

A NEW SHALLOW WATER SPECIES OF THE GENUS *PHILINE ASCANIUS*, 1772 (MOLLUSCA: OPISTHOBRANCHIA: PHILINIDAE) FROM VENEZUELA

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Abstract A new shallow water species of the genus *Philine* *Ascanius*, 1772 is described from the coastal lagoons of the Bay of Buche, Venezuela. This species is characterized by the color pattern of its body, yellowish with white dots, the cephalic shield, as long as the posterior shield, the internal shell with the rear posterior edge not surpassing the apex and the sculpture composed of 6 to 18 striking spiral lines, the innermost lateral teeth of the radula, bearing 10–19 denticles in the masticatory margin and by lacking gizzard plates. *Philine buchensis* new species is compared with all the species of the genus known to date in the Caribbean, particularly with those from coastal areas (0–10m): *Philine sagra* (d'Orbigny, 1841) and *Philine caballeri* Ortea, Espinosa & Moro, 2001.

Key words *Philine buchensis*, new species, coastal lagoons, Caribbean.

INTRODUCTION

The genus *Philine* *Ascanius*, 1772 is composed of flattened sea slugs, white to pale brown, rarely red or orange, sometimes with dark, red or white spots (Burn & Thompson, 1998), that are commonly called headshield slugs. Most of them are only known from their shells (Price, Gosliner & Valdés, 2011), which are internal, weakly calcified and proportionally small in relation to the size of the body. Of the 85 species known (Bouchet & Gofas, 2014), 22 live in the Western Atlantic, of which, 8 have been recorded in the Caribbean (Rosenberg, 2009). In this area the coastal species, those found near the shore line in depths of less than 10 metres, are very rare and, to date, *Philine sagra* (d'Orbigny, 1841) and *Philine caballeri* Ortea, Espinosa & Moro, 2001 are the only representatives known who fit in this category. *P. sagra* has been recorded from Bermuda (Jensen & Pearce, 2009) and around the Caribbean; in Colombia (Díaz & Puyana, 1994; Yidi & Sarmiento, 2011), Cuba (Espinosa, Ortea, Caballer & Moro, 2006), Florida (doubtful *sensu* Lee, 2009), Martinique (type locality: d'Orbigny, 1941), North Carolina (doubtful *sensu* Lee, 2009) and Venezuela (Princz, 1983; Mello & Perrier, 1986; Massemin, Lamy, Pointier & Gargominy, 2009; Rosenberg, 2009: Sucre and Margarita Island; Miloslavich,

Díaz, Klein, Alvarado, Díaz, *et al.*, 2010; Yidi & Sarmiento, 2011) among other localities. *P. caballeri*, originally described in the Caribbean coast of Costa Rica (Ortea, Espinosa & Moro, 2001), has been recorded in Bahamas (Redfern, 2001: as 645 – *Philine* sp. (partially); Redfern, 2013), Cuba (Espinosa *et al.*, 2006) and Guadeloupe (Ortea, Espinosa, Caballer & Buske, 2012).

During the course of a field trip to the mangrove coastal lagoons found in the Bay of Buche, Venezuela, a species of *Philine* was captured at 1m depth. This species is similar in size to *P. caballeri*, but the color, proportions and the internal shell are quite different. The aim of this paper is to describe this taxon as new to science.

MATERIAL AND METHODS

The specimens were obtained by snorkeling in the mangrove coastal lagoon of El Ocho, Buche (10°32'27.69"N 66°5'53.77"W), Miranda, Venezuela, between 0.5 and 1.5m depth. They were captured by hand in tufts of filamentous green (*Chaetomorpha linum*) and red algae (*Gracilaria venezuelensis*) associated with *Halimeda* spp. on muddy bottom. A Nikon D80 camera with extension tubes was used to take photographs of the living specimens in an aquarium at the lab. The animals were preserved in 96% ethanol. Afterwards, diagrams were made of the radula,

shell and internal anatomy, using an Olympus SZ16 stereomicroscope. The type specimens are deposited in the Muséum national d'Histoire Naturelle (MNHN), 55 rue Buffon, Paris, France, and in the Marine Organisms Section of the Biological Collections (National register number n°028) of the Instituto Venezolano de Investigaciones Científicas (IVIC), Centro de Oceanología y Estudios Antárticos, Carretera Panamericana km 11, Altos de Pipe, Venezuela.

SYSTEMATICS

Family Philinidae Gray, 1850

Genus *Philine* Ascanius, 1772

Type species: *Philine quadripartita* Ascanius, 1772, by monotypy.

Philine buchensis new species

Holotype 3mm long alive (1.4mm preserved), March 19 2010, dissected, MNHN IM-2013–55821.

Paratype 3mm long alive (1.5mm preserved), collected in the type locality, March 19 2010, IVICCM017.

Type locality Coastal lagoon of El Ocho, Buche (10°32'27.69"N 66°5'53.77"W), Miranda, Venezuela, 1m depth.

Complementary material 2 specimens, 3 and 4mm long, alive, collected in the type locality, October 28 2009, IVICCM000133. The 4mm long specimen dissected. 1 specimen 3mm long, alive (1.5mm preserved), collected in the type locality, March 19 2010, dissected, remaining in MC collections.

Diagnosis Body yellowish with irregular opaque white dots. Cephalic shield as long as the posterior shield. Parapodia short. Internal shell with the rear posterior edge not extending the apex. Apex truncated. Sculpture composed of transversal growth striae and 6 to 18 striking spiral lines. Radular formula 15–17×2.1.0.1.2. Innermost lateral teeth with 10–19 denticles in the masticatory margin. Gizzard plates absent. Inhabits shallow water near the coast.

Description Body up to 4mm (mean size 3mm), three times as long as wide, translucent yellowish

with irregular opaque white dots all over (Fig. 1 A–B), including the sole of the foot. Visceral mass pinkish brown, visible through transparent body wall. Cephalic shield as long as the posterior shield and triangular at the back. Posterior shield bearing a notch. Parapodia short, reaching but not covering the cephalic shield, which remains visible (Figs 1 A–B). Eyes not visible through the skin in the living specimens, but present (Fig. 2 A).

Shell Internal, translucent, not calcified, very thin, very fragile, covered by a delicate periostracum, 1.2mm long (Fig. 1 C) in two specimens 3 and 4mm long. Surface apparently smooth but ornamented with numerous transversal growth striae and 6 to 18 striking spiral bands (Fig. 2 B). Spiral bands 3.5–5.5µm wide, apparently paired, composed of incomplete irregular perforations (Fig. 2 C), occupying a fifth to slightly more than half of the shell length. Rear posterior edge of the aperture does not extend over the apex, which is truncated and oriented as a prolongation of the border. Edge smooth.

Digestive system Mouth thick, strong and amber-colored inside. Buccal mass large, occupying the most of the cephalic shield in preserved specimens (Fig. 2 A). Radular formula in three specimens 3 to 4mm long: 15–17×2.1.0.1.2. Innermost lateral teeth large, with a broad base, a lateral groove, 10–19 denticles in the masticatory margin and a single cusp, curved inwards (Fig. 2 D–F). Inner marginal teeth half as long as the previous tooth, bearing a curved to hooked cusp, depending on the angle of observation. Outer marginal teeth smaller than the middle lateral. Digestive gland big and oval. Salivary glands not observed. Gizzard absent or vestigial, not seen. Gizzard plates absent.

Etymology *buchensis*, after the type locality Buche.

Habitat The specimens were captured in a coastal mangrove lagoon, together with the molluscs *Bulla occidentalis* A. Adams, 1850, *Gibberula conejoensis* McCleery, 2008 (Álvarez, Bastidas & Caballer, 2011), *Haminoea* spp. and *Caecum* spp.

Geographic range Only known from Buche, Venezuela.

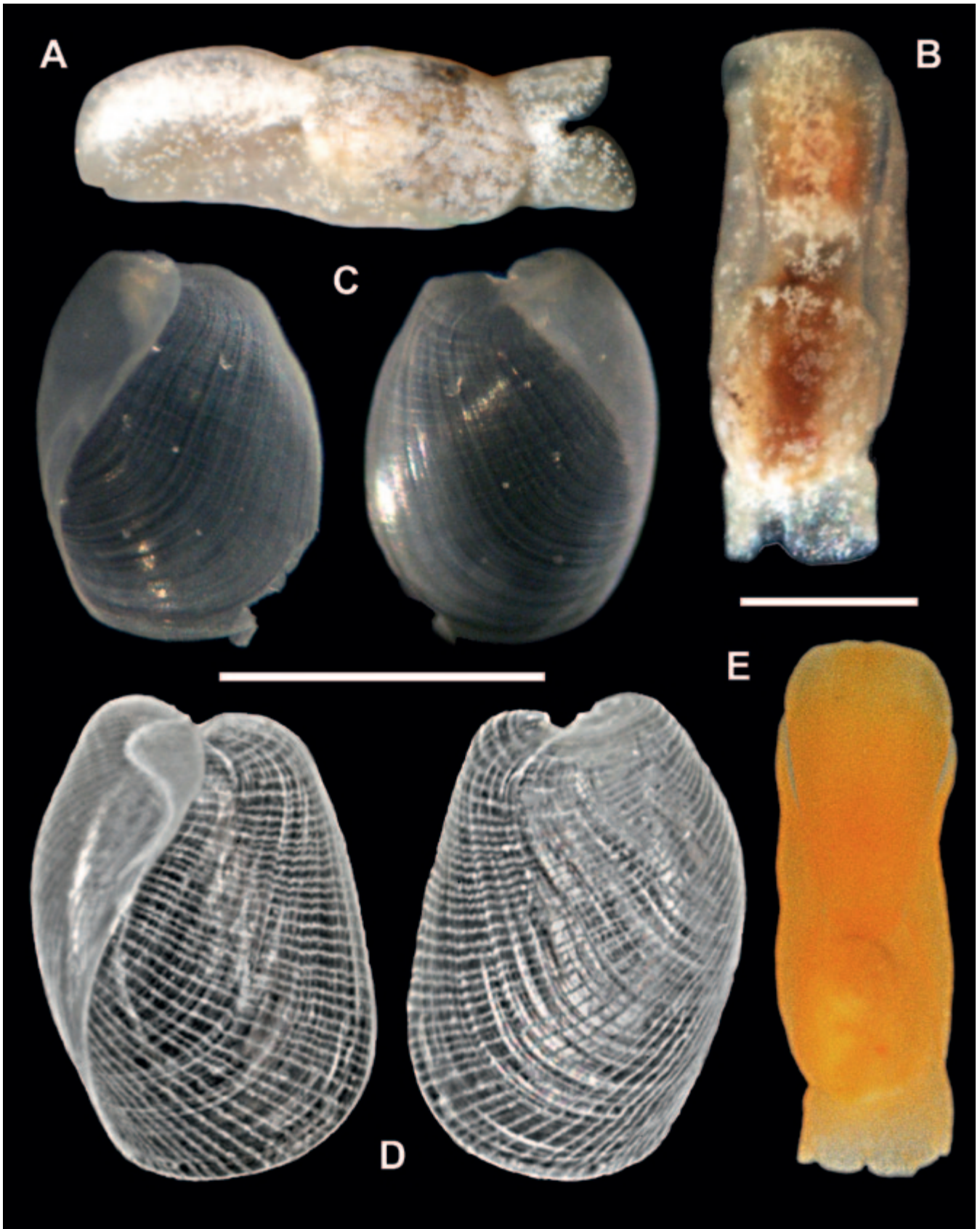


Figure 1a–c *Philine buchensis* n. sp.: **a** Lateral view of the living animal; **b** Dorsal view of the living animal; **c** Shell, ventral and dorsal views. **Fig. 1d–e** *Philine caballeri* Ortea, Espinosa & Moro, 2001: **d** Shell, ventral and dorsal views; **e** Dorsal view of the living animal from Bahamas (courtesy of Colin Redfern). (Scale bars=1mm).

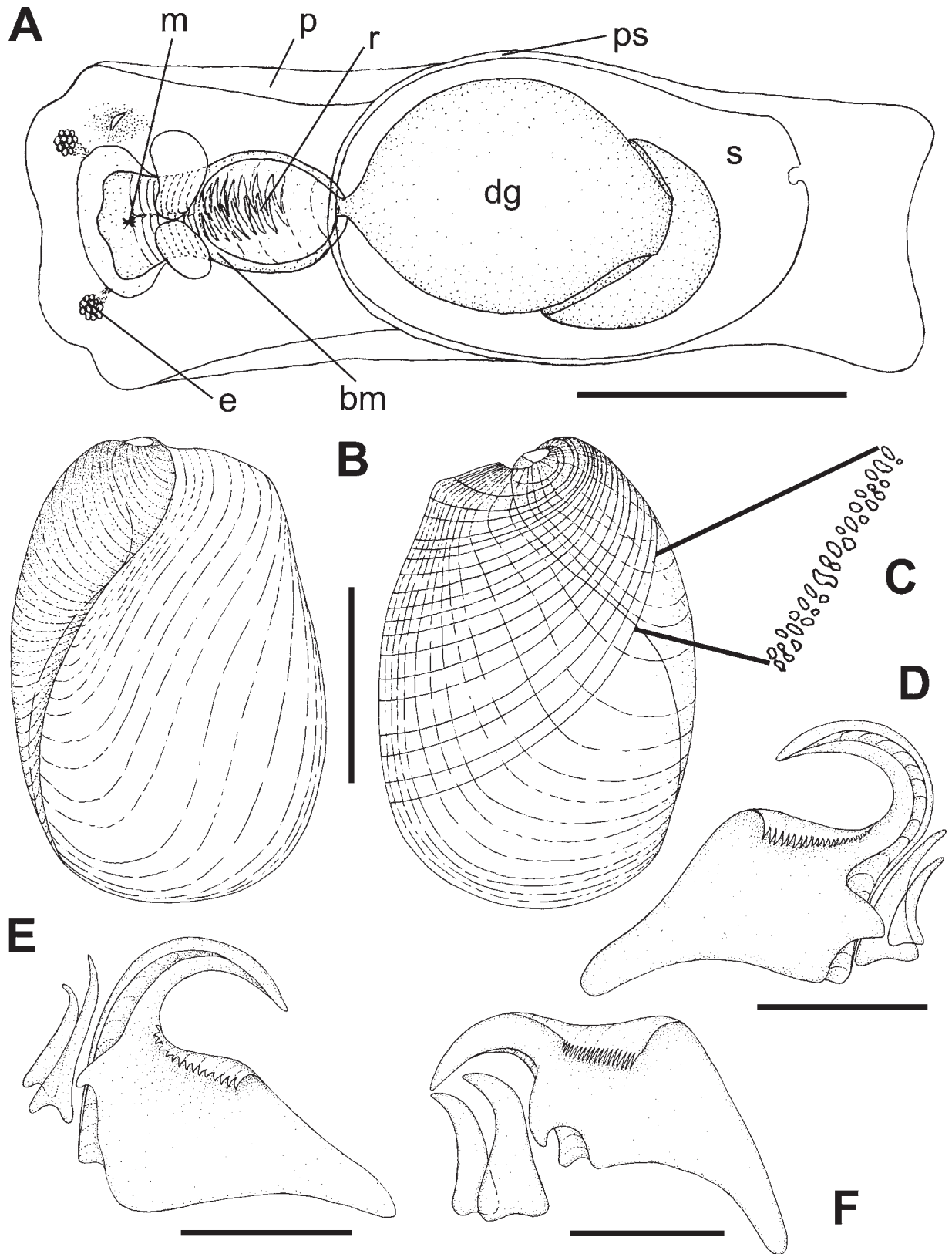


Figure 2 *Philine buchensis* n. sp.: **a** Scheme of digestive system in the holotype. (Scale bar=500 μ m); **b** Shell, ventral and dorsal views, specimen 1.5mm long preserved, MC collections. (Scale bar=500 μ m); **c** Detail on the morphology of the spiral lines in the shell; **d-f** Radula. (Scale bar=30 μ m); **d** IVICCM000133; **e** Holotype; **f** Twisted cusp, specimen 1.5mm long preserved, MC collections. **e** eye; **bm** buccal mass; **dg** digestive gland; **m** mouth; **p** parapodia; **ps** posterior shield; **r** radula; **s** internal shell.

DISCUSSION

Rosenberg (2009) synthesizes the records of the 8 species of *Philine* known to inhabit the Caribbean (or nearby areas) and the data on their distribution and size are given here (Table 1): *Philine alboides* Price, Gosliner & Valdés, 2011, *P. caballeri*, *Philine candeana* (d'Orbigny, 1841), *Philine finmarchica* M. Sars, 1859, *Philine flexuosa* M. Sars, 1870, *Philine infundibulum* Dall, 1889, *Philine planata* Dall, 1889 and *P. sagra*.

Of these species, only *P. caballeri* and *P. sagra* have been found near the shoreline, in waters shallower than 10m depth (Table 1), and only *P. sagra* has been recorded in Venezuela (see Introduction).

Price *et al.* (2011) made a revision of the *Philine aperta* (Linnaeus, 1767) species complex that included some of the non-littoral Western Atlantic species in which the rear posterior edge

of the aperture extends over the apex, as well as the description of *P. alboides*, from Florida. The latter species has been recorded in the Caribbean as *Philine alba* Mattox, 1958 (Marcus & Marcus, 1967; Marcus, 1974). *P. alboides* is distinguished from *P. buchensis* n. sp. by the greater length of its body, up to 44mm; its body colour white rather than yellowish; by the cephalic shield being longer than the posterior shield, which lacks a posterior notch; by the shell being very wide and lacking sculpture; by the radular teeth in lacking denticles, and by the presence of 3 evenly-sized gizzard plates (Price *et al.*, 2011).

P. caballeri is distinguished from *P. buchensis* n. sp. by the coloration of the body, uniformly orange rather than yellowish (Fig. 1 E); the cephalic shield being longer than the posterior shield; the shape of the tail in having a smaller notch in a different place; the shell, which, in *P. caballeri* is stronger, bigger, more elongated, with

Table 1 Comparison of the species of *Philine* recorded in the Caribbean in the literature.

Species	Caribbean distribution	Bathymetrical distribution	Size	Body color	Reference
<i>P. alboides</i>	Straits of Florida and Gulf of Mexico to Brazil	110 to 329 m	19–44mm preserved (body)	Uniformly white	Price <i>et al.</i> , 2011
<i>P. caballeri</i>	Bahamas, Costa Rica, Cuba, Guadeloupe	1–23 m	To 3.5mm (body)	Orange	Ortea <i>et al.</i> , 2001; Redfern, 2001 (partially); Espinosa <i>et al.</i> , 2006; Ortea <i>et al.</i> , 2012; Redfern, 2013
<i>P. candeana</i>	Guadeloupe	?	To 12mm (shell)	Uniformly white (shell)	d'Orbigny, 1841
<i>P. finmarchica</i>	Off Surinam (7°37'N 55°22'W)??	1220–1335 m	18mm (body)	Uniformly white	Marcus, 1974; Price <i>et al.</i> , 2011
<i>P. flexuosa</i>	Yucatan Strait	1170 m	?	?	Dall, 1881; 1889a; 1889b
<i>P. infundibulum</i>	Antilles, Barbados, Colombia, Cuba, Dominican Republic, Guadeloupe, Gulf of Darien (Colombia-Panama), St. Kitts/St. Christopher, Straits of Florida; to Brazil	68-724-	To 30mm (body)	Uniformly white	Dall, 1889a; Marcus, 1974; Díaz & Puyana, 1994; Yidi & Sarmiento, 2011; Price <i>et al.</i> , 2011
<i>P. planata</i>	Off Dominica, off Barbados	252–384 m	To 11,5mm (shell)	?	Dall, 1889a
<i>P. sagra</i>	Bermuda, Colombia, Cuba, Florida, Martinique, North Carolina, Panama, Puerto Rico, Venezuela; to Brazil	2–86 m	To 6mm (shell)	Uniformly white (shell)	d'Orbigny, 1841; Díaz & Puyana, 1994; Espinosa <i>et al.</i> , 2006; Jensen & Pearce, 2009; Lee, 2009; Yidi & Sarmiento, 2011

irregular and thick growth marks and a sculpture composed of remarkable spiral irregular hollow cords, separated by smooth areas wider than them (Fig. 1 D) (Ortea *et al.*, 2001; Redfern, 2013). In addition, *P. caballeri* bears acicular gizzard plates (Ortea *et al.*, 2001).

P. candeana is a rare species that was described by d'Orbigny (1841) from Guadeloupe. The expedition Karubenthos-2012 to the archipelago, coordinated by the National Natural History Museum in Paris, carried out an intensive sampling which included 92 stations from the shore to 258m depth. As a result of this expedition the number of sea slugs known in Guadeloupe rose to 150 species (Ortea *et al.*, 2012; Ortea, Espinosa, Buske & Caballer, 2013; Caballer & Ortea, 2014), but *P. candeana* was not re-captured. *P. candeana* can be distinguished from *P. buchensis* n. sp. by its shell (Table 1), being ten times bigger, opaque white, regularly oval, concave but markedly flattened ventrally (d'Orbigny, 1841: plate 4, figure 3), with a rounded spire and transversal striae all over (d'Orbigny, 1841).

Dall (1881) cited *Philine* sp. from the Yucatan Straits. This specimen was determined as *P. flexuosa* by Dall (1889a; 1889b), after a comparison with samples of *P. flexuosa* M. Sars, 1870 identified by Sars (Dall, 1889a). Subsequently, *P. flexuosa* has been regarded as a junior synonym of *Philine pruinosa* (Clark, 1827) by Ohnheiser & Malaquias (2013), who examined the probable type material of *P. flexuosa*. The specimen collected by Dall (1881; 1889a; Dall 1889b) from 1170m depth, was described as "A fragment of a species... It is of a yellow brown, with strong lines of growth crossed by very numerous punctulate grooves all over the surface." (Dall, 1881), which is different from the translucent and apparently smooth shell of *P. buchensis* n. sp., which lives shallower than 1m depth. The presence of *P. pruinosa* (described in northern Europe) in the Caribbean was not considered by Ohnheiser & Malaquias (2013) and is doubtful.

The record of *P. finmarchica* in Surinam was established on the basis of two damaged specimens collected by Marcus (1974) between 1220 and 1335m depth. This author considered *P. finmarchica* a polar species and compared the cold waters and habitat in the deep sea of Surinam with a shallower environment in higher latitudes where the species is common. This finding (Marcus, 1974) was not considered by Price *et al.*

(2011) in the distribution of the species, which does not include the Caribbean Sea. *P. finmarchica* grows up to 18mm, has a white body, a radular formula of 18×0.1.0.1.0., radular teeth bearing 60–70 denticles and 3 evenly-sized gizzard plates (Marcus, 1974), very different from the characters of *P. buchensis* n. sp.

P. infundibulum is widely distributed in the Caribbean (see Table 1) and it has been recorded near the coasts of Colombia, but it is distinguished from *P. buchensis* n. sp. by its body being white and 8–10 times larger, with the cephalic shield bigger than the posterior shield; shell about 10 times larger, more rounded and lacking sculpture other than growth striae; radular formula: 20–24×1.1.0.1.1.; teeth, bearing 28–37 denticles; the presence of 3 gizzard plates in the digestive and because *P. infundibulum* lives deeper than 68m (Dall, 1889a; Marcus, 1974; Díaz & Puyana, 1994; Yidi & Sarmiento, 2011; Price *et al.*, 2011).

There is not much information about *P. planata*, only what is known from the original description Dall (1889a), but there is sufficient detail to distinguish *P. planata* from *P. buchensis*; the shell is 10 times bigger; the proportional length shell-body is 1/6 against 1/3 in *P. buchensis*, and at least 2 gizzard plates are present.

P. sagra has an elongated and white shell (3×1,5mm), with the edge of the outer lip serrate and a characteristic sculpture composed of cords formed by oval rings alternating with undulated bands (d'Orbigny, 1841; Díaz & Puyana, 1994; Espinosa *et al.*, 2006). This species is quite easy to distinguish from *P. buchensis* n. sp., which has a smaller shell, translucent, wider and more rounded, with the outer edge smooth and lacking such a complex sculpture.

The type locality of this species is Martinique, but there are some doubts of its presence in North Carolina and Florida (Lee, 2009) where a sibling species could occur, although in Bermuda it is apparently confirmed (Jensen & Pearce, 2009).

Based on the general appearance of the body, the shell and the radula, we have placed our species in the genus *Philine*. However, recent results by Gonzales & Gosliner (2014) may indicate that *Philine* or even the Philinidae could be polyphyletic. The internal anatomy of *P. buchensis* n. sp., with an absent or vestigial gizzard, is quite characteristic, and future molecular studies could separate this species from the ones in the

Philine aperta clade (Price *et al.*, 2011; Gonzales & Gosliner, 2014).

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