

A new killifish of the genus *Melanorivulus* from the upper Paraná river basin, Brazil (Cyprinodontiformes: Rivulidae)

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Abstract

Melanorivulus leali, new species, from the Grande river drainage, south-eastern Brazil, is described. It differs from all other congeners by possessing a unique colour pattern, comprising red dots on body side arranged in chevron shaped rows, a broad dark grey stripe along the whole flank, flank light blue in males, dorsal and ventral portions of the caudal fin light orangish red in males, conspicuous orangish red bars on the middle of the caudal fin in males, and dorsal portion of the caudal-fin base with a small vertically elongated black spot. The presence of a black bar on the anterior and another on the posterior portion of the iris almost in contact with the pupil and the shape of the chevron-like rows of red spots on the flank, in which the angle is placed on the midline of the flank indicate that *M. leali* is more closely related to congeners endemic to the Paraná-Paraguay river system than to congeners endemic to the Amazonas river basin. This first record of the genus *Melanorivulus* from the Grande river drainage suggests that it may have formerly occupied a larger region of this basin, presently under severe process of deforestation and aquatic habitat decline.

Key words

Biodiversity, conservation, Grande river, Neotropical region, taxonomy.

Introduction

Melanorivulus COSTA, 2006 is a genus of small killifishes inhabiting shallow freshwater habitats of central, northern and north-eastern South America (COSTA, 2011). It comprises over 50 species and its greatest species diversity is concentrated in the region encompassing the upper Paraná and upper Araguaia river basins (COSTA, 2005, 2006, 2007, 2008a–c, 2013). Records for the Paraná river basin include numerous localities in the Paranaíba river drainage and some localities associated to the western part of the middle Paraná basin (COSTA, 2005, 2007, 2008a–c). Material collected in the Grande river drainage, a large tributary coming from the East to

form the main course of the Paraná river, was sent for study by FABIANO LEAL in 2007. This material was preliminarily identified as *M. zygonectes* (MYERS, 1927) by the overall similarity in colour pattern, fin morphology, morphometric and meristic data, despite *M. zygonectes* being endemic to an area of the Tocantins river basin about 900 km distant from the that locality in the Grande river drainage. After recently obtaining larger collections of *M. zygonectes* from its the type locality region as comparative material, it was possible to recognise the material collected in the Grande river drainage as a new species, which is herein described.

Material and methods

Material is deposited in UFRJ, Instituto de Biologia, Universidade Federal do Rio de Janeiro, Rio de Janeiro. Morphological characters used in the description below were obtained from specimens fixed in formalin just after collection, for a period of about ten days, and then transferred to 70 % ethanol. Descriptions of colour patterns were based on photographs of the both known specimens taken in small aquaria a few days after collection. Measurements and counts follow COSTA (1995). Measurements are presented as percentages of standard length (SL), except for those related to head morphology, which are expressed as percentages of head length. Fin-ray counts include all elements. Number of vertebrae and gill-rakers were recorded only from the cleared and stained specimen; the compound caudal centrum was counted as a single element. The osteological preparation was made according to TAYLOR & VAN DYKE (1985). Terminology for cephalic neuromast series COSTA (2001). The abbreviation c&s means specimens cleared and stained for bone and cartilage. Delimitation of species is according to the methodology of the Population Aggregation Analysis (DAVIS & NIXON, 1992), in which species are delimited by a unique combination of morphological character states. Comparisons focus on characters extracted from the colour pattern of living individuals just after collections, which have been demonstrated to be highly informative to infer species limits in aplocheiloid killifishes (e.g., COSTA et al., 2012).

Melanorivulus leali spec. nov.

Figs. 1–2, Table 1

Holotype: UFRJ 6866, 28.8 mm SL, male; Brazil: Estado de São Paulo: Município de Serra Azul: stream tributary of Tamanduazinho river, Pardo river drainage, itself part of Grande river drainage, upper Paraná river basin, 21°20'00"S 47°34'20", altitude about 700 m; M. MARTINS, 22 July 2007.

Paratypes: UFRJ 6539, 9 males, 24.6–29.3 mm SL, 10 females, 19.0–32.0 mm SL; UFRJ 6540, 2 males, 23.0–24.4 mm SL, 2 females, 22.4–27.6 mm SL (c&s); collected with the holotype.

Diagnosis. *Melanorivulus leali* is distinguished from all other congeners by the following character states in combination: red dots on body side arranged in chevron shaped rows with angle on the midline of the flank, a broad dark grey stripe along the whole flank, flank light blue in males, dorsal and ventral portions of the caudal fin light orangish red in males, conspicuous orangish red bars on the middle of the caudal fin in males, dorsal portion of the caudal-fin base with a small vertically elongated black spot, and a black bar on the anterior and another

Table 1. Morphometric data of *Melanorivulus leali*.

	holotype	paratypes	
	male	males (4)	females (5)
Standard length (mm)	28.8	24.7–29.3	24.7–27.9
Percent of standard length			
Body depth	21.4	19.9–20.9	19.3–20.4
Caudal peduncle depth	12.8	12.3–13.0	11.7–12.8
Predorsal length	74.9	72.6–75.8	73.8–77.1
Prepelvic length	55.1	52.1–54.7	52.9–55.3
Length of dorsal-fin base	11.9	11.1–12.1	11.2–12.3
Length of anal-fin base	20.0	16.7–21.5	16.8–21.2
Caudal-fin length	36.1	36.1–37.6	34.1–36.8
Pectoral-fin length	21.4	20.2–21.5	18.3–21.2
Pelvic-fin length	10.8	9.1–12.1	8.7–9.8
Head length	25.4	24.3–25.5	24.0–26.4
Percent of head length			
Head depth	69.6	66.9–71.8	64.9–70.3
Head width	84.2	75.8–81.1	76.0–80.1
Snout length	14.5	13.6–15.0	12.5–13.7
Lower jaw length	21.1	19.2–21.8	18.3–21.2
Eye diameter	30.0	30.0–33.1	30.9–34.9

on the posterior portion of the iris almost in contact with the pupil.

Description. Morphometric data appear in Table 1. Dorsal profile about straight from snout to dorsal-fin origin, posteriorly inclined and nearly straight on dorsal-fin base and caudal peduncle. Ventral profile gently convex from lower jaw to end of anal-fin base, about straight on caudal peduncle. Body slender, subcylindrical anteriorly, slightly deeper than wide, to compressed posteriorly. Greatest body depth at vertical just in front to pelvic-fin base. Jaws short, snout blunt.

Extremity of dorsal and anal fins rounded. Caudal fin rounded, slightly longer than deep. Pectoral fin rounded, posterior margin reaching vertical at about 90 % of length between pectoral-fin and pelvic-fin bases. Pelvic fin small, tip reaching between anus and base of 1st anal-fin ray. Pelvic-fin bases medially in contact. Dorsal-fin origin on vertical through base of 8th or 9th anal-fin ray; second proximal radial of dorsal fin between neural spines of 19th and 21st vertebrae, first proximal radial of anal fin between pleural ribs of 14th and 15th vertebrae. Dorsal-fin rays 9–11; anal-fin rays 13–15; caudal-fin rays 30–31; pectoral-fin rays 13; pelvic-fin rays 7.

Scales small, cycloid. Body and head entirely scaled, except anterior ventral surface of head. Body squamation extending over anterior 30 % of caudal-fin base; no scales on dorsal and anal-fin bases. Frontal squamation F-patterned; E-scales not overlapping medially; scales arranged in regular circular pattern around A-scale without exposed margins; transverse row of scales anterior to H-scale. Five supraorbital scales. Longitudinal series of scales 32–35; transverse series of scales 7; scale rows around caudal peduncle 16. No contact organs on flank and fins.



Fig. 1. *Melanorivulus leali*, UFRJ 6866, holotype, male, 28.8 mm SL: Brazil: São Paulo: Serra Azul.



Fig. 2. *Melanorivulus leali*, UFRJ 6539, paratype, female, 27.9 mm SL: Brazil: São Paulo: Serra Azul.

Cephalic neuromasts: supraorbital 3+3, parietal 1, anterior rostral 1, posterior rostral 1, infraorbital 1+11–12+1, preorbital 2, otic 1, post-otic 2, supratemporal 1, median opercular 1, ventral opercular 1–2, preopercular 2+4, mandibular 3+1, lateral mandibular 2, paramandibular 1. Lateral line interrupted, alternating sets of 3–4 scales with one neuromast and without neuromasts. Two neuromasts on caudal-fin base.

Basihyal subtriangular, greatest width about 45–50 % of length; basihyal cartilage about 20 % of total length of basihyal. Six branchiostegal rays. Second pharyngo-branchial teeth absent. Gill-rakers on first branchial arch 1+7. Vomerine teeth 1–2. Dermosphenotic present. Ventral process of posttemporal absent. Total vertebrae 31–32.

Colouration. Males. Side of head and flank light blue, with broad dark grey mid-lateral stripe between postorbital region and caudal-fin base; oblique rows of red dots on flank, more concentrated on caudal peduncle, forming

chevron-like marks anteriorly directed with angle on midline of flank. Dorsum light brown with dark brown dots. Venter white. Upper jaw light grey, lower jaw dark grey to black; light blue iridescence on sub-orbital region, golden on ventral part of opercle. Iris pale yellow, with broad dark brown to black bar on anterior and posterior portions, close to pupil. Dorsal fin light bluish grey to pale yellow on distal portion, with short transverse red stripes on posterior region. Anal fin light blue with red dots on basis, pale yellow on middle and distal portion. Caudal fin orangish red on dorsal and ventral portions, bluish hyaline with vertical rows of orangish red dots on middle. Pectoral fins hyaline. Pelvic fins yellowish hyaline.

Females. Similar to males, except by absence of red marks on unpaired fins; distal margin of dorsal and anal fins, whole margin of caudal fin and anterior margin of pelvic fin dark grey to black; small; and caudal fin pale yellow with 5–6 dark grey to black bars and dorsally elongated, black spot on dorsal portion of fin base.

Distribution. Known only from the type locality, a small stream of the Grande river drainage, upper Paraná river basin, south-eastern Brazil.

Etymology. The name *leali* is honour of FABIANO LEAL for his dedication in breeding aplocheiloid killifishes and for providing material of the new species.

Discussion

The description of *M. leali* constitutes the first record of a rivulid for the Grande river drainage, which with a course about 1,100 km long is one of the most important tributaries of the upper Paraná river basin. This new record for the genus suggests that *Melanorivulus* may have had a larger geographical distribution in the past along the several tributaries of the Grande river. However, this region have been intensively deforested in the last 200 years, today resting rare vestiges of the original vegetation, a process greatly affecting the integrity of aquatic habitats.

Melanorivulus leali is distinguished from *M. zygonectes* by the former having flank light blue in males (vs. pale grey, without iridescent colours), conspicuous red bars on caudal fin in males (vs. vertical rows of faint red dots, sometimes forming pale bars), depth of dark grey stripe on flank about half body depth (vs. about one third), and caudal spot in females often almost inconspicuous, vertically elongated and highly overlapped by anterior caudal fin bar (vs. always conspicuous, horizontally elongated). Two other details of the colour pattern indicate that *M. leali* is more closely related to species endemic to the Paraguay and Paraná river basins than to *M. zygonectes*: there is a black bar on the anterior and another on the posterior portion of the iris almost in contact to the pupil (vs. anterior and posterior portion of the pupil dark, but not forming distinctive bars close to the pupil in *M. zygonectes*) and red dots on body side arranged in chevron shaped rows with angle on the midline of flank (vs. angle on the ventral part of the flank).

It is possible that *M. dapazi*, endemic to the Paraguay river basin (COSTA, 2005) is the closest relative of *M. leali*. Both species share a broad dark grey stripe on the posterior part of the flank and red pigmentation on the caudal fin in males. *Melanorivulus leali* is distinguished from *M. dapazi* by the former having oblique rows of red dots on the flank (vs. bars), absence of a dark orangish red stripe on the distal margin of the anal fin in males (vs. presence), and caudal fin light orangish red on dorsal and ventral portions (vs. whole marginal zone dark orangish red with black outline).

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