

THE GENUS *Plesiophysa*, WITH A REDESCRIPTION OF *P. ornata* (HAAS, 1938) (GASTROPODA: PLANORBIDAE)

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(With 11 figures)

ABSTRACT

A redescription of conchological and anatomical characters of the planorbid mollusc *Plesiophysa ornata* (Haas, 1938) is presented, based on topotypic material and specimens from 14 additional localities in the Brazilian states of Rio Grande do Norte, Paraíba, Sergipe, Bahia, Espírito Santo and Minas Gerais. Due to the close similarity of their shells, a sure discrimination of the five species of *Plesiophysa* described so far (*P. pilsbryi*, *P. granulata*, *P. guadeloupensis*, *P. ornata* and *P. hubendicki*) is only possible through their anatomical features. The present study points to the high probability of synonymy of *P. hubendicki* with *P. ornata*. Investigations on the anatomy of *P. pilsbryi* and *P. guadeloupensis* are needed to define their taxonomic relation with the other nominal species.

Key words: Planorbidae, *Plesiophysa*, *Plesiophysa ornata*, taxonomy, anatomy.

RESUMO

O gênero *Plesiophysa*, com redescricao de *P. ornata* (Haas, 1938) (Gastropoda: Planorbidae)

É apresentada uma descrição de caracteres conchológicos e anatômicos do molusco planorbídeo *Plesiophysa ornata* (Haas, 1938), baseada em material topotípico, de 14 outras localidades dos seguintes Estados brasileiros: Rio Grande do Norte, Paraíba, Sergipe, Bahia, Espírito Santo e Minas Gerais. Devido à grande semelhança de suas conchas, uma distinção segura das cinco espécies de *Plesiophysa* até agora descritas (*P. pilsbryi*, *P. granulata*, *P. guadeloupensis*, *P. ornata* e *P. hubendicki*) só é possível por intermédio de suas características anatômicas. Os dados sobre *B. hubendicki* indicam alta probabilidade de sinonímia com *P. ornata*. São necessárias investigações sobre a anatomia de *P. pilsbryi* e *P. guadeloupensis* para definir sua relação taxionômica com as outras espécies nominais.

Palavras-chave: Planorbidae, *Plesiophysa*, *Plesiophysa ornata*, taxionomia, anatomia.

INTRODUCTION

The name *Plesiophysa* (Greek *plesio* = close, near) was proposed by Fischer (1883: 509) as a subgenus of *Bulinus* Adanson, 1757, with the following definition: “S.g. *Plesiophysa*, Fischer. 1883. Coquille assez courte. Dent centrale de la radule portant 5 cuspides dont la médiane est la plus longue. Ex.: *P. striata*, d’Orbigny, Antilles”.

Owing to its importance as type species of *Plesiophysa*, the original description of *Physa*

striata is transcribed from Orbigny (1841: 192-193, Pl. 13, Figs. 14-16):

“*Physa testa ovata, luteo-rubra, diaphana, transversim striata; spira obtusissima, anfractibus tribus inflatis, ultimo gibbosulo; apertura ovali; columella recta, labro castaneo, incrassato.*

Dimensions. Longueur 6 millim. Diamètre 4.

Coquille ovale, diaphane, fortement striée en travers. *Spire* des plus courtes, très obtuse à son sommet, composée de trois tours croissant rapi-

dement, tous très renflés, très séparés par une suture des plus profonde, le dernier très renflé et très grand par rapport aux autres. *Bouche* ovale, bien circonscrite en arrière, à columelle droite ou légèrement arquée; le bord est légèrement épaissi.

Couleur générale jaune rougeâtre, plus teintée au sommet de la spire; le bord de la bouche brun foncé.

Cette charmante espèce se distinguerait nettement de toutes les autres par ses stries transverses, si elle n'en différait pas encore par la convexité de ses tours et sa spire des plus obtuse.

Nous en devons la connaissance à M. Ferdinand de Candé; seulement nous ne savons pas positivement si elle est de la Martinique ou de Cuba."

Aguayo (1935) proposed the substitute name *Plesiophysa pilsbryi* for Orbigny's species, after verifying that its denomination was preoccupied by *Physa striata* Menke, 1830.

So far only a species of *Plesiophysa* was recorded in continental South America. It was named *Physa* (?*Plesiophysa*) *ornata* by Haas (1938), who described its shell characters, emphasizing that its general shape is that of *Bulinus* rather than of *Physa*, and that its placing under the latter genus was due to the absence of *Bulinus* in South and Central Americas. However, he acknowledged the impossibility of ranging his species together with the other American physae in the absence of anatomical data, and ascribed it provisionally to the subgenus *Plesiophysa* owing to the spiral striation of the shell.

Bequaert & Clench (1939), on the basis of radular characteristics, and "until more of the soft anatomy is known", placed *Plesiophysa* in the Planorbidae as a distinct subfamily Plesiophysinae. In their paper the radula of *P. ornata* is described and figured.

P. ornata has been referred to the northeastern Brazilian states of Paraíba and Pernambuco (Haas, 1938; Benthem Jutting, 1943; Hubendick, 1949; Lucena, 1956). Anatomical observations were published by Hubendick (1949) and myself (Paraense, 1975).

MATERIAL AND METHODS

This study is based on 8 topotypes of *Plesiophysa ornata* from São João do Cariri (Açu-

de Ligeiro), 78 from Souza (Açude Russo Velho), 12 from São Mamede (Açude da Pia), all in the state of Paraíba; 1 from Santo Antônio (pond at Fazenda Lages), state of Rio Grande do Norte; 120 from Tarumirim (creek under small bridge on the "Vai e Vem" road), state of Minas Gerais. Anatomical observations were made on 7 specimens from Açude Ligeiro, 25 from Açude Russo Velho and 25 from Tarumirim.

Empty shells from the states of Minas Gerais (Aimorés, Governador Valadares), Espírito Santo (Quilômetro 14 do Mutum), Bahia (Carinhanha, Conceição, Jaíba, Pontal), Sergipe (Itabaianinha), and Rio Grande do Norte (Grossos, Marcelino Vieira, Olho D'água do Borges, Presidente Juscelino, São Fernando, Senador Elói de Souza) in all probability belong to this species.

The snails dissected for anatomic study were collected in 1960-1961. Since at that time we used no relaxing agents, the following protocol was adopted. A specimen freely moving about, with its head and foot well exposed, is carefully picked up with a forceps, so as to prevent it from retracting back to the shell. The shell aperture is kept upward, and the snail is gradually plunged into hot water at about 70°C for a time proportional to the animal's size (approximately 30 seconds for snails about 10 mm in shell length or diameter). If the shell is plunged to the level of the aperture for the first 15 seconds, the animal usually will not retract and then, after being completely submerged, will die. Care must be taken not to exceed the suitable temperature and time of immersion, since blood and tissue cooking would hinder dissection. The dead animal is plunged into cold water and gently pulled by the head-foot with a small forceps, so as to disconnect the insertion of the columellar muscle. The whole animal is then drawn out of the shell, which remains unbroken and filled with water, which dilutes the blood residuum avoiding its putrefaction within the shell. The animal is fixed in slightly modified Railliet-Henry's fluid (distilled water 930 ml, sodium chloride 6 g, formalin 50 ml, glacial acetic acid 20 ml), where it must remain for at least 24 hours before dissection. One change of the fixative after the first 24 hours is advisable. The amount of fluid should be not less than 10 times the volume of material to be fixed. The radulae are separated from the buccal mass by digestion in a vial with 10% NaOH (left overnight in the incubator at 56°C). They are then rinsed in tap

water and mounted in a drop of glycerin on a microscopic slide, with the dorsal (toothed) surface upwards as in the living animal.

Voucher specimens are deposited in the Malacological Collection of the Oswaldo Cruz Institute.

DESCRIPTION

The egg capsule (Fig. 1) is shaped like a flattened subovate disc, resembling that of other planorbids. The shell of hatchlings (Fig. 2) has spiral rows of hairy projections, which tend to disappear as the animal grows.

The adult shell (Figs. 3, 4) is sinistral, elongato-ovate, from pale amber to deep brown, with 3 to 3.5 rapidly expanding whorls separated by a deep suture. It varies in color and translucency according to the degree of saturation or incrustation with environmental material. The outer whorl is exceedingly swollen, as compared with the inner ones. The spire is most often flattened, sometimes sub-acute, and shows various degrees of elevation beyond the general curve of the surface. The aperture is very wide, elongato-ovate, and corresponds to 60%-75% of the whole shell length. The lip is very thin and the columellar fold reflects over the umbilicus. In some specimens the newly formed and still uncalcified border has a membranous consistency and shrinks after desiccation. The outer surface is sculptured with fine spiral striae, which intercross with the growth lines. In many specimens residual rows of hairy projections may be seen, usually confined to the proximity of the suture. Our largest shell is 9 mm long and 5 mm wide.

The exposed soft parts are light gray, excepting the head and the axis of the tentacles, which are deeply pigmented. The tentacles are slender and very extensible. The foot is oblanceolate.

The roof of the pulmonary cavity is irregularly pigmented black, leaving many irregular spots unpigmented. Internally it is widely occupied by the renal organ (Fig. 5), which extends from the left of the heart to the region of the pneumostome; from there it bends on itself to reach the heart auricle, turns again in a sharp curve to descend along the right margin of the previous loop, and finally bends leftward to open inside the mantle aperture. A small vesicle, lying on the right side of the heart, exactly corresponds to that described

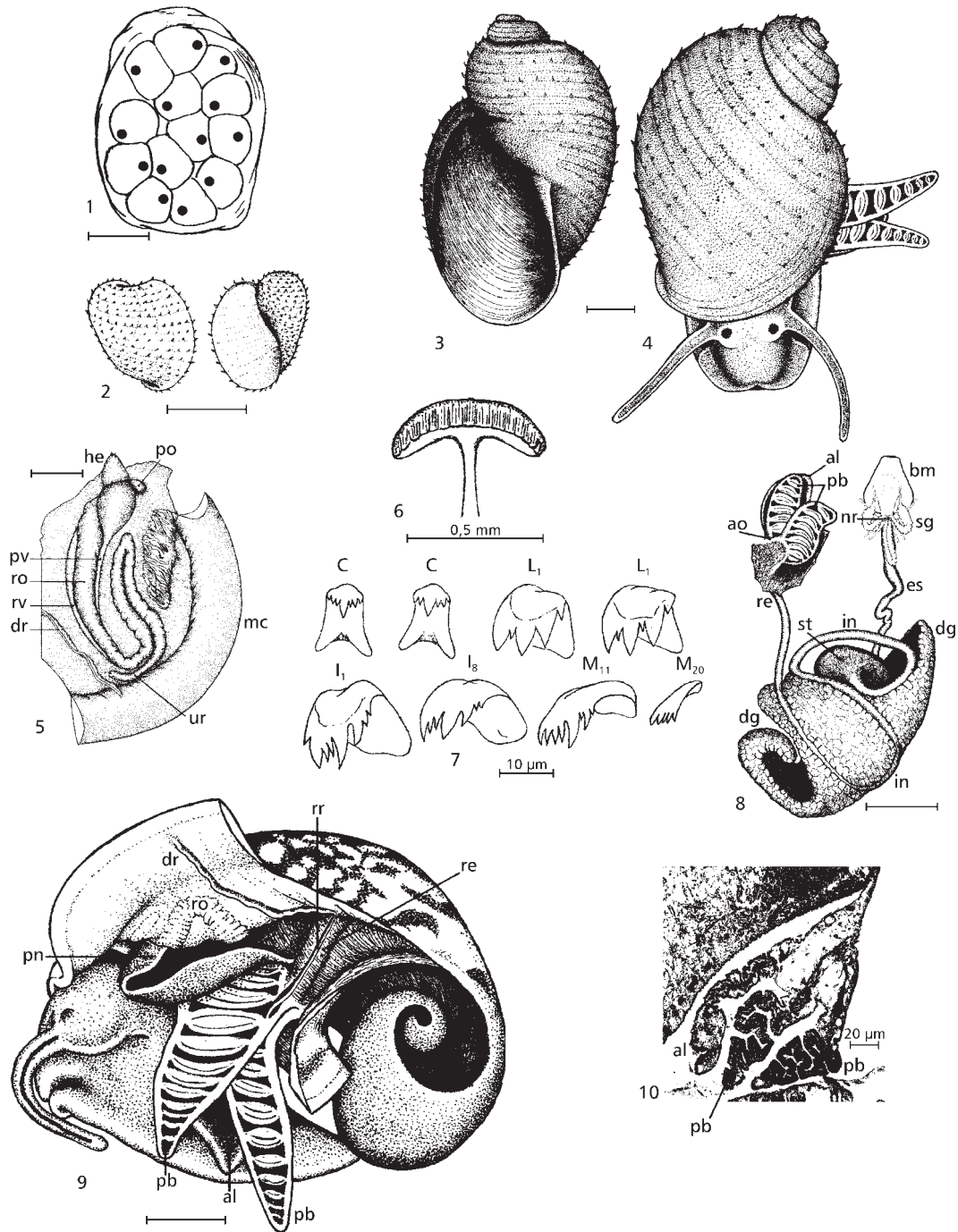
as "pericardial organ" by Harry & Hubendick (1964) in *Plesiophysa granulata*. A dorsolateral ridge runs on the left of the renal organ, reflecting ventrally at the back of the pulmonary cavity to proceed cephalad as the rectal ridge.

As in most planorbid genera, the mouth is provided with a large superior jaw, striated vertically, and two smaller lateral jaws (Fig. 6). The radular formula of eight specimens varied from 16-1-16 to 22-1-22, there being 107 to 120 transverse rows of teeth in the radular ribbon. Fig. 7 shows a series of radular teeth. The central tooth has a sharp triangular cusp and two or three small cusps high on either side of the main one. There are 6 to 8 laterals, 3 to 5 intermediates and 6 to 12 marginals. The laterals are squarish, tricuspid, with a small accessory cusp between the endocone and the mesocone, and another one lateral to the ectocone, sometimes also between the mesocone and the ectocone. The intermediates show interstitial cusps between the endocone and the mesocone and small cusps above the ectocone. The mesocone persists in the earlier marginals, flanked on both sides with smaller cusps. The extreme marginals are claw-like with about five small cusps.

The remaining digestive system is shown in Fig. 8. The salivary glands pass through the nerve ring and are joined to each other behind. The disposition of the digestive organs does not substantially differ from that in other planorbid genera, except for the position of the anterior intestinal loop between the stomach and the albumen gland. The anal opening is situated at the dorso-caudal base of a lappet (Figs. 8, 9, 10, al) under the pseudobranch, corresponding to the "anal lobe" shown by Hubendick (1949, Fig. 15, *an.l.*).

The pseudobranch (Figs. 8, 9, 10, pb) is represented by two much folded lanceolate leaves which in the live animal are usually held as shown in Fig. 4.

In the reproductive system (Fig. 11) the ovotestis and the albumen gland show a noticeable degree of development in comparison with the remaining organs. The ovotestis shows a great number (over 100) of club-shaped diverticula; most of them are simple, and a number of bifid, trifid and subdivided ones are also present. The ovispermiduct and the seminal vesicle show no special features.



Figs. 1-10 — *Plesiophysa ornata*. 1. Egg capsule. 2. Hatchling shell. 3. Adult shell. 4. Crawling animal. 5. Roof of pulmonary cavity. 6. Jaw. 7. Radular teeth (C – central; L₁ – 1st lateral; I₁ – 1st intermediate; I₈ – 8th intermediate; M₁₁ – 11th marginal; M₂₀ – 20th marginal). 8. Digestive system and pseudobranch. 9. Left side of roof of pulmonary cavity dissected and raised to expose pseudobranch, anal lobe, pneumostome, rectum and rectal ridge. 10. Longitudinal section through anal lobe and pseudobranch. (al – anal lobe; ao – anal opening; bm – buccal mass; dg – digestive gland; dr – dorsal ridge; es – esophagus; he – heart; in – intestine; mc – mantle collar; nr – nerve ring; pb – pseudobranch; pn – pneumostome; po – pericardial organ; pv – pulmonary vein; re – rectum; ro – renal organ; rr – rectal ridge; rv – renal vein; sg – salivary gland; st – stomach; ur – ureter). Scale bar = 1 mm (unless otherwise stated).

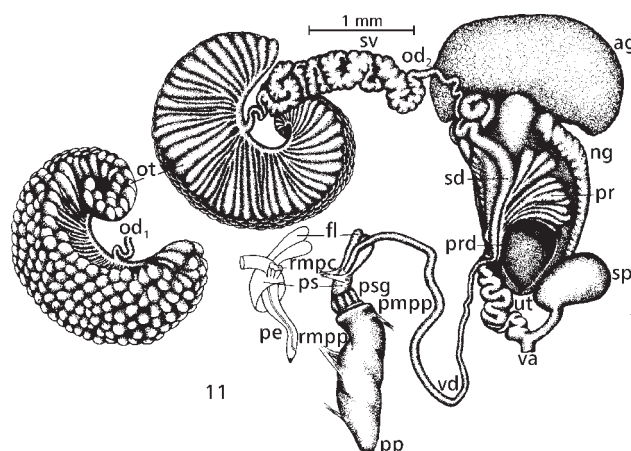


Fig. 11 — *Plesiophysa ornata*: Reproductive system. (ag – albumen gland; fl – flagellum; ng – nidamental gland; od_1 – proximal ovispermiduct; od_2 – distal ovispermiduct; ot – ovotestis; ov – oviduct; pe – penis; pmpp – protractor muscle of prepuce; pp – prepuce; pr – prostate diverticula; prd – prostate duct; ps – penis sheath; psg – penis sheath gland; rmppc – retractor muscle of penial complex; rmpp – retractor muscle of prepuce; sd – spermiduct; sp – spermatheca, pulled away from its position on the nidamental gland; sv – seminal vesicle; ut – uterus; va – vagina; vd – vas deferens).

The oviduct is short and crooked, continuing into a voluminous nidamental gland that suddenly narrows into a convoluted uterus followed by a short vagina. The spermatheca varies in shape with the amount of its contents, showing a usually rounded or ovoid body partly embedded in the wall of the nidamental gland, and a duct about as long as the body emptying near the vaginal opening. The spermiduct extends alongside of the nidamental gland down to the level of the spermatheca. The prostate consists of 2 to 7 club-shaped, unbranched to trifurcate diverticula emptying into a separate duct, which joins the spermiduct to form the vas deferens. The penial complex is topped by a retractor muscle and two short flagella, equal or unequal in length, sometimes split, which are glandular organs emptying their secretion into the penis sheath. The penis sheath, about a third as long as the prepuce, is encircled by eight glands at its distal end, and contains a verge somewhat longer than it, with a subterminal opening and a cuticularized tip. The prepuce, much wider than the penis sheath, is provided with retractor and protractor muscles.

DISCUSSION

Hubendick's (1949, 1955) investigation on the anatomy of *P. ornata* was impaired by unsatisfactory preservation of the material available to

him. He studied the proximal portions of the alimentary canal (jaw, teeth and salivary glands), the pseudobranch, the kidney, and the distal parts of the reproductive system: uterus, vagina and spermatheca, and penial complex. In two points his observation differs from the present one: he describes the prostate as "constituted by a large number of fold formations directed outwards from the vas deferens", and the outlet of the penial canal as "terminal". In our specimens the prostate diverticula empty into a separate duct that joins the spermiduct at the level of the spermatheca; and the penial canal opens subterminally. In other respects the present description confirms his findings.

There is a high degree of similarity between the present species and *Plesiophysa hubendicki*, as described by Richards & Ferguson (1962). The only appreciable unlikeness is in the ovotestis, not described and represented in a different position from Fig. 11 of the present paper. If a closer observation of that organ reveals its similarity with *P. ornata*'s, there will remain no anatomical support for considering them different species.

Significant anatomical features separate *P. ornata* from Puerto Rican *P. granulata* ("Shuttleworth" Sowerby, 1873), as described by Harry & Hubendick (1964): ovotestis (not figured) with about twelve short, thick, cylindrical, unbranched diverticula; few unbranched, digitiform prostate

follicles attached directly to the vas deferens; penis with a terminal opening on a non-cuticularized tip. The flagella are described as “about 5 digitiform glands”.

Nowadays the genus *Plesiophysa* comprises five nominal species, practically indistinguishable by shell characters: 1. *Plesiophysa pilsbryi* Aguayo, 1935 (new name for *Physa striata* Orbigny, 1841), Martinique or Cuba; 2. *Physa (Plesiophysa) granulata* “Shuttleworth” Sowerby, 1873, Barbados; 3. *Physa (Plesiophysa) guadeloupensis* “Fischer” Mazé, 1883, Guadeloupe; 4. *Physa (?Plesiophysa) ornata* Haas, 1938, Brazil; 5. *Plesiophysa hubendicki* Richards & Ferguson, 1962, Puerto Rico. As seen above, anatomical features have been investigated in three of them: *P. granulata*, *P. hubendicki* and *P. ornata*.

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