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Sciadicleithrum spp. (Dactylogyridae, Monopisthocotyla) parasitizing *Saxatilia brasiliensis* (Cichlidae, Cichliformes) from the Munim River Basin, northeastern Brazil, with a description of a new species

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Abstract

During a study conducted on the helminth fauna of fishes in the middle Munim River Basin, Maranhão State, northeastern Brazil, a new species of *Sciadicleithrum*, *S. anapurusensis* **sp. nov.**, is reported from the gills of *Saxatilia brasiliensis* (Bloch, 1792), a cichlid endemic to the Northeast region of Brazil. In addition, a known species, *Sciadicleithrum araguariensis* Paschoal, Scholz, Tavares-Dias & Luque, 2016, was recovered from the same host and is redescribed here, providing new morphological and biogeographical data. *Sciadicleithrum anapurusensis* **sp. nov.** differs from all congeneric species in the general morphology of sclerotized structures (anchors, bars, vagina, accessory piece, and the number of MCO rings), being mainly characterized by the bifurcated accessory piece with unequal branches at the distal portion, with a subterminal thin projection and a hook-shaped terminal end. The findings of this study emphasize the importance of carrying out comparable surveys on different host species in order to increase the knowledge on monopisthocotylan parasites of fishes in this area. Furthermore, the finding of two congeneric species in the same host species reinforces the host specificity of *Sciadicleithrum* species to cichlid hosts.

Key Words

Cichlinae, Crenicichlina, hosts, Maranhão, *Saxatilia brasiliensis*

Introduction

Brazil has a significant richness of fish species and plays a fundamental role in discussions about the freshwater ecosystem, as well as its biodiversity and conservation (Azevedo-Santos et al. 2021). Nevertheless, like the rest of the planet, due to the exponential increase in anthropogenic impacts on ecosystems and the high extinction rates of species and populations, leading to a rapid loss of biodiversity, we are facing a serious global phenomenon, known as the "Biodiversity Crisis", which is rapidly leading our planet towards a mass extinction (Savage 1995; Brooks et al. 2002; Singh 2002; Brook et al. 2006; Pimm et al. 2014; Ceballos et al. 2015; Hogue and Breon 2022).

This global crisis is more serious in freshwater ecosystems, which are more vulnerable to anthropogenic impacts and have higher rates of species and population extinctions, as these freshwater ecosystems are being altered, degraded, or destroyed more quickly and sharply, a phenomenon called the “Freshwater Biodiversity Crisis” (Darwall et al. 2018; Harrison et al. 2018; Reid et al. 2019; Albert et al. 2020; Tickner et al. 2020; Ottoni et al. 2023). Therefore, the mitigation of the effects of human actions on freshwater ecosystems and their conservation needs to be a priority (Albert et al. 2020; Tickner et al. 2020; Ottoni et al. 2023). Brazil is facing all the problems and scenarios mentioned above, including the accelerated rate of degradation, fragmentation, and loss of freshwater ecosystems, and consequently, of the related biodiversity (Pereira-Júnior and Pereira 2017; Azevedo-Santos et al. 2023).

The Cichlidae comprises the greatest species richness among families of Cichliformes, currently comprising 1762 valid species, among which 564 are included within Cichlinae (Fricke et al. 2025a), a subfamily that naturally occurs exclusively in the Neotropical region (Smith et al. 2008; López-Fernández et al. 2010). Cichlinae is divided into seven tribes: Cichlini, Retroculini, Astronotini, Chaetobranchini, Geophagini, Cichlasomatini, and Heroini; the last three being the most diverse ones (Smith et al. 2008; López-Fernández et al. 2010). However, despite the great fish species richness, especially in the tropics, little is known about the diversity and richness of the parasite fauna from these potential hosts (Avise et al. 2008). Tavares-Dias et al. (2022) estimated that only 6% of monopisthocotylan richness is known, incipient knowledge given the richness of fish species that exists, and that each host species hosts at least two monopisthocotylan species.

The proportion of cichlid species worldwide examined for the presence of Monopishtocotyla is low, and the diversity of these helminths parasitizing cichlid fishes in the Neotropical Region remains understudied compared to their counterparts in Africa. However, this imbalance is more likely due to differences in sampling efforts rather than actual variations in species richness among genera (Pariselle et al. 2011).

Sciadicleithrum Kritsky, Thatcher & Boeger, 1989 was proposed to accommodate *Sciadicleithrum uncinatum* Kritsky,Thatcher & Boeger, 1989 parasite from *Cichla ocellaris* Bloch & Schneider, 1801. To date, 30 species of *Sciadicleithrum* have been described from different host species, belonging to the family Cichlidae listed in Table 1.

The Munim River Basin is mainly located at the Cerrado Biome of the Maranhão State; however, its lower portion is located in a region between the Cerrado and Amazon biomes, and its mouth is at the Bay of São José, in a region known as the “Golfão Maranhense” (Vieira et al. 2023). A recent fish inventory, conducted by Vieira et al. (2023), revealed the existence of 123 fish species in this river system, considerably increasing its known fish diversity, which was underestimated until the publication of the inventory.

During studies with *Saxatilia brasiliensis* (Bloch, 1792), a cichlid endemic to the Northeastern region of Brazil (Fricke et al. 2025b; Froese and Pauly 2024) in the Munim River Basin in Maranhão state, a new species and a previously known species, both *Sciadicleithrum*, were identified. This new species of *Sciadicleithrum* is not morphologically similar to those previously known. In the present study, the species are described and redescribed, respectively, based on morphological features. These results expand the knowledge of the biodiversity of the fish parasites of the region.

Materials and methods

Specimens of *Saxatilia brasiliensis* were collected in two tributaries of the Munim River Basin, named Stream Feio (03°51'18.1"S, 043°17'14.0"W) (S1) at the rural zone of the Municipality of Chapadinha and Stream Estrela (03°40'15.6"S, 043°7'9.7"W) (S2) in the Municipality of Anapurus, both located in the Maranhão State, Northeastern region of Brazil (Fig. 1).

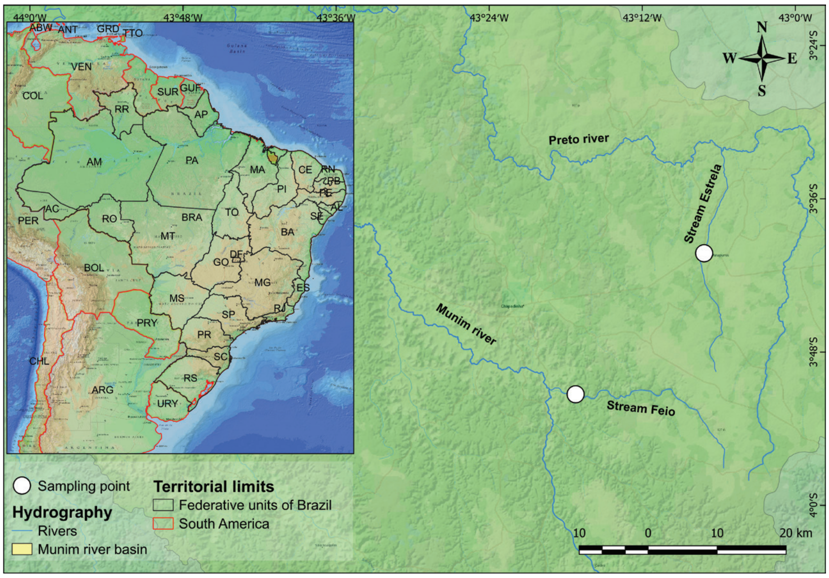

Figure 1. Map with the geographic location of the sample sites: S1— Stream Feio in São José Village, in the Municipality of Chapadinha, and S2—Stream Estrela, Balneary of Anapurus, in the Municipality of Anapurus, Munim River Basin, Maranhão State, Brazil.

Table 1. Checklist of *Sciadicleithrum* species parasites of cichlid fishes from the Neotropical Region.

Monopisthocotyla	Host	Countries	References
Sciadicleithrum amazoniensis Morey, Dávila, Arimuya, Sousa, Cruces & Chero, 2024	*Biotodoma cupido* (Heckel, 1840)	Peru	Morey et al. (2024)
Sciadicleithrum aequidens (Price and Schlueter, 1967) Kritsky, Thatcher & Boeger, 1989	*Cleithracara maronii* (Steindachner, 1881)	Guiana	Kritsky et al. (1989)
Sciadicleithrum araguariensis Paschoal, Scholz, Tavares-Dias & Luque, 2016	*Saxatilia labrina* (Spix & Agassiz, 1831)	Brazil	Paschoal et al. (2016)
Sciadicleithrum bravohollisae Kritsky, Vidal-Martinez & Rodriguez-Canul, 1994	*Cincelichthys pearsei* (Hubbs, 1936)	Mexico	Kritsky et al. (1994)
Sciadicleithrum cavanaughi (Price, 1966) Kritsky, Thatcher & Boeger, 1989	*Cleithracara maronii* (Steindachner, 1881)	Guiana	Kritsky et al. (1989)
Sciadicleithrum bicuense Vidal-Martínez, Scholz & Agulrre-Macedo, 2001	*Amatitlania nigrofasciata* (Günther, 1867)	Nicaragua	Vidal-Martínez et al. (2001)
Sciadicleithrum edgari Paschoal, Scholz, Tavares-Dias & Luque, 2016	*Satanoperca jurupari* (Heckel, 1840)	Brazil	Paschoal et al. (2016)
Sciadicleithrum ergensi Kritsky, Thatcher & Boeger, 1989	*Cichla ocellaris* (Bloch & Schneider, 1801)	Brazil	Kritsky et al. (1989)
Sciadicleithrum feliciajaramae Morey, Dávila, Arimuya, Sousa, Cruces & Chero, 2024	*Bujurquina peregrinabunda* Kullander, 1986	Peru	Morey et al. (2024)
Sciadicleithrum frequens Bellay, Takemoto, Yamada & Pavanelli, 2008	*Geophagus brasiliensis* (Quoy & Gaimard, 1824)	Brazil	Bellay et al. (2008)
Sdadicleithrum geophagi Kritsky, Thatcher & Boeger, 1989	*Geophagus surinamensis* (Bloch, 1791)	Brazil	Kritsky et al. (1989)
Sciadicleithrum guanduensis Carvalho, Tavares & Luque, 2008	*Geophagus brasiliensis* (Quoy & Gaimard, 1824)	Brazil	Carvalho et al. (2008)
Sciadicleithrum iphthimum Kritsky, Thatcher & Boeger, 1989	*Pterophyllum scalare* (Lichtenstein, 1823)	Brazil	Kritsky et al. (1989)
Sciadicleithrum joanae Yamada, Takemoto, Bellay & Pavanelli, 2009	*Crenicichla niederleinii* (Holmberg, 1891)	Brazil	Yamada et al. (2009)
Sciadicleithrum juruparii Melo, Santos & Santos, 2012	*Satanoperca jurupari* (Heckel, 1840)	Brazil	Melo et al. (2012)
Sciadicleithrum kritskyi Bellay, Takemoto, Yamada & Pavanelli, 2009	*Geophagus proximus* (Castelnau, 1855)	Brazil	Bellay et al. 2009
Sciadicleithrum maculicaudae Vidal-Martínez, Scholz & Agulrre-Macedo, 2001	*Vieja maculicauda* (Regan, 1905)	Nicaragua	Vidal-Martínez et al. (2001)
Sciadicleithrum meekii Mendoza-Franco, Scholz & Vidal-Marstínez, 1997	*Thorichthys meeki* Brind, 1918	Mexico	Mendoza-Franco et al. (1997)
Sciadicleithrum mexicanum Kritsky, Vidal-Martinez & Rodriguez-Canul, 1994	*Mayaheros urophthalmus* (Günther, 1862)	Mexico	Kritsky et al. (1994)
Sciadicleithrum nicaraguense Vidal-Martínez, Scholz & Agulrre-Macedo, 2001	*Cribroheros alfari* (Meek, 1907)	Nicaragua	Vidal-Martínez et al. (2001)
Sciadicleithrum panamensis Mendoza-Franco, Aguirre-Macedo, & Vidal-Martínez, 2007	*Andinoacara coeruleopunctatus* (Kner 1863)	Panama	Mendoza-Franco et al. (2007)
Sciadicleithrum paranaenses Bellay, Takemoto, Yamada & Pavanelli, 2009	*Geophagus proximus* (Castelnau, 1855)	Brazil	Bellay et al. (2009)
Sciadicleithrum satanopercae Yamada, Takemoto, Bellay & Pavanelli, 2009	*Satanoperca pappaterra* (Heckel, 1840)	Brazil	Yamada et al. (2009)
Sciadicleithrum souzatecci Morey, Dávila, Arimuya, Sousa, Cruces & Chero, 2024	*Bujurquina peregrinabunda* Kullander, 1986	Peru	Morey et al. (2024)
Sciadicleithrum splendidae Kritsky, Vidal-Martinez & Rodriguez-Canul, 1994	*Petenia splendida* Günther, 1862	Mexico	Kritsky et al. (1994)
Sciadicleithrum tortrix Kritsky, Thatcher & Boeger, 1989	*Uaru amphiacanthoides* Heckel, 1840	Brazil	Kritsky et al. (1989)
Sciadicleithrum umbilicum Kritsky, Thatcher & Boeger, 1989	*Cichla ocellaris* Bloch & Schneider, 1801	Brazil	Kritsky et al. (1989)
Sciadicleithrum uncinatum Kritsky, Thatcher & Boeger, 1989	*Cichla ocellaris* Bloch & Schneider, 1801	Brazil	Kritsky et al. (1989)
Sciadicleithrum variabilum (Mizelle & Kritsky, 1969) Kritsky, Thatcher & Boeger, 1989	*Symphysodon discus* Heckel, 1840	Brazil	Kritsky et al. (1989)

Fishes were collected using nets 240 cm long and 100 cm high. A total of sixty-four specimens of *S. brasiliensis* were obtained, 32 from each locality (sixteen specimens were collected in the dry season and sixteen in the rainy season).

The collections were authorized by the "Sistema de Autorização e Informação em Biodiversidade (SISBIO)" under the number 6441-5, while the laboratory procedures were licensed by the "Comitê de Ética em Experimentação Animal (CEA)" from the Estadual University of Maranhão, under the protocol 11/2021-01200.002200/2015-06.

The fishes were taken to the "Laboratório de Sistematica e Ecologia de Organismos Aquáticos", Federal University of Maranhão (UFMA), where fish euthanasia, preservation and identification were carried out by the laboratory team. The fishes were deposited at the "Coleção Ictiológica do Centro de Ciências Agrárias e Ambientais (CICCAA)" of the Universidade Federal do Maranhão under voucher numbers CICCAA07121 - CICCAA07151.

At the laboratory, the branchial arches were removed and placed in vials containing hot water (~65 °C) for relaxing and detaching of Monopisthocotyla, and then the vials were vigorously shaken. After cooling, absolute ethanol was added to reach the concentration of 70%. The content (liquid and branchial arches) was analyzed under a stereoscopic microscope for collection of the parasites. For morphological studies of sclerotized parts (copulatory complex and haptoral sclerites), parasites were mounted in Hoyer's medium (Humason, 1979). The material was sent to "Laboratório de Helmintos Parasitos de Peixes, Instituto Oswaldo Cruz, FIOCRUZ", Rio de Janeiro State, Brazil, to be characterized and identified. Specimens of *Sciadicleithrum araguariensis* Paschoal, Scholz, Tavares-Dias & Luque, 2016 (Holotype CHIOC no. 38091a; paratypes CHIOC no. 38091b, c, d) were examined for comparative purposes.

Drawings 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, equipped with a camera lucida. Measurements are presented in micrometers; means are followed by range and number of structures measured (n) in parenthesis; lengths of curved or bent structures represent the straight-line distances between extreme ends, except for the copulatory complex, measured using IMAGEJ software (Wayne 2010), distributed by the National Institutes of Health (NIH), and available at https://imagej.nih.gov/ij/download.html. Distribution of hooks followed Mizelle and Price (1963). The studied specimens were deposited in the "Coleção Helmintológica do Instituto Oswaldo Cruz (CHIOC)", Rio de Janeiro, Brazil.

Results

Phylum Platyhelminthes Gegenbaur, 1859
Class Monopisthocotyla Brabec, Salomaki, Kolısko, Scholz & Kuchta, 2023
Order Dactylogyridea Bychowsky, 1937
Dactylogyridae Bychowsky, 1933
***Sciadicleithrum* Kritsky, Thatcher & Boeger, 1989**

***Sciadicleithrum anapurusensis* sp. nov.**
https://zoobank.org/018120EB-D65E-494C-B4FE-45316CA0D1CA
Fig. 2

Host. *Saxatilia brasiliensis* (Bloch, 1792) (Cichlidae, Cichliformes)

Type-locality. Stream Estrela, balneary of Anapurus, urban zone of the municipality of Anapurus, Munim River Basin, Maranhão State, Brazil (03°40'15.6"S, 043°7'9.7"W).

Other localities. Stream Feio, San José village, rural zone of the municipality of Chapadinha, Munim River Basin, Maranhão State, Brazil (03°51'18.1"S, 043°17'14.0"W)

Etymology. The epithet specific refers to the host's location, the municipality of Anapurus, Maranhão State, Brazil.

Specimens deposited. Holotype (CHIOC 40480), Paratypes (CHIOC: 40481a, b; 40482; 40483; 40484; 40485; 40486a, b; 40487)

Number of examined hosts. 64.

Number of parasites. 274.

Prevalence. 64.1%.

Range of intensity. 1–27 parasites per fish.

Mean intensity. 6.7 parasites per infected fish.

Mean abundance. 4.3 parasites per analyzed fish.

Description. (Based on 27 specimens mounted in Hoyer's medium): Body elongated, fusiform, 363 (256–470, n = 27) long, including haptor, by 138 (108–195, n = 27) wide at level of ovary; tegument smooth; three developed cephalic lobes, two lateral and one terminal; four pairs of head organs; cephalic glands indistinct; accessory granules sparse in cephalic area; four equidistant eyespots, eye granules elongate ovate. Pharynx 32 (28–38, n = 5) in diameter; esophagus short; caeca confluent posterior to testis, without diverticula (Fig. 2A). Copulatory complex comprises male copulatory organ (MCO) and accessory piece. MCO 111 (92–123, n = 16) long and 18 (15–22, n = 15) wide, composed of 2 clockwise rings; accessory piece 40 (27–50, n = 22) long, 12 (10–14, n = 19) wide, non-articulated to MCO base, bifurcated, with unequal branches at distal portion, the longest widens to distal region, with a subterminal thin projection and terminal end hook-shaped (Fig. 2B). Gonads slightly overlapping. Testis dorsal to germarium; vas deferens looping left intestinal cecum; seminal vesicle elongated and single rounded prostatic reservoir. Germarium pretesticular; seminal receptacle, Mehlis' glands, ootype, eggs, and uterus not observed (Fig. 2A). Vagina weakly sclerotized, opening ventrally, forming a bulb near the aperture, vaginal canal long, thin (Fig. 2C). Vitellaria distributed throughout the trunk (Fig. 2A). Peduncle broad; haptor subhexagonal 97 (75–133, n = 25) wide. Ventral anchor 17 (13–20, n = 26) long, straight, with short deep root, superficial root developed presenting a little hump between the superficial and deep roots, base 14 (11–16, n = 26) wide (Fig. 2D); dorsal anchor 31 (23–37, n = 27), long, with differentiated roots, well-developed superficial root, and short and developed deep root, base 19 (14–22, n = 24) (Fig. 2E). Ventral bar 27 (22–35, n = 26) long, yoke-shaped, with enlarged extremities and delicate postero-medial umbiliform membrane (Fig. 2F, G); dorsal bar 19 (15–22, n = 25) long, straight, with extremities directed posteriorly (Fig. 2H). Hook pairs similar in shape and dissimilar in size, pairs 1 and 5 slightly smaller: Pair 1, 11 (11–12, n = 10); pair 2, 12 (12–13, n = 10); pair 3, 13 (12–13, n = 10); pair 4, 13 (13, n = 10); pair 5, 11 (10–12, n = 9); pair 6, 13 (12–13, n = 9); pair 7, 12 (12–13, n = 9) with Ancyrocephalinae distribution, straight shank with protuberant thumb, recurved shaft, point; FH loop about ¾ shaft length.

Remarks. *Sciadicleithrum anapurusensis* sp. nov. was allocated in *Sciadicleithrum* by the diagnostic characters of the genus, such as the male copulatory organ that consists of a spiral tube comprising one to several clockwise rings, gonads overlapping, testis dorsal to ovary, and hooks of similar shape and size and not dilated shank (Kritsky et al. 1989). Species of the genus were characterized as presenting two variably developed umbeliform membranes on the anterior bar margin, but this character is no longer considered differential, as some species that do not exhibit these characteristics were included in the genus. The new species differs from all congeneric species in the general morphology of the sclerotized structures (anchors, bars, vagina, accessory piece, and the number of MCO rings). The new species is closely related to *Sciadicleithrum satanopercae* Yamada, Takemoto, Bellay & Pavanelli, 2009, *Sciadicleithrum araguariensis* Paschoal, Tavares-Dias, Scholz & Luque, 2016, *Sciadicleithrum edgari* Paschoal, Tavares-Dias, Scholz & Luque, 2016, and *Sciadicleithrum amazoniensis* Morey, Dávila, Arimuya, Sousa, Cruces & Chero, 2024 by the bifurcated accessory piece, but differs by the presence of postero-medial umbiliform membranes in the ventral bar.

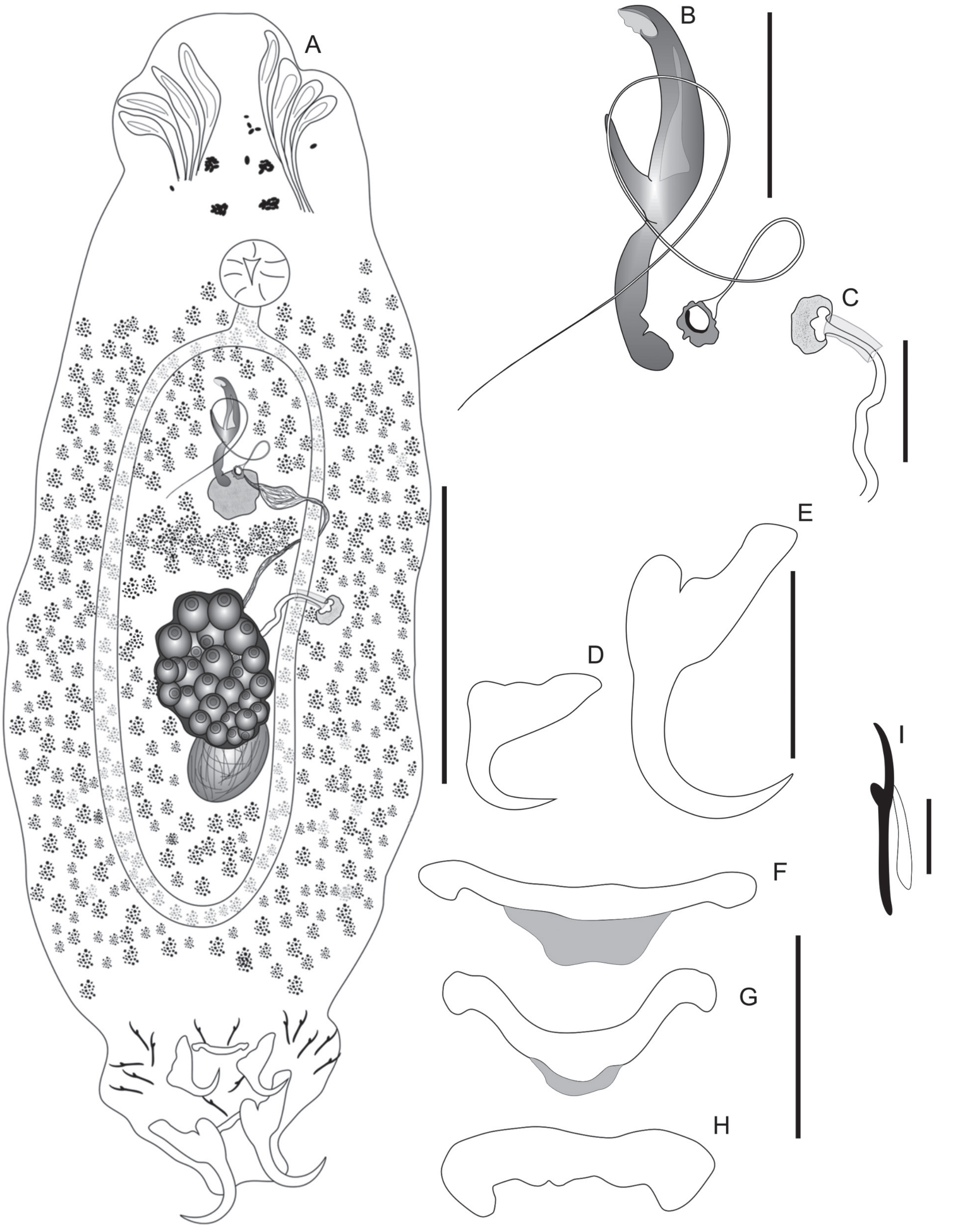

Figure 2. *Sciadicleithrum anapurusensis* sp. nov. **A.** Total, ventral; **B.** Copulatory complex; **C.** Vagina; **D.** Ventral anchor; **E.** Dorsal anchor; **F, G.** Ventral bar; **H.** Dorsal bar; **I.** Hook. Scale bars: 100 µm (**A**); 20 µm (**B, D–H**); 40 µm (**C**); 5 µm (**I**).

***Sciadicleithrum araguariensis* Paschoal, Scholz, Tavares-Dias & Luque, 2016**

Fig. 3

Type host and locality. *Saxatilia labrina* (Spix & Agassiz, 1831) [=*Crenicichla labrina* (Spix & Agassiz, 1831)] (Cichlidae, Cichliformes), Araguari River in Ferreira Gomes (0°52'N, 51°12'W), Amapá State, Brazil.

Other host. *Saxatilia brasiliensis* (Bloch, 1792) (Cichlidae, Cichliformes)

Other localities. Stream Estrela, balneary of Anapurus, urban zone of the municipality of Anapurus, Munim River Basin, Maranhão State (03°40'15.6"S, 043°7'9.7"W); Stream Feio, San José village, rural zone of the municipality of Chapadinha, Munim River Basin, Maranhão State, Brazil (03°51'18.1"S, 043°17'14.0"W).

Specimens deposited. Voucher (CHIOC 40488; 40489; 40490; 40491a-d).

Number of examined hosts. 64.

Number of parasites. 83.

Prevalence. 50%.

Range of intensity. 1–6 parasites per fish.

Mean intensity. 2.6 parasites per infected fish.

Mean abundance. 1.3 parasites per analyzed fish.

Redescription. (based on 20 specimens mounted in Hoyer's medium; original measurements are presented in brackets): Body elongated, fusiform, 342 (250–397, n = 15) [412–430 (419; n = 8)] long, 141 (71–198, n = 17) [95 (90–102; n = 6)], width at the region near vagina; tegument smooth; three cephalic lobes, two lateral and one terminal; four well-developed eye spots, posterior pair larger than anterior; pharynx spherical, 35 (32–41, n = 6) [22 (21–24; n = 4)] in diameter (Fig. 3A). Copulatory complex comprises male copulatory organ (MCO) and accessory piece. MCO tubular, thin, with 1.5 to 2 clockwise rings, 97 (75–110; n = 9) [100 (92–104; n = 4)] long. Accessory piece 29 (21–38; n = 7) [40 (38–42; n = 5)] long by 12 (8–15; n = 9) wide, non-articulated to the MCO base, formed by a bifurcated tube at mid-region and a slightly sclerotized cap at distal region (Fig. 3B). Vagina strongly sclerotized, vaginal aperture bulbous-shaped, and vaginal canal long (Fig. 3C). Egg 60 (n = 1) in diameter. Haptor 101 (81–128, n = 17) [43 (40–48; n = 8)] wide (Fig. 3A); ventral anchor 18 (15–22, n = 17) [26 (24–28; n = 7)] long, base 12 (11–16, n = 17) [22 (21–24; n = 7)], superficial root elongated and short deep root, presenting a little hump between the roots, straight shaft and recurved point (Fig. 3D); dorsal anchor 27 (23–30, n = 16) [34 (31–39; n = 7)] long, base, 13 (11–18, n = 16) [32 (30–34; n = 6)] base, slightly elongated superficial root, inconspicuous deep root (Fig. 3E); ventral bar 30 (24–34, n = 20) [31 (29–34; n = 4)] long, yoke-shaped, with expanded ends and delicate umbelliform membrane (Fig. 3F); dorsal bar 22 (18–26, n = 14) [22 (21–25; n = 5)] long, straight, with expanded ends directed posteriorly and postero-medial umbelliform membrane (Fig. 3G). Hooks of similar shape and size: Pair 1, 11 (10–12, n = 12); pair 2, 12 (11–12, n = 12); pair 3, 13 (12–13, n = 12); pair 4, 13 (12–13, n = 11); pair 5, 11 (10–11, n = 6); pair 6, 12 (12–13, n = 9); pair 7, 12 (12–13, n = 11) [14 (12–16; n = 9)] with ancyrocephaline distribution, straight shaft, prominent thumb, recurved point; FH loop about ¾ shaft length (Fig. 3H).

Remarks. *Sciadicleithrum araguariensis* was originally described from specimens of *Crenicichla labrina* (now recognized as *Saxatilia labrina*) collected from the Araguari River in Ferreira Gomes, Amapá State, Brazil. The species is now reported in *S. brasiliensis* from Maranhão State. The specimens analyzed in this study are morphologically similar to those described originally, except for the presence of a cap at the distal portion of the accessory piece. While the original description characterized the accessory piece as Y-shaped and proximally bent, it did not mention the structure observed in the current specimens. Upon re-examining the holotype and paratypes, the cap was observed by the authors of this study.

Discussion

The parasitofauna associated with the vast majority of Neotropical cichlid hosts remains largely unknown. To date, six genera of dactylogyrids are known to parasitize Neotropical cichlids: *Biotodomella* Morey, Arimuya & Boeger, 2019 (1 sp.), *Gussevia* Kohn & Paperna, 1964 (13 spp.), *Sciadicleithrum* Kritsky, Thatcher & Boeger, 1989 (30 spp.), *Trinidactylus* Hanek, Molnar & Fernando, 1974, *Tucuranella* Mendoza-Franco, Scholz & Rozkosná, 2010, and *Parasciadicleithrum* Mendoza-Palmero, Blasco-Costa, Hernández-Mena & Pérez-Ponce de León, 2017, each with one species described from Brazil, Peru, Venezuela, Mexico, Panama, and Nicaragua. In addition, species of *Cichlidogyrus* Paperna, 1960, *Enterogyrus* Paperna, 1963, and *Scutogyrus* Pariselle & Euzet, 1995, were reported from African introduced hosts, such as *Oreochromis* spp. (Kritsky et al. 1986, 1989; Bellay et al. 2008, 2009; Carvalho et al. 2008; Yamada et al. 2009; Mendoza-Franco et al. 2010; Melo et al. 2012; Paschoal et al. 2016; Mendoza-Palmero et al. 2017; Morey et al. 2019, 2024; Justo et al. 2020; Seidlová et al. 2022), also in the Neotropical Region.

Monopishtocotylans are known to be host specific, with the majority of species parasitizing a single host species. Nevertheless, members of *Sciadicleithrum* are recognized to parasitize from one to 15 cichlid species, considering that *Sciadicleithrum bravohollisae* Kristky, Vidal-Martinez & Rodriguez-Canul, 1994 is reported from 15 different host species (Seidlová et al. 2022). Species of *Sciadicleithrum* were recorded in 18 genera of fish, all from the family Cichlidae.

Recently, Varella et al. (2023) conducted a taxonomic review and phylogeny of the subtribe Crenicichlina, the largest clade of the tribe Geophagini, and subfamily Cichlinae, including over 100 species, which previously included only two genera: *Crenicichla* Heckel, 1840 and *Teleocichla* Kullander, 1988 (Varella et al. 2023). As a result of that work, the genus *Crenicichla* was split, resulting in the description of four new genera. Thus, the current composition of the subtribe Crenicichlina includes the following genera: *Crenicichla*, *Teleocichla*, *Lugubria* Varella, Kullander, Menezes, Oliveira & López-Fernández, 2023, *Saxatilia* Varella, Kullander, Menezes, Oliveira & López-Fernández, 2023, *Wallaciia* Varella, Kullander, Menezes, Oliveira & López-Fernández, 2023, and *Hemeraia* Varella, Kullander, Menezes, Oliveira & López-Fernández, 2023 (Varella et al. 2023). After this taxonomic review, *Crenicichla labrina* and *Crenicichla brasiliensis* were allocated to the genus *Saxatilia*, currently comprising 23 valid species (Varella et al. 2023; Fricke et al. 2025b).

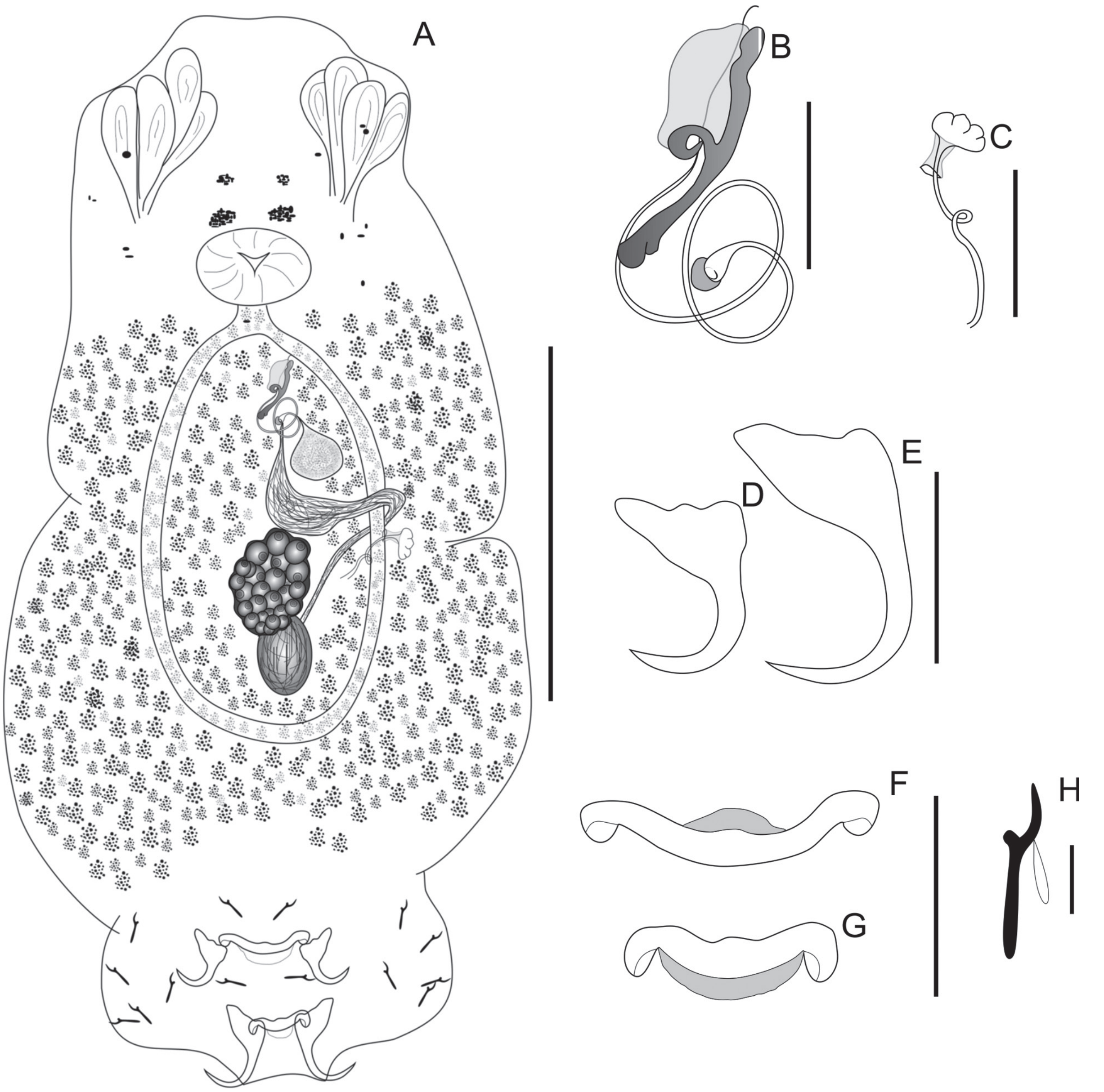

Figure 3. *Sciadicleithrum araguariensis*. **A.** Total, ventral; **B.** Copulatory complex; **C.** Vagina; **D.** Ventral anchor; **E.** Dorsal anchor; **F.** Ventral bar; **G.** Dorsal bar; **H.** Hook. Scale bars: 100 μm (**A**); 20 μm (**B, D–G**); 40 μm (**C**); 5 μm (**I**).

Considering this, *Sciadicleithrum araguariensis* is presently known from two congeneric hosts belonging to *Saxatilia.* In addition, the new species described herein is also a parasite from a member of this genus. Furthermore, *Crenicichla niederleinii* Holmberg, 1891, the host of *Sciadicleithrum joanae* Yamada, Takemoto, Bellay & Pavanelli, 2009, became a *nomen dubium*, and its current taxonomic status is uncertain (Varella et al. 2023; Fricke et al. 2025b).

The finding of two species of *Sciadicleithrum* on *Saxatilia brasiliensis* enhances our understanding of parasite biodiversity in the Neotropical Region, specifically within the Munim River Basin located in Maranhão State, and reinforces the host specificity of *Sciadicleithrum* species to cichlid hosts. The results presented provide data to answer questions of the systematics and taxonomy of Monopisthocotyla in a megadiverse region like the Neotropics.

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