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***Rivulus schuncki*, a new species of the killifish subgenus *Melanorivulus*, from eastern Brazilian Amazon (Cyprinodontiformes: Rivulidae)**

Wilson J. E. M. Costa* and Andre C. De Luca

Rivulus schuncki, new species, is described from the Anauerapucu River drainage, lower Amazonas River basin, northern Brazil. It is distinguished from all other species of the subgenus *Melanorivulus* by its pointed snout in lateral view, 12 rows of scales around the caudal peduncle, bright green bars on the flank and caudal fin in males, flank dark brown with small light gray spots on ventral part in females, pelvic fin without dark gray or black anterior margin in females and by the absence of red bars or dots arranged in chevron-like pattern on flank. *Rivulus schuncki* constitutes the first record of the subgenus *Melanorivulus* north of the Amazonas River.

Rivulus schuncki, sp. nov., é descrita da drenagem do rio Anauerapucu, bacia do baixo rio Amazonas, norte do Brasil. Ela se distingue de todas as outras espécies do subgênero *Melanorivulus* pela presença de focinho pontiagudo em vista lateral, 12 fileiras de escamas em torno do pedúnculo caudal, barras verde brilhante no flanco e nadadeira caudal de machos, flanco castanho escuro com pequenas manchas cinza claras na parte ventral em fêmeas, nadadeira pélvica sem margem anterior cinza escura ou negra em fêmeas e pela ausência barras ou pontos vermelhos arranjados em padrão de divisa no flanco. *Rivulus schuncki* constitui o primeiro registro de uma espécie de *Melanorivulus* ao norte do rio Amazonas.

Introduction

Melanorivulus is a diversified killifish clade with a broad geographic distribution in central and northeastern South America (Costa, 2006a). A total of 34 valid species have been recorded from the Paraguay, Paraná, São Francisco, Parnaíba, and Amazonas river basins (Costa, 1989, 1991, 2003a-b, 2005, 2006b, 2007a-b, 2008a-e, 2009, 2010;

Costa & Brasil, 2008). Among the 11 species endemic to the Amazonas river basin, all are restricted to the southern tributaries of the Amazonas River, including the Tocantins, Araguaia, Xingu and Tapajós river drainages (Costa, 1991, 2005, 2006b, 2007a, 2008a, 2009, 2010). The new species herein described constitutes the first record for a species of *Melanorivulus* north of the Amazonas River.

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Material and methods

Morphological characters were obtained from specimens fixed in formalin just after collection, for a period of 10 days, and then transferred to ethanol 70 %. Material is deposited in the ichthyological collection of the Instituto de Biologia, Universidade Federal do Rio de Janeiro, Rio de Janeiro (UFRJ).

Descriptions of color patterns were based both on direct examination of freshly preserved specimens and photos taken just after collection. Measurements and counts follow Costa (1995); a complete set of measurements was made only in specimens adequately preserved, avoiding errors due to bad fixation (e.g., specimens with twisted body). Measurements are presented as percent of standard length (SL), except for those related to head morphology, which are expressed as percent of head length. Fin-ray counts include all elements. Number of vertebrae and gill-rakers were recorded from cleared and stained specimens; the compound caudal centrum was counted as a single element. Osteological preparations (c&s) were made according to Taylor & Van Dyke (1985), but cartilages were not stained to avoid ossification damage produced by the acetic acid present in the Alcian Blue solution. Terminology for frontal squamation follows Hoedeman (1958) and for cephalic neuromast series Costa (2001).

Delimitation of species follows the methodology of the Population Aggregation Analysis (Davis & Nixon, 1992).

Rivulus schuncki, new species

(Fig. 1)

Holotype. UFRJ 6766, male, 24.4 mm SL; Brazil: Estado do Amapá, stream near Vila Nova, road AP 030, Anauerapucu River drainage, Amazonas River basin, 0°8'23"N 51°32'14"W; A. C. De Luca and F. Schunck, 7 Feb 2010.

Paratypes. UFRJ 6767, 1 male, 19.8 mm SL, and 3 females, 20.8-23.1 mm SL; UFRJ 6768, 3 males, 16.8-20.9 mm SL, and 3 females, 18.0 mm SL (c&s); all collected with holotype.

Diagnosis. Distinguished from all other species of *Melanorivulus* by having the snout pointed in lateral view (vs. rounded), 12 rows of scales around caudal peduncle (vs. 14 in *R. decoratus* and 16 in the remaining species), bright green bars on the flank and caudal fin in males (vs. green bars absent), absence of red bars or dots arranged in chevron-like pattern on flank (vs. presence), flank dark brown with small light gray spots on ventral part in females (vs. never a similar color pattern), and pelvic fin without a

Table 1. Morphometric data of *Rivulus schuncki* (male ranges include holotype values).

	holotype UFRJ 6766	males (n=3)	females (n=3)
Standard length (mm)	24.4	19.8-24.4	20.8-23.1
Percent of standard length			
Body depth	19.0	18.6-19.0	19.0-20.0
Caudal peduncle depth	12.5	12.4-13.6	12.2-12.4
Predorsal length	75.9	75.9-77.8	77.2-79.7
Prepelvic length	52.2	52.2-55.4	54.1-56.0
Length of dorsal-fin base	9.8	9.0-9.8	8.9-9.7
Length of anal-fin base	18.5	17.9-18.6	15.4-16.4
Caudal-fin length	39.2	39.2-40.3	37.6-40.5
Pectoral-fin length	22.5	21.9-23.2	21.3-23.1
Pelvic-fin length	14.4	12.7-15.4	10.5-12.0
Head length	26.5	26.5-27.7	27.0-28.4
Percent of head length			
Head depth	59.0	55.8-59.9	57.7-59.9
Head width	70.9	68.9-70.9	72.5-72.8
Snout length	12.7	12.6-13.2	13.6-14.5
Lower jaw length	16.3	15.7-16.3	15.4-18.2
Eye diameter	35.1	35.1-35.9	31.9-36.2



dark gray or black anterior margin in females (vs. anterior margin of pelvic fin always dark gray or black).

Description. Morphometric data appear in Table 1. Largest male examined 24.4 mm SL; largest female examined 23.1 mm SL. Dorsal profile slightly convex, almost straight, from snout to end of dorsal-fin base, approximately straight to slightly concave on caudal peduncle. Ventral profile gently convex from lower jaw to anal-fin origin, nearly straight along caudal peduncle. Body slender, subcylindrical anteriorly, slightly deeper than wide, to compressed posteriorly. Greatest body depth just anterior to pelvic-fin base. Jaws short, snout slightly pointed in lateral view.

Extremity of dorsal and anal fins rounded in both sexes. Caudal fin elliptical. Pectoral fin rounded, its posterior margin reaching pelvic-fin base in males, and about 90 % of distance between bases of pectoral and pelvic fins in females. Pelvic fin tip reaching between base of 2nd and 3rd anal-fin rays in males, between anus and urogenital papilla in females. Pelvic-fin bases in close proximity. Dorsal-fin origin in vertical through base of 9th or 10th anal-fin rays, between neural spines of 18th and 20th vertebrae. Anal-fin origin between pleural ribs of 12th and 14th vertebrae. Dorsal-fin rays 8-9; anal-fin rays 11-13; caudal-fin rays 27-30; pectoral-fin rays 12-13; pelvic-fin rays 7.

Scales large, cycloid. Trunk and head entirely scaled, except on anterior portion of ventral surface of head. No scales on dorsal and anal-fin bases. Scales extending over anterior 20 % of caudal fin. Frontal squamation F-patterned, frontal scales circularly arranged around A-scale without free margins; E-scales not overlapping medially; supraorbital scales 2. Longitudinal series of scales 28-30; transverse series of scales 6; scale rows around caudal peduncle 12. No contact organ on flank and fins.

Cephalic neuromasts: supraorbital 3+3, parietal 2, anterior rostral 1, posterior rostral 1, infraorbital 1+14+1, preorbital 2, otic 1, post-otic 2, supratemporal 1, median opercular 1, ventral opercular 1, preopercular 2+4, mandibular 3+1, lateral mandibular 2, paramandibular 1. One neuromast per scale of lateral line, often absent. Two neuromasts on caudal-fin base.

Premaxillary and dentary teeth conical. Basihyal subtriangular, greatest width about 55 % of

length; basihyal cartilage about 30 % of total basihyal length. Six branchiostegal rays. Second pharyngobranchial teeth absent. Gill-rakers on first branchial arch 1+8. Vomerine teeth absent. Dermosphenotic present. Ventral process of post-temporal absent. Total vertebrae 28-29.

Coloration. Males. Side of body gray to light blue on ventral portion, scale margin reddish brown, with oblique bright green bars. Side of head light gray; black stripe with irregular margins on midline of body, between head side just posterior to posterior margin of orbit and anterior third of flank. Lower jaw black. Dark brown reticulation on ventral part of head. Dorsum greenish brown with brown blotches. Venter white. Iris light brown. Dorsal fin greenish yellow, with faint gray spots on basal region. Anal fin pale blue, with faint reddish gray oblique bars. Caudal fin with reddish brown and bright green alternating bars, upper and ventral regions pale blue to pale greenish yellow; whole caudal fin with narrow dark gray margin. Pectoral fin yellowish hyaline. Pelvic fin hyaline.

Females. Flank dark brown with small light gray spots on ventral part. Dorsum light brown with brown blotches. Venter white. Side of head light brown; black stripe with irregular margins on midline of body, between head side just posterior to posterior margin of orbit and anterior third of flank. Lower jaw black. Iris light brown. Unpaired fins hyaline; transverse dark brown bars on caudal fin; oblique dark brown bars on basal portion of dorsal fin; small dark brown spots on basal portion of anal fin; distal margin of dorsal fin, and all margins of caudal fin dark gray; distal margin of anal fin black; elliptical black spot on upper portion of caudal-fin base, separated from upper margin of fin by interspace about equal or slightly shorter than spot depth. Paired fins hyaline.

Distribution and habitat. *Rivulus schuncki* is known only from the type locality, a small clear water stream tributary to the Vila Nova River, which is a tributary of the Anauerapucu River drainage, Amapá state, northern Brazil. The Anauerapucu River empties directly on the left margin of the Amazonas River delta. The stream was about 3 m wide and 2 m deep at the type locality area, but all individuals of the type series were collected near the stream bank, in places between 5-50 cm deep. The type locality area is



Fig. 1. *Rivulus schuncki*, UFRJ 6766, male, holotype, 24.4 mm SL; Brazil: Amapá: Vila Nova (just after collection).

within a savanna area, the stream margins being densely populated by the buriti-palm *Mauritia flexuosa*.

Etymology. The new species is named after Fábio Schunck, in recognition to his great enthusiasm and efforts directed to collecting trips.

Discussion

The subgenus *Melanorivulus* was erected to include an assemblage of species easily recognized by the distinctive concentration of melanophores on the margins of unpaired and pelvic fins in females (Costa, 2006a), formerly known as the *Rivulus punctatus* species group (Costa, 1995b). *Melanorivulus* was diagnosed by three derived color pattern features: two oblique bars on the post-orbital region, at least in females, often more conspicuous in preserved specimens (vs. never a similar color pattern); melanophores concentrated on the margin of unpaired and pelvic fins in females (vs. not concentrated); and a black spot on the upper portion of the caudal fin not close to fin margin in females (vs. close or contacting fin margin when the spot is present) (Costa,

2006a). These character states are present in all species of *Melanorivulus*, including those described after 2006 (Costa, 2007a-b, 2008a-e, 2009, 2010). In *R. schuncki*, the typical female caudal spot of *Melanorivulus* is present and melanophores are concentrated on the distal margin of the dorsal and anal fins, and on the whole margin of the caudal fin. However, the anterior margin of the pelvic fin is not distinctively pigmented and there is no vestige of the post-orbital bars. Presently, it is not possible to infer if the absence of the post-orbital bars and melanophores on pelvic fin in females are plesiomorphic conditions retained in *R. schuncki* or they represent reversals within the *Melanorivulus* clade. Morphological characters examined (i.e., color patterns, osteology, laterosensory system) do not suggest closer relationships to any other species of *Melanorivulus*.

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Microcobitis misgurnoides (photograph by Jörg Bohlen)
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