

Original Article

First record of *Trichodina heterodontata* (Ciliophora: Trichodinidae) in banded knifefish *Gymnotus carapo* (Gymnotidae) cultured in Brazil

Primeiro registro de *Trichodina heterodontata* (Ciliophora: Trichodinidae) em tucunaré *Gymnotus carapo* (Gymnotidae), cultivado no Brasil

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Abstract

The aim of this study was to report the first record of *Trichodina heterodontata* in banded knifefish *Gymnotus carapo*. Banded knifefish cultivated in the municipality of Jataí, state of Goiás, in the central western region of Brazil, experienced fish mortality rates of 3–4% per tank. Macroscopic analysis found that fish had lesions on their skin and gills. Smears of the integument and gills were confectioned and air-dried at room temperature and impregnated with silver nitrate to identify the Trichodinidae species causing the lesions. The trichodinid were identified as *T. heterodontata*, and their characteristics were compared to those from *T. heterodontata* recorded from other species of host fish. It was observed that the presence of *T. heterodontata* was associated with inadequate fish management, low water quality, high rates of stocking density, and inadequate nutritional management.

Keywords: fish farm, infestation, parasites, production, trichodinids.

Resumo

O objetivo deste estudo foi relatar o primeiro registro de *Trichodina heterodontata* em tucunarés *Gymnotus carapo*. Um cultivo de tucunarés no município de Jataí, estado de Goiás, na região Centro-Oeste do Brasil, apresentou taxas de mortalidade de peixes de 3–4% por tanque. A análise macroscópica constatou que os peixes tinham lesões na pele e brânquias. Raspados do tegumento e brânquias foram confeccionadas e secas ao ar à temperatura ambiente e impregnadas com nitrato de prata para identificar as espécies de Trichodinidae causadoras das lesões. Os tricodinídeos foram identificados como *T. heterodontata*, e suas características foram comparadas com as de *T. heterodontata* registradas para outras espécies de peixes hospedeiros. Observou-se que a presença de *T. heterodontata* estava associada ao manejo inadequado dos peixes, baixa qualidade da água, altas taxas de densidade de estocagem e manejo nutricional inadequado.

Palavras-chave: piscicultura, infestação, parasito, produção, tricodinídeos.

1. Introduction

The banded knifefish *Gymnotus carapo* Linnaeus, 1758, is a species in the order Gymnotiformes and the family Gymnotidae. Banded knifefish have electrical organs that are mainly used for electrocommunication (Rotta, 2004). Banded knifefish are distributed in Central and South America, from south-eastern Mexico to Paraguay, including Trinidad and Tobago (Froese & Pauly, 2019). In their natural habitat, banded knifefish live in places with aquatic plants with dense roots that retain organic matter, and feed on small organisms, such as insects and microcrustaceans (Rotta, 2004;

Resende et al., 2006; Froese & Pauly, 2019). This fish species is farmed in several places, including in central Brazil, for its use as live bait for sport fishing in rivers, lagoons, and even in fish-pays (Rotta, 2004). Hence, the use of banded knifefish in sport fishing stimulates the cultivation of this species, and the development of enterprises for its production. However, there is no available information about the parasites that infect cultivated banded knifefish. The present study expands our knowledge on this topic by describing the first record of *Trichodina heterodontata* Duncan 1977 from this fish species.

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2. Material and Methods

Banded knifefish are cultivated in the municipality of Jataí, state of Goiás, Brazil, for the purpose of producing baits for commercial use in sport fishing. The fish included in this study were kept at a local fish farm, 17°52'27.6"S and 51°37'49.3"W, in 500 L water tanks at densities of 90-110 fish per tank. There was neither renewal nor circulation of water, and fish were fed once a day with commercial feed (0.8 mm) containing 45% crude protein. The reservoirs were cleaned every two days, by siphoning and removing organic matter from the bottom of the tanks, and replacing approximately 5% of the water. At the fish farm included in this study, 3-4 fish per tank died, and the dead fish had small dark skin lesions. Six fish were sent to the Veterinary Pathology and Parasitology Laboratory at the Federal University of Goiás, in Jataí, for parasitological analysis. Smears of body mucus and gills were analyzed under an optical microscope (Nikkon Eclipse E200, Japan) for the presence of Trichodinidae Claus, 1874. The smears were air dried at room temperature and impregnated with silver nitrate for visualization of the adhesive discs of trichodinids (Lom, 1958).

3. Results

Trichodinid were identified as *T. heterodentata* (Figure 1), and compared with literature descriptions for *T. heterodentata* collected from other species of host fish (Table 1). We compared the measurements of the specimens in this study to those reported in other studies, and found that their characteristics were similar to those of *T. heterodentata* described by Duncan (1977), Martins et al. (2010), Pádua et al. (2012), and Miranda et al. (2012).

4. Discussion

Trichodina heterodentata has been described since 1977 from a variety of freshwater fish (Jager & Basson, 2019), mainly in cichlid species (Basson & Van As, 2006). In Brazil, *T. heterodentata* have been reported from small-scaled pacu *Piaractus mesopotamicus* Holmberg, 1887 (Pádua et al., 2012), channel catfish *Ictalurus punctatus* Rafinesque, 1818 (Martins et al., 2010), Nile tilapia *Oreochromis niloticus* Linnaeus, 1758 (Valladão et al., 2016), and in a hybrid toad species, *Rhinella pombali* Baldissera, Caramaschi & Haddad, 2004 (Dias et al., 2009; Fernandes et al., 2011). However, *T. heterodentata* has not been previously reported in banded knifefish until present moment.

Jager & Basson (2019) questioned the validity of the species *T. heterodentata*, based on the variety of reported morphometric data. Also, these authors pointed

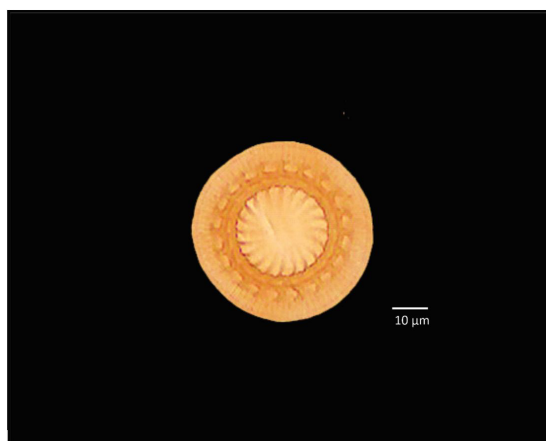


Figure 1. *Trichodina heterodentata* collected from the gills of banded knifefish, *Gymnotus carapo*, farmed in Jataí, state of Goiás, Brazil. Stain: silver nitrate impregnation.

Table 1. Measurements of *Trichodina heterodentata* collected from different species of host fish, including samples from *Gymnotus carapo* from Jataí, Goiás, Brazil.

Fish species	Banded knifefish <i>Gymnotus carapo</i>	Mozambique tilapia <i>Tilapia mossambica</i>	Channel catfish <i>Ictalurus punctatus</i>	Pirarucu <i>Arapaima gigas</i>	Small-scaled pacu <i>Piaractus mesopotamicus</i>
Characteristic	Present study	Duncan (1977)	Martins et al. (2010)	Miranda et al. (2012)	Pádua et al. (2012)
Body ^D	52.8 ± 0.9 (51.9-53.7)	80 (58.0-108.0)	59.4 ± 8.5 (27.0-77.0)	56 ± 5.25 (47.3-76.0)	50.4 ± 3.7 (45.0-58.8)
Border membrane ^W	4.3 ± 0.2 (4.1-4.5)	4.7 (3.4-5.5)	5.1 ± 1.7 (3.0-7.0)	-	4.3 ± 0.4 (3.5-5.5)
Adhesive disc ^D	45.0 ± 3.8 (41.2-48.8)	57 (45.0-74.0)	60.2 ± 6.7 (40.0-72.0)	45.7 ± 3.8 (37.1-51.3)	41.2 ± 3.3 (35.1-49.7)
Denticular ring ^D	30.8 ± 0.2 (30.6-31.0)	36 (29.0-45.0)	38.5 ± 4.5 (27.0-47.0)	28.21 ± 2.71 (20-34.7)	24.4 ± 2.4 (19.9-30.3)
Denticle number	20.0 ± 0.0	26 (20.0-27.0)	24.4 ± 1.6 (23.0-28.0)	20.7 ± 2.6 (12-24)	20 (16.0-22.0)
Denticle ^L	8.4 ± 0.4 (8.0-8.4)	9.2 (7.5-11.0)	10.3 ± 1.2 (7.0-13.0)	7.55 ± 0.62 (6.31-8.6)	7.7 ± 0.7 (6.1-9.1)
Blade ^L	3.5 ± 0.2 (3.3-3.7)	5.7 (4.7-7.1)	6.2 ± 0.8 (4.0-8.0)	4.46 ± 0.59 (3.9-5.5)	4.6 ± 0.4 (3.7-5.5)
Central part ^W	2.0 ± 0.0	2.6 (1.4-3.4)	3.8 ± 0.7 (2.0-6.0)	2.35 ± 0.28 (1.5-3.1)	1.9 ± 0.4 (1.2-2.7)
Denticle span	14.1 ± 0.3 (13.8-14.4)	-	18.4 ± 2.2 (12.0-22.0)	3.19 ± 1.74 (7.1-15.7)	13.7 ± 0.9 (11.6-15.5)

Means are followed by standard deviations, and in parenthesis, the minimum and maximum values. D: Diameter (in μm), W: Width, L: Length.

morphometric descriptions which can bring synonyms, such as *Trichodina hypsilepis*. However, this does not occur only with *T. heterodentata*. In fact, several species, not only of parasites, present different morphometric data, especially when they are cosmopolitan. Likewise, species with same morphology, but different taxonomy are re-arranged in a single taxon. This is the scientific dynamic that occurs in studies of species description and distribution. Surely, this study will not end the discussion on trichodinids and *T. heterodentata*. This study only provides data, so that within the evolution of this scientific knowledge, it will possibly be rearranged as the techniques evolve, and when the analyzing of specimens from various parts of the world becomes possible.

There was an outbreak of *T. heterodentata* in the examined banded knifefish due to the low water quality in the tanks and the excess of organic matter, which were visible. Ciliated trichodinids (Mobilida) are among the main etiological agents of mortality in farmed fish. Trichodinids are of great importance in fish cultivation, especially when the environment favors their reproduction, in which case severe infestations can damage the gills and skin of the fish, making them susceptible to respiratory problems and secondary infections (Zanolo & Yamamura, 2006; Valladão et al., 2016; Rodrigues et al., 2019). In addition, the banded knifefish included in this study were farmed at a high stocking density (90-110 fish/500 L tank), which was well above the recommended stocking density for this species (approximately 100 fish for every 1,000 L of water, Ishikawa et al., 2017). High stocking densities are stressful for fish, making them susceptible to ectoparasite infections, including trichodinid infections.

In summary, the occurrence of *T. heterodentata* in banded knifefish was associated with poor fish management conditions, indicating the need for adequate management and sanitary conditions.

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