

III. FRESH-WATER SPONGES FROM NEW CALEDONIA

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RÉSUMÉ

Quatre espèces et une forme d'Éponges d'eau douce (Spongillidae) sont signalées de Nouvelle-Calédonie. Deux espèces, *Spongilla* (Stratospongilla) diahoti et *Spongilla* (Stratospongilla) raceki ainsi que la forme *Ephydatia multidentata* f. caledonensis sont nouvelles. *Spongilla crassissima*? (identification incertaine) est également connue de l'Inde et *Ephydatia multidentata* de l'Australie orientale. Quelques données physico-chimiques sont indiquées concernant les localités de récolte.

ABSTRACT

Four species and one form of freshwater sponges (Spongillidae) are reported from New Caledonia. Two species, *Spongilla* (Stratospongilla) diahoti and *Spongilla* (Stratospongilla) raceki and the form, *Ephydatia multidentata* f. caledonensis are new. *Spongilla crassissima*? (uncertain identification) is also known from India, and *Ephydatia multidentata* from Eastern Australia. Some physico-chemical data are given for the collecting places.

INTRODUCTION

During a limnological investigation of New Caledonia in the summer months of 1965 Dr. Ferdinand STARMÜHLNER from the I. Zoologisches Institut der Universität Wien collected 4 species and 1 form of Spongillidae, the first to our knowledge to be reported from this island. The material comprises about 45 small specimens (or fragments of specimens) and was collected at five localities from diametrical parts of the island.

I am very grateful to my friend Dr. STARMÜHLNER, who made the sponge material and the ecological data available to me. Dr. A. A. RACEK, Sidney, was kind enough to compare many of my specimens with the material upon which his monograph (PENNEY and RACEK, in press) is based. I am indebted to him for his efforts and have pleasure in giving a species of *Spongilla* (*Stratospongilla*) his name.

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COLLECTING LOCALITIES (Fig. 1)

Station No. FNK 36, July 25, 1965, is a blind stagnant arm of a stream flowing towards La Foa (SW-New Caledonia). The bottom consists of crystalline slate, degree of hardness 2-3° DH, and is densely overgrown with *Eichhornia*, *Lemna*, *Characea*, and *Potamogetonacea*. The pond is well shaded by surrounding trees and includes masses of fallen leaves and decaying wood. In the center it attains a depth of 0.5 m. The temperature of the water at 13.00 hrs. was 18.6° C, the electrical conductivity 100-120, alkalinity (SBV) about 1, pH value 7.2-7.5. The only sponge found, *Ephydatia multidentata* f. *caledonensis*, was growing on decaying wood, dead leaves and plant stems.

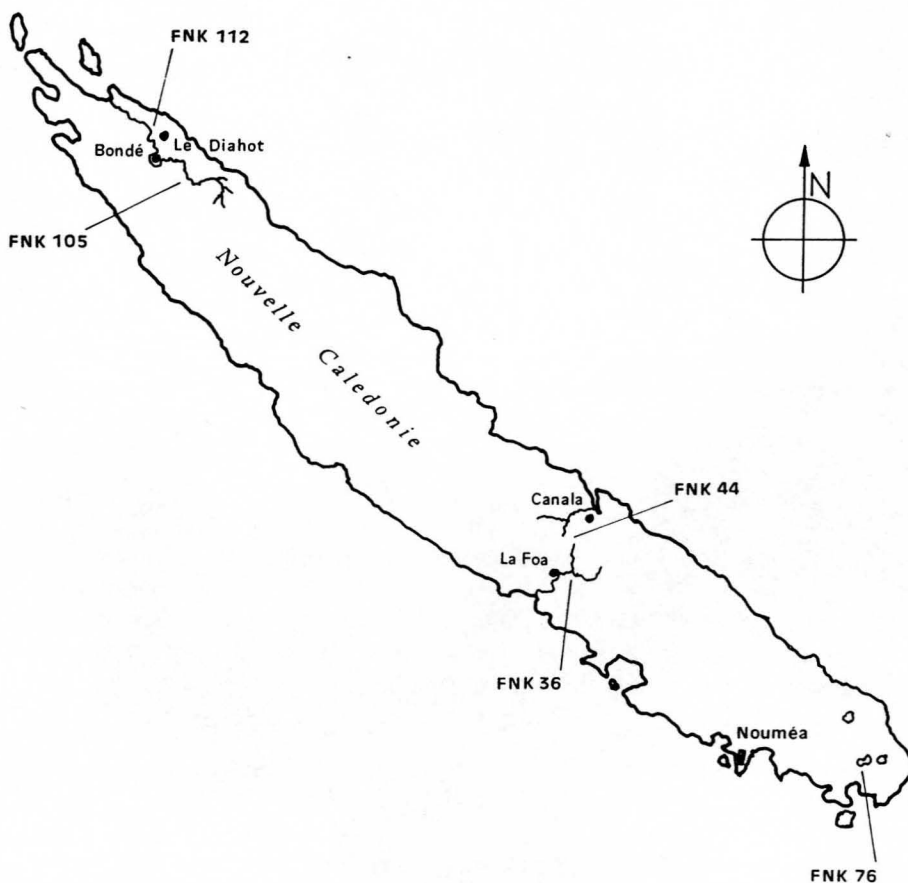


Fig. 1. — Collecting localities.

Station No. FNK 44, July 28, 1965, was occupied in the river La Farino near Col d'Amieu, between La Foa and Canala (middle S-New Caledonia). The river is 2-5 m wide, cuts deeply into crystalline slate and is well shaded by trees. The bottom is covered with gravel. The depth in the middle is 0.1 m with 50-100 cm/sec current; in back-water zones the depth is 0.5 m with 20 cm/sec current. The temperature at 16.00 hrs. was 16.1° C, the conductivity 106, alkalinity (SBV) 0.8, pH value 7.4, Chlorine 10.3 mg/l. Stagnant zones were heavily covered with Cyanophytes. *Ephydatia multidentata* occurred here in minute quantities, growing on dead plant stems.

Station No. FNK 76, July 19, 1965. Lac en Huit is a pond in the Plaines des Lacs in S-New Caledonia. It is 1.5-2 m deep, and the bottom consists of volcanic serpentine and peridotite, covered with a loose stand of rushes. The temperature was 21.5° C at 11.00 hrs. The ecological conditions in this pond are quite unfavorable. The presence of minute quantities of mineral substances is shown by the extremely low electrical conductivity of 56. Alkalinity (SBV) 0.5, pH value 6.6 (slightly acid). There is no crustacean plankton and almost no organic material apart from a few micro-organisms. Under these condition lives the only New Caledonian fresh-water fish *Galaxias neocaledonicus* Weber & DeBeaufort which is an endemic and stunted species. Near the shore in a depth of 5-30 cm, tiny specimens of *Spongilla (Stratospongilla) raceki* are growing on reddish and blackish boulders of ferric peroxide, which resemble meteorite with pierced and dissured surface.

Station No. FNK 105, September 16, 1965. The Diahot is the longest river of New Caledonia (60 km) and the only one flowing longitudinal to the island. The station was occupied at the middle course near Quénia (Chapel St. Joseph), North New Caledonia, two days after flooding. There is a deeply cut valley 250 m above sea-level with steep banks partly covered with rain forest. Here the river is 5 m wide and 0.05 to 0.20 m deep with 50-100 cm/sec current. The temperature at 10.00 hrs. was 20.3° C, conductivity extremely low (28), alkalinity (SBV) 0.14, pH value 6.7 and chlorine 6 mg/l. *Spongilla (Stratospongilla) diahoti* and *Spongilla (Stratospongilla) raceki* were growing on the lower surfaces of stones.

Station No. FNK 112, September 18, 1965. This station was occupied at the lower course of the Diahot river, next to the mission-house Bondé (N-New Caledonia), about 10 km up-stream from the sea coast. Here the river is still under the influence of the tidal back water. It is 20 m wide and 0.5 m deep and at this location has a current of 30-50 cm/sec, elsewhere reaching more than 100 cm/sec. The bottom consists of crystalline rock. The temperature was 24.6° C (16.30 hrs.), the conductivity extremely low (39), alkalinity 0.4, pH value 7.1. There was a sparse animal population, probably because of recent high-water caused by heavy rains. Small flat colonies of two sponge species *Spongilla (Stratospongilla) raceki* and *Spongilla crassissima* (?) were growing on the lower surfaces of stones, which were thickly covered with mud.

SYSTEMATICS

Spongilla (Stratospongilla) diahoti nov. spec.

Figs. 2-4

MATERIAL EXAMINED: 5 fragments from station no. FNK 105 (Holotype: U.S.N.M. No. 23881).

HABITUS: The tiny patches are 1 mm thick and cover less than 1 cm². They are dark grey in color (alcohol), porous, and very soft, compressible. The specimens were growing next to the paratype of *Spongilla (Stratospongilla) raceki* (described below) and both species were preserved in the same vial. Therefore, fragments of both and loose gemmules became mixed, and could only be distinguished under the microscope.

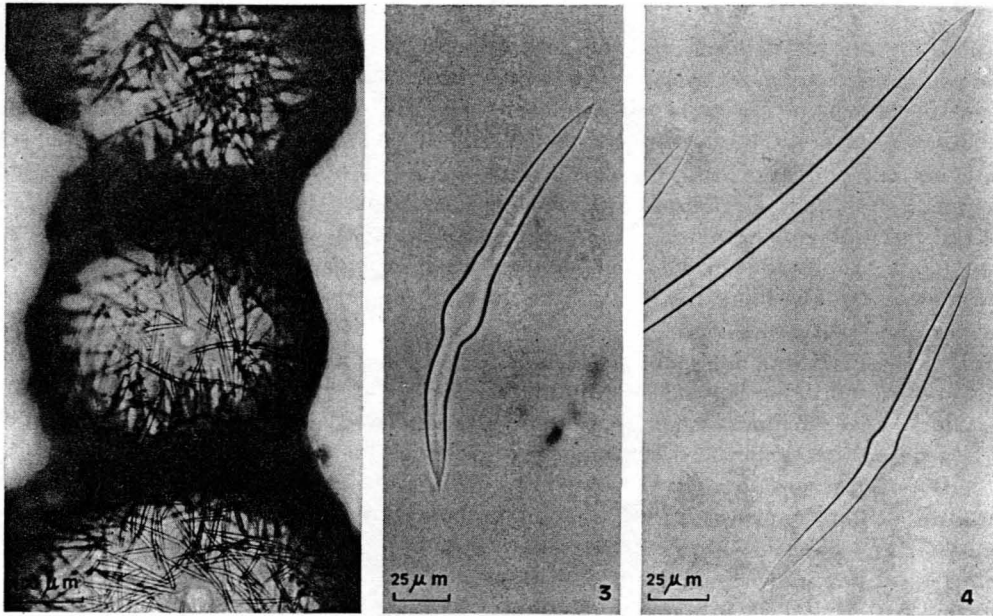
ANATOMY: The skeleton spicules form an irregular meshwork connected at their ends by little spongin. No fiber tracks can be distinguished. They are smooth, slightly but not very regularly bent and taper gradually to become sharply pointed. They do not vary greatly in size.

Length: Minimum 210 μ m, maximum 280 μ m, average 250 μ m.

Width: Minimum 9 μ m, maximum 14 μ m, average 11 μ m.

There are no flesh-spicules present.

Where the gemmules were still in place they seemed to be attached to a basal membrane, either singly or in a row of up to 4, with the pori facing the interior of the sponge (Fig. 2). They



Figs. 2-4. — *Spongilla (Stratospongilla) diaholi*; 2, gemmules; 3, gemmosclere; 4, gemmosclere and part of skeleton spicule.

are spherical (350-500 μm) or egg-shaped (520-600 μm) and have simple pori (40-50 μm). There is no air cell layer, the gemmoscleres being arranged loosely and tangentially to the surface. The gemmoscleres are smooth, more or less strongly bent centrotyle oxea (Figs. 3, 4) which can be deformed to resemble styli or oxea. They vary between 100 and 250 μm in length, between 2 and 8 μm in width. The diameter of the swelling, if present, is 6 to 11 μm .

Remarks: This species falls into the subgenus *Stratospongilla* Annandale for the gemmules lack an air cell layer and have tangentially placed gemmoscleres. It appears to be related to *Spongilla aspinosa* Potts (1880) from New Jersey, U.S.A. and *Spongilla (Stratospongilla) sinensis* Annandale (1910) from East Central China. From both it is distinguished by the growth form (not branching) and in having centrotylote gemmoscleres.

Spongilla (Stratospongilla) schubotzi Weltner 1913 (described from Central Africa) is quite different in internal structure and possesses extremely short and thick oxea and their derivatives (styles, strongyles) which form skeleton- and gemmospiculation.

Spongilla (Stratospongilla) raceki nov. spec.

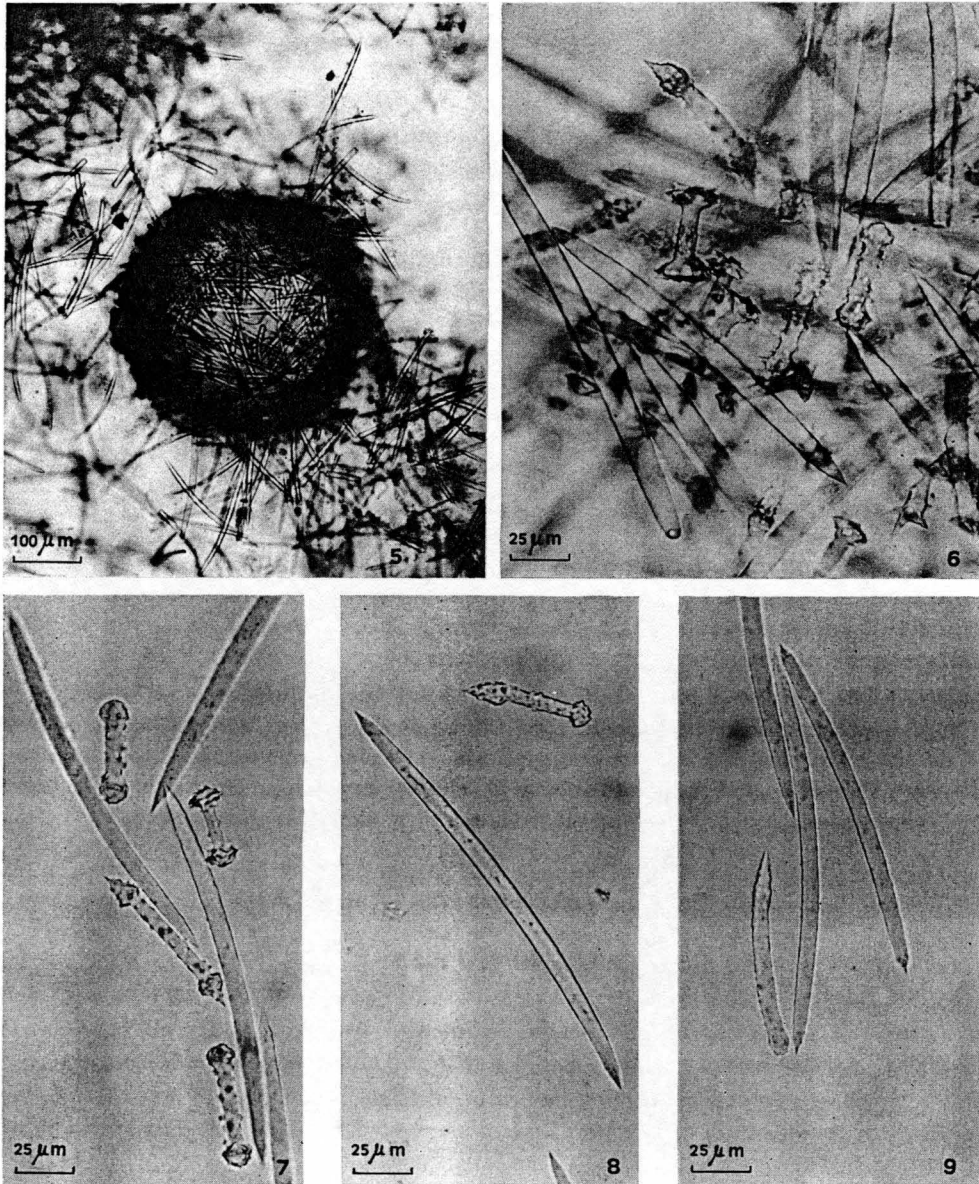
Figs. 5-9

MATERIAL EXAMINED: 6 fragments from station no. FNK 112 (Holotype U.S.N.M. No. 23882). About 20 fragments from station no. FNK 105 (Paratype U.S.N.M. No. 23883). Several fragments from station no. FNK 76.

HABITUS: The greyish-ochre (alcohol) fragments of incrustations (1 mm thickness) do not cover more than 1 cm^2 per station. They were growing on the lower surface of stones. The sponge is very porous and of soft consistency. No oscula or pori could be distinguished at the surface. The gemmules are placed loosely in the tissue near the base of the animal.

ANATOMY: A dense polygonal meshwork of spicules bound together by little spongin forms the skeleton.

The skeleton spicules of the holotype are slender, finely spined oxea, irregularly bent and rather abruptly pointed (Figs. 7-9).



Figs. 5-9. — *Spongilla (Stratospongilla) raceki*; 5, gemmule; 6, spicule arrangement on gemmule surface; 7-9, acanthoxea of the skeleton and gemmoscleres.

Length: Minimum 160 μm , maximum 245 μm , average 215 μm .

Width: Minimum 7.5 μm , maximum 10.5 μm , average 9 μm .

The acanthoxea of the paratype are somewhat shorter and considerably thicker, and their spines are more developed.

Length: Minimum 170 μm , maximum 230 μm , average 210 μm .

Width: Minimum 10 μm , maximum 14 μm , average 13 μm .

The flesh spicules, smooth slender and gradually pointed, varying between 140 and 170 μm in length and between 4 and 5 μm in width (in both holotype and paratype). In addition to these a few giant oxea (smooth 700 \times 5 μm) could be found in the holotype. They were mostly broken and it is uncertain whether they belong to this sponge.

The gemmules are perfectly spherical, 350-480 μm (holotype) respectively 380-650 μm (paratype) in diameter (Fig. 5). The simple porus is 45-50 μm wide. There is no air cell layer recognizable; only a thin spongin cover surrounds the gemmule. The gemmoscleres are placed tangentially (Fig. 6).

These gemmoscleres are of peculiar and variable shape (Figs. 7-9). The more common forms resemble dumb-bells covered with minute spines or longer irregular tubercles. In some cases the shaft extends beyond the almost spherical knobs and ends with a point. Both ends of the shaft may be pointed, or only one end; in the latter case the gemmosclere is cubshaped. The knobs sometimes degenerate to form a group of slightly more prominent spines, thus forming amphioxea (similar to the ones in *Ephydatia multiformis* f. *caledonensis*).

Dumb-bell shaped gemmoscleres in the Holotype

Overall-length: Minimum 20 μm , maximum 60 μm , average 50 μm .

Width of shaft: Minimum 5.5 μm , maximum 6.5 μm , average 6 μm .

Diameter of knobs: Minimum 11 μm , maximum 16 μm , average 13 μm .

Acanthox-shaped gemmoscleres: Maximal $120 \times 6.5 \mu\text{m}$, all intermediate sizes.

Paratype dumb-bells

Overall-length: Minimum 38 μm , maximum 80 μm , average 50 μm .

Width of Shaft: Minimum 5 μm , maximum 8 μm , average 6.5 μm .

Diameter of knobs: Minimum 9 μm , maximum 20 μm , average 13 μm .

Paratype gemmoacanthoxea: Maximal $135 \times 8 \mu\text{m}$.

Remarks: The fragments from station FNK 76 did not include any gemmules. However, the shape and measurements of skeleton- and flesh spicules and of the few gemmoscleres found indicate that the fragments belong to this species. The characters of the skeleton spicules and the gemmules indicate that this new species is closely related to *Spongilla* (*Stratospongilla*) *gilsoni* Topsent, which has been described from the Fiji Island (Topsent 1912).

Spongilla crassissima (?) Annandale

MATERIAL EXAMINED: 3 patches (Station FNK 112).

HABITUS: 3 small crusts (1 $\frac{1}{2}$ cm^2 , 1-3 mm thick) were collected from lower surfaces of stones. The color in alcohol is dark grey. Numerous oscula (200 μm) and pori (6-100 μm) are distributed over the surface. The consistency is soft and spongy.

ANATOMY: The skeleton spicules are connected at their ends by small amounts of spongin to form a triangular to polygonal meshwork. They are perfectly smooth, hardly bent and abruptly pointed. They measure $190-250 \times 11-14 \mu\text{m}$.

No gemmules nor gemmoscleres could be detected.

DISTRIBUTION: Calcutta, India (Annandale, 1907).

Remarks: The certain determination of this sponge is not possible because no gemmoscleres could be found. The morphometry of the megascleres indicate that the specimens fall closest to *S. crassissima* Annandale.

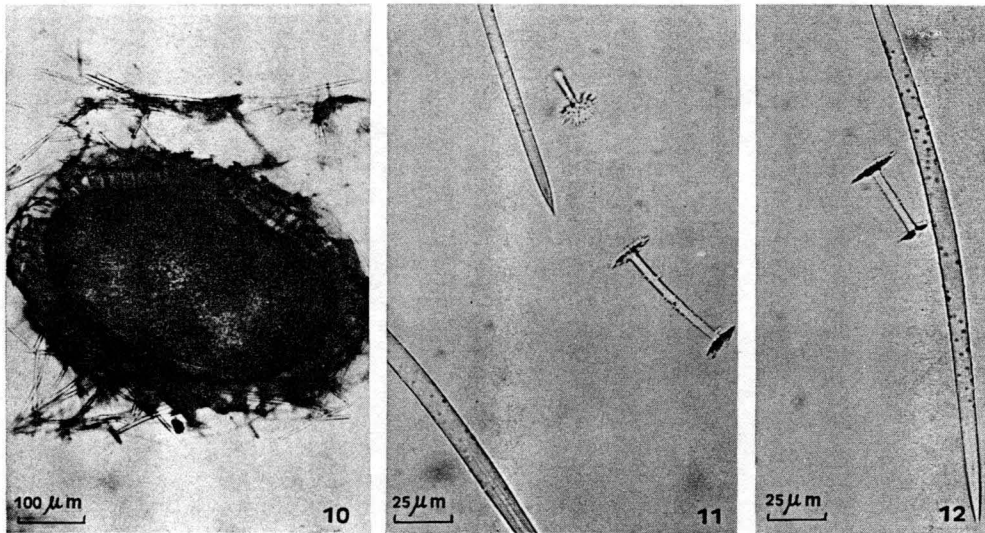
Ephydatia multidentata (Weltner)

Figs. 10-12

Synonyme: *Tubella* m. Weltner, 1895.

MATERIAL EXAMINED: 1 specimen (station no. FNK 44).

HABITUS: The dark grey (alcohol) cushion (about $\frac{1}{2}$ cm^3) was growing around a dead plant stem. Neither oscula nor pori are visible. The consistency is very soft, compressible.



Figs. 10-12. — *Ephydatia multidentata*. 10, gemmule ; 11-12, amphidiscs and parts of acanthoxea.

ANATOMY: Main fibres, 2-5 spicules wide and 100-200 μm apart lead vertically towards the surface. The oxea of the primary fibers as well as the interconnecting ones are bound together by small quantities of spongin.

The curved skeleton spicules are comparatively short and unusually thin. They are usually covered with tiny spines except near the gradually tapering but sharply pointed ends.

Length: Minimum 200 μm , maximum 300 μm , average 27 μm .

Width: 8-9.5 μm .

There are no flesh spicules present.

The brownish gemmules (Fig. 10) are numerous for such a small specimen and are accumulated at its base. They are spherical or egg-shaped, 500 to 650 μm in diameter, provided with a simple porus (35 μm). The air cell layer just covers the amphidiscs, which are placed perpendicularly in a single row.

The amphidiscs (Figs. 11-12) are shaped as usual in this species, but are somewhat smaller:

Overall length: 35 to 60 μm .

Diameter of shaft: 4 μm .

Diameter of outer discs: 17-24 μm .

Diameter of inner discs: 19-26 μm .

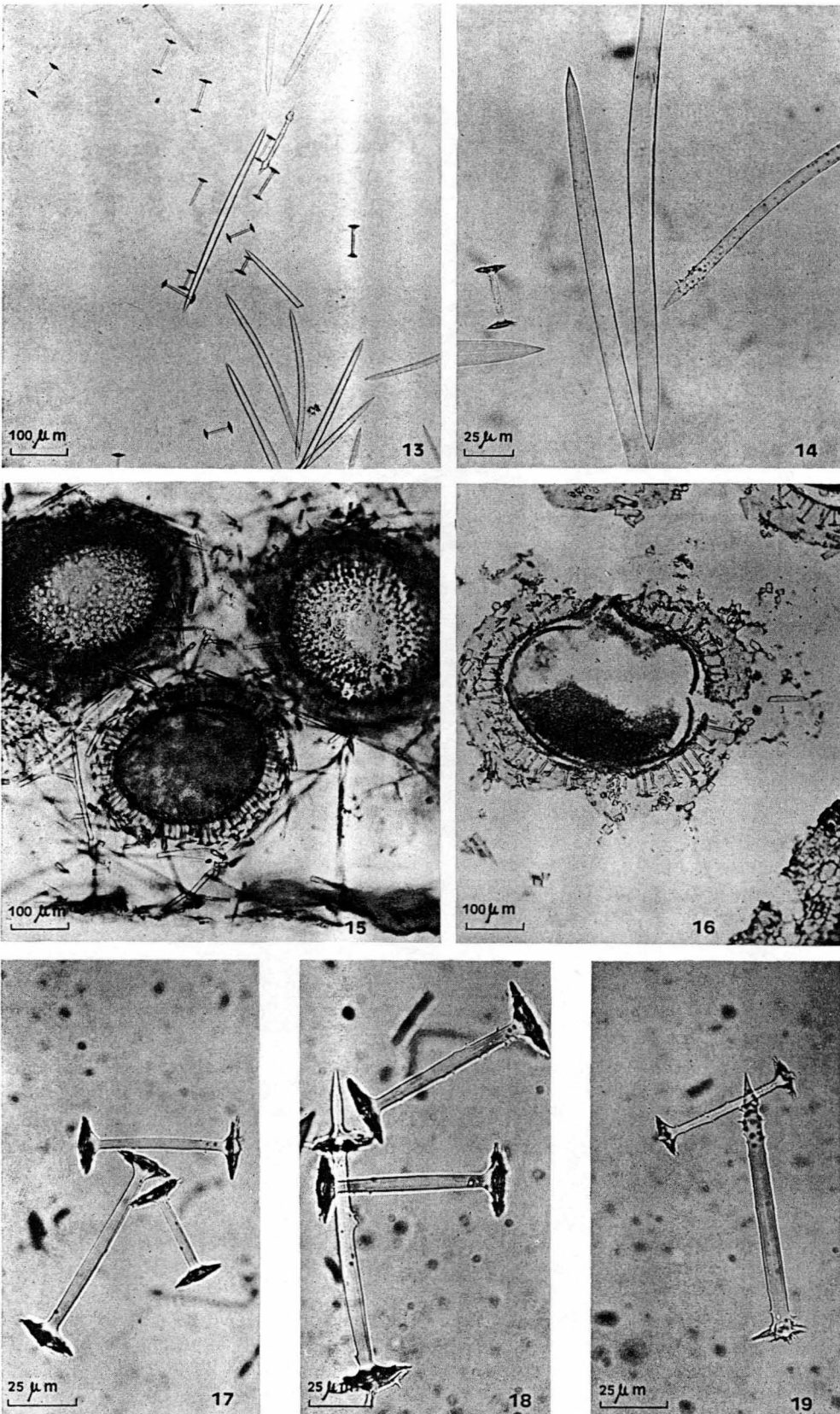
DISTRIBUTION: This species has previously been reported from Eastern Australia (Weltner 1895, Gee 1931).

Remarks : The skeleton spicules of this specimen are about 20 % shorter and thinner than in the type-specimen. Dr. A. Racek (personal communication) suggests that it might be placed between *Ephydatia multidentata* and *E. nigra* (Lendenfeld), but because of the small amount of material and the little significance of spicule size it is considered preferable to refer the specimen to *Ephydatia multidentata*.

***Ephydatia multidentata* (Weltner) f. *caledonensis* nov.**

Figs. 13-19

MATERIAL EXAMINED: Several fragments represent 3 specimens, as can be judged by the different substrates from which they were collected (station no. FNK 36). Specimens are lodged in the U.S.N.M. under No. 23884.



Figs. 13-19. — *Ephydatia multidentata* f. *caledonensis*. 13-14, skeleton spicules and gemmoscleres ; 15-16, gemmules ; 17-19, amphidiscs and their derivatives.

HABITUS: 2 specimens are small (about $1 \frac{1}{2} \text{ cm}^2$) irregular cushions growing around dead plant stems. One is a thin crust (2 mm) covering 2 cm^2 of a dead leaf. The color in life was not recorded. In alcohol it is whitish in the peripheral parts of the sponges which are to a great extent macerated, greyish brown centrally this latter colour resulting from the gemmules accumulated there in several layers. The large number of gemmules which fill the greater part of the animals and the partly disintegrated tissue suggest imminent or partly accomplished death of the sponge bodies at the time of preservation. No oscula or pori could be detected. The consistency is soft compressible.

ANATOMY: Primary spicule tacks lead perpendicularly, sometimes branching to the surface, where they are 200-600 μm apart. Their width is 2-3 longitudinally placed oxeas which are bound together by minute quantities of spongin. In the interior of the sponge these are connected by single skeleton spicules, thus forming a polygonal meshwork.

The oxea (Figs. 13-14) of the skeleton are slender, slightly curved and sharply pointed. They are covered with a varying number of very fine spines, only a small percentage is smooth. Their size is quite variable but the limits of variation are the same in each specimen.

Minimum length: 250 μm , maximum 410 μm , average 360 μm .

Minimum thickness: 8 μm , maximum 20 μm , average 15 μm .

No flesh spicules are present.

The brownish gemmules (Figs. 15-16) are spherical or slightly egg-shaped and vary between 450-600 μm . The air cell layer is about as thick or slightly thicker than the length of the amphidiscs which are placed radially in a single row. A single poretube of 40 μm diameter does not extend beyond the surface of the gemmules.

The amphidiscs and their derivatives (Figs. 13-14, 17-19) are highly variable in size and shape. The shafts are typically uniform, slender (4 μm in diameter), and more or less covered with minute spines. A few show larger spines or tubercles. The edges of the biconvex discs are finely incised as described for the typical form. The outer discs usually are slightly smaller.

Overall length: Minimum 35 μm , maximum 85 μm , average 60 μm .

Diameter of outer discs: 18-22 μm , diameter of inner discs 19-26 μm .

Approximately 4 % of the gemmoscleres can not be called amphidiscs although they are clearly derived from them, which is shown by the complete series of transitional forms. The shaft projects more and more beyond the rotule, either on one side only or on both, and ends in a point. The shaft stretches, the rotules becomes spherical and spiny, and degenerate more and more until finally there remains only an acanthox. These forms lie in the gemmules the same way as the amphidiscs. These can be distinguished from the skeleton spicules because they are smaller (up to $175 \times 7.5 \mu\text{m}$), more abruptly pointed and more densely spined.

Remarks: Although the variability of spiculation in *Ephydatia multidentata* is great, it is believed that the combination of deviations from the typical form justifies the establishment of this nova forma. The skeleton spicules are larger, thinner and less abruptly pointed, the variation in size of the gemmule spicules is greater than in other specimens of the species. The anomalies among the amphidiscs which lead in a series to acanthoxea could not be observed in any specimen of the typical form examined from Eastern Australia.

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