



## Article

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### ***Hemicycla (Hemicycla) fuenterroquensis* (Gastropoda: Helicoidea: Helicidae), a new species from La Palma, Canary Islands**

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The rugged, volcanic oceanic island of La Palma (Fig. 1), with the oldest subaerial rocks dated at 1.7 Ma, is one of the youngest islands of the Atlantic Canarian Archipelago. La Palma is an elongated island with North-South orientation (about 45 km long and near 28 km wide in the northern half, then tapering towards its southernmost tip), with an area of 708 km<sup>2</sup> and an altitude of 2426 m above sea level (a.s.l.). The island is in the second stage (“emergence and subaerial construction”) out of the six phases of the hotspot island’s life cycle (Fernández-Palacios & Whittaker, 2010). The most recent volcanic eruption occurred at the Teneguía volcano in 1971. The island exhibits a considerable range of habitats (from arid lowland shrub zones to humid highland evergreen forests) generated by high mountains that intercept the moist trade winds. This great variety of habitats has enhanced land snail radiation and speciation, so the island accommodates about 30 validly described endemic species of land snails, most of them belonging to the main genera (e. g., *Napaeus* Albers, 1850, *Canariella* Hesse, 1918, *Insulivitrina* Hesse, 1923) living today in the archipelago. The genus *Hemicycla* Swainson, 1840 is second land gastropods in terms of species richness within the Canary Islands, with about 40 known living species (Neiber et al., 2011). Only two of these *Hemicycla* species are present in La Palma, *H. vermiplicata* (Wollaston, 1878) and *H. granomalleata* (Wollaston, 1878) (Fig. 2 A, E), which were merely studied conchologically back in the 19<sup>th</sup> century. Moreover, Odhner (1937) mentions the presence in Santa Cruz de La Palma of *H. ethelema* Mabille, 1882, a species viewed as endemic to the Gran Canaria Island, in basis to three shells placed at his disposal by Count C. Strömfelt, Stockholm, and he compares these shells with those of *H. granomalleata*, indicating that he finds the best concordance in all essential characteristics, but having the *H. granomalleata* shells finer granulation than those of *H. ethelema*.

A new species is described in the present study and compared with the two previously known species (*H. vermiplicata* and *H. granomalleata*) and also with *H. ethelema*, using (1) shell features (Figs. 2, 3), (2) genital system anatomy (Fig. 4), and (3) geographical distribution (Fig. 1) data combined. The presence of other, as yet undescribed species on La Palma, was already presumed by Wollaston (1878, p. 358): “Mousson's monograph does not enumerate a single Palman representative of the great section *Hemicycla*; nevertheless, seeing that Gomera is so rich in insular forms, we can hardly suppose that Palma, with its superior elevation and more extensive area, is deficient in them, but must merely conclude that the smaller amount of research which has been expended on it accounts for the fauna having been less investigated”.

The studied land snail specimens here were drowned in water and fixed in 80% ethanol. The methodology employed is described in Kerney *et al.* (1979) and Yanes *et al.* (2009a, b). “Proximal” and “distal” refer to the position in relation to the ovotestis.

## Institutional and other abbreviations

AIT	Alonso and Ibáñez collection, Department of Animal Biology, University of La Laguna, Tenerife, Canary Islands, Spain
JMC	J. M. Castro private collection, La Palma, Canary Islands, Spain
RG	R. Gómez private collection, La Palma, Canary Islands, Spain
TFMC (MT)	Museo de Ciencias Naturales de Tenerife, Canary Islands, Spain
UTM	Universal Transverse Mercator cartographic projection system

## Family Helicidae

Genus *Hemicycla* Swainson, 1840

Type species (by monotypy): *Helix plicaria* Lamarck, 1816.

*Hemicycla (Hemicycla) fuerterroquensis* sp. nov.

**Type locality.** Fuente de los Roques, La Palma. UTM: 28RBS2257, 880 m a.s.l.

**Holotype** (shell): TFMC (MT0841; Fig. 2 C, Table 1), Leg. J. M. Castro, 15<sup>th</sup> April 2012.

**Paratypes.** 1 ethanol specimen and 25 shells (AIT), 94 shells (JMC) and 5 shells (RG), collected between 24<sup>th</sup> April 2011 and 5<sup>th</sup> May 2012 at the type locality and its surroundings.

**Etymology.** The specific epithet refers to the name of the type locality of the new species.

**Distribution and habitat (Fig. 1).** The species is endemic to La Palma. It is present between 50–1160 m (a.s.l.). Living specimens were found exclusively between 830–1160 m (a.s.l.) in a dry pine forest of the Fuente de los Roques area, which is exposed to the moist trade winds from the Northeast. This locality is situated in the Southeast of the dorsal chain of the Cumbre Vieja Mountains. A part of these mountains belongs to the Cumbre Vieja Natural Park.

**Description.** Body dark blue-greyish coloured dorsally, more bluish laterally (Fig. 1), sole greyish. Jaw odontognathous with 6 ribs, the two central ribs are the most developed, while the two outer ribs are almost inconspicuous.

Shell (Fig. 2 C; Table 1) imperforate, unkeeled, depressed globular, with soft shine, about 4 ¼ convex whorls and well-marked sutures, protoconch with about 1 ¼ whorls. Shell colour on the dorsal side reddish-brown but with two wide, diffuse darker brown spiral bands occupying the dorsal surface almost completely; the colour of the ventral side is corneous, with one or two narrow spiral bands, also of a darker brown colour. Aperture oblique and rounded, without angulations, the margins barely converge at the insertion. White peristome largely reflected covering the umbilicus in adult specimens (juvenile specimens have it open and subadults have an opened split).

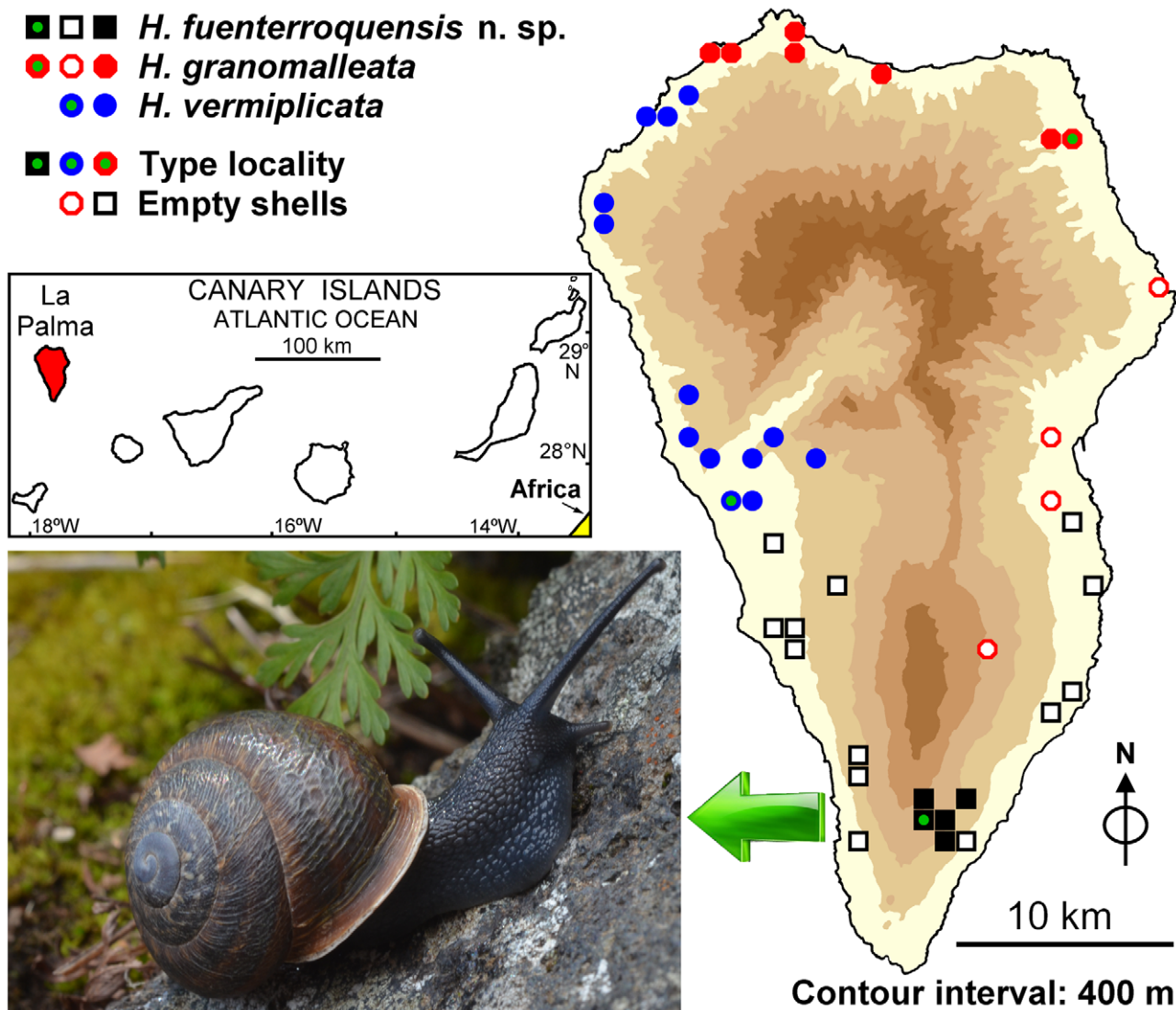
Shell ornamentation (Fig. 2 D). The protoconch is almost smooth, with minute radial folds. The teleoconch has many radial folds regularly arranged on the dorsal side near the suture, but a short distance below the suture the folds join irregularly, making up a well developed malleation. The shell surface has a faint microsculpture (Fig. 2 D, arrows) of very weak radial and spiral folds, occasionally, where the radial and spiral folds intersect, a very weak microgranulation is developed.

Genital system (Fig. 4 B; 3 specimens dissected): Atrium short. Bursa copulatrix complex with a well developed diverticulum, near 4/3 times longer than the bursa duct and up to 3 times longer than the common stalk. The bursa copulatrix is globular. The dart sac is accompanied by a pair of mucus glands, each one with 3–4 long terminal tubules. The penial complex has a long flagellum, slightly shorter than the bursa copulatrix diverticulum and more than twice longer than penis and epiphallus together. The retractor muscle has an epiphallar insertion.

The penis has a system of twin papillae with a penial chamber between them (Fig. 4 B), similar to those described for other *Hemicycla* species (Alonso & Ibáñez, 2007, Ibáñez & Alonso, 2007) and several other genera of the subfamily Helicinae (Neubert & Bank, 2006).

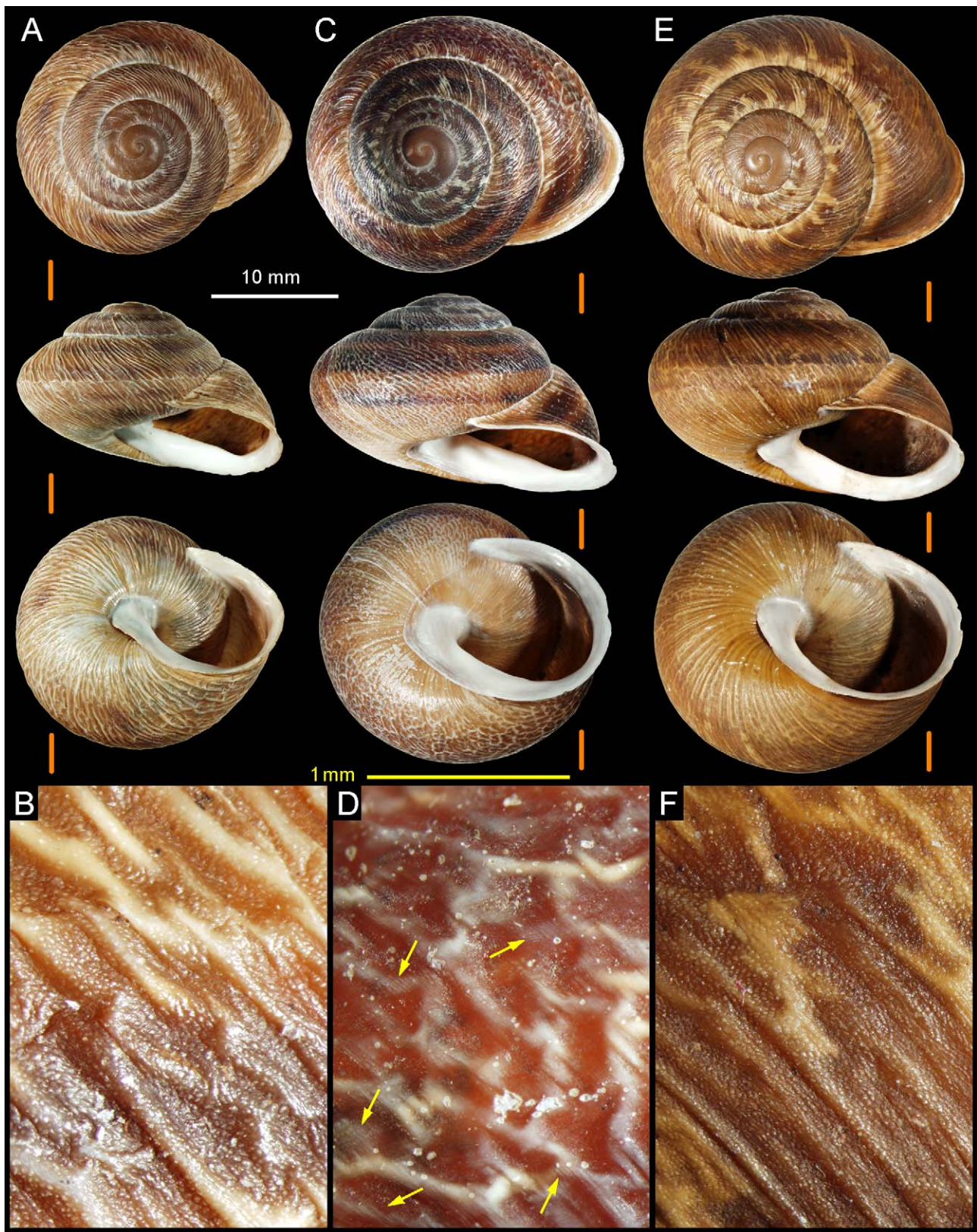
**TABLE 1.** Shell dimensions (in mm or mm<sup>2</sup>) of the three *Hemicycla* species from La Palma Island. BH, body whorl height (at columella level); BP, body whorl frontal perimeter; BS, body whorl frontal surface (plane view); D1, maximum shell diameter; D2, shell diameter perpendicular to D1; FP, shell frontal perimeter; FS, shell frontal surface (plane view); SH, shell height; SP, shell perimeter (dorsal plane view); SS, shell surface (dorsal plane view); n, number of specimens measured.

character	<i>H. fuerterroquensis</i> sp. nov., holotype	<i>H. fuerterroquensis</i> sp. nov.; n = 10	<i>H. vermiplicata</i> n = 11	<i>H. granomalleata</i> n = 10
D1	25,2	21.9–25.2	21.7–25.3	23.6–25.4
D2	20,3	18.4–20,3	18.4–21.2	19.8–21.5
SS	381,2	303.5–381.2	290.1–398.1	352.4–410.8
SP	72,3	64.9–72.3	62.3–73.0	68.4–75.4
SH	15,6	14.3–15.9	13.4–15.7	15.1–17.7
FS	257,7	212.5–257.7	191.1–258.6	250.9–297.6
FP	64,6	59.5–64.6	54.6–64.0	62.4–67.6
BH	12,6	11.5–13.3	10.9–13.2	12.5–14.8
BS	231,6	187.7–231.6	171.8–238.6	232.7–275.0
BP	61,4	56.3–61.4	53.3–62.6	60.3–66.6

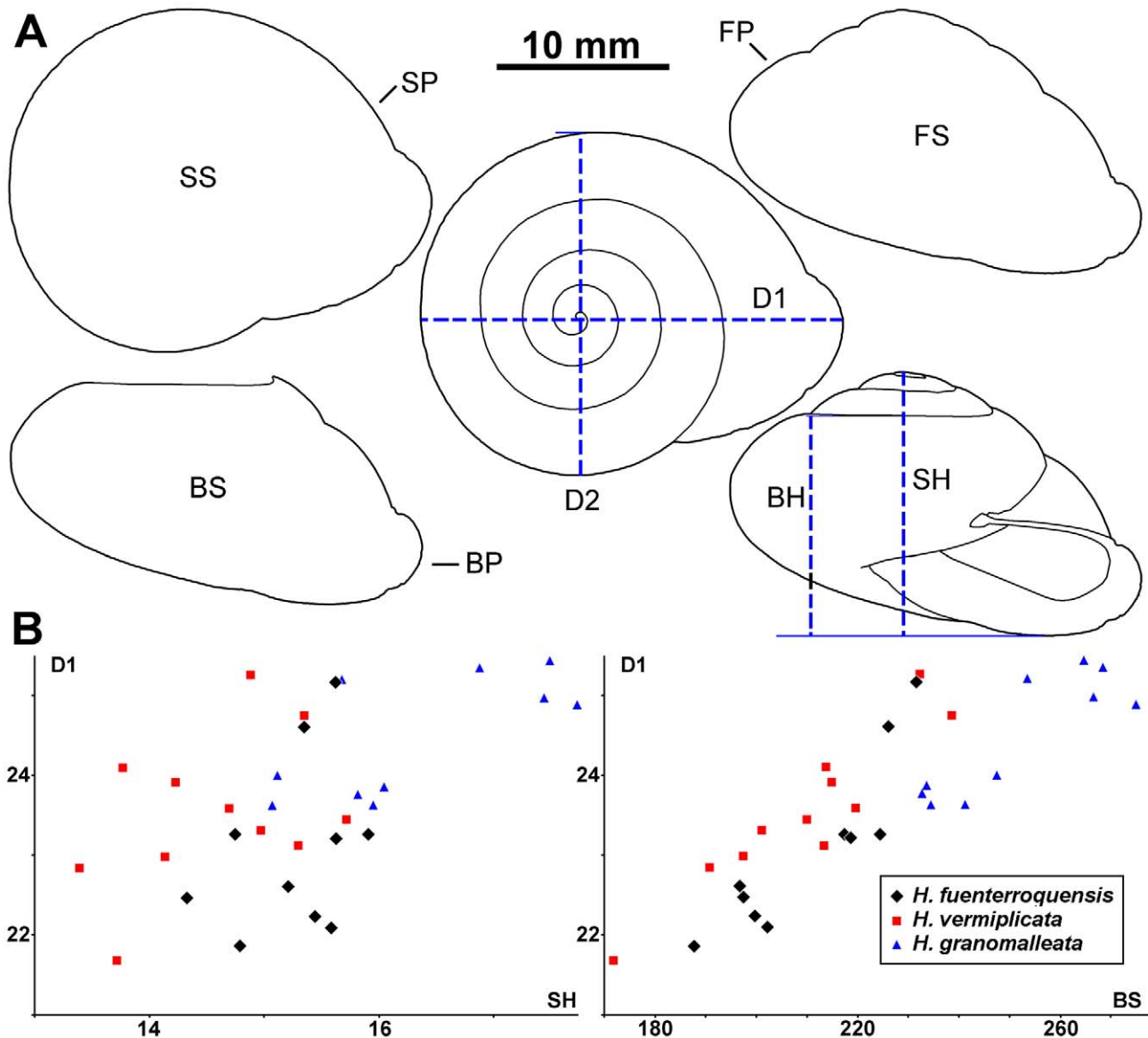


**FIGURE 1.** Geographical distribution of the known *Hemicycla* species from La Palma Island, and a detailed photograph of a *Hemicycla fuerterroquensis* sp. nov. specimen described in the present study.





**FIGURE 2.** Shells and details of the body whorl ornamentation of the three known *Hemicycla* species from La Palma Island. A, B, *Hemicycla vermiplicata*; C, D, *H. fuerterroquensis* sp. nov.; E, F, *H. granomalleata*. The arrows in Fig. 2 D highlight the weak microsculpture of the *H. fuerterroquensis* sp. nov. shell.



**FIGURE 3.** A, Shell drawings of *Hemicycla fuerterroquensis* sp. nov., holotype, showing the placement of the measurements obtained for Table 1. B, Scatter plots of some shell measurements of the studied species. BH, body whorl height (at columella level); BP, body whorl frontal perimeter; BS, body whorl frontal surface (plane view); D1, maximum shell diameter; D2, shell diameter perpendicular to D1; FP, shell frontal perimeter; FS, shell frontal surface (plane view); SH, shell height; SP, shell perimeter (dorsal plane view); SS, shell surface (dorsal plane view).

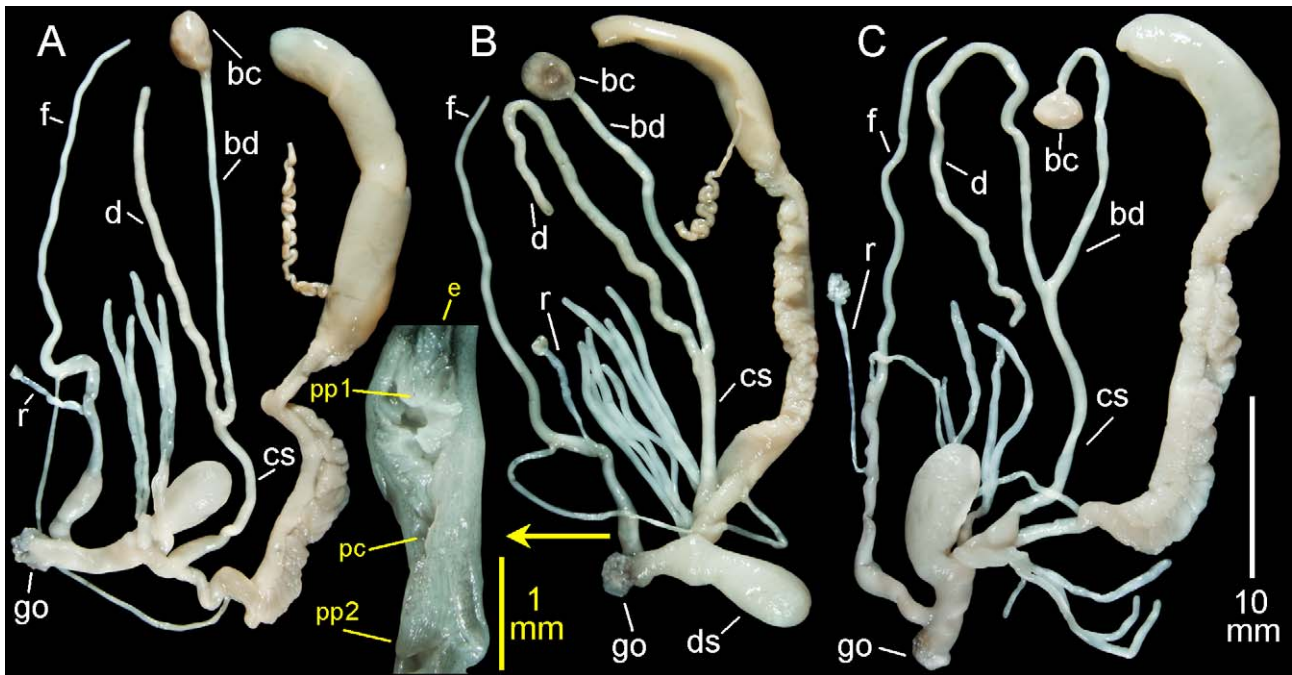
## Remarks

Regarding the shell, there are several marked differences among the three species. The *H. vermiplicata* shell is the only clearly keeled (Fig. 2 A), and the *H. granomalleata* shell is the largest, especially the body whorl is relatively larger than that of *H. fuerterroquensis* sp. nov. (Figs. 2 E, 3 B, Table 1: BS). *Hemicycla fuerterroquensis* sp. nov. (Fig. 2 C, D) also differs from the other two species, and also from *H. ethelema*, by the shell micro-ornamentation. The shell surface of *H. fuerterroquensis* sp. nov. does not exhibit the well-developed, rough, dense granular microsculpture typical of the other three species (Fig. 2 B, F), but it has a weak microsculpture (Fig. 2 D, arrows in shell detail) as described above. Moreover, the *H. fuerterroquensis* sp. nov. shell is more globose than that of *H. ethelema*, and the well developed malleation of the *H. fuerterroquensis* sp. nov. shell is absent in *H. ethelema*.

Several noticeable differences were found among *H. fuerterroquensis* sp. nov., *H. vermiplicata* (Fig. 4 A) and *H. granomalleata* regarding the genital system anatomy (that of *H. ethelema* has not yet been described): *H.*



*fuenterroquensis* sp. nov. (Fig. 4 B) differs mainly from *H. vermiplicata* (Fig. 4 A) and *H. granomalleata* (Fig. 4 C) in the length of some ducts, namely the diverticulum and the common stalk of the bursa copulatrix complex. The absolute length of the diverticulum of *H. fuenterroquensis* sp. nov. is clearly longer than that of *H. vermiplicata* and notably shorter than that of *H. granomalleata*, whereas the common stalk of the new species is shorter than that of the other two species.



**FIGURE 4.** Genital system. A, *Hemicycla vermiplicata*; B, *H. fuenterroquensis* sp. nov.; C, *H. granomalleata*; bc, bursa copulatrix; bd, bursa duct; cs, common stalk of the bursa copulatrix complex; d, diverticulum; ds, dart sac; e, epiphallus; f, flagellum; go, genital orifice; pp1, proximal penial papilla; pp2, distal penial papilla; pc, penial chamber; r, retractor muscle.

## Habitat

The three *Hemicycla* species live in dry areas and show an allopatric distribution (Fig. 1). The *H. vermiplicata* biotope is generally located in the leeward, more xeric slopes (Norwest and West of the island), between 50 and 700 m (a.s.l.). *Hemicycla granomalleata* is found in the windward slopes (North and Northeast of the island), between 50 and 500 m (a.s.l.), up to the lower reaches of the humid laurel forest. *Hemicycla fuenterroquensis* sp. nov. inhabits the South of the island, and the biotope of the living specimens collected by us corresponds to a dry pine forest, the dryness being somewhat deminished by the exposure to the humid trade winds.

## Acknowledgements

Special thanks go to Mr. Ramón Gómez, who collected the first shells of *H. fuenterroquensis* sp. nov. and to Mr. Rafael García (Santa Cruz de La Palma) for his geographical distribution data of the species. This study was partly supported by the project CGL2011-29898/BTE funded by the Spanish "Ministerio de Economía y Competitividad".

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