SPONGES FROM BRACKISH WATER ON VERLATEN ISLAND NEAR KRAKATAU.

By

N. ANNANDALE, *D. Sc.*,

(Zoological Survey of India, Calcutta).

In his interesting account of the fauna of Krakatau and the neighbouring islands Dr. K. W. DAMMERMAN [1]) refers to a sponge found in a small lake recently shut off from the sea on Verlaten Island. The water of this lake varies in salinity with the seasons, naturally becoming much fresher in the rainy season, while the salinity is increased by evaporation in the dry season. Thus in April, 1920 the proportion of salts (at what temperature is not stated) was 20.6 $^0/_{00}$, while in October, 1921 it was 29.0 $^0/_{00}$. In a small pool on the shore of the lake the corresponding salinities were 12.85 $^0/_{00}$ and 27.9 $^0/_{00}$. Dr. DAMMERMAN has been kind enough to send me the specimens of sponges collected by himself and Dr. SUNIER in brackish water on the island, while Professor MAX WEBER has sent me others from Amsterdam. Among them I find examples of four species:—

Laxosuberites lacustris ANNANDALE, var. *collaris*, nov.,
Reniera cinerea (GRANT),
Mycale relicta, sp. nov.,
Amorphinopsis excavans CARTER, var. *mollis*, nov.

The first of these species was only known hitherto from a lagoon of brackish water of very variable salinity on the east coast of Peninsular India. It is a species in which both gemmules and embryos seem to be peculiarly adapted for a life in water of low salinity [2]). The gemmules are capable of being transported by the wind, but probably not for very great distances. The species probably occurs in the open sea, though it has been found as yet only in brackish water. It would be bery interesting to know whether its reproductive bodies are similar in different types of environment. Unfortunately neither gemmules nor embryos are present in the specimens from Verlaten Island, the spicules of which are sufficiently different from those of the *forma typica* to justify the description of a new variety.

The *Reniera* is apparently identical with a species originally described from British seas but since recorded both from the Arctic Region and the tropical Pacific. There is no previous record of its occurrence in brackish water.

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[1]) DAMMERMAN, *Treubia* III, p. 89, fig. 2 (1922).
[2]) ANNANDALE, *Mem. Ind. Mus.* V, p. 48, fig. 11 (1915).

Amorphinopsis excavans was originally described by CARTER [1]) from the Mergui Archipelago, off the coast of Burma. It was known to him as a boring species in dead coral, or rather, as I have shown elsewhere [2]), as an invader of the excavations made by *Cliona*. The species is, however, porymorphic and other phases or varieties have been described from the coast of Burma and from a creek in the Malay Peninsula [3]). In the latter situation the water, though tidal, may have been a little brackish. The sponge was found to be able to endure partial desiccation for considerable periods at low tide.

The *Mycale* is apparantly an undescribed species. I do not know the genus as an inhabitant of brackish water in the East, but there are many species on the coasts of India and Malaysia. I found three living together in Madras harbour [4]).

The type-specimens of the new species and varieties have been retained in the Indian Museum, Calcutta, which schizotypes have been returned to Java.

Fam. SUBERITIDAE.

Laxosuberites lacustris, ANNANDALE.

Several very small specimens consisting of delicate films on fragments of pumice seem to represent a variety of this species.

L. lacustris was only known hitherto from the Chilka Lake on the east coast of Peninsular India, where it was found in brackish and even fresh water.

var. **collaris,** nov.

The structure of the sponge is identical with that of the *forma typica*, but the spicules are rather larger on an average (though there is considerable variation in this respect in specimens from the Chilka Lake), include a large proportion of slightly curved tylostyles and are distinguished almost invariably by the presence of delicate ring or collar round the base of the head,

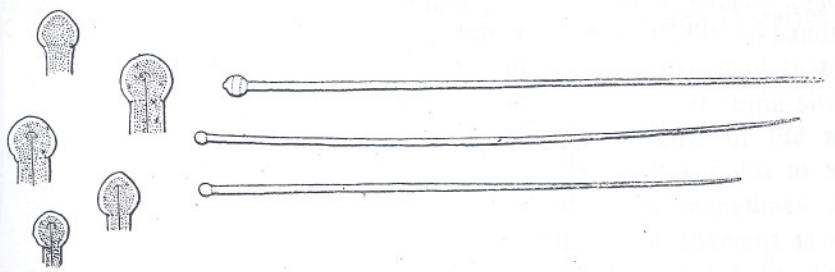

Fig. 1. Spicules of *Laxosuberites lacustris* var. *collaris*, nov.
The upper complete spicules × 375.
The lower complete spicules × 250.
Heads further enlarged (× 375).

[1]) CARTER, *Journ. Linn. Soc.* (*Zool*). XXI, p. 77, pl. v, figs. 12-15 (1889).
[2]) ANNANDALE, *Rec. Ind. Mus.* XI, p. 467, figs. 4,5 (1915).
[3]) ANNANDALE, *Mem. Asiat. Soc. Bengal* VI, p. 198. pl. ii, fig. 3; p. ix fig. 1.
[4]) ANNANDALE, *Rec. Ind. Mus.* X, p. 150 (1914).

which is often acuminate or heart-shaped, rarely quite spherical. The axial filament is conspicuous in most spicules. The largest spicules are as much as 0.8 in length or even slightly longer.

This form is probably allied to *L. proteus,* HENTSCHEL [1]), but differs from all the varieties of that species in the horizontal course of the spicule-fibres immediately below the epidermal membrane.

The specimens were collected by Dr. DAMMERMAN in the lake on Verlaten Island in October, 1921, when the salinity of the water was 29 $^0/_{00}$.

Fam. **HAPLOSCHERIDAE.**

Reniera cinerea (GRANT).

1866. *Isodictya cinerea,* BOWERBANK, *Mon. Brit. Spong.* II, p. 241, and III, pl. XLVIII, figs. 1, 5.

1902. *Reniera cinerea,* LUNDBECK, *Ingolf-Exp.* VI, *Porifera* I, p. 43, pl. XI, fig. 10.

It is without much doubt that I refer to this cosmopolitan species several small, colourless fragments collected among algae in the lake on Verlaten Island with some small Ophiuroids in October, 1921, presumably in water of a salinity of 17.9. The general structure of these fragments, so far as it can be seen, agrees well with BOWERBANK's description, while the outlines, and particularly the curvature of the spicules resemble those of LUNDBECK's figures. The proportions of the spicules are somewhat variable and they may be slightly larger than those of LUNDBECK's specimens, but the Danish author's statement on this point is not very precise and there is considerable variation in different specimens. The following measurements have been taken by my assistant Mr. H. SRINIVASA RAO on a series of spicules from Verlaten Island: —

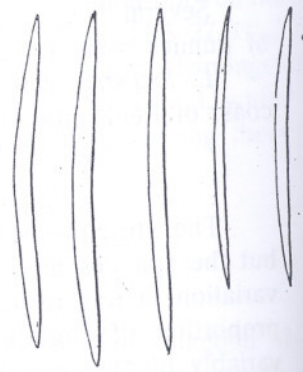

Fig. 2. Spicules of *Reniera cinerea* (Grant) × 250.

Length	Max. Diam.
0.156	0.0072
0.168	0.0080
0.148	0.0080
0.180	0.0072
0.172	0.0072
0.160	0.0080

Scattered in the parenchyma there are numerous small rounded bodies covered densely with spicules resembling those of the skeleton but much smaller. They are probably embryos.

[1]) HENTSCHEL in MICHAELSEN and HARTMEYER's *Fauna Südwest-Australiens* II, p. 389, figs. 20—23 (1910).

R. cinerea, though not found hitherto, so far as I am aware, in brackish water, is evidently a species capable of adapting itself to very diverse types of environment. It has been taken in fairly deep but warm water off the Philippines and also on the coast of Spitzbergen and in Davis Strait.

Fam. DESMACIDONIDAE.

Mycale relicta, sp. nov.

The only specimen of this species I have examined is somewhat macerated, having been preserved in formalin. It was attached to a stick with specimens of *Balanus amphitrite* var. *formosus* and with a small branching alga the branches of which permeated the sponge, which seems to have been massive or possibly plumose, of small size, (not exceeding 3 cm. in maximum diameter), soft and without well-defined outlines. The colour in formalin is pale grey with a pinkish tinge. The arrangement of the spicules and fibres is rendered obscure by the bad state of preservation, but the fibres especially towards the periphery, evidently originated from the branches of alga very much in the same way as those of *M. mytilorum* do from worm-tubes in the sponge (ANNANDALE, *op. cit.*, 1914, pl. xi, figs. 2, 3).

Fig. 3. Spicules of *Mycale relicta*, sp. nov. Tylostyles and Sigmata × 250. Anisochelae × 700.

There are three types of spicules, *viz.*, tylostyles, anisochelae and sigmata, all of which except the tylostyles (megascleres) are rather scarce.

Tylostyles. These spicules constitute the skeleton. They are slender, straight and rather short, with a broadly oval, not clearly differentiated, head which merges gradually into the shaft. This is somewhat contracted for some distance below the head and then gradually expands to a breadth slightly greater than that of the head, the broadest point being situated a little below the middle of the spicule, which tapers from this point to a sharp tip. The outline is sometimes a little irregular. The axial filament is distinct and often slightly dilated in the head. The length varies from 0.216 to 0.383 mm. and the maximum diameter of the shaft from 0.0072 to 0.01 mm.

Anisochelae. They are not arranged in rosettes but scattered somewhat sparingly in the parenchyma. They are very small (0.02— 0.026 mm. in length) and are remarkable for their small hoods and for the way in which the extremity is produced into a sharp point in lateral view and often slightly

retroverted. The hood is pressed in rather close to the shaft. It is short and broad in anterior view. The other retroverted extremity of the spicule is rather short, sometimes blunt in lateral view and sometimes produced into a fine point, as a rule twisted a little to one side. The whole structure of the spicule is simple.

Sigmata. These are scarce but appear to be less so in some parts of the parenchyma than in others. They are slender, (especially towards the tips), rather small, C-shaped, sometimes a little contorted or even S-shaped in their long axis. The greatest length varies, measured from point to point on the curve, from 0.044 to 0.6 mm.

What appear to be gemmules in an early stage of development are scattered through the sponge.

Habitat. Small lake of brackish water on Verlaten Island, near Krakatau, Malay Archipelago (A. SUNIER coll., 27—29. iv.'19). DAMMERMAN gives the salinity of the water at the time as 22.8 $^0/_{00}$.

Fam. **AXINELLIDAE.**

Amorphinopsis excavans CARTER.

This sponge (the genus of which is of very doubtful systematic position but certainly synonomous with *Spongosorites*, TOPSENT [1]) seems to be polymorphic. On each occasion on which it has been found it has occurred in a different variety or phase. The *forma typica* (CARTER. 1889) occupies and enlarges the burrows of *Cliona* in dead coral in the Mergui Archipelago off the coast of Tenasserim, the form *digitifera* (ANNANDALE, 1915) grows on rocks on the shore of Tavoy Island off the same coast and produces compressed finger-like processes, while the form *robinsoni* (ANNANDALE, 1918) encrusts the wooden piles of a pier up a creek on the west coast of the Malay Peninsula. A specimen from Verlaten Island represents yet a fourth form.

A. excavans appears to be related to DENDY's *Spongosorites topsenti* [2]) from Ceylon, but the spicules of that species are much shorter and often more irregular than in any of the varieties of CARTER's species.

var. **mollis.**

The only specimen I have examined forms an almost spherical mass about 5 cm. in diameter but with many fragments of pumice and at least one bivalve shell in its interior. A single patent osculum of oval form, 2 mm. x 1.5 mm. in greater and smaller diameter, is situated on one side on a low, broad, rounded eminence. The form of the sponge is more massive, the structure more cavernous and the consistency softer than that of the other varieties described and the ectosome appears to be more delicate. The spicules

[1]) TOPSENT, *Mem. Zool. Soc. France* IX, p. 117 (1896) and *Arch. Zool. Exp. et. gen.* (3) VIII, p. 265 (1900).

[2]) DENDY in HEDMAN's, *Ceylon Pearl Fisheries* III, p. 182, pl. xii, fig. 1.

agree closely with those of the typical form except that none of the styli are quite so large as the largest in that form.

This specimen was found by Dr. DAMMERMAN in the lake on Verlaten Island. It was apparently attached to fragments of pumice. The date was Oct. 25., 1912, when the water had a salinity of 29 $^0/_{00}$ the highest found at any season.

The typical form of the species and the var. *digitifera* were found in the sea, but the water in which the encrusting form *robinsoni* occurred to me was probably brackish, at any rate in floods.

The drawings of spicules reproduced in this paper have been prepared under my supervision by Mr. H. SRINIVASA RAO and BABU D. N. BAGCHI, to whom my best thanks are due.