

A new species of *Hypancistrus* Isbrücker & Nijssen 1991 (Loricariidae, Siluriformes) from the rapids of the middle Rio Tocantins

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Abstract

The *Hypancistrus* genus is recognized in the Río Orinoco basin and Rio Xingu in the Guiana and Brazilian Shields, respectively. Some of its species are important in ornamental fishing. Despite this significance, many other undescribed species are still awaiting to be named. Here we describe a new species of *Hypancistrus* found on bedrock in the Rio Tocantins, representing an extension of the distribution of the genus. Also, a multigene phylogeny is presented to evaluate the taxonomic position of this species concerning congeners. The new species differs from all congeners by (1) hypertrophied odontodes on cheeks reaching beyond the cleithrum, (2) a supraoccipital crest conspicuously elevated, (3) a supraorbital crest slightly convex, (4) oblique bars on the anterior part of the body, (5) a dark E-shaped mark on the snout, (6) three oblique dark bars on the anterior part of the body and horizontal vermicular bars from the pectoral girdle to the posterior insertion of the dorsal fin, (7) a thin light gray bar on the posterior of the head extending across the branchial opening, (8) a tan background color, (9) a developed suspensorium with a diminished appendix in the metapterygoid, and (10) a dentary plate robust significantly fused with the angulo-articular bone. The molecular phylogenetic results show the new species forming a group with *Hypancistrus zebra* (Brazilian Shield–Rio Xingu) as a clade, a sister group of a monophyletic group consisting of all congeners from the Río Orinoco.

KEYWORDS

armored catfish, molecular phylogeny, new taxon, rheophilic fish

1 | INTRODUCTION

Among the Hypostominae (Loricariidae, Siluriformes), *Hypancistrus* includes nine recognized species occurring in the Río Orinoco basin and in the Rio Amazon basin (Rio Negro and Rio Xingu basins). However, many other species still need to be described. A major effort has been taken in the research of cytogenetics and reproductive biology of *Hypancistrus*, as many of these species have commercial importance in ornamental fish trade (Cardoso et al., 2016; dos Santos et al., 2023; Reis et al., 2021). They are predominantly associated with bedrock in moderately flowing water (Armbruster, 2002;

Armbruster et al., 2007; Isbrücker & Nijssen, 1991; Tan & Armbruster, 2016). The genus is usually distinguished by the number and form of dentary teeth, although these characters are broadly shared among many taxa on Loricariidae (Armbruster, 2002). Armbruster (2002) presented a description of *Hypancistrus*, suggesting a larger gap between the metapterygoid and the lateral ethmoid skull bones, and the front of the skull. In addition, the adductor palatini crest is very pointed, and the metapterygoid channel has no side wall.

Rapid-flowing water habitats have been intensely altered by hydrological alterations of a series of dams for electric power

production in the Rio Tocantins basin (Akama, 2017). In a scenario of species loss caused by anthropic alterations to natural habitats, it is necessary to make a taxonomic effort to characterize species and develop conservation strategies. Considering it, here we describe the first species of *Hypancistrus* in the rapids from the Rio Tocantins, extending the knowledge of this genus.

Comments on phylogenetic relationships, biogeography, distributions, and morphological and molecular characters are presented.

2 | METHODS

2.1 | Ethics statement

The care and use of experimental animals complied with Brazilian animal welfare laws, guidelines, and policies as approved under licensing 70940-1 SISBIO/IBAMA.

2.1.1 | Taxonomic description

Morphometric data from type material were taken from recently collected specimens by the authors that are deposited in the fish collection of Museu Paraense Emílio Goeldi (MPEG). Institutional abbreviations follow Sabaj (2020). Morphometric measurements were made with direct corporal measurements taken using digital calipers to the nearest 0.1 mm. Counts and measurements follow Armbruster (2003), with added counts for lateral plate series from Armbruster et al. (2007). Morphometric variations express the percentages of standard length (SL) and partial head length. Comparative data were retrieved based on original *Hypancistrus* species descriptions (Armbruster, 2002; Armbruster et al., 2007; Isbrücker & Nijssen, 1991; Lujan & Armbruster, 2011; Tan & Armbruster, 2016). Anatomical nomenclature follows Schaefer (1987) and Geerinckx et al. (2007) for skeletal characteristics, Schaefer (1997) for names of plate rows, Douglas et al. (2002) for the term “iris operculum,” and Armbruster et al. (2007) for the term “dark E.” Holotype is represented by “*” in meristic data. The complete morphometric dataset is presented in Data S1.

X-ray scanning and three-dimensional image reconstructions were conducted using nanocomputerized tomography of the described species, *Hypancistrus zebra* and *Peckoltia vittata*, for comparison. The samples were scanned using a GE v|tome|x m dual tube 300/180-kV system in the Coordenação de Zoologia of the MPEG. Each specimen was scanned with an energy beam of 80 kV and a flux of 80 μ A using a 360° rotation and then reconstructed into the 4096 \times 4096 matrix of 1536 slices. The final computed tomography (CT)-reconstructed images were exported with a minimum resolution of 6.099 μ m. The three-dimensional (3D) suspensorium images were segmented manually using 3DSlicer. The scale bar of the holotype and comparative material is presented in millimeters.

2.1.2 | Molecular analyses

To compound the molecular analysis, samples from the new *Hypancistrus* species deposited at the MPEG tissue collection were used in the present study. Global DNA was extracted using the DNeasy Blood and Tissue Kit (Qiagen Inc.) according to the manufacturer's protocol. To assess the extracted DNA quality, samples were stained with GelRed and electrophoresed on 1% agarose gel for 40 min at 60 V. The molecular marker fragments' amplifications follow Lujan et al. (2015) and Ward et al. (2005). For this study we included two mitochondrial molecular markers (16S and COI) and one nuclear molecular marker (myostatin: MyH6). Positive PCR products were purified using the ExoSAP-IT PCR Product Cleanup Reagent (Thermo Fisher Scientific) according to the manufacturer's protocol and then sequenced using the BigDye Kit (ABI Prism Terminator Cycle Sequencing Ready Reaction—PE Applied Biosystems) on an ABI 3500 automatic capillary sequencer (Applied Biosystems).

2.1.3 | Phylogenetic analysis

Sequence editing and alignment were performed in Geneious, version 8.1.7. To recover the relationships among taxa, maximum likelihood (ML) and Bayesian inference (BI) analyses were conducted. BI was conducted using MrBayes software, version 3.2.7 (Ronquist et al., 2012), with the evolutionary model and the best partition scheme for each gene estimated using PartitionFinder2 (Lanfear et al., 2016). Two independent runs were performed with four Markovian chains (MC3) based on 2 million generations, with tree sampling at every 10,000 generations, discarding 25% as burn-in. ML analyses were conducted using RAxML, version 8 (Stamatakis, 2014), with 1000 rapid bootstrap replicates. For comparison, we included in our analysis *Hypancistrus*'s sequences from the genes used in this study available on GenBank from Lujan et al. (2015, 2017). Thus, our molecular dataset contained most of the valid *Hypancistrus* species (except *Hypancistrus inspector*, *Hypancistrus margaritatus*, and *Hypancistrus phantasma*), retrieved sequences from previously published Hypostominae phylogenies (Lujan et al., 2015; Lujan et al., 2017), also adding representatives of species phylogenetically related to the *Peckoltia* clade (Lujan et al., 2015), with a species of Pimelodidae (*Zungaro zungaro*) as out-group. The complete list of access code of sequence data utilized in this study is found in Supplementary material Data S2.

3 | RESULTS

Hypancistrus parkateje, new species (Figure 1).

3.1 | Holotype

MPEG 39646, 64.5 mm SL, Brazil, Pará State, Bom Jesus do Tocantins, Rio Tocantins: Região do Caju Amigo, almost in front of São João do Araguaia city, 5°20'27" S, 48°47'18.3" W, November 9, 2019.

FIGURE 1 Holotype of *Hypancistrus parkateje*, 64.5 mm SL (standard length), Brazil, Pará, Bom Jesus do Tocantins, Rio Tocantins basin.



3.2 | Paratype

MPEG 039604, 10, 48.2–64.5 mm SL, same data as holotype. MPEG 039563, 5, 49.2–58.7 mm SL, Brazil, Pará State, São João do Araguaia, Rio Tocantins: Cachoeira da Mãe Maria—“Barca velha afundada” 5°16′12.5″ S, 48°57′09.1″ W, November 11, 2019. MPEG 039494, 3, 53.3–58.6 mm SL, Brazil, Pará State, São João do Araguaia, Rio Tocantins: Ilha das Cabras, 5°17′37″ S, 48°57′32.7″ W, November 6, 2019. MPEG 039541, 2, 67.6–69.9 mm SL, Brazil, Pará State, Bom Jesus do Tocantins, Rio Tocantins: beach in front of Ilha do Jaú, 5°20′11.9″ S, 48°51′15.5″ W, November 7, 2019. MPEG39647, 1, 43.7 mm SL, Brazil, Pará State, Itupiranga, Pedral do Lourenço, Rio Tocantins: rocky stretch near the Tucuruí Dam, 4°54′40.4″ S,

49°23′03.1″ W, December 17, 2023. MPEG 39648, 1, 45.2 mm SL, Brazil, Pará State, Itupiranga, Pedral do Lourenço, Rio Tocantins: rocky stretch near the Tucuruí Dam, 4°53′39.2″ S, 49°24′42.2″ W, December 12, 2023. MPEG 39649, 1, 45.0 mm SL, Brazil, Pará State, Itupiranga, Pedral do Lourenço, Rio Tocantins: rocky stretch near the Tucuruí Dam, 4°52′20.0″ S, 49°24′35.5″ W, December 15, 2023.

3.3 | Diagnosis

Hypancistrus parkateje is distinguished from all congeners by hypertrophied odontodes on cheeks reaching beyond the cleithrum, contacting mid-lateral plate rows (vs. diminute or do not exceed the base of the

pectoral-fin spine); by a conspicuously elevated supraoccipital crest (vs. slightly elevated); and a slightly convex supraorbital crest (vs. flattened). *Hypancistrus parkateje* can be further distinguished from *H. contradens* Armbruster et al., 2007, *H. inspector* Armbruster, 2002, *H. lunaorum* Armbruster et al., 2007, *H. margaritatus* Tan & Armbruster, 2016, *H. phantasma* Tan & Armbruster, 2016, and *H. vandragti* (Lujan & Armbruster, 2011) by the presence of oblique bars on the anterior part of the body (vs. spots). The new species can be distinguished from *Hypancistrus debilittera* Armbruster et al., 2007, by the presence of an E-shaped mark on the snout (vs. absent or indistinct). *Hypancistrus parkateje* is distinguished from *H. furunculus* Armbruster et al., 2007, by three oblique dark bars on the anterior part of the body and horizontal vermicular bars from the pectoral girdle to the posterior insertion of the dorsal fin (vs. four) and a thin light-gray bar on the posterior of the head extending across the branchial opening (vs. bar does not reach branchial opening). The new species can be distinguished from *H. zebra* Isbrücker & Nijssen, 1991, by a tan background color (vs. whitish); by dentary with 5–8 teeth and 10–14 teeth on premaxilla (vs. 4–7 teeth on dentary and 8–16 teeth on premaxilla); by a more developed suspensorium with a diminished appendix in the metapterygoid (vs. metapterygoid appendix absent); a robust dentary plate markedly fused with the angulo-articular bone (vs. diminute dentary plate with narrow angulo-articular); a sharply angled adductor palatine crest (vs. a slightly salient adductor palatine crest); a triangular-shaped diminute hyomandibula (vs. a larger and thicker hyomandibula) (Figure 2a). Additionally, *H. parkateje* differs from congeners (except *H. margaritatus*, *H. contradens*, and *H. lunaorum*) by the contact of the posterior extremity of the adipose-fin base with the beginning of the dorsal caudal-fin lobe (vs. not in contact), a series of plate rows between the adipose posterior base and the anterior caudal. *Hypancistrus parkateje* is distinguished from all congeners (except *H. margaritatus*) by the short maxillary barbels not reaching the edges of the lower lips (vs. reaching past posterior edge of the lower lip when extended posteriorly).

3.4 | Description

Morphometric data are provided in Table 1. Largest specimen examined, 69.9 mm SL. Head tall. Snout short, triangular on dorsal view. Head dorsal profile convex from tip of snout to supraorbital crest. Supraorbital crest convex, from little to moderately developed. Profile of head ascends slightly convex from posterior region of supraorbital crest to posterior margin of parieto-supraoccipital. Body depth increases subtly from posterior margin of parieto-supraoccipital to origin of dorsal fin, gradually decreases from origin of dorsal fin to posterior insertion of adipose fin; caudal peduncle short, depth increasing markedly from end of adipose-fin base to upper caudal-fin lobe.

Eye large, present iris operculum. Orbital opening oriented at 45° sagittal plane. Supraoccipital crest short to moderately high. Interorbital isthmus between supraorbital crest flat. Lips papillose, in oral disk less than half width of head. Maxillary barbels short, not reaching past posterior edge of lower lip when extended posteriorly, thin, and pointed; barbel rugose proximally, smooth distally. Dentary teeth 5–8 (mode 6), teeth long and wide; premaxillary teeth 10–14 (mode 12), fairly wide (but not as wide as dentary teeth) and short; lateral and medial cusps approximately equal in width; lateral cusp slightly shorter than medial.

Nasal contacting frontal anteriorly. Frontal relatively wide, width greater than half bone; ventral region forming anterodorsal margin of orbit. Sphenotic dorsolaterally, forming posterodorsal orbital margin. Frontal and sphenotic forming supraorbital ridge. Compound pterotic wide, posterior margin markedly convex; dorsal margin contacting parieto-supraoccipital. Parieto-supraoccipital broad, with well-developed process on posterior margin, variably prominent in lateral view. Frontal, infraorbitals, nasal, preopercle, compound pterotic, and suprapreopercle supporting odontodes.

Dorsal fin II,7; dorsal-fin spine same size of first branched ray; last branched ray reaching anterior border or slightly beyond pre-adipose plate. Pectoral fin I,6; pectoral-fin spine depressed, reach base of rays of pelvic-fin rays when relaxed against body. Pelvic fin I,5; pelvic-fin spine depressed, reach further edge of posterior insertion of anal fin.

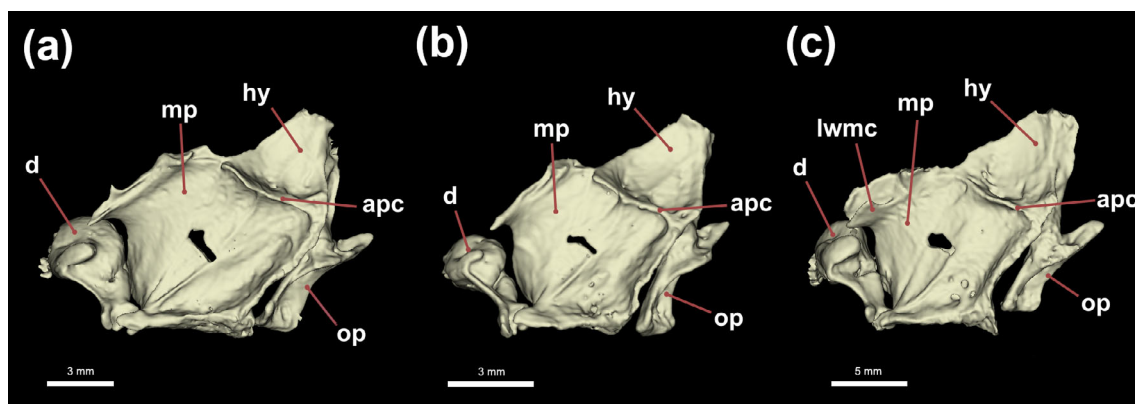


FIGURE 2 Computed tomography renderings of suspensorium (dorsal view) of holotype (a) of *Hypancistrus parkateje* MPEG 39646, (b) *Hypancistrus zebra* MPEG 39650, and (c) *Peckoltia vitatta* MPEG 13428. apc, adductor palatine crest; d, dentary plate; hy, hyomandibula; lwmc, lateral wall of metapterygoid channel; mp, metapterygoid; op, opercle.

TABLE 1 Morphometric data of *Hypancistrus parkateje* from Rio Tocantins basin.

	N	H	Range	Mean	SD
SL (1–20)	21	64.5	43.7–69.9	55.6	7.2
SL%					
Predorsal L. (1–10)	21	46.8	43.6–51.0	46.1	1.8
Head L. (1–7)	21	31.0	31.0–43.3	39.1	2.2
Head-dorsal L. (7–10)	21	7.4	4.6–11.4	7.8	1.5
Cleithral W. (8–9)	21	35.2	31.4–37.0	35.5	1.3
Head-pectoral L. (1–12)	21	31.3	23.6–34.0	29.3	2.3
Thorax L. (12–13)	21	23.1	20.5–26.5	24.2	1.6
Pectoral-spine L. (12–29)	21	31.2	30.3–36.7	33.1	1.6
Abdominal L. (13–14)	20	23.9	22.5–26.3	24.4	1.0
Pelvic-spine L. (13–30)	21	27.3	26.4–29.3	27.7	0.8
Postanal L. (14–15)	20	33.3	29.3–36.8	32.5	1.8
Anal-fin spine L. (14–31)	19	12.7	12.5–16.5	14.3	1.3
Dorsal-pectoral D. (10–12)	21	32.2	29.7–38.1	32.0	1.7
Dorsal spine L. (10–11)	20	24.0	24.0–31.0	28.1	2.1
Dorsal-pelvic D. (10–13)	21	30.4	25.2–31.4	29.5	1.4
Dorsal-fin base L. (10–16)	21	26.5	22.3–30.1	25.9	2.1
Dorsal-adipose D. (16–17)	21	10.2	10.2–15.0	12.5	1.4
Adipose-spine L. (17–18)	20	7.9	7.1–12.4	9.2	1.5
Adipose-spine caudal D. (17–19)	21	15.5	12.0–18.6	16.1	1.7
Caudal peduncle Dp. (15–19)	21	13.5	11.3–13.5	12.4	0.5
Adipose-low caudal D. (15–17)	21	25.0	21.0–27.7	25.1	1.3
Adipose-anal D. (14–17)	20	37.2	16.2–37.2	19.1	4.4
Dorsal-anal D. (14–16)	20	31.0	16.2–31.0	18.7	3.1
Pelvic-dorsal D. (13–16)	21	49.0	26.1–49.0	30.6	4.4
HL%					
Head-eye L. (5–7)	21	45.0	33.9–45.0	37.2	2.6
Orbit diameter (4–5)	21	26.0	18.0–26.0	21.7	1.6
Snout L. (1–4)	21	74.0	51.9–74.0	56.2	4.4
Internares W. (2–3)	21	16.0	8.7–16.0	12.2	1.6
Interorbital width (5–6)	21	51.0	28.2–51.0	35.7	5.0
Head Dp. (7–12)	21	97.5	66.8–97.5	73.1	6.0
Mouth L. (1–24)	21	58.5	35.8–58.5	41.3	5.2
Mouth W. (21–22)	21	52.5	32.7–52.5	39.8	3.9
Barbel L. (22–23)	21	24.0	14.7–24.0	18.3	2.0
Dentary tooth cup L. (25–26)	21	16.5	5.5–16.5	8.8	2.5
Premaxillary tooth cup L. (27–28)	21	10.5	7.7–10.6	9.2	0.9

Notes: Morphometric data related to body except standard length are given as percentages of standard length (SL%), and morphometric data related to head are expressed in percentages of head length (HL%). Numbers in parentheses indicate the landmarks in Armbruster (2003).

Abbreviations: D, distance; Dp, depth; H, holotype values; L, length; N, number of individuals; W, width.

Anal fin I,4; reach vertical ventral line in insertion of adipose-fin spine. Caudal fin I,14,I* (one specimen I,15,I); emarginate, lower lobe longer than upper; four dorsal procurrent rays and three ventral procurrent rays. Fin spines and rays supporting odontodes; conspicuously stretched on pectoral-fin spines.

Median plates 21–24 (22*, mode 23); mid-dorsal plates 20–24* (mode 23); mid-ventral plates 20–23* (mode 22); rows of plates on caudal peduncle five. Row of mid-ventral plates folded above pectoral girdle, continuous ridge with cleithrum. Body plates with diminute odontodes. Ventral surface flat, almost completely unplated; five

specimens, including holotype, with small plates near posterior margin of pectoral-fin base (Figure 1). Small plates with odontodes posteriorly pelvic girdle, absent in juvenile individuals. Cheek plates with 10–34* (mode 23) hypertrophied odontodes, reaching beyond cleithrum.

3.5 | Sexual dimorphism

None observed.

3.6 | Colouration

In ethanol, body with dark banding pattern on light brown to tan base. Three dark E-shaped oblique marks on tip of snout. A thin light-gray bar on posterior of head, extending across branchial opening. Vertical vermicular bars from pectoral-fin base to caudal peduncle; four dark bars in caudal fin. Ventral surface white to light gray from oral disk to urogenital opening. Live specimens yellow ground colouration, with limits of body bars and markings on snout more prominent than described above (Figure 3).

3.7 | Distribution and conservation status

H. parkateje is found in the Middle Rio Tocantins, specifically in areas characterized by moderate water flow in a bedrock background. Its habitat ranges from Pedral do Lourenço (in Itupiranga) to the municipality of Bom Jesus do Tocantins (Figure 4). The species has a limited distribution and resides in the remaining stretches of rapids that have not been directly impacted by the Tucuruí Dam. These rapids have been extensively sampled and studied in recent years, and an inventory has found that these remaining lotic habitats still host a



FIGURE 3 Live specimen of *Hypancistrus parkateje* collected at the Pedral do Lourenço, Itupiranga, PA, Brazil. Yellow ground colouration is more conspicuous than alcohol-preserved specimens; the bars on snout, body, and fin bars are considerably more pronounced.

diversified fish fauna (Araújo et al., *in press*). Despite this, these habitats in the Rio Tocantins basin have been significantly affected by dam construction by numerous hydroelectric plants, which poses a threat to rheophilic species such as *H. parkateje*. Consequently, this species could be categorized as vulnerable (VU) according to the IUCN criteria due to its limited distribution, low population numbers observed in the field campaigns, and the ongoing threats to its habitat from potential megaprojects such as the Tocantins-Araguaia waterway and planned hydroelectric plants like the UHE Marabá and the UHE Serra Quebrada (Akama, 2017; Chamon et al., 2022).

3.8 | Etymology

The specific epithet is treated as a noun in apposition in honor of the Parkatêjê traditional Indigenous community (Mãe Maria Land Reserve), near the sampling site where the holotype was collected (Bom Jesus do Tocantins, Pará, Brazil).

3.9 | Phylogenetic relationships

The sequences generated in this research were deposited in GenBank with access numbers 16S: PP663037–PP663040, COI: PQ218506–PQ218507, and MyH6: PP663037–PP663040. The phylogeny of *Hypancistrus* shows two main clustering among the species in both methodologic approaches (ML and BI); we show only the BI topology, including the support values of the three analyses (Figure 5). The species are separated into two clades: one including species from the Río Orinoco basin (*H. lunaorum* (*H. vandragtii*, *H. furunculus*) (*H. lunaorum*, *H. contradens*)) and the other including the species distributed in the Brazilian Shield (*H. zebra*, *H. parkateje*). The new species was strongly supported by both phylogenetic methods (ML: 93%; BI: 100%). The ML tree is found in Supplementary Material 2.

4 | DISCUSSION

Hypancistrus parkateje is justified to be described in the present genus by the low number of teeth on dentary, presenting all osteological synapomorphies of suspensorium anatomy that align with the genus as designated by Armbruster (2002). These include the separation between the metapterygoid and the lateral ethmoid, a sharply angled adductor palatine crest, a triangular-shaped diminute hyomandibula, and a thin margin in the opercle fusion; the metapterygoid channel has no side wall, distinguishably as found in closely related species that hold a lateral wall of metapterygoid, channel, as found in the comparative species (*P. vittata*—Figure 2c). Furthermore, our multilocus molecular phylogenetic analysis substantiates this morphological classification.

Our description represents an extension in the distribution of *Hypancistrus*, representing its 10th and 4th species recognized in Brazilian river basins. Despite being remarkably similar to

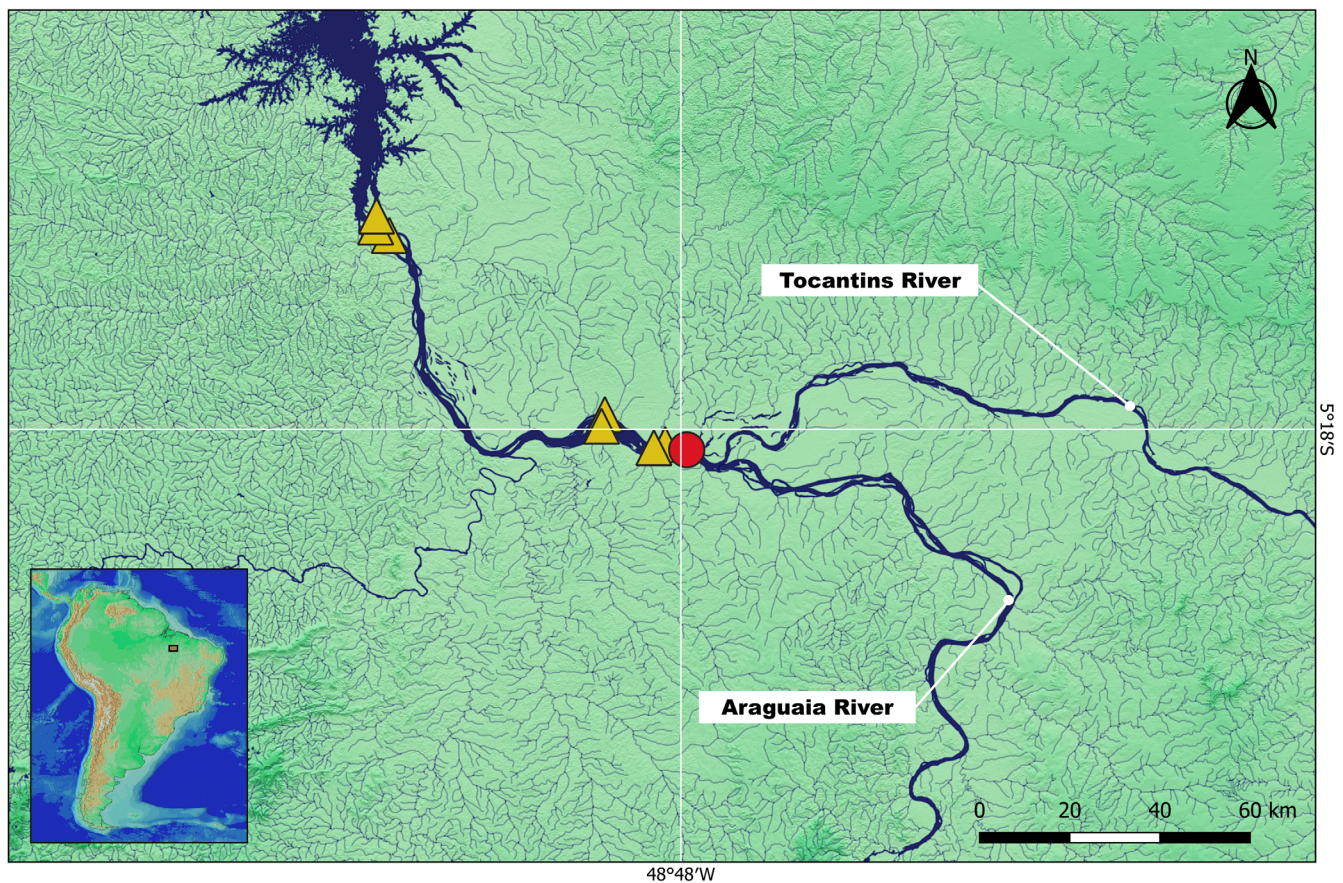


FIGURE 4 Distribution of *Hypancistrus parkateje*; yellow triangles indicate sampling sites; red circle indicates the type locality.

H. furunculus, especially concerning its color pattern, taking apart the suspensorium anatomy, *H. parkateje* can be distinguished from all congeners by hypertrophied odontodes on cheeks reaching beyond the cleithrum, the supraoccipital crest conspicuously elevated, the supraorbital crest slightly convex, oblique bars on the anterior part of the body, the presence of a dark E-shaped mark on the snout, three oblique dark bars on the anterior part of the body and horizontal vermicular bars from the pectoral girdle to the posterior insertion of the dorsal fin, a thin light-gray bar on the posterior of the head extending across the branchial opening, the tan background color, its short caudal peduncle, the contact of the posterior point of the adipose-fin base with the base of dorsal caudal-fin lobe, and the short maxillary barbels not reaching the edges of the lower lips. The molecular topology recovered *H. parkateje* in a group with *H. zebra*, and sister group of the clade consisting of Río Orinoco's species (*H. lunaorum* (*H. contradens* + *H. debilittera* + *H. furunculus* + *H. vandragtii*)) (Figure 5), differing from previous phylogenies, which included exclusively species from the Río Orinoco and an undescribed *Hypancistrus* species from the Río Xingu (L174) (Lujan et al., 2015, 2017).

Furthermore, morphologically similar species are recorded in different river basins, such as *H. furunculus* and *H. debilittera* of Río Orinoco, and *H. zebra* of Río Xingu. These similarities regard the color pattern of these species, which may present vermiculations or bands on the body.

Considering this character, *Hypancistrus* species can be separated into two groups: (1) species presenting vertical stripes, dark bands, and/or vermiculations on the body (*H. furunculus*, *H. debilittera*, *H. parkateje*, and *H. zebra*), and (2) species presenting saddles or spots (*H. contradens*, *H. inspector*, *H. lunaorum*, *H. phantasma*, *H. margaritatus*, and *H. vandragtii*) (Armbruster et al., 2007). However, such differentiation does not seem taxonomically accurate, once the multigene phylogenies by Lujan et al. (2015, 2017) recovered a polytomy among *Hypancistrus* species, without an apparent species boundary among them.

Regarding the molecular phylogeny, our analyses present additional data for a better understanding of the clustering and diversification patterns of *Hypancistrus*, showing that the hypothesis of the monophyly of the group is maintained. Distinct from the preceding proposed topologies that failed to reveal species relationships within *Hypancistrus* (Lujan et al., 2015; Lujan et al., 2017), our analysis with the inclusion of the species *H. zebra* and *H. parkateje* could find a split in the genus into two clades. We designed these groups based on the distribution of their species, the Brazilian group consisting of *H. zebra* and *H. parkateje* species, and the Orinoco clade consisting of *H. contradens*, *H. debilittera*, *H. furunculus*, *H. lunaorum*, and *H. vandragtii*, although the phylogenetic relationships of *H. margaritatus* and *H. phantasma*, from the Río Negro basin, remain unknown as they were not included in our analysis. Our multilocus assay provides evidence that the speciation events of *Hypancistrus*

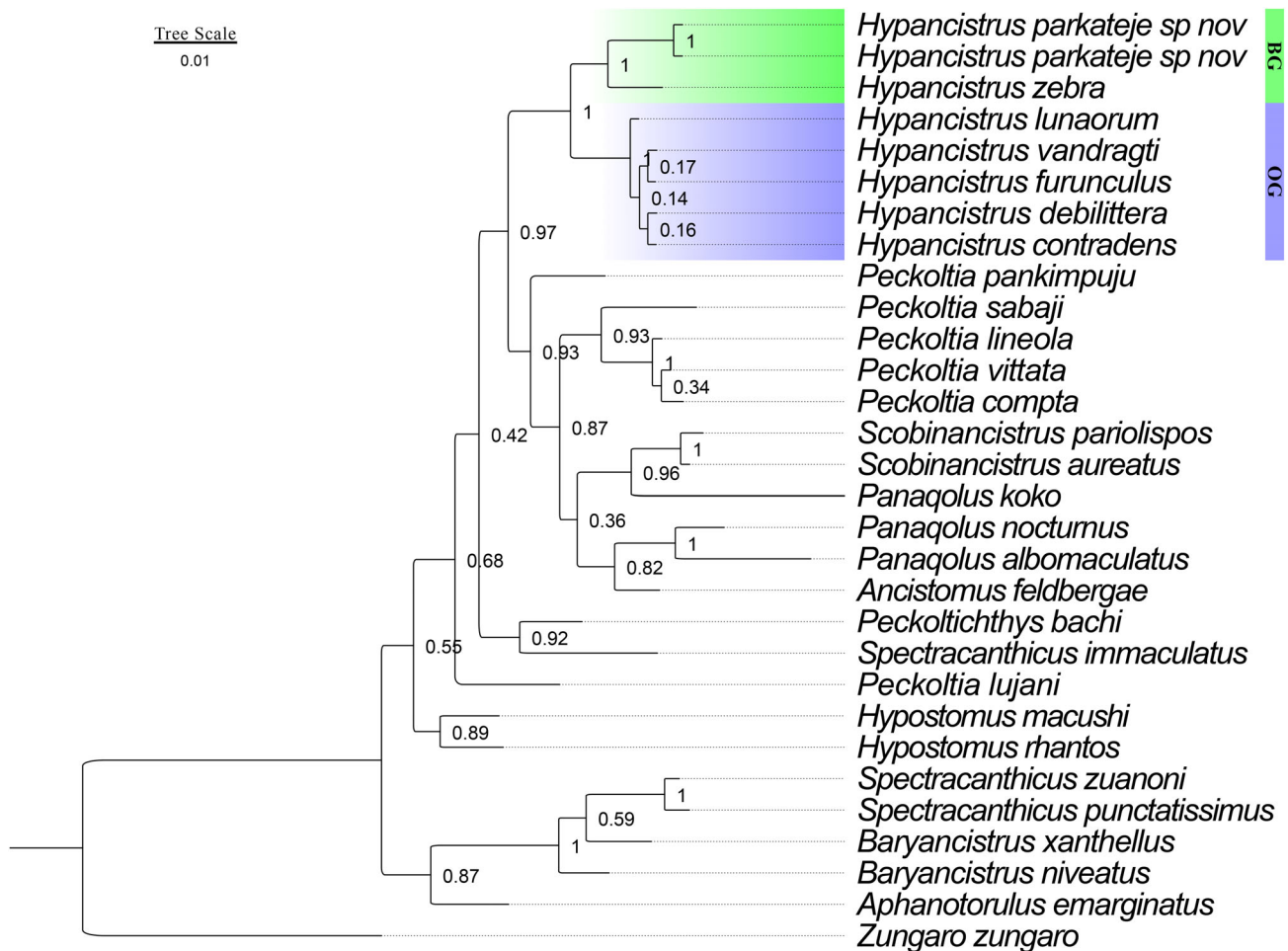


FIGURE 5 Phylogenetic hypothesis based on multilocus dataset comprising mitochondrial (16S and COI) and nuclear (MyH6) molecular markers for taxa of the *Hypancistrus* genus through Bayesian inference. Probability values are presented at nodes between clades. Green clade refers to the new species described here (*Hypancistrus parkateje*) with type species (*Hypancistrus zebra*), forming the *Hypancistrus* Brazilian group (BG, green branch). The lavender clade refers to the Orinoco-derived species (OG, lavender branch).

species might be related to biogeographical events that shaped their dispersal patterns. This includes the dominant hypothesis of the rise of the Vaupes Arch in eastern Colombia, which split the modern-day Orinoco and Amazon River basins in the late Miocene (~10 million years ago) (Albert & Carvalho, 2011; Hoorn et al., 2010). Therefore, this hypothesis requires further investigation, although there is strong evidence for it as numerous taxa are shared between the Río Orinoco and the rivers of the Brazilian Shield (Albert et al., 2020; Cassemiro et al., 2023; Dagosta & de Pinna, 2017, 2019).

Since the genus was proposed, *Hypancistrus* was allocated within Ancistrini. However, molecular studies, using 16S and 12S, demonstrated that the group delimited by Isbrücker (1980) was paraphyletic, in addition to demonstrating that *Peckoltia* was a sister group (Montoya-Burgos, 1998). After the description of more species and revisions of families and subfamilies (Armbruster, 2002; Armbruster, 2003; Armbruster et al., 2007; Tan & Armbruster, 2016), the monophyly of the genus and its positioning in the Hypostominae as part of the *Peckoltia* clade have been corroborated (Lujan et al., 2015; Lujan et al., 2017).

Taking account of the distribution of *H. parkateje*, it was collected in a lotic environment, characterized by a bedrock habitat of

moderate to fast flow. This particular habitat hosts a rich biodiversity characteristic of intense hydrological dynamics (Fitzgerald et al., 2018; Lujan & Conway, 2015; Zuanon, 1999). In the Rio Tocantins-Araguaia basin, many hydroelectric power plants were set up, promoting serious hydrological alterations to its freshwater biodiversity (Akama, 2017; Chamon et al., 2022; Pelicice et al., 2021). Also, there is a proposal to build a waterway across the area where *H. parkateje* has been recorded (Machado et al., 2021). These threats may cause species loss, if rheophilic fish biodiversity is seriously affected by environmental shifts. Therefore, populations of *H. parkateje* can be considered at risk, especially those individuals from the Pedral do Lourenço (near Marabá city), due to the removal of rocky substrate to deepen the river channel to promote ferry navigation.

4.1 | Comparative material

H. zebra: MPEG 39650, 1, 56.6 mm SL, Brazil, Rio Xingu, Senador José Porfírio, Porto Vitória, Pará, 2°51'34.9" S, 51°58'02.7" W, November

20, 2022. *P. vittata*: MPEG 13428, 1, 100.3 mm SL, Brazil, Rio Xingu, Altamira, Pará, 3°12'48" S, 52°12'41.7" W, October 1, 2002.

AUTHOR CONTRIBUTIONS

Felipe Araújo: conceptualization, method, manuscript writing and editing; Marlon Ferreira: methodology, manuscript writing and editing; Iann Monteiro: data collection, manuscript writing and editing; Wolmar Wosiacki: funding, manuscript writing and editing, critic review.

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