

# The rediscovery of a semi-slug: *Coloniconcha prima* Pilsbry, 1933 (Gastropoda, Pleurodontidae) from Hispaniola

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The semi-slug *Coloniconcha prima* Pilsbry, 1933 is redescribed and its anatomy is described for the first time. The taxonomic position of this species within the Pleurodontidae is being discussed.

Key words: Gastropoda, Stylommatophora, Camaenidae, Pleurodontidae, *Coloniconcha*, taxonomy, anatomy, Hispaniola, Dominican Republic, Haiti.

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## INTRODUCTION

The body plan referred to as semi-slug occurs in a wide diversity of gastropod families and several examples are known from the Neotropics, e.g. *Amphibulima* and *Gaeotis* (Amphibulimidae; Breure, 1974), *Cryptostrakon* and *Semiconchula* (Xantonychidae; Cuzzo, 1997; Naranjo-Garcia, Polaco & Pearce, 2000; Naranjo-Garcia et al., 2003). In the West Indies semi-slugs are present on different islands, usually as endemics. Hispaniola also has an endemic semi-slug in its malacofauna, *Coloniconcha prima* Pilsbry, 1933 (Wetherbee & Clench, 1987).

The land snail fauna of Hispaniola remains poorly known, despite the fact that several authors have published

on families occurring there (e.g. Bartsch, 1946; Clench, 1932, 1934, 1935, 1962a, b; Clench & Aguayo, 1937; Crosse, 1891; Pilsbry, 1933; Thompson, 1978; Thompson & Franz, 1976; Wetherbee & Clench, 1984). The most recent checklist of the non-marine molluscs of Hispaniola was published by Wetherbee & Clench (1987).

The genus *Coloniconcha* Pilsbry, 1933, was proposed for a semi-slug occurring at a coffee plantation in the province of Barahona, Dominican Republic. Although the type material was collected alive, the soft parts were not preserved and Pilsbry placed it in the family Camaenidae. The species, *C. prima* Pilsbry, 1933, was described as the first member of this family with a reduced shell. Since the original description no further details on it have been published. Recently some photographs of live specimens of *Coloniconcha* have become available, the best of which is reproduced in figure 1. A number of specimens of what is now interpreted to be this species, were collected by Fred G. Thompson and colleagues in both the Dominican Republic and Haiti. These included dry and alcohol-preserved specimens. The localities where these were found lie in two massifs, the Sierra de Bahoruco/Massif de la Selle and the Sierra de Martin García (Fig. 2B). The Sierra de Bahoruco lies in the southwestern part of the Dominican Republic and continues westernly as the Massif de la Selle in Haiti. The Dominican part of this mountain range is relatively



Fig. 1. Living specimen of *Coloniconcha prima*, Sierra de Bahoruco, Dominican Republic. Photo: Pedro Genaro Rodriguez.

inaccessible. The mountain system is largely made up of marine calcareous sediments of Eocene-Miocene age (Marcano, 2008). With the prevailing winds coming from the southeast, the eastern part of the Sierra de Bahoruco has the highest precipitation, gradually diminishing towards the (north)west. The highest peak in the eastern part is de Pie de Palo (1603 m). The higher parts of the mountains were originally covered by humid broadleaf forest, which still harbours many endemic, epiphytic plants (Zanoni, 1989). Where the virgin cloud forest has been cleared, the soils are usually poor. Northeast of Sierra de Bahoruco lies the isolated Sierra de Martin García; the highest peak is Loma Busú (1350 m) on the border between the provinces Barahona and Azua. Geologically, the Sierra de Bahoruco and Sierra de Martin García are separated by the Enriquillo Basin—an arid lowland that was part of a large marine channel during the Miocene and which separated Hispaniola into two palaeo-islands (Cooper, 1983; Graham, 2003; Iturralde-Vinent & MacPhee, 1999).

Cuezzo (2003) made a morphological and cladistic analysis of the Camaenidae (s.l.), discussing the relationships of the American genera. However, *Coloniconcha* was not included in her study. The aim of the present paper is to establish the position of this monotypic genus, using the framework of Cuezzo as a reference.

## METHODS

All material studied is kept in the Florida Museum of Natural History, Gainesville, USA (abbreviation: UF). Unless otherwise stated, the material has been collected by Fred G. Thompson (FGT station numbers). Other abbreviations used are: AG, albumen gland; BC, bursa copulatrix; BCD, bursa copulatrix duct; D, diameter of shell; EP, epiphallus; FC, flagellar caecum; FL, flagellum; HA, apertural height; HD, hermaphroditic duct; LW, height of last whorl; M, mantle; N, nephridium; n, number of specimens measured; OT, ovotestis; P, penis; PC, pericard; PN, pneumostome; PV, pulmonary vein; R, rectum; SOV, spermoviduct; U1, adrenal ureter; U2, adrectal ureter; V, vagina; W, number of whorls; WA, width aperture. Drawings were made with a WILD M-5 stereomicroscope with drawing device. Radula and jaw were studied using a JEOL JSM-6480LV Scanning Electron Microscope.

## SYSTEMATICS

Family Pleurodontidae Von Ihering, 1912

### *Coloniconcha* Pilsbry, 1933

*Coloniconcha* Pilsbry, 1933: 143. Type species by monotypy *Coloniconcha prima* Pilsbry, 1933. *Coloniconcha*; Zilch, 1960: 600; Vaught, 1989: 102; Millard, 2003: 577; Schileyko, 2006: 1830.

*Coloniconcha prima* Pilsbry, 1933 (Figs 1-6).

*Coloniconcha prima* Pilsbry, 1933: 143, pl. 8 figs 6-8. Type locality: coffee plantation of Sr. Del Monte, between base and top of Aliés, near Salvation, 1775-3200 feet; holotype ANSP 160973. Zilch 1960: 600, fig. 2110; Weatherbee & Clench, 1987: 34; Schileyko, 2006: 1830, fig. 2342.

*Coloniconcha* n. sp.?; Thompson, 1986: 15.

Material. — Dominican Republic, Prov. Barahona, Sierra de Bahoruco, Polo, 750 m, FGT-2664, 15.i.1976 (UF 125326/1) [18° 05' 14" N 071° 16' 39" W]; 4 km N Polo, 870 m, FGT-3647, 7.ix.1983 (UF 45601/12); ibidem, FGT-3673, 12.ix.1983 (UF 45775/2) [18° 06' 59" N 071° 16' 25" W]; 7 km NNE Polo, 710 m, FGT-2876, 18.1.1977 (UF 125324/1) [18° 09' 27" N 071° 09' 49" W]; FGT-2669 17.i.1976 (UF 125321/1, UF 125328/9), [18° 07' 40" N 071° 12' 04" W]; ibidem, 1310 m, FGT-2918,

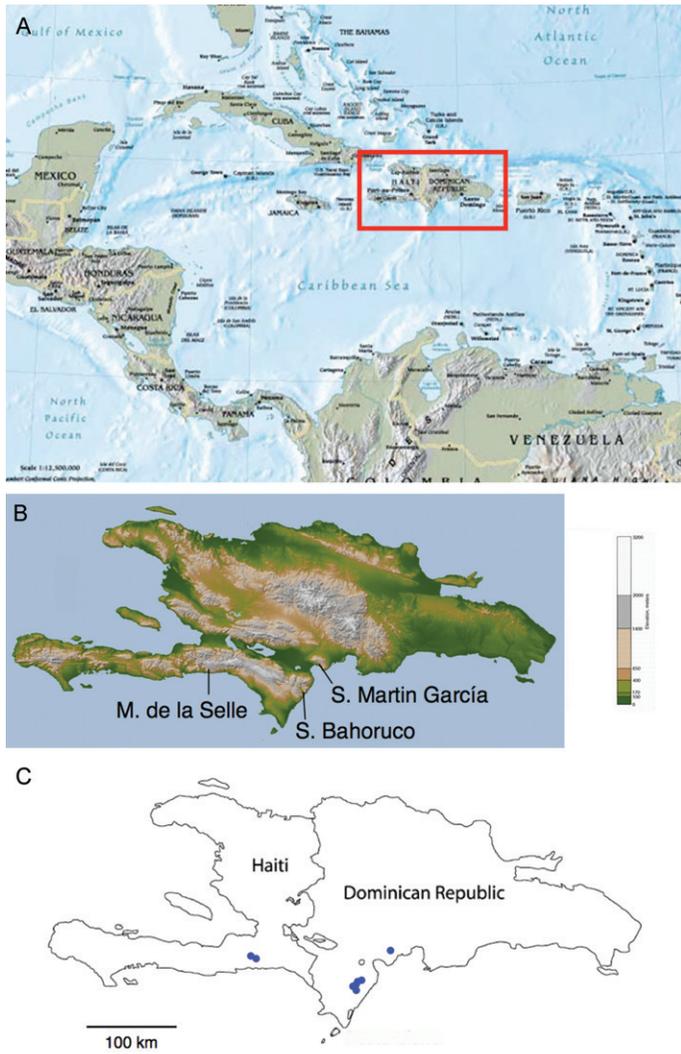


Fig. 2. Study area. **A**, Caribbean; red box showing the position of Hispaniola. **B**, Altitudinal map of Hispaniola, with the three mountain ranges mentioned in the text. **C**, Outline map of Hispaniola, showing the localities mentioned in the text.

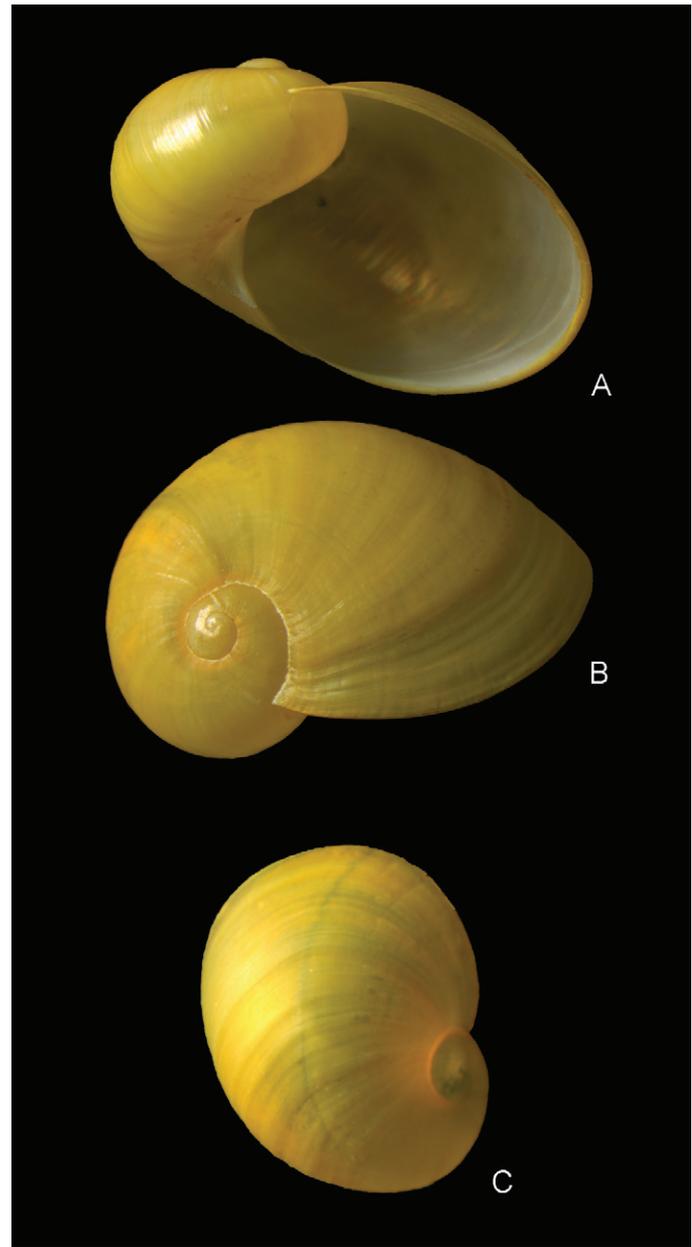


Fig. 3. Shell. **A**, Ventral view. Actual shell diameter 22.3 mm. **B**, Dorsolateral view. **C**, Juvenile shell showing peripheral band. (All UF 125314).

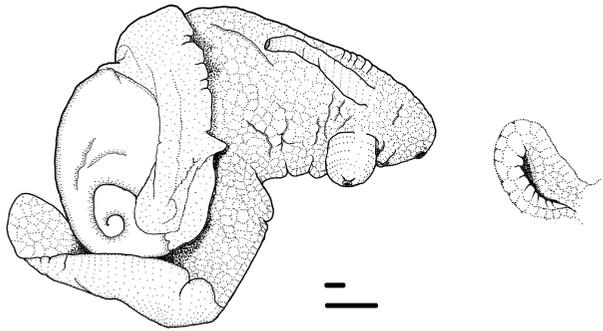


Fig. 4. A, Lateral view of preserved specimen; notice the broad mantle. B, Detail, showing genital pore. Scale lines equal 5 mm.

18.i.1977 (UF 125329/1), FGT-2918, 18.vi.1977 (UF 257925/14) [18° 07' 47" N 071° 12' 04" W]; 5 km NNE Polo, 990 m, FGT-2167, 19.iii.1974 (UF 125314/12, UF 125315/10, UF 257924/20) [18° 05' 50" N 071° 14' 08" W], FGT-2698, 29.i.1976 (UF 125319/1, UF 125322/4, UF 257923/7), FGT-2702, 31.i.1976 (UF 125320/7) [18° 19' 55" N 70° 57' 34" W]; 2.8 km NE Las Auyamas, 930 m, R.I. Crombie leg., 12.i.1976 (UF 125323/1); Haiti, Dept. Sud-Est, ridge of Morne d'Enfer, 1790 m, K. Auffenbach leg., KA-305, 14.v.1984 (UF 47737/3) [18° 20' 55" N 072° 20' 37" W]; ibidem, 1860 m, KA-310, 15.v.1984 (UF 47815/13) [18° 20' 55" N 072° 20' 48" W]; Fé Noir, E Morne d'Enfer, [?1345] m, W. Judd leg., KA-312, 16.v.1984 (UF 47888/1) [18° 20' 00" N 072° 19' 00" W].

Additional material (not seen). — Dominican Republic, Prov. Barahona, Sierra de Bahoruco, coffee plantation of Sr. Del Monte, between base and top of Alies, near Salvation, 1775-3200 feet [541-975 m] (holotype ANSP 160973); Loma Caña Brava [=Pie de Palo], 6 km E Polo, 1370 m, 15.i.1976 (UF 125317); ibidem, 18.i.1976 (UF 125325); ibidem, 13.i.1977 (UF 125313); Sierra Martin Garcia, Loma del Aguacate, 1000 m, 4.ii.1976 (UF 125318, UF 125327).

Shell (modified after Pilsbry, 1933). — Semioval, vitriniform, thin, dull buckthorn brown, polished on the basal area around the columella; spire glossy and much paler or whitish. Whorls 2.5, the first a little projecting, the last whorl rapidly enlarging, not descending behind the aperture, its periphery rounded. Spire smooth, last whorl sculptured

with low, rather coarse growth wrinkles and a microscopic texture of crisscross scratches giving the shell a dull appearance; in dorso-lateral view shallow spiral lines may be discernible, with relatively broad intervals (Fig. 3B). Some juvenile shells with a small peripheral band without these scratches (and dullness), the growth wrinkles more conspicuous under a lens (Fig. 3C). Aperture circular, strongly oblique; peristome thin. Columella evenly concave, slightly thickened, white. Umbilicus closed, with a very small "false umbilicus" when viewed basally. See table 1 for dimensions. Animal exterior. — Body of snail greenish yellow, slender, with a relatively long tail. Tentacles dark pigmented (Fig. 1). Black pigment spots on the pulmonary roof visible if the shell is very thin (Fig. 6B); more abundant on the left side near the rectum. Broad mantle rim (Figs 1, 4A). Head wart absent. Genital orifice an oval slit, outlined by pustules (Fig. 4B).

Genitalia (terminology following Cuezco, 2003) (Figs 5-6). — Flagellum long, ca. half the length of penis + epiphallus, base thick and apical portion half the diameter of the base. Accessory flagellum (= flagellar caecum) short-cylindrical. Distal part of epiphallus notably constricted, otherwise the epiphallus is enclosed in the extension of the penis sheath, internally with longitudinal folds. No epiphallic pouch or gland externally discernible. Transition between epiphallus and penis with a sphincter. Penis straight, with a muscular sheath; its proximal part with blunt cusp-like structures. Vas deferens not twisted, descending to peni-oviducal angle. No penial retractor muscle observed. Genital atrium very short. Vagina about half the length of penis + epiphallus; internally sculptured with longitudinal zig-zag folds. Bursa copulatrix without diverticulum, long and slender, simple, its distal portion ending below the base of the albumen gland. Bursa copulatrix sac straight relative to the longitudinal axis of the duct. Folding of uterus (= spermoviduct) longitudinal. Distal part of hermaphroditic duct slightly convoluted. Fertilization pouch-spermathecal complex hidden inside albumen gland. Albumen gland relatively large. Ototestis with ovoid to round alveoli. Terminal genitalia not twisted around each other. Right ocular retractor passing through the peni-oviducal angle.

Radula. — Radula formula C/3 + LM 30/2, 101 rows ob-

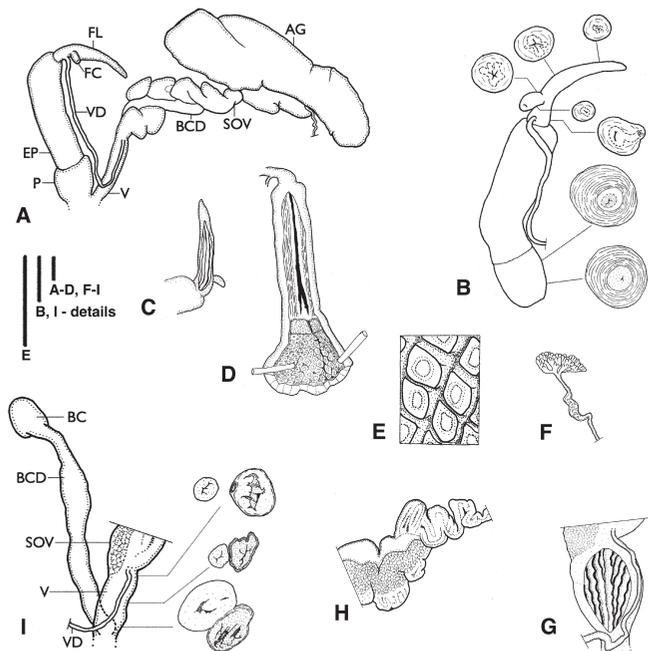


Fig. 5. A, Genitalia. B, Penial complex, with cross-sections. C-D, Semi-schematic longitudinal view of penis. E, Detail of proximal part of penis. F, ovistestis and hermaphroditic duct. G, Semi-schematic longitudinal view of vagina. H, detail of spermoviduct. I, Female part with cross-sections. Scale lines equal 5 mm.

served. Central teeth tricuspid, with lanceolate mesocones and acute-ovate ectocones, which are clearly differentiated and half the length of the mesocones (Fig. 6C). Lateromarginal teeth bicuspid, mesocones elongate to wedge-shaped and acute, ectocones ovate to deltoid; outer lateromarginals deformed by wear (Fig. 6D).

Mandibula. — Strongly ribbed longitudinally, with 8-9 ribs observed. Otherwise with very fine striae, both longitudinally directed and parallel to the anterior border; the latter more regular and somewhat stronger than the former (Figs 6E-F).

Palleal organs. — Lung surface not extending beyond the top of the kidney. Kidney long and relatively thin, extending to ca. 80% the pulmonary roof length. Secondary ureter

open from top of the lung along the rectum. Pulmonary vein abundantly ramified and dense.

Ecology. — The species was found in coffee groves and in montane forest, usually on leaves of trees, shrubs and other plants. At most sampling stations *Coloniconcha* was quite common. As the shell is ochre coloured, it resembles dead part of leaves on which it may occur. When active, snails are very long and narrow, stretching up to 10 cm. They stretch between leaves up to 5 cm apart (field notes of K. Auffenbach).

Remarks. — The type locality, which was part of a private plantation, is hard to locate nowadays. It was stated by Pilsbry as being "5 or 6 miles west of Barahona as the crow flies", which means about 9.5 km. However, the reported altitude (540-975 m) is not reached westward of Barahona until 18.6 km west of the village. At the distance quoted by Pilsbry the altitude is only ca. 250 m. Given the localities mentioned above it seems thus more likely that the type locality was further westward than the original publication states and may be found around 18°12'N 71°17'W.

Thompson (1986) listed the land molluscs in two areas, at that time proposed as National Parks, viz. La Visite and Pic Macaya. In the former he stated that a colony of *Coloniconcha* was present and he thought it was a new species of that genus. This is the material mentioned above and collected by K. Auffenbach and W. Judd. The shells in these samples are either completely dissolved or very weakened, making measurements impossible. All specimens lack the black spots on the lung roof as described above.

The specimens from the isolated populations in Sierra Martin Garcia are somewhat stouter, with the spire more protruding. However, it is unclear at the moment whether this warrants subspecific distinction.

#### DISCUSSION

Pilsbry (1933) already noted the similarity of *Coloniconcha* with *Xanthonyx* (Xanthonychidae). Also *Cryptostrakon* and *Semiconchula* (belonging to the same family) bear a strong resemblance. The Xanthonychidae all occur in Central America, from Mexico to Costa Rica (Cuezzo, 1997; Naranjo-Garcia, 2003; Naranjo-Garcia et al., 2000). Also *Gaeotis* (Am-

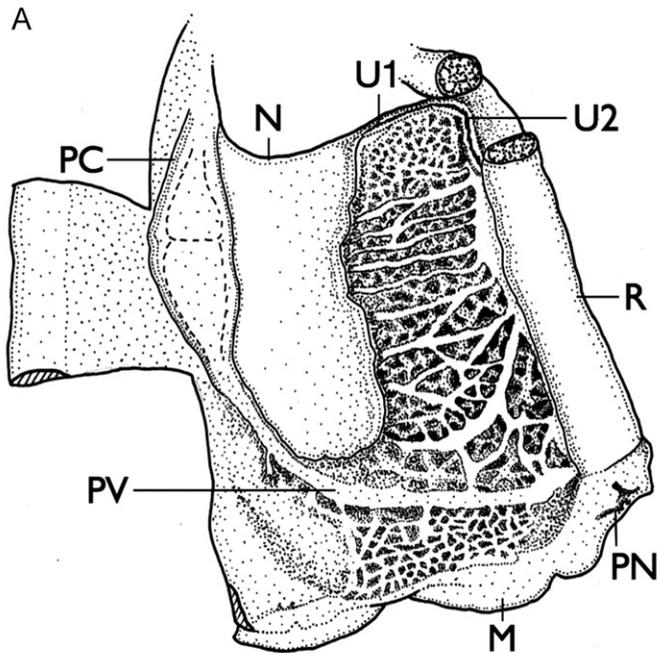
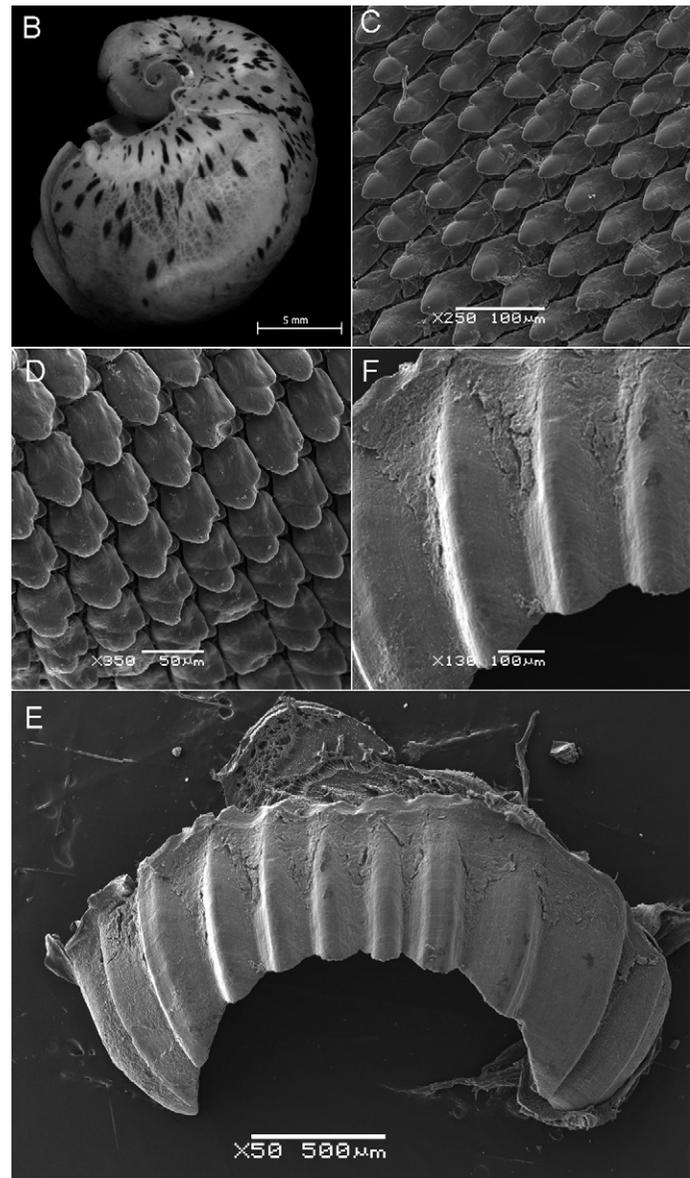


Fig. 6. A, Palaeal organs. B, Dorsal view of lung roof *in situ*, showing the pattern of dark spots. C-D, Radula. C, Central part. D, Lateromarginal teeth. E-F, Mandibula. E, overview. F, detail showing sculpture. (B-C: UF 125300; D-F: UF 257925).

phibulimidae; Breure, 1974), occurring on Puerto Rico, may be confused with *Coloniconcha*. All genera have in common that they are semi-slugs. Tillier (1984) considered semi-slugs as a stage in the evolution from snails to slugs, which process he called 'limacisation'. During that process a snail with a helicoid visceral hump evolves into a slug without a prominent visceral hump. Semi-slugs are thus snails in which the shell reduction has proceeded so far that the esophageal crop is at least partly contained in the foot cavity and the animal cannot retract inside the shell. Within the Camaenidae, a semi-slug is exceptional.

The systematic position of *Coloniconcha* with the Camaenidae was based by Pilsbry on the assumed affinities with *Polydotes dilatata* (Pfeiffer, 1846). The classification and deli-



mitation of this family have been discussed by several authors (Pilsbry, 1895; Von Ihering, 1912; Wurtz, 1955; Solem, 1978; Nordsieck, 1986; Tillier, 1989; Scott, 1996, 1997; Cuezco, 2003, 2006; Bouchet et al., 2005; Schileyko, 2006; Wade et al., 2007), some of them separating the Australasian clades from the Neotropical ones as separate subfamilies. Cuezco

(2003) studied the relationships between the different genera groups, using a cladistic analysis based on 50 morphological characters from the shell and anatomy. The results of this analysis supports the Camaenidae as a monophyletic family, divided into five subfamilies of which two (Pleurodontinae and Caracolinae) comprised the Neotropical species. In the classification of Cuezco (2003), the genus *Coloniconcha* has to be grouped in the Caracolinae, sharing the autapomorphous characters (oval-horizontal aperture shape, kidney length more than half pulmonary roof and flagellum tapering) with the genera *Eurycratera*, *Polydontes*, *Zachryisia*, *Caracolus*, *Solaropsis*, *Labyrinthus* and *Isomeria*.

On the contrary, Schileyko (2006) separated the Neotropical genera in the Pleurodontidae, recognizing five subfamilies, of which three were newly erected. *Coloniconcha* was placed by him in the Polydontinae, which he separated from the Pleurodontinae on account of the presence of a penial caecum and conspicuous penial gland(s). The current study shows that the latter structures are not present in *Coloniconcha* and the systematic placement in the Polydontinae *sensu* Schileyko is thus unjustified. However, the terminology for the different parts of the genitalia of this group is somewhat confusing. Schileyko's denomination of a penial caecum (PC in Schileyko, 2006: fig. 2339b) corresponds to Cuezco's flagellar caecum (fc in Cuezco, 2003: fig. 6A), called accessory flagellum in her list of characters (Cuezco, 2003: Table 2, number 26). In her data matrix (Cuezco, 2003: Table 3), this character is present in *Polydontes*, *Zachryisia* and *Eurycratera* species. The latter genus is placed by Schileyko (2006), however, into Pleurodontinae. The genitalia of *Coloniconcha* resemble most those of *Hispaniolana undulata* (Férussac, 1821), figured by Schileyko (2006: fig. 2339). *Hispaniolana* was originally proposed by Pilsbry (1933: 141) as a subgenus of *Polydontes*. *Coloniconcha* differs clearly in the penial complex from *Hispaniolana*, viz. the absence of a penial gland, the presence of longitudinal grooves inside the flagellum and the presence of blunt cusps in the proximal part of the penis in *Coloniconcha*.

Wade et al. (2007) investigated the relationships within the Helicoidea using a phylogenetic analysis with a fragment of the rRNA genus cluster (ITS2/28S). Their results show that the Camaenidae *sensu* Cuezco is not monophyletic, providing

strong support for a separation of the family into an Asian/Australasian and a Neotropical group. The latter may be further divided into two groups, based on four genera for which sequences were available: *Polydontes* and *Zachryisia* in one, *Pleurodonte* and *Thelidomus* in another cluster. Although their conclusion is in strong contrast to that of Cuezco (2003), it may be noted that the molecular affinities of *Polydontes* and *Zachryisia* are in agreement with the strict consensus tree based on morphological characters by Cuezco (2003). Further molecular work is needed to clarify the relationships between the Neotropical taxa. Until then I suggest to follow for these taxa a modified classification from Schileyko (2006) and Cuezco (2003), viz. Pleurodontidae with two subfamilies, Pleurodontinae von Ihering, 1912 and Caracolinae Cuezco, 2003. *Coloniconcha* should be placed in the latter.

Pilsbry (1933: 143) stated "if I may hazard a guess at the affinities of so dubious a snail, I would suggest that it is allied to *Polydontes*". Given the data presented in this paper, it may be concluded that his guess was right.

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