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Philocorydoras longus sp. n. (Monogenea, Dactylogyridae) from the gills of *Hoplosternum littorale* (Siluriformes, Callichthyidae) in Southeastern Brazil and the reassignment of two species from the genus *Urocleidoides* to *Philocorydoras*

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Summary

Philocorydoras longus sp. n. (Dactylogryridae) is described from the gills of the freshwater fish *Hoplosternum littorale* (Hancock, 1828) (Callichthyidae) from Jurumirim reservoir, Upper Paranapanema River, São Paulo State, Brazil. This new species belongs to the genus *Philocorydoras* mainly by possessing a curved cirrus accompanied by an accessory piece attached by a conspicuous filament. *Philocorydoras longus* sp. n. most resembles *P. platensis*, but differs by having delicate and smaller hooks, grooves in ventral and dorsal anchors, larger cirrus and accessory piece, and ventral bar with a long postero-medial process. Two species of the genus *Urocleidoides* (*U. corydori* Molnar, Hanek et Fernando, 1974 and *U. margolisi* Molnar, Hanek et Fernando, 1974) originally described from the gills of *Corydoras aeneus* (Gill, 1858) from Talparo River, Trinidad (near Brazil), were transferred to the genus *Philocorydoras* mostly by the absence of a sinistral vaginal sclerite (i. e., the primary characters of *Urocleidoides*) and counterclockwise cirral rings (i.e., curved tube, and tapered anteriorly in *Philocorydoras*). The new species is the fourth species assigned to the genus and the first recorded for Brazil.

Keywords: Ancyrocephalinae; Freshwater fish; Neotropical region; Paranapanema river

Introduction

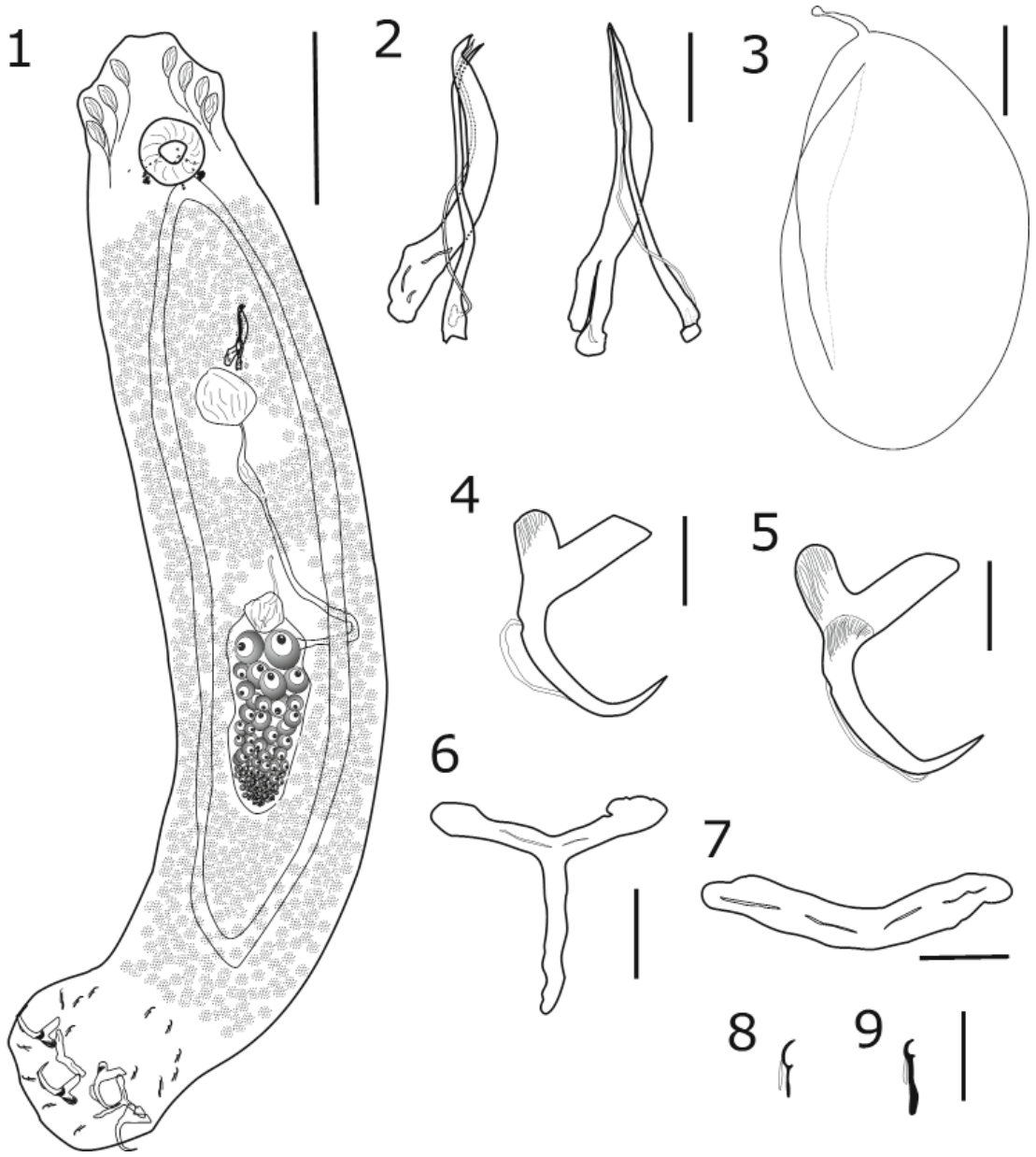
The Siluriformes is a very large fish group, widely distributed across the tropical regions of the world. *Hoplosternum littorale* (Hancock, 1828) is a callichthyid armoured catfish of freshwater ecosystems from South America (Reis, 1997). The first record of monogeneans parasitizing this fish species was made by Pavanelli *et al.* (2004), but they did not identify the species.

To date, *Gyrodactylus* von Nordmann, 1832 and *Philocorydoras* Suriano, 1986 are the two known monogenean genera found on callichthyid armoured catfishes in the Neotropical region (see Cohen *et al*., 2013). The genus *Philocorydoras* was originally proposed for gill monogeneans of *Corydoras paleatus* (Jenyns, 1842) in Laguna Chascomús, Argentina. The genus is characterized by possessing a sclerotized curved cirrus and accessory piece attached to the base of the cirrus by a conspicuous filament (see Suriano, 1986).

The purpose of the present paper is to describe a new species of *Philocorydoras* from *H. littorale* in Upper Paranapanema River, São Paulo State, Brazil, and elucidate the taxonomic status of *Urocleidoides corydori* and *U. margolisi*.

Materials and methods

Twenty-two specimens of *H. littorale* (Standard length range: 10.60 – 16.00 cm) were collected between April 2011 and July 2012 from Jurumirim reservoir (23°12'17''S; 49°13'19''W), Upper Paranapanema River, Municipality of Taquarituba, São Paulo State, Brazil. Gills were removed and placed in vials containing 5 % formalin solution. Parasites were stored in 70 % ethanol solution. Some specimens were mounted unstained in Hoyer's medium in order to study the sclerotized structures. Specimens stained with Gomori's trichrome were used to observe internal organs (Eiras *et al.,* 2006). Measurements are in micrometers and expressed as the mean ± standard deviation followed by range in parentheses. Landmark definition and morphometric measurements of haptor

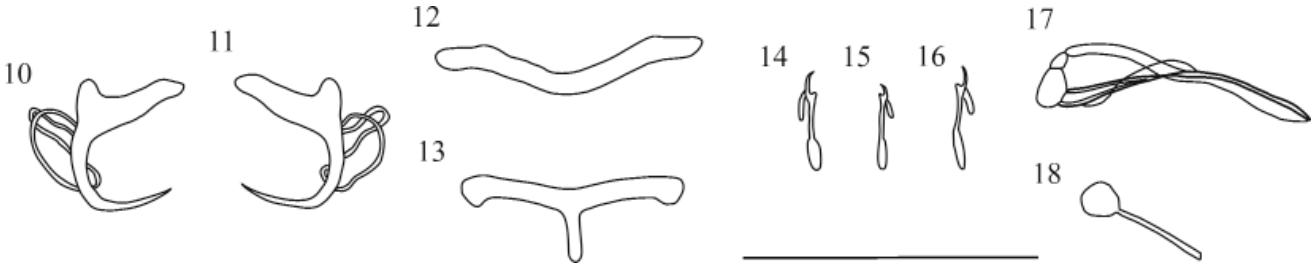


Figs. 1 – 9. *Philocorydoras longus* sp. n., line drawings. (**1**) Composite drawing of whole-mount, ventral view; (**2**) Copulatory complex, ventral view; (**3**) Egg; (**4**) Ventral anchor; (**5**) Dorsal anchor; (**6**) Ventral bar; (**7**) Dorsal bar; (**8**) Hook pairs 1, 2, 3, 5, 6, 7; (**9**) Hook pair 4. Scale bars: Fig. 1 = 200 µm, Figs. 2–9 = 20 µm

sclerotized parts [total length of anchor (a), length of base (b), length of inner root (c), length of outer root (d), length of point (e); total length of marginal hook (f); total length of bar (g), total width (h); median width (i)] are in accordance with Gussev (1985). Numbering and distribution of hook pairs follows Mizelle (1936). Specific terminology to genus *Philocorydoras* follows Suriano (1986). Type specimens are deposited in the helminthological collections of the Instituto Oswaldo Cruz (CHIOC), and the Instituto de Biociências de Botucatu (CHIBB), both in Brazil.

Results

Philocorydoras longus sp. n.
(Figs. 1 – 9)
Description (measurements based on 15 adult specimens): Body elongate, fusiform, 951 ± 276 (644 – 1463) long; maximum width 211 ± 47 (146 – 300) near mid-length or anterior half of body (Fig. 1). Four cephalic lobes and two eyespots present; eye granules small, generally elongate; accessory granules sparse in cephalic region. Pharynx spherical 65 ± 15 (51 – 100) in diameter; oesophagus absent. Peduncle broad; haptor rectangular 151 ± 8 (145 – 157) long, 210 ± 7 (205 – 215) wide. Ventral anchor: (a) 48 ± 2 (45 – 52); (b) 45 ± 1 (43 – 47); (c) 20 ± 2 (18 – 23); (d) 12 ± 1 (10 – 14); (e) 18 ± 2 (15 – 24), roots well defined, deep root with grooves, elongate shaft and short tip (Fig. 4). Dorsal anchor: (a) 50 ± 2 (46 – 52); (b) 45 ± 1 (43 – 47); (c) 22 ± 2 (19 – 24); (d) 13 ± 2 (10 – 16); (e) 18 ± 2 (16 – 20), roots well defined, deep root with grooves, grooves between roots and shaft, elongate shaft and short tip (Fig. 5). Ventral bar: (g) 58 ± 8 (49 – 73); (h) 45 ± 6 (36 – 57); (i) 6 ± 1 (5 – 7), T-shaped, with a postero-medial projection



Figs. 10 – 18. *Philocorydoras corydori* (Molnar, Hanek et Fernando, 1974) comb. n., line drawings. (**10**) Dorsal anchor; (**11**) Ventral anchor; (**12**) Dorsal bar; (**13**) Ventral bar; (**14**) Hook pairs 2, 3, 4, 6; (**15**) Hook pairs 1, 5; (**16**) Hook pair 7; (**17**) Copulatory complex; (**18**) Vagina (drawing adapted from Molnar *et al*., 1974). Scale bar = 40 µm

(Fig. 6). Dorsal bar: (g) 60 ± 7 (48 – 73); (h) 21 ± 5 (15 – 33); (i) 9 ± 2 (6 – 14), yoked-shaped, with tapered ends (Fig. 7). Hook pairs 1, 2, 3, 5, 6 and 7 similar, (f) 11 ± 1 (10 – 12) long, each with elongate point, upright thumb, uniform shank, filament hook loop 2/3 shank length (Fig. 8); hook pair 4, (f) 15 ± 2 (14 – 18) long, with short point, upright thumb, shank with distal portion inflated, filament hook loop 1/3 shank length (Fig. 9). Cirrus an arced tube, straight, 70 ± 4 (66 – 77) long (Fig. 2). Accessory piece 74 ± 10 (58 – 96) long, expanded anteriorly, sclerotized, non-articulated to base of cirrus (Fig. 2). Copulatory ligament originated at the base of cirrus and linked to accessory piece. An unsclerotized mid-ventral vagina, with delicate tube leading to seminal receptacle. Gonads overlapping. Seminal vesicle elongate and a dilatation of vas deferens. Oviduct, ootype and uterus not observed. Vitelline follicles dense, dispersed throughout trunk, absent in region of reproductive organs and MCO. Eggs oval 92 ± 7 (87 – 97) long, 59 ± 0.5 (58 – 59) wide, with appendage (Fig. 3).

Taxonomic summary

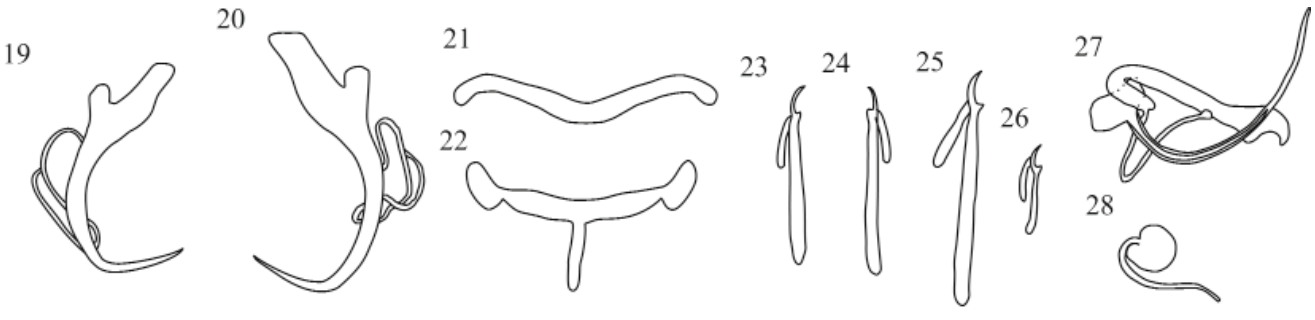
Type host: *Hoplosternum littorale* (Hancock, 1828) (Siluriformes, Callichthyidae).
Type locality: Jurumirim reservoir, Upper Paranapanema River (23°12'17"S; 49°13'19"W), Municipality of Taquarituba, São Paulo State, Brazil.
Site of infection: Gill filaments.
Type specimens: Holotype, CHIOC 38205; paratypes, CHIOC 38206 and CHIBB 138L and 139L
Prevalence: 50 % (11 of 22 fishes examined).
Mean intensity of infection: 9.27 parasites per parasitized host.
Etymology: The new species is from Latin (*longus* = elongated) and is derived from the presence of an elongated projection in ventral bar.

Remarks

Philocorydoras longus sp. n. belongs to the genus *Philocorydoras* by having a curved cirrus tube, tapered anteriorly, accompanied by an accessory piece attached to the base of the cirrus by a copulatory ligament. The new species most resembles *P. platensis* but it differs from this latter species by having delicate and smaller hooks (10-18 vs. 15-30), grooves in ventral and dorsal anchors, larger cirrus (mean 70 vs. 40) and accessory piece (mean 74 vs. 35), ventral bar with a long postero-medial process (mean 45 vs. 18). Suriano (1986) in the original description of the genus did not mention the presence of grooves in both anchors. The new species has grooves in the deep root of ventral anchors, and in the deep root and between shaft and root of dorsal anchors. The tip of both anchors of *P. longus* sp. n. does not exceed the level of the superficial root as opposed to *P. platensis*. *Philocorydoras platensis* has hook pairs 1 and 2 smaller than others, whereas in the new species hook pairs 1, 2, 3, 5, 6 and 7 are smaller than hook pair 4.

Philocorydoras corydori (Molnar, Hanek et Fernando, 1974) comb. n.
Synonym: *Urocleidoides corydori* Molnar, Hanek et Fernando, 1974
(Figs. 10 – 18)

Description (based on Molnar *et al*., 1974): Body fusiform, cuticle smooth, thin. Prohaptor area obscure. Eyes two. Peduncle short.



Figs. 19 – 28. *Philocorydoras margolisi* (Molnar, Hanek et Fernando, 1974) comb. n., line drawings. (**19**) Dorsal anchor; (**20**) Ventral anchor; (**21**) Dorsal bar; (**22**) Ventral bar; (**23**) Hook pair 1; (**24**) Hook pairs 2, 3, 6, 7; (**25**) Hook pair 4; (**26**) Hook pair 5; (**27**) Copulatory complex; (**28**) Vagina (drawing adapted from Molnar *et al*., 1974). Scale bar = 40 µm

Haptor subquadrate. Dorsal and ventral anchors simple and well developed superficial roots. Dorsal bar V-shaped, ends directed laterally. Ventral bar straight, slightly enlarged ends, with a postero-medial projection. Hooks similar in shape. Cirrus a straight curved tube, tapered anteriorly. Accessory piece a simple bar parallel to and articulated with cirrus. Copulatory ligament present. Parasites of gills of *Corydoras aeneus* (type host) from Talparo River, Trinidad (type locality).

Philocorydoras margolisi (Molnar, Hanek et Fernando, 1974) comb. n.
Synonym: *Urocleidoides margolisi* Molnar, Hanek et Fernando, 1974
(Figs. 19 – 28)

Description (based on Molnar *et al*., 1974): Body fusiform, cuticle smooth, thin. Prohaptor with two cephalic lobes. Eyes two. Haptor subquadrate. Dorsal and ventral anchors slender, well-developed roots, possessing a conspicuous anchor filament. Dorsal bar V-shaped with laterally directed ends. Ventral bar straight, enlarged ends, with a posteromedial projection. Hooks similar in shape. Cirrus curved tube and tapered anteriorly. Accessory piece distally sickle-shaped and articulated with cirrus. Copulatory ligament present. Egg flattened on one side. Parasites of gills of *C. aeneus* (type host) from Talparo River, Trinidad (type locality).

Remarks

Philocorydoras corydori comb. n. and *P. margolisi* comb. n. closely resemble others members of *Philocorydoras* by having a curved cirrus tube, accompanied by an accessory piece attached to the base of the cirrus by a copulatory ligament (see Suriano, 1986), as well as the morphology of dorsal (i.e., yoked-shaped) and ventral bars (i.e., T-shaped, with a postero-medial projection). Both species differs from *P. platensis* and *P. longus* sp. n. by the accessory piece articulated with cirrus base. *Philocorydoras margolisi* comb. n. can be distinguished from its congeners by having accessory piece with sickle-shaped terminal portion bent; ventral and dorsal anchors slender; and hooks more robust than the other species.

Discussion

To date, only the type species (*P. platensis*) of *Philocorydoras* has been described in South America. Kritsky *et al.* (2000) suggested a relationship of the genus *Philocorydoras* with *Vancleaveus* Kritsky, Thatcher, et Boeger, 1986, and *Ameloblastella* Kritsky, Mendoza-Franco, et Scholz, 2000. These three genera possess overlapping gonads, ventral bar with a medial process, hook shanks comprised of two subunits, subspherical eye granules, and dilatation of the vas deferens to form the seminal vesicle. *Philocorydoras* differs from both *Vancleaveus* and *Ameloblastella* by having an arced tube cirrus (Kritsky *et al.,* 2000), and the presence of one pair of eyespots. *Ameloblastella* and *Philocorydoras* have some similarities like a copulatory ligament, and hooks with shank comprising two subunits. These genera parasitize fish species within the Siluriformes.

Molnar *et al.* (1974) described two species of monogeneans parasitizing *C. aeneus* (Gill, 1858) from Talparo River, Trinidad (near Brazil), as belonging to the genus *Urocleidoides* (*U. corydori* and *U. margolisi*). Suriano (1986) and Kritsky *et al.* (1986) pointed out that these species do not belong to the genus *Urocleidoides* mostly by the absence of a sinistral vaginal sclerite and counterclockwise cirral rings. Furthermore, these species were considered *incertae sedis* by Kritsky *et al.* (1986). The anatomy of the male copulatory organ do not belong to the genus *Urocleidoides* (i.e. cirrus coil counterclockwise), and it is more related to the genus *Philocorydoras*. Kritsky *et al.* (2000) based on the comparative morphology of the male copulatory organ suggests that both species should be transferred to *Philocorydoras*; however, they did not transfer them because the lacking of details of the internal anatomy. *Philocorydoras longus* sp. n. has an accessory piece attached to the base of the cirrus by a conspicuous filament as *P. corydori* comb. n. and *P. margolisi* comb. n. However, the new species differs from this latter species by having the accessory piece not articulated with the cirrus base. *Philocorydoras longus* sp. n. and *P. corydori* comb. n. resemble in the morphometry of hooks, however smaller than *P. margolisi* comb. n. According to Kaci-Chaouch *et. al.* (2008), the morphometric intraspecific variability within monogeneans would be a consequence of host specificity, i.e. the more a parasite species uses different host species, the more its intraspecific variance increases. All known species of *Philocorydoras* are gills parasites of callichthyids. Therefore, all the features mentioned above justify the transference of *U. corydori* and *U. margolisi* to *Philocorydoras*

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