

A New Pelvicless Killifish Species of the Genus *Rivulus*, Subgenus *Melanorivulus* (Cyprinodontiformes: Rivulidae), from the Upper Tocantins River Basin, Central Brazil

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***Rivulus planaltinus*, new species, from the Maranhão River drainage, upper Tocantins River basin, central Brazil, is described. It is a member of a subclade of the subgenus *Melanorivulus* endemic to the central Brazilian plateau, which is diagnosed by having ventral process of angulo-articular vestigial and flank intense greenish blue or greenish golden, to purplish blue above anal-fin base in males. The new species differs from all other species of the subgenus *Melanorivulus* by the absence or extreme reduction of pelvic fins and pelvic girdle, numerous vomerine teeth, and a wide basihyal.**

***Rivulus planaltinus*, sp. n., da drenagem do rio Maranhão, bacia do alto rio Tocantins, Brasil central, é descrita. Ela é um membro de um sub-clado do subgênero *Melanorivulus* endêmico do planalto central brasileiro, o qual é diagnosticado por possuir processo ventral de ângulo-articular vestigial e flanco azul esverdeado intenso ou dourado esverdeado, a azul arroxado acima da base da nadadeira anal em machos. A nova espécie difere de todas as outras espécies do subgênero *Melanorivulus* pela ausência ou redução extrema de nadadeiras pélvicas e cintura pélvica, dentes de vomer numerosos, e um largo basial.**

THE subgenus *Melanorivulus* consists of a diversified clade of killifishes, first taxonomically treated in Costa (1989), and also formerly known as “the *punctatus* superspecies” (Huber, 1992), “the *Rivulus punctatus* species-complex” (Costa, 1995a), or “the *Rivulus punctatus* group” (Costa, 1998). It is diagnosed by an osteological feature (dorsal portion of preopercle short and pointed) and three derived color patterns (melanophores concentrated on opercular region to form oblique stripes, melanophores concentrated on margins of unpaired and pelvic fins in females, black spot on upper portion of caudal-fin base not close to fin margin in females). *Melanorivulus* includes 19 valid described species and several undescribed species, occurring in the river basins draining the Brazilian Shield (southern tributaries to the Amazonas, Paraná-Paraguay-Uruguay, São Francisco, and Parnaíba river basins; Costa, 2006a, 2006b). All except two species, *R. punctatus* and *R. zygometes*, were described after 1989, as a result of collections directed to sample *Melanorivulus* habitats. Species of *Melanorivulus* inhabit sunny aquatic environments, such as shallow pools, canals, and streams, with orange clay bottom, clear water, pH 5.0–6.5 (Costa, 2006a). They are often found in the Veredas, streams dominated by the buriti-palm *Mauritia flexuosa*, typical of the savanna-like Brazilian Cerrado. A new species with an unusual absence or great reduction of pelvic fins, collected in the upper Tocantins River basin, is herein described.

MATERIALS AND METHODS

Measurements and counts follow Costa (1995a). 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, gill-rakers, and pectoral-, pelvic-, and caudal-fin rays were recorded only from cleared-and-stained specimens; the compound caudal centrum was counted as a single element. Meristic values for holotype are given in parenthesis. Osteological preparations (CS) were made according to Taylor and Van Dyke (1985). Terminology for frontal squamation follows Hoedeman (1958), for cephalic neuromast series Costa (2001), and for bones Costa (1998).

Rivulus planaltinus, new species

Figures 1, 2

Holotype.—UFRJ 6496, male, 28.8 mm SL, Brazil, Estado de Goiás, Município de Planaltina de Goiás, Cocal River floodplains, road BR-010 about 4 km S of São Gabriel de Goiás, Maranhão River drainage, upper Tocantins River basin, 15°16'11''S, 47°33'13''W, altitude 1,100 m, 24 Jan. 2007, G. C. Brasil and W. J. E. M. Costa.

Paratypes.—UFRJ 6497, 12 males, 21.4–31.1 mm SL, 8 females, 22.3–27.6 mm SL; MCP 41324, 2 males, 25.2–25.8 mm SL, 2 females, 22.2–25.6 mm SL; UFRJ 6499, 2 males, 26.9–30.2 mm SL, 2 females, 24.7–27.8 mm SL (CS); all collected with holotype.

Diagnosis.—*Rivulus planaltinus* is a member of the subgenus *Melanorivulus* by having all the subgeneric synapomorphic features: dorsal portion of preopercle short and pointed, melanophores concentrated on opercular region to form oblique stripes, melanophores concentrated on margins of unpaired fins in females, black spot on upper portion of

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Fig. 1. *Rivulus planaltinus*, UFRJ 6496, male, holotype, 28.8 mm SL; Brazil: Goiás: Planaltina de Goiás (Photo by W. J. E. M. Costa).

caudal-fin base not close to fin margin in females. It is distinguished from all other species of *Melanorivulus* by the absence or extreme reduction of pelvic fins and pelvic girdle (vs. pelvic fins and pelvic girdle always present and well-developed), more vomerine teeth (5–7 vs. 1–5) and wider basihyal (basihyal width about 70% basihyal length, vs. 45–60%).

Description.—Morphometric data appear in Table 1. Largest male examined 31.1 mm SL; largest female examined 27.6 mm SL. Dorsal profile slightly convex from snout to end of dorsal-fin base, about straight to slightly concave on caudal peduncle. Ventral profile weakly convex from lower jaw to anal-fin origin, approximately straight or slightly concave to end of caudal peduncle. Body slender, compressed, greatest body depth at midlength between pectoral-fin base and anal-fin origin. Snout short, rounded.

Dorsal and anal fins rounded and without filaments in both sexes. Pectoral fin rounded, its posterior margin reaching about 40% of distance between pectoral-fin base

and anal-fin origin. Pelvic fin and pelvic girdle usually absent ($n = 22$), sometimes single pelvic fin ($n = 5$) or rarely paired pelvic fins present ($n = 2$), always minute, tip not reaching to anus, length 6.0–7.2% SL. Dorsal-fin origin in vertical through base of 8th or 9th anal-fin ray, between neural spines of vertebrae 19 and 21. Anal-fin origin between pleural ribs of vertebrae 14 and 16. Dorsal-fin rays 8–10 (9); anal-fin rays 12–14 (12); caudal-fin rays 32; pectoral-fin rays 13. Pelvic-fin rays 5–6 when pelvic fin is present.

Scales large, cycloid. Body and head entirely scaled, except on anterior part of ventral surface of head. No scales on dorsal and anal-fin bases. Scales extending on anterior 30% of caudal fin. Frontal squamation E-patterned; E-scales not overlapping. No scale anterior to H-scale. Supraorbital scales 5. Longitudinal series of scales 31–33 (33); transverse series of scales 8; scale rows around caudal peduncle 16. No contact organs on scales and fin rays.

Cephalic neuromasts: supraorbital 3 + 3, parietal 2, anterior rostral 1, posterior rostral 1, infraorbital 1 + 10 +

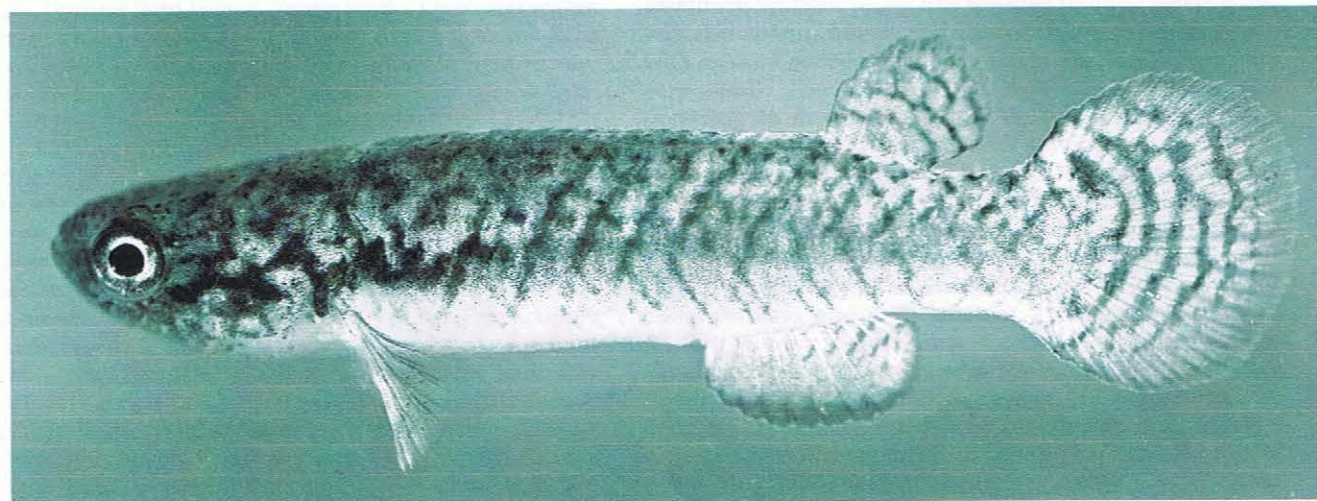


Fig. 2. *Rivulus planaltinus*, UFRJ 6497, female, paratype, 27.2 mm SL; Brazil: Goiás: Planaltina de Goiás (Photo by W. J. E. M. Costa).

Table 1. Morphometric Data of *Rivulus planaltinus*.

	Holotype	Males (n = 10)	Females (n = 10)
Standard length (mm)	28.8	21.4–31.1	22.2–27.6
Percents of standard length			
Body depth	25.3	23.7–26.5	22.4–25.0
Caudal peduncle depth	15.8	14.6–16.8	14.1–15.8
Predorsal length	76.0	76.0–81.4	77.3–81.6
Length of dorsal-fin base	12.1	10.8–12.2	10.2–11.7
Length of anal-fin base	17.4	16.8–20.9	15.6–17.7
Caudal-fin length	29.5	29.4–32.1	28.7–31.6
Pectoral-fin length	19.5	17.7–20.1	16.9–19.7
Head length	27.3	27.3–30.8	27.4–29.2
Percents of head length			
Head depth	79.0	70.4–79.0	72.5–78.0
Head width	80.2	73.4–84.6	75.4–81.1
Snout length	13.3	11.4–13.3	11.4–13.7
Lower jaw length	18.6	16.0–19.0	15.5–18.9
Eye diameter	33.3	30.5–35.1	30.9–35.4

1, preorbital 1, otic 1, post-otic 1–2, supratemporal 1, median opercular 1, ventral opercular 1, preopercular 2 + 4, mandibular 3 + 1, lateral mandibular 2, paramandibular 1. Lateral line interrupted, alternating one scale with one neuromast and sets of 3–4 scales without neuromasts. Two neuromasts on caudal-fin base.

Basihyal subtriangular, greatest width about 70% of length; basihyal cartilage about 15% of total length of basihyal. Six branchiostegal rays. Second pharyngobranchial teeth absent. Gill-rakers on first branchial arch 1 + 8. Vomerine teeth 5–7. Dermosphenotic present. Ventral process of posttemporal absent. Total vertebrae 30–32.

Coloration.—Males with side of body light blue to light greenish blue, purplish blue above anal-fin base, pale brownish golden on dorsolateral portion of body between postorbital region and anterior portion of flank; narrow red oblique bars on entire flank, often forming chevron-like marks with anterior tip, ventral extension of bars often duplicated; black melanophores irregularly extending between postorbital and humeral regions, forming oblique stripes. Dorsum light brown. Venter white. Opercular region greenish golden. Ventral part of head gray. Upper jaw light brown, lower jaw dark gray. Iris pale yellow to light brown. Dorsal fin pale yellow with 3–4 oblique reddish gray stripes. Anal fin pale yellow to light blue on basal region. Caudal fin pale yellow with 5 narrow reddish gray bars. Pectoral fin hyaline.

Females with side of body light blue to light greenish blue, with narrow red oblique bars on entire flank, often forming chevron-like marks with anterior tip; black irregular shaped stripes between postorbital and humeral regions. Dorsum light brown. Venter white. Ventral part of head gray. Upper jaw light brown, lower jaw dark gray. Iris pale yellow to light brown. Dorsal fin pale yellow with 3–4 oblique dark gray stripes; dark gray to black distal margin. Anal fin pale yellow, base light blue, with short oblique dark brown bars on posterior portion; dark gray to black distal margin. Caudal fin light pink, to pale yellow on basal portion, with 5–6 narrow dark brown bars; dark gray to black margin; small, vertically elongate, dark gray spot, dorsally margined by

short yellow zone, on dorsal portion of caudal-fin base. Pectoral fin hyaline.

Distribution.—*Rivulus planaltinus* is known only from the type locality in the Cocal River floodplains, Maranhão River drainage, upper Tocantins River basin at an altitude of 1,100 m, central Brazil.

Etymology.—The name *planaltinus* is derived from the Planaltina (=from the high plains), a Portuguese name for the county where the type locality is located.

DISCUSSION

The most distinctive feature of *R. planaltinus* is the absence or reduction of the pelvic fins. Among the 29 specimens examined, 22 lack the pelvic fins (about 76% of all examined specimens), whereas seven have minute pelvic fins. Among specimens with minute pelvic fins, five specimens (about 17%) have a single pelvic fin, and two (about 7%) have paired pelvic fins. Examination of three cleared and stained specimens without pelvic fins revealed that the pelvic girdle was also absent, but in one cleared and stained specimen with minute paired pelvic fins, the girdle was present, but very small. The loss or great reduction of pelvic fins occurring in *R. planaltinus* is a unique condition among species of *Melanorivulus*. Absence of pelvic fin and pelvic-fin support was also reported for *R. nudiventris*, a species endemic to the coastal plains of eastern Brazil (Costa and Brasil, 1991). *Rivulus planaltinus* is a typical member of *Melanorivulus*, possessing all the diagnostic features of the subgenus, whereas *R. nudiventris* belongs to the subgenus *Cynodonichthys* and a member of a clade known as the *Rivulus santensis* species group (Costa, 1998), which are not closely related to *Melanorivulus* (Costa, 2006a), and diagnosed by a curved ventral process of the angulo-articular bone and numerous infraorbital neuromasts disposed in a zigzag pattern (Costa, 2006a, in press). Therefore, the loss of pelvic fins in *R. nudiventris* and a similar loss or great reduction in *R. planaltinus* are considered as independently arisen in *Melanorivulus* and *Cynodonichthys*.

Among species of *Melanorivulus*, *R. planaltinus* fits into a species-clade endemic to the central Brazilian plateau and adjacent Paraná River floodplains, which includes *R. apiamici*, *R. egens*, *R. kayapo*, *R. litteratus*, *R. pictus*, *R. pinima*, *R. rutilicaudus*, *R. scalaris*, and *R. vittatus*, in which are distinguished in having two apomorphic features, as pointed out by Costa (2005, 2006a): vestigial ventral process of angulo-articular (vs. process well-developed) and flank intense greenish blue or greenish golden, to purplish blue above anal-fin base (vs. never a similar color pattern). *Rivulus planaltinus* is most similar to *R. pictus*, which is endemic to a region adjacent to the type locality of *R. planaltinus*, but draining into the upper São Bartolomeu River drainage of the upper Paraná River basin (Costa, 1989, 2005). Both species have identical color patterns in males and females (see color description above) and similar meristic data. *Rivulus planaltinus* differs from those species all other species the central Brazilian plateau in having more vomerine teeth (5–7 vs. 1–3) and a wider basihyal (basihyal width about 70% basihyal length, vs. 45–55%).

The only other species of *Melanorivulus* reported to occur in the Tocantins River basin is *R. zygones*, which occurs in the middle section of the basin. *Rivulus zygones* has a well-developed, pointed ventral process of angulo-articular and flank pale purplish blue in males, instead the apomorphic conditions shared by *R. planaltinus* and other species endemic to the central Brazilian plateau (i.e., ventral process of angulo-articular vestigial and flank intense greenish blue or greenish golden, to purplish blue above anal-fin). *Rivulus zygones* has been considered a member of another clade of *Melanorivulus*, which is diagnosed by the presence of a diffuse broad midlateral dark gray stripe between postorbital region and caudal-fin base, conspicuous when the fish is exposed to sunlight or is stressed (Costa, 2006a). This derived condition is also present in *R. parnaibensis* from the Parnaíba Basin, and *R. punctatus*, *R. dapazi*, *R. rossoi*, and *R. cyanopterus*, from the Paraguay Basin (Costa, 2005, 2006a). In addition to diagnostic characters of their respective subgeneric clades, *R. zygones* is further distinguished from *R. planaltinus* in having well-developed pelvic fins, 4 or 5 vomerine teeth, a basihyal width of 60% of its length, 33–35 scales in the longitudinal series and F-patterned frontal squamation.

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