

A new species of *Rhinonastes* (Monogenoidea, Dactylogyridae), nasal parasite of *Prochilodus argenteus* (Actinopterygii, Characiformes) from Brazil

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Abstract

A new species of *Rhinonastes*, hitherto monotypic, is described and illustrated from the nasal cavity of ‘curimatã-pacu’, *Prochilodus argenteus* from São Francisco River, Brazil. *Rhinonastes curimatae* n. sp. presents a male copulatory organ with more than five rings while the type species of the genus is characterized by male copulatory organ with less than two rings. This is the first record of a nasal parasite in *P. argenteus*.

Keywords

Ectoparasites, freshwater fish; nasal cavity, São Francisco River

Introduction

Rhinonastes Kritsky, Thatcher and Boeger, 1988; *Pavanelliella* Kritsky and Boeger, 1998; *Rhinoxenus* Kritsky, Boeger and Thatcher, 1988; and *Telethecium* Kritsky, van Every and Boeger, 1996 were proposed for species recorded from the nasal cavities of Neotropical freshwater fishes (Kritsky *et al.* 1996). Rosim *et al.* (2011) described *Urocleidoides naris* Rosim, Mendoza-Franco and Luque, 2011 from the nasal cavity of *Hoplias malabaricus* (Bloch, 1794), and this was the first record of *Urocleidoides* Mizelle and Price, 1964 out of the host's gills. Presently, five genera of monogenoideans were recorded from the nasal cavities of Neotropical freshwater fishes.

Two species were described of specimens collected in the nasal cavity of prochilodontids: *Rhinonastes pseudocapsaloideum* Kritsky, Thatcher and Boeger, 1988 from *Prochilodus nigricans* Spix and Agassiz, 1829 (Kritsky *et al.* 1988) and *Rhinoxenus curimbatae* Domingues and Boeger, 2005 from *P. cf. lineatus* (Domingues and Boeger 2005), all from the Paraná River basin. *Pavanelliella pavanelli* Kritsky and Thatcher, 1988 of *Pimelodus maculatus* Lacepède, 1803 (Pimelodidae) is the only monogenoidean recorded in the nasal cavity of a fish from São Francisco River (Brasil-Sato and Pavanelli 2000).

The goal of this manuscript is to continue the study of Dactylogyridae parasites of fishes of the São Francisco basin (see Brasil-Sato and Pavanelli 2000; Monteiro *et al.* 2010a; 2010b, Monteiro and Brasil-Sato 2014), describing the first parasite species from the nasal cavity of a prochilodontid fish from this important Brazilian river basin.

Materials and Methods

Specimens of ‘curimatã-pacu’, *P. argenteus* were collected from the upper São Francisco River near the Municipality of Três Marias (18°12'32"S, 45°15'41"W), State of Minas Gerais, Brazil, by professional fishermen between March and November 2009.

Live hosts were taken from the field to the Laboratório de Ictiologia, Estação de Hidrobiologia e Piscicultura/Companhia de Desenvolvimento dos Vales do São Francisco e Parnaíba (EPT/CODEVASF) in Três Marias; the gills were immediately removed and placed in vials containing hot (60°C) water. After vigorous shaking for about 1 min, sufficient formalin was added to each vial to reach a 5% formalin solution. Worms were collected with a fine probe and dissecting microscope. For the study of haptorial and reproductive hard parts, some specimens were mounted unstained in Gray and Wess medium

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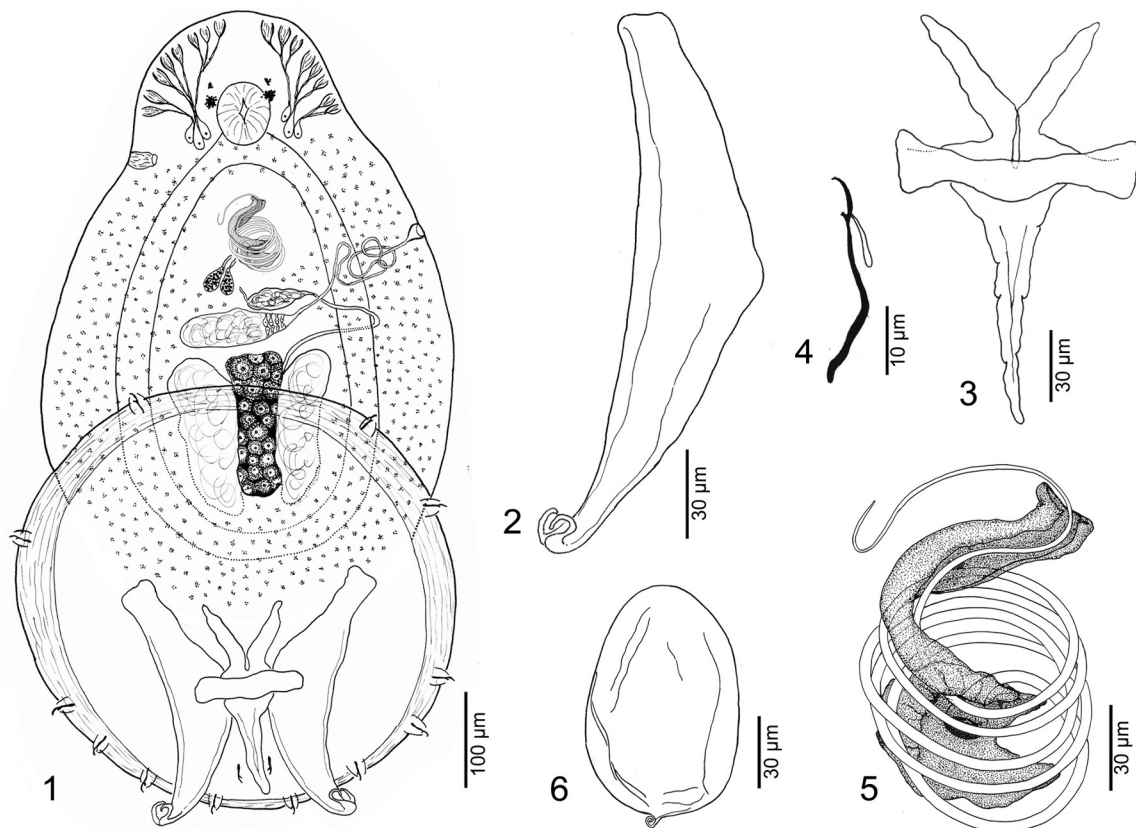
(Humason 1979). Other specimens were stained with Gomori's trichrome (Humason 1979) and mounted in Canada balsam for the study of their soft internal structures. All mounted specimens were examined under an Olympus BX41TF phase contrast microscope. Measurements, all in micrometers (μm), are presented as the mean followed by the range and number (n) of specimens measured in parentheses. The direction of the coil of the male copulatory organ (MCO) was determined using the method of Kritsky *et al.* (1985), and the numbering of the hook pairs followed Mizelle (1936; see Mizelle and Price 1963). Scientific names of fish hosts were those of Froese and Pauly (2013). Holotype and paratypes were deposited in the Coleção Helminológica do Instituto Oswaldo Cruz, Rio de Janeiro, Brazil (CHIOC). Voucher specimens of the host, *P. argenteus*, were deposited in the collection of the Museu de Zoologia of the Universidade de São Paulo, Brazil (MZUSP 95167).

Results

Rhinonastes curimatae n. sp. (Figs 1–6)

Description (based on 10 specimens). Body 702 (480–840; n = 8) long, oval, robust, tapering anteriorly; greatest width at

ovary region, 340 (260–400; n = 8). Cephalic lobes poorly developed; head organs comprising groups in cephalic areas, variable in number; cephalic glands elongate, ovate. Eyes four, equidistant, members of the posterior pair larger than those of the anterior pair; eyespot granules small, variable in shape. Pharynx ovate, 50 (43–58; n = 6) long, 44 (41–51; n = 6) wide. Peduncle tapering rapidly, attaching centrally to dorsal surface of subcircular haptor. Haptor 330 (280–410; n = 8) in greatest diameter. Ventral anchor lacking deep root, large subtriangular base, recurved point; 180 (134–216; n = 7) long; 43 (38–47; n = 7) at greatest width. Ventral bar 171 (147–197; n = 9) long, 86 (78–102; n = 9) wide, with two submedial anterior projections, 52 (42–65; n = 9) long; 14 (12–17; n = 9) wide, anteromedial cleft, posteromedial telescoping projection, 80 (76–92; n = 9) long, 32 (26–36; n = 10) wide. Dorsal anchors and bar lacking. Seven pairs of hooks similar in size and shape, six pairs marginal to the haptor and one pair ventral, between the anchors, 26 (25–28; n = 12) long, with delicate point, erect thumb, shank inflated along proximal two thirds; filamentous hooklet (FH) loop one-fourth of shank length. Testis constricted medially by ovary, 138 (122–163; n = 5) long, 93 (79–112; n = 5) wide; vas deferens arising from anteromedial margin of testes dorsal to ovary; prostatic reservoir pyriform or fusiform. Male copulatory organ a coil of at least $5\frac{1}{2}$ counterclockwise rings, 48 (41–58; n = 6) diameter



FIGS 1–6. *Rhinonastes curimatae* from 'curimatã-pacu', *Prochilodus argenteus* from the São Francisco River, Brazil, in ventral view. 1 – Whole mount (composite). 2 – Ventral anchor. 3 – Ventral bar. 4 – Hook. 5 – Copulatory complex. 6 – Egg

at proximal ring, arising from a flanged, conspicuous base. Accessory piece 139 (122–157; $n = 4$) long, flume-shaped with ventral groove, serving as a guide for the distal portion of the MCO, rests on the flanged base of the male body copulatory organ. Ovary 119 (107–152; $n = 5$) long, 93 (79–112; $n = 5$) wide. Ootype not observed; oviduct short; uterus delicate. Vaginal pore single, sinistral, comprising proximal delicate sclerotized coiled tube and distal bulbous vesicle. Seminal receptacle elongate, fusiform. Vitellaria dense, coextensive with ceca. Eggs 99 (99–100; $n = 2$) long, 63 (62–64; $n = 2$) wide with small, curved and delicate filament.

Taxonomic summary

Type host: *Prochilodus argenteus* Spix and Agassiz, 1829, 'curimatã-pacu' (Prochilodontidae).

Site: Nasal cavity.

Locality: São Francisco River, near Municipality of Três Marias, State of Minas Gerais, Brazil (18°12'32"S; 45°14'41"W).

Deposited specimens: Holotype CHIOC 37953a; paratypes CHIOC 37953b, 37954a–f and 37955

Etymology: the specific epithet refers to the local name of the host, 'curimatã'.

Remarks: The new species was included in *Rhinonastes* by the combination of the following characteristics: 1) a disc-shaped haptor; 2) the presence of a single anchor-bar complex in the ventral region of the haptor; 3) six pairs of hooks marginal and one pair of hooks ventral in the haptor; 4) dextro-ventral genital pore; 5) bilobed testis; and 6) an ovary lying between the two testicular lobes. *Rhinonastes curimatae* n. sp. differs from *R. pseudocapsaloideum* in the following features: a MCO with at least 5½ rings and one flange at the base of the MCO, while the type species is characterized by a MCO with less than two rings and three flanges at the base of the MCO.

The accessory piece *R. pseudocapsaloideum* was described as articulated to the base of male copulatory organ. In *R. curimatae* n. sp. the accessory piece rests on the base of the male copulatory organ. In some specimens was possible to observe this accessory piece completely separated from the base of the copulatory organ and no connection between them was observed. There are also some differences in the morphology of the bar and accessory piece that justify the description of the new species.

Discussion

Rhinonastes was previously represented only by *Rhinonastes pseudocapsaloideum* Kritsky, Thatcher and Boeger, 1988, which was proposed from parasites collected from the nasal cavity of *P. nigricans* from Lake Januaca, Amazonas, Brazil (Kritsky *et al.* 1988) and subsequently recorded in *P. lineatus* from the Paraná River basin (Lizama *et al.* 2005; 2006). The description of *R. curimatae* n. sp. from *P. argenteus* expands

the knowledge geographic distribution of this genus in prochilodontid fishes.

According to Kritsky *et al.* (1988), a disc-shaped haptor, the presence of a single anchor-bar complex and six pairs of hooks marginal and one pair of hooks ventral in the haptor of *Rhinonastes* are relatively rare characteristics among Dactylogyridae species, and occur in species allocated in different subfamilies. In the original description, Kritsky *et al.* (1988) included *Rhinonastes* in Ancyrocephalinae, although the authors mentioned that the evolutionary relationships of this genus with the other place in Dactylogyridae were unclear. It is likely that other species of *Prochilodus* harboring in their nasal cavity known or new species of *Rhinonastes*. Only after a thorough study of prochilodontid parasite fauna will it be possible tell the real diversity of this genus and establish clear phylogenetic relationships of this genus in the Dactylogyridae.

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References

- Brasil-Sato M.C., Pavanelli G.C. 2000. *Pavanelliella pavanellii* Kritsky e Boeger, 1998 (Monogenea: Dactylogyridae) parasito das cavidades nasais de *Pimelodus maculatus* Lac., 1803, "mandi", das bacias do Rio São Francisco e do Rio Paraná, Brasil. *Parasitologia al Dia*, 24, 123–126. DOI: <http://dx.doi.org/10.4067/S0716-07202000000300011>.
- Domingues M.V., Boeger W.A. 2005. Neotropical Monogeneoidea. 47 Phylogeny and coevolution of species of *Rhinoxenus* (Platyhelminthes, Monogeneoidea, Dactylogyridae) and their Characiformes hosts (Teleostei, Ostariophysi) with description of four new species. *Zoosystema*, 27, 441–467.
- Froese R., Pauly D. (Eds) 2013. Fish Base. World Wide Web electronic publication. Version 12/2013. Available from <http://www.fishbase.org> (accessed January 2014).
- Humason G.L. 1979: Animal Tissue Techniques. W.H. Freeman Co., USA, 661 pp.
- Kritsky D.C., Boeger W.A. Thatcher V.E. 1985. Neotropical Monogenea. 7. Parasites of the pirarucu, *Arapaima gigas* (Cuvier), with descriptions of two new species and redescription of *Dawestrema cycloancistrum* Price and Nowlin, 1967 (Dactylogyridae: Ancyrocephalinae). *Proceedings of the Biological Society of Washington*, 98, 321–331.
- Kritsky D.C., Thatcher V.E., Boeger W.A. 1988. Neotropical Monogenea. 13. *Rhinonastes pseudocapsaloideum* n. gen., n. sp. (Dactylogyridae, Ancyrocephalinae), a nasal parasite of curimatã, *Prochilodus nigricans* Agassiz (Cypriniformes, Prochilodontidae), in Brazil. *Journal of Parasitology*, 74, 695–698. DOI: <http://dx.doi.org/10.2307/3282192>.
- Kritsky D.C., Van Every L.R., Boeger W.A. 1996. Neotropical Monogeneoidea. 27. Two New Species of *Telethecium* gen. n. from the Nasal Cavities of Central Amazonian Fishes and a redescription of *Kritskyia moravecii* Kohn, 1990 (Dactylogyridae, Ancyrocephalinae). *Journal of Helminthological Society of Washington*, 63, 35–41.

- Lizama M.A.P., Takemoto R.M., Pavanelli G.C. 2005. Influence of host sex and age on infracommunities of metazoan parasites of *Prochilodus lineatus* (Valenciennes, 1836) (Prochilodontidae) of the upper Paraná River floodplain, Brazil. *Parasite*, 12, 299–304.
- Lizama M.A.P., Takemoto R.M., Pavanelli G.C. 2006. Parasitism influence on the hepato, splenosomatic and weight/length relation and relative condition factor of *Prochilodus lineatus* (Valenciennes, 1836) (Prochilodontidae) of the upper Paraná River floodplain, Brazil. *Revista Brasileira de Parasitologia Veterinária*, 15, 116–122.
- Mizelle J.D. 1936. New species of trematodes from the gills of Illinois fishes. *American Midland Naturalist*, 17, 785–806. DOI: <http://dx.doi.org/10.2307/2420687>
- Mizelle J.D., Price C.E. 1963. Additional haptor hooks in the genus *Dactylogyrus*. *Journal of Parasitology*, 49, 1028–1029. DOI: <http://dx.doi.org/10.2307/3275746>.
- Monteiro C.M., Brasil-Sato M.C. 2014. A new species of *Anacanthoroides* and redescription of *Apedunculata discoidea* (Monogenoidea) parasitizing *Prochilodus argenteus* (Actinopterygii) from the São Francisco River, Brazil. *Zootaxa*, 3784 (3): 259–266. DOI: <http://dx.doi.org/10.11646/zootaxa.3784.3.5>
- Monteiro C.M., Kritsky D.C., Brasil-Sato M.C. 2010a. Neotropical Monogenoidea. 55. Dactylogyrids parasitizing the pintado-amarelo *Pimelodus maculatus* Lacépède (Actinopterygii: Pimelodidae) from the Rio São Francisco, Brazil. *Systematic Parasitology*, 76, 179–190. DOI: <http://dx.doi.org/10.1007/s11230-010-9250-2>.
- Monteiro C.M., Kritsky D.C., Brasil-Sato M.C. 2010b. Neotropical Monogenoidea. 56. New species of *Anacanthorus* (Dactylogyridae) from the gills of matrinhã, *Brycon orthotaenia* (Characiformes: Characidae), in the Rio São Francisco, Brazil. *Folia Parasitologica*, 57, 164–168.
- Rosim D.F., Mendoza-Franco E.F., Luque J.L. 2011. New and Previously Described Species of *Urocleidoides* (Monogenoidea: Dactylogyridae) Infecting the Gills and Nasal Cavities of *Hoplias malabaricus* (Characiformes: Erythrinidae) from Brazil. *Journal of Parasitology*, 97, 406–417. DOI: <http://dx.doi.org/10.1645/GE-2593.1>.

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