

Melanorivulus polychromus, a new species of killifish from the rio São José dos Dourados drainage, middle rio Paraná basin, southwestern Brazil, with a redescription of *Melanorivulus apiamici* (Cyprinodontiformes: Rivulidae)

Dalton Tavares Bressane Nielsen¹, Pedro Alvaro Barbosa Aguiar Neves², Eric Venturini Ywamoto³
and Michel de Aguiar Passos⁴

1) Laboratório de Zoologia, departamento de Biologia, Universidade de Taubaté, Av. Tiradentes 180, 12030-180, Taubaté, SP, Brazil. E-mail: dnielsen@uol.com.br

2) Rua Parati, 362, Werner Plaas, 13478-360, Americana – SP, Brazil.
E-mail: pedro.alvaro@alvaroaguiar.com.br

3) Departamentos de Zoologia, Universidade Estadual Paulista “Júlio de Mesquita Filho”- UNESP Rio Claro, Avenida 24^a, 1515, Bela Vista, CEP: 13506-900 Rio Claro, SP, Brazil.
E-mail: eric.ywamoto@gmail.com

4) Rua São Miguel Arcanjo 1316, Jardim Nova Europa, Campinas, SP, Brazil.
Email: michel.aguiar@hotmail.com

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Abstract

A new species of *Melanorivulus* is described from the middle rio Paraná basin, São Paulo state, Brazil. *Melanorivulus polychromus*, new species, is found in a tributary of the left bank of the rio Paraná basin, the rio São José dos Dourados. It differs from all congeners by the combination of a metallic green to light green ground color in males, with 6-8 oblique red bars forming chevron-like rows, the chevron tips along the midline of the body pointing toward the head, and irregular narrow red lines and incomplete red bars along the lower half of the body. *Melanorivulus apiamici*, also endemic from the middle rio Paraná basin, is redescribed.

Zusammenfassung

Beschrieben wird eine neue Art von *Melanorivulus* vom mittleren Rio-Paraná-Becken im Staat São Paulo, Brasilien. Die neue Art *Melanorivulus polychromus* fand sich in einem Nebenfluss am rechten Ufer des Rio-Paraná-Beckens, im Rio São José dos Dourados. Ihre Unterscheidungsmerkmale zu den anderen Angehörigen der Gattung: metallisch grüne bis hellgrüne Grundfarbe bei den Männchen, 6-8 schräge rote Streifen, in Reihen wie Winkelabzeichen, wobei die Spitzen der Winkel auf der Mittellinie des Rumpfes liegen und zum Kopf hin zeigen, sowie unregelmäßige schmale rote Linien und unvollständige rote Streifen auf der unteren Rumpfhälfte. *Melanorivulus apiamici*, ebenfalls endemisch vom mittleren Rio-Paraná-Becken, wird neu beschrieben.

Resumo

Uma nova espécie do gênero *Melanorivulus*, é descrita para drenagem do médio rio Paraná, estado de São Paulo, Brazil. *Melanorivulus polychromus* é encontrado em um afluente da margem esquerda do rio Paraná, o rio São José dos Dourados. Ela difere de todas as outras espécies do gênero *Melanorivulus* pelo padrão de colorido dos machos, por possuir um colorido de fundo verde metálico a verde-claro, com 6-8 barras vermelhas oblíquas formando bifurcações, a ponta das barras ao longo do centro do corpo apontando para a cabeça, e linhas irregulares e, algumas barras vermelhas incompletas ao longo da parte inferior do corpo. *Melanorivulus apiamici*, também endêmica da bacia do médio rio Paraná é redescrito.

Résumé

Une nouvelle espèce de *Melanorivulus* est décrite provenant du bassin du moyen rio Parana, état de Sao Paulo, Brésil. *Melanorivulus polychromus*, nouvelle espèce, provient d'un tributaire du bord gauche du bassin du rio Parana, le rio Sao José dos Dourados. Elle diffère de tous ses congénères par la combinaison d'une couleur vert métallique à vert clair pour les mâles, avec 6-8 barres rouges obliques, en rangées en forme de chevrons dont les sommets, situés le long de la ligne centrale, pointent vers la tête et d'étroites barres rouges irrégulières et des barres rouges incomplètes le long de la moitié inférieure du corps. *Melanorivulus apiamici*, autre endémique du moyen bassin du rio Parana, est redécrit.

Sommario

Una nuova specie di *Melanorivulus* è descritta dal tratto centrale del bacino del Rio Paraná, stato di San Paolo, Brasile. *Melanorivulus polychromos*, nuova specie, è stato rinvenuto in un affluente della riva sinistra del bacino del Rio Paraná, il Rio São José dos Dourados. Si differenzia da tutti i congeneri per la colorazione basata su un fondo che va da un verde metallico a un verde chiaro nei maschi, con 6-8 barre oblique rosse formanti file a V con le punte lungo la linea mediana del corpo rivolte verso la testa, e sottili linee rosse irregolari e barre rosse incomplete lungo la parte inferiore del corpo. *Melanorivulus apiamici*, anch'essa specie endemica del bacino centrale del Rio Paraná, è ridescritta.

INTRODUCTION

Melanorivulus apiamici was originally described by Costa (1989) based on specimens collected by Pérsio S. Santos Filho in 1975 at Bataguáçu, Mato Grosso do Sul state, in a wetland, immediately after the bridge over the Rio Paraná, which divides São Paulo and Mato Grosso do Sul states. It has been also collected near Três Lagoas, about 120 km to the north (Costa 1989). In the original description of the species (Costa 1989), the color pattern in life was not discussed or depicted, a gap in the knowledge of the species which is filled herein.

Melanorivulus is a genus which comprises small South American Rivulidae species, presenting maximum size of 35 mm SL (Costa 2010). Species belonging to the genus *Melanorivulus* were first considered a group within the genus *Rivulus* by Costa (1989), which was named as “*punctatus* super-species” by Huber (1992) and latter as “*Rivulus punctatus* species-complex” by Costa (1995b, 1998). Costa (2006a) erected the subgenus *Melanorivulus*, and a little later the same author raised it to the generic level (Costa 2011a).

Field work conducted on the last 15 years has greatly increased the number of known species in *Melanorivulus*, as well as revealing a broader geographical distribution for the genus. The genus has been found in the last few years in the lower Amazon (*M. schunki*; Costa 2011b), middle rio Tocantins (*M. imperatrizensis*; Nielsen & Pinto 2015), and Brazilian northeastern coastal areas (*M. atlanticus*; Costa et al. 2015). However, the majority of the recently described species have been found in the Cerrado biome, central Brazil. High species richness within the genus is found at the Rio Paraná basin, on the upper and middle portions of the basin (Costa 2005). There are 14 described *Melanorivulus* species in the rio Paraná basin, ten

species from its right bank and four species from tributaries of the left bank. In spite of the fact that *Melanorivulus apiamici* was one the earlier described *Melanorivulus* species, very little research has been done regarding the genus at its southern distribution limit, which is the rio Paraná basin at western São Paulo and eastern Mato Grosso do Sul states, Brazil.

In a first taxonomic study of the collections formerly assigned to the genus *Rivulus* from the Rio Paraguai and Rio Paraná, deposited at the Museu de Zoologia Universidade de São Paulo (MZUSP), Costa (1989) limited the distribution of *M. punctatus* to the rio Paraguai basin and recognized four new species from the Paraná river basin, *M. pictus*, *M. pinima*, *M. vittatus*, and *M. apiamici*.

Costa (1995a) concluded that there was only a single polymorphic species in the Paraná river basin, and considered the three species described back in 1989 as synonyms of *M. pictus*. Later, Costa (2005) recognized again *M. pinima*, *M. vittatus*, and *M. apiamici* as valid species and described four additional species from the rio Paraná basin, *M. rutilicaudus*, *M. scalaris*, *M. egens*, and *M. illuminatus* (Costa 2005, 2007).

We herein describe an additional species from the rio Paraná basin, and also take the opportunity to redescribe *Melanorivulus apiamici*, which is the geographically closest congener.

Both the new species and *M. apiamici* are considered members of the *Melanorivulus pictus* clade, which is diagnosed by presenting sides of body intensely greenish blue to purplish blue above the anal-fin base in males (Costa 2007, 2008), which includes *M. pictus*, *M. planaltinus*, *M. pinima*, *M. kayapo*, *M. illuminatus*, *M. giarettai*, *M. scalaris*, *M. litteratus*, *M. faucireticulatus*, *M. vittatus*, and *M. rutilicaudatus*.

MATERIALS AND METHODS

Measurements were taken point-to-point under a stereomicroscope with a digital caliper to the nearest 0.01 mm on the left side of the specimens, whenever possible, following Costa (1995b; 2007). Measurements are expressed as percentages of standard length (SL), except subunits of the head, which are recorded as percentages of head length (HL).

In the description, counts of vertebrae and pleural ribs were taken from cleared and stained specimens (c&s) (one male and one female paratypes) of *M. polychromus* and from three males and three females paratypes of *M. apiamici*, prepared according

to Taylor & Van Dyke (1985). Terminology from frontal squamation follows Hoedeman (1958) and Costa (2006b). For vertebral counts, the caudal compound centrum was counted as a single element. Osteological features included in the description are those considered phylogenetically informative by recent studies on *Melanorivulus* (Costa 2006b, 2011a). Institutional abbreviations follow Sabaj-Pérez (2010), with addition of UNITAU (Universidade de Taubaté).

Melanorivulus polychromus, n. sp.

(Figs 1-2, Table 1)

Holotype: MZUSP 119054, male, 26.1 mm SL: Brazil, São Paulo, Suzanápolis, Córrego Ranchin-

ho, tributary of rio São José dos Dourados, rio Paraná basin, 20°31'39.50"S, 51°03'06.64"W, altitude 337 m; Pedro Alvaro Barbosa Aguiar Neves & Eric Venturini Ywamoto 19 August 2014.

Paratypes: MZUSP 119052, 5 males (18.1-27.9 mm SL), 5 females (18.2-26.4 mm SL), 2 c&cs, one male 21.1 mm and one female 18.8 mm; collected with the holotype.

Diagnosis: *Melanorivulus polychromus* is distinguished from all other congeners by males presenting the combination overall ground color metallic green to light green on flanks, with 6-8 oblique red lines forming chevron-like bars, their tips along midline pointing towards the head; some males with X-shaped red bars instead of exclusive chevron-like rows; lower portion of the body presenting irregular narrow red lines, and also some



Fig. 1. *Melanorivulus polychromus*, MZUSP 119054, holotype, male, 26.1 mm SL. Photo by P. A. Barbosa Aguiar Neves.



Fig. 2. *Melanorivulus polychromus*, MZUSP 119052, paratype, female, 26.4 mm SL. Photo by P. A. Barbosa Aguiar Neves.

Table I. Morphometric and selected meristic data for the holotype (H) and paratypes of *Melanorivulus polychromus*. SD = Standard Deviation.

	H	Paratypes	
	Male	Male n = 4	Females n = 6
Standard length (mm)	26.1	18.1-27.9	18.2-26.4
Percents of SL			
Body depth	21.2	20.2-22.8	20.2-22.5
Caudal peduncle depth	13.4	12.6-13.9	12.7-15.2
Pre-dorsal length	73.1	73.7-77.0	74.4-77.6
Pre-pelvic length	54.6	53.4-56.4	52.7-56.6
Length of dorsal-fin base	11.8	10.4-12.2	9.4-10.9
Length of anal-fin base	20.3	17.8-20.4	14.7-17.1
Caudal-fin length	26.8	22.2-27.6	23.3-25.8
Pectoral-fin length	19.5	16.8-20.9	17.9-19.6
Pelvic-fin length	11.0	9.7-11.1	6.8-7.4
Head length	25.1	24.3-27.4	24.7-25.8
Percents of HL			
Head depth	65.8	65.2-67.6	62.1-68.5
Head width	73.5	72.2-76.6	69.9-75.5
Snout length	14.9	14.5-17.0	14.9-16.5
Lower jaw length	14.9	14.5-17.0	14.9-16.5
Eye diameter	30.9	18.4-20.1	18.3-19.3
Counts			
Dorsal fin	10	10	9-10
Caudal fin	31	31	30-31
Anal fin	13	13	13
Pelvic fin	6	6	6
Pectoral fin	12	12	12

incomplete red bars (vs. never a similar color pattern on congeners, or side bars branching on their upper portion forming a Y-shaped red marks in *M. formosensis*), absence of red color in dorsal fin (vs. red pigmentation present in dorsal fin), presence of small red spots, and sometimes narrow lines, irregularly distributed on the flanks (vs. never a similar color pattern), dorsal and middle portions of caudal fin with light, irregular, short dark thin vertical lines on a light blue-green background, ventral portion of caudal fin greenish yellow, without black thin lines (vs. never a similar color pattern or middle portion of caudal fin with color pattern different from dorsal and ventral portions in *M. dapazi*, *M. vittatus*, *M. leali*, and *M. giarettai*), and short caudal fin length (22.2-27.6% SL vs. 29.4-42.3% SL).

Melanorivulus polychromus differs from all other *Melanorivulus* species, with exception of *M. apiamici*, by presenting dorsal and anal fins pointed in males (vs. rounded or slightly pointed in *M. illuminatus*).

Females of *Melanorivulus polychromus* can be distinguished from all remaining *Melanorivulus* species by presenting dark spots on the branchiostegal region (vs. never a similar color pattern).

Additionally, *Melanorivulus polychromus* differs from other species of *Melanorivulus*, except *M. schuncki*, by presenting a pointed snout (vs. blunt snout), and with exception of *M. giarettai*, by presenting the caudal fin with thin dark vertical lines in both males and females (vs. thin dark vertical lines absent or present only in females).

Description: Morphometric data presented in Table 1. Largest male examined 27.9 mm SL, largest female examined 26.4 mm SL. Dorsal profile gently convex from snout to end of dorsal-fin base, approximately straight along caudal peduncle. Ventral profile slightly convex from lower jaw to anal-fin origin, approximately straight along caudal peduncle. Body slender, compressed, greatest body depth at level of pelvic-fin base. Snout pointed in lateral view. Jaws short.

Short dorsal and anal fins; pointed in males and

rounded in females, without filaments in both sexes. Caudal fin oval shaped, longer than deep. Pectoral fin rounded, with its posterior margin reaching 83 % of the distance between pectoral and pelvic fins bases. Pelvic fin elliptical, short, its tip reaching the first anal-fin ray base in males and urogenital papilla in females. Pelvic-fin bases in close proximity medially. Dorsal fin origin at vertical through base of 10th anal-fin ray in males and females and between neural spines of vertebrae 21th-22th. Anal-fin origin between vertebrae 15th-16th; dorsal-fin rays 9-10; anal-fin rays 13; caudal-fin rays 30-31; pectoral-fin rays 12; pelvic-fin rays 6.

Scales large, cycloid. Body and head entirely scaled, except on anterior portion of ventral surface of the head. No scales on dorsal and anal-fin bases.

Scales extending on the basal half of caudal-fin length. Frontal squamation E-patterned; E-scales not overlapping. Longitudinal series of scales 30-31; 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 1, anterior rostral 1, posterior rostral 1, infraorbital 1 + 9-10 + 1, preorbital 1, otic 1, post-otic 1, supratemporal 1, median opercular 1, ventral opercular 1, preopercular 2 + 4, mandibular 3 + 1, lateral mandibular 2, paramandibular 1. Two neuromasts on caudal-fin base. Six branchiostegal rays. Gill-rakers on first branchial arch 1 + 7. Vomerine teeth 2. Total vertebrae 30.

Coloration: Males: (Fig. 1) Sides of body metallic green to light green, with 6-8 oblique red bars, forming chevron-like rows, their tips along body midline with forward-pointing vertex; some



Fig. 3. Type locality of *Melanorivulus polychromus*, Córrego Ranchinho, tributary of rio São José dos Dourados, rio Paraná basin. Photo by P. A. Barbosa Aguiar Neves.

males presenting X-shaped red bars; irregular thin lines at the lower half of body, and also some incomplete red bars. Anteroventral portion of flank golden, long dark longitudinal stripe with irregular shape extending between opercular area and first red chevron-like bar. Dorsum light brown. Venter whitish. Sides of head light brown, opercular region light green with a golden tint and irregular dark stripes. Jaws whitish, with dark spots. Iris pale yellow, anterior and posterior margins of eye dark brown. Dorsal fin pale green, with 3-4 irregular thin brown lines. Anal fin middle portion light yellow, basal area light blue, with short narrow reds bars, and distal portion with black margin. Dorsal and middle portions of caudal fin with light, irregular, short dark thin vertical lines on a light blue-green background, ventral portion of caudal fin greenish yellow, without black thin lines. Pectoral and pelvic-fins hyaline, with a yellowish tint.

Females: (Fig. 2) Sides of body light brown, with 8-10 dark red oblique bars forming a chevron-like pattern, chevron vertex on lateral midline and pointing forward to the head; irregular thin vertical lines at the lower portion of body and also some incomplete red bars. A long longitudinal dark stripe with irregular shape extending between postorbital region and the first red chevron-like bar. Some females present Y-shaped red bars. Opercular area golden, with black spots. Dorsum light brown, presenting scattered dark spots. Venter white. Jaws brown, with black spots. Iris pale orange, anterior and posterior edges of eye dark brown. Dorsal fin light green, with irregular, thin dark lines and small dark spots, anal fin with basal portion light blue to metallic green with short narrow dark bars, and distal portion with a black margin. Caudal fin metallic green with dark vertical bars; elongated black spot on its dorsal portion, relatively inconspicuous. Pectoral-fin hyaline, with yellowish tint. Pelvic fin metallic green, with dark bar on its distal portion.

Distribution: Known only from the type-locality, a stream tributary of rio São José dos Dourados, rio Paraná basin, western São Paulo state, Brazil (Fig. 6).

Habitat notes: The type locality is a small first order stream tributary located in a highly anthropized landscape, a formerly semideciduous forest replaced by pastureland. The stream has a slightly dark water, with maximum depth of 5 cm. The stream channel is hidden by grasses and sedges (Fig. 3).

Behavior in captivity: *Melanorivulus polychromus* prefer to spawn at the bottom, which is an uncom-

mon behavior for the genus, which is usually known to spawn into floating plants roots, close to the water surface. The eggs are laid in the substrate, close to substrate surface, and the couple did not bury themselves for spawning, a behavior similar to the one found in *Notholebias*, *Nothobranchius* and *Fundulopanchax*.

Etymology: From the greek “*poly*”, several, plus “*chromus*”, color, in allusion to the variegated color pattern in males.

***Melanorivulus apiamici* (Costa 1989)**

(Figs 4-5; Table II)

Rivulus apiamici Costa 1989, 527-528, figs. 7-8; type locality: “Bataguáçu, próximo a ponte de divisa do Estado, Mato Grosso do Sul, Brasil”.

Material examined: All from rio Paraná river basin, Mato Grosso do Sul state: MZUSP 39976, holotype, one male 28.3 mm SL; MZUSP 39977 paratypes, 3 males and 3 females, 21.9- 29.0 mm SL, near the bridge on the border between Mato Grosso do Sul and São Paulo states, Pêrsio S. Santos F., 1975. MZUSP 119053, 5 males and 5 females, 21.9-31.5 mm SL, topotypes, Brazil, Mato Grosso do Sul, Bataguáçu, Porto Quinze de Novembro, near the bridge of the state border, rio Paraná basin, 21°43’31.6”S 52°15’39.0”W (altitude 173 m), Pedro A. B. A. Neves & Eric V. Ywamoto, 21 Nov 2014. MZUSP 38488, 29, Três Lagoas, Ribeirão do Diogo, tributary of rio Sucuruí, rio Paraná drainage, F. Lane, February 1969. MZUSP 38464, 60, Três Lagoas, Fazenda Canaã, F. Lane, May 1966.



Fig. 4. *Melanorivulus apiamici*, MZUSP 119053, topotype, male, 30.1 mm SL. Photo by P. A.B.A. Neves.



Fig. 5. *Melanorivulus apiamici*, MZUSP 119053, topotype, female, 28.0 mm SL. Photo by P. A.B.A. Neves.

Table II. Morphometric and selected meristic data for the holotype (H) and paratypes of *Melanorivulus apiamici*. SD = Standard Deviation.

	H	Paratypes	
	Male	Male n = 6	Females n = 6
Standard length (mm)	28.3	26.9-31.5	21.9-28.2
Percents of SL			
Body depth	23.5	22.2-25.0	17.4-25.9
Caudal peduncle depth	15.4	13.2-16.1	11.9-17.4
Pre-dorsal length	79.5	76.5-83.8	76.5-86.7
Pre-pelvic length	52.8	52.9-56.8	55.3-59.3
Length of dorsal-fin base	9.4	10.1-13.9	10.2-13.8
Length of anal-fin base	22.1	20.6-23.6	19.1-24.1
Caudal-fin length	34.6	31.6-35.2	28.8-32.7
Pectoral-fin length	22.6	17.4-26.4	18.2-25.0
Pelvic-fin length	12.3	9.6-14.7	8.1-12.7
Head length	26.2	25.0-28.2	26.6-31.3
Percents of HL			
Head depth	63.7	68.4-78.8	62.1-66.2
Head width	53.7	50.0-58.8	43.4-49.3
Snout length	16.6	15.9-19.7	12.6-12.9
Lower jaw length	17.3	17.1-19.5	13.7-17.1
Eye diameter	31.2	27.6-36.0	28.3-32.0
Counts			
Dorsal fin	8	8-9	8-9
Caudal fin	29	29	29
Anal fin	13	13-15	15
Pelvic fin	5	5	5
Pectoral fin	10	10	10

Diagnosis: Distinguished from all remaining *Melanorivulus* by a low number of pectoral-fin rays (10 vs. 11-14), low number of vertebrae (27 vs. 28-33), and by presenting the combination of the following features, in males: unique pattern of caudal-fin on males, consisting in dorsal and middle caudal-fin rays presenting vertical red narrow lines on a light blue background, ventral portion of caudal-fin greenish yellow with black margin (vs. never a similar color pattern), dorsal-fin greenish yellow with 3-4 irregular thin red lines (vs. large red bars in *M. vittatus* and *M. faucireticulatus*, 6-7 short red bars on basal and posterior portion of body in *M. crixas*, *M. jalapensis*, and *M. javabe*, three large red bars in *M. illuminatus*, two large red bars in *M. kayapo*, red bars absent in the remaining species), anal-fin base iridescent blue, with 4-5 small and thin red lines, distal area golden yellow, with black margin (vs. never a similar color pattern), dorsal and anal fins pointed (vs. rounded or slightly pointed in *M. illuminatus*).

Additionally, *M. apiamici* can be distinguished of from all congeners, except *Melanorivulus rossoi*, by

presenting the origin of dorsal fin at vertical through base of anal-fin ray (11th vs. 7th-10th), by presenting a low number of pelvic-fin rays (5 vs. 6-7 in other species, except *M. planaltinus*), and by presenting, in females, a large pectoral fin length (18.2-25.0% SL vs. 16.9-24.3% SL).

Description: Morphometric data presented in Table II. Largest male examined 31.5 mm SL; largest female examined 28.2 mm SL. Dorsal profile gently convex from snout to end of dorsal-fin base, approximately straight on caudal peduncle. Ventral profile slightly convex from lower jaw to anal-fin origin, approximately straight to end of caudal peduncle. Body slender, compressed, greatest body depth at level of pelvic-fin base. Snout blunt. Jaws short.

Dorsal and anal fins pointed in males and rounded in females, without filaments in both sexes. Pectoral-fin rounded with its posterior margin reaching two thirds of distance between base of pectoral and pelvic-fin bases. Pelvic fin elliptical, short, tip reaching base of 1st or 2nd anal-fin ray in males and

urogenital papilla in females. Pelvic-fin bases medially in close proximity. Dorsal fin origin in vertical through base of 9th anal-fin ray in males and females, and between neural spines of vertebrae 18th-19th. Anal fin origin between pleural ribs of vertebrae 15th. Dorsal-fin rays 8-9; anal-fin rays 13-15; caudal-fin rays 29; pectoral-fin rays 10; pelvic-fin rays 5. Scales large, cycloid. Body and head entirely scaled, except on anterior part of ventral surface of the head. No scales on dorsal, caudal and anal fin bases.

Frontal squamation E-patterned; E-scales not overlapping. Longitudinal series of scales 31; transverse series of scales 8-9; scale rows around caudal peduncle 16. No contact organs on scales and fin rays. Cephalic neuromasts: supraorbital 3 + 3, parietal 1, anterior rostral 1, posterior rostral 1, infra-orbital 1 + 9-10 + 1, preorbital 2, otic 1, post-otic 1, supratemporal 1, median opercular 1, ventral opercular 1, preopercular 2 + 4, mandibular 3 + 1, lateral mandibular 1, paramandibular 1. Two neuromasts on caudal-fin base. Six branchiostegal rays.

Gill-rakers on first branchial arch 1 + 7. Vomerine teeth 2. Total vertebrae 27.

Coloration: Males: (Fig. 4) Side of body iridescent purplish blue, with 8-9 oblique red bars forming chevron-like rows, their angle along midline pointing forward, anteroventral portion of flanks golden, longitudinal black stripe with irregular shape between postorbital region and the first red chevron-like bar. Dorsum light brown, with scattered dark brown spots. Venter white. Side of head light brown, opercular region light greenish with black stripes. Jaws dark gray. Iris pale yellow, anterior and posterior eye margins dark brown. Dorsal fin greenish yellow, with 3-4 irregular thin red lines. Anal fin light yellow, basal portion light metallic blue with short narrow reds bars, distal portion with dark margin. Caudal fin with dorsal and middle portions presenting vertical red narrow lines on a light blue background, ventral portion of caudal fin greenish yellow with black margin. Pectoral-fin hyaline, with yellowish tint. Pelvic fin yellow, with black bar at distal area.

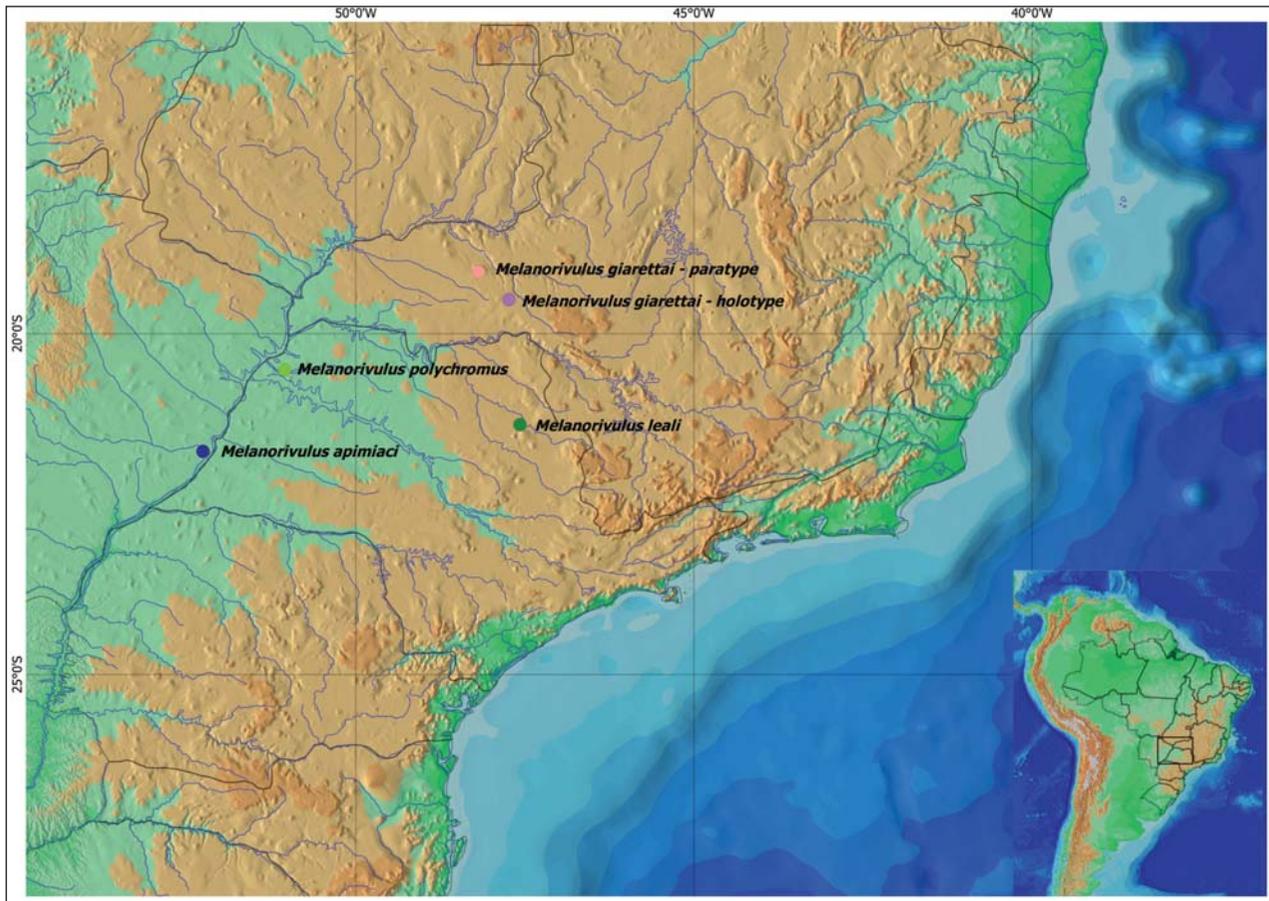


Fig. 6. Geographical distribution of the species of the genus *Melanorivulus* in middle rio Paraná basin.

Females: (Fig. 5) Sides of body light brown, with dark red oblique bars forming chevron-like pattern along midline and pointing forward; elongated, wide irregularly-shaped black stripe extending between postorbital region and the first red chevron-like bar. Dorsum light brown, with scattered dark brown spots. Iris pale yellow, anterior and posterior margins of eye dark brown. Dorsal fin yellow, with irregular thin red lines, anal fin light yellow, basal portion light yellow, distal portion with black margin. Caudal fin orange, 3-4 vertical dark bars on central portion, elongated black spot on dorsal portion, relatively inconspicuous. Pectoral-fin hyaline, with yellowish tint. Pelvic fin yellow, with black bar in distal area.

Distribution: *Melanorivulus apiamici* is known from right bank tributaries of the rio Paraná basin between the towns of Bataguçu and Três Lagoas, Mato Grosso do Sul state, Brazil.

DISCUSSION

The presence of a black stripe along the flanks was considered to be a synapomorphy for *M. punctatus*, from the rio Paraguai basin, and for the *M. zygometes* clade from the Tocantins, Araguaia, Xingu and Tapajós basins (Costa 2006a). Within the *M. pictus* clade, this black stripe has an irregular shape and extends between the postorbital region and the first red chevron-like bar, with variable thickness and length according to the species. In both *M. apiamici* and *M. polychromus*, these stripes are thick, with irregular design and extend up to a little beyond the level of the pectoral fin insertion.

M. apiamici and *M. polychromus* belong to the *M. pictus* clade (Costa 2007), which also includes *M. egeus*, *M. pictus*, *M. planaltinus*, *M. kayapo*, *M. gairretai*, *M. faucireticulatus*, *M. formosensis*, *M. vittatus*, *M. litteratus*, *M. illuminatus*, *M. pinima*, *M. rutilicaudus*, and *M. scalaris*, all from the rio Paraná basin (Costa 2008). Species in this clade are distinguished from all other congeners by the presence of some unique conditions, as the vestigial ventral process of angulo-articular (vs. process well-developed), curved first epibranchial (vs. approximately straight) and intense greenish blue or greenish golden to purplish blue flank above anal-fin base (vs. never similar color pattern) (Costa 2005). The knowledge about the relationships among the species within *Melanorivulus* is still tentative, based on a few characters considered to be phylogenetic informative by Costa (2006b).

Melanorivulus polychromus differs from *M. api-*

amic by having pectoral fin tip at vertical through 5/6 of the length from pectoral-fin base to pelvic fin base (vs. about 2/3 of the length from pectoral-fin base to pelvic-fin base), dorsal fin origin at vertical through base of 10th anal-fin ray (vs. 9th *M. apiamici*), dorsal fin origin at the level of 22th vertebra (vs. at the level of 18-19th vertebrae), anal fin origin at level of 17th vertebra (vs. at level of 15th vertebra), caudal-fin pattern in males light yellow with thin black bars (vs. metallic blue-green with thin red bars on its dorsal and middle portions, ventral portion yellow without red bars), presence of red marks on flanks in males, formed by the fragmentation of the chevron-like bars (vs. absence of such a pattern), pectoral-fin rays counts (12 vs. 10), and caudal-fin rays counts (31-33 vs. 29).

Melanorivulus apiamici and *M. polychromus* possibly are closely related species, as both species share several color pattern features, such as the presence of a black stripe with irregular shape between the postorbital region and the first red chevron-like bar, a black margin at the distal portion of anal fin, jaws whitish with dark spots in males, and the presence of a relatively inconspicuous elongated black spot on the dorsal portion of the caudal fin in females.

Melanorivulus polychromus is the second species of the genus described for the São Paulo state, occurring in an area originally covered with semideciduous forest, in the transition between the Cerrado and Atlantic Forest biomes. During the past 70 years, the western portion of São Paulo state, the region where the type-locality of *M. polychromus* lies, was severely modified for agricultural and livestock activities, but in spite of that, there are still many sites that present the physical and biotic features that indicates the likely presence of representatives of the genus *Melanorivulus*. These sites are usually headwater, first order streams, narrow and very shallow, often presenting buriti (*Mauritia flexuosa*) palms.

For the redescription of *Melanorivulus apiamici* herein presented, topotypes were collected and compared with the typical series. In spite of the fact that the area has changed and have undergone some urbanization over the years, the type locality is still relatively well preserved, a large flooded area very close to the banks of the rio Paraná. Other than the type locality, the species was found in three other sites across Bataguçu and Três Lagoas, all in Mato Grosso do Sul state, extending approximately 120 km along the right banks of the rio

Paraná. There was no sampling to the south of the type locality (Bataguaçu) and it is not unlikely that the species may be distributed more southward.

Melanorivulus polychromus, *M. giarettai* and *M. leali* occur on tributaries of the left bank of the Rio Paraná basin. That indicates that possibly additional species of *Melanorivulus* may be discovered in the area, but the intense disturbance that this region has undertaken due to agricultural, cattle raising, and urbanization might have damaged many sites of putative former occurrence of the genus in this region.

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