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Pathology of Pentastomid Infections (*Sebekia mississippiensis*) in Fish

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ABSTRACT: Differential pathogenesis was observed in two species of fish naturally infected with the pentastome *Sebekia mississippiensis*. Mosquitofish (*Gambusia affinis*) showed a mild inflammatory response to developing nymphs, whereas swordtails (*Xiphophorus helleri*) had an extensive granulomatous inflammatory reaction with accompanying hemorrhage, myositis, and myodegeneration. This suggested that certain species of tropical fish reared in the southeastern United States may be at risk to potentially harmful infections with this parasite.

Key words: Pentastome, *Sebekia mississippiensis*, *Gambusia affinis*, *Xiphophorus helleri*, *Alligator mississippiensis*, pathology.

The pentastome *Sebekia mississippiensis* utilizes alligators (*Alligator mississippiensis*) as definitive hosts and several species of fish as intermediate hosts (Overstreet et al., 1985). Adult pentastomes in the lungs of alligators deposit eggs containing larvae which are passed with the feces. Following ingestion by an appropriate piscine host the larvae hatch and undergo several molts. This report describes the pathology associated with nymphal development in naturally infected mosquitofish (*Gambusia affinis*) and swordtails (*Xiphophorus helleri*).

Mosquitofish were obtained from a lake in Hillsborough County, Florida, known to harbor large populations of alligators and mosquitofish infected with *S. mississippiensis* (Boyce, 1985). Infected swordtails were obtained from pet stores in West Lafayette, Indiana. These swordtails had been reared in Florida by a commercial tropical fish breeder and were infected with *S. mississippiensis* prior to distribution to pet stores throughout the United States. Twelve mosquitofish and four swordtails were killed and fixed in neutral-buffered 10% formalin. Fish were decalcified for 48 hr in a 1:1 mixture of 20% sodium citrate and 45% formic acid, washed in running water, and embedded in paraffin. Transverse and sagittal 6-μm sections were stained with hematoxylin and eosin and examined for histopathologic alterations.

In mosquitofish, nymphs were frequently visible through disruptions in the pigmented body wall as circular, white foci overlying the posterior body cavity. Encapsulated nymphs were found on or within tissues surrounding the gastrointestinal tract including liver, pancreas, mesentery, and attached to the coelomic lining of the body wall. Rarely, nymphs were found retroperitoneally adjacent to the kidney and in the tail musculature just posterior to the coelom. Histopathologic alterations were characterized by fibrosis and a mild inflammatory reaction (Fig. 1). The fibrous capsules surrounding nymphs had variable degrees of thickness and were surrounded by a few lymphocytes, macrophages, neutrophils and eosinophils. Occasionally, epithelioid cells and pigmented macrophages were present at the periphery of a capsule.

In contrast, extensive traumatic damage was associated with nymphs found in infected swordtails. Prominent, disfiguring swellings were present on the integumentary surface overlying subcutaneously located nymphs. Nymphs in subcutaneous and intramuscular locations were associated with large accumulations of degenerating leukocytes and erythrocytes, an extensive granulomatous inflammatory reaction, hemorrhage, myositis, myodegeneration, and pigment deposition (Fig. 2). Distinct migration tracks present in adjacent somatic muscles were characterized by hemorrhage and/or granulomatous inflammation (Fig. 3). Nymphs within the body cavity tended to be encapsulated and

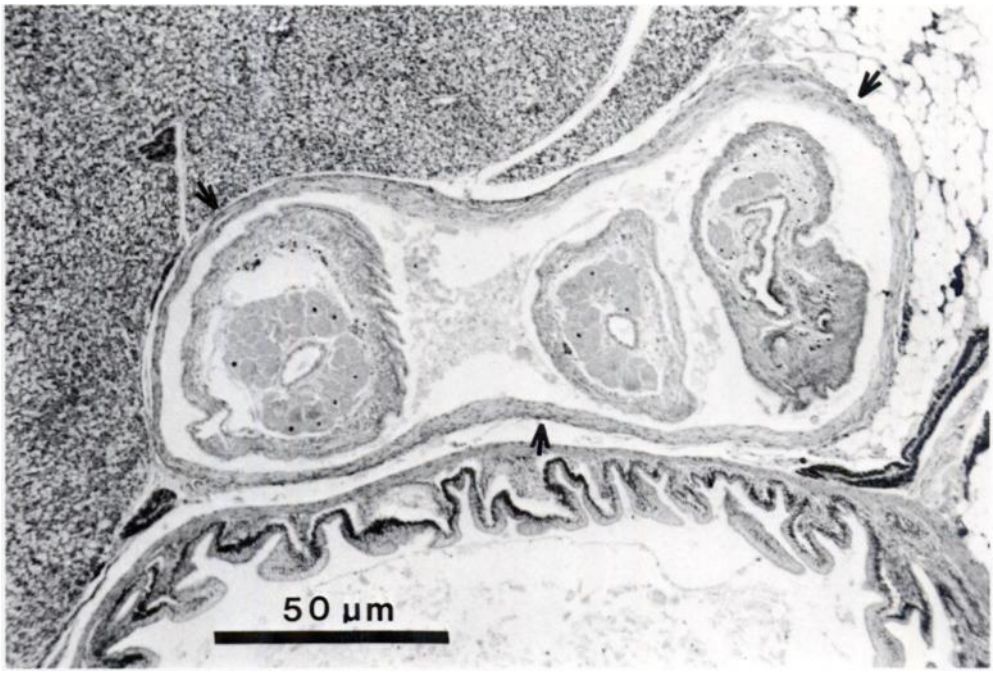

FIGURE 1. Section of *Sebekia mississippiensis* nymph in viscera of mosquitofish. Note fibrous capsule (arrows) surrounding nymph and minimal inflammatory response. H&E.

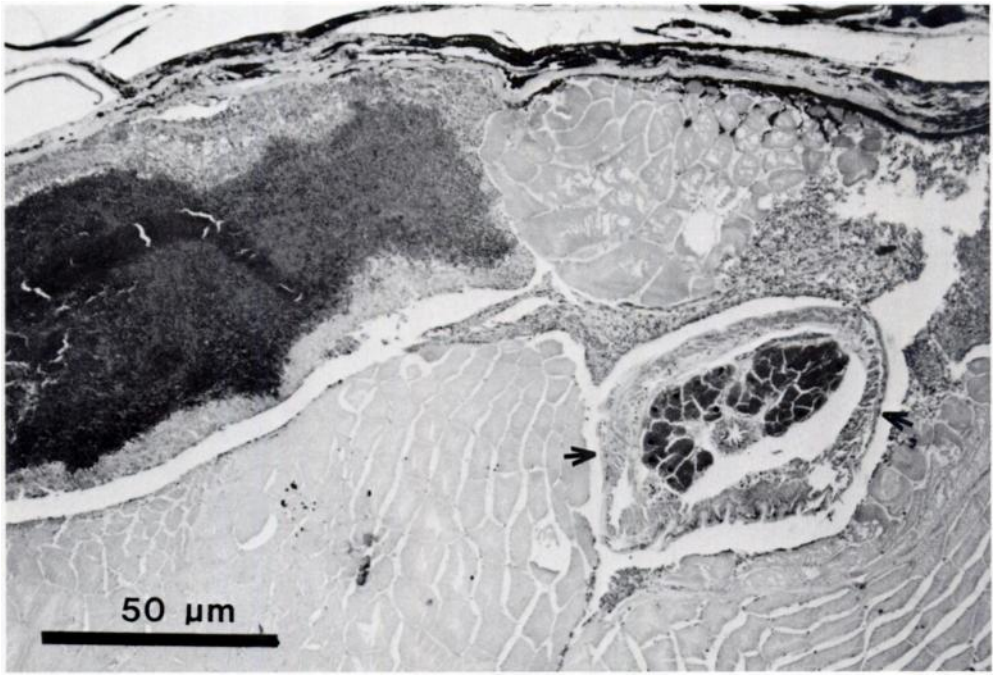

FIGURE 2. Section of *Sebekia mississippiensis* nymph (arrows) in subcutaneous/intramuscular tissues of a swordtail. Note marked inflammatory reaction. H&E.

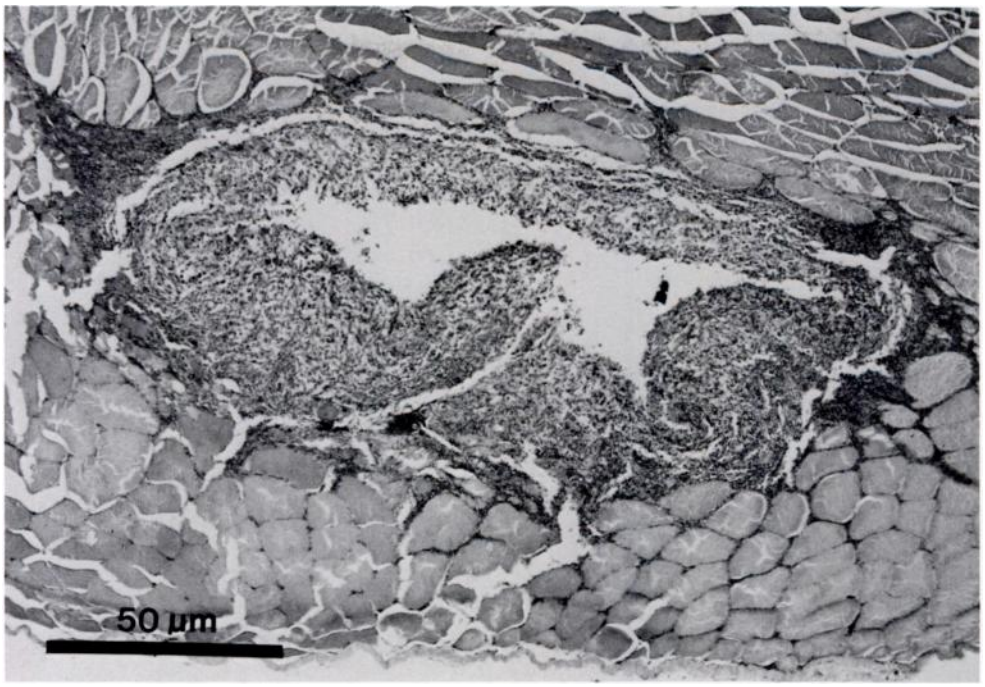

FIGURE 3. Large inflammatory track resulting from pentastome migration in the musculature of a swordtail. H&E.

stimulated a low-grade, granulomatous peritonitis.

Antemortem examination of one swordtail infected for several weeks prior to necropsy revealed that integumentary swellings would form, subside, and then form again in different locations as the nymphs migrated through the tissues. Overstreet et al. (1985) also reported finding nymphs of *S. mississippiensis* under the connective tissues lining muscle, kidney, liver, and swim bladder of swordtails reared in the southeastern United States, while Dukes et al. (1971) found nymphs in musculature near the ribs and backbone of largemouth bass (*Micropterus salmoides*). In contrast, developing nymphs of *S. mississippiensis* were found primarily in the body cavity of mosquitofish, similar to the situation described by Winch and Riley (1986) for the closely related pentastome from crocodilians in South America, *S. oxycephala*. They found that nymphs of *S. oxycephala* developed primarily on the surfaces of the viscera of four species of fish including mollies (*Poecilia latipinna*), guppies (*Poecilia reticulata*), platies (*Xiphophorus maculatus*) and *Tilapia zilli*.

Self (1972) pointed out that the pathology of pentastome infections depends on several factors including the intensity of infection, size relationship between parasite and host, and exposure to previous infections. In the present study, prominent lesions were observed in swordtails infected with small numbers of nymphs ($n \leq 5$). In contrast, mosquitofish infected with larger numbers of nymphs ($n \geq 10$) showed only mild inflammatory reactions. Previously, Boyce (1985) also found that naturally infected mosquitofish harboring as many as 79 nymphs could be maintained in aquaria for over 5 mo without apparent pathological consequences.

In their description of the development of *S. oxycephala* in fish, Winch and Riley (1986) suggested that intense inflammatory responses should occur following

molting of developing nymphs. The development of *S. mississippiensis* in piscine hosts has not been described, and the precise nymphal stage present in infected mosquitofish and swordtails in the present study was not determined. However, intact nymphs recovered from both species of fish were of similar size and appearance at both the light and electron microscope level. Also, earlier observations of other naturally infected mosquitofish revealed that even when obviously different developmental stages of *S. mississippiensis* were present in the body cavity, there was no marked host inflammatory response.

The present study indicates that certain species of tropical fish reared in the southeastern United States may be at risk to potentially harmful infections with *S. mississippiensis*. This parasite should be considered in the differential diagnosis of nodular swellings, migration tracks, and focal necrosis in fish species originating from that region.

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