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A N I N T E R N A T I O N A L J O U R N A L

Nematode Parasites of Pescada Gó, *Macrodon ancylodon* Bloch and Schneider, 1801 (Osteichthyes, Sciaenidae), from Vila dos Pescadores, Bragança-PA, Brazil

Rodrigo Yudi Fujimoto[1*], Aline de Melo Braun Sarmento[2], Daniel Guerreiro Diniz[3] and Jorge Costa Eiras[4]

[1]Embrapa Tabuleiros Costeiros; Av. Beira Mar, 3250; 49025-040; Aracaju – SE - Brasil. [2]Laboratório de Ictioparasitologia e Piscicultura; Universidade Federal do Pará; Alameda Leandro Ribeiro s/n; Bragança - PA - Brasil. [3]Laboratório de Investigações em Neurodegeneração e Infecção; Instituto de Ciências Biológicas; Universidade Federal do Pará; Hospital Universitário João de Barros Barreto; Rua dos Mundurucus, 4487; 66073-000; Belém - PA - Brasil. [4]Departamento de Biologia; Faculdade de Ciências; Universidade do Porto; Rua do Campo Alegre s/n; 4169-007; Porto - Portugal

ABSTRACT

The objective of this work was to evaluate the host/parasite relationship of nematodes in Macrodon ancylodon. Ninety seven fishes (50 in wet season and 47 in dry season) were weighed (167.1 ± 109.9g) and measured (28.3 ± 5.2cm). Only twelve specimens were not infected by any parasites and the prevalence of infection was 87.6%. The highest prevalence values were observed in August and September (dry season, 100%). The stomach was the most infected organ during the whole months (prevalence of 64.2%, and mean intensity of 4.6±7.8 parasites/fish), and the medium intestine showed the lowest infection (prevalence 27.3% and mean intensity 2.5±2.1 parasites/fish). The nematodes were identified as Raphidascaris *sp.,* Goezia *sp. and* Cucullanus *sp. Only the male and juvenile fishes could be presented different values of infection according to rainfall, being more infected in August to October. The female hosts presented higher values of abundance and mean intensity of infection ($p<0.01$) throughout the year.*

Key words: Macrodon ancylodon, Pescada Gó, *Nematodes, Raphidascaris sp., Goezia sp., Cucullanus sp.*

INTRODUCTION

In the coast of the Northeast of Pará State, commonly named as "Salgado Paraense", fishes are abundant and some species are greatly appreciated, getting high market prices (Isaac et al. 2005). "Pescada Gó", *Macrodon ancylodon* is the only Sciaenidae present in the north and northeast regions of the country (Nunes et al. 2004) and includes two genetically different species although morphologically indistinguishable (Santos et al. 2006). They may reach about 40 cm in length, are carnivorous and the crustaceans decapodes and fishes of gobiidae family are their preys (Piorski et al. 2004). Others aspects of their biology have been elucidated by Nunes et al. (2004), Espírito Santo et al. (2005), Castro (2000), Leal and Bemvenut (2006) and Haimovici et al. (2005). This species is highly appreciated for consumption and is abundant all the year round in the northeast region of Pará. Due to these reasons, it is a highly economically important species for the region (Espírito Santo et al. 2005, Oliveira 2005).

In spite of the knowledge of several aspects of the biology of this species, practically nothing is known about its parasites. The lack of information

*Author for correspondence: ryfujim@hotmail.com

must be corrected once the fish parasites can be important for the wild and farmed fishes, as well as some parasite species (namely worms) may infect humans if the fish is ingested raw or undercooked.
This study evaluated the host/parasite relationship of nematodes in *M. ancylodon* captured in northeast Pará region.

MATERIALS AND METHODS

Fish were collected between April and October 2007 with aid of traps at Vila dos Pescadores, Bragança city-PA (00° 50' 57'' S and 046° 35' 46'' W); 50 fishes were caught in April, May and June, and 47 in August, September and October. The specimens were sacrificed, weighed, measured and transported to the laboratory where they were frozen (-4°C) until further necropsy for parasitological examination. The inspection of fishes was done according to Eiras et al. (2006), and the stomach, anterior intestine, medium intestine and posterior intestine were examined separately.
The parasites were fixed in AFA and stained with lugol according to Amato et al. (1991), mounted with permount and identified according to Thatcher (2006) and Moravec (1994). The mean intensity, prevalence and abundance were calculated according to Bush et al. (1997).
In order to study the relationship of the infection with the environmental conditions, the rainfall data from the meteorological station of Tracuateua-PA was used to determine the dry and wet seasons during the sampling time, according to Schaelfer-Novelli and Cintrón (1986).
For statistical evaluation of data, the t test was used to compare infection between sexes in dry and wet season, Tukey test was employed to compare the mean weight and length of the specimens, and Linear Correlation of Pearson was used to verify the relationship between the size of the fishes and infection in the different organs. The data were submitted at normality test extreme values basis (out liers) which, when present, were eliminated from the tests.

RESULTS

According to the meteorological data, the dry season was comprised between August to October (precipitation under 100 mm of rain), and the wet season between February to July (precipitation higher than 100 mm of rain).

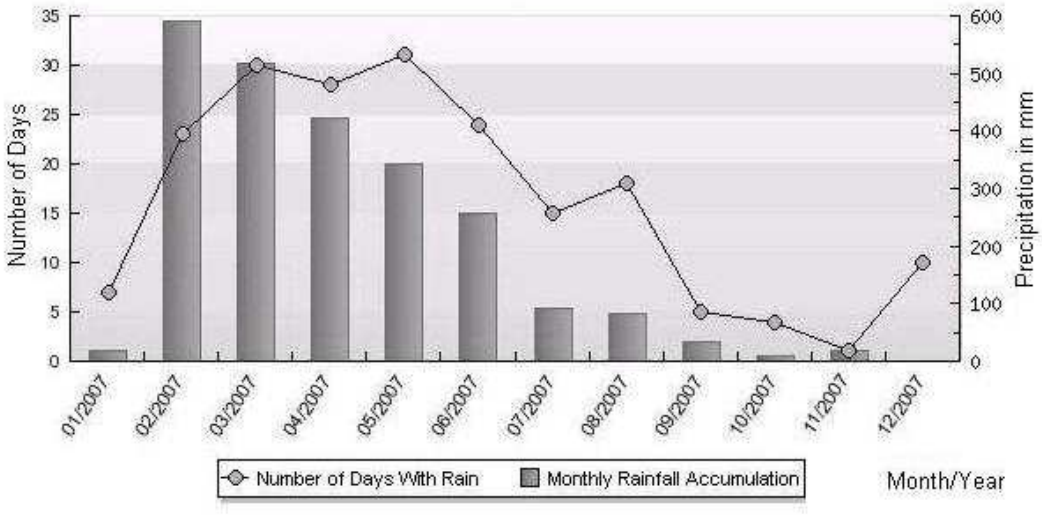

Figure 1 - Monthly precipitation (mm) and number of raining days during 2007.

A total of 19 males (standard length: 21.6 ± 4.0 cm; total length: 26.6 ± 4.1 cm; mean weight: 176.8 ± 95.2 g), 42 females (standard length: 22.2 ± 3.7 cm, total length: 27.5 ± 4.1 cm, mean weight: 202.8 ± 125.9 g), and 36 juveniles (standard length: 18.5 ± 3.9 cm, total length: 23.1

± 3.8 cm, mean weight: 117.5 ± 74.5 g) were captured. Eighty five out of the 97 specimens examined (87.6%) were infected, 63 specimens presented nematodes in the digestive tract and 20 specimens were infected simultaneously by nematodes and not identified digenetic trematodes.
The nematodes were identified as belonging to the genera *Raphidascaris* and *Goezia* (Anisakidae), and *Cucullanus* (Cuccullanidae).
The characteristics of the specimens of the three genera are indicated in Table 1.
Table 2 shows the features of the infection (number of fish infected, intensity of infection, mean intensity of infection and prevalence). The stomach and the posterior intestine were more infected than the other parts of the digestive tract, while the anterior and medium intestine were not heavily infected.
Concerning the association of the parasites of different sites, the parasites found in the stomach and posterior intestine were positively correlated, as well as the parasites of medium and posterior intestine were also positively correlated (Table 3).

Table 1 - Mean values (mm) and standard deviation of the total length, width, oesophagus length and spicules length of *Goezia* sp., *Raphidascaris* sp. and *Cucullanus* sp. infecting *Macrodon ancylodon.*

Genus	Total length	Body width	Esophagous length	Spicules length
Cucullanus sp.	5.9 ± 0.2	0.49 ± 0.01	1. 14 ± 0.1	1.1 ± 0.6
Goezia sp.	9.9 ± 4.2	0.78 ± 0.5	0.7 ± 0.0005	0.9 ± 0.3
Raphidascaris sp.	15.0 ± 0.7	0.33 ± 0.1	0.4 ± 0.06	----

Table 2 - Site of infection (number of fish infected, intensity of infection, mean intensity of infection and prevalence) by nematodes in the digestive tract of *Macrodon ancylodon*.

Organ infected	Number of fish infected	Intensity of infection	Mean intensity of infection	Prevalence (%)
Stomach	61	284	4.6± 7.8	64.2
Anterior intestine	39	92	2.3± 2.4	42.0
Medium intestine	26	67	2.5± 2.1	27.3
Posterior intestine	40	175	4.7± 4.4	42.1

Table 3 - Values of R^2 obtained in the matrix of linear correlation between the size (standard length, total length, and weight) of *Macrodon ancylodon* and the infestation indexes in each infected organ (significant values in bold and underlined).

Standard Parameters	Weight	Length	Total Length	Stomach Nematodes	Anterior Intestine Nematodes	Medium Intestine Nematodes	Posterior Intestine Nematodes
Weight	1.0000	---	---	---	---	---	---
Standard Length	0.8276	1.0000	---	---	---	---	---
Total Length	0.8495	0.9711	1.0000	---	---	---	---
Stomach Nematodes	0.1567	0.1633	0.1824	1.0000	---	---	---
Anterior Intestine Nematodes	0.0069	0.0095	0.0224	0.0003	1.0000	---	---
Medium Intestine Nematodes	-0.0555	0.0128	0.0216	-0.0178	0.0163	1.0000	---
Posterior Intest. Nematodes	0.1215	0.1498	0.1610	0.5781	0.0009	0.5894	1.0000

The abundance and mean intensity of infection were higher in the female fish ($p<0.01$), but the prevalence did not show significant differences between sexes (Table 4).

Concerning the relationship of infection and rainfall, it was observed that in the males and juveniles, the infestation values were significantly higher ($p<0.01$) in the dry season (August to October). However, for the female specimens, the prevalence value did not presented significant difference for the rainfall, and was quite similar throughout the year (Table 5).

Table 4 - Mean abundance, mean intensity and prevalence (%) of infection for juveniles, males and females of Macrodon ancylodon.

	Abundance	**Intensity**	**Prevalence**
Juveniles	4.80+17.26	5.76+17.26	86.11
Males	3.26+10.48	3.87+10.48	84.21
Females	9.64+74.32	16.94+74.32	88.09

Table 5 - Prevalence (%) and of mean intensity of infection in *Macrodon ancylodon* at relationship related to rainfall.

	Juveniles prevalence	**Males prevalence**	**Females prevalence**
Dry season	91.66	92.3	86.95
Wet season	83.33	83.33	89.47

DISCUSSION

This work constitutes the first report on the presence of three genera of nematodes in *M. ancylodon* captured in Pará. In Rio de Janeiro state other three different species were described for this host. The fishes in the south of Brazil were parasitized by the nematodes *Hysterothylacium* sp., *Cucullanus* sp. and *Terranova* sp. larvae (Sabas and Luque 2003). The presence of many species of nematode larvae infecting this host was due the bentopelagic habit and the intermediate position of this species on the food web (Sabas and Luque 2003). The high prevalence value (87.6%) indicated that the fish predated actively the intermediate invertebrate hosts. Juras and Yamaguti (1985) reported that the species consumed invertebrates actively through the year.

The statistical data showed that the feeding preferences concerning the intermediate host were not different between males and females, and similar results were found by Piorski et al. (2004). However, female fishes apparently predated more intensely the intermediate hosts as observed by the significant higher values of the abundance and mean intensity of infection. In a study by Juras and Yamaguti (1985) the females presented higher values of relative frequency of stomach fullness compared to the males and immature specimens.

It was interesting to note that the males and juveniles showed the highest prevalence and mean intensity in the dry season (August to October), while for the females there were no differences throughout the year. It mean that the juveniles predated more intensely in the dry season. This could be explained by the study of Juras and Yamaguti (1985) that reported that immature females consumed more preys in summer. The highest values of prevalence and mean intensity for the mature males could be explained by the fact that these values were obtained during the spawning season (Juras and Yamaguti 1985), a time of the year that provokes high energy demand, therefore favoring the infection. This infection/reproduction relationship was observed in stone loach (*Barbatula barbatula*) (Simková et al. 2005). Therefore, the differences in the parasitological indexes between the males and juveniles, and the females, could not apparently be attributed to the differences in the size of the hosts as observed by Sabas and Luque (2003), Luque and Poulin (2004) and Oliveira (2005), which found a direct relationship between the host size and the prevalence and abundance of the parasites. In the present case, the dry season apparently stimulated the predation of the intermediate hosts the juveniles and males. The females of *M. ancylodon* have several reproductive cycles throughout the year (Gurgel 2004),

therefore having higher nutritional demands than compared to the juveniles and males. This eventually explained a more intense predation activity, not related to season, and therefore could explain the similar prevalence values all the year round. The increased predation on the intermediate hosts lead to a cumulative infection higher than that observed in the males and juveniles which did not feed so actively.

The association of the parasites in the different parts of the digestive tract was difficult to explain. It was possibly associated to the more or less quick movements of the parasites into the digestive tract and the eventual displacement of parasites to the exterior of the intestine. More studies are necessary to clarify this question.

In general, the infection caused by the nematodes located outside the intestine of the host was more severe than that caused by the parasites within the gastro-intestinal tract. Several pathological conditions were observed for *Cucullanus* sp. in the intestine of flounders (Sindermann 1990), for *Cucullanus minutus* in the gut wall and mesenteric blood vessels of *Platichthys flesus* and *Pleuronectes platessa* (Janiszewska 1939, Margolis 1970), for *Goezia leporini* infecting the stomach of *Leporinus macrocephalus* (Martins et al. 2004), and *G. sinamora* and *G. pelagia* infecting the stomach of *Tilapia aurea* and *Rachicentron canadum* respectively (Deardorf and Overstreet 1980), and for *Raphidascaris acus* in the intestine of *Esox lucius* (Grabda 1989) and *Leuciscus cephalus cabeda* (Eiras and Reichenbach-Klinke 1982). In specimens of the present study, pathological conditions due to the infection by the nematodes were not observed. Even the abundance of parasites was not supposed enough to cause the blockage of the intestine. It could be assumed that some degree of exploitation of nutrients within the digestive tract existed but this could not be quantified.

Finally, it must be stressed out that some anisakid nematodes, like *Anisakis* spp., are dangerous parasites for the humans, if the fishes are eaten raw or undercooked (Cruz et al. 2010, Silva and Eiras 2003). The fishes in the present study were infected by these parasites, thus the probability of dangerous zoonotic infections through the consumption of raw *M. ancylodon* is not likely.

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