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FIRST REPORT OF METACERCARIAE (DIGENEA) INFECTING *ASTRONOTUS OCELLATUS* (PERCIFORMES: CICHLIDAE) FROM THE AMAZON REGION, BRAZIL

PRIMER REGISTRO DE METACERCARIAS (DIGENEA) INFECTANDO *ASTRONOTUS OCELLATUS* (PERCIFORMES: CICHLIDAE) DE LA REGIÓN AMAZÓNICA, BRASIL

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Abstract

This study aimed to report infection by metacercariae of the genera *Posthodiplostomum* Dubois, 1936 (Diplostomidae) and *Herpetodiplostomum* Dubois, 1936 (Proterodiplostomidae) in the gills of Oscar *Astronotus ocellatus* Agassiz, 1831 (Cichlidae) from Lake Pracuúba, in the municipality of Pracuúba, State of Amapá (eastern Amazonia), Brazil. Out of 202 *A. ocellatus* examined, 142 had gills infected by metacercariae of *Herpetodiplostomum* sp. (prevalence= 70.3%) and *Posthodiplostomum* sp. (prevalence= 59.4%). However, 97 hosts were infected by both metacercariae species (prevalence= 48.0%). A total of 1123 specimens of *Herpetodiplostomum* sp. and 463 specimens of *Posthodiplostomum* sp. were collected and the mean intensity of infection was 7.8 ± 11.6 and 3.9 ± 4.4 , respectively. This is the first report of Digenea in *A. ocellatus*.

Key-words: Brazil – Digenea - Freshwater fish – Metacercariae.

Resumen

Este estudio tiene como objetivo el registro de la infestación por metacercarias de los géneros *Posthodiplostomum* Dubois, 1936 (Diplostomidae) y *Herpetodiplostomum* Dubois, 1936 (Proterodiplostomidae) en las branquias del *Astronotus ocellatus* Agassiz, 1831 (Cichlidae) del lago Pracuúba, en el Municipio de Pracuúba, Estado de Amapá, Brasil. De doscientos ejemplares de *A. ocellatus* examinados, 142 tenían las branquias infestadas por *Herpetodiplostomum* sp. (prevalencia = 70,3%) y por *Posthodiplostomum* sp. (prevalencia = 59,4%). Sin embargo 97 hospederos fueron infestados por estas dos especies de metacercarias (prevalencia = 48,0%). Del total de ejemplares de *A. ocellatus* examinados fueron extraídos 1.123 parásitos de *Herpetodiplostomum* sp. y 463 parásitos de *Posthodiplostomum* sp., y la media de intensidad de la infestación fue de $7,8 \pm 3,9$ y $11,6 \pm 4,4$, respectivamente. Este es el primer registro de Digenea en *A. ocellatus*.

Palabras claves: Brasil - Digenea - Metacercarias - Peces de agua dulce.

INTRODUCTION

During studies on the parasitic fauna of freshwater fish from the Amapá State, Brazil, two hundred and two specimens of *Astronotus ocellatus* Agassiz, 1831 (Perciformes: Cichlidae) were examined.

One hundred and forty-two specimens were parasitized in the gills by metacercariae belonging to the genera *Herpetodiplostomum* Dubois, 1936 and *Posthodiplostomum* Dubois, 1936.

The *A. ocellatus*, commonly named as “acará-açu” or Oscar, is a benthopelagic species, commonly caught in lakes of “white, “clear” and “black” waters from the Amazonia. In lakes, this fish inhabits shallow water and with low flow water, margins, aquatic vegetation or flooded forest. It usually forms small groups. It is carnivorous, feeding on fish, mollusks, crustaceans and aquatic insects. This species is much appreciated by the riverine population and it is also sold in markets in the Amazonian region (Soares *et al.*, 2007). In Brazil, in 2007, the caught of *A. ocellatus* was of 1825.5 t (Ibama, 2007), and this species is already being bred in captivity. The present work studied the infection by metacercariae of the digeneans *Posthodiplostomum* sp. and *Herpetodiplostomum* in the gills of *A. ocellatus* from the Lake Pracuúba, in State of Amapá, Brazil.

MATERIAL AND METHODS

Between May 2010 and April 2011, 202 specimens of Oscar *A. ocellatus* from the Lake Pracuúba (01°43'47"N, 50°47'45"W), in the municipality of Pracuúba, State of Amapá, Brazil were examined. The fish measured 23.4 ± 3.0 cm in total length and had 367.7 ± 134.1 g of body weight. Specimens were necropsied and their organs were analyzed. Only the gills were found being parasitized by helminths. The gills were placed in vials and fixed in formalin 5%; the metacercariae collected were counted and stored in cold AFA (alcohol-formaldehyde-acetic acid), without compression, for identification. Specimens were stained with Langeron's alcoholic acid carmine, dehydrated in an ethyl alcohol series, cleared in beechwood creosote and mounted in Canada balsam as permanent slides. Light micrographs were made using a Nikon Eclipse 800 camera. Terms ecological were according to Bush *et al.* (1997). The specimens studied were deposited in the Helminthological Collection of the “Instituto Oswaldo Cruz” (CHIOC), Brazil. *Posthodiplostomum* sp. (CHIOC: 37530) and *Herpetodiplostomum* sp. (CHIOC: 37531).

RESULTS AND DISCUSSION

Metacercariae specimens of *Posthodiplostomum* Dubois, 1936 (Fig. 1) and of *Herpetodiplostomum* Dubois, 1938 (Fig. 2) were collected from the gills of *A. ocellatus* from Lake Pracuúba, eastern Amazona.

Notes concerning the infection by these digeneans are provided. This is the first report of both Digenea metacercariae for *A. ocellatus*. Members of the family Diplostomidae have wide geographic distribution, and most of them are known for infecting fish species from Europe, Asia and North America (Kent & Fournie, 2007; Yamada *et al.*, 2008); just a small number of species is known for infecting Neotropical fish (Scholz *et al.*, 1995; Yamada *et al.*, 2008; Takemoto *et al.*, 2009). Scholz *et al.* (1995) noticed that from a geographical point of view, the fauna of metacercariae is diversified. It is composed of cosmopolitan species, species widely distributed in North and South America and of trematodes species whose distribution is restricted to Mexico and Central America.

Several species of diplostomids metacercariae have been reported in Brazilian freshwater fishes, but *Austrodiplostomum compactum* Lutz, 1928 (Diplostomidae) has been the most frequent. Species of diplostomids have been responsible for “wormy cataract”, also called diplostomiasis. Fish heavily infected by metacercariae in the eyes have loss of vision and reduced growth or deformation of the vertebral column, brain tumor, cellular necrosis which eventually leads to death (Eiras *et al.*, 2010; Zica *et al.*, 2010).

Digeneans are parasites of the intestine, and has been assumed that this is their plesiomorphic site of infection. However, numerous families of digeneans have adopted new sites of infection in hosts (Cribb *et al.*, 2002). Historically, infection of fish gills by metacercariae of Diplostomidae species has been uncommon. It can cause moderate to severe hyperplasia of epithelial gill of the primary gill lamellae, forming cysts surrounded with multiple cellular reactions, including mononuclear inflammatory cells (Eissa *et al.*, 2011). In addition, a massive and widespread infection by these metacercariae, particularly in little fish can cause intensive inflammatory response and mortality (Mitcheli *et al.*, 1982; Paperna & Dzikowski, 2006).

Adult members of the family Diplostomidae Poirier, 1886 has been reported parasitizing birds and mammals. Adult specimens of the genus *Posthodiplostomum* Dubois, 1936 have been reported in almost all countries of South America parasitizing birds. Only metacercariae

Posthodiplostomum macrocotyle Dubois, 1937 (Diplostomidae) has been reported in fish from Brazil; it was found in the eyes, buccal cavity, stomach and gonads of *Geophagus brasiliensis* Quoy & Gairmad (Cichlidae) from Guandu River, State of Rio de Janeiro (Azevedo *et al.*, 2006) and in the stomach of *Trachelyopterus striatulus* Steindachner, 1877 (Auchenipteridae), also from Guandu River (Mesquita *et al.*, 2011).

The family Proterodiplostomidae Dubois, 1936 is represented by a genus reported parasitizing exclusively reptiles. Adult members of these genera have been found in Neotropical crocodylians and occasionally, in snakes. Several species belonging to eleven genera of Proterodiplostomidae have been described in South American reptiles. Metacercariae belonging to the genus *Herpetodiplostomum* Dubois, 1938 have been reported in South American fishes from Argentina by Szidat (1969), who erected the new species *Herpetodiplostomum gymnoti* for metacercariae recovered from skin, particularly of the head of *Gymnotus carapo* Linnaeus, 1758 (Gymnotidae). In Brazil, metacercariae of *H. gymnoti* was reported in the gonads of *Iheringichthys labrosus* Lütken, 1874 (Pimelodidae) by Moreira *et al.* (2005) and *Herpetodiplostomum* sp. (metacercariae) has been found in the eyes of *Astyanax altiparanae* Garutti & Britski, 2000 (Characidae) by Lizama *et al.* (2008); of *Leporinus elongatus* Valenciennes, 1850, *Leporinus friderici* Bloch, 1794, *Leporinus obtusidens* Valenciennes, 1837, *Leporinus lacustris* Amaral Campos, 1945 (Anostomidae), *G. carapo*, *I. labrosus* and *A. altiparanae* by Takemoto *et al.* (2009), and in the swim bladder of *L. lacustris* (Pavanelli, 2006); all records above are from upper Paraná River (South of Brazil). Isaac *et al.* (2004) reported the presence of metacercariae of *Herpetodiplostomum* sp. in the gonads and mesentery of *Gymnotus* spp. from Baía River, State of Mato Grosso do Sul (Midwest Brazil) and Abdallah *et al.* (2006) find progenetic metacercariae of *Herpetodiplostomum caimancola* Dollfus, 1935 in the intestine of *Hoplosternum littorale* Hancock, 1828 (Callichthyidae) from Guandu River, State of Rio de Janeiro (Southeast Brazil). This is the first report of *Herpetodiplostomum* sp. and *Posthodiplostomum* sp. (metacercariae) regarding the Brazil, and occurred in *A. ocellatus* from the eastern Amazonia (North of Brazil).

Parasitological studies need to be encouraged because they may demonstrate the intricate relationships among organisms in systems and the need for biodiversity conservation (Brasil-Sato & Santos, 2005; Takemoto *et al.*, 2009). The prevalence of *Herpetodiplostomum* sp. was 70.3% and the mean intensity 7.8 ± 11.6 ; while for *Posthodiplostomum* sp. the prevalence was 59.4% and the mean intensity 3.9 ± 4.4 . For *Posthodiplostomum* sp. the lowest prevalence was observed in September, and for *Herpetodiplostomum* sp. it was in April and September (Table 1), probably because the emergence of cercariae can be affected by increase of the temperature. The epidemiology of digeneans metacercariae can also reflect differences due to exposure time to cercariae in the environment. Azevedo *et al.* (2006) described mean intensity of 2.4 ± 1.23 to metacercariae of *P. macrocotyle* in 88.0% from *G. brasiliensis* examined. For the same host and locality, Carvalho *et al.* (2010) reported a prevalence of 74.5% and mean intensity of 7.3 ± 7.8 in the eyes, swim bladder and intestine. Levels of infection by digeneans can vary according to the environment or the species of host, and they can be related to size, longevity and particularly the feeding habits of the host. Moreover, fish with longer lifespan may have more exposure time to these parasites, favoring cumulative processes in the host (Cribb *et al.*, 2002; Takemoto *et al.*, 2009; Carvalho *et al.*, 2010). However, we found not correlation between the size of *A. ocellatus* and the intensity of digeneans metacercariae. Therefore, for *A. ocellatus* from the Lake Pracuúba (State of Amapá, Brazil), the prevalence and intensity of *Herpetodiplostomum* sp. and *Posthodiplostomum* sp. metacercariae indicates that the abundance of bird hosts and the presence of favorable conditions for the first intermediate host, being a snail the most common, are the causes of the infections on the gills of this host fish. In addition, the definitive host in the lake is a fish-eating bird. Furthermore, these results corroborate that the life-habit of the fish have a great importance in its levels of infection by digenean species.

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Figures 1-2. Metacercariae of *Posthodiplostomum* sp. (1) and *Herpetodiplostomum* sp. (2) in the gills from *Astronotus ocellatus* collected in Lake Pracuúba, State of Amapá, Brazil. Bar = 100 μ m.

Table 1. Levels of infection by Digenea metacercariae species in the gills of *Astronotus ocellatus* from the Lake Pracuúba, in the State of Amapá, Brazil. Examined fish (EF), parasitized fish (PF), prevalence (P), mean intensity (MI).

Parasites	<i>Herpetodiplostomum</i> sp.			<i>Posthodiplostomum</i> sp.		
	EF/PF	P (%)	MI \pm SD	EF/PP	P (%)	IM \pm SD
May/2010	8/6	75.0	5.4 \pm 3.0	8/6	75.0	5.8 \pm 2.5
Jun/2010	12/11	91.7	16.7 \pm 30.0	12/11	91.7	3.9 \pm 2.3
Jul/2010	19/18	94.7	10.2 \pm 11.3	19/10	52.6	1.8 \pm 1.8
Aug/2010	21/16	76.2	3.7 \pm 2.5	21/15	71.4	1.5 \pm 0.9
Sep/2010	32/12	37.5	4.4 \pm 5.8	32/8	25.0	2.1 \pm 1.3
Oct/2010	11-10	90.9	6.6 \pm 8.2	11/8	72.7	3.4 \pm 3.7
Nov/2010	15/13	86.7	6.5 \pm 3.9	15/14	93.3	5.3 \pm 4.3
Dec/2010	27/23	81.5	9.8 \pm 11.4	27/12	44.4	9.1 \pm 9.4
Jan/2011	10/8	80.0	5.6 \pm 8.8	10/7	70.0	3.1 \pm 3.3
Feb/2011	11/9	81.8	6.9 \pm 6.2	11/6	54.5	3.7 \pm 2.6
Mar/2011	15/13	86.7	8.5 \pm 9.6	15/9	60.0	2.3 \pm 1.9
Apr/2011	21/4	19.0	5.8 \pm 4.9	21/14	66.7	4.0 \pm 3.4
Total	202/142	70.3	7.9 \pm 11.6	202/120	59.4	3.9 \pm 4.4

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