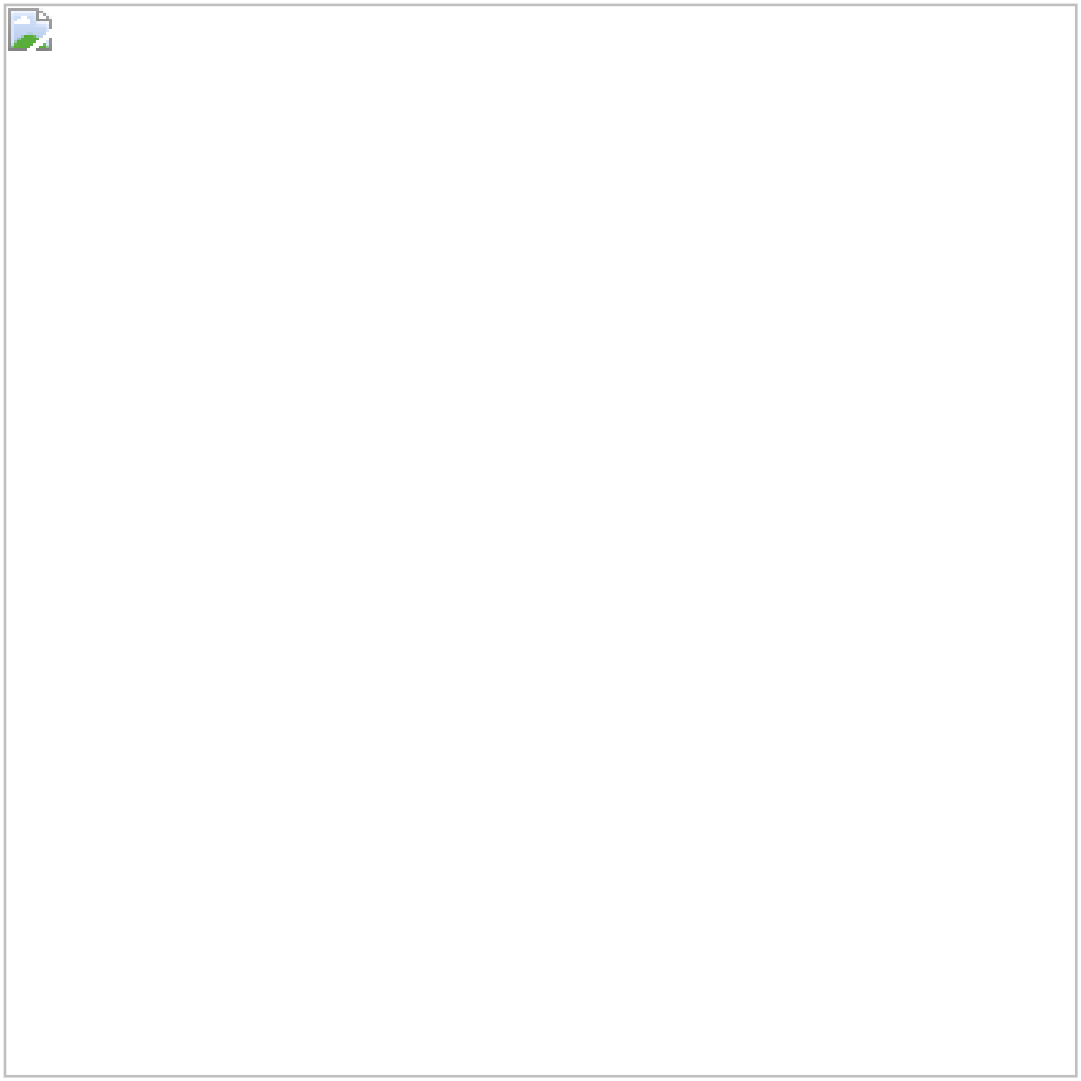

PATHOBIOLOGY OF Artystone trysibia SCHIOEDTE (ISOPODA: CYMOTHOIDAE), AN ENDOPARASITIC ISOPOD OF SOUTH AMERICAN FRESH WATER FISHES*

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PATHOBIOLOGY OF *Artystone trysibia* SCHIOEDTE (ISOPODA: CYMOTHOIDAE), AN ENDOPARASITIC ISOPOD OF SOUTH AMERICAN FRESH WATER FISHES*

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Abstract: The endoparasitic isopod, *Artystone trysibia*, was found within a pouch-like encapsulation in the abdomen of a naturally-infected, fresh water discus fish, *Symphysodon discus*, imported from South America. Larval stages released from the female isopod penetrated various body sites in the albino catfish, *Corydoras aeneus*, where they caused mechanical damage and hemorrhage. In one case, a larva that penetrated behind a pectoral fin was observed during a 72 day period to grow and develop into an immature male isopod which was separated from the internal organs of the catfish by a host-produced capsule. The isopod maintained an opening to the outside by the continuous movement of its abdominal appendages. The capsules surrounding isopods in both the discus fish and albino catfish contained tissue elements of body wall origin suggesting that the growing isopod causes fibrous changes of the body wall which expands to form a protective invagination. A proposed life history is discussed.

INTRODUCTION

The endoparasitic isopod, *Artystone trysibia* Schioedte, has been observed with increasing frequency in the body cavity of cichlid fish imported into the United States from South America.[4] Previous reports on *A. trysibia* were restricted to systematic studies of adult specimens collected from South American fishes,[2,3,6,7] and the mode of infection and development of the larval parasite within fish was unknown. The limited knowledge of the harmful effects upon fish of parasitic isopods in the Family Cymothoidae has been stressed,[5] and the present study gives observations on the pathobiology of larval and adult *A. trysibia* in naturally and laboratory infected fish.

MATERIALS AND METHODS

A discus fish, *Symphysodon discus*, imported from South America by Pioneer Pet Supply, Franklin Park, Illinois, was found infected with *Artystone trysibia* by Mr. Tilfred Eades of Fin and Feather Aquarium, Hudson, Illinois, who provided fish used in this study. Upon death of the discus fish, an adult female isopod was dissected out and lesions were photographed. The fish was first frozen by the collector and then fixed by the author in 10% formalin. Representative tissue for histopathology was processed by the routine paraffin embedding method and stained with hematoxylin and eosin.

Larval stages of *A. trysibia*, which had escaped from the parent isopod at dissection, were observed attaching to the surfaces of eight albino catfish, *Corydoras aeneus*, originally present with the discus fish in a 95 liter aquarium. The catfish were isolated in 7.5 liter aquaria and the penetration and development of *A. trysibia* was studied during a 72 day period at about 24 C. These fish were killed in 10% formalin, photographed and processed for histopathology as stated above.

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RESULTS

1. Adult Isopod in Naturally Infected Discus Fish.

The moving posterior appendages of *A. trysibia* were observed extending through an abdominal opening located immediately behind the left pelvic fin of a naturally infected, 13.0 cm long discus fish. Upon the sudden death of the fish from an unknown cause, the abdominal wall was opened and a 2.4 cm long, gravid female isopod removed (Figures 1, 2, 5). The adult isopod held approximately 200 larval stages in its abdominal marsupium. These larvae were released into a 95 liter aquarium which also contained eight young albino catfish.

Histopathology

The adult isopod was contained within a pouch-like, fibrous capsule of host origin which separated the parasite from the adjacent internal organs of the fish (Figure 2). There were no gross signs of hemorrhage within the cavity. The liver was compressed and the visceral organs were displaced, but there were no cellular responses in these organs (Figure 3). The capsule shown in Figure 4 contained a mixture of disorganized tissue elements including a predominance of fibrous connective tissue interspersed with muscle fibers and mucoid epithelial cells which had expanded to accommodate the large isopod. Necrotic tissue was evident in various sections of the capsule and the fibrous stroma was infiltrated with sparse numbers of eosinophilic and basophilic granulocytes.

2. Larval Isopod in Laboratory Infected Catfish.

When released from the marsupium of the female isopod, larvae of *A. trysibia* swam actively and attached to aquatic plants or fish. The larvae attached firmly to the surfaces of several albino catfish and penetrated vigorously with the aid of clasping thoracic appendages into the skin and various body openings including the eye, vent, and gill chamber (Figure 6). Some larvae penetrated into the skin on various areas of the fish, but these usually detached within a few days. Free-swimming isopod larvae were eaten by two immature angelfish added to the tank to test their susceptibility.

In a single catfish, one larva crawled into the depression located immediately behind the left pectoral fin (Figure 6A). This larva was observed to gradually increase in size and move slowly into the abdomen of the catfish during a 72 day period. The rapidly moving tail appendages of the isopod were continuously visible as they extended to the outside through an opening in the abdominal wall of the fish (Figure 7). The developing isopod retracted into the fish and covered its ventral appendages with the terminal abdominal segment (telson) when touched. Throughout the period of infection the catfish continued to feed and behave in a manner similar to a non-infected sibling catfish maintained in the same aquarium. By day 54 post infection the isopod had grown too large to exit through the original penetration opening. After 72 days, the infected fish was swollen on the left side, pale colored and somewhat smaller in total length (3.5 cm) in comparison with a 4.1 cm long, reddish-hued, non-infected sibling. The infected fish was killed on day 72 post infection, an immature male isopod measuring 2.34 mm wide by 4.02 mm long was dissected out and the tissue adjacent to the parasite was examined histologically.

Histopathology

The penetrating larvae caused hemorrhages and mechanical damage on various body sites of the catfish (Figure 8). A larva entered the left orbital cavity causing severe hemorrhage which destroyed the eye (Figure 6D).

The isopod which penetrated behind the left pectoral fin (Figure 6A) initially caused a gross inflammation and swelling of the left side accompanied by a white, muco-cellular exudate around the penetration opening. The inflammation subsided by day 30, but the entrance hole into the fish's body did not heal over, presumably due to the continuous movement of the abdominal appendages of the

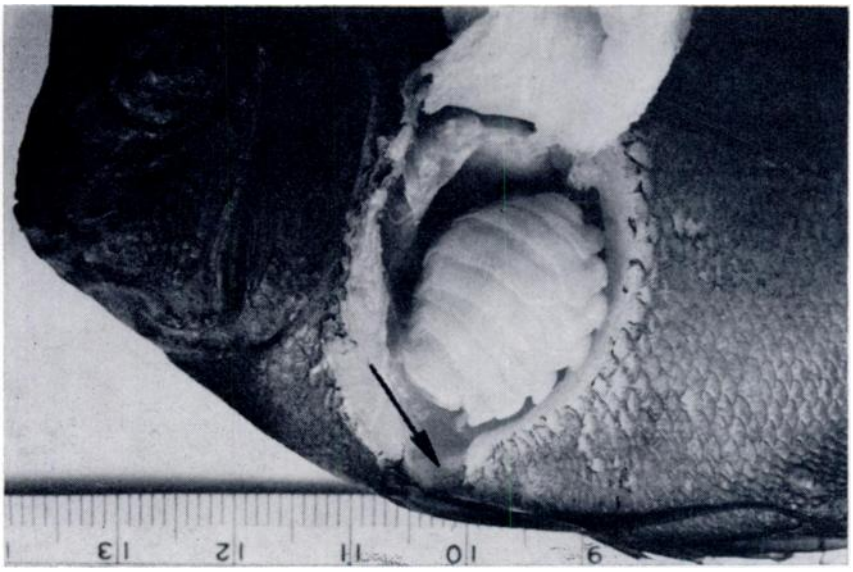

FIGURE 1. Endoparasitic adult female isopod, **Artystone trysibia,** in abdomen of naturally infected discus fish. Note opening in body wall (arrow) behind pelvic fin.

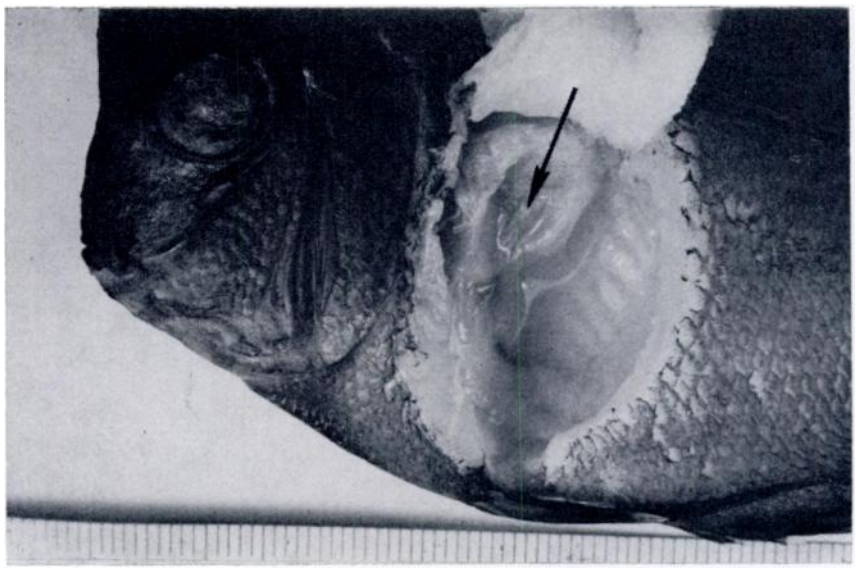

FIGURE 2. As Figure 1, but with isopod removed to show fibrous capsule covering internal organs with underlying liver compression (arrow) below head position of isopod.

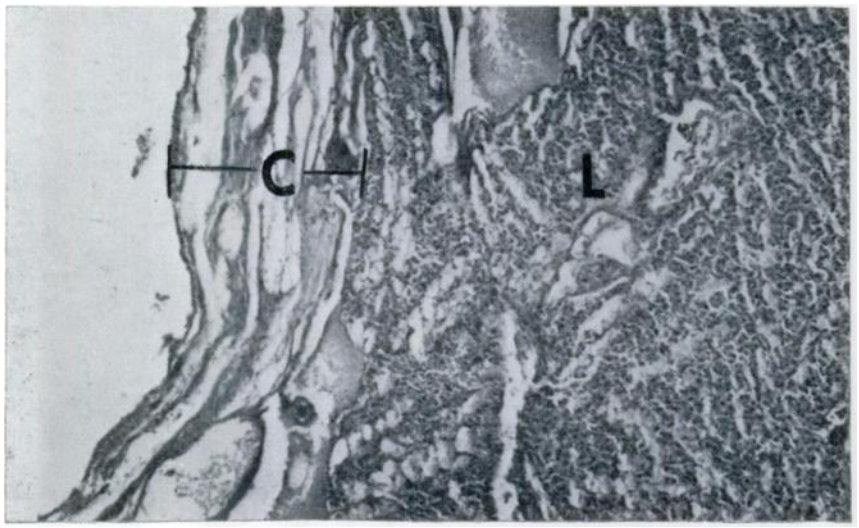

FIGURE 3. Section through liver (L) and capsule (C) of discus fish shown in Figure 2 with plane of section in direction of arrow. Tissue frozen by collector before formalin fixation. X 33.

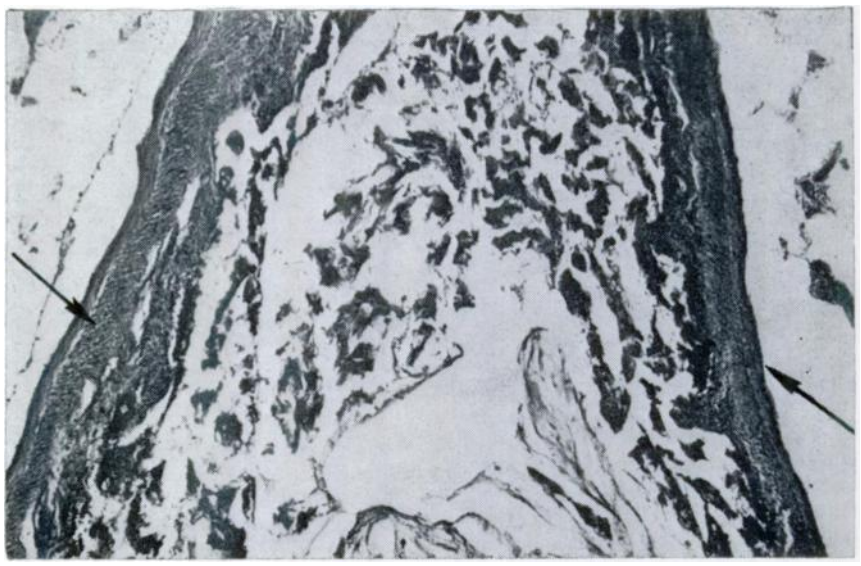

FIGURE 4. As Figure 3, higher magnification of capsule showing regions of muscle and epithelium (arrows) originating from body wall. Tissue frozen by collector before formalin fixation. X 87.

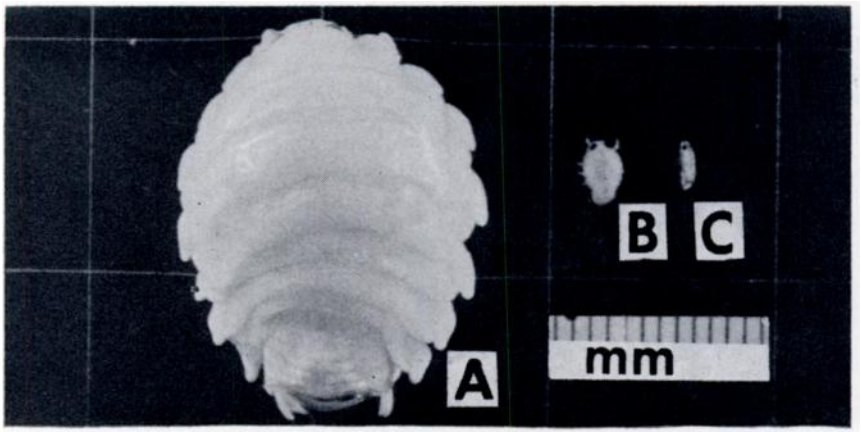

FIGURE 5. Comparative sizes of adult female (A), immature male (B), and infective larva (C) of **A. trysibia.**

FIGURE 6. Infective larval stages penetrating into depression behind pectoral fin (A), abdomen (B), lateral skin (C), and eye (D) of albino catfish on day 2.

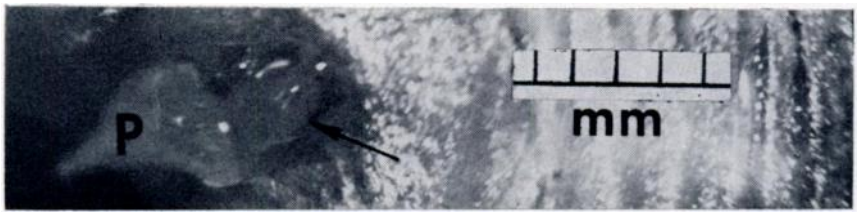

FIGURE 7. Closeup of catfish in Figure 6 on day 70 showing abdominal appendages (arrow) of male isopod extending through opening in body wall behind pectoral fin (P). Isopod was moving when photographed.

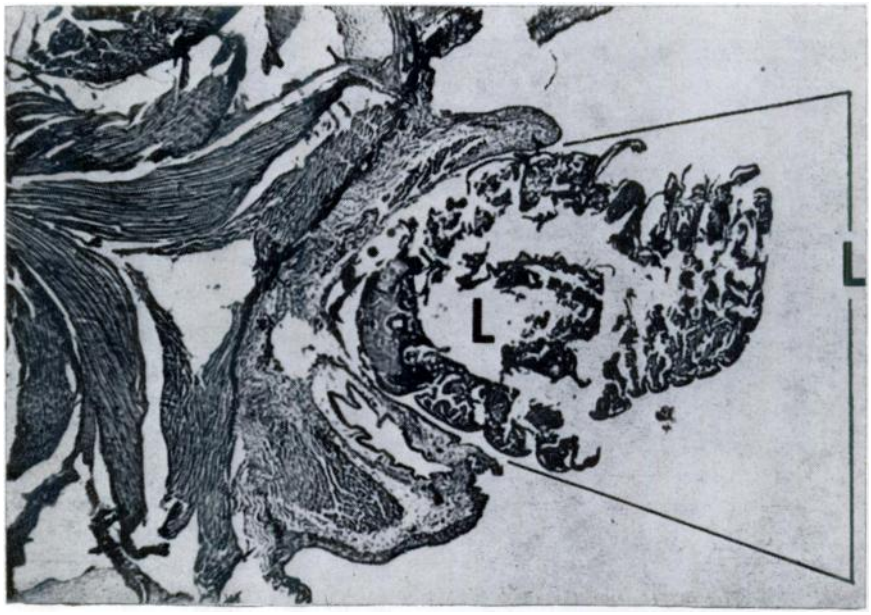

FIGURE 8. Section of larva (L) penetrating lateral skin of catfish. X 35.

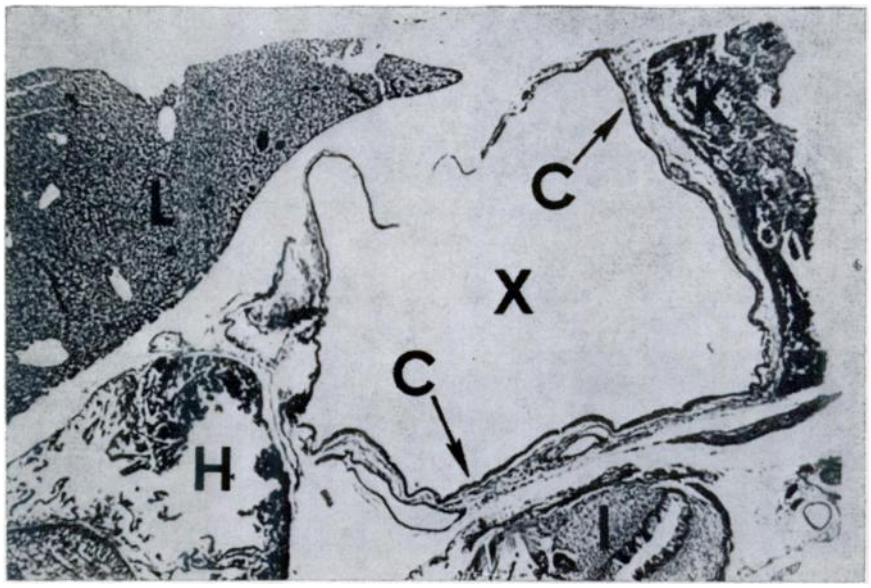

FIGURE 9. Section through visceral organs of catfish shown in Figure 7 with isopod removed from cavity (X) Abbreviations: capsule, C; liver, L; heart, H; intestine, I; kidney, K. X 35.

isopod. Histological sections revealed that the isopod was encapsulated with a pouch-like invagination of the fish's body wall which was similar in construction to the capsule observed in the naturally infected discus fish. The capsule was primarily fibrous, but contained scattered mucoid epithelial cells, apparently of body wall origin (Figure 9). The liver tissue adjacent to the capsule was slightly compressed due to the isopod's body, but there was no evidence of host cellular response in the visceral organs. It appeared that, although displaced, the host's internal organs were functioning normally with the isopod *in situ*.

DISCUSSION

Although *A. trysibia* was described in 1866 from the body cavity of South American fish,[6] this study gives the first observations on the penetration, development and pathobiology of the larval stage.

While limited numbers of fish were studied, the striking similarity between the mode of infection of *A. trysibia* in a naturally infected discus fish and laboratory infected albino catfish merits preliminary description of the life history as follows. The larval stage is released from the marsupium of the adult female isopod and swims to the outside through an opening in the abdominal wall of the infected fish. The free-swimming larva actively seeks and attaches to the surface of a suitable fish host where it may enter various body openings and cause mechanical damage. The larva typically crawls into a depression located immediately behind the pectoral or pelvic fins. With the aid of its claw-like thoracic appendages, the larva penetrates into tissue and undergoes a gradual development to the adult which takes several months. The method of feeding is unknown, but fish tissue is probably ingested. The growing isopod is surrounded by an invagination of the fish's body wall which gradually expands into a pouch-like capsule. Although an endoparasite, the isopod is separated from the fish's internal organs. This explains the reduced histopathology which is limited to organ compression and displacement. The parasite maintains an opening to the outside by the continuous movement of its posterior appendages which prevents the wound healing process, thereby, allowing oxygenated water to circulate over the isopod and providing an exit route for progeny.

Other species in the Family Cymothoidae have been observed in pouches behind the pectoral and pelvic fins of naturally infected fish which supports the above proposed life history.[7] Dr. Thomas E. Bowman (personal communication, Smithsonian Institution) identified specimens of *A. trysibia* collected by aquarium hobbyists from the albino catfish, *Corydoras aeneus*, and cichlid fish, *Symphysodon* sp. (U.S. National Museum Specimen Numbers 101891 and 112662, respectively).

This study also confirms the observations of Akhmerov[1] who suggested that the penetrating isopod, *Ichthyozenos amurensis*, produces a progressive sac-like depression at the base of the pectoral fin of *Leuciscus waleckii* by causing a metaplasia of the tissues contained within the skin.

The infective larval stage of *A. trysibia* will be described elsewhere and research is in progress to establish the isopod for studies of comparative pathology in fishes.

Acknowledgements

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