NOTE

Parasitic infections in juveniles of *Prochilodus nigricans* kept in a semi-intensive fish farm in the Peruvian Amazon

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Abstract
The boquichico *Prochilodus nigricans* 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. Three species of parasites were collected and identified: *Rhinonastes pseudocapsaloideum*, *Trichodina* sp. and *Lecithobotrioides elongates*. *R. pseudocapsaloideum* was the most prevalent species (100%) with highest mean intensity and mean abundance (168.5).

Fishes of the genus *Prochilodus* are among the most conspicuous, abundant, and widespread freshwater species living in South American rivers flowing to the Atlantic Ocean (Sivasundar et al., 2001). These fishes inhabit a wide variety of aquatic ecosystems. *P. nigricans*, known as boquichico or curimata, is a species with migratory behavior, which synchronizes its movements with water level fluctuations. It is found in several Amazonian landscape biotypes, such as "várzea" (floodplain inundated by white water rivers) and "igapó" (floodplain inundated by black water rivers) forests, streams and rapids (Lopera-Barreto et al., 2008). *P. nigricans* can reach up to 45 cm in length, weighing 3 kg (Castro and Vari, 2004). Moreover, this fish species is of high economic importance with a promising potential for intensive and extensive aquaculture. Despite the importance of boquichico as a valuable food fish and a desirable aquarium species, little has been published on its diseases.

Therefore, with the gradual increase of intensive and semi-intensive fish farming in the Peruvian Amazon, there is a need for constant monitoring of the fish for the diagnosis and timely control of the parasites.

Between August and September 2011, corresponding to the relative dry season, 50 individuals of *P. nigricans* were collected with drag nets

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from a semi-intensive fish farm, located at 328 m above sea level in the northeast of Loreto State (Peru), at latitude 3° 48′ 48.9′′ S and longitude 73° 19′ 18′′ W. The area has an average annual temperature of 28.6°C and relative humidity of 85%.

The farmed fish were fed twice daily with extruded diet containing 25% crude protein and 2.6 Mcal/kg of digestible energy. The mean length (±SD) of the 50 sampled fish was 23.5 ± 0.4 cm and the mean weight (±SD) was 220.7 ± 15.4 g. Following sampling, the fish were killed by cerebral puncture and placed individually in containers. Gills were placed in finger bowls and covered with a 1:4000 formalin solution. After one-half hour, the gills were agitated in this liquid and then removed from the bowl. Helminthes were allowed to settle on the bottom and were subsequently collected with the aid of a small pipette under a dissecting microscope (Nikon SM-30). The counting of protozoa of the skin scrapings of each fish was performed using MacMaster chamber under light microscopy and estimated by evaluating the number of parasites/field. The nasal fossae of fish were washed with formalin 1:4000, and the liquid was analyzed under a stereomicroscope. For parasitological exams of their stomachs and intestines, the organs were removed and placed in Petri dishes and then examined. For identification the monogeneans, permanent slides were prepared with total parasites assembly according to Thatcher (2006). For the observation of sclerotized structures, monogeneans were fixed in a solution of ammonium picrate glycerine and mounted in Canada balsam according to Malmberg (1970). Other specimens were mounted unstained in Gray and Wess' medium and Gomori's trichrome to visualize internal structures. Whole mount preparations were made by means of the phenol balsam method according to Thatcher (1991). The identification of the parasites was based on the methodology of Kritsky et al. (1988), Thatcher (1999) and Thatcher (2006). The prevalence, mean intensity and mean abundance of the parasites were calculated according to Bush et al. (1997).

The necropsy of juveniles of *P. nigricans* from a semi-intensive farm in the Peruvian Amazon evidenced the occurrence of the monogenean *Rhinonastes pseudocapsaloideum* in the gill filaments and the nasal cavity, the trematode *Lecithobotrioides elongatus* in the intestine and the ciliate *Trichodina* sp. in the skin. *R. pseudocapsaloideum* was found in all the 50 examined fish while *Trichodina* sp. and *L. elongatus* were found in 30 (60%) and 1 (2%) host specimens, respectively (Table 1).

Several studies report the parasitism of neotropical characids by monogeneans and ciliates belonging to the genera *Rhinonastes* and *Trichodina*. These parasites groups were also reported in other fish species cultivated in Peru (Iannacone and Luque, 1991; Mathews et al., 2007; Dinis et al., 2007).

Parasites that have a direct life cycle, such as monogeneans and protozoan, are more frequently found in lentic environments and this type of environment favors the transmission of these parasites. Adult parasites can be found in gills, skin, finds and nasal cavity, where they lay eggs an die soon afterwards. Eggs develop directly on the host, and after hatching, give rise to larvae that swim until finding new host where they mature sexually (Thoney and Hargis, 1991; Flores-Crespo and Flores,

Table 1. Prevalence (P), mean intensity (MI; ± Standard Deviation) and mean abundance (MA; ± Standard Deviation) of parasites collected from juveniles of *Prochilodus nigricans* cultivated in the Peruvian Amazon.

Parasites	P(%)	MI	MA	Site of infection
Rhinonastes pseudocapsaloideum	100.0	165.8 ± 1.39	165.8 ± 1.41	Gills/nasal cavity
Trichodina sp.	60.0	138.2 ± 0.17	95.8 ± 0.20	Skin
Lecithobotrioides elongatus	2.0	19.5 ± 0.12	4.9 ± 0.16	Intestine

2003). This explain why parasites find greater opportunities for development and reproduction in lentic environments and overpopulated fish farm ponds. In regions with tropical and semi-tropical climate, the life cycle of ectoparasites can be completed in less than one day and thus proliferate explosively (Flores-Crespo and Flores, 2003). The climate in the Peruvian Amazon is tropical humid with annual temperature average of 28.6°C and relative humidity of 85%. In the earthen ponds where the fish were collected, the water circulation is almost negligible or non-existent and the fish density is high. This favor transmission of ectoparasites (Flores-Crespo and Flores, 2003; Cable et al., 2002), and may explain the elevated prevalence and abundance of monogenean and trichodinids among the fishes.

Among the various groups of helminthes which parasite freshwater fishes, many monogenean species cause considerable economic losses in fish farming in different regions of the world (Marcogliese et al., 2001). Three species of Monogenoidea are known to parasite the genus *Prochilodus* in the Amazonas River Basin, *R. pseudocapsaloideum*, *Anacanthoroides mizellei*, *Tereancistrum ornatus* (Kritsky et al., 1988; Thatcher, 2006). In our study *R. pseudocapsaloideum* is reported for the first time in juveniles of boquichico (*P. nigiricans*) in farmed conditions in the Peruvian Amazon. Massive infestations by *R. pseudocapsaloideum* may explain why the fish stopped feeding, and over a few days, each fish successively began to show signs of lethargy, colour loss, anorexia and mild hyperpnea occasionally leading to mortality.

R. pseudocapsaloideum was described by Kritsky et al. (1988) from the nasal cavity of *P. nigricans* collected from Janauaca Lake near Manaus, Amazonas, Brazil. Furthermore, Lizana et al. (2005) identified specimens of *R. pseudocapsaloideum* in nasal cavity of *Prochilodus lineatus* juvenile of the upper Paraná River floodplain, Brazil, confirming the occurrence of this species of parasite in the genus *Prochilodus*.

Lizana et al. (2005) reported a prevalence of 43.6% and a mean abundance of 1.3 for *R. pseudocapsaloideum* in wild *P. lineatus* collected from Paraná River, Brazil. In addition, Kritsky et al. (1988) reported a 15 % prevalence of monogeneans in *P. nigricans* but without giving other parasitic indexes. The much higher prevalence and mean intensity of *R. pseudocapsaloideum* in *P. nigricans* in our study can be explained by the unfavorable environmental conditions and high fish densities in the fish farm.

In the present study we report for the first time parasitic infections in farmed *P. nigricans*

farms in the Peruvian Amazon. There was a high prevalence and abundance of the monogenean *R. pseudocapsaloideum*. The results of this study and studies addressing various aspects of parasites in other species cultivated in the same region (Mathews et al., 2011; Alcantara et al., 2008) confirm the necessity of constant monitoring of fish, seeking the diagnosis and timely control of infestations by monogeneans, in order to reduce fish mortality.

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