



***Riggia cryptocularis* (Crustacea: Cymothoidae) parasitizing three fish species in a hydroelectric dam**

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ABSTRACT

Introduction: Parasites play important roles in ecosystems, but can also create disturbances in the composition of host fauna in anthropogenic environments. **Objective:** Knowledge about these organisms can contribute to the conservation of diversity and environmental quality and prediction of disease risks. **Methods:** Parasites were collected from fish hosts in the Doce River (Claro River Basin, Middle Paranaíba) in areas of a small hydropower plant, following specific protocol and identified in the laboratory. **Results:** This is the first report of *Riggia cryptocularis* (Crustacea: Cymothoidae) parasitizing *Hypostomus ancistroides*, *Leporinus friderici* and *Serrasalmus maculatus*. **Conclusion:** The presence of this parasite in three fish species during the same sampling period and the severity of mutilation in the host suggest that the dam may favor a possible outbreak of the parasite *R. cryptocularis* due to changes introduced in the environment by the establishment of this type of project.

Keywords: Ectoparasites, fish, hydroelectric, isopod.

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1. INTRODUCTION

The freshwater fauna of the Neotropical region is the most diverse in the world, and it is associated with the geomorphological history of this region (Lévêque *et al.* 2008). The evolution of fish populations and parasites determine the diversification of neotropical aquatic fauna (Poulin 1995; Wilson 2008; Mendlová and Simková 2014).

The loss of biodiversity in freshwater ecosystems can be attributed to factors such as siltation, eutrophication, introduction of exotic species, pollution, building of dams, and flood control measures (Barletta *et al.* 2010). These anthropogenic factors impact the aquatic ecosystems and the stability of fish and parasites assemblages (Morley 2007; Agostinho *et al.* 2008).

The parasitic fauna is an important component of the functioning of the global biodiversity and ecosystem (Luque and Poulin 2008; Lefèvre *et al.* 2009). Fish parasites include Cymothoidae (Isopod) species. These organisms are ectoparasites that settle in various parts of the host body such as fins and gills and feeding on the host blood, which can kill the fish hosts, causing losses in aquaculture (Williams-Jr *et al.* 1994; Rameshkumar and Ravichandran

2014; Bharadhirajan *et al.* 2014).

The economic and ecological interests in parasites make it important to determine their diversity for the conservation of organisms, to predict disease risks, and to evaluate the environment quality (Osowiecki, 1991; Poulin *et al.* 2011).

The objective of this study was to report for the first time *Riggia cryptocularis* (Crustacea: Cymothoidae) parasitizing *Hypostomus ancistroides* (Siluriformes: Loricariidae), *Leporinus friderici* (Characiformes: Anostomidae) and *Serrasalmus maculatus* (Characiformes: Serrasalmidae).

2. MATERIALS AND METHODS

Host fishes were collected (License SEMARHNo2588/2012) by using fishing tackle from the Doce River (Basin Claro River, Middle Paranaíba) in areas of a small hydropower plant in the municipality of Aparecida do Rio Doce, Goiás State, Brazil (UTM-22K 0482331/8002422). The parasites were isolated from fishes in the field by external examination, and they were preserved in 70% ethanol with 10% glycerol (Acácio *et al.* 2012). In the laboratory, the parasites were identified with reference to the dichotomous keys (Thatcher *et al.*

2002; 2003; Luque *et al.* 2013), followed by confirmation by parasitological experts. The parasites were listed in the ichthyology collection of the Zoology Museum of the Universidade Federal de Viçosa.

3. RESULTS

Riggia cryptocularis (Crustacea: Cymothoidae) parasitized *Leporinus friderici* (Characiformes: Anostomidae), *Hypostomus ancistroides* (Siluriformes: Loricariidae), and *Serrasalmus maculatus* (Characiformes: Serrasalmidae). A male of this parasite was found walking on the caudal peduncle of a *H. ancistroides* specimen and another on the abdomen of a female of *R. cryptocularis* that parasiting specimen of the *L. friderici*. Female species of this parasite were found in the opercular region of two *S. maculatus* and on the right pectoral fin of two *L. friderici* (Fig. 1A-D).

Riggia cryptocularis has the first report with *L. friderici*, *H. ancistroides* and *S. maculatus*. Its adults parasitize fishes and present body features with striking sexual dimorphism, with females having larger body size (30 mm) than males (5 mm). *R. cryptocularis* females present a dorsally concave head, rounded frontally area, immersed in the first somite and non-functional eyes. In addition, the pleon and pleotelson are fused on the seventh somite. The male parasites do not show immersion of the head in the first somite; their pleon is not immersed in the seventh somite and taper toward the pleotelson in a shield-shaped sharp-tipped end. *R. cryptocularis* females present seven peropods, six with claws and one without it, in addition to having elongated uropods with thin branches and exopod longer than the endopods. The males have thinner and less elongated uropods and marginal bristles (Fig. 2A-B).

4. DISCUSSION

Isopods such as *R. cryptocularis* feature among the parasites that cause fish mortality in Brazil, with about 40 species associated with 123 fish species (Luque *et al.* 2013;

Kostadinova 2008; Alsarakini and Wadeh 2014). Several species of these parasites are associated with saltwater fish such as *Ceratothoa banksii* with *Latris lineata* (Andrews *et al.* 2013) and *Nerocila phaeopleura* with *Liza parsia* (Bharadhirajan *et al.* 2014), similarly, in freshwater, *Braga cichlae* is associated with *Acestorhynchus microlepis*, *Cichla ocellaris*, and *Galeocharax kneri* (Brandão *et al.* 2012). *Riggia* species have been reported on *Ancistrus sp.*, *Curimata platana*, *Cyphocharax gilbert*, *Leporellus vittatus*, *Leporinus copelandii*, *Leporinus octofasciatus*, *Leporinus striatus*, *Odontostilbe sp.* and *Schizodon nasutus* (Thatcher *et al.* 2002; Thatcher *et al.* 2003, Luque *et al.* 2013; Oda *et al.* 2015).

Riggia cryptocularis caused damage to the host *L. friderici*, with two cases of pectoral fin amputated by the parasite. Associations between the Anostomidae species and ectoparasites are negative for this fish group, suggesting that quality of the environment induces changes in the parasite population structure (Morley 2007; Guidellin *et al.* 2011). Isopods Cymothoidae can cause host death, but these last ones have developed strategies to reduce parasitism (Mikheev *et al.* 2013). Solitary fishes such as *S. maculatus* are more prone to parasitism than those living in shoal such as *L. friderici*. This finding suggests that living in a group decreases parasitism among fishes through physiological and behavioral mechanisms and development of social learning in a group. In a group, the more active individuals exploit more habitats and discover foraging areas as well as those with lower predation and parasitism risks (Binning *et al.* 2013; Mikheev *et al.* 2013; Bharadhirajan *et al.* 2014).

The parasitism of *R. cryptocularis* on fishes of the Doce River (Paranaíba Basin) indicates that the quality of habitat was influenced with the building of the small hydroelectric plant. Anthropogenic processes reduce diversity with changes in the composition and prevalence of parasites having a negative impact on the ecosystem (Horton and Okamura 2003; Blonar *et al.* 2011; Catalano *et al.* 2011; Saravanakuma *et al.* 2012; Hulme 2014).

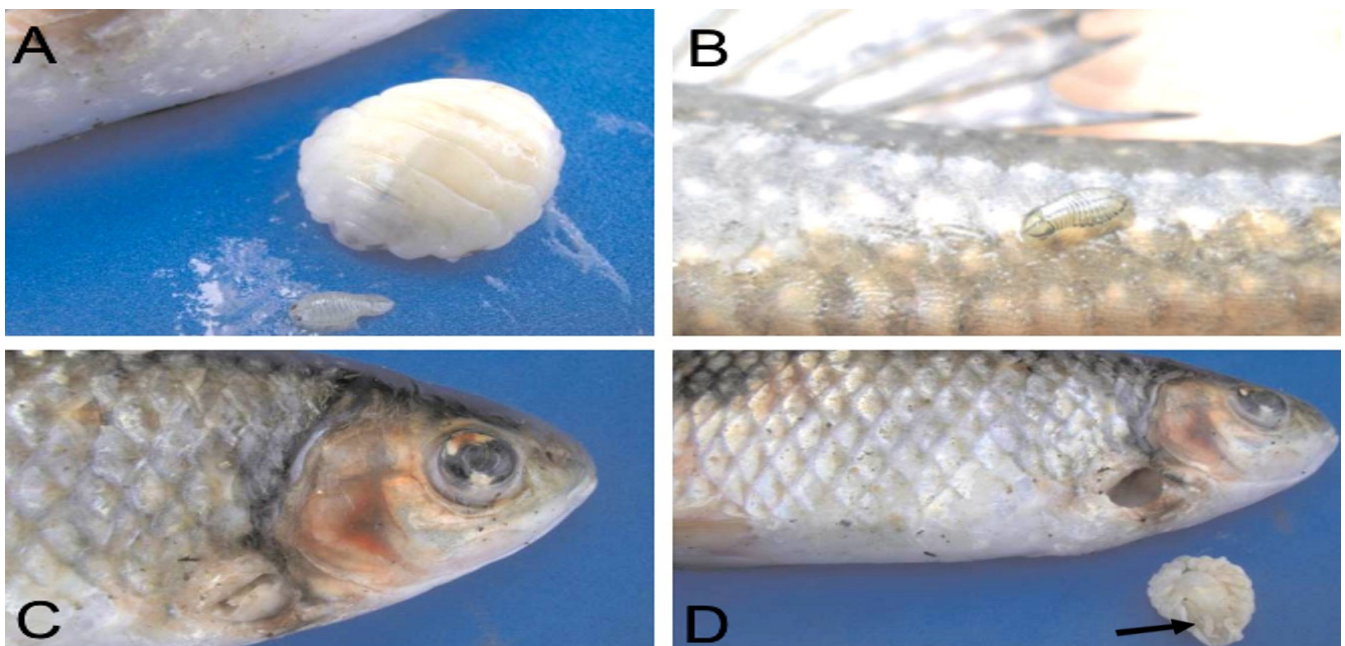


Figure 1. (A) Male and female *Riggia cryptocularis* (Crustacea: Cymothoidae). (B) Male parasite on the host *Hypostomus ancistroides* (Siluriformes: Loricariidae). (C) Pectoral fin amputated by *Leporinus friderici* (Characiformes: Anostomidae) and substituted by the parasite. (D) Arrow indicates the location of *R. cryptocularis* on the body of the female host.



Figure 2. *Riggia cryptocularis* (Crustacea: Cymothoidae) individuals captured from fishes of the Doce river. (A) Female specimens in diverse views. (B) Male specimens in diverse views.

Barred environments change aquatic habitats and the natural relationship between fish fauna and their parasites, which makes an aquatic community favorable for parasitic outbreaks (Morley 2007; Smit *et al.* 2014). Furthermore, inadequate exploitation of fishery resources and species introduction in hydropower projects disrupt the ecosystem by inducing homogenization of biotic components, extinction of native species, and parasitic outbreaks (Vitule *et al.* 2012; Lacerda *et al.* 2013; Pulkkinen *et al.* 2013; Hulme 2014).

5. CONCLUSION

The detection of *R. cryptocularis* as a parasite to three fish species (*L. friderici*, *H. ancistroides*, and *S. maculatus*) simultaneously in the Doce River demonstrates the epidemiological potential of this parasite negatively affect fish species of economic importance and that building of hydroelectric dams may favor such phenomenon. Since dams generate complex environmental changes, destabilizing the aquatic ecosystems and creating favorable conditions for the establishment of parasites and increasing the index of contamination in fish species of economic importance and for subsistence. In this sense, more studies about the evaluation of parasitic fauna of rivers impacted by the construction of hydroelectric dams are important to devise strategies of prevention and control of the parasitic fauna within conditions considered healthy in these ecosystems.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this paper.

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