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Ctenostomatous Bryozoa from São Paulo, Brazil, with descriptions of twelve new species

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Abstract

This paper describes 21 ctenostomatous bryozoans from the state of São Paulo, Brazil, based on specimens observed *in vivo*. A new family, Jebramellidae **n. fam.**, is erected for a newly described genus and species, *Jebramella angusta* **n. gen. et sp.** Eleven other species are described as new: *Alcyonidium exiguum* **n. sp.**, *Alcyonidium pulvinatum* **n. sp.**, *Alcyonidium torquatum* **n. sp.**, *Alcyonidium vitreum* **n. sp.**, *Bowerbankia ernsti* **n. sp.**, *Bowerbankia evelinae* **n. sp.**, *Bowerbankia mobilis* **n. sp.**, *Nolella elizae* **n. sp.**, *Panolicella brasiliensis* **n. sp.**, *Sundanella rosea* **n. sp.**, *Victorella araceae* **n. sp.** Taxonomic and ecological notes are also included for nine previously described species: *Aeverrillia setigera* (Hincks, 1887), *Alcyonidium hauffi* Marcus, 1939, *Alcyonidium polypylum* Marcus, 1941, *Anguinella palmata* van Beneden, 1845, *Arachnoidella evelinae* (Marcus, 1937), *Bantariella firmata* (Marcus, 1938) **n. comb.**, *Nolella sawayai* Marcus, 1938, *Nolella stipata* Gosse, 1855 and *Zoobotryon verticillatum* (delle Chiaje, 1822).

Key words: *Alcyonidium*, bryozoans, *Bowerbankia*, Ctenostomata, *Jebramella*, Jebramellidae, new combination, new family, new species, *Nolella*, *Panolicella*, *Sundanella*, taxonomy, *Victorella*

Introduction

Vieira *et al.* (2008) listed 42 species of ctenostomatous Bryozoa from the Brazilian coast, most of them recorded from São Paulo state. The authors remarked that among these species, at least four required taxonomic revision: *Alcyonidium mamillatum* Alder, 1857, *Alcyonidium polyoum* (Hassall, 1841), *Sundanella sibogae* Harmer, 1915 and *Bowerbankia gracilis* Leidy, 1855. Recently, Fehlaue-Ale *et al.* (2011) reported a previously synonymized species from São Paulo, *Amathia brasiliensis* Busk, 1886, and clarified its taxonomic status based on molecular genetics and morphological characteristics observed in living specimens (e.g. pigmentation of autozooids and kenozooids).

Species of Ctenostomata have been traditionally described based on morphological characteristics of preserved zooids, complemented with studies of the microscopic anatomy of polypides (e.g. Harmer 1915; Busk 1886). However, the additional information obtained from colonies *in vivo* is essential for identification of some species as preserved specimens do not always reveal all the essential characters for identification, causing them to be lumped together or misidentified in taxonomic studies (Jebram 1985). Studies using molecular techniques have revealed that some widespread ctenostomatous ‘species’ belong to complexes of species with different morphology and behavior (Thorpe *et al.* 1978; Porter *et al.* 2002).

In the present study we give an account of the ctenostomatous bryozoan fauna collected on the north coast of São Paulo state, Brazil. Twelve new species are described and another nine previously described species are included with description of additional characters based on living material.

Material and methods

The samples were collected from several coastal localities of São Paulo State, Southeast Brazil (Fig. 1), with part of the material obtained from a long-term study (BIOTA/FAPESP/Bentos Marinho Project; see Amaral & Nallin 2011, for an overview of the results of this Program) of marine organisms of the coast of São Paulo state. Living specimens were collected along with their substrata and maintained in running seawater at the Centro de Biologia Marinha, Universidade de São Paulo (CEBIMar) in São Sebastião. Colonies were cleaned with a jet of filtered seawater and then placed in a bowl of clean seawater to be examined and measured under stereoscopic microscopy. Specimens were photographed and filmed alive in seawater using a Nikon Coolpix and Nikon SLR D5100 digital camera mounted on a Zeiss SV-11 stereoscopic microscope, using dark-field illumination and incident light.



FIGURE 1. Map showing sampling area (black rectangle in inset map of Brazilian coast). **A**, Santos Bay (collected by Ernst Marcus in the 1930s); **B**, Alcatrazes; **C**, Calhetas; **D**, São Sebastião channel (Pitangueiras, Araçá Bay, Praia Preta, PETROBRAS Pier and Pontal da Cruz Pier); **E**, Enseada and Porto Novo; **F**, Comprida and Selinha islands.

Measurements were made by light microscopy using a Zeiss SV-11 stereomicroscope. Detailed tables are included for comparison of species of *Alcyonidium* and *Nolella* owing to the high number of species on the Brazilian coast and the similar appearance of specimens after they are preserved.

Voucher specimens were fixed and preserved in 92% alcohol, unless otherwise stated. Some specimens were previously anesthetized with isotonic magnesium chloride solution, added gradually, and then with clove oil. All specimens are stored in the Bryozoa Collection of the Museu de Zoologia of Universidade de São Paulo, Brazil (MZUSP). Other material studied included specimens from the bryozoan collections in the Natural History Museum, London (NHMUK).

Systematic account

Class Gymnolaemata Allman, 1856

Order Ctenostomata Busk, 1852

Suborder Alcyonidiina Johnston, 1847

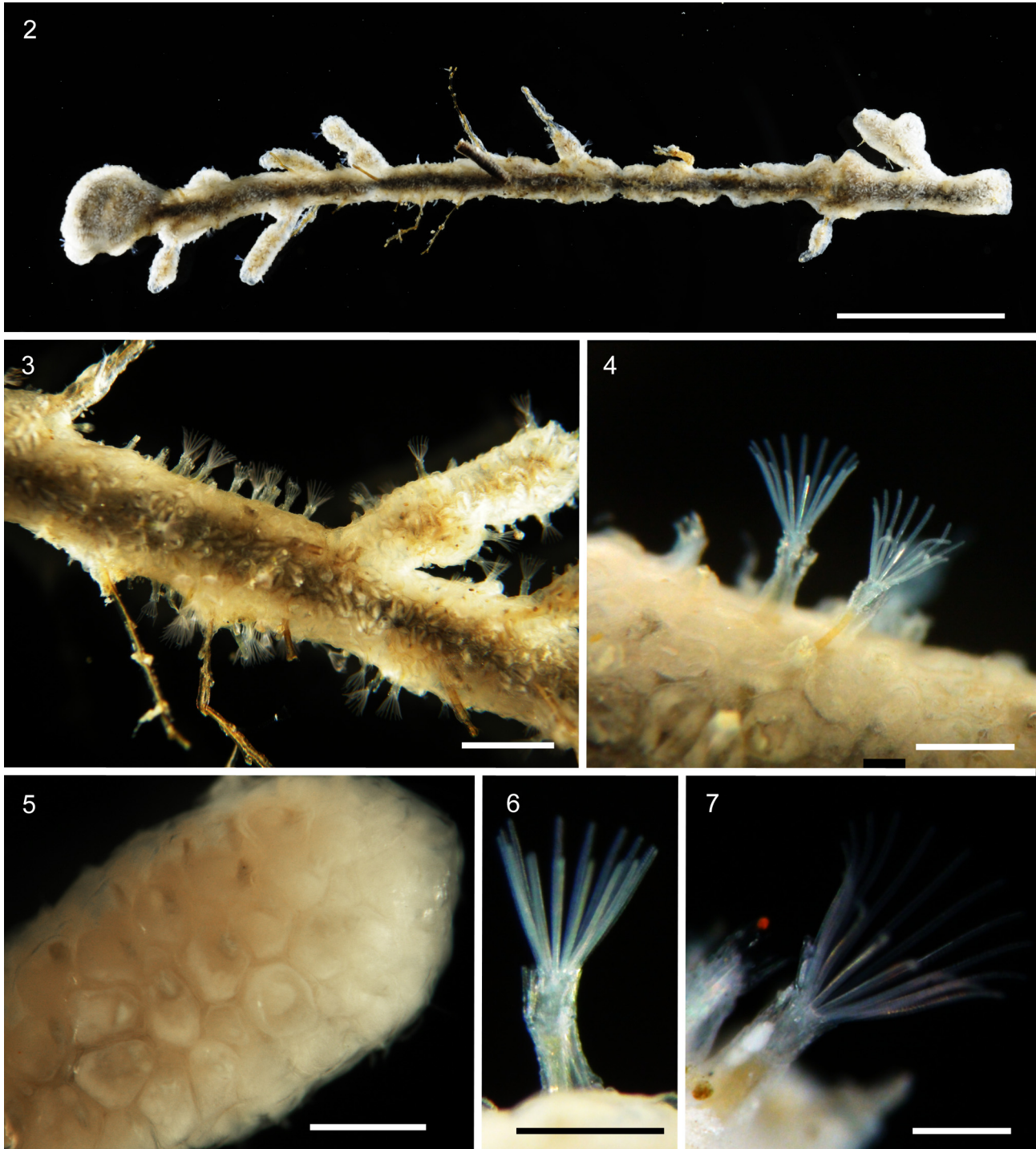
Family Alcyonidiidae Johnston, 1838

Genus *Alcyonidium* Lamouroux, 1813

Alcyonidium hauffi Marcus, 1939

(Figs 2–7, 9; Table 1)

Alcyonidium hauffi Marcus, 1939:164, pl. 13, fig. 26A,B; 1941a: 68; Vieira *et al.* 2008: 8 (checklist); Migotto *et al.* 2011: 269.



FIGURES 2–6. *Alcyonidium hauffi* Marcus, 1939, from Caraguatatuba, São Paulo, Brazil; 2–6, MZUSP 815; 2–3, colony encrusting skeleton of gorgonian and hydroid stems; 4, portion of colony with two expanded tentacle crowns; 5, surface of autozooids; 6, close-up of expanded polypide, showing the short setigerous collar and the tentacles; 7, MZUSP 858, close-up of expanded polypide of female zooid, showing an intertentacular organ. Scale bars: 2, 1 cm; 3, 1 mm; 4, 6, 0.3 mm; 5, 0.5 mm; 7, 0.15 mm.



FIGURES 8–10. Clumps of octocorals, seaweeds, and debris washed ashore in Caraguatatuba, São Paulo, Brazil, where [9] *Alcyonidium hauffi* Marcus, 1939 and [10] *Alcyonidium torquatum* n. sp. were found. Scale bars: 8, 30 cm; 9, 5 cm; 10, 2 cm.

Material examined. *Lectotype* (chosen here): NHMUK 1948.2.16.14, *Alcyonidium hauffi*, E. Marcus det. Santos, São Paulo state, Brazil. *Additional specimens*: MZUSP 811, BIOTA/FAPESP, BRY 606, A.E. Migotto and J.E. Winston coll., 13 February 2005, 23°41'15" S, 45°25'48" W, Praia do Porto Novo, Caraguatatuba, São Paulo, Brazil, intertidal, on gorgonian *Leptogorgia setacea* (Pallas). MZUSP 812, BIOTA/FAPESP, BRY 290, 16 March 2001, between Comprida and Selinha Islands, Ubatuba, São Paulo, Brazil, intertidal, on hydroid *Pennaria disticha* (Goldfuss). MZUSP 813–814, L.M.Vieira, A.E. Migotto, K.B. Nascimento and B.S. Aguiar coll., 11 October 2011, 23°40'28.7" S, 45°25'48.1" W, Praia do Porto Novo, Caraguatatuba, São Paulo, Brazil, intertidal, on gorgonian *Leptogorgia setacea* (Pallas). MZUSP 815, L.M.Vieira, A.E. Migotto, K.B. Nascimento and B.S. Aguiar coll., 11 October 2011, 23°41'24.1" S, 45°25'46.9" W, Praia do Porto Novo, Caraguatatuba, São Paulo, Brazil, intertidal, on hydroid *Pennaria disticha* (Goldfuss). MZUSP 854, A. Morandini coll., 21 November 2013, Enseada, Caraguatatuba, São Paulo, Brazil, on gorgonian *Leptogorgia setacea* (Pallas). MZUSP 858, F.P.P. Leite coll., 29 May 2014, Barequeçaba, São Sebastião, São Paulo, Brazil, intertidal, on gorgonian *Leptogorgia setacea* (Pallas). MZUSP 860, 11 December 2013, A.E. Migotto coll., Cigarras, São Sebastião, on gorgonian *Leptogorgia setacea* (Pallas).

Description. Colonies translucent grayish-white, cylindrically encrusting axial skeleton of *Leptogorgia setacea* (Cnidaria, Anthozoa, Gorgoniidae) and hydrocaulus and hydrocladia of *Pennaria disticha* (Cnidaria, Hydrozoa, Pennariidae); frontal budding of zooids enabling colonies to increase their diameter and to develop projecting regular branches, frills and knobs. Zooids oval to rounded-hexagonal (primary layer) to irregularly polygonal in frontally budded areas; small quadrangular to polygonal kenozooids also present among autozooids. Zooid openings not marked by raised oral papillae, except in fertile zooids; orifice c. 0.04–0.06 mm. Polypides translucent white, with brownish-yellow gut; campanulate tentacle crown with 15–17 tentacles, about 0.300–0.330 mm long, held straight (male zooids) or slightly bent outward at tips (female zooids). Setigerous collar tubular, parallel to base of introvert, with scalloped distal edge. Small intertentacular organs present in female zooids; embryos white in color.

Supplementary video. <http://cifonauta.cebimar.usp.br/taxon/alcyonidium-hauffi>.

Remarks. Marcus (1939) described *Alcyonidium hauffi* from São Paulo state, characterizing it as having encrusting colonies with projecting branches/knobs, polygonal zooids without oral papillae and 15–17 tentacles. In some colonies, the small oral papillae are found in some zooids (female zooids), often at the growing edge of colonies. Colonies of this species differ from those of *Alcyonidium torquatum* n. sp. and *Alcyonidium vitreum* n. sp. in their smaller zooid size (Table 1). *Alcyonidium hauffi* is also distinguished from *A. torquatum* n. sp. by the presence of smaller kenozooids between the autozooids in younger regions of colony, short tentacles about

0.300–0.330 mm long and a tubular, elongate setigerous collar. In Caraguatatuba Bay, *A. hauffi* and *A. torquatum* **n. sp.** co-occur in the same habit, encrusting the similar-looking growths of the soft coral *Leptogorgia setacea* and the hydroid *Pennaria disticha*. Both *Alcyonidium* species, sometimes sharing the same stem, were found on *L. setacea*, which was attached to empty bivalve shells or loose on the substratum; often these cnidarian stems were wrapped in debris, *Diopatra* tubes and beach-cast seaweeds (Figs 8–10).

Recently, Winston and Hayward (2012) reported *A. hauffi* from the northeastern coast of the United States, but these specimens are larger than those described and figured here.

Distribution. Brazil: São Paulo. Specimens reported from United States (Maturó 1957:19, fig. 5; Winston & Hayward 2012: 12, fig. 5) may comprise a different species.

TABLE 1. Comparative characteristics of *Alcyonidium* species found in São Paulo state, Brazil. Measurements (in mm): mean (SD) [min–max].

	<i>Alcyonidium exiguum</i> n. sp.	<i>Alcyonidium hauffi</i>	<i>Alcyonidium polypylum</i>	<i>Alcyonidium pulvinatum</i> n. sp.	<i>Alcyonidium torquatum</i> n. sp.	<i>Alcyonidium vitreum</i> n. sp.
Autozooids	irregularly polygonal	oval to irregularly polygonal	irregularly polygonal	subhexagonal to oval	subhexagonal to irregularly polygonal	hexagonal distally, subhexagonal proximally
Zooidal length	0.294 (0.051) [0.208–0.354]	0.411 (0.058) [0.323–0.515]	0.339 (0.051) [0.285–0.437]	0.618 (0.048) [0.570–0.703]	0.517 (0.111) [0.342–0.733]	0.603 (0.078) [0.475–0.760]
Zooidal width	0.234 (0.030) [0.183–0.281]	0.307 (0.032) [0.247–0.361]	0.294 (0.057) [0.209–0.418]	0.393 (0.042) [0.342–0.456]	0.287 (0.050) [0.208–0.367]	0.361 (0.036) [0.304–0.418]
Kenozooids	absent	present; quadrangular to polygonal	present; quadrangular to polygonal	present in anastomosing areas; large	rarely present; polygonal	absent
Orificial papillae	present	present in female zooids	absent	present	present	present
Tentacle crown	campanulate	campanulate	obliquely truncate	campanulate	campanulate	campanulate
Tentacles	11–13	15–17	14–15	17–18	14–17	14–16
Setigerous collar	inconspicuous	absent	absent	absent	present	absent
Intertentacular organ	absent	present	present	absent	present	absent
Embryos	unknown	white	unknown	unknown	unknown	light orange

Alcyonidium torquatum **n. sp.**

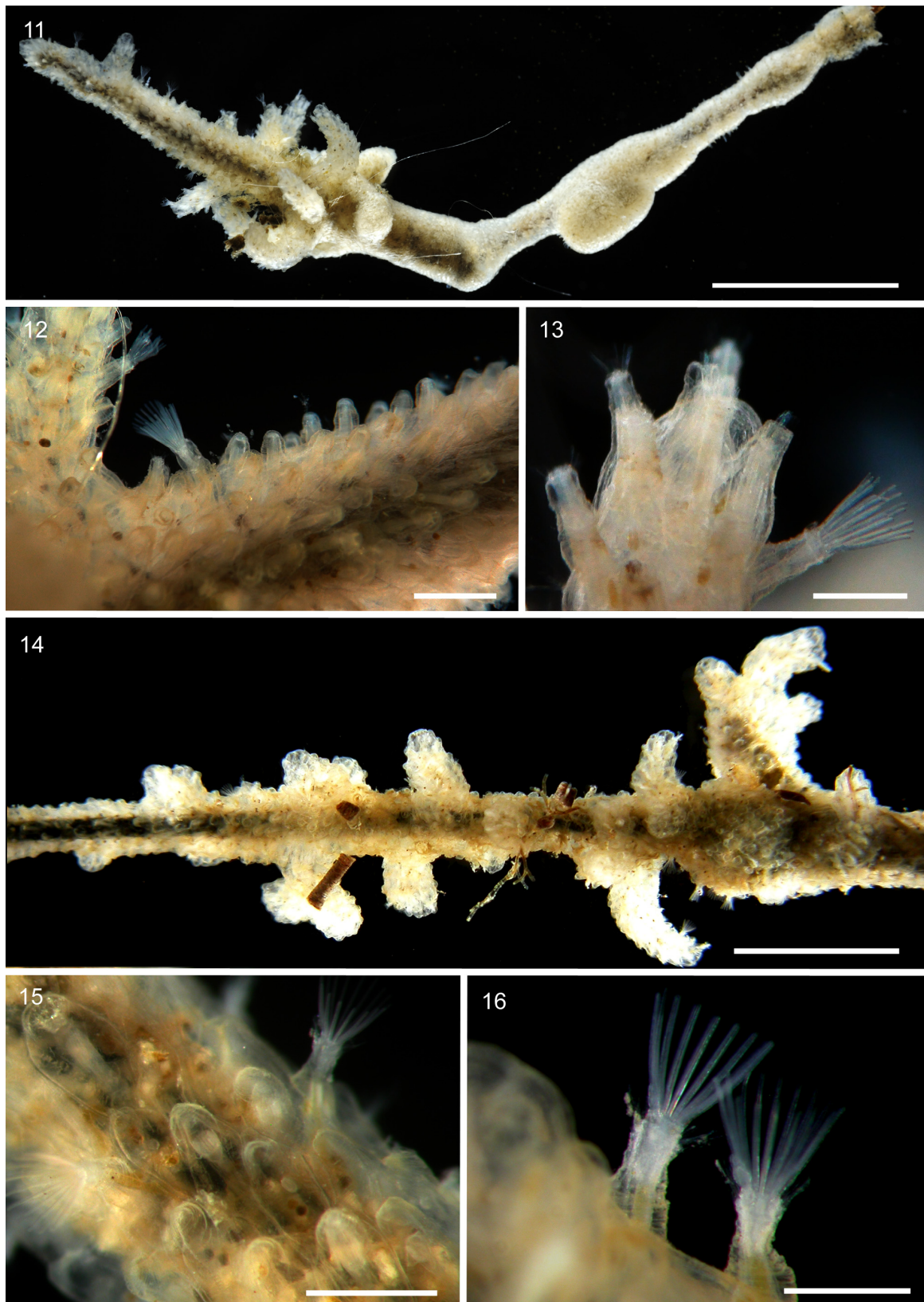
(Figs 10–16; Table 1)

Alcyonidium sp2 Migotto *et al.* 2011: 269.

Material examined. *Holotype*: MZUSP 839, L.M.Vieira, A.E. Migotto, K.B. Nascimento and B.S. Aguiar coll., 11 October 2011, 23°41'24.1" S, 45°25'46.9" W, Enseada, Caraguatatuba, São Paulo, Brazil, intertidal, on gorgonian *Leptogorgia setacea* (Pallas). *Paratypes*: MZUSP 840–841, A.E. Migotto and J.E. Winston coll., 13 February 2005, 23°41'15" S, 45°25'48" W, Caraguatatuba, São Paulo, Brazil, intertidal, on gorgonian *Leptogorgia setacea* (Pallas).

Etymology. Latin *torquatus*, collar, alluding to the presence of a long funnel-shaped setigerous collar around the base of the tentacle crown.

Description. Colonies translucent grayish-white, cylindrically encrusting stems of *Leptogorgia setacea*; frontal budding of zooids enabling colonies to increase in diameter and to develop projecting branches, frills, and knobs as they grow. Zooids convex, oval to rounded-hexagonal (primary layer) to irregularly polygonal in frontally budded areas, variable in size. Large irregularly polygonal kenozooids, about half the size of autozooids, present in



FIGURES 11–16. *Alcyonidium torquatum* n. sp., from Caraguatatuba, São Paulo, Brazil; **11–13**, MZUSP 839, holotype; **11**, colony encrusting octocoral axis; **12**, autozooids; **13**, close-up of erect portion of the colony; **14–16**, MZUSP 840, paratype; **14**, colony encrusting octocoral axis; **15**, autozooids; **16**, close-up of two expanded tentacle crowns showing setigerous collar attached to base of tentacle crown and intertentacular organs. Scale bars: **11**, 1 cm; **12**, **15**, 0.6 mm; **13**, 0.4 mm; **14**, 5 mm; **16**, 0.3 mm.

older portion of colonies. Zooid openings marked by raised oral papillae c. 0.16–0.25 mm in diameter, with ringed striations; orifice about 0.04–0.06 mm. Polypides translucent, off white to light yellow; campanulate tentacle crown with 14–17 (often 16) stiffly held tentacles, c. 0.400 mm long. Expanded polypides showing a striking setigerous collar, a funnel-like corolla projecting outward around the tentacle crown base. Small intertentacular organs present. Eggs not observed.

Supplementary video. <http://cifonauta.cebimar.usp.br/taxon/alcyonidium-torquatium>.

Remarks. *Alcyonidium torquatium* n. sp. is characterized by polypides with 14–17 tentacles, a prominent setigerous collar and a small intertentacular organ. Colonies of this species occur on the firm parts of hydroids and octocorals and can be distinguished from *Alcyonidium vitreum* n. sp. by the presence of a noticeable setigerous collar around the base of the tentacle crown. *Alcyonidium torquatium* n. sp. is closely related to *Alcyonidium hauffi*, but is distinguished by its larger autozooid size, greater tentacle length (c. 0.400 mm in *A. torquatium* n. sp. vs 0.330 in *A. hauffi*) and the occurrence of larger kenozooids in older, rather than younger, parts of the colony.

Distribution. Brazil: São Paulo state (Caraguatatuba).

Alcyonidium polypylum Marcus, 1941a

(Figs 17–25; Table 1)

Alcyonidium polypylum Marcus, 1941a: 63, figs 27–30, 35–37; Marcus 1941b: 26, fig. 25; Winston 1982: 106, fig. 2; Vieira *et al.* 2008: 9 (checklist); Migotto *et al.* 2011: 269; ?Winston & Hayward 2012: 12, fig. 5.

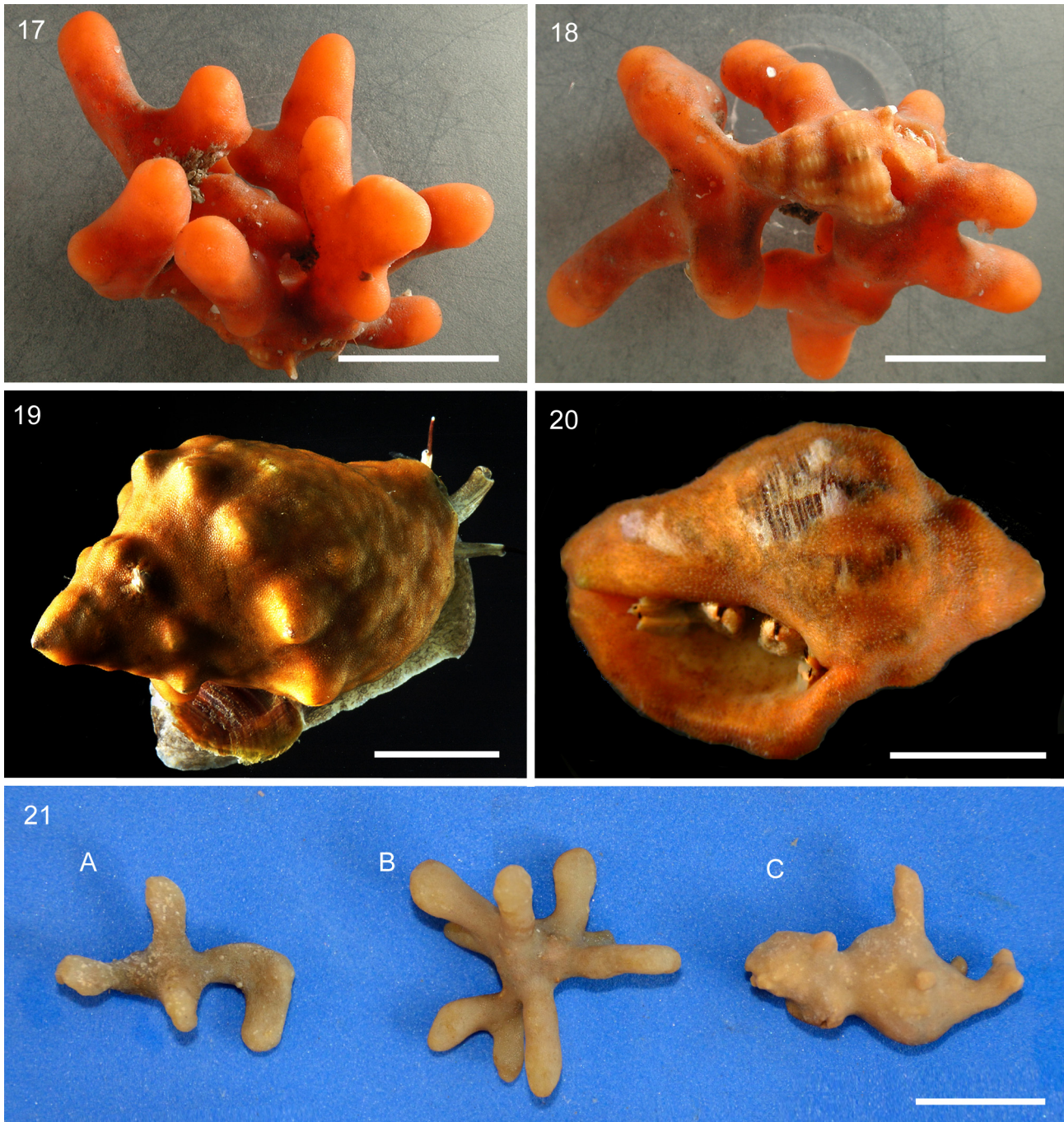
Material examined. *Lectotype* (chosen here): NHMUK 1948.2.16.13, *Alcyonidium polypylum*, E. Marcus det., Santos, São Paulo, Brazil. *Additional specimens*: MZUSP 806, R.V. ‘Soloncy Moura’, Plano de Manejo ICMBio/Alcatrazes, 06 October 2011, Alcatrazes, São Sebastião, São Paulo, Brazil, 45 m, on gastropod shell. MZUSP 807, C.M. Cunha coll., 23 November 2011, Ponta da Praia, Santos, São Paulo, Brazil, on gastropod shells. MZUSP 808, BIOTA/FAPESP, Station 21i, BRY 135, 22 April 2001, Caraguatatuba, São Paulo, Brazil, 20 m, on gastropod shell. MZUSP 809, BIOTA/FAPESP, Station 22i, BYR 289, 22 April 2001, J.E. Winston det., Caraguatatuba, São Paulo, Brazil, 35 m, on gastropod shell. MZUSP 810, BIOTA/FAPESP, Station 41i, dredge, BRY 454, 11 June, 2001, J.E. Winston det., Ubatuba, São Paulo, Brazil, 15 m, on gastropod shell. MZUSP 859, 11 December 2013, A.E. Migotto coll., Cigarras, São Sebastião, on gastropod *Thais haemastoma* (Linnaeus).

Description. Colony orange to brownish-red, initially encrusting; larger colonies becoming erect in rounded lobes and branches. Colony surface smooth, clean, without deposition of sediment or debris. Zooids irregularly polygonal, variable in shape and size. Zooid frontal walls somewhat translucent, but not transparent, with inconspicuous zooidal margins. Rarely, small kenozooids filling in spaces between autozooids. Orifices c. 0.04–0.06 mm in diameter, not raised on large papillae. Polypides with obliquely truncate tentacle crown with 14–15 tentacles, curving outward at tips. Large intertentacular organs present. Eggs not observed.

Supplementary video. <http://cifonauta.cebimar.usp.br/taxon/alcyonidium-polypylum>.

Remarks. Marcus (1941a) described *Alcyonidium polypylum* from Brazil (São Paulo and Paraná states), as characterized by large orange to reddish colonies and polypides with tentacle crowns with 14–15 tentacles and a large intertentacular organ. The British species *Alcyonidium diaphanum* (Hudson, 1778) also has inconspicuous zooidal margins and 14–16 tentacles, but it is a brooding species with lecithotrophic larvae (Porter *et al.* 2001), lacking the intertentacular organs characteristic of *Alcyonidium polypylum*. *Alcyonidium polypylum* occurs in shallow subtidal depths where colonies are associated with the gastropod *Thais haemastoma* (Linnaeus) and empty gastropod shells, including those inhabited by hermit crabs, or are attached to dead shell or rock substrata. Specimens reported from the NE coast of the United States (Winston & Hayward 2012) have larger zooids (0.420–0.764 mm long) and a wider orifice (0.096–0.153 mm wide) than those from Brazil; these specimens require reinvestigation and may belong to a different species.

Distribution. Western Atlantic: At least from São Paulo to Paraná, Brazil (Vieira *et al.* 2008). Records from the USA (Winston 1982) are of colonies with zooids similar in size to those of Brazilian colonies (0.47 x 0.34 mm) and with large intertentacular organs. Colonies from the NE coast of the USA are much larger (Winston & Hayward 2012) and likely represent a different species.



FIGURES 17–21. *Alcyonidium polypylum* Marcus, 1941a, from Caraguatatuba, São Paulo, Brazil; **17–18**, multilaminar colony encrusting an empty gastropod shell; **19–20**, unilaminar colonies on gastropod shell (**19**) and on a shell occupied by a hermit crab (**20**); **21**, colonies on gastropod shells (A, MZUSP 808; B, MZUSP 809; C, MZUSP 810). Scale bars: **17–21**, 2 cm.

***Alcyonidium exiguum* n. sp.**

(Figs 26–28; Table 1)

Material examined. *Holotype*: MZUSP 837, L.M.Vieira, A.E. Migotto, K.B. Nascimento and B.S. Aguiar coll., 11 October 2011, 23°41'24.1" S, 45°25'46.9" W, Praia do Porto Novo, Caraguatatuba, São Paulo, Brazil, intertidal, on *Amathia* sp.

Etymology. Latin *exiguus*, small, little, in allusion to the small size of the autozooids and tentacle crowns.

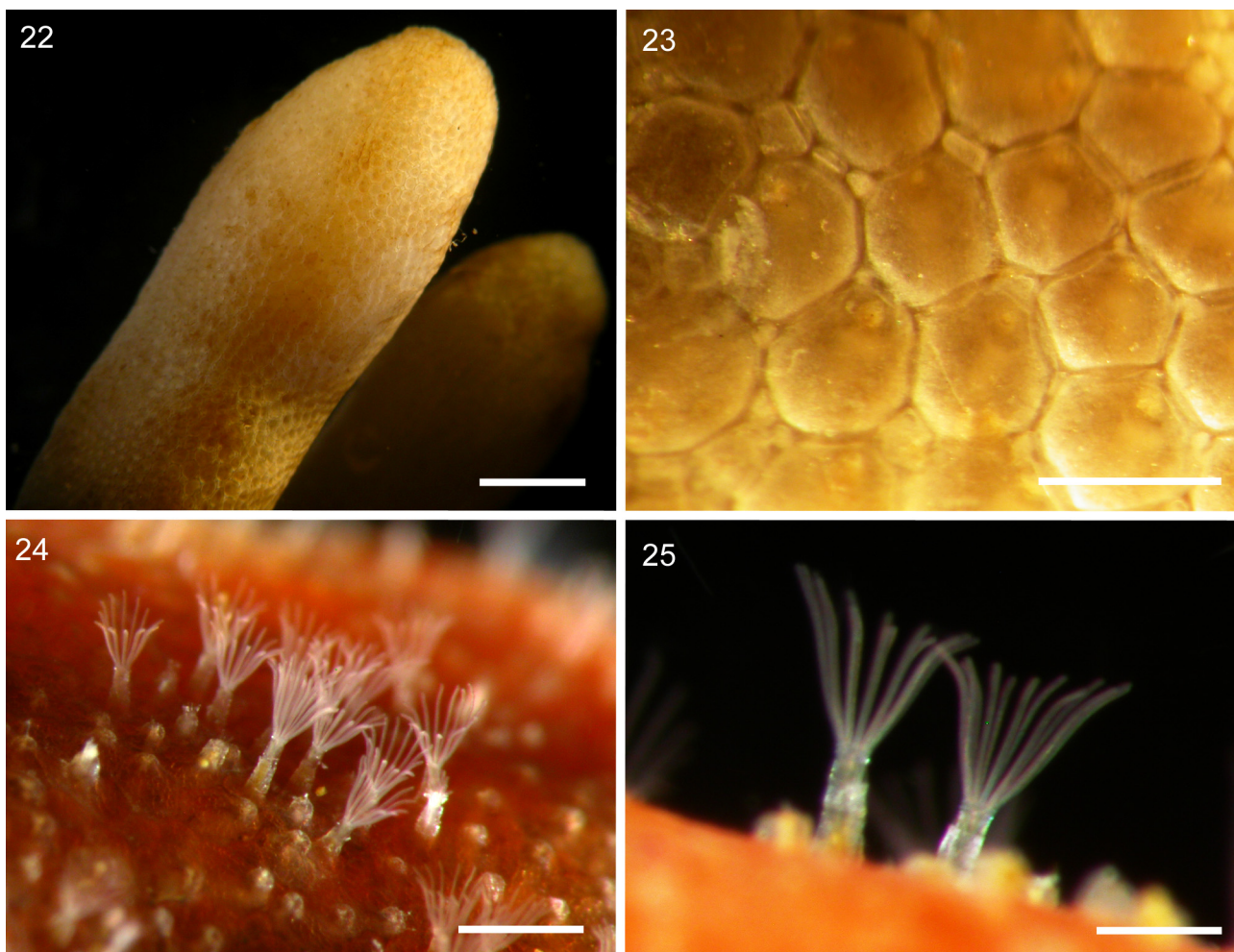
Description. Colony small, whitish, encrusting around the stolon of *Amathia* sp. in a single layer. Zooids

small, about 0.3 mm long, irregularly polygonal, with transparent frontal walls and inconspicuous zooidal margins. Orificial papillae can form an inconspicuous wrinkled knob c. 0.09 mm at the distal part of the zooid. Kenozooids absent. Polypides translucent-white; campanulate tentacle crown with 11–13 stiff, straight tentacles about 0.170–0.240 mm long, and with a short and inconspicuous setigerous collar. Mode of sexual reproduction unknown.

Supplementary video. <http://cifonauta.cebimar.usp.br/taxon/alcyonidium-exiguum>

Remarks. *Alcyonidium exiguum* n. sp. is distinguished from its congeners by its inconspicuous single-layered colonies, small zooids, and polypides with 12–13 short stiff tentacles. *Alcyonidium capronae* Winston & Hakånsson, 1986 from Florida, USA, also has small colonies, but can be distinguished by its larger, semi-erect zooids and its apparent restriction to cupuladriid bryozoans as substrata. A single colony of *Alcyonidium exiguum* n. sp. was found on a stolon of the bryozoan *Amathia* sp.

Distribution. Brazil: São Paulo (Caraguatatuba).



FIGURES 22–25. *Alcyonidium polypylum* Marcus, 1941a, from Caraguatatuba, São Paulo, Brazil; **22–23**, MZUSP 809; **22**, branch; **23**, close-up of zooidal surface, with small kenozooids; **24**, zooids with expanded tentacle crowns; **25**, close-up of two expanded tentacle crowns. Scale bars. **22**: 2 mm; **23**, **24**: 0.4 mm; **25**: 0.2 mm.

***Alcyonidium pulvinatum* n. sp.**

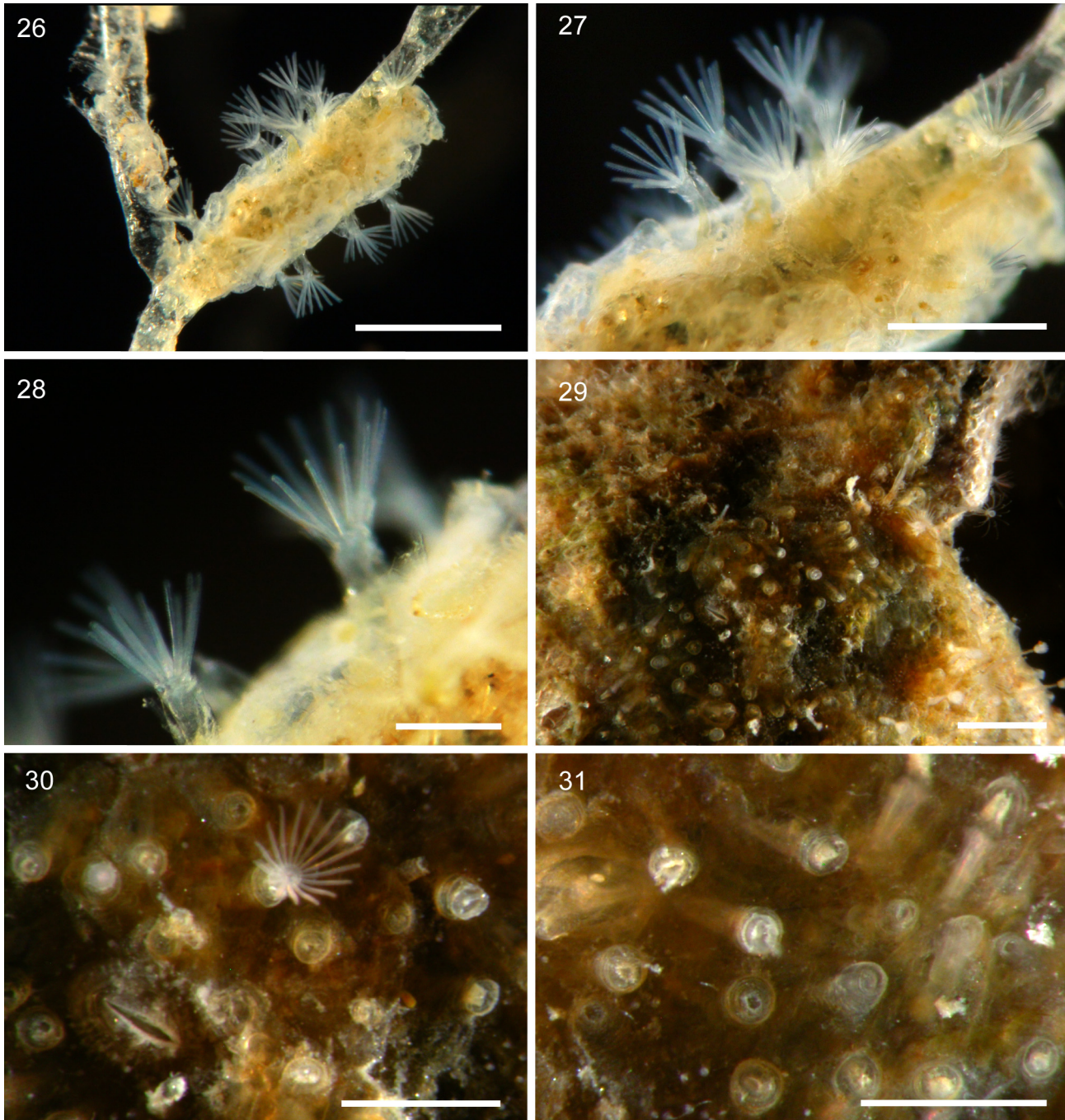
(Figs 29–31; Table 1)

Alcyonidium mamillatum: Marcus 1937: 126, pl. 25, fig. 67; 1939: 162, pl. 13, fig. 25A–C; 1941b: 26, fig. 24; Vieira *et al.* 2008: 8 (checklist); Migotto *et al.* 2011: 269. Not *Alcyonidium mamillatum* Alder, 1857.

Material examined. *Holotype*: MZUSP 838, A.E. Migotto and J.E. Winston col, 21 January 2005, 23°38'4.76"S,

45°23'31.03"W, Pier Pontal da Cruz, São Sebastião, São Paulo, Brazil. *Paratype*: NHMUK 1948.2.16.15, *Alcyonidium mamillatum*, E. Marcus det., Santos, São Paulo, Brazil. *Additional material*: MZUSP (three badly preserved balsam slides), *Alcyonidium mamillatum*, E. Marcus det., slides n. 547–548, Santos, São Paulo, Brazil. MZUSP (one badly preserved balsam slide), *Alcyonidium mamillatum*, E. Marcus det., slides n. 725, Santos, São Paulo, Brazil. MZUSP (six badly preserved balsam slides), *Alcyonidium mamillatum*, E. Marcus det., slides n. 961–953, Santos, São Paulo, Brazil.

Etymology. Latin *pulvinatus*, cushioned, pillow-like.



FIGURES 26–28. *Alcyonidium exiguum* n. sp., MZUSP 837, holotype, from Caraguatatuba, São Paulo, Brazil; **26**, small colony encrusting *Amathia* sp.; **27**, group of zooids with tentacle crowns expanded; **28**, close-up of two expanded tentacle crowns. **FIGURES 29–31.** *Alcyonidium pulvinatum* n. sp., MZUSP 838, holotype, from São Sebastião, São Paulo, Brazil; **29**, small colony encrusting substratum; **30**, group of zooids, one with expanded tentacle crown; **31**, group of zooids with retracted tentacle crowns. Scale bars: **26, 29**, 1 mm; **27**, 0.5 mm; **28**, 0.2 mm; **30, 31**, 0.6 mm.

Description. Colony encrusting, with a bumpy appearance owing to prominent conical oral papillae of zooids; colony surface translucent to transparent, but usually fouled greenish or brownish by algal films. Zooids forming unilaminar sheets to anastomosing lobes, zooid outline subhexagonal to oval, with distinct margins, walls translucent to transparent; white tentacles of polypides visible inside; frontal surface flat except for area around orifice, which is raised into long, transversely wrinkled papilla c. 0.14–0.16 mm diameter. Polypides translucent white; campanulate tentacle crown with 17–18 straight tentacles and a twitchy active behavior pattern. Large kenozooids present in anastomosing areas or in colony lobes. Mode of reproduction not known.

Remarks. Marcus (1937) called his unilaminar specimens *Alcyonidium mamillatum* Alder, 1857, a species described and known from cold-water regions of the North Atlantic Ocean. Twelve specimens identified by E. Marcus were found: one is deposited at NHMUK (1948.2.16.15) and ten other badly preserved specimens in balsam on glass slides are deposited at MZUSP (see material examined). *Alcyonidium mamillatum* is characterized by brownish zooids with 16–18 tentacles and lacks the relatively large connecting kenozooids that are found in anastomosing regions of the Brazilian colonies. *Alcyonidium pulvinatum* n. sp. forms encrusting, irregular patches a few millimeters to centimeters in size or encircling cylindrical substrata such as hydroid stolons, algal stipes, large bryozoans like *Amathia* spp., and shells.

Distribution. Brazil: São Paulo and Paraná (= *Alcyonidium mamillatum* sensu Marcus 1937, 1941b).

Alcyonidium vitreum n. sp.

(Figs 32–34; Table 1)

Alcyonidium polyoum: Marcus 1937: 125, pl. 25, fig. 66A,B [part; only Santos, Brazil]; 1941a: 68 [part; only Santos, Brazil]; Vieira *et al.* 2008: 8 (checklist). Not *Sarcochiton polyoum* Hassall, 1841.

Alcyonidium sp1 Migotto *et al.* 2011: 269.

Alcyonidium sp. Marques *et al.* 2013: 271.

Material examined. *Holotype*: MZUSP 836, BRY 576, A.E. Migotto and J.E. Winston coll., 31 January 2005, 23°48'50" S, 45°24'41" W, Araçá Bay, São Sebastião, São Paulo, Brazil. *Paratype*: NHMUK 1948.2.16.16, *Alcyonidium polyoum*, E. Marcus det., Santos, São Paulo, Brazil. *Additional material*: MZUSP (six balsam slides badly preserved), *Alcyonidium polyoum*, E. Marcus det., slides n. 541–543, Santos, São Paulo, Brazil.

Etymology. Latin *vitreus*, glassy.

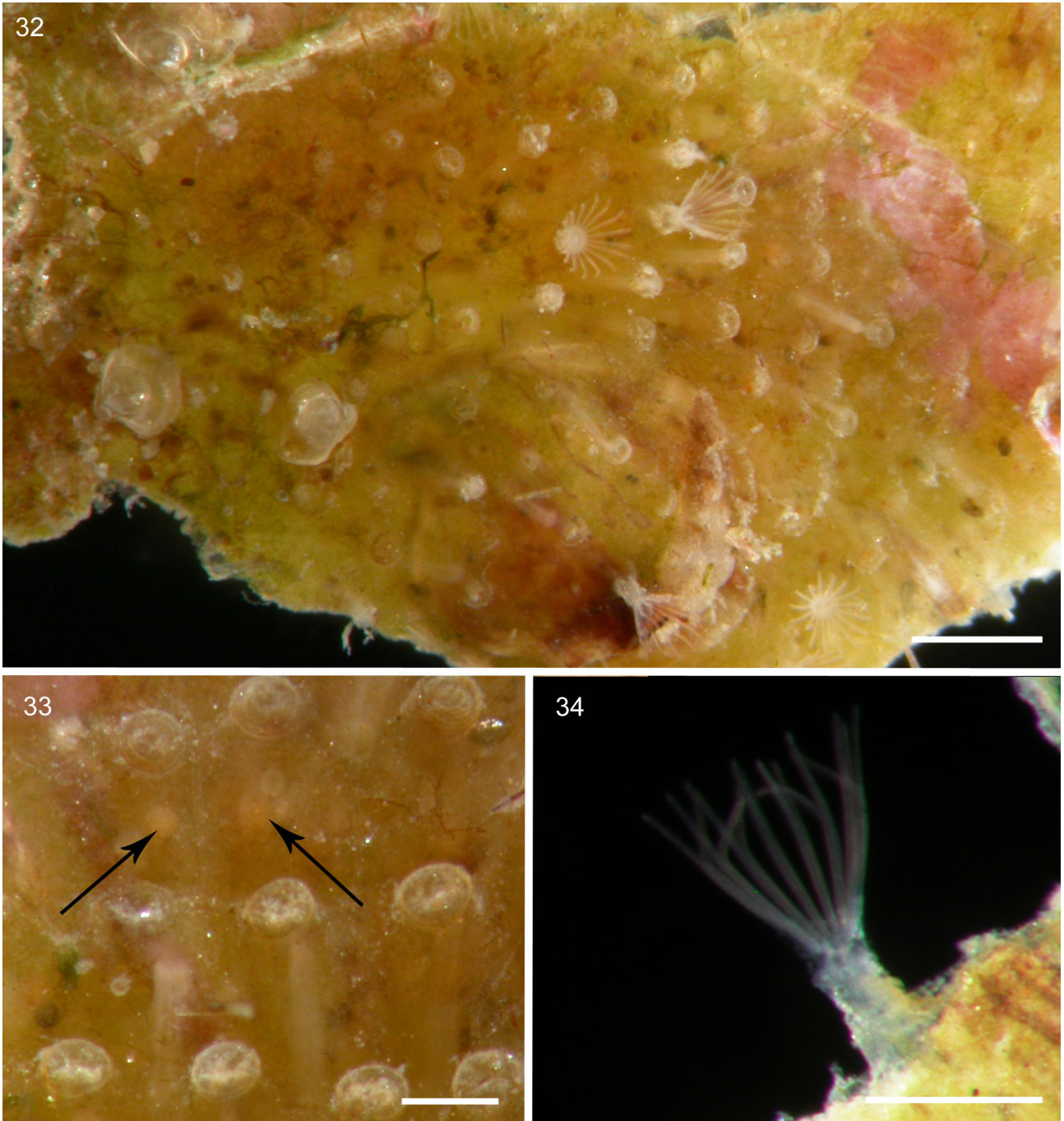
Description. Colony encrusting, unilaminar, transparent at growing edge, but with frontal membranes of zooids becoming increasingly fouled by filamentous algae, diatoms, and other organisms as colonies age. Zooids transparent, hexagonal distally, rounded-hexagonal proximally, with distinct margins. Orifice of each zooid indicated by slightly raised, rounded papilla, c. 0.10 mm diameter. Polypides and internal structures visible inside unfouled zooids. Kenozooids absent. Polypides translucent white; campanulate tentacle crown c. 0.46–0.50 mm in diameter with 14–16 tentacles. Reproduction characterized by internal brooding. Eggs light orange.

Remarks. In morphology, tentacle number and size characteristics the São Paulo material (from São Sebastião) agrees with Marcus's (1937) description of putative *Alcyonidium polyoum* from the Bay of Santos. The balsam-slide specimens from Santos deposited at MZUSP and identified by Marcus were lost, but some specimens identified by him were sent to A.B. Hastings and deposited at NHMUK (M.E. Spencer Jones, pers. comm. 2010).

The name *A. polyoum* has been used for many flat encrusting species of *Alcyonidium* (Ryland & Porter 2003). The colonies found in São Paulo, herein described as *Alcyonidium vitreum* n. sp., are characterized by transparent zooids, translucent white polypides with 14–16 tentacles and light orange eggs. *Alcyonidium polyoum* Hassall, 1841 from Great Britain is characterized by 18–21 tentacles and buff embryos (Ryland & Porter 2006). *Alcyonidium albescens* Winston & Key, 1999 is distinguished from *A. vitreum* n. sp. in having small kenozooids between the autozooids and wider orificial papillae (0.15 mm in *A. albescens* vs 0.10 mm in *A. vitreum* n. sp.).

Alcyonidium vitreum n. sp., like *A. polyoum*, has colonies a few millimeters to centimeters in size, encrusting as an inconspicuous transparent or fouled layer, often visible only when tentacle crowns expand. It is found in shallow water, encrusting shell, rock, bryozoans, barnacles, and other hard substrata.

Distribution. Brazil: São Paulo.



FIGURES 32–34. *Alcyonidium vitreum* n. sp., MZUSP 836, holotype, from São Sebastião, São Paulo, Brazil; **32**, colony; **33**, group of retracted zooids showing oral papillae marking closed orifices, with white tentacles of polypides visible beneath frontal walls; eggs developing inside zooids (arrows); **34**, close-up of one expanded tentacle crown. Scale bars: **32**, 0.6 mm; **33**, 0.3 mm; **34**, 0.4 mm.

Suborder Victorellina Jebram, 1973

Superfamily Victorelloidea Jebram, 1973

Family Nolellidae Harmer, 1915

Genus *Nolella* Gosse, 1855

Nolella sawayai Marcus, 1938

(Figs 35–39; Table 2)

Nolella sawayai Marcus, 1938: 52, pl. 12, fig. 30; Vieira *et al.* 2008: 9 (checklist); Migotto *et al.* 2011: 269; Marques *et al.* 2013: 272.

Material examined. *Neotype* (chosen here): MZUSP 802, 22 July 2009, 23°48'4.76" S, 45°23'31.03" W, PETROBRAS Pier, São Sebastião, São Paulo, Brazil. *Additional specimens*: MZUSP (badly preserved balsam slides; holotype has been destroyed), *Nolella sawayai*, E. Marcus det., slide n. 901, Santos, São Paulo, Brazil. MZUSP 801, BRY 618, 16 February 2005, 23°48'4.76" S, 45°23'31.03" W, PETROBRAS Pier, São Sebastião, São Paulo, Brazil. MZUSP 803, 22 July 2009, 23°48'4.76" S, 45°23'31.03" W, PETROBRAS Pier, São Sebastião, São Paulo, Brazil. MZUSP 804, 30 January 2005, 23°49'29.03" S, 45°25'11.53" W, Pitangueiras, São Sebastião, São Paulo, Brazil.

Description. Colony comprising a loose to dense network of sac-like zooids with a flattened adherent proximal portion and an erect tubular portion; zooids connected to each other by stoloniform elongations about 0.04 mm wide. Each zooid has several connections, resulting in a network of neighboring zooids. Transparent cuticle of zooid with cuticularized spiny projections all over (including the stolon portion); these projections inconspicuous and sparse in young zooids. Polypides with campanulate tentacle crown and 14–15 thin tentacles bent outward at tips.

Supplementary video. <http://cifonauta.cebimar.usp.br/taxon/nolella-sawayai>.

Remarks. The original material of *Nolella sawayai* was destroyed (slide n. 901 deposited at MZUSP), therefore we have selected a neotype for the species (MZUSP 802).

Vieira *et al.* (2008) listed four species of *Nolella* for Brazil: *Nolella stipata* Gosse, 1855, *Nolella dilatata* (Hincks, 1860), *Nolella alta* (Kirkpatrick, 1888) and *Nolella sawayai* Marcus, 1938, which can be distinguished from each other by differences in zooid length, shape of basal prolongations and presence or absence of slender spines on zooidal surfaces.

Nolella sawayai was described by Marcus (1938) from shallow waters of southeastern Brazil (São Paulo state). Colonies of this species consist of a dense or loose network of zooids as described above; the coating of sediment that clings particularly to the erect portions of zooids, makes the colony look like a series of muddy projections on the surfaces of the shell or other surfaces it encrusts. The sediment must be brushed away and the colony examined under a dissecting microscope for the cuticularized zooidal spines to be apparent.

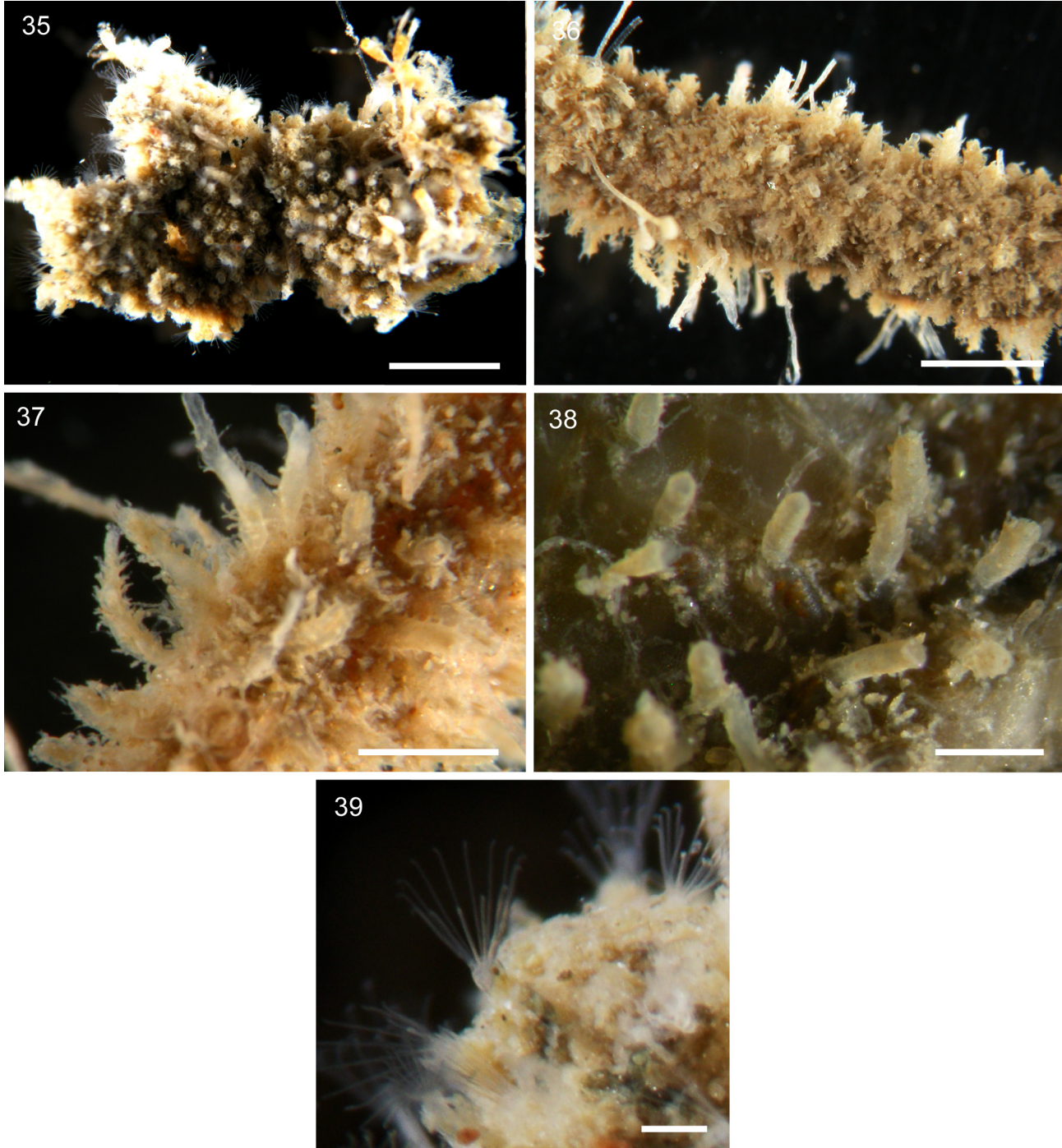
The other *Nolella* species from São Paulo state all lack cuticularized spines. *Nolella alta* (Kirkpatrick, 1888) has very long, slender zooids reaching 9 mm in length, with zooids in the erect portion of colonies budding from each other much like those of *Anguinella palmata* van Beneden, 1845, but with radicles at the proximal end of each autozooid. Marcus (1937) recorded *Nolella gigantea* (Busk, 1856) in shallow waters of São Paulo state but this species is considered to be a junior synonym of *Nolella stipata* Gosse, 1855.

Nolella stipata has been considered a common shallow-water species in the Western Atlantic by several authors (e.g. Winston 1982; Vieira *et al.* 2007, 2008; Winston & Hayward 2012). Marcus (1938) differentiated the Brazilian specimens from *Nolella dilatata* (Hincks, 1860), described from Ireland and also recorded in the Adriatic (Hayward & McKinney 2002), through the presence of tubular zooids arising from substrata, and connected by very slender tubes, but without the distinct dilated basal portion characteristic of *N. dilatata*. Winston (1982), following Soule in Osburn (1953), synonymized *N. stipata* and *Nolella dilatata*, but as more recent work has shown, *N. dilatata* has a transversely wrinkled ectocyst and an expanded basal region with slender tubular prolongations (see Hayward & McKinney 2002).

Osburn (1940) recorded both *N. dilatata* and *N. gigantea* in the Caribbean, with *N. gigantea* creeping over shells, algae, hydroids and bryozoans. However, Soule in Osburn (1953) synonymized both species, considering them as two ecological variants of *N. stipata*, in which colonies attaching on algae or hydroids have fewer basal dilatations (*gigantea* form) than those attaching to hard substrata (*dilatata* form). In looking at living colonies from the Western Atlantic we have found variations in zooids (e.g. length, width, shape of orifice and basal prolongations) and polypides (e.g. number and color of tentacles) in colonies previously identified as *Nolella stipata* and *Nolella gigantea* (see also Winston & Hayward 2012, p. 20). We conclude that *Nolella stipata* most likely represents a species group including two or more species, rather than a single widespread species, which occurs in tropical to warm-temperate waters. The specimens recorded as *N. dilatata* by Marcus (1938) belong to *Panolicella brasiliensis* n. sp. (see below).

Colonies of two *Nolella* species, *Nolella elizae* n. sp. and *Nolella stipata*, found in the littoral of São Paulo attached to hard substrata, algae and hydroids, lack basal dilatations in zooids and have one to four slender tubular extensions at proximal ends of zooids, connecting adjacent autozooids. Characteristically, São Paulo specimens have long zooids, forming dense groups of zooids on substrata. They are described below.

Distribution. Brazil: São Paulo.



FIGURES 35–39. *Nolella sawayai* Marcus, 1938, from São Sebastião, São Paulo, Brazil; **35**, MZUSP 802, Neotype, colony; **36–37**, MZUSP 801; **36**, colony on algae; **37**, close-up of zooids showing transparent spiny cuticular projections of tubular zooids; **38**, young colony on stone; **39**, MZUSP 802, Neotype, close-up of tentacles. Scale bars. **35**: 1.5 mm; **36**: 1.0 mm; **37**, **38**: 0.5 mm; **39**: 0.1 mm.

TABLE 2. Comparative characteristics of *Nolella* species included in present study. Measurements (in mm): mean (SD) [min–max].

	<i>Nolella elizae</i> n. sp.	<i>Nolella stipata</i>	<i>Nolella sawayai</i>
Zooids	cylindrical and erect	cylindrical and erect	cylindrical, with basal flattened adherent region
Zooidal surface	smooth	smooth	spinous
Zooidal length	1.847 (0.307) [1.343–2.226]	2.282 (0.469) [1.535–3.186]	0.521 (0.151) [0.285–0.760]
Zooidal width	0.252 (0.032) [0.192–0.307]	0.187 (0.029) [0.133–0.247]	0.139 (0.012) [0.114–0.152]
Orifice	circular	circular	circular
Connection of zooids	with delicate basal elongations	with delicate basal elongations	expanded, with dense network
Tentacle number	20–22	18–22	14–15
Tentacle color	light orange	translucent white	translucent white
Embryo color	orange	yellow	unknown

Nolella stipata Gosse, 1855

(Figs 40–42; Table 2)

Nolella stipata Gosse, 1855: 35, pl. 4, fig. 29; Hayward 1985: 88, fig. 26; Migotto *et al.* 2011: 269.

?*Farrella gigantea* Busk, 1856: 93, pl. 5, figs 1–2.

Nolella gigantea: Marcus 1937: 131, pl. 26, fig. 70; 1939: 114, 269 (larvae); 1955: 313.

Nolella sp. Marques *et al.* 2013: 272.

Material examined. MZUSP 816, BRY 531, A.E. Migotto and J.E. Winston coll., 31 January 2005, 23°49'5.38" S, 45°24'20.83" W, Araçá Bay, São Sebastião, São Paulo, Brazil, intertidal, on stone. MZUSP 817, L.M. Vieira and A.E. Migotto coll., 07 July 2009, 23°48'5.2" S, 45°24'20.8" W, Ilha do Pedroso, Araçá Bay, São Sebastião, São Paulo state, Brazil, intertidal, on oyster shells. MZUSP 818, L.M. Vieira and A.E. Migotto coll., 07 November 2011, 23°48'5.2" S, 45°24'20.8" W, Ilha do Pedroso, Araçá Bay, São Sebastião, São Paulo state, Brazil, intertidal, on stones. MZUSP 819–821, 824, L.M. Vieira and A.E. Migotto coll., 12 October 2011, 23°48'5.2" S, 45°24'20.8" W, Ilha do Pedroso, Araçá Bay, São Sebastião, São Paulo state, Brazil, intertidal, on oyster shells. MZUSP (balsam slide specimen n. 756), *Nolella gigantea*, E. Marcus det. Santos, São Paulo, Brazil. MZUSP 827, BIOTA/FAPESP, Station 178ia, BRY 465, 19 August 2002, 23°23'43" S, 44°50'57" W, Ubatuba, São Paulo, Brazil, 7 meters, on rocks. MZUSP 828, BIOTA/FAPESP, BRY 528, A.E. Migotto and J.E. Winston coll., 30 January 2005, 23°49'29.03" S, 45°25'11.53" W, Pitangueiras, São Sebastião, São Paulo, Brazil, shallow water. MZUSP 829, BIOTA/FAPESP, Station 175ib, BRY 461, 29 August 2002, 23°24'41" S, 44°55'14" W, Ubatuba, São Paulo, Brazil, 8 m, on stone. MZUSP 830, BIOTA/FAPESP, BRY 255, 10 April 2001, 23°46' S, 45°39' W, between Baleia e Ilha dos Gatos, São Paulo, Brazil, on algae. MZUSP 831, F.L. Silveira coll., 07 July 2009, 26°49'5.38" S, 48°24'20.83" W, Praia Preta, São Sebastião, São Paulo, Brazil, on algae. MZUSP 832, L.M. Vieira coll., 12 December 2009, 23°48'4.76" S, 45°23'31.03" W, Pier Pontal da Cruz, São Sebastião, São Paulo, Brazil. NHMUK 1948.2.16.77, *Nolella gigantea*, E. Marcus det. Santos, São Paulo, Brazil.

Description. Colony comprising narrow tubular zooids, variable in length and usually connected by 1–4 basal stoloniform elongations, very narrow relative to zooid size. Individual zooids cylindrical, brownish in color, with an almost opaque cuticle obscured by particles of sediment and debris. Orifice flat at top of zooid tube, often square in outline. Polypides with campanulate tentacle crown and 18–22 thin tentacles. Yellow embryos brooded in zooids, upper portions of which may then become slightly dilated.

Supplementary video. <http://cifonauta.cebimar.usp.br/taxon/nolella-stipata>.

Remarks. The muddy tubes of the zooids resemble tubes of polychaetes or amphipods, and often go unrecognized unless tentacle crowns are expanded, but the squared-off orifice shape helps distinguish the tubes as belonging to *Nolella*. Marcus (1937, 1939, 1955) determined this species to be *Nolella gigantea* (Busk, 1856), a synonym of *Nolella stipata* Gosse, 1855, used here. *Nolella elizae* n. sp. differs from *N. stipata* by the size of autozooids, as well the presence of longer light-orange tentacles and orange embryos. It was not possible to

compare tentacle number in specimens from NE Brazil (e.g. Rio Grande do Norte state (MZUSP 641, MZUSP 646) and Ceará (MZUSP 191–193)) identified as *Nolella stipata* (L.M. Vieira, unpubl. data), but they have slightly wider zooids than those from São Paulo. Winston & Hayward (2012) noted that specimens from Virginia have 13 tentacles and specimens from Florida have 17 tentacles; these specimens may belong to distinct species. The specimens from São Paulo have 18–22 tentacles, like those from British Isles (Hayward 1985).



FIGURES 40–42. *Nolella stipata* Gosse, 1855, from São Sebastião, São Paulo, Brazil; **40**, MZUSP 816, colony attached to calcareous nodule; **41**, MZUSP 819, detail of two zooids, one with tentacle crown expanded; **42**, detail of yellow embryos at distal third of peristome. **FIGURES 43–45.** *Nolella elizae* n. sp., MZUSP 833, holotype, from São Sebastião, São Paulo, Brazil; **43**, colony on algae; **44**, close-up (oral region) of zooid with tentacles expanded; **45**, close-up (lateral view) of zooid with tentacles expanded. Scale bars: **40, 41, 44, 45**, 0.5 mm; **42**, 0.2 mm; **43**, 0.3 mm.

The colonies found at São Paulo are characterized by zooids with tall tubes (up to 3.1 mm in height), often clumped together with other benthic organisms on algae, rock or shells in intertidal and shallow subtidal habitats. Colonies may be very inconspicuous, consisting of scattered zooids with their stolonate links almost invisible, or larger and more obvious as dense muddy clumps of zooids on rocks and oyster shells.

Distribution. Cosmopolitan, but this nominal widespread species may actually comprise a species complex.

***Nolella elizae* n. sp.**

(Figs 43–45; Table 2)

Nolella sp. Migotto *et al.* 2011: 269.

Material examined. *Holotype*: MZUSP 833, F.L. Silveira col., 07 July 2009, 23°49'19.08" S, 45°24'38.75" W, Praia Preta, São Sebastião, São Paulo, Brazil, intertidal, on algae. *Paratype*: MZUSP 834, L.M. Vieira and A.E. Migotto coll., 04 November 2009, 26°49'5.38" S, 48°24'20.83" W, Araçá Bay, São Sebastião, São Paulo, Brazil, intertidal, on stones and shells.

Etymology. The species is named for Judith Winston's daughter Eliza, whose strawberry blonde hair matches the tentacles of its tentacle crowns.

Description. Colony comprising narrow tubular zooids, variable in length and connected by very delicate basal elongations. Individual zooids cylindrical, light brown in color, with an almost opaque cuticle, but with the orange colored polypide faintly visible inside the zooecium. Orifice flat at the top of the zooid tube, often squared. Polypides with campanulate tentacle crown and 20–22 large tentacles, light orange in color. Orange embryos brooded inside zooid, in distal third of zooid length.

Supplementary video. <http://cifonauta.cebimar.usp.br/taxon/nolella-elizae>.

Remarks. *Nolella elizae* n. sp. is characterized by tentacle crowns with longer (more than 0.6 mm long) and thicker tentacles than those of most *Nolella* species, more like those found in *Sundanella* species, and tentacle color a light orange rather than transparent white. The colonies are found on algae, rocks and shells, sometimes with other species of *Nolella*.

Distribution. Brazil: São Paulo (São Sebastião).

Genus *Anguinella* van Beneden, 1845

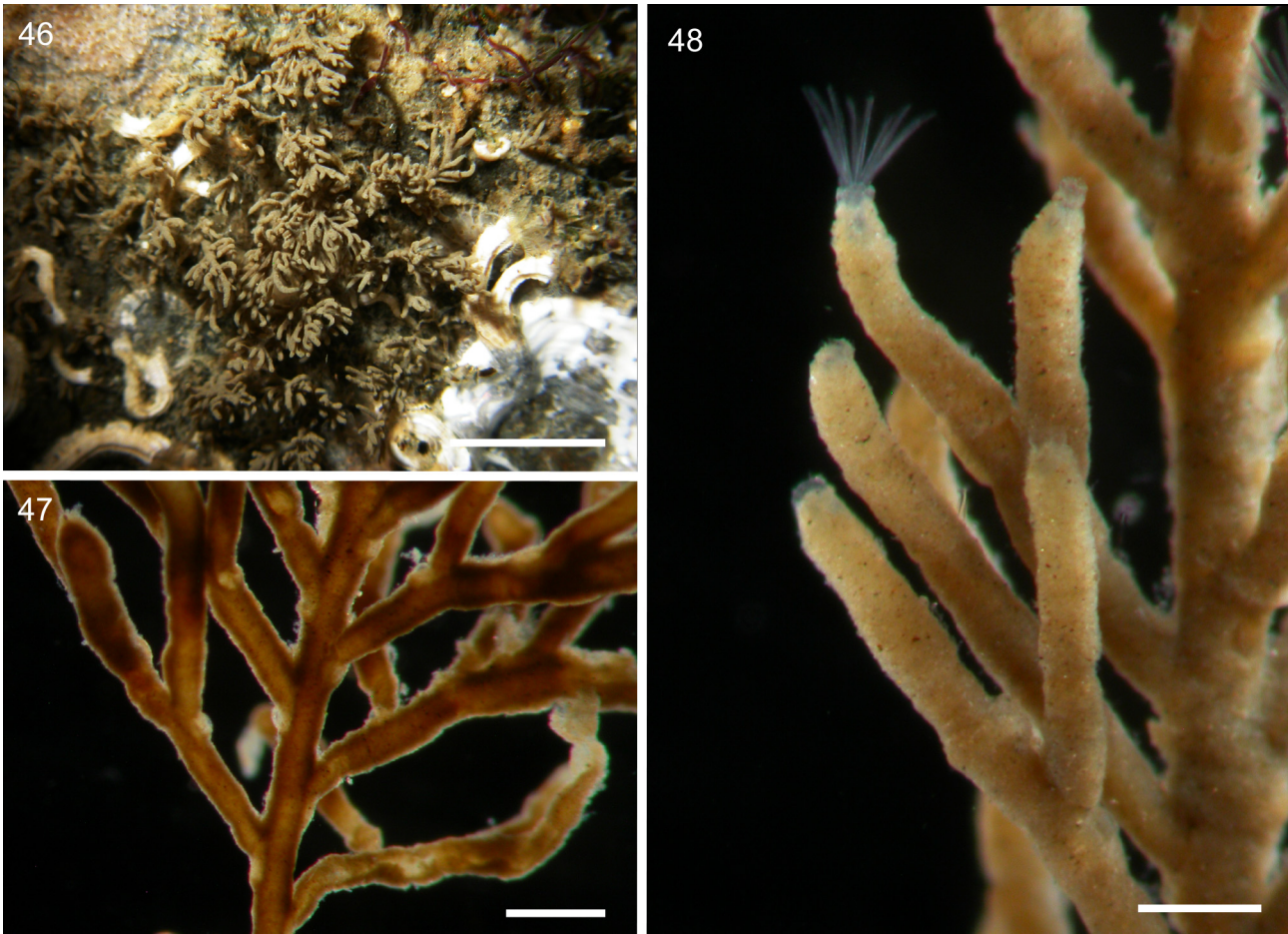
***Anguinella palmata* van Beneden, 1845**

(Figs 46–48)

Anguinella palmata van Beneden, 1845: 34; Marcus 1937: 133, pl. 26, fig. 71A,B; 1941b: 28, fig. 28; Soule *in* Osburn 1953: 738, pl. 78, fig. 4; Shier 1964: 649; Winston 1982: 108, fig. 7; Hayward 1985: 92, fig. 29; Gordon & Mawatari 1992: 11, pl. 5A. Vieira *et al.* 2008: 9 (checklist); Migotto *et al.* 2011: 269; Winston & Hayward 2012: 22, fig. 11; Marques *et al.* 2013: 272; Souto *et al.* 2014: 133, fig. 2D.

Material examined. MZUSP 189, PROCAD/CAPES, L.M. Vieira coll., 25 August 2009, 03 43.47' S, 038 29.63' W, Meirelles, Fortaleza, Ceará, Brazil, on algae. MZUSP 792, BRY 592, 09 February 2005, A.E. Migotto and J.E. Winston col., 23°49'5.38" S, 45°24'20.83" W, Araçá, São Sebastião, São Paulo, Brazil. NHMUK 1948.2.16.66, *Anguinella palmata*, E. Marcus det. Santos, São Paulo, Brazil. MZUSP (four badly preserved specimens), *Anguinella palmata*, E. Marcus det., slides n. 553–554, Santos, São Paulo, Brazil.

Description. Colony comprising a floppy brown tuft resembling a diminutive mud-coated seaweed, anchored to the substratum by rhizoids; branches sometimes in a spiral pattern, grading in length to a pointed tip. A main axis buds primary and secondary zooids. Zooids tubular, 0.7–2.5 mm long and about 0.2 mm wide, with the orifice at the tip of the tube often obscured by the coating of sediment that covers the fragile zooids. Zooids straight to slightly curving towards the colony axis, with proximal translucent knobs. Polypides with campanulate tentacle crown with slightly outward bent tips and 10 short translucent white tentacles. Mode of sexual reproduction unknown.



FIGURES 46–48. *Anguinella palmata* van Beneden, 1845, MZUSP 792, from Araçá, São Sebastião, São Paulo, Brazil; **46**, colonies on hard substratum; **47**, basal region of the colony, showing the growing pattern; **48**, close-up of zooids with one zooid with expanded tentacles. Scale bars: **46**, 5.0 mm; **47**, 0.5 mm; **48**, 0.3 mm.

Remarks. Characteristically, the polypides of *A. palmata* lack a gizzard (Marcus 1937). Most of the zooid tube is peristomial, and new zooids are budded from the peristomes of previous zooids. As in other rooted bryozoan species, the anchoring rhizoids of *Anguinella* are actually kenozooids. Colonies of *A. palmata* found in São Paulo are often misidentified with algae; they have colonies up to 25 mm in height (smaller than those from Britain; see Hayward 1985), covering undersides of rocks with other benthic organisms in intertidal habitats. Marcus (1937) reported this species on wood, algae, barnacles and ascidians in intertidal habitats, while Souto *et al.* (2014) found it at a rocky exposed shore.

Distribution. Western Atlantic: Massachusetts to Brazil. Also reported from European coasts, Africa and the Pacific.

Family Panolicellidae Jebram, 1985

Genus *Panolicella* Jebram, 1985

Panolicella brasiliensis n. sp.

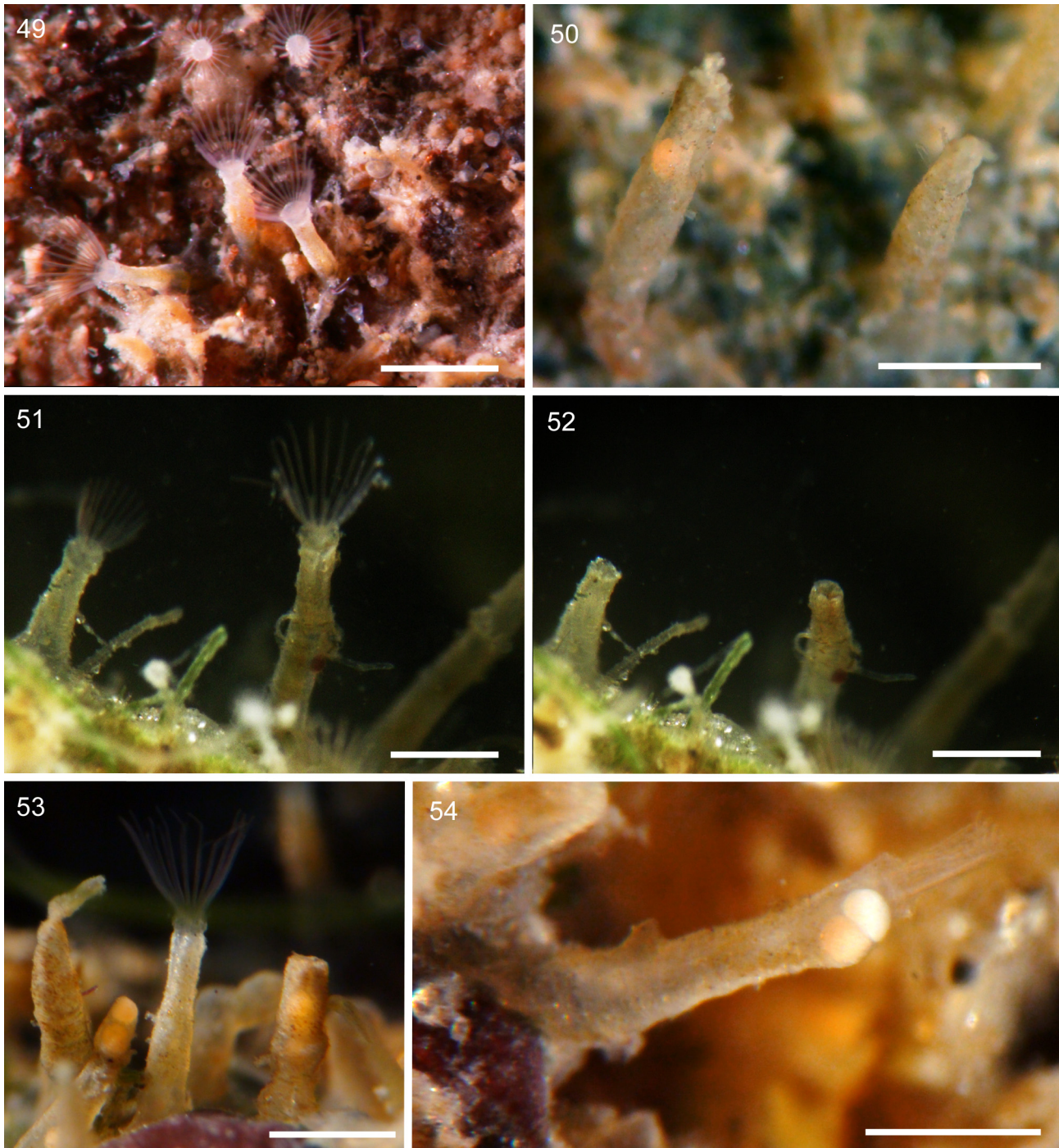
(Figs 49–54)

Nolella dilatata: Marcus 1938: 53, pl. 13, fig. 31. Not *Farrella dilatata* Hincks, 1860.

Material examined. *Holotype*: MZUSP 842 (with *Victorella araceae* n. sp.), L.M. Vieira, A.E. Migotto and J.E. Winston coll., 7 July 2009, 23°49'5.38" S, 45°24'20.83" W, Araçá Bay, São Sebastião, São Paulo, Brazil, intertidal,

on shell. *Paratype*: MZUSP 849 (with MZUSP 847, *Bowerbankia mobilis* **n. sp.**, and MZUSP 848, *Bowerbankia ernsti* **n. sp.**), BRY 591, A.E. Migotto and J.E. Winston, 01 February 2002, 23°49'5.38" S, 45°24'20.83" W, Araçá Bay, São Sebastião, São Paulo, Brazil, intertidal, on stone.

Etymology. Epithet geographical, alluding to the occurrence of the genus *Panolicella* Jebram, 1985 in Brazilian waters.



FIGURES 49–54. *Panolicella brasiliensis* **n. sp.**, from São Sebastião, São Paulo, Brazil; **49**, MZUSP 849, paratype, colony encrusting on stone; **50–52**, MZUSP 842, holotype; **50**, zooid with orange embryos; **51–52**, two zooids with expanded (**51**) and retracted (**52**) tentacles; **53**, fertile colony with embryos and expanded tentacles; **54**, close-up of zooid with two masses of embryos. Scale bars: **49**, 1.0 mm; **50–54**, 0.5 mm.

Description. Colony cryptic, sandy brown in color (erect peristomial region), forming a loose network of autozooids. Individual zooids with an adherent proximal portion with a saccular or slightly flattened frontal

surface, about 0.30 mm long, and an erect tubular distal portion, narrower distally than proximally, about 0.95–1.45 mm long by 0.15–0.23 mm wide when polypides expanded; erect tubular portion may become smaller than 0.50 mm long when polypide retracted. Erect peristomial region continues to grow during life of zooid. Zooids connected to each other by inconspicuous stoloniform elongations, more often distal than lateral. Retracted polypide with squared orifice; expanded polypide exhibits long introvert and tentacle-crown base lacking setigerous collar. Polypides with campanulate tentacle crown and 18–20 tentacles. Ova developing in base of zooid on funiculus; as they mature they move to distal region of zooid and are extruded through an intertentacular pore. Color pinkish to pale orange. Extruded ova seized by tentacles, adhering to outside of peristomial area, but drawn back into the vestibule around tentacle sheath when polypide retracts.

Supplementary video. <http://cifonauta.cebimar.usp.br/taxon/panolicella-brasiliensis>.

Remarks. Jebram (1985) introduced *Panolicella* to accommodate a distinctive ctenostomatous bryozoan with serial zooids connected to each other without a kenozooidal stolon, with the wall of the of tentacle sheath/introvert remaining partially gathered up in a hidden fold when the tentacle crown everts, and with the tentacle crown lacking a setigerous collar at its base. The genus shares some characters with *Nolella*, *Victorella* Saville Kent, 1870 and *Paludicella* Gervais, 1836. Jebram (1985) placed the genus in the superfamily Paludicelloidea because of the similarity of parietal-muscle ontology with *Paludicella*: during zooid development there is a stage in which there is a double row of parietal muscles, well separated from the polypide bud.

Panolicella brasiliensis **n. sp.** is characterized by small, inconspicuous young colonies (sometimes older colonies may be conspicuous, occupying the entire surface of stones and shells), transparent to tan in color, with variably shaped adherent and erect portions; the peristome is small when the polypide is retracted, becoming longer and showing more of the introvert when the polypide is expanded. Polypides have 18–20 tentacles; tentacle crowns bell-shaped like those of species of *Sundanella*. *Panolicella brasiliensis* **n. sp.** differs from *Panolicella nutans* Jebram, 1985 in number of tentacles (7–11 tentacles in *P. nutans*). Marcus (1938) recorded *Nolella dilatata* from São Paulo, also characterized by cylindrical zooids with a dilated encrusting base linked by slender prolongations and the presence of 18–20 tentacles; thus, we believe Marcus's *N. dilatata* is conspecific with *Panolicella brasiliensis* **n. sp.**

Panolicella brasiliensis **n. sp.** was found on stones, often in cryptic habitats between oyster shells and cirripedes; old colonies often cover the entire substratum in association with other benthic organisms. The species can occur with other ctenostomatous bryozoans, such as *Nolella* spp., *Bowerbankia* spp., and *Victorella araceae* **n. sp.**

Distribution. Brazil: São Paulo.

Family Victorellidae Hincks, 1880

Genus *Victorella* Saville Kent, 1870

Victorella araceae **n. sp.**

(Figs 55–60)

Victorella pavidia: ?Marcus 1955: 312, pl. 8, fig. 94; Migotto *et al.* 2011: 269. Not *Victorella pavidia* Saville Kent, 1870.

Victorella sp. Marques *et al.* 2013: 272.

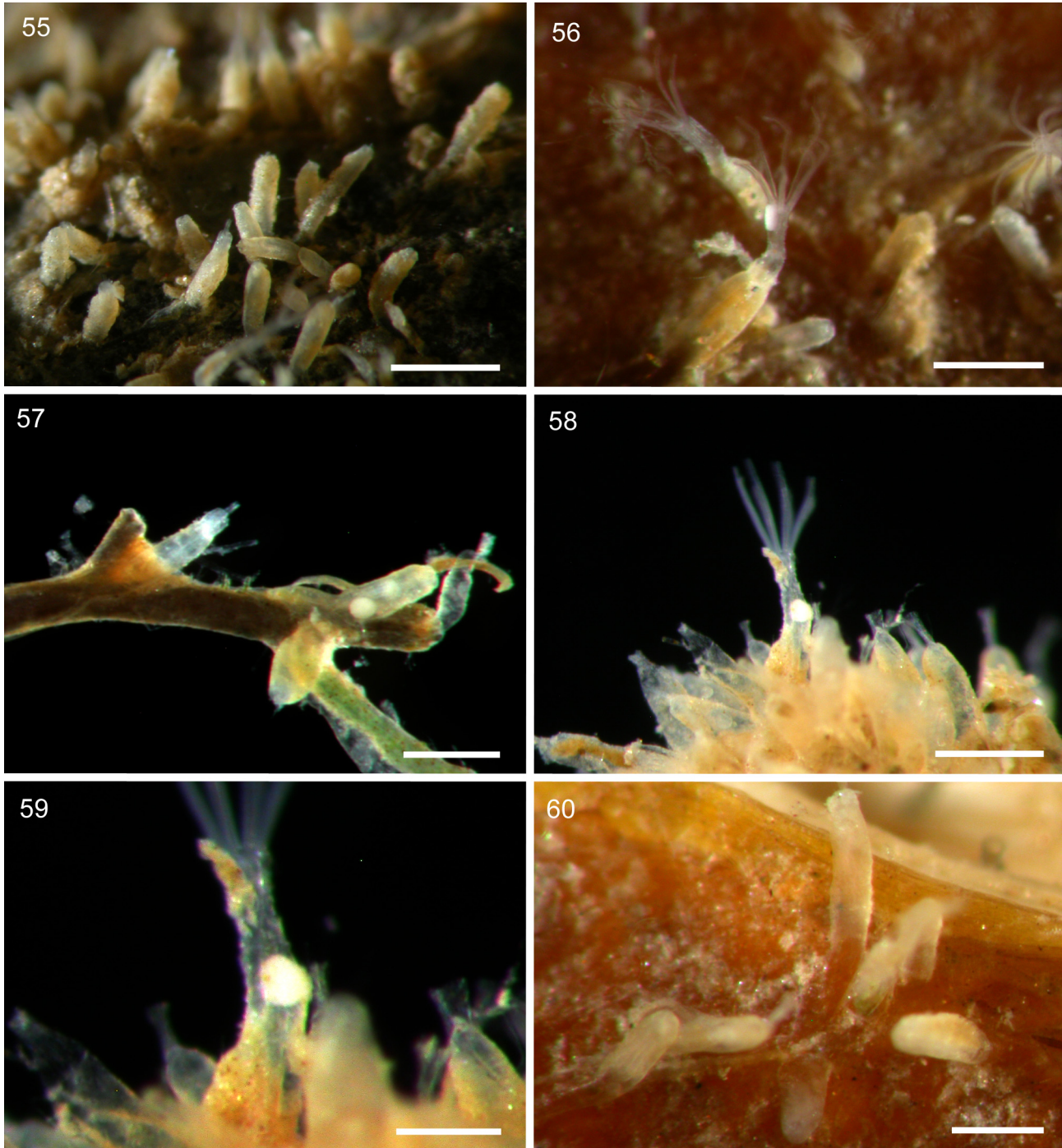
Material examined. *Holotype*: MZUSP 844, BRY 536, 31 January 2005, A.E. Migotto and J.E. Winston coll., 23°49'5.38" S, 45°24'20.83" W, Araçá Bay, São Sebastião, São Paulo, Brazil. *Paratypes*: MZUSP 843 (with *Panolicella brasiliensis* **n. sp.**), L.M. Vieira, A.E. Migotto and J.E. Winston coll., 07 July 2009, 23°49'5.38" S, 45°24'20.83" W, Araçá Bay, São Sebastião, São Paulo, Brazil, intertidal, on shell. MZUSP 845–846, 31 January 2005, A.E. Migotto and J.E. Winston coll., Araçá Bay, São Sebastião, São Paulo, Brazil, intertidal, on shells and algae.

Etymology. Named for the locality where it was collected, the Baía do Araçá, in São Sebastião, São Paulo, *araceae*, of Araçá.

Description. Young colonies forming delicate chains of white to tan zooids, each developing from its predecessor. Individual zooids elongate, occasionally budding additional zooids vertically from peristomes and

horizontally from basal parts of zooids to form dense clusters. Zooids tubular, elongate, about 0.8–1.2 mm in length and 0.15 mm in width; slender proximal pseudostolonal portion encrusting, distal peristomial portion erect. Polypide with campylonemidan tentacle crown, 8 tentacles, and elongate gut. Intertentacular organ present. White embryos brooded in vestibules of zooids.

Supplementary video. <http://cifonauta.cebimar.usp.br/taxon/victorella-araceae>.



FIGURES 55–60. *Victorella araceae* n. sp., from Araçá, São Sebastião, São Paulo, Brazil; **55–56**, MZUSP 844, holotype; **55**, densely budded colony; **56**, zooids with expanded polypides; **57**, MZUSP 846, paratype, diffuse colony on algae; note white eggs in zooid; **58–59**, MZUSP 844, holotype; **58**, single expanded zooid; note the two bent tentacles of the campylonemidan tentacle crown and the white egg; **59**, close-up of the white egg; **60**, young colony on algae. Scale bars: **55**, 0.7 mm; **56–58**, 0.5 mm; **59**, 0.2 mm; **60**, 0.3 mm.

Remarks. Although colonies of *Victorella* superficially resemble those of *Bowerbankia* species, on close examination *Bowerbankia* zooids can be seen to be budded from a kenozooidal stolon and separated from the stolon by a wall containing communication pores, whereas new zooids of *Victorella* develop from a portion of the previous autozooid. *Victorella* species are also distinguished from *Bowerbankia* in having campylonemidan tentacle crowns—i.e. bilaterally symmetrical, with a variable number of tentacles and two abanal tentacles bent outwards (Winston 1978; Hayward 1985; Wood *et al.* 2006)—and intertentacular organs. Although most bryozoans with intertentacular organs spawn eggs that develop in seawater into cyphonautes larvae, some ctenostomes (e.g. *Victorella*, *Nolella*) brood their eggs in a pouch that develops from the outer portion of the tentacle sheath, which when invaginated into the zooid is called the vestibule (Hayward 1985). Colonies may form dense fuzzy masses several millimeters high and covering several centimeters of substratum.

Victorella pavida Saville Kent, 1870, reported from Rio de Janeiro by Marcus (1955), has wider zooids (0.18–0.30 mm) than those from São Paulo; no specimens, however, have been found among other specimens studied by Marcus (deposited at MZUSP and NHMUK), thus it is not possible to assign his specimens from Rio de Janeiro to *Victorella araceae* n. sp. While *Victorella pavida* is found in fresh or brackish water (Hayward 1985), *Victorella araceae* n. sp. occurs in shallow coastal environments where salinity is 30–35 ppt.

Victorella araceae n. sp. was found in sheltered marine conditions near the harbor area of São Sebastião where colonies occurred on rocks, shells, and artificial substrata with other ctenostomatous bryozoans such as *Bowerbankia* spp., *Nolella* spp. and *Panolicella brasiliensis* n. sp. Most *Victorella* species are primarily estuarine, some capable of surviving zero salinity, thus overlapping in distribution with phylactolaemate bryozoans.

Distribution. Brazil: São Paulo (São Sebastião).

Family Sundanellidae Jebram, 1973

Genus *Sundanella* Braem, 1939

Sundanella rosea n. sp.

(Figs 61–64)

Victorella sibogae: Marcus 1937: 129, pl. 25, fig. 68. Not *Victorella sibogae* Harmer, 1915.

Sundanella sibogae: Marcus 1941a: 69, pl. 9, figs 38–43; 1941b: 27, fig. 26; Vieira *et al.* 2008: 9 (checklist); Migotto *et al.* 2011: 269.

Sundanella sp. Marques *et al.* 2013: 272.

Material examined. *Holotype*: MZUSP 835, BRY 532, 31 January 2005, A.E. Migotto and J.E. Winston coll., 23°48'59" S, 45°24'21" W, Araçá Bay, São Sebastião, São Paulo, Brazil, intertidal, on algae. *Paratype*: MZUSP 516, L.M. Vieira, A.E. Migotto and J.E. Winston coll., 07 July 2009, 23°49'5.38" S, 45°24'20.83" W, Araçá Bay, São Sebastião, São Paulo, Brazil. *Additional material*: MZUSP (three balsam slides badly preserved), *Victorella sibogae*, E. Marcus det., slides n. 545–545, Santos and Rio de Janeiro, Brazil

Etymology. Latin *roseus*, rose-colored, alluding to the color of the brooded embryos.

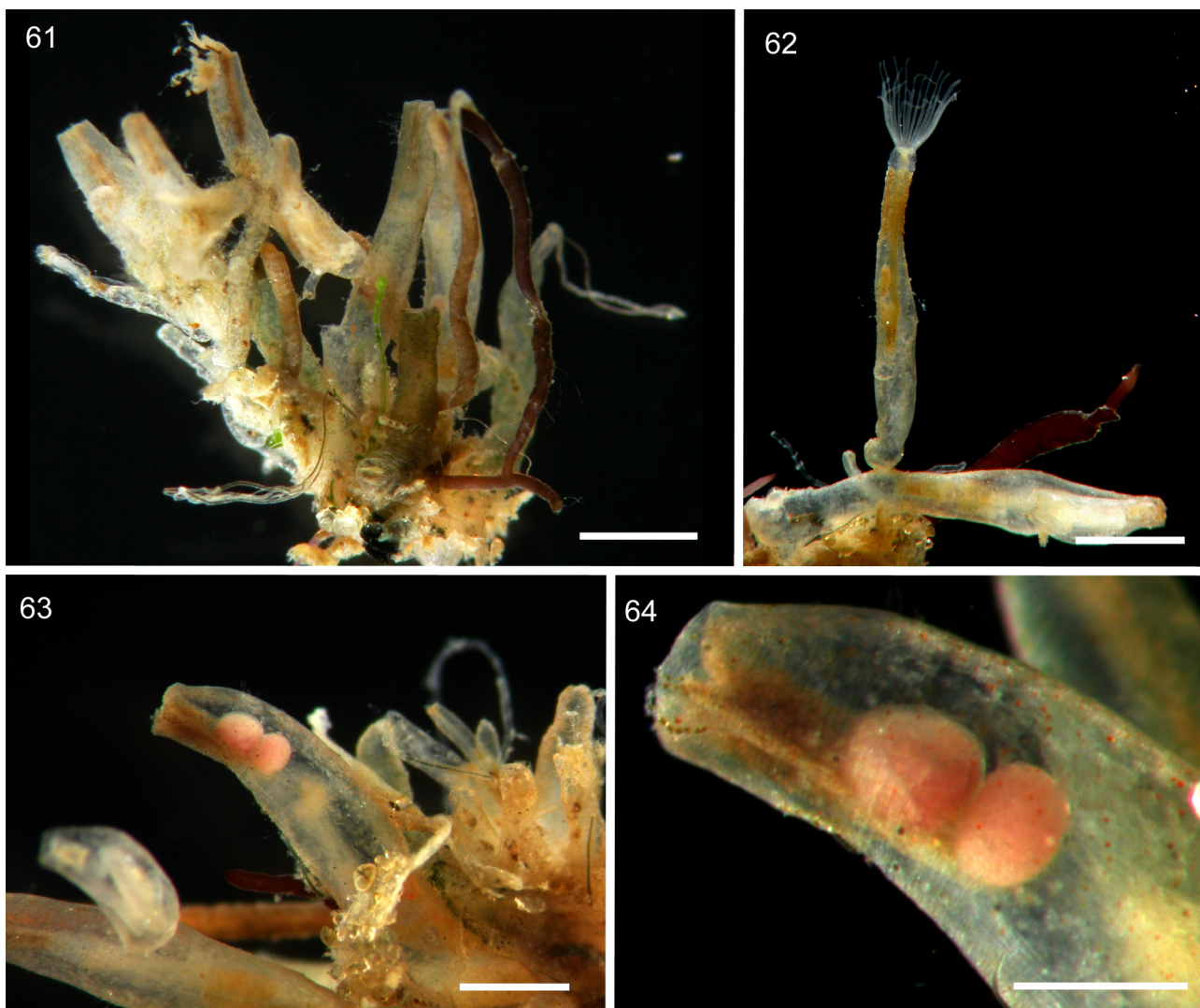
Description. Colonies forming yellowish-brown encrusting chains of zooids, budded directly from each other without true stolons; new buds arising on lateral or proximal side of each zooid. Zooids large, up to 5 mm long (Marcus 1937) and 0.50 mm wide, sac-like, with adherent proximal region and raised distal region ending terminating in narrowed concentrically wrinkled orifice. Polypides very large, with campanulate tentacle crown about 0.85 mm diameter and 31 tentacles. Large pink eggs and embryos brooded in zooids; more than one may be present at a time.

Remarks. Marcus (1937) used the name *Victorella sibogae* Harmer, 1915—described originally from Indonesia and also reported from Africa (Cape Verde Islands to Angola) from about 30 m depth—for Brazilian *Sundanella*, but the latter is a shallow-water resident characterized by larger zooids (to about 5 mm), often forming small and cryptic colonies with other bryozoans and algae. We have examined the slide specimens identified by Marcus from Rio de Janeiro and Santos, but they were destroyed in the balsam.

Harmer (1915) did not mention an exact number of tentacles, only that there were more than 20 tentacles in *Sundanella sibogae*, but Braem (1939) described specimens with 32–34 tentacles. The Brazilian species, here

described as *Sundanella rosea* n. sp., is characterized in having polypides with 31 tentacles and large pink eggs and embryos brooded in zooids. *Sundanella rosea* n. sp. occurs in the low intertidal on algae, shells, hydroids and wood, and may not be tolerant of variable temperature and salinity conditions.

Distribution. Brazil: Rio de Janeiro, São Paulo and Paraná.



FIGURES 61–64. *Sundanella rosea* n. sp., MZUSP 835, holotype, from Araçá, São Sebastião, São Paulo, Brazil; **61**, colony; **62**, two zooids, one with tentacle crown expanded; **63**, close-up of zooid brooding two pink eggs in vestibule; **64**, close-up of the pink eggs in vestibule. Scale bars: **61**, **62**, 1.0 mm; **63**, 0.5 mm; **64**, 0.25 mm.

Suborder Stoloniferina Ehlers, 1876

Superfamily Aevevillioidea d'Hondt, 1983

Family Aevevillidae Jebram, 1973

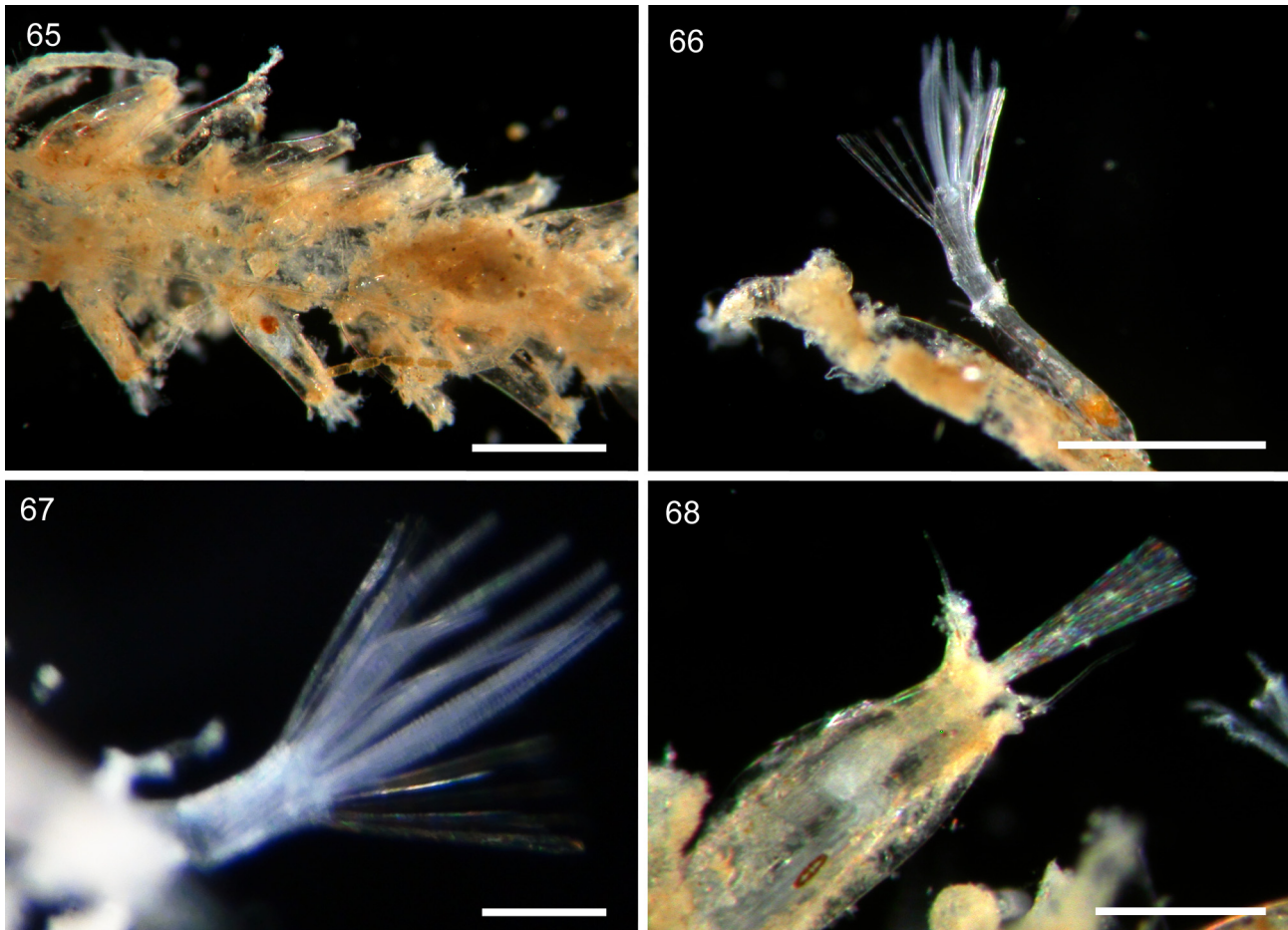
Genus *Aevevillia* Marcus, 1941a

Aevevillia setigera (Hincks, 1887)

(Figs 65–68)

Buskia setigera Hincks, 1887: 127, pl. 12, figs 9–13; Marcus 1937: 142, pl. 29, fig. 76; Osburn 1940: 343.

Aevevillia setigera: Rogick 1945: 201, pls 1–2; Maturo 1957: 26, fig. 16; Soule in Osburn 1953: 745, pl. 79, fig. 8; Shier 1964: 653; Migotto *et al.* 2011: 268; Winston & Hayward 2012: 35, fig. 20F; Marques *et al.* 2013: 271.



FIGURES 65–68. *Aeverrillia setigera* (Hincks, 1881), from São Sebastião, São Paulo, Brazil; **65–66**, MZUSP 791; **65**, part of a colony; **66**, close-up of one zooid with expanded tentacles; **67–68**, MZUSP 855; **67**, close-up of collar and expanded tentacles; **68**, close-up of zooid, showing collar and the acicular cuticularized distal spines. Scale bars: **65, 66**, 0.5 mm; **67**, 0.1 mm; **68**, 0.2 mm.

Material examined. MZUSP 004–005, E. Marcus Collection, no locality given, but presumably Santos, São Paulo, Brazil. MZUSP 188, PROCAD/USP, 25 August 2009, 03°43.47' S, 038°29.63' W, Meireles, Fortaleza, Ceará, Brazil. MZUSP 790, BIOTA/FAPESP, Station 151i, BRY 284, 23 May 2001, 23°41'42" S, 45°17'39" W, Caraguatatuba, São Paulo, Brazil, 15 m. MZUSP 791, BRY 617, A.E. Migotto and J.E. Winston coll., 16 February 2005, 23°48'4.76" S, 45°23'31.03" W, PETROBRAS Pier, São Sebastião, São Paulo, Brazil, 1–7 m. MZUSP 855, A. Morandini coll., 21 November 2013, Enseada, Caraguatatuba, São Paulo, Brazil, on gorgonian *Leptogorgia setacea* (Pallas).

Description. Colony consisting of narrow, well-chitinized, stiff creeping stolon (0.020 mm diameter or less) with zooids budded, usually in pairs, from short kenozooids developed on either side of main stolon. Zooids strongly chitinized and translucent brown in color, flask-shaped, c. 0.58 mm long, 0.20 mm wide, with rounded base and sides and flattened frontal wall tapering to narrow curved orifice surrounded by 4 jointed, acicular cuticular spines, each projecting from conical base. Zooids attached to substratum by anchoring rhizoid-like projections from zooid bases. Polypide with gizzard. Tentacle crown campylonemidan, tentacles 8 tentacles. Setigerous collar very long, stiff, with spiral twisting of collar setae that form the pleats; unfurled collar with delicate transparent membrane that folds like a fan when polypide retracted. Large embryos brooded in zooids.

Supplementary video. <http://cifonauta.cebimar.usp.br/taxon/aeverrillia-setigera>

Remarks. *Aeverrillia setigera* is found in the low intertidal to subtidal zone, usually attached to stems of hydroids but occasionally found on branches of other bryozoans. The species is distinguished from *Aeverrillia armata* (Verrill, 1873) by the presence of clasping chitinous projections from zooid bases that firmly anchor zooids to the substratum.

In retracted or degenerated zooids of *A. setigera*, the setigerous collar is often partially protruded. It is also protruded as a polypide ‘tests’ the water conditions before slowly protruding tentacle crown and introvert and expanding to feed. According to Marcus (1937, p. 142), in rare cases zooids may have eight, rather than four cuticularized spines. Dead or degenerated zooids lose the spines and only the conical bases remain.

Distribution. Widespread in circumtropical areas.

Superfamily Arachnidoidea Jebram, 1973

Family Arachnidiidae Hincks, 1880

Genus *Arachnoidella* d’Hondt, 1983

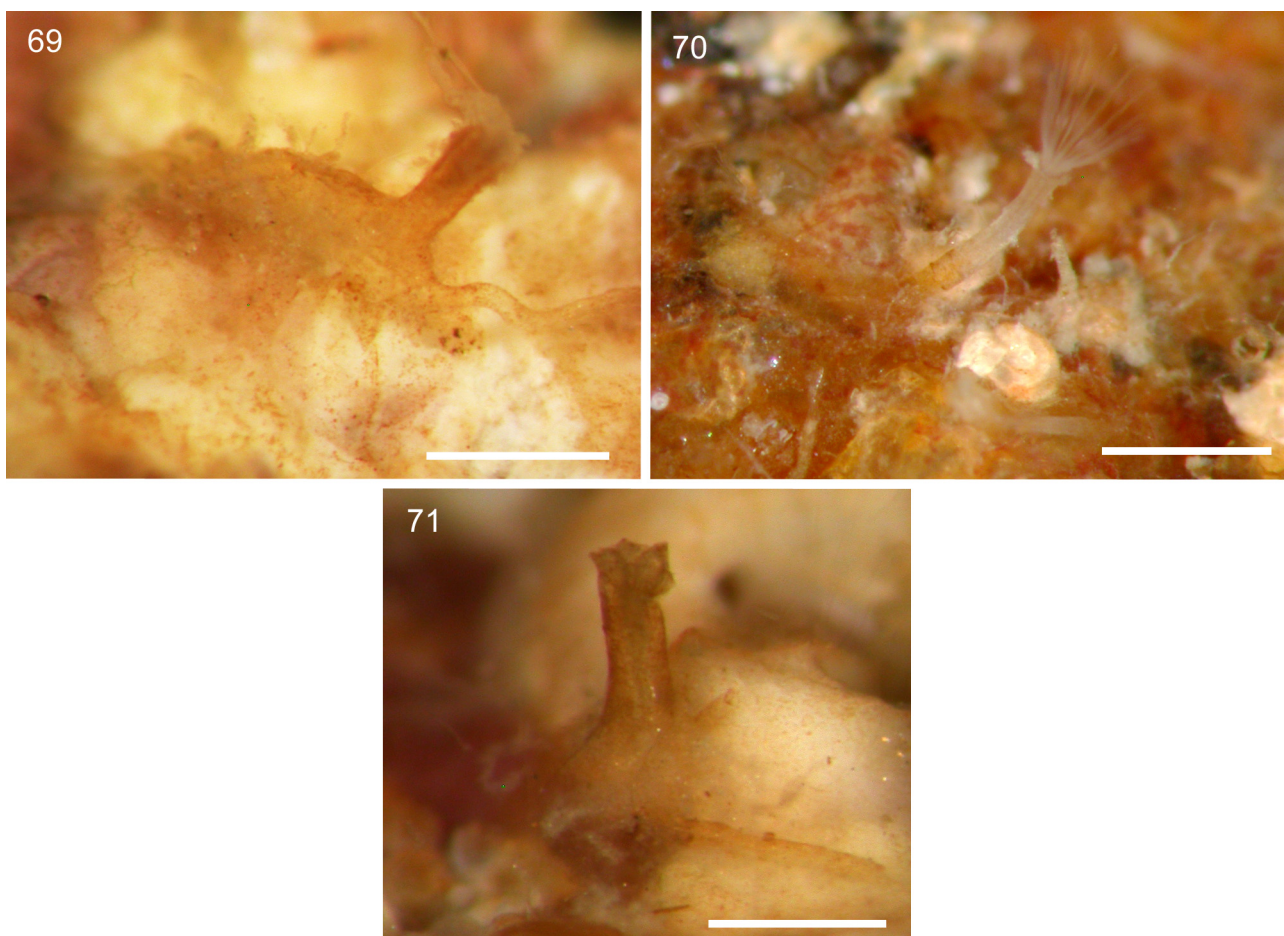
Arachnoidella evelinae (Marcus, 1937)

(Figs 69–71)

Arachnoidea evelinae Marcus, 1937: 130, pl. 26, fig. 69.

Arachnoidella evelinae: Vieira *et al.* 2008: 10 (checklist); Migotto *et al.* 2011: 269; Marques *et al.* 2013: 271.

Material examined. *Lectotype* (chosen here): NHMUK 1948.2.16.50, *Arachnoidea evelinae*, E. Marcus det., Santos, São Paulo, Brazil. *Paralectotypes*: MZUSP (two balsam slides badly preserved), *Arachnoidea evelinae*, E. Marcus det., slide no. 551, Santos, São Paulo, Brazil. *Additional material*: MZUSP 805, BRY 613, 14 February 2005, 23°46’45.42” S, 45°38’46.89” W, Calhetas, São Sebastião, São Paulo, Brazil.



FIGURES 69–71. *Arachnoidella evelinae* (Marcus, 1937), MZUSP 805, from São Sebastião, São Paulo, Brazil; **69**, transparent brown zooid with erect distal regions and adnate proximal regions with stolonate basal extensions; **70**, zooid with tentacle crown expanded; **71**, close-up of orifice. Scale bars: **69**, 0.3 mm; **70**, 0.5 mm; **71**, 0.25 mm.

Description. Colony forming a network of delicate transparent chitinous brown zooids, connected by stolon-like extensions and almost invisible on their substratum. Individual zooids with flattened ovoid adherent portion (c. 0.54–0.70 mm long, 0.34 mm wide) with occasional irregular attachment projections, and a four-sided tubular erect distal portion about 0.16–0.30 mm high. Zooids connected by delicate stolon-like extensions (c. 0.06 mm diameter). Polypides with campanulate tentacle crown about 0.38 mm in diameter, with 16–17 tentacles. Tentacle sheath with chitinous denticles on its wrinkled lower portion and a long setigerous collar, which, when tentacle crown is expanded, extends almost to its base. No information on reproduction.

Remarks. *Arachnoidella evelinae* was described by Marcus (1937) from Santos, São Paulo state. This species is characterized by the long and striking setigerous collar, glistening depending on the light, and by the presence of chitinous teeth on the lower part of the introvert. We have found three specimens studied by Marcus (1937), but two of these have been destroyed in the balsam slide (MZUSP) and it is not possible to see the morphological characteristics; hence, the specimen deposited at NHMUK is selected as lectotype.

Distribution. Brazil: São Paulo.

Superfamily Walkeriodea Hincks, 1880

Family Mimosellidae Hincks, 1877

Genus *Bantariella* Jebram, 1973

Bantariella firmata (Marcus, 1938) n. comb.

(Figs 72–74)

Mimosella verticillata var. *firmata* Marcus, 1938: 57, pl. 14, fig. 34^A,B; 1939: 114.

Mimosella firmata: Vieira *et al.* 2008: 11 (checklist); Migotto *et al.* 2011: 269.

Material examined. *Neotype* (chosen here): MZUSP 794, A.E. Migotto and J.E. Winston coll., 24 January 2005, Canal de São Sebastião, São Paulo, Brazil. *Additional specimens*: MZUSP (badly preserved balsam slide; holotype destroyed), *Mimosella verticillata* v. *firmata*, E. Marcus det., slide n. 908, Santos, São Paulo, Brazil. MZUSP 793, A.E. Migotto and J.E. Winston coll., 24 January 2005, Canal de São Sebastião, São Paulo, Brazil.

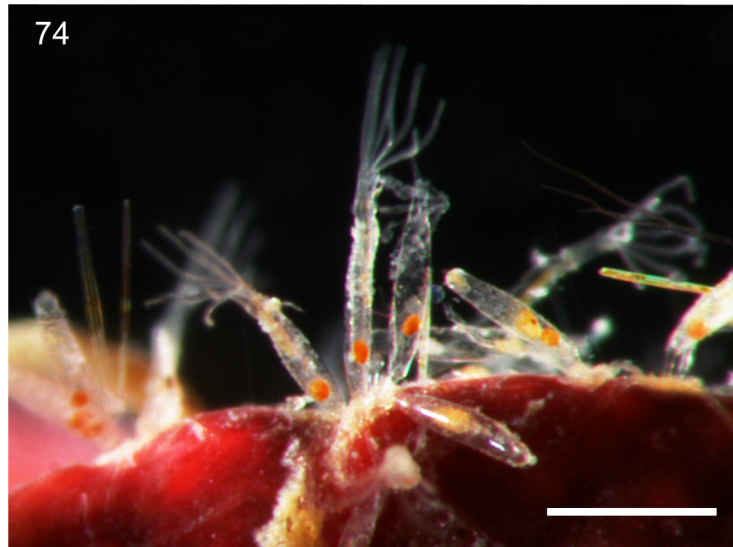
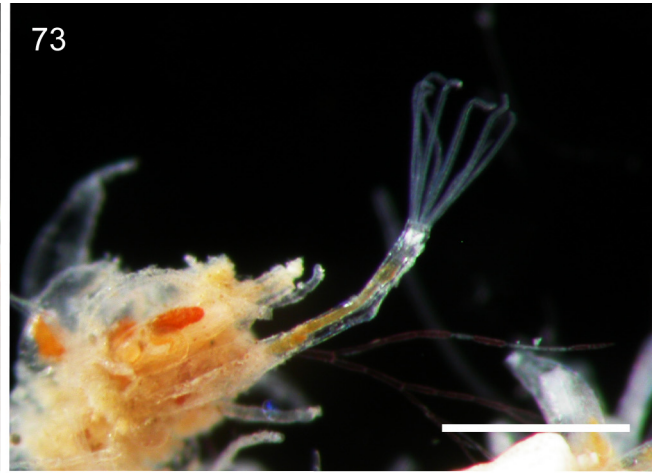
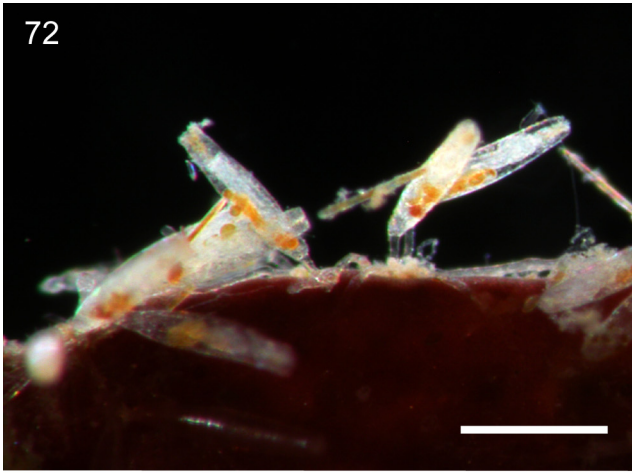
Description. Colony with narrow stolons (c. 0.020 mm diameter) interrupted by clusters of fusiform zooids. These are budded from short kenozooidal peduncles rather than directly from the main stolon, forming a fan-shaped array of 3–5 zooids. Zooids shiny, transparent, well-chitinized, c. 0.60–0.70 mm long, 0.14 mm at widest point, tapering both proximally and distally. Polypides with long setigerous collar, campylonemidan tentacle crown c. 0.34 mm diameter, with 8 translucent white tentacles. Retracted zooids lying parallel to substratum but inclining to vertical position and actively tilting back and forth when tentacle crowns expand.

Remarks. Because the original material of *Mimosella verticillata* var. *firmata* had been destroyed (MZUSP slide n. 908) we have selected a neotype for the species (MZUSP 794).

Jebram (1973) described a new genus, *Bantariella*, distinguished from *Mimosella* Hincks, 1851 by the number of autozooids arising from the kenozooids (paired in *Mimosella*, not paired in *Bantariella*). Later, Gordon (1984) suggested, following Banta (1968) who distinguished two groups of *Mimosella*, assigning to *Bantariella* species of Banta's group 2, those with a creeping main stolon anchored by lateral stolons. Based on both criteria we have reassigned Marcus's *firmata* to *Bantariella*.

Bantariella firmata n. comb. is similar to some Brazilian *Bowerbankia* species in having zooids clustered along a narrow stolon, but it differs from *Bowerbankia* both in the shape of the zooids (those of *Bowerbankia* being rounded at the proximal end rather than pointed) and in its mode of budding from a peduncle attached to the stolon rather than directly from the stolon as do zooids in *Bowerbankia*.

Distribution. Western Atlantic: Florida to São Paulo, Brazil.



FIGURES 72–74. *Bantariella firmata* (Marcus, 1938) **n. comb.**, MZUSP 794, from São Sebastião, São Paulo, Brazil; **72**, rosettes of zooids attached to stolons by short peduncles; **73**, close-up of zooid with campylonemidan tentacle crown; **74**, colony, with some zooids with expanded tentacles. Scale bars all 0.5 mm.

Family Jebramellidae n. fam.

Type genus. *Jebramella* **n. gen.**

Diagnosis. Walkerioidea with very narrow creeping uniserial stolons, ramifying distally at right angles in cruciform pattern. Zooids budding laterally at distal end of stolons, single or paired. Rhizoids and other kenozooids absent. Aperture subquadrangular. Setigerous collar present. Polypide with campylonemidan tentacle crown (bilaterally symmetrical, with abanal pair bent outwards); gizzard absent. Intertentacular organ absent. Yellow embryos brooded externally in evagination of collar, covering orifice when polypide is retracted.

Remarks. We here introduce Jebramellidae **n. fam.** for a single genus and species: *Jebramella angusta* **n. gen. et sp.** This new family is assigned to superfamily Walkerioidea because of the presence of a stoloniferous colony form, polypides with a campylonemidan tentacle crown (characteristic of the majority of species, except Hypophorellidae Prenant & Bobin, 1956), no gizzard and external brooding of embryos. Among the families of Walkerioidea with eight tentacles, viz Walkeriidae Hincks, 1880 (emend. Bassler 1953) and Mimosellidae Jebram, 1973, Jebramellidae is distinguished by having embryos brooded externally in an evagination of the setigerous collar and autozooids budding directly from the main stolons without intervening basal kenozooids.

Genus *Jebramella* n. gen.

Type species. *Jebramella angusta* n. sp.

Diagnosis. Same diagnosis as the family.

Etymology. Honorific for the late Dr Diethardt Horst Armin Jebram (1937–2005), in recognition of his contributions to knowledge of ctenostome anatomy, behavior and taxonomy.

Jebramella angusta n. sp.

(Figs 75–83)

Material examined. *Holotype*: MZUSP 857, 31 March 2014, Gustavo Muniz Dias coll., 23°49'5.38" S, 45°24'20.83" W, Araçá Bay, São Sebastião, São Paulo, Brazil.

Etymology. Latin *angustus*, narrow, alluding to the narrow, inconspicuous stolon, characteristic of the species.

Description. Young colonies inconspicuous, forming delicate chains of translucent zooids, each developing directly from narrow stolon. Stolons inconspicuous, tubular, sometimes with uneven surface, much more slender than autozooids, 0.010–0.018 mm diameter (c. 0.040 mm diameter where zooid is inserted). Individual zooids single or paired, tubular, laterally budded directly from stolon at irregular intervals, c. 0.55–0.75 mm long (up to 1 mm when polypide expanded), 0.070–0.085 mm wide; base of zooid rounded, a short attachment projection opposite stolon insertion. Zooid with 20 transverse parietal muscles. Polypide with campylonemidan tentacle crown, 8 tentacles and elongate gut; tentacles 0.35–0.40 mm long. Collar present, inconspicuous. Intertentacular organ absent. Yellow embryos brooded externally in evagination of collar; a single embryo at a time per zooid; embryo situated on top of zooid, covering orifice, when polypide retracted.

Supplementary video. <http://cifonauta.cebimar.usp.br/taxon/jebramella-angusta>

Remarks. *Jebramella angusta* n. sp. resembles *Bowerbankia* species owing to the presence of a kenozooidal stolon, a similar autozooid shape and a tentacle crown with eight tentacles. It is distinguished, however, by the shape of the tentacle crown (campylonemidan in *J. angusta* n. sp. vs campanulate in *Bowerbankia* spp.) and the position of the embryos (brooded externally in *J. angusta* n. sp. vs internally in *Bowerbankia*). *Walkeria atlantica* Busk, 1886, also reported from Brazil, is distinguished from *J. angusta* n. sp. by its wider stolons (0.02–0.04 mm diameter) and the mode of budding of the zooids on the stolon, being placed on small kenozooids, and by its smaller zooids, attaining only about 0.5 mm long. *Bantariella firmata* differs from *J. angusta* by its zooids being budded from short kenozooidal peduncles and forming a fan-shaped array of three to five zooids.

Jebramella angusta n. sp. was found on stones with other ctenostomatous bryozoans such as *Bowerbankia* spp. and *Panolicella brasiliensis* n. sp. Infertile colonies are inconspicuous on substrata, but stand out when fertile owing to the presence of yellow eggs external to the zooids.

Distribution. Brazil: São Paulo (São Sebastião).

Suborder Vesicularina Johnston, 1838

Superfamily Vesicularioidea Johnston, 1847

Family Vesiculariidae Hincks, 1880

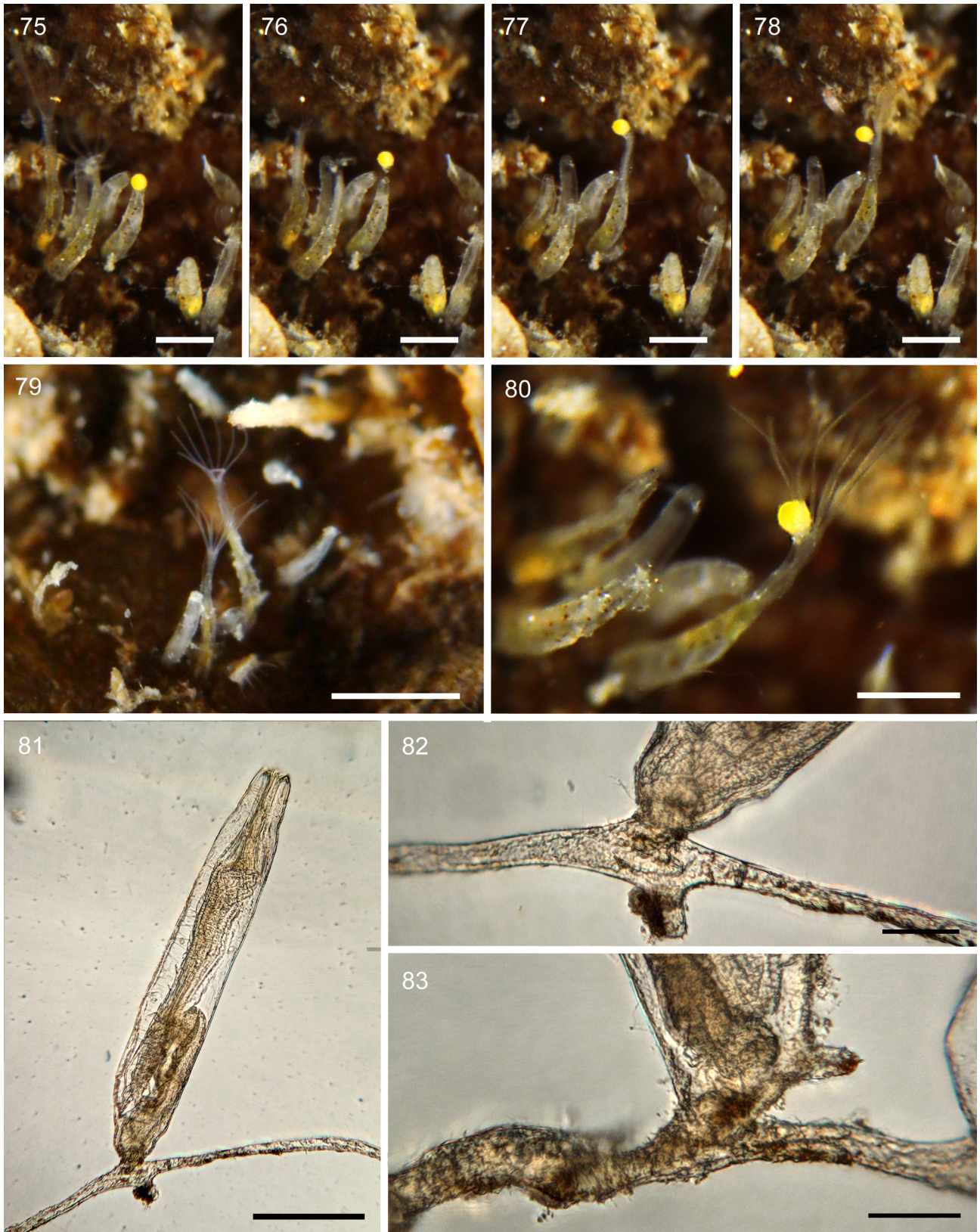
Genus *Amathia* Lamouroux, 1812

Amathia brasiliensis Busk, 1886

Amathia brasiliensis Busk, 1886: 33, pl. 7, fig. 2; Fehlaue-Ale *et al.* 2011: 52, figs 1, 2, 5, 7, 9 (cum syn.); Marques *et al.* 2013: 271.

Remarks. This species was recently redescribed by Fehlaue-Ale *et al.* (2011). It is readily distinguished from *Amathia distans* in having wide stolons about 0.22 mm in diameter.

Distribution. Western Atlantic: Florida to Santa Catarina (Fehlaue-Ale *et al.* 2011).



FIGURES 75–83. *Jebramella angusta* n. sp., MZUSP 857, holotype, from Araçá, São Sebastião, São Paulo, Brazil. **75–78**, fertile colony; note the yellow egg placed distally in the zooid; the eggs are elevated with expansion of tentacle crown (sequence of figures **75**, **76**, **77**, **78** is about 2 seconds apart); **79**, two expanded tentacle crowns; **80**, fertile zooid with expanded campylonemidan tentacle crown and egg; **81**, detail of zooid; **82–83**, lateral insertion points of zooids on stolons; note the basal projection of one zooid (**83**). Scale bars: **75–78**, 0.2 mm; **79**, 0.5 mm; **80**, 0.25 mm; **81**, 0.2 mm; **82**, **83**, 0.05 mm.

Amathia distans Busk, 1886

Amathia distans Busk, 1886: 33, pl. 7, fig. 1; Fehlaue-Ale *et al.* 2011: 56, figs 3, 4, 6, 8, 10 (cum syn.); Migotto *et al.* 2011: 269; Marques *et al.* 2013: 271.

Remarks. This species was recently redescribed by Fehlaue-Ale *et al.* (2011). It is readily distinguished from *Amathia brasiliensis* in having slender stolons 0.09–0.14 mm in diameter.

Distribution. At least from Florida to Paraná in the Western Atlantic; some records from the Pacific and Indian Oceans require reinvestigation (Fehlaue-Ale *et al.* 2011).

Genus *Bowerbankia* Farre, 1837

Bowerbankia ernsti n. sp.

(Figs 84–86)

Bowerbankia gracilis: Marcus 1938: 56, pl. 13, fig. 33A,B. Not *Bowerbankia gracilis* Leidy, 1855.
Bowerbankia sp. Migotto *et al.* 2011: 269.

Material examined. *Holotype*: MZUSP 848 (with MZUSP 847, *Bowerbankia mobilis* n. sp., and MZUSP 849, *Panolicella brasiliensis* n. sp.), A.E. Migotto and J.E. Winston coll., 01 February 2005, 24°49'5.38" S, 46°24'20.83" W, Araçá Bay, São Sebastião, São Paulo, Brazil, intertidal, on stone. *Paratypes*: MZUSP 825 (with MZUSP 824, *Nolella stipata*), L.M. Vieira and A.E. Migotto coll., 12 October 2011, 23°48'5.2" S, 45°24'20.8" W, Ilha do Pedroso, Araçá Bay, São Sebastião, São Paulo state, Brazil, intertidal, on oyster shell.

Etymology. Honorific for Ernst Marcus (1893–1968) for his invaluable contributions to zoology.

Description. Colony forming creeping network of stolons, without erect branches, individual zooids or zooid clusters budded laterally from stolon at irregular intervals, larger colonies having dense clusters. Individual zooids appearing as thick baggy sacs with rounded bases, often with sediment particles clinging to their walls. Each zooid c. 0.40–0.60 mm long, 0.14–0.20 mm wide when contracted. Stolon diameter about 0.08 mm. Polypide with 8 unpigmented tentacles of equal length, diameter of tentacle crown diameter c. 0.36 mm. Setigerous collar short, tubular, inconspicuous when polypide expanded. Embryos mustard yellow, c. 0.10 mm diameter, brooded internally in zooids without functional polypides.

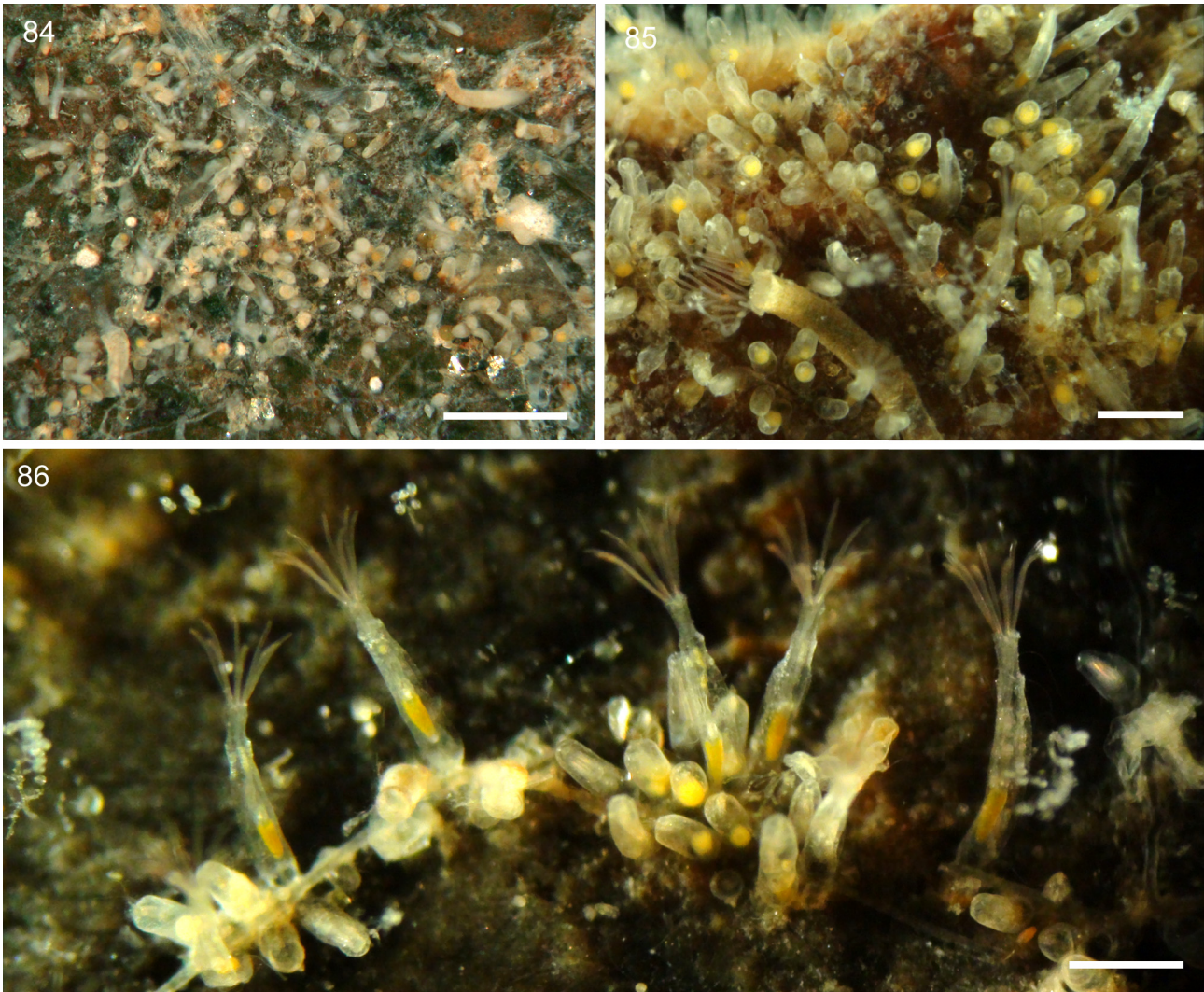
Supplementary video. <http://cifonauta.cebimar.usp.br/taxon/bowerbankia-ernsti>

Remarks. Small unpigmented *Bowerbankia* with eight tentacles have traditionally been called *Bowerbankia gracilis* (Leidy, 1855), but that name can cover a group of species (Waeschenbach, Vieira, Souto, Reverter-Gil, Nascimento & Fehlaue-Ale, unpubl. data). *Bowerbankia gracilis* was described from cold temperate waters in the northwestern Atlantic (Rhode Island, USA). It has probably been introduced to many ports and harbors as a fouling species. However, many similar species, especially in tropical and subtropical regions, are still unnamed and undescribed.

Like *Bowerbankia gracilis* from the northwestern Atlantic and *Bowerbankia maxima* Winston, 1982, from Florida (Winston 1982), the three species here described—viz *Bowerbankia ernsti* n. sp., *Bowerbankia evelinae* n. sp. and *Bowerbankia mobilis* n. sp.—have zooids with 8-tentacled crowns. *Bowerbankia ernsti* n. sp. differs from *B. evelinae* n. sp. and *B. mobilis* n. sp. in having smaller zooids, a slender stolon and mustard-yellow embryos. *Bowerbankia imbricata* (Adams, 1798) also has yellow embryos, but it is distinguished from *B. ernsti* n. sp. in having 10 tentacles (de Blauwe 2009; Winston & Hayward, 2012).

Bowerbankia ernsti n. sp. has small colonies forming inconspicuous microscopic networks; more massive mature colonies may form a brownish fuzz on the substratum, with yellow eggs and embryos brooded in zooids. This species occurs in the mid-intertidal to shallow subtidal on shells, rocks, algae, hydroids, other bryozoans, wood and artificial substrata.

Distribution. Brazil: São Paulo.



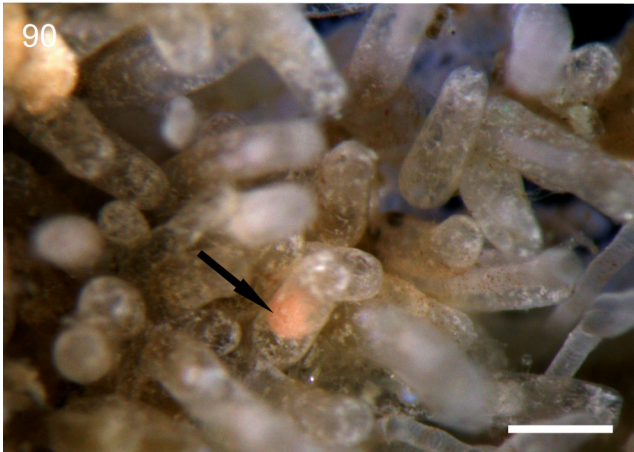
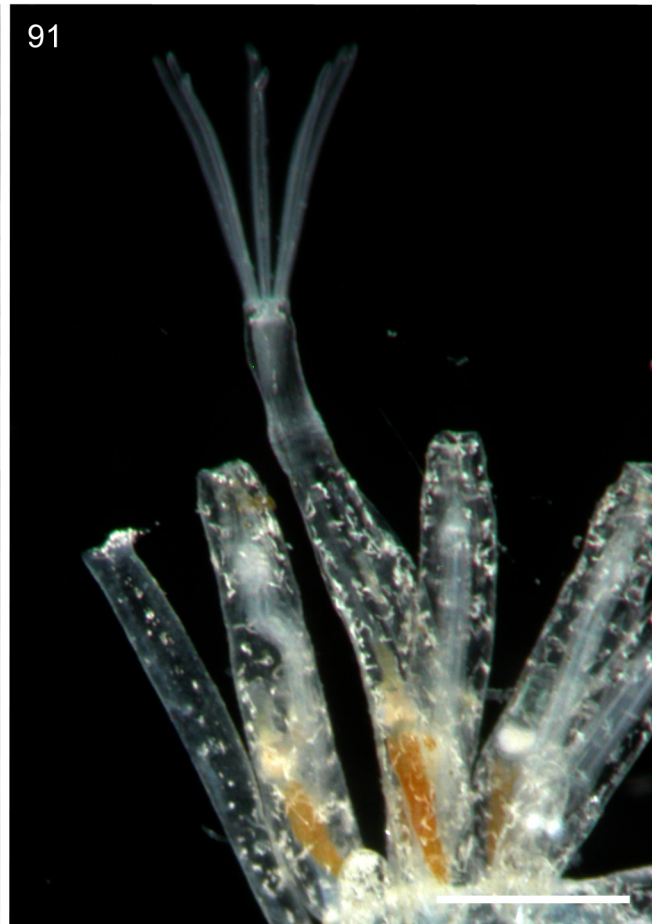
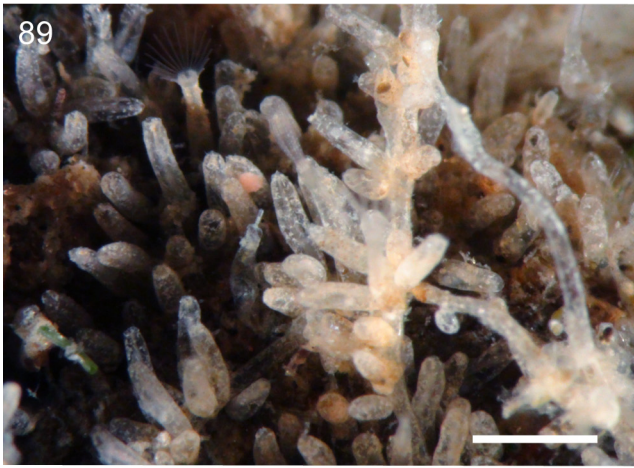
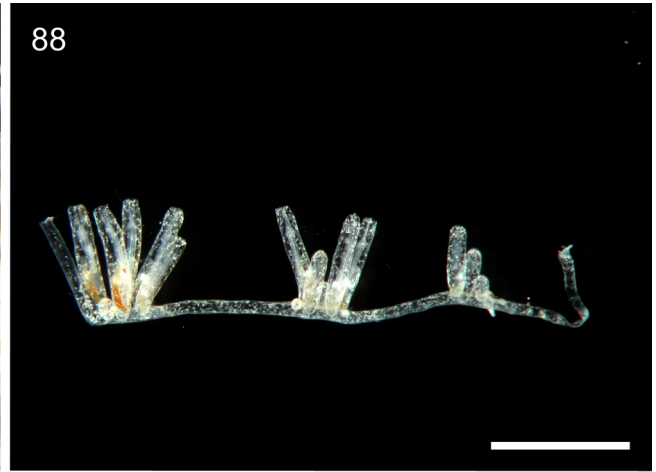
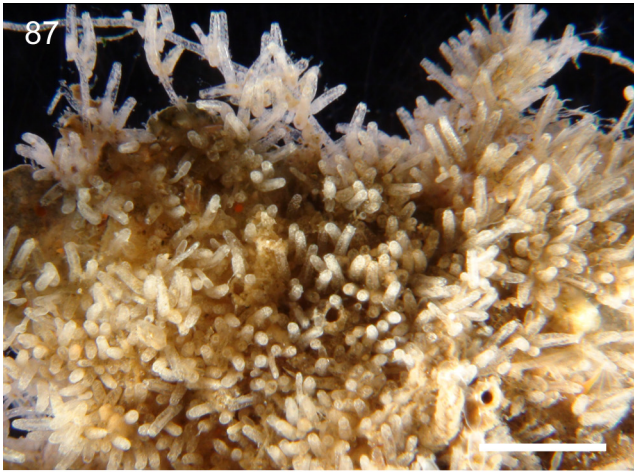
FIGURES 84–86. *Bowerbankia ernsti* n. sp., Araçá, São Sebastião, São Paulo, Brazil. **84**, MZUSP 848, holotype; colony with dense network of zooids and stolons; **85**, colony with yellow embryos; **86**, MZUSP 825, paratype; close-up of zooids with yellow embryos. Scale bars. **84**, 2 mm; **85**, 0.5 mm; **86**, 0.3 mm.

***Bowerbankia evelinae* n. sp.**

(Figs 87–91)

Bowerbankia maxima: Migotto *et al.* 2011: 269; Marques *et al.* 2013: 272. Not *Bowerbankia maxima* Winston, 1982.

Material examined. *Holotype*: MZUSP 850, A.E. Migotto and J.E. Winston coll., 31 January 2005, 24°49'50" S, 46°24'21" W, Araçá Bay, São Sebastião, São Paulo, Brazil, intertidal, on stone (with algae). *Paratypes*: MZUSP 251 (with MZUSP 516, *Sundanella rosea* n. sp.), L.M. Vieira, A.E. Migotto and J.E. Winston coll., 07 July 2009, 23°48'50" S, 45°24'21" W, Araçá Bay, São Sebastião, São Paulo state, Brazil, intertidal, on shells. MZUSP 822 (with MZUSP 821, *Nolella stipata*), L.M. Vieira and A.E. Migotto coll., 12 October 2011, 23°48'5.2" S, 45°24'20.8" W, Ilha do Pedroso, Araçá Bay, São Sebastião, São Paulo state, Brazil, intertidal, on oyster shell. MZUSP 826 (with MZUSP 824, *Nolella stipata*), L.M. Vieira and A.E. Migotto coll., 12 October 2011, 23°48'5.2" S, 45°24'20.8" W, Ilha do Pedroso, Araçá Bay, São Sebastião, São Paulo state, Brazil, intertidal, on oyster shell. MZUSP 851, A.E. Migotto and J.E. Winston coll., 31 January 2005, 24°49'50" S, 46°24'21" W, Araçá Bay, São Sebastião, São Paulo, Brazil, intertidal. MZUSP 852, A.E. Migotto and J.E. Winston coll., 9 February 2005, 24°49'5.38" S, 46°24'20.83" W, Araçá Bay, São Sebastião, São Paulo, Brazil, intertidal, on stone. MZUSP 853, L.M. Vieira and A.E. Migotto coll., 12 October 2011, 23°48'5.2" S, 45°24'20.8" W, Ilha do Pedroso, Araçá Bay, São Sebastião, São Paulo state, Brazil, intertidal, on shell.



FIGURES 87–91. *Bowerbankia evelinae* n. sp., Araçá, São Sebastião, São Paulo, Brazil. **87**, colony with dense network of zooids and stolons; **88**, stolon showing the groups of zooids budding laterally; **89**, fertile colony, with pink embryos brooded inside zooids; **90**, close-up of zooid brooding the pink egg (arrow); **91**, close-up of stolon and zooids, one with expanded tentacle crown. Scale bars: **87**, 2 mm; **88**, 1.5 mm; **89**, 1.0 mm; **90**, 0.2 mm; **91**, 0.4 mm.

Etymology. Honorific for Eveline du Bois-Reymond Marcus (1901–1990), artist and zoologist, for her work with her spouse Ernst Marcus on the biology of Brazilian marine invertebrates, including bryozoans.

Description. Colonies encrusting, vine-like, with zooids in groups along a relatively thick stolon c. 0.15–0.20 mm diameter. Zooids budded laterally, organized in variable numbers along stolon. Creeping stolons flexible, growing loosely relative to substratum, with erect irregular branches. Zooids appearing as tubular sacs, with rounded base and narrower distal end, c. 0.76–1.4 mm long and 0.30–0.32 mm wide when contracted, 1.6 mm long and 0.26–0.30 mm wide when expanded. Zooid body wall stiff, well cuticularized, with small to large white pigment cells; zooidal internal structures visible inside transparent cuticle. Polypides with a conspicuous rounded

gizzard and tentacle crown with 8 equal tentacles about 0.42 mm in length. Tentacles straight or bent outward, with white pigmentation inside. Pink eggs and embryos brooded in zooids.

Supplementary video. <http://cifonauta.cebimar.usp.br/taxon/bowerbankia-evelinae>

Remarks. *Bowerbankia evelinae* n. sp. is characterized by the presence of white-pigmented cells inside zooids and polypides, including the tentacles, and by the pink color of eggs and embryos. *Bowerbankia evelinae* n. sp. forms colonies with conspicuous networks, rather than those of *B. ernsti* n. sp. and *B. mobilis* n. sp.

Vieira *et al.* (2008) suggested that the species reported from Brazil as *Bowerbankia caudata* belong to *Bowerbankia maxima* Winston, 1982. This misinterpretation resulted from the occurrence of a white-pigmented species of *Bowerbankia* on coast of São Paulo, Brazil (see Migotto *et al.* 2011). Marcus (1937) did not mention white-pigmented cells in *Bowerbankia caudata* from Rio de Janeiro, which was characterized by pale-yellow or tan colonies like those of *Bowerbankia mobilis* n. sp. Differences in stolon width are also observed in Marcus's *caudata* and *B. evelinae* n. sp. (stolons are 0.07–0.10 mm diameter in Marcus's *caudata* and 0.15–0.20 mm diameter in *B. evelinae* n. sp.).

Bowerbankia evelinae n. sp. resembles *Bowerbankia maxima* Winston, 1982 from Florida, but the species differ in zooid size (0.26–0.32 mm wide in *B. evelinae* n. sp. vs 0.20–0.27 mm wide in *B. maxima*) and stolon diameter (0.15–0.20 mm in *B. evelinae* n. sp. vs 0.09–0.17 mm in *B. maxima*). *Bowerbankia evelinae* n. sp. is the most conspicuous species of *Bowerbankia* on the coast of São Paulo, Brazil. Other specimens with white-pigmented cells recently collected in Brazil (Ceará, Alagoas, Bahia, Rio de Janeiro and Paraná states; L.M. Vieira unpubl. data) may belong to *Bowerbankia evelinae* n. sp.

Distribution. Brazil: São Paulo (São Sebastião).

***Bowerbankia mobilis* n. sp.**

(Figs 92–97)

?*Bowerbankia caudata*: Marcus 1937: 137, pl. 28, fig. 74; 1939: 114; 1941b: 29. Not *Valkeria caudata* Hincks, 1877.

Material examined. *Holotype*: MZUSP 847 (with MZUSP 848, *Bowerbankia ernsti* n. sp., and MZUSP 849, *Panolicella brasiliensis* n. sp.), A.E. Migotto and J.E. Winston coll., 01 February 2005, 24°49'5.38" S, 46°24'20.83" W, Araçá Bay, São Sebastião, São Paulo, Brazil, intertidal, on stone.

Etymology. Latin *mobilis*, movable, aluding to the movement of individual zooids when the tentacle crown expands.

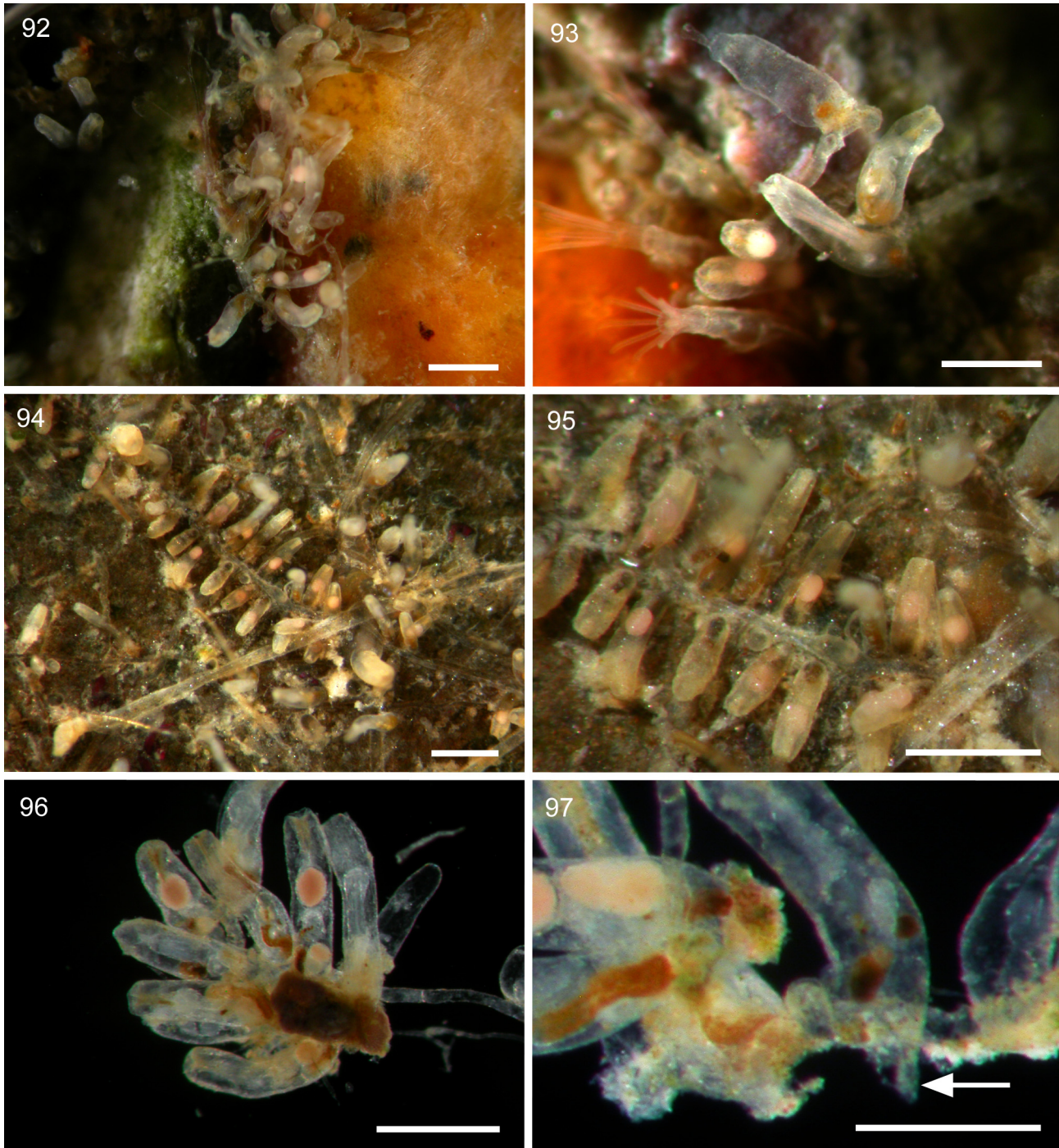
Description. Colony creeping, without erect branches, composed of clumps of tan zooids budded from a relatively thick stolon c. 0.08–0.13 mm diameter. Zooids budded laterally in opposite pairs from stolon, the number of zooids in a cluster variable. Zooids vasiform, appearing as short tubes with a rounded base, c. 0.55 mm long and 0.12 mm wide when contracted, about 0.70 long and 0.10 mm wide when polypide expanded; body wall well-cuticularized but flexible and internal structure of zooid remains visible. When retracted, zooids lie parallel to substratum, but move to a vertical position when tentacle crowns expand. Polypide with a conspicuous rounded gizzard, tentacle crown 0.40 to 0.44 mm diameter, with 8 equal tentacles c. 0.42 mm in length. Pink eggs and embryos brooded in zooids.

Supplementary video. <http://cifonauta.cebimar.usp.br/taxon/bowerbankia-mobilis>

Remarks. Colonies of *Bowerbankia mobilis* often co-occur with *B. ernsti* n. sp. If reproductive, the two species can be distinguished from each other in life by the color of eggs and embryos: pink in *B. mobilis* n. sp. and mustard yellow in *B. ernsti* n. sp. Distinguishing the two species is more difficult when they are not reproductive or when they are preserved, but *B. ernsti* n. sp. colonies have larger stolons and slightly larger zooids. *Bowerbankia mobilis* n. sp. also differs from *B. ernsti* n. sp. in having elongate zooids that lie parallel to the substratum when the tentacle crown is retracted but are erect when tentacle crowns expand.

Winston (1982) described motile zooids in *Bowerbankia tertia* Winston & Hayward, 2012 (as *Bowerbankia gracilis*)—retracted zooids are flattened against the substratum, but erect when expanded—like those of *B. mobilis* n. sp., but this species differs in having orange embryos and a very slender stolon about 0.05 mm in diameter. *Bowerbankia mobilis* n. sp. may form massive brownish colonies with pink eggs when fertile. The species occurs in the mid-intertidal to shallow subtidal on shells and rocks.

Distribution. Brazil: São Paulo (São Sebastião).



FIGURES 92–97. *Bowerbankia mobilis* n. sp., MZUSP 847, holotype, Araçá, São Sebastião, São Paulo, Brazil. **92**, fertile colony; **93**, close-up of zooids, with one expanded tentacle crown; **94**, colony with elongate zooids that lie parallel to the substratum when the tentacle crown is retracted; note up to two pink eggs inside zooids; **95**, close-up of fertile zooids lying parallel to the substratum; **96**, some zooids at end of the branch; **97**, close-up of stolonial region, showing basal elongations of one zooid (arrow). Scale bars: **92, 94–96**, 0.5 mm; **93**, 0.3 mm; **97**, 0.25 mm.

Genus *Zoobotryon* Ehrenberg, 1831

***Zoobotryon verticillatum* (delle Chiaje, 1822)**

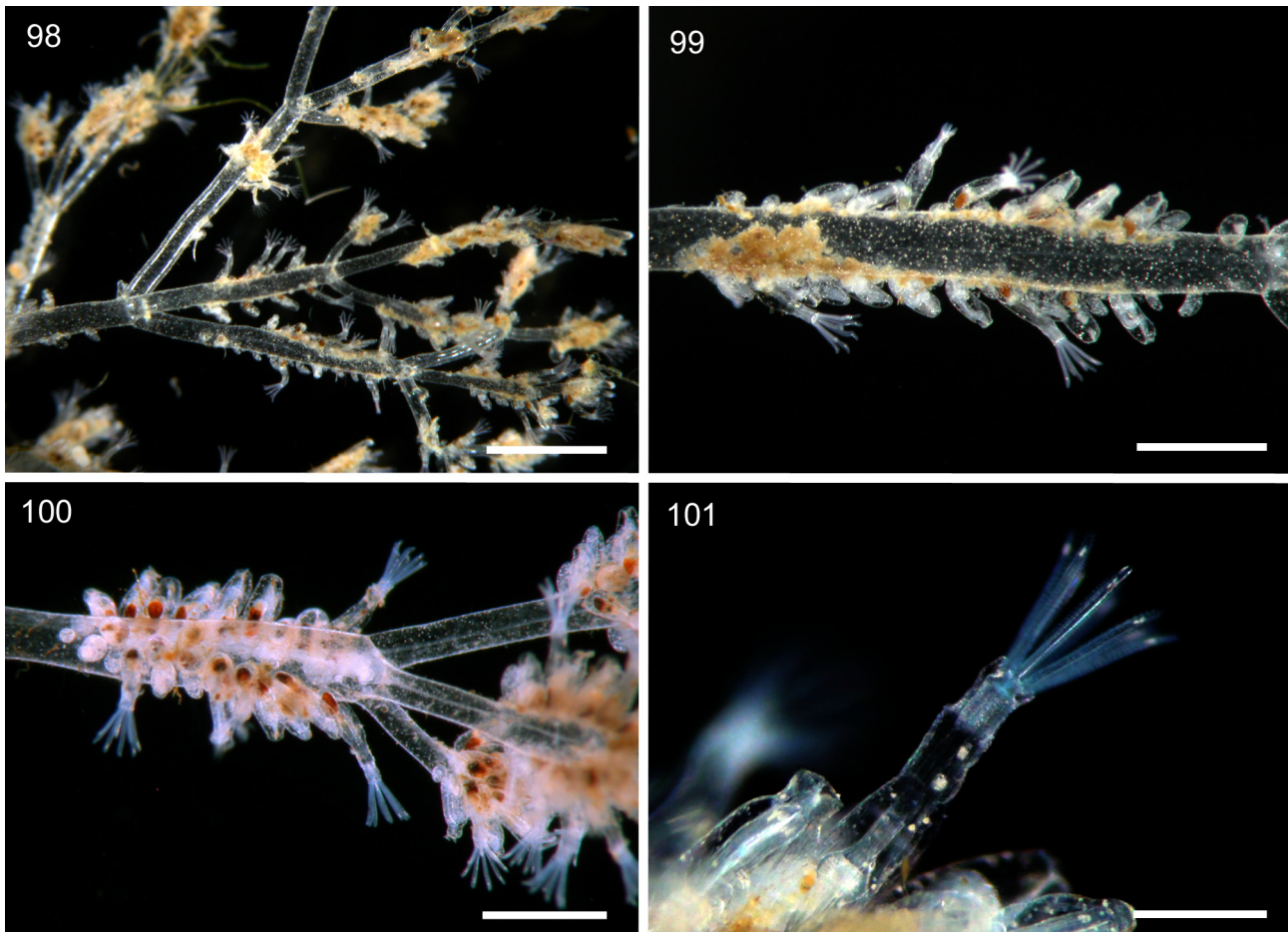
(Figs 98–101)

Hydra verticillata delle Chiaje, 1828: 203, [1822] pl. 47, figs 1, 2.

Serialaria coutinhii Müller, 1860: 313, pl. 11, figs 1–7.

Zoobotryon pellucidum: Osburn 1927: 124; 1940: 341; Marcus 1937: 139, pl. 28, fig. 75A,B.

Zoobotryon verticillatum: Soule in Osburn 1953: 742, pl. 79, fig. 3; Winston 1982: 113, fig. 13; 1984: 6, fig. 11; Gordon & Mawatari 1992: 14, fig. 2F; Abdel-Salam & Ramadan 2008: 35, fig. 3; Vieira *et al.* 2008: 10 (checklist); Migotto *et al.* 2011: 269, fig. 3.24.I; Marques *et al.* 2013: 272; Galil & Gevili 2014: 1, figs 1–2.



FIGURES 98–101. *Zoobotryon verticillatum* (delle Chiaje, 1822), MZUSP 799, from Ponta do Baleeiro, São Sebastião; **98**, trifurcating branches of the colony; **99**, wide stolon with zooids; **100**, close-up of a trifurcating branch with some expanded tentacle crowns; **101**, close-up of an expanded tentacle crown. Scale bars: **98**, 2 mm; **99**, **100**, 1.0 mm; **101**, 0.25 mm.

Material examined. MZUSP 795, BIOTA/FAPESP, BRY 192, 10 April 2001, 23°46' S, 45°39' W, Ponta da Baleia, São Sebastião, São Paulo, Brazil. MZUSP 796, BIOTA/FAPESP, BRY 291, 25 January 2001, São Sebastião, São Paulo, Brazil. MZUSP 797, BRY 520, A.E. Migotto and J.E. Winston coll., 25 January 2005, Praia do Segredo, São Sebastião, São Paulo, Brazil. MZUSP 798, BRY 572, A.E. Migotto and J.E. Winston coll., 25 January 2005, Praia do Cabelo Gordo, São Sebastião, São Paulo, Brazil. MZUSP 799, A.E. Migotto coll., 05 December 2005, Ponta do Baleeiro, São Sebastião, São Paulo, Brazil. MZUSP 800, L.M. Vieira coll., 22 January 2008, Praia do Segredo, São Sebastião, São Paulo, Brazil.

Description. Colony consisting of thick transparent stolons with a characteristic trifurcating branching pattern. Stolons with clusters of small zooids. Zooids appearing as ovoid sacs c. 0.54 mm long, 0.22 mm wide. Polypide with 8 short, equal-length tentacles and a large gizzard. Embryos brooded internally.

Supplementary video. <http://cifonauta.cebimar.usp.br/taxon/zoobotryon-verticillatum>

Remarks. *Zoobotryon verticillatum* was first reported in Brazil from Santa Catarina state by Müller (1860) as *Serialaria coutinhii*. Young colonies of *Zoobotryon verticillatum* have clean, transparent stolons resembling rice vermicelli, but as colonies age they become fouled by diatoms, algae and sediment, and take on a greenish or brownish color; in older areas of the colony zooids may degenerate and drop off stolons. Mature colonies may also be fouled by other bryozoans, e.g. *Aetea* spp. and *Bugula* spp. At least one nudibranch, *Okenia zoobotryon* (Smallwood, 1910), preys upon and deposits egg masses on *Zoobotryon*. The species has been widely reported

from the intertidal to about 10 m depth on fouling mooring lines, docks, boats, pilings and various hard substrata, frequently in association with algae and hydroids; it can also be found drifting in sea-grass beds.

Distribution. Cosmopolitan in warm water.

Discussion

In the last decade, bryozoans on the Brazilian coast have been the subject of several taxonomic studies using morphological and molecular techniques that have allowed the clarification of the status of some taxa previously treated as widespread and the description of previously unrecognized bryozoan biodiversity in southwestern Atlantic waters (Vieira *et al.* 2007, 2010a–c, 2012, 2013; Ramalho *et al.* 2010, 2011). Observation of specimens *in vivo* has provided important complementary data to distinguish two *Amathia* species recorded from the Atlantic (Fehlauer-Ale *et al.* 2011). Studies based on living specimens can be necessary for comparison of closely related taxa of ctenostome species, by providing valuable information about reproduction, colony growth, and zooidal development, including morphology and behavior of polypides (Rogick 1949; Jebram 1985; Porter *et al.* 2002). However, few studies on living specimens have been carried out on Brazilian ctenostomes since the early studies of Marcus (1939, 1941a).

Vieira *et al.* (2008) listed 42 ctenostomatous bryozoans from the Brazilian coast, 34 of them from São Paulo state. The present study, which has included observations, microphotography and videography of living colonies collected in São Paulo state, has revealed an unexpected diversity of Ctenostomata and provided information that has enabled us to describe 11 new species: *Alcyonidium exiguum* n. sp., *Alcyonidium pulvinatum* n. sp. (= *Alcyonidium mamillatum* sensu Marcus, 1937), *Alcyonidium torquatum* n. sp., *Alcyonidium vitreum* n. sp. (= *Alcyonidium polyoum* sensu Marcus, 1937), *Bowerbankia ernsti* n. sp., *Bowerbankia evelinae* n. sp., *Bowerbankia mobilis* n. sp., *Nolella elizae* n. sp., *Panolicella brasiliensis* n. sp. (= *Nolella dilatata* sensu Marcus, 1938), *Sundanella rosea* n. sp. (= *Sundanella sibogae* sensu Marcus, 1937) and *Victorella araceae* n. sp. (= *Victorella pavidata* sensu Marcus, 1955). A new family, Jebramellidae n. fam. is also established for a newly described genus and species, *Jebramella angusta* n. gen. et sp. Because of the loss of certain characters when specimens are preserved in alcohol, all taxa are more easily identified with living specimens, which allow observation of coloration (zooids, polypides, eggs and embryos) and behavior of polypides (e.g. tentacle activity, retraction and protraction of polypides). For this reason, living specimens of the species covered here are illustrated to accompany the descriptions and digital video images made available via Internet links.

Ctenostomes make up only a small percentage (6–10 %) of the total diversity of Recent marine bryozoans, the greatest taxon diversity in most habitats being shown by cheilostomes (Hayward & McKinney 2002; Vieira *et al.* 2008). However, ctenostome bryozoans are often more prominent in shallow, warm and/or estuarine habitats. A survey of bryozoan distributions in estuarine habitats worldwide found that 25.6% (52 of 203) of the species recorded were ctenostomes (Winston 1977).

In the BIOTA survey in which the species described above occurred, 18.6% of the bryozoans found were ctenostomes (24 of 129 species; Migotto *et al.* 2011). In comparison, in the Indian River Lagoon area in Florida, a subtropical region at a similar northern latitude to the São Paulo coast south of the equator, 17.8 % (15 of 84 species) of bryozoans found in a year-long survey were ctenostomes (Winston 1982). A re-survey of three sites within the Lagoon 24 years later to assess the amount of stability of the bryozoan fauna found that 20.4% (10 of 49) of the bryozoan taxa at the selected sites were ctenostomes (Winston 2009). During the year of this later survey there was a drought and salinities remained at 35–37 ppt, although in other years they may be more variable. This second survey recorded a number of changes in the bryozoan fauna that were possibly related to increasing summer sea temperatures, but none of the species affected were ctenostomes (Winston 2009). Ctenostomes are also well-represented in shallow habitats in cold-temperate water in the northwest Atlantic. On the northeastern US coast between Virginia and Maine, ctenostomes made up 18.7% (21 of 113) of the bryozoans found (Winston & Hayward 2012). Many of them were living in habitats below the 32 ppt of the open ocean in that region.

In taxonomic surveys in the past, most ctenostomes recorded were interpreted as belonging to a few European species such as *Alcyonidium polyoum* or *Bowerbankia gracilis*, then thought to have broad distributions. Some of this perceived lack of diversity may have been due to the fact that early taxonomists had only a limited amount of literature to work with, but the view that ctenostome species were more plastic morphologically than currently

understood may also have contributed to this perception. More recent surveys such as BIOTA/FAPESP have given us a fuller picture of ctenostome diversity in shallow water. Some ctenostomes do appear to be eurytopic, capable of living in varied habitats and under varying conditions, therefore showing widespread distributions. This seems to be true for some well-known fouling or invasive species such as *Zoobotryon verticillatum* and *Anguinella palmata*, although that belief may change as molecular studies are carried out on these species. The larger part of the ctenostome fauna seems to consist of species with more restricted distributions. For example, *B. imbricata*, a species also found on British coasts, occurs on the northeastern US coast. *Bowerbankia gracilis*, a US East Coast native that has been introduced in other regions, is widespread in the region, whereas a newly described species, *Bowerbankia tertia* Winston & Hayward, 2012 is so far limited to the east coast of the US. In Brazil, the original studies of Brazilian bryozoans by Ernst Marcus identified *Bowerbankia* specimens as *B. gracilis*, but in the BIOTA study three morphologically similar species of *Bowerbankia* (*Bowerbankia ernsti* n. sp., *Bowerbankia evelinae* n. sp. and *Bowerbankia mobilis* n. sp.) were found, whereas *B. gracilis* did not occur. Both studies also found new and more localized species of *Alcyonidium*, but the species listed most frequently in past work—*Alcyonidium polyoum*—did not occur in either region.

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