

strong tooth near apex, hind tibiae about twice the length of the hind tarsi, deeply grooved beneath with a fringe of fine black hairs inside groove; hind tarsi also fringed with black hairs beneath.

Type. No. 8064/H.I. in the collection of the Zoological Survey of India.

This species is very closely related to *E. indica* and *E. paivana* from which it differs chiefly in the total absence of any black markings on its upperside; the transversely impressed line near the base of the scutellum is sufficient to differentiate it structurally from any allied form.

Enithares templetoni (Kirby).

Three specimens from small pools at the edge of the river at Medha, and three from small rocky streams at Khandalla. "Dives under water and clings to stones some inches below the surface. N. A." Evidently a very widely distributed species. Represented in the collection of the Zoological Survey of India from various localities in the Western Himalayas, Bombay Presidency, Ceylon and Southern Shan States.

Family CORIXIDAE.

Corixa hieroglyphica, Duf.

A number of specimens from small pools at the edge of the river at Medha.

VIII. SPONGES FROM THE SATARA AND POONA DISTRICTS AND FROM CHOTA (CHUTIA) NAGPUR.

I have already discussed Spongillidae from the Satara district in my paper on the sponges of the Malabar Zone (*Rec. Ind. Mus.* VII, pp. 383-397: 1912) and have referred to specimens from the Poona district in an earlier paper (*ibid.*, VI, pp. 225, 226: 1911); but when I wrote these papers I had not visited the districts myself, and observation of sponges in the natural surroundings is always important. The species that inhabit the beds of rocky streams are of particular interest, and I am now able to compare those that do so at Medha with those found in a very similar stream at Chakradharpur in Chota Nagpur near the centre of Peninsular India. I have not yet found any sponge in a small mountain torrent such as those at Khandalla, in which food is probably deficient; but when these streams are dammed to form ponds in which aquatic vegetation grows up, sponges soon make their appearance.

So far as my experience goes, Spongillidae that grow on the rocks of Indian streams are always encrusting forms. Massive sponges would be in danger of destruction in floods, and although

the lax branches of *Spongilla lacustris* may be observed hanging in the water of placid streams such as the Isis at Oxford, the only branched form from running water that I can call to mind in the tropics is the South American *Uruguayia*, in which the skeleton is of coralline hardness. In the creeks of the Gangetic delta *Spongilla alba* may seem to be a branched form even when the water is moved by sluggish currents. It is not really so, but an encrusting sponge covering the roots or stems of grasses.

The sponges of Indian streams vary considerably both in external appearance and in internal structure. As a rule they are either of a vivid leaf-green colour or of a dense purplish-brown or black. They may be either soft or extremely hard; they usually spread over considerable areas, but are sometimes confined to pockets in the rock. Their colour, whether black or green, is due to the presence of large numbers of minute organized bodies in their cells. These bodies probably represent in all cases a stage in the life history of a microscopic alga, but whether the green corpuscles are all specifically identical we do not know, and no investigation has been made of the purple corpuscles which cause the darker colour. Black or brown sponges occur together with green ones and though their colour has no generic significance, it appears to be, in spite of its quasi-parasitic origin, of specific importance.

All the green sponges from rocky streams with which I am acquainted have a peculiar type of circulatory system that is often to be found in thin encrusting sponges, not only among the Spongillidae but also in several marine Tetraxonid families. In this type the pores, which are usually of relatively large size, are arranged in more or less circular groups immediately over the mouths of relatively wide inhalent canals, which run vertically downwards to near the base of the sponge, giving off lateral channels which convey the incoming water to the ciliated chambers. The exhausted water returns through other channels of similar calibre to the surface of the parenchyma, where it enters relatively wide horizontal canals that ramify immediately below the dermal membrane, which forms their roof. Each system has an osculum situated near the centre of these ramifying channels. It is never of large size and is always protected by a conical dermal collar, which is highly contractile and disappears in preserved specimens. This type of circulatory system is found among marine sponges that encrust rocks in shallow water and is by no means peculiar to green species; among the Spongillidae it is also found in almost colourless lacustrine species that grow near the edge of lakes on the lower surface of stones. Its development has no taxonomic significance but appears to be correlated with growth in the form of a thin layer on smooth surfaces in situations in which there is considerable movement in the water and danger from the accumulation of silt.

I collected specimens of the following species in the Satara and Poona districts and in Chota Nagpur:—

<i>Spongilla lacustris</i> var. <i>proliferens</i> , Annand.	..	Artificial pond at Khandalla
<i>S. cinerea</i> , Carter	.. ..	Streams near Chakradharpur
<i>S. perviridis</i> , sp. nov.	.. ..	Stream at Medha; rocky artificial pools in Satara fort and at Karla in the Poona district.
<i>S. crateriformis</i> , Potts	.. ..	Artificial pond at Khandalla.
<i>S. sumatrana</i> , Weber	.. ..	Well at Medha.
<i>S. sumatrana</i> var. <i>rvularis</i> , nov.	.. ..	Stream at Medha.
<i>S. sumatrana</i> var. <i>centralis</i> , nov.	.. ..	Stream at Chakradharpur.
<i>S. carteri</i> , Carter	.. ..	Reservoir in the Satara fort.
<i>Corvospongilla ultima</i> var. <i>spinosa</i> , Annand.	..	Stream at Medha.

Of these species I need only discuss *S. cinerea*, *S. perviridis*, and *S. sumatrana* with its varieties.

***Spongilla* (*Euspongilla*) *cinerea*, Carter.**

(Plate VI, figs. 1, 1a, 1b).

1911. *Spongilla cinerea*, Annandale, *Faun. Brit. Ind., Freshw. Sponges*, etc., p. 79, fig. 10.

This sponge, which appears to be very rare, has been known to me until recently merely from Carter's description, from a dried schizotype of the original specimen from a tank at Bombay and from some very imperfect material from Nasik. Living specimens were, however, obtained by Dr. Gravely and myself in Chota Nagpur some months ago and I am now able to differentiate from Carter's species a closely allied form (here described under the name *S. perviridis*) that I formerly believed to be a mountain phase of it.

S. cinerea may be distinguished from all other species of the subgenus *Euspongilla* yet known by three characters:—

- (1) Its dense purplish-brown or black colour.
- (2) Its very finely spinose or subspinose skeleton-spicules.
- (3) The great regularity of its skeletal structure.

To take these characters in order. The colour is due to the presence in the cells of both the parenchyma and the dermal membrane¹ of minute organized bodies resembling the green

¹ This is also the case in *Corvospongilla ultima* var. *spinosa*.

corpuscles of many freshwater sponges in structure but of a deep purple colour, which is not soluble in spirit.

The spinosity of the megascleres is so faint that it is apt to escape notice altogether unless they are examined under a very high power of the microscope. The tips are smooth.

The regularity of the skeleton is due mainly to the compact formation and large number of the primary radiating or vertical spicule-fibres, which run upwards through the sponge for considerable distances without branching and are joined together by much less regular cross-fibres or by groups of spicules. The vertical fibres contain a considerable amount of binding substance.

The gemmules are small and very numerous in all the specimens I have examined. They have a thick pneumatic layer in which the air-spaces are very minute, and a slender, straight, projecting foraminal tubule.

In February, 1918 Dr. Gravely and I found specimens at two localities in the Singbhum district of Chota Nagpur, in a rocky stream close to Chakradharpur and in a pool of muddy water, evidently part of a sluggish stream in the rains, on the road between that place and Chaibassa.

At Chakradharpur the sponge was growing on the rocky bed of the stream in clear running water. It was essentially of encrusting habit but in little pockets in the rock showed a tendency to adopt a cushion-like form and was then a centimetre or more thick. The oscula were small on the flat rock but in the pockets become larger (about 5 mm. in diameter). In all cases they opened into wide vertical exhalent canals and horizontal subdermal exhalent canals were absent. The sponge was very soft and of a deep purple-brown colour. Our specimens from a pool on the Chaibassa road were attached to the lower surface of bricks at the base of the piers of a bridge. They had a cushion-like form and were harder and blacker than those from the stream. Their oscula were small and branching horizontal exhalent channels were conspicuous on the surface of the parenchyma.

***Spongilla (Euspongilla) perviridis*, sp. nov.**

(Plate VI, figs. 2, 2a, 2b).

1912. *Spongilla cinerea*, Annandale (*nec* Carter), *Rec. Ind. Mus.* VII, pp. 137, 387.

This sponge, though closely related to *S. cinerea*, can always be distinguished by the following characters:—

- (1) Purple corpuscles are absent from both parenchyma and dermal membrane and are replaced in the former only by green corpuscles.
- (2) The skeleton-spicules are more distinctly spiny, but also have smooth extremities.
- (3) The skeleton is much less regular.
- (4) The oscula are always small and surrounded by radiating exhalent channels.

Type-specimen.—P 59/1 *Zoological Survey of India (Ind. Mus.)*.

Distribution.—I have examined specimens from the Kumaon lakes in the Western Himalayas as well as from the Koyna and Yenna rivers in the Satara district and from artificial reservoirs in the Satara fort and at Karla in the Poona district. At the last-named place I found the surface of the water densely covered with gemmules from dried sponges exposed on rocks.

***Spongilla (Stratospongilla) sumatrana*, Weber.**

1800. *Spongilla sumatrana*, Weber, *Zool. Ergebn. Niederl. Ost.-Ind.*, 1, p. 38, pl. iv, figs. 6-10.

S. sumatrana has not hitherto been recognized as occurring in British India, though reported from both Sumatra and the Nile. In describing *S. indica* and *S. gravelyi* I pointed out their close relationship to this species, but in the absence of linking forms was obliged to regard them as specifically distinct. Linking forms have, however, now been found and specimens of the *forma typica* discovered in Indian territory. The species seems to be an extremely plastic one and at least five varieties may be recognized. The species as a species must, therefore, be defined in somewhat general terms. I believe that the following description should be adequate.

Sponge thin and encrusting, of a bright green colour except when in deep shade or very muddy water, with small oscula and horizontal ramifying subdermal exhalent channels, with a hard but very friable skeleton formed of large numbers of macroscleres without well-defined spicule-fibres, with short slender macroscleres the majority of which are spiny, with slender amphioxous or amphistrongylous free microscleres that are always densely covered with short spines and are usually abundant in the dermal membrane, with short, compact amphistrongylous gemmule-spicules also covered with short spines; gemmules small, spherical, covered with a single layer of microscleres arranged mosaic wise in a single layer in an outer horny membrane, with a short, nearly straight foraminal tubule.

***forma typica*.**

In this form the skeleton-spicules are sharply pointed and irregularly spiny; there are two kinds of free microscleres, one larger and more sharply pointed than the other; the gemmule-spicules are very short and stout, uniformly spiny and either straight or slightly curved. The gemmules are free. The skeleton is very compact.

The form was described from Lake Singkarah in Sumatra. I found small patches of dried sponge on the walls of a well at Medha that agree with a co-type sent me by Prof. Max Weber. The nilotic variety described by Weltner¹ seems to differ from the

¹ "Die Coelenteraten und Schwämme des Süßen Wassers Ost-Afrikas" in Möbius' *Ost.-Afrika*, IV (1908).

forma typica merely in slight differences in the measurements of the spicules.

var. *rivularis*, nov.

(Plate VII, fig. 2).

The skeleton-spicules are stouter and as a rule less sharply pointed than in the *forma typica*; the gemmule-spicules are relatively longer, more variable and often more irregular in outline; the skeleton is less compact; the gemmules are either free or fixed by means of their outer spiculiferous coat at the base of the sponge.

Type-specimen.—P 66/1 *Zool. Survey of India (Ind. Mus.)*.

Locality.—Rocks in the river Yenua at Medha.

I could not distinguish living specimens from *S. perviridis*, side by side with which they were growing.

var. *centralis*, nov.

(Plate VI, fig. 3; plate VII, fig. 1).

The skeleton-spicules, though remaining long and relatively slender, are for the most part distinctly blunt at the tips. Otherwise the form resembles the var. *rivularis*.

Type-specimen.—P 71/1, *Zool. Survey of India (Ind. Mus.)*.

Locality.—Rocky bed of a stream at Chakradharpur, Chota Nagpur.

var. *indica*, Annandale.

(Plate VII, fig. 3).

1908. *Spongilla indica*, Annandale, *Rec. Ind. Mus.*, II, p. 25, figs. 1, 2.

1911. *Spongilla indica*, *id.*, *Faun. Brit Ind.*, tom. cit., p. 100, fig. 17.

Most of the skeleton-spicules are blunter and shorter than in the last variety; the gemmule-spicules are on an average much smaller and more slender; the skeleton is more compact and the gemmules are as a rule fixed at the base of the sponge.

Localities.—Nasik and Igatpuri in the Nasik district, Bombay.

var. *gravelyi*, Annandale.

1912. *Spongilla gravelyi*, Annandale, *Rec. Ind. Mus.*, VII, p. 385, fig. 1.

The skeleton-spicules are relatively long, slender, sharply pointed and sparsely spined; the gemmule-spicules have a peculiar curvature and are often knobbed at the end; the gemmules are free.

Locality.—Koyna river at Taloshi, Satara district, Bombay.

In distinguishing these varieties reference should be made to the figures here reproduced or cited. I have avoided giving detailed descriptions as it is possible that intermediate forms exist and it seems best in dealing with the varieties of a plastic species not to be too exact.

EXPLANATION OF PLATE VI.

Freshwater sponges from Bombay and Chota Nagpur.

Spongilla cinerea, Carter.

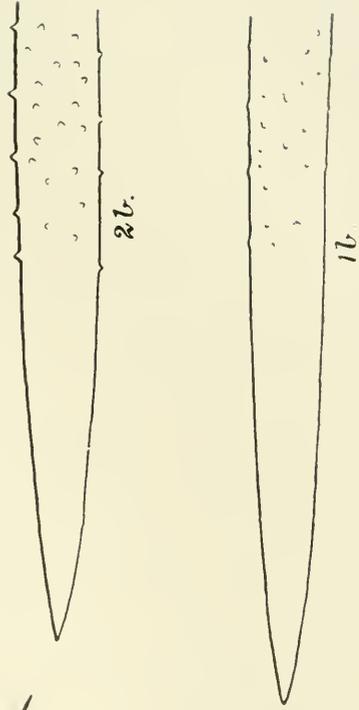
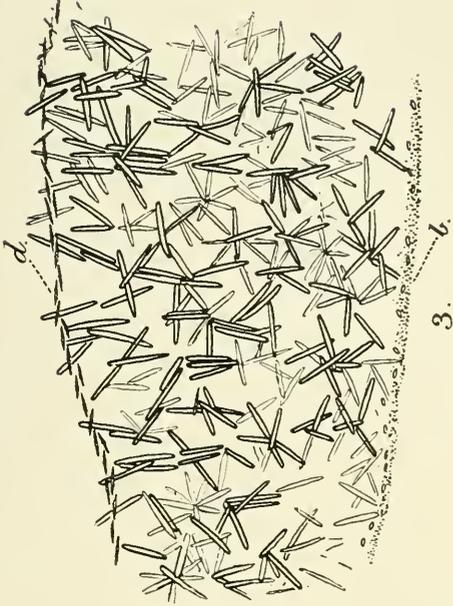
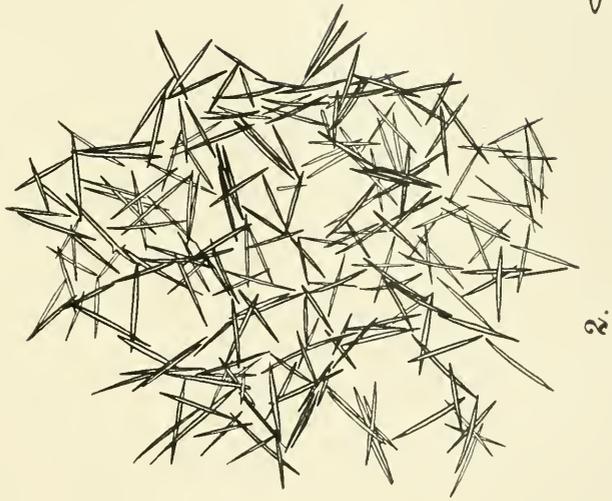
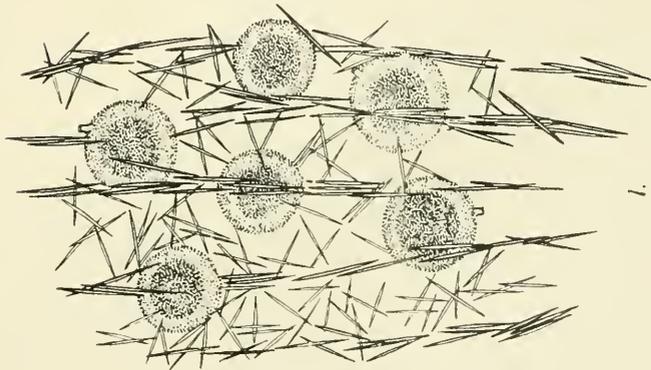
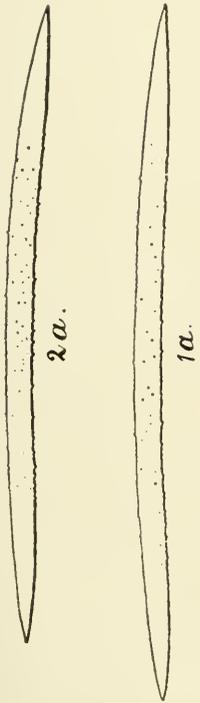
- FIG. 1.—Vertical section through middle region of skeleton with gemmules *in situ*, $\times 30$. Schizotype from Bombay I.
,, 1a.—Typical skeleton-spicule, $\times 250$.
,, 1b.—Part of same spicule, $\times 750$.

Spongilla perviridis, sp. nov.

- FIG. 2.—Vertical section through middle region of skeleton, $\times 30$. Specimen from Yenna R.
,, 2a.—Typical skeleton-spicule, $\times 250$.
,, 2b.—Part of same spicule, $\times 750$.

Spongilla sumatrana var. **centralis**, nov.

- FIG. 3.—Vertical section through skeleton, $\times 30$. *b* = basal membrane with microscopic algae. *d* = dermal membrane with free microscleres. Specimen from Chakradharpur.



FRESHWATER SPONGES FROM BOMBAY, ETC.

EXPLANATION OF PLATE VII.

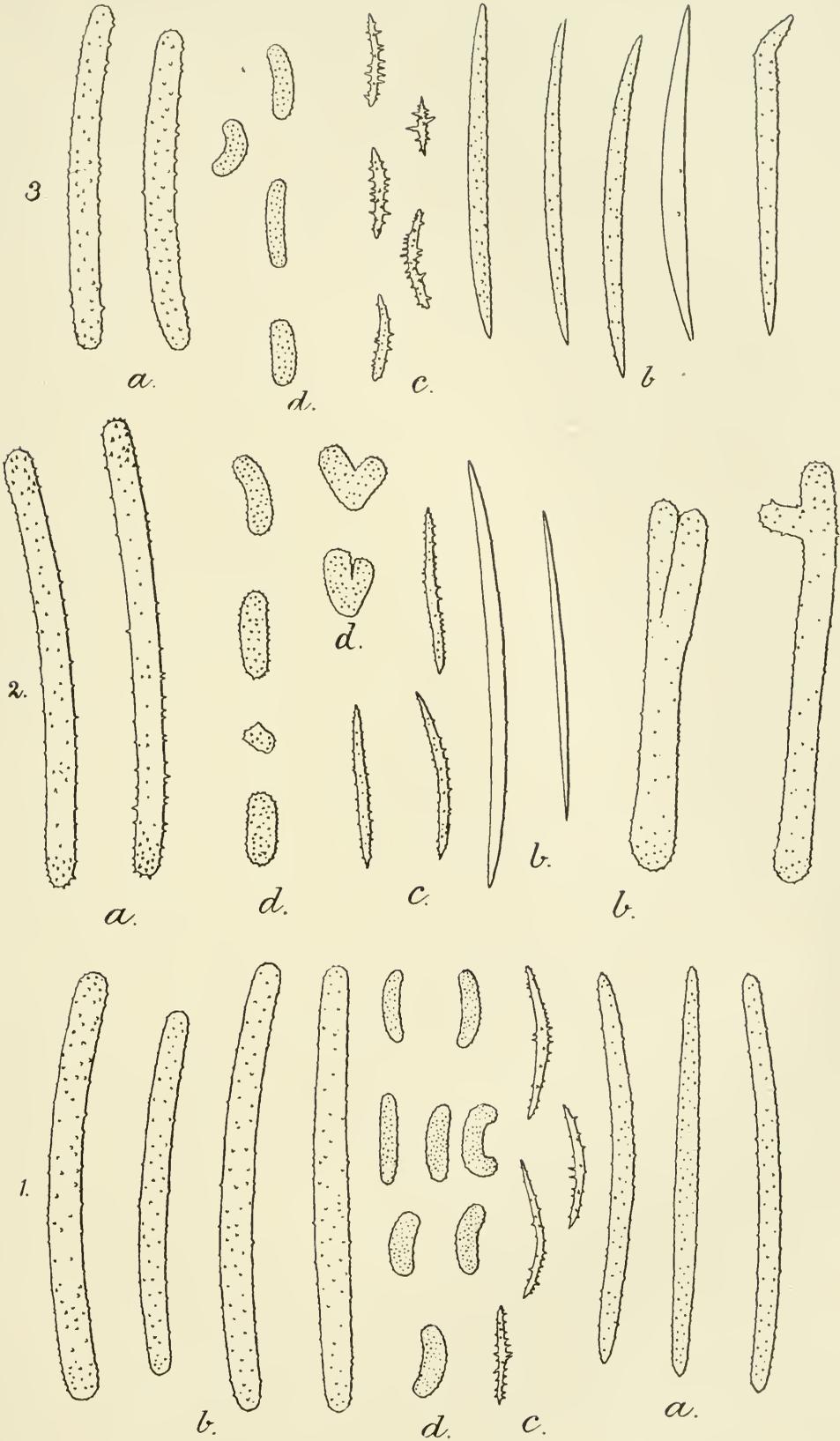
Spicules of Indian varieties of *Spongilla sumatrana*, Weber

a = typical macroscleres. *b* = other macroscleres. *c* = free microscleres.
d = gemmule-spicules.

FIG. 1.—*Spongilla sumatrana* var. *centralis*, nov., × 250.

„ 2.—*Spongilla sumatrana* var. *rivularis*, nov., × 250.

„ 3.—*Spongilla sumatrana* var. *indica*, Annand., × 250.



FRESHWATER SPONGES FROM BOMBAY, ETC.

A. C. Chowdhary del.