

Histopathology of the porcupine fish gill nematode, *Moravecia australiensis*

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Abstract

The leading edge of gill filaments of the porcupine fish *Tragulichthys jaculiferus* were heavily infected with larvae of the guyanemid nematode *Moravecia australiensis*. Host tissue reactions in the gill filaments were investigated by histological examination. The host tissue response toward the parasite included thinning and mild oedema of the gill epithelium, compression and narrowing of the efferent artery, disruption and loss of subepithelial connective tissue and decrease in number of mucous cells. The lack of marked or severe host reaction in infected filaments suggests a high degree of adaptation of parasite to its host.

To date, only two parasitic nematodes have been reported from fish gills: *Philometra obturans* in the northern pike (*Esox lucius*) (Moravec & Dykova, 1978) and the guyanemid, *Histodytes microocellatus*, in the European elasmobranch (*Raja microocellata*) (Aragort et al., 2002). In Finland, *P. obturans* was found to cause obstruction of gill arteries, stretching of the arterial wall around intact worms and caused hypertrophy of the arterial wall around disintegrating remains of the worm (Kall et al., 2004). Aragort et al. (2002) reported that *H. microocellatus* caused significant inflammatory response in affected tissue and induced haemorrhage and significant host tissue damage. During the current study, larvae and adults of the guyanemid, *Moravecia australiensis* (Dracunculoidea: Nematoda), were found in the gill filaments of the porcupine fish, *Tragulichthys jaculiferus* in Australia, between the gill epithelium and efferent artery. The length of the larvae ranged from 0.75 to 3.0mm, the males reached 5.5mm in length and the longest non-gravid female was 8.1mm (Ribu & Lester, 2004).

Materials and methods

Infected and uninfected gill filaments dissected from the fish host collected at various locations between 1996 -2001 were fixed in 10% formalin, dehydrated in ethanol, embedded in paraffin, sectioned at 6µm and stained with haematoxylin and eosin (H&E). The filaments were sectioned longitudinally and transversely to enable relative thickness of epithelium to be assessed.

Results and discussion

Gill filaments containing adults were always

located near the middle of the gill arch with the adjacent filaments containing larvae only. The shorter filaments on both ends of the arch were always negative for both adults and larvae. In heavy infections, the entire length of the filament was occupied with larvae, which appeared to move freely from one end of the filament to the other. However, when stimulated by the tip of the dissecting needle, they would start to coil, get entangled and clumped (Figure 1). When the number of larvae infecting the gill filament was less than 10, they tend to occupy just a portion of

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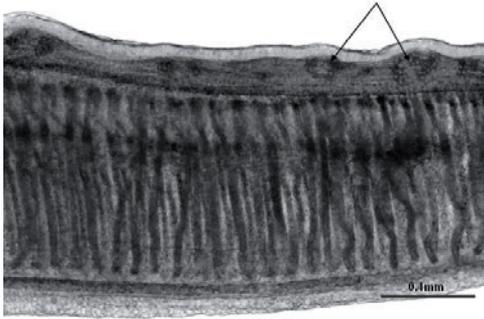


Figure 1. Gill filament of *T. jaculiferus* with coiled larvae of *M. australiensis* (arrows), whole mount.

the filament. The adults were fully extended in the gill filament almost filling its entire length. When stimulated they moved forward or reversed, bending part of their body but no coiling was observed.

Figure 2 shows transverse sections of an uninfected gill filament. It is covered by a stratified epithelium (GE), 7-9 cells thick, which is well endowed with mucous cells (MU). It rests on a basement membrane (BM) that separates it from the underlying support stroma made up of somewhat loose connective tissue (CT) containing irregularly shaped cells, the macrophages. The secondary lamellae (SL) are a thin layer of epithelial cells supported by pillar cells. The afferent artery (AA) is located adjacent to the lamellar cartilage (LC).

The gross appearance of a gill filament was normal when infected with a few larvae and slightly swollen or oedematous when heavily infected. Marked oedema of the filament was observed from its gross appearance. As a result of oedema the basement membrane separated from the epithelium and the underlying tissue. The presence of the larvae caused disruption of the subepithelial connective tissue creating

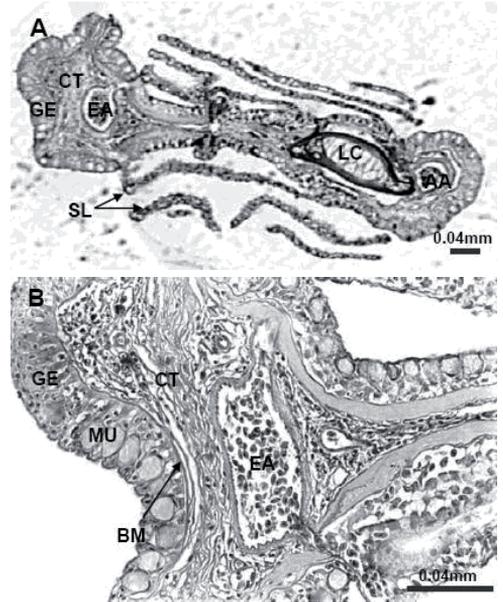


Figure 2. Transverse sections of an uninfected *T. jaculiferus* gill filament. A- Low magnification. B- High magnification. AA, afferent artery; EA, efferent artery; BM, basement membrane; CT, connective tissue; GE, gill epithelium; LC, lamellar cartilage; MU, mucous cell; SL, secondary lamellae. (H&E).



Figure 3. Longitudinal section of gill filament infected with larvae showing oedema (arrow) and compression and narrowing of the efferent artery, EA. (H&E).

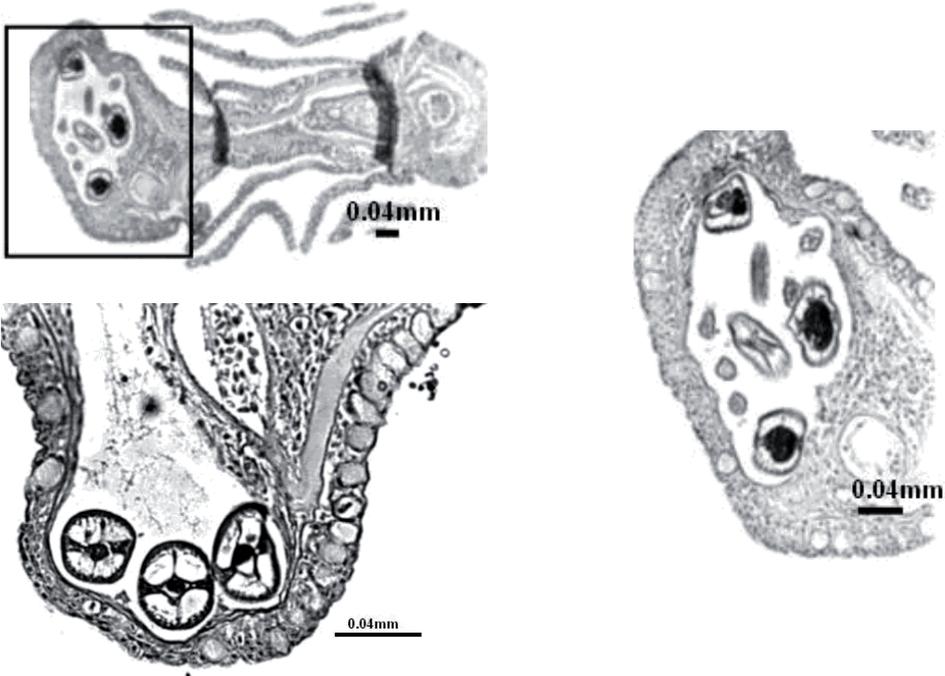


Figure 4. Transverse sections of gill filaments infected with adult *M. australiensis* showing attenuation of epithelium, disruption and loss of subepithelial connective tissue and decrease in number and size of mucous cells. Low and higher magnifications. (H&E).

spaces around the worms without a significant accompanying inflammatory response. A few histological changes in the gill filament became apparent when heavily infected with larvae or when the worms reached adult size. The gill spaces surrounding the parasites expanded resulting in compression and narrowing of the efferent artery (Figure 3). Compression also resulted in a marked disruption of the subepithelial connective tissue and its gradual loss in some areas, and the attenuation or thinning of the overlying epithelium (Figure 4). The resulting thin epithelium had fewer mucous cells and contained about 4-5 layers of epithelial cells compared to 7-9 layers in the uninfected gill filament.

In the gill filaments of *T. jaculiferus*, large numbers of larvae and a few adults stimulated little host cellular response. There was oedema of the loose connective tissue and the epithelium. Oedema, manifested by the lifting of the outer epithelial cells, is a typical inflammatory reaction (Mitrovic et al., 1968) caused by the swelling of the lymphatic space between the vascular bed and the gill epithelium (Christie and Battle, 1963). The absence of dead worms and lack of marked host reaction in infected filaments suggests a high degree of adaptation of *M. australiensis* to *T. jaculiferus*.

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