



New sciophilous sponges from the Caribbean (Porifera: Demospongiae)

ROB W.M. VAN SOEST

Zoölogisch Museum, University of Amsterdam, P.O. Box 94766, 1090 GT Amsterdam, The Netherlands.

E-mail: R.W.M.vanSoest@uva.nl

Table of contents

Abstract	2
Introduction	3
Material and methods	3
Systematic descriptions	4
Class Demospongiae	4
Order Astrophorida	4
Family Pachastrellidae	4
Genus <i>Triptolemma</i> de Laubenfels, 1955a	4
<i>Triptolemma endolithicum</i> n. sp.	4
Order Hadromerida	6
Family Placospongiidae	6
Genus <i>Placosphaerastra</i> n. g.	6
<i>Placosphaerastra antillensis</i> n. g., n. sp.	6
Family Timeidae	12
Genus <i>Timea</i> Gray, 1867b	12
<i>Timea curacaoensis</i> n. sp.	12
Key to the <i>Timea</i> species of the Central West Atlantic	14
Order Poecilosclerida	14
Suborder Microcionina	14
Family Acarnidae Dendy, 1922	14
Genus <i>Megaciella</i> Hallmann, 1920	14
<i>Megaciella incrustans</i> n. sp.	14
Family Microcionidae	16
Subfamily Microcioninae	16
Genus <i>Clathria</i> Schmidt, 1862	16
Subgenus <i>Thalysias</i> Duchassaing & Michelotti, 1864	16
<i>Clathria (Thalysias) collosclera</i> n. sp.	16
Suborder Myxillina	19
Family Chondropsidae Carter, 1886	19
Genus <i>Batzella</i> Topsent, 1893	19
<i>Batzella fusca</i> n. sp.	19
Genus <i>Strongylacidon</i> Lendenfeld, 1897	21
<i>Strongylacidon unguiferum</i> n. sp.	21
Key to the <i>Chondropsidae</i> species of the Caribbean	23
Family Coelosphaeridae Dendy, 1922	23
Genus <i>Forcepia</i> Carter, 1874	23
Subgenus <i>Forcepia</i> Carter, 1874	23
<i>Forcepia (Forcepia) minima</i> n. sp.	24
<i>Forcepia (Forcepia) fistulosa</i> n. sp.	25
Subgenus <i>Leptolabis</i> Topsent, 1901	27
<i>Forcepia (Leptolabis) microlabis</i> n. sp.	27
Key to the <i>Forcepia</i> species of the Western Atlantic	29

Family Crellidae Dendy, 1922	29
Genus <i>Crella</i> Gray, 1867b	29
Subgenus <i>Grayella</i> Carter, 1869	29
<i>Crella (Grayella) beglingeræ</i> n. sp.	30
Family Hymedesmiidae Topsent, 1928	31
Genus <i>Hymedesmia</i> Bowerbank, 1864	31
Subgenus <i>Hymedesmia</i> Bowerbank, 1864	31
<i>Hymedesmia (Hymedesmia) bonairensis</i> n. sp.	31
Key to the <i>Hymedesmia (Hymedesmia)</i> species of the Central West Atlantic	33
Suborder Mycalina	34
Family Mycalidae Lundbeck, 1905	34
Genus <i>Mycale</i> Gray, 1867b	34
<i>Mycale (Paresperella) vitellina</i> n. sp.	34
Discussion	36
Acknowledgements	36
References	36

Abstract

Thirteen new species of sponges are described from coral reefs of the Netherlands Antilles and the Colombian Caribbean. Species were collected during quantitative investigations of reef sponges performed by students of the University of Amsterdam in the period between 1984 and 1991. Most of the reported specimens were taken from undersides of coral rubble, crevices or reef caves (sciophilous habitats) and without exception are small encrusting or fistular sponges. The material reported in this paper includes a new genus and species of Placospongiidae, *Placosphaerastra antillensis* **n. g. n. sp.**, the first Caribbean representatives of the genera *Triptolemma* (Pachastrellidae) and *Megaciella* (Acarinidae), viz. *Triptolemma endolithicum* **n. sp.** and *Megaciella incrustans* **n. sp.**, a new species of Timeidae, *Timea curacaoensis* **n. sp.**, a new species of Microcionidae with peculiar colloscleres, *Clathria (Thalysias) collosclera* **n. sp.**, two new species of Chondropsidae, viz. *Batzella fusca* **n. sp.**, and *Strongylacidon unguiferum* **n. sp.**, three new species of Coelosphaeridae, viz. *Forcepia (Forcepia) minima* **n. sp.**, *Forcepia (Forcepia) fistulosa* **n. sp.**, and *Forcepia (Leptolabis) microlabis* **n. sp.**, a new species of Crellidae, *Crella (Grayella) beglingeræ* **n. sp.**, a new species of Hymedesmiidae, *Hymedesmia (Hymedesmia) bonairensis* **n. sp.**, and a new species of Mycalidae, *Mycale (Paresperella) vitellina* **n. sp.** Most species are represented by only small fragments removed from the substrate by scalpel or diving knife, leaving little and often crumbled preserved type material. This study is intended to demonstrate that the small crusts dominating easily accessible shallow water coral rubble habitats in the Caribbean remain understudied.

Key words: sponges, new species, coral rubble, reef cavities, Caribbean

Introduction

Caribbean sponge systematics faces a new era of critical revision and refinement of the knowledge base. The larger species are relatively well-known region-wide from many regional monographs (e.g. Zea, 1986) and field guides are now reliable enough (e.g. Humann, 1992) to allow quick recognition in surveys and ecological studies. Following the example from European waters, we are now turning towards (1) revision of 'generalized' widespread taxa with the purpose of testing morphological integrity, and (2) focussing on small and hidden taxa, so far largely ignored. An example of the former is a recent study of Caribbean *Lissodendoryx* (cf. Rützler *et al.* 2007), which demonstrated that the ubiquitously reported *L. (L.) isodictyalis* in fact consists of a complex of closely related species. The discovery and description of small and hidden taxa is the subject of the present paper, which is also intended to generate attention to this rich fauna.

Coral rubble and other sciophilous habitats such as crevices and reef cavities of the southern Caribbean were studied by students of the University of Amsterdam in the periods 1984–1991 based in various institutes on Curaçao (CARMABI), Bonaire (Karpata) and Santa Marta (INVEMAR). These habitats are characterized by mosaics of small and thinly encrusting faunal inhabitants, notably sponges, bryozoans and colonial tunicates. Sizes of these organisms usually are measured in mm rather than cm making sampling and identification often problematic. Results of these investigations were partly published by Meesters *et al.* (1992), van Soest *et al.* (1994), Aerts & van Soest (1997), Aerts (1998) employing often provisional taxon names, but much of the necessary taxonomic work was postponed due to the difficulty posed by the small size of the sponges in these habitats. In the expectation that more elaborate specimens of these taxa would eventually be found to supplement the small fragments we preserved a representative set of specimens and shelved these for later. However, the expected larger specimens did not come to light in the ensuing years, so a gradual realization that these tiny sponges in most cases are never reaching macroscopic size induced me to a reevaluation of the preserved material. I investigated which of the undescribed species was represented by sufficient material to yield both a reproducible description of microscopic characters and sufficient residue material to act as type material and allow future sampling for additional preparations and/or DNA material. This amounted to thirteen undescribed species and it is the purpose of this paper to present descriptions of these new sponges. Where it is warranted, the new species are keyed out with their congeneric species known from the Central West Atlantic.

Material and methods

Specimens were collected by the original collectors using scalpels and small knives. They noted down live characteristics, including color and size. In the field laboratory, provisional identifications were made by examination of teased preparations of fragments. These preparations were made permanent by air drying and mounting in Canada balsam. The left-over material was preserved in 96 % ethanol and transported to the Zoölogisch Museum of the University of Amsterdam. Original notes of the collectors and preserved fragments were combined to describe macroscopical features of the specimens, however scanty the material. The original preparations as well as subsequently made dissociated spicule preparations were studied with light microscope and a JEOL Scanning Electron Microscope. Spicules were dissociated by cooking with concentrated nitric acid and the washed spicule suspension was concentrated on a SEM stub covered with a rounded cover glass and coated with gold, prior to examination. Digital images of the spicules were assembled on a black background and aligned and cleaned up using Adobe Photoshop CS3. The left over last part of the spicule suspension was used for light microscopy measurements. All measurements, unless otherwise stated, have been made from the holotypes of the species described below. Unless otherwise stated, minimum-*mean*-maximum from 25 of each spicule type encountered are given.

All specimens and slides are incorporated in the Porifera collection of the Zoological Museum of the University of Amsterdam. Material of the new species described below was designated as holotype and

paratypes only if precise localities were known and sufficient tissue was left after preparations were made. Additional specimens, registered (specimens and slides) and unregistered (slides only), are listed, but do not form part of the type material.

Specimens were collected from the following general areas and by the following persons:

- Curaçao, Netherlands Antilles: E. Meesters, P. Willemsen, M. Kielman, J.H. Stock, J.J. Vermeulen, S. Scheffers, I. Wünsch, N. van der Hal.
- Bonaire, Netherlands Antilles: H.G.J. Pennaertz, G.J. Roebbers, D. Kobluk
- Santa Marta and Cartagena, Colombia: M. Kielman, L. Aerts, M. Rozemeier, W. Dulfer
- St. Croix, U.S. Virgin Islands: W. Gladfelter
- W coast Puerto Rico, U.S.A.: J.H. Stock

The precise locations of the specimens are given in decimal coordinates.

Order and classification of the sponges follows the Systema Porifera (Hooper & van Soest, 2002)

Systematic descriptions

Class Demospongiae

Order Astrophorida

Family Pachastrellidae

Genus *Triptolemma* de Laubenfels, 1955a

Triptolemma endolithicum n. sp.

(Figs 1A–G)

Holotype. ZMA Por. 21062, Colombia, Cartagena area, Islas del Rosario, Isla Pavitos, 10.1275 N -75.7688 W, 25 m, 25-10-1990, coll. M. Kielman #S141.

Description. Sponge insinuating inside two fragments, 1 x 1 x 2 cm and 1 x 1 x 0.5 cm, of an original single piece of coral covered on the outside by *Diplastrella megastellata* (Hechtel, 1965) (Hadromerida, Spirastrellidae). No traces of the sponge were detected on the upper/outer side of the coral, but inside it several corridors and holes of approx. 1 mm diameter and 5–10 mm long are filled with tissues of the new species. Live color not noted, beige colored in alcohol. Consistency soft.

Skeleton. Confused, no apparent organization.

Spicules. Mesotriaenes (dichomesotriaenes, mesocalthrops), small amphitriaenes, oxea-like spicules, amphiasters, microrhabds. Measurements presented here are based on 10 spicules instead of 25, due to large variability of shape and sizes of the various types.

Mesotriaenes (Figs 1A–B), predominantly dichomesotriaenes, large size differences among spicules, but no clear size categories, protocladi 48-148.4-302 x 12-27.6-48 μm , deuterocladi 12-33.2-72 x 6-10.5-20 μm , tritocladi 6-23.5-60 x 5–7 μm ; rhabdomes, conical, sharp-pointed, 24-45.9-62 x 20-25 μm ; cladomes up to 400 μm .

Mesocalthrops (Fig. 1C), rare, long cladi up to 108 x 10 μm , short cladi 15–62 μm .

Oxea-like spicules (Figs 1D–E), usually with cladose ends, rarely symmetrically sharply pointed, 186-267.0-372 x 10-17.0-28 μm .

Small amphitriaenes, rare, rhabd 15 x 2 μm , cladi 15 x 2 μm .

Amphiasters (Fig. 1F), with short rhabd and long rugose or lightly spined rays, 9-11.4-13 μm , rays 3–4 μm long.

Microrhabds (Figs 1G–H), in two distinct size categories, short relatively fat, 14-15.8-18 x 2-2.9-4 μm ,

long, slim, slightly sinuous, densely spined, 32–33.7–37 x 0.5 µm.

Ecology. Insinuating in dead coral material, at 25 m depth.

Etymology. The name refers to the endolithic habit, occupying spaces within dead coral fragments.

Remarks. This is the first record of the genus *Triptolemma* from the tropical western Atlantic. The genus so far numbers four accepted species (Maldonado, 2002; van Soest et al. 2008 on line): *T. cladosum* (Sollas, 1888 as *Triptolemus*) from deep water (250 m) off the Kai Islands, Indonesia, *T. intextum* (Carter, 1876 as *Pachastrella*) from deep water (674 m) off the SW coast of Portugal, *T. incertum* (Kirkpatrick, 1903 as *Triptolemus*) from deep water (150–180 m) off the east coast of South Africa, and *T. simplex* (Sarà, 1959 as *Triptolemus*) from a shallow cave (0–1 m) in the Mediterranean. A fifth species, *T. parasiticum* (Carter, 1876 as *Pachastrella*) from unknown origin is considered a junior synonym of *T. intextum*, although the proof for this is still wanting. The description by Carter (twice, in 1876: 410, pl. XVI fig. 50, and 1880: 60, as *Samus*) remains uncritical with respect to the other species. The material is considered lost, so we will remain in doubt over its true affinities. The name *Samus parasiticus* was also used for a specimen occupying spaces within calcareous algae in the Gulf of Mannaar, India, which possibly is conspecific with *T. cladosum* (but again this remains undecided). Samaai (2006), without explanation, referred *Triptolemma incertum* to the genus *Dercitus* Gray (1867b), but Kirkpatrick's description leaves no doubt that it belongs to *Triptolemma*.

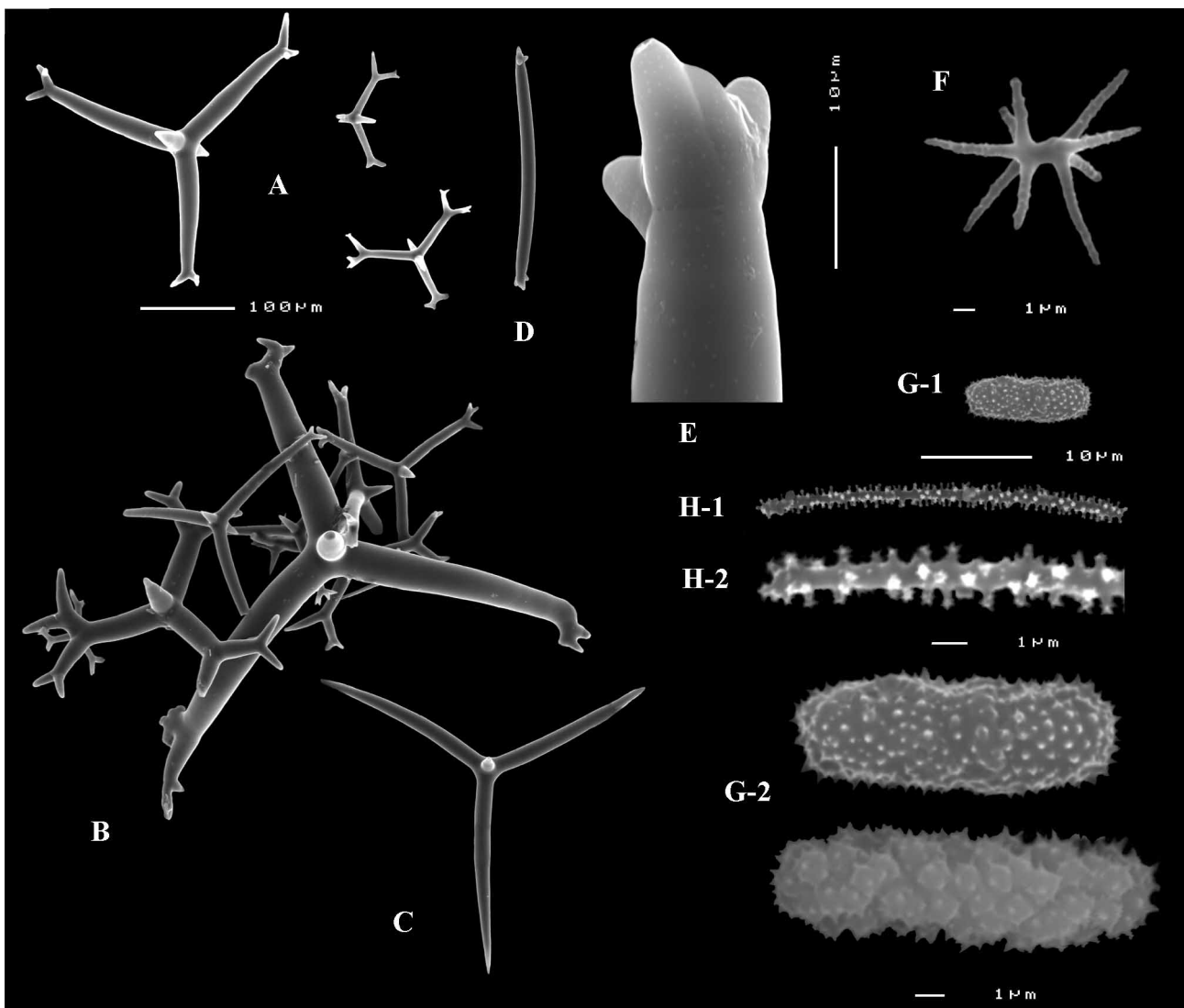


FIGURE 1. *Triptolemma endolithicum* n. sp., SEM images of spicules (Holotype ZMA Por. 21062). A–C. Various sizes and forms of mesotriaenes; D–E. oxea and detail of one of the proliferated apices; F. Amphiaster; G–H. Acanthose microrhabds in two size categories, G-1 and H-1 in the same magnification, G-2 and H-2 showing details of surface.

The genus is predominantly of deep-water occurrence, but the present new species and *T. simplex* share a sciophilous shallow-water habitat.

Maldonado (2002) in his re-description of the type species refers to the spined microrhabds as sanidasters, but this appears incorrect; both Sollas' and Sarà's description use the term microrhabd and Maldonado's own drawing (*l.c.* p. 159, fig. 14D) makes it clear that this cannot be considered a sanidaster. Similarly, the streptaster microscleres are not metasters, but amphiasters or spirasters as they clearly show a (short) rhabd. The alleged presence of small smooth oxeas in *T. cladosum* and *T. incertum* is drawn into doubt by Maldonado (*l.c.*) and we concur with this, as the endolithic habit of the sponges makes it virtually impossible to avoid contaminations with spicules of neighbouring sponges. Still, we report the presence of large oxeas in the same size range and thickness as the triaenes, which are certainly proper to the sponge, but may be interpreted as reduced triaenes.

The new species differs from *T. cladosum* in the generally more robust, larger and thicker triaenes (protocladi of *T. cladosum* only up to 52 x 21 µm, against up to 300 x 48 µm in our new species); other features appear generally similar, with long microrhabds somewhat smaller (up to 27.6 µm) than *T. endolithicum* **n. sp.** (up 37 µm). It differs from *T. intextum* (which is not fully described by Carter) in the smaller mesotriaenes (figured spicule has a cladome of approx. 140 µm) and its deep-water East Atlantic occurrence make conspecificity with our new species unlikely; by proxy, we assume the same for *T. parasiticum*. *T. incertum* differs in the shape of the long spined microrhabds. These were not mentioned by Kirkpatrick, but subsequently described by Maldonado as present; the longer category is depicted (*l.c.* p. 159, fig. 14G) as oxea-like with pointed ends, whereas those of our new species are clearly strongylote. Other features including spicules sizes appear closely similar. The deep-water occurrence in East Africa makes conspecificity with our new species unlikely. *T. simplex* has smaller triaenes (cladome of the largest mesotriaenes up to 245 µm) and possibly has a second category of amphiasters/spirasters (but these could be contaminations). In summary, the new species has (1) larger upper size of the mesotriaenes than any other *Triptolemma*, (2) clearly separated categories of small fat microrhabds and long curved or sinuous microrhabds, both blunt-ending, shared with at least *T. simplex*, and (3) fat smooth oxeas often with cladose endings.

Order Hadromerida

Family Placospongiidae

Genus *Placosphaera* **n. g.**

Definition. Placospongiidae with globose spherasters replacing the selenasters in the surface armour, with selenasters entirely lacking. Megascleres tylostyles. Additional microscleres diplasters and tiny streptasters.

Type species: *Placosphaera antillensis* **n. sp.**

Placosphaera antillensis **n. g., n. sp.**

(Figs 2A–E, 3A–B)

Holotype. ZMA Por. 08973, Netherlands Antilles, Bonaire, Red Slave 2, 12.034°N -68.259°W, 23 m, 20-08-1987, coll. G.J. Roebbers #202.

Paratypes. ZMA Por. 08974, Curaçao, Blauwbaai, under rubble, 12.131°N -68.987°W, 35 m, 2-1989, coll. E. Meesters & P. Willemsen; ZMA Por. 21077, Curaçao, SeaQuarium, 12.081°N -68.8919°W, 25 m, 1991, coll. M. Kielman #S64.

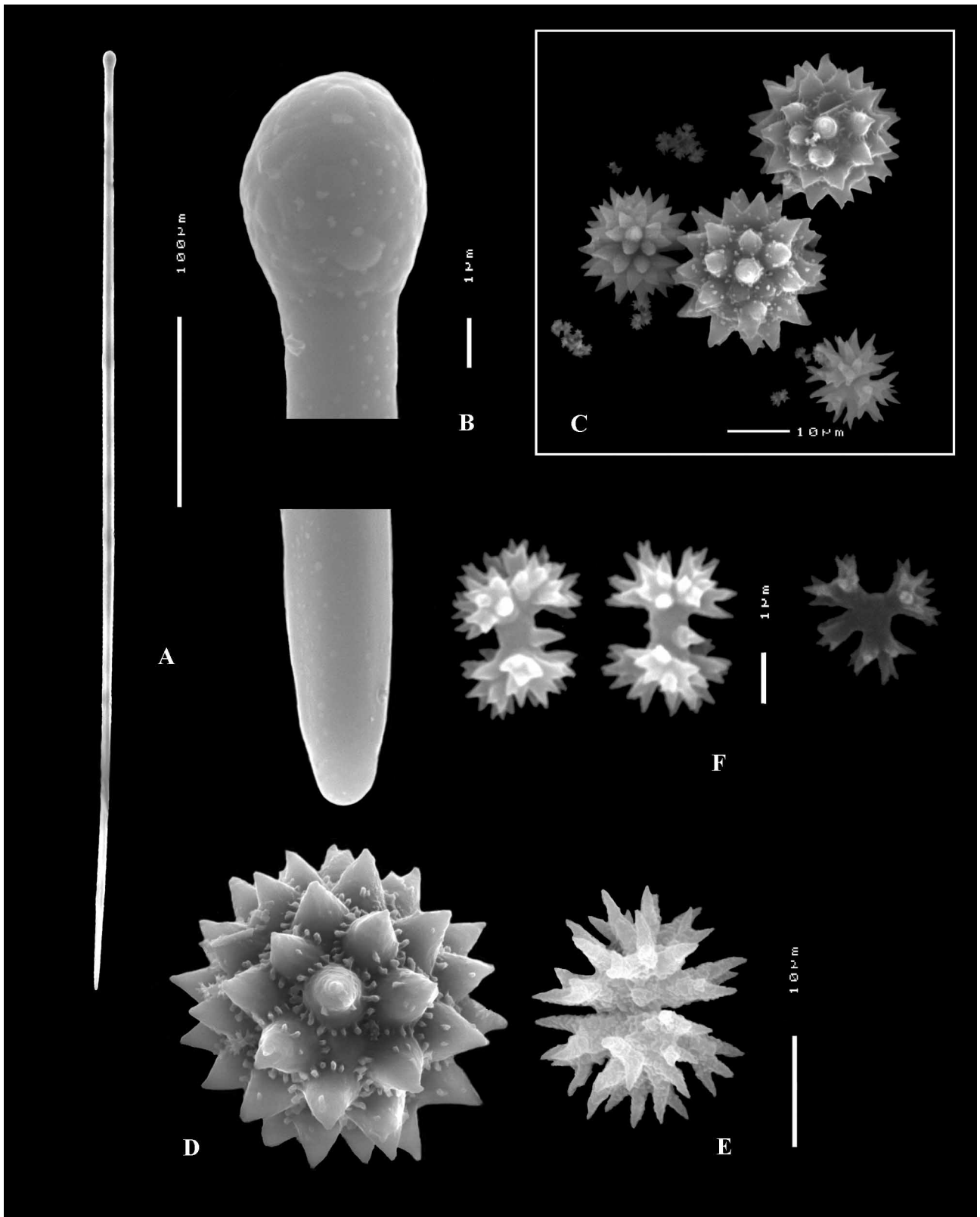


FIGURE 2. *Placosphaerastra antillensis* n.g., n. sp., SEM images of spicules (Holotype ZMA Por. 08973). A–B. Tylostyle and details of head and apex; C. Group of asters to show diversity and size differences; D. Spheraster of the surface plates (note ring-shaped ornamentation of spines between the rays); E. ‘Diplaster’, possibly juvenile condition of the spheraster; F. Various types of microstreptasters (microamphiasters and microspirasters).

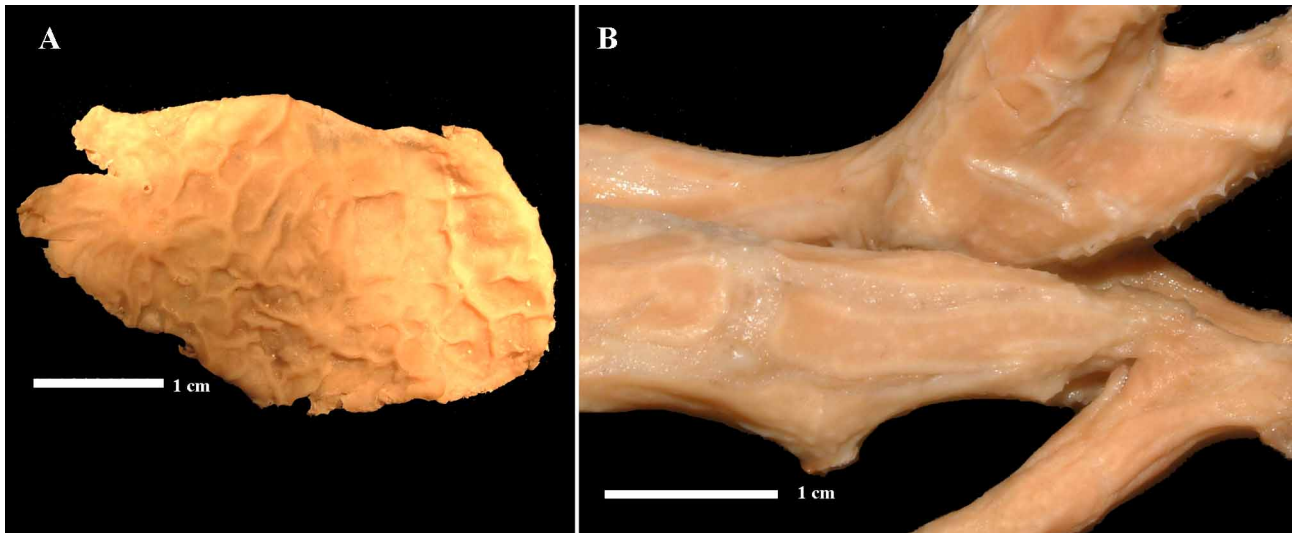


FIGURE 3. *Placosphaera antillensis* n.g., n. sp. A. Photo of holotype ZMA Por. 08973; B. Photo of deviating Puerto Rican specimen (ZMA Por. 03347) with wide white pore grooves and seemingly branching habit.

Additional material (not belonging to the type series). ZMA Por. 08487, Bonaire, reef caves, 12–43 m, 1984, coll. D. Kobluk; ZMA Por. 13716 & 14085, Curaçao, Buoy 0, 12.124°N -68.974°W, in reef caves, 01-1999, coll. I. Wunsch; ZMA Por. 19063, Curaçao, Buoy 3, 12.136°N -68.97°W, reef, 2006, coll. N. van der Hall; ZMA Por. 08879, U.S. Virgin Islands, St. Croix, Cane Bay, 17.7417°N -64.7392°W, 1990, coll. W. Gladfelter; ZMA Por. 03347, Puerto Rico, off Mayaguez, 18.25°N -67.225°W, dredged at 60–75 m, bottom muddy sand, 21-02-1963, coll. J.H. Stock.

Description. Thick encrustations with *Placospongia*-like surface of elongated polygonal plates, separated by meandering ridges below which thin pore grooves are situated (Fig. 3A). The system of plates and ridges is irregular and forms a maze, with few ridges entirely enclosing the plates. Size of holotype 5 x 2.5 cm, thickness 1–5 mm. Color in life orange, dark orange, brown-orange or more yellow; in alcohol pale yellow or off-white. Consistency hard, rough to the touch.

Skeleton. Distinctly zoned similar to the skeleton of *Placospongia*. A dense ectosomal layer of spherasters forms the surface of the polygonal plates. These are surrounded by strong columns of tylostyles rising up from the bottom of the sponge supporting the plates and forming the sides of the meandering pore grooves, in which they also protrude slightly causing the sides of the grooves to be elevated. No clear separation or localization of a smaller and a larger category of tylostyles is apparent, but the tylostyles have a large size range (see below). Subdermal tissue between the columns with few spherasters, scattered ‘diplasters’ and densely distributed microspirasters forming a distinct fibrous layer devoid of heavy spiculation. At the bottom of the sponge a thin layer of spherasters lines the boundary with the substrate.

Spicules. Tylostyles, spherasters, ‘diplasters’, microspirasters/amphiasters.

Tylostyles (Fig. 2A–B), with prominent elongated heads, often annulated beneath the tyle, in a large size range, 162-428.6-578 x 3.5-5.4-8 μ m.

Spherasters (Fig. 2D and part of C), globular, with short conical rays, in full-grown condition ornamented with little blunt spines in a ring around the base of the cones, 27-28.6-31 μ m in diameter.

Diplasters (Fig. 2E and part of C), elongated with an often one-sided constriction in the middle, with long conical rays, with crenulated surface, 14-17.8-21 μ m. Possibly these are juvenile forms of the spherasters, in which case, nonetheless, one would expect to find more intermediate forms.

Micramphiasters, microspirasters, and related forms (Fig. 2F and part of C), tiny, with short rhabds and composite rays, often a bit irregular in shape, 2– 4.5 μ m in length.

Ecology. Usually under coral rubble and in reef caves, 20–23 m; occasionally exposed in deeper locations.

Etymology. The genus name refers to the placospongia-like aspect of the surface and to the spherasters that replace the placospongiid selenasters. The species name indicates the so far Antillean occurrence (both Lesser and Greater Antilles) of the species.

Remarks. With this new genus the family Placospongiidae, until recently monotypical, consists now of three genera. *Placospongia* Gray (1867a) so far has six species, while *Onotoa* de Laubenfels (1955b) has two species, and the new genus *Placosphaestra* so far has one species (but see below). All three genera are closely similar in outlook and skeletal structure, making membership of a single family quite obvious, but possession of selenasters, until recently considered a strong synapomorphy for the family, is now restricted to the genus *Placospongia*. The two other genera lack selenasters and have instead amphinolasters (genus *Onotoa*) or globose spherasters (*Placosphaestra* n. g.) in the same position, i.e. making up the surface armour. The new species was previously identified as an undescribed *Placospongia*, but to accommodate it within this genus would widen the definition too far. Following the erection of *Onotoa* for placospongiid species with a replacement spicule type for the surface armour, it is proposed here to erect a separate genus for placospongiid sponges with yet another replacement spicule type. One could argue that this is unnecessary, since the lack of selenasters may be merely a loss, and the remaining spicules all occur in one or more true *Placospongia* species. *Placospongia* species frequently have tiny (2–3 µm diameter) spherasters lodged in the spaces among the selenasters at the surface. In *Placospongia melobesioides* Gray (1867a) from Borneo, *P. melobesioides* sensu Arndt (1927) from Curaçao, *P. intermedia* Sollas (1888) from the Caribbean end of the Panama Canal, and *P. cristata* Boury-Esnault (1973) from Brazil, a complement of medium-sized spherasters occurs in the choanosome, looking surprisingly similar to golf balls in SEM images. In *Placospongia decorticans* (Hanitsch, 1895), spherasters of 16 µm diameter apparently form an extra surface armour on the outside of the layer of selenasters, which could indicate that the surface structure in *P. antillensis* n. g., n. sp. is induced by loss of the selenasters and the need for a replacement structure. Of the true *Placospongia* species, *P. decorticans* resembles *P. antillensis* n. g., n. sp. closest, sharing most spicule types. The same observations apply *mutatis mutandis* to differences between *Placospongia* and *Onotoa*, but the case for the latter genus is stronger since there are two species sharing the same surface spicule types. It is expected that more species lacking selenasters and having a surface armour of globose spherasters will be found to exist (see below). A further argument for keeping the new species in a genus of its own, is that the spherasters are morphologically distinct from those of *P. melobesioides* and *P. decorticans* in having an ornamentation of small spines encircling the conical rays. Possibly the term spheraster in this case does not cover homologous spicule forms.

A somewhat deviating specimen (Fig. 3B) of the new species, or possibly a representative of a second species of the new genus, is here recorded from a non-sciophilous muddy deep water habitat off the west coast of Puerto Rico (ZMA Por. 03347, details listed above). The sponge is seemingly branching, with branches 6 cm long and 0.5–1 cm in diameter, but cross section of the branches showed that the centre is formed by dead bryozoan material, indicating that the sponge is encrusting. Color was given as vermillion by the original collector, in alcohol it is yellow-brown. A striking feature are the white striated grooves separating the polygonal plates, which are much wider (4–5 mm) than in the sciophilous specimens described above (Fig. 3B). The spicules are generally similar to those of the sciophilous specimens, but sizes of tylostyles (up to 600 x 10–12 µm) and spherasters (32–40 µm) are on the upper side of the range or exceeding those of the type and paratypes. In spite of this and in spite of the unusual live color, for the time being the specimen is treated as a somewhat extreme specimen of the new species.

Four other species of Placospongiidae were recorded from the Central West Atlantic: *Placospongia carinata* (Bowerbank, 1858), *P. melobesioides* Gray (1867a), *P. intermedia* Sollas (1888) and *P. cristata* Boury-Esnault (1973).

Placospongia carinata was recorded by Little (1963) from the Gulf of Mexico, Pulitzer-Finali (1986) from Jamaica, Hechtel (1976), Coelho & Mello-Leitão (1978) and Rua et al. (2006) from Brazil. We report here material from sciophilous habitats along the Caribbean coast of Colombia, (ZMA Por. 21078, Cartagena area, Islas del Rosario, Isla Pavitos, 10.2333°N -75.75°W, 15 m, 30-IX-1990, coll. M. Kielman, #S29; ZMA Por.

20871, Colombia, Cartagena area, Islas del Rosario, Isla Pavitos, 10.2333°N -75.75°W, 5 m, 30-IX-1990, coll. M. Kielman, #S71), and from Grenada (ZMA Por. 07643, St. Georges, 12.044°N -61.749°W, 5 m, 05-03-1986, coll. J.J. Vermeulen #86-122). Since the specimens do not entirely conform with descriptions of the type from Borneo, Indonesia, a short combined description of the ZMA material is given here to aid future decisions about the status of the Caribbean populations: Brown encrustations, 5 mm in thickness, lateral expansion indefinite, at least 5 cm. Surface 'veined' by a combination of polygonal plates and pore-bearing grooves. Skeleton: Ectosomal crust of selenasters carried by a palisade of smaller tylostyles; sides of the grooves fortified by strong bundles of larger tylostyles which traverse the body down to the substrate. Selenasters are cemented by a dense mass of microrhabds/microspirasters. Subectosomal space between the megasclere bundles with a mixture of microrhabds and amphiasters. Spicules: tylostyles in two size categories, selenasters, juvenile selenasters, amphiasters/spirasters possibly divisible in two types, acanthomicrorhabds. Large tylostyles with prominent tyles and usually bluntly rounded apices, 669-875.3-1069 x 12-15.3-20 µm; small tylostyles, not overlapping with large tylostyles, 170-263.5-330 x 6-7 µm. Selenasters, ellipsoid-rounded, 54-79.3-90 x 37-65.1-72 µm; juvenile selenasters, bean-shaped with spines irregularly distributed, 36-39.8-48 x 18-23.2-30 µm. Amphiasters, with a straight rhabd and 3-4 terminally branched rays at each end, each ray with two -three terminally branched secondary rays, with or without fine spines on rhabd and rays, size of rhabd 12-16.2-19 x 3-4 µm, of rays 6-9 x 1.5 µm; spirasters, similar in size to amphiasters, but with rays distributed along the rhabd, which is spirally curved. Acanthomicrorhabds, undulate or with faint spiral twist, 6-8.6-15 x 1-2 µm. The specimens described here are at first glance assignable to *Placospongia carinata* Bowerbank (1858) s.l. This species was originally described from the 'South Seas', presumably the South Pacific Ocean, a considerable distance away from the South Caribbean. It has become customary to consider *Placospongia* specimens with 'spirasters' as members of a cosmopolitan species. However, the present specimens have the sizes of at least two spicule types clearly different from the type specimen of *P. carinata* and this could be interpreted as evidence of specific distinctness. 'Spirasters' measure 35-40 µm in the type and thus are twice as large as the amphiasters/spirasters of the Caribbean material (12-19 µm), while the acanthomicrorhabds in the type measure 20 µm against 8-15 µm in our Caribbean specimens. The morphology of the spirasters/amphiasters in both are also clearly distinct, with those in South Pacific *P. carinata* with robust thick rhabd and long irregularly branched rays, and those of the Caribbean specimens with thinnish rhabd and shorter rays. Possibly, these streptasters are divisible in two distinct types, one more amphiaster-like, the other more spiraster-like, but this needs to be established in more specimens from various localities in the Caribbean. Other records of *P. carinata* from various parts of the world also show discrepancies from the type description: for example larger (Lindgren, 1897) or less branched spirasters (Green & Gómez, 1986), two size categories of acanthomicrorhabds (Vacelet & Vasseur, 1965), much smaller tylostyles (Lévi, 1956). This indicates in our opinion a much higher diversity of *Placospongia* than currently recognized in specimens assigned to *P. carinata* dating back from Vosmaer & Vernhout (1902). I predict that the 'variability' in spicule categories and sizes is caused by the occurrence of several more species in this species complex.

Placospongia melobesioides Gray (1867a) specimens, recorded from the Central West Atlantic originated from Florida, Curaçao and Campeche (Schmidt, 1870; Arndt, 1927; de Laubenfels, 1936a; González-Farías, 1989), may be attributable to a separate regional species, *P. cristata* Boury-Esnault (1973) originally described from Brazil. Rützler (2002a) suggested this to be a synonym of *P. melobesioides*, but apart from the large geographic separation of the original locality (Borneo) and the Central West Atlantic, there is also a consistent difference in the upper size of the tylostyles (up to 1200 µm in the type specimen against up to 900 µm in the Central West Atlantic material identified as *P. melobesioides* and *P. cristata*). It is likely that such differences are attributable to specific distinctness. There are a few discrepancies between the descriptions of Arndt (1927) and Boury-Esnault (1973), as Arndt denies the presence of spherasters in his specimens, whereas Boury-Esnault does not mention the presence of microspherasters. The specimens of Arndt were reexamined as they are in the collections of the Zoölogisch Museum of the University of Amsterdam (ZMA Por. 01816 and 01817, both from Spaanse Water, Curaçao). They contain spherasters of 15-18 µm, of the

typical ‘golf-ball’ shape, so Arndt’s specimens do conform to Boury-Esnault’s description in that respect. It is assumed that microspherasters or spheres are present in the type material of *P. cristata*, but this needs to be demonstrated. *P. melobesioides* is also recorded from Northern Brazil (Mothes *et al.* 2006), and these authors provide SEM images of the spicules, as well as measurements. It appears as if this is yet again a different form, deviating from the type specimens of *P. melobesioides* and from *P. cristata* in the lack of the discussed medium-sized (‘golf-ball’) spherasters. Instead, the specimen possess microspirasters similar to those of *Placosphaera antillensis* **n. g., n. sp.**

P. intermedia Sollas (1888) as recorded from the Caribbean end of the Panama canal by de Laubenfels (1936b) deviates strongly from the description of Sollas (1888). Possibly this concerns a further separate as yet undescribed species of *Placospongia*. Color reported by de Laubenfels was orange (chocolate brown in the type of *P. intermedia*), selenasters were only 35–50 x 20–35 µm (64 x 58 µm in the type), spherasters of 1–8 µm diameter (in fact these are probably microspherasters or spheres, whereas Sollas reports spherasters of 20 µm diameter). Other features are similar in both. Sollas’ material was from the Pacific side, whereas de Laubenfels reported his specimens from both sides of the isthmus, while his spicule data were apparently taken from the Caribbean specimens. *P. intermedia* was also listed by Díaz (2005) from Bocas del Toro, Panama, but no description was provided. Lehnert & van Soest (1996) incorrectly assigned the Jamaican specimen described by Pulitzer-Finali (1986) as *P. carinata* to *P. intermedia*.

In summary the status of records of placospongiids from the Central West Atlantic is as follows:

- (1) *Placospongia carinata* sensu Little (1963), Hechtel (1976), Coelho & Mello-Leitão (1978), Pulitzer-Finali (1986) (including citation of Lehnert & van Soest, 1998), Rua *et al.* (2006), and unpublished specimens from the ZMA collection mentioned above = *Placospongia* sp. 1 (not: *P. carinata* (Bowerbank, 1858))
- (2) *Placospongia melobesioides* sensu Schmidt (1870), Arndt (1927), de Laubenfels (1936a), González-Farías (1989) = ?*P. cristata* Boury-Esnault (1973) (not: *P. melobesioides* Gray, 1867a)
- (3) *Placospongia cristata* Boury-Esnault (1973) = valid species, see also above.
- (4) *Placospongia melobesioides* sensu Mothes *et al.* (2006) = *Placospongia* sp. 2 (not: *P. melobesioides* Gray, 1867a)
- (5) *Placospongia intermedia* sensu de Laubenfels (1936b) = *Placospongia* sp. 3 (not: *P. intermedia* Sollas, 1888)
- (6) *Placosphaera antillensis* **n. g., n. sp.** = valid species.

Scott & Barnes (2005) performed sequence analysis of a world-wide set of *Placospongia* specimens, not further identified to species. Their conclusions were that more genetic differentiation is found than would be expected if there were only two or three cosmopolitan ‘species’. Our critical comparison of spicule sizes and types appear to support the conclusions of the genetic research.

Several hadromerid species possessing tylostyles and spherasters occur in the Central West Atlantic. For completeness sake we present an overview to demonstrate they are not conspecific with our new species. *Paratimea galaxa* de Laubenfels (1936a) from Florida differs in lacking the surface plates and possessing tornotes in addition to the tylostyles and the spherasters. *Columnitis squamata*, also from Florida, as described by Schmidt (1870) reminds of our new species in having polygonal surface ornamentation, but redescription by Sarà & Bavestrello (1996), made it clear that this is a tethyid genus and species (after previously having been assigned to the synonymy of *Timea* by de Laubenfels, 1936a) showing little in common with our new species.

The definition of the new genus resembles that given by de Laubenfels (1936a) for the genus *Kotimea*, with type species *Hymedesmia moorei* Carter (1880, from the Gulf of Mannaar, India). The precise affinity of Carter’s species with tylostyles and spherasters remains undecided because the type material is lost. There are no indications in Carter’s description that the surface would have had armoured placospongiid plates. Rützler (2002b) assigned *Kotimea* to the synonymy of *Timea* Gray (1867b). A second species assigned to *Kotimea*, *Hymenaphia spiniglobata* Carter (1879) is a *Diplastrella*, while *Kotimea tethya* de Laubenfels (1954) is a *Timea*.

Family Timeidae

Genus *Timea* Gray, 1867b

Timea curacaoensis n. sp.

(Figs 4A–E)

Holotype. ZMA Por. 16887, Netherlands Antilles, Curaçao, near Carmabi, 12.124°N -68.975°W, in reef cavity at approx. 10 m, 10-2001, coll. S. Scheffers #35.

Description. Thinly encrusting, microlobate and microhispid; size of now fragmented holotype 15 x 3 x 1.5 mm. Live color not noted, off-white in alcohol.

Skeleton. Individual tylostyles are erect on the substrate, tyles down. Pointed ends protrude far beyond the surface. The tylostyles are partly hidden by a dense layer of asters.

Spicules. Tylostyles and two categories of asters, one of which has branching rays.

Tylostyles (Figs 4A–B) with elongate tyles, often style-like or with subterminal tyles, 299-834.2-1357 x 2-8.2-14 µm

Larger asters (Figs 4C–D), seemingly but not truly asymmetrical, with 4–5 rays which have 2 or 3 secondary branches, juvenile large asters have smooth rays, while adult asters have thicker rays, often with a few spines along the shaft, and they have proliferated terminal branches, overall diameter 14-19.2-23 µm.

Small tylasters (Fig. 4E) with 8–9 unbranched terminally spined rays, 5.5-6.0-7.5 µm in diameter.

Ecology. In reef cavities at approx. 10 m.

Etymology. Named after its type locality.

Remarks. Members of the genus are typical sciophilous specialists, invariably found in thin patches under stones or overhangs (e.g. Rützler, 2002b; Carballo & Cruz-Barraza, 2006). The North Atlantic and Mediterranean *Timea* species were recently listed by Lehnert & Heimler (2001). Along with some representatives of other genera (*Diplastrella* and *Adreus*), they list seven recognizably described species reported from the Caribbean region, *T. parasitica* (Higgin, 1877), *T. stelligera* (Carter, 1882), *T. stenosclera* Hechtel (1969), *T. mixta* sensu Wiedenmayer (1977), *T. unistellata* sensu Pulitzer-Finali (1986), *T. hechteli* Lehnert & Heimler (2001), and *T. micraster* Lehnert & Heimler (2001). In view of the proximity it makes sense to include in a comparison of our new species also Brazilian representatives: *Timea agnani* Boury-Esnault (1973) and *T. stellifasciata* sensu Boury-Esnault (1973), *T. authia* sensu de Laubenfels (1956), *T. mixta* sensu Hechtel (1976) and *T. bioxyasterina* Mothes *et al.* (2004). Of these species, only *Timea stellifasciata* sensu Boury-Esnault (1973) bears some resemblance to our new species. Boury-Esnault records two types of asters, the larger of which has reduced number of rays with ‘multifide’ endings, size also similar to ours, 12–28 µm. These asters, called ‘sphaeranthasters’ by Boury-Esnault, do not have really branched rays. The second smaller category of asters are oxyasters, unlike the tylasters of our species. The Brazil material probably belongs to an undescribed species, as the Mediterranean *Timea stellifasciata* sensu Sarà & Siribelli (1960) appears to be distinct from the Brazil material, with irregular, but unbranched asters, showing no signs of having ‘multifide’ rays. *T. hechteli*, *T. mixta*, *T. stenosclera* and *T. micraster* possess two categories of asters one of which is a sphaeraster, which is not found in our new species, while *T. stelligera* and *T. perastra* have only one category of tiny asters, lacking the larger ones, whereas *T. unistellata* has a single category of larger spheroxyasters. *T. stelligera* may not be a true *Timea* as its type is described as a massive conical sponge, unlike any other *Timea*. *T. authia* sensu de Laubenfels (1956) is not described, but the use of the name of a species originally described from California is presumed to testify of morphological similarities between the Californian and Brazilian specimens. *T. authia* was extensively redescribed by Carballo & Cruz-Barraza (2006) and the asters are regular strongylasters quite different from the present new species. *T. bioxyasterina* has three categories of asters, one tylaster and two categories of oxyasters. *T. agnani* has a single category of very large four-rayed asters, and reexamination of the type material led Mothes *et al.* (2004) to conclude that this is probably a *Cyamon* (Poecilosclerida, Raspailiidae).

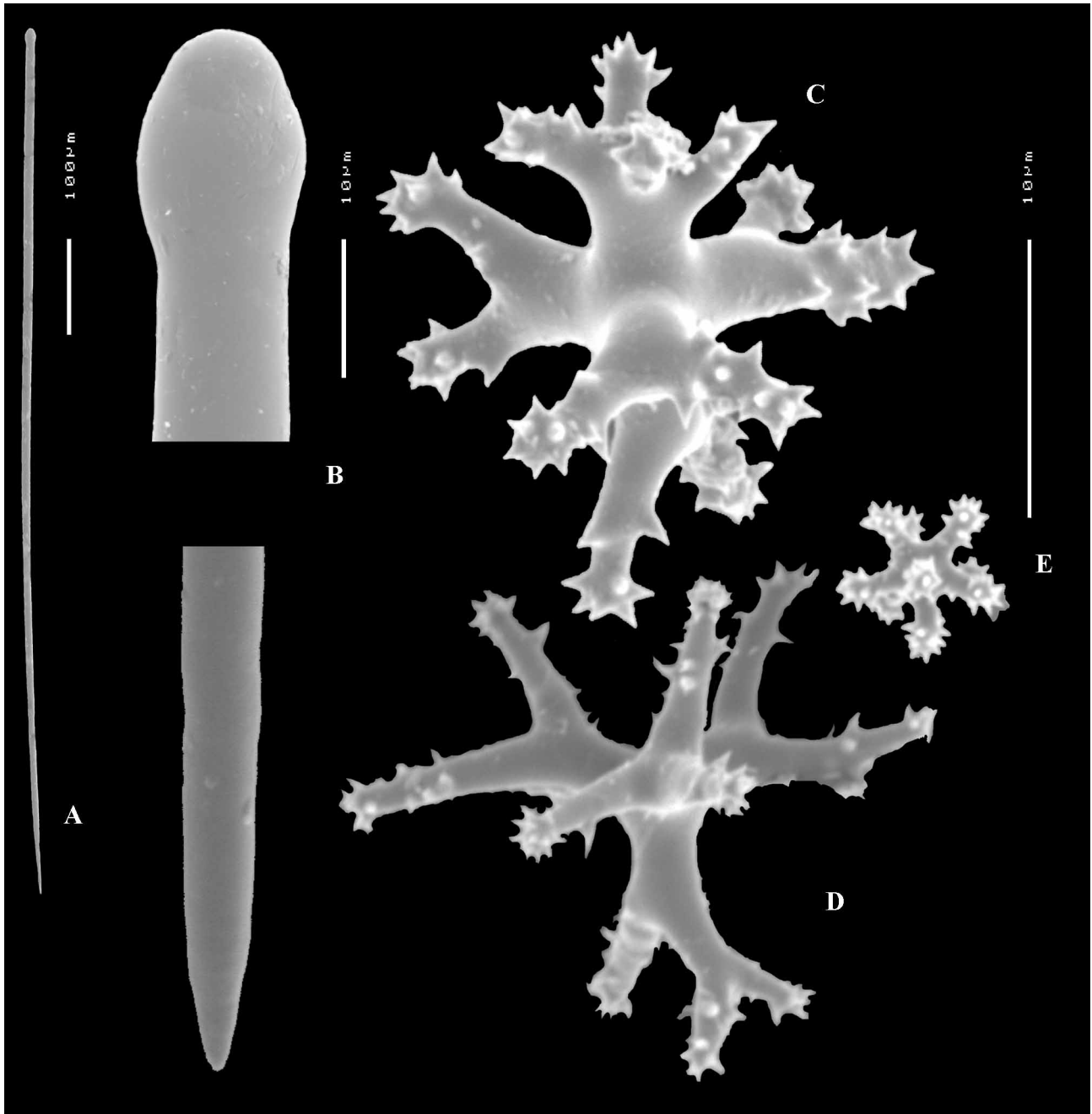


FIGURE 4. *Timea curacaoensis* n. sp., SEM images of spicules (Holotype ZMA Por. 16887). A–B. Tylostyle and details of head and apex; C. Full grown, thick-rayed, branched euaster, each ray with 2–4 spined cladi; D. Thinner branched euaster, each ray showing 2–3 spined cladi; E. small tylaster.

Elsewhere, several species seem close, notably Mediterranean *T. fasciata* Topsent (1934), which has irregular asters with proliferated ray endings, next to smaller normal strongylasters. Mediterranean *T. geministellata* Pulitzer-Finali (1978) possesses similar ambiguous spicules but some of these assume a diplaster-shape. Mediterranean *T. irregularis* Sarà & Siribelli (1960) has irregular larger asters of which some shapes could be interpreted as having branching rays in addition to small regular asters. The same could perhaps be said for Mediterranean *T. bifidostellata* Pulitzer-Finali (1983), but the drawings of the spicules do not look very much like those of the new species, possibly because the drawings are rather vague. No other *Timea* species appear to possess similar branched asters.

To facilitate recognition of *Timea* species in the area, a key is presented below.

Key to the *Timea* species of the Central West Atlantic

This is to supplement the key provided in Lehnert & Heimler (2001) which covered the North Atlantic and Mediterranean and included some additional genera. Species included here are all thin encrustations and all have single tylostyles, perpendicular to and protruding beyond the surface, and an ectosomal crust of euasters. *T. innocens* Schmidt (1870) (unrecognizable), *T. authia* sensu de Laubenfels (1956, no description), *T. agnani* Boury-Esnault (1973, possibly a *Cyamon*), and *T. stelligera* (Carter, 1882, probably not a proper *Timea*) are not included.

- 1 Single category of aster 2
- Two or more categories of asters 3
- 2 Large oxyspherasters only *T. unistellata* sensu Pulitzer-Finali (1986)
- Small tylasters only *T. perastra*
- 3 Three categories of asters, one tylaster and two oxyaster categories *T. bioxyasterina*
- Two categories of asters, usually a larger and smaller category 4
- 4 Large category with proliferated rays 5
- Large category with simple rays 6
- 5 Large category with branching rays, proliferated at their endings, small category tylaster *T. curacaoensis* n. sp.
- Large category with unbranched proliferated rays, small category oxyasters
..... *T. stellifasciata* sensu Boury-Esnault (1973)
- 6 Small aster category tiny (2–3 µm) with proliferated rays, larger asters spherasters *T. micraster*
- Small aster category with normal rays, larger asters oxyasters 7
- 7 Asters a combination of small tylasters or strongylasters (chiasters) and large oxyasters 8
- Asters a combination of small and large oxyasters *T. stenoscлера*
- 8 Strongylasters (chiasters) all less than 10 µm *T. mixta* sensu Wiedenmayer (1977)
- Strongylasters or tylasters > 10 µm 9
- 9 Small asters are strongylasters (chiasters) *T. hechteli*
- Small asters are tylasters *T. parasitica*

Order Poecilosclerida

Suborder Microcionina

Family Acarnidae Dendy, 1922

Genus *Megaciella* Hallmann, 1920

Megaciella incrustans n. sp.

(Figs 5A–E)

Holotype. ZMA Por. 21063, Colombia, Santa Marta area, Cabo de Aguja, 11.309°N -74.194°W, 8–15 m, 5-11-1986, coll. M. Rozemeijer & W. Dulfer.

Description. Thinly encrusting patches on barnacles, largest patch approx. 2 x 3 mm, less than 0.5 mm in thickness. Microhispid, soft. Color: brick-red.

Skeleton. Acanthostyles erect on the substrate, in clumps or bouquets, with the larger penetrating the surface. Ectosomal tylotes arranged in bundles fanning out and carrying the surface membrane; scattered tylotes arranged tangentially. Chelae forming a dense mass in the surface membrane.

Spicules. Ectosomal microspined tylotes, acanthostyles in two size categories, palmate isochelae.

Tylotes (Figs 5A–B), with elongate, slightly unequal heads, microspined at both ends, 237-279.9-309 x 2-3.0-3.5 µm.

Large acanthostyles (Fig. 5C) without prominent heads, spined all over but fewer spines toward the pointed end, 129-215.5-293 x 6-7.7-10 µm, small acanthostyles (Figs 5C–D), similarly shaped, 63-76.2-93 x

3.5-4.7-7 μm . The two size categories are not sharply delimited.

Palmate isochelae (Fig. 5E), rather narrow, but otherwise of quite usual shape, very little size variation, 9-12.5-14 μm .

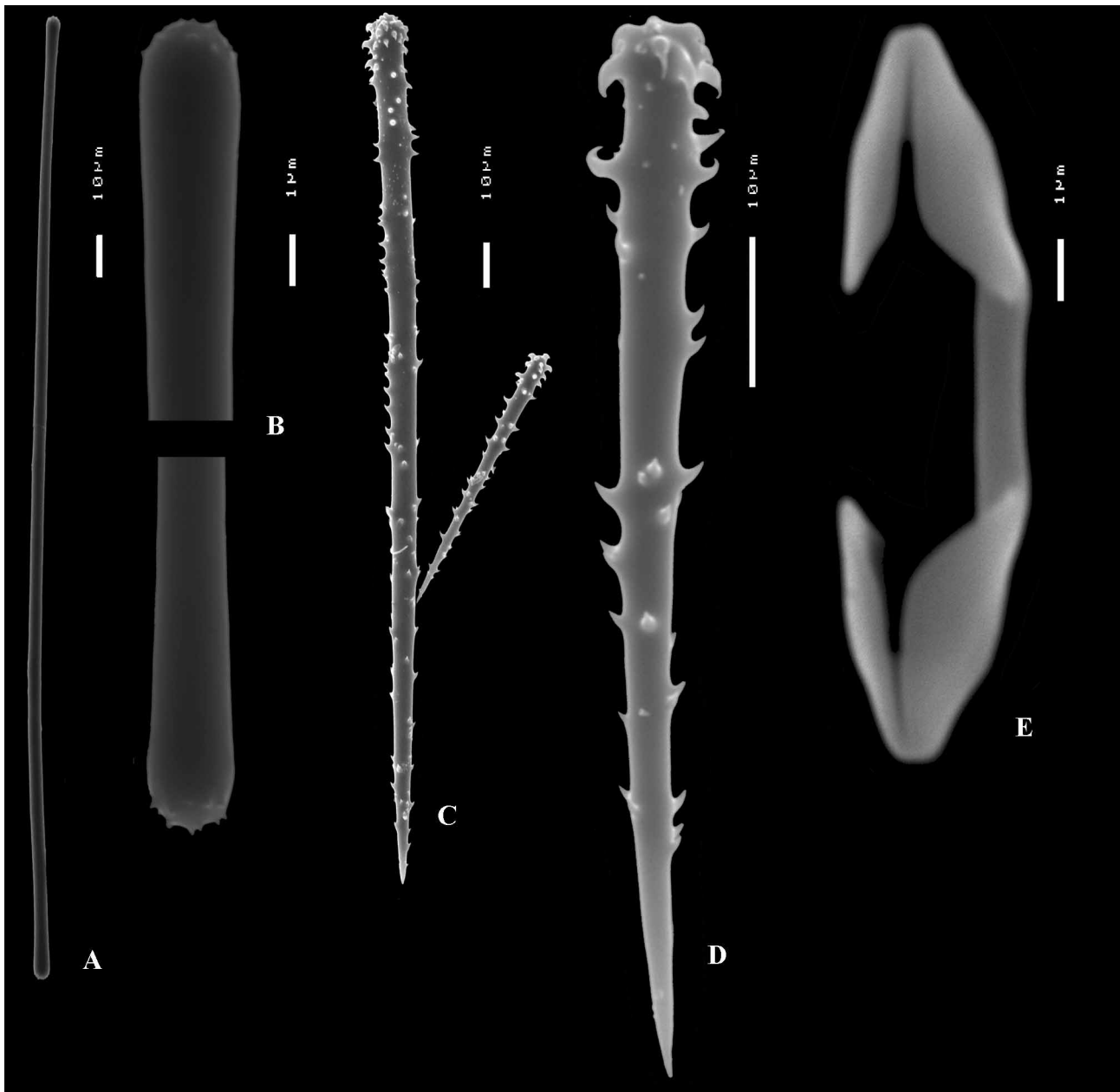


FIGURE 5. *Megaciella incrustans* n. sp., SEM images of spicules (Holotype ZMA Por. 21063). A–B. Ectosomal microspined tylote, and details of apices; C. Large and small acanthostyles; D. Detail of small acanthostyle; E. Palmate isochela.

Ecology. Encrusting on and between barnacles, in shallow reef caves, approx. 10 m.

Etymology. The name refers to the thinly encrusting habit.

Remarks. This species is provisionally assigned to *Megaciella*, a genus predominantly consisting of elaborate coldwater forms, with reticulate skeletons (Hooper, 2002a). No *Megaciella* species have been reported from the Central West Atlantic (van Soest et al. 2008, on line). The species would fit more easily in *Clathria* (*Microciona*) Bowerbank (1862), but this is precluded by the microspined tylotes, instead of which it should have had microspined subtylostyles. A remote possibility is that it is an *Acarinus* lacking both cladotylotes and toxas, which would then be unrecognizable as *Acarinus*, as some similarity exists with tylotes

and isochelae of e.g. *Acarnus nicoleae* van Soest *et al.* (1991). Still, many genera in the Microcionina share elaborate reticulate species as well as species with hymedemioid skeletons, such as *Clathria* Schmidt (1862), *Antho* Gray (1867b), *Acarnus* Gray (1867b), or *Iophon* Gray (1867b), and the species described here is merely the first such form reported for *Megaciella*. No matching descriptions are known from the Central West Atlantic.

Family Microcionidae

Subfamily Microcioninae

Genus *Clathria* Schmidt, 1862

Subgenus *Thalysias* Duchassaing & Michelotti, 1864

Clathria (Thalysias) collosclera n. sp.

(Figs 6A–I)

Holotype. ZMA POR. 16880, Curaçao, in front of Carmabi, 12.124°N -68.975°W, reef cavities at approx. 10 m, 10-2001, coll. S.Scheffers, # 18.

Paratype. ZMA POR. 16881, Curaçao, in front of Carmabi, 12.124°N -68.975°W, reef cavities at approx. 10 m, 10-2001, coll. S.Scheffers # 19.

Description. Thinly encrusting sponge, size of holotype 5 x 8 x 1–2 mm, paratype even smaller. It was found growing in the interstices of encrusting coralline algae and bryozans without forming large patches. Color red alive, beige in alcohol. Surface microhispid, consistency very soft, easily damaged.

Skeleton. Plumose with discrete spicular columns rising up from a basal spongin plate on the substrate and fanning out at the surface in characteristic bouquets. Columns consist, from the substrate upwards successively of 3–5 principal styles, recognizable as the longest and thickest of the megascleres, gradually replaced by 10 or more auxiliary subectosomal subtylostyles, which in turn carry the surface bouquets of smaller ectosomal subtylostyles. The base of the columns is echinated by small auxiliary acanthostyles. Colloscleres are densely distributed throughout the choanosome and the ectosomal region, without distinct concentrations.

Spicules. Choanosomal principal styles, two categories of auxiliary ectosomal subtylostyles, echinating acanthostyles, toxas, colloscleres, no proper chelae.

Principal styles (Figs 6A–B), entirely smooth, somewhat fusiform (the rounded end less thick than the upper part of the shaft), sharply and gradually pointed, 237–320.7–423 x 3–4.8–7 µm. Subectosomal larger auxiliary subtylostyles (Figs C–D), entirely smooth, thin, with faintly swollen head, 219–244.5–303 x 2–2.3–3 µm, and ectosomal small auxiliary subtylostyles (Figs 6E–F), entirely smooth, thin, with faintly swollen head, 96–113.3–156 x 0.5–1.0–1.5 µm. Echinating acanthostyles 42–52.1–66 x 3.5–4.4–5 µm.

Microscleres toxas (Fig. 6H), bow-shaped, shallow-curved, fairly thick, entirely smooth, not abundant, 92–106.8–126 µm, and bean-shaped colloscleres (Fig. 6I), hollow, faintly reminiscent of chela-shape but no clear alae or shaft can be detected, surface appears smooth under the light microscope, but is slightly wrinkled under SEM (possibly artefactual), 11–12.8–15 µm; occasionally clusters occur consisting of two, three up to a dozen of colloscleres, possibly artefactual, as they appear to be rare or absent in the teased preparations.

Ecology. Shallow depth, reef cavity dweller, encrusting coralline algae and bryozoans.

Etymology. Named for the peculiar colloscleres.

Remarks. The subgenus *Thalysias* has seven junior synonyms (cf. Hooper, 2002), among which is *Colloclathria* Dendy (1922), a so far monotypical genus erected for a ramose sponge from the Seychelles, *Colloclathria ramosa* Dendy (1922), with peculiar 'grain-of-rice' microscleres, among an otherwise typical *Clathria (Thalysias)* spicule complement and skeleton. Hooper (1996, 2002b) concluded that the peculiar

microscleres are derivatives of isochelae and assumed they were extremes of a hypertrophied chela-type called 'cleistochelae', in which both frontal alae meet and the shaft extends with a ridge or plate to fill up the space between the alae. Such microscleres are not uncommon in various apparently unrelated *Clathria* and *Mycale* species. Because of this and also because *Colloclathria* so far was monotypical, the species was assigned to *Clathria* (*Thalysias*). The combination *Clathria ramosa* was already occupied by *C. (T.) ramosa* (Kieschnick, 1896 as *Rhaphidophlus*), so Hooper (1996) proposed *Clathria* (*Thalysias*) *amiranteiensis* as a replacement name.

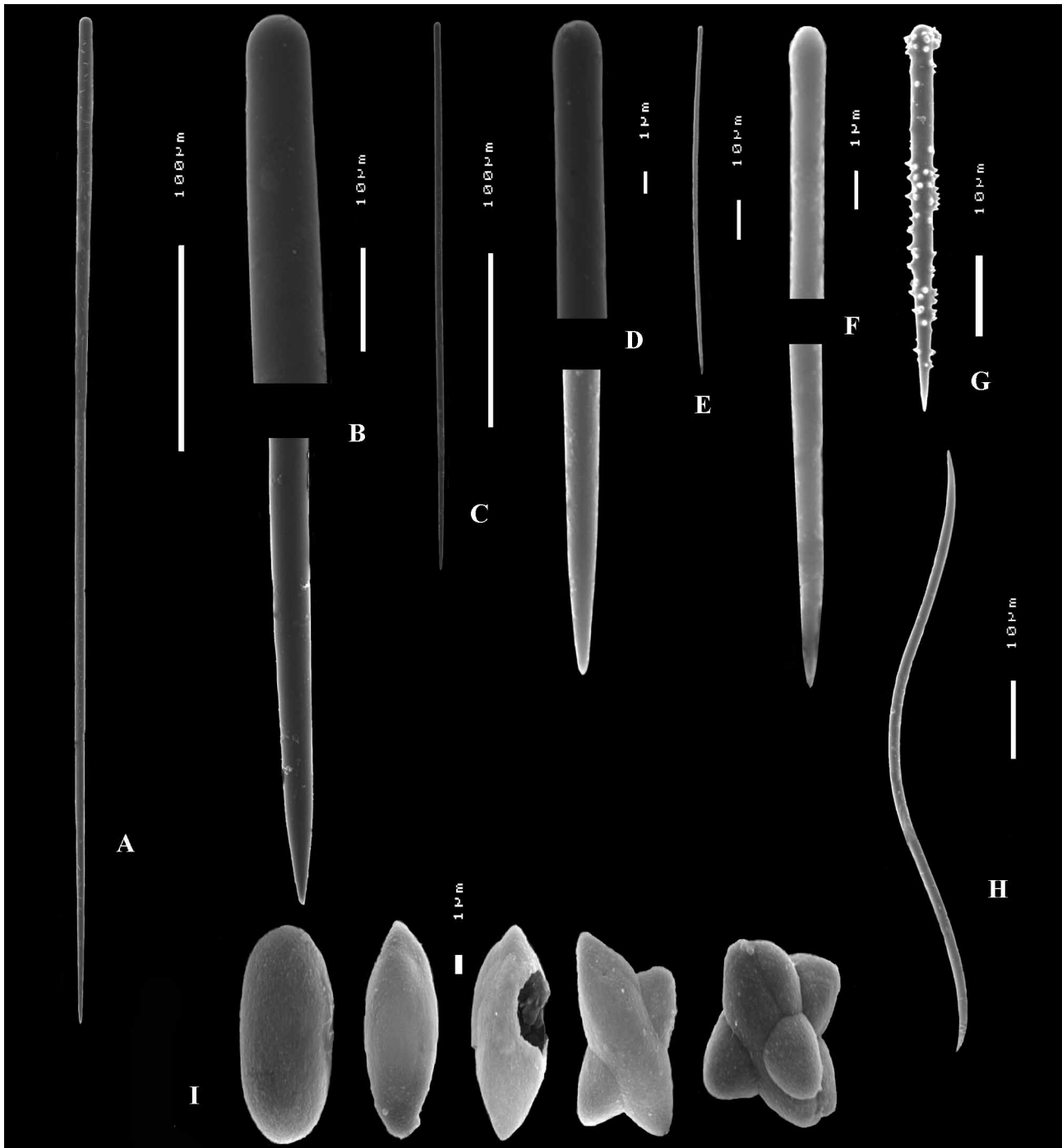


FIGURE 6. *Clathria* (*Thalysias*) *collosclera* n. sp., SEM images of spicules (Holotype ZMA Por. 16880). A–B. Choanosomal style and details of head and apex; C–D. Larger subectosomal subtylostyle and details of head and apex; E–F. Small ectosomal subtylostyle and details of head and apex; G. Acanthostyle; H. Toxa; I. Various individual colloscleres (left) and – possibly artefactual – merged colloscleres.

The ZMA collections holds three Seychelles samples (ZMA Por. 11890, Seychelles, St. Joseph Atoll, S rim, 5.45°S 53.35°E, 28-12-1992, 10 m, coll. R.W.M. van Soest, SCUBA, Netherlands Indian Ocean Program stat. E-759/01; ZMA Por. 11992, Seychelles, N of Poivre Atoll, 5.7°S 53.3°E, 31-12-1992, 42-45 m, coll. R.W.M. van Soest, Agassiz-trawl, Netherlands Indian Ocean Program stat. E-776/12; ZMA Por. 10644, Seychelles, W of Poivre Atoll, 5.7667°S 53.1833°E, 01-01-1993, 57 m, coll. R.W.M. van Soest, rectangular dredge, Netherlands Indian Ocean Program stat. E-778/21). I examined these and included Dendy's (1922: 74) description of three samples from the Seychelles/Amirante group and Coetivity, in a comparison with the new species. The Seychelles species can be characterized as repent-ramose, with a tendency to have the branches undivided or branching only close to the surface. The sponges encrust the substrate of dead corals and from this occasional branches are formed which are partially erect, but tend to follow a tortuous course, ending roundly. Diameter of the branches is 2–5 mm, and length varies from 2 to 14 cm. Color is yellow, orange, or orange-red; in alcohol the branches are light brown. Surface is optically smooth but microhispid, feeling slightly rough. Oscules are not apparent, but encrusting parts have a veinal pattern. Consistency firm, slightly compressible, tough. The ectosomal skeleton is characteristic for *Thalysias* with surface bouquets of smaller microspined ectosomal styles (approx. 120 x 3 µm), supported subectosomally by larger microspined ectosomal styles (220 x 5 µm). The distribution of the surface bouquets is not very dense, with individual bouquets flaring widely and touching each other's outer spicules only barely. The ectosomal skeleton is carried by an irregular reticulation of spicule tracts making up the internal skeleton of the branches. Tracts consist of two or three smooth fusiform main styles with rugose or occasionally smooth heads (200 x 15 µm), cemented by light spongin and echinated sparingly by auxiliary acanthostyles (72 x 10 µm). They make rounded or squarish meshes, and leave large open spaces, which are presumably canals. Many megascleres and microscleres are loosely scattered in the interior. Microscleres are toxas (60–120 x 1 µm), palmate isochelae (12–15 µm), and abundant oval or bean-shaped colloscleres of 10–12 µm in length.

From these observations it is obvious that the two sponges discussed here are quite dissimilar in morphology and spiculation: tough branches vs. soft thin crust, microspined ectosomal spicules vs. smooth, presence of true palmate isochelae vs. absence thereof. Nevertheless, the peculiar colloscleres are a compelling synapomorphy for the two species discussed here. It is unclear whether these are truly derivations of the chelae as Dendy (1922) maintained from his observation of 'intermediate forms' drawn rather suggestively by him (pl. 14 fig. 4e). Hooper's (1996) opinion that the colloscleres are cleistochelae is here rejected, because in cleistochelae the frontal alae meet and/or the shaft grows a forward extension, but the obvious derivation from palmate isochelae is never in any doubt with such spicules. In colloscleres the entire spicule - if it is chela-derived - is enveloped in a siliceous thin coat which is dramatically different from a chela developing secondarily infilling of the open space between alae and shaft.

If the colloscleres of both species are to be considered a homologous derived character, then close phylogenetic relationship is the likely assumption, since no other *Clathria* species with such microscleres are known. *Collocathria* may need to be reinstated as a subgenus or a similar infrageneric unit to distinguish these sponges from the bulk of the *Clathria* (*Thalysias*) species. Several spicular features of the two sponges support such close affinity: the shape and size of the toxas are quite similar and the size of the ectosomal and choanosomal megascleres is also not dissimilar. Biogeographically, such a taxon would show a disjunct distribution in Indian Ocean and Caribbean reefs, which may be easily explained as a relict Tethyan pattern. So far, no reliable records of *C. amiranteiensis* in other parts of the Indo-West Pacific are known, so a more widespread Tethyan distribution remains to be demonstrated.

Alternatively, although both *C. collosclera* n. sp. and *C. amiranteiensis* belong to the subgenus *Thalysias* and the colloscleres appear uniquely derived, it is possible that they represent independent developments. Possibly, the colloscleres are an environmentally induced derivative of chelae. This is supported by the occurrence of potentially homologous colloscleres in the enigmatic sponge described as *Collosclerophora arenacea* Dendy (1917). The morphological and skeletal features of this South Australian sponge are radically different again from the two above described *Clathria* (*Thalysias*) species. The growth form is massive, solid, and the skeleton consists chiefly of sand. The only megascleres present are thin strongyles occurring in

plumose bundles among the sand grains. By these characters, this sponge is classified as *Chondropsis* in the poecilosclerid family Chondropsidae (cf. van Soest, 2002a). The colloscleres are bean-shaped and were demonstrated to be siliceous, but soft-skinned, capable of swelling when water is added to them. This might well conform to the colloscleres of *C.(T.) collosclera* n. sp. as the surface of many of them appear wrinkled under SEM. Verifying the homology of both types of colloscleres unfortunately is virtually impossible as there is precious little material left of *C. arenacea*. There is no rationale for assigning *Chondropsis arenacea* and *Clathria (Thalysias) collosclera* – *C. (T.) amiranteiensis* to a single monophyletic group, as this would violate a large number of convincing skeletal and spicular synapomorphies. If the colloscleres are all of similar build and material, that would surely indicate they have been developed independently, at least in different families.

Suborder Myxillina

Family Chondropsidae Carter, 1886

Genus *Batzella* Topsent, 1893

Batzella fusca n. sp.

(Figs 7A–C)

Holotype. ZMA Por. 21064, Bonaire, Karpata, 12.222°N -68.351°W, under rubble, 5 m, 1987, coll. H.G.J. Pennartz #5.

Additional material (not belonging to the type series). Bonaire, Karpata, 12.222°N -68.351°W, under rubble, 5 m (2 specimens); Bonaire, Punt Vierkant, 12.116°N -68.295°W, under rubble, 5 m (2 specimens); Bonaire, Red Slave, 12.034°N -68.259°W, under rubble, 5 m; all observed by H.G.J. Pennartz & G.J. Roebers.

Description. Thin smooth crust, size 4 x 3.5 cm, thickness less than 0.5 mm (Fig. 7C). Color dark brown with purple veins; interiorly the sponge is orange–brown. Pigment grains in the lighter parts of the surface form areolae-like formations of approx. 100 µm in diameter. Consistency soft.

Skeleton. Feebly developed bundles of megascleres traverse the choanosome vertically ending at and pushing up the surface to cause microconules. No tangential surface skeleton.

Spicules. Strongyles only, no further spicules.

Strongyles (Figs 7A–B), straight, isodiametric, with evenly rounded (not swollen) apices, often with wide axial cavity, 213–252.7–277 x 3–3.9–4.5 µm.

Ecology. Under coral rubble at 5 m

Etymology. *Fusca* (Latin) = brown.

Remarks. The mottled aspect of the surface reminds of specimens of *Strongylodesma* Lévi (1969) (see e.g. Samaai *et al.* 2004), so it was carefully verified whether the strongyles were also arranged tangentially as is the case in species of *Strongylodesma*. However, strongyles were only found in choanosomal bundles perpendicular to the surface, which consisted only of an organic membrane. One other species is known from the Central West Atlantic, *B. rosea* van Soest (1984), differing from the new species in color (rosy red) and presence of characteristic looped malformations of the strongyles found in that species. *B. rosea* was also observed to occur under Bonaire rubble stones (Pennartz & Roebers, unpubl. data) and could be easily distinguished from the new species. *Strongylacidon bermudae* (de Laubenfels, 1950 as *Fibulia*), having strongyles of 180–200 µm and lacking microscleres, in addition to being dark colored, may be reminiscent of the new species, but it is a large species with tubes of 12 cm height, quite unlike the thin encrustation described here (cf. Rützler, 1986). The strongyles are also neatly smaller than *Batzella fusca* n. sp. and *B. rosea*, without overlap.

The *Batzella* species of the Central West Atlantic are keyed out along with the species of the genus *Strongylacidon* in a key presented below.

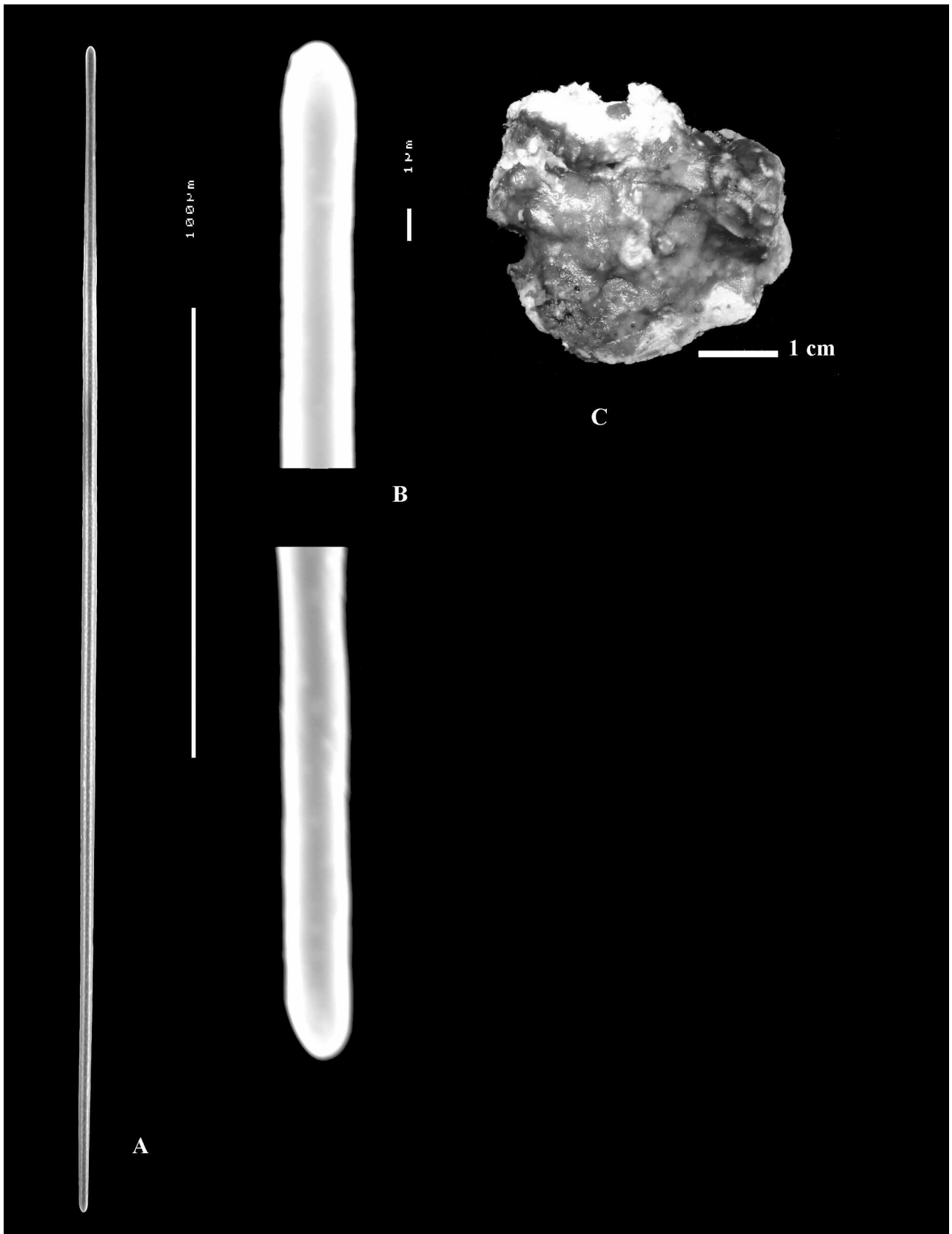


FIGURE 7. *Batzella fusca* n. sp., SEM images of spicules (Holotype ZMA Por. 21064). A–B. Strongyle and details of apices; C. photo of holotype encrusting a piece of coral.

Genus *Strongylacidon* Lendenfeld, 1897

Strongylacidon unguiferum n. sp.

(Figs 8A–D)

Holotype. ZMA Por. 21067, Bonaire, Red Slave, 12.034°N -68.259°W, under rubble, 4 m, 1987, coll. H.G.J. Pennartz #242.

Paratype. ZMA Por. 21068, same data as holotype, coll. G.J. Roegers # G02-12.

Additional material (not belonging to the type series). ZMA Por. 12397 Belize, Dangriga, Pelican Cays, Cat Cay, lagoon, mangrove root, 16-11-1996, coll. K. Smith & C. Díaz #KS 96-11.

Description. Thinly encrusting, black-grey sponge, becoming greenish in alcohol, 1–2 mm in thickness, under coral rubble. Surface smooth. The type material is fragmented and beige colored. The holotype now consists of four coral fragments with patches of the sponge not exceeding 2 x 2 mm, and the paratype consists of two similar-sized fragments. The patches are tightly adhering to the coral surface overgrowing also dead bryozoans and *Homotrema*, but the surface may be peeled off easily.

Skeleton. Dendritic, rather scanty, consisting of bundles of 10–20 megascleres rising individually from the substrate and dividing dichotomously without anastomosing. At the periphery, the spicule bundles fan out to carry the surface membrane without forming a separate ectosomal skeleton. Organic surface membrane carries numerous scattered microscleres.

Spicules. Strongyles and isochelae.

Strongyles (Figs 8A–B) straight, cylindrical, isodiametrical, with evenly rounded symmetrical apices, 204–218.7–258 x 2–3.4–4.5 μ m.

Microscleres (Figs 8C–D) shallow-curved unguiferate isochelae, 15–18.3–22 μ m in length, often slightly anisochelate by having different numbers of teeth at both ends of the same spicule: variously 3 or 5, occasionally 4, short conical sharp-ending teeth. Teeth are on average up to 1/8 of the length of the entire chela. Not uncommonly, the teeth are partly or entirely reduced (Fig. 8D) and such spicules simulate sigma shapes, but these are obviously the same spicule type, not constituting a separate category of microscleres.

Ecology. Encrusting undersides of coral rubble in shallow reef habitats, 4 m.

Etymology. The name refers to the unguiferate isochelae.

Remarks. The species may be also represented in the mangrove habitat and if such specimens are indeed the same species, it may be quite elaborate in shape and size, e.g. the specimens recorded above from Belize mangrove roots grew around a branch of *Aplysina fulva* over distances of 6 x 4 and 12 x 4 cm, with a thickness of 1–3 mm. This concerns the species named *Strongylacidon* aff. *zanzibarensis* in Rützler et al. (2000), found commonly on mangrove roots in Belizean mangrove habitats in the Pelican Keys. Color, spicule sizes and skeletal characteristics match closely with the sub-rubble specimens, but size and habitat differences induced us to exclude these specimens from the type series.

Strongylacidon zanzibarensis Lendenfeld (1897) from the beach of Kokotoni, Zanzibar, collected from the underside of stones, where the holotype apparently encrusted a crab, is quite similar in most characteristics: encrusting, 4–5 mm thickness, grey-brown in alcohol, strongyles and unguiferate chelae. However, the strongyles of that species although overlapping, are distinctly smaller (160–260 μ m) and the chelae are only 6–9 μ m. The shape of the chelae is apparently slightly anisochelate in being less curved at one end than at the other, but the number of teeth unlike that of *S. unguiferum* n. sp. is invariably 3 at both ends. The skeleton is supported by a symbiotic alga and the spicule bundles are ensheathed in spongin. With these small but clear differences it is unlikely that Zanzibar and Caribbean specimens belong to a single amphitropical species.

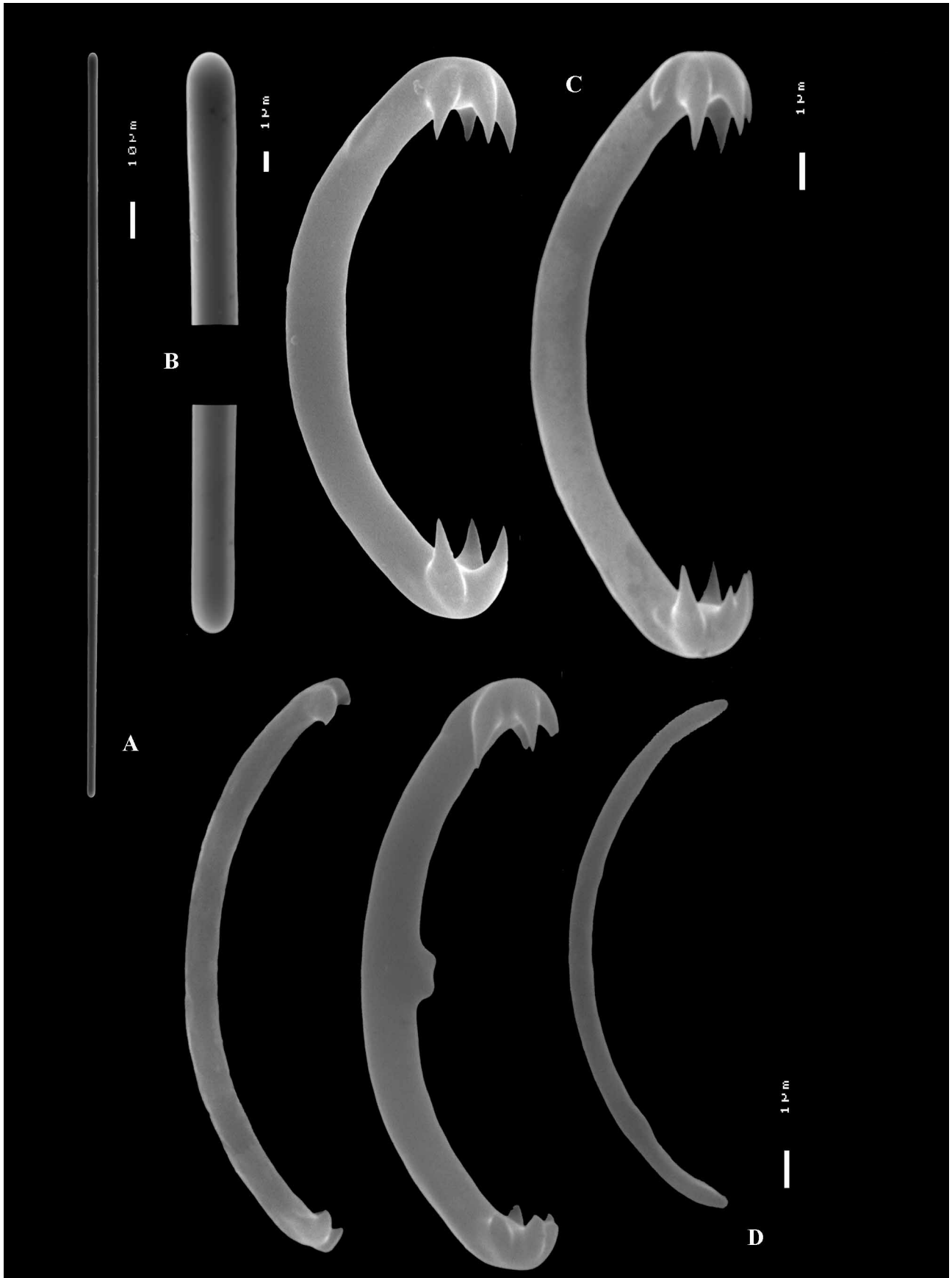


FIGURE 8. *Strongylacidon unguiferum* n. sp., SEM images of spicules (Holotype ZMA Por. 21067). A–B. Strongyle and details of apices. C–D. Various shapes of unguiferate reduced chelae.

Western Atlantic *Strongylacidon* species include *S. osburnense* (George & Wilson, 1919 as *Phoriospongia*), *S. poriticola* van Soest (1984), *S. viride* van Soest (1984) and *S. rubrum* van Soest (1984), and possibly *S. bermudae* (de Laubenfels, 1950 as *Fibulia*).

Strongylacidon osburnense is described as a thin white (in alcohol) sponge encrusting an alcyonarian coral, not unlike *S. unguiferum* **n. sp.** in thickness (1 mm). The strongyles are similar to that of *S. unguiferum* **n. sp.** but neatly separated in size (160–180 x 2–3 µm), the unguiferate chelae appear indistinguishable in size and shape from those of *S. unguiferum* **n. sp.**, but there is an added genuine category of sigmas of 12–16 µm. Moreover, the skeleton of *S. osburnense* is not formed by spicule bundles, but by columns of sand grains ensheathed in spongin fibers. Together these characteristics make *S. osburnense* clearly distinct. The species is considered a junior synonym of *Desmacidon griseum* Schmidt (1870) by van Soest (2002a), so the species should be named *Strongylacidon griseum*.

Strongylacidon poriticola is a bright red encrustation on corals, with strongyles smaller and thinner (155–190 x 2 µm) and ‘anchorate’ chelae, which are after reexamination diagnosed as arcuate, with normal alae, not unguiferate. *Strongylacidon viride* (green-colored) and *Strongylacidon rubrum* (bright red) do not have chelae, only true sigmas (verified in type specimen slides), respectively 13–18 and 20–30 µm. Both have clearly smaller strongyles (not exceeding 204 µm).

Strongylacidon bermudae is an elaborate sponge with tubes of 12 cm height, quite unlike the thin encrustation described here (cf. Rützler, 1986; it has no microscleres, only bundles of strongyles, 180–200 x 2 µm). Assignment to *Strongylacidon* was made by van Soest (1984) on authority of Rützler (*in litteris*), but on paper it conforms to *Batzella* rather than to *Strongylacidon*. Its status needs to be reevaluated.

The known species assigned to *Strongylacidon* in the Central West Atlantic are keyed out below along with *Batzella* species.

Key to the Chondropsidae species of the Caribbean

The skeleton is made up of thin strongyles, arranged in plumose bundles; no separate ectosomal skeleton; microscleres if present arcuate or unguiferate isochelae and/or sigmas.

1	Microscleres (chelae and / or sigmas) present	4
-	No microscleres	2
2	Thin smooth crusts	3
-	Tubular sponges	<i>Strongylacidon bermudae</i>
3	Color mottled brown (keeps in alcohol)	<i>Batzella fusca</i> n. sp.
-	Color rose (off-white in alcohol); strongyles often crooked	<i>Batzella rosea</i>
4	Chelae present (may be rare)	6
-	No chelae, only microscleres present are sigmas	5
5	Color green (keeps in alcohol), a single category of sigmas	<i>Strongylacidon viride</i>
-	Color red (white in alcohol)	<i>Strongylacidon rubrum</i>
6	Chelae unguiferate	7
-	Chelae arcuate, no sigmas	<i>Strongylacidon poriticola</i>
7	Strongyles less than 200 µm, sigmas present	<i>Strongylacidon griseum</i>
-	Strongyles 200–300 µm, no sigmas	<i>Strongylacidon unguiferum</i> n. sp.

Family Coelosphaeridae Dendy, 1922

Genus *Forcepia* Carter, 1874

Subgenus *Forcepia* Carter, 1874

***Forcepia (Forcepia) minima* sp. n.**

(Figs 9A–F)

Holotype. ZMA Por. 20880, Netherlands Antilles, Curaçao, Avila Beach, 12.098°N -68.926°W, 25 m, 03-10-1991, coll. M. Kielman #S 111.

Paratypes. ZMA Por. 12715, Bonaire, Punt Vierkant, 12.116°N -68.295°W, under rubble, 5 m, 04-08-1987, coll. G.J. Roebbers # 183; ZMA Por. 20882, Netherlands Antilles, Curaçao, SeaQuarium, 12.081°N -68.8919°W, 25 m, 1991, coll. M. Kielman #S 54 ; ZMA Por. 20883, same locality as previous paratype, 25 m, 24-9-1991, coll. M. Kielman #S 62.

Additional material (not belonging to the type series). Curaçao, Playa Hundu, 12.258°N -69.127°W, under rubble, 5 m, 1989, coll. E. Meesters & P. Willemsen # H26C13; Curaçao, Cornelisbaai, 12.084°N -68.897°W, under rubble, 3.5 m, 1989, coll. E. Meesters & P. Willemsen # C23-9; Curaçao, Kaap Malmeeuw, 12.137°N -68.999°W, under rubble, 12–16 m, 12-1980, coll. R.W.M. van Soest.

Description. Tiny hollow encrustations of approx. 0.5–1 mm thickness and maximum of 2 cm² in widest expansion, with one (holotype) or up to three fistules of 2 mm diameter and 4–5 mm high. Consolidating coarse sediment under coral rubble and occupying depressions in the coral rubble. Color pale brown or pale orange, which keeps in alcohol.

Skeleton. Thick irregularly connected bundles of spicules, 50–60 µm in diameter traverse the bladder-like main body, and these fan out at the surface where they get dispersed tangentially, forming an irregular ectosomal skeleton.

Spicules. Tylotes, isochelae, forcipes.

Tylotes (Figs 9A–B), smooth, curved, with elongate but prominent tyles, which have a characteristically visible elongate axial lumen, 258-292.9-345 x 5-5.7-7 µm.

Arcuate isochelae (Fig. 9C) with short broad alae, which occasionally show incipient polydentation, 15-22.3-24 µm.

Forcipes (Figs 9D–F) of varied shape, divisible in two size categories, and each occurring in a heavily or a more lightly spined form, with or without toothed apices: (1) larger heavily spined forcipes, 54-68.5-91 µm (widest expansion of legs 20–22 µm), toothed apices; (2) larger faintly spined forcipes, without toothed apices, are in a similar size range and are interpreted as growth stages (Figs 9D–E); (3) smaller spined forcipes, 27-39.5-48 mm (widest expansion of legs 10–27 µm), toothed apices; (4) smaller less spined forcipes, without toothed apices have similar size range and are interpreted as growth stages (Fig. 9F).

Ecology. Subrubble habitat at shallow and reef crevices at intermediate depths, range 3.5–25 m.

Etymology. The name refers to the tiny size, the smallest in the subgenus *Forcepia (Forcepia)*.

Remarks. Up to now, four *Forcepia* species have been recorded from the Central West Atlantic, *Forcepia (Forcepia) colonensis* Carter (1874), redescribed by Van Soest (2002b), based on *Forcepia trilabis* sensu van Soest (1984) from Panama and Barbados, *Forcepia (Forcepia) trilabis* (Boury-Esnault, 1973 as *Ectoforcepia*) from Brazil, *Forcepia (Forcepia) grandisigmata* van Soest (1984) from Jamaica, and *Forcepia (Leptolabis) vermicola* Lehnert & van Soest (1996), likewise from Jamaica. Of these, *F. colonensis* is closest in spiculation to our new species and shares a thinly encrusting habit. However, the tylotes (330–360 µm) and larger acanthose forcipes (200–260 µm) of *F. colonensis* are clearly larger than those of our new species. The chelae of *F. colonensis* are divisible in two size categories with the larger having reduced alae (see Van Soest, 2002b fig. 3C). *F. trilabis* is also close, having similar tylote sizes and both acanthose forcipes and relatively smooth growth stages in two size categories, but like *F. colonensis* this has very large forcipes (even up to 303 µm) and chelae with reduced alae, whereas there is only a single size category, rendering it inbetween *F. colonensis* and *F. minima* n. sp. in that respect. *F. grandisigmata* is more distant in possessing huge sigmas (up to 202 µm) and peculiarly deformed chelae (similar to those of *F. fistulosa* n. sp. described below).

F. vermicola is distant from the new species by possessing acanthostyles; it is a member of the subgenus *Leptolabis*.

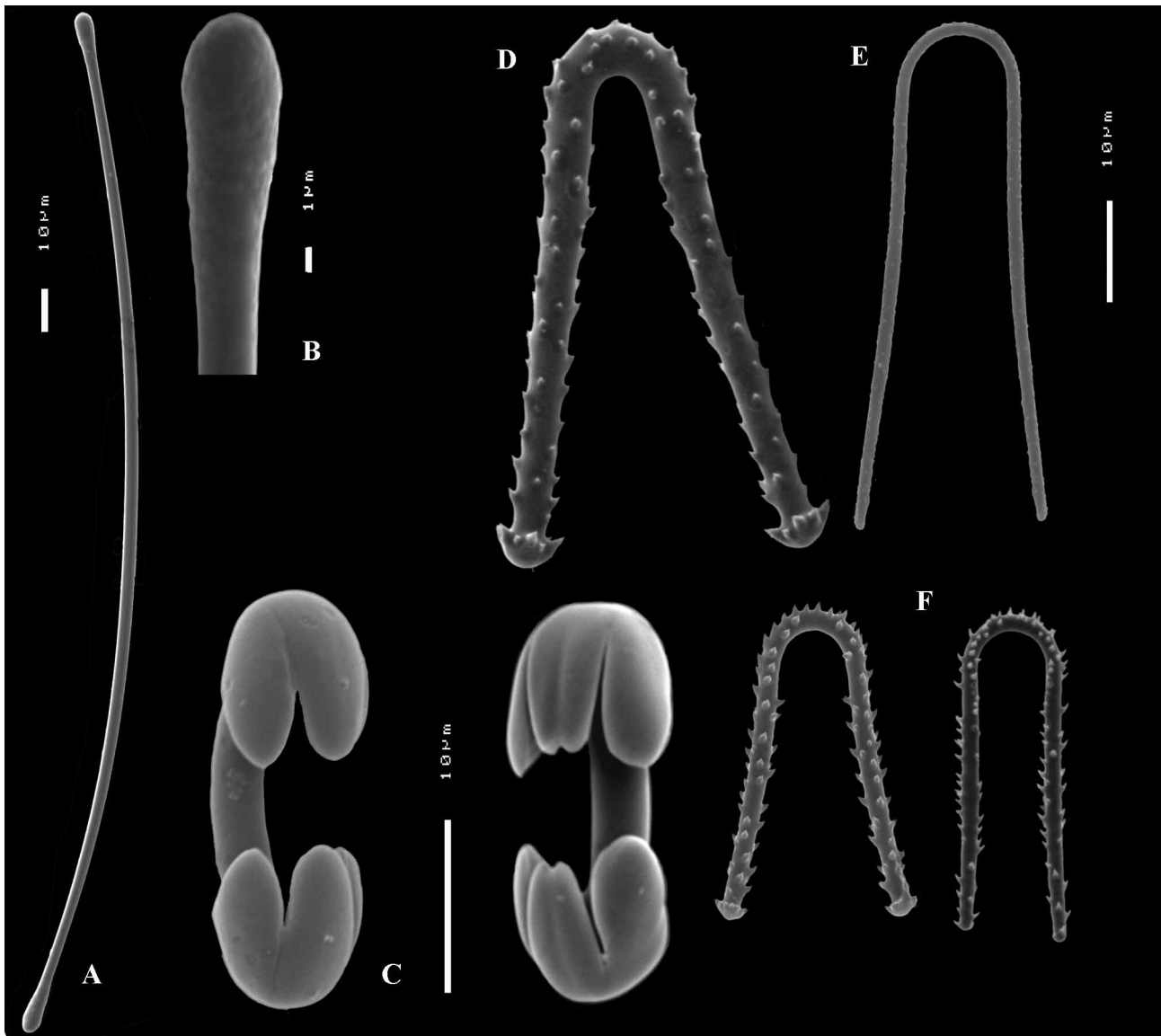


FIGURE 9. *Forcepia (Forcepia) minima* n. sp., SEM images of spicules (Holotype ZMA Por. 20880). A–B. Tylole and detail of one of the apices; C. Diversity of arcuate isochelae; D–E. Spined and smooth larger forceps category; F. Small forcipes.

***Forcepia (Forcepia) fistulosa* n. sp.**
(Figs 10A–G)

Holotype. ZMA Por. 21070, Colombia, Santa Marta area, Punta Betín, 11.25°N -74.2167°W, reef crevices, 25 m, 18-02-1991, coll. L. Aerts.

Paratypes. ZMA Por. 21072, Colombia, Cartagena area, Islas del Rosario, Isla Pavitos, 10.2333°N - 75.75°W, 25 m, 27-10-1990, coll. M. Kielman #S155; ZMA Por. 21071, Santa Marta area, El Morro, 11.25°N -74.2167°W, 25 m, 18-02-1991, coll. M. Kielman #S168.

Description. Hollow fistules (Fig. 10G) rising up from a small, encrusting base; fistules single or divided in two or three. Holotype now broken into three fragments. Length of longest single fistule 2.5 cm, diameter 0.4 cm, complex fistules up to 1.2 cm wide. Surface smooth, glistening. Consistency stiff. Color orange in life, pale brown or pale orange in alcohol.

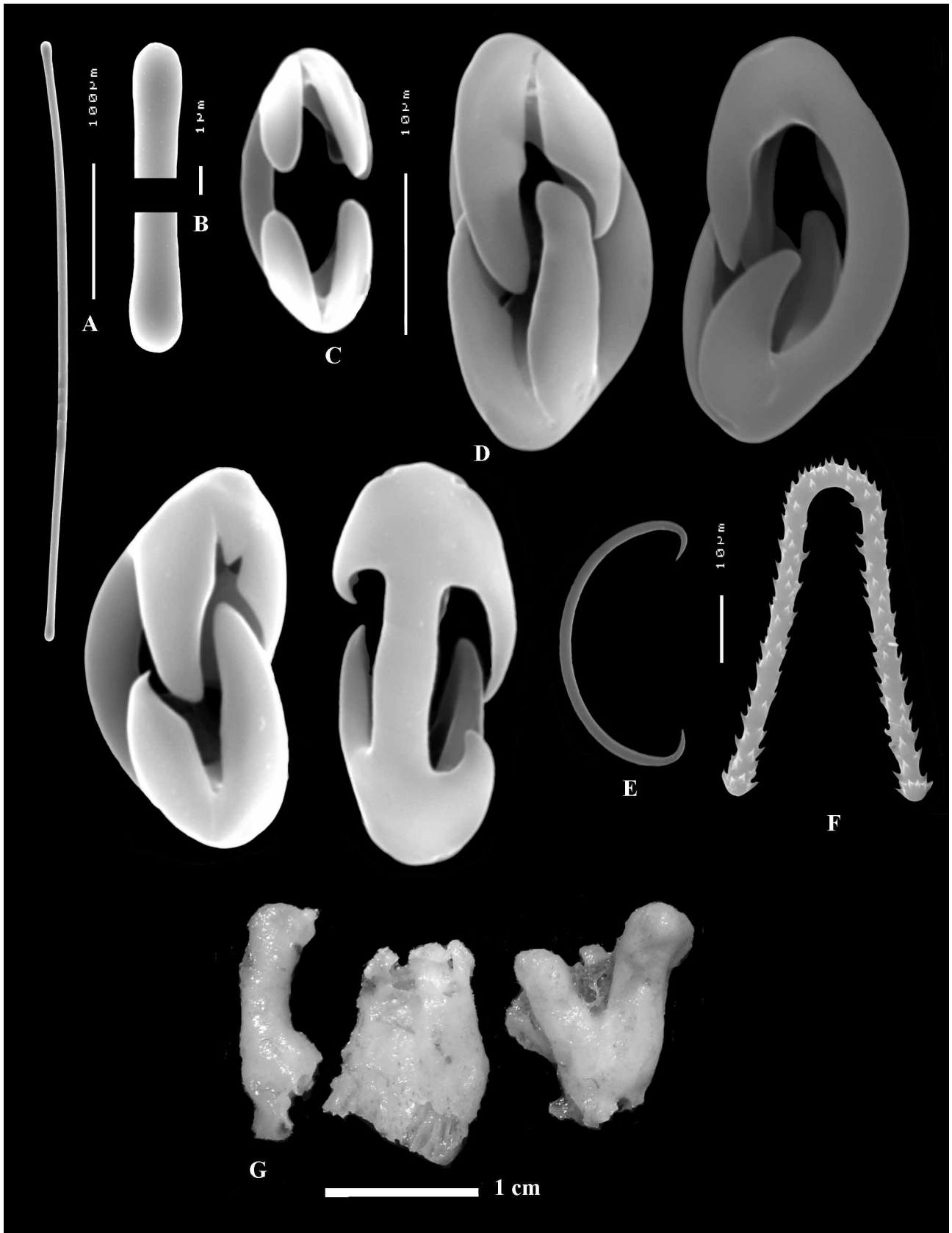


FIGURE 10. *Forcepia (Forcepia) fistulosa* n. sp., SEM images of spicules (Holotype ZMA Por. 21070). A–B. Tylole and details of the apices; C. Normal-shaped arcuate isochelae; D. Various types of twisted chelae; E. Sigma; F. Forceps; G. photo of fragmented holotype.

Skeleton. In the outer wall lies a layer of intercrossing single megascleres, carried by occasional choanosomal spicule bundles fanning out beneath the surface membrane.

Spicules. Tylotes, chelae, forcipes, sigmas.

Tylotes (Figs 10A–B) with well-developed elongate tyles, robust, usually evenly curved, 294–391.8–444 13–14 μm .

Arcuate chelae (Figs C–D) predominantly twisted, but including ‘normal’ ones (Fig. 10C) occurring in different quantities in different specimens, 21–24.6–27 μm , normal chelae usually slightly smaller.

Forcipes (Fig. 10F) robust, all heavily spined, in a large size range but not clearly divisible in size categories (rare in paratype 21071), 29–58.0–102 μm .

In the holotype and in paratype 21071, thin, strongly incurved sigmas (Fig. 10E) occur rarely, 39–42 μm . It is not certain that these are proper.

Ecology. In shaded parts of the deeper reef (25 m), in crevices, under overhangs and under larger rubble.

Etymology. The name refers to the persistent fistular habit.

Remarks. The specimens were compared with the neotype of *F. colonensis* Carter (1874) ZMA Por. 04564, which on paper would seem very close. The chelae of this species are definitely in two size categories and the larger has the teeth always severely reduced, resembling sigmas at first glance. An unregistered specimen from Colombia (El Morro, 15 m, 20-10-1989, coll. M. Kielman, color light orange, tylotes 450 μm , chelae 21–27, possibly in two categories, forcipes 102–236 μm) considered to belong to *Forcepia (Forcepia) colonensis* has less pronounced reduced alae in the larger chelae, but other features appear similar. The habit of this specimen is also fistular, whereas the neotype of *F. (F.) colonensis* is a thin hollow crust. These varying characters are here interpreted as differences of maturity, but nevertheless, the new species approaches *F. (F.) colonensis* closely and the major difference rests in the presence of the peculiarly twisted chelae.

The new species also is close to *F. minima* n. sp. resembling it in habit, but in the new species the fistules are much larger than in *F. minima* n. sp.; tylotes are distinctly larger and thicker (no overlap) and the forcipes are of one type only, whereas those of *F. minima* are in two categories. Some specimens (holotype and one of the paratypes) bear sigmas, though rare, and these may be proper but vestigial. The chelae are in majority peculiarly twisted, resembling those of *F. grandisigmata* closely, and as in that species also occur in a normal form. Some specimens have only a low proportion of twisted chelae. Sizes of these chelae are slightly different between *F. fistulosa* n. sp. (on average smaller) and *F. grandisigmata* (on average larger). Forcipes are similar in shape and ornamentation in the two, with those of *F. fistulosa* n. sp. showing a larger size range. The major difference, however, are the sigmas, which reach very large size (up to 202) in *F. grandisigmata* as the name implies.

Subgenus *Leptolabis* Topsent, 1901

Forcepia (Leptolabis) microlabis n. sp.

(Figs. 11A–K)

Holotype. ZMA Por. 21069, Curaçao, Blauwbaai, 12.131°N -68.987°W, under rubble, 35 m, 1989, coll. E. Meesters & P. Willemsen #B18B8.

Description. Thinly encrusting, englobing and consolidating a few small pieces of coarse coral sediment, under big rubble blocks. Surface faintly hispid. Color brown. The holotype now consists of 5 pieces, each less than 1 cm^2 , and the total surface area in all is a few mm^2 . The encrustations of this species are thoroughly mixed in with two other encrusting sponge species, *Rhabderemia minutula* Carter (1876) and *Timea unistellata* sensu Pulitzer-Finali (1986), the spicules of which appear as contamination in the spicule preparations.

Skeleton. Due to the mix-up with other sponge species, the details of the skeleton are not easy to ascertain; thin tylotes and large sigmas are found in the surface membrane, the acanthostyles, forcipes, small

sigmas and chelae occur in the interior, the former in hymedesmioid fashion.

Spicules. Tylotes, acanthostyles in two not sharply delimited size categories, sigmas in two size categories, forcipes in two size categories, chelae in two size categories.

Tylotes (Figs 11A–B) thin, somewhat flexuous, with elongate more or less equal-shaped tyles at both ends, 172-188.6-209 x 2.5-2.6-3 μm .

Large acanthostyles (Fig. 11C), head barely differentiated from the shaft, 152-160.5-171 x 5-6.7-9 μm ; small acanthostyles (Fig. 11D), similar in shape to large acanthostyles, 75-83.9-90 x 4-5.2-6 μm .

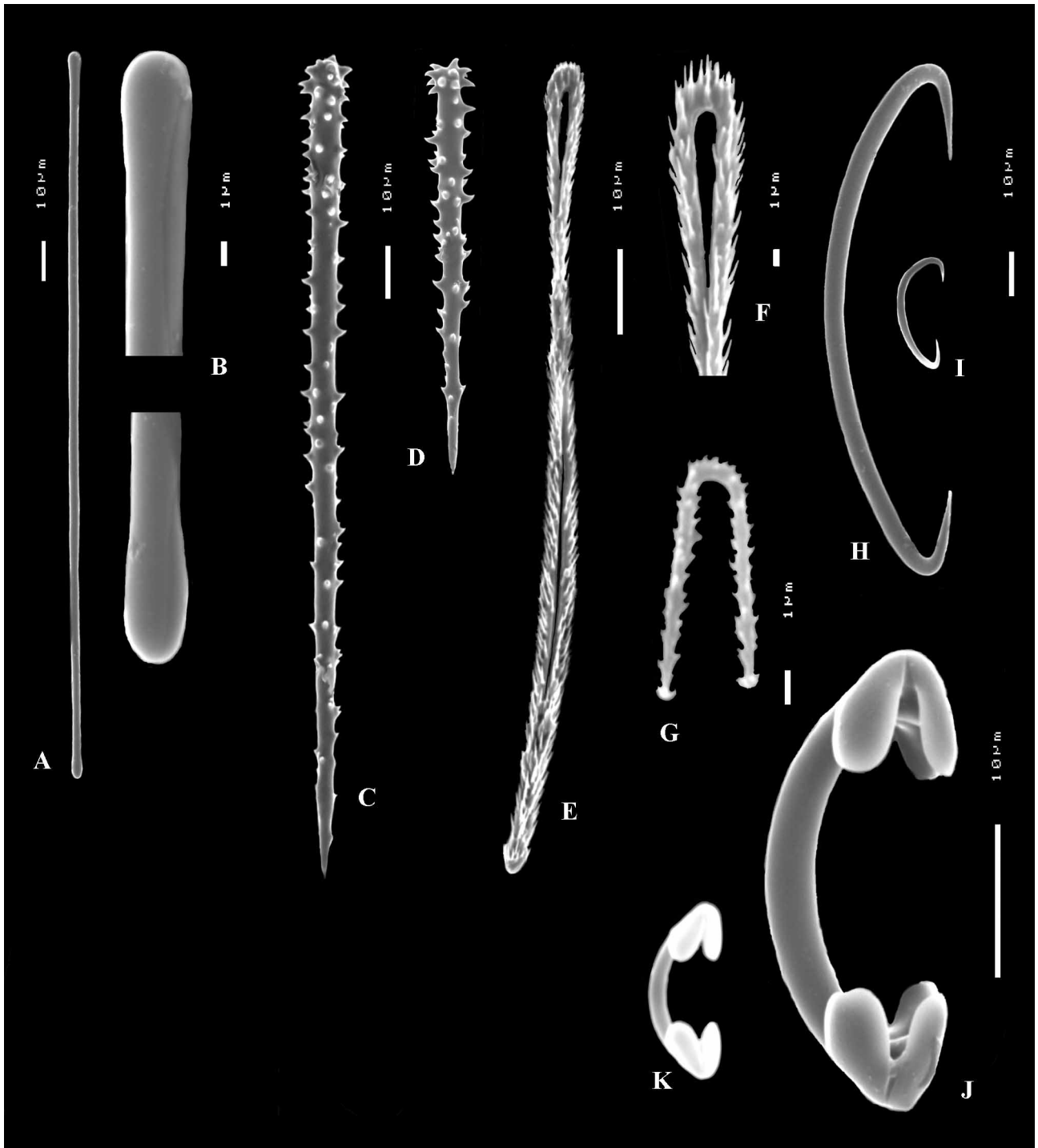


FIGURE 11. *Forcepia (Leptolabis) microlabis* n. sp., SEM images of spicules (Holotype ZMA Por. 21069). A–B. Tylote and detail of one of the apices; C. Large acanthostyle category; D. Small acanthostyle category; E–F. Entangled large forceps and detail of curved part; G. Microforceps; H–I. Large and small sigma categories; J–K. Large and small arcuate chela categories.

Forcipes in two distinct sizes and shapes, the larger (Figs 11E–F) rather peculiar with long heavily spined legs which due the narrow space between them tend to become entangled, which causes them to look as if the legs are fused at their ends, the whole spicule rather flexuous, 66–87.4–106 μm . Small forcipes (Fig. 11G) of common horseshoe shape, but so tiny and feeble that they were only observed in light microscopic preparations after they were first detected in the SEM, coarsely spined, 6–6.8–8 (legs approx. 0.5 μm in thickness).

Large sigmas (Fig. 11H), robust, evenly curved, 102–113.0–123 μm ; small sigmas (Fig. 11I), more variable in shape, including S-shaped forms, often with sharply pointed endings, 27–31.9–39 μm .

Large arcuate chelae (Fig. 11J) with fairly short alae and curved shaft, 21–30.3–32 μm , small arcuate chelae (Fig. 11K) with larger alae, 11–12.9–16 μm .

Ecology. Consolidating coarse coral sediment under rubble in deeper reef parts (35 m).

Etymology. The name refers to the tiny forceps category found in this species.

Remarks. This is the second *Forcepia* (*Leptolabis*) species recorded from the Central West Atlantic. Previously, *Forcepia* (*Leptolabis*) *vermicola* Lehnert & van Soest, 1996 (as *Forcepia* (*Trachyforcepia*)), was recorded in deep reefs (88.4 m) at the north coast of Jamaica. We take this opportunity to report its occurrence in reef caves at 10 m depth off the coast of Curaçao, collected by S. Scheffers (ZMA Por. 16597). The two species differ clearly in the presence of sigmas (absent in *F. (L.) vermicola*) and the shape and diversity of the forcipes (a single category of forceps with flaring legs in *F. (L.) vermicola*). Elsewhere, species of this subgenus occur off the coasts of the North Eastern Atlantic, in deep water off the Azores, and off the coast of West Australia (van Soest, 2002; van Soest et al. 2008, online). The new species stands out among these species by the peculiar heavily spined flexuous forceps, combined with the tiny normal forceps. The tiny forceps is shared only with *F. (L.) luciensis*, and this species also has forcipes with long spines like our new species, but these are curled into a tight ball rather than stretched out as in *F. (L.) microlabis* **n. sp.** Most of the species of this subgenus possess sigmas (the type species, *F. (L.) luciensis* (Topsent, 1888) excluded), and most are either from sciophilous or deep sea habitats. Species of the subgenus *Forcepia* also may have tiny forceps, e.g. Californian *F. (F.) hartmani* Lee, 2001 with forceps of 5–11 μm , so this is not an exclusive feature of *Leptolabis*.

The species of the Central West Atlantic assigned to *Forcepia* s.l. are keyed out below.

Key to the *Forcepia* species of the Western Atlantic.

Sponges considered here must have some form of forceps.

- | | | |
|---|--|---|
| 1 | Spicules include acanthostyles erect on the substrate | 2 |
| - | No acanthostyles | 3 |
| 2 | Sigmas present | <i>F. (L.) microlabis</i> n. sp. |
| - | No sigmas | <i>F. (L.) vermicola</i> |
| 3 | Chelae with peculiarly twisted alae in varying quantity; sigmas may be present | 4 |
| - | All chelae of symmetrical shape; no sigmas..... | 5 |
| 4 | Sigmas up to 200 μm ; tylotes only up 300 μm | <i>F. (F.) grandisigmata</i> |
| - | Sigmas, if present < 40 μm or absent; tylotes > 400 μm | <i>F. (F.) fistulosa</i> n. sp. |
| 5 | Forcipes up to 260 μm ; chelae partly with reduced alae | <i>F. (F.) colonensis</i> |
| - | Forcipes up to only 92 μm ; chelae normal | <i>F. (F.) minima</i> n. sp. |

Family Crellidae Dendy, 1922

Genus *Crella* Gray, 1867b

Subgenus *Grayella* Carter, 1869

Crella (Grayella) beglingeræ n. sp.
(Figs 12A–C)

Holotype. ZMA Por. 21073, Netherlands Antilles, Bonaire, Red Slave, 12.034°N -68.259°W, under rubble, 5 m, 01-08-1987, coll. R. Pennartz, #R10810R.

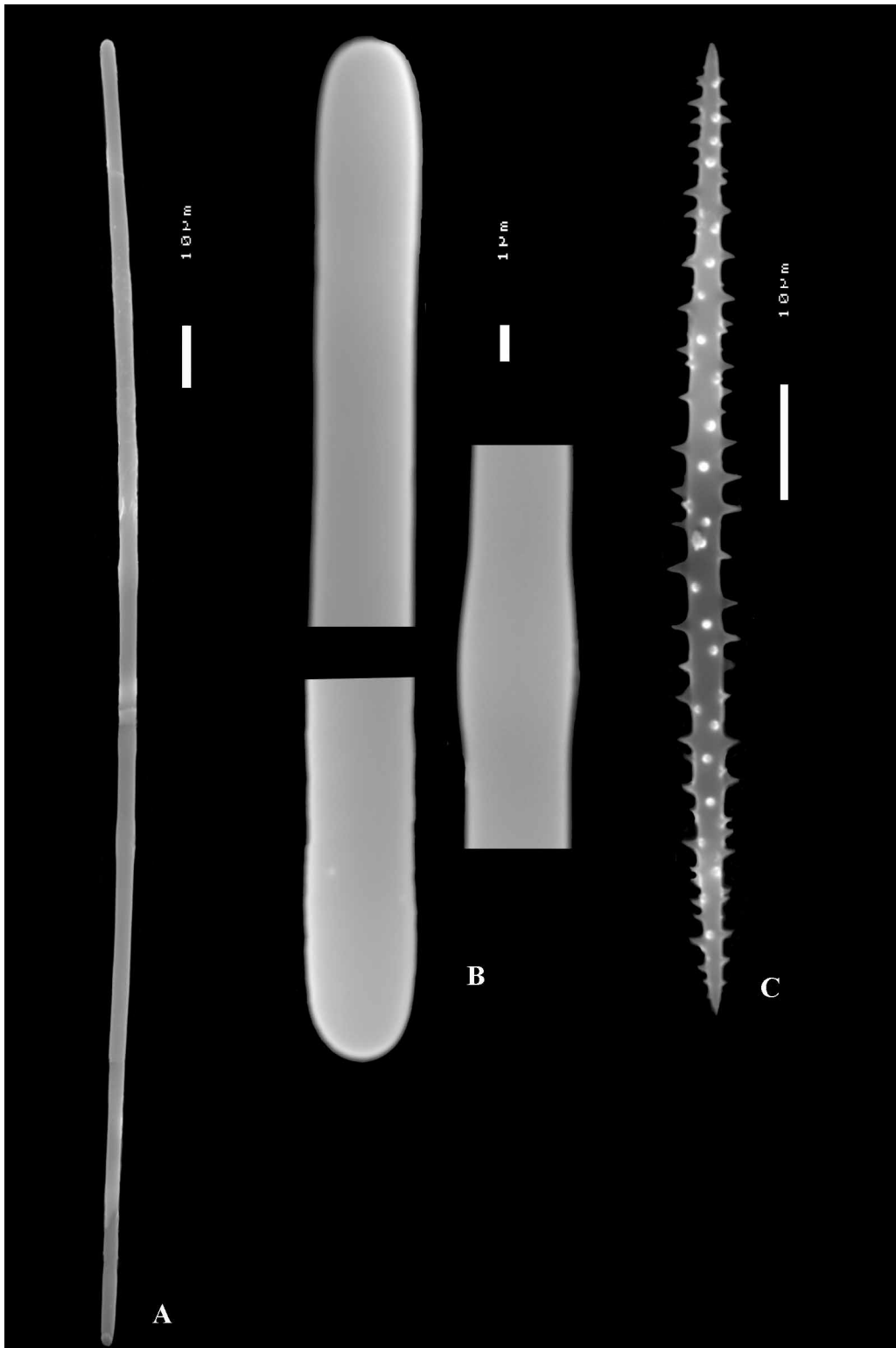


FIGURE 12. *Crella (Grayella) beglingeræ* n. sp., SEM images of spicules (Holotype ZMA Por. 21073). A–B. Polytylote strongylotornote and details of apices and middle part; C. Acanthoxea.

Paratypes. ZMA Por. 21075, Bonaire, Karpata, 12.222°N -68.351°W, under rubble, 5 m, 17-07-1987, coll. G.J. Roebbers, # K1G.16-03, 155; ZMA Por. 21074, Bonaire, Red Slave, 12.034°N -68.259°W, under rubble, 5 m, 1987, coll. G.J. Roebbers, # G03.06; ZMA Por. 05404, Curaçao, Buoy 1, 12.125°N -68.976°W, under rubble, 14 m, 25-V-1984, coll. J.H. Stock & J.J. Vermeulen.

Additional material (not belonging to the type series). ZMA Por. 16879, Curaçao, near Carmabi, 12.124°N -68.975°W, reef caves, 10-2001, coll. S. Scheffers #17; Bonaire, Punt Vierkant, 12.116°N -68.295°W, under rubble, 5 m, 1987, G.J. Roebbers & R. Pennartz; Curaçao, Anna Baai, 12.108°N -68.946°W, under rubble, 5 m, coll. E. Meesters & P. Willemsen #A24-5.

Description. Thinly encrusting, under coral rubble, surrounding *Homotrema* specimens; smooth surface, easy to peel off; soft consistency. Size of holotype approx. 1 x 1.5 x 0.1 cm. Transparent pale yellow color.

Skeleton. Surface provided with moderately dense complement of slightly raised areolae, each approx. 1.5 mm in diameter, spaced out approx. 1 mm. The sides of the areolae are supported by bundles of 3–5 tornotes at regular distances of approx. 30 µm. Surface between the areolae densely crowded by intercrossing acanthoxeas arranged in a single layer.

Spicules. Tornotes and acanthoxeas.

Tornotes (Fig. 12A–B) smooth, faintly polytylote (Fig. 10B), usually rounded but occasionally bluntly oxeote or abruptly pointed, equal ended, 201-257.3-294 x 2-3.1-4 µm.

Acanthoxeas (Fig. 12C), thinly fusiform, approx. symmetrical, little variation in shape and size, entirely spined, straight, 66- 87.2-97 x 1.5-2.3-3 µm.

Ecology. Under coral stones and in caves. So far known only from shallow-water reefs (5–14 m) on Bonaire and Curaçao.

Etymology. Named for Elly Beglinger, manager of the Porifera collection of the Zoological Museum of the University of Amsterdam.

Remarks. The subgenus *Grayella* is so far represented in the Central West Atlantic by *C. (G.) spinosa* (Hechtel, 1983 as *Crelloxea*) from Brazil. This species has large fusiform oxeote tornotes (up to 400 x 24 µm) quite unlike the thin tornotes of the present new species. The ectosomal spicules are a mix of acanthoxeas and acanthostrongyles, longer and thicker than those of *C. (G.) beglingerae* n. sp. The new species resembles Red Sea *C. (G.) cyathophora* (Carter, 1869) in spiculation, but this is an elaborate open reef species, unlike *C. (G.) beglingerae* n. sp.. Two further *Crella* species, both possessing chelae unlike our new species, are known from the Caribbean region, *Crella (Crella) papillosa* (Schmidt, 1870 as *Cribrella*) from Florida and *Crella (Pytheas) chelifera* van Soest, 1984 from Barbados, both from much deeper habitats.

Family Hymedesmiidae Topsent, 1928

Genus *Hymedesmia* Bowerbank, 1864

Subgenus *Hymedesmia* Bowerbank, 1864

Hymedesmia (Hymedesmia) bonairensis n. sp.

(Figs 13A–H)

Holotype. ZMA Por. 21065, Bonaire, Jachthaven, 12.162°N -68.286°W, under rubble, 3.5 m, 30-06-1987, coll. R. Pennaerts & G.J. Roebbers, # J.07.07-103.

Paratype. ZMA Por. 21066, same data as the holotype, coll. G.J. Roebbers #73.

Additional material (not belonging to the type series). Bonaire, Punt Vierkant, 12.116°N -68.295°W, under rubble, 5 m, 1987, coll. G.J. Roebbers, #G.02-5.

Description. Thinly encrusting under coral rubble. Surface bumpy, provided with small areolae. Color an intense rich yellow (like egg yolk) or paler yellow; in alcohol it is greyish white. Consistency soft.

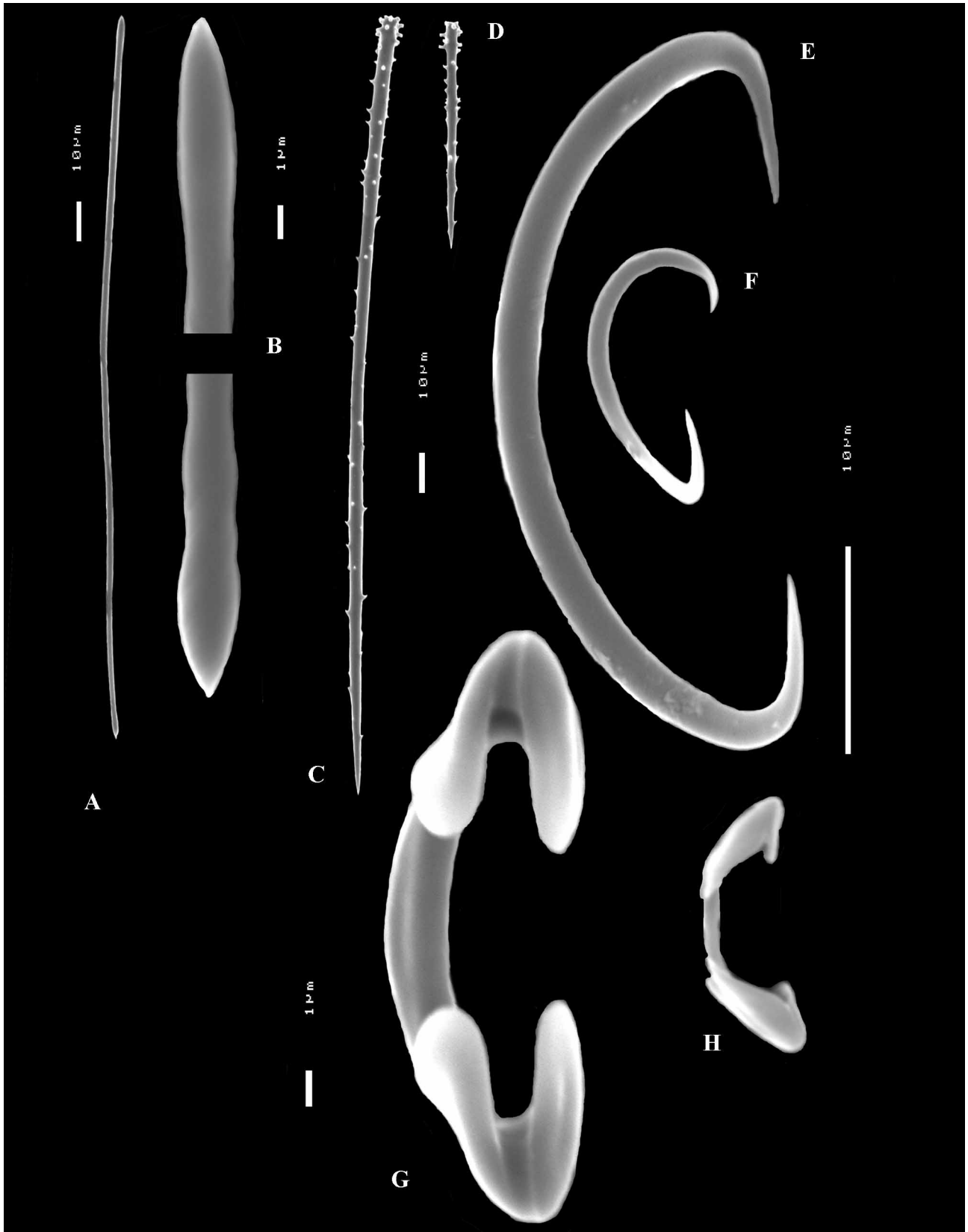


FIGURE 13. *Hymedesmia (Hymedesmia) bonairensis* n. sp., SEM images of spicules (Holotype ZMA Por. 21065). A–B. Tornote and details of apices; C. Large acanthostyle category; D. Small acanthostyle category; E–F. Large and small sigma categories; G–H. Large and small arcuate chela categories.

Skeleton. Acanthostyles erect on the surface, tornotes loosely arranged in the ectosome. Densely scattered sigmas in all parts of the sponge.

Spicules. Tornotes, acanthostyles in two size categories, isochelae in two size categories, sigmas in two size categories.

Tornotes (Figs 13A–B) thin, slim, with slightly unequal endings, one mucronate, the other oxeote, 179–192.6–213 x 1.5–2.1–2.5 μm .

Large acanthostyles (Fig. 13C), with blunt spines at the head, 144–176.1–207 x 4–5.3–6.5 μm ; small acanthostyles (Fig. 13D), 48–63.1–75 x 3–3.6–4.5 μm .

Large sigmas (Fig. 13E), shaped normally, 35–38.7–42 μm ; small sigmas (Fig. 13F), thin, shaped normally, 11–12.8–14 μm .

Large arcuate isochelae (Fig. 13G), with the shaft grooved on the outside, 17–20.6–24 μm ; small isochelae (Fig. 13H), with reduced side alae attached to the shaft over their entire length, 9–9.8–11 μm .

Ecology. Under stones at shallow depth, 3.5–5 m.

Etymology. Named after the island of Bonaire, Netherlands Antilles.

Remarks. Among the species of *Hymedesmia* (*Hymedesmia*) known from Central West Atlantic waters, the new form stands out by the possession of sigmas, in two size categories. Elsewhere in the North Atlantic Ocean, approx. 15 species of *Hymedesmia* are known to possess sigmas, but only one species, *H. ebria* Alander (1937) from deep water fjord habitat (180–210 m) in northern Norway has a similar spicule complement of sharp-ending tornotes, two size classes of acanthostyles, more than one size class of chelae and two size classes of sigmas. However, the chelae of *H. ebria* occur in three sizes, the largest of which is clearly much larger (55–75 μm) than the largest chela in our new species. Further differences are the larger size of both sigma categories in Alander's material (20–30 and 55–75 μm), and the larger size of both acanthostyle categories (350–425 and 125–145 μm).

Caribbean *Hymedesmia* (*Hymedesmia*) species comprise *H. nummota* de Laubenfels (1936) from deep water off Florida, *H. jamaicensis* van Soest (1984) from deep water off Jamaica, *H. palmatichelefera* van Soest (1984) from the Curaçao reefs, *H. agariciicola* van Soest (1984) from the Curaçao reefs, *H. curacaoensis* van Soest (1984) from the Curaçao reefs, and *H. caribica* Lehnert & van Soest (1986) from Jamaican deep reefs. *Hymedesmia agariciicola* has orange color and spicule sizes similar to that of the new species and the small chela category is similarly palmate-like, but it lacks sigmas, and the tornotes are thinner, shorter and equiended. There can be no question that the new species is conspecific with *H. agariciicola* as the sigmas are the dominant microsclere in the former. None of the other Caribbean species show close relationship with the new species in spicule complement and chela morphology.

To help identify species in this difficult group a key to the Central West Atlantic *Hymedesmia* (*Hymedesmia*) is presented below updating the table given in van Soest (1984: table 3, p. 84).

Key to the *Hymedesmia* (*Hymedesmia*) species of the Central West Atlantic

Species included always have their acanthostyles singly erect on the substrate, smooth tornotes and arcuate isochelae; they may have distinct categories of acanthostyles, chelae and additional microscleres such as sigmas.

- | | | |
|---|---|-----------------------------------|
| 1 | Sigmas are present | <i>H. (H.) bonairensis</i> n. sp. |
| - | No sigmas | 2 |
| 2 | Tornotes > 400 μm , acanthostyles > 600 μm | <i>H. (H.) nummota</i> |
| - | Tornotes <300, acanthostyles < 400 μm | 3 |
| 3 | Chelae in two size categories | <i>H. (H.) agariciicola</i> |
| - | Chelae in a single size category | 4 |
| 4 | Isochelae strongly curved with very small alae | <i>H. (H.) caribica</i> |
| - | Isochelae with normal-sized alae, with less strongly curved shaft | 5 |

- 5 Chelae > 25 μm *H. (H.) curacaoensis*
 - Chelae < 20 μm , palmate-like (alae covering the shaft) 6
 6 Large category of acanthostyles < 300 μm , tornotes less than 1 μm in thickness *H. (H.) jamaicensis*
 - Large category of acanthostyles > 300 μm , tornotes > 1.5 μm in thickness *H. (H.) palmatichelifera*

Suborder Mycalina

Family Mycalidae Lundbeck, 1905

Genus *Mycale* Gray, 1867b

Subgenus *Paresperella* Dendy, 1905

Mycale (Paresperella) vitellina sp.n.

(Figs 14A–E)

? *Mycale (Paresperella)* sp. in: Hajdu & Rützler, 1998: 766, fig. 16a–c.

Holotype. ZMA Por. 05389, Curaçao, Barbara Beach, 12.065°N -68.855°W, under coral rubble, 1–3 m, 03-06-1984, coll. J.H. Stock & J.J. Vermeulen.

Paratypes. ZMA Por. 21076, Curaçao, Cornelis Baai, 12.084°N -68.897°W, under coral rubble, 3.5 m, 13-03-1989, coll. E. Meesters & P. Willemse # C23-9; ZMA Por. 21086, Curaçao, Cornelis Baai, 12.084°N -68.897°W, under coral rubble, 4 m, 03-03-1989, coll. E. Meesters & P. Willemse #C6-12.

Additional material (not belonging to the type series). Curaçao, Cornelis Baai, 12.084°N -68.897°W, under coral rubble, 3.5 m, 1989, coll. E. Meesters & P. Willemse # C6-12; Curaçao, Cornelis Baai, 12.084°N -68.897°W, under coral rubble, 3.5 m, 1989, coll. E. Meesters & P. Willemse # C20-9; Curaçao, Blauwbaai, 12.131°N -68.987°W, under coral rubble, 35 m, 27-02-1989, coll. E. Meesters & P. Willemse #B19A1.

Description. Thin encrustation under coral rubble, up to 3 mm in thickness and several mm² in widest expansion. Consistency soft, fragile. Color: described by collectors as ‘egg-yellow’, light yellow, transparent orange.

Skeleton. Plumose, thin wavy bundles of megascleres carrying the surface membrane in which scattered megascleres are arranged tangentially, with many microscleres inbetween, notably numerous rosettes of the larger anisochelae.

Spicules. Styles, anisochelae, spined sigmas and toxas.

Styles (Figs 14A–B) relatively long and flexuous, without conspicuous subterminal constriction (looking like proper styles rather than mycalostyles), 276–307.7–348 x 1.5–2.7–3.5 μm .

Sigmas (Fig. 14C), relatively large, thin, asymmetrical with prominent long teeth on the outer curve of the larger/upper part, 78–86.4–93 μm long, 1.5–2.3–3 μm in thickness.

Anisochelae I (Fig. 14D), usually forming rosettes of 65–70 μm diameter, with relatively pointed larger alae, 21–26.9–30 μm ; anisochelae II (Fig. 14E), not forming rosettes, usually more rare than anisochelae I, thin and inconspicuous, 10–12.8–15 μm .

Ecology. Under coral rubble, 1–35 m.

Etymology. Vitellinus (Latin) = like the yolk of an egg, referring to the color of the sponge.

Remarks. A provisional description of the holotype, ZMA Por. 05389, was already provided by Hajdu & Rützler (1998: 766) in a discussion of isolated spined sigmas found in material of another *Mycale* species (*M. citrina*) from Belize. These authors also mention the presence of an isolated toxa of 34 μm long, but this could not be confirmed from the present investigation of this and other specimens quoted above, so presumably the toxa was foreign. The serrated sigmas in the Belize material were of similar size and shape, which may indicate the presence of *M. (P.) vitellina* n. sp. in Belize.

The present species is the second Central Western Atlantic species of the subgenus *Paresperella*. On

paper, the Brazilian *Mycale* (*Paresperella*) *spinosigma* (Boury-Esnault, 1973 as *Paresperella*) appears quite similar to our new species, sharing all spicule types. The Brazilian specimen, however, possessed styles neatly larger, without overlap (400–627 μm), the anisochelae I and II likewise were larger (37–53 μm and 16–19 μm), while the spined sigmas were clearly smaller (37–68 μm), although a few apparently reach 156 μm (?). Boury-Esnault (*l.c.*) also records a separate category of oxeads, larger than the styles (600–821 μm), which are an unusual spicule type for *Mycale*. The Brazilian specimen was reported from approx. 100 m depth. Combined, these differences are judged to be of specific level, but both species are considered closely related if Boury-Esnault's (*l.c.*) description is accurate. Curiously, however, Hajdu & Rützler (1998) failed to find anisochelae in the holotype of *M. spinosigma* (MNHN D NBE 968), whereas serrated sigmas were quite rare. Combined with their findings of isolated serrated sigmas in *Mycale citrina*, they arrived at the hypothesis that the serrated sigmas were possible contaminations in a specimen of uncertain affinity. The presence of *M. (P.) spinosigma* in Brazil waters needs to be confirmed.

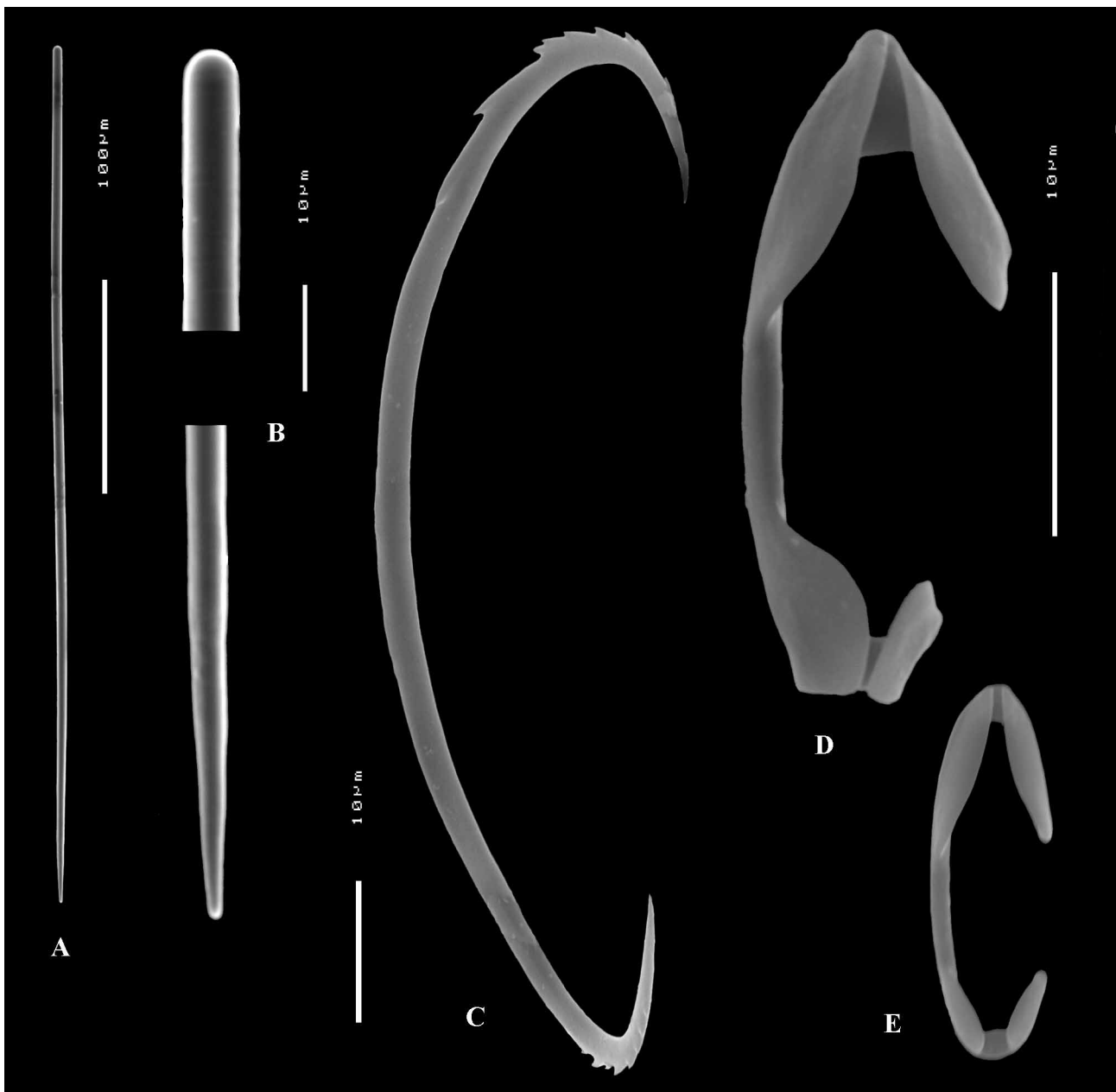


FIGURE 14. *Mycale* (*Paresperella*) *vitellina* n. sp., SEM images of spicules (Holotype ZMA Por. 05389). A–B. Style and details of the apices; C. Spined sigma; D–E. Large and small palmate chela categories.

Discussion

The present series of new species from Caribbean sciophilous habitats is only a minority of the undescribed species collected during the University of Amsterdam student investigations. Their spicule complement is sufficiently elaborate and unique to ensure that despite the small sizes and lack of *in situ* images they could be distinguished from congeners with confidence. Many other equally small species reported during the rubble and reef cavity research must remain undescribed for now as their characters in preserved condition preclude such distinction from congeners, notably in members of the Haplosclerida, microsclere-devoid Hadromerida, and the keratose groups. It is a reasonable assumption that the sciophilous habitats are poorly studied taxonomically and that the number of new species to be detected will be a magnitude higher than reported here. For a proper elucidation of the real sciophilous sponge diversity, a more focussed approach is necessary, including *in situ* microphotography, *in situ* fixation for histology, in combination with DNA barcoding for reproducible results.

Acknowledgements

Sincere thanks are due to the directors and support staff of the host institutes of the students and other collectors who brought the material together (see Material and Methods section) the CARMABI foundation at Piscadera Baai, Curaçao, the Karpata foundation at Bonaire (both run by STINAPA), and the INVEMAR at Santa Marta, Colombia. Special thanks are due to Prof. Sven Zea (INVEMAR) for his unremitting support and friendship over a period of many years. The editor, Professor Eduardo Hajdu, made valuable suggestions for improvement. Elly Beglinger and Dirk Platvoet (ZMA) assisted with the SEM work.

References

- Aerts, L.A.M. (1998) Sponge/coral interactions in Caribbean reefs: analysis of overgrowth patterns in relation to species identity and cover. *Marine Ecology Progress Series*, 175, 251–259.
- Aerts, L.A.M. & van Soest, R.W.M. (1997) Quantification of sponge/coral interactions in a physically stressed-reef-community, NE Colombia. *Marine Ecology Progress Series*, 148, 125–134.
- Alander, H. (1937) Sponges from the Trondheimsfjord and adjacent waters I. *Kongelige Norske Videnskabelige Selskab Forhandling*, 10 (18), 68–70.
- Arndt, W. (1927) Kalk- und Kieselschwämme von Curaçao. *Bijdragen tot de Dierkunde*, 25, 133–158.
- Boury-Esnault, N. (1973) Résultats scientifiques des campagnes de la ‘Calypso’. Campagne de la ‘Calypso’ au large des côtes atlantiques de l’Amérique du Sud (1961–1962). I. 29. Spongiaires. *Annales de l’Institut océanographique*, 49 (Supplement 10), 263–295.
- Bowerbank, J.S. (1858) On the anatomy and physiology of the Spongiadae. Part I. On the spicula. *Philosophical Transactions of the Royal Society*, 148 (2), 279–332.
- Bowerbank, J.S. (1862) On the anatomy and physiology of the Spongiadae. Part III On the generic characters, the specific characters, and on the method of examination. *Philosophical Transactions of the Royal Society*, 152 (2), 1087–1135.
- Carballo, J.L. & Cruz-Barraza, J.A. (2006) The genus *Timea* (Porifera: Timeidae) in the Eastern Pacific Ocean: revision of type material, new species and intraspecific variability. *Cahiers de Biologie Marine*, 47 (3), 301–320.
- Carter, H.J. (1869) On *Grayella cyathophora*, a new genus and species of sponges. *Annals and Magazine of Natural History*, (4) 4, 189–197.
- Carter, H.J. (1874) Descriptions and figures of deep-sea sponges and their spicules from the Atlantic Ocean, dredged up on board H.M.S. ‘Porcupine’, chiefly in 1869; with figures and descriptions of some remarkable spicules from the Agulhas Shoal and Colon, Panama. *Annals and Magazine of Natural History*, (4) 14, 207–221.
- Carter, H.J. (1876) Descriptions and figures of deep-sea sponges and their spicules, from the Atlantic Ocean, dredged up on board H.M.S. ‘Porcupine’, chiefly in 1869 (concluded). *Annals and Magazine of Natural History*, (4) 18, 226–240, 307–324, 388–410, 458–479.
- Carter, H.J. (1879b) Contributions to our knowledge of the Spongida. *Annals and Magazine of Natural History*, (5) 3,

284–304, 343–360.

- Carter, H.J. (1880) Report on specimens dredged up from the Gulf of Manaar and presented to the Liverpool Free Museum by Capt. W.H. Cawne Warren. *Annals and Magazine of Natural History*, (5) 6, 35–61, 129–156.
- Carter, H.J. (1882) Some sponges from the West Indies and Acapulco in the Liverpool Free Museum described, with general and classificatory remarks. *Annals and Magazine of Natural History*, (5) 9, 266–301, 346–368.
- Carter, H.J. (1886) Descriptions of sponges from the neighbourhood of Port Phillip Heads, South Australia, continued. *Annals and Magazine of Natural History*, (5) 17, 40–53, 112–127, 431–441, 502–516.
- Coelho, E.P. & Mello-Leitão, A. (1978) *Placospongia carinata* e sua ocorrência em costas brasileiras. *Avulso Departamento de Zoologia, Universidade Federal do Rio de Janeiro, Rio de Janeiro*, 29, 1–5.
- Dendy, A. (1905) Report on the sponges collected by Professor Herdman, at Ceylon, in 1902. In: Herdman, W.A. (Ed.), *Report to the Government of Ceylon on the Pearl Oyster Fisheries of the Gulf of Manaar*. 3 (Supplement 18). Royal Society, London, p. 57–246.
- Dendy, A. (1917) On the occurrence of gelatinous spicules, and their mode of origin, in a new genus of siliceous sponges. *Proceedings of the Royal Society*, (B) 89, 315–322.
- Dendy, A. (1922) Report on the Sigmatotetraxonida collected by H.M.S. 'Sealark' in the Indian Ocean. In: Reports of the Percy Sladen Trust Expedition to the Indian Ocean in 1905, Volume 7. *Transactions of the Linnean Society of London*, (2) 18 (1), 1–164.
- Díaz, M.C. (2005) Common sponges from shallow-marine habitats from Bocas del Toro region, Panama. *Caribbean Journal of Science*, 41 (3), 465–475.
- Duchassaing De Fonbressin, P. & Michelotti, G. (1864) Spongiaires de la mer Caraïbe. *Natuurkundige Verhandelingen van de Hollandsche Maatschappij der Wetenschappen te Haarlem*, 21 (2), 1–124.
- George, W.C & Wilson, H.V (1919) Sponges of Beaufort (N.C.) harbor and vicinity. *Bulletin of the Bureau of Fisheries Washington*, 36, 129–179.
- Gonzales-Farías, F (1989) Estudio al microscopio electrónico de barrido de la estructura esquelética de la esponja *Placospongia melobesioides* Gray. *Anales del Instituto de Ciencias del Mar y Limnología Universidad Nacional Autónoma de México*, 16 (1), 81–90.
- Gray, J.E (1867a) On *Placospongia*, a new generic form of Spongiadae in the British Museum. *Proceedings of the Zoological Society of London*, 1867 (1), 127–129.
- Gray, J.E. (1867b) Notes on the arrangement of sponges, with the descriptions of some new genera. *Proceedings of the Zoological Society of London*, 1867 (2), 492–558.
- Green, G. & Gómez, P. (1986). Estudio taxonómico de las esponjas de la Bahía de Mazatlán, Sinaloa, México. *Anales del Instituto de Ciencias del Mar y Limnología del Universidad Nacional Autónoma de México*, 13 (3), 273–300.
- Hajdu, E. & Rützler, K. (1998) Sponges, genus *Mycale* (Poecilosclerida: Demospongiae: Porifera), from a Caribbean mangrove and comments on subgeneric classification. *Proceedings of the Biological Society of Washington*, 111 (4), 737–773.
- Hallmann, E.F. (1920) New genera of monaxonid sponges related to the genus *Clathria*. *Proceedings of the Linnean Society of New South Wales*, 44 (4), 767–792.
- Hanitsch, R. (1895) Notes on a collection of sponges from the west coast of Portugal. *Transactions of the Liverpool Biological Society*, 9, 205–219.
- Hechtel, G.J. (1965) A Systematic study of the Demospongiae of Port Royal, Jamaica. *Bulletin of the Peabody Museum of Natural History*, 20, 1–103.
- Hechtel, G.J. (1969) New species and records of shallow water Demospongiae from Barbados, West Indies. *Postilla*, 132, 1–38.
- Hechtel, G.J. (1976) Zoogeography of Brazilian Marine Demospongiae. Pp. 237–260. In: Harrison, F.W. & Cowden, R.R. (Eds), *Aspects of Sponge Biology*. Academic Press, New York & London, i–xiii, 1–354.
- Hechtel, G.J. (1983) New species of marine Demospongiae from Brazil. *Iheringia (Zoologia)*, 63, 58–78.
- Hentschel, E. (1909) Tetraxonida. I. Teil. Pp. 347–402. In: Michaelsen, W. & Hartmeyer, R. (Eds), *Die Fauna Südwest-Australiens. Ergebnisse der Hamburger südwest-australischen Forschungsreise 1905*. Volume 2 (21). Fischer, Jena.
- Higgin, T. (1877) Description of some sponges obtained during a cruise of the steam-yacht 'Argo' in the Caribbean and neighbouring seas. *Annals and Magazine of Natural History*, (4) 19, 291–299.
- Hooper, J.N.A. (1996a) Revision of Microcionidae (Porifera: Poecilosclerida: Demospongiae), with description of Australian species. *Memoirs of the Queensland Museum*, 40, 1–626.
- Hooper, J.N.A. (2002a) Family Acarnidae Dendy, 1922. Pp. 412–431. In: Hooper, J. N. A. & Van Soest, R. W. M. (Eds.) *Systema Porifera. A guide to the classification of sponges*, 1. Kluwer Academic/ Plenum Publishers, New York, Boston, Dordrecht, London, Moscow.
- Hooper, J.N.A. (2002b) Family Microcionidae Carter, 1875. Pp. 432–468. In: Hooper, J. N. A. & Van Soest, R. W. M. (Eds.) *Systema Porifera. A guide to the classification of sponges*, 1. Kluwer Academic/ Plenum Publishers, New York, Boston, Dordrecht, London, Moscow.
- Hooper, J.N.A. & van Soest, R.W.M. (Eds.) (2002) *Systema Porifera. A guide to the classification of sponges*, 1 & 2.

- Kluwer Academic/ Plenum Publishers, New York, Boston, Dordrecht, London, Moscow, 1810 pp.
- Humann, P. (1992) Reef creature identification. Florida Caribbean Bahamas. New World Publications, Jacksonville, Fla., pp. 1–344.
- Kieschnick, O. (1896) Silicispongiae von Ternate nach den Sammlungen von Herrn Prof. Dr. W. Kükenthal. *Zoologischer Anzeiger*, 19 (520), 526–534.
- Kirkpatrick, R. (1903) Descriptions of South African sponges. Part II. *Marine Investigations in South Africa*, 2 (14), 171–180.
- Kobluk, D.R. & van Soest, R.W.M. (1989) Cavity-dwelling sponges in a Southern Caribbean coral reef and their paleontological implications. *Bulletin of Marine Science*, 44 (3), 1207–1235.
- Laubenfels, M.W. de (1936a) A discussion of the sponge fauna of the Dry Tortugas in particular and the West Indies in general, with material for a revision of the families and orders of the Porifera. *Carnegie Institute of Washington (Tortugas Laboratory Paper N° 467)*, 30, 1–225.
- Laubenfels, M.W. de (1936b) A comparison of the shallow-water sponges near the Pacific end of the Panama Canal with those at the Caribbean end. *Proceedings of the United States National Museum*, 83 (2993), 441–466.
- Laubenfels, M.W. de (1950) The Porifera of the Bermuda Archipelago. *Transactions of the Zoological Society of London*, 27(1), 1–154.
- Laubenfels, M.W. de (1954) Occurrence of sponges in an aquarium. *Pacific Science*, 8, 337–340.
- Laubenfels, M.W. de (1955a) Porifera. Pp. E21–E112. In: Moore, R.C. (Ed.), *Treatise on Invertebrate Paleontology. Part E, Archaeocyatha and Porifera*. Geological Society of America and University of Kansas Press, New York & Lawrence, Kansas, i–xviii, E1–E122.
- Laubenfels, M.W. de (1955b) The sponges of Onotoa. *Pacific Science*, 9 (2), 137–143.
- Laubenfels, M.W. de (1956) Preliminary discussion of the sponges of Brasil. *Contribuições Avulsas Instituto Oceanográfico São Paulo*, 1, 1–4.
- Lee, W.L. (2001) Four new species of *Forcepia* (Porifera, Demospongiae, Poecilosclerida, Coelosphaeridae) from California, and synonymy of *Wilsa* de Laubenfels, 1930, with *Forcepia* Carter, 1874. *Proceedings of the California Academy of Sciences*, 52 (18), 227–244.
- Lehnert, H. & Heimler, W. (2001) Description of the North Jamaican *Timea micraster* n.sp. (Porifera: Demospongiae: Hadromerida: Timeidae). *Beaufortia*, 51 (12), 213–220.
- Lehnert, H. & van Soest, R.W.M. (1996) North Jamaican deep fore-reef sponges. *Beaufortia*, 46 (4), 53–81.
- Lendenfeld, R. Von (1897) Spongien von Sansibar. *Abhandlungen der Senckenbergischen naturforschenden Gesellschaft*, 21, 93–133.
- Lévi, C. (1956) Spongiaires des côtes de Madagascar. *Mémoires de l'Institut scientifique de Madagascar*, (A) 10, 1–23.
- Lévi, C. (1961) Résultats scientifiques des Campagnes de la 'Calypso'. Campagne 1954 dans l'Océan Indien (suite). 2. Les spongiaires de l'Île Aldabra. *Annales de l'Institut océanographique*, 39 (1), 1–32.
- Lévi, C. (1969) Spongiaires du Vema Seamount (Atlantique Sud). *Bulletin du Muséum national d'Histoire naturelle*, (2) 41 (4), 952–973.
- Lindgren, N.G. (1898) Beitrag zur Kenntniss der Spongienfauna des Malayischen Archipels und der chinesischen Meere. *Zoologische Jahrbücher Abteilung für Systematik, Geographie und Biologie der Thiere*, 11, 283–378.
- Little, F.J. Jr. (1963) The sponge fauna of the St. George's Sound, Apalache Bay, and Panama City Regions of the Florida Gulf Coast. *Tulane Studies in Zoology*, 11 (2), 31–71.
- Lundbeck, W. (1905) Porifera. (Part II.) Desmacidonidae (pars). *The Danish Ingolf-Expedition*, 6 (2), 1–219.
- Maldonado, M. (2002) Family Pachastrellidae. Pp. 141–162. In: Hooper, J.N.A., van Soest, R.W.M. (Eds) *Systema Porifera. A guide to the classification of sponges*. Kluwer Academic/Plenum Publ., New York, 1708 pp.
- Meesters, E., Knijn, R., Willemsen, P., Pennartz, R. Roebbers, G. & van Soest, R.W.M. (1991) Sub-rubble communities of Curaçao and Bonaire coral reefs. *Coral Reefs*, 10 (4), 189–197.
- Mothes, B., Campos, M.A. de, Lerner, C.B. & da Silva, C.M.M. (2006) Esponjas (Porifera, Demospongiae) da plataforma continental ao largo do Estado do Amapá, Brasil. *Revista Brasileira de Zoologia*, 23 (3), 667–677.
- Mothes, B., Santos, C.P. & Campos, M.A. (2004). *Timea bioxyasterina* sp.n., a new species from the Northeastern coast of Brazil (Demospongiae, Hadromerida). *Zootaxa*, 443, 1–8.
- Nichols, S.A. & Barnes, P.A.G. (2005) A molecular phylogeny and historical biogeography of the marine sponge genus *Placospongia* (Phylum Porifera) indicate low dispersal capabilities and widespread cryptic speciation. *Journal of Experimental Marine Biology and Ecology*, 323, 1–15.
- Pulitzer-Finali, G. (1978). Report on a collection of sponges from the Bay of Naples. III Hadromerida, Axinellida, Poecilosclerida, Halichondrida, Haplosclerida. *Bollettino dei Musei e degli Istituti Biologici della Università di Genova*, 45, 7–89.
- Pulitzer-Finali, G. (1983) A collection of Mediterranean Demospongiae (Porifera) with, in appendix, a list of the Demospongiae hitherto recorded from the Mediterranean Sea. *Annali del Museo Civico di Storia Naturale Giacomo Doria*, 84, 445–621.
- Pulitzer-Finali, G. (1986) A collection of West Indian Demospongiae (Porifera). In appendix, a list of the Demospongiae

- hitherto recorded from the West Indies. *Annali del Museo Civico di Storia Naturale Giacomo Doria*, 86, 65–216.
- Rua, C.P.J., Mattos, A. & Solé-Cava (2006) Cryptic speciation and correspondence between spiculation and molecular markers in *Placospongia*. P. 197, In: *Book of Abstracts 7th International Sponge Symposium, Biodiversity, Innovation, Sustainability*. Museu Nacional, Rio de Janeiro.
- Rützler, K. (1986) Phylum Porifera (Sponges). Pp. 111–126, In: W. Sterrer (Ed.) *Marine Fauna and Flora of Bermuda*. John Wiley & Sons, New York, i–xxx, 1–742.
- Rützler, K. (2002a) Family Placospongiidae Gray, 1867. Pp. 196–200. In: Hooper, J. N. A. & Van Soest, R. W. M. (Eds.) *Systema Porifera. A guide to the classification of sponges*, 1. Kluwer Academic/ Plenum Publishers, New York, Boston, Dordrecht, London, Moscow.
- Rützler, K. (2002b) Family Timeidae Topsent, 1928. Pp. 266–267. In: Hooper, J. N. A. & Van Soest, R. W. M. (Eds.) *Systema Porifera. A guide to the classification of sponges*, 1. Kluwer Academic/ Plenum Publishers, New York, Boston, Dordrecht, London, Moscow.
- Rützler, K., Díaz, M.C., van Soest, R.W.M., Zea, S., Smith, K.P., Alvarez, B. & Wulff (2000) Diversity of sponge fauna in mangrove ponds, Pelican Cays, Belize. *Atoll Research Bulletin*, 476, 230–248.
- Rützler, K., Piantoni, C. & Díaz, M.C. (2007) *Lissodendoryx*: rediscovered type and new tropical western Atlantic species (Porifera: Demospongiae: Poecilosclerida: Coelosphaeridae). *Journal of the Marine Biological Association of the United Kingdom*, 87 (6), 1491–1510.
- Samaai, T. (2006) Biodiversity "hotspots", patterns of richness and endemism, and distribution of marine sponges in South Africa based on actual and interpolation data: A comparative approach. *Zootaxa*, 1358, 1–37.
- Samaai, T., Keyzers, R. & Davies-Coleman, M. (2004) A new species of *Strongylodesma* Lévi, 1969 (Porifera; Demospongiae; Poecilosclerida; Latrunculiidae) from Aliwal Shoal on the east coast of South Africa. *Zootaxa*, 584, 1–11.
- Sarà, M. (1959) Specie nuove di Demospongie provenienti da acque superficiali del golfo di Napoli. *Annuario dell'Istituto e Museo de Zoologia dell'Università di Napoli*, 11 (7), 1–22.
- Sarà, M. & Bavestrello, G. (1996) West Indies genera *Columnitis*, *Tectitethya* and *Nucleotethya* new genus, with description of new species (Porifera, Tethyidae). *Bulletin of Marine Science*, 59 (2), 370–392.
- Sarà, M. & Siribelli, L. (1960) La fauna di Poriferi delle 'secche' del Golfo di Napoli. 1. La 'secca' della Gaiola. *Annuario dell'Istituto e Museo de Zoologia dell'Università di Napoli*, 12 (3), 1–93.
- Schmidt, O. (1870) *Grundzüge einer Spongien-Fauna des atlantischen Gebietes*. Wilhelm Engelmann, Leipzig, p. iii–iv, 1–88.
- van Soest, R.W.M. (1984) Marine sponges from Curaçao and other Caribbean localities. Part III. Poecilosclerida. *Studies on the Fauna of Curaçao and other Caribbean Islands*, 62 (191), 1–173.
- van Soest, R.W.M. (2002a) Family Chondropsidae Carter, 1886. Pp. 521–527. In: Hooper, J. N. A. & Van Soest, R. W. M. (Eds.) *Systema Porifera. A guide to the classification of sponges*, 1. Kluwer Academic/ Plenum Publishers, New York, Boston, Dordrecht, London, Moscow.
- van Soest, R.W.M. (2002b) Family Coelosphaeridae Dendy, 1922. Pp. 528–546. In: Hooper, J. N. A. & Van Soest, R. W. M. (Eds.) *Systema Porifera. A guide to the classification of sponges*, 1. Kluwer Academic/ Plenum Publishers, New York, Boston, Dordrecht, London, Moscow.
- van Soest, R.W.M., Hooper, J.N.A. & Hiemstra, F. (1991). Taxonomy, phylogeny and biogeography of the marine sponge genus *Acarus* (Porifera: Poecilosclerida). *Beaufortia* 42(3), 49–88.
- van Soest, R.W.M., Zea, S. & Kielman, M. (1994) New species of *Zyzzya*, *Cornulella*, *Damiria*, and *Acheliderma* (Porifera: Poecilosclerida), with a review of fistular genera of Iophonidae. *Bijdragen tot de Dierkunde*, 64 (3), 163–192.
- van Soest, R.W.M., Boury-Esnault, N., Hooper, J.N.A., de Voogd, N.J., Rützler, K., Alvarez de Glasby, B., Hajdu, E., Pisera, A., Vacelet, J., Manconi, R., Schoenberg, C., Janussen, D., Tabachnick, K.R. & Klautau, M. (2008) *World Porifera Database*. Available online at <http://www.marinespecies.org/porifera>. Consulted on 2008-11-15.
- Sollas, W.J. (1888) Report on the Tetractinellida collected by H.M.S. Challenger, during the years 1873–1876. *Report on the Scientific Results of the Voyage of H.M.S. Challenger, 1873–1876. Zoology*, 25 (63), 1–458.
- Topsent, E. (1888) Contribution à l'étude des Clionides. *Archives de Zoologie expérimentale et générale*, (2) 5bis, 1–165.
- Topsent, E. (1893) Nouvelle série de diagnoses d'éponges de Roscoff et de Banyuls. *Archives de Zoologie expérimentale et générale*, (3) 1 (Notes et Revue 10), xxxiii–xliv.
- Topsent, E. (1901) Éponges nouvelles des Açores. *Mémoires de la Société zoologique de France*, 14, 448–466
- Topsent, E. (1928) Spongiaires de l'Atlantique et de la Méditerranée provenant des croisières du Prince Albert ler de Monaco. *Résultats des campagnes scientifiques accomplies par le Prince Albert I de Monaco*, 74, 1–376.
- Topsent, E. (1934) Éponges observées dans les parages de Monaco. (Première partie) *Bulletin de l'Institut océanographique, Monaco*, 650, 1–42.
- Vacelet, J. & Vasseur, P. (1965) Spongiaires des grottes et surplombs des récifs de Tuléar (Madagascar). *Recueil des Travaux de la Station marine d'Endoume*, 2–4, 71–123.
- Vosmaer, G.C.J. & Vernhout, J.H (1902) The Porifera of the Siboga-Expedition. I. The genus *Placospongia*. In: Weber,

- M. (Ed.), *Siboga-Expeditie. Uitkomsten op zoologisch, botanisch, oceanographisch en geologisch gebied verzameld in Nederlandsch Oost-Indië 1899–1900aan boord H.M. ‘Siboga’ onder commando van Luitenant ter Zee 1e kl. G.F. Tydeman. 9 (Monographie Via)*. E.J. Brill, Leiden, 1–17.
- Wiedenmayer, F. (1977b) Shallow-water sponges of the western Bahamas. *Experientia Supplementum*, 28, 1–287.
- Zea, S. (1987) *Esponjas del Caribe Colombiano*. Catálogo Científico, Bogotá, Colombia, 1–286.