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Aplysina Nardo (Porifera, Verongida, Aplysinidae) from the Brazilian coast with description of eight new species

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Abstract

A revision of Brazilian *Aplysina* was conducted based on morphological study of species alive as well as preserved in the collections of Museu Nacional. In total, 190 specimens were studied in the lab. Identification was achieved by analysis of the external morphology, in combination with skeletal architecture and its components. Our analyses revealed marked within individual variation for most species in characters associated to the spongin fibres, suggesting a low diagnostic strength for this set of characters in *Aplysina*. External morphology, on the other hand, permitted clearcut diagnoses for most species. Fifteen species were identified and are fully described below. Eight of these are new to science. A neotype for *A. fulva* is proposed here. The amended list of *Aplysina* species for the Brazilian coast is: *A. alcicornis* sp.n., *A. caissara*, *A. cauliformis*, *A. cristagallus* sp.n, *A. fistularis*, *A. fulva*, *A. insularis*, *A. lacunosa*, *A. lactuca* sp.n., *A. lingua* sp.n., *A. muricyana* sp.n., *A. orthoreticulata* sp.n., *A. pergamentacea*, *A. pseudolacunosa* sp.n. and *A. solangeae* sp.n. A tentative identification key for these species is provided.

Key words: *Aplysina*, Porifera, Sponges, Taxonomy, marine biodiversity, continental shelf, SW Atlantic, REVIZEE

Introduction

Aplysina Nardo, 1834 often comprises large sponges, with live colours and varied forms. These sponges possess a skeleton formed only by pithed spongin fibers arranged in tridimensional geometric meshes, without spicules or foreign detritus. The presence of a rich array of brominated compounds in these animals motivated Bergquist (1978, 1980) to propose their classification in a separate order, Verongida. A series of biological activities is already known for *Aplysina*–derived compounds, viz. antibiotic (antibacterial—Fattorusso et al., 1972; D'ambrósio et al., 1983; antifungal—Murata et al., 1992), antiviral (Gunasekera and Cross, 1992) and especially cytotoxic/antitumoral (e.g. Kreuter et.al., 1989; Acosta & Rodriguez, 1992). *Aplysina* is highly conspicuous in the Tropical South-western Atlantic, being widely distributed on the Brazilian coast. In some localities it constitutes an important fraction of the biomass of Porifera (Muricy et al., 1991, 2006) as well as relative to other sessile benthic invertebrates. *Aplysina* is one of a few sponge genera which are markedly richer in the Atlantic, in contrast to the Indian and Pacific Oceans.

Only eight species of *Aplysina* were this far known from the Brazilian coast: *A. archeri* (Higgin, 1875), *A. caissara* Pinheiro and Hajdu, 2001, *A. capensis* (Carter, 1881), *A. cauliformis* (Carter, 1882), *A. fistularis* (Esper, 1794), *A. fulva* (Pallas, 1766), *A. lacunosa* (Pallas, 1766) and *A. pergamentacea* Hechtel, 1983. Two of these records, viz. *A. archeri* (Higgin, 1875) sensu Lendenfeld (1889) and *A. capensis* (Carter, 1881), are considered invalid here. The rationale for this decision will be presented in the discussion section. In this work, we describe fifteen species of *Aplysina* from the Brazilian coast, eight of which are new to science, based on underwater observations of large populations as well as on preserved material in collections (ca. 200 specimens examined).

Material and Methods

The specimens were collected by snorkeling, scuba diving or dredging and photographed *in situ* whenever possible. The main sources for the materials worked with here were a series of bioprospecting expeditions to Salvador (BA; Berlinck et al., 2004) and Fortaleza (CE), Programme REVIZEE – Central Score (Lavrado & Ignacio, 2006), as well as isolated research projects on Brazilian islands and archipelagoes (e.g. Muricy et al., 2003; Ribeiro & Muricy, 2004; Moraes et al., 2006). Mostly, specimens were preserved in 70 or 96% ethanol. The microscopic slides of spongin fibers were prepared according to Pinheiro & Hajdu (2001).

Abbreviations used are: AL (Alagoas State), BA (Bahia State), BMNH (The Natural History Museum, London), CAPES (Coordination for the Improvement of Graduate Level Personnel), CE (Ceará State), MNRJ

(Museu Nacional, Universidade Federal do Rio de Janeiro, Rio de Janeiro), PB (Paraíba State), PE (Pernambuco State), Programme REVIZEE (Programme for the Evaluation of the Sustainable Potencial of Life Resources in the Exclusive Economic Zone—Brazil), RJ (Rio de Janeiro State), RN (Rio Grande do Norte State), SE (Sergipe State), SP (São Paulo State), UFRJPOR (Porifera collection of Departamento de Zoologia, Instituto de Biologia, Universidade Federal do Rio de Janeiro, housed at Museu Nacional), YPM (Yale Peabody Museum, Yale University, New Haven) ZMAPOR (Zoologish Museum Amsterdam, Amsterdam).

Results

Verongida Bergquist, 1978

Aplysinidae Carter, 1875

Diagnosis: Verongida with an anastomosing spongin skeleton of polygonal meshes, which have no tendency to be organized in one plane. The fibers have normal bark and pith elements, contain no foreign detritus and are of moderately even dimensions throughout the sponge. The choanocyte chambers are diplodal, small, and spherical, and are set in a dense collagenous matrix. All species display a marked oxidative colour change at death or on exposure to air, quickly changing from the normal yellow or yellow-green through blue to dark brown or purple. Pigmentation, other than superficial casts attributable to cyanobacteria, is uniform throughout the sponge. Secondary metabolites include a range of brominated tyrosine derivatives with strong antimicrobial activity. The sponges are oviparous and, while extrusion of gametes has been observed, no larvae have been described (Berquist & Cook, 2002).

Genus *Aplysina* Nardo, 1834

Diagnosis: Aplysinidae characterized by possession of fibers of only one kind with no foreign detritus and having a thick pith component. The fibers form a regular reticulum with large polygonal meshes and no specialized surface arrangement (Bergquist & Cook, 2002).

Type species: *Aplysina aerophoba* Schmidt, 1862.

Aplysina caissara Pinheiro & Hajdu, 2001 (Figs. 1A, 2, 3A, Tab. I)

Aplysina caissara, Pinheiro & Hajdu (2001: 145); Mothes et al. (2006: 76). *Aplysina fistularis fulva sensu* Mothes de Moraes (1987: 133). Non *Aplysina fistularis* (Pallas, 1766; a valid species). *Aplysina fulva sensu* Lerner (1996: 115). Non *Aplysina fulva* (Pallas, 1766; a valid species).

Holotype: MNRJ 1988, rocky coast between Prainha beach and Brava beach (Costão do Navio, São Sebastião, SP, 23º50.067' S-45º29.449' W), 6 m depth, E. Hajdu *coll.*, 29/I/1999.

Paratypes: MNRJ 268, Ponta Recife, (São Sebastião, SP, 23º49.501' S - 45º24.796' W), 2 m depth, E. Hajdu *coll.*, 22/I/1996. MNRJ 578, southern side of Toque-Toque Island, (São Sebastião, SP, 23º51.209' S - 45º31.600' W), 11 m depth, E. Hajdu *coll.*, 15/VI/1997. MNRJ 1673, Ponta do Jarobá (São Sebastião, SP, 23º49.679' S - 45º25.278' W), 4.5 m depth, E. Hajdu *coll.*, 22/IV/1998. MNRJ 1989, 2013, rocky coast between Prainha beach and Brava beach (Costão do Navio, São Sebastião, SP, 23º50.067' S-45º29.449' W), 6 m depth, E. Hajdu *coll.*, 29/I/1999.

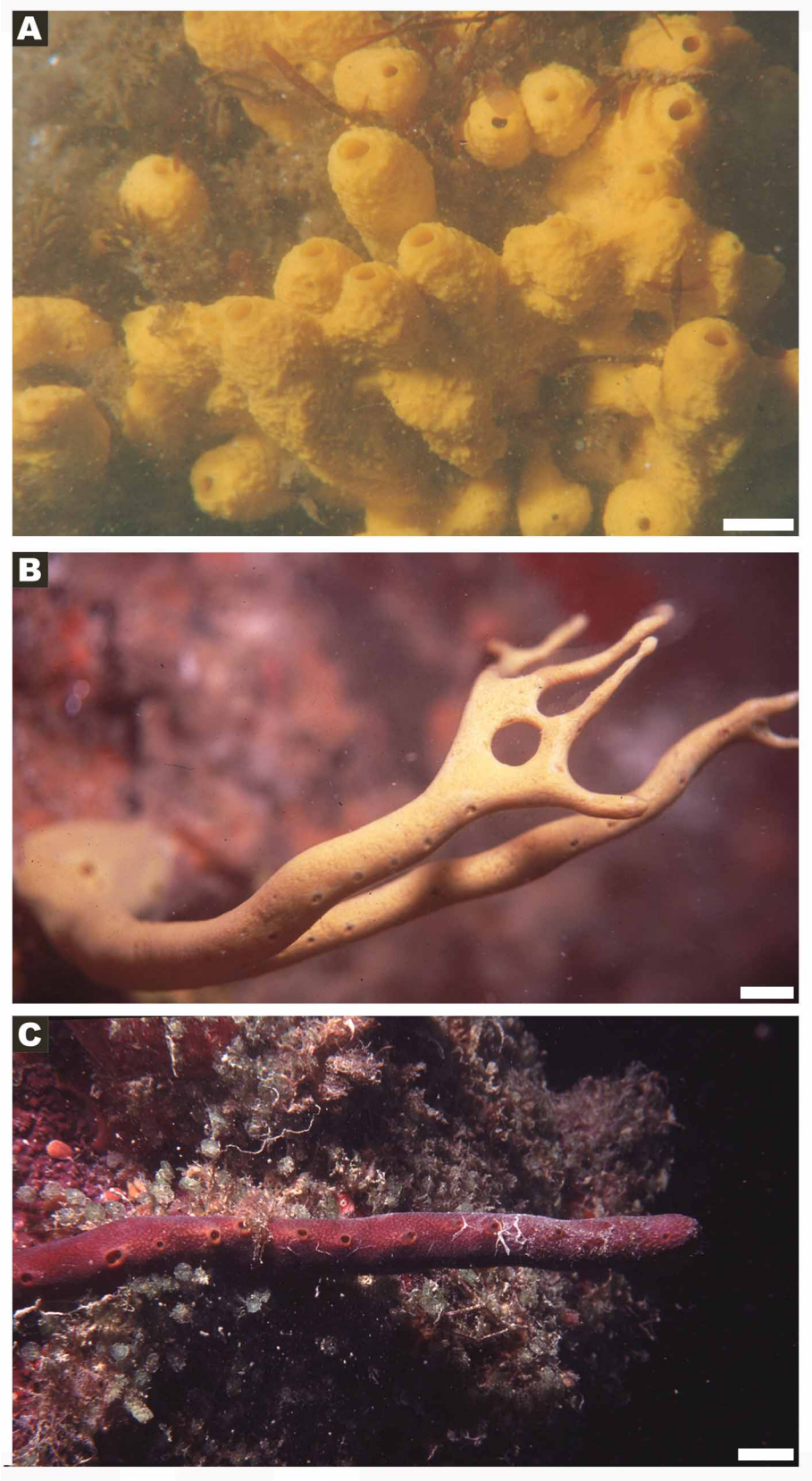

FIGURE 1: A. *Aplysina caissara* Pinheiro & Hajdu, 2001—in situ (São Sebastião, SP, Brazil). B–C. *Aplysina cauliformis* (Carter, 1882) in situ (B. MNRJ 5462, C. MNRJ 5467, Parque Nacional Marinho dos Abrolhos, BA, Brazil). Scale bar = 1 cm.

Additional material: MNRJ 5087, da Vila beach, left side, (Picinguaba, Ubatuba, SP), 2 m depth, R. N. Costa *coll.*, 23/X/2001. MNRJ 5287, (Arvoredo Island, SC), 7 m depth, E. Hajdu and C.B. Lerner *coll.*, 19/II/2002. MNRJ 5308, (Arvoredo Island, SC), 7 m depth, U.S. Pinheiro *coll.*, 19/II/2002. MNRJ 5284 (Arvoredo Island, SC), 7 m depth, E. Hajdu and C.B. Lerner *coll.*, 19/II/2002. MCN 0383 (João da Cunha Island, Porto Belo, SC), 3 m depth, S.M. Pauls *coll.*. MCN 1034 (João da Cunha Island, Porto Belo, SC), 0.5 m depth, A.A. Lise *coll.*, 22/X/1977. MCN 1035 (João da Cunha Island, Porto Belo, SC), 0.5 m depth, A.A. Lise *coll.*, 06/XI/1981. MCN 2235, Saco da Mulata (Galé Island, Bombinhas, SC), 12 m depth, C.B. Lerner *coll.*, 14/II/1991. MCN 2278, small SW bay (Galé Island, Bombinhas, SC), 8 m depth, C.B. Lerner *coll.*, 29/III/1991.

Diagnosis: Bright yellow live-colour and small (1-6 cm high) digits and/or fusiform processes topped by oscula.

Description:

Specimens can have few (3–4) or many digits (60–80), which are mostly erect. Digits can be single or anastomosed, cylindrical (fusiform or straight) or slightly volcaniform (rare), 1–6 cm high and 0.6–1.5 cm wide (Figs. 1A, 2A–B). Area coverage can be as large as 25x15 cm, but more often about 6x6 cm. Surface is finely conulose. Oscula are mostly apical (1.5–4 mm in diameters), but few lateral and smaller (ca. 1 mm in diameter) can occur. The colour is bright yellow *in vivo*, which turns into deep purple after preservation in alcohol. Consistency is soft and flexible

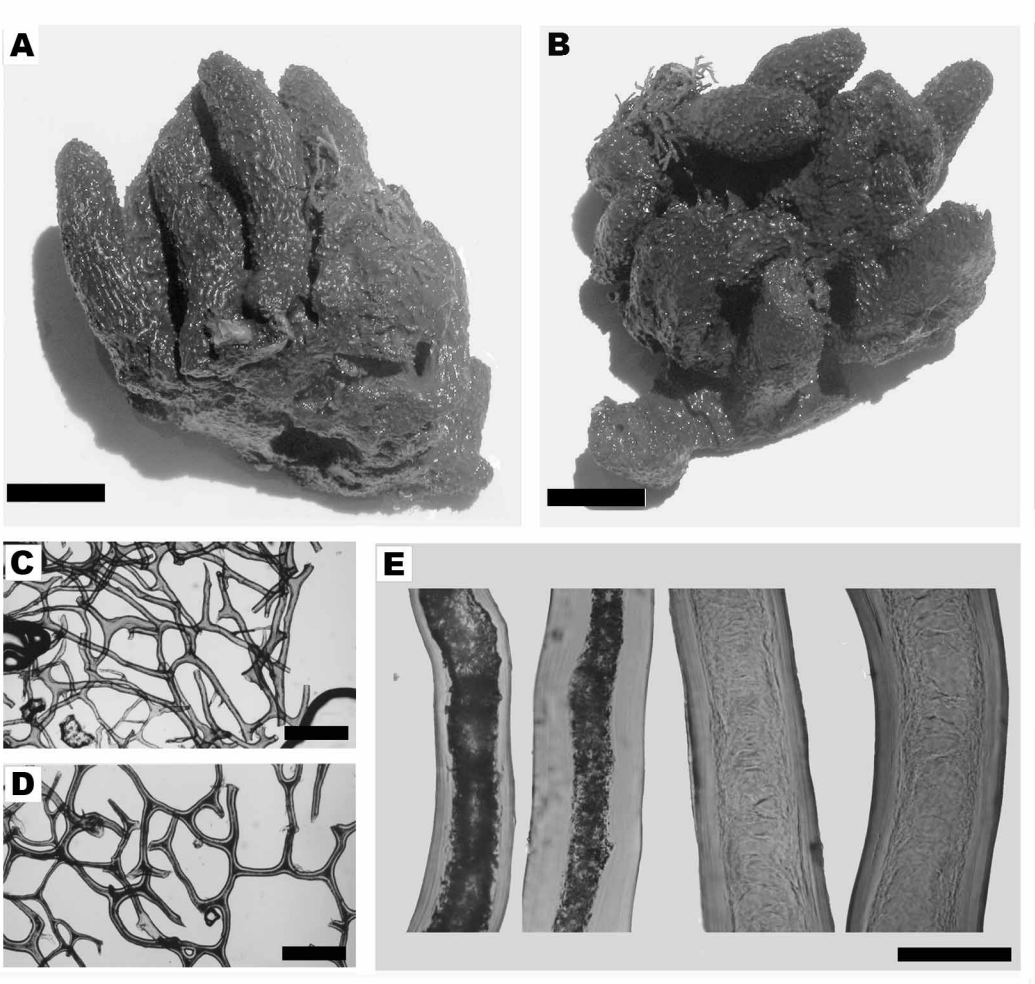

FIGURE 2: A–E. *Aplysina caissara* Pinheiro & Hajdu, 2001. A–B. Holotype (MNRJ 1988, after preservation). C–D. Skeletal architecture(C. MNRJ 1675, D. MNRJ 5087). E. Spongin fibres (MNRJ 1675, 5087). Scale bars = A–B. 1 cm, C–D. 500 µm, E. 50 µm.

Skeleton: Choanosome with a delicate and irregular network of spongin fibers. They have a bark with amber colour and thickness of 25–100 µm (average 44 µm), and black or amber pith with thickness varying between 11 and 81 µm (average 16 µm) (Figs. 2C–E, Tab. I).

TABLE I: Spongin fibres' measurement data for *Aplysina caissara* Pinheiro & Hajdu, 2001 (in micrometers; S.D. = Standard Deviation and N=30).

Specimens	Locality*	Fibers				Piths			
		Thinnest	Mean	Thickest	S.D.	Thinnest	Mean	Thickest	S.D.
Holotype MNRJ 1988	São Sebastião, SP	26.0	41.5	50.0	6.8	19.0	26.3	36.0	5.5
Paratype MNRJ 0268	São Sebastião, SP	31.0	43.3	53.0	6.0	19.0	32.2	40.0	5.6
Paratype MNRJ 0578	São Sebastião, SP	31.0	43.1	53.0	5.9	21.0	33.7	45.0	6.7
Paratype MNRJ 1673	São Sebastião, SP	29.0	45.6	62.0	9.5	22.0	31.3	50.0	7.4
Paratype MNRJ 1675	São Sebastião, SP	32.0	52.6	86.0	12.4	14.0	27.1	44.0	7.5
Paratype MNRJ 1988	São Sebastião, SP	26.0	49.6	77.0	10.6	17.0	36.9	60.0	10.8
Paratype MNRJ 2013	São Sebastião, SP	32.0	45.5	57.0	5.9	17.0	32.9	41.0	6.1
MNRJ 0283	Arvoredo, SC	26.3	40.8	65.0	8.2	13.8	28.8	51.3	8.1
MNRJ 5087	Picinguaba, SP	25.0	43.0	70.0	10.2	11.3	16.1	25.0	3.3
MNRJ 5284	Arvoredo, SC	25.0	36.1	63.8	9.0	13.8	24.7	50.0	8.3
MNRJ 5287	Arvoredo, SC	25.0	35.7	47.5	5.5	12.5	24.5	36.3	6.1
MNRJ 5308	Arvoredo, SC	27.5	37.6	51.3	6.8	20.0	25.9	41.3	5.7
MCN 0383	Arvoredo, SC	31.0	44.9	67.0	8.7	16.0	28.0	55.0	9.3
MCN 1034	Arvoredo, SC	36.0	45.4	74.0	9.5	16.0	35.2	62.0	11.9
MCN 1035	Arvoredo, SC	28.0	47.8	76.0	11.6	24.0	39.0	81.0	14.0
MCN 2275	Arvoredo, SC	36.0	54.2	100.0	14.2	24.0	42.5	64.0	10.3
MCN 2278	Arvoredo, SC	40.0	58.8	84.0	11.8	14.0	24.3	52.0	9.1

*SC, Santa Catarina State; SP, São Paulo State.

Distribution: Provisionally endemic from southern and southeastern Brazil (24–28º S, Fig. 3A). This area is known as the Paulista Biogeographic Province.

Ecology: The species has a typically patchy distribution, being often very rare, but reaching considerable densities at a few spots, where specimens can be found every couple of meters. Its known depth distribution is from 0.5 to 12 m. Few specimens are found at very shallow depths (0.5–3 m) in places of somewhat restricted water flow, where temperatures may reach 28º C. However, most are located in areas of large water circulation

and intermittently exposed to the Central South Atlantic waters, with temperatures reaching a minimum around 13º C (Pinheiro & Hajdu, 2001).

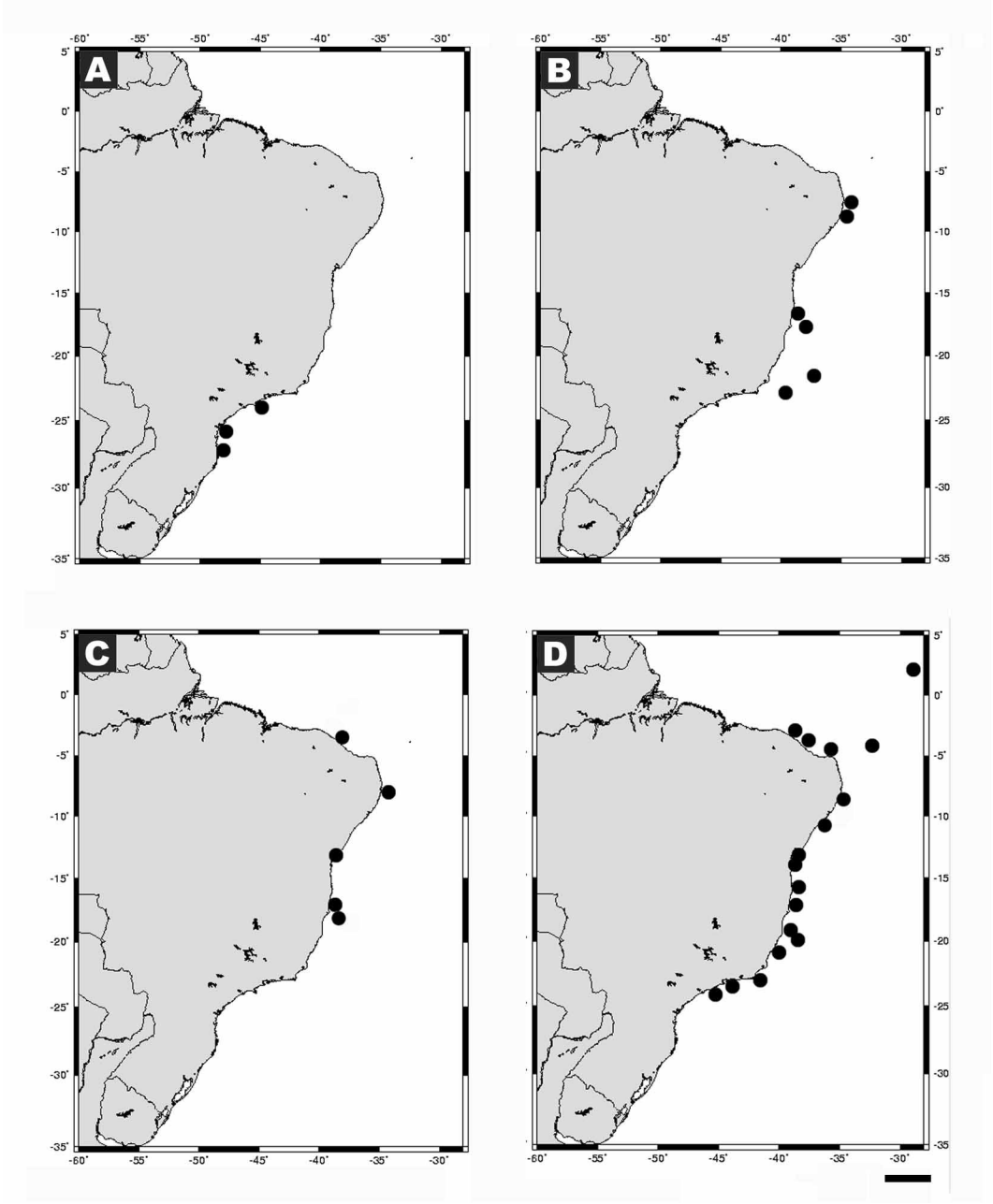

FIGURE 3: Map showing the distribution of *Aplysina* along the Brazilian coastline. A. *Aplysina caissara* Pinheiro & Hajdu, 2001. B. *Aplysina cauliformis* (Carter, 1882). C. *Aplysina fistularis* (Pallas, 1766). D. *Aplysina fulva* (Pallas, 1766). Scale bar = 500 km.

Remarks: Among the Tropical South-western Atlantic *Aplysina* that possess digitiform processes, the species which most closely resembles *A. caissara* is *A. fulva*, known by its large morphologic variability along the Brazilian coast (cf. Pinheiro & Hajdu, 2001). However, *A. caissara* combines a bright yellow colour in life, the consistently small dimensions (digits < 5 cm high) accross both known populations, the apical oscula, and a very delicate reticulation of thin spongin fibers. Contrastingly, a bright yellow colour is only seldom present in *A. fulva*, which frequently reaches larger dimensions (digits > 5 cm high), never possesses typically apical oscula, nor a comparably delicate reticulation of spongin fibres.

***Aplysina cauliformis* (Carter, 1882) (Figs. 1B–C, 3B, 4, Tab. II)**

Luffaria fulva Duchassaing & Michelotti (1864: 63, in part). *Verongia longissima sensu* de Laubenfels (1956: 2), Johnson (1971: 105), Hechtel (1976: 239). *Verongia cauliformis sensu* Collette & Rützler (1977: 309). *Aplysina cauliformis sensu* Zea (1987: 57), Muricy & Moraes (1998: 216), Muricy et al. (2006: 118). Non *Aplysina aff. cauliformis* sensu Pinheiro & Hajdu (2001; = *A. fulva*). Non *Aplysina fulva* (Pallas, 1766; a valid species). For further synonymy cf. Wiedenmayer (1977: 68).

Sintypes: BMNH 39.3.24.76 and BMNH 39.3.24.2 (not examined).

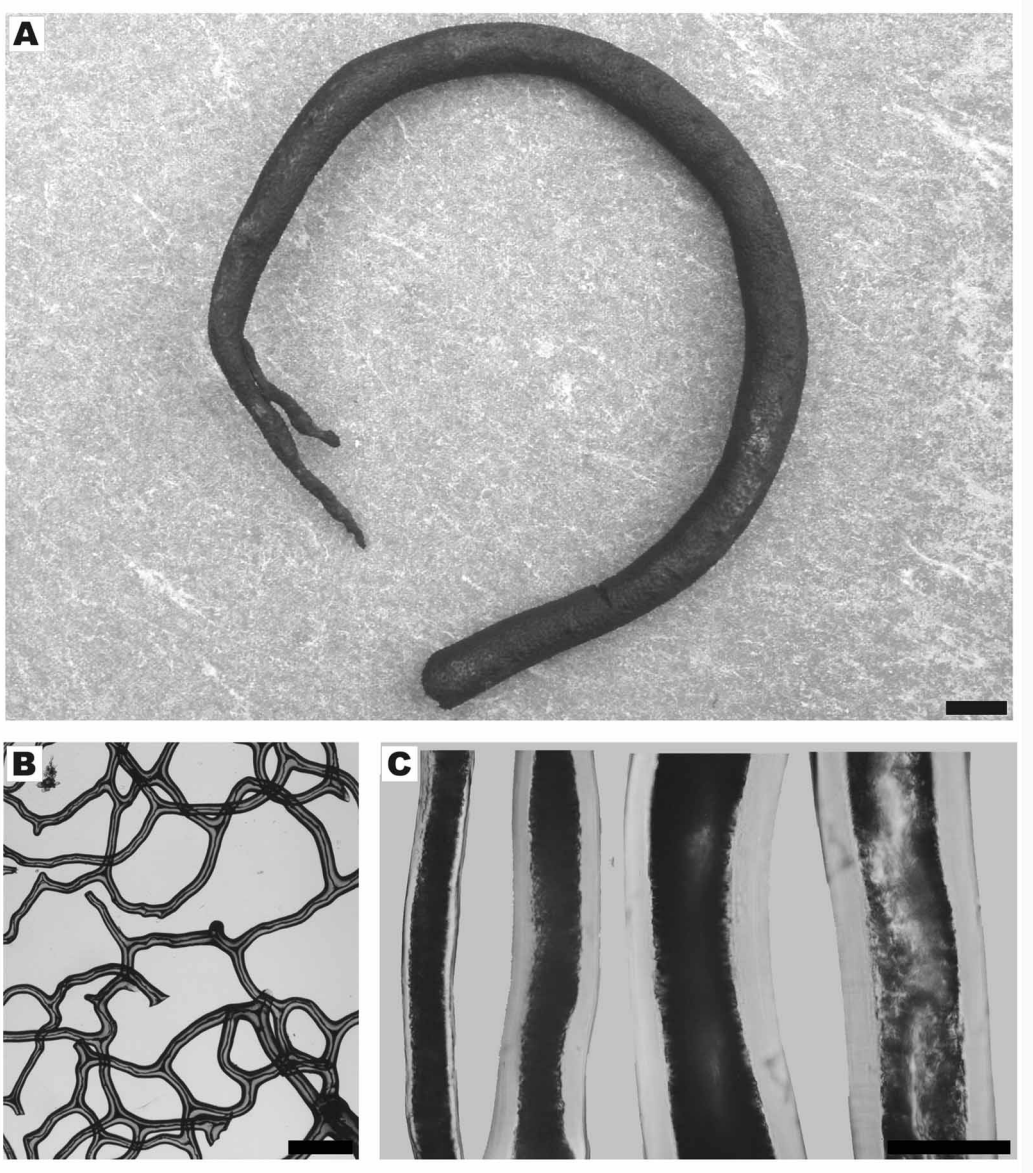

FIGURE 4: A–C. *Aplysina cauliformis* (Carter, 1882). A. MNRJ 5482 (after preservation). B. Skeletal architecture (MNRJ 1137). C. Spongin fibres (MNRJ 1137). Scale bars = A. 1 cm, B. 500 µm, C. 50 µm.

Studied material: MNRJ 1135, 1137 (Almirante Saldanha seamount, ES, 22º20' S - 37º37' W), Programme REVIZEE *coll.*, 100 m depth, 27/XI/1997. MNRJ 4561 (Dogaresa seamount, Vitória-Trindade Seamount Chain, ES, start: 20º44'28" S - 31º50'03" W, end: 20º44'30" S - 31º50'48" W), Programme REVIZEE *coll.*, 65 m depth, 11/VII/2001. MNRJ 3381 (BA), Programme REVIZEE *coll.*, 31/V/1999. MNRJ 5277, Pedra do Silva (north side), Reserva Extrativista de Corumbau (Prado, BA, 16º53'41.1" S - 39º05'31.2" W),

U.S. Pinheiro *coll.*, 3 m depth, 23/I/2002. MNRJ 5462, Parcel Paredes, south side (Parque Nacional Marinho dos Abrolhos, BA, 17º56.800' S - 38º54.264' W), G. Muricy *coll.*, 15 m depth, 01/III/2002. MNRJ 5467, Parcel Paredes, south side (Parque Nacional Marinho dos Abrolhos, BA, 17º56.800' S - 38º54.264' W), E. Vilanova *coll.*, 15 m depth, 01/III/2002. MNRJ 5475, 5481, 5482, Cave of Siriba Island (Parque Nacional Marinho dos Abrolhos, BA), G. Muricy and E. Esteves *coll.*, 10 m depth, 02/III/2002. UFRJPOR 4027 (Tamandaré, PE), 09/III/1996. UFRJPOR 4167, Santo Aleixo Island (Serinhaem, PE), P.S. Young and C.S. Serejo *coll.*, 18/II/1995. UFRJPOR 4407 (BA, 16º34.015' S - 38º16.182' W), Programme REVIZEE *coll.*

Diagnosis: Slender cylindrical branches with regular diameter along all the extension.

Description:

Specimens consist of slender cylindrical branches with regular diameter, single or grouped, sometimes with anastomoses and ramifications. In studied specimens the projections present a maximum length of 36 cm, and maximum diameter of 1cm. Oscula are often longitudinally aligned on the projections. The surface is finely conulose. Consistency hard. Purple or light-yellow *in vivo*, and purple after preservation in alcohol (Figs. 1B–C, 4A).

Skeleton: Choanosome formed by an irregular polygonal reticulation of spongin fibers (Fig. 4B). Bark with amber colour 22–190 µm thick (average 74 µm) and a thick pith that can be black or amber, 7–115 µm (average 30 µm) (Fig. 4C, Tab. II).

TABLE II: Spongin fibres' measurement data for *Aplysina cauliformis* (Carter, 1882) (in micrometers, S.D. = Standard Deviation and N=30).

Specimens	Locality*	Fibers				Piths			
		Thinnest	Mean	Thickest	S.D.	Thinnest	Mean	Thickest	S.D.
MNRJ 1135	(REVIZEE) BA	33.8	53.2	72.5	10.8	12.5	22.2	37.5	6.8
MNRJ 1137	(REVIZEE) BA	41.3	63.2	82.5	10.5	17.5	32.5	51.3	9.2
MNRJ 3381	(REVIZEE) BA	45.0	68.4	116.3	13.9	18.8	30.0	42.5	7.3
MNRJ 4561	(REVIZEE) BA	22.5	52.5	96.3	19.5	7.5	17.1	33.8	7.8
UFRJPOR 4027	Tamandaré, PE	62.5	76.6	116.3	10.9	16.3	24.2	36.3	4.3
UFRJPOR 4167	Serinhaem, PE	50.0	78.8	120.0	17.8	16.3	25.6	42.5	6.2
UFRJPOR 4407	(REVIZEE) BA	77.5	126.2	190.0	22.8	30.0	58.2	115.0	18.6

*BA, Bahia State; PE, Pernambuco State.

Distribution: Tropical western Atlantic: Brazil (8–23º S, Fig. 3B): Pernambuco State (Santo Aleixo Island and Tamandaré), Bahia State (Reserva Extrativista de Corumbau and Parque Nacional Marinho dos Abrolhos), Espirito Santo State (Vitória-Trindade Seamount Chain and Almirante Saldanha Seamount). World: Florida, Bahamas, Virgin Islands, Belize, Jamaica, Puerto Rico, Curaçao and Colombia.

Bathymetry: Known depth distribution in Brazil is from 3 to 100 m.

Remarks: van Soest (1978) commented that it was possible to differentiate *A. cauliformis* from *A. fulva* by the colouration of preserved specimens, with the former showing a lighter colouration and the second a darker one, an opinion shared by Zea (1987). However, as argued below, Brazilian *A. fulva* turned into various lighter or darker shades of brown, or even black, making it impossible to set both species apart on the basis of this criterion. Therefore, the best character to differentiate both species in Brazil is the cylindrical branches, always thin and with a regular diameter along the extension in *A. cauliformis*, and of varied thickness and

irregular diameter in *A. fulva*. This is a case where extended investigation must be done, and this will need to rely on additional sources of evidence, as morphology alone is frequently permitting only hesitating assignments.

Zea (1987) hinted upon the existence of two morphotypes within Caribbean *A. cauliformis*, further remarked upon in Schmitt et al. (2005). These, so far, are recognized solely on the basis of their habit (Zea, pers. comm.): morphotype I - brown, erect, ramifying rather dichotomously from a single trunk; and morphotype II - lilac or cinammon with lilac tinges, less ramified, often repent. We failed to recognize any such distinction in the Brazilian materials studied. The possibility that one of these could match *A. orthoreticulata* sp.n. (described below) depends on an evaluation of their skeletal architecture, which has not been done here.

Aplysina fistularis (Pallas, 1766) (Figs. 3C, 5–6, Tab. III)

Spongia fistularis, Pallas (1766: 385). *Aplysina fistularis sensu* Lendenfeld (1889: 422). *Verongia fistularis sensu* de Laubenfels (1956: 2), Hechtel (1976: 239). *Verongia fistularis* forma *fistularis sensu* Collete & Rützler (1977: 309). Further synonymy cf. Hechtel (1965: 12) and Wiedenmayer (1977: 64).

Type specimens status: All type material of Pallas was destroyed by fire in Küstrin (Poland) in 1758 during the Seven Years' War, including the holotypes of *A. fistularis* and *A. fulva* (Wiedenmayer, 1977). It is likely that Pallas had actual specimens at hand because he mentioned (cf. Wiedenmayer, 1977) that *A. fistularis* (as *Spongia fistularis*) was denser and harder than *A. fulva* (as *S. fulva*). De Laubenfels' (1948) designation of a neotype from Topsent's (1931) redescription of Lamarck's (1814) *Spongia fistularis* was considered unhappy by Wiedenmayer (1977), who argued that these specimens were far from representing the typical form of the species, where the specimen was a single large tube with brown colour when dry (cf. Seba, 1758; Esper, 1791–1799; Ehlers, 1870). Additionally, he pointed out that de Laubenfels did not select which from three hypotypes in Lamarck´s collection he meant. We had the opportunity to reexamine the three hypotypes [MNHN LBIM No D.T. 3379, plus another two unregistered specimens of *Spongia fistularis* var. *aggregata*]. In spite of their cospecificity with *Aplysina fistularis* not being 100% ruled out, they are considerably atypical by consisting of clusters of relatively small, largely anastomosed tubes.

From repeatedly reading the above quoted references, it appears to us this whole argument is basically flawed, because it seems quite unlike that de Laubenfels might have overlooked Topsent's clear mention of the existence of three specimens in Lamarck's series of *Spongia fistularis*, referred by Topsent to *Aplysina fistularis* var. *aggregata* (= *Aplysina insularis* of authors). Rather, we prefer to consider that he was actually referring to Topsent's redescription of *Spongia tubaeformis* Lamarck, referred by the former to *Aplysina fistularis*, and obviously comprising a single, illustrated specimen, much more likely to match the current concept of *A. fistularis* (e.g. van Soest, 1978; Zea, 1987; present description). This specimen is still extant in the MNHN Lamarck collection, registered under MNHN LBIM No D.T. 598, but reported to be broken at mid length in two equal pieces (I. Domart-Coulon, pers. comm.). Despite the fact that this description starts at page 71, instead of 72, as quoted by de Laubenfels (1948), it does continue into the latter page, where the specimen under consideration is actually described. If this argument is accepted, then de Laubenfels' (1948) neotype designation fulfills a significant set of the qualifying conditions listed in ICZN's Article 75 for recognition of the validity of any neotype designation. Nevertheless, it appears to us that conditions 75.3.4 and 75.3.6 were not satisfactorily matched. As recommended by the ICZN, a subsequent reviewer should prioritize the validation of a former (prior to 1961) invalid designation, which is attempted here. Condition 75.3.4 can be satisfied by reference to Wiedenmayer's (1977) quotation of the Seven Years' War fire at Küstrin which destroyed Pallas' collection. The choice for Lamarck's (1814) specimen was a natural one, as this possibly was the oldest available, reasonably described and illustrated specimen. Condition 75.3.6 is matched by the realization that Puerto Rico, type locality for Lamarck's specimen falls within Pallas' "Mare Ameri-

canum". Unfortunately, the possibility that *A. fistularis*' neotype might belong to *A. archeri* (Higgin, 1875) instead cannot be entirely ruled out, because the live colour of Lamarck's specimen was unknown.

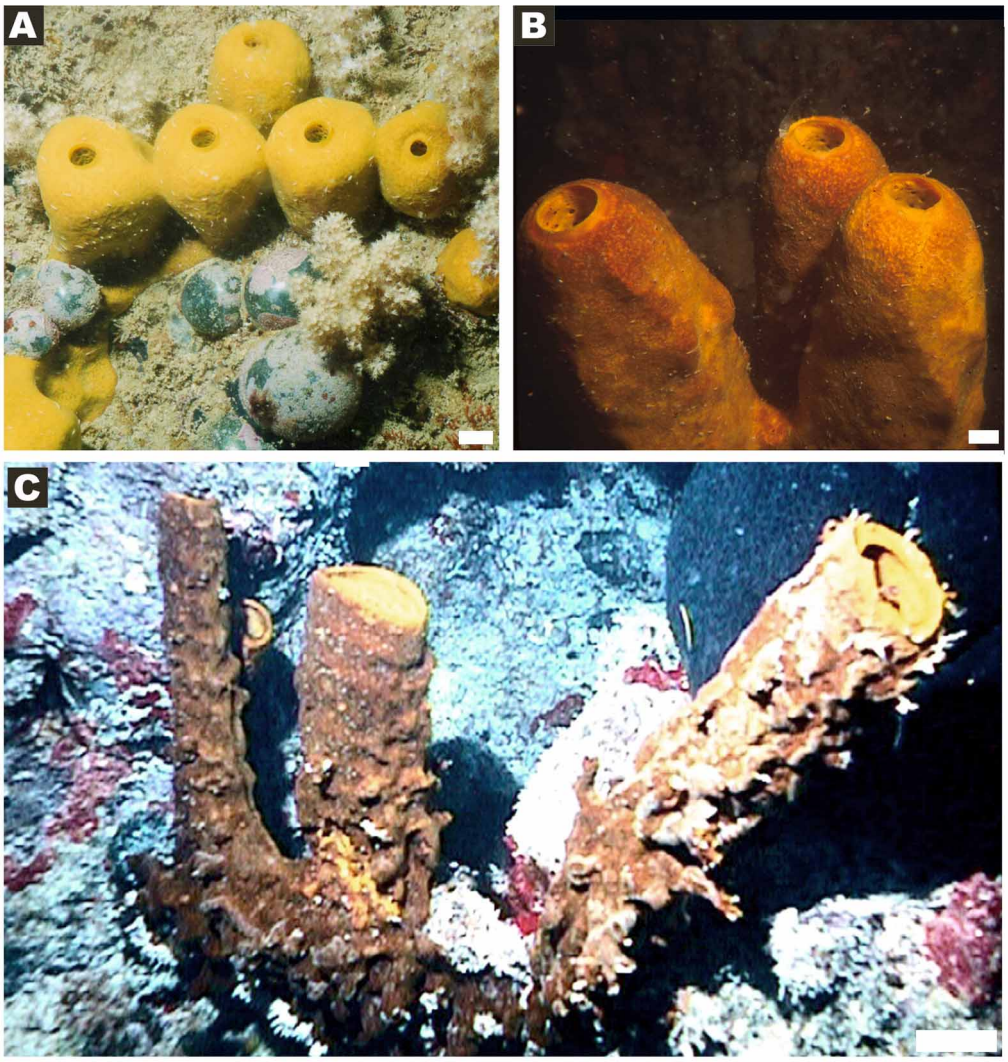

FIGURE 5: A–C. *Aplysina fistularis* (Pallas, 1766)—in situ. A. MNRJ 4172 (Salvador, BA, Brazil). B. MNRJ 2666 (Salvador, BA, Brazil). C. Parque Nacional Marinho dos Abrolhos (BA, Brazil). Scale bar = A–B, 1 cm; C, 2 cm.

Studied material : MNRJ 690, Sueste Island, east side (Parque Nacional Marinho dos Abrolhos, BA), C.A. Secchin *coll.*, 16/IV/1981. MNRJ 1548, Pirapama´s shipwreck (off Recife, PE), G. Muricy *coll.*, 20 m depth, 11/II/1998. MNRJ 2526, shipwreck, off Cantagalo Beach (Salvador, BA, 12º56.211' S - 38º30.698' W), E. Hajdu *coll.*, 5 m. depth, 03/VIII/1999. MNRJ 2666, Northern Breakwater, Todos os Santos Bay (Salvador, BA, 12º57.7' S - 38º31.1' W or 12º58.3' S - 38º31.2' W), 5m depth, E. Hajdu *coll.*, 01/VIII/1999. MNRJ 3523 (Reserva Extrativista de Corumbau, Prado, BA), G. Muricy *coll.*, 14/XI/1999. MNRJ 4164, 4166, 4172, 4174, Salvador´s Yacht Club (Salvador, BA), E. Hajdu *coll.*, 3–5 m depth, 4/VII/2001. MNRJ 5275, Salvador´s Yacht Club (Salvador, BA) U.S. Pinheiro *coll.*, 3 m depth, 29/I/2002. MNRJ 5468, Parcel Paredes, south side, (Parque Nacional Marinho dos Abrolhos, BA, 17º56.800´ S - 38º54.260' W), S. Ribeiro *coll.*, 15 m depth, 01/III/2002. MNRJ 5470, Patch Reef between Rosalina´s shipwreck and Santa Bárbara Island (Parque Nacional Marinho dos Abrolhos, BA, 17º57.765' S - 38º40.271' W), U.S. Pinheiro and E. L. Esteves *coll.*, 15 m depth, 4/III/2002. MNRJ 5471, Patch Reef between Rosalina´s shipwreck and Santa Barbara Island, (Parque Nacional Marinho dos Abrolhos, BA, 17º57.750' S - 38º40.710' W), G. Muricy and E. Vilanova *coll.*, 14 m depth, 4/III/2002. MNRJ 5944, Patch Reef between Rosalina´s shipwreck and Santa Bárbara Island (Parque Nacional

Marinho dos Abrolhos, BA, 17º57.765' S - 38º40.271' W), U.S. Pinheiro and E. L. Esteves *coll.*, 15 m depth, 4/III/2002.

Comparative material: Fragment from IdO-401 (holotype of *Aplysina ocracea*).

Diagnosis: Specimens consist of tubes which can be cylindrical, fusiform or slightly barrel-shaped, single or grouped, and topped by a large apical pseudoscule. Tubes can be as tall as 1 m, or more. The surface can vary from nearly smooth to very irregular with variably shaped projections, such as shallow-ridges, folds, digitiform processes and lobes. Shorter digitiform projections, frequently constricted at the base, the size of small fistules, can also be abundant. Specimens turn nearly black upon fixation.

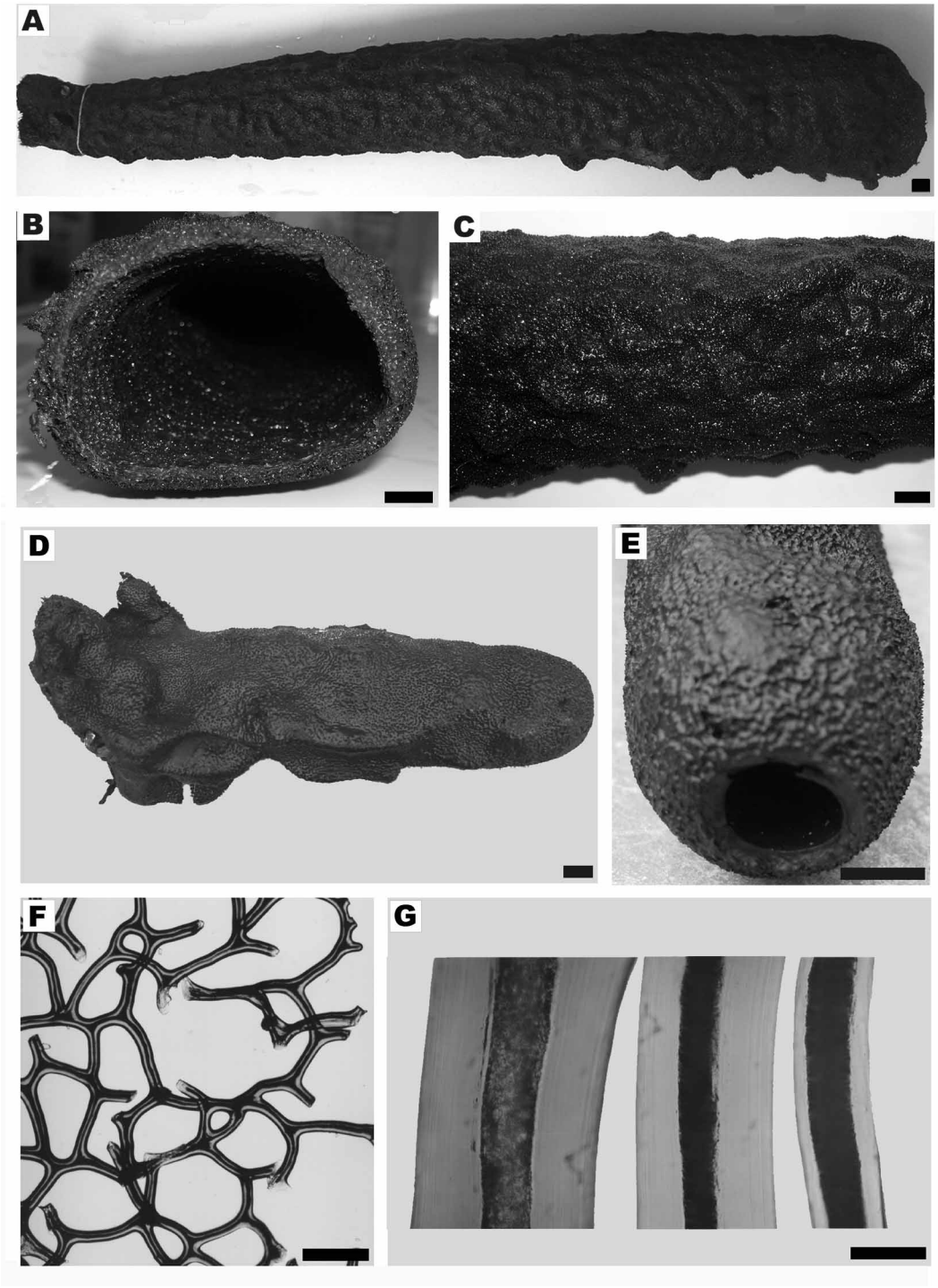

FIGURE 6: A–D. *Aplysina fistularis* (Pallas, 1766). A–C. MNRJ 5944. D–E. MNRJ 2666. F. Skeletal architecture (MNRJ 4166). G. Spongin fibres (MNRJ 1548, 2526). Scale bars = A–E. 1 cm, F. 500 µm, G. 50 µm.

Description of the species:

Shape: Individuals consist of tubes which can be stout-cylindrical, fusiform or slightly barrel-shaped, single or grouped, and topped by a large apical pseudoscule. Tubes can be as tall as 1 m, or more (up to 60 cm high and 9 cm wide on collected specimens). Smaller, presumably young individuals can be only 3 cm high and 0.8 cm wide. Tube walls vary from 0.5 to over 2 cm in thickness. These tubes can be smooth, finely conulose or very irregular, and many bear lateral projections (6A–E), which vary from shallow-ridges and folds, to digitiform processes and lobes. All the tubes possess large apical pseudoscula 0.8–7.5 cm in diameter (Fig. 6B, E), but small lateral oscula can be observed. In MNRJ 4164 and 4174 these pseudoscula have iris-type diaphragms, mainly in smaller tubes. These structures are commonly seen on live specimens, but easily lost on preserved material. In MNRJ 5471 and 5944, small digitiform projections (up to 1 cm high) rising from the large apical pseudoscula can be noticed. Live-colour is normally yellow or ochre-yellow (brownish). After preservation in ethanol, all specimens turned into purple, dark brown or black. The specimens are mostly very soft, apart from MNRJ 5471 which is very hard.

Skeleton: Choanosome formed by an irregular polygonal reticulation of spongin fibers, 37–275 µm thick (average 92 µm; Fig. 6D). They have an amber coloured bark, with the exception of specimen MNRJ 5471 which is reddish coloured. The pith can be black or amber, with thickness of 10–60 µm (average 26 µm; Fig. 6E).

TABLE III: Spongin fibres' measurement data for *Aplysina fistularis* (Pallas, 1766) (in micrometers; S.D. = Standard Deviation and N=30).

Specimens	Locality*	Fibers				Piths			
		Thinnest	Mean	Thickest	S.D.	Thinnest	Mean	Thickest	S.D.
Neotype MNRJ 5944	Abrolhos, BA	90.0	122.2	160.0	15.9	10.0	22.8	35.0	5.9
MNRJ 0690	Abrolhos, BA	45.0	75.0	130.0	21.1	12.5	23.0	35.0	5.8
MNRJ 1548	Recife, PE	45.0	71.3	97.5	12.2	16.3	25.4	42.5	5.7
MNRJ 2526	Salvador, BA	45.0	100.2	127.5	15.4	17.5	28.9	42.5	6.1
MNRJ 2666	Salvador, BA	55.0	75.3	112.5	12.0	12.5	27.5	42.5	6.4
MNRJ 3523	Corumbau,BA	37.5	69.4	92.5	12.6	18.8	25.3	33.8	4.3
MNRJ 4164	Salvador, BA	40.0	85.8	123.8	19.8	12.5	34.2	57.5	12.4
MNRJ 4166	Salvador, BA	47.5	77.4	112.5	14.3	22.5	31.6	45.0	5.7
MNRJ 4172	Salvador, BA	52.5	76.5	160.0	21.7	12.5	21.3	27.5	4.0
MNRJ 4174	Salvador, BA	42.5	58.3	75.0	7.3	12.5	24.4	30.0	4.1
MNRJ 5275	Salvador, BA	52.5	73.8	95.0	12.4	20.0	27.4	40.0	4.0
MNRJ 5468	Abrolhos, BA	80.0	98.8	125.0	10.4	12.5	26.8	60.0	9.3
MNRJ 5471	Abrolhos, BA	110.0	210.5	275.0	43.0	15.0	25.8	35.0	5.3

*BA, Bahia State; PE, Pernambuco State.

Distribution: Tropical western Atlantic: Brazil (3–18º S, Fig. 3C): Ceará State, Pernambuco State, Bahia State, Parque Nacional Marinho dos Abrolhos. World: British Virgin Islands, Cuba, Cozumel, San Andres, Turks & Caicos, Curaçao.

Ecology: The specimens were collected in warm and clear waters; smaller specimens were found as shallow as 4 m deep, larger ones deeper than 12 m. *Aplysina fistularis* is one of the most conspicuous and abundant sponges of Parque Estadual da Pedra da Risca do Meio (off Fortaleza, Ceará).

Remarks: Alcolado (1984) described *Aplysina ocracea* from Cuba mentioning that it differed from *A. fistularis* by the possession of thicker fibers and the preservation of its natural colouration (ochre) after fixation. However, in the *A. fistularis* material examined here, we can observe a large variation of fiber thickness that includes the variation described for *A. ocracea* (small fragment of the holotype, IdO-401, has been reexamined). A study of morphological variability of whole specimens is necessary to settle its limits as regards the variability of *A. fistularis*. For the present, we take P. Alcolado´s (pers. comm.) that the species is pedunculate as evidence that it deserves the status of a valid species.

Aplysina fistularis is a considerably plastic species, which stretches a continuum between small, smooth tubes; to very large ones, full of variably shaped projections, with or without their own apical pseudoscule. Such smaller, apparently solid projections were already reported by de Laubenfels (1948) as partially bridging the gap between *A. fistularis* and *A. fulva*. Other species described here may approach the limits of this variability, but we consider that morphologic gaps exist, and these will be discussed below.

Aplysina fulva (Pallas, 1766) (Figs. 3D, 7–8, Tab. IV)

Spongia fulva, Pallas (1766: 383). *Verongia fistularis* forma *fulva sensu* Collete & Rützler (1977: 309). *Aplysina fistularis sensu* Muricy (1989: 351). Non *Aplysina fistularis* (Pallas, 1766; a valid species). *Aplysina fulva sensu* Muricy et al. (1991: 1187), Muricy et al. (1993: 429), Pinheiro & Hajdu (2001: 149). *Aplysina* aff. *cauliformis sensu* Pinheiro & Hajdu (2001: 154). Non *Aplysina cauliformis* (Carter, 1882, a valid species). For further synonymy cf. Wiedenmayer (1977: 66).

Type specimens status: As stated in the discussion on the type-specimen status for *A. fistularis*, the type material of *Spongia fulva* was also lost in the Seven Years´ War. *Aplysina fulva* is a very inadequately diagnosed species amongst its congeners, as the debate upon its specific status lasted until the 1990s, when the species has been referred to *A. fistularis* forma *fulva* for the last time. In other words, doubts persisted on its specific status until very recently, and designation of a neotype would be most welcome. Surprisingly, this has never been done.

From Wiedenmayer's (1977), van Soest's (1978) and Zea's (1987) descriptions of *A. fulva*, it appears that what seemed typical to them has some discrepancies to what appears typical, both from interpretation of Pallas´(1766) description and from extensive analysis of Brazilian populations. The few exceptions regarding *A. fulva´*s morphospace according to our judgement are Wiedenmayer´s (1977) mention of "hollow cylinders" at the base of specimens, van Soest´s (1978) quotation of "large oscula with iris-type diaphragm" also on the massively encrusting base of specimens (his Plate XI, Fig. 2), and Zea´s (1987) mention of oscula on top of tubular elevations up to 1–2 cm high. These features are absent from the Brazilian material studied here, and are suggestive to us that these authors might have been studying a complex of species, rather than *A. fulva* alone. Above all, these features do not match the description provided by Pallas (1766; translated in Wiedenmayer, 1977), nor the illustrations provided by Seba (1758) and reproduced in Wiedenmayer (1977; Pl. 6, figs. 2–3). None of these speak of, or picture any type of atrial cavity or large, iris-bearing oscula in *A. fulva*. Our choice of a neotype for *A. fulva* takes into consideration the description by Pallas (1766), the illustrations by Seba (1758), one of Wiedenmayer´s (1977) illustrated specimens (Plate 6, Figure 4), Vacelet´s *A. fulva* (1990: colour photo on p. 31), and the colour pictures provided in Pinheiro & Hajdu (2001; figs. 3, 7–12).

The ICZN lists seven qualifying conditions for recognition of the validity of any neotype designation. We will argue how we match each of these.

- Condition 75.3.1 determines that a neotype designation must be accompanied by a statement that it is selected with the express purpose of clarifying the taxonomic status or the type locality of a nominal taxon. This is so here. The arguments presented above clearly indicate how much confusion persists in the recent literature regarding the actual morphospace of *A. fulva*, above all through the realization that until very recently this species was considered only a variety of *A. fistularis*.
- Condition 75.3.2. determines that a neotype designation must also be accompanied by a statement of the characters that the author regards as differentiating from other taxa the nominal species-group taxon for which the neotype is designated, or a bibliographic reference to such a statement. A diagnosis for the species is provided below.
- Condition 75.3.3. determines that a neotype designation must also be accompanied by data and description sufficient to ensure recognition of the specimen designated. Both a description of the neotype, including underwater photo of the live specimen, and a full description of the species on the basis of extensive evaluation of Brazilian populations are provided below.
- Condition 75.3.4. determines that a neotype designation must include the author's reasons for believing the name-bearing type specimen(s) (i.e. holotype, or lectotype, or all syntypes, or prior neotype) to be lost or destroyed, and the steps that had been taken to trace it or them. The holotype of *Aplysina fulva* is *Spongia fulva* Pallas, 1766 as argued by Wiedenmayer (1977), who also pointed to the fact that this collection was entirely lost in a fire in Küstrin in the Seven Year´s War.
- Condition 75.3.5. determines that a neotype designation must include evidence that the neotype is consistent with what is known of the former name-bearing type from the original description and from other sources. This has been extensively argued above. In spite of the few points of disagreement with the descriptions provided by Wiedenmayer (1977), van Soest (1978) and Zea (1987), the neotype proposed here would undoubtedly have been identified as *A. fulva* by all these authors. On top of that, our specimen appears to perfectly match Pallas´ (1766) description. Our choice for a newly collected specimen stresses the importance of knowing the specimen´s live-colour, as seen in Fig. 7A. The lighter extremities exhibited by the proposed neotype were reported upon by Wiedenmayer (1977) too, for specimens from the Bahamas.
- Condition 75.3.6. determines that a neotype designation must include evidence that the neotype came as nearly as practicable from the original type locality. Pallas (1766) stated the original locality to be "Mare Americanum", which, according to our comprehension must be taken as comprising all the Tropical western Atlantic. Given that Peter Simon Pallas did his doctorate in Leiden in 1760 and subsequently spent some time in The Hague, where he published his *Elenchus Zoophytorum*, it appears quite conceivable to us that he might have had access to Brazilian materials. These could have been brought back to The Netherlands a century before during the time the Dutch had a colony in north-eastern Brazil, where *A. fulva* is abundant (even as debris at the many beaches), or subsequently, by any merchants or corsairs. Also, Pallas referred to pictures provided in Seba (1758), who lived in Amsterdam, and had been buying "curiosities" (such as sponges) at the docks of this port town, so that a Brazilian origin for his samples cannot be discarded either.
- Condition 75.3.7. determines that a neotype designation must include a statement that the neotype is, or immediately upon publication has become, the property of a recognized scientific or educational institution, cited by name, that maintains a research collection, with proper facilities for preserving name-bearing types, and that makes them accessible for study. The natural history collections of Museu Nacional/UFRJ are nearly 190 years old. The sponge collection comprises over 16000 specimens, over 150 of which are types or fragments from types.

Neotype: MNRJ 7975 (Figs. 7A, 8A), Tartarugas Beach, (Búzios, RJ), 5 m depth, U. S. Pinheiro and E. Hajdu *coll.*, 15/v/2003. The Neotype consists of a cluster of twenty-seven digitiform processes (cylindrical or

fusiform), always with irregular diameter. The specimen is 19 cm high and 18 cm wide. The small oscula (0.5–2 mm) appear randomly spread all over the surface, which can be smooth or finely conulose. The colour *in vivo* varies from yellow (mostly on the apices of the branches) to brown, becoming deep brownish-purple after preservation in alcohol. Without ectosomal specialization. Choanosome with an irregular network of smooth, straight, curved or undulating spongin fibers (fibres 39–68 µm in diameter, pith 34–58 µm in diameter). After preservation and preparation, fibers are yellow to dark-brown, nearly black. The same specimen has pith of both colours.

Additional material studied: Ceará State - MNRJ 689, Meirelles Beach (Fortaleza), A.L. Castro *coll.* MNRJ 3044, 3045, 3047 (Canoa Quebrada), M. Guimarães *coll.*, 25 m depth, II/2000. UFRJPOR 4285, E. Araujo *coll.* Rio Grande do Norte State - UFRJPOR 3582 Urca do Tubarão, (04º50´ S - 36º27´ W), diver of Cooperbrasub *coll.* Pernambuco State - UFRJPOR 4804, Rata Island (Fernando de Noronha Archipelago), G. Muricy *coll.*, 12 m depth, 14/II/1998. Alagoas State - MNRJ 1987, do Francês Beach (Marechal Deodoro), M.D. Correia *coll.*, 1 m depth, 22/IX/1998. Bahia State - MNRJ 823, Coroa de Pedra, off Itaparica Island, Todos os Santos Bay (Itaparica), P.S. Young and M.B. Pereira *coll.*, 03/II/1993. MNRJ 1486, 1487, Tacimirim Beach (Morro de São Paulo), R. Fernandes *coll.*, 13 m depth, 11/I/1998. MNRJ 1506, Recife Califórnia, Programme REVIZEE *coll.*, 20–30 m depth, 25/XII/1997. MNRJ 2599, Portinho de Itaparica (Itaparica, 12º53.44' S - 38º41.021' W), E. Hajdu *coll.*, 2–4 m, 04/VIII/1999. MNRJ 2603, breakwater of the Harbour Authority, (Salvador, 12º58.191' S - 38º31.237' W), E. Hajdu *coll.*, 07/VIII/1999. MNRJ 3056, 3064 (Itacaré, 14º16.631´ S - 38º58.888´ W), A.C. da Silva *coll.*, 15 m depth, 25/III/2000. MNRJ 3531, Pedra do Silva (Reserva Extrativista de Corumbau, Prado), G. Muricy *coll.*, 1–3 m depth, 14/XI/1999. MNRJ 3541, 3547 (Reserva Extrativista de Corumbau, Prado, 16 º56'29" S 39º00'24" W), B. Segal and C.B. Castro *coll.*, 14–22 m depth, 18/XI/1999. MNRJ 4168, 4171, 4177, 4178, 4180, 4181 Salvador Yacht Club (Salvador), E. Hajdu *coll.*, 3–5 m. depth, 4/VII/2001. MNRJ 5479, Parcel Paredes, south side, (Parque Nacional Marinho dos Abrolhos, 17º53'499" S - 38º58'034" W), U.S. Pinheiro and G. Muricy *coll.*, 10 m depth, 05/III/2002. UFRJPOR 3423, Calypso *coll.*, station 67 (13º28´ S - 38º48´ W), 39 m depth. Espírito Santo State - MNRJ 2298 (Guarapari), A.M. Solé-Cava *coll.*, III/1989. Rio de Janeiro State - MNRJ 83, João Fernandinho Beach (Armação dos Búzios), D. Pires *coll.*, 26/VII/1983. MNRJ 1704, João Fernandinho Beach (Armação dos Búzios), E. Hajdu *coll.*, 2–7 m depth, 09/V/1998. MNRJ 3554, Forno Beach (Arraial do Cabo), 2 m depth, 05/XII/1998. MNRJ 3957, Tartaruga Beach, (Armação dos Búzios), J. Creed *coll.*, 02/IX/2000. MNRJ 3958, Azedinha Beach, (Armação dos Búzios), J. Creed *coll.*, 07/IX/2000. MNRJ 3961, Canto Beach (Armação dos Búzios), J. Creed. *coll.*, 30/IX/2000. MNRJ 3963, Caboclo Island (Armação dos Búzios), J. Creed. *coll.*, 05/IX/2000. MNRJ 4084, Ponta do Anequim (Cabo Frio Island, Arraial do Cabo), E. Hajdu and E. Vilanova *coll.*, 6–10 m, 08/IV/2001. MNRJ 4152, Porcos Pequena Island (Angra dos Reis), G. Muricy and E. Vilanova *coll.*, 2–5 m depth, 26/V/2001. MNRJ 4153, 4154, 4155, 4156, 4157, 4158, 4159, 4160, Porcos Pequena Island (Angra dos Reis), G. Muricy and E. Vilanova *coll.*, 2–5 m depth, 26/V/2001. UFRJPOR 1204, Prainha Beach (Arraial do Cabo). UFRJPOR 1206, Boqueirão (Arraial do Cabo). UFRJPOR 2917, Pedra Vermelha (Cabo Frio Island, Arraial do Cabo), 10/V/1987. UFRJPOR 2940, Pedra Vermelha (Cabo Frio Island, Arraial do Cabo), N. Boury-Esnault *coll.*, 14/VI/1987. UFRJPOR 2965, Pedra Vermelha (Cabo Frio Island, Arraial do Cabo), C. Russo *coll.*, 24/VIII/1987. São Paulo State - MNRJ 357, Ponta do Jarobá, São Sebastião Channel (São Sebastião, 23º49.676' S - 45º25.278' W), E. Hajdu and G. Muricy *coll.*, 0.5–2.5m depth, 26/I/1996. MNRJ 445, São Sebastião Channel (São Sebastião, 23º49.676' S - 45º25.278' W), E. Hajdu *coll.*, 4 m depth, 19/II/1997. MNRJ 735, Barequeçaba, São Sebastião Channel (São Sebastião, 23º49.746' S - 45º26.478' W), E. Hajdu *coll.*, 1 m depth, 08/I/1996. MNRJ 762, Saco do Poço, São Sebastião Island (Ilhabela, 23º45.658' S - 45º14.862' W), E. Hajdu *coll.*, 8 m depth, 09/I/1996. MNRJ 1025, São Sebastião Channel (São Sebastião), R.G.S. Berlinck *coll.*, I/1994. MNRJ 1302, Ponta do Jarobá, (São Sebastião), E. Hajdu *coll.*, 2 m depth, 21/XII/1997. MNRJ 1674, rocky coast between Prainha Beach and Toque-toque Beach (São Sebastião, 23º50.067' S - 45º29.449' W), E. Hajdu *coll.*, 8 m depth, 24/IV/1998. MNRJ 1990, rocky coast between

Prainha beach and Brava beach (Costão do Navio, São Sebastião, 23º49.607´ S - 45º28.557´ W), E. Hajdu *coll.*, 6 m. depth, 29/I/1999. MNRJ 1991, Pedra Montada, Barequeçaba (São Sebastião, 23º49.746' S - 45º26.478' W), E. Hajdu *coll.*, 4 m depth, 01/II/1999. MNRJ 3004, Curral Beach, São Sebastião Channel (Ilhabela), E. Hajdu *coll.*, 10/I/2000. MNRJ 3561, between São Pedro and Veloso, (Ilhabela), E. Hajdu *coll.*, 6 m depth, 10/XI/2000.

Diagnosis: Single branches or clusters of erect or repent projections, mostly digitiform of irregular diameter, but also lamellate, palmate and volcaniform, with small, scattered oscula. Live-colour mostly ochre-yellow, but also brown, lemon-yellow or purplish-rose.

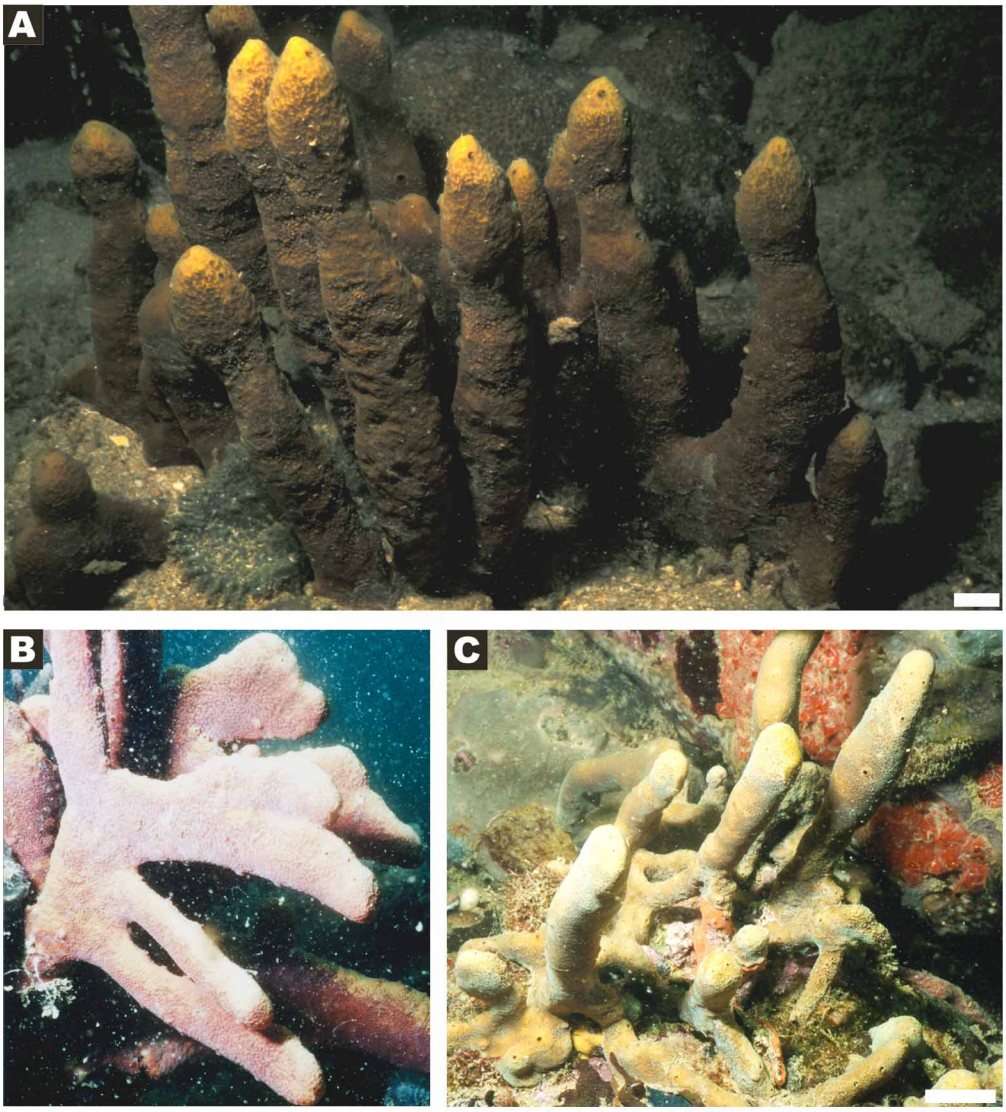

FIGURE 7: A–C. *Aplysina fulva* (Pallas, 1766)—in situ. A. Neotype—MNRJ 7975 (Armação dos Búzios, RJ, Brazil). B–C. Salvador (BA, Brazil). Scale bar = 1 cm.

Description

The majority of specimens are composed of clusters of digitiform branches (cylindrical or fusiform), always with irregular diameter (Fig. 7C). However, other morphologies are found, such as cushion-shaped, reptant (e.g. MNRJ 4177, 4178), lamellate (e.g. MNRJ 3056), palmate/pinnate (e.g. MNRJ 3963; Fig. 7B), ficiform/flabellate (e.g. MNRJ 2298) and volcaniform (e.g. MNRJ 4178). The size of specimens also varies considerably, with fused processes over 2 m high observed at Parque Nacional Marinho dos Abrolhos, while

others are smaller than 3 cm in height, at the species known southern distribution limit (24º S). The processes can be found single or in groups of 2 to 80. The small oscula (0.5–2 mm) appear randomly spread all over the surface, most frequently, but some alignment is also visible. The surface can be smooth, finely conulose, rugose or marked by short irregular ridges and grooves. The colour *in vivo* is most often a brownish-yellow, but varies in diverse hues of yellow, green, lilac or brown, becoming purple, pink or dark brown after preservation in alcohol. Specimens in semi-obscure environments are often bright lemon-yellow, as well as small. The consistency is variable from extremely soft to considerably hard.

Skeleton: Choanosome formed by an irregular polygonal reticulation of spongin fibers, with a diameter of 21–275 µm (average 75 µm; Fig. 8B–C). The bark is amber in colour, with the exception of specimens with stouter fibers, which have a reddish bark. The pith is black, with diameter of 10–72 µm (average 27 µm; Fig. 8D).

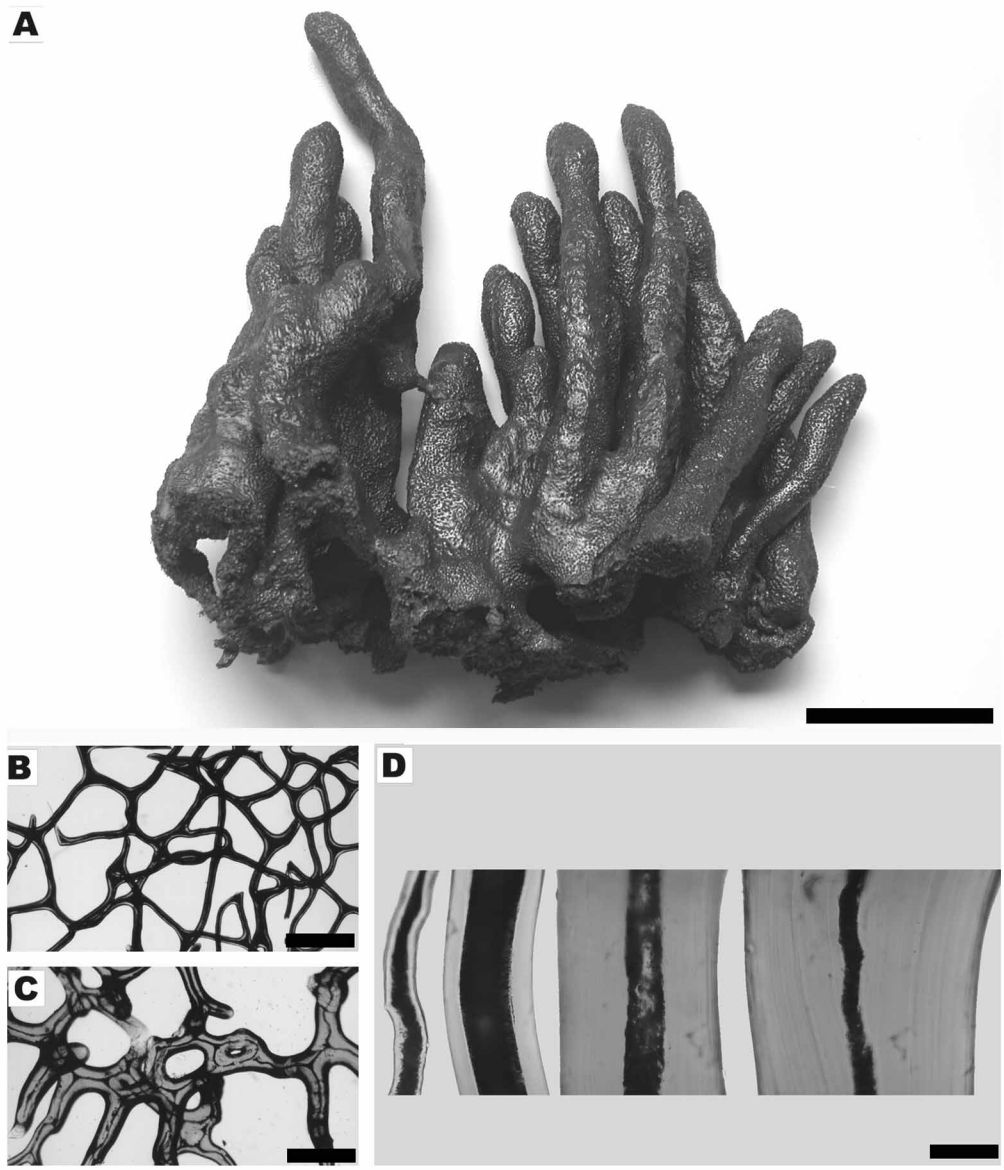

FIGURE 8: A–D. *Aplysina fulva* (Pallas, 1766). A. Neotype (MNRJ 7975, after preservation). B–C. Skeletal architecture (MNRJ 3044). D. Spongin fibres (MNRJ 2603, 3004, 3044). Scale bars = A. 5 cm, B–C. 500 µm, D. 50 µm.

TABLE IV: Spongin fibres' measurement data for *Aplysina fulva* (Pallas, 1766) (in micrometers; S.D. = Standard Deviation and N=30).

Specimens	Locality*	Fibers				Piths			
		Thinnest	Mean	Thickest	S.D.	Thinnest	Mean	Thickest	S.D.
Neotype MNRJ 7975	Búzios, RJ	38.8	53.6	67.9	9.8	33.9	46.1	58.2	8.3
MNRJ 0083	Búzios, RJ	28.8	52.4	62.5	8.0	13.8	25.7	36.3	5.2
MNRJ 0357	São Sebastião, SP	21.6	36.2	48.0	5.5	14.4	20.2	31.2	5.1
MNRJ 0445	São Sebastião, SP	26.0	42.6	76.0	13.4	16.0	30.7	52.0	9.5
MNRJ 0689	Fortaleza, CE	45.0	69.9	101.3	12.7	12.5	28.2	52.5	10.7
MNRJ 0699	São Sebastião, SP	60.0	103.9	150.0	22.7	30.0	39.4	72.5	9.5
MNRJ 0735	São Sebastião, SP	33.0	46.8	69.0	9.0	16.0	31.7	48.0	7.7
MNRJ 0762	São Sebastião, SP	36.0	53.0	76.0	9.0	14.0	26.6	48.0	8.4
MNRJ 0794	(REVIZEE)RJ	52.5	114.3	150.0	23.0	17.5	40.7	60.0	9.0
MNRJ 0823	Itaparica, BA	55.0	70.0	96.3	12.2	13.8	23.3	37.5	4.8
MNRJ 1025	São Sebastião, SP	33.8	45.4	65.0	6.9	18.8	27.5	43.8	6.4
MNRJ 1204	Arraial do Cabo, RJ	33.8	55.5	75.0	9.8	12.5	25.7	42.5	8.3
MNRJ 1206	Arraial do Cabo, RJ	31.3	47.3	65.0	7.9	17.5	28.4	42.5	7.0
MNRJ 1302	São Sebastião, SP	28.0	47.0	91.0	13.6	24.0	33.1	45.0	6.9
MNRJ 1486	Morro de S. Paulo, BA	60.0	84.8	107.5	12.6	12.5	19.4	26.3	3.0
MNRJ 1487	Morro de S. Paulo, BA	65.0	97.7	205.0	28.4	10.0	20.3	37.5	7.7
MNRJ 1506	(REVIZEE), BA	41.3	90.8	141.3	24.9	7.5	19.9	30.0	5.8
MNRJ 1674	São Sebastião, SP	36.0	54.2	79.0	12.6	19.0	30.9	50.0	9.4
MNRJ 1704	Búzios, RJ	30.0	72.3	110.0	26.2	10.0	23.8	40.0	7.6
MNRJ 1987	Maceió, AL	36.3	61.6	81.3	8.6	17.5	26.4	45.0	5.3
MNRJ 1990	São Sebastião, SP	38.0	56.0	103.0	13.6	24.0	29.5	52.0	5.9
MNRJ 1991	São Sebastião, SP	33.0	59.3	67.0	7.8	19.0	27.7	45.0	6.5
MNRJ 2298	Guaraparí, ES	112.5	182.7	275.0	39.8	20.0	30.6	47.5	6.1
MNRJ 2599	Itaparica, BA	45.0	72.0	90.0	11.6	11.3	18.0	25.0	4.4
MNRJ 2603	Salvador, BA	82.5	140.4	207.5	35.4	10.0	22.3	40.0	8.3
MNRJ 3004	São Sebastião, SP	35.0	51.1	72.5	7.5	11.3	23.6	40.0	5.7
MNRJ 3044	Canoa Quebrada, CE	45.0	70.9	102.5	16.6	17.5	31.1	62.5	10.1
MNRJ 3045	Canoa Quebrada, CE	72.5	130.9	210.0	36.1	10.0	29.1	50.0	9.4
MNRJ 3047	Canoa Quebrada, CE	57.5	83.4	120.0	17.0	12.5	27.5	62.5	11.8
MNRJ 3056	Itacaré, BA	60.0	81.8	95.0	9.2	16.3	23.8	41.3	5.8
MNRJ 3064	Itacaré, BA	61.3	89.4	125.0	14.3	13.8	21.7	36.3	4.6
MNRJ 3423	Corumbau, BA	36.3	70.2	96.3	16.0	10.0	25.9	51.3	11.2
MNRJ 3531	Corumbau, BA	43.8	95.2	136.3	28.3	17.5	32.7	51.3	9.0

..... *continued (next page)*

TABLE IV (continued)

Specimens	Locality*	Fibers				Piths			
		Thinnest	Mean	Thickest	S.D.	Thinnest	Mean	Thickest	S.D.
MNRJ 3541	Corumbau, BA	100.0	155.4	200.0	24.1	12.5	19.2	25.0	3.6
MNRJ 3547	Corumbau. BA	87.5	104.6	132.5	14.5	12.5	23.8	41.3	6.7
MNRJ 3554	Arraial do Cabo, RJ	37.5	113.3	180.0	36.5	17.5	39.8	67.5	13.8
MNRJ 3561	São Sebastião, SP	28.8	39.8	53.8	6.1	13.8	22.8	37.5	5.0
MNRJ 3957	Búzios, RJ	35.0	92.5	131.3	26.0	11.3	22.5	40.0	6.5
MNRJ 3958	Abrolhos, BA	63.8	76.6	92.5	6.6	21.3	31.9	48.8	6.4
MNRJ 3961	Búzios, RJ	43.8	66.6	92.5	9.9	16.3	26.4	42.5	7.3
MNRJ 3963	Búzios, RJ	46.3	93.8	153.8	24.4	22.5	35.4	53.8	8.6
MNRJ 4084	Arraial do Cabo, RJ	42.5	119.5	170.0	38.5	12.5	27.4	42.5	8.3
MNRJ 4152	Angra dos Reis, RJ	37.5	65.8	91.3	10.8	15.0	31.0	51.3	10.3
MNRJ 4153	Angra dos Reis, RJ	27.5	42.3	57.5	8.3	15.0	22.0	32.5	5.1
MNRJ 4154	Angra dos Reis, RJ	41.3	62.4	85.0	11.0	18.8	27.0	46.3	6.6
MNRJ 4155	Angra dos Reis, RJ	37.5	67.5	91.3	11.3	21.3	36.2	52.5	7.8
MNRJ 4156	Angra dos Reis, RJ	38.8	67.3	90.0	11.7	16.3	30.7	46.3	6.6
MNRJ 4157	Angra dos Reis, RJ	45.0	63.8	90.0	10.4	21.3	41.4	66.3	9.7
MNRJ 4158	Angra dos Reis, RJ	30.0	52.3	66.3	8.2	17.5	29.8	45.0	7.4
MNRJ 4159	Angra dos Reis, RJ	30.0	56.5	75.0	9.9	17.5	25.3	42.5	5.8
MNRJ 4160	Angra dos Reis, RJ	36.3	64.4	87.5	11.1	17.5	30.7	48.8	7.3
MNRJ 4167	Salvador, BA	53.8	89.5	117.5	13.5	11.3	27.9	41.3	7.6
MNRJ 4167	Canoa Quebrada, CE	33.8	83.6	118.8	18.2	16.3	25.9	43.8	7.4
MNRJ 4168	Angra dos Reis, RJ	50.0	75.1	112.5	15.5	15.0	37.5	68.8	11.8
MNRJ 4171	Arraial do Cabo, RJ	40.0	67.3	95.0	14.5	16.3	23.8	38.8	5.6
MNRJ 4177	Salvador, BA	41.3	85.0	120.0	20.9	13.8	27.1	55.0	8.5
MNRJ 4178	Salvador, BA	30.0	54.5	78.8	12.6	15.0	28.1	41.3	6.1
MNRJ 4180	Salvador, BA	50.0	92.4	118.8	18.8	17.5	24.8	41.3	6.1
MNRJ 4181	Salvador, BA	50.0	86.2	128.8	14.6	16.3	27.3	58.8	9.1
MNRJ 4670	Salvador, BA	41.3	64.7	95.0	12.4	13.8	23.5	55.0	10.4
MNRJ 5479	Abrolhos, BA	60.0	94.4	140.0	22.5	10.0	17.2	25.0	4.5
UFRJPOR 2917	Arraial do Cabo, RJ	38.8	52.6	67.5	8.1	12.5	20.3	33.8	5.4
UFRJPOR 2940	Arraial do Cabo, RJ	40.0	55.6	81.3	10.5	17.5	33.5	61.3	10.8
UFRJPOR 2965	Arraial do Cabo, RJ	36.3	51.4	65.0	8.4	12.5	20.0	25.0	4.4
UFRJPOR 3582	Urca do Tubarão, RN	48.8	71.0	95.0	12.1	18.8	25.1	35.0	4.4
UFRJPOR 4285	Salvador, BA	67.5	91.4	122.5	12.0	12.5	30.1	50.0	9.6
UFRJPOR 4804	F. de Noronha, PE	21.3	51.1	81.3	13.5	13.8	19.1	30.0	3.6

*AL, Algoas State; BA, Bahia State; CE, Ceará State; ES, Espirito Santo State; PE, Pernambuco State; RJ, Rio de Janeiro State; RN, Rio Grande do Norte State; SP, São Paulo State.

Distribution: Tropical western Atlantic: Brazil (3–24º S, Fig. 3D): Ceará, Rio Grande do Norte, Pernambuco (Fernando de Noronha Archipelago), Alagoas, Bahia (Salvador, Parque Nacional Marinho dos Abrolhos), Espírito Santo, Rio de Janeiro, São Paulo. World: Colombia, Cuba, Curaçao, Bahamas, Barbados, Bonaire, Florida, U.S. Virgin Islands and Virgin Island.

Ecology: *Aplysina fulva* is found on diverse environments. Habitats can have high or low hydrodynamic conditions, be exposed or protected from light, and range from 1 to 40 m in depht. Specimens living in high-energy environments were seen to be creeping, forming an anastomosing system of ridges topped by a dense series of small oscula. *Aplysina fulva´*s population can be scarce, with only some individuals, or one of the most conspicuous components of all benthic fauna of the locality (e.g. Porcos Island, Arraial do Cabo; Tartaruga Beach, Búzios, RJ). This sponge also presents a substantial aggregated fauna, such as polychaetes, ophiuroids, amphipods and decapods. We observed the seastar *Oreaster reticulatus* feeding upon *Aplysina fulva* at Búzios (RJ). The specimen had turned black at the point of contact with its predator.

Remarks: Our knowledge of *Aplysina fulva*'s morphologic plasticity is based on nearly two decades of *in situ* observation of variably dense populations, mostly from São Paulo, Rio de Janeiro and Bahia States. These were coupled to isolated observations of other Brazilian populations, frequent underwater photography, some videos, and laboratory work on the collections of Museu Nacional. Our conclusion is that a typical Brazilian *A. fulva* will be composed of an erect cluster of solid, irregular, digitiform branches, mostly 10–30 cm high and 1–4 cm thick, and will be of a brownish-yellow live-colour. Nevertheless, variability is the rule for *A. fulva*, and no clear morphologic gaps appear to allow recognition of additional species. Specifically, a doubt persists on how much flat palmate *A. fulva* can be. This is a crucial point to evaluate its status in face of *A. pergamentacea*, and some new, mainly lamelate species described below. The specimens of *A. fulva* studied here which showed some sort of considerable lateral compression of their branches (e.g. Fig. 7B), were referred to *A. fulva* instead of *A. pergamentacea*, because they possessed cylindrical branches in addition, and/or turned to very dark shades of purplish-brown in the fixative, nearly black if formerly exposed to the air. Contrastingly, as shown below, *A. pergamentacea* remains lighter coloured in the fixative.

Further variability is seen in the number of digits, which spread from a single to over 80 in a cluster. Their height may be consistently smaller than 10 cm in an entire population (São Sebastião Channel; cf. Pinheiro & Hajdu, 2001), or reach over 1 m (Parque Nacional Marinho dos Abrolhos), as illustrated by Humann (1992) for the West Indies (det. S. Pomponi).

An investigation of the cellular morphology of *A. fulva* showed that despite the external morphologic variability, the cellular morphotypes from distant localities (ca. 400 km) do not present significant differences (Pinheiro et al, 2004). However, complementary studies, perhaps with the use of molecular techniques, will still be necessary to clear the status of the species along its large distribution range on the Tropical western Atlantic.

Aplysina insularis (Duchassaing & Michelotti, 1864) (Fig. 9A, 10, 11A, Tab. V)

Aplysina insularis (Duchassaing & Michelotti, 1864) *sensu* van Soest (1978: 56); non *A. insularis* sensu Zea (1987); non *A. aff. insularis* sensu Collin *et al.* (2005).

Aplysina fistularis forma *fistularis* sensu Wiedenmayer (1977, in part, specimen B877); non W. Atlantic *A. fistularis* of authors.

Studied material: MNRJ 4175–4176, Salvador´s Yacht Club (Salvador, BA, 12º59'58.2" S - 38º31'54.2" W), 3–5 m depth, E. Hajdu *coll.*, 4/VII/2001. MNRJ 5463, Parcel Paredes, south side (Parque Nacional Marinho dos Abrolhos, BA, 17º56'800" S - 38º54'264" W), 15 m depth, E. Vilanova *coll.*, 01/III/2002.

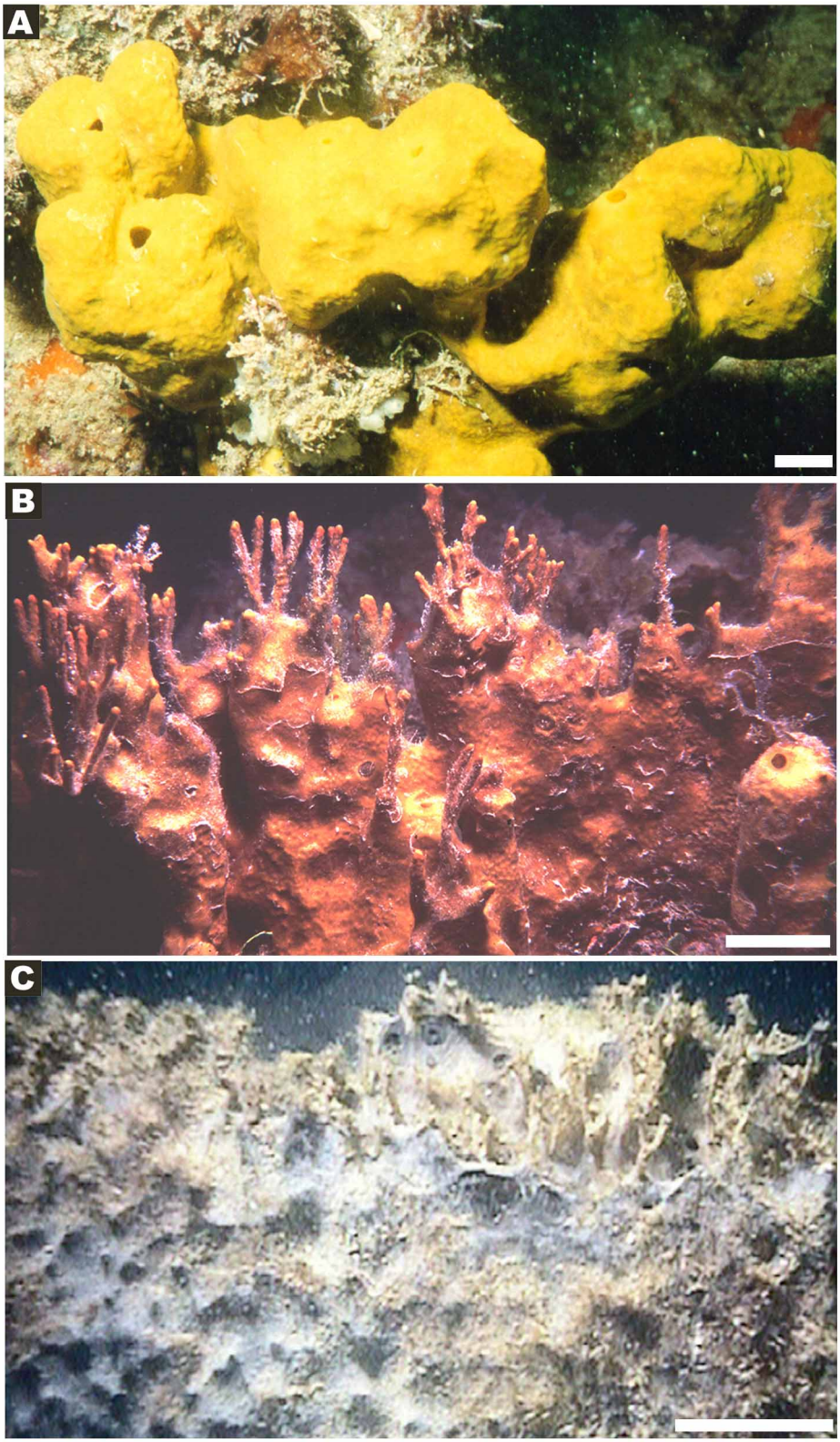

FIGURE 9: A. *Aplysina insularis* (Duchassaing & Michelotti, 1864: 64). B. *Aplysina alcicornis* sp.n. in situ, Holotype – MNRJ 5473 (Parque Nacional Marinho dos Abrolhos, BA, Brazil). C. *Aplysina cristagallus* sp.n. in situ, Holotype— MNRJ 3528 (Prado, BA, Brazil). Scale bar = 1 cm.

Comparative material: ZMAPOR. 1475, St. Thomas (Lectotype of *Luffaria insularis* Duchassaing & Michelotti, 1864 *sensu* Wiendemayer, 1977). BMNH 1928.5.12.75 and 172, Crawshay´s West Indian coll. (as *Aplysina fistularis*). ZMAPOR 3325, Pta. Cadena (NW of Mayaguez, Puerto Rico), 3 m depth, J.H. Stock

coll., 21/II/1963 (Det. R.W.M. van Soest, as *Aplysina fistularis insularis*). ZMAPOR 3349, Puerto Rico (18º15' N, 67º13.5' W), 72–90 m depth, J.H. Stock *coll.* (# PR. 99), 27/I/1963, dredged on muddy-sand (Det. R.W.M. van Soest, as *Aplysina lacunosa*). ZMAPOR 16292, 800 m of landing stage, Fort Bay (Saba), J. Vermeulen *coll.*, 12/III/1986 (Det. R.W.M. van Soest, as *Aplysina insularis*). ZMAPOR 16303, Kralendijk Bay (Bonaire), 2 m depth, P.L.van Pel. *coll.*, 1965 (Det. R.W.M. van Soest, as *Aplysina insularis*).

Diagnosis: This is the only *Aplysina* with markedly short, irregularly outlined (frequently lobate), stout, soft tubes bearing large, apical oscula. Tubes frequently wider at their apices. Colour in life yellow or brown, turning into black in ethanol.

Description of the species:

Groups of low tubes averaging 7 cm height and 2.5 cm in diameter, anastomosed, with irregular outlines (often lobate), frequently wider at their apices, where oscula 1 cm in diameter occur (Fig. 9A). The largest specimen is 11.5 cm long, 7 cm in maximum height and 4 cm in maximum width. Surface quite smooth alive, becoming markedly conulose upon preservation (Fig. 10A–B). Colour *in vivo* golden yellow (MNRJ 4175 and MNRJ 4176) or brown (MNRJ 5463), turning black after preservation in ethanol. Consistency is very soft.

Skeleton: Choanosome with a delicate and irregular network of spongin fibers (Fig. 10C). Bark with amber colour, 35–125 µm wide (average 75 µm). Thick pith, black or amber, 12–37 µm wide (average 23 µm; Fig. 10D).

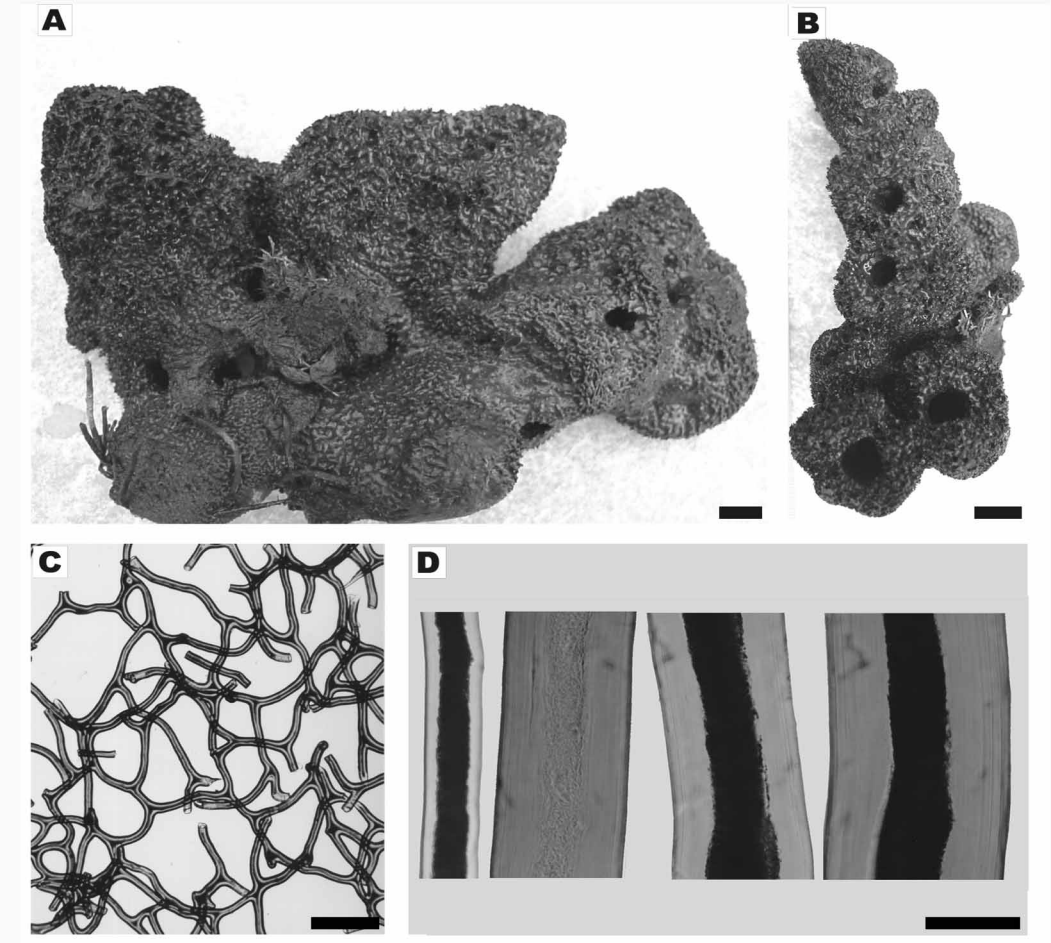

FIGURE 10: A–D. *Aplysina insularis* (Duchassaing & Michelotti, 1864), MNRJ 4175. A–B. habit after preservation. C. Skeletal architecture. D. Spongin fibres. Scale bars = A–B. 1cm, C. 500 µm, D. 50 µm.

TABLE V: Spongin fibres' measurement data for *Aplysina insularis* (in micrometers; S.D. = Standard Deviation and N=30).

Specimens	Locality*	Fibers				Piths			
		Thinnest	Mean	Thickest	S.D.	Thinnest	Mean	Thickest	S.D.
MNRJ 4175	Salvador, BA	28.8	68.6	91.3	14.9	12.5	21.4	37.5	5.7
MNRJ 4176	Salvador, BA	37.5	55.7	92.5	14.5	12.5	23.0	37.5	5.5
MNRJ 5463	Abrolhos, BA	55.0	101.7	125.0	16.1	17.5	25.2	35.0	4.2

*BA, Bahia State.

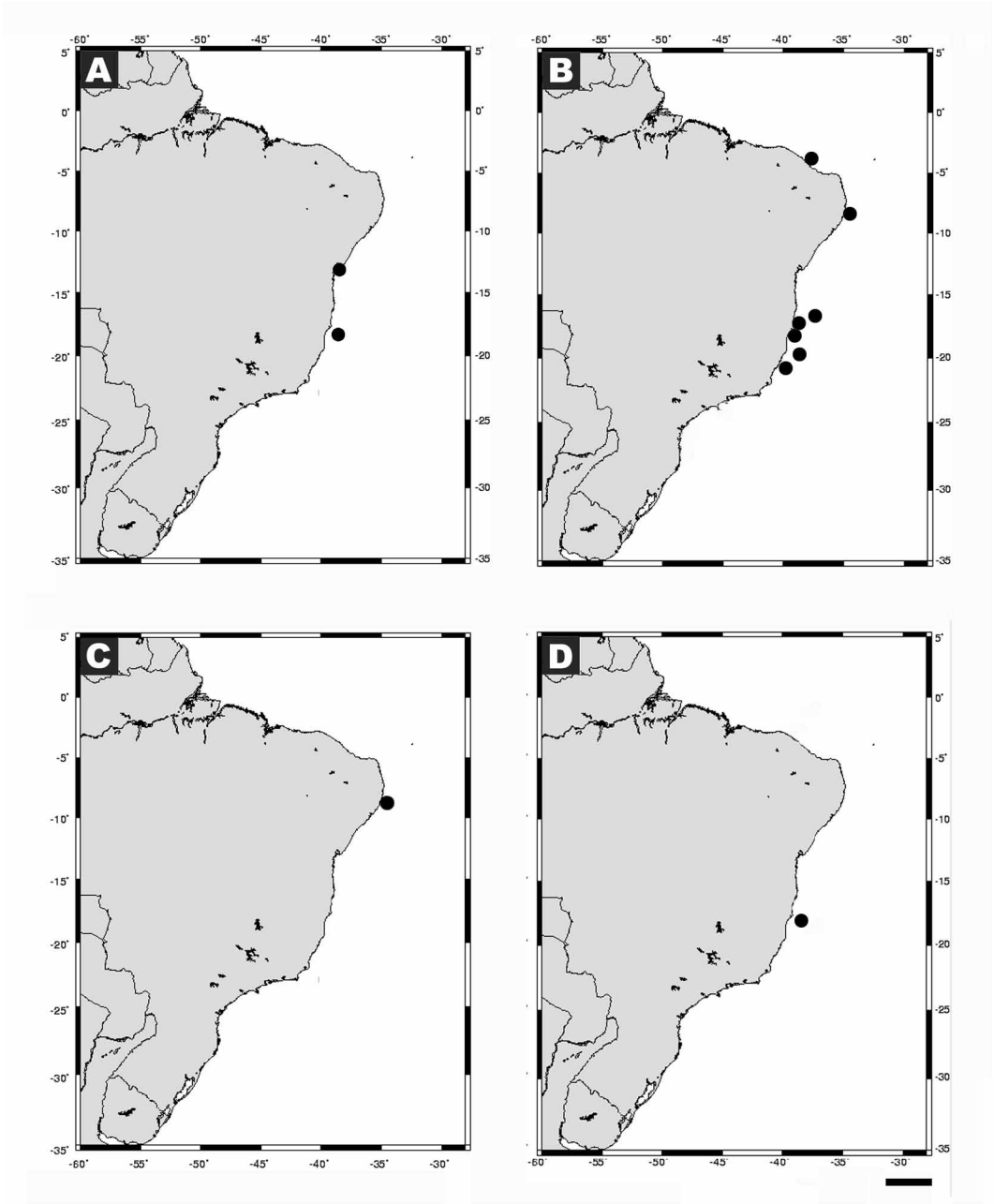

FIGURE 11: Map showing the distribution of *Aplysina* along the Brazilian coastline. A. *Aplysina insularis* (Duchassaing & Michelotti, 1864) B. *Aplysina lacunosa* (Pallas, 1766). C. *Aplysina pergamentacea* Hechtel, 1983. D. *Aplysina alcicornis* sp.n.. Scale bar = 500 km.

Distribution: Brazil (Fig. 11A): Bahia State. World: Bahamas, U.S. Virgin Islands, Puerto Rico, Saba, Bonaire.

Ecology: The specimens were collected in warm, clear waters, in depths between 3 and 12 m. The specimens from Salvador (BA) were all exposed to direct light.

Remarks: Study of *A. insularis´*s lectotype (ZMAPOR 1475) convinced us of it's unrecognizability as a consequence of its dry, macerated condition. Essential diagnostic characters recognized by us after completion of this revision are the species' external morphology, and colour alive as well as after preservation. All these are unrecognizable in ZMAPOR 1475, apart from the likelihood that it consisted from a cluster of short tubes. At least three species described here can bear quite comparable morphologies, viz. *A. fistularis, A. insularis* and *A. muricyana* sp.n. Considering this, it appears to us advisable to request the International Commission of Zoological Nomenclature, following the steps outlined in article 75.5 of the ICZN, to set the above mentioned lectotype aside for a newly established neotype under the Commission´s plenary power. This has not been done here to avoid a further delay in the publication of this article, which has been under preparation since 2003.

The diagnosis of *A. insularis* by modern authors is also problematic, and care must be taken in the selection of the neotype, to make it representative of the majority of the specimens collected this far. van Soest (1978) and Zea (1987), for example, differentiated *A. insularis* from *A. fistularis* simply by the former's short tubes against the latter's long ones. When the plates of van Soest (1978, Plate X, Fig. 4) and Zea (1987, Fig.5. p. 244), plus the BMNH and ZMA specimens analyzed here are compared, it appears that at least two species are included. We consider both BMNH specimens as well as many of the ZMA ones to belong to *A. insularis* as described here (ZMAPOR 3325, 6814, 16292 and 16303), but Zea's (1987) material probably belongs to yet another species, as well as ZMAPOR 3349 (with rhizoidal processes). Zea's (1987) "group of low tubes (2 cm in height), that leave an expanded basal mass, with a ramose stalk that penetrates the sockets of the substratum", as well as the reported "slightly compressible" consistency (as opposed to the very soft consistency of *A. insularis* reported here) appear distinct from every Tropical western Atlantic species of *Aplysina* described to date. This material probably belong to a new species which we refrain from naming here before further study of specimens confirms their status as a new species.

Similarly, the specimen illustrated alive by Collin et al. (2005) appears distinct from every specimen of *A. insularis* dealt with here, as well as from those formerly assigned to *A. insularis*, but suggested above to be best assigned to a new species. Collin et al´s specimen misses the large apical pseudoscule and the irregularly lobate form so common in the specimens which are considered to reflect the currently ammended concept of *A. insularis*. For the sake of nomenclatorial stability, it is advisable to accept the many specimens assigned to *A. insularis* as argued above, and assign Collin et al.´s specimen to another species, possibly new, rather than the opposite.

Aplysina lacunosa (Lamarck, 1814) (Figs. 11B–12, Tab. VI)

Aplysina lacunosa, Hechtel (1983: 59), Muricy et al. (2006: 118); *Verongia* sp.a. *sensu* Hechtel (1976: 239). For further synonymy cf. van Soest (1978: 61).

Lectotype: MNHN unregistered (designated by Topsent, 1932: 70, Pl. I, Fig. 5; cf. Wiedenmayer, 1977: 67)

Studied material: Ceará - MNRJ 3046 (Canoa Quebrada). M. Guimarães coll, 25 m depth, II/2000. Bahia - MNRJ 3387, Bank Rodger, G. Nunan *coll.*, 40–50 m depth, 6/VI/1999. MNRJ 3402, Bank Rodger, G. Nunan *coll.*, 40–50 m depth, 6/VI/1999. MNRJ 3524 (Reserva Extrativista de Corumbau, Prado, 16º56`29`` S - 39º00`24`` W), B. Segal and C.B. Castro *coll.*, 18/XI/1999. MNRJ 3557 (Reserva Extrativista de Corumbau, Prado) G. Muricy *coll.*, 2 m depth, III/99. MNRJ 4436 (Programme REVIZEE Central V, Porto Seguro, 17º06'18" S - 36º44'74" W), 50 m depth, 07/VII/2001. MNRJ 4652 (Programme REVIZEE Central V), 29/VI/

2001. Espírito Santo - MNRJ 4429 (20º30'37.32" S 37º19'05.39" W), 89 m depth, 24/IV/1996. MNRJ 4587 (Programme REVIZEE Central V., 19º48'47" S - 037º56'33" W), 60 m depth, 18/VII/2001.

Diagnosis: Tubular sponge with a large apical pseudoscule, surface with irregular grooves (caliciform, meandriform) of variable depth.

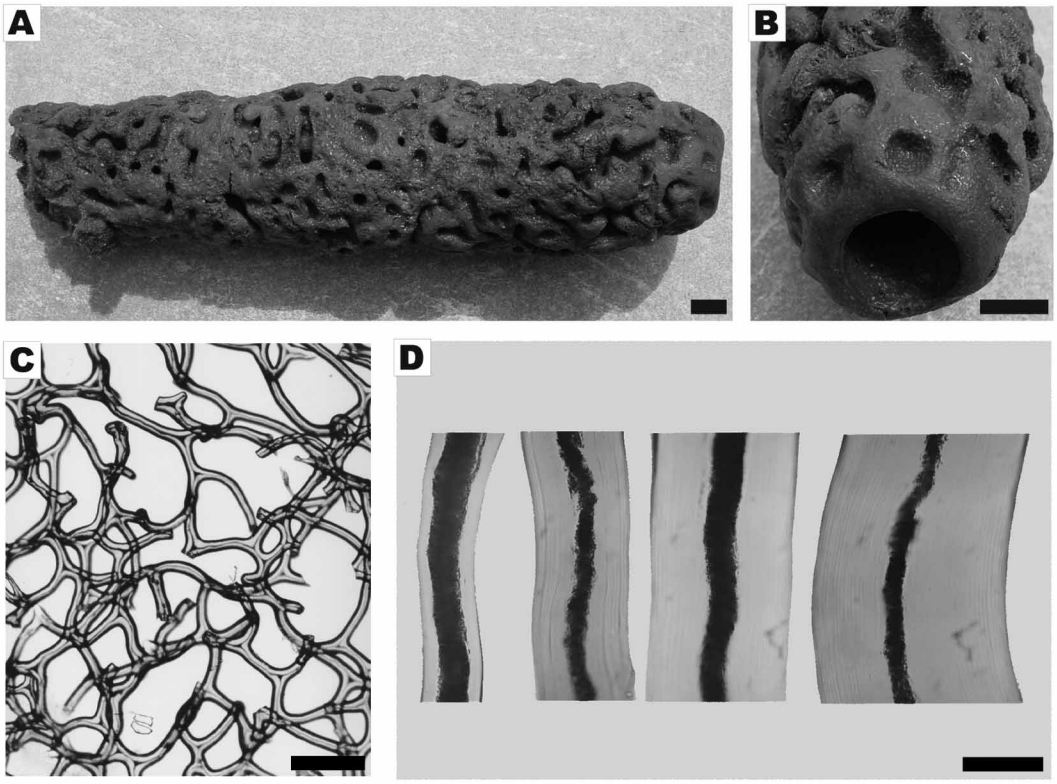

FIGURE 12: A–D. *Aplysina lacunosa* (Pallas, 1766). A–B. MNRJ 3387 (after preservation). C. Skeletal architecture (MNRJ 3046). D. Spongin fibres (MNRJ 3387). Scale bars = A–B. 1 cm, C. 500 µm, D. 50 µm.
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Description

The sponge consists of a single tube or clusters of up to 19 tubes, with a maximum length of 18.5 by 4.5 cm in diameter, and a large apical pseudoscule with 2.5 cm in diameter. The surface is characterized by irregular grooves (caliciform or meandriform) of variable depth. Specimens are finely conulose, small digitiform processes (ca. 0.5 cm in diameter) being observed in some specimens, projecting themselves from the rim of the pseudoscule. The colour is bright yellow *in vivo*, turning beige, purple or dark brown after preservation in alcohol. Consistency varies from hard to soft.

Skeleton: Choanosome with a delicate and irregular network of spongin fibers with amber colour and thickness of 7–196 µm (average 89 µm). They have rather irregular (eccentric) black pith with thickness 7–37 µm (average 16 µm).

Distribution: Tropical western Atlantic, Brazil (3–20ºS): Ceará State, Bahia State, Reserva Extrativista de Corumbau, Espírito Santo State. World: Bahamas, Florida, Jamaica, Puerto Rico, Dominican Republic, Colombia, Bonaire, Curaçao.

Ecology: The specimens were collected in warm and clear waters, 3–89 m deep.

Remarks: Wiedenmayer (1977) commented that the fine pith was the character that differentiated *A. lacunosa* from its congeners. However, corroborating van Soest (1978), in this work we observed fibers in *A.*

fistularis (MNRJ 5471) and *A. fulva* (MNRJ 5479) with fine pith and thick bark, and some specimens of *A. lacunosa* with thick pith and reduced bark (e.g. MNRJ 3387). These facts lead us to believe that the best diagnostic character for the species is the external morphology (surface with irregular, caliciform or meandriform grooves of variable depth), since this is not observed in any other species of the genus. van Soest (1978) and Zea (1987) raised the possibility that material identified as *A. lacunosa* from the Caribbean could comprise two species. Following this, Schmitt et al. (2005) differentiated a hard morphotype with reticulate skeleton of typically thinly pithed spongin fibers, and a soft morphotype with a more dendritic skeleton of heavily pithed fibers, reminiscent of the genus *Suberea* of the verongid family Aplysinellidae. The Brazilian material appears to us to belong to a single species, and having a typical reticulate skeleton, it conforms to the hard form of these authors.

TABLE VI: Spongin fibres' measurement data for *Aplysina lacunosa* (Lamarck, 1814) (in micrometers; S.D. = Standard Deviation and N=30).

Specimens	Locality*	Fibers				Piths			
		Thinnest	Mean	Thickest	S.D.	Thinnest	Mean	Thickest	S.D.
MNRJ 3046	Canoa Quebrada, CE	17.5	95.6	130.0	23.1	10.0	18.2	30.0	5.2
MNRJ 3387	(REVIZEE), BA	46.3	79.9	111.3	15.1	8.8	13.7	22.5	3.0
MNRJ 3402	(REVIZEE), BA	12.5	94.1	147.5	29.8	12.5	22.7	37.5	6.8
MNRJ 3524	Corumbau, BA	66.3	128.9	196.3	29.3	10.0	17.0	25.0	3.8
MNRJ 3557	Corumbau, BA	45.0	73.8	92.5	12.3	12.5	15.6	23.8	2.6
MNRJ 4429	(REVIZEE), BA	45.0	73.6	92.5	12.2	12.5	15.6	23.8	2.6
MNRJ 4436	Porto Seguro, BA	52.5	74.1	102.5	12.0	7.5	13.5	21.3	3.8
MNRJ 4587	(REVIZEE), BA	55.0	81.7	106.3	12.8	11.3	17.8	27.5	3.8
MNRJ 4652	(REVIZEE), BA	63.8	85.1	123.8	14.2	12.5	15.2	18.8	2.1

*BA, Bahia State; CE, Ceará State.

Aplysina pergamentacea Hechtel, 1983 (Figs. 11C–13)

Aplysina pergamentacea Hechtel (1983): 61.

Holotype: YPM 9004, Piedade (near Recife, Pernambuco, Brazil. 8º10' S, 34º54' W) 5 m depth, J. Laborel *coll.* 22/IX/1961.

Paratype: YPM 9005, Piedade (near Recife, Pernambuco, Brazil. 8º10' S, 34º54' W) 5 m depth, J. Laborel *coll.* 22/IX/1961.

Diagnosis: Laterally compressed lamellar form, resembling an axe, with marginal oscula. Specimens stay lighter-coloured (beige) in ethanol.

Description

Laterally compressed lamellar form, resembling an axe with maximum dimensions of 7 cm in length, 5.8 cm in width and 0.8 cm in thickness, with a very narrow base (Fig. 13A). The oscula are located marginally in the sponge (Fig.13B). The surface is slightly/finely conulose. Colour after preservation in alcohol is reddish-brown. Consistency is compressible and elastic.

Skeleton: Choanosome formed by an irregular polygonal reticulation of spongin fibers (Fig. 13C), with amber coloured bark and thickness of 42–95 µm (average 69 µm). The pith can be black or amber, 12–30 µm (average 19 µm, Fig. 13D).

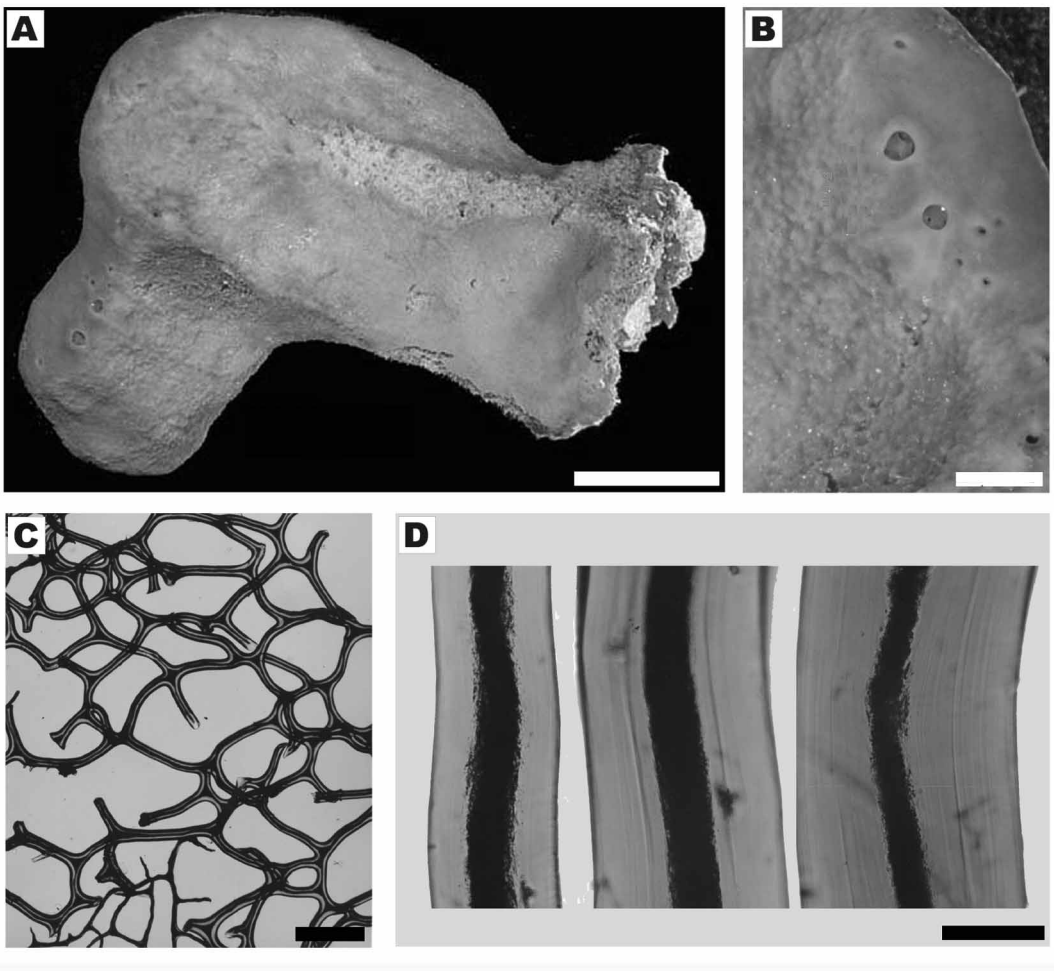

FIGURE 13: A–D. *Aplysina pergamentacea* Hechtel, 1983—Holotype (YPM 9004). A–B. habit after preservation. C. Skeletal architecture. D. Spongin fibres. Scale bars = A. 2 cm, B. 0.5 cm, C. 500 µm, D. 50 µm.

Distribution: Provisionally known only from Piedade, in Pernambuco State (Brazil, Fig. 11C).

Bathymetry: Both specimens were collected at 5 m depth .

Remarks: *Aplysina pergamentacea* remains enigmatic, known from the two originally collected specimens only, in spite of extensive (albeit fragmentary) collecting effort undertaken all over the Brazilian Coast in the last decades. We had the opportunity to examine fragments from both the holotype and paratype, as well as a photo of the first one, and the few remaining diagnostic characters are the absence of any cylindrical branches, the possession of marginal oscula and the lighter shades of brown exhibited in ethanol. Supposing that *A. pergamentacea* is indeed a valid species, and endemic to the type locality, an alternative scenario could be constructed, where it could have been extinct due to the drastic environmental deterioration caused by construction of Suape Harbor (Pernambuco, Brazil) in the 1980's (e.g. Neumann-Leitão et al., 1999).

***Aplysina alcicornis* sp.n. (Fig. 9B, 11D, 14, Tab. VII)**

Holotype: MNRJ 5473, Coral Head at Parque Nacional Marinho dos Abrolhos (BA), 12 m depth, G. Muricy and E. Esteves *coll.*, 02/III/2002.

Paratype: MNRJ 5472, 5474, southeast Patch Reef (Parque Nacional Marinho dos Abrolhos, BA), 12 m depth, G. Muricy and E. Esteves *coll.*, 02/III/2002.

Diagnosis: Lamellar habit with flattened digitiform branches, conspicuous small apical digitiform projections and oscula with iris-type diaphragms situated in depressions on the surface of the sponge. Specimens turn to dark-brown in ethanol.

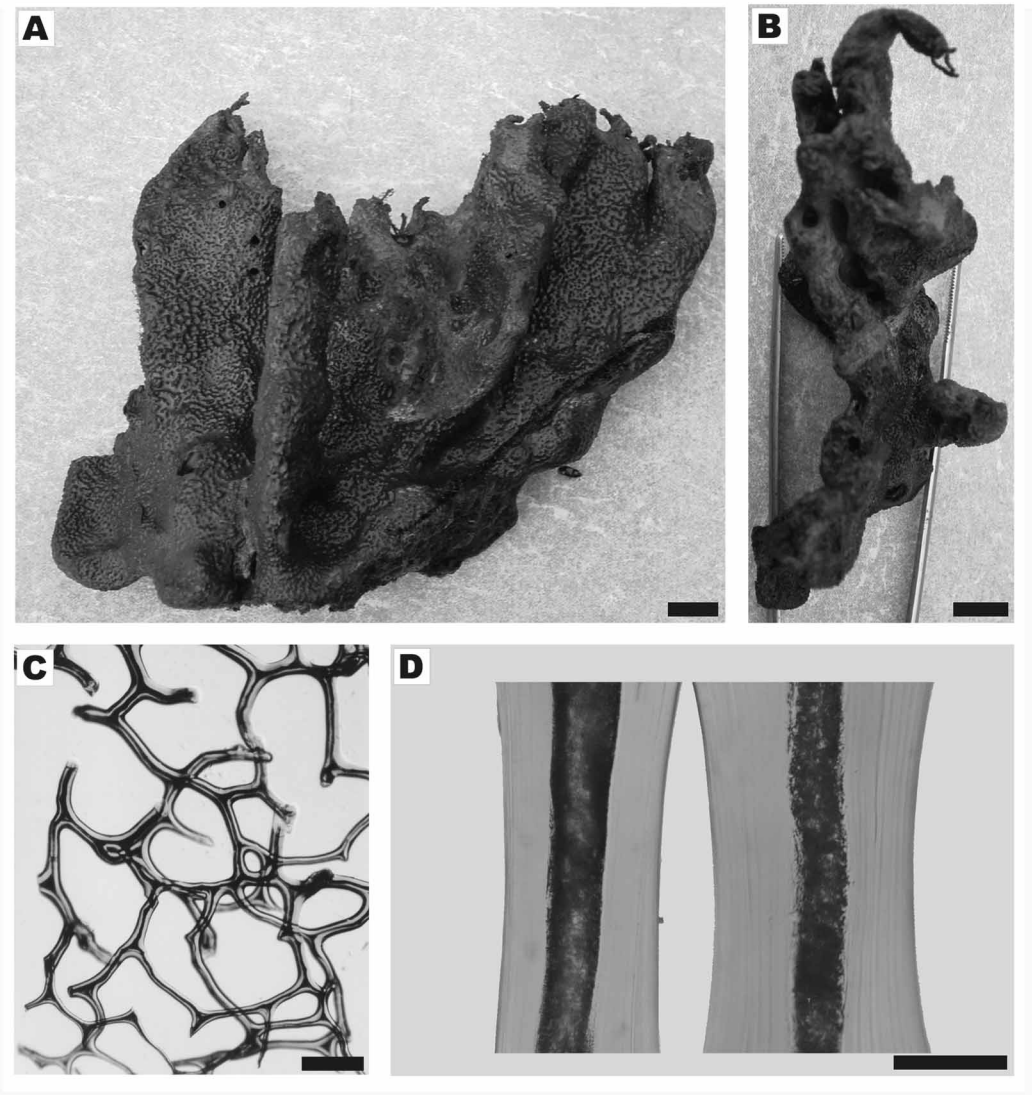

FIGURE 14: A–D. *Aplysina alcicornis* sp.n. Holotype (MNRJ 5473). A–B. habit after preservation. C. Skeletal architecture. D. Spongin fibres. Scale bars = A–B. 1 cm, C. 500 µm, D. 50 µm.

Description of the species:

The specimens are lamellar, with 11 cm in width 10 cm in height and 1 cm in thickness. The general appearance somewhat resembles the fire coral *Millepora alcicornis* Linneus, 1758, larger digitiform projections being observed at the base and the apex of the specimens. In the upper part of these larger projections, several much smaller apical digitiform projections up to 1 cm long, can be observed (Fig. 9B). These fistules are frequently branching dichotomously or trichotomously, and remained on specimens after preservation

(Figs. 14A–B). Oscula 0.3 cm in diameter, bearing iris-type diaphragms are situated in depressions which occur close to the apical portion of the lamellas. Other oscula, with 0.1 cm, open on the sides of the sponge. The surface is finely conulose. The colour is brown or yellow *in vivo*, turning to dark-brown after preservation in alcohol. Consistency is compressible.

Skeleton: Choanosome with a delicate and irregular network of spongin fibers with amber coloured bark and thickness of 40–142 µm (average 92 µm) and a thick black or amber pith with thickness of 15–82 µm (average 24 µm; Figs. 14C–D; Table VII). In the small apical digitiform projections, the fibers present a dendritic arrangement. In these structures the fibers are composed mostly by the pith, with only a thin layer of bark.

TABLE VII: Spongin fibres' measurement data for *Aplysina alcicornis* sp.n. (in micrometers; S.D. = Standard Deviation and N=30).

Specimens	Locality*	Fibers				Piths			
		Thinnest	Mean	Thickest	S.D.	Thinnest	Mean	Thickest	S.D.
Holotype MNRJ 5473	Abrolhos, BA	50.0	96.1	142.5	20.1	15.0	32.1	82.5	14.1
Paratype MNRJ 5472	Abrolhos, BA	57.5	97.3	140.0	19.5	15.0	25.5	67.5	12.5
Paratype MNRJ 5474	Abrolhos, BA	40.0	82.6	107.5	17.2	15.0	25.8	35.0	5.3

*BA, Bahia State.

Distribution: Provisionally known only from Parque Nacional Marinho dos Abrolhos, (Bahia State, Brazil; Fig. 11D).

Ecology: All the specimens were collected at 12 m depth, attached on the sides of coral heads.

Etymology: The name of this species stresses its resemblance to the fire coral *Millepora alcicornis*.

Remarks: The species which most closely resembles *A. alcicornis* sp.n. is *A. cristagallus* sp.n. which is described below. *Aplysina insularis* sensu Zea (1987; Pl. 6, fig. 5) bear some resemblance to *A. alcicornis* sp.n. (non *A. insularis* of authors). Nevertheless, Zea´s specimen is not considered conspecific on the basis of its markedly anastomosed cluster of otherwise cylindrical branches topped by oscula, which contrasts to the overall flattened habit of the new species.

Aplysina cristagallus sp.n. (Fig. 9C, 15, 16A)

Holotype: MNRJ 3528, Pedra do Silva (Reserva Extrativista de Corumbau, Prado, BA), 8 m depth, G. Muricy *coll.*, 14/XI/1999.

Diagnosis: Thinly lamellar habit, similar to a rooster's crest, covered by rows of small apical digitiform projections bearing a darker colour on their apices. Bluish gray colour *in vivo*, turning into a light shade of brown in ethanol.

Description:

The sponge is lamellar, somewhat resembling a rooster's crest. It is 0.3 cm thick, 7 cm long and 7 cm high. The apical portion of the crest has many small apical digitiform projections 0.6 cm high (more than 50) distributed in rows. The small apical digitiform projections remain in the preserved specimen and show their

apical portion darker than the base, which has the same colour of the rest of the sponge (Figs. 15A–B). In the upper part of the crest the sponge attains 1 cm in thickness. Small oscula appear on the apex and sides, where small projections are observed also bearing fistules on their top. The surface is very coarsely finely conulose. The colour is bluish gray *in vivo* (Fig. 9C), which turns into a light shade of brown after preservation in ethanol. Consistency is very soft and flexible.

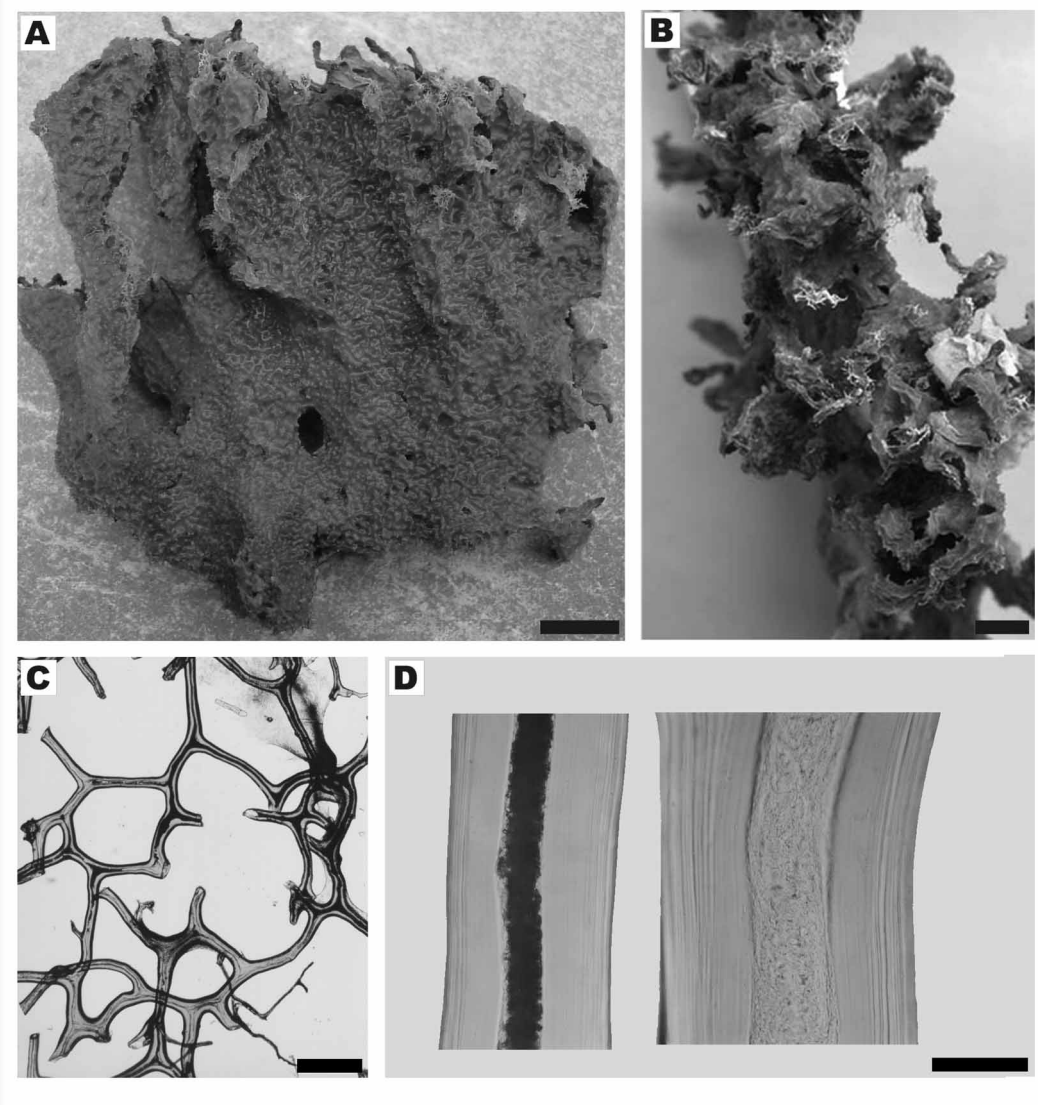

FIGURE 15: A–D. *Aplysina cristagallus* sp.n. Holotype (MNRJ 3528). A–B. habit after preservation. C. Skeletal architecture. D. Spongin fibres. Scale bars = A–B. 1 cm, C. 500 µm, D. 50 µm.

Skeleton: Choanosome with a delicate and irregular network of spongin fibers (Fig. 15C). Bark with amber colour and 46–232 µm thickness (average 117 µm). Thick, black or amber pith, 13–50 µm thick (average 32 µm; Fig. 15D).

Distribution: Provisionally known only from the type locality off the State of Bahia (Brazil; Fig. 16A).

Bathymetry: The specimen was collected at 8 m of depth.

Etymology: The name of the species is a noun in apposition and recognizes its similarity with the rooster´s crest (crest = *crista*, and rooster = *gallus* in latin).

Remarks: The species which appears closest to *A. cristagallus* sp.n. is *A. alcicornis* sp.n.. Both possess a lamelar habit, less than 1 cm thick, with small apical digitiform processes. However, *A. alcicornis* sp.n. is

stouter and has a harder consistency, is yellowish-brown *in vivo* becoming dark brown when preserved, and its small digitiform processes are larger, frequently ramified and located solely on top of projections. Moreover, the oscula on *A. alcicornis* sp.n. are situated inside depressions and are surrounded by iris-type membranes. In contrast, *A. cristagallus* sp.n. is rather slender and possesses a very soft consistency, is bluish gray *in vivo* turning into a light shade of brown after preservation, and presents more numerous fistules which are organized in crests and bear darker apical portions. Both species are thus considered well distinguished from one another.

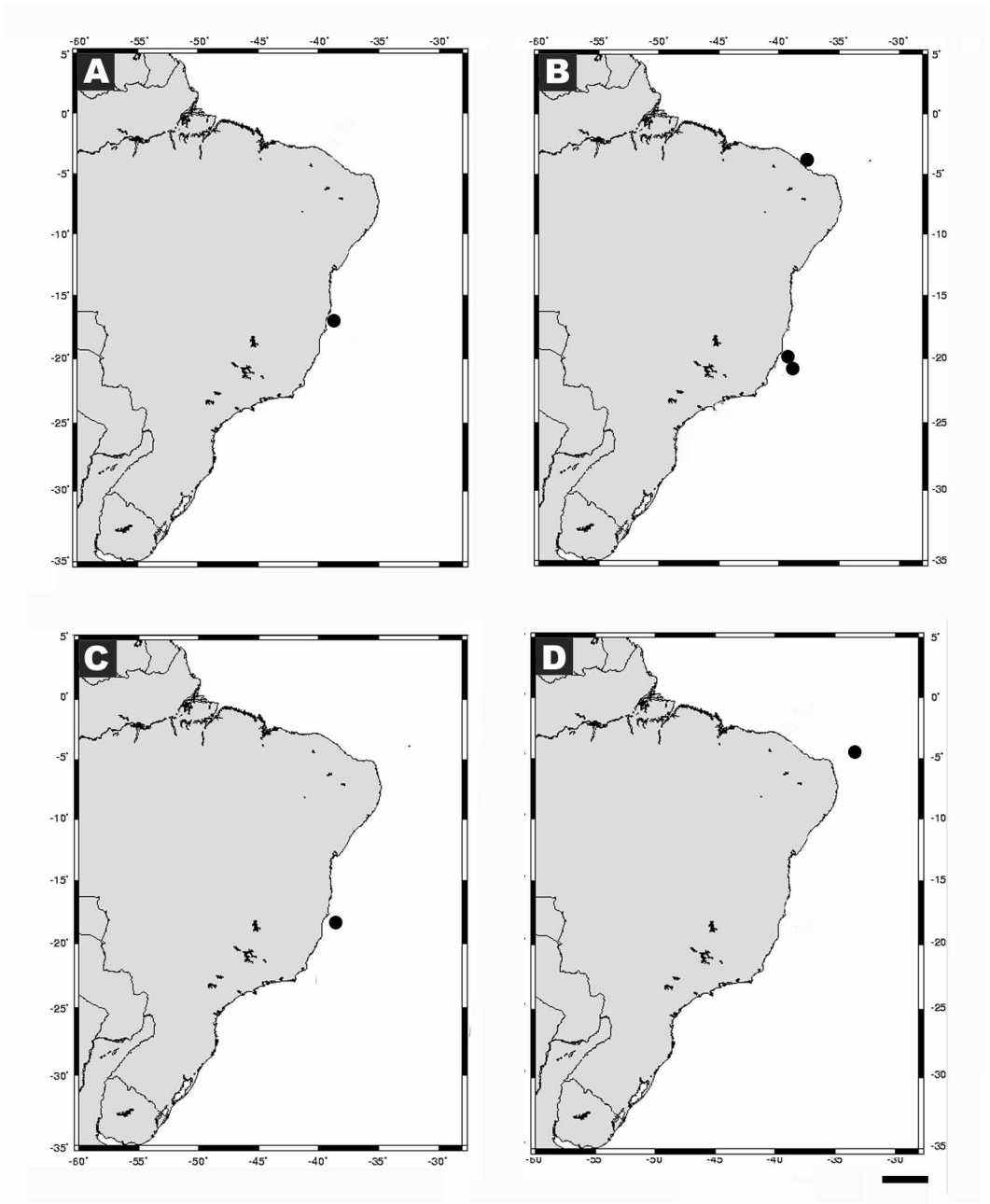

FIGURE 16: Map showing the distribution of *Aplysina* along the Brazilian coastline. A. *Aplysina cristagallus* sp.n.. B. *Aplysina lactuca* sp.n.. C. *Aplysina lingua* sp.n.. D. *Aplysina muricyana* sp.n.. Scale bar = 500 km.

***Aplysina lactuca* sp.n. (Figs. 16B, 17A, 18, Tab. VIII)**

Holotype: MNRJ 5477, Siriba Island, (Parque Nacional Marinho dos Abrolhos, BA), 10 m depth, U.S.Pinheiro and E. Esteves *coll.*, 02/III/2002.

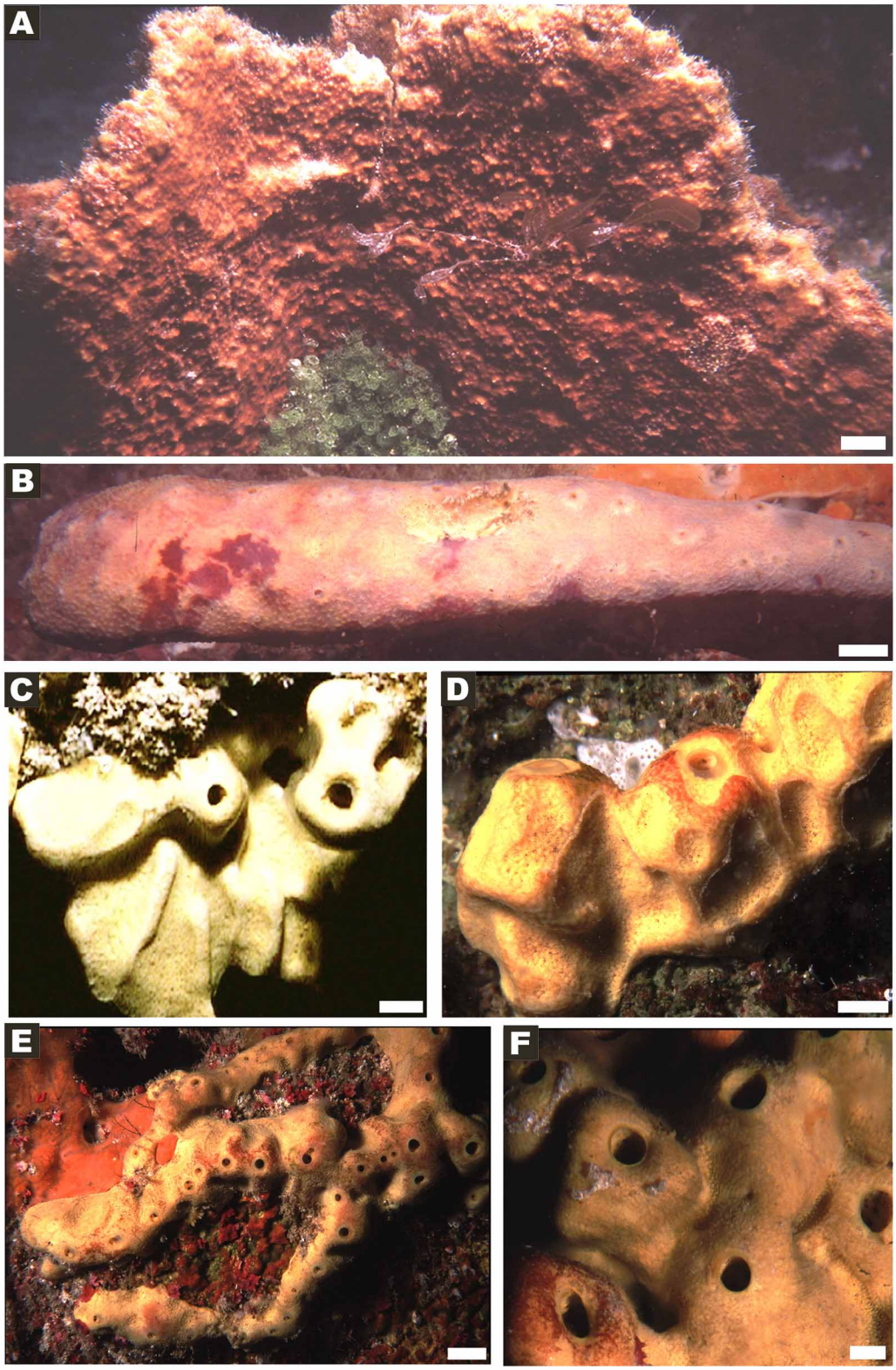

FIGURE 17: A. *Aplysina lactuca* sp.n. in situ, Holotype – MNRJ 5477 (Parque Nacional Marinho dos Abrolhos, BA, Brazil). B. *Aplysina lingua* in situ, Paratype—MNRJ 5469 (Parque Nacional Marinho dos Abrolhos, BA, Brazil). C–F. *Aplysina muricyana* in situ, Reserva Biológica do Atol das Rocas, (RN, Brazil). Scale bar = 1 cm.

Paratypes: MNRJ 5276, 5278, Pedra do Silva, south side, (Reserva Extrativista de Corumbau, Prado, BA, 16º53'42.1" S - 39º05'31.2" W), 5 m depth, U.S. Pinheiro *coll.*, 23/I/2002.

Additional material: MNRJ 8672, Parque Estadual da Pedra da Risca do Meio (03°35'889 S - 38°23'481 W, Fortaleza, CE, Brazil), 22 m depth, E. Hajdu *coll.*, 14/VII/2004.

Diagnosis: It presents a centrally anastomosed lamellar form, which reminds the root buttresses of large tropical canopy trees. The species is yellowish-brown *in vivo*, turning purple after preservation in ethanol.

Description of the species:

The specimens besrs centrally anastomosed lamellas, giving the sponge a form which reminds the root buttresses of large tropical canopy trees (Figs. 17A, 18A–B). Some lamellas possess ridges and holes longitudinaly extending themselves from the base to the top, in only one of the sides. Small oscula (0.1 cm wide) are spread on all sides. The surface is finely conulose, with small depressions. The colour is yellowish-brown *in vivo*, turning purple after preservation in ethanol. Consistency is very soft and flexible.

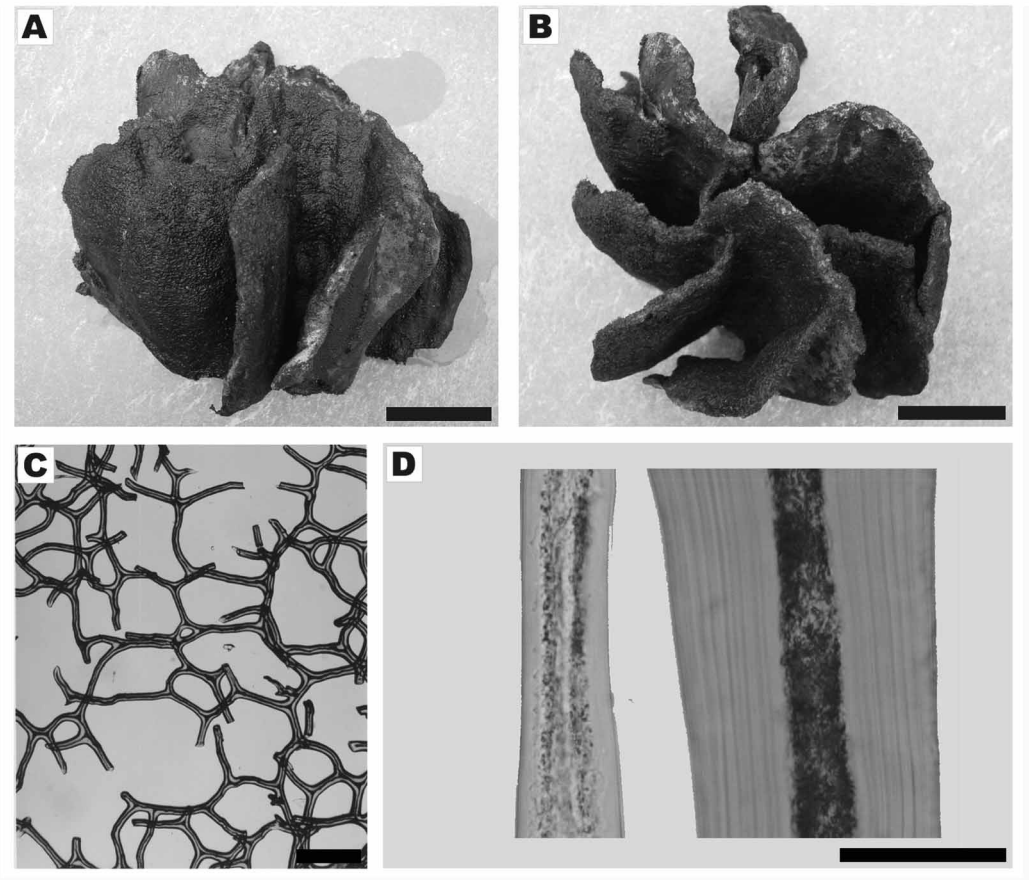

FIGURE 18: A–D. *Aplysina lactuca* sp.n. Holotype (MNRJ 5477). A–B. habit after preservation. C. Skeletal architecture. D. Spongin fibres. Scale bars = A–B. 5 cm, C. 500 µm, D. 50 µm.

Skeleton: Choanosome with a delicate and irregular network of spongin fibers (Fig. 18C). Bark with amber colour and thickness of 37–155 µm (average 74 µm). Thick pith can be black or amber with thickness of 7 –35 µm (average 19 µm; Fig. 18D).

Distribution: Provisionally endemic from the northeastern Brazilian coast (Fig. 16B). The type locality is the Abrolhos region, located in the southern limit of the northeastern Brazilian sector.

Ecology: The four collected specimens were photophilous, and always found on the upper part of rocks or coral heads. They were collected in depths that varied from 5 to 22 m.

Etymology: The name of this species is related to its resemblance to a lettuce (*lactuca* in Latin).

Remarks: Other species which bear some resemblance to *A. lactuca* sp.n. are *A. alcicornis* sp.n., *A. cristagallus* sp.n. and *A. solangeae* sp.n. However, although they all possess a lamellar form, none of them have centrally anastomosed lamellas as seen in *A. lactuca* sp.n.

TABLE VIII: Spongin fibres' measurement data for *Aplysina lactuca* sp.n. (in micrometers; S.D. = Standard Deviation and N=30).

Specimens	Locality*	Fibers				Piths			
		Thinnest	Mean	Thickest	S.D.	Thinnest	Mean	Thickest	S.D.
Holotype MNRJ 5477	Abrolhos, BA	62.5	90.3	155.0	18.6	7.5	18.2	35.0	5.7
Paratype MNRJ 5276	Corumbau, BA	37.5	63.2	75.0	9.8	15.0	25.3	35.0	4.8
Paratype MNRJ 5278	Corumbau, BA	55.0	69.3	90.0	8.4	15.0	24.7	35.0	6.6

* BA, Bahia State.

Aplysina lingua sp.n. (Figs. 16C, 17B, 19, Tab. IX)

Holotype: MNRJ 5476, west coral head (Parque Nacional Marinho dos Abrolhos, BA, 17º57'703" S - 36º14'795" W), 18 m depth, E. Esteves and G. Muricy *coll.*, 03/III/2002.

Paratype: MNRJ 5469, Parcel Paredes, south side, (Parque Nacional Marinho dos Abrolhos, BA, 17º53'499" S - 38º58'034" W), 10 m depth, U.S. Pinheiro and G. Muricy *coll.*, 05/III/2002.

Diagnosis: Elongate lamellar form, similar to a tongue, Light yellow colour *in vivo*.

Description of the species

The specimen has an erect, tongue form (long, flattened, lamelar) with 18 cm length by 4 cm width and 2 cm thickness expanding toward the apex (Fig. 17B, 19A). The small oscula (1 mm) are spread over the entire surface, which is very finely conulose. The colour is a mixture of light yellowish-brown, light pinkish-brown and light-yellow *in vivo*, which turns into dark brownish-purple after preservation in ethanol. Consistency is flexible.

Skeleton: Choanosome with a delicate and irregular network of spongin fibers (Fig. 19B). Bark with amber or reddish colour, thickness of 37–192 µm (average 117 µm) and thick pith that can be black or amber with thickness varying between 10 and 35 µm (average 31 µm; Fig. 19C).

Distribution: Provisionally known only from the type locality off the State of Bahia (Brazil; Fig. 16C).

Ecology: The specimens were collected in a maximum of 18 m depth in shaded areas of coral heads.

Etymology: The name of the species is a noum in apposition and relates to its morphology tongue-like (tongue = *lingua* in Latin).

Remarks: *A. lingua* sp.n. approaches more closely the morphospace of *A. fulva*, known for its plasticity and undelimited diagnosis. Nevertheless, the hundreds to thousands of specimens of *A. fulva* observed at many localities along the Brazilian Coast only very seldom possessed a comparable mixture of colours when alive, and none of them were observed to comprise a single branch with a flattened, elongate, lamelar form.

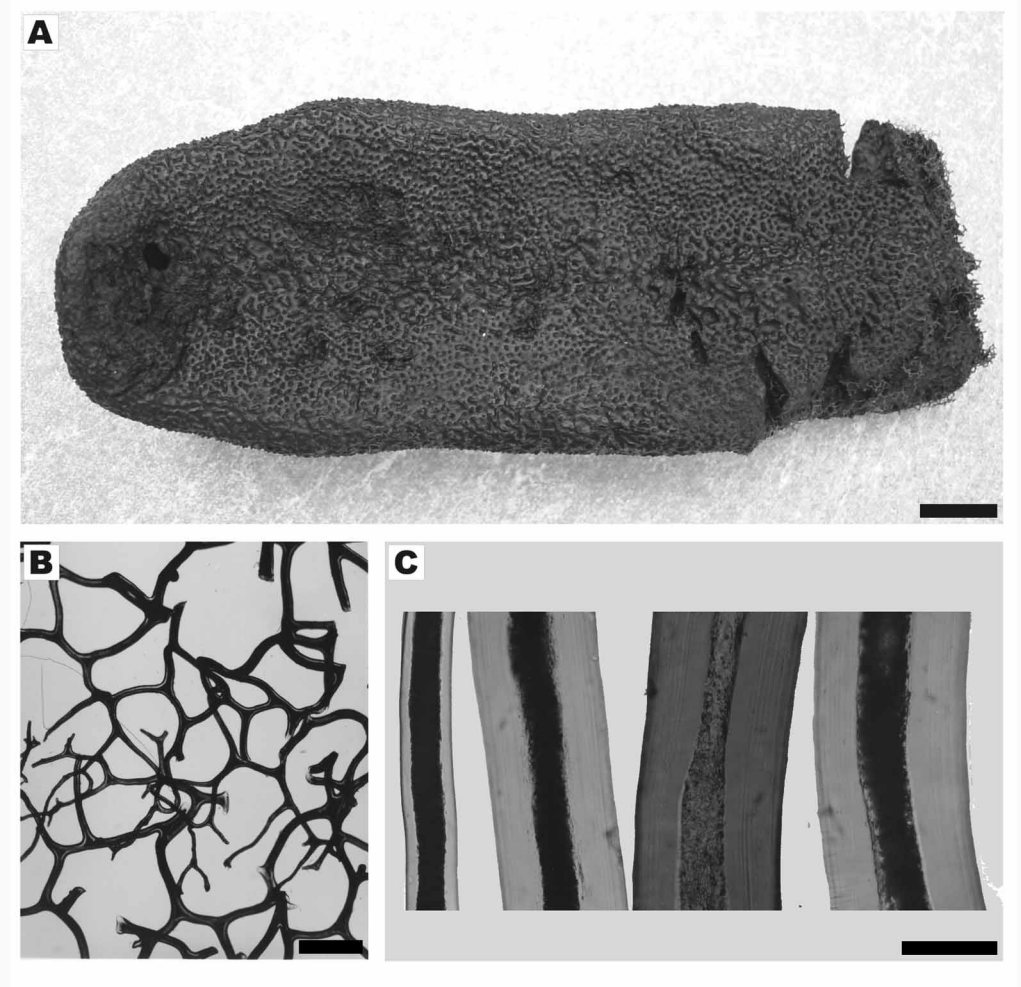

FIGURE 19: A–C. *Aplysina lingua* sp.n.—Holotype. (MNRJ 5476) A. habit after preservation. B. Skeletal architecture. C. Spongin fibres. Scale bars = A. 2 cm, B. 500 µm, C. 50 µm.

TABLE IX: Spongin fibres' measurement data for *Aplysina lingua* sp.n. (in micrometers; S.D. = Standard Deviation and N=30).

Specimens	Locality*	Fibers				Piths			
		Thinnest	Mean	Thickest	S.D.	Thinnest	Mean	Thickest	S.D.
Holotype MNRJ 5476	Abrolhos, BA	60.0	147.7	192.5	35.6	10.0	20.5	35.0	6.1
Paratype MNRJ 5469	Abrolhos, BA	37.5	88.3	175.0	25.1	10.0	16.4	27.5	4.8

*BA, Bahia State.

Aplysina muricyana sp.n. (Fig. 16D, 17C–F, 20, Tab. X)

Aplysina sp. *sensu* Neves & Omena (2003)

Holotype: MNRJ 6196, Laguna (Reserva Biológica do Atol das Rocas, RN) E. Hajdu, M.V. Oliveira and U. Pinheiro *coll.*, 25/VIII/2002.

Paratypes: Reserva Biológica do Atol das Rocas (RN) - MNRJ 2139, Salão (ca. 03º52'52" S – 33º48'51" W), 4 m depth, G. Muricy *coll.*, 28/II/1999. MNRJ 2168, Piscina do Barretão , 3 m depth, F. Moraes *coll.*, 01/III/1999. MNRJ 2173, Fenda (03º51'18.6" S – 33º47'52.1" W), G. Muricy *coll.*, 02/III/1999. MNRJ 6195, Laguna, E. Hajdu, M.V. Oliveira and U. Pinheiro *coll.*, 21/VIII/2002. MNRJ 6197, E. Hajdu, M.V. Oliveira and U. Pinheiro *coll.*, 24/VIII/2002. MNRJ 6198, Laguna, E. Hajdu, M.V. Oliveira and U. Pinheiro *coll.*, 21/VIII/2002. MNRJ 6199, Salão, E. Hajdu, M.V. Oliveira and U. Pinheiro *coll.*, 30/VIII/2002. MNRJ 6200–6202, Fenda (03º51'20.1" S – 33º47'50.2" W), E. Hajdu, M.V. Oliveira and U. Pinheiro *coll.*, 25/VIII/2002, voucher. MNRJ 6203–6204, Piscina das Rocas, E. Hajdu, M.V. Oliveira and U. Pinheiro *coll.*, 24/VIII/2002. MNRJ 6205, Laguna, E. Hajdu, M.V. Oliveira and U. Pinheiro *coll.*, 25/VIII/2002. MNRJ 6301, Piscina das Rocas, E. Hajdu, M.V. Oliveira and U. Pinheiro *coll.*, 24/VIII/2002. MNRJ 6364, Fenda (03º51'20.1" S – 33º47'50.2" W), E. Hajdu, M.V. Oliveira and U. Pinheiro *coll.*, 27/VIII/2002. MNRJ 6663, Piscina das Âncoras (03º52'31.5" S – 33º48'20.8" W), E. Hajdu, M.V. Oliveira and U. Pinheiro *coll.*, 31/VIII/2002.

Additional material: Reserva Biológica do Atol das Rocas (RN) - MNRJ 4493, 4494, Salão (ca. 03º52'52" S – 33º48'51" W), G. Neves *coll.*, XI/1999. MNRJ 4502, Fenda, G. Neves *coll.*, XI/1999.

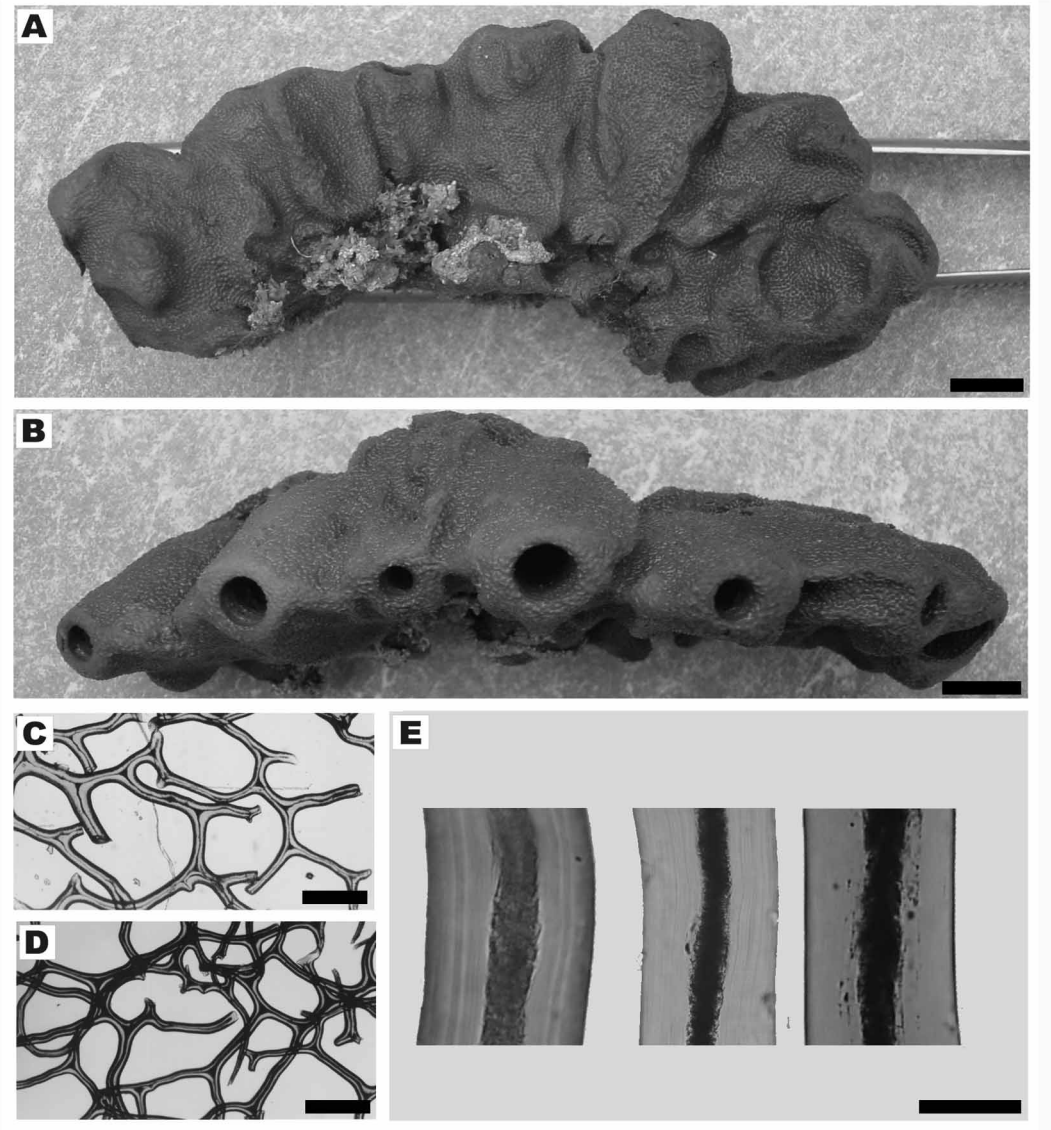

FIGURE 20: A–E. *Aplysina muricyana* sp.n. Holotype (MNRJ 6196). A–B. habit after preservation. C–D. Skeletal architecture. E. Spongin fibres. Scale bars = A–B. 1 cm, C–D. 500 µm, E. 50 µm.

Diagnosis: Irregular polygonal tubes, laterally anastomosed, predominantly beige *in vivo*. Colour ranging from bright pale-yellow to dark reddish-brown.

Description of the species:

Specimens are composed of laterally anastomosed tubes with an irregular polygonal outline, in creeping groups of up to 45 tubes, with clusters having a maximum of 36 cm in length and 3 cm in width. The polygonal outline results from discrete edges extending upwards from the base of the sponge on its free sides (Figs. 17C–F, 20A–B). Some short tubes are projected from the base in varied directions. The surface is finely conulose. The sponge possesses large pseudoscula, frequently apical or pseudo-apical (eccentric), varying from 0.5 cm to 1 cm in diameter, small oscula on the tubes' outer sides being also visible. In specimen MNRJ 2139, oscula have an iris-type diaphragm. The predominant colour *in vivo* is beige, specimens with green, brown, brownish-beige and red tinges being also common. After preservation in ethanol specimens vary from beige to brown. Consistency is soft.

Skeleton: Choanosome with a delicate and irregular network of spongin fibers (Figs. 20C–D) with amber colour bark 38–126 µm thick (average 72 µm) and a thick pith that can be black or amber 8 to 50 µm (average 29 µm; Fig. 20E). The presence of spongin fibers wrapped and excavated by filamentous structures, possibly fungi, was observed in some specimens as in *Aplysina pseudolacunosa* sp.n.

TABLE X: Spongin fibres' measurement data for *Aplysina muricyana* sp.n. (in micrometers; S.D. = Standard Deviation and N=30).

Specimens	Locality*	Fibers				Piths			
		Thinnest	Mean	Thickest	S.D.	Thin-nest	Mean	Thickest	S.D.
Holotype MNRJ 6196	Atol das Rocas, RN	51.3	75.2	117.3	12.3	11.3	17.4	27.6	3.4
Paratype MNRJ 2139	Atol das Rocas, RN	50.0	84.2	126.3	18.6	12.5	16.4	22.5	3.0
Paratype MNRJ 2168	Atol das Rocas, RN	52.5	73.8	91.3	9.0	12.5	19.3	28.8	3.8
Paratype MNRJ 2173	Atol das Rocas, RN	41.3	74.5	105.0	16.7	10.0	14.9	28.8	4.1
MNRJ 4493	Atol das Rocas, RN	42.5	65.3	83.8	9.8	12.5	18.2	25.0	4.2
MNRJ 4494	Atol das Rocas, RN	48.8	74.2	106.3	12.9	12.5	18.3	27.5	4.0
MNRJ 4502	Atol das Rocas, RN	40.0	63.3	93.8	14.2	8.8	15.1	27.5	4.4

* RN, Rio Grande do Norte State.

Distribution: Provisionally known only from the type locality, Atol das Rocas (RN, Brazil; Fig. 16D).

Ecology: All specimens were collected in shallow-waters at Atol das Rocas, inside large crevices, and the species is thus considered to be sciaphilous. Inside the atoll, depth of occurrence was limited to 5 m, but outside the atoll ring, specimens were seen down to 15 m. Specimens in darker areas were completely beige, and those more exposed to light, more intensely pigmented with darker colours, as a likely consequence of association with cyanobacteria.

Etymology: The name of the species honours Dr. Guilherme Muricy, for his pioneering studies on the taxonomy of Atol das Rocas sponges, who also collected many of the specimens studied here.

Remarks: The species which appear closest to *A. muricyana* sp.n are *A. insularis* and *A. pseudolacunosa* sp.n. described below. Another similar species is *A. fistularis*, which presents tubes of distinct morphology, never forming the large, frequently creeping clusters so frequently observed in the new species. Tubes in *A. fistularis*, albeit varied as regards length, as well as number and size of projections, were never seen to have a polygonal cross section. The possibility that *A. muricyana* sp.n. could be nothing but an ecomorph of a well established species appears quite unlikely, as dives performed on the outer ring of Atol das Rocas, down to 15m depth, failed to reveal any additional *Aplysina* species. Rather, the same *A. muricyana* sp.n. was present inside somewhat deeper crevices (10–15 m depth). Another species which also presents anastomosed tubes is *A. insularis*. However, *A. insularis* has soft and stout tubes, with yellow or brown colour *in vivo* turning black after preservation. In contrast, *A. muricyana* sp.n. has hard, much less stouter polygonal tubes, with variable colour *in vivo* and brown or beige colour after preservation. Comparison with *A. pseudolacunosa* sp.n. will be provided below.

Aplysina orthoreticulata sp.n. (Figs. 21, 22A)

Holotype: MNRJ 4651 (BA, 16º07'30" S - 38º10'52" W), 40 m depth, Programme REVIZEE Central V *coll.*, 30/VI/2001.

Diagnosis: This is the only digitiform *Aplysina* with a surface covered by shallow depressions and having a skeleton made of an orthogonal reticulation of stout spongin fibres. The colour is beige with purple spots *in vivo*, turning into purple when preserved in ethanol.

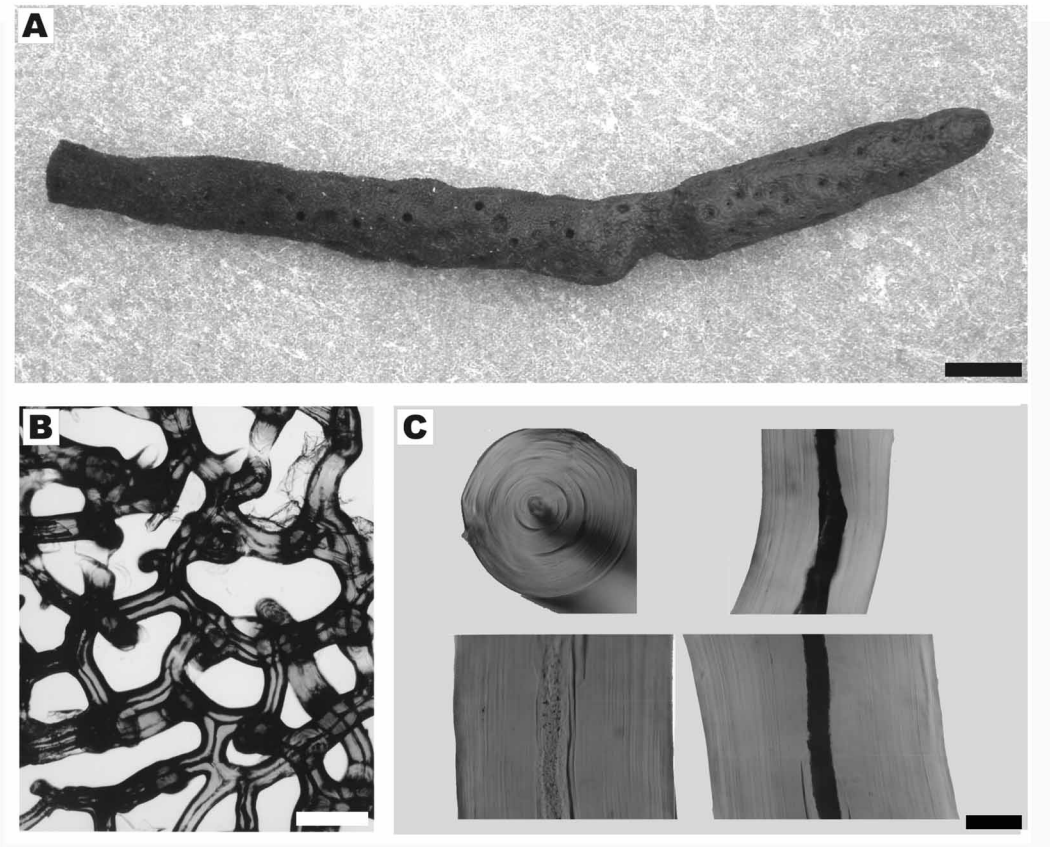

FIGURE 21: A–C. *Aplysina orthoreticulata* sp.n.—Holotype. (MNRJ 4651) A. habit after preservation. B. Skeletal architecture. C. Spongin fibres. Scale bars = A. 1 cm, B. 500 µm, C. 50 µm.

Description

The specimen is a digitiform projection, 16 cm long and 1 cm in diameter (Fig. 21A), covered by shallow irregular depressions. It possesses many small oscula (0.1 cm across) restricted to the sides of the sponge. The diameter of the projections is mostly regular, with the exception of a constriction in the upper portion that reduces the sponge diameter to 0.5 cm. Fibers are observed projecting themselves perpendicularly from the surface of the sponge. The colour is beige with purple spots *in vivo*, turning completely purple when preserved in ethanol. Consistency very hard, incompressible.

Skeleton: Choanosome with an orthogonal reticulation of spongin fibers, resulting in small meshes (average 550 µm) in which the fibers are organized perpendicularly to each other (Fig. 21B). The fibers possess a laminated bark with reddish colour and thickness of 100–307 µm (average 184 µm) and fine black or reddish pith, with thickness between 10 and 40 µm (average 22 µm; Fig. 21C).

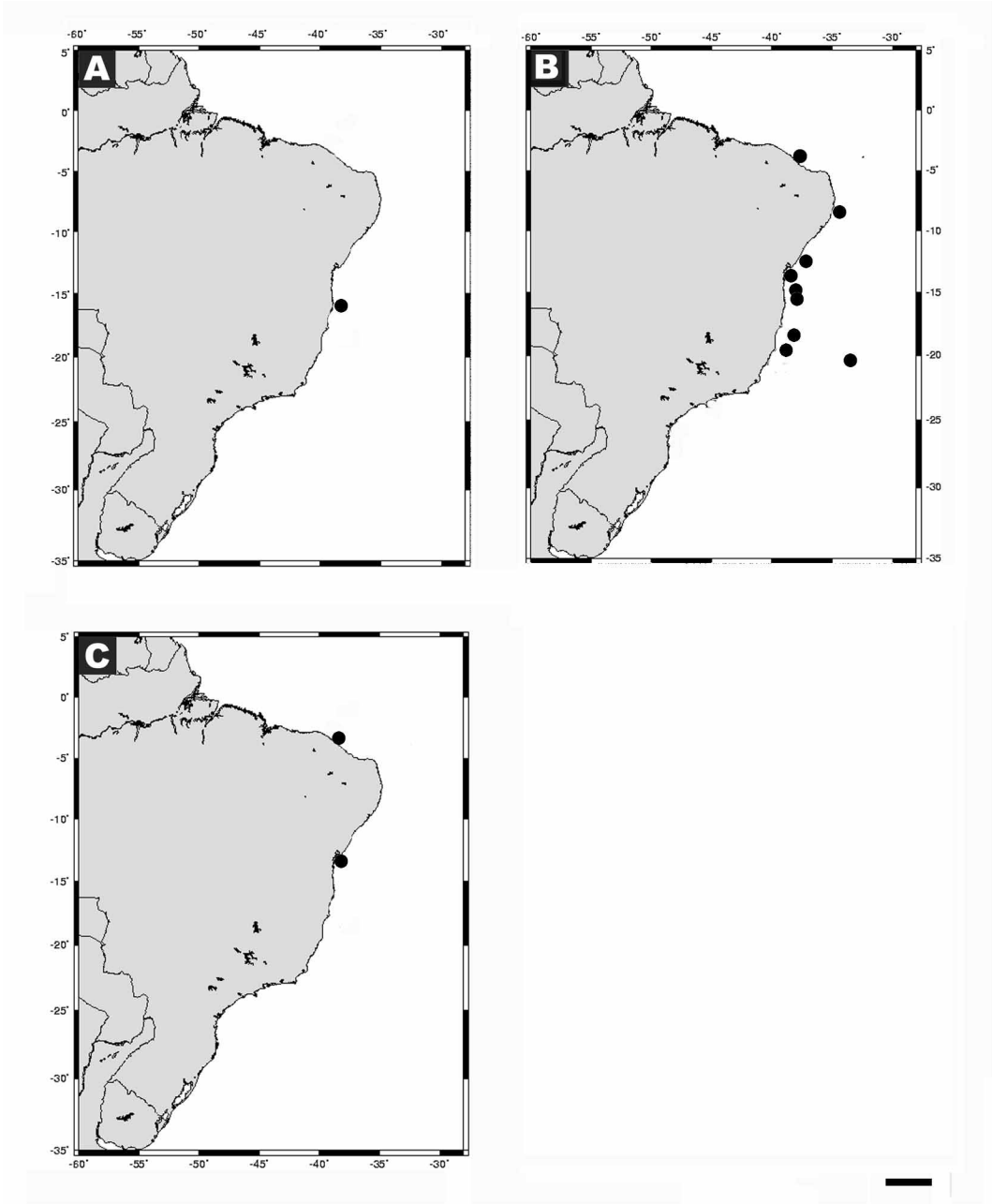

FIGURE 22: Map showing the distribution of *Aplysina* along the Brazilian coastline. A. *Aplysina orthoreticulata* sp.n. B. *Aplysina pseudolacunosa* sp.n. C. *Aplysina solangeae* sp.n.. Scale bar = 500 km.

Bathymetry: The only specimen was dredged at 40 m depth.

Distribution: Provisionally known only from the type locality off the State of Bahia (Brazil; Fig. 22A).

Etymology: The specific name orthoreticulata is derived from the new species' orthogonal reticulation.

Remarks: *Aplysina orthoreticulata* sp.n. presents a superficial resemblance to *A. cauliformis* (cf. above), both comprising digitiform branches of regular diameter. However, none of the currently recognized morphotypes of the latter (see above) possess their surface excavated by shallow depressions and the orthogonal reticulation, which is unique within the genus.

Aplysina pseudolacunosa sp.n. (Figs. 22B, 23A–B, 24, Tab. XI)

Holotype: MNRJ 5478, western coral head (patch reef, Parque Nacional Marinho dos Abrolhos, BA, 17º57'703" S - 36º14'795" W), 18 m depth, E. Vilanova and G. Muricy *coll.*, 03/III/2002.

Paratypes: MNRJ 4581, stn. 34 (shallow, start: 20º24'10" S - 39º55'35" W, finish: 20º24'08" S - 39º55'33" W, off Vitória, ES), 50 m depth, Programme REVIZEE Central V *coll.*, 15/VII/2001. MNRJ 4665, stn. 2 (13º38.98' S - 38º45.94' W, BA), 55 m depth, Programme REVIZEE Central V *coll.*, 02/VII/2001. MNRJ 5461, coral head (patch reef, Parque Nacional Marinho dos Abrolhos, BA, 17º57'703" S - 36º14'795" W), 18 m depth, E. Esteves and G. Muricy *coll.*, 03/III/2002.

Additional material: MNRJ 1549, Pirapama´s Shipwreck (Recife, PE), 20 m depth, G. Muricy *coll.*, 11/II/1998. MNRJ 3048, Canoa Quebrada (CE), 25 m depth, M. Guimarães *coll.*, II/2000. MNRJ 4299, stn. 7 (shallow, Royal Charlotte Bank, BA, start: 16º19'55" S - 38º14'39" W, finish: 16º07'00" S - 38º 10'20" W), 40 m depth, Programme REVIZEE Central V *coll.*, 30/VI/2001. MNRJ 4359, BA (15º34'08" S - 038º49'81" W), 20 m depth, Programme REVIZEE Central V *coll.*, 01/VII/2001. MNRJ 4420, stn 2 (shallow, off Ponta de Castelhanos, SE of Morro de São Paulo, BA, 13º38'98" S - 38º45'94" W), 55 m depth, Programme REVIZEE Central V *coll.*, 02/VII/2001. MNRJ 4669, stn 45 (shallow, ES, 20º40'70" S - 34º35'03" W), 108 m depth, Programme REVIZEE Central V *coll.*, 12/VII/2001.

Diagnosis: Specimens consist of tubes or small globules covered with pronounced ridges which render the surface very irregular. Abundant, variably large digital projections stem from nearly the entire surface of specimens. Specimens always turn beige or purple upon fixation, never black.

Description of the species:

Specimens vary from globose to tubular, with a maximum of 25 cm in height and 4 cm in width (holotype), covered by ridges, which render the surface very irregular (Figs. 23A–B, 24A). These ridges cover the entire surface of the specimens, are always short, and surround shallow valleys. Some small, slender digitiform projections are also observed. These projections can be anastomosed or not with other such ridges or the sponge main body. The sponges possess large apical pseudoscula, 1.5 cm in diameter, sometimes with an iris-type diaphragm. Small oscula are also observed on the outer sides of the sponge. In some samples, small globes with apical oscula are present in the digitiform projections. The surface is finely conulose. The colour is bright yellow and beige *in vivo*, turning purple or brown after preservation in alcohol, never black. Consistency was firmly compressible.

Skeleton: Choanosome with a delicate, irregular network of spongin fibers (Fig. 24B) with amber coloured bark and width of 22–167 µm (average 85 µm), and a thick, black or amber pith with 8–47 µm width (average 20 µm; Figs. 24C). The presence of spongin fibers wrapped and excavated by filamentous structures, possibly fungi, was observed in some specimens (MNRJ 4420, 4665) as in *Aplysina muricyana* sp.n..

Distribution: Brazilian Province (Fig. 22B): Ceará State, Pernambuco State, Bahia State (Parque Nacional Marinho dos Abrolhos) and Espírito Santo State.

Bathymetry: Found between 18 and 55 m depth.

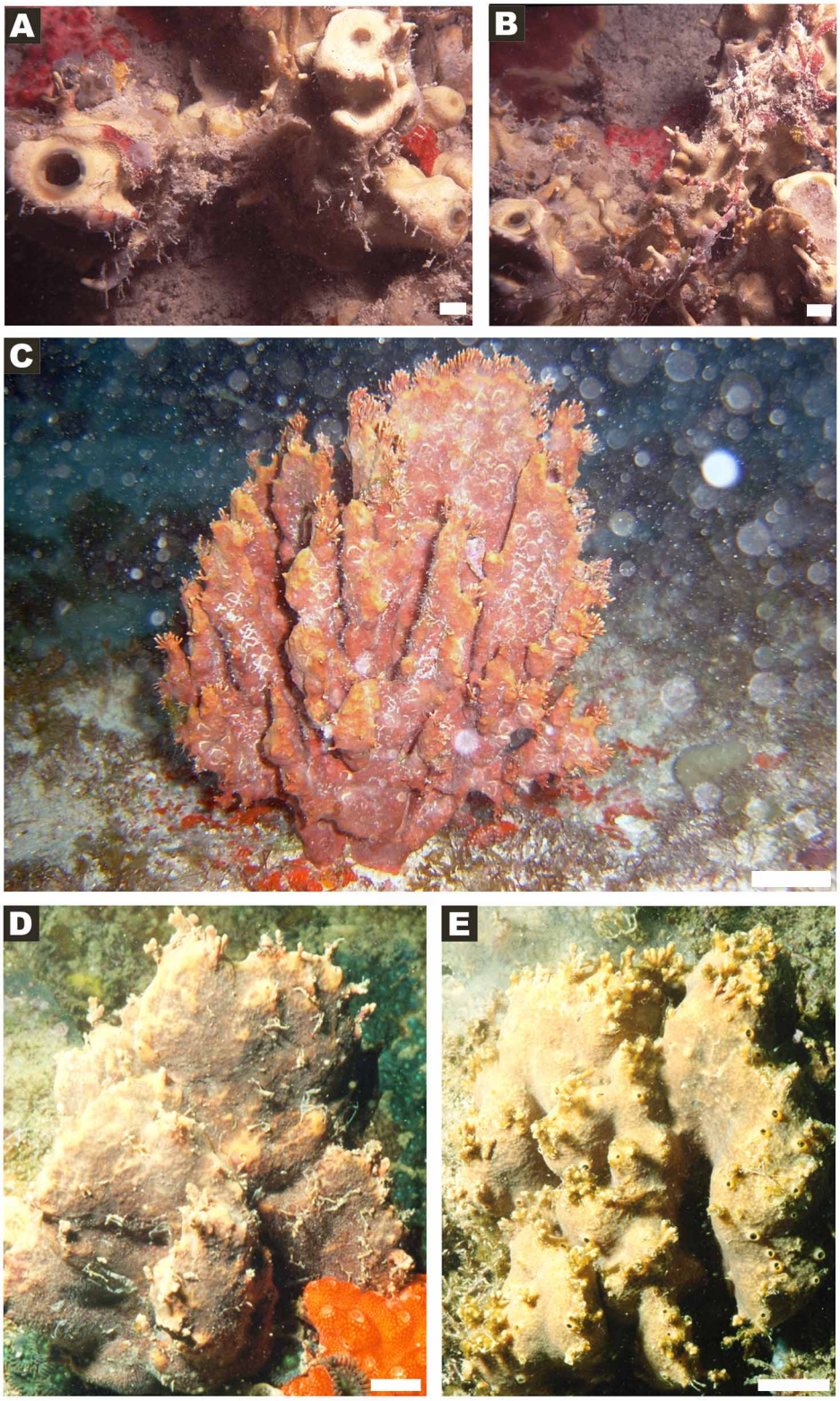

FIGURE 23: A–B. *Aplysina pseudolacunosa* sp.n. in situ, Holotype – MNRJ 5478 (Parque Nacional Marinho dos Abrolhos, BA, Brazil). C–E. *Aplysina solageae* sp.n. in situ. C. Fortaleza (CE, Brazil). D–E. Salvador (BA, Brazil). Scale bar = 1 cm.

Etymology: The new species name, pseudolacunosa, stresses the superficial resemblance of its large inter-ridge depressions (valleys) to the surface lacunae of *A. lacunosa.*

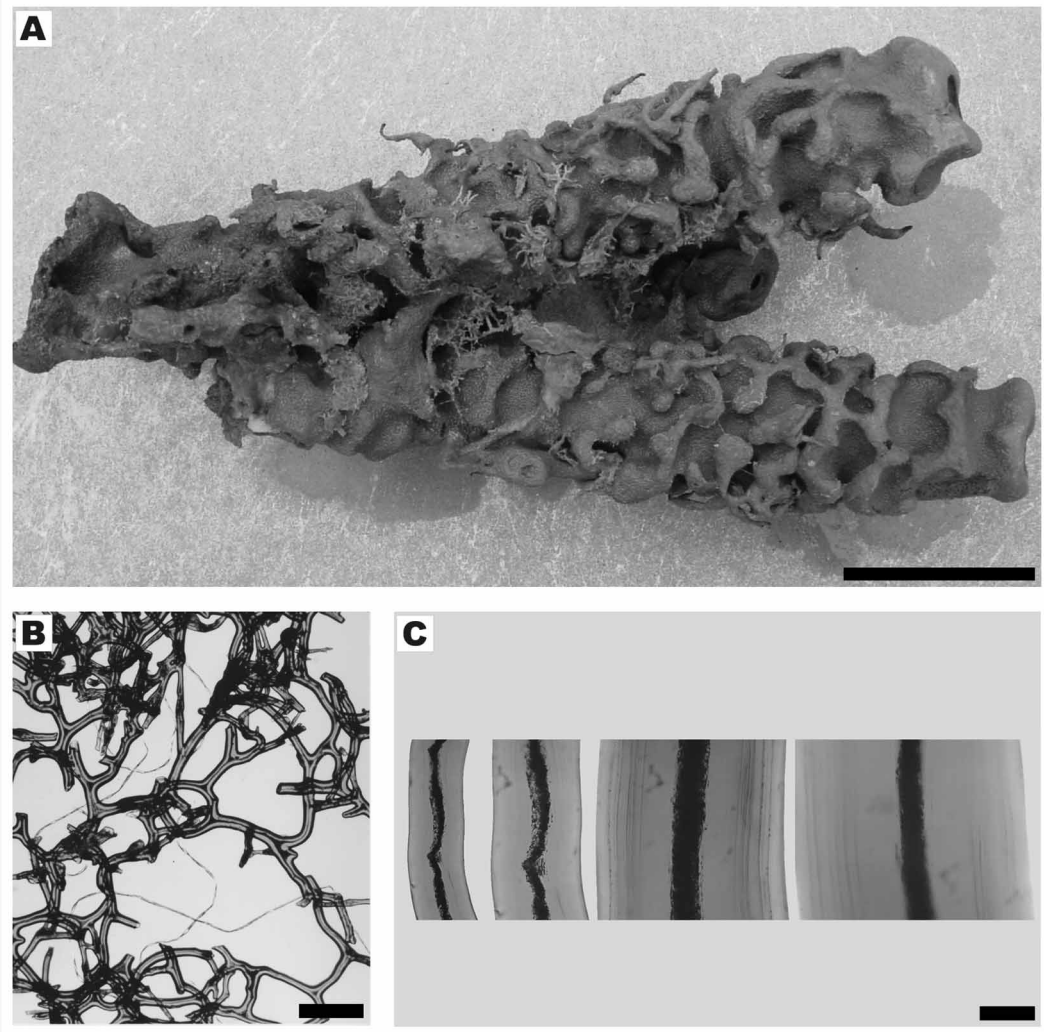

FIGURE 24: A–C. *Aplysina pseudolacunosa* sp.n.. A. Holotype. (MNRJ 5478, after preservation). B–C. Paratype (MNRJ 4581). B. Skeletal architecture. C. Spongin fibres. Scale bars = A. 5 cm, B. 500 µm, C. 50 µm.

Remarks: The species most closely related to *A. pseudolacunosa* sp.n. is *A. lacunosa*, which also possesses tubes with a very marked relief. *A. lacunosa* has a surface characterized by irregular, reticulated ridges, producing caliciform depressions of variable depth, observed even in the smallest studied specimen (MNRJ 3557). We have analyzed a series of individuals (N = 10) of different sizes of *A. pseudolacunosa* sp.n. and they all possess a more open arrangement of ridges and valleys, as well as globular projections, instead of the narrow caliciform depressions formed amidst the reticulate arrangement of ridges in *A. lacunosa*. Both species have different spongin fibers too. *A. lacunosa* possesses a thinner (in average 16.6 µm), irregular pith, while in *A. pseudolacunosa* sp.n. they are thicker (in average 20 µm) and regular.

Aplysina fistularis has also been observed to possess abundant projections of diverse morphologies. These are never similar to those reported here for *A. pseudolacunosa* sp.n., which cover the entire specimens, are always short, and produce shallow valleys.

Specimen MNRJ 4669 was dredged at 108 m and presents a different morphology. It is globose, smaller and without projections, making its assignement to *A. pseudolacunosa* sp.n. rather uncertain. Thus, the occurrence of this species at such a depth is still doubtful.

TABLE XI: Spongin fibres' measurement data for *Aplysina pseudolacunosa* sp.n (in micrometers; S.D. = Standard Deviation and N=30).

Specimens	Locality*	Fibers				Piths			
		Thinnest	Mean	Thickest	S.D.	Thinnest	Mean	Thickest	S.D.
Holotype MNRJ 5478	Abrolhos, BA	75.0	106.2	150.0	18.8	10.0	19.5	30.0	5.14
Paratype MNRJ 4581	(REVIZEE), BA	22.5	60.8	87.5	16.6	8.8	21.8	42.5	8.80
Paratype MNRJ 4584	Atol das Rocas, RN	43.8	79.5	122.5	15.8	11.3	23.9	32.5	5.68
Paratype MNRJ 4665	(REVIZEE), BA	36.3	66.3	92.5	14.7	11.3	20.0	36.3	6.13
Paratype MNRJ 5461	Abrolhos, BA	67.5	109.3	167.5	22.8	10.0	20.5	40.0	7.29
MNRJ 1549	Recife, PE	53.8	85.6	103.8	13.9	15.0	20.2	33.8	4.12
MNRJ 3048	Canoa Quebrada, CE	70.0	90.5	107.5	9.3	12.5	21.9	35.0	5.67
MNRJ 4299	(REVIZEE), BA	25.0	86.1	150.0	28.6	12.5	20.3	47.5	7.18
MNRJ 4359	(REVIZEE), BA	46.3	80.8	116.3	15.3	11.3	18.6	35.0	4.24
MNRJ 4420	(REVIZEE), BA	47.5	80.3	116.3	21.9	10.0	19.3	32.5	5.49

* BA, Bahia State; CE, Ceará State; PE, Pernambuco State; RN, Rio Grande do Norte State.

***Aplysina solangeae* sp.n. (Fig. 22C, 23C–E, 25, Tab. XII)**

Holotype: MNRJ 4173, Salvador´s Yacht Club (Salvador, BA, 12º59'58.2" S - 38º31'54.2" W), 3–5 m depth, E. Hajdu *coll.*, 4/VII/2001.

Paratype: MNRJ 2578, Porto da Barra, Forte de Santa Maria, (Salvador, BA, 13º03' S - 38º32' W); E. Hajdu *coll.*, 30/VII/1999.

Additional material: MNRJ 5268–5274, Salvador´s Yacht Club (Salvador, BA, 12º59'58.2" S - 38º31'54.2" W), U.S. Pinheiro *coll.*, 3 m depth, 29/I/2002). MNRJ 8675, Parque Estadual da Pedra da Risca do Meio (Fortaleza, CE, 03º35'889 S-38º23'481 W), 22 m depth, E. Hajdu *coll.*, 14/VII/2004.

Diagnosis: Predominantly lamellar form in a semi-radial arrangement. Lamellae moderately stout, with very short, slender digitiform projections in their apices, and oscula situated at the top of discrete volcanifom projections. Live colour yellow or yellow with purple stains, turning pinkish-brown or dark-brown after preservation in ethanol. Consistency very soft.

Description of the species:

The specimens have a predominantly lamellar form, with moderately stout lamellae (frequently ca. 1 cm thick) in a semi-radial arrangement, but digitiform processes anastomosed to the main lamella can also be observed. They have a maximum of 11 cm in height and 7 cm in width. In the apex of the lamellae there are several short, slender digitiform projections up to 0.4 cm in height, frequently in tufts, that are released from the sponge after preservation in alcohol (Figs. 23D–E, 25A–B). The small oscula of 0.15 cm in diameter are normally restricted to the upper part of the lamella on top of small volcaniform projections, but oscula of this

type in the sides of the sponge are not rare. The surface is finely conulose, with small, irregular and shallow depressions. The colour is yellow or yellow with purple stains *in vivo*, turning pinkish-brown or dark-brown after preservation in ethanol. Consistency is very soft.

Skeleton: Choanosome with a delicate and irregular network of spongin fibers (Fig. 25C) with amber coloured bark 37–158 µm thick (average 77 µm) and a thick pith that can be black or amber and is 11–55 µm thick (average 24 µm; Fig. 25D).

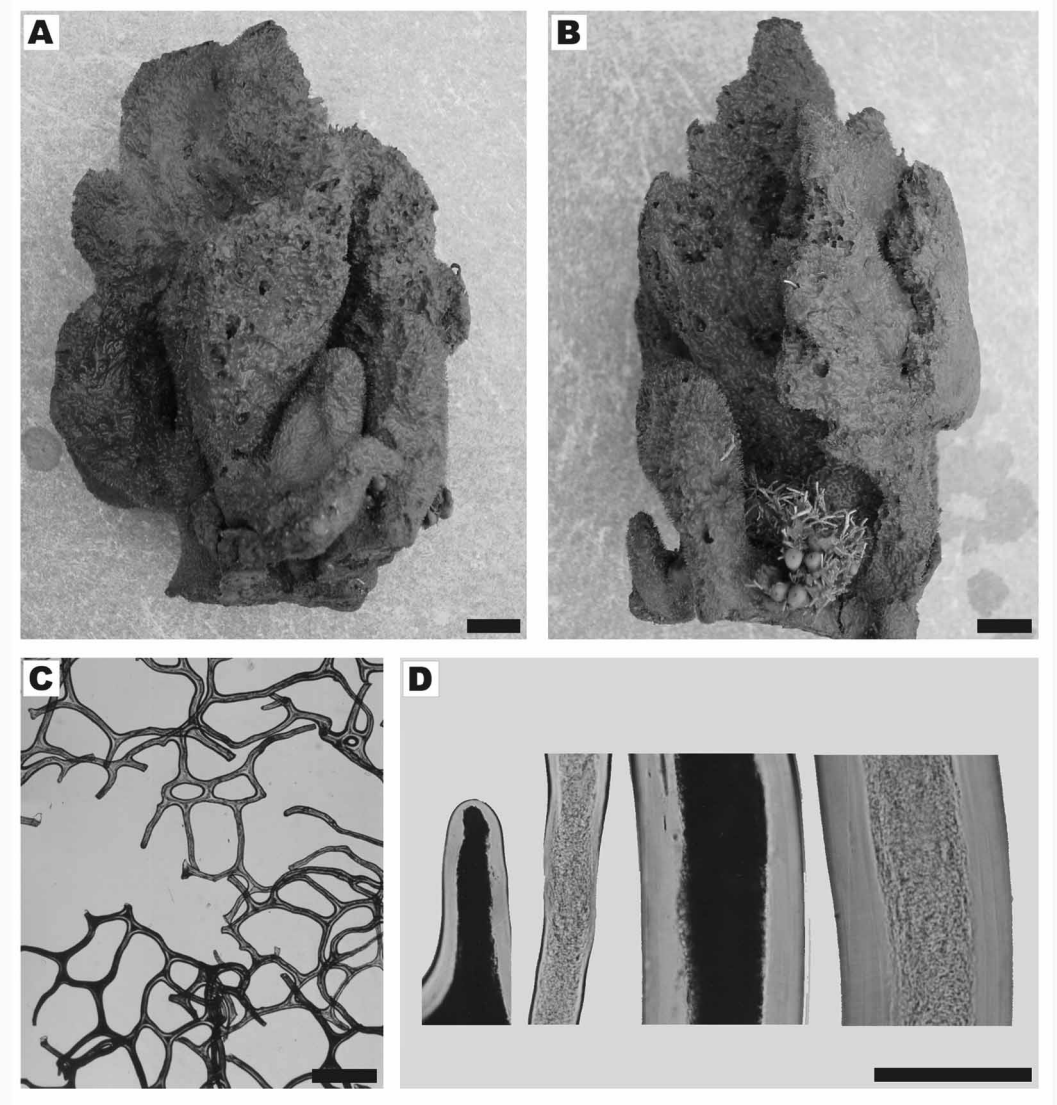

FIGURE 25: A–D. *Aplysina solangeae* sp.n. Holotype (MNRJ 4173). A–B. habit after preservation. C. Skeletal architecture. D. Spongin fibres. Scale bars = A–B. 1 cm, C. 500 µm, D. 50 µm.

Distribution: So far endemic from the northeastern Brazilian coast (Fig. 22C).

Ecological observations: Bahian specimens were collected in very shallow-waters, with a maximum of 4 m depth. The specimen from Ceará was collected with scuba diving at 22 m depth. In both cases, water temperature is warm, tropical, throughout the year.

Etymology: The specific name solangeae is dedicated to Prof. Dr. Solange Peixinho, for her enthusiastic scientific supervision of EH's first steps on the taxonomy of sponges, her always warm welcome and priceless logistic support to every collecting trip undertaken in the Salvador area since 1987, her over 30 years teaching Bahian sponges to hundreds of biology students, and a similar time dedicated to the study of varied aspects of sponge biology in the State of Bahia.

TABLE XII: Spongin fibres' measurement data for *Aplysina solangeae* sp.n. (in micrometers; S.D. = Standard Deviation and N=30).

Specimens	Locality*	Fibers				Piths			
		Thinnest	Mean	Thickest	S.D.	Thinnest	Mean	Thickest	S.D.
Holotype MNRJ 4173	Salvador, BA	37.5	53.8	92.5	11.6	12.5	24.8	55.0	10.4
Paratype MNRJ 2578	Salvador, BA	62.5	101.3	158.8	23.3	11.3	23.0	53.8	8.2
MNRJ 5270	Salvador, BA	30.0	74.0	137.5	26.9	12.5	24.1	75.0	11.7
MNRJ 5268	Salvador, BA	47.5	66.1	90.0	12.2	12.5	20.6	30.0	5.2
MNRJ 5269	Salvador, BA	28.8	61.6	92.5	14.2	13.8	30.7	70.0	14.6
MNRJ 5271	Salvador, BA	32.5	48.2	67.5	8.8	6.3	24.8	45.0	8.2
MNRJ 5272	Salvador, BA	31.3	63.6	96.6	12.8	16.3	20.4	28.8	3.0
MNRJ 5273	Salvador, BA	32.5	62.0	88.8	15.6	12.5	26.4	55.0	10.8
MNRJ 5274	Salvador, BA	50.0	69.5	85.0	8.7	17.5	24.1	37.5	4.1

*BA, Bahia State.

Remarks: Despite the large morphologic plasticity observed in the collected specimens, all share the diagnostic characters (relatively stout lamellar form; short, slender digitiform projections; small oscula spread all over the sponge and soft consistency). *Aplysina solangeae* sp.n. is the closest species to *A. fulva* as far as external morphology goes. *Aplysina fulva* is another species which shows large morphologic plasticity and may have a lamellar shape in a few cases. However, the latter differs from *A. solangeae* sp.n. because its consistency is only rarely soft, it is typically digitiform and without short, slender digitiform projections (even when lamellate), while the new species described here is predominantly lamellar with short, slender digitiform projections. Lamellate specimens of *A. fulva* do not show lamellae in a semi-radial arrangement, and their lamellae also tend to be more slender and smooth.

Discussion

Taxonomic characters

Skeletal architecture and its components (fibres, spicules) are traditionally used as the main characters for the taxonomy of almost all groups of Porifera. In *Aplysina*, the examination of fiber width and type is currently an important step in identification protocols (e.g. Wiendemayer, 1977; van Soest, 1978; Zea, 1987; Pinheiro & Hajdu, 2001). However, due to the limited knowledge regarding the biology of these animals as well as by a lack of enough redescriptions, very little data is available on their morphologic variability and the external factors affecting these variables. The impossibility of identification of dry, preserved specimens was already raised by Bergquist (1980), and is corroborated here in determining the unrecognizability of *A. insularis*'s holotype. In the present work we have shown that, with the exception of *Aplysina orthoreticulata* sp.n., the morphologic variation of spongin fibers is a rather weak taxonomic character for species diagnoses. All studied species possess, even in a single individual, spongin fibers of varied thickness, concerning both bark and pith. After the analysis of a vast material of *Aplysina*, we have observed that external morphologic characters, such as shape, live-colour, as well as colour in the preserved state, size and distribution of oscula, and consistency are usually more stable than the traditional skeleton-derived data. Therefore, it is mandatory that

such characters be observed and used together with fiber morphology to achieve a correct identification of the species in this genus.

Although more reliable than the traditional analysis of the skeleton, external morphology also has some limitations. In some species (e.g. *A. fulva* and *A. fistularis*) a large morphologic variability is observed, hampering easy identifications of preserved material and occasionally causing mistakes in diagnoses. For example, Alcolado (pers.comm.) reported *A. fulva*-like projections stemming from otherwise typical *A. fistularis* specimens in Cuba, as did de Laubenfels (1948). In such a case, depending on which fragment was available to the taxonomist, a different identification could have been arrived at. Therefore, the utilization of new taxonomic characters, either through ecological, molecular or cytological studies, is still necessary for a comprehensive clarification of the taxonomic status of those species with vast morphologic variation, specially in view of the continued need for identification of small, fragmentary specimens, such as those frequently catched through trawling and dredging. One such attempt was made by Pinheiro et al (2004) who found out that cellular morphology was another good taxonomic character for differentiating between *A. caissara* and *A fulva*. The latter, known for its overall morphologic plasticity, had surprisingly stable citology across populations from localities 320 Km apart. Another such effort was undertaken by Schmitt et al. (2005) who attempted to diagnose several *Aplysina* species on the basis of ITS-2 and 18S rRNA, which unfortunately turned out to be highly invariable at this level of universality. A great need for good molecular markers for species of *Aplysina* exists, and the Tropical western Atlantic is the natural choice for challenging biological materials.

Aplysina in the Tropical western Atlantic

Despite the extensive faunistic surveys on the Brazilian littoral zone and continental shelf undertaken between the 1960's and the turn of the century, no other specimen of *A. archeri* (Higgins, 1875) was recollected. Therefore, we believe the record by Lendenfeld [1889; for Polejaeff's (1884) *A. tenuissima*] to be a mistaken identification (probably *A. lacunosa* cf. Pinheiro & Hajdu, 2001) and consider this record invalid. We also invalidated *A. capensis*, following the steps of Carter (1881) and Bergquist (1980). We had the opportunity to reexamine several of Carter's (1881), South African specimens (BMNH ? – type, BMNH 1871.5.12.1, BMNH 1938.3.26.82), which clearly contain abundant foreign inclusions in their fibres, thus being exclused from *Aplysina*'s scope. De Laubenfels' (1956) Brazilian record of the species is thus unreliable in view of the absence of a description, absence of a voucher specimen, and unrecognizable identification.

Aplysina is one of a few sponge genera to present a larger diversity in the Atlantic (ca. twenty species), than the Indo-Pacific (fifteen species—many of which undoubtedly unrecognizable) oceans. In the Atlantic Ocean, the Caribbean region was the center of larger diversity, with seven species known: *A. archeri*, *A. Bathyphila*, *A. cauliformis*, *A. fistularis*, *A. fulva*, *A. lacunosa* and *A. ocracea* (*sensu* Maldonado & Young, 1998). In the present work we described eight additional new species and a new record for the Brazilian coast, raising the number of annotated species in this region from six (Pinheiro & Hajdu, 2001) to fifteen. Additional species for the Caribbean are also certain, as realized from a preliminary comparative assessment of *Aplysina* specimens in the BMNH and ZMA collections. These await a much needed revision of Caribbean specimens, which given the rationale above, is to be based on extensive field observations conducted on as many localities, as far apart from each other, as possible, as already argued for by Wiedenmayer (1977) for sponges in general. Considering *Aplysina*'s conspicuousness, abundance and diversified chemistry associated to promising biological activities, it is a clear priority for a deeper, comprehensive taxonomic revision.

Following is the amended list of species of *Aplysina* occurring in the South-western Atlantic, after which a tentative identification key for these species is offered: *A. alcicornis* sp.n., *A. caissara*, *A. cauliformis*, *A. cristagallus* sp.n., *A. fistularis*, *A. fulva*, *A. insularis*, *A. lacunosa*, *A. lactuca* sp.n., *A. lingua* sp.n., *A. muricyana* sp.n., *A. orthoreticulata* sp.n., *A. pergamentacea*, *A. pseudolacunosa* sp.n. and *A. solangeae* sp.n. In total, fifteen species were recognized.

Identification key for the South-western Atlantic species of *Aplysina*

1a. Predominantly solid-digitiform; may be ridged when creeping; if lamelar, lamellae not centrally anastomosed; if apical oscula occur, these are not pseudoscula, nor form any sort of atrial cavity .....(2)
1b. Predominantly tubular, always with apical oscula or pseudoscula, often with atrial cavities ..... (5)
1c. Predominantly lamelar; if apical oscula occur, these are not pseudoscula, nor form any sort of atrial cavity ..... (11)
2a. Small digits (3–4 cm high), apical oscula, live colour always bright yellow ..... *A. caissara*
2b. Digits of various dimensions, consistently small (< 10 cm high), medium (> 10 or < 30 cm high) or large (> 30 cm high), oscula never apical (neither exclusively, nor predominantly).....(3)
3a. Diameter of digitiform branches mostly irregular, frequently thick (> 3 cm across), live colour predominantly brownish-yellow or mustard-yellow ..... *A. fulva*
3b. Diameter of digitiform branches mostly regular ..... (4)
4a. Surface marked by depressions scattered all over its length, oscula situated inside these depressions, orthogonal reticulation of stout spongin fibres (100–307 µm in diameter) ..... *A. orthoreticulata* sp.n.
4b. Surface not predominantly marked by depressions, polygonal reticulation of slender spongin fibres (33–120 µm in diameter) ..... *A. cauliformis*
5a. Surface of tubes with marked relief (e.g. ridges, digits of various dimensions, grooves) ..... (6)
5b. Surface with much less marked relief (e.g. smooth, shallow-grooves, short volcaniform ridges, slightly lobate) (9)
6a. Surface totally marked by relatively deep grooves of irregular shape (e.g. caliciform, meandriform) .... *A. lacunosa*
6b. Surface may be totally marked by shallow, wider-depressions of irregular shape, frequently more spaced from each other.....(7)
7a. Surface with various projections of varied shape, never producing a regular pattern of short ridges; dark-brown to black in ethanol .....*A. fistularis*
7b. Surface with relatively regular pattern of short ridges; light-brown to brown in ethanol ..... (8)
8a. Maybe large; short, frequent irregular digitiform or globular projections..... *A. pseudolacunosa* sp.n.
8b. Consistently short, often creeping; slender digitiform projections may occur ..... *A. muriciana* sp.n.
9a. Frequently large (over 20 cm high); tubes mostly cylindrical; may be nearly totally smooth; when anastomosed, anastomoses occur mostly at basal portion; dark-brown to black in ethanol ..... *A. fistularis*
9b. Consistently short (less than 10 cm high); tubes polygonal or lobate, frequently anastomosed along their full length; light-brown/beige or dark-brown to black in ethanol.....(10)
10a. Tubes frequently polygonal, often creeping; tough; light-brown/beige in ethanol ..... *A. muriciana* sp.n.
10b. Tubes frequently cylindrical, lobate, slightly inverted-conical; very soft; dark-brown to black in ethanol .....*A. insularis*
11a. Small, slender, mostly apical, variably abundant digitiform projections present ..... (12)
11b. Small, slender digitiform projections absent ..... (14)
12a. Lamellae mostly centrally anastomosed, stout (> 1 cm thick); small, slender, mostly apical, digitiform projections usually few ..... *A. solangeae* sp.n.
12b. Lamellae not centrally anastomosed, slender (usually < 1 cm thick); slender, mostly apical, digitiform projections usually abundant ..... (13)
13a. Dark-brown in ethanol; slender, mostly apical, digitiform projections of homogeneous colour, which may bifurcate and trifurcate .....*A. alcicornis* sp.n.
13b. Light-brown in ethanol; slender, mostly apical, digitiform projections which are darker in their apical portion ..... *A. cristagallus* sp.n.
14a. Lamellae slender (< 1 cm thick), centrally anastomosed (buttress-like) along most of their length, may

branch into secondary ones ..... *A. lactuca* sp.n.

14b. Lamellae never centrally anastomosed, mostly a single lamella, or lamellae arranged in a single plane (slightly palmate) ..... (15)

15a. Single, ax-like lamella; marginal oscula; light-brown in ethanol ..... *A. pergamentacea*

15b. Lamellae never ax-like; oscula scattered; dark-brown in ethanol ..... (16)

16a. Single, long, flat (tongue-like) lamella ..... *A. lingua* sp.n.

16b. Lamellae may be single or grouped (slightly palmate), never tongue-like ..... *A. fulva*

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