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A COLLECTION OF SPONGES FROM THE WEST COAST OF THE YUCATAN PENINSULA WITH DESCRIPTIONS OF TWO NEW SPECIES

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ABSTRACT

A collection of sponges made by Dr. Henry Hildebrand in the Gulf of Campeche, Mexico, is described. Nine species in seven genera are included, all within the Class Demospongiae. Two species are new: *Callyspongia strongylophora* and *Axinella nanaspiculata*. Also recorded are specimens of (?) *Oligoceras hemorrhages* de L., *Ircinia campana* (Lamarck) de L., *Ircinia ramosa* (Keller) de L., *Haliclona rubens* (Pallas) de L., *Microciona juniperina* (Lamarck) new comb., *Axinella polycapella* de L., and *Higginsia strigilata* (Lamarck) de L. The taxonomic status of Lamarck's *Spongia juniperina* is discussed.

This report concerns a small collection of sponges made in 1951 by Dr. Henry Hildebrand in the Gulf of Campeche, Mexico. The sponges were taken in shrimp trawls in water 12 to 20 meters deep over shell sand off the coast of the state of Campeche, Mexico, between Campeche and Champotón. Although the sponge fauna of the Gulf of Mexico has been the subject of a number of previous studies, the sponges of the southern part of the Gulf are not well known. This is indicated by the fact that two of the nine species reported here are new.

Topsent (1889, 1894), in describing a collection of sponges from the Campeche Bank, listed 40 species, 13 of which were new. Of the nine species herein described only one, *Microciona juniperina* (Lamarck) = *Clathria copiosa* Topsent, was also represented in Topsent's collection. Topsent's papers are the only published accounts known to the present writer on the sponge fauna of the southern part of the Gulf of Mexico.

The specimens in the present collection are preserved in the dried state and are therefore not ideal for study. However, the specimens

were dried immediately after collection from deep water, and hence the skeletal elements are preserved in good condition. There is no reason to believe that some elements of the skeleton have been lost through being tossed about by the waves, as is sometimes true of beach-cast specimens.

I am most grateful to Dr. Henry Hildebrand of the Institute of Marine Science, University of Texas, for making this collection available to me for study. I am also indebted to Dr. Maurice Burton, British Museum (Natural History), and Dr. M. W. de Laubenfels, Dept. of Zoology, Oregon State College, for advice on several of the species, and to Dr. Frederick M. Bayer who granted me permission to study material in the U. S. National Museum. Dr. de Laubenfels has also made available to the writer a copy of his card index of sponge species which has proved to be of inestimable value.

Miss Shirley P. Glaser has kindly assisted in the preparation of drawings, and Mrs. Patricia J. Harris has helped with the photographic work.

CLASS *DEMOSPONGIAE*
Subclass Cornacuspongida
ORDER KERATOSA
Family SPONGIIDAE

(?) *Oligoceras hemorrhages* de Laubenfels, 1936

It is impossible to be certain of the identity of this specimen since the soft parts are not preserved. In skeletal and dermal characteristics the specimen agrees with this species, although it is possible that it belongs in the genus *Dysidea*. A study of the flagellated chambers would be necessary to decide the matter definitely. The principal fibers are packed with sand grains and broken spicules; the secondary ones have only a few included particles. The dermis is filled with broken spicules.

I am indebted to Dr. M. W. de Laubenfels for examining a section of the specimen and suggesting the above tentative identification.

Ircinia campana (Lamarck, 1813) de Laubenfels, 1948

Synonymy:

Spongia campana Lamarck, 1813, p. 385 [type: "probablement les mers d'Amérique"] Mus. nat. Hist. nat. Paris; Lamarck, 1816, p. 364; 1836, p. 553.

Stematumenia scyphus Bowerbank, 1845, p. 407.

Polytherses campana, Duchassaing and Michelotti, 1864, p. 68.

Filifera campana, Schmidt, 1870, p. 31.
Hircinia campana, Schmidt, 1870, p. 31; Hyatt, 1877, p. 546; Lendenfeld, 1888, p. 178; Lendenfeld, 1889, p. 569; de Laubenfels, 1936a, p. 20; de Laubenfels, 1936b, p. 456.
Ircinia campana, de Laubenfels, 1948, p. 71; 1953, p. 514.

Description.

This common species is represented in the collection by one cup-shaped specimen, 14 cm high and 9.5x9.0 cm across the apical opening. The surface is conulose with conules varying from 2 to 6 mm in height and distributed over the surface at intervals of 2 to 5 mm. Oscula, varying from 2 to 7 mm in diameter, are located on the inside of the cup. In addition, some oscula, varying from 2 to 4 mm in diameter, are distributed irregularly over the outer surface of the cup, mostly near the attached end. The skeleton is made up of fasciculated fibers, the fascicles varying from 600 to 1400 μ in width. The main fibers range from 55 to 130 μ in diameter, the secondary ones from 15 to 35 μ. Some fibers are cored with foreign materials, chiefly broken sponge spicules and sand; others are devoid of included matter. Localized regions of the sponge have sand grains and foreign spicules adhering to the outer surfaces of the fibers. The filaments, distinctive for this genus, vary from 1.5 to 4.5 μ in diameter, enlarging terminally into knobs, 6.5 to 13 μ in diameter. The filaments are colorless, and their surfaces are provided with sparsely distributed yellow granules.

The specimen in the present collection differs from those described by de Laubenfels (1936a) in two ways: (1) the fibers are not as densely packed with foreign matter; (2) oscula occur on the outer as well as the inner surface of the cup. The first difference is probably of no significance, since the amount of foreign matter included in the fibers doubtless varies with the amount available in the environment. The second point is of interest since Lendenfeld (1888, p. 180) reports a similar distribution of oscula in the Australian species which he named *Hircinia calyculata.* De Laubenfels (1948, p. 71) regards Lendenfeld's species as a subspecies of *Ircinia campana,* a position perhaps strengthened by the oscular distribution of the present specimen.

Further distribution:

West Indies: St. Thomas (Duchassaing and Michelotti, 1864; Lendenfeld, 1888); Bahamas (Hyatt, 1877; Lendenfeld, 1888); Cuba (4 to 10 ft., Hyatt, 1877; Lendenfeld, 1888).

Florida: Key West (Hyatt, 1877; de Laubenfels, 1953); Biscayne Bay (Hyatt, 1877); Conch Reef (40 fms., Hyatt, 1877; Lendenfeld, 1888, 1889); Dry Tortugas (de Laubenfels, 1936a); west coast of Florida from off St. Andrew's Bay to Key West (de Laubenfels, 1953).

Central America: Fort Sherman, Canal Zone (de Laubenfels, 1936b).

Other localities: Hyatt (1877) reports this species from La Paz, Lower California, and from Zanzibar; these records are not certainly of this species. Lendenfeld (1888) records it from Port Jackson, New South Wales; de Laubenfels regards this form as a subspecies of *campana*.

Ircinia ramosa (Keller, 1889) de Laubenfels, 1948

Synonymy.

Hircinia ramosa Keller, 1889, p. 345.
Hircinia ramosa de Laubenfels, 1934, p. 24.
Hircinia dickinsoni de Laubenfels, 1936a, p. 18. This name was given to the species by de Laubenfels when he realized that *ramosa* had been preoccupied by Keller; later de Laubenfels argued that the West Indian species is synonymous with Keller's species.
Ircinia ramosa, de Laubenfels, 1948, p. 73; 1950, p. 12; 1954, p. 23.

Description.

One specimen in the collection is referred to this species with some uncertainty. In external form the colony is not unlike that illustrated by de Laubenfels (1950, pl. 1, fig. 1). Distal branches arise from a massive base but remain coalesced throughout most of their length. Only the terminal one or two centimeters of the branches are free; these vary in diameter from 1.5 to 2.0 cm and are rounded. The total height of the colony is 12.5 cm; at the base it measures 5 cm wide and 4 cm thick.

The surface is conulose with conules varying from 1 to 2 mm high and placed 1 to 4 mm apart. The dermis is covered with an abundance of foreign spicules and sand; the pores are sparsely distributed and vary from 16x33 μ across to 23x43 μ across. (Measurements of surface characters were made after soaking the specimen in a saturated solution of tribasic calcium phosphate.) The oscules occur at random over the surface and vary from 0.2 to 2.5 mm in diameter.

The skeleton consists of a loose network of fasciculated fibers cored with foreign spicules and some sand. The primary fibers measure 72 to 93 μ in diameter; the secondary, 21 to 50 μ. The mesh size varies from 400x300 μ to 1100x600 μ. The flesh is packed with filaments 2.5 to 3.0 μ in diameter, bearing terminal knobs measuring 7.5 to 10 μ in diameter.

Although it bears some resemblance to *Ircinia fasciculata* (Pallas) de Laubenfels, this specimen is referred to *I. ramosa* for several reasons. (1). In general form it is similar to the specimen described by de Laubenfels from Bermuda as discussed above. Its branch ends are rounded rather than acute as is true of branching specimens of *I.* fasciculata. (2). In surface characteristics it agrees with specimens of *I. ramosa* in the U. S. National Museum from Puerto Rico (USNM Nos. 22397, 22258). In these the dermis is packed to a greater or less extent with foreign spicules and sand. The pores are small and sparsely distributed. The oscules lack a pigmented rim unlike *I. fasciculata.* In two specimens of *I. fasciculata* studied (USNM No. 22-763, Bimini; YPM No. 705, Bermuda) the dermal detritus consists chiefly of sand grains arranged in a reticulate pattern around the pores which are larger, more abundant, and regularly distributed in the areas between conules. In a third specimen (YPM No. 644, Florida) siliceous spicules largely replace the sand grains but show the same reticulate pattern. Underlying the network of detritus are conspicuous bundles of filaments which arise on the conules and likewise form a reticulate pattern around the pores. In *I. ramosa* both detritus and filaments are more evenly distributed in the dermis. (3). The filaments are thin and have small knobs in comparison with those of *I. fasciculata* (see Table 1), although there is some overlap in these characteristics between the two species.

Further distribution:

West Indies: Off Puerto Rico (33 to 160 fms., de Laubenfels, 1934); Bermuda (shallow water, de Laubenfels, 1950).

Other localities: Bay of Assab, Red Sea (Keller, 1889). It is doubtful if Keller's species is identical with that of the West Indies, but in the absence of comparative material, de Laubenfels' conclusion that they are synonymous is accepted provisionally. Palaus (2 meters) and Ponapé, Carolines (5 meters) (de Laubenfels, 1954). These forms are of doubtful synonymy with the West Indian species.

TABLE 1. *Ircinia ramosa* and *fasciculata* compared.

Ircinia ramosa (Keller) de Laubenfels

	USNM No. 22397 Puerto Rico	USNM No. 22258 Puerto Rico	Keller, 1889 Red Sea	de Laubenfels 1934, Puerto Rico	de Laubenfels 1950, Bermuda	YPM No. 1231 Gulf of Campeche
Filament diameters	4 - 6 μ	3.3 μ	2 μ	3 μ	2 - 5 μ	2.5 - 3 μ
Knob diameters	10 - 11.5 μ	7 - 11.5 μ	---	10 μ	---	7.5 - 10.5 μ
Pore diameters	closed	closed	---	---	---	16x33 μ - 23x43 μ
Oscule diameters	---	---	---	---	2 - 4 mm	0.2 - 2.5 mm

Ircinia fasciculata (Pallas) de Laubenfels

	USNM No. 23429 Puerto Rico	USNM No. 22763 Bimini	YPM No. 644 Florida	YPM No. 705 Bermuda	de Laubenfels 1936a, Tortugas	de Laubenfels 1950, Bermuda
Filament diameters	3.3 - 4 μ	4 - 6 μ	3.3 - 6 μ	1.6 - 5 μ	4 μ	5 μ
Knob diameters	9 - 11 μ	10 - 13 μ	13x10 μ - 16x11 μ	8 μ - 16x15 μ 83x50 μ - 116 μ	--- 125 - 200 μ	8 μ 130 - 200 μ
Pore diameters	---	50x26 μ - 100x60 μ	closed	1.0x1.5 mm -	3 - 7 mm	5 - 10 mm
Oscule diameters	---	---	0.5 - 2.0 mm	2x3 mm		

ORDER HAPLOSCLERINA

Family HALICLONIDAE

Haliclona rubens (Pallas, 1766) de Laubenfels, 1936

Synonymy:

Spongia rubens Pallas, 1766, p. 389; Duchassaing and Michelotti, 1864, p. 41.
Pachychalina rubens, Schmidt, 1870, p. 37 (identity uncertain; no specimen available); Wilson, 1902, p. 392.
Chalina rubens, Carter, 1882, p. 276.
Haliclona rubens, de Laubenfels, 1936a, p. 40; 1949a, p. 9; 1953, p. 519.

Description.

This is a common and widely distributed sponge in the West Indian region. The Gulf of Campeche specimen is a low, wide-spreading mass of anastomosing branches forming a colony 20 cm across and 8 cm high. The branches vary in width from 1 to 2 cm. The oscules are distributed irregularly over the surface and vary from 2 to 5 mm in diameter. The surface is provided with low conules.

The spicules are chiefly hastate oxeas of the following dimensions (range and mean of 180): length, 109 - *135* - 155 μ; width, 1.5 - *5.5* - 8.0 μ. About 8 percent of the spicules are styles (range of 16) 86 - 145 μ by 4.5 - 7.5 μ; 2 percent are strongyles (range of 4) 112 - 119 μ by 5.0 - 6.0 μ. Previous authors have not recorded the occurrence of the last two spicule categories.

TABLE 2. Spicule sizes of *Haliclona rubens*

Author	Locality	Size of oxeas
Carter, 1882	Bahamas, Florida	230x3 μ
Wilson, 1902	Puerto Rico	160x4 μ
de Laubenfels, 1936a	Florida	100x3 - 117x4 μ
de Laubenfels, 1949a	Bahamas	100x4 μ
Hartman	Gulf of Campeche	109 - *135* - 155 μx 1.5 - *5.5* - 8.0 μ

The spicules are packed in spongin fibers which have a reticulate pattern. The fibers vary in thickness mostly from 20 to 90 μ, with some up to 140 μ. The meshes are rectangular, triangular, or rounded and vary in diameter from 50x100 μ to 200x400 μ.

Further distribution:

West Indies: Guadeloupe, Viecques, St. Domingue, Cuba, St. Thomas (Duchassaing and Michelotti, 1864); Antilles (intertidal region to 12 fms., Schmidt, 1870); Nassau, Bahamas (Carter, 1882); south end of Bimini Group, Bahamas (de Laubenfels, 1949a); Playa de Ponce Lighthouse Reef, Puerto Rico (Wilson, 1902).

Florida: Long Key Island (Carter, 1882); Dry Tortugas (3 to 17 meters, de Laubenfels, 1936a; 6 to 20 meters, de Laubenfels, 1953); Florida (intertidal region to 12 fms., Schmidt, 1870).

Other localities: Carter's record (1882) of this sponge "in the sea about S. Australia" is questionable.

Family CALLYSPONGIIDAE

Callyspongia strongylophora, n. sp.

Holotype: Yale Peabody Museum, No. 1229. One specimen. Collected by H. Hildebrand.

Locality: Gulf of Campeche. Taken in shrimp trawl between Campeche and Champotón, State of Campeche, Mexico. Depth, 12-20 meters. Bottom, shell sand.

Shape: Ramose, the numerous branches anastomosing frequently (Fig. 6). No definite basal attachment; since amount of sand adhering to surface is greater on one side of colony than other, it is probable that sponge was lying on sand bottom.

Size: Total length of colony—27.5 cm; width of colony—7 cm at one end, tapering to 1.5 cm at other; height of colony—(assuming colony was repent) 5 cm. Branches round to flattened in cross section. Rounded branches vary from 2.5 to 3.5 mm in diameter; flattened ends (representing fused branches) vary up to 10x2.5 to 3.0 mm in diameter.

Color: Dry sponge varies in color from cinnamon brown (Maerz and Paul, 1950, pl. 13, F - 7) in the case of branches with little sand to beige (Maerz and Paul, 1950, pl. 11, C - 2) in the case of branches with much sand.

Consistency: When wet the sponge is compressible, with resilient fibers; when dry it is compressible and easily torn.

Surface: Smooth, with occasional low tubercles or ridges.

Oscules: Distributed rather irregularly on the branches, with a tendency to occur in lines on the sides; largely absent from basal, sand-filled branches which were presumably in contact with the substratum. Oscules small in size, round (1 mm in diameter) or elliptical (1x1.5 mm), not raised above general surface of sponge.

Pores: Not apparent.

Skeleton: An irregular network of light yellow spongin fibers cored with long, thin strongyles. Dermal skeleton includes a network of principal fibers, 15 to 35 μ in diameter, forming irregular meshes varying from 275x500 μ to 575x700 μ across. Within the primary

network, secondary fibers, 5 to 15 μ in width, form a smaller reticulum with meshes varying from 70x100 μ to 275x575 μ across (Fig. 1).

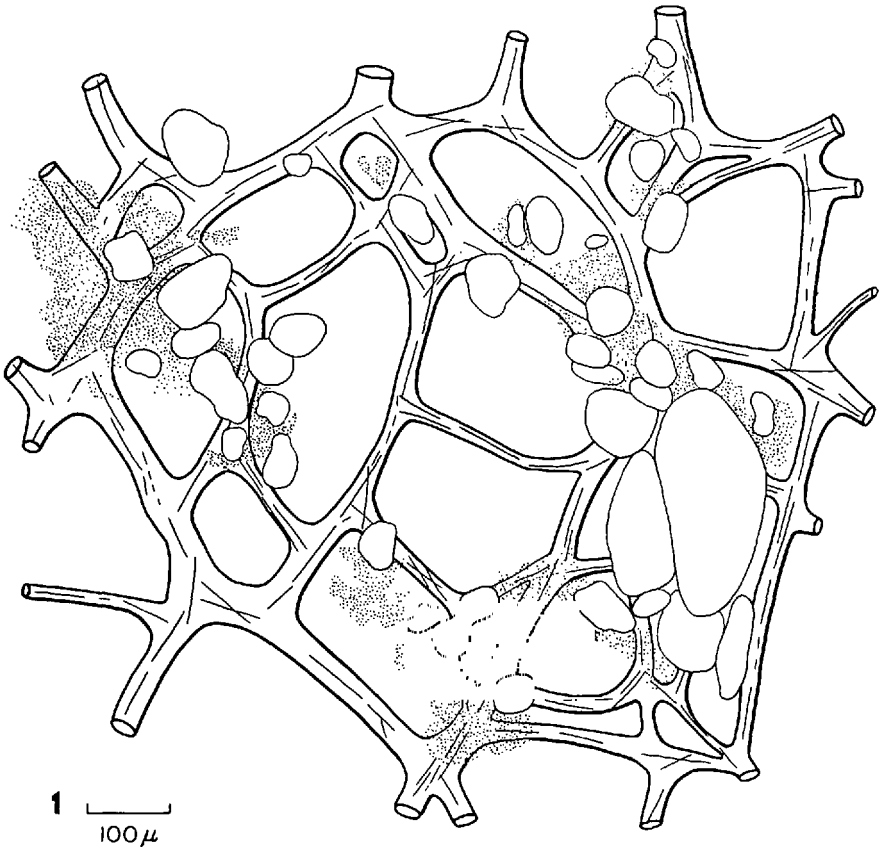

FIGURE 1. Portion of dermal skeleton of *Callyspongia strongylophora* n. sp. Sand grains (in outline) and detritus (stippled) are shown adhering to the surface. Thin strongyles core the spongin fibers.

Endosomal skeleton, a network of fibers with principal ones varying from 30 to 60 μ in width and connecting ones, 15 to 50 μ in width (Fig. 2). Meshes are square, rounded, rectangular, or trapezoidal in outline and vary greatly in size, ranging from 80x80 μ to 575x500 μ in dimensions. Occasional thorns (30 to 60 μ long) occur along the fibers. Where fibers reach surface, they end in rounded tubercles (40 to 75 μ long). Peripheral region of sponge (about 150 μ) packed with sand grains and foreign spicules which adhere to dermal membrane and surface fibers, but are not included in latter.

Sparsely distributed sand grains adhere to fibers throughout interior of sponge as well.

Spicules: Strongyles (Fig. 3) of following dimensions (range and mean of 200: length, 56 - *79* - 92 μ; width 0.9 - *1.5* - 2.4 μ. Spicules are all enclosed in fibers, placed in a parallel fashion; interstitial spicules are absent. Dermal fibers chiefly unispicular, sometimes bispicular. Principal endosomal fibers have 2 to 8 spicules per cross section of fiber; connecting fibers have 1 to 6 spicules per cross section. Thorns and surface tubercles are also provided with spicules. About 1 percent of the spicules are oxeas.

Discussion. The specialized dermal skeleton divided into irregular primary and secondary reticulations places this species in the genus

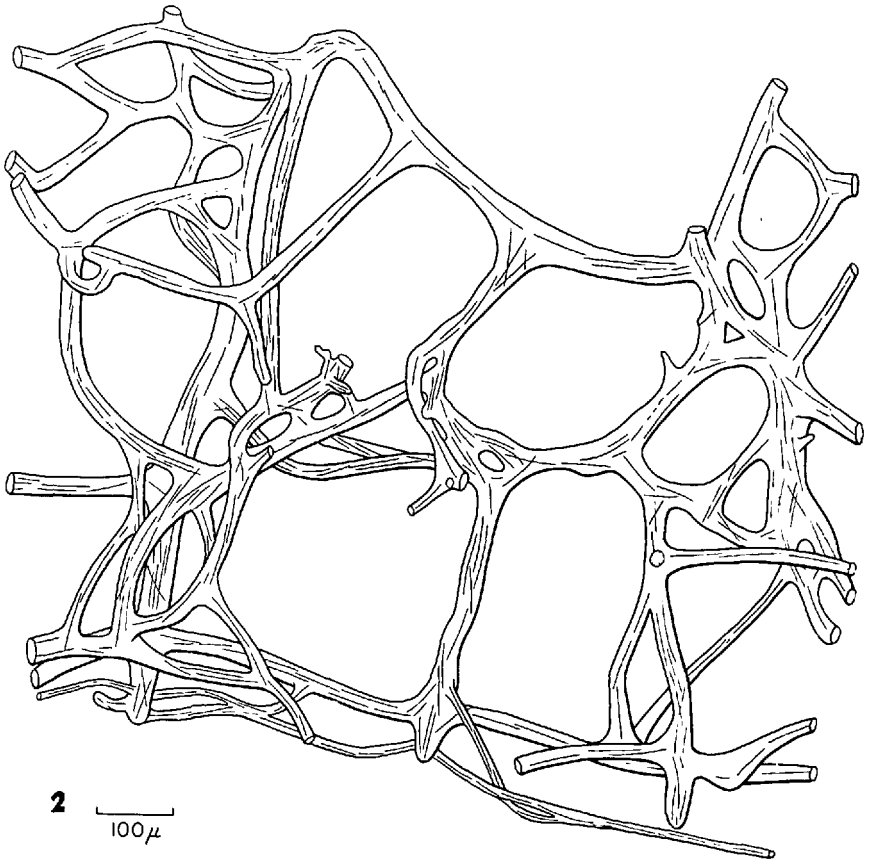

FIGURE 2. Section through skeleton of *Callyspongia strongylophora* n. sp. perpendicular to surface. Dermal skeleton below.

Callyspongia. Dr. Maurice Burton, who kindly examined a portion of the sponge and compared it with specimens in the British Museum (Natural History) has pointed out its similarity to *C. ramosa* (Gray) Burton from which it differs chiefly in spiculation, having strongyles rather than oxeas and toxas. The skeletal reticulation in the two species is very similar, as is the distribution of oscula. Burton (1934, p. 609) has noted that in Australian specimens of *C. ramosa* there is a tendency for some of the megascleres to be strongylote, but typical oxeas are always more abundant, and there are toxas present as microscleres.

In external form both *C. strongylophora* and *C. ramosa* (see Burton 1934, p. 603) resemble colonies of *Haliclona oculata* (Linnaeus). *C. strongylophora* is especially like specimens of *H. oculata* in the Peabody Museum collected off the Channel Coast of Normandy. These two species are readily differentiated by skeletal structures, however.

To the author's knowledge there are no other known ramose, strongyle-bearing species of *Callyspongia* with which this species can be confused.

ORDER POECILOSCLERINA
Family MICROCIONIDAE

Microciona juniperina (Lamarck, 1813) new comb.

Synonymy:

Spongia juniperina Lamarck, 1813, p. 444. [type: Indian Ocean; Mus. nat. Hist. nat. Paris]; Lamarck, 1816, p. 373; 1836, p. 563.
Thalysias virgultosa, Duchassaing and Michelotti, 1864, p. 86.
Pandaros juniperina, Duchassaing and Michelotti, 1864, p. 90.
Tenacia clathrata Schmidt, 1870, p. 56.
Clathria copiosa Topsent, 1889, p. 40.
Clathria clathrata, Wilson, 1902, p. 37.
Clathria jugosa Wilson, 1902, p. 37.
Rhaphidophlus clathratus, Topsent, 1932, p. 97.
Microciona prolifera (Ellis and Solander) Verrill, Vosmaer, 1935, p. 612-613. Vosmaer regards *Tenacia clathrata* Schmidt, *Clathria copiosa* Topsent, and *Clathria jugosa* Wilson as synonyms of *Microciona prolifera.*
Thalysias juniperina, de Laubenfels, 1936a, p. 105.

This common sponge of Florida and the West Indies has been known by the array of names listed above. The present writer follows Vosmaer (1935, pp. 608-611) in including it in the genus *Microciona*. This genus was established by Bowerbank (1862, p. 1109) with the type designated as *atrosanguinea* (a species first described

in full in 1864, p. 188). *M. atrosanguinea* is an encrusting sponge, and this habit of growth has been considered typical of the genus by most subsequent authors. Vosmaer (1935, p. 606), on the basis of his exhaustive studies of *Microciona* in the Bay of Naples, noted a great variation in external form and other characters and gave a revised definition of the genus to include sponges with upright branches and laminae which had previously been included in other genera. The species in question here, *juniperina,* fits into Vosmaer's extended concept of *Microciona.*

Since *juniperina* has been known by such a variety of names in the past, a review of its nomenclatural history would seem to be justified. In 1813 Lamarck (pp. 444 and 446) described *Spongia juniperina* and *Spongia virgultosa,* the former from specimens from the Indian Ocean, the latter from specimens of uncertain locality but possibly from "les mers du nord de l'Europe." Both species are unrecognizably described by Lamarck who makes no mention of diagnostic microscopic characters, but fortunately Lamarck's specimens of *Spongia juniperina* are still extant in the Muséum National d'Histoire Naturelle in Paris and have been redescribed in detail by Topsent (1932, p. 97). Topsent (1933, p. 57) was unable to find the specimen upon which Lamarck based his *Spongia virgultosa.*

Duchassaing and Michelotti (1864, pp. 86 and 90) were the first authors to mention Lamarck's species. They considered one of their West Indian specimens as identical to *Spongia virgultosa* Lamarck and included it in their genus *Thalysias.* As Carter (1882, p. 267) has pointed out, the name of this genus is spelled four different ways in the paper of Duchassaing and Michelotti (1864): *Talysias,* p. 24; *Halysios,* p. 76; *Thalisias,* p. 82-83; *Thalysias,* p. 84-87. Three of these are obviously printer's errors, but there is no way of knowing which spelling the authors preferred, especially since Duchassaing in a later paper (1870, p. 38) spells it in a fifth way, *Thalysios.* Carter (1875, p. 196), probably the first subsequent writer to mention the name, adopted the spelling *Thalysias,* and de Laubenfels (1936a, p. 104) uses this spelling in redefining the genus probably because it is so spelled in Duchassaing and Michelotti's paper when used with the species *virgultosa* which de Laubenfels chose as the type. It seems advisable to retain the last-mentioned orthography.

In the same paper Duchassaing and Michelotti identified another sponge with *Spongia juniperina* Lamarck and placed it in another of their ill-defined genera, *Pandaros.* These two species are still unrec-

ognizable on the basis of the poor descriptions and figures of Duchassaing and Michelotti. De Laubenfels *(in litt.)* found their specimens at the University of Turin, has restudied them, and deposited them in the British Museum (Natural History).

As a result of his studies, de Laubenfels (1936a, p. 106) decided to establish *virgultosa* of Duchassaing and Michelotti as the type of the genus *Thalysias,* pointing out that the synonymy of this species with Lamarck's *Spongia virgultosa* as suggested by the above authors is doubtful. Since Lamarck's specimen could not be found by Topsent, this question cannot be resolved, and de Laubenfels has proposed that *T. virgultosa* be considered as Duchassaing and Michelotti's species. De Laubenfels concluded that *T. virgultosa* Duchassaing and Michelotti is synonymous with another species established by these authors, viz., *Pandaros juniperina.* Duchassaing and Michelotti regarded *P. juniperina* as identical to *Spongia juniperina* Lamarck, a conclusion borne out by Topsent's re-study of Lamarck's material. The specific name *juniperina* of Lamarck must therefore be used in place of *virgultosa* for the type of the genus *Thalysias,* a procedure followed by de Laubenfels, who states, "although Duchassaing and Michelotti did not place the specimen which they identified as *juniperina* in *Thalysias,* but instead in *Pandaros,* it is not at all typical of this latter genus, and since it appears to be the first species name correctly used with the form in question it would appear proper to employ *juniperina* as the species name." Actually both *Thalysias* and *Pandaros* are so widely defined by Duchassaing and Michelotti that it is difficult to speak of any species included in either as typical. Of the eleven species placed in *Thalysias* by these authors, four are unrecognizable and lost, and six of the others have been distributed subsequently in as many widely-separated genera. The remaining species, *T. virgultosa,* was established as the type of the genus by de Laubenfels. In *Pandaros,* one of Duchassaing and Michelotti's seven species is unrecognizable and lost; five others have been distributed among four other genera; the remaining species, *P. acanthifolium,* was established as the type of the genus by de Laubenfels. The valid reason for using the name *juniperina* is simply its prior usage by Lamarck for what is, on the basis of available knowledge, the same species. If the locality on the label of Lamarck's specimen is valid, i.e., if the specimen did come from the Indian Ocean, there is actually reason to doubt its synonymy with the West Indian species. De Laubenfels (1936a, p. 106) suggests that the label may be in error, and

the close morphological agreement of Lamarck's specimen with known West Indian specimens would seem to bear this out. Although there is no way of proving whether Lamarck's label is correct or not, it seems simplest to assume the latter for the present, at least until other specimens turn up from the Indian Ocean to enable a comparative study to be made.

The validity of the genus *Thalysias* as redefined by de Laubenfels is open to question as this author has pointed out himself. He says, "This genus is very closely related to *Microciona,* and in fact may technically be congeneric; practically the only difference is the more elaborate development of both horny fibrous skeleton and dermal skeleton." He goes on to suggest that only those species "which remain very thin without any extensive reticulation throughout their entire life history be regarded as *Microciona* proper, and if it should prove that there are none such, but that all which begin by being Microcionid later become Thalysid, that then the name *Thalysias* should drop into synonymy to *Microciona.* We do not have adequate data to justify such a step at present." It seems to the present writer that *Microciona prolifera* (Ellis and Solander) Verrill is of importance here as representing an intermediate between the two genera. Colonies of this sponge begin life as thin encrustations on shells and rocks; later vertical fingerlike branches appear, and eventually these anastomose to form large bushy colonies up to 20 cm in height and 25 cm in width. As de Laubenfels (1949b, p. 12) has pointed out, the branching colonies are characteristic of deeper water, although they are not infrequently found intertidally in the present writer's experience.

That *Thalysias* is congeneric with *Microciona* is borne out by the extensive studies of this group by Vosmaer (1935, p. 604 and ff.). Vosmaer does not mention either Lamarck's species or those of Duchassaing and Michelotti; presumably he did not recognize them as possible synonyms from the poor descriptions given by these authors. But he assigned to *Microciona* specimens of the species in question as reported by other authors under still different names (*Tenacia clathrata* Schmidt, *Clathria copiosa* Topsent, and *Clathria jugosa* Wilson). In his studies of the species of *Microciona* occurring in the Bay of Naples, Vosmaer noted great variation among the specimens in regard to the development of a distinct dermal spiculation, the regularity of the skeletal reticulation, the occurrence and abundance of several spicule categories, and the external form of the col-

ony. He stated that it would be possible to regard each specimen as a distinct species, but followed the opposite course by placing them all in a single, highly variable species, *Microciona prolifera* (Ellis and Solander) Verrill, thus identifying them with the common North American sponge. (Vosmaer retained the species *ambigua* for individuals with diactinal ectosomal spicules.) Vosmaer's extensive synonymies within the species *prolifera* are open to question in the opinion of the present writer. Thus, he would include the species *juniperina* in his extended concept of *M. prolifera. M. juniperina,* however, does show morphological differences from *prolifera;* the dermal skeleton tends to be better developed, the echinating acanthostyles and the microscleres are more abundant, and in external shape the former species commonly assumes a laminate form. (Laminate colonies also occur rarely in *M. prolifera;* one of Verrill's specimens from New England deposited in Yale Peabody Museum is cup-shaped.) These are differences of degree to be sure, but they assume a significance when it is realized that the two species are geographically isolated. *M. prolifera, sensu stricto,* is found on the Atlantic coast of North America from Beaufort, North Carolina, to Cape Cod and less commonly northward, whereas *M. juniperina* is found in Floridian and West Indian waters. To the present writer it seems justifiable to recognize them as distinct species.

In summary, the proposal is made to drop *Thalysias* in synonymy to *Microciona* since the two distinguishing characteristics noted by de Laubenfels (1936a, p. 104) intergrade (branching colony form *versus* encrusting form and distinct dermal specialization *versus* little such specialization). The specific name *juniperina* of Lamarck is retained for the West Indian sponge in question in spite of some uncertainty about the source of Lamarck's type specimen.

Description. The specimen of *M. juniperina* in the present collection is branching with a tendency for the branches to fuse and assume a laminate structure especially in the middle region of the sponge. Distally the laminae break up into short branches with subclavate ends The colony is roughly ellipsoidal in outline, 8 cm in height and 13x8 cm across. The branches are 1 to 2 mm thick, the clavate ends, 3 to 4 mm thick.

The skeleton consists of a reticulation of spongin fibers, 40 to 90 μ thick, forming rectangular to rounded meshes measuring 90x150 μ to 350x400 μ. The most abundant spicules are styles and subtylostyles with the following measurements: length (range and mean of

200), 114 - *257* - 358 μ; width (range and mean of 200), 3 - *10* - 20 μ. Of these some are packed in the dermis in an irregular manner, with a few placed perpendicular to the surface with their points directed outward. The dermis is not characterized by distinct spicule tufts, however, as mentioned by Topsent (1932, p. 98) and de Laubenfels (1936a, p. 105). The dermal spicules vary chiefly from 275 to 330 μ in length and 6 to 9 μ in width. Similar spicules occur in the endosome, both coring the fibers and interstitially. Here they are mixed with other size categories of styles and subtylostyles of the full range mentioned above. In a small number (about 0.5 percent) of the endosomal styles the rounded ends are microspined; a few strongyles occur also. In addition there are very fine subtylostyles distributed at random in the endosome, ranging in length from 82 to 297 μ and in width from 1.3 to 4.0 μ. These may represent growth stages.

The fibers are echinated by acanthosubtylostyles of the following sizes: length (range and mean of 100) 40 - *66* - 83 μ; width (range and mean of 100), 3 - *7* - 10 μ. These spicules typically have spines on the head and in the mid-region of the shaft, the latter being smooth at its proximal and distal ends.

Two categories of microscleres are distributed at random in the endosome: palmate isochelas of length (range and mean of 100), 11 - *15* - 20 μ, and width (across the ends), 3 to 5 μ; toxas, ranging in length from 33 to 106 μ and in width from 1 to 1.5 μ.

Further distribution:

West Indies: Guadeloupe, St. Thomas, Viecques (Duchassaing and Michelotti, 1864); Antilles (Schmidt, 1870); Puerto Rico (Wilson, 1902).

Florida: Dry Tortugas (somewhat deeper than 10 meters, de Laubenfels, 1936a); Florida (Schmidt, 1870).

Other localities: *Rhaphidophlus cratitius* (Esper, 1797, p. 195) Ehlers, 1870, p. 18, a species from the East Indies, should be mentioned here. It is similar in many respects to the West Indian species, *M. juniperina,* but possesses a peculiar category of microscleres. These are described by Ehlers as being hairlike and of a form varying from rhaphidelike to toxalike to C-shaped (spangenförmig?) and S-shaped to a form bent several times along its length. Vosmaer (1880, p. 159) first interpreted these as sigmas following Ridley and Dendy (1887, p. 152) but later was inclined to the view that they are modified toxas, following Hallmann's (1912, p. 187) comments about their similarity to the toxas of *Rhaphidophlus typicus* (Carter) Hall-

mann. Vosmaer concluded that *R. cratitius* is merely another variant of *Microciona prolifera.* De Laubenfels (1954, p. 137) described a specimen of *R. cratitius* from Ponapé, eastern Carolines, and placed it in the genus *Thalysias* (misspelling the specific name *cratita).* He retained the species as a distinct one chiefly on the basis of the peculiar toxas, a procedure in which the present writer concurs, transferring it, however, to the genus *Microciona.*

TABLE 3. Spicule measurements for *Microciona juniperina*

	Topsent, 1932	de Laubenfels, 1936a	Hartman
Dermal spicules	Thin subtylostyles 120-130 x 2-3 μ	Thin subtylostyles 170x2 μ to 210x4 μ	Styles and subtylostyles 275-329 x 5-10 μ
Endosomal spicules	Styles: 200-250 x 12-13 μ Subtylostyles: 250-300 x 4-6 μ	Styles and subtylostyles 170x7 μ to 165x9 μ	Styles and subtylostyles 114-*257*-329 x 3-*10*-20 μ Thin subtylostyles 82-297 x 1.3-4.0 μ
Acanthostyles	50x6 μ to 65x8 μ	42x4 μ to 50x5 μ	40-*66*-83 x 3-*7*-10 μ
Toxas	60 - 200 μ	27-36 x 0.4 μ	33-106 x 1-1.5 μ
Chelas	11-12 μ, up to 15 μ	11 μ	11-*15*-20 x 3-5 μ

Family AXINELLIDAE

Axinella polycapella de Laubenfels, 1953

Description.

Although this is apparently a common sponge in Floridian waters, it was first described in 1953 by de Laubenfels. Both Schmidt (1870) and Carter (1885a) had identified axinellids (presumably the species in question here) from the west coast of Florida as being synonymous with the Mediterranean form, *Axinella polypoides* Schmidt 1862, a species which Vosmaer (1935) in turn considered a variant of the Mediterranean sponge, *Axinella verrucosa* (Esper) Schmidt. There is thus some doubt about the validity of *polycapella* as a species, but this matter can be cleared up only by a careful comparative study of specimens from both localities.

There is one specimen (Fig. 9) of this species in the present collection, and this record extends the known range of the species from the west coast of Florida to the southern part of the Gulf. The specimen shows good agreement with de Laubenfels' description except for the much greater variability of the spicules in shape and size.

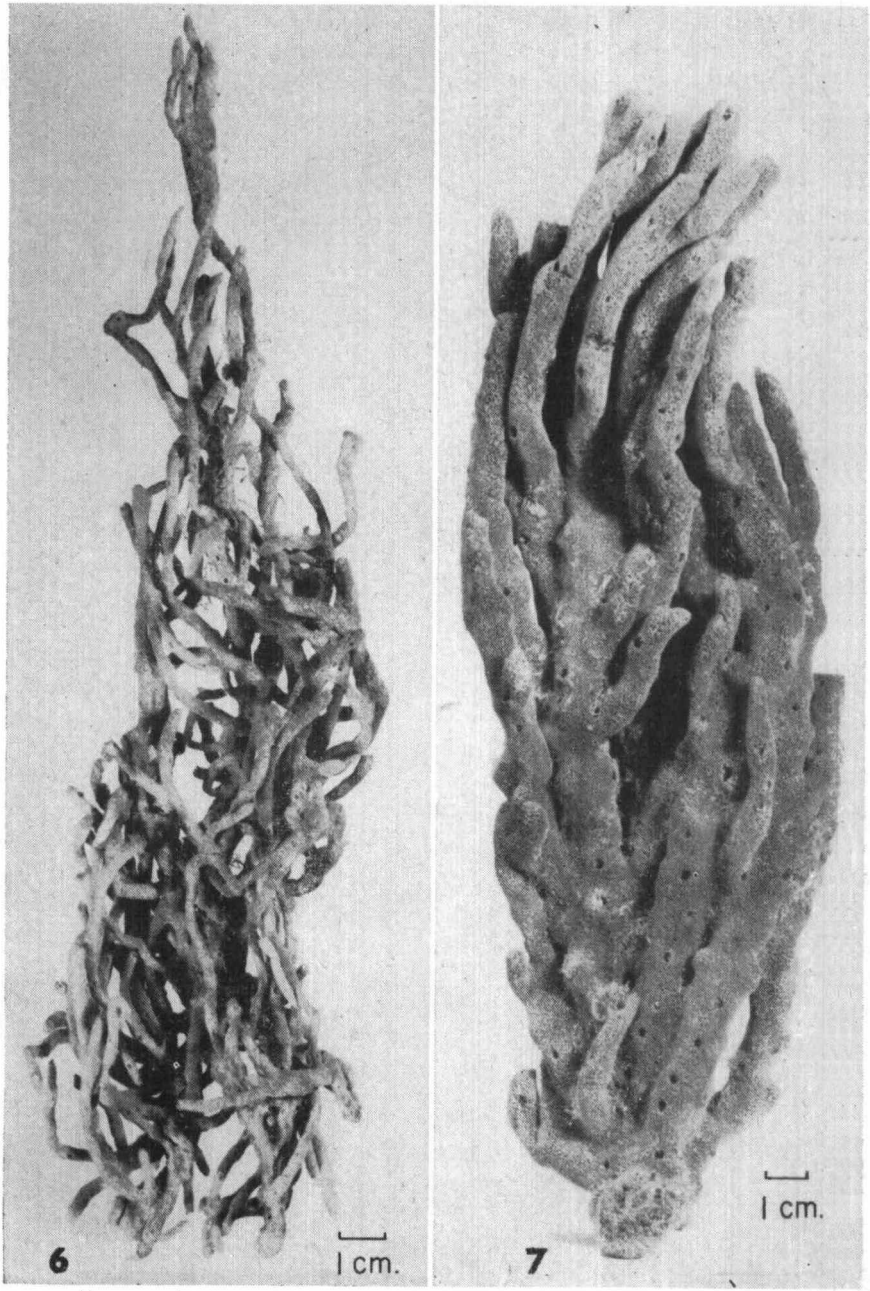

FIGURE 6. *Callyspongia strongylophora* n. sp. The type colony.
FIGURE 7. *Axinella nanaspiculata* n. sp. The type colony.

The surface is punctiform and hispid; the oscules vary from 1.0 to 2.5 mm in diameter. About 20 percent of the oscules are surrounded by a stellate pattern of radiating grooves; the remainder lack these. The skeleton is made up of a reticulation of spongin fibers in which the spicules are enclosed. Axially (about 1/5 of the total diameter of a branch) the reticulation is dense. The axial fibers are wide (55 to 115 μ in diameter) and form meshes, rectangular to elliptical in outline, varying from 100x75 μ to 250x200 μ in size. The fibers originating in the axis arch over to the periphery of each branch, these extra-axial branches ending perpendicular to the surface. The extra-axial fibers are somewhat finer, ranging from 20 to 90 μ in diameter and form larger meshes, ranging from 125x100 μ to 350x300 μ in size. The connecting fibers of the extra-axial region are so arranged that in cross section they appear to form concentric circles around the axis (Fig. 8). Peripherally these concentric circles

TABLE 4. Spicule sizes in *Axinella polycapella* and *Axinella polypoides*

	Axinella polycapella (Data of Hartman)	*Axinella polycapella* (Data of de Laubenfels, 1953)	*Axinella polypoides* (Data of Vosmaer, 1935)
Oxeas	Length, 186-*257*-358 μ Width, 3.5-*15.5*-21.5 μ (Range and mean of 138)	Length, 215-234 μ Width, 7-11 μ	Length, 180-380 μ
Styles	Length, 172-*229*-257 μ Width, 11.5-*16.5*-21.5 μ (Range and mean of 15)	Length, 178 μ Width, 7 μ	Length, 150-380 μ
Strongyles	Length, 157-257 μ Width, 15.0-21.5 μ (Range of 4)		
Intermediate strongyles	Length, 229-*257*-343 μ Width, 11.5-*16.5*-21.5 μ (Range and mean of 42)		
Subtylostyles	Length, 215 μ Width, 18.2 μ (one spicule)		

are closer together and form a denser network of fibers with a greater abundance of spicules; the obvious, dense cortical layer so formed measures about 500 μ.

The spicules range in shape from oxeas (67% of the total, Fig. 4a) to styles (7.5% of total, Fig. 4b) and strongyles (2% of total, Fig. 4d) with many intermediates between these categories (23.5% of total, Fig. 4c). Occasionally the spicules are provided with knobs (Fig. 4d) or spines (Fig. 4e). Spicule sizes are given in the accompanying table.

Further distribution:

Florida: west coast, from Laguna Beach to Rebecca Shoal (5.5 to 18 meters, de Laubenfels, 1953).

Axinella nanaspiculata, n. sp.

Holotype. Yale Peabody Museum No. 1228. Collected by H. Hildebrand.

Locality. Gulf of Campeche. One specimen taken in shrimp trawl between Campeche and Champotón, State of Campeche, Mexico. Depth, 12 to 20 m. Bottom, shell sand.

Shape and size: Ramose, the colony arising from a basal attachment and branching at the base (Fig. 7). The basal branches anastomose to form broad, flattened branches, 2 to 3 cm across and 8 to 12 mm thick; these break up distally into digitate branches, some of which dichotomize. The distal branches vary from 4 to 14 cm in length, are rounded in cross section and vary from 8 to 12 mm in diameter; the side branches are from 1 to 4 cm in length and are thinner than the main distal branches. The total height of the colony is 25 cm; its width is 8 cm; its thickness, 5 cm.

Color: The dry sponge is tan with a red-purple tinge (Maerz and Paul, 1950, Pl. 13, C - 7, to Pl. 14, B - 7).

Consistency: The dry specimen is somewhat compressible and easily torn.

Surface: Slightly hispid and covered with pits, 0.2 to 0.4 mm across.

Oscules: Circular in outline; 1.5 to 2.0 mm across. Most tend to occur in vertical lines along the branches, 3 to 10 mm apart; others are scattered at random. Some are raised slightly above the general surface of the branches.

Pores: Not apparent in specimen studied.

Skeleton: A complex network of spongin fibers (tan in color) enclosing spicules (mostly oxeas, some styles and strongyles). The fibers

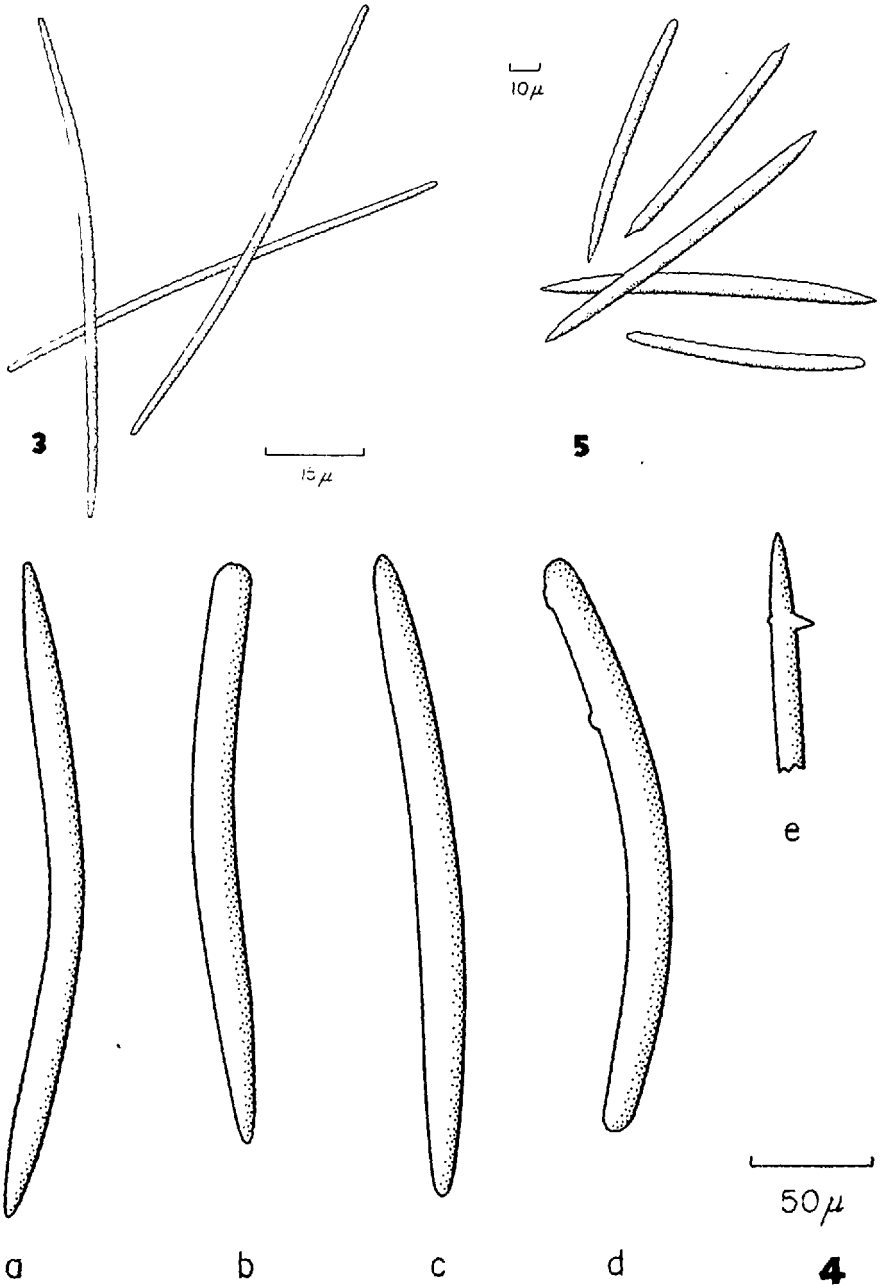

FIGURE 3. Spicules of *Callyspongia strongylophora* n. sp.

FIGURE 4. Spicules of *Axinella polycapella* de L. a, Oxea. b, Style. c, Spicule intermediate between oxea and strongyle. d, Strongyle with knobs. e, Portion of oxea with spines.

FIGURE 5. Spicules of *Axinella nanaspiculata* n. sp. From top to bottom: style, oxeas, and strongyle.

arise in the center of the branches, where they form a loose axial mass of parallel spongin and spicule tracts, and arch over to the periphery of the branches, reaching the surface perpendicular to it and the central axis (Fig. 10). The long tracts, both axially and extra-axially, are joined together by a meshwork of thinner fibers, also cored with spicules. In the peripheral region of the branches the network becomes denser as a result both of an increase in number of fibers and of the greater thickness of the individual fibers, forming a cortical layer, about 1 mm in thickness. Where the tracts meet the surface, they often end in small tufts of spicules (seldom more than 5 or 6) which give the surface a slightly hispid appearance.

The principal fibers vary in width from 35 to 85μ and enclose from 5 to 12 spicules per cross section; the connecting fibers range from 14 to 25 μ in width, increasing peripherally to 25 to 35 μ. In the endosome the connecting fibers usually contain only one spicule per cross section, occasionally 2 or 3; in the cortical region, they bear up to 6 or 8. The meshes are rounded, square, or rectangular and vary from 45x45 μ to 290x160 μ.

The spicules (Fig. 5) are chiefly oxeas, straight or slightly bent often with the ends tapering off in a stepwise fashion. Their dimensions are: length (range and mean of 200), 56-*112* - 132 μ; width (range and mean of 200), 3.3 - *5.3* - 7.3 μ. About 4 percent of the spicules are styles with dimensions as follows: length (range of 8), 59 to 109 μ; width (range of 8), 3.6 to 5.9 μ. About 1 percent strongyles are also present of dimensions: length (range of 3) 83 to 106 μ; width (range of 3), 4.0 to 4.6 μ.

Discussion. This species differs considerably from the *Axinella verrucosa* (Esper) Schmidt complex discussed by Vosmaer (1935, p. 734) and from *Axinella polycapella* de Laubenfels (1953, p. 530). The *Axinella nanaspiculata* colony studied is smaller in overall dimensions than either of the other species; its spicules are decidedly smaller; its axial skeleton is less dense than in the others; it lacks the stellate pattern of grooves radiating from the oscules of the other species. (Vosmaer has observed great variation in the occurrence of the last character in *A. verrucosa*). Table 5 compares the dimensions of several characters of these species.

Axinella nanaspiculata differs from other species of *Axinella* known to the present author chiefly in regard to the small size of the spicules. The fact that the oxeas in this species are larger than the styles is

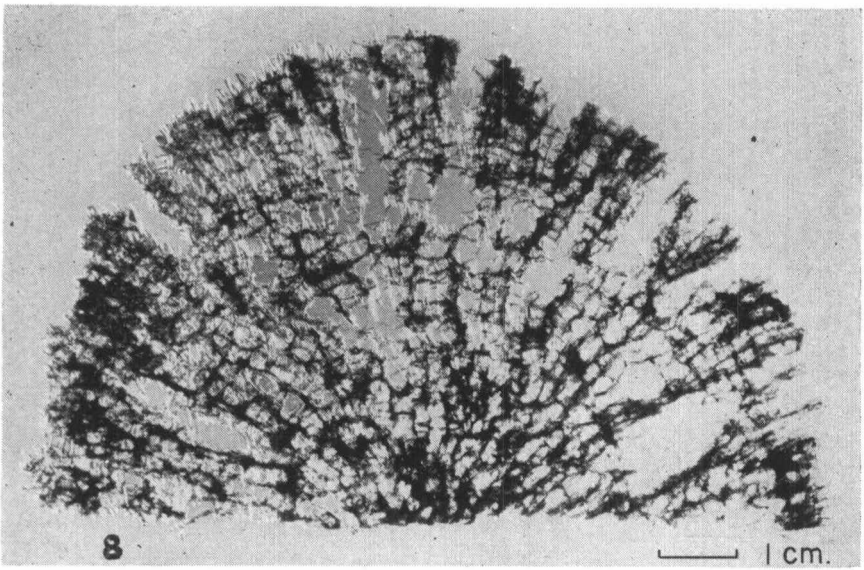

FIGURE 8. *Axinella polycapella* de L. Cross-section of half of branch.

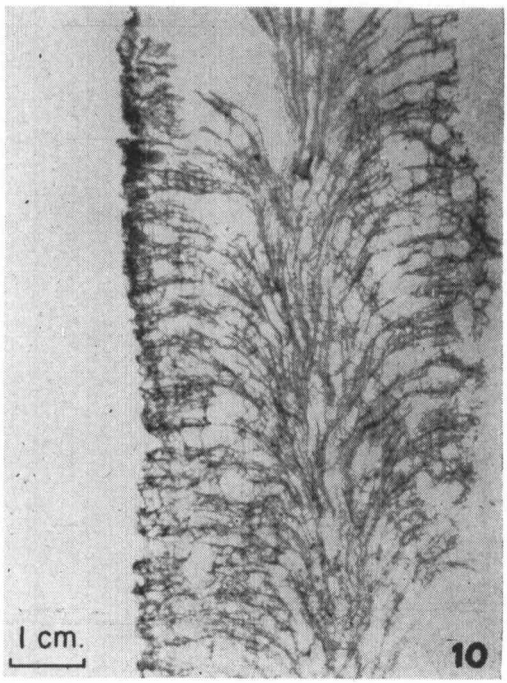

FIGURE 9. *Axinella polycapella* de L. Colony from Gulf of Campeche.
FIGURE 10. *Axinella nanaspiculata* n. sp. Longitudinal section of branch.

TABLE 5

COMPARISON OF AXINELLID CHARACTERS.

Species	*Author*	*Length of oxeas (range)*	*Length of styles (range)*	*Total height of colony*	*Branch diameter*	*Oscule diameter*
Axinella nanaspiculata Hartman	Hartman	56-132 μ	59-109 μ	25 cm	8-12 mm, up to 30 mm in flattened branches	1.5-2.0 mm
Axinella polycapella de Laubenfels 1953	de Laubenfels 1953	215-234 μ	178 μ	Up to 75 cm	15 mm	1.0-2.0 mm
Axinella polycapella de Laubenfels 1953	Hartman (2 specimens, Gulf of Mexico)	200-471 μ	200-286 μ	30 cm	10-20 mm	1.0-1.8 mm
Axinella polypoides Schmidt 1862[1]	Vosmaer 1935	180-350 μ	150-380 μ			
Axinella verrucosa (Esper 1794) Schmidt	Vosmaer 1935	250-567 μ	200-734 μ	30-50 cm	3-10 mm, up to 50 mm in flattened branches	

[1]Vosmaer regards *A. polypoides* Schmidt as a synonym of *A. verrucosa* (Esper) Schmidt.

somewhat unusual in the genus, although it is also true of *A. polycapella* (which differs from *nanaspiculata* in other ways) and several other species which differ in shape or spicule dimensions (see de Laubenfels 1935, p. 7).

Higginsia strigilata (Lamarck, 1813) de Laubenfels, 1953

Synonymy.

Spongia strigilata Lamarck, 1813, p. 450 [type: probably Indian Ocean; Mus. nat. Hist. nat. Paris]; Lamarck, 1816, p. 377; 1836, p. 567.

Higginsia coralloides Higgin, 1877, p. 291; Carter, 1885a, p. 205; Topsent, 1932, p. 112; de Laubenfels, 1949a, p. 17.

Higginsia strigilata, de Laubenfels, 1953, p. 534.

Description.

The Gulf of Campeche specimen agrees well with Lamarck's specimen as restudied by Topsent (1932). The sponge is branching with branches 2.0 to 2.5 cm thick, the total colony height being 12 cm. Spicule dimensions are given in Table 6, which compares them with specimens reported by other authors.

Further distribution:

West Indies: Carinage Harbor, Grenada (Higgin, 1877); Bahamas, especially south and east of Bimini (most abundant below 3 meters, de Laubenfels, 1949a).

Florida: west coast (Carter, 1885); off Tampa Bay (9 meters, de Laubenfels, 1953).

Other localities: Lamarck's specimen is labelled "probablement l'Ocean indien"; Topsent believes this is an error and that the specimen was more probably from the Antilles. The following varieties of this species have been described: var. *liberiensis* Higgin, Cape Palmas, Liberia (Higgin, 1877); var. *arcuata* Higgin, Bantry Bay, Ireland (Higgin, 1877); var. *massalis* Carter, Port Phillip Heads, Victoria (Carter, 1885b; Dendy, 1897; Hallmann, 1916), Amboina (Topsent, 1897); var. *scabra* Whitelegge, Port Jackson, N. S. W. (Hallmann, 1916).

TABLE 6.
SPICULE SIZES OF *Higginsia strigilata.*

Author	*Oxeas*	*Styles*	*Strongyles*	*Acanthoxeas*
Topsent, 1932	Endosomal: range of length and width; 365x8 μ to 490x23μ Ectosomal: length, 490-770 μ width, 4-7 μ	Length, 1150-1400 μ Width 10-16 μ		Length, 130-245 μ Width, 3-4 μ
Higgin, 1877	Two categories of oxeas are reported: stout, 630x25 μ slender, 630 or longer x 5 μ			Length 200 μ Width 4 μ
de Laubenfels, 1949a	360x16 μ			Range of length and width: 80x2 μ to 150x3 μ
Hartman	Length (range and mean of 182): 286-*429*-529 μ. Width (range and mean of 182): 3.5-*20.0*-28.0 μ[2]	6% of total megascleres. Length (range of 12): 343-473, up to 1573 μ. Width (range of 12): 13-23 μ	3% of total megascleres. Length (range of 6): 286-486 μ. Width (range of 6) 13-18 μ	Length (range and mean of 200): 36-*99*-172 μ Width (range and mean of 200): 2-*3*-4 μ

[2]There is no evidence of two categories of oxeas in the Gulf of Campeche specimen. Plots of both length and width measurements give normal curves.

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