ON *URNATELLA INDICA* SESHAIYA, A FRESHWATER ENTOPROCTAN FROM SOUTH INDIA.

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INTRODUCTION.

The Entoprocta (Calyssozoa or Kamptozoa, as they are now called) are almost entirely marine. Two genera, *Loxosomatoides* Annandale (1908) and *Chitaspis* Annandale (1916) occur in brackish water. The only representative in freshwater, described so far, is *Urnatella gracilis* Leidy (1845), which is known only from the Schuylkill River, Pennsylvania, North America.

In 1944, I reported in the *Current Science* (10) the occurrence of a freshwater Entoproctan in Annamalainager, South India. But I was not able at that time to define its systematic position, although I pointed out its resemblance to *Urnatella gracilis*. Subsequent examination of a large number of specimens, entire as well as in sections, led me to the conclusion that the freshwater Entoproctan from South India is a new species of *Urnatella*, for which I proposed the name *Urnatella indica* in a paper (11) submitted to the Indian Science Congress in 1946.

Genus **Urnatella** Leidy.

The genus *Urnatella* was constituted by Leidy (7) who gave the generic diagnosis as follows :—" Coenecium consists of a series of segments up to eighteen in number and forming free, semi-erect, curved stems attached only by the base of the lowest segment. Segments except the last three are urniform, the ante-penultimate and penultimate oblong, with simple or compound branches of the same form; the last segment or active polyp is companulate and supplied with cylindrical ciliated arms, arranged in a circle round the mouth " Leidy (8) also found that several stems arise from a common disc of attachment to the substratum. The tentacles vary from twelve to sixteen in number, but are usually fourteen.

A general description of *Urnatella gracilis* was published by Leidy (9) in 1884. Later, Davenport (5) investigated the species in detail and published a complete account of its structure and asexual mode of reproduction. Annandale (2, 3) in his account of the fauna of the Chilka lake and of the Talé Sap on the Gulf of Siam defined the limits and characteristics of the family Urnatellidae and commented on the genus *Urnatella*. More recently Cori (4) in his exhaustive account of the Kamptozoa defined the genus and its taxonomic position in the phylum.

In the light of the descriptions given by the authors mentioned above, the distinctive features of *Urnatella* may be summarised as

follows :—*Urnatella* is intermediate between *Pedicellina* Sars 1835 and *Loxosoma* Keferstein 1863 in the mode of attachment to the substratum. One or more, single or branched stalks arise from a basal disc. The stalks are segmented and each segment has a thick cuticle, and presents a 'heavily chitinised' appearance. The segments of the stalk, when old, present a beaded appearance, with alternate whitish and dark brown rings, due to the variation in the thickness of the cuticle in the segmental and intersegmental zones. The old or basal segments are usually uniform in appearance. *Urnatella* is unique among the Entoprocta in the storage of 'food-material' in the segments of the stalk in the form of refractile bodies resembling yolk spherules, by virtue of which the segments of the stalk are capable of functioning as resting buds. Another feature which distinguishes *Urnatella* from other Entoproctan genera is the opening of the nephridium, rectum, and genital duct into a cloaca instead of opening directly into the vestibule.

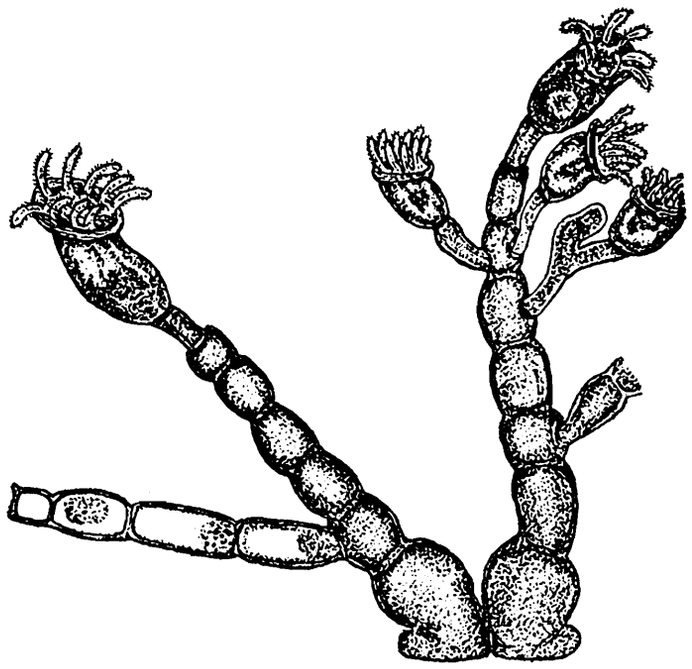
A reference to my earlier note (10) and to text-figs. 1 and 2*a* will show that the freshwater Entoproctan from South India has all the characteristics of *Urnatella* mentioned above. The beaded appearance of the segments of the stalk and the urniform shape of the lower segments, as well as the heavily thickened cuticle, can be made out in text fig. 1. The opening of the nephridium, rectum, and genital duct into the cloaca can be seen in fig. 2*a*, and the presence of refractile yolk-like spherules, in fig. 3*a*. A comparison of text-fig. 1. with the illustration of *Urnatella gracilis* given by Cori (4) will further corroborate the identification of the South Indian freshwater Entoproctan as an *Urnatella*.

The distinctive features of *Urnatella gracilis*, in comparison with the South Indian species may be stated as follows :—The stalks arise either singly from a basal plate, or in clusters of two or more from a common disc of attachment. The segments of the stem may be as many as eighteen in number. The tentacles of the polyp are usually fourteen, but may vary from twelve to sixteen in number. The colonies grow up to 5 mm., in height. As will be explained below, the South Indian species differs from the North American species in respect of all these features.

Urnatella indica Seshaiya.

The specimens of this species were all collected from the living shells of Molluscs like *Paludomus*, *Potomida* (=*Parreysia*), and particularly *Lamellidens*. In the case of *Lamellidens*, encrusting the posterior region of the shell valves, and in the neighbourhood of the inhalent and exhalent siphons, there is a very interesting association of epizoic organisms including species of Algae, Ciliophora, Suctoria, Rotifera, and Oligochaeta, besides dense colonies of *Urnatella indica*. From their position of vantage on the shells, in the neighbourhood of the siphons, the colonies of *Urnatella* continually divert into their vestibules, by ciliary action,

an abundance of food particles from the water currents in the siphons of the bivalve. *Urnatella indica*, like *Loxosoma*, is a commensal.

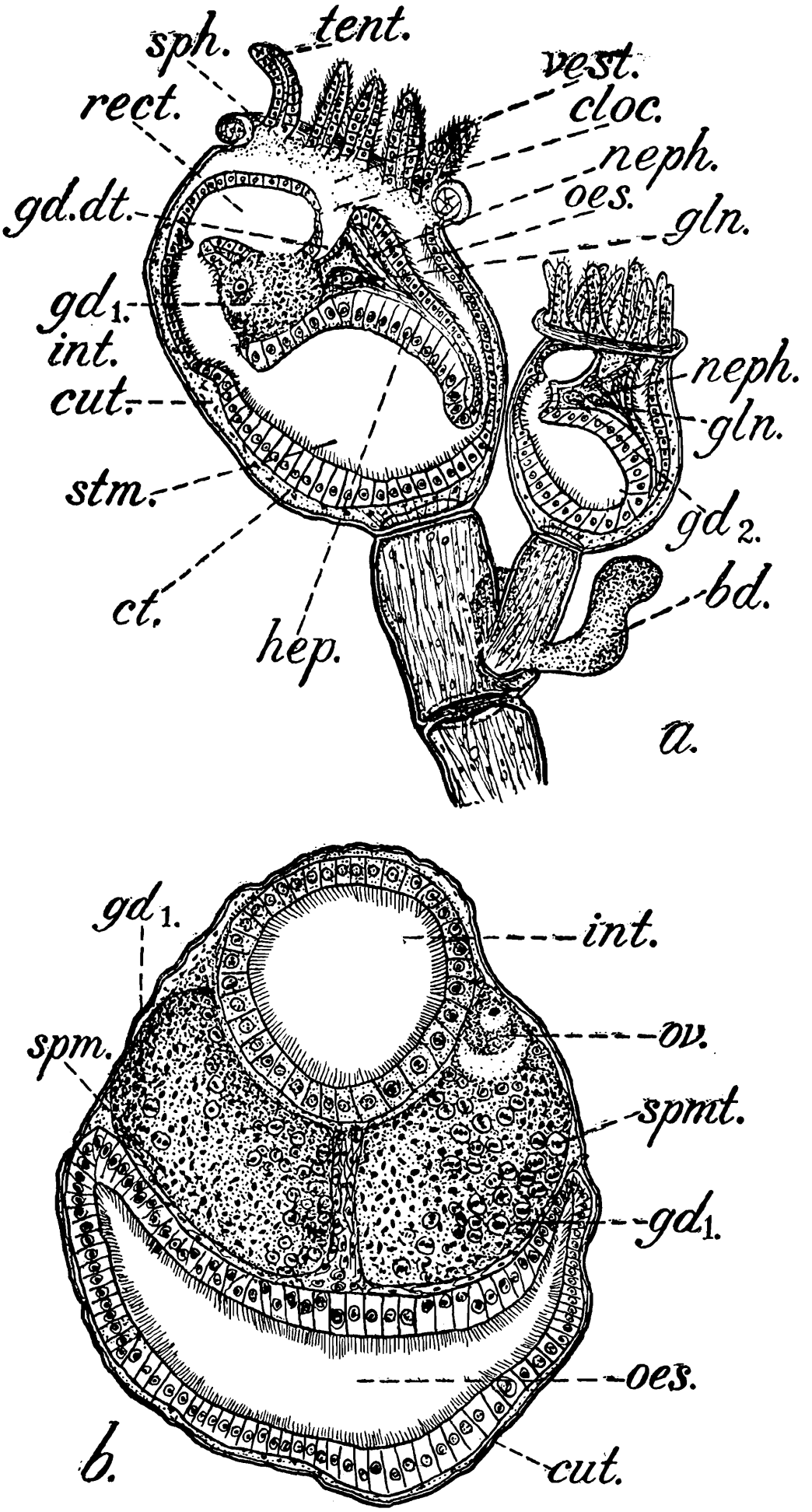


TEXT-FIG. 1.—Two colonies of *Urnatella indica* sketched from life. (Reproduced from *Current Science*.)

In the laboratory, I was able to grow the colonies on glass slides and in watch glasses placed in troughs containing pond water. For successful culturing, it was found necessary to renew the water in the troughs once or twice a day, not only to ensure a constant supply of food-particles but also to maintain the optimum pH of the water. The susceptibility of the colonies to the alterations in the pH of the surrounding water is very striking. If the colonies are placed in tap-water of the laboratory, having a pH value of 7·89, the polyps are shed within a few hours, although the food supply is kept adequate. If such headless stalks are transferred to pond water with a pH value of 8·3 new heads grow on the ' old shoulders ' in two or three days.

The colonies of *Urnatella indica* are shorter than those of the North American species, being usually about 1 mm. and never more than 2 mm. in height. The exceptionally tall colonies of about 2 mm., which I came across, were very few, and all instances of luxuriant growth resulting from the regeneration of old 'headless ' stalks.

The stalks arise either singly, or in groups of two or more. Instances of three or four stalks occurring together are quite common. In these cases, the basal disc is not a simple, uniform structure, but is always distinctly segmented and stolon-like, with as many segments as there are stalks, each segment giving rise to one stalk only. The segments of the stolon, which are usually two or three in number, are oblong in outline, and separated from each other by transverse dissepiments. The segments enclose yolk-like spherules and amoeboid cells, by virtue of which the basal plate, like the stalk, can function as a



TEXT-FIG. 2.—*Urnatella indica Seshaiyah.*

a.—Two polyps with buds seen in median optical section (slightly diagrammatic); *b.* Transverse section of a mature polyp through the region of the gonads.

bd. bud; *cloc.* cloaca; *ct.* connective tissue (parenchyma); *cut.* cuticle; *gd.* 1. ripe gonad; *gd.* 2. immature gonad; *gd.dt.* genital duct; *gln.* ganglion; *hep.* hepatic cells of stomach; *int.* intestine; *neph.* nephridium; *oes.* oesophagus; *ov.* ovary; *rect.* rectum; *sph.* sphincter; *spm.* sperms; *spmt.* developing sperms; *stm.* stomach; *tent.* tentacle; *vest.* vestibule.

resting bud, and sprouts into new stalks under favourable conditions. The distinctive features of the basal plate of *Urnatella indica* can be seen in text-figs. 3*a* and 3*b*.

In *Pedicellina* a creeping stolon is present, which continually produces new buds, and becomes segmented by the formation of dissepiments. In *Urnatella gracilis*, there is no such stolon, two or more stalks arising from a common base which is unsegmented, as described and illustrated in the accounts of Leidy (9). Davenport (5), and Cori (4).

In this connection it will be of interest to allude to the comments of Davenport (5) on the homology of the basal disc of *Urnatella gracilis*. The young stalks of the animal arise from the basal disc of the parent stalks, which, as Leidy (9) pointed out 'habitually become free for founding new stalks' The young stalk, may be regarded on this account as having a stolon. The presence of this ' stolon ' in the young stalk is regarded by Davenport (5) as an indication that *Urnatella* is derived from an ancestral condition possessing a stolon in the adult. According to Davenport (5) the 'stolon' of the young stalk of *Urnatella gracilis* is homologous with the stolon of the adult *Pedicellina*. In this connection he remarks ; " If, however, the stolon of the young *Urnatella* stalk is homologous with that of *Pedicellina*, we ought to find it sometimes at least giving rise to more individuals than two, and perhaps becoming segmented " He found both these conditions occasionally fulfilled. He came across three instances of the 'stolon' of young *Urnatella gracilis* giving rise to three stalks, and *only one* instance in which the young 'stolon' showed three segments with two dissepiments.

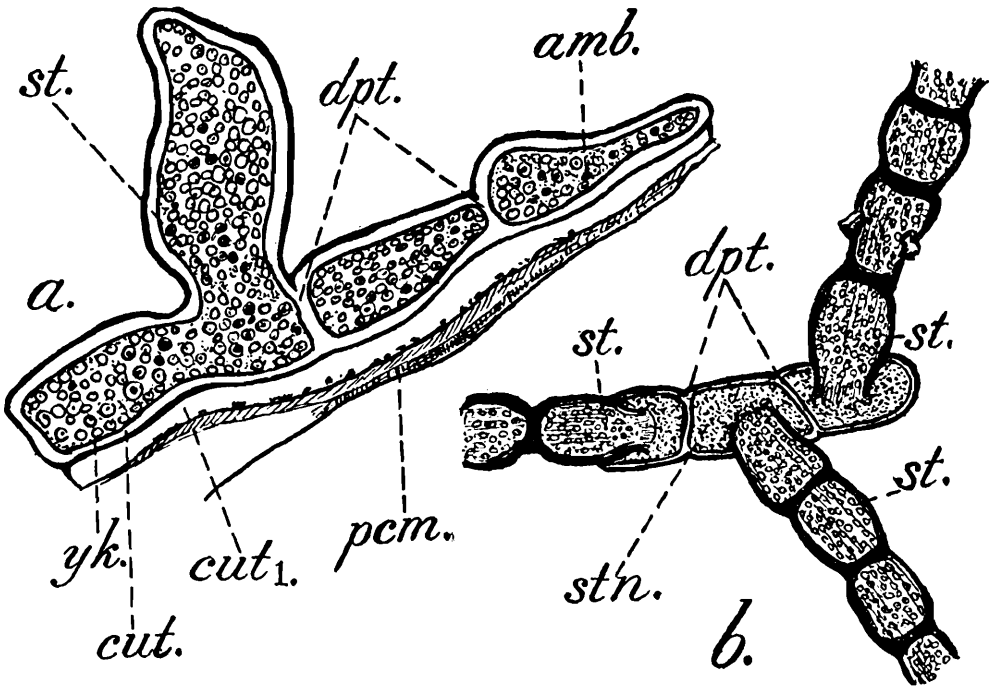
In the light of the above remarks, the presence of a distinctly segmented stolon in the *adult Urnatella indica* is interesting. The basal plate of this species is less specialised than that of the North American species, and intermediate between it and *Pedicellina*.

The stalks of *Urnatella indica* have the appearance characteristic of the genus. They do not have more than seven segments as a rule. Rarely, when old 'headless' segments regenerate and grow luxuriantly, the segments, including the old ones, may be eight or nine ; but this is found only in very exceptional cases. If we may judge from the illustrations of *Urnatella gracilis*, the segments of *Urnatella indica* are of stouter build.

The tentacles in the South Indian species vary in number from nine to eleven. The variation seems to be seasonal, for in the specimens which I examined during January, February and March, the tentacles were never more than nine, but in those examined later in the year, during August and September, they were very often ten or eleven. It is interesting to note that during the latter months the polyps showed also a considerable increase in the size of the gonads.

In text-figs 2*a* and 2*b* the well developed gonads are represented. None of the illustrations of *Urnatella gracilis*, given by Leidy (8), Davenport (5), or Cori (4) give any indication of the gonads attaining such large size as in *Urnatella indica*, where they occupy all the available space between the oesophagus and intestine. Davenport (5) found all

the mature specimens collected by him to be males, and failed to discover any trace of the ovary. He therefore concluded that the re-



TEXT-FIG. 3.—*Urnatella indica.*

a.—A sagittal section through the stolon of a specimen which was adherent to the periostracum of the shell of *Lamellidens.*

b.—A three-jointed stolon of *U. indica* w ith a stalk arising from each of the joint (Sketched from a specimen mounted in Canada balsam. The stalks are represented as pressed down.)

amb. amoeboid cells; *cut.* cuticle; *cut.* 2 lower layer of the stolon which adheres to the substratum; *dpt.* dissepiment; *pcm.* periostracum of the shell of *Lamellidens* to which *Urnatella* was attached; *st.* stalk; *stn.* stolon; *yk.* yolk spherules ".

production of *Urnatella gracilis* is entirely by budding and by regeneration of the stalks. Cori (4) is of the opinion that the freshwater habitat and intensive vegetative reproduction have resulted in the suppression of the ovary in the species. In *Urnatella indica*, however, a well-developed ovum is occasionally seen in the gonads besides developing sperms (text-fig. 2*b*). The South Indian species is therefore definitely hermaphrodite. But I have not been able so far to determine whether sexual reproduction occurs, though the large size of the gonads during certain months of the year and the occasional occurrence of a well-developed ovum would point to the probability of sexual reproduction.

In features other than those relating to the basal disc, height of the stalks, number of stalk-segments, and development of gonads, *Urnatella indica* resembles very closely *Urnatella gracilis*. In view of the detailed account of the North American species given by Davenport (5), I have refrained from describing the complete anatomy of *Urnatella indica*.

The two known species of *Urnatella* may be distinguished with the help of the following key :—

I. One or more stalks arising in the adult from an unsegmented basal plate; in the adult; segments up to eighteen in number; colonies up to 5 mm. in height; tentacles twelve to sixteen in number; North American.... .....*Urnatella gracilis*.

II. Stalks, if more than one, arising from a segmented basal plate, resembling a short stolon, each segment giving rise to one stalk only; stalk segments usually not more than seven, very rarely eight or nine, but never more than nine; colonies not more then 2 mm- in height; number of tentacles nine to eleven South Indian. ... .*Urnatella indica*

The type-specimens (No. Z.E.V. $\frac{7511\text{-}12}{7}$) of *Urnatella indica* mounted on slides have been deposited in the collections of the Zoological Survey of India.

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