

ON *POMACEA CANALICULATA* (LAMARCK, 1822) (MOLLUSCA; PULMONATA; AMPULLARIIDAE)

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This paper deals with the morphology of Pomacea canaliculata (Lamarck, 1822) collected at Corrientes, Argentina. Comparison is made with Pomacea lineata (Spix, 1827) and Pomacea sordida (Swainson, 1823).

The shell is globose, heavy, with greenish or horn-colored periostracum and dark spiral bands; apex subelevated, 5-6 whorls increasing rather rapidly and separated by very deep suture. Aperture large, rounded to subelongated; lip sometimes reddish; umbilicus large and deep; operculum corneous, entirely closing the aperture. Ratios: shell width/shell length = 0.78-0.96 (mean 0.86); aperture length/shell length = 0.68-0.77 (mean 0.72).

Radula similar to other congeneric species.

Testis and spermiduct as in P. lineata and P. sordida; prostate cylindrical and short, cream in color as the testis. Penial sheath straight bearing a central outer gland deeply embedded in the tissue of its basal portion and a large wrinkled gland occupying 2/3 of the distal tip of its inner surface; the right margin of the sheath overlaps the left one until 2/3 of its proximal end. Female reproductive apparatus similar to that of P. lineata; vestigial male copulatory apparatus (penis and its sheath) present in all females examined.

Key words: Mollusca – Pulmonata (=Ampullariidae) – *Pomacea canaliculata* – *Pomacea lineata* – *Pomacea sordida* – morphology

Pomacea canaliculata was described in 1822 by Lamarck as *Ampullaria canaliculata* without illustrations, the Guadeloupe Island being indicated as type locality.

The history of this species shows some misdiagnoses as the following: it was illustrated by Philippi (1851) as *A. gigas* Spix, 1827 and as *A. speciosa* Philippi, 1851 by Reeve (1856). Martens (1857) gathered *A. gigas*, *A. haustum* Reeve, 1856, *A. immersa* Reeve, 1856, *A. insularum* Orbigny, 1835, *A. vermiformis*, *A. dolioides* and *A. orbignyana* Philippi, under the name *P. canaliculata*.

Sowerby (1909), based on specimens of Lamarck's collection, gave the first correct identification of *P. canaliculata* and in Alderson's monograph (1925) we had the first illustration of this species.

Ihering (1919) considered Guadeloupe a probably erroneous type locality of *P. canaliculata* and cited its occurrence in the Amazonian system, Argentina, Guianas, Bolivia, Brazil, Paraguay and Uruguay.

Alderson (1925) based on the shape of the shell suggested that its type locality is South America, probably La Plata, Argentina.

Pain (1946) agreed with Alderson and argued that he got only *Pomacea glauca* (L.) after collecting in Guadeloupe for many weeks in 1939. According to Maze (1883) and Pointier (1974) only *P. glauca* inhabits that island.

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Scott (1957) indicated Laguna Guadeloupe in Santa Fe, Argentina, as probable type locality, owing to abundance of *P. canaliculata* in that Laguna and, in her opinion, what had probably happened was a misidentification of Laguna Guadeloupe as Guadeloupe Island in the collection labels.

Orbigny (1835-1846) described and figured *P. canaliculata* and its varieties from Corrientes, Argentina, where according to him typical specimens were collected.

In this paper a redescription of *P. canaliculata* is presented, based on material collected by the authors in Corrientes, Argentina, in March 1989.

MATERIAL AND METHODS

Fifty live specimens were relaxed in a 0.1% solution of nembutal for 16 hr, drawn from the shell and placed in slightly modified Railliet-Henry's fixative (distilled water 930 ml, sodium chloride 6g, formalin 50 ml, acetic acid 20 ml). After 48 hr they were dissected under the stereomicroscope.

The radulae were separated from the buccal mass by digestion, for about 2 hr, in a vial with 10% NaOH immersed in gently boiling water.

Voucher specimens were deposited in the Malacological Collection of Instituto Oswaldo Cruz, no. 3982.

DESCRIPTION

The shell (Fig. 1) is globose, heavy, with greenish or horn-colored periostracum and dark spiral bands; apex subelevated, 5-6 whorls increasing rather rapidly and separated by very deep suture. Aperture large, rounded to subelongated; lip sometimes reddish; umbilicus large and deep; operculum corneous, entirely closing the aperture. Ratios: shell width/shell length = 0.78-0.98 (mean 0.86); aperture length/shell length = 0.68-0.77 (mean 0.72).

Some specimens show a rather square body-whorl and a reddish lip, also observed by Orbigny (1835), Sowerby (1909), Alderson (1925) and others.

The jaw and the radula (Fig. 2) are similar to those of other known congeneric species.

Since in the following description comparison is made with *P. lineata* and *P. sordida* the reader is referred to previous papers on those species (Thiengo, 1987; 1989).

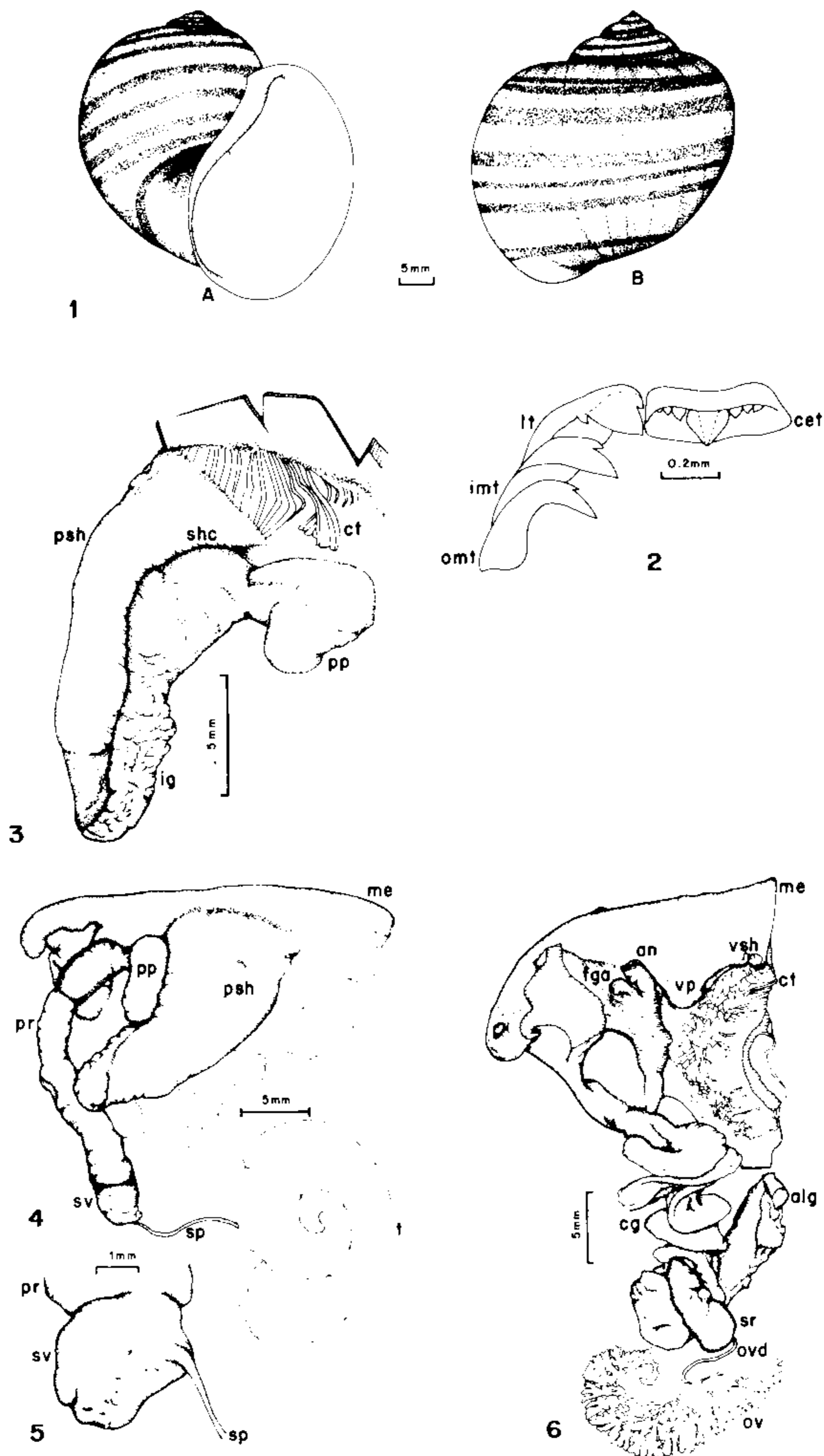
The kidney has the same appearance as in *P. lineata* and *P. sordida*.

The testis (Fig. 3) is a cream-colored mass occupying the first three whorls of the spire. Short and numerous efferent ducts fuse into two main branches that converge into the spermiduct. The latter is very narrow and runs to the base of the spire. Near the pericardium it turns to the right, opening into the seminal vesicle, a whitish rounded structure. The cream-colored prostate is cylindrical, has a slitlike lumen and a pointed tip ending below the penis pouch. This latter is rather rounded and thin-walled so that the coiled penis is seen by transparency. The proximal end of the pouch is pink and thick whereas its distal tip forms a U-shaped channel leading the penis during copulation. The flange of tissue in the seminal groove is also present. The whiplike penis is roughly 30 mm in length in a 35 mm long specimen, its duct being circular and closed.

The straight and well developed penial sheath (Figs 3, 4) rises to the left of the anus and tapers distally. It has two margins which juxtapose, forming a median longitudinal channel in its inner surface. The right margin overlaps the left one until the beginning of the distal 1/3 of the sheath, where the penis emerges during mating. There is a large central gland embedded in its outer basal tissue with a slitlike opening and an elongated wrinkly gland occupying its distal 2/3 in the inner surface.

The female reproductive apparatus is similar to that of *P. lineata*. The arborescent ovary (Fig. 5) lies in the same location as the testis and its whitish branched tubules are easily distinguished from the green digestive gland. Its main branches fuse to form a thin oviduct that runs to the base of the spire and near the pericardium turns to the right and merges into the albumen gland before opening into the seminal receptacle. The latter is thick-walled, tapers distally and is almost completely enclosed by the albumen gland.

The large pink-reddish albumen gland encloses entirely the spiral capsule gland that begins at the receptacle and extends until it



Pomacea canaliculata – Fig. 1: shell (A = ventral view, B = dorsal view). Fig. 2: radula. Fig. 3: penial sheath. Fig. 4: male reproductive system. Fig. 5: seminal vesicle. Fig. 6: female reproductive system.

Abbreviations: alg: albumen gland, an: anus, cet: central tooth, cg: capsule gland, ct: ctenidium, fga: female genital aperture, ig: inner gland, imt: inner marginal tooth, lt: lateral tooth, me: mantle edge, omt: outer marginal tooth, ov: ovary, ovd: oviduct, pp: penis pouch, pr: prostate, psh: penial sheath, shc: sheath channel, sp: spermiduct, sr: seminal receptacle, sv: seminal vesicle, t: testis, vp: vestigial penis, vsh: vestigial sheath.

emerges from the proximal end of the albumen gland. The pallial oviduct runs along the rectum until reaching the female genital aperture beside the anus.

The male vestigial copulatory apparatus (penis and its sheath) was present in all females examined.

The pink-reddish calcareous-shelled eggs are roughly 3 mm in width, are laid in clusters always above the water level and at a room temperature of 25 °C hatching takes place about 15 days after oviposition.

DISCUSSION

In 1991 Dr J. P. Pointier sent us some specimens from Guadeloupe Island that were identified as *P. glauca* according to previous observations (Maze, 1883; Pain, 1946; Pointier, 1974).

P. canaliculata occurs mainly in south and southeast Brazil and in Argentina, Bolivia, Paraguay and Uruguay. It is an abundant species in the basins of the rivers Paraná, Prata, Paraguay and Uruguay. Ihering (1919) cites its occurrence also in the Amazonian system.

Maintenance of *P. canaliculata* under laboratory conditions is easy, because they feed voraciously on fresh lettuce, mate well and almost all eggs hatch.

The shell of *P. canaliculata* is similar to that of *P. lineata*, but deeper sutures and more globose and sometimes square body whorl characterizes the former.

The shell of our specimens are similar to those figured by Scott (1957), Mermod (1952) and Alderson (1925).

The radula and the kidney are similar to those of *P. lineata* and *P. sordida*.

The female reproductive apparatus is similar to that of *P. lineata*, except by the albumen gland that is almost red in *P. canaliculata* in contrast with the pink-colored gland of the former.

Significant diagnostic characters are mainly in the male reproductive apparatus: the penial sheath and prostate shape, the length of the sheath, prostate and penis and the distribution of the glands in the inner and outer surfaces of the sheath. Scott (1957) and Keawjam (1987) also observed that in the male reproductive

apparatus are the main diagnostic characters in Pilidae.

The male reproductive system of our material agrees with the descriptions by Andrews (1964) and Scott (1957). It is different from that figured by Lopes (1956) and Cazzaniga (1987a) in the penial sheath shape and distribution of its glands.

P. canaliculata and *P. lineata* are close species and microanatomic, biochemical and crossbreeding studies must be done to a better understanding of their relationships.

P. canaliculata is a widespread species for having been introduced into some Asiatic countries as human food, or as tropical exotic snails sold in aquarist stores. It became a pest in rice fields in Japan, Philippines and Taiwan and was found naturally infected with *Angiostrongylus cantonensis* (Chen) in Hawaii (Wallace & Rosen, 1969) and in Ryukyu Island (Nishimura, 1986).

Colman (personal communication) commented about its introduction and its quick multiplication in Australia where governmental authorities are interested in its eradication before it becomes a pest in that country too.

Cazzaniga (1987b) wrote about *P. canaliculata* dangerous introduction into Asia.

Thiengo (unpublished data) observed that *P. canaliculata* is susceptible to *Angiostrongylus costaricensis* (Morera & Céspedes, 1971), the etiologic agent of abdominal angiostrongyliasis.

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