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A NEW SPECIES OF NOTASPIDEAN OF THE GENUS *PLEUROBRANCHUS* CUVIER, 1804 (GASTROPODA, OPISTHOBRANCHIA) FROM THE CAPE VERDE ARCHIPELAGO

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ABSTRACT

A new species of notaspidean, *Pleurobranchus garciagomezi,* is described from Ilha do Sal, Cape Verde Archipelago off the coast of West Africa. The color of the mantle with its conspicuous opaque white network, the shape of the shell and the anatomy of the reproductive system distinguish this species from all other Atlantic *Pleurobranchus.* A color plate of *P. garciagomezi* together with two other species of the genus is given to illustrate the distinctiveness of this species.

The first records of opisthobranch mollusks from the Cape Verde Archipelago were those of Rochebrune (1881, 1882) and Eliot (1906). More recently, knowledge of the opisthobranch fauna of this archipelago has increased as a result of material collected during the First Iberian Expedition to the Cape Verde Islands in 1985 (Ortea and García-Gómez, 1986; Ortea, 1988, 1989a, 1989b; Ortea and Rolán, 1989; Avila et al., 1992). However, few data are available regarding the notaspideans from these islands or from elsewhere in the eastern Atlantic. Species of this order are not as well known in the eastern Atlantic as they are from the western Atlantic (Marcus, 1984).

From the Cape Verde Islands, Rochebrune (1881) recorded *Berthella stellata* (Risso, 1826). *Berthellina edwardsi* (Vayssière, 1896) was probably also described, in part, from material from Cape Verde (White, 1955). Haefelfinger and Kress (1970) reported *Pleurobranchaea meckelii* (Blainville, 1825) and an uncertain species of *Berthellina.*

During a brief survey of Ilha do Sal, Cape Verde Islands in December 1990 and January 1991, two specimens of an undescribed species of notaspidean belonging to the genus *Pleurobranchus* Cuvier, 1804, were collected by one of us (R.C.V). This species is described in this paper, and new information is also given on certain other eastern Atlantic or Mediterranean species of the genus with which it might be confused.

Order Notaspidea Fischer, 1883
Suborder Pleurobranchacea Férussac, 1822
Family Pleurobranchidae Férussac, 1822
Subfamily Pleurobranchinae Férussac, 1822
Tribe Pleurobranchini Férussac, 1822
Pleurobranchus Cuvier, 1804

Pleurobranchus garciagomezi new species
Figures 1–3 and Plate 1

Material Examined.—HOLOTYPE. One specimen, 40 mm in length, collected at 9 m depth under stones, Albacora Bay, Ilha do Sal, Cape Verde Islands (16°45'N; 23°00'W), 7 January 1991. Specimen deposited in the collections of the Museo Nacional de Ciencias Naturales (MNCN) in Madrid, catalog number 15.05/15840.

PARATYPE. One specimen, 50 mm in length, collected at 30 m depth in a crevice, Punta do Jaohsihao, Ilha do Sal (16°45'N, 23°00'W), 31 December 1990. Specimen deposited in the collections of the

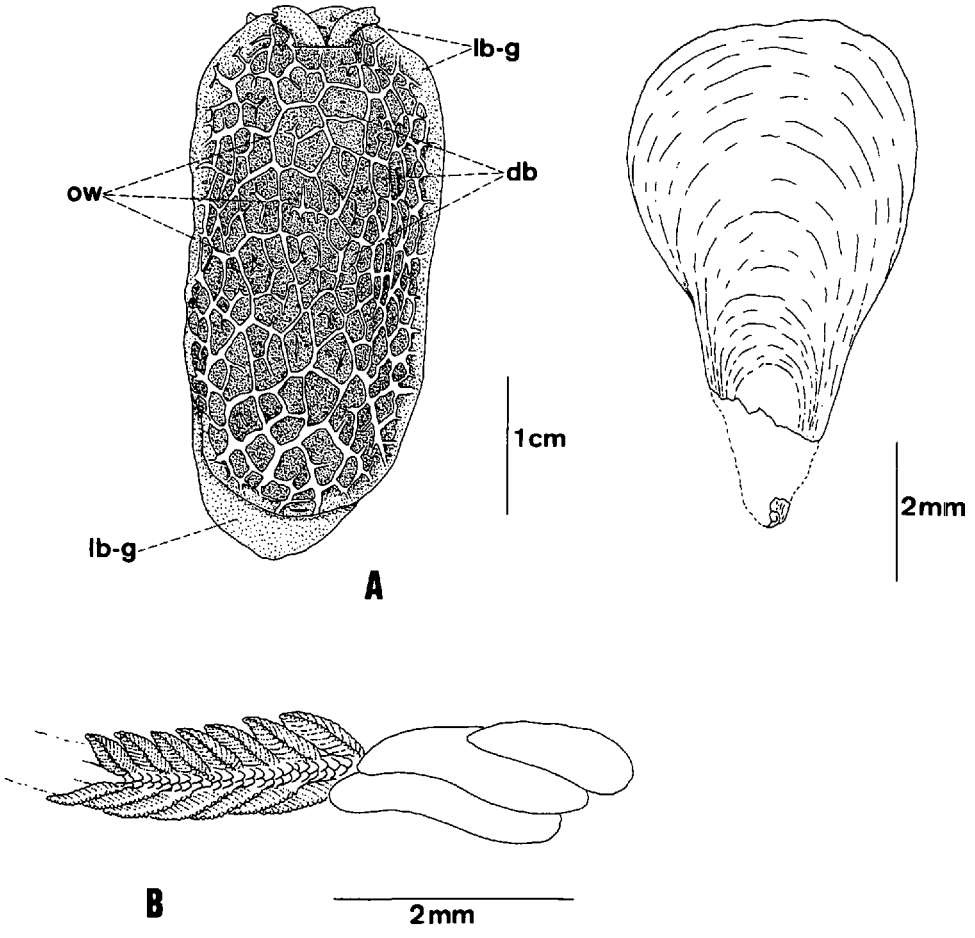

Figure 1. A and B (left). *Pleurobranchus garciagomezi.* A, Dorsal view of living specimen. B, Detail of the external flaps covering the genital orifices, and anterior part of the gill. db, dark brown; lb-g, light greyish-brown; ow, opaque white.

Figure 2. (right) *Pleurobranchus garciagomezi.* Detail of the shell.

Natural History Museum of Genova (Italy). Color transparencies of both specimens are on file at the Istituto de Zoologia, Università di Genova.

Description.—Body (Fig. 1A, Pl. 1A) oval and mantle deeply notched anteriorly, but does not have a posterior siphonal crenulation. Mantle covers broad foot, except at posterior tip. Rhinophores involute and joined basally. Oral veil has grooved edges and projects slightly from mantle. Foot corners bilabiate. Bipinnate gill (Fig. 1B) has approximately 20–23 pinnae on each side. Its central axis and axes of pinnae bear double row of alternating and conspicuous tubercles. Gill not visible in living specimens, as it is covered by mantle. Anus located just behind posterior end of membrane that attaches gill to body. Genital apertures located anteriorly to gill and surrounded by three enlarged flaps arranged at three different levels. Male pore between upper and middle flaps, while female pores located between middle and lower flaps. Pedal gland not observed at posterior end of foot.

Ground color varies from creamy brown to dark brown. Edges of notum always

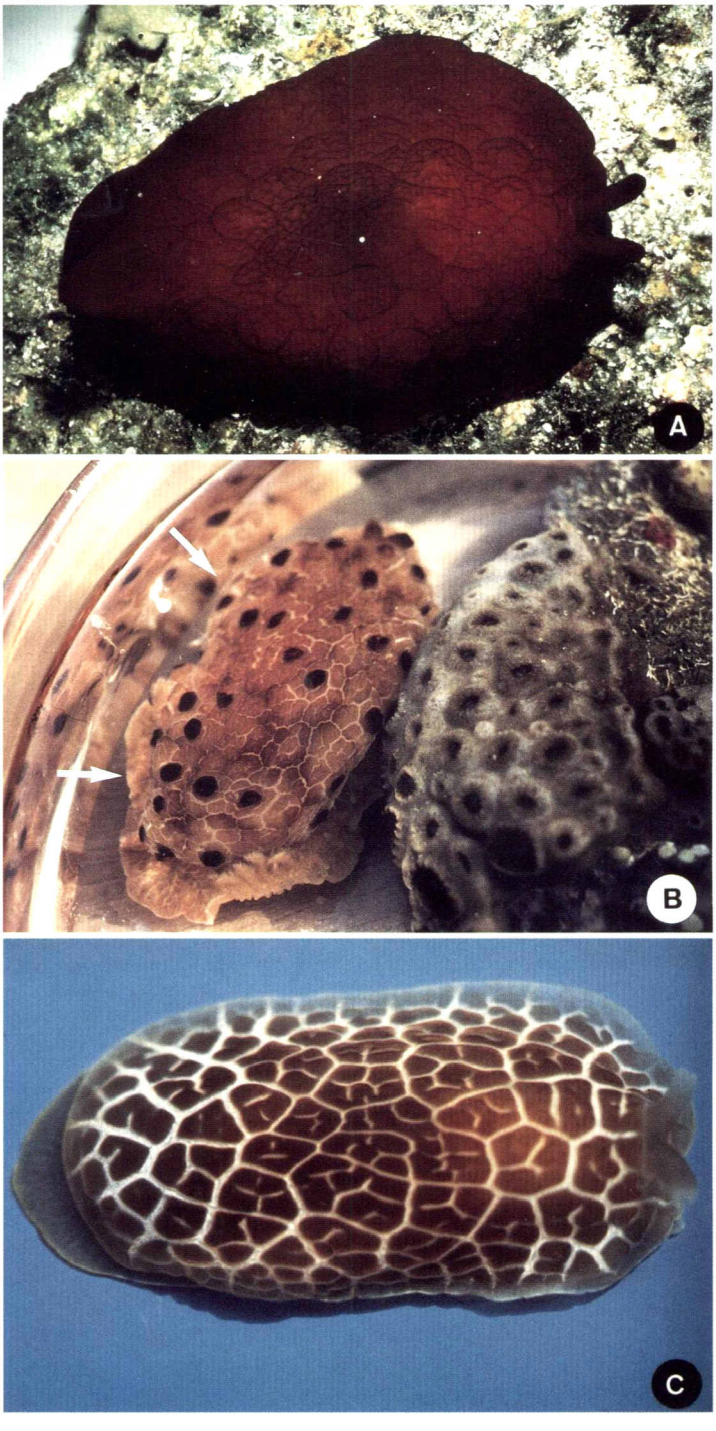

Plate 1. A, *Pleurobranchus forskalii* Rüppell and Leuckart, 1828 (the specimen does not show an opaque white network). B, *P. reticulatus* Rang, 1832 (see the arrows). C, *P. garciagomezi* new species.

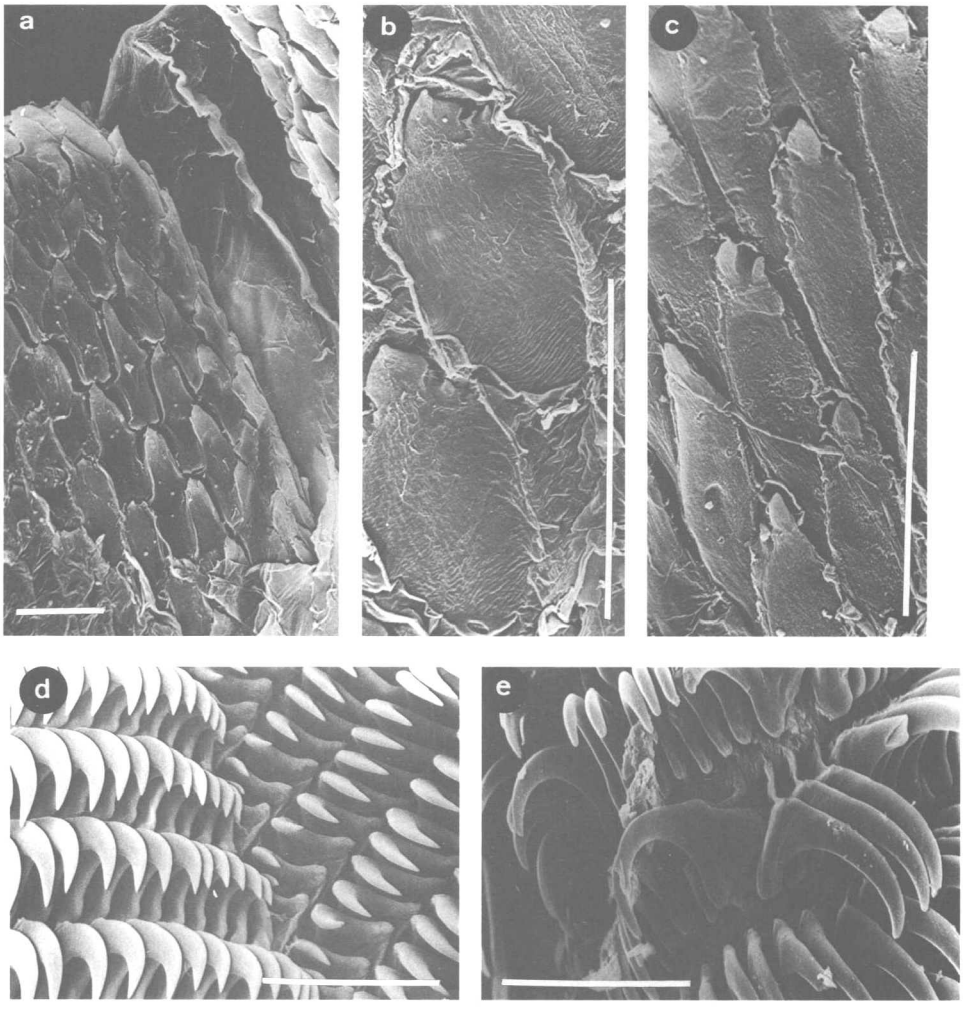

Figure 3. *Pleurobranchus garciagomezi.* Jaw platelets from the: anterior edge (a), central region (b), marginal areas (c). Radula: rachidian zone (d), outermost teeth (e) (scale bar = 100 μm in all cases).

paler. Mantle has conspicuous opaque white network arranged in delicate, shallow grooves that delimit smaller areas. Many of these lines form polygons of different sizes (Fig. 1A, Pl. 1A). Rhinophores, oral veil and foot are pale gray. There is a thin whitish border around edge of foot.

Shell of the 50 mm specimen was calcified (Fig. 2), but broken, whereas that of smaller specimen uncalcified. As both specimens were preserved in 4% formalin, this difference in calcification is probably due to differences in shells rather than an artifact of preservation. Shell located anteriorly over pericardium, or in anterior region of digestive gland, posterior to pericardium. Shell spatulate, 5.5–6.5 mm in length and 3.0–3.5 mm wide. Protoconch and teloconch lack distinct sculpture.

Jaws are 2.3 mm in length. On their surface are elongate, cruciform mandibular elements; shape of these elements varies according to their location on jaws; widest in the central region (Fig. 3b). Here they average 120 μm in length while

marginal elements (Fig. 3a, c) average 150 μm in length. All elements have prominent cusp flanked by irregular short denticle on each side.

Radular formulae 90 × 185.0.185 and 65 × 170.0.170. Radular teeth smooth and hook-shaped (Fig. 3d, e). Inner teeth slightly smaller than those from middle portion of half-row. No marginal teeth present and outermost teeth are less hooked (Fig. 3e).

Medial buccal gland present. No spicules found in tissue of mantle.

Reproductive system (Fig. 4) characterized by very long and convoluted hermaphroditic duct. Narrower and convoluted efferent duct passes under prostate. More distally it is appressed to prostate. It then passes through prostate gland which discharges into small duct. More distally, efferent duct emerges from prostate and enters penial papilla, which is large and terminates in long hook-shaped penis. Vaginal duct long and wide with several convolutions. Oviduct extremely short. Small and round gametolytic gland and elongated receptaculum both have long ducts which enter oviduct close together.

Discussion

To date, nine valid species of the genus *Pleurobranchus* have been reported from the Atlantic. *Pleurobranchus evelinae* Thompson, 1977, *P. iouspi* Marcus, 1984 and *P. emys* Marcus, 1984 have been reported only from the western Atlantic. *P. reticulatus* Rang, 1832 and *P. testudinarius* (Cantraine, 1840) are known from the eastern Atlantic while *P. membranaceus* (Montagu, 1803) and *P. areolatus* Mörch, 1863 have been reported from both sides of the Atlantic (Thompson, 1977; Marcus, 1984; Pérez Sánchez and Moreno, 1991). Additionally, *P. forskalii* (Rüppell and Leuckart, 1828) has been reported from the eastern Mediterranean (Barash and Danin, 1977) while *P. albiguttatus* Bergh, 1905 has been recorded from the coasts of South Africa (Gosliner, 1987, as *P. nigropunctatus*). Other western Atlantic species have been considered as invalid or dubious by Willan (1978) and Marcus (1984): *P. lacteus* Dall and Simpson, 1902, *P. reesi* White, 1952, *P. gigas* Sawaya and Grempel, 1971 and *P. verrilli* Thiele, 1931. *P. gardineri* White, 1952 was considered a synonym of *P. areolatus* by Marcus (1984).

The photo illustrating a specimen of *Pleurobranchus* from the Canary Islands in Pérez Sánchez and Moreno (1991) compares well with the known variation of the external morphology of *P. areolatus,* and it differs from *P. garciagomezi* in color pattern. However, the specimen reported from Ghana by Edmunds (1968) has a network of opaque white lines with large black spots in the center of many of the polygons surrounded by this network. We therefore identify the *P. areolatus* of Edmunds (1968) with *P. reticulatus* Rang, 1832.

Pleurobranchus reticulatus Rang, 1832 differs from *P. garciagomezi* in several important regards (Table 1, Pl. 1). It has large black spots on the mantle that are absent in *P. garciagomezi.* Internally, *P. reticulatus* has an ovoid shell, while that of *P. garciagomezi* is spatulate. The reproductive system of *P. reticulatus* has not been described.

The only other species which has been described with a network of opaque white lines is *P. forskalii* (Rüppell and Leuckart, 1828) (Table 1, Pl. I). Willan and Coleman (1984) and Wells and Bryce (1993) illustrate specimens with a well developed white network. Other specimens may have a network of black lines. Confusion exists regarding the differences between *P. forskalii, P. semperi* (Vayssière, 1896) and *P. perrieri* (Vayssière, 1896) (Thompson, 1970; Edmunds and Thompson, 1972). Rudman (1993) points out that *P. semperi* is the light color form of *P. forskalii* (with a network of black lines), but these problems are beyond the scope

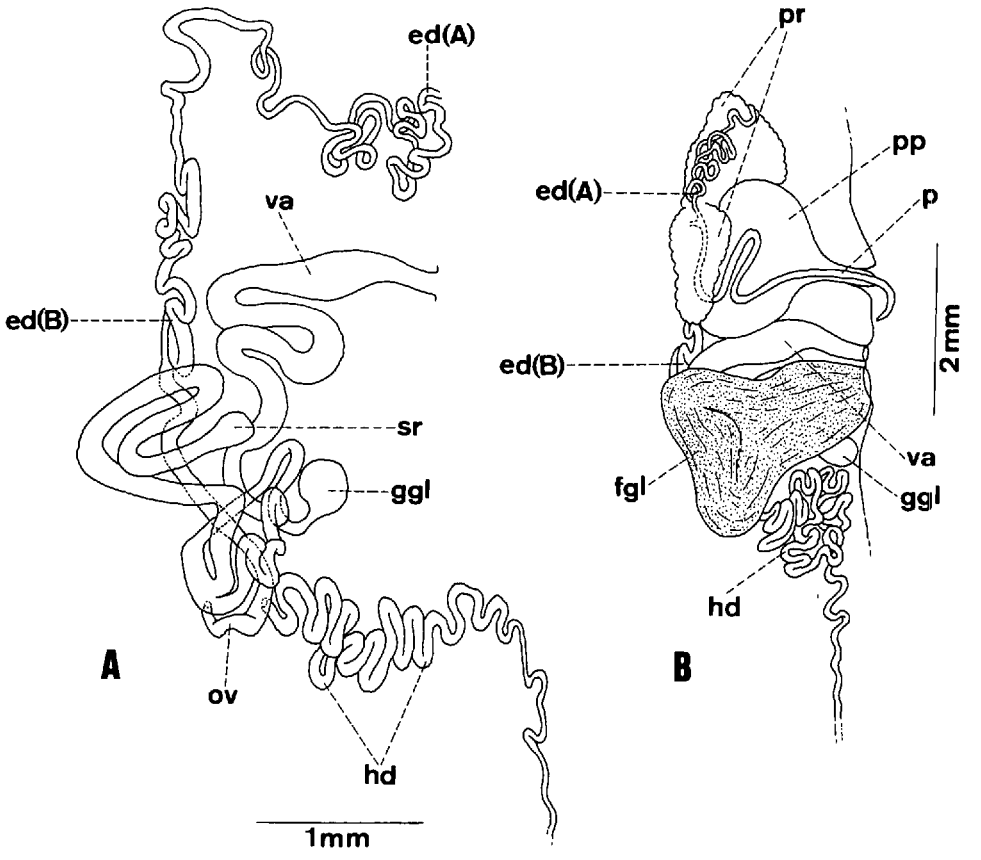

Figure 4. *Pleurobranchus garciagomezi.* A, Reproductive system (the female gland, prostate, and penial papilla are removed). B, Arrangement of reproductive system prior to removal of the organs. fgl, female gland; ed, efferent duct; ggl, gametolytic gland; hd, hermaphroditic duct; ov, oviduct; p, penis; pp, penial papilla; sr, seminal receptacle; va, vagina.

of the present paper. The important point is that there are clear differences between these species and *P. garciagomezi.* In the above species the white network does not extend to the border of the mantle, while in *P. garciagomezi* the reticulations cover the entire surface of the mantle. In the above species the shell is ovoid, while that of *P. garciagomezi* is spatulate. The mandibular elements of *P. forskalii* have more denticles (Thompson, 1970) than do those of *P. garciagomezi.*

In addition, there are some differences between the reproductive systems of *P. forskalii* and *P. garciagomezi* (Table 1), although it is desirable to dissect further material of the latter species in order to establish if these differences really are diagnostic.

Etymology.—The species is dedicated to our friend and colleague Dr. José Carlos García-Gómez from the University of Seville.

ACKNOWLEDGMENTS

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Table 1. Comparison of the characters of *Pleurobranchus forskali, P. reticulatus* and *P. garciagomezi* n. sp.

Species	Ground color	Rhinophores and foot color	Network	Tubercles of the mantle	Shell	Gametolytic gland	Seminal receptacle	References
Pleurobranchus forskalii (Rüppel and Leuckart, 1828)	Purple/violet or cream	The same as in the mantle	White, irregular. It does not reach the mantle edge. However, sometime, it could be black or dark brown	Small in size	Oval	Smaller than in *P. garciagomezi*. Its duct is shorter than in this species	Elongate, but not as in *P. garciagomezi*	Pilsbry, 1895–6; Vayssiere, 1989; Thompson, 1970; Willan and Coleman, 1984; Wells and Bryce, 1993
P. reticulatus Rang, 1832	Pale yellow, with a delicate dark brown pigmentation	Dark brown	Whitish, irregular. It reaches the mantle edge	Many black or dark brown tubercles, different in size	Oval	Not known*	Not known*	Rang, 1832; Pilsbry, 1985–6; Edmunds, 1968
P. garciagomezi n. sp.	Cream to dark brown	Pale grey	Opaque white, complicated. It reaches the mantle edge	—	Spatulate	See *P. forskalii*	See *P. forskalii*	Present study

* We have not examined the reproductive system so as not to damage more the unique specimen from Ghana (deposited at the Natural History Museum of London). The type material of this species is missing.

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