Notes on the Freshwater Fauna of India. No. IX.—
Descriptions of new Freshwater Sponges from
Calcutta, with a record of two known
species from the Himalayas
and a list of the
Indian forms.

By N. ANNANDALE, D.Sc.
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All the forms described below have been found within the
last few months in the Museum tank, Calcutta. Spongilla carteri,
Bowerbank, and S. decipiens, Weber, also occur in this tank,
which is a very favourable habitat for the lower aquatic inverte-
brates. Indeed, I know of no habitat in the neighbourhood of
Calcutta so favourable. I hope to publish later an account of
observations on the biology of several of these Freshwater
Sponges.

Spongilla proliferens, sp. nov. (Fig. 1.)

Diagnosis.

Sponge encrusting, thin, surrounding or spreading over the
roots, leaves and stems of water-plants, and often matting them
together, leaf-green (when exposed to light), rarely extending for
more than about 2 square inches; the surface frequently covered
with minute, rounded branches not more than 3 mm. long,
which separate as buds from the parent at an early stage. Der-
mal membrane delicate, often widely separated from the underly-
ing parts and forming conspicuous, flask-shaped collars round the
oscula, which are congregated; pores few and inconspicuous; deep
channels covered only by the dermal membrane frequently occur
on the surface. Skeleton spicules slender, smooth amphioxo-
I, generally crescentic but sometimes almost straight, 25—30 times
as long as their greatest transverse diameter, gradually pointed.
They are loosely bound together in strands which form an ir-
regularly reticulated skeleton, and on the surface project vertically
upwards through the dermal membrane. Flesh spicules short,
slender, cylindrical amphioxoi or, more commonly, amphistrongyi,
which are profusely and evenly microspined, the spines being
straight and conical; the spicules about 9 times as long as broad.
Gemmule spicules often identical with the flesh spicules, but
less frequently amphioxous and on an average stouter and shorter.
Gemmules separate, subspherical or spherical, often slightly
flattened on one face; the single aperture lateral; the chitinous
coating rather stout, surrounded by a layer of microcell substance
of variable thickness in which the gemmule spicules are arranged
tangentially and vertically, crossing one another irregularly;
the aperture provided with a stout foraminial tubule, which is
constricted near the middle, projects beyond the microcell coating and opens by means of a heart-shaped aperture distally.

Average diameter of gemmule ... 0·55 mm.
" length of skeleton spicule ... 0·36 "
" " flesh spicule ... 0·085 "
" " gemmule ... 0·075 "

Fig. 1. Spongilla proliferans.
A = skeleton spicule, x 200. B = gemmule spicule, x 530. C = flesh spicule, x 530. D = gemmule in optical section, x 55.
Remarks.

This sponge is related to Carter’s *Spongilla alba* from Bombay and Bowerbank’s *S. cerebellata* from central India. It may be recognized by the structure of its gemmules. Its most remarkable feature, however, is its prolific production of buds, which as regards origin are nothing more than branches that become separated from the parent by the ingrowth of the dermal membrane round their bases. I hope to discuss their structure on another occasion. The flesh spicules are very numerous in the dermal membrane, in which they lie pointing in all directions parallel to the surface of the Sponge. They also occur scattered irregularly in the sarcode. The skeleton is feebly coherent owing to the small amount of spongin present.

*Spongilla crassissima*, sp. nov. (Figs. 2, 3.)

**Diagnosis.**

Sponge massive, spherical or spindle-shaped, primarily encrusting, very hard, dark leaden-grey, smooth on the surface as a whole, but with spicules protruding through the delicate external membrane in a slanting direction; oscula grouped in star-shaped areas, which are often approached on the surface of the sponge by radiating channels covered only by the dermal membrane for a considerable distance. Skeleton spicules smooth straight or feebly curved, cylindrical, as a rule rounded at the extremities but bearing a minute conical terminal projection (which contains the end of the axial thread), occasionally pointed abruptly, from 11 to 18 times as long as broad; immature skeleton spicules always slender and amphioxous. Skeleton formed of very firm spicule fascic and extensive spongine webs. No flesh spicules. Gemmule spicules short, cylindrical, irregularly, somewhat sparsely microspined, straight or curved, rounded or abruptly pointed at the ends, about 13 times as long as broad. Gemmules small, spherical, covered with a thick layer of large air-cells and bound together in errant groups of from four to eight; each gemmule provided with a stout, bent foraminal tubule, which is

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**Fig. 2. Spongilla crassissima.**

*Spicules, x 260.*
enlarged at the distant extremity and projects outwards through the air-cells; each group bears a single external layer of gemmule spicules, which lie along its surface; each gemmule has a denser layer of similar spicules immediately outside its chitinous coat, to which they are parallel or tangential; subsidiary apertures sometimes occur.

**Var. bigemmulata.**

Sponge less massive than in the typical form; its surface more or less ridged; colour dull green. Skeleton containing less spongin although very firm. Gemmules arranged both in errant groups and as a pavement layer at the base of the Sponge on its support. Gemmule spicules generally more slender than in the typical form; those in the errant gemmule groups slightly more slender (in the variety) than those on the pavement layer.

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<th>Metric</th>
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<td>&quot; length of the skeleton spicule</td>
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<tr>
<td>(Typical form) average length of the gemmule spicule</td>
<td>0.1275</td>
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<tr>
<td>(Var. bigemmulata) average length of the gemmule spicule (fixed gemmule)</td>
<td>0.1</td>
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<tr>
<td>(Var. bigemmulata) average length of the gemmule spicule (errant)</td>
<td>0.105</td>
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![Diagram](image)

**Fig. 3. Spongilla crassissima.**

Node of skeleton, showing spongin web.

**Remarks.**

The skeleton in these Sponges is constructed of stout fasciae of spicules very firmly bound together by spongin, which also occurs in the form of extensive, sometimes perforate webs at the nodes of the skeleton and occasionally as delicate filaments between the fascie. The fascie are arranged in a close reticulation somewhat irregular as regards its meshes, which are crossed diagonally by single spicules and fascie composed of two or three spicules. The mesh-work surrounds the canals, which radiate outwards from the support of the Sponge and are relatively narrow.
Notes on the Freshwater Fauna of India.

S. crassissima is closely related to the widely distributed and variable species S. frugilis, Leidy; but apart from the form of the skeleton spicules and the great development of spongini in the skeleton, the enlargement of the distal extremity of the foraminiferous tubes of the gemmules is characteristic. The errant gemmule-groups bear a close resemblance to those of Spongia decipiens, Weber; but in the latter the air-cells surrounding each gemmule remain much more distinct from those which surround the other gemmules of the same group than is the case in the new species, and the gemmules are not quite spherical. I have taken great care in satisfying myself that the pavement layer of gemmules is quite absent in the form here defined as typical of the species; while it is a conspicuous feature of the form regarded as a variety of the same species.

Young amphioxous skeleton spicules are numerous immediately under the dermal membrane and in the neighbourhood of the gemmules (which are confined to the inner parts of the sponge); a few of the young spicules are also found lying parallel to the skeleton fasciae. Many of these amphioxo are as long or almost as long as the skeleton spicules, into which they develop (as is evident from the study of intermediate stages) by a thickening of the body of the spicule which does not affect its extreme ends. It is this mode of growth that produces the characteristic skeleton spicule of the species. I was at first inclined to regard the amphioxo in Spongia crassissima as gigantic microscleres, or rather as microscleres varying from extremely minute filamentous structures to spicules as long as, but not as thick as the microscleres. But this view is precluded by the fact that intermediate stages between the extremes as regards these amphioxo on the one hand and between the amphioxo as a whole and the characteristic microscleres which have already been incorporated in the skeleton, on the other, occur frequently, and that the amphioxo are most abundant in parts of the Sponge in which either active growth or active change is most evident; while those amphioxo which occur in neither of these regions generally lie parallel to the fasciae of the skeleton, ready to be affixed to it by the secretion of spongini when they shall be mature. That growth is active on the external surface of the Sponge is proved by the fact that snail-shells which chance to come in contact with it are rapidly overgrown by it; while that considerable changes take place in the neighbourhood of the gemmules is evident from the structure of these bodies. The amphioxo near the surface are not in the dermal membrane but below it. In spite of the large amount of spongini present in the skeleton, the membrane contains comparatively little of this substance and is as delicate as in softer members of the genus.
**Ephydatia indica**, sp. nov. (Fig. 4.)

**Diagnosis.**

Sponge encrusting, flat, firm, thin, matting together the roots of floating plants, almost colourless even in a bright light; the surface smooth; pores and oscula scattered, inconspicuous; external membrane delicate. Skeleton spicules subcylindrical, rounded at the extremities, somewhat irregular in outline, often thicker at one end than at the other, smooth or sparsely spined, 22—25 times as long as broad. (Irregularly shaped amphixoss occur among them occasionally.) Skeleton of very loose and irregular texture, formed of feebly coherent fascic. No flesh spicules. Birotulates with a long, stout shaft covered, especially towards the ends, with straight, slender spines, which are mostly set at right angles to the main axis; rotulae somewhat feebly developed, consisting of circles of similar spines; one rotula often slightly larger than the other; diameter of rotulae not greatly exceeding that of the shaft, which is about 10 times as long as broad. Gemmules small, spherical, scattered in the interior of the Sponge, each surrounded by a thick layer of microcell substance, in which a single layer of birotulates is embedded vertically; the single aperture on a conical prominence.

Average diameter of gemmule ... 0.13 mm.

" length of skeleton spicule 0.258 "

" " birotulate spicule 0.065 "

" diameter of rotulae ... 0.00875 "

**Remarks.**

This Sponge is perhaps related to Pott's *Mecenia crateriformis* from North America and is very distinct from those members

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1 *Mecenia* or *Ephydatia crateriformis* has also been recorded from Ireland, but Weltner is apparently doubtful of the identification.
of the genus which have hitherto been recorded from India. It is common in Calcutta.

_Trochospongilla latouchiana._ sp. nov. (Fig. 5.)

Sponge forming small, shallow, cushion-shaped masses on the stems and roots of water-plants, pale, yellowish-brown in colour; surface minutely hispid; pores and oscula inconspicuous; older specimens divided into two transverse layers by a definite mem-

brane, the gemmules being confined to the lower layer. Skeleton spicules smooth, stout amphixoi about 15 times as long as broad in the middle, sub fusiform, often with one or several irregular projections. (Stout amphistrongylus, often dilated in the middle, occur among them occasionally). Skeleton very loose and irregular. No flesh spicules. Birotulates of simple structure; the rotule circular, flat or nearly flat, sometimes not quite equal; diameter of rotule 4½ to 5½ times that of the shaft, which is about 2½ times as long as broad. Gemmules small, scattered, non-adherent, spherical, covered with a thin layer of microcell substance; the aperture on a slight prominence.

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<tr>
<td>&quot; length of skeleton spicule</td>
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<tr>
<td>&quot; &quot; birotulate spicule</td>
<td>0·0175 &quot;</td>
</tr>
<tr>
<td>diameter of rotula</td>
<td>0·02 &quot;</td>
</tr>
</tbody>
</table>

**Remarks.**

This form is related to the N. American species _Trochospongilla leidyi_ (Bowerbank), from which it is differentiated by its more slender skeleton spicules and the flat or nearly flat discs of its birotulates. Possibly it is no more than a variety of the American species. I have not seen a specimen more than about two inches long and a quarter of an inch deep. All those examined have been narrow and elongate, owing to the fact that they were on
the slender stems and roots of water-plants. In spite of their small size, some of them had evidently persisted long enough for a new layer of skeleton and sarcode to be formed on the top of one in which numbers of gemmules had been produced. Each gemmule is enclosed in an irregular basket-work of skeleton spicules.

As regards the generic position of this and the succeeding forms some doubt may be expressed. Trochospongilla, as accepted by Weltner, is differentiated from Tabella, by the fact that the discs of the birotulates are both equal and entire. In the present instance they are often both equal and entire; but at least as often the outer disc is distinctly, if very slightly, smaller than the inner. In Trochospongilla leidyi, however, which, as I agree with Weltner, is a true Trochospongilla, this is also the case, so far as can be judged from Pott's figures (Proc. Acad. Sci. Philadelphia, xxxiv., pl. xi, fig. 1.) In Vejdovsky's original definition of the genus, the birotulates are described as having discs which are "smooth with entire margins"; no mention is made of their equality or inequality. As regards most of the genera into which the "sub-family" Spongillineae has been divided, it is difficult to draw exact lines of demarcation; indeed, in most cases, one "genus" merges gradually into another. It might be well to regard Ephydalia, Trochospongilla, Tabella, Heteromegenia, and possibly Carterius as no more than sub-genera of the genus Meyenia; but the Spongillineae, as a whole (including all the fresh-water genera) form a group so ill-defined that great difference of opinion is inevitable as to their sub-division.

No species of the genus Trochospongilla has hitherto been recorded from Asia. I name T. latouchiana after Mr. T. Latouche, of the Geological Survey of India.

**Trochospongilla philottiana**, sp. nov. (Fig. 6.)

Sponge flat, encrusting, very thin, spreading in large patches over flat surfaces, almost colourless; surface minutely hispid,

![Diagram](image)

**Fig. 6. Trochospongilla philottiana.**
Spicules, × about 370.

pores and oscula inconspicuous. Skeleton spicules small, moderately stout, cylindrical, amphistrongyls sparsely covered with rounded prominences, straight or almost straight, 16 to 18 times
as long as broad. Skeleton forming a close reticulation with triangular or subtriangular meshes. No flesh spicules. Birotilates with the edge of the outer disc turned inwards and the lower disc flat, the diameter of the discs about five times that of the shaft, which is about half as broad as long. The gemmules separate, cylindrical, with a thin microcol layer, in which the birotulates are embedded vertically, their upper discs forming prominences on its external surface; the aperture infundibular; each gemmule enclosed in a dense basket-work of skeleton spicules; the gemmules forming irregular, one-layered patches in the base of the sponge, not distributed uniformly over its support.

Average diameter of gummule ... 0.18 mm.
" length of skeleton spicules ... 0.1775 "
" " biretulate spicules ... 0.015 "
" diameter of amphidisc ... 0.0225 "

Remarks.

This Sponge is readily distinguishable from the preceding species by the form of its skeleton spicules. It often extends for at least 60 square inches over the surface of brickwork at the edge of the tank, but is never more than four or five millimetres thick. The patches of gemmules at its base are of very irregular outline, and often form almost a reticulated pattern; they are a striking feature in living specimens, in which they are of a bright golden-yellow colour. Owing to the situations it affects, T. philottiana is more liable to desiccation than the majority of the Freshwater Sponges found in Calcutta. When it dries up the gemmules remain attached to its support on account of the firm receptacle of skeleton spicules in which each is held. The affinities of the species are probably with the preceding form. T. philottiana is named after Lieut.-Col. D. C. Philott, Secretary to the Board of Examiners, Calcutta, and Honorary General Secretary of the Asiatic Society of Bengal.

II.

The following note refers to the lake named Bhim Tal, which is situated at an altitude of 4,500 feet in the outer range of the central Himalayas, and to a smaller tarn, one of those known as the Seven Lakes (Sath Tal), at a distance of about three miles from Bhim Tal and at a slightly lower altitude. Naini Tal (6,400 feet) was also searched for Sponges, but in vain.

At the end of the rains (the time of my visit) Bhim Tal is rather over a mile in length and about a quarter of a mile broad. Its depth has been artificially increased during the last few years for purposes of irrigation, and varies at present at different spots from about 15 to over 100 feet. Such water-weeds as grow in it were entirely or almost entirely submerged, and the water was thick and slightly malodorous, apparently owing to the growth of a
microscopic alga, among which the Protozoan *Ceratium longicorne*, Perty, was abundant. The water of the small tarn in the neighbourhood was found, however, to be singularly clear, and I was told that this was the case also as regards several other lakes at about the same altitude which I had not time to visit. Naini Tal is somewhat smaller than Bhim Tal and now not quite so deep. Its water was by no means clear, and the leaves of the numerous water-plants in it were covered with a hard mineral deposit, possibly due to the large amount of lime which exists in the neighbouring rocks.

So far as I have been able to discover, the only lower Invertebrate hitherto recorded from the lakes has been *Ceratium kameonense*, which was described by Carter as long ago as 1871, in the *Annals and Magazine of Natural History*, vol. VII, p. 229. This organism multiplies greatly from time to time, giving the water, according to Carter’s informant, a “rusty brown” colour. Mr. R. K. Ruxton, of Bhim Tal, tells me that when this occurs, or at any rate when the water “turns like blood,” the natives of the district believe that the god of the lake is angry and demanding a human sacrifice.

Collections of Protozoa, Oligochaeta, Rotifers and Entomobranchiata were made both in Bhim Tal and in Naini Tal; but these will be submitted to specialists in Europe who have been kind enough to undertake their description. Several forms of Polyzoa (*Lophopora* and *Plumatella*), with which I hope to deal later, were also found in Bhim Tal. I was disappointed not to find in any of the lakes, or in smaller pools in their vicinity, any species of *Hydra*, although many likely spots were examined.

**Spongilla carteri**, Bowerbank.

Probably the only growing Sponge taken in Bhim Tal (a minute specimen attached to a floating water-plant) should be referred to this species; but its immature condition and the total absence of gemmules renders the identification a little doubtful. There can be no doubt, however, as regards the numerous gemmules of *S. carteri*, which were found floating on the surface both of the lake itself and of other bodies of water in its vicinity. These gemmules were quite normal and agreed in every particular with those produced in the Calcutta tanks. The consistency of this Sponge differs very greatly in different pools even in the same vicinity. It appears to be, so far as can be said at present, the most widely distributed in India of the Indian species.

**Ephydatia robusta** (Potts). (Fig. 7.)

Among the gemmules of *Spongilla carteri* from Bhim Tal, there are a few belonging to the genus *Ephydatia*. These I have little hesitation in identifying with Potts' *Menusa robusta*, which, as Potts himself says, may be a variety of *Ephydatia fluviatilis*. The original definition of the form is as follows:

"Sponge massive, encrusting. Skeleton spicules sub fusiform, pointed, smooth. Gemmules scarce, biretulacases of large size and generally "monstrous" in form; irregularly shaped, shafts abounding in spines as long as rays of the rotulae, cylindrical of conical."

Potts' description of the gemmule spicules applies exactly to those from Bhim Tal, except that among the latter there are a few which have smooth shafts. The average length of the biretulacases is 0.047 mm; and the average diameter of the rotulae 0.027 mm. In Californian specimens the equivalent measurements are approximately 0.023 mm. and 0.02 mm. It would appear, therefore, that in Kumaon specimens the gemmule spicules are slightly larger than in those from America. A few of the

![Diagram](image_url)

**Fig. 7. Ephydatia robusta.**

Gemmules of gemmules from Kumaon, x about 340.

Gemmules from the former locality had skeleton spicules adhering to them which were "sub fusiform, pointed, smooth." Unfortunately they were either broken or so small as to suggest that they were immature. The larger spicules of this class, however, must have had when complete approximately the same actual and relative dimensions as those of the typical *E. robusta*. The gemmules were spherical, with a single, deeply depressed aperture, which was not provided with a foraminal tabule. There was only one layer of gemmule spicules, which were quite vertical in their cellular coating. They varied considerably in size.

*Ephydatia robusta* has only been recorded hitherto from California; so that its occurrence in Kumaon is of considerable interest. The material at my disposal is not sufficient for it to be possible to decide whether or not the Indian form should be regarded as a subspecies or variety of the American.
III.

LIST OF THE INDIAN SPONGILLINÆ.

The list of the Freshwater Sponges recorded from India now stands as follows:—

Genus Spongilla,
S. lacustris var. bengalensis, Annandale. Lower Bengal (brackish water).

" cerebellata,1 Bowerbank. Aurangabad in central India (Nizam’s dominions): Lower Bengal (brackish water).
S. prolificus, Annandale. Calcutta.
S. carteri, Bowerbank Bombay; Kumaon (4,500 feet); Chota Nagpur; Calcutta; central India.
" crassissima, Annandale " var., bipennisata, Annandale. Calcutta.

Genus Ephydatia.
E. mülleri var. meyenii (Carter.) Bombay.
" robusta (Potta) Kumaon (4,500 feet).
S. indica, Annandale. Calcutta.
" plumosa (Carter) Bombay.

Genus Trochospongilla.
" philottiana, "

1 I have lately (October, 1906) found S. cerebellata growing luxuriously in canals of brackish water near Calcutta, while Mr. G. Patra obtained specimens in the present month in brackish pools at Fort Canning. I strongly suspect that both this form and S. alba will be found to be no more than varieties or phases of S. lacustris —N. A., 21: xi-06.