

SPONGES OF PAPUA AND NEW GUINEA I. ORDER KERATOSIDA GRANT

P. A. THOMAS*

Central Marine Fisheries Research Institute, Cochin 682 031

ABSTRACT

As the first part in a series on the sponges of the Papua and New Guinea Island eight species referable to seven genera of Keratose sponges are described herein. Illustrations are provided wherever necessary to the various species described.

INTRODUCTION

THE PRESENT account which deals with the order Keratosida of the phylum Porifera forms the first part in a series dealing with the Demospongiae of the Papua and New Guinea Island. The specimens were collected from the shallow areas of Hansa Bay (Madang Province, west of Bogia), by Dr. J. C. Braekman and his associates in connection with their studies on chemicals from marine organisms. All the specimens were preserved in dry condition and, except in a few, all are represented by sufficiently thick slices representing all morphozones to facilitate easy and correct identification.

The author is thankful to Dr. E. G. Silas, Director, Central Marine Fisheries Research Institute, Cochin for permitting to study and publish the results. His thanks are also due to Prof. Dr. J. C. Braekman, Universite Libre de Bruxelles, Brussels, Belgium for forwarding the material to him for identification and to Mr. C. Mukundan, C. M. F. R. Institute for going through the account suggesting several improvements.

ORDER : KERATOSIDA GRANT

This order is divisible into 4 families: *Spongiidae* Gray, *Dysideidae* Gray, *Aplysillidae* Vosmaer and *Halisarcidae* Vosmaer. Of these,

species belonging to the first three families only are represented in the present collection.

FAMILY *Spongiidae* GRAY

Two subfamilies are considered: in the first, viz. *Spongiinae*, the spongin fibre is elastic with no axial specialisation or stratification. The fibre, in the case of the second subfamily, i.e. *Verongiinae*, is stratified with axial specialisation. Spongin fibre, in this case, is not elastic.

The following genera of the former subfamily are represented in the collection: *Spongia* Linnaeus, *Heteronema* Keller and *Phyllospongia* Ehlers. Of the three genera, the first two possess non trellised main fibres and the sand cortex, as a rule, is wanting. The third genus, viz., *Phyllospongia*, is similar to the above mentioned two except for the sand cortex.

The other subfamily viz., *Verongiinae*, is represented here by the genus *Fasciospongia* de Laubenfels.

Genus *Spongia* Linnaeus

Spongia officinalis (Lin.) sub sp. *ceylonensis*
Dendy (Fig. 2 a)

Euspongia officinalis var. *ceylonensis* Dendy 1905,
p. 211, pl. 14, fig. 3, pl. 16, fig. 5.

Spongia officinalis var. *ceylonensis* Burton 1937, p. 39.
Thomas 1981, p. 9, pl. 1 (synonymy).

Material: Several bits.

* Present address: V. R. C. of C.M.F.R.I., Vizhinjam, Kerala State.

Description: The largest bit in the present collection has a size of 3 x 6 x 4 cm, and is amorphous in shape with conical projections or stomatopods. All the other bits in the collection resemble the one described above in general shape and skeletal arrangements.

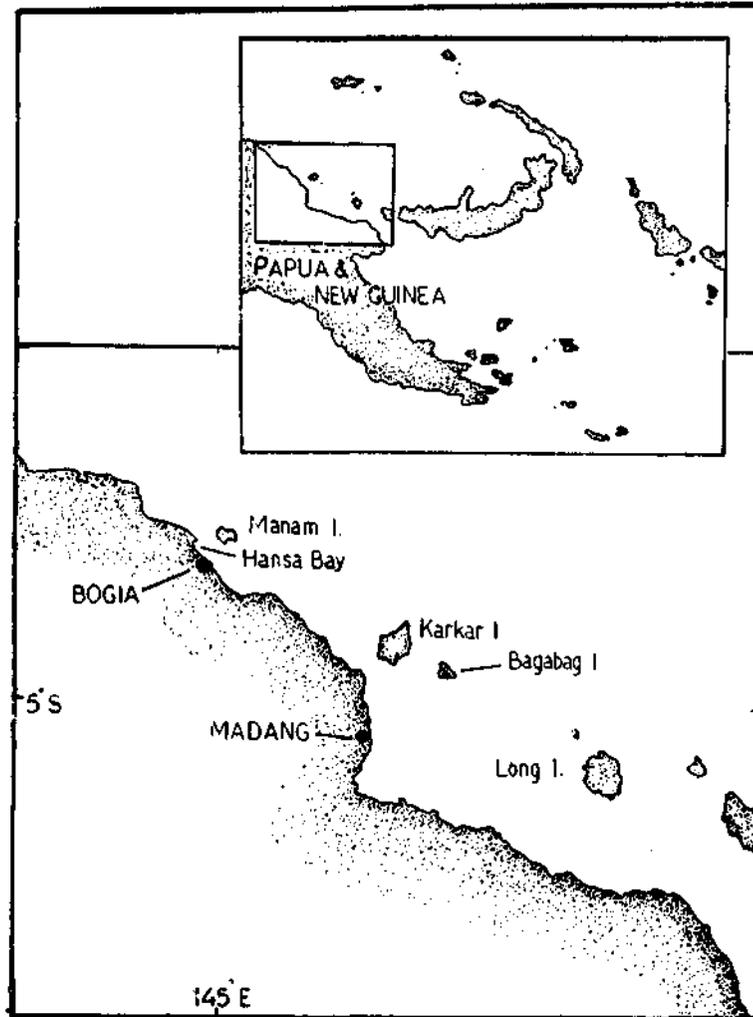


Fig. 1. Map showing the geographic position of Papua and New Guinea Island and the area marked is enlarged below to show Hansa Bay from which the collections were made.

arising from the upper parts. There are two vertical cavities running along the entire length and opening out at the surface. These cavities have a diameter of 10 mm and may represent the house of associated animals such as alpheid

Colour: Dark brown externally and pale yellow internally in dry condition.

Consistency: Soft and spongy with good resiliency.

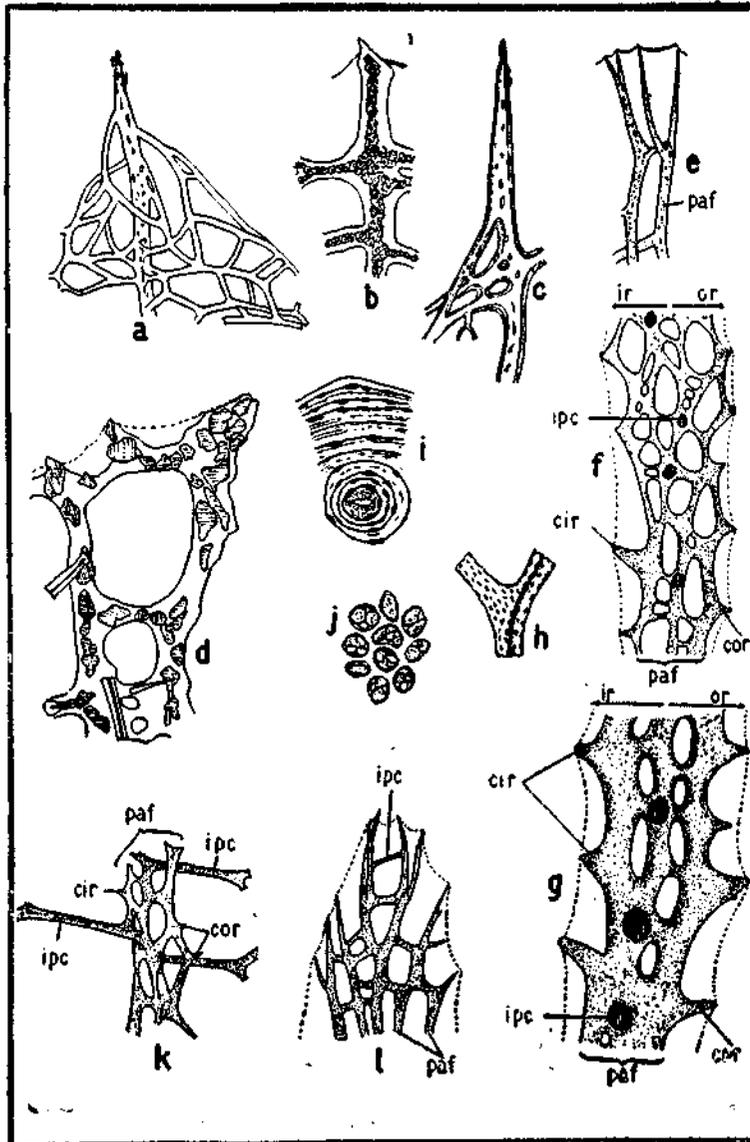


Fig. 2. a. *Spongia officinalis* sub sp. *ceylonensis* — Skeletal arrangement, b. *Heteronema erecta* — Skeletal arrangement, c. *Fasciospongia vavernosa* — Skeletal arrangement, d. *Dysidea herbacea* — Skeletal arrangement, e-l. *Ianthella flabelliformis* — Details of skeleton: e-g. Section of the lamella showing the trellis like arrangement of the primary ascending fibres at three places, tip (e), middle portion (f), and basal part (g), h. part of a fibre enlarged to show the distribution of 'fibre cells', i. Cross section of fibre showing its laminated nature, pith, and also the distribution of 'fibre cells', j. 'fibre cells' (two types) enlarged, k. Skeleton showing primary ascending fibre and inter primary connectives originating from the former, l. Growing tip showing 5 primary fibres.
 (cir—conule ornamenting the inner ridge, cor—conule ornamenting the outer ridge, ipc—inter primary connectives, ir—inner ridge on the lamella, or—outer ridge on the lamella, paf—principal ascending fibres forming trellis-like structure supporting the outer and inner ridges on the lamella).

Oscules large, 3—4 mm in diameter. Surface with closely set conules; height up to 1 mm. Larger conules are confined to the oscular vicinity; sometimes compound conules may also be noted.

Skeletal arrangement is typical of the genus. Main fibres run at intervals of 0.21–0.4 mm in an almost parallel course and end at the surface. They are, as a rule, cored by foreign objects and the diameter may vary from 0.025 to 0.04 mm. The connectives are transparent with a diameter varying between 0.01 and 0.025 mm and form fine meshes of rectangular to polygonal nature. These meshes are rather well defined towards the surface but in deeper areas they become irregular. Mesh size may vary from 0.084 to 0.21 mm.

Remarks: This variety is well distributed in the Indian Ocean, and the discovery of the same from Papua and New Guinea widens its distribution considerably.

Distribution: Red Sea, Indian Ocean and Australian region.

Genus *Heteronema* Keller

Heteronema erecta Keller (Fig. 2 b)

Heteronema erecta Thomas 1979, p. 15, pl. 1, fig. 2 (synonymy).

Material: Several specimens representing the encrusting portion as well as the upright branches given off from the encrusting part.

Description: The largest branch in the collection has a height of 7 cm with a diameter of 11 mm at its base. Two branchlets are seen on either side at a distance of 25 mm from the base. Both branch and branchlets have pointed extremities.

Colour: Dark brown to black when dry.

Consistency: Hard and incompressible.

Surface conulose, ectosome which extends between the conules give a characteristic

appearance to the surface. Conules often blunt, 0.5—1.0 mm apart normally, but rather wide apart at actively growing parts. Ectosome charged with brown pigment granules; demarcation between ectosome and endosome quite vague.

Skeleton composed of an irregular reticulation of primaries and secondaries. Both primaries and secondaries are cored with sand grains etc. Primaries may have an average diameter of 0.18 mm and the same for secondaries, from 0.05—0.09 mm. Slender connectives may be seen towards the surface supporting the dermal part. Fibres devoid of any inclusion may also be noted occasionally. Spongin is pale yellow in colour and the reticulation may become quite irregular in deeper areas of the specimen.

Distribution: Red Sea, Indian Ocean and Pacific Ocean.

Genus *Phyllospongia* Ehlers

Phyllospongia foliascens (Pallas)

Phyllospongia foliascens Thomas 1973, p. 14, pl. 1, fig. 4, pl. 6, figs. 1, 2, 4 (synonymy)

Material: Several bits, probably parts of the same specimen.

Description: The morphology and skeletal details of the specimens at hand bear close resemblance to those described by previous workers.

Colour: Sandy gray to white when dry.

Consistency: Soft and leathery.

Oscules at lower part of the lamella, 0.4—0.9 mm in diameter. The systematic position of this species has been well discussed in Bergquist (1965).

Distribution: Red Sea, Indian Ocean, Australian region and Pacific Ocean.

Subfamily *Verongiinae* de LaubenfelsGenus *Fasciospongia* Burton***Fasciospongia cavernosa* (Schmidt) (Fig. 2 c)**

Fasciospongia cavernosa Thomas 1979, p. 18, pl. 1, fig. 7 (synonymy).

Material: Three specimens.

Descriptions: Specimen massive, club shaped or even branched; branches rarely anastomose. Though the three specimens are similar in skeletal details, the general nature of the surface shows no such resemblance. In one specimen the dermal ornamentation is quite similar to that seen in the specimens from Indian region, and the dermal part contains less silt as compared to the other specimens. Conules are long and a sizable portion of the supporting fibre projects out at the summit. This may, probably, be an adaptation to suit the environment which is so heavily laden with sand silt etc.

Colour: Dark brown in dry condition.

Consistency: Hard and fibrous.

Oscules few and scattered, 2—4 mm in diameter and compound. Extensive areas without any conule may also be noted. Pores distributed either singly or in groups.

Surface highly conulose and the height of which may vary from place to place; tips of adjacent conules often connected by ectosomal ridges in a characteristic pattern. Skeleton reticulate, primaries and secondaries are well marked; meshes rectangular to irregular and more confused at the deeper parts. The primaries, which have a diameter varying between 0.12 and 0.18 mm, are cored with arenaceous objects and run vertically up and end in surface conules. These fibres are interconnected by slender fibres of 0.04 to 0.08 mm diameter, which are devoid of any foreign inclusions. In between the meshes thus formed, slender fibres, measuring about 0.016—0.021 mm in diameter, form a fine reticulation at places.

The fibre is semitransparent and distinctly laminated.

Distribution: Mediterranean Sea, Red Sea, Indian Ocean and Australian region.

Family *Dysideidae* GRAY

Two genera, *Dysidea* Johnston and *Ianthella* Gray are represented in the present collection.

Genus *Dysidea* Johnston***Dysidea fragilis* (Montagu)**

Dysidea fragilis Thomas 1981, p. 12, pl. 1, fig. 4 (synonymy).

Material: One specimen.

This well known cosmopolitan species is represented in the collection by a macerated specimen. The dermal portion is preserved only at places. The measurements of primaries and secondaries are highly exaggerated due to the extra quantity of sand incorporated.

The specimen has a fragile consistency and the colour, in dry state, is sandy gray. The conules are blunt.

Distribution: Cosmopolitan.

***Dysidea herbacea* (Keller) (Fig. 2 d)**

Dysidea herbacea Thomas 1976, p. 643, fig. 2 b (synonymy).

Material: Several bits removed from the substratum.

Description: Encrusting, with flattened branches arising from the older parts, branches 6-10 mm high, 1-1.5 mm thick and 2-8 mm wide.

Colour: Dark brown in dry condition.

Consistency: Hard and incompressible when dry.

Surface conulose, conules up to 0.5 mm high in fast growing areas but closely set and smaller in older parts. Larger conules are often supported by extremities of primary fibres, and smaller

conules, by fibres arising vertically from the dermal connectives.

Ectosome is thin and densely charged with arenaceous objects. Symbiotic alga, *Phormidium spongelliae* Schulze, is well represented in the ectosomal part. Oscules and pores are not traceable due to the dry nature of the specimens. At the encrusting portion the skeletal arrangement is rather confused and the primaries are seldom differentiated from the secondaries. But in places, where the upright branches originate, the fibres arise vertically from the encrusting part. These fibres, as they go, diverge and as a result the mesh size becomes larger and larger. The fibres are distinctly divisible into primaries and secondaries but their measurements get exaggerated due to the extra quantity of foreign matter they contain. The diameter of primaries may vary from 0.04 to 0.09 mm, while that of connectives from 0.02 to 0.05 mm. Spongin content is appreciably high in both primaries and secondaries.

Distribution: Red Sea, Indian Ocean, Australian region and Pacific Ocean.

Genus *Ianthella* Gray

Ianthella flabelliformis (Linnaeus)

(Fig. 2 e-1)

Ianthella flabelliformis de Laubenfels 1948, p. 157, figs. 49, 50 (synonymy).

Material: One bit; probably part of a funnel shaped specimen.

Description: Size of the lamella 13 × 13 cm, and thickness, 0.5-2.5 mm. Both surfaces have ridges closely corresponding to each other, ridges, as they go, divide dichotomously corresponding to the division of primary fibres which support them. The maximum thickness of the lamella is noted at the summit of these dermal ridges where the ectosome of both the surfaces form a semi-transparent membrane supported by the interprimary connectives arranged in a

scalariform pattern. The distance between adjacent ridges may vary from 1 to 3 mm; but closely set ridges are normally present in the older parts of the specimen.

Colour: Black in dry condition.

Consistency: Soft and leathery.

The exact nature of the pores could not be studied due to the dry nature of the specimen. The ectosome is not separable from the endosome. There is conspicuous lack of sub-dermal spaces, and according to de Laubenfels (1948) the dermal part is composed of inanimate colloidal stuff.

The arrangement of skeleton and the minute structure of fibre noted in this species are unique among sponges. The fibres are amber-coloured and contain "fibre cells" embedded inside the layers of spongin. The pith is granular and the fibres are distinctly laminated (Fig. 2 h, i). The "fibre cells" are irregular in outline with the maximum diameter varying between 0.009 and 0.016 mm. "Two types of fibre cells" could be noted, based on the nature of their interior, some have uniformly granular interior while others have segmented interior (Fig. 2 j). When different layers of a fibre are peeled off one by one from the outer side, it may appear that these 'cells' are attached to the inner surface of each layer with the major portion of the 'cell' jutting into the layer located just beneath, often filling into a cavity formed on the upper surface of the latter. The inner and outer layers of the fibre contain more such 'cells' but in the middle layers of the fibre the 'cells' are meagre (Fig. 2 i).

The principal or ascending fibres (Fig. 2 f, g, paf) run length-wise in a parallel course and, as they go, may divide dichotomously (Fig. 2 l). As stated above, the position of these principal fibres correspond to the ridges present on the surface of the lamella. Unlike in other sponges, here the principal fibres form a trellis like

structure by their division and anastomoses in a plane vertical to the general plane of the lamella (Fig. 2 f, g). The inner half of the trellis like principal fibre support the inner ridge (ir) on the lamella and the outer half supports the outer ridge (or) on the lamella (Fig. 2 f, g). Two adjacent principal fibres are interconnected by slender fibers (ipc) arranged in a scalariform pattern (Fig. 2 k, l). Though the mesh thus formed shows considerable variation in size, an average of 3 X 1.5 mm may be cited as normal mesh size. These connectives are much thicker (up to 0.3 mm) in older parts.

All the component fibres constituting the trellis-like plate of the principal fibre may have the same thickness except in the older parts where some fibres (probably the outer ones bearing the conules of the outer ridge (cor) and conules of the inner ridge (cir)), are much thicker. In older parts the fibre may measure up to 0.75 mm in diameter.

Distribution: Australian region.

Family *Aplysillidae* VOSMAER

Skeletal fibres tree-like and seldom anastomose. One species is represented in the collection.

Genus *Psammaplysilla* Keller

Psammaplysilla purpurea (Carter)

Psammaplysilla purpurea Thomas 1981, p. 13 (synonymy).

Material: Two specimens.

Description: Both specimens are more or less club-shaped. The bigger one has a basal width of 10 mm and the stalk-like portion expands distally to a size of about 40 mm. The total length of this specimen is 23 cm. The other specimen is rather small, measuring about 5 cm. The stalk portion is rather constricted, measuring about 5 mm in diameter.

Colour: Pale to dark brown in dry condition.

Consistency: Hard and incompressible.

Oscules and pores not traceable. Surface conulose; conules show considerable variation in their size, shape and arrangement depending on the area of distribution. Smaller conules are met with in older parts and larger ones, in actively growing tips. Extensive areas without any conule may also be met with occasionally. In some places the conule may get arranged in a linear series forming ridges.

Ectosome is highly pigmented and is provided with a cuticle; thickness from 0.1 to 0.3 mm.

Endosome is dense. Fibres are confined to older parts; they are lumpy and may contain sand grains at places. In cross section the fibres may have a reticulate appearance.

The anatomy and other details have been well discussed in Carter (1881), Wilson (1925) and Bergquist (1965).

Distribution: Red Sea, Indian Ocean, Australian region and Pacific Ocean.

REFERENCES

- BERGQUIST, P. R. 1965. The sponges of Micronesia, Part I. The Palau Archipelago. *Pacif. Sci.*, 19 (2): 123-204.
- BURTON, M. 1937. Supplement to the littoral fauna of Krusadai Island. *Bull. Madras Govt Mus.*, 1 (2) Part 4: 1-58.
- CARTER, H. J. 1881. Contribution to our knowledge of the spongia. *Ann. Mag. nat. Hist.*, 5(8): 101-112; 241-259.
- DE LAUBENFELS, M. W. 1948. The Order Keratosa of the Phylum Porifera - A monographic study. *Occ. Pap. Allan Hancock Fdn.*, 3: 1-217.
- DENDY, A. 1905. Report on the sponges collected by Prof. Herdman, at Ceylon, in 1902. *Rep. Govt. Ceylon Pearl Oyster Fish. Gulf Mannar*, Suppl. 18: 57-246.
- THOMAS, P. A. 1973. Marine Demospongiae of Mahe Island in the Seychelles Bank (Indian Ocean). *Mus. Roy. L'Afr. Cent.*, 203: 1-98.

——— 1976. Marine Demospongiae of Ras Iwatine (Kenya). *J. mar. biol. Ass. India*, 18(3): 642-649.

——— 1979. Marine Demospongiae of Inhaca Island (Indian Ocean). *Mus. Roy. L' Afr. Cent.*, 227: 1-45.

——— 1981. A second collection of Marine Demospongiae from Mahe Island in the Seychelles Bank (Indian Ocean) *Ibid.*, 233: 1-54.

WILSON, H. V. 1925. Siliceous and horny sponges collected by the U. S. Fisheries Steamer 'Albatross' during the Philippine Expedition, 1907-1910. *Bull. U.S. natn. Mus.*, 100(2) Part IV: 273-532.