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MYXOBOLUS MISSISSIPPIENSIS N. SP. (MYXOSPORA) FROM GILLS OF LEPOMIS MACROCHIRUS IN MISSISSIPPI

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ABSTRACT: *Myxobolus mississippiensis* n. sp. is described from gill lamellae of the bluegill (*Lepomis macrochirus*) inhabiting the Pascagoula River System, Mississippi. Fresh spores measure 16.4–18.7 μm long, 3.9–6.2 μm wide, and 4.7–6.2 μm thick. Spore width to length ratio is 1:3.2. Polar capsules are 5.5–7.8 μm long and 1.5–2.3 μm wide, with 9–10 filament coils that when extruded measure 42.1 ± 4.2 μm. This parasite is unique among known species of *Myxobolus* in having spores that are lenticular in frontal view.

During examination of centrarchid fishes of Mississippi for myxosporean parasites, we found a previously undescribed species of *Myxobolus* Bütschli, 1882 (Myxosporea) parasitizing gills of the bluegill. This report describes that material and discusses its possible relation to species in *Henneguya* Thélouan, 1892.

MATERIALS AND METHODS

Five adult specimens of the bluegill (*Lepomis macrochirus*) were collected in September 1994 by seining in the Pascagoula River and joining bayous, near Vancleave, Mississippi. Fish were fixed whole in 10% buffered formalin and rinsed overnight in tap water prior to necropsy, which included microscopic examination of all organs. Sample tissues were dehydrated in a graded ethanol series, cleared in xylene, and embedded in Paraplast. Histological sections (7 μm thick) were stained with hematoxylin and eosin. Fresh spores were obtained from gills of the bluegill. This report describes that material and discusses its possible relation to species in *Henneguya* Thélouan, 1892.

**DESCRIPTION**

*Myxobolus mississippiensis* n. sp. (Figs. 1–12)

Plasmodia occurring as subspherical pseudocysts, up to 300 μm long; ectoplasm thin; endoplasm poorly defined, containing randomly arranged fully developed spores. Spores lenticular in frontal view; anterior end usually more blunt than posterior end (see figures); posterior extremity tapered, rounded, or pointed; posterior tip frequently bending slightly away from sutural plane; aberrant spore specimens (0.5% of spores in a pseudocyst) often with pair of thin posterior extensions of spore valves; extensions 1–16 long (Fig. 12). Fresh spores (*n* = 15) 17.7 ± 0.6 (16.4–18.7) long, 5.2 ± 0.7 (3.9–6.2) wide, 5.4 ± 0.8 (4.7–6.2) thick, without mucous envelope; fixed spores (*n* = 15) from different specimen 16.8 ± 0.8 (16.1–18) long, 5.2 ± 0.3 (5.0–5.3) wide, 5.3 ± 0.5 (4.7–6.4), in fixed spores 1:3.2 ± 0.2 (1:2.9–3.5). Spore valves smooth, devoid of sutural ridge folds. Polar capsules narrowly pyriform, converging anteriorly but not crossing, 7.2 ± 0.59 (5.5–7.8) long (6.3 ± 0.6 [5.5–7.0] long in fixed specimens), with ratio of length to spore length 1:2.4 ± 0.2 (1:2.2–2.8), 1.5 ± 0.2 (1.5–2.3) wide (1.5 ± 0.2 [1.0–2.0] wide in fixed specimens), typically equal in length but frequently with 1 capsule 1–2 shorter than other, with intercapsular appendix absent. Polar filament exhibiting 9–10 coils arranged perpendicular to long axis of capsule, 42.1 ± 4.2 (35–46) long when extruded. Sporoplasm single, occupying almost 1/3 of spore length, sometimes containing prominent (2 μm wide) roundish-shaped vacuole. Iodinophilous vacuole absent.

**Taxonomic summary**

*Type host:* *Lepomis macrochirus* Rafinesque, 1819, bluegill (Centrarchidae).

*Site of infection:* Capillary bed of secondary gill lamellae. Other organs not infected.

*Type locality:* Bluff Creek; also in nearby Swift Bayou and associated Pascagoula River, Jackson County, Mississippi.

*Type specimens:* Syntypes on Giemsa-stained, air-dried smear in U.S. National Parasite Collection no. 86817, Beltsville, Maryland.

**Etymology:** The species is named for the type locality.

**DISCUSSION**

Four-hundred sixty-six nominal species of *Myxobolus* have been described from aquatic vertebrates, the majority of which are from fishes (Cone et al., 1990; Maeno et al., 1990; Landsberg and Lom, 1991; Segovia Salinas et al., 1991; Fomena et al., 1993; Lom and Dyková, 1994; Masoumian et al., 1994). Of these, 110 species are known from freshwater fishes of North America (Cone and Raesly, 1995; Cone et al., 1996). *Myxobolus mississippiensis* n. sp. is unique in its lenticular frontal view. Spores of all other known species of *Myxobolus* are either circular, ellipsoidal, pyriform, or narrowly pyriform in frontal view (Shulman, 1966; Lom and Dyková, 1992).

Three species of *Myxobolus* in addition to *M. mississippiensis* have been reported from *Lepomis macrochirus*: *Myxobolus osburni* Herrick, 1936, *Myxobolus cartilaginis* Hoffman, Putz, and Dunbar, 1965, and *Myxobolus corneus* Cone, Horner, and Hoffman, 1990 (see Herrick, 1936; Otto and Jahn, 1943; Hoffman et al., 1965; Cone et al., 1990). Spores of these species can be easily distinguished from those of *M. mississippiensis* by their circular or suboval frontal aspect.

**FIGURES 1–10. Myxobolus mississippiensis n. sp. parasitizing Lepomis macrochirus from the Pascagoula River system, Mississippi.**

1. Small oval plasmodium from fresh tissue smear, unstained. Scale bar 30 μm.

2. Histological section (H&E stained) through a plasmodium revealing its location within secondary lamellae. Scale bar 20 μm.

3–5. Photomicrographs of series of developed spores in frontal view.


7–10. Series of spores with atypical development of posterior extremity.
cies of Myxobolus. The finding of abnormal spore extensions that certain species of Myxobolus apparently had closer phylogenetic ties with species of Henneguya, provide the more likely explanation that M. mississippiensis is related to species of Henneguya. The valves differ by normally not extending as posterior filaments. Perhaps the occasional filamentous spore of M. mississippiensis is rare. On the other hand, those spores of M. mississippiensis with short filament-like posterior extensions on spores of species of Henneguya are homoplasies resulting from convergent evolution. If so, such an event among species of Myxobolus is rare. We have assigned M. mississippiensis to Myxobolus because it complies with the revised definition of the genus, characterized by having species with 2 polar capsules in the apex of the spore, both of which are set in the sutural plane (Lom and Noble, 1984; Lom and Dyková, 1992). The unique lenticular shape of spores of M. mississippiensis expresses a similarity to that for spores of species in Henneguya. The valves differ by normally not extending as posterior filaments. Perhaps the occasional filamentous spore of M. mississippiensis and the filaments on spores of species of Henneguya are homoplasies resulting from convergent evolution. If so, such an event among species of Myxobolus is rare. On the other hand, those spores of M. mississippiensis with short filament-like posterior extensions on the valves, similar in appearance to the spores with normal filaments on species of Henneguya, provide the more likely explanation that M. mississippiensis is related to species of Henneguya. That relationship suggested by morphological features similar to those of some species of Henneguya would support rRNA sequence studies by Smothers et al. (1994) that suggest Henneguya and Myxobolus are related. They showed that certain species of Myxobolus apparently had closer phylogenetic ties with species of Henneguya than with other species of Myxobolus. The finding of abnormal spore extensions is not unique for M. mississippiensis. Some spores of at least one other species, Myxobolus muelleri Mitchell, 1989 from freshwater fishes in Montana, also exhibited abnormal posterior filaments (Mitchell, 1989).

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LITERATURE CITED


