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Paratrichodina africana (Ciliophora: Trichodinidae) of wild and cultured Nile tilapia in the Northern Brazil

Paratrichodina africana (Ciliophora: Trichodinidae) de tilápia do Nilo selvagem e cultivada no Norte do Brasil

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Abstract

The present work morphologically characterizes *Paratrichodina africana* from the gills of wild and farmed Nile tilapia from Northern Brazil (eastern Amazonia). Ninety fish were captured for parasitological analysis in Macapá, State of Amapá, from a wetland area bathed by the Amazon River commonly called 'Ressaca do Zerão' (n = 52), as well as from a local fish farm (n = 38). Wet smears of the skin and gills of the captured fish were air dried at room temperature and impregnated with silver nitrate by Klein's method for posterior examination of the adhesive disc structures. Total prevalence of parasitism was 16.6% (23% in fish from wetland and 7.8% in farmed fish). Characterized as a small-sized trichodinid, it presented the following measures: 33.2 ± 4.7 µm body diameter, 17.5 ± 2.1 µm adhesive disc, 10.0 ± 0.9 µm denticulate ring, and 22.6 ± 2.0 denticles. *Paratrichodina africana* reported in this study strongly resembles those described for other localities, but it differs by presenting greater body length. This is the fourth report of *P. africana* parasitizing a host fish.

Keywords: Tilapia, *Paratrichodina africana*, prevalence, Brazil.

Resumo

O presente estudo descreve pela primeira vez *Paratrichodina africana* nas brânquias de tilápia do Nilo selvagem e de cultivo no Norte do Brasil (Amazônia oriental). Noventa peixes foram capturados em Macapá, Estado do Amapá, provenientes de uma área de várzea banhada pelo Rio Amazonas comumente conhecida como "Ressacão Zero" (n = 52) e de uma piscicultura local (n = 38) para análise parasitológica. Esfregaços do muco da pele e das brânquias foram secos à temperatura ambiente e impregnados com nitrato de prata pelo método de Klein para posterior análise das estruturas do disco adesivo e dentículos. A prevalência total do parasitismo foi de 16,6% (23% em peixes coletados da area de várzea e 7,8% em peixes de cultivo). Caracterizado como pequeno tricodinídeo apresentou diâmetro do corpo de 33, 2 ± 4,7 µm, disco adesivo de 17,5 ± 2,1 µm, anel denticulado de 10,0 ± 0,9 µm e 22,6 ± 2,0 dentículos. *Paratrichodina africana* relatada neste estudo se assemelha fortemente a registros prévios para a espécie, mas difere por apresentar maior tamanho do corpo. Este é o quarto registro de *P. africana* parasitando um hospedeiro peixe.

Palavras-chave: Tilapia, *Paratrichodina africana*, prevalência, Brasil.

Introduction

Trichodinid ciliates are one of the most common fish ectoparasites in the aquatic environment (BASSON; VAN AS, 2006). Besides, this ciliated protozoan is able to cause considerable damage to farmed tilapia *Oreochromis niloticus* Linnaeus, 1758 in Brazil (GHIRALDELLI et al., 2006a), especially under inadequate handling conditions (MADSEN et al., 2000; MORAES; MARTINS, 2004). Braccini et al. (2008) observed the presence of trichodinids in tilapia kept in cages in the Corvo and Guairacá Rivers, Paraná state, and suggested that the amount of parasites is directly related to environmental quality.

Evans et al. (2007) infected two groups of channel catfish (*Ictalurus punctatus*) fingerlings, parasitized and non-parasitized by *Trichodina* sp., with *Streptococcus iniae* and *Streptococcus agalactiae*. The mortality rate was significantly higher in fish that were coinfected. In addition, the studies by Martins et al. (2011) demonstrated reduction in vaccine performance in tilapia parasitized by *Trichodina*.

So far, studies concerning the identification of trichodinid ciliates have received little attention in Brazil and there is need

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for further investigation. The following species have already been identified: *Trichodina steini* Claparede et Lachmann, 1858 from *Bufo ictericus* (KATTAR, 1975); *Trichodina magna* Van As & Basson, 1989 (see MARTINS; GHIRALDELLI, 2008) and *Trichodina compacta* Van As & Basson, 1989 (see GHIRALDELLI et al., 2006b) from *Oreochromis niloticus*; *Trichodina acuta* Lom, 1961 from freshwater ornamental fishes (PIAZZA et al., 2006); *Trichodina diaptomi* Basson & Van As, 1991 from the American calanoid *Notodiaptomus deitersi* (SILVA et al., 2009); *Trichodina heterodentata* Duncan, 1977 from channel catfish *Ictalurus punctatus* (MARTINS et al., 2010); *Piaractus mesopotamicus* (PÁDUA et al., 2012) and tadpoles *Rhinella pombali* (DIAS et al., 2009); *Trichodina machadoi* Pinto et al. 2006 from *Biomphalaria schrammi* (PINTO et al., 2006); *Tripartiella pseudoplatystomae* Pinto et al., 2009 from *Pseudoplatystoma corruscans* (PINTO et al., 2009); *Trichodina colisae* Asmat & Sultana, 2005 from *Piaractus mesopotamicus*, and hybrid *P. mesopotamicus* × *P. brachypomus* (JERÔNIMO et al., 2012). Despite the low number of species already identified, it is reasonable to assume that, due to the abundance of trichodinids and the great diversity of the Brazilian ichthyofauna, an even greater number of species may be identified in the coming years.

This study morphologically characterizes *Paratrichodina africana* Kazubski & El-Tantawy, 1986 from wild and farmed Nile tilapia in eastern Amazonia. Prevalence and a list of comparative measures are also provided.

Materials and Methods

Ninety specimens of non sex-reversed Nile tilapia O. *niloticus* of 8.6-29.0 cm total length (17.8 ± 5.4) and 12.0-396.0 g (126.7 ± 92.2) were collected in Macapá, State of Amapá between December 2009 and November 2010 from two distinct areas: a wetland area bathed by the Amazon River commonly called 'Ressaca do Zerão' (00° 00' 09.8" N and 051° 05' 25.2" W) (n = 52) and a local fish farm (00° 02' 31.4" S and 051° 07' 34.4" W) (n = 38). The fish were transferred alive to the Laboratory of Aquaculture and Fisheries at 'Embrapa Amapá' for parasite examination

Wet smears of the skin and gills of the captured fish were air dried at room temperature and impregnated with silver nitrate by Klein's method for posterior examination of the adhesive disc structures and denticles under optical microscopy, as suggested by Lom (1958). All measures (in micrometers) were taken in camera lucida. The span of the denticle was measured from the tip of the blade to the tip of the ray, as described by Arthur and Lom (1984). Arithmetic means ± standard deviation is followed, in parentheses, by the minimum and maximum values, and the number of structures measured. Denticles description follows the recommendations by Van As and Basson (1989). Specimens were deposited in the National Institute of Amazonian Research (INPA), Manaus, AM, Brazil.

Results

Description based on 40 specimens: characterized as a small sized trichodinid (Table 1, Figure 1a). Adoral ciliary spiral 260°. Shape of blade resembles an equilateral triangle with vertex angle directed towards to the adhesive disc center. Distal surface of blade rounded. Tangent point situated just below distal point of distal surface. Anterior surface usually with rounded tips without touching y-axes (Figure 2). Posterior surface of blade deeply curved. Blade connection thin and long. Distinct central part, with a spine-like processus in its tip, which extends halfway towards y-1 axis (Figure 2). Ray slightly shorter than blade, straight, narrow, finger-shaped and distinctly concave at base of posterior surface. Ray apophysis absent. Wide border membrane surrounding the adhesive disc, measuring about 2.24 µm in width. Horse-shoe shaped macronucleus 17.0 µm in diameter and 2.6 µm in width (Figure 1b). Micronucleus not viewed.

Table 1. Comparative measurements (µm) of *Paratrichodina africana* from Northern Brazil.

	Paratrichodina africana **Present study**	***Paratrichodina africana*** **Kazubski and El-Tantawy, 1986**	***Paratrichodina africana*** **Kazubski and El-Tantawy, 1986 in Mitra and Bandyopadhyay, 2006**
Hosts	***O. niloticus***	***O. niloticus***	***O. mossambicus***
Site of infection	**Gills**	**Gills**	**Gills**
Body[D]	33.2 ± 4.7 (24.4-41.0; 16)	32.8 (24-45)	20.1 (15.4-24.8)
Adhesive disc[D]	17.5 ± 2.1 (12.6-19.7; 16)	20.4 (15.0-25.0)	14.2 (12.2-18.3)
Denticulare ring[D]	10.0 ± 0.9 (8.6-12.6)	12.2 (8.5-16.5)	9.2 (5.7-11.3)
Number of denticles	22.6 ± 2.0 (18-26; 12)	23.8 (19-27)	20 (17-22)
Pins per denticle	5 ± 0.5 (4-6; 10)	-	4 (3-6)
Denticle[L]	2.7 ± 0.6 (2.1-4.1; 23)	-	3.7 (3.1-4.4)
Blade[L]	2.0 ± 0.3 (1.5-2.7; 40)	-	2.8 (2.0-3.8)
Central part[W]	1.0 ± 0.2 (0.5-1.4; 35)	-	0.6 (0.5-0.9)
Ray[L]	1.3 ± 0.3 (0.7-2.1; 40)	-	1.1 (0.5-2.1)
Span	4.8 ± 0.3 (4.0-5.5; 34)	-	3.7 (2.9-5.1)

The averages ± standard deviation are followed by minimum and maximum values and the number of structures or specimens measured in parenthesis. [D]Diameter, [L]Length, [W]Width.

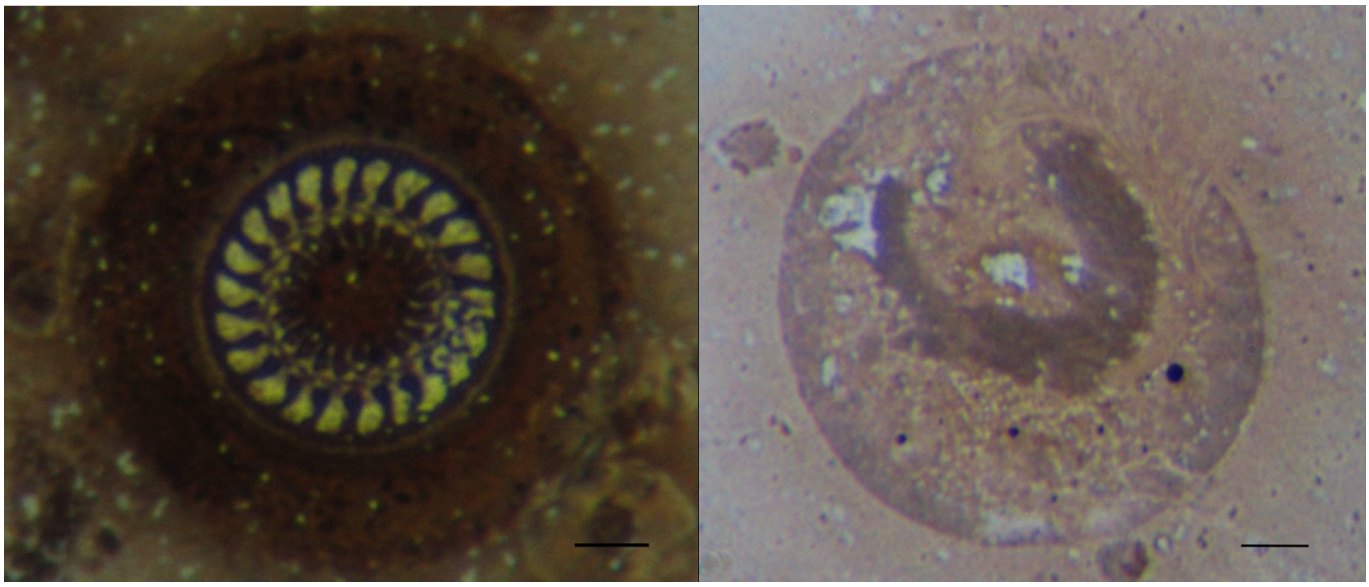

Figure 1. Photomicrographs of *Paratrichodina africana* from *Oreochromis niloticus* in the State of Amapá, North of Brazil. Silver impregnated specimens. A. Aboral view. B. Macronucleus horse-shoe shaped. Bars: 5 μm.

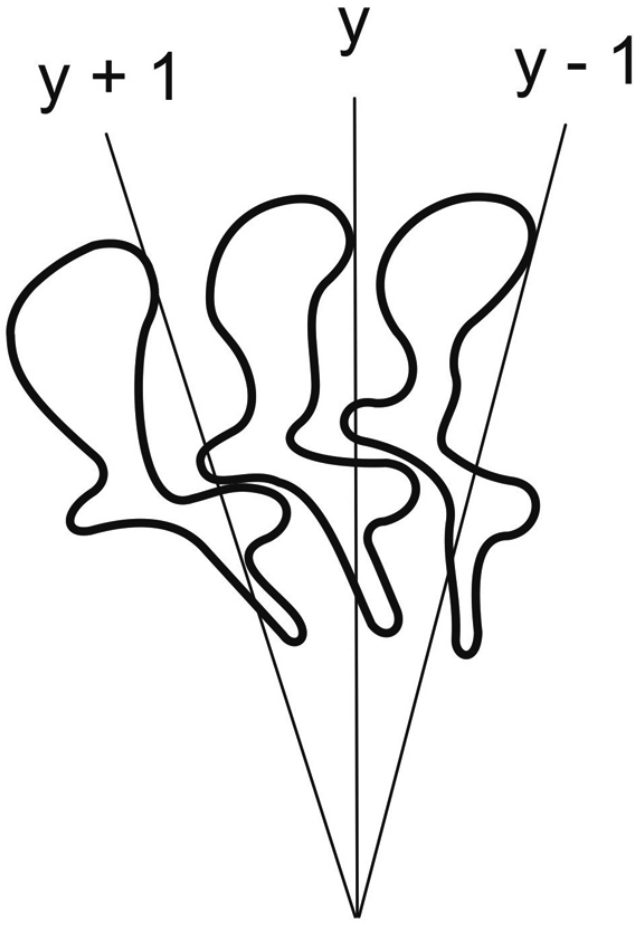

Figure 2. Diagrammatic representation of the denticles of *Paratrichodina africana* from *Oreochromis niloticus* in the State of Amapá, North of Brazil.

Taxonomic summary

Type Hosts: *Tilapia nilotica* (=*Oreochromis niloticus* Linnaeus, 1758)

Type locality: Nile Delta near El-Masoura

New locality: Macapá, State of Amapá, Northern Brazil (Lat. N 00° 02' 20", Long W 51° 03' 59")

Site of infection: Gills

Total prevalence: 16.6% (23% in fish from wetlands and 7.8% in cultured fish).

Remarks

Paratrichodina africana was first described in Nile tilapia by Kazubski and El-Tantawy (1986). The authors allocated the species to the genus *Paratrichodina* due to the presence of two important features: the straight blade, in line with the radius of the adhesive disc and the absence of incision at the base of the blade, where the central part of the neighbouring denticle could enter. Later, the species was reported in *Oreochromis mossambicus* in West Bengal, India by Mitra and Bandyopadhyay (2006) and in *O. niloticus* in Northern Brazil by Pantoja et al. (2012).

Paratrichodina Lom, 1963 comprises approximately 14 species, all characterized by small body dimensions and occurrence in the gills of the host (except for *Paratrichodina phoxini*, *P. alburni*, and *P. degiustii* - all endoparasites of the urinary tract). *Paratrichodina incisa,* the genus type, shows great similarity with *P. africana* in respect to some morphological features (Table 2). However, it differs from the latter by presenting a smaller and less rounded spine-like processus continuous with the central part. In addition, the distal surface of the blade of *P. incisa* is clearly straight, whereas it tends to be rounded in *P. africana*. *Paratrichodina lizae* also

Table 2. Measurements (μm) of the most similar species of *Paratrichodina* with the present material from Northern Brazil.

	Paratrichodina incisa	***Paratrichodina incisa***	***Paratrichodina incisa***	***Paratrichodina lizae***
	Lom, 1959 in Arthur and Lom, 1984	**Lom, 1959 in Kazubski and El-Tantawy, 1986**	**Lom, 1959 Lom and Haldar, 1977 in Gaze and Wootten, 1999**	**Asmat, 2002 in Mitra and Bandyopadhyay, 2006**
Hosts	***Leuciscus idus***	**Non provided**	***Phoxinus phoxinus*** ***Rutilus rutilus***	***Liza parsia***
Site of infection	**Gills**	**Non provided**	**Non provided**	**Gills**
Body[D]	35.3 (30.6-42.8)	14.0-54.5	-	22.1 (17.2-24.4)
Adhesive disc[D]	30.2 (25.5-35.7)	11.0-36.0	15.7-29.2	17.5 (13.2-20.4)
Denticulare ring[D]	15.2 (12.8-18.9)	7.0-20.0	-	10.2 (8.7-11.2)
Number of denticles	26.1 (24.0-28.0)	17.0-31.0	21-28	19.6 (18.0-21.0)
Pins per denticle	4-5	-	-	4.2 (3-5)
Denticle[L]	3.5 (2.6-4.1)	-	-	2.1 (2.0-2.5)
Blade[L]	3.6 (2.6-4.1)	-	2.3-4.3	2.9 (1.9-3.6)
Central part[W]	1.3 (1.0-1.5)	-	-	0.8 (0.5-1.0)
Ray[L]	2.9 (2.0-3.5)	-	1.3-3.7	1.8 (1.2-2.0)
Span	7.7 (6.1-8.7)	-	-	5.3 (3.6-6.1)

The minimum and maximum values are presented in parentheses. [D]Diameter, [L]Length, [W]Width.

presents biometrical data similar to the present species (Table 2). However, as reported by Mitra and Bandyopadhyay (2006), the species contains one to eight non-impregnable round particles in the central part of the adhesive disc, which are absolutely absent in *P. africana*.

Lom (1963) reported "If there is an anterior projection near the base of the blade, it does not communicate with a notch in the blade of the preceding denticle". Later, Gaze and Wootten (1999) illustrated the distinct interlocking mechanism of the denticles of *P. incisa* and better elucidated the positioning of the anterior projection, describing it as a well-defined structure continuous with the central part.

Gaze and Wootten (1999) suggested the absence of ray apophysis in *P. incisa* as an additional discriminating feature of the genus. Our observations support this idea since it was also not recorded in the specimens of *P. africana* herein observed.

Paratrichodina africana reported in this study fall within the ranges for *P. africana* presented in the original description by Kazubski and El-Tantawy (1986) with respect to measures of body diameter, number of denticles, denticulate ring, size of adoral spiral, and wide border membrane. The subsequent report provided by Mitra and Bandyopadhyay (2006) also presents similar measures of the denticulate ring, number of denticles, pins per denticle, and some dimensions of denticle components, but it differs in body diameter (Table 1). Additionally, all other *Paratrichodina* species biometrically differed from the present studied specimens, as presented in Table 2.

Conclusion

This is the fourth register of *P. africana* parasitizing a fish host and the first report of the genus in eastern Amazonia. By the fact that tilapia is one of the most popular and cultured freshwater fish, fish farmers must be careful with the water quality and feeding rate in ponds and especially in cages when the fish stocking density are higher than normal predisposing the fish for parasitism.

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