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# Monopisthocotyla (Platyhelminthes, Neodermata) parasites from *Brycon cephalus* (Günther, 1869) from the Moa River, state of Acre, Brazil

**Marcia Cristina Nascimento Justo**[1], **Williane Maria Oliveira Martins**[2], **Simone Chinicz Cohen**[1]

1 Laboratório de Helmintos Parasitos de Peixes, Instituto Oswaldo Cruz, FIOCRUZ. Avenida Brasil 4365, Rio de Janeiro, RJ, 21040-900, Brazil
2 Instituto Federal do Acre, IFAC. Rodovia AC-90, Transacreana, KM 20, Rio Branco-Acre,69912-290, Brazil.

Corresponding author: Marcia Cristina Nascimento Justo (marciajusto@ioc.fiocruz.br)

**Abstract.** During studies on parasites of fishes from Moa River, state of Acre, five species of Dactylogyridae were identified parasitizing *Brycon cephalus* (Günther, 1869): *Anacanthorus elegans* Kritsky, Thatcher & Kayton, 1979, *Anacanthorus kruidenieri* Kritsky, Thatcher & Kayton, 1979, *Anacanthorus spiralocirrus* Kritsky, Thatcher & Kayton, 1979, *Annulotrematoides bryconi* Cuglianna, Cordeiro & Luque, 2003, and *Tereancistrum kerri* Kritsky, Thatcher & Kayton, 1980. New morphological and biogeographic data are provided. Records of these parasites in congeneric hosts reinforce the host specificity of these species, restricted to species of Bryconidae.

**Key words.** Characiformes, Dactylogyridae, freshwater fishes, Neotropical Region

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## Introduction

Characiformes currently comprises 2,309 species treated as valid, of which 2,065 occur in the Neotropical Region and 244 belong to the four African fish families (Toledo-Piza et al. 2024). Among the characiform genera of the Neotropical region, *Brycon* Müller & Troschel, 1844 stands out, comprising 46 valid species, of which some exhibit migratory behavior (Toledo-Piza et al. 2024). These fish are medium-sized to large and are widely distributed across the major hydrographic basins of South America, as well as most Caribbean and Atlantic coastal systems (Lima 2017). The major species diversity occurs in Panama and the Colombian and Ecuadorian trans-Andean rivers (Lima 2003, 2017).

*Brycon cephalus* (Günther, 1869) (Characiformes, Bryconidae), known in Brazil as matrinxã, is a freshwater fish species native to the Amazon Basin, widely recognized for its importance in Brazilian aquaculture due to its rapid growth and high-quality meat (Frasca-Scorvo et al. 2001). *Brycon cephalus* inhabits the tropical regions of South America, especially in the Amazon Basin, including countries such as Peru and Bolivia (Lima 2003).

Monopisthocotylans of the family Dactylogyridae are common ectoparasites primarily infecting the gills of freshwater and marine fishes. In South American river systems, several species of Dactylogyridae have been documented infecting characiform fishes. Recent parasitological surveys have revealed a diversity of dactylogyrid genus as *Anacanthorus* Mizelle & Price, 1965, *Annulotrematoides* Cuglianna, Cordeiro & Luque, 2003, *Jainus* Mizelle, Kritsky & Crane, 1968, *Notozothecium* Boeger & Kritsky, 1988, *Telethecium* Kritsky, Van Every & Boeger, 1996, *Tereancistrum* Kritsky, Thatcher & Kayton, 1980, *Trinibaculum* Kritsky, Thatcher & Kayton, 1980 associated with members of the genus *Brycon* (Table 1). These parasites exhibit high host specificity and morphological adaptation to the microhabitat provided by the fish gill arches.

During studies on parasitic fauna of fishes from the Brazilian Amazon, specimens of monopisthocotylans were collected from the characiform *Brycon cephalus* and are reported/redescribed herein.

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**Table.** Monopisthocotylans (Dactylogyridae) from South American river systems associated with *Brycon* species.

| Monopisthocotyla | Host species | Localities | References |
|---|---|---|---|
| *Anacanthorus brevicirrus* Monteiro, Kritsky & Brazil-Sato, 2010 | *B. orthotaenia* | Brazil | Monteiro et al. 2010 |
| *Anacanthorus brevis* Mizelle & Kritsky, 1969 | *B. melanopterus* | Brazil | Mizelle and Kritsky 1969 |
| *Anacanthorus elegans* Kritsky, Thatcher & Kayton, 1979 | *B. melanopterus* | Brazil | Kritsky et al. 1979 |
| *Anacanthorus femoris* Morey, Sol, & Cachique, 2021 | *B. amazonicus* | Peru | Morey et al. 2021 |
| *Anacanthorus franciscanus* Monteiro, Kritsky & Brazil-Sato, 2010 | *B. orthotaenia* | Brazil | Monteiro et al. 2010 |
| *Anacanthorus kukamensis* Morey, Sol & Cachique, 2021 | *B. amazonicus* | Peru | Morey et al. 2021 |
| *Anacanthorus kruidenieri* Kritsky, Thatcher & Kayton, 1979 | *B. melanopterus* | Brazil | Kritsky et al. 1979 |
| *Anacanthorus rarus* Morey, Sol & Cachique, 2021 | *B. amazonicus* | Peru | Morey et al. 2021 |
| *Anacanthorus sabaloi* Morey, Sol & Cachique, 2021 | *B.amazonicus* | Peru | Morey et al. 2021 |
| *Anacanthorus spiralocirrus* Kritsky, Thatcher & Kayton, 1979 | *B. amazonicus; B. melanopterus* | Brazil | Andrade and Malta, 2006; Kritsky et al. 1979 |
| *Annulotrematoides bryconi* Cuglianna, Cordeiro & Luque, 2003 | *B. cephalus* | Brazil | Cuglianna et al. 2003 |
| *Jainus amazonensis* Kritsky, Thatcher & Kayton, 1980 | *B. amazonicus;*<br>*B. cephalus; B. melanopterus* | Brazil<br>Peru | Andrade et al. 2001; Andrade and Malta, 2006; Kritsky et al. 1980; Mathews Delgado et al. 2014 |
| *Jainus peruensis* Cruces, Santillan, Silvera, Morey, Rubin & Chero, 2024 | *B. amazonicus* | Peru | Cruces et al. 2024 |
| *Notozothecium agusti* Cruces, Santillán, Silvera & Chero, 2024 | *B. amazonicus* | Peru | Kritsky et al. 1998 |
| *Rhinoxenus anaclaudiae* Domingues & Boeger, 2005 | *B.* sp. | Brazil | Domingues and Boeger 2005 |
| *Tereancistrum kerri* Kritsky, Thatcher & Kayton, 1980 | *B. amazonicus; B. melanopterus* | Brazil | Andrade and Malta, 2006; Kritsky et al. 1980 |
| *Trinibaculum brazilensis* Kritsky, Thatcher & Kayton, 1980 | *B. amazonicus; B. melanopterus* | Brazil | Andrade and Malta, 2006; Kritsky et al. 1980 |

# Methods

In January 2024, during research conducted from Moa River, state of Acre, Brazil (07°33′13″S, 073°59′32″W) (Figure 1), one specimen of *Brycon cephalus* was captured with gill nets and hook and line. All collections obtained environmental licensing through the Biodiversity Authorization and Information System (SISBIO, 396871-1). The gills were carefully excised and submerged in vials filled with warm water (~65°C), where they were gently agitated. Following this, absolute ethanol was added to achieve a concentration of 70%. Monopisthocotylans were meticulously extracted from both the sediment and gill arches in the "Laboratório de Helmintos Parasitos de Peixes, Instituto Oswaldo Cruz, Fiocruz", Brazil, using a stereoscopic microscope. The specimens were mounted unstained in Hoyer's medium to examine the sclerotized parts. Photomicrographs were taken using a Zeiss Axioskop microscope micrographic system, with a differential interference contrast (DIC) apparatus and an Olympus BX 41 microscope with phase contrast. All measurements are in micrometers, and the range is followed by the mean in parentheses and the number of specimens measured when more than two. Dimensions of organs and other structures represent the greatest distance; lengths of curved or bent structures (bar and accessory piece) represent the straight-line distances between extreme ends. Measurements of haptoral parts follow Freitas et al. (2021). Numbering of hook pairs follows Mizelle

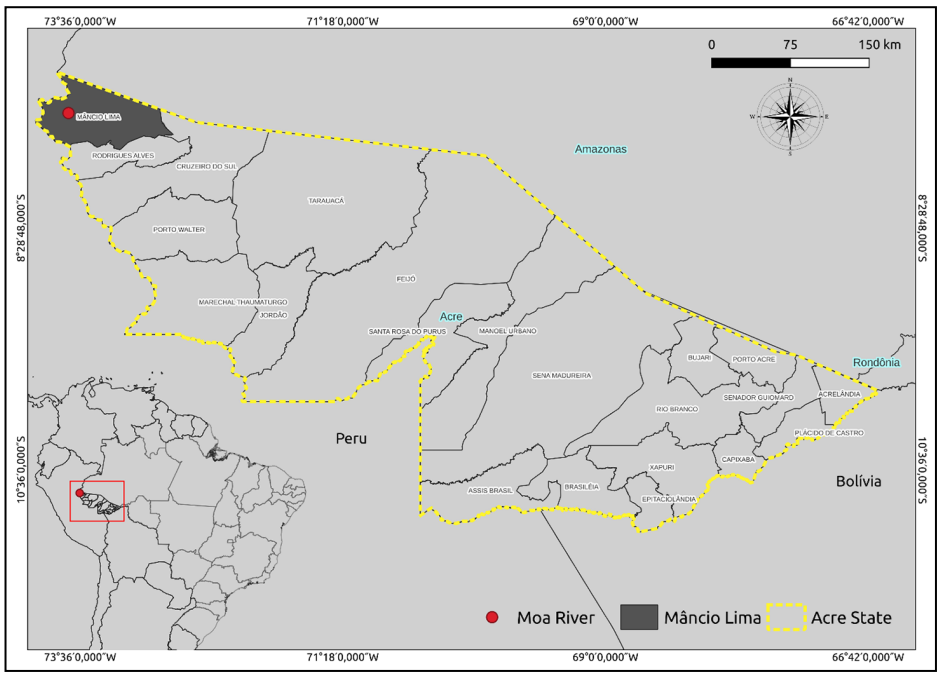


**Figure 1.** Map showing the point of collection of the host in the Moa River, Acre, Brazil.

and Price (1963). Measurements of the original descriptions are shown in square brackets. Vouchers are deposited in the helminthological collection of Instituto Oswaldo Cruz (CHIOC).

# Results

Class Monopisthocotyla Brabec, Salomaki, Kolísko, Scholz & Kuchta, 2023
Order Dactylogyridea Bychowsky, 1937
Family Dactylogyridae Bychowsky, 1933
Subfamily Anacanthorinae Price, 1967

***Anacanthorus elegans* Kritsky, Thatcher & Kayton, 1979**
Figure 2A, B

**New record.** Brazil — Acre • Moa River, municipality of Mancio Lima; 07°33′13″S, 073°59′32″W; 200 m alt.; 20 Aug. 2023; W. Martins leg.; new host *Brycon cephalus*; deposited material: CHIOC voucher no. 40845a–d; mounted in Hoyer's medium.

**Identification.** Morphometric data (based on 8 specimens mounted in Hoyer's medium, original measurements in brackets): body fusiform, 890 (620–980, *n* = 8) [908 (704–1,061)] long by 208 (170–270, *n* = 8) [120 (92–184)] wide, including haptor. Two terminal and two lateral cephalic lobes; poorly developed head organs; cephalic glands inconspicuous. Four eyes; members of posterior pair larger. Pharynx 46 (37–55, *n* = 8) [50 (39–70)] wide. Peduncle broad; haptor bilobed, 105 (70–130, *n* = 8) [77 (51–133)] wide. Hooks uniformly distributed on both lobes. Hooks similar in shape and size, with proximal bulb, needle-shaped, small thumb, 37 (35–40, *n* = 24) [37 (34–41)] long, 4A 15 (14–16, *n* = 5) [14 (12–15)] long (Figure 2B). Gonads occasionally somewhat overlapping; testis subovate; vas deferens looping left intestinal caeca; seminal vesicle a dilation of vas deferens. Copulatory complex comprises a male copulatory organ (MCO) tubular, simple reflexive tube, with flared distal end, 324 (300–337, *n* = 8) [189 (148–224)] long (Figure 2A). Accessory piece a membranous sheath covering

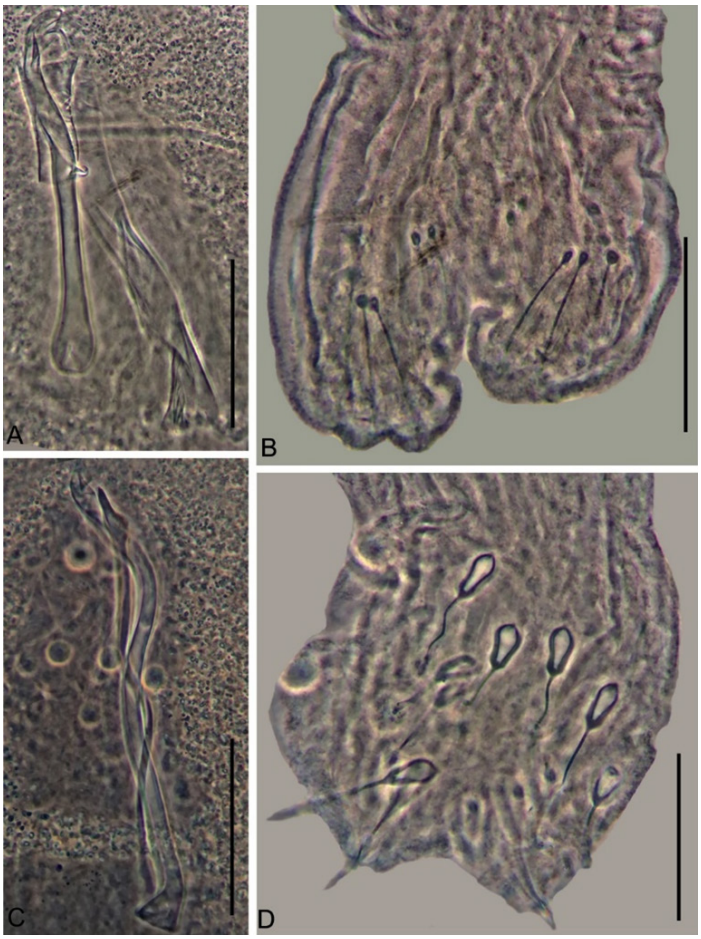


**Figure 2.** Monopisthocotyla from *Brycon cephalus*. **A, B.** *Anacanthorus elegans*: (**A**) male copulatory complex; (**B**) haptor. **C, D.** *Anacanthorus kruidenieri*: (**C**) male copulatory complex; (**D**) haptor. Scale bars: A = 150 µm; B, D = 50 µm; C = 70 µm.

about ½ of the proximal portion of the MCO, between the base and the reflex (recurve), with fringed lamina and a proximal tip hook-shaped, 72 (58– 82) [50 (42–56)] (Figure 2A). Germarium; ootype and uterus not observed; vagina, seminal receptacle absent. Vitellaria scattered on trunk, except in other reproductive organs.

*Anacanthorus elegans* was originally described from *B. melanopterus* collected from Lake Janauaca, near Manaus, Amazonas state, Brazil by Kritsky et al. (1979) and has no longer been reported in the literature. The present study adds a morphological feature to the accessory piece of this species, as the hook-shaped proximal tip observed in the studied specimens, considering that this character was not observed in the original description. The Moa River in Acre, Brazil, represents a new geographic record, and *B. cephalus* is a new host record.

***Anacanthorus kruidenieri* Kritsky, Thatcher & Kayton, 1979**

Figure 2C, D

**New record.** BRAZIL — Acre • Moa River, municipality of Mancio Lima; 07°33′13″S, 073°59′32″W; 200 m alt.; 20 Aug. 2023; W. Martins leg.; new host *Brycon cephalus*; deposited material: CHIOC voucher no. 40846a–b; mounted in Hoyer's medium.

Morphometric data (based on 2 specimens mounted in Hoyer's medium, original measurements in brackets): Body fusiform, 1,200 and 1,130 (*n* = 2) [755 (612–959)] long; greatest width 230 (*n* = 2) [157 (122–214)], including haptor. Cephalic lobes well developed, one terminal and two bilateral; head organs and cephalic glands inconspicuous. Eyes four, posterior pair larger, farther apart than those of anterior pair; accessory granules absent. Pharynx [53 (39–73)] ovate; esophagus moderately long; two intestinal caeca confluent, posterior to the gonads. Peduncle broad; haptor 120 (*n* = 2) [90 (51–133)] wide. Hooks similar in shape and size, with Anacanthorinae distribution, 51 (50–53, *n* = 6) [44 (42–46)] long, with a truncated thumb, straight shaft, recurved point, shank with expanded proximal bulbous portion with anterior subcircular foramen (Figure 2D); FH loop 0.3 shank length; 4A 14 (*n* = 1) [18 (15–20)] long, splinter-shaped. Male copulatory organ (MCO) 175 and 177 (*n* = 2) [176 (162–190)] long, scythe-shaped; accessory piece 172–197 (*n* = 2) [162 (148–174)] long, rod-shaped, single, twisting the MCO, articulated to cirrus base (Figure 2C). Vitellaria random in trunk, except absent in the region of other reproductive organs.

*Anacanthorus kruidenieri* was originally described from *Brycon melanopterus* (Cope, 1872) from Lake Janauaca, near Manaus, Amazonas state, Brazil by Kritsky et al. (1979). Measurements of the specimens of the present study agree with those previously presented in the original description. This finding represents the first report since the original description in a congeneric host, *B. cephalus*, and a new geographical record.

***Anacanthorus spiralocirrus* Kritsky, Thatcher & Kayton, 1979**

Figure 3A, B

**New record.** BRAZIL — Acre • Moa River, municipality of Mancio Lima; 07°33′13″S, 073°59′32″W; 200 m alt.; 20 Aug. 2023; W. Martins leg.; new host *Brycon cephalus*; deposited material: CHIOC voucher no. 40847a–d; mounted in Hoyer's medium.

Morphometric data (based on 5 specimens mounted in Hoyer's medium, original measurements in brackets): body fusiform, 872 (550–1,100, *n* = 5) [808 (541–1,020)] long, 309 (227–390, *n* = 5) [181 (122–255)] wide, including haptor. Two lateral and one terminal cephalic lobes; cephalic glands, head organs poorly differentiated. Eyes equidistant; posterior pair larger than anterior one; accessory granules scattered in anterior trunk. Pharynx 109 (92–125, *n* = 4) [80 (53–115)] wide, ovate; esophagus short; intestinal caeca uniting posteriorly of testes. Peduncle broad; haptor 142 (120–175, *n* = 5) [97 (51–163)] wide, bilobed, with concave posterior border. Hooks similar in size and shape, 23 (21–24, *n* = 10) [22 (21–24)] long, with shank with expanded proximal bulbous portion with anterior elongated foramen, depressed thumb; FH loop 0.8 shank length; 4A 20 (19–20, *n* = 5) [14 (12–19)] long, splinter shaped (Figure 3B). MCO 80 (62–105, *n* = 5) [74 (59–87)] long, spiraled, with base, 1.5–2 coils, with distal flare. Accessory piece 35 (34–37, *n* = 5) [38 (36–42)] long, nonarticulated with male copulatory organ, sickle-shaped (Figure 3A).

**Remarks.** *Anacanthorus spiralocirrus* was originally described by Kritsky et al. (1979) parasitizing *B. melanopterus* from Lake Janauaca, near Manaus, Amazonas state, Brazil. The species was also reported from *Brycon amazonicus* (Spix & Agassiz, 1829), collected from cultivated fishes in Canal de Igarapé, located 17 km of Manaus, Amazonas state, Brazil (Andrade and Malta 2006) and from the River Tahuayo, a tributary of the Amazon in Loreto, Peru (Morey et al. 2021). The morphometry of the specimens analyzed in this study are consistent with those reported in the original species description. The

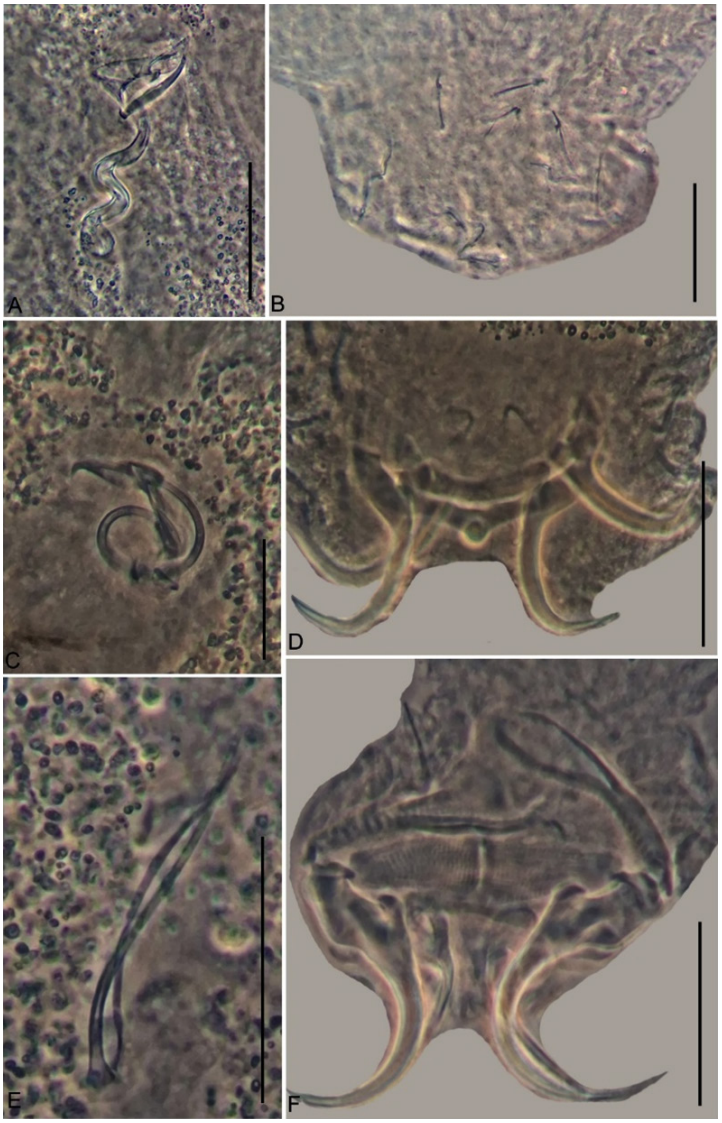


**Figure 3.** Monopisthocotyla from *Brycon cephalus*. **A, B.** *Anacanthorus spiralocirrus*: (**A**) male copulatory complex; (**B**) haptor. **C, D.** *Annulotrematoides bryconi*: (**C**) male copulatory complex; (**D**) haptor. **E, F.** *Tereancistrum kerri*: (**E**) male copulatory complex; (**F**) haptor. Scale bars: A, B, D–F = 50 µm; C = 30 µm.

Moa River in the state of Acre, Brazil represents a new geographical record and *B. cephalus* is a new host record.

Subfamily Ancyrocephalinae Bychowsky, 1937

***Annulotrematoides bryconi* Cuglianna, Cordeiro & Luque, 2003**
Figure 3C, D

**New record.** BRAZIL — Acre • Moa River, municipality of Mancio Lima; 07°33′13″S, 073°59′32″W; 200 m alt.; 20 Aug. 2023; W. Martins leg.; host *Brycon cephalus*; deposited material: CHIOC voucher no. 40848a–d; mounted in Hoyer's medium.

Morphometric data (based on 5 specimens mounted in Hoyer's medium, original measurements in brackets): tegument with annulations. Body fusiform, 431 (340–510, *n* = 5) [376 (264–495)] long by 134 (120–165, *n* = 5) [127 (77–165)] wide, including haptor. Cephalic lobes moderately developed, two lateral and two terminal; eyes 4: posterior pair larger than anterior one. Pharynx spherical 25 (*n* = 3) [18–23] in diameter. Haptor with 7 pairs of hooks with Ancyrocephalinae distribution, 117 (110–120, *n* = 5) [103 (60–181)] (Figure 3D). Ventral bar with slightly expanded ends, 54 (49–60, *n* = 5) [48 (38–57)], with a postero-median projection. Dorsal bar rod-shaped, with slightly expanded ends, 53 (50–55, *n* = 4) [44 (33–51)]. Ventral anchor with well-differentiated roots, superficial root with a delicate sclerotization on the distal extremity, shaft slightly curved, straight point, 38 (34–43, *n* = 5) [37 (30–44)] long, and base 18 (15–18, *n* = 5) [11 (8–15)]. Dorsal anchor with elongate tapering superficial root, short deep root, evenly curved shaft, point, 39 (38–41, *n* = 5) [37 (36–39)] long, and base 18 (15–21, *n* = 5) [14 (11–16)]. Hook with erected thumb, with shank divided into 2 subunits, proximal subunit of shank

expanded. FH loop well developed, 0.4 shank length; hook pair 1 16 (16–17, *n* = 4), pair 2 21 (20–23, *n* = 5), pair 3 21 (20–22, *n* = 5), pair 4 20 (20–21, *n* = 4), pair 5 16 (15–17, *n* = 5), pair 6 21 (20–21, *n* = 4), pair 7 22 (21–24, *n* = 5) [hook pairs 1, 5, 18 (18–19) long; pairs 2, 3, 4, 6, 7, 23 (20–26) long]. MCO a tube of 1½ coils, funnel-shaped base with sclerotized flange, proximal ring 13 (10–17) [47(33–60)] in diameter. Accessory piece comprising a folded, ribbon-like structure, distally. Copulatory ligament thin, linking MCO base with accessory piece, passing through the first coil (Figure 3C).

**Remarks.** *Annulotrematoides bryconi* was originally described from *Brycon cephalus* in fish farming ponds of CEPTA (Center for Research and Management of Continental Fisheries Resources), Pirassununga, São Paulo state, Brazil (Cuglianna et al. 2003) and also reported from *Salminus brasiliensis* (Cuvier, 1816), collected in the reservoir of Itaipu Hydroelectric Power Station, Foz do Iguaçú, Paraná state, Brazil (Cohen et al. 2012), and in the Amambai River, Mato Grosso do Sul state (Pereira et al. 2018). Specimens of *A. bryconi* collected from *B. cephalus* in the present study are in accordance with the general morphometry of the original description and those of Cohen et al. (2012), with the exception of the diameter of the MCO, which is larger in the specimens of the present study. The Moa River in Acre, Brazil, represents a new geographic record.

***Tereancistrum kerri* Kritsky, Thatcher & Kayton, 1980**

Figure 3E, F

**New record**. BRAZIL — Acre • Moa River, municipality of Mancio Lima; 07°33′13″S, 073°59′32″W; 200 m alt.; 20 Aug. 2023; W. Martins leg.; **new host** *Brycon cephalus*; deposited material: CHIOC voucher no. 40849a–d; mounted in Hoyer's medium.

Morphometric data (based on 4 specimens mounted in Hoyer's medium, original measurements in brackets): body fusiform, 476 (450–550, *n* = 4) [340 (275–400)] long by 107 (88–130, *n* = 4) [80 (51–102)] wide, including haptor. Cephalic region with two inconspicuous lateral lobes and one terminal. Eyes four, posterior pair larger than anterior. Pharynx 26 (25–27, *n* = 3) [21 (20–22)] in diameter. Haptor 105 (95–120, *n* = 4) [93 (51–122)] wide (Figure 3F). Ventral bar inverted V-shaped, 65 (56–72, *n* = 4) [62 (54–74)]. Dorsal bar U-shaped, 41 (40–43, *n* = 3) [ 33 (30–36]. Ventral anchor with well-differentiated roots, deep root conspicuous and superficial root elongated, evenly curved shaft and point, 57 (55–60, *n* = 4) [55 (51–59)] long, and base 21 (19–22, *n* = 4) [17 (15–18)]. Accessory sclerite large, spathulate 61 (56–66, *n* = 4) [50 (39–56)] long. Dorsal anchor with well-developed roots, both elongated, straight shaft and upturned point, 46 (40–50, *n* = 4) [46 (43–50)] long, and base 14 (10–15, *n* = 4) [13 (12–14)], Hook pair 1, 5, 14 (14–15, *n* = 5) [16 (15–17)], pairs 2-, 6, 7, 21 (20–22, *n* = 16) [22 (21–23)], each with straight thumb, curved shaft, short point, dilated proximal half of shank; FH loop about ½ shank length. Copulatory complex comprises male copulatory organ (MCO) and accessory piece. MCO 65 (64–65, *n* = 4) [61 (55–72)], accessory piece 61 (55–65, *n* = 4) [63 (46–72)] (Figure 3E).

**Remarks.** *Tereancistrum kerri* was described parasitizing *B. melanopterus*, collected from the Lake Janauaca, near Manaus, Amazonas state, Brazil by Kritsky et al. (1980) and was also found parasitizing cultivated *B. amazonicus* in Canal de Igarapé, 17 km of Manaus, Amazonas state, Brazil (Andrade and Malta, 2006). The morphometric data of the specimens of the present study are in accordance with the original description of Kritsky et al. (1980). The Moa River in Acre, Brazil, represents a new geographic record, and *B. cephalus* is a new host record.

# Discussion

Research on the phylogenetic relationships within the Bryconidae has been carried out over time. Regan (1911) suggested a close relationship between *Salminus* and *Brycon*. Eigenmann (1912) classified *Brycon* and *Chalceus* within the subfamily Bryconinae, a classification later adopted by Géry (1977). Uj (1990) proposed the establishment of the Bryconidae, encompassing *Brycon*, and *Salminus*, among others. Phylogenetic studies based on molecular data (Orti 1997; Calcagnotto et al. 2005; Javonillo et al. 2010) support the close relationship between *Brycon* and *Salminus* initially proposed by Uj (1990), and this relationship was confirmed by Oliveira et al. (2011) in the most comprehensive molecular phylogenetic study of Characiformes published to date. Additionally, Abe et al. (2014) corroborated previous molecular hypotheses identifying *Salminus* as closely related to *Brycon* (Calcagnotto et al. 2005; Hilsdorf et al. 2008; Javonillo et al. 2010; Oliveira et al. 2011).

These phylogenetic studies, using morphological and molecular approaches, culminated in the proposition of the family Bryconidae, composed by these two genera. Studies on parasitism by Monopishtocotyla from *Brycon* spp. and *Salminus* spp. agree with the results of the present study,

because within *Anacanthorus* it is possible to observe a close relationship between species that parasitize species from both genera (Cohen et al. 2012; Monteiro et al. 2015). Shape of marginal hooks, with an inconspicuous point, truncate thumb, and a shank with a foramen at the terminal portion, and the morphology of the copulatory complex suggest the morphological and probably phylogenetic proximity of *Anacanthorus parakruidenieri* Cohen, Kohn & Boeger, 2012 and *A. adkruidenireri* Monteiro, Brasil-Sato & Cohen, 2015 described from *S. brasiliensis* and *S. franciscanus* Lima & Britski, 2007, respectively, with *A. kruidenieri* originally described from *B. melanopterus*. Besides these characteristics, there is a greatly similar morphology of the copulatory complex.

Monteiro et al. (2010) described *A. franciscanus* Monteiro, Kritsky & Brasil-Sato, 2010 and *A. brevicirrus* Monteiro, Kritsky & Brasil-Sato, 2010 from *Brycon orthotaenia* Günther, 1864 from the São Francisco River Basin and observed that these species share morphological characteristics with some species collected from the Amazon Basin (i.e. *A. kruidenieri*, *A. brevis* Mizelle & Kritsky, 1969, and *A. elegans*), all parasites from *B. melanopterus*. These similarities are based on the morphology of the copulatory complex (MCO tubular and membranous accessory pieces are found in four of five species) and hooks (poorly developed thumb and the presence of a foramen in the distal portion of the shank). Morey et al. (2021) described *A. femoris* Morey, Sol & Cachique, 2021, *A. kukamensis* Morey, Sol & Cachique, 2021, *A. rarus* Morey, Sol & Cachique, 2021, and *A. sabaloi* Morey, Sol & Cachique, 2021 collected from *Brycon amazonicus* in Peru, following the morphological pattern of species that parasitize *Brycon* spp.

Using molecular data, Graça et al. (2018) studied co-evolutionary relationships between *Anacanthorus* and their characiform hosts of Bryconidae, Serrasalmidae, and Erythrinidae. These authors verified that phylogenies of both groups presented a topological congruence between parasites and hosts lineages, suggesting an evolutionary common history. Those results obtained by Graça et al. (2018) corroborate with the scenario presented, since each group of host species has an exclusive composition of *Anacanthorus* spp.

Kritsky et al. (1979) proposed *Anacanthorus spiralocirrus*, noting that it is the only species with a spiraled cirrus. However, they observed its resemblance to *A. colombianus* Kritsky & Thatcher, 1974, and *A. cuticulovaginus* Kritsky & Thatcher, 1974. Later, Cohen et al. (2012) described *Anacanthorus douradensis* Cohen, Kohn & Boeger, 2012 and stated that it appears closely related to *A. colombianus* from the gills of *Salminus affinis* Steindachner, 1880 in Colombia, primarily due to their shared feature of a male copulatory organ (MCO) composed of a loosely spiraled tube. Given the similarity in the spiraled MCO among these species, they can be grouped together as parasites of *Salminus* and *Brycon* spp. hosts.

The occurrence of multiple monopisthocotylan species on a single host suggests potential for parasite competition and niche partitioning within the gill environment. Furthermore, the presence of these ectoparasites may have implications for fish health, especially under environmental stress or in aquaculture settings, where parasite burdens can increase significantly. Understanding the diversity and host associations of Dactylogyridae in Neotropical characiforms contributes to the broader knowledge of fish parasite biodiversity and host-parasite coevolution in freshwater ecosystems. The finding of these species on congeneric species of those originally described or posteriorly referred confirms the specificity of Monopisthocotyla to their hosts, since this species has been recorded on different species of *Brycon*.

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## Additional information

**Conflict of interest**

The authors declare that no competing interests exist.

**Ethical statement**

No ethical statement is reported.

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**Author contributions**

Conceptualization: MCNJ, SCC, WMOM. Data curation: MCNJ, SCC, WMOM. Formal analysis: MCNJ,

SCC, WMOM. Funding acquisition: SCC. Investigation: MCNJ, SCC. Methodology: WMOM. Resources: SCC. Supervision: SCC. Visualization: MCNJ, SCC, WMOM. Project administration: SCC. Writing – original draft: MCNJ, SCC. Writing – review and editing: MCNJ, SCC, WMOM.

**Author ORCID iDs**
Marcia C.N. Justo https://orcid.org/0000-0002-0684-3389
Simone C. Cohen https://orcid.org/0000-0001-8204-336X
Williane M.O. Martins https://orcid.org/0000-0003-2078-7587

**Data availability**
All data that support the findings of this study are available in the main text.

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