubular. Excretory pore postero-terminal.

Host—*Aoria aoria=Macrones aoria*, Day and *Aoria seenghala=Macrones seenghala*, Day.

Habitat.—Small intestine, hinder region.

Locality.—Allahabad, India.

2. **Bucephalus aoria** Verma, 1936.

(TEXT-FIG. 2.)

Dawes. B. (1946). The Trematoda. Camb. Univ. Press., Lond. : 192.

Specific diagonosis :—*Bucephalus* Baer, 1827, with Generic characters.

Size small, shape elongate, slightly broader about its middle, measuring 0·8-1·0 in length and 0·25-0·27 in maximum width, in unpreserved state. Length in preserved specimens 0·5-0·6. Anterior sucker placed ventrally measuring 0·118-0·14 in diamteter, bearing along its latero-dorsal margin 14-22 short processes or fimbriae. Pharynx round, situated behind the middle of body, diamter 0·6. Oesophagus short. Intestine sac-like, directed anteriorly or dorso-laterally, measuring 0·125 in length and 0·05-0·067 in breadth in life. Ovary round, lying about the middle length of the body towards the right side, measuring 0·06-0·08 in diameter. Vitelline follicles arranged in two compact masses, one on each side of the body, extending from the level of anterior margin of ovary to midway between it and the sucker. They are minute, varying 16-20 in number on each side, measuring 0·01-0·014 in diameter. Testes nearly oval or somewhat triangular in outline, nearly as big as the ovary, varying in position ; the anterior situated closely behind the female gonad and measuring 0·06×0·04, the posterior lying on the same side as the anterior, separated from it by a distance nearly equal to half its length or lying on the opposite of the body, with the pharynx intervening between it and the anterior testis. It measures 0·05-0·08×0·04-0·06. Cirrus sac nearly equal to one fourth the body length. Genital sinus large, with the bifid muscular tongue inside, surrounded by a narrow circle of unicellular glands. Genital pore subterminal. Egg light yellow in colour, 0·012-0·016×0·0106-0·011 in size.

Host.—*Aoria aoria=Macrones aoria* Day.

Habitat.—Small intestine.

Locality.—Allahabad.

Species created provisionally by Verma (1936).

3. **Bucephalus jagannathai** Verma, 1936.

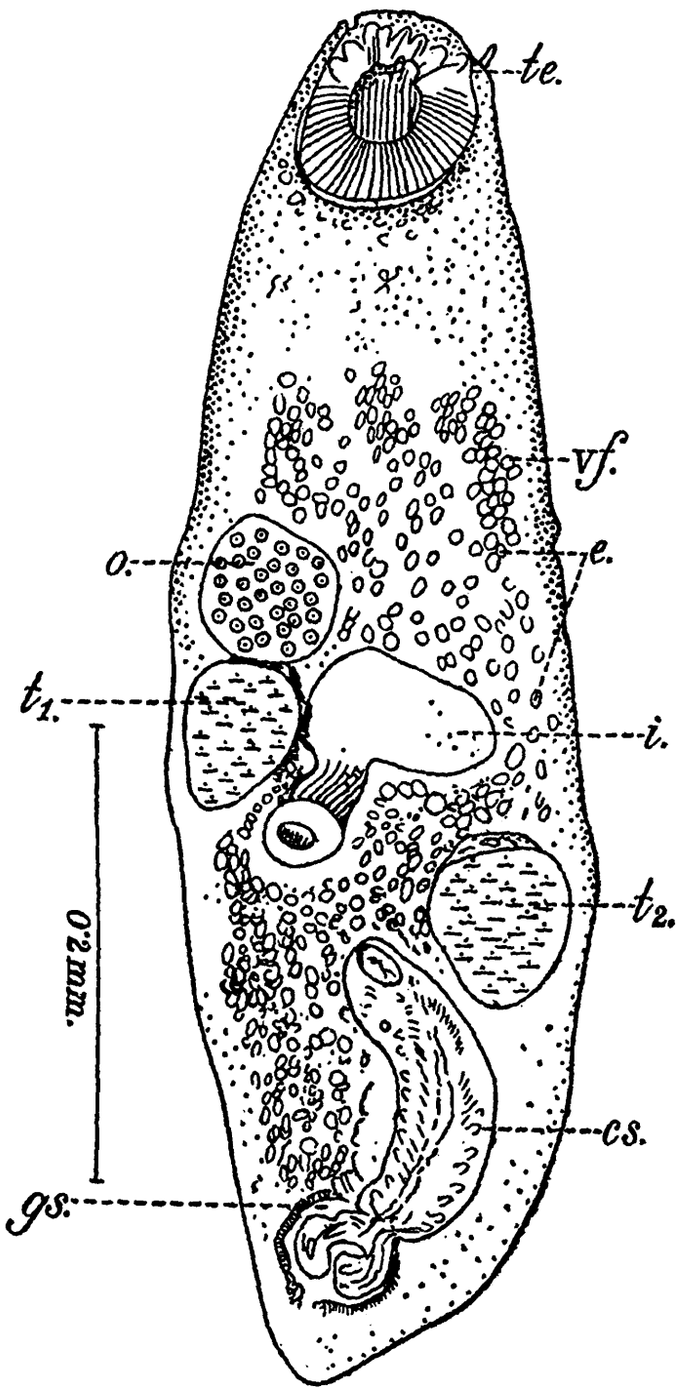
(TEXT-FIG. 3.)

Srivastava, H.D. (1938), *Indian J. vet. Sci.* **8** (4) : 320.

Specific diagnosis. : *Bucephalus* Baer, 1927 ; with Generic characters.

In balsam mounts 1·1-1·7 long by 0·42-0·54 broad, in region of

ovary or intestine. Sucker shallow, ventro-terminal, usually scoop shaped, 0·166-0·193×0·11-0·17 Cephalic tentacles six, each 0·7-0·9 long and 0·016-0·017 broad near middle, where it gives off a short lateral process. Pharynx equatorial, feeble, partly or wholly overlapped by ovary and shell glands, 0·17 in diameter. Intestine sac like, short, 0·15-0·17×0·117-0·126 in size, bent over oesophagus. Gonads packed

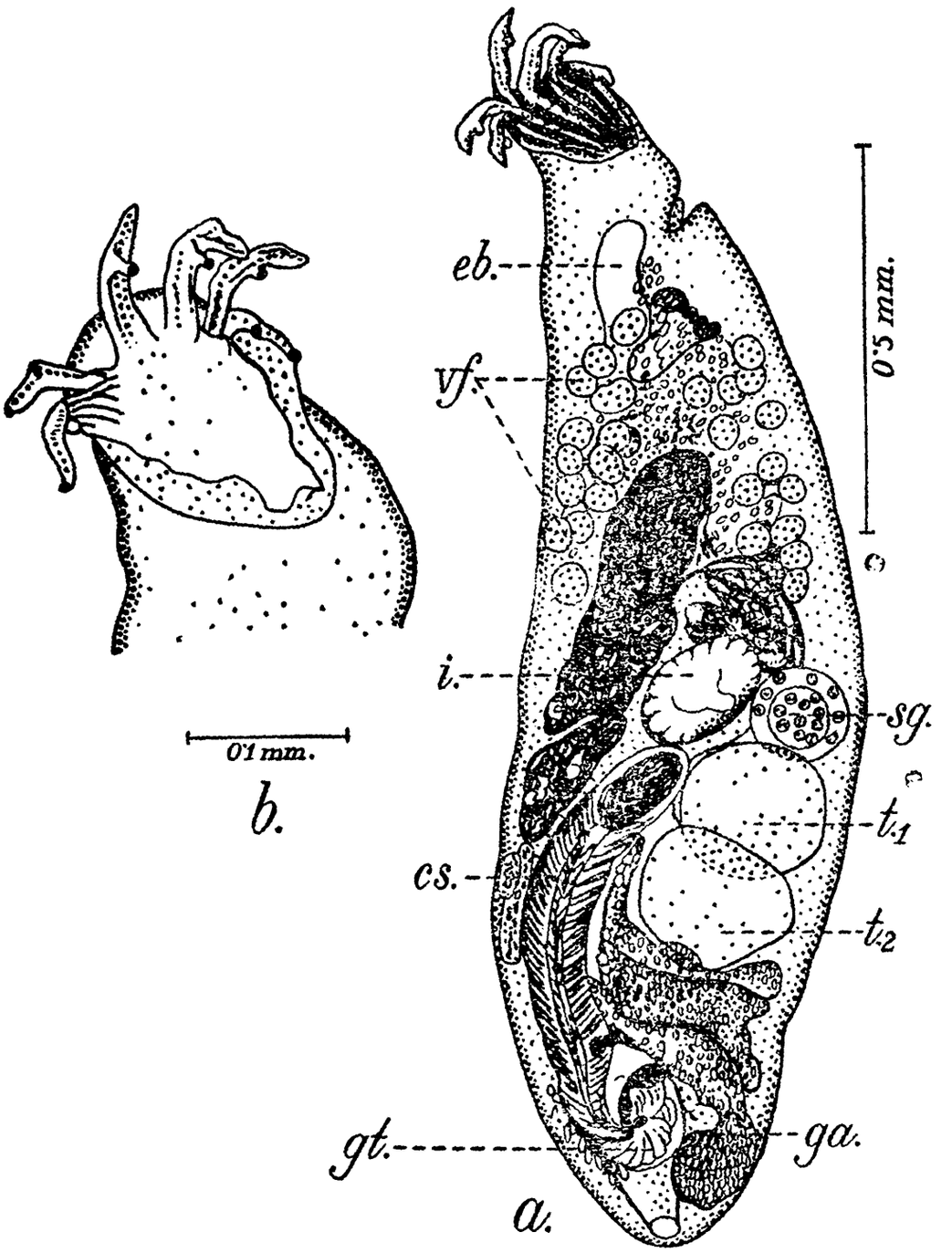


Text-fig. 2. *Bucephalus aoria*; entire specimen, ventral view (after Verma).

cs, Cirrus sac; *e*, Egg; *gs*, Genital sinus; *i*, Intestine; *o*, Ovary; t_1, Anterior testis; t_2, Posterior testis; *te*, Tentacle; *vf*, Vitelline follicles.

together, usually overlapping one another, mostly in third fourth of body. Ovary 0·42-0·84 in diameter, lateral to intestine, near commencement of third quarter of body. Uterine coils extend from near genital atrium to anterior level of vitellaria. Vitellaria lateral, at somewhat unequal levels, in second quarter of body; follicles large, rounded, 0·042—0·058 in diameter, 14-15 in number on the ovarian side, 16-17 on the other.

Testes larger than ovary, partly overlapping one another, along inner side of anterior half of cirrus sac : anterior 0·18—0·23 in diameter, in close contact with ovary or slightly overlapping, posterior smaller than or nearly equal to anterior. Cirrus sac 0·38-0·55×0·08-0·11, sickle



TEXT-FIG. 3.—*Bucephalus jagannathai* ; *a.* entire specimen, ventral view ; *b.* Cephalic part of same showing tentacles (after Verma).

cs, Cirrus sac ; *eb*, Excretory bladder; *ga*, Genital atrium ; *gt*, Genital tongue *i*, Intestine ; *sg*, Shell glands ; t_1, Anterior testis ; t_2, Posterior testis ; *vf*, Vitelline follicles.

shaped, about one third as long as body, to level of front margin of anterior testis. Genital atrium 0·126—0·18 in diameter, 0·09-0·134 ahead of hind end. Genital tongue well developed, muscular, protrusible beyond genital pore. Genital pore ventroterminal, leading into atrium by short sinus. Excretory bladder broadly tubular, to midway between

vitellaria and sucker; pore postero-terminal. Eggs numerous, light to deep yellow, broadly oval, 0·0186-0·0199×0·0116-0·0133.

Host.—Spotted mackerel, *Cymbium guttatum* (Bl. & Schn.).
Habitat.—Lower intestine.
Locality.—Puri, Bay of Bengal.

4. **Bucephalus indicus** Srivastava, 1938.

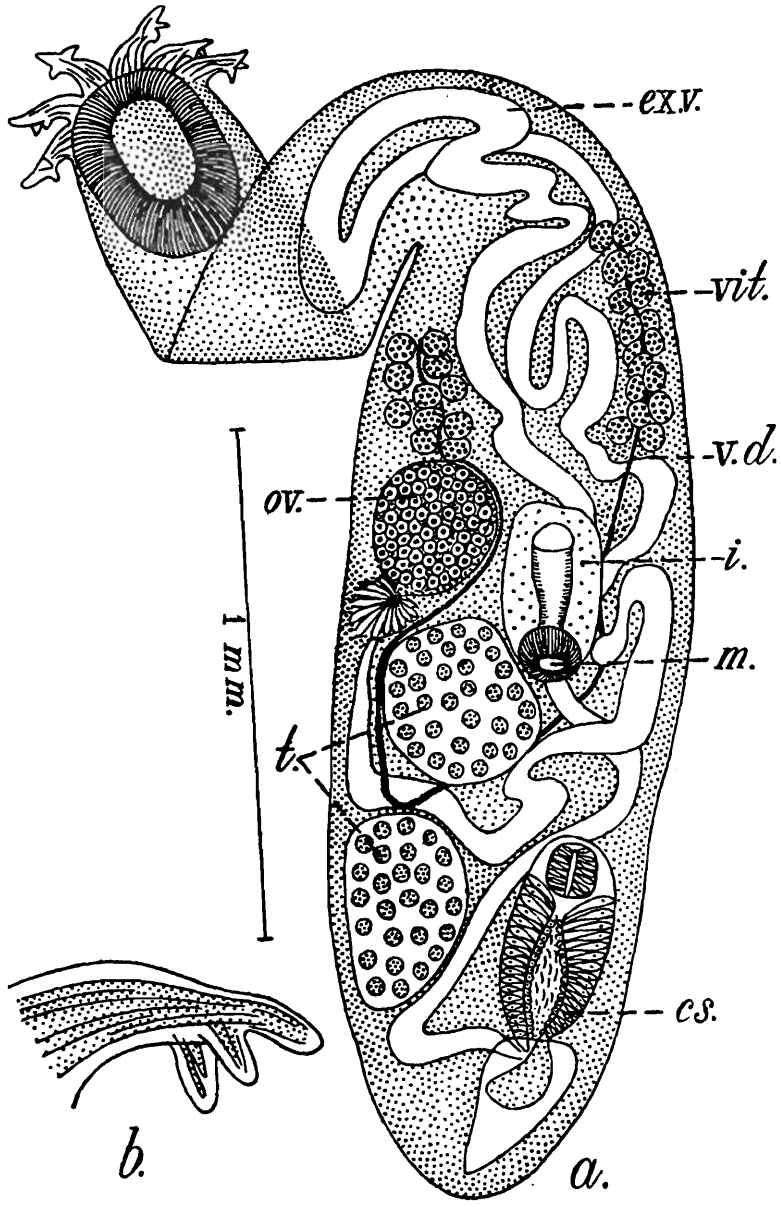
(Text-fig. 4 : a,b.).

Specific diagnosis : *Bucephalus* Baer, 1927, with Generic characters.

Body elongate, somewhat cylindrical, with broadly rounded ends studded with minute backwardly directed spines, more closely set in the anterior part of the worm, measuring 1·4-3·2 in length and 0·28-0·68 in maximum breadth (across the level of the pharynx). Anterior sucker measuring 0·16-0·36×0·14-0·24, with a crown of six well developed and contractile tentacles, having a broad triangular base and two fairly well developed lateral processes on either side. Pharynx circular, 0·08-0·14 in diameter, situated in midline, at about the middle posterior third of body length. Mouth ventral. Oesophagus bottle shaped, 0·06-0·18 in length. Intestine simple, ovoid sac, measuring 0·24-0·4×0·12-0·2, extending forward from pharynx to anterior level of ovary. Testes two, varying in size and shape, situated tandem on left side, separated by uterine coil and the vitelline duct of right side, usually in the first two third of the posterior third of body. Anterior testis 0·14-0·32×0·12-0·32. Cirrus sac elongate, oval, measuring 0·3-0·5×0·06--0·2, extending anteriorly almost to the level of the anterior limit of the posterior testis, enclosing a small ovoid vesicula seminalis, measuring ·06-0·14×0·04-0·12 and spindle shaped. Pars prostatica 0·16-0·36×0·14-0·1 in size, surrounded by prostate glands and a narrow ductus ejaculatorius, measuring 0·06-0·14 in length, having a cuticular lining and opening into a roughly triangular genital sinus, at the base of the tongue like structure, known as genital tongue or cone. Genital sinus surrounded by numerous gland cells. Genital pore subterminal on the ventral surface, a little in front of the hinder end. Ovary spherical, 0·1-0·26 in diameter, lying at the junction of second and posterior third of body length, close in front of anterior testis, separated from it by the compact shell gland complex and vitelline duct of left side. Shell gland complex lies between the left body wall, ovary and anterior testis. Laurer's canal small, starting from the oviduct just before it receives the common vitelline duct. Vitelline glands composed of small and compact, pear-shaped or oval follicles, arranged roughly in pairs along each side of the body, extending longitudinally from the anterior margin of ovary to first third of body length, aggregated into a compact mass in contracted specimens. Initial part of uterus runs backward and passing between the two testes, crosses over to the opposite side, continuing anteriorly into an irregular coil upto the first sixth of the body length and then turning backwards, opening into the genital sinus. It is full of light yellow coloured eggs measuring 0·023-0·027×0·014 in size, oval in shape, with a small knob at one end.

Excretory bladder straight, tubular, extends from a little in front of the anterior limits of the vitellaria to the excretory pore, situated close to the genital opening.

The species resembles *B. jagannathai*, in its number of tentacles, but differs from it in most of its characters *e.g.* shape of body, shape and character of tentacles, extent of cirrus sac, vitellaria and uterus and



TEXT-FIG. 4.—*Bucephalus indicus* ; *a.* entire specimen ; *b.* cephalic tentacles, enlarged (after Srivastava).

cs, Cirrus sac ; *ex. v.*, Excretory vessel ; *i*, Intestine ; *m*, mouth ; *ov*, Ovary *t*, testes ; *vit*, vitellaria ; *v.d.*, Vitelline duct.

topography of gonads, besides difference in measurements. It resembles slightly *B. tridenticularia* in the nature of its tentacles, topography of gonads, extent of vitellaria and shape of excretory bladder, but differs from it in the number of tentacles, anterior extent of cirrus sac and vitellaria, shape of anterior sucker and the difference in the size of the various organs.

Host.—*Macrones seenghala* Day.

Habitat.—Intestine.

Locality.—Rivers, the Ganges and the Jumna, winter months, Allahabad, (India).

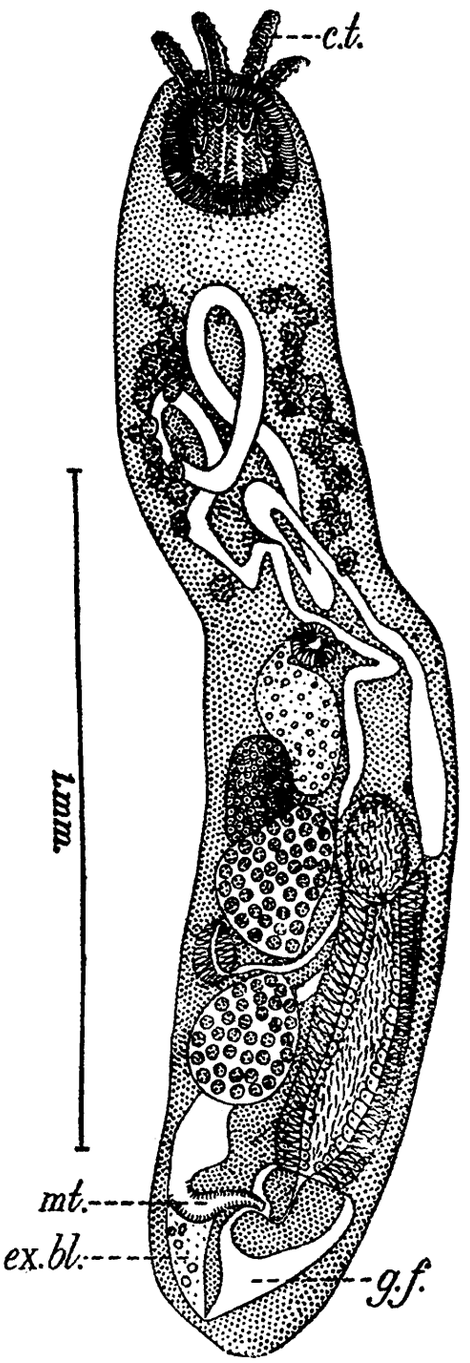
5. **Bucephalus gangeticus** Srivastava, 1938.

(Text-fig. 5.)

Srivastava, H.D. (1937), *Proc. Indian Sci. Congr.* 24: 298.

Specific diagnosis: *Bucephalus* Baer, 1827, with Generic characters.

Body elongate, almost uniformly broad, measuring 1·76×0·38, covered with minute, backwardly directed spines. Anterior sucker situated



Text-fig. 5.—*Bucephalus gangeticus*; entire specimen (after Srivastava).

c.t., Cephalic tentacle; *ex. bl.*, Excretory bladder; *g.f.*, Genital funnel; *mt.* Metraterm.

subterminally, on the ventral side, measuring 0·2 in diameter, with a dorsal crown of four cylindrical and highly contractile tentacles, measuring 0·08×0·02 in size, studded with minute pointed spines. Pharynx small, spherical, 0·06 in diameter, situated in the middle of body length, leading posteriorly through a very short and narrow oesophagus into a saccular intestine, measuring 0·2×0·14.

Testes tandem, situated to the right of the median line, in the posterior half of body. The posterior testis is situated at one sixth of body length from the posterior end, measuring 0·18×0·14 in size, separated from the anterior by the uterus, measuring 0·22×0·18. Cirrus sac is an elongated tubular structure, measuring 0·74×0·14, extending anteriorly upto the posterior end of intestine, enclosing a well developed, ovoid,vesicula seminalis, measuring 0·16×0·10; a long pars prostatica, measuring 0·4×0·1, surrounded by prostate gland cells and a short and narrow ductus ejaculatorius, measuring 0·1 in length and opening into the genital sinus, at the base of the genital tongue or cone. Genital sinus is surrounded by gland cells which secrete the wall of spermatophore. Genital pore is situated at the posterior end, very close to the excretory pore. Ovary pear shaped, situated in the space between the anterior third of the anterior testis, posterior half of intestine and the right body wall, measuring 0·16×0·10. Metraterm small and tubular. Shell gland complex between the two testes and the right body wall. Laurer's canal present. Vitellaria composed of small, rounded follicles, arranged longitudinally on the lateral sides of the body, beginning from a little in front of the pharynx to the anterior fifth of body length. Uterus well developed, containing a large number of oval eggs, measuring 0·015—0·023×0·0076-0095.

Excretory bladder long, tube, extending from anterior fifth of body length to the posterior end, opening, close to the genital pore.

This species resembles, *Gasterostomum* sp. of Linton, 1910 from the gut of *Sphyraena barracuda*, in the number of its tentacles but differs from it in most of its characters *e.g.* shape of body, topography of gonads, position of vitellaria, extent of uterus, cirrus sac, besides differences in measurements.

Host.—*Macrones seenghala* Day.
Habitat.—Intestine.
Locality.—Allahabad (India).

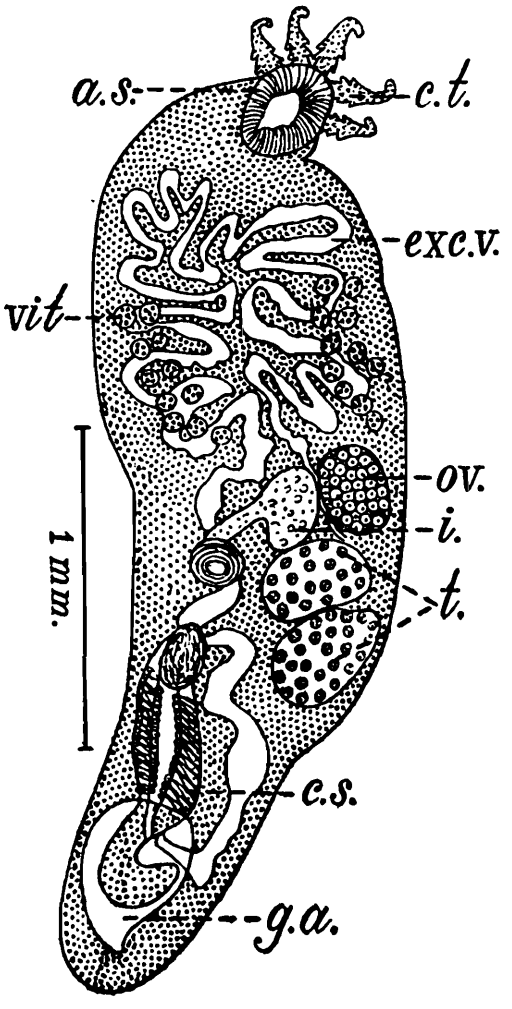
6. **Bucephalus barina** Srivastava, 1938.

(TEXT-FIG. 6.)

Specific diagnosis : *Bucephalus* Baer, 1827; with Generic characters.

Body measures 1·52-2·8 in length and 0·5-0·68 in maximum width (across the middle of vitellaria), covered with very fine, backwardly directed spines. Anterior sucker a fairly muscular structure, measuring 0·14-2×0·12-0·22, bearing on its antero-dorsal surface a crown of five tentacles, measuring 0·076-0·084×0·019-023, with a number of small rose-thorn shaped processes or hooks, arranged radially round their basal halves. Pharynx small, transversely oval, situated usually in the median line, a little behind the anterior half of body. Oesophagus narrow, 0·08 long. Intestine small, sac like, lying at level with ovary, measuring 0·13-0·2×0·1. Testes two, transversely oval, lying in contact, one behind the other, on left side, close behind the cephalic half of body. Anterior testis measuring 0·2-0·32×0·16-0·24 and the posterior 0·18-0·28×0·14-0·18. Cirrus lies along the left side, extending forward up to

the level of anterior margin of posterior testis and measuring 0·44-0·7×0·12-0·2. Vesicula seminalis small, oval, 0·12-0·16×0·06-0·12. Pars prostatica 0·2×0·04-0·08. Prostate glands present. Dutcus ejaculatorius narrow, opens at the base of well developed genital tongue, extending into genital sinus. Genital pore sub-terminal, on ventral surface, a little in front of the posterior end. Ovary lies in front of anterior testis, at middle of body, measuring 0·14-0·22×0·12-0·18, separated from anterior testis by a small and compact shell gland mass. Laurer's canal arising from oviduct, present. Vitellaria consist of small, rounded,



Text-fig. 6.—*Bucephalus barina* ; entire specimen (after Srivastava).

a.s, Anterior sucker ; *c.s*, Cirrus sac ; *c.t*, Cephalic tentacle ; *exc. v*, Excretory vesicle ; *g.a.*, Genital atrium ; *i*, Intestine ; *ov*, Ovary ; *t*, Testis ; *vit*, Vitellaria.

follicles, arranged roughly in pairs along the lateral sides of body, extending from the level of ovary to the first sixth of body length. Uterus well developed, contains a very large number of yellowish-brown oval eggs, measuring 0·015-0·019×0·0095-0·011, extending anteriorly up to a little in front of the suckers. Excretory bladder more or less a straight tube, extending from the anterior limit of vitellaria to the posterior end.

The species is characterised by the number and character of its tentacles It resembles *B. Jagannathai* rather closely in its internal anatomy but differs from it by the number and character of tentacles, besides differences in measurements.

Host.—*Scatophagus argus* Bloch.

Habitat.—Intestine.

Locality.—Puri, Bay of Bengal.

(ii) Genus **Bucephalopsis** (Diesing, 1855) Nicoll, 1914.

syns. *Bucephalopsis* Diesing, 1853 (subgenus).

Prosorhynchoides Dollfus, 1929.

Rudolphi (1819) described a gasterostome from *Lophius piscatorius* from Triesta, as *Distoma gracilescens*. Lacaze-Duthiers (1854) described a larval form from oysters, *Ostrea edulis* and *Cardium rusticum* from Balearic Islands, off the Spanish Coast, in the Mediterranean, as *Bucephalus haimeanus*. Diesing (1855) created a subgenus, *Bucephalopsis* of the genus *Bucephalus* Baer, 1827 for *Bucephalus haimeanus* Lacaze-Duthiers, 1854. Nicoll (1914) on the ground that since *Bucephalus haimeanus* has been proved larval form of *Gasterostomum gracilescens* raised the subgenus, *Bucephalopsis* Diesing, 1855 to the generic rank with *B. gracilescens* (Rud., 1819) nec. Tennent 1906, as type species.

Generic diagnosis : *Bucephalinae* Nicoll, 1914 ; with Subfamily characters.

Body usually elongate or ovate. Cuticle covered with spines. Anterior end having a sucker on the ventral surface but lacking any processes. Oral aperture on the ventral surface, away from the anterior or posterior end. Oral sucker absent. Pharynx present, welldeveloped and muscular. Intestinal caecum simple, sac shaped. Testes two, smooth contoured. Cirrus sac at the posterior half, towards the left side of body. Ovary smooth contoured, usually anterior to testes. Vitelline glands in two separate groups, usually in the anterior half of body.

Type species—*B. gracilescens* (Rud., 1819) nec. Tennent, 1906.

syns. *Distoma gracilescens* Rudolphi, 1819 ;

Gasterostomum gracilescens (Rudolphi, 1819).

The following species of the genus have been recorded, so far, from the Indian region—

1. *B. fusiformis* Verma, 1936.
2. *B. garuai* Verma, 1936.
3. *B. magnum* Verma, 1936.
4. *B. confusus* Verma, 1936.
5. *B. minimus* Verma, 1936.
6. *B. karvei* Bhalerao, 1937.
7. *B. belonea* Srivastava, 1938.
8. *B. microcirrus* Chauhan, 1943.
9. *B. sinhai* Dayal, 1948.
10. *B. thapari* Dayal, 1948.
11. *B. macronius* Dayal, 1948.

Bhalerao (1937) regards, *B. magnum* Verma, 1936 ; *B. confusus* Verma, 1936 and *B. minimus* Verma, 1936 as synonymous to *B. garuaz* Verma, 1936. Srivastava (1938) is inclined to accept *B. magnum* as a valid species but maintains that *B. confusus* and *B. minimus* are synonymous to *B. garuai*. Nagaty (1937) and Chauhan (1943) regard *B. confusus* and *B. minimus* as synonymous to *B. magnum* and not to *B. garuai*

as held both by Bhalerao and Srivastava. Nagaty (1937) further points out that *B. belonea* Srivastava, 1938 shows close resemblance to *B. southwelli* Nagaty, 1937 and that they are obtained from the same host. Chauhan (1943) however, included it as a distinct species in his key to the valid species of the genus.

The Indian species can be identified by the following key—

KEY TO INDIAN SPECIES OF GENUS **Bucephalopsis** (DIESING, 1855 NICOLL, 1914 ; after CHAUHAN (1943).

1.	Excretory bladder Y-shaped . .	2
	Excretory bladder tubular . .	4
2.	Vitelline follicles bilobed, large uterine coils extend on both sides of the body up to near the anterior extremity, ovary anterior to pharynx	3
3.	Distinct vesicula seminalis externa present . .	*B. sinhai* Dayal, 1948.
	Vesicula seminalis externa absent	*B. garuai* Verma, 1936.
4.	Vitelline glands not extending like a band along the sides of the body .	5
	Vitelline glands extending like a band along the sides of the body	6
5.	Cirrus sac half or more than half the body length	*B. karvei*, Bhalerao, 1937.
	Cirrus sac less than half the body length	*B. fusiformis* Verma, 1936.
6.	Testes situated in diagonal position, one on either side of the pharynx	*B. thapari* Dayal, 1948.
	Testes not situated in diagonal position, one on either side of the pharynx . .	7
7.	Vitellaria lie in the middle of body .	*B. microcirrus* Chauhan, 1943.
	Vitellaria lie in the anterior part of the body	8
8.	Cirrus sac extending forward up to the level of the anterior end of oesophagus beyond pharynx. Pharynx situated at the level of posterior testis. Anterior testis comparatively much smaller	*B. belonea* Srivastava, 1938.
	Cirrus sac not extending up to the level of oesophagus. Pharynx situated near anterior portion of the anterior testis . .	*B. macronius* Dayal, 1948.

7. **Bucephalopsis fusiformis** Verma, 1936.

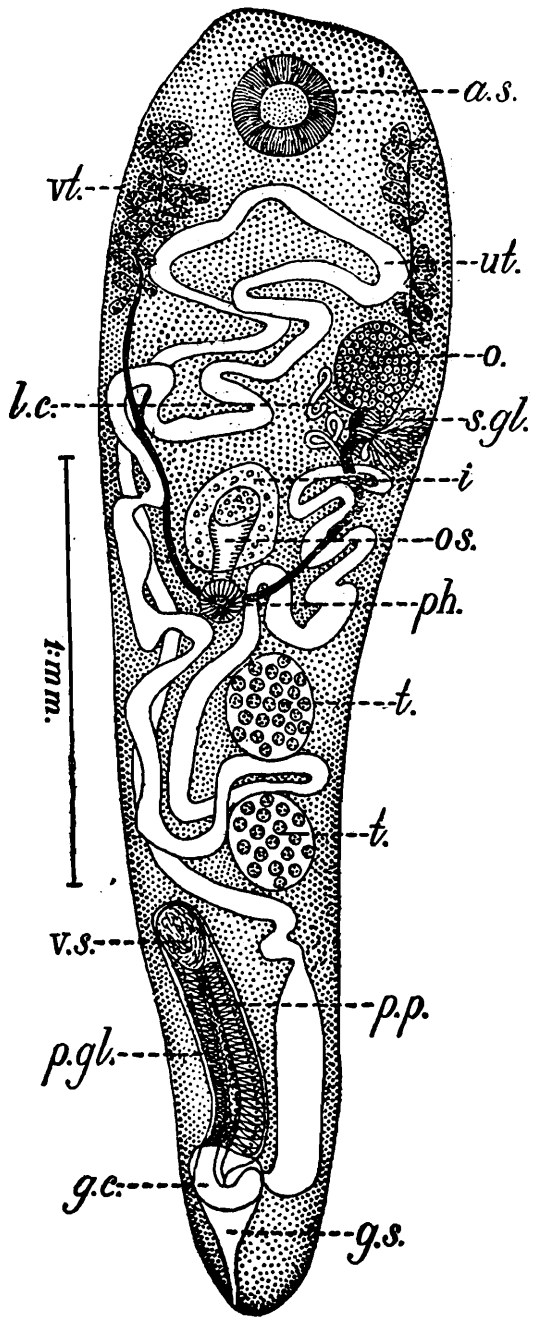
(TEXT-FIG. 7.)

Srivastava, H. D. (1938), *Indian J. vet. Sci.* **8** (4): 330-332.

Dawes, B. (1946). The Trematoda. Lond, : 193.

Specific diagnosis : *Bucephalopsis* (Diesing, 1855) Nicoll, 1914 ; with Generic characters.

Body minute, fusiform ; in balsam mounts length 1·24-2·52 ; greatest breadth, in region of vitellaria or anterior sucker, 0·39-0·84. Anterior sucker subterminal, diameter 0·17-0·245. Vitellaria compact, between ovary and anterior sucker, follicles 14-16 in each lateral group, on left 1 or 2 more than on right, 0·07-0·09 in diameter. Pharynx inconspicuous



TEXT-FIG. 7.—*Bucephalopsis fusiformis* ; entire specimen (after Srivastava).

a.s. Anterior sucker ; *g.c.* Genital cone or tongue ; *g.s.* Genital sinus ; *i.* Intestine ; *l.c.* Laurer's canal ; *o.* Ovary ; *os.* Oesophagus ; *p.gl.* Prostate glands ; *ph.* Pharynx *p.p.* Pars prostatica ; *s.gl.* Shell gland complex ; *t.* Testis ; *ut.* Uterus ; *v.s.* Vesicula seminalis ; *vt.* Vitellaria.

about middle of body, between ovary and testis, 0·07-0·084. Oesophagus short, curved. Intestine wide, 0·21-0·46 long. Ovary near right margin, rounded, at one fourth body length from anterior end, 0·14-0·21 in diameter. Testes roundish to ovoid ; anterior to right side, equatorial or slightly more ahead, 0·18-0·29 × 0·26 ; posterior behind middle of body, either in same line as anterior or more internal, 0·16-0·25 × 0·15-0·21.

Cirrus pouch long one third to nearly half as long as body, reaches posterior testis or more ahead; 0·46-0·7 long, 0·1-0·14 broad. Genital sinus 0·13-0·16 in diameter. Excretory bladder elongate, tubular or narrow, sac like. Eggs vary in size, 0·013-0·0226×0·0084-0·0146.

Host.—*Eutropiichthys vacha* Day (Butterfish).

Habitat.—Intestine; once in stomach; encysted larval forms on liver, kidney, mesentery round stomach and duodenum.

Locality.—Allahabad (India).

The species resembles *B. haimeanus* (Lacaze—Duthiers, 1854) and *B. ovatus* Ozaki, 1928, in having the vitellaria closely aggregated but differs from the former specially in its fusiform body and in its testes, lying on the same side of the pharynx, instead of, on opposite sides. From the latter it is differentiated by its longer excretory bladder and by the more forward position of its ovary. Leaving aside the character of the vitellaria, the species comes nearest to *B. elongatus* Ozaki, 1928 which has a similar excretory vessel and uterus but the Japanese form has a quite different body form, a longer range of vitellaria and a comparatively longer cirrus sac.

This species is characterised in the position of its intestine which lies between the ovary and anterior testis.

Srivastava (1938) collected specimens of this parasite from the same host at Allahabad. His specimens resemble the type, except for differences in measurements.

8. **Bucephalopsis garuai** Verma, 1936.

(Text-fig. 8.)

Bhalerao, G. D. (1937). *J. Helminth* **15** (2): 103.
Nagaty, H. F. (1937). *Pub., Fac. Med. Egyptian Univ.* **12,**: 1—172.
Srivastava, H. D. (1938). *Indian J. vet. Sci.* **8** (4): 329-330.
Chauhan, B. S. (1943). *Proc. Indian Acad. Sci.*, **18,** 102.
Dawes, B. (1946). The Trematoda. Lond.: 193.

Specific diagnosis: *Bucephalopsis* (Diesing, 1855) Nicoll, 1914; with Generic characters.

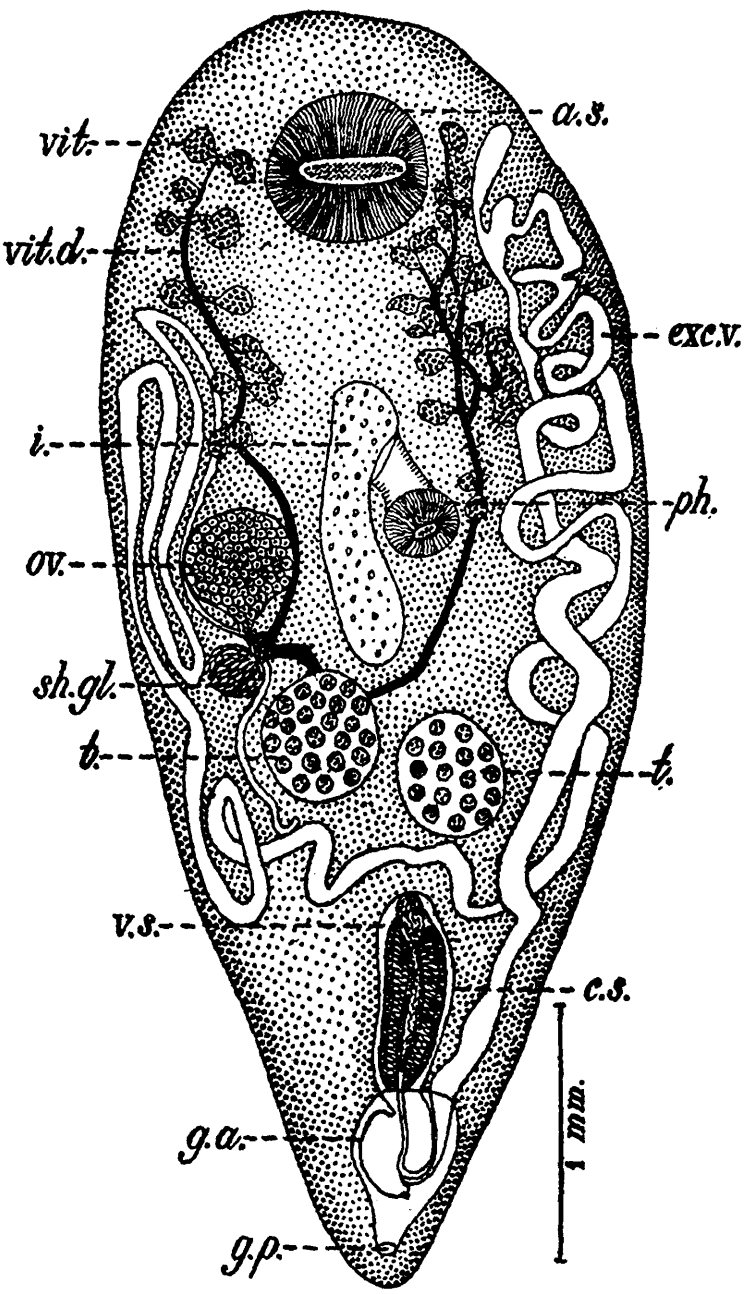
In balsam mounts: body medium sized, with nearly parallel lateral margins, broadly rounded anteriorly; length 5·73-6·20; greatest breadth, 1·38-1·90. Anterior sucker sub-terminal, at times slightly broader than long, 0·56-0·69 in diameter. Vitellaria not compact, follicles extending from ovary to anterior sucker large, bilobed or paired; 12-14 groups on the right, 14-18 on left; largest roundish follicles 0·25×0·21, elongated ones 0·252×0·1008, average sized ones 0·168×0·134. Pharynx in front of middle of body, conspicuous, 0·25-0·2938×0·336. Oesophagus distinct, narrow, anteriorly directed. Intestine doubled upon the oesophagus and pharynx, elongated saccular or tubular, 0·88×0·168-1·26×0·335. Ovary pear shaped, right-sided, a little behind one-third of body length from anterior end, 0·67×0·29-0·58×0·39. Anterior testis variable in form and outline, usually rounded and regular, anterior to right of median line, behind middle of body, 0·68×0·48-0·756×0·463; posterior, more centrally placed, behind anterior, 0·588×0·42-0·67×

0·547. Cirrus pouch short, not reaching posterior testis, about one fifth as long as body, 0·6×0·3-0·924×0·35. Seminal vesicle short, narrow, 0·151×0·042. Eggs, 0·226-0·239×0·0146-0·173. Excretory bladder wide, filling the whole body, Y-shaped.

Host.—*Pseudotropius garua* Day.

Habitat.—Intestine, posterior part and rectum; encysted larval forms in gonads, liver and on mesentery.

Locality.—Allahabad (India).



TEXT-FIG. 8.—*Bucephalopsis garuai*; entire specimen (after Srivastava).

a.s. Anterior sucker; *c.s.* Cirrus sac; *exc. v.* Excretory vesicle; *g.a.* Genital atrium; *g.p.* Genital pore; *i.* Intestine; *ov.* Ovary; *ph.* Pharynx; *sh.gl.* Shell gland; *t.* Testis; *v.s.* Vesicula seminalis; *vit.* Vitellaria; *vit.d.* Vitelline duct.

The species is characterised specially by having Y-shaped excretory bladder, bilobed nature of vitelline follicles, comparatively small seminal vesicle and cirrus pouch and character and disposition of uterine coils.

Srivastava (1938) records it from the intestine of *Silundia gangetica* Cuv. & Val., from Allahabad. He found that this fish was nearly always infested with these flukes and the infestation was often found to be very heavy, the number of parasites from a single host varying from 20 to 860. Specimens in his collection differ slightly from Verma's in measurements, number of vitelline follicles and the anterior extent of vitellaria, in the shape of excretory bladder and absence of a muscular sphincter around the genital pore. Bhalerao (1937) regards *B. magnum*, *B. confusus* and *B. minimus* as synonymous to *B. garuai*. Srivastava (1938) however thinks, *B. magnum* as a valid species but regards *B. confusus* and *B. minimus* as synonymous to *B. garuai*. Nagaty (1936), Chauhan (1943) and Dawes (1946) however regard *B. confusus* and *B. minimus* as synonymous to *B. magnum* and not *B. garuai* Verma.

9. **Bucephalopsis magnum** Verma, 1936.

(Text-fig. 9.)

Bhalerao, G. D. (1937). *J. Helminth* **15**, arab (2) : 100—101.
Nagaty, H. F. (1937). *Publ. Fac. Med. Egypt. Univ.* **12** : 1—172.
Srivastava, H. D. (1938). *Indian J. vet. Sci.* **8** (3) : 333.
Chauhan, B. S. (1943). *Proc. Indian Acad. Sci.* **17**, arab: 102.
Dawes, Ben (1946). The Trematoda, Lond. : 193.

Specific diagnosis : *Bucephalopsis* (Diesing, 1855) Nicoll, 1914 ; with Generic characters.

In balsam mounts, body ovo-oblongish, broadly rounded at both extremities, of large size ; length 8·0-10·0, greatest breadth about middle, 4·2-4·8. Anterior sucker 0·30—0·40 behind anterior end, 0.84 in diameter. Vitellaria from level of pharynx to some distance behind anterior sucker, midway between median line and side of body ; follicles small, round, separate from one another, size 0·26×0·126-0·134×0·11, number 13-16 on right, 17-18 on left. Pharynx conspicuous, in middle of body, 0·46-0·5 in diameter. Oesophagus short. Intestine very wide, broadly oval, backwardly directed, 1·6 long, 0·9 broad. Ovary globular or pear shaped, on right side of intenstine, near equatorial line, 0·38 in diameter. Testes large, rounded, anterior to right of median line, 0·9-1·0 in diameter ; posterior, either on median line or slightly to left of it, smaller than anterior, 0·75-0·84 in diameter. Cirrus sac less than one-fourth as long as body, 1·4-1·6×0·3-0·45. Uterus nearly confined to posterior half of body, coils mainly on left, cross from left to right and *vice versa* between hind testis and cirrus sac. Genital atrium 0·42-0·5 in diameter, both metraterm and genital sinus surrounded by numerous gland cells. Genital pore subterminal. Excretory bladder Y-shaped. Eggs, 0·026-0·028× 0·0167-0·028.

Host.—*Pangasius buchanani* (Cuv. & Val.).

Habitat.—Large intestine.

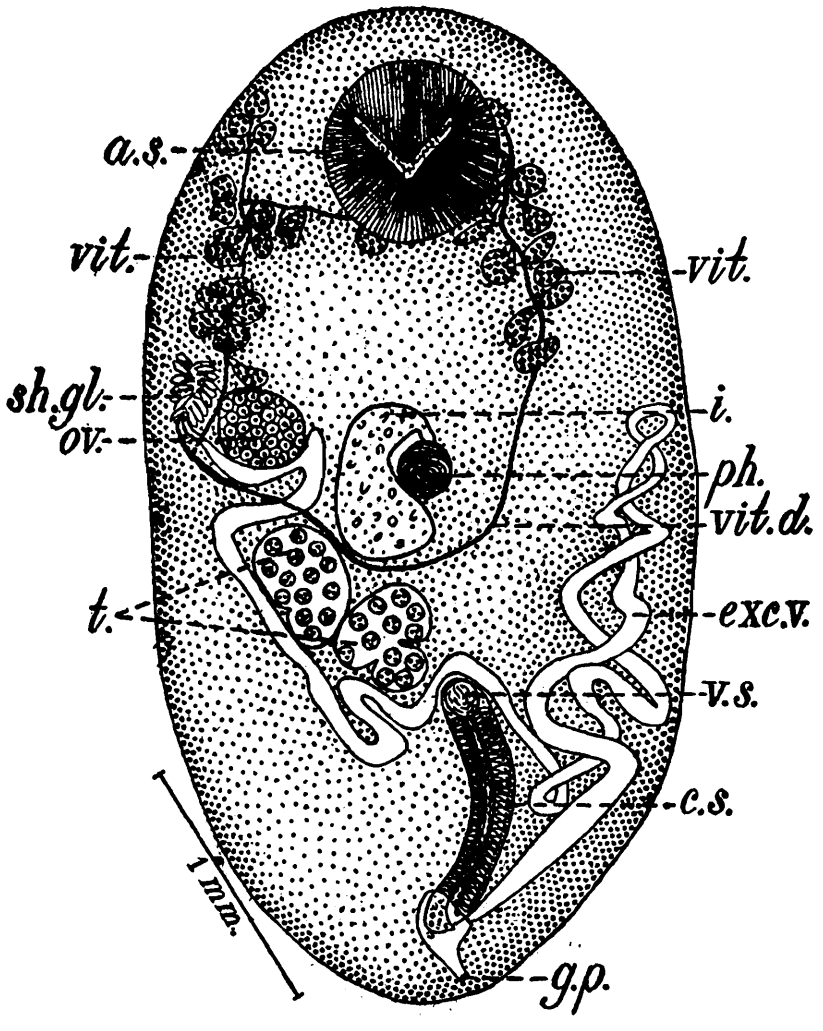
Locality.—Allahabad (India).

The species resembles *B. garurai* in the shape of excretory bladder.

Srivastava (1938) collected specimens of this parasite from the intestines of *Silundia gigantica* Cuv. & Val. at Allahabad. He obtained

only two specimens from the intestine of one out of more than 150 intestines of hosts. They differ from specimens of Verma, besides in measurements, in the anterior extent and conflagration of vitellaria, and in the size and shape of cirrus sac.

Bhalerao (1937) regards *B. magnum* as synonymous to *B. garuai*. From the study of the collection in the possession of Srivastava (1938), he is inclined to accept *B. magnum* as valid species. Nagaty (1936), Chauhan (1943) and Dawes (1946) are in agreement with this view. Dawes (1946) further regards *B. confusus* Verma, 1936 and *B. minimus* Verma, 1936 as synonymous to *B. magnum* Verma.



TEXT-FIG. 9.—*Bucephalopsis magnum*; entire specimen (after Srivastava).

a.s. Anterior sucker; *c.s.* Cirrus sac; *exc.v.* Excretory vesicle; *g.p.* Genital pore; *i.* Intestine; *ov.* Ovary; *ph.* Pharynx; *sh.gl.* Shell gland; *t.* Testes; *vit.* Vitellaria; *vit.d.* Vitelline duct; *v.s.* Vesicula seminalis.

10. **Bucephalopsis confusus** Verma, 1936.

(TEXT-FIG. 10.)

Bhalerao, G. D. (1937). *J. Helmint* **15** (2) : 103.

Nagaty, H. F. (1937). *Publ., Fac. Med. Egypt. Univ.* **12** : 1—172.

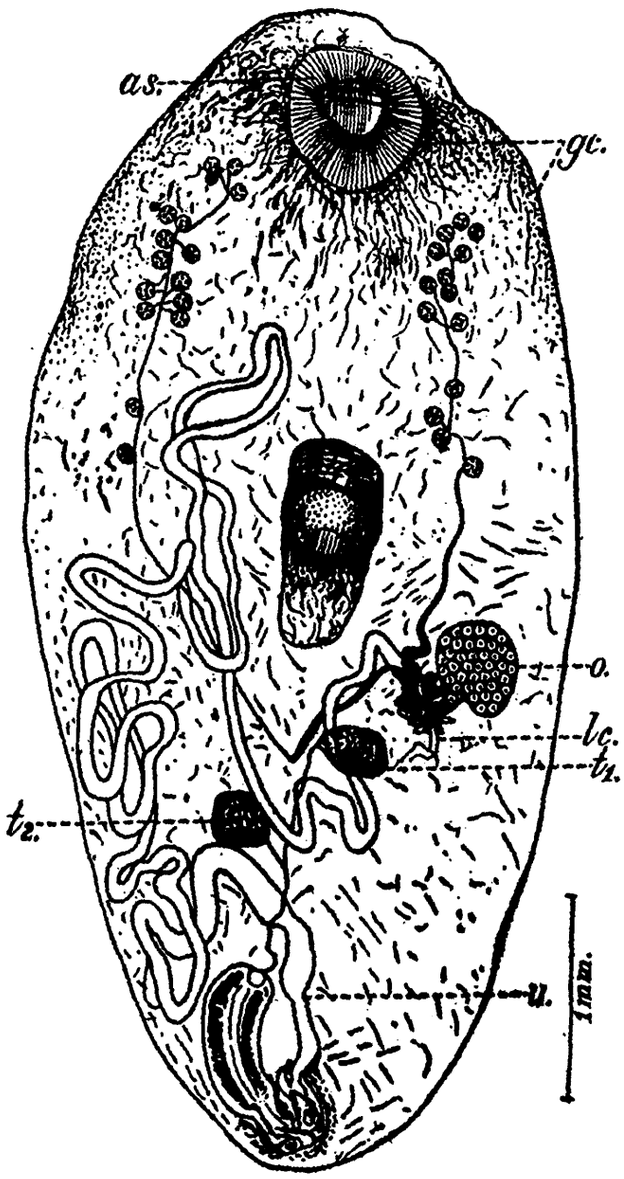
Srivastava, H. D. (1938). *Indian J. vet . Sci.* **8** (4) : 333.

Chauhan, B. S. (1943). *Proc. Indian Acad. Sci.* **17** : 101.

Dawes, B. (1946). The Trematoda, Lond. : 193.

Specific diagnosis : *Bucephalopsis* (Diesing, 1855) Nicoll 1914 ; with Generic characters.

Body spiny, thick, cylindrical in life ; oval, on fixation under pressure. In balsam mounts, length 4·0-6·5 ; greatest breadth 0·5-0·71. Anterior sucker 0·67 in diameter, with a wide cavity. Pharynx distinct, near middle of body, 0·3 in diameter. Oesophagus short, 0·1-0·15 long. Intestine antero-posteriorly directed, in third sixth of body, 0·88×0·4. Ovary round, right-sided, nearer body margin than intestinal wall,



Text-fig. 10.—*Bucephalopsis confusus* ; entire specimen, dorssal view (after Verma).
a.s. Anterior sucker ; *gc.* Unitellular gland cells ; *lc.* Laurer's canal ; *o.* Ovary ; t_1. anterior testis ; t_2. Posterior testis ; *u.* Uterus.

larger than or nearly equal to testes, behind equatorial line or just touching it, 0·336-0·46×0·306-0·40. Uterine coils few, mostly on left, to midway between pharynx and sucker, internal to vitellaria. Vitellaria from level of anterior border of pharynx to level of posterior border of sucker ; follicles small, rounded, 13-15 on right, 17 or 18 on left, 0·08 in diameter, or 0·1×0·075. Testes variable in shape, usually smaller than ovary, anterior to right of median line, 0·25-0·38×0·26-0·27 ; posterior to left

of median line, 0·25-0·294×0·21-0·294. Cirrus sac curved, one-sixth as long as body; 0·67-0·84×0·21-0·25. Seminal vesicle indistinct. Vas deferens inside cirrus sac, with thicker muscular walls. Gland cells numerous, round anterior sucker and genital atrium. Genital pore subterminal or ventral, 0·12-0·18 ahead of posterior end. Excretory bladder large, Y-shaped. Excretory pore terminal, separate from the genital aperture. Eggs yellowish, 0·0199-0·0239×0·0146-0·0159.

Host.—*Pangasius buchanani* and *Silundia gangetica* Cuv. & Val.

Habitat.—Terminal part of small intestine and rectum.

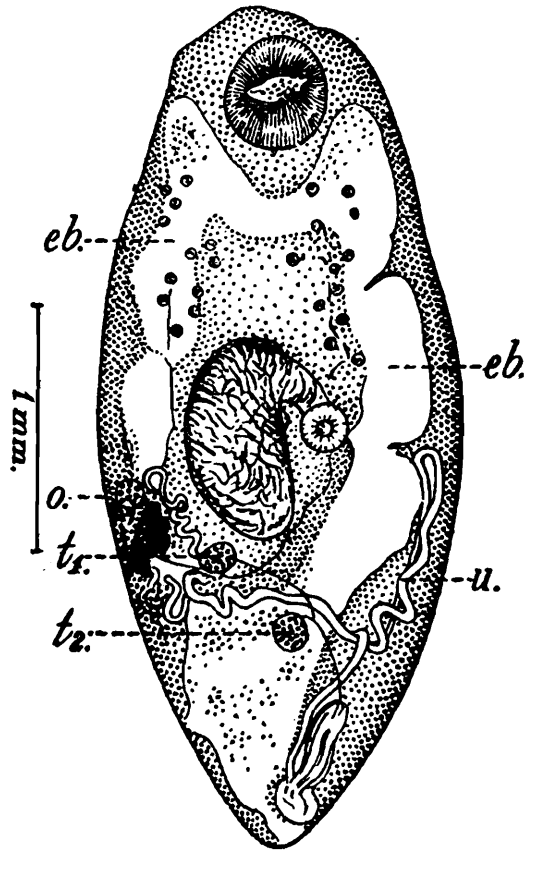
Locality.—Allahabad (India).

Bhalerao (1937) and Srivastava (1938) regard this species as synonymous to *B. garuai*. Nagaty (1937) and Chauhan (1943) however, regard it as synonymous to *B. magnum*. Ben Dawes (1946) also mentions it as synonymous to *B. magnum* Verma, 1936.

11. Bucephalopsis minimus Verma, 1936.

(TEXT-FIG. 11.)

Bhalerao, G. D. (1937). *Ind. J. Helminth.* **15** (2) : 97-124.
Nagaty, H. F. (1937). *Publ. Fac. Med. Egypt. Univ.* **12** : 1—172.
Srivastava, H. D. (1938). *Indian J. vet. Sci.* **8** (4) : 113-118.
Chauhan, B. S. (1943). *Proc. Indian Acad. Sci.* B **17**: 101.
Dawes, B. (1946). The Trematoda, Lond. : 193.



TEXT-FIG. 11.—*Bucephalopsis minimus*; entire specimen, ventral view (after Verma). *eb* .Excretory bladder; *o.* Ovary; t_1. Anterior testis; t_2. Posterior testis *u.* Uterus.

Specific diagnosis: *Bucephalopsis* (Diesing, 1855) Nicoll, 1914; with Generic characters.

Small sized body, like thick spindle, anterior end broader than posterior. Cuticular spines feeble. Length 3·0-3·36, greatest breadth, about middle, 1·2-·147. Vitelline follicles minute, 0·0588 in diameter, or 0·059×0·042, from pharynx to near hinder margin of sucker. Pharynx on equatorial line, 0·21-0·25 in diameter. Intestine sac like, 0·75 long. Ovary smaller than testes, right-sided, posterior to pharynx, 0·168× 0·126. Shell gland variable in position, either behind or in front of ovary. Testes ovoidal, larger than ovary; anterior 0·277×0·142 near anterior limit of posterior third of body; posterior, more behind, 0·21× 0·168. Cirrus sac nearly straight, very small, one-eighth to one-ninth as long as body, 0·378×0·126. Genital tongue broad, triangular. Excretory bladder Y-shaped, with very long descending arm. Excretory pore subterminal, separate from genital aperture. Eggs, 0·0226-0·0239× 0·0133-0·0145.

Host.—*Pseudotropius garua* Day.
Habitat.—Large intestine.
Locality.—Allahabad.

Bhalerao (1937) and Srivastava (1938) regard this specios as synonymous to *B. garuai.*

Nagaty (1937) and Chauhan (1943) however regard it as synonymous to *B. magnum.* Ben Dawes (1946) mentions *B. minimus* as a synonym. to *B. magnum* Verma, 1936.

12. Bucephalopsis karvei Bhalerao, 1937

(Text-fig. 12.)

Manter, H. W. and Van Cleave, J. H. (1951). *Proc. U.S. nat. Mus.* **101**: 318.

Specific diagnosis: *Bucephalopsis* (Diesing, 1855) Nicoll, 1914; with Generic characters.

Body inversely pear shaped. Length 0·5-0·965. Maximum breadth 0·27-0·57. Cuticle covered with spines. Anterior sucker subterminal. Pharynx large, muscular, situated at about the posterior third of body. Oesophagus long and slender. Intestine almost round, with thick walls. Excretory bladder tubular. Testes almost tandem, to the right, close to intestine, anterior one usually larger. Cirrus sac to the left, larger than half the length of the body. Ovary to the right, antero-lateral to intestine, occasionally partially overlapping anterior testis and vitelline gland of the right side. Vitellaria antero-lateral, compact groups, round or elongate. Uterine coils on the left side of the body. Eggs, 0·018-0·0215×0·009-0·013.

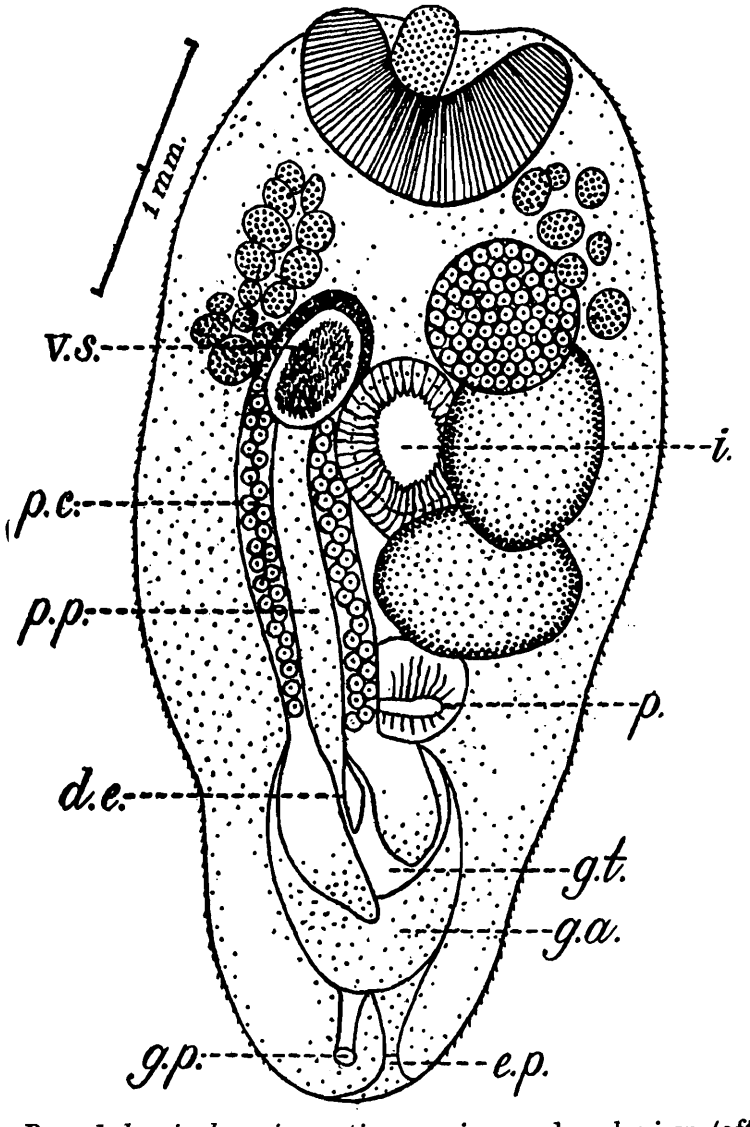
Host.—*Belone cancila.*
Location.—Intestine.
Locality.—Poona, India.

Manter and Van Cleave (1951) think that their species, *Bucephalopsis labiatus* Manter & Van Cleave (1951) is most similar to *B. karvei* Bhalerao, 1937 from *Belone* sp. from the Indian Ocean. They observe that the two species agree in having small body size, mouth posterior to mid-body and cirrus sac reaching anterior to mid-body but differ in that *B. karvei*

has vitellaria in two widely separated groups, does not have a recurved caecum, lacks the preoval lip and has smaller eggs.

They further observe that B. *magnacetabulum* Nagaty, 1937 from *Belone choram*, in the Red Sea resembles and differs from *B. labiatusin* in the same respects except that its cirrus sac is relatively shorter. They believe it may be found that *B. karvei* and *B. magnacetabulum* are a single species.

They also make an interesting observation that the occurrence in Belonidae of species of trematodes apparently most similar to a species occurring in sinistral flat fishes (Bothidae) suggests the host distribution of the species of *Steganoderma* (Manter, 1947). Neither the ecology nor the phylogeny of these families of fishes indicates any relationship that would be suggested by their treamatode parasites.



TEXT-FIG. 12.—*Bucephalopsis karvei* ; entire specimen, dorsal view (after Bhalerao).

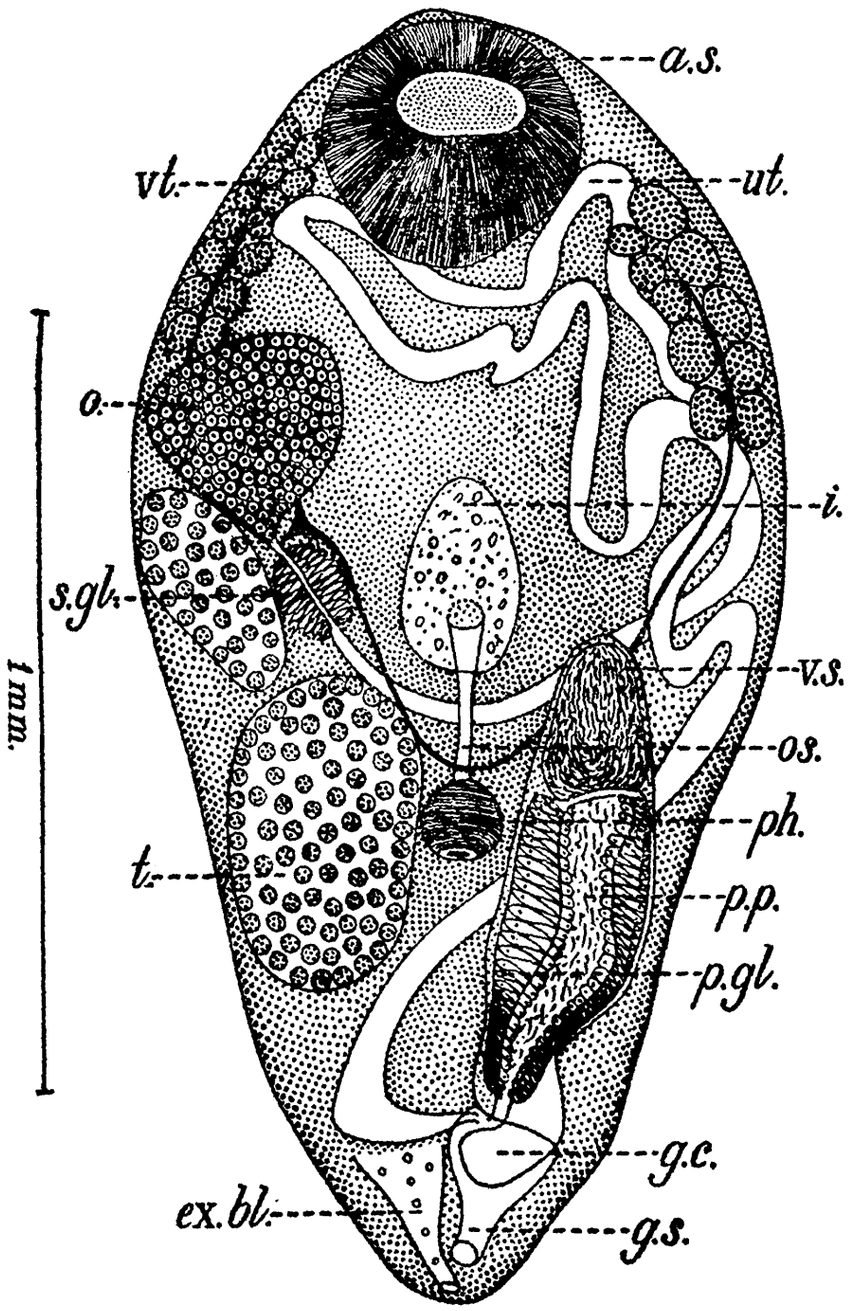
d.e. Ductus ejaculatorius; *e.p.* Exeretory pore; *g.a.* Genital atrium; *g.p.* Genital pore; *g.t.* Genital tongue; *i.* Intestine; *p*, Pharynx; *p.c.* Prostatic cells; *p.p.* Pars prostatica; *v.s.* Vesicula seminalis.

13. Bucephalopsis belonea Srivastava, 1938.

(TEXT-FIG. 13.)

Specific diagnosis : *Bucephalopsis* (Diesing, 1855) Nicoll, 1914 ; with Generic characters.

Body pear shaped, with broadly rounded anterior end and a narrow, pointed, posterior end, studded with very minute spines, measuring 1·68-2·5 length and 0·82-1·2 maximum breadth (across the level of ovary). Anterior sucker large with diameter 0·3-0·4, ventral, situated at the anterior end. Pharynx muscular, surrounding mouth, 0·1-0·12 in diameter, situated in the median line, at the junction of the middle and



Text-fig. 13.—*Bucephalopsis belonea*; entire specimen (after Srivastava).

a.s. Anterior sucker; *ex.bl.* Excretory bladder; *g.c.* Genital tongue; *g.s* Genital sinus; *i.* Intestine; *o.* Ovary; *os.* Oesophagus; *p.p.* Pars prostatica; *p.gl.* Prostate glands; *ph.* Pharynx; *s.gl.* Shell gland complex; *t.* Testes; *ut.* Uterus; *v.s.* Vesicula seminalis; *vt.* Vitellaria.

posterior third of body. Oesophagus straight narrow tube, 0·2-0·25 in length. Intestine sac shaped, 0·26-0·35×0·14-0·2 in size, situated in the median line, at the level of anterior testis. Anterior testis, 0·24-0·4×0·14-0·26 in size, situated obliquely in front of posterior testis, between the right body wall, posterior half of ovary and the shell gland

complex. Posterior testis 0·42-0·6×0·24-0·3 in size, situated between the pharynx and right body wall, extending from the last quarter of body to the level of the posterior margin of the intestine. Cirrus sac highly developed, 0·66-0·9×0·2-0·3, extending forward up to the level of the anterior end of oesophagus and enclosing a vesicula seminalis, 0·2-0·3×0·14-0·2 ; pars prostatica surrounded by gland cells, 0·36-0·54×0·1-0·15 and a narrow ductus ejaculatorius, 0·1-0·15 long. Genital tongue extends into funnel shaped genital sinus, opening ventrally, a little behind the posterior end. Ovary 0·26-0·32×0·26-0·3, pear shaped, situated to the right of the median line, extending from the leve of the middle of anterior testis to first quarter of body length. Shell gland oval, compact, lying immediately behind ovary. Laurer's canal short arising from oviduct. Vitellaria large, rounded follicles arranged longitudinally in pairs, on the lateral sides of the body, extending from the level of the middle of ovary to that of the anterior sucker. Uterus extends forward up to the anterior limit of vitellaria, containing a large number of light brown eggs, 0·034-0·036×0·011-0·013. Excretory bladder as in *B. karvei*.

In its systematic relationship the species stands nearest to *B. karvei* It resembles it, in the shape of body, excretory bladder, genital pores, and the position and extent of vitellaria but differs from it in being twice its size, anterior extent of cirrus sac, which stops at the posterior level of anterior testis.

Host.—*Belone strongylina* V Hasselt.

Habitat.—Intestine.

Locality.—Allahabad.

Nagaty (1937) states that this species is obtained from the same host as *B. southwelli* and Chauhan (1943) states that the two species resemble rather closely.

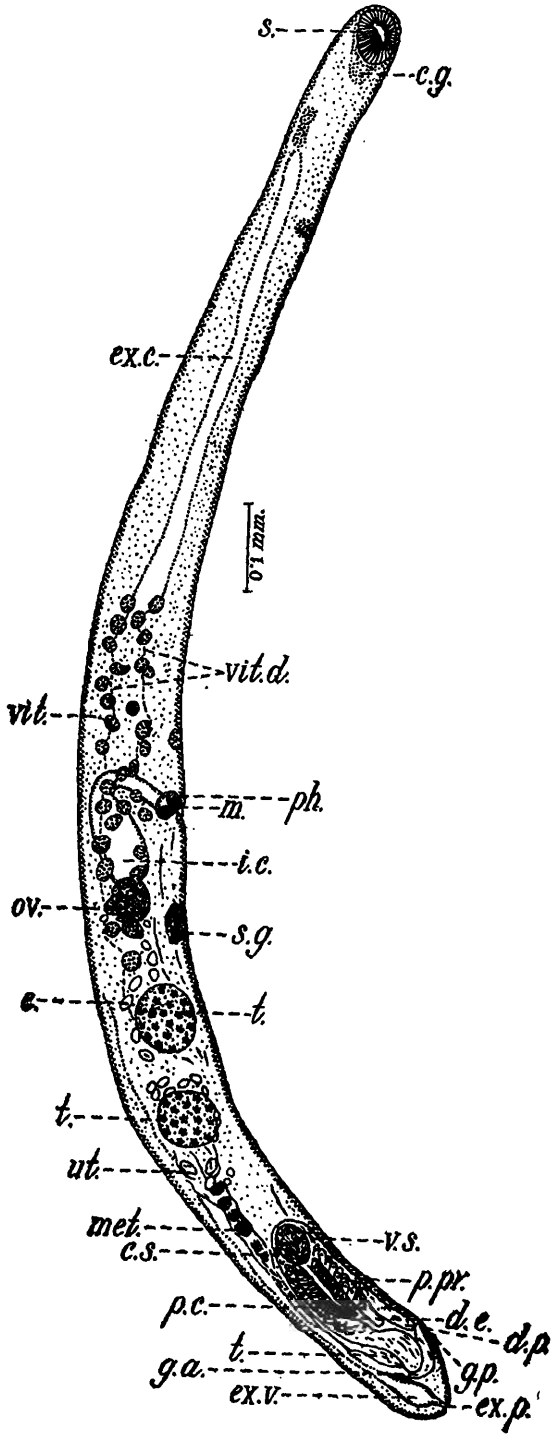
14. **Bucephalopsis microcirrus** Chauhan, 1943.

(TEXT-FIG. 14.)

Specific diagnosis : *Bucephalopsis* (Diesing, 1855) Nicoll, 1914 ; with Generic characters.

Body with spines, very much elongate, with a slightly tapering anterior end, broadly rounded posterior end. Almost all the important organs of the body are contained in the posterior half. Body length 1·71, width 0·12 maximum (in the region of testes). Anterior sucker oval, subterminal, 0·016×0·04, with ' Cytogenous organ ' of Tennent (1906) and,' Penetration organ ' of Woodhead (1929) present. Mouth simple, inconspicuous, ventrally situated at a distance of 0·9 from anterior end. Pharynx small, compact, globular and muscular, 0·222×0·03. Oesophagus a narrow, thin, straight tube, 0·075. Intestine ovoid, very thin walled, 0·1×0·055 in size. Testes two, globular, post ovarian, median, tandem and separate ; the anterior slightly larger than posterior, 0·075×0·06. The posterior 0·065×0·064. Cirrus sac comparatively small, median, ovoid, highly developed muscular organ, 0·22, Vesicula seminalis compact, ovoid. Pars prosttica elongate,

well developed, surrounded by prostate gland cells. Ductus ejaculatorius elongate. Genital atrium (sinus) large and globular. Genital pore



Text-fig. 14.—*Bucephalopsis microcirrus* ; entire specimen (after Chauhan).

c.g. Cytogenous glands; *c.s.* Cirrus sac; *d.e.* Ductus ejaculatorius; *d.p.* Dorsal process (genital lobe); *e.* Egg; *ex.c.* Excretory canal; *ex.p.* Excretory pore; *ex.v.* Excretory vesicle; *g.a.* Genital atrium; *g.p.* Genital pore; *i.c.* Intestinal canal; *m.* Mouth; *met.* Metraterm; *ov.* Ovary; *ph.* Pharynx; *p.c.* Prostrate gland cells; *p.pr.* Pars prostatica; *s.* Anterior sucke; *s.g.* Shell gland; *t.* Testis; *ut.* Uterus; *vit.* Vitellaria; *vit.d.* Vitelline duct; *v.s.* Vesicula seminalis.

inconspicuous, ventral, a little behind the posterior end. Genital tongue with two processes, the right and left genital lobe or papilla. Ovary globular, pre-testicular, lying partly over the posterior end of intestine, measuring 0·05×0·04. Vitelline glands composed of few large and round follicles, arranged in two lateral rows, 15-17 in number on right and left side respectively, extending from half the distance between ovary and anterior testis to a region much anterior to mouth. Shell gland complex pear shaped. Uterine coils not heavy, longitudinal in extension. Excretory system tubular. Eggs few, thin walled, oval, 0·0035×0·0023.

The species is characterised by very long body, comparatively very small cirrus sac, extension of vitellaria anterior to intestine and pharynx, position of ovary at the posterior end of elongated intestine, clear space between the ovary and anterior testis, and between the two testes and the cirrus sac.

Host.—*Sciæna belengeri.*

Location.—Alimentary canal.

Locality.—Bombay, India.

15. **Bucephalopsis sinhai** Dayal, 1948.

(TEXT-FIG. 15 *a, b, c.*)

Specific diagnosis : *Bucephalopsis* (Diesing, 1855) Nicoll, 1914; with Generic characters.

Body large, oval, with smooth skin, measuring 3·5×1·95 maximum width (in the region of ootype). Anterior sucker oval, 0·59×0·55. Mouth in the middle of body. Pharynx well developed, 0·28 in diameter. Oesophagus small, 0·10. Intestine sac like, 0·8×0·25. Testes two, oval in shape, obliquely one behind the other, in the posterior half. Anterior testis on the left side of intestine, oval in shape, 0·51×0·4. Posterior testis, 0·41×0·5. Cirrus sac long, cylindrical, extending from posterior testis to posterior end of body, 1·15×0·21. Vesicula seminalis interna, pars prostatica, prostate gland cells, ejaculatory duct and genital lobe present. Ovary situated at the posterior end of the anterior half of body, on the left side, smaller than testes, 0·41 in diameter. Ootype lying posterior to ovary. Shell gland mass compact, oval. Vitelline glands consist of large rounded or oval, sometimes bilobed follicles, running longitudinally on either side, in the anterior portion of body, 15-17 on right side and 12-14 on left. Laurer's canal present. Receptaculum seminis absent. Uterus forms transverse coils. Metraterm well developed, muscular. Eggs thick, brown shelled, 0·021-0·025×0·014-0·016. Excretory bladder Y-shaped. Excretory pore at the posterior end of the body.

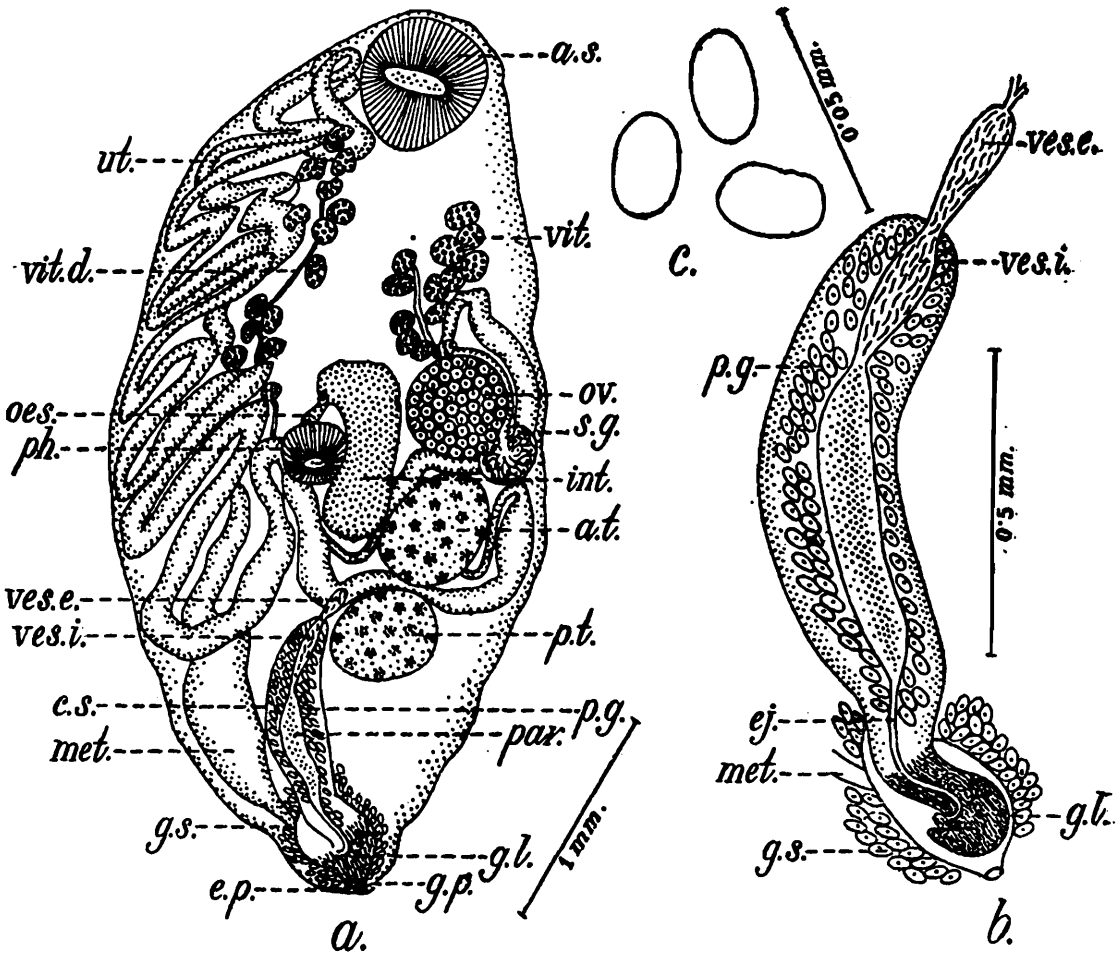
The species resembles *B. garuai* Verma but differs from it in the possession of a distinct vesicula seminalis external and in the relative position of the genital organs.

Opinions may differ, however, it may not be advisable to multiply the number of species on the basis of the character of presence or absence of a distinct vesicula seminalis externa only.

Host.—*Eutropiichthys vacha.*

Location.—Intestine.

Locality.—India.



Text-fig. 15.—*Bucephalopsis sinhai: a.* Entire specimen, ventral view; *b.* Cirrus sac, ventral view; *c.* Eggs (after Dayal).

a.s. Anterior sucker; *a.t.* Anterior testis; *c.s.* Cirrus sac; *e.j.* Ejaculatory duct; *e.p.* Excretory pore; *g.l.* Genital lobe; *g.p.* Genital pore; *g.s.* Genital sinus; *int.* Intestine; *met.* Metraterm; *oes.* Oesophagus; *ov.* Ovary; *ph*; Pharynx; *par.* Pars prostatica; *p.g.* Prostate glands; *p.t.* Posterior testis; *s.g*, Shell glands; *ut.* Uterus; *ves.e*, Vesicula seminalis externa; *ves.i.* Vesicula seminalis interna; *vit.* Vitelline glands; *vit.d.* Vitelline duct.

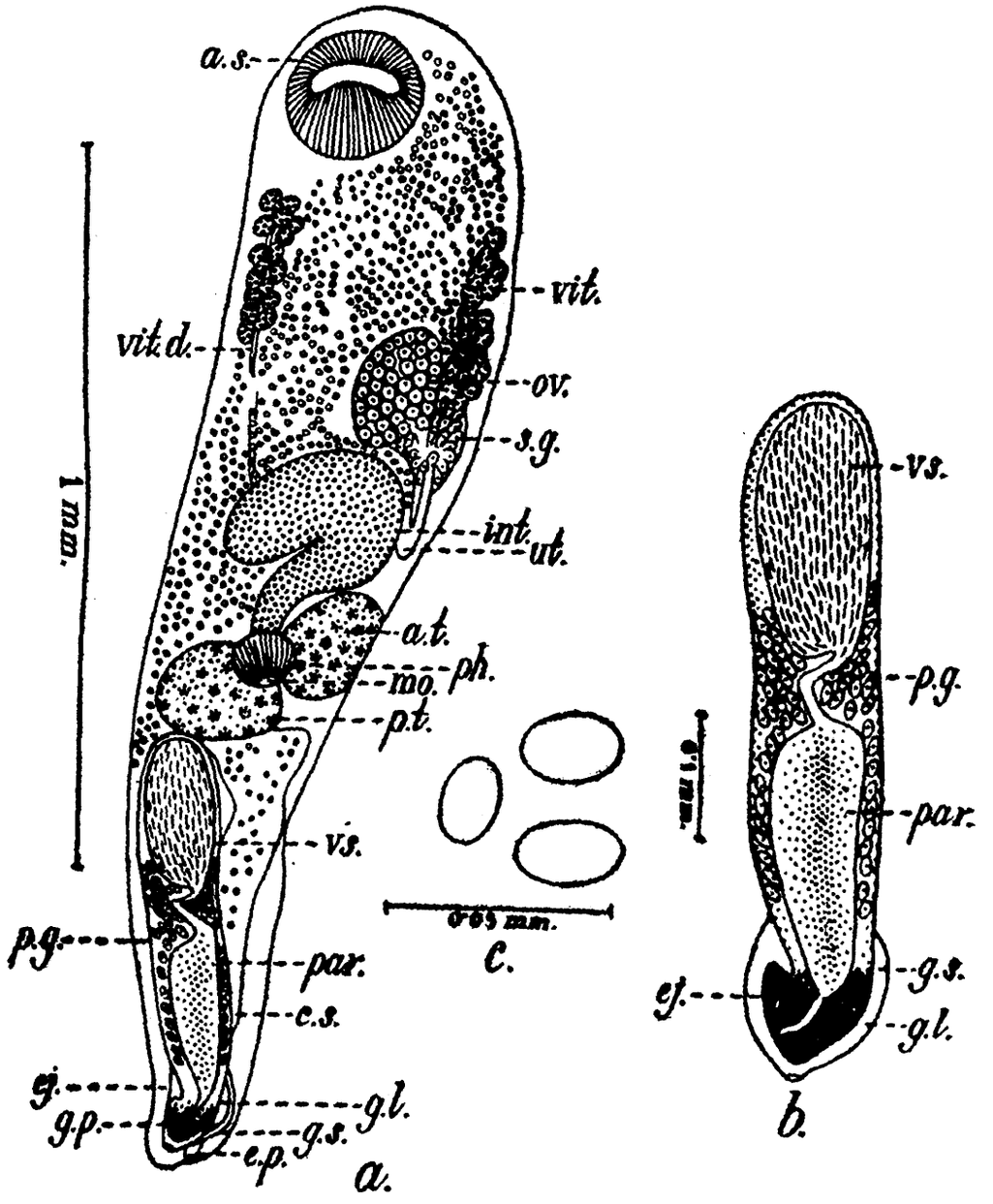
16. **Bucephalopsis thapari** Dayal, 1953.

(Text-fig. 16 *a, b, c.*)

Specific diagnosis : *Bucephalopsis* (Diesing, 1855) Nicoll, 1914; with Generic characters.

Body small, elongated and dorso-ventrally flattened, with anterior end broader than the posterior end of body, measuring 1·62 in length and 0·38 in maximum width (just behind the anterior sucker). Cuticle spined. Anterior sucker well developed, muscular, subterminal, 0·18×0·19. Mouth lying behind the middle of body. Pharynx well developed, muscular, 0·08 in diameter. Oesophagus long, 0·14×0·05. Intestine sac like. Testes two, oval, situated diagonally

on either side of the pharynx, partly overlapping it. Anterior testis lies on the left side of the pharynx, 0·17×0·12. Posterior testis lies on the right side of pharynx, 0·13×0·16. Cirrus sac long, cylindrical, extending from posterior end of body to posterior testis, 0·58×0·11. Vesicula seminalis, pars prostatica, prostate gland cells, ejaculatory duct, genital lobe present. Ovary oval, lies in the anterior half of body,



TEXT-FIG. 16.—*Bucephalopsis thapari* : *a*. Entire specimen, ventral view ; *b*. Cirrus sac, ventral view ; *c*. Eggs (after Dayal).

a.s. Anterior sucker ; *a.t*. Anterior testis ; *c.s*. Cirrus sac ; *e.j*. Ejaculatory duct ; *e.p*. Excretory pore ; *g.l*. Genital lobe ; *g.p*. Genital pore ; *g.s*. Geni sinus ; *int*. Intestine ; *mo*. Mouth ; *ov*. Ovary ; *p.g*. Prostate glands ; *ph* Pharyn x. *par*. Pars prostatica ; *p.t*. Posterior testis ; *s.g*. Shell gland ; *ut*. Uterus ; *v.s*. Vesicula seminalis ; *vit*. Vitelline gland ; *vit. d*. Vitelline duct.

in front of the intestine, on the left side, 0·18×0·12. Vitelline glands consist of large rounded follicles, 16-18, in number extending longitudinally on either side of body from shell glands to about 0·28 from anterior end. Uterus runs into the anterior end of body and occupies the entire space between the anterior sucker and posterior testis. Eggs, a large

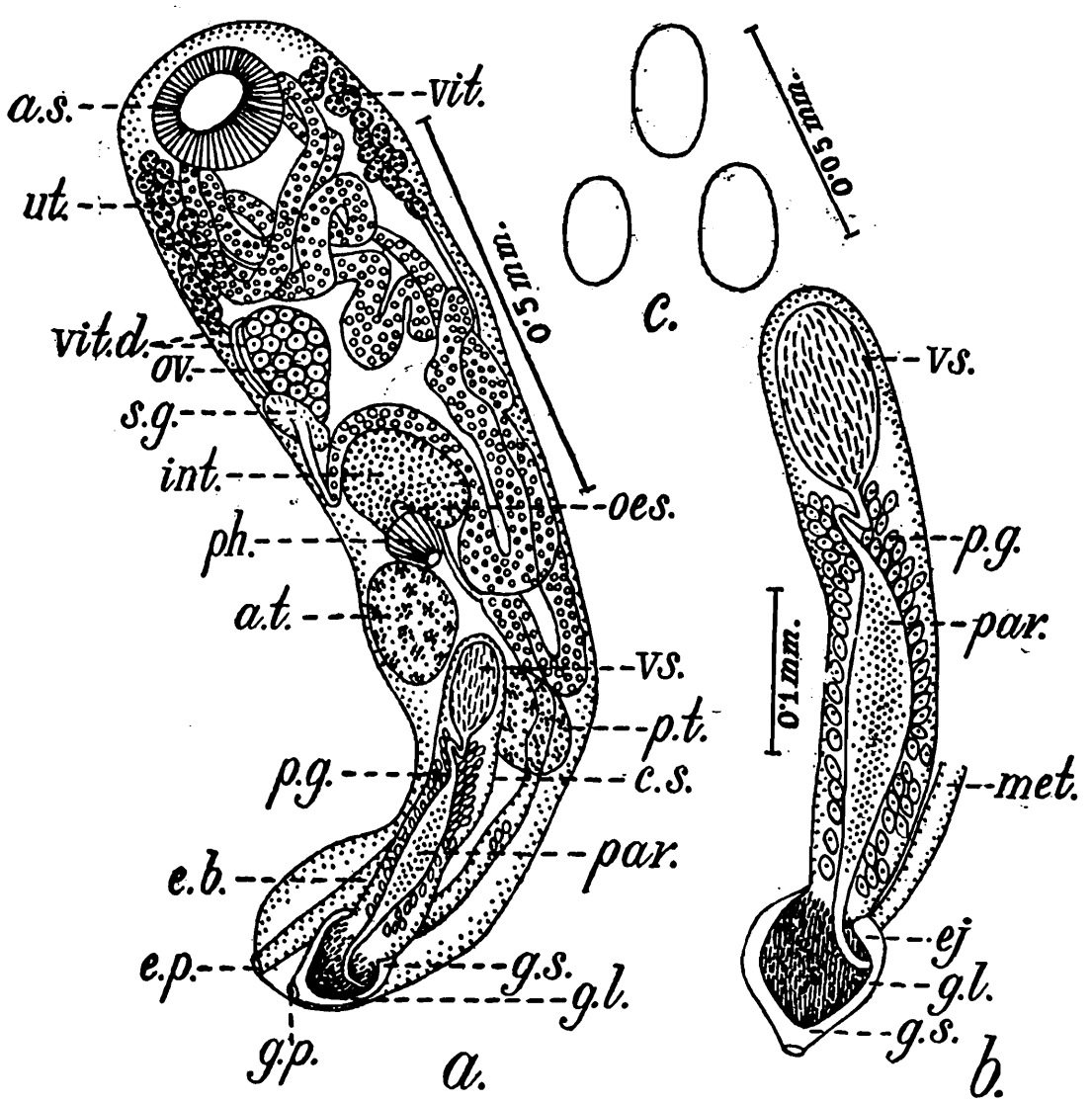
number, with a thin light brown shell, 0·018-0·023×0·012-0·015. Genital pore ventral, in front of the excretory pore, which lies at the posterior end of body. Excretory vessel elongate sac like bladder, extending upto the posterior testis.

The species differs from other species in the diagonal position of testes, one on either side of pharynx, in the position and arrangement of vitelline glands, and relative size of cirrus sac. *B. haimeanus* has testes on opposite side of the pharynx but *B. thapari* differs from it in the arrangement of vitelline glands, position of ovary and extended disposition of uterus.

Host.—*Macrones seenghala.*
Habitat.—Intestine.
Locality.—Lucknow, India.

17. **Bucephalopsis macronius** Dayal, 1948.

(Text-Fig. 17 *a, b, c.*)



Text-Fig. 17.—*Bucephalopsis macronius* : *a.* Entire specimen, ventral view; *b.* Cirrus sac, ventral view ; *c.* Eggs (after Dayal).

a.s. Anterior sucker ; *a.t.* Anterior testis ; *c.s.* Cirrus sac ; *e.b.* Excretory bladder ; *e.j.* Ejaculatory duct ; *e.p.* Excretory pore ; *g.l.* Genital lobe ; *g.p.* Genital pore ; *g.s.* Genital sinus ; *int.* Intestine ; *met.* Metraterm ; *oes.* Oesophagus ; *ov.* Ovary ; *p.g.* Prostrate gland ; *ph.* Pharynx ; *par.* Pars prostatica ; *p.t.* Posterior testis ; *s.g.* Shell gland ; *ut.* Uterus ; *v.s.* Vesicula seminalis ; *vit.* Vitelline gland ; *vit.d.* Vitelline duct.

Specific diagnosis : *Bucephalopsis* (Diesing, 1855) Nicoll, 1914 ; with Generic characters.

Body small, elongate, dorso-ventrally flattened, with broad anterior end and narrow posterior one, measuring 1·4×0·34 (behind anterior sucker). Cuticle smooth. Anterior sucker oval, 0·14×0·16. Mouth lies in the middle of body, on ventral side. Pharynx oval, 0·07×0·06. Oesophagus small, 0·02. Intestine sac like, recurved, 0·17×0·09. Testes two, oval, equal in size, diagonal in position, lying on either side of cirrus sac. Anterior testis lies on right side of cirrus sac, near mouth opening, 0·15×0·11. Posterior testis lies on the left side of cirrus sac. Cirrus sac long, tubular, with all component parts, vesicula seminalis, pars prostatica, prostate gland cells, ejaculatory duct, genital lobe, etc., extending from posterior end of body to middle of anterior testis, 0·49×0·08. Vesicula seminalis oval. Prostate gland cells numerous, genital lobe muscular, spoon shaped. Ovary pear shaped, lying on the right side, anterior to intestine, 0·15×0·09. Vitelline glands consist of 15-16 rounded or oval follicles, extending longitudinally on either side of body from anterior sucker to anterior end of ovary. Uterine coils extend posteriorly upto the anterior region of intestine and anteriorly upto the anterior sucker. Eggs oval, thin shelled, 0·012-0·015×0·01-0·012.

The species resembles *B. thapari* in the longitudinal arrangement of vitelline glands but differs from it in the posterior position of testes, in the extension of vitelline glands upto the anterior sucker and in the relative size of cirrus sac.

Host.—*Macrones seenghala.*

Habitat.—Intestine.

Locality.—India.

(iii) Genus **Rhipidocotyle** Diesing, 1858.

syn. *Nannoenterum* Ozaki, 1924. (Subgenus).

Diesing (1858) created the subgenus, *Rhipidocotyle* with two species, *Gasterostomum gracilescens* (Rudolphi, 1819) and *G. minimum* Wagner, 1852, alloted to it but without naming the type species. Stiles and Hassall (1908) regarded *G. gracilescens* (Rud. 1819) as the probable type. Nicoll (1914) while elevating the subgenus to a generic rank pointed out that the alternative species, *G. minimum* Wagner, 1852, must stand as the type, being the only one of the two species in which a sucker and a fanshaped hood are combined as implied by the name chosen by Diesing. Eckmann (1932) reexamined the original specimens and *G. minimum* Wagner, 1852 from Berlin Museum and came to the conclusion that *G. gracilescens* belongs to the genus *Bucephalopsis* and that *G. minimum* Wagner, 1852 did possess the additional process to the sucker and concurred with the opinion of Nicoll (1914) expressed previously. She also examined the material collected and labelled by Rudolphi (1819) as *G. galeatum* from *Centrontus glaucus*, Naples and considered it to be identical with *G. minimum*, with the result that *G. galeatum* (Rud. 1819) with *G. minimum* as synonymous to it, obtained the status of type species

of the Genus *Rhipidocotyle*. She also relegated *Nannœnterum* in to synonymy with *Rhipidocotyle*, the only difference between the two being trifling matters of shape and the relative positions of the uterus and vitellaria.

Generic diagnosis : *Bucephalinæ* Nicoll, 1914; with Subfamily characters.

Body elongate, cylindrical at its anterior half. Anterior sucker with a horse-shoe shaped structure with or without papillæ or with a fan shaped hood. Cuticle with spines. Oral aperture ventro-central, without sucker. Pharynx present. Cæcum simple, short. Genital aperture ventral, near the posterior end of the body. Ovary pretesticular. Receptaculum seminis present or absent. Laurer's canal present. Vitellaria lateral or transverse. Excretory vesicle a simple tubular sac with terminal pore.

Type species : *R. galeatum* (Rud. 1819) Eckmann, 1932 : syns. *Monotomum galeatum* Rudolphi, 1819; *Gasterostomum galeatum* (Rudolphi) of Stossich, 1898; *G. minimum* Wagner, 1852; *G. triglæ* (Beneden, 1870) of Nicoll, 1909; *Rhipidocotyle minimum* (Wagener) of Diesing, 1858; *Rhipidocotyle viperæ* Nicoll, 1914 nec. Beneden, 1870.

Chauhan (1943) recorded for the first time the following representatives of the genus from India : (1) *Rhipidocotyle ligulum* Chauhan, 1943 (2) *Rhipidocotyle apapillosum* Chauhan, 1943 and (3) *Rhipidocotyle septapapillata* Krull, 1934.

He gave a key to the species of the genus, which he considered to be valid. The Indian species can be distinguished by the following key :—

Key to Indian Species of Genus *Rhipidocotyle* Diesing, 1858.

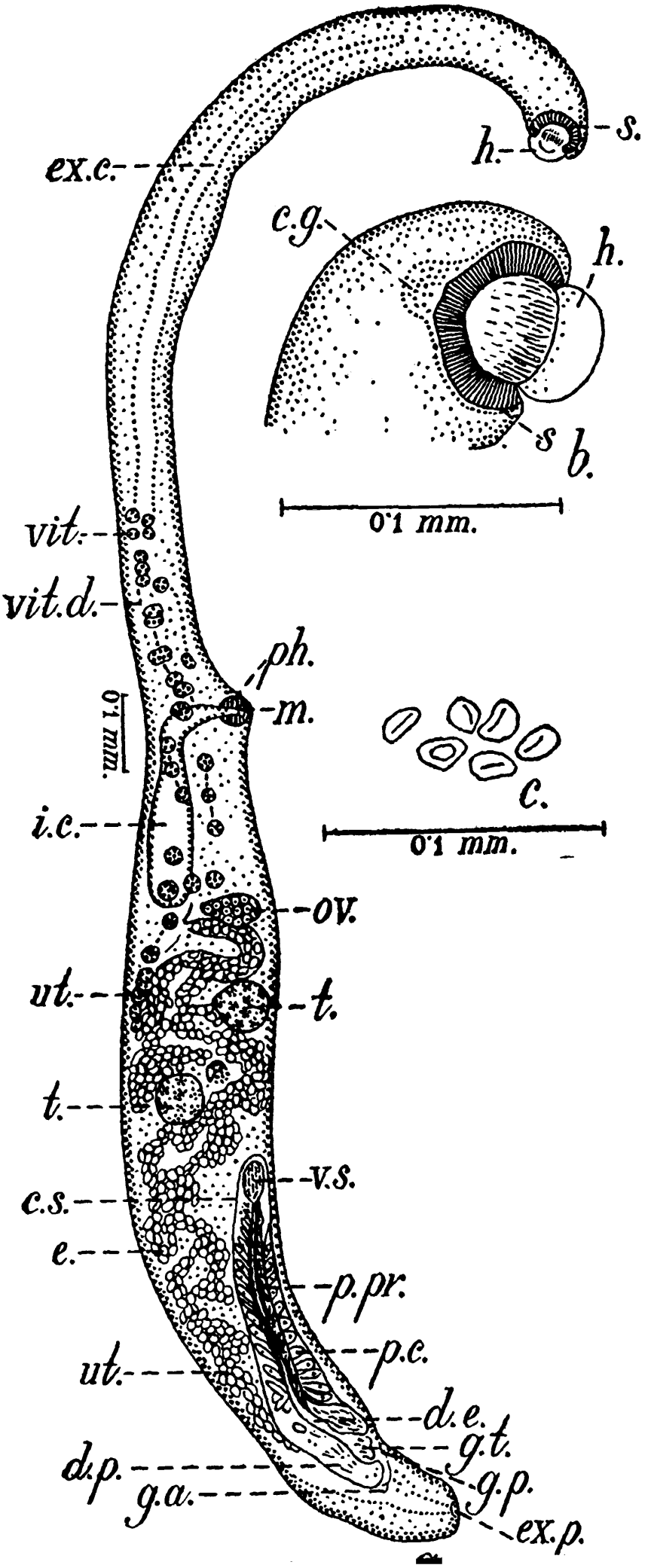
1. Hood or cephalic disc with seven papillæ	*R. septapapillata* Krull, 1934.
Hood or cephalic disc without papillæ	2.
2. Ovary situated in contact with anterior testis; testes contiguous, situated near the posterior end of intestinal sac; cirrus sac reaches upto the level of posterior testis	*R. apapillosum* Chauhan, 1943.
3. Ovary situated at the base of intestinal sac, separated from anterior testis; testes not contiguous, situated midway in the space between the posterior end of intestine and cirrus sac; cirrus sac not extending upto the level of posterior testis	*R. ligulum* Chauhan, 1943.

18. **Rhipidocotyle ligulum** Chauhan, 1943.

(Text-Fig. 18 *a*, *b*, *c*.)

Specific diagnosis : *Rhipidocotyle* Diesing, 1858; with Generic characters.

Body thin, narrow, elongate, measuring 2·68×0·21 maximum (at the level of testes); cuticle with spines. Most of the organs confined to the posterior, cylindrical half of body. Anterior half flat, containing a few vitelline follicles, excretory vessel and anterior organ of attachment. Anterior sucker muscular, subterminal, 0·12×0·075, with a prominent



TEXT-FIG. 18.—*Rhipidocotyle ligulum* : *a*. Entire specimen; *b*. Hood; *c*. Eggs magnified (after Chauhan).

c.g. Cytogenous glands; *c.s.* Cirrus sac; *d.e.* Ductus ejaculatorius; *d.p.* Dorsal process (genital lobe); *e.* Egg; *ex.c.* Excretory canal; *ag.* Genital atrium; *g.p.* Genital pore; *g.t.* Genital tongue; *h.* Hood or Cephalic disc; *i.c.* Intestinal canal; *m.* Mouth; *ov.* Ovary; *p.c.* Prostrate gland cells; *ph.* Pharynx; *p.pr.* Pars prostatica; *s.* Sucker; *t.* Testis; *ut.* Uterus; *vit.* Vitellaia; *vit. d.* vitelline duct; *v.s.* Vesicula seminalis.

but feebly developed muscular, crescent shaped, hood or cephalic disc without any papillæ, with no mid-ventral notch. Mouth small, ventral and indistinct. Pharynx small, compact, muscular and sub-spherical. Oesophagus narrow, very small, horizontal in extension, 0·03 mm. Intestine long, narrow, very thin walled, running along antero-posterior axis, 0·31 long, with maximum width at the level of posterior third of the organ. Gonads spaced, situated posterior to the intestine. Ovary elongate, pear shaped, smooth, pre-testicular, just posterior and lateral to intestine, to its left, 0·085×0·045. Mehlis gland situated midway between testes. Vitelline follicles large, round, about 21 on the right side and 13 on the left, in two longitudinal lateral rows. Uterus not much coiled but heavily laden with eggs, not extending anterior to ovary and posterior to genital atrium. Eggs very small, numerous, ovoid, 0·0035×0·0017 (average). Testes two, post ovarian, separate, obliquely tandem. Anterior testis situated behind ovary, on the left side, 0·07× 0·06. Posterior testis globular, slightly smaller than anterior, 0·06× 0 06. Cirrus sac much elongate and narrow, 0·53×0·08 maximum (in the region of genital lobes). Vesicula seminalis small, compact and oval. Pars prostatica long and sinuous but poorly developed. Prostate gland cells well developed. Genital atrium big with genital tongue and dorsal and ventral genital lobes or papillæ, the left being slender and small and dorsal, massive. Ductus ejaculatorius very narrow, tube like. Genital pore median, ventral, placed at some distance anterior to the posterior end of body. Excretory vessel tubular. Excretory pore terminal posteriorly.

Host.—*Arius falcarius*.

Location.—Alimentary canal.

Locality.—West Coast, Bombay (India).

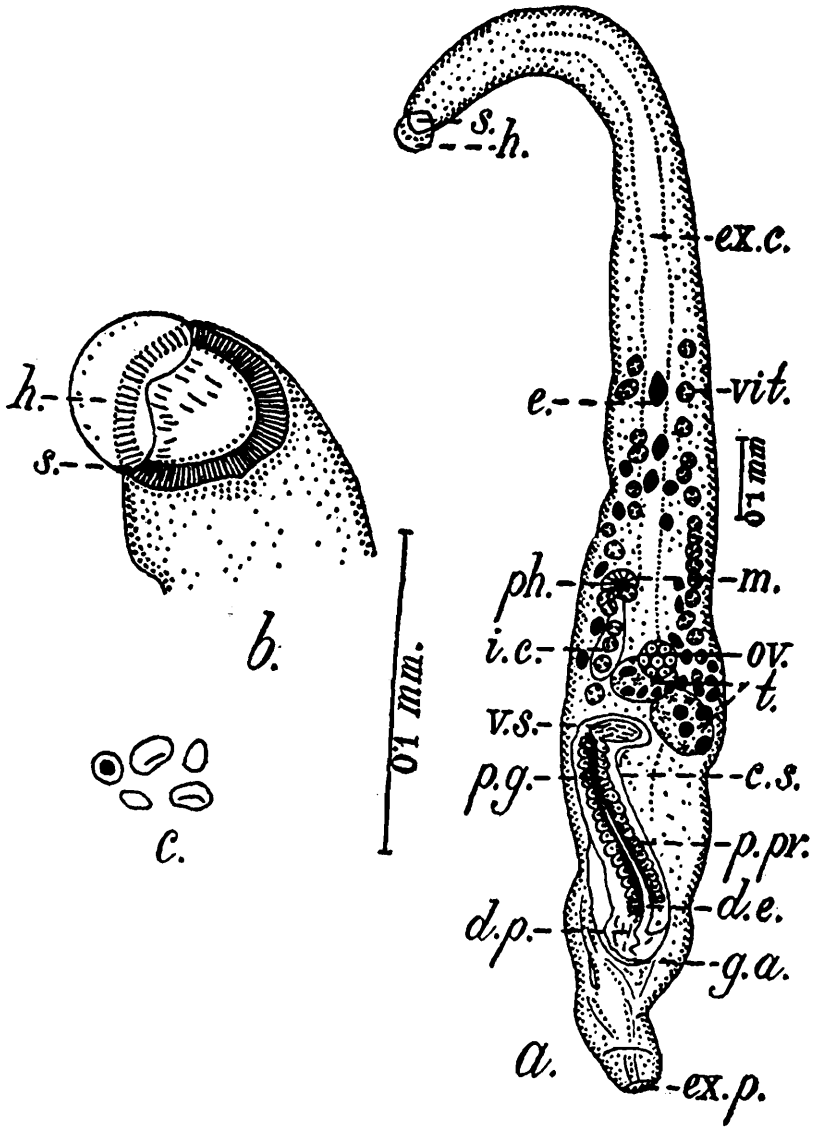
19. **Rhipidocotyle apapillosum** Chauhan, 1943.

(Text-Fig. 19 *a*, *b*, *c*.)

Specific diagnosis : *Rhipidocotyle* Diesing, 1858; with Generic characters.

Body small, elongate, 1·51×0·18 maximum (in the region of posterior testis). Anterior third of body slender, tapering anteriorly and flat; posterior two third contains almost all the important organs and is cylindrical, thick and wider; posterior end broadly tapering and flat. Anterior sucker sub-terminal, weakly muscular, 0·095×0·085. Hood or cephalic disc, in living specimens, slightly wider than anterior end of body, with a dorsal pad-like structure, with a semi-circular anterior edge and posterior edge prominently notched mid-ventrally, so as to divide it into two lateral lobes with rounded edges. Disc measures 0·09×0·06. No cytogenous organ was observed. Mouth ventral, small. Pharynx sucker like, spherical, 0·03 in diameter. Oesophagus small. Intestine sacular, extending posteriorly upto nearly the middle of the anterior testis, about 1/12 body length. Gonads contiguous, crowded together almost at the same level. Ovary small, sub-spherical, by the left side of intestine, anterior to anterior testis, slightly over-lapping it, 0·05×0·04. Vitellaria in two lateral, separated, longitudinal rows of

follicles. Follicles small, round, 14 on the right and 16 on the left side. Uterus does not extend beyond the anterior limit of vitellaria. Eggs minute, few, oval, very thin walled, 0·0125×0·0083 (average). Testes two, obliquely tandem, contiguous, oval. Anterior testis slightly smaller than posterior, situated slightly in mid-axis of body, in the posterior region of intestine, partly below ovary, 0·05×0·07. Posterior testis situated to the left, in contact with anterior one, 0·09×0·07. Cirrus sac extends almost to the anterior end of posterior testis, 0·36. Vesicula



TEXT-FIG. 19.—*Rhipidocotyle apapillosum*: *a*. Entire specimen; *b*. Hood enlarged; *c*. Eggs; enlarged (after Chauhan).

c.s. Cirrus sac; *d.e.* Ductus ejaculatorius; *d.p.* Dorsal process (genital lobe); *e.* Egg, *ex.c.* Excretory canal; *exc.p.* Excretory pore; *g.a.* Genital atrium *g.t.* Genital tongue; *h.* Hood or Cephalic disc; *i.c.* Intestinal canal; *m.* Mouth; *ov.* Ovary; *ph.* Pharynx; *p.pr.* Pars prostatica; *s.* Anterior sucker *t.* Testis; *vit.* Vitellaria; *v.s.* Vesicula seminalis.

seminalis ovoid; pars prostatica rather poorly developed. Prostate gland cells tall. Genital tongue not very conspicuous; left genital lobe or papilla slender, finger-like process; right sided a big spoon shaped papillated structure. Genital pore sub-terminal and inconspicuous. Excretory vesicle tubular bladder. Excretory pore terminal.

Host.—*Clupea* sp.

Location.—Alimentary canal.

Locality.—West Coast of India, Bombay.

20. **Rhipidocotyle septapapillata** Krull, 1934.

Specimens obtained by Chauhan (1943) were very much longer than the type species collected by Krull in Virginia, from *Fundulus diaphanus.*

Host.—*Chrysophrys berda.*

Location.—Intestine; January 1941.

Locality.—Bombay (India).

(iv) Genus **Neobucephalopsis** Dayal, 1948.

The genus has been created by Dayal (1948) to accommodate his new species, *Neobucephalopsis bagarius* which he states resembles the genus *Bucephalopsis* in the structure of the anterior sucker and the relative position of the genital organs but differs from it chiefly in the presence of a distinct receptaculum seminis and in having eggs with thin shell. He further states that receptaculum seminis, as far as, he is aware, is absent in all the known species of *Bucephalopsis* and this difference together with the general topography and the relative size of organs appears to him sufficient to warrant the erection of a new genus for his form.

I will, personally, not regard this as sufficient basis for the creation of a new genus and will therefore like to regard *Neobucephalopsis* Dayal, 1948 as synonymous to the genus *Bucephalopsis* and thus the species, *Neobucephalopsis bagarius* Dayal, 1948 becomes *Bucephalopsis bagarius* (Dayal, 1948), characterised from all the other species of the genus *Bucephalopsis*, known hitherto, chiefly by the presence of a distinct receptaculum seminis and other characters. However, pending the concurrence of other workers on the group, I am mentioning it here separately, under the new genus.

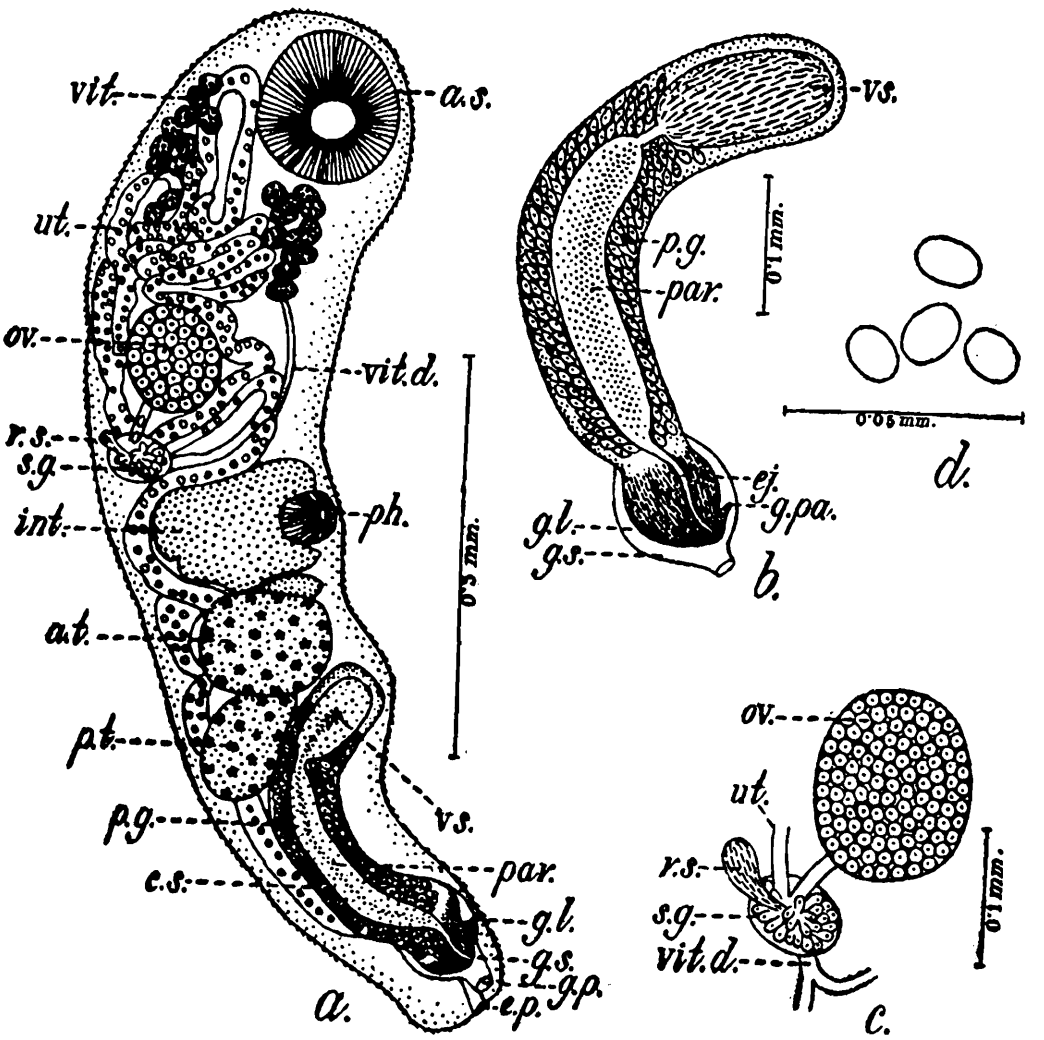
21. **Neobucephalopsis bagarius** Dayal, 1948.

(Text-Fig. 20 *a*, *b*, *c*.)

Specific diagnosis : *Neobucephalopsis* Dayal, 1948; with Generic characters.

Body small, cylindrical, elongate, with a broad anterior and narrow posterior portion, $1{\cdot}34 \times 0{\cdot}32$ maximum (in the anterior region of ovary). Cuticle spined. Anterior sucker sub-terminal, circular, $0{\cdot}17 \times 0{\cdot}175$. Mouth opening lies in the middle of body. Pharynx muscular, 0·07 diameter. Intestine sac like, lying transversely in the middle of body. Excretory bladder tubular, extending upto the anterior testis. Excretory pore terminal, posteriorly. Genital pore ventral, lying in front of excretory pore. Testes two, one behind the other, posterior to intestine. Anterior testis larger than posterior, $0{\cdot}13 \times 0{\cdot}016$ and posterior, $0{\cdot}15 \times 0{\cdot}1$, partly covered by anterior. Cirrus sac large, crescentic, extending upto anterior testis, $1{\cdot}51 \times 0{\cdot}08$. Vesicula seminalis

pars prostatica, prostate glands, ejaculatory duct and genital lobe present. Ovary oval, lies anterior to intestine, 0·14×0·12. Vitelline glands consist of large rounded or oval follicles, forming a compact mass, on each side of the body, behind the anterior sucker, 10-13 on each side. Receptaculum seminis present, on the right side of the ootype. Uterine



TEXT-FIG. 20.—*Neobucephalopsis bagarius* : *a.* Entire specimen, ventral view ; *b.* Cirrus sac, ventral view ; *c.* Ovary and ootype, ventral view ; *d.* Eggs, enlarged (after Dayal).

a.s, Anterior sucker ; *a.t*, Anterior testis ; *c.s*, Cirrus sac ; *ej*, Ejaculatory duct ; *e.p*, Excretory pore ; *g.l*, Genital lobe ; *g.p*, Genital pore ; *g.psa*, Genital papilla ; *g.s*, Genital sinus ; *int*, Intestine ; *ov.*, Ovary ; *p.g*, Prostate gland ; *ph*, Pharynx; *par*, Pars prostatica ; *p.t*, Posterior testis ; *r.s*, Receptaculum seminis ; *s.g*, Shell gland ; *ut*, Uterus ; *v.s*, Vesicula seminalis; *vit*, Vitelline gland ; *vit.d*, Vitelline duct.

coils irregular. Eggs, oval, thin shelled, 0·01-0·02×0·009-0·01. (Type species).

Host.—*Bagarius yarrellii.*

Habitat.—Intestine.

Locality.—India.

B. Subfamily *PROSORHYNCHINAE* Nicoll, 1914.

Syns. *Prosorhynchia* Pigulewsky, 1931 (tribe)
Gotonia Pigulewsky, 1931 (tribe).

A number of genera have been referred to this subfami y, from time to time, with the result that the validity of many of them in the

subfamily has become a rather confused matter. Number of workers have tried to study but opinions widely differ. Nagaty (1937) regards only three genera valid under the subfamily *viz.* *Prosorhynchus* Odhner, 1905; *Alcicornis* MacCallum, 1917 and *Neidhartia* Nagaty, 1937. He regards *Gotonius* Ozaki, 1924; *Skrjabiniella* Issaitschikow, 1928; *Mordvilkovia* Piguleswsky, 1931; *Dollfusina* Eckmann, 1932 (pre-occupied) and *Dollfustrema* Eckmann, 1934 as synonymous to *Prosorhynchus Odhner, 1905.* Manter (*1940*,b) believed that *Dollfustrema* and *Mordvilkovia* should be excluded from the synonymy proposed by Nagaty. He further regarded *Pseudoprosorhynchus* Yamaguti, 1938 as a synonym of *Neidhartia.* Jones (1943) considered *Skrjabiniella* to be a valid genus. Ben Dawes (1946) considers only two, *Prosorhynchus* and *Alcicornis* as valid genera under the subfamily. Crowcroft (1946) also does not agree with Jones in regarding *Skrjabiniella* as a valid genus. He divides all the known species of the genus *Prosorhynchus* under two groups, on the basis of disposition of vitelline follicles and shape of rhynchus and puts *P. aculeatus* Odhner, *P. squamatus* Odhner, *P. uniporus* Ozaki and *P. grandis* Lebour under group I, with the yolk follicles in an anterior arc and the rhynchus being oval, and the species, P. *facilis* Ozaki, *P. cortai* Trav., Art. & Per; *P. platycephali* (Yamaguti), *P. manteri* Srivastava; *P. arabiana* Srivastava, *P. ozakii* Manter, *P. rotundus* Manter, *P. gonoderus* Manter, *P. pacificus* Manter, *P. atlanticus* Manter and *P. promicropsi* Manter under Group II, with follicles in two lateral groups and rhynchus being tapering internally. He considers genus *Gotonius* Ozaki to be most suitable genus to receive the members of Group II. He disagrees with the attempt of Srivastava (1938) to show *Prosorhynchus* and *Gotonius* as synonyms based upon comparison of body shape and relative positions of the gonads, neither of which characters he states can be regarded as a sound basis, for comparison in this group. He further considers *Mordvilkovia* as a valid genus. He creates a new genus, *Telorhynchus* with *T arripidis* as type species as possessing a conical rhynchus and yolk follicles in the form of an anterior arc and regards it as a linking form. He states that it differs from the species listed by him under Group I and II, in that the rhynchus is armed with a single circle of spines, interrupted in the mid-ventral line. Dayal (1948) adds another genus, *Neoprosorhynchus* to the subfamily.

The valid genera of the subfamily *Prosorhynchinae* can be identified by the following key.—

Key to Genera of Subfamily *Prosorhynchinae* Nicoll, 1914—

1. Ovary at opposite side of testes, on the left side.	*Neidhartia*, Nagaty, 1937.
Ovary anterior to anterior testis, on the right side	2.
2. Anterior end provided with a rhynchus only	*Prosorhynchus* Odhner, 1905.
Anterior end provided with a rhynchus and tentacles	*Alcicornis* MacCallum, 1917.

(i) Genus **Prosorhynchus** Odhner, 1905.

syns. *Gotonius* Ozaki, 1924.
Skrjabiniella Issaitschikow, 1928.

Mordvilkovia Piguleswky, 1931.
Dollfusina Eckmann, 1932, pre-occupied.
Dollfustrema Eckmann, 1934.

Odhner (1905) created the genus *Prosorhynchus* to accommodate the species he described as *P. squamatus* from the pyloric cæca and intestine of *Cottus scorpius* and *P. aculeatus* from the intestine of *Conger vulgaris* from Arctic regions, along with *P. crucibulus* (Rudolphi, 1819). He designated *P. squamatus* as the type species. However, as this was found later to be synonymous to *P. crucibulum*, the latter is now regarded as the type of the genus.

Generic diagnosis: *PROSORHYNCHINAE* Nicoll, 1914; with Sub-family characters.

Body elongate, cylindrical, anterior half flatened and posterior cylindrical in some of the species. Cuticle spiny. Anterior end with a conical rhynchus but without tentacles or a sucker. Oral aperture simple, not guarded by an oral sucker and opens on the ventral surface. Pharynx present, muscular. Intestinal cæcum simple and sac shaped with its blind end either directed anteriorly or posteriorly. Testes two, smooth contoured. Cirrus sac elongate, at the posterior end and towards the left side of the body. Ovary anterior to testes. Receptaculum seminis absent. Vitelline glands composed of two sets. Uterine coils extend anteriorly as well as posteriorly. Male and female genital ducts open in a common genital atrium at the posterior end. Excretory vesicle a simple tubular sac, opening at the posterior end.

Type species—*P. crucibulum* (Rud., 1819) Odhner, 1905.

syns. *Monostomum crucibulum* Rudolphi, 1819.
Gasterostomum crucibulum (Rudolphi, 1819) nec. G. *crucibulum* Beneden, 1870.
G. armatum Molin, 1859.
Prosorhynchus costai Travassos, Artigas & Pereira, 1928.
Mordvilkovia elongata Piguleswky, 1931.
Prosorhynchus scalpellus McFarlane, 1936.
P. squamatus Odhner, 1905.
Bucephalus crux Levinsen, 1881.
Prosorhynchus grandis Lebour, 1908.
Prosorhynchus triglæ sq. inqurenda Nicoll, 1914.
P. aculeatus Odhner, 1905.
G. crucibulum Beneden, 1870.
G. armatum Olsson, 1876.
Skrjabiniella aculeatus (Odhner, 1905) Issaitschikow, 1928.

The following species of the genus have been, so far, recorded from the Indian region 1. *P. truncatus* Verma, 1936; 2. *P. manteri* Srivastava, 1937; 3. *P. arabiana* Srivastava, 1937 and 4. *Prosorhynchus* sp. Chauhan, 1943. They can be distinguished from the following key.—

Key to Indian Species of Genus *Prosorhynchus* Odhner, 1905.

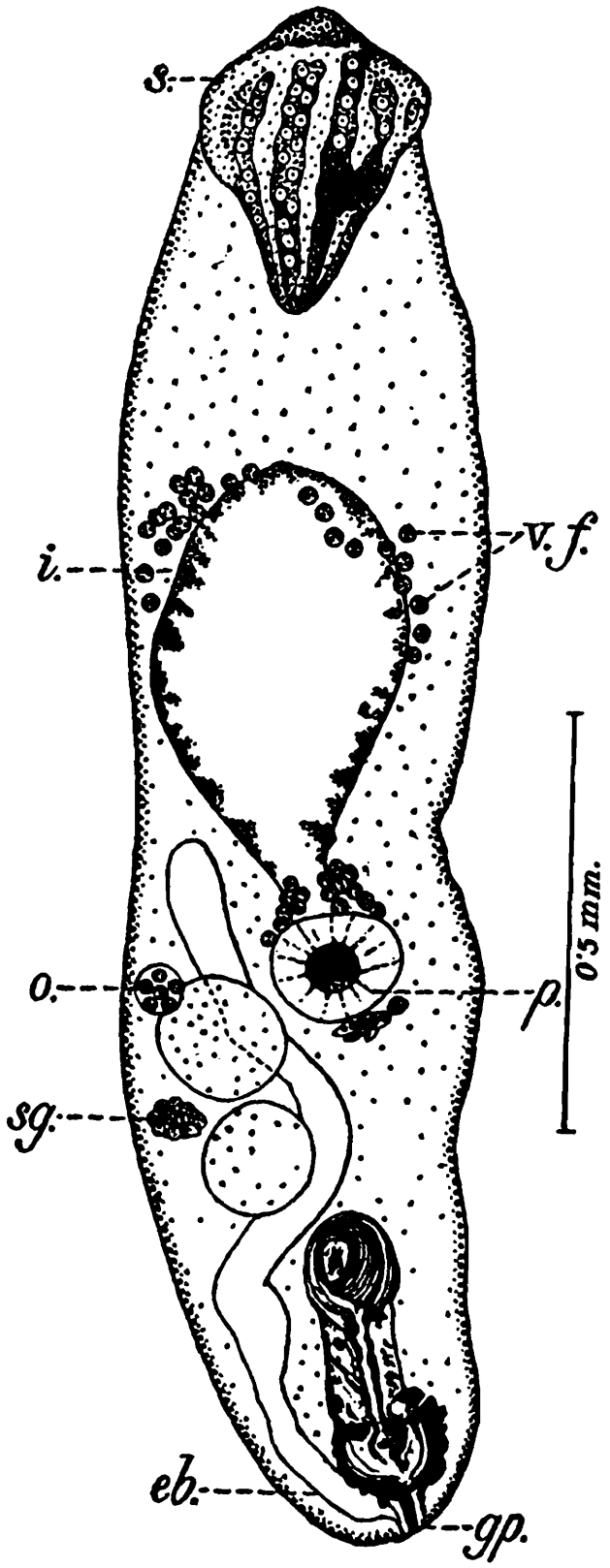
1. Vitelline follicles, extending beyond the middle of body . . . 2.
   Vitellaria, confined to the posterior half of body — *P. arabiana* Srivastava, 1938.
2. Ovary, intestinal sac, mouth opening, vitellaria and pharynx situated in the anterior half of body — *P. manteri* Srivastava, 1938.

Ovary, pharynx, mouth opening, situated in the posterior half and the intestinal sac and vitellaria in the middle third of body — *P. truncatus* Verma, 1936.

22. **Prosorhynchus truncatus** Verma, 1936.

(Text-Fig. 21).

Srivastava, H. D. 1938 *J. Indian vet. Sci.* **8**, (4,) : 333.



Text-Fig. 21.—*Prosorhynchus truncatus* : Entire specimen, ventral view (after Verma) *eb*, Excretory bladder; *g.p*, Genital pore; *i*, Intestine; *o*, Ovary; *p*. Pharynx; *s*, Sucker or rhynchus; *sg*, Shell gland; *vf*, Vitelline follicles.

Specific diagnosis : *Prosorhynchus* Odhner, 1905; with Generic characters.

Body elongate, cylindrical, more or less four times, as long as thick, measuring 1·76×0·42 maximum (at the level of pharynx). At the anterior end a truncated triangular rhynchus, 0·25. Cuticle spined. Pharynx globular, situated one third the body length from the posterior end, 0·15 in diameter. Oesophagus 0·084 long. Intestine saccular, 0·46×0·3. Ovary lies at the level of mouth opening, in close contact with the anterior border of anterior testis. Shell gland forms a compact, oval mass in between the two testes. Vitellaria consist of 29, small, rounded follicles, arranged in semi-circles, along the anterior curve of intestine. Follicles do not extend beyond the level of middle of intestine. Testes obliquely tandem, oval. Anterior testis measures 0·151×0·134; posterior 0·134 in diameter, smaller, more rounded, separated from the anterior. Cirrus sac short, 0·33×0·08, extending to the level of the posterior margin of the posterior testis. Genital pore lies at the posterior end. Excretory bladder sinuous and tubular. Eggs, 35-40μ×18-20μ.

Host.—*Arius jatuis.*

Location.—Intestine.

Locality.—Puri, Bay of Bengal, India.

23. **Prosorhynchus manteri** Srivastava, 1938.

(TEXT-FIG. 22).

Jones, D. O. (1943). *Parasitology* **35**, (1 & 2) : 46.
Crowcroft, P. W. (1946). *Proc. Linn Soc.* N.S. Wales 71, (3/4): 113.
Dawes, Ben (1946). The Trematoda of British Fishes. London : 159, 197.

Specific diagnosis : *Prosorhynchus* Odhner, 1905; with Generic characters.

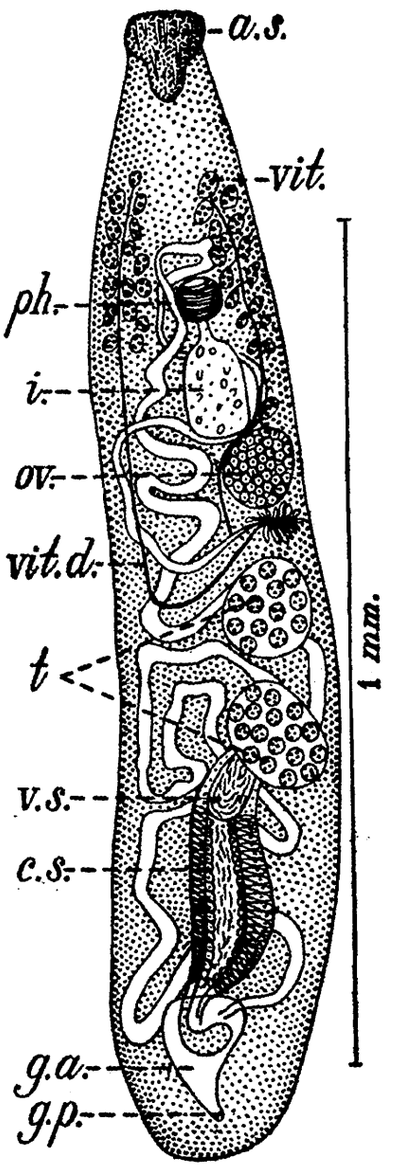
Body cylindrical, anterior end truncated, posterior rounded 0·86-2·26×0·3-0·64. Cuticle with spines. At the anterior end a plug-shaped rhynchus, 0·1-0·12×0·08-0·1, with a thin muscular wall. Pre-pharynx extremely short. Pharynx conspicuous, 0·05-0·1×0·05-0·1 situated in the median axis, at the junction of first and second quarters. Oesophagus short. Intestine bell shaped, 0·12-0·36×0·6-0·34, extending up to the posterior margin of ovary. Testes two, oval, tandem, in the middle third of body. Anterior testis 0·16-0·5×0·18-0·56, posterior 0·12-0·48×0·18-0·5, lying partly on the anterior part of vesicula seminalis. Cirrus sac 0·28-0·6×0·8-0·14. Genital pore ventral. Ovary spherical, with a diameter of 0·16-0·44, lying in front of anterior testis. Vitellaria composed of small, oval follicles, arranged longitudinally, in pairs, along the sides of the body and extending from in front of ovary to the anterior one fifth or eighth of body length. Uterine coils occupy most of the space between the genital sinus and first quarter of body. Eggs oval, 0·019—0·02×0·011-0·013. Excretory bladder a simple, long tube, extending from the anterior level of vitellaria to the posterior end.

The species resembles *P. truncatus* Verma in the shape of body but differs from it in most of its characters, *e.g.* the topography of the gonads, position of pharynx ; intestine, genital pore and vitellaria.

Host.—*Tetradon oblongus* Bl.

Location.—Intestine, duodenum.

Locality.—Puri, Bay of Bengal.



Text-Fig. 22.—*Prosorhynchus manteri.* Entire specimen (after Srivastava).

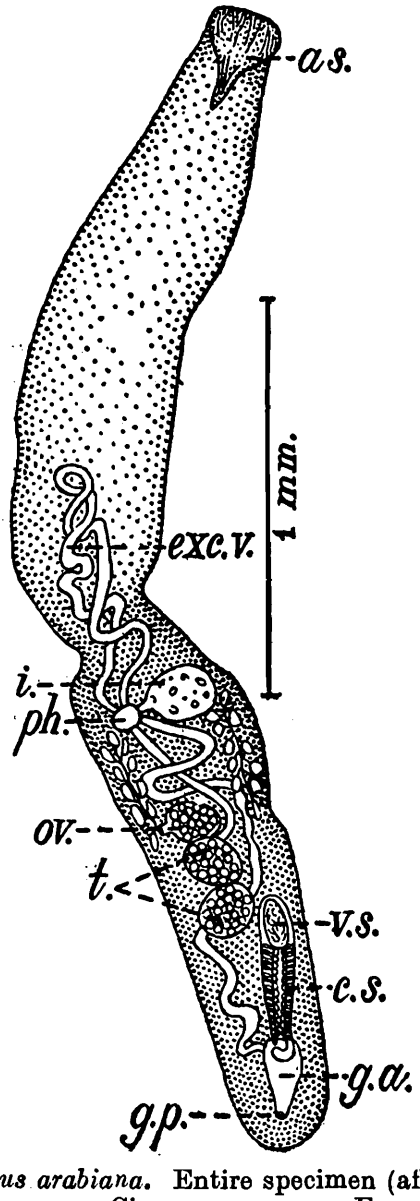
a.s, Anterior sucker; *c.s*, Cirrus sac; *g.a*, Genital atrium; *g.p*, Genital pore; *i*, Intestine; *ov*, Ovary; *ph*, Pharynx; *t*, Testes; *vit*, Vitellaria; *vit.d*, Vitelline duct; *v.s*, Vesicula seminalis.

24. **Prosorhynchus arabiana** Srivastava, 1938.

Crowcroft, P. W. (1946). Proc. Linn. Soc. N. S. W. **71** (3/4) : 113.
Dawes, Ben (1946). The Trematoda of British Fishes. Lond ; 159, 197.
Jones, D. O. (1943). *Parasitology.* **35** (1/2) : 46.

Specific diagnosis : *Prosorhynchus* Odhner, 1905 ; with Generic characters.

Body elongated, cylindrical, 3·3-4·5×0·4-0·6, maximum (at the level of ovary). Cuticle spined. Anterior rhynchus baloon shaped, 0·22-0·3×0·16. Pharynx small, globular, 0·06-0·08 in diameter, situated to the left of median axis, about three fifths of body length from anterior end. Oesophagus small. Intestine bulb shaped 0·16-0·24× 0·12-0·15. Testes tandem. Posterior testis 0·1-0·12×0·08-0·12, anterior 0·1-0·12 in diameter. Cirrus sac small, narrow, club shaped, 0·4-0·26× 0·06-0·08, extending upto the middle of posterior testis. Genital tongue



TEXT-FIG. 23.—*Prosorhynchus arabiana.* Entire specimen (after Srivastava).
a.s, Anter ior sucker ; *c.s*, Cirrus sac ; *exc.v*, Excretory vesicle ; *g.a*, Genitah atrium ; *g.p*, Genital pore ; *i*, Intestine ; *ov*, Ovary ; *ph*, Pharynx ; *t*, Testes ; *v.s*, Vesicula seminalis.

small, hook shaped. Ovary small, ovoid, 0·08-0·12 in diameter, lying in front of anterior testis. Laurer's canal present. Vitellaria consist of small, pear shaped follicles, arranged longitudinally in pairs, on either side, extending from the level of posterior margin of ovary to the level of pharynx. Uterus with many eggs, extending from anterior two fifths of body length upto the genital tongue. Eggs, 0·023×0·012.

Excretory bladder small, elongate, saccular tube, extending from the level of pharynx to excretory pore, which is situated near the genital pore.

Host.—*Synaptura orientalis* Bloch.

Habitat.—Intestine.

Locality.—Karachi, Arabian Sea (Pakistan).

25. **Prosorhynchus** sp. Chauhan, 1943.

Only a few specimens were obtained by Chauhan in 1940.

Host.—*Serranus lanceolatus.*

Location.—Alimentary canal.

Locality.—Bombay (India).

(ii) Genus **Neidhartia** Nagaty, 1937.

syn. *Pseudoprosorhynchus* Yamaguti, 1938.

Dawes, B. (1946). The Trematoda. Cambridge University Press.
Chauhan, B.S. (1943). *Proc. Indian Acad. Sci.* **17** : 112-117.

The genus was created by Nagaty (1937) to accommodate the two new species described by him in 1937 as *N. neidharti* and *N. ghardagae* from the intestine of the fish *Serranus* sp. from Red Sea. Ben Dawes (1946) regards this genus as synonymous to *Prosorhynchus* Odhner, 1905.

Generic diagnosis : *Prosorhynchinae* Nicoll, 1914 ; with Subfamily characters.

Body elongate, cylindrical. Cuticle spiny. Anterior end with a conical rhynchus but without tentacles or a sucker. Oral aperture simple, removed from the anterior end and posterior extremities of the body. There is no oral sucker. A muscular pharynx is present. Intestinal caecum simple and sac shaped. Testes two, smooth contoured, on the right side of body. Cirrus sac elongate, at the posterior end and towards the left side of body. Ovary on the left side of body, opposite the testes. Vitelline glands composed of two sets. Uterine coils extend anteriorly as well as posteriorly. Excretory vesicle simple, tubular sac, opening at the posterior end.

Type species—*N. neidharti* Nagaty, 1937.

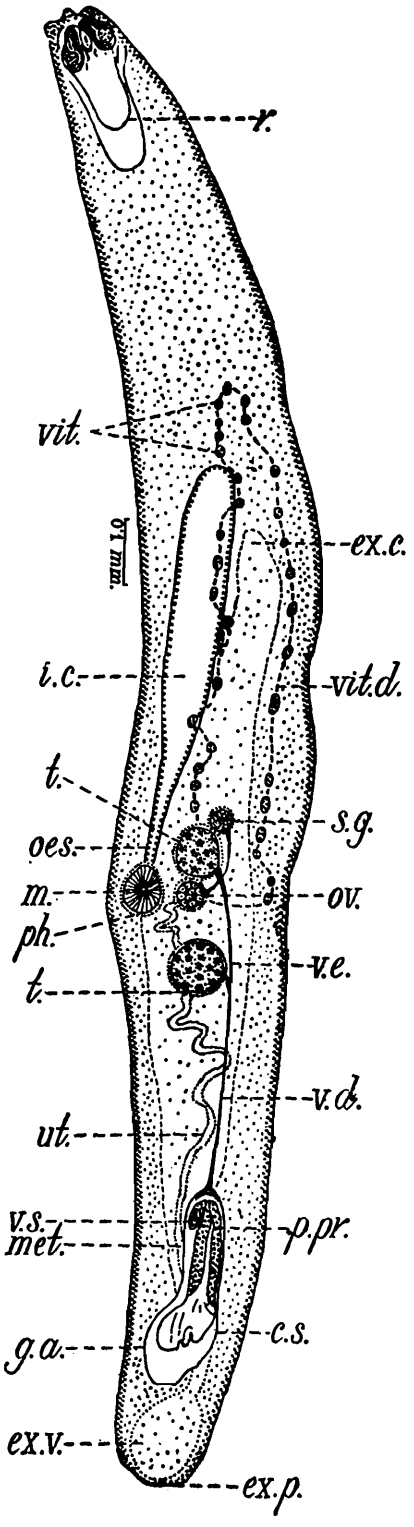
The representatives of this genus were recorded for the first time in India by Chauhan (1943) who recorded the occurrence of *Neidhartia neidharti* Nagaty, 1937 and described a new species, *Neidhartia microrhyncha* Chauhan. These can be distingusihed as follows :—

Key to Indian Species of Genus *Neidhartia* Nagaty, 1937.

Body ovate ; rhynchus large ; cirrus sac small, 1/8 to 1/9 body length ; vitellaria extend upto rhynchus. Cirrus sac extending upto posterior testis and ovary	*N. neidharti* Nagaty, 1937.
Body elongate ; rhynchus small ; cirrus sac large, 1/3 body length ; vitellaria short in extension, much behind the rhynchus. Cirrus sac not extending upto testes and ovary	*N. microrhyncha* Chauhan 1943.

26. **Neidhartia microrhyncha** Chauhan, 1943.

Specific diagnosis: *Neidhartia* Nagaty, 1937; with Generic characters.



TEXT-FIG. 24.—*Neidhartia microrhyncha*. Entire specimen (after Chauhan)

c.s, Cirrus sac; *ex.c*, Excretory canal; *exc.p*, Excretory pore; *ex.v*, Excretory vesicle; *g.a*, Genital atrium; *i.c*, Intestinal canal; *m*, Mouth; *met*, Metraterm; œs., Oesophagus; *ov*, Ovary; ph, pharynx; *p.pr*, Pars prostatica; *r*, Rhynchus; *s.g* Shell Gland; *t*, Testis; *ut*, Uterus; *v.d.*, vas deferens; *v.e.*, vasa efferentia; *vit.*, Vitellaria; *vit.d.*, Vitelline duct; *v.s*, Vesicula seminalis.

Body very elongate, truncated, 1·39-2·93 × 0·23-0·4, maximum width (in the region of pharynx). Cuticle spiny. Anterior end with a well

developed rhynchus or rostellum, 0·144-0·23 × 0·07-0·106, with two highly muscular ridges. Important organs confined to the posterior half. Mouth simple, ventral. Pharynx small, compact, oval or globular, 0·06 × 0·03-0·10-0·11. The position of pharynx in relation to gonads variable. Oesophagus small. Intestine saccular, thin walled, shape variable, elongate or oval, 0·34-0·8. Gonads always situated much anterior to cirrus sac about the neighbourhood of pharynx and mouth. Testes two, oval or spherical, obliquely tandem. Anterior testis smaller than posterior, 0·062 × 0·062-0·08 × 0·09; posterior 0·075 × 0·062-0·1 × 0·12. Cirrus sac elongate, situated at the posterior end to the left side, 1/8 to 1/9 body length, measuring 0·175-0·33. Vesicula seminalis ovoid; prostate gland cells poorly developed. Ovary small, oval or spherical, inter-testicular, smaller than testes, 0·37 × 0·37-0·08 × 0·05. Shell gland round. Laurer's canal present. Vitelline glands composed of two longitudinal strands of vitelline follicles, arranged laterally, probably coming together anteriorly. Follicles are oval granular, numbering 16-17 on right side and 15 on the left. Uterus consists of few very narrow, thin coils. Excretory organ is a simple bladder.

Host.—*Psettodes erumei.*

Location.—Alimentary canal.

Locality.—Bombay (India).

27. **Neidhartia neidharti** Nagaty, 1937.

Chauhan, B. S. (1943). Proc. Indian Acad. Sci. B **17** : 102

The rhynchus of the specimen obtained by Chauhan (1943) was smaller than that of specimens of Nagaty (1937).

Host.—*Belone* sp.

Location.—Small Intestine.

Locality.—Bombay (India).

(iii) Genus **Neoprosorhynchus** Dayal, 1948.

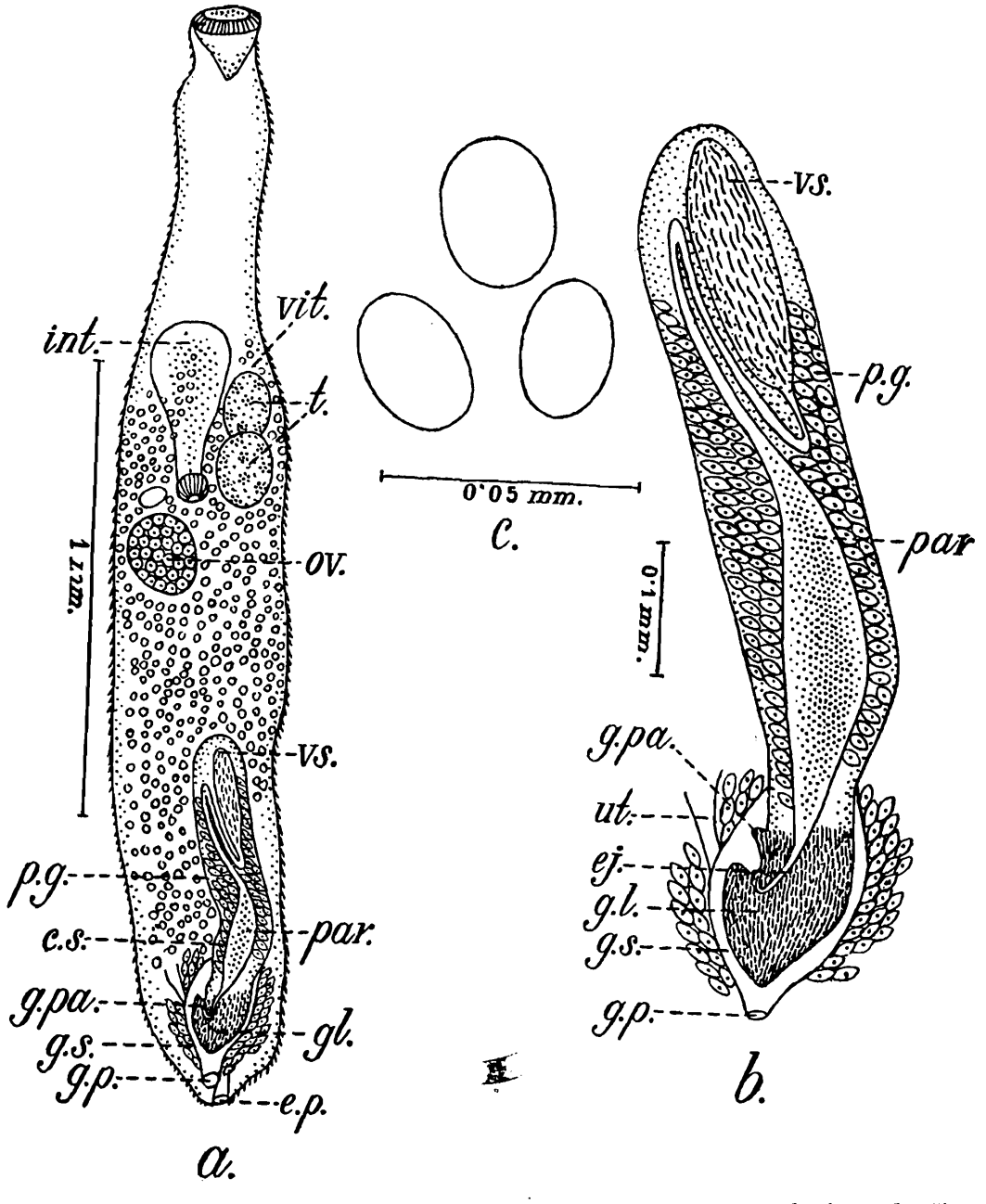
Dayal (1948) created a new genus, to accommodate his new species, *Neoprosorhynchus purius*, on the ground that his species differs from all the known genera in the relative position of ovary and testes and in the possession of a *Y*-shaped excretory bladder. These points seem to him to be sufficient to warrant the creation of the new genus.

28. **Neoprosorhynchus purius** Dayal, 1948.

Specific diagnosis : *Neoprosorhynchus* Dayal, 1948; with Generic characters.

Body small, cylindrical, elongate, with a broad anterior and a narrow posterior portion, measuring 2·4 × 0·37 Cuticle spiny. Anterior rostellum 0·15, having the shape of an inverted cone. Pharynx, 0·07 in diameter. Oesophagus long. Intestine sac like, about 0·26 × 0·19. Excretory pore terminal. Excretory bladder *Y*-shaped. Genital pore ventral. Testes two, oval, tandem, on the left side, at about

the level of pharynx and oesophagus. Anterior testis 0·15×0·1; posterior larger than anterior, partly covering it, 0·16×0·11. Cirrus sac 0·72×0·11. Vesicula seminalis tubular; pars prostatica S-shaped Genital lobe large, muscular. Ovary lies posterior to testes, behind the



TEXT-FIG. 25.—*Neoprosorhynchus purius*: *a*. Entire specimen, ventral view; *b*. Cirrus sac, enlarged; c. Egg, enlarged (after Dayal).

c.s, Cirrus sac; *ej*, Ejaculatory duct; *e.p*, Excretory pore; *g.l*, Genital lobe; *g.p*, Genital pore; *g.pa*, Genital papilla; *g.s*, Genital sinus; *int*, Intestine; *ov*, Ovary; *p.g*, Prostate gland; *par*, Pars prostatica; *p.t*, Posterior testis; *ut*, Uterus; *v.s*, Vesicula seminalis; *vit*, Vitelline gland; *vit.d*, Vitelline duct.

oral aperture, on the right side of median line, 0·18. Vitelline glands consist of small follicles, scattered irregularly, on either side of intestine, partly covering it. Uterine coils, fill up entirely space between ovary and cirrus sac. Eggs, in large number, oval, with a thick brown shell, 0·025-0·027×0·018-0·021.

Host.—*Epinephelus lanceolatus* (Bl.).

Location.—Intestine.

Locality.—Puri, India.

IV. *List of hosts, localities, with parasites recorded from them from the Indian region described in this paper.*

Host.	Parasite.
Aoria aoria (-*Macrones aoria*) Day, Allahabad .	*Bucephalus tridenticularia* *Bucephalus aoria.*
Aoria seengha la (-*M. seenghala*) Day, Allahabad.	*Bucephalus tridenticularia.*
Arius falcarius, Bombay	*Rhipidocotyle ligulum.*
Arius jatuis, Puri	*Prosorhynchus truncatus.*
Bagarius yarrellii, Lucknow	*Neobucephalopsis bagarius.*
Belone sp., Bombay	*Neidhartia neidharti.*
Belone cancila, Poona . . .	*Bucephalopsis karvei.*
Belone strongylina V. Hasselt, Allahabad .	*Bucephalopsis belonea.*
hrysophrys berda, Bombay . . .	*Rhipidocotyle septapapillata.*
Clupea, sp., Bombay . . .	*Rhipidocotyle apapillosum.*
Cymbium guttatum, (Bl. & Schn.) spotted mackerel, Puri.	*Bucephalus jagannathai.*
Epinephelus lanceolatus (Bl.) Puri . . .	*Neoprosorhynchus purius.*
Eutropiichthys vacha Day (Butter fish), Allahabad	*Bucephalopsis fusiformis.* *Bucephalopsis sinhai.*
Macrones seenghala Day, Allahabad . .	*Bucephalus indicus.* *Bucephalus gangeticus.* *Bucephalopsis thapari.* *Bucephalopsis macronius.*
Pangasius buchanani Cuv. & Val. . .	*Bucephalopsis magnum.* *Bucephalopsis confusus.*
Psettodes erumei, Bombay . .	*Neidhartia microrhyncha.*
Pseudotropius garua, Day, Allahabad . .	*Bucephalopsis garuai.* *Bucephalopsis minimus.*
Scatophagus argus Bloch., Puri	*Bucephalus barina.*
Sciaena belengeri, Bombay.	*Bucephalopsis microcirrus*
Serranus lanceolatus, Bombay . . .	*Prosorhynchus* sp.
Synaptura orientalis Bloch, Karachi . . .	*Prosorhynchus arabiana.*
Tetradon oblongus Bl., Puri	*Prosorhynchus manteri.*

V. *Classified list of parasites from the Indian region, with their host and localities.*

Gasterostomata.

Bucephalidae.

A. *Bucephalinae.*

Bucephalus.

Bucephalus tridenticularia . . .	*Aoria aoria* (=*Macrones aoria*) Day Allahabad.
	Aoria seenghala (-*M. seenghala*) Day, Allahabad.
Bucephalus aoria	*Aoria aoria* (-*Macrones aoria*) Day, Allahabad.
Bucephalus jagannathai	Spotted mackerel, *Cymbium guttatum* (Bl. & Schn). Puri.
Bucephalus indicus	*Macrones seenghala* Day, Allahabad.

Host.	Parasite.
Bucephalus gangeticus	*Macrones seenghala* Day, Allahabad (India).
Bucephalus barina	*Scatophagus argus* Bloch, Puri, Bay of Bengal.
Bucephalopsis.	
Bucephalopsis fusiformis	*Eutropiichthys vacha* Day (Butter fish), Allahabad (India).
Bucephalopsis garuai	*Pseudotropius garua*, Day, Allahabad (India).
Bucephalopsis magnum	*Pangasius buchanani* Cuv. & Val. Allahabad (India).
Bucephalopsis confusus	*Pangasius buchanani* Cuv. & Val. *Silundia gangetica*, Cuv. & Val., Allahabad (India).
Bucephalopsis minimus	*Pseudotropius garua* Day, Allahabad (India).
Bucephalopsis karvei	*Belone cancila*, Poona (Bombay Pres.).
Bucephalopsis belonea	*Belone strongylina* V. Hasselt, Allahabad (India).
Bucephalopsis microcirrus	*Sciaena belengeri*, Bombay (India).
Bucephalopsis sinhai	*Eutropiichthys vacha*, India.
Bucephalopsis thapari	*Macrones seenghala*, India.
Bucephalopsis macronius	*Macrones seenghala*, India.
Rhipidocotyle.—	
Rhipidocotyle ligulum	*Arius falcarius*, West Coast, Bombay (India).
Rhipidocotyle apapillosum	*Clupea* sp., West Coast of India, Bombay.
Rhipidocotyle septapapillata	*Chrysophrys berda*, Bombay (India).
Neobucephalopsis.—	
Neobucephalopsis bagarius	*Bagarius yarrellii*, India.
B. *Prosorhynchinae.*—	
Prosorhynchus.—	
Prosorhynchus truncatus	*Arius jatuis*, Puri, Bay of Bengal (India).
Prosorhynchus manteri	*Tetradon oblongus* Bl., Puri, Bay of Bengal.
Prosorhynchus arabiana	*Synaptura orientalis* Bloch, Karachi, Arabian Sea.
Prosorhynchus sp.	*Serranus lanceolatus*, Bombay (India).
Neidhartia.—	
Neidhartia microrhyncha	*Psettodes erumei*, Bombay (India).
Neidhartia neidharti	*Belone* sp., Bombay (India).
Neoprosorhynchus.—	
Neoprosorhynchus purius	*Epinephelus lanceolatus* (Bl.), Pur (India).

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VII. Summary.

This paper deals with all the Gasterostome Trematode parasites described, from the Indian region so far. A brief account or diagnosis with necessary diagrams, has been given almost in each case; their latest systematic position reviewed and as far as possible, views of other workers on the group given up to date. Identification keys have also been provided at every taxonomic stage.

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