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New-Guinean *Tethya* (Porifera Demospongiae) from Laing Island with description of three new species.

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Abstract : Seven species of Porifera belonging to the genus *Tethya* (Demospongiae Hadromerida) have been collected on the coral reef of Laing Island (Bismarck Sea, Papua New Guinea). Three new species, *T. boeroi*, *T. densa* and *T. pulchra*, are described and for the other species, *T. microstella* Sarà, *T. robusta* Bow., *T. seychellensis* Wright and *T. viridis* Baer, a redescription with additional data is given. One small specimen, probably not fully developed, is described as *Tethya sp*. Field notes on the ecology and biology of these species are also reported.

Résumé : Sept espèces d'éponges du genre *Tethya* ont été récoltées sur le récif corallien de Laing Island (Mer de Bismarck, Papouasie Nouvelle-Guinée). Trois nouvelles espèces, *T. boeroi, T. densa* et *T. pulchra*, sont décrites et une redescription avec des données intégratives a été fournie pour les autres espèces : *T. microstella* Sarà, *T. robusta* Bow., *T. seychellensis* Wright et *T. viridis* Baer. Un petit specimen, probablement en voie de développement, a été décrit comme *Tethya* sp. Des observations sur l'écologie et la biologie de ces espèces sont aussi reportées.

INTRODUCTION

A remarkable number of species of *Tethya*, seven, has been identified in a collection of 23 specimens of this genus from the coral reef around the small Laing Island, made during my stay in the Biological Station Leopold III in january 1989. This is the first record of *Tethya* species from the Bismarck Sea, Papua New Guinea. Three species, *T. boeroi, T. densa* and *T. pulchra*, are new, *T. seychellensis* is a circumtropical species, *T. robusta* has been found in several stations along the australian pacific coasts and in the Indian Ocean, *T. microstella* has been recorded only once before, from the australian pacific reef, and *T. viridis* twice before in Polynesia. One specimen, 2 mm in diameter, likely not fully developed, is described as *Tethya* sp. Bergquist & Kelly-Borges (1991) described *T. coccinea* and recorded *T. robusta* and *T. seychellensis* from the Southern Paqua-New Guinea.

Tethya taxonomy is poorly known (Sarà, 1987) and therefore the intraspecific variability should always be taken in consideration. So morphological and spicular details have been given also for the hitherto known species. Considering the scarcity of knowledge on the life of *Tethya* species in a reef environment I include in this paper all the data which I can get on the ecological distribution, biology and alive characteristics of the different species on the basis of field notes taken during my stay in Laing Island.

MATERIAL AND METHODS

Habitat description

The hydrological and climatic conditions prevailing in the waters of the Bismarck Sea around the small Laing Island, on the northern coast of Papua-New Guinea, have been described by Bouillon *et al.* (1986). Here I summarize the observations which may be more interesting for the ecology of *Tethya*.

Laing Island, 800 m long and 50-150 m wide, is completely surrounded by coral reefs. On the West side the reefs show a soft slope, build a platform and encircle a lagoon, with sandy bottom and a maximal depth of 20 m. On the North, East and South sides a narrower and more abrupt fringing reef is developed and forms a boundary for a submerged narrow platform between the reef and the shore. The difference between the water levels at high and low tides is small, with a maximum of 1.30 m. The equatorial superficial currents change during the year : in the rain season the main direction is from the North while during the dry season they come prevalently from the South. However, near the coast, the direction of currents is often influenced by the local geographical and hydrological conditions as well as from the tidal regime. Water transparence is also changing with the seasonal cycle and may be strongly affected during the rain season by the terrigenous material driven to Laing lsland by the rivers flood. This flood conveys in the sea also a large quantity of nutrients and organic material. The yearly mean value of water temperature is 29,4 C but of course in *Tethya* habitats as the shallow waters on the platform exposed to the sun higher temperatures are reached. The yearly mean salinity is 33.4 %.

Collecting sites and *Tethya* sampling

Tethya specimens were collected during the rain season (January) by myself and by prof. F. Boero by hand in four different sites. Hundreds of coral stones on the platforms between the shore and the fringing reef were removed to score their under surfaces. Also the outer borders of the fringing reef were explored by diving until a depth of 10 m. On the whole only 23 Tethya specimens were found. However, this restricted collection is rich in number of species. The following information on their relative abundance and ecological distribution may be given (Fig. 1).

Eastern platform - It is a restricted platform covered at mean low tide by 10-20 cm of water. Fragments of dead madrepores of different size lay on the rocky substrate covered by a thin layer of sediment. A sponge population, rich in number of species and individuals generally encrusting and of small dimensions, with many boring Clionids, is developed on the under surfaces of these coral stones. The more suitable for sponge colonization are flattened stones with a side area of about 400 cm^2 and leaving between their under surface and the substrate a narrow free space.

The more frequent species of *Tethya* are *T. viridis* (4 specimens) and *T. microstella* (3 specimens). Also *T. robusta* (1 specimen) has been found.

Western shore : platform and inner board of the reef around the lagoon. The habitat is similar, also in depth, to the eastern platform but more sandy and influenced by the lagoon

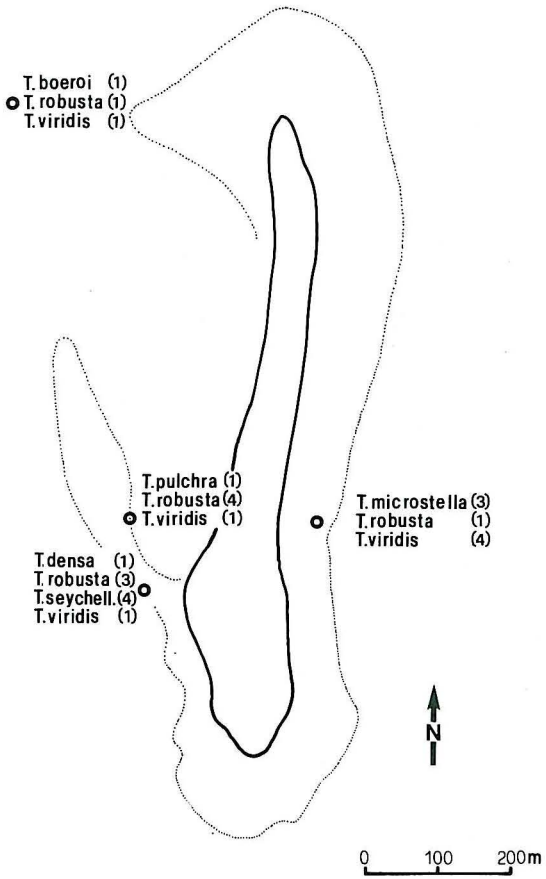

Fig. 1 : Collecting sites of *Tethya* species at Laing Island. In brackets the number of specimens.

waters. The more frequent *Tethya* is *T. robusta* (4 specimens). Other species collected were *T. viridis* (1 specimen) and *T. pulchra* (1 specimen).

Western shore : outer border of the reef. *Tethya* specimens were found under dead corals by diving at different depths. The habitat is exposed and free from sediment. At - 1.5 m *T. robusta* (3 specimens) and *T. viridis* (1 specimen), at - 3 m *T. densa* (1 specimen) and at - 4 m *T. seychellensis* (4 specimens) have been found.

North-western shore : outer border of the reef. This is the more exposed site. At - 5-6 m were found : *T. robusta* (1 specimen), *T. viridis* (1 specimen) and *T. boeroi* (1 specimen).

Field notes on the ecology and biology of the collected species

In spite of the restricted size of the sample some general remarks can be made : a) *Tethya* species differ in occurrence and frequence in the four collecting sites of Laing

Island : this uneven distribution may be related to the different ecological requirements of the species ; b) *T. robusta* and *T. viridis* are ubiquitous in the explored Laing Island sites : the two species share the same sites but with different frequence. *T. viridis* and *T. microstella*, two soft body species with a lacunar cortex, seem more linked than *T. robusta*, an hard body species with a compact cortex, to sheltered habitats. In fact the coexistence of *T. viridis* and *T. microstella* with *T. robusta* in Laing Island may be compared with the coexistence on the north australian reef of *T. orphei* and *T. microstella* with *T. robusta* (Sarà, 1990). In both cases two different morpho-functional types of *Tethya* can coexist in the same place : the *orphei-viridis-microstella* type with a soft structure and a lacunar cortex and the *robusta* type with an hard structure and a compact cortex. There is also an analogy with the mediterranean situation where *T. citrina*, with a soft structure and a lacunar cortex and *T. aurantium* with an hard structure and a compact cortex live in simpatry but in slightly different habitats (Corriero *et al.*, 1989). These differences regard the skeletal architecture and the features of the aquiferous system and may be explained through hypotheses on a resource partitioning, linked to different feeding modalities. At this regard it is interesting to remark that the surface of the compact species as *T. robusta* and *T. aurantium* is normally devoid from sediment while that of the soft species as *T. citrina*, *T. viridis* and *T. seychellensis* is normally covered by sediment.

The diffuse intertropical *T. seychellensis* was found only in exposed sites and at a certain depth. Besides *T. microstella* and *T. viridis* the more sheltered sites are inhabited by a rich population of a yellow *Cinachyra* sp., which, at difference with the *Tethya*, lives also on the upper surface of the coral stones, completely covered by sediment. *Cinachyra* sp. and *T. viridis* show often external buds. Also one specimen of *T. robusta* shows buds. One specimen of *T. seychellensis* (NG 181 T) shows mature eggs, ovoidal, with a maximum diameter of 70 µm.

The shape as well as the situation of the species of *Tethya* on the substrate is strongly affected by the water turbulence in relation with waves and tidal currents. The shape normally globose of *Tethya* is in many cases modified to hemispherical or also cap- and cushion-like or in other irregular form in relation to the holes and crevices of the substrate. In some cases outgrowths and filaments anchoring the sponges to the substrate are developed. In *T. pulchra* an horizontal outgrowth, stalk-like, 1,5 cm long and 1 mm thick, accompanied by an opposite smaller filament, anchors the sponge in a small cavity of the substrate.

Colour in life is a distinctive character for some new guinean species but may be also variable. *T. seychellensis* is always purple red in the cortex, orange in the medulla. *T. viridis* is black, green black or brown black in the cortex and ochraceous yellow in the medulla. Two specimens of *T. microstella* are also black in the cortex and ochraceous yellow in the medulla but the third is, as in the type description from Australia, externally yellowish. The black colour of *T. viridis* and *T. microstella* is in fact due to a dense population of filamentous Cyanobacteria inside the cortex. *T. robusta* has a cortical colour which in different specimens may be yellowish, pale brown or pale orange ; the medulla may be ochraceous yellow, green or olive-green. *T. pulchra* is externally grayish. internally ochraceous orange,

T. densa externally orange brown and internally dark green, *T. boeroi* externally brownish, internally ochraceous yellow. The surfaces of *T. seychellensis*, *T. viridis*, *T. pulchra*, *T. densa* and *T. boeroi* are generally covered by sediment at difference with that of *T. robusta.*

Histological sections of one specimen of *T. microstella* (NG 30 T) shows the occurrence of endosymbiotic, perhaps parasitic, nematodes in the parenchymatous medulla of the sponge.

Histological and ultrastructural procedures

Spicule preparations were made by dissolving small fragments of the sponge cortex and medulla in concentrated nitric acid, rinsing with water, dehydrating in ethanol and mounting with Canada balsam. Thick transversal sections were made by hand or microtome on unembedded or paraffin-embedded ethanol fixed samples to study skeletal architecture and general aquiferous system organization. Thin sections were also made on paraffin-embedded Bouin's fixed samples and stained with hematoxylin-eosin to study histological details.

For SEM analysis, spicular slides of *Tethya* species were covered with gold-palladium using a Balzers Union evaporator, and observed in a Philips EM 515 scanning electron microscope.

DESCRIPTION OF THE SPECIES

The types of the three new species and some specimens of *T. viridis* and *T. seychellensis* are deposited in the Natural History Museum of Genoa (Italy) (MSNG). The other specimens and the slides are in the author's collection. In the following descriptions D = diameter and R/C = lenght of the ray/diameter of the center.

Tethya boeroi n. sp. (Fig. 2, Table I, A-C)

Material and collecting site : NG 197 T (holotype, MSNG C.E. 48473), north-western shore, outer border of the reef, - 5-6 m, leg. Boero.

Shape : hemispheric.

Size : diameter 0,6 cm.

Colour : cortex brownish, medulla ochraceous yellow.

Surface : with elongated conuli, covered by sediment.

Cortex : thin, 0,5 mm thick, without clear lacunes and oscules.

Medulla : with a nucleus in its center (D = 1 mm) formed by short transversal strongyloxeas which cross the main bundles.

Strongyloxeas : 400-1 200 x 3-17 µm. With all the intermediate sizes. The basis is subtylote with a small vesicle.

Spherasters : distributed in the cortex and in the outer medulla ; main concentrations occur in the outer medulla and along ascending lines from the medulla into the middle cortex. D = 1 060 µm ; R/C = 0,2-0,5. Generally in the cortex D = 40-60 µm and R/C = 0,3-0,5. In the medulla frequently smaller with D = 25 µm and R/C = 0,2. Ray number = 20-24.

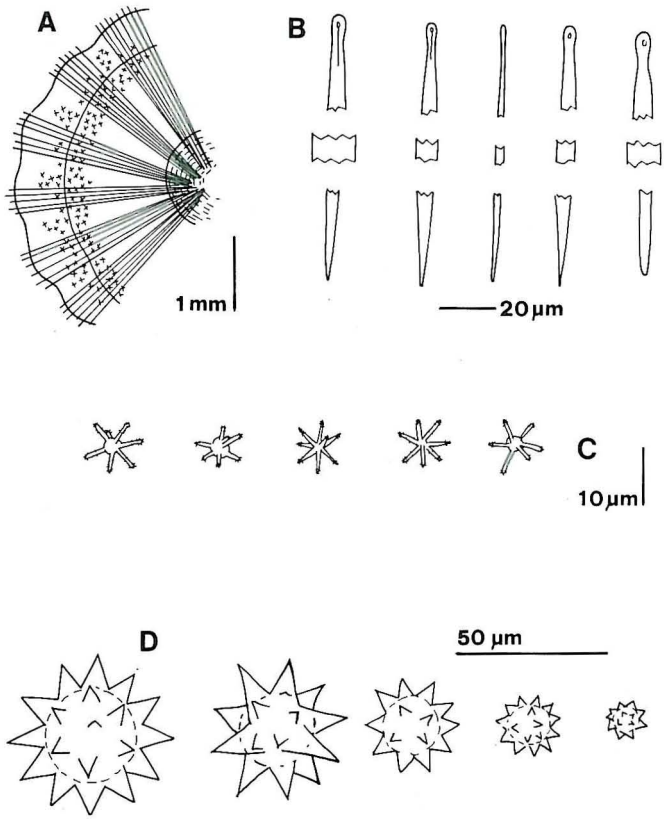

Fig. 2 : *Tethya boeroi* n. sp. : A, transversal section with spherasters distribution ; B, strongyloxeas ; C, micrasters ; D, spherasters.

Micrasters : Oxyasters, chiasters and tylasters often with center. The oxyaster type, frequently apically blunt or knobbed, is predominant. The rugose rays are numerous and slender. D = 8-12 µm in the cortex and in the medulla.

Remarks : *Tethya boeroi* is distinguished from *T. robusta* and *T. aurantium*, to which may be compared, chiefly for the spherasters distribution and rarefaction, the predominant oxyaster shape of the micrasters, their similarity in the cortex and in the medulla. In addition, a medullar nucleus, as in *T. boeroi*, has not been recorded for *T. robusta* and *T. aurantium* The same traits distinguish *T. boeroi* from the here described new species *T. densa* which may be attributed to the *robusta* group.

Derivatio nominis : the name is derived from the collector, prof. Ferdinando Boero.

Tethya densa n. sp. (Fig. 3, Table I, D-F)

Material and collecting site : NG 164 T (holotype, MSNG CE 48474), western shore. outer border of the reef, - 4 m. leg., Boero.

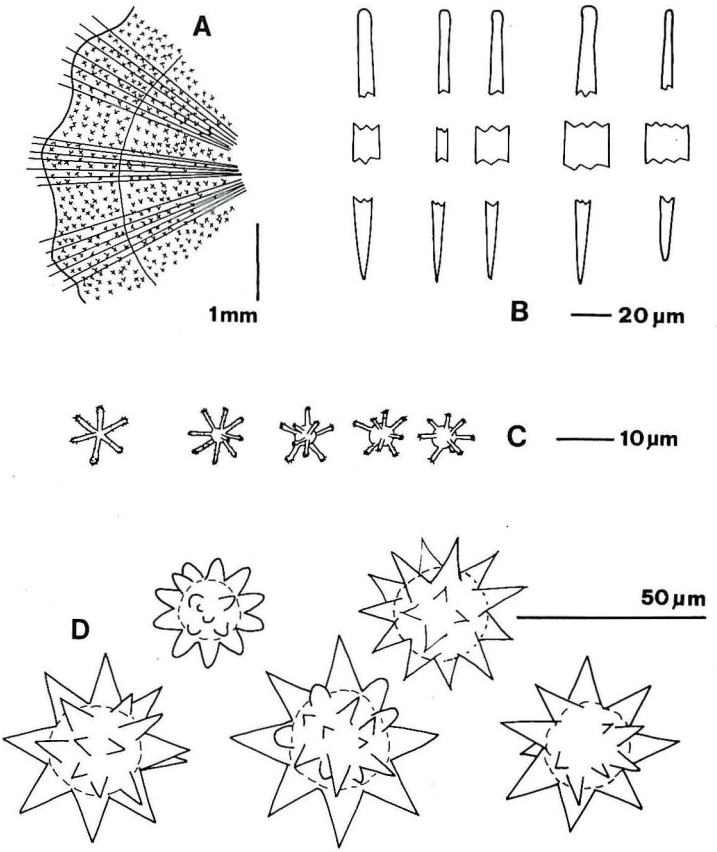

Fig. 3 : *Tethya densa* n. sp. : A, transversal section with spherasters distribution ; B, strongyloxeas ; C, microsters ; D, spherasters.

Shape : hemispheric.

Size : D = 0,5 cm.

Colour : cortex brownish-orange, medulla dark green.

Surface : smooth, with sediment.

Cortex : 1 mm thick, compact, without lacunes and apparent oscules. With a dense outer layer of eosinophilous cells.

Consistence : hard.

Strongyloxeas : in the bundles, 300-1 250 x 8-22 µm. The large strongyloxeas measure 1 100-1 250 x 20-22 µm. In the cortical part of the bundles characteristic short and thick strongyloxeas 300-400 x 8-12 µm.

Spherasters : situated densely in the whole cortex and in the medulla. In the cortex : D = 45-70 µm, R/C = 0,5. In the medulla : D = 40-60 µm (smaller spherasters 30 µm) R/C = 0,3. The rays are sometimes forked or rounded and then shortened. Ray number = 20-24.

Micrasters : tylasters often with a center and 10-14 rays.

In the cortex a little stouter (D = 10-12 µm) than in the medulla (D = 10 µm). In the tylasters with a center R/C = 1-2. There is some variability in the thickness of the rays, which may be sometimes slender.

Remarks : *Tethya densa* differs from *T. robusta*, with which shares the compactness of the cortex, chiefly in the occurrence of the spherasters also in the whole medulla, in the lack of a differentiation between the cortical and medullar micrasters and in the shape of the micrasters (tylasters with center). The dense distribution of the spherasters into the whole cortex and medulla and the tylaster shape of the micrasters distinguish sharply this species from the other new species here described, *T. boeroi* and *T. pulchra*.

Derivatio nominis : The name refers to the compactness of the sponge, filled with spherasters in the cortex and in the medulla.

Tethya pulchra n. sp. (Fig. 4, 5, Table I, G-I)

Material and collecting site : NG 16 T (holotype, MSNG C.E. 48475), western platform, - 0-1 m, leg. Sarà.

Shape : ellipsoidal. The sponge is placed horizontally in a crevice of the substratum and is anchored with two opposite outgrowths, the larger stalk-like and the other filamentous.

Size : 1,5 x 1 cm. The larger peduncle is 1,5 cm long and 1 mm thick the other 2 mm long and 0,25 mm thick.

Colour : cortex gray, medulla ochraceous orange.

Surface : covered by flattened and contiguous poligonal papillae. Each papilla shows a clearer area around a central depression.

Cortex : well developed, about 1 mm thick. With subdermal lacunes, alternated with the bundles of strongyloxeas. Without apparent oscules. Covered with sediment. With many scattered eosinophilous cells and a distinct fibrous contractile ring in the inner zone.

Consistence : moderately soft.

Skeleton : the body, in addition to the strongyloxeas bundles, is occupied by spherasters in the whole cortex and medulla. The denser layers are in the outer cortex and in the outer medulla. The area in which are more rarefied is the inner fibrous cortical ring. Micrasters are diffuse in the cortex and in the medulla but are less abundant than normally in *Tethya*. In particular the usual dense surface layer of micrasters is considerably reduced.

In the stalk the skeleton is composed by a bundle of strongyloxeas accompanied by many spherasters and also micrasters. Spherasters and micrasters are similar to those of the body.

Strongyloxeas - Fusiform shape with a conspicuous thickening in the middle. Basis somewhat elongated and frequently subtylote with a neck. Larger strongyloxeas in the bundles : 1 100-1 500 x 18-26 µm. Smaller strongyloxeas : in the outer medulla between the bundles 600-800 x 8-12 µm, in the cortical part of the bundles 600-800 x 9-20 µm.

Spherasters - D = 50-85 µm, more frequent size 80 µm ; R/C = 0,3-0,7, chiefly 0,4. Rays often with teeth, forks or rounded. Ray number = 16-22.

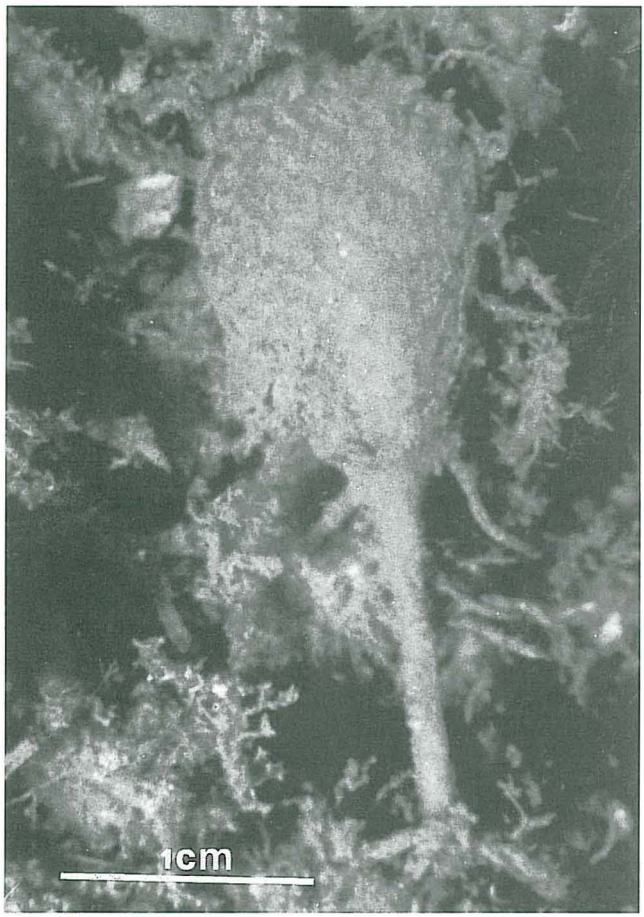

Fig. 4 : *Tethya pulchra* n. sp. : photo of the holotype "in situ".

Micrasters - Chiasters with many, about 12, slender roughed cylindrical rays and irregularly rounded tips, sometimes with small swellings at the tips (tylasters) or with pointed tips (oxyasters). Without center. Frequently with anomalies as deplacement of some rays which do not originate all from the same center, rays with forks, teeth or bendings. Similar for shape in the cortex, the medulla and the stalk. D = 8-14 µm (generally 10-12 µm). A little smaller in the outer cortex and in the stalk, with a mean diameter of 10 µm.

Remarks : T. pulchra is well distinct for the complex of the external and spicular characters from the hitherto known species of *Tethya* including the new species here described, *T. boeroi* and *T. densa.*

Derivatio nominis : The name has been given for the nice texture of the surface and the beautiful general shape.

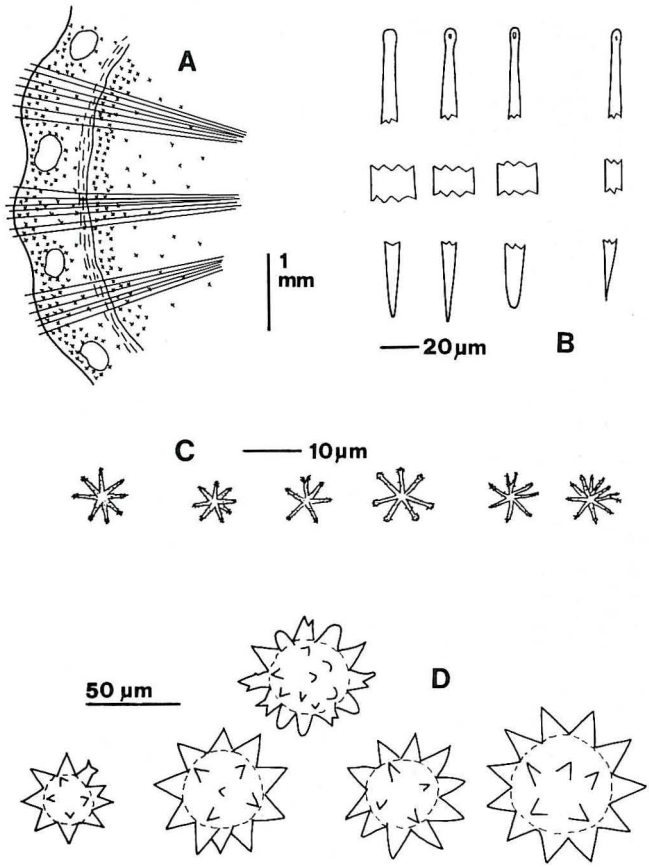

Fig. 5 : *Tethya pulchra* n. sp. : A, transversal section with spherasters distribution ; B, strongyloxeas ; C, microrasters ; D, spherasters.

Tethya microstella Sarà (Fig. 6, Table I, L-M)

T. microstella Sarà, 1990, 153

Material and collecting sites : 3 specimens : NG 30 T, NG 176 T ; NG 190 T : leg. Sarà eastern platform, - 0-1 m, on the underside of coral stones.

Shape and size (diameter) : NG 30 T globose, 0,5 cm ; NG 176 T hemispheric, 0,6 cm ; NG 190 T cap-like, 0,4 cm.

Colour : NG 30 T and NG 176 T with cortex black and medulla ochraceous yellow ; NG 190 T with cortex yellowish and medulla ochraceous yellow. The black colour of the cortex in NG 30 T and NG 176 T is due to filamentous Cyanobacteria.

Surface : smooth or with rounded flattened papillae.

Cortex : with wide lacunes.

Consistence : soft.

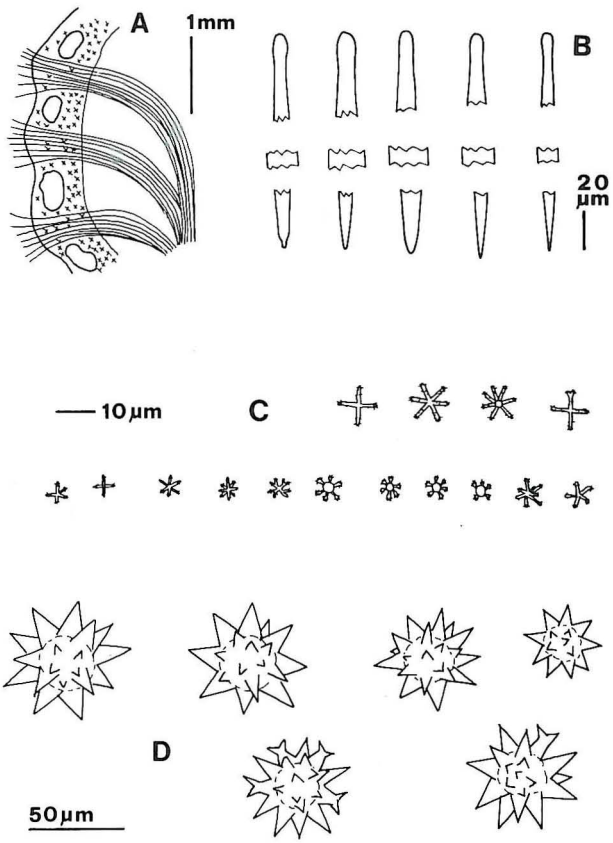

Fig. 6 : *Tethya microstella* Sarà : A, transversal section with spherasters distribution ; B, strongyloxeas ; C, micrasters ; D, spherasters.

Strongyloxeas : main category 800-1 200 x 13-20 µm ; slender cortical 400-600 x 5-10 µm. A reconsideration of the australian type shows that the main category measures 1 100-1 300 µm instead of 1 200-1 600 µm (Sarà 1990) and that many intermediates exist between the two categories of strongyloxeas. On the whole in *T. microstella* the main category is characterized by a minor lenght and the occurrence of strongyloxeas very thick (16-20 µm) but shortened (800-1 000 µm) with rounded, somewhat strongylote distal ends. The bundles of strongyloxeas are strongly coiled.

Spherasters : situated in the whole cortex with a denser belt around the medulla. D = 20-50 µm, R/C = 0,5-0,8 ; in 176 T R/C= 0,7-0,8. The diameter of the spherasters is on the whole remarkably smaller than in the australian specimens. However this measure is considerably variable and also in the australian material there are some specimens with comparable diameter. The R/C values are generally a little smaller than in the australian specimens. The number of rays, as in the australian material, is considerably high, 24-30. Some rays are forked.

Micrasters : slender tylasters in the cortex and in the medulla. Generally D = 4-6 m but also 6-10 µm. The larger tylasters are more frequent in the medulla. Often the number of rays is reduced and the spicule looks cruciform. Some rays are forked. At difference with the australian material the new-guinean micrasters show sometimes a center more or less developed.

Geographic distribution : Australia, New Guinea.

Tethya robusta (Bowerbank) (Fig. 7, Table I, P-Q)

Tethea robusta Bowerbank 1873, p. 10.

Tethya robusta Sarà 1990, p. 156.

Material and collecting sites : 9 specimens : NG 29 T, NG 184 T, NG 185 T, western side, outer border of the reef, 1,5 m, leg. Boero ; NG 199 T, north-western side, outer bor-

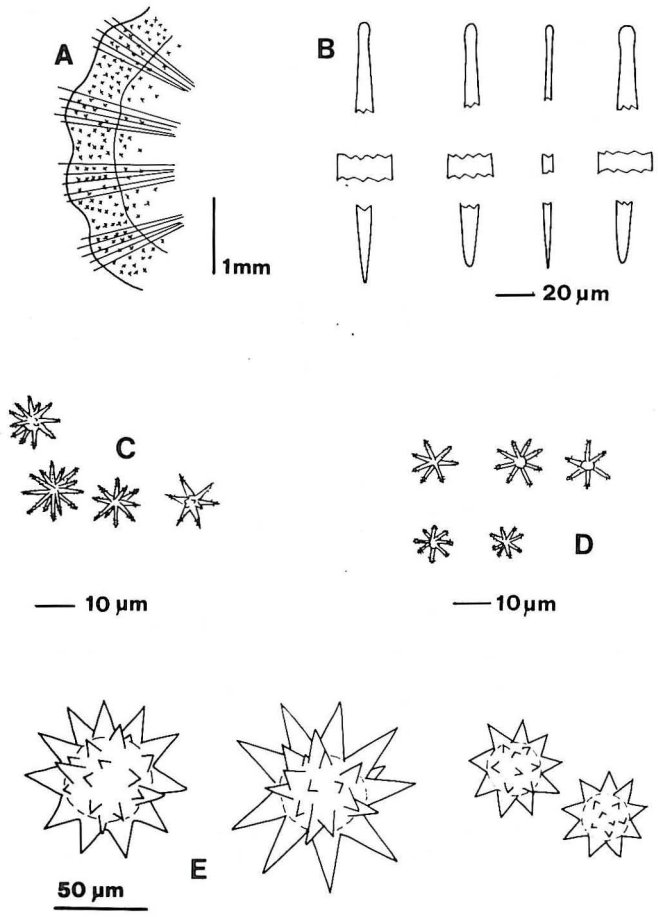

Fig. 7 : *Tethya robusta* Bowerbank : A, transversal section with spherasters distribution ; B, strongyloxeas ; C, medullar micrasters ; D, cortical micrasters ; E, spherasters.

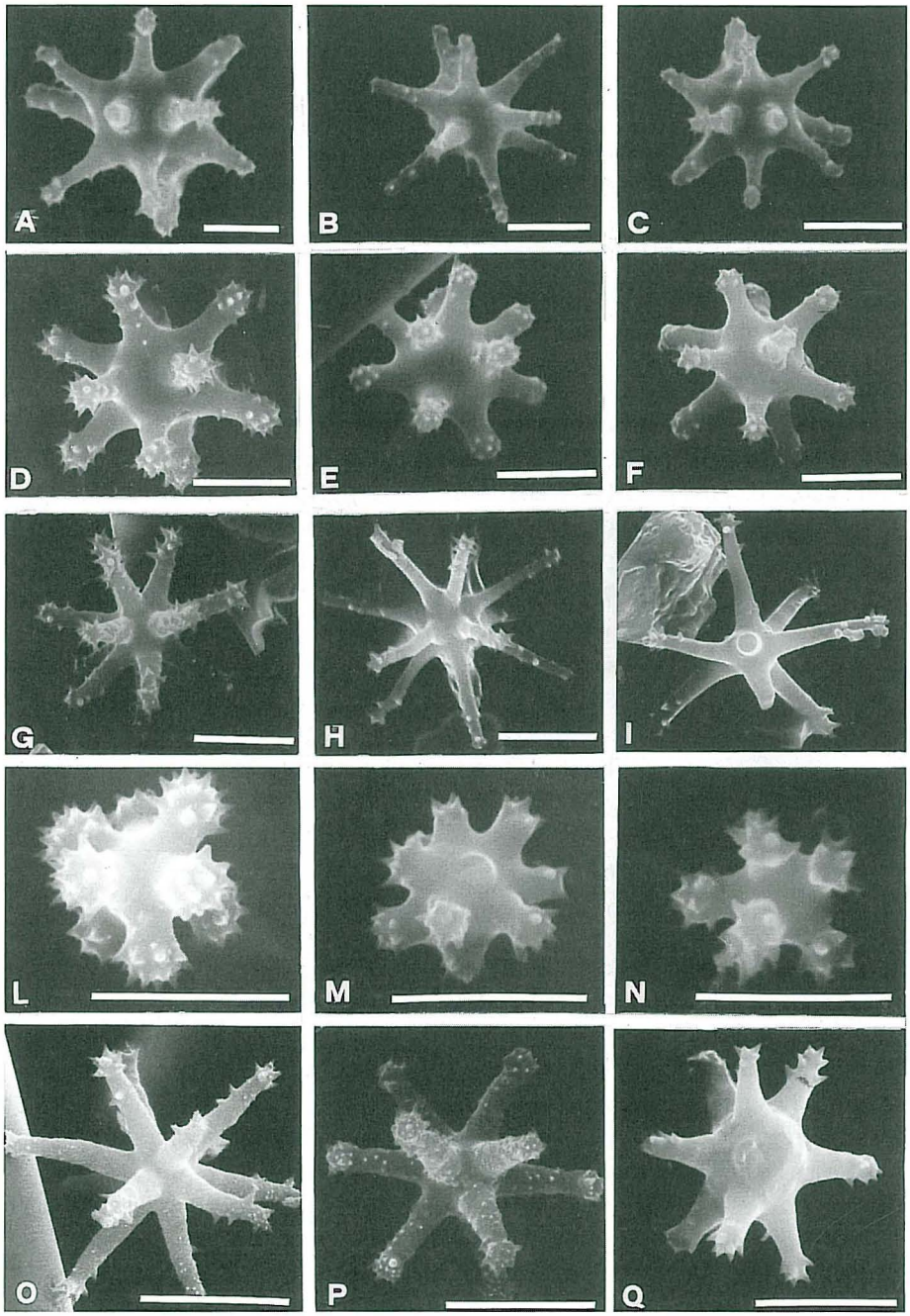

TABLE I

Micrasters of *Tethya boeroi* (A-C), *Tethya densa* (D-F), *Tethya pulchra* (G-I), *Tethya microstella* (L-N, small micrasters) and *Tethya robusta* (O, small medullar and P-Q, cortical micrasters). Bar = 5 µm.

der of the reef, 5-6 m, leg. Boero ; NG 119 T, NG 189 T, NG 206 T, NG 207 T, western platform, 0-1 m, leg. Sarà ; NG 163 T, eastern platform, 0-1 m, leg. Sarà.

Shape : globose, hemispherical or irregular. NG 199 T is reduced to a slice in a slit of the substrate.

Size : 0,7 to 1,5 cm in diameter.

Colour : cortex from yellowish-brownish to pale orange ; medulla from ochraceous yellow to apple or olive green.

Surface : smooth or with flattened rounded papillae. One specimen (NG 199 T) conulose with bent scale- like conules. NG 185 T with buds.

Consistence : hard.

Strongyloxeas : Main category : 500-1 400 µm in lenght. Several spicules are apically shortened or rounded.

Spherasters : D = 20-80 µm ; R/C = 0,3-1, more frequently 0,5-0,7. Number of rays : 24-30. The spheraster size and R/C are variable in the different specimens : 29 T, D = 20-80 µm and R/C = 0,3-0,5 ; 119 T and 169 T, D = 40-60 µm and R/C = 0,3-0,6 ; 184 T, D = 40-60 µm and R/C = 0,5-0,8 ; 185 T, D = 20-80 m and R/C = 0,5-0,6 ; 189 T, D = 20-70 µm and R/C = 0,5-0,8 ; 199 T, D = 10-60 µm and R/C = 0,5-0,8 ; 206 T, D = 20-70 µm and R/C = 0,5-1 ; 207 T, D = 20-70 µm and R/C = 0,3-0,9. Medullar spherasters are generally smaller than the cortical ones in their mean and maximum size.

Micrasters : cortical tylasters, chiasters and oxyasters with or without center : 8-12 µm ; medullar oxyasters-chiasters 12-16 µm. In the new-guinean specimens the occurrence and development of a center is more considerable than in the australian ones.

Geographic distribution : Pacific Ocean (Australia, Solomon Islands, Papua New Guinea), Indian Ocean.

Tethya seychellensis (Wright) (Fig. 8, Table II, A-F)
Alemo seychellensis Wright 1881, p. 13.

Material and collecting sites : 4 specimens : NG 165 T, NG 166 T, NG 167 T and NG 168 T, western side, outer border of the reef, - 4 m, leg. Boero.

Shape : roughly ellipsoidal ; NG 168 T discoidal.

Size : 2 x 1,5 cm ; NG 168 T 1 cm.

Colour : cortex red purple, medulla orange.

Surface : irregularly conulated. With 1 mm long or bent scale-like papillae.

Consistence : soft, with cortical lacunes.

Strongyloxeas : remarkably fusiform. Basis without or with a slight thickening. 450-1 500 x 5-30 µm.

Spherasters : D = 20-60 µm, generally smaller in the medulla than in the cortex. R/C = 0,5 (0,3-0,6). With 20-24 rays.

Micrasters : cortical tylasters with 3-9 rays, but often with 3-4 rays, 6-8 µm ; medullar oxyasters generally with 4-6 rays, 20-40 µm. Rays frequently with spines, apical forks, thickenings and windings.

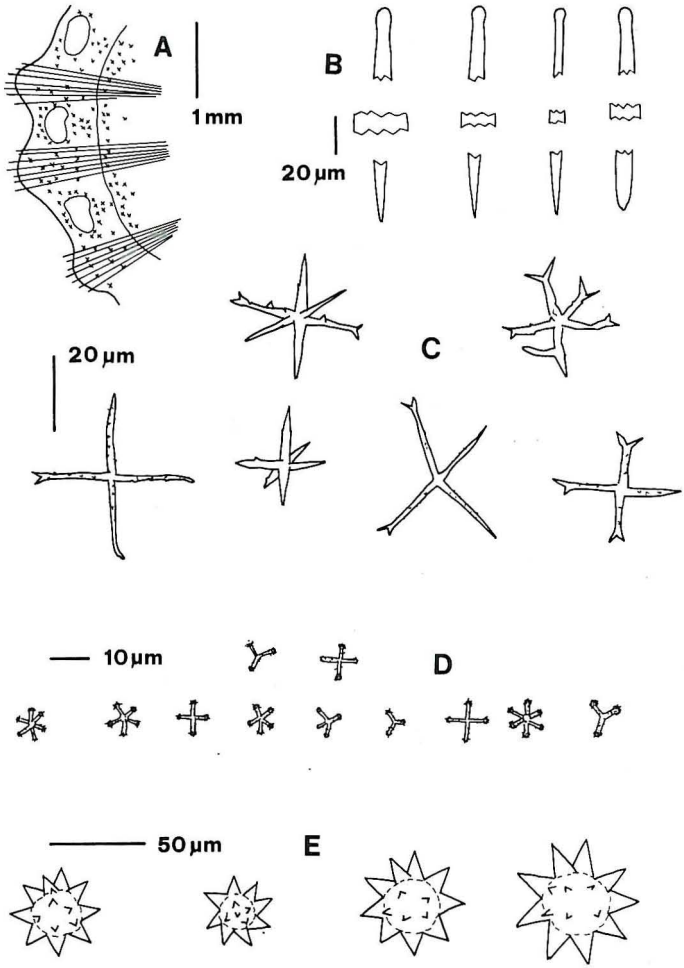

Fig. 8 : *Tethya seychellensis* (Wright) : A, transversal section with spherasters distribution ; B, strongyloxeas ; C, medullar oxyasters ; D, cortical tylasters ; E, spherasters.

Geographic distribution : ubiquitous in the intertropical atlantic and indo-pacific regions.

Remarks : after the study of the types (spicules on slides) of *T. diploderma* Schmidt and *T. seychellensis* Wright, both in the British Museum of Natural History, I consider the two species distinct. But the type slide and the original description of Schmidt 1870 are not sufficient to well characterize the atlantic species *T. diploderma*, which should be considered therefore as *nomen nudum* (in agreement with Hechtel, 1965). On the contrary the slide and the original description of Wright characterize well *T. seychellensis*. Consequently, studying the rich collection of *Tethya* in the BMNH, I was able to identify as *T. seychellensis* many

specimens collected in indo-pacific as well as in atlantic tropical areas and labelled as *T. diploderma* or under other names. I consider therefore *T. seychellensis* as a species which is spread in the whole circumtropical zone.

Tethya viridis Baer (Fig. 9, Table II, G-M)
Tethya viridis Baer 1905, p. 26.

Material and collecting sites : seven specimens : NG 28 T, western shore, outer border of the reef, - 1.5 m, leg. Boero ; NG 196 T, north-western shore, outer border of the reef, - 5-6 m, leg Boero ; NG 209 T, western platform, - 0-1 m, leg. Sarà ; NG 1 T, NG 175 T, NG 181 T, NG 204 T, eastern platform, - 0-1 m, leg Sarà.

Shape : globose (1 T), depressed globose (28 T), hemispheric (175 T, 181 T), cap-like or slice-like (196 T, 204 T, 209 T).

Size : main diameter : 0.6-1.2 cm.

Colour : cortex black, sometimes black greenish, medulla ochraceous yellow. The cortical colour is due to filamentous Cyanobacteria.

Surface : conulated with conules 1 mm high. Sometimes the conules are flattened, scale-like and disposed horizontally on the surface of the sponge. Sometimes with flattened poligonal papillae. Different aspects of the surface may occur in the same specimen. Four specimens (1 T, 175 T, 181 T and 204 T) with buds.

Consistence : soft, with lacunes.

Strongyloxeas : µm 400-1 500 x 5-20. Basis only slightly thickened.

Spherasters : D = 10-50 µm, R/C = 0.8-0.9. In the medulla chiefly 10-20 µm, R/C = 0.3-0.5. Ray number =18-22. Distributed in the whole cortex, more numerous in its middle zone, and in the outer medulla where are smaller.

Microasters : cortical tylasters or chiasters, sometimes with center with 3-12 rather thickened rays. The number of rays may be often reduced and the spicules appear as cruciform or also triradiate. D = 8-12 µm.

Medullar oxyasters, often with reduced number of rays (4-6) and cruciform. D = 15-30 µm.

Geographic distribution : Polynesia, Papua New Guinea.

Remarks : this is the third record of the species after those of Baer (1905) and de Laubenfels (1954) and confirms the validity of the species put in synonymy with T. *diploderma* (= *T. seychellensis*) by Topsent (1918) and Burton (1924). *T. viridis* is akin to *T. seychellensis* but a comparison among the neo-guinean specimens of *T. viridis* and *T. seychellensis* shows that the two species can be easily distinguished in the field by external characters. *T. viridis* differs from *T. seychellensis* also in spicular details as the different shape and minor dimensions of the medullar oxyasters, the different shape and minor dimensions of the cortical tylasters and the greater R/C of the spherasters, which is already highly variable in both species. Another species akin to *T. viridis* and *T. seychellensis* is *T. orphei* described from Australia (Sarà, 1990).

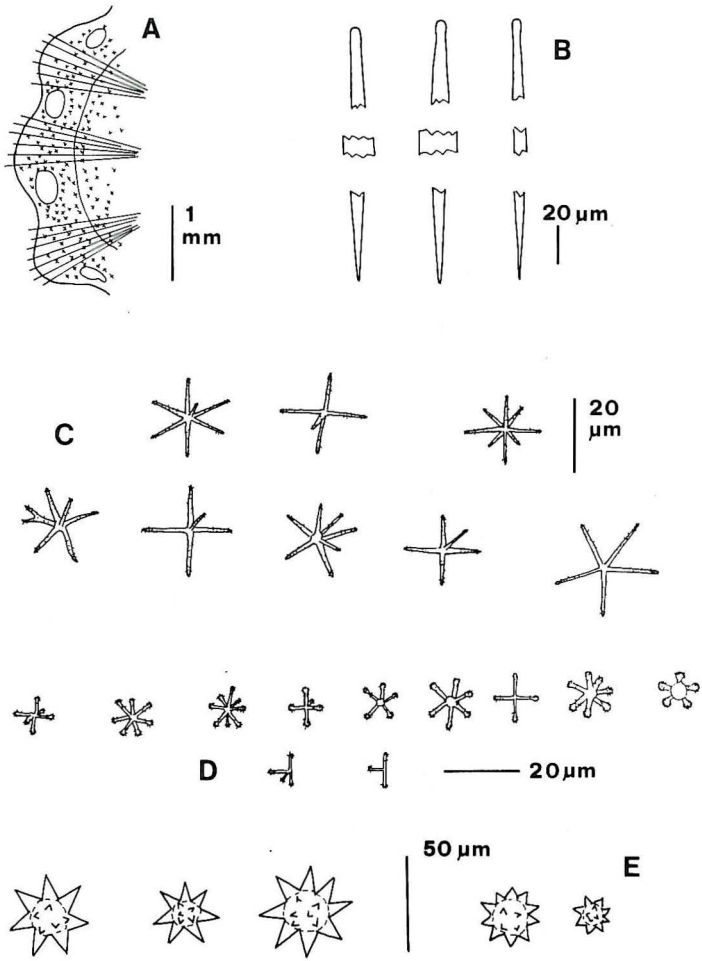

Fig. 9 : *Tethya viridis* Baer : A. transversal section with spherasters distribution ; B, strongyloxeas ; C, medullar oxyasters ; D, cortical tylasters ; E, spherasters.

Tethya sp. (Fig. 10).

Material and collecting site : NG 111 T, western platform. - 0-1 m, leg Sarà.

Shape : cushion like.

Size : 0.2 cm (maximum diameter).

Colour : pale brown.

Surface : covered by sediment.

Structure : cortex not developed. The sponge is filled by densely packed radiating bundles of strongyloxeas and spherasters. Micrasters rare.

Strongyloxeas : fusiform with small subtylote basis followed by a neck. 370-850 x 8-15 µm.

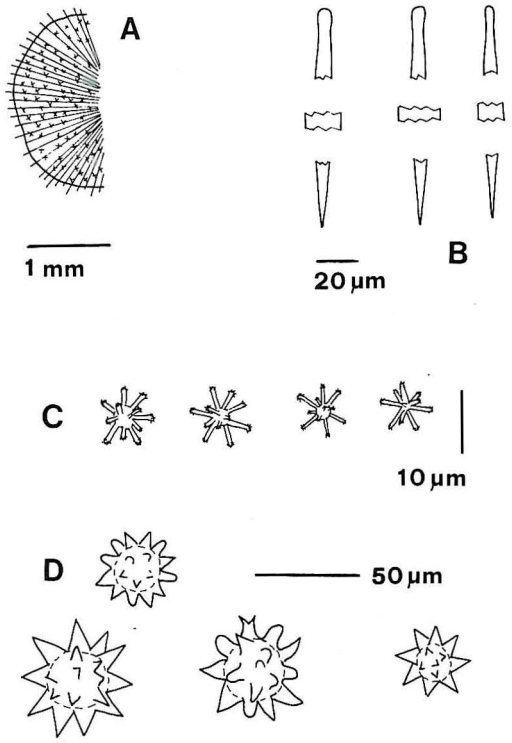

Fig. 10 : *Tethya* sp. : A. transversal section with spherasters distribution ; B, strongyloxeas ; C, micrasters ; D, spherasters.

Spherasters : D = 20-50 µm, R/C = 0.3-0.6. Sometimes with rounded shortened rays. The rays may be also bent or forked. Ray number = 24-26.

Micrasters : tylasters, sometimes chiasters, with or without center. D = 8-10 µm. Rare.

Foreign spicules : in a slide of the outer part of the sponge many bent acanthomicrostrongyles with thickened center and attenuated ends, 60 x 7 µm. Also some acanthoxeas and tetractines.

Remarks - This specimen is certainly a *Tethyidae*. More likely it is an immature stage of some *Tethya* species. This is indicated by its very small size, and the absence of cortex. Less likely it may be considered as representative of a new genus of *Tethyidae* without cortex. The surface acanthomicrostrongyles are clearly foreign.

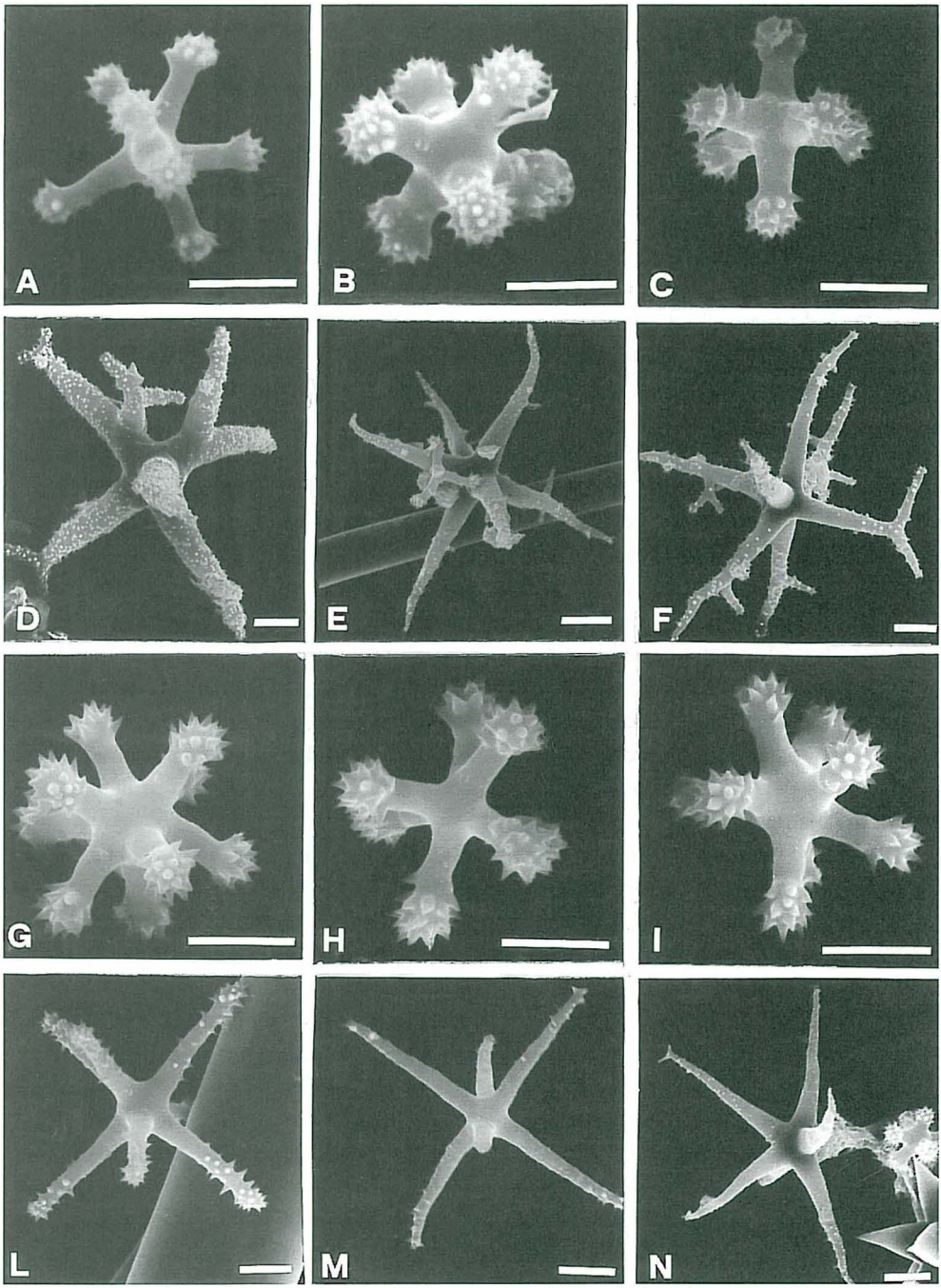

TABLE II

Tethya seychellensis, A-C, cortical and D-F, medullar microsters ; *Tethya viridis*, G-I, cortical and L-M, medullar microsters. Bar = 5 µm.

CONCLUSIONS

The number of *Tethya* species found at Laing Island, seven, is remarkably high, considering the restricted area and range of habitats investigated.

These species show alive a different contractility and resilience which derives essentially from the different, lacunar or not lacunar, structure of the cortex. Two different, soft and hard, morphofunctional types of *Tethya* may be characterized. The soft type is represented by *T. microstella*, *T. viridis*, *T. seychellensis* and likely *T. pulchra*. The hard type is represented by *T. robusta*, *T. boeroi* and *T. densa*. Species of the two types can coexist in the same sites but with a slight difference in frequences. A coexistence of the two types occurs in the australian reef of Orpheus Island (Sarà, 1990). In the Mediterranean Sea the soft *T. citrina* and the hard *T. aurantium* live in sympatry, occasionally in the same sites, but generally with a difference in habitat preferences. This difference has been analyzed by Corriero *et al.* (1989) at the Stagnone (Sicily). More data on the distribution and ecological requirements of the coral reef *Tethya* are however needed before reaching general conclusion on this point which suggests a resource partitioning among the species of the genus and is therefore of great evolutionary significance.

The hemispheric, cap-like, cushion-like or irregular shape of the specimens, frequently filling small cavities of the coral stones, is common in all the species, which live in the shallow waters of an interstitial habitat characterized by strong tidal currents and instability of the substratum. The same occurs for the *Tethya* of a similar reef habitat at Orpheus Island in Australia (Sarà, 1990). An exception at Laing Island is *T. seychellensis* but this species has been found on the exposed rock at 4 m of depth. A similar adaptation reinforcing the attachment of the specimen to the substrate is represented in *T. pulchra* by structures as a stalk and a filament.

The colour is variable but *T. microstella* and *T. viridis* have generally a blackish colour due to a dense cortical population of Cyanobacteria. Data on reproductive biology are limited to the second half of January. In this period gemmulation is shown by *T. viridis* (4 specimens on 7) and *T. robusta* (1 specimen on 9). *T. seychellensis* (1 specimen on 4) shows mature eggs. The medulla of one specimen of *T. microstella* harbours a nematode.

The systematic affinities of the species found in Laing Island cannot be elucidated without a general cladistic analysis of the genus *Tethya* and electrophoretic allozyme data. On morphological grounds two soft species, *T. seychellensis* and *T. viridis* show that the lacunar structure of the cortex is accompanied by a marked distinction of the cortical and medullar microasters. But in *T. microstella*, also with a lacunar cortex, this distinction is very slight and it is absent in *T. pulchra*, however well characterized by many external and spicular details. Among the hard species, *T. robusta* shows a slight distinction between the cortical and medullar microasters while this distinction is lacking in *T. boeroi* and *T. densa*. These two species show uncommon characters. *T. boeroi* is characterized in the medulla by a central nucleus made by many layers of transversal strongyloxeas and *T. densa* by the filling of the whole sponge (cortex and medulla) with spherasters.

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