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PROPILIDIUM CURUMIM, A NEW SPECIES OF LEPETIDAE (GASTROPODA, PATELLOGASTROPODA) FROM OFF SOUTHERN AND SOUTHEASTERN BRAZIL

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ABSTRACT

Propilidium curumim n. sp. is described from the southeastern and southern coasts of Brazil. A large number of specimens was found on sandy bottoms from 166 to 181 m. Descriptions of shell morphology, radula, and anatomy are provided. These descriptions, based on SEM micrographs, histological sections, and microanatomical dissections, indicate that the new species differs from its closest relatives by smaller size, distinctive protoconch, and larger head.

The relatively poorly known Patellogastropoda family Lepetidae includes minute, deep-water limpets. There is no previous reference to occurrences of members of the family off the Brazilian coast (Rios, 1994). Dredge hauls made by the R/V WLADIMIR BESNARD of the Instituto Oceanográfico of Universidade de São Paulo (IOUSP) between 1972–1992 retrieved several specimens belonging to the genus *Propilidium* Forbes, 1849 (Aartsen and Giannuzzi-Savelli (1991) for a discussion on the authorship of the genus). Analyses of shell and anatomical characters revealed that they belong to a single and unnamed species described herein. Anatomical studies of the Lepetidae are scanty. Yonge (1960) described some of the external morphology and mantle cavity of the European species *Lepeta concentrica* (Middendorf). Fretter and Graham (1994: 493) figured a ventral view of *Propilidium exiguum* (Thompson, 1844), Boss (1982: 971) reviewed the anatomical data then known for the family, and Dantart and Luque (1994) provided information and line drawing of external features of the latter species. McLean and Harasewych (1995) provided SEM micrographs of the shell and protoconch of the lectotype of *P. lissocona* (Dall, 1927). Angerer and Hazsprunar (1996) prepared a more extensive anatomical discussion of the family, comparing the northern Atlantic species *Lepeta caeca* (Müller, 1776), *Iothia fulva* (Müller, 1776), and *Propilidium exiguum*. A detailed anatomical discussion is included in the description of the new taxon; this allows for future intraspecific comparisons and for better characterizations at generic and familial levels.

MATERIAL AND METHODS

Part of the examined material (MORG 20033) was collected in 1972 by the University of São Paulo as part of benthic studies of the Brazilian shelf, and part (MZSP 28199, 28200) as a result of the project "Marine Environmental Monitoring of the Campos Basin" carried out by the University of São Paulo. The latter project intended to determine eventual environmental changes taking place in the oil drilling area of the Campos Basin, off Rio de Janeiro State. All study specimens were obtained by dredging and, with exception of MORG 20033, were immediately preserved in 70% ethanol. Specimens from lot MORG 20033 were originally preserved dry, rehydrated in a 10% solution of trisodium phosphate for 18 h, dehydrated through a standard ethanol series, and chemically dried in hexamethyldisilazane (HMDS) for 10 min. Radulae were macerated in 5–10% sodium hydroxide for 24–48 h at room temperature, thoroughly rinsed in deionized water, dehydrated

through a standard ethanol series, and air-dried. Shells, dried soft parts, and radulae were coated with palladium and examined and photographed in an International Scientific Instruments ISI-130 Dual Stage scanning electron microscope at the Electron Microscopy Laboratory, University of Miami Rosenstiel School of Marine and Atmospheric Science. Specimens for histological sections are from lots MZSP 28199, 28200, and were easily extracted from the shells. The largest specimen from lot MZSP 28199 was dissected. Some parts of this specimen such as visceral and buccal masses, and complete specimens of lot MZSP 28211, were dehydrated in a standard ethanol series, stained with carmine, and diaphanized and fixed in creosote. The smaller specimen of lot MZSP 28199 was sectioned transversally at 4 μm using a standard microtome, and stained with Mallory. All line drawings were made under camera lucida. Anatomical terminology follows Fretter and Graham (1994). Institutional abbreviations used in this study are: ANSP, Academy of Natural Sciences of Philadelphia; BMSM, The Bailey-Matthews Shell Museum, Sanibel, Florida; LACM, Natural History Museum of Los Angeles County; MNHN, Muséum National d'Histoire Naturelle, Paris, France; MORG, Museu Oceanográfico, Fundação Universidade do Rio Grande, Brasil; MZSP, Museu de Zoologia, Universidade de São Paulo, Brasil; USNM, National Museum of Natural History, Smithsonian Institution, Washington, DC.

Systematics

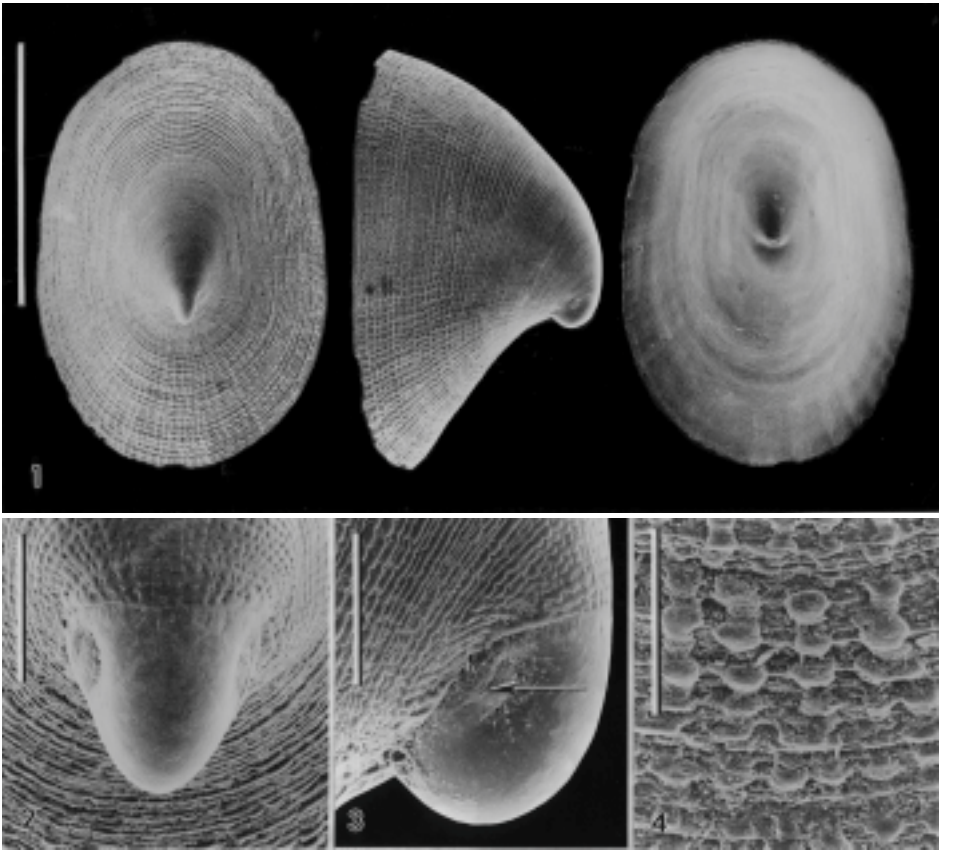
Family Lepetidae Dall, 1869
Propilidium curumim new species
(Figs. 1–31)

Description.—Shell (Figs. 1–4,31) small for genus, length to 2.3 mm, width to 1.7 mm, height to 1.2 mm, elevated, strongly arched, height/length ratio about 0.6. Anterior slope strongly concave. Posterior slope about 50% of shell length, convex. Aperture oval, wider part usually on posterior third. Shell margin smooth, continuous. Protoconch smooth, with lateral fold. Teleoconch translucent, with reticulated sculpture of fine concentric ribs stronger than and crossed by fine radial ribs. Apex internally with septum-like fold. Periostracum not detected.

Head relatively large, length more than half foot length (Figs. 14–18), semi-transparent, non-pigmented. Snout very large and broad. Ventral margin of snout smooth, rounded anteriorly, posteriorly with two small lateral projections (labial processes) (Figs. 16-18). Mouth central, large, bordered anteriorly and posteriorly by horseshoe-shaped jaw. Head tegument thick, muscular in snout margin (Fig. 25), thin in other regions. Tentacles short, stubby, eyes lacking (Figs. 17–18). Foot relatively small, flat (Figs. 15–16), non-pigmented. Deep furrow present between snout and foot. Head retractor muscle separated from dorsoventral fibers. Shell muscle horseshoe-shaped, very thin posteriorly, becoming gradually thicker in anterior region. Anterior extremities of shell muscle bending inward (Fig. 18). Shell muscle anteriorly with several visible muscle fibers radially and obliquely oriented, and originating in adjacent areas of mantle and head.

Mantle edge thick and broad (Figs. 14,15,18), without pigment, margin undulated. Mantle cavity shallow around foot, deeper around head (nuchal cavity). Gill and osphradium lacking. Kidney pore, anus, and genital aperture to right and posteriorly in mantle cavity (Fig. 18).

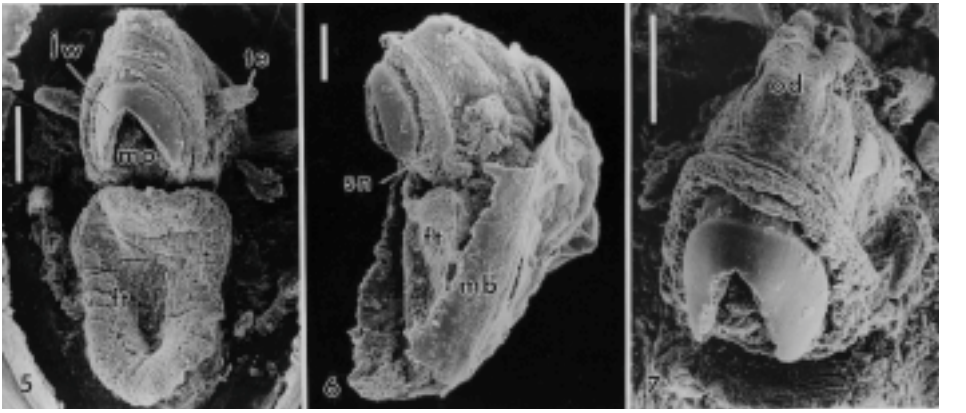
Circulatory and Excretory Systems.—Heart and large vessels apparently lacking. Pair of pedal and palial sinuses well-differentiated. Right kidney triangular, flattened, white,



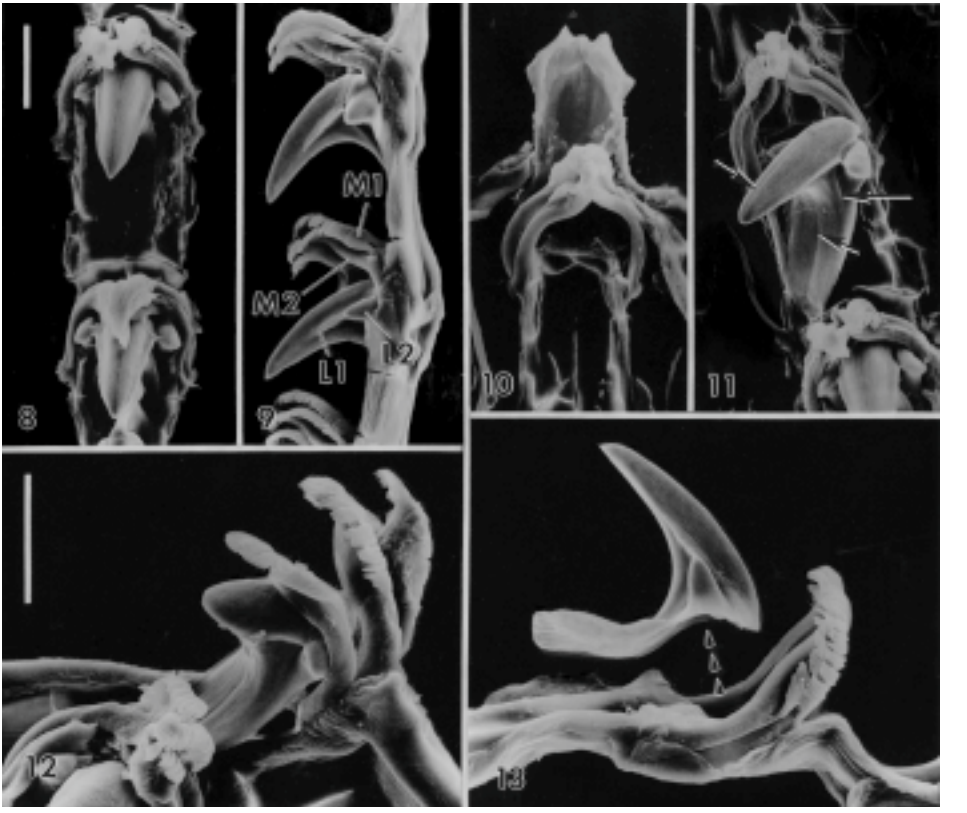
Figures 1–4. Holotype of *Propilidium curumim* new species (SEM micrographs of shell) 1. 1. Dorsal, lateral (left side), and ventral views. 2–3. Protoconch. 2. Dorsal view. 3. Lateral view showing folds (arrow). 4. Shell sculpture near margin. Scale lines: 1 = 1 mm; 2–3 = 100 μm; 4 = 50 μm.

situated to right of terminal region of rectum (Fig. 18). Left kidney not found, most likely absent.

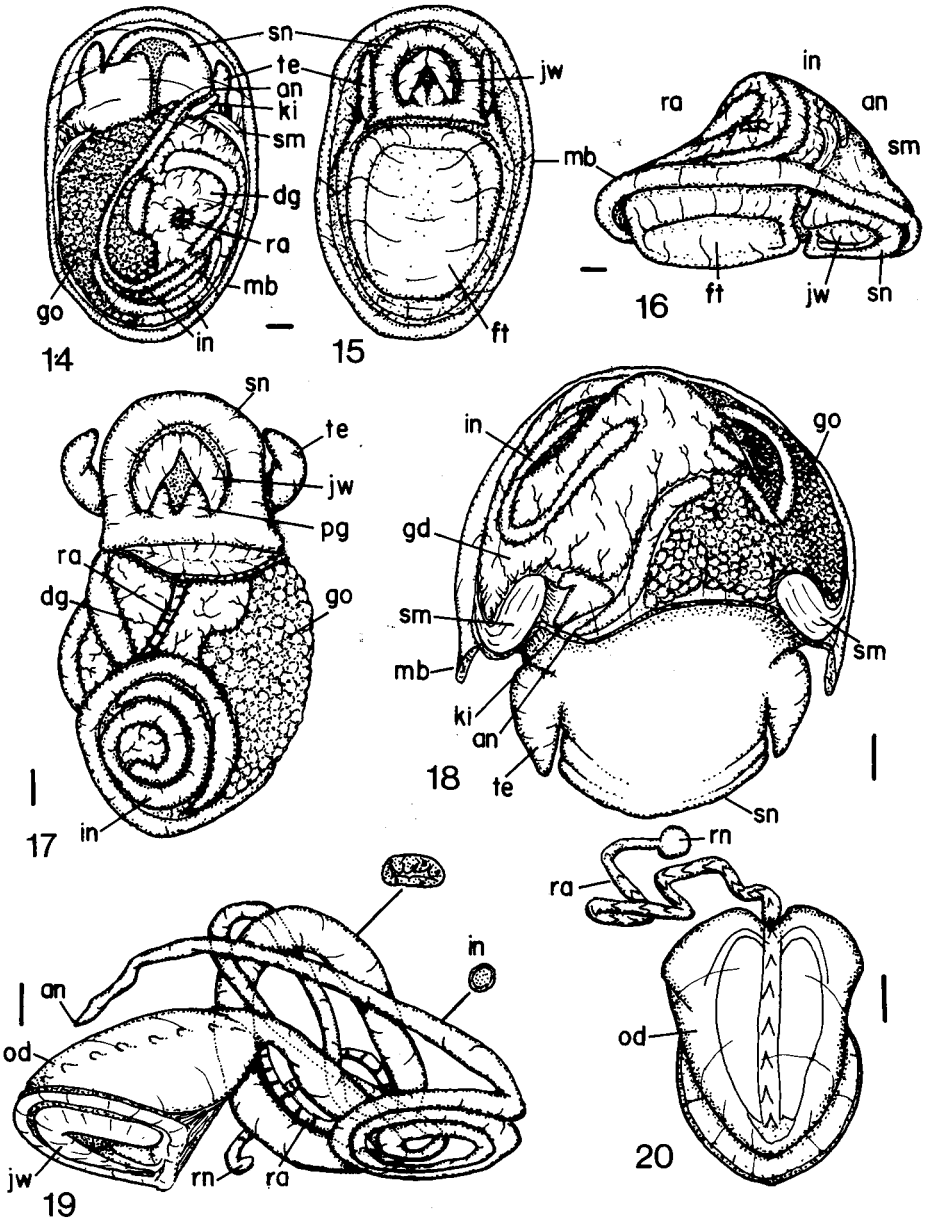
DIGESTIVE SYSTEM.—Mouth relatively large and ample. Jaws large, formed by two divergent lateral plates fused anteriorly (Figs. 15–17,19,21–22,25). Salivary glands represented by pair of small glandular masses in latero-anterior region of odontophore. Pharyngeal glands a pair of oval bulging masses situated near middle line in posterior margin of mouth (Figs. 17,22,25). Anterior region of pharyngeal glands richly secretory, posterior region hollow, containing hyaline secretion. Odontophore well-developed, occupying most of head space (Fig. 19). Odontophore muscles (Figs. 21–29): m1) pair of outer ventral buccal protractor muscles, with origin at lateral posterior inner margin of peribuccal wall, and insertion at postero-lateral region of odontophore; m2) inner ventral buccal protractor muscle, with origin in median posterior inner margin of peribuccal wall, and insertion at postero-ventral region of odontophore; m3) pair of short mandibular protractor muscles, with origin at median inner anterior region of peribuccal wall, and insertion at antero-ventral region of odontophore; m4) pair of large and flattened, posterior radular retractor muscles, with origin at postero-ventral region of cartilages, and insertion at pos-



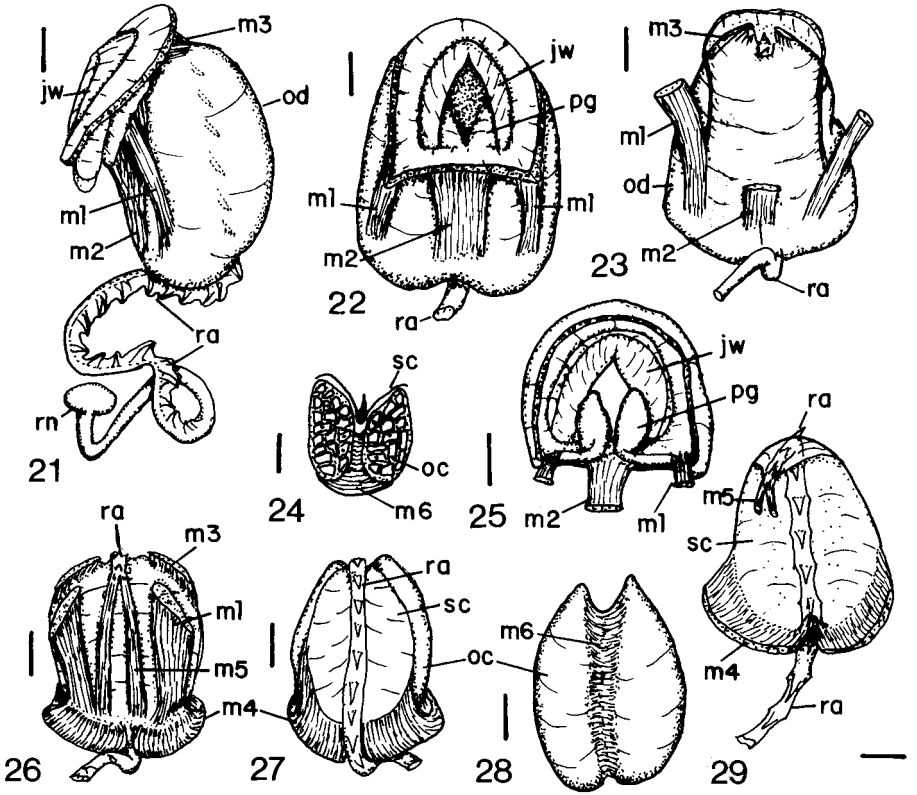
Figures 5–7. External morphology based on dried soft parts of *Propilidium curumim* new species (SEM micrographs). 5. Ventral view. 6. Left side view. 7. Detail of head in frontal view. Soft parts have been dry for more than 20 yrs (see material and methods), then were re-hydrated, fixed, and chemically dried. Scale lines = 100 μm. Abbreviations: ft = foot; jw = jaw; mb = mantle edge; mo = mouth; od = odontophore; sn = snout; te = cephalic tentacle.



Figures 8–13. Radula of *Propilidium curumim* new species (SEM micrographs). 8-10. Two adjacent rows. 8. Dorsal view. 9. Left side view. 10. Dorsal view with fused lateral teeth removed; only marginal teeth remain. 11. Dorsal view with fused lateral teeth rotated about 60° in clockwise direction. Arrows show suture line; 12. Left side view showing incipiently formed, fused lateral teeth and three adjacent pairs of marginal teeth. 13. "Exploded" view of fused lateral teeth and marginal teeth in same row. Scale bars (top and bottom) = 20 μm. Abbreviations: L1 = first lateral teeth; L2 = second lateral teeth; M1 = first marginal teeth; M2 = second marginal teeth.



Figures 14–20. Anatomy of *Propilidium curumim* new species. 14–16. External morphology. 14. Dorsal view. 15. Ventral view. 16. Right side view. 17. Ventral view with foot and mantle removed. 18. Frontal view with anterior part of mantle removed. 19. Digestive system, left side view, with cross-sections indicated. 20. Extracted odontophore and buccal region in dorsal view.



Figures 21–29. Anatomy of *Propilidium curumim* new species. 21-22. Odontophore and buccal region. 21. Left side view. 22. Ventral view. 23. Odontophore in ventral view with buccal structures removed. 24. Transversal section in median region of odontophore showing horizontal muscle (m6). 25. Buccal structures, inner-dorsal view. 26–27. Odontophore with first layer of muscles and membranes partially removed. 26. Ventral view. 27. Dorsal view. 28. Isolated cartilages in dorsal view. 29. Isolated radular ribbon and subradular cartilage in ventral view. Scale lines = 0.1 mm. Abbreviations: an = anus; dg = digestive gland; ft = foot; go = gonad; in = intestine; jw = jaws; ki = kidney; m1 to m6 = odontophore muscles; mb = mantle edge; od = odontophore; pg = pharyngeal gland; ra = radula; rn = radular nucleus; sc = subradular cartilage; sm = shell muscle; sn = snout; te = cephalic tentacle.

terior limit of subradular cartilage and adjacent region of radular ribbon; m5) pair of direct radular tensor muscles narrow and long, with origin at postero-ventral region of cartilages, just between m1 pair, with insertion at the antero-ventral extremity of radular ribbon; m6) broad and thick horizontal muscle. Cartilages a pair of massive and relatively soft plates united medially by horizontal muscle (Figs. 24,28); posterior region rounded, anterior region angulose (Fig. 28).

Radula (Figs. 8-13) docoglossate, formula 2-2-0-2-2. First pair of lateral teeth (Fig. 9,L1) fused, forming pointed and elongated “rachidian tooth”, excavated ventrally (Figs. 8–9,11–13). Second pair of lateral teeth (Fig. 9,L2) fused to sides of central tooth, resembling outward pointing cusps with about 25% length of “rachidian tooth” (Figs. 8–9,11,13).

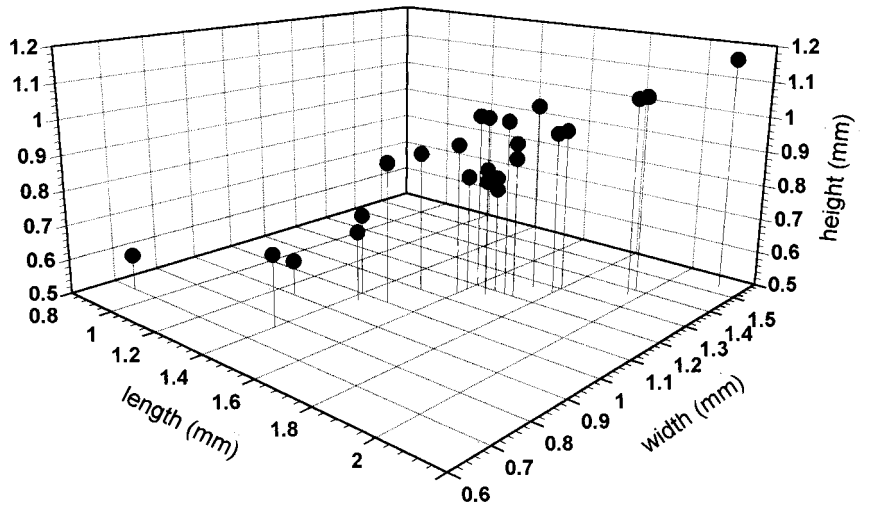


Figure 30. Shell measurements of randomly selected specimens of *Propilidium curumim* new species (n = 24).

Fusion lines between first pair of lateral teeth and of second pair of lateral teeth at sides of "rachidian tooth" clearly visible under SEM (Fig. 11, arrows). Two pairs of marginal teeth similar (Figs. 8,9,M1,M2,10–13). Bases of elongated marginal teeth shaft-like, surrounding latero-posteriorly "rachidian tooth" (Fig. 13) shows relative positions of "rachidian tooth" and marginal teeth after removal of former), marginal teeth distally multicuspid, brush-like, cusps facing anteriorly. Distal extremities of two pairs of marginal teeth joined, without fusion, posteriorly to "rachidian tooth" (Figs. 8,10,11).

Radular sac narrow and very long (Figs. 20-21); odontophore situated posteriorly near esophagus, forming a long loop immersed in digestive gland (Figs. 14,17,19). Bulk of radular ribbon in right side of median region of animal. Gut extremely long and convoluted (Fig. 19), differentiation among esophagus, stomach, intestine, and rectum hard to define. Examined specimens show following arrangement (Fig. 19): esophagus wider near dorso-posterior region of odontophore forming "stomach sac", and running ventro-posteriorly to median region of foot, then twisting to right and producing an ample loop that lies immediately beneath shell apex. Digestive tract narrows abruptly near median region of foot, giving origin to a second loop that returns to shell apex region, and descends back almost to median region of foot. There, digestive tract forms three successive spiral loops contained in horizontal plane. Posterior extremity of digestive tract twists abruptly dorso-anteriorly, crossing left side of dorsal region of animal, toward dorsal region of head. In this region gut sigmoid, and crosses to right, near kidney. Anus posterior, on right side of mantle cavity (Figs. 14-18). In cross-section, wider, proximal segments of gut with thick walls and several longitudinal inner folds, and narrow, distal segments with thinner walls and smooth inner surface (Fig. 19). Intestines of most animals filled with sand grains, which suggests detrivory.

REPRODUCTIVE SYSTEM.—Gonad situated in left side of visceral mass (Figs. 14,17-18), intersected by intestinal loops, and limited on right side of mantle cavity by digestive

gland (in lot MZSP 28199, larger specimen is female, and smaller male). Genital aperture to left of anus, both on right side of posterior region of mantle cavity.

TYPES.—Holotype, MZSP 28350; MZSP 28211, 16 paratypes; MORG 33666, 10 paratypes; USNM 880183, 10 paratypes; BMSM 1002, 10 paratypes, ANSP 399410, 10 paratypes, MNHN unnumbered, 10 paratypes; LACM 2806, 10 paratypes. All above dredged at type-locality, R/V WLADIMIR BESNARD (Universidade de São Paulo), 17 January 1972; MZSP 28199, two paratypes, off Campos, Rio de Janeiro State, Brazil, 23°34′ 29″S, 41°26′56″W, 138 m depth, dredged, R/V WLADIMIR BESNARD (Universidade de São Paulo), stn 49, March 1992; MZSP 28200, one paratype, off Campos, Rio de Janeiro State, Brazil, 23°38′18″S,41°22′ 59″W,181 m depth, dredged, R/V WLADIMIR BESNARD (Universidade de São Paulo), stn 151, March 1992.

TYPE LOCALITY.—Off Chuí (about 34°S), Rio Grande do Sul State, Brazil, 166 m depth.

OTHER MATERIAL EXAMINED.—MORG 20033, 240 specimens, from type locality.

ETYMOLOGY.—Named after the Brazilian Tupi-language noun for small children, an allusion to the small species size.

DISCUSSION

Propilidium differs anatomically from *Lepeta concentrica* Middendorf (Yonge, 1960) and *Lepeta caeca* in having a simple and smooth mantle edge (tentacles lacking), head relatively larger, pair of labial processes less developed, and absence of left kidney. *Propilidium curumim* new species differs from the northwestern Atlantic species *P. lissocona* by having smaller shell, more centrally located apex, and wider, more flared protoconch (no anatomical data are known for this latter species.) The new species can be distinguished from the northeastern Atlantic *Propilidium exiguum* by relatively larger snout and head. According to the characterization of the family Lepetidae provided by Angerer and Hazsprunar (1996, including *P. exiguum*), *P. curumim* n. sp. is anomalous in having only one pair of radular cartilages, and by lacking eyes on cephalic tentacles and apparently lacking a heart.

No evidence in examined material indicates that the new species is hermaphroditic like other members of the family. However, in lot MZSP 28199 the larger specimen has ovarian gonad and the smaller a mature testicular gonad, suggesting protandrous hermaphroditism. *Propilidium curumim* new species, as other Lepetidae, exhibits a simplified anatomy when compared with other Docoglossa (Patellidae, Nacellidae, Acmaeidae), perhaps due to miniaturization and deep-water lifestyle (but see comments in Angerer and Hazsprunar (1996) about miniaturization in monoplacophorans). In addition, gut content and length, and size of buccal apparatus hint at high feeding rates usually associated with detritivory.

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