

***Rivulus kirovskyi*, a new killifish from the central Amazon, Brazil (Cyprinodontiformes: Rivulidae)**

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Rivulus kirovskyi, new species, from the central Amazon, lower rio Negro drainage, northern Brazil, is described. It is a member of an assemblage that includes *R. amanapira*, *R. atratus*, *R. ornatus*, *R. rectocaudatus*, *R. romeri*, *R. tecminae*, and *R. uakti*, and is diagnosed by a unique pattern of frontal squamation and a derived color pattern of the infraorbital region. Relationships of the new species with other taxa of the group are unclear at the present. It is similar to *R. atratus*, *R. ornatus*, and *R. romeri* in having an apomorphic reduction of anal-fin rays and by the absence of caudal spot in females, and similar to *R. amanapira*, *R. rectocaudatus*, *R. romeri*, *R. tecminae*, and *R. uakti*, by the absence of preopercular canal and dermosphenotic. *Rivulus kirovskyi* differs from all other species of the group by its unique color pattern of the caudal fin in males.

Rivulus kirovskyi, espécie nova, da Amazônia central, drenagem do baixo rio Negro, é descrita. Ela é um membro de um agrupamento que inclui *R. amanapira*, *R. atratus*, *R. ornatus*, *R. rectocaudatus*, *R. romeri*, *R. tecminae*, e *R. uakti*, e é diagnosticado pelo padrão exclusivo de escamação frontal e um padrão de colorido derivado da região infra-orbital. Relações de parentesco da nova espécie com outros táxons do grupo não são presentemente claras. Ela é semelhante a *R. atratus*, *R. ornatus* e *R. romeri* por possuir uma redução apomórfica de raios da nadadeira anal e pela ausência de mancha caudal em fêmeas, e semelhante a *R. amanapira*, *R. rectocaudatus*, *R. romeri*, *R. tecminae*, e *R. uakti*, pela ausência de canal pré-opercular e de dermosfenótico. *Rivulus kirovskyi* difere de todas as outras espécies do grupo pelo padrão de colorido exclusivo da nadadeira caudal em machos.

Key words: Systematics, rio Amazonas basin, rio Negro, Neotropical.

Introduction

Rivulus Poey is a speciose assemblage of neotropical killifishes, including about 100 valid species, occurring in most river basins of Middle and South America between southeastern Mexico and northeastern Argentina (Costa, 2003a, in press). It comprises small to median sized species, about 22-110 mm SL, living in shallow freshwater streams and marginal pools (Costa, 1998, 2004, in press). The highest diversification of the genus is concentrated in northern South America, including river basins draining the Guianan Shield and the Amazonian lowlands. Costa (2003b, 2004) recognized a clade endemic to this area, diagnosed by a unique arrangement of frontal scales and the presence of an oblique infraorbital dark gray bar through chin, that includes *R. amanapira* Costa, *R. romeri* Costa, and *R. uakti* Costa, from the upper rio Negro basin, *R. atratus* Garman and *R. ornatus* Garman, widespread along central and eastern Amazon, *R. rectocaudatus* Fels & de Rham from the Peruvian Amazon,

and *R. tecminae* Thomerson, Nico & Taphorn, from the upper rio Negro and upper rio Orinoco basins. A new species of this clade, from the lower rio Negro basin, is herein described.

Material and Methods

Measurements and counts follow Costa (1995). Measurements are presented as percentages of standard length (SL), except for those relative to head morphology, 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. Osteological preparations were made according to Taylor & Van Dyke (1985). Terminology for frontal squamation follows Hoedeman (1958), and for cephalic neuromast series Costa (2001). Osteological features presented in the descriptions are those considered phylogenetically informative in recent studies on basal rivulids (Costa, 1998).

The abbreviation c&s means specimens cleared and stained for bone and cartilage. The material is deposited in INPA, Instituto Nacional de Pesquisas da Amazônia, Manaus, and UFRJ, Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil. Comparative material is listed in Costa (1998).

***Rivulus kirovskyi*, new species**

Fig. 1

Holotype. UFRJ 5935, male, 20.3 mm SL; Brazil: Estado do Amazonas: Manaus: Reserva Ducke, temporary pools near Igarapé Acará, lower rio Negro drainage, rio Amazonas basin (about 3°0'S 60°30'W; altitude 90 m); A. Kirovsky, 22 February 1996.

Paratypes. UFRJ 5936, male, 22.7 mm SL (c&s); collected with holotype. - UFRJ 5937, 1 female, 16.1 mm SL (c&s); UFRJ 5938, 1 female, 14.8 mm SL; same locality and collector, 25 January 1996. - UFRJ 5939, 2 females, 14.7-17.2 mm SL; same locality and collector, 1 February 1996. - INPA 1850, 2 females, 14.8-16.8 mm SL; same locality; J. Zuanon, 22 November 1986.

Diagnosis. Similar to *R. amanapira*, *R. atratus*, *R. ornatus*, *R. rectocaudatus*, *R. romeri*, *R. tecminae*, and *R. uakti* Costa, and distinguished from all other species of the genus by possessing a frontal squamation pattern consisting of one scale with all margins exposed just posterior to snout (*vs.* scale with all margins exposed near the center of median portion of frontal region) and an oblique infraorbital dark gray bar through chin (*vs.* never a similar color pattern). Similar to *R. atratus*, *R. ornatus* and *R. romeri* and distinguished from the remaining congeners by having fewer anal-fin rays (8-10, *vs.* 11-19). Distinguished from *R. romeri*, *R. ornatus* and *R. atratus* by having a marginal dark reddish brown stripe on the caudal fin in males (*vs.* dark marginal stripes absent). Differs from *R. atratus* and *R. ornatus* by the absence of dermosphenotic (*vs.* presence), absence of preopercular canal absent (*vs.* conspicuous short canal), and frontal scales arranged transversally (*vs.* circularly). Differs from *R. romeri* by having short anal fin, its tip reaching vertical through

caudal peduncle (*vs.* long anal fin in males, tip reaching vertical through caudal-fin base), 32 scales on the longitudinal series (*vs.* 29-30), 16 scale rows around caudal peduncle (*vs.* 12), and six branchiostegal rays (*vs.* five).

Description. Morphometric data given in Table 1. Male larger than female, largest male 22.7 mm SL. Dorsal profile slightly convex from snout to end of dorsal-fin base, approximately straight on caudal peduncle. Ventral profile convex on head, almost straight from anterior portion of venter to end of anal-fin base, nearly straight on caudal peduncle. Body slender, subcylindrical anteriorly, slightly wider than deep, to compressed posteriorly. Greatest body depth at level of pelvic-fin base.

Tip of dorsal fin rounded. Tip of anal fin slightly pointed in male, rounded in female. Caudal fin oval. Pectoral fin rounded, posterior margin on vertical anterior to pelvic-fin base. Tip of pelvic fin reaching between base of 1st and 3rd anal-fin ray in male, and urogenital opening in female. Pelvic-fin bases in close proximity. Dorsal-fin origin on vertical through base of 8th or 9th anal-fin ray, and between neural spines of 19th and 20th vertebra. Anal-fin origin between pleural ribs of 14th and 15th vertebra. Dorsal-fin rays 6-7; anal-fin rays 9-10; caudal-fin rays 23; pectoral-fin rays 15; pelvic-fin rays 6.

Scales large, cycloid. Trunk entirely scaled; head scaled, except in anterior ventral surface. Few scales on caudal-fin base; no scales on dorsal and anal fins. Frontal squamation comprising scales arranged in transverse pattern, each scale with exposed posterior margin, except scale just posterior to snout with all borders free; E-scales not overlapping medially. Longitudinal series of scales 32; transverse series of scales 7; scale rows around caudal peduncle 16. Ctenii-like contact organ in each scale of ventral portion of male flank. Supraorbital neuromasts 3+3.

Basihyal subtriangular, greatest width about 40 % of length; basihyal cartilage about 25 % of basihyal length. Interhyal vestigial, not ossified. Six branchiostegal rays. Second pharyngobranchial teeth absent. Gill-rakers of first

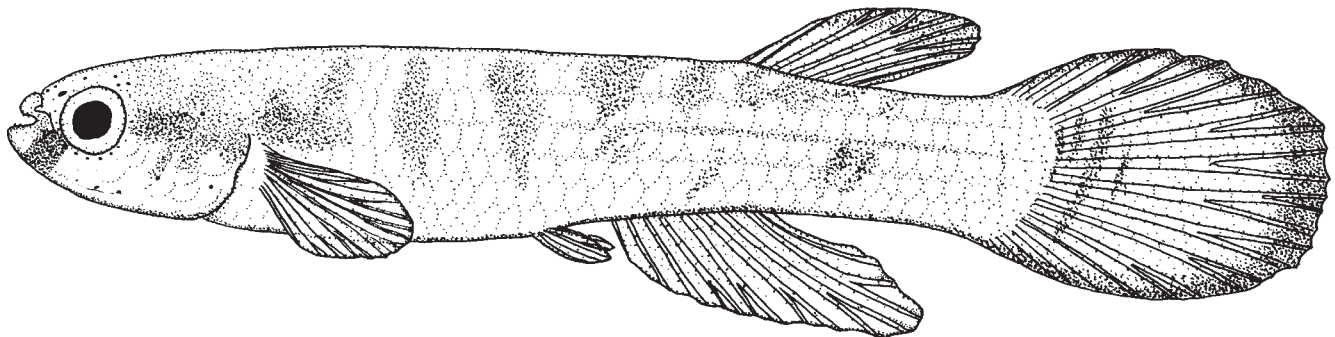


Fig. 1. *Rivulus kirovskyi*, holotype, UFRJ 5935, male, 20.3 mm SL; Brazil: Amazonas: Manaus.

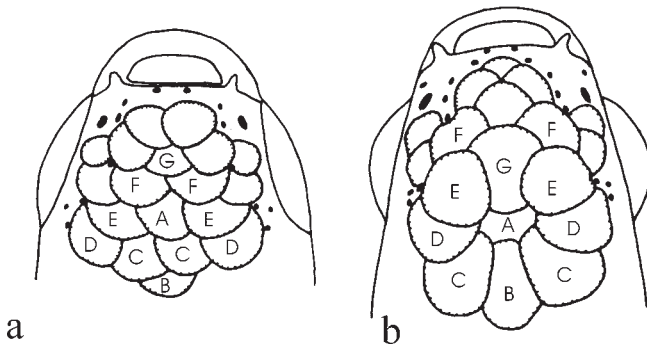


Fig. 2. Diagrammatic representation of the frontal squamation pattern. **a:** *Rivulus kirovskyi*, holotype, UFRJ 5935, male, 20.3 mm SL; Brazil: Amazonas: Manaus; **b:** *Rivulus santensis*, UFRJ 123, male, 38.5 mm SL; Brazil: São Paulo: Bertiooga.

branchial arch 1 + 7. Vomerine teeth absent. Preopercular canal absent. Dermosphenotic absent. Ventral process of posttemporal absent. Neural prezygapophyses long, about 25 % of neural spine length in fifth caudal vertebra. Epipleural ribs rod-like. Total vertebrae 29-30.

Coloration. Unknown in live specimens, but faint dark marks weakly observable in preserved specimens. Flank of male with brown stripes and oblique brown bars on anterodorsal portion; female with irregular brown marks. Postorbital dark brown blotch and transverse preorbital bar through chin in both sexes. Dorsal fin with subbasal stripe, darker in female. No dark marks on anal fin. Caudal fin with brown bars on basal portion, darker in female; reddish brown marginal stripe around fin in male.

Distribution. Known only from the floodplains of Igarapé Acará, lower rio Negro drainage, rio Amazonas basin, northern Brazil.

Etymology. Named in honor of the biologist Alexandre Kirovsky, collector of most specimens of the type series.

Discussion

A phylogenetic analysis among species of *Rivulus* is not part of the scope of the present paper, but some considerations about possible relationships of the new taxon are briefly herein discussed. *Rivulus kirovskyi* possesses the two apomorphic diagnostic features of the assemblage also including *R. amanapira*, *R. atratus*, *R. ornatus*, *R. rectocaudatus*, *R. romeri*, *R. tecminae*, and *R. uakti*: frontal squamation consisting of one scale with all margins exposed just posterior to snout and an oblique infraorbital dark gray bar through chin (Fig. 2a) (Costa, 2003b, 2004). In all other species of *Rivulus* and in other rivulids, the scales on the anterior portion of the frontal region have their posterior margins overlapped by the anterior margin of the scales posterior to them, and scales with all margins free are always situated near the center of the frontal region (Fig. 2b); there is never an infraorbital oblique bar ventrally extending to cross the chin. However, relationships of *R. kirovskyi* with other species of this clade are not clear at the present. Among these species, *R. kirovskyi* and *R. romeri* are the smallest species of the genus, reaching the maximum adult size of 22.7 and 21.7 mm SL, respectively. A reduced number of 8-10 anal-fin rays occurs in *R. atratus*, *R. ornatus*, *R. kirovskyi*, and *R. romeri*, and 5-7 dorsal-fin rays in *R. atratus*, *R. ornatus*, and *R. kirovskyi*, features not found elsewhere among rivulids. However, these apomorphic character states are incongruent with three other apomorphic conditions uniquely occurring in *R. kirovskyi*, *R. amanapira*, *R. rectocaudatus*, *R. romeri*, *R. tecminae*, and *R. uakti*: preopercular canal and dermosphenotic absent, and frontal scales transversely arranged (Fig. 2a). In other basal rivulids, the preopercular canal and the dermosphenotic are present,

Table 1. Morphometric data of *Rivulus kirovskyi*. H: holotype (UFRJ 3935).

	males		females			
	H		paratypes (UFRJ 5936)			
Standard length (mm)	20.3	22.7	17.2	16.1	14.8	14.7
Percents of standard length						
Body depth	17.3	18.3	18.8	17.8	17.8	18.8
Caudal peduncle depth	13.0	13.4	13.1	13.1	12.7	13.2
Predorsal length	72.9	73.6	77.3	79.1	77.4	80.7
Prepelvic length	54.7	54.9	58.3	57.8	58.9	58.2
Length of dorsal-fin base	9.6	9.6	9.4	8.8	9.2	9.0
Length of anal-fin base	16.2	14.8	14.3	13.9	15.4	16.7
Caudal-fin length	40.7	38.9	40.9	40.5	38.6	41.1
Pectoral-fin length	18.6	20.3	20.5	-	17.7	21.7
Pelvic-fin length	9.1	10.5	6.6	6.5	5.7	6.3
Head length	25.4	23.4	25.9	27.0	26.4	27.3
Percents of head length						
Head depth	65.4	68.5	69.8	63.4	64.0	66.9
Head width	77.8	79.0	79.5	74.9	80.1	80.3
Snout length	14.1	12.6	13.1	11.8	10.2	10.9
Lower jaw length	21.5	22.6	24.8	20.5	22.4	17.4
Eye diameter	34.4	35.1	35.6	37.6	36.0	36.8

and frontal scales are circularly arranged around the A-scale (Costa, in press). Inclusion of other characters in a future phylogenetic study, even not unique within the genus, as for example the absence of a black spot on the caudal-fin base of females, that occurs in *R. atratus*, *R. ornatus*, *R. kirovskyi*, and *R. romeri*, will be important to find the most parsimonious hypothesis or relationships among species of this assemblage.

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