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# *Jainus amazonensis* (Monogenea: Dactylogyridae) PARASITES OF *Brycon cephalus* (GÜNTHER, 1869) CULTURED IN THE LOWLAND OF THE PERUVIAN AMAZON

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## ABSTRACT

*Brycon cephalus* Günther, 1869, (*Characidae: Bryoconinae*) represents a socio-economically important species in the Amazon basin and semi-intensive and intensive production for human consumption has emerged in the last years. Therefore, more studies are required in fish farming development, especially concerning the populations of parasites that are affecting production yields. In this sense, the present study intended to evaluate the parasitic infection in *B. cephalus* bred in a fish farm of the Peruvian Amazon. This study identified a high infestation of the monogenean *Jainus amazonensis* in semi-intensive fish farming of *B. cephalus*. The prevalence was 100%. The mean intensity and abundance of the parasite was 230 of parasites per individual. This is the first report of a high infestation by *J. amazonensis* in cultured *B. cephalus* from the Peruvian Amazon.

## INTRODUCTION

Species of *Brycon* genus are fishes with significant importance as food resource and they have great potential for intensive aquaculture in the Amazonian basin (Andrade et al., 2001; Ramagosa et al., 2002). *Brycon cephalus*, known as sábalo or matrinxã (Günther, 1869), is a species with migratory behavior, which synchronizes its movements with water level fluctuations (Ramagosa et al., 2002). This fish can reach up to 45 cm in length and 4 kg in mass (Pizango et al., 2001; Arbelaez et al., 2002) and is a highly appreciated species with great acceptance in the Amazonian region and worldwide market, being regarded as an eatable fish of the highest quality. Hence, it is one of the most important species for the development and improvement of intensive aquaculture in the Amazonian region (Andrade et al., 2001; Pizango et al., 2001). Despite its great importance to the Amazonian people, little is known about the parasitic infections of farmed *B. cephalus*, because these studies have been carried out, in general, in wild fish.

In fish farming the intensive exploitation allows the handling of high densities of organisms per unit area. Indeed, this type of management frequently leads to break the balance between pathogen and host, consequently resulting in the emergence of infectious and parasitic diseases that cause various problems ranging from slow growth, reduced fertility rates, until the appearance of severe epidemics resulting in high mortality (Flores-Crespo and Flores, 2003; Gjurčević et al., 2006; Mathews et al., 2011). Despite the importance of *B. cephalus* as a valuable nutritional source and desirable aquarium specimen, little has been reported on its diseases. Therefore, this article provides information on the prevalence and intensity of parasites in farmed *B. cephalus* juveniles in the Peruvian Amazon. This contribution is crucial for disease research and management programs that could serve as a tool to monitor and analyse the causes and trends in disease occurrences and epidemiology in the Amazon region.

## MATERIALS AND METHODS

Between July 2011 and August 2012, which corresponds to the relatively dry season, 80 individuals of the species *B. cephalus* were collected with drag nets from a semi-intensive fish farm, located between the cities of Iquitos and Nauta, northeast of Department of Loreto, Peru (Fig 1.), between latitudes 3° 48' 48.9" N and 073° 19' 18.2" W, with

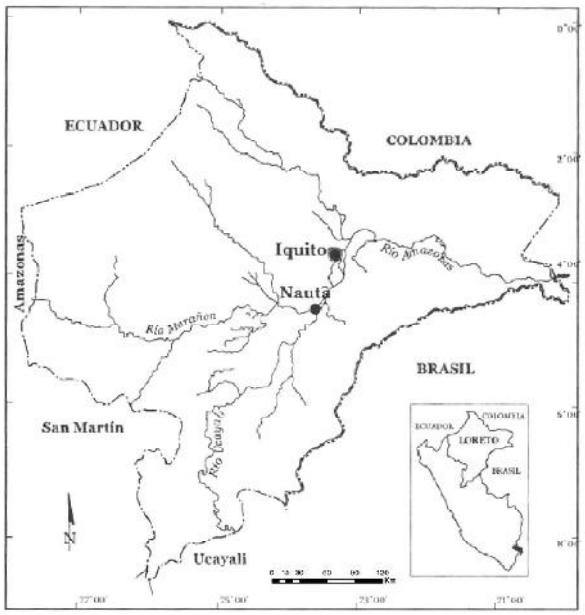


**Fig 1.** Map of Department of Loreto (left inset shows Peru) showing the location of the sampled fishes, between Iquitos and Nauta

average annual temperature of 28.3°C and relative humidity of 85% at 328 mean sea level.

The physico-chemical parameters of the water were measured three times daily (at 8 a.m., noon and at 4 p.m.) with daily checks of dissolved oxygen, pH, temperature and conductivity by means of a YSI multiparameter meter (Model MPS 556). Ammonium values, hardness, carbon dioxide and total alkalinity were monitored weekly in the morning at 8 a.m., using a complete package for analysis of freshwater (LaMotte AQ-2).

Fish were fed twice daily with extruded diet containing 25% crude protein and 2.6 Mcal/kg of digestible energy and feeding rate of 5% of the biomass of the pond. The sampled fish presented length of 23.5 ± 0.4 cm and weight of 220.7 ± 15.4 g; these data were collected in individual records. The moribund fishes collected for investigations were in emaciated condition. Due to the accumulation of mucus, the gills were pale and viscous. Following, the fish were sacrificed by cerebral puncture and placed in individual containers. Using a stereoscope the body surface, fins, nostrils, mouth, opercula and gills were examined, looking for possible injuries and excess of mucus production. By means of a scalpel, scraping of the skin, fins and gills was also performed to observe possible attached parasites. Body mucous and pieces of gills were compressed between a glass and a cover slip with a drop of 0.65% saline solution for microscope observation.

For the examination of the gills, the samples were separated and placed in glass containers with a 1:4,000 formalin solution. After one hour, the gills were stirred in the solution and then removed from the container. Helminthes were allowed to settle on the bottom of the containers and were subsequently collected with the aid of a small probe and a dissecting microscope (Nikon SM-30). To study the monogeneans, permanent slides were prepared with total parasites assembly according to Thatcher (2006). For the study of sclerotized structures, parasites were fixed in a solution of ammonium picrate glycerin (GAP) and mounted in Canada balsam according to Malmberg (1970). Some specimens were mounted unstained in Gray and Wess' medium. To visualize internal structures, parasites were fixed in hot formaldehyde solution (4%) for staining with Gomori'strichrome. The identification of the parasites was based on the methodology of Thatcher (2006), Kritsky et al. (1980). The parasitic indexes calculated for assessing the level of infestation of parasites in the fish were prevalence, mean intensity and mean abundance (Bush et al., 1997).

## RESULTS AND DISCUSSION

The occurrence of diseases in fish farms is a consequence of several factors pertaining to the rearing methods and environmental conditions variations. Also, it is known that the increment of parasitic infections in artificial environments has been associated with low quality of water (Queiroz et al., 2004).

The values of the physico-chemical parameters of the water in the studied culture ponds were: dissolved oxygen (4.64 ± 0.8 mg $L^{-1}$), pH (6.8 ± 0.10), temperature (27.23 ± 1.50°C), conductivity (106.1 ±14.0 µs cm-1), ammonium values (0.50 ± 0.10 mg $L^{-1}$), hardness (21.40 ±1.80 mg $L^{-1}$), carbon dioxide (3.2 ± 0.9 mg $L^{-1}$) and total alkalinity (16.14 ± 0.80 mg $L^{-1}$). In our study, the concentration of ammonia found in the ponds of cultivated *B. cephalus* was not within the expected range of values for tropical species. According to Hargreaves and Tucker (2004), ammonia is toxic to fish if allowed to accumulate in the fish production systems. When ammonia accumulates to toxic levels, fish can not efficiently obtain energy from feed. If the ammonia concentration becomes high enough, the fish will become lethargic and eventually fall into a coma and die (Hargreaves and Tucker, 2004). However, ammonia can have so-called sublethal effects such as reduced growth, poor feed conversion and reduced disease resistance at concentrations that are lower than lethal concentrations (Gross et al., 2000; Hargreaves and Tucker, 2004). In the present study, the high concentration of ammonia in ponds may be related to inadequate fertilization, high density of fish population that is common in intensive farming systems and no-recirculation of water in the ponds. In this context, the fish are subjected to stress thus becoming more susceptible to infestation by parasites. Among the various groups of helminthes which parasitize freshwater fishes, monogeneans represented by many species cause considerable economic losses in fish farming from different regions of the world (Flores-Crespo and Flores, 2003). Indeed, the parasite infestation figures as a menace for a wide variety of fish of tropical and semitropical regions where parasites proliferation is favored by eco-

logical conditions (Flores-Crespo and Flores, 2003; Martins et al., 2002). Seven species of Monogenean are known to parasite *B. cephalus* from natural environments, *Anacanthorus brevis, A. elegans, A. kruidenieri, A. spiralocirrus, Jainus amazonensis, Tereancistrum kerri, Trinibaculum braziliensis* and other parasites as *Annulotrematoides bryconi sp. n.* (Thatcher, 2006). However, to our knowledge, nothing is known about parasitic infection in *B. cephalus* in Peru, in fishponds. Hence, this is the first report of massive infestation by *J. amazonensis* in *B. cephalus* from the semi-intensive fish farms in the Peruvian Amazon.

The Monogenoidea *J. amazonensis* were previously described by Andrade et al. (2001) parasitizing the gills of *B. cephalus* fingerlings collected from fish farms of the state of Amazonas, northern Brazil. Furthermore, Andrade and Malta (2006) identified specimens of *J. amazonensis* in gills of *Brycon amazonicus* juveniles, synonym of *B. cephalus*, raised in an intensive husbandry system in a stream channel in the state of Amazonas, Brazil, confirming the occurrence of this specie of parasite in cultivated *B. cephalus* and other congeneric species, evidencing a high specificity of *Jainus amazonensis* parasitizing species of genus Brycon. However, this specificity may be related to the fact that many of the monogeneans which parasitize fish are host-specific, because of co-evolution of parasites with their hosts (Šimková et al., 2006).

In this study, *J. amazonensis* showed high levels of parasitism along with prevalence rates of 100%, mean intensity and mean abundance of 230 (Table 1). Our results agree with Andrade et al. (2001) who reported similar prevalence, with mean intensity of 222.4 and mean abundance of 115.7 for specimens of *B. cephalus* collected from fish farming. In addition, Cuglianna et al. (2003) also reported a prevalence o monogeneans (100%) without informing, however, other parasitic indexes. Notwithstanding, Andrade and Malta (2006) have described a prevalence of 71% in *B. amazonicus* juveniles collected from fish farms in the northeast of Brazil. However, the presence of *J. amazonensis* in fishes of several species of the genus *Brycon* may be related to the high phylogenetic proximity between them.

**Table 1.** Values of prevalence (P), mean intensity (MI; ± standard deviation) and mean abundance (MA; ± standard deviation) of parasites collected from juveniles of *Brycon cephalus* cultivated in the Peruvian Amazon

| Parasite | P | MI | MA | Site of infection |
|---|---|---|---|---|
| *Jainus amazonensis* | 100.0% | 230 ± 1.26 | 230 ± 1.34 | Gills |

The results in the present study and studies addressing various aspects of parasite in other species cultivated in the same region (Mathews et al., 2012; Mathews et al., 2013a; Mathews et al., 2013b; Mathews et al., 2013c) confirm the necessity of constant monitoring of fish, seeking the diagnosis and timely control of infestations by monogeneans in order to eradicate the mortality of the fish.

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## Sažetak

**PARAZITI *Jainus amazonensis* (Monogenea: Dactylogyridae) KOD VRSTE *Brycon cephalus* (GÜNTHER, 1869) UZGOJENE U NIZINSKOM DIJELU PERUANSKE AMAZONE**

*Brycon cephalus*, Günther, 1869 (Characidae: Bryoconinae) je socioekonomski važna vrsta u Amazoni te je posljednjih godina počela njezina polu-intenzivna i intenzivna proizvodnja za ljudsku prehranu. Neophodna su stoga dodatna istraživanja u akvakulturi radi njezinog razvoja, a naročito istraživanja populacija parazita koji utječu na prinose proizvodnje. U tom smislu ovo istraživanje prati parazitske infekcije u uzgoju *B. cephalus* u ribogojilištu peruanske Amazone. Istraživanjem je utvrđena visoka zaraza jednostaničnim *Jainus amazonensis* u polu-intenzivnom uzgoju ribe *B. cephalus*. Vrijednost prevalencije bila je 100%. Srednji intenzitet i zastupljenost parazita bili su 230 parazita po jedinki. Ovo je prvi izvještaj o visokoj zarazi parazitom *J. amazonensis* u uzgojenoj vrsti *B. cephalus* iz peruanske Amazone.

**Ključne riječi:** *Brycon cephalus*, *Jainus amazonensis*, jednostanični parazit (Monogenean), riblji paraziti, akvakultura, peruanska Amazona

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