

***Galaxias maculatus* (Galaxiidae, Salmoniformes) infected with *Acanthostomoides apophalliformis* (Digenea, Platyhelminthes) in Southern Argentina. Pathology and absence of parasite induced mortality**

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Received: 09/11/2004
Accepted: 13/02/2006

Abstract

This study was conducted to analyze at histopathological level, lesions produced by *Acanthostomoides apophalliformis* in the native fish *Galaxias maculatus*, and relate them to quantitative results on parasite-induced fish mortality, in Lake Moreno, Southern, Argentina. Absence in most lesions of inflammatory reaction, unaltered hepatic parenchyma at a short distance from the foci of the lesions and viable appearance of parasites, all suggest a good reciprocal adaptation. This hypothesis is reinforced by data showing the absence of *A. apophalliformis*-induced mortality in the fish population.

Key-words:

Galaxias maculatus.
Acanthostomoides apophalliformis.
Histopathology.
Parasite - induced host mortality.

Introduction

Lesions produced by parasites on wild fish are usually studied at histopathological level, i.e. at individual level. Nevertheless, only a mortality study (a population level study), can show the ecological significance of individual lesions.

Anderson and Gordon¹ introduced a quantitative analysis for detecting signs of parasite-induced host mortality (PIHM) in fish populations. They used simulation experiments (Monte Carlo) and considered a decline in older fish of both parasite abundance and degree of aggregation of parasite frequency distribution (measured as the variance to mean ratio), to be clear signs of such a mortality. Furthermore, these authors pointed out that fish-metacercaria systems, are more reliable to detect PIHM by using their method, because parasite life spans are long in relation to that of their hosts, so that death of parasites results mainly from hosts death¹.

Acanthostomoides apophalliformis (Szidat) is a digenetic trematode whose liver dwelling metacercaria parasitizes “puyenes” *Galaxias*

maculatus (Jenyns), a small native fish under protection in Nahuel Huapi National Park and Reserve. Several papers report biological data both on *A. apophalliformis*'s and *G. maculatus*^{2,3,4,5,6,7,8}.

Although a high abundance of *A. apophalliformis* infecting “puyenes” in Lake Moreno (mean intensity range, 1.8 – 4.4 ; prevalence range, 41.4 -96.7 %), has been reported⁴, there are no studies on pathology and PIHM in this host-parasite system.

We analyzed at histopathological level, lesions produced by *A. apophalliformis* in *G. maculatus* in Lake Moreno, Southern Argentina, and related them to parasite-induced host mortality.

Materials and Methods

The study was carried out at Lake Moreno, in the Nahuel Huapi National Park and Reserve (40° 08'-41° 35' S; 71° 02'-71° 57' W), Southern Argentina. A total of 477 *G. maculatus* were captured by using baited traps on January 2001 and processed in the laboratory by one of us⁹. One part of the information gathered from these fish was

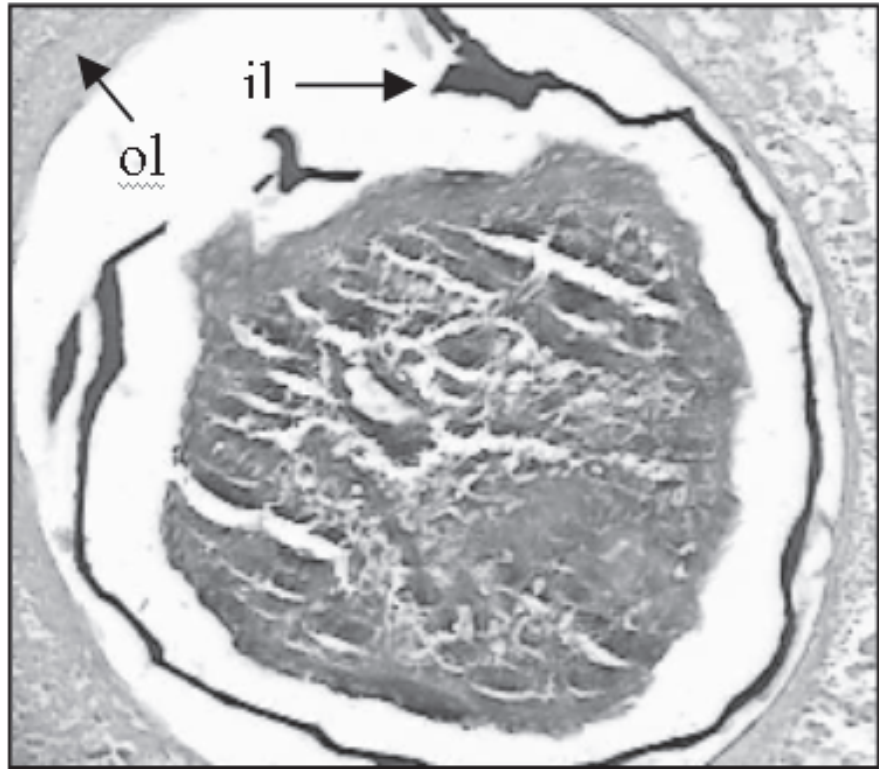


Figure 1 - Section of *Acanthostomoides apophalliformis* metacercaria showing inner (il) (PAS +, parasite origin) and outer (ol) (PAS -, produced by the host) layers of the capsule (PAS, x 100).

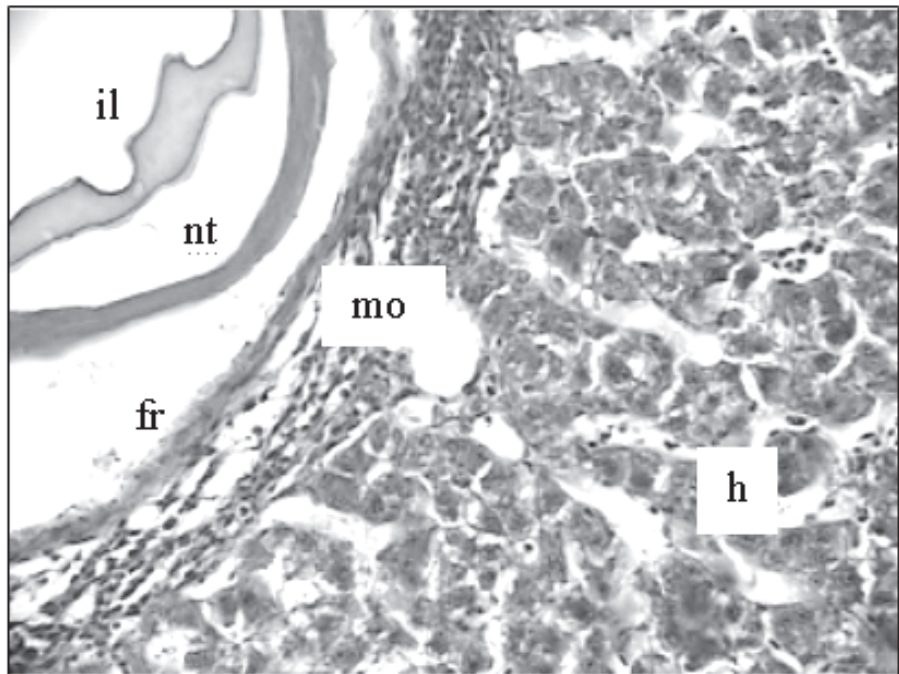


Figure 2 - Section showing a lesion produced by *Acanthostomoides apophalliformis* in the liver of *Galaxias maculatus*, il as in Figura. 1, h = normal hepatocytes, nt = host tissue with necrotic aspect, fr = fibroblastic reaction, mo = mononuclear cells (H & E, x 200).

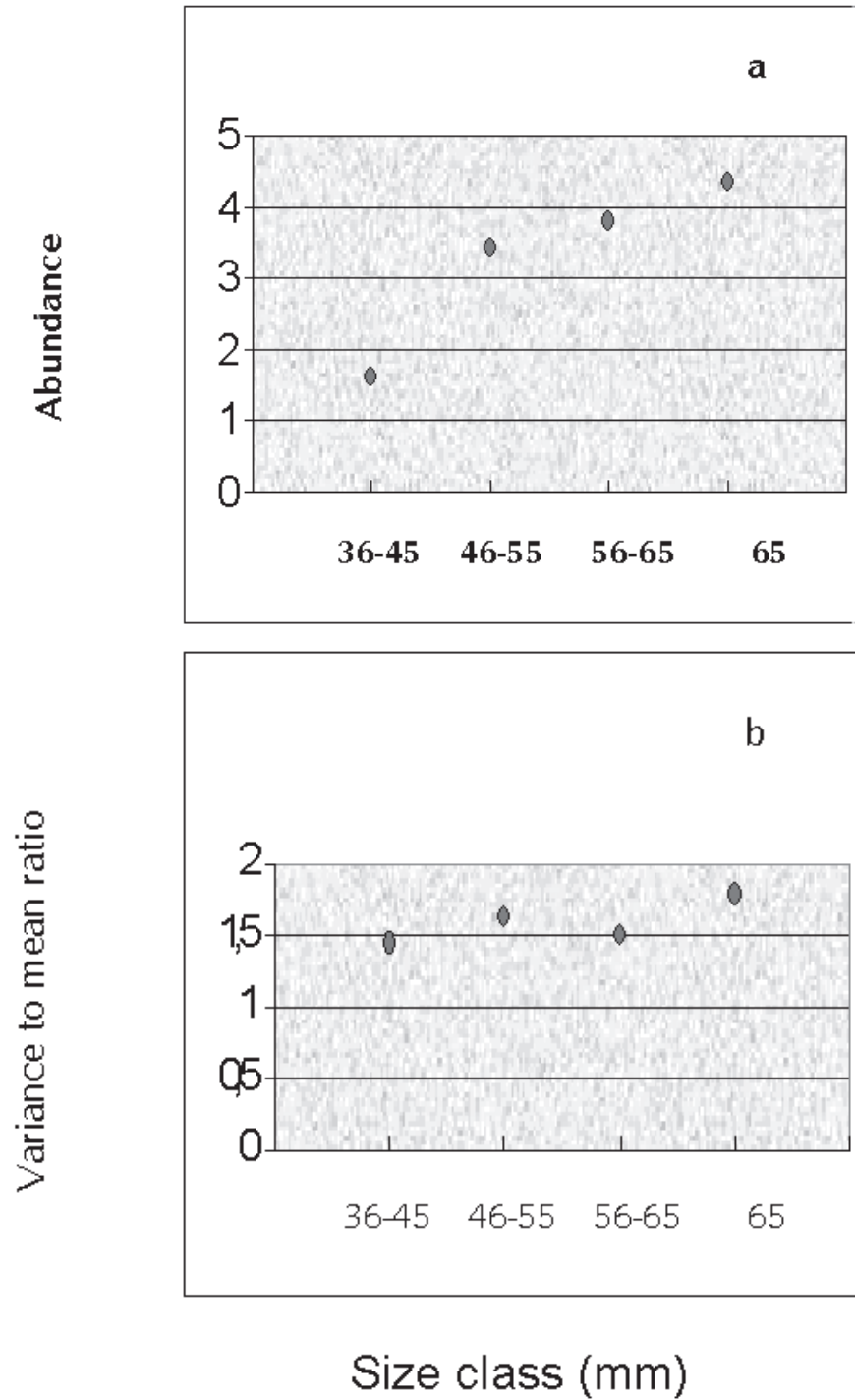


Figure 3 - Variation of parameters for detecting parasite-induced host mortality according to host size (taken as age indicator) for *Galaxias maculatus* from Lake Moreno. a: abundance; b: variance to mean ratio

used for an other study⁹, and the rest was used for the present one. In the lab, all the fish were dissected under stereomicroscope to collect and count *A. apophalliformis* but only 20 of them were studied for histopathology. The livers were fixed in 10% buffered formalin, or in Carnoy's fluid. After fixation, they were embedded in paraffin wax, sectioned at 5-7 μ m and stained with haematoxylin and eosin (H&E), or Schiff's periodic acid (PAS).

In the present study we define abundance as N° parasites/examined fish (including fish without parasites in the calculation) and mean intensity as mean N° parasites/infected fish².

Results and Discussion

Up to 13 encapsulated metacercariae of *A. apophalliformis* were found in the hepatic parenchyma of "puyenes". Metacercarial capsules showed two layers, the inner layer being a cyst wall of parasite origin, with a positive PAS reaction, and the outer layer being formed by the host and consisting of fibrous connective tissue (Figure 1).

Independently of the number of metacercariae, inflammatory reaction was absent in most cases (17 of 20 fish) and the hepatic parenchyma was unaltered a short distance from the foci of the lesions (Figure 2). Weak inflammatory reactions were observed in three specimens (Figure 2).

Pathological findings differ from others on "puyenes" infected with the same parasite in Chile where lesions with more degenerative changes in the hepatic parenchyma were observed^{7,11}.

***Galaxias maculatus* (Galaxiidae, Salmoniformes) infectados com *Acanthostomoides apophalliformis* (Digenea, Platyhelminthes) no Sul da Argentina. Histopatologia e ausência de mortalidade induzida**

Resumo

Este estudo foi conduzido para analisar ao nível histopatológico, lesões produzidas por *Acanthostomoides apophalliformis* no peixe nativo *Galaxias maculatus*, e relacioná-las com os resultados do mortalidade induzida por parasitas na população dessa espécie, no lago Moreno,

Absence of a chronic inflammatory response and the viable aspect of the parasites in all the lesions strongly suggest a good mutual adaptation between host and parasite. This hypothesis is further reinforced at population level with the PIHM analysis. Figure 3 shows that mean abundance of parasites increased steadily with size (as age indicator) of fish (a), whereas variance to mean ratio increased from size class 36-45 to size class 46-55 mm, decreased in size class 56-65 mm and increased again in size class > 65 (b). This pattern clearly differs from that shown by Anderson and Gordon¹, of "convex" or "peaked" curves of parasite abundance, declining concomitantly with the variance to mean ratio in older fish. It is therefore concluded that lesions do not induce significant mortality in the "puyenes" population studied. This result agrees with findings for *Tylodelphys bariloehensis*, an other native trematode infecting "puyenes" in the metacercaria stage¹². Nevertheless it does not agree with the mortality suggested by results of Revenga¹³ for rainbow trout *Oncorhynchus mykiss*, infected by the cestode *Diphyllobotrium dendriticum*, both fish and parasite species being introduced.

The fact that both fish and parasites are native, high parasite abundance (prevalences: 41.4-96.7 %) reported⁹, lack of inflammatory reaction in most cases and absence of PIHM, all suggest that the system has coevolved according to a mutualistic model¹⁴.

Acknowledgements

We thank M. Beveraggi owner of the fish farm, L. Samengo for taking pictures and valuable advice and A. Ruffini for her assistance in the laboratory.

Palavras-chave:

Galaxias maculatus.
Acanthostomoides apophalliformis.
Histopatologia.
Mortalidade induzida por parasitas.

Parque Nacional Nahuel Huapi, Argentina. A ausência de inflamação na maioria das lesões, o fígado sem alterações em uma distância curta do foco das lesões e a aparência viável dos parasitas, sugerem uma boa relação parasita-hospedeiro. Esta hipótese é reforçada pelos dados que mostram a ausência de mortalidade induzida por *A. apophalliformis* na população dos peixes.

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