

I.—THE FAUNA OF BRACKISH PONDS
AT PORT CANNING, LOWER BENGAL.

PART VII.—FURTHER OBSERVATIONS ON THE POLYZOA,
WITH THE DESCRIPTION OF A NEW GENUS
OF ENTOPROCTA.

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A considerable change has taken place in the Polyzoa of the ponds this winter, apparently owing to last summer's floods, which broke down the embankment that separated the ponds from the river, joining them together temporarily. It will, therefore, be well to publish the observations arising from a visit to Port Canning in December, 1907, both as regards the species already recorded and as regards a new genus that appears to have been introduced since last winter. A comparison with European specimens, moreover, has also made it necessary to recognize the Bengal *Victorella* as a distinct species.

ECTOPROCTA.

Victorella bengalensis, sp. nov.

*V. pavid*a, Kent, Annandale, *Rec. Ind. Mus.*, i, p. 200.

The numerous colonies recently obtained in the ponds are more luxuriant than any I have seen before in India. Thanks to the kindness of Mr. R. Kirkpatrick, of the British Museum, and Mr. C. F. Rousselet, I have been able to compare them with some exceedingly beautiful preparations of the true *Victorella pavid*a made by the latter. In my former account of the form that occurs at Port Canning, I stated that I had found no specimens in which the proliferation was comparable in complexity with that of the colony of which a part is figured by Kraepelin in fig. 75, pl. iii of his *Süsswasser-Bryozoen*. Examples taken in the ponds this winter, however, are quite as complicated. The general appearance of the colonies is that of a thick fur coating the grass stems, etc., on which they grow. When free from green algæ they are of a very pale flesh-colour as a whole, some of the zoecia being tinged with yellow, but the majority being practically colourless. The exact tint of the stomach depends on its contents, but it has intrinsically a

faint yellowish tinge. The complexity of budding is well illustrated by the accompanying figure (fig. 1) of the upper part of a parent zoöcium with its buds of the first, second, third and fourth degrees. As a rule buds of the first degree arise direct from the upper part of a large zoöcium, but sometimes a short tubular outgrowth intervenes, such outgrowths being more common in the case of buds of younger generations. A common form of what we may take as the unit of the colony (*viz.*, a parent zoöcium and its direct offspring produced by budding) is that of an upright stem (the parent zoöcium) with a single antler-like branch, consisting of buds and their buds, at one side; but two or more such branches are not infrequently produced.

No trace of resting buds was found in specimens killed on December 24th.

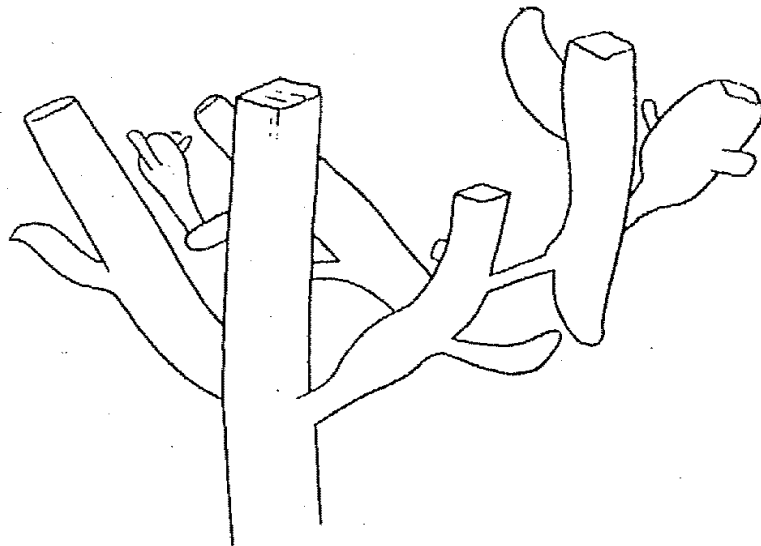


FIG. 1.—*V. bengalensis*, Port Canning, Dec. 1907.

In the following points the Indian species differs from the European examples of *V. pavida* I have examined:—

- (1) in the small size of the swelling from which the zoöcia arise;
- (2) in the fact that a considerable number of zoöcia are frequently grouped together with very short intervening false stola;
- (3) in the more powerful development of the gizzard;
- (4) in the fact that the distal part of *some* of the adult zoöcia is approximately circular in cross-section.

In the first two of these points, and to some extent in the fourth, *V. bengalensis* resembles Rousselet's recently described *V. symbiotica*¹ from Lake Tanganyika; but we have no details of the anatomy of this African form, which was found growing in the substance of a freshwater sponge very much in the same way as the *coralloides* phase of *Plumatella fruticosa* grows in

¹ *Proc. Zool. Soc.*, 1907 (i), p. 255. The colonies seen by Mr. Rousselet were apparently devoid of lateral buds, but so are many examples of *V. bengalensis*.

Spongilla lacustris in Europe and in *S. carteri*, *S. reticulata* and *S. crassissima* in India. The Port Canning form of *Victorella* has not as yet been found in close connection with the sponge (*S. alba*) so common in the same ponds, but owing to the small area of the objects to which the colonies are attached, the zoœcia are crowded together in very much the same way as would be the case if they were included in the substance of a sponge; they stand to one another, to put the matter in a different way, in much the same relation as the zoœcia of *Plumatella coralloides* stand to the tissues of the sponge in which they are inclosed.

All the zoœcia of *V. symbiotica* figured by Rousselet are circular in cross-section throughout; while in *V. bengalensis* some are circular or nearly so, some distinctly square.

The nature of the gizzard, which in the Indian form though thin-walled (as compared with that of *Bowerbankia*) is decidedly muscular, may be a more important feature from a systematic point of view. Saville Kent denied that *V. pavidata* had a gizzard at all, while Bousfield called attention to its existence. That the statement of the former author was due to a misapprehension is very possible, for even Hincks, whose experience of the Polyzoa was very much greater, at first placed the form he afterwards called *Bowerbankia caudata* in the genus *Valkeria*, on the ground that it had no gizzard. In this case, however, Hincks had only somewhat badly preserved specimens on which to base his diagnosis in the first instance, while Kent observed his specimens alive and was accustomed to minute microscopic investigation. I cannot, therefore, see any ground at present for separating the *Victorella* of Lower Bengal generically from that of Europe, although I am forced to regard it as a new species, for it is possible that the nature of the gizzard is a variable character, while the exact form of the connection between the zoœcia is one that actually differs in different parts of the same colony: as a rule it has the quadriradiate formation regarded as so important by Rousselet, whose remarks on this point (*op. cit.*, p. 252) are in full agreement with mine (*Rec. Ind. Mus.*, i, p. 201) on the "false stolon" of the Paludicellidæ.

I have recently found *Victorella* in a pond of fresh water near Calcutta, the specimens agreeing in every respect with those taken this winter at Port Canning.

Bowerbankia caudata (Hincks).

I have been able to observe no difference between the specimens taken last year and those taken this. In several of the tanks I found colonies of the species interlaced with colonies of the hydroid *Irene ceylonensis*, which the floods already alluded to have apparently enabled to extend its range in the ponds considerably, as it was previously found in one of them only but is now common in nearly all. It will, I think, be convenient to distinguish the Port Canning form as "race *bengalensis*."

ENTOPROCTA.

Among dense masses of *Victorella*, *Bowerbankia* and *Trene* on grass stems I noticed, in some preserved material obtained from Port Canning at the beginning of December, 1907, numerous little polypoid organisms, evidently Entoproctous polyzoa. Their condition made it impossible to examine them properly, but on December 24th I was able to collect living specimens. An investigation based on these and on carefully preserved material proved them to represent a new genus, for which I have coined the name *Loxosomatoides*, in order to indicate its resemblance in one important character to *Loxosoma*; in some of its characters, however, it resembles *Pedicellina* more closely, and in others *Urnatella*, while it is perhaps more closely allied to the American *Myosoma* than to any other genus.

LOXOSOMATOIDES, gen. nov.

Colonial, deciduous Entoprocta arising from a creeping stolon; the calyx separated from the stalk by a diaphragm, with a slanting or vertical lophophore, and bearing on its aboral surface a chitinous shield, which is absent from the stalk.

Loxosomatoides colonialis, sp. nov.

Colony consisting of a large number of polypides, which arise, singly and at considerable intervals, from a sparsely branched, unsegmented stolon. Stalk smooth, minutely and irregularly annulated, variable in length. Calyx with from twelve to sixteen tentacles, which are bluntly pointed and relatively short. The shield borne on the aboral surface covering the whole of one side of the calyx, of an oval shape, covered with a large number of minute subrectangular depressions, which are separated from one another by narrow ridges, giving the whole structure a reticulated appearance; stout spines, very variable in number and size, scattered irregularly on the shield. Alimentary canal more or less asymmetrical, the colon emerging from the stomach at one side; stomach subspherical, very large.

Two distinct forms of the species can be distinguished. It is impossible to separate them specifically, because polypides intermediate between them occur, but the colonies representing them are quite easy to distinguish as colonies, and the differences are probably due to differences in environment.

Form A.—Stalk much longer than calyx, clean; calyx of full-grown polypide measuring about 0.414 mm. in vertical length; spines on shield not very strongly developed (figs. 2, 3).

Form B.—Stalk not or very little longer than calyx, encrusted with inorganic débris; calyx of full-grown polypide measuring about 0.357 mm. in vertical length; spines on shield strongly developed, black at the tip (fig. 4).

Form A was found growing amidst dense colonies of *Victorella*, *Bowerbankia* and *Irene*, while Form B was by itself on grass stems.

The structure of the new Entoproct does not differ materially from that of other members of the group; its main outlines are

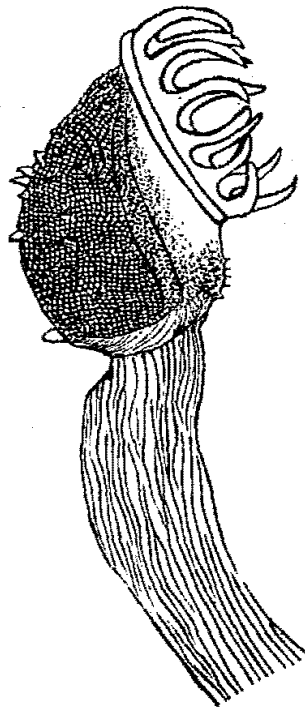


FIG. 2.

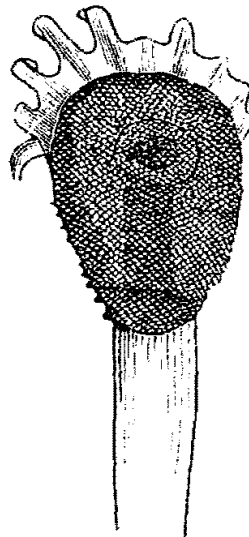


FIG. 3.

FIGS. 2 AND 3.—*L. colonialis*, form A, $\times 70$ (from preserved specimens).

clearly shown in fig. 5, which is drawn from a camera-lucida sketch of a carefully stained specimen. It will be well, however, to give a brief description of the more important and conspicuous organs.

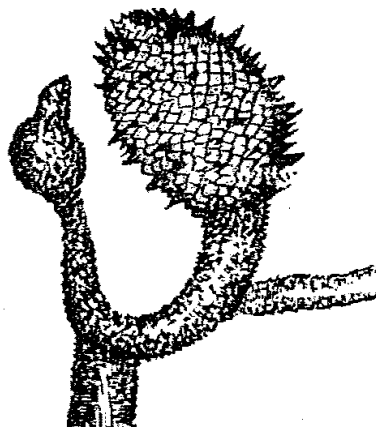


FIG. 4.—*L. colonialis*, form B, $\times 70$ (from preserved specimen).

Lophophore—

The extended lophophore bears a very close resemblance to that of *Urnatella* as figured by Leidy, owing not only to the direction of its main axis but also to the outline of the sphincter muscle, which in the living polypide has, when relaxed, a

peculiarly delicate and at the same time expanded appearance; it extends as a delicate, web-like structure for a considerable distance beyond the circle of tentacles. The tentacles are distinctly webbed at the base, apart from the sphincter, and, like those of *Pedicellina*, terminate somewhat abruptly. The fringe of cilia appears to be continuous round the distal extremity. When the tentacles are folded and the sphincter is contracted, the integument drawn together forms a papilla on the surface, the aperture being extremely minute and having a tubular form. The direction of the lophophore is capable of a certain change. When contracted, it stands parallel to the main axis of the calyx, but when the sphincter is fully relaxed it slants considerably.

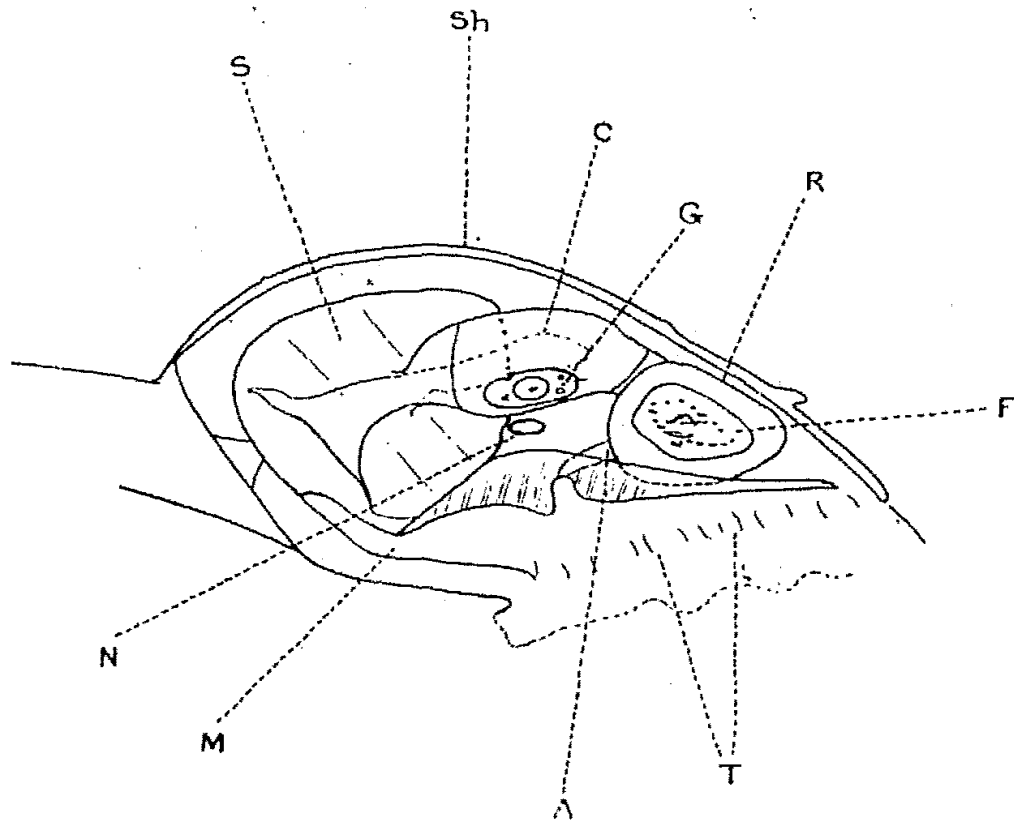


FIG. 5.—Anatomy of *L. colonialis*: A=anus; C=colon; F=faecal pellet; G=young ovary; M=mouth; N=ganglion; R=rectum; S=stomach; Sh=aboral shield; T=base of tentacles.

Calyx—

Owing to the presence of the aboral shield, the calyx is more rigid and less liable to change in outline than is the case with some Entoprocta. It has an ovoid and slightly flattened shape, the flattening being in the plane at right angles to the main axis of the calyx. The cuticle is fairly thick, but smooth and quite transparent on what may be called, in *Loxosomatoides*, the oral surface of the calyx; on the aboral surface it is thickened and chitinized to form the aboral shield. The spines are variable in outline; as a rule they are bluntly pointed; when they are well developed their tips are pigmented. Otherwise the shield has a yellowish

colour in living polypides and in specimens preserved in spirit. In specimens which have been cleared with cedar-wood or clove oil and mounted in canada balsam, however, the whole shield practically disappears, unless some method of double staining is employed.

Alimentary Canal—

When the tentacles are unfolded the circle of the lophophore surrounds a relatively large vestibule, the floor of which is often rather deeply concave, its exact form depending on the state of the alimentary canal. It is covered with long cilia which waive towards the mouth, a large circular aperture situated at the lower end of the vestibule. The mouth leads into a funnel-shaped œsophagus, which opens in its turn into the stomach, to which it is at right angles; the opening is almost exactly in the middle of the anterior ("oral") surface of the stomach. There is no epistome. The colon, a wide tube which can be entirely shut off from the stomach by a constriction, starts from one side of the latter but bends round behind it in such a way that the rectum, which is separated from the colon by a distinct constriction, comes to lie parallel to the œsophagus. The rectum is capable of great contraction and often takes on a spherical outline. In this condition it does not

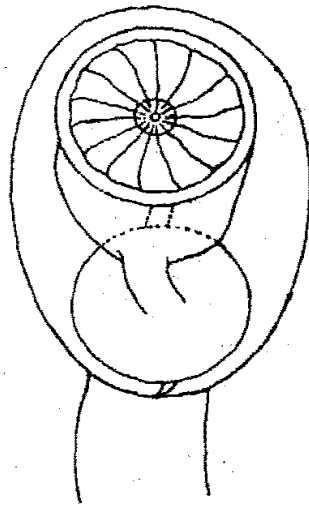


FIG. 6.—*L. colonialis*, polypide with retracted lophophore, from in front.

reach the floor of the vestibule but lies at the base of a narrow pit devoid of cilia. When the rectum is extended, however, the anus opens on the floor of the vestibule a short distance from its upper limits. Of all the divisions of the alimentary canal the stomach is by far the most bulky, filling up the greater part of the space in the calyx. Its anterior and posterior walls consist of greatly elongated cells; its base is fastened to the base of the calyx by means of a strand of tissue apparently resembling a dice-box in shape but very difficult to distinguish clearly as it takes all the stains I have tried on it feebly. The only part of the animal (except the shield) that is not absolutely colourless, is the stomach, which has a faint yellowish tinge.

Gonads—

The gonads arise as a pair of small reniform bodies, one lying on each side of the stomach. They branch as they develop, however, and become at first lobate, then dendritic, and finally form a broad zone, interrupted in front and behind, round the calyx, the branches being closely pressed together. All the colonies I have examined have been either male or female as colonies, but there were some indications in the female ones of protandry having occurred. I have not seen fully ripe ovaries or embryos, and am uncertain whether a brood-pouch exists.

Nervous System—

A relatively large ganglion exists near the centre of the calyx, in the bend of the alimentary canal, and sends off radiating nerves. Its position is the same as that occupied by the ganglion of *Pedicularina*.

Musculature—

I have been unable to detect muscles in the calyx, unless the structure joining the stomach to the base of the calyx is of this nature. The greater part of the stalk consists of vertical, nucleated muscle-fibres.

Stalk—

The stalk is covered by a smooth, minutely annulated cuticle, not very thin but quite transparent and colourless. Within the cuticle, for a short distance below the calyx, there is a single layer of flattened cells with nuclei that stain deeply; but this layer only extends for a short distance. The diaphragm is tangential to the main axis of the stalk. The remainder of the stalk apparently consists of a uniform mass of muscle-fibres. Whether flame-cells occur in this mass I am unable to say, not having cut sections. The calyx apparently dies at not very infrequent intervals and falls off, leaving a pointed tip to the stalk. A new calyx is then formed within the distal part of the stalk, apparently from that part of it which possesses a layer of flattened cells immediately within the cuticle.

Movements—

The movements of the polypide are slow, except in the case of the tentacles and sphincter muscle, which are folded in and contracted with great rapidity. The tentacles, when extruded, are usually held with their tips bent inwards towards the centre of the circle outlined by the lophophore, but they can be straightened out so as to lie parallel to the main axis of the polypide, and their tips can be applied together when they are fully extended, in order that food, consisting of various minute organisms, may be seized between them. I am indebted to my friend, Mr. F. M. Howlett, for the sketches reproduced in figure 7 and representing living polypides in various attitudes.

The calyx, when the tentacles are stretched out, either stands up vertically on the stem or is bent backwards so that its main axis is at right angles to that of the stalk and the lophopore is parallel or almost parallel to the stolon. When the animal is disturbed the calyx bends forwards and the aboral shield is presented in the direction from which danger threatens. At the same time slow writhing movements, which seldom cease altogether, cause the stalk to curl into a loose spiral with a single whorl. There is not, however, any nodding of the calyx such as takes place in some Entoprocta with deciduous calices.

Affinities—

In its mode of growth *Loxosomatoides* closely resembles *Pediceolina*, from which the direction of the lophophore at once distinguishes it; *Loxosoma* it only resembles in this one particular. The polypides bear a very close resemblance to young polypides

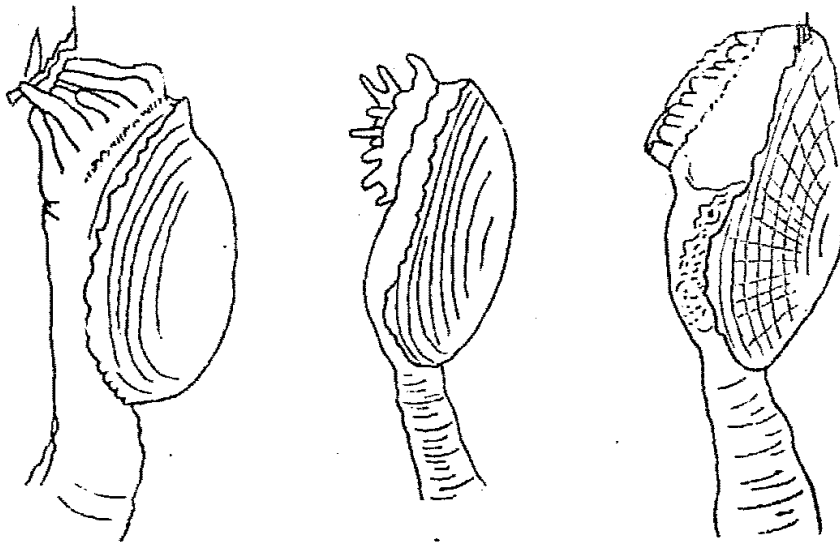


FIG. 7.

of the freshwater North American genus *Urnatella*¹ in which the stalk has not yet become segmented; this is particularly the case as regards the lophophore and the sphincter muscle. Probably, however, the closest affinities are with *Myosoma*,² in which an aboral shield is developed but extends down the aboral surface of the stalk. This genus, as its name is intended to indicate, is distinguished by the possession of definite muscles in the calyx, a character which I have been unable to detect in *Loxosomatoides*. The aboral shield of the new genus and of *Myosoma* is possibly homologous with the zoecium of the Ectoprocta, but a study of its development would be necessary before it would be possible to make a definite statement on this point.

¹ Leidy, *Journ. Acad. Nat. Sci. Philadelphia*, ix (2), p. 5, pl. i, fig. 5, 1884.

² Robertson, "Studies in Pacific Coast Entoprocta," *Proc. California Acad. Sci.*, ii (3), p. 324, 1900.