

Neotropical Planorbid Snails with Apertural Lamellae. I. *Biomphalaria helophila* (Orbigny, 1835)

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A definition of *Biomphalaria helophila* (Orbigny, 1835) is presented, based on examination of the shell and reproductive system of topotypic specimens and extended to a number of samples from other localities. The following nominal species and subspecies, collected from type localities, proved junior synonyms of *B. helophila*: *Planorbis albicans* Pfeiffer, 1839; *Planorbis dentatus* Gould, 1844; *Planorbis dentiferus* CB Adams, 1845; *Planorbis dentiferus edentatus* CB Adams, 1851; *Planorbis dentiens* Morelet, 1849; *Planorbula dentiens edentula* Fischer & Crosse, 1880; *Planorbis stagnicola* Morelet, 1851; and *Tropicorbis shimeki* FC Baker, 1945.

B. helophila was also identified in samples from Costa Rica, Guatemala, Haiti, Dominican Republic, Puerto Rico and Barbados.

Key words: Neotropical Planorbidae - synonymy - *Biomphalaria helophila* - *Planorbis albicans* - *Planorbis dentatus* - *Planorbis dentiferus* - *Planorbis dentiens* - *Planorbis stagnicola* - *Tropicorbis shimeki*

Several species of pulmonate snails of the family Planorbidae develop a set of usually six inward projections from the shell, called lamellae, deeply situated in the apertural region. In classical treatises of malacology (e.g. FC Baker 1945) lamellate species are placed in separate genera or subgenera: *Segmentina* Fleming, 1817, *Planorbula* Haldeman, 1840, *Haldemanina* Dahl, 1905, *Odontogyrorbis* Lörentz, 1906, and *Obstructio* Haas, 1939. So far no adequate explanation has been given to the presence of apertural lamellae in those snails. A common observation is the association of the latter with temporary bodies of water - that is, those which contain water at certain times or seasons and become dry at others. Consequently their populations are adapted to life in some quiescent condition (Paraense & Deslandes 1956, Paraense 1957). In the Neotropics this group is represented by about 20 nominal species, of which *Planorbis helophilus* Orbigny, 1835 bears the oldest available name.

Examination of samples I have collected from type localities of Neotropical planorbids point to the identity of some nominal species with *P. helophilus* - now called *Biomphalaria helophila* (Orbigny, 1835) - as shown below.

Although there is no record of natural infection of *B. helophila* with *Schistosoma mansoni*, it

proved susceptible in laboratory experiments by Richards (1963), using specimens from Puerto Rico under the name *Tropicorbis albicans*.

Voucher specimens of the studied material are deposited in the malacological collection of Instituto Oswaldo Cruz (CMIOC).

ORBIGNY'S DESCRIPTION OF *BIOMPHALARIA HELOPHILA*

The original description reads as follows (Orbigny 1835 : 27, no figure; type locality Callao, Peru):

10. *P. helophilus*, Nob. - Testa depressa, tenui, laevigata, albida; superne plana; centro concavo, subtus plano, umbilicato; quatuor anfractibus; suturis profundis; apertura obliqua, semi-lunari. - Alt. 1½ millim., ampl. 5 millim. - Habit. Provincia Limacensi (republica Peruviana).

Another description with figures appeared later (Orbigny 1837 : 349-350):

PLANORBE HÉLOPHILE, *Planorbis helophilus*, d'Orb.

Mollusques, pl. XLV, fig. 13-16.

Planorbis helophilus, d'Orb., Syn., Mag.de zool. (1835), p. 27, no 10.

P. testâ depressâ, crassâ, laevigatâ, albidâ, supernè subtusque concavâ; anfractibus tribus rotundis, convexis; suturâ profundâ; aperturâ gibbâ, obliquâ; labro crasso. Diam. 5 millim.; alt. 1½ millim.

Coquille: Déprimée, épaisse, lisse; spire presque plane, mais très-concave au centre, en dessus et en dessous, composée de trois tours arrondis, tous convexes, séparés par une suture profonde; bouche transverse, souvent difforme, un peu comprimée en dessous, à bords épais.

Couleur: Gris blanchâtre, uniforme.

Le Planorbe hélophile a encore beaucoup de rapports de forme avec le Planorbe pélerin: les tours de spire en sont de même arrondis et peu déprimés; mais il est toujours de moitié plus petit, lisse; son enroulement sur un plan horizontal est constamment et également concave, au centre, des deux côtés; sa bouche épaissie et difforme; enfin, il n'a jamais que trois tours de spire.

Nous avons rencontré cette espèce dans les marais qui avoisinent, au nord, le port du Callao, sur la côte du Pérou; elle y est peu commune et se tient principalement dans les marais, près des lieux rocailleux.

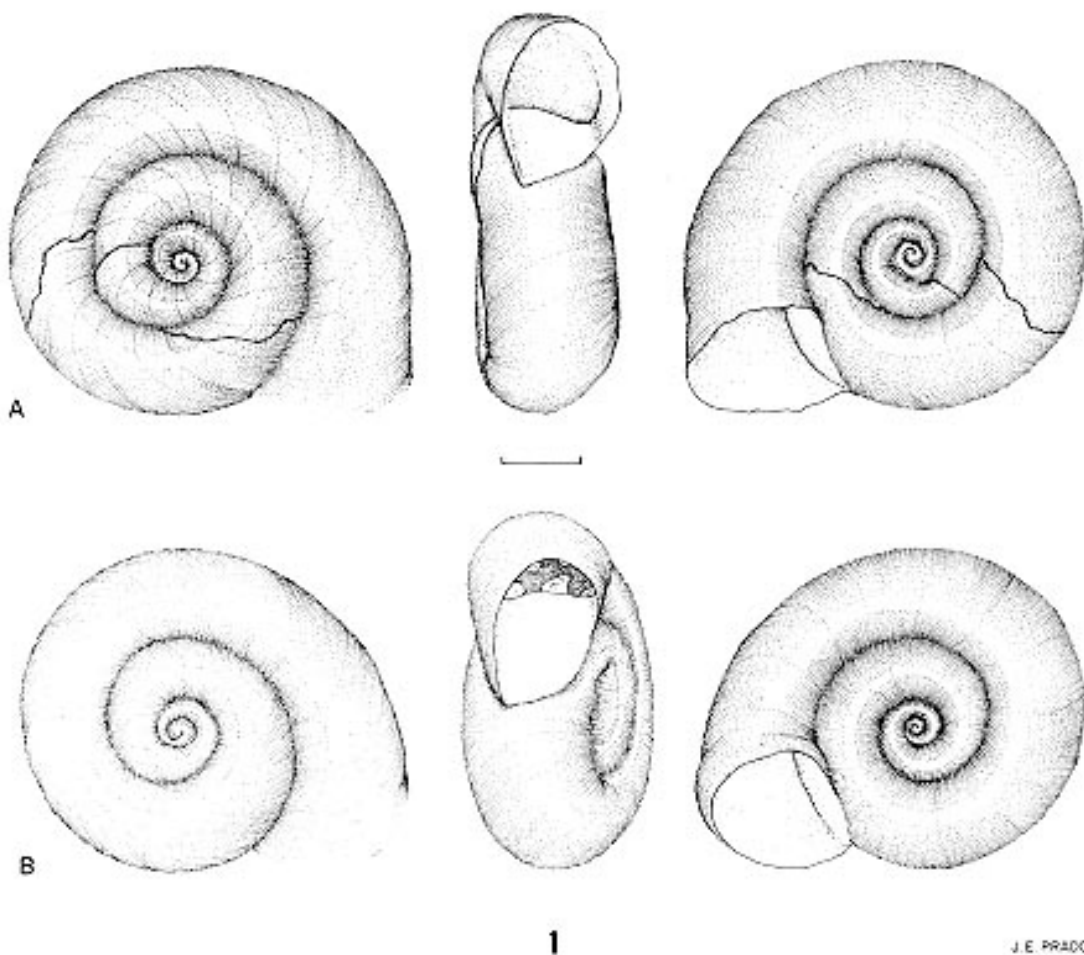
In the Natural History Museum, London, there are 11 syntypes of *B. helophila*, the largest one 5.5 mm in diameter (Fig. 1A). Seven specimens, 4-5 mm, show a set of apertural lamellae, a character overlooked by Orbigny; one of them is shown in Fig. 1B. The larger shells have really four whorls, as stated by Orbigny in 1835 (see his Figs 13-14

of 1837), not "never more than three" (Orbigny 1837). Moreover, the whorls are actually subangular - as depicted in mentioned Figs 13-14 - rather than "rounded".

A REDESCRIPTION OF SPECIMENS FROM CALLAO

A study of *B. helophila*, based on material collected at Fundo SanAndrés, about 1 km west of Trujillo, Peru, and 500 km north of Callao (CMIOC-783), was published by Paraense and Ibañez (1964). A brief redescription of specimens collected by the author from a marsh at Callao in April 1965 (CMIOC-1071) is presented below.

The largest shell (Fig. 2A) is 5.5 mm in diameter, 2 mm in width at the aperture (1.5 mm at the beginning of the outer whorl), and has 4.5 whorls. Each side shows a central depression, funnel-like on the right, broadly concave on the left. The

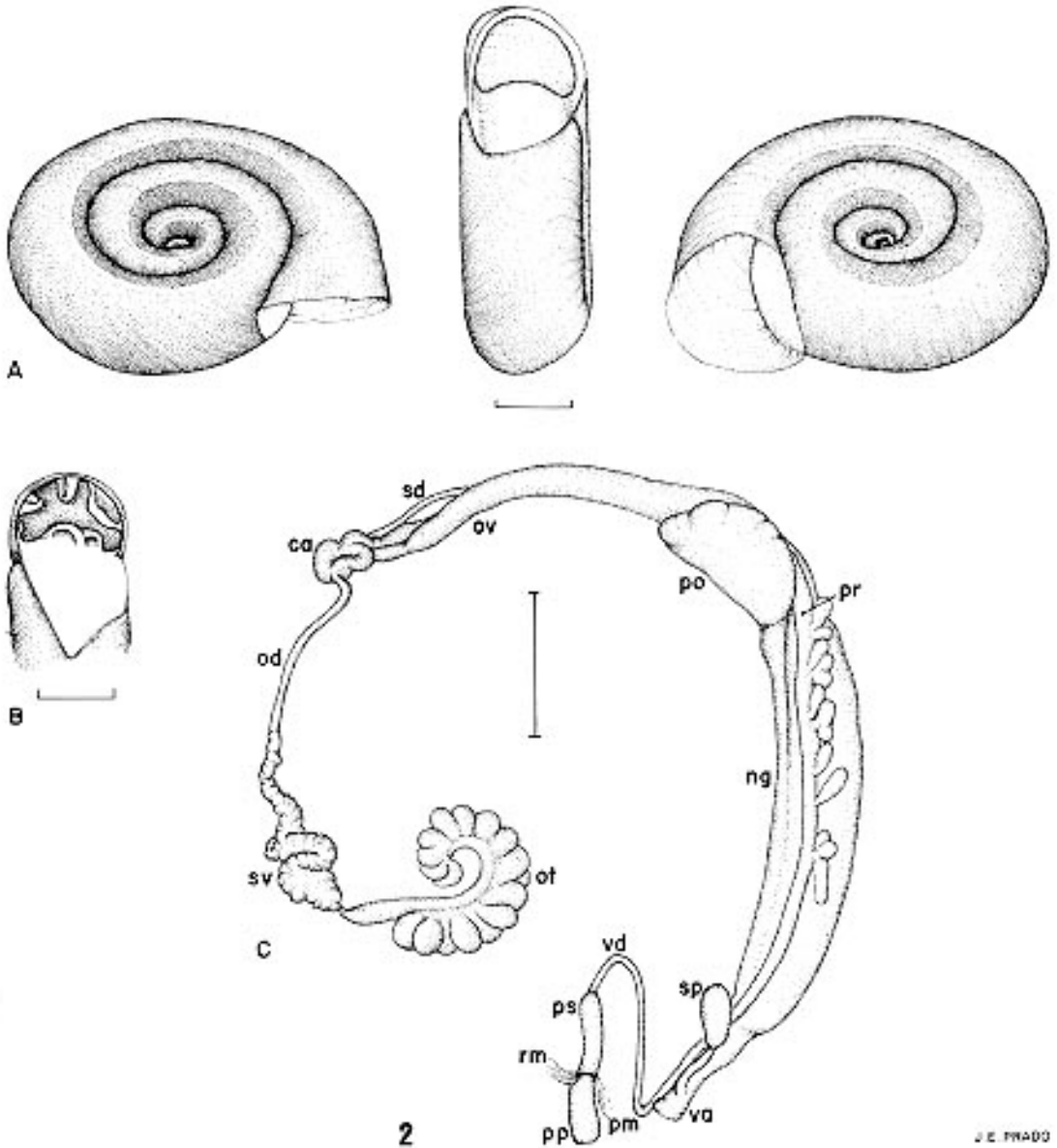


Biomphalaria helophila from Callao, Peru - Syntypes, Natural History Museum, London - Fig. 1A: shell of largest specimen (non-lamellate). Fig. 1B: lamellate specimen. Bar = 1mm.

whorls are obtusely angular on both sides, more prominently on the left, and separated by a deep suture. The innermost whorls are visible on both sides, more plainly on the left. The periphery is rounded and tends to the right. The aperture is oblique and egg-shaped; its right wall is from a little convex to flattened, and its left wall and periphery are rounded. In mature specimens the aperture is usually deflected, sometimes sharply, to the left. The lips are usually thin, but may be thickened by

an inner callous deposit. Three out of 18 shells 4 to 5 mm in diameter show a set of six apertural lamellae, of which two are parietal and four palatal (Fig. 2B).

The cephalopedal mass is diffusely brownish-gray. The pigmentation is deeper on the velum, grows lighter toward the foot margins and is lacking on the tentacles and their lappets. White granules are scattered on the foot, head, tentacles and mantle collar, gathering into a granular fleck in



Biomphalaria helophila from Callao, Peru - Topotypes (CMIOC-1071) - Fig. 2A: shell. Fig. 2B: lamellate specimen. Fig. 2C: reproductive system. ca = carrefour, ng = nidamental gland, od = distal segment of ovispermiduct, ot = ovotestis, ov = oviduct, pm = protractor muscle of penial complex, po = pouch of oviduct, pp = prepuce, pr = prostate, ps = penis sheath, rm = retractor muscle of penial complex, sd = spermiduct, sp = spermatheca, sv = seminal vesicle, va = vagina, vd = vas deferens. Bar = 1 mm.

front of each eye and on each lappet. The roof of the pulmonary cavity is blotched with black. There is no renal ridge.

The reproductive system is shown in Fig. 2C. The ovotestis has about 20-30 pear-shaped, predominantly unbranched, occasionally bifurcate diverticula. The seminal vesicle is beset with numerous small knobs corresponding to parietal diverticula. The oviduct, the oviducal pouch, the nidamental gland and the uterus show no special features. The vagina is short and smooth-walled. The spermatheca varies in shape with the amount of its contents, showing a usually obovate body nearly as long as the duct or a little longer. The spermiduct gives off a series of 5-14 prostatic diverticula, mainly bi- or trifurcate, less frequently unbranched or arborescent. The penis sheath is about the same length to twice as long as the prepuce (range 1.04-2.08, mean 1.35 ± 0.24 SD, $N = 20$). The prepuce is only a little wider than the penis sheath. As usual with *Biomphalaria*, there are two main extrinsic muscles inserted into the junction of the penis sheath with the prepuce: a retractor arising from the columellar muscle and a protractor connected with the head wall. The cephalic portion of the female duct (from the middle of the oviducal pouch to the vaginal opening) is more than twice as long as the penial complex (penis sheath plus prepuce) (range 2.74-4.57, mean 3.63 ± 0.46 SD, $N = 20$).

PLANORBIS ALBICANS PFEIFFER, 1839

Original description (Pfeiffer 1839: 354, no figure; type locality Cuba):

43. Planorbis albicans Pfr. - Testa orbiculari, utrinque umbilicata, solidula, albicante vel pallide fulvicante, anfract. 3 teretibus; labro subincrassato albo; apertura subovata. - Diam. $2 \frac{1}{2}$ [about 5.3 mm], alt. 1''' [about 2 mm]. - Dem Pl. albus (hispidus) am nachsten verwandt.

In the above description no reference is made to apertural lamellae, but it applies well to Orbigny's non-lamellate syntypes of *P. helophilus*. Moreover, *P. albicans* was described as a lamella-producing species by Clessin (1884).

My specimens from Cuba (Paraense & Deslandes 1962) were collected, in December 1956, at Laguna Somorostro (Havana, CMIOC-258) and Laguna La Canoa (Candelaria, province of Pinar del Río, CMIOC-261). In shell characters (Fig. 3A) they are similar to the Peruvian specimens, 2 out of 11 of them showing apertural lamellae (Fig. 3B). In the reproductive system (Fig. 3C) they also agree with the Callao specimens, showing 8-16 prostatic diverticula, penis sheath/prepuce ratio 1.20-2.38, cephalic portion of female duct/penial complex ratio 2.75-3.81.

PLANORBIS DENTATUS GOULD, 1844

Original description (Gould 1844 : 496, Pl. 24, Fig. 14; type locality San Jorge, Cuba):

Testâ discoideâ, solidulâ, pallidè corneâ, utroque umbilicatâ; anfr. 3 leviter striatis, supra et infra subcarinatis; suturâ profundâ; aperturâ sublunatâ; labro intus callo albo incrassato; fauce dentibus sex, abditis, armatâ.

Shell discoidal, rather solid, pale horn-colored, about equally umbilicated on both sides; whorls three or a little more, feebly striated and slightly carinated above and below; aperture embracing about half the penultimate whorl, rounded lunate, the lip supported within a rib-like, white callus; at a distance of about one fourth of a revolution within the throat are six unequal, lamellar teeth, two on the inner, one on the upper, and three on the outer aspect of the throat; their place may be readily seen through the shell; diameter, $\frac{3}{20}$ inch [about 4 mm]; height, $\frac{1}{20}$ inch [about 1.3 mm]. Found in a small lagoon at San Jorge [a sugar plantation on Sagua La Grande river].

Commenting on his *P. dentatus*, Gould says: "It may possibly be the species characterized by Pfeiffer under the name of *P. albicans*, but if so, he has failed to notice its most interesting character [the apertural lamellae], I therefore venture to propose for it the name *P. dentatus*."

Really, Gould's figure shows a shell very similar to that of *albicans*, only differing from the latter in being a little smaller.

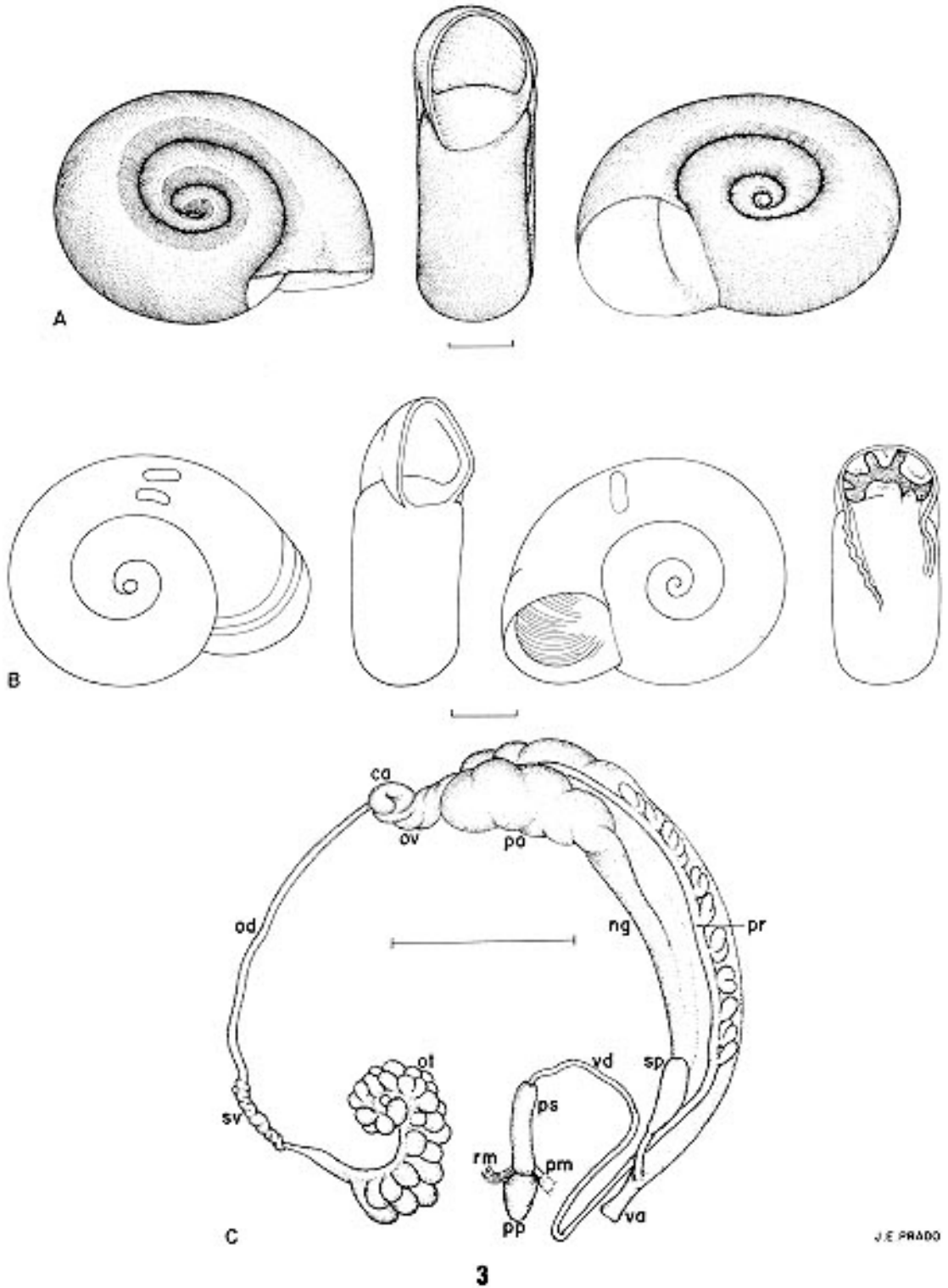
For many years the only dentate planorbis recorded in Cuba (Aguayo 1938: 228) was *P. albicans*. Afterwards this same author (Aguayo 1961 : 98) referred to Gould's *P. dentatus* as the *dentata* form of *albicans*. The identity of *albicans* with *helophila* was demonstrated on anatomical grounds by Paraense and Ibañez (1964). Two other dentate species occurring in Cuba are *Biomphalaria obstructa* and *B. schrammi*, as referred to by Yong et al. (1984), but they are quite distinct, in shell and anatomy, from *helophila*.

PLANORBIS DENTIFERUS CB ADAMS, 1845

Original description (Adams 1845 : 17, no figure; type locality Jamaica):

PLANORBIS DENTIFERUS. *P. dentato*, Gould, affinis; t.anf. 4, ultimo quam penultimo, haud multò latiore; sed *P. dentatus* ultimum maximum habet, (v.fig. Gouldianam); dentium labialium dextrâ bifidâ, magnâ; dentibus sicut in specie Gouldianâ dispositis.

P. dentiferus Adams and *P. dentatus* Gould are not sibling species, as stated above; they are actually identical and synonyms of *B. helophila*. The specimen shown in Fig. 4 was collected in May 1967 from a pond at Dahlford, St. Elizabeth parish (CMIOC-1605), and has two sets of lamellae. Ad-



Biomphalaria helophila from Havana, Cuba (= *Planorbis albicans* Pfeiffer, 1839) - Topotypes (CMIOC-258) - Fig. 3A: shell. Fig. 3B: lamellate specimen. Fig. 3C: reproductive system. Abbreviations as in Fig. 2C. Bar = 1 mm.

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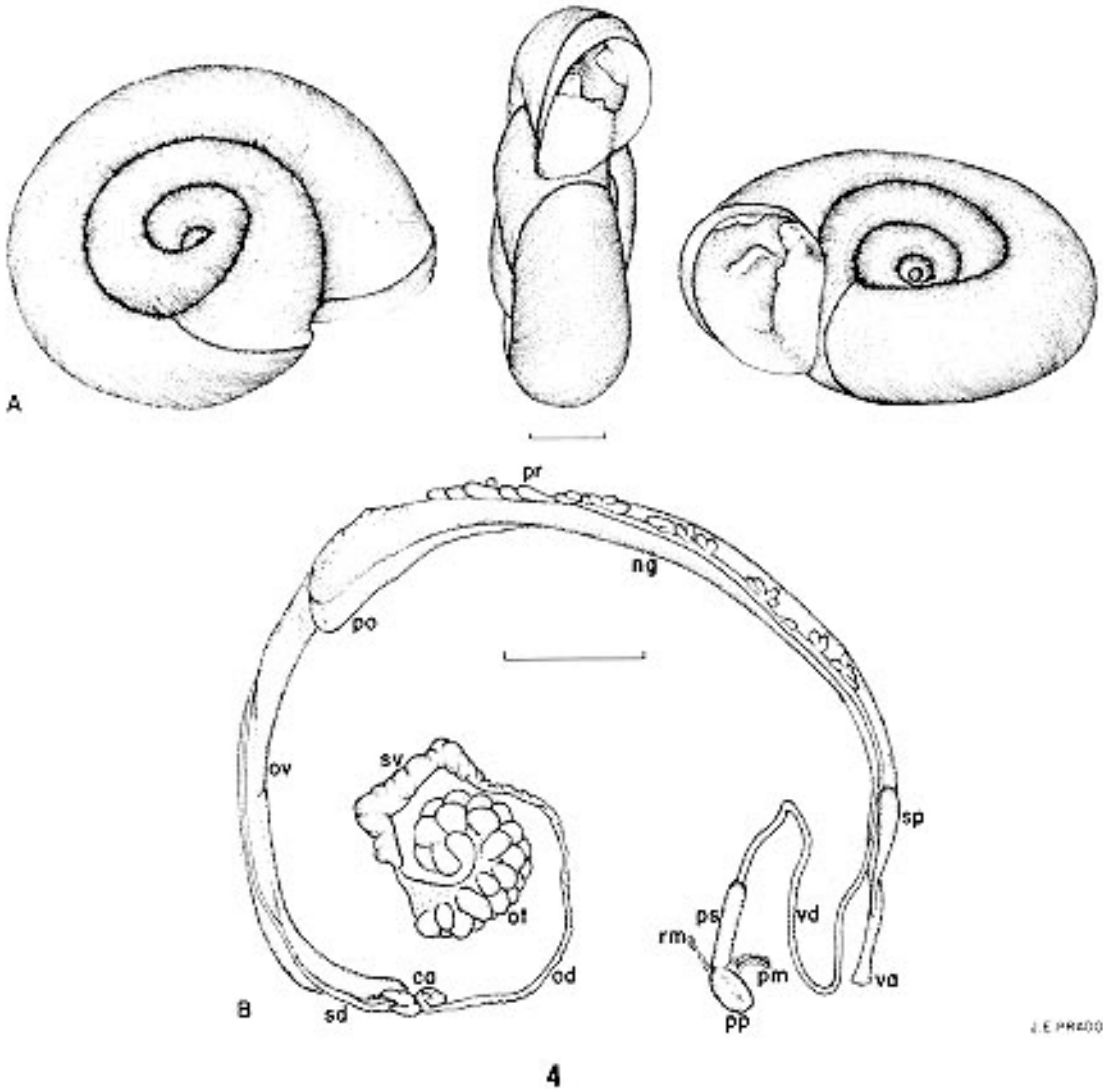
ditional samples were collected from small ponds and slow-running shallow creeks at Middle Quarters (St. Elizabeth, CMIOC-1614), Toms River, Castleton (St. Andrew, CMIOC-1594), Hectors River (Portland, CMIOC-1589), Qwaw Hill and White Horses (St. Thomas, CMIOC-1587, 1582), and Ferry River, Caymanas Bay (St. Catherine, CMIOC-1600).

In all those samples both lamellate and unarmed shells are present, totaling 70 and 74 specimens, respectively. This fact had been observed by Adams (1851 : 132), who wrote:
Of *Planorbis dentiferus* Ad., (Proc.Bost.Soc. Jan. 1,

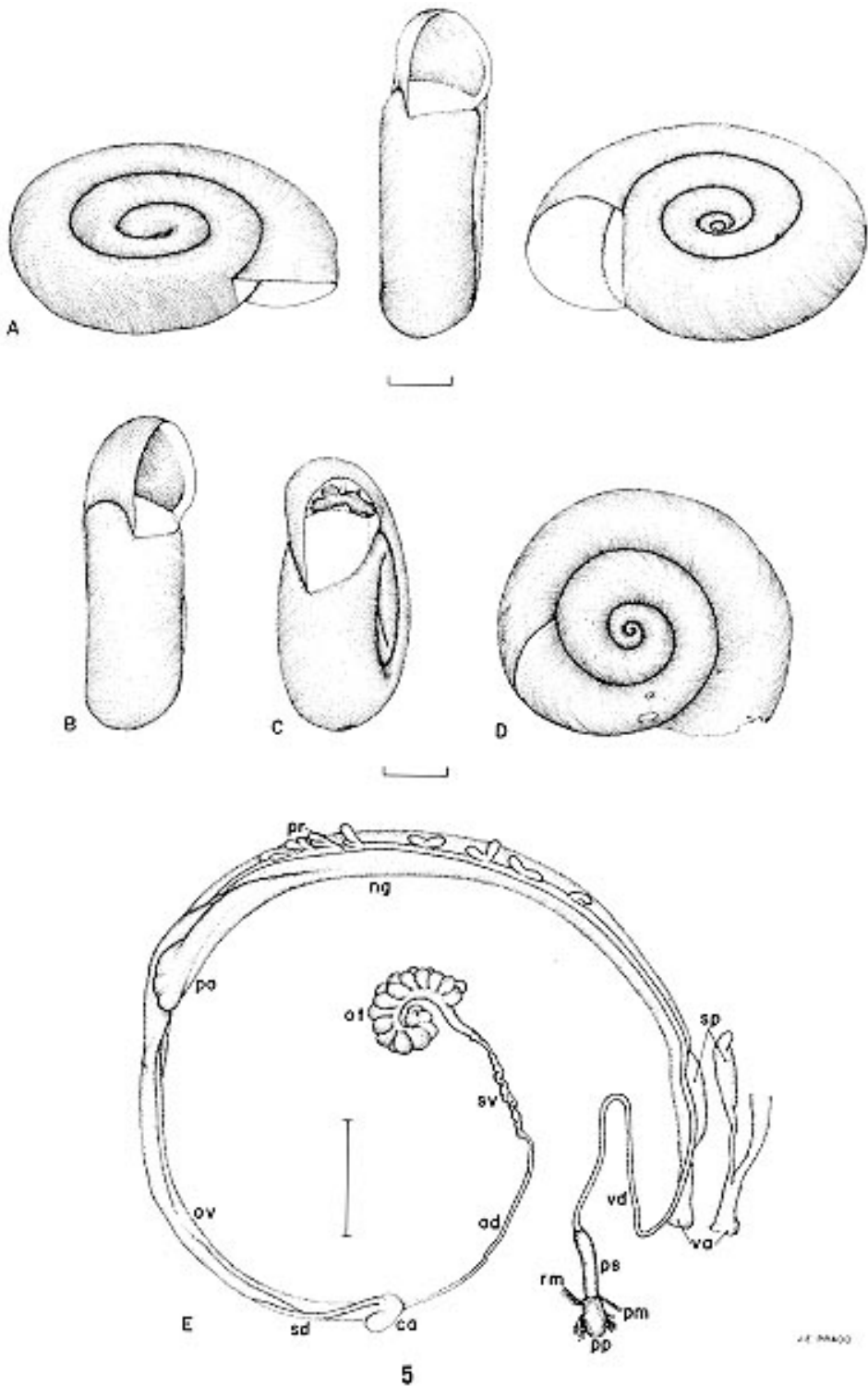
1845,) a variety occurs, which is destitute of teeth! After a careful examination of many specimens, I am unable to find any other differences constantly associated with this peculiarity. Many of the toothless shells are more compressed obliquely just below the periphery, than the type, but the same is true of some of the shells in which the teeth are well developed. It is not a *local* variety, both kinds occurring together at Hatfield, in Westmoreland. The variety may be designated by the name EDENTATUS."

PLANORBIS DENTIENS MORELET, 1849

Original description (Morelet 1849 : 18, no figure; type locality Belize, British Honduras):



Biomphalaria helophila from Dahlford, St. Elizabeth parish, Jamaica (= *Planorbis dentiferus* CB Adams, 1845) - Topotype (CMIOC-1605) - Fig. 4A: shell with two sets of lamellae: the first set was formed in a shell of 3.5 mm diameter, when the snail stopped growing, in all probability as an adjustment to environmental severities; then it resumed growth, leaving behind a ridge (rest mark, or growth ring) indicative of growth stop; a second set of lamellae was formed at a size of 5.5 mm, followed by a second rest mark and further growth resumption. Fig. 4B: reproductive system. Abbreviations as in Fig. 2C. Bar = 1 mm.



Biomphalaria helophila from Belize, British Honduras (= *Planorbis dentiensi* Morelet, 1849) - Topotypes (CMIOC-2293) - Figs 5A, B: non-lamellate specimens, 5B with strongly deflected aperture. Fig 5C: lamellae at apertural region. Fig 5D: lamellae farther back in former apertural region (delimited by growth ring indicative of growth stop); after resumed growth no lamellae were produced in newly formed portion. Fig. 5E: reproductive system. Abbreviations as in Fig. 2C. Bar = 1 mm.

40. *P. dentiens*. - T. discoidea, solidula, levis, superne subtiliter perforata, inferne vix excavata; anfr. 7 depressi, ultimo obsolete angulato; apertura oblique lunaris, intus lamellis 4 in ventre anfractus ultimi et dentibus 2 in pariete aperturali oppositis, una punctiformi, altera obliqua, compressa, utraque albida, profunde coarctata; peristoma simplex. - Diam 5. Altit. 2. - H. paludosa circa Belize, in littore Hondurano.

In July 1976 I collected 38 specimens, answering to the above description, from a little pool beside the road from Belize city to the international airport (Air Port Mile 8, CMIOC-2293). The largest one is 6 mm in diameter and has 4.75 whorls (not 7, as recorded by Morelet, which for a Neotropical planorbid 5 mm in diameter must be a misprint). Four of those specimens, measuring 4.0 to 5.5 mm, are lamellate. As shown in Fig. 5, *P. dentiens* is indistinguishable from *B. helophila*.

The non-lamellate form of this snail was named *Planorbula dentiens* var. *edentula* by Fischer and Crosse (1880 : 80-81, Pl. 34, Figs 6-6c).

PLANORBIS STAGNICOLA MORELET, 1851

Original description (Morelet 1851 : 14-15, no figure; type locality Bahia Honda, Cuba):

113. Pl. stagnicola. - T. depressa, supra umbilicata, subtus vix concava, subtiliter striata; anfr. 5 superne semiteretes, subtus angulati, ultimo basi subdilato. Apertura obliqua, semirotunda; perist. simplex, marginibus callo contiguus. - Diam. 6. - Altit. 2. - H. paludosa littoris Cubensis, ad portum *Bahia-Honda*.

In the above description no mention is made of apertural lamellae.

The largest of five syntypes in the Natural History Museum, London, is 6 mm in diameter by 2 mm in width (1.5 at the beginning of the outer whorl), and has 4.5 whorls. A specimen, 5.5 mm

in diameter, has a well-marked growth ring followed by 1 mm of newly formed aperture, and a set of lamellae, not outwardly apparent (Fig. 6A). Another specimen, with strongly deflected aperture, has deeply situated lamellae visible through the shell wall (Fig. 6B). All these shells are identical with that of *B. helophila*, differing from those of *B. obstructa* and *B. schrammi*, the other lamellate species recognized in Cuba.

TROPICORBIS SHIMEKI FC BAKER, 1945

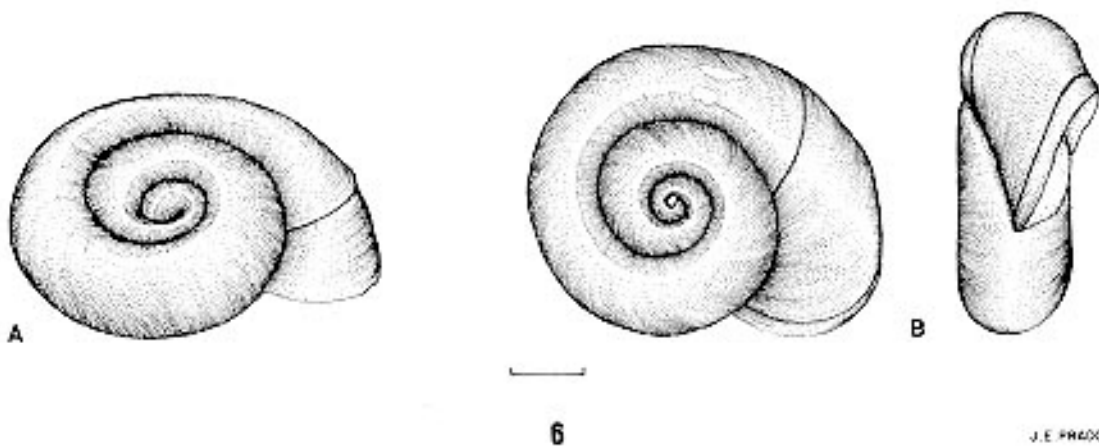
Original description (Baker 1945 : 218-219, Pl. 134, Figs 12-14, 28; type locality Ometepe, Nicaragua):

Shell solid, small, of three and one-half whorls. Upper surface showing three and one-half whorls which are subangulate above, sutures very deep. Lower surface showing three and one-half whorls which are subangulate in the middle, sutures very deep. Whorls rounded on the periphery. Apical whorls sunken on both surfaces. Whorl slightly deflected at aperture. Aperture lunately rounded, outer lip thick with callus. A callus on parietal wall connecting the extremities of the outer lip. Sculpture of coarse growth lines with fine spiral lines. Apertural lamellae six, those of sigmoid form extremely short and thick, only slightly more than half the length of those found in *obstructus*.

Shell Height	Greater Diameter	Lesser Diameter	Aperture Height	Aperture Diameter	
1.5	4.0	3.2	1.1	1.0	Holotype
1.6	3.8	3.1	1.1	1.1	Paratype
1.5	3.4	2.8	1.1	1.0	Paratype

Type Locality. Ometepe [misprint for Ometepe], Nicaragua.

Type Material. Collected by B. Shimek in 1893. Four specimens deposited in United States National Museum, Accession no. 534290. The holotype is shown on plate



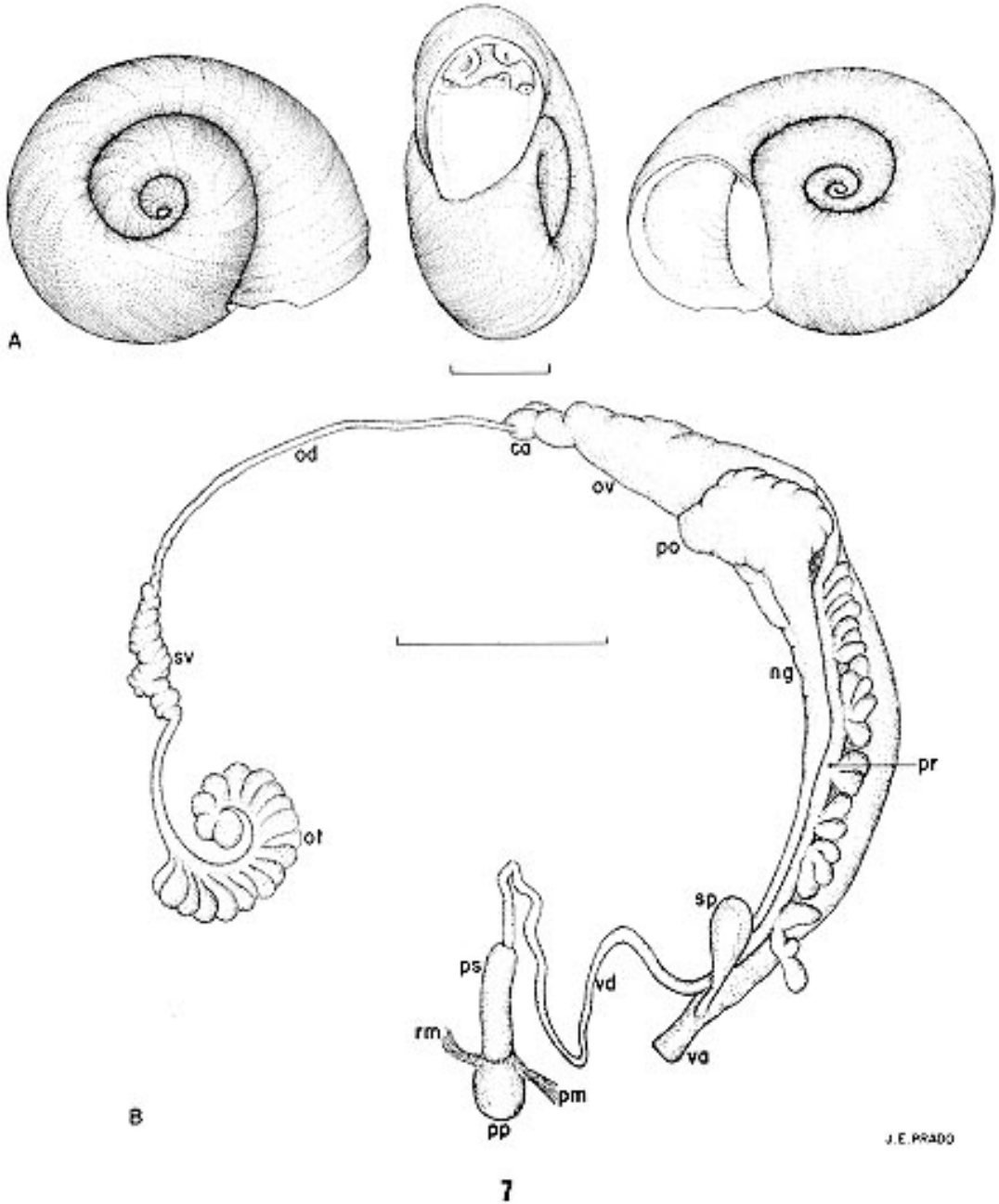
Biomphalaria helophila from Bahia Honda, Cuba (= *Planorbis stagnicola* Morelet, 1851) - Syntypes, Natural History Museum, London - Fig. 6A: shell with outwardly unapparent lamellae. Fig. 6B: lamellate shell with strongly deflected aperture. Bar = 1 mm.

134 as fig. 12; figs. 13, 14 are paratypes. *Tropicorbis shimeki* resembles *albicans* but is smaller, has a greater axial height, and has subcarinate whorls. The parietal lamellae are distinctly shorter and thicker than in other forms of the genus. *T. shimeki* is smaller than *declivis* and its axial height is greater; it also has deeper sutures than are found in *declivis*. Additional representatives of *T. shimeki* were collected by Orcutt in Coatzacoales [misprint for Coatzacoalcos],

Mexico (United States National Museum, Accession no. 219696).

This species is named in honor of Professor B. Shimek.

In August 1976 I collected a sample of this snail from a pond at Moyogalpa (on the Ometepe island), consisting of 12 lamellate and 5 non-lamellate specimens (CMIOC-2328), 3.5-5.0 mm in diameter. Fig. 7 shows that they do not differ from *B. helophila*.



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Biomphalaria helophila from Ometepe island, Nicaragua (= *Tropicorbis shimeki* FC Baker, 1945) - Topotype (CMIOC-2328) - Fig. 7A: shell. Fig. 7B: reproductive system. Abbreviations as in Fig. 2C. Bar = 1 mm .

As seen above, *T. shimeki* is stated by Baker to differ from *albicans* (= *helophila*) in having subcarinate whorls. However, his figures of *albicans* (Baker 1945, Pl. 134, Figs 4-6) show clearly subcarinate shells. Other alleged differences should be assigned to individual variation.

ADDITIONAL LOCALITIES FOR *BIOMPHALARIA HELOPHILA*

Besides the above-mentioned type localities, I collected samples of *B. helophila* at the following places:

- Costa Rica: Catalina, Guanacaste province, near San Miguel (CMIOC-2329, 2334);
- Guatemala: El Prado, Izabal department (CMIOC-2312);
- Haiti: lake Miragoane (CMIOC-1571);
- Dominican Republic: Maguá river at Hato Mayor, El Seibo province (CMIOC-1566); San Cristóbal, San Cristóbal province (CMIOC-1567);
- Puerto Rico: Caguaitas river at Caguas (CMIOC-1544);
- Barbados: Drax Hall, St. George parish (CMIOC-1483, 1484); Kendel, St. John parish (CMIOC-1488).

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