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NEW DATA ON *TEREANCISTRUM PARVUS* KRITSKY *ET AL.* AND *T. PARANAENSIS* KARLING *ET AL.* (MONOGENEA: DACTYLOGYRIDAE) FROM *LEPORINUS OBTUSIDENS* VALENCIENNES (CHARACIFORMES: ANOSTOMIDAE) FROM LAKE GUAÍBA, SOUTHERN BRAZIL

NUEVOS DATOS ACERCA DE *TEREANCISTRUM PARVUS* KRITSKY *ET AL.* Y *T. PARANAENSIS* KARLING *ET AL.* (MONOGENEA: DACTYLOGYRIDAE) DE *LEPORINUS OBTUSIDENS* VALENCIENNES (CHARACIFORMES: ANOSTOMIDAE) DEL LAGO GUAÍBA, REGIÓN SUR DE BRASIL

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ABSTRACT

Tereancistrum parvus Kritsky, Thatcher & Kayton, 1980 and *T. paranaensis* Karling, Lopes, Takemoto & Pavanelli, 2014 are recorded for the first time on the gills of *Leporinus obtusidens* Valenciennes from Lake Guaíba, State of Rio Grande do Sul, southern Brazil. The original description of *Tereancistrum paranaensis* was altered in order to correct the position of vagina, which was described as dextral, but it is actually sinistral; some morphometric data were revised. The description of *T. parvus* is complemented with the drawings of a specimen mounted *in toto*, with details of the vagina and gonads as well as with measurements of the internal structures of specimens collected from the gills of 'piava', *L. obtusidens* from Lake Guaíba.

Key words: gills - *Leporinus* - morphological structures - measurements - 'piava' - *Tereancistrum*.

RESUMO

Terencistrum parvus Kritsky, Thatcher & Kayton, 1980 e *T. paranaensis* Karling, Lopes, Takemoto & Pavanelli, 2014, são registrados pela primeira vez em brânquias de *Leporinus obtusidens* Valenciennes, 1837 do Lago Guaíba, Rio Grande do Sul, região sul do Brasil. *Tereancistrum paranaensis* teve sua descrição original alterada para corrigir a posição da vagina, que foi descrita como dextra, quando na verdade é sinistra, além disso, alguns dados morfométricos foram revisados. A descrição de *T. parvus* é complementada com desenhos de um espécime montado *in toto*, detalhes da vagina e gônadas, bem como com medidas das estruturas internas dos espécimes coletados em brânquias de piava, *L. obtusidens* do Lago Guaíba.

Palavras-chave: brânquias - estruturas morfológicas - medidas - piava.

INTRODUCTION

Tereancistrum Kritsky, Thatcher & Kayton, 1980 is a well characterized genus being represented by several species, although the description of one of them was based on few specimens, thus preventing the authors to observe and describe some important characters. An example is *Tereancistrum parvum* Kritsky, Thatcher & Kayton, 1980, whose description was based on morphological data from a single specimen and the illustration of the body did not include the position of the vagina and gonads. Thus, some morphological characters of this species were not well described and there are no ranges of measurements for the characters. For these reasons a complementation of the description of *T. parvum* collected from the host *Leporinus obtusidens* Valenciennes, 1837 of Lake Guaíba is presented. Besides, in the description of *Tereancistrum paranaensis* Karling, Lopes, Takemoto & Pavanelli, 2014, the authors left some doubts about the position of the vagina, some structures of the haptor, anchors, bars, and the male copulatory organ (MCO). In this paper, we add new information on the morphology, parasitic indices, and report for the first time the occurrence of *T. paranaensis* and *T. parvum* in Lake Guaíba, Brazil.

MATERIAL AND METHODS

Sixty specimens of *L. obtusidens* were collected by professional fishermen from Lake Guaíba (30°01'S, 51°16'W), State of Rio Grande do Sul, southern Brazil, in October of 2013. The fish studied were bought directly from the fishermen as they were taken to the local market, immediately after the catch. The study was approved by the Universidade Federal do Rio Grande do Sul (UFRGS) Ethics Committee under the number 27531. After fixation in formalin 5% (Amato *et al.*, 1991),

the gills were removed and parasites collected under a stereomicroscope. Some specimens were stained with Gomori's Trichrome (Humason, 1979) and mounted in Canada balsam for study of the internal organs, while other specimens were mounted in Gray and Wess' medium (Humason, 1979) for the study of the sclerotized structures. Measurements are in micrometers (μm), ranges are followed, between parentheses, by the mean, standard deviation, and total number of individuals measured when different than 19 (*T. paranaensis*) and 34 (*T. parvum*), respectively. The number of hooks was counted according to Mizelle & Price (1963), and the description of the male copulatory organ (MCO) followed Kritsky *et al.* (1985). Voucher specimens were deposited in the 'Coleção Helminológica do Instituto Oswaldo Cruz (CHIOC)', Rio de Janeiro, Brazil. Ecological terms follow Bush *et al.* (1997).

RESULTS

Tereancistrum paranaensis Karling, Lopes, Takemoto & Pavanelli, 2014
(Fig. 1)

Description. Based on 19 specimens, 2 stained in Gomori's Trichrome and mounted in Canada balsam, 17 mounted in Gray & Wess. Body elongated, fusiform, 350-500 (421 ± 44 ; $n = 15$) long, 70-130 (88 ± 17 ; $n = 18$) wide. Cephalic lobes poorly developed. Four pairs of cephalic organs poorly developed. Cephalic glands at level of pharynx. One pair of eyespots, anterior to pharynx. Pharynx sub-spherical, 25-35 (28 ± 3 ; $n = 11$) wide. Peduncle elongated, distinct from the rest of the body. Haptor sub-hexagonal, 55-68 (63 ± 3 ; $n = 14$) long, 63-88 (75 ± 7 ; $n = 16$) width. Presence of two haptor muscles attached to the accessory sclerites, probably to assist movement. Seven pairs of hooks, 5 ventral, 2 dorsal. Hooks similar in size and shape, 15-25 (23 ± 2 ; $n = 12$)

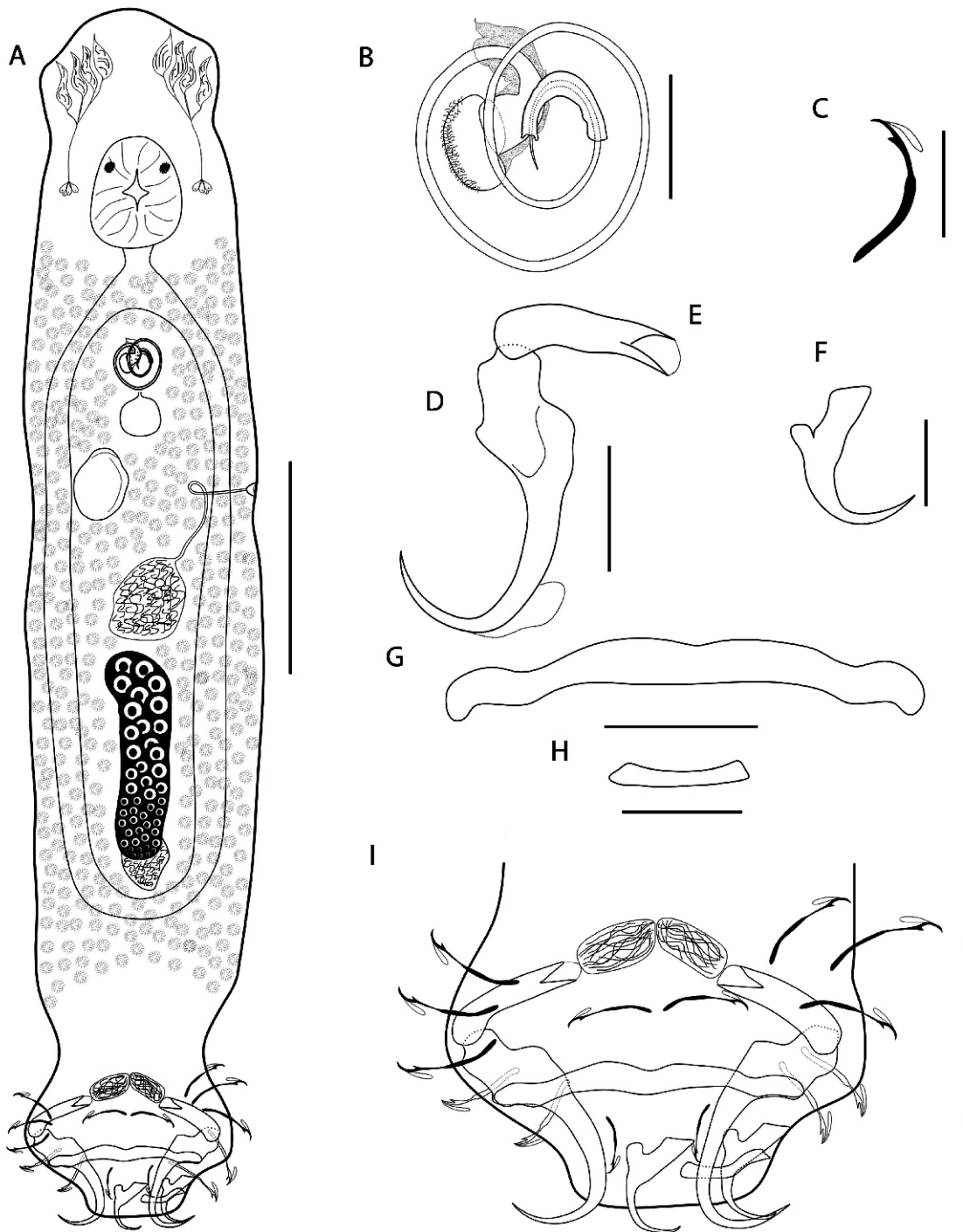


Figure 1: *Tereancistrum paranaensis*, composite drawing (ventral view). A: *in toto*; B: male copulatory organ; C: hook; D: ventral anchor and accessory sclerite; E: dorsal anchor; F: ventral bar; G: dorsal bar; H: haptor. Scales: A = 80 μm ; B = 5 μm ; C = 20 μm ; D = 20 μm ; F = 20 μm ; G = 20 μm ; H = 15 μm ; I = 30 μm .

long, well developed thumb, recurved shank, with inflated proximal portion. Filamentous hook loop (FH) reach inflated portion of the shank. Ventral anchor 45-50 (46 ± 2 ; $n = 18$) long, 14-20 (16 ± 2 ; $n = 16$) wide at base, deep root indistinct, superficial root well developed, shaft, and recurved point. Accessory sclerite, short and spatuliform, 24-27 (25 ± 1 ; $n = 15$) long, associated to superficial root of the ventral anchor. Dorsal anchor well developed, 15-27 (25 ± 3 ; $n = 17$) long, 6-15 (10 ± 3 ; $n = 6$) wide at base, with divergent roots, short shaft, and straight point. Ventral bar rectangular, 48-65 (56 ± 4 ; $n = 15$) long. Dorsal bar rectangular, 1019 (14 ± 3 ; $n = 8$) long. Gonads overlapping. Testis dorsal to ovary, difficult to observe. Ovary 8088 (84 ± 4 ; $n = 4$) long, 15-38 (24 ± 10 ; $n = 4$) wide. MCO is a coiled tube with $1 \frac{1}{2}$ to $2 \frac{1}{2}$ counterclockwise rings, proximal ring diameter 15-22 (18 ± 2 ; $n = 16$). Accessory piece 10-18 (14 ± 3 ; $n = 5$) long, non-articulated with the MCO. Vagina sinistral, slightly sclerotized, in the anterior portion of the body. Vitelline glands posterior to pharynx, extending to the end of intestinal ceca, except in the region of male copulatory complex and gonads.

Taxonomic summary.

Host: *Leporinus obtusidens* Valenciennes, 1837.

Site of infestation: gills.

Locality: Lake Guaíba, State of Rio Grande do Sul ($30^{\circ}01'S$, $51^{\circ}16'W$), southern Brazil.

Prevalence: 26.66%.

Mean intensity of infestation: 1.75 specimens/host.

Abundance of infestation: 0.46 specimen/host.

Range of infestation: 15 specimens/host.

Specimens deposited: CHIOC 38085; CHIOC 38086 (vouchers).

Specimens examined: *T. paranaensis* (CHIOC 37866; CHIOC 37867) paratypes deposited by Karling *et al.* (2014).

Remarks.

The morphology of the haptor structures,

anchors, bars, and MCO was revised. In the original description of *T. paranaensis*, Karling *et al.* (2014) characterized the vaginal opening as dextral when it is sinistral. Furthermore, in the original illustration the MCO was represented as coiled clockwise, however, after examining the specimens deposited in the 'Coleção Helmintológica do Instituto Oswaldo Cruz (CHIOC)' and the specimens collected from the gills of *L. obtusidens* of Lake Guaíba it was seen that this structure is coiled counterclockwise. An explanation for this might be that the specimen was observed in dorsal view, but described as ventral view, which resulted in a misleading interpretation between ventral and dorsal structures. The morphometric data presented in the original description of *T. paranaensis* are incompatible with the scales presented together with the illustrations. So, the morphometric data were corrected based on the new specimens available.

The peduncle of *T. paranaensis* is not short as referred by Karling *et al.* (2014), instead, this structure quite visible. In the original description of *T. paranaensis* the measurements of the haptor were not included. If we compare these structures in the illustrations presented by the authors, the haptor appears to be $\frac{1}{4}$ of total body length. When the same structure is observed in the specimens deposited in the CHIOC and in those collected from *L. obtusidens* (present work) it is possible to verify that its size is closer to $\frac{1}{7}$ of the body length. Karling *et al.* (2014) did not mention the presence of haptor muscles connected to the accessory sclerite, although these structures are present, they are well developed, and probably related to movement of the haptor structures.

Finally, it should be noted that despite the observations made in the present work, the validity of *T. paranaensis* is preserved, and the species is recorded for the first time on *L. obtusidens* of Lake Guaíba, expanding the

known geographic distribution and the list of known hosts for this parasite.

Tereancistrum parvus Kritsky, Thatcher & Kayton, 1980
(Fig. 2)

Description. Based on 34 specimens, eight stained in Gomori's Trichome and 26 mounted in Gray & Wess. Body slender, fusiform, 450-650 (530 ± 55 ; $n = 34$) long, 60-120 (86 ± 15 ; $n = 34$) at maximum width. Cephalic lobes well developed, one apical and two bilateral. Four cephalic organs. Cephalic glands anterior to pharynx. One pair of eyespots, immediately anterior to pharynx; sub-spherical, granular, and variable in size; granules are spread throughout the body. Pharynx sub-ovate, 28-40 (34 ± 4 ; $n = 30$) in diameter. Peduncle broad, sub-hexagonal, 88-128 (113 ± 11 ; $n = 27$) long, 143-225 (182 ± 20 ; $n = 30$) wide. Haptoral muscles dense, connecting the accessory sclerites. Seven pairs of hooks, five ventral and two dorsal. Hooks similar in size and shape, 3040 (35 ± 2 ; $n = 18$) long, with erect thumb, curved shaft, short point, and proximal portion of shank dilated, FH loop with $\frac{1}{4}$ of shank length. Ventral anchor 68-108 (91 ± 8 ; $n = 30$) long, 13-28 (22 ± 4 ; $n = 28$) wide at base, with a root deep and incipient, the other root superficial and well developed, shaft and point strongly recurved. Accessory sclerites delicate, elongated, spatuliform, 88-135 (109 ± 11 ; $n = 32$) long. Dorsal anchor 68-88 (79 ± 4 ; $n = 30$) long, 18-25 (20 ± 3 ; $n = 25$) wide at base. Ventral bar V-shaped, elongated with rounded, dilated ends, 100-138 (117 ± 10 ; $n = 26$) long. Dorsal bar 45-88 (68 ± 10 ; $n = 27$) long. Gonads overlapping. Testis dorsal to ovary. Ovary 63-100 (77 ± 11 ; $n = 10$) long, 13-40 (22 ± 8 ; $n = 11$) wide. Male copulatory organ is a coiled tube with 3 $\frac{1}{2}$ counterclockwise rings, proximal ring 13-16 (15 ± 1 ; $n = 25$) in diameter. Accessory piece 25-36 (29 ± 3 ; $n = 18$) long, a tube with a ventral groove serving as guide to the distal portion of the MCO. Vagina sinistral, cone shaped, strongly

sclerotized, in the middle region of body. Vitellarium distributed throughout the body except anterior to pharynx and in the gonads region.

Taxonomic summary.

Host: *Leporinus obtusidens* Valenciennes, 1837.

Site of infestation: gills.

Locality: Lake Guaíba, State of Rio Grande do Sul ($30^{\circ}01'S$, $51^{\circ}16'W$), Brazil.

Prevalence: 40%.

Mean intensity of infestation: 2.58 specimens/host.

Mean abundance of infestation: 1.03 specimens/host.

Range of infestation: 112 specimens/host.

Specimens deposited: CHIOC 38087; CHIOC 38088 (vouchers).

Specimens examined: *T. parvus*, (CHIOC 37863; CHIOC 37864; CHIOC 37865) voucher specimens deposited by Karling *et al.* (2014).

Remarks.

Tereancistrum parvus was described by Kritsky *et al.* (1980) based on a single specimen. Recently, an emended diagnosis of *T. parvus* was proposed by Karling *et al.* (2014). Thus, we present more morphological data based on specimens collected in *L. obtusidens* from Lake Guaíba, and reaffirm the validity of *T. parvus*, when it was compared with other species grouped in *Tereancistrum*.

Tereancistrum parvus is considered valid based on the morphology of the anchors, the accessory sclerites and the copulatory complex, which together form a set of characteristics which separates this species from the others placed in *Tereancistrum* (Kritsky *et al.*, 1980; Lizama *et al.*, 2004; Cohen *et al.*, 2012; Cepeda *et al.*, 2012). However, the detailed study of the samples revealed some morphological differences. First, the vagina, strongly sclerotized, is located in the middle region of the body and is

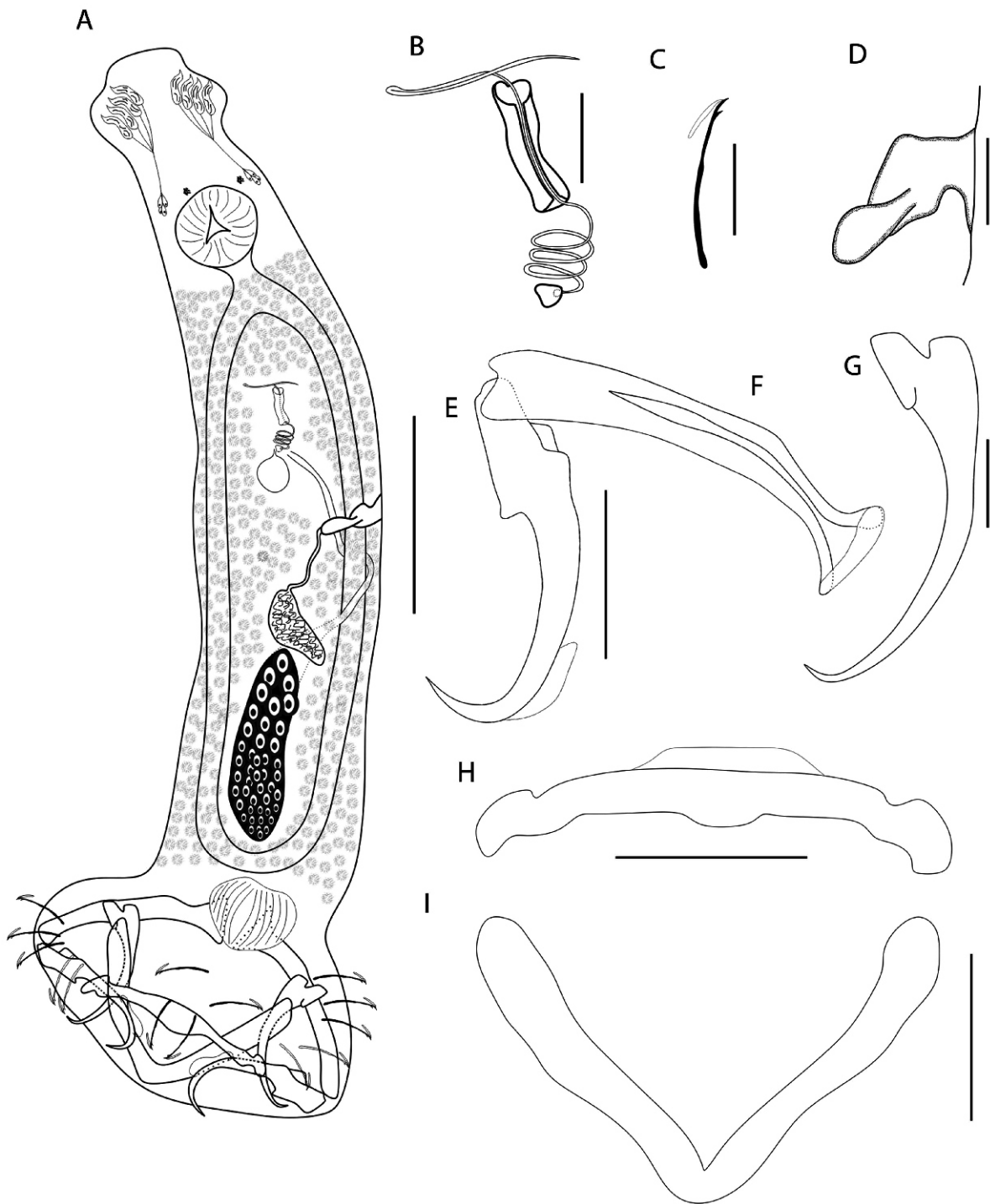


Figure 2: *Tereancistrum parvus*, composite drawing (ventral view). A: *in toto*; B: male copulatory organ; C: dorsal anchor; D: ventral anchor and accessory sclerite; E: hooks; F: ventral bar; G: dorsal bar. Scales: A = 96 μm ; B = 20 μm ; C = 20 μm ; D = 10 μm ; E = 45 μm ; G = 40 μm ; H = 50 μm ; I = 15 μm .

cone-shaped, divided into two chambers, one distal tapered and the other connected to the vaginal canal. The copulatory complex shows two differences when compared with the description of Kritsky *et al.* (1980): (1) the male copulatory organ consists of three counterclockwise rings, its terminal portion goes inside the accessory piece and ends in a round-shaped loop that rests on it; (2) the accessory piece is elongated, has a ventral groove that serves as a guide for the MCO, and does not present the projection mentioned in the original description.

Furthermore, with respect to haptor structures, the ventral bar is nearly twice as large and presents rounded and enlarged terminal portions, which differ from the description made by Kritsky *et al.* (1980). The hooks are longer, thin with a slight dilation in the shank. Kritsky *et al.* (1980) and Karling *et al.* (2014) did not mention the presence of a haptoral muscle in this species, although this structure is present, it is ventral and well developed. The morphology of the other structures are in accordance with the original description, although in ours specimens they are larger. The differences in size of the structures can be attributed to the study of a larger number of specimens, or due to the influence of development in different hosts.

DISCUSSION

According to Kritsky *et al.* (1980), *Tereancistrum* is characterized by the presence of an accessory sclerite articulated to the ventral anchor and by having a typically ancyrocephaline haptor (Mizelle, 1936), one or two pairs of eyespots, and overlapping gonads. *Tereancistrum* groups eight species which parasitize the gill filaments of Neotropical freshwater characiforms. Seven species have been described in Brazil, the other was described from specimens collected in

Colombia (Kritsky *et al.*, 1980; Lizama *et al.*, 2004; Cohen *et al.*, 2012; Cepeda *et al.*, 2012; Karling *et al.*, 2014). In Brazil, species of *Tereancistrum* have been recorded in the following rivers: Amazonas, Paraná, and Mogi Guaçu. The records of *T. parvus* and *T. paranaensis* in *L. obtusidens* from Lake Guaíba, State of Rio Grande do Sul extend the known geographic distribution of these species. The descriptions of our specimens of *T. paranaensis* and of *T. parvus* presented here improve those of the original authors.

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