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RESEARCH

New Species of *Cosmetocleithrum* (Monopisthocotyla: Dactylogyridae) from *Centromochlus Heckelii* (Osteichthyes: Auchenipteridae) from the Itaya River, Peru

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Abstract

Introduction Studies concentrating on description, identification, and analysis of monogenoids are required to further our understanding of this group of parasites connected to Amazonian fish. Based on the above, the main objective of this research was to identify new species of monogenoids in the gills of *Centromochlus heckelii* (De Filippi, 1853) (Siluriformes: Auchenipteridae) collected in the Itaya river, Loreto-Peru.

Materials and methods Two hundred and forty specimens of *C. heckelii* were collected in the Itaya River (3°47'20.70"S 73°15'40.90"W), Loreto, Peru in March 2025. The collected fish were transported in boxes with ice to the laboratory for parasitological analyses.

Results Three species of monogeneans of the family Dactylogyridae were registered, two new species and one previously known: *Demidospermus centromochlii* Mendoza-Franco & Scholz, 2009 which is proposed to be reassigned into *Cosmetocleithrum* Kritsky, Thatcher & Boeger, 1986 due to morphological characteristics. The new species *Cosmetocleithrum itayensis* **n. sp.** and *Cosmetocleithrum iiapensis* **n. sp.** are similar by presenting the MCO as a sigmoid tube and a seed-shaped accessory piece, but they differ from each other in the shape of the MCO, accessory piece, vagina, and the size of the anchors and of the submedial projections in dorsal bar.

Conclusions The results of the present investigation represent the second report of parasites in *C. heckelii*, with the discovery of two new dactylogyrid species. This increases the knowledge of the biodiversity of monogenoids reported for Peru and the Neotropical region.

Keywords Ectoparasite · Monogenoidea · Spiny driftwood catfish · Peruvian amazon

Introduction

The Peruvian Amazon has a very diverse ichthyofauna; approximately 1000 species of freshwater fish have been recorded [1], which are commercial resources and human food. Belonging to the order Siluriformes, *Centromochlus heckelii* (De Filippi, 1853) commonly named as "spiny driftwood catfish" and locally named in Peru as "novia aceitera" is a species demanded by the ornamental market in the Peruvian Amazon [2]. They are crepuscular and prefer the open water surface of both the river and its adjacent lagoons. They feed on aquatic insects, crustaceans and, to a lesser extent, fruits, seeds, plant debris, fish and algae [3].

Several parasitic groups parasitize freshwater fishes in the Amazon, with Monogenoidea species being especially noticeable as direct life cycle parasites. Many species have been described, while others have not yet been found [3]. Studies on monogenoids carried out in species of the Auchenipteridae show the presence of species of *Demidosperus* Suriano, 1983 and *Cosmetocleithrum* Kritsky, Thatcher & Boeger, 1986 (Table 1).

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Table 1 List of valid species of Monogenoidea from species of the Auchenipteridae with their respective hosts, country and reference

Species	Type host	Country	References
Demidospermus bidiverticulatum (Suriano & Incorvaia, 1995)	*Auchenipterus osteomystax* (Miranda Ribeiro, 1918)	Brazil	Cohen et al. [4]
Demidospermus osteomystax Tavernari, Takemoto, Lacerda & Pavanelli, 2010	*Auchenipterus osteomystax* (Miranda Ribeiro, 1918)	Brazil	Cohen et al. [4]
Demidospermus centromochli Mendoza-Franco & Scholz, 2009	*Centromochlus heckelii* (De Filippi, 1853)	Peru	Cohen et al. [4]
Demidospermus uncusvalidu Gutierrez & Suriano, 1992	*Trachelyopterus galeatus* (Linnaeus, 1766)	Argentina	Cohen et al. [4]
Cosmetocleithrum striatuli Abdallah, Azevedo & Luque, 2012	*Trachelyopterus striatulus* (Steindachner, 1877)	Brazil	Cohen et al. [4]
Cosmetocleithrum laciniatum Yamada, Yamada, da Silva & dos Anjos, 2017	*Trachelyopterus galeatus* (Linnaeus, 1766)	Brazil	Yamada et al. [5]
Cosmetocleithrum bulbocirrus Kritsky, Thatcher & Boeger, 1986	*Ageneiosus ucayalensis* Castelnau, 1855	Brazil	Soares et al. [6]
Cosmetocleithrum berecae Cohen, Justo, Gen & Boeger, 2020	*Auchenipterus nuchalis* (Spix & Agassiz, 1829)	Brazil	Cohen et al. [7]
Cosmetocleithrum nunani Justo, Gen & Boeger, 2020	*Auchenipterus nuchalis* (Spix & Agassiz, 1829)	Brazil	Cohen et al. [7]
Demidospermus tocantinensis Justo, Gen & Boeger, 2020	*Auchenipterus nuchalis* (Spix & Agassiz, 1829)	Brazil	Cohen et al. [7]
Cosmetocleithrum spathulatum Yamada, Yamada & da Silva, 2020	*Trachelyopterus galeatus* (Linnaeus, 1766)	Brazil	Yamada et al. [8]
Cosmetocleithrum baculum Yamada, Yamada & da Silva, 2020	*Trachelyopterus galeatus* (Linnaeus, 1766)	Brazil	Yamada et al. [8]
Cosmetocleithrum galeatum Yamada, Yamada & da Silva, 2020	*Trachelyopterus galeatus* (Linnaeus, 1766)	Brazil	Yamada et al. [8]
Cosmetocleithrum amazonensis Morey, Tuesta-Rojas, Arellano, Chu, 2024	*Auchenipterichthys coracoideus* Eigenmann and Allen, 1942	Peru	Morey et al. [9]
Demidospermus centromochli	*Centromochlus heckelii* (De Filippi, 1853)	Peru	Present study
Cosmetocleithrum itayensis n.sp.	*Centromochlus heckelii* (De Filippi, 1853)	Peru	Present study
Cosmetocleithrum iiapensis n.sp.	*Centromochlus heckelii* (De Filippi, 1853)	Peru	Present study

Studies concentrating on description, identification, and analysis are required to further our understanding of the monogenoids connected to Amazonian fish. This makes it possible to maintain current information on the parasitic fauna that is specific to this group of parasites. Based on the above, the main objective of this research was to identify new species of monogenoids in the gills of *C. heckelii* collected in the Itaya River, Loreto-Peru.

Materials and Methods

Two hundred and forty *C. heckelii* were collected in the Itaya River (3°47'20.70"S 73°15'40.90"W), in Loreto, Peru. Samples were collected in March 2025 under the license for collection of biological material: Resolution No132-2014-GRL-DIREPRO; Resolution No21-2016 GRL-DIREPRO; and PTH-068-16-PECSANIPES. The collected fish were transported in boxes with ice to the Laboratory of Parasitology of the "Instituto de Investigaciones de la Amazonía Peruana" (IIAP), in Iquitos, Loreto-Peru. Gill arches were immediately removed and placed in vials containing heated water (approximately 68 °C). Each vial was vigorously shaken, and 96% ethanol was added. In the laboratory, the content of each vial was examined using a dissecting microscope and parasites were removed from the gills or sediment using dissection needles. Some monogenean specimens were stained with Gomori's trichrome [10] and mounted in Canada Balsam to determine internal soft structures, while others were cleared in Hoyer's medium for the study of sclerotized structures [10].

Sclerotized structures of all parasites were photographed with a digital camera (LEICA ICC50W) connected to a phase contrast microscope (LEICA DM750), and the images

were used to obtain the measurements of the male copulatory organ (MCO) and haptoral sclerites [11] Measurements are expressed as the range followed by the mean and number (n) of structures measured in parentheses. Measurements, all in micrometers were made using the LAS EZ software from LEICA and following the procedures of [12]. Lengths of curved or bent structures (anchors, bars, and accessory piece) represent the straight-line distances between extreme ends. Illustrations were prepared with the aid of a drawing tube and microprojector. Illustrations were prepared using Adobe Illustrator 2024 for Microsoft Windows.

The type specimens were deposited in the Helminthological Collection of the Museum of Natural History at the San Marcos University (MUSM) Peru, and in the collection of the Laboratorio de Parasitología y Sanidad Acuícola of the Instituto de Investigaciones de la Amazonía Peruana (LAPYSA). To comply with the regulations set out in article 8.5 of the amended 2012 version of the International Code of Zoological Nomenclature (ICZN, 2012), details of the new taxon have been submitted to ZooBank (i.e., generic name, specific name). The Life Science Identifier (LSID) is reported in the taxonomic summary. Parasitological indices were calculated according to Bush et al. [13].

Ethic aspects: statement on ethical approval from an ethics committee and license for working with fish species were followed according to the resolutions: Resolution No132-2014-GRL-DIREPRO; Resolution No21-2016 GRL-DIREPRO; and PTH-068-16-PECSANIPES.

Results

Order Dactylogyridea Bychowsky, 1937

Dactylogyridae Bychowsky, 1937

***Demidospermus* Suriano, 1983**

***Demidospermus centromochlii* Mendoza-Franco & Scholz, 2009**

(Figs. 1A-H)

With the general characteristics of the genus as described by Kritsky & Gutierrez [14], the description (based on 10 adult specimens; four stained in Gomori's Trichrome and eight clarified in Hoyer's medium) is presented: Body robust, 386–522 (458; n = 10) long; greatest width (at the level of the germarium) 88−187 (129; n = 10). Three cephalic lobes, the lateral ones being poorly developed and the middle one well developed. Three bilateral pairs of conspicuous head organs. Eyes absent. Pharynx spherical 33–53 (40; n = 10) long, 30–40 (36; n = 10) wide. MCO 26–42 (34; n = 10) long, as an elongated sigmoid tube, with termination tapering to the distal part. Accessory piece articulated to the base of the MCO by a thin and delicate membrane. Accessory piece 28–40 (33; n = 10) long, formed by two units, the proximal one robust and seed-shaped, the distal unit small and cone-shaped. Vaginal aperture sinistral, as a sclerotized thin tube, followed by a cone-shaped vestibule. Testis subspherical, posterior to germarium 42–64 (52; n = 4) long, 14–20 (18; n = 4) wide. Prostatic reservoir piriform, seminal vesicle as an elongated sack. Germarium spherical 26–38 (30; n = 4) long, 20–28 (24; n = 4) wide; oviduct, oötype, and uterus not observed, seminal receptacle oval-shaped. Haptor truncated, 63–97 (75; n = 10) long; 69–148 (99; n = 10) wide. Arched elongated ventral bar 42–60 (49; n = 10) long, 3–6 (4; n = 10) wide, boomerang-shaped. Dorsal bar 46–57 (52; n = 10) long; 4–5 (5; n = 10) wide, coat hanger-shaped, presenting two tiny and delicate submedial projections. Anchors similar in shape and size, with well-developed superficial roots and small deep roots. Ventral anchor 18–22 (20; n = 10) long, 14–19 (16; n = 10) wide. Dorsal anchor 19–25 (22; n = 10) long, 14–17 (15; n = 10) wide. Hooks similar in shape and size 12–14 (13; n = 10) long, with erected thumb, slender shank with inflated termination, short and recurved point; filamentous hook (FH) almost the size of the shank.

Taxonomic Summary

Host: *Centromochlus heckelii* (De Filippi, 1853) (Siluriformes: Auchenipteridae).

Site in Host: Gill filaments.

Locality: River Itaya, Loreto, Peru (3°47'20.70"S 73°15'40.90"W)

Parasitological indices: prevalence 98% (235/240), total number of parasites recorded: 1355, range of intensity 3–8, mean intensity of infestation 9.7 ± 1.8, mean abundance of infestation 9.5 ± 1.5.

Remarks

Demidospermus centromochlii was described from the gills of *C. heckelii* captured in Iquitos, Peru [15]. This species was placed into *Demidospermus* based on the diagnosis provided by Kritsky & Gutierrez [14]: species without eyes (accessory granules subspherical), gonads in tandem, elongate bars (V-or W-shaped), vaginal aperture sinistral, and tubular MCO with sheath-like accessory piece. These characteristics are observed in the original description of the species; however, it is necessary to mention that according to Mendoza-Franco and Scholz [15] *Cosmetocleithrum* also presents the same characteristics mentioned for *Demidospermus*, except for MCO that does not present sheath-like accessory piece, and the dorsal bars, which present two submedial projections arising from anterodorsal surface of

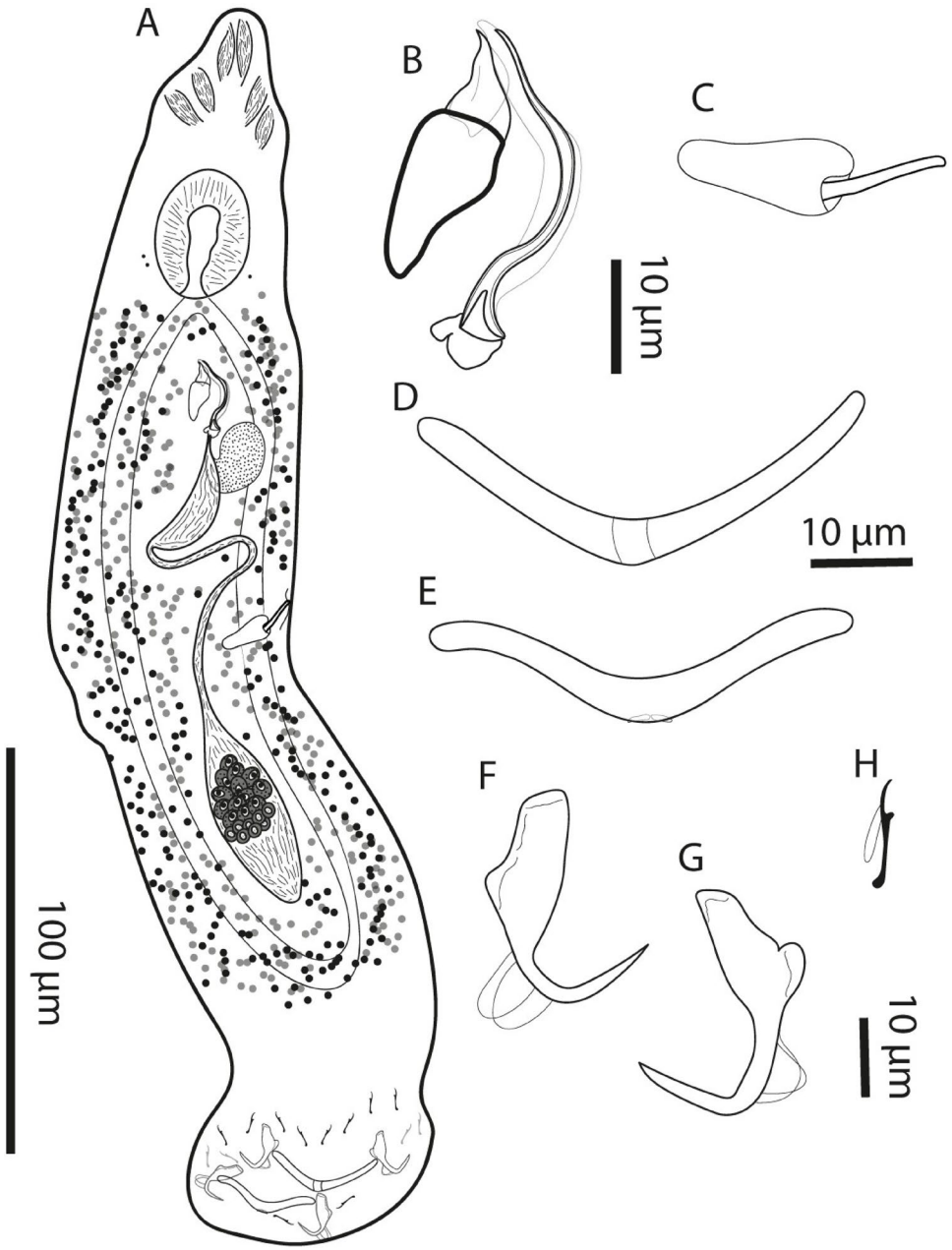

Fig. 1 *Demidospermus centromochli* Mendoza-Franco & Scholz, 2009 from the gills of *Centromochlus* heckelii (De Filippi, 1853). **A** Whole body ventral view. **B** Copulatory complex. **C** Vagina. **D** Ventral bar. **E** Dorsal bar. **F** Ventral anchor. **G** Dorsal anchor. **H** Hook pair I

bar, directed posteriorly or posterolaterally. Additionally, in the specimens of *D. centromochlii* recorded in the present study, two minuscule but extant projections were observed on the dorsal bar. Adding to all these arguments, comparing the morphology of the copulatory complexes (sigmoid tube and seed-shaped accessory piece) (Fig. 2); and sinistral vagina presented as a sclerotized tube, followed by a cone-shaped vestibule (Fig. 3) of the three species presented in this study, quite marked similarities are observed, which reinforce the idea of reassigning *D. centromochilii* within *Cosmetocleithrum*.

***Cosmetocleithrum itayensis* n. sp.**

(Figs. 4A-H)

With the general characteristics of the genus as described by Mendoza-Franco & Scholz [15], the description (based on 10 adult specimens; four stained in Gomori's Trichrome and eight clarified in Hoyer's medium) is presented: Body robust, 421–796 (577; n = 10) long; greatest width (at the level of the germarium) 119–219 (158; n = 10). Three cephalic lobes poorly developed. Three bilateral pairs of conspicuous head organs. Eyes absent. Accessory granules present. Pharynx spherical 47–73 (58; n = 10) long, 38–46 (34; n = 10) wide. MCO 26–40 (34; n = 10) long, as an elongated sigmoid tube, with termination tapering to the distal part. Accessory piece articulated to the base of the MCO by a thin and delicate membrane. Accessory piece 27–53 (38; n

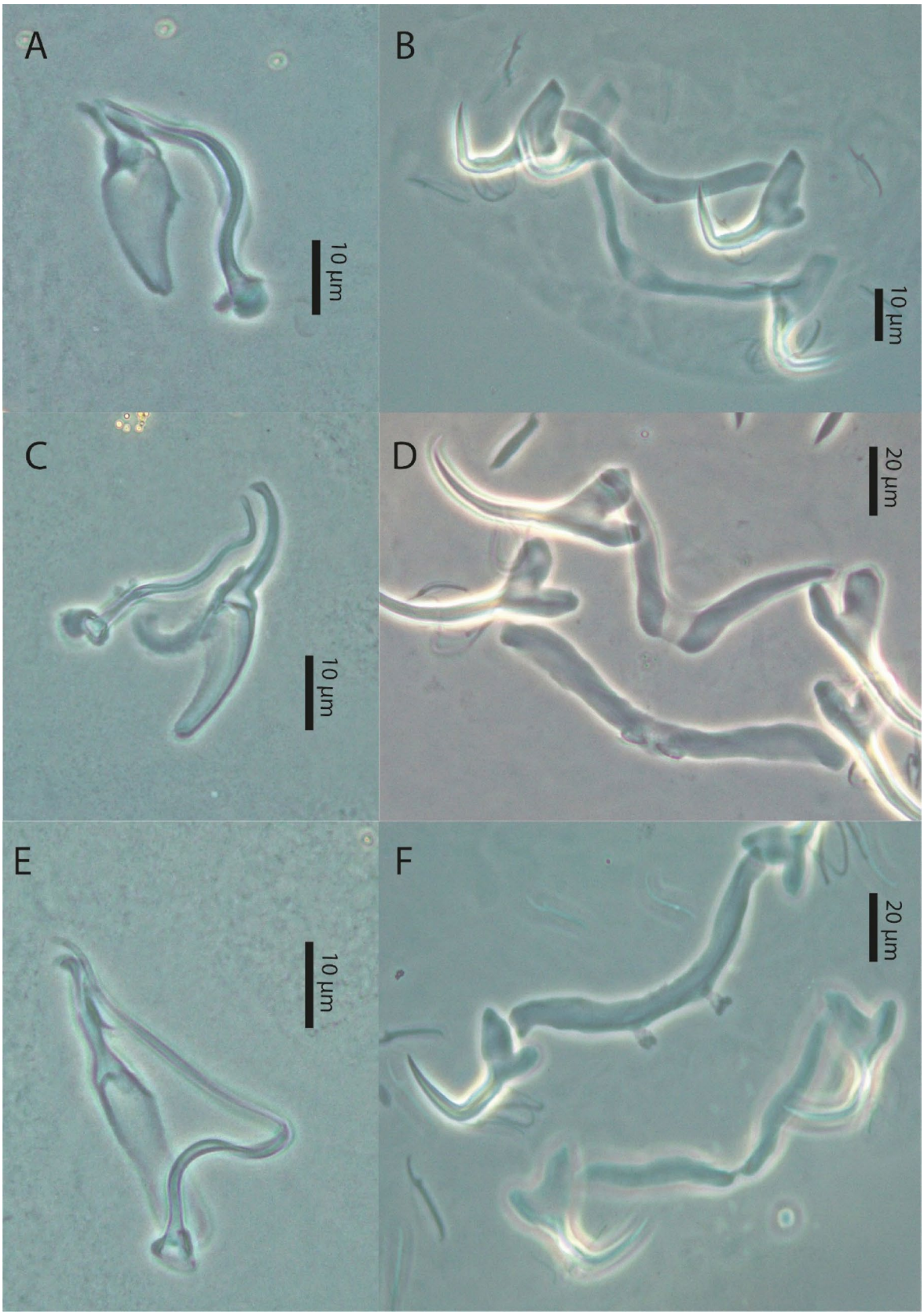

Fig. 2 **A** Copulatory complex of *Demidospermus centromochli* Mendoza-Franco & Scholz, 2009. **B** Haptor. **C** Copulatory complex of *Cosmetocleithrum itayensis***n. sp.D** Haptor. **E** Copulatory complex of *Cosmetocleithrum iiapensis***n. sp.f** Haptor

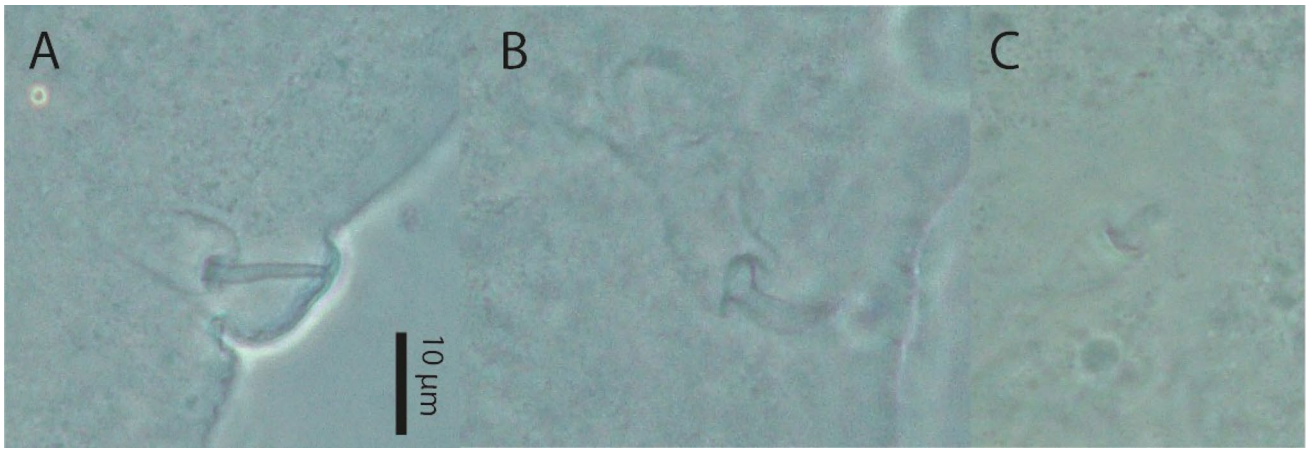

Fig. 3 **A** Vagina of *Demidospermus centromochli* Mendoza-Franco & Scholz, 2009. **B** Vagina of *Cosmetocleithrum itayensis***n. sp.C** Vagina of *Cosmetocleithrum iiapensis***n. sp**

= 10) long, formed by two units, the proximal seed-shaped, the distal unit small and cone-shaped, with a curvature that forms a kind of hook. Vaginal aperture sinistral, as a sclerotized robust tube, followed by a cone-shaped vestibule. Testis subspherical, posterior to germarium 52–80 (64; *n* = 4) long, 18–28 (26; *n* = 4) wide. Prostatic reservoir piriform, small, seminal vesicle as sack. Germarium spherical 50–78 (62; *n* = 4) long, 16–24 (22; *n* = 4) wide; oviduct, oötype, uterus, and seminal receptacle not observed. Haptor hexagonal, 87–109 (92; *n* = 10) long; 120–190 (154; *n* = 10) wide. "V" shaped ventral bar 46–66 (56; *n* = 10) long, 5–7 (6; *n* = 10) wide. Dorsal bar 59–81 (70; *n* = 10) long; 6–9 (7; *n* = 10) wide, yoked-shaped, with 2 submedial small projections. Anchors similar in shape and size, with well-developed roots, elongated shaft, and short point. Ventral anchor 40–51 (47; *n* = 10) long, 14–20 (17; *n* = 10) wide. Dorsal anchor 40–48 (45; *n* = 10) long, 13–19 (16; *n* = 10) wide. Hooks similar in shape and size 18–20 (20; *n* = 10) long, with erected thumb, thick shank with inflated termination, short and recurved point; filamentous hook (FH) almost the size of the shank.

Taxonomic Summary

Type-host: *Centromochlus heckelii* (De Filippi, 1853) (Siluriformes: Auchenipteridae).

Site in host: Gill filaments.

Type-locality: River Itaya, Loreto, Peru (3°47'20.70"S 73°15'40.90"W).

Type-material: Holotype (MUSM 5380), three paratypes (MUSM 5381 a-c), four vouchers (LAPYSA M-20 a-d)

ZooBank registration: The Life Science Identifier (LSID) for *Cosmetocleithrum centromochlii* **n. sp.** is urn:lsid:zoobank.org:act:urn:lsid:zoobank.org:pub:6884BFB4-4084-4485-9711-983E6CA1861D

Parasitological indices: prevalence 29% (70/240), total number of parasites 310, range of intensity 2-6, mean intensity of infestation 8.1 ± 1.4, mean abundance of infestation 2.3 ± 0.8

Etimology: the specific name derives from the type-locality of the parasite (River Itaya).

Remarks

Cosmetocleithrum itayensis **n. sp.** is assigned into *Cosmetocleithrum* mainly by the presence of the dorsal bar with two submedial projections arising from anterodorsal surface of bar, directed posteriorly or posterolaterally. The new species shares some characteristics with *Cosmetocleithrum basicomplexum* Silva, Meneses, Martins, Cohen, Costa & Justo, 2023, such as: MCO a sclerotized tube, with wide base opening; straight and robust accessory piece, with an apparently hollow structure and sclerotized walls, dorsal bar arch-shaped, with small projections, but it differs mainly by the shape of the body, that is very elongated in *C. basicomplexum*, with a very long peduncle, and a small haptor in relation to the body. Additionally, the new species presents anchors with well-developed roots and elongated shaft, while in *C*, *basicomplexum* the anchors are dissimilar and with a short shaft.

***Cosmetocleithrum iiapensis* n. sp.**

(Figs. 5A-H)

With the general characteristics of the genus as described by Kritsky and Gutierrez [14], the description (based on 10 adult specimens; four stained in Gomori's Trichrome and eight clarified in Hoyer's medium) is presented: Body robust, 399–792 (543; *n* = 10) long; greatest width (at the

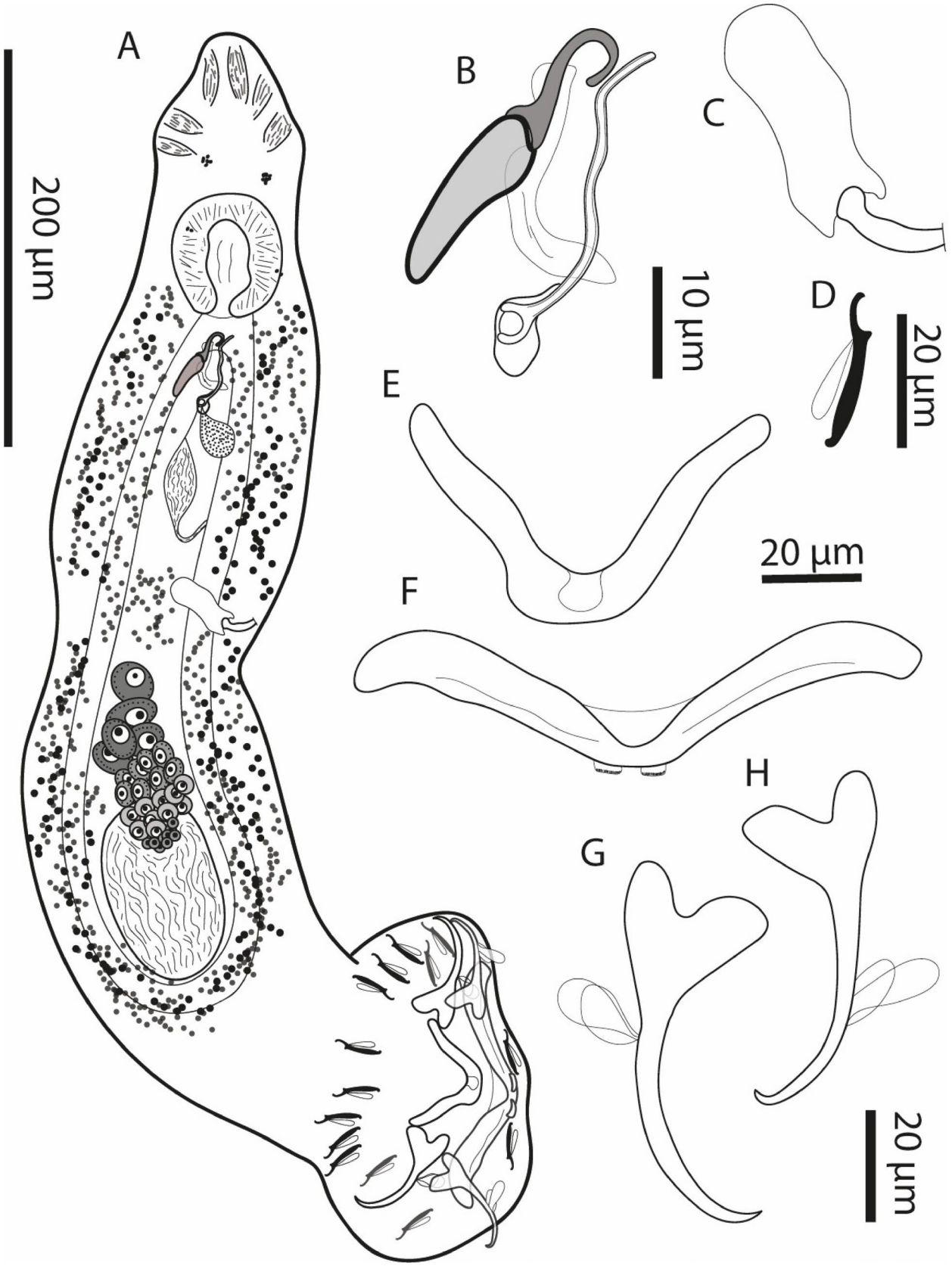

Fig. 4 *Cosmetocleithrum itayensis***n. sp.** from the gills of *Centromochlus heckelii* (De Filippi, 1853). **A** Whole body ventral view. **B** Copulatory complex. **C** Vagina. **D** Hook pair I. **E** Ventral bar. **F** Dorsal bar. **G** Ventral anchor. **H** Dorsal anchor

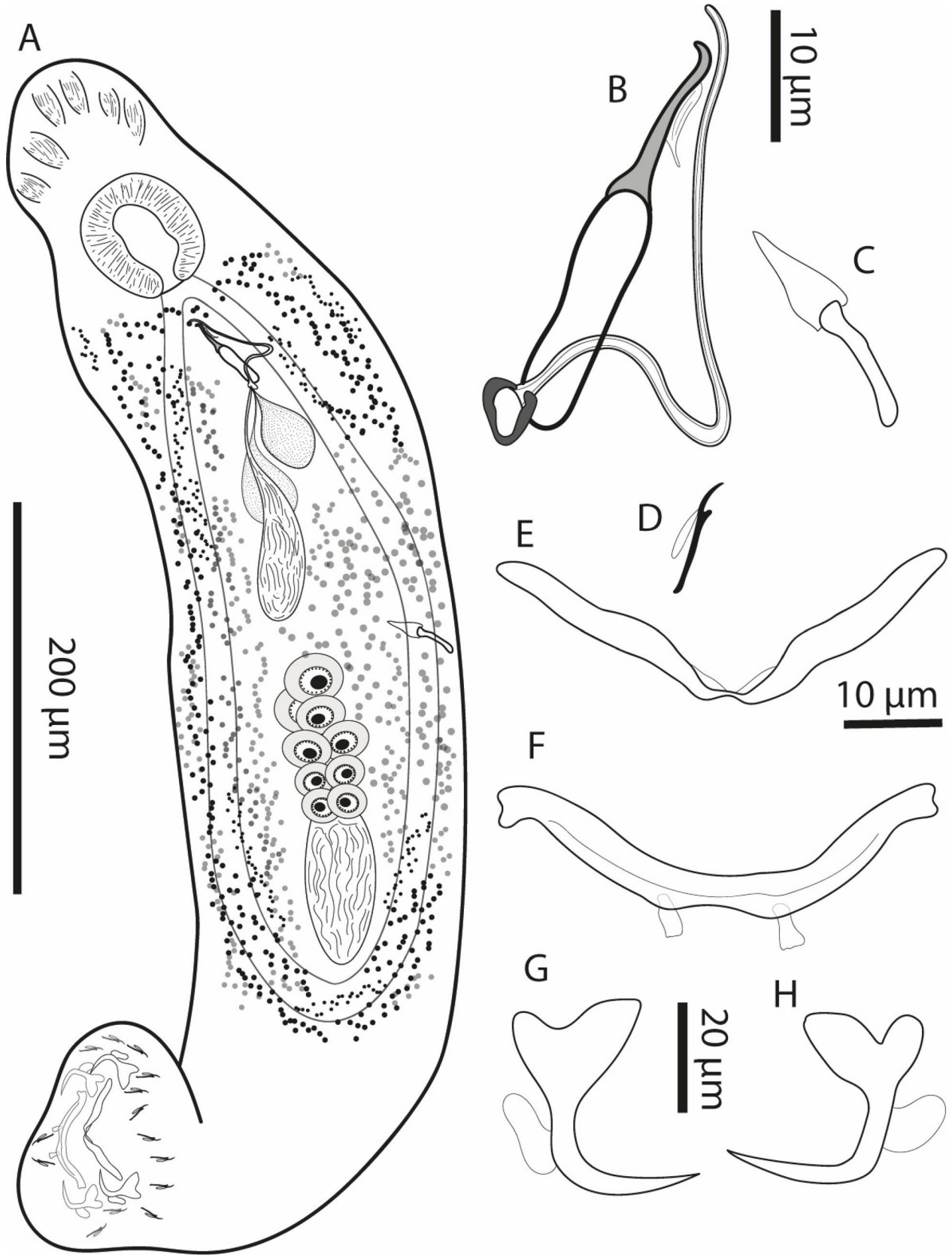

Fig. 5 *Cosmetocleithrum iiapensis***n. sp.** from the gills of *Centromochlus heckelii* (De Filippi, 1853). **A** Whole body ventral view. **B** Copulatory complex. **C** Vagina. **D** Hook pair I. **E** Ventral bar. **F** Dorsal bar. **G** Ventral anchor. **H** Dorsal anchor

level of the germarium) 120 − 186 (132; *n* = 10). Head unlobed. Three bilateral pairs of conspicuous head organs. Eyes absent. Accessory granules absent. Pharynx spherical 44–68 (60; *n* = 10) long, 32–71 (49; *n* = 10) wide. MCO 31–46 (40; *n* = 10) long, as an elongated sigmoid tube. Accessory piece non-articulated to the base of the MCO. Accessory piece 31–54 (40; *n* = 10) long, formed by two units, the proximal seed-shaped, the distal unit small and cone-shaped. Both together look like aubergine. Vaginal aperture sinistral, as a sclerotized thin tube, followed by a cone-shaped vestibule. Testis subspherical, posterior to germarium 45–60 (55; *n* = 4) long, 20–30 (24; *n* = 4) wide. Prostatic reservoirs piriforms, seminal vesicle as an elongated sack. Germarium spherical 46–62 (56; *n* = 4) long, 15–25 (20; *n* = 4) wide; oviduct, oötype, uterus, and seminal receptacle not observed. Haptor hexagonal, 45–186 (70; *n* = 10) long; 80–184 (70; *n* = 10) wide. Expanded V-shaped bars. Ventral bar 41–68 (54; *n* = 10) long, 4–6 (5; *n* = 10) wide. Dorsal bar 38–63 (52; *n* = 10) long; 4–7 (5; *n* = 10) wide, yoked-shaped, with 2 submedial projections. Anchors similar in shape and size, with well-developed roots, being the superficial root a little bigger than the deep, short shaft, small and almost straight point. Ventral anchor 24–44 (29; *n* = 10) long, 11–16 (14; *n* = 10) wide. Dorsal anchor 21–45 (28; *n* = 10) long, 9–17 (13; *n* = 10) wide. Hooks similar in shape and size 15–17 (16; *n* = 10) long, with erected thumb, straight shank, short and recurved point; filamentous hook (FH) almost half the size of the shank.

Taxonomic Summary

Type-host: *Centromochlus heckelii* (De Filippi, 1853) (Siluriformes: Auchenipteridae).

Type-host: Centromochlus heckelii (De Filippi, 1853) (Siluriformes: Auchenipteridae)

Site in host: Gill filaments.

Type-locality: River Itaya, Loreto, Peru (3°47'20.70"S 73°15'40.90"W)

Type-material: Holotype (MUSM 5382), three paratypes (MUSM 5383 a - c), four vouchers (LAPYSA M-21 a-d)

ZooBank registration: The Life Science Identifier (LSID) for Cosmetocleithrum centromochlii n. sp. is urn:lsid:zoobank.org:act: urn:lsid:zoobank.org:pub:6884BFB4-4084-4485-9711-983E6CA1861D

Parasitological indices: prevalence 15% (35/240), total number of parasites 130, range of intensity 2-5, mean intensity of infestation 4.5 ± 1.2, mean abundance of infestation 0.6 ± 0.4

Etimology the specific name derives from the city of Iquitos, locality where the parasite was found.

Remarks

Cosmetocleithrum iiapensis **n. sp.** is assigned into *Cosmetocleithrum* mainly by the presence of the dorsal bar with two submedial projections arising from anterodorsal surface of bar, directed posteriorly or posterolaterally. The new species shares some characteristics with *Cosmetocleithrum ludovicense* Silva, Meneses, Martins, Cohen, Costa & Justo, 2023, such as: accessory piece straight, robust, and elongated, with a hollow structure and sclerotized walls, bars V-shaped, with two submedial projections, but it differs mainly by the shape of MCO that in *C. ludovicense* is presented as a small and delicate tube, inverted J-shaped, presenting a cap through which its tip penetrates, while in the new species the MCO is presented as an elongated sigmoid tube.

Discussion

The copulatory complexes of *Cosmetocleithrum itayensis* n. sp., *Cosmetocleithrum iiapensis* n. sp. and, *D. centromochlii* Mendoza-Franco & Scholz, 2009 share similar characteristics among themselves: all of them present the MCO as a sigmoid tube; an accessory piece in the shape of a seed or eggplant; sinistral vagina as a sclerotized tube, followed by a cone-shaped vestibule. This indicates the need to study these parasites phylogenetically, to establish possible lineages between *Cosmetocleithrum* spp. and their fish host species.

In the present investigation, *D. centromochlii* was identified from the gills of *C. heckelii*, this being the second record for this parasite on this host. However, some differences were noted in relation to the original description of the species by Kritsky et al. [16]. Among the differences observed is the shape of the body, which in the original description looks contracted and in other sclerotized structures, the main feature that is not mentioned in the original description of the species is the presence of the two tiny, but extant submedian expansions on the dorsal bar, the main distinguishing feature of *Cosmetocleithrum* species. This, coupled with the similarity between the three copulatory complexes of the three species of Monogenoidea recorded in this investigation, along with the similarities between vaginas, suggests that *D. centromochlii* should be reassigned to the genus *Cosmetocleithrum.*

The variations in size observed between *D. centromoclii* presented in this research, compared to the original description of the species by Mendoza-Franco and Scholz [15] can be explained according to the hypotheses of [17–19], who mentioned that the morphology of the haptor in monogenoids (anchors and hooks) reflects adaptations for host attachment. The morphological variation observed

among *D. centromoclii* collected from the Itaya River and the specimens used in its original description may result from phenotypic plasticity for anchoring to the host in response to different environments. Given that the specimens used in the original description were collected in tributaries of the Amazon River and those presented in this study were collected in the Itaya River, the conditions of both rivers are likely to be different, influencing the phenotypic plasticity of the size of the haptor structures.

Another explanation for the variations in size of the sclerotized structures observed between the specimens used in the original description of *D. centromoclii* and those used in the present investigation can be explained according to the arguments of [20], who mention that the use of Hoyer for clarifying monogenoids significantly increases the size of haptoral sclerites [marginal hooks, bars, anchors], and changes their shape [angle opening between shaft and guard (outer and inner roots) in both ventral and dorsal anchors, ventral bar much wider, dorsal one less curved]. This influence seems to be reduced when specimens/samples are fixed in formalin. Additionally [20], recommend the use of glycerin-ammonium picrate (GAP) as mounting medium; and Hoyer's one should be restricted to monogenean specimens fixed for a long time which are more shrunken. In the present study we used Hoyer's medium and in the original description of *D. centromoclii* by Mendoza-Franco and Scholz [15] it was used GAP. This could probably be another argument to explain the differences in size recorded between the individuals of *D. centromoclii* in this study and those used in the original description of the species.

To date, ten species of *Cosmetocleithrum* have been reported parasitizing species of the Auchenipteridae. Of the ten species recorded, nine correspond to research conducted in Brazil [4; 5; 6; 7; 8] and only one, for Peru [9]. With the results of the present investigation, the number of known species rises to 12, thus contributing to the knowledge of parasitological biodiversity of monogenoids in the Neotropical Region.

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Data Availability No datasets were generated or analysed during the current study.

Declarations

Competing Interests The authors declare no competing interests.

Ethical Approval All applicable institutional, national, and international guidelines for the care and use of animals were followed.

References

1. Renno JF, Carvajal-Vallejos F, Pablo J, Sirvas S, Bonhomme F, Desmarais E (2011) Biodiversidad y evolución de Los peces En Amazonia. Biología de las Poblaciones de Peces Amazónicos y Piscicultura, p 13
2. García-Dávila C, Estivals G, Mejia J, Flores M, Angulo C, Sánchez H, Nolorbe C, Chuquipiondo C, Castro-Ruiz D, García A, Ortega H, Pinedo L, Oliveira C, Römer U, Mariac C, Duponchelle F, Renno J-F (2020) Peces ornamentales de La Amazonía Peruana. Instituto de Investigaciones de la Amazonia Peruana (IIAP). Iquitos, Perú, p 503
3. Galvis G, Mojica JI, Duque SR, Castellanos C, Sánchez-Duarte P, Arce M, Leiva M (2006) Peces Del medio Amazonas región de Leticia. Panamericana, formas e impresos SA, Bogotá, Colombia
4. Cohen SC, Justo MCN, Kohn A (2013) South American Monogenoidea parasites of fishes, amphibians and reptiles
5. Yamada PDO, Yamada FH, Silva RJ, Anjos LA (2017) A new species of *Cosmetocleithrum* (Monogenea, Dactylogyridae), a gill parasite of *Trachelyopterus galeatus* (Siluriformes, Auchenipteridae) from Brazil, with notes on the morphology of *Cosmetocleithrum striatuli*. Comp Parasitol 84(2):119–123
6. Soares GB, Dos Santos Neto JF, Domingues MV (2018) Dactylogyrids (Platyhelminthes: Monogenoidea) from the gills of *Hassar Gabiru* and *Hassar Orestis* (Siluriformes: Doradidae) from the Xingu Basin, Brazil. Zoologia (Curitiba) 35:1–19. https://doi.org/10.3897/zoologia.35
7. Cohen SC, Justo MCN, Gen DVS, Boeger WA (2020) Dactylogyridae (Monogenoidea, Polyonchoinea) from the gills of *Auchenipterus nuchalis* (Siluriformes, Auchenipteridae) from the Tocantins river. Brazil Parasite. https://doi.org/10.1051/parasite/2020002
8. Yamada PD, Yamada FH, Silva RJ (2020) Three new species of *Cosmetocleithrum* (Monogenea: Dactylogyridae) gill parasites of *Trachelyopterus galeatus* (Siluriformes: Auchenipteridae) in southeastern Brazil. Acta Parasitol 66(2):436–445. https://doi.org/10.1007/s11686-020-00282-3
9. Morey GAM, Tuesta Rojas CA, Satalaya Arellano H, Rodríguez LA (2024) Una Nueva especie de *Cosmetocleithrum* (Monogenea, Dactylogyridae) de Las Branquias de *Auchenipterichthys coracoideus* (Siluriformes, Auchenipteridae) de La Amazonía Peruana. Rev Peru Biol 31:e26253
10. Morey GAM (2019) Parasitología En peces de La Amazonía: fundamentos y técnicas parasitológicas, profilaxis, diagnóstico y Tratamiento [Internet]. Instituto de Investigaciones de la Amazonía Peruana. Instituto de Investigaciones de la Amazonía Peruana
11. Boeger WA, Vianna RT, Monogenoidea (2006) In: Thatcher VE. *Aquatic biodiversity in Latin America.* Vol. 1. 2nd ed. Sofia-Moscow: Pensoft Publishers
12. Humason GL (1979) Animal tissue techniques. 4th ed. USA: W.H. Freeman Co
13. Bush AO, Lafferty KD, Lotz JM, Shostak AW (1997) Parasitology meets ecology on its own terms: Margolis et al. revisited. J Parasitol 83:575–583
14. Kritsky DC, Gutierrez PA (1998) Neotropical Monogenoidea. 34. Species of *Demidospermus* (Dactylogyridae, Ancyrocephalinae) from the gills of pimelodids (Teleostei, Siluriformes) in Argentina. J Helminthol Soc Wash 65:147–159

15. Mendoza-Franco EF, Scholz T (2009) New dactylogyrids (Monogenea) parasitizing the gills of catfishes (Siluriformes) from the Amazon river basin in Peru. J Parasitol 95:865–870
16. Kritsky DC, Thatcher VE, Boeger WA (1986) Neotropical monogenea. 8. revision of *Urocleidoides* (Dactylogyridae, Ancyrocephalinae). Proc. Helminthol. Soc. Wash. 53:1–37
17. Rodríguez-González A, Míguez-Lozano R, Sarabeev V, Balbuena JA (2016) Evolutionary modularity and morphological integration in the haptoral anchor structures of ligophorus spp. (Monogenea: Dactylogyridae). Parasitol Res 115:3519–3533. https://doi.org/10.1007/s00436-016-5117-z
18. Rodríguez-Gonzalez A, Sarabeev V, Balbuena JA (2017) Evolutionary morphology in shape and size of haptoral anchors in 14 ligophorus spp. (Monogenea: Dactylogyridae). Evolutionary morphology in shape and size of haptoral anchors in 14 ligophorus spp. (Monogenea: Dactylogyridae). PLoS ONE 12(5):e0178367. https://doi.org/10.1371/journal.pone.0178367
19. Soares GB, Adriano EA, Domingues MV, Rodríguez-González A, Balbuena JA (2024) Evolutionary morphology of haptoral anchors in monogenoids (Dactylogyridae) of marine catfish (Siluriformes: Ariidae) from the Atlantic Coast of South America. Parasitology 151:390–399. https://doi.org/10.1017/S0031182024000192
20. Fankoua SO, Bitja-Nyom AR, Bahanak DND, Bilong Bilong CF, Pariselle A (2017) Influence of preservative and mounting media on the size and shape of monogenean sclerites. Parasitol Res 116(8):2277–2281