# A New Species of *Moenkhausia* Eigenmann, 1903 (Characiformes, Characidae) from the Upper Rio Negro Basin, Brazil

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**A new species of *Moenkhausia* is described from Rio Curicuriari and Rio Tiquié, both right-bank tributaries of the upper Rio Negro basin, Amazonas State, Brazil. The new taxon differs from all congeners, except *M. agnesae* and *M. beninei*, by the combination of a sinuous humeral blotch, similar to a compressed letter Z, and distinct dark longitudinal stripes along the body sides. The new species can be distinguished from *M. agnesae* and *M. beninei* by the presence of a single humeral blotch and of longitudinal stripes running through the center of the scales, more conspicuous dorsally.**

**Uma nova espécie de *Moenkhausia* é descrita do Rio Curicuriari e Rio Tiquié, ambos tributários da margem direita da bacia do alto Rio Negro, Estado do Amazonas, Brasil. O novo táxon difere de todos os congêneres, exceto *M. agnesae* e *M. beninei*, pela combinação de uma mancha umeral sinuosa, lembrando uma letra Z comprimida, e distintas faixas longitudinais escuras ao longo dos lados do corpo. A nova espécie pode ser distinguida de *M. agnesae* e *M. beninei* pela presença de uma única mancha umeral e de faixas longitudinais passando pelo centro das escamas, mais conspícuas dorsalmente.**

*MOENKHAUSIA* is one of the most species-rich genera of Characidae, with 90 species currently recognized as valid (Lima et al., 2003; Deprá et al., 2018; Lima and Soares, 2018). The genus is broadly distributed in the South American cis-Andean river drainages, from the Orinoco basin to the La Plata basin, with its greatest diversity in northern cis-Andean South America, i.e., the Orinoco basin, the Amazon basin, and Guyanese river drainages.

The genus was listed as *incertae sedis* in Characidae by Lima et al. (2003), and recent phylogenetic hypotheses did not recover *Moenkhausia* as a monophyletic group (Oliveira et al., 2011; Mariguela et al., 2013). More recently, Mirande (2018), although also not recovering the genus as monophyletic, considered the representatives of the genus as belonging to his newly defined subfamily Stethaprioninae.

The new species herein described was collected for the first time in 2006 by one of the authors (FCTL) in the Rio Tiquié, a tributary of the Rio Uaupés, upper Rio Negro basin, Brazil. Additional specimens were collected by the other authors in 2015 in the Rio Curicuriari, a tributary of the Rio Negro just below São Gabriel da Cachoeira. The objectives of the present paper are to describe this distinctive new taxon and to comment on its putative relationships.

## MATERIALS AND METHODS

Counts and measurements were taken on the left side of specimens whenever possible, following Fink and Weitzman (1974) and Menezes and Weitzman (1990), with the addition of head depth, which was measured at the vertical through the tip of the supraoccipital spine, and the distance from eye to dorsal-fin origin, which was measured from the posterior limit of the orbit to the dorsal-fin origin. Measurements are given as percent of standard length (SL), except subunits of the head, which are given as percent of head length (HL). Counts of vertebrae, supraneurals, procurrent caudal-fin rays, and unbranched rays of the anal fin were taken from cleared and stained specimens (CS) prepared according to Taylor and Van Dyke (1985). Counts of vertebrae include the Weberian apparatus, counted as four elements, and the fused PU1+U1 of the caudal region counted as a single vertebral element. Scanning electronic microscopy (SEM) images were taken from upper and lower jaws. In the description, counts are followed by the total number of examined specimens in parentheses, then by the number of cleared and stained individuals (if any); asterisks indicate values for the holotype. Institutional abbreviations follow Sabaj (2016).

### *Moenkhausia bellasomniosa*, new species

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Figures 1–4a; Table 1

***Holotype.***—INPA 49753, 54.1 mm SL, Brazil, Amazonas, São Gabriel da Cachoeira, small tributary of Rio Curicuriari (a tributary of Rio Negro), 0°14′39″S, 67°03′31″W, A. S. Oliveira, L. Rapp Py-Daniel, and I. M. Soares, 28 February 2015.

***Paratypes.***—All from Brazil, Amazonas, São Gabriel da Cachoeira, Rio Negro basin: ANSP 206175, 2, 41.0–55.9 mm SL, INPA 49722, 8, 39.5–57.2 mm SL, 2 CS, 47.0–51.7 mm SL, Igarapé Bucu, tributary of Rio Curicuriari, 0°14′39″S, 67°03′31″W, A. S. Oliveira, L. Rapp Py-Daniel, and I. M. Soares, 27 February 2015; FMNH 138665, 2, 34.6–37.0 mm SL, MZUSP 92566, 17, 25.0–43.4 mm SL, ZUEC 16932, 3, 17.0–40.2 mm SL, stream tributary of Rio Tiquié, Cunuri village, 0°12′23″N, 69°22′28″W, F. C. T. Lima, 27 August

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**Fig. 1.** *Moenkhausia bellasomniosa*. (A) INPA 49753, holotype, male, 54.1 mm SL, Brazil, Amazonas, tributary of Rio Curicuriari; (B) MZUSP 92566, paratype, female, 41.5 mm SL, Brazil, Amazonas, tributary of Rio Tiquié; (C) INPA 49722, paratype, female, 57.2 mm SL, Brazil, Amazonas, tributary of Rio Curicuriari; color in life.

**Fig. 2.** *Moenkhausia bellasomniosa*, INPA 49722, paratype, 51.7 mm SL. Scanning electronic micrographs of inner view of left premaxilla, maxilla, and dentary. Scale bar = 300 μm. Photographs by L. Castanhola.

2006; MZUSP 93337, 4, 24.9–38.5 mm SL, stream tributary of Rio Tiquié, Serra do Mucura village, 0°10′7″N, 69°7′46″W, F. C. T. Lima et al., 10–11 November 2006.

***Diagnosis.***—*Moenkhausia bellasomniosa* is diagnosed from all congeners, except *M. agnesae*, *M. beninei*, *M. chlorophthalma*, *M. cotinho*, *M. lineomaculata*, *M. nigromarginata*, *M. parecis*, *M. petymbuaba*, and *M. plumbea*, by its color pattern characterized by the presence of distinct dark longitudinal stripes along the body (vs. longitudinal stripes absent). The new species differs from *M. cotinho*, *M. lineomaculata*, *M. parecis*, and *M. plumbea* by the absence of a caudal-peduncle blotch (vs. blotch present), and from *M. chlorophthalma* and *M. petymbuaba* by the absence of a broad longitudinal dark midlateral stripe (vs. stripe present). *Moenkhausia bellasomniosa* can be additionally distinguished from all aforementioned species, except from *M. agnesae* and *M. beninei*, by possessing a sinuous humeral blotch, roughly similar to a compressed letter Z (vs. humeral blotch as a vertically elongated bar), but differs from the latter species by having only one humeral blotch (vs. two). *Moenkhausia bellasomniosa* can be easily separated from *M. agnesae, M. beninei,* and *M. nigromarginata* by possessing longitudinal stripes running through the center of the scales (vs. longitudinal stripes running between the rows of scales). *Moenkhausia bellasomniosa* can be additionally diagnosed from *M. agnesae* by having conspicuous longitudinal stripes only dorsally (vs. conspicuous both dorsally and ventrally) and a lower number of lateral line scales (32–35, mode 33 vs. 35–36, mode 36 in *M. agnesae*). The new species can be further differentiated from *M. beninei* by a greater number of maxillary teeth (4–7 vs. 2–3 in *M. beninei*) and by a lower number of branched anal-fin rays (19–23, mode 21 vs. 22–26, mode 25 in *M. beninei*).

***Description.***—Morphometrics summarized in Table 1. Body compressed, deep, moderately elongate, greatest body depth immediately anterior to dorsal-fin origin. Dorsal profile of head slightly convex from tip of upper jaw to vertical through anterior nostril; straight or slightly concave from that point to tip of supraoccipital spine. Dorsal profile of body convex from tip of supraoccipital spine to base of last dorsal-fin ray, straight from latter point to adipose-fin origin, and concave between adipose-fin insertion and origin of anteriormost dorsal procurrent caudal-fin ray. Ventral profile of body convex from anterior tip of lower jaw to pelvic-fin origin; straight or slightly convex from pelvic-fin origin to anal-fin origin; straight and posterodorsally slanted along anal-fin base; and slightly concave along caudal peduncle.

Mouth terminal, jaws isognathous. Two tooth rows in premaxilla: outer with 3(1), 4(17), 5*(9), or 6(1) tricuspid teeth; inner with 5*(25) or 6(3) pentacuspid teeth, symphyseal tooth of inner row with four cusps. Maxilla with 4(6), 5(10), 6*(6), or 7(6) tricuspid teeth. Dentary with anteriormost 4*(25) or 5(3) teeth pentacuspid, followed by middle-sized tricuspid tooth, and posteriormost 8–9 smaller, tricuspid or conical teeth. Central cusp of all teeth more developed than lateral cusps (Fig. 2).

Scales cycloid, moderately large, with parallel *radii*. Lateral line completely pored, slightly curved anteriorly, with 32(2), 33(10), 34*(8), or 35(5) perforated scales. Longitudinal scale rows between dorsal-fin origin and lateral line 4(2) or 5*(25);

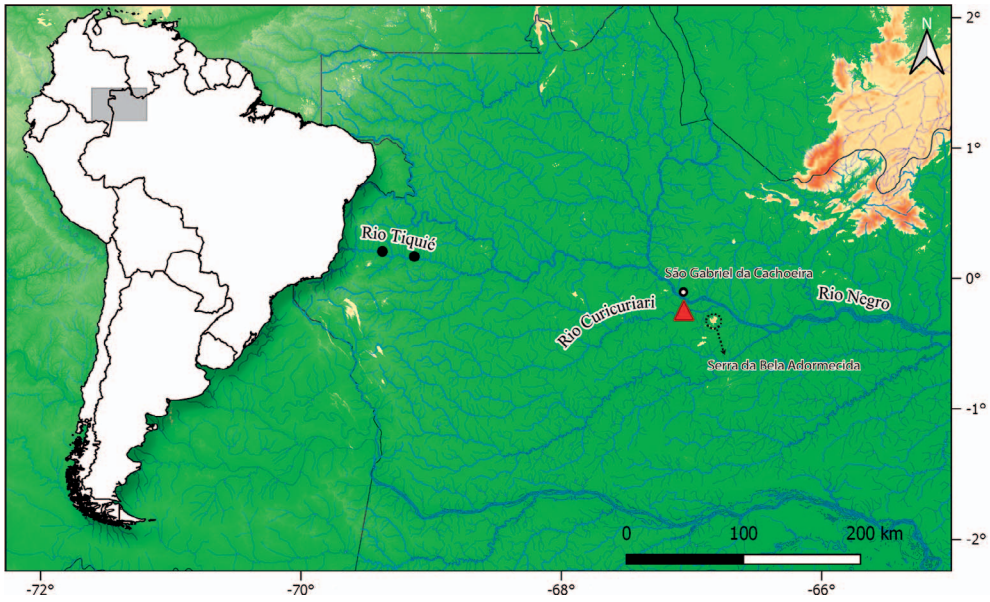


**Fig. 3.** Geographic distribution of *Moenkhausia bellasomniosa* in the upper Rio Negro basin, Brazil (type locality is represented by the triangle).

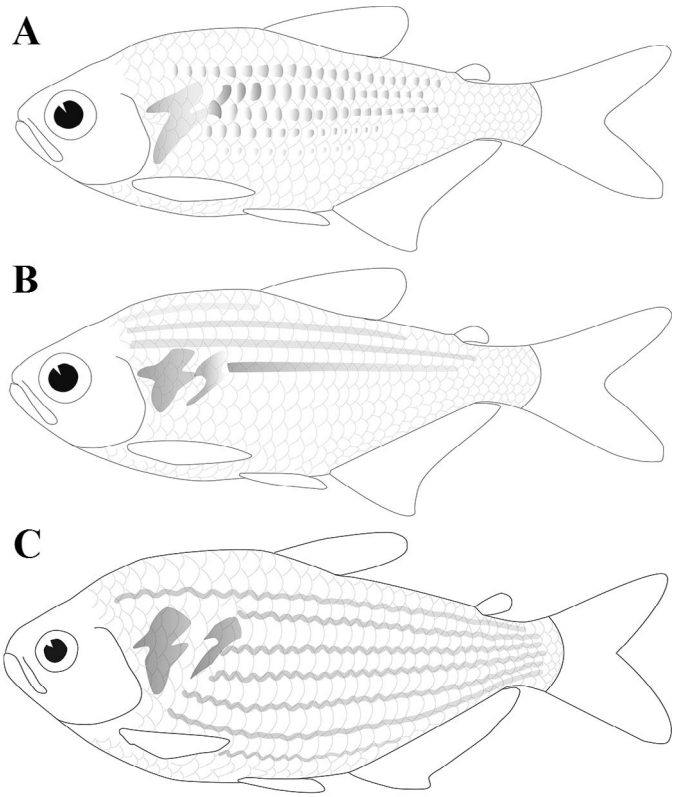


**Fig. 4.** Schematic representation of humeral blotches and longitudinal dark stripes in (A) *Moenkhausia bellasomniosa*, (B) *Moenkhausia beninei*, and (C) *Moenkhausia agnesae*.

longitudinal scale rows between lateral line and pelvic-fin origin 4*(17) or 5(10). Predorsal scale row with 9(11), 10(9), or 11(2) scales, arranged in median series (22), or irregularly arranged* (4). Circumpeduncular scales 14(23). Scale sheath along anal-fin base with 9–13 small scales, in single row, overlying basal portion of anteriormost anal-fin rays. Caudal fin scaled, scales covering first third of caudal-fin lobes.

Dorsal-fin rays ii, 9*(28). Dorsal-fin origin near middle of standard length, slightly posterior to vertical through pelvic-fin origin. First unbranched ray shorter than second one.

**Table 1.** Morphometric data of *Moenkhausia bellasomniosa*. Values for the holotype (INPA 49753), range ($n = 28$; including holotype and paratypes), and mean±SD (standard deviation).

| Character | Holotype | *n* | Range | Mean±SD |
|---|---|---|---|---|
| Standard length (mm) | 54.1 | 28 | 24.9–57.2 | |
| Head length (mm) | 13.7 | 28 | 7.0–15.2 | |
| **Percentages of standard length** | | | | |
| Body depth at dorsal-fin origin | 36.7 | 28 | 30.9–41.5 | 36.3±2.4 |
| Head length | 25.3 | 28 | 25.3–28.6 | 26.7±0.8 |
| Snout to dorsal-fin origin | 50.7 | 28 | 48.8–52.6 | 50.9±1.0 |
| Snout to pectoral-fin origin | 26.2 | 28 | 26.2–29.7 | 27.5±0.8 |
| Snout to pelvic-fin origin | 47.1 | 28 | 45.6–53.3 | 48.1±1.6 |
| Snout to anal-fin origin | 65.3 | 28 | 61.9–71.3 | 65.5±1.7 |
| Dorsal-fin base | 15.2 | 28 | 14.2–16.1 | 15.2±0.6 |
| Dorsal-fin length | 27.5 | 28 | 26.8–32.2 | 29.3±1.4 |
| Pectoral-fin length | 24.1 | 27 | 21.7–27.1 | 23.6±1.2 |
| Pelvic-fin length | 18.4 | 28 | 16.4–21.9 | 17.9±1.2 |
| Anal-fin base | 29.8 | 28 | 28.0–31.7 | 29.7±1.0 |
| Anal-fin length | 15.6 | 28 | 15.6–20.4 | 18.6±1.4 |
| Caudal-peduncle depth | 11.2 | 28 | 9.4–11.8 | 10.7±0.6 |
| Caudal-peduncle length | 11.5 | 26 | 8.6–12.5 | 10.7±1.0 |
| Posterior margin of eye to dorsal-fin origin | 36.8 | 26 | 33.3–39.4 | 36.5±1.3 |
| **Percentages of head length** | | | | |
| Snout length | 22.0 | 28 | 19.4–25.7 | 22.0±1.7 |
| Upper jaw length | 48.5 | 28 | 45.5–51.8 | 49.8±1.4 |
| Horizontal eye diameter | 35.2 | 28 | 33.8–43.3 | 38.4±2.1 |
| Interorbital width | 34.2 | 28 | 29.9–35.2 | 33.1±1.2 |

Adipose fin present; its origin approximately at vertical through base of 16th to 18th branched anal-fin rays. Pectoral-fin rays i, 10(2), 11(12), or 12*(14); tip of adpressed longest rays usually reaching pelvic-fin insertion. Pelvic-fin rays i, 7*(28); tip of adpressed longest rays not reaching anal-fin insertion in specimens larger than 50.0 mm SL. Anal-fin rays iii(1) or iv(1), 19(1), 20(1), 21*(14), 22(11), or 23(1); anteriormost rays slightly longer than remaining, subsequent rays gradually decreasing in size. Principal caudal-fin rays i,9+8,i(28). Dorsal procurrent caudal-fin rays 9(1) or 10(1) and ventral procurrent caudal-fin rays 8(1) or 9(1). Caudal fin forked, lobes similar in size. Supraneurals 4(1) or 5(1). Precaudal vertebrae 15(2); caudal vertebrae 17(1) or 19(1); total vertebrae 32(1) or 34(1). First gill arch with 6*(27) or 7(1) gill rakers on upper limb and 10(4) or 11*(24) gill rakers on lower limb.

***Color in alcohol.***—Ground color tan, dorsal and dorsolateral portions of head and body dark brown (Fig. 1A–B). Small brown chromatophores densely concentrated on snout, opercle, and dorsal surface of head, imparting an overall dark brown color. Infraorbitals, preopercle, and opercle light brown, with numerous minute brown chromatophores, especially on opercle. Ventral portion of head light brown, with small brown chromatophores densely concentrated on dentary and isthmus. Scales on body, except those on mid-ventral region, with dark chromatophores concentrated along posterior edge, forming longitudinal stripes composed by rows of blotches; first to third longitudinal scale rows above lateral line typically with dark pigmentation more developed on free scale margin and consequently with longitudinal stripes more conspicuous. Humeral blotch vertically elongated, extending longitudinally over 2nd–5th lateral line scales, and vertically through two scales rows above lateral line and two below it. Humeral blotch anteroventrally inclined, its lower portion at 2nd longitudinal scale series below lateral line. Overall shape of humeral blotch sinuous, similar to compressed letter Z. Light area anterior and posterior to humeral blotch. Dark area immediately posterior to light area not readily discernible as second humeral blotch. Fins hyaline, with scattered small dark brown chromatophores densely concentrated at interradial membranes, especially in dorsal, anal, and caudal fins. Adipose fin with scattered dark chromatophores concentrated in proximal portion, its tip devoid of chromatophores.

***Color in life.***—Based on photographs taken in the field from one paratype (INPA 49722; Fig. 1C) and from two freshly collected paratypes (MZUSP 92566). Head golden; anterior and middle portion of body golden (INPA 49722) or purplish pink (MZUSP 92566). Posterior portion of body purplish pink. Scales iridescent on mid-ventral portion of body, color ranging from purple to yellow. Ventral area ivory. Eye mostly yellow, with dorsal portion red. Dorsal and adipose fins yellow or pink. Pectoral and pelvic fins orange. Proximal half of caudal fin with rays intensely reddish pink and distal portion hyaline. Anal fin with diffused red pigmentation.

***Sexual dimorphism.***—Mature males of *Moenkhausia bellasomniosa* possess small bony hooks along the distal half of the last unbranched ray and from 1st to 5th branched anal-fin rays. One or two pairs of hooks per ray segment. Fin hooks were observed in ten males (ANSP 206175, 1, 41.0 mm SL; INPA 49722, 8, 39.5–51.7 mm SL; INPA 49753, holotype, 54.1 mm SL). Two CS specimens (INPA 49722, 47.0 and 51.7 mm SL) show small hooks on dorsal, pectoral, and pelvic fins distributed along the distal tip of rays.

**Fig. 5.** *Moenkhausia agnesae*, INPA 48936, 49.4 mm SL, Brazil, Amazonas, Rio Japurá basin. Photograph by P. Ito.

***Distribution.***—*Moenkhausia bellasomniosa* is known from tributaries of the Rio Curicuriari and Rio Tiquié, both right-bank tributaries of the upper Rio Negro basin, Amazonas state, Brazil (Fig. 3).

***Ecological notes.***—*Moenkhausia bellasomniosa* was collected in the Rio Tiquié in small "terra firme" forest streams (i.e., non-floodable) with dark water. Specimens were collected in small pools. At the Rio Curicuriari, specimens of the new species were collected in a small, fast-water tea-like colored forest stream, with rocky bottom.

***Common name.***—*Moenkhausia bellasomniosa* is called "batia-wu" by the Tukano Indians, a name employed for the species in the middle Rio Tiquié basin. However, in the upper Rio Tiquié the same name is employed for a congener, *M. comma* (Lima et al., 2005).

***Etymology.***—The specific epithet *bellasomniosa* comes from the Latin, meaning sleeping beauty (*bella*, pretty; *somniosa*, sleepy). It is an allusion to the Serra do Curicuriari, a granitic massif situated immediately to the south of the eponymous Rio Curicuriari, composed by three peaks, ranging from 800–1000 meters a.s.l. The Serra do Curicuriari provides majestic scenery when viewed from the city of São Gabriel da Cachoeira, situated upstream in the Rio Negro, where it is dubbed "Bela adormecida" (sleeping beauty) due to its perceived rough resemblance to a lying young woman. An adjective.

## DISCUSSION

As mentioned in the introduction, *Moenkhausia* is presently recognized as a non-monophyletic genus, and, consequently, the relationships among its species are still poorly understood. Recently, several authors have assumed that species of *Moenkhausia* sharing similar color patterns might represent natural groups (e.g., Benine et al., 2009; Marinho and Langeani, 2010; Ohara and Lima, 2015; Soares and Bührnheim, 2016). Lima and Soares (2018), in the description of *M. beninei*, considered that the latter species might be closely related to *M. agnesae* (Fig. 5), with which *M. bellasomniosa* shares several uncommon features of color pattern. To some extent, the same color features shared by *M. agnesae* and *M. beninei* are also present in *M. bellasomniosa*. The new species shares with *M. agnesae* and *M. beninei* the presence of distinct dark longitudinal stripes along the body (more conspicuous in preserved specimens) and the presence of an obliquely oriented, irregularly shaped first humeral blotch. However, and as mentioned in the diagnosis, the new

species can be promptly distinguished from both *M. agnesae* and *M. beninei* by possessing a single humeral blotch (vs. two humeral blotches in *M. agnesae* and *M. beninei*) and by presenting dark longitudinal stripes running through the center of the scales, which are more conspicuous dorsally (vs. stripes wavy, between series of scales, and conspicuous both dorsally and ventrally in *M. agnesae*; stripes straight, between series of scales, and more conspicuous dorsally in *M. beninei;* see Fig. 4). Regarding the absence of a second humeral blotch in *M. bellasomniosa*, it is important to note that a possibly homologous dark pigmentation in the same position of the second humeral blotch of *M. agnesae* and *M. beninei* occurs in the species, but this pigmentation is not distinctly darker than the subsequent pigmentation along the midline of the body. Teixeira et al. (2016: 472–473) discuss similar instances of other characids for which a second humeral blotch cannot be unequivocally identified.

It seems very likely that *Moenkhausia agnesae, M. bellasomniosa*, and *M. beninei* are closely related species; however, the relationships among them, as well as the relationships of these species with other species of *Moenkhausia* and related characid genera, need to be further investigated. A broader phylogenetic analysis of *Moenkhausia* is being currently conducted by the first author (IMS), and it is hoped that a test of the monophyly of the putative group formed by *M. agnesae, M. bellasomniosa,* and *M. beninei* herein proposed will be available in the near future.

## MATERIAL EXAMINED

All from Brazil except when otherwise noted.

*Moenkhausia agnesae*: INPA 48936, 2, 49.4–50.0 mm SL; INPA 48948, 1, 26.5 mm SL; INPA 53347, 3, 28.3–40.1 mm SL, Amazonas, Rio Japurá basin; MCP 29466, 2, 65.5–70.5 mm SL, Peru, Loreto, Río Nanay; MHNG 2176.78, 4, 49.4–50.0 mm SL, paratypes, Amazonas, Rio Solimões basin.

*Moenkhausia beninei*: ZUEC 16838, 55.5 mm SL, holotype; ANSP 205848, 5, 22.7–33.6 mm SL; FMNH 136857, 3, 24.2–35.4 mm SL, paratypes; INPA 57625, 5, 23.4–35.3 mm SL, paratypes; MZUSP 85649, 92, 4 CS, 12.1–40.3 mm SL, paratypes; ZUEC 16146, 47, 14.8–49.5 mm SL; Amazonas, Rio Negro basin.

*Moenkhausia chlorophthalma*: INPA 33764, 5, 34.7–49.4 mm SL, paratypes, Pará, Rio Curuá basin.

*Moenkhausia cotinho*: ZUEC 10229, 11, 39.5–50.9 mm SL; ZUEC 10262, 14, 38.6–55.4 mm SL, Mato Grosso, São José do Rio Claro, Rio Claro.

*Moenkhausia lineomaculata*: INPA 48035, 3, 26.0–36.5 mm SL, paratypes, Mato Grosso, Rio Juruena.

*Moenkhausia nigromarginata*: LBP 9033, 28, 35.5–50.6 mm SL, Mato Grosso, Rio Verde.

*Moenkhausia parecis*: INPA 46708, 10, 28.0–52.8 mm SL, paratypes, Rondônia, upper Rio Machado basin.

*Moenkhausia plumbea*: INPA 33765, 5, 35.5–43.7 mm SL, paratypes, Pará, Rio Curuá basin; LBP 25268, 5, 35.3–51.7 mm SL, Pará, Rio Tapajós basin.

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