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# PARASITES OF THE STOUT RAZOR CLAM *TAGELUS PLEBEIUS* (PSAMMOBIIDAE) FROM THE SOUTHWESTERN ATLANTIC OCEAN

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***ABSTRACT*** This work describes the parasites and their respective pathologies in the stout razor clam, *Tagelus plebeius* (Lightfoot, 1786) (Psammobiidae) from Argentinean coasts. It represents the first report about a histopathological survey for these species in the Southwestern Atlantic. Specimens of *T. plebeius* were collected at Mar Chiquita coastal lagoon (37°46′S, 57°27′W) ($n = 104$ dissected under stereomicroscope, $n = 28$ histologically sectioned and microscopically examined) and from the mouth of the Quequén Salado River (38°56′S, 60°33′W) ($n = 14$ dissected under stereomicroscope). *Tagelus plebeius* was found housing two ciliate species without apparent host reaction and acting as first intermediate host for two digenetic trematode species of the families Fellodistomidae and Gymnophallidae, by hosting sporocysts (mainly in gonad and digestive gland that results in the replacement of host tissues) and as second intermediate host by housing a gymnophallid metacercaria. Likewise, *T. plebeius* was found parasitized by a larval spirurinae nematode encapsulated by hemocytes. The finding of two ciliate species, the gymnophallid cercaria and metacercaria, and the larval nematode represents the first record for the host. The Southwestern Atlantic populations of this clam seem to be devoid of serious pathogens in the study area.

***KEY WORDS:*** *Tagelus plebeius*, pathology, parasites, southwestern Atlantic

## INTRODUCTION

The stout razor clam *Tagelus plebeius* (Psammobiidae) inhabits estuarine tidal flats along the American Atlantic coast from Cape Cod, Massachusetts (42°N, USA) (Leal 2002) to the north of Argentinean Patagonia (San Matías Gulf, 41°S) (Scarabino 1977). Despite its wide geographic distribution and its importance as dominant species in intertidal communities of some Southwestern Atlantic estuarine areas, to date a histopathological survey of this clam has not been undertaken. At present, only three parasites have been recorded: a protozoan of the genus *Perkinsus* (Dungan et al. 2002), a digenean larva at sporocyst stage containing trichocercous cercariae (Wardle 1983) and a cestode larva (Holland & Dean 1977). These reports are all from the Northern Hemisphere. Along the Argentinean coast, *T. plebeius* supports a small-scale artisanal fishery. Furthermore, histopathological surveys in commercially exploited bivalves are very scarce in Southwestern Atlantic coast (e.g., Cremonte & Figueras 2004, Cremonte et al. 2005).

The aim of this work is to report the parasites and the histopathologies that they evoke in the stout razor clam, *Tagelus plebeius*, from the Argentinean coast.

## MATERIAL AND METHODS

Specimens of *Tagelus plebeius* (Lightfoot, 1786) (Psammobiidae) ($n = 104$) were collected from May 1996 to July 1997 at the intertidal of Mar Chiquita coastal lagoon (37°46′S, 57°27′W), Argentina by excavating the sediment with a shovel. Specimens measured 11–62 mm in maximum shell length (mean = 39). In January 1997, an additional sample of 14 specimens was collected at the mouth of Quequén Salado River (38°56′S, 60°33′W) comprising specimens of 31–68 mm in maximum shell length (mean = 53). Clams were examined for parasites under a stereomicroscope immediately after collection or fixed in 10% formaline to be examined later. Digenean larvae were studied from whole acetocarmin stained worms. Nematodes found both free and recovered from their capsules, were stored in 70% ethanol, cleared in lactofenol or alcohol-glicerine and examined under a light microscope. Drawings were made with the aid of a camera lucida. All larval measurements are given in micrometers as mean values followed by the range within parentheses. Ten digenean metacercariae and five nematode larvae were dried using the critical point method, examined with a scanning electron microscope (SEM) (Jeol/SET 100II) and photographed. Prevalence (P) and mean intensity (MI) were calculated according to Bush et al. (1997). In June 2001, the soft parts of 28 clams from Mar Chiquita coastal lagoon, measuring from 26–67 mm of maximum shell length (mean = 55) were fixed in Davidson's solution (Shaw & Battle 1957) for 24 h and stored in 70% ethanol for histopathological survey. Tissue samples were embedded in Paraplast, and oblique transverse sections, approximately 5-mm thick, were taken from each specimen including mantle, gills, gonad, digestive gland, nephridia and foot. They were stained with haematoxylin and eosin. Histological sections were examined by light microscope under ×400 magnification for presence of parasites and pathological alterations.

To estimate the total number of metacercariae present, the cluster of larvae was detached, divided in four equal parts, the larvae present in one quarter counted and multiplied by four. The intensity of color and the calcareous alterations of the inner surface of shells were ranked in four categories as follows: 0 = no alteration, 1 = only dorsal area of shell slightly colored, 2 = dorsal area of shell heavily colored and extended to pallial sinus and 3 = almost the entire inner shell surface heavily colored with calcareous alterations present. The maximum shell length, the number of metacercariae and the intensity of shell alterations (using the 4 above referred categories) were correlated by a Spearman-rank test (Morales & Pino 1987).

Histological sections of parasitized clams were deposited at the Helminthological and Protozoological Collections, Museo de La

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Plata (MLP No. 5624, 5624/1, 5624/2 and MLP 023, 023/1, and 023/2), La Plata, Argentina; some valves of the examined clams were also deposited at the Malacological Collection, Museo de La Plata (MLP No. 5696).

## RESULTS

A total of six parasitic or commensal taxa were found in the clam samples examined; two of them were ciliate protozoans and the other four, metazoan parasites. Prevalences and mean intensities of infection found at both study sites are given in Table 1.

All measurements in this section will be assumed to indicate microns.

### *Ciliate sp. 1*

This protozoan was found in clams examined alive and from histological sections, mostly parasitizing the base of the gills in low intensities of infection (Table 1, Fig. 1 [2]).

### *Ciliate sp. 2*

This ciliate, which is similar to a *Trichodina* species, was also found in clams examined both alive and from histological sections parasitizing the gills in low intensities (Table 1).

### *Fellodistomid Cercaria sp.*

#### General Morphology

According to Cable (1956), a fellodistomid cercariae can be identified by the following characteristics: Distome, pharyngeate larva, tegument spinose or smooth, eyespots present or absent, stylet lacking, excretory vesicle thin-walled, and a long and slender trichocercous tail, developing in marine bivalves.

***Sporocyst*** [measurements based on 10 mounted specimens]

Elongated, thick-walled sac without constrictions, 2,520 (1,750–3,051) in length by 310 (260–370) in maximum wide, each containing 10–21 (mean: 14) trichocercous cercariae at different developmental stages (Fig. 1 [3, 4]).

***Cercaria*** [not released, measurements based on the 10 largest mounted specimens]

Body oval to pyrifom, 343 (328–362) long by 154 (123–175) wide. Tegument spinose. Oral sucker subterminal, 65 (58–71) long by 67 (62–73) wide. Forebody (distance from anterior end of body to anterior edge of ventral sucker) 127 (120–135). Ventral sucker 52 (47–56) long by 51 (46–54) wide. Sucker ratio (ventral sucker length/oral sucker length): 1: 0.80 (0.79–0.81). Prepharynx absent. Pharynx ovoid, 43 (39–52) long by 33 (31–37) wide. Esophagus 23 (17–30) long. Caeca bifurcating just anteriorly to ventral sucker, 151 (140–160) long by 18 (16–21) wide. Parenchyma full of cystogenous cells. Excretory vesicle V-shaped, arms reaching acetabular level; caudal excretory tubule conspicuous, opening at end of tail in two pores. Primordial testes opposite, located at the level of the caecal end. Tail 484 (452–520) long by 47 (43–51) wide, with about 25 finlet-like structures on each side with 15 (9–22) setae joined by a membrane (Fig. 1 [5]).

#### Site of Infection

Mainly in gonad, also in digestive gland.

#### Histopathology

Sporocysts were replacing host tissues (Fig. 1 [3]).

### *Gymnophallid cercaria sp.*

#### General Morphology

According to Bartoli (1974), a gymnophallid cercaria can be identified by the following characteristics: Distome, pharyngeate larva, tegument spinose, eyespots absent, stylet lacking, excretory vesicle thin-walled V or Y shaped, furcated tail, developing in marine bivalves.

***Sporocyst*** [measurements based on 10 mounted specimens]

Elongated, thin-walled sac without constrictions, 750 (470–1101) long by 250 (160–331) in maximum wide, each containing 50–55 (mean: 50) furcocercariae at different developmental stages (Fig. 1 [6a]).

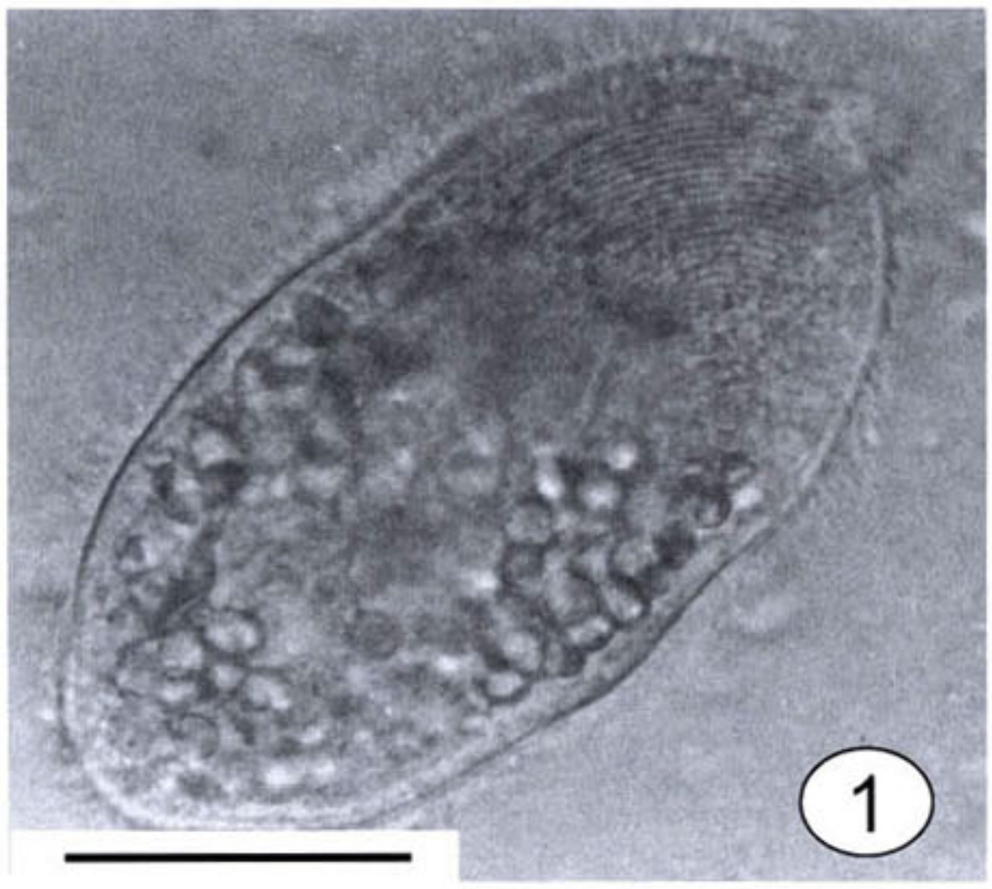
***Cercaria*** [not released, measurements based on the 10 largest mounted specimens]

Body minute, transversely spinose, 136 (126–151) long by 61 (52–67) wide at ventral sucker level. Oral sucker opening subterminally, 35 (30–41) long by 31 (29–36) wide. Ventral sucker located in hindbody, 25 (23–28) in diameter. Sucker ratio (ventral sucker length/oral sucker length): 1:1.4 (0.68–0.77). Pharynx ovoid, 20 (16–23) long by 15 (12–17) wide. Esophagus 15 (13–16) length. Caeca short, reaching acetabular level. Excretory vesicle V-shaped filled with excretory granules, arms reaching pharynx level, opening on the inner side of each furca end. Tail stem 45 (41–51) in length, furcae 55 (50–65) in length (Fig. 1 [6b]).

**TABLE 1.**

**Prevalence and mean intensities of parasites of the stout razor clam *Tagelus plebeius* from Argentina.**

| | Mar Chiquita Coastal Lagoon (n = 104) | | Mar Chiquita Coastal Lagoon (n = 28) | | Quequén Salado Mouth River (n = 14) | |
|---|---|---|---|---|---|---|
| Examination method | Dissection under stereomicroscope | | Microscoical examination of histological sections | | Dissection under stereomicroscope | |
| Prevalence (P) and mean intensity (MI) | P (%) | MI | P (%) | MI | P (%) | MI |
| Ciliate sp. 1 | Not quantified | | 25 | low | Not quantified | |
| Ciliate sp. 2 (*Trichodina* sp.) | Not quantified | | 0.35 | low | Not quantified | |
| Fellodistomid sporocysts | 0.96 | — | 0 | — | 0 | — |
| Gymnophallid sporocysts | 0.96 | — | 0 | — | 7.14 | — |
| Gymnophallid metacercariae | 100 | 662 | 54 | low | 100 | 546 |
| Spirurine larval nematodes | 35.58 | 3.38 | Not quantified | Not quantified | 21.43 | 1.33 |



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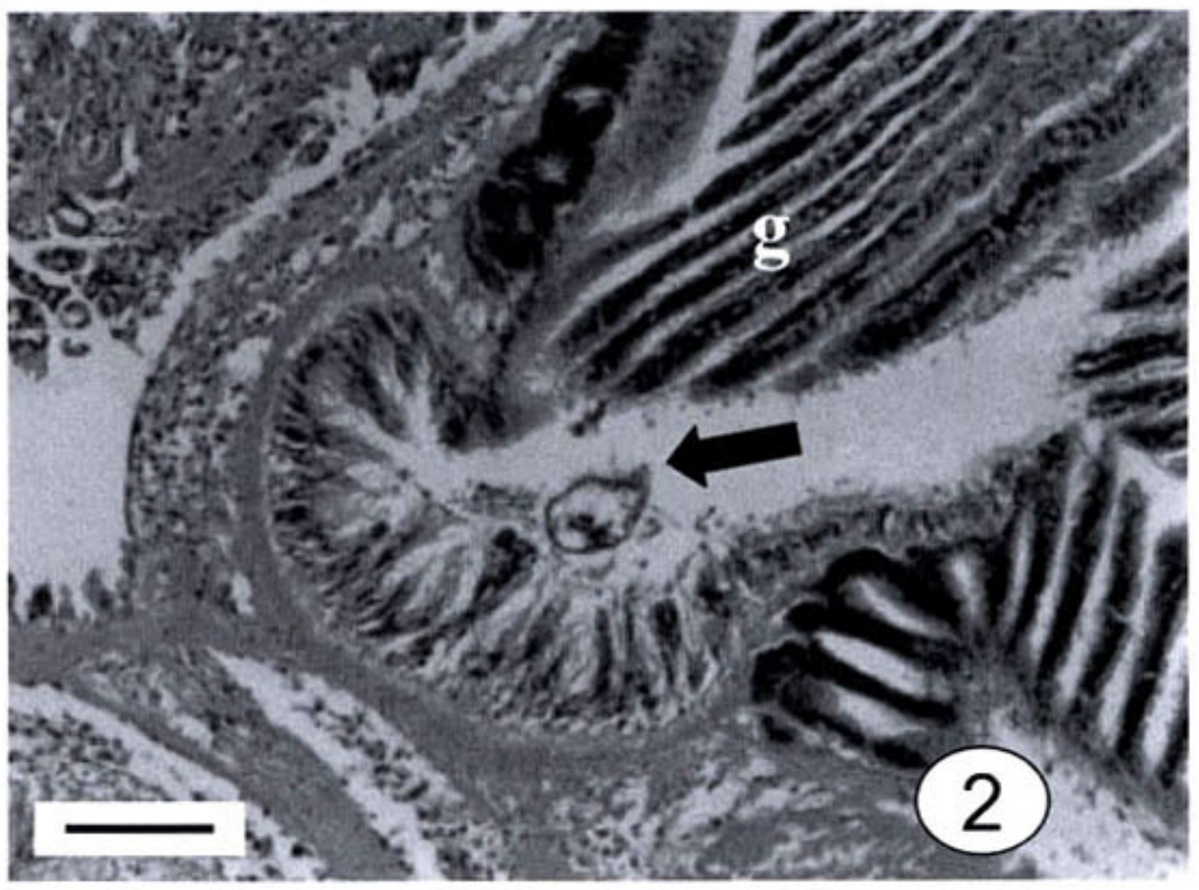


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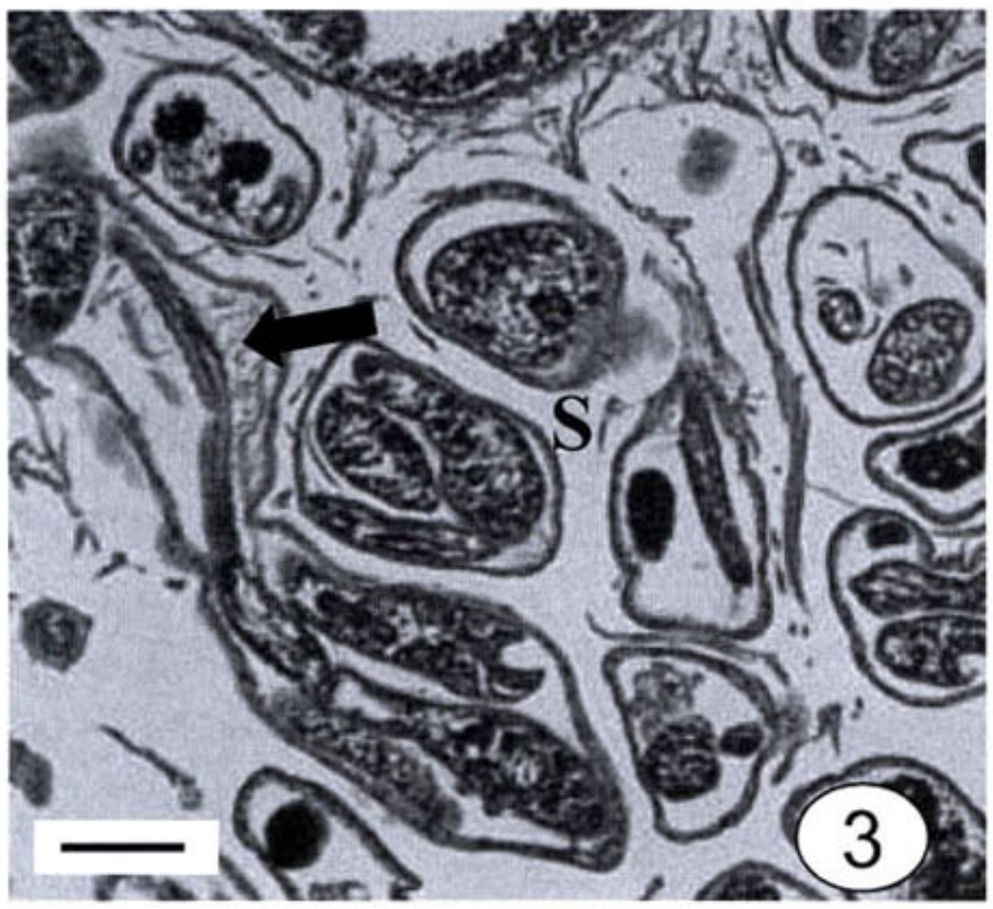


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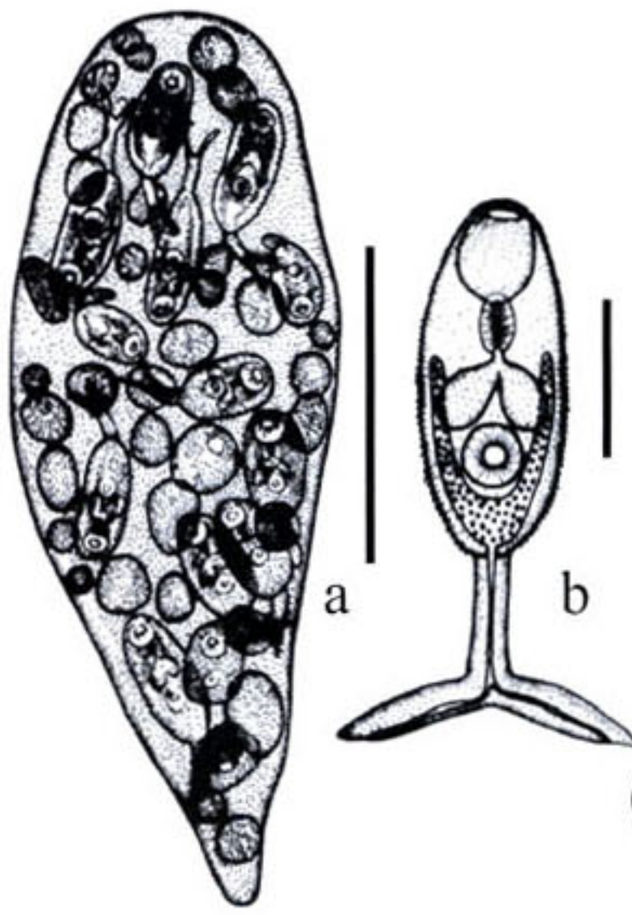


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**Figure 1. Parasites of *Tagelus plebeius* from Southwest Atlantic coast. 1. Live specimen of ciliate sp. from the gill, scale bar = 20 µm. 2. Histological section showing a ciliate at the base of gills, scale bar = 250 µm. References: g = gill. 3. Gonad replaced by the fellodistomid sporocysts, note the trichocercous tail of cercariae (arrow), scale bar = 600 µm. References: s = sporocyst. 4. Sporocyst of Fellodistomidae (Digenea), scale bar = 200 µm. 5a. Cercaria of Fellodistomidae, scale bare = 200 µm. b. Detail of a set of the trichocercous furcae, scale bar = 30 µm. 6a. Sporocyst of Gymnophallidae (Digenea), scale bar = 200 µm. 6b. Cercaria of the family Gymnophallidae, scale bar = 50 µm.**

**Site of Infection**

Mainly in gonad, also in digestive gland.

**Histopathology**

Sporocysts were replacing host tissues.

***Gymnophallid metacercaria sp.***

**General Morphology**

According to Bartoli (1974), a gymnophallid metacercariae can be identified by the following characteristics: small or minute worms, tegument spinose, oral sucker larger than ventral sucker with or without lateral projections, ventral sucker equatorial to postequatorial, excretory vesicle V or Y shaped, with long lateral arms extending to pharyngeal level and filled with excretory granules. Reproductive organs in an advanced stage of development (testes opposite to diagonal, ovary pre or post testicular).

***Metacercaria*** [measurements based on 10 largest mounted specimens]

Body small, oval to pyriform, 329 (284–374) long by 167 (110–230) wide at ventral sucker level. Body rounded when enveloped by host tissues. Spines arranged transversely over all body length. Oral sucker subterminal, 70 (46–90) long by 75 (27–90) wide, with two conspicuous lateral projections. Twelve papillae located around oral sucker opening. At least 5 pairs of cephalic glands opening dorsally to oral sucker. Ventral sucker post equatorial, 35 (30–41) in diameter, with 6 papillae. Sucker ratio (ventral sucker length/oral sucker length): 1:0.46 (0.50–0.65). Pharynx ovoid, 34 (29–38) long by 29 (23–41) wide. Esophagus 19 (10–40) in length. Caeca 84 (63–98) long by 54 (37–88) wide, reaching acetabular level. Testes ovoid to rounded, located postero-lateral to ventral sucker, symmetrically to obliquely disposed. Testis posterior to ovary, 49 (37–60) long by 41 (32–58) wide; testis opposite to ovary 46 (28–62) long by 42 (34–47) wide. Ovary rounded, pretesticular 30 (28–32) in diameter. Genital pore wide, oval, located somewhat apart and anteriorly to ventral sucker. Genital atrium oval and shallow. Vitellaria formed by two compact lobes, located at sides of ventral sucker. Excretory vesicle V-shaped, with diverticulated arms reaching oral sucker and filled with excretory granules (Fig. 2 [7–10]).

**Site of Infection**

Metacercariae lay forming a compact and easily detachable cluster (see Fig. 3 [13] later) just below the dorsal shell margin, immediately below hinge and above the rectum (Fig. 2 [11]). In heavy infections metacercariae were also found in the extrapallial space adjacent to the anterior end of the pallial sinus (Fig. 2 [11] Fig. 3 [13]).

**Histopathology**

Macroscopically, metacercariae appear crowded, forming an orange-colored cluster enveloped by host tissues (Fig. 3 [13]). In heavy infections, a brownish-orange pigmentation is also present on the inner shell surface at the sites where metacercariae are located (Fig. 3 [12]) (i.e., below hinge) and also along the pallial sinus. In histological sections, each metacercaria appear surrounded by a hyaline, non cellular envelope, which is formed by several concentric layers (Fig. 3 [14]). This envelope has a jelly-like appearance under the stereomicroscope (Fig. 3 [13]). Metacercariae and their envelope are surrounded, individually or in groups, by a sac formed by one-cell-thick cubic or somewhat flattened epithelium (Fig. 3 [14]), which results from the invagination of the outer mantle epithelium at the isthmus region. Cumuli of orange pigment were observed as amorphous aggregates, between the epithelial layer and the hyaline envelope of each metacercaria (Fig. 3 [14]). In some clams, abnormal calcifications in the form of loose calcium concretions or growth disruptions on the inner shell surface were present, which were from slightly to strongly colored (Fig. 3 [12]). Small calcareous concretions like pearls or amorphous calcium carbonate were also found within sacs, near dead metacercariae (Fig. 3 [12–14]).

**Relationship Between Shell Length, Shell Alteration and Intensity of Infection by Gymnophallid metacercariae**

Spearman-rank correlation test was statistically significant in all cases ($n = 104$; $P < 0.001$), rs = 0.85 obtained when plotting maximum shell length and intensity of infection by metacercariae; rs = 0.45 obtained when plotting maximum shell length and shell alteration; rs = 0.45 obtained when plotting intensity of infection by metacercariae and shell alteration.

***Sipirurina larval nematode***

**General Morphology**

According to Chaubaud (1975), a nematode with the following characteristics can be included into the Order Spirurida Chabaud, 1975, Suborder Spirurina Chabaud, 1974: anterior extremity bilaterally symmetrical, pseudolabia well developed, esophagus divided into an anterior muscular portion and a posterior, longer and glandular portion.

**Description** [measurements based on 20 specimens]

Stout small nematode with cuticle finely and transversely striated and pseudolabia well developed. The lateral groove starts in the anterior part and ends near fasmids. Two cephalic papillae are at each side, and amphids large with Deirids absent. Body unarmed, 1,238 (805–1,610) long by 47 (32–68) wide. Esophagus elongate, clavate, 278 (102–410) long; divided into anterior muscular part, 116 (88–149) long, and posterior glandular part, 177 (109–272) long. Nerve ring slightly anterior to the junction of both parts of esophagus, distant 106 (91–123) from anterior end. Excretory pore 185 (129–223) from anterior end. Genital primordia observed in some specimens as one cell located in the middle of body length. Three rectal cells (one dorsal and two ventral). Tail conical, 96 (81–120) long, ending in a sharp cuticular spike (Fig. 4 [15–19]).

**Site of Infection**

Muscular wall of visceral mass (48%), labial palps (28%), siphon retractor muscles (8%), adductor muscles (8%), radial muscles of the mantle border (4%), mantle (4%) (Fig. 5 [20–23]).

**Histopathology**

Larvae are found free or individually surrounded by a capsule. At the stereomicroscope, the capsule appears as a brownish spot that measures 1–3 mm in diameter; larva inside is alive and able to move. The degree of tissue reaction elicited by the presence of this parasite varies from no reaction to the formation of a thick capsule (Fig. 5 [20–23]). Histological sections show that the capsule is formed by a dense aggregation of hemocytes (Fig. 5 [22, 23]). In some cases, bundles of fibers of the muscle affected are seques-

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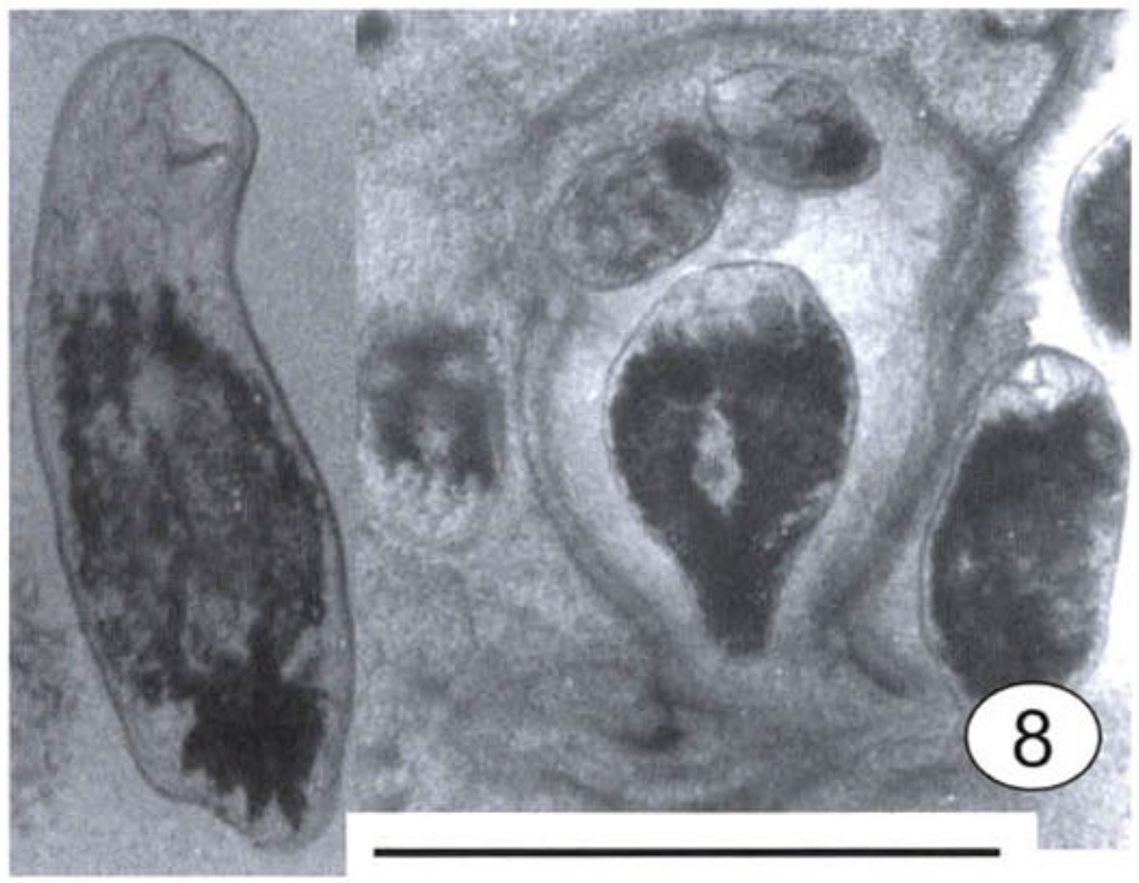

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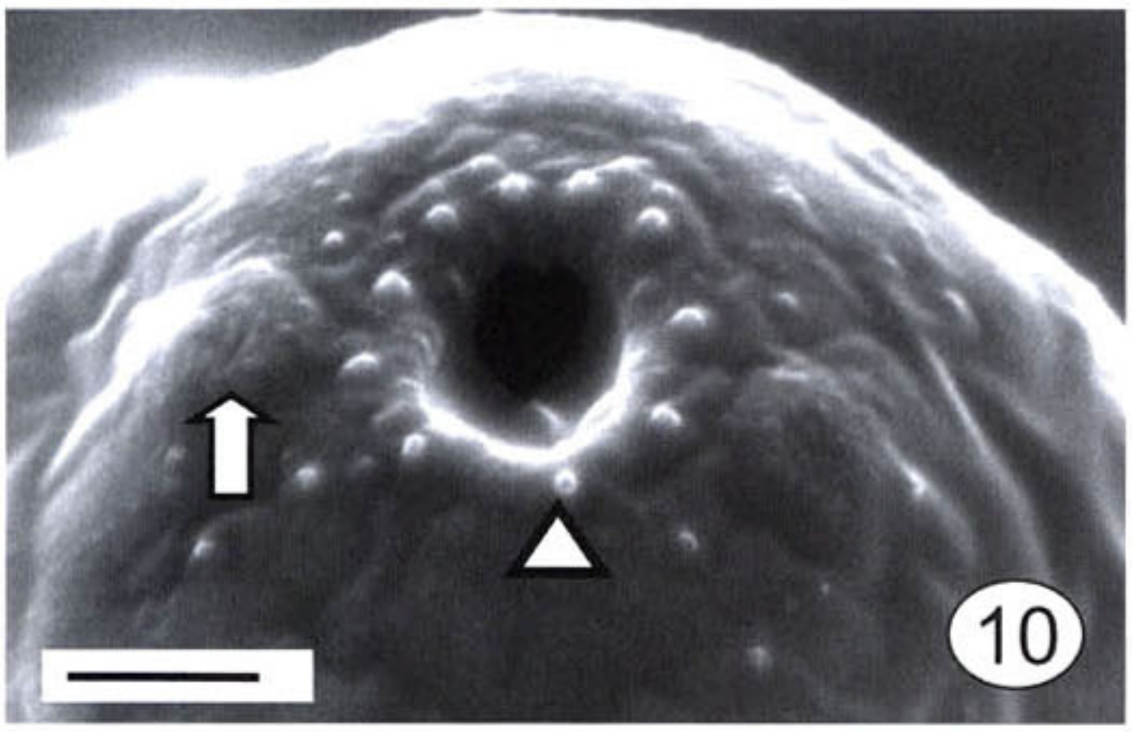

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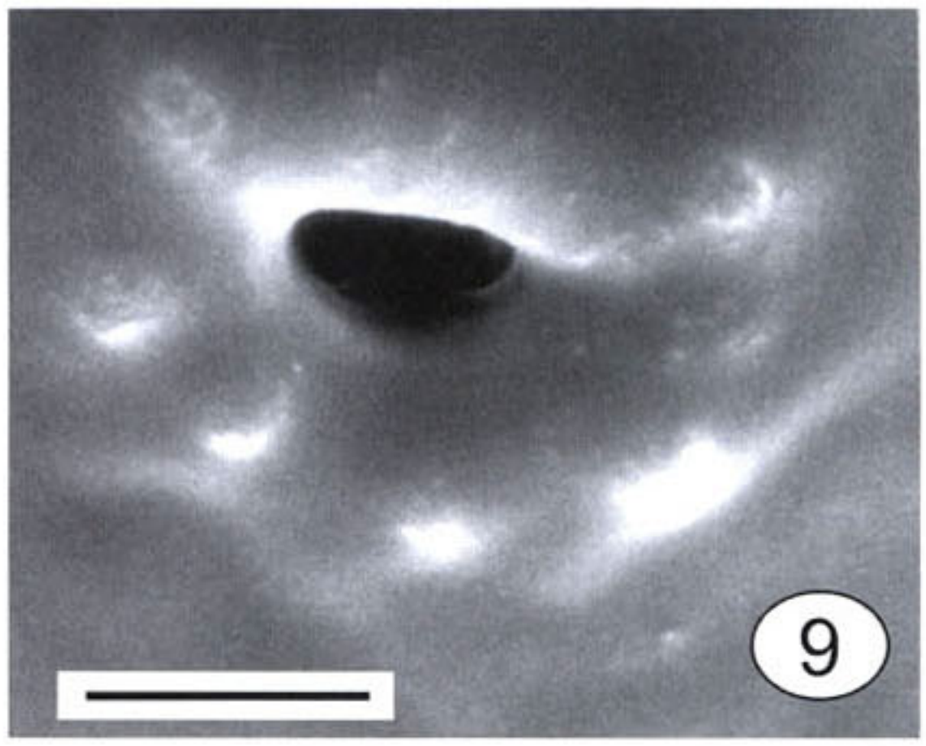

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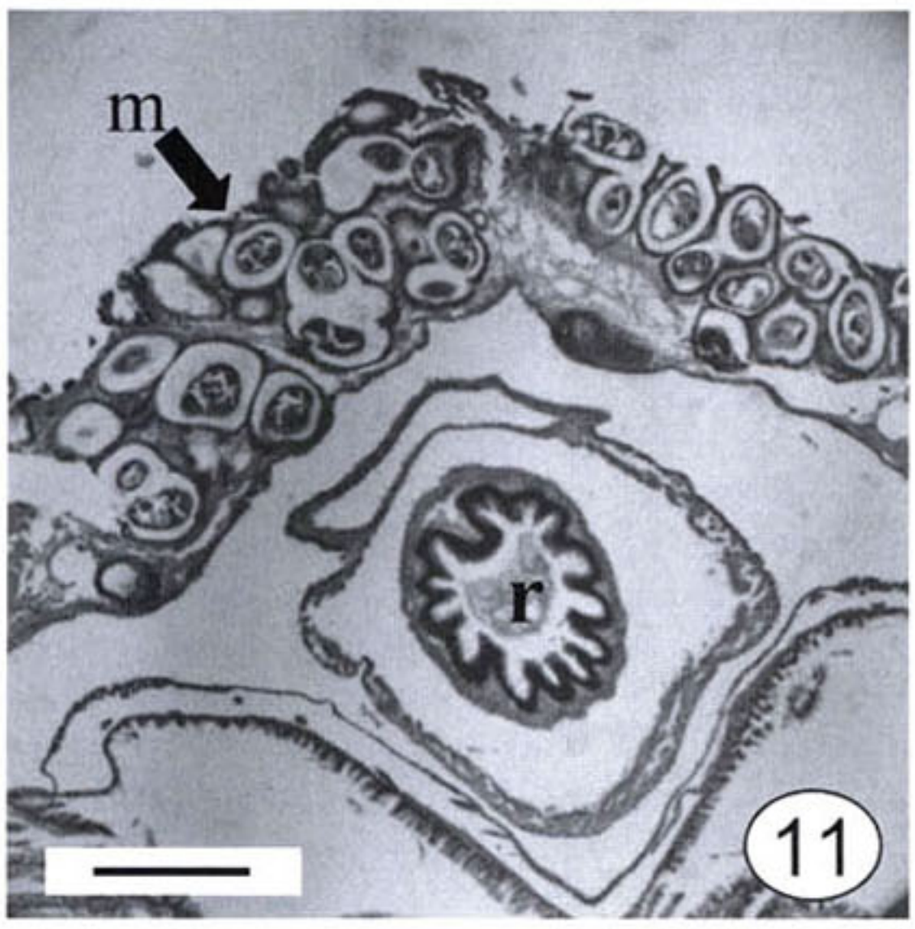


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**Figure 2. Parasites of *Tagelus plebeius* from Southwest Atlantic coast. 7. Metacercariae of Gymnophallidae, scale bar = 100 µm. 8. Live specimens of metacercaria of the family Gymnophallidae, scale bar = 300 µm. 9. Detail of oral sucker at SEM, note the two lateral projections slightly retracted (arrow) and papillae (arrow head), scale bar = 10 µm. 10. Detail of ventral sucker at SEM, note the six papillae, scale bar = 10 µm. 11. Histological section of dorsal part where gymnophallid metacercariae are located scale bar = 200 µm. References: m = metacercaria, r = rectum.**

tered to form part of the outer wall of the capsule (Fig. 5 [23]). In other cases, the reaction complex only causes the splitting of the adjacent muscle fibers; however, the later do not form part of the capsule.

## DISCUSSION

The present report is the first parasitological survey of the stout razor clam *Tagelus plebeius* from the Southwestern Atlantic

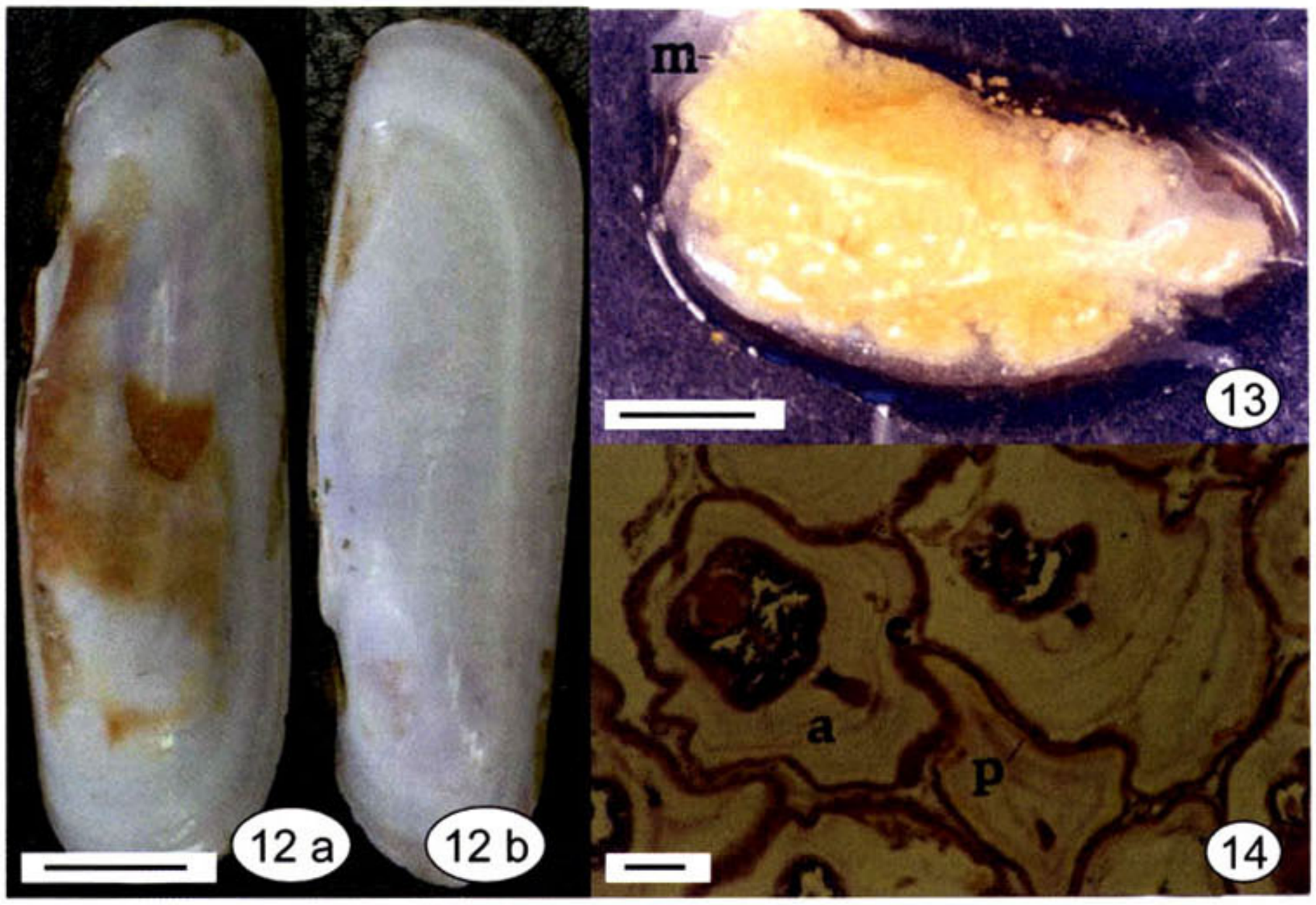



**Figure 3. Shell alterations in *Tagelus plebeius* caused by gymnophallid metacercariae. 12a. Left valve strongly colored in a specimen with high parasitic infection by gymnophallid metacercariae; 12b. Left valve slightly colored in a specimen with light parasitic infection of gymnophallid metacercaria, scale bar = 2 cm. 13. Metacercaria crowd removed from a bivalve specimen, scale bar 1000 µm. 14. Histological section of *Tagelus plebeius* showing the pigment accumulated inside the sacs, scale bar = 200 µm. References : m = metacercaria; a = noncellular matrix; p = orange pigment; e = epithelium.**

Ocean. The finding of two ciliate species, the gymnophallid cercaria and metacercaria, and the larval nematode represent first records for the host. The only digenean previously recorded in *T. plebeius* is a felloditomid cercaria (Wardle, 1983). The larval cestode (Holland & Dean 1977) and the protozoa species of *Perkinsus* (Dungan et al. 2002), all reported from the Northwestern Atlantic coast were not found in this study. From biogeography point of view, this result is in accordance with that hypothesized for many adult parasites: most parasite species have restricted, continental, geographical distributions, even though their hosts have wider, intercontinental, distributions (Carney & Dick 2000).

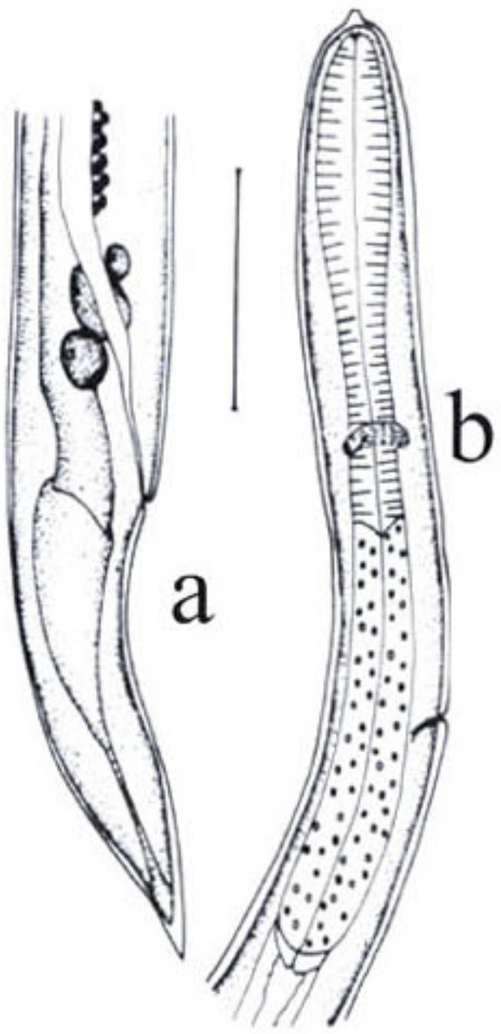
*Tagelus plebeius* was found acting as first intermediate host for two digenetic trematode species of the families Fellodistomidae and Gymnophallidae, hosting the sporocyst stage. Most trematode species parasitize gastropods. Only a few families infect bivalves, and as were found in this study, low prevalences were the rule (Lauckner 1983). In our study, sporocysts of both families were found replacing host tissues without host reaction. They do not become encapsulated when they are found in their natural intramolluscan habitats because both are well adapted with each other (Cheng & Rifkin 1970).

According to Bray (1988), nonoculate cercariae carrying long trichocercous tails without furcae, with fin-like setae joined by a membrane and spinose tegument belong to the subfamily Baccigerinae Yamaguti, 1958. Thus, the fellodistomid cercaria observed in the present study likely belongs to the subfamily Baccigeriinae. The life cycle of Baccigerinae involves a heterodont bivalve, which acts as first intermediate host, some representative of gelatinous plankton or a crustacean usually act as second intermediate hosts and fishes are the definitive host (Bray 1988).

As regard the finding of cercaria of the family Gymnophallidae, its identification below family or subfamily level is not possible because cercariae of different species in this family are almost indistinguishable (Lauckner 1983). Because most gymnophallid life cycles have a swimming cercaria that enter in a second intermediate host that is the same species as the first one, it seems probable that gymnophallid cercaria found belongs to the same species that the metacercaria hosted by *T. plebeius* (Cremonte 2004). It would be necessary to perform experimental infections to confirm this assumption and to obtain the adult form to identify it at genus and species level. High prevalences and intensities of gymnophallid metacercariae (Table 1) could be explained by the hydrodynamic of the studied environment. The quiet circulation of water masses facilitates the transmission of cercaria (Bartoli 1984). The oystercatcher, *Haematopus palliatus* (Aves: Haematopodidae) seems to be the definitive host, because it was reported to feed mainly on *T. plebeius* along this environment (Bachmann 1995).

The only gymnophallids reported from South American mollusks are *Lacunovermis* sp. from *Patinigera* spp. (Gastropoda: Patellidae) (Martorelli & Morriconi 1998), *Bartolius* sp. from *Gaimardia trapesina* (Bivalvia: Gaimardiidae) (Ituarte et al. 2001) (both from Magellan Strait and Beagle Channel) and *Bartolius pierrei* from *Darina solenoides* (Bivalvia: Mactridae) from Patagonian coast (Cremonte 2001).

Regarding the pathology caused by metacercariae of the family Gymnophallidae, it is variable and depends on the parasite and the host species involved (e.g., deposition of additional shell material in the form of calcareous concretions, blisters and crests, ridges, or igloo-like structures on the inner surface of the valves, pearls, shell erosions like pits, depletion of host body reserves, alterations of host behavior and general debilitation and morbidity) (Lauckner 1983, Ituarte et al. 2001, Cremonte & Ituarte 2003, Ituarte et al. 2005). In the present case, the host reaction observed in *T. plebeius* is very similar to that reported in *D. solenoides* infected by *B.*

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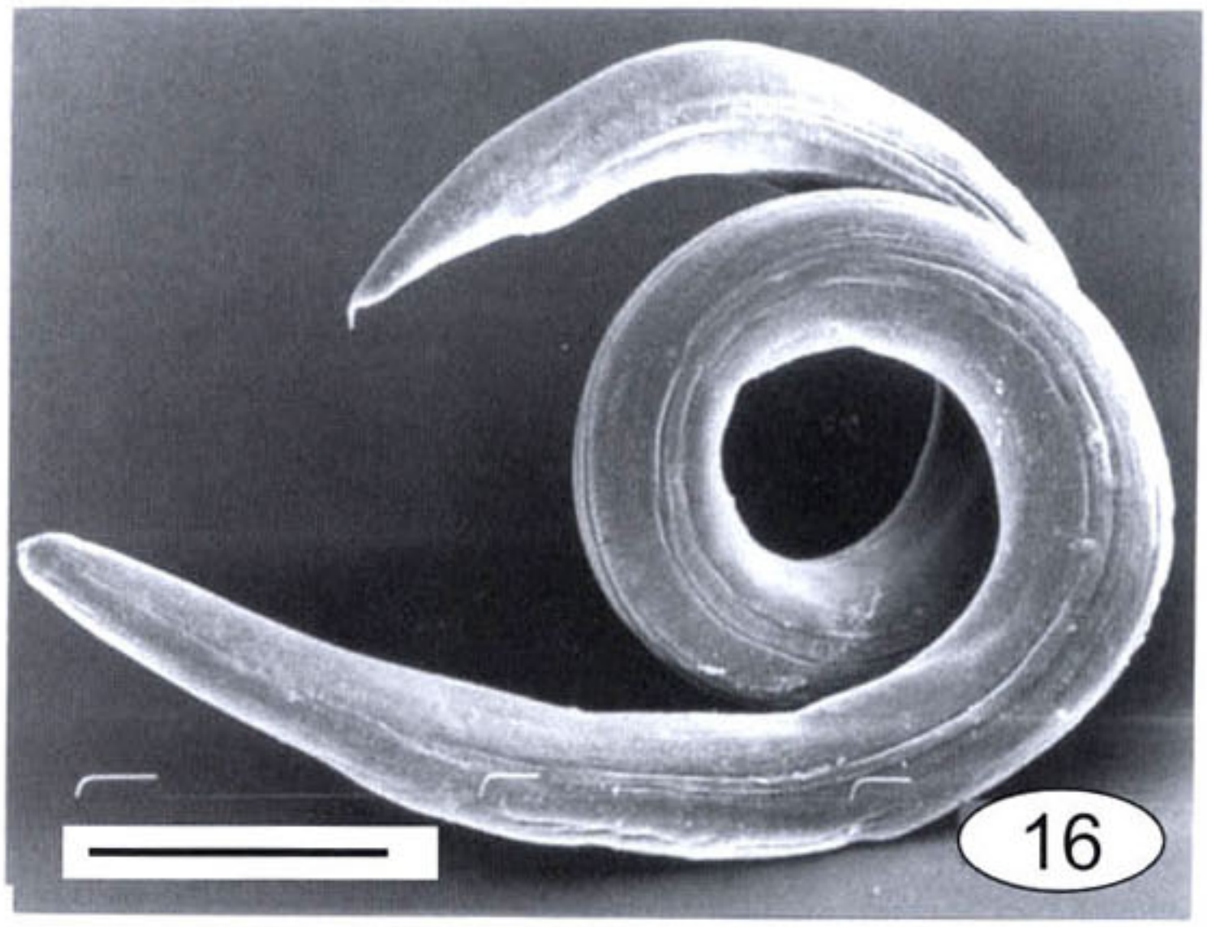

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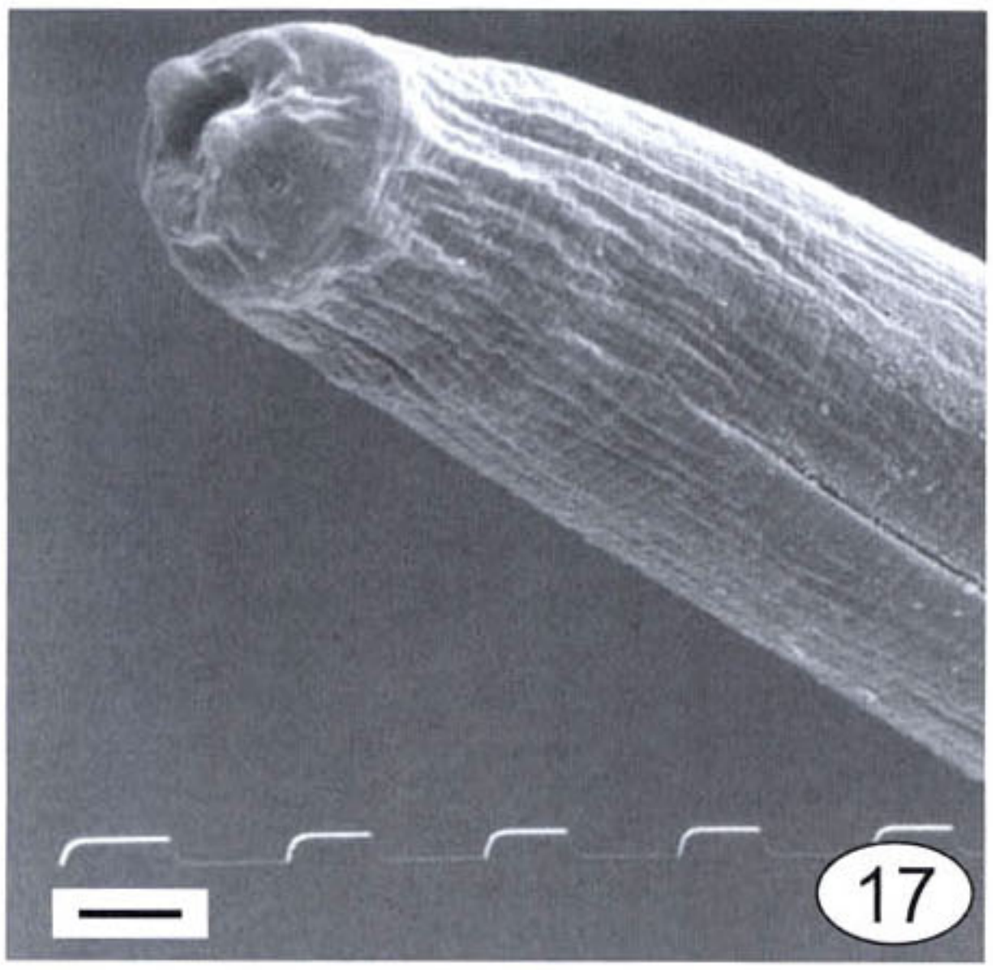

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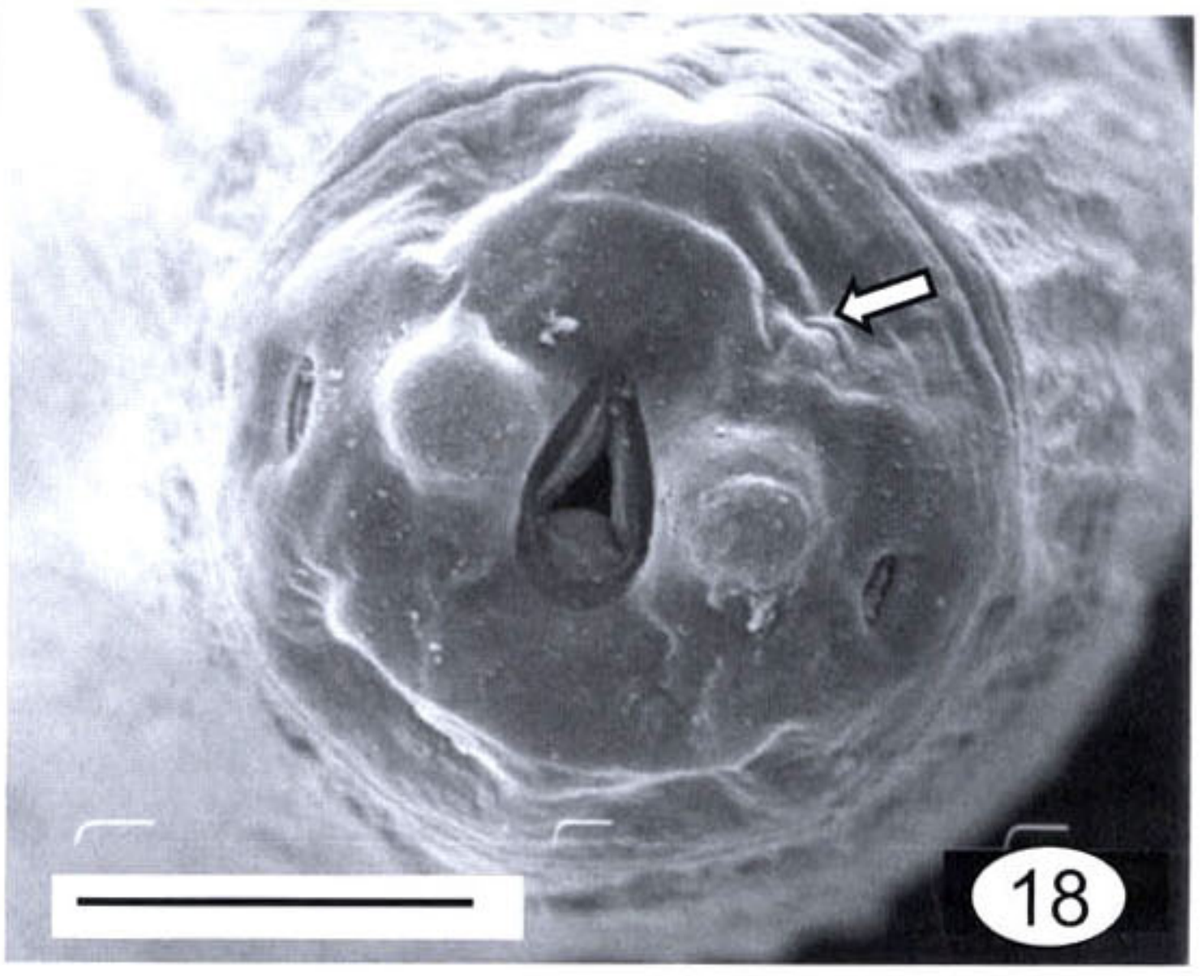

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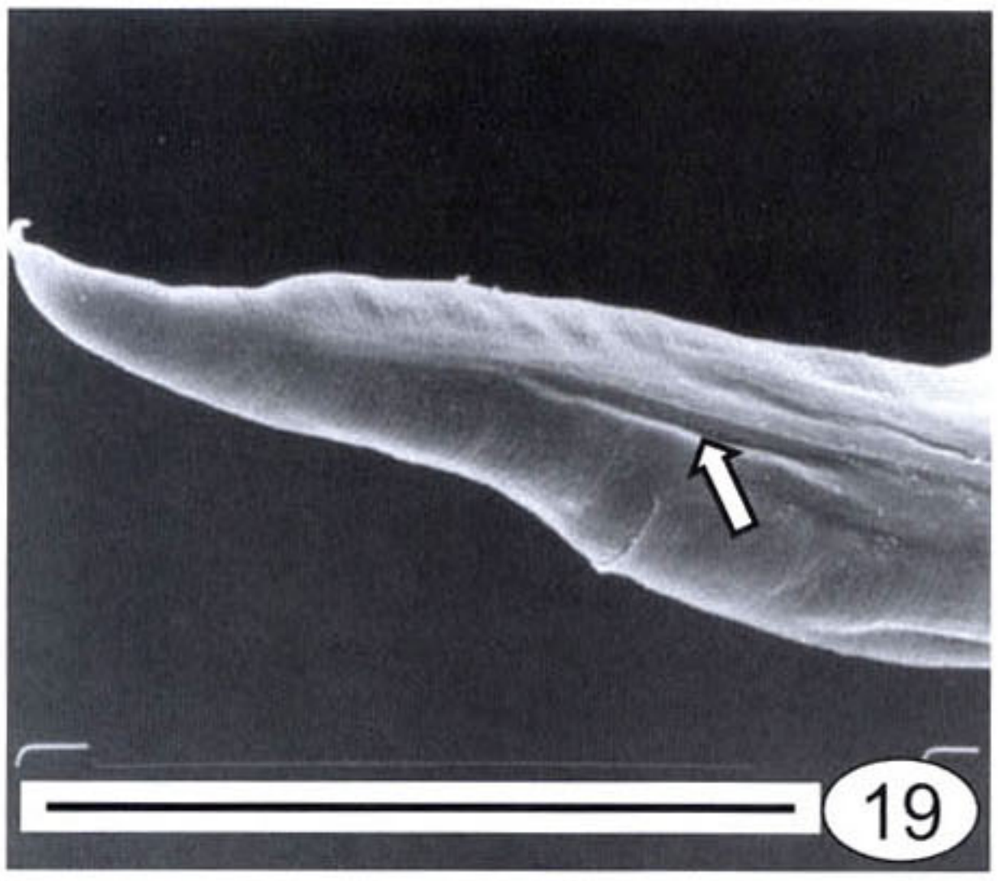

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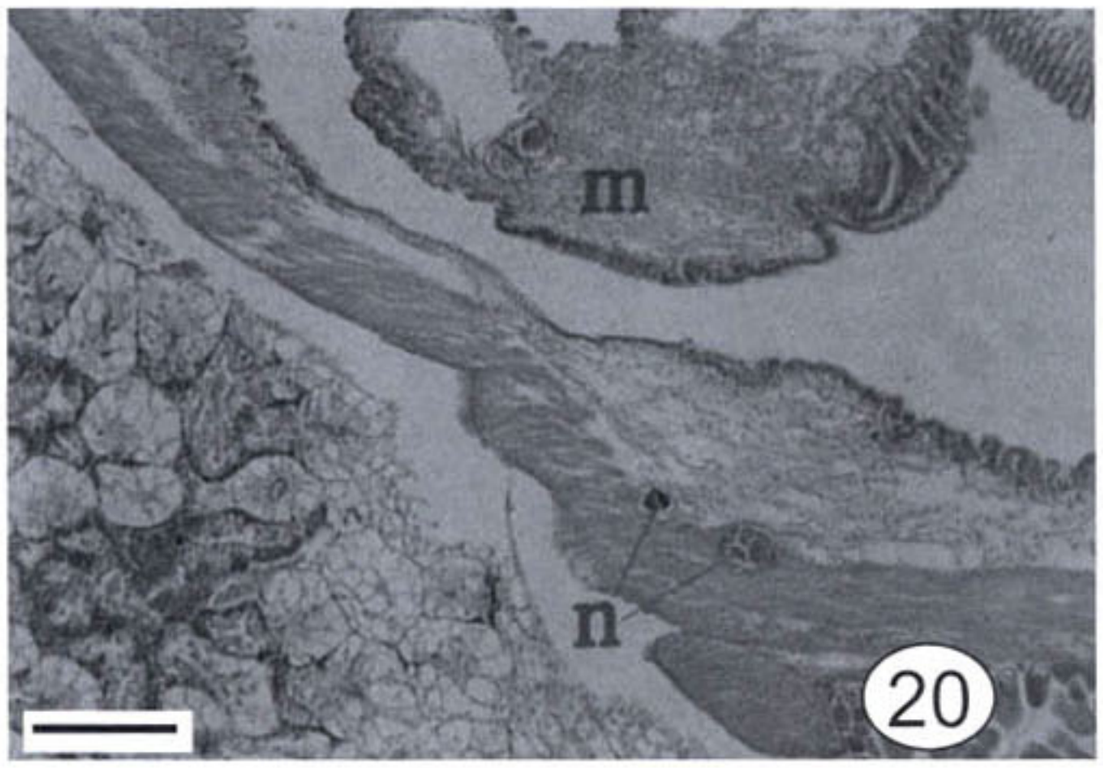
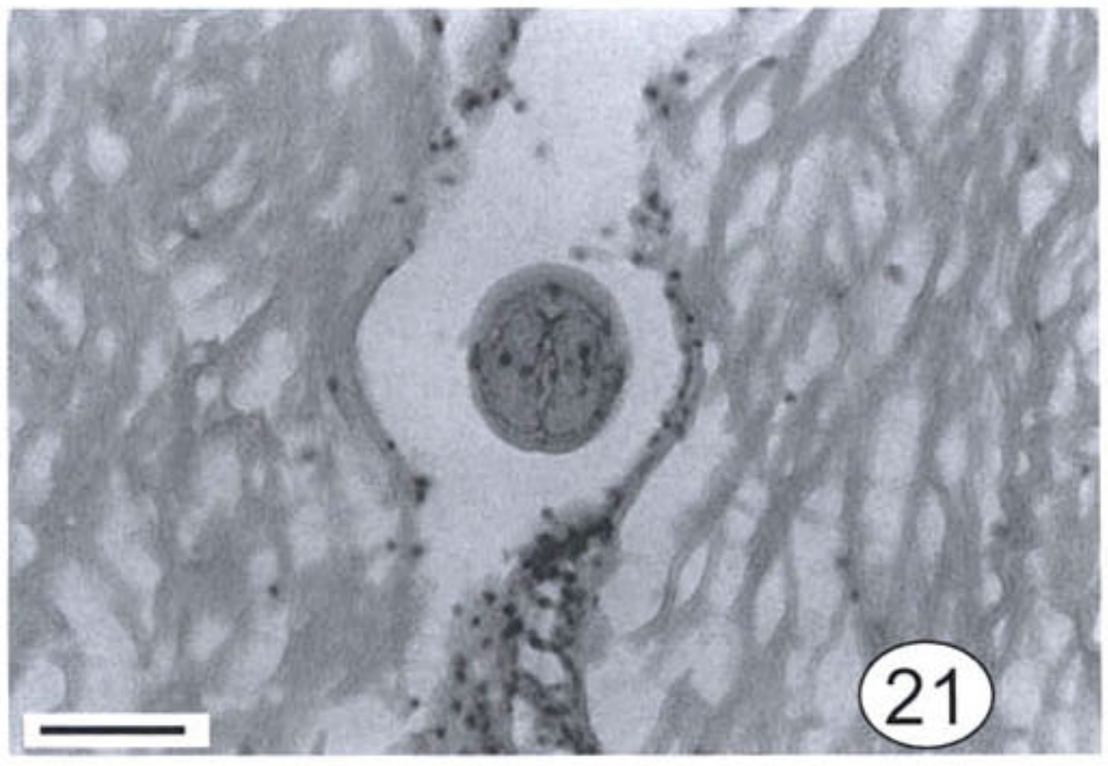
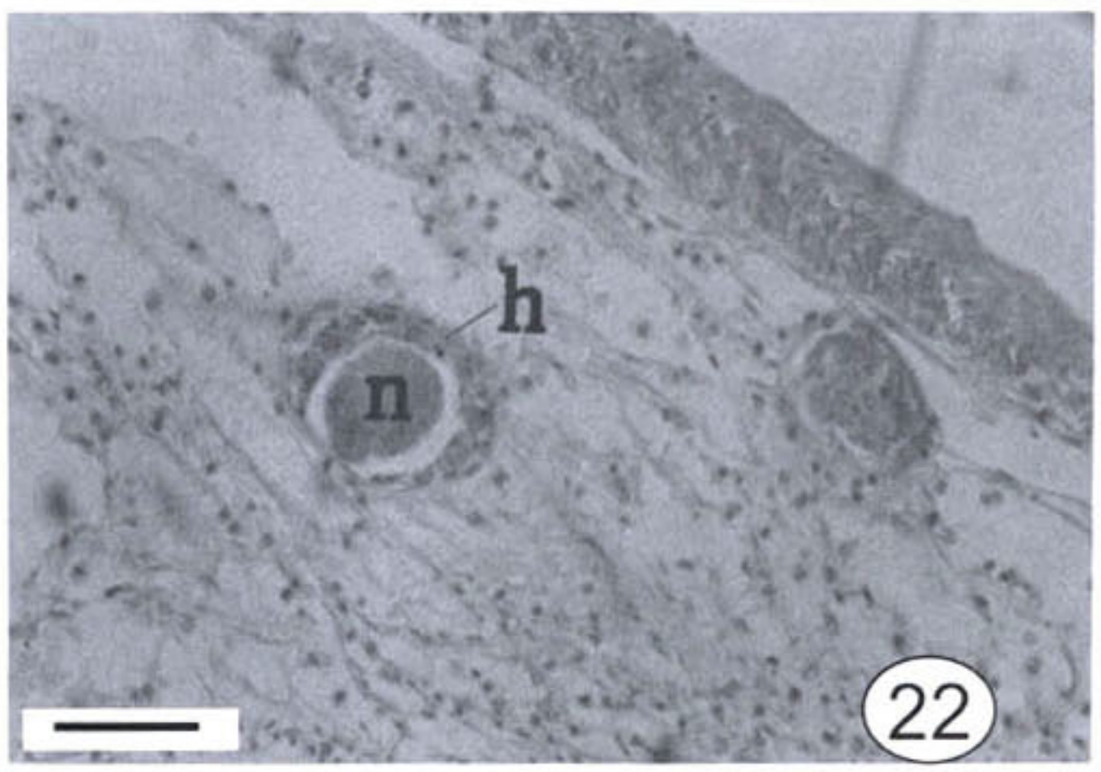
**Figure 4.** Larval nematode of the subfamily Spirurinae. 15a. posterior extremity; 15b. anterior extremity, scale bar = 50 µm (16–19). SEM photographs of the larval spirurine nematode in *Tagelus plebeius* from Argentina. 16. Whole coiled worm, scale bar = 100 µm. 17. Anterior part of the body, note the lateral groove and the absence of deirids, scale bar = 10 µm. 18. Apical view of the anterior end, showing pseudolabia, cephalic papillae (arrow) and amphids, scale bar = 10 µm. 19. Caudal end, note the terminal cuticular spike, anus and the end of the lateral groove (arrow), scale bar = 10 µm.



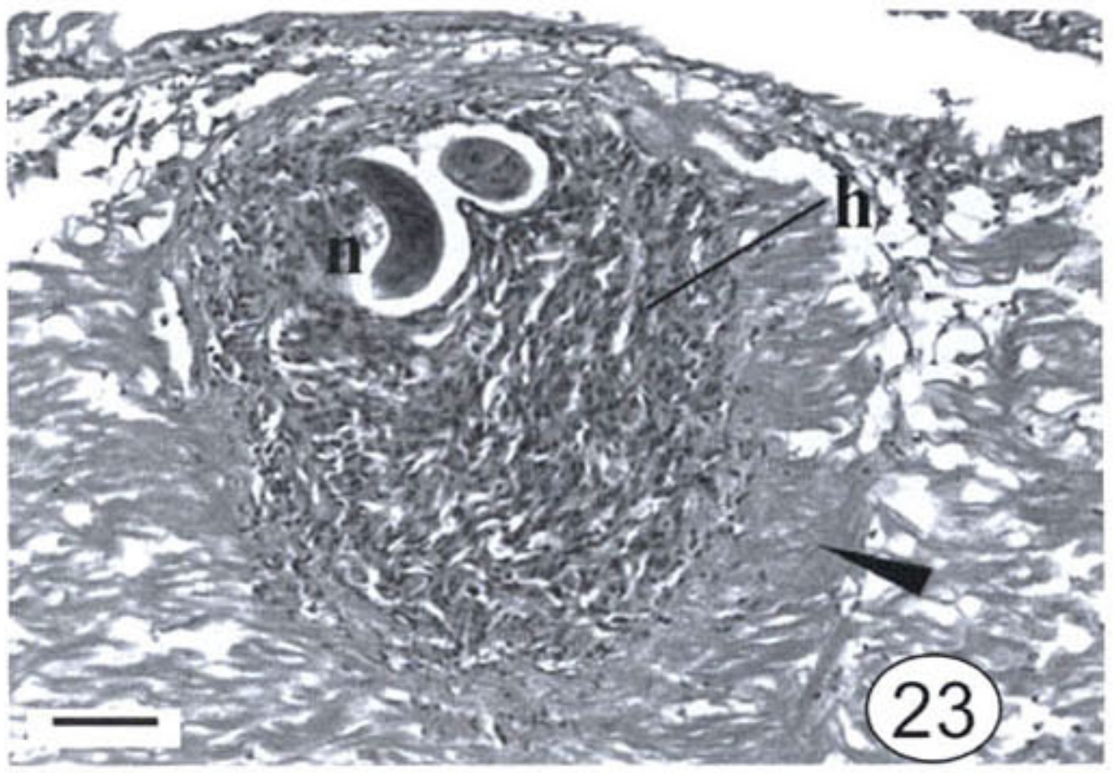




**Figure 5. Histological section of *Tagelus plebeius* parasitized with larval spirurine nematode from Argentina. 20. General view showing larval nematode transversally sectioned in connective tissue of mantle and muscle, scale bar = 200 µm. 21. Detail of larval nematode transversally sectioned at esophagus level showing muscle fibers divided, note hemocytes, scale bar = 50 µm. 22. Initial formation of capsule by hemocytes (h) in connective tissue of mantle, scale bar = 50 µm. 23. Advanced stage of a capsule formed by hemocytes in tegument musculature (arrow), scale bar = 100 µm. References: n = nematode; m = mantle; h = hemocytes.**

*pierrei* (Cremonte & Ituarte 2003). The main difference observed in *T. plebeius* is the presence of a brownish-orange colored pigment within sacs containing larvae, particularly in older bivalve hosts, in concordance with correlations among shell length, shell alteration and intensity of infection observed. A similar but yellowish conchiolin material was reported in *Tellina* spp. (Bivalvia: Tellinidae) by Giard (1897) and brownish material by Bartoli (1974) in *Tapes aureus* (Bivalvia: Veneridae) infected by gymnophallid metacercariae.

Metacercariae of Gymnophallidae are known to be able to prevent nacreazation around them, allowing most larvae to remain alive inside their envelope until reaching a suitable definitive host. This peculiarity of the gymnophallids encapsulation was discussed by Ituarte et al. (2001), Cremonte & Ituarte (2003) and Ituarte et al. (2005). However, in advanced stages of parasitism (i.e., in older infections) it seems that several metacercariae die, and just after this, the deposition of calcium to form blisters seems to be possible. In *T. plebeius*, calcium concretions in the form of blisters or loose pearls were only seen in older clam specimens, and seem to affect a reduced number of adult bivalves. Lomovasky et al. (2005) reported this phenomenon in only the 5.9% of the 620 specimens of *T. plebeius* studied.

Marine bivalves, as a group, are rather uncommon hosts for nematodes. However, ascaridoids and gnathostomids have been reported several times from representatives of commercially exploited bivalve species (Lauckner 1983). The nematode taxa more frequently reported from marine bivalves are *Sulcascaris sulcata* (Ascaridoidea: Anisakidae) and *Echinocephalus* spp. (Gnathostomoidea: Gnathostomidae); their adults occur in fishes, which prey on clams (Sindermann 1990). The nematode larva described in this study clearly does not correspond to an ascaridoid, because it has pseudolabia and an esophagus divided into glandular and muscular portions (Anderson et al. 1974). Moreover, the larva described here is not a gnathostomid because it has not trilobed pseudalabia and lacks the anterior extremity swollen into bulb (Anderson et al. 1974). Thus, the present record represents a new group of nematode using marine bivalves, *T. plebeius* in this case, as intermediate or paratenic hosts.

High values of prevalence and mean intensity of infection found in this study (Table 1) indicate these are not cases of an accidental infection. This represents the first record of a nematode larva parasitizing a bivalve in the Southwestern Atlantic Ocean. Because all nematodes found in marine bivalves are larvae, they are extremely difficult to identify (i.e., lack the diagnostic characters that are carried by the adult stage); thus, the importance of nematodes as parasites of this group have been sadly neglected

(Cheng 1978). The nematode larva described in this survey is not specific regarding its site of infection, being located mainly in muscles but also in other organs such as labial palps. Sites of infection of larval nematodes in other bivalves also showed to be highly variable: *Echinocephalus uncinatus* Molin, 1858 was found in the adductor muscle of pearl oyster *Margaritifera vulgaris*, *E. pseudouncinatus*, Millemann, 1951 in the foot of pink abalone *Haliotis corrugata* (Millemann 1963) and *E. crassostreai* Cheng 1975 in the gonoducts of Japanese oyster *Crassostrea gigas* with a reaction of the tunic elements that are surrounding the gonoduct (Cheng 1975).

The pathogenicity of larval nematodes in marine bivalves varies from nonreaction to a strong tissue response (Ko et al. 1975). Different degrees of host reaction observed in the present work would correspond to the time of infection. The capsule formed by a dense aggregation of hemocytes such as observed in *T. plebeius*, is known as hemocytosis according to Cheng & Rifkin (1970). Despite the large number of capsules studied, fibrous-appearing nodules as it was described by Harris (1975) for the case of *Angiostrongylus cantonensis* (Metastrongylidae) parasitizing a gastropod, were not observed. Harris (1975) noted some variability in the extent of response even within the same snail host. In that case, the granuloma loses the appearance of a loose aggregation of basophilic cells and becomes more fibrous and eosinophile, similar to the capsule reported for the cestode *Echineibotrium* sp. by Cheng (1978).

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