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TWO NEW SPECIES OF THE AGLAJID GENUS **MELANOCHLAMYS**  
(GASTROPODA: OPISTHOBRANCHIA)

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RESUMO - São descritas duas espécies novas de opistobrânquios aglajídeos do gênero **Melanochlamys**. **M. papillata** é proveniente da Tailândia e **M. barryi** foi coletada apenas em "False Bay", África do Sul. Ambas as espécies diferem pronunciadamente de outras congêneras em detalhes da sua anatomia reprodutiva e na morfologia peniana. A disposição dos órgãos reprodutivos em **M. barryi** representa o modelo mais primitivo dentro do gênero e fornece dados adicionais para a pesquisa da filogenia da família Aglajidae.

ABSTRACT - Two new species of aglajid opisthobranchs of the genus **Melanochlamys** are described. **Melanochlamys papillata** is described from Thailand and **M. barryi** has been collected only from False Bay, South Africa. Both species differ markedly from other congeners in details of their reproductive anatomy and penial morphology. The arrangement of the reproductive organs in **M. barryi** represents the most primitive arrangement within the genus and provides additional data for the investigation of the phylogeny of the Aglajidae.

INTRODUCTION

The genus **Melanochlamys** has been recently reviewed (Rudman, 1972, 1974; Gosliner, 1980). Eight constituent species are recognized. Examination of specimens from the National Museum of Natural History, Washington, D.C. and the South African Museum, Cape Town yielded specimens of two undescribed species of **Melanochlamys**. This paper describes the anatomy of these taxa and compares them to previously described species.

As **Melanochlamys** represents the least derived genus within the Aglajidae (Rudman, 1974, 1978; Gosliner 1980; Gosliner & Ghiselin, 1984) an understanding of the range of morphological variability is fundamental to the study of the phylogeny of the family. Therefore, a detailed comparison of

members of the genus is required.

#### DESCRIPTIONS

#### *Melanochlamys papillata* sp. nov.

Figures 1-8

Type Material: Holotype, Division of Mollusks, National Museum of Natural History, Washington, D.C., USNM 859086, Hua Hin, Thailand, 12°33'N, 99°58'E, 21 February 1959, collected by George Moore from a fine sand on an exposed beach.

Paratypes: National Museum of Natural History, Washington, D.C. USNM 577355, 16 specimens, Hua Hin, Thailand, 21 February 1959, collected by George Moore

Paratypes: California Academy of Sciences, San Francisco, CASIZ 061415, 2 specimens, Hua Hin, Thailand, 21 February 1959, collected by George Moore.

Etymology: The epithet *papillata* refers to the numerous papillae covering the surface of the penis.

External Morphology: The preserved specimens (Fig. 1) reach a length of 9 mm. Their color is off-white with varying amounts of brownish pigment situated on the dorsal surface of the body. This pigment is concentrated in the posterior end of the head shield and the anterior end of the posterior shield. The head shield is elongate, half of the length of the body. Anteriorly it is rounded and narrow, widening gradually to its truncate posterior end. The posterior shield is elongate with short, rounded caudal lobes that are separated by a u-shaped notch. The parapodia are elongate and thin, extending for most of the body length. No eyes are visible externally. The sensory mounds (Fig. 2) are large and simply lobate. The gill (Fig. 3) is about 1 mm in length and simple plicate. The genital aperture is located near the posterior end of the parapodia on the right side of the body. The anus opens into the mantle cavity at the posterior end of the animal.

Shell: The shell (Fig. 4) is thickly and uniformly calcified, approximately 1.5 mm in height. It consists of about 1 1/2 whorls and has an expanded anterior lobe,

Digestive system (Fig. 5): The buccal mass is thick and highly muscular. Devoid of jaws or radula. It is approximately 1/4 of the total body length. Dorsal and ventral oral glands are present near the anterior limit of the buccal mass. At the posterior limit of the buccal mass are the short, paired salivary glands. Extending from the posterior end of the buccal mass is the oesophagus. After a short distance it expands into a thin-walled crop. The oesophagus narrows again posteriorly, passes through a thin-walled visceral diaphragm and enters the digestive gland. Within the digestive gland the oesophagus expands into the stomach and again narrows as the intestine. The intestine emerges from the digestive gland on

the right side of the body and terminates at the anus, within the mantle cavity.

Central nervous system (Fig. 6): The paired cerebral ganglia are separated by an elongate commissure. From their anterodorsal side the optic nerves connect with the dermal eyes. The buccal nerves extend posteriorly to the paired buccal ganglion, which are situated near the juncture of the oesophagus and buccal mass. The pedal ganglia are situated ventral to the cerebral ganglia and are connected to the cerebral and pedal ganglia. The pleural ganglia are located immediately posterior to the cerebral ganglia. Adjacent to the right pleural ganglion is the supraintestinal ganglion. Extending from the supraintestinal ganglion are the osphradial and right lateral nerves. The right lateral nerve extends posteriorly and expands into a distinct genital ganglion with its own genital nerve. The right lateral nerve narrows again and, after a short distance, expands into the visceral ganglion. The thick visceral nerve extends posteriorly from the posterior end of the visceral ganglion. Connected to the anterior surface of the visceral ganglion is the smaller subintestinal ganglion. Anteriorly, the left lateral nerve emerges from the subintestinal ganglion. Near the middle of its length, the left lateral nerve expands slightly into a parietal ganglion with a short parietal nerve. It again narrows and continues anteriorly to join the left pleural ganglion.

Reproductive system (Fig. 7): The ovotestis is partially embedded with the digestive gland. Emerging from the ovotestis is the muscular, convoluted ampulla. The ampulla narrows into the post ampullary hermaphroditic duct and winds around the albumen and membrane glands and branches to the glands ectally. The hermaphroditic duct continues ectally to the genital atrium. Here it joins the receptaculum seminis, the mucous gland and the duct of the bursa copulatrix. The mucous gland is elongate and curved, consisting of two elongate lobes. It forms the largest portion of the posterior reproductive organs. The receptaculum seminis is a large muscular sphere, which joins the genital atrium by means of a short stalk. The spherical, thin walled bursa copulatrix joins the atrium via an elongate duct. From the genital aperture the ciliated sperm groove extends anteriorly to the penial pore on the right side of the head.

The elongate penis (Fig. 8) extends to the posterior end of the anterior body cavity. The penial sac contains complex lobed penial papillae. There is a rounded paddle-shaped structure and a bifid basal papilla. Both of these portions of the penis are covered by numerous cuticular papillae. At the posterior end of the penial sac is the retractor muscle. The elongate convoluted prostate joins the penial sac adjacent to the retractor muscle. An elongate seminal vesicle is also present and joins the penial sac at the base of the bifid papilla.

Discussion of *Melanochlamys papillata*: The presence of a simply rounded head shield, short, blunt caudal lobes and a thickly and completely calcified shell suggests that this species should be placed in the genus *Melanochlamys*. The body of *M. papillata*, like that of *M. cylindrica*, is thin and elongate. The remainder of described species are squatter in shape.

Aspects of the reproductive anatomy also clearly distinguish *M. papillata* from all other species. Of the five species of *Melanochlamys* in which the reproductive system has been described, none have a penis with two distinct papillae. Similarly, the presence of numerous cuticular papillae of the surface of the penis is unique to *M. papillata*. *Melanochlamys papillata*, *M. diomedea* and *M. barryi* are the only members of the genus that have a seminal vesicle in addition to a prostate gland (Rudman, 1972; Gosliner, 1980; present study). *Melanochlamys diomedea* and *M. barryi* differ from *M. papillata* in that they have a single chitinous stylet at the tip of the simple penis.

#### *Melanochlamys barryi* sp. nov.

Figures 9-14

Type material: Holotype: South African Museum, Cape Town, SAM A 37245, False Bay. Cape Province, South Africa, 34° 09.5'S, 18°50.6'E, 7 m depth, collected by University of Cape Town, station FAL 743R, 16 February 1965.

Paratype: 1 specimen, SAM A 37246, False Bay, Cape Province, South Africa, 34°14.3'S, 16°29.7'E, 40 m depth, collected by University of Cape Town, station FAL 833G, 15 March 1965.

Etymology: This species is named for Dr Thomas H. Barry the late Director of the South African Museum, Cape Town.

External morphology: The smaller of the two specimens is the holotype (Fig. 9) which is about 8 mm in length. The paratype was approximately 12 mm in length, prior to dissection. The holotype is off-white with scattered brown maculations on the notum, parapodia and foot. The paratype lacks spotting, but this may be an artifact of preservation. The head shield is simply rounded anteriorly and of equal width throughout most of its length. Posteriorly, it is rounded, without a fleshy lobe. The posterior shield is widest anteriorly and gradually tapers. At the hind end, the shield terminates in a pair of short, rounded caudal lobes. The parapodia are short and thin, about two-thirds of the body length. No eyes are visible externally. The sensory mounds (Fig. 10) are simple bands of tissue, situated on either side of the mouth. The genital aperture is situated on the right side of the body, near the posterior limit of the parapodia.

**Shell:** The shell (Fig. 11) is thickly and uniformly calcified, consisting of 1 1/2 whorls. It is 2 mm in height and 3 mm wide.

**Digestive system (Fig. 10):** The arrangement of the digestive organs is essentially identical to that described for the preceding species. The bulbous, muscular buccal mass is thick and muscular, about 1/4 of the body length. Dorsal and ventral oral glands are present near the anterior end of the buccal mass. Inserting into the buccal mass near its junction with the oesophagus are the long salivary glands. The short oesophagus expands into a wide, thin-walled crop.

**Central nervous system:** The arrangement of the anterior ganglia of the central nervous system is essentially the same as in *M. papillata*. The posterior ganglia vary slightly however. In *M. barryi* (Fig. 12) the genital ganglion is much closer to the visceral ganglion than in the preceding species.

**Reproductive system (Fig. 13):** The ovotestis is partially embedded within the digestive gland. From the ovotestis a narrow preampullary duct widens into the convoluted ampulla. At the genital mass proper, the ampulla narrows into the postampullary hermaphroditic duct, which recurves prior to winding around the tubular albumen and membrane glands. The pyriform receptaculum seminis joins the hermaphroditic duct via a short duct, near the middle of the albumen and membrane glands. The hermaphroditic duct enters the albumen gland a short distance from the genital atrium. The mucous gland consists of a large curving lobe and a smaller lobe at the distal end. The thin walled bursa copulatrix joins the hermaphroditic duct and mucous gland at the genital atrium. From the atrium the ciliated sperm groove conducts endogenous sperm to the penial aperture on the right side of the head.

The penis (Fig. 14) occupies much of the anterior body cavity. The penial papilla is conical and slightly convoluted. At its apex is a chitinous stylet. The prostate is elongate and convoluted, entering the penial sac on the right side. A seminal vesicle is present near the penial retractor muscle, and enters the penial sac at the base of the papilla.

**Discussion of *Melanochlamys barryi*:** Three species of aglajid opisthobranchs have been recorded from southern Africa (Bergh, 1907; O'Donoghue, 1929; Macnae, 1962). All three of these species, *Philinopsis cyanea* (Martens, 1879), *P. capensis* (Bergh, 1907) and *P. dubia* (O'Donoghue, 1929) have a posterior lobe on the head shield and a shell with a tiny calcified base with an expanded conchiolin wing. On this basis they were regarded as members of the genus *Philinopsis* (Gosliner, 1980). The uniformly calcified shell, lack of a posterior lobe on the head shield and short, blunt caudal suggest that *M. barryi* is correctly placed in the genus *Melanochlamys*. The morphology of the penis closely resembles that

of *M. diomedea* (Bergh, 1903). However, the prostate of *M. barryi* is more elongate and highly convoluted. *Melanochlamys barryi* differs from *M. diomedea* and other members of the genus in several other significant regards. In *M. barryi* the receptaculum seminis enters the hermaphroditic duct near the middle of its length, while in all other species the receptaculum joins the hermaphroditic duct at the genital atrium (Rudman, 1972; Gosliner 1980). In the central nervous system of *M. barryi* there is a distinct genital ganglion as in *M. cy lindrica* and *M. papillata*. In *M. diomedea* the genital ganglion appears to have fused with the visceral ganglion (Gosliner 1980).

#### DISCUSSION

Gosliner (1980) and Gosliner and Ghiselin (1984) have discussed the primitive and derived features within the Aglajidae. *Melanochlamys* retains several primitive features, not found in other members of the family. These include a thickly and uniformly calcified shell, a simply rounded head without anterior or posterior lobes, a distinct diaphragm separating the anterior and posterior body cavities and short caudal lobes.

Aspects of the reproductive system have been important in distinguishing the genera of aglajids (Rudman, 1974, 1978; Gosliner 1980). *Philinopsis* and *Melanochlamys* retain a bilobed mucous gland (Gosliner, 1980). This is considered a primitive feature, since members of the closely allied Philinidae all have a bilobed mucous gland. All known members of the genera *Aglaja* and *Navanax* have the receptaculum seminis situated near the middle of the hermaphroditic duct (Gosliner, 1980). This is considered to be the ancestral configuration within the Aglajidae. In *Chelidonura* and *Odontaglaja* the receptaculum is situated more distally, near the genital aperture. In *Philinopsis*, all species except *P. depicta* have a single, distal receptaculum seminis. In *P. depicta* a proximal and a distal receptaculum seminis are present. This was suggested to represent a condition intermediate to the ancestral and derived configurations. All species of *Melanochlamys* were thought to possess only a distal receptaculum seminis. The presence of a single proximal receptaculum in *M. barryi* indicates that the ancestral and derived conditions are both present within species of the genus *Melanochlamys*. The fact that ancestral or intermediate and derived states are present in both *Melanochlamys* and *Philinopsis* suggests that a distal receptaculum seminis has evolved more than once within the Aglajidae. This is also the case in the closely allied Philinidae, where both ancestral and derived positions are present (present study). This represents yet another example of parallel evolution within the opisthobranch gastropods.

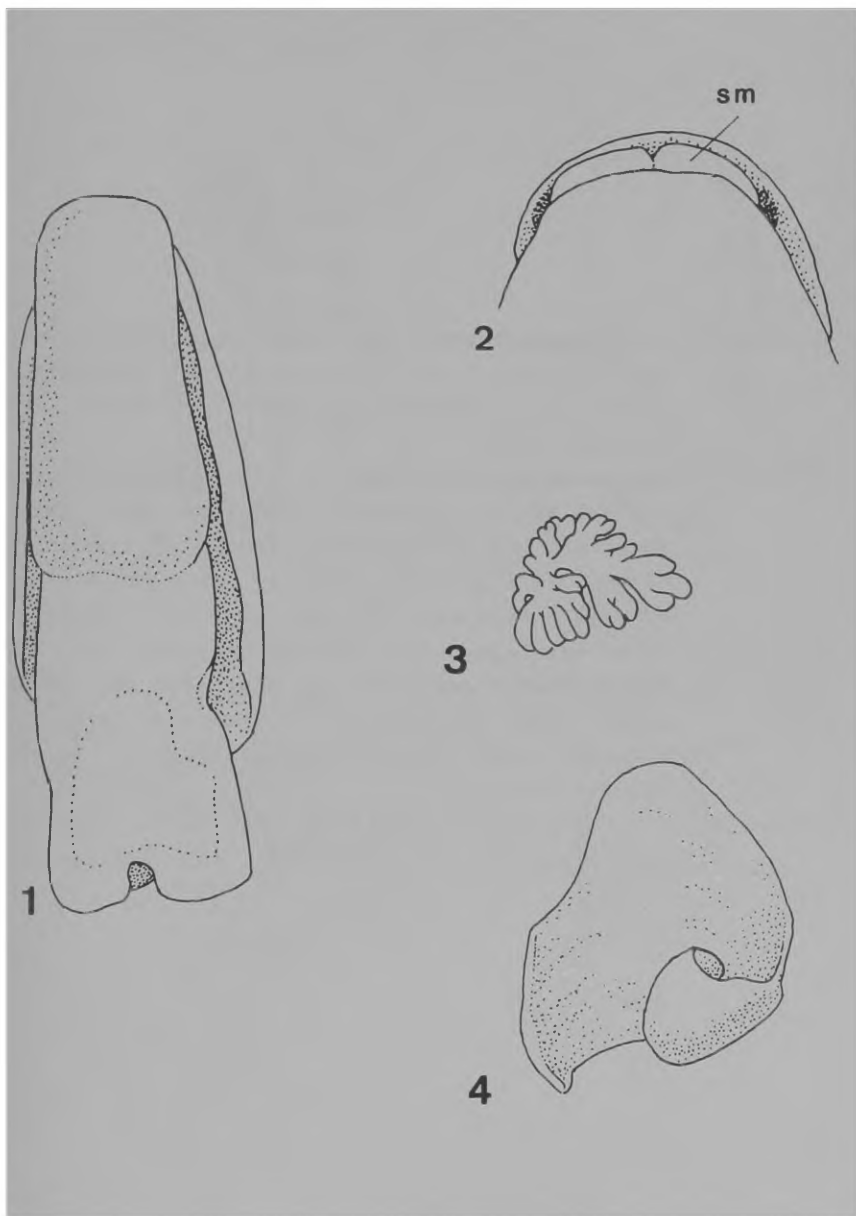
ACKNOWLEDGEMENTS - I thank Barbara Weitbrecht for preparing the final figures.

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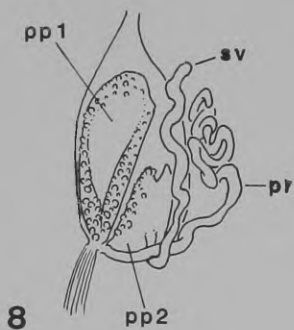
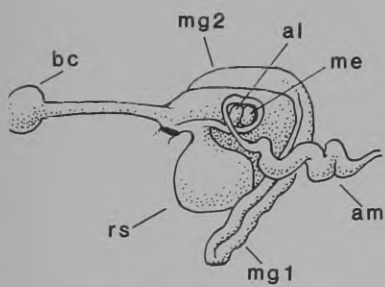
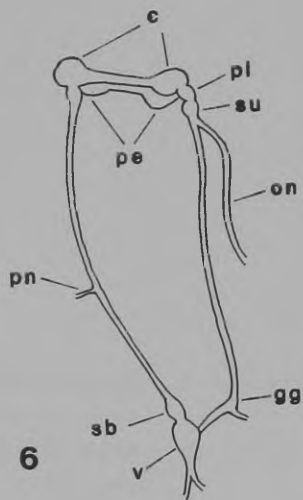
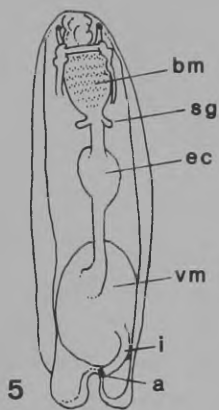
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- Figure 1 - **Melanochlamys papillata** sp. nov. Dorsal view of preserved specimen. 18X.
- Figure 2 - **Melanochlamys papillata** sp. nov. Ventral view of head. 35X. sm - sensory mound.
- Figure 3 - **Melanochlamys papillata** sp. nov. Gill. 40X.
- Figure 4 - **Melanochlamys papillata** sp. nov. Ventral view of shell. 30X.





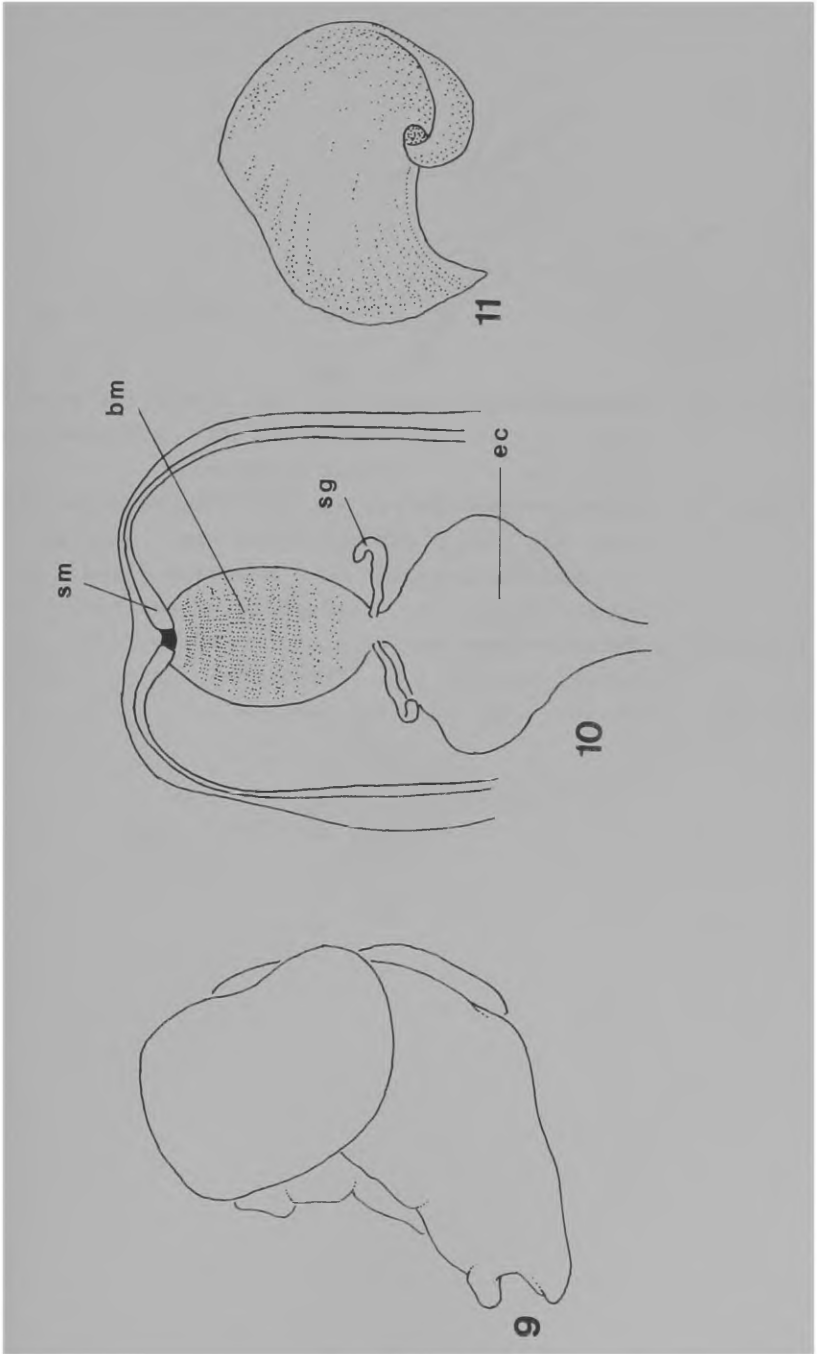
- Figure 5 - **Melanochlamys papillata** sp. nov. Digestive system. 12X. a - anus. bm - buccal mass. ec - oesophageal crop. i - intestine. sg - salivary gland. vm - visceral mass.
- Figure 6 - **Melanochlamys papillata** sp. nov. Central nervous system. 8X. c - cerebral ganglion. gg - genital ganglion. on - osphradial nerve. pe - pedal ganglion. pl - pleural ganglion. pn - parietal nerve. sb - subintestinal ganglion. su - supraintestinal ganglion. v - visceral ganglion.
- Figure 7 - **Melanochlamys papillata** sp. nov. 30X. al - albumen gland. am - ampulla. bc - bursa copulatrix. me - membrane gland. mg - mucous gland. rs - receptaculum seminis.
- Figure 8 - **Melanochlamys papillata** sp. nov. Penis. 18X. pp - penial papilla. pr - prostate. sv - seminal vesicle.



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- Figure 9 - **Melanochlamys barryi** sp. nov. Preserved holotype. 12.5X.
- Figure 10 - **Melanochlamys barryi** sp. nov. Digestive system. 15X. bm - buccal mass. ec - oesophageal crop. sg - salivary gland. sm - sensory mound.
- Figure 11 - **Melanochlamys barryi** sp. nov. Ventral view of shell. 18X.



- Figure 12 - **Melanochlamys barryi** sp. nov. Posterior ganglia. 40X. g - genital ganglion. sb - subintestinal ganglion. v - visceral ganglion.
- Figure 13 - **Melanochlamys barryi** sp. nov. Reproductive system. 30X. al - albumen gland. am - ampulla. bc - bursa copulatrix. me - membrane gland. mg - mucous gland. rs - receptaculum seminis.
- Figure 14 - **Melanochlamys barryi** sp. nov. Penis. 18X. pp - penial papilla. pr - prostate. ps - penial stylet. sv - seminal vesicle.

