

***Pareiorhaphis scutula*, a new species of neoplecostomine catfish (Siluriformes: Loricariidae) from the upper rio Doce basin, Southeastern Brazil**

Edson H. L. Pereira¹, Fábio Vieira² and Roberto E. Reis¹

Pareiorhaphis scutula, new species, is described from the headwaters of the rio Piracicaba, tributary to the upper rio Doce basin in the State of Minas Gerais, southeastern Brazil. The new species is distinguished from all congeners by having an unique autapomorphic feature: the abdominal surface from pectoral girdle to pelvic-fin insertions covered with small platelets imbedded in skin and irregularly scattered. This feature is not shared with any other *Pareiorhaphis* species. *Pareiorhaphis scutula* is further compared with the sympatric *P. nasuta*.

Pareiorhaphis scutula, nova espécie, é descrita das cabeceiras do rio Piracicaba, tributário do rio Doce no Estado de Minas Gerais, sudeste do Brasil. A nova espécie se distingue de todos os demais congêneres por apresentar como autapomorfia a superfície abdominal, entre as nadadeiras peitorais e a inserção das nadadeiras pélvicas, coberta por pequenas placas irregularmente arranjadas. Esse caráter não é compartilhado com nenhuma outra espécie de *Pareiorhaphis*. *Pareiorhaphis scutula* é ainda comparado com a espécie simpátrica *P. nasuta*.

Key words: Neotropical, Taxonomy, *Isbrueckerichthys*, *Pareiorhaphis nasuta*, cascudo.

Introduction

The last decade has witnessed a remarkable increase in our understanding about the diversity of the neoplecostomine genus *Pareiorhaphis* Miranda Ribeiro, 1918, with 10 of the 18 currently known species described in this period. The geographic range of the genus also suffered considerably augmentation due to the new species records. Species of *Pareiorhaphis* that were formerly recorded from upper rio Uruguai, coastal drainages from Santa Catarina to Rio de Janeiro, and rio Almada in Bahia are nowadays recorded from the upper reaches of rios Jacui, Uruguai, Iguacu, and São Francisco to most of coastal basin from Rio Grande do Sul to southern Bahia. *Pareiorhaphis nasuta* Pereira, Vieira & Reis, 2007 was described from the upper rio Matipó basin, representing the first *Pareiorhaphis* species in the rio Doce drainage. In this paper we report on a second new species of *Pareiorhaphis* from the upper rio Piracicaba basin in the rio Doce drainage.

Material and Methods

Museum abbreviations follow Ferraris (2007). All morphometric features were measured with digital calipers to

the nearest 0.1 mm and were made from point to point under a stereomicroscope. Measurements follow Pereira *et al.* (2007). Body plate counts and nomenclature follow the schemes of serial homology proposed by Schaefer (1997). Standard length is expressed in millimeters while all other measurements are given as percents of standard length, except for subunits of the head, which are presented as percents of the head length. Osteological preparations were cleared and counterstained for cartilage and bone (c&s) using the method of Taylor & van Dyke (1985). In the lists of examined material museum abbreviation and catalog number come first, followed by the number and SL range of specimens in that lot, the number and SL range of specimens measured for the morphometric comparisons, in parentheses, and locality. For type specimens, date of collection and collectors are also given. Abbreviations used are H (holotype), SL (standard length), and HL (head length).

Adult males of *Pareiorhaphis* are herein defined as specimens having distinctive modifications that involves the shape of the pectoral spine, hypertrophied odontodes along the margins of head, and fleshy lobes on lateral margins of head, although not necessarily in reproductive maturity. The other specimens included in the list of material examined are a combination of females, young males and immature specimens of both sexes.

¹Laboratório de Sistemática de Vertebrados, Pontifícia Universidade Católica do Rio Grande do Sul. Av. Ipiranga, 6681, 90619-900 Porto Alegre, RS, Brazil. ehlpereira@gmail.com, reis@puers.br

²Agência Shopping Del Rey, CP 4011, 31250-970 Belo Horizonte, MG, Brazil. small.catfish@gmail.com

Pareiorhaphis scutula, new species

Fig. 1

Holotype. MCP 44046, 84.7 mm SL, Brazil, Minas Gerais, Nova Era, rio Doce drainage, córrego Prainha, tributary to rio Piracicaba, 19°38'54"S 42°57'37"W, 17 Aug 2007, F. Vieira & I. A. Figueiredo.

Paratypes. Brazil: Minas Gerais: rio Doce drainage: MCP 44045, 15, 21.3-67.6 mm SL (10, 51.1-67.6 mm SL); UFRGS 10820, 2, 53.0-53.7 mm SL; MNRJ 33986, 2, 47.2-53.2 mm SL; AMNH 249486, 2, 45.3-55.9 mm SL; ANSP 189490, 2, 47.9-59.5 mm SL, all collected with the holotype. MCP 37182, 27 + 2 c&s, 28.2-84.7 mm SL (6, 58.1-84.7 mm SL), Nova Era, córrego Prainha on Road to Cachoeira da Fumaça, 19°38'53"S 42°57'37"W, 9 Oct 2004, E. H. L. Pereira, R. E. Reis & P. Lehmann. MCP 28683, 10 + 1 c&s, 25.3-90.5 mm SL (7, 54.9-90.5 mm SL), Nova Era, córrego Prainha, tributary to rio Piracicaba, 19°45'S 43°03'W, Jun 2001, F. Vieira & P. S. Pompeu. MCP 38811, 3, 69.9-87.7 mm SL (3), Nova Era, córrego Prainha, tributary to rio Piracicaba, at limit between Antônio Dias and Nova Era, Aug 1998, F. Vieira & P. S. Pompeu. MCP 38810, 6 + 1 c&s, 42.5-77.1 mm SL (2, 64.3-77.1 mm SL), Nova Era, córrego Prainha, tributary to rio Piracicaba, 19°39'12"S 42°57'20"W, 28 Jul 2004, F. Vieira & I. A. Figueiredo.

Diagnosis. *Pareiorhaphis scutula* is uniquely diagnosed from all remaining *Pareiorhaphis* species by having the abdomen entirely covered with small platelets imbedded in skin and irregularly scattered from pectoral girdle to pelvic-fin insertions (vs. abdomen totally naked or with one to four small platelets on each side just posterior to gill opening in *P. parmula* and *P. nasuta*; Fig. 2). The new species can be further distinguished from *P. parmula* by having 51-71 premaxillary teeth (vs. 31-48), 24-28 lateral plates in the median series (vs. 28-31), and longer snout length (62.1-70.0 vs. 53.8-63.0% HL) and from *P. nasuta* by having a shorter snout length (62.1-70.0 vs. 71.1-75.6% HL) and a larger orbital diameter (11.9-14.8 vs. 8.6-11.3% HL; Fig. 3).

Description. Member of Neoplecostominae as diagnosed by Pereira (2009). Counts and proportional measurements in Table 1. Small to medium-sized loriciid with standard length of measured specimens 51.1-90.5 mm SL. Body elongate and moderately depressed, progressively tapering from cleithrum to end of caudal peduncle. Dorsal profile of body gently convex, rising from snout tip to origin of dorsal fin and then descending to end of caudal peduncle. Greatest body depth at dorsal-fin origin. Least body depth at shallowest part of caudal peduncle. Trunk and caudal peduncle mostly oval in cross-section, slightly flattened ventrally and more compressed caudally. Lateral-line canal in median series complete, pored tube visible from compound pterotic to caudal-fin base. Ventral profile almost straight between snout tip and pelvic girdle, slightly elevating posteriorly along anal-fin base, almost straight along caudal peduncle. Dorsal surface of body covered by plates except for small naked area around dorsal-fin base. Ventral surface of head, portion from pelvic-fin insertions to anal-fin origin, and portion around anal fin totally naked. Abdomen covered by small, embedded

platelets, irregularly arranged from pectoral girdle to insertion of pelvic fins. Some adult males with few small platelets behind insertion of pelvic fin but never reaching to anal-fin origin.

Head broad and moderately depressed. Dorsal profile of head round in dorsal view; females and juveniles more slender. Interorbital space straight or slightly concave. Three weakly elevated ridges between orbits and snout tip. Outer ridges from middle of snout to upper margins of orbits slightly more prominent. These ridges ornamented with short hypertrophied odontodes in adult males. Snout gently convex in lateral profile; snout tip with small ovoid area of naked skin. Adult males with well-developed soft fleshy lobes extending along lateral portion of head. Soft fleshy area ornamented with short hypertrophied odontodes, approximately perpendicular to body axis. Eye small, dorsolaterally placed; orbit diameter 11.9-14.8% HL of head length. Iris operculum absent or very small. Nares ovoid, slightly longer than wide, positioned midway between snout tip and anterior orbit margin. Oral disk roughly circular. Lips well developed, occupying most of ventral surface of head. Lower lip wide and long but not reaching pectoral girdle, upper lip narrow. Lower lip densely covered by minute papillae. Papillae surrounded by small naked areas, decreasing in size towards edge. Posterior edge slightly fringed. Maxillary barbel short and united to lip by membrane basally, free distally. Both premaxillae and dentaries angled at approximately 120°, with mesial ends slightly curved inwards. Teeth slender, asymmetrically bifid, medial cusp slightly curved inwards. Lateral cusp small and pointed, almost reaching half-length of medial cusp.

Dorsal fin originating slightly anterior to vertical line passing through pelvic-fin origin. Dorsal fin short, not reaching preadipose azygous plates when adpressed. Nuchal plate exposed, not covered by skin. Dorsal-fin spinelet present but dorsal-fin locking mechanism non-functional. Dorsal-fin spinelet transversely oval-shaped, wider than base of dorsal spine. Dorsal spine moderately flexible, followed by seven branched rays. Adipose fin with well-ossified leading spine bearing odontodes. Adipose-fin membrane extended slightly beyond adipose-fin spine. Adipose fin preceded by two to four median unpaired preadipose azygous plates. Pectoral fin moderate in size, with curved and flattened unbranched ray, covered by minute odontodes in immature males and females. Adult males with pectoral-fin spine very broad; bearing straight and short hypertrophied odontodes on its entire surface. Six branched rays, first and second as long as spine. Subsequent branched rays decrease gradually in size. Posterior margin of pectoral fin slightly round, overlapping pelvic-fin origin when adpressed. Pelvic fin with one unbranched and five branched rays, not reaching anal-fin origin when adpressed. Pelvic-fin unbranched ray depressed, covered with minute odontodes ventrally and laterally; dermal flap on its dorsal surface present and well developed, extending to ray tip. Pelvic-fin flap distinctly higher near fin base. Anal fin long with one unbranched and five branched rays; passing vertical at adipose-fin origin when adpressed. Caudal fin forked or slightly concave; lower lobe slightly



Fig. 1. *Pareiorhaphis scutula*, holotype, male, MCP 44046, 84.7 mm SL, córrego Prainha, tributary to rio Piracicaba, Nova Era, rio Doce drainage, Minas Gerais, Brazil.

longer than upper; one upper unbranched, 14 branched, and one lower unbranched rays. Upper caudal-fin lobe with five and lower lobe with four or five ventral plate-like procurrent rays, posteriormost elongate. Odontodes on principal and procurrent rays small and irregularly arranged.

Color in alcohol. Ground color of dorsal surface of body and head greyish-brown, darker anteriorly; light brown to yellowish white ventrally, skin of abdomen white and lips pale yellow. Dorsum irregularly spotted with dark brown, forming three irregular and diffuse saddles located at origin of dorsal fin,

behind dorsal-fin base, and at adipose fin. Skin between dermal plates darker, conferring slightly reticulate pattern, especially on ventral surface of caudal peduncle. Adult males with fleshy lobes on margin of head and pectoral-fin spines whitish-grey and yellow to orange hypertrophied odontodes. Dorsal-fin rays with 3-5 and caudal-fin rays with 4-5 dark spots forming irregular transverse bands on orange-brown background. Pectoral-, pelvic-, and anal-fin rays also spotted with dark brown on a pale yellow background, but spots not forming clear bands. Pectoral and pelvic fins whitish tan on ventral surface. Interradial membrane of all fins hyaline or pale white.

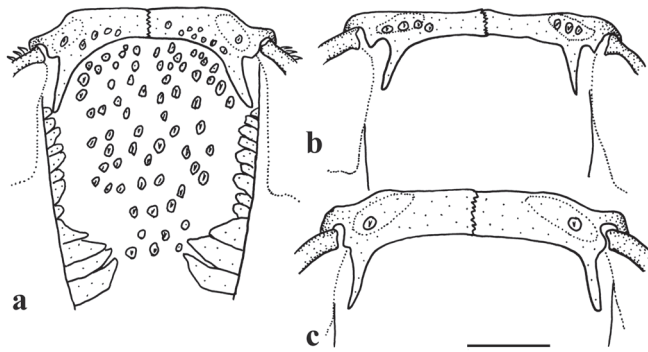


Fig. 2. Abdominal plates of *Pareiorhaphis*. (a) *P. scutula*, MCP 37182; (b) *P. nasuta*, MCP 37176; and (c) *P. parmula*, MCP 29434. Scale bar = 5 mm.

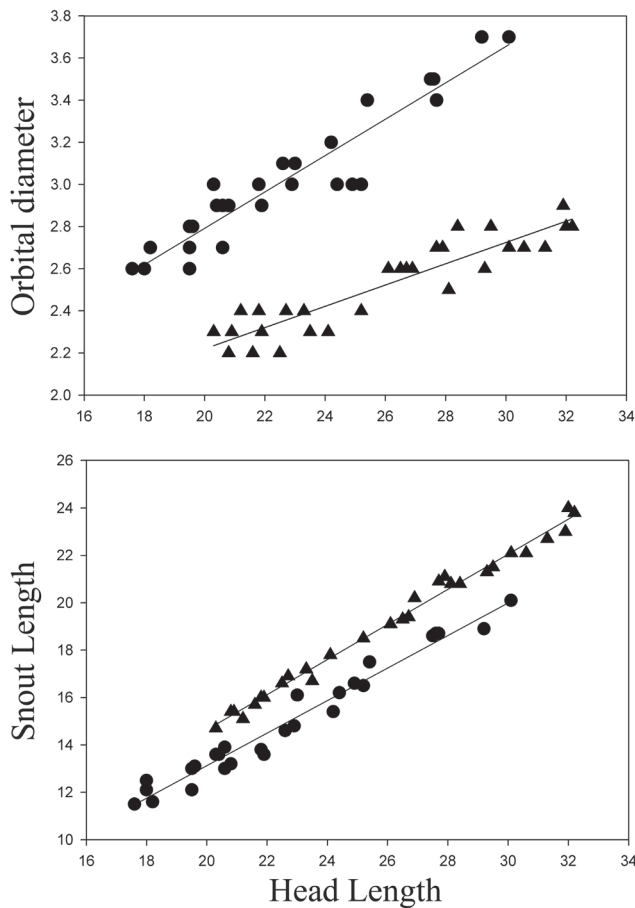


Fig. 3. Scatter plot and regression line of orbital diameter and snout length on head length, in *Pareiorhaphis scutula* (dots) and *P. nasuta* (triangles).

Distribution. *Pareiorhaphis scutula* is so far known from the córrego Prainha, a creek tributary to the rio Piracicaba in the upper reaches of the rio Doce drainage basin near Nova Era, Minas Gerais, Brazil (Fig. 4).

Habitat and ecological notes. The córrego Prainha, where most specimens of *Pareiorhaphis scutula* were collected,

Table 1. Morphometric and meristic data of *Pareiorhaphis scutula*. Values are given as percent of standard length or head length. SD = standard deviation, n = number of specimens, H = holotype.

	Types					
	H	n	Low	High	Mean	SD
Standard length (mm)	84.7	28	51.1	90.5	67.5	
Percent of Standard Length						
Head length	32.5	28	31.3	35.3	33.4	1.11
Predorsal length	43.9	28	42.0	47.0	44.4	1.08
Postdorsal length	41.6	28	38.3	44.1	40.8	1.42
Preanal length	65.9	27	62.9	68.1	65.7	1.21
Preadipose length	78.6	27	78.1	82.0	79.9	1.02
Dorsal-fin spine length	19.7	27	18.7	22.8	20.8	0.94
Anal-fin unbranched ray length	14.6	28	14.1	16.9	15.5	0.87
Pectoral-fin spine length	14.7	28	13.5	18.6	16.3	1.43
Ventral-fin unbranched ray length	20.4	28	19.1	23.9	21.1	1.06
Upper principal caudal-fin ray	22.5	28	19.2	28.9	24.2	2.21
Lower principal caudal-fin ray	25.8	25	22.0	30.6	26.0	2.28
Adipose-fin spine length	9.1	26	7.9	11.1	9.5	0.82
Adipose to caudal fin distance	21.2	27	17.6	22.7	20.2	1.41
Trunk length	17.4	28	15.6	19.5	17.8	0.91
Abdominal length	23.5	28	21.0	26.3	23.8	1.17
Cleithral width	27.4	28	26.1	29.9	28.1	0.94
Body depth at dorsal-fin origin	20.8	28	18.3	23.0	20.9	1.17
Body width at dorsal-fin origin	22.0	28	20.8	25.3	23.2	1.16
Body width at anal-fin origin	14.4	28	13.4	16.1	14.8	0.75
Caudal peduncle length	33.1	28	31.8	36.7	34.7	1.21
Caudal peduncle depth	9.3	28	8.5	10.8	9.8	0.61
Caudal peduncle width	4.4	28	4.1	5.9	4.8	0.49
Percent of Head Length						
Snout length	67.6	28	62.1	70.0	65.9	2.12
Orbital diameter	12.5	28	11.9	14.8	13.5	0.88
Interorbital width	32.2	27	27.9	34.1	30.9	1.32
Head depth	59.8	28	49.2	64.8	55.9	3.28
Mandibular ramus	22.1	27	18.3	22.8	20.8	1.17
Meristics						
Premaxillary teeth	62/64	28	51	71	61.5	4.17
Dentary teeth	60/62	28	48	68	59.2	3.78
Plates in median lateral series	26	27	24	28	25.6	0.86
Plates at dorsal-fin base	5	28	5	6	5.7	0.46
Plates between dorsal and adipose	7	28	7	8	7.3	0.46
Plates between adipose and caudal	4	28	3	5	3.9	0.57
Plates at anal-fin base	3	28	2	4	3.2	0.48
Plates between anal and caudal	11	28	10	12	10.9	0.59
Pre-adipose azygous plates	2	28	2	4	2.8	0.72

is a shallow creek (0.2-0.5 m depth and approximately 5 m wide) with rocky bottom, swift current, and clear water. Most of the creek banks are deforested and covered with grasses. Other fish species collected syntopically are *Trichomycterus* sp., *Geophagus brasiliensis*, *Neoplecostomus* sp., and *Astyanax* sp.

Sexual dimorphism. According to Pereira *et al.* (2007: 444) adult males of *Pareiorhaphis* can be recognized by having cheeks (postrostral and cheek plates) covered with hypertrophied odontodes. In addition, adult males of *Pareiorhaphis scutula* are also characterized by the following sexually dimorphic character: (1) Large soft fleshy lobes extending along the entire lateral margins of head. This soft fleshy area is ornamented with short hypertrophied odontodes, approximately perpendicular to the body axis. Odontodes also occur in females and juveniles, but are much

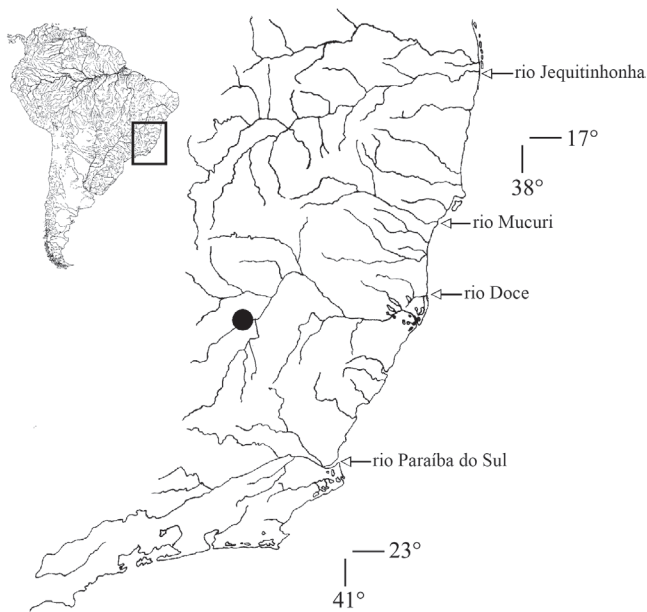


Fig. 4. Map of eastern Brazil showing type-locality of *Pareiorhaphis scutula*. One symbol represents more than one lot and locality.

smaller, while soft fleshy lobes are absent in females and juveniles. (2) Unbranched pectoral-fin ray very thick from the base to approximately three-fourths of its length, with distal portion soft and with somewhat short hypertrophied odontodes on outer and ventral surfaces. (3) Fully developed males have a well-developed flashy flap along the entire length of the dorsal margin of the pectoral-fin spine. (4) Unbranched pelvic-fin ray with developed dermal flap on dorsal surface, extending to ray tip and distinctly higher near fin base.

Etymology. The specific epithet *scutula* from the Latin, a diminutive of *scuta*, plate, scute, in allusion to the small plates that cover the abdominal region of *Pareiorhaphis scutula*. A noun in apposition.

Discussion

The new species is diagnosed as a member of *Pareiorhaphis* based on the possession of the derived features listed by Pereira *et al.* (2007) as diagnostic for the genus: cheeks, opercle, and the exposed lateral process of the cleithrum of adult males covered with hypertrophied odontodes, and lateroventral portion of preopercle deeply rugose due to the implantation of hypertrophied odontodes.

The most distinctive feature of *Pareiorhaphis scutula*, however, is the presence of small platelets irregularly scattered on the abdominal surface from pectoral girdle to pelvic-fin insertions (Fig. 2a), a feature common to the species of *Isbrueckerichthys* and that has not been previously reported among *Pareiorhaphis* species. The new species is not a member of *Isbrueckerichthys*, however, because its second infraorbital bone forms part of the lateral edge of nasal opening

(vs. infraorbital 2 not forming the edge of the nasal opening in *Isbrueckerichthys*) and because it possesses a dorsal-fin spinelet (vs. dorsal-fin spinelet usually absent in *Isbrueckerichthys*).

Two other species of *Pareiorhaphis*, *P. parmula* and *P. nasuta*, share the possession of a few platelets on each side of the pectoral girdle, just posterior to the gill opening (Pereira, 2005; Pereira *et al.*, 2007). Among these three species, *P. nasuta* shares with the new species four derived features, not found in other *Pareiorhaphis*, and are hypothesized to be sister-species. These characters are: (1) In most loricariids the lateral ethmoid forms the posterior rim of the nasal opening and is covered by skin or by dermal plates. In both *P. nasuta* and *P. scutula* the lateral ethmoid is exposed posterior to the nasal opening and support short odontodes. (2) Among neoplecostomines the interhyal articulates to the hyomandibula anteriorly, near the cartilaginous section between the hyomandibula and the quadrate. Contrarily, in *P. nasuta* and *P. scutula* the interhyal is articulated more posteriorly, near the central region of the ventral margin of the hyomandibula. (3) The articulation between the hyomandibula and the quadrate of loricariids occurs through a synchondral joint and, in some taxa, also via an interdigitate suture. In most loricariids the synchondral joint invariably reaches the posterior margin of the metapterygoid (Fig. 5a) while in *P. nasuta* and *P. scutula* the synchondral joint is shorter and never reaches the metapterygoid. In these species there is a bony process from the hyomandibula that articulates with the quadrate dorsally, preventing the cartilage to contact the metapterygoid (Fig. 5b; condition also shared with *Neoplecostomus paranensis*). (4) Contrary to most other loricariids, where the ventral process of the complex centrum falls short or extend to the mesial tip of the rib in the sixth centrum (Fig. 6a), *P. nasuta* and *P. scutula* share a longer ventral process, which reaches beyond the mesial tip of the rib in the sixth centrum (Fig. 6b; also shared with *Isbrueckerichthys*).

Comparative material examined. All from Brazil (in addition to that listed in Pereira & Reis, 2002): *Pareiorhaphis cameroni*: MCP 17276, 1 c&s, 83.8 mm SL, Santa Catarina, Água Mornas, rio Teresópolis, tributary to rio Cubatão at Águas Mornas. *Pareiorhaphis nasuta*: MCP 41476, 78.6 mm SL, holotype, Minas Gerais, Abre Campo, District of Granada, rio Doce drainage, ribeirão Areia Branca, tributary to the rio Matipó. MCP 37176, 10 + 2 c&s, 25.1-78.6 mm SL, paratypes, collected with the holotype. *Pareiorhaphis parmula*: MCP 35826, 93.3 mm SL, holotype, Paraná, Lapa, rio dos Patos, tributary to rio da Várzea on road PR-427 from Lapa to Campo Tenente. MCP 35827, 59 + 2 c&s, 45.0-94.5 mm SL (29, 45.7-94.5 mm SL), collected with the holotype. *Isbrueckerichthys epakmos*: MZUSP 79804, 103.1 mm SL, holotype, São Paulo, Tapiraí, Ribeira de Iguape drainage, rio Verde at Piúva, on road to Rio Verde. MCP 28276, 63, 39.5-83.3 mm SL, (20, 56.4-83.3 mm SL), paratypes, São Paulo, Tapiraí, rio Coruja, tributary to rio Juquiá, on road from Tapiraí to Juquiá near Cachoeira do Chá. *Isbrueckerichthys saxicola*: MCP 40209, 2, 59.7-84.7 mm SL, paratypes, Paraná, Londrina, rio Tibagi drainage, ribeirão Jacutinga. *Isbrueckerichthys calvus*: MCP 40208, 2, 72.5-86.2

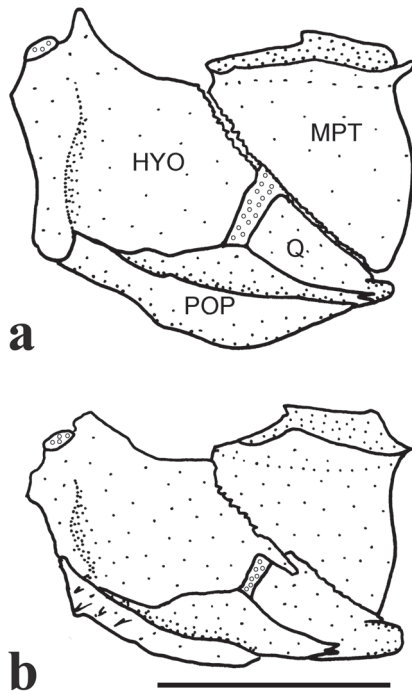


Fig. 5. Suspensory bones of *Pareiorhaphis*. (a) *P. parmula*, MCP 35827 and (b) *P. scutulula*, MCP 37182. HYO - hyomadibula, MPT - metapterygoid, POP - preopercle, Q - quadrate. Right side, lateral view. Scale bar = 5 mm.

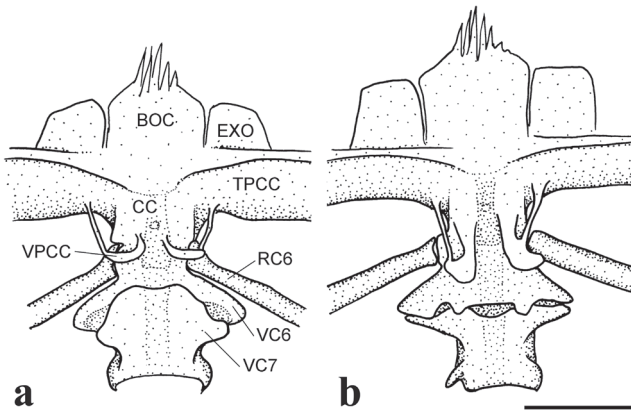


Fig. 6. Complex centrum of *Pareiorhaphis*. (a) *P. cameroni*, MCP 17276 and (b) *P. scutulula*, MCP 37182. BOC - basioccipital, CC - complex centrum, EXO - exoccipital, RC6 - rib of the sixth vertebral centrum, TPCC - transverse process of the complex centrum, VC - vertebral centrum, VPCC - ventral process of the complex centrum. Ventral view. Scale bar = 2 mm.

mm SL, paratypes, Paraná, Apucarana, rio Tibagi drainage, córrego Juruba. *Neoplecostomus microps*: MCP 20069, 4, 47.1-89.3 mm SL, São Paulo, Piquete, ribeirão Benfica at Benfica, ca. 1 km of Piquete. MCP 20071, 13, 45.1-98.3 mm SL, São Paulo, Silveiras, ribeirão Macacos at Bairro dos Macacos. *Pareiorhina carrancas*: LIRP 2280, 1 + 1 c&s, 35.8-36.9 mm SL, paratypes, Minas Gerais, Carrancas, córrego Debaixo da Serra. *Pareiorhina rudolphi*: MCP 18052, 23 + 1 c&s, 30.4-49.3 mm SL, São Paulo, Piquete, creek tributary of rio Piquete at Benfica. *Kronichthys subteres*: MCP

20150, 32, 38.1-76.8 mm SL, São Paulo, Iporanga, córrego Areias, ca. 1 km SE from Bairro da Serra. *Hemipsilichthys nimius*: MCP 33049, 105.1 mm SL, holotype, Rio de Janeiro, Parati, rio Carrasquinho below Cachoeira do Tobogã. MCP 31990, 11, 45.7-98.1 mm SL, paratypes, collected with the holotype. *Delturus brevis*: MCP 26927, 2 + 1 c&s, 86.5-146.7 mm SL, paratypes, Minas Gerais, Rubelita, rio Salinas, tributary of rio Jequitinhonha near Rubelita.

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