



New species of *Peruanella* (Dactylogyridae) from *Brachyplatystoma tigrinum* (Osteichthyes: Pimelodidae) from the Amazonas River, Peru

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Received: 15 September 2025 / Accepted: 29 October 2025
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Abstract

Introduction Given the need to identify parasites that may affect commercially important fish, and to contribute to knowledge of the parasitic fauna in Amazonian fish species, the main objective of this research was to study parasites from the gills of *Brachyplatystoma tigrinum* (Britski, 1981) (Siluriformes: Pimelodidae) what led to the discovery of a new species.

Material and Methods Five *B. tigrinum* with 20–30 (25 cm) were collected in the section between Gran Perú, near the town of Tamishiyacu, in the Amazonas River (3°47'20.70"S 73°15'40.90"W), in Loreto, Peru. The collected fish were transported in boxes with ice to the laboratory for parasitological analyses.

Results One species of the Dactylogyridae was registered: *Peruanella jorgepanduroi* n. sp. The new species differs from its congener *Peruanella madredeiosensis* Cruces, Santillán, Silvera, Morey, Rubin and Chero, 2024 by the termination of the MCO and the accessory piece, which in the new species have a pointed, almost straight termination, while in *P. madredeiosensis*, both the MCO and the accessory piece bend forward; additionally, the presence of striations on the surface of the shaft and the point of anchors in *P. madredeiosensis* is absent in the new species.

Conclusions The results of this study constitute the second report of a dactylogyrid species parasitizing *B. tigrinum*, and at the same time, the second species of *Peruanella* Cruces, Santillán, Silvera, Morey, Rubin and Chero, 2024 described. This increases the knowledge of the biodiversity of monogenoids reported for Peru and the Neotropical region.

Keywords Ectoparasite · Monogenoid · Tigerstriped catfish · Peruvian Amazon

Introduction

The Peruvian Amazon has a very diverse ichthyofauna; approximately 1.000 species of freshwater fish have been recorded [1], which are commercial resources and human food. Belonging to the order Siluriformes, seven species of *Brachyplatystoma* have been identified in the Neotropical region, in which eight species of Monogenoidea have been recorded, distributed among the genera *Demi-dospermus* Suriano, 1983 (see the compilation of Cohen et al. [2], *Pavanelliella* Kritsky and Boeger, 1998 [3], and *Peruanella* Cruces, Santillán, Silvera, Morey, Rubin and Chero, 2024 [4].

Among the *Brachyplatystoma* species, *B. tigrinum* (Britski, 1981) commonly named as “tigerstriped catfish” and locally named in Peru as “zúngaro tigrinum” is a species highly demanded by the ornamental market in the Peruvian Amazon [5] reaching an export price per unit

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of between €300 and €600 each, with growing demand in Asian markets [6].

Despite being a species of high commercial value, to date there are only two studies on its parasitic fauna: the first reports parasitism by the branchiuran *Argulus pestifer* Ringuelet, 1948 in specimens of *B. tigrinum* bred in captivity in Loreto, Peru [7]; and the second reports for monogenean, *Peruanella madredeiosensis* Cruces, Santillán, Silvera, Morey, Rubin and Chero, 2024 parasitizing the gills of individuals collected in the Madre de Dios Region of Peru, that represents the only species within the *Peruanella* [4].

Given the need to identify the parasites that can affect this species, which is of great commercial importance for the ornamental market in Peru, and given the urgent need to contribute to knowledge of the parasitic fauna in Amazonian fish, this study presents the description of a new species of Monogeneoidea collected from the gills of juvenile *B. tigrinum* from Loreto, Peru.

Materials and Methods

Five *B. tigrinum* with 20–30 (25 cm) were collected in the section between Gran Perú, near the town of Tamishiyacu, Amazonas River (3°47'20.70"S 73°15'40.90"W), 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 monogeneoidean specimens were stained with Gomori's trichrome [8, 9] and mounted in Canada Balsam to determine internal soft structures, while others were cleared in Hoyer's medium for the study of sclerotized structures [8, 9].

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 haptor sclerites [7]. 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 [10]. 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 and digitalized with 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 Acuicola 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) [11], 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. [12].

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

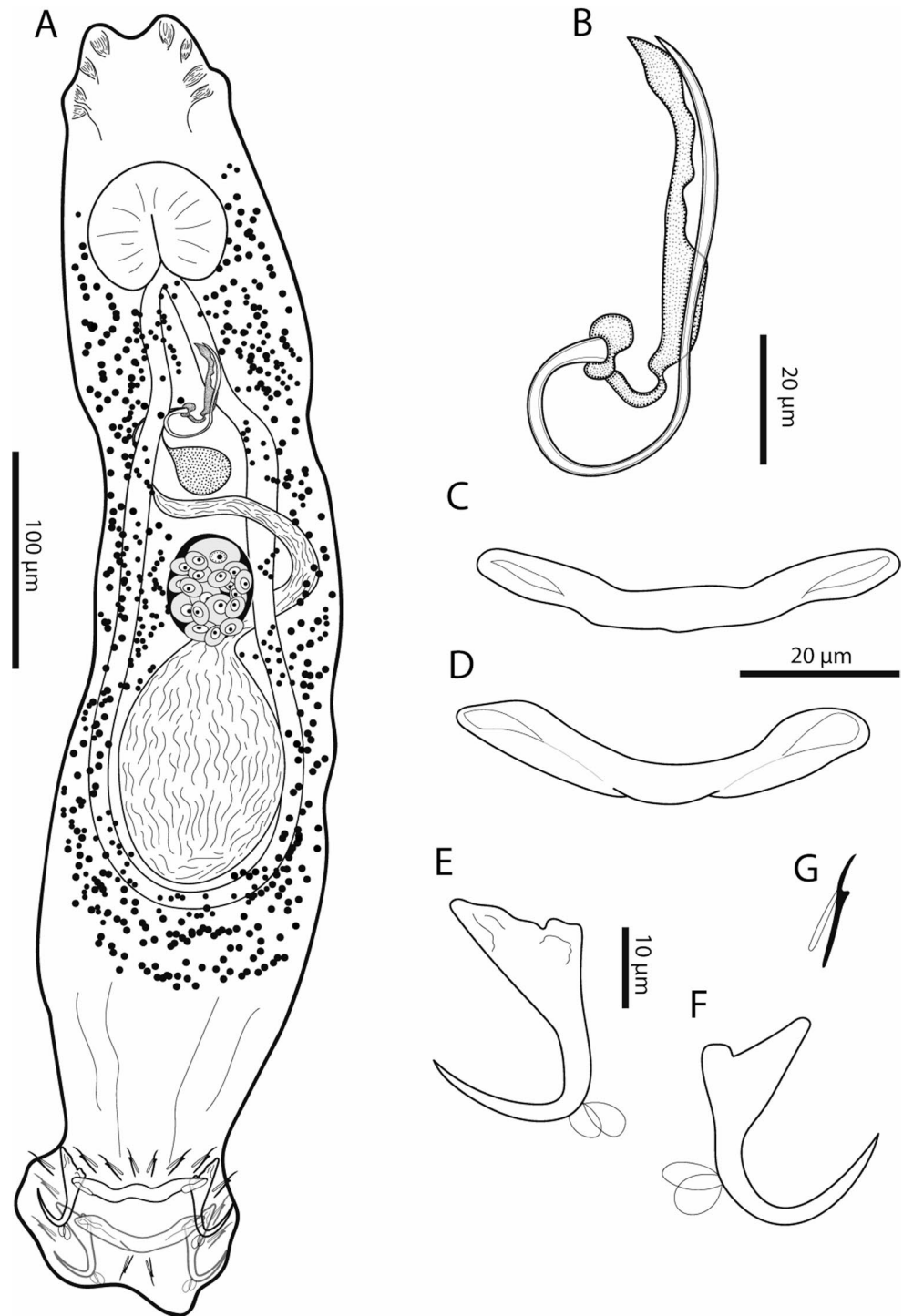
Peruanella Cruces, Santillán, Silvera, Morey, Rubin and Chero, 2024

Peruanella jorgepanduroi n. sp.

(Fig. 1A–G).

With the general characteristics of the genus as described by Cruces et al. [5], the description (based on 10 adult specimens; four stained in Gomori's Trichrome and six clarified in Hoyer's medium) is presented: Body elongate, fusiform, 350–692 (543; n=10) long; greatest width 101–180 (126; n=10) usually at level of testes. Four cephalic lobes moderately developed. Four bilateral pairs of conspicuous head organs. Eyes and accessory eyespot granules absent. Pharynx spherical, well developed, 47–92 (76; n=10) in diameter. Haptor hexagonal 71–137 (98; n=10) long; 81–142 (110; n=10) wide. Male copulatory organ (MCO) 32–50 (41; n=10) long, tubular, J-shaped, slightly expanded sclerotized base. Irregularly shaped accessory piece articulated to MCO base by a thin ligament, with the proximal part being wider, tapering in the middle, then widening slightly again, with the distal part being sword-shaped, 30–59 (45; n=10) long.

Fig. 1 *Peruanella jorgepanduroi* n. sp. from *Brachyplatystoma tigrinum* (Britski, 1981). **A** Whole worm, ventral view; **B** copulatory complex; **C** ventral bar; **D** dorsal bar; **E** ventral anchor; **F** dorsal anchor; **G** hook pair I



Testis subspherical, 82–124 (90; n=4) long, 55–85 (65; n=4) wide; prostatic reservoir pyriform. Ovary ovate, 46–68 (58; n=4) long, 32–62 (40; n=4) wide; vagina, oviduct, oötype, uterus and eggs not observed. Anchors similar in shape and size, moderately developed roots, short and robust shaft, and elongated straight point. Ventral anchor 24–27 (26; n=10) long, 17–20 (18; n=10) wide, with elongated, triangular-shaped superficial root,

short, quadrangular deep root, short and robust shaft, and elongated straight point. Dorsal anchor 23–27 (25; n=10), 14–19 (16; n=10) wide, with short and robust shaft, and elongated straight point; both, the shaft and the point exceeding the level of the superficial root. Slightly curved, grooved bars. Ventral bar straight, elongated, 48–62 (54; n=10) long. Dorsal bar with a slight bulge in the middle, 52–61 (56; n=10) long. Hooks, 12–16 (14;

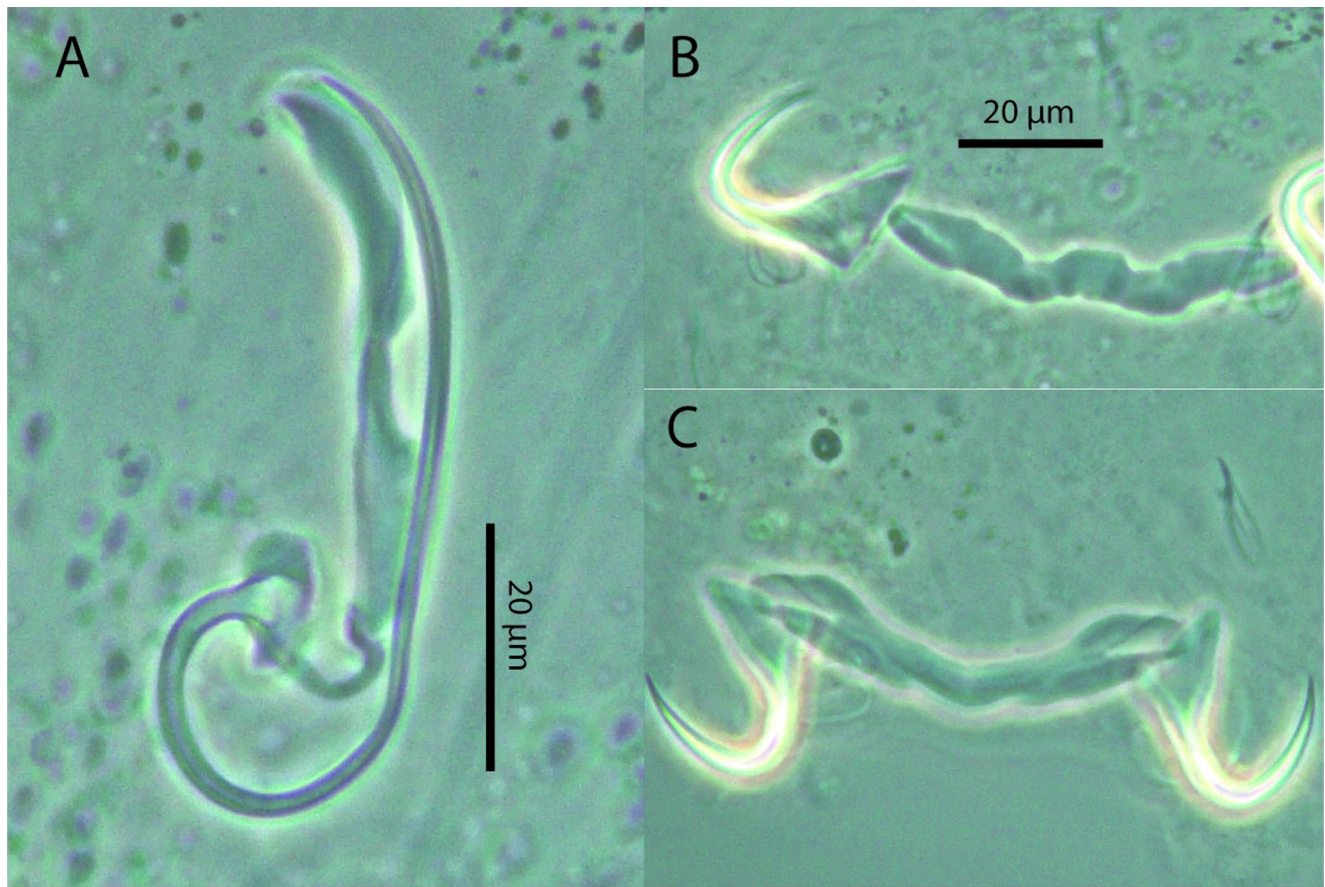


Fig. 2 Compound micrographs of *Peruanella jorgepanduroi* n. sp. from *Brachyplatystoma tigrinum* (Britski, 1981). **A** copulatory complex; **B** ventral bar and ventral anchor; **C** dorsal bar and dorsal anchor

n=10) long, similar in shape and size, each with erected thumb, straight shank, and short point; filamentous hook (FH) exceeding the shank length.

Etimology: the specific name is in honor of Jorge Luis Panduro Noronha, a person who dedicated his life to the world of ornamental fish.

Taxonomic Summary

Type-host: *Brachyplatystoma tigrinum* (Britski, 1981) (Siluriformes: Pimelodidae).

Site in host: Gill filaments.

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

Type-material: Holotype (MUSM 5384), four paratypes (MUSM 5385 a-d), four vouchers (LAPYSA M-22 a-d).

ZooBank registration: The Life Science Identifier (LSID) for *Peruanella jorgepanduroi* n. sp. is urn:lsid:zoobank.org:pub:FDDF1902-C60C-42BE-A460-506FB5ADFEC2.

Parasitological indices: prevalence 100% (5/5), total number of parasites 74, range of intensity 9–20, mean intensity and mean abundance of infestation 14.8 ± 2.6 .

Remarks

Peruanella jorgepanduroi n. sp. is assigned into *Peruanella* Cruces, Santillán, Silvera, Morey, Rubin and Chero, 2024 mainly by presenting tandem gonads, a tubular J-shaped MCO, and an accessory piece connected to the base of the MCO via a filament (Fig. 2A–C). The new species shares some characteristics with *Peruanella madredeiosensis*, such as: MCO a sclerotized J-shaped tube, with an accessory piece connected to the base of the MCO via a filament and a dorsal grooved bar; but it differs mainly by the termination of the MCO and the accessory piece, which in the new species have a pointed, almost straight termination, while in *P. madredeiosensis*, both the MCO and the accessory piece bend forward. Additionally, in the new species, both bars are grooved (Fig. 2D, E), while in *P. madredeiosensis*, only

the dorsal bar has this characteristic. Furthermore, the anchors of both species have different characteristics as the presence of striations on the surface of the shaft and point noticeable in *P. madredeiosensis* and absent in the new species.

Discussion

For the Neotropical region, 15 genera of Monogenoidea were recorded parasitizing the gills of Pimelodidae species: *Ameloblastella* Kritsky, Mendoza-Franco and Scholz, 2000, *Amphocleithrum* Price and Romero, 1969, *Cosmetocleithrum* Thatcher and Boeger, 1986, *Demidospermus*, *Omothecium* Thatcher and Boeger, 1987, *Pavanelliella*, *Phanerothecioides* Kritsky, Vianna and Boeger, 2007, *Phanerothecium* Kritsky and Thatcher, 1977, *Scleroductus* Jara and Cone, 1989, *Unibarra* Suriano and Incorvaia, 1995, *Urocleidoides* Mizelle and Price, 1964, *Vancleaveus* Kritsky, Thatcher and Boeger, 1986 (see the compilation of [2]), *Nanayella* Acosta, Mendoza-Palmero, da Silva and Scholz, 2019 [13], *Boegeriella* Mendoza-Palmero and Hsiao, 2020 [14], and *Peruanella* [4].

For species of *Brachyplatystoma* the following species have been identified and are listed in the compilation of Cohen et al. [2]: *Demidospermus brachyplatystomae* Cepeda and Luque, 2010; *D. ceccarelli* Cepeda and Luque, 2010 from *B. filamentosum* (Lichtenstein, 1819); *D. araguaiaensis* Cepeda and Luque, 2010 from *B. vaillanti*; *D. mortenthaleri* Mendoza-Palmero, Scholz, Mendoza-Franco and Kuchta, 2012 from *B. juruense* (Boulenger, 1898); *Pavanelliella jarui* Aguiar, Maia, Silva, Ceccarelli, Domingues and Adriano, 2017 from *B. rousseauxii* (Castelnau, 1855) [3]; *Boegeriella conica* Mendoza-Palmero, Mendoza-Franco, Acosta, and Scholz, 2019 from *B. juruense* [13] Also, Cruces et al. [4] transferred *D. aureagarcae* to the *Peruanella*, as *P. aureagarcae*. The discovery of *P. jorgepanduroi* n. sp. constitutes the ninth record of a monogenean parasitizing a host of the *Brachyplatystoma*, contributing to the knowledge of parasitological biodiversity of monogenoids in the Neotropical Region.

Currently, only one species of *Peruanella* was described, but according to [4], a species described into *Demidospermus* Suriano, 1983: *D. aureagarcae* Morey, Rojas, Dávila, Chu and de Pina, 2023 [15] exhibits characteristics that are compatible with *Peruanella*, transferring this species to the genus, and so, constituting the second known species for this genus. The characteristics used by [4] to transfer *D. aureagarcae* into *Peruanella* were: straight and robust bars, J-shaped MCO, an

accessory piece connected to the base of the MCO via a filament, and similar hooks. These characteristics are also shared with *P. jorgepanduroi* n. sp. supporting the transference of *D. aureagarcae* into *Peruanella*.

To properly understand the classification of these dactylogyrids, additional review of all species reported for pimelodids based on morphological and molecular data (integrative taxonomy) is needed. An integrative approach may lead to the identification of monophyletic groups and their corresponding morphological synapomorphies, as mentioned by Cohen et al. [16].

Among hosts, Pimelodidae is a family with great richness of parasite genera and are also species-rich clades [17]. Network of interactions between fish families and parasite genera reported by [17] showed that Pimelodidae shares genera and species of Monogenoidea with Auchenipteridae, Doradidae, Heptapteridae, and Loricariidae. *Vancleaveus* is known for Pimelodidae and Doradidae hosts; *Ameloblastella* is known from Pimelodidae and Heptapteridae hosts; and *Demidospermus* is known from Pimelodidae, Auchenipteridae and Loricariidae hosts.

Braga et al. [17] found that most fish orders have a unique composition of parasite genera. These phylogenetic restrictions can also be found at the family level. Previous studies suggest that broad historical constraints act at large scales, restricting parasites to host higher taxa, e.g., orders and families [18, 19]. The identification of a new Monogenoidea species from *B. tigrinum* collected in Iquitos, Peru, represents a significant advancement in our understanding of host-parasite dynamics within Neotropical freshwater ecosystems. This discovery highlights the complexity of parasitic networks, considering the diversity of fish lineages and their associated resources, which influence the structure and specificity of monogenoid-host interactions. Given that Siluriformes—the host fish family in this case—is a highly diverse and non-monophyletic assemblage [17], the presence of a new parasite species suggests potential co-evolutionary processes driven by the host's evolutionary history and lineage-specific traits.

The findings align with the notion that host specificity in Monogenoidea might be an intrinsic trait shaped by host shifts and subsequent adaptation, as proposed by existing studies on host-parasite co-evolution [17]. The capacity of monogenoid parasites to switch hosts and radiate adaptively could explain the emergence of this new species, especially within the context of the diverse and phylogenetically complex fish hosts in the Neotropics. Moreover, considering the host's taxonomic and biogeographic background, this discovery may reflect either a specialized relationship developed over evolutionary time or a recent host shift, contributing to the apparent richness of the monogenoid fauna in Amazonian waters.

This finding emphasizes the importance of exploring parasitic diversity in Amazonian freshwater habitats, which remain relatively understudied yet are hotspots of biodiversity and evolutionary processes. It opens new avenues for future research focusing on the mechanisms driving host specificity, the role of host lineage divergence in parasite evolution, and the biogeographic patterns that influence parasite distribution. Overall, this discovery not only adds to the documented biodiversity of Monogonoidea but also provides a valuable case study for understanding the evolutionary ecology of host-parasite interactions in tropical river systems.

A significant limitation in the current understanding of *Peruanella* species is the lack of molecular data, which hampers comprehensive phylogenetic and evolutionary studies within this genus. In the absence of genetic sequences, taxonomic identification relies heavily on morphological characteristics, making detailed morphological descriptions—such as those presented in this study—particularly vital for the accurate recognition and differentiation of species. While these morphological data provide a crucial foundation, they also highlight the urgent need for future research to incorporate molecular approaches. Integrating DNA-based analyses will be essential to clarify phylogenetic relationships, assess genetic diversity, and confirm species boundaries within *Peruanella*. Gathering molecular data will ultimately enhance our understanding of the evolutionary processes shaping this group and facilitate comparisons with related taxa, contributing to a more robust and integrative taxonomy of Monogonoidea in Neotropical freshwater systems.

Acknowledgements We would like to thank the Amazon Research Center for Ornamental Fish (ARCOF) for providing us with the facilities to obtain the fish used in this study.

Author Contributions The study was designed by GAMM, HADP, Collection of parasites was performed by RFCG, CTCG, Laboratory tests were performed by GAMM, HADP, RFCG, and CTCG. The manuscript was written by GAMM and subsequently revised by all other authors.

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

Declarations

Conflict of interest The authors declare that they have no conflict of interest.

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

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