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Astyanax vermilion and *Astyanax burgerai*: new characid fishes (Ostariophysi: Characiformes) from Northeastern Bahia, Brazil

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Two new *Astyanax* species, *A. vermilion*, from rio Almada and rio Cachoeira, and *A. burgerai*, from rio Almada, Bahia State, Brazil, are described. *Astyanax vermilion* is distinguished from most of its congeners and from all other *Astyanax* species known from northeastern Brazilian drainages by having distal portion of pelvic fins dark, a combination of sexually dimorphic characters, posteroventral portion of body and fins (except pectoral) reddish in life, and inconspicuous humeral and caudal spots. It also differs by having highest body depth just anterior of dorsal-fin origin, 32-34 lateral-line scales, and presence of one or two maxillary teeth. *Astyanax burgerai* is diagnosed by the presence of two vertically elongated humeral blotches, absence of a conspicuous and broad dark midlateral stripe (at least on anterior half of body), body highest along vertical slightly behind midlength of pectoral fin, 31-34 lateral-line scales, and two or three teeth on premaxillary outer series.

Duas espécies novas de *Astyanax*, *A. vermilion*, do rio Almada e rio Cachoeira, e *A. burgerai*, do rio Almada, Estado da Bahia, Brasil, são descritas. *Astyanax vermilion* distingue-se da maioria de suas congêneres e de todas as espécies de *Astyanax* conhecidas das drenagens do Nordeste do Brasil por ter porção distal da nadadeira pélvica escurecida, uma combinação de caracteres sexualmente dimórficos, porção póstero-ventral do corpo e nadadeiras (exceto peitoral) avermelhadas em vida e manchas umeral e caudal inconspícuas. Difere também por ter maior altura do corpo imediatamente anterior à origem da nadadeira dorsal, 32-34 escamas na linha lateral e presença de um ou dois dentes no maxilar. *Astyanax burgerai* é diagnosticada pela presença de duas manchas umerais alongadas verticalmente, ausência de faixa lateral larga e conspícua, ao menos na metade anterior do corpo, maior altura do corpo na vertical situada levemente posterior à metade da nadadeira peitoral, 31-34 escamas na linha lateral e dois ou três dentes na série externa do pré-maxilar.

Key words: New species, Sexual dimorphism, Coastal drainages, Characidae.

Introduction

Astyanax is one of the most speciose characid genus (Lima *et al*., 2003), including over 100 species distributed from Texas to Argentina. Ten species of *Astyanax* are currently known from northeastern Brazilian coastal rivers, *A. fasciatus* (Cuvier), *A. intermedius* Eigenmann, *A. lacustris* (Lütken), *A. rivularis* (Lütken), and *A. taeniatus* (Jenyns) from rio São Francisco and other coastal basins nearby, *A. brevirhinus* Eigenmann and *A. turmalinensis* Triques, Vono & Caiafa from rio Jequitinhonha, and the more recently described *A. pelecus* Bertaco & Lucena from rio Pardo, *A. epiagos* Zanata & Camelier and *A. jacobinae* Zanata & Camelier from upper Paraguaçu and Itapicuru rivers basins, respectively. Some of these species (*A. fasciatus*, *A. intermedius*, *A. lacustris-bimaculatus* group) represent species complexes broadly distributed that have been treated as taxonomically poorly understood. Other species, as *A. epiagos*, *A. jacobinae*, and *A. pelecus* were only sampled in restricted areas and are probably endemic to upper portions of relatively small northeastern coastal Brazilian drainages. The continuous increase in new descriptions of small characids from small coastal Brazilian drainages in the recent literature (some *Astyanax* species cited above plus *A. microschemos* (Bertaco & Lucena, 2006), *Hyphessobrycon negodagua* (Lima & Gerhard, 2001), *Myxiops aphos* (Zanata & Akama, 2004), *Moenkhausia diamantina* (Benine *et al*., 2007)) attests for the low scientific knowledge and endemic nature of these coastal freshwater fish faunas, specially from northeastern drainages.

Recent collecting efforts in southern Bahia state revealed the existence of two new species of *Astyanax*, known only

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from rio Almada and rio Cachoeira drainages. These species are described herein.

Material and Methods

Counts and measurements were taken according to Fink & Weitzman (1974) and Menezes & Weitzman (1990). In the descriptions, the frequency of each count is provided in parentheses after the respective count. An asterisk indicates counts of the holotype. Radiographs (R) of holotype and two paratypes of *Astyanax burgerai* were provided for osteological details. Position of first dorsal- and anal-fin pterygiophores and vertebrae, supraneurals, procurrent caudal-fin rays, branchiostegal rays, gill-rakers, and dentary teeth counts and cusps number were taken only from cleared and stained paratypes (c&s), prepared according to the method of Taylor & Van Dyke (1985), and also from radiographed material of *A. burgerai*. Vertebrae of the Weberian apparatus were counted as four elements, included in the vertebral counts, and the fused PU1+U1 as a single element. Pattern of *circuli* and *radii* was defined on scales sampled from region between the lateral line and the insertion of dorsal fin. In the material listed, the total number of specimens and its size range comes first, followed by the number and size range of measured specimens (in parentheses), if different. Institutional abbreviations follow Ferraris (2007), with the inclusion of UFBA (Universidade Federal da Bahia, Salvador, Brazil) and DZUFMG (Departamento de Zoologia da Universidade Federal de Minas Gerais, Belo Horizonte, Brazil). The arithmetic mean used in some instances is represented by *X*. Specimens utilized for comparative analysis are listed under 'Comparative material examined' and other comparisons provided elsewhere were based on the literature information (Eigenmann, 1921, 1927; Azpelicueta & Garcia, 2000; Bertaco & Malabarba, 2001; Azpelicueta *et al*., 2002; Azpelicueta & Casciotta, 2002; Almirón *et al*., 2002; Haluch & Abilhoa, 2005; Bertaco & Lucena, 2006; Triques *et al*., 2006; Abilhoa & Duboc, 2007; Zanata & Camelier, 2008).

Astyanax vermilion, new species
Figs. 1-3

Holotype. MZUSP 101243, 39.4 mm SL, Brazil, Bahia State, Floresta Azul, rio Salgado under bridge on road BA 130, rio Cachoeira drainage, 14°51'18.0"S 39°39'41"W, 189 m alt., 12 Feb 2008, A. M. Zanata, P. Camelier, R. Burger & A. B. A. Góes.

Paratypes. All from Brazil, Bahia State. ANSP 189328,10, 35.4-39.0 mm SL, MZUSP 101244,10, 37.4-38.7 mm SL, UFBA 4344, 76, 30.5-40.8 mm SL (12, 30.5-40.8 mm SL), collected with holotype. UFBA 4342, 31, 26.9-39.2 mm SL (12, 3 c&s, 26.9-39.2 mm SL), Floresta Azul, streamlet tributary of rio Salgado drainage on road between Floresta Azul and Almadina, rio Cachoeira drainage, 14°48'31"S 39°39'13"W, 188 m alt., 12 Feb 2008, Zanata *et al*. UFBA 4343, 56, 35.1-40.3 mm SL (12, 35.1-40.3 mm SL), Itajuípe, rio Almada on Fazenda Luanda, 14°40'53"S 39°24'24"W, 258 m alt., 12 Feb 2008, Zanata *et al*. UFBA 4813, 24, 25.7-42.8 mm SL, Ilhéus, district of Rio do Braço, rio do Braço, rio Almada basin, in front of Fazenda Norma, between roads BR 415 and BA 262,14°41'10''S 39°16'27''W, 80 m alt., 24 Feb 2009, Zanata *et al*. UFBA 4905, 32, 32.4-39.5 mm SL, Ilhéus, rio Santana, on road between Ilhéus and Buerarema, rio Cachoeira basin, 14°54'42''S 39°08'36''W, 53 m alt., 24 Feb 2009, Zanata *et al*.

Diagnosis. *Astyanax vermilion* can be distinguished from all other *Astyanax* species known from northeastern Brazilian drainages (*A. brevirhinus*, *A. epiagos*, *A. fasciatus*, *A. intermedius*, *A. jacobinae*, *A. lacustris*, *A. pelecus*, *A. rivularis*, *A. taeniatus*, and *A. turmalinensis*) by having distal portion of pelvic fin dark, a combination of sexually dimorphic characters, the posteroventral portion of body

Fig. 1. *Astyanax vermilion*, new species, holotype, male, MZUSP 101243, 39.4 mm SL, Brazil, Bahia State, Floresta Azul, rio Cachoeira drainage.

Fig. 2. *Astyanax vermilion*, new species, paratype barely dead, male, UFBA 4344, 37.2 mm SL.

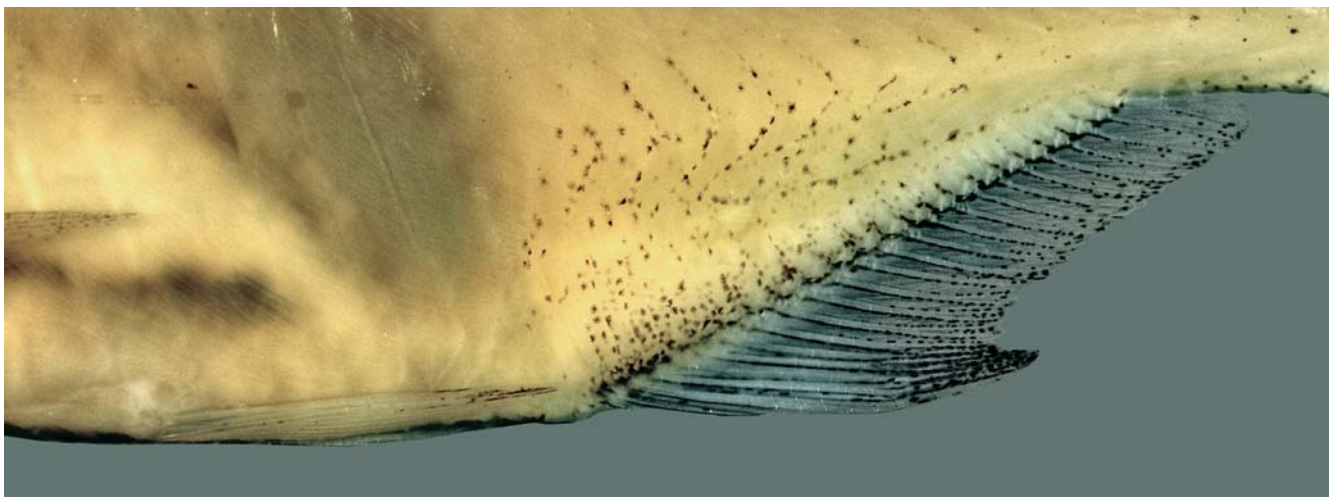

Fig. 3. *Astyanax vermilion*, new species, paratype, female UFBA 4344, 37.5 mm SL.

and all fins (except pectoral) reddish in life, and an inconspicuous humeral and caudal spots. Differs further by having highest body depth just anterior to dorsal-fin origin (*vs*. body highest on a vertical around middle or posterior portion of pectoral fin in *A. epiagos*, *A. intermedius*, *A. jacobinae*, and *A. rivularis*), 32-34 lateral-line scales (*vs*. 35 or more in *A. brevirhinus*, *A. intermedius*, *A. jacobinae*, *A. pelecus*, *A. rivularis*), five series of scales between dorsal-fin origin and lateral line (*vs*. six or more in *A. brevirhinus*, *A. fasciatus*, *A. lacustris*), three series of scales between lateral line and pelvic-fin origin (*vs*. 4.5 or more, respectively, in *A. brevirhinus*, *A. lacustris*, *A. turmalinensis*, *A. intermedius*), presence of one or two maxillary teeth (*vs*. none in *A. lacustris* or three or more in *A. brevirhinus* and *A. fasciatus*). *Astyanax vermilion* can be further diagnosed from *A. epiagos* and *A. pelecus* by having 20-23 branched anal-fin rays (*vs*. 13-17 and 16-18, respectively), from *A. jacobinae* and *A. lacustris* by having one or two maxillary teeth (*vs*. three and none, respectively), from *A. taeniatus* by having no more than five cusps and dentary teeth abruptly decreasing in size posteriorly (*vs*. usually seven cusps on dentary and premaxillary teeth and dentary teeth gradually smaller posteriorly). This new species differs further from *A. turmalinensis* by having 32-34 lateral-line scales (*vs*. 34-36) and dorsal fin usually ii,8,i (*vs*. dorsal fin always with ii,9 rays). *Astyanax vermilion* differs from *A. burgerai* on its overall body shape and color, including an inconspicuous humeral spot (*vs*. humeral blotch conspicuous and vertically elongated), posteroventral portion of body reddish when alive (*vs*. absence of red pigmentation on body), branched anal-fin rays 20-23 (*vs*. 18-19), dorsal-fin rays usually ii,8,i (*vs*. ii,9), and 8-12 scales aligned on base of anterior anal-fin rays (*vs*. 3-6).

Description. Morphometric data of holotype and paratypes are presented in Table 1. Body somewhat compressed.

Table 1. Morphometric data for *Astyanax vermilion*, new species. Based on holotype (MZUSP 101243) and paratypes (UFBA 4342 [n = 12], UFBA 4343 [n=12], UFBA 4344 [n=12]).

		Paratypes/males		Paratypes/females	
	H	range	mean	range	mean
Standard length (mm)	39.4	35.7-40.3	38.1	30.5-40.8	
Percents of standard length					
Depth at dorsal-fin origin	34.8	33.4-37.4	35.4	30.5-35.9	33.6
Snout to dorsal-fin origin	51.3	50.9-53.9	52.5	50.5-55.1	52.8
Snout to pectoral-fin origin	25.9	24.5-27.8	26.4	24.5-27.8	25.9
Snout to pelvic-fin origin	47.0	46.5-48.6	47.6	46.0-50.1	47.8
Snout to anal-fin origin	63.7	62.1-66.1	64.2	62.3-66.8	64.6
Caudal-peduncle depth	10.9	10.6-12.5	11.3	9.7-11.5	10.7
Caudal-peduncle length	13.5	13.0-15.1	13.8	12.2-15.2	13.6
Pectoral-fin length	23.4	22.4-26.3	24.6	21.0-23.9	22.5
Pelvic-fin length	19.3	19.1-22.0	20.3	17.3-19.7	18.5
Dorsal-fin base length	12.7	11.1-14.0	12.7	11.2-13.5	12.5
Dorsal-fin heigth	27.9	27.3-31.4	29.2	25.4-30.6	28.0
Anal-fin base length	29.7	27.9-30.3	29.2	26.2-29.7	27.7
Anal-fin lobe length	15.2	15.2-19.1	17.5	17.8-22.0	19.9
Eye to dorsal-fin origin	38.1	37.8-40.3	39.2	37.4-41.1	39.0
Dorsal-fin origin to caudal-fin base	52.5	50.8-53.6	52.1	48.7-53.0	51.1
Head length	22.6	22.2-24.7	23.4	21.6-23.8	23.0
Percents of head length					
Horizontal eye diameter	41.6	39.4-46.6	43.7	40.7-47.1	44.6
Snout length	22.5	20.8-24.7	22.9	20.5-24.7	22.8
Least interorbital width	33.7	30.9-36.0	33.3	29.6-36.6	33.0
Upper jaw length	43.8	41.6-46.8	44.1	40.9-49.4	44.3

Greatest body depth along vertical through dorsal-fin origin. Dorsal profile of head convex from upper lip to vertical through anterior nostrils; straight to slightly convex from latter point to tip of supraoccipital spine and nearly straight to slightly convex from this point to dorsal-fin origin. Body profile straight and posteroventrally slanted along dorsal-fin base; straight from dorsal-fin base terminus to adipose fin, and slightly concave along caudal peduncle. Ventral profile of head and body strongly convex anteriorly and convex from region below eye to anal-fin origin. Body profile along anal-fin base straight and posterodorsally slanted. Ventral profile of caudal peduncle nearly straight to slightly concave.

Head somewhat pointed to rounded anteriorly in lateral profile; mouth terminal. Posterior terminus of maxilla extending slightly beyond vertical through anterior margin of orbit. Premaxillary teeth somewhat narrow, distributed in two rows. Outer row with 3 (7), 4 (24), or 5* (4) teeth bearing 3 cusps. Inner row with 4 (1), 5* (32), or 6 (3) teeth bearing 3, 4 or 5 cusps. Symphyseal tooth of inner series narrow, asymmetrical, with one cusp on anteromedial side, one larger central cusp and two smaller on lateral side; second tooth the larger, with 5 cusps; last teeth with 3 cusps. Maxilla with 2 (1) or 3 (2) teeth bearing one or 3 cusps. Dentary with 10 (1) or 11 (2) symmetrical teeth; 5 anterior teeth larger, with 5 cusps, followed by 6 teeth unicuspidate; posterior smaller teeth abruptly smaller than anterior ones in one c&s specimen and somewhat decreasing gradually in size posteriorly in the other two.

Scales cycloid, *circuli* absent on exposed area of scales, with few slightly divergent *radii* extending to posterior margin of scales. Lateral line slightly decurved anteriorly, completely pored from supracleithrum to base of caudal fin, with 32 (7), 33* (8), or 34 (6) perforated scales. Horizontal scale rows between dorsal-fin origin and lateral line 5 (36), not including scale of predorsal series situated just anterior to first dorsal-fin ray. Horizontal scale rows between lateral line and pelvic-fin insertion 3 (36). Scales along middorsal line between tip of supraoccipital process and origin of dorsal fin 9 (6), 10* (24), or 11 (2). Horizontal scale rows around caudal peduncle 14 (13). Base of anteriormost anal-fin rays covered by a series of 8-12 scales.

Dorsal-fin rays ii,8 (1), ii,8,i* (29), or ii,9 (6). Distal margin of dorsal fin straight. Dorsal-fin origin situated at vertical approximately at or slightly posterior to middle of standard length. Base of last dorsal-fin ray posterior to vertical through anal-fin origin. First dorsal-fin pterygiophore inserting behind neural spine of 10th (3) vertebra. Adipose fin present. Anal-fin rays iii,20 (9), 21 (16), 22* (10), or 23 (1); cleared and stained specimens revealed 5 unbranched rays (3). Distal margin of anal fin in males slightly concave to nearly straight and females with anterior portion of fin distinctly concave. First anal-fin pterygiophore inserting behind haemal spine of 16th (3) vertebra. Pectoral-fin rays i,9 (1), 10* (6), 11 (25), or 12 (4). Tip of pectoral fin usually reaching vertical through pelvic-fin insertion. Pelvic-fin rays i,6 (1) or 7* (35); in males, tip of pelvic fin usually trespasses insertion of first anal-fin rays, while in females the pelvic fin does not reach or barely reaches the anal-fin origin. Caudal fin forked, lobes pointed, similar in size. Principal caudal-fin rays 10+9 (3). Eight (2) or 9 (1) dorsal procurrent caudal-fin rays, and 9 (3) ventral procurrent caudal-fin rays. First gill arch with 7 (2) or 8 (1) + 1 (3) + 13 (3) rakers. Vertebrae 33 (3). Supraneurals 4 (1) or 5 (2).

Color in alcohol. Overall ground color yellow (Figs. 1-2). Guanine restricted to part of infraorbitals, preopercle, and opercle. Anteriormost portion of head dark; upper and lower lips completely dark, followed by areas with lower concentration of chromatophores, usually forming a black border on anterior portion of mouth. Head dorsum moderately dark, with relatively sparse dark chromatophores; central area between eyes less pigmented. Dark chromatophores sparsely distributed over anterior half of maxillary bone. Infraorbitals, preopercle and opercle clear. Ventral portion of head clear, unless by presence of scattered dark chromatophores on its anteriormost portion.

Scales of dorsalmost four longitudinal series and middorsal series with dark chromatophores concentrated along its posterior margin resulting in reticulate pattern; center of scales usually clear, except for some more pigmented specimens that have chromatophores on central portion of scales, masquerading the reticulate pattern. Scales below the lateral line less or no pigmented on anteriormost portion of body and with sparse dark chromatophores on posterior half of body; dark lines usually present along myosepts above anal-fin base. Abdominal region without dark chromatophores.

Humeral region with a roughly rounded and

inconspicuous humeral spot, formed by underlying dark chromatophores; spot over third and fourth scales of horizontal series immediately above lateral line. Dark and narrow stripe extending usually from humeral spot to caudal peduncle; stripe more conspicuous behind vertical through origin of dorsal fin. Stripe usually enlarged at the end of caudal peduncle, forming an inconspicuous spot, extending to end of median caudal-fin rays.

All fin rays dark. Dorsal fin with dark chromatophores over membranes on area close to borders of rays and pectoral fin with chromatophores over borders of rays, forming dark lines along borders. Anal fin similarly colored, with dark chromatophores over lateral borders of rays and also with concentration of chromatophores close to distal border of fin, over rays and interradial membranes, forming an inconspicuous dark margin on fin; dark margin usually more visible on males, more evident on longest unbranched and first branched rays. Pelvic fins with dark chromatophores over borders of rays, mainly on unbranched and first four branched rays; distal portion of rays usually darker; males with distal portion of first pelvic-fin rays distinctly darker than females (Figs. 1-2 *vs*. Fig. 3). Caudal fin usually darker than remaining fins, with chromatophores over rays and interradial membranes, apparently more concentrated on its distal half. Adipose fin clear, with a few dark chromatophores on its margin.

Color in life. Life color pattern taken from photographs of specimens soon after fixation (Fig. 2). Overall body coloration silver to yellowish. Head silvery, at least on infraorbitals, preopercle, and opercle. Scales on dorsal half of body with borders dark, forming a reticulate pattern. Posteroventral portion of body, above anal fin, reddish; red pigment on body more intense in males. Midlateral line of body darkened, formed apparently mostly by underlying dark pigment, and extending from area below dorsal fin to caudal peduncle. All fins reddish, except pectoral, with scattered dark chromatophores; red pigmentation more intense in males. Caudal fin somewhat darker, with dark chromatophores concentrated on its median rays.

Sexual dimorphism. Males of *Astyanax vermilion* are easily recognized by the presence of bony hooks on anal fin rays of all males examined. Hooks are distributed over the two posteriormost unbranched and all branched rays, except for the last two. Usually 8 to 10 large and dorsally curved hooks are present on most rays, decreasing in number and size towards posterior branched rays. Hooks absent on remaining fins. Males and females can be also distinguished externally by the shape of the anal fin and coloration of the pelvic fin (Figs. 1-3). Anal-fin border of males somewhat straight to slightly concave whereas in females it is concave on its anterior half. Males also have distal portion of first pelvic-fin rays distinctly darker than females. Some morphometric data also showed to be dimorphic, including males with slightly higher body depth than females (35.7-40.3%, X = 38.1% *vs.* 30.5-40.8%, X = 37.3%), longer pectoral fin (22.4-26.3%, X = 24.6% *vs.* 21.0-23.9%, X = 22.5%), longer pelvic fin (19.1-22.0%, X = 20.3% *vs*. 17.3-19.7%, X = 18.5%), and shorter anal-fin lobe (15.2-19.1%, X = 17.5% *vs.* 17.8-22.0%, X =19.9%). Examined immature males (27.1 and 31.7 mm SL) also show hooks on fins, although less developed, and also somewhat elongated pelvic fin.

Geographic distribution and ecological notes. *Astyanax vermilion* is known from rio Salgado, a tributary of rio Cachoeira, and also from rio Almada (Fig. 4). Both are relatively small Eastern Brazilian coastal drainages, with estuaries around Ilhéus, Bahia State. The species was collected in clear water streams, running over rocky, pebbles and sand bottom at low altitudes (188-258 m), in habitats characterized by slow to moderate water current, less than one meter deep (Fig. 5). The surrounding vegetation is mainly composed by remains of the Atlantic Forest, with trees, cocoa trees and grass. *Astyanax vermilion* was collected syntopically with several fish species, including *Nematocharax venustus*, *Lignobrycon myersi*, *Astyanax* aff. *bimaculatus*, *Leporinus* sp., *Oligosarcus acutirostris*, *Steindachnerina elegans*, *Parotocinclus* sp., and *Geophagus* sp..

The analysis of the stomach contents of three specimens revealed the presence of two distinct forms of filamentous algae, fragments of vascular plants and seeds, larvae of Diptera (Chironomidae), adults of Hemiptera and Coleoptera (Chrysomelidae), fragments of Hymenoptera (Formicidae) and of other unidentified arthropods, and organic debris.

Etymology. The name *vermilion* comes from the Latin word *vermiculus* (small worm which yields a red dye), meaning an orangish red pigment, originally derived from the powdered mineral cinnabar. Used herein in reference to the red coloration of posterior body portion of this fish when alive.

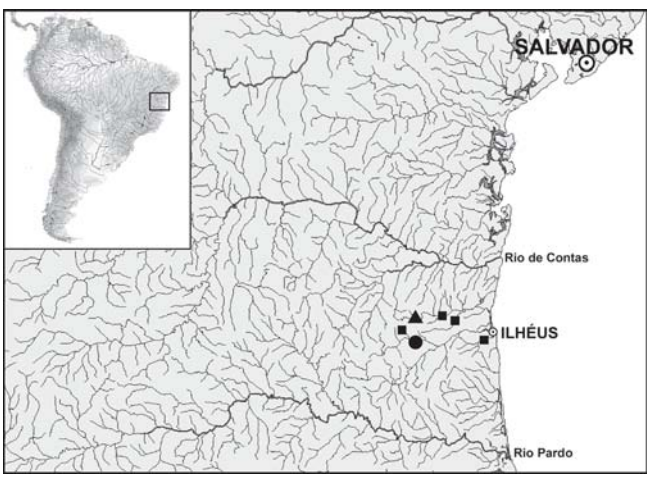

Fig. 4. Map of northeastern Brazil, showing position of type locality of *Astyanax burgerai* (full triangle), type locality (full circle) and other sampled sites of *Astyanax vermilion* (full square), new species.

Fig. 5. Type locality of *Astyanax vermilion*, Brazil, Bahia, Floresta Azul, rio Cachoeira drainage.

Astyanax burgerai, new species
Figs. 6-7

Holotype. MZUSP 101245, 53.2 mm SL, Brazil, Bahia State, Almadina, córrego Água Boa on road between Floresta Azul and Almadina, tributary of riacho Pancadinha, itself a tributary of rio Almada, 14°44'42"S 39°38'40"W, 212 m alt., 12 Feb 2008, A. M. Zanata, P. Camelier, R. Burger & A. B. A. Góes.

Paratypes. UFBA 4346, 15, 1 c&s, 2 R, 19.5-54.4 mm SL, collected with holotype.

Diagnosis. *Astyanax burgerai* can be distinguished from all other *Astyanax* species known from northeastern Brazilian drainages (*A. brevirhinus*, *A. epiagos*, *A. fasciatus*, *A. intermedius*, *A. jacobinae*, *A. lacustris*, *A. pelecus*, *A. rivularis*, *A. taeniatus*, and *A. turmalinensis*) by the presence of two vertically elongated humeral blotches (*vs*. only one humeral blotch, rounded or distinctly horizontally elongated in *A. brevirhinus*, *A. lacustris* and *A. pelecus*, and vertically elongated in *A. epiagos*, *A. fasciatus*, *A. intermedius*, *A. jacobinae*, *A. rivularis*, and *A. taeniatus*), absence of a conspicuous and broad dark midlateral stripe, at least on anterior half of body (*vs*. presence in *A. brevirhinus*, *A. fasciatus*, *A. intermedius*, *A. jacobinae*, *A. rivularis*, *A. taeniatus*, and *A. turmalinensis*), body highest along vertical slightly behind midlength of pectoral fin (*vs*. highest body depth just anterior to dorsal-fin origin in *A. brevirhinus*, *A. fasciatus*, *A. lacustris*, *A. pelecus*, *A. taeniatus*, and *A. turmalinensis*), 31-34 lateral-line perforated scales (*vs*. 35 or more in *A. brevirhinus*, *A. intermedius*, *A. jacobinae*, *A. pelecus*, and *A. rivularis*), and two or three teeth on premaxillary outer series (*vs*. three, four or five in *A. brevirhinus*, *A. fasciatus*, *A. jacobinae*, and *A. lacustris*). *Astyanax burgerai* can be further distinguished from *A. fasciatus* and *A. lacustris* by having 21-22 total anal-fin rays (*vs*. 25-34), and from *A. jacobinae* by having one or two maxillary teeth (*vs*. three teeth). This new species differs further from *A. turmalinensis* by having 2-3 teeth on outer premaxillary row (*vs*. four teeth) and fins homogeneously darkened by chromatophores (*vs*. dark chromatophores concentrated on edges of rays). *Astyanax burgerai* differs from *A. vermilion* on its overall body shape and color, including a conspicuous and vertically elongated humeral blotch (*vs*. humeral spot poorly defined), absence of red pigmentation on body when alive (*vs*. posteroventral portion of body reddish), 18-19 branched anal-fin rays (*vs*. 20-23), dorsal-fin rays ii,9 (*vs*. usually ii,8,i), and 3-6 scales on base of anterior anal-fin rays (*vs*. 8-12).

Description. Morphometric data of holotype and paratypes presented in Table 2. Body somewhat compressed and elongate. Greatest body depth along vertical slightly behind midlength of pectoral fin. Dorsal profile of head convex from upper lip to vertical through anterior nostrils; straight to slightly convex from latter point to tip of supraoccipital spine and moderately convex from this point to dorsal-fin origin. Body profile straight and posteroventrally slanted along dorsal-fin base; straight from dorsal-fin base terminus to adipose fin, and slightly concave along caudal peduncle. Ventral profile of head and body convex on its anteriormost portion and moderately convex from region below eye to anal-fin origin. Body profile along anal-fin base straight and posterodorsally slanted. Ventral profile of caudal peduncle nearly straight to slightly concave.

Head somewhat pointed anteriorly in lateral profile; mouth terminal. Posterior terminus of maxilla trespassing vertical through anterior margin of orbit. Premaxillary teeth in two rows. Outer row with 2* (6) or 3 (8) teeth bearing 3 cusps. Inner row with 4 (1), 5* (13), teeth bearing 5 to 7 cusps. Symphyseal tooth of inner series relatively narrow, asymmetrical, with one cusp on anteromedial side, one larger central cusp and three smaller on lateral side; second teeth the larger, with 7 cusps; remaining teeth with 5 cusps. Maxilla with 1* (3) or 2 (11) broad teeth bearing 5 cusps of similar size. Dentary with 8 (1) or 9* (2) teeth decreasing gradually in size posteriorly; first to third teeth somewhat asymmetrical, with six cusps, two on anteromedial side, one median larger cusp and three smaller on lateral side; fourth and fifth teeth with 5 cusps and posterior ones with 3 cusps.

Scales cycloid; *circuli* absent on exposed area of scales, with few slightly divergent *radii* extending to posterior margin of scales. Lateral line slightly decurved anteriorly, completely pored from supracleithrum to base of caudal fin, with 31 (1), 32* (3), 33 (3), or 34 (7) perforated scales. Horizontal scale rows between dorsal-fin origin and lateral line 5 (14), not including scale of predorsal series situated just anterior to first dorsal-fin ray. Horizontal scale rows between lateral line and pelvic-fin insertion 4* (10) or 5 (4). Scales along middorsal line between tip of supraoccipital process and origin of dorsal fin 9 (1), 10* (10), 11 (2), or not ordered in a line (1). Horizontal scale rows around caudal peduncle 13* (2), 14 (11), or15 (1). Base of anteriormost anal-fin rays covered by a series of 3-6 scales.

Dorsal-fin rays ii,9 (14). Distal margin of dorsal fin somewhat rounded. Dorsal-fin origin situated at vertical approximately at or slightly posterior to the middle of standard length. Base of last dorsal-fin ray aligned with anal-fin origin.

Fig. 6. *Astyanax burgerai*, new species, holotype, male, MZUSP 101245, 53.2 mm SL, Brazil, Bahia State, Almadina, córrego Água Boa, rio Almada drainage.

Fig. 7. *Astyanax burgerai*, new species, paratype alive, male, UFBA 4346, 54.4 mm SL.

First dorsal-fin pterygiophore inserting behind neural spine of 10th (4) vertebra. Adipose fin present. Anal-fin rays iii,18* (5) or 19 (9). Distal margin of anal fin slightly concave to nearly straight. First anal-fin pterygiophore inserting behind haemal spine of 16th (3) or 17th (1) vertebra. Pectoral-fin rays i,9* (1), 10 (2), 11 (6), or 12 (5). Tip of pectoral fin never reaching vertical through pelvic-fin insertion. Pelvic-fin rays i,7 (14). Caudal fin forked, lobes rounded, similar in size. Principal caudal-fin rays 10+9 (2), 10+10 (1). Eight (2) or 9 (2) dorsal procurrent caudal-fin rays, and 7 (1), 8 (2) or 9 (1) ventral procurrent caudal-fin rays. First gill arch with 6 (1) + 1 (1) + 11 (1) rakers. Vertebrae 33 (4). Supraneurals 5 (3).

Color in alcohol. Examined specimens lack guanine on body or head (Fig. 6). Overall ground color tan, yellowish on ventral half of body. Head dorsum dark due to concentration of diminute dark chromatophores, as on most extension of maxilla. Infraorbitals, preopercle and opercle clearer, with sparse larger dark chromatophores. Ventral portion of head clear, except by concentration of diminute dark chromatophores on anteriormost portion. Middorsal line dark similarly to head dorsum. Small dark chromatophores homogeneously distributed over four or five dorsalmost longitudinal series of body scales; chromatophores larger on scale series immediately above lateral line. Ventral half of body with scattered dark chromatophores and abdominal region without dark pigmentation. Humeral region with two dark blotches. Anterior blotch more evident, vertically elongated, wider dorsally and situated behind first vertical scale series on rear of opercle opening; blotch bordered anteriorly and posteriorly by regions of paler coloration. Posterior humeral blotch much less conspicuous, with variable shape, situated

Table 2. Morphometric data for *Astyanax burgerai*, new species. Based on holotype (MZUSP 101245) and paratypes (UFBA 4346 [n = 15]).

	holotype	range	Mean
Standard length (mm)	53.2	32.6-53.7	
Percents of standard length			
Depth at dorsal-fin origin	32.7	29.4-34.6	32.6
Snout to dorsal-fin origin	52.1	50.1-54.4	51.9
Snout to pectoral-fin origin	25.0	24.9-28.1	26.0
Snout to pelvic-fin origin	47.2	45.5-50.2	47.2
Snout to anal-fin origin	62.4	62.4-67.3	64.2
Caudal-peduncle depth	12.8	11.4-13.0	12.1
Caudal-peduncle length	13.3	11.1-14.7	13.5
Pectoral-fin length	19.4	19.4-24.1	22.5
Pelvic-fin length	16.7	15.8-18.5	17.4
Dorsal-fin base length	13.9	12.6-15.2	13.6
Dorsal-fin heigth	23.7	23.7-27.2	25.5
Anal-fin base length	28.0	23.4-28.3	26.4
Anal-fin lobe length	17.5	17.5-20.8	18.9
Eye to dorsal-fin origin	38.0	35.6-38.2	36.9
Dorsal-fin origin to caudal-fin base	52.4	50.0-53.7	52.2
Head length	25.4	23.8-27.9	25.5
Percents of head length			
Horizontal eye diameter	37.0	34.6-40.6	38.0
Snout length	27.4	21.8-27.4	24.4
Least interorbital width	31.1	28.8-33.0	31.6
Upper jaw length	42.2	41.5-46.5	43.8

posterior to clear area on rear of first blotch, and formed by dark chromatophores over three series of scales immediately above lateral line. A dark midlateral line extends from second humeral blotch to caudal peduncle; dark chromatophores over midlateral line usually more visible behind vertical through end of dorsal-fin base, resulting in an inconspicuous stripe, enlarged posteriorly and forming an elongated caudal blotch. All fins equally colored, with small chromatophores homogeneously distributed over membranes and borders of rays. Adipose fin with scattered small dark chromatophores. Caudal fin with base of median rays somewhat dark, as part of caudal blotch.

Color in life. Life color pattern taken from specimen barely dead and another specimen kept alive in aquarium (Fig. 7). Overall body coloration silvery to pale, with golden reflexes mainly on dorsal half. Midlateral region somewhat reddish. Humeral blotches poorly visible. Caudal blotch poorly visible on specimens barely dead but well defined after several days in aquarium. Small dark chromatophores scattered over head and body. All fins pale to yellowish.

Sexual dimorphism. Small hooks over anal-fin rays present in three male specimens (39.3-53.2 mm SL), distributed over longer unbranched ray and first six branched rays; unbranched rays with four hooks and posterior rays with five to seven hooks in each ray. Hooks absent on remaining fins.

Geographic distribution and ecological notes. *Astyanax burgerai* is known only from córrego Água Boa, a streamlet on the road between Floresta Azul and Almadina, tributary of riacho Pancadinha, itself a tributary of rio Almada, a coastal drainage on southern Bahia, Brazil (Fig. 4). The species was collected at 212 meters of altitude, in clear water stream, running over rocky and sandy bottom, in habitat characterized by very small pools, 20-70 cm deep (Fig. 8). The surrounding vegetation is composed by remains of the Atlantic Forest, with trees and shrubs. The only other syntopic species is *Trichomycterus* cf. *bahianus*.

The analysis of the stomach contents of two specimens revealed the presence of filamentous algae, fragments of arthropods, fragments of vascular plants and organic debris.

Etymology. The name *burgerai* is given in honor of Rafael Burger, a student who enthusiastically collected the new species.

Discussion

Astyanax vermilion and *A. burgerai* are diagnosed from its congeners of northeastern Brazilian drainages by a series of characters, as provided in the "Diagnosis" section of each species. *Astyanax vermilion* differs from remaining species of the genus by a combination of characters including overall body shape and coloration, as absence of a well defined humeral spot (*vs*. conspicuous humeral blotch distinctly elongated vertically (*e.g.*, *A. fasciatus*, *A. eigenmanniorum*, *A. ribeirae*) or horizontally ("*A. bimaculatus* species complex"), absence of a conspicuous dark stripe from humeral region to caudal peduncle (*vs*. well defined dark midlateral stripe along most of body length in several species with morphology similar to *A. fasciatus*, *A. giton*, *A. taeniatus*), a series of regular predorsal median scales (*vs*. absence of a regular predorsal series of scales in many species of *Astyanax*, as *A. anterior*, *A. janeiroensis*), and body deepest just in front of dorsal fin (*vs*. body deepest on a more anteriorly displaced position in the "*A. scabripinnis* species complex"). The dimorphic features observed in *A. vermilion* (see details under "Sexual dimorphism" section of the species) also serves to diagnose it from remaining congeners.

Astyanax burgerai differs from its congeners of drainages other than the northeastern Brazilians, by a combination of characters of overall body shape and coloration, including presence of two humeral blotches, the anteriormost conspicuous and elongated vertically (*vs*. one humeral blotch in the majority of *Astyanax* species or blotch horizontally elongated in "*A. bimaculatus* species complex"), body deepest along vertical slightly behind midlength of pectoral fin (*vs*. body deepest just in front of dorsal fin in several species with morphology similar to *A. fasciatus*, *A. intermedius*, *A. eigenmanniorum*), and a series of predorsal median scales (*vs*. absence of predorsal series of scales in many species of *Astyanax*, as *A. anterior* and *A. janeiroensis*). Moreover, *Astyanax burgerai* possesses relatively fewer branched anal-fin rays (18-19) and is morphologically similar to what is traditionally defined as the "*Astyanax scabripinnis* species complex" (Moreira-Filho & Bertollo, 1991; Bertaco & Malabarba, 2001; Bertaco & Lucena, 2006), a group that nowadays informally assembles sixteen described species, plus *A. burgerai* described herein, *A. jordanensis* Alcaraz *et al*. (this volume), and possibly *A. turmalinensis*. To distinguish *A.*

Fig. 8. Type locality of *Astyanax burgerai*, Brazil, Bahia State, Almadina, córrego Água Boa, rio Almada drainage.

burgerai from the northeastern Brazilian *A. rivularis*, *A. intermedius*, and *A. turmalinensis* see "Diagnosis" section under description of the species. From the remaining species of the "*A. scabripinnis* species complex", *Astyanax burgerai* can be distinguished from *A. brachypterygium*, *A. cremnobates*, *A. microschemos*, *A. totae*, and *A. varzeae* by the absence of a conspicuous dark stripe extending from humeral to caudal blotches (*vs*. presence). It can be further diagnosed from *A. brachypterygium*, *A. cremnobates*, and *A. varzeae* by having fewer lateral-line scales (31-34 *vs*. 37-42), and from *A. totae* by having fewer circumpeduncular scales (13-14 *vs*. 15-19). From the remaining species, *A. burgerai* differs from *A. scabripinnis* and *A. paranae* by having fewer lateral-line scales (31-34 *vs*. 39 and 36-41, respectively), and fewer caudal peduncle scales in the first (13-14 *vs*. 16) and the body less deep in the second species (26.8-30.8% *vs*. 33.6-38.3%). *Astyanax burgerai* can be diagnosed from *A. jenynsii* by having more branched anal-fin rays (18-19 *vs*. 14), shorter head length (21.2-24.0% *vs*. 27.1-29.3%) and larger eye diameter (31.7-40.7% *vs*. 24.7-27.6%), from *A. paris* and *A. leonidas* by the absence of conspicuous dark stripe along most of body extension (*vs*. presence), from *A. ojiara* and *A. troya* by the presence of hooks only on anal-fin rays (*vs*. hooks on all fins of males), and from *A. ita* by having two humeral blotches (*vs*. one), maxillary teeth with 5 cusps (*vs*. 7 cusps), and 18-19 branched anal-fin rays (*vs*. 20-24). *Astyanax burgerai* can be further diagnosed from *A. leonidas* and *A. ojiara* by having 31-34 lateral-line scales (*vs*. 35-37 or 36-38, respectively). The new species differs from *A. jordanensis* by a series of characters, including the number of lateral-line scales (31-34 *vs*. 35-38), number of branched anal-fin rays (18-19 *vs*. 13-17), horizontal eye diameter (34.6-40.6% *vs*. 22.6-29.1%), presence of two humeral blotches (*vs*. one), and males with hooks only on anal fin (*vs*. presence of hooks on all fins, except caudal).

Astyanax vermilion exhibits a series of sexually dimorphic characters relatively common in small characids and recently discussed elsewhere (*e.g*., Garutti, 1990; Azpelicueta & Garcia, 2000; Malabarba & Weitzman, 2003), concerning presence of hooks on anal fin. Nevertheless, the species has external differences between males and females not commonly described for *Astyanax* species, such as distinctness in the color pattern of body and fins, together with morphometric traits (see details under "Sexual dimorphism" section of the species). Therefore, *A. vermilion* shows various interesting features associated with sexual dimorphism, as the black borders on fins more evident on males, that distinguishes the species.

Coastal northeastern Brazilian rivers are recognized by its high degree of endemism together with the increasing description of new species in the last decade (Lima & Gerhard, 2001; Malabarba *et al*., 2004; Zanata & Akama, 2004; Britto *et al*., 2005; Sarmento-Soares *et al*., 2005; Benine *et al*., 2007; Birindelli *et al*., 2007; Zanata & Camelier, 2008). This assertion fits precisely for rivers crossing the area around Ilhéus on Bahia State, as rio Almada, rio Cachoeira and rio do Braço, which holds various putatively endemic species. Species described for rio Almada include *Gymnotus bahianus* Campos-da-Paz & Costa, *Pareiorhaphis bahianus* (Gosline), *Parotocinclus cristatus* Garavello, together with *Astyanax burgerai* and *A. vermilion* described herein, while for Cachoeira drainage only *Simpsonichthys bokermani* (Carvalho & Cruz) was previously described.

Comparative material examined. In addition to the specimens listed above, the following specimens were examined for this study. All listed specimens are alcohol-preserved material unless when indicated as cleared and counterstained (c&s). *Astyanax scabripinnis*, BMNH 1917.7.14:15, holotype, 71.4 mm SL, Brazil, Rio de Janeiro, Rio de Janeiro State. *A. rivularis*, MZUSP 50734, 6, 76.7-99.1 mm SL, Brazil, Minas Gerais State, rio São Francisco; UFBA 246, 111, 22.3-46.7mm SL, Brazil, Bahia State, rio São Francisco basin. *A. paranae*, MZUSP 85864, 7, 29.2-68.2 mm SL, Brazil, São Paulo State, rio Tietê basin; MZUSP 55000, 3 c&s , 43.4-47.6 mm SL, Brazil, Paraná State, rio Iguaçu basin. *A. intermedius*, MZUSP 79409, 7, 28.7-72.7 mm SL, Brazil, São Paulo State, rio Paraíba do Sul basin. *A. brachypterygium*, MZUSP 62713, paratypes, 5, 40.6-60.8 mm SL, Brazil, Rio Grande do Sul State, rio Uruguai basin. *A. cremnobates*, MZUSP 62712, paratypes, 5, 40.8-60.2 mm SL, Brazil, Rio Grande do Sul State, rio Jacuí basin. *A. taeniatus*, MZUSP 84624, 4, 54.3-84.6 mm SL, Brazil, São Paulo State, rio Guaratuba. *A. turmalinensis*, DZUFMG 8, 5, 28.7-56.3 mm SL, Brazil, Minas Gerais State, rio Jequitinhonha basin. *A. epiagos*, UFBA 2792, paratypes, 344, 3 c&s, 14.0-52.6 mm SL, Brazil, Bahia State, rio Paraguaçu basin. *A. jacobinae*, UFBA 2793, paratypes, 5, 1 c&s, 22.8-38.2 mm SL, Brazil, Bahia State, rio Itapicuru basin.

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Literature Cited

Abilhoa, V. & L. F. Duboc. 2007. A new species of the freshwater fish genus *Astyanax* (Ostariophysi: Characidae) from the rio Iguaçu basin, southeastern Brazil. Zootaxa, 1587: 43-52.

Alcaraz, H. S. V., C. S. Pavanelli & V. A. Bertaco. 2009. *Astyanax jordanensis* (Ostariophysi: Characidae), a new species from the rio Iguaçu basin, Paraná, Brazil. Neotropical Ichthyology, 7(2): 185-190.

Almirón, A. E., M. M. Azpelicueta & J. R. Casciotta. 2002. *Astyanax ita* sp. n. - a new species from the Río Iguazú basin, in Argentina (Teleostei, Characiformes, Characidae). Zoologische Abhandlungen, 52: 3-10.

Azpelicueta, M. M., A. E. Almirón & J. R. Casciotta. 2002. *Astyanax paris*: a new species from the Río Uruguay basin of Argentina (Characiformes, Characidae). Copeia, 2002(4): 1052-1056.

Azpelicueta, M. M. & J. R. Casciotta. 2002. Two new species of the genus *Astyanax* (Characiformes, Characidae) from the Paraná river basin in Argentina. Revue Suisse de Zoologie, 109(2): 243-259.

Azpelicueta, M. M. & J. O. Garcia. 2000. A new species of *Astyanax* (Characiformes, Characidae) from Uruguay river basin in Argentina, with remarks on hook presence in Characidae. Revue Suisse de Zoologie, 107(2): 245-257.

Bertaco, V. A. & C. A. S. Lucena. 2006. Two new species of *Astyanax* (Ostariophysi: Characiformes: Characidae) from eastern Brazil, with a synopsis of the *Astyanax scabripinnis* species complex. Neotropical Ichthyology, 4(1): 53-60.

Bertaco, V. A. & L. R. Malabarba. 2001. Description of two new species of *Astyanax* (Teleostei: Characidae) from headwater streams of Southern Brazil, with comments on the "*A. scabripinnis* species complex". Ichthyological Exploration of Freshwaters, 12(3): 221-234.

Birindelli, J. L. O., A. M. Zanata & F. C. T. Lima. 2007. *Hypostomus chrysostiktos*, a new species of armored catfish (Siluriformes: Loricariidae) from rio Paraguaçu, Bahia State, Brazil. Neotropical Ichthyology, 5(3): 271-278.

Britto, M. R., F. C. T. Lima & A. C. A. Santos. 2005. A new *Aspidoras* (Siluriformes: Callichthyidae) from rio Paraguaçu basin, Chapada Diamantina, Bahia, Brazil. Neotropical Ichthyology, 3(4): 473-479.

Eigenmann, C. H. 1921. The American Characidae. Part 3. Memoirs of the Museum of Comparative Zoology, 43: 208-310.

Eigenmann, C. H. 1927. The American Characidae. Part 4. Memoirs of the Museum of Comparative Zoology, 43: 311-428.

Ferraris, C. J. Jr. 2007. Checklist of catfishes, recent and fossil (Osteichthyes: Siluriformes), and catalogue of siluriform primary types. Zootaxa, 1418:1-300.

Fink, W. L. & S. H. Weitzman. 1974. The so-called cheirodontin fishes of Central America with description of two new species (Pisces, Characidae). Smithsonian Contributions to Zoology, 172: 1-46.

Garutti, V. 1990. Caráter sexual secundário em *Astyanax bimaculatus* (Ostariophysi, Characidae), relacionado às nadadeiras anal e pélvicas. Naturalia, 15: 109-119.

Haluch, C. F. & V. Abilhoa. 2005. *Astyanax totae*, a new characid species (Teleostei: Characidae) from the upper rio Iguaçu basin, southeastern Brazil. Neotropical Ichthyology, 3(3): 383-388.

Lima, F. C. T. & P. Gerhard. 2001. A new *Hyphessobrycon* (Characiformes: Characidae) from Chapada Diamantina, Bahia, Brazil with notes on its natural history. Ichthyological Exploration of Freshwaters, 12(2): 105-114.

Lima, F. C. T., L. R. Malabarba, P. A. Buckup, J. F. P. Silva, R. P. Vari, A. Harold, R. Benine, O. T. Oyakawa, C. S. Pavanelli, N. A. Menezes, C. A. S. Lucena, M. C. S. L. Malabarba, Z. M. S. Lucena, R. E. Reis, F. Langeani, L. Cassati, V. A. Bertaco, C. Moreira, & P. H. F. Lucinda. 2003. Genera *Incertae Sedis* in Characidae. Pp. 134-141. In: Reis, R. E., S. O. Kullander & C. J. Ferraris (Eds.). Check List of the Freshwater Fishes of South and Central America. Porto Alegre, Edipucrs, 729p.

Malabarba, L. R. & S. H. Weitzman. 2003. Description of a new genus with six new species from southern Brazil, Uruguay and Argentina, with a discussion of a putative characid clade (Teleostei: Characiformes: Characidae). Comunicações do Museu de Ciências e Tecnologia da PUCRS, Série Zoologia, 16(1): 67-151.

Malabarba, L. R., F. C T. Lima & S. Weitzman. 2004. A new species of *Kolpotocheirodon* (Teleostei: Characidae: Cheirodontinae: Compsurini) from Bahia, northeastern Brazil, with a new diagnosis of the genus. Proceedings of the Biological Society of Washington, 117(3): 317-329.

Menezes, N. A. & S. H. Weitzman. 1990. Two new species of *Mimagoniates* (Teleostei: Characidae: Glandulocaudinae), their phylogeny and biogeography and a key to the glandulocaudin fishes of Brazil and Paraguay. Proceedings of the Biological Society of Washington, 103(2): 380-426.

Moreira-Filho, O. & L. A. C. Bertollo. 1991. *Astyanax scabripinnis* (Pisces, Characidae): a species complex. Revista Brasileira de Genética, 14: 331-357.

Sarmento-Soares, L. M., R. F. Martins-Pinheiro, A.T. Aranda & C. C. Chamon (2005). *Trichomycterus pradensis*, a new catfish from southern Bahia coastal rivers, northeastern Brazil (Siluriformes: Trichomycteridae). Ichthyological Exploration of Freshwaters, 16(4): 289-302.

Taylor, W. R. & G. C. Van Dyke. 1985. Revised procedures for staining and clearing small fishes and other vertebrates for bone and cartilage study. Cybium, 9: 107-109.

Triques, M. L., V. Vono & E. V. Caiafa. 2003. *Astyanax turmalinensis*, a new species from the Rio Jequitinhonha basin, Minas Gerais, Brazil (Characiformes: Characidae: Tetragonopterinae). Aqua, Journal of Ichthyology and Aquatic Biology, 7(4): 145-150.

Zanata, A. M. & A. Akama. 2004. *Myxiops aphos*, new characid genus and species (Characiformes: Characidae) from the rio Lençóis, Bahia, Brazil. Neotropical Ichthyology, 2(2): 45-54.

Zanata, A. M. & P. Camelier. 2008. Two new species of *Astyanax* (Characiformes: Characidae) from upper rio Paraguaçu and rio Itapicuru basins, Chapada Diamantina, Bahia, Brazil. Zootaxa, 1908: 28-40.

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