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Three new species of Monogenea (Platyhelminthes) parasites of fish in the Guandu river, southeastern Brazil

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ABSTRACT. Current essay describes three new Monogenean species, namely, *Cosmetocleithrum striatuli* sp. nov., *Jainus leporini* sp. nov. and *Rhabdosynochus guanduensis* sp. nov., parasites on the gills of *Trachelyopterus striatulus* (Steindachner, 1877), *Leporinus copelandii* Steindachner, 1875 and *Centropomus undecimalis* (Bloch, 1792), respectively. Fish were collected from the Guandu river, State of Rio de Janeiro, Brazil between August 2005 and November 2008. *Cosmetocleithrum striatuli* sp. nov. differs from all other congeneric species by the shape of an accessory piece (more robust and resembling a crustacean claw or chela) and by the shape of its ventral and dorsal bars (not V-shaped and with expanded lateral ends directed to the rear). *Jainus leporini* sp. nov. differs from all other *Jainus* species by the male copulation organ (MCO), with a 2-ring coil, by the absence of medial projection on ventral bar and by a plate-like sclerotized structure associated to the vagina. *Rhabdosynochus guanduensis* sp. nov. differs from all other congeneric species by the morphology of the copulation complex and by a shell-shaped vagina.

Keywords: *Centropomus undecimalis*, *Cosmetocleithrum striatuli* sp. nov., *Jainus leporini* sp. nov., *Rhabdosynochus guanduensis* sp. nov., *Trachelyopterus striatulus*, *Leporinus copelandii*.

Três novas espécies de Monogenea (Platyhelminthes) parasitos de peixes do rio Guandu, Sudeste do Brasil

RESUMO. Três novas espécies, *Cosmetocleithrum striatuli* sp. nov., *Jainus leporini* sp. nov. e *Rhabdosynochus guanduensis* sp. nov., parasitando as brânquias de *Trachelyopterus striatulus* (Steindachner, 1877), *Leporinus copelandii* Steindachner, 1875 e *Centropomus undecimalis* (Bloch, 1792), respectivamente, são descritas no presente trabalho. Os peixes foram coletados do rio Guandu, Estado do Rio de Janeiro, Brasil, no período de agosto de 2005 a novembro de 2008. *Cosmetocleithrum striatuli* sp. nov. difere de todas as outras espécies congênicas pelo formato da pesca acessória (muito robusta e semelhante a uma quela de crustáceo) e pelo formato das barras ventral e dorsal (sem o formato de V e com as extremidades laterais expandidas e direcionadas posteriormente). *Jainus leporini* sp. nov. difere de todas as outras espécies do gênero pelo órgão copulatório masculino (OCM) ter duas voltas de diâmetro do anel, pela ausência de projeção medial na barra ventral e por possuir uma vagina associada a uma estrutura esclerotizada em forma de placa. *Rhabdosynochus guanduensis* sp. nov. difere de todas as outras espécies congênicas pela morfologia do complexo copulatório e pela vagina em forma de concha.

Palavras-chave: *Centropomus undecimalis*, *Cosmetocleithrum striatuli* sp. nov., *Jainus leporini* sp. nov., *Rhabdosynochus guanduensis* sp. nov., *Trachelyopterus striatulus*, *Leporinus copelandii*.

Introduction

Despite the efforts of taxonomists, the diversity of the Monogenea in neotropical waters is still largely unknown (BOEGER; VIANNA, 2006) and further efforts to carry out studies on their biodiversity are relevant. The Guandu river supplies water to 90% of the population of the city of Rio de Janeiro, Brazil. It has the greatest diversity of fish and the highest biomass within the Bay of Sepetiba Hydrographic Basin (BIZERRIL; PRIMO, 2001). To date, five taxonomic studies on monogenean

species have been carried out on fishes from the Guandu river. Boeger and Popazoglo (1995) described a new species of *Gyrodactylus*, parasitic on *Hoplias malabaricus* (Bloch, 1794); Kritsky et al. (1995) studied the morphometric variability of the anchors and hooks of *Scleroductus* spp.; Abdallah et al. (2008) published a note on the morphology of *Gussevia asota*; Kritsky et al. (1986) on *G. astronoti*; Kritsky et al. (1986) collected *Astronotus ocellatus* (Agassiz, 1831); Carvalho et al. (2008) described a new species of *Sciadicleithrum* in *Geophagus brasiliensis*

(Quoy and Gaimard, 1824), and more recently, Abdallah et al. (2009) described four new species of *Ligophorus* parasitizing the gills of *Mugil liza* Valenciennes, 1836.

This paper provides the description of three new species of Monogenea from the Guandu river, or rather, *Cosmetocleithrum striatuli* sp. nov., *Jainus leporini* sp. nov. and *Rhabdosynochus guanduensis* sp. nov. parasitizing the gills of *Trachelyopterus striatulus* (Steindachner, 1877), *Leporinus copelandii* Steindachner, 1875 and *Centropomus undecimalis* (Bloch, 1792) respectively.

Material and methods

Sixty specimens of cumbaca (*T. striatulus*), 30 of piau (*L. copelandii*) and 31 of robalo (*C. undecimalis*) were collected between August 2005 and November 2008 from the Guandu river (22°48'32"S; 43°37'35"W), State of Rio de Janeiro, Brazil, to study the above-mentioned monogenean species. The gills were removed and placed in vials with formalin 5% to fix ectoparasites. Some specimens were stained with Gomori trichrome and mounted in Canada balsam; other specimens were mounted in Gray and Wess medium (HUMASON, 1979) for study of sclerotized structures. Measurements are given in micrometers. Average measurements are followed by ranges and number of specimens measured (*n*) between parentheses. Unstained flattened specimens mounted in Gray and Wess medium were used to obtain measurements of the haptor sclerites; all other measurements were obtained from non-flattened specimens stained in Gomori trichrome. Drawings were made with the aid of a drawing tube mounted on a Hund Wetzlar H-600 phase contrast microscope. Measurements were made using software Motic Images Plus™ 2.0. Type specimens were deposited at the Instituto Nacional de Pesquisas da Amazônia (INPA), Manaus, Amazonas State, Brazil.

Results and discussion

Dactylogyridae Bychowsky, 1933.

Cosmetocleithrum striatuli sp. nov. (Figure 1, A-G).

Type host: *Trachelyopterus striatulus* (Steindachner, 1877) (Auchenipteridae).

Type locality: Guandu river (22°48'32"S; 43°37'35"W), State of Rio de Janeiro, Brazil.

Site of infection: Gills.

Prevalence: 95% (57 of 60 fish examined).

Type specimens: Holotype INPA No 532, Paratypes INPA No 533a-c.

Specimens studied for comparative purposes: One paratype of *Cosmetocleithrum gussevi* Kritsky et al. (1986) (INPA No 158b).

Etymology: The specific designation *striatuli* refers to the specific name of the type-host.

Description: Body 735 (564-898; *n* = 15) long, fusiform; 122 (92-152; *n* = 15) wide near gonad level. Tegument smooth. Cephalic lobes moderately developed; cephalic glands at level of pharynx. Eyes 2, accessory granules in cephalic area. Pharynx ovate 61 (52-68; *n* = 15) in diameter; esophagus elongate; intestinal ceca confluent posterior to testis. Peduncle broad; haptor oval 91 (78-116; *n* = 15) long, 103 (88-122; *n* = 15) wide. Anchors similar; each with developed roots, large base, curved shaft and point. Ventral anchor 67 (59-73; *n* = 10) long, anchor base 15 (12-18; *n* = 10) wide; dorsal anchor 58 (50-64; *n* = 10) long; anchor base 12 (10-15; *n* = 10) wide. Ventral bar 40 (33-49; *n* = 11) long, straight with rounded ends directed posteriorly; dorsal bar 40 (33-48; *n* = 11) long, slightly curved with elongate projections directed to the rear. Hooks 17 (16-18; *n* = 10) long, similar, each with tapered shaft and point, slender shank; FH loop ½ shank length. Testis intercecal, postovarian, subovate 106 (87-123; *n* = 12) long, 46 (31-58; *n* = 12) wide; vas deferens looping left intestinal caecum; seminal vesicle elongate. Male copulation organ (MCO) a coil of 2 rings, base with one sclerotized part; accessory piece 38 (34-40; *n* = 8) long, resembles crustacean chela. Ovary subovate 37 (29-48; *n* = 12) long, 22 (14-35; *n* = 12) wide, vagina sinistral, with lateral opening, sclerotized. Vitellaria dense.

Remarks: Species of *Cosmetocleithrum* are parasites on Neotropical siluriform fishes and are characterized by having gonads tandem, MCO J-shaped or coiled, non-articulated accessory piece and by having posterior projections on ribbon-like dorsal bar. According Boeger and Vianna (2006), seven *Cosmetocleithrum* species were described, six of them with known distribution restricted to the Amazon basin and described by Kritsky et al. (1986) and the other, *C. longivaginatum*, is from Paranean-Platean province, Argentina (SURIANO; INCORVAIA, 1995).

Cosmetocleithrum striatuli sp. n. differs from all other congeneric species by the shape of accessory piece (very robust and resembling a crustacean claw or chela) and by the shape of ventral and dorsal bars (not V-shaped and with expanded lateral ends directed to the rear). Based on the morphology of the copulation complex of the *Cosmetocleithrum* species, *C. striatuli* sp. n. is close to *C. gussevi* Kritsky et al. (1986) parasite of *Oxydoras niger* (Valenciennes, 1821) from Janauacá lake, Brazil. The new species differs from *C. gussevi* mainly by having robust accessory piece resembling

a crustacean chela (accessory piece is slender and Y-shaped in *C. gussevi*); by well-defined anchors roots (*C. gussevi* has non well-defined anchor roots); by the dorsal bar shape (the new species lack a pointed posteromedial protuberance, present in *C. gussevi*); by the ventral bar shape (without posteromedial rounded keel, present in *C. gussevi*); and by presence of seven pairs of haptoral hooks

(*C. gussevi* do not have hook pairs 5 and 6). Also, eyes and eye granules are present in the new species (absent in *C. gussevi*). Examination of paratype of *C. gussevi* shows that this species was adequately described by Kritsky et al. (1986) and confirmed the differences reported in this study. This is the first record of *Cosmetocleithrum* species in auchenipterid siluriform fishes.

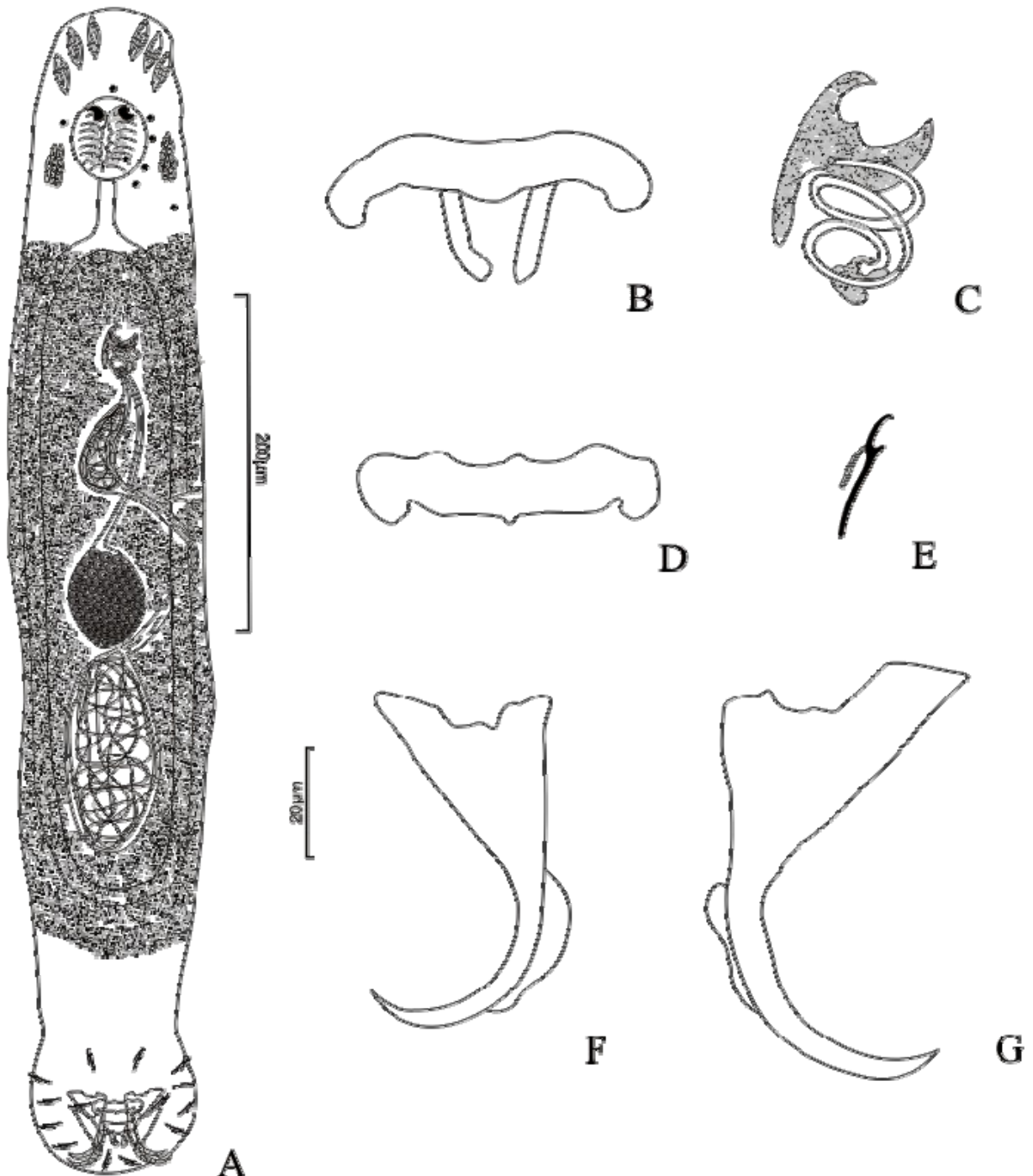


Figure 1. *Cosmetocleithrum striatuli* sp. nov. (A) whole worm, ventral view. (B) Dorsal bar. (C) Male copulation complex: MCO and accessory piece. (D) Ventral bar. (E) Hook. (F) Dorsal anchor. (G) Ventral anchor.

Jainus leporini sp. nov.

(Figure 2, A–I).

Type host: *Leporinus copelandii* Steindachner, 1875 (Anostomidae).

Type locality: Guandu river (22°48'32"S, 43°37'35"W), State of Rio de Janeiro, Brazil.

Site of infection: Gills.

Prevalence: 13.3% (4 of 30 fishes examined).

Type specimens: Holotype INPA No 534, Paratypes INPA No 535a–c

Specimens studied for comparative purposes: Nine paratypes of *Jainus amazonensis* Kritsky et al. (1986) (INPA No 013a–i).

Etymology: The specific designation *leporini* refers to the generic name of the type-host.

Description: Body 539 (456–660; $n = 20$) long, fusiform; 120 (99–146; $n = 20$) wide near level of gonads. Tegument smooth. Cephalic lobes moderately developed; cephalic glands not observed. Eyes 4, posterior pair larger and closer than anterior pair; accessory granules present at level of pharynx. Pharynx spherical 29 (27–31; $n = 20$) in diameter; esophagus short; intestinal caeca confluent posterior to testis. Peduncle short; haptor oval 59 (51–67; $n = 18$) long, 61 (54–67; $n = 18$) wide. Anchors very dissimilar; ventral anchor 15 (12–19; $n = 12$) long, base 8 (7–10; $n = 12$) wide, with elongate and fine roots widely separated, greater superficial root with constriction on distal portion, curved shaft, curved tip; dorsal anchor 40 (33–43; $n = 15$) long, anchor base 17 (16–18; $n = 15$) wide, superficial root greater than deep root, distal portion roots truncated, nearly straight shaft, recurved tip. Ventral bar 23 (21–25; $n = 13$) long, filamentous; dorsal bar 36 (33–40; $n = 15$) long, simple, curved with rounded end. Hook 17 (15–18; $n = 10$) long, with slightly curved point and shaft, straight shank; FH loop 0.9 shank length. Testis intercecal, postovarian, bacilliform 119 (101–131; $n = 12$) long, 30 (27–38; $n = 12$) wide, vas deferens looping left intestinal caecum; seminal vesicle saccate, immediately posterior to copulation complex; prostatic reservoir saccate, besides the seminal vesicle. Copulation complex posterior to pharynx. MCO a coil of 1½ rings, base with small sclerotized structure; accessory piece 18 (15–21; $n = 5$) long, composed of two united circles of different diameters resembling closed cuffs. Ovary ovate 43 (35–49; $n = 11$) long, 30 (26–34; $n = 11$) wide, vagina sinistral, elongate, associated to plate-like sclerotized structure; seminal receptacle spherical. Vitellaria dense. Egg elongate without filament 62 (59–66; $n = 5$) long, 32 (30–34; $n = 5$) wide.

Remarks: *Jainus* Mizelle, Kritsky and Crane, 1968 included dactylogyrid species parasitic on

characiform fish, characterized by having gonads tandem or overlapping, accessory piece articulated or non-articulated proximally, and ventral anchor robust with elongate superficial and deep roots. To date, five species of *Jainus* are known, four from Brazil, *J. jainus* Mizelle, Kritsky and Crane, 1968 on *Chalceus macrolepidotus* Cuvier, 1818, *J. robustus* Mizelle Mizelle, Kritsky and Crane, 1968 on *Cretochanes affinis* (Günther, 1864), *J. amazonensis* Kritsky, Thatcher and Kayton, 1980 from *Brycon melanopterus* (Cope, 1872) and *Jainus iocensins* Cohen, Kohn and Boeger, 2012 from *Salminus brasiliensis* (Cuvier, 1817); and one from Costa Rica, *J. hexops* Kritsky and Leiby, 1972 on *Astyanax fasciatus* (Cuvier, 1819) (MIZELLE et al., 1968; KRITSKY; LEIBY, 1972; KRITSKY et al., 1980; BOEGER; VIANNA, 2006; COHEN et al., 2012).

Jainus leporini sp. nov. differs from all other congeneric species by male copulation organ (MCO) with a coil of 2 rings, by absence of medial projection in ventral bar and by a vagina associated to a plate-like sclerotized structure. Based on the shape of the accessory piece, *J. leporini* sp. nov. is close to *J. amazonensis*. The new species differs from *J. amazonensis* by accessory piece not flabellate distally (flabellate in *J. amazonensis*), by a vagina associated to plate-like sclerotized structure (simple in *J. amazonensis*) and by possessing a coiled male copulation organ comprising 2 rings (cirrus is a coil of one ring in *J. amazonensis*). Also, the new species does not have an elongate terminal extension on the superficial root of the ventral anchor (present in *J. amazonensis*) and a medial projection in ventral bar. Examination of paratypes of *J. amazonensis* showed that this species was adequately described by Kritsky et al. (1980) and confirmed the differences reported in current study. This is the first record of *Jainus* species in anostomid characiform fishes.

Diplectanidae Monticelli, 1903.

Rhabdosynochus guanduensis sp. nov.

(Figure 3, A–H).

Type host: *Centropomus undecimalis* (Bloch, 1792) (Centropomidae).

Type locality: Guandu river (22°48'32"S, 43°37'35"W), State of Rio de Janeiro, Brazil.

Site of infection: Gills.

Prevalence: 55% (17 of 31 fishes examined).

Type specimens: Holotype INPA No 536, Paratypes INPA No 537a–c

Specimens studied for comparative purposes: Seven paratypes of *Rhabdosynochus hudsoni* Kritsky, Boeger and Robaldo, 2001 (INPA No 382a–g).

Etymology: The specific name refers to type-locality of the new species.

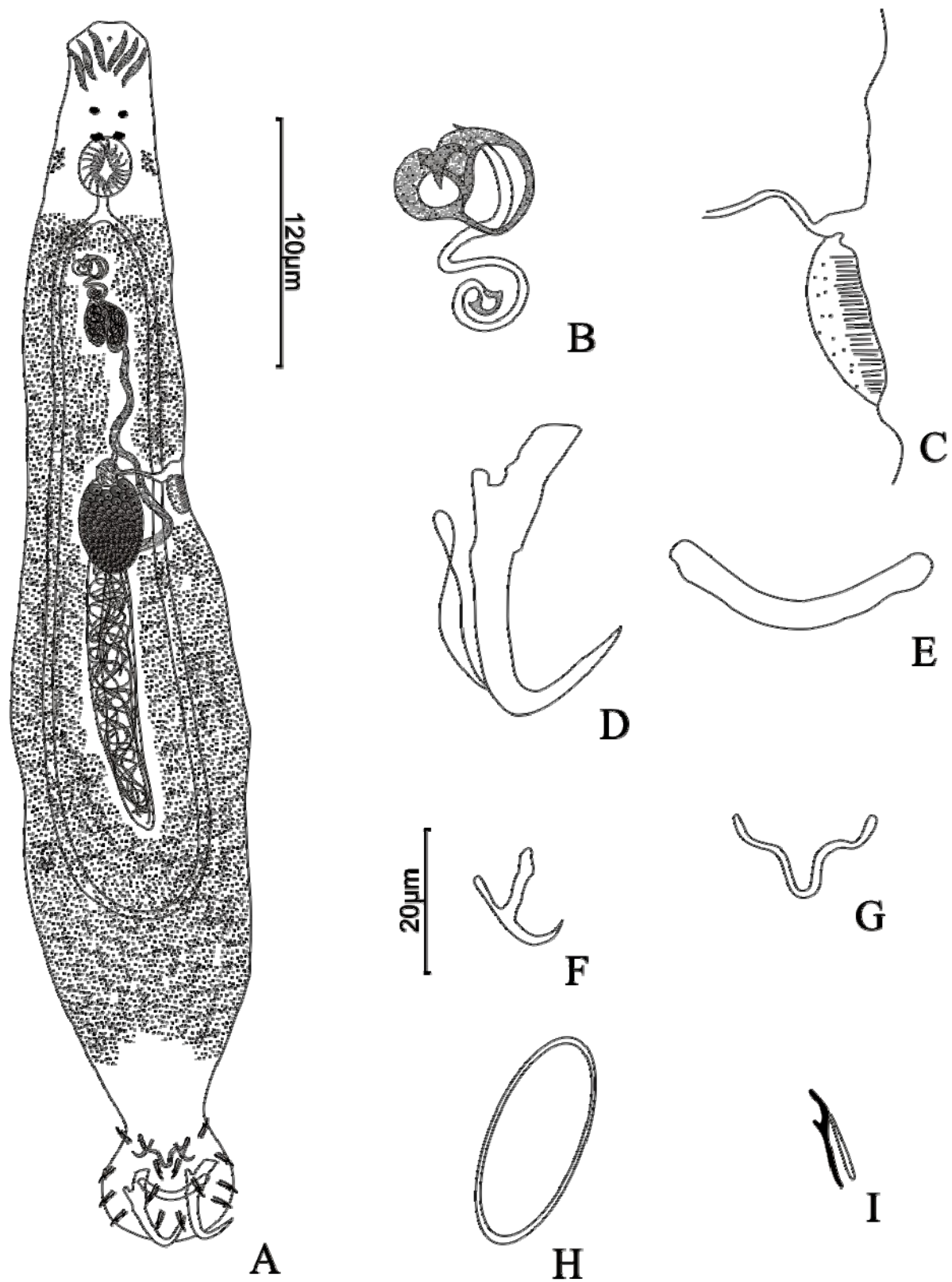


Figure 2. *Jainus leporini* sp. nov. (A) whole worm, ventral view. (B) Male copulation complex: MCO and accessory piece. (C) Vagina. (D) Dorsal anchor. (E) Dorsal bar. (F) Ventral anchor. (G) Ventral bar. (H) Egg. (I) Hook.

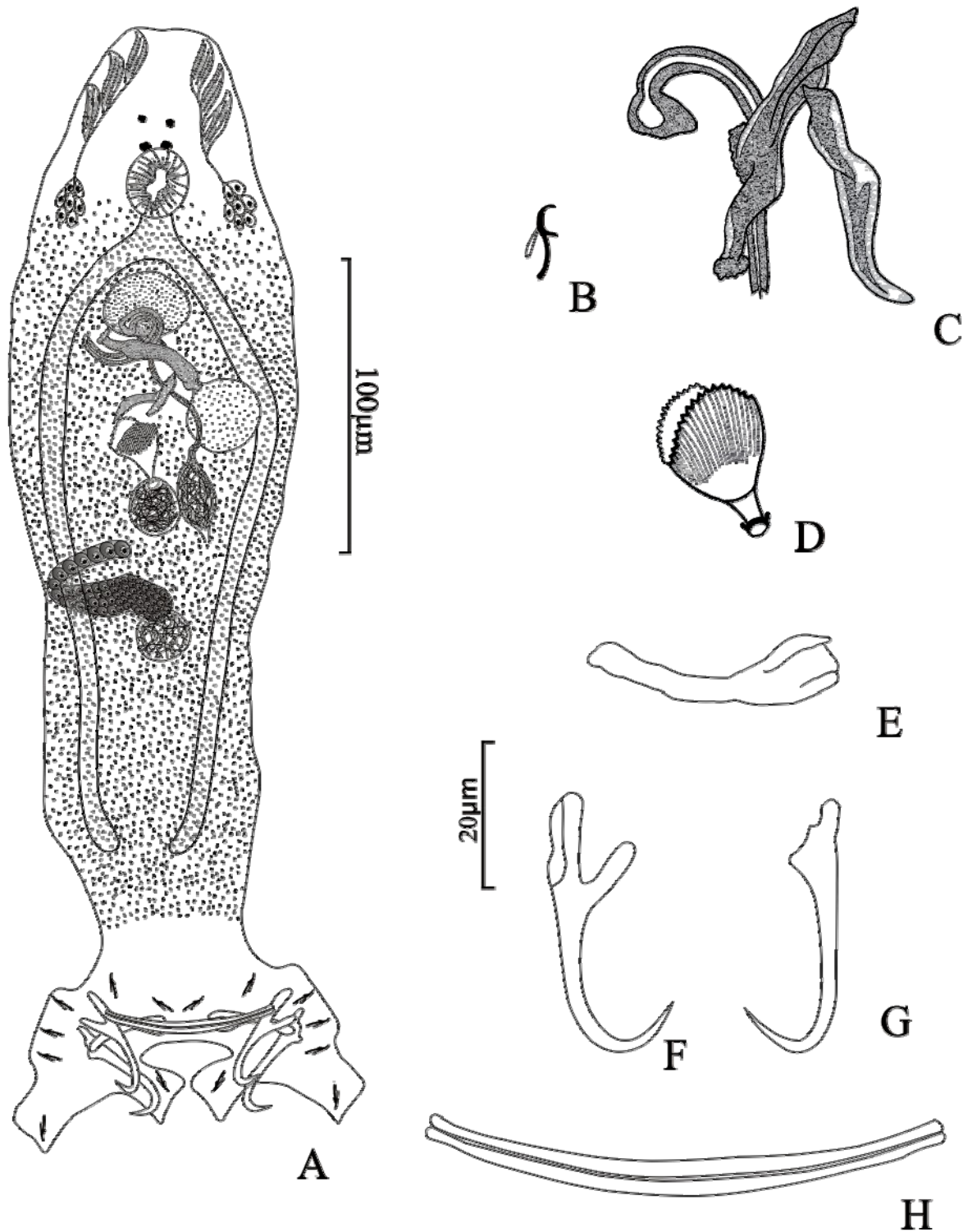


Figure 3. *Rhabdosynochus guanduensis* sp. nov. (A) whole worm, ventral view. (B) Hook. (C) Male copulation complex: MCO and accessory piece. (D) Vagina. (E) Left dorsal bar. (F) Ventral anchor. (G) Dorsal anchor. (H) Ventral bar.

Description: Body 381 (279-493; $n = 20$) long, fusiform; 82 (70-94; $n = 20$) wide near level to copulation complex. Tegument smooth. Cephalic margin broad, cephalic lobes moderately developed, cephalic glands at level of pharynx. Eyes 4, posterior

pair larger and closer than anterior pair; accessory granules usually absent. Pharynx sub-spherical 19 (18-22; $n = 20$) long, 20 (19-23; $n = 20$) wide; esophagus short; tips of intestinal ceca converging in peduncle. Peduncle broad; haptor 47 (41-54; $n = 20$) long, 86

(74-98; $n = 20$) wide. Anchors dissimilar; ventral anchor 33 (28-37; $n = 18$) long, with elongate roots, curved shaft, recurved point; deep root flattened; point extending slightly past level of tip of superficial root; anchor base 7 (5-8; $n = 18$) wide. Dorsal anchor 34 (29-36; $n = 18$) long, triangular base, nearly straight shaft, recurved point extending past tip of superficial root; anchor base 6 (5-8; $n = 18$) wide. Ventral bar 67 (59-81; $n = 19$) long, with bifurcated and tapered ends; paired dorsal bar 37 (32-44; $n = 19$) long, spatulate medial end. Hooks 9 (8-12; $n = 14$) long, with elongate, slightly depressed thumb, delicate point, uniform shank; FH loop $\frac{1}{2}$ shank length. Copulation complex 53 (44-61; $n = 18$) long. MCO a loose coil of about $\frac{1}{2}$ ring, inverted U-shaped; base to right of body midline, with delicate basal opening directed posteriorly. Accessory piece comprising 3 subunits: 1 grooved, serving as guide for MCO; 1 rod-shaped with distal branch and 1 tongue-shaped, constricted proximally. Testis 24 (22-29; $n = 18$) wide, sub-spherical; seminal vesicle a simple dilation of vas deferens, to left of body midline; prostatic reservoir spherical; prostatic cells (glands) anterodorsal to MCO, occupying space from base to U-shaped shaft of MCO. Ovary 21 (18-28; $n = 16$) wide, looping right intestinal caecum; oviduct, ootype not observed; vagina sclerotized, shell-shaped, opening into small seminal receptacle lying on body midline; vitellaria dense.

Remarks: *Rhabdosynochus* Mizelle and Blatz, 1942 - included diplectanid species which parasitize centropomid fish and characterized by having or not scaled tegument; MCO tubular, coiled; accessory piece complex; vaginal sclerotized with medial vaginal aperture; accessory adhesive organ absent and superficial root of ventral anchor reduced. Currently, seven species of this genus are known as parasites of *Centropomus* species from Brazil and Mexico (DOMINGUES; BOEGER, 2008).

Rhabdosynochus guanduensis sp. nov. differs from all other congeneric species by the morphology of the copulation complex and by having a shell-shaped vagina. According to key provided by Kritsky et al. (2001), *R. guanduensis* sp. nov. appears to be close to *R. hudsoni* Kritsky, Boeger and Robaldo, 2001 by lacking bilateral membranous frills on peduncle and by shape of haptor. The new species differs from *R. hudsoni* by the morphology of the accessory piece and MCO; lacking tegumental scales; absence of the superficial bulbous blade arising from the inner surface of distal shaft of the dorsal anchor and by the morphology of the vagina. Examination of paratypes of *R. hudsoni* showed that this species was adequately described by Kritsky et al. (2001) and confirmed the differences observed in this study.

Conclusion

The description of the three new species of monogeneans parasitic on fish is an indicator of the biodiversity of Guandu River which supplies water to 90% of the population of the city of Rio de Janeiro, Brazil.

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