

Two new shallow-water species of *Haliclona* from north-eastern Brazil (Demospongiae: Haplosclerida: Chalinidae)

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Haliclona is an unusually species-rich genus in Porifera, with more than 400 species described. In spite of many subgenera used in the taxonomic housekeeping of these sponges, over half of them remain unassigned to a subgenus, thus encouraging a wide range of redescriptions and taxonomic revisions of materials from all around the world. In this paper, we describe two new *Haliclona* spp. collected at Pernambuco, Alagoas and Bahia States (north-eastern Brazil, between 08°46'S and 13°56'S). *Haliclona* (*Reniera*) *chlorilla* sp. nov. is a dark green or black coloured, delicately-branched species; and *Haliclona* (*Soestella*) *peixinhoae* sp. nov., a beige-coloured, tubular species, where tubes frequently bear large thorns and possess a conspicuous sub-superficial meandering reticulation. These species highlight the importance of including ex-situ collections in compiling baseline data, as both were already present in scientific collections by the 1980s and 1990s.

Keywords: Porifera, biodiversity, taxonomy, tropical western Atlantic

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INTRODUCTION

Chalinidae Gray, 1867 is the largest family within the Haplosclerida Topsent, 1928. It is also the most complicated taxonomically due to the paucity, simplicity and high variability of its taxonomic characters (De Weerd, 1989, 2000). *Haliclona* is the richest genus in the family and an unusually species-rich genus in the Porifera, with more than 400 species listed in the *World Porifera Database* (Van Soest *et al.*, 2013). Many of these species were described for other genera, later synonymized with *Haliclona*. In spite of the six subgenera currently used for taxonomic housekeeping in *Haliclona*, over 200 species remain unassigned to a subgenus, which reflects the exceedingly poor knowledge on the morphology of these sponges, and calls for urgent redescription of historical materials from all around the world. Ideally, these reassessments will be conducted side by side with taxonomic revisions of regional faunas, undertaken on the basis of large series of freshly collected materials. This is the rationale underpinning our efforts for an improved knowledge about Brazilian *Haliclona* spp. In this paper, we describe two new species of *Haliclona*, collected at Pernambuco, Alagoas and Bahia States, between 08°46'S and 13°56'S.

MATERIALS AND METHODS

Specimens were collected by snorkelling or SCUBA diving in several localities indicated in Figure 1. The preparation of

spicules for light and electron microscopy (SEM), and thick sections were made following the method of Hajdu *et al.* (2011). The SEM microscope used was a JEOL 6390 LV of the Departamento de Invertebrados of Museu Nacional/UF RJ. Spicule dimensions are based on measurements of 30 fully grown spicules for each specimen, and presented as minimum(mi.)–mean(me.)–maximum(ma.) length/mi.–me.–ma. width. To avoid confusion of Brazilian geopolitical regions (north-eastern) and marine ecoregions (Eastern and North-eastern), whenever referring to the latter, the word ecoregion is employed.

Holotype and paratypes of *Haliclona* (*Reniera*) *chlorilla* sp. nov. are deposited in the Museu Nacional, Universidade Federal do Rio de Janeiro Porifera collection (MNRJ). Holotype and two paratypes of *Haliclona* (*Soestella*) *peixinhoae* sp. nov. are deposited in the MNRJ Porifera collection. The three remaining paratypes of this species are deposited in the Porifera collection of Universidade Federal da Bahia (UFBA-POR). Fragments of types originating from Alagoas State are deposited in the Porifera collection of Universidade Federal de Alagoas (UFALPOR).

Classification follows the Chalinidae chapter in the *Systema Porifera* (De Weerd, 2002)

SYSTEMATICS

Class DEMOSPONGIAE Sollas, 1885
Order HAPLOSCLERIDA Topsent, 1928
Family CHALINIDAE Gray, 1867
Genus *Haliclona* Grant, 1836
Subgenus *Reniera* Schmidt, 1862

Haliclona (*Reniera*) *chlorilla* sp. nov.
(Figures 2, 3; Tables 1, 2)

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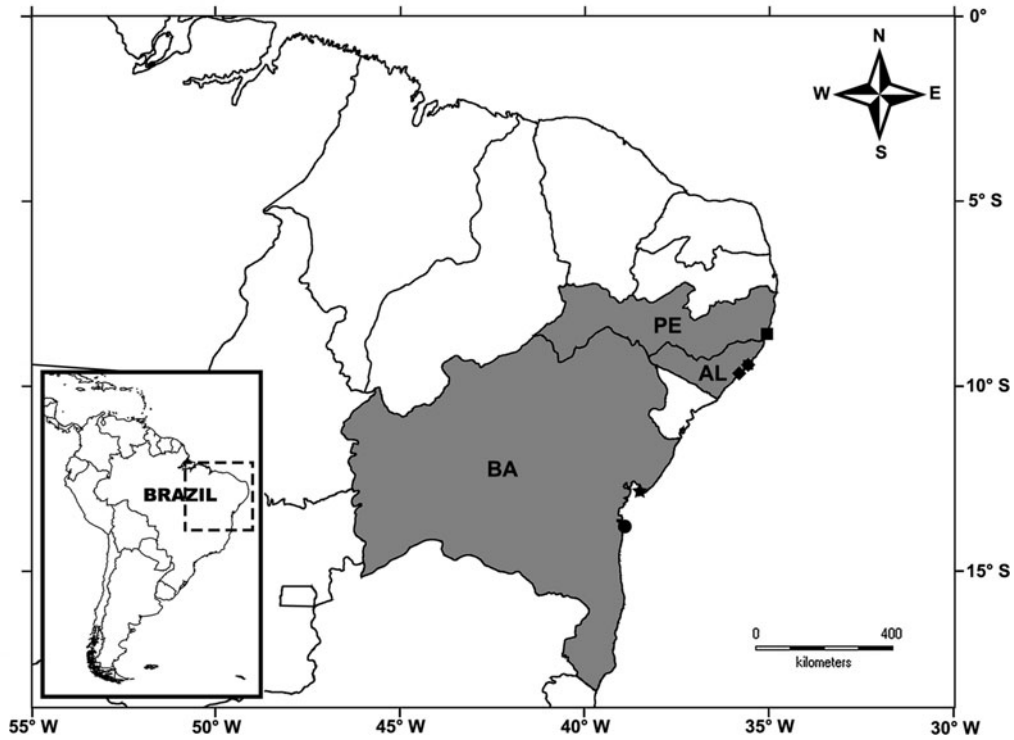


Fig. 1. Collection sites of the two new species. ■, Ponta dos Carneiros, Tamandaré, PE; ●, Ponta do Prego, Maceió, AL; ◆, Praia do Francês, Marechal Deodoro, AL; ★, Ponta de Montserrat, Salvador, BA; ●, Taipús de Fora, Marau, BA. Abbreviations of the States are as follow: AL, Alagoas; BA, Bahia; PE, Pernambuco.

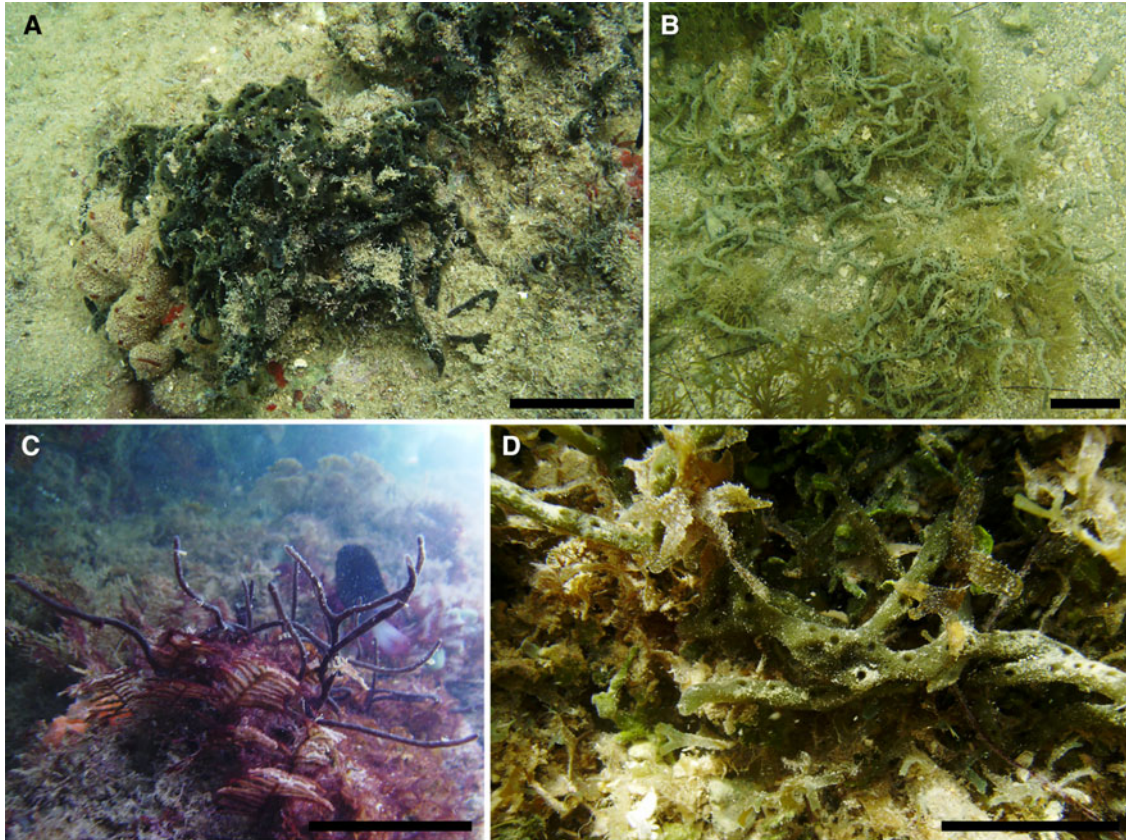


Fig. 2. Morphological variability of *Haliclona (Reniera) chlorilla* sp. nov. *in situ*: (A) black specimen growing on calcareous algae (MNRJ 17026, holotype); (B) dark green specimen growing together with macroalgae and covered by fine sediment; (C) black specimen with tendency to form erect branches in a reef crevice; (D) dark green specimen growing together with macroalgae in close up (MNRJ 17027, paratype). Scales bars: A–C, 5 cm; D, 2 cm.

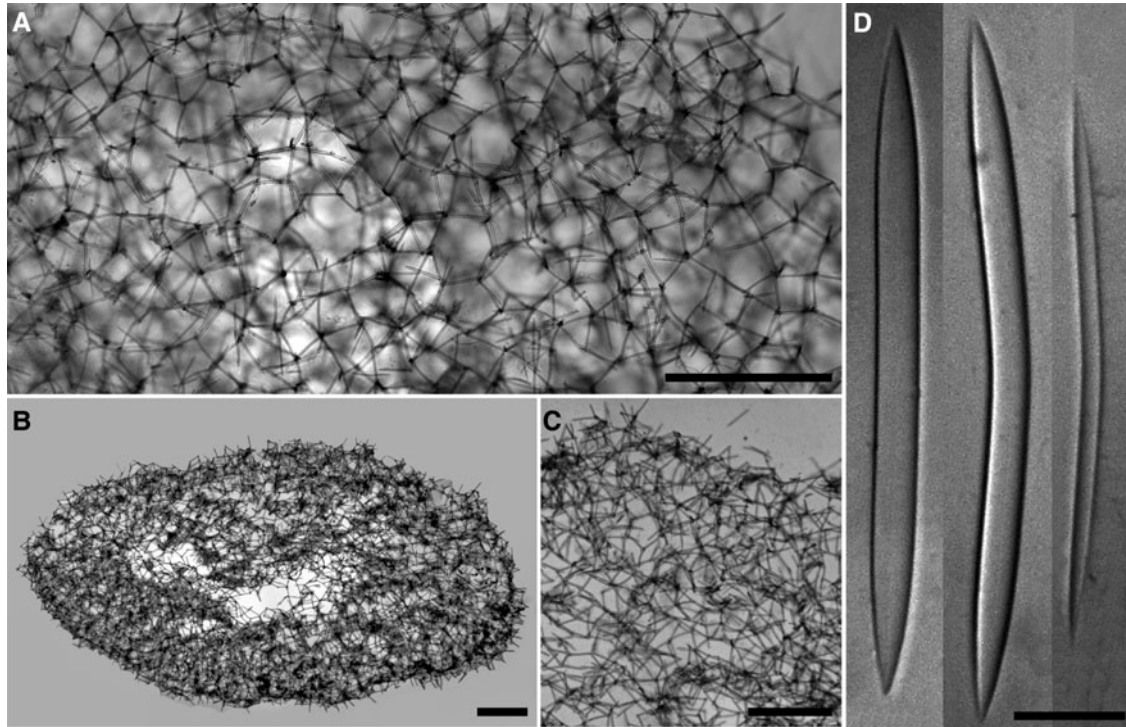


Fig. 3. *Haliclona (Reniera) chlorilla* sp. nov.: (A) ectosomal skeleton; (B) choanosomal skeleton; (C) detail of the choanosomal skeleton; (D) oxeas. Scale bars: A, C, 400 μm ; B, 500 μm ; D, 20 μm .

TYPE MATERIAL

Holotype: MNRJ 17026—Praia do Francês (sandstone reefs, $\sim 09^{\circ}45'58.35''\text{S}$ $35^{\circ}50'10.62''\text{W}$), Marechal Deodoro (AL, Brazil), ~ 1 m depth, coll. M.D. Correia, 16 June 2011. Fragment deposited under UFALPOR 0718.

Paratypes: MNRJ 1528—Praia de Ponta dos Carneiros (seagrass, $\sim 08^{\circ}41'46.14''\text{S}$ $35^{\circ}04'42.59''\text{W}$), Tamandaré (PE, Brazil), ~ 1 m depth, coll. E. Hajdu & G. Muricy, 1998; MNRJ 17027—Ponta do Prego (tide pool on coral reef, $\sim 09^{\circ}31'48''\text{S}$ $35^{\circ}35'30''\text{W}$), Maceió (AL, Brazil), 1 m depth, coll. A. Bispo, 11 January 2012. Fragment deposited under UFALPOR 0773; MNRJ 17610—Ponta Verde (tide pool on coral reef, $\sim 09^{\circ}39'58''\text{S}$ $35^{\circ}41'38''\text{W}$), Maceió (AL, Brazil), ~ 0.5 m depth, coll. M.D. Correia, 6 February 2008. Fragment deposited under UFALPOR 0454.

DIAGNOSIS

Haliclona (Re.) chlorilla sp. nov. is set apart from other tropical western Atlantic (TWA) *Haliclona* spp. by the combination of delicate, anastomosing branches, dark green or black live colour, and absence of any microscleres.

Table 1. Spicule dimensions of *Haliclona (Reniera) chlorilla* sp. nov. Values are as follow: minimum–mean–maximum length \times mi.–me.–ma. width. N = 30.

Specimen	Oxeas (μm)
MNRJ 17026, holotype	110–120.5–128 \times 5–6.9–7.5
MNRJ 1528, paratype	105–115.4–125 \times 4–5.2–6.5
MNRJ 17027, paratype	113–123.0–133 \times 3.8–5.6–6.3
MNRJ 17610, paratype	118–126.3–135 \times 5–5.4–6

DESCRIPTION

The holotype was growing on calcareous macroalgae (*Jania adhaerens*) and has a more compact morphology than observed in other specimens (Figure 2A). The species is most frequently repent (Figure 2A–D), consisting of slender and delicate, cylindrical, anastomosing branches, 2–5 mm in diameter, with a smooth surface. These branches could grow erect in specimens found in more sheltered habitats, such as crevices in sandstone reefs (Figure 2C). Oscula are numerous, circular, flush with the surface or just slightly elevated, usually aligned in rows along the branches, 0.4–1 mm in diameter. Consistency is very delicate, soft and fragile. Colour alive is dark green or black, becoming beige in ethanol.

Skeleton

The ectosomal skeleton is a tangential, isotropic and unispicular reticulation forming three-, four-sided or polygonal meshes (Figure 3A). The choanosomal skeleton is an isotropic and unispicular reticulation, forming three-, four-sided or polygonal meshes, around an off-central lumen running longitudinally inside the branches (Figure 3B, C). Spongin is scarce, present at the nodes of the reticulation, as usual in the subgenus.







Spicules






Megascleres are robust, straight or slightly curved oxeas with sharp points. Mature oxeas are 105–135 μm long and 3.8–7.5 μm wide (Figure 3D; Table 1). No microscleres were found.

ECOLOGY

Found in very shallow waters (~ 0.1 –2 m) and in tide pools, growing together with macroalgae or seagrass, mostly in well lit microhabitats.





Table 2. Comparative morphological and distributional data for the shallow-water species of *Haliclona* known from the tropical western Atlantic. *Halicl.*, *Haliclona*; *Re.*, *Reniera*; *S.*, *Soestella*; *Halich.*, *Halichoelona*; *Rh.*, *Rhizoniera*. Scale bars = 50 µm.


Species	External morphology	Anatomy	Oxeas morphology	Colour—locality, depth
<i>H. (Halicl.) catarinensis</i> Mothes & Lerner, 1994 (original description)	Encrust., oscs. circ., scattered, 2 mm diam., surf. irreg., compressible after preservation	Ectos. – unspecialized. Choan. – multispic. ascend. parallel tracts, connect. by single spics. or more in confusion, subsodict. network. Oxeas , straight or slightly curved, sharp ends, 111–161 × 3–9 µm		Live colour grey and orange—southern Brazil
<i>H. (Halicl.) epiphytica</i> Zea & De Weerd, 1999 (original description)	Encrust. on seaweeds, 10–40 mm long, 2–11/1.5–11 mm diam./thickn.; surf. smooth, even; many oscs., 0.3–1.4 mm diam.; consist. compressible, elastic, fragile	Ectos. – tangent. unispic. retic. w. nodal spongin, meshes triang. to polyg., 30–80 µm diam. Choan. – reg., ladder-like, ascend. lines unispic. to 3 spics. across, interconnect. by single spics., meshes polyg. 25–60 µm diam., choan. canals 95–500 µm wide. Oxeas , robust, short, acerate points, slightly curved, few styles and styloids, axial canal visible, 63–76 × 2.9–6.9 µm		Cream alive, light cream in spirit or dry—Colombian Caribbean, ~1 m
<i>H. (Halicl.) lilaceus</i> Mothes & Lerner, 1994 (original description)	Encrust., osc. not observed, surf. conul., fragile consis. when preserved, compressible	Ectos. – unspecialized. Choan. – multispic. ascend. parallel tracts, connect. by single spics. or more in subsodict. network, many spics. strewn among tracts. Oxeas , straight or slightly curved, sharp or constricted ends, 88–113 × 3–7 µm		Live colour light lilac—southern Brazil
<i>H. (Re.) implexiformis</i> (Hechtel, 1965) (sensu De Weerd, 2000)	Cushions 2–4 cm thick; circ. osc. 6–10 mm diam., regularly distrib., flush or slightly elev.; surf. even, smooth, occas. with slightly tubercul. areas, strongly punctate; consist. soft, compressible	Ectos. – tangent. unispic., isotrop. retic. Choan. – unispic., isotrop. Nodal spongin. Oxeas , slightly curved, blunt or strongly lute ends, 96–167 × 3.7–9.3 µm		Live colour pinkish-violet, with creamish shades, light tan in spirit—wider Caribbean, Brazil
<i>H. (Re.) manglaris</i> Alcolado, 1984 (sensu De Weerd, 2000)	Encrust., 1–2 mm thick, low chimney- and volcano-shaped elev., about 8/4–12 mm height/diam.; circ. osc. 1–2.5 mm diam., flush, scattered; several rope-like projections; surf. smooth, even, slightly punctate; consis. soft, not very fragile	Ectos. – tangent. unispic., isotrop. retic. with 3–5 sided meshes. Choan. – delicate, unispic., isotrop. retic. with 3–5 sided meshes, numerous choan. spaces. Nodal spongin. Oxeas , fusiform, with long, very sharp points, slightly to strongly curved, 77–109 × 2–4 µm		Live colour bright turquoise green or green, sometimes brownish—wider Caribbean, Brazil, 0.5–1 m
<i>H. (Re.) mucifibrosa</i> De Weerd, Rützler & Smith, 1991 (sensu De Weerd, 2000)	Irreg. lumpy, massive base (~10 cm diam.), with 2–3 cm high, thick-walled osc. chimneys, lateral fistules 10–15 cm long; osc. diam. up to 1 cm., surf. smooth. consis. elastic compressible, easily torn, release mucus when torned apart	Ectos. – reg., tangent., (sub)isotrop. retic. Choan. – reg., uni- to paucispic., (sub)isotrop.; reinforced in places by short spic. tracts 4–6 spic. wide, numerous choan. spaces, Nodal spongin. Oxeas , stout, straight or slightly curved, acerate points, 186–249 × 7.4–13.5 µm		Live colour greyish purple to bluish grey, light tan in ethanol—wider Caribbean, 0–20 m

<p><i>H. (Re.) portroyalensis</i> Jackson, De Weerd & Webber, 2006 (original description)</p>	<p>Digitate, few slightly swollen areas, up to 6/1 cm high/thick; osc. flush, scattered, 2–3 mm diam.; surf. smooth, even, microhispid; consist. soft, easily torn, somewhat resilient</p>	<p>Ectos. – Nodal spongin and some spicules fully enclosed, surf. pierced by irreg. distrib. pores, 56–89 µm diam. Choan. – unispic., less unif. than ectos., few multispic. tracts. Gemmule-like bodies present. Oxeas, straight to slightly curved, with short, conical points, 153–210 × 6–8.7 µm. Toxas, abund., variable morphol., 3.6–112.5 × 0.3–1.5 µm</p>		<p>Live colour purple, beige in ethanol—Jamaica, 1.25 m</p>
<p><i>H. (Re.) ruetzleri</i> De Weerd, 2000 (original description)</p>	<p>Delicate, slender, anastom. branches, 30–60/1–3 mm long/thick; surf. smooth; numerous circ. to slightly ellipt. oscs. scattered along branches, flush or very slightly elevated, 0.5–1.5 mm diam.; consist. very soft, easily torn</p>	<p>Ectos. – tangent. unispic., isotrop. retic. Choan. – unispic., isotrop. Nodal spongin. Oxeas, slender, straight or slightly curved, long and sharp points, 104–168 × 3.3–6 µm. Toxas, common, varied morphol., 21–96 × 0.5–1.9 µm. Sigmas, uncommon, 9.5–19 × 0.5–1.3 µm</p>		<p>Live colour light brown—Belize, 0.5–2 m</p>
<p><i>H. (Re.) strongylophora</i> Lehnert & Van Soest, 1996 (original description)</p>	<p>Encrust., up to 15 × 30 cm, ~1 cm thick, osc. not seen, surf. smooth, consist. soft</p>	<p>Ectos. – irreg., unispic. retic. Choan. – isotrop., unispic., few paucispic. ascend. tracts, connect. by single spics. Strongyles, 150–200 × 4–10 µm</p>		<p>Live colour dark brown, in dry state it is light grey—Jamaica, 76–78 m</p>
<p><i>H. (Re.) tubifera</i> (George & Wilson, 1919) (<i>sensu</i> De Weerd, 2000)</p>	<p>Cushion-shaped base with up to 5 cm high osc. elevations, oscs. 1–10 mm diam., with numerous thin, long proliferations branching off from main body; or delic. clusters of anastom. thin branches, 2–5 mm thick, with small oscs., 0.5–1 mm diam. on top of slight elevat. or flush with surf.; consist. soft, compressible, fragile, release mucus when squeezed or torn apart; surf. smooth, even, slightly punctate</p>	<p>Ectos. – tangent. unispic., isotrop. retic. Choan. – unispic., isotrop. retic. reinforced by short, loosely organ. spic. tracts, 3–6 spics. wide. Nodal spongin. Oxeas, sharp points, hastate, commonly thinner in the middle, 104–172 × 4.1–9.5 µm</p>		<p>Live colour different shades of purple and pink—North Carolina, wider Caribbean, 0.1–15 m</p>
<p><i>H. (S.) caerulea</i> (Hechtel, 1965) (<i>sensu</i> De Weerd, 2000)</p>	<p>Irreg. cushion-shaped, with oscular mounds or chimneys, digitate (0.3–1 mm diam.); numerous thin, long proliferations branching off from the distal parts (up to 8 cm long); oscs. not abundant, scattered along branches, 1–4 mm diam., flush or slightly raised; consist. soft to moderat. firm, compressible, fragile; surf. smooth, even, punctate</p>	<p>Ectos. – tangent., paucispic., rounded to polyg. meshes, 170–400 µm diam., many spics. in confusion. Choan. – paucispic., ill-defined primary and secondary tracts, choan. spaces present. Nodal spongin. Oxeas, slender, slightly curved, hastate, sharp or blunt ends, rarely strongylote, 128–204 × 3–9.5 µm. Sigmas, slightly centrangulated or weakly bent, 13–28 × 0.5–1.9 µm</p>		<p>Live colour yellowish green to sky blue, rarely light purplish brown, tan in ethanol—wider Caribbean, Pacific side Panama, Brazil, 0–27 m</p>

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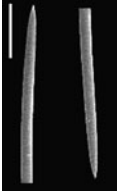

Table 2. Continued

Species	External morphology	Anatomy	Oxeas morphology	Colour—locality, depth
<i>H. (S.) lehnerti</i> De Weerd, 2000 (original description)	Thick cushions, low partially hollow digitations, apical oscs. 1–4 mm in diam.; surf. uneven, slightly hispid, with meandering and anastom. grooves; consist. moderately firm, incompressible when dry	Ectos. – tangent., uni- to paucispic., ill-defined rounded to elliptical meshes, 190–570 µm diam., framed by tracts 2–4 spics. wide. Choan. – ill-defined paucispic. primary and secondary tracts, rounded to subelliptical meshes, 200–300 µm diam. Nodal spongin. Oxeas , straight to slightly curved, hastate, sharp points, 127–156 × 3.3–6.3 µm		Live colour dark red, dark yellowish-cream when dry—Jamaica, 8–12 m
<i>H. (S.) luciensis</i> De Weerd, 2000 (original description)	Thick crust to lobate/cushion-shaped, up to 2.5/1.5 cm high/thick; wide oscs., circular, up to 8 mm diam., surf. smooth, even; consist. very soft, fragile	Ectos. – tangent. retic. of vaguely strewn oxeas around and in-between irreg. meshes, 250–665 µm diam. Choan. – subanisotrop., ill-defined paucispic. primary tracts, irreg. connect. by unispic. primaries (?), many spics. in confusion, many rounded/elliptical meshes, choan. spaces present. Nodal spongin. Oxeas , straight or slightly curved, with short, conical points, 144–174 × 4.4–7 µm Raphides , found mainly in the ectos., 51–93 × 0.3 µm		Live colour dark brown, also in ethanol—St Lucia
<i>H. (S.) melana</i> Muricy & Ribeiro, 1999 (sensu De Weerd, 2000)	Repent/lobate base, several osc. chimneys and anastom. branches, up to 7/1 cm high/thick; osc. at the end of the chimneys, to 4 mm diam., irregularly scattered on the surf.; consis. soft, compressible, fragile; surf. smooth, even	Ectos. – tangent., discontinuous, with irreg. distrib. meshes, 228–513 µm diam., framed by single spic. Choan. – ill-defined, paucispic. prim. lines, irreg. connect. by unispic. primaries (?), many rounded meshes and choan. spaces, many spics. in confusion. Nodal spongin. Oxeas , slightly curved, hastate, with long and sharp points, 105–159 × 2.8–6 µm. Toxas , weakly curved, straight legs or slightly recurved apices, 30–72 × 0.6–1.3 µm		Live colour black, dark brown in spirit—St Lucia, Brazil, up to 6 m
<i>H. (S.) piscaderensis</i> (Van Soest, 1980) (sensu De Weerd, 2000)	Flat cushions, up to ~55/1–4 mm diam./thick, with few, circ. osc. flush or slightly raised elevations, 1–2 mm diam.; consis. soft, fragile; surf. even, strongly reticulate	Ectos. – consisting of vaguely strewn, tangentially oriented spic. Choan. – confused retic., ill-defined paucispic. prim. lines, many spic. in confusion. Nodal spongin. Oxeas , slightly curved or sinuous, hastate, very long and sharp points, 140–227 × 2.3–7.4 µm; Sigmas , C-shaped, numerous, 7–12 × 0.3–1.2 µm		Live colour varying from greyish yellow to light purplish brown—wider Caribbean, 1–20 m

<p><i>H. (S.) smithae</i> De Weerd, 2000 (original description)</p>	<p>Tubes partly fused, 1–2/0.7–1 cm height/diam., or cushion-shaped base with osc. mounds, the tubes end in an osc., 1–3 mm diam.; surf. smooth, punctate; consis. firm but fragile, incompressible</p>	<p>Ectos. – stout, tangent., paucispic., with well-defined rounded to elliptical meshes, 247–513 μm diam., many spic. in confusion. Choan. – stout retic. with ill-defined paucispic. primary lines, irreg. connect. by uni- paucispic. secondary lines, many spic. in confusion and many choan. spaces. Spongin not visible. Oxeas, straight to slightly curved, with hastate, sharp points, 138–172 \times 3.9–8.8 μm. Rhaphides, abundant in the ectos., absent in the choan., ca 70 \times 0.3 μm</p>		<p>Live colour yellow–green, drab in spirit—Belize, 1 m</p>
<p><i>H. (S.) twincayensis</i> De Weerd, Rützler & Smith, 1991 (<i>sensu</i> De Weerd, 2000)</p>	<p>Slender to very thin, erect, partly fused branches, 5–10/0.2–1.2 cm long/thick, projecting directly from the subst.; osc. rare, ~1 mm, irregularly distrib. along the branches; consis. firm, slightly compressible, fragile; surf. smooth, stongly punctate</p>	<p>Ectos. – discontinuous, tangent., retic. of oxeas, tendency to form short paucispic. lines of 2–5 spic. thick around wide meshes of 190–475 μm diam. Choan. – irreg., somewhat confused, paucispic. primary lines, irreg. connect. by unispic. secondary lines, many spics. in confusion. Nodal spongin. Oxeas, slightly curved, hastate, 161–186 \times 6–9 μm</p>		<p>Live colour whitish grey to pinkish, light tan in spirit—wider Caribbean, up to 3 m</p>
<p><i>H. (S.) vermeuleni</i> De Weerd, 2000 (original description)</p>	<p>Encrust. or cushion-shaped base, with small outgrowths as osc. chimneys, hollow fistules, blind-ending digitations and lobes, 15/1–4 mm high/diam.; osc. small, circular, 1–2 mm diam., at the end of the chimneys and alongside outgrowths; surf. smooth, even, slightly punctate; consis. soft, fragile</p>	<p>Ectos. – dense, tangent. retic., slight tendency to form rounded meshes, 130–215 μm diam., many spics. in confusion. Choan. – somewhat irreg., dense retic., with ill-defined, paucispic. prim. lines, irregularly connect. by uni- paucispic. second. lines, many spics. in confusion. Nodal spongin. Oxeas, very slender, with long, sharp points, straight or slightly, evenly curved, 75–167 \times 2.1–5.7 μm</p>		<p>Live colour blue to sky blue, light cream in spirit—North Carolina, wider Caribbean</p>
<p><i>H. (S.) walentinae</i> Diaz, Thacker, Rützler & Piantoni, 2007 (original description)</p>	<p>Encrust., 1–2 mm thick; osc. 1–2 mm diam., with transparent membran., reg. distrib., radial canals converg. toward osc.; surf. smooth to irreg. rugose, porous and microhispid under microscope; consis. soft, compressible, resilient</p>	<p>Ectos. – poorly develop., paucispic. spic. tracts and loosely strewn spics., not peelable. Choan. – paucispic., loosely organized primary tracts (20–40 μm diam.), connect. by unispic. tracts or single spics., tracts enveloped by filamentous cyanobacteria. Scarce spongin. Oxeas, hastate to fusiform, straight or slightly curved, 100–180 \times 3–9 μm</p>		<p>Live colour deep dark-brown to purple outside, tan inside; cream to white in alcohol—Panama</p>
<p><i>H. (Halich.) albifragilis</i> (Hechtel, 1965) (<i>sensu</i> De Weerd, 2000)</p>	<p>Encrust., ~1/1 cm diam./thick; osc. not apparent; consis. friable, slightly brittle; surf. even, smooth</p>	<p>Ectos. – dense, tangent., subisotrop.; easily detachable, but without large subectos. spaces. Choan. – subisotrop., dense, few choan. spaces. Nodal spongin. Oxeas, slender, weakly to strongly curved, with long, sharp points, 63–168 \times 2.1–8.4 μm</p>		<p>Live colour opaque white or light cream—wider Caribbean, up to 74 m</p>

Continued

Table 2. Continued

Species	External morphology	Anatomy	Oxeas morphology	Colour—locality, depth
<i>H. (Halich.) lernerae</i> Campos, Mothes, Eckert & Van Soest, 2005 (original description)	Massive, osc. 0.3–0.6 cm diam., osc. projections tube-like, 2.6 × 1.1 cm; surf. smooth, slightly rough; consis. little compressible, firm	Ectos. – dense, tangent., subisotrop. Choan. – subisotrop., few choan. spaces. Oxeas , thin, slightly curved, some straight, acerate ends, but hastate and blunt also occur, 138–161 × 1.2–4.6 μm		Colour in spirit creamy white—north-eastern Brazil, 94 m
<i>H. (Halich.) magnifica</i> De Weerd, Rützler & Smith, 1991 (sensu De Weerd, 2000)	Irreg. massive base, thickwalled tubes, up to 15/5 cm high/thick, each tube tapers towards an osc. of 1–2 cm diam. with a membran. rim; smaller fistules arise at all parts of the sponge; consis. slightly crisp, fragile, slightly compressible; surf. smooth	Ectos. – dense, subisotrop., loosely lying on the choan. skel., easily detachable. Choan. – dense, subisotrop., with few choan. spaces. Nodal spongin. Oxeas , long, slender, slightly flexuous, fusiform, 147–221 × 3.6–6.7 μm		Live colour pink to dull pink and drab, oscular fistules whitish transparent—wider Caribbean, 0–1 m
<i>H. (Halich.) perforata</i> (Pulitzer-Finali, 1986) (original description)	Massive; consis. firm, compressible, not resilient, easy to tear; pierced by canals up to 6 mm wide	Ectos. – tangent., unispic., meshes ~100 μm wide. Choan. – similar to ectos., only tridimensional, no main tracts are observable. Nodal spongin. Oxeas , straight to slightly curved, ends not quite sharp, 100–115 × 3.5–4.5 μm		Colour dull violaceous drab externally, tan-cream internally, drab in formalin—Puerto Rico, 0.5–1 m
<i>H. (Halich.) vansoesti</i> De Weerd, Kluijver & Gomez, 1999 (original description)	Thick cushions, loose and cavernous structure, up to 15/2–3 cm diam./thick, with large, circ. to elliptic. osc., 0.8–1 cm diam., on slightly raised elevations, with transparent rims; surf. smooth; consis. crispy, fragile, slightly compressible	Ectos. – delicate, tangent., subisotrop., extremely loosely lying on the choan. skel. Choan. – subisotrop., denser than ectos., many subectos. and choan. spaces. Oxeas , slightly curved, hastate, 120–222 × 3.6–10.7 μm		Live colour in the choanosome is light purple, and white (semi-transparent) in the ectosome—wider Caribbean, 2–52 m
<i>H. (Halich.) stoneae</i> De Weerd, 2000 (original description)	Thick cushions, ~12/2 cm diam./thick, with large, circ. osc., 0.4–0.9 cm diam., flush with the surf. or on low volcano-shaped elevations; surf. smooth, even, punctate; consis. brittle, fragile, slightly compressible	Ectos. – tangent., subisotrop., paucispic. Choan. – paucispic., subisotrop. Oxeas , large, straight or slightly, evenly curved, with short, acerate points, 286–359 × 7.7–12.8 μm. Sigmas , weakly to strongly curved, abund. in both ectos. and choan., 12–21 × 0.6–1.5 μm		Live colour whitish-pink, light greenish in spirit—Belize, 21 m
<i>H. (Rh.) curacaoensis</i> (Van Soest, 1980) (sensu De Weerd, 2000)	Encrust. base with close-packed osc. mounds, 2–4/2–3 cm high/diam.; osc. 2–3 cm diam.; consis. soft, easily torn, sticky to the touch, mucous when rubbed; surf. smooth, strongly punctuate	Ectos. – absent, or consist. vaguely strewn, tangentially oriented. spic. Choan. – irregular, paucispic, somewhat sinuous, primary lines, irreg. connect. by unispic. secondary lines, many choan. meshes. Nodal spongin. Oxeas , slender, with acerate to conical points, slightly to strongly curved, 78–146 × 2.8–5.7 μm		Live colour bluish purple—South Carolina, wider Caribbean, 0.3–58 m

Colour in spirit white—southern
Brazil



Ectos. – not specialized. Choan. – multispic. ascend. tracts, 2–6 spics., parallels, connect. by single spics., or many spics. disorganized, creating a subsodict. network. Oxeas, straight or slightly curved, sharp ends, $99-131 \times 3-5 \mu\text{m}$

Encrust., osc. circ., ca 0.2 cm diam., at the top of mammilliform projections. Preserved material has consis. fragile, compressible

H. (Rh.) mammillaris Mothes & Lerner, 1994 (original description)

DISTRIBUTION

The type locality is Praia do Francês (Marechal Deodoro, AL, Brazil), at the southern limit of the species' known geographical distribution, which extends northwards to the southern coast of Pernambuco State. This far the species is not yet known outside the North-eastern Brazil ecoregion.

ETYMOLOGY

The specific epithet is used as a noun in apposition. It is derived from the juxtaposition of two Greek words, *chloros* (green) and *illas* (rope), and conveys the dark-green, slender ramose habit of the new species.

REMARKS

Table 2 compiles literature data on *Haliclona* spp. used in comparison with the new species. *Haliclona (Reniera) chlorilla* sp. nov. is distinguished within the subgenus by the combination of its repent delicate cylindrical branches of dark green or black colour, and absence of microscleres of any sort. In the TWA, such slender cylindrical branches are mostly seen as off-shoots from the main sponge body, as reported by De Weerd (2000) for *H. (Re.) manglaris* and *H. (Re.) tubifera*. The exception is *H. (Re.) ruetzleri* De Weerd, 2000, reported to be entirely composed of slender, delicate, anastomosing branches, 1–3 mm in diameter. This species, albeit its rather similar habit, has light brown live colour, larger oxeas, as well as sigmas and toxas as microscleres, which renders it clearly distinct from the new species.

The only additional TWA *Haliclona (Reniera)* with a dark live colour (dark brown to black) is *H. (Re.) strongylophora* Lehnert & Van Soest, 1996. This Jamaican species is cushion-shaped and has strongyles as megascleres, two markedly distinct features given what is seen in the new species. Furthermore, its single record was obtained at 77 m depth, while the new species is this far known only from 0.1–2 m. Other rather dark TWA *Haliclona* spp. fall within *H. (Soestella)*, being notably distinct from the new species in terms of skeletal architecture. These are *H. (S.) luciencis* De Weerd, 2000; *H. (S.) melana* Muricy & Ribeiro, 1999 and *H. (S.) walentinae* Díaz *et al.*, 2007.

Subgenus *Soestella* De Weerd, 2000

Haliclona (Soestella) peixinhoae sp. nov.
(Figures 4, 5; Tables 2, 3)

Haliclona sp.: Hajdu *et al.*, 2011: 188–190.

MATERIAL EXAMINED

Holotype: MNRJ 13299—Taipús de Fora (algal/coral reef, $\sim 13^{\circ}56'03.64''\text{S}$ $38^{\circ}55'32.55''\text{W}$), Maraú (BA, Brazil), 1 m depth, coll. E. Hajdu & G. Lôbo-Hajdu, 26 July 2009.

Paratypes: MNRJ 2472, 2563—Ponta de Montserrat (rocky coast, $\sim 12^{\circ}55'37''\text{S}$ $38^{\circ}31'11''\text{W}$), Salvador (BA, Brazil), 3–5 m depth, coll. E. Hajdu *et al.*, 31 July 1999 and 5 August 1999, respectively; UFBA 1596–POR, UFBA 1602–POR, UFBA 1616–POR—Ponta de Montserrat ($\sim 12^{\circ}55'37''\text{S}$ – $38^{\circ}31'11''\text{W}$), Salvador (BA, Brazil), 4.5 m depth, coll. E. Hajdu, 14 January 1997.

DIAGNOSIS

Haliclona (Soestella) peixinhoae sp. nov. is set apart from other TWA *Haliclona* spp. by a combination of its habit comprising a dense aggregation of erect tubes, mostly bearing large

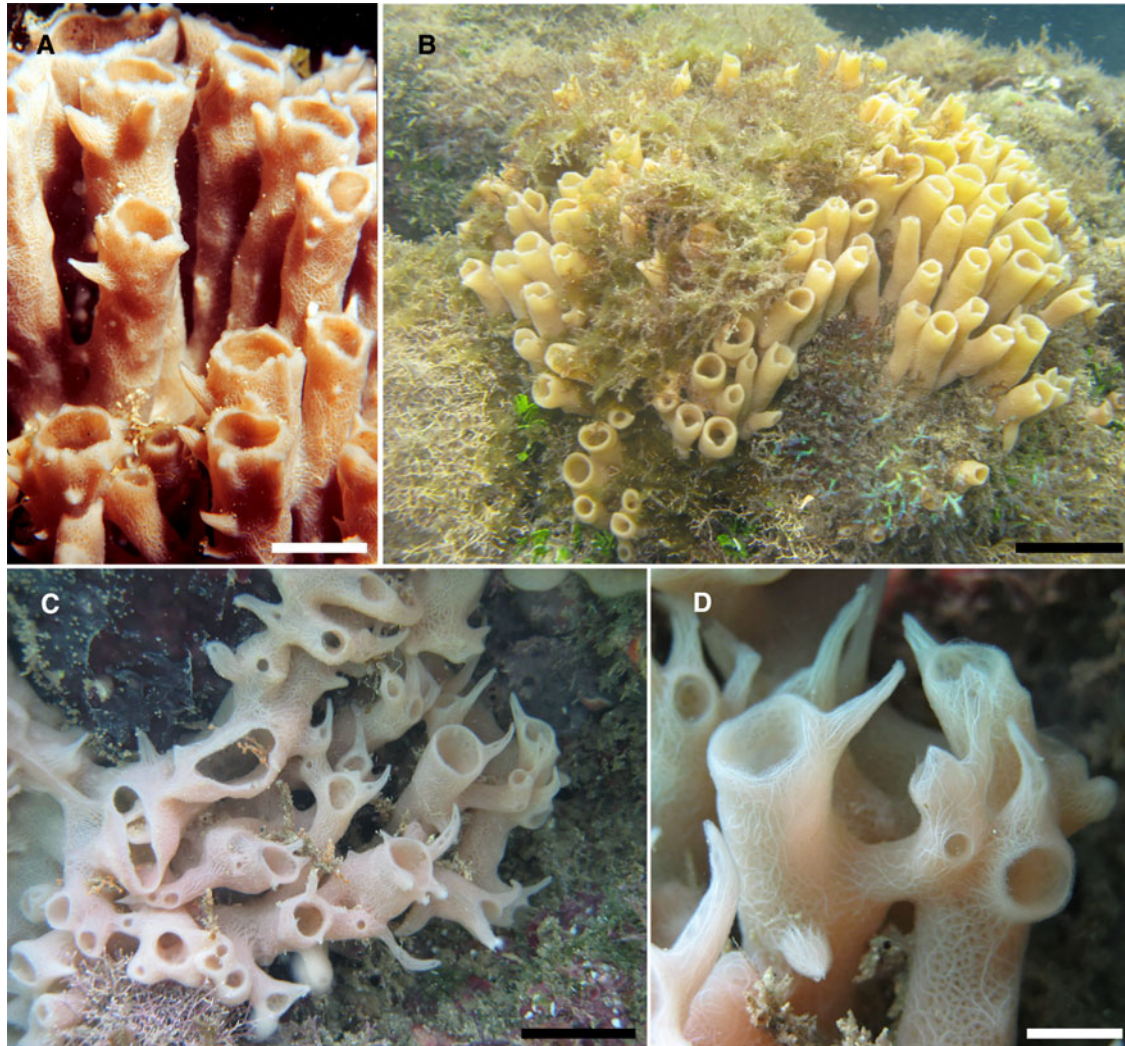


Fig. 4. Morphological variability of *Haliclona (Soestella) peixinhoae* sp. nov. *in situ*: (A) yellowish beige specimen with full-growth tubes and thorn-like projections (uncollected specimen from Ponta de Montserrat, Salvador, BA); (B) yellowish specimen with juxtapsed tubes growing with macroalgae (Taipús de Fora, Marau, BA); (C, D) beige specimen with a repent-tubular shape (MNRJ 13299, holotype). Scale bars: A, 2 cm; B, 5 cm; C, 2 cm; D, 1 cm.

thorns, albeit very soft, and a conspicuous subsuperficial reticulation visible to the naked eye on live specimens.

DESCRIPTION

Sponge forming dense aggregations of tubes up to 5 cm high (Figure 4), sometimes recalling a pan flute (partially fused tubes, Figure 4A–B). Specimens usually reach up to 15–25 cm in diameter. Tubes stand mostly erect, and appear to originate from a reptant tube (holotype). Tubes usually bear slender thorn-like projections up to 1 cm long (Figure 4A, C, D). Oscula are abundant, large (1–15 mm in diameter), usually circular and located apically on tubes. Surface smooth, but sometimes irregularly outlined due to development of early stage tubes or thorn-like projections. A conspicuous, irregular sub-superficial meandering reticulation is visible to the naked eye (Figure 4D), but disappears in ethanol. Consistency is very soft and fragile, easily torn. Colour alive is light brown, beige or yellowish beige, fading in alcohol.

Skeleton

The ectosome is a tangential, uni- to paucispicular reticulation with a tendency to form ill- or well-defined rounded meshes

(Figure 5A). The choanosome consists of ill-defined, uni- to paucispicular primary lines, irregularly connected by uni- to paucispicular secondary ones, with a slight tendency to form rounded meshes (Figure 5B). A few of the secondary lines, if not artefactual, are two or three spicules long, forming an open and discontinuous reticulation with wide and irregular meshes.

Spicules

The megascleres are straight or slightly curved oxeas, with blunt ends, $73\text{--}115 \times 3\text{--}5.5 \mu\text{m}$ (Figure 5C; Table 3). Immature oxeas are variably common and thinner than mature ones ($1\text{--}2.5 \mu\text{m}$).

ECOLOGY

A rare species, found in 1–5 m depth, in well-lit areas with low hydrodynamics. It frequently grows intermingled to bushy algae.

DISTRIBUTION

The type locality is Taipús de Fora (Marau, BA, Brazil). This far the species is endemic from the upper half of the state of

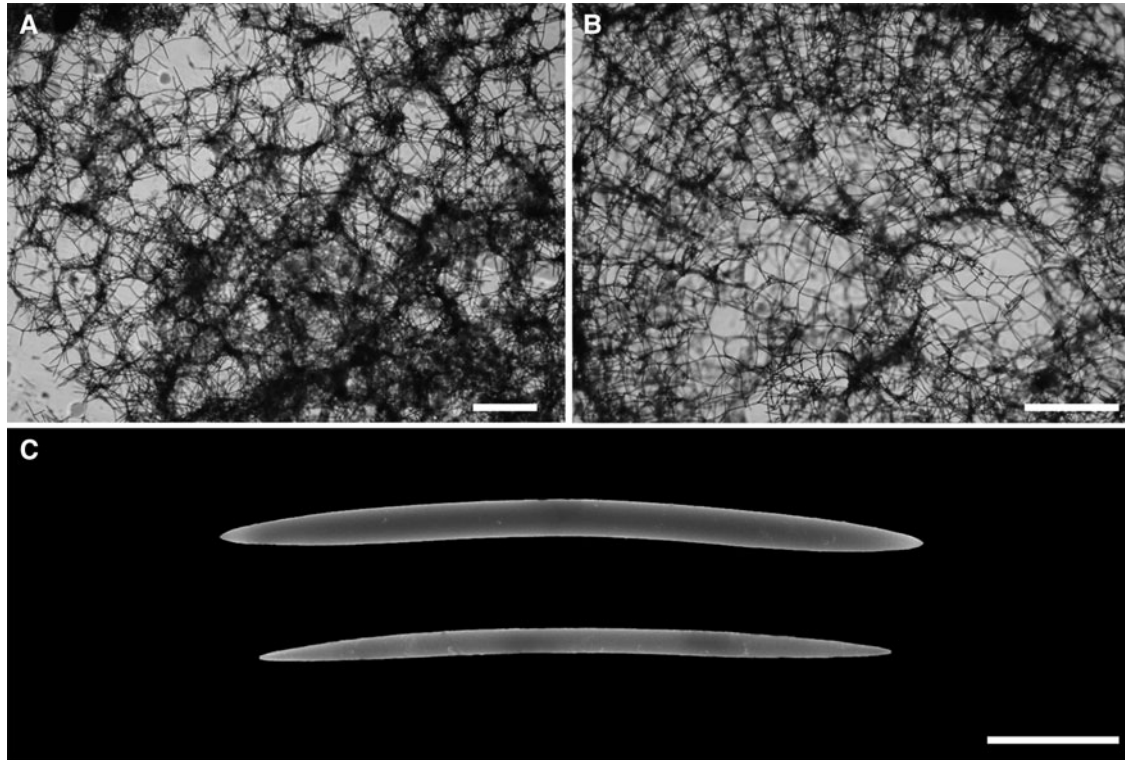


Fig. 5. *Haliclona (Soestella) peixinhoae* sp. nov.: (A) ectosomal skeleton; (B) choanosomal skeleton; (C) oxeas. Scale bars: A, B, 500 µm; C, 20 µm.

Bahia (Eastern Brazil ecoregion, north-eastern Brazil geopolitical region), known from Salvador and Marauá only.

ETYMOLOGY

The new species is named after the late Professor Dr Solange Peixinho, a dear friend, and an important advocate of the importance of taxonomy, and more specifically, taxonomy of Bahian sponges.

REMARKS

Hajdu *et al.* (2011) referred to the presence of rare toxas in *Haliclona (Soestella) peixinhoae* sp. nov. (as *Haliclona* sp.), but we carefully re-examined all the material available of this species and no toxa was found. The illustration given by those authors surely represents a contamination.

Haliclona (Soestella) peixinhoae sp. nov. is well distinguished among other *Haliclona* spp. in the TWA by its habit, comprising a dense aggregation of erect tubes with large apical oscula, mostly bearing large thorns, albeit very soft, and by a conspicuous subsuperficial reticulation visible to the naked eye on live specimens.

Tropical western Atlantic *Haliclona (Soestella)* spp. includes only *H. (S.) melana* and *Haliclona (S.) smithae* De

Weerd, 2000 as tubular sponges (Table 2). Both are rather distinct from the new species in that they do not form dense aggregates of erect tubes, do not possess the conspicuous subsuperficial reticulation, have black or yellow-green (respectively) live-colour, and possess microscleres (respectively, toxas and raphides). Other subgenera comprise a few additional tubular species in this area, even if optional. These are *H. (Halichoelona) magnifica* De Weerd *et al.*, 1991; *H. (Re.) mucifibrosa* De Weerd *et al.*, 1991; *Haliclona (Re.) tubifera* De Weerd, 2000; and *H. (Rhizoniera) curacaoensis* (Van Soest, 1980). Besides their skeletal architectures, these species differ from the new species in several traits. The first of these has a crispy consistency and much larger oxeas, reaching up to 220 µm, in contrast to the rather soft consistency and oxeas only up to 115 µm. *H. (Re.) mucifibrosa* produces copious amounts of mucus when torn apart, a feature not observed in the new species, and also has much larger oxeas, up to 250 µm. *Haliclona (Re.) tubifera*, albeit its name, has only optional tubes. Specimens are frequently thin, ramose. Live colour is generally pink or pink/violet, and oxeas can reach over 170 µm. Finally, *H. (Rh.) curacaoensis* has oxeas only a bit larger (up to 146 µm) than those of the new species, but its bluish purple live colour adds to the skeletal architecture in setting it quite far apart from the new species.

Table 3. Spicule dimensions of *Haliclona (Soestella) peixinhoae* sp. nov. Values are as follow: minimum–mean–maximum length × mi.–me.–ma. width. N = 30.

Specimen	Oxeas (µm)
MNRJ 13299 (holotype)	83–94.3–115 × 3–4.9–5.5
MNRJ 2472 (paratype)	73–91.4–110 × 3–4.7–5.5
MNRJ 2563 (paratype)	75–88.7–100 × 3–4.4–5.5

DISCUSSION

Recent taxonomic effort dedicated to sponges of reef ecosystems in the north-east Brazilian geopolitical region has been rewarding in terms of new records and species found (Cedro *et al.*, 2007, 2011, 2013; Peixinho *et al.*, 2007; Hajdu *et al.*, 2011; Barros *et al.*, 2013; Sandes & Pinheiro, 2013).

The two new *Haliclona* spp. reported upon here highlight the fact that discoveries need not always rely on new fieldwork, as both were already present in scientific collections by the 1980s and 1990s.

Notwithstanding the 400+ extant species of *Haliclona*, only eleven have been registered for the Brazilian coast so far (Hajdu *et al.*, 2011; Muricy *et al.*, 2011; this study). Six are provisional endemics from various sectors of this coastline. *Haliclona* (*Halicl.*) *catarinensis* Mothes & Lerner, 1994; *H. (Halicl.) lilaceus* Mothes & Lerner, 1994; and *H. (Rh.) mammillaris* Mothes & Lerner, 1994 are known only from their type localities in the South-eastern Brazil ecoregion (Bombinhas, ca 27°S). *Haliclona* (*Halich.*) *lerneriae* Campos *et al.*, 2005 is known from a single record for the Amazonia ecoregion (off São Luís, ~0°S), and both new species described herein stem each from a distinct ecoregion, namely North-eastern Brazil with *H. (Re.) chlorilla* sp.nov., and Eastern Brazil with *H. (S.) peixinhoae* sp. nov. (cf. above).

We have adopted De Weerd's (2000) subgeneric assignment for *H. (Rh.) mammillaris*, as she had access to the holotype. Muricy *et al.*'s (2011) assignment of this species to *Haliclona* (*Halicl.*) is thus considered mistaken. On the other hand, these latter authors also assigned *H. (Halicl.) catarinensis* and *H. (Halicl.) lilaceus* to the nominotypical subgenus, which is followed here, despite types not being re-examined so far. From Mothes & Lerner's (1994) descriptions, all three *Haliclona* spp. would appear to have nearly the same architecture.

The remaining five *Haliclona* spp. known from Brazil also occur in the Tropical North-western Atlantic (Caribbean region): *H. (Soestella) caerulea* (Hechtel, 1965); *H. (Reniera) implexiformis* (Hechtel, 1965); *H. (Re.) manglaris* Alcolado, 1984; *H. (S.) melana* Muricy & Ribeiro, 1999; and *H. (Re.) tubifera* (George & Wilson, 1919) (*sensu* Lerner (1996), = *H. (Halich.)* sp. *sensu* De Weerd (2000)). The record of *H. (Rh.) curacaoensis* by Cedro *et al.* (2007; MNRJ 10280, UFALPOR 0241) has been briefly revised here and found to be best assigned to *H. (Re.) manglaris*. Its oxeas were found to reach only up to 85 µm in length, and its architecture, to be more on the *Reniera* side of the spectrum.

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