ON A NEW FRESH-WATER POLYZOON FROM RHODESIA, *LOPHOPODELLA THOMASI*, gen. et sp. nov.

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Plate 3.

Up to quite recent times not a single species of fresh-water Polyzoa was known from the continent of Africa. To Dr. Stuhlmann is due the credit of having been the first to discover representatives of this class in Egypt, and later in German East Africa (24), between the years 1890 and 1892. These were *Fredericella* and *Plumatella*, and also some statoblasts of Hyatt's *Pectinatella carteri*, a species previously known only from India. Then in 1893 and 1897, Dr. M. Meissner (23) found sessile statoblasts of *Plumatella* on some shells of fresh-water molluscs, preserved in the Berlin Museum, which had come from East and West Africa, and this completes the whole known records of fresh-water Polyzoa in Africa to the present time.

In October last, one of our members, Mr. R. H. Thomas, of Salisbury, Rhodesia, sent me a little bottle containing a gelatinous mass which, he said, was a fresh-water Polyzoon collected early in 1900, and preserved in alcohol. The polypides were all decayed, but in a piece of the gelatinous zoarium the hollow tracts which they had occupied can well be seen (Fig. 1), and in these branching tracts, which preserve the shape of the entocyst, I found a number of peculiar statoblasts in all stages of growth. An examination of these enabled me to inform Mr. Thomas at once that a Polyzoon having such statoblasts was not known in England, but I could not at the time say if any such form had been described in any other part of the world. Since then I have looked up all the recent literature on the subject, and have also made enquiries of specialists, and am now in a position to say that this is undoubtedly a new species, for which a new genus must be created, and moreover, it is the first

representative of fresh-water Polyzoa recorded from any part of Africa south of the Equator.

Before describing the characters of this new species, it may be instructive to hark back a little and see what has been done before, and what is the present state of our knowledge about these animals.

The fresh-water Polyzoa (or Bryozoa) form a very distinctive group containing only about 20 to 50 species, according to whether a number of these forms are considered good species, or merely varieties, or synonyms. Professor G. J. Allman, who in 1856 published his fine work, "A Monograph of the Fresh-water Polyzoa," seems to have almost exhausted the subject as far as Great Britain is concerned, for, with the exception of the description of two very doubtful new Plumatellas by Parfitt (8) in 1866, and one remarkable new species, Kent's *Victorella pavida* * (9), from the Victoria Docks in 1870, no work at all, or work of any importance, on this group seems to have been done or published in England. The marine Polyzoa, on the other hand, have come in for much more attention at the hands of zoologists.

During the last decades the principal descriptive work on fresh-water Polyzoa has been done in America by J. Leidy (2, 11, 12) and A. Hyatt (7), in Germany by Professor K. Kraepelin (17), and Dr. M. Meissner (22, 23, 24, 25), in France by J. Jullien (15), in Bohemia by Kafka (18), and in Japan by Oka (20). From India, Japan, South America, Australia, and Indo-China a few new species have been described, so that the total number of undisputed species does not at present exceed 20, leaving out all the more or less doubtful names which have been alternately accepted and rejected by different investigators.

I will make no attempt to give even a short description of the known species of fresh-water Polyzoa, which can readily be found in the works mentioned in the bibliography at the end of this paper; but a bare list of the recognised species, and of those named since Allman's monograph was published, may prove useful for reference.

* This was first found by Mr. W. Saville Kent at one of the earliest Quekett excursions, on September 12th, 1868. See Mr. Kent's first note in *Science Gossip* for 1868, p. 255. Later it has also been found in the Regent's and Surrey Canals, always parasitic on *Cordylophora lacustris*.

List of the Known Fresh-water Polyzoa.

British Species.

Lophophore horse-shoe shaped.

Cristatella mucedo. Cuvier. Statoblasts circular, with hooked spines.

Lophopus crystallinus. Pallas. Statoblasts elliptical, pointed at both ends, without spines.

Plumatella repens. Linnaeus. Statoblasts oval, without spines.

,, *fruticosa.* Allman
,, *coralloides* ,,
,, *emarginata* ,,
,, *elegans* ,,
,, *dumortieri* ,,
,, *jugalis* ,,
,, *allmani.* Hancock
Alcionella fungosa. Pallas
,, *benedeni.* Allman
,, *flabellum.* Van Beneden

} All these are considered to be synonyms or varieties of *Pl. repens* by continental writers.

Plumatella lineata. Parfitt
,, *limnias.* ,,

} Two very doubtful species.

,, (*Hyalinella*) *punctata.* Hancock

} With soft gelatinous creeping tubes.

Lophophore circular.

Fredericella sultana. Blumenthal. Statoblasts kidney-shaped, without annulus.

Paludicella ehrenbergi. Van Beneden
Victorella pavida. Kent

} Statoblasts absent.

Foreign Species.

Lophophore horse-shoe shaped.

Cristatella idae. Leidy (America)
,, *ophidioidea.* Hyatt ,,
,, *lacustris.* Potts ,,

} All three considered to be synonyms of *C. mucedo.*

Lophopus jheringi. Meissner (Brazil).
,, (*Hyalinella*) *lendenfeldi.* Ridley (Australia).
Lophopodella thomasi. Rousselet (Rhodesia, S. Africa).
,, (*Pectinatella*) *carteri.* Hyatt (India, East Africa).

Plumatella stricta. Allman (Belgium)
„ *diffusa.* Leidy (America)
„ *nitida.* „ „
„ *arethusa.* Hyatt „
„ *aplini.* Mac Gillivray (Australia)
„ *lucifuga.* Vaucher, Jullien
„ *hyalina.* Kafka (Bohemia)
„ *polymorpha.* Kraepelin (Germany, etc.)
„ *princeps.* Kraepelin (Germany, etc.)

} All these are considered to be synonyms or varieties of *Pl. repens.*

„ *philippinensis.* Kraepelin (Philippine Islands).
„ (*Hyalinella*) *vesicularis.* Leidy, Jullien (America)
„ „ *vitrea.* Hyatt, Jullien (America)
„ „ *lophopoida* Kafka (Bohemia)

} These are considered synonyms of Hancock's *Pl. punctata.*

Pectinatella magnifica. Leidy (America, Germany).
„ *gelatinosa.* Oka (Japan).

Lophophore circular.

Fredericella regina. Leidy (America)
„ *walkottii.* Hyatt „
„ *pulcherrima.* „ „

} These are considered synonyms of *F. sultana.*

Paludicella mülleri. Kraepelin (Germany).
„ (*Pottsiella*) *erecta.* Potts. Kraepelin (America).

Urnatella gracilis. Leidy (America)
Hislopia lacustris. Carter (Central India)
Norodonia cambodgiensis. Jullien (Indo-China)
„ *sinensis.* Jullien (Indo-China)

} These four species are unlike the other fresh-water Polyzoa, and their affinities lie with the marine species.

As will be seen, the very variable genus *Plumatella*, having a horny, chitinous, tubular, branching ectocyst has the greatest number of species, but the claim to specific rank of nearly every one of these has been denied by one or the other eminent student of this group, who holds that they are synonyms, or at most

only varieties of *Plumatella repens*. It has been stated, with much appearance of truth, that though the extreme forms differ markedly from the type, yet in every case a number of intermediate varieties have been found connecting them with *Plumatella repens*. Monsieur J. Jullien (15), in 1885, was the first to reduce all European Plumatellas to the one species *Pl. repens*; but he strangely accepted all the American species. Professor Kraepelin (17), unable to find a way out of this maze, deposed all the Plumatellas from their specific rank, and created out of them two new types, *Pl. polyforma* and *Pl. princeps*, to which he subordinated the principal varieties. These types are mainly distinguished by their statoblasts, whether broad oval or elongated oval in shape. Some more recent investigators have accepted, whilst others have rejected, this arrangement. For the creeping Plumatellas, with soft, gelatinous tubes, M. Jullien has proposed the new name *Hyalinella*. Mr. Ridley's Australian *Lophopus lendenfeldi* (19) seems to me to belong to this genus. M. Jullien (15) has also renamed the well-known *Lophopus crystallinus* into *L. trembleyi*, which is quite inadmissible according to the rules laid down by the International Congress of Zoology.

As regards their geographical distribution, most of the species have been found in England, America, Germany, France, Bohemia, Hungary, and Russia—that is, wherever they have been really looked for. Isolated species are known from India, Australia, Japan, South America, Egypt, East and West Africa, and now from Rhodesia, but it seems clear that it only requires a systematic search to find them in most countries where there are lakes, pools, canals, or slow-flowing streams.

Coming now more particularly to the species which forms the subject of this paper, I had only the statoblast to guide me in my search for its nearest allies. It is well known, however, that these resting or winter buds, produced only by the phylactolaematous* fresh-water Polyzoa, are very characteristic of the different species, and are mostly quite sufficient by themselves to establish the identity of the animals to which they belong.

The statoblast consists of a central capsule surrounded by a dark brown ring of air cells, called the annulus, which enables the structure to float on the surface of the water. In *Cristatella*

* Which means possessed of a fleshy tongue, or epistome guarding the entrance to the mouth.

mucedo the shape of the statoblasts is circular, surrounded by a number of long hooked spines. *Pectinatella magnifica* has very similar rounded statoblasts furnished with stouter hooked spines, and fewer in number (Fig. 9). In *Plumatella* the shape is a more or less elongated oval, without spines; in *Fredericella* they are kidney-shaped, and without annulus; and in *Lophopus crystallinus* the statoblasts are elliptical, and pointed at both ends (Fig. 8.)

The statoblast of the new species *Lophopodella thomasi*, from Rhodesia (Fig. 3), has some considerable affinity with that of *Lophopus crystallinus*, being elliptical in shape, and also slightly curved in the direction of its longer axis, but instead of being pointed at the ends, it is truncated, and the points are replaced normally by five spines on each side, but their number may be reduced to three or four, and sometimes increased to six. These spines consist of short flattened rods of chitin, which appear to be outgrowths of the lateral edges of the annulus. Some of these spines I have seen to be bifurcate. All round their lateral edges these rods are beset with a number of minute, closely set, and curled-up hooks (Fig. 4) which appear of little functional use. Their structure is clearly seen in immature statoblasts, where the hooklets are still thin and not so much curled (Fig. 5). Collectively the hooklets give a beaded appearance to the spines, and it was only by examining an immature statoblast with as yet very thin annulus that I became aware of their structure. I have counted twenty and twenty-two hooklets round the edge of one of the spines. I have also seen one of the spines split horizontally into two, the hooklets adhering to both halves, showing that when the young bursts open the statoblast, it splits horizontally through the edge of the capsule and annulus, leaving one half of the complete annulus adherent to each half of the central capsule.

The central capsule has a thick, dark reddish brown chitinous covering membrane of lenticular form, convex on one side and flattened on the other; it is very nearly, but not quite circular, having a longer diameter of 385 μ, and shorter diameter of 343 μ, and consists of two halves, similar to two watch-glasses, of different convexity, closely apposed round their edges. I found several of these naked capsules in the tubes of the polypides without annulus. The annulus forms a broad and thick cellular ring, not infrequently a little irregular or

asymetric in shape, and is made up of two horizontal strata, each consisting of a single layer of hollow prismatic cells arranged like the two layers of cells of a honeycomb. The polygonal air cells are largest at the periphery, and become gradually smaller towards the centre. In mature statoblasts the cells cover the central capsule completely on the upper or convex side, whilst they leave a small bare central space on the concave side. The size of the statoblast of *Lophopodella thomasi* is 857 μ long by 642 μ broad; the spines attain a length of 75 μ, but of course the exact shape and size of the whole statoblast are subject to some variation.

The only Polyzoon having statoblasts approaching the characters above described is the one found in 1859 by Mr. H. J. Carter (4) in Bombay, and figured by him in *Ann. Mag. Nat. Hist.*, 1859, ser. 3, vol. iii., p. 341. The statoblast (Fig. 6) is a broad oval in shape, with fourteen short spines at each end, and each of these is provided with six curled hooklets round its edge (Fig. 6). Mr. Carter considered his animal to be a *Lophopus*, though probably different from the European *L. crystallinus*, but he gave it no name. Later, in 1866, Hyatt (7) joined this animal to Leidy's genus *Pectinatella*, and called it *P. carteri*, for insufficient reasons, it seems to me, as I shall show presently. The statoblasts of this same species have in later years (1890) been found by Dr. Stuhlmann in Ugógo, not far from the Victoria Nyanza, in German East Africa, as reported in a paper by Dr. Meissner (24), showing that the species must have a wide distribution.

Reverting to my description of *Lophopodella thomasi*, Mr. Thomas, its discoverer, informs me in a second letter that the only colony he found was attached to the upper surface of a rotten stick, floating in a pool of still water, being an overflow of a small Rhodesian stream. He remarks that the colony was exposed to the full sunshine, and not in a dark and shady place, where he had expected to find Polyzoa. The zoarium (or coenoecium of Allman)—that is, the whole colony stock—consisted of an oval patch of stiff gelatinous hyaline substance (Figs. 1 and 2), about $2\frac{1}{2}$ in. long by $1\frac{1}{4}$ in. broad, and about $\frac{1}{8}$ in. thick, with branching tubular channels radiating from the centre, which were tenanted by numerous polypides. The polypides protruded all round the edge and on the surface of the gelatinous ectocyst, leaving, however, a central oval space quite free of them. They

are quite decayed in the preserved zoarium, but Mr. Thomas says that they had a horse-shoe shaped lophophore and an epistome, and the internal arrangement conformed, no doubt, to that obtaining in *Lophopus*, *Cristatella*, and *Plumatella*, in all of which there is practically no difference in this respect.

At first I felt uncertain whether to place this new species in the genus *Lophopus* or *Pectinatella*, but after a careful study of all the ascertained characters I have come to the conclusion that it must be placed in a new genus, to which I have given the name *Lophopodella*, with *Lophopus* as its nearest ally.

It cannot belong to *Pectinatella*, as *P. magnifica*, the type of this genus, first discovered by Professor Leidy in America, and since found also in Germany, near Hamburg and Berlin, forms very large agglomerated rounded masses, with a gelatinous ectocyst often several inches thick, on the surface of which the animals form closely-set irregular rosette-shaped colonies, with horizontal tubes. The mass may attain the size of a man's head on submerged timber, but has never yet been found on green water-plants. The statoblasts of this species (Fig. 9) are altogether different, being circular, resembling those of *Cristatella mucedo*, with a ring of twelve to twenty long hooked spines, projecting from the outer edge of the annulus.

The statoblasts of *Lophopodella thomasi* have, in general shape and character, a much greater resemblance to those of *Lophopus crystallinus*; but as one of the generic characters of *Lophopus* is, "statoblasts without spines," it is not possible to include this new species in this genus.

I have mentioned above that the Polyzoon which Mr. Carter discovered near Bombay in 1859, and which was named *Pectinatella carteri* by Hyatt (7), has a statoblast (Fig. 6) resembling that of the new species, with fourteen short hooked spines at each end. The following is an extract of Mr. Carter's (4) remarks on his animal (*loc. cit.*, p. 341): "The Lophopus is essentially *L. crystallinus*, but with a different form of statoblast, so that it is probably a new species; but this I leave to others who are acquainted with the fresh-water Polyzoa better than myself to determine, merely observing that, should it be considered a new species, the form of the statoblast will afford the chief distinguishing character. I have not, however, been able to trace the gelatinous envelope, which Professor Allman calls the ectocyst,

beyond the base of the coenoecium, or polypidom, of this Lophopus, where it looks to me like the deciduous tunic of the first or original group, although I have had the opportunity of examining the coenoecium on bodies (the shells of *Paludina bengalensis*) from which it has never been removed. The group, no doubt, can move from place to place if necessary, but its habit is to remain fixed."

From this short and incomplete description, and considering the shape and character of its statoblast, it is clear that this animal does not belong to, and has no affinity with, the genus *Pectinatella*, and I have no hesitation to remove it to the new genus.*

In order to give a clear idea of the appearance of the statoblasts of these various species, I give a figure of those of *Lophopodella thomasi* and *Lophopus crystallinus*, drawn for me by Mr. F. R. Dixon-Nuttall, and reproduce the drawings of Kraepelin and Carter for those of *Pectinatella magnifica* and *Lophopodella carteri* respectively. I may mention here that Allman's figure of the statoblast of *Lophopus crystallinus* is not quite correct, as the polygonal cells of the annulus are very much smaller than there represented.

I have not in this paper touched upon the anatomy nor the development of the Polyzoa from buds, eggs, and statoblasts. These details can readily be studied in the works mentioned in the bibliography (1, 7, 10, 17, 20).

A few words on the preparation and preservation of Polyzoa may be acceptable. By adopting the following method, little difficulty will be found in killing these animals fully extended. A clean and healthy colony is placed in a watch-glass full of water, and when fully expanded one drop of 1 per cent. solution of cocaine or eucaine (β) is mixed with the water. After five to six minutes another drop is added, and so on until five or six drops have been added. In twenty to thirty minutes from the

* Since writing the above I have seen in the British Natural History Museum a slide of this statoblast made by Mr. Carter, from which I observe that its affinity to that of *L. thomasi* is fully confirmed. The spines are thin, with few hooklets, and vary in number from seven to fourteen on each side; the latter, shown in Mr. Carter's figure, is probably the greatest number which he observed. Would it not be possible for some microscopist living in Bombay or Bengal to rediscover this animal and send over some well-preserved specimen?

beginning, the animals will be narcotised and insensible to needle pricks, and are then to be killed and fixed with a solution of 2 per cent. formaldehyde, 1 part of the commercial solution in 15 parts of water (the solution usually sold being mostly much nearer 30 per cent. than the nominal strength of 40 per cent), to which a very little osmic acid solution has been added. After five minutes the Polyzoa are removed and washed in 1 per cent. formaldehyde, and finally preserved in the same fluid.

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Explanation of Plate 3.

Fig. 1. *Lophopodella thomasi*, gelatinous zoarium, with the branching tubes shown at one end only, natural size.

„ 2. *Lophopodella thomasi*. The branching tubes in zoarium magnified about 5 diam.

„ 3. *Lophopodella thomasi*. Statoblast, × 50.

„ 4. „ „ „ the hooked spines, × 200.

„ 5. „ „ the hooked spines of an immature statoblast, × 200.

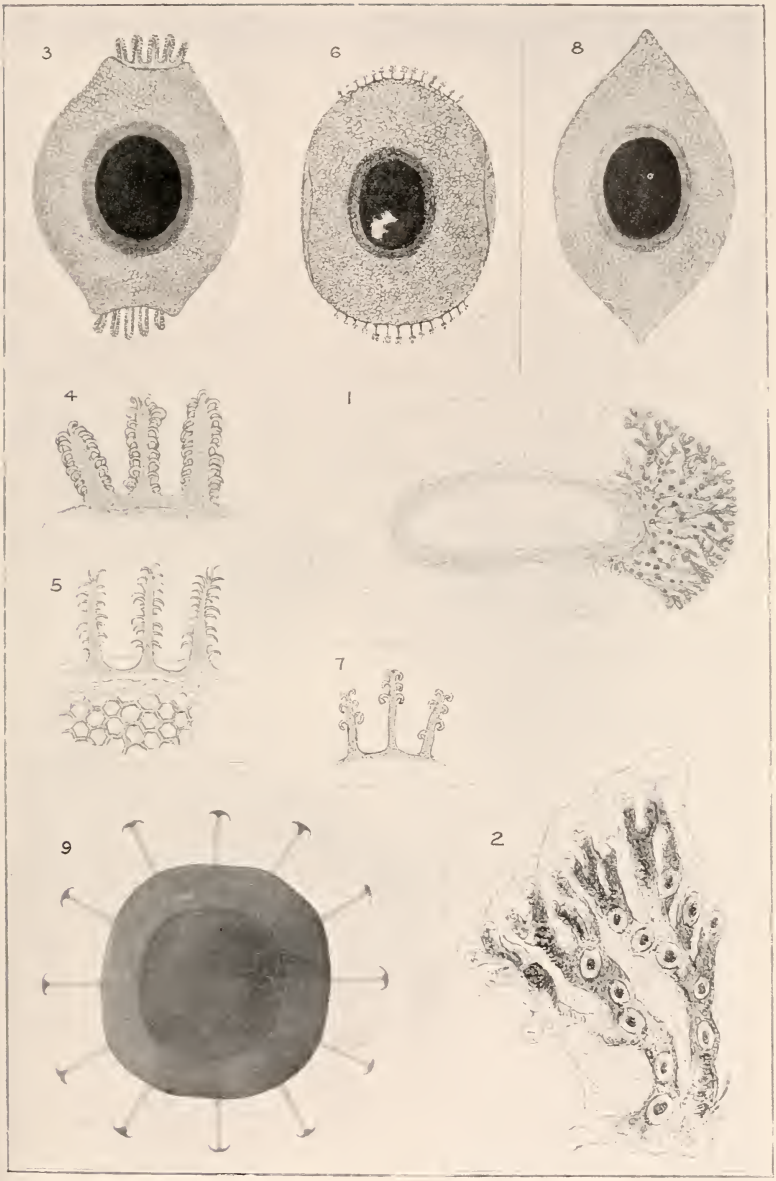
„ 6. *Lophopodella carteri*. Statoblast, × about 44. Copy of Mr. H. J. Carter's figure.

„ 7. *Lophopodella carteri*. Statoblast, the hooked spines, × 200. Copy of Mr. H. J. Carter's figure.

„ 8. *Lophopus crystallinus*. Statoblast, × 50.

„ 9. *Pectinatella magnifica*. Statoblast, × 36. Copy of K. Kraepelin's figure.

Figs. 1 to 5 and 8 have been drawn from nature by Mr. F. R. Dixon-Nuttall, to whom I am greatly indebted for the same; Figs. 6, 7, and 9, are copies from Carter and Kraepelin respectively.



F. R. DIXON-NUTTALL, *del ad nat.*

LOPHOPODELLA THOMASI. GEN. & SP. NOV.