DOI: 10.1590/1808-1657v69n4p0272002

CERCARIAE INFECTION IN PLANORBIDAE MOLLUSCS FROM THE FLOODPLAIN OF THE HIGH PARANÁ RIVER, BRAZIL

M.L.G.G. Dias[1], J.C. Eiras[2], M.H. Machado[1], G.T.R. Souza[1], G.C. Pavanelli[1]

[1]Universidade Estadual de Maringá, Departamento de Biologia, NUPELIA, Av. Colombo, 5790, CEP 87020-900, Maringá, PR, Brazil.

ABSTRACT

The outhous investigated the infection by cercariae of molluscs collected from the floodplain of the high Paraná river, Brazil. A total of 4,620 specimens of Planorbidae molluscs were sampled, including *Biomphalaria peregrina*, *Physa cubensis*, and *Ampullaria* sp. Only the *B. peregrina* specimens released cercariae, after artificial exposure to light. The cercariae were identified as *Apharyngostrigea* sp., three forms that belong to the group Strigeidae / Diplostomidae, one form that belongs to the Strigeidae and another one that belongs to the Diplostomidae.

KEY WORDS: Brazil, cercariae, Digenea, Paraná river, Planorbidae molluscs.

RESUMO

INFECÇÃO POR CERCÁRIAS DE MOLUSCOS PLANORDÍDEOS DA PLANÍCIE DE INUNDAÇÃO DO ALTO RIO PARANÁ, BRASIL. Estudou-se a parasitose de moluscos coletados na planície de inundação do alto rio Paraná, Brasil, por cercárias. Foi coletado um total de 4.260 moluscos planorbídeos, distribuídos em *Biomphalaria peregrina*, *Physa cubensis* e *Ampullaria* sp. Apenas os exemplares de *B. peregrina* liberaram cercárias depois de expostos a luz artificial. As cercárias obtidas foram identificadas como *Apharyngostrigea* sp., três formas pertencendo ao grupo Strigeidae / Diplostomidae, uma forma pertencendo aos Strigeidea, e outra aos Diplostomidae.

PALAVRAS-CHAVE: Brasil, cercarias, Digenea, moluscos planorbídeos, rio Paraná.

INTRODUCTION

The digenetic trematodes are parasites which have a heteroxenous life cycle. Most of the species have the molluscs as first intermediate hosts, which are infected by several larval stages, including the cercariae. This stage is very important for the completion of the life cycle of the parasite, because after release from the molluscs they swim till contact with a new host species.

In Brazil, there are a number of papers dealing with the occurrence of cercariae infecting molluscs (MENDEZ, 1981, 1982; MACHADO et al., 1987; PARAENSE, 1986 a,b; DIAS, 2002). Most of these studies are about the species which are important for human health, like *Schistosoma mansoni* (LIMA & LUZ, 1960; LUZ et al., 1998), or animal health, like *Fasciola hepatica* (LUZ et al., 1996). The biology of other species is mostly unknown.

The floodplain of the high Paraná river has biotic and abiotic conditions that favour the life cycle of digenetic trematodes (DIAS, 2002). Despite the report about the distribution of Planorbidae molluscs within Paraná State (LUZ et al., 1998), the infection of molluscs by cercariae is almost restricted to the digenean species relevant for human or animal health.

Taking into account this lack of knowledge, and also the ecological importance of the digenetic trematodes, the authors made a study of the cercariae infecting molluscs from the floodplain of the high Paraná river, from which the results are presented in this paper.

MATERIAL AND METHODS

Due to the great diversity of the habitats on the floodplain of the high Paraná river (22º50' – 22º70'S and 53º15'- 53º 40'W) the sampling was done in the lentic environments Lagoa das Garças, Lagoa Pousada, Lagoa Figueira, Ressaco do Leopoldo and Ressaco do "Pau Véio", and in the semi-lotic environment (river Baía).

[2]Departamento de Zoologia e Antropologia, Faculdade de Ciências, Universidade do Porto, Porto, Portugal

The sampling of molluscs was performed between June, 1999 and June, 2000. The sampling included the species *Biomphalaria peregrina* D'Orbigny, 1835 (4,022 specimens), *Physa cubensis* Pfeiffer, 1839 (299), and *Ampullaria* sp. (299).

Immediately after sampling, the molluscs were exposed to artificial light in order to induce the release of cercariae. The exposure was done in two ways: individually, in small Petri dishes, and by exposing groups of about 20 specimens to the light. After the exposure the molluscs were maintained in aquaria, fed *ad libitum* with lettuce, and exposed again to light every week over a one-month period.

The cercariae were observed alive. After fixation in hot formalin at 10% the specimens were stained with diluted neutral red and, subsequently, observed for measuring. Their identification was carried out according to OSTROWSKIDE NÚÑEZ (1992). The cercariae were identified at the family level and, in some cases, the identification of the genus was possible.

RESULTS

From all the molluscs collected, only *B. peregrina* (0.75% of the specimens) released cercariae. All the cercariae were furcocoercous of the genera *Clinostomum* and *Apharyngostrigea*, and the group Strigeidae / Diplostomidae. Their dimensions are depicted in Table 1. The description of the cercariae of *Clinostomum* sp. was already reported by DIAS (2002) as part of the study of the life cycle of the parasite within the area.

***Apharyngostrigea* sp. (Fig. 1).**

The body was typically of a furcocoercus cercariae having the caudal trunk wider than the body, and relatively short furcae. Caudal corps (transparent cells which store glycogen) were not present. Six pairs of penetration glands located antero-laterally to the acetabulum, and eight pairs of protonefridia in the body, and two pairs of protonefridia in the caudal trunk were observed. The specimens had a vibratory movement. In the resting periods they had the body contracted and a rectilinear caudal trunk, with the furcae forming a small angle. The specimens survived for approximately 24 hours after the exposure of the molluscs to the light.

Remarks: the adults of this genus infect preferentially birds from the family Ardeidae.

Strigeidae/Diplostomidae

The other five types of cercariae had a well-developed oral sucker, an intestinal cecae well-developed, the penetration glands located before the acetabulum, and the primordium of the sexual organs located in the body. Two to six pairs of protonefridia, and caudal corps, were located in the trunk.

Remarks: the final hosts for the species from both families are mainly the birds and the mammals. The cercariae are usually found in freshwater gastropods, and they have in the caudal trunk longitudinal and circular muscles. Some species have caudal corps. The furcae have muscular fibbers, which are important for the locomotion of the specimens. The excretory channel, which opens in the middle of the furca, is an important systematic feature.

Strigeidae/Diplostomidae 1 (Fig. 2)

The body was narrow and had two pairs of penetration glands, located before the acetabulum, one over the other. The excretory system was composed by five pairs of protonefridia located in the body, and two pairs located in the caudal trunk. The caudal trunk was narrow and had two pairs of caudal corps. The excretory channel opened in the internal face of the furcae, in a median position. In the resting specimens the body and caudal trunk were straight and the furcae formed a small angle.

Strigeidae/Diplostomidae 2 (Fig. 3)

The body was elongated and oval, and it had three pairs of penetration glands located antero-laterally to the acetabulum, and six pairs of protonefridia. The caudal trunk had five pairs of caudal corps and one pair of protonefridia. The excretory channel opened internally, in a post-median part of the furcae. In the resting specimens the furcae formed an obtuse angle, and the body and caudal trunk remained straight.

Table 1 - Morphometry of the cercariae released by *Biomphalaria peregrina* from the floodplain of the high Paraná river.

Cercaria type	Body (L x W)	Caudal trunk (L x W)	Furcae (W x W)
Apharyngostrigea sp.	218.00 x 32.72	589.00 x 41.91	333.00 x 15.63
Strigeidae / Diplostomidae 1	17.10 x 5.00	5.00 x 3.07	5.00 x 0.75
Strigeidae / Diplostomidae 2	49.00 x 33.00	56.00 x 19.00	51.00 x 11.00
Strigeidae / Diplostomidae 3	157.87 x 33.08	230.31 x 28.38	182.33 x 7.16
Strigeidae	197.50 x 50.00	300.00 x 41.80	300.00 x 20.00
Diplostomidae	84.93 x 20.10	146.97 x 18.11	142.35 x 8.83

L: length; W: width. Value

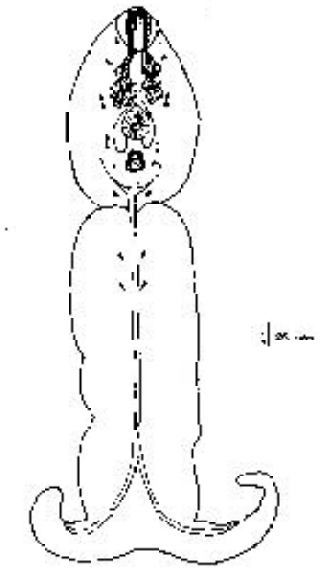

Fig. 1 - Cercaria of *Apharyngostrigea* sp.

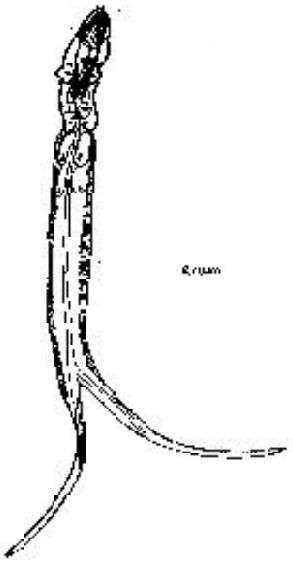

Fig. 2 - Cercaria of Strigeidae / Diplostomidae type 1.

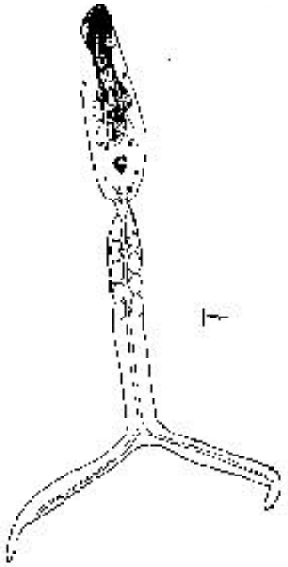

Fig. 3 - Cercaria of Strigeidae / Diplostomidae type 2.

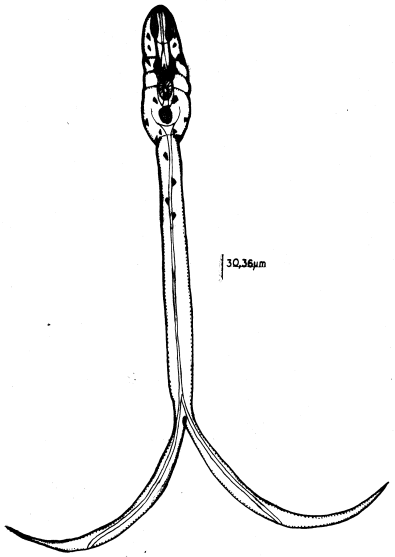

Fig. 4 - Cercaria of Strigeidae / Diplostomidae type 3.

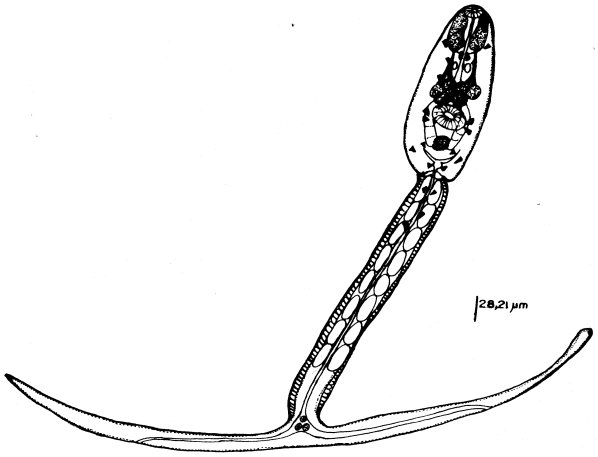

Fig. 5 - Cercaria of Strigeidae.

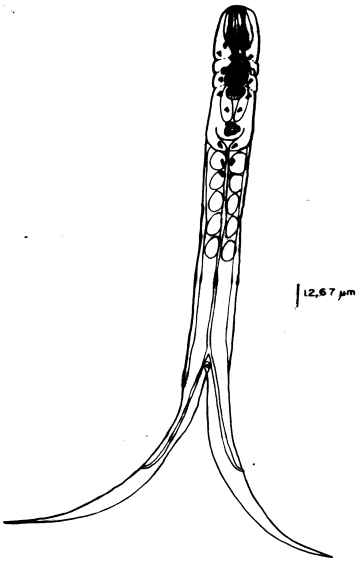

Fig. 6 - Cercaria of Diplostomidae.

Strigeidae/Diplostomidae 3 (Fig. 4)

The body was arched, and it had two pairs of penetration glands located antero-laterally to the acetabulum, and eight pairs of protonefridia. In the caudal trunk there were two pairs of protonefridia. Caudal corps were not observed. The excretory channel opened in the median region of the inner wall of the furcae. In the resting specimens the body was bent, the caudal trunk was straight, and the furcae formed an acute angle.

Strigeidae (Fig. 5)

The body was oval and elongated, and it had three pairs of penetration glands located before the acetabulum, not pigmented eyespots, and eight pairs of protonefridia. The caudal trunk had eight pairs of caudal corps, and two pairs of protonefridia. The excretory channel opened in the middle of the inner side of the furcae. In the resting specimens the furcae formed an angle of about 180º, and the body and trunk were straight forming an angle of about 90º with the furcae.

Diplostomidae (Fig. 6)

The body was narrow, and it had two pairs of penetration glands and six pairs of protonefridia. The caudal trunk was straight, and it had two pairs of protonefridia. Caudal corps were not observed. The excretory channel opened externally in the furcae. In the resting specimens the caudal trunk was straight, the body was slightly bent, and the furcae formed an acute angle.

DISCUSSION

The study of the digenean larval stages, both cercariae and metacercariae, is important. The necessary control measures, namely for the species important to human health, require the identification of the several stages of the parasite, the knowledge of the life cycles, and the way to distinguish the different parasites which infect the same host (Ostrowski de Núñez, 1992). Therefore, there is the need to identify the larval stages of all the digenetic trematodes, even of those which are not so important, because of the possibility of competition for the same intermediate hosts.

From the three mollusc species we observed only *B. peregrina* was infected by cercariae. However, taking into consideration that the prevalence of the infection was low (0.75%), and that the number of the other mollusc species observed was relatively low, the possibility of infection in these species cannot be ruled out.

The prevalence of the infection of *B. peregrina* (0.75%), and the specific diversity of the cercariae released (7 species), were quite low when compared with the records of the digenetic trematodes in fishes and birds from the same area. Pavanelli et al. (1990, 1997) and Almeida (1998) reported several species of metacercariae and adult digeneans in fish. Machado (2000) found fifteen species of Diplostomidae in the bird *Phalacrocorax brasilianus*. Extekoetter (2000) observed, in *P. brasilianus*, seven species belonging to the Strigeidae / Diplostomidae, as well as four species in *Egretta alba*, and two species in *E. thula*.

The great diversity of infection in both the second intermediate and definitive hosts suggests the existence of other species of first intermediate hosts. This conclusion is also supported by the peculiar ecological conditions of the floodplain of the high Paraná river, which represents a complex hydrological system. During the flood the plain is almost completely inundated, and during that time the high amount of water causes an increase of productivity (Veríssimo, 1999). After the flow out of the water numerous lagoons are formed, where the fluctuant macrofita are very abundant (Veríssimo, 1994). Therefore, there are good conditions for the development of molluscs and fish. Moreover, the abundance of fish attract a large number of fish-eating birds, especially in the dry season, which create good conditions for the perpetuation of the life cycle of the digenetic trematodes.

References

Almeida, S.C. *Aspectos ecológicos dos endohelmintos parasitos de Hoplias malabaricus (Bloch, 1794) (Osteichthyes, Erythrinidae) do alto rio Paraná, região de Porto Rico, Paraná, Brasil.* Maringá: 1998. 50p. [Dissertação (Mestrado) – Universidade Estadual de Maringá].

Dias, M.L.G.G. *Ciclo de vida e aspectos ecológicos de* Clinostomum complanatum *(Rudolphi, 1814) (Trematoda: Clinostomidae).* Maringá: 2002. 73p. [Tese (Doutorado) – Universidade Estadual de Maringá].

Extekoetter, D. *Levantamento da fauna helmíntica do trato intestinal de três espécies de aves aquáticas da planície de inundação do alto rio Paraná.* Maringá: 2000. 19p. [Monografia – Universidade Estadual de Maringá].

Lima, E.C. & Luz, E. Mollusca Planorbidae: sua distribuição no estado do Paraná. *An. Fac. Méd. Univ. Paraná*, v.3, n.1-2, p.17-23, 1960.

Luz, E., Cirio, S.M., Diniz, J.M.F., Leite, L.C., Kozemjakin, D.A. & Werka, L. Infecção experimental de *Lymnea columella, Physa cubensis* e *Physa marmorata* com miracídios de *Fasciola hepatica*, provenientes de gado das regiões metropolitanas de Curitiba e do litoral paranaense, Brasil. *Arq. Biol. Tecnol.*, v.39, n.2, p.401-408, 1996.

Luz, E., Silva, S.M., Carvalho, A.P. & Castro, N. Atualização da sistemática e distribuição geográfica dos planorbídeos (Gastropoda, Pulmonata) no estado do Paraná (Brasil). *Acta Biol. Para.*, v.27, n.1-4, p.39-55, 1998.

MACHADO, M.H. *Estrutura da infracomunidade de helmintos de biguás,* Phalacrocorax brasilianus *(Gmelin, 1789) (Aves: Perciformes), coletados na planície de inundação do alto rio Paraná, PR*. São Carlos: 2000. 109p. [Tese (Doutorado) – Universidade Federal de São Carlos].

MACHADO, S.P.M., CORDEIRO, N.S., ARTIGAS, T.A. & MAGALHÃES, L.A. Algumas considerações sobre cercárias naturalmente encontradas em *Biomphalaria teganophila* (Orbigny) capturadas em Louveira, SP. *Mem. Inst. Butantan*, v.49, n.3, p.79-86, 1987.

OSTROWSKI DE NÚÑEZ, M. Trematoda. Familias Strigeidae, Diplostomidae, Clinostomidae, Schistosomatidae, Spirorchidae y Bucephalidae. *Fauna de Agua Dulce de la Republica Argentina*, v.9, n.1, p.1-55, 1992.

PARAENSE, W.L. *Lymnea columella*: two new brasilian localities in the states of Amazonas and Bahia. *Mem. Inst. Oswaldo Cruz*, v.81, n.1, p.121-123, 1986a.

PARAENSE, W.L. *Physa marmorata* Guilding 1828 (Pulmonata, Physidae). *Mem. Inst. Oswaldo Cruz*, v.81, n.4, p.459-469, 1986b.

PAVANELLI, G.C., SCHAEFFER, G.V., SANTOS, M.S. Ocorrência e histopatologia de *Ithyoclinostomum dimorphum* (Diesing, 1850) (Trematoda: Clinostomatidae) em traíras coletadas no rio Paraná. *Unimar*, v.12, n.1, p.69-75, 1990.

PAVANELLI, G.C., MACHADO, M.H. & TAKEMOTO, R.M. Fauna helmíntica de peixes do rio Paraná, região de Porto Rico, PR. In: VAZZOLER, A.E.A.M.; AGOSTINHO, A.A.; HAHN, N.S.(Ed.) *Planície de inundação do alto rio Paraná: aspectos físicos, biológicos e socioeconómicos*. Maringá: EDUEM, 1997. p.307-329.

MENDEZ, V.L. Cercárias em *Biomphalaria teganophila* (Orbigny, 1835) (Mollusca, Planorbidae) de Guaíba, Rio Grande do Sul, Brasil. *Iheringia, Ser. Zool*, v.60, p.3-12, 1981.

MENDEZ, V.L. Cercárias em moluscos planorbídeos de Camaqua, Rio Grande do Sul, Brasil. *Rev. Brasil. Biol.*, v.42, p.545-551, 1982.

VERÍSSIMO, S. *Variações na composição da ictiofauna em três lagoas sazonalmente isoladas na planície de inundação do alto rio Paraná, ilha de Porto Rico, PR – Brasil.* São Carlos: 1994. 77p. [Dissertação (Mestrado) – Universidade Federal de São Carlos].

VERÍSSIMO, S. *Influência do regime hidrológico sobre a ictiocenose de três lagoas da planície aluvial do alto rio Paraná.* São Carlos: 1999. 90p. [Tese (Doutorado) – Universidade Federal de São Carlos].

Received on 12/8/02
Accepted on 28/11/02