

# A new species of *Moenkhausia* Eigenmann (Characiformes: Characidae) from the rio Xingu basin, Brazil

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A new species of *Moenkhausia* from the upper rio Xingu basin is described. *Moenkhausia eurystaenia* is distinguished from all congeners, except *M. heikoi* and *M. phaeonota*, by the presence of a dark, broad longitudinal stripe from the opercle to the end of caudal peduncle. The new species is distinguished from *M. heikoi* mainly by having 18-21 branched anal-fin rays (*vs.* 24-26) and the absence of a round blotch at the end of the caudal peduncle (*vs.* present). *Moenkhausia eurystaenia* can be distinguished from *M. phaeonota* mainly by the anterior portion of longitudinal band darker at horizontal septum (*vs.* darker below horizontal septum), the deep dark pigmentation along horizontal septum extending anteriorly up to humeral region (*vs.* extending up to vertical through pelvic-fin origin), number of vertebrae 34 (*vs.* 36-37), and others additional measurements.

Uma espécie nova de *Moenkhausia* da bacia do alto rio Xingu é descrita. *Moenkhausia eurystaenia* distingue-se de todas as congêneres, exceto *M. heikoi* e *M. phaeonota*, pela presença de uma faixa longitudinal larga e escura que se estende do opérculo ao pedúnculo caudal. A espécie nova distingue-se de *Moenkhausia heikoi* principalmente por apresentar 18-21 raios ramificados na nadadeira anal (*vs.* 24-26), e ausência de uma mácula circular no final do pedúnculo caudal (*vs.* presença). *Moenkhausia eurystaenia* distingue-se de *M. phaeonota* principalmente pela porção anterior da faixa longitudinal ser mais escura no septo horizontal (*vs.* mais escura abaixo do septo horizontal), pigmentação profunda e escura ao longo do septo horizontal se estendendo até a região umeral (*vs.* se estendendo até a vertical que passa pela origem da nadadeira pélvica), 34 vértebras (*vs.* 36-37), e outras medidas adicionais.

**Key words:** Systematics, Tetra, Amazon basin, Taxonomy.

## Introduction

*Moenkhausia* Eigenmann, 1903 was redefined by Eigenmann (1917) to include species with a combination of premaxillary teeth in two rows, the inner with five teeth, complete lateral line, and partially scaled caudal fin. At the present time, *Moenkhausia* is represented by 70 valid species occurring in South American drainages (Lima *et al.*, 2003; Eshmeyer, 2010).

The new *Moenkhausia* species described below was collected sympatrically with a similar congener, *M. phaeonota* Fink, in a clear water stream in the upper rio Xingu basin, Brazil. Both species share a dark broad and straight longitudinal band on body, extending to middle caudal-fin rays, with a pale longitudinal line immediately above, and concentration of dark chromatophores behind the opercle. Similar color pattern is found in other small characids such as *Moenkhausia heikoi* Géry & Zarske, *Tucanoichthys tucano* Géry & Römer, and some *Hypessobrycon* Durbin in Eigenmann species.

## Material and Methods

Counts and measurements were taken with digital calipers under a stereo microscope, according to Fink & Weitzman (1974), with the addition of head depth, measured at vertical through the posteriormost tip of bony opercle. Horizontal scale rows below lateral line were counted to the pelvic-fin insertion. Counts are followed by their occurrence in parentheses; asterisks indicate the count of the holotype. Measurements are given as percents of standard length (SL), except subunits of the head, which are given as percents of head length (HL). Supraneurals, gill-rakers of first arch, tooth cusps, unbranched anal-fin rays, procurrent caudal-fin ray counts and position of pterygiophores were taken from cleared and stained (c&s) specimens, prepared following Taylor & van Dyke (1985). Vertebrae count was taken from c&s and radiographs from alcohol preserved specimens. Vertebrae of the Weberian apparatus were counted as four elements and the fused PU1+U1 of the caudal region as a single element.

Jaws for Scanning Electron Micrographs (SEM) images were removed from c&s specimens, immersed in weak (less than 1%) sodium hypochlorite solution and dried by a successively more concentrated solutions of alcohol, and then acetone. Catalog numbers are followed by the number of specimens in alcohol and the SL range, the number and SL range of measured specimens in parenthesis, when different, and if any, the number of c&s specimens and their SL range. Measured specimens of *Moenkhausia phaeonota* comes from the lots MZUSP, 13793, 13794, 13795, 45301, 61043, and 91403. Institutional abbreviations used are: CPUFMT, Coleção de Peixes da Universidade Federal do Mato Grosso; DZSJRP, Departamento de Zoologia e Botânica da Universidade Estadual Paulista, São José do Rio Preto; INPA, Instituto Nacional de Pesquisas da Amazônia, Manaus; MCP, Museu de Ciências e Tecnologia, Pontifícia Universidade Católica do Rio Grande do Sul, Porto Alegre; MPEG, Museu Paraense Emílio Goeldi, Belém; MZUSP, Museu de Zoologia da Universidade de São Paulo, São Paulo; and USNM, National Museum of Natural History, Smithsonian Institution, Washington, DC.

***Moenkhausia eurystaenia*, new species**

**Figs. 1-2**

**Holotype.** MZUSP 106058, 36.8 mm SL, rio Von Den Stein, on the road to Água Limpa, 13°14'19"S 54°53'01"W, rio Ronuro drainage, rio Xingu basin, Nova Ubiratã, Mato Grosso, Brazil, 24 Oct 2004, J. L. Birindelli, O. T. Oyakawa, C. R. Moreira, M. I. Landim, A. K. Oliveira, A. Datovo & J. C. Nolasco.

**Paratypes.** CPUFMT 610, 3, 25.2-28.6 mm SL; DZSJRP 12547, 3, 24.4-24.6 mm SL; INPA 34095, 3, 23.3-26.1 mm SL, MCP 45547, 3, 24.9-26.1 mm SL, MPEG 18924, 3, 25.5-27.2 mm SL, MZUSP 91404, 109, 18.5-36.8 mm SL (17, 25.6-36.8 mm SL), 3 c&s, 23.3-26.1 mm SL, USNM 398648, 3, 23.2-27.5 mm SL, all with same data of holotype.

**Diagnosis.** *Moenkhausia eurystaenia* is distinguished from all congeners, except *M. heikoi* and *M. phaeonota*, by the presence of a dark, broad stripe, from the opercle to the end of the caudal peduncle (*vs.* stripe, when present, narrow and frequently originating approximately at vertical through dorsal-fin origin). The new species is distinguished from *M. heikoi* by having 18-21 branched anal-fin rays (*vs.* 24-26), by the absence of a round blotch at the end of the caudal peduncle (*vs.* blotch present), and by the dark stripe formed by relatively small chromatophores (*vs.* large chromatophores). *Moenkhausia eurystaenia* is distinguished from *M. phaeonota* (Fig. 3) by its more dispersed dark stripe, not well delimited (*vs.* less disperse, relatively well delimited), the anterior portion of the stripe darker at horizontal septum (*vs.* darker below horizontal septum), the deep dark pigmentation along horizontal septum extending anteriorly up to umeral region (*vs.* extending up to vertical through pelvic-fin origin), the melanophores of interradial membranae between first and fifth branched dorsal-fin rays restricted to the edge of lepidotrichia (*vs.* spread over interradial membranae), the distance between snout to pelvic-fin origin 46.9-50% SL,  $n = 35$  (*vs.* 43.2-46.6,  $n = 30$ ), the distance from snout to anal-fin origin 62.1-65.4% SL,  $n = 35$  (*vs.* 55.9-61.2,  $n = 30$ ), the anal-fin base length 25.1-28.4% SL,  $n = 35$  (*vs.* 28.5-33.8,  $n = 30$ ), and the number of vertebrae 34,  $n = 13$  (*vs.* 36-37,  $n = 12$ ).

**Description.** Morphometrics in Table 1. Largest specimen examined 36.8 mm SL. Body compressed, greatest body depth slightly ahead of vertical through dorsal-fin origin. Dorsal profile of body convex from upper lip to vertical through anterior edge of nostril; straight from latter point to tip of supraoccipital spine; convex from supraoccipital spine to dorsal-fin origin; straight to slightly convex and posteroventrally inclined along dorsal-fin base; straight to slightly convex from posterior terminus of dorsal-fin base to adipose-fin origin; slightly concave along caudal peduncle. Ventral profile of body convex from tip of lower jaw to pelvic-



**Fig. 1.** *Moenkhausia eurystaenia*, holotype, MZUSP 106058, 36.8 mm SL, rio Von Den Stein, rio Xingu basin, Nova Ubiratã, Mato Grosso, Brazil.

fin origin; straight from pelvic-fin origin to anal-fin origin; straight and posterodorsally inclined along anal-fin base and slightly concave along caudal peduncle.

Jaws vertically aligned, mouth terminal. Premaxillary teeth in two rows, outer with 3\*(13) or 4(22) tricuspid teeth, inner with five tri- to pentacuspid teeth. Maxilla reaching vertical through anterior fourth of orbit, with 2(14), 3\*(17), or 4(1) uni- to tricuspid teeth. Dentary with three pentacuspid teeth, followed by smaller tricuspid and series of 5-10 small conical teeth decreasing gradually in size (Fig. 2).

Pectoral-fin rays i,10\*(30), 11(4), or 12(1), reaching pelvic-fin origin in adults, not reaching in juveniles, when adpressed. Pelvic-fin rays i,7, reaching pelvic-fin origin in adults, not reaching in juveniles, when adpressed. Anal-fin rays iv(2) or v(1), and 18(6), 19(13), 20\*(13), or 21(3); last unbranched and first four or five branched anal-fin rays longer than remaining rays. Supraneurals 4, all rod-shaped, with bony lamellae in upper portion. Dorsal-fin rays ii,9, first unbranched dorsal-fin ray almost half length of second unbranched ray. Dorsal-fin

origin slightly ahead midbody, located at vertical through anterior third of pelvic fin; base of last dorsal-fin ray at vertical through anal-fin origin. First dorsal-fin pterygiophore behind neural spine of 9<sup>th</sup> vertebra. Adipose-fin origin situated approximately at vertical through 14<sup>th</sup> to 16<sup>th</sup> branched anal-fin rays. Caudal-fin rays i,17,i\*(32) or i,16,i(2). Caudal fin forked, with lobes of similar size. Dorsal procurrent caudal-fin rays 11, ventral procurrent caudal-fin rays 10(1) or 11(2).

Lateral line completely pored, slightly curved ventrally, with 32(3), 33(9), 34\*(8), or 35(4), perforated scales. Longitudinal scale rows between dorsal-fin origin and lateral line 5; longitudinal scale rows between lateral line and pelvic-fin origin 3. Single row of 9\*(15), 10(19) or 11(1) predorsal scales. Single row of 3-5 scales overlying base of anteriormost anal-fin rays. Scale rows around caudal peduncle 14. Small scales along first third of upper caudal-fin lobe and first half of lower lobe.

Vertebrae 34(13). Branchiostegal rays 4. First gill arch with 17(2) or 19(1) gill rakers: six on epibranchial, one on intermediate cartilage, eight(2) or 10(1) on ceratobranchial, and two on hypobranchial. Gill rakers without small denticles.



**Fig. 2.** Scanning electron microscope photograph of left side of upper and lower jaw of *Moenkhausia eurystaenia*, MZUSP 91404, paratype, 24.3 mm SL. Scale bar = 0.5 mm.

**Color in alcohol.** Overall ground color yellowish. Infraorbital, opercular and gular areas silvery. Dorsal portion of head and body dark. Dark chromatophores scattered at infraorbital and opercular areas, upper and lower jaws. First three dorsal horizontal scale rows on body with slightly reticulated pattern, formed by scales bordered by dark pigment. Faint pale stripe posterodorsally from eye to caudal peduncle. A broad stripe on body, from opercle to end of caudal-peduncle, darker over horizontal septum, fading ventrally, and extending over middle caudal-fin rays as faint stripe. Smaller specimens with clearer stripe. Narrow midlateral dark stripe at horizontal septum conspicuous, formed by deeper dark chromatophores, extending from humeral region to end of caudal peduncle. Concentration of dark chromatophores immediately posterior to opercle, on first to fourth lateral scales, forming inconspicuous triangular humeral blotch. Scattered dark chromatophores above anal-fin base. All fins with dark chromatophores along edge of lepidotrichia.



**Fig. 3.** *Moenkhausia phaeonota*, MZUSP 91403, 26.3 mm SL, collected in sympatry with *M. eurystaenia* at rio Von Den Stein, rio Xingu basin, Nova Ubitatã, Mato Grosso, Brazil.

**Distribution.** *Moenkhausia eurystaenia* is known from the type-locality in the rio Ronuro drainage, upper rio Xingu basin, Brazil (Figs. 4-5).

**Etymology.** The specific name *eurystaenia* comes from the Greek *eurys*, broad, and the Latin *taenia*, band, a reference to the broad dark stripe.

### Discussion

Several authors agree that the species currently included in the genus *Moenkhausia* most likely do not form a monophyletic group (Fink, 1979; Costa, 1994; Lucena & Lucena, 1999; Lima *et al.*, 2007; Benine *et al.*, 2009). According to the most comprehensive phylogenetic analysis of Characidae to date (Mirande, 2009), the analyzed species of *Moenkhausia* [*M. dichroua* (Kner), *Moenkhausia* cf. *intermedia* Eigenmann, *M. sanctaefilomenae* (Steindachner), and *M. xinguensis* (Steindachner)], compose a monophyletic group with *Bario steindachneri* (Eigenmann). Nonetheless, the synapomorphies of most characid clades, including the synapomorphies of *Moenkhausia*, are not shown in the appendix 3.

The species of *Moenkhausia* have a great variety of body shapes, including deep bodied forms as *Moenkhausia chrysargyrea* (Günther), *M. comma* Eigenmann and *M. doceana* (Steindachner), and shallow bodied as *M. collettii* (Steindachner), *M. lopesi* Britski & Silimon and the new species. They also exhibit distinct color patterns, such as an overall dark reticulated pattern [*i.e.* *Moenkhausia oligolepis* (Günther) and *M. sanctaefilomenae*]; presence of a dark blotch on the upper caudal-fin lobe [*i.e.* *Moenkhausia lepidura* (Kner) and *Moenkhausia gracilima* Eigenmann]; and dark zigzag lines on body [*i.e.* *Moenkhausia rara* Zarske, Géry & Isbrücker and *M. simulata* (Eigenmann)]. *Moenkhausia eurystaenia* shares with *Moenkhausia phaeonota* and *M. heikoi*, both also occurring in the rio Xingu basin, a dark broad stripe on body, unique in the genus, but

also found in other Tetragonopterinae (*sensu* Géry, 1977), *i.e.* *Tucanoichthys tucano*, and some *Hyphessobrycon* species.

Lima & Zuanon (2004) characterized three types of dark longitudinal bands on body of small characids, without purporting homology: narrow and straight such as in *Hyphessobrycon borealis* Zarske, Le Bail & Géry, *H. heterorhabdus* (Ulrey), and *H. stegemanni* Géry, broad and curve as in *Hemigrammus skolioplatus* Bertaco & Carvalho and *Nematobrycon palmeri* Eigenmann, and broad and straight as presented by *Moenkhausia eurystaenia* and also found in *Hyphessobrycon loretoensis* Ladiges, *H. metae* Eigenmann & Henn, *H. peruvianus* Ladiges, *H. notidanus* Carvalho & Bertaco, *H. herbertaxelrodi* Géry, *Tucanoichthys tucano*, *Moenkhausia phaeonota*, and *M. heikoi* Fink (1979) suggested a close relationship between *Moenkhausia phaeonota* and *H. loretoensis*, *H. metae*, *H. peruvianus*, and perhaps *H. agulha* and *H. herbertaxelrodi*. These species share a dark broad and straight stripe, which generally extends from the eye to the caudal-fin base, usually more conspicuous above the anal-fin base. These species also present a pale longitudinal line immediately above the dark stripe, and a concentration of dark chromatophores near the opercle. This color pattern is similar to the one found in *Moenkhausia eurystaenia*, except by the fainter overall black pigmentation, presented by the later.



**Fig. 4.** Type-locality of *Moenkhausia eurystaenia* in the upper rio Xingu basin, Brazil.



**Fig. 5.** Rio Von Den Stein in the upper rio Xingu basin, Brazil, type-locality of *Moenkhausia eurystaenia*.

**Table 1.** Morphometrics of *Moenkhausia eurystaenia*. Three specimens were measured from each of the following lots: CPUFMT 610, DZSJRP 12547, INPA 34095, MCP45547, MPEG 18924, USNM 398648, and 16 specimens from MZUSP 91404 and the holotype (MZUSP 106058). SD = Standard deviation.

	Holotype	n	Paratypes	Mean	SD
Standard length (mm)	36.8	35	22.8-36.8	27.4	3.7
Percents of standard length					
Depth at dorsal-fin origin	11.5	35	26.1-31.8	28.2	1.5
Snout to dorsal-fin origin	18.5	35	49.8-52.0	50.9	0.6
Snout to pectoral-fin origin	9.8	35	25.9-28.5	27.3	0.5
Snout to pelvic-fin origin	17.6	35	46.9-50.0	48.4	0.8
Snout to anal-fin origin	23.3	35	62.1-65.4	63.5	0.7
Caudal-peduncle depth	3.6	35	8.4-10.0	9.1	0.4
Caudal-peduncle length	4.2	35	10.4-13.6	11.7	0.8
Pectoral-fin length	7.9	35	19.1-23.1	21.3	0.8
Pelvic-fin length	6.2	35	14.4-18.3	15.9	0.8
Pelvic-fin origin to anal-fin origin	16.6	35	15.1-21.2	16.6	1.0
Dorsal-fin length	10.2	35	24.5-29.2	26.7	1.0
Dorsal-fin base length	5.2	35	12.7-15.1	14.1	0.5
Anal-fin length	6.7	35	17.7-19.8	18.9	0.6
Anal-fin base length	10.3	35	25.1-28.4	26.8	0.8
Eye to dorsal-fin origin	13.1	35	33.7-37.2	35.4	0.8
Dorsal-fin origin to caudal-fin base	19.4	35	49.0-53.5	51.3	1.0
Head depth	9.7	35	23.2-26.4	24.6	0.9
Head length	9.4	35	25.0-27.2	26.4	0.6
Percents of head length					
Horizontal eye diameter	4.2	35	42.4-52.4	46.8	2.5
Snout length	2.4	35	22.0-29.7	25.4	1.4
Interorbital width	3.2	35	32.9-36.6	34.3	1.0
Upper jaw length	4.4	35	44.8-49.3	46.7	1.2

**Comparative material.** *Hyphessobrycon* cf. *agulha*: MZUSP 81299, 5, 22.2-30.3 mm SL, rio Negro basin. *Hyphessobrycon herbertaxelrodi*: MZUSP 96656, 72, 15.1-20.5 mm SL, rio Paraguay basin. *Hyphessobrycon loretoensis*: MZUSP 85591, 3, 22.0-24.4 mm SL, rio Ucayali basin. *Hyphessobrycon metae*: MZUSP 50095, 27, 20.5-31.5 mm SL, rio Tapajós basin. *Hyphessobrycon notidanus*: MZUSP 89645, 15 paratypes, 12.6-35.1 mm SL, rio Tapajós basin. *Hyphessobrycon peruvianus*: MZUSP 85593, 1, 40.1 mm SL, rio Ucayali basin. *Moenkhausia heikoi*: MZUSP 82460, 3, 29.5-33.2 mm SL, paratypes of *Astyanax dnophos*, rio Xingu basin. *Moenkhausia phaeonota*: MZUSP 78732, 34, 16.0-28.6 mm SL, MZUSP 82292, 1, 33.5 mm SL, rio Paraguay basin; MZUSP 13793, holotype, 32.3 mm SL, MZUSP 13794, 1 paratype, 19.3 mm SL, MZUSP 13795, paratype, 20.7 mm SL, MZUSP 45301, 193, 19.1-43.7 mm SL (7, 28.9-42.9 mm SL), 2 c&s, 29.1-36.2 mm SL, MZUSP 61043, 10, 18.8-37.6 mm SL (5, 33.8-37.9 mm SL), MZUSP 98941, 20, 19.4-36.1 mm SL, rio Tapajós basin; MZUSP 91403, 197, 17.3-31.3 mm SL (15, 24.1-31.0 mm SL), MZUSP 91094, 6, 32.0-39.3 mm SL, MZUSP 98988, 4, 18.7-34.3 mm SL, rio Xingu basin. *Nematobrycon palmeri*: MZUSP 62432, 1, 36.7 mm SL, aquarium specimen. *Tucanoichthys tucano*: MZUSP 51322, 10 paratypes, 12.6-15.4 mm SL, rio Negro basin.

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