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NOTES ON BULIMULIDAE (GASTROPODA, EUTHYNEURA), 7[1]) ANATOMY AND HISTOLOGY OF *SIMPULOPSIS (SIMPULOPSIS) MIERSI* PFEIFFER, 1856

by

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With 7 text-figures and two plates

During recent years a group of Brazilian malacologists has contributed substantially to our knowledge of Brazilian Bulimulidae. The second author has been fortunate enough to have had the opportunity to visit some of these specialists twice and to establish a close cooperation. This paper is the second in our joint series treating several species in greater detail. The first paper in this series is by Breure & Dos Santos Coelho (1976).

Simpulopsis (Simpulopsis) miersi Pfeiffer, 1856 (figs. 1-7, pls. 1, 2)

Simpulopsis miersi Pfeiffer, 1856: 260; Pfeiffer, 1859: 800; Pfeiffer, 1868: 21; Pfeiffer, 1876: 28; Pfeiffer & Clessin, 1881: 229; Pilsbry, 1899: 218; Morretes, 1949: 162.

Type locality. — Brazil, State of Espírito Santo.

Type material. — Lectotype (here designated; shell height 22 mm, diameter 23 mm; pl. 1 figs. 1-3) and one paralectotype in British Museum (Nat. Hist.), registration numbers 1975489 and 1975490 respectively, "Espirits Santo" [sic] (ex Cuming ex Miers).

This is the first time that *S. (S.) miersi* is figured.

[1]) Notes on Bulimulidae, 6. — Basteria 41 (1977).

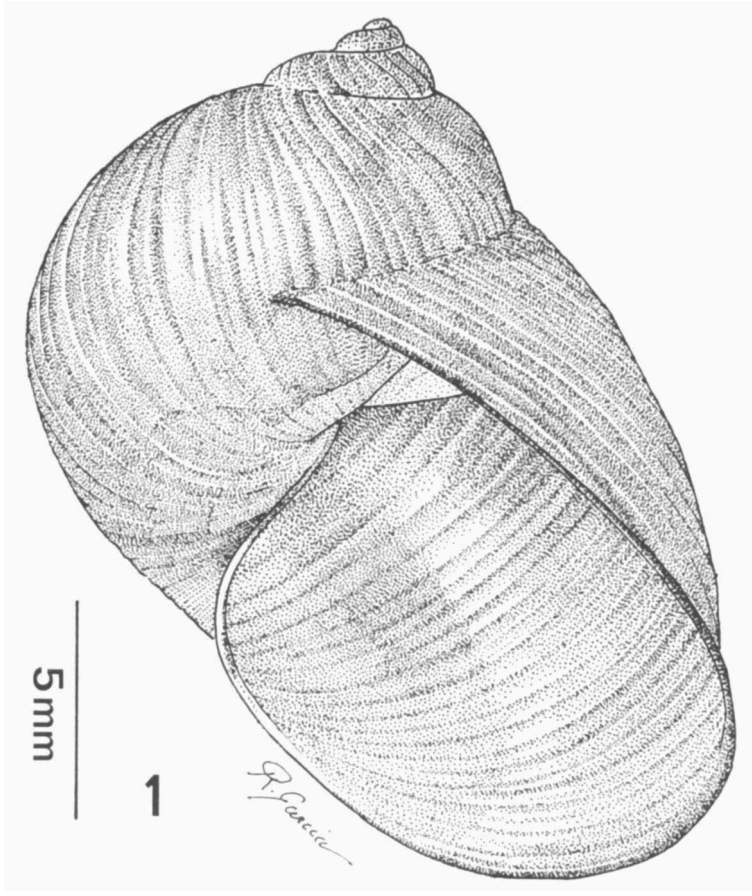


Fig. 1. *Simpulopsis miersi* Pfeiffer. Brazil Espírito Santo, Linhares (MN 3572). R. Garcia del.

Material and methods

All material was collected at Linhares, State of Espírito Santo, by J. L. de Barros Araujo, E. Izecksohn and A. L. Peracchi (Museu Nacional, Rio de Janeiro, Moll. 3572/3; MN 3723/2), by A. C. Domingos (MN 3726/11, Rijksmuseum van Natuurlijke Historie, Leiden Moll. 9036/5) and by C. Elias (MN 3725/18, MN 3724/5, RMNH 9037/3) respectively.

Specimens were fixed in an alcohol-glycerol mixture (ethanol 70%: glycerol = 9:1). Dissections were carried out under a Wild M4 stereomicroscope and the drawings made with the help of a camera lucida.

Histological investigations were performed on two specimens. After embedding in paraffin the material was sectioned at 7 μm and stained with

1% Alcian Blue after kalium permanganate oxidation, followed by staining with Haemalum and 0.5% Phloxine. A number of slides were stained with Haemalum and Eosine-Erythrosine in ethanol 80%. The sections were mounted in malinol and have been deposited in the Leiden museum (Moll. slides H 837-890).

The radula was extracted from the buccal mass using 10% KOH and was studied with a Cambridge scanning electron microscope (Moll. stubs 50-51).

Anatomy

Radula. — The transverse rows are V-shaped. Central tooth with a broadly ovate mesocone, unicuspid. Lateromarginals with a small endocone (becoming more prominent towards the margins) and a rather prominent ectocone which is situated posteriorly on the basal plate and which is bifid in the outer teeth.

$$\text{Formula: } C \frac{1}{1} LM \frac{48}{3} \quad \text{(pl. 1 figs. 4-7).}$$

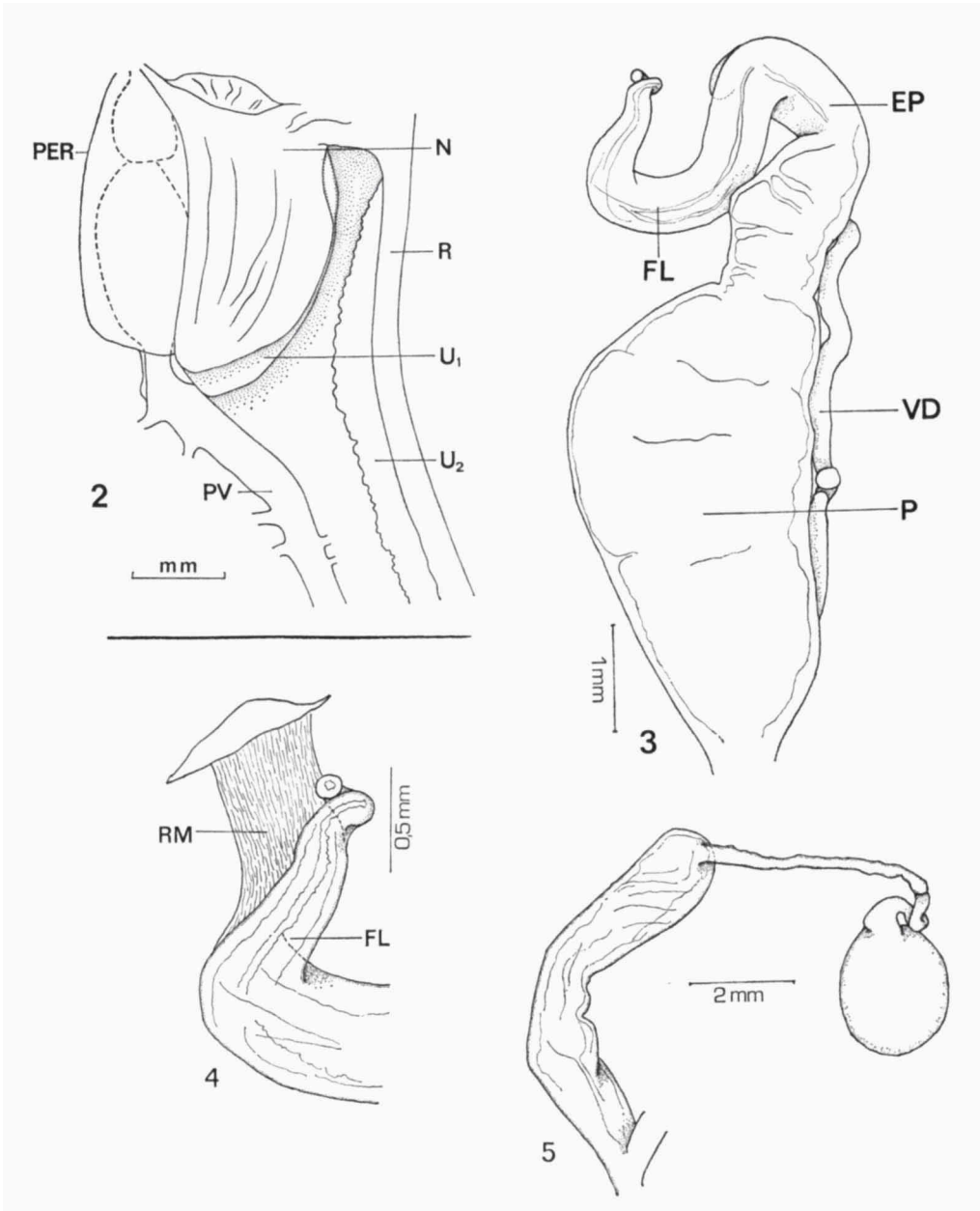
Pallial organs. — Nephridium partially covering the adrenal (primary) ureter, while the adrectal (secondary) ureter passes below the rectum and discharges through the urinary opening. Pericardium at the left side of the nephridium (fig. 2).

Genitalia. — Penis slender at its base, but otherwise strongly swollen, and again slender towards the transition to the epiphallus. Penis surrounded by a thin tunica (cf. fig. 6). Epiphallus very short, ca. 1/4-1/5 the length of the penis. Flagellum tapering, twice as long as epiphallus. Penis retractor subdistally inserted. Spermathecal duct more or less club-shaped in its proximal part, continuing as a narrow duct. Distal and proximal part are of equal length. Spermathecal appendix very short and not clearly separated (figs. 3-5).

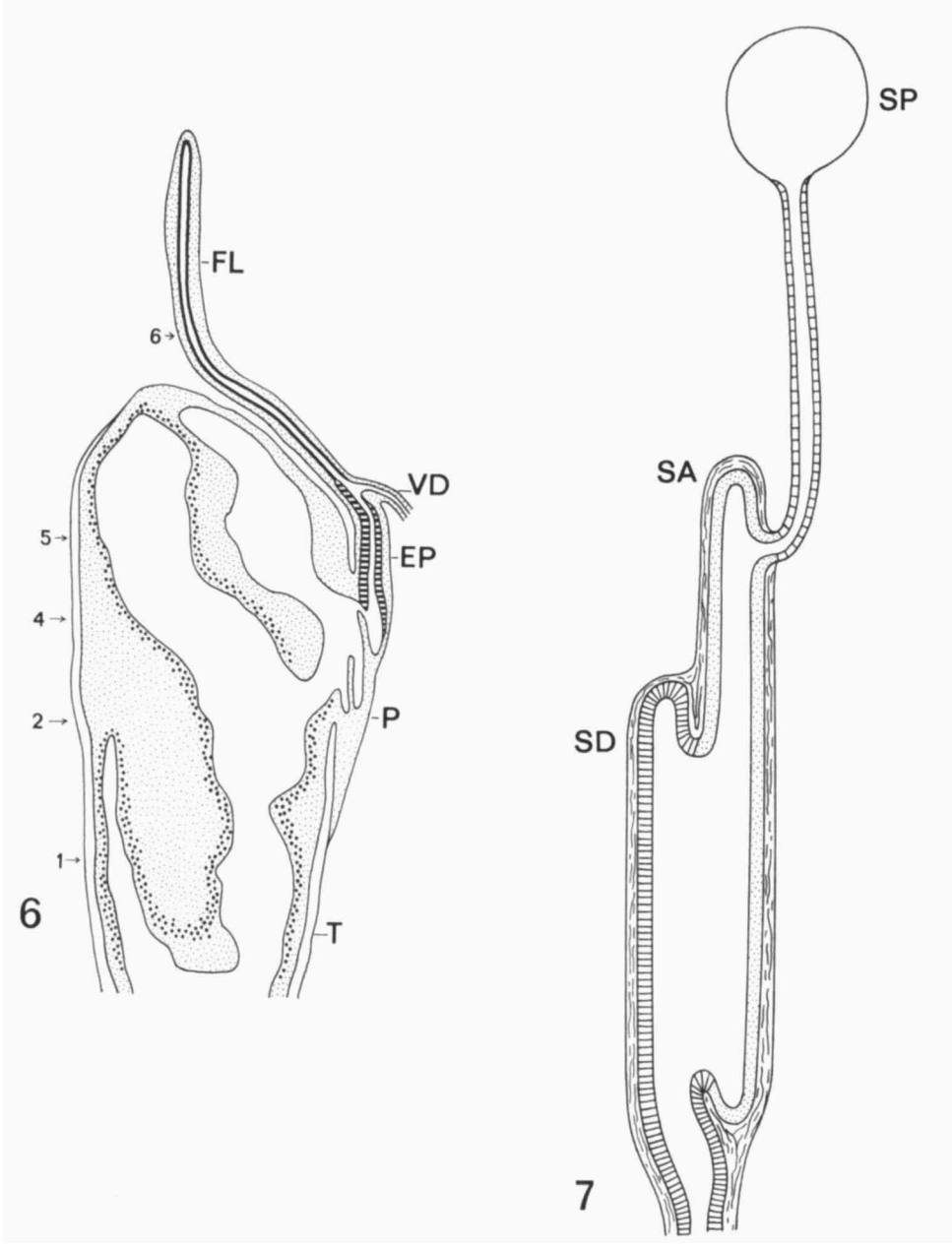
Genital atrium. The elongate lumen has small infoldings and is lined with a low cylindrical epithelium (cell height 9 μm). Subepithelial tissue vacuolized (possibly the cell contents has been washed out during the upgrading procedure).

Penis. The lumen is rather large and more or less U-shaped in the proximal part of the penis. Two cell types may be distinguished:

Type 1. The epithelium is cylindrical (cell height ca. 30 μm), with a large, basal nucleus, which stains griseous with Alcian Blue. In the subepithelial muscle layer glandular cells of irregular shape are filled with large secretion granules (diameter 1-2 μm), which stain dark violet with Alcian Blue.



Figs. 2-5. *Simpulopsis miersi* Pfeiffer. Fig. 2: pallial organs; fig. 3: phallus complex; fig. 4: detail of phallus complex, showing the retractor muscle subterminally inserted at the flagellum; fig. 5: spermathecal duct and spermatheca. EP, epiphallus; FL, flagellum; N, nephridium; P, penis; PER, pericardium; PV, pulmonary vein; R, rectum; RM, retractor muscle; SP, spermatheca; U_1, adrenal ureter; U_2, adrectal ureter; VD, vas deferens.



Figs. 6-7. *Simpulopsis miersi* Pfeiffer. Fig. 6: Schematic reconstruction of phallus complex (scale: 15 mm is 1 mm vertical, 0.45 mm is 1 cm horizontal; numbers refer to transverse sections shown in plate 2); fig. 7: schematic reconstruction of the spermathecal duct (not to scale). SA, spermathecal appendix; SD, spermathecal duct; SP, spermatheca; T, tunica.

Type 2 differs from type 1 by having a cell height of ca. 20 μm. There are no subepithelial glandular cells. Type 2 is confined to the distal-lateral tube, while type 1 occurs in the main tube (cf. fig. 6).

Epiphallus. A low cylindrical epithelium (cell height 9 μm; provided with a brush-border?) lines the star-shaped lumen. Subepithelial glandular tissue is dispersed in the muscle layer, but still rather homogeneous. The cells of this glandular tissue are rather small and more or less rounded to elongate in shape. They are filled with secretion granules staining violet with Alcian Blue.

Flagellum. The lumen is more or less Y-shaped. The epithelium consists of shortly ciliated cylindrical cells (cell height 20 μm). The nucleus is situated in the basal part of the cells, while the distal part seems to be rather vacuolized.

Spermathecal duct. In the proximal part of this duct two different types of epithelium are found. The first type starts proximal to the junction with the oviduct. The cells are irregular in shape, varying from cubic (cell height 8 μm) to cylindrical (cell height 40 μm). The nuclei are situated in the distal part of the cells, which is somewhat unusual. The epithelium projects villiform in the elongate lumen. The second type is a highly cylindrical pseudostratified epithelium (cell height up to 45 μm) lining a more ovate lumen. These two types occur in parallel tubes (cf. fig. 7), which are connected with each other over the greatest part of their length.

The distal part of the spermathecal duct has a narrow duct lined with a highly ciliated, low cylindrical epithelium (cell height 14 μm).

Discussion

The radula of this species is rather aberrant in structure when compared with that of other *Simpulopsis* species (Breure & Ploeger, 1977). The transverse rows are more strongly V-shaped than in other species hitherto examined, which may be due to a different type of food. It is noteworthy that *Simpulopsis miersi* strongly resembles strictly arboreal bulimulid species, such as *Drymaeus, Sultana, Orthalicus, Amphibulima, Gaeotis* (Breure, 1974), etc. The shape of the teeth is also unlike that in other *Simpulopsis* species, whereas in all other aspects the anatomy (pallial organs, genitalia) of *S. miersi* is quite normal.

The histology of the genitalia can not be compared to that of other *Simpulopsis* species, as no other data exist. In general the structure shown by *Simpulopsis miersi* corresponds to that observed in other Bulimulidae, but the topography within the phallus complex is completely different and

unique for this species. It is now anticipated that future investigations of *Simpulopsis* species will reveal structures of the phallus complex closely resembling those described in this paper.

Acknowledgements

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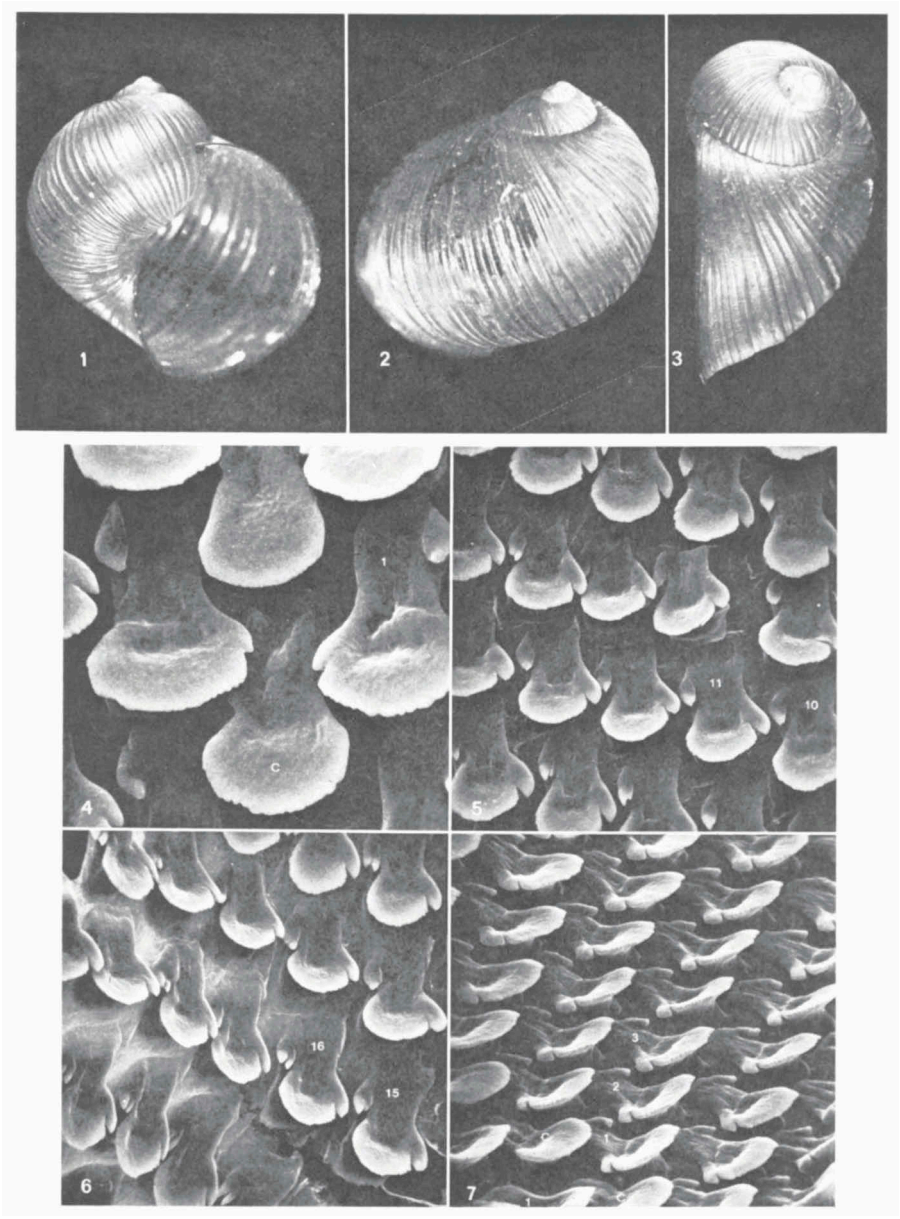
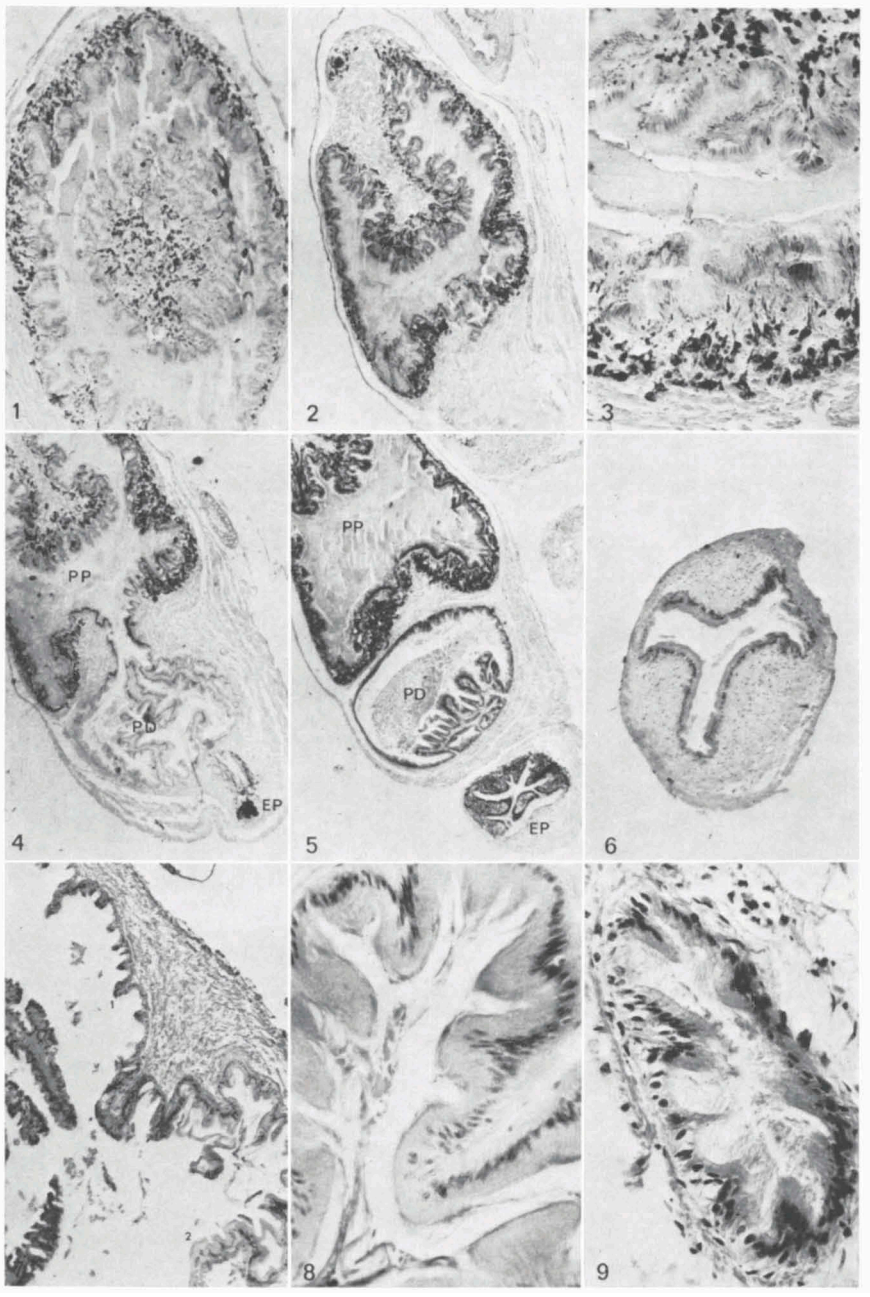


Simpulopsis miersi Pfeiffer. Figs. 1-3. Lectotype (BMNH 1975.489) × 2. Fig. 4. Central part of radula (RMNH; 875-32) × 550. Figs. 5-6. Lateromarginal teeth (RMNH; 875-34/35) × 225. Fig. 7. Side view of central part of the radula under 50 degrees (RMNH; 876-3) × 225.



Simpulopsis miersi Pfeiffer. Figs. 1-3. Proximal part of penis (Alcian Blue; slides H 847, 852, 847 respectively) × 85, 53, 264 respectively. Figs. 4-5. Proximal (PP) and distal part (PD) of penis and epiphallus (EP) (Haemalum-Eosin; slide H 854) both × 53. Fig. 6. Flagellum (Alcian Blue; slide H 857) × 127. Fig. 7. Proximal part of spermathecal duct, showing the two cell types (Alcian Blue; slide H 857) × 127. Fig. 8. Detail of cell type 2 in the proximal part of the spermathecal duct, also found in the spermathecal appendix (Haemalum-Eosin; slide H 859) × 528. Fig. 9. Distal part of spermathecal duct (Haemalum-Eosin; slide H 869) × 528.