

XXVII.—NOTES ON FRESHWATER SPONGES.

By N. ANNANDALE, B.A., D.Sc., Superintendent, Indian Museum.

VI.—THE MIDDAY SIESTA OF *Spongilla* IN THE TROPICS.

During last winter I was able to keep specimens of *Spongilla crassissima* and *S. proliferens* alive for some weeks in an aquarium. Accidentally, while attempting to demonstrate the currents set up in the water by their activity, I discovered that for some hours in the middle of the day these currents ceased. During their cessation the oscular collars were considerably contracted but not altogether closed, but I have been able to obtain no evidence that the cells that surround the inhalent pores have the power of contraction at all well developed. The cessation of the currents can, therefore, have been due only to cessation of movement on the part of the flagellæ of the collar cells. It is by no means uncommon for coelenterates to remain in a state of quiescence during the heat of the day in the tropics and even in temperate climates, and it is not surprising that sponges should follow the same course. The great majority of the organisms found in ponds in Lower Bengal appear to be adversely affected by heat and, as it were, imperfectly acclimatized. Winter is the only time at which many of them flourish, although this is by far the driest season in Calcutta, and the majority are most active in the evening and early morning.

VII.—DESCRIPTION OF TWO NEW FRESHWATER SPONGES FROM EASTERN BENGAL, WITH REMARKS ON ALLIED FORMS.

The two new sponges here described were found at Rampur Bhoolia (Rajshahi), Eastern Bengal, in February last. Both of them were abundant on reeds and twigs, together with *Spongilla carteri*, Bowerbank, in several ponds near the European quarter of the town.

Spongilla reticulata, (?) sp. nov.

Subgenus *Euspongilla*, Vejdovsky.

Sponge soft, consisting of a thin layer incrusting the support, and of numerous transversely elongated, laterally compressed, delicate branches, which frequently anastomose so as to form a reticulated structure. Colour bright green. Surface smooth, minutely hispid; oscula surrounded by conspicuous membranous collars, which are supported by a delicate ring of spongin; pores minute. Primary radiating fibres of skeleton delicate, feebly coherent, never with more than a few spicules parallel to one another, secondary (transverse) fibres barely distinguishable as such, irregular; the whole skeleton ex-

tremely fragile, spongin being present in exceedingly small quantities. Skeleton spicules smooth, moderately stout, comparatively large, ampioxous, gradually pointed; flesh spicules numerous both in the dermal membrane and in the parenchyma, slender, abruptly pointed or blunt, curved in a wide arc or nearly straight, covered irregularly with relatively large spines, which tend, especially towards the ends of the spicule, to be bent backwards and inwards; gemmule spicules closely similar but stouter. Gemmules large, spherical, yellow, abundant, both in the basal layer and in the branches, covered with a thick layer of granular substance, which is confined externally by a definite chitinous coat; the gemmule spicules arranged horizontally in the latter and tangentially on the former; the single aperture infundibular, not provided with a chitinous tube.

This Sponge is closely related to the very variable species *Spongilla alba*, Carter, from which it may be distinguished by its external form, by the presence of green bodies in the cells of its parenchyma, and by its soft consistency and fragile skeleton.

*Spongilla alba*¹ is, again, very closely allied to *S. lacustris*,¹ of which *S. reticulata* may be no more than a specialized race. An examination of a considerable number of specimens from different parts of Bengal convinces me that the only constant differences between *S. alba* and *S. lacustris* are the following:—

Spongilla alba.

Branches frequently absent, when present, laterally compressed. Colour even in a bright light, white or grey, occasionally dark green owing to the presence in the tissues of extracellular algæ.

Spongilla lacustris.

Branches rarely absent, when present, cylindrical. Colour, in a bright light, leaf-green owing to the presence of chlorophyl corpuscles in cells of the parenchyma.

The skeleton is also stouter in *S. alba* than in *S. lacustris*, and this is perhaps the most important difference.

Differences in external form and in colour are by no means satisfactory foundations for the creating of species in the Spongillinae as a rule. The latter is liable to change from a variety of causes, e.g., leaden-grey examples of *Ephydatia indica* become white if kept alive in an aquarium, and it is well known that the chlorophyl corpuscles, which probably start life as independent organisms, become colourless if kept in the dark or even in a dull light. As regards the presence of such bodies in *S. lacustris*, however, and their absence from *S. alba*, it is not sufficient to suppose that the free-living organism does not occur in the

¹ Petr differentiates between the two forms (in Bohemian) in *Abh. Böhmisch Ges.*, viii, p. 27, pl. i. Unfortunately I am unable to read what he says. His figures of the gemmules are clear, if somewhat diagrammatic, but do not, of course, illustrate their range of variation. (Lately I have found the typical *S. lacustris* in W. India. Dec., 1907.)

water of Indian ponds, for the " corpuscles " are found not only in the closely allied *S. reticulata* but also in *S. proliferens*, a form that I have frequently taken in the same pond as *S. alba*. Some peculiarity, structural or physiological, in the cells of the parenchyma is argued by their absence from *S. alba*. Both *S. lacustris* and *S. alba* vary greatly in external form; but it is noteworthy that not only is *S. alba* far more frequently devoid of branches than *S. lacustris*, but in the latter the branches appear never to show any tendency to be laterally compressed—the shape they always take in *S. alba*, if they are present at all. Very often they occur in this species merely as ridges or irregular projections on the surface, but frequently they are well developed. Gemmules of *S. lacustris* generally have a chitinous cup surrounding the aperture; such a cup is sometimes present in those of *S. alba* but often completely absent.

For these reasons I think it advisable to regard *S. alba* conventionally as a species distinct from *S. lacustris*, of which, however, it is a close ally.

My *S. lacustris* var. *bengalensis* is a synonym of *S. alba*, between the typical form of which and Bowerbank's *S. cerebellata* I can draw no line, although Carter recognized *S. cerebellata* as a variety of his species. The arrangement, as well as the proportions, of the gemmule spicules differs even in different gemmules of the same specimen, and I find that flesh spicules are often present in one part of a sponge and absent from another.

Specimens of *S. alba* were obtained during winter in salt water in the Chilka Lake, Orissa, by Babu Gopal Chandra Chatterjee, who has presented them to the Museum. They form a thin layer, without a trace of branches, on and between the shells of mussels (*Mytilus striatulus*), are devoid of flesh spicules and have larger and stouter skeleton spicules than any other form of the species with which I am acquainted. Their finder tells me that they were white in life. I name this form provisionally *S. alba* var. *marina*, but it is possible that it is only a temporary phase. In the Port Canning ponds *S. alba* (*bengalensis*) was devoid of branches in the winter of 1905-1906, but was profusely branched in the succeeding cold weather, all the individuals of the first phase having died down in the intervening seasons. It is worthy of note that *S. alba* resembles *S. lacustris* not only in its structure and its variability, but also in being able to live in salt water, a medium in which the latter species has frequently been found in the Northern Hemisphere.

Spongilla crassior, sp. nov.

Subgenus *Spongilla*, Wierzejski.

Sponge incrusting its support in a thin layer, very hard and firm, of a yellowish colour, the external surface smooth, without projecting spicules, the oscula situated on star-shaped areas, the pores minute. Both vertical and transverse fibres of the

skeleton extremely massive, especially so (but irregularly arranged) towards the external surface; a large amount of spongin present in the skeleton. Skeleton spicules short, stout, smooth, straight or nearly straight, abruptly rounded at the ends, but often with a very slender and minute terminal projection; no flesh spicules; gemmule spicules slender, cylindrical, amphistrongylous, nearly straight, uniformly covered with minute blunt spines; arranged in distinct layers, one of which lies horizontally on the external surface of the gemmule group, while the other is situated, with the spicules lying tangentially, immediately outside each gemmule. The gemmules small, spherical, grouped together in groups of various sizes; the "cells" surrounding them large, polygonal in cross section, in many layers; the main aperture of each gemmule provided with a long, trumpet-shaped, curved tubule, which opens outwards; subsidiary apertures sometimes present. The gemmules occupying the whole of sponge except a thin external layer, in which the interstices of the skeleton are small.

In external appearance this species closely resembles *S. fragilis*, Leidy, a form widely distributed in Europe and America, recorded from Australia, and lately found by myself in the Museum tank in Calcutta, in which it was growing (together with *S. alba*, *S. carteri*, *Ephydatia fluviatilis* var. *meyeni*, *Trochospongilla phillottiana* and *T. latouchiana*) on a brick wall. *Spongilla crassior* is, however, most nearly related to my *S. crassissima*, but its skeleton spicules are stouter. The four Indian representatives of the subgenus are all very close to one another, and I have had much difficulty in separating them. As three of them are common in Calcutta and I have, therefore, been able to examine a considerable number of specimens, I think the following key will be found useful in distinguishing them:—

SUBGENUS *Spongilla* (GEMMULES BOUND TOGETHER IN GROUPS, EACH OF WHICH IS ENCLOSED IN A MASS OF POLYGONAL "CELLS").

- A. *Gemmule spicules apparently not arranged in two layers*—
 - a. Skeleton spicules amphioxous; fibres of skeleton delicate—*Spongilla decipiens*, Weber.
- B. *Gemmule spicules clearly arranged in an outer and an inner layer*—
 - b. Framework of skeleton not very stout; skeleton spicules amphioxous; sponge incrusting—*Spongilla fragilis*, Leidy.
 - b. Fibres of skeleton moderate, forming a close, hard reticulation; sponge forming spherical or spindle-shaped masses—*Spongilla crassissima*, mihi.

- b². Fibres of skeleton extremely massive, especially towards the external surface, skeleton spicules sausage-shaped, sponge incrusting—*Spongilla crassior*, sp. nov.

Weber says in his original description of *S. decipiens* that the gemmule tubules are short and straight, but I do not find this feature to be constant in Indian specimens. In the same gemmule group, indeed, short, straight tubules and long curved ones often occur, and although Potts states that in *S. fragilis* the tubules are of equal diameter throughout, I cannot regard this character as of specific value by itself, for in all the species of the subgenus as yet recorded from India the outline of the tubules is frequently irregular. My examples of *S. fragilis* differ from the figures of palæarctic specimens in having stouter skeleton spicules, some of which are pointed so abruptly that they are almost amphistrongyloous.

I now see reason to regard my *S. crassissima* var. *bigemmulata* not as a true variety but as a temporary phase of the species. I have only found it at the beginning of the cold season, that is to say, at a date at which the typical *S. crassissima* is still rare, and the very numerous amphioxi and comparative looseness of the skeleton in all my specimens point to immaturity. In several other species, notably in *S. carteri*, I find that the skeleton is less compact at the beginning of the season than it afterwards becomes, although I also find that in *S. carteri* the strengthening of the skeleton, due chiefly to the development of the transverse fibres, does not go so far in some ponds as in others in the same neighbourhood. Indeed, I feel confident in stating, after examining a large number of examples of this species *in situ* in different ponds in Calcutta at different times of the year, and on single occasions at Rajshahi and Lucknow, that the strength of the skeleton is correlated, whether fortuitously or not I cannot as yet say, with the character of the vegetation of the pond; examples from ponds in which Phanerogamic plants are few, have, towards the end of the cold weather, comparatively stout skeletons, whereas those from ponds in which such plants grow luxuriantly, are fragile even at this date; specimens from both are fragile during the hot weather and the rains—seasons during which few individuals of *S. carteri* are found alive and gemmules are rarely formed. Specimens of this species taken at these seasons are, moreover, as a rule smooth and rounded on the surface, with the exhalent apertures few, large and very deep. They are of a pale flesh-colour, rarely tinged with green in life, and have the peculiar property of turning spirit a dark brown and becoming brown themselves in alcohol, a property I have not seen in specimens taken at other times of the year. Although the majority of "hot-weather" specimens are of this form, I have, however, taken others of a more typical one even at this season.

Ephydatia indica also shows seasonal variation as regards its

skeleton spicules, which in May are pointed and irregularly inflated, and in July and August are blunt at the extremities and much more nearly regular in outline; gemmules are found at both seasons but their spicules likewise differ in shape (*Rec. Ind. Mus.*, i, part 3, p. 273).

There can be no doubt, therefore, that considerable seasonal variation occurs in the freshwater sponges of the Ganges delta, and, indeed, this might have been expected from the plastic nature of these organisms and the wide range of temperature to which they are exposed in a district on the verge of the tropics.

REFERENCES.

- Carter, H. J. "History, etc., of known species of *Spongilla*," *Ann. Mag. Nat. Hist.* (5), vii, p. 77 (1881).
- Potts, E. "Contributions towards a Synopsis of the American Forms of Freshwater Sponges," etc., *Proc. Acad. Sci. Philadelphia*, xxix, p. 159 (1887).
- Weber, M. "Spongillidæ des Indischen Archipels," *Zool. Ergebnisse einer Reise in Niederländisch Ost Indien*, vol. i, p. 30 (1890).
- Weltner, W. "Die Süßwasserschwämme," in Zacharias, *Die Tier- und Pflanzenwelt des Süßwassers*, vol. i, p. 187 (1891).
- Weltner, W. "Spongillidenstudien, III," *Archiv f. Naturgesch.*, lxi, p. 114 (1895).
- Annandale, N. "Notes on the Freshwater Fauna of India, No. IX," *Journ. Asiat. Soc. Bengal*, 1907, p. 15.
- Annandale, N. "The Fauna of Brackish Ponds at Port Canning, Lower Bengal, Part I," *Rec. Ind. Mus.*, i, p. 37 (1907).