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An outbreak of myxozoan parasites in farmed freshwater fish *Colossoma macropomum* (Cuvier, 1818) (Characidae, Serrasalminae) in the Amazon region, Brazil

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ABSTRACT

The tambaqui (*Colossoma macropomum*) is a native fish species that is farmed most frequently and in the largest quantities throughout Brazil. The high production of this species from fish farms has contributed to the occurrence of emerging parasites, which may compromise fish health and productivity. In a batch of 2500 tambaqui fry acquired for experimental farming procedures in Brazil, a mortality rate of 80% was observed, with the fish swimming erratically and gasping for air at the water surface. From among the specimens that were still alive, 60 individuals were selected at random. Organs or fragments of organs containing lesions and/or cysts were examined under an optical microscope to investigate for the presence of parasitic spores. Of the 60 specimens of tambaqui analyzed, 83.3% were found to be infected in different organs, such as the gills, liver, and gallbladder with myxosporidian species belonging to four genera, namely, *Myxobolus*, *Ellipsomyxa*, *Henneguya* and *Thelohanellus*. The parasite with the greatest prevalence was *Myxobolus* sp., located in the gills (70%), followed by *Henneguya* sp. in the gills region (68.3%), *Myxobolus* sp. in the liver (63.3%), *Thelohanellus* sp. in the liver (58.3%), and *Ellipsomyxa* in the gallbladder (50%). This is the first report of parasitic infection caused by the genera *Ellipsomyxa* and *Thelohanellus* in *C. macropomum*. The present study reported the second incidence of the occurrence of the genus Thelohanellus in South America. This study suggested that the mortality among *C. macropomum* specimens was caused by the outbreak of myxosporidians.

1. Introduction

The tambaqui (*Colossoma macropomum*) is considered one of the largest freshwater fish in South America. It can reach up to 90 cm in total length and can weigh up to 30 kg (Gomes et al., 2010). However, this species has been suffering drastic reductions in its natural stocks because it is a highly prized fish among the riverbank and urban communities of the Amazon region. To compensate for the overexploitation of this fish species, various farming techniques can be employed, such as use of fish cage, excavated hatcheries, and barrages, among others (Lopera-Barrero et al., 2011).

The tambaqui is the native species that is farmed most frequently and in the largest quantities throughout Brazil. It is farmed in 24 of the 27 states in this country, with an increase in the national production by 66% from 2007 to 2009 (Lopera-Barrero et al., 2011). Data from the Ministry of Fisheries and Aquaculture (MPA, 2010) show that the production of this fish from Brazilian pisciculture reached 46,454 t for the year 2009. The large amount of production of this species from fish farms has contributed toward occurrence of emerging parasites, which may compromise fish health and productivity (Tavares-Dias et al., 2011). Parasites cause great losses of farmed fish, especially in the Neotropical region. This is because of its ecological characteristics, which facilitate rapid progression, and because of the huge diversity of species (Cohen and Kohn, 2009). Many parasites in farmed tambaquishave been described in literature. These belong to several taxonomic groups, such as Monogenea, Digenea, Acanthocephala, Cestoda, Crustacea, Hirundinea, and Protozoa (Santos et al., 2013; Tavares-Dias et al., 2013). Among these parasites, myxosporidians are prominent. In the class Myxosporea, vegetative stages may be coelozoic or histozoic, intercellular or often intracellular, and affecting freshwater and marine fish in different geographical areas (Casal, 2009; Lom

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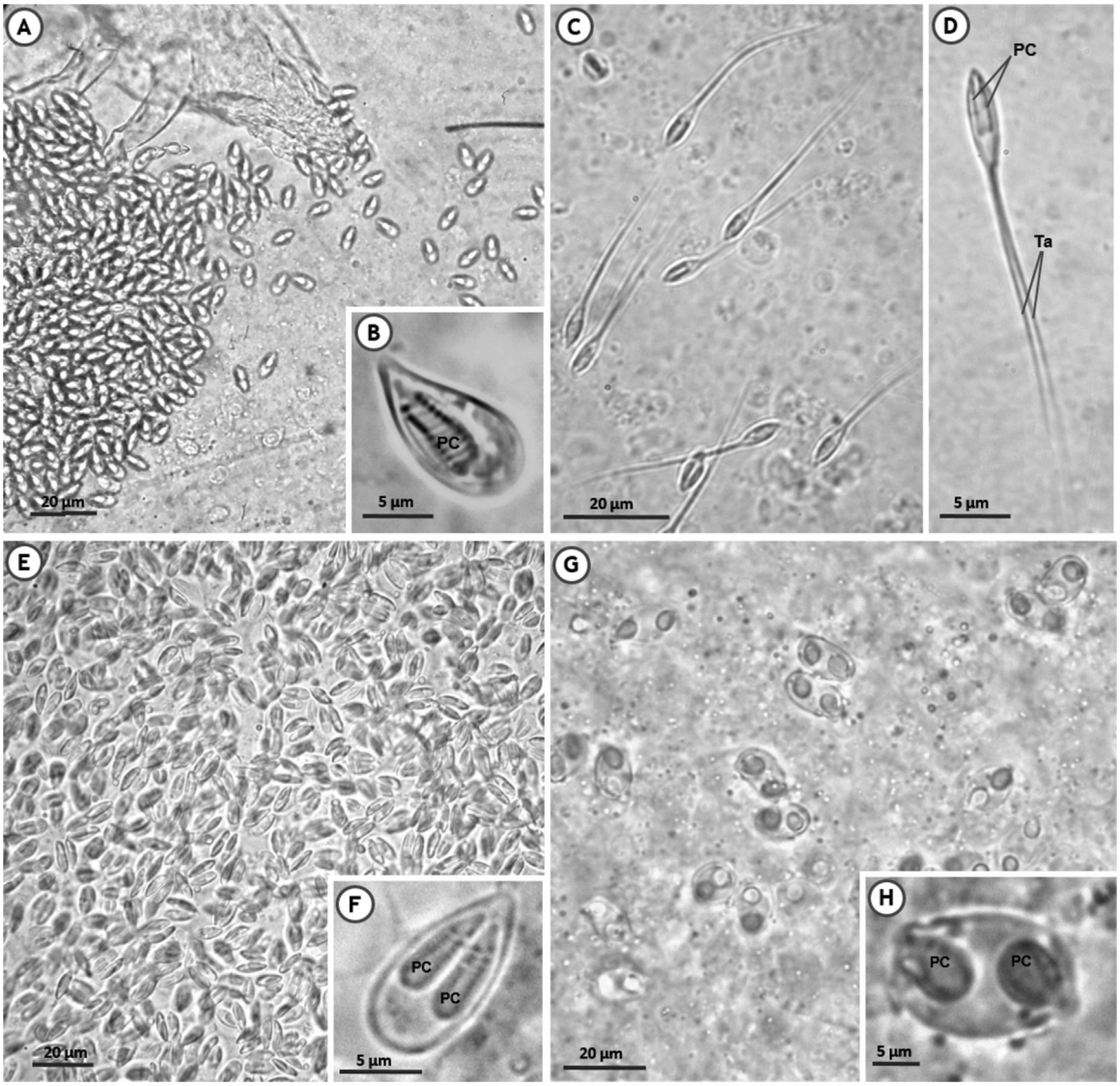

Fig. 1. Myxozoan parasites of *Colossoma macropomum* in the Amazon region. (A) Spores of *Thelohanellus* sp. found in a fresh preparation of liver. (B) Spore of *Thelohanellus* sp. in high magnification, highlighting its unique polar capsule. (C) Spores of *Henneguya* sp. in a fresh preparation of gills. (D) Spore of *Henneguya* sp. with two tails and two polar capsules in gills. (E) Spores of *Myxobolus* sp. in gills (fresh preparation). (F) Spore of *Myxobolus* sp. in gills, showing the presence of two polar capsules. (G) Spores of *Ellipsomyxa* sp. observed in a fresh preparation of gallbladder. (H) Spore of *Ellipsomyxa* sp. with two polar capsules. PC, Polar capsule; Ta, tail.

and Dyková, 2006). They infect a variety of tissues and organs, such as the liver, kidneys, gills, gonads, intestine, skin, and other tissues (Luque, 2004).

Myxosporidians belong to the phylum Myxozoa Grassé, 1970, and more than 2200 species have been described. Some of these are responsible for diseases that give rise to high mortality rates worldwide (Lom and Dyková, 2006), such as whirling disease among salmonids that has a severe economic and ecological impact (Granath et al., 2007). Considering the lack of epidemiological, clinical, and pathological information on diseases of economic importance among fishes in the Amazon region, the present study aimed to report an outbreak of an infection with high mortality rate among fry of *C. macropomum*, caused by myxosporidiosis.

2. Material and methods

Among a batch of 2500 tambaqui fry acquired for experimental farming at the Federal Rural University of the Amazon Region (UFRA), in Belém, Pará, Brazil (1°27′18″S 48°26′43″W), a mortality rate of 80% was observed, with the fish swimming erratically and gasping for air at the water surface. Their mean weight was 3.87 ± 0.45 g and their mean total length was 7.0 ± 1.2 cm. The abiotic water parameters were recorded as temperature 28.0 ± 0.8 °C, salinity 0.5‰, pH 6.5 ± 0.2, and dissolved oxygen 7.0 ± 0.6 mg/L.

Among the specimens that were still alive, 60 individuals were picked at random. They were caught with the aid of a small net and transported alive to the Carlos Azevedo Research Laboratory (LPCA, UFRA), where they were anesthetized using tricaine methanesulfonate (MS-222) at a concentration of 50 mg/L and dissected under a stereo microscope (Ethics committee on use of animals n°. 013/2014-UFRA). Organs or fragments of organs with lesions and/or cysts were examined under an optical microscope to investigate for the presence of parasitic spores.

For histological examination, small fragments (0.5 cm) of the parasitized tissue extracted from the fish specimens were fixed in Davidson's solution (neutral-buffered formalin, glacial acetic acid, 95% ethanol and distilled water) for 24 h and were then processed for embedding in paraffin. Sections were cut and stained with Hematoxylin and Eosin and Ziehl–Neelsen stain (Luna, 1968), then mounted on slides with a coverslip, and photographed under