INDIAN AND CEYLON SPONGES OF THE NATURHISTORISKA RIKSMUSEET, STOCKHOLM, COLLECTED BY K. FRISTEDT.

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(Plates XII, XIII.)

The sponges on which the present report is based were collected by the late Dr. Konrad Fristedt in March and April 1889. At my request, Professor Dr. Sixten Bock of the Natural History Museum, Stockholm, was good enough to place the collection at my disposal for study and report as long ago as 1931. Owing to circumstances beyond my control the study of this collection was interrupted repeatedly, and it was not until early last year that I was able to give my undivided attention to it.

The sponge fauna of the Gulf of Manaar and its adjacent Indian and Ceylonese waters has been well known for many years now through the researches of Carter, Dendy, Kumar, Burton and Rao, and it is all the more surprising, therefore, to find 7 new species and 3 new varieties of sponges in the present small collection consisting of 42 species and 3 varieties representing 28 genera in all. No representatives of the orders Hexactinellida and Calcarea are present in the collection. Most of the collection is preserved in alcohol but a few are preserved dry.

I take this opportunity to offer my best thanks to Professor Dr. Sixten Bock of the Natural History Museum, Stockholm, not only for his courtesy and readiness in sending me the collection, but also for his kind indulgence in allowing me to keep the collection for over nine years.[1] I have also to thank Dr. Baini Prashad, Director, Zoological Survey of India, for facilities to study and report on this collection, and for readily agreeing to publish the present paper in the *Records of the Indian Museum* as suggested by Dr. Bock.

The photographs and drawings illustrating the present paper were executed under my supervision by Babus Subodh C. Mondul and R. Bagchi respectively, artists of the Zoological Survey of India, to whom my thanks are also due.

List of Indian and Ceylonese Sponges in the Fristedt Collection.

Order TETRAXONIDA.[2]

Sub-order *ASTROSCLEROPHORA.*

Fam. Stellettidae.

1. *Stelletta purpurea* Ridley.
2. *Stelletta bocki*, sp. nov.

Fam. Geodidae.

3. *Geodia inconspicua* (Bowerbank).

Fam. Chondrosiidae.

4. *Chondrosia reniformis* Nardo.

Fam. Tetillidae.

5. *Chrotella australiensis* (Carter).

[1] Owing to the considerable risks involved at present in forwarding valuable manuscripts to neutral countries, Dr. Bock has very kindly accepted my suggestion to publish the present Report in India, although it was originally intended to be published in Sweden.

[2] I have followed the classification adopted by Burton (1937).

Fam. CLAVULIDAE.

6. *Pseudosuberites andrewsi* Kirkpatrick.
7. *Laxosuberites cruciatus* (Dendy).
8. *Suberites carnosus* (Johnston) Gray.
9. *Spirastrella inconstans* (Dendy).
10. *Spirastrella vagabunda* Ridley.
11. *Spirastrella purpurea* (Lamarck) Ridley.
12. *Cliona* sp.

Sub-order *SIGMATOSCLEROPHORA.*

Fam. HAPLOSCLERIDAE.

13. *Haliclona oculata* (Pallas).
14. *Adocia pumila* (Lendenfeld).
15. *Callyspongia diffusa* (Ridley).
16. *Callyspongia obtusispiculifera* (Dendy).
17. *Callyspongia cellaria*, sp. nov.
    Callyspongia cellaria var. *fusca*, nov.
18. *Callyspongia pambanensis*, sp. nov.
19. *Oceanapia fistulosa* (Bowerbank).
20. *Oceanapia arenosa*, sp. nov.

Fam. DESMACIDONIDAE.

Sec. *MYCALEAE.*

21. *Mycale indica* (Carter).
22. *Mycale aegagropila* (Johnston).
23. *Mycale monanchorata* Burton & Rao.
24. *Mycale trincomaliensis*, sp. nov.
25. *Biemna tubulata* (Dendy).

Sec. *MYXILLEAE*

26. *Strongylacidon stelliderma* (Carter).
27. *Iotrochota baculifera* Ridley.

Sec. *CLATHRIEAE.*

28. *Echinodictyum clathratum* Dendy.

Sec. *RASPELIEAE.*

29. *Prostylyssa foetida* (Dendy).
30. *Trachyopsis halichondroides* Dendy.

Order KERATOSA.

Sub-order *DICTYOCERATIDA.*

31. *Phyllospongia papyracea* (Esper).
32. *Spongia officinalis* Linn.
    S. officinalis var. *fenestrata*, nov.
    S. officinalis var. *bibulus*, nov.
33. *Hircinia fusca* Carter.
34. *Hircinia ramodigitata* Burton.
35. *Hircinia cactiformis*, sp. nov.
36. *Hircinia pellita*, sp. nov.
37. *Dysidea fragilis* (Montagu).
38. *Dysidea herbacea* (Keller).
39. *Luffariospongia clathrata* (Carter).
40. *Aplysinopsis reticulata* Hentschel.
41. *Spongionella tubulosa* Burton.

Sub-order *DENDROCERATIDA.*

42. *Hexadella purpurea* Burton.

Order TETRAXONIDA.

Sub-order *ASTROSCLEROPHORA.*

Family STELLETTIDAE.

Stelletta purpurea Ridley.

1884. *Stelletta purpurea* & var. *retroflexa*, Ridley, *Report Zool. Coll.* "*Alert*", p. 473, pl. xl, fig. c, pl. xliii, figs. j-j".
1926. *Stelletta purpurea*, Burton, *Ann. Mag. Nat. Hist.* (9) XVIII, pp. 44-49.
1932. *Stelletta purpurea* Burton & Rao, *Rec. Ind. Mus.* XXXIV, p. 310.

There are four lots of specimens in the collection three of which are from Pamban, South India, and one from Trincomalee on the east coast of Ceylon. The external form and other features of these sponges vary considerably, and it seems best to describe each lot separately to enable a comparison to be made.

The Trincomalee specimen (Stockholm Museum No. 656-H[1]) attached to a brown alga is roughly rectangular with straight and curved sides, 30×20 mm. The dorsal surface is convex and the ventral less so,

[1] The letters S. M. will be used to indicate the abbreviation for the words 'Stockholm Museum' in the rest of this paper,

purple above and paler below. The closely pitted upper surface is very rough with the pores not apparent. There is a single osculum 1·6 mm. in diameter on the edge of the straight side of the sponge. The sponge is hard and very little compressible. The smaller orthotriaenes and anatriaenes form a more distinct row below the sub-dermal spaces than in some of the Pamban specimens.

S. M. No. 668 from Pamban, S. India (2 fathoms) consists of three small irregularly oval or oblong sponges, 12×6 mm., 6×4·5 mm., and 5×5 mm. in diameter. The first is attached, has a rough surface, minute pores and an oblong osculum (1·5×0·5 mm.) with thickened lips, and the remaining two which are not attached have no oscula.

S. M. No. 682-A from Pamban is a cake-like concavo-convex form, with a roughly square outline and two short cornua-like processes resembling those of the hyoid apparatus of the frog and other vertebrates, 44×42 mm., 16-18 mm. thick, with the cornua 5-10 mm. high and 6-8 mm. thick. The sponge is apparently attached by its paler ventral surface to a substratum of calcareous nodules on which a few strands of algae are also found. The pores on the dorsal surface are not uniformly conspicuous. An oval osculum 2-3 mm. in diameter without a thickening of its outline is present at the angle opposite to which the bigger cornua arises. In the skeleton the oxea of the choanosome form a more or less confused reticulum of loose spicules.

S. M. No. 683-F from Pamban, S. India (3-5 fathoms) is a roughly spherical, pale to pale-yellow or dirty brown, firm but slightly compressible sponge, 26·5-40·0 mm. in diameter, attached by its basal surface to calcareous nodules. Groups of three or more conical prominences 2-4 mm. high and as broad at base are present on the sides. The surface is rough and full of minute pores. Two small oscula 1·0-1·5 mm. in diameter lead into a cavity or pit at the bottom of which is a small oblong opening. Spreading brushes of orthotriaenes (with a few anatriaenes) constitute a thin cortex enclosing oval spaces between the cones of the brushes which form subdermal cavities. A few of these spicules occur below the level of these cavities as well. Oxea are in irregular radial bundles, 1·0-1·4 mm. long, and 0·01-0·02 mm. thick; tylasters 0·018-0·022 mm. in diameter have few rays and do not occur in abundance.

Localities.—Pamban, Gulf of Manaar (S. M. Nos. 668, 682-A, 683-F); Trincomalee, Ceylon (S. M. No. 656-H).

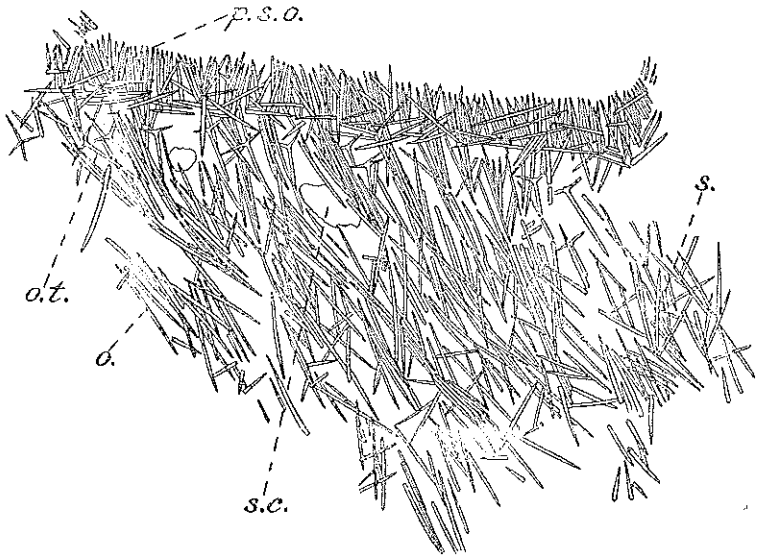
Stelletta bocki[1], sp. nov.

(Plate XII, fig. 15.)

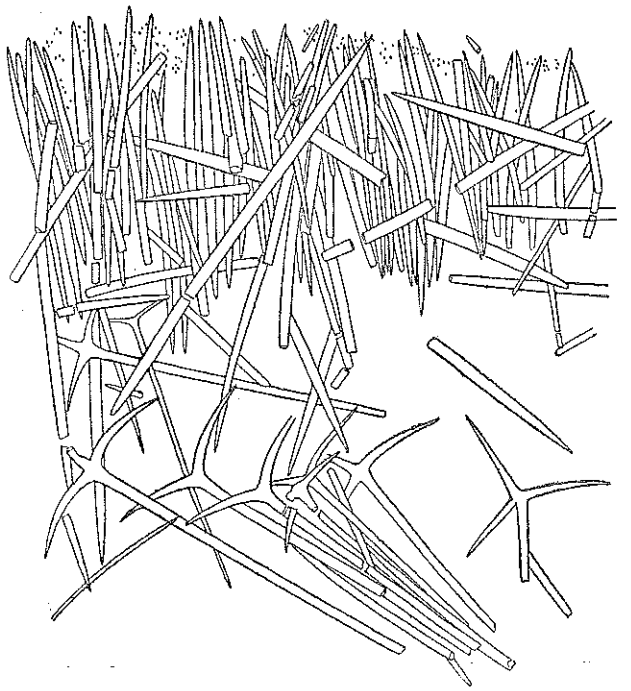
The sponge is a roughly oval, cake-like mass, 41 mm. long, 29·5 mm. broad, and 15·5 mm. thick, with a more or less plane ventral surface and a moderately convex dorsal surface, and with a thin cortex distinct from the underlying crumb-of-bread-like soft choanosome. It has a triangular compressed promontory from one side near the basal surface, and on the same side a prominent sinuous ridge near the dorsal surface.

[1] I have named this species after Prof. Dr. Sixten Bock of the Stockholm Museum through whose courtesy I was able to study the Fristedt collection of Indian and Ceylon sponges.

The sponge is firm and slightly compressible, smooth to the naked eye and slightly rough to the touch. The dorsal surface has numerous

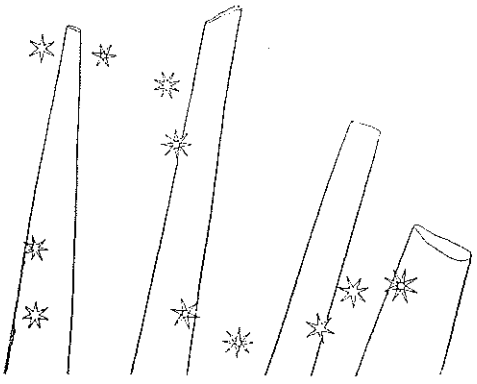


TEXT-FIG. 1.—Vertical section of cortex of *Stelletta bocki*, sp. nov. showing skeletal elements. *o.*, oxea ; *o. t.*, orthotriaenes ; *p. s. o.*, palisade of small oxea ; *s.*, style ; *s. c.*, sub-cortical space. ×26·6.



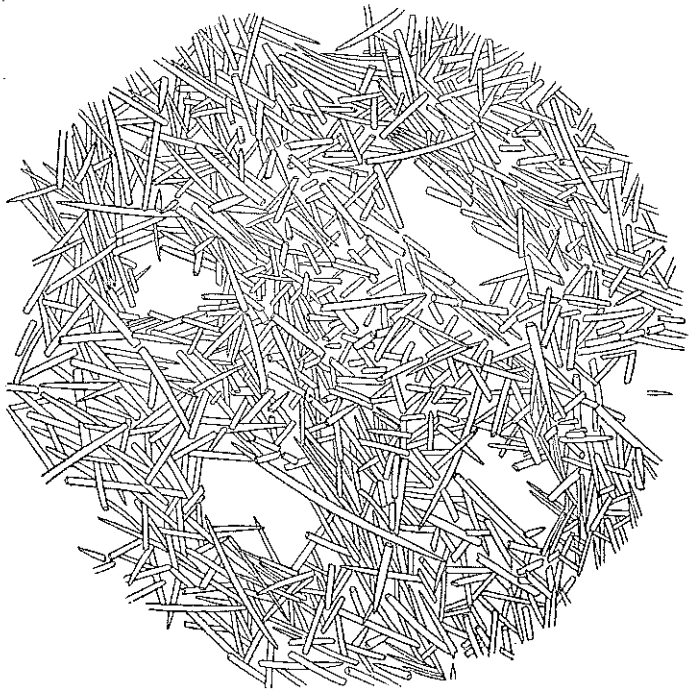
TEXT-FIG. 2.—Vertical section of cortex of *Stelletta bocki*, sp. nov. showing palisade of oxea, orthotriaenes, and the minute oxyspherasters. ×125.

minute closely-packed contracted pores (text-fig. 4) while the ventral has scattered cribriform pores and an arch-like row of about 20 oscula each 1·0 to 1·5 mm. in diameter (Pl. XII, fig. 15). The ventral surface and the sides are covered with a thin layer of sand particles while the dorsal surface is free from them. The colour of the sponge is pale brown



TEXT-FIG. 3.—Oxyspherasters of the cortical layer of *Stelletta bocki*, sp. nov. shown greatly enlarged. ×800.

to pink with the ventral surface distinctly of a lighter shade of brown. The choanosome is yellow and the cortex pink or pale brown. The skeleton is strikingly distinctive with its palisade of radially directed *small oxea*, not *microxea*, constituting a cortex, with a discontinuous

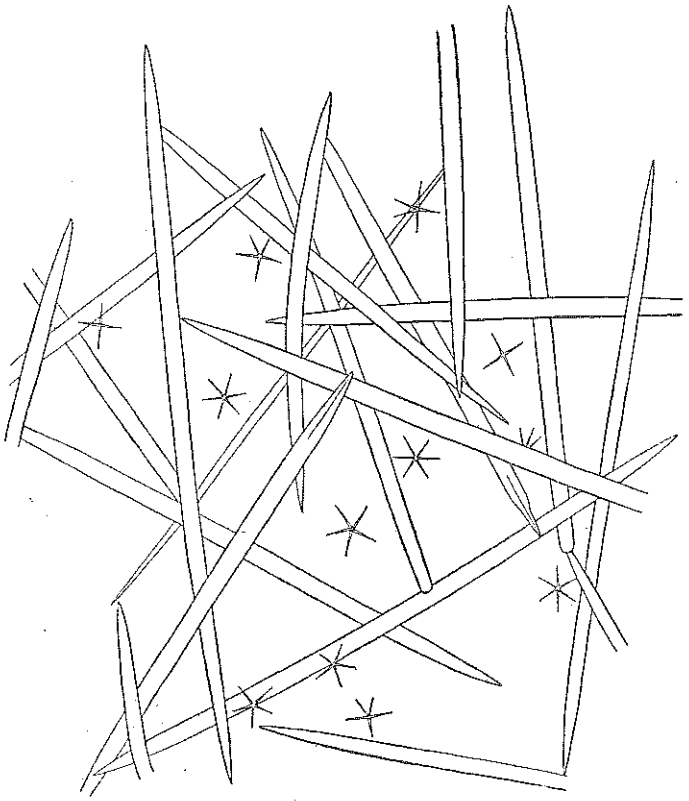


TEXT-FIG. 4.—Tangential section through cortex of *Stelletta bocki*, sp. nov. showing surface pores and skeleton. ×59.

single row of orthotriaenes below the palisade of oxea, and with radiating spicular fibres of a few moderately large oxea going up to the cortex. Loose oxea of large size and a few styles are scattered between the fibres, while oxyasters are confined to the choanosome only. In spicule preparations of the cortical portion very minute oxyspherasters with conspicuous centrum and short stout rays are occasionally found, but these are not abundant and may probably represent the developmental stages of the oxyasters (text-figs. 1-3 and 5).

Small oxea of the cortex 0·24-0·28 mm. long, straight or slightly curved; orthotriaenes 0·40-0·50 mm. long with cladi 0·060-0·080 mm. long; large oxea 0·50-0·60×0·02 mm., straight or curved and abruptly or gradually pointed; oxyasters with inconspicuous centrum, 0·032-0·048 mm. in diameter inclusive of the long, thin, pointed rays which never exceed 8 in number; and oxyspherasters 0·004 mm. in diameter.

The skeletal elements leave no doubt as to the genus to which the specimen should be assigned, but the curious palisade-like arrangement of the small oxea in the distinct cortex does not appear to have been described in any previously known *Stelletta*. The palisade-like cortical



TEXT-FIG. 5.—A portion of the choanosome of *Stelletta bocki*, sp. nov. showing oxea, styles, and oxyasters. ×170.

oxea recall strongly the arrangement of similar oxea in *Scolopes moseleyi* Sollas. *Scolopes* Schmidt is characterised by "a thin fibrous cortex

containing oxeas and microxeas radially arranged, palisade fashion. The megascleres are oxeas mostly collected into fibres, radially arranged. The microsclere when present is an amphiaster". It is clear that the present species has no generic relationship with *Scolopes* judging from the categories of skeletal elements present, and there is little justification for the erection of a new genus to receive the present species. The confusion that prevails in the grouping of genera assigned to families such as Epipolasidae, Donatiidae, Stellettidae and Jaspidae has been a deterrent on my inclination to refer the present species to a new genus. Students of sponges interested in discursive matter on these families may find the following references of some help: Topsent (1898 and 1900), Dendy (1916), Wilson (1925), Burton & Rao (1932) and de Laubenfels (1936).

Locality.—Trincomalee, Ceylon (8 fathoms), (S. M. No. 656-F)[1].

Family Geodidae.

Geodia inconspicua (Bowerbank).

1932. *Goedia inconspicua*, Burton & Rao, *op. cit.* p. 322.
1937. *Geodia areolata* and *Geodia picteti*, Burton, *Bull. Madras Govt. Mus.* (N. S.) *Nat. Hist. Sec.* I, pp. 8-9, pl. 1, fig. 3.

An incomplete irregularly oval specimen 32·0 mm. long and 21·5 mm. broad is referrable to this species. The sponge was apparently growing on a small mass of calcareous nodules and shell-debris, fragments of which are still attached to it. The surface of the sponge is smooth in parts and rough in others. Conspicuous cribriform pores are confined to some parts of the sponge, while rounded pores 0·3-0·5 mm. in diameter are present in scattered groups on the basal part. The colour of the surface of the sponge is light brown, and of the soft crumb-of-bread-like inner mass pink. The texture is hard and very little compressible. The cortical layer of sterrasters is about a mm. thick. There are wide cylindrical conduits 1-2 mm. in diameter in the soft portion of the sponge which are lined by a transversely wrinkled membrane. The cortical layer of sterrasters is supported by the cladomes of the orthotriaenes and by the upper extremities of the larger oxea. A few anatrianes with thin rhabdomes penetrate the cortical layer with their cladomes projecting some distance above the surface. A few small oxea and small asters are scattered between the thin transparent dermal membrane and the layer of sterrasters. Where the membrane has peeled off, these skeletal elements have dropped out exposing the sterrastral layer. The oxyasters with small centrum and long thin rays are scattered in the choanosome singly or in groups. A few small oxea are also scattered in the choanosome immediately below the sterrastral layer in the interspaces between the large oxea and the rhabdomes of the triaenes.

Small Oxea 0·10-0·14 mm.×0·002-0·004 mm., large oxea 1·4-1·8 mm.×0·03, sterrasters 0·06-0·10 mm. in diameter, euasters 0·027-0·036

[1] The holotypes of all the new species and varieties described in the present paper will be deposited in the Naturhistoriska Riksmuseet, Stockholm, as soon as transport and other conditions in Europe are rendered safe, while a complete set of paratypes will be retained in the collection of the Zoological Survey of India, Indian Museum, Calcutta.

mm. in diameter, small euasters (probably developmental stages) 0·004-0·006 mm. in diameter.

Locality.—Trincomalee, Ceylon (8 fathoms), (S. M. No. 657-B).

Family CHONDROSIIDAE.

Chondrosia reniformis Nardo.

1932. *Chondrosia reniformis*, Burton & Rao, *op. cit.*, p. 324.
1937. *Chondrosia reniformis*, Burton, *op. cit.*, p. 10.

There are two lots of specimens in the collection which belong to this species. S. M. No. 683-B from Pamban is a flattened roughly rectangular piece 65 mm. long, 32 mm. broad, and 4·10 mm. thick, and has at its narrower end a conical process on one side 23·5 × 14·5 mm. It is hard and inflexible and is very like a piece of untanned hide, and the colour varies from a dark greyish brown to a pale muddy yellow or grey. Although smooth to the naked eye, the surface of the sponge is minutely pitted and bears very small scattered pores, and extensive whitish dendritic markings which seem to underlie the dermis. In addition to these there are areolae or cellular markings in the greyish portions which seem to be better developed than the dendritic ones. The surface of the sponge has also grooves and depressions. There are two elongated oscular openings 4 mm. in maximum diameter, one on the upper surface and the other on the periphery of the narrower side opposite the conical process. The under surface is rugged and the presence on it of sand particles in patches indicates that it was attached to some dead coral rock or shingle in shallow water. Of the two specimens from Trincomalee (S. M. No. 656-B) attached to filaments of brown algae, one is roughly rectangular in outline, 20 mm. in diameter and 5 mm. thick, and the other trapezoidal in outline, 23 × 18 mm. in dimensions and 2-4 mm. thick. Both are pink in colour and have the characteristic areolae formed by the coalescence of the dendritic markings. The single osculum, 1·5-2·0 mm. in diameter, is slightly raised above the rest of the surface. In both the lots pigment granules are found in great abundance arranged in groups of a few granules each, and below the dermis they are concentrated in a deeply coloured layer. No trace of the 'glary bodies' of Carter has been found.

Localities.—Pamban, Gulf of Manaar (S. M. No. 683-B); Trincomalee, Ceylon (S. M. No. 656-B).

Family TETILLIDAE.

Chrotella australiensis (Carter).

1934. *Cinachyra australiensis*, Burton, *Sci. Rep. Great Barrier Reef Exped. 1928-29*, IV, p. 523.
1937. *Chrotella australiensis*, Burton, *op. cit.*, p. 12.

Burton has fully discussed the synonymy of this species in the first reference cited. In the present collection this species is represented by a single incomplete roughly hemispherical specimen with probably only its basal part intact. It is 41·5 mm. long, 30·5 mm. broad, and has conspicuous porocalices 4·5-7·0 mm. × 2·5-3·5 mm. The spicules do not as a rule, project much above the surface of the sponge, but

there is a certain degree of roughness due to the projecting broken ends of oxea. The spicular categories are typically arranged with a fair number of pro- and ana- triaenes and numerous microxea and sigmaspires. The microscleres seem to be somewhat roughened when examined under the high power of the microscope. The projecting megascleres are nearly all broken at their tip, but from their shape and size they seem to be mostly oxea. The pro-and ana- triaenes are found below the surface of the sponge so that many of them are complete. The microxea are generally disposed roughly at right angles to the megascleres.

Locality.—Pamban, Gulf of Manaar (3-5 fathoms), (S. M. No. 683-A).

Family Clavulidae.

Pseudosuberites andrewsi Kirkpatrick.

1900. *Pseudosuberites andrewsi*, Kirkpatrick, *Proc. Zool. Soc. London*, p. 135, pl. xii, figs. 2*a-b*, pl. xiii, fig. 7.
1937. *Pseudosuberites andrewsi*, Burton, *op. cit.*, p. 14.

The species assigned to the genus *Pseudosuberites* are somewhat ill-defined in their features, and I, therefore, refer to this species with some hesitation a massive sepcimen 40×32 mm., and several small fragments which have been detached from this mass owing to its friability. The sponge is associated with coral, shell, and calcareous algal debris which are found in the substance of the sponge as well as at its base, and on some of which, at any rate, there are encrusting forms of what appear to be *Mycale*. The external form is difficult to describe owing to the occurrence of foreign particles which project in some parts above the surface of the sponge obscuring its general outline. Where the surface appears to be smooth to the naked eye it bears small flattened or cylindrical mamilliform processes 3-4 mm. high recalling those of *Pseudosuberites undulatus* (George & Wilson, 1919, pl. lvii, fig. 8) and of *P. hyalinus* Ridley & Dendy (Topsent, 1900, p. 171). The processes do not terminate in openings, but small pores about a mm. in diameter are scattered singly or in groups on various parts of the sponge. The canalicular markings in the ectosome of the type are not present in the specimen. The colour of the sponge varies from pink to purple or pale brown. The sponge is very soft and compressible in spite of the presence of embedded foreign particles, and the dermal membrane can be peeled off from the underlying choanosome. The sub-dermal spaces are inconspicuous and may be seen as narrow transverse streaks. The tylostyles are 0·2-0·3 mm. long and 0·0045-0·0075 mm. thick. The spicules of the dermal membrane form a reticulum or a pavement of spicules lying side by side. In parts of the choanosome the spicules form irregular fibres ascending to the surface of the sponge. Although the present specimen agrees with that recorded by Burton in spicular measurements, the external form, the sub-dermal canals, the dermal skeleton and the colour of the sponge differ considerably. Until the criteria of specific differences in the genus are more clearly defined, it will be undesirable to erect more new species. The size of the tylostyles seems to be a fairly reliable distinguishing feature between *P. andrewsi* and *P. hyalinus*.

Locality.—Trincomalee, Ceylon (8 fathoms), (S. M. No. 657-D).

Laxosuberites cruciatus (Dendy).

1905. *Suberites cruciatus*, Dendy, *Rep. Ceylon Pearl Oys. Fish.* Suppl. Rep. XVIII, p. 131, pl. v, fig. 10.
1916. *Suberites cruciatus*, Dendy, *Rep. Govt. Baroda Mar. Zool. Okhamandal in Kattiawar*, Pt. ii, p. 135.
1921. *Suberites cruciatus* var. *depressa*, Dendy, *Trans. Linn. Soc. London*, (2) Zool. XVIII, p. 147.
1937. *Laxosuberites cruciatus*, Burton, *op. cit.*, p. 14, pl. viii, fig. 47.

There are two lots of specimens in the collection from different depths on the coast of Trincomalee. S. M. No. 659 from a depth of 12 fathoms consists of five fragments 15-35 mm. high. Each is part of a branching colony of short rounded or cylindrical processes not more than 15 mm. high, and 3-6 mm. in diameter. The whole colony has some resemblance to a Zoanthid colony in external form. A few irregularly scattered transparent spots on the surface of the sponge covered by a thin dermal layer of spicules may represent pore areas. There are one or two elongated shallow pits with small rounded apertures at their bottom on the sides of some of the processes, which probably represent oscula. The colour of the sponge in spirit is pale brown. The sponge is closely associated at its base with a colony of Hydroids which seems to have grown on it. One of the fragments is a growth on a small Purpurid or Mitrid Gastropod shell occupied by a hermit-crab and partly covered by a Polyzoan colony. S. M. No. 661 from 8 fathoms consists of fragments as in the other lot. There is a more profuse growth of Hydroids which are adherent to the surface of the sponge, and the processes which are longer (20 mm.) tend to be flabellate instead of cylindrical. The oscula are relatively large but irregular in outline. The skeleton agrees very well with the description given by Dendy and Burton. The tylostyles are in various stages of growth, the younger ones being thin and hair-like and less than 0·002 mm. thick. An average fully developed spicule is 0·3 mm. long and 0·006 mm. thick. The tylostyles resemble fairly closely those of *Suberites lobiceps* Schmidt (1870, p. 47, pl. v, fig. 5) and *S. epiphytum* (Lamarck) Ridley (1884, pl. xliii, fig. h). Had Schmidt's description been adequate the present species would have been designated *Laxosuberites lobiceps* (Schmidt). *S. epiphytum* and *S. cruciatus* var. *depressa* seem to be encrusting forms of the present species.

Locality.—Trincomalee, Ceylon (8-12 fathoms), (S. M. Nos. 659 and 661).

Suberites carnosus (Johnston) Gray.

1897. *Suberites carnosus*, Dendy, *Proc. Roy. Soc. Victoria* (N. S.) IX, p. 245.
1900. *Suberites carnosus*, Topsent, *Arch. Zool. Exper. Gen.* (3) VIII, p. 233, pl. vii, figs. 1-5.
1916. *Suberites carnosus* var. Dendy, *op. cit.*, p. 134.
1925. *Suberites carnosus*, Kumar, *Rec. Ind. Mus.* XXVII, p. 229.
1934. *Suberites carnosus*, Burton, *Ann. Mag. Nat. Hist.* (10) XIII, p. 314.

There are two lots of specimens from Pamban which belong to this species. S. M. No. 682-B consists of four fragments 37-50 mm. high and 24-40 mm. broad. Each of these consists of 2-4 stout club-shaped processes closely adherent by their sides to one another from one-third to three-fourths their height, and strongly recalling the shape of some forms of *Ficulina ficus*. The sponge is compact, soft and compressible,

and its colour varies from a light pink or brown to sandal-wood. The external surface of the sponge is minutely pilose or velvety when observed under a lens although smooth to the naked eye, and is often thrown into minute folds, elongate knobs or rugae. A few rounded pores not more than 1 mm. in diameter are found on the sides near the base of the club-shaped processes. Terminal or sub-terminal oscular openings, ellipsoidal, slit-like or triangular, and not more than a mm. in length or diameter, are present on the processes. The projecting ends of the tylostyles form several rows of oscular fringes. The presence of dead Gastropod shells at the base of some of the fragments of the sponge shows that it was growing on a bottom of shingle or shell-deposit. The ill-defined thin radiating spicular fibres end in fan-shaped surface brushes of tylostyles the extremities of which project above the surface of the sponge giving it the minutely pilose appearance described above. Below the brushes the tylostyles are scattered irregularly, sometimes in loose bundles in various directions. The spicules are 0·4-0·6 mm.×0·006-0·008 mm. with their heads usually conical or top-shaped and with or without a constriction. In the younger spicules the conical shape of the head is more ponounced.

S. M. No. 683-C seems to represent a complete sponge growing on a base 26 mm.×10 mm. sticking to sand or calcareous matter. The sponge is 30 mm. high, 25 mm. broad and consists of 5-6 finger-shaped processes 15-18 mm. high and 4-7 mm. diameter. The texture is a little more firm than in the previous lot, and the surface relatively more rugose and pilose. No trace of oscula or pores is present. A large quantity of diatoms and desmids is entangled among the spicules of the surface brushes and the choanosome.

Locality.—Pamban, Gulf of Manaar (1-6 fathoms), (S. M. Nos. 682-B and 683-C).

Spirastrella inconstans (Dendy).

1887. *Suberites inconstans* and vars. *globosa, meandrina* and *digitata*, Dendy, *Ann. Mag. Nat. Hist.* (5) XX, pp. 154-157, pls. ix-x.
1934. *Spirastrella inconstans*, Burton, *op. cit.*, p. 570.

This species is represented in the collection by a dry specimen about 200 mm. high and 95 mm. broad which belongs to the var. *digitata* of Dendy. The individual digitate processes are 60-70 mm. high and 15-45 mm. in diameter. Some have at their extremity small or large oscular openings 4-12 mm. in diameter. Some processes are more or less solid with closely anastomosing spicular fibres, while others are hollow and chimney-shaped. There are several ramifying canals in the interior of the solid processes, while in the hollow processes they are very small and confined to the thickness of their walls. The inner surface of the chimney-shaped tube and of some of the larger ramifying canals is smooth. The base of the sponge is covered by calcareous nodules and particles of dead corals, algae, etc., while the upper parts are smooth. The colour of the sponge is a light brick-red. The tylostyles are 0·4-0·54 mm.×0·009-0·013 mm. There is considerable variation in the shape of the head of the megasclere which may be oval, elongate oval, hour-glass-shaped, or rounded. No microscleres were found in the preparations from various parts of the sponge.

This species corresponds to the tropi *tubulifera*, *digitata* and *concrescens* of *S. purpurea* of Vosmaer (1911), but it seems advisable to keep this species distinct from *S. purpurea* into which a great variety of closely allied forms has been merged.

Locality.—Trincomalee, Ceylon (1-3 fathoms), (S. M. No. 268).

Spirastrella vagabunda Ridley.

1884. *Spirastrella vagabunda*, Ridley, *op. cit.*, p. 468, pl. xliii, figs. c, c'.
1921. *Spirastrella vagabunda*, Dendy, *op. cit.*, p. 139.

A single pale brown roughly angular or cylindrical fragment 40 mm. long 2·5-4·5 mm. in diameter belongs to this species. A few fragments of dead mollusc and barnacle shells, and of coral debris project from the surface of the sponge. No base of attachment, pores or oscula are discernible. The sponge has a smooth surface and a firm texture. Four or five canals pass vertically through the sponge. There is a cortex 0·2-0·4 mm. thick consisting of a close reticulation of tylostyles 0·22-0·54 mm.×0·02 mm. The spirasters of the surface layer are 0·018-0·027 mm. long.

Locality.—Trincomalee, Ceylon (10 fathoms), (S. M. No. 666-A).

Spirastrella purpurea (Lamarck) Ridley.

1911. *Spirastrella purpurea*, Vosmaer, *Siboga Expedite*, VIa[1], pp. 6-67, 14 pls.

The single specimen in the collection seems to agree with the trop. *pyramidalis* of Vosmaer both in the form of the skeleton and in colour and texture. The specimen is 25·0-27·5 mm. long, 7-14 mm. thick, roughly triangular and cushion-like in form, light purple in colour, and firm and compact in texture (*cf.* Vosmaer, 1911, pl. i, fig. 1). Its surface is uneven and studded with small abscess-like eminences. It was apparently found unattached, but a small hemispherical depression on one side in which the spicules are visible suggests the probability of its having grown over a small pebble. The surface of the sponge although smooth in appearance is somewhat rough to the touch. Except for a narrow elongate opening at one extremity which may represent the osculum, there are no pores or other openings on the surface. In section a few rounded canals may be seen in the periphery of the choanosome in addition to the thin dermal cortex of spinispirae. The tylostyles are 0·44-0·50 mm. long, 0·010-0·016 mm. thick with the diameter of the head 0·013-0·020 mm. The spinispirae are slender and long with 3-5 sharp bends in the course of their length, and with minute spines in a linear series or separated by short gaps and concentrated usually at the bends. The average spinispirae are 0·013-0·220 mm. long, and 0·002 mm. thick. A few rare stout ones in the choanosome are 0·018 mm. long and 0·004 mm. thick.

Locality.—Trincomalee, Ceylon (8 fathoms), (S. M. No. 656-G).

Cliona sp.[1]

A beach-worn shell of *Ostrea* bearing pit-like and canalicular excavations on the outer surface of the shell near the umbo was probably bored

[1] For an account of the Indian *Cliona* see Annandale, *Rec. Ind. Mus.* XI, pp. 1-24, pl. i (1915).

by a species of *Cliona*, but in the absence of spicules characteristic of the genus in the preparations made from scrapings of the excavations I am not at all certain that my identification is correct. I have seen in preparations only amphioxi and sigmata characteristic of Gelliine sponges, but these seem to be later growths in the excavations made by a *Cliona*. The evidence that the present specimen is a *Cliona*-bored shell is therefore presumptive.

Locality.—Trincomalee, Ceylon (1-5 fathoms), (S. M. No. 271).

Sub-order *SIGMATOSCLEROPHORA.*

Family Haplosclerida.

There is very little evidence in recent literature on the subject that the last word on the diagnostic features of the genera included in the family has yet been said, and that the differentiation of the genera is any simpler or easier now than it was at the beginning of the present century. The identification of specimens belonging to this family in the present collection has been attended with considerable difficulty, and I am not sure that I have reached the 95 per cent correctness which Burton (1934*b*, p. 528) claims for his method of identification by examining tangential sections of sponges of this family under three different magnifications. For example, there are specimens of Chalinine sponges in the present collection which from the general features of the skeleton and from the structure, texture, and colour of the sponges are assignable to *Haliclona*, but which, following Burton, should be assigned actually to *Adocia*. In a number of cases the problem of what constitutes a dermal skeleton as distinct from the underlying main skeletal fibres seems very difficult to solve. To save confusion to future workers it would seem to me to be a good plan for authors to support their identification with a good figure or photograph of the external form and the skeleton and with a short description of the main features of the sponge concerned. In the species assigned to this family in the present paper I have followed this plan subject to the limitations of space and cost of publication.

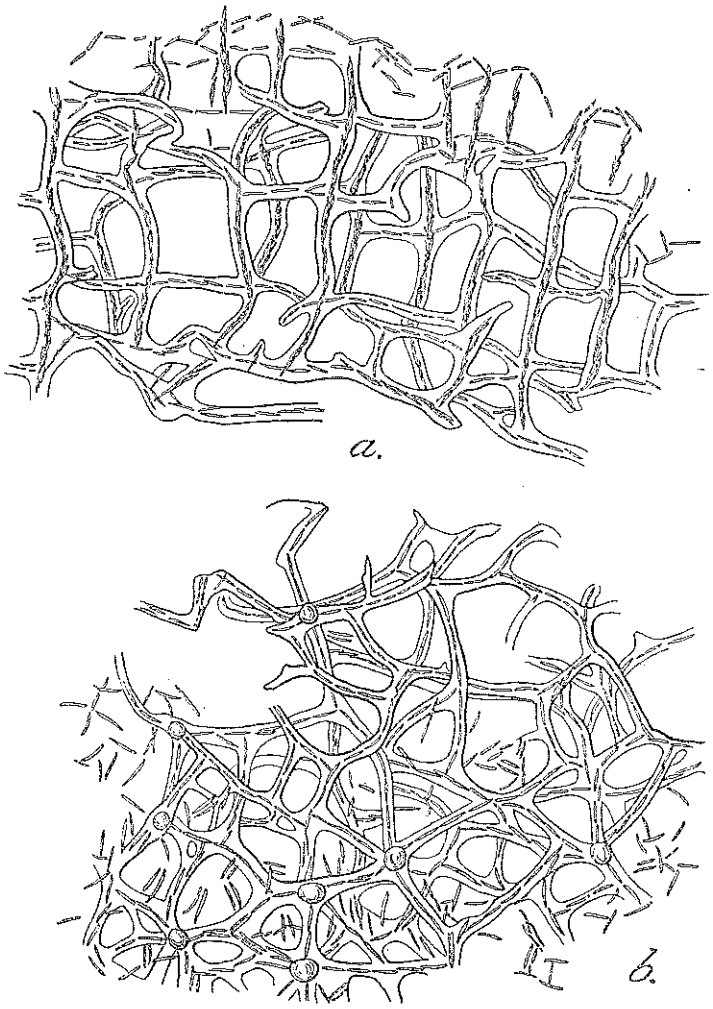
Burton (1934*b*, p. 539) has admirably clarified the position of the genera, *Haliclona*, *Adocia* and *Callyspongia* as "Haplosceridae with main skeleton a reticulation of spongin fibres cored with oxea; special dermal skeleton a network of similar fibres subdivided by secondary or even tertiary fibres. Microscleres toxa (and possibly sigmata)." The species described below as new to this family are so like *Callyspongia* in the general arrangement of the skeleton that I have no hesitation in ignoring the absence of toxa, and their replacement by sigmata as features characteristic of *Callyspongia*.

Haliclona oculata (Pallas).

1794. *Spongia oculata*, Esper, *Pflanzenthiere*, *Spongia* Tab. I, figs. 1-2.
1934. *Haliclona oculata*, Burton, *op. cit.*, p. 529.

There are two specimens in the collection, one preserved in spirit and the other dry, which may be referred to this species. S. M. No. 680 is an elongate, solid, rod-like sponge with anastomosing branches

5-10 mm. in diameter. It is of a pale golden-yellow colour and has a number of slightly elevated oscula 2-4 mm. in diameter arranged in a series on one side of the branches at a distance of 8-10 mm. between successive oscula. There is a definite surface tangential skeleton of thin transparent or pale spongin fibres cored by a row of single oxea. The polygonal meshes of the skeleton fibres are covered by a thin transparent membrane. The dermal spongin fibres arise from the tip of the main or radiating fibres at right angles to them. Although they are inconspicuous on account of the pale colour of the spongin, the disposition of the coring oxea indicates the occurrence of the dermal layer and the polygonal



TEXT-FIG. 6.—Skeletal fibres of *Haliclona oculata*. *a*. Vertical section showing tangential and radial fibres. *b*. Tangential fibres viewed from surface of sponge.

meshes of the skeleton (text-fig. 6). The fibres of the dermal skeleton are 0·01-0·04 mm. in diameter and are, as a rule, unispicular. The main

ascending or radial fibres are multispicular, containing usually not more than two oxea, while the transverse secondary fibres are yellow, unispicular, and of the same diameter as the dermal fibres. Microscleres are absent. The meshes of the primary skeleton fibres are generally oblong, rectangular or square. Spicules are straight or curved, 0·08-0·09 mm. × 0·004-0·008 mm., many of which are broken into two or three pieces within the spongin envelope.

S. M. No. 262 is a dry incomplete specimen 155 mm. long and 76 mm. broad, with a number of closely anastomosing irregularly cylindrical branches 5-17 mm. in diameter, and several rounded oscula on small mound-shaped eminences which are more common on one side of the branches than on the other. No evidence of a base of attachment is present on the sponge. The skeleton fibres vary as in S. M. No. 680. Microscleres are absent. The fibres of the dermal tangential skeleton appear to be stouter (0·06 mm.) than those of the transverse secondary fibres (0·02-0·04 mm.) of the main skeleton, the spongin of the latter being of a paler yellow than that of the former. The radiating or ascending fibres are cored by bundles of 2-5 straight or curved oxea (0·09 × 0·004 mm.), while the dermal and the secondary fibres of the skeleton are cored by the same kind of oxea joined end to end or overlapping the adjacent oxea.

Localities.—Pamban, Gulf of Manaar (3 fathoms), (S. M. No. 680); Trincomalee, Ceylon (3 fathoms), (S. M. No. 262).

Grant's *Haliclona occulata*[1] probably represents a Chalinine sponge as understood by later authors. The close resemblance of *H. oculata* (Pallas) to *Callyspongia ramosa* (Gray) has already been pointed out by Burton (1934*b*, p. 603), and unless the dermal skeleton is well-preserved it will be difficult to distinguish between the two species.

Adocia pumila (Lendenfeld).

1934. *Adocia pumila*, Burton, *op. cit.*, p. 537, pl. i, figs. 1-7.
1937. *Adocia pumila*, Burton, *op. cit.*, p. 20.

The species is well represented in this collection by a large number of branching and anastomosing fragments varying in colour from pale yellow to rusty brown. S. M. Nos. 686-B and 690 from Pamban are pale yellow to light brown, somewhat flattened, 10-15 mm. in diameter, and with oscula 3-5 mm. in diameter either slightly raised or on fistulous processes 8-10 mm. high and 6 mm. in diameter. S. M. No. 692 from Trincomalee is a small grayish brown sponge growing on the anterior end of a gastropod, 16 × 10 mm., with two elongate-ovate depressions or concavities (8·5 mm. long) at the base which give the specimen a compressed appearance. There is an osculum 2 mm. in diameter flush with the surface of the sponge at the broader end. S. M. No. 651 from Trincomalee consists of a large number of fragments of the colony, pale brown to rusty brown in colour. The branches are somewhat flattened with the outline of their cross-section irregular. Low conical tubercles less than 2 mm. high are present on the surface giving it a roughened appearance, but some parts of the sponge are smooth. Small fistulous

[1] Grant, R. E., *Outlines of Comparative Anatomy*, p. 6, fig. 2 (London, 1841)

outgrowths 8-25 mm. high and 10 mm. in diameter arise from various parts of the sponge with a rounded or oval osculum at the extremity of each, but there are a few which attain a height up to 55 mm. Small barnacles are embedded in the sponge surface. Spongin is better developed in this lot than in the other two.

Oxea—0·14-0·15 mm.×0·009-0·013 mm., sigmata 0·013-0·018 mm.

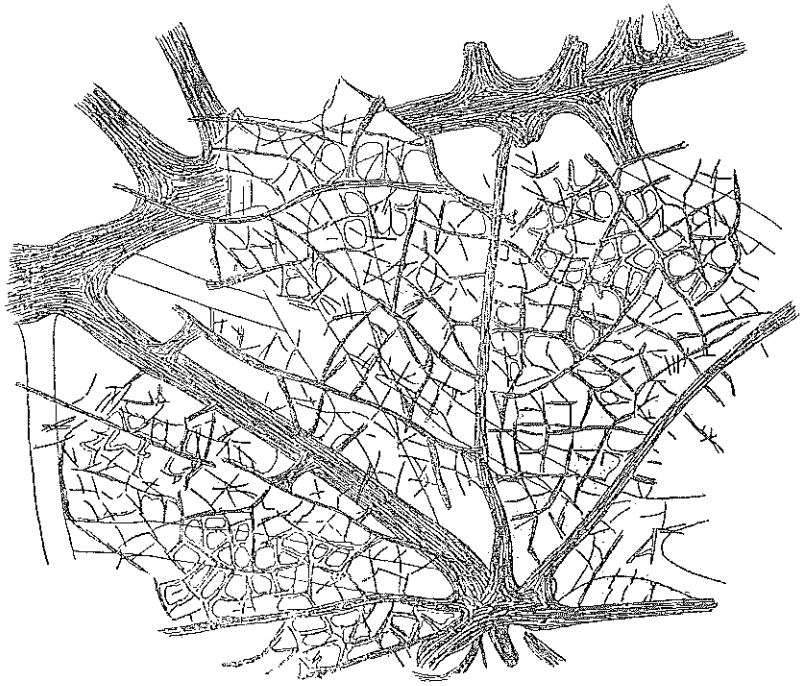
Localities.—Pamban, Gulf of Manaar (S. M. Nos. 686-B and 690); Trincomalee, Ceylon (S. M. Nos. 651 ($\frac{1}{2}$ fathom), and 692).

Callyspongia diffusa (Ridley).

(Plate XII, fig. 14.)

1881. *Tubulodigitus communis*, Carter, *Ann. Mag. Nat. Hist.* (5), VII, p. 367.
1889. *Siphonochalina communis*, Dendy & *Siphonochalina crassifibra*, Dendy, *Ann. Mag. Nat. Hist.* (6), III, pp. 81-82.
1890. *Siphonochalina procumbens*, Dendy, *Trans. Zool. Soc. London*, XII, p. 355.
Siphonochalina communis var. *tenuispiculata*, Dendy, *op. cit.*, p. 155, pl. vii, fig. 1.
1905. *Toxochalina robusta* var. *ridleyi*, Dendy, *op. cit.*, p. 140, pl. ix, fig. 2.
1916. *Siphonochalina crassifibra* and *S. minor*, Dendy, *op. cit.*, pp. 114-115.
1934. *Callyspongia diffusa*, Burton, *op. cit.*, p. 541.
1937. *Callyspongia diffusa*, Burton, *op. cit.*, p. 20.

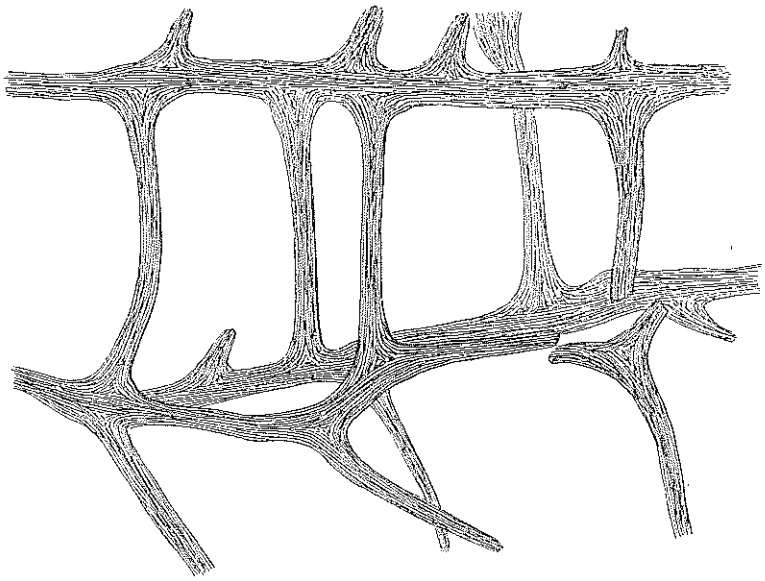
I refer to this species a flabellate, fan-shaped specimen from Pamban with low tubes and oscular openings along its margin. Its length is 83 mm. on its broadest side and 60-72 mm. on the narrower sides, and



TEXT-FIG. 7.—Dermal skeleton of a dry specimen of *Callyspongia diffusa*. ×48·6.

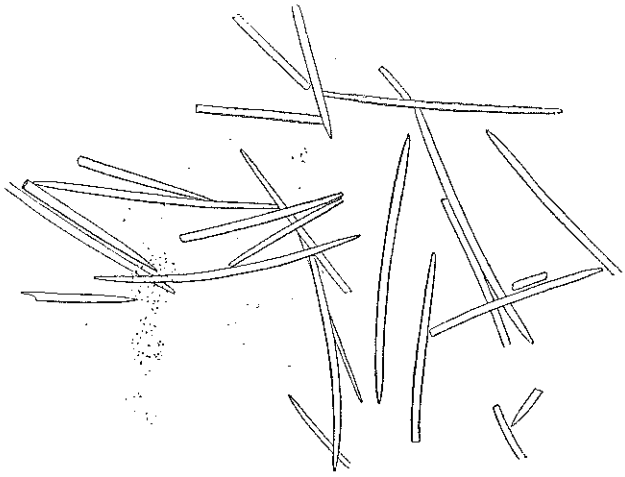
its thickness 4-8 mm. It was found on a colony of Polyzoa and Vermetid tubes and in between the valves of a young pearl oyster. On its upper

surface are four funnel-shaped processes 5-15 mm. high and 6-12 mm. in diameter, each with an osculum 2-5 mm. diameter at its extremity. On the longer arched side of the specimen are two irregular rows of slightly elevated oscular openings 1-5 mm. in diameter. The sponge is compressible and resilient, brown in the centre and somewhat paler on the periphery. The dermal and primary skeleton fibres are well develop-



Text-fig. 8.—Primary fibres of a dry specimen of *Callyspongia diffusa*. ×44.

ed with the spongin yellowish brown in the latter and pale yellow in the former. A form of toxa not unlike that found in *Toxochalina robusta*



Text-fig. 9.—Sharp and abruptly pointed oxea of a dry specimen of *Callyspongia diffusa*. ×340.

var. *ridleyi* Dendy, 0·0135-0·0225 mm. long is scattered along the fibres. The oxea, 0·072×0·004 mm., are in bundles of four or more, and do not

fill the spongin fibres of the main skeleton. In secondary fibres they are found singly or in twos (text-fig. 10).

A flat specimen from Trincomalee, 102 mm. long, 54-84 mm. wide, and 18-25 mm. thick attached by a base 15-20 mm. in diameter to a nullipore, and having four large, more or less contiguous, bulbous processes projecting above the surface of the sponge, is also to be referred to this species. The processes are narrow at base (15·25 mm. diameter) and broad distally (24-50 mm. diameter). What appear to be pores are the openings of hollows in which small barnacles are lodged. Oscula 3·15 mm. in diameter occur in pairs on the distal end of the processes. The dermal sub-reticulum of small fibres is often obliterated, but usually present on the underside of the sponge (text-figs. 7-8). The colour of the sponge is a light dirty brown. The character and arrangement of the skeleton fibres are as in *C. obtusispiculifera* (S. M. No. 263),

TEXT-FIG. 10.—Skeletal fibres of a specimen of *Callyspongia diffusa*. *a*. Portion of the primary skeleton. *b*. A single mesh of the primary skeleton enlarged to show the arrangement of the spicules.

but the spicules are generally oxea with sharp and abruptly pointed ends, the dimensions, colour and character being as in that species (text-fig.

9). Except in the external form, the mode of branching, and the nature of the spicules, the two specimens assigned to this species seem to be very closely allied, if not identical. In fact, the subtlety of points of difference between species assigned to the genus *Callyspongia* should serve as an indication that a too rigid system of classification has its pit-falls.

Localities.—Pamban, Gulf of Manaar (3 fathoms), (S. M. No. 681-B); Trincomalee, Ceylon (1-3 fathoms), (S. M. No. 265). Dry.

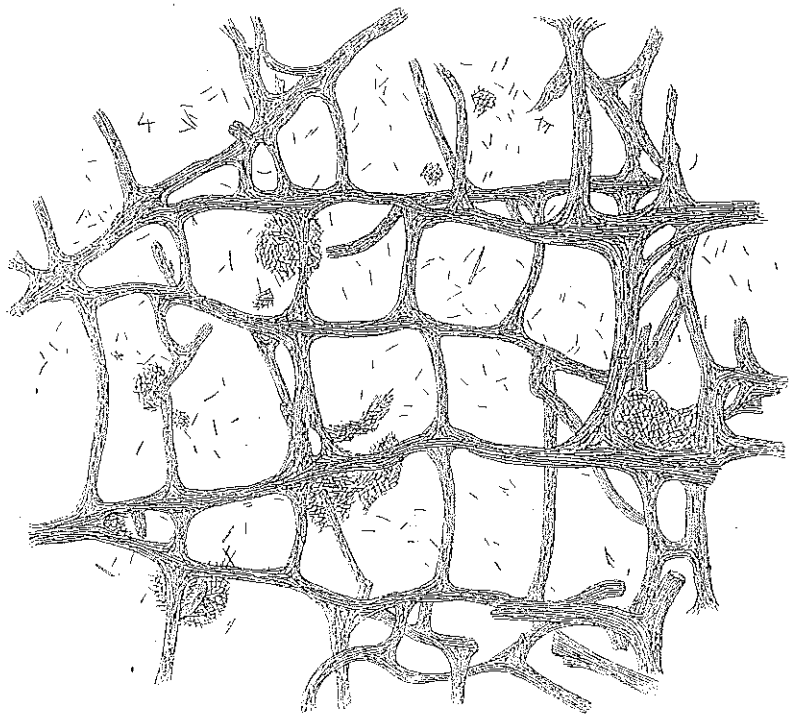
The second specimen has also a close resemblance to *Ceraochalina implexa* Topsent (1892, *Mem. Soc. Zool. France* V, p. 27, pl. i, fig. 6) from the Red Sea.

Callyspongia obtusispiculifera (Dendy).

(Plate XII, fig. 13.)

1905. *Chalina obtusispiculifera*, Dendy, *op. cit.*, p. 150, pl. x, fig. 9.

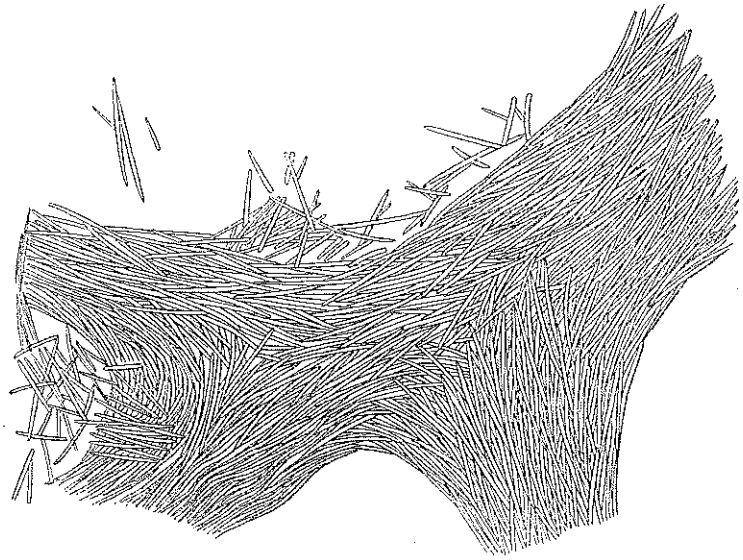
A bushy colony (of closely branching and anastomosing, vertically disposed, digitate processes) 147 mm. broad, 122 mm. high, and 78-95 mm. thick seems to belong to this species. Dendy has not figured the external form of the sponge. The processes are 10-75 mm. high and



Text-fig. 11.—Primary skeleton of *Callyspongia obtusispiculifera* showing the regular meshes. ×26·6.

4-16 mm. in diameter, and rise unequally one above the other like the trees in a forest. They may be cylindrical, angulate or flattened, and

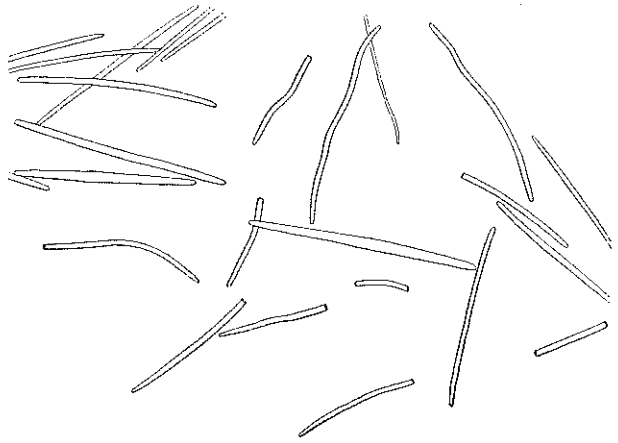
disposed at various angles to one another. On the base of the colony there is a roughly rounded hollow 40 mm. in diameter and 50 mm. in depth which had presumably lodged in life a piece of coral, nullipore nodule, or stone around which the colony started growing. Except for a few fragments of a barnacle sticking to the fibres on the outer fringe of the mouth of this hollow, the sponge bears no trace of the substratum on which it was found. There are no pores on the surface of the sponge apart from the polygonal openings of the cribriform dermal membrane which has been damaged at many points. Oscula 2-4 mm. in diameter are present at the free extremity of most of the digitate processes and rarely on the sides below it. The skeleton consists of an anastomosis of stout spicular fibres (0·06-0·10 mm. in diameter) in more or less regular patterns, chiefly a triangle or a rectangle. The primary fibres at the surface have a polygonal sub-reticulation of smaller fibres (0·02-0·04 mm. in diameter) in the interspaces between the larger fibres. The arrangement of the primary fibres is very regular and consequently the fibres rise one above the other as in a scaffold or ladder (text-fig. 11) At the surface of the sponge the primary fibres appear as prominent ridges, and the junction of two or more fibres is raised into a knob. There



Text-fig. 12.—A junction of the primary fibres of *Callyspongia obtusispiculifera*. ×220.

is thus no distinct dermal membrane which can be peeled off from the surface of the sponge, but it is constituted by the anastomosis of the smaller branching fibres arising from the primary fibres. Spicules are strongyles, or rarely, slightly centrotylote strongyles, straight, flexuous or vermiform, 0·07-0·09 mm. × 0·002-0·004 mm., and of a pale pink colour (text-fig. 13). The spicules are closely packed together in the centre of the fibre, often leaving clear spongin of a thickness of about 0·009 mm. on the periphery of the fibre. Where the fibres join or branch off the junctions are broad, triangular, diamond-shaped, or rectangular (text-fig. 12). No microscleres are present. The colour of the sponge

in its dry state is dirty grey, and the texture brittle. The surface of the sponge in its living or fresh state was probably smooth as the absence of projections, aculeations or knobs on the dry sponge indicates.



Text-fig. 13.—Vermiform, straight, or curved centrotylote strongyles of *Callyspongia obtusispiculifera*. ×340.

Locality.—Trincomalee, Ceylon (1-3 fathoms), (S. M. No. 263).

Although the present specimen does not agree fully with Dendy's description of the species, I prefer to place it here with a full description of it to calling it a new variety or new species with close affinities to Dendy's species. The close relationship of this species to *Callyspongia diffusa* is undoubted, and I should have no hesitation in referring it to this species but for the form of the spicules.

Callyspongia cellaria, sp. nov.

(Plate XII, figs. 1-7.)

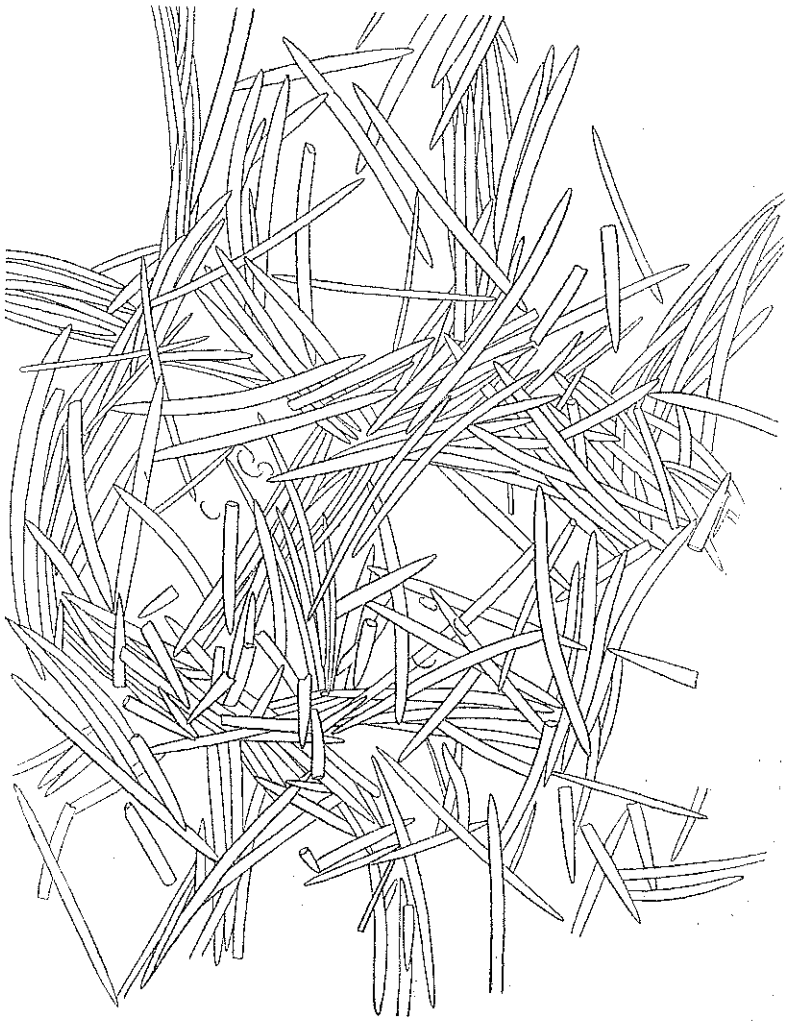
There are two lots of specimens in the collection, one from Pamban and the other from Trincomalee, which I am unable to match with any known species of *Callyspongia*.

S. M. No. 658 from Trincomalee consists of four fragments. One is femuroid in shape, 75 mm. long, 15-20 mm. in diameter where it is flat, and 22·5 to 35·0 mm. where it is convex, a second one 55 mm.×20-25 mm. of a somewhat similar shape, a third 45·0×27·5 mm., irregularly ovoid or oblong and found attached to the valve of a dead Pelecypod shell, and lastly a compressed specimen with a roughly hastate outline 46·0 mm. long and 22·0-29·0 mm. in diameter on the convex portion and 14·0 mm. in diameter on the flat portion. The colour of the fragments in spirit is a dirty yellowish brown.

S. M. No. 689 from Pamban is a small bun-like specimen 38-48 mm. in diameter and 29 mm. in height attached to the valve of a dead Spondylid Lamellibranch mollusc and other shell-debris. The colour of the sponge in spirit is a pale yellowish brown.

The most characteristic features of the species are the presence of well developed spongin forming in conjunction with oxeote spicules *broad band-shaped or lamellar spicular fibres and the extremely fenestrated*

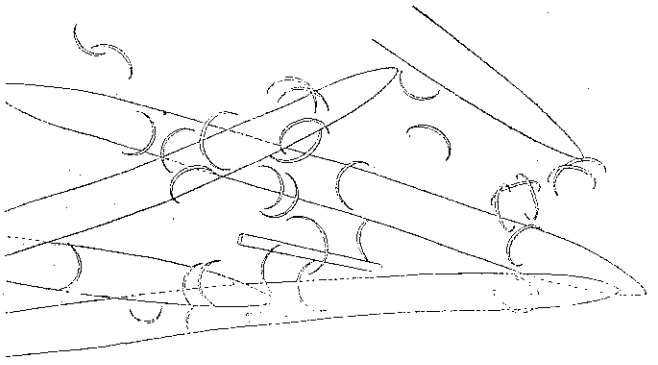
and cellular appearance of the surface and interior of the sponge. The general external appearance of the sponges belonging to the species is thus that of a honey-comb. The texture is firm and very little compressible. The pores, more numerous on the upper surface, are extremely variable in shape and size (0·5-1·5 mm. diameter) and freely coalesce with the adjacent ones, and the oscula (3-5 mm. in diameter) are scattered on the sides and upper surface of the sponge. The skeleton consists



TEXT-FIG. 14.—Skeletal fibres near surface of *Callyspongiae ellaria*, sp. nov. ×166·6.

of an irregular reticulation of loose spicules or spicular fibres of one or more oxea, straight or curved, forming a rough isodictyum with no special dermal layer of spicules except in parts of the sponge very little exposed to the abrasive action of foreign particles, where small vertical bundles of oxea form a pilose covering (text-fig. 14). Loose spicules are often scattered in the meshes of the reticulum. The oxea are 0·16-0·24 mm. long and 0·0022-0·0135 mm. thick, and gradually or abruptly

narrowed at the extremities. Many thin hair-like oxea, which presumably represent the growth stages of the same category of spicules, are also present. The crescent-shaped sigmata, 0·018-0·027 mm. chord,



Text-fig. 15.—Spicules of *Callyspongia cellaria*, sp. nov. ×406·6.

are quite abundant on the surface dermal membrane where preserved and in the interspaces between spicules (text-fig. 15). They are more common where spongin is present. Particles of calcareous debris are commonly sticking to the surface skeletal fibres, and filaments of brown algae are often found sticking out of the lumen of the oscula.

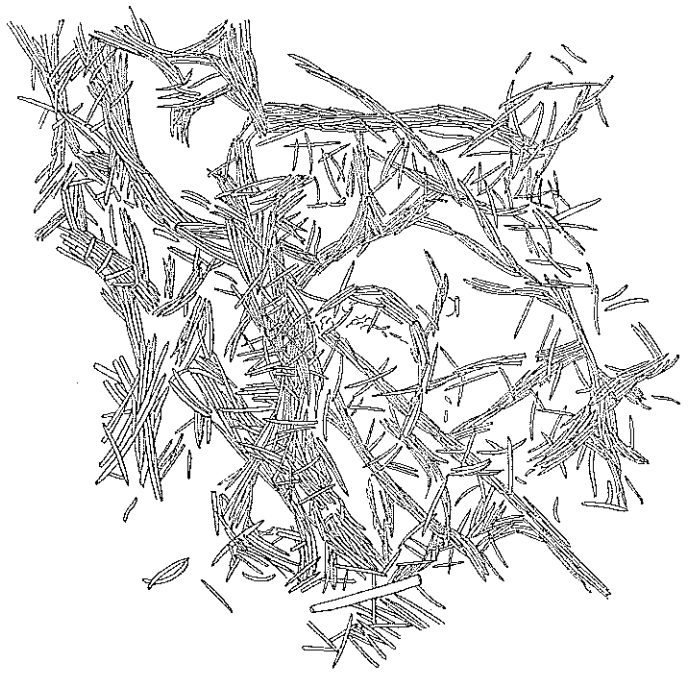
Localities.—Trincomalee, Ceylon (8-10 fathoms), (S. M. No. 689).

Callyspongia cellaria var. **fusca,** nov.

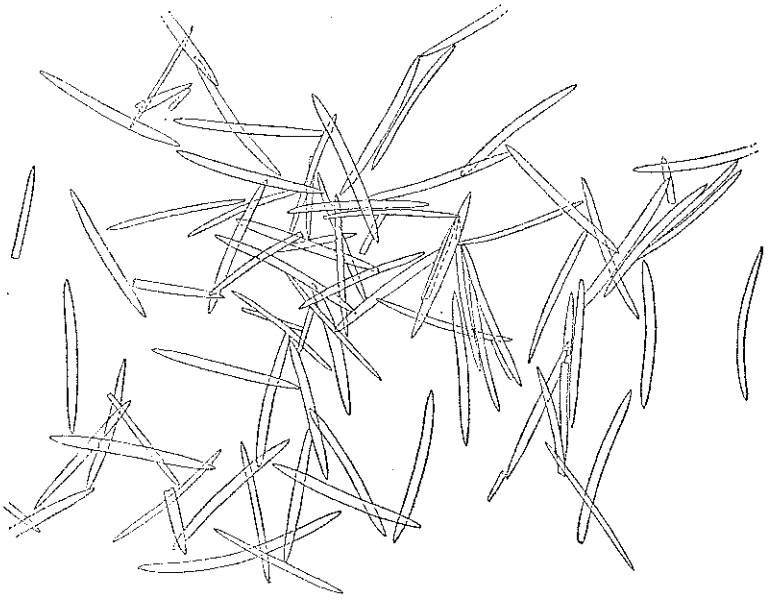
(Plate XII, figs. 8 and 9.)

This sponge differs from the one described above chiefly in colour and texture and in the dimensions of the spicular elements. The specimens are somewhat incomplete and include two fragments. Of the fragments, one is 54·0 mm. long, 24 mm. broad, and 11-13 mm. thick, and the other, a short club-shaped specimen, 35·5 mm. long, 15·5 mm. broad at the tip and 9·5 mm. broad at base. Of the incomplete specimens one is in the form of a pair of clubs joined together a little above the base. It is 118 mm. long, 22·0 mm. to 41·0 mm. broad at the club-shaped extremities, 13·5-23·5 mm. in diameter below the club-shaped part, and 33·5 mm. in diameter where the two clubs are joined together. The other specimen is transversely elongate, hoof-shaped, 97·5 mm. broad, 40-50 mm. high, and has a few short mound-shaped projections 10-15 mm. high from the upper surface. In life it was apparently attached to a dead coral or other calcareous debris at three separate points where fragments of calcareous matter are embedded in the substance of the sponge. All the specimens have numerous oscula 5-8 mm. in diameter, usually flush with the surface of the sponge but sometimes with a slightly tumid lip. A dermal reticulation of spicular fibres formed of one or more spicules is apparently present all over the sponge, but in the state in which it is preserved it is found only in depressions of the sponge surface where it has not suffered damage by abrasive foreign debris. The spicular fibres are relatively thin and form a circular or polygonal reticulation. In the meshes of the spicular fibres a sub-

isodictyal skeleton of a few spicules may be formed (text-fig. 16). The oxea are straight or curved with the extremities abruptly narrowed,

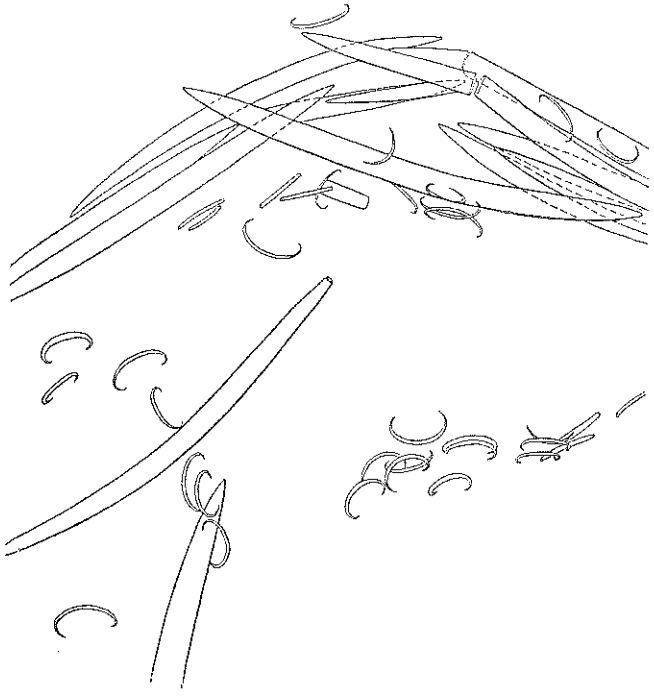


Text-fig. 16.—Skeletal fibres of *Callyspongia cellaria* var. *fusca*, nov. below the dermis with a few sigmata in the centre. ×49·3.



Text-fig. 17.—Oxea of *Callyspongia cellaria* var. *fusca*, nov. ×125.

0·15-0·23 mm. long, and 0·013-0·014 mm. in diameter. The sigmata, 0·0135-0·018 mm. chord, are thin and confined to the dermal skeleton



Text-fig. 18.—Oxea and sigmata of *Callyspongia cellaria* var. *fusca*, nov. ×560.

(text-figs. 17 and 18). The sponge is dark brown in colour, less firm and relatively more resilient than the specimens of *Callyspongia cellaria*.

Locality.—Pamban, Gulf of Manaar (3 fathoms), (S. M. No. 686-A).

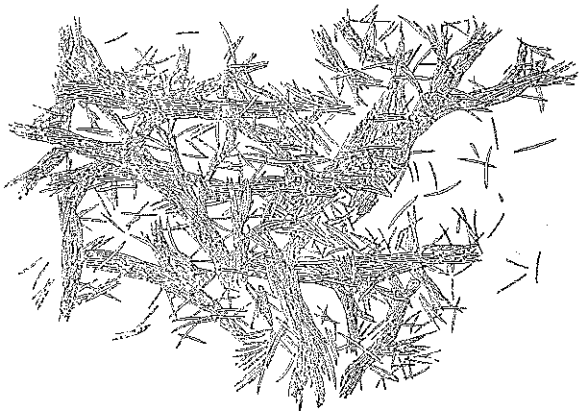
Callyspongia pambanensis, sp. nov.

(Plate XII, figs. 10-12.)

Form digitate or flabellate, slightly branching and anastomosing, texture resilient, furry external surface, and the colour light brown. Pores and oscula numerous. Main skeleton consisting of more or less parallel ascending spicular fibres arching towards the distal end and the periphery of the sponge and connected by short thin transverse fibres. The brush-like termini of individual fibres anastomose with similar adjacent termini to form a dermal membrane, with a small bunch of short spicular fibres projecting at the junction of the main and dermal fibres. It is the projecting fibres which give the sponge surface its furry appearance.

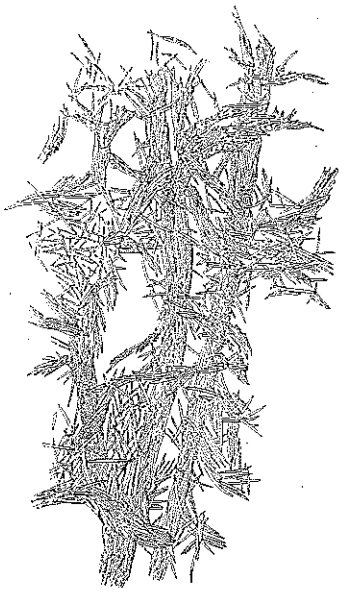
Several stout finger-shaped fragments are present in the collection. One of them is 74·5 mm. long, 25-31 mm. broad, and 14·5-15·5 mm. thick. Another, which is somewhat flabellate, is 51·0 mm. broad, 51·0 mm. high, and 10-20 mm. thick. The pores are less than 1 mm. in diameter, and

the oscula, which may be flush with the surface of the sponge or elevated on mounds, are rounded, oval, or stellar in outline. The oscula are 3-7 mm. in diameter and lead into chambers at the bottom of which are



Text-fig. 19.—Surface fibres of the skeleton of *Callyspongia pambanensis*, sp. nov. ×21·6.

several smaller openings. The primary spicular fibres are 0·12-0·20 mm. in diameter. The surface brushes of spicular fibres are 0·40-0·60



Text-fig. 20.—Radiating fibres of the skeleton of *Callyspongia pambanensis*, sp. nov. ×21·6.

mm. high and 0·08-0·10 mm. in diameter (text-figs. 19 and 20). The oxea are usually sharply and abruptly ended, but a few have gradually

narrowing extremities (text-fig. 21). Occasional styles and strongyles may occur. The oxea are 0·18-0·26 mm. long and 0·004-0·018 mm.

Text-fig. 21.—Oxea of *Callyspongia pambanensis*, sp. nov. ×83·3.

in diameter. No sigmata or other microscleres present. The spongin is less developed than in *C. cellaria*.

Locality.—Pamban, Gulf of Manaar (3 fathoms), (S. M. No. 688).

Oceanapia fistulosa (Bowerbank).

1905. *Phlocodictyon fistulosum*, Dendy, *op. cit.*, p. 165.

This species is represented in the collection by a single incomplete fistula 72·5 mm. high, 10·5-16·5 mm. in diameter, tapering to a narrow cone (above the narrowest part of the cylindrical portion) 25 mm. high. The thickness of the rind varies from 2·0 to 2·5 mm. At the distal extremity of the cylindrical portion is a large transverse osculum shaped like a printer's roller with handles, *i.e.*, with a circular outline in the middle and oblong at the ends. A few smaller oscula, oval or oblong in outline occur scattered over the rest of the fistula. The conical part of the fistula ends blindly and is without an osculum. The numerous pores are found closely packed together all over the fistula. The dermal skeleton consists of a loose reticulum of spicular fibres with two or more spicules while the deeper main or primary skeleton is formed of a relatively larger number of spicules. The primary fibres are at right angles to the dermal skeleton at various points and their extremities project on the surface giving the sponge its roughness. Oxea 0·26-0·48 mm. × 0·006-0·009 mm. Very little spongin is present.

Locality.—Pamban, Gulf of Manaar (S. M. No. 683-D).

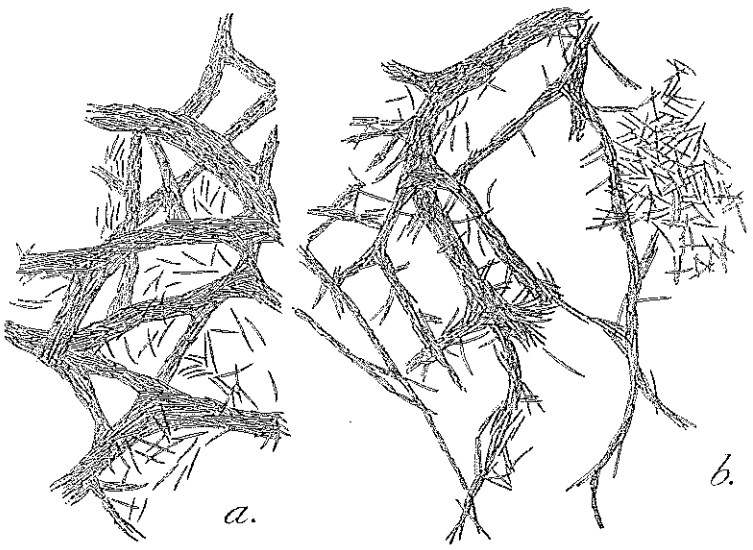
The sandy tubes of a Polychaete worm are found adhering to the sides of the fistulum.

Oceanapia arenosa, sp. nov.

(Plate XII, figs. 16-18.)

A fistulum, 27 mm. long, 8 mm. in diameter, with an osculum 2 mm. in diameter, which presumably represents only a part of the sponge does

not agree with the description of any hitherto known species of *Oceanapia*. The specimen is sharply geniculate near the base where the diameter of the fistulum is reduced by nearly half. It is firm though compressible, slightly rough on the surface, and pale yellowish in colour. Numerous pores 0·3-0·5 mm. in diameter are present on the surface of the sponge. The sponge is covered by a thin transparent dermal membrane supported by a few tangentially disposed oxea forming a loose reticulum, or by uni- or multispicular fibres (0·01-0·04 mm. thick) which anastomose, and give rise to the porous appearance of the sponge surface. The naked-eye appearance of the sponge is, however, smooth. Underlying the



TEXT-FIG. 22.—Skeletal fibres of *Oceanapia arenosa*, sp. nov. *a*. Deeper fibres; *b*. surface fibres.

membrane and the surface fibres are the stouter primary spicular fibres 0·06-0·12 mm. thick. The lumen of the fistulum is lined by a closely agglutinated layer of fine sand and other foreign particles which form a mosaic from the base to the extremity of the fistulum. This mosaic is, however, overlaid by a thin transparent membrane which can be peeled off the layer of sand particles. The spicular fibres consist of gently curved, sharply pointed oxea (0·16-0·18 mm. × 0·0045-0·0060 mm.) which taper gradually from the middle of the spicule to the end. The spicules of the primary skeleton are generally stouter than those of the dermal skeleton, but do not, on that account, form a distinct category of skeletal element. No microscleres are present (text-fig. 22).

The sponge is closely associated with a colony of Zoanthids the surface of which is coated with sand particles, and it is difficult to say whether a bulb-like or root-like main body of the sponge was present or not buried in sand.

The spiculation is characteristic of the genus *Oceanapia*, but in all other features the species seems to differ from previously described forms. The narrow lumen of the fistulum lined by an agglutination of sand particles, the occurrence of a lining membrane over the mosaic of sand

particles, and the presence of a thick cortex distinguish this species from the other known species of the genus.

Locality.—Pamban, Gulf of Manaar (1-5 fathoms), (S. M. No. 671).

Family Desmacidonidae.

Section *MYCALEAE.*

Mycale indica (Carter).

1889. *Esperia indica*, Carter, *Journ. Linn. Soc. London*, XXI, pp. 72-73, pl. vi, figs. 3-6.
1932. *Mycale indica*, Burton & Rao, *op. cit.*, pp. 327-328.

Three massive specimens, of which one is dry and the other two preserved in alcohol, belong to this species. S. M. Nos. 683-E and 687 from Pamban are incomplete and are very much alike in form and consistency. The dry specimen, S. M. No. 264 from Trincomalee, is extremely fragile although it has at present a more or less oval form. The larger of the two specimens preserved in alcohol is 120 mm. broad, 70 mm. thick with finger-like processes 10-15 mm. long on the upper surface, while the other, 48 mm. broad and 18 mm. thick, has no digitate processes. The range of colour in preservation is light yellow to pale. Foreign matter, such as dead shells, corals, etc., is imbedded in the substance of the sponge in both the specimens. No pores or oscula are evident, but invaginations of the sponge surface in some parts give it a cavernous form. The sponges are slightly compressible though fragile. The naked-eye view of the surface of the sponge is smooth, but under a hand lens the dermal layer of tangential styles which forms a cortex 1 mm. thick shows it to be minutely roughened. The primary skeleton consists of a reticulum of spicular fibres which, radiating fan-wise towards the dermal spicular layer, seems to support it. The categories of spicules are styles 0·44-0·66 mm.×0·0135 mm., large anisochelae 0·112-0·135 mm., small anisochelae 0·0135-0·0270 mm., small and large C- and S-shaped or contort sigmata 0·0135-0·0180 mm. and 0·045 mm. chord respectively, and trichodragmata 0·0225-0·0450 mm. The large anisochelae seem to echinate the spicular fibres at many points. S. M. No. 264 is 130 mm. broad, 65 mm. thick, and resembles S. M. No. 687 from Pamban. Its spiculation is very similar except in the anisochelae being relatively fewer.

Localities.—Pamban, Gulf of Manaar (1-5 fathoms), (S. M. Nos. 683-E, 687); Trincomalee, Ceylon (1-5 fathoms), (S. M. No. 264).

Mycale aegagropila (Johnston).

1898. *Esperella aegagropila*, Vosmaer & Pekelharing, *Verhand. Kon. Akad. Wetensch. Amsterdam* VI (2), pp. 19-31, pls. i-iii.
1911. *Mycale macilenta* var. *australis*, Hentschel, *Die Faun. Südwest Austral. Tetraxonida* III, pp. 296-297, text-fig. 6.
1925. *Mycale aegagropila*, Wilson, *Bull. U. S. Nat. Mus.* II, Bull. 100, p. 426.

To this species I refer a few small fragments of an incrustation which invests the zooids of a branching colony of Alcyonaria, white in colour. It agrees in many respects, including size of spicule categories, with the description of the Philippine specimens in the last reference cited

above. The sponge forms a thin diaphanous or lace-like investment less than a millimetre thick over the zooids. The dermal tangential skeleton consists of a reticulum of spicular fibres with only a few subtylostyles. The microscleres are also scanty. Bundles of subtylostyles project here and there from the surface of the sponge. The occurrence of two sizes of anisochelae and of slender hair-like subtylostyles may prove to be distinctive characters justifying the recognition of a new variety, if not of a new species, but in view of the fact that distinctions based on measurements of spicule categories, some of which wholly drop out, have been carried too far towards a state of nomenclatorial confusion I refrain from burdening the literature on the subject. The hair-like subtylostyles are undoubtedly stages in the growth of the spicules of this category. In his report on the Philippine sponges Wilson (1925) mentions young stages of anisochelae 0·004 mm. long. The problem of distinguishing various growth stages of a single category of spicules from the different sizes occurring in spicule categories of a given kind is far from being solved. Until extensive biometrical studies of sponges come into vogue the problem will remain unsolved resulting in needless confusion in taxonomic studies.[1]

Measurements of spicules.

Subtylostyles (needle-shaped)	0·20-0·26 mm.
Slender hair-like subtylostyles	0·22 mm.
Large anisochelae in rosettes	0·036-0·045 mm.
Small anisochelae (loose)	0·013-0·023 mm.
Sigmata (C- and S-shaped)	0·05-0·09 mm. (chord).
Toxa (few)	0·07-0·18 mm. rarely 0·24 mm.

Locality.—Pamban, Gulf of Manaar (1 fathom), (S. M. No. 669-B).

Mycale monanchorata Burton and Rao.

1932. *Mycale monanchorata*, Burton & Rao, *op cit.*, p. 329.

This species is represented by four small, more or less rounded, pale brown, soft and compressible masses 20-30 mm. in diameter and 20 mm. in height, with the terminal parts of the radiating fibres projecting on the sponge surface as white hairy prolongations. The sponge is somewhat cavernous and bears no trace of a dermal skeleton or membrane or of a base of attachment to the substratum unless the dark brown patch on the lower surface of the sponge represents it. The spicular fibres (0·06-0·20 mm. in diameter) branch and anastomose to form a net-work with spongin well developed in the thicker fibres. In addition to the characteristic needle-shaped subtylostyles which occur in the fibres and in the choanosome there are thin hair-like subtylostyles 0·002 mm. thick, irregularly scattered in the choanosome. These are probably the early growth forms of the larger subtylostyles. The

[1] Brondsted, H. V. (*Vidensk. Medd. Dansk Naturh. Foren.* 88, 1929) has led the way by his valuable studies on the spicule length in an individual of *Halichondria panicea* Pallas.

anisochelae, invariably in rosettes, are found in large numbers all over the sponge. The curious foreign particles which occur in great profusion in the choanosome between the spicular fibres in the holotype are singularly absent in the present specimens.

Measurements of spicules.

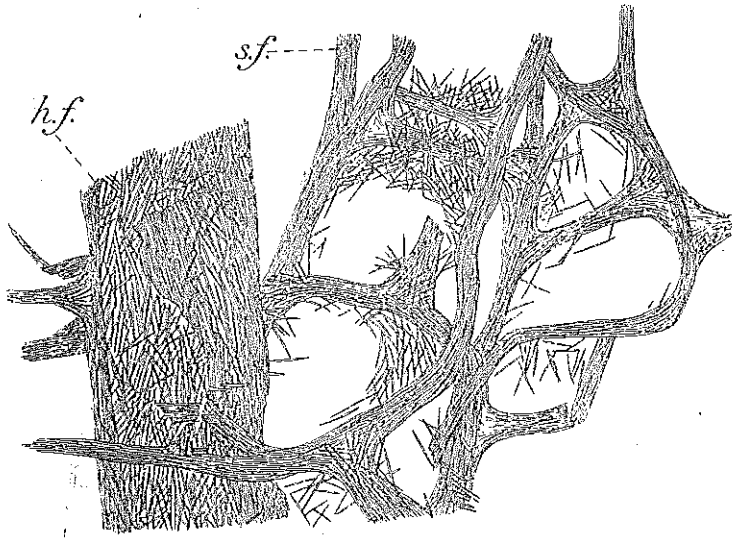
Subtylostyles	0·24-0·28 mm. × 0·004 mm.
Hair-like subtylostyles	0·18-0·23 mm. × 0·002 mm.
Anisochelae	0·022-0·027 mm.

Locality.—Pamban, Gulf of Manaar (1-5 fathoms), (S. M. No. 685-A). The type locality, Kilakarai, is a few miles south of Pamban.

Mycale trincomaliensis, sp. nov.

(Plate XII, fig. 19.)

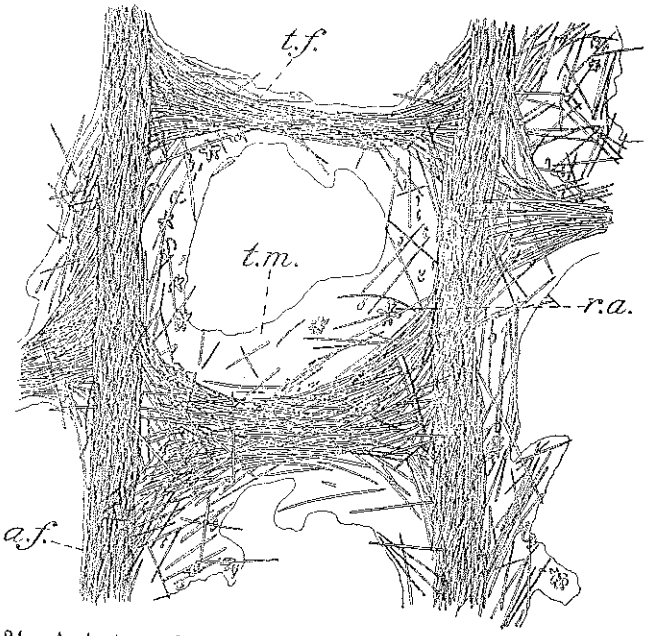
A very fibrous macerated specimen, 85 mm. broad and 70-80 mm. high, is difficult to match with any previously described species of *Mycale*. It is of a pale yellow colour, compactly bushy, compressible and fragile, and has a close anastomosis of the numerous more or less vertically ascending spicular fibres with similar transverse fibres. The dermal membrane is lacking and consequently the ascending and transverse fibres are clearly visible. The ascending fibres are usually stout at the base, 1·0-1·5 mm. in diameter, hollow, and gradually narrow towards



Text-fig. 23.—Skeletal fibres of *Mycale trincomaliensis*, sp. nov. *h. f.*, ascending hollow primary fibres; *s. f.*, secondary solid fibres. ×20.

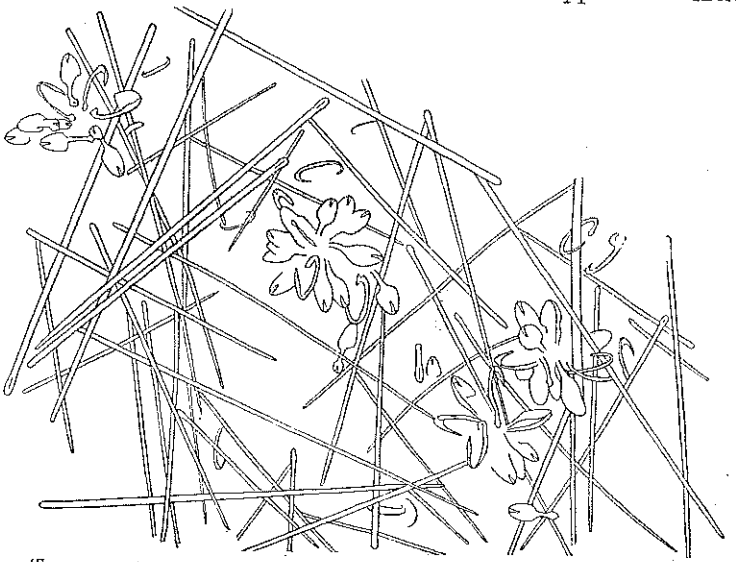
the distal extremities which are solid and end in short or long whip-like filaments. The interfibral spaces are covered by a thin transparent membrane in some places, but are usually open. In the lower parts of the sponge the fibres are covered with foreign particles of small but varied size. The secondary branches (0·1 mm.-0·2 mm. in diameter)

from the hollow main stem are solid and consist of bundles of subtylostyles which branch and anastomose to form the main skeleton (text-



TEXT-FIG. 24.—A single mesh of the skeletal fibres of *Mycale trincomaliensis*, sp. nov. *a. f.*, ascending fibres; *r. a.*, rosettes of anisochelae; *t. f.*, transverse fibres; *t. m.*, transparent membrane. ×20.

fig. 23). The megascleres of the hollow stem are disposed more or less longitudinally forming an irregular palisade of subtylostyles somewhat loosely packed, and a layer of foreign particles supports the inside of



TEXT-FIG. 25.—Spicules of *Mycale trincomaliensis*, sp. nov. ×220.

the hollow stem. At the points of origin of the solid spicular fibres from the hollow stem, and of the anastomosis of the secondary fibres the spicules spread fan-wise (text-fig. 24). The spicular elements consist of thin needle-shaped subtylostyles, occasional hair-like subtylostyles of the same length representing probably the growth stages of the needle-shaped spicules, small anisochelae, loose or in rosettes, of nearly uniform size, and large contort sigmata which are less numerous than the anisochelae. No trace of toxa has been found (text-fig. 25).

Measurements of spicules.

Subtylostyles	..	..	..	0·26-0·30 mm. × 0·0045 mm.
Anisochelae	..	..	..	0·32-0·36 mm.
Sigmata .	..	..	..	0·058 mm. chord.

Locality.—Trincomalee, Ceylon (3-10 fathoms), (S. M. No. 655).

The present species seems to be closely allied to *Mycale parishii* (Bwk.) in its branching and clathrous form, but differs in being bushy and fragile, in having both hollow and solid spicular fibres, in the form of its megascleres, in lacking toxa, and in having only one form of chelae. In the form of the subtylostyles it resembles *M. monanchorata* Burton and Rao and *M. tenuispiculata* Dendy but differs from both in the external form of the sponge.

Biemna tubulata (Dendy).

1905. *Desmacella tubulata*, Dendy, *op. cit.*, p. 155, pl. ix, fig. 4.
1924. *Biemna tubulata*, Dendy & Frederick, *Journ. Linn. Soc. Zool.* XXXV, p. 503.
1932. *Biemna tubulata*, Burton & Rao, *op. cit.*, p. 327.

There are two pieces of sponge in the collection which belong to this species. One of them consists of two incomplete tubes closely adherent on the sides, 20 mm. high, 7-9 mm. in diameter and 1·5-2·5 mm. thick. The other is too fragmentary to be measured, but it is evident, however, that the fragments form part of a tube. Both the specimens are soft, limp, compressible and of a pale pink colour, and in these characters differ from other specimens of the species (in the collection of the Zoological Survey of India, Indian Museum) from the Andamans and Nicobars, the Mergui Archipelago, and the Pearl Oyster banks near Tuticorin. The specimens in the present collection from Ceylon seem to represent the early stages of growth of individuals of the species. The stiffness and roughness of the tubes, and the yellow or brown colour of the sponge seem to represent characters associated with growth.

Locality.—Trincomalee, Ceylon (8 fathoms), (S. M. Nos. 657-A, 657-C).

Section *MYXILLEAE.*

Strongylacidon stelliderma (Carter).

1886. *Halichondria stelliderma*, Carter, *Ann. Mag. Nat. Hist.* (5) XVIII, p. 451.
1896. *Desmacidon stelliderma*, Dendy, *Proc. Roy. Soc. Victoria*, (N. S.) VIII, p. 20.

I refer to this species with some doubt a few fragments of a sponge found on the base of a colony of *Adocia pumila* Lendfld. In external

form some of the larger fragments, at any rate, are not unlike the figure of *Strongylacidon plicatum* (Hentschel, 1911, p. 321, fig. 21*a*). They are crumb-of-bred like in appearance with more or less prominent aculeations, yellowish brown in colour, and somewhat incompressible in texture. The spicular fibres branch and anastomose and project on the surface of the sponge, the consecutive fibres being connected by a membranous tissue strengthened by large numbers of microscleres. Surface wisps of megascleres are present here and there, but the stellar nature of their arrangement round the projecting ends of the spicular fibres is not at all clear. The megascleres are thin strongyles 0·14-0·22 mm. long and 0·002-0·004 mm. in diameter. Apart from being constituents of fibres they are also irregularly scattered in the soft tissue between the fibres. They have evenly rounded ends and bear no trace of the slight inflation referred to in Dendy's account of the species. The microscleres are present in great abundance throughout the sponge, more particularly in the soft membranous tissue between the fibres. A few elongate ova are present in the tissues, but they do not bear any trace of the microscleres which are present in the spherical embryos of *S. plicatum*, a specimen of which collected by the S. W. Australian Expedition I was able to examine in the Zoological Museum at Berlin. The isochelae unguiferae are 0·009 mm. long.

The type of *Strongylacidon*, *e.g. S. sansibarense*, has anisochelae according to Lendenfeld (1897), while *S. stelliderma* and *S. plicatum* have isochelae unguiferae. Burton (1934*b*) is of the opinion that *S. plicatum* is identical with *S. stelliderma*, but Hentschel's (*loc. cit.*) figures of the former show that there are two categories of strongyles and that the microscleres have 4 or 5 denticles, whereas the latter, as far as the specimens under examination are concerned, has only 3 denticles as in the type species. The question whether these differences constitute a specific character cannot be settled until the genus is better known. The occurrence of *Strongylacidon* in Indian waters is, as far as I am aware, recorded for the first time.

Locality.—Trincomalee, Ceylon ($\frac{1}{2}$ fathom), (S. M. No. 651-A).

Iotrochota baculifera Ridley.

1884. *Iotrochota baculifera*, Ridley, *Rep. Zool. Coll. Alert*, p. 435, pls. xxxix, fig. M and xlii, fig. F.
1916. *Iotrochota baculifera*, Dendy, *op. cit.*, p. 125.

A massive dried specimen 200 mm. long, 140 mm. broad, and 50-60 mm. thick, and a small encrustation on a calcareous nodule belong to this species. The former is dark purple in colour, hard and incompressible, with its surface uneven and irregularly pitted. The latter is somewhat damaged and the spicular fibres of the interior are exposed up to the base of attachment. Of the spicular elements, the strongyles seem to be fewer than the others, while the birotulae are the most numerous in the membrane connecting the spicular fibres or overlying the meshes of the skeleton. The dimensions of the styles vary greatly. Strongyles 0·24-0·28 mm.×0·004-0·009 mm., styles 0·20-0·24 mm.× 0·013-0·02, and birotulae 0·0135-0·0180 mm.

Locality.—Trincomalee, Ceylon (1-5 fathoms), (S. M. No. 269).

Section *CLATHRIEAE.*

Echinodictyum clathratum Dendy.

1905. *Echinodictyum clathratum*, Dendy, *op. cit.*, p. 175, pl. xi, fig. 4.
1921. *Echinodictyum clathratum*, Dendy, *op. cit.*, p. 73.
1937. *Echinodictyum clathratum*, Burton, *op. cit.*, p. 31, pl. iv, fig. 25.

The species is represented in the collection by three complete specimens. S. M. No. 675-B from Pamban is 60 mm. high and 50 mm. broad, presumably attached to some hard object, coral or shell by a very short stalk 10 mm. high and 18-22 mm. broad at the base. The aculeated processes on the surface are 8-10 mm. high. The body of the sponge is cavernous, and its surface is covered with a smooth membrane bearing numerous minute pores and what appear to be oscula 1·5 mm. in diameter leading into a shallow pit-like depression in which a group of small openings is seen. The pores are far more numerous than the oscula and scattered all over the membrane. The aculeations on the surface bear spiny processes which are the projecting ends of the spicular fibres, and in addition brushes of thin styles which are more numerous than on the smooth membranous part supported by a loose reticulum of oxea and a few large styli. The colour of the sponge in spirit is pale brown. Polychaete worms, copepods and other small organisms are found associated with the sponge both near the pore areas and in the cavernous passages of the sponge. The present specimen more closely resembles *Echinodictyum asperum* from Tahiti (Ridley and Dendy, 1887, p. 165, pl. xxxii, fig. 2) and *E. fruticosum* from S. W. Australia (Hentschel, 1911, p. 390, fig. 53) than *E. cavernosum* from Celebes (Thiele, 1899, p. 15, pl. ii, fig. 4). S. M. No. 664 from Trincomalee is more or less spherical in outline, 72 mm. high, 80 mm. broad at the widest point and 30 mm. at the narrowest point near the base. It was apparently attached to a piece of coral rock by a broad stalkless base 20-25 mm. in diameter. The sponge is dark brown in patches on the apical part where the dermal membrane is intact, and of a pale brown or sand colour in the basal part and in portions of the apex where the dermal membrane is damaged or absent. The spicular fibres are often connected by a pale transparent membrane. The pores and oscula are not so common or clear as in S. M. No. 675-B. S. M. No. 675-A is a hemispherical honeycomb like specimen, 55 mm. long, 44 mm. broad and 36 mm. high, with the surface aculeations markedly insignificant or absent. The dermal membrane is relatively thick and the surface brushes of tylostyles more evident than in the foregoing specimens. The spicular measurements in this specimen and in S. M. No. 664 are generally higher than those of S. M. No. 675-B, as may be seen in the table of measurements given below.

Measurements of spicules in millimeters.

	S. M. No. 675-B.	S. M. No. 664.	S. M. No. 675-A.
Large styli	0·3-0·76 × 0·009-0·0135	0·3-0·9 × 0·0045-0·0135	1·00
Oxea	0·16-0·36 × 0·0045-0·009	0·16-0·56 × 0·0045-0·009	0·40
Acanthostyli	0·06-0·08 × 0·009	0·14-0·20 × 0·009	0·10
Thin styli of surface brushes.	0·20-0·28 × 0·0045	0·28-0·32 × 0·0045-0·0060	0·30

Localities.—Pamban, Gulf of Manaar (1-5 fathoms), (S. M. Nos. 675-A and 675-B) Trincomalee, Ceylon (3-10 fathoms), (S. M. No. 664).

The present species is closely related to *E. asperum*, *E. fruticosum*, and *E. cavernosum* referred to above, but as Dendy (1921) has pointed out the presence of large styli serves to distinguish it from them. It is, however, not improbable that the large styli in these three species may have been overlooked on account of their scarcity. I am of opinion that *E. fruticosum* and *E. clathratum* will ultimately prove to be synonyms of *E. asperum*. *E. cavernosum*, however, seems to be distinct in its external form.

Section *RASPELIEAE.*

Prostylyssa foetida (Dendy).

1914. (*Reniera ?*) *Amorphinopsis megarrhaphea*, Hallmann, *Proc. Linn. Soc. N. S. Wales* XXXIX, p. 330, pl. xvii, figs. 4, 5.
1925. *Prostylyssa siamensis*, Topsent, *Bull. Soc. Zool. France* I, p. 208.
1927. *Prostylissa*[1] *foetida*, Burton, *op. cit.*, p. 37.

There are two lots of specimens in the collection from Ceylon which belong to this species. S. M. No. 656-E has the form of a bull's head with a pair of conical inwardly curved horn-like processes, one slender and cylindrical, 16 mm. high and 7·5 mm. diameter at its base, and the other stout and pyramidal, 14 mm. high and 11 mm. diameter at base. The latter has three small conical prominences at its extremity arranged in a linear series at right angles to the base of the sponge. Fragments of coral and shell debris are imbedded in the sponge at its base, on the sides above the base, and in between the processes. The specimen is 26·5 mm. broad, 22·0-28·0 mm. high, firm and compressible, light brown to purple in colour, the latter hue being more evident on one side near the base and on the stouter horn-like process. The surface of the sponge is rough and bears depressions and pits from which the shell and coral debris have fallen off. Groups of small pores, some of them cribriform, open on the dermal membrane at the base of and on the horn-like processes. These pores and a system of branching channels are more common in the basal parts and sides of the sponge under the transparent dermal membrane. No terminal oscula are present on the horn-like processes, and the only opening which may be of an oscular nature is a small irregularly oval aperture 1 mm. in diameter at the base of the sponge. The dermal membrane is supported by a mosaic of oxea arranged more or less parallel to one another which makes the sponge surface rough, but the direction of groups of spicules at the surface varies, one group of tangential spicules being at an angle to the adjacent group. The bundles of oxea which lie at a right angle to the dermal skeleton give the specimen a slight resemblance to *Trachyopsis halichondroides* but the occurrence of styli places it undoubtedly in *Prostylyssa*. The curious mosaic-like arrangement of the dermal oxea seems to be a hitherto undescribed feature in the species, but it seems to me scarcely necessary to erect a new species to emphasise this feature. The form, texture

[1] Burton does not state why the spelling of the generic name has been changed from *Prostylyssa* to *Prostylissa*.

and colour of the species seem to be so variable that these features cannot be used to separate the present specimen from those previously referred to this species. The measurements of oxea and styli are 0·3-0·9 mm.×0·01-0·03 mm., and 0·16-0·22 mm.× 0·009 mm. respectively.

S. M. No. 666, which from its skeletal characters appears to belong to this species, consists of a few dichotomously branching fragments 24-34 mm. long and 2-4 mm. in diameter. The sponge is somewhat flattened basally and cylindrical in the distal half. The subdermal cribriform pores and the skeleton are as in the previous specimen. The colour of the sponge in alcohol is a pale yellow or white.

Locality.—Trincomalee, Ceylon (8-10 fathoms), (S. M. Nos. 656-E and 666).

Trachyopsis halichondroides Dendy.

1905. *Trachyopsis halichondroides*, Dendy, *op. cit.*, p. 147, pl. x, fig. 10.
1921. *Halichondria aplysinoides*, Dendy, *op. cit.*, p. 39, pl. 3, figs. 3-5, pl. 12, fig. 9.
1925. *Trachyopsis halichondroides*, Wilson, *op. cit.*, p. 409.
1926. *Trachyopsis halichondroides*, Burton, *Trans. Zool. Soc. London* XXII, p. 75.
1937. *Trachyopsis aplysinoides*, Burton, *op. cit.*, p. 38.

The species is represented by two specimens, one roughly cylindrical 50 mm. long and 24 mm. in diameter, and the other roughly spherical, 16-18 mm. in diameter. The colour of the sponge is pinkish brown to deep chocolate or purple, one surface being of a lighter shade than the other. The interior of the sponge is pink in colour. The sponge proper is overgrown by a layer of what appears to be a *Hexadella* which invests and masks it in several places. There is an abundance of calcareous debris of broken mollusc shells, algal nodules, bits of coral, Echinoid spines, sand grains, etc. imbedded in the substance of the investing horny sponge, and protruding at various points on the surface giving it a rough appearance externally. There is a pair of oscula at one end, one elongate and the other circular or cruciform, the former 6 mm. in maximum diameter and the latter 1-5 mm. in diameter. There are a few small pores on fleshy eminences which seem to belong to the investing horny sponge, but there are others on the uninvested portions which presumably represent the pores of the specimen under report. The skeleton consists of a dense reticulation of spicular fibres, with wisps of spicules directed towards the surface which is often supported by loose tangential spicules. In some parts the reticulate skeleton consists of thin loose fibres of only 3 or 4 spicules, while in others it consists of fairly thick fibres of several spicules. The oxea vary considerably in dimensions (0·4-0·7 mm.×0·01-0·02 mm.) and are stout in the middle tapering gradually towards the ends.

Reading through the descriptions of the species in the literature cited above, I have no doubt that the specimens in the present collection are well within the recorded limits of variation in the species both in regard to the external form and the skeleton.

Locality.—Trincomalee, Ceylon (8 fathoms), (S. M. No. 656-C).

Order KERATOSA.

Sub-order *DICTYOCERATIDA.*

Phyllospongia papyracea (Esper).

1905. *Phyllospongia papyracea* (Esper) var., Dendy, *op. cit.*, p. 217, pl. xiv, fig. 6.

There are two specimens in the collection which belong to this species. S. M. No. 266 preserved dry agrees closely with the figure and description of the Ceylon specimen examined by Dendy. It is 215 mm. long, 150 mm. broad, 1·25-2·00 mm. thick. The entire sponge colony was apparently attached to a bottom of shingle judging from the fragments of dead coral and *Arca* shells attached to the extremities of the lower surface. Several foliaceous vertical projections are present on the upper surface, while slender band shaped branches which anastomose to form arches are present on the lower surface. Many of the primary fibres contain particles of foreign matter including sand grains and broken sponge spicules, but those that stick to the sponge surface are so few and minute that they are hardly noticeable. S. M. No. 684 from Pamban preserved in alcohol consists of four sheet-like fragments of probably an entire piece. One fragment of a light yellow colour with foliaceous projections on the upper surface is attached to a small piece of dead coral by 3 short pillar-like processes of sponge from the under surface. In the other fragments of a brown colour the projections of the upper surface are small while the under surface bears several long thread-like and short pillar-like outgrowths by which the sponge was attached to a piece of coral or rock. Foreign particles are found in moderate quantities on the surface of the sponge, and in sections at right angles to the surface of the sponge a large number of sponge spicules is usually present on and among the thin fibres.

Localities.—Trincomalee, Ceylon (3 fathoms), (S. M. No. 266); Pamban, Gulf of Manaar (3 fathoms), (S. M. No. 684).

Spongia officinalis Linnaeus.

Plate XIII, figs. 1 and 2.)

1889. *Euspongia officinalis*, Lendenfeld, *Monogr. Horny Sponges*, p. 262.
1925. *Euspongia officinalis*, Wilson, *op. cit.*, p. 484.
1934. *Spongia officinalis*, Burton, *op. cit.*, p. 576.

There are two flat cake-like specimens in the collection which belong to the present species. The larger of the two was apparently attached to the convex surface of a submarine rock or coral mass, and its base of attachment is therefore concave. It is roughly pentagonal in outline, 70 mm. high, 85 mm. broad and 15 mm. thick with its distal margin marked off into four triangular prominences 10-15 mm. high which are darker in colour than the rest of the sponge. The numerous very short conuli connected by membranous ridges of a somewhat muscular consistency give the surface its reticulated and rough appearance. The darker portions of the sponge bear several oscula 3-5 mm. in diameter on the distal margin of the sponge and at or near the bases of the triangular prominences. The dermal membrane is transparent and entire even on some of the oscula. The other specimen is 90 mm. high, 45 mm.

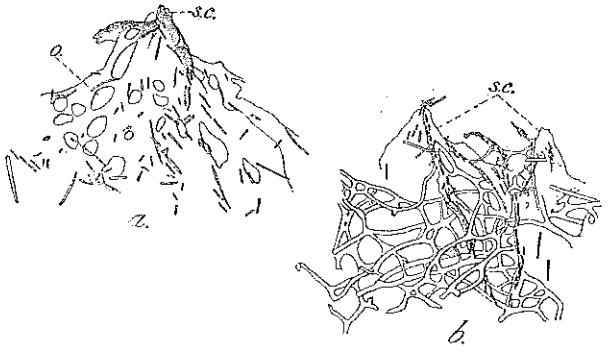
broad, and 10 mm. thick and is roughly rectangular in outline with the distal margin indented into two large and two very small conical prominences. Its base of attachment is 40 mm.×28 mm. There are one large and two small oscular openings on the darker portion of the sponge with the transparent dermal membrane entire in all but one. The texture of both the specimens is firm and compressible. The primary fibres terminating in conules are knotted, and 0·06-0·08 mm. in diameter, and the anastomosing secondary fibres are thinner, and 0·02-0·04 mm. in diameter. The primary fibres have usually a core of broken spicules.

Locality.—Trincomalee, Ceylon (3-10 fathoms), (S. M. No. 653).

Spongia officinalis var. **fenestrata,** nov.

(Plate XIII, figs. 3 and 4.)

A specimen from Pamban which in texture and structure closely resembles *S. officinalis* described above differs from it in having a distinctive fenestrated dermal membrane, not unlike that figured by George & Wilson (*Bull. U. S. Bur. Fish.* XXXVI, pl. lxv, fig. 48, 1919) for their *Aplysilla longispina.* It is 80 mm.×55 mm., and 37 mm. high, somewhat bun-shaped, and attached presumably to a small rounded piece of coral which has left a cavernous oval hollow 34 mm.×26 mm. and 22 mm. deep on the under-surface of the sponge. There are a few digitate processes, 5-25 mm. high and 3-10 mm. in diameter, at various levels projecting from its basal and distal portions like a group of chimneys. A few oscula 1·5-6·0 mm., found on various parts of the sponge except the extremities of the digitate processes, lead to the interior of the sponge but rarely communicate with the cavernous basal part of the sponge or its extensions. The upper surface of the sponge is rough in general appearance due to the presence of the numerous minute conuli and is covered by a characteristic fenestrated, granulated, more or less



Text-fig. 26.—Skeletal fibres of *Spongia officinalis* var. *fenestrata,* nov a. View of a surface conule with the trellis-membrane and supporting spicules; b. View of vertical section of the sponge near the surface showing the distribution of the sponge fibres. *o.*, openings in the transparent membrane; *s. c.*, surface conules.

transparent membrane supported by scattered broken spicules of various sponges. On the basal portion of the sponge, however, the membrane is without the fenestrae. The colour of the sponge varies from light

to chestnut brown on the upper surface to pale white on the under. The interior of the basal cavity is yellowish. The texture of the sponge is compressible though firm. The primary and secondary skeletal fibres are hardly distinguishable except by the presence in the former of a core of broken sponge spicules. The primary fibres ending below a group of conules often divide into subsidiary branches, one for each of the conules in the group. Sometimes more than one branch are given off to individual conules from the tip of which they project considerably. These projecting fibres give the woolly appearance seen in some parts of the sponge. The secondary fibres form a close reticulum throughout the sponge.

Although the sponge has some distinctive features which may justify its separation from *S. officinalis*, it is hardly necessary to give it more than a varietal status.

Locality.—Pamban, Gulf of Manaar (5 fathoms), (S. M. No. 676).

Spongia officinalis var. **bibulus,** nov.

(Plate XIII, figs. 5 and 6.)

The specimen described here as a new variety would, according to Lendenfeld and Dendy, have belonged to the genus *Hippospongia* Schulze, but following Burton I prefer to assign it to *Spongia* Linn. It does not agree exactly with the published descriptions or figures of any of the species of *Euspongia* or *Hippospongia* hitherto known, but I do not think that the differences are such as to warrant the creation of a new species. I have, however, separated it from *S. officinalis* as a distinct variety with reference to the tendency of the sponge to absorb fluids quickly resulting in its rigidity.

TEXT-FIG. 27.—Primary fibres of the deeper portions of the skeleton of *Spongia officinalis* var. *bibulus*, nov. ×22·5.

There are two flabellate fragments of the sponge in the collection. One is roughly hexagonal in outline, 90 mm.×70 mm., 2-18 mm. thick, and the other triangular, 62 mm. at its base, 52 mm. and 60 mm. long on the other two sides, and 10-15 mm. thick. A surface view of the

former from above and a side view of the latter are shown in plate XIII, figs. 5 and 6. Both are attached by their smooth base to a few fragments of calcareous algae. A number of band-shaped trabeculae of reticulated spongin fibres arises from the upper surface of the sponge anastomosing to form cavernous passages. These trabeculae are produced over the anastomoses into lamellate or roughly cylindrical branches into which the primary fibres and their branches enter. The meshes between the fibres of the basal plate are smaller than those of the trabeculae. The fibres of the flat base of the sponge are pale and transparent, 0·02-0·04 mm. in diameter with the primary fibres 0·06 mm. in diameter. The peripheral fibres are of an amber yellow to brown colour, 0·02-0·08 mm. in diameter, with the primaries 0·06-0·10 mm. in diameter, and a core of pith 0·02 mm. in diameter. The primary fibres are cored by sand grains, sponge spicules and other foreign bodies, and their outlines are not always clearly distinguishable. Particles of fine matter may

Text-fig. 28.—Primary fibres of the surface skeleton of *Spongia officinalis* var. *bibulus*, nov. ending in conuli. ×24.

also be sticking in a row to the outer sides of the fibres. The secondary fibres are free from inclusions. Certain rusty brown *Nostoc*-like algal filaments are sometimes found lodged in the fibres.

The sponge is rigid and incompressible in alcohol, but soft, compressible and elastic when dry. The moment the dry sponge is put into alcohol, it takes up the preservative very rapidly becoming at the same time very rigid and incompressible.

Locality.—Trincomalee, Ceylon (3-10 fathoms), (S. M. No. 654-A).

Hircinia fusca Carter.

1905. *Hircinia fusca*, Dendy, *op. cit.*, p. 219, pl. xiv, fig. 1.
1937. *Hircinia fusca*, Burton, *op. cit.*, p. 40.

The specimen agrees with the detailed general description of the species given by Dendy. It is 160 mm. high 65 mm. broad, and fixed, by a more or less flat base, 100 mm.×75 mm., presumably to a coral mass or the hard sandy surface of the sea-bottom, as a thin layer of sand particles adhering to the base suggests. It consists of flabellate and two digitate processes. The latter stand apart from the former and appear to have been formed by the fusion in the early stages of growth of three or four digitate processes judging from the number of terminal oscula present. The conules are arranged in longitudinal series on the sponge, the distance between two consecutive conules being 3-13 mm. They are 1·5-3·0 mm. high, each consecutive pair in the longitudinal series being connected by an arched ridge. Besides the terminal oscula there are large ones 6-10 mm. in diameter on the side of the sponge and at the base of the digitate processes, into the cavity of which open 2-4 smaller oscula. The basal part of the sponge is somewhat paler than the upper portions which are of a dark brown colour. The conules are supported by an anastomosis of stout fibres cored by broken sponge spicules. The filaments characteristic of *Hircinia* seem to form fibres below the ectosome with broken spicules entangled between them. In the choanosome large grains of sand, Formaniferan shells, and spicules of Alcyonaria are attached to the fibres. The dermal membrane is studded with broken spicules of sponges.

Locality.—Pamban, Gulf of Manaar (3 fathoms), (S. M. No. 679).

Hircinia ramodigitata Burton.

(Plate XIII, fig. 7.)

1934. *Hircinia ramodigitata*, Burton, *op. cit.*, p. 500, pl. i, fig. 12.

There are two specimens in the collection, one preserved in alcohol and the other preserved dry, which belong to this species. S. M. No. 267 from Trincomalee is a colony of anastomosing tubes some of which are vertical and 10-70 mm. high. The colony is 100-140 mm. long and 75-95 mm. broad. The diameter of the individual tubes varies from 5 to 20 mm., and of the oscula from 5 to 10 mm. The sponge wall in the hollow tubes is 3-5 mm. thick. The pores on the surface of the sponge are 1-5 mm. in diameter and usually more numerous on the dorsal than on the ventral side. The distal ends of the tubes may have pores or oscula. The latter are rounded, oval or hour-glass shaped. A parchment-like membrane often covers the pores. The colour of the sponge is dirty gray or brown. Most of the primary fibres are cored by particles of sand and a few broken sponge spicules.

S. M. No. 691 from Pamban is a branched colony of tubular sponge with minute surface conulations and conspicuous oscula of various sizes scattered over the sponge, and sometimes oscular sieves on the distal extremity of the digitate processes. The external form of the specimen resembles *Psammoclema ramosum* (Marshall in *Zeit. Wiss. Zool.* XXXV,

pl. vii, figs. 12-15, 1880), and of the same species figured by Polejaeff (*Challenger Rep.* XI, pl. iii, fig. 8, pl. iv, fig. 1, 1884). The diagnosis of *Psammoclema* as given by Marshall is hardly adequate to enable any detailed comparison with the present specimens. The whole colony seems to arise from a small plate-like horizontal mass of sponge attached to a coral mass or debris. It is more or less dichotomously branched, non-anastomosing, 120 mm. high with the digitate branches 20-25 mm. high, 12-20 mm. in external and 10-18 mm. in internal diameter, and the sponge-wall 1·5-4·0 mm. thick. Oscula are scattered all over the sponge and vary in diameter from 1 mm. to 10 mm. The digitate branches may have at their extremities oscular sieves 14 mm. in diameter with individual oscula 3-4 mm. in diameter. The oscula may be open, or wholly or partly covered with a whitish semi-transparent membrane. Some of them lead into shallow or deep cavities into which open a few rounded exhalent apertures. The external surface is minutely conulated with the conules 0·1-0·2 mm. high. In the solid portions of the colony where the internal cavity is just beginning to be formed, the disposition of the primary and secondary fibres is clearly seen. The primary fibres radiate like the spokes of a wheel to the periphery of the sponge while the secondary fibres form a regular reticulum with the primary fibres. The meshes of the reticulum are more or less rectangular and fairly compact. The outlines of the primaries are obscured by the mass of sand grains and other debris which fill them, but the secondaries are well formed. The distinction between the primary and secondary fibres lies only in the presence of coring debris in the former, the diameter of the latter being sometimes more than that of the primary fibres. The fibres vary in diameter from 0·02 mm. to 0·06 mm. The characteristic dermis described by Burton is present in the specimen, but I have not been able to find any filaments or algae in the tissues, although the choanosome is filled with a granular substance.

A small species of crab, *Porcellana* sp., and several small polychaete worms were found in the cavity of one of the branches of the sponge.

It is probable that *Psammoclema* Marshall, which is not a well-defined genus, will ultimately prove to be a *Hircinia*. *P. ramosum* and *P. vosmaeri* are so like the Ceylon specimens of *Hircinia ramodigitata* described here in external and internal features that they may also prove to be identical with the latter, or, at best, varieties of it. The arrangement of the dermal debris in a polygonal reticulation seems to be the only distinctive character of the present species, and this is hardly such an important character as to distinguish it from *Hircinia variabilis* (Schulze), of which it may prove to be only a variety.

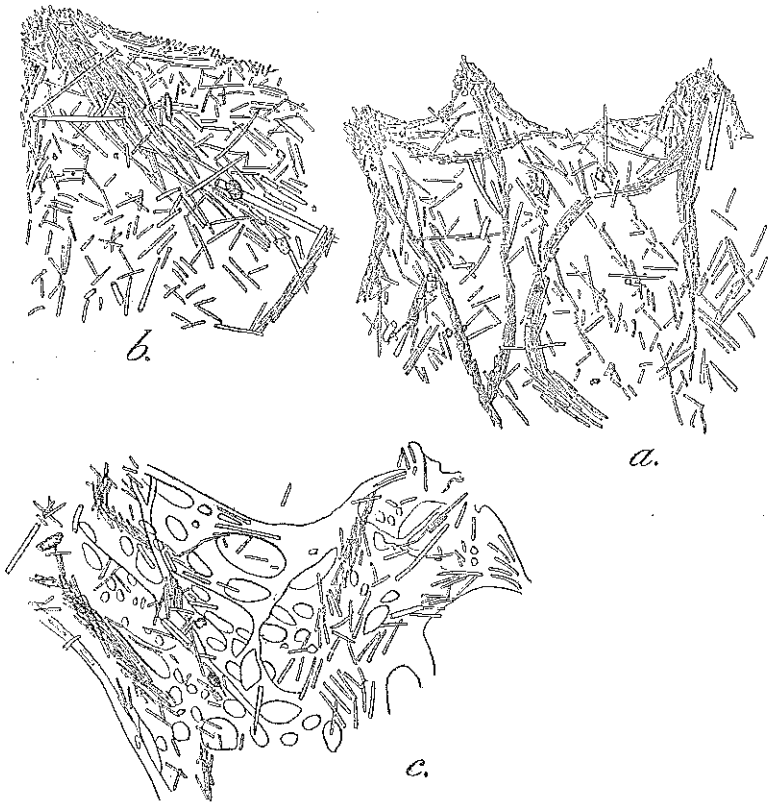
Localities.—Pamban, Gulf of Manaar (5 fathoms), (S. M. No. 691); Trincomalee, Ceylon (3 fathoms), (S. M. No. 267).

Hircinia cactiformis, sp. nov.

(Plate III, fig. 8.)

A small cake-like specimen 65 mm. long, 35-45 mm. broad, and 30 mm. high with a number of cactiform processes on its upper surface does not match with any known species of *Hircinia*. The sponge was

apparently found on a bottom of shell and coral debris or sand judging from the number of calcareous and flinty particles attached to the under surface of the sponge. The ventral surface is more or less convex and bears elongate canalicular excavations in the sponge substance inhabited by Polychaete worms. Two small Pelecypods are also found in a pit-like excavation on the sides near the base. The dorsal surface is more or less plane and has on or about the centre a stout, cylindrical, pillar-like slanting process 20 mm. long and 15 mm. in diameter, and a number of short cactiform[1] or aculeate processes, 3-15 mm. long and 1-4 mm. in diameter, also projecting at an angle to the dorsal surface. The rest of the sponge surface is granular. There are no definite pores, but two small oscula 1·0-1·5 mm. in diameter are present, one at one end of the sponge near the base and the other on the summit of the pillar-like processes hidden among the cactiform conules. The sponge is



TEXT-FIG. 29.—Skeletal fibres of *Hircinia cactiformis*, sp. nov. a. Digitate process of the surface with terminal conules; b. Surface conule of sponge with a core of radiating spicules; c. Vertical section of sponge near surface with ascending fibres cored with broken spicules.

soft, flabby, and compressible. The dermal membrane is transparent, and the fibres of the skeleton can be easily seen through it, more parti-

[1] The cactiform processes are not unlike the stems of certain Xerophytes of the atural order Euphorbiaceae.

cularly on the cactiform processes. The skeleton consists of diaphanous, frequently branching and anastomosing spongin fibres, cored completely or partially by sponge spicules. The fibres are very irregular in outline and vary in diameter from 0·06 mm. to 0·20 mm. They end in the conules on the processes. The dermal membrane is supported by short broken sponge spicules which are usually disposed along the axes of the processes. The long filaments with bulbous terminations believed to be characteristic of the genus occur in great abundance in between the skeletal fibres. In some places they lie side by side so closely as to form a mat-like structure.

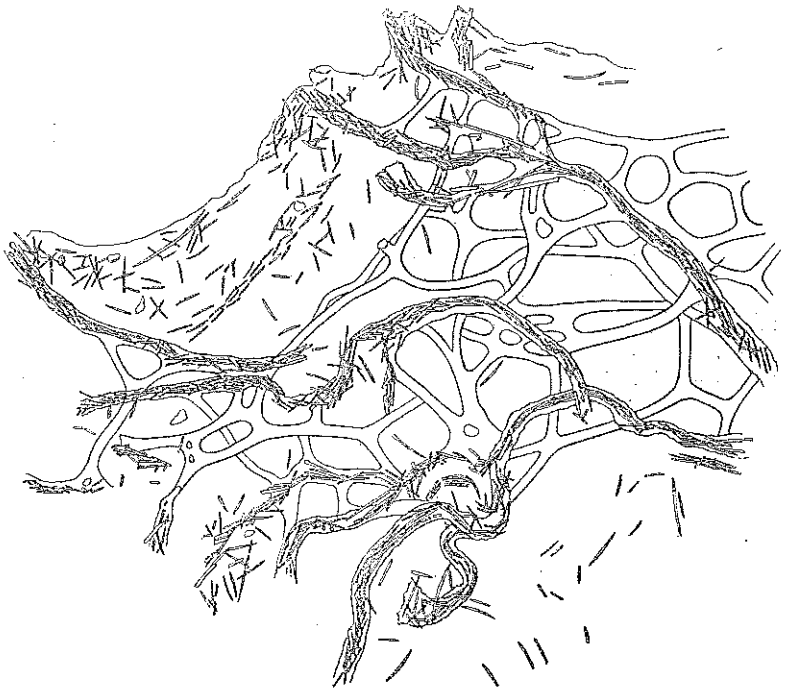
The species is to be distinguished from previously described species of *Hircinia* chiefly by the external form of the sponge and the pale, transparent dermal membrane investing the entire sponge.

Locality.—Pamban, Gulf of Manaar (5 fathoms), (S. M. No. 677).

Hircinia pellita, sp. nov.

(Plate XIII, fig. 9.)

Sponge clathrous ; firm but compressible, consisting of anastomosing bands of a network of spongin fibres ; primary and secondary fibres not easily distinguishable in the interior bands, but near the surface they are quite distinct. The primary fibres are generally knotted and

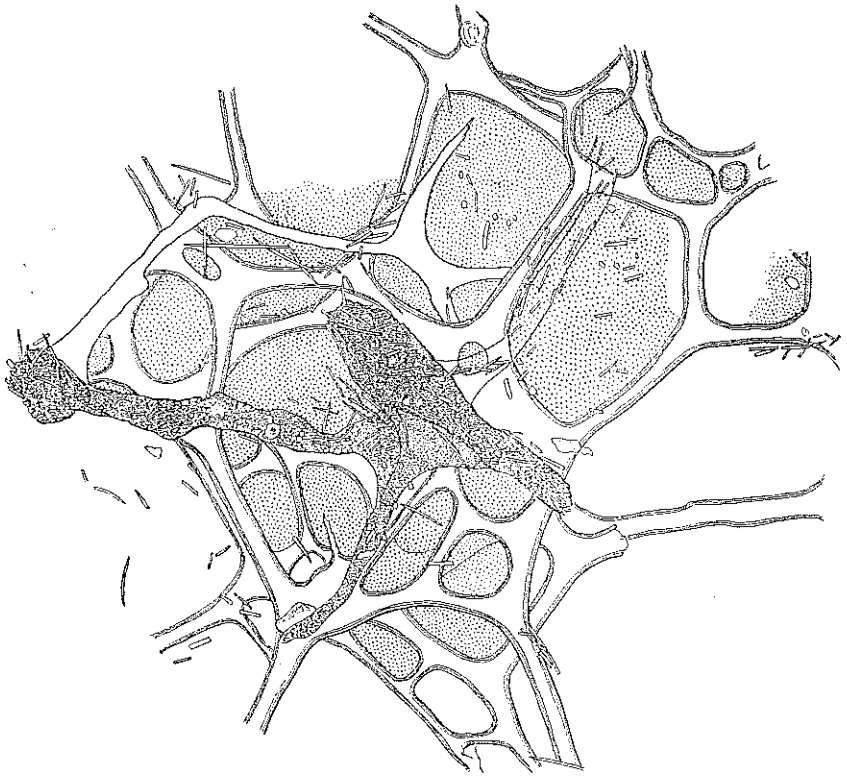


Text-fig. 30.—Vertical section through surface of *Hircinia pellita*, sp. nov. showing the primary and secondary skeletal fibres and the conules. ×26·6.

angulated in places owing to the irregular disposition of the enclosed fragments of spicules which often project outside the fibre. Some

distance below the surface they branch out fan-wise supporting a group of minute surface conules. The entire sponge surface is covered by a transparent pale white membrane which shows out conspicuously in between the bands of spongin fibres and conforms to the polygonal pattern of the surface meshes by being raised as ridges connecting the conules. On the under surface of the sponge the membrane is so transparent and smooth that the surface meshes of fibres are clearly visible through it. Oscula are present on the margin of the sponge, and minute pores in between the conules. The dermal membrane is supported by scattered broken spicules of sponges and by other foreign matter which may, in places, be arranged in a reticular pattern. The characteristic anastomosis of the secondary with the primary fibres may be seen clearly near the surface, and more particularly below the surface conules. The deeper secondary fibres are conspicuously laminated with the central pith only a third of the diameter of the entire fibre. Peripheral fibres are pale in colour while the deeper ones are yellowish. The large branching cavities which intercommunicate in the interior of the sponge, the finger-shaped processes, and the investing dermal membrane give the sponge its resemblance to a glove.

The sponge was, probably, taken on a substratum of coral or shell debris fragments of which are sticking to what is presumably the basal



TEXT-FIG. 31.—Enlarged view of the skeletal fibres of *Hircinia pellita*, sp. nov. near the surface showing the transparent outer membrane and the structureless fibrous tissue. ×49·3.

part of the sponge. The holotype is roughly pentagonal in shape, 114 mm. in diameter and 30 mm. thick. On the periphery of the sponge there are stout digitiform processes, 10-45 mm. high and 15-25 mm. in diameter, on the extremity of which are one or more oscula 4-5 mm. in diameter. Oscula are also present on other parts of the sponge, one of which on the upper surface 10 mm. in diameter appears to be the central or main osculum (see centre of fig. 9 in plate XIII). The small conules, 1-2 mm. high, are generally present on the upper surface and periphery of the sponge, and are supported by the terminal branches of the primary fibres. The bands of sponge fibres are 3-5 mm. thick, with the primary fibres 0·04-0·16 mm. and the secondary fibres 0·04-0·12 mm. in diameter, and the meshes of the reticulating fibres 0·10-0·15 mm. in diameter. No filaments are present in the choanosome, but their place seems to have been taken by a structureless fibrous tissue which is found all over the interior of the sponge and below the dermal membrane.

In the form of its skeleton the species closely resembles Polejaeff's *Cacospongia irregularis* and *Hippospongia anomala* both of which are probably *Hircinia*, but in the glove-shaped external form and in the occurrence of a transparent dermal membrane which reveals the clathrous internal structure of the sponge, the present species seems to differ from all other *Hircinia* hitherto described.

Locality.—Trincomalee, Ceylon (3-10 fathoms), (S. M. No. 652).

Dysidea fragilis (Montagu).

1905. *Spongelia fragilis* var. *ramosa*, Dendy, *op. cit.*, p. 208.
1934. *Dysidea fragilis*, Burton, *op. cit.*, p. 583, pl. ii.
1937. *Dysidea fragilis*, Burton, *op. cit.*, p. 41.

Of the three specimens in the collection belonging to the present species, S. M. No. 270 from Trincomalee is a colony of dried sponge which has been reduced to powder owing to its extreme fragility. A few digitiform fragments which somewhat resemble a specimen from the British coast figured by Burton (1934, pl. ii, fig. 8) are, however, still intact. The lumen of the skeletal fibres are so crammed with sand grains, Foraminiferan remains, and sponge spicules that their outlines are hardly discernible. The inclusions of the fibres project into the meshes which are often covered by a very thin membrane with whitish granular markings.

The other two specimens from Pamban are preserved in spirit. S. M. No. 685-B is a flat sheet-like sponge attached by a broad base from which a few short processes arise. The whole sponge surface is studded with small conules supported by the distal terminations of the primary fibres. Particles of a darkish colour and grains of sand are found sticking to the sponge. The specimen is flabby, compressible, and of a pale dirty brown or grey colour. S. M. No. 675-C is of a firmer texture and a more decidedly pale dirty brown colour. Large channels or conduits passing through the interior of the sponge give it a cavernous appearance. The soft structureless membrane between the conules on the surface and near the channels bears small or large apertures leading into the cavernous interior. The conules are less conspicuous and the black particles less numerous than in S. M. No. 685-B.

Localities.—Trincomalee, Ceylon (1-5 fathoms), (S. M. No. 270); Pamban, Gulf of Manaar (1-5 fathoms), (S. M. Nos. 685-B and 675-C).

Dysidea herbacea (Keller).

(Plate XIII, fig. 10.)

1889. *Spongelia herbacea*, Keller, *Zeit. Wiss. Zool.* XLVIII, p. 336, pl. xx, fig. 1.
1902. *Spongelia digitata*, Sollas, I. B. J., *Proc. Zool. Soc. London*, p. 220, pl. xiv, fig. 4, pl. xv, fig. 2.
1934. *Dysidea herbacea*, Burton, *op. cit.*, p. 593.

Three specimens in the present collection agree closely with the figure of the Malayan specimen on which Sollas based her description of *Spongelia digitata*. They cover small masses of calcareous nodules in the form of flabby sheets of pale tissue with lamellate or digitate projecting processes, $20 \times 10 \times 2$ millimetres, with a series of low surface tubercles arranged in some parts in regular rows. The primary spicular fibres seem to terminate under these tubercles. The skeleton consists of an irregular anastomosis of pale or transparent spongin fibres the presence of which is indicated by the few broken sponge spicules, sand, and other foreign bodies which core the fibres. The relatively thick dermal membrane is supported by similarly cored branching surface fibres. Oscula few, elongate-ovate, and found in between the digitate processes. Most of the rounded openings present on the surface of the sponge are the mouths of small vermetid tubes of which there are several sticking to the calcareous nodules. The sponge is filled almost entirely with the filaments of an alga[1] packed together to form in places continuous sheets of tissue.

Locality.—Trincomalee, Ceylon (8 fathoms), (S. M. No. 657-A).

Luffariospongia clathrata (Carter).

1881. *Hircinia clathrata*, Carter, *Ann. Mag. Nat. Hist.* (5) VII, p. 366.
1905. *Hippospongia clathrata*, Dendy, *op. cit.*, p. 215, pl. xiv, fig. 2.
1937. *Luffariospongia clathrata*, Burton, *op. cit.*, p. 41.

S. M. No. 681-A, preserved in alcohol and of a deep brown colour, seems to agree with the descriptions of the Indian and Ceylonese specimens given by Carter and Dendy, more especially the latter. It is 55 mm. high and 88 mm. in maximum diameter. The sponge was presumably attached by a short stout stalk 8 mm. high and 15 mm. in diameter. It has five digitate processes 25-40 mm. long and 15-20 mm. in diameter. The hollow of the stalk is cored by a mass of firmly agglutinated large sand grains which seems to support the stalk. A dead gastropod shell is enclosed by the growing sponge between two of the processes. The rough appearance of the upper surface of the sponge is due to small aggregations of sand grains present here and there. The large oscular openings are confined to the under surface of the sponge although a few of them are found in the centre of the upper surface as well. The ectosomal tympanic membranes have been torn off from their position at many points, but traces of them can be seen at the entrace to the openings. The yellowish surface fibres are relatively thin

[1] This alga has been identified as *Phormidium spongeliae* (Schulze) Gomont by Prof. M. O. P. Iyengar, Director of the University Botany Laboratory, Madras, to whom my thanks are due.

while the yellowish brown deeper fibres are stout. The primary fibres are 0·06-0·08 mm., and the secondary fibres 0·04-0·06 mm. in diameter. A few fibres which occasionally dichotomously branch and run parallel in ascending to the surface contain inclusions of sand grains and broken sponge spicules while the intermediate fibres are without them.

Locality.—Pamban, Gulf of Manaar (3 fathoms), (S. M. No. 681-A).

The synonymy of the species given by Burton in the reference cited is somewhat confusing. In his Report on the Great Barrier Reef Sponges (1934) he mentions *Hircinia clathrata* Carter (1881) and *H. clathrata* Dendy (1889) under the synonymy of *Carterispongia clathrata* (Carter), but in the present reference (1937) under *L. clathrata* he omits *Carterispongia clathrata* without comment. It seems doubtful if *Luffariospongia* can stand well-differentiated from *Spongia*. The dichotomous branching fibres which run more or less parallel for some distance below the periphery of the sponge seems to point to its probable relationship to *Polyfibrospongia* Bowerbank through forms like the present species [cf. de Laubenfels (1936, *Papers from Tortugas Laboratory* XXX, p. 14), and Kirkpatrick (1900, *Ann. Mag. Nat. Hist.* (7) VI, p. 358, pl. xv, fig. 2)].

Aplysinopsis reticulata Hentschel.

(Plate XIII, figs. 11 and 12.)

1912. *Aplysinopsis reticulata*, Hentschel, *Abhandl. Senckenb. Naturf. Gesellsch.* XXXIV, p. 437, pl. xv, fig. 1 ; pl. xvi, fig. 9.
1937. *Aplysinopsis reticulata*, Burton, *op. cit.*, p. 42.

Three specimens in the present collection belong to this species. One of the two from Pamban is in a greatly macerated condition, but its characteristic skeleton seems to leave no room for doubt.

S. M. No. 662 from Trincomalee is a roughly conical fragment 59 mm. high, 54 mm. broad, and 29 mm. thick with an arched base by which it was apparently attached to a fragment of a coral mass. A few fragments of calcareous algae are still attached to the bottom of a small cavity on the sides above the arched base of the sponge. The colour of the sponge in alcohol is coffee or chocolate brown. The surface of the sponge bears a cellular appearance owing to the formation of polygonal facets by the anastomosis of the surface fibres. The vertical fibres at the junctions of anastomosis project above the surface of the sponge, and may be simple or branched. The meshes between the fibres are covered by a thin but tough membrane which sometimes bears what may represent small rounded pores. Oscula 3-5 mm. in diameter and as many millimeters deep with a few smaller oscula at the bottom of the pits are present on both sides of the sponge. The surface fibres are yellowish brown in colour, and the texture of the sponge is firm though very slightly compressible. The primary ascending fibres are 0·10-0·20 mm. in diameter while the secondary fibres are 0·04-0·14 mm. in diameter. The central pith of the fibres varies in diameter accordingly from 0·06 to 0·10 mm. The foreign sponge spicules of the primary fibres do not quite fill the central core. The surface membrane is structureless, firm, and has a few scattered supporting foreign sponge spicules. The choanosome of the deeper parts of the sponge has, however, a minute cellular structure.

S. M. No. 673 from Pamban is somewhat similar to the specimen described above, but has a more definite triangular outline with two tall chimney-like outgrowths from one side. The sponge was presumably attached to the overhanging ledge of a sea-grotto as the concave surface of attachment on one side indicates. This surface bears traces of calcareous nodules, dead bivalves, and sand grains. The side which may have been facing the interior of the grotto and is probably the older part of the sponge is of a greyish brown colour, while the side which bears the outgrowths and was probably facing away from the grotto is of a chocolate brown colour. The cellular markings on the surface are prominent and the ascending fibres are only rarely produced above the surface of the sponge. The specimen is 85 mm. high and 88 mm. broad at base, with the chimney-like outgrowths 64 mm. high and 40 mm. broad at base. There is a long closed conduit 10 mm. in diameter running along the base of the inner chimney-like outgrowth which opens on both sides. The ascending fibres in the conduit end in small knobs, and the fact that the cellular structure and the trellis-like membrane are present in this conduit also indicates that the sponge surface in the conduit was external and has since been covered by the growing sponge. A few well-defined small rounded pores are also present in the trellis-like surface membrane. There is no osculum unless an elongate deep pit at the base of attachment of the sponge with smaller openings at its bottom represents it. The fibres are of the same dimensions as in S. M. No. 662, but have a dark granular pigment which cores or completely fills up the secondary and nearly all the ascending primary fibres obscuring the sponge spicules and other foreign bodies. The fibres form an irregular reticulation.

S. M. No. 678 from Pamban consists of two macerated fragments, one cake-like and roughly pentagonal, 60 mm. high and nearly as broad, and the other roughly pyramidal 68 mm. broad at base, 48 mm. thick, and 43 mm. high. The dermal membrane is more or less completely macerated so that the stout primary ascending fibres and the secondary anastomosing fibres appear like the stumps and branches of trees in a deciduous forest. The texture of the sponge is firm and incompressible. The colour of the sponge is golden brown with the anastomosis of secondary fibres in some parts of the sponge pale yellow or more or less bleached in appearance. Fragments of calcareous nodules and barnacle shells are found deeply imbedded in the sponge. The primary ascending fibres are 0·20-0·30 mm. in diameter with a core (0·06-0·10 mm. in diameter) of loosely packed sponge spicules. The secondary fibres are 0·02-0·16 mm. in diameter and form an irregular reticulation.

Localities.—Trincomalee, Ceylon (8-10 fathoms), (S. M. No. 662); Pamban, Gulf of Manaar (3-6 fathoms), (S. M. Nos. 673 and 678).

Spongionella tubulosa Burton.

(Plate XIII, fig. 13.)

1937. *Spongionella tubulosa*, Burton, *op. cit.*, p. 42.

To this species I refer with some doubt a brown-coloured, completely macerated, alcohol-preserved specimen, 32 mm. high, 44 mm. broad.

It has a number of short stout digitate processes 8-14 mm. high, 10-15 mm. broad, each terminating in a circular osculum 3-5 mm. in diameter. The specimen was apparently attached to the convex side of a bivalve shell or to a piece of coral, and its base is consequently concave. With the dermal membrane absent, the surface of the sponge is rough to the touch owing to the projecting end-fibres of the surface reticulation. The texture is compressible and resilient. The skeleton is a more or less regular reticulum of anastomosing fibres enclosing usually quadrangular or triangular, and often polygonal meshes between them. The fibres are golden yellow in colour and vary in diameter from 0·02 to 0·16 mm. with the pith in the stouter fibres 0·06-0·08 mm. in diameter. The fibres and pith resemble those of *Megalopastas pulvillus* Dendy (1905, pl. xv, fig. 3).

Sub-order *DENDROCERATIDA.*

Hexadella purpurea Burton.

1900. *Psammopemma purpureum*, Kirkpatrick, *Ann. Mag. Nat. Hist.* (7) VI, p. 358.
1937. *Hexadella purpurea*, Burton, *op. cit.*, p. 43[1].

I refer to the present species a small triangular flabellate mass 8 mm. thick, with equal sides 28-30 mm. long. It is soft, compressible, fleshy and smooth, and is attached to some calcareous debris by one of its corners. Small particles of the debris are also found imbedded in the substance of the sponge. A small Dromiid crab[2], *Polyonyx hendersoni* Southwell, is found lodged in a cavity excavated by its activity on the under surface of the sponge. Elongate or oval openings by which the crab seems to be in communication with the outside world are present on the surface of the sponge. Apart from these openings there do not seem to be any oscula proper. A few minute pores less than a millimeter in diameter may be seen in groups of two or more in a few places on the surface. A few mamillate processes projecting from the surface may also be observed on the sponge.

Locality.—Trincomalee, Ceylon (8 fathoms), (S. M. No. 656-B).

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[1] In this reference Burton has unfortunately omitted mention of Kirkpatrick's paper (1900) on the Funafuti Sponges in the Bibliography given at the end of the paper on p. 47.

[2] For the identification of crabs found in the sponges of the present collection I am indebted to my colleague, Dr. B. N. Chopra. This crab has been previously recorded from the Gulf of Manaar in the cavities of sponges, and of dead coral rock.

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EXPLANATION OF PLATE XII.

Indian and Ceylonese Tetraxonid Sponges.

Callyspongia cellaria, sp. nov.

FIG. 1. Side view of a piece growing on dead shell. $\times\frac{2}{3}$.
FIG. 2. View of cut surface of another piece of sponge. $\times\frac{2}{3}$.
FIG. 3. View of upper surface of a small sponge. $\times\frac{2}{3}$.
FIG. 4. View of cut surface of the same sponge. $\times\frac{2}{3}$.
FIG. 5. View of cut surface of a cylindrical piece of sponge at its base. $\times\frac{2}{3}$.
FIG. 6. View of cut surface of the same at its extremity. $\times\frac{2}{3}$.
FIG. 7. A club-shaped piece of sponge viewed from a side. $\times\frac{2}{3}$.

Callyspongia cellaria var. **fusca,** nov.

FIGS. 8 and 9. Side view of two specimens showing rounded oscula $\times\frac{1}{3}$.

Callyspongia pambanensis, sp. nov.

FIG. 10. A lamellar form of the sponge viewed from the surface. $\times\frac{2}{3}$.
FIG. 11. View of cut surface of another piece of the sponge. $\times\frac{2}{3}$.
FIG. 12. A cylindrical form of the sponge viewed from the side. $\times\frac{2}{3}$.

Callyspongia obtusispiculifera (Dendy).

FIG. 13. A much-branched dried specimen viewed from the side. $\times\frac{1}{3}$.

Callyspongia diffusa (Ridley).

FIG. 14. A macerated dried specimen viewed from above. $\times\frac{1}{2}$.

Stelletta bocki, sp. nov.

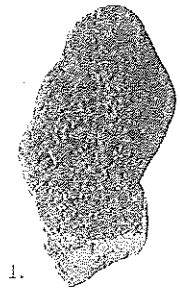
FIG. 15. Ventral view of the Holotype. The specimen has been cut into two in the centre. $\times\frac{2}{3}$.

Oceanapia arenosa, sp. nov.

FIG. 16. View of convex outer surface of the Holotype. $\times 2$.
FIGS. 17 and 18. Interior view of the two pieces of the sponge resulting from a median longitudinal cut showing the sand-lined central cavity. $\times 2$.

Mycale trincomaliensis, sp. nov.

FIG. 19. Surface view of the Holotype preserved in alcohol. $\times\frac{2}{3}$.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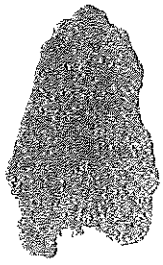
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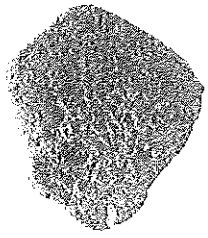
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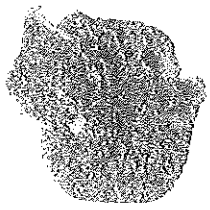
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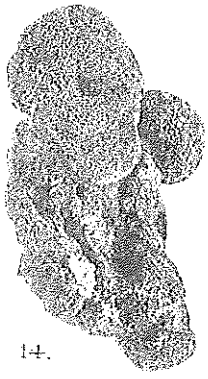
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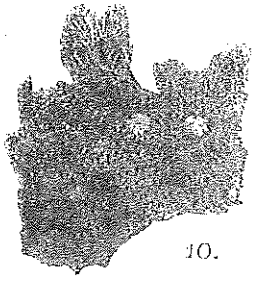
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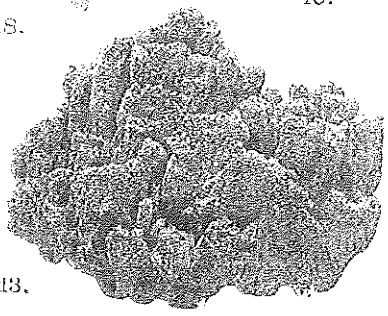
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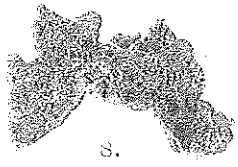
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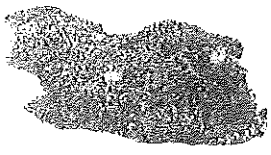
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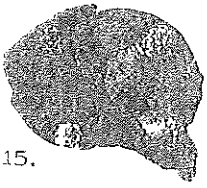
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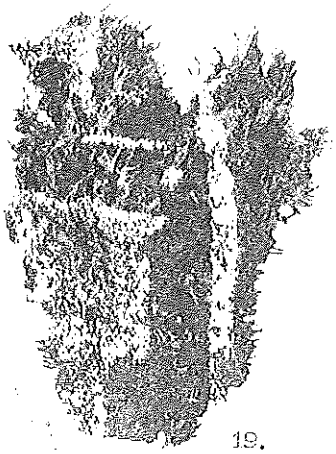
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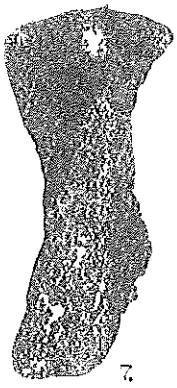
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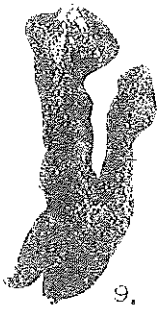
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12.

S. C. Mondal, Photo.

Indian and Ceylonese Tetraxonid Sponges.

EXPLANATION OF PLATE XIII.

Indian and Ceylonese Keratose Sponges.

Spongia officinalis Linn.

FIG. 1. A lamellar form of the sponge viewed from the surface. × ⅔.
FIG. 2. A closer view of the surface sponge fibres. ×4·6.

Spongia officinalis var. **fenestrata,** nov.

FIG. 3. Viewed from a side. × ⅔.
FIG. 4. A closer view of the dermal fibres of the sponge. ×4·6.

Spongia officinalis var. **bibulus,** nov.

FIG. 5. Holotype viewed from its surface. × ⅔.
FIG. 6. A fragment of the sponge viewed from the side. × ⅔.

Hircinia ramodigitata Burton.

FIG. 7. A portion of the colony viewed from the side. × 4·3

Hircinia cactiformis, sp. nov.

FIG. 8. Holotype viewed from the side. × ⅔.

Hircinia pellita, sp. nov.

FIG. 9. Holotype viewed from its surface. ×4·3.

Dysidea herbacea (Keller).

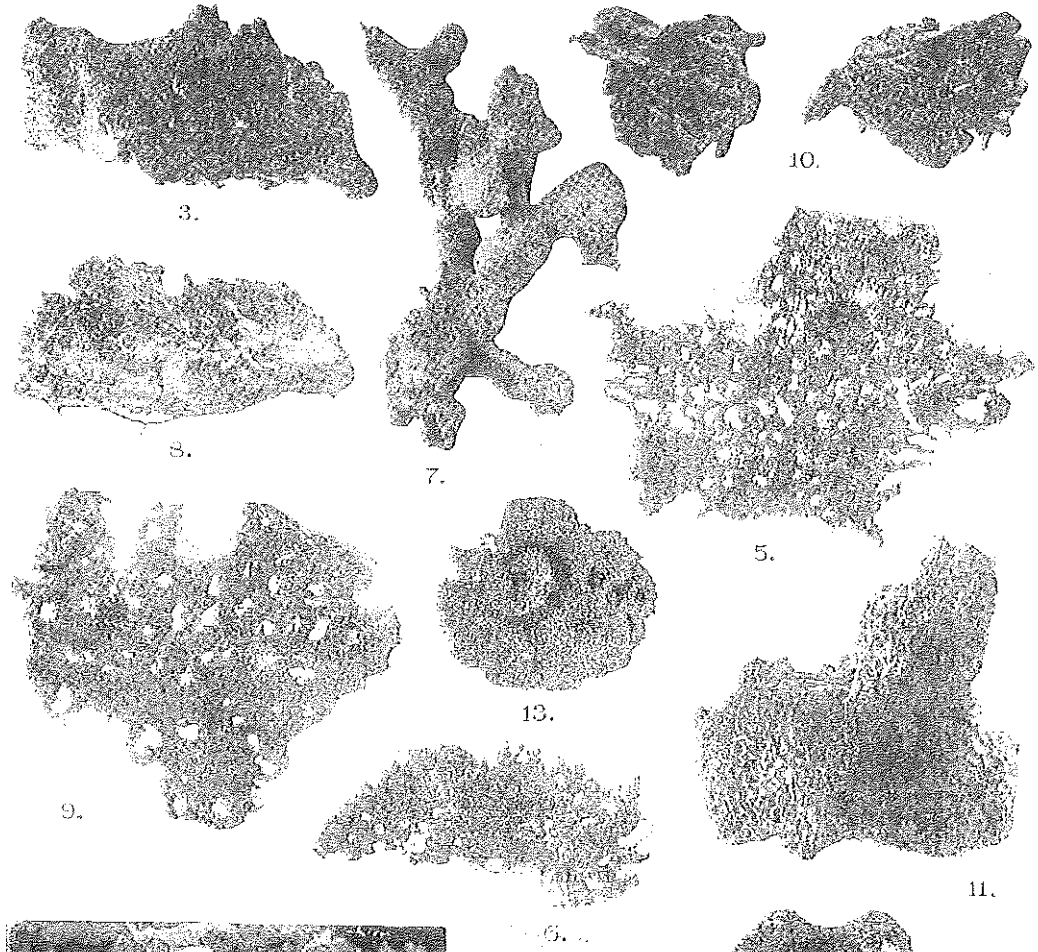
FIG. 10. Two pieces of the sponge growing contiguously on a piece of dead coral. × ⅔.

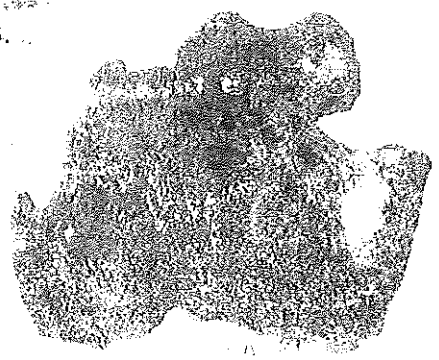
Aplysinopsis reticulata Hentschel.

FIG. 11. A massive specimen viewed from the side ×⅔.
FIG. 12. A closer view of the dermal fibres of the sponge. ×4·6.

Spongionella tubulosa Burton.

FIG. 13. Small colony of bulbous tubes of a macerated specimen preserved in alcohol viewed from above. × ⅔.





A. C. Mandal, Photo. Indian and Ceylonese Teratoses.