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SHALLOW-WATER HAPLOSCLERIDA (PORIFERA, DEMOSPONGIAE) FROM RIO DE JANEIRO STATE, BRAZIL (SOUTHWESTERN ATLANTIC)

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ABSTRACT

Six species of haplosclerid sponges are described from shallow waters in the coast of Rio de Janeiro state, southeastern Brazil (southwestern Atlantic). Three species: *Amphimedon viridis* Duchassaing & Michelotti, 1864, *Callyspongia* (*Callyspongia*) *pallida* Hechtel, 1965 and *Oceanapia nodosa* (George & Wilson, 1919) are already known from neighbouring biogeographic provinces (viz., the Caribbean) and the other three are new to science, viz., *Callyspongia (Toxochalina) pseudotoxa* sp. n., *Arenosclera brasiliensis* sp. n. (both provisional endemics from Rio de Janeiro state), and *Haliclona melana* sp. n. Ecological data, known pharmacological properties, and morphological variations along the geographic range of the species are discussed, and a key to the species described is given.

INTRODUCTION

Sponges of the order Haplosclerida (Porifera, Demospongiae) are widely distributed in shallow-water hard substrates around the world and participate as important elements of shallow-water benthic marine communities. The Haplosclerida is also one of the most problematic and unstable taxonomic groups within the Demospongiae, due to a paucity of taxonomically useful characters, high intraspecific variability, large number of species, and divergent views on the taxonomic significance of most characters. The haplosclerid faunas from several geographic regions have been relatively well studied (e.g., North and Central Atlantic - Topsent, 1928; De Weerdt, 1985, 1986, 1991; De Weerdt & Van Soest, 1986; Mediterranean

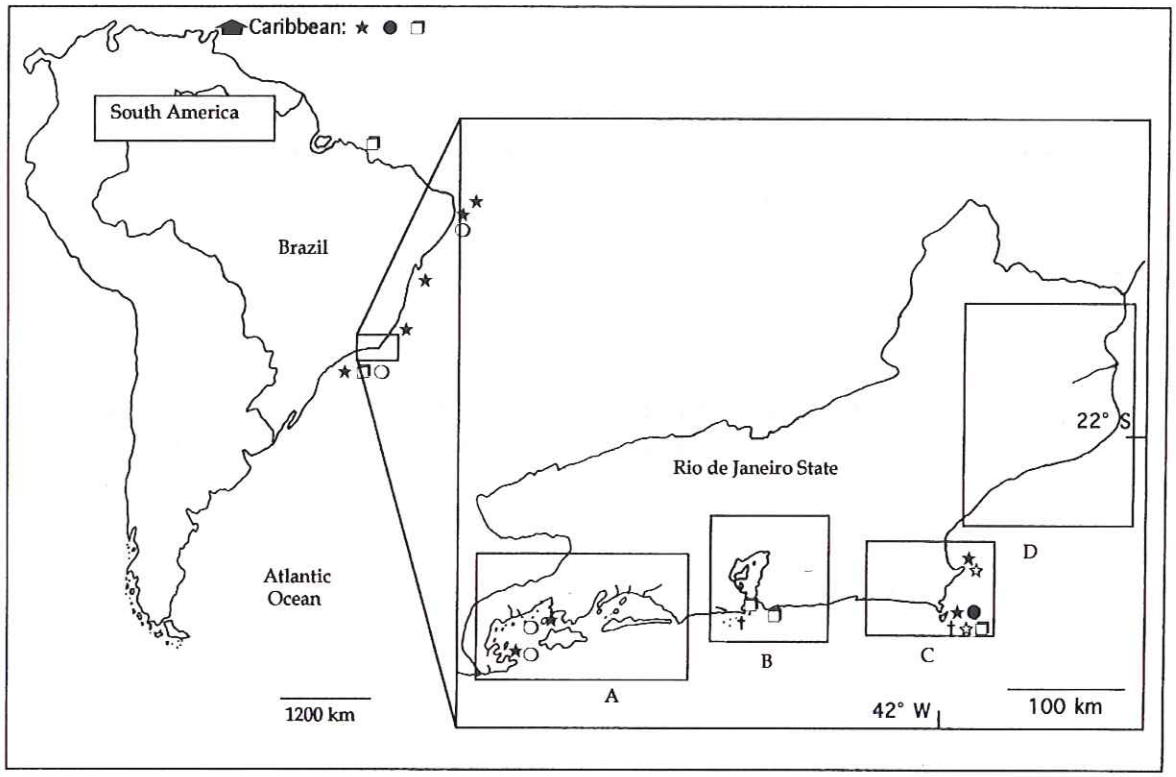

Fig.1. Distribution of six species of southwestern Atlantic Haplosclerida along the brazilian coast and in Rio de Janeiro state (inset). Area A, Costa Verde; area B, central coast; area C, Costa do Sol; area D, northern coast. ★, *Amphimedon viridis*; ●, *Callyspongia (Callyspongia) pallida*; ✢, *Callyspongia (Toxochalina) pseudotoxa*; ☆, *Arenosclera brasiliensis*; ❍, *Haliclona melana*; ❒, *Oceanapia nodosa*.

- Griessinger, 1971; Caribbean and Bahamas - Wiedenmayer, 1977; Van Soest, 1980; Zea, 1987; De Weerdt et al., 1991; New Zealand - Bergquist & Warne, 1980; New Caledonia - Desqueyroux-Faundez, 1984, 1987; northeastern Australia - Fromont, 1991). In contrast, southwestern Atlantic haplosclerids have been much less studied, although 36 species have already been recorded from the brazilian coast (e.g., Ridley & Dendy, 1887; Johnson, 1971; Mothes de Moraes, 1985; Mothes & Bastian, 1993; Mothes & Lerner, 1994). Only one haplosclerid species has been described so far from Rio de Janeiro state, *Toxochalina robusta* Ridley (*sensu* Mothes de Moraes, 1985), which is here redescribed as *Callyspongia (Toxochalina) pseudotoxa* sp. n.

From a biogeographic viewpoint, the coast of Rio de Janeiro state shows a transition from tropical to subtropical benthic faunas, including sponges (Boury-Esnault, 1973; Hechtel, 1976) and scleractinian corals (Laborel, 1967). It presents sharp gradients of temperature, wave action, and both chemical and organic pollution (see, e.g., Yoneshigue, 1985; Muricy, 1989; Paranhos et al., 1998). Its sponge fauna is quite diverse, with both tropical and subtropical species (Boury-Esnault, 1973; Hechtel, 1976; Mothes de Moraes, 1985; Muricy et al., 1991). The aim of this study was to describe six species of haplosclerid sponges from the coast of Rio de Janeiro state, SE Brazil, of which three are new to science. Particular attention was given to the ecology, morphological variations, distribution, and production of secondary metabolites with pharmacological properties. A key to the species described is given.

MATERIALS AND METHODS

The coast of Rio de Janeiro state ranges from 23°22'S 44°41' W to 21°15'S 40°58'W (Fig. 1). It may be divided in four major areas with different oceanographic and biological characteristics. The southern part ("Costa Verde" - area A, Fig. 1) is formed by two shallow bays, with high terrigenous influence (rivers and rainforests). The central area (area B; Fig. 1) has relatively few, exposed rocky shores separated by long sandy beaches. The so-called "Costa do Sol" (area C, Fig. 1) marks a shift in the coastline from North-South to East-West, with high influence of cold upwelling waters (minimum 12°C) in summer (Valentin, 1984). The northern coast (area D, Fig. 1) is subjected to heavy sediment input by relatively large rivers with few sheltered places.

Several independent collections were made by SCUBA, snorkeling and dredging along the coast in areas A, B, and C (Fig. 1) from 1961 to 1998. Identification was made through comparison with the literature and type specimens when necessary. Spicules and skeletal arrangement were observed in light microscopy through the usual techniques (Rützler, 1978). Specimens were deposited at the sponge collections of the Universidade Federal do Rio de Janeiro (UFRJPOR and MNRJ). Other abbreviations: C.E.Z, Centro de Estudos Zoológicos, Rio de Janeiro; N.O.A.S., Navio Oceanografico Almirante Saldanha; ZMAPOR, sponge collection of the Zoological Museum of Amsterdam; MHNG, Museum d'Histoire Naturelle, Geneve; BMNH, Natural History Museum, London; YPM, Yale Peabody Museum. F1, primary fibers; F2, secondary fibers; F3, tertiary fibers.

SYSTEMATIC DESCRIPTIONS

Phylum Porifera Grant
Class Demospongiae Sollas
Subclass Ceractinomorpha Lévi
Order Haplosclerida Topsent

Diagnosis: "Ceractinomorpha with a reticulate skeleton of smooth oxeote spicules and a microsclere complement, if present, of sigmata, toxa and smooth microxea." (Van Soest, 1980).

Family Niphatidae Van Soest, 1980
Diagnosis: "Haplosclerida with an ectosomal para-tangential (three-dimensional) multispicular reticulation of fibers or tracts, and with a choanosomal reticulation of multispicular fibers and tracts. Microscleres, if present, sigmata." (Van Soest, 1980).

Genus *Amphimedon* Duchassaing & Miche-lotti, 1864
Diagnosis: "Niphatidae with an optically smooth surface, caused by the relatively inconspicuous choanosomal primary fibers. Ectosomal reticulation of uniform mesh size. Spongin dominating. No microscleres." (Van Soest, 1980).

Amphimedon viridis Duchassaing & Michelotti, 1864
Figs. 2A, 3-4

Amphimedon viridis Duchassaing & Michelotti, 1864: 81
Amphimedon viridis; Van Soest, 1980: 29; ?Desqueyroux-Faundez, 1984: 778; Zea, 1987: 76; Muricy, 1989: 351; Muricy et al., 1991: 1186; Muricy et al., 1993: 429
Haliclona viridis; Pomponi, 1976: 218
Further synonymy: see Wiedenmayer, 1977: 84

Paratypes: BMNH 28.11.12.36 (portion of a Turin specimen, Mus. Turin POR. no. 40); and BMNH 28.11.12.35 (portion of a Turin specimen, also Mus. Turin POR. no. 40).
Type locality: St. Thomas, Virgin Islands.

MATERIAL EXAMINED

Rio de Janeiro state: Trindade: UFRJPOR 4747, 2 m depth, coll. G. Muricy, 01/III/98. Angra dos Reis: UFRJPOR 1645, 5 m depth, 21/IV/87; UFRJPOR 1802, 2.5 m depth, 22/IV/87; UFRJPOR 1992, 1 m depth, 08/V/87; UFRJPOR 2135, 1 m depth, 20/IX/80; UFRJPOR 2163, 1 m depth, 13/III/80; coll. C.E.Z.; UFRJPOR 4233, 2 m depth, 24/V/90, coll. G. Muricy & E. Hajdu. Arraial do Cabo: UFRJPOR 2917-A, 5 m depth, coll. G. Muricy; UFRJPOR 2878, 3 m depth, coll. F. Cordeiro; UFRJPOR 2928, 3 m depth, coll. M. Custodio, 10/V/87; UFRJPOR 2714, 5 m depth, coll. M. Klautau, 12/V/87,

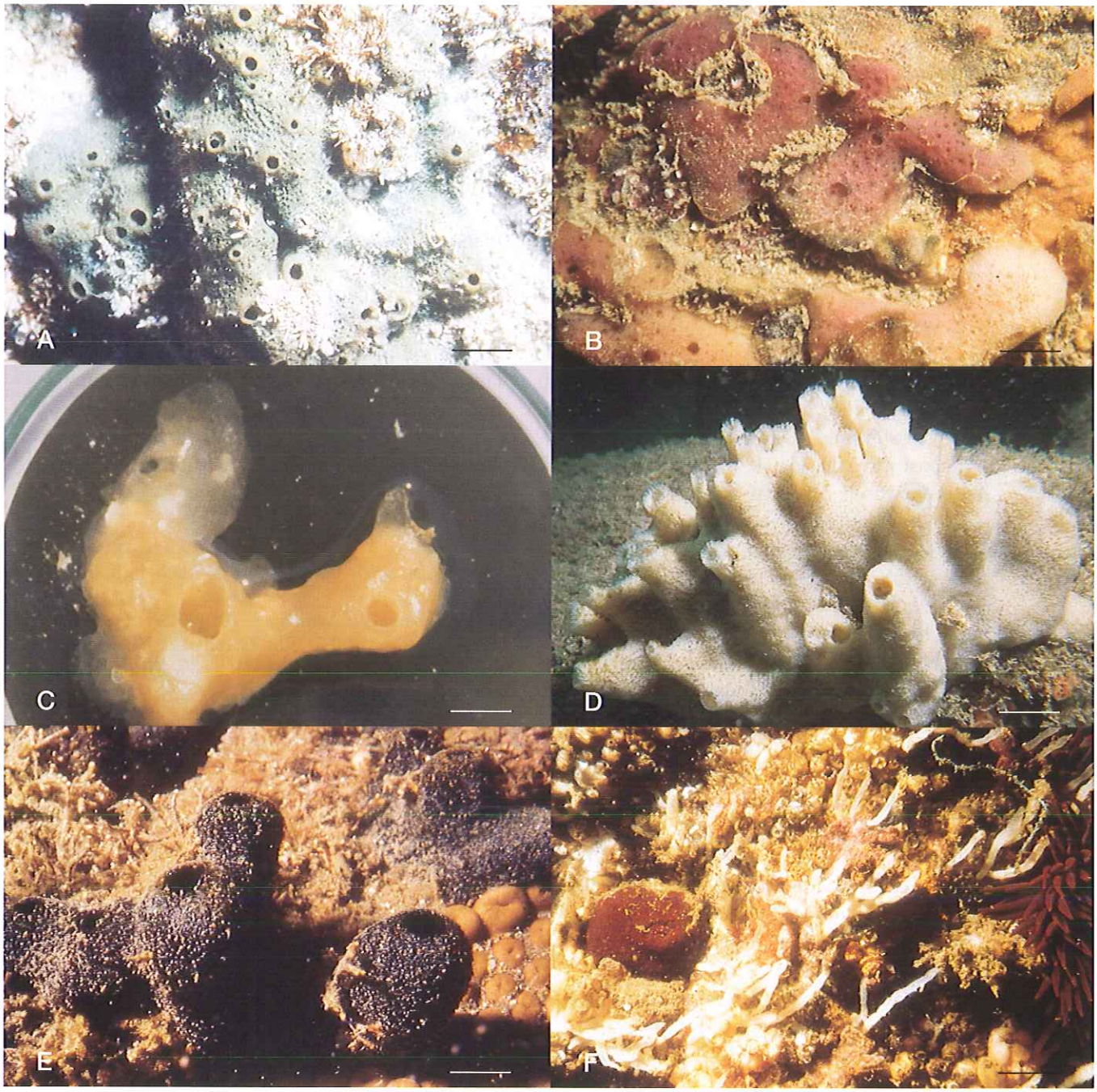

Fig. 2. Haplosclerids from Rio de Janeiro state. A, *Amphimedon viridis* (scale bar = 2.4 cm). B, *Callyspongia (Callyspongia) pallida* (scale bar = 1.6 cm). C, *Callyspongia (Toxochalina) pseudotoxa* sp. n. (scale bar = 1.0 cm). D, *Arenosclera brasiliensis* sp. n. (scale bar = 2.4 cm). E, *Haliclona melana* sp. n. (scale bar = 0.6 cm). F, *Oceanapia nodosa* (scale bar = 2.4 cm). A-B and D-F, *in situ* close-ups; C, preserved specimen soon after collection. Photos by E. Hajdu (A-C and E-F) and G. Muricy (D).

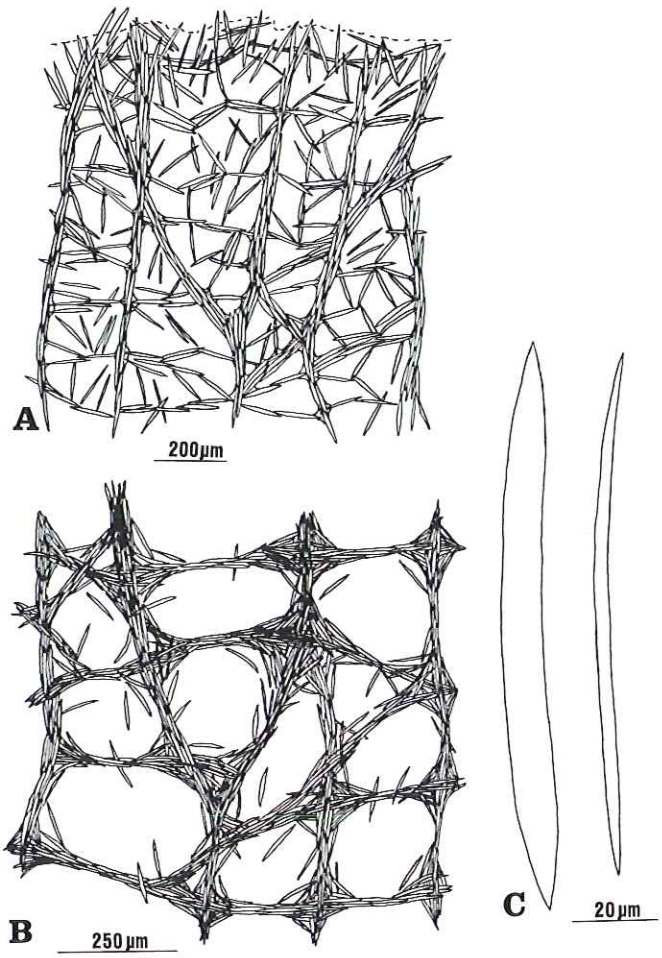

Fig. 3. *Amphimedon viridis*. A, transversal section of the ectosome; B, tangential section of the ectosome; C, oxeas.

UFRJPOR 3059-A, coll. G. Muricy, 06/XII/86; UFRJPOR 4771, 3 m depth, coll. G. Muricy, 14/III/87.
São Paulo state: São Sebastião: UFRJPOR 102, coll. Lopes & Pêgo, VII/61; UFRJPOR 3604, Praia do Cabelo Gordo, coll. E. Hajdu, 6/XII/88, 2 m depth; UFRJPOR 3631, Ponta do Jatobá, coll. A. E. Migotto, 6/III/86, 4 m depth.
Espirito Santo state: Santa Cruz: UFRJPOR 182, coll. C.E.Z., VII/70.
Pernambuco state: Tamandaré: UFRJPOR 3680, Ponta dos Carneiros, coll. E. Hajdu & S. Peixinho, 30/I/89, 1 m depth; UFRJPOR 4070, Pier CEPENE, 8/III/96, coll. Brian Chanas, 1 m depth.
Fernando de Noronha: UFRJPOR 4813, Baia do Sueste, Fernando de Noronha, 17/II/98, coll. G. Muricy, 2 m depth.

Description (Figs. 2A, 4A): Massively encrusting, irregular or lobate sponge, often with volcano-shaped lobes. Size variable from 3 to 50 cm long and up to 8 cm high. Colour alive green or bluish-green, light or dark brown in spirit. Surface finely rough and hispid. Low, circular oscula 1-8 mm in diameter are dispersed at the apex of some lobes. Consistency soft, friable. Mucus relatively abundant.
Skeleton: Ectosome (Figs. 3B, 4C): Tangential reticulation of multispicular fibers forming rounded meshes, 180-500 µm in diameter. The extremities of the choanosomal primary fibers may protrude slightly beyond the dermal reticulation. Choanosome (Figs. 3A, 4B): Choanosomal reticulation regular, with multispicular

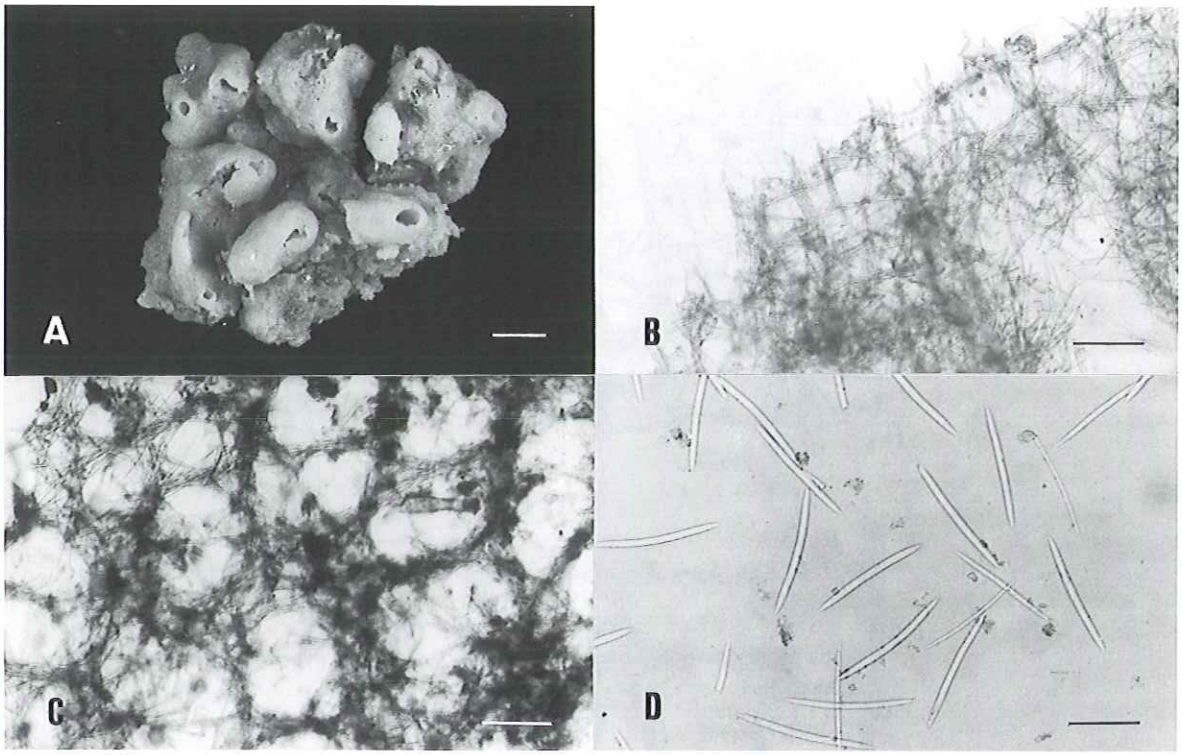

Fig. 4. *Amphimedon viridis*. A, preserved specimen (UFRJPOR 1992) (scale bar = 1 cm). B, transversal section of the ectosome (scale bar = 230 μm). C, tangential section of the ectosome (scale bar = 230 μm). D, oxeas (scale bar = 75 μm).

ascending primary fibers (25-85 μm in diameter, 3-8 spicules per cross section), parallel, and 120-200 μm apart. Interconnecting secondary fibers irregular, uni-or paucispicular (10-30 μm in diameter, 1-4 spicules per cross section). Spongin is abundant, and loose spicules are common in the choanosome.

Spicules (Figs. 3C, 4D): oxeas acerate, slightly curved, occasionally hastate or stylote, with variable length and width: 110-*146*-175/1.3-7.5 μm (n=210).

Ecology: Abundant on sublittoral rocky substrates, 1-8 m depth. It occurs on both exposed and cryptic microhabitats, sometimes subjected to sedimentation. It appears to be relatively tolerant to domestic pollution (Muricy, 1989; Muricy et al., 1991).

Distribution: West Indies (Wiedenmayer, 1977; Van Soest, 1980; Zea, 1987); ?New Caledonia (Desqueyroux-Faundez, 1984); ?Indian Ocean (Burton, 1937 as *Hemihaliclona*); ?Red Sea (Row, 1911, as *Reniera tabernacula*); ?Central West Pacific (De Laubenfels, 1954 as *Haliclona*); Brazil: Rio de Janeiro (Trindade, Angra dos Reis, Arraial do Cabo, and Búzios), São Paulo, Espirito Santo, Bahia, and Pernambuco states.

Pharmacology: Amphimedon viridis is rich in compounds with pharmacological activities. Extracts from this species have shown antibacterial, antimitotic, antitumoral, neurotoxic, hemolytic, hypoglycemic and icthyotoxic properties (Baslow & Read, 1968; Schmitz et al., 1978, 1983; Green et al., 1990; Ajabnoor et al., 1991; Muricy et al., 1993; Sevcik et al., 1994; Berlinck et al., 1996; partly as *Haliclona viridis*).

Remarks: The specimens studied here are very similar to those described by Wiedenmayer (1977), Van Soest (1980), and Zea (1987) from the Caribbean. Indo-pacific and Red Sea records of this species are doubtful, and differ

from Atlantic specimens by a frequently ramose shape, smaller oscules, slightly smaller oxeas, and fewer spongin (cf. Row, 1911; Burton, 1937; De Laubenfels, 1954; Desqueyroux-Faundez, 1984). Specimens observed in Pernambuco, Bahia and São Paulo bear more often volcano-shaped lobes, and are slightly firmer in consistency than specimens from Rio de Janeiro. In sheltered places (e.g., Angra dos Reis) lobes can grow much higher, and the sponge assumes an erect, ramose shape. This species is easily recognized by its bluish-green colour, friable consistency with some mucus, the reticulated surface and the ectosomal skeleton with multispicular tracts forming rounded, uniform meshes.

Only three other niphatids have been recorded so far from the Brazilian coast. *Amphimedon erina* (De Laubenfels, 1936), reported from São Paulo state (De Laubenfels, 1956) differs from *A. viridis* only by a lighter shade of green, harder consistency, and the larger size of its spicules. The two species may be synonymous (cf. Alcolado, 1984; Zea, 1987). *Niphates alba* Van Soest, 1980 was reported from northern Brazil (Mothes, 1996), and *Niphates erecta* Duchassaing & Michelotti, 1864 was recorded from Pernambuco (Hechtel, 1976) and Amapá states (Mothes, 1996). The genus *Niphates* differs from *Amphimedon* by the protrusion of tufts of the ascending primary tracts in the surface and by the presence of rare sigmas.

Family Callyspongiidae De Laubenfels, 1936
Diagnosis: "Haplosclerida with a two-dimensional tangential ectosomal reticulation of sparsely or uncored spongin fibers, and a choanosomal reticulation of primary spongin fibers cored by two or more spicules or uncored, and interconnecting fibers cored by a single spicule or uncored. Microscleres, if present, toxa." (Van Soest, 1980).

Genus *Callyspongia* Duchassaing & Michelotti, 1864
Diagnosis: "Callyspongiidae with a beautifully regular ectosomal tangential reticulation of primary and secondary (sometimes tertiary) spongin fibers." (Van Soest, 1980).

Subgenus *Callyspongia* Duchassaing & Michelotti, 1864
Diagnosis: "*Callyspongia* with rectangular choanosomal meshes, without fibrofascicules." (Van Soest, 1980).

Callyspongia (Callyspongia) pallida Hechtel, 1965
Figs. 2B, 5-6

Callyspongia pallida Hechtel, 1965: 36
Callyspongia fallax forma *debilis* Wiedenmayer, 1977: 95
Callyspongia (Callyspongia) pallida; Van Soest, 1980: 51; Zea, 1987: 102
Callyspongia sp. 1, Muricy et al., 1991: 1187
Callyspongia sp., Muricy et al., 1993: 429

Holotype: YPM 5038, Seawall of Police Post, 11.30.1960.
Type locality: Port Royal, Jamaica.

MATERIAL EXAMINED

Rio de Janeiro state: Arraial do Cabo: UFRJPOR 2531, 1 m depth, 7/III/88; UFRJPOR 2543, 2 m depth, 15/III/87; UFRJPOR 2582, 3 m depth, 9/V/87; UFRJPOR 2600, 2 m depth, 20/VIII/87; UFRJPOR 2627, 2 m depth, 9/III/88; UFRJPOR 2629, 2 m depth, 9/III/88; UFRJPOR 2665, 5 m depth, 18/IV/87; UFRJPOR 2675, 7 m depth, 19/IV/87; UFRJPOR 2738, 2 m depth, 12/V/87; UFRJPOR 2823, 3 m depth, 7/III/88; UFRJPOR 2830, 3 m depth, 7/III/88; UFRJPOR 2888, 5 m depth, 10/V/87; UFRJPOR 3007, 7 m depth, 14/XI/87; UFRJPOR 3066, 2 m depth, 6/XII/86; coll. G. Muricy; UFRJPOR 2949, 5 m depth, 14/VI/87; UFRJPOR 2990, 7 m depth, 24/VIII/87; UFRJPOR 3019, 5 m depth, 14/XI/87; coll. E. Hajdu; UFRJPOR 3034, 5 m depth, 8/III/88; coll. M. Klautau; UFRJPOR 2589, 2 m depth, 20/VIII/87; UFRJPOR 3026, 2 m depth, 8/III/88; coll. C. Russo.

Material studied for comparison: *Callyspongia fibrosa* (Ridley & Dendy, 1886): BMNH 1887.5.2.266, Challenger coll., off Bahia.
Callyspongia (Spinosella) vaginalis (Lamarck, 1814):

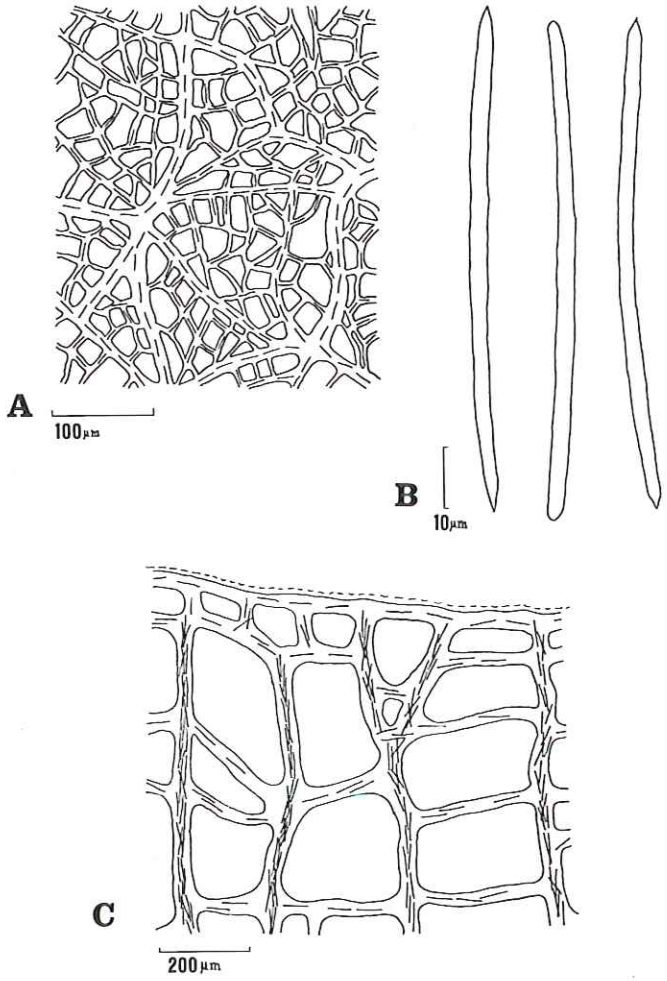

Fig. 5. *Callyspongia (Callyspongia) pallida*. A, tangential section of the ectosome; B, oxeas; C, transversal section of the ectosome.

BMNH 1948.8.6.25, det. M.W. De Laubenfels, Bermuda.
Callyspongia fortis (Ridley, 1881): BMNH 33.6.10.67, "Undine" coll., Mar del Plata (cf. Burton, 1940).
Callyspongia (Spinosella) armigera (Duchassaing & Michelotti, 1864): BMNH 32.4.5.36, det. M. Burton, Dry Tortugas.

Description (Figs. 2B, 6A): Sponge thickly encrusting to cushion-shaped or lobate, often with irregular lobes or repent branches. Maximum size is 15-20 cm long by 1-5 cm high, but most specimens attain only around 5 cm in length by 2 cm high. Colour alive orange, pink or violet; it always becomes drab in spirit. Oscules circular, 1-5 mm in diameter, located at the apex of the lobes or scattered on the smooth surface. Consistency is soft, elastic, but resistant. The surface is slightly sticky due to mucus produced by the sponge.

Skeleton: Ectosome (Figs. 5A, 6C): The ectosomal reticulation is sustained by the extremities of the ascending choanosomal primary fibers, which terminate abruptly, without piercing the surface. Tangential reticulation is composed of secondary and tertiary fibers. Secondary fibers, 12-25 µm in diameter, are cored by 1-2 spicules per cross section or uncored, and form large, irregular meshes. Tertiary fibers

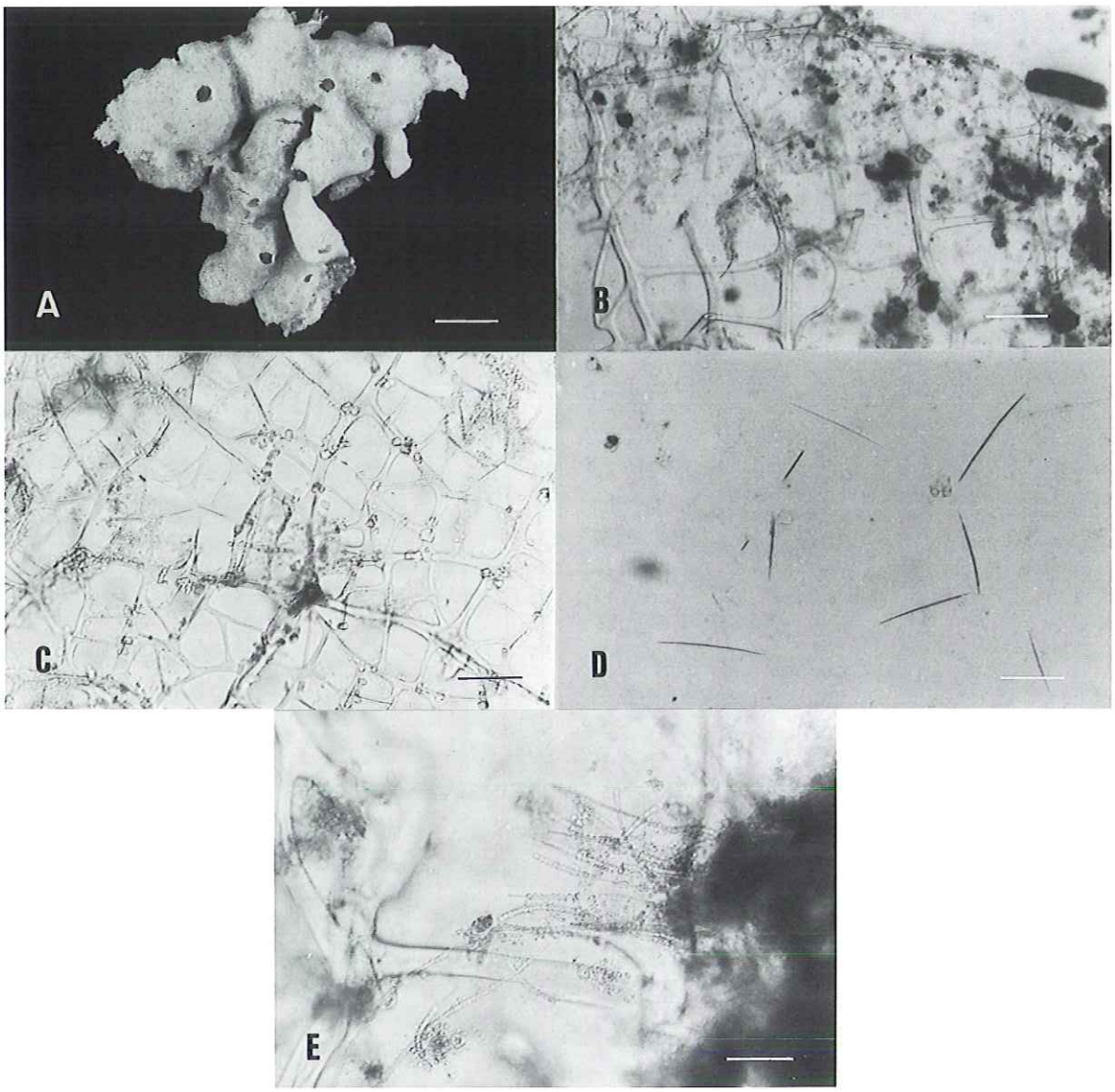

Fig. 6. *Callyspongia (Callyspongia) pallida*. A, preserved specimen (UFRJPOR 2627) (scale bar = 12 μm). B, transversal section of the ectosome (scale bar = 250 μm). C, tangential section of the ectosome (scale bar = 80 μm). D, oxeas (scale bar = 70 μm). E, intracellular spongin filaments (scale bar = 100 μm).

are unispicular or uncored, 5-20 μm in diameter, and form a secondary tangential reticulation with rounded, rectangular or triangular meshes, 40-100 μm in diameter. Choanosome (Figs. 5C, 6B): Reticulation of spongin fibers with rectangular meshes, 130-830 μm wide. Ascending primary fibers are paucispicular to multispicular (3-8 spicules per cross-section), rarely uncored, 25-60 μm in diameter. The spicular core occupies up to one third of the fibre diameter. Secondary, interconnecting fibers are paucispicular or uncored (up to 3 spicules per cross-section), 17-38 μm in diameter. Loose spicules are common. Many specimens show abundant smooth, segmented spongin filaments (1-3 μm in diameter), surrounded by granular cells (7-10 μm in diameter), which are similar to the intracellular segmented fibers of *Haliclona cinerea* (Grant) and other haplosclerids (cf. Lévi, 1967, as *Reniera elegans*, and refer-

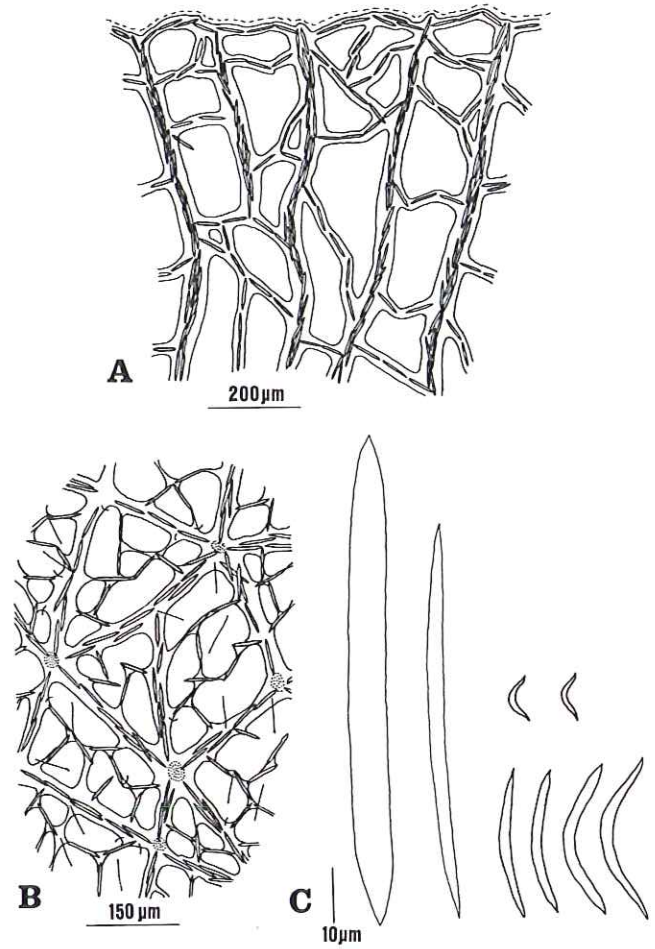

Fig. 7. *Callyspongia (Toxochalina) pseudotoxa* sp. n. A, transversal section of the ectosome; B, tangential section of the ectosome; C, oxeas and toxas.

ences therein) (Fig. 6E).

Spicules (Figs. 5B, 6D): Oxeas, slightly curved, acerate or strongylote: 60-*74*-85/1-3.5 µm (n = 200).

Ecology: Common inside small caves, on the undersurface of boulders and in other cryptic habitats, or fully exposed to light, often associated to zoanthids (*Zoanthus* spp.).

Distribution: Caribbean: Curaçao, Bonaire (Van Soest, 1980), Jamaica (Hechtel, 1965), and Bahamas (Wiedenmayer, 1977, as *C. fallax* forma *debilis*); Brazil: Rio de Janeiro state (Arraial do Cabo).

Pharmacology: The chemistry of this species has not been studied so far. Its methanolic extract has shown some antibacterial activity (Muricy et al., 1993).

Remarks: Our specimens are well within the range of variation of *Callyspongia (Callyspongia) pallida* as described by Hechtel (1965), Van Soest (1980), and Zea (1987). This species shows relatively high variation in shape, size, colour, and spicule morphology. In Rio de Janeiro state it can be recognized by its reticulate surface and mucous, elastic consistency. Further studies using biochemical or molecular characters are needed to ascertain the taxonomic status of the different phenotypes and of the apparently disjunct populations of Rio de Janeiro and the Caribbean.

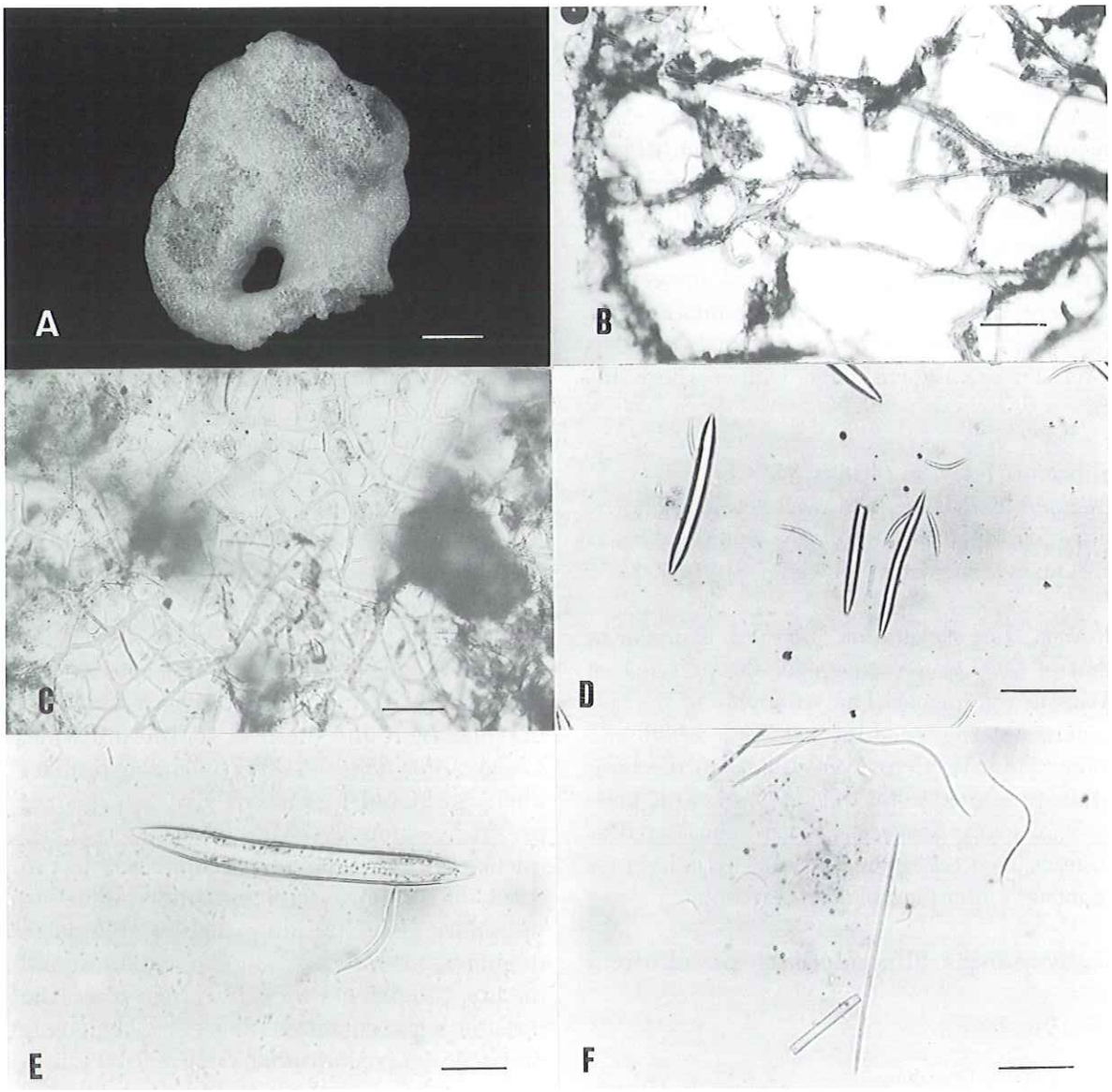

Fig. 8. A-E, *Callyspongia (Toxochalina) pseudotoxa* sp. n. A, preserved specimen (UFRJPOR 4152b) (scale bar = 6 μm). B, transversal section of the ectosome (scale bar = 220 μm). C, tangential section of the ectosome (scale bar = 220 μm). D, oxea and toxas (scale bar = 20 μm). E, oxea and toxa (scale bar = 10 μm). F, *Callyspongia* (*Toxochalina*) *robusta* (Ridley), BMNH 1881.10.21.336, Port Jackson, Australia, oxea and toxa (scale bar = 20 μm).

Seven other species of the genus *Callyspongia* without toxas have been reported from the Brazilian coast, all of which can be easily distinguished from *C. (C.) pallida*. *Callyspongia coppingeri* (Ridley, 1881) has thin tertiary fibers in the choanosome, and the extremities of the primary fibers protrude through the surface. *Callyspongia aff. diffusa* (Ridley, 1884) *sensu* Johnson (1971), from northeastern Brazil, is sprawling ramose, with flattened branches and oscules in rows at the sides of the branches. This record of *C.* aff. *diffusa* does not have the ectosomal tufts of erect spicules found in Indo-Pacific *C. diffusa* Ridley (cf. Burton, 1934), which would thus fit better in the genus *Euplacella* Lendenfeld, 1887 (*sensu* Van Soest, 1980). *Callyspongia fibrosa* (Ridley & Dendy, 1886) has a conulose surface, a branched, erect or repent habit, and stout choanoso-

mal primary fibers (up to 140 μm in diameter). *Callyspongia pergamentacea* (Ridley, 1881) is erect, laterally compressed, with rows of lateral oscules. *Callyspongia (Spinosella) vaginalis* is easily recognized by the tubular shape with large conules. *Callyspongia (Spinosella) armigera* (Duchassaing & Michelotti, 1864) can be discriminated by the presence of multispicular secondary fibers in both choanosomal and ectosomal reticulations, and by a repent, ramose shape. *Callyspongia (Spinosella) laborelli* Hechtel, 1983 has a tubular or vasiform shape, with conulose surface.

Subgenus *Toxochalina* Ridley, 1884
Diagnosis: Callyspongia with well-developed horny fibre arranged rectangularly. Spicules, oxeas and toxas (emended from Ridley, 1884).

Remarks: The skeleton of *Toxochalina* is similar to that of *Callyspongia*, except for the presence of toxas in the former. The synonymy of the two genera was suggested by Van Soest (1980) and followed by Wiedenmayer (1989), on the basis of the presumed primitive condition of the presence of toxas. *Toxochalina* is here considered as distinct from *Callyspongia* at subgeneric level for practical rather than biological reasons.

Callyspongia (Toxochalina) pseudotoxa sp. n.
Figs. 2C, 7-8

Toxochalina robusta Ridley *sensu* Mothes de Moraes, 1985: 234
(non: *Toxochalina robusta* Ridley, 1884: 403; *sensu* Ridley & Dendy, 1887: 50; Dendy, 1905: 39; Lévi, 1961: 524; Desqueyroux-Faundez, 1984: 813; *Toxochalina robusta* Ridley ssp. *dendyi* Burton *sensu* Vacelet et al. 1976: 84; *Callyspongia robusta* (Ridley), *sensu* Bergquist, 1961: 171; Bergquist & Warne, 1980: 31)

MATERIAL EXAMINED

Rio de Janeiro state: Arraial do Cabo. *Holotype:* UFRJPOR 4271, Enseada, 5 m depth, coll. G. Muricy, 9/XI/86. Rio de Janeiro: *Paratype:* UFRJPOR 4152b , Ilha Redonda, 30 m depth, coll. P.S. Young & F. Pitombo, 20/II/ 94.

Material studied for comparison: *Toxochalina robusta* Ridley 1884: BMNH 81.10.21.336, Port Jackson, Australia, "Alert" coll.
Toxochalina robusta; Ridley & Dendy, 1887: BMNH 1887.5.2.265, off Bahia, Brazil, "Challenger" coll.

Description (Figs. 2C, 8A): Massive, lobate sponge, 2 x 10 cm long by 3 cm high. Each lobe bears 1-3 large, oval oscules, up to 10 mm in diameter. Colour alive purple and in spirit light brown to tan. Surface even, smooth, and not easily detachable. Consistency soft, elastic, but resistant. Without any mucus.

Skeleton: Ectosome (Figs. 7B, 8C): A tangential ectosomal reticulation is sustained by the extremities of ascending choanosomal primary fibers, which just trespass the surface. Ectosomal primary fibers are unispicular, 15-70 μm in diameter, and form triangular or irregular meshes 120-560 μm wide. These meshes are subdivided by unispicular secondary fibers, 15-40 μm in diameter, and by unispicular tertiary fibers, 7.5-23 μm in diameter, which form rectangular or round meshes, 40-180 μm wide. Choanosome (Figs. 7A, 8B): Ascending primary fibers are parallel, paucispicular (2-6 spicules per cross-section, 20-70 μm in diameter). Their spicular core is dense and occupies one to two thirds of the fibre diameter. Interconnecting secondary fibers are unispicular, 10-60 μm in diameter, forming rectangular choanosomal meshes, 125-625 μm wide. In certain places the skeleton is less organized, fibers become loosely oriented, unispicular tertiary fibers 7-30 μm in diameter are present in the choanosome, and meshes are small and irregular (45-250 μm wide). Loose spicules are common between the fibers.

Spicules (Figs. 7C, 8D, 8E): Stout oxeas, with acerate or telescopic endings, sometimes stylote, straight or slightly bent: 89-*99*-122/1.6-10 μm (n = 40). Toxas stout, usually bent only in the middle, with variable angle of curvature and extremities acerate, in two size categories (the smallest one is very rare): 19.6-*31.8*-40.7/2-4 μm (n = 58), and 5.0-*8.3*-11.0/1-3 μm (n=6).

Ecology: The species seems to be rare and sciaphilic; the specimens studied were found in an overhang 5 m depth and on a rocky wall 30 m depth.

Table 1. Morphological characteristics of *Callyspongia (Toxochalina) robusta* Ridley and *C. (T.) pseudotoxa* sp. n. All measurements are in micrometers unless stated otherwise. "Core" means number of spicules per cross section.

Species	*robusta*	*?robusta*	*pseudotoxa*	*pseudotoxa*
Specimen	BMNH 1881.10.21.336	BMNH 1887.5.2.265	UFRJPOR 4271	UFRJPOR 4152
Collection site	Port Jackson, Australia	off Bahia, Brazil	Arraial do Cabo, Brazil	Rio de Janeiro, Brazil
shape	repent branching	cylindrical branching	massive lobate	massive lobate
surface	smooth	smooth	smooth	smooth
colour	light brown	light brown	light brown	light brown
consistency	soft elastic	soft elastic	elastic	elastic
oscule diameter (mm)	3-6	2	10	8
Choanosome:				
F1 diameter	50-120	40-70	30-70	20-50
F1 core	5-10	2-8	2-5	3-6
F1 meshes	500-700	120-500	125-500	200-625
F2 diameter	30-70	20-70	20-60	10-40
F2 core	2-6	1	1	1
F3 diameter	15-50	10-30	7-20	15-30
F3 core	0-1	1	1	1
Ectosome:				
F1 diameter	40-100	50-80	20-70	15-40
F1 core	3-8	1	1	1
F1 meshes	350-1400	250-500	120-400	150-560
F2 diameter	20-40	20-50	20-40	15-40
F2 core	0-2	1	1	1
F3 diameter	4-45	10-30	7.5-20	12-23
F3 core	0-1	1	1	1
F3 meshes	20-120	20-120	40-100	50-180
Oxea shape	slender, straight, hastate	slightly curved, variable	stout, straight or curved	stout, curved, variable
Oxea length	75-*91*-99	69-*83*-101	90-*96*-106	89-*108*-122
Oxea width	1.6-4.2	1.0-6.2	5-8	1.6-10
Toxa shape	large slender	short slender	short stout	short stout
Toxa abundance	abundant	very rare	common	common
Toxa I length	35-*47*-63	27-*30*-34	19-*25*-36	21-*33*-41
Toxa I width	1.0-2.1	1.6-3.2	2.0-4.2	1.8-4.0
Toxa II length	8-*18*-32	-	8-*9.4*-11	5-*8.2*-9.7
Toxa II width	0.8-1.5	-	1.5-3.0	1.0-2.5

Distribution: Brazil: Endemic of Rio de Janeiro state (Rio de Janeiro, Arraial do Cabo) (Mothes de Moraes, 1985; present paper).

Pharmacology: Unknown.

Etymology: The name *pseudotoxa* refers to the peculiar shape of the toxas, reminding an oxea bent in the middle.

Remarks: Our specimens are clearly conspecific with the sponge described by Mothes de Moraes (1985) from Arraial do Cabo as *Toxochalina robusta* Ridley. *Callyspongia (Toxochalina) pseudotoxa* seems most closely related to *Callyspongia (Callyspongia) fallax* Duchassaing & Michelotti, 1864 from the Caribbean, which may also possess toxas of a similar shape. They differ however by the tubular shape, violet colour, firmer consistency, larger mesh size in the secondary ectosomal reticulation, smaller oxeas, and larger but thinner toxas of *C. (C.) fallax* (Wiedenmayer, 1977; Van Soest, 1980; Zea, 1987). *Callyspongia (Toxochalina) robusta* (Ridley, 1884) from Australia differs from *C. (T.) pseudotoxa* by a massive,

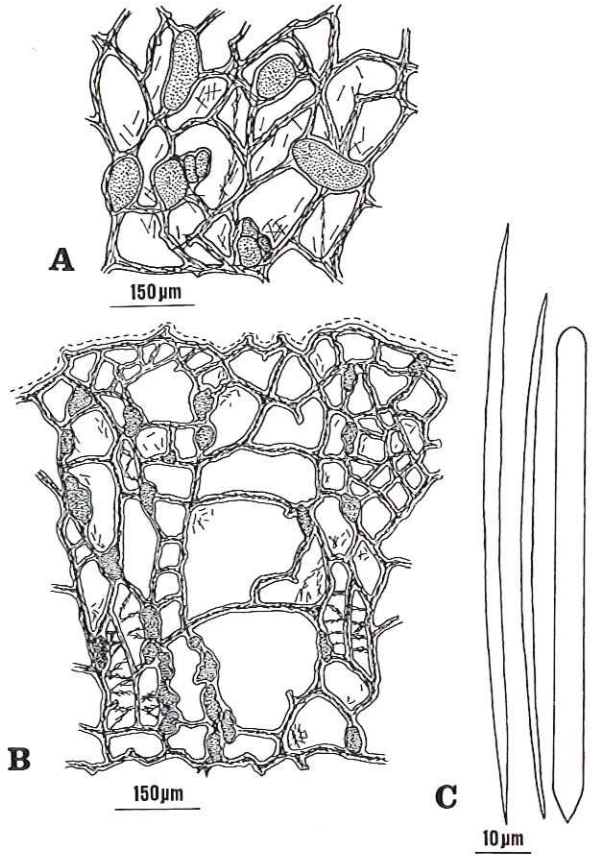

Fig. 9. *Arenosclera brasiliensis* sp. n. A, tangential section of the ectosome; B, transversal section of the ectosome; C, oxeas.

lobate shape, thinner choanosomal primaries, smaller primary mesh size, degree of spicule coring of ectosomal secondary and tertiary fibers (unispicular in *C. (T.) pseudotoxa*, respectively multispicular and aspicular in *T. robusta*), shape of oxeas, and especially by the shape and size of toxas (Fig. 8F, Table 1; see also Ridley, 1884; Bergquist & Warne, 1980; Desqueyroux-Faundez, 1984). A specimen of *T. robusta* from Bahia (BMNH 1887.5.2.265; Ridley & Dendy, 1887) has a ramose shape with cylindrical branches, very rare toxas in a single category and thinner oxeas. It probably belongs to a third, as yet undescribed species, and we presently consider that there are no valid records of *C. (T). robusta* for the Brazilian coast. No other species of *Callyspongia (Toxochalina)* has been reported so far from Brazil or the Caribbean.

Genus *Arenosclera* Pulitzer-Finali, 1982

Diagnosis: "Callyspongiidae with a specialized dermal skeleton consisting of a regular tangential network of foreign debris joined by scarce spongin and a rather irregularly reticulated choanosomal skeleton of spongin fibers cored by both foreign material and proper diactines in variable proportion. Secondary fibers uncored or cored by proper spicules only may be present or absent in the ectosomal skeleton. In the choanosomal skeleton the secondary fibers - not always distinguishable from the primary ones - are generally cored by proper spicules only (Pulitzer-Finali, 1982).

Remarks: The genus *Arenosclera* has been synonymised with *Callyspongia* by Wiedenmayer (1989), who enlarged the definition of the latter to include species with spongin fibers cored by sand grains and oxeote spicules. Some species of *Callyspongia* and its proposed junior synonym *Dactylia* Carter, 1885 indeed bear spongin fibers

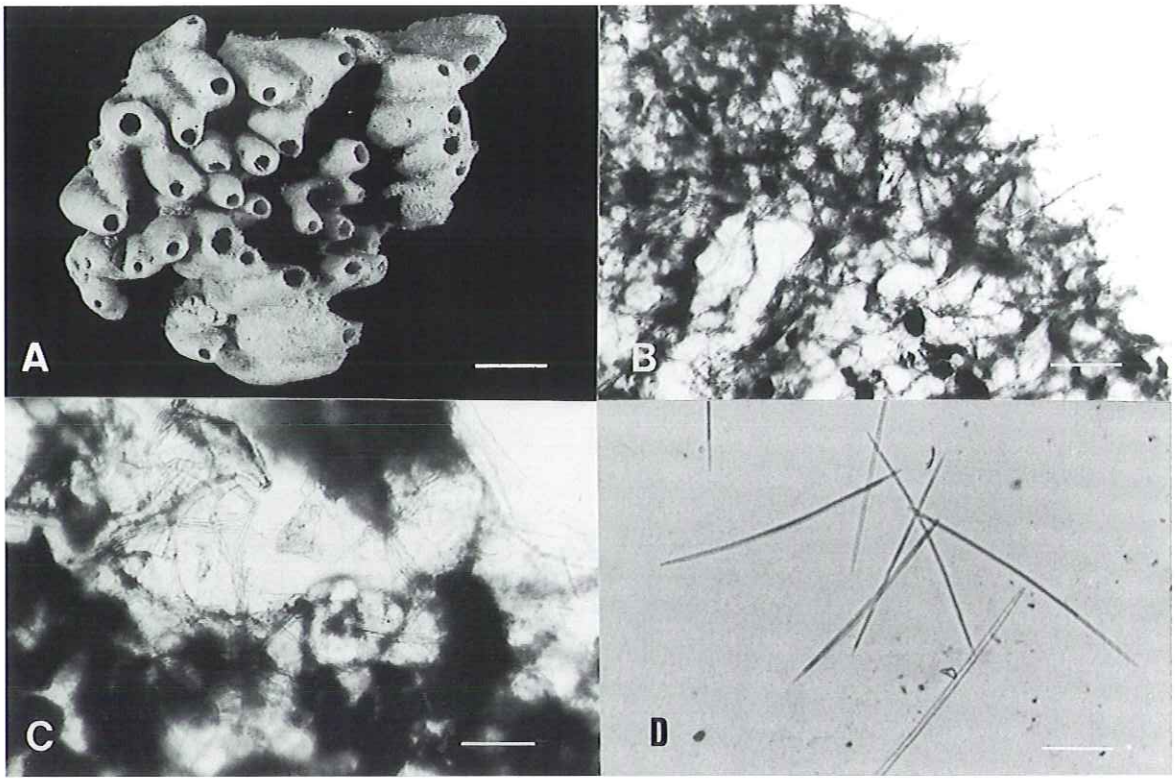

Fig. 10. *Arenosclera brasiliensis* sp. n. A, preserved specimen (UFRJPOR 4628) (scale bar = 12 mm). B, transversal section of the ectosome (scale bar = 150 μm). C, tangential section of the ectosome (scale bar = 150 μm). D, oxeas (scale bar = 25 μm).

cored with sand grains (e.g., *Callyspongia flammea* Desqueyroux-Faundez, 1984; *Dactylia palmata* Carter, 1885), but they never attain the degree of inclusion of mineral particles observed in *A. heroni* Pulitzer-Finali 1982 and in all other species of *Arenosclera*, in which the spongin of the fibers is almost completely obscured by exogenous debris. We thus prefer to keep *Arenosclera* separated from *Callyspongia*, waiting for a comprehensive revision of the latter.

Arenosclera brasiliensis sp.n.
Figs. 2D, 9-10.

Arenosclera sp., Muricy et al., 1991: 1187
cf. *Arenosclera* sp., Muricy et al., 1993: 429

MATERIAL EXAMINED

Rio de Janeiro state: Búzios: *Holotype:* UFRJPOR 4627, João Fernandinho, 3 m depth, coll. G. Muricy, 30/VIII/97. *Paratypes:* UFRJPOR 4155, João Fernandinho, 3 m depth, coll. C. A. Rangel, 13/XI/93; UFRJPOR 3073, coll. E. Hajdu, 06/XII/86; UFRJPOR 4628, João Fernandinho, 3 m depth, coll. G. Muricy, 30/VIII/97.
Arraial do Cabo: UFRJPOR 4231, Praia do Forno, 5 m depth, coll. G. Muricy, 05/VII/91; UFRJPOR 4383, coll. G. Muricy, 06/XII/86, UFRJPOR 4603, coll. G. Muricy, 01/VIII/97, Prainha, 3m depth; UFRJPOR 3071, Prainha, coll. G. Muricy, 06/XII/86.

Material studied for comparison: *Arenosclera heroni* Pulitzer-Finali, 1982: MHNG 22920, Daougae Is., N. Caledonia; MNRJ 1839, 1859, 1860, Heron Is., Australia.
Arenosclera parca Pulitzer-Finali, 1982: MHNG 22921, Tiaré, N. Caledonia.
Arenosclera rosacea Desqueyroux-Faundez, 1984: MHNG 22922 (paratype), Santa Maria Bay, N.

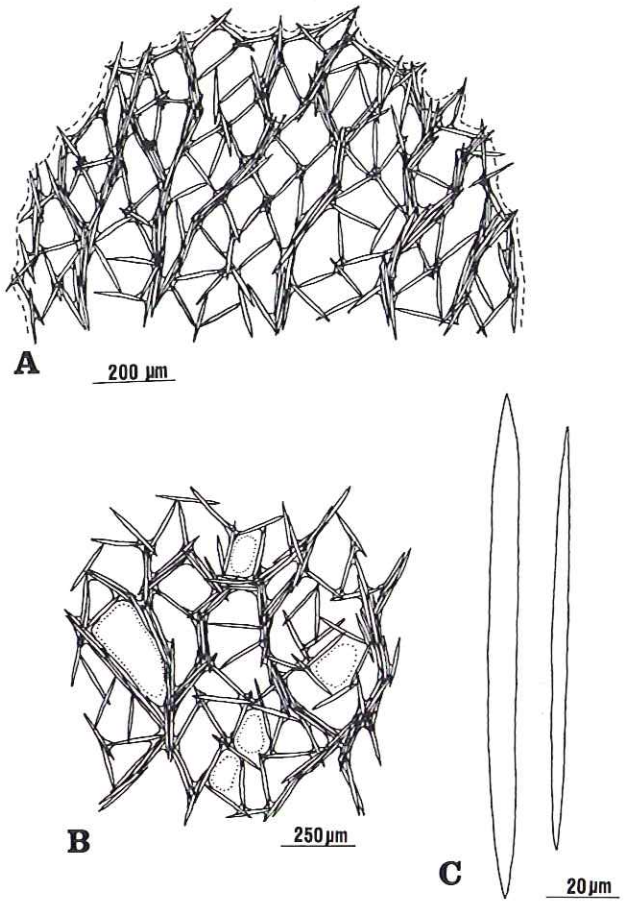

Fig. 11. *Haliclona melana* sp. n. A, transversal section of the ectosome; B, tangential section of the ectosome; C, oxeas.

Caledonia.

Description (Figs. 2D, 10A): Massive, lobate sponge, with up to 50 lobes or tubes 5-20 mm in diameter by 22-30 mm high, fused laterally. The whole sponge reaches 12 cm in heigth and 30 cm in width. Each lobe bears a circular oscule at the top, 1-10 mm in diameter, surrounded by a translucent oscular rim. Surface is rough to touch, filled with abundant debris and sand particles. Colour is whitish, drab or cream, both alive and in spirit. Consistency is soft, compressible, with abundant mucus.

Skeleton: Ectosome (Figs. 9A, 10C): Irregular tangential reticulation of spongin fibers cored by 2-10 spicules and abundant sand grains. F1 are 19.6-39.2 µm in diameter, 100-800 µm apart, and form rectangular or rounded meshes. F2 with 1-5 spicules and sand grains, 10-20 µm in diameter, forming irregular to rectangular meshes, 4-70 µm in diameter. Choanosome (Figs. 9B, 10B): F1 cored by 2-10 spicules and abundant sand grains, 29-50 µm in diameter, forming rounded or irregular meshes 30-900 µm in diameter. F2 cored by 2-5 spicules and sand grains, 10-40 µm in diameter, forming irregular meshes, 5-150 µm in diameter.

Spicules (Figs. 9C, 10D): Oxeas, slightly curved, hastate or fusiform, extremities acerate or blunt: 41-*75*-108/1.5-6.5 µm (n = 80).

Ecology: A. brasiliensis colonizes mostly horizontal to sub-vertical rocky substrates, exposed to direct sunlight and abrasion by sandy sediment, in the *Phyllogorgia* zone, 2 to 10 m depth. Sur-

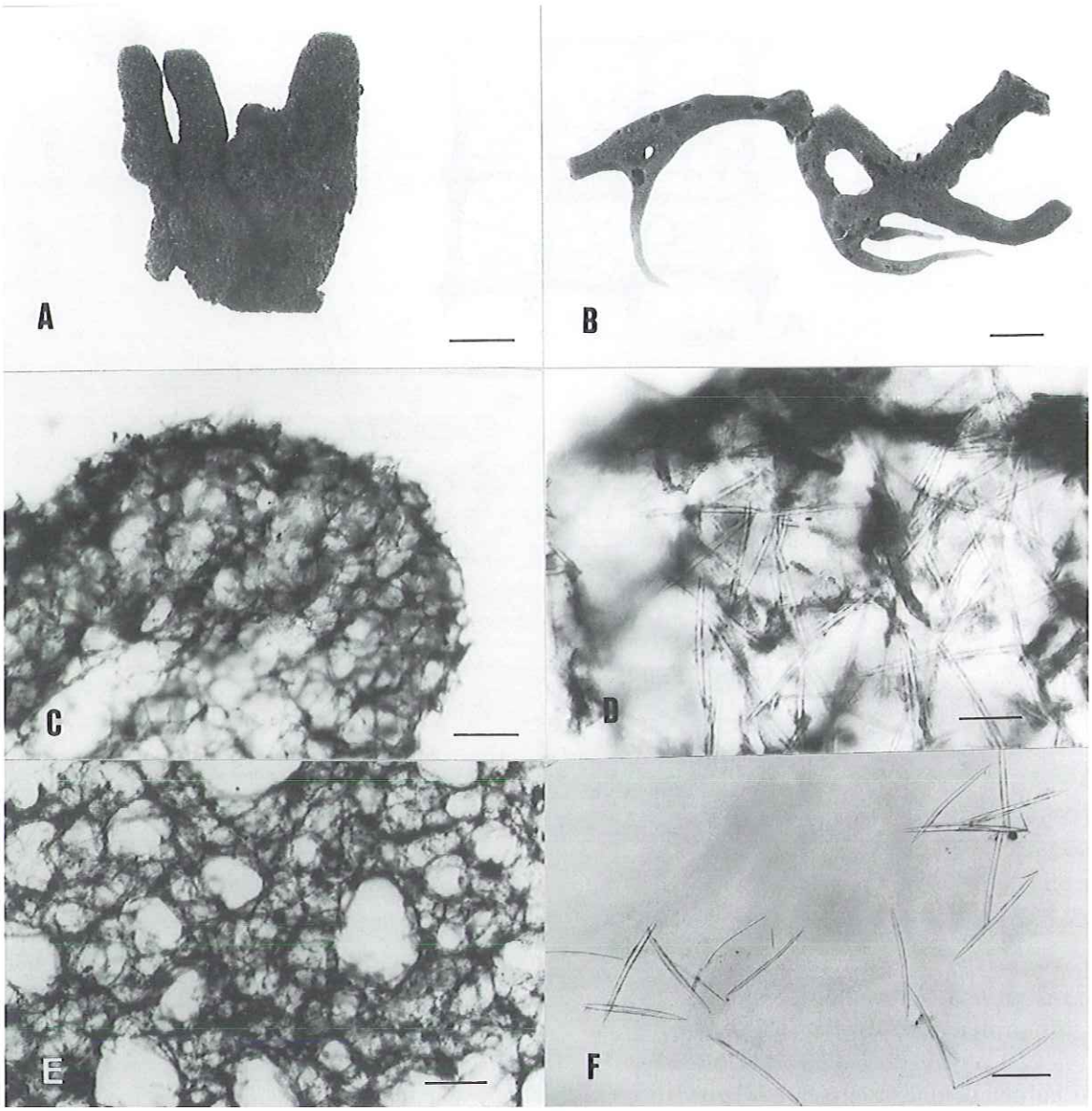

Fig. 12. *Haliclona melana* sp. n. A, preserved specimen (UFRJPOR 4269) (scale bar = 1 cm). B, preserved specimen (UFRJ-POR 4232) (scale bar = 1 cm). C, transversal section of the ectosome (scale bar = 200 μm). D, transversal section of the ectosome (scale bar = 75 μm). E, tangential section of the ectosome (scale bar = 200 μm). F, oxeas (scale bar = 75 μm).

face of specimens is usually clean of epi-bionts.

Distribution: Endemic from Rio de Janeiro state (Búzios, Arraial do Cabo).

Pharmacology: The crude extract of *A. brasiliensis* is antibacterial and antifungal (Muricy et al., 1993), and has also shown potent cytotoxic activity (R. Berlinck, pers. comm., 1997).

Etymology: The species name refers to its distribution, apparently endemic from the Brazilian coast.

Remarks: This is the first record of the genus *Arenosclera* from the Atlantic Ocean, the other five valid species of the genus being known only from the Indo-Pacific and Red Sea. *A. brasiliensis*

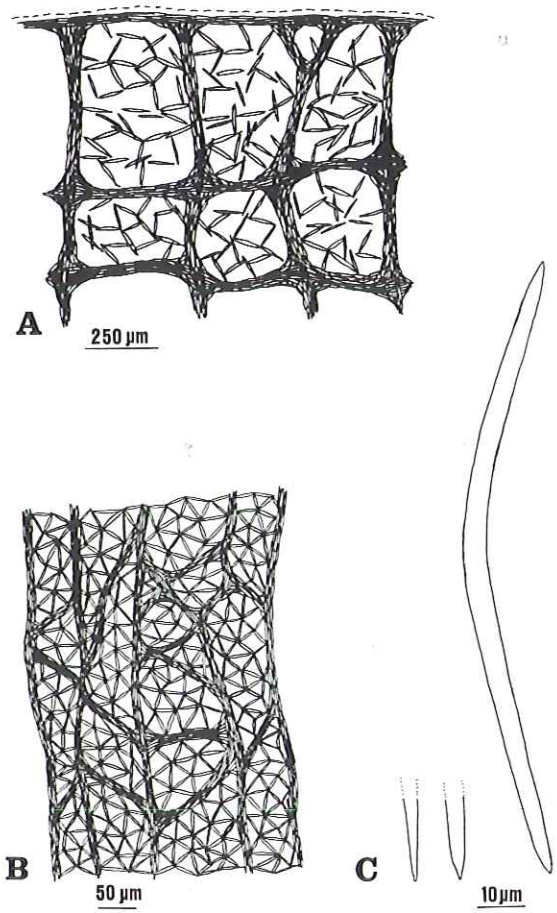

Fig. 13. *Oceanapia nodosa*. A, transversal section of the ectosome; B, tangential section of the fistule wall; C, oxea.

shares with *A. heroni* Pulitzer-Finali, 1982 a highly arenaceous surface with an irregular ectosomal reticulation. They differ however by the lighter colour, stronger tendency to form coalescent tubes and larger ectosomal skeletal meshes in *A. brasiliensis*. The new species resembles *A. parca* Pulitzer-Finali, 1982 and *A. rosacea* Desqueyroux-Faundez, 1984 in the possession of coalescent tubes but the surface of these two species is smoother, and tube walls are thicker in *A. parca*. The ectosomal skeleton of *A. parca* and *A. rosacea* is formed by polygonal meshes, whereas *A. brasiliensis* and *A. heroni* have irregular ectosomal meshes. *A. arabica* (Keller, 1889) differs from *A. brasiliensis* by its much smaller choanosomal meshes (49-147 µm against 98-800 µm in *A. brasiliensis*), while *A. arborea* (Lendenfeld, 1889) has much larger choanosomal meshes (900-1400 µm).

Family Chalinidae Gray, 1867
Diagnosis: "Haplosclerida with a delicate, reticulated skeleton of uni- or paucispicular primary lines which are regularly connected by uni- or paucispicular secondary lines. Ectosomal skeleton, if present, a unispicular, tangential reticulation." (De Weerdt, 1986) .

Genus **Haliclona** Grant, 1835
Diagnosis: "Chalinidae with unispicular secondary lines." (De Weerdt, 1986).

Haliclona melana sp.n.
Figs. 2E, 11-12.

MATERIAL EXAMINED

Rio de Janeiro state: Angra dos Reis. *Holotype:* UFRJPOR 4269, Ponta Leste, 4 m, coll. E. Omena, 11/XII/87. *Paratypes:* UFRJPOR 4232, Jamanta, 2 m, coll. G. Muricy & E. Hajdu, 24/V/90; UFRJPOR 4382, Jamanta, 1 m, coll. E. Omena, 20/XI/87. Parati: UFRJPOR 4751, Praia Vermelha, 3 m, coll. G. Muricy & R. Albano, 28/II/98.
São Paulo state: São Sebastião: UFRJPOR 3618, Praia do Cabelo Gordo, 0.5 m, coll. E. Hajdu, 05/XII/88.
Pernambuco state: Tamandaré: UFRJPOR 3683, Ponta dos Carneiros, 1 m, coll. E. Hajdu & S. Peixinho, 30/I/89.

Material studied for comparison: *Haliclona implexiformis* (Hechtel, 1965): UFRJPOR 4124, Twin Cays, Belize.
Acervochalina molitba (De Laubenfels, 1949): UFRJPOR 4111, Twin Cays, Belize.

Description (Figs. 2E, 12A, 12B): Thinly to massively encrusting, lobate, or repent sponge, with up to 25 lobes 5-20 μm in diameter, often fused laterally at their lower half. The whole sponge reaches 30 cm in heigth and 35 cm in width, but typical specimens measure approximately 5 cm high by 10 cm wide. In sheltered places, it can develop long and thin cylindrical, finger-like processes, up to 10 cm high by 1 cm in diameter, gradually tapering to thinner endings. These processes may ramify and anastomose several times. Oscules are low, circular, 1-5 mm in diameter, on top of lobes or on the sides of finger-like processes. Smaller openings, 0.2 to 0.8 mm in diameter, are dispersed throughout the surface, which is even, generally smooth, but not easily detachable. Colour is dark brown to black both externally and internally, preserved in spirit. Consistency is very soft, compressible, fragile.

Skeleton: Ectosome (Figs. 11B, 12E): Ectosomal skeleton is an irregular tangential reticulation of single spicules with nodal spongin, with few sinuous, paucispicular spicule tracts bounded by relatively little spongin. Choanosome (Figs. 11A, 12C, 12D): Choanoso-mal skeleton is formed by primary ascending, sinuous, paucispicular spicule tracts reinforced by little spongin (20-50 μm in diameter). Primary tracts are connected by an irregular reticulation of single spicules with nodal spongin, and free spicules are frequent.

Spicules (Figs. 11C, 12F): Hastate oxeas, straight or slightly curved, with acerate ends, rarely stylote: 105-*123*-156/1-*3.5*-6.0 μm (n = 60).

Ecology: Haliclona melana is relatively common in shallow-water rocky substrates in unpolluted, calm bays, 0.5 to 6 m depth, either cryptic or exposed to light. Its surface is usually clean of epibionts.

Distribution: Rio de Janeiro state (Parati, Angra dos Reis); São Paulo state (São Sebastião); Pernambuco state (Ponta dos Carneiros).

Pharmacology: Unknown, but the surface clean from epibionts is suggestive of presence of antifouling compounds.

Etymology: The name *melana* refers to the typical black to dark brown colour of the species.

Remarks: Haliclona melana is here included in the "*arenata*" species group (De Weerdt, 1986) due to its vague, sinuous ascending tracts connected by an isotropic reticulation with nodal spongin. Most *Haliclona* species are pink, violet, cream, orange, or green, and only two other dark colored chalinids are known from the Atlantic: *Haliclona nigra* (Burton, 1929) from Tropical West Africa and *Acervochalina nigra* (Boury-Esnault & Lopes, 1985) from the Azores. *Haliclona nigra* differs from *H. melana* by its skeleton composed by a triangular network of single spicules bound by nodal spongin, absence of spicule tracts, and smaller size of oscules. *Acervochalina nigra* differs from *H. melana* by its conulose surface, the skeleton composed multispicu-

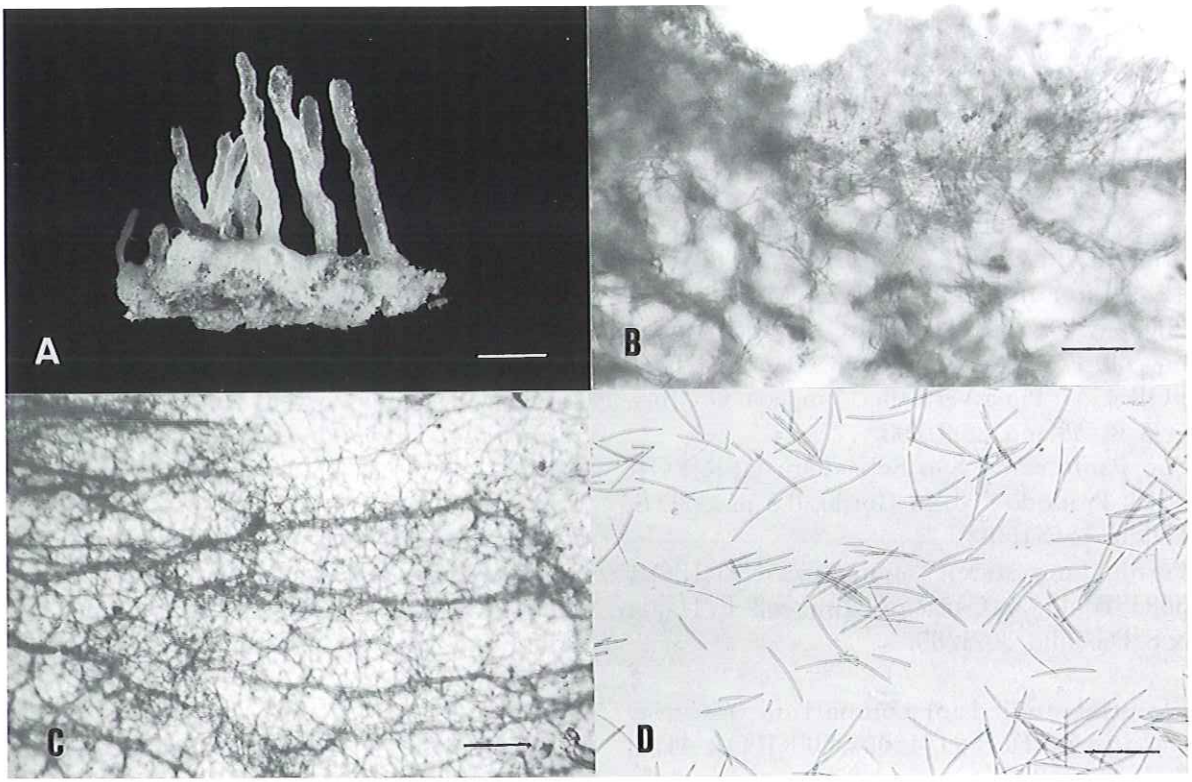

Fig. 14. *Oceanapia nodosa*. A, preserved specimen (UFRJPOR 4374) (scale bar = 5 mm). B, transversal section of the ectosome (scale bar = 20 μm). C, tangential section of the fistule wall (scale bar = 120 μm). D, oxeas (scale bar = 120 μm).

lar spongin fibres, and the larger size of its oxeas. *H. melana* is also similar in colour and shape to *Pellina carbonaria* (Lamarck, 1814) from the Caribbean (Hechtel, 1965; Van Soest, 1980; Zea, 1987) and Recife (Hechtel, 1976, as *Adocia*), from which it differs by a softer consistency, an unilayered, unispicular tangential ectosomal reticulation, absence of large subdermal spaces, and a more organized choanosomal reticulation.

Only five other chalinids have been reported from the brazilian coast. *Acervochalina molitba* (De Laubenfels, 1949), quoted by Hechtel (1976) from Recife is light violet and has a choanosomal skeleton composed of spongin fibers cored by spicules, no dermal specialization, and smaller oxeas (Van Soest, 1980). *Haliclona catarinensis* Mothes & Lerner, 1994, is orange-grey, thinly encrusting, and has thicker oxeas. *Haliclona mammilaris* Mothes & Lerner, 1994, is white, with mamiliform projections. *Haliclona lilacea* Mothes & Lerner, 1994, is violet, with a microconulose surface. These three *Haliclona* species have been described from Santa Catarina state, and also fit in the *"arenata"* species group. *Haliclona tubifera* (George & Wilson, 1919) is bluish purple to pink, with an incomplete tangential reticulation. *Haliclona hogarti* Hechtel, 1965, quoted by De Laubenfels (1956, as *H. permollis*) from São Paulo state, is a junior synonym of *H. tubifera* (cf. De Weerdt et al., 1991).

Family Phloeodictyidae Carter, 1882
Syn. Oceanapiidae Van Soest, 1980
Diagnosis: "Haplosclerida with an ectosomal skeleton consisting of a tangential, sub-isotropic reticulation of single spicules; choanosomal skeleton a sub-isotropic reticulation of single spicules to which there is added an irregular system of spicule tracts." (De Weerdt, 1985).

Genus *Oceanapia* Norman, 1869
Diagnosis: "Fistulae-bearing Phloeodictyidae. Fistule walls supported by a longitudinal reticulation of spicule tracts with minimal spongin. This type of skeleton is responsible for the pulpy consistency, which occurs in *Oceanapia robusta* (Bowerbank, 1866). Spongin may be highly developed in other species." (De Weerdt, 1985).

Oceanapia nodosa (George & Wilson, 1919)
Figs. 2F, 13-14.

Phloeodictyon nodosum George & Wilson, 1919: 152
Pellina nodosa; Van Soest, 1980: 80; Zea, 1987: 124
Oceanapia isodictyiformis; Muricy et al., 1991: 1187
(non: *Phloeodictyon isodictyiformis* Carter, 1882: 122; *Oceanapia isodictyiformis* (Carter) *sensu* De Weerdt, 1985: 80)

Holotype: ?
Type locality: Beaufort Harbour, North Carolina, USA.

MATERIAL EXAMINED

Rio de Janeiro state: Arraial do Cabo: UFRJPOR 2622, 3 m, coll. E. Hajdu, 15/XI/87; UFRJPOR 2915b, 4 m, coll. G. Muricy, 10/V/87; UFRJPOR 2969, 2 m, coll. G. Muricy, 24/VIII/87; UFRJPOR 2948, 2970, 3 m, coll. E. Hajdu, 14/VI/87; UFRJPOR 3777, 3778, 3779, 4276, 5 m, coll. G. Muricy, 29/III/87.
Niterói: MNRJ 1577, 1 m, MNRJ 1578, 2 m, Itaipú, coll. R. Albano, E. Hajdu & G. Muricy, 24/II/98.
Rio de Janeiro: UFRJPOR 3780, 3781, 4374, 1 m, Urca, coll. E. Hajdu, VIII/1988.
São Paulo state: São Sebastião: UFRJPOR 174, coll. Araujo, J. Luiz & Neuza, IX/1967.
Maranhão state: UFRJPOR 504, coll. N.O.A.S. st. 1749a.

Material examined for comparison: *Oceanapia nodosa* (George & Wilson, 1919): ZMAPOR 3686, Florida (USA).
Phloeodictyon isodictyiformis Carter, 1882: BMNH 1872.5.4.1, NE Atlantic (Spain).
Pellina fistulosa (Bowerbank, 1866): UFRJPOR 3223, Marseille (France).
Description (Figs. 2F, 14A): Sponge encrusting or massive, with up to a hundred (usually 10-30) delicate fistules, 2-5 mm in diameter and up to 4 cm high. The base often agglomerates coarse sediment, to a point that it is doubtful whether it is perforating the substrate. Fistules are hollow, cylindrical, unbranched or rarely bifurcated, most often closed in the apex and coalescent at the base. Specimens from Niterói bear particularly irregular fistules, from which arise thin filamentous projections, 7.0 x 0.6 mm. These projections may be unbranched or bifurcate, and often bear a central (inhalant?) canal, 100-200 mm in diameter. Projections are easily broken off from the sponge, and they may be asexual propagules. Surface is smooth or minutely hispid both at the base and on fistules. Colour alive is white or drab at the base and translucent white in fistules. Consistency of the base is soft, spongy. Fistules are soft, delicate, but stiff enough to stay erect when taken out of the water.

Skeleton: Ectosome (Figs. 13B, 14C): Ectosomal skeleton is a unispicular, sub-isotropic tangential reticulation with nodal spongin. Underlining this unispicular reticulation, there is a loose longitudinal subectosomal reticulation of spongin-reinforced multispicular tracts, 3-8 μm in diameter, which forms rectangular or rounded meshes 108-220 μm wide and sustains the walls of fistules. Choanosome (Figs. 13A, 14B): Irregular spongin-reinforced multispicular tracts are organized in more or less parallel ascending lines, 39-98 μm in diameter and 147-440 μm apart, which merge with the subectosomal reticulation. A relatively dense, sub-isotropic, uni- or paucispicular reticulation with nodal spongin, 29-49 μm in diameter and 196-540 μm apart, is disposed between the multispicular tracts. Fistules do not possess choanosome.

Spicules (Figs. 13C, 14D): Oxeas, slender and uniform, centrally bent, acerate: 90-*98*-104/1.5-3.0 μm (n=160).

Ecology: This species is common in both horizontal and vertical rocky substrates from 3 to at

least 30 m depth. It seems to be tolerant to moderate organic pollution. The base is often covered by algae, hydroids, and ectoprocts, but the fistules are usually clean from epibionts.

Distribution: Atlantic. Caribbean: Curaçao, Margarita, Florida (Van Soest, 1980). North Atlantic: North Carolina (George & Wilson, 1919). Brazil: Rio de Janeiro state (Rio de Janeiro, Niterói, and Arraial do Cabo), São Paulo state, and Maranhão state.

Pharmacology: Unknown.

Remarks: Our specimens conform in detail with *O. nodosa* from the Caribbean (Van Soest, 1980; Zea, 1987; and reexamination of *Pellina nodosa* ZMAPOR 3686, det. R.W.M. Van Soest). De Weerdt (1985) suggested a possible synonymy of *Oceanapia nodosa* (George & Wilson, 1919) and *O. isodictyiformis* (Carter, 1882). Re-examination of the type specimen of *O. isodictyiformis* (BMNH 1872.5.4.1) however showed that it has thinner fistules, larger oxeas, and a more regular, less dense isodictyal reticulation than *O. nodosa*. Although we did not examine the holotype of *O. nodosa* George & Wilson, we prefer to consider them as sibling species in view of these differences. *Pellina fistulosa* (Bowerbank, 1866) from the northeastern Atlantic and the Mediterranean is close to both *O. nodosa and O. isodictyiformis*, but it has smaller fistules, which are often yellowish or greenish *in vivo*, larger spicules, and a more confused longitudinal multispicular reticulation than the latter two species. The status of this species complex probably can only be determined with the help of molecular methods.

Six other species of *Oceanapia* have been reported from the Brazilian coast. *Oceanapia bartschi* (De Laubenfels, 1934), recorded from the mouth of the Amazon (Colette & Rützler, 1977, as *Inflatella*), is blackish brown and has thin strongyles in tracts with abundant spongin. *Oceanapia* aff. *eusiphonia* (Ridley, 1884), described from Ceará state, has three size categories of oxeas (Johnson, 1971). *Oceanapia robusta* (Bowerbank, 1866) *sensu* Ridley & Dendy (1887) from Bahia was synonymised with *O. fistulosa* (Bowerbank, 1873) (cf. Van Soest, 1980); it is yellow to yellow-brown in spirit, globular, with a root system and long fistules. *Oceanapia nodulosa* (Hechtel, 1983) from Recife has solid superficial nodules and raphids. *Oceanapia putridosa* (Lamarck, 1814) described by Ridley & Dendy (1887) from Bahia has a firm consistency, bladder-like swellings in the surface, and larger oxeas (195 x 13 µm). *Oceanapia oleracea* (Schmidt, 1870) reported by Hechtel (1976) from Recife, is brownish grey, with a root system, and has rare sigmata.

DISCUSSION

In this paper we described six species of haplosclerid sponges from Rio de Janeiro state, Brazil, representing four families of the order. The list is however far from complete and many other, less conspicuous haplosclerids remain to be described from the same area. The Haplosclerida is one of the most abundant and diverse orders of Porifera in the coast of Rio de Janeiro state, being second only to the Poecilosclerida (Hajdu, 1991; Muricy et al., 1991, and GM, unpublished observations).

External morphological features such as colour, surface texture, the arrangement and size of openings of the aquiferous system and body shape are characteristic of each species, and are thus essential for species identification. Many of these external traits are lost after fixation, and therefore careful *in situ* observations and/or photographs should be taken prior to collection to ensure a precise identification. Some species however seem to vary in external features, particularly colour and shape (e.g., *Callyspongia (Callyspongia) pallida)*, raising the possibility that there may be sibling species involved. Such problems can only be approached by molecular or cytological analyses, which were out of the scope of this paper.

The intracellular spongin filaments found in *Callyspongia (Callyspongia) pallida* have not been recorded in prior descriptions of the species (Hechtel, 1965; Van Soest, 1980). Such spongin filaments are known from several other hap-

losclerids such as *Haliclona neens* (Topsent, 1918), *H. cinerea* (Grant, 1826), and *Acervochalina finitima* Ridley, 1884 (cf. Topsent, 1893, 1898, 1918; Loisel, 1898; Lévi, 1967). They probably play a supportive role in the sponge, in addition to the normal fibre skeleton (Lévi, 1967). The phylogenetic significance of the presence of spongin filaments in haplosclerids is still unclear.

Most species studied here are relatively euryoecious, and colonize a range of different shallow water rocky habitats, both exposed and protected from direct wave currents and light. This is the case of *Amphimedon viridis, Callyspongia (Callyspongia) pallida, Haliclona melana* sp. n. and *Oceanapia nodosa*. *A. viridis* and *O. nodosa* are tolerant to moderate levels of organic pollution, in contrast to all other species studied. *Arenosclera brasiliensis* sp. n. and *Callyspongia* (*Toxochalina*) *pseudotoxa* sp. n. have more restricted requirements; the former is usually confined to rocky substrates partially covered by sand and exposed to light, and the latter seems to prefer shaded environments.

Half of the species described here were already known from the Caribbean (*Amphimedon viridis*, *Callyspongia (Callyspongia) pallida* and *Oceanapia nodosa*). *A. viridis* is also present in the northeastern brazilian coast, and the apparently disjunct distribution of *C. (C.) pallida* and *O. nodosa* is probably an artifact due to the small size and low abundance of these species (see also De Weerdt, 1985, for *O. isodictyiformis*). *Haliclona melana* sp. n. is also widely distributed along the brazilian coast. The shallow water haplosclerid fauna of Rio de Janeiro state therefore has affinities with the caribbean fauna, but also has an endemic faunal component represented in this study by *Callyspongia* (*Toxochalina*) *pseudotoxa* sp. n. and *Arenosclera brasiliensis* sp. n.

Only three of the species studied here have been screened for pharmacological properties so far. Extracts from *Amphimedon viridis* have shown antibacterial, antimitotic, antitumoral, neurotoxic, hemolytic, hypoglycemic and icthyotoxic properties (see, e.g., Muricy et al., 1993; Berlinck et al., 1996). *Callyspongia (Callyspongia) pallida* has antibacterial activity (Muricy et al., 1993 as *Callyspongia* sp.). Extracts of *Arenosclera brasiliensis* sp. n. are antibacterial and antifungal (Muricy et al., 1993, as cf. *Arenosclera* sp.), and have also shown potent antitumoral activity (R. Berlink, pers. comm., 1998). The wide range of activities found in these species and in other haplosclerids suggests a high pharmacological potential for the other three species, *Callyspongia* (*Toxochalina*) *pseudotoxa, Oceanapia nodosa* and *Haliclona melana*, although of these only *H. melana* seems abundant enough for detailed chemical and pharmacological studies.

KEY TO THE SPECIES DESCRIBED

1.1. Skeleton is a reticulation of spongin fibers, cored by spicules or sand grains 2
1.2. Skeleton is a reticulation of spicule tracts or single spicules, reinforced by spongin in variable degrees.....4

2.1. Fibers cored mainly by spicules 3
2.2. Fibers cored mainly by sand grains, sponge whitish ..... *Arenosclera brasiliensis*

3.1. Colour light brown, microscleres toxas..... .....*Callyspongia (Toxochalina) pseudotoxa*
3.2. Colour orange, pink, or violet; toxas absent ..... *Callyspongia (Callyspongia) pallida*

4.1. Habit fistulose, with translucent-white, hollow and delicate fistules arising from a common base ..... *Oceanapia nodosa*
4.2. Habit massively encrusting, lobate, or ramose 5

5.1. Colour green or bluish-green ....*Amphimedon viridis*
5.2. Colour black or dark brown ....*Haliclona melana*

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