

Endoparasite fauna of *Brycon amazonicus* and *B. melanopterus* (Characidae, Bryconinae) from Negro and Solimões rivers, Amazon, Brazil

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ABSTRACT

Congeneric host species present similar biological and behavioral aspects, what may favor the presence of a similar parasite fauna. The aim of the present study was to compare the composition and structure of the parasite community from congeneric species, *Brycon amazonicus* and *B. melanopterus*, collected on the Negro and Solimões Rivers. The fish internal organs were longitudinally opened and analyzed under stereomicroscope. The examination revealed that *B. amazonicus* was parasitized by *Procamallanus* (*Spirocamallanus*) *inopinatus* (26.7% and 35.5%), *Contracaecum* type 2 (10% and 16.13%) and *Rhabdochona acuminata* (0% and 3.23%), prevalence values for Negro and Solimões River, respectively. The analysis of *B. melanopterus*, a fish species found only in the Solimões River, revealed *P. (S.) inopinatus* (33.3%), *Contracaecum* type 1 (60%) and *R. acuminata* (3.34%). These results indicate that the taxonomic proximity of the hosts was a stronger influence on the parasite species than external host environment.

KEYWORDS: Negro River, Solimões River, 'matrinxã', metazoan parasites, nematode.

Fauna endoparasitária de *Brycon amazonicus* e *B. melanopterus* (Characidae, Bryconinae) dos rios Negro e Solimões, Amazônia, Brasil

RESUMO

Espécies hospedeiras congêneras apresentam aspectos biológicos e comportamentais semelhantes, o que pode favorecer a presença de uma fauna de parasitas semelhantes. O objetivo do presente estudo foi comparar a composição e a estrutura da comunidade parasitária de espécies congêneras, *Brycon amazonicus* e *B. melanopterus*, coletados nos rios Negro e Solimões. Os órgãos internos dos peixes foram longitudinalmente abertos e analisados com o auxílio de estereomicroscópio. O exame revelou que *B. amazonicus* foi parasitada por *Procamallanus* (*Spirocamallanus*) *inopinatus* (26,7% e 35,5%), tipo *Contracaecum* 2 (10% e 16,13%) e *Rhabdochona acuminata* (0% e 3,23%), os valores de prevalência para os rios Negro e Solimões, respectivamente. A análise de *B. melanopterus*, uma espécie de peixe encontradas somente no Rio Solimões, revelou *P. (S.) inopinatus* (33,3%), *Contracaecum* tipo 1 (60%) e *R. acuminata* (3,34%). Estes resultados indicam que a proximidade taxonômica dos hospedeiros foi uma influência mais forte sobre as espécies de parasitas do que ambiente externo ao peixe.

PALAVRAS-CHAVE: Rio Negro, Rio Solimões, parasitos metazoários, 'matrinxã', nematóides.

The Bryconinae subfamily includes 74 nominal species, 42 of which are from the genus *Brycon*, an important group in almost all Brazilian river basins, with several examples used in the aquaculture industry (Bittencourt and Cox-Fernandes 1990; Gomes *et al.* 2000). Among these Bryconinae species are the ‘matrinxá’ *Brycon amazonicus* Spix and Agassiz, 1829, and *Brycon melanopterus* Cope, 1872, two congeneric species that present similar length (about 35 cm) and superposition on the feeding spectrum, with omnivorous behavior, feeding on fruits, seeds and arthropods (Santos *et al.* 2006). The similar diet may result on similar parasite faunas, as reported by a classic pattern, where the endoparasite species composition is influenced by the diet of the host (Dogiel 1961; Morand *et al.* 2000; Poulin 2011).

On the other hand, Santos *et al.* (2006) also found that these two *Brycon* species differ in some behavioral aspects, such as the sedentary behavior of *B. melanopterus*, while *B. amazonicus* performs reproductive migration on the flood season, also dispersing to the rivers during the dry season. Several studies have observed that the reproductive migration pattern of a host can be a determining factor in the composition and structure of parasite communities, as the short and long migrations performed by this species over its lifetime permit the fish to exploit diverse environments, increasing the possibility of infection/infestation by diverse species of parasites (Lizama *et al.* 2006). Consequently, these divergent migratory characteristics may affect the endoparasite fauna, as related species usually exhibit divergent characteristics that make the coexistence possible (Dogiel 1961; Balassa *et al.* 2004).

The parasite fauna of these *Brycon* species is not yet well known – as most of the published studies regarding the parasite fauna of the *Brycon* genus were conducted on fish farms or were based on taxonomic descriptions (Andrade *et al.* 2001; Lemos *et al.* 2007; Milanin *et al.* 2010).

The aim of the present study was to test the hypothesis that the parasite fauna of two congeneric species will be more similar than the parasite fauna of two different environments. For this, it was analyzed the main characteristics of the endoparasites community, such as richness, abundance, diversity and dominance, from two species of *Brycon* genus.

Thirty specimens of *B. melanopterus* and 31 specimens of *B. amazonicus* were collected in the Solimões River, on February 2012 and September 2013, respectively. Thirty one individuals of *B. amazonicus* were collected in the Negro River, on September 2013. All the collections were performed with help of local fishermen and some fishes were deposited in the collection of Nupélia.

After the taxonomic identification of fish, the parasitological procedures were performed according to Eiras *et al.* (2006). The use of the terms ‘component community’

and ‘infracommunity’, as well as the calculation of the prevalence, mean intensity, mean abundance and richness value, were all according to Bush *et al.* (1997). Prevalence is the number of hosts infected by a particular parasite species divided by the number of hosts examined. Mean intensity is the average intensity of a particular species of parasite among the infected host. Mean abundance is the total number of individuals of a particular parasite species in a sample of a particular host species divided by the total number of hosts of that species examined. The diversity was inferred according to the Brillouin index (H) to each infracommunity from each collection site (Zar 1996). These H values were statistically compared by Kruskal-Wallis analysis on the R program version 3.1.0 (significance level $p < 0.05$).

The analysis of the *B. amazonicus* demonstrated that this fish species presented a parasite richness of three species: *Procamallanus (Spirocamallanus) inopinatus* Travassos, Artigas and Pereira, 1928, *Contracaecum* type 2 of Moravec, Kohn and Fernandes, 1993 and *Rhabdochona acuminata* (Molin, 1860). While *P. (S.) inopinatus* was observed in all the collection sites, *R. acuminata* was found only on the Solimões River. The higher prevalence indices were observed in *B. amazonicus* and *B. melanopterus* from the Solimões River, but the mean intensities and mean abundances were quite similar in all the collection sites – except for the *R. acuminata*, which presented the highest mean intensity level (Table 1).

The analysis of the *B. melanopterus* internal organs revealed that this host also presented a parasite richness of three species: *P. (S.) inopinatus*, *R. acuminata* and *Contracaecum* type 1 of Moravec, Kohn and Fernandes, 1993. The parasite indexes demonstrated that *Contracaecum* type 1 was the most prevalent nematode observed for *B. melanopterus* collected on the Solimões River, followed by *P. (S.) inopinatus* (Table 1).

The higher prevalence levels were observed on *P. (S.) inopinatus* infecting *B. amazonicus* and *Contracaecum* larvae type 1 infecting *B. melanopterus*, both on Solimões River. *Rhabdochona acuminata* presented the lower levels of prevalence, with no record on Negro River.

The Brillouin index demonstrated that the most diverse fauna was observed on both host species, *B. amazonicus* ($H=0.29$) and *B. melanopterus* ($H=0.19$), collected on Solimões River, but the Kruskal-Wallis test revealed no statistical difference between the diversity of each host from each collection site ($p=0.27$; $H=3.94$), what corroborates the null hypothesis - the parasite diversity of the two collection sites was not statistically different. For *B. amazonicus*, there was a dominance of *P. (S.) inopinatus* on all the collection sites, while for *B. melanopterus* there was a dominance of *Contracaecum* type 1 (Table 1).

Table 1. Parasite fauna of *Brycon amazonicus* and *B. melanopterus* collected in Negro and Solimões River, with their respective infection sites, prevalence (P), mean intensity (MI) and mean abundance (MA). The hyphen means that the parasite species was not recorded in this host/local.

Parasite	Infection site	<i>Brycon amazonicus</i>						<i>Brycon melanopterus</i>		
		Negro River (n=31)			Solimões River (n=31)			Solimões River (n=30)		
		P (%)	MI	MA	P (%)	MI	MA	P (%)	MI	MA
<i>Procamallanus (Spirocamallanus) inopinatus</i>	Intestine	26.70	2.62 (±0.4)	0.70 (±0.3)	35.50	2.19 (±0.6)	0.77 (±0.3)	33.33	1.3 (±0.6)	0.43 (±0.1)
<i>Contracaecum</i> type 1	Mesenterium	-	-	-	-	-	-	60	3.6 (±0.4)	0.60 (±0.2)
<i>Contracaecum</i> type 2	Mesenterium	10.00	1.34 (±0.1)	0.14 (±0.1)	16.13	1.20 (±0.2)	0.20 (±0.1)	-	-	-
<i>Rhabdochona acuminata</i>	Intestine	-	-	-	3.23	13.00 (±0.1)	0.42 (±0.2)	3.34	1 (±0.5)	0.04 (±0.0)

It is commonly said that hosts with similar biological and behavioral aspects present similar parasite fauna (Poulin 2011), and this affirmation was corroborated by the results here presented. Regardless the fact that *B. amazonicus* performs migrations on the reproductive period, and *B. melanopterus* presents a more sedentary behavior, the similarity between the hosts diet had a more important impact on the resemblance of the parasite fauna. This conclusion is also reinforced by the absence of statistical differences on the parasite diversity between the collection sites, what evidences that different environments, with different physic-chemical characteristics, is not an impediment to similar parasite diversity for the parasite species observed on the present study.

Procamallanus (S.) inopinatus was also observed on *Brycon cephalus* on the Negro and Solimões Rivers and on *B. amazonicus* collected on raised system (Andrade *et al.* 2001; Andrade and Malta 2006). Comparing these results with the present study it can be observed that the endoparasite fauna of *Brycon* species is not rich. Besides, some of these parasites, such as *P. (S.) inopinatus*, are not exclusive to the *Brycon* genus, also occurring on other 44 hosts from Amazon hydrographic basin, such as *Salminus brasiliensis*, *Astronotus ocellatus* and *Hoplias malabaricus* (Thatcher 2006), three fish species with a strong commercial importance; these records, along with the present results, may indicate a low specificity and biological characteristics that allow this widespread presence.

The present study records for the first time the presence of *Contracaecum* larvae on *Brycon* species on the Amazon hydrographic basin, but this register only emphasizes the low specificity of this parasite, as this species has already been recorded on several host from the Amazon basin (Thatcher 2006). This larva belongs to the Anisakidae family, a taxonomic group well known for its zoonotic potential.

Many studies have described that the characteristics of the Solimões River are favorable for aquatic fauna and flora, such as high suspended sediment, salt and organic matter load (Leenheer and Santos 1980; Hedges *et al.* 1994), while the Negro River presents a general depletion of the species, which is associated to the low concentration of dissolved salts and absence of suspended matter, low pH and the high concentrations of humic compounds (Leon *et al.* 2006). These abiotic advantages that support a higher diversity on the Solimões River may have influenced the parasite fauna of *B. amazonicus* on the present study, as the Brillouin diversity index established that the parasite fauna was more diverse in the hosts of this local.

The present study demonstrated that, despite the different rivers where the fishes were collected, the endoparasite fauna was similar. Corroborating the hypothesis, the taxonomic proximity of the hosts was a stronger influence on the parasite species than external host environment.

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