STUDIES ON THE TREMATODE FAUNA OF INDIA

Part I. Subclass MONOGENEA.

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I. INTRODUCTION.

Countries situated in tropical and sub-tropical regions abound in helminth fauna. India is by no means an exception to this. Therefore our trematode fauna is also very rich and varied. But, unfortunately, their studies do not seem to have received adequate attention either in proportion to the richness or in regard to the national problem of public health or welfare of animal or cattle. Comparatively speaking, the subject has received greater attention during the past twenty five to thirty years. However, although the trematode parasites form an important group in the study of helminth fauna of India but unfortunately, so far, there has been no compact publication dealing with the Indian fauna in a comprehensive way. We have volumes in the Fauna of (*formerly* British) India Series dealing with Cestodes and Nematodes, but so far no volume has been taken up for Trematodes. This greatly handicaps the work and studies specially of university post-graduate students, junior research workers and various scientific technical personnel engaged in this work in various National Research Laboratories and Research Institutes of applied research, like those dealing with fisheries, parasitology, medicine, public health, national hygiene

and sanitation, veterinary zoology, animal husbandry, etc. The need is more keenly felt, particularly after their post-war development, when the various activities have expanded or increased many-fold, but there is great national shortage of technically trained scientific personnel with requisite experience. The publication of this series has therefore been taken up by the author to meet, at least partly, this national demand. Part II of this series, dealing with Order Gasterostomata (Digenea) was the first to be completed and is in the press. That followed Part III, dealing with Subclass Aspidogastrea. Part IV, which is also in the press, is the first in the series to deal with Digenea (Prosostomata) and deals with Hemiuroidea from the Indian region. Parts dealing with other Prosostomata are expected to follow. In fact, studies with regard to Part V, dealing with Paramphistomoidea from the Indian region, is already in hand. Part I, presented herewith, deals with forms of the Subclass Monogenea recorded from the Indian region. The geographical area covered in the series includes the whole of India, Burma, Pakistan and Ceylon, *i.e.*, as it has been for the Fauna of India series.

The main object in preparing this series, has been to make it a self contained publication including all forms discovered from the region so far, give brief diagnosis of each systematic category concerned, provide diagnostic keys at every taxonomic stage, where considered necessary and include a representative diagram, if possible, of each species, described. At the beginning of each specific description, wherever considered desirable, a brief reference has been made to all those workers who have made any observations regarding it. At the end of each part, a systematic list of parasites along with their host, location and locality of record or discovery has been given. A host-parasite list has also been added. Regarding the references, attempt has been made generally to give only such important references as have been actually cited in the text, but such others also as have been considered to have any fundamental bearing on the approach to their study have been included. However, as far as the references to worms dealt with from this region in particular are concerned, an attempt has been made to make them as complete as possible.

The author does not put forth any claim that the publication is absolutely complete and perfect, but he will be obliged if his attention be drawn to omissions, or suggestions if any are kindly advanced to him, to make the series still more useful.

II. Systematic Account.

In recent years, Price (1936-43) has revised the classification of this group extensively. Sproston (1946) also brought out a large monograph on the subject after exhaustive studies. In view of these, I am not dealing with the subject at length here. Therefore for further details a reference may be made to their work if necessary.

I am also not including any general account of the group, as I have done in earlier parts of the series dealing with Gasterostomata, Aspidogastrea and Hemiuroidea, although I had already prepared it as early as 1945; because Dawes recently (1946; 1947) has dealt with the matter

fairly adequately. In fact, since 1939, I was also engaged in studies on the group, similar to those of Sproston, but due to World War II my progress could not be as expected. However, just wnen I had also made headway Sproston's monograpn appeared.

In earlier parts of this series, particularly Parts IV and II, I have attempted to deal with the evolution and inter-relationships in the Platyhelminthes and have given briefly the history of classification of the Class Trematoda. I have proposed there that following Faust and Tang (1936) and other former authors, we should revert to the earlier classification and divide the Class into three Subclasses, *viz.*, 1. *Monogenea*, 2. *Aspidogastrea* and 3. *Digenea*. If this is followed the two Suborders of *Monogenea* of Odhner (1912), *viz.*, *Monopisthocotylea* and *Polyopisthocotylea*, will have to be regarded as of the rank of Orders and not Suborders.

In Part III of this series, I have given the distinguishing features differentiating the three Subclasses, as given by Dawes (1946). The Subclass *Monogenea* could be defined somewhat as follows :—

Subclass *MONOGENEA* (Carus, 1863).

Syns. *Pectobothrii* Burmeister, 1856.
Polystomea Leuckart, 1856.
"*Monogénèses*" of von Beneden, 1858.
Crypoocoela Johnston, 1865.
Ectoparasitica Lang, 1888.
Enterocotylea Montic, 1892.
Heterocotylea Braun, 1893.
Monogenetica Haswell, 1893.
Heterocotylida Lahille, 1918.

Diagnosis of Subclass : *Trematode* Rudolphi, 1808; with characters of the Class.

Small to medium sized Trematoda. Anterior adhesive organs may be groups of gland cells opening in " head organs " or as suckers and pseudosuckers. Eyes present or absent. Mouth at or near anterior end. Pharynx is always present. Intestine usually formed of two lateral crura; separate or confluent; branched or unbranched; rarely sac-like. Chief organ of attachment, the" haptor " is posterior or lateral; may be as in Monopisthocotylea, more or less discoidal, muscular and sometimes provided with localised cuticular thickenings; with nearly always 2-16 hooklets round the margin of the larval haptor, which may persist in the adult and frequently 1-3 pairs of large hooks " anchors " more centrally placed. The secondary haptor of adults may be discoidal or in reduced form, as in some Polyopisthocotylea, with cuticular or muscular developments upon it, or may be formed of a fixed number of muscular suckers, with or without supporting sclerites or of a fixed or indefinite number of characteristically formed cuticular adhesive units " clamps " which are either located on a definite haptoral region or cotylophore or are disposed along the margins of the body proper. Animals always hermaphroditic, though the male and female systems may not mature simultaneously. Ovary nearly always pretesticular. Genital pore usually opening into a common sinus. Uterus usually short. Genito-intestinal canal present or absent. Vagina may be absent. Vitellaria

nearly always composed of minute follicles, co-extensive with intestinal crura, occurring above and below them and between their branches, usually not extending across the median region, which is occupied by the reproductive system. Excretory system double, opening dorsally by two symmetrically placed pores, at or near the level of the genital aperture. Eggs comparatively few and relatively large, frequently with polar prolongations. The life-cycle is direct, *i.e.*, the whole of life-cycle is on one host, there being incomplete metamorphosis and alternation of generations rare, present only in some *Polystoma* spp. Parasites usually of cold-blooded aquatic vertebrates or of crustaceans, semi-parasitic on them ; very rarely on cephalopods or mammals.

Odhner (1912) proposed a division of the Order Monogenea into two Suborders, (1) Monopisthocotylea and (2) Polyopisthocotylea on the basis of the absence or presence of a genitointestinal canal, *i.e.*, the tubular connection between oviduct and right (rarely left) caecum. But Fuhrmann (1928) proposed a tripartite division of the Order, (1) Monopisthodiscinea Fuhrmann, (2) Monopisthocotylinea Odhner, (3) Polyopisthocotylinea Odhner, two of the groups thus formed representing subdivisions of Odhner's Monopisthocotylea. Price (1937) thinks that there is little taxonomic advantage in this scheme and Odhner's scheme has been generally followed by later workers.

TAXONOMY AND PHYLOGENY OF MONOGENEA.

It is true, as pointed out by Dawes (1947) that a complete classification of the Subclass Monogenea has not yet been accomplished in a modern sense, although Price (1936-43) has made very substantial progress with a scheme of his own, now accepted by almost all, excepting with a few minor adjustments here and there. He has firmly established a number of superfamilies, families and lower taxonomic units. I also agree with Dawes, that it is doubtful if some of the superfamilies have any phylogenetic significance, but they are serviceable units in diagnosis and taxonomy. I (Chauhan, 1953*d*) met with the same situation in the Subclass Digenea also, while revising a group recently. I find that as far as the classification of the class Trematoda into three Subclasses, *viz.*, Monogenea, Aspidogastrea and Digenea is concerned, probably there is some phylogenetic basis, but when one comes to the further sub-division of the Subclass Digenea, into two Orders, Gasterostomata and Prosostomata, one finds that it is probably more in a way a convenient taxonomic arrangement than phylogenetic. Recently, my studies of the family Haplosplanchnidae led me to propose further sub-division of the Order Prosostomata into two new Suborders, *viz.* *Preprosostomata* and *Prosostomatida*. The Class Trematoda is obviously a group of polyphylogenic origin and it appears to me that the Gasterostomes have developed from their pre-trematode, parasitic, rhabdocoelidan Turbellarian stock, probably common or closely allied to that of ancestors of other groups of Platyhelminthes also, through a line of evolution of their own, separately or probably running parallel in the tree of evolution upto a certain stage, along with other Prosostomes ; probably under similar, ecological and environmental conditions of living and food habits. There appears to be more phylogenetic affinity in the

taxonomic units : Turbellaria, Temnocephala, Monogenea, Aspidogastrea, Digenea, Preprosostomata, Prosostomatida, etc.

As suggested by Dawes, perhaps before an ideal scheme can be propounded, we shall need to consider life-histories and growth cycles in greater detail. Probably more intensive and detailed studies will also have to be carried out of some archaic, transitory forms, representing some intermediate stages like, *Chimaericola* Brinkmann, 1942 ; *Diplozoon* Nordmann, 1832 ; *Protomicrocotyle* Johnston and Tiegs, 1922 ; *Bilateracotyle* Chauhan, 1945, etc. A closer study of relative growth rate may enable us better to assess variability in relative sizes of organs and parts within a species. We also seem to have been misled to a certain extent, while dealing with shapes and structures, like anchors or hooks, hooklets, sclerites, etc. Dawes thinks that these may be differences more indicative of the processes of growth than phylogenetic distinction. I may add that they could also represent, at least to some extent, different stages of secondary adaptation to meet similar conditions of living and food habits. Sproston (1946) has brought in another useful factor in consideration in the study of this group, *i.e.* larval characters, but as Dawes put it, in lieu of information concerning the growing trematodes, we have to depend more on the characters of the adult, which have been put to good use by Price.

Another group of special interest in the study of phylogeny of the Subclass Monogenea is the family *Discocotylidae*. The position about this has been summarised by Sproston (1946). She states that among the vere numerous modifications of structure and habit found in Discocotylida are the several separate appearances of asymmetry, which may be a sign of the phylogenetic plasticity of these forms. The asymmetry in *Anthocotyle*, for instance, is highly irregular. Some individuals have the larger anterior clamp on one side of the body and some, from the same batch of fish, may have it on the other ; while in others the anterior pair of clamps may be nearly equal in size. The family is clearly polyphylectic and represents only a tentative grouping for convenience of those genera which are probably nearest to the evolutionary stem of the superfamily though they are probably not the most primitive members. From the point of view of clamp structure, the most primitive members are thought to be represented by the Mazocraeidae and on a divergent line, the Chimericolidae—the Choricotylinae and Hexostomatidae representing the ends of two different lines of evolution.

The two Orders of the Subclass Monogenea are differentiated by the following key :—

Key to Orders of Subclass Monogenea.

Anterior end with gland-organs ; mouth without oral sucker ; paired suckers within mouth always absent ; accessory suckers outside mouth may be present ; haptor a single unit : a well developed postero-ventral disc, sometimes sucker like, with or without radial septa partitioning it into loculi, armed with 1—3 pairs of large hooks or anchors and 12—16 marginal hooklets ; genito-intestinal canal usually absent	*Monopisthocotylea.*

Anterior end nearly always devoid of adhesive gland-organs; mouth surrounded by an oral sucker or with a pair of "suckers" within mouth; haptor consisting of several units; a number of suckerlets or clamps borne on a disc-like process or on the ventral surface; Genito-intestinal canal present .. .. .. *Polyopisthocotylea.*

1. ORDER *MONOPISTHOCOTYLEA* ODHNER, 1919.

Syns. *Monocotylea* Blainville, 1828.
Tricotylea Diesing, 1850.
Calicotylea Diesing, 1850.
Tristomae Taschenberg, 1879.
Oligocotylea Monticelli, 1903.
Monopisthodiscinea Fuhrmann, 1928.
Monopisthocotylinea Fuhrmann, 1928.

The Order is defined as below :—

Diagnosis : *Monogenea;* with characters of the Subclass.

Anterior end without prohaptor or with a feeble oral sucker or a pair of anterior accessory suckers or two elongate anterolateral depressions receiving the ducts from numerous unicellular glands or frequently provided with one or more pairs of adhesive glands in the form of "head organs" receiving the ducts of the cephalic glands. Mouth not surrounded by an oral sucker. Paired cuticular suckers within mouth never present; accessory muscular suckers may be present outside mouth. Haptor a single unit; a well developed disc; sometimes sucker-like, with or without radial septa, dividing it into loculi on its ventral side but the septa never subdividing it into distinct sucker and clamps; armed generally with 1-3 pairs of large hooks or anchors, the hooks being often supported by transverse cuticular bars, and 12-16 marginal hooklets or poorly developed and leaf-like body, acting as a generalised sucker. Eyes and a vagina present or absent. Genitointestinal canal absent; except, possibly, in the Australian family, Protogyrodactylidae.

The Order contains three Superfamilies, Gyrodactyloidea Johnston and Tiegs, 1922; Capsaloidea Price, 1936; Acanthocotyloidea Sproston, 1946. Dawes (1946) does not appear to recognise the new superfamily of Sproston. Representatives of only two Superfamilies have been so far recorded from the Indian region. They can be differentiated by the following key :—

Key to Superfamilies of Order MONOPISTHOCOTYLEA.

Haptor armed with large hooks or anchors and with supporting transverse bars .. *Gyrodactyloidea.*

Haptor armed or unarmed; when armed, the large hooks or anchors lack supporting transverse bars .. *Capsaloidea.*

A. Superfamily *GYRODACTYLOIDEA* Johnston & Tiegs, 1922.

Syn. *Gyrodaclylides* Poche, 1926.

Superfamily diagnosis : *Monopisthocotylea* Odhner, 1912; with characters of the Order.

Prohaptor absent or represented by at least one pair of head or cephalic glands usually in two groups, one on either side of pharynx, their ducts opening into one or two pairs of head organs. Intestine simple, sac-like, or with two crura without or with short diverticula. Haptor discoidal or wedge-shaped, bearing one or two pairs of large hooks or anchors, almost always supported by 1-2 rarely 3 cuticular supporting transverse bars. Cirrus simple, cuticular, frequently with a complicated cuticular accessory apparatus. Vagina present or absent. Genital aperture median or sub-median. Genito or Vitello-intestinal canal rarely present. Oviparous or viviparous.

The Superfamily contains, at present, four families, *viz.* Gyrodactyidae Cobbold, 1864 ; 2. Protogyrodactylidae Johnston & Tiegs, 1922; 3. Dactylogyridae Bychowsky, 1933 and 4. Calceostomatidae Parona & Perugia, 1890. They can be differentiated by the following key :—

Key to Families of Superfamily GYRODACTYLOIDEA (after Sproston)

1. Viviparous	*Gyrodactylidae.*
Oviparous	2.
2. Vitellaria frond-like in palmate groups. Genito-intestinal canal present	*Protogyrodactylidae.*
Vitellaria not frond-like or in distinct groups. Genito-intestinal canal absent	3.
3. Anterior end expanded forming conspicuous head lappets	*Calceostomatidae.*
Anterior end not expanded to form head-lappets ..	*Dactylogyridae.*

The Superfamily is recorded to be represented so far in India by only one of these families, *viz. Dactylogyridae.*

Family DACTYLOGYRIDAE Bychowsky, 1933.

Syn. *Amphibdellidae* Carus, 1885.

The family is defined as :—

Family diagnosis : *Gyrodactyloidea* Johnston & Tiegs, 1922 with Superfamily characters.

Small, elongate worms. Anterior end with two or more pairs of head-organs ; head lappets absent ; cephalic glands lateral or distributed throughout the median preoral region. Haptor with or without accessory structures or squamodiscs ; with one or two pairs of anchors and usually 14 marginal hooklets. Ovary pretesticular, elongate, curved or globular. Vagina present or absent. Vitellaria well developed. Oviparous. Parasites of marine and freshwater fishes.

Type genus—*Dactylogyrus* Diesing, 1850.

The family contains at present four subfamilies. They are distinguished by the number of anchors and presence or absence of squamodiscs, as in the following key :—

Key to Subfamilies of Family DACTYLOGYRIDAE—

1. Haptor with one pair of anchors ..	2.
Haptor with two pairs of anchors	3.

2. Haptor with circle of heavily cuticularised tubular structures	*Bothitrematinae.*
Haptor without these subsidiary structures	*Dactylogyrinae.*
3. Haptor with a pair of accessory plaques (dorsal and ventral squamodiscs)	*Diplectaninae.*
Haptor without squamodiscs ..	*Tetraonchinae.*

Representatives of three subfamilies, *viz.* Dactylogyrinae, Diplectaninae and Tetraonchinae have been so far recorded from India.

(*a*) Subfamily *Dactylogyrinae* Bychowsky, 1933.

This monotypic subfamily was created by Bychowsky in 1933, for the genus *Dactylogyrus* Diesing. The other genera included under it are *Dogielius* Bychowsky, 1933; *Neodactylogyrus* Price, 1938 and *Paradactylogyrus* Thapar, 1948. The subfamily is defined below :—

Subfamily diagnosis : *Dactylogyridae* Bychowsky, 1933 ; with Family characters.

Haptor well developed, without accessory cuticular structures or squamodiscs and with one pair of anchors, supported by one or two cuticular transverse bars ; marginal hooklets 14 pairs. Eyes present. Intestine bifurcate and the crura confluent posteriorly. Ovary pretesticular. Testes and ovary spherical. Vagina present, with or without supporting structures.

Type genus—*Dactylogyrus* Diesing, 1850.

Price (1938) raised the two groups of species of the genus *Dactylogyrus* Diesing, 1850 to independent generic rank. He retained the forms having a single haptoral bar in the genus *Dactylogyrus* and the forms with two haptoral bars were assigned to his new genus, *Neodactylogyrus* Price, 1938.

Thapar (1948) added another genus to the family. He did not assign it to any subfamily. Chauhan (1953), however, allotted it to this subfamily.

The subfamily is recorded to be represented in India so far by two genera, *Dactylogyrus* and *Paradactylogyrus*. These genera can be differentiated as follows :—

Key to Indian Genera of Subfamily Dactylogyrinae.

Haptor without any median " onchium " ..	*Dactylogyrus.*
A single median " *onchium* " present on haptor	*Paradactylogyrus.*

(i) Genus **Dactylogyrus** (Diesing, 1850) *emend.* Price, 1938.

Generic diagnosis : *Dactylogyrinae* Bychowsky, 1933 ; with Subfamily characters.

Head organs two pairs. Eyes present. Haptor disclike, without any accessory structures like squamodiscs but with one pair of anchors, a single clamp-like supporting transverse bar and 14 marginal hooklets. Ovary pretesticular. Copulatory apparatus complicated. Vagina sometimes with cuticular supporting structures.

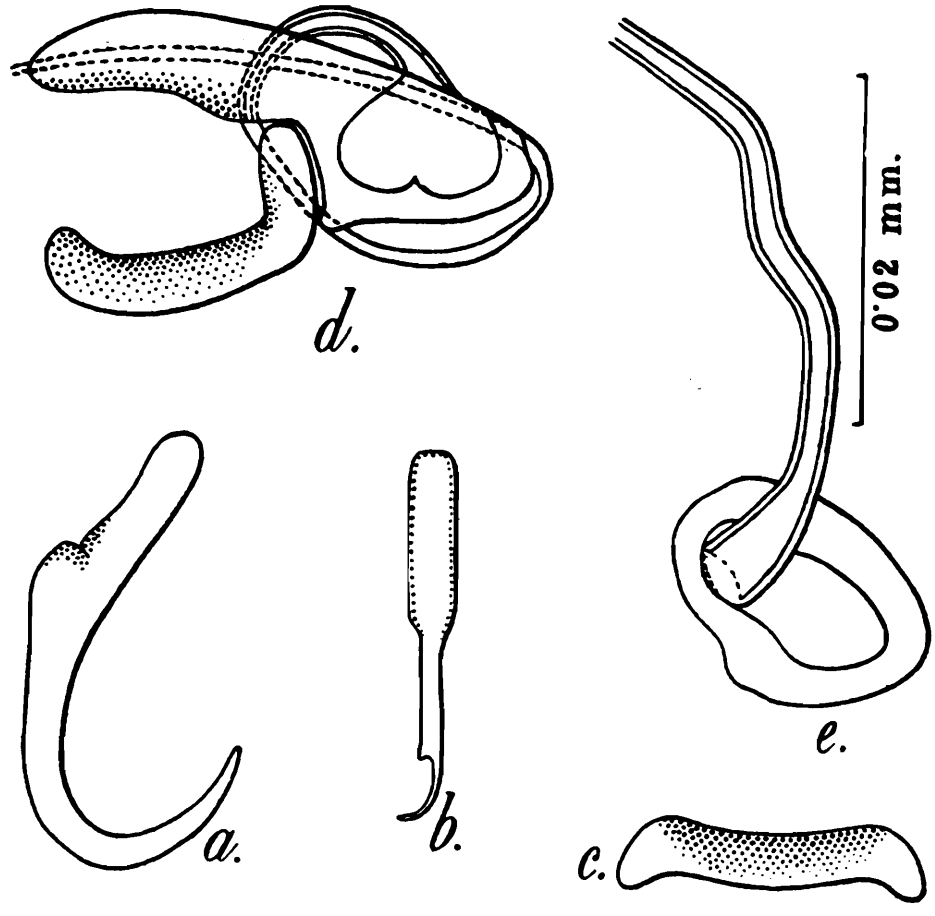
Type species—*Dactylogyrus auriculatus* (Nordmann, 1832) Diesing, 1850.

1. **Dactylogyrus moorthyi** Price, 1938.

(Text-fig. 1, *a*, *b*, *c*, *d*, *e*.)

Specific diagnosis : *Dactylogyrus* Diesing, 1850 ; with Generic characters.

Body elongate, 165 to 266μ long by 37 to 75μ wide. Haptor 22 to 44μ wide, armed with 1 pair of large hooks (anchors) 18 to 30μ long and supported by a single ox-yoke shaped bar about 18μ long and with 14 marginal hooklets 15 to 18μ long. Eyes present. Oral aperture about 35 to 45μ from anterior end of body ; pharynx globular, 15 to 18μ in diameter ; remainder of digestive tract not observed. Genital aperture about 55 to 65μ from anterior end of body. Male copulatory apparatus consisting of a long slender cirrus describing a complete loop at its proximal end and an accessory piece consisting of 2 parts, one portion finger-shaped, about 28μ long, and a crescentic portion about 20μ long. Vagina



TEXT-FIG. 1.—*Dactylogyrus moorthyi*. (*a*) Large haptoral anchor (*b*) Marginal hooklet (*c*) Haptoral bar (*d*) Male copulatory apparatus (*e*) Vagina, (after Price).

present, opening on right side of body. Gonads and vitellaria not distinctive. Eggs not observed.

Hosts.—Freshwater fishes, *Puntius puckelli* and *P. ticto*.

Location.—Gills.

Distribution.—India (Chitaldurg District, Mysore State).

Specimens.—U. S. N. M. Helm. Coll. Nos. 41144 (type) and 41145 (paratypes).

This species differs from all other species of the genus *Dactylogyrus* in the morphology of the male copulatory apparatus and in the shape of the haptoral bar.

(ii) Genus **Paradactylogyrus** Thapar, 1948.

Generic diagnosis : *Dactylogyrinae* Bychowsky, 1953 ; with Subfamily characters.

Small monogenetic forms, bearing one pair of anchors and a single anchor bar on the haptor. Besides the usual fourteen haptoral hooklets it bears a single median " onchium " There is a pair of cephalic lobes bearing the openings of several cephalic glands. The intestinal caeca unite posteriorly in front of the haptor. There is a single ovary and a single postovarial testis. The vagina is cuticularised structure and the copulatory apparatus consists of a highly cuticularised cirrus, a cirrhal thread and a horse-shoe shaped accessory piece provided with a posterior shaft. There is a single egg in the uterus. Parasites of fresh water fishes.

Genotype—*Paradactylogyrus catlarius* Thapar, 1948.

2. **Paradactylogyrus catlarius** Thapar, 1948.
(Text-fig. 2, *a, b, c, d, e, f.*)

Specific diagnosis : *Paradactylogyrus* Thapar, 1948 with Generic characters.

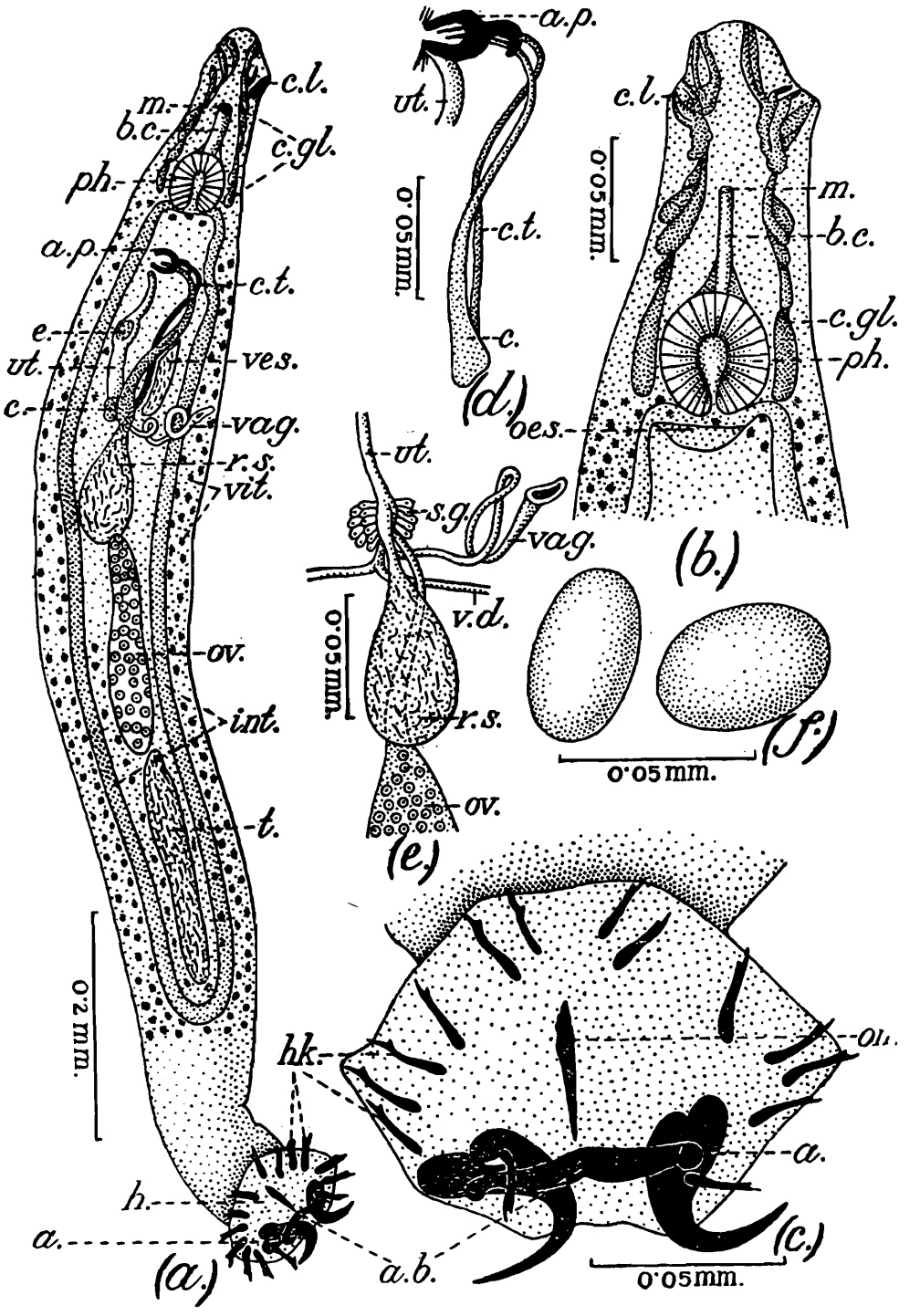
Body elongate, dorso-ventrally flattened ; length 0·75—1·01, width 0·095—0·15 (maximum). Anterior end with cephalic lobes. Integument smooth. Haptoral disc hexagonal, armed with two strong anchors, with bifid roots, and 14 small marginal hooks. Transverse cuticular bar hooked downwards at both the ends. An elongate, accessory cuticular piece " *onchium* " present in the centre of haptoral disc. Mouth ventral, subterminal. Buccal canal short. Pharynx globular, muscular. Oesophagus short, represented by a shallow outpocket behind pharynx. Intestinal caeca unite posteriorly before haptoral disc. Testis single, elongated, post-ovarial, in the posterior region of body. Vesicula seminalis pear shaped, large, dilated, near vaginal pore. Copulatory apparatus highly cuticularised consisting of an anterior horse-shoe shaped, clasper-like accessory piece, with a downwardly directed shaft, a cirrus and cirrhal thread. Cirrus very long, slender, tubular. Ovary single, elongated, sausage shaped, situated immediately behind middle, in front of testis. Receptaculum seminis large. Vagina a narrow, coiled, cuticularised duct on left side. Vitellaria numerous, small follicles, mainly extra-caecal. Uterine egg single, oval, 0·041—0·045×0·0295—0·031 (Type species).

Host.—Freshwater fish, *Catla catla.*
Location—Gills.
Locality—Lucknow.

(*b*) Subfamily—*Tetraonchinae* Monticelli, 1903 *emend* Price, 1937

Subfamily diagnosis : *Dactylogyridae* Bychowsky, 1933 ; with Family characters.

[1] All measurements in this paper are given in millimetres.



TEXT-FIG. 2.—*Paradactylogyrus catlarius* (*a*) Entire worm, ventral view (*b*) Anterior end, greatly enlarged (*c*) Haptor, ventral view (*d*) Copulatory apparatus (*e*) Ootype complex (*f*) Eggs. (after Thapar).

a., Anchor ; *a.b.*, Anchor bar ; *a.p.*, Accessory piece ; *b.c.*, Buccal canal ; *c.*, Cirrcus ; *c.gl.*, Cephalic glands ; *c.l.*, Cephalic lobes ; *c.t.*, Cirrhal thread ; *e.*, Egg ; *h.*, Haptor ; *hk.*, Hooklets ; *int.*, Intestinal caeca ; *m.*, Mouth ; *oes.*, Oesophagus ; *on.*, Onchium ; *ov.*, Ovary ; *ph.*, Pharynx ; *r.s.*, Receptaculum seminis ; *s.g.*, Shell gland ; *t.*, Testis ; *ut.*, Uterus ; *ves.*, Vesicula seminalis ; *vag.*, Vagina ; *vit.*, Vitellaria ; *v.d.*, Vetelline duct.

Body devoid of scales or spines. Eyes present or absent. Haptor without squamodiscs, but bears two pairs of anchors and 12—16 marginal hooklets. Intestine single or double. Testes usually without lobes. Ovary unlobed. Vagina present or absent.

Type genus—*Tetraonchus* Diesing, 1858.

Chauhan (1945) gave a key to 18 genera of the subfamily, considered valid. Sproston (1946) considered 20 genera under the subfamily as valid. She also gave a key to those genera, as follows :—

Key to Genera of Subfamily Tetraonchinae.

1. Haptor with 3 separate transverse bars	*Murraytrema* Price.
Haptor with 2 separate transverse bars ..	2.
Haptor with 2 articulated bars	3.
Haptor with 2 bars fused by their mid-regions ..	*Rhabdosynochus* Miz. & Blatz.
Haptor with one transverse bar	4.
Haptor without transverse bars	5.
2-A. Haptoral bars similar—	
Intestinal crura not confluent posteriorly ..	2*a*.
Intestinal crura confluent posteriorly ..	2*b*.
2a. Vagina absent ; eyes present	*Anchylodiscus* J. & T.
Vagina conspicuous on right	*Haliotrema* J. & T.
2b. Vagina on left margin ; accessory piece basally articulate with cirrus	*Cleidodiscus* Muell.
Vagina on right margin ; accessory piece never basally articulate with cirrus	*Urocleidus* Muell.
2-B. Haptoral bars dissimilar—	
Intestinal crura not confluent ; vagina on left side ..	*Ancyrocephalus* Crepl.
Intestinal crura confluent posteriorly—	
Vagina on left, in mid-lateral region	*Ancylodiscoides* Yam.
Vagina on right margin	*Tetrancistrum* Goto & Kikuc.
3. Haptoral bars similar—	
Anchor bases abnormally developed and occupying the whole of haptor area ; vagina on left	*Anchoradiscus* Miz.
Haptoral bars dissimilar	
Anchor bases normal ; vagina on left	*Anctinocleidus* Miz.
4-A. Haptoral bar butterfly-shaped, articulating directly with both pairs of anchors ; intestine unbranched and sac-like	*Tetraonchus* Dies.
B. Haptoral bar simple, articulating directly with only one pair of anchors ; intestine bifurcate. Intestinal crura not confluent ; 14 (? or 12) marginal hooks ..	4a.
Intestinal crura confluent ; 2 or 14 marginal hooks ..	4b.
4a. 3 pairs of head organs ; vagina present ; anchors similar ; 14 marginal hooks	*Amphibdelloides* Price.
1 pair of head organs ; vagina absent ; anchors dissimilar ; 14 marginal hooks	*Diplectanotrema* J. & T.
Numerous scattered head glands ; vagina absent ; anchors dissimilar ; ? 12 marginal hooks ..	*Linguadactyla* Brinkm.
4b. 2 marginal hooklets—	
4 pairs of head organs ; vagina absent	*Empleurosoma* J. & T.

2 pairs of head organs; conspicuous vagina on left margin	*Daitreosoma* J. & T.
14 marginal hooklets	
2 pairs of head organs; vagina in left mid-lateral region	*Parancyrocephaloides* Yam.
5. Intestinal crura not confluent; anchors similar; vagina in left lateral region	*Amphibdella* Chatin.
Intestinal crura confluent; anchors dissimilar; vagina in left mid-lateral region	*Ancyrocephaloides* Yam.

Genus **Ancyrocephalus** Creplin, 1839.

Generic diagnosis: *Tetraonchinae* Monticelli, 1903; with Subfamily characters.

Head organs generally 3 pairs bearing the opening of cephalic glands. Eyes present. Haptor distinctly set off from body proper. Anchors two pairs, supported by two dissimilar supporting bars. Marginal hooklets 14. Intestine bifurcate, crura not confluent posteriorly. Gonads situated near the middle of body or further back. Vagina present, opening on left side. Vitellaria usually extend into posterior third of body.

Type species—*Ancyrocephalus paradoxus* Creplin, 1839.

3. **Ancyrocephalus alatus** Chauhan, 1945.

(Text-fig. 3, *a*, *b*, *c*, *d*, *e*.)

Sproston, N. G. (1946). *Trans. zool. Soc. Lond.* **25**(4); 507

———————(1948). *Sinensia*. **19**(1—6); 77 & 79

Specific diagnosis: *Ancyrocephalus* Creplin, 1839; with Generic characters.

Body elongate, minute, 0·71—2·43×0·11—0·27. Haptor discoidal, with a dorsal and a ventral pair of anchors, each pair supported by a transverse bar. Marginal hooklets 12. Cephalic glands 7-9 on each side. Head organs three on each side. Eyes 2 pairs. Pharynx small, muscular, sub-spherical. Mouth terminal. Oesophagus very short. Intestinal caeca do not extend up to haptor, not united posteriorly. Testis single, post ovarian, elongate. Vesicula seminalis very elongate. Prostate gland well developed. Penis sac rounded with accessory elongate, cuticularised, tubular, hollow structure, pointed at its extremity, with a spiral ala and a cuticular, supporting bent rod. Ovary simple, pear shaped in the middle of body. Vagina simple. Shell gland small. Vitellaria small follicles.

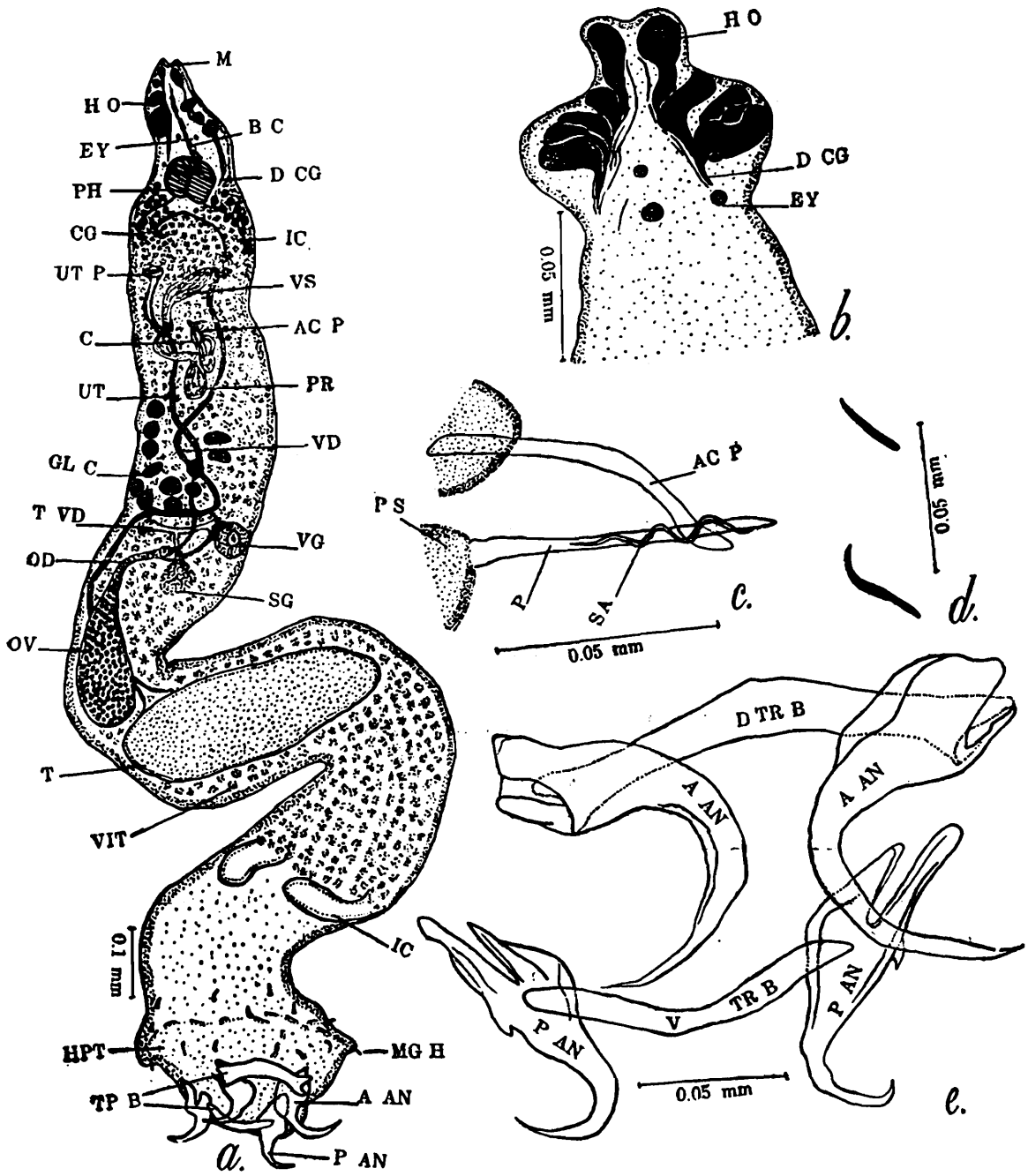
The species is characterised by the possession of three pairs of head organs, large anchors supported by cuticular transverse bars, only 12 marginal hooks; intestinal caeca not united posteriorly; two pairs of eyes and the vitellaria extending into the posterior region of body.

It differs from other species, in the general shape of body, the number of marginal hooklets, which is only 12, the structure of vesicula seminalis and penis, possessing a spiral ala and in the shape of the accessory piece.

Host.—*Muraenesox talabonoides*; *Arius fulcarius*; *Mugil parsia*; *Harpodon neherius*.

Location.—Gills.

Locality.—Bombay; Arabian Sea, Indian Ocean.



Test-fig. 3.—*Ancyrocephalus alatus* (*a*) Entire view (*b*) Anterior end, to show head organs and eyes (*c*) Dorsal and ventral pair of anchors with transverse bars (*d*) Two marginal hooklets (*e*) Penis with spiral ala, accessory piece and a portion of penis sac. (after Chauhan).

A AN., Anterior anchor; *AC P.*, Accessory piece of penis; *B C.*, Buccal cavity; *C.*, Cirrus; *CG.*, Cephalic glands; *D CG.*, Duct of cephalic glands; *D TR B.*, Dorsal transverse bar; *EY.*, Eye; *GL C.*, Gland cells; *H O.*, Head organs; *HPT.*, Haptor; *IC.*, Intestinal caecum; *M.*, Mouth; *MG H.*, Marginal hooklet; *OD.*, Oviduct; *OV.*, Ovary; *P AN.*, Posterior anchor; *PH.*, Pharynx; *PR.*, Prostate reservoir; *P.*, Penis; *PS.*, Penis sac; *SA.*, Spiral ala; *SG.*, Shell gland; *T.*, Testis; *TR B.*, Transverse bar; *T VD.*, Transverse vitelline duct; *UT.*, Uterus; *UT P.*, Uterine pore; *VD.* Vas deferens; *VG.*, Vagina; *VIT.*, Vitellaria; *VS.*, Vesicula seminalis; *V TR B.*, Ventral transverse bar.

(*c*) Subfamily Diplectaninae Monticelli, 1903.

Syn. *Lepidotreminae* Johnston & Tiegs, 1922.

Subfamily diagnosis: *Dactylogyridae* Bychowsky, 1933, with Family characters.

Body, especially posterior half (except in *Neodiplectanum*) covered with anteriorly directed scale-like spines. Cephalic glands present, opening to exterior through head organs. Eyes two pairs. Haptor

bearing paired squamodiscs, dorsal and ventral; sessile or sub-sessile; covered with concentric rows of scale-like spines or lamellae, with or without accessory hooks. Anchors two pairs, with 2, 3 or 5 supporting bars. 14 marginal hooklets probably always present. Intestine sac-like or crura without diverticula. Testis and ovary without lobes, cirrus simple or complex; vagina present.

Type genus—*Diplectanum* Diesing, 1858.

Key to Genera of Subfamily DIPLECTANINAE.

1.	Squamodiscs with concentric rows of paired lamellae and three haptoral bars	*Lamellodiscus* J. & T.
	Squamodiscs with concentric rows of scale-like spines or spine-like hooks and 2, 3 or 5 bars	2.
2.	Squamodiscs with spine-like hooks and 5 bars ..	*Lepidotrema* J. & T.
	Squamodiscs with scale-like spines and 2-3 bars ..	3.
3.	Intestine bifurcate	*Diplectanum* Dies.
	Intestine a single lobed sac	*Neodiplectanum* Miz. Blatz.

Sproston (1946) included the genus *Squamodiscus* Yamaguti, 1934 as a valid genus, in her key to the genera of the subfamily. I[1] regard it a synonym of the genus *Diplectanum* (Diesing).

Genus **Diplectanum** Diesing, 1858, *emend.* Price, 1937.

Syns. *Acleotrema* Johnston & Tiegs, 1922.
Lepidotes Johnston & Tiegs, 1922.
Squamodiscus Yamaguti, 1934.

The outstanding generic character is the squamodiscs, which are absent in *Ancyrocephalus*. Most authors regarded it as synonymous to the genus *Ancyrocephalus* but Price (1937) established its independent validity.

Generic diagnosis : *Diplectaninae* Monticelli, 1903 ; with Subfamily characters.

Squamodiscs consist of dorsal and ventral concentric rows of scale-like spines or rodlets, without groups of accessory spine-like hooks. Transverse haptoral cuticular bars three. Cirrus with ejaculatory bulb. Vagina present or absent.

Type species—*Diplectanum aequans* (Wagner, 1857), Diesing, 1858.

Syn. *Dactylogyrus aequans* Wagner, 1857.

4. **Diplectanum belengeri** (Chauhan, 1945) Chauhan, 1953.

(Text-fig. 4, *a*, *b*, *c*, *d*, *e*.)

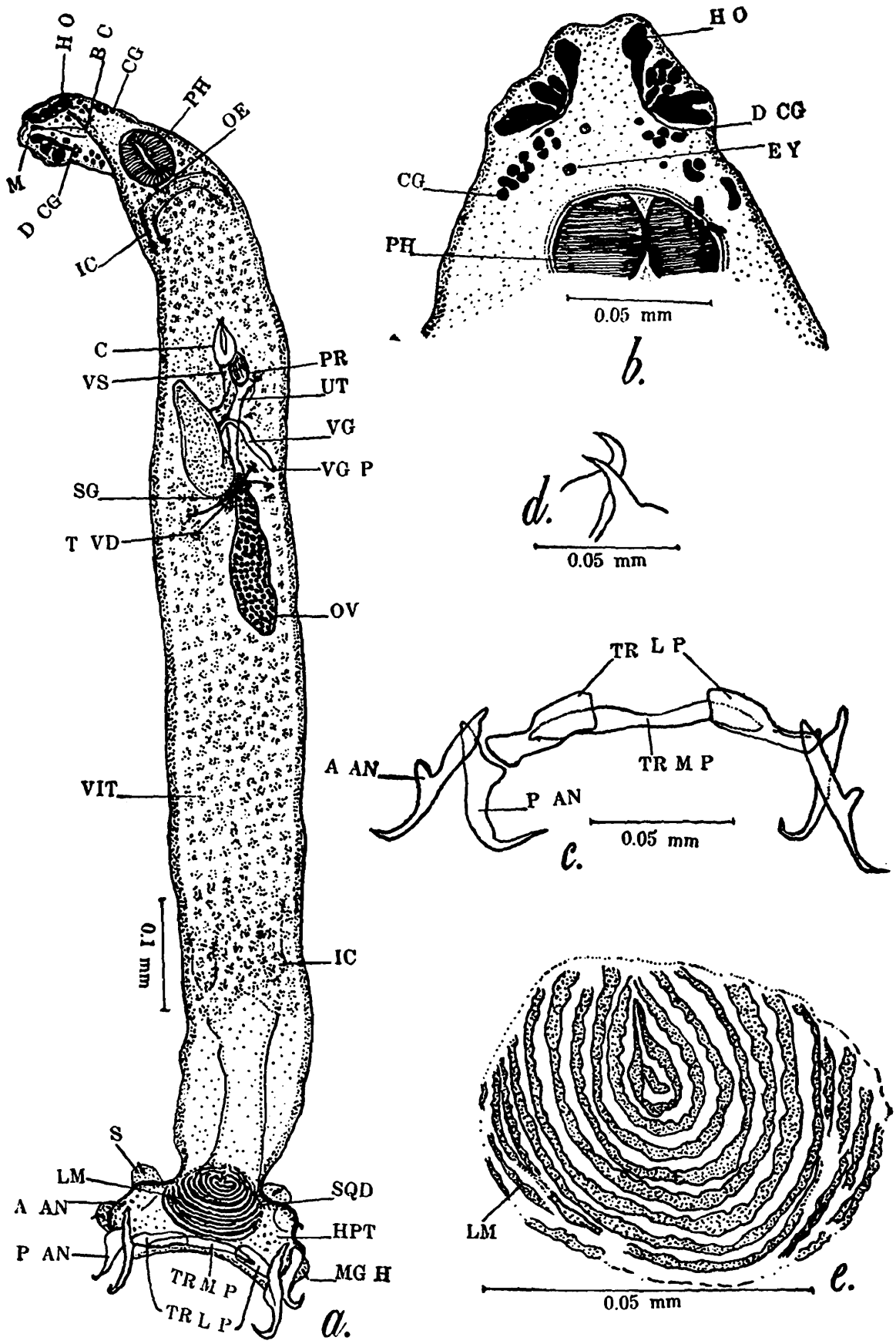
Syn. *Lamellodiscus belengeri* Chauhan, 1945.

Sproston, N. G. (1946). *Trans. zool. Soc.* Lond **25** (4) : 507.

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

Body elongate to oval, 0·52—1·17 × 0·11—0·225. Cephalic glands 8-9. Head organs 3 pairs. Eyes two pairs. Haptor distinct, with

[1]While this paper has been in the Press, Yamaguti (1953, p 227) himself thinks that the presence or absence of the ejaculatory bulb as well as the structure of the squamodisc in terms of hooks, rodlets or scales—distinguishing characters between the genera *Squamodiscus* and *Dipleccanum*—are of no generic importance.



Text-fig. 4.—*Diplectanum belengeri* (*a*) Entire view (*b*) Anterior end, to show head organs ; cephalic glands, their ducts and eyes (*c*) Dorsal and ventral pairs of anchors with transverse bars (*d*) Penis hooks (*e*) Squamodisc, showing concentric lamellae. (after Chauhan).

A AN., Anterior anchor ; *B C.*, Buccal cavity ; C., Cirrus ; *CG.*, Cephalic glands ; *D CG.*, Duct of cephalic glands ; *EY.*, Eye ; *H O.*, Head organs ; *HPT.*, Haptor ; *IC.*, Intestinal caecum ; *LM.*, Lamellae ; *M.*, Mouth ; *MG H.*, Marginal hooklet ; *OE.*, Oesophagus ; *OV.*, Ovary ; *P AN.*, Posterior anchor ; *PH.*, Pharynx ; *PR.*, Prostate reservoir ; S., Outgrowth on haptor ; *SG.*, Shell gland ; *SQD.*, Squamodisc ; *T VD.*, Transverse vitelline duct ; *UT.*, Uterus ; *VG.*, Vagina ; *VIT.*, Vitellaria ; *TR LP.*, Lateral piece of transverse bar ; *TR MP.*, Median piece of transverse bar ; *VG P.*, Vaginal pore. *VS.*, Vesicula seminalis.

2 pairs of anchors, one dorsal and one ventral, curved distally. Transverse cuticular bar, composite, made of three pieces. Haptor carries three pairs of foliate, round, cutaneous outgrowths, each pair bearing a marginal hook. Squamodisc consisting of concentric rows of continuous, 5-16 lamellae. Mouth terminal or sub-terminal, mid ventral. Buccal cavity small. Pharynx muscular. Oesophagus practically absent. Intestinal crura not uniting posteriorly. Gonads situated in the posterior part of anterior half. Testis single, elongate, oval. Vesicula seminalis short. Penis enclosed in a sac, simple with two hook-like structures. Ovary elongate, oval, in the middle of body. Vagina median. Shell gland small. Vitellaria small follicles.

The species is characterised by the possession of the peculiar six outgrowths on the haptor, number of marginal hooks being only six ; the peculiar but simple structure of penis, with two simple hooks, vagina being without cuticular development and the lamellae of the squamodisc being continuous.

Hosts.—Sciaena belengeri ; Sciaena carulta ; Muraenesox talabonoides.

Location.—Gills.

Locality.—Bombay, Indian Ocean.

B. Superfamily CAPSALOIDEA Price, 1936.

Superfamily diagnosis: *Monopisthocotylea* Odhner, 1912 ; with the characters of the Order.

Prohaptors absent or if present, a weakly developed oral sucker or a pseudo-sucker or two lateral suckers or glandular grooves. Heaa organs sometimes present. Intestine sac-like or if bifurcated, crura generally with median and lateral diverticula. Haptor armed or unarmed, discoidal, muscular, generally comparatively large ; usually divided ventrally by septa into sucker-like depressions or loculi, without anchors or with anchors, always without any cuticular, supporting transverse bar. Testis one or more. Cirrus without accessory structures, sometimes circular. Genital pore median or lateral. Vagina present or absent. Oviparous.

Type family—*Capsalidae* Baird, 1853.

Sproston (1946) in her key to families of the Superfamily included only four families under the Superfamily, *viz. Udonellidae* Taschenberg, 1879 ; *Microbothridae* Price, 1936 ; *Monocotylidae* Taschenberg, 1879 and *Capsalidae* Baird, 1853. She placed the family *Acanthocotylidas* Price, 1936 separately under a new Superfamily *Acanthocotyloidea* created by her for the purpose. Brinkmann (1952) seems to accept t. Dawes (1946 ; 1947), however, includes it under the Superfamily *Capsaloidea*.

These five families can be differentiated as follows :—

Key to Families of Superfamily Capsaloidea.

1.	Prohaptor a pair of anterior suckers or glandular depressions	2.
	Prohaptor not a pair of anterior suckers or glandular depressions	4.
2.	Intestine simple and sac-like ..	*Udonellidae.*
	Intestine bifurcate	3.
3.	Genital pores nearly together	*Capsalidae.*
	Genital pores not nearly together	*Acanthocotylidae.*
4.	Haptor armed with hooks	*Monocotylidae.*
	Haptor not armed with hooks ..	*Microbothriidae.*

Representatives of only two families out of these, *viz. Monocotylidae* and *Capsalidae* have been recorded, so far from, the Indian region.

(*a*) Family Monocotylidae Taschenberg, 1879.

Family diagnosis: *Capsaloidea* Price, 1936; with characters of the Superfamily.

Oval or elliptical, flattened forms. Eyes present or absent. Prohaptor, if present, an oral sucker or several pre-oral suckers or head organs. Cephalic glands present. Mouth ventral not quite terminal. Pharynx large. Oesophagus short or absent. Intestine bifurcated; crura long and simple, without lateral diverticula along the crura; crura sometimes united posteriorly. Haptor discoidal, generally divided ventrally by septa into depressed sucker-like loculi, armed usually with one pair of anchors (absent in *Empruthotrema*); marginal hooklets usually 14. Testes generally one, rarely 3 or more. Cirrus heavily cuticularised (except in *Dionchus*). Ovary curved, often embracing right intestinal crus. Vagina single or paired. Genital pores, usually near together, in median region.

Type genus *Monocotyle* Taschenberg, 1878.

Price (1938) differentiated the Subfamilies, included under the Family as follows :—

Key to Subfamilies of Family Monocotylidae.

1.	Haptor without septa	*Loimoinae.*
	Haptor with septa	2.
2.	Vagina absent	*Dionchinae.*
	Vagina present . ..	3.
3.	Vagina single .. , ...	*Monocotylinae.*
	Vagina double ..	4.
4.	With oral sucker	*Calicotylinae.*
	Without oral sucker ..	*Merizocotylinae.*

The family is so far recorded to be represented in the Indian region by a single subfamily.

Subfamily—*Loimoinae* Price, 1936.

Price (1936) separated the subfamily from other Monocotylidae on account of the character of a separate haptor and removed it from the family Udonellidae, where it was placed by Fuhrmann (1928), owing to armoured haptor and cuticularised cirrus. Manter (1944) re-examined type material of MacCallum (1917) and discovered in it a vagina, several testes, a bipartite pharynx and also that the dorsal cuticular ridges

on the haptor are file-like. He therefore transferred *Tricotyle scoliodoni* Manter (1938) from the family Calceostomatidae Parona & Perugia. (1890) to the genus, *Loimos* under the subfamily Loimoinae (Price, 1936) family Monocotylidae. The subfamily is defined as follows :—

Subfamily diagnosis : *Monocotylidae* Taschenberg, 1879 ; with Family characters.

Prohaptor as 1-3 pre-oral suckers. Testis single, in anterior half of body. Cirrus long, cuticularised. Vagina present. Genital pore median or submedian. Hoptor discoidal, aseptate but with a pair of relatively small anchors and a number of marginal hooklets, usually with a pair of dorsal ridges.

Type genus—*Loimos* MacCallum, 1917.

The subfamily contains, at present, two genera ; *Loimos* MacCallum, 1917 and *Loimosina* Manter, 1944. They can be differentiated as follows :—

Key to Genera of Subfamily LOIMOINAE Price, 1936.

Pre-oral suckers 1 or 2 pairs ; cirrus well developed. Testes several, tandem ; dorsal haptoral ridges well developed ..	*Loimos.*
Oral suckers 3 pairs ; cirrus rudimentary ; Testes single, deeply lobed ; posterior cuticular ridges on haptor inconspicuous or absent	*Loimosina.*

The subfamily is recorded so far, to be represented in the Indian region by a species of the genus *Loimos* only.

Genus **Loimos** MacCallum, 1917 *emend.* Manter, 1944.

Generic diagnosis : *Loimoinae* Price, 1936 ; with Subfamily characters.

Pre-oral suckers one or two pair, cirrus well developed. Testes several, tandem. Dorsal haptoral ridges well developed.

Type species—*Loimos salpinggoides* MacCallum, 1917.

5. Loimos secundus (Chauhan & Bhalerao, 1945) Chauhan and Bhalerao, 1945.

(Text-fig, 5, *a*, *b*. *c*.)

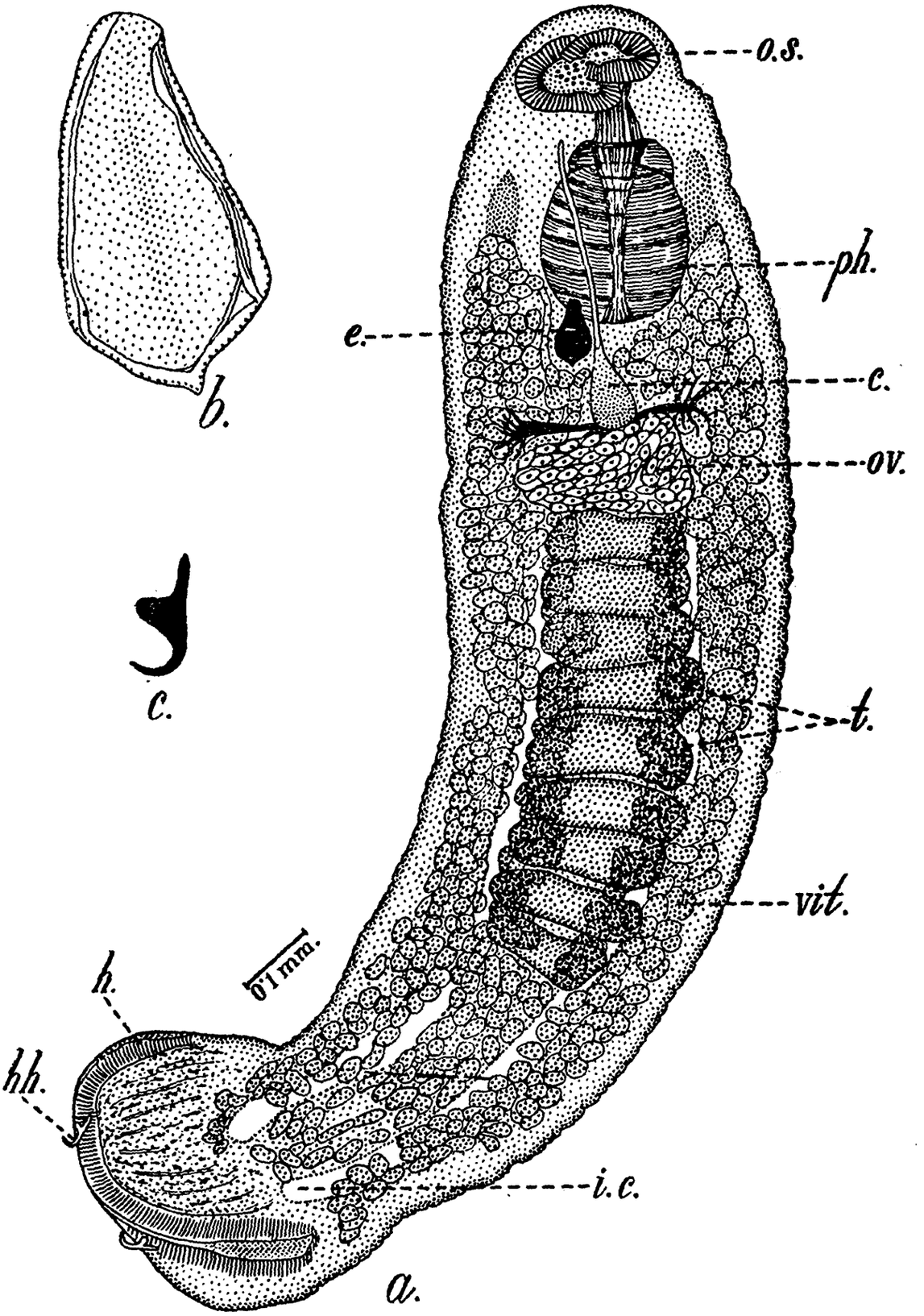
Syn. *Tricotyle secundus* Chauhan & Bhalerao, 1945.

Sproston, N. G. (1946). *Proc. zool. Soc. Lond.* **25** (4) : 508

Specific diagnosis : *Loimos* MacCallum, 1917 ; with Generic characters.

Body flat, elongate, tapering anteriorly, broadest in the middle, with a spatula-shaped posterior haptor, distinctly set off from body. Length 1·61-1·63×0·38-0·48. Head lobe constricted. Mouth subterminal, guarded by two inconspicuous sucker-like structures. Prepharynx present. Pharynx large, elongate, oval, higly muscular, with characteristic muscle bands. Intestinal crura simple, unbranched, not continuous. Haptor disc-like, without septa, bi-partite, with dorsal and ventral sucker-like semi-circular, convex, muscular, ribbed borders. It has a large, widely separated pair of hooks, with heavy, small, truncated roots. Ovary large, much branched, pre-testicular with numerous sinuous tubes, in the anterior third of body. Uterus with single conical egg, with highly cuticularised shell. Vitellaria spherical or elongate, small follicles. Vagina thick walled muscular Testes large, post-ovarian ; 9-10, median, tandem, intercrural transversely elliptical, somewhat lobed. Cirrus sac median, small, flask-shaped;

anterior end cuticularised and with a long, slender tube. Genital pore on right side, in the region of prepharynx.



Text-fig. 5.—*Loimos secundus*; (*a*) Ventral view; (*b*) Egg; (*c*) Haptoral hook. (after Chauhan and Bhalerao).

C., Cirrus; *E.*, Egg; *h.*, Haptor; hh., Haptoral hook; *IC.*, Intestinal caecum; *O.S.*, Oral sucker; *OV.*, Ovary; ph., Pharynx; t., Testes; vit., Vitellaria.

The species is characterised by the possession of a pair of anterior suckers; well developed cirrus, with a long, cuticularised tube; 9-10.

testes ; much branched ovary ; haptor with two sucker-like borders and a pair of anchors.

The genus *Loimos* contains three species, *L. salpinggoides* MacCallum, 1917 ; *L. scoliodoni* (Manter, 1938) Manter, 1944 and *L. secundus* (Chauhan & Bhalerao, 1945) Chauhan and Bhalerao, 1945. The last species resembles *L. salpinggoides* in the possession of nine testes and probably in the shape of egg and cirrus tube, but differs from it in having a single pair of anterior suckers, absence of marginal hooklets on the haptor, the position of genital pore, the egg and in the relative position of the terminal portions of genitalia. It resembles *L. scoliodoni* in the number of anterior suckers, but differs from it in the structure of vagina, more anterior position of the genital pore, a longer cirrus-tube, absence of marginal hooklets on the haptor and in the lack of three well marked anterior lobes. The number of testes is also different, being 9-10, whereas in *L. scoliodoni* they are only five.

Taxonomic Position.

Chauhan & Bhalerao (1945) suggested the transfer of the subfamily Loimoinae from the family Monocotylidae to the family Microbothriidae, on the grounds that members of the subfamily Loimoinae differ from Monocotylids, in the total absence of septa from the haptorial disc, number of testes and in the form of ovary and anterior haptors. They more nearly resemble Microbothrids, in the anterior haptor consisting of suckers, the structure of buccal cavity and oesophagus, and in the posterior haptor being non-separate.

Sproston (1946) does not agree with this view.

Host.—Indian dog-fish, *Scoliodon sorrakowah.*

Location.—Gills.

Locality.—Rangoon, Burma.

(*b*) Family CAPSALIDAE Baird, 1853.

Syns. *Phyllinidae* Johnston, 1846.
Tristomidae Cobbold, 1877.
Encotyllabidae Monticelli, 1888.
Tristomatidae Gamble, 1896.

Family diagnosis : *Capsaloidea* Price, 1936 ; with the characters of Superfamily.

Body elliptical, oval or cordate ; flattened dorso-ventrally. Cuticle smooth or papillate or sometimes with spines along the cuticular, lateral margins and on the dorsal surface. Anterior region forming a pre-oral cephalic lobe and adhesive apparatus, subterminal or ventral, on this lobe ; consisting of a pair of suckers or glandular areas or both. Sense organs present as two pairs of papillae on cephalic lobe. Eyes two pairs. Mouth or oral aperture ventral, never surrounded by an oral sucker. Pharynx always well developed. Intestinal caeca generally with median and lateral, more or less branched diverticula. Haptor well developed, muscular, discoidal, sessile or pedunculated (in *Encotyllabinae*). Sometimes partitioned by septa to form loculi. Anchors 1 to 3 pairs. Marginal hooklets 14, probably always present. Testes two or numerous. Ovary median, pretesticular. Vagina present, single or absent. Male and

female genital pores open separately, close together, at level of pharynx or in a common genital atrium, situated laterally. Excretory pore dorso-lateral at or near level of pharynx.

Type genus—*Capsala* Bosc, 1811.

Sproston (1946) gave a modified key to Subfamilies of the Family after Price (1939) as follows :—

Key to Subfamilies of Family CAPSALIDAE.

1.	Haptor on a muscular peduncle, aseptate	*Encotyllabinae.*
	Haptor sessile, or nearly so ; septate or aseptate ..	2.
2.	Haptor septate	3.
	Haptor aseptate	4.
3.	Two testes	*Trochopodinae.*
	Numerous testes	*Capsalinae.*
4.	Two testes	*Benedeniinae.*
	Numerous testes	*Nitzschiinae.*

Species of *Capsalinae* and *Benedeniinae* only have so far been recorded from the Indian region.

(i) Subfamily *CAPSALINAE* Johnston, 1929 ; *emend.* Price, 1939.

Syns. *Tristominae* Braun, 1893.
Tristomatinae Gamble, 1896.

Subfamily diognosis : *Capsalidae* Baird, 1853 ; with Family characters.

Cephalic lobe with a pair of suckers, of about the size of pharynx, on either side. Testes very numerous. Ovary lobed. Haptor sessile, divided by septa into a central polygonal and seven subtriangular areas. Anchors generally present, spine-like. Marginal hooklets 14.

Type genus-*Capsala* Bosc, 1811.

Price (1939) differentiated the various genera included under the family by a key as follows :—

Key to Genera of Subfamily CAPSALINAE.

1.	Pharynx with a constriction ; testes usually, if not always, extending laterally to intestinal crura .	*Capsala.*
	Pharynx without a constriction ; testes confined to the area between intestinal crura	2.
2.	Posterior rays of haptor bifid distally ; anchors clawed ; dorsal marginal spines crown-shaped, in a single longitudinal row	*Capsaloides.*
	Posterior rays of haptor not bifid distally ; anchors without clawed tips ; dorsal marginal spines, when present, not crown-shaped and in numerous short rows	*Tristoma.*

Genus **Capsala** Bosc, 1811 ; *emend.* Price, 1939.

Syns. *Tricotyle* Guiart, 1938.
Tristomella Guiart, 1938.

Generic diagnosis : *Capsalinae* Johnston, 1929 ; with Subfamily characters.

Posterior rays of haptor not bifid. Anchors, when present simple, without claw-like tips. Dorsal marginal spines present or absent. Pharynx with a transverse constriction at or slightly posterior to middle. Testes numerous, usually if not always, extending laterally to intestinal crura.

Type species—*Capsala martinieri* Bosc, 1811.

Chauhan (1952) while describing a new species, *C. gouri* gave a list of species considered valid under the genus. Out of those 21, four have been recorded from the Indian region.

6. **Capsala laevis** (Verrill, 1875) ; Johnston, 1929 ; Price, 1938.

(Text-fig. 6, *a. b*).

Syns. *Tristoma laeve* Verrill, 1875.

Tristoma histiophori Bell, 1891.

Tristoma laeve var. *armata* Goto, 1899.

Bell, F. J. (1891). *Ann. Mag. nat. Hist.* (6) 6 : 534-545.

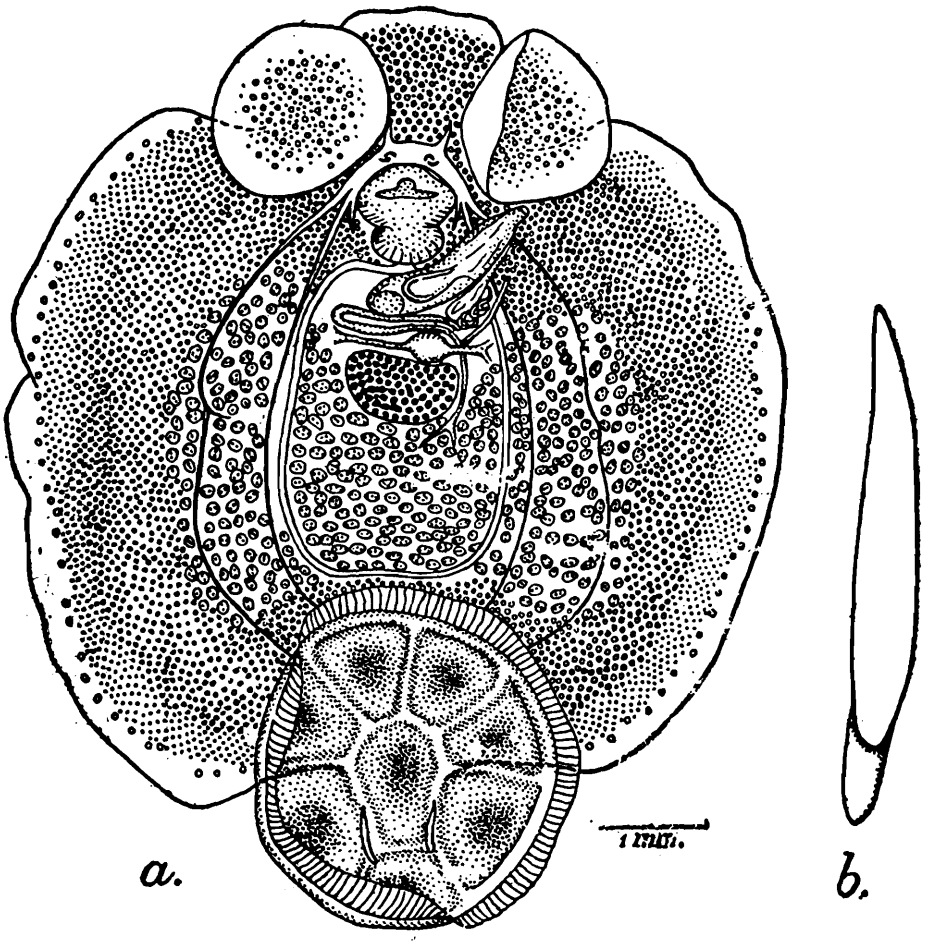
Goto, S. (1894). *J. Coll. Sci. Tokyo.* 8 : 1-273.

—— (1899). *J. Coll. Sci. Tokyo.* 12 : 263-295.

Price, E. W. (1939). *J. Wash. Acad. Sci.* 29 (2) : 79.

Sproston, N. G. (1946). *Trans. zool. Soc. Lond.* 25 (4) : 299.

Chauhan, B. S. (1952). *Rec. Indian Mus.* 49 (1) : 45-54.



TEXT-FIG. 6.—*Capsala laevis ;* (*a*) Entire worm ; (*b*) Haptoral hook (after Price).

Bell (1891) records that his species bears close resemblance to and is clearly allied to but is quite distinct from *Tristomum coccineum*. It is stated to be distinguished from it by the absence of parallel rows of body spines and by the fact that the posterior sucker projects by about one third of its diameter beyond the margin of body.

He gave the measurements of his specimens as follows :—

Breadth 12 mm., length (including suckers) 15 mm.

Breadth 11·5 mm., length (including suckers) 14 mm.

Breadth 10·0 mm., length (including suckers) 10·5 mm.

Chauhan (1952) has fully discussed the present systematic position of the species.

Host.—*Histiophorus* (sic) *brevirostris*—collections of Dr. Francis Day

Locality.—Madras, India.

7. **Capsala megacotyle** (v. Linstow, 1906) Johnston, 1929; *emend.* Price, 1938.

(Text-fig. 7, *a*, *b*).

Syns. *Tristoma megacotyle* von Linstow, 1906.

Capsala megacephala Johnston, 1929—a *lapsus* for *megacotyle*.

Tristomella megacotyle Guiart, 1938.

Linstow, O. F. B. von (1906). *Spolia zeylan.* **2**: 163-188.

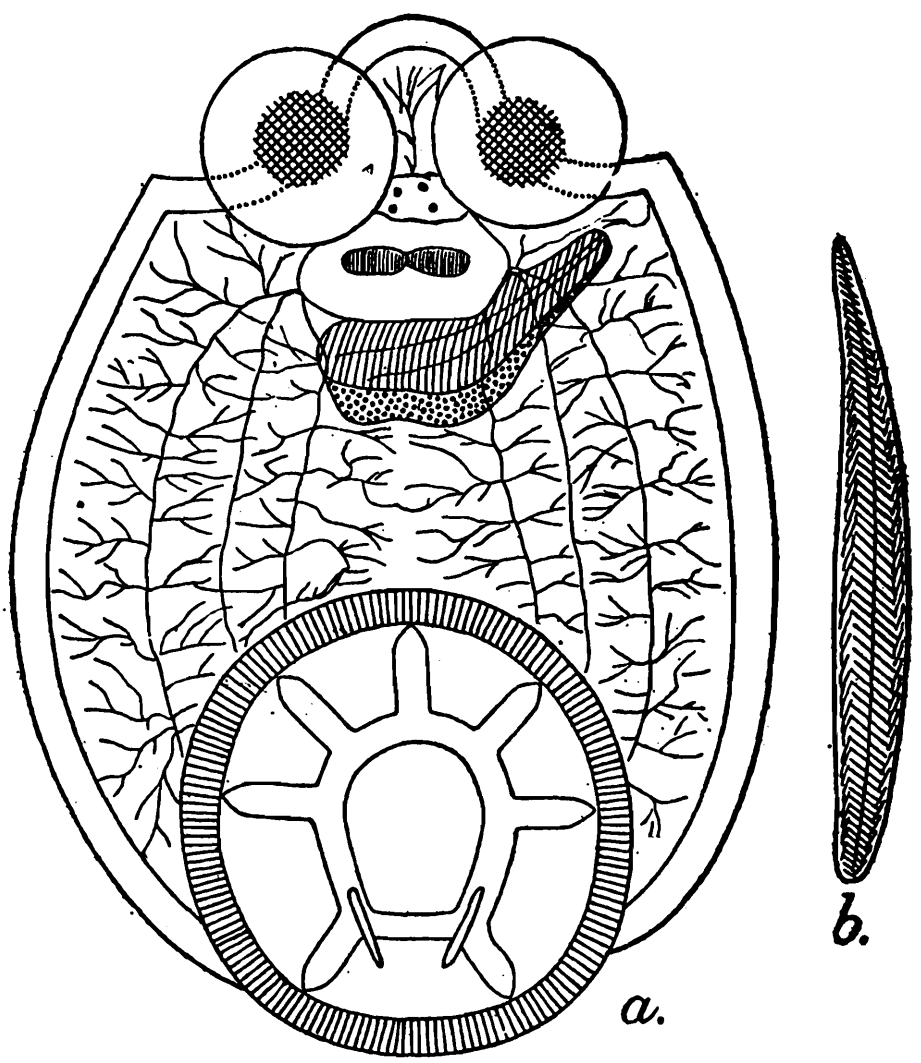
Johnston, T. H. (1929). *Trans. roy. Soc. S. Aust.* **53**: 71-78.

Guiart, J. (1938). Trematodes parasites provenant des campagnes scientifiques de S. A. S. le Prince Albert de Monaco (1886-1921) (Monogenea): 1-16.

Price, E. W. (1938). *J. Wash. Acad. Sci.* **29** (2): 79.

Sproston, N. G. (1946). *Trans. zool. Soc. Lond.* **25** (4): 300.

Chauhan, B. S. (1952). *Rec. Indian Mus.* **49** (1): 45-54.



Text-fig. 7.—*Capsala megacotyle*; (*a*) Entire worm; (*b*) Haptoral hook (after Linstow).

Linstow (1906) records the following specification of his species:—

"Length 7·5; breadth 6·0; ventral cuticle except on the sucker ann head thickly beset with circular papillae, measuring 0·31. The two

anterior suckers are equal to 1/5 of body length ; the caudal sucker has a diameter equal to ½ the body length and shows seven radial ribs, which abut upon a central roundish area produced backwards ; the sucker is bound at the periphery by a striated border ; in the posterior region of the sucker there are two straight undivided rods attenuated at the ends, 0·48 long ; these rods are always described as hooks in the definition of the genus *Tristomum*".

Chauhan (1952) has discussed its latest systematic position.

Host.—Sword fish, *Histiophorus* sp.

Location.—Body surface.

Locality.—Beruwala, Ceylon.

8. **Capsala ovalis** (Goto, 1894) Price, 1938 ; *emend.* Sproston, 1946.

(Text-fig. 8, *a*, *b*, *c*.)

Syns. *Tristomum ovale* Goto, 1894.

Tristomum ovale Setti, 1899.

Tristomum laeve var *inermis* Goto, 1899.

Capsala ovale Price, 1938.

Linstow, O. F. B. von (1906). *Spolia zeylan.* **3** : 163-188.

Johnston, T. H. (1929). *Trans. roy. Soc. S. Aust.* **53** : 71-78.

Guiart, J. (1938). Trematode Parasites Provenant des compagnes scientifiques S. A. S. le Prince albert de Monaco (1886-1921) (Monogenea) : 1-16.

Price, E. W. (1938). *J. Wash. Acad. Sci.* **29** (2) : 79.

Sproston, N. G. (1946). *Trans. zool. Soc. Lond.* **25** (4) : 300.

Chauhan, B. S. (1952). *Rec. Indian Mus.* **49** (1) : 45-54.

Linstow (1906), while describing his new species, *Tristomum megacotyle*, since regarded as *Capsala megacotyle*, stated that " a similar, though much larger species, also living upon *Histiophorus*, is *Tristomum laeve* Verrill=*T ovale* Goto ; the length of this species amounts to 13 mm. and its breadth 12 mm. ; the diameter of the anterior suckers equal to 1/7 of the body length ; the rays of the caudal sucker are narrow, its margin unstriated and the rods are expanded and irregularly laciniate at the roots. (Cf. S. Goto 1894 : Studies on the Ectoparasitic Trematodes of Japan. *J. Coll. Sci. Tokyo* **8** (1) : 241-244".

Chauhan (1952) has discussed the taxonomic position of this material.

Host.—*Histiophorus* sp.

Location.—Body surface.

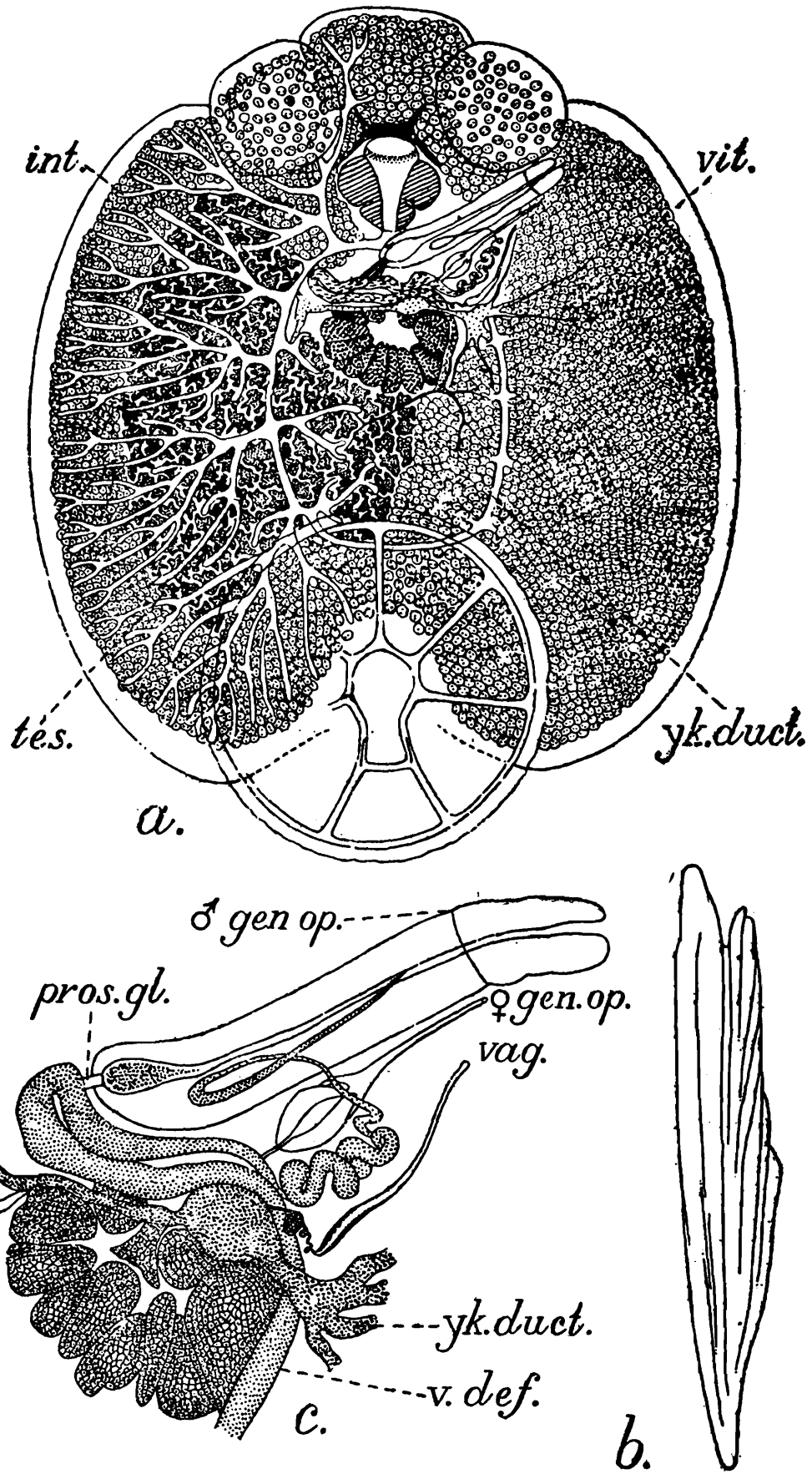
Locality.—Beruwala, Ceylon.

9. **Capsala gouri** Chauhan, 1952.

(Text-fig. 9, *a*, *b*, *c* ; 10, *a*, *b*.)

Chauhan, B. S. (1952). *Rec. Indian Mus.* **49**(1) : 49-53.

Specific diagnosis : *Capsala* Bosc, 1811 ; with Generic characters.



TEXT-FIG. 8.—*Capsala ovalis* ; (*a*) Entire worm (ventral view), testes represented only on one side ; (*b*) Haptoral hook, x 70 diam ; (*c*) Central portion of the genital organs ; viewed as a transparent object from the ventral side, x 29 diam (after Goto).

int., Intestine ; *pros. gl.*, Prostate gland ; *tes.*, Testes ; *vag.*, Vagina ; *v. def.*, Vas deferens ; *vit.*, Vitellaria ; *yk. duct.*, Yolk duct ; ♂ *gen. op.*, male genital opening ; ♀ *gen. op.*, Female genital opening.

Body elongately oval, slightly tapering anteriorly. Anterior lobe of body separated from the median by a slight constriction, where the anterior suckers are attached. Ventral papillae absent. Length 3·30

×1·55 (maximum). Lateral margin entire, with a single row of dorsal marginal chitinous spines ; not crown shaped, simple, 5—6 cuspid. Anterior suckers oval, 0·4 diameter, about one eighth of body length. Posterior sucker circular, projecting about one third its length, about one third of body length, provided with marginal striated membrane ; divided into septal regions by six ridges ; its ventral surface papillate. Pair of hooks on haptor one. Mouth subterminal. Pharynx constricted. Oesophagus very short. Intestinal crura with numerous dendritic branches on outerside, continuous posteriorly. Genital opening on left side of pharynx. Cirrus pouch club-shaped. Penis long and thick. Ovary median and situated at hinder end of anterior third of body, oval, compact, without lobes. Uterus short. Vitellaria mostly confined to lateral margins. Vaginal opening on the left. Receptaculum seminis globular. Testes small, globular, numerous, confined to mid-region between intestinal crura.

The species, *C. gouri* is unique in having a combination of some characters of all the three genera of the subfamily. It resembles *Capsala* in having the pharynx distinctly constricted and also in the shape of the anchors. It agrees with *Capsaloides* and *Tristoma* in having the testes entirely between the intestinal crura. It further resembles *Capsaloides* in probably having the posterior rays of haptor bifid distally and in having the dorsal marginal spines in a definite single longitudinal row. It resembles *Tristomum* in having anchors without clawed tips.

Price (1938) gave a list of 16 species as valid under the genus. Of the 21 species considered valid by Chauhan (1952), three are recorded from the Indian region viz. *C. megacotyle*, *C. laevis* and *C. ovalis*.

The species, *C. gouri* differs from *C. megacotyle* in the relative shape, ratio of the anterior and posterior suckers to the body length ; number of ribs on the posterior sucker and shape of cuticular rods on the posterior sucker. Specimens of *C. laevis* of Linstow, 1906, appear to differ from *C. gouri* in the ratio of the suckers and in the nature of the margin of the posterior sucker being unstriated, the rods being expanded and irregularly laciniate at the roots and in the shape of bars. *C. histiophori* Bell (syn. of *C. laevis*) differs from *C. gouri* in that its posterior sucker projects by about one third of its diameter beyond the margin of body and the parallel rows of cuticular corpuscles are absent.

C. gouri is particularly characterised in having a constricted pharynx, testes being confined between the intestinal crura, posterior sucker with a striated fringe, the posterior pairs of ribs on the posterior sucker having a tendency for bifurcation and in the shape of the anchors, being simple curved rods and the marginal spines being in a definite longitudinal row with typical shape of *Capsala* spines.

Host.—Marine fish, *Thynnus thunnina* C. *et.* V.

Location.—Operculum.

Locality.—Bombay, India.

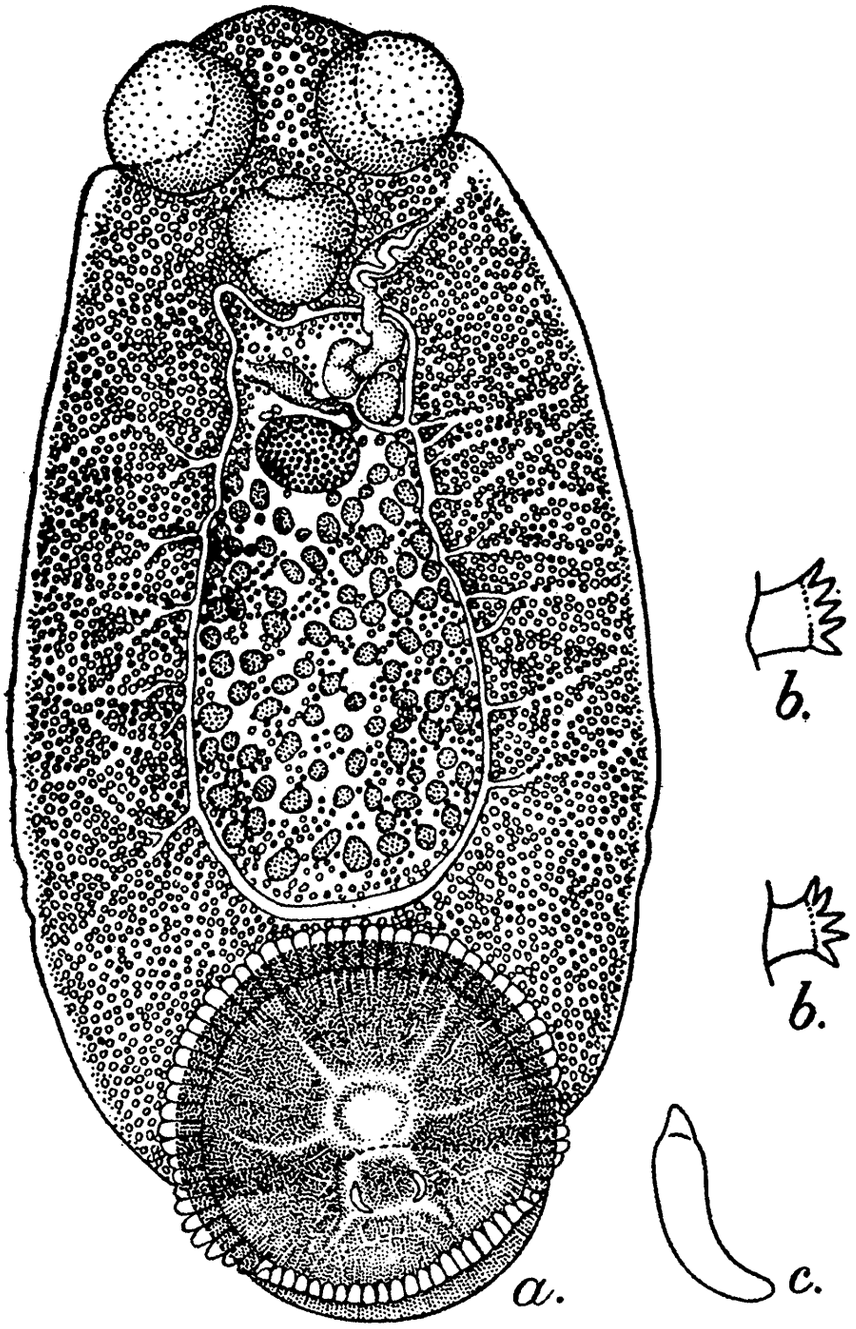
(ii) Subfamily *BENEDENIINAE* Johnston, 1931.

Syns. *Tristominae* Braun, 1893.
Ancyrocotylinae Monticelli, 1903.

Subfamily diagnosis : *Capsalidae* Baird, 1853 ; with Family characters.

Prohaptor: glandular areas, a pair of sucker or both. Haptor discoidal, aseptate, more or less sessile. Anchors 3 pairs in linear series. Marginal hooklets 14. Testes two, symmetrical. Glands of Goto present, immediately posterior to testes or absent.

Type genus—*Benedenia* Diesing, 1858.



Text-fig. 9.—*Capsala gouri*; (*a*) Entire worm, ventral view, x 50; (*b*) Dorsal marginal spines, x 600; (*c*) Haptoral hook, x 300 (after Chauhan).

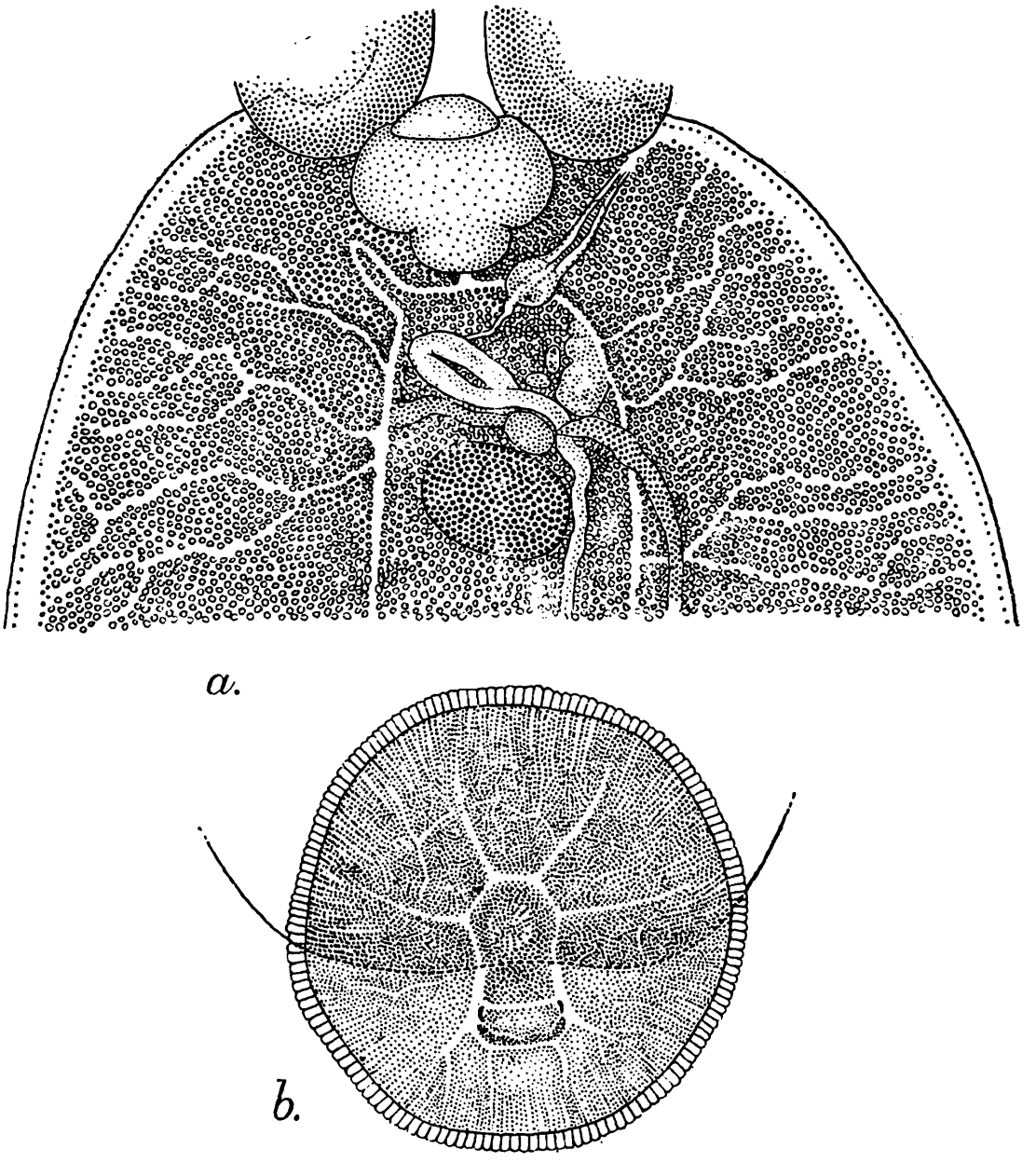
Sproston (1946) gives a key to genera of the subfamily. She also includes various subgenera of Johnston (1929) which following Price, I am deleting, as descriptions of some later species appear to cut across the subgeneric limits.

Key to Genera of Subfamily Benedeniinae.

1. Intestinal crura unbranched .. .. .. *Ancyrocotyle.*
   Intestinal crura with lateral and median branches .. 2.

2. Anterior end with glandular areas only ..	*Entobdella.*
Anterior end with suckers or both suckers and glandular areas ..	3.
3. Anterior end with suckers only	*Benedenia.*
Anterior end with suckers and a pre-oral lobe with glandular areas	*Pseudobenedenia.*

Out of these four genera, *Benedenia* Diesing, 1858; *Entobdella* Blainville, 1818; *Pseudobenedenia* Johnston, 1931 and *Ancyrocotyle* Parona & Monticelli, 1903, a species of only the first genus has so far been recorded from Indian region.



TEXT-FIG. 10.—*Capsala gouri*; (*a*) Anterior portion, enlarged, showing genital organs, x 50; (*b*) Haptor showing haptoral rays, x 30 (after Chauhan).

Genus—**Benedenia** Diesing, 1858.

Generic diagnosis : *Benedeniinae* Jahnston, 1931 ; with Subfamily characters.

Anterior end or prohaptor, with a pair of sucker-like discs ; may or may not be connected by a pre-oral lobe. Vagina present or absent. Ovary pre-testicular, separated from testes by only a narrow band of vitelline

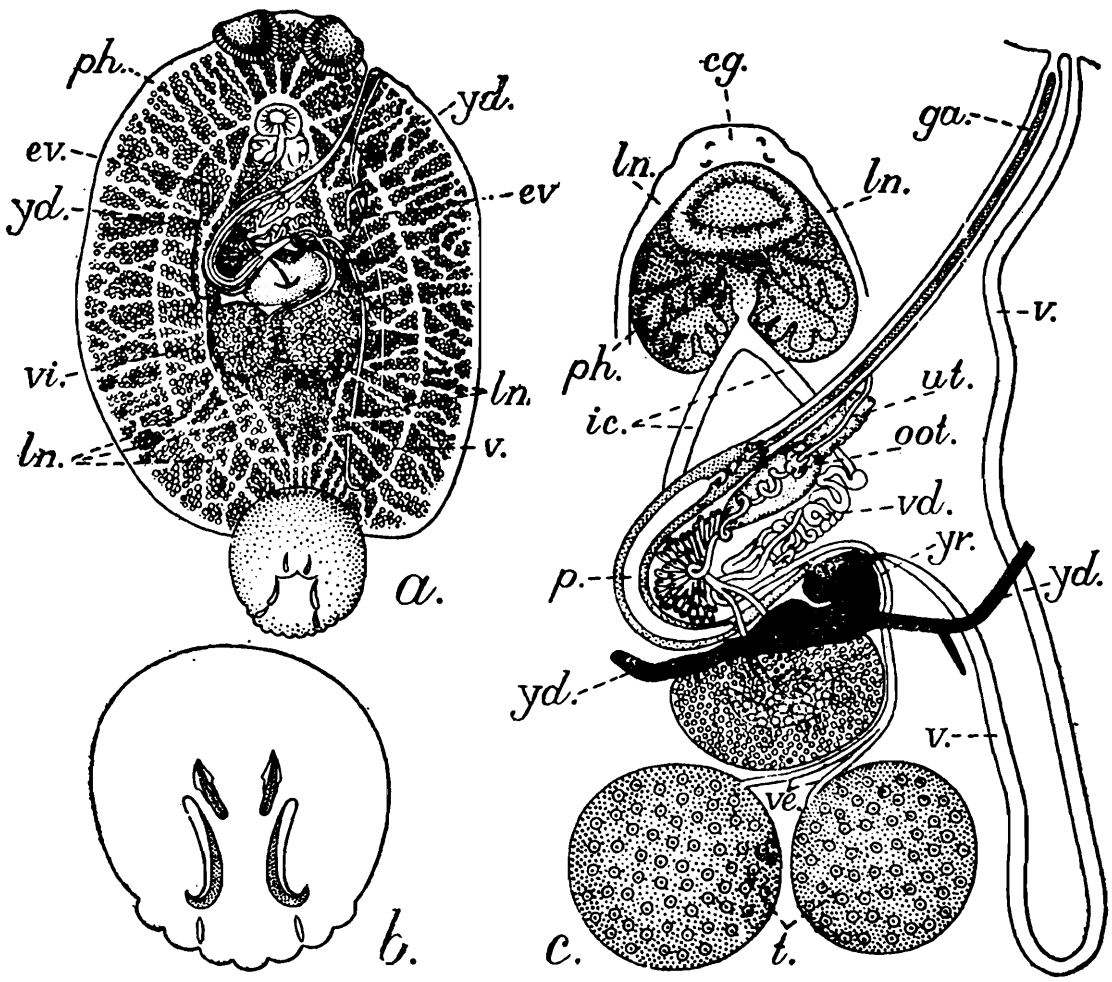
follicles. Testes two, symmetrical. Vas deferens generally not forming a preovarian loop. Haptor discoidal, aseptate with three pairs of dissimilar anchors and 14 marginal hooklets.

Type species – *Benedenia sciaenae* (van Beneden, 1852) Odhner 1905.

10. **Benedenia macrocolpa** (Lühe, 1906) Johnston, 1939.

(Test-fig. 11, *a*, *b*, *c*.)

Syns. *Epibdella* (*Benedenia*) *macrocolpa* Linstow, 1960.
Epibdella macrocolpa MacCallum, 1927.
Benedenia macrocolpa Meserve, 1938.
Benedenia (*Benedeniella*) *macrocolpa* Johnston, 1959.



Text-fig. 11.—*Benedenia macrocolpa* ; (*a*) Entire worm, ventral view ; (*b*) Haptor with three pairs of hooks ; (*c*) Genital organs, magnified (after Linstow).

cg., Cerebral ganglion with the two pairs of eyes ; *ev.*, Excretory vesicle ; *ga.*, Genital atrium ; *ic.*, Intestinal caeca ; *ln.*, Longitudinal nerve ; *oot.*, Ootype ; *ov.*, Ovary ; *p.*, Penis ; *ph.*, Pharynx ; *te.*, Testis ; *ut.*, Uterus ; *v.*, Vagina ; *ve.*, Vasa efferentia ; *vi.*, Vitellarium ; *yd.*, Yolk ducts ; *yr.*, Yolk reservoir.

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

Body oval, flattened, 9–10 × 5–7 Anterior sucker circular, diameter about 1·0. Posterior sucker oval, 2·1—2·4 × 2·3—2.6, with three pairs of hooks and with 4 pairs of notches on the posterior surface. Mouth subterminal. Oesophagus absent. Eyes two pairs. Genital opening on the left lateral edge, near anterior end, by the side of anterior sucker. Vagina present. Testes large, paired, irregularly round, symmetrical. Ovary large, elliptical, situated just in front of testes. Vitellaria small follicles, extend from anterior end, between two suckers, to about the

end of posterior sucker. Vagina exceedingly long (hence the specific name *macrocolpa*). Vasa efferentia relatively long. Penis long. Genital atrium very long.

Host.—*Rhinoptera javanica* Mull. & Henle.

Location.—Skin.

Locality.—Kalpitiya and Dutch Bay, Ceylon.

2. Order POLYOPISTHOCOTYLEA Odhner, 1 12.

Syns. *Polycotyla Blainville*, 1828.
Octobothrii Blanchard, 1847.
Eupolycolylea Diesing, 1850.
Polycotylea Diesing, 1850, *partim.*
Polystomida Vogt, 1851.
Octobothria Troschel, 1853.
Polystomeae Taschenberg, 1879.
Polyopisthocotylinea Odhner of Fuhrmann, 1928.

Diagnosis of Order : *Monogenea* (Carus, 1863) ; with characters of the Subclass.

Prohaptor, an oral sucker or a pair of cuticular buccal suckers, within mouth or two ventral grooves or bothria. Cephalic glands seldom well developed. Eyes rarely present. Haptor consists of separate adhesive units, supported by cuticular sclerites. Suckers or clamps, with or without hooks, borne on a disc-like process or on ventral surface. Genito-intestinal canal present. Vagina present or absent.

Price (1936) divided the order into two superfamilies : *Polystomatoidea* Price, 1936 and *Diclidophoroidea* Price, 1936, mainly on the basis of presence or absence of suckers in the buccal cavity.

Sproston (1946) adds another superfamily, *Avielloidea* Sproston, 1946, to the Order. She includes in her this new superfamily forms having anterior end with Gyrodactyloid-like head organs and haptor with 6 muscular suckers and 4 large anchors, arising centrally on the stalked haptor. Dawes (1946 ; 1947) does not mention about this arrangement but Brinkmann (1952) seems to accept it.

Forms belonging only to the superfamilies Polystomatoidea and Diclidophoroidea have so far been recorded from the Indian region. These two superfamilies can be differentiated as follows :—

Key to Superfamilies of Order POLYOPISTHOCOTYLEA

Anterior end of body usually with an oral sucker, never paired buccal suckers. Haptor with three pairs of cup-like suckers (except in *Sphyranura*)	*Polystomatoidea.*
Anterior end of body with a pair of small suckers opening into the oral cavity. Haptor with few or many pairs of suckers or clamps, each organ supported by a number of cuticular pieces or sclerites	*Diclidophoroidea.*

A. Superfamily *POLYSTOMATOIDEA* Price, 1936.

The Superfamily is defined by Price (1939) as follows :—

Superfamily diagnosis : *Polyopisthocotylea* Odhner, 1912 ; with characters of the Order.

Anterior haptor in the form of an oral sucker, terminal or slightly subterminal. Posterior haptor more or less disc-like, usually with 3 pairs of well developed cup-like suckers (1 pair in *Sphyranura*), with or without appendix-like projection, bearing a pair of small suckers and 1 to 3 pairs of hooks ; suckers of haptor proper provided with a single hook each, large in Onchocotylidæ and small in Polystomatidæ. Alimentary tract consisting of short prepharynx, bulbous pharynx, short esophagus, and intestinal branches with or without diverticula or anastomoses. Eyes usually absent. Male and female genital apertures opening to exterior through common opening, situated ventrally. Testis single or multiple, postovarial. Vagina double, usually opening laterally. Parasites of amphibians, reptiles and fishes, rarely in eyes of mammals.

Type family.—*Polystomatidæ* Gamble, 1896.

The Superfamily includes two families, *Polystomatidæ* Gamble, 1899 and *Hexabothriidæ* Price, 1942 (Syn. *Onchocotylidæ* Monticelli, 1903), which according to Sproston (1946) can be differentiated as follows :—

Key to Families of Superfamily Polystomatoidea.

Haptor with an appendix-like prolongation ; suckers with a large hook-like sclerite ..	*Hexabothriidæ.*
Haptor without an appendix-like prolongation ; suckers without a large hook-like sclerite	*Polystomatidae.*

Family POLYSTOMATIDAE Gamble, 1896.

Syns. *Polystomidae* Carus, 1863.
Dicotylidæ Monticelli, 1903.
Sphyranuridae Poche, 1926.

Family diagnosis : P*olystomatoidea* Price, 1936 ; with Superfamily characters.

Anterior haptor in the form of a more or less well developed oral sucker ; posterior haptor disc-like (bilobed in *Sphyranura*), bearing 1 to 3 pairs of cup-like suckers, with or without large hooks, and with 16 larval hooklets. Intestine consisting of 2 branches, sometimes united posteriorly, with or without diverticula. Eyes usually absent in adults. Common genital aperture ventral, median ; cirrus usually with coronet of hooks. Testis single or multiple. Ovary small, dextral or sinistral, pretesticular. Vagina present or absent. Parasitic in mouth, pharynx, esophagus and urinary bladder of reptiles and amphibians and, rarely, in eyes of aquatic mammals.

Type genus—*Polystoma* Zeder, 1800.

The Family contains two Subfamilies, *Polystomatinæ* Gamble, 1896. and *Sphyranurinæ* Price, 1939 (Syn. *Dicotylinæ* Monticelli, 1903). They can be differentiated as follows.—

Key to Subfamilies of Family Polystomatidae Gamble, 1896.

Haptor with 6 suckers	*Polystomatinae.*
Haptor with 2 suckers ..	*Sphyranurinae.*

Subfamily *POLYSTOMATINAE* Gamble, 1896.

Syn. *Polystominae* Pratt, 1900.

Subfamily diagnosis : *Polystominatidæ* Gamble, 1896 ; with Family characters.

Haptor with 6 cup-like suckers. Eyes present or absent. Testes one, two or many. Vaginæ, when present, with ventro-lateral openings.

Type genus—*Polystoma* Zeder, 1800.

Kaw (1950) described a new genus, *Eupolystoma*. He modified the key of Price (1939) to the genera of the Subfamily to accommodate his new genus, as below :—

Key to Genera of Subfamily POLYSTOMATINAE.

1.	Vaginæ absent	*Oculotrema*.
	Vaginæ present ..	2.
2.	Uterus postovarial	3.
	Uterus preovarial	4.
3.	Testes lateral, two	*Diplorchis*.
	Testes median, numerous (rarely one) ..	*Parapolystoma*.
4.	Testis single ; uterus short, usually containing one egg at a time ..	5.
	Testes numerous ; uterus relatively long, containing many eggs	7.
5.	Haptor without large hooks	*Neopolystoma*.
	Haptor with large hooks	6.
6.	Haptor with one pair of large hooks	*Polystomoidella*.
	Haptor with two pairs of large hooks	*Polystomoides*.
7.	Haptor with one pair of large hooks ..	*Polystoma*.
	Haptor without large hooks . ..	*Eupolystoma*.

(i) Genus **Polystomoides** Ward, 1917

Ward (1917) created *Polystomoides*, as a subgenus of *Polystoma* Zedar, 1800 to separate those North American polystomes which differed from the European forms in having a short uterus, with only one egg. Stunkard (1924) raised it to generic rank. Price (1939) redefined it.

Generic diagnosis : *Polystomatinae* Gamble, 1896 ; with Subfamily characters.

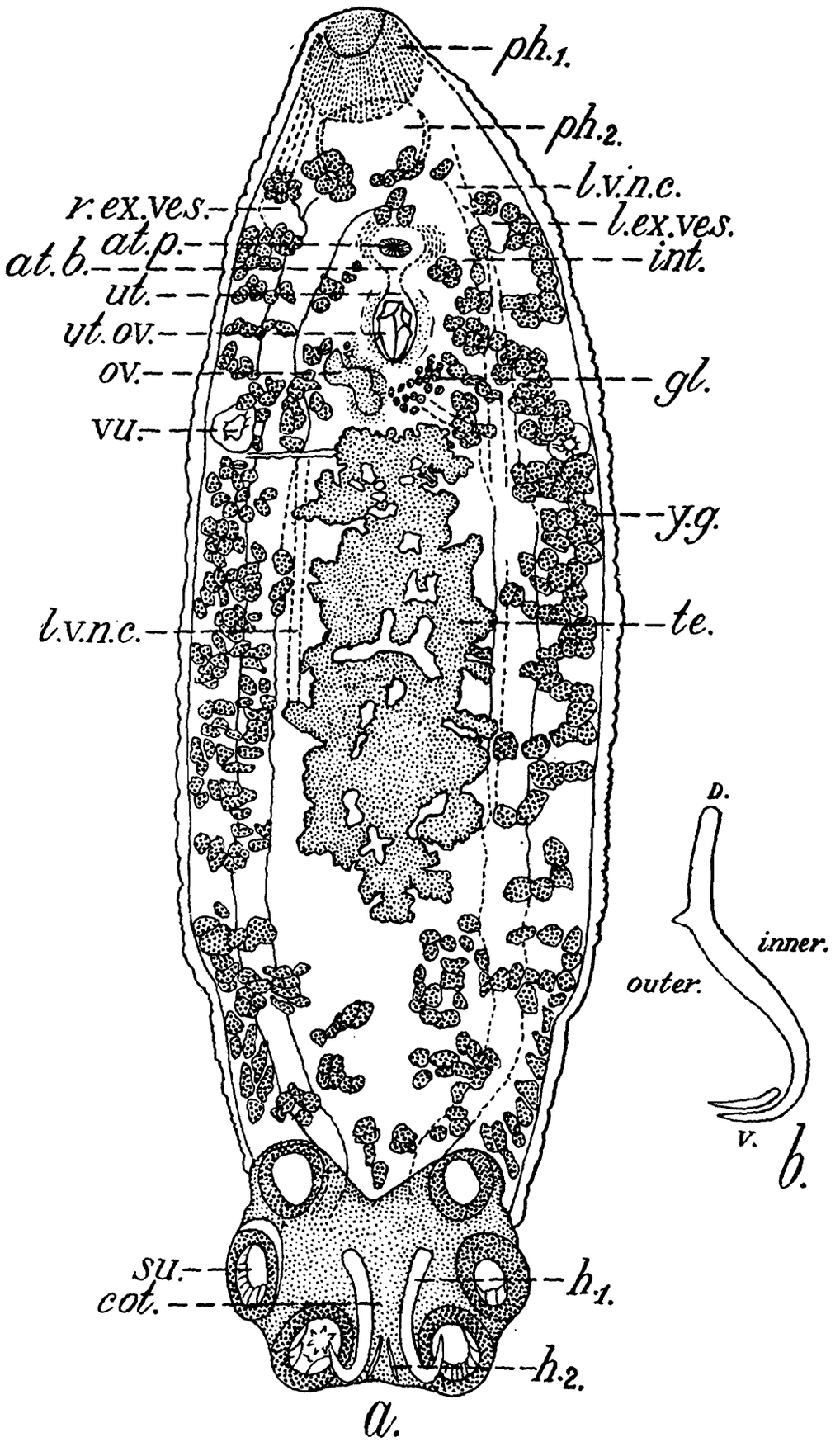
Haptor with 2 pairs of large hooks or anchors, outer pair larger than inner. Eyes absent in adults. Testis single. Uterus preovarian, short, usually containing one egg at a time. Vitellaria extend into posterior part of body. Vaginæ present. Parasitic in mouth, oesophagus and nasal passages usually and in urinary bladder, rarely of freshwater tortoises.

Type species—*Polystomoides coronatum* (Leidy, 1888) Ozaki, 1935.

11. **Polystomoides kachugae**, (Stewart, 1914) Fukui & Ogata, 1936.

(Text-figs. 12, *a*, *b* ; 13, *a*, *b*.)

Syn. *Polystomum kachugæ* Stewart, 1914.



Text-fig. 12.—*Polystomum kachugae* ; (*a*) ventral view, x 30 ; (*b*) A spine of the atria circlet, with the point of a second spine, × 1000 (after Stewart).

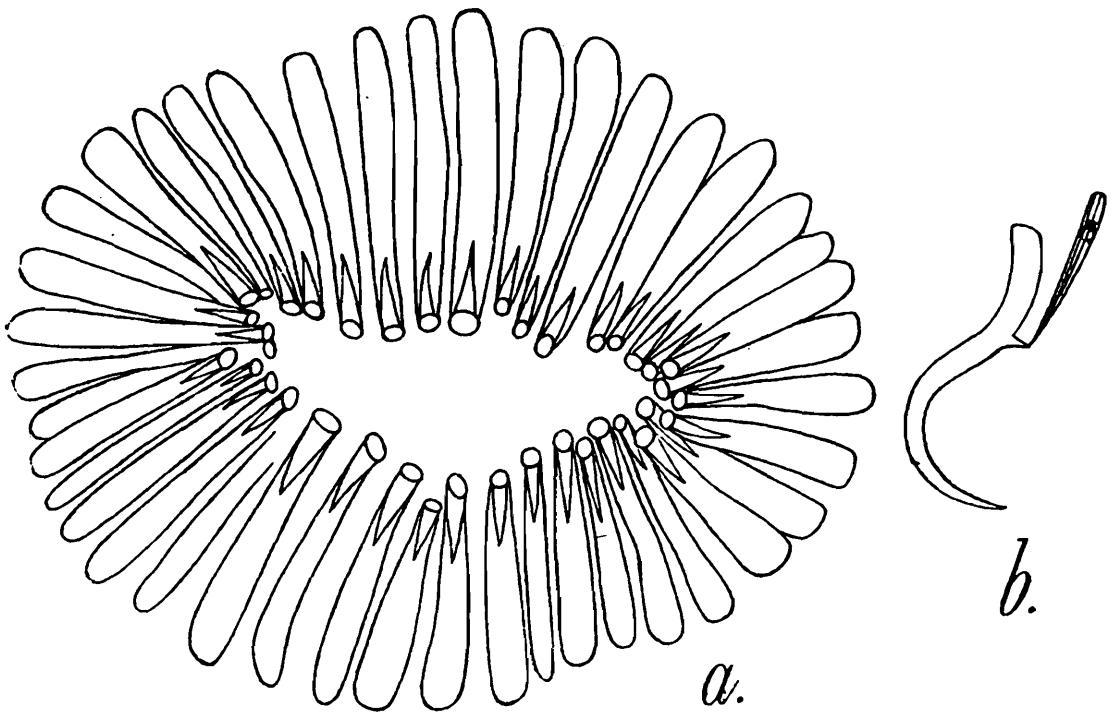
at. b., Atrial bulb ; *at p.*, Atrial pore ; *cot.*, Cotylophore ; *d.*, Dorsal ; *gl.*, Gland innominate ; h. $_1$, h. $_2$, Hook ; *int.*, Intestine ; *ov.*, Ovary ; *l.v.n.c.*, Lateral ventral nerve cord ; ph.$_1$., ph.$_2$., Pharynx ; *r. ex. ves.*, Right excretory vesicle ; *l.ex. ves.*, Left excretory vesicle ; *su.*, Sucker., *te.*, Testis ; *ut.*, Uterus ; *ut. ov.*, Uterine Ovum ; *v.*, Ventral ; *vu.*, Vulva ; *y.g.*, Yolk gland.

Stewart, F. H. (1914). *Rec. Indian Mus.* **10**(3) : 195-205.
Stunkard, H. W. (1916). *J. Parasit.* **3**(22) : 22.
——— (1917). *Illinois biol. Monogr.* **3** : 297-309.
Srivastava, H. D. (1930). *Proc. Indian Sci. Congr.* **3**(6) : 69.
Fukui, T. & Ogata, T. (1936). *Zool Mag., Tokyo* **48** : 765-770.
—— (1939). *Vol. Jub.* pro. Prof. S. Yoshida **2** : 200.
Price, E. W. (1939). *Proc. helm. Soc. Wash* **6**(2) : 84.
Dawes, B. (1946). *The trematoda : 148.*
Sproston, N. G. (1946). *Trans. Zool. Soc. Lond.* **25**(4) : 351.

Stewart (1914) described the species as *Polystomum kachugæ*. Fukui & Ogata (1936) assigned the species to its present taxonomic position.

Specific diagnosis (after Stewart's description)—*Polystomoides* Ward, 1917 ; with Generic characters.

Body elongate, bluntly pointed at the head, length 6·5, width about 2·0 maximum. Mouth subterminal. Eyes absent. Cotylophore 1·33 in breadth, bearing six cup-shaped suckers and two pairs of hooks, situated between the posterior pair of suckers ; one pair large, sabre-shaped, the other short, simply curved. First pharynx, muscular, spherical ; second pharynx identical with first, lying dorsal and posterior to it. Oesophagus short, muscular. Intestine bifurcate, caeca unbranched, extending posteriorly in the region of haptor. Testis single,



TEXT-FIG. 13.—*Polystomum kachugae* ; (*a*) The circlet of atrial hooks as seen from the ventral surface, x 650 ; (*b*) Single atrial spine, lateral view (after Stewart).

broad, flat, lobulated, lying in median third of body. Vesicula seminalis present. Penis a short, protrusible, muscular tube. Genital atrium cavity enclosed in a muscular bulb, divided by a diaphragm into a dorsal male atrium and a flattened ventral female atrium ; the former opening into the latter, which in its turn opens to exterior. Diaphragm armed with a circle of forty spines, appearing ventrally straight truncated rods but laterally as S-shaped hooks, sharp pointed at the projecting extremity. Ovary situated on the right, in one side and on the left in

second specimen. It is curved, sausage-shaped, fundus somewhat bulbous. Oviduct a narrow canal. Uterus oval, containing a single ovum. Vaginæ two. Vitelline glands extend from level of posterior border of second pharynx to anterior margin of cotylophore. Genito-intestinal canal present. Excretory pore a fine pore, on dorsal surface.

Host—*Kachuga lineata* (Gray).
Location—Urinary bladder.
Locality—Lucknow.

(ii) Genus **Eupolystoma** Kaw, 1950.

Generic diagnosis : *Polystomotinæ* Gamble, 1896 ; with Subfamily characters.

Haptor without large hooks ; larval hooks present. Gonads post equatorial ; testes median post-ovarial and follicular. Uterus long and preovarial, containing many eggs. Vaginæ present. Genital hooks present. Parasitic in the urinary bladder of amphibian.

Type species—*Eupolystoma rajai* Kaw, 1950.

12. **Eupolystoma rajai** Kaw, 1950.
(Text-fig. 14 *a*, *b*, *c*, *d*, *e*, *f*, *g*.).

Specific diagnosis, *Eupolystoma* Kaw. : 1950 ; with Generic characters.

Body oval, 2·4-3·22×0·98-1·4. Prohaptor sucker-like. Eyes absent. Haptor discoidal, broader than long, bearing three pairs of cup-like suckers. Large haptoral hooks absent, but 16 small, marginal hooks present on haptor, on ventral side. Mouth subterminal ; prepharynx funnel-like. Pharynx globular. Oesophagus almost absent. Intestinal caeca unite posteriorly, just in front of haptor. Gonads post-equatorial, inter-caecal, just in front of union of intestinal cæcum. Testes numerous, follicular, median, post-ovarian. Vas deferens long, narrow. Vesicula seminalis a narrow tube. Cirrus armed with genital coronet of eight hooks. Ovary sinistral, elongated, more or less comma-shaped. Genito-intestinal canal a small duct. Vitelline follicles scattered throughout body. Vaginæ present. Uterus greatly developed, inter-cæcal. Genital atrium thick-walled, globular. Genital pore median, lying ventral to intestinal bifurcation. Eggs numerous, oval thin-walled, 157-170×81-99μ, with well developed embryoes.

Host—*Rana* sp.
Location—Urinary bladder.
Locality—Punch, Kashmir.

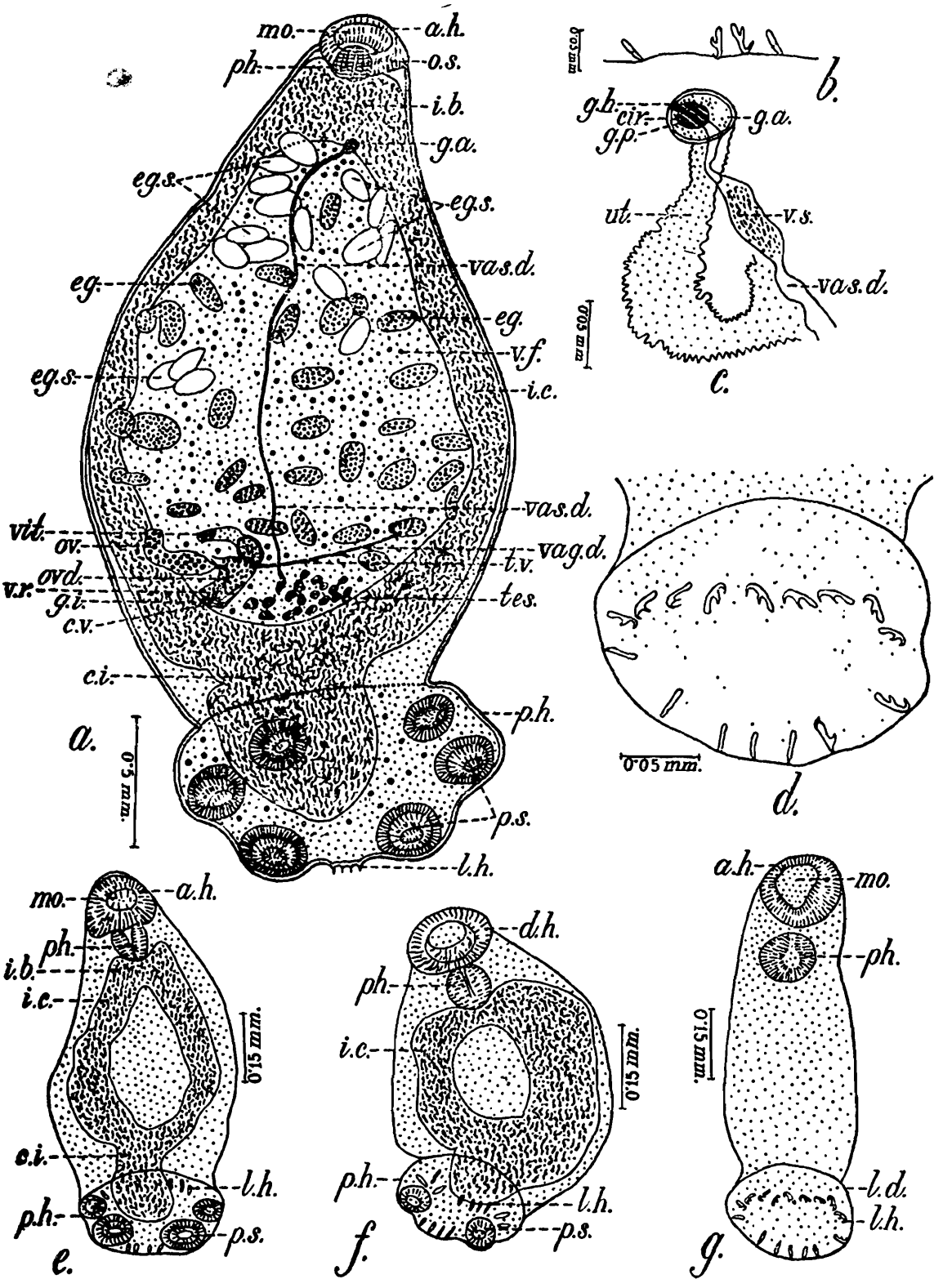
2. Superfamily DICLIDOPHOROIDEA Price, 1936.
Syn. *Dactylocotyloidea* Brinkmann, 1942.

Price (1943) who created the superfamily in (1936) defines it as follows :—

Superfamily diagnosis : *Polypisthocotylea* Odhner, 1912 ; with characters of the Order.

Anterior haptor in the form of two lateral, oval or circular suckers opening into the oral cavity. Posterior haptor variable in shape and position, usually at the posterior end of body, sometimes ventral or lateral, usually provided with two rows of suckers or clamp-like adhesive organs having a complicated, heavily cuticularized, rib-like supporting structure ; posterior tip of haptor often terminating in a tongue-like structure or " languette " or "lappet", armed with one to three pairs of hooks. Digestive system consisting of a prepharynx serving as an oral cavity,

a bulbous pharynx, a short oesophagus, and an intestine consisting,except in *Diplozoon*, of two principal branches provided with numerous median and lateral diverticula. Eyes absent in adults. Male and female genital



TEXT-FIG. 14.—*Eupolystoma rajai* ; (*a*) Entire, dorsal view ; (*b*) Larval hooks of adult ; (*c*) Distal portion of genital ducts ; (*d*) Larval disc ; (*e*) Third stage larva ; (*f*) Second stage larva ; (*g*) First stage larva (after Kaw).

a.h. or dh., Anterior haptor ; *ci.*, Fused intestine ; *cir.*, Cirrus ; *c. v.*, Common vitelline duct ; *eg.*, Egg ; *eg. s.*, Egg-shell ; *g. a.*, Genital atrium ; *g. h.*, Genital hook ; *g. i.*, Genito-intestinal canal ; *g. p.*, Genital pore ; *i. b.*, Intestinal bifurcation ; *i. c.*, Intestinal crus ; *l. d.*, Larval disc., *l. h.*, Larval hook ; *mo.*, Mouth ; *o. s.*, Oral sucker ; *oc.*, Ovary ; *ovd.*, Oviduct ; *ph.*, Pharynx ; *p. h.*, Postrior haptor ; *p.s.*, Posterior sucker (Haptoral sucker) ; *tes.*, Testes ; *t. v.*, Transverse vitelline duct ; *ut.*, Uterus ; *vag. d.*, Vaginal duct ; *vas. d.*, Vas deferens ; *v. f.*, Vitelline follicle ; *v.r.*, Vitelline receptacle, *v.s.*, Vesicula seminalis ; *vit.*, Vitellaria.

apertures usually opening to exterior through a common pore situated ventrally. Cirrus armed or unarmed. Testes usually numerous, postovarial, occasionally preovarial. Ovary elongate, folded. Vaginæ present or absent, usually opening dorsally. Parasites of fishes or of crustaceans parasitic on fishes.

Type family—*Diclidophoridæ* Fuhrmann, 1928.

Key to Families of Superfamily DICLIDOPHOROIDEA.

1.	Skeleton of clamps symmetrical ..	2.
	Skeleton of clamps asymmetrical ..	5.
2.	Spring double, formed by the shoulders between the ventral and dorsal loops of capsule skeleton ; dorsal loop complete ; tendon cuticularised only at distal end	*Mazorcæidæ.*
	Spring three-fold ; tendon completely cuticularised ; both loops incomplete in median line ; exceptional in circumoral sucker, replacing the pair of suckers within the mouth ..	*Chimæricolidæ.*
	Spring single, formed by the completely cuticularised tendon ; dorsal loop of capsule skeleton vestigial	3.
3.	Numerous clamps on haptor	4.
	Eight or fewer, clamps on haptor	*Discocotylidæ.*
4.	Main spring simple, one piece ; three paired and symmetrical lateral cuticular long bars supporting each clamp on the haptor, simple without any accessory structures	*Microcotylidæ.*
	Main spring may be a composite piece, with accessory pieces ; three paired and symmetrical, lateral cuticular long bars, supporting each clamp structure on the haptor, may be supported by an additonal transverse bar and usually with other transverse rib-like, lightly cuticularized, fine structures in wall of clamp-capsule	*Gastrocotylidæ.*
5.	Haptoral sclerites reduced to three dissimilar pieces embedded in lateral margin and partition of muscular sucker ..	*Hexostomatidæ.*
	Haptoral sclerites well developed ; muscles shifted towards the medial margin of the clamp-capsule	*Diclidophoridæ.*

Species belonging only to four of these families have so far, been recorded from the Indian region which are dealt with below.

(a) Family DICLIDOPHORIDAE Fuhrmann, 1928.

Syns. *Choricotylidæ* Rees & Llewellyn, 1941.

Dactylocotylidæ Brinkmann, 1942.

Family diagnosis (after Price, 1943) : *Diclidophoroidea* Price, 1936 ; with Superfamily characters.

Haptor terminal, usually bearing four pairs of cup-like adhesive structures having a complicated, heavily cuticularised frame of the type indicated for the family by Price (1943). Cirrus usually armed with a circle of curved hooks, which are crescentic in cross section. Seminal receptacle usually, if not always, present. Vaginæ usually absent.

Type genus—*Diclidophora* Diesing, 1850.

Price (1943) sub-divided the family into two subfamilies, which were differentiated as follows :—

Key to Subfamilies of Family DICLIDOPHORIDAE.

Haptoral sucker clamp or pincerlike	*Diclidophorinæ* Cerfontaine, 1895.
Haptoral sucker cup-like	*Cyclocotylinæ* Price, 1943.

Subfamily *CYCLOCOTYLINAE* Price, 1943.

Syns. *Choricotylidæ* Llewellyn, 1941.
Choricotylinæ Sproston, 1946.

Price (1943) while creating the new subfamily defined it as follows :—

Subfamily diagnosis : *Diclidophoridae* Fuhrmann, 1928 ; with Family characters.

Haptor with four pairs of sessile, sub-sessile or pedunculated, cup-like suckers, each provided with a heavily cuticularised framework of the kind typical of the family. Cirrus armed (except in *Cyclocotyloides*) with hooks as in Diclidophorinæ. Vaginæ usually absent.

Type genus—*Cyclocotyla* Otto, 1823.

Key to Genera of Subfamily CYCLOCOTYLINE.

1. Cirrus hooks absent	*Cyclocotyloides* Price, 1943
Cirrus hooks present	**2.**
2. Vaginæ present	**3.**
Vaginæ absent	**4.**
3. Vagina single, dorso-lateral	*Echinopelma* Raecke, 1945
Vaginæ two, lateral ..	*Diclidophoropsis* Gallien 1937.
4. Frame work of anterior pair of haptoral suckers orientated inversely as compared with those of posterior 3 pairs	*Heterobothrium* Cerfontaine, 1895.
Framework of all 4 pairs of haptoral suckers with the same relative orientation	**5.**
5. Testes both pre-and post-ovarial	*Cyclobothrium* Cerfontaine, 1895.
Testes entirely post-ovarial	**6.**
6. Posterior pair of suckers sessile and widely removed from anterior 3 pairs of pedunculated suckers	*Pedocotyle* MacCallum, 1913.
Posterior pair of suckers either sub-sessile or pedunculated and not separated from other pairs	**7.**
7. Vitellaria extending into haptor	*Cyclocotyla* Otto, 1823.
Vitellaria not extending into haptor	*Neoheterobothrium* Price, 1943.

Genus **Cyclocotyla** OTTO, 1823.

Syns. *Cyclostoma* Otto, 1823, *non* Lamarck, 1799.
Octostoma Otto, 1823, *non* Kuhn, 1829.
Choricotyle Beneden & Hesse, 1863.
Mesocotyle Parona & Perugia, 1889.

The genus, *Cyclocotyla* Otto (1823) was revived by Price (1943). Sproston (1946) does not agree with this contention. Dawes (1946; 1947) however, accepts classification of Price. I have followed Price and Dawes provisionally, pending the clarification of the status of the generic name.

Generic diagnosis—*Cyclocotylinae* Price, 1943; with Subfamily characters.

Haptor distinctly set off from body proper; suckers either subsessile or pedunculated, more or less equally spaced. Genital atrium non-muscular. Cirrus armed. Testes post-ovarial. Vaginae absent. Vitellaria extending into haptor.

Type species—*Cyclocotyla bellones* Otto, 1823.

Price (1943) gave a complete list of species of this genus. Chauhan (1945) described a new species, *C. multaetesticulae* from India and gave a key to species, which clearly indicates the taxonomic position of his species, under the genus, as shown below.—

Key to Species of Genus Cyclocotyla.

1. Vaginae two, opening near the zone of the genital atrium	*C. taschenbergii* (Parona and Perugia, 1889) Price, 1943.
Vaginae absent ..	2.
2. Body proper (not including the haptor) clearly divisible into two regions	3.
Body proper not divisible into two regions	4.
3. Anterior part of body demarcated from posterior by distinct shoulders ..	*C. bellones* Otto, 1823, (Type species)
	C. charcoti (Dollfus, 1942) Price, 1943.
Two regions of the body merge imperceptibly into one another	*C. smaris* (Ijima, in Goto, 1894) Price, 1943.
4. Peduncles of unequal length ..	5.
Peduncles of equal length ..	7.
5. Penis with 10 or 13 hooks ..	*C. prionti* (MacCallum, 1917) Price, 1943.
Penis with eight hooks	6.
6. Body proper oval, anterior end obtuse, peduncles comparatively short and robust ..	*C. labracis* (Cerfontaine, 1895) Price, 1943.
Body proper lanceolate, anterior end rather narrow, peduncles comparatively longer and slender	8.
7. Three anterior pairs of peduncles of equal size and relatively large, posterior pair relatively small, with smaller suckers ..	8.
Peduncles progressively shorter in antero-posterior succession	9.
8. Larger, with 25 testes and 12 cirrus hooks ..	*C. neomaenis* (MacCallum, 1917) Price, 1943.
Smaller, with 56 to 65 testes and 13 cirrus hooks ..	*C. caulolatali* (Meserve, 1938) Price, 1943.

9. Origin of the anterior-most peduncles contiguous	*C. pagelli* (Gallien, 1937) Price, 1943.
Origin of the anterior-most pair of peduncles separated by the width of the body, *i.e.*, haptor not distinctly set off from body proper	10.
10. Body ovate, peduncles of the posterior-most pair of haptoral suckers reach the haptoral disc separately, languette present, number of testes about 30	*C. chrysophryi* (Beneden and Hesse, 1863) Price, 1943.
Body elongate, posterior-most pair of haptoral suckers pedunculated but the two peduncles unite posteriorly into a single median stem, joining the haptor, languette absent, number of testes more than 30	*C. multaetesticulae* Chauhan 1945.

13. **Cyclocotyla multaetesticulae** Chauhan, 1945.

(Text-fig. 15, *a*, *b*, *c*.).

Syn. *Choricotyle multaetesticulae* (Chauhan, 1945) Sproston, 1946.

Sproston, N. G. (1946). *Trans zool. Soc. Lond* **25**(4) : 491.

Specific diagnosis : *Cyclocotyla* Otto, 1823 ; with Generic characters.

Body elongate, 2·83 × 0·13. Haptor palmate, carrying four pairs of pedunculated suckers. Peduncles long and thick. Suckers cup-like, almost equal in size ; clamp structure typically of Diclidophorid type, Languette absent. Mouth subterminal, transversely oval. Anterior suckers two, oval, muscular, opening into buccal cavity. Pharynx muscular, spherical. Oesophagus narrow. Intestinal caeca branched laterally, on outer side, uniting posteriorly, running practically to the end of haptor. Testes about 150, small, follicular, intercaecal, post-ovarian. Vas deferens ventral to receptaculum seminis. Vesicula seminalis at the base of cirrus. Cirrus provided anteriorly with a crown of eight, inwardly curved hooks. Genital pore situated half way between pharynx and intestinal bifurcation. Ovary small, median, pre-equatorial. Receptaculum seminis massive. Vitelline follicles numerous, relatively large, extending from the level, slightly below genital pore to posterior end of body, and into the haptor.

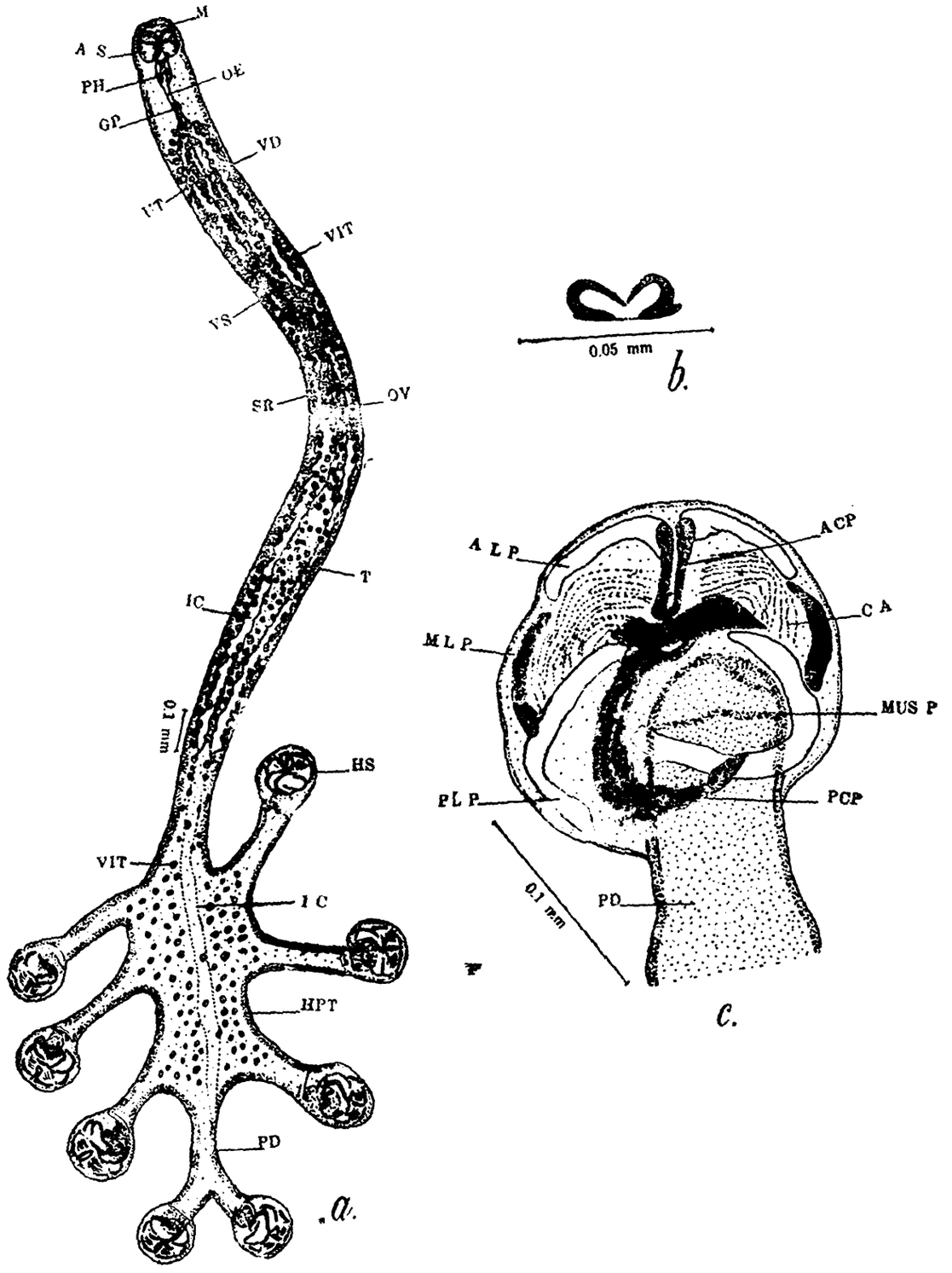
Chauhan (1945) characterised his species in having the haptor distinctly set off from the body ; vitellaria extending into the haptor ; vagina being absent ; testes, being post-ovarial and cirrus armed.

Sproston (1946) states that the species is distinguished in the key given by Chauhan as having vitellaria and a united intestinal caecum entering haptor ; the subequal clamps being borne on long stalks ; those of posterior pair being united for more than half their length and eight hooks in the genital corona.

Host.—*Pellona* sp.

Location.—Gills.

Locality.—Bombay ; Arabian Sea, Indian Ocean.



Text-fig. 15.—*Cyclocotyla multaetesticulae*; (*a*) Entire view; (*b*) Two of the cirrus hook; (*c*) Haptoral sucker, showing arrangement of the cuticular pieces of its framework (after Chauhan).

A C P., Anterior central piece; *A LP.*, Anterior lateral piece; *AS.*, Anterior suckers; *CA.*, Rodlets of concentric arcs; *GP.*, Genital pore; *HS.*, Haptoral sucker; *HPT.*, Haptor; *IC.*, Intestin l caecum; *M.*, Mouth; *MLP.*, Median lateral piece; *MUS. P.*, Muscle pad; OV., Ovary; *P CP.*, Posterior central piece; *PD.*, Peduncle; *PLP.*, Posterior lateral piece; *PH.*, Pharynx; *SR.*, Receptaculum seminis; *T.*, Testis; *UT.*, Uterus; *VD.*, Vas deferens; *VS.*, Vesicula seminalis; *VIT.*, Vitallaria.

(*b*) Family Mazocraeidae Price, 1936.

Syns. *Octocotylidae* Beneden & Hesse, 1863.

Octobothriidae Taschenberg, 1879.

Octobothridae Monticelli, 1888.

Mazocriidae Southwell & Kirshner, 1937.

Family diagnosis : *Diclidophoroidea* Price, 1936 ; with Superfamily characters.

Haptor generally with 4 pairs of clamp-like suckers, equally spaced out along the lateral regions of an indistinct cotylophore or of postero-lateral regions of body. Clamp-skeleton relatively simple, of most generalised type, consisting of a single dorsal and a ventral loop with forked tips which articulate with a straight basal piece, sometimes having a rudimentary piece attached to it. The scoop or U-shaped middle piece perforated to receive T-shaped cuticularised distal end of tendon. Terminal lappet—vestige of larval haptor—with 2-3 pairs of dissimilar hooklets. Larval hooklets may persist between the pair of anchors or just above them. Genital pore armed usually with 2 types of hooks, the lateral pair being larger than others and alate at the base. Testes generally numerous, wide follicles or sometimes a single, elongate and lobed mass between the intestinal crura. Vagina, when present, single and opening mid—dorsally, rarely Y-shaped and opening laterally. Ovary elongate, folded vermiform, situated near the anterior end of testis or testes. Vitellaria lateral and follicular.

Type genus—*Mazocraës* Hermann, 1782.

Key to Genera of Family MAZOCRAEIDAE.

1.	Haptor with two pairs of small, accessory suckers	*Ophiocotyle* Beneden & Hesse, 1863 ; *gen. inq.*
	Haptor without small, accessory suckers	2.
2.	Haptor symmetrical, bearing lateral rows of four clamps	3.
	Haptor asymmetrical, with one row of four clamps and a single smaller one on the other side : genital hooks 16 small and 2 larger laterals	*Grubea*, Diesing, 1858.
3.	Genital hooks, only the large lateral pair present ; vagina opening mid-dorsally ; ovary extends to end of body	*Mazocraeoides* Price, 1936.
	Genital hooks, slightly larger lateral pair and smaller hooks in two transverse rows ; vagina opening mid-dorsally ; ovary in anterior half, anterior to testes	*Mazocraës* Hermann 1782.
	Genital hooks, large lateral pair and smaller hooks in two vertical rows ; ovary in mid-body, anterior to testes	4.
4.	Vagina absent ; clamps like those of *Mazocraës* (typical)	*Kuhnia* Sproston, 1945.
	Vagina double, opening laterally ; clamps atypical	*Neomazocräes* Price 1948.

(i) Genus **Mazocraës** Hermann, 1782.

Syns. *Octostoma* Kuhn, 1782.
Octobothrium Leuckart, 1827.
Octocotyle Diesing, 1850.
Octoplectanum Diesing, 1858.
Glossocotyle Beneden & Hesse, 1863.
Octobothrium (*Octocotyle*) of St. Remy, 1891.

Generic diagnosis : *Mazocraeidae* Price, 1936 ; with Family character .

Body narrow, tapering to bluntly rounded either end ; haptor slightly wider than body, almost triangular, into which the diverticulate

intestinal crura extend, accompanied by the vitellaria. Clamps symmetrically arranged in lateral rows of four each side, on short pedicles which decrease in length backwards—the posterior clamps may be slightly smaller than the anterior, especially in younger worms. Typically two pairs of dissimilar anchors present, but the inner smaller pair may be lost in older worms—large anchors with bifid roots and recurved tip: these are borne on a short terminal lappet. Genital pore transversely elongate with 12 bipartite hooklets : with two lateral larger hooks and an anterior and posterior transverse row of a few (4-5) hooks each. The long, wide vas deferens apparently acts as a vesicula seminalis. The testes composed of numerous ill-defined transverse follicles which do not extend to the haptor : fill the region between the crura, in the posterior half of body. Ovary anterior to testes on the left side, vermiform and curved towards the descending oviduct. Genito-intestinal canal as long as ovary, opening into the right intestinal crus. Vagina opening on the dorsal side in the median line just posterior to the intestinal bifurcation, unarmed, and leading directly to a coiled receptaculum seminis vaginae. Eggs usually with two polar filaments. Parasites of gills of Clupeoid fishes.

Type species—*Mazocräes alosae* Hermann, 1782.

14. **Mazocräes orientalis** Chauhan, 1950.

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

Specific diagnosis : *Mazocräes* Hermann, 1782 ; with Generic characters.

Body flat, narrow, elongate, 1·15×0·15 (type). Mouth terminal. Anterior suckers paired, oval, obliquely placed, lined by refractile prismatic muscle fibres. Pharynx spherical, comparatively large, situated just behind anterior suckers. Prepharynx absent. Oesophagus thin, elongate. Intestinal crura extend nearly up to posterior end of body. Haptor somewhat triangular, continuous with body, carrying spatulate, terminal lappet, bearing at posterior end a pair of unequal hooks, which have bifid roots and recurved tips. Haptor bears four pairs of oval clamps, symmetrically arranged in lateral rows of four on each side, with short and stout retractile peduncles, decreasing slightly in length backwards. Clamps of almost equal size ; clamp—sclerite structure characteristic. Testes consist of eight oval follicles, arranged irregularly, somewhat in a double row medially, in middle third of body Ovary elongate, oval, anterior to testes, to the left. Vitellaria extend from the region near about intestinal bifurcation almost up to haptor. Vitelline follicles irregularly shaped, densely placed ; irregularly scattered. Genital pore oval, situated midway between pharynx and oesophageal bifurcation, armed with five pairs of hooks, with curved tips, arranged in two discontinuous rows.

The species is broadly distinguished by its pattern of the frame-work of clamps on the haptor ; shape and arrangement of genital hooks ; number of terminal hooks on posterior lappet of haptor and structure of lappet.

Host—A clupeid fish, *Dussumieria* sp.

Location—Gills.

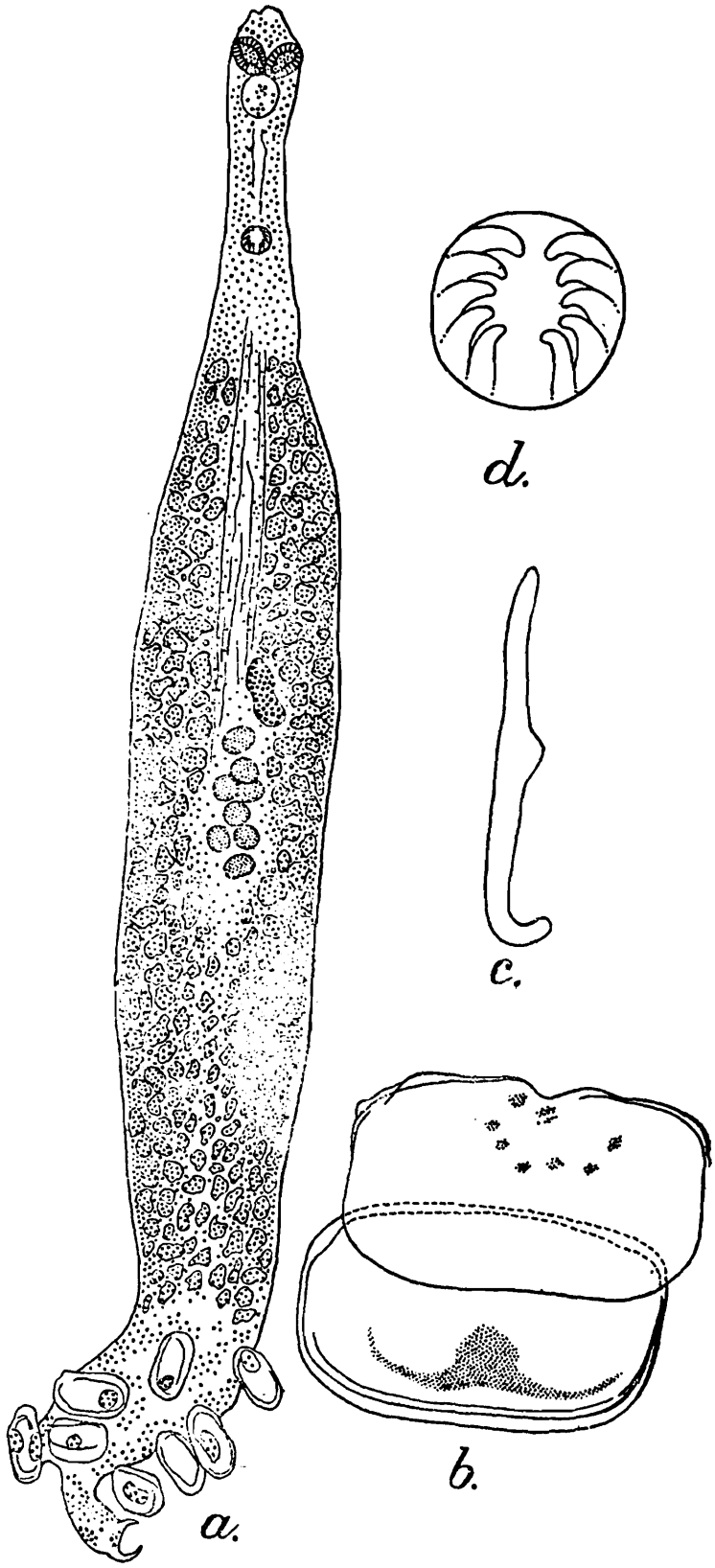
Locality—Puri, Bay of Bengal.

(ii) Genus **Mazocraeoides** Price, 1936. *emend.*

Syn. *Pseudoctocotyla* Yamaguti, 1936.

Generic diagnosis : *Mazocraeidae* Price, 1936 ; with Family characters.

Body broad, flattened. Haptor not differentiated as a separate organ ; clamps arranged on the margin of body proper, the anterior pair may be anterior to middle of body. Terminal lappet short, bearing



TEXT-FIG. 16.—*Mazocräes orientalis* ; (*a*) Entire specimen, ventral view, x 125 ; (*b*) Cuticular framework of the clamp on the posterior haptor, x 693 ; (*c*) One of the hooks of the terminal lappet of posterior haptor, x 693 ; (*d*) Genital atrium, showing cuticularised spines, x 700 (after Chauhan).

2-3 pairs of small hooks or anchors. Intestinal crura richly branched and along with vitellaria extend up to the posterior end of body. Ovary looped, sometimes extending to posterior third of body, sometimes posterior to testes. Testes follicular or a compact ovoid mass, in the median field usually, on left. Vagina single, dorsal, may be ending blindly. Genital pore with numerous small hooks, or with a single large pair, with alate spines at their bases. Eggs large, thick-shelled, without polar filaments.

Type species—*Mazrocraeoides georgei* Price, 1936.

15. **Mazocraeoides prashadi** Chauhan, 1952.

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

Specific diagnosis : *Mazocraeoides* Price, 1936 : with Generic characters.

Body lanceolate, flattened, 0·5×0·14 (type). Clamps four pairs on either side of posterior half of body proper. Clamp sclerites typical. Clamps pedunculated with retractile pedicels. Only two pairs of recurved terminal hooks at posterior end of body; the outer pair being larger. Mouth terminal. Prepharynx long, vestibular. Pharynx elliptical, compact, muscular. Oesophagus short. Intestinal may extend to the posterior end of body. Anterior or buccal suckers, one pair, oval. Genital sucker very prominent, highly muscular, bulb-like, situated just behind intestinal bifurcation; genital corona armed with a double row of five recurved hooks and an extra pair of comparatively long hooks, inserted between first and second pair. Testis single, elongately oval. Vas deferens massive. Ovary elongate. Vitellaria very dense, extending broadly along lateral region from genital sucker to posterior end.

The genus contains three species: *M. georgei* Price, 1936 (type), *M. dorosomatis* (Yamaguti, 1938) Sproston, 1946 and *M. prashadi* Chauhan, 1952.

Chauhan (1950) states that *M. prashadi* differs from the type species in having only two pairs of posterior hooks, in the shape of testis and clamps; details of the framework of clamps in the genital sucker abutting against the intestinal bifurcation and being very prominent, muscular and differing in its structure.

M. prashadi differs from *M. dorosomatis*, in the shape of body; very different structure of genital sucker; pattern of cuticular framework of clamp and the number of posterior pairs of hooks.

Host—A Clupeid fish.

Location—Body surface.

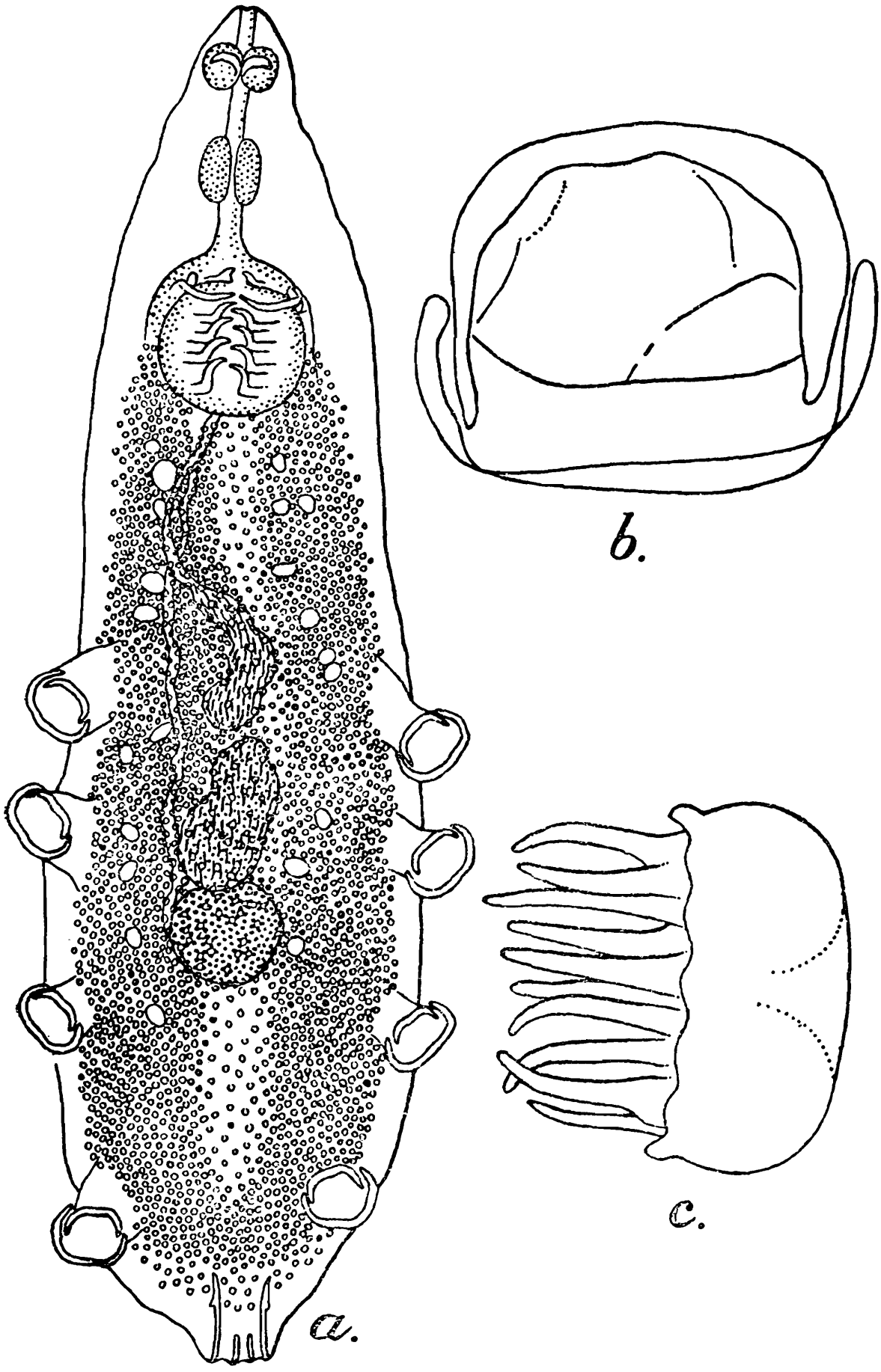
Locality—Puri, Bay of Bengal.

(*c*) Family Discocotylidae Price, 1936.

Family diagnosis : *Diclidophoroidea* Price, 1936 : Superfamily characters.

Body or haptor only sometimes asymmetrical. Haptor terminal, usually linguiform, with 3-4, usually 4 pairs of clamp-like suckers and with 1-3 pairs of terminal hooks. Clamp structure distinctive; ventral loop complete and often with articulations; dorsal loop incomplete

represented by two inwardly directed arms; middle piece usually not well developed farther than posterior rim, which is in at least two parts,



TEXT-FIG. 17.—*Mazocraeoides prashadi*; (*a*) entire worm, ventral view; (*b*) frame-work of posterior sucker; (*c*) genital sucker, showing genital spines (after Chauhan).

though it may carry accessory sclerites as in some Gastrocotylidae. Tendon always well cuticularised and forming a single median spring. Terminal lappet or languette often present, bearing 1-3 disimilar, pairs of hooklets. Lateral vaginae present or absent.

Type genus—*Discocotyle* Diesing, 1850.

Taxonomic position of subfamilies and genera included in the family.

Price (1943) included under the family three subfamilies: Anthocotylinae Price, 1936; Discocotylinae Price, 1936 and Vallisinae Price, 1943. Sproston (1946) reinstates the subfamily Plectanocotylinae Monticelli, 1903 in this family. Dawes (1946) creates under the family a new subfamily, Chimaericolinae for the genus *Chimaericola* Brinkmann, 1942. He regards the family Chimaericolidae of Brinkmann (1942) as synonymous to his new subfamily.

The family Chimaericolidae was created by Brinkmann (1942) for *Octobothrium leptogaster* Leuckart, 1830, an archaic form of very uncertain position. Diesing (1850) placed this species first under the genus *Discocotyle* as *sp. inq.* and later (1858) renamed it under *Placoplectanum*. Parona and Perugia (1892) mentioned it as *Octocotyle* (*Octobothrium*). Price (1943) places it under the genus, *Neoheterobothrium* (Fam Diclidophoridae).

Brinkmann* placed his new family along with Onchocotylidae (=Hexabothriidae) in superfamily Polystomatoidea, on account of the absence of mouth-suckers and their replacement by a weak circumoral sucker as in typical Polystomatoidea. He pointed out that it is clearly a transitory family between the two superfamilies, Polystomatoidea and Diclidophoroidea, approaching the latter in the form of haptor and clamps, though having the vaginal pattern of the former. It is an archaic form of great interest, probably an intermediate connecting link between the two superfamilies of the order Polyopisthocotylea, and I concur with Sproston (1946) that on account of similarity of its clamp skeleton with that of other Diclidophoroidea and the appearance of Discocotylid fancies in relation to several organs, it may be placed in the superfamily Diclidophoroidea but in a separate and independent family, near to Discocotylidae.

Dawes also does not mention subfamily Vallisinae of Price (1943) but mentions the genus *Vallisia* under the subfamily, Discocotylinae. There also appears to be divergence of opinion regarding family assignment of the genus *Grubea* Diesing, 1858. Price (1943) does not include it under the family Discocotylidae. Sproston (1946) mentions it under the family Mazocraeidae. Dawes (1946; 1947) puts it under the family Discocotylidae (subfamily: Discocotylinae). I am inclined to follow Sproston and Price.

Key to Subfamilies of Family Discocotylidae.

1. Three pairs of clamps; vaginae absent	*Plectanocotylinae.*
Four pairs of clamps; vaginae generally present ..	2.
2. Clamps of the anterior most pair very large, the remaining ones very small	*Anthocotylinae.*
Clamps of the anterior most pair not markedly larger than the others	3.

* Brinkmann (1952) creates a new superfamily, *C. chimaericoloidea* for his family.

3. Testes pre-ovarial ; body asymmetrical ; cirrus armed	*Vallisinae.*
Testes post-ovarial ; body symmetrical ; cirrus armed ..	*Discocotylinae.*

(i) Subfamily *DISCOCOTYLINAE* Price, 1936.

Subfamily diagnosis : *Discocotylidae* Price, 1936 ; with Family characters.

Mature individuals sometimes fused in the form of " X " (*Diplozoon*). Body symmetrical. Haptor bears 4 pairs of equally developed clamp-like suckers and a short terminal lappet with only one pair of bent, crook-shaped hooks near its posterior tip. Testes lobed, follicular or a compact mass, post-ovarial. Terminal male genitalia, an unarmed cirrus or sucker. Vaginae present or absent ; if present, either, Y-shaped with two marginal pores or single and ventral. Eggs with or without filaments.

Typegenus—*Discocotyle* Diesing, 1850.

Key to Genera of Subfamily DISCOTYLINAE.

1. Mature individuals fused in pairs, in the form of " X "	*Diplozoon* Nordmann, 1832.
Mature individuals, separate . .	2.
2. Genital sucker present ; testis single, extensively lobed ; vagina absent	*Octomacrum* Mueller, 1934.
Genital sucker absent ; testes follicular ; vagina present, Y-shaped	*Discocotyle* Diesing, 1850.

Genus **Diplozoon** Nordmann, 1832.

Syns. *Diplozoum* (Nordmann, 1832) of Burmeister, 1835.
Diporpa Dujardin, 1845.

Generic diagnosis : *Discocotylinae* Price, 1936 ; Subfamily characters.

Mature individuals and late larval stages fused in the form " X " Haptor rectangular, concave ventrally, bearing 4 pairs of clamp-like suckers, set close together, along the postero-lateral margins, symmetrically, in thick capsules. Ventral capsule wall shows papilla-like process within the area, bounded by ventral loop and a pair of crook-shaped, recurved hooks, on the ventral side, near posterior end ; the other pair of hooks may be needle-like. Intestine not bifurcated, but with numerous lateral, branched diverticula. Testis single, rounded with crenulate margins, posterior to ovary, lying partly in haptor, at posterior end of body proper. Ovary elongate, looped, pretesticular. Genital pores encircled by a genital sucker (gonotype), all close together, in posterior half, united with complementary pore of the uniting worm ; on maturity gonotyl fuses with the dorsal papilla bearing the vaginal pore of the other individual ; corresponding change occurring in the inverse sense so that the male duct of each individual is contiguous with the female duct of the other. Vitellaria massive, with numerous, large follicles, preovarial, filling available space in the anterior part of body, between intestinal meshes, in front of the point of union of the two individuals. Vagina absent or single, lateral on ventral side. Eggs oval, with a very long and much coiled filament at the anopercular pole. Parasites on gills of freshwater fishes.

Type species—*Diplozoon paradoxum* Nordmann, 1832.

The genus contains, at present, four species ; *D. paradoxum* Nordmann, 1832 ; *D. nipponicum* Goto, 1891 ; *D. indicum* Dayal, 1941 and *D. kashmirensis* Kaw, 1950. Out of these the latter two have been recorded from India. Kaw (1950) gave a key to species of the genus, as below.

Key to Species of Genus Diplozoon.

1. Intestine bifurcates into two branches behind the place of the union of two individuals and the branches unite posterior to testis ..	2.
Intestine runs as a single tube without branching behind the place of the union of two individuals and gives out lateral branches posterior to testis	*D. paradoxum.*
2. Testis lobed and lies midway between the crossing of individuals and the posterior margin of the body	3.
Testis smooth and lies more near the crossing of individuals than the posterior margin of the body	*D. indicum.*
3. A pair of sticky glands present at the entrance of the mouth	*D. nipponicum.*
No sticky glands present at the entrance of the mouth	*D. kashmirensis.*

16. **Diplozoon indicum** Dayal, 1941.

(Text-figs. 18 ; 19, *a*, *b*, *c*, *d*, *e*.)

Dayal (1941) gave the following distinguishing characters of the species :

1. The union of the two individuals takes place behind the fore end of the posterior third of the body.

2. A pair of anterior suckers, one on each side of the mouth.

3. Four pairs of posterior suckers, the anterior pair of suckers is the largest, while those that follow are smaller than the preceding one, the last pair is the smallest.

4. Mouth a triangular opening on the ventral side, prepharynx and pharynx present, intestine tubular and gives out dichotomously branched caeca anterior to the place of union of the two individuals, behind the place of union the intestine branches in two caeca which unite again posterior to testis. Behind the testis the intestine extends as a simple tube upto the posterior end of the second hind sucker.

5. Testis round or oval and lies in a sac anterior to the first pair of posterior suckers.

6. Ovary in the form of a long band which bends twice on itself thus forming an inverted overlapping double U.

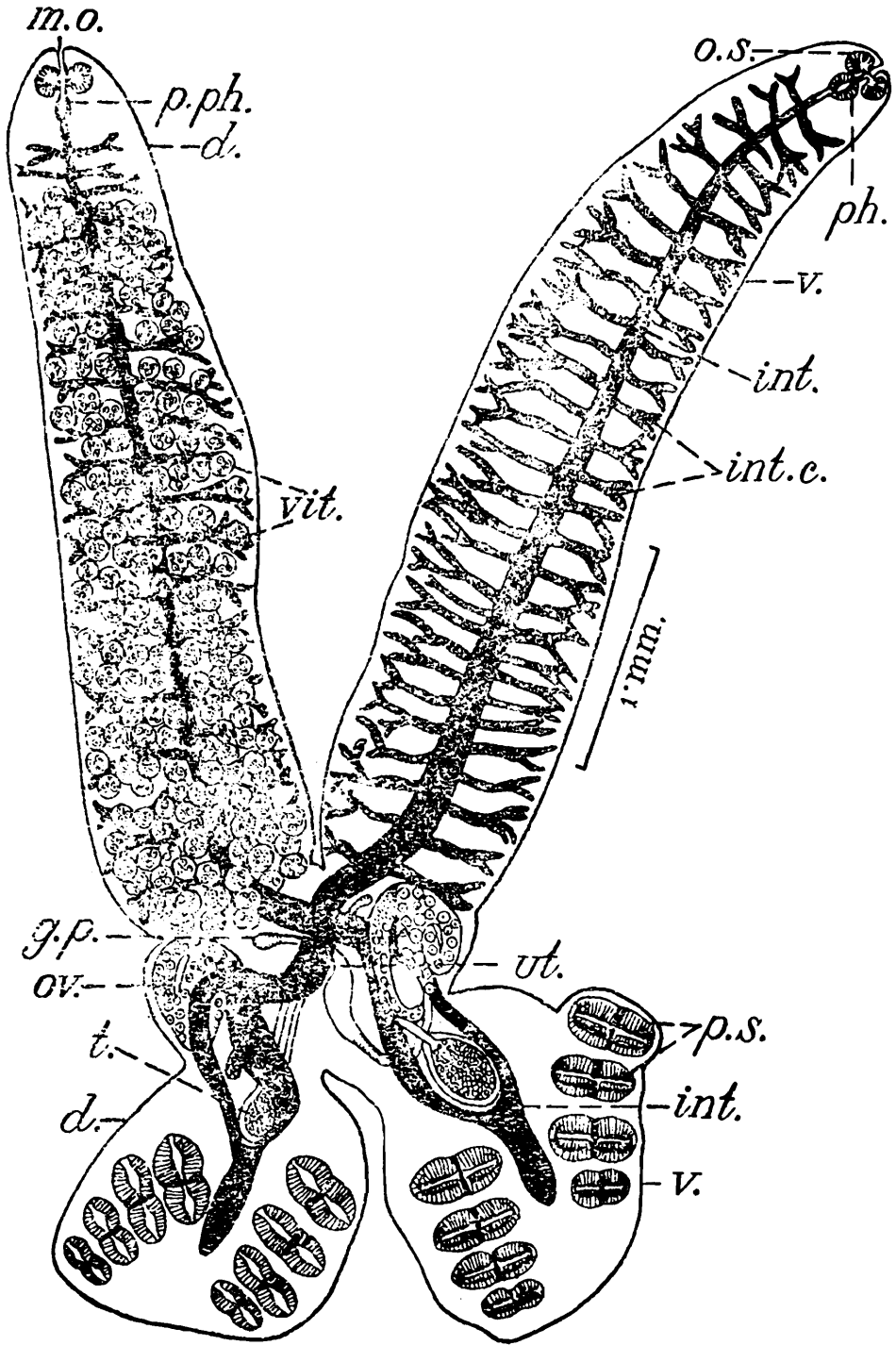
7 Eggs large, operculated, with a long coiled filament and a thick shell, they contain a large amount of yolk and the germplasm is limited in the centre of the egg.

He further states that *D. indicum* differs from *D. paradoxum* and *D. nipponicum*, in the position of the union of the two individuals, in the comparative size of the posterior suckers, in the structure and extent of the intestine, in the position and shape of the ovary and testis, and in the size of the eggs.

Host—Fresh-water fish, *Barbus* (*Puntius*) *sarana* (Ham.).

Location—Gills.

Locality—Gomati river, Lucknow.



TEXT-FIG. 18.—*Diplozoon indicum*; entire view of the two individuals fixed under pressure of a cover glass. The vitelline glands have not been shown on the right side. Genital organs not completely shown (after Dayal).

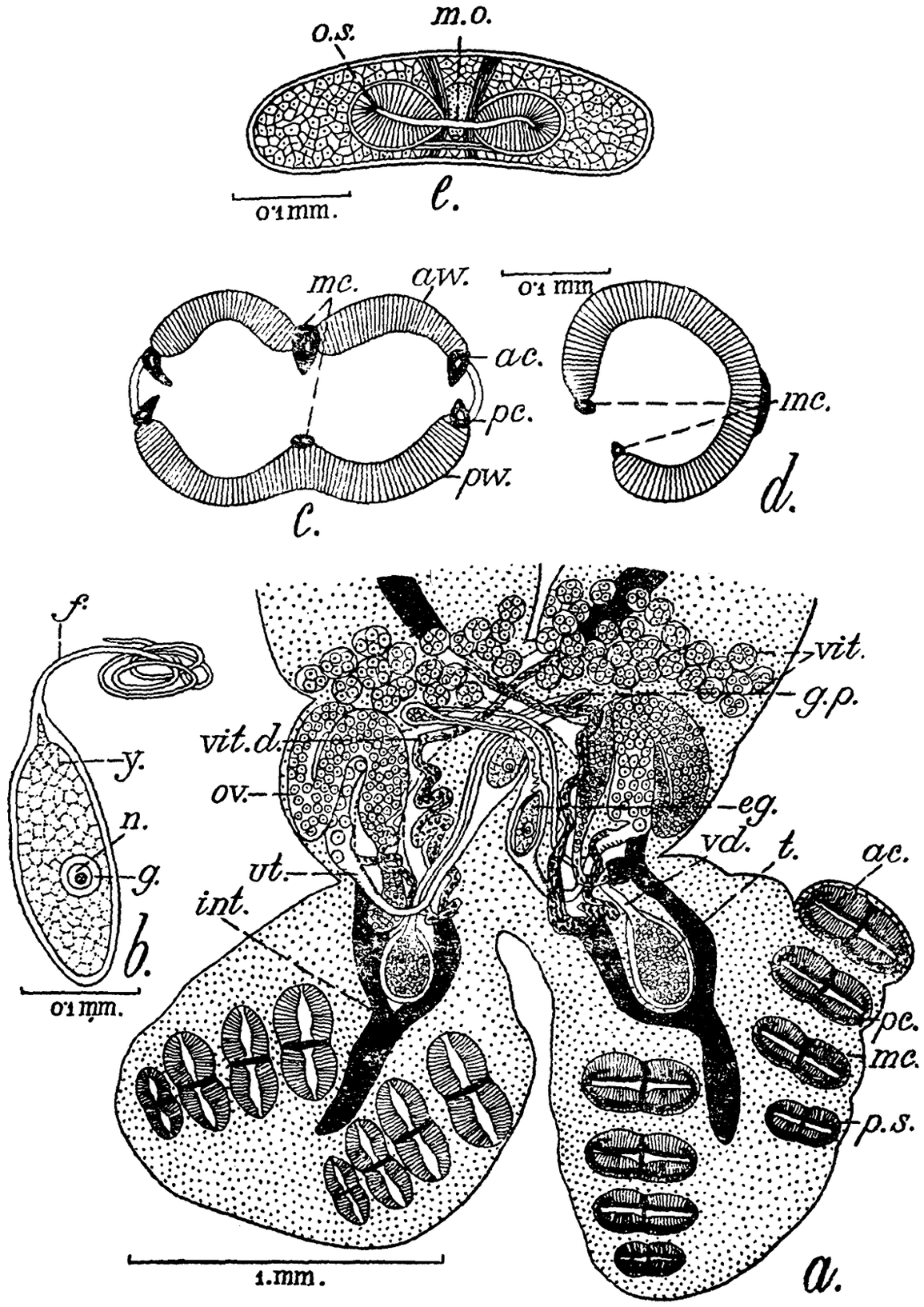
d., Dorsal view; *g. p.*, Genital pore; *int.*, Intestine; *int. c.*, Intestinal caeca; *m. o.* Mouth opening; *o. s.*, Oral sucker; *ov.*, Ovary; *ph.*, Pharynx; *p. ph.*, Prepharynx; *p. s.* Posterior sucker; *t.*, Testis; *ut.*, Uterus; *vit.*, Vitelline glands; *v.*, Ventral view.

17 **Diplozoon kashmirensis** Kaw, 1950.

(Text-fig. 20, *a*, *b*, *c*, *d*.)

Specific diagnosis : *Diplozoon* Nordmann, 1832; with Generic characters.

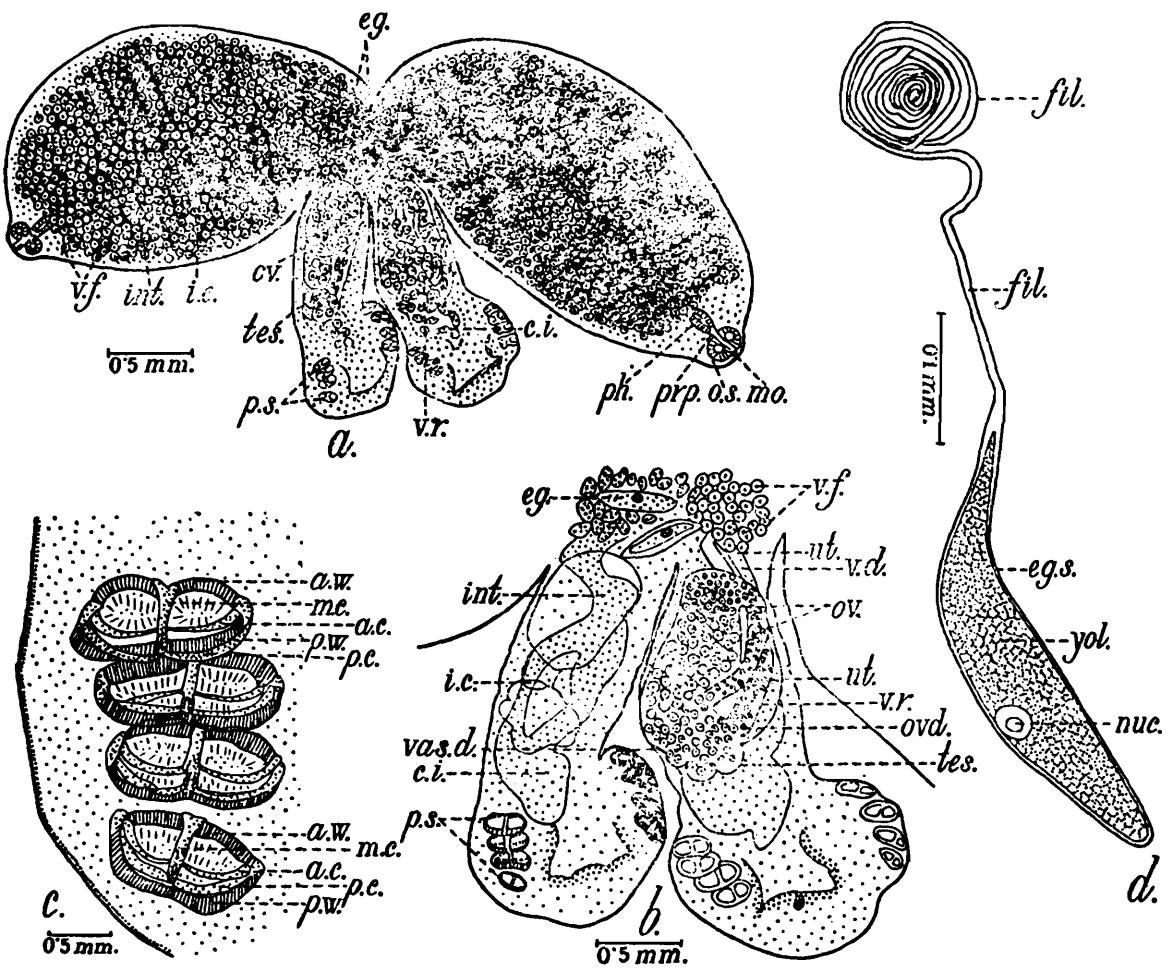
Individuals found in pairs, union taking place in the form of a cross, at about threefifth of body length, then they twist. Body 2·3—4·32. Region in front of cross, dorso-ventrally flattened, leaf-like,



Text-fig. 19.—*Diplozoon indicum*; (*a*) Enlarged view of the posterior region of the body with a diagrammatic representation of the genital organs and the posterior suckers; (*b*) Egg, highly magnified; (*c*) A longitudinal horizontal section through one of the posterior suckers; (*d*) A saggital section through one of the posterior suckers; (*e*) T.S. in the region of the oral suckers and the mouth, showing the groove connecting the mouth and the cavity of the oral suckers (after Dayal).

a. c., Anterior cuticular rod; *a. w.*, Anterior wall of posterior sucker; *eg.*, Egg; *f.*, Filament; *g. p.*, Genital pore; *g.*, Germ-plasm; *int.*, Intestine; cuticular *mc.*, Median rod; *m.o.*, Mouth opening; *n.*, Nucleus; *o.s.*, Oral sucker; *ov.*, Ovary; *p. c.*, Posterior rod; *p. s.*, Posterior sucker; *p. w.*, Posterior wall of cuticular posterior sucker; *t.*, Testis; *ut.*, Uterus; *vd.*, Vas deferens; *vit.*, Vitelline glands; *vit. d.*, Vitelline duct; *y.*, Yolk.

1·4—2·6×0·71—1·51 ; length being more or less double width. Region behind the cross, 0·9—1·72×0—5·0—69, sub-cylindrical, except in posterior region. Anterior suckers, two, cup-shaped, oval. Posterior suckers, in four pairs, lying ventrally on posterior concave disc of body ; cup-shaped,transversely oval, with five cuticular hollow rods ; the median cuticular rod being U-shaped. Size of suckers variable, usually second pair being the largest, while last is the smallest. Mouth terminal. Prepharynx present. Pharynx globular. Intestine very much branched in anterior region of body ; bifurcating in the posterior region, behind the cross and the intestinal crura uniting again, immediately posterior to ovary ; extending down to second pair of posterior suckers. Testis single, globular, situated behind cross. Ovary large, band shaped, folded upon itself, extending from point of body-cross upto testis. Vitelline follicles numerous, scattered from pharynx to body-cross. Uterus elongate tube, containing only one, mature egg. Egg large, oval, operculate, thickshelled, 0·27—0·29×0·07—0·09, with a very long coiled filament.



TEXT-FIG. 20.—*Diplozoon kashmirensis* ; (*a*) Entire ; (*b*) Posterior region ; (*c*) Posterior suckers ; (*d*) Egg (after Kaw).

a. c., Anterior cuticular rod ; *a. w.*, Anterior wall of posterior sucker ; *c. i.*, Fused intestine ; *eg.*, Egg ; *eg. s.*, Egg shell ; *fil.*, Filament ; *i. c.*, Intestinal caecum ; *int.*, Intestine; *m. c.*, Median cuticular rod ; *mo.*, Mouth ; *nuc.*, Nucleus ; *o. s.*, Oral sucker ; *ov.*, Ovary ; *ovd.*, Oviduct ; *p. c.*, Posterior cuticular rod ; *ph.*, Pharynx ; *prp.*, Prepharynx ; *p. s.*, Posterior sucker (haptoral sucker) ; *p. w.*, Posterior wall of posterior sucker ; *tes.*, Testis ; *ut.*, Uterus ; *vas. d.*, Vas deferens ; *v. d.*, Vitelline duct ; *v. f.* Vitelline follicle ; *v. r.*, Vitelline receptacle ; *yol.*, Yolk.

There are four known species of the genus *Diplozoon*, viz. *D. paradoxum* Nordmann, 1832 ; *D. nipponicum* Goto, 1891 ; *D. indicum* Dayal, 1941 and *D. kashmirensis* Kaw, 1950. Out of these *D. kashmirensis*

resembles *D. paradoxum*, in the comparative size of posterior suckers, the form of testis and ovary and the size of eggs, but differs in the proportion of the body-length to its breadth, the position of union of two worms, the arrangement of intestine in the hind portion of the body and the position of testis. It resembles *D. nipponicum* in the comparative size of suckers, the arrangement of intestine in the hind portion of the body and the form and position of testis, but differs in the proportion of the body length to its breadth, the position of union of two worms, the size and position of the ovary, the size of posterior suckers and absence of sticky glands at the entrance of the mouth. It resembles *D. indicum* only in the arrangement of intestine in the hind portion of the worm but differs from it in the proportion of the body-length to its breadth, the position of crossing of two worms, the comparative size of posterior suckers, the form of testis and the size of eggs.

Host—Freshwater fish, *Schizothorax* sp.

Location—Gills.

Locality—Dal Lake, Kashmir.

(*ii*) Subfamily *Vallisinae* Price, 1943.

Taxonomic Observations.

The subfamily was created by Price (1943) as a monotypic subfamily, with *Vallisia* Perugia & Parona, 1890 as the type genus. Sproston (1946) transferred to it the genus *Protomicrocotyle* of Johnston & Tiegs, 1922, which was put by them under a new subfamily Protomicrocotylinae of the family Microcotylidae Taschenberg, 1879.

Sproston herself does not seem to be very much satisfied with this arrangement and regarded it only as a matter of convenience, and as a temporary measure, until our knowledge of these aberrant forms had increased, since it is the only other monogenetic genus (besides *Vallisia*) in which the ovary is wholly posterior to testes, both genera have the body axis bent at an angle, though in *Protomicrocotyle* this asymmetry is in the posterior quarter of worm. She further states that " the structure of the larval haptor and of the region bearing the asymmetrically placed clamps, indicates that this genus is clearly of a different evolutionary line from *Vallisia*." According to her " it is not more closely allied to Microcotylidae and owing to the limited number of clamps it is perhaps preferable to group it with Discocotylidae—albeit—a somewhat heterogenous assemblage "

It may be added here that both the genera, *Protomicrocotyle* and *Bilateracotyle*, differ fundamentally from *Vallisia* or as a matter of fact, probably from any member of the family Discocotylidae also, in the fact that in both of them the clamp structures are not borne on any structure like a separate, discoid haptor or cotylophore but occur on the posterior part of body proper, itself.

Chauhan (1945) added another genus *Bilateracotyle* to the subfamily Protomicrocotylinae, which he mentioned as a subfamily of the family Microcotylidae. As Sproston transfers the type genus, *Protomicrocotyle* of the subfamily to Vallisinae, which has its type genus as *Vallisia*, the subfamily Protomicrocotylinae which was mono-typic becomes synonymous to Vallisinae.

As pointed out elsewhere in this paper, the subfamily Vallisinae has not been recognised by Dawes (1946 ; 1947) who placed the genus *Vallisia* in the subfamily Discocotylinae of the family Discocotylidae and retained the genus *Protomicrocotyle* under the family Microcotylidae.

As I have had no opportunity to handle specimens of either *Vallisia* or *Protomicrocotyle* I am not in a position to express any opinion in this matter. It may, however, be pointed out that Sproston (1946, p. 399) while discussing the position of the genus *Plectanocotyle*, subfamily Plectanocotylinae, in the family Discocotylidae stated that originally the subfamily Plectanocotylinae Montic., 1903 was placed in the family Hexacotylidae Montic., 1899, which was created for those monogenea with six suckers irrespecitve of their other structures and thus such a heterogenous group included together as widely different forms as Hexabothriidae and *Plectanocotyle*. She further added that it is unnecessary to stress the unimportance of the number of clamps developed in this superfamily (Diclidophoroidea), as it is obviously their structure which is significant, hence also the unreality and ultimate breaking up of the old family Octocotylidae. The importance which should be given to this consideration will be evident from the fact that Price (1943) based his entire classification of the families of the superfamily Diclidophoroidea on the type and details of clamp structure only.

When I apply the above considerations to the clamp structure of the genus *Bilateracotyle*, I find that it is so typically microcotylid in form that the genus *Bilateracotyle* cannot be removed from the family Microcotylidae and placed in the subfamily of such a different nature as Vallisinae. In my opinion, the clamp structure of the genus *Protomicrocotyle* as far as I know it, is so closely allied to the genus *Bilateracotyle* that both of them should come together, in the subfamily Protomicrocotylinae which should be retained under the family Microcotylidae. However, in case, if it is considered that the genus *Protomicrocotyle* cannot be separated from the subfamily Vallisinae and it must remain there, then the use of the subfamily name Protomicrocotylinae will be misleading. Therefore the genus *Bilateracotyle* will then have to be placed under a new subfamily *Bilateracotylinae* subfam. nov. of the family Microcotylidae. The proposed new subfamily will then have provisionally, more or less the same subfamily diagnosis as that given elsewhere for the genus *Bilateracotyle* which will be the type genus.

Subhapradha (1951) created another genus, *Vallisiopsis* and assigned it to the subfamily Vallisinae. In my opinion the clamp structure of this genus is so closely allied and similar to that of forms in the family Gastrocotylidae that I propose to remove this genus from the subfamily Vallisinae and transfer it to the family Gastrocotylidae.

(*d*) Family MICROCOTYLIDAE Taschenberg, 1879.

The family diagnosis is emended here to accommodate the subfamily Protomicrocotylinae.

Family diagnosis : *Diclidophoroidea* Price, 1936 : with Superfamily chraacters.

Haptor or cotylophore symmetrical or asymmetrical. Clamps usually numerous ; a paired series ; relatively small in size, usually weakly

cuticularised, borne on either side of the haptor or on posterior part of body proper. Clamp-sclerites are secondarily the simplest, without any accessory sclerites, arranged in a typical way, each having 2 pairs of curved lateral half-hoops which articulate with a single median U-shaped sclerite or with distal pieces, the dorsal most being spurred; distal end of the haptor with 1 or 2 pairs of larval hooks persisting in adults. Testes numerous, follicular, entirely post-ovarial except in Protomicrocotylinae. Ovary generally in front of testes, situated in the middle third of body, elongate, folded in various ways. Vagina usually single, dorsal or lateral; genital atrium generally with a complicated armature of hooks, in more than one series. Eggs with polar filaments.

Type genus—*Microcotyle* Beneden & Hesse, 1863.

I have included in the family as defined above, two subfamilies; Microcotylinae Monticelli, 1892 and Protomicrocotylinae Johnston & Tiegs, 1922. They can be differentiated as follows :—

Key to Subfamilies of Family Microcotylidae.

Clamps numerous; usually borne on haptor. Ovary pretesticular	*Microcotylinae.*
Clamps generally few 4-6; borne on the posterior end of body proper. Haptor, usually set off from body, muscular, transversely oval, discoidal or dumb-bell shaped bearing 2-3 pairs of hooks. Ovary posttesticular ..	*Protomicrocotylinae.*

(i) Subfamily : *Microcotylinae* Monticelli, 1892.

Syns. *Axininae* Monticelli, 1892.
Axininae Nicoll, 1915.

Subfamily diagnosis : *Microcotylinae* Taschenberg, 1879 ; with Family characters.

Haptor symmetrical or asymmetrical, clamps usually numerous, relatively small in size, borne on either side of haptor, which is variable in form ; haptoral, larval hooks may persist. Testes follicular, post-ovarian. Vagina single. Genital atrium armed with cuticular hooks. Eggs with polar filaments.

Type genus—*Microcotyle* Beneden & Hesse, 1863.

Sproston (1946) gave a key to the genera of subfamily as follows :

Key to Genera of Subfamily Microcotylinae.

1.	Some clamps of modified structure present ..	2.
	Clamps all of the same structure	3.
2.	Modified clamps in two rows on one arc of a fishtail-shaped haptor, which is separated off from the body; anchors absent	*Pyragraphorus* Sproston, 1946.
	Modified clamps on a unilateral extension of the haptor along the body-margin; anchors present.. ..	*Cemocotyle* Sproston, 1946.
3.	Posterior end of haptor at the posterior end of the worm; clamps of equal or unequal size; anchors present or absent	4.
	Posterior end of haptor lateral; a tendency to the suppression of growth on one lateral clamp-row present or not; anchors present (? or absent)	5.

4. An approximately equal number of clamps on either side of the haptor ; clamps of equal size.	
Anchors absent in adult	*Microcotyle* von Beneden & Hesse 1863.
Anchors persist in adult	*Gotocotyla* Ishii, 1936.
Unequal numbers of clamps on either side ; clamps in two parallel rows of equal length ; one row of large clamps and the other of very small clamps (anchors ? absent)	*Lintaxine* Sproston, 1946.
5. One side of haptor more or less suppressed, bearing few clamps, which may be of the normal size or smaller (anchors ? absent)	*Heteraxine* Yamaguti, 1938.
Both sides of haptor equally developed, but a complete suppression in growth of the median haptoral axis ; region of formation of clamps on either side of small anchors in the middle of the straight row of clamps	6.
6. Vaginal pore lateral ; anchors present	*Axine* Abildgaard, 1794.
Vaginal pore mid-dorsal ; anchors ? absent ..	*Axinoides* Yamaguti, 1938.

Some more genera may have to be added to it now to make it up to date, with all the valid genera included.

(ii) Subfamily *Protomicrocotylinae* Johnston & Tiegs, 1922.

This subfamily contains aberrant forms of interest from the phylogenetic point of view. As discussed elsewhere, on one hand it has close affinities with the family Discocotylidae through forms like *Vallisia* (subfamily, Vallisinae) whereas, on the other, it is typically more microcotylid fundamentally, however, at the same time, retaining some special characters of its own, which entitle it to this separate taxonomic independent rank and status.

Subfamily diagnosis: *Microcotylidae* Taschenberg, 1879; with Family characters.

Haptor distinctly set off from body, symmetrical, muscular, discoidal, transversely oval or dumb-bell shaped with 2-3 pairs of hooks. Clamps may be pedunculated, few in number, 4-6 placed asymmetrically on one side or symmetrically in two lateral rows, relatively large in size, at the posterior end of body proper. Testes follicular. Ovary elongate, tubular or lobed. Vagina single, to the left ; simple or aperture surrounded by a cuticularised area bearing numerous short spines. Cirrus and genital pore armed or unarmed. Vitellaria follicular. Egg operculate, with filaments at one or both the poles.

Type genus—*Protomicrocotyle* Johnston & Tiegs, 1922.

The genera included under this subfamily can be differentiated as follows :—

Key to Genera of Subfamily PROTOMICROCOTYLINAE.

Haptor dumb-bell shaped with 2 pairs of hooks. Clamps 5 in number, in one row. Ovary looped ; vagina with its aperture surrounded by a cuticularised area bearing numerous short spines. Cirrus armed. Egg with single polar filament ..	*Protomicrocotyle* Johnston & Tiegs, 1922.

Haptor transversely oval, with 3 pairs of hooks. Clamps pedunculated 6, in two lateral symmetrical rows. Ovary tubular; vagina simple. Cirrus unarmed. Egg with polar filament at both ends — *Bilateracotyle* Chauhan, 1945.

Genus **Bilateracotyle** Chauhan, 1945.

The genus, which is monotypic, was created by Chauhan (1945) with *B. chirocentrosus* as the type species and assigned to the subfamily Protomicrocotylinae (Fam. Microcotylidae). He (Chauhan, 1945, p. 154) characterised the genus by the possession of three pairs of clamps in two rows, on the posterior end of body, an oval haptor; only 20-28 testes; an unarmed, long and tubular cirrus and numerous spines in the genital atrium. Sproston (1946, p. 508-9) transferred the genus to the subfamily Vallisinae (Fam. Discocotylidae). She stated "placed by its author in subfamily Protomicrocotylinae Johnst. & Tiegs, which he follows other authors in assigning to Microcotylidae—though, as pointed out above (p. 407) there seems little reason for this. The new genus resembles *Protomicrocotyle*. The asymmetrically placed haptor is muscular and bears two rows of three pairs of small anchors. Anterior to this, the body bears two rows of three small clamps, similar in type to those of other members of the subfamily. The vagina is unarmed distally, and the egg has two polar filaments" I have discussed its systematic position in detail, while dealing with the subfamily Vallisinae elsewhere in this paper.

Generic diagnosis (*emend.*) : *Protomicrocotylinae* Johnston & Tiegs, 1922 ; with Subfamily characters.

Body elongate, asymmetrical, with two elliptical buccal suckers. Intestine bifurcate ; the two lateral caeca, have lateral ramifying branches especially on their outer sides. Haptor distinctly set off from the body, transversely oval, muscular, with 3 pairs of dissimilar hooks but with no other organ running into it. Clamps pedunculated, three pairs, situated symmetrically, in 2 lateral rows, at the posterior end of body proper. Peduncles retractile. Clamp structure typically microcotylid in form. Testes follicular, 20-28, situated in the middle of body, preovarian, intercaecal. Vesicula seminalis very long, sinuous and with well developed prostate gland cells, tubular. Cirrus unarmed. Ovary elongate, median, situated in the anterior portion of posterior half of body, not lobed. Vagina on the left, simple, unarmed. Genito-intestinal canal present. Genital pore situated on the right, elliptical, large, armed with a coronet of long 24-38 cuticular spines. Vitellaria large, follicular. Uterine egg single, elliptical, operculate with a short coiled polar filament at both the poles.

Parasites of marine fishes.

Type species—*B. chirocentrosus* Chauhan, 1945.

18. **Bilateracotyle chirocentrosus** Chauhan, 1945.

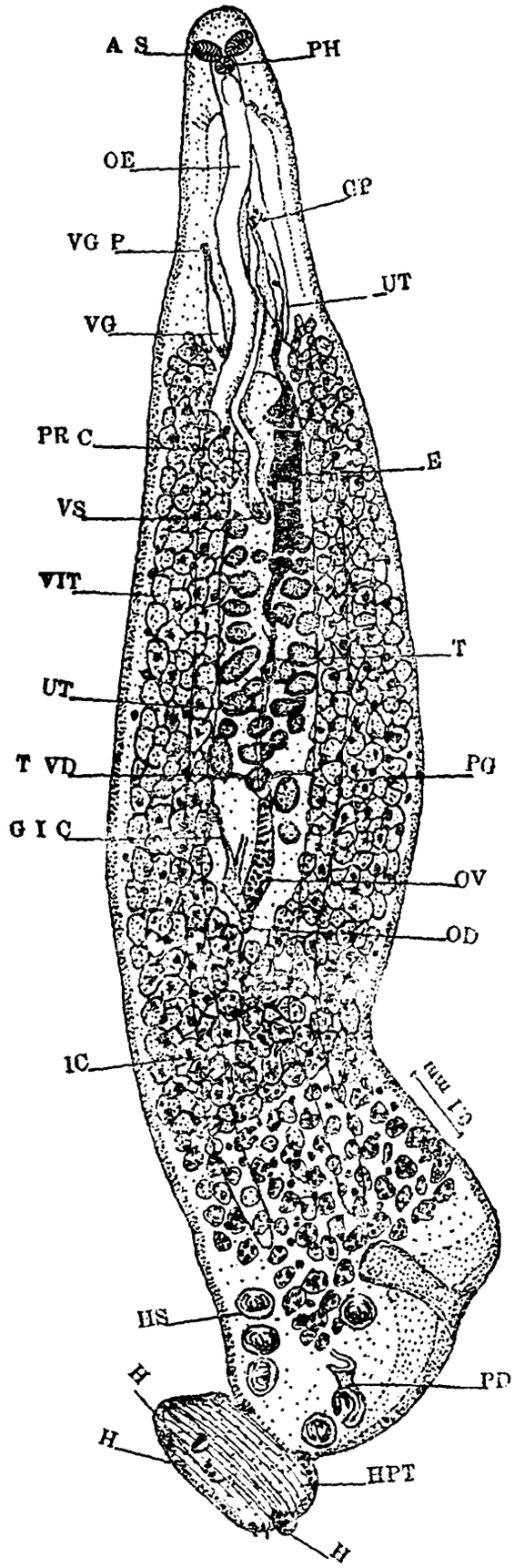
(Text-fig. 21, 22 *a, b, c, d.*)

Sproston, N. G. (1946), *Trans. zool. Soc. Lond. 25* (4) : 508-509.

Manter, H. W. and Donald F. Prince (1953) *Proc. hel. Soc. Washington* **20** (2) : 107.

Specfic diagnosis : *Bilateracotyle* Chauhan, 1945 ; with Generic characters.

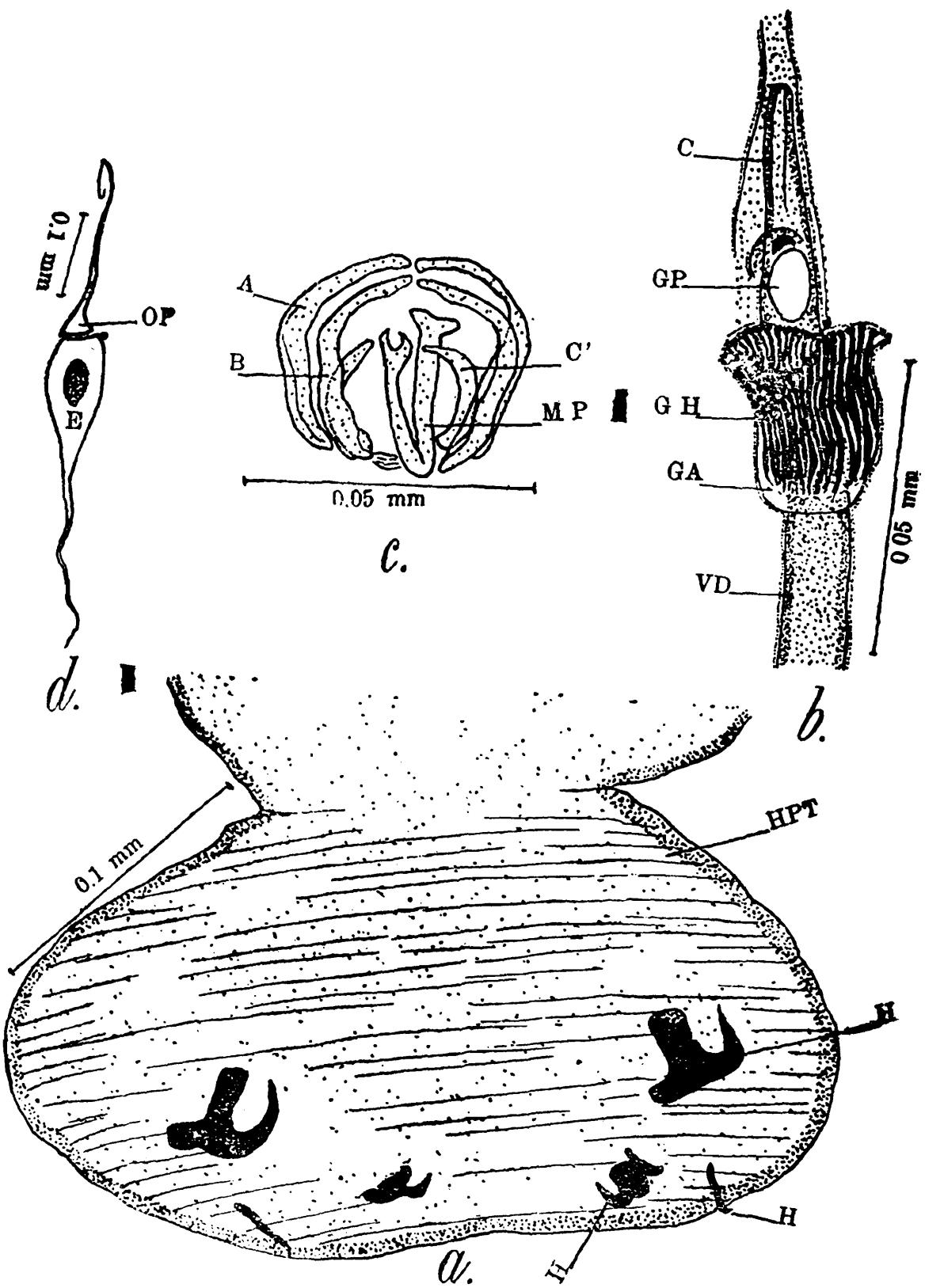
Body asymmetrical, elongate, tapering anteriorly, 2·05×0·41 (maximum). Haptor distinctly set off from body proper, discoidal, transversely oval, highly muscular, usually with three, dissimilar pairs of hooks.



TEXT-FIG. 21.—*Bilateracotyle chirocentrosus*, entire view, dorsal (after Chauhan).

AS, Anterior sucker; *GIC*, Genito-intestinal canal; *GP.*, Genital pore; *E*, Egg., H., Haptoral hooks; *HPT*, Haptor; *HS*, Haptoral sucker; *IC*, Intestinal caecum; *OD*, Oviduct; *OV.*, Ovary; *OE*, Oesophagus; *PD.*, Peduncle; *PH*, Pharynx; PRC, Prostate gland cells; *T*, Testes; *T. VD*, Transverse vitelline duct; *UT*, Uterus; *VG*, Vagina; *VG P*, Vaginal pore; *VIT*, Vitellaria; *VS* Vesicula seminalia.

Posterior end of body proper with three pairs of cuticular clamps, on retractile peduncles, in two symmetrical, lateral rows; structure of clamp sclerites typically microcotylid in nature. Anterior or buccal suckers elongately oval, with membranous septa. Pharynx bulb-shaped. Oesophagus very long, slightly sinuous. Intestine bifurcated



Text-fig. 22.—*Bilateracotyle chirocentrosus*; (*a*) Haptor, showing three pairs of haptoral hooks; (*b*) Genital atrium, showing genital spines; (*c*) Frame-works of cuticular pieces of haptoral sucker; (*d*) Egg. (after Chauhan).

A, Outermost; *B*, Middle; *C'*, Innermost and *MP*, Median pieces of the cuticular framework of the haptoral sucker; *C''*, Cirrus protruded out; *E*, Egg., *GA*, Genital atrium; *GH*, Genital hooks, *GP*, Genital pore; *H*, Haptoral hooks; *OP*. Operculum; *HPT*, Haptor; *VD*, Vas deferens.

with ramifying branches laterally, not united posteriorly, terminating just anterior to clamps. Testes follicular, 20-28, situated in middle third of body, intra-caecal, pre-ovarian. Vas deferens much coiled. Vesicula seminalis very long, sinuous tube, surrounded by well developed prostatic gland cells. Cirrus tubular, long, unarmed. Genital pore on right side, midway between pharynx and intestinal bifurcation. Genital atrium elliptical, large, armed by a coronet of long 24-38 cuticular spines. Ovary median, elongate, situated in anterior portion of posterior half of body. Genito-intestinal canal present. Vitellaria large, follicular, extending from the point of intestinal bifurcation to suckers. Uterus median. Vagina a simple tube, opening laterally on left side, slightly below the level of genital pore. Uterine egg single, spindle-shaped, operculate, with polar filaments, 0·23×0·04 (without filaments). (Type species.)

Host.—*Sciaena belengeri* (type) ; *Chirocentrosus dorab.*

Location.—Gills.

Locality.—Bombay ; Arabian sea, Indian Ocean.

(*e*) Family GASTROCOTYLIDAE Price, 1943.

The forms belonging to this family were formerly included under the closely allied family Microcotylidae Taschenberg, 1879. They also indicate certain resemblances with family Discocotylidae. Price (1943) separated them under a separate and independent family, Gastrocotylidae. He also gave a brief diagnosis. Chauhan (1945) and Dawes (1946) accept independent status of this taxonomic unit. However, Sproston (1946) regards it only as subfamily, Gastrocotylinae Sproston, 1946, of the family Microcotylidae.

Chauhan (1945, p. 155) while creating the genus *Pricea* observed that if criterion of Price for basing the classification of families on the structure and arrangement of the cuticular pieces of framework of haptoral clamps or suckers is followed strictly, probably a new family will have to be created to accommodate his three species of his genus. He further stated that there are a large number of other differences as well to warrant that. However, since this family was in a process of revision by Price himself, he contented himself then, by creating the new genus only, without then proposing a new family for his genus containing these three new species.

He, however, now proposes that the family Gastrocotylidae should be divided into two subfamilies. Subfamily, 1. Gastrocotylinae Sproston (1946) *emend.*, with *Gastrocotyle* (as Type genus) and the other genera included there being *Pseudaxine*, *Vallisiopsis* and Subfamily, 2. *Priceinae*, subfam. nov. with *Pricea* as type genus and other genera included under it being *Thoracocotyle* and *Lithidiocotyle.*

Family diagnosis : *Diclidophoroidea* Price, 1943 ; with characters of the Superfamily.

Haptor with numerous small clamps. Cotylophore may be a simple lateral flange like process, bearing a single row of small clamps ; may also be equipped with 2-3 pair of dissimilar terminal hooks at the tip of haptor and additional hooks on body or haptor (as in *Pricea*). The

clamps may be arranged along the margin of a very large and asymmetrical cotylophore, occupying the posterior two-third of body. Clamps structure stout, consisting of two pairs of lateral pieces, joined but not fused distally; those of the more dorsal lateral pair with curved, inwardly directed spurs; one pair of basal pieces, meeting the laterals; a single curved middle piece, simple or composite which may bifurcate ventrally and additional pair of submarginal, dorsal to main spring and additional pieces sometimes presenting U-shaped appearance and extending from the ventral lateral towards middle sclerite, in one of the valves. Additional sclerites in varying number, in the form of ventral, rib-like, thin, cuticular, transverse bars or plaques between the lateral pairs and middle piece, as in the subfamily Plectanocotylinae (Fam: Discocotylidae) may be present. Testes few, occupying posterior region. Ovary pre-testicular, elongate, folded. Vagina single, opening mid-dorsally. Eggs, each with two pointed filaments. Genital atrium may be armed with a corona of spines. Male pore may bear a simple regular corona of spines or the penis itself is protrusible and regularly armed.

Type genus—*Gastrocotyle* Beneden & Hesse, 1863.

Key to Subfamilies of Family Gastrocotylidae.

Haptor unilateral; rib-like thickenings in clamp-capsule absent; anchors present	*Gastrocotylinae* Sproston, 1946, *emend.*
Haptor bilateral; rib-like thickenings in clamp-capsule present; anchors present or absent	*Priceinae, sub. fam. nov.*

(*i*) Subfamily *Gastrocotylinae* (Sproston, 1946), *emend.*

Subfamily diagnosis: *Gastrocotylidae* Price, 1943; with Family characters.

Haptor unilateral. Rib-like thickenings or plaques in clamp-capsule absent. Anchors present, structure of clamp sclerites as in the genus *Gastrocotyle.*

Type genus—*Gastrocotyle* van Beneden & Hesse, 1863.

Key to Genera of Subfamily Gastrocotylinae (Sproston, 1946), *emend.*

1.	Haptor a terminal frill not covering region of gonads; anchors lateral	*Pseudaxine* Parona & Perugia, 1890.
	Haptor extending forward beyond region of gonads; anchors terminal	2.
2.	Haptor a marginal frill of body; clamp structures numerous; gonads situated in the middle of haptoral portion of body; terminal hooks 2-3 pairs ..	*Gastrocotyle* van Beneden & Hesse, 1863.
	Haptor distinctly separated from body in proper; clamp structures, and gonads situated in region of union of body proper and haptor; 4 pairs; terminal hooks one pair	*Vallisiopsis* Subhapradha, 1951.

(1) Genus **Gastrocotyle** Beneden & Hesse, 1863.

Syn. *Gastrocotyla* Ishii & Sawada, 1938.

Generic diagnosis: *Gastrocotylinae* (Sproston, 1946), *emend.*; with Subfamily characters.

Anterior half of body narrow; posterior wide and with a haptor. Haptor a marginal frill of body, with a single row of numerous, small clamps extending along one side of body to about half way between the anterior end of ovary and vaginal pore. Clamp skeleton with characteristic U-shaped pair of sclerites on middle piece and ventral end of spring attached to ventral loop by bifurcate extensions on both sides of bifurcate end. Rib-like thickenings from the capsule wall absent. Two or three pairs of hooks on terminal lappet. Male pore armed with a regular corona of stout hooks on the genital bulb. Vagina unarmed; pore in the median dorsal line, some way posterior to male pore. Ovary with distal end directed backwards.

Type species—*Gastrocotyle trachuri* van. Ben. & Hesse, 1863.

19. **Gastrocotyle indica** Subhapradha, 1951.

(Text-fig. 23, *a, b, c, d, e, f, g, h, i.*)

Specific diagnosis : *Gastrocotyle* van. Beneden & Hosse, 1863; with Generic characters.

The species is characterised by the haptoral frill not extending beyond the gonads and stopping short of posterior end of ovary; an accessory sclerite being present in dorsal wall in connection with the spring; there being two pairs of hooks on a short languette; the ovary being in the form of an elongated loop.

Length 3·0×530μ width (maximum). Number of clamps varies according to age, maximum number recorded being 36. Two pairs of anchors, one behind the other, on a short languette. Shape of anchor as in *Pseudaxine*. Genital corona with 11-12 hooks, with bifid bases. Ovary in the form of loop, with distal end directed backwards, its greater part lying anterior to haptoral frill. Intestinal crura branched. The two intestinal crura unite together posterior to gonads.

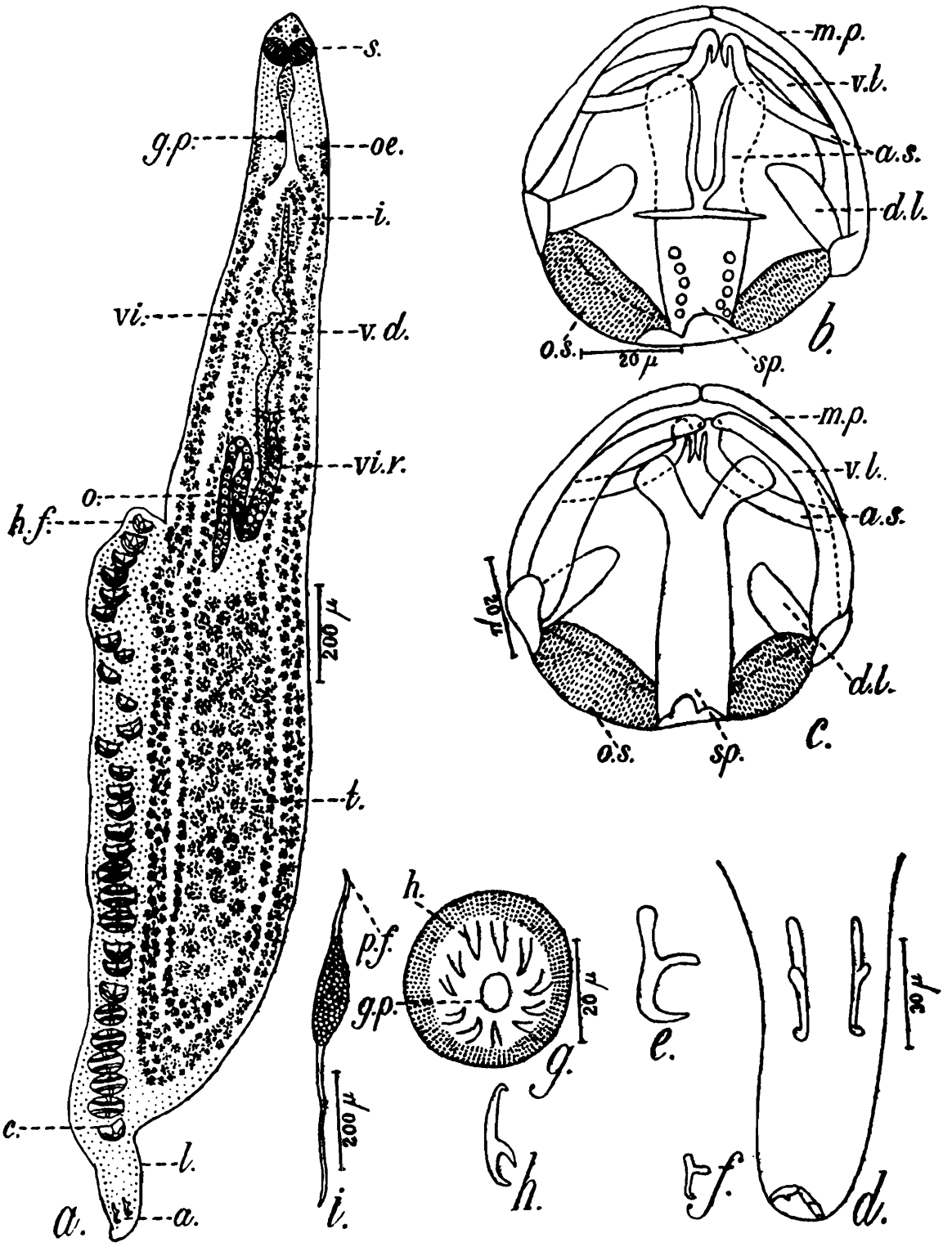
Subhapradha (1951) states that the species agrees with the generic diagnosis of *Gastrocotyle* given in Sproston's work (1946), except that, first, the haptoral frill does not extend forward beyond the gonads and stops short of the posterior end of the ovary, and secondly, the bifurcate ventral end of the spring is not further divided. She does not consider these differences as of generic importance and hence included the species in *Gastrocotyle*. She further records that the species differs from both the existing species in the presence of an additional sclerite in the dorsal wall of the capsule in connection with the spring. It differs from *G. trachuri* in having two pairs of anchors instead of three pairs and from *G. japonica* in the shape of the ovary. In *G. japonica* the ovary is oval, while it is in the form of a loop in *G. indica*.

Host.—Marine fish, *Caranx kalla* Cuv. and Val.
Location.—Gills.
Locality.—Madras.

(2) Genus **Vallisiopsis** Subhapradha, 1951.

The genus was created by Subhapradha (1951). She placed it under the subfamily Vallisinae of the family Discocotylidae. I have discussed under the subfamily Vallisinae, the reasons for its transfer under this family.

Generic diagnosis : *Gastrocotylinae* (Sproston, 1946), *emend.*; with Subfamily characters.



Text-fig. 23.—*Gastrocotyle indica* ; (*a*) Entire specimen, mounted ; (*b*) Clamp skeleton, dorsal view ; (*c*) Clamp skeleton, ventral view; (*d*) Languette, showing the arrangement of the anchors ; (*e*) Larger anchor, lateral view ; (*f*) Smaller anchor, lateral view ; (*g*) Genital corona, front view ; (*h*) Genital hook, lateral view ; (*i*) Egg (after Subhapradha).

a., Anchor ; *a. s.*, Accessory sclerite ; *c.*, Clamp ; *d.l.*, Dorsal loop ; *g.p.*, Genital pore ; *h.*, Hook ; *h. f.*, Haptoral frill ; *i.*, Intestine ; *l.*, Languette ; *m. p.*, Middle piece ; *o.*, Ovary ; *oe.*, Oesophagus ; *o. s.*, Optical section of anterior wall of the capsule ; *p. f.*, Polar filament ; *s.*, Sucker ; *sp.*, Spring ; *t.*, Testis ; *v. d.*, Vas deferens ; *vi.*, Vitellaria ; *vi. r.*, Vitelline reservoir ; *v. l.*, Ventral loop.

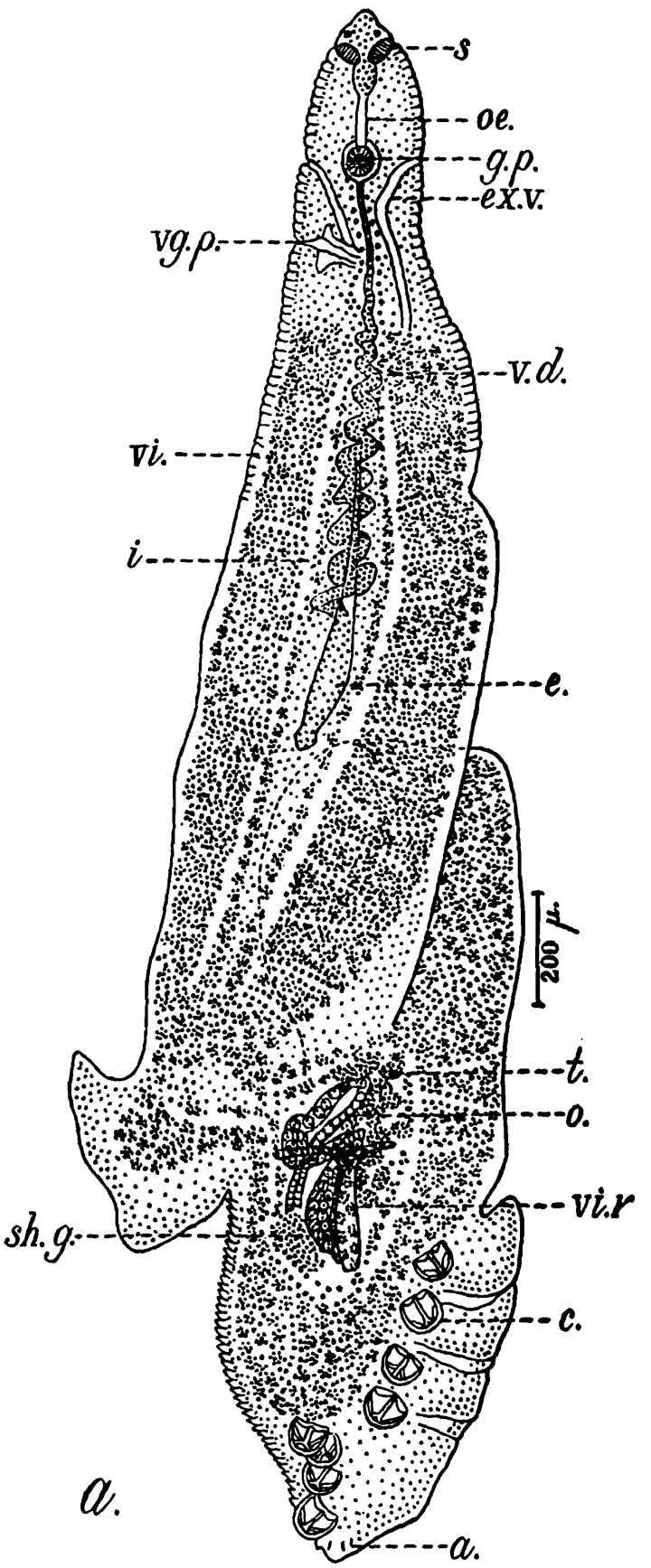
Both the body and the haptor asymmetrical ; gonads lying in the posterior half of the body ; testes follicular, overlapping the anterior part of the ovary and also extending anterior to it ; genital pore armed with hooks ; cirrus armed ; oesophagus long, extending below the genital pore ; haptor with four clamps on either side and one pair of anchors ; clamp skeleton resembles Discocotylids ; with one pair of accessory sclerites ; eggs spindle-shaped, with polar filaments.

Parasites of marine fishes.

Type species—*Vallisiopsis contorta* Subhapradha, 1951.

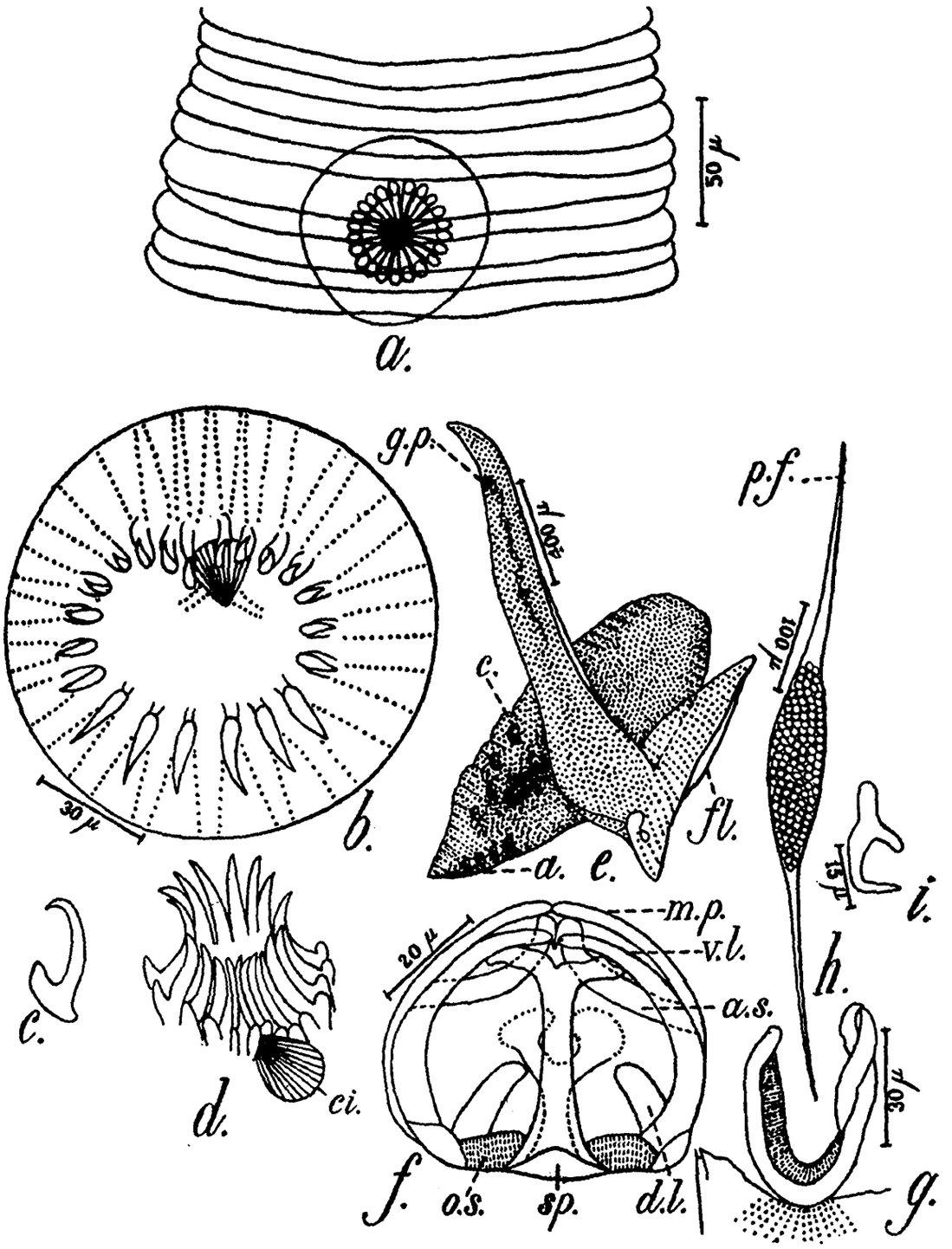
20. **Vallisiopsis contorta** Subhapradha, 1951.

(Text-figs. 24; 25, *a*, *b*, *c*, *d*, *e*, *f*, *g*, *h*, *i*.)



TEXT-FIG. 24.—*Vallisiopsis contorta*; entire specimen, mounted (after Subhapradha). *a.*, Anchor; *c.*, Clamp; *e.*, Egg; *ex. v.*, Excretory vessel; *g. p.*, Genital pore; *i.*, Intestine; *o.*, Ovary; *oe.*, Oesophagus; *s.*, Sucker; *Sh. g.*, Shell gland; *t.*, Testis; *v. d.*, Vas deferens; *vg. p.*, Vaginal pore; *vi.*, Vitellaria; *vi. r.*, Vitelline reservoir.

The species is characterised in having genital corona with 20-21 hooks; vaginal pore being lateral, below the level of common genital pore and ovary in the form of a double loop.



Text-fig. 25.—*Vallisiopsis contorta*; (*a*) Part of an entire specimen magnified, to show the ringed appearance of the surface of the body; (*b*) Genital corona with cirrus, front view; (*c*) Genital hook, lateral view; (*d*) Genital corona, with cirrus, lateral view; (*e*) Entire specimen, drawn from life, showing the natural disposition of the various parts of the body; (*f*) Clamp skeleton, ventral view; (*g*) Lateral view of clamp, partly open; (*h*) egg; (*i*) Anchor, lateral view (after Subhapradha).

a., Anchor; *c.*, Clamp; *c. i.*, Cirrus; *d. l.*, Dorsal loop; *fl.*, Flap; *g. p.*, Genital pore; *m. p.*, Middle piece; *o. s.*, Optical section of anterior wall of the capsule; *p. f.*, Polar filament, *sp.*, Spring., *v. l.*, Ventral loop.

Specific diagnosis : *Vallisiopsis* Subhapradha, 1951; with Generic characters.

Body asymmetrical, bent upon itself and also twisted. In normal condition anterior part lies at right angle to the posterior ; dorso-ventral axis of anterior part is twisted through about 90° ; just at the region where body is flexed there is a flap-like outgrowth. Entire surface of body transversely ringed, presenting laterally serrated appearance. Maximum length 3·5. Haptor asymmetrical, with a pair of hooks terminally and 4 pairs of clamps on each side, placed asymmetrically. Clamp skeleton is recorded typically Discocotylid in pattern and bearing a pair of accessory sclerites in connection with the middle piece, very similar to U-shaped pair of sclerites present in Gastrocotylinae. Two rami of middle piece, joined or quite distinct. Oesophagus long. Intestinal crura branched, the two arms uniting together, posterior to gonads. Testes follicular, ovarlapping anterior half of ovary and extending beyond it. Ovary in the form of double loop ; extending posterior to testes. Vitellaria follicular, co-extensive with intestinal rami. Eggs spindle-shaped, with polar filaments, length 750μ, with filaments ; 200μ, without filament ; width 50μ.

Host.—Marine fish, *Lactarius lactarius* (Bl. Schn.)

Location.—Gills.

Locality.—Madras, India.

(3) Genus **Pseudaxine** Parona & Perugia, 1890.

Generic diagnosis : *Gastrocotylinae* (Sproston, 1946), *emend.* ; with Generic characters.

Haptor unilateral, placed at the posterior end of body, at right angle to body, transversely elongate, not covering region of gonads, clamps in a single row, on the cotylophore. Structure of clamp sclerites, typical of the family and as in *Gastrocotyle*, without rib-like thickening. Terminal lappet, stout at the posterior end of cotylophore, with a large and a small pair of hooks, with bifid roots. Ovary elongate. Genital atrium armed. Genital corona simple. Vagina single, opening in a mid dorsal pore or paired and opening in lateral pores near pharynx. Egg uterine, single, with polar filaments.

Type species—*Pseudaxine trachuri* Parona and Perugia, 1890.

21. **Pseudaxine indicana** Chauhan, 1945.

(Text-figs. 26 ; 27, *a, b, c, d, e, f, g, h, i.*)

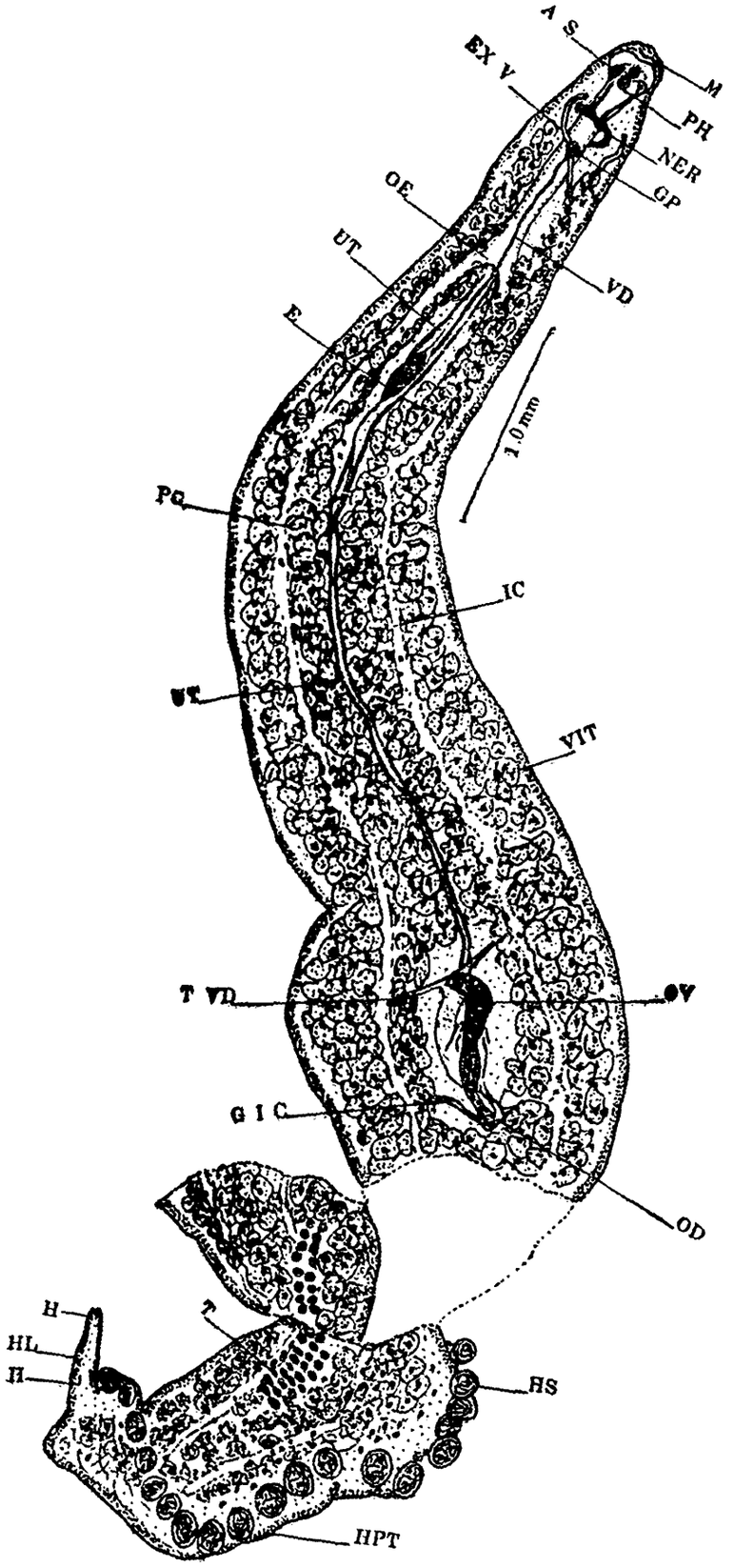
Sproston, N. G. (1946). *Trans. Zool. Soc. Lond.* **25** (4) : 465.

Manter, H. W. and Donald F. Prince (1953). *Proc. Hel. Soc. Washington*, **20** (2) : 108.

Specific diagnosis : *Pseudaxine* Parona & Perugia, 1890 ; with Generic characters.

Body elongate, tapering anteriorly, broad posteriorly, 9·16×1·6 (maximum). Haptor or cotylophore fan-shaped, separated from body by a notch, carrying 19 suckers or clamps, in a single row, on its lower margin. Cuticular structure of clamp sclerites typical. Extreme end of cotylophore carries an elongated, proboscis-like process (hence the specific name *indicana*) bearing 2 pairs of hooks, one in the middle and the other at the tip. Mouth terminal, with two egg-shaped anterior buccal suckers. Pharynx oval. Oesophagus present. Intestinal crura, with lateral, ramifying diverteculae specially on the outer side. Crura

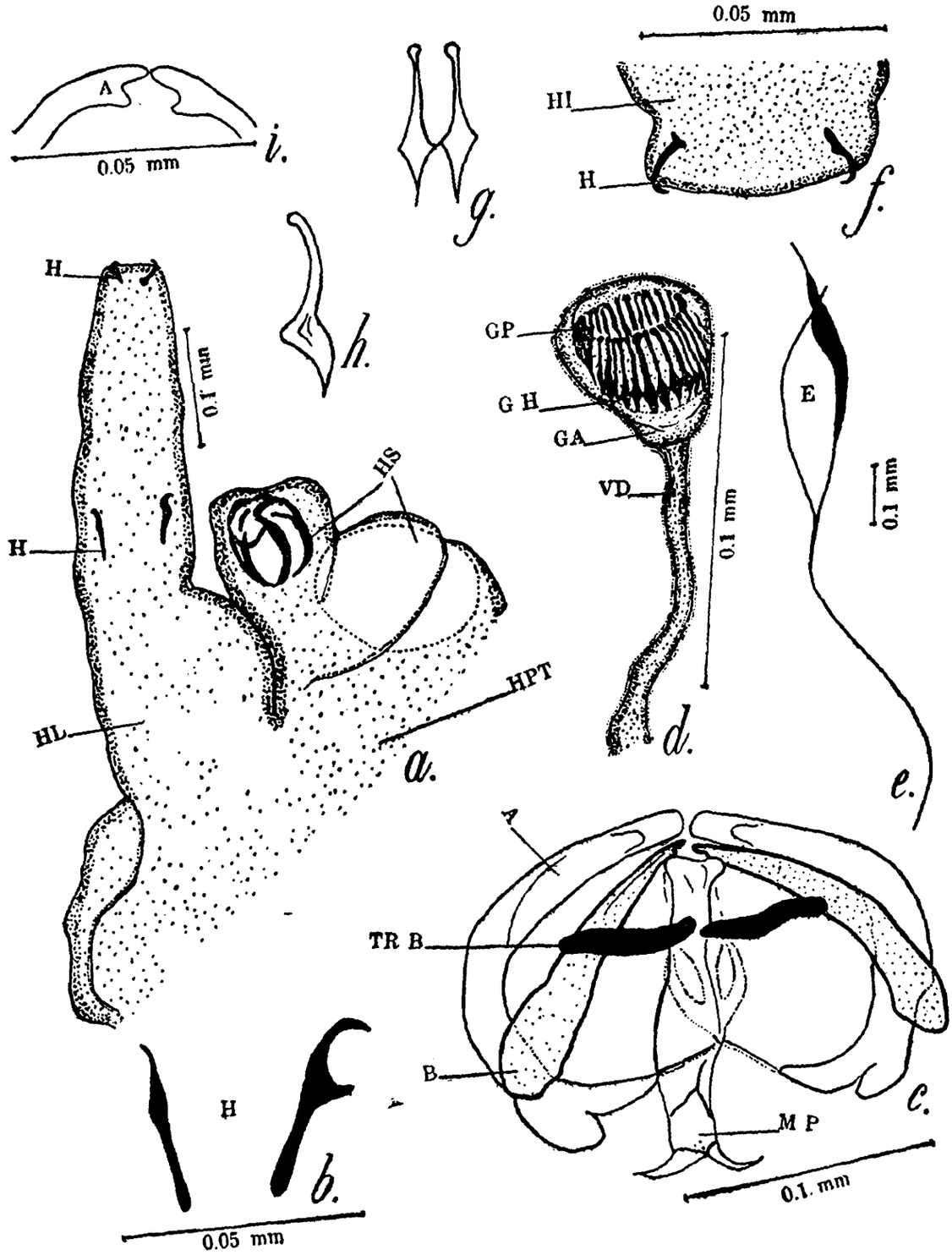
separate posteriorly. Testes small, follicular, about 40, lying irregularly inter-caecal, in two rows, anteriorly and three, posteriorly, post-ovarian;



Text-fig. 26.—*Pseudaxine indicana*; entire view (after Chauhan).

AS., Anterior sucker; *E.*, Egg; *Ex. V.*, Excretory vessel; *GIC.*, Genito-intestinal canal; *GP.*, Genital opening; *H.*, Haptoral hooks; *HL.*, Haptoral languette; *HPT.*, Haptor; *HS.*, Haptoral sucker; *IC.*, Intestinal crura; *M.*, Mouth; *NER.*, Part of nervous system; *OD.*, Oviduct; *OE.*, Oesophagus; *OV.*, Ovary; *PH.*, Pharynx; *T.*, Testis; *TVD.*, Transverse vitelline ducts; *UT.*, Uterus; *VD.*, Vas deferens; *VIT.*, Vitellaria.

a few extending into haptor. Genital pore lying on oesophagus, halfway between pharynx and intestinal bifurcation, armed with a coronet of 24 hooks. Ovary elongate, cylindrical, medial, in posterior half of body. Genito-intestinal canal present. Vitellaria on both sides of body, from the level of genital pore, to end of cotylophore. Uterine egg, single, with polar filaments, 0·3×0·08 (without filament).



TEXT-FIG. 27.—*Pseudaxine indicana* ; (*a*) Haptoral languette ; (*b*) Second pair of haptoral hooks, situated in the middle length of the languette ; (*c*) Framework supporting the haptoral sucker ; (*d*) Genital atrium, showing the genital hooks and genital pore ; (*e*) Egg ; (*f*) Terminal portion of languette, showing the first pair of haptoral hooks ; (*g*) Genital hooks, enlarged ; (*h*) Genital hook, lateral view ; (*i*) Outermost piece, lateral view (after Chauhan).

A, Outermost ; *B*, Middle piece of Clamp ; *E*, Egg.; *GA*, Genital atrium ; *GH* ; Genital hooks ; *GP*, Genital pore ; *H*, Haptoral hooks ; *HL*, Haptoral languette ; *HS*, Haptoral sucker ; *HPT*, Haptor ; *MP*, Median piece of the cuticular framework of the haptoral sucker ; *TRB*, Transverse bar ; *VD*, Vas deferens.

The species differs from other species of the genus in the general shape of body, in the number of testes and suckers, in the number and shape of hooks in the genital atrium, in the position of ovary and particularly in the structure of frame work of haptoral suckers or clamps.

Host.—Marine fish, *Chrysophrys berda.*

Location.—Gills.

Locality.—Bombay ; Arabian Sea, Indian Ocean.

(ii) Subfamily *Priceinae*, subfam. nov.

Subfamily diagnosis : *Gastrocotylidae* Price, 1943 ; with Family characters.

Haptor bilateral. Rib-like thickenings or plaques in clamp-capsule present. Anchors present. Structure of clamp-sclerites as in the genus *Pricea* ; much different from what in the genus *Gastrocotyle* ; specially middle piece, the shape of additional cuticular transverse bars, etc.

Type genus—*Pricea* Chauhan, 1945.

Key to Genera of Subfamily Priceinae, **subfam. nov.**

1. Haptor a bilateral marginal frill, extending forward beyond the region of gonads ; anchors present ..	*Thoracocotyle*	MacCallum, 1913.
Haptor bilateral, separate from body proper ; placed posterior to the region of gonads ..	2.	
2. Haptor a bilateral frill on a posterior extension of body with the two intestinal caeca extending into it ; clamp structures a single row ; terminal anchors on cotylophore not persisting in adult ; vagina smooth ; cirrus long, with many spines	*Lithidiocotyle*	Sproston, 1946.
Haptor a well developed organ, separate from body proper, attached to it at its posterior end ; the two intestinal caeca not extending into it ; clamp structures in double row with retractile peduncle. Vagina with a U-shaped cuticular skeleton. Cirrus has only 10-15 spines. Prehaptoral (Body hooks) present ; terminal end of cotylophore with a pair of hooks	*Pricea* Chauhan, 1945.	

Genus **Pricea** Chauhan, 1945.

Sproston, N. G. (1946). *Proc. Zool. Soc. Lond.* **25** (4) : 469.

Ramalingam, K. (1952). *Rec. Ind. Mus.* **49** (32 and 4) : 337—348.

Ramalingam, K. (1953). *Zool. Soc. India.* **5** (1) : 59—63.

Generic diagnosis : *Priceinae*, subfam. nov. ; with Family characters.

Body elongate, with two elliptical, oral suckers ; intestinal crura discontinuous, with ramifying lateral branches into the vitellaria, specially on the outer sides, terminating before the beginning of the haptor ; a pair of hooks present, at one end of the haptor and one pair above it in the posterior portion of the body proper. Testes post-ovarian 25-38, follicular, not extending beyond the ends of the intestinal crura. Vitellaria follicular, extending from the level of genital pore anteriorly, to the termination of the intestinal caeca, posteriorly. Vaginal opening situated

at the point of bifurcation of oesophagus into intestinal limbs, having a pouch and a U-shaped cuticular hook. Genital pouch situated on the oesophagus, halfway between the pharynx and oesophageal end. It has twelve paired cirrus hooks. Ovary situated in the mid-region. Haptoral suckers with a characteristic structure, situated on both sides of the haptor, in double row, the number varying from 70-122. They may be pedunculated, retractile. Excretory pores two, lateral, situated in the region, slightly below the brain. Parasites of marine fishes.

Type species—*Pricea multae* Chauhan, 1945.

The genus was created with *P. minimae* Chauhan, 1945 and *P. microcotylae* Chauhan, 1945, as the other species besides the Type.

Ramalingam (1952) added another six species from marine fish *Cybium guttatum* from Madras.

He gave a key to the species of the genus, as follows :

Key to Species of Genus PRICEA Chauhan, 1945.

1.	Body hooks present	2.
	Body hooks absent	5.
2.	Number of hooks two	3.
	Number of hooks one	4.
3.	Number of testes 26, genital hooks 12	*P. multae* Chauhan, 1945
	Number of testes 28, genital hooks 10 . ..	*P. minimae* Chauhan, 1945
	Number of testes 25, genital hooks 12	*P. microcotylae* Chauhan, 1945.
	Number of testes 31, genital hooks 14	*P. armatum* Ramalingam, 1952.
4.	One hook in the body only	*P. melane* Ramalingam, 1952.
	One hook in the body and other hook in the haptor ..	*P. tricanthum* Ramalingam, 1952.
5.	Additional hooks present in the haptor	6.
	Additional hooks absent in the haptor ..	*P. robustum* Ramalingam, 1952.
6.	Two additional hooks in the haptor ..	*P. tetracanthum* Ramalingam, 1952.
	One additional hook in the haptor only	*P. minutum* Ramalingam, 1952.

Ramalingam also gave a comparative table showing the characters of the various species of the genus. I am appending it to this paper.

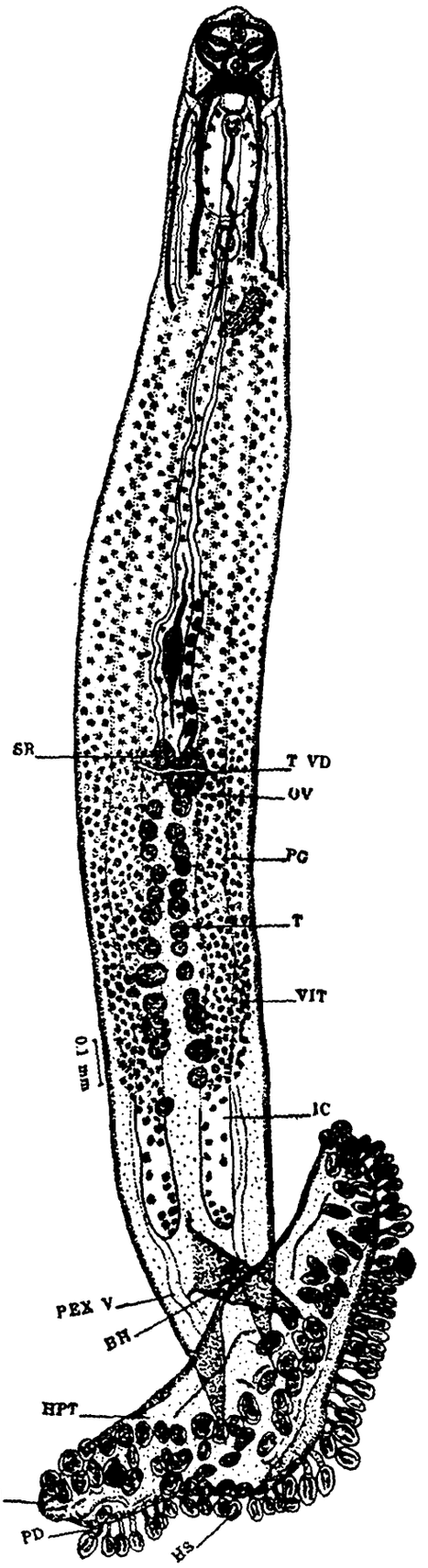
In view of these key and chart, I am not giving below, in this paper, the specific diagnosis of other than the type species.

22. **Pricea multae** Chauhan, 1945.

(Test-figs. 28 ; 29 ; 30 ; *a, b, c, d, e, f.*)

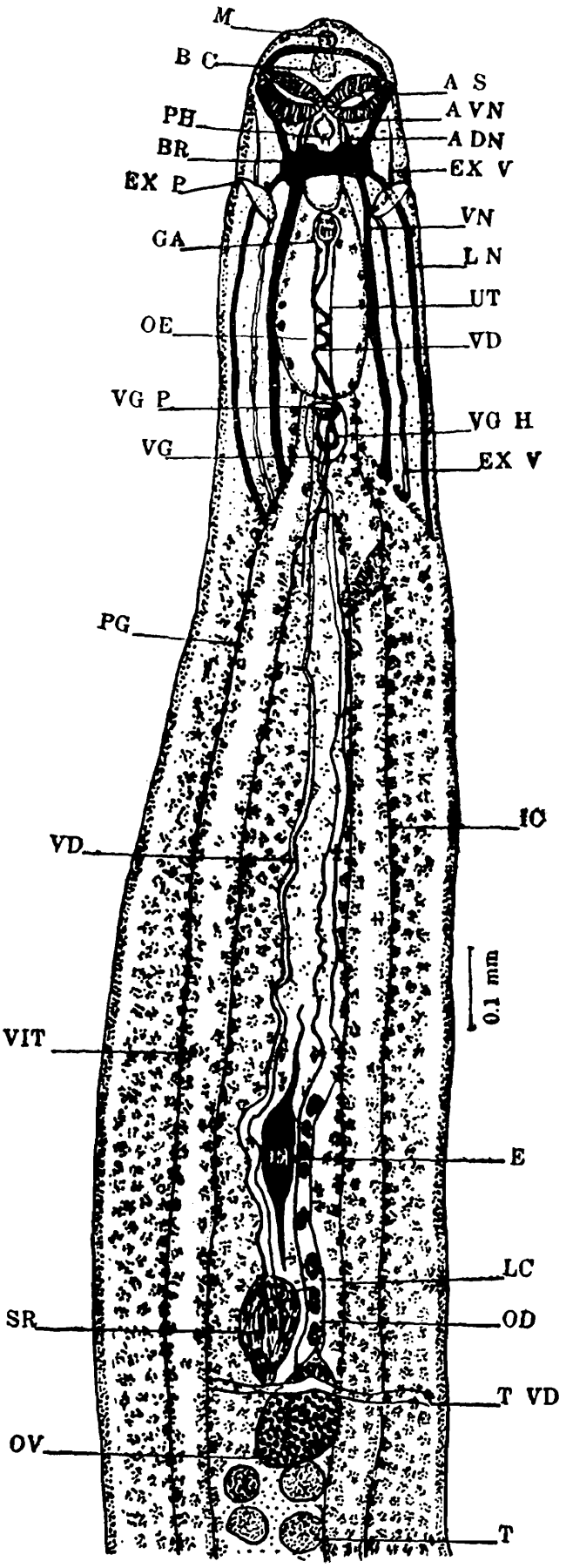
Specific diagnosis : *Pricea* Chauhan, 1945 ; with Generic characters.

Body elongate, cylindrical, slightly tapering anteriorly, 3·22×0·4. Haptor distinctly set off from body, at right angles to it, folded upon



Text-fig. 28.—*Pricea multae*; entire specimen (after Chauhan).

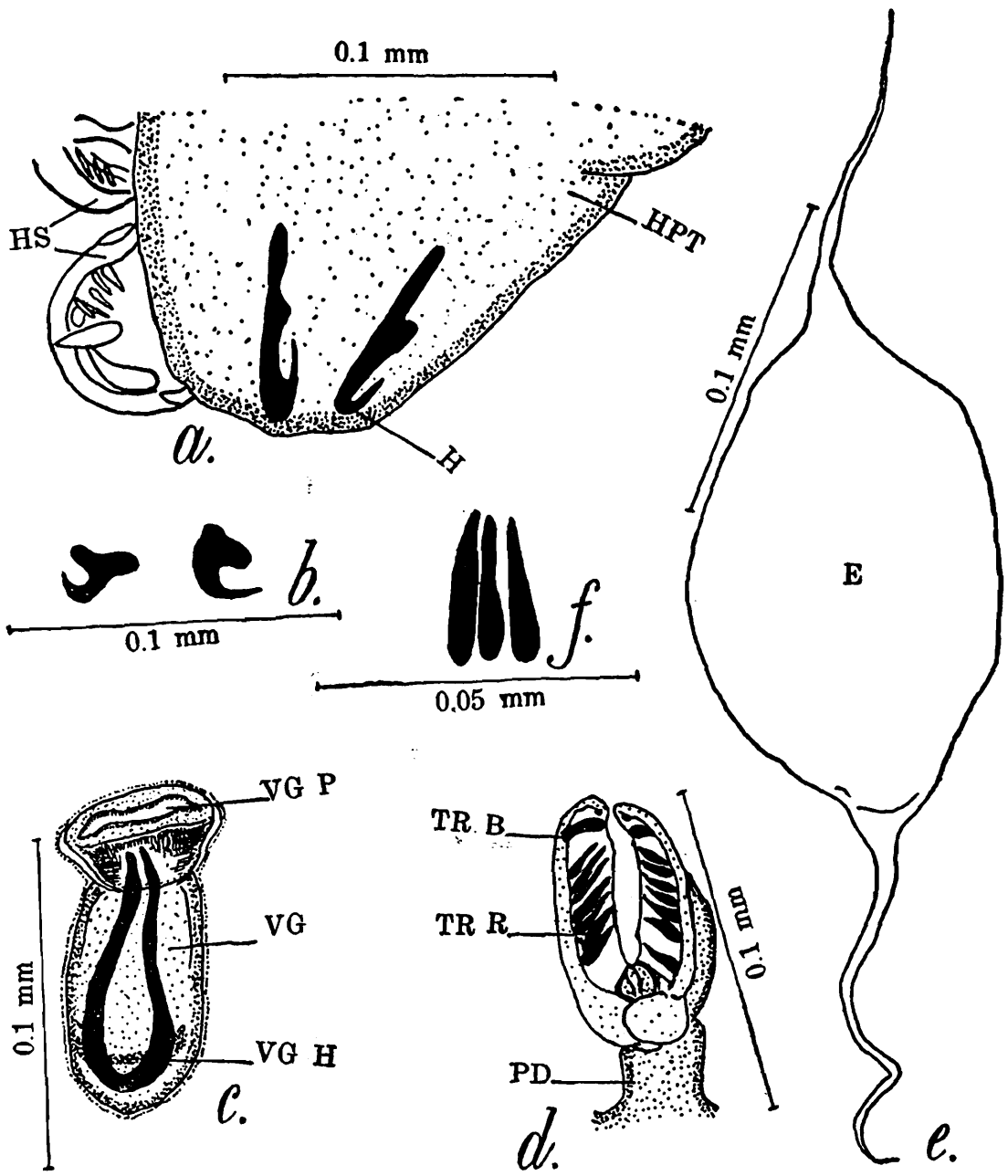
BH, Pre-haptoral hook; *H*, Haptoral hook; *HS*, Haptoral sucker; *HPT*, Haptor; *IC*, Intestinal crura; *OV*, Ovary; *PD*, Peduncle; *PEX V*, Posterior excretory vessel; *SR*, Receptaculum seminis; *T*, Testis; *TVD*, Transverse vitelline yolk ducts; *VIT*, Vitellaria.



TEXT-FIG. 29.—*Pricea multae* ; only anterior half of the parasite (after Chauhan).

AS., Anterior sucker ; *A DN.*, Anterior dorsal nerve ; *A VN.*, Anterior ventral nerve ; *B. C.*, Buccal cavity ; *BR.*, Brain ; *E.*, Egg., *EX P.*, Excretory pore ; *EX V.*, Excretory vessel ; *GA.*, Genital atrium ; *IC.*, Intestinal crura ; *LC.*, Laurer's canal ; *LN.*, Lateral nerve ; *M.*, Mouth ; *OD.*, Oviduct ; *OE.*, Oesophagus ; *OV.*, Ovary ; *PH.*, Pharynx ; *SR.*, Receptaculum seminis ; *T.*, Testis ; *TVD.*, Transverse vitelline duct ; *UT.*, Uterus ; *VD.*, Vas deferens ; *VGH.*, Vaginal hook ; *VG.*, Vagina ; *VG. P.*, Vaginal pouch ; *VIT.*, Vitellaria ; *VN.*, Ventral nerve.

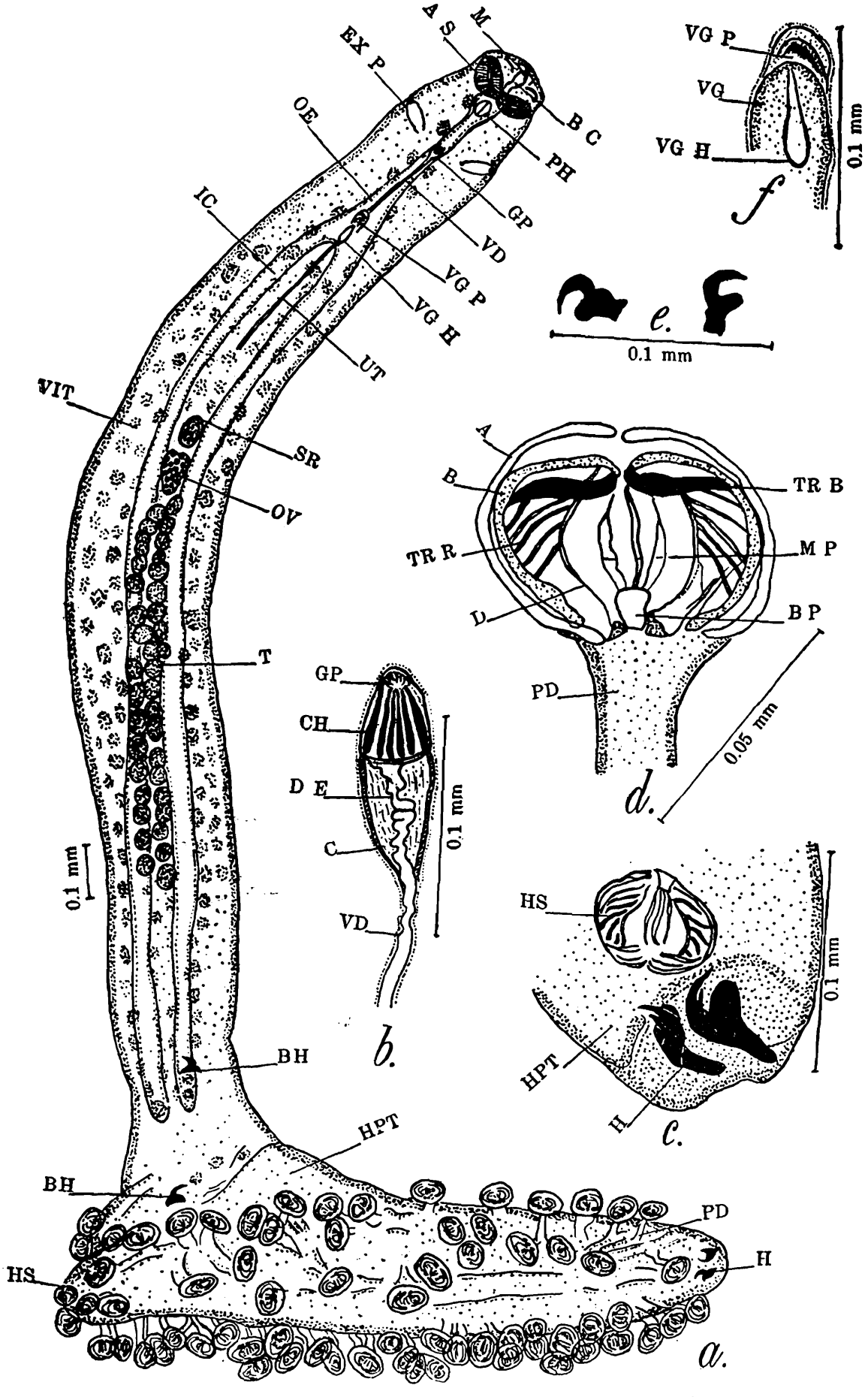
itself, comparatively very broad, transversely oval, carrying a pair of recurved hooks with bifid roots at one end and 122 suckers on retractile peduncles, arranged in two rows, at its margin on both sides. Framework of clamp sclerites very peculiar with additional rib-like thickenings, additional transverse bar, not U-shaped and median piece, with three fork like arms, on a basal piece. An additional pair of hooks—prehaptoral or body hooks just above haptor present. Mouth subterminal. Pharynx very small, globular. Buccal cavity small.



Text-fig. 30.—*Pricea multae*; (*a*) Extreme lateral side of the haptor; (*b*) Body hooks; (*c*) Terminal portion of vagina, showing the vaginal hook and the vaginal opening; (*d*) Haptoral sucker, lateral view; (*e*) Egg; (*f*) Three cirrus hooks.

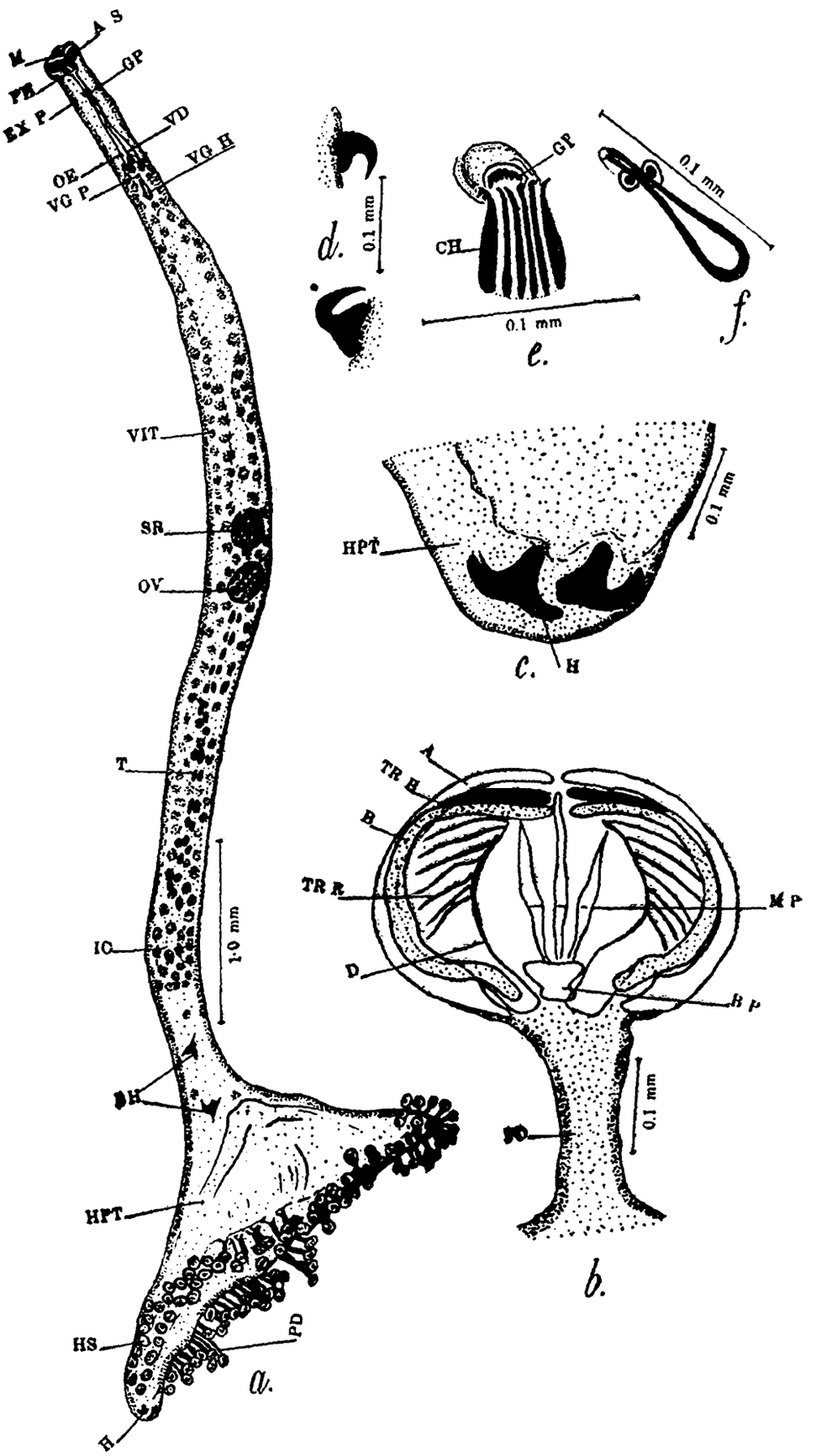
E., Egg.; *H.*, Haptoral hook; *HS.*, Haptoral sucker; *HPT.*, Haptor; *PD.*, Peduncle; *TR. R.*, Transverse rib of the framework of the haptoral sucker; *TR. B.*, Transverse bar; *VG.* Vagina; *VG H.*, Vagina hook; *VG. P.*, Vaginal pouch.

Anterior sucker, bilocular; with two egg-shaped, highly muscular organs, with membranous septa. Oesophagus elongate, club-shaped, bifurcating into intestinal crura; terminating just a little before origin of haptor; with ramifying branches, laterally, more numerous on outer sides. Testes 26, post-ovarian, follicular, in two lateral rows, inter-caecal,



TEXT-FIG. 31.—*Pricea minimae* ; (*a*) Entire view ; (*b*) Cirrus showing the genital pore, arrangement and shape of cirrus hooks, and ductus ejaculatorius ; (*c*) Extreme lateral side of the haptor, showing haptoral hooks ; (*d*) Haptoral sucker, showing the arrangement of the cuticular pieces of the framework supporting it ; (*e*) Body hook ; (*f*) Terminal part of vagina, showing its opening and the vaginal hook (after Chauhan).

A., Outermost ; *AS.*, Anterior sucker ; *B.*, Middle ; *BC.*, Buccal cavity ; *BP.*, Basal piece, supporting the three pronged middle piece of the cuticular framework supporting the haptoral sucker ; *BH.*, Body hook ; *C.*, Cirrus ; *CH.*, Cirrus hook ; *D.*, Innermost thin and lamellar lateral piece of the framework of the haptoral sucker ; *DE.*, Ductus ejaculatorius ; *EX. P.*, Excretory pore ; *GP.*, Genital pore ; *H.*, Haptoral hook ; *HS.*, Haptoral sucker ; *HPT.*, Haptor; *IC.*, Intestinal canal ; *M.*, Mouth ; *MP.*, Median piece of the cuticular framework of the haptoral sucker ; *OE.*, Oesophagus ; *OV.*, Ovary; *PD.*, Peduncle ; *PH.*, Pharynx ; *SR.*, Receptaculum seminis ; *T.*, Testis ; *T. R. R.* Transverse rib of the framework of the haptoral sucker ; *TR. B.*, Transverse bar ; *UT.*, Uterus ; *VD.*, Vas deferens ; *VG.*, *H.*



TEXT-FIG. 32.—*Pricea microcotylae* ; (*a*) Entire view ; (*b*) Haptoral sucker ; showing the arrangement of the cuticular pieces of its framework ; (*c*) Extreme side of the haptor, showing the two haptoral hooks ; (*d*) Body hook ; (*e*) Cirrus hook, showing their arrangement in the cirrus ; (*f*) Vaginal hook (after Chauhan).

A., Outermost ; *AS*., Anterior sucker ; *B*., Middle ; *BP*., Basal piece, supporting the three-pronged middle piece of the cuticular framework supporting the haptoral sucker, *BH*., Body hook ; *CH*., Cirrus hook ; *D*., Innermost thin and lamellar lateral piece of the framework of the haptoral sucker ; *EX. P*., Excretory pore ; *GP*., Genital pore ; *H*., Haptoral hook ; *HPT*., Haptor, *HS*., Haptoral sucker ; *IC*., Intestinal canal ; *M*., Mouth ; *MP*., Median piece of the cuticular framework of the haptoral sucker ; *OE*., Oesophagus ; *OV*., Ovary ; *PD*., Peduncle ; *PH*., Pharynx ; *SR*., Receptaculum seminis ; *T*., Testis ; *TR. B*., Transverse bar ; *TR R*., Transverse rib of the framework of the haptoral sucker; *VD*., Vas deferens ; *VGH*., Vaginal hook ; *VIT*., Vitellaria ; *VGP*., Vaginal pouch.

of varying size. Genital atrium, unarmed, situated on oesophagus. Cirrus long, muscular, cylindrical, armed with 12 small club-shaped cuticular spines. Ovary spherical, in the middle of body. Genito-intestinal canal present. Receptaculum seminis big, oval. Uterus with a single, spindle shaped egg ; operculated, with polar filament at both ends. Vagina, with a U-shaped hook, situated just on the point of bifurcation of oesophagus. Vaginal opening with fleshy, muscular flaps, presenting appearance of rudimentary pseudo-genital sucker. Vitellaria follicular, extending from the level of genital pore upto the extent of testes. Excretory pore double, dorso-lateral, spindle-shaped, at the level of genital pore.

Host.—Cybrium lanceolatus.

Location.—Gill.

Locality.—Bombay ; Arabian Sea, Indian Ocean.

23. **Pricea minimae** Chauhan, 1945.

(Text-fig. 31, *a, b, c, d, e, f.*)

The species has been named so, as comparatively speaking, the number of clamps is few in this ; other differences are given in the table.

Host.—Thynnus pelamys.

Location.—Gills.

Locality.—Bombay, Arabian Sea, Indian Ocean.

24. **Pricea microcotylæ** Chauhan, 1945.

(Text-fig. 32, *a, b, c, d, e, f.*)

Chauhan (1945) states that all the above three forms included in this genus differ from each other in the shape and size of body and haptor ; number of suckers (clamp) ; extent of vitellaria ; number of testes and position and size of body (pre-haptoral) hooks.

Host.—Scomber microlepidotus.

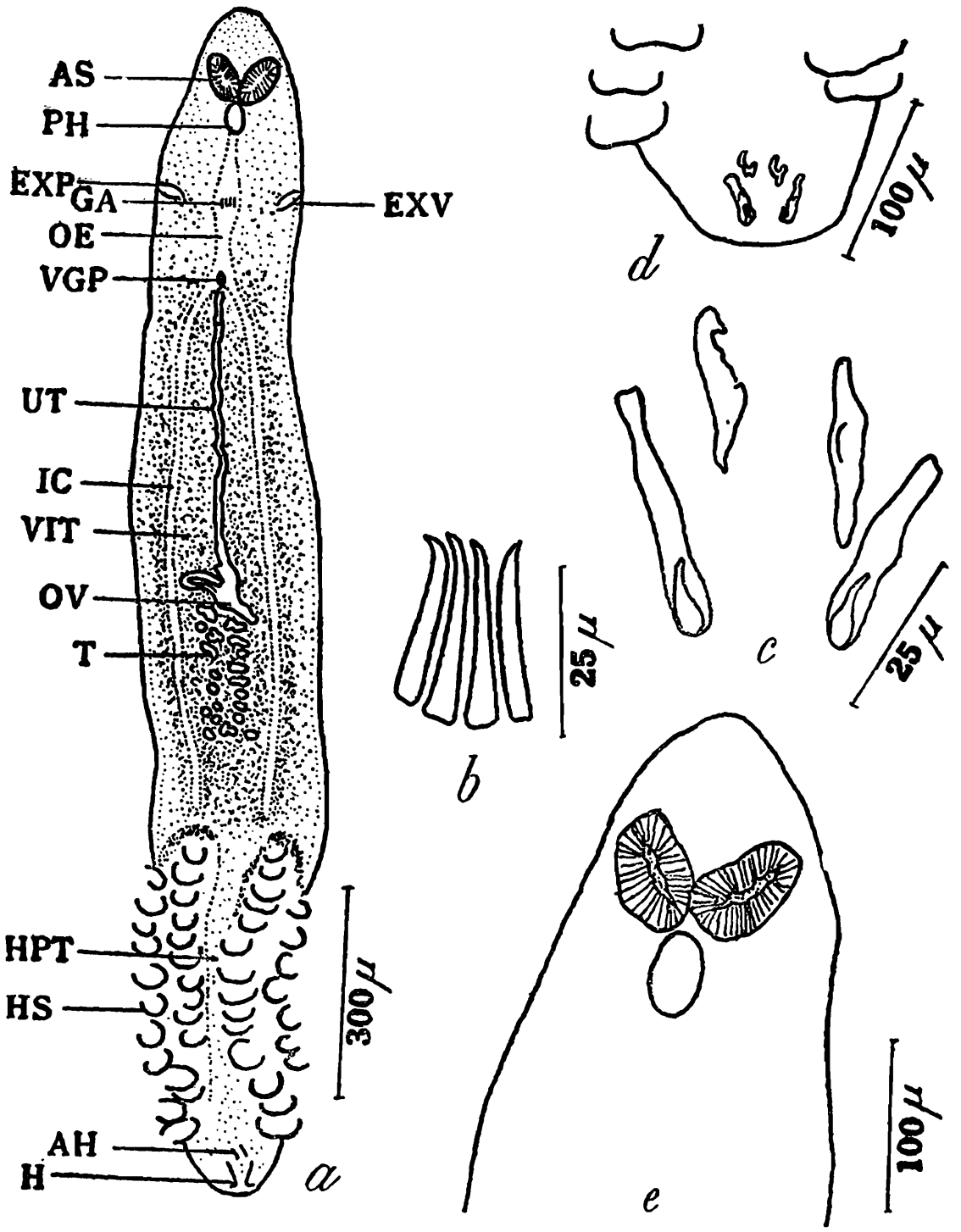
Location.—Gills.

Locality.—Bombay, Arabian Sea, Indian Ocean.

25. **Pricea tetracanthum** Ramalingam, 1952.

(Text-fig. 33, *a, b, c, d, e.*)

Ramalingam (1952) states that *P. tetracanthum* resembles the species, *P. multae*, *P. minimae* and *P. microcotylae* established by Chauhan, 1945, in the general shape of the body and the haptor and in the general structure of the clamps of the haptor. It agrees with *P. multae* and *P. microcotylae* in having 12 genital hooks. It is unique in having four hooks in the haptor, two as additional hooks and two as posterior hooks or anchors, but differs from the rest in the absence of the vaginal hook, in having 20 testes and haptoral suckers, 42 in number. The species is stated to be distinguished by the presence of four hooks in the haptor.



TEXT-FIG. 33.—*Pricea tetracanthum*; (*a*) Entire specimen ; (*b*) Genital hooks; (*c*) One pair of posterior hooks and a pair of additional hooks; (*d*) Position of hooks in situ; (*e*) Anterior portion of the body, showing esoplate and speculate suckers and pharynx (after Ramalingam).

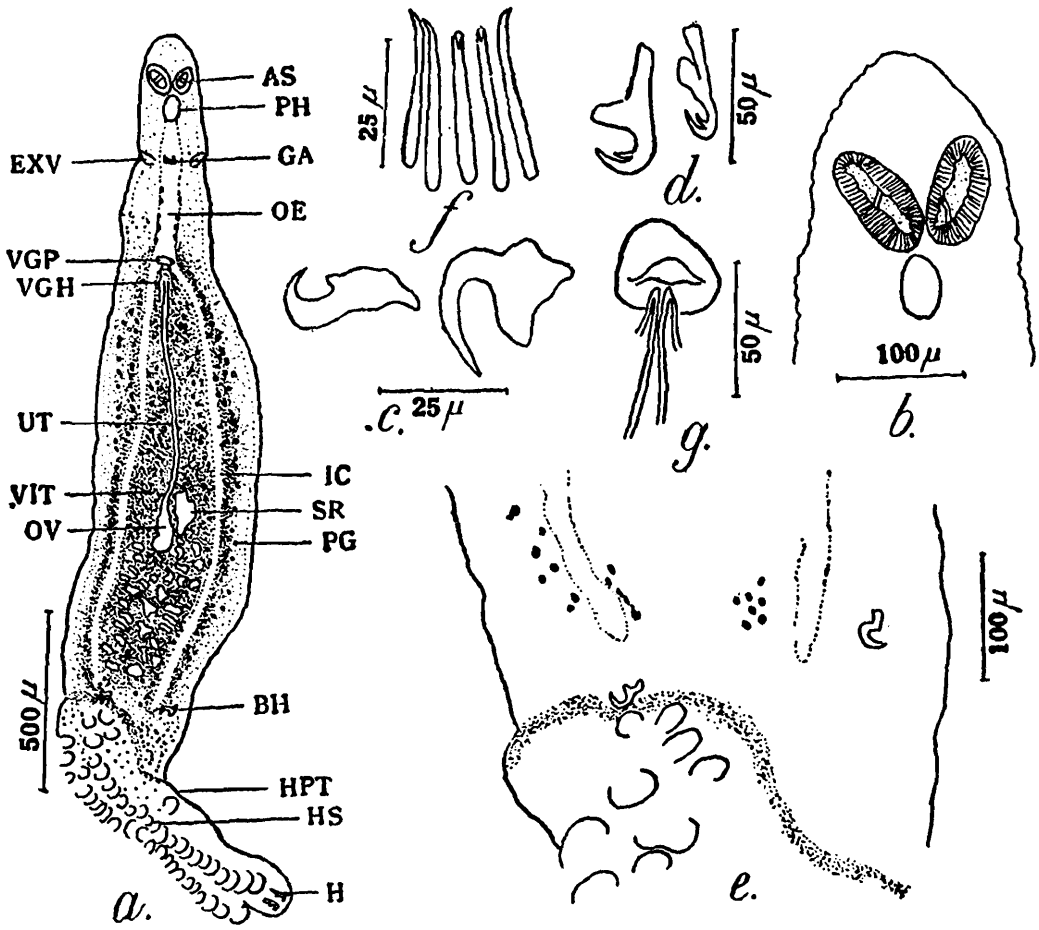
AH., additional hook ; *AS.*, Anterior sucker ; *EXP.*, Excretory pore; *EXV.*, Excretory vesicle ; *GA.*, Genital atrium ; *H.*, Posterior hook or anchor ; *HPT.*, Haptor ; *HS.*, Haptoral sucker ; *IC.*, Intestinal crura ; *OE.*, Oesophagus ; *OV.*, Ovary ; *PH.*, Pharynx ; *T.*, Testis ; *UT.*, Uterus ; *VGP.*, Vaginal pore ; *VIT.*, Vitellaria.

26. **Pricea armatum** Ramalingam, 1952.

(Text-fig. 34, *a*, *b*, *c*, *d*, *e*, *f*, *g*.)

The species is recorded to agree with the other forms in the general shape of the body, the haptor, and in the general pattern o the clamp structure. It agrees with Chauhan's species in having armed vaginal pore and two body-hooks. But it differs from *P. tetracan'hum* in having vaginal hook and in the absence of the additional hooks and differs from

all the species in having 31 testes, 50 clamps in the haptor and in the position of the body hooks, one just below left intestinal diverticula and the other on the right side of the right diverticula.



TEXT-FIG. 34.—*Pricea armatum* ; (*a*) Entire specimen ; (*b*) Anterior part of the body showing the septate and speculate anterior suckers and pharynx ; (*c*) Body hooks or prehaptoral hooks ; (*d*) Posterior hooks ; (*e*) Position of the body hooks, in situ ; (*f*) Genital hooks ; (*g*) Pseudogenital sucker and the vaginal hook. (after Ramalingam).

AS., Anterior sucker ; *BH.*, Body hook ; *EXV.*, Excretory vesicle ; *GA.*, Genital atrium ; *H.*, Posterior hook or anchor ; *HPT.*, Haptor ; *HS.*, Haptoral sucker ; *IC*, Intestinal crura ; *OE.*, Oesophagus ; *OV.*, Ovary ; *PH.*, Pharynx ; *PG.*, Pigment granules ; *SR.*, Receptaculum seminis ; *UT.*, Uterus ; *VGP.*, Vaginal pore ; *VGH.*, Vaginal hook ; *VIT.*, Vitellaria.

27. **Pricea tricanthum** Ramalingam, 1952.

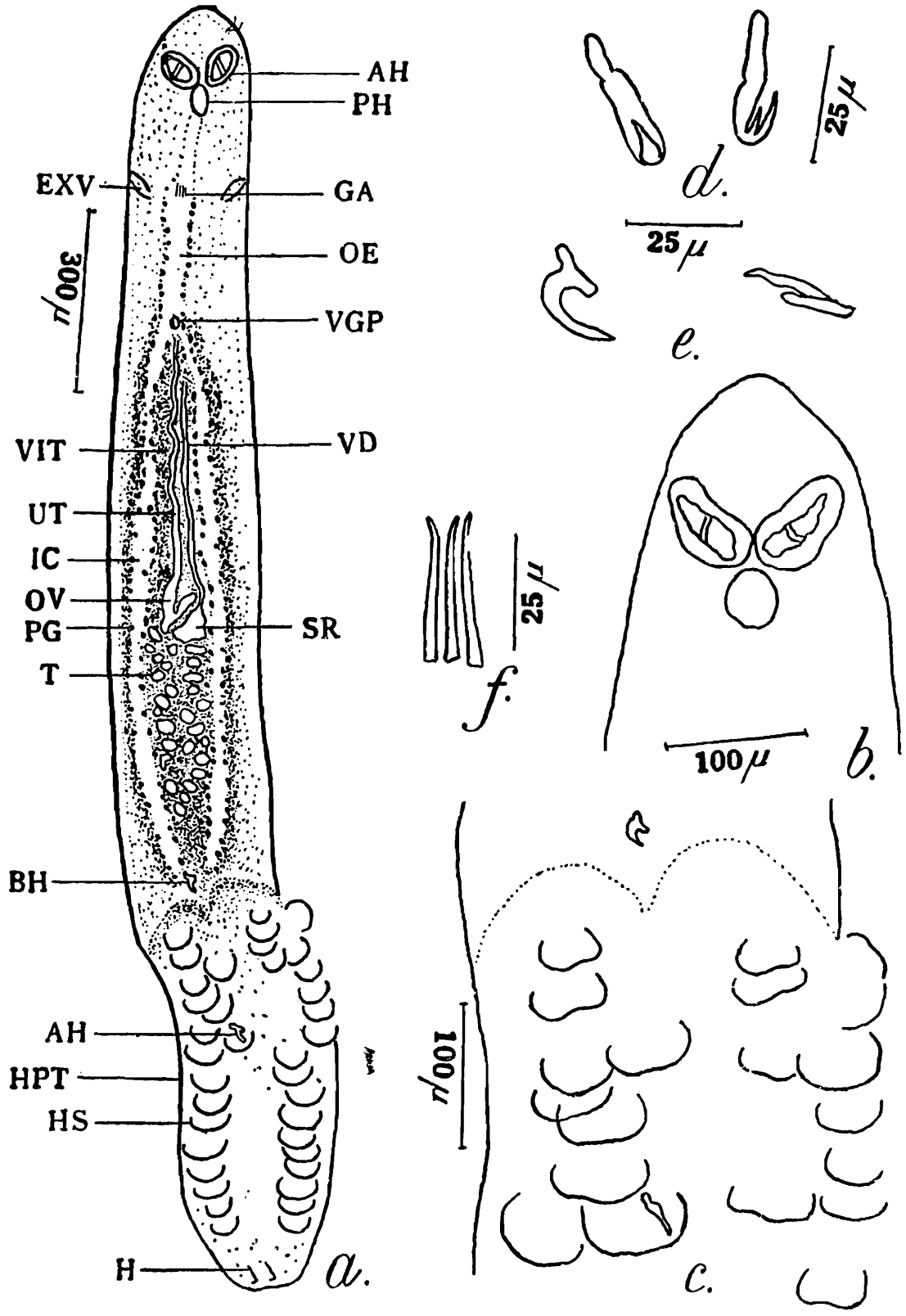
(Text-fig. 35, *a, b, c, d, e, f.*)

This species agrees with other forms in the general shape of the body and the haptor. It differs from *P. minimae*, *P. armatum* and *P. tricanthum* in having 12 genital hooks, agrees with Chauhan's species and *P. armatum* in having U-shaped vaginal hook. It differs from all the species in having only one body hook, 23 testes and 66 haptoral suckers.

28. **Pricea melane** Ramalingam, 1952.

(Text-fig. 36, *a, b, c, d, e, f, g, h.*)

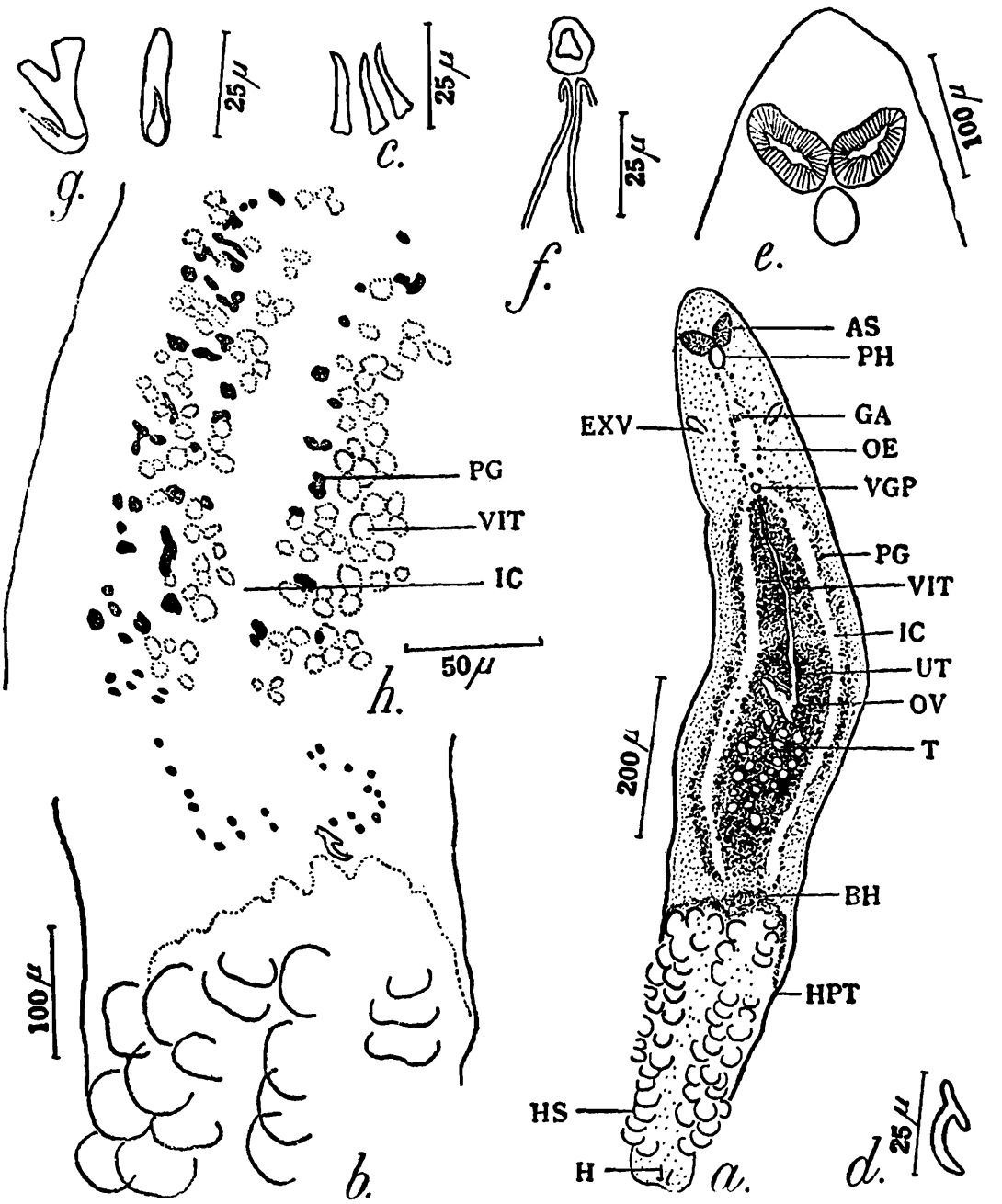
Like *P. tricanthum*, this species agrees with other forms in the general shape of the body and the haptor. It differs from *P. minimae*, *P. armatum*, and *P. tricanthum* in having 12 genital hooks. It agrees with



Text-fig. 35.—*Pricea tricanthum*; (*a*) Entire specimen; (*b*) Anterior part of the body, showing the septate and speculate anterior suckers and pharynx; (*c*) Additional hook and prehaptoral hook, in situ; (*d*) Posterior hooks; (*e*) Prehaptoral hook (left) and additional hook (right); (*f*) Genital hook (after Ramalingam).

AH., Additional hook; *BH.*, Body hook; *EXV.*, Excretory vesicle; *GA.*, Genital atrium; *H.*, Posterior hook or anchor; *HPT.*, Haptor; *HS.*, Haptoral sucker; *IC.*, Intestinal crura; *OE.*, Oesophagus; *OV.*, Ovary; *PG.*, Pigment granules; *PH.*, Pharynx; *SR.*, Receptaculum seminis; *T.*, Testis; *UT.*, Uterus; *VD.*, Vas deferens, *VGP.*, Vaginal pore; *VIT.*, Vitellaria.

Chauhan's species and *P. armatum* in having U-shaped vaginal hook. It differs from all the species in having only one body hook, 23 testes and 56 haptoral suckers.



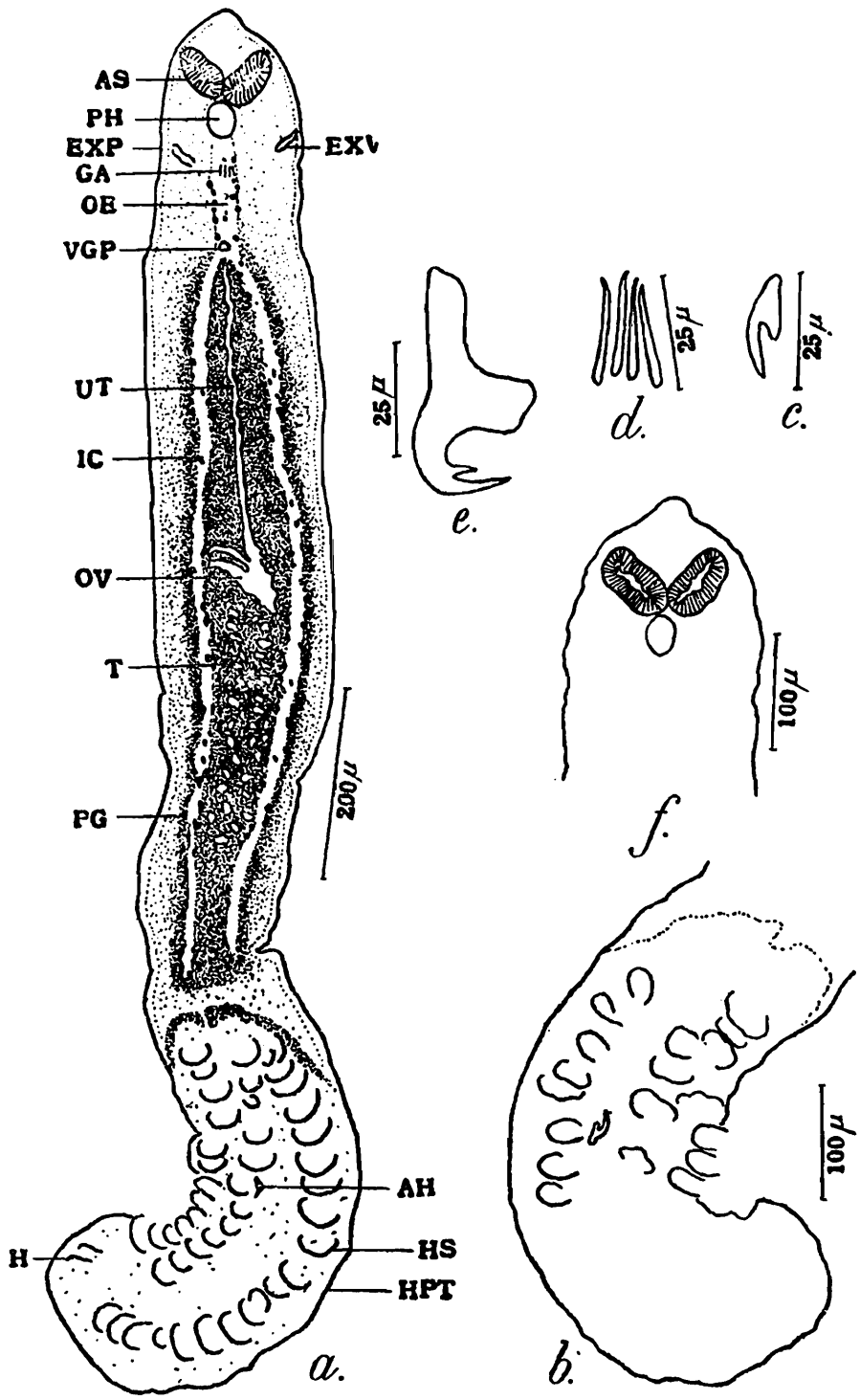
TEXT-FIG. 36.—*Pricea melane* ; (*a*) Entire specimen ; (*b*) Body hook or prehaptoral hook, in situ ; (*c*) Genital hook ; (*d*) Body hook ; (*e*) Anterior part of body, showing the aseptate and speculate anterior suckers and pharynx ; (*f*) Pseudogenital sucker and vaginal hook ; (*g*) Posterior hooks ; (*h*) A portion of the body enlarged to show distribution of the vitellaria and pigment granules. (after Ramalingam).

AS., Anterior sucker ; *BH.*, Body hook ; *EXP.*, Excretory pore ; *EXV.*, Excretory vesicle ; *GA.*, Genital atrium ; *HPT.*, Haptor ; *IC.*, Intestinal crura ; *OE.*, Oesophagus ; *OV.*, Ovary ; *PG.*, Pigment granules ; *PH.*, Pharynx ; *T.*, Testes ; *UT.*, Uterus ; *VGP.*, Vaginal pore ; *VIT.*, Vitellaria.

29. **Pricea minutum** Ramalingam, 1952.

(Test-fig. 37, *a*, *b*, *c*, *d*, *e*, *f*.)

This species resembles other forms in general form of the body, the haptor and in the general structure of the clamps. It agrees with Chauhan's species and *P. armatum* and *P. melane* in having U-shaped vaginal hook ; with *P. armatum*, *P. tricanthum* and *P. minimae* in having 14 genital hooks. But differs from all the species in the absence of both body-hooks as well as additional hooks, in having 19 testes and 110 haptoral suckers.



Text-fig. 37.—*Pricea minutum*; (*a*) Entire specimen; (*b*) Additional hook, in situ; (*c*) Additional hook; (*d*) Genital hooks; (*e*) Posterior hooks; (*f*) Anterior portion of body, showing the aseptate and speculate anterior sucker and pharynx. (after Ramalingam).

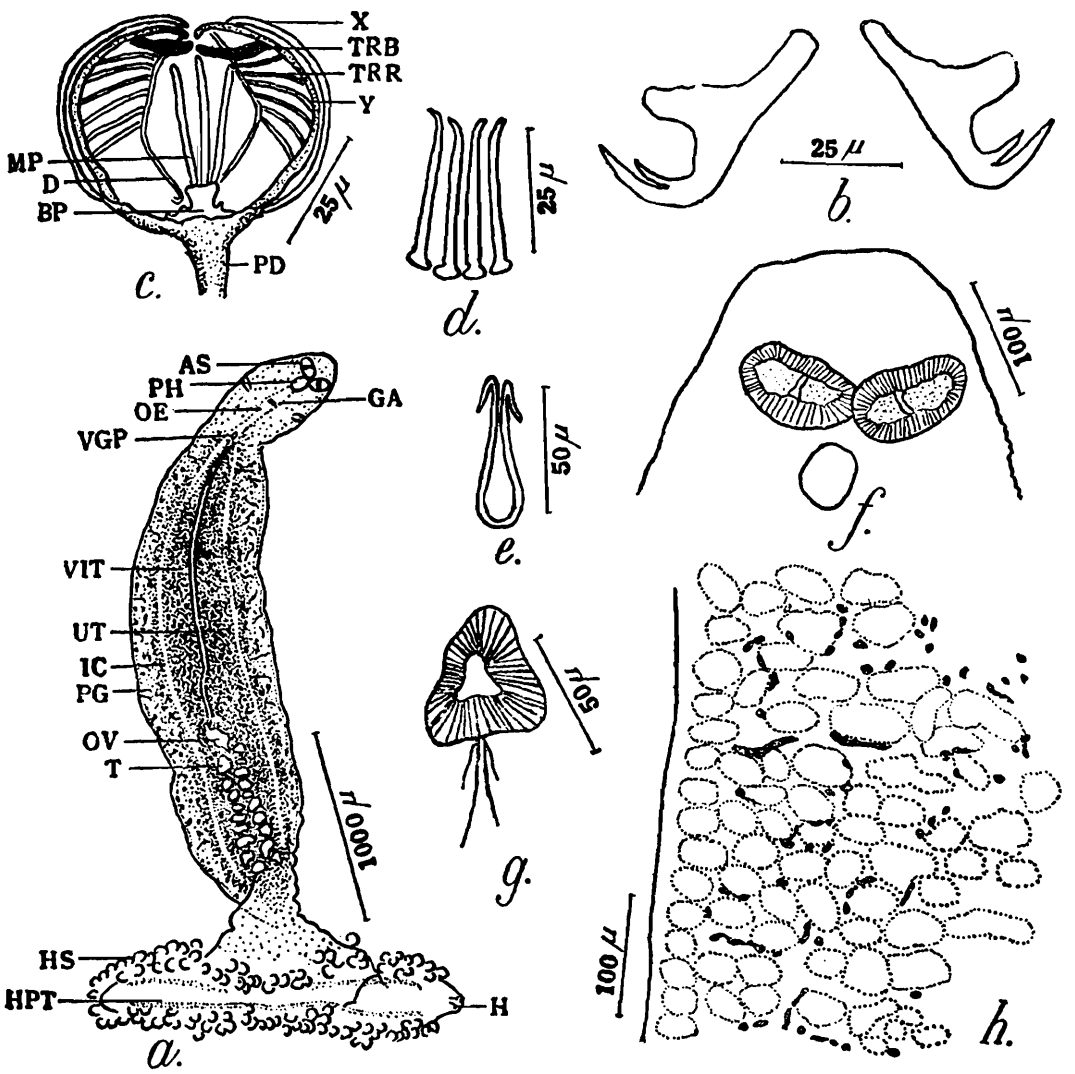
AH., Additional hook; *AS.*, Anterior sucker; *EXP.*, Excretory pore; *EXV.*, Excretory vesicle; *GA.*, Genital atrium; *H.*, Posterior hook or anchor; *HPT.*, Haptor; *HS.*, Haptoral sucker; *UT.*, Uterus; *PG.*, Pigment granules; *VGP.*, Vaginal pore; *VIT.*, Vitellaria.

30. **Pricea robustum** Ramalingam, 1951.

(Text-fig. 38, *a*, *b*, *c*, *d*, *e*, *f*, *g*, *h*.)

This species resembles other forms in general form of the body, the haptor and in the general structure of the clamps. It agrees with Chauhan's species and *P. armatum* and *P. melane* in having U-shaped vaginal hook, with *P. armatum*, *P. tricanthum* and *P. minimae* in having 14 genital hooks; but differs from all the species in the absence of both body hooks as well as additional hooks, in having 19 testes and

110 haptoral suckers. Ramalingam states that *Pricea robus'um* is the largest form described by him, under the genus.



TEXT-FIG. 38.—*Pricea robustum*; (*a*) Entire specimen; (*b*) Posterior hooks; (*c*) A haptoral ucker or clamp; (*d*) Genital hooks; (*e*) Vaginal hook; (*f*) Anterior part of the body showing the septate and spiculate anterior suckers and pharynx; (*g*) Pseudo-genital sucker and vaginal hook; (*h*) A portion of the body enlarged, to show the distribution of the vitellaria and pigment granules. (after Ramalingam).

AS., Anterior sucker; *BP.*, Basal piece; *D.*, Innermost thin and lamellar lateral piece; *EXP.*, Excretory pore; *EXV.*, Excretory vesicle; *GA.*, Genital atrium; *H.*, Posterior hook or anchor; *HPT.*, Haptor; *HS.*, Haptoral; *PG.*, Pigment granules; *MP.*, Median piece; *PD.*, Peduncle; *TRB.*, Transverse bar; *TRR.*, Transverse rib; *T.*, Testes; *UT.*, Uterus; *VGP.*, Vaginal pore; *VIT.*, Vitellaria; *X.*, Median outermost piece; *Y.*, Middle piece.

III. SUMMARY.

The paper deals with thirty monogenetic trematodes recorded so far from the Indian region—India, Burma, Ceylon and Pakistan. In each case a representative diagram and specific diagnosis is given. Diagnostic keys have been provided at each taxonomic stage, wherever found necessary. The paper is a complete revision of the group, known from this region, gives a brief review of the views of various workers about them and their latest systematic position. Taxonomic position of the

family Chimaericolidae and subfamilies, Vallisinae and Protomicrocotylinae and various genera has been discussed and a new subfamily *Priceinae* proposed. Phylogeny and evolution in the Subclass has been dealt with. At the end, parasite-host and host-parasite lists have been added. Bibliography is confined to selected references, mainly those dealing with forms from the region.

IV. Acknowledgments.

I am grateful to Shri A. K. Bose, Shri G. Ramakrishna and Shri S. Ghoshal for helping me in various ways. I wish to thank my colleague, Shri M. N. Datta, Assistant Superintendent, for going through the manuscript, to make it press ready. I am also obliged to Miss N. G. Sproston for going through the manuscript, making valuable, suggestions and for help in correcting the first page proof.

VI. Parasite—Host List.

List of Monogenetic trematodes recorded from the Indian Region, arranged alphabetically, with their hosts, location, localities of distribution, etc.)

Parasite	Host.
Ancyrocephalus alatus	*Muraenesox talabonoides.* *Arius fulcarius.* *Mugil parsia.* *Harpodon neherius.*
Benedenia macrocolpa	*Rhinoptera javanica Mull. and Henle.*
Bilateracotyle chirocentrosus	*Sciaena belengeri.* *Chirocentrus dorsab.*
Capsala gouri .	Marine Fish, *Thynnus thunnina.*
Capsala laevis	*Histiophorus* (sic) *brevirostris.*
Capsal meagacotyle . . .	Sword fish, *Histiophorus* sp.
Capsala ovalis	*Histiophorus* sp.
Cyclocotyla multaetesticulae .	*Pellona* sp.
Dactylogyrus moorthyi . .	Freshwater fishes, *Puntius puckelli.* *Puntius ticto.*
Diplectanum belengeri . .	*Sciaena belengeri.* *Sciaena carulta,* *Muraenesox talabonoides.*
Diplozoon indicum	*Barbus* (*Puntius*) *sarana* (Ham).
Diplozoon kashmirensis	Fish, *Schizothorax* sp.

Parasite.	Host.
Eupolystoma rajai	*Rana* sp.
Gastrocotyle indica	Marine fish, *Caranx kalla* Cuv. and Val.
Loimos secundus	Indian dog-fish, *Scoliodon sorrakowah.*
Mazocräes orientalis	Clupeid fish, *Dussumieria* sp.
Mazocraeoides prashadi	Clupeid fish.
Paradactylogyrus catlarius	Freshwater fish, *Catla catla* Ham.
Polystomoides kachugae	Water tortoise, *Kachuga lineata* Gray.
Pseudaxone indicana	*Chrysophrys berda.*
Pricea armatum	*Cybium guttatum.*
Pricea melane	*Cybium guttatum.*
Pricea microcotylae	*Scomber microlepidotus.*
Pricea minimae	*Thynnus pelamys.*
Pricea minutum	*Cybium guttatum.*
Pricea multae	*Cybium lanceolatus.*
Pricea robustum	*Cybium guttatum.*
Pricea tetracanthum	*Cybium guttatum*
Pricea tricanthum	*Cybium guttatum.*
Vallisiopsis contorta	Marine fish, *Lactarius lactarius* (Bl. Schn.)

VI. HOST-PARASITE LIST

Host.	Parasite.
Arius fuscarius	*Ancyrocephalus alatus*
Barbus (Puntius) sarana	*Diplozoon indicum*
Caranx kalla	*Gastrocotyle indica.*
Catla catla	*Paradactylogyrus catlarius*
Chirocentrus dorsab	*Bilateracotyle chirocentrosus*
Chrysophrys berda	*Pseudaxine indicana*
Cybium guttatum	*Pricea armatum.*
,, ,,	*P. melane*
,, ,,	*P. minutum*
,, ,,	*P. robustum*
,, ,,	*P. tricanthum*
,, ,,	*P. tetracanthum*
Cybium lanceolatus	*Pricea multae*
Clupeid fish	*Mazocraeoides prashadi*

Host.	Parasite.
Dussumieria sp.	*Mazocräes orientalis*
Harpodon neherius	*Ancyrocephalus alatus*
Histiophorus brevirostris	*Capsala laevis*
Histiophorus sp.	*Capsala megacotyle*
	Capsala ovalis
Kachuga lineata	*Polystomoides kachugae*
Lactarius lactarius	*Vallisiopsis contorta*
Mugil parsia	*Ancyrocephalus alatus*
Muraenesox talabonoides	*Ancyrocephalus alatus*
	Diplectanum belengeri
Pellona sp.	*Cyclocotyla multaetesticulae*
Puntius puckelli	*Dactylogyrus moorthyi*
Puntius ticto	*Dactylogyrus moorthyi*
Rana sp.	*Eupolystoma rajai*
Rhinoptera javanica	*Benedenia macrocolpa*
Sciaena belengeri	*Diplectanum belengeri*
	Bilateracotyle chirocentrosus
Schizothorax sp.	*Diplozoon kashmirensis*
Sciaena carulta	*Diplectanum belengeri*
Scoliodon sorrakowah	*Loimos secundus*
Scomber microlepidotus	*Pricea microcotylae*
Thynnus pelamys	*Pricea minimae*
Thynnus thunnina	*Capsala gouri*

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lanes h, 1952.	*Pricea minutum* Ramalingam, 1952.	*Pricea robustum* Ramalingam, 1952.
m (Gills.)	*Cybium guttatum* (Gills.)	*Cybium guttatum* (Gills.)
ylindrical and body almost	Body elongately cylindrical and the sides of the body almost parallel. Length 1·404 mm. Breadth 0·201 mm.	Body elongately cylindrical and the sides of the body almost parallel. This species is comparatively bigger in size. Length 3·58 mm. Breadth 0·75 mm.
y oval with the haptor in line s of the body.	Haptor elongately oval with the long axis of the haptor in line with the long axis of the body. Length 0·384 mm. Breadth 0·170 mm.	Haptor elongately oval whose long axis at right angles to the long axis of the body. The specimen of this species were got alive and present an appearance as shown in Text fig. 6*a*, where as the specimens of the rest of the species described were not alive and the haptor appears to be in line with the axis of the body, probably due to post-mortal contraction. Length 1·88 mm. Breadth 0·35 mm.
ractile clamp nsverse ribs.	46 pedunculated retractile clamp with six transve ribs. 21μ × 47μ	110 peduculated retractile clamps with six transverse ribs. 46—51μ × 58μ—69μ.
	31	19
l hook in the anterior to in length.	Only one additional hook near the middle of the haptor. 27μ in length.	There are neither body hooks nor additional hooks.
	36μ	23μ
tuated 0·259 nterior end,	12 genital hooks, situated 0·161 mm. from the anterior end, 25μ in length.	14 genital hooks, situated 0·31 mm. from the anterior end, 30μ in length.
es in dense	Vitellarian follicles not so much in dense clusters.	Vitellarian follicles in dense clusters.

VIII. A Comparative table indicating main characters of the various Species of the Genus *Pricea* Chauhan,

Species Host & Location.	*Pricea multae* Chauhan, 1945. *Cybium lanceolatus* (Gills).	*Pricea minimae* Chauhan, 1945. *Thynnus pelamys* (Gills.)	*Pricea microctylae* Chauhan, 1945. *Scomber microlepidotus* (Gills.)	*Pricea tetracanthum* Ramalingam, 1952. *Cybium guttatum* (Gills)	*Pricea armatum* Ramalingam, 1952. *Cybium guttatum* (Gills.)	*Pricea tricanthum* Ramalingam, 1952. *Cybium guttatum* (Gills.)	*Pricea m* Ramalingar *Cybium guttat*
Shape and Size of body.	Body elongately cylindrical and the sides of the body almost parallel. Length 3·22 mm. Breadth 0·4 mm.	Body elongately cylindrical and the sides of the body almost parallel. Length 3·46 mm. Breadth 0·27 mm.	Body elongately cylindrical and the sides of the body almost parallel. Length 7·0 mm. Breadth 0·37 mm.	Body elongately cylindrical and the sides of the body almost parallel. Length 1·678 mm. Breadth 0·357 mm.	Body elongately cylindrical and the sides of the body almost parallel. Length 2·695 mm. Breadth 0·473 mm.	Body elongately cylindrical and the sides of the body almost parallel. Length 2·1 mm. Breadth 0·24 mm.	Body elongately c the sides of the parallel. Length 1·981 mm Breadth 0·398 mr
Shape and Size of haptor.	Haptor elongately oval structure whose long axis is at right angles to the axis of the body. Length 1·02 mm. Breadth 0·33 mm.	The entire haptor has the same relation to the body as a foot has to the leg. Length 0·12 mm. Breadth 0·033 mm.	The haptor asymmetrically placed. — —	Haptor elongately oval with the long axis of the haptor in line with the long axis of the body. Length 0·499 mm. Breadth 0·258 mm.	Haptor elongately oval with the long axis of the haptor in line with the long axis of the body. Length 0·757 mm.. Breadth 0·170 mm.	Haptor elongately oval with the long axis of the haptor in line with the long axis of the body. Length 0·66 mm. Breadth 0·24 mm.	Haptor elongate long axis of the with the long a Length 0·660 mr Breadth 0·295 m
Number of clamps and size.	122 pedunculated retractile clamps with seven transverse ribs. 70μ.	70 retractile and pedunculated clamps with 5-7 transverse ribs. 30μ × 70μ.	113 pedunculated retractile clamps with seven transverse ribs. 26μ × 78μ.	42 pedunculated clamps with seven transverse ribs. 39μ × 59μ.	50 pedunculated retractile clamps with 5—6 transverse ribs. 50μ × 71μ.	40 pedunculated retractile clamp with six transverse ribs. 43μ × 66μ.	6 pedunculated r with 6—8 t 37μ × 66μ.
Number of testes.	26	28	25	20	31	28	2
Position and Size of the prehaptoral (body) hooks as well as additional hook.	A pair recurved hooks (pre-haptroal) situated in the posterior end of the body just above the haptor. 30μ in length.	Body hooks one behind the other on the posterior end of the body proper. One hook situated on the right intestinal caecum, near its posterior end and the other just anterior to the haptor slightly to the left. 40u in length.	Body hooks situated on behind the other at the posterior end of the body proper, one on the right intestinal caecum as in the last species. 80μ in length.	One pair hooks present as additional hooks in the haptor, just in front of and in between the pair of posterior hooks. 27u in length.	Two pre-haptoral hooks, one situated just below the left diverticula and the other on the right side of the right diverticula. 21μ in length.	One hook as additional hook in the middle of the haptor and other as prehaptoral hook just anterior to the haptor and in the mid-line. 30u and 29μ in length.	A single prehapt body region the haptor.
Posterior hooks or anchors.	80μ	60μ	110μ	39μ	48μ	27μ	
Number of Genital hooks & their size.	12 genital hooks, situated 0·23 mm. from the anterior end. 25μ in length.	10 genital hooks, situated 0·21 mm. from the anterior end. 30μ in length.	12 genital hooks, situated 0·26 mm. from the anterior end. 50μ in length.	12 genital hooks, situated 0·259 mm. from the anterior end, 29μ in length.	14 genital hooks, situated 0·348 mm. from the anterior end, 32μ in length.	14 genital hooks, situated 0·256 mm. from the anterior end, 29μ in length.	12 genital hook mm. from t 21μ in length
Extent of Vitellaria	Vitellaria extending from the level of the genital pore up to the extent of the testes though few follicles extending posteriorly, on the intestinal caeca upto the point of their termination.	Vitellarian follicles very few.	Vitellaria extending from the region anterior to the vaginal pore up to a distance a little posterior to the end of the intestinal crura.	Vitellarian follicles not dense and scattered very loosely.	Vitellarian follicles in dense clusters.	Vitellarian follicles uniformly spread and not in dense clusters.	Vitellarian clusters.

Addendum.

Since this paper went to the Press another paper has appeared on Indian Monogenea. Ramalingam (1953)* has described a new genus *Chauhanea* with *Chauhanea madrasensis* Ramalingam, 1953 as the type species, from *Sphyraena acutipinnis* Day, from Madras. He has assigned the genus to the subfamily Gastrocotylinae *sensu* Sproston, 1946 and has also given a key to the genera of the subfamily, as follows,—

Key to Genera of the Subfamily Gastrocotylinae.

1. Haptor unilateral; rib-like thickenings in the clamp capsule absent; anchors persistent ..	2
Haptor bilateral; rib-like thickenings in the clamp capsule present; anchors persistent or not	3
Haptor bilateral asymmetrical; rib-like thickenings in the clamp capsule absent; anchors absent; genital pore lateral and unarmed. Vagina lateral and armed	*Chauhanea* Ramalingam, 1953.
2. Haptor as a marginal frill, extending forwards beyond the region of gonads; anchors terminal	*Gastrocotyle* van Beneden and Hesse, 1863.
Haptor as a terminal frill not overlapping the region of gonads; anchors lateral ..	*Psoudaxine* Parona and Perugia, 1890.
3. Haptor as a bilateral frill extending forwards beyond the region of the gonads; anchors persistent	*Thoracocotyle* MacCallum, 1913.
Haptor as a bilateral frill on a posterior extension of the body beyond the region of the gonads	
(*i*) Anchors not persistent in the adult ..	*Lithidiocotyle* Sproston, 1946.
(*ii*) Anchors persistent and in addition a pair of " body hooks " one above the other just anterior to the haptor ..	*Pricea* Chauhan, 1945.

Subfamily *Gastrocotylinae* Sproston, 1946.

Genus **Chauhanea** Ramalingam, 1953.

Chauhanea madrasensis Ramalingam, 1953.

(Text-figs. 39)**

Specific diagnosis.: *Chauhanea* Ramalingam, 1953 ; with Generic characters.

Length 3·079-5·64 mm.; breadth 0·682-1·011 mm. Haptor has 30-49 clamps on the right side, 0·846-1·398 mm. in length and 36·55 clamps on the left side, 0·987-1·622 mm. in length. Clamp structure is of the Gastrocotylid type, without rib-like thickenings or plaques. Clamp size is 60-69×48-55μ. Testicular follicles 48-65 in number. Cirrus 0·121-0·130 mm. long. Eggs with unequal filaments, body of the egg is 0·214 mm. long; the posterior and the anterior filaments are 0223 mm. and 0·129 mm. long respectively.

Host. *Sphyraena acutipinnis* Day.

Location. Gills.

Locality. Madras.

*Ramalingam, K (1953). A new genus of Trematode (*Chauhanea*) from the gills of *Sphyraena acutipinnis* Day, *J. zool. Soc. India*, **5** (1) : 59-63.

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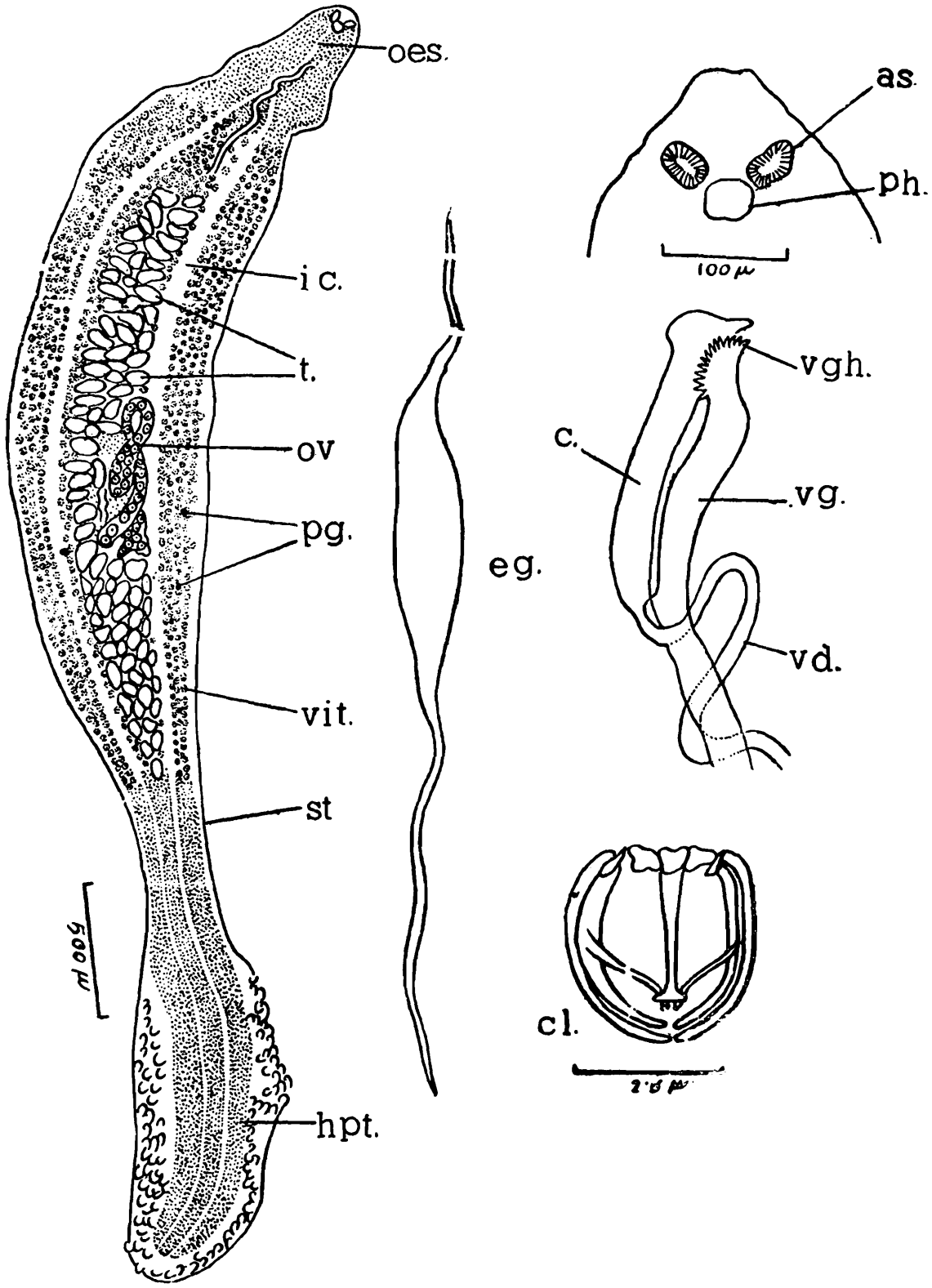

TEXT-FIG. 39.—*Chauhanea madrasensis*, Ramalingam (after Ramalingam.)

a. s., Anterior sucker ; *c*,. Cirrus ; *cl.*, Clamp ; *eg.*, Egg ; hpt., Haptor ; *i. c.*, Intestinal crura *Oes.*, Oesophagus ; *ov.*, Ovary ; *ph.*, Pharynx ; *p. g.*, Pigment granules ; *st.*, Stem ; *t.*, Testes ; *vit.*, Vitellaria ; *v. d.*, Vas deferens ; *vg.*, Vagina ; *vg.h.*, Vaginal hook.