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The family Aeolidiidae Gray, 1827 (Gastropoda Opisthobranchia) from Brazil, with a description of a new species belonging to the genus *Berghia* Trinchese, 1877

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Species belonging to the family Aeolidiidae (Opisthobranchia: Nudibranchia) were studied. The specimens were collected from localities in two states of Brazil (Rio de Janeiro and Bahia). Some Western Atlantic specimens of *Berghia* Trinchese, 1877 were previously assigned to *Berghia verrucicornis* (A. Costa, 1864). The study of the specimens from the Brazilian coast allowed us to observe diverse characters, such as the presence of orange markings at the bases of the cerata, which differ from the specimens of the Mediterranean and Eastern Atlantic. The species *B. verrucicornis* is different from Western Atlantic *Berghia*. Our Brazilian specimens belong to a new species, ***Berghia marcusi* sp. nov.**. The species *Berghia creutzbergi* (Marcus & Marcus, 1970), re-described in this paper, constitutes the first record from Brazil (Buzios, Rio de Janeiro State), and new morphological data are provided for *Berghia benteva* (Marcus, 1958). This is the first record of *B. benteva* since its original description in 1958. The Brazilian specimens of *Spurilla neapolitana* (Delle Chiaje, 1841) were examined and compared with specimens from the Eastern Atlantic. © 2008 The Linnean Society of London, *Zoological Journal of the Linnean Society*, 2008, **153**, 349–368.

ADDITIONAL KEYWORDS: *Anteaeolidiella indica* – *Berghia benteva* – *Berghia creutzbergi* – ***Berghia marcusi* sp. nov.** – morphological characteristics – new record – re-description – *Spurilla neapolitana*.

INTRODUCTION

The presence of the genus *Berghia* Trinchese, 1877 in the Western Atlantic has been an object of discussion. Species were previously assigned to the European *Berghia coerulescens* (Laurillard, 1830) and *Berghia verrucicornis* (A. Costa, 1864) species. During the last few years, several authors have suspected the existence in the West Atlantic of some *Berghia* that differ from these species (Edmunds, 1968; García-Gómez & Thompson, 1990; Muniain & Ortea, 1999). However, the lack of additional material collected from the West Atlantic has so far prevented clarification of the genus taxonomy.

The present paper is a contribution to the knowledge of the aeolid fauna from the Western Atlantic, based on the study of species collected from Brazilian waters.

MATERIAL AND METHODS

The material was collected at three localities from Buzios, Rio de Janeiro State, between March 1998 and June 2000 (Praia dos Ossos, Praia de Armação, and Praia de Manguinhos), and at two localities from Bahia State, in July 2003 (Ilha de Itaparica and Praia

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do Forte). A total of 167 specimens belonging to the genera *Anteaeolidiella*, *Berghia*, and *Spurilla* (Nudibranchia, Aeolidiidae) were studied, and these were lodged at the Department of Ecology and Animal Biology of the University of Vigo (Spain). The holotype and paratype of the new species, *Berghia marcusi* sp. nov., was deposited at the Museu de Zoologia da Universidade de São Paulo (Brazil).

The specimens were collected in the intertidal level. Measurements and photographs were taken from live specimens, before they were anaesthetized. The animals were frozen prior to fixation in 5% formalin and seawater over 24–48 h, and were then transferred to 70% ethanol. Radulae and jaws were extracted and studied by using both light microscopy and scanning electron microscopy (SEM).

SYSTEMATICS

ORDER NUDIBRANCHIA BLAINVILLE, 1814
SUBORDER AEOLIDIINA ODHNER, 1934
FAMILY AEOLIDIIDAE D'ORBIGNY, 1834
GENUS *ANTEAEOLIDIELLA* MILLER, 2001
ANTEAEOLIDIELLA INDICA (BERGH, 1888)

Aeolidiella indica Bergh, 1888a: 755, pl. 78, figs 1, 2.
Aeolidiella orientalis Bergh, 1888b: 673, pl. 16, figs 8–13.
Aeolidiella saldanhensis Barnard, 1927: 201, figs 2, 3.
Aeolidiella hulli Risbec, 1928: 262, fig. 88, pl. 10, fig. 7, pl. 12, fig. 4.
Aeolidiella takanosimensis Baba, 1930: 122, fig. 4a–b, pl. 4, fig. 5a–c.
Aeolidiella multicolor Macnae, 1954: 36, figs 27–29, pl. 2, fig. 4.
Aeolidiella lurana Marcus & Marcus, 1967: 115, figs 149, 150.

Material examined: Praia dos Ossos (Buzios, Rio de Janeiro), 21 March 1998, four specimens, 0-m depth, 5.5–10.5-mm long. Praia dos Ossos (Buzios, Rio de Janeiro), 26 March 1998, two specimens, 0-m depth, 4–5-mm long. Praia dos Ossos (Buzios, Rio de Janeiro), 24 June 2000, one specimen, 0-m depth, 8-mm long. Praia dos Ossos (Buzios, Rio de Janeiro), 24 July 2003, one specimen, 1-m depth, 10-mm long.

External morphology: The general colour is whitish. The oral tentacles are long and thin (Fig. 1A), with a slight pale orange tinge on the external side. The smooth rhinophores are smaller than the oral tentacles, and are pale orange with a whitish tip. The preserved specimens have rhinophores and oral tentacles that are perfoliated or wrinkled, but this is a result of the fixation. There is an orange line on each side of the head, and another line between the rhinophores and the oral tentacles. Behind the rhinophores, the black eyes are visible through the skin and there is an orange line between them. There are two orange zigzag stripes along the body following the limits of the ceratal clusters. These stripes meet where the ceratal clusters of the two sides are closest medially. Opaque white rhomboidal spots are present mid-dorsally, and are flanked by the orange stripes. The cerata are pale orange, with a brown digestive gland and a white ring towards the white tip. The anteriormost clusters consist of rows of two or three cerata. The remaining clusters consist of about five cerata forming an arch and, next to this, a row of three or four cerata. The genital opening is situated in the right side, beneath the first group of cerata, and the anus is located behind it. The foot is white and translucent.

Internal morphology: The radula is uniseriated. One specimen measuring 10-mm long when alive possesses a row of 14 teeth. Each tooth is bilobed with a median cusp (Figs 2, 3A). The smallest tooth is 40-μm wide, and bears up to 11–12 denticles on each side (Fig. 2C). The largest teeth are about 95-μm wide and bear up to 19 denticles on each side (Fig. 2A). The border of the masticatory process of the jaws is smooth (Fig. 3B).

Remarks: This species has a very distinctive dorsal pattern, but has variation in the coloration between specimens. For this reason, numerous animals have been misidentified. For example, Marcus & Marcus (1967) described this species (cited as *Aeolidiella lurana*) as a bluish white species, with pink colour on both sides of the head and pink oral tentacles. On both sides of the body, on the central part of the head, and towards the tips of the rhinophores, there is yellow pigmentation. Marcus & Marcus (1970) found another specimen in Puerto Rico with different coloration from that of the Brazilian animal described previously in Marcus & Marcus (1967). Our specimens are transparent, with orange patches on the top of the head and behind the rhinophores. There are two dorsal orange stripes, and the rhinophores have orange bases. Although some differences exist between both specimens, they have similar coloration on the cerata, similar dorsal patterns, and similar shapes of teeth.

According to Valdés (2005) this species has similar anatomical characteristics as those of *Aeolidiella stephanieae* (Valdés, 2005), but they do have external differences such as coloration. Furthermore, internal differences also exist, such as the masticatory border of the jaws which in *A. stephanieae*, which has several irregular denticles.

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Figure 1. Living animals. A, *Anteaeolidiella indica* from Praia dos Ossos. B, *Berghia benteva* from Praia de Armação (10-mm-long specimen). C, D, *Berghia benteva* from Praia dos Ossos (18- and 19-mm-long specimens). E, *Berghia creutzbergi* from Praia de Armação (13-mm-long specimen). F, ***Berghia marcusi* sp. nov.**, from Praia de Armação (dorsal view, 12-mm-long specimen). G, ***Berghia marcusi* sp. nov.** (ventral view of the same specimen). H–J, *Spurilla neapolitana* from Praia de Armação. K, *Spurilla neapolitana* from Praia dos Ossos.

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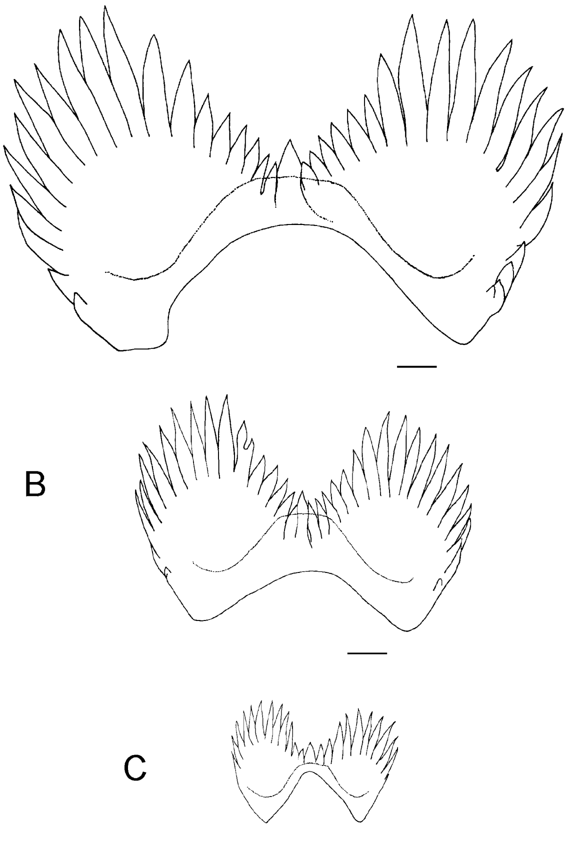

Figure 2. *Anteaeolidiella indica* from Praia dos Ossos (10-mm-long specimen). A, the largest radular tooth. B, one median tooth. C, the smallest tooth. Scale bars = 10 μm.

Distribution: Mauritius (Bergh, 1888a); Noordwachter Island (Bergh, 1888b); Japan (Baba, 1930, 1949, 1979); Red Sea (Eliot, 1908); Tanzania (Edmunds, 1969); New Caledonia (Risbec, 1928); Naples (Schmekel, 1970); California, San Diego (Sphon, 1971); Mexico (Ferreira & Bertsch, 1975); Curaçao, Puerto Rico, Laurel Reef (Marcus & Marcus, 1970); Hawaii (Gosliner, 1980); South African (Gosliner & Griffiths, 1981); New Zealand (Miller, 2001).

Brazil: Bahia de Santos, Urubuqueçaba Island, São Paulo (Marcus & Marcus, 1967); Praia dos Ossos (Buzios, Rio de Janeiro) (present paper).

GENUS *BERGHIA* TRINCHESE, 1877
BERGHIA BENTEVA (MARCUS, 1958)

Baeolidia benteva Marcus, 1958: 65, figs 105–111.

Material examined: Praia dos Ossos (Buzios, Rio de Janeiro), 21 March 1998, two specimens, 0-m depth, 18–19-mm long. Praia dos Ossos (Buzios, Rio de Janeiro), 26 March 1998, one specimen, 0-m depth, 18-mm long. Praia de Armação (Buzios, Rio de Janeiro), 1 July 1999, one specimen, 0-m depth, 10-mm long.

External morphology: Whitish to cream body (Fig. 1B–D), and translucent oral tentacles with white tips. The rhinophores have the same colour as the body, and bear papillae on their posterior side. On top of the head, in front of the rhinophores, there is opaque white pigmentation. Behind the rhinophores the black eyes are visible through the skin. Between the eyes there is a white patch of rhomboidal shape (Fig. 4A). The zone of pericardium is covered with irregular white spots. In addition to these characters, the smallest specimen (Fig. 1B) has an opaque white line on the back, between the pericardium and the tail, and white dots on each side of the line. The cerata are arranged in 12–15 pairs of groups: four or five precardial and between eight and ten postcardial (Fig. 4B). The postcardial cerata are thicker than the precardial ones. This characteristic is most evident in the smallest specimen. The first cluster consists of numerous cerata, which are smaller than those of the remaining groups. The cerata are organized in horseshoe-shaped arches, very close. There are one or two cerata rows in the ends of each arch; the larger cerata are located on the central part of the body. The digestive gland within each cerata is brown and the cnidosac is pink–red. The genital opening is situated below the second or third precardial ceratal group, and the anus is located approximately to the right of the pericardium. There is a broad foot and a long translucent tail with a white longitudinal line.

Internal morphology: The radulae in one 18-mm-long specimen have the formula $16 \times 0.1.0$; in a 19-mm-long specimen they have the formula $22 \times 0.1.0$. The teeth are arched and bilobed, with a notch in the central part and 27–29 denticles on each side (Fig. 3C, D). The radular formula in one 10-mm-long specimen is $16 \times 0.1.0$. In this specimen the oldest teeth have short broad central cusps (Fig. 4C), which diminish in size from the first to the fourth tooth, and disappear from the fifth tooth (Fig. 4D). The masticatory borders of the jaws are smooth.

Remarks: The specimens studied are similar to those described by Marcus (1958). Unfortunately, his preserved material was faded at the time of the description, and we do not know the coloration of the living animals, but these had other very similar characteristics to our specimens, and we consider that they are the same species. Both have rhinophores with papillae on

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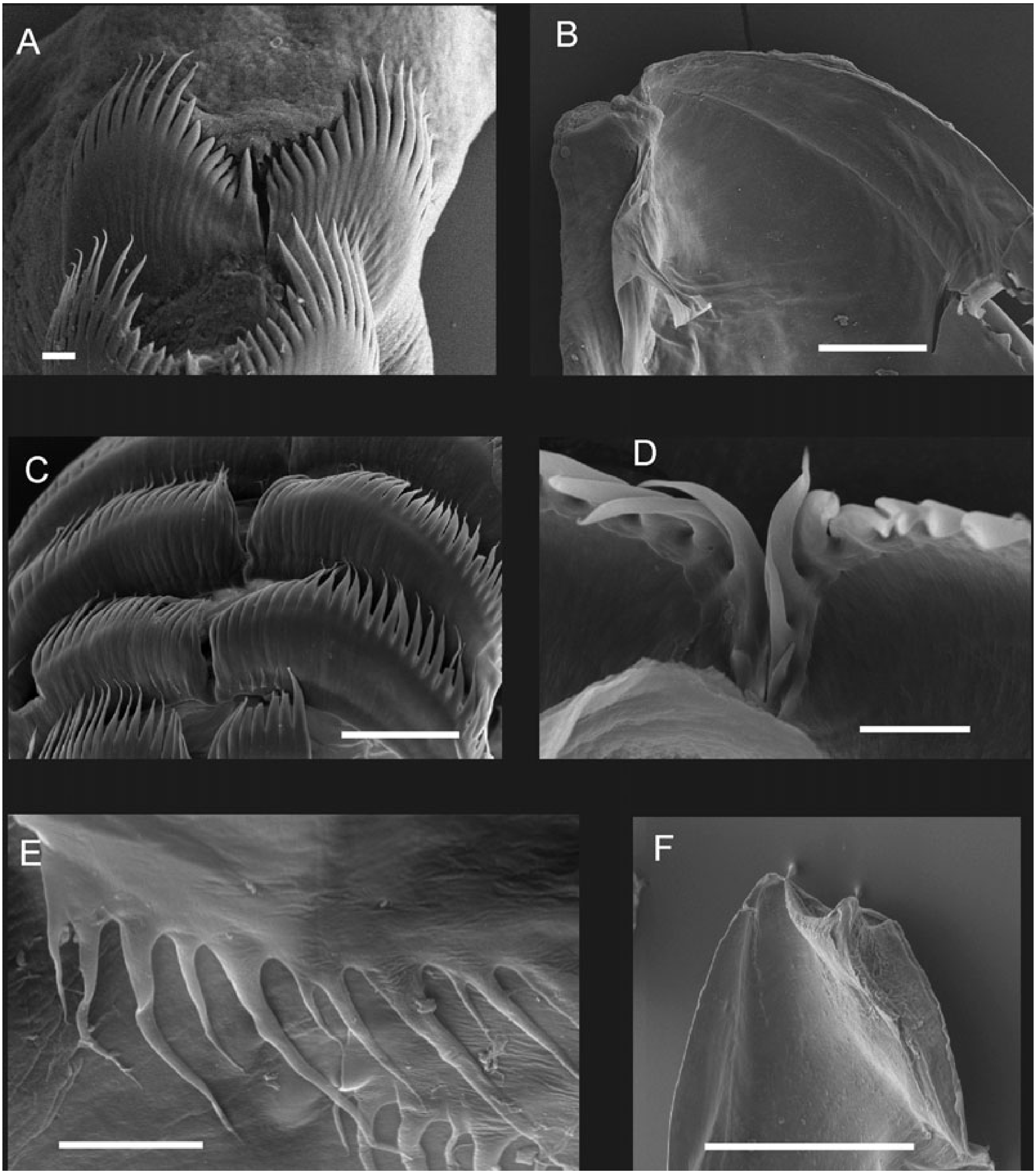

Figure 3. SEM images of radulae and jaws. A, radula of *Anteaeolidiella indica* from Praia dos Ossos; scale bar = 10 μm. B, jaw of *A. indica*; scale bar = 100 μm. C, radula of *Berghia benteva* from Praia dos Ossos (18-mm-long specimen); scale bar = 50 μm. D, central part of the tooth of *B. benteva*; scale bar = 10 μm. E, detail of the tooth of *Berghia creutzbergi* from Praia de Armação (13-mm-long specimen); scale bar = 10 μm. F, jaw of *B. creutzbergi* (13-mm-long specimen); scale bar = 200 μm.

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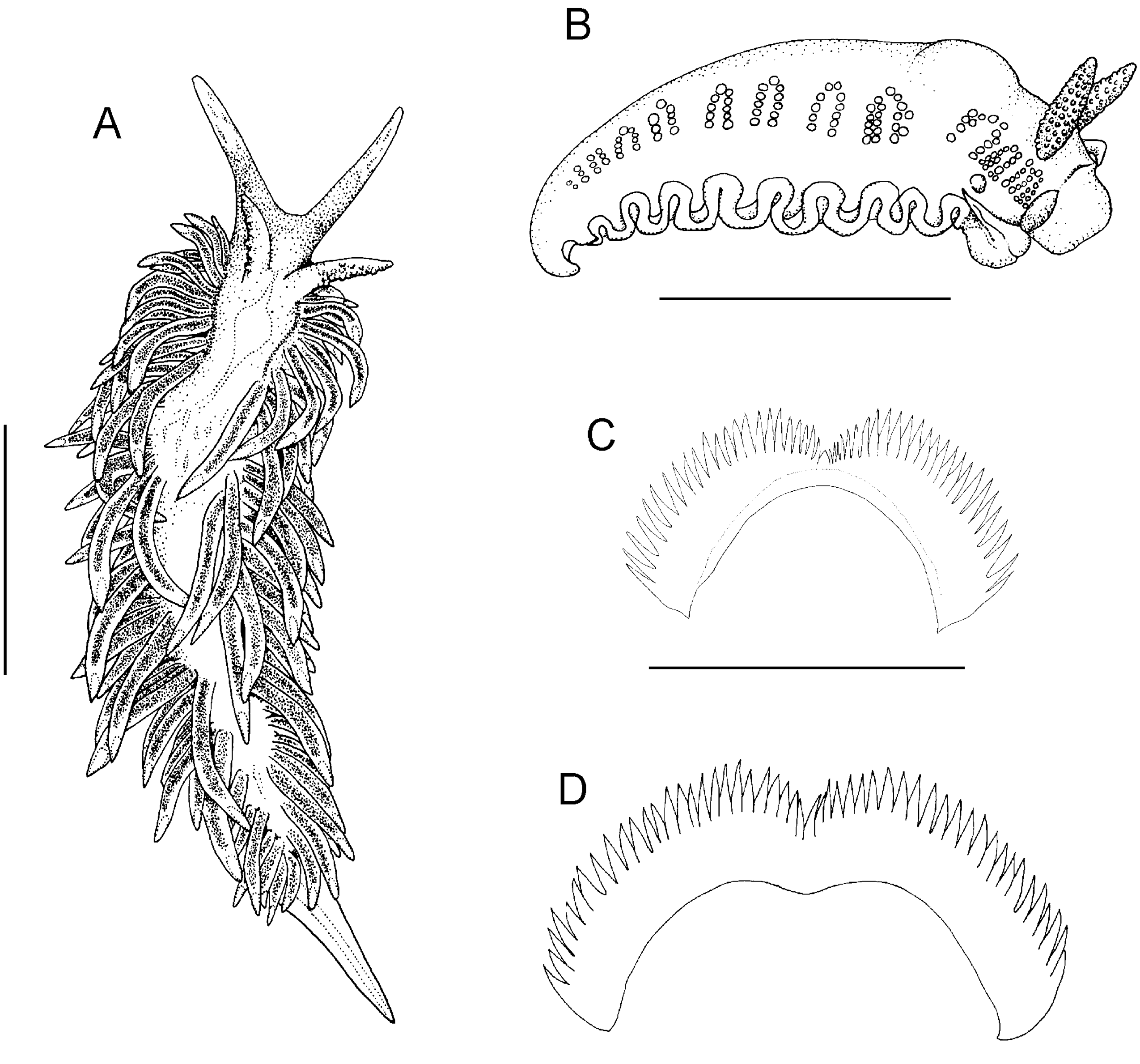

Figure 4. *Berghia benteva.* A, dorsal view of the external morphology; scale bar = 5 mm. B, lateral view of a specimen, showing the arrangement of the cerata; scale bar = 5 mm. C, D, radular teeth (10-mm-long specimen, from Praia de Armação); scale bars = 100 μm.

the posterior side, the cerata are arranged in up to 12 groups on each side of dorsum, and the masticatory border of the jaws is smooth. Furthermore, the teeth are bi-arched, and the central denticle is absent, except in the oldest teeth. This is the first record of *B. benteva* since its original description in 1958.

Distribution: Near Ubatuba, São Paulo (Marcus, 1958); Praia dos Ossos (Buzios, Rio de Janeiro) (present paper).

Berghia creutzbergi Marcus & Marcus, 1970

Material examined: Praia de Armação (Buzios, Rio de Janeiro), 1 July 1999, one specimen, 0-m depth, 13-mm long.

External morphology: The animal is thin and elongated. The body colour is brown with whitish spots on the dorsum and cerata (Fig. 1E). Oral tentacles are elongate with translucent brown bases and whitish pigment on the apical portion. The brown rhinophores

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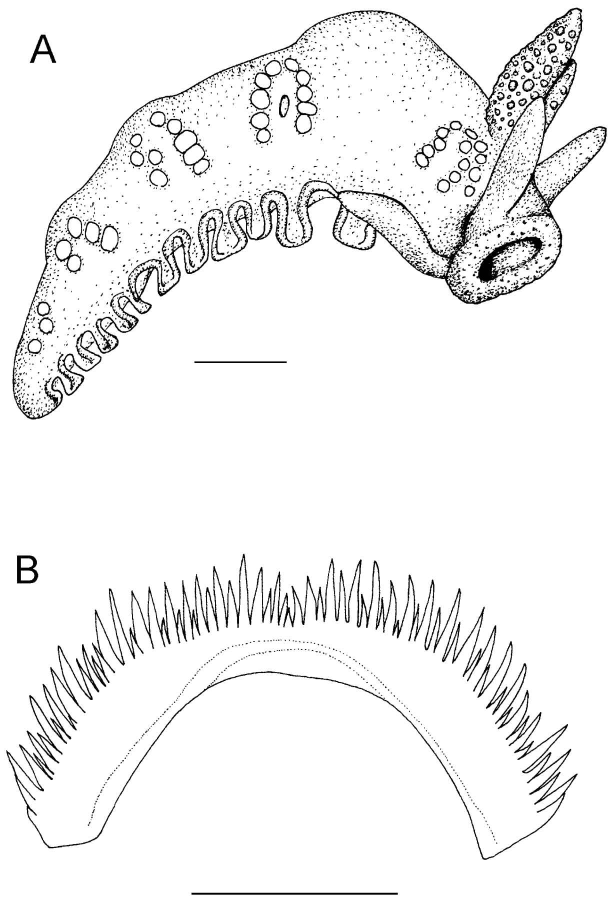

Figure 5. *Berghia creutzbergi*. A, lateral view of a specimen, showing the arrangement of the cerata; scale bar = 1 mm. B, radular tooth (13-mm-long specimen, from Praia de Armação); scale bar = 100 μm.

bear papillae. In the preserved state, a narrow longitudinal fold on the anterior face is present in each rhinophore. The bases of the rhinophores are very close, and have a white spot on the head below them. The cerata are organized in five pairs of horseshoe-shaped arches (Fig. 5A). The first group contains the largest number of cerata (about 14). The second arch contains ten cerata, and the number diminishes toward the posterior end. The cerata of the posterior groups are stouter than the anterior ones, and have pointed tips. The genital opening is located on the right side, in front of the first arch of cerata. The anus is situated inside the second arch. The whitish foot ends in a thin and translucent tail.

Internal morphology: The radular formula is $18 \times 0.1.0$. The arched teeth posses numerous denticles (Fig. 5B). One large tooth has 35 denticles on each side. The central denticle is smaller, and on its sides larger and a smaller denticles are arranged alternately (Fig. 3E). The jaws are each 820-μm long, and are nearly transparent–yellowish. The masticatory border is smooth (Fig. 3F).

Remarks: Our specimen coincides with that described by Marcus & Marcus (1970), in coloration, ceratal arrangement, and radula.

The species *Millereolidia ritmica* (Ortea, Caballer & Espinosa, 2003) from Costa Rica has similar teeth to those of *B. creutzbergi*, with alternating large and small denticles. Both species have brown body colour with whitish spots on the dorsum, the rhinophores bear papillae, and most of the cerata are organized in five pairs of horseshoe-shape arches. However *M. ritmica* differs from *B. creutzbergi*: it has an extremely thin and long tail, the papillae of the rhinophores are arranged in rings, the first ceratal group forms a triangle, and the masticatory border is denticulate.

Distribution: Curaçao (Marcus & Marcus, 1970); Barbados (Edmunds & Just, 1983); Cayman Island (Hess *et al*., 1994); Bahamas (Redfern, 2001).

Brazil: This is the first record of this species from Brazil (Praia de Armação, Buzios, Rio de Janeiro).

BERGHIA MARCUSI SP. NOV.

Berghia coerulescens Marcus, 1957: 477–481, figs 237, 240, 241, 245.

Type material: Holotype: one specimen, 12-mm long, 0-m depth at Praia de Armação (Buzios, Rio de Janeiro), 22 June 2000, deposited in the Museo de Zoologia de la Universidad de São Paulo, Brazil (catalogue number MZUSP 64150).

Paratype: one specimen, same data as for holotype, 11-mm long, deposited in the Museo de Zoologia de la Universidad de São Paulo, Brazil (catalogue number MZUSP 64151).

Other material: Praia dos Ossos (Buzios, Rio de Janeiro), 21 March 1998, two specimens, 0-m depth, 5–7-mm long. Praia de Armação (Buzios, Rio de Janeiro), 22 March 1998, one specimen, 0-m depth, 16.6-mm long. Praia de Armação (Buzios, Rio de Janeiro), 23 March 1998, one specimen, 0-m depth, 7-mm long. Praia dos Ossos (Buzios, Rio de Janeiro), 26 March 1998, two specimens, 0-m depth, 6–7-mm long. Praia dos Ossos (Buzios, Rio de Janeiro), 27 June 1999, one specimen, 0-m depth, 11-mm long. Praia de Armação (Buzios, Rio de Janeiro), 25 June 2000, one specimen, 0-m depth, 13-mm long.

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Etymology: This species is named after Ernst Marcus, who first described these specimens. Marcus contributed considerably to the knowledge of the Brazilian opisthobranchs.

External morphology: The general body colour is whitish. The oral tentacles are elongate, their bases are translucent with orange pigment, and the apical two-thirds of each is white (Fig. 1F). The rhinophores bear papillae on their posterior faces. Some specimens have papillae arranged in oblique rows on the anterior and lateral faces. Approximately, the apical two-thirds of the rhinophores are white–cream, and the bases are reddish. An orange band is on either side of the head, between the oral tentacles and rhinophores. The cerata are organized into between five and seven pairs of groups (Fig. 6A). The cerata have translucent tips, below which there is an orange ring, and the digestive gland is brown. Below the orange ring there is a whitish area that is more visible in some specimens. The cerata are arranged in horseshoe-shaped arches (Fig. 6B). The cerata of the middle part are larger than those at the ends. The first group contains ten or 11 cerata, and the number diminishes towards the tail. The posterior groups consist of two or three cerata, not in arches. There are oblique bright orange lines on the borders of the insertions of the cerata, especially on the first group. Near the cerata the dorsum is translucent white, and extending posteriorly from the base of the rhinophores there is an undulating opaque white band. This band may be broken, or can extend uninterrupted to the tip of the tail. On the largest specimens the dorsal band is broken on the pericardium, and there are some spots of the same colour on this area. The genital opening is among the cerata of the anteriormost group on the right. The anus is located below the second right arch. The foot is translucent, with elongated foot corners curved posteriorly (Fig. 1G).

Internal morphology: The radula is uniseriate with between ten and 12 bi-arched teeth (Fig. 7A). Each tooth has a triangular median cusp with a very fine denticle on each side (in some teeth it only appears on one of the sides). In a 5-mm-long specimen the median teeth have 17–21 denticles on each side (Fig. 6C), and the smallest tooth has 12–13 denticles on each side (Fig. 6D). In an 11-mm-long specimen the smaller teeth have 19–23 denticles on each side, and the larger teeth have 24–28 denticles.

Some specimens have radular teeth with denticles that are piled up (Fig. 6E), or with denticles ending in two or more tips (Fig. 6F).

The masticatory border of each jaw plate shows a long row of small rounded denticles. (Fig. 7B).

Remarks: The presence of the European species *B. verrucicornis* and *B. coerulescens* in the Western Atlantic has been an object of discussion. The Western Atlantic specimens of *Berghia* were assigned to a very variable species, *B. coerulescens* (Engel, 1925; Marcus, 1957; Edmunds, 1964, 1966; Marcus, 1976), although some of them were re-examined and subsequently assigned to *B. verrucicornis* by Tardy (1962). However, several authors have doubted the amphiatlantism of these *Berghia* species, and have recognized the need for future investigations to clarify this question (Edmunds, 1968; García-Gómez & Thompson, 1990; Muniain & Ortea, 1999).

The study of the specimens from the Brazilian coast allows us to observe several characters, mainly related to the coloration, that differ from the specimens of the Mediterranean and Eastern Atlantic (Table 1). The animals from Rio de Janeiro present orange markings at the bases of the ceratal clusters, which are especially visible in the anterior groups. This characteristic is present in all examined specimens, but is not present in the descriptions of *B. verrucicornis* from the Eastern Atlantic (Tardy, 1962; Edmunds, 1968; Ballesteros, 1977; García-Gómez & Thompson, 1990; Garcia-Gomez, 2002). To corroborate this affirmation, we have examined specimens of *B. verrucicornis* from the Atlantic coast of Huelva (south-western Spain). Variations of colour are shown in Fig. 8A and B. The back of one specimen is mostly orange (Fig. 8A). The other specimen has a whitish back with a translucent orange mid-dorsal band, and the pericardium has further orange pigmentation (Fig. 8B). These animals differ from the Brazilian *Berghia* specimens in the lack of an orange line on the ceratal insertion, and the opaque white band on the dorsum is also absent. Furthermore, the Western Atlantic specimens possess fewer pairs of ceratal groups than the Eastern specimens. The Brazilian animals are 5–16.5-mm long, and have between five and seven groups. Ballesteros (1977) described a 13-mm-long specimen from the Mediterranean Sea with ten ceratal clusters, and Edmunds (1968) studied a 15-mm-long specimen from Ghana with eight groups.

Internal characters of Brazilian material were also compared with those from Huelva. The radular teeth of *B. verrucicornis* (Fig. 7C) have more elongated and numerous denticles than those of *B. marcusi* sp. nov. The teeth of *B. verrucicornis* have a vertical crack below the median cusp, and the lateral denticles become large gradually (Fig. 7D). *Berghia marcusi* sp. nov. radulae have larger and stouter denticles than those of *B. verrucicornis*, but a very fine denticle on one or both sides of the median cusp may be present. Furthermore, *B. marcusi* sp. nov. has the masticatory border of the jaws with rounded denticles, whereas

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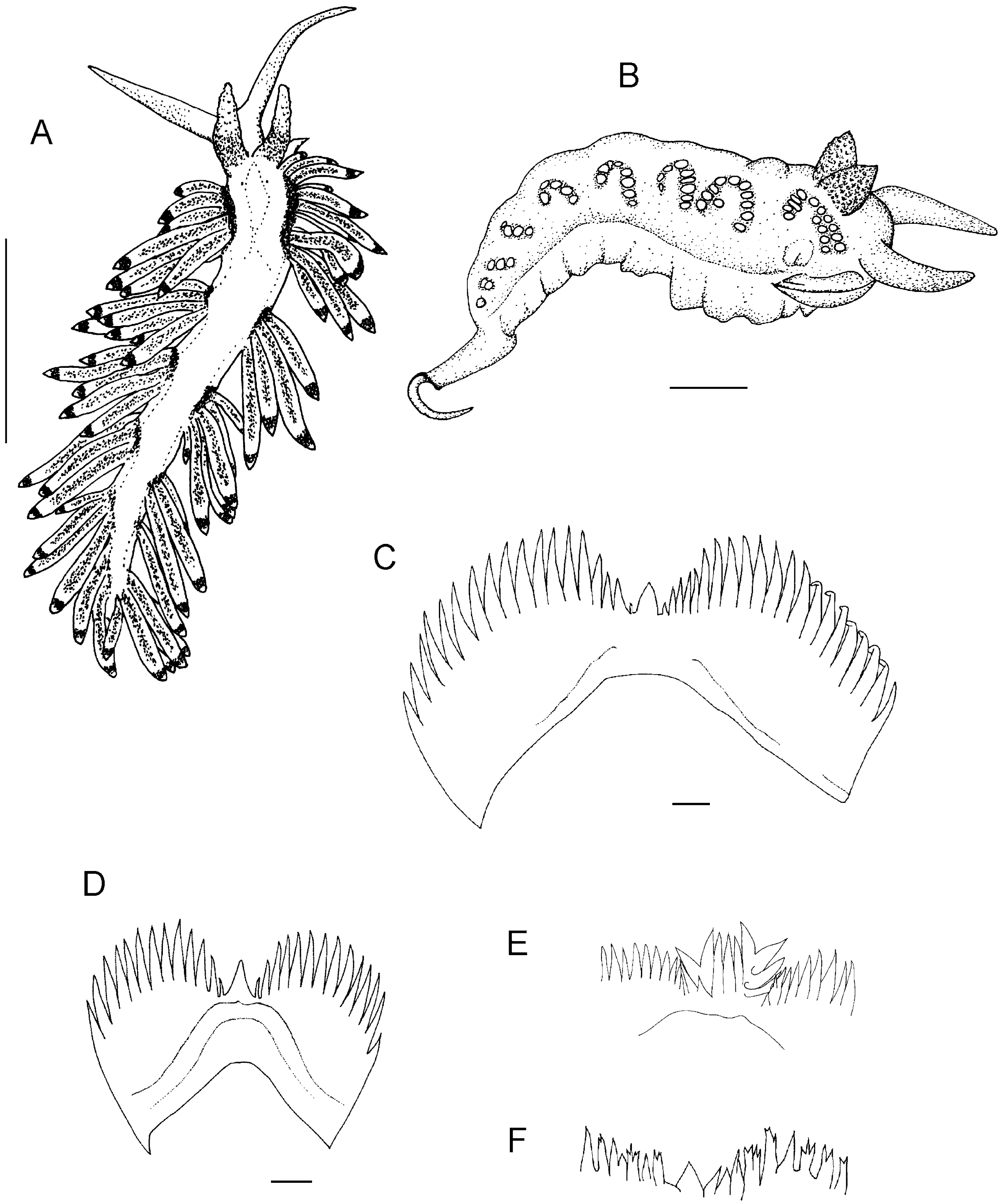

Figure 6. ***Berghia marcusi* sp. nov.** A, dorsal view of the external morphology; scale bar = 5 mm. B, lateral view of a specimen, showing the arrangement of the cerata; scale bar = 1 mm. C, D, radular teeth (Praia dos Ossos, 5-mm-long specimen); scale bars = 10 µm. E, detail of a tooth with piled up denticles (16.5-mm-long specimen, from Praia de Aramaçao). F, detail of a tooth with denticles ending in either two or more tips (16.5-mm long specimen, from Praia de Aramaçao).

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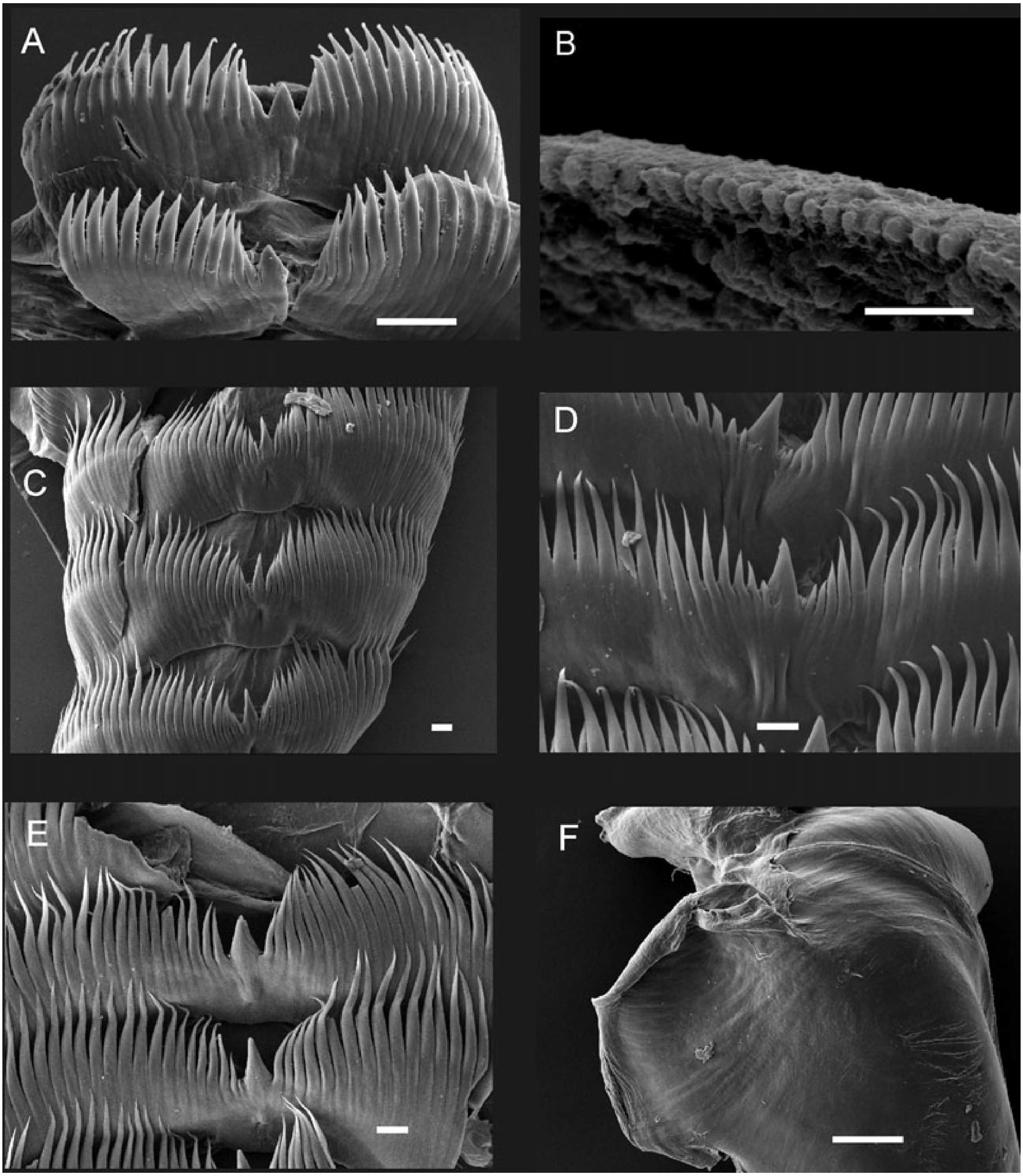

Figure 7. SEM images of the radulae and jaws. A, radula of ***Berghia marcusi* sp. nov.** (12-mm-long specimen, from Praia de Aramaçao); scale bar = 20 μm. B, masticatory border of the jaw of ***Berghia marcusi* sp. nov.** (12-mm-long specimen, from Praia de Aramaçao); scale bar = 5 μm. C, D, radula of *Berghia verrucicornis* from Huelva; scale bar = 10 μm. E, radula of *Berghia columbina* from Huelva; scale bar = 10 μm. F, jaw of *Berghia columbina* from Huelva; scale bar = 100 μm.

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Table 1. Distinctive features of our ***Berghia marcusi* sp. nov.** specimens, of ***Berghia marcusi* sp. nov.** specimens described by other authors, and of *Berghia verrucicornis* and *Berghia columbina* specimens

	Distribution	Length alive (mm)	N° of ceratal groups	Marks on dorsum	Orange line on ceratal insertion	Colour of the cerata	Colour of rhinophores	N° of radular teeth	N° of denticles on radular tooth	Masticatory border
Berghia marcusi	Buzios (Rio de Janeiro) (present paper)	5–16	5–7	Mid-dorsal white band	Present	Translucent tip, below orange ring and whitish zone	Distal two thirds white or cream; reddish base	10–12 (specimen 5 mm)	12–21 on either side (specimen 5 mm); 28 (specimen 16 mm)	Small denticles
Berghia marcusi cited as *B. coerulescens*	Ubatuba (Sao Paulo) (Marcus, 1957)	12–20	6–10	Yellow mid-line and yellow triangle between eyes	Present (red coloured)	Red ring around cnidosac	Pink base; yellow tip	–	Oldest tooth 10–22 on either side; a big tooth with 21–23	Minutes denticles
Berghia marcusi cited as Berghia B	Jamaica (Edmunds, 1968)	12	8	Mid-dorsal white line	Present	Pale buff or greyish yellow digestive gland. Pale yellow ring and white band	Orange papillae in the basal half; creamy white tip	16	40–64 per tooth	With denticles
'*Berghia verrucicornis*'	Jamaica (Thompson, 1980)	18	10	Mid-dorsal white streak. Orange patch over the pericardium, and triangles behind the rhinophores	Present	Brown digestive gland. White, lemon yellow and white bands.	Orange, with lemon-yellow tips	22	About 30 on either side	Smooth
Berghia verrucicornis	île de Ré (French) (Tardy, 1962)	20–30	10	Mid-dorsal white band	Absent	Yellowish brown digestive gland; red-orange ring	Red, with white tip	–	44–50 per tooth	Pectinate
Berghia verrucicornis	Tema (Ghana) (Edmunds, 1968)	15	8	Mid-dorsal white line	Absent	Pale brown digestive gland; vermilion ring below tip. Distal third white	Vermilion on sides and posterior papillae; cream tip and distal papillae	13	44–48 per tooth	With denticles
Berghia verrucicornis	Florida (Marcus, 1972)	12	9	Opaque white pattern	Present	There is no orange ring	Colorless rhinophore; orange base	19	30–38 on either side	About 350 hair-shaped denticles

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Table 1. *Continued*

	Distribution	Length alive (mm)	N° of ceratal groups	Marks on dorsum	Orange line on ceratal insertion	Colour of the cerata	Colour of rhinophores	N° of radular teeth	N° of denticles on radular tooth	Masticatory border
Berghia verrucicornis	Medirerranean Sea (Spain) (Ballesteros, 1977)	13	10	White longitudinal band. Orange pigment on pericardium	Absent	White tip and red-orange band below	Red papillae	–	–	–
Berghia verrucicornis	E. Atlantic (Spain) (García-Gómez & Thompson, 1990)	8–30	9	Mid-dorsal orange line	Absent	Ring over cnidosac orange-red with a gold-orange crescent	Orange rhinophoral papillae	–	42–70 per tooth	–
Berghia verrucicornis	E. Atlantic (Spain) (Garcia-Gomez, 2002)	8–33	8–9	Mid-dorsal orange line	Absent	Brown digestive gland, white tip and orange ring below	Orange papillae; white tip	20–21	30–35 on either side	Smooth
Berghia rissodominguezi	Mar Plata (Buenos Aires), Patagonia (Muniain & Ortea, 1999)	52	6–8	Brown-red line. Orange triangle on head	Present	White cnidosac; orange band with thin suapical red ring	Cream-white with yellow apical portion	27	47–50 on either side	Smooth
Berghia columbina	E. Atlantic (Spain) (García-Gómez & Thompson, 1990)	10–30	11	Mid-dorsal orange line	Present	White tip and brown digestive gland	Orange papillae on the posterior and lateral faces; white tip	24	46–76 on either side	Fine pointed denticles
Berghia columbina	E. Atlantic (Spain) (Garcia-Gomez, 2002)	12–30	9–11	Mid-dorsal orange line	Present	White tip and brown-orange digestive gland	Red-orange papillae and white tip	22–24	30–38 on either side	Smooth
Berghia A	Jamaica (Edmunds, 1968)	40	11	Grey suffused with orange	Present	Dark brown digestive gland. Yellow ring	Yellow distal half, orange basal papillae	23	74–98 per tooth	With denticles
Berghia C	Jamaica (Edmunds, 1968)	13	8	Front half orange, rear half grey	Present	Pale olive-green digestive gland; white tip and white, orange or creamy yellow ring	Orange middle half, and cream tip	–	–	–

The absence of data is indicated by: '–'.

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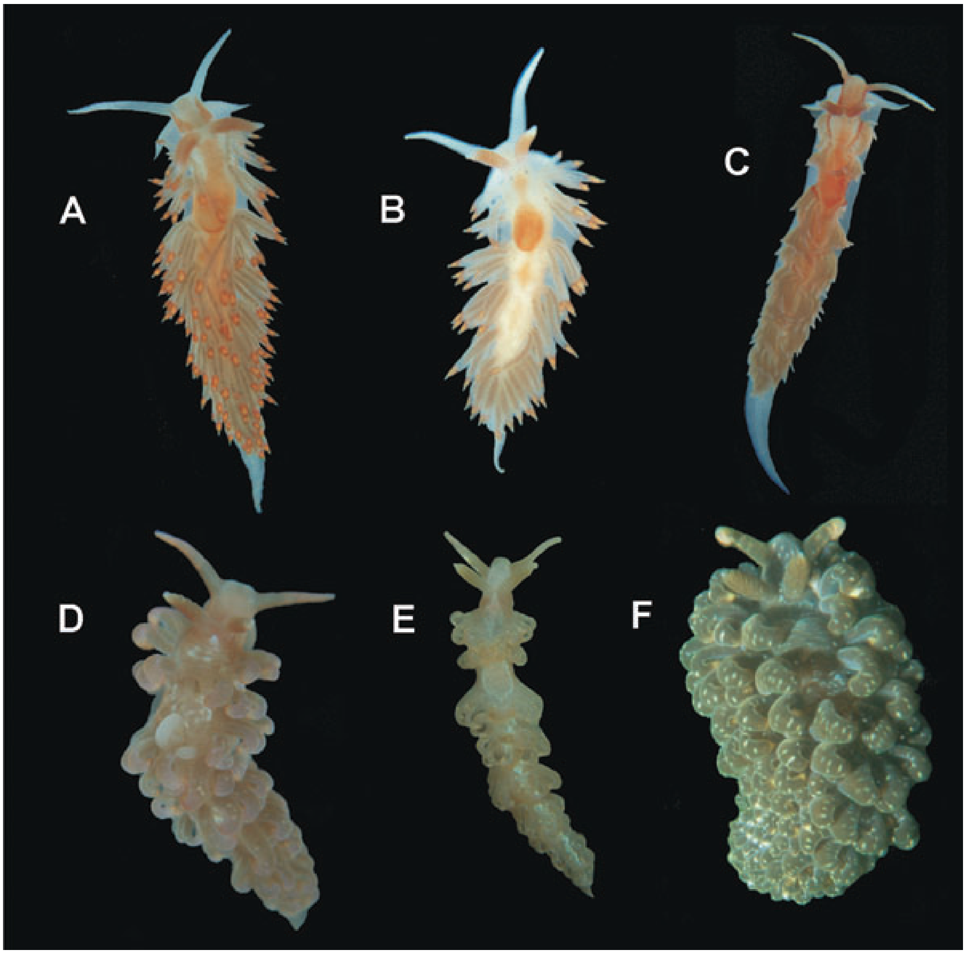

Figure 8. Living animals. A, B, *Berghia verruciconnis* from Huelva. C, *Berghia columbina* from Huelva. D, E, *Spurilla neapolitana* from Huelva. F, *Spurilla neapolitana* from El Grove.

B. verrucicornis has either smooth jaws (Thompson, 1980; Garcia-Gomez, 2002) or jaws with hair-shaped denticles (Tardy, 1962; Marcus, 1972).

Our specimens from Rio de Janeiro show great similarity with those examined from Ubatuba by Marcus (1957). Other authors such as García-Gómez & Thompson (1990) reported special features for these animals, which differed from the other specimens from the Western Atlantic. They stated that the specimens from Brazil identified as *Spurilla coerulescens* by Marcus may belong to another (new) species. Small differences exist between our material and the Ubatuba specimens (orange pigment in our animals and red pigment in those of Marcus), but both animals have orange markings on the dorsum, have oral tentacles and rhinophores that are yellow-tipped and have red bases, have red marks on the head, and have cerata with red rings.

Edmunds (1968) described three specimens of *Berghia* from Jamaica, called A, B, and C, that showed orange markings at the ceratal insertions. He compared these animals with those from Ghana, and suggested two possibilities: first, a very variable species is present in the Western Atlantic; second, two or more new species of Western Atlantic *Berghia* exist. According to García-Gómez & Thompson (1990), specimen B is distinct from any described species, and it can be distinguished from *B. verrucicornis* by the orange marks at the base of the cerata, and the oral tentacles with orange bases. The description of specimen B from Jamaica agrees with the description of our animals, except for the pale yellow ring and the white ring below the cnidosacs. Our specimens possess cerata with orange rings.

Specimens A and C from Jamaica also possess orange markings at the base of the cerata, but differ from the Brazilian animals in that specimen A lacks the whitish dorsal band, and specimen C has the front half of the body orange, and the rear half grey.

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Thompson (1980) assigned to *B. verrucicornis* two specimens from Jamaica with orange lines at the ceratal insertions, and a mid-dorsal white band. However, these specimens are different from our animals because the cerata have three bands (white, yellow, and white) inside the orange ring, and the masticatory border of the jaws is smooth (our specimens possess denticles). The animals assigned to *B. verrucicornis* from Florida by Marcus (1972) are very similar to the Brazilian ones. Both have orange markings at the ceratal insertions, and a mid-dorsal white band, but the specimens from Florida have greyish coloration, and they have more ceratal groups (nine groups in a 12-mm-long specimen). Furthermore, the cerata lack rings on cnidosacs. The radulae possess more teeth and more denticles per tooth (19 teeth and 30–38 denticles on each side).

The species *Berghia columbina* (García-Gómez & Thompson, 1990) found in south-western Spain has a similar colour pattern to our specimens (Fig. 8C). *Berghia columbina* has orange markings at the ceratal insertions and on the head, orange or reddish rhinophores with white tips, and translucent orange oral tentacles with white tips. However, *B. columbina* possesses more pairs of ceratal groups (between nine and 11 groups according to Garcia-Gomez, 2002), whereas *B. marcusi* sp. nov. presents between five and seven groups. Furthermore, a mid-dorsal orange line exists in *B. columbina* inside a white band, and the cerata do not have orange rings. The radula presents more teeth and more denticles per tooth (Fig. 7E), and the jaw masticatory border is smooth (Fig. 7F).

Muniain & Ortea (1999) described a new species from the Western Atlantic, *Berghia rissodominguezi*, which is similar to the Brazilian specimens, but there are also several differences. The specimens are larger than *B. marcusi* sp. nov., having an orange triangle on the head, and a mid-dorsal reddish-brown line from the third cerata group (our specimens have a cream or opaque white spot on the head and dorsal band). The rhinophores of *B. rissodominguezi* are cream–white in colour, with yellow on the apical portion inside a red base and yellow tip. The translucent oral tentacles have a yellow area covering two-thirds of them (the oral tentacles of *B. marcusi* sp. nov. have white tips). Finally, the masticatory border of the jaw in *B. rissodominguezi* is smooth (Muniain & Ortea, 1999; MD, JT & FG, this paper, pers. observ.), differing from the denticulate border of *B. marcusi* sp. nov.

For all of these reasons, we consider that the Eastern Atlantic and Mediterranean specimens of *B. verrucicornis* are different from the Western Atlantic *Berghia* specimens, and possibly that there are two or more West Atlantic species assigned to *B. verrucicornis*. Our animals from Rio de Janeiro are very similar to the specimens cited as *B. coerulescens* from São Paulo (Marcus, 1957), and *Berghia* specimen B from Jamaica (Edmunds, 1968). Therefore, we suggest that our Brazilian specimens, *Berghia* specimen B by Edmunds (1968) and *B. coerulescens* by Marcus (1957), belong to the same new taxon, which is different from *B. verrucicornis*. The distinguishing characteristics of the species studied in this work are compiled in Table 2.

Distribution: Jamaica (Edmunds, 1964).

Brazil: Ubatuba, São Paulo (Marcus, 1957), Praia de Armação, Praia dos Ossos (Buzios, Rio de Janeiro) (present paper).

GENUS *SPURILLA* BERGH, 1864
SPURILLA NEAPOLITANA (DELLE CHIAJE, 1841)

Eolis neapolitana Delle Chiaje: 1841: pl. 73, figs 14–16, pl. 88, figs 13–15.
Flabellina neapolitana A. Costa, 1866: 71, pl. 1, fig. 1.
Flabellina inornata A. Costa, 1866: 72, pl. 2, fig. 6.
Spurilla gabriellae Vannucci, 1952: 283.
Spurilla mograbina Pruvot-Fol, 1953: 55.
Spurilla dakariensis Pruvot-Fol, 1953: 55.

Material examined: Praia de Manguinhos (Buzios, Rio de Janeiro), 18 March 1998, 0-m depth, one specimen, 18-mm long. Praia de Manguinhos (Buzios, Rio de Janeiro), 23 June 2000, one specimen, 0-m depth, 25-mm long. Praia dos Ossos (Buzios, Rio de Janeiro), 51 specimens, 0-m depth, 4.5–20.5-mm long. Praia dos Ossos (Buzios, Rio de Janeiro), 26 March 1998, 15 specimens, 0-m depth, 4.5–25.5-mm long Praia dos Ossos (Buzios, Rio de Janeiro), 27 June 1999, one specimen, 0-m depth, 8.5-mm long. Praia dos Ossos (Buzios, Rio de Janeiro), 24 June 2000, 11 specimens, 0-m depth, 9–35-mm long. Praia dos Ossos (Buzios, Rio de Janeiro), 25 June 2000, seven specimens, 0-m depth, 11–21-mm long. Praia dos Ossos (Buzios, Rio de Janeiro), 24 July 2003, five specimens, 1 m depth, 11–20-mm long. Praia de Armação (Buzios, Rio de Janeiro), 22 March 1998, 24 specimens, 0-m depth, 9–26-mm long. Praia de Armação (Buzios, Rio de Janeiro), 23 March 1998, five specimens, 0-m depth, 7–20-mm long. Praia de Armação (Buzios, Rio de Janeiro), 24 March 1998, four specimens, 0-m depth, 8–12-mm long. Praia de Armação (Buzios, Rio de Janeiro), 30 June 1999, three specimens, 0-m depth, 13–14-mm long. Praia de Armação (Buzios, Rio de Janeiro), 1 July 1999, six specimens, 0-m depth, 9.5–27-mm long. Praia de Armação (Buzios, Rio de Janeiro), 22 June 2000, one specimen, 0-m depth, 18-mm long. Praia de Armação (Buzios, Rio de Janeiro), 25 June 2000, one specimen, 0-m depth, 20-mm long. Praia dos Ossos (Buzios, Rio de Janeiro), 24 July 2003, five specimens, 1-m depth, 11–20-mm

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Table 2. Distinguishing characteristics of the five species of Aeolidiidae collected from Rio de Janeiro and Bahia, and studied in this work

	Anteaeolidiella indica	*Berghia benteva*	*Berghia creutzbergi*	***Berghia marcusi* sp. nov.**	*Spurilla neapolitana*
Length alive (mm)	4–10.5	10–19	13	5–16.5	4.5–35
General colour of the body	Whitish	Whitish to cream	Brown	Whitish	Brown, orange, or red.
Marks on dorsum	Two orange zigzag stripes along the body, and hite rhomboidal spots flanked by them	White patch on head and pericardium	Whitish spots	Orange band on either side of the head, and on insertions of the cerata. White band on dorsum	White spots
Oral tentacles	Long and thin with orange tinge	Translucent with white tips	Elongate with brown bases and whitish apice	Elongate, orange base and white distal part	The same colour as the body
Rhinophores	Smooth. Pale orange colour and whitish tip	Papillae on their posterior side. Whitish to cream colour.	Brown coloured and covered by papillae	Papillae on their posterior face. White-cream colour with reddish bases.	Lamellated. Reddish colour with white apices.
Organization of the ceratal groups	The anterior clusters consist of rows and the rest clusters forming an arch	12–15 pairs in horseshoe-shaped arches	5 pairs of horseshoe-shape arches	5–7 pairs of horseshoe-shape arches	6–8 pairs of arched groups
Colour of the cerata	Pale orange with brown digestive glandand a white ring	Brown digestive gland and pink-red cnidosac	Brown with whitish spots	Brown digestive gland, orange ring and translucent tips	Pale brown with whitish spots and pinkish white cnidosac
N° of radular teeth	14 (specimen 10 mm)	16–22 (specimen 18–19 mm)	18 (specimen 13 mm)	10–12 (specimen 5 mm)	10–13
Shape of the teeth	Bilobed, having a median cusp and denticles on each side	Arched and bilobed, with a notch in the central part and denticles on each side	Arched with a central denticle and larger and smaller alternate denticles on each side	Bi-arched with a triangular median cusp and fine denticles on each side.	Curved teeth with a central cusp and elongated denticles on each side
Masticatory border	Smooth	Smooth	Smooth	Long row of small rounded denticles	Smooth
Distribution in Brazil	Bahia de Santos, Urubuqueçaba Island, São Paulo (Marcus & Marcus, 1967); Praia dos Ossos (Buzios, Rio de Janeiro) (present paper)	Near Ubatuba, São Paulo (Marcus, 1958); Praia dos Ossos (Buzios, Rio de Janeiro) (present paper)	This is the first record of this species from Brazil (Praia de Armação, Buzios, Rio de Janeiro)	Ubatuba, São Paulo (Marcus, 1957), Praia de Armação, Praia dos Ossos (Buzios, Rio de Janeiro) (present paper).	Gaibu, PE, Alagoas (MacFarland, 1909), São Sebastião (Marcus, 1955), Praia de Manguinhos, Praia dos Ossos, Praia de Armação (Rio de Janeiro), Praia do Forte, Praia Mar Grande, Ilha de Itaparica (Bahia) (present paper).

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long. Praia do Forte (Bahia), 14 July 2003, one specimen, 0-m depth, 19-mm long. Praia Mar Grande, Ilha de Itaparica (Bahia), 17 July 2003, two specimens, 0-m depth, 7.5–11-mm long.

External morphology: The oral tentacles are elongate, and the rhinophores are perfoliate with between nine and 14 lamellae. Short and fine propodial tentacles are situated on both sides of the mouth. The coloration is variable, from pale brown to pale orange, red–orange or intense red. Ontogenetic variations of coloration exist. The youngest specimens have paler bodies and translucent light spots (Fig. 1H). As they grow, further orange pigmentation is accumulated on the body (Fig. 1I, J, K). The oral tentacles of larger animals have the same colours as the body (a little translucent with whitish tips). The lamellated rhinophores are reddish with white apices. White spots occur on the back and cerata. The cerata are curved at the apex towards the midline of the dorsum; they are long and thick, narrower towards the tip, and are arranged in between six and eight arched groups on either side of the body. The largest cerata are situated on the middle part, and the smallest cerata are at the ends of each arch. The digestive gland inside them is pale brown, and the cnidosacs are pinkish white. The prominent pericardium is located between the first and second ceratal group. The genital opening lies under the first arch, which contains 13–21 cerata, and the anus lies under the second group. The tail is translucent and the foot sole is reddish. The youngest specimens have a whitish body, and brown cerata arranged in three or four groups.

Internal morphology: The radula is uniseriate with between ten and 13 curved teeth. The teeth have a central triangular cusp and numerous elongated denticles (Fig. 9A, B). There are 19–28 denticles on each side of the median cusp, although the small teeth of the radula can have between ten and 12 denticles, and the largest specimens possess teeth with 37–42 denticles on each side (Fig. 10A, B). Furthermore, it is common to find a small and fine denticle next to each side of the median cusp, although this can occur only on one of the sides, or may even be absent (Fig. 10C). The jaws have a smooth masticatory border (Fig. 10D).

Remarks: Spurilla neapolitana is a species that is variable in colour (Garcia-Gomez & Cervera, 1985; Just & Edmunds, 1985). Haefelfinger (1969) attributed this wide range of colour to variable feeding habits. Our specimens, like those from Brazil described by Marcus (1955) and those from Jamaica (Edmunds, 1964), have a predominantly orange body, with white spots covering the dorsum and cerata, and greenish brown digestive glands. Marcus (1955) also mentioned that young specimens are transparent and that the orange pigmentation is lacking.

Some specimens from the Pacific Ocean have pink or orange coloration and brown or grey digestive glands (Gosliner, 1980). Other Pacific animals have yellowish to pink colour and green, brown, or grey digestive glands (Kerstitch, 1989).

Gosliner (1980) observed in his animals that the white pigment may be absent, differing from our animals in that white spots are always present.

Besides the orange or pinkish colour, specimens from the Eastern Atlantic and Mediterranean Sea have yellowish, greenish, or brown coloration (Schmekel & Portmann, 1982; Garcia-Gomez & Cervera, 1985; Just & Edmunds, 1985).

The circular white spots also exhibit variability. According to Schmekel & Portmann (1982) the spots cover the posterior and dorsal faces of the cerata, especially behind the pericardium. Garcia-Gomez & Cervera (1985) only found white spots in some examined specimens, mainly on the anterior faces of the cerata. Just & Edmunds (1985) found white spots on both the body and cerata, and, furthermore, found that the dorsum might be white. Specimens from Huelva (south-western Spain) studied by us have brown–orange or pinkish bodies and cerata (Fig. 8D). Some specimens have a very pale colour, with opaque white pigment on the dorsum (Fig. 8E). Some specimens from O Grove (north-western Spain) were also examined. These specimens had green cerata (Fig. 8F), and circular white spots covering the body and cerata.

A great majority of authors found that the masticatory border of the jaws is smooth (MacFarland, 1909; Marcus, 1955; Marcus & Marcus, 1967; Gosliner, 1980; Schmekel & Portmann, 1982; Garcia-Gomez & Cervera, 1985). However, Bergh (1877) described jaws with a denticulate margin, and Gosliner (1985) proposed that in *S. neapolitana* the denticulation of the jaws varies intraspecifically. The Eastern and Western Atlantic specimens examined in this paper have smooth jaw margins (Fig. 9C).

The uniseriate radula comprises teeth with denticles on either side of a triangular central cusp. The presence of a very small denticle next to the central cusp was illustrated by Marcus (1955), who did not, however, comment about it in the description. The teeth of our animals have this small denticle on either side of the cusp, although in one radula the denticle may be on one side only or absent. The radular teeth of the Brazilian specimens are clearly different from those of Huelva: the specimens from Huelva lack a median cusp, and in its place have two small denticles (Fig. 9D, E). This characteristic has been observed previously by other authors (Garcia-Gomez &

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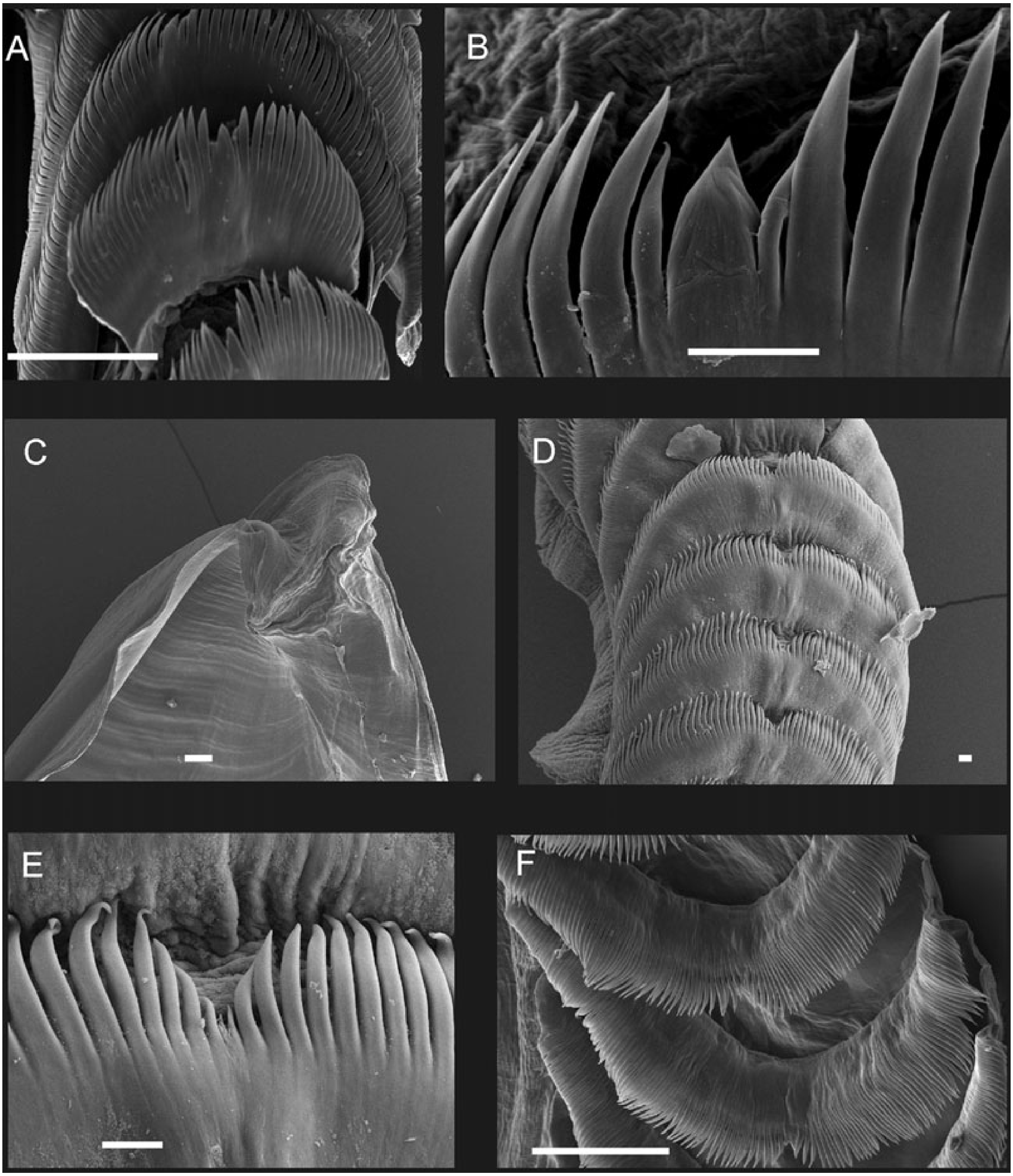

Figure 9. *Spurilla neapolitana*: SEM images of the radula and jaws. A, radula of a specimen from Buzios; scale bar = 100 µm. B, detail of the tooth of a specimen from Buzios; scale bar = 20 µm. C, jaw of a specimen from El Grove; scale bar = 100 µm. D, radula of a specimen from Huelva; scale bar = 10 µm. E, detail of the tooth of specimen from Huelva; scale bar = 10 µm. F, radula of a specimen from El Grove; scale bar = 100 µm.

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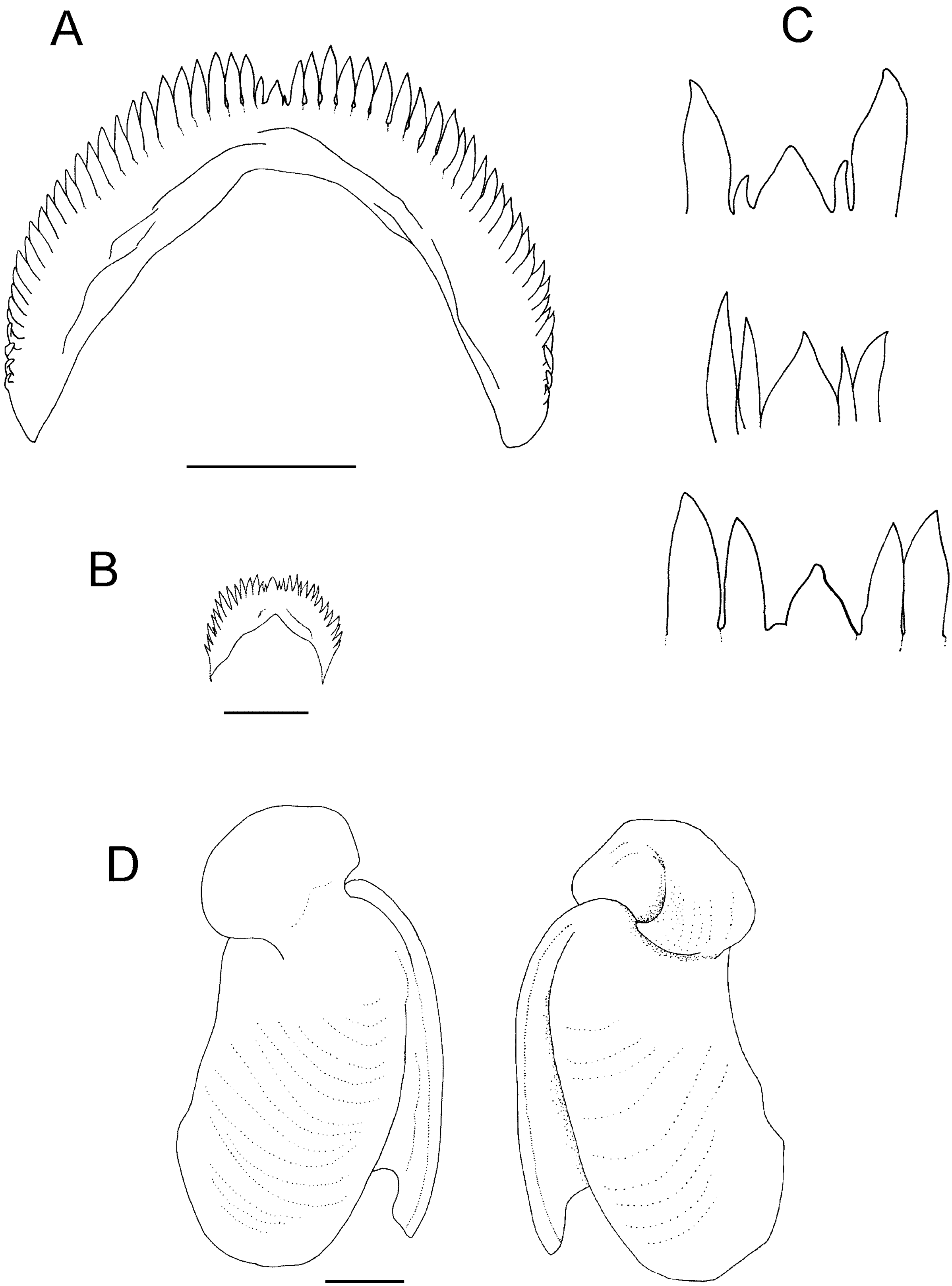

Figure 10. *Spurilla neapolitana*. A, radular teeth (18-mm-long specimen, from Praia de Manguihos); scale bar = 100 µm. B, smaller radular teeth of the same specimen; scale bar = 50 µm. C, central cusp of some teeth. D, jaws; scale bar = 0.5 mm.

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Cervera, 1985) who examined animals collected from the Eastern Atlantic (Cádiz and Huelva) and the Mediterranean Sea. They compared the radular teeth of these specimens, and verified that there is considerable variability in the central zone of the tooth. One specimen from Cubellas (Spanish Mediterranean Sea) studied by Garcia-Gomez & Cervera (1985) has identical teeth to those of our animal from El Portil (Huelva), in that both have two small central denticles. The radulae of the specimens from northwestern Spain comprise about 22 teeth with numerous denticles on each side (Fig. 9F).

Spurilla chromosoma Cockerell in Cockerell & Eliot, 1905 is very similar to *S. neapolitana*, but possesses ceratal rows in the anterior region of the body (Marcus, 1961; Gosliner, 1985), whereas *S. neapolitana* presents horseshoe-shaped arches. The newest teeth of *S. neapolitana* are up to seven times the width of the oldest (this characteristic is present in our animals). In *S. chromosoma* the teeth are uniform in width or increase only slightly. Another difference is that *S. chromosoma* has rhinophores with a few lamellae arranged diagonally, whereas in *S. neapolitana* there are numerous transverse lamellae (Gosliner, 1985).

Distribution: Cape Verde Islands (Pruvot-Fol, 1953); Morocco (Pruvot-Fol, 1953); Senegal (Pruvot-Fol, 1953); Texas (Marcus & Marcus, 1958); Mediterranean Sea (Bergh, 1864, 1876, 1877; Pruvot-Fol, 1954; Schmekel & Portmann, 1982; Garcia-Gomez & Cervera, 1985); French Atlantic coast (Pruvot-Fol, 1954; Just & Edmunds, 1985); Hawaii (Gosliner, 1980); Mexican Pacific coast (Bertsch, 1979); Jamaica (Edmunds, 1964); Miami (Edmunds, 1964); Florida (Engel, 1925; Edmunds, 1964; Marcus & Marcus, 1967; Marcus & Marcus, 1970); Puerto Rico (Marcus & Marcus, 1970); Curaçao (Marcus & Marcus, 1970).

Brazil: Gaibu, PE, Alagoas (MacFarland, 1909), Is. São Sebastião, São Paulo (Marcus, 1955), Praia de Manguinhos, Praia dos Ossos, Praia de Armação (Buzios, Rio de Janeiro), Praia do Forte, Praia Mar Grande, Ilha de Itaparica (Bahia) (present paper).

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