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104(1), 1991, pp. 189-205THE CHALINIDAE (PORIFERA) OF TWIN CAYS,
BELIZE, AND ADJACENT WATERS

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Abstract.—Eight species of the sponge family Chalinidae Gray (Haplosclerida, Demospongiae) are described from shallow-water habitats, primarily mangroves, of Twin Cays and Glover's Reef, Belize. Four species are new: *Haliclona mucifibrosa*, *H. magnifica*, *H. twincayensis*, and *H. pseudomolitba*. A key to the species and illustrations are provided.

The Twin Cays mangrove islands (16°49.4'N, 88°05.8'W) are situated about 3 km northwest of Carrie Bow Cay (Belize) on the southern extent of the extensive Belizean barrier reef complex (Fig. 1) (Rützler & Macintyre 1982). The islands harbor a rich sponge fauna, with a fair number of species possibly new to science. From collecting and monitoring studies by two of us (K. Rützler & K. Smith) during 1984-1989, it was determined that the sponge family Chalinidae Gray (Haplosclerida: Demospongiae) is represented by eight species, four of which are still undescribed. The goal of the present paper is to describe these four new species and to elucidate the taxonomic identity of the four species by comparison with type material. A key to the species is provided and based on characters of living and preserved specimens. One of the new species was never collected outside Belize. The other three have been found in the Florida Keys; one also in Curaçao, the Bahamas and Colombia; and one also in Guadeloupe. It seems therefore reasonable to designate paratypes from other localities than Twin Cays as well. The grouping of the species follows the classification of the Chalinidae as proposed by de Weerd (1989). The renewed use of the family name Chalinidae instead of Haliclonaidae was justified by de Weerd (1986).

Materials and Methods

Most of the material has been collected by K. Rützler and K. Smith at Twin Cays during 1984-1986, 1988 and 1989, and by W. H. de Weerd in December 1988. This material is housed in the collection of the National Museum of Natural History (NMNH) and catalogued under numbers of the United States National Museum (USNM). W. H. de Weerd has had the opportunity to collect sponges from several other Caribbean localities during cruises to the Lesser Antilles in March/April and June/July 1989 on the R/V *Seward Johnson*, and during a field trip to the Florida Keys in July 1989. This material is incorporated in the sponge collections of NMNH and the Zoological Museum Amsterdam (ZMA), the Netherlands. A few specimens have also been collected by W. H. de Weerd in Curaçao in December 1986 and are part of the ZMA collection. Type material has been examined at the Peabody Museum of Natural History, Yale University (YPM), New Haven, Connecticut, and at ZMA. The present descriptions are based on external morphological characters and the architecture of the skeleton. To study skeleton architecture and spicules, hand-cut tangential sections of the ectosome and cross sections of the choanosome have been made. Spicule sizes are

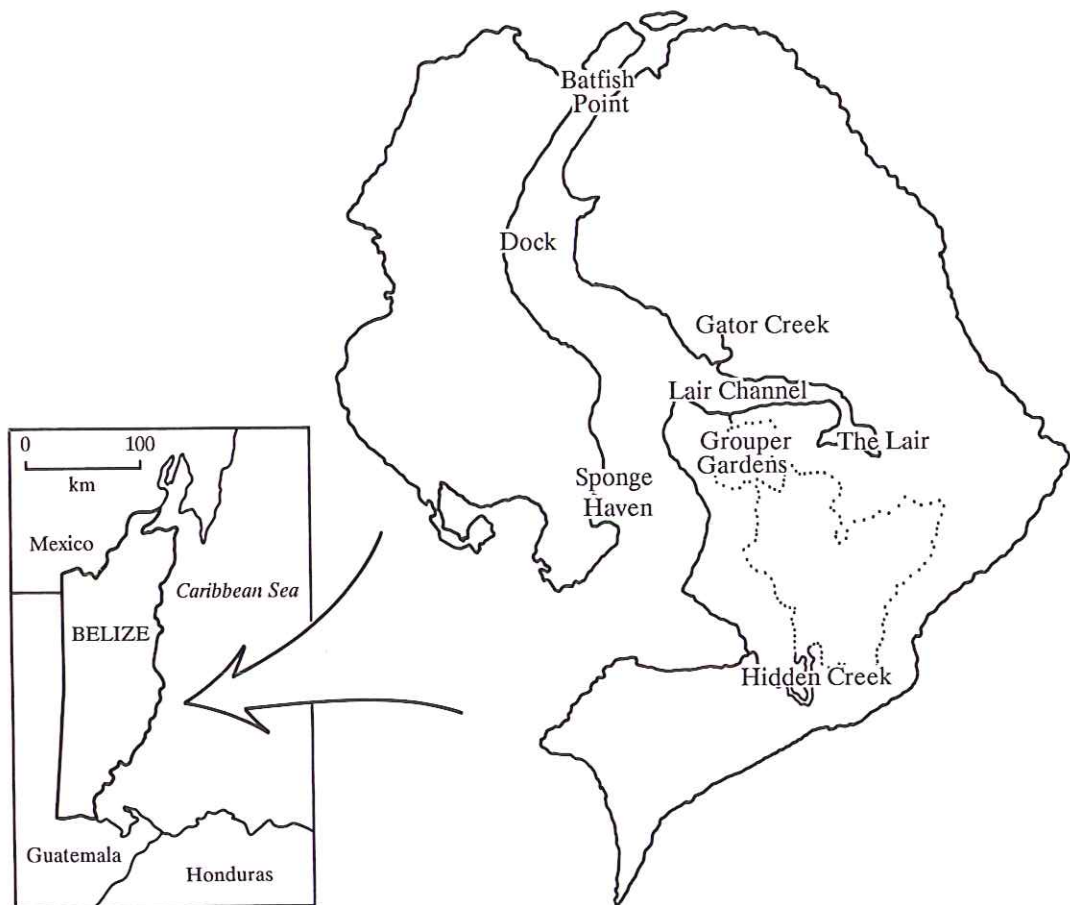


Fig. 1. Map of Belize detailing study sites at Twin Cays.

based on measurements of 25 fully-developed spicules in each specimen.

Systematic Descriptions

Order Haplosclerida Topsent

Family Chalinidae Gray

Genus *Haliclona* Grant, 1835

Species of the *fistulosa* Group

Architectural plan (Fig. 2a, b).—Choanosomal skeleton a rather dense, subisotropic reticulation, usually intercepted by many choanosomal spaces. Ectosomal skeleton of the same structure as the choanosome; ectosome usually very loosely overlaying the choanosome from which it is separated by extensive subectosomal spaces.

Haliclona mucifbrosa, new species

Figs. 2a–c, 3b, 4a, b

Type material.—Holotype, USNM 41517 (Belize, Twin Cays, Sponge Haven, 0.2 m, 26 Apr 1989, coll. K. Rützler & K. Smith). Paratypes, USNM 41521 (=ZMA 7580) (Belize, Twin Cays, Sponge Haven, NE corner, on oyster shells, 5 Jun 1984, coll. K. Rützler & K. Smith); USNM 41762 (Florida, Florida Keys, ca. 1 km NW of Menon Island, back reef flat, on sandy bottom, ca. 1 m, 13 Jul 1989, coll. W. H. de Weerd & S. Viada); ZMA POR. 6403 (Curaçao, entrance Fuikbaai, on sandy bottom, 3 m, 13 Jan 1987, coll. W. H. de Weerd & P. Hoetjes). Additional material, USNM 41518 (Belize, Twin Cays, Batfish Point, on

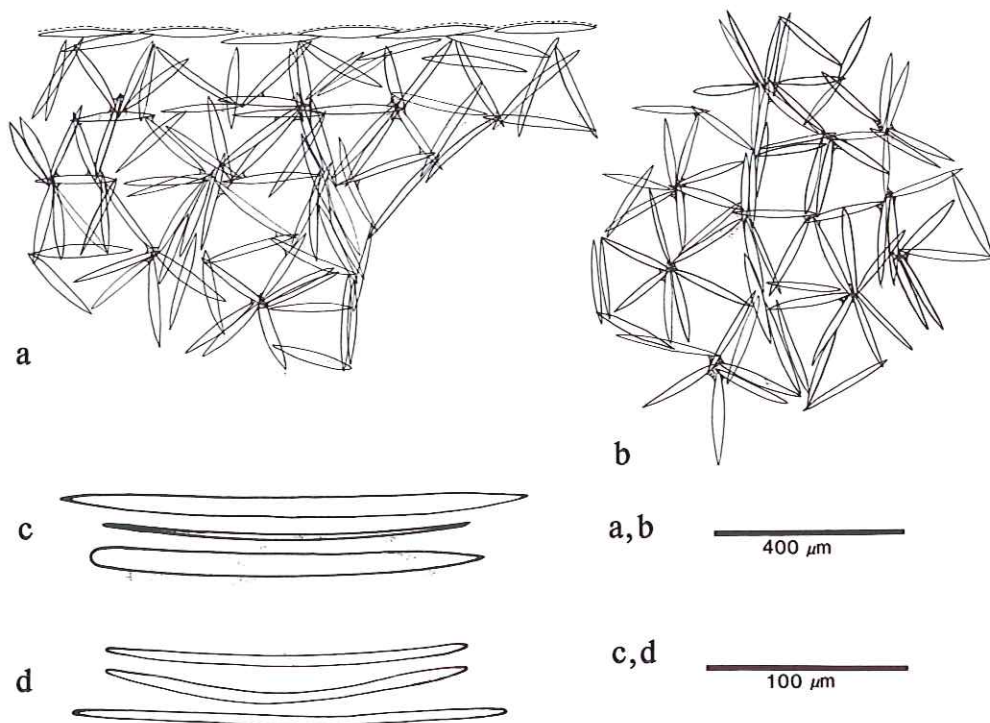


Fig. 2. Chaliniidae of the *fistulosa* Group: a, Choanosomal skeleton; b, Ectosomal skeleton; c, Spicules of *Haliclona mucifibrosa*; d, Spicules of *H. magnifica*.

mangrove roots and bank, 0–1 m, 28 Apr 1986, coll. K. Smith & K. Rützler); USNM 41519 (Belize, Twin Cays, Grouper Gardens, 0.5 m, 19 Apr 1986, coll. K. Rützler & K. Smith); USNM 41520 (Belize, Twin Cays, Sponge Haven, 21 Apr 1986, associated with *Xestospongia wiedenmayeri* van Soest, coll. K. Rützler & K. Smith); Bahamas, USNM 33572 (Bahamas, Andros Island, 30 m, 1982, coll. British Cave Diving Expedition); Florida, USNM 41761 (Florida, Biscayne Bay, Jul 1948, coll. M. W. de Laubenfels; unpublished specimen, originally identified by de Laubenfels as *Haliclona*); USNM 41763 (Florida, Florida Keys, under the bridge between Ramrod Key and Little Torch Key, pillars and muddy bottom, 1–3 m, 11 Jul 1989, coll. W. H. de Weerd & S. Viada); USNM 41764 (Florida, Florida Keys, unnamed mangrove island ca. 400 m E of Big Torch Key, on mangrove roots, 12 Jul 1989, coll. W. H. de Weerd

& S. Viada); Colombia, USNM 41832 (Colombia, Bahia Portete, Guajira peninsula, 0.5 m, on lower parts of *Millepora* on *Thalassia*, 27 Jul 1987, coll. S. Zea).

Diagnosis.—Shape: Irregularly lumpy, massive base, typically about 10 cm in diameter, from which arise short (2–3 cm), truncate, rather thick-walled oscular chimneys. Oscules to 1 cm in diameter. Lateral expansions (fistules) 10–15 cm or more.

Color: Greyish purple to bluish gray in life (Fig. 3b).

Surface: Smooth, but occasionally with tuberculate areas caused by short fistule-like projections.

Consistency: Elastic compressible but easily torn; pronounced mucus strands appear when fragments are torn apart.

Choanosomal skeleton: Subisotropic, rigid reticulation of high spicule density, spongin inconspicuous (Figs. 2a, 4a).

Ectosomal skeleton: Tangential, sub-iso-

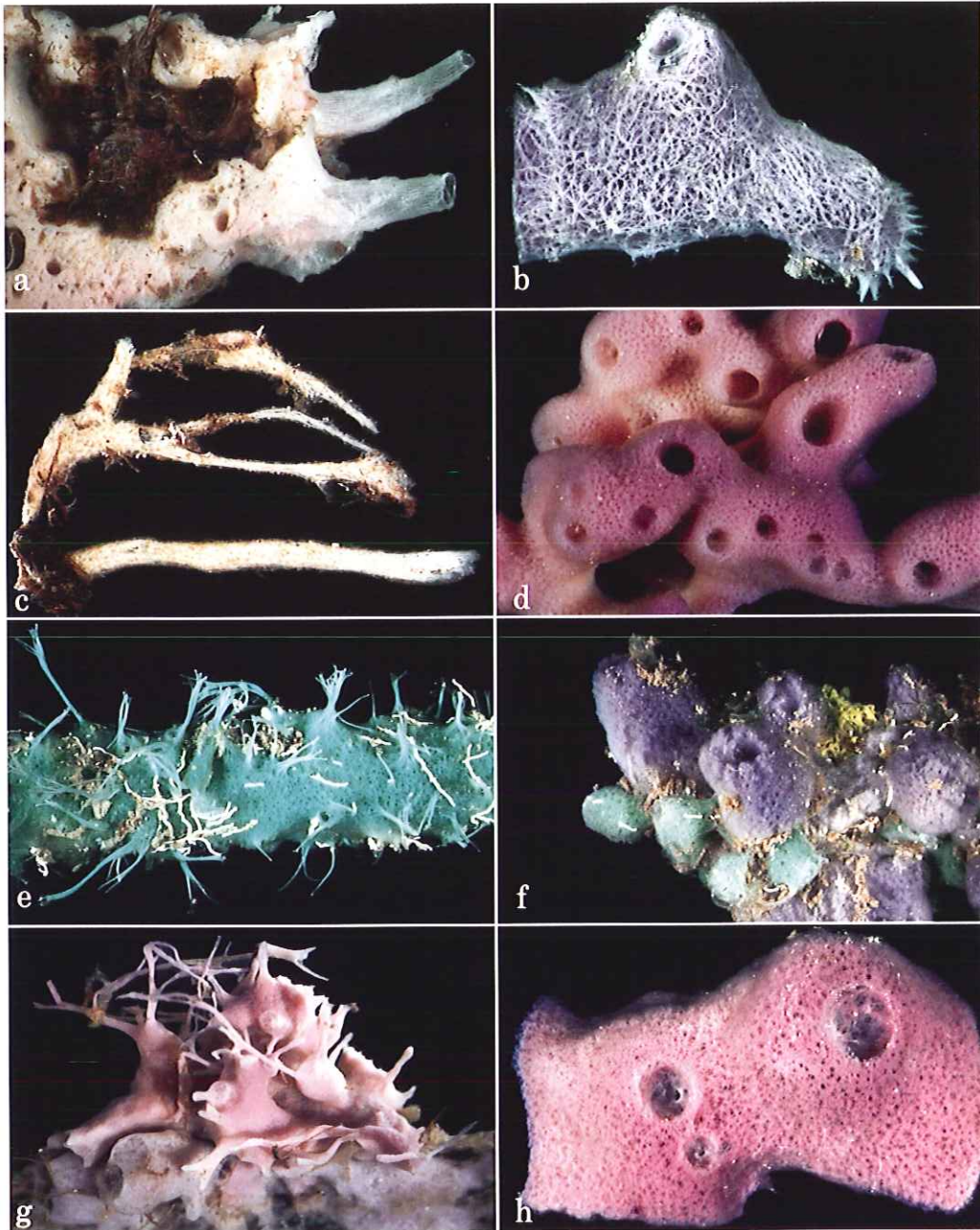


Fig. 3. Photomicrographs of live *Haliclona* specimens from Twin Cays mangroves: a, *Haliclona magnifica*, freshly dislocated from its peat substrate which is apparent at the upper left, $\times 0.7$; b, *Haliclona mucifibrosa*, $\times 0.9$; c, *Haliclona twincayensis*, $\times 0.8$; d, *Haliclona pseudomolitba*, $\times 0.8$; e, *Haliclona manglaris*, $\times 0.9$; f, *Haliclona curacaoensis*, $\times 0.9$; g, *Haliclona tubifera*, $\times 0.8$; h, *Haliclona implexiformis*, $\times 0.9$

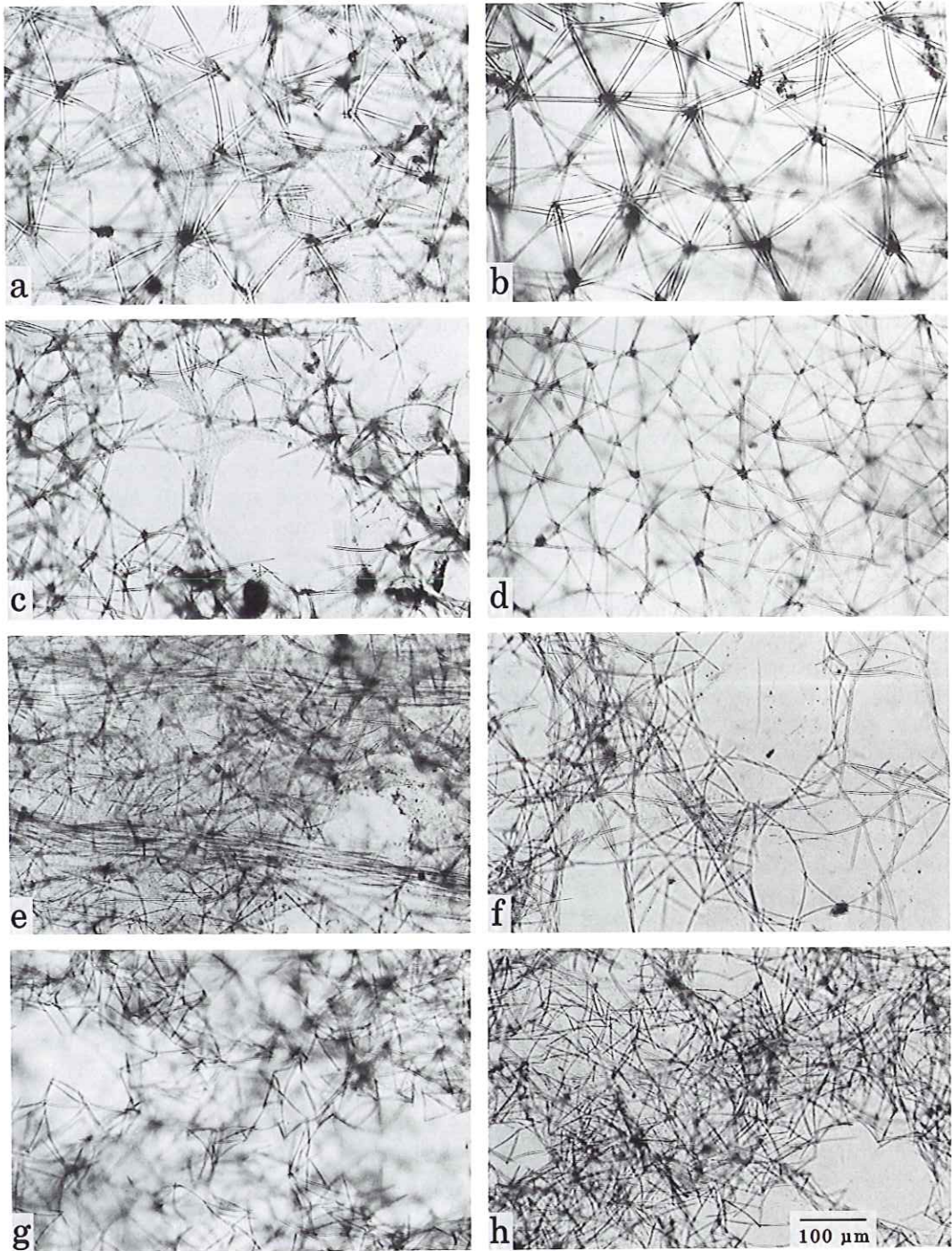


Fig. 4. Photomicrographs of holotype tissue sections from all four new species of *Haliclona*; choanosome to the left (a, c, e, g), ectosome to the right (b, d, f, h): a, b, *H. mucifibrosa*; c, d, *H. magnifica*; e, f, *H. twincayensis*; g, h, *H. pseudomolitba*. (Scale on h applies to all photomicrographs.)

Table 1.—Spicule sizes, length \times width (μm), of four specimens of *Haliclona mucifibrosa* (ranges, means, standard deviations, $n = 25$).

USNM	41517	214.6–237.1	(± 9.2)–250.6 \times 9.3–11.7	(± 1.0)–13.7
	41521	207.5–220.5	(± 10.6)–237.5 \times 7.0–10.7	(± 2.2)–14.0
	41762	188.6–208.2	(± 8.0)–220.4 \times 7.4– 9.1	(± 0.5)–10.0
ZMA	6403	148.5–180.5	(± 14.0)–204.2 \times 4.9– 6.4	(± 0.7)– 7.2

tropic spicule-rich reticulation, similar to choanosomal network (Figs. 2b, 4b).

Fistule architecture: Same as ectosome and choanosome, no special reinforcement.

Spongin: Distinct, at the nodes of the spicules.

Spicules: Oxeas, straight or slightly, evenly curved, robust, with long and sharp points; occasionally the points are mucronate (Fig. 2c). Length \times width (range of means for four specimens measured, Table 1): 180.5–237.1 \times 6.4–11.7 μm .

Ecology.—Habitats are mangrove roots, peat banks, shallow sandy bays, and reef caves. The species is abundant on lower intertidal peat banks of Cuda Cut, Twin Cays, where specimens can become fully air-exposed during low ebb tides.

Distribution.—Belize, Curaçao, Bahamas, and Florida.

Etymology.—This species was named for heavy mucus strands that develop when fragments are torn apart.

Discussion.—*Haliclona mucifibrosa* is, to our knowledge, the only chalinid species of the *fistulosa* group that develops mucus strands. So far, this feature has only been observed in species of the *aquaeducta* group (de Weerd 1989). Because of the mucus strands, but also because of the color and growth form, *H. mucifibrosa* may be confused with *H. tubifera* (George & Wilson). The latter species has smaller spicula (105–155 \times 4.0–7.5 μm) and a very delicate, unispicular, isotropic ectosomal and choanosomal skeleton. *H. tubifera* also has a more delicate shape and a tendency to form long, thin proliferations. *H. mucifibrosa* differs from *H. magnifica*, described below, by the

pronounced mucus strands and its much more robust oxeas. A third Caribbean species belonging to the *fistulosa* group is *H. albifragilis* Hechtel. This species stands out by its shape (thinly encrusting) and color (white) and occurs in cryptic habitats (under coral rubble). *Haliclona albifragilis* has not been found in Belize, but this may be due to its cryptic and apparently also rare occurrence. Specimen USNM 41832 (Colombia) stands out by the large size of its oxeas (mean length \times width = 254.2 \times 14.0 μm), but this feature seems to be common in sponges from certain areas of the Atlantic coast of Colombia (Zea 1987, and in litt.).

Haliclona magnifica, new species

Figs. 2a, b, d, 3a, 4c, d

Type material.—Holotype, USNM 41500 (Belize, Twin Cays, Hidden Creek, 1 m, 9 May 1985, coll. K. Smith & K. Rützler). Paratypes, USNM 41501 (Belize, Twin Cays, Batfish Point, 1 m, 19 Apr 1986, coll. K. Rützler & K. Smith); USNM 41502 (Florida, Florida Keys, unnamed mangrove island 400 m E of Big Torch Key, 13 Jul 1989, coll. W. H. de Weerd & S. Viada); ZMA POR. 7579 (same site as USNM 41502, 12 Jul 1989, coll. W. H. de Weerd & S. Viada). Additional material, USNM 41514 (Belize, Twin Cays, Grouper Gardens, peat bank, 0.2 m, 7 Dec 1988, coll. W. H. de Weerd); USNM 41522 (Belize, Twin Cays, Hidden Creek, 29 Jun 1984, coll. K. Smith & K. Rützler).

Diagnosis.—Shape: Irregularly massive base from which arise one to four thick-walled tubes, to 15 cm high and 5 cm thick.

Table 2.—Spicule sizes, length \times width (μm), of four specimens of *Haliclona magnifica* (ranges, means, standard deviations, $n = 25$).

USNM	41500	189.6–206.9	(± 8.8)–220.6 \times 3.8–5.5	(± 0.5)–5.9
	41501	181.2–198.5	(± 9.6)–215.8 \times 4.6–5.2	(± 0.3)–5.8
	41502	174.0–196.7	(± 13.7)–220.4 \times 5.1–6.0	(± 0.5)–6.7
ZMA	7579	171.7–194.6	(± 11.9)–218.1 \times 4.9–5.6	(± 0.6)–6.7

Each tube tapers towards an oscular chimney and osculum of 1–2 cm diameter. Characteristically, the choanosome, still present in the basal parts of the tubes, disappears towards the osculum, so that the distal part of the tubes consists of the ectosomal skeleton only. In addition, several smaller fistules, 2–5 cm thick and as much as 8 cm high, may arise at irregular distances from all parts of the sponges.

Color: Pink, to dull pink and drab, with white oscular fistules (Fig. 3a).

Surface: Smooth.

Consistency: Slightly crisp, very fragile, compressible, but not elastic; mucuous when rubbed between fingers.

Choanosomal skeleton: Regular, subisotropic reticulation dominated by spicules (Figs. 2a, 4c).

Ectosomal skeleton: Indistinguishable from choanosomal skeleton but easily detached (Figs. 2b, 4d); in addition, the ectosomal skeleton is reinforced by longitudinal spicula tracts towards the distal portions of the tubes where the choanosomal skeleton is absent.

Fistule architecture: Subisotropic, reinforced by loosely organized longitudinal spicula tracts that consist of 4–6 spicules with overlapping points.

Spongin: Scarce, confined to the nodes of the spicules.

Spicules: Oxeas, slender, fusiform, slightly flexuous (Fig. 2d). Length \times width (range of means for 6 specimens, including those of Table 2): 194.6–206.9 \times 5.2–6.0 μm .

Ecology.—Typical habitats are peat undercuts and banks in mangrove channels. The basal mass of specimens is typically

hugging depressions in the exposed peat surface, with only the whitish oscular chimneys protruding. The species has a remarkable tolerance to sudden changes of temperature and salinity that occur in the mangrove channels with changes of tidal flow.

Distribution.—Belize, Florida, Puerto Rico.

Etymology.—The species is named *Haliclona magnifica* because of its magnificent color and shape.

Discussion.—*Haliclona magnifica* is a very characteristic species, not only for its color and growth form, but also for its slender, flexuous spicula, and confusion with other local species is hardly possible. As far as Belizean chalinids are concerned, *H. magnifica* is most closely related to *H. mucifibrosa* (see above). It differs from this species by its color and shape, the lack of pronounced mucus strands, the much thinner oxeas and scarcer spongin. *Haliclona magnifica* stands out among other species of the *fistulosa* group by its slender flexuous spicula, which is a common feature in the *arenata* and *rosea* groups (cf., de Weerd 1989). As far as North Atlantic species are concerned, the oxeas of the *fistulosa* group are consistently robust, straight “needles.” Yet, by its subisotropic skeleton and extensive subectosomal spaces, *H. magnifica* clearly belongs to the *fistulosa* group.

Species of the *arenata* Group

Architectural plan (Fig. 5a, b).—Choanosomal skeleton a rather irregular reticulation with ill-defined paucispicular primary lines which are irregularly connected by uni-

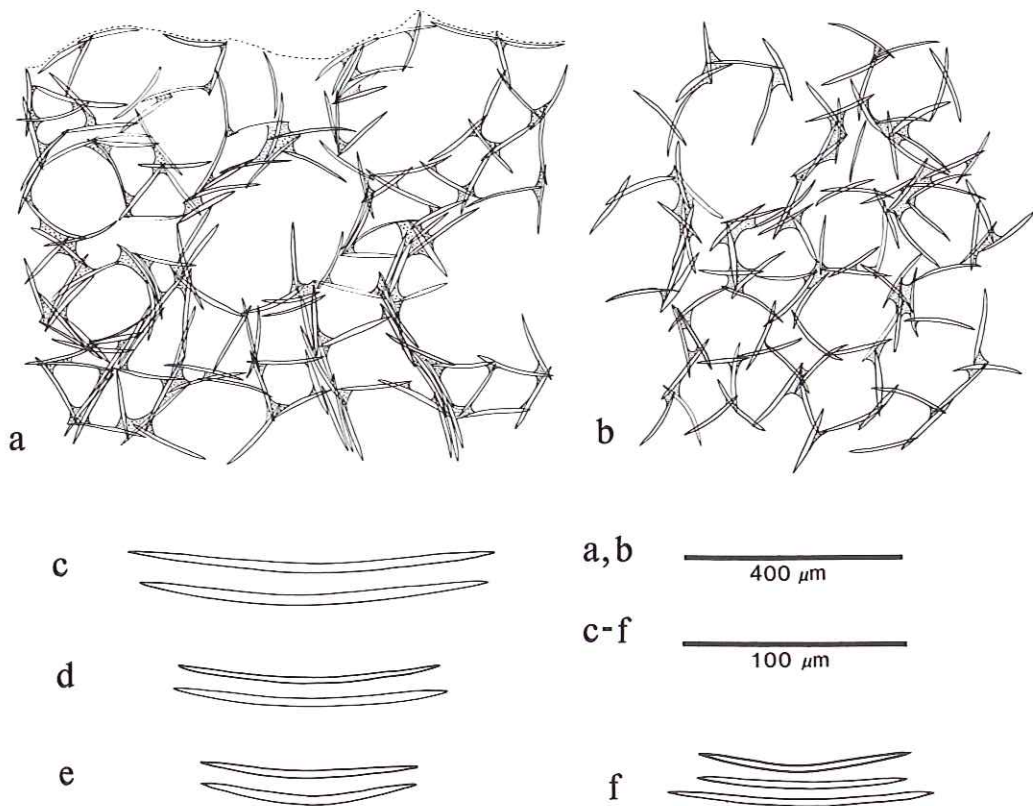


Fig. 5. Chaliniidae of the *arenata* Group: a, Choanosomal skeleton; b, Ectosomal skeleton; c, Spicules of *Haliclona twincayensis*; d, Spicules of *H. pseudomolitba*; e, Spicules of *H. manglaris*; f, Spicules of *H. curacaoensis*.

spicular secondary lines. There is a vague tendency towards rounded meshes. Ectosomal skeleton, if present, a discontinuous but coherent tangential reticulation of single spicules. The tendency to form rounded meshes is more pronounced in the ectosomal skeleton than in the choanosomal skeleton. Usually, the ectosomal membrane is clearly observable with closely-packed pores in the open spaces between the spicules. Spongin is always present at the nodes of the spicules, but never abundant. Oxeas fusiform, slender, usually curved or flexuous. Microscleres sometimes present.

Haliclona twincayensis, new species

Figs. 3c, 4e, f, 5a-c

Type material.—Holotype, USNM 41515 (Belize, Twin Cays, Hidden Creek, 1.5 m,

1 May 1989, coll. K. Smith & K. Rützler). Paratypes, USNM 41289 (Belize, Twin Cays, Grouper Gardens, 0.5 m, 10 Jun 1983, coll. K. Rützler); USNM 41516 (Belize, Twin Cays, Hidden Creek, 1.5 m, 1 May 1989, coll. K. Smith & K. Rützler); USNM 41770 (Florida, Florida Keys, under the bridge between Ramrod Key and Little Torch Key, on piles, 1–3 m, 11 Jul 1989, coll. W. H. de Weerd & S. Viada); ZMA POR. 7582 (same data as USNM 41515); USNM 41771 (Guadeloupe, Grand Cul-de-Sac Marin, ca. 0.5 mi N of Petit Canal, E side Bay, 16°23.5'N, 61°30.60'W, piling off dock and old house, 0.2 m, 23 Jun 1989, coll. W. H. de Weerd).

Diagnosis.—Shape: Slender, solid, partly fused, erect whips or branches, 2–12 mm thick, 5–10 cm long, projecting without an

Table 3.—Spicule sizes, length \times width (μm), of six specimens of *Haliclona twincayensis* (ranges, means, standard deviations, $n = 25$).

USNM	41515	146.2–155.4	(± 6.2)–165.9 \times 4.2–4.6	(± 0.3)–5.3
	41516	137.5–152.8	(± 10.2)–167.5 \times 3.7–4.9	(± 1.1)–6.2
	41289	142.5–151.7	(± 9.4)–162.5 \times 3.5–4.4	(± 0.5)–5.5
	41770	141.5–162.2	(± 9.3)–176.3 \times 5.1–6.1	(± 0.6)–7.0
	41771	111.4–120.3	(± 4.4)–127.6 \times 4.4–4.8	(± 0.3)–5.8
ZMA	7582	150.0–158.6	(± 5.2)–167.5 \times 3.7–4.5	(± 0.5)–5.2

apparent base directly perpendicular from the substratum (mangrove roots, peat banks, piles). Oscula inconspicuous, rare, ca. 1 mm, irregularly distributed along all sides of the branches.

Color: Whitish gray to light tan in life, light tan in spirit (Fig. 3c).

Surface: Strongly punctate, with pronounced longitudinal subectosomal spaces, which are roofed by tangential ectosomal spicules.

Consistency: Rather firm, only slightly compressible, but fragile.

Choanosomal skeleton: Paucispicular primary lines connected by unispicular secondary lines, ill-defined and irregular (Figs 4e, 5a); many spicules, including numerous developmental forms, are placed in confusion.

Ectosomal skeleton: Unispicular, tangential reticulation, irregular and discontinuous (Figs. 4f, 5b); with many open spaces between the spicules.

Spongine: Scarce, confined to the nodes of the spicules.

Spicules: Oxeas, slender, fusiform, slightly flexuous (Fig. 5c). Length \times width (range of means for six specimens measured, Table 3): 120.3–162.2 \times 4.4–6.1 μm .

Ecology.—Habitats are stilt roots of red mangrove, peat undercuts and bank, artificial wood piling from just below tide level to 3 m depth. Fairly extreme and sudden temperature and salinity changes are tolerated in mangrove channels during changing tides.

Distribution.—Belize, Florida, Guadeloupe.

Etymology.—The species is named after its type locality, Twin Cays.

Discussion.—*Haliclona twincayensis* is related to the Caribbean species *H. caerulea* (Hechtel), *H. manglaris* Alcolado and *H. curacaoensis* (van Soest). The latter two species occur also in Belize. *H. caerulea* is distinct by its bluish gray color and the possession of sigmata. *H. manglaris* (see below) is thinly encrusting, bright turquoise green, and has much smaller oxeas (75–108 \times 2–4 μm) than *H. twincayensis*. *H. curacaoensis* is distinct by its shape (close-packed oscular mounds), sticky consistency, and smaller oxeas (93.5–135 \times 2.3–5.7 μm).

Haliclona pseudomolitba, new species
Figs. 3d, 4g, h, 5a, b, d

Type material.—Holotype, USNM 41743 (Belize, Twin Cays, Hidden Creek, 0.5 m, 1 May 1989, coll. K. Smith & K. Rützler). Paratypes, USNM 41503 (Belize, Twin Cays, Hidden Creek, 1 m, 10 Dec 1988, coll. W. H. de Weerd); USNM 41797 (Martinique, Diamond Rock, 18 m, 3 Jul 1989); ZMA POR. 7595 (same data as USNM 41503). Other material, USNM 41742 (Belize, Hidden Creek, 0.5 m, 1 May 1989, coll. K. Smith & K. Rützler).

Diagnosis.—Shape: Erect, finger-shaped, partly fused branches, to 15 cm high. Oscules numerous, circular, flush with surface, 2–3 mm regularly distributed along the branches.

Color: Rich pink with yellowish cream tinges (Fig. 3d).

Surface: Even, rather smooth.

Consistency: Extremely soft, limp, highly compressible.

Choanosomal skeleton: Paucispicular primaries, unispicular secondaries (Figs. 4g,

Table 4.—Spicule sizes, length \times width (μm), of four specimens of *Haliclona pseudomolitba* (ranges, means, standard deviations, $n = 25$).

USNM 41503	107.0–115.3 (± 5.1)–126.1 \times 3.6–4.5 (± 0.5)–5.6
41742	110.0–115.7 (± 5.6)–125.0 \times 3.8–4.3 (± 0.3)–5.0
41743	110.0–125.1 (± 5.5)–133.0 \times 2.5–4.0 (± 1.0)–5.0
41797	111.4–124.5 (± 8.6)–142.0 \times 4.4–5.5 (± 0.8)–7.0

5a), with many spicules placed in confusion, commonly reinforced by loosely organized spicule tracts of 3 or more spicules.

Ecosomal skeleton: Irregular, unispicular tangential reticulation (Figs. 4h, 5b); no particular specialization.

Spongins: Scarce, confined to nodes of spicules.

Spicules: Oxeas, fusiform, straight or evenly curved, occasionally the points are mucronate (Fig. 5d). Length \times width (range of means for four specimens measured, Table 4): 115.3–125.1 \times 4.0–5.5 μm .

Ecology.—Habitats are stilt roots of red mangrove, peat undercuts and bank. Fairly extreme and sudden temperature and salinity changes are tolerated in mangrove channels during changing tides.

Distribution.—Belize, Martinique.

Etymology.—The species is named for its similarity of habit with *Acervochalina molitba*.

Discussion.—*Haliclona pseudomolitba* appears at first to be very similar to *Acervochalina molitba* (de Laubenfels, 1949). Both are pink, finger-like, soft and limp, but the skeletons are distinctly different, *H. pseudomolitba* lacking any semblance of a spongin fiber skeleton. We acknowledge the marked variation in spicule size and amount of spongin in *Acervochalina* species (cf., van Soest 1980; de Weerd 1986, 1989), but the lack of any intermediate form between the spongin-dominated forms of *A. molitba* as found in Bermuda (and described from Bimini, Bahamas by de Laubenfels 1949, and from Bermuda by de Laubenfels 1950) and our spicule-dominated specimens from

Belize and Martinique prompted us to describe the latter material as a new species. The skeleton of *H. pseudomolitba* is closest to *H. twincayensis*, *H. manglaris*, and *H. curacaoensis* because it has a rather irregular reticulation with many spicules in confusion.

Haliclona manglaris Alcolado

Fig. 3e, 5a, b, e

Haliclona manglaris Alcolado, 1984:4, figs. 1B, 2A.

Material.—USNM 32960 (Belize, Twin Cays, Sponge Haven, associated with the tunicate *Distaplia bermudensis*, 25 Feb 1984, coll. I Goodbody); USNM 33581 (Belize, Twin Cays, Lair Channel, associated with *Distaplia* sp., 26 Feb 1985, coll. I. Goodbody); USNM 41737 (Belize, Twin Cays, Grouper Gardens, 19 Apr 1986, coll. K. Rützel & K. Smith); USNM 41752 (Belize, Twin Cays, The Lair, mangrove roots, 1 m, 8 Dec 1988, coll. W. H. de Weerd); USNM 41757 (Belize, Twin Cays, Grouper Gardens, on mangrove roots, 0.3 m, 6 Dec 1988, coll. W. H. de Weerd); USNM 41758 (Belize, Twin Cays, Hidden Creek, on mangrove roots, 0.5 m, 10 Dec 1988, coll. W. H. de Weerd); USNM 41759 (Belize, Twin Cays, Grouper Gardens, on mangrove roots, 0.5 m, 12 Dec 1988, coll. W. H. de Weerd).

Diagnosis.—Shape: Laterally spreading, thinly encrusting base (1–5 cm diameter) with low volcano- or chimney-shaped oscular elevations, usually not higher than 1.5 cm, and 2–5 mm thick. Oscular 0.5–2.5 mm in diameter. Commonly, thin (2–3 mm) sto-

lons branch off from the main body. Consistently occurring on mangrove roots.

Color: Bright turquoise green, drab in spirit (Fig. 3e).

Surface: Smooth, even, slightly punctate.

Consistency: Very soft, mucuous when rubbed between fingers.

Choanosomal skeleton: See architectural plan (Fig. 5a).

Ectosomal skeleton: See architectural plan (Fig. 5b), but more regular with less pronounced open spaces.

Spongin: Scarce, nodal.

Spicules: Oxeas, slender, rather strongly curved, fusiform, with marked long, very thin points (Fig. 4e). Dimensions: 75–108 \times 2–4 μm .

Distribution.—Cuba (Alcolado 1984), Belize, Martinique, Florida, Grenadines, Grenada, Venezuela.

Discussion.—*Haliclona manglaris* is represented in a USNM collection by the schizotype (USNM 39225), which enabled us to confirm the identity of the species. Its name proves to be most appropriate because the species has so far only been found on roots of red mangrove, *Rhizophora mangle*. The species stands out by its bright turquoise green color.

Haliclona curacaoensis (van Soest)
Fig. 3f, 5a, b, f

Reniera curacaoensis van Soest, 1980:12, pl. I fig. 4, text-fig. 3.

Material.—USNM 41733 (Belize, Twin Cays, Hidden Creek, entrance to 30 m inside, mangrove roots and mud bank, 0–0.5 m, 28 Apr 1986, coll. K. Smith & K. Rützler); USNM 41734 (Belize, Hidden Creek, Twin Cays, mangrove roots, 0–0.5 m, 29 Jun 1984, coll. K. Smith & K. Rützler); USNM 41735 (Belize, Twin Cays, Hidden Creek, mangrove roots, 9 May 1985, coll. K. Rützler & K. Smith); USNM 41745 (Belize, Twin Cays, Grouper Gardens, 0.3 m, 1 May 1989, coll. K. Rützler & K. Smith);

USNM 41755 (Belize, Twin Cays, Hidden Creek, on mangrove root, 0.5 m, 10 Dec 1988, coll. W. H. de Weerd); USNM 41756 (Belize, Twin Cays, Sponge Haven, on mangrove roots, 1 m, 8 Dec 1988, coll. W. H. de Weerd); USNM 41760 (Belize, Twin Cays, Grouper Gardens, on mangrove roots, 6 Dec 1988, coll. W. H. de Weerd); USNM 41768 (Belize, Twin Cays, Gator Creek, 30 Jun 1984, coll. K. Smith & K. Rützler).

Diagnosis.—Shape: Rather close-packed, low oscular mounds, 2–3 cm thick at the basis, gradually diminishing in size towards the distal parts, 2–4 cm high; occasionally encrusting. Oscula about 3 mm in diameter.

Color: Purple, greyish purple to blue gray in life, drab in spirit. (Fig. 3f).

Surface: Smooth, but strongly punctate; commonly beset by calcareous (serpulid) worm tubes.

Consistency: Soft, sticky to the touch, mucuous when rubbed.

Choanosomal skeleton: See architectural plan (Fig. 5a), but with wavy paucispicular primary lines.

Ectosomal skeleton: See architectural plan (Fig. 5b), but less coherent.

Spongin: Very scarce, confined to the nodes of the spicules.

Spicules: Oxeas, very slender, fusiform, with long, thin points (Fig. 5f). Dimensions: 93.5–135.0 \times 2.3–5.7 μm .

Distribution.—Curaçao (van Soest 1980), Belize, Grenada, Florida, Martinique.

Discussion.—The identity of our material with *Haliclona curacaoensis* could be firmly established through study of the holotype in the ZMA (POR. 3662). Van Soest (1980) did not mention the sticky surface, but otherwise his description fits very well with our specimens. Our records are the first since van Soest's description of the species, which was based on specimens from Curaçao. *H. curacaoensis* is distinguished from other Caribbean species with the same characteristic skeletal architecture by its compressed form, soft consistency, and grayish purple

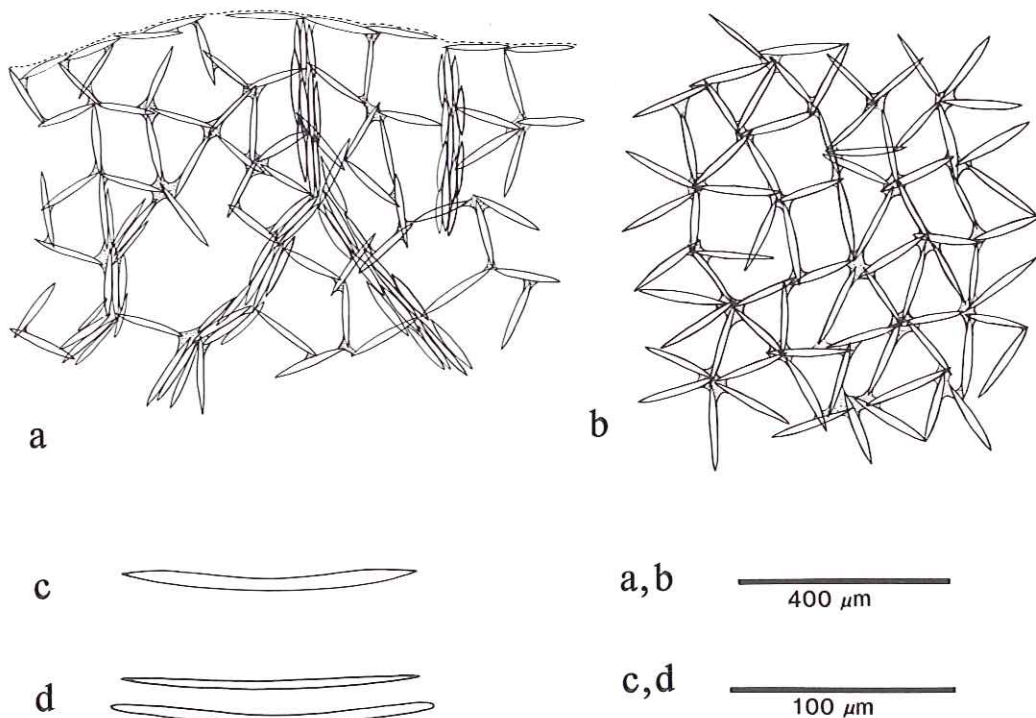


Fig. 6. Chaliniidae of the *aquaeducta* Group: a, Choanosomal skeleton; b, Ectosomal skeleton; c, Spicules of *Haliclona tubifera*; d, Spicules of *H. implexiformis*.

color. The spicula are similar to those of *H. manglaris* but less strongly curved.

Species of the *aquaeducta* Group

Architectural plan (Fig. 6a, b).—Choanosomal skeleton a very regular, isotropic unispicular reticulation. Ectosomal skeleton, if present, of the same structure as the choanosomal skeleton. Spongin always present at the nodes of the spicules, but never very abundant. Spicules of variable size and form; many species have strongyles or blunt pointed oxeas as megascleres. Microscleres sometimes present.

Haliclona tubifera (George & Wilson),
new combination
Figs. 3g, 6a–c

Reniera tubifera George & Wilson, 1919:
145; pl. LVII, fig. 12; pl. LVIII, fig. 15;

pl. LIX, fig. 16; pl. LXVI, fig. 55a–c. *Haliclona hogarthi* Hechtel, 1965:20; pl. II, fig. 1; text-fig. 1.

Material.—USNM 32383 (Belize, Glover's Reef, SW fore reef, turtle grass, 10 m, Jul 1977, coll. J. Faulkner); USNM 34632 (Belize, Twin Cays, 24 May 1985, coll. I. Goodbody); USNM 41729 (Belize, Twin Cays, main channel near dock, *Rhizophora* roots, 26 Apr 1986, coll. K. Rützler & K. Smith); USNM 41730 (Belize, Twin Cays, Lair Channel near Lair, in undercuts, 11 May 1985, coll. K. Smith & K. Rützler); USNM 41731, USNM 41732 (same data as USNM 41729); USNM 41736 (Belize, Twin Cays, Hidden Creek, mangrove roots, 29 Jun 1984, coll. K. Rützler & K. Smith); USNM 41739, USNM 41740 (Belize, Twin Cays, Grouper Gardens, 0.2 m, 22 Apr 1989, coll. K. Rützler & K. Smith); USNM 41744

(Belize, Twin Cays, Gator Creek, 0.3 m, 3 May 1989, coll. K. Rützler & K. Smith); USNM 41746 (Belize, Twin Cays, Grouper Gardens, mangrove roots, 0.4 m, 6 Dec 1988, coll. W. H. de Weerd); USNM 41750, USNM 41751 (Belize, Twin Cays, Sponge Haven, mangrove roots, 1 m, 8 Dec 1988, coll. W. H. de Weerd); USNM 41754 (Belize, Twin Cays, Hidden Creek, mangrove roots, 0.5 m, 10 Dec 1988, coll. W. H. de Weerd); USNM 41767 (Belize, Batfish Point, Twin Cays, 0–2 m, 20 Apr 1986, coll. K. Smith & K. Rützler); USNM 41773 (Belize, Twin Cays, Hidden Creek, 0.2 m, 23 Apr 1989, coll. K. Smith & K. Rützler).

Diagnosis.—Shape: Very variable; commonly a thickly encrusting or cushion-shaped base with numerous volcano- or chimney-shaped oscular elevations and rope-like stolons. The chimneys may be very pronounced and reach a height of 5 cm or more. Size of the oscula is very variable, from 1 mm to over 10 mm. The sponges have a marked tendency to form laterally spreading masses of infinite size, leaving the substratum (e.g., mangrove roots), to which they are basically attached. Other specimens may remain small, thinly encrusting or delicately branched, with irregularly distributed, small (1–2 mm), oscula which are flush with the surface or with slightly raised collars. In addition, long, thin, irregularly fused, rope-like stolons commonly branch off from the main body. These stolons may form large masses of 60 cm or more, especially when the main body is of considerable size too, but also in smaller specimens there is a tendency towards the forming of these proliferations.

Color: Bluish purple, purple, pink, purplish gray, whitish to cream in life, light tan in spirit (Fig. 3g).

Surface: Smooth, slightly punctate.

Consistency: Soft, elastic compressible, but fragile; mucous when rubbed, mucus strands appear when sponge is squeezed or pulled apart.

Choanosomal skeleton: See architectural

plan (Fig. 6a); skeleton commonly reinforced by short, loosely organized spicule tracts of 3–6 spicules.

Ectosomal skeleton: See architectural plan (Fig. 6b); the skeleton occasionally superimposed on subectosomal tangentially oriented tracts of 8–10 spicules which have their points laying abreast.

Spongin: Usually confined to the nodes of the spicules, but occasionally more abundant.

Spicules: Oxeas, sharply pointed, hastate, commonly thinner in the middle than near the ends (Fig. 6c). Dimensions: 105–155 × 4.0–7.5 μm.

Ecology.—Habitats include mangrove roots and peat banks, seagrass meadows, shallow sandy bays and fore reefs. Depth range from very shallow to ca. 10 m.

Distribution.—North Carolina (George & Wilson 1919, as *Reniera tubifera*), Jamaica (Hechtel 1965, as *Haliclona hogarthi*), Belize, Curaçao, Bonaire, Aruba, La Desirade, Florida (van Soest 1980, as *H. hogarthi*), South Carolina, Bahamas, Bermuda, Nigeria, Venezuela, Colombia, Martinique, Antigua, Grenada.

Discussion.—*Haliclona hogarthi* is here synonymized with *Reniera tubifera* on the basis of study of both the specimen of *H. tubifera* described by Wells et al. 1960 (USNM 23610; no holotype designation by George & Wilson 1919) and the holotype of *H. hogarthi* (YPM 5033). Of all the purple chalinids occurring in Belize, *H. tubifera* is, in the living state, most easily confused with *H. mucifibrosa*, yet is otherwise most closely related to *H. implexiformis* (Hechtel). The color and form of *H. tubifera* and *H. mucifibrosa* are quite similar, but *H. tubifera* has generally a more delicate habit and consistency and the proliferations (although not always present) of *H. tubifera* seem to be consistently absent in *H. mucifibrosa*. Both species have mucus strands but they are much less pronounced in *H. tubifera*. The two species may, therefore, be difficult to separate in the field, but microscopic char-

acters distinguish them immediately. The most distinguishing feature is the delicate unispicular skeleton of *H. tubifera*, which is intermittently reinforced by short spicule tracts but lacks conspicuous choanosomal spaces. *H. mucifibrosa*, on the other hand, has a rather dense, subisotropic although regular, choanosomal skeleton with many choanosomal spaces. Furthermore, the spicula of *H. tubifera* are of much smaller size than those of *H. mucifibrosa* (150–220 × 5.0–13.5 μm). The latter species has been assigned to the *fistulosa* group (see above). *Haliclona tubifera* differs from *H. implexiformis* by its more irregular form with proliferations, mucus strands, its bluish purple color, and the hastate shape of its oxeas (strongylote in *H. implexiformis*).

Haliclona implexiformis (Hechtel)

Figs. 3h, 6a, b, d

Adocia implexiformis Hechtel, 1965:27, pl.

II, fig. 2, text-fig. 2. For further synonymy see van Soest (1980).

Material.—USNM 41523 (Belize, Twin Cays, Lair Channel, near Lair, undercuts, 11 May 1985, coll. K. Rützler & K. Smith); USNM 41524 (Belize, Twin Cays, Hidden Creek, entrance to 30 m inside, mangrove roots and mud bank, 0.0–0.5 m, 28 Apr 1986, coll. K. Smith & K. Rützler); USNM 41525 (Belize, Twin Cays, Sponge Haven, mangrove roots, 0.5 m, 8 Dec 1988, coll. W. H. de Weerd); USNM 41726 (Belize, Twin Cays, Hidden Creek, mangrove roots, 0.5 m, 12 Dec 1988, coll. W. H. de Weerd); USNM 41728 (Belize, Twin Cays, Grouper Gardens, 19 Apr 1986, coll. K. Rützler & K. Smith); USNM 41741 (Belize, Hidden Creek, Twin Cays, 1 May 1989, coll. K. Smith & K. Rützler); USNM 41748 (Belize, Twin Cays, Grouper Gardens, on mangrove roots, 0.5 m, 7 Dec 1988, coll. W. H. de Weerd); USNM 41749 (Belize, Twin Cays, Grouper Gardens, mangrove roots, 0.5 m, 7 Dec 1988, coll. W. H. de Weerd); USNM 41753 (Belize, Twin Cays, The Lair, on

mangrove roots, 1 m, 8 Dec 1988, coll. W. H. de Weerd).

Diagnosis.—Shape: Thick (2–4 cm) cushions, with a well-defined, although somewhat irregular outline. Oscula conspicuous, circular, rather large (6–10 mm), regularly distributed, usually flush with the surface, but also on slightly elevated mounds.

Color: Pinkish violet in life, occasionally cream, light tan in spirit; pigment can be easily squeezed out, leaving tan skeleton behind (Fig. 3h).

Surface: Usually even and smooth, rarely with tuberculate areas, rather strongly punctate.

Consistency: Soft, compressible; no obvious mucus, only slippery exudate when squeezed.

Choanosomal skeleton: See architectural plan (Fig. 6a).

Ecotosomal skeleton: See architectural plan (Fig. 6b); easily detachable.

Spongin: Scarce but clearly visible, confined to the nodes of the spicules.

Spicules: Oxeas, slightly, evenly curved, with blunt points (strongylote) (Fig. 6d). Dimensions: 110–150 × 4.5–7.5 μm.

Distribution.—Jamaica (Hechtel 1965), Belize, Curaçao, Bonaire, Puerto Rico (van Soest 1980), Florida, Bahamas, St. Thomas, Dominican Republic, Guadeloupe, Martinique, Barbuda, Margarita.

Discussion.—*Haliclona implexiformis* differs from *H. tubifera* by its violet-pink color, lack of mucus strands, the more regular form, its lack of proliferating outgrowths, and the form of its oxeas. The species has caused much confusion in the literature, and quite a few records under the names of *Adocia* (= *Haliclona*) *neens* (Top-sent) and *Haliclona permollis* (Bowerbank) (e.g., de Laubenfels 1936, Little 1963) are referable to *H. implexiformis*. Study of the holotype in the YPM (YPM 5034) has shown that this species is definitely not conspecific with *H. neens* nor with *H. permollis*. *Haliclona neens* is a valid northeastern Atlantic species (cf., de Weerd & van Soest 1986);

H. permollis is a synonym of *H. cinerea* (Grant) (cf. de Weerd 1986).

Key to the Species

- 1a. Sponges bright turquoise green. Soft, encrusting on mangrove roots, with low oscular mounds or chimneys or with small (1–2 mm) oscula flush with the surface; choanosomal skeleton consisting of ill-defined paucispicular primary lines, irregularly connected by unispicular secondary lines; ectosomal skeleton an irregular discontinuous, tangential, unispicular reticulation; spongin scarce; oxeas slender, rather strongly curved, with long points, $75\text{--}108 \times 2\text{--}4 \mu\text{m}$ *Haliclona manglaris*
- b. Sponges brown, purple, pink, violet, bluish gray, or of unknown color; choanosomal skeleton consisting of ill-defined paucispicular primary lines, irregularly connected by unispicular secondary lines, or more regular, unispicular, isotropic or subisotropic; ectosomal skeleton an irregular discontinuous, tangential unispicular reticulation or very regular, isotropic or subisotropic; spongin scarce or more abundant; oxeas slender, fusiform, hastate, strongly lute or robust needles 2
- 2a. Sponges delicately pink with drab tinges, extremely soft and limp, immediately collapsing when removed from the water. Finger-shaped with partly fused branches, oscula flush, circular, regularly distributed at all sides of the branches; choanosomal skeleton a delicate, rather irregular reticulation with ill-defined primary and secondary lines; ectosomal skeleton an irregular discontinuous, tangential, unispicular reticulation; spongin scarce, confined to the nodes of the spicules; oxeas fusiform, $115\text{--}125 \times 4\text{--}6 \mu\text{m}$ *H. pseudomolitba*
- b. Sponge not pink, not limp, not collapsing outside water 3
- 3a. Sponges sticky to the touch, even, although much less so, after preservation in spirit. Bluish gray; habit of pronounced closely-packed oscular mounds without a laterally spreading encrusting base; choanosomal skeleton consisting of ill-defined, paucispicular, primary lines, irregularly connected by unispicular secondary lines; ectosomal skeleton an irregular discontinuous, tangential, unispicular reticulation; spongin scarce; oxeas fusiform, $94\text{--}135 \times 2\text{--}6 \mu\text{m}$ *H. curacaoensis*
- b. Sponges not sticky to the touch, although mucus strands may be present when the sponge is torn apart 4
- 4a. Mucus strands clearly present when sponge is torn apart 5
- b. No mucus strands, or not observable because the sponges are preserved 6
- 5a. Sponges bluish purple, purplish brown or brown; forming a thickly encrusting base with volcano- or chimney-shaped oscular elevations, or thinly encrusting throughout, commonly with long, slender, irregularly fused ropy proliferations; skeleton of both the choanosome and ectosome a very delicate, unispicular, isotropic reticulation with low number of spicules, but intermittently reinforced by short spicule tracts; spongin usually confined to the nodes of the spicules, sometimes more abundant; oxeas hastate, with sharp points, usually slightly

- thinner in the center than near the ends, 105–155 × 4–8 μm
 *H. tubifera*
- b. Sponges grayish purple or bluish gray; forming a thickly encrusting base with pronounced, truncate oscular chimneys, without ropy proliferations; skeleton a subisotropic, rather rigid reticulation with high spicule density, spongin distinctly present at the nodes of the spicules; oxeas robust needles, 149–251 × 5–14 μm
 *H. mucifibrosa*
- 6a. Choanosomal skeleton rather irregular, with ill-defined primary lines; ectosomal skeleton a rather irregular, discontinuous, unispicular, tangential reticulation 7
- b. Choanosomal and ectosomal skeletons more regular, unispicular, isotropic or subisotropic; ectosome easily detachable 8
- 7a. Slender branches, directly projecting from the substratum without conspicuous oscula; color whitish to light brown; spongin scarce; oxeas slender, fusiform, slightly sinuous, 111–176 × 5–7 μm *H. twincayensis*
- b. Thinly encrusting, with low oscular chimneys or with small (1–2 mm) oscula flush with the surface; color bright turquoise-green; oxeas slender, rather strongly curved, fusiform, with long, thin points, 75–108 × 2–4 μm
 *H. manglaris*
- 8a. Skeleton very regular, isotropic, delicate, unispicular, with low spicule density 9
- b. Skeleton regular but subisotropic, with high spicule density, many choanosomal spaces 10
- 9a. Oxeas hastate, sharp-pointed, slightly thinner in the middle than near the ends, 105–155 × 4–8 μm
 *H. tubifera*

- b. Sponge pinkish violet; thick cushions with conspicuous, rather large (6–10 mm), circular, regularly distributed oscula; soft; oxeas blunt-pointed or strongylote, 110–150 × 5–8 *H. implexiformis*
- 10a. Sponge pink, dull pink or drab, forming an irregularly massive base from which arise one to four thick-walled tubes and several smaller fistules; slightly crisp, very fragile; oscular tubes and fistules reinforced by spicule tracts, especially towards the distal ends; oxeas flexuous, slender, 172–221 × 4–7 μm *H. magnifica*
- b. No tubular structures; oxeas robust needles, straight or slightly, evenly curved, 149–215 × 5–14 μm *H. mucifibrosa*

Discussion

The Twin Cays mangrove islands in Belize harbor a very rich chalinid sponge fauna, as compared to mangrove communities in other Caribbean localities. Only the Florida Keys are found to have a comparably high chalinid species diversity. These two localities are not only comparable in the composition of Chalinidae species but also in the apparent absence of species that we found common in similar habitats elsewhere in the Caribbean region. An example is *Haliclona caerulea* (Hechtel), which occurs in great abundance in Curaçao, Bonaire, the Lesser Antilles and the Bahamas, but is absent from the Belizean and Florida Key mangroves.

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Literature Cited

- Alcolado, P. M. 1984. Nuevas especies de esponjas encontrada en Cuba.—*Poeyana* 271:1–22.
- George, W. C., & H. V. Wilson. 1919. Sponges of Beaufort (N.C.) Harbor and vicinity.—*Bulletin of the Bureau of Fisheries* 36:130–179.
- Grant, R. E. 1835. Animal kingdom. Pp. 107–118 in R. B. Todd, ed., *The cyclopedia of anatomy and physiology*, Vol. 1. Sherwood, Gilbert and Piper, London.
- Hechtel, G. J. 1965. A systematic study of the Demospongiae of Port Royal, Jamaica.—*Bulletin, Peabody Museum of Natural History* 20:1–94.
- Laubenfels, M. W. de. 1936. 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.—*Papers from the Tortugas Laboratory* 30: 1–225.
- . 1949. Sponges of the Western Bahamas.—*American Museum Novitates* 1431:1–25.
- . 1950. The Porifera of the Bermuda Archipelago.—*Transactions of the Zoological Society of London* 27:1–154.
- Little, F. J. 1963. The sponge fauna of the St. George's Sound, Apalachee Bay, and Panama City regions of the Florida Gulf Coast.—*Tulane Studies in Zoology* 11:31–71.
- Rützler, K., & I. G. Macintyre. 1982. The habitat distribution and community structure of the barrier reef complex at Carrie Bow Cay, Belize. Pp. 9–45 in K. Rützler and I. G. Macintyre, eds., *The Atlantic barrier reef ecosystem at Carrie Bow Cay, Belize, I: Structure and communities*.—*Smithsonian Contribution to the Marine Sciences* 12. Smithsonian Institution Press, City of Washington, 539 pp.
- Soest, R. W. M. van. 1980. Marine sponges from Curaçao and other Caribbean localities. Part II: Haplosclerida.—*Studies on the Fauna Curaçao and Other Caribbean Islands* 62(104):1–174.
- Weerd, W. H. de. 1986. A systematic revision of the north-eastern Atlantic shallow-water Haplosclerida (Porifera, Demospongiae), part II: Chalinidae.—*Beaufortia* 36:81–165.
- . 1989. Phylogeny and vicariance biogeography of North Atlantic Chalinidae (Haplosclerida, Demospongiae).—*Beaufortia* 39:55–88.
- , & R. W. M. van Soest. 1986. Marine shallow-water Haplosclerida (Porifera) from the south-eastern part of the North Atlantic Ocean.—*Zoologische Verhandlungen* 225:1–49.
- Zea, S. 1987. *Espongas del Caribe Colombiano*. *Catalago Científico, Colciencias, Bogotá*, 286 pp.

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