

Two new *Bryconamericus*:
B. cinarucoense n. sp. and *B. singularis* n. sp.
(Characiformes, Characidae)
from the Cinaruco River, Orinoco Basin,
with keys to all Venezuelan species

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Abstract

Two new *Bryconamericus*: *B. cinarucoense* n. sp. and *B. singularis* n. sp. (Characiformes, Characidae) from the Cinaruco River, Orinoco Basin, with keys to all Venezuelan species.— Here we describe for the first time *Bryconamericus cinarucoense* n. sp. and *Bryconamericus singularis* n. sp., two new species of Characiformes from the Cinaruco River, Orinoco Basin in Venezuela. *B. cinarucoense* n. sp. is distinguished from all other species of the genus in having: upper jaw extending beyond lower, maxilla short with only one or two teeth, cartilaginous rhinosphenoid extending to anterior part of prevomer, pelvic bone with cartilage along anterior edge, lateral line pores in straight line. *B. singularis* n. sp. is distinguished from congeners by having top of head flat, dentary with six or seven small unicuspid teeth, a dark lateral band extending from posterior edge of humeral spot to midbase of caudal fin which widens behind dorsal–fin origin, and in having five supraneurals which lack cartilage on the upper and lower extremities. Keys to aid identification of all known Venezuela species are included. *Bryconamericus motatanensis* is placed in the synonymy of *B. alpha*. Previous reports of *B. breviceps* and *B. heteresthes* from Venezuela are misidentifications, and are here considered as either *B. cinarucoense* n. sp., or another as yet undescribed species.

Key words: *B. cinarucoense* n. sp., *B. singularis* n. sp., Tropical fish, Taxonomy, Osteology, Teeth.

Resumen

Dos nuevos *Bryconamericus*: *B. cinarucoense* sp. n. y *B. singularis* sp. n. (Characiformes, Characidae) del río Cinaruco, cuenca del Orinoco, con claves para todas las especies de Venezuela.— Se describen dos especies nuevas de *Bryconamericus* de la cuenca del Orinoco en Venezuela: *Bryconamericus cinarucoense* sp. n. y *B. singularis* sp. n. (Characiformes, Characidae). *B. cinarucoense* sp. n. se distingue de sus congéneres por presentar la mandíbula superior sobresaliente, la maxila corta y con uno o dos dientes, el rinoesfenoides cartilaginoso se extiende hacia la parte anterior del prevomer, el hueso pélvico con cartílago a lo largo de su margen anterior, y por presentar los poros de la línea lateral en línea recta. *B. singularis* sp. n. se diferencia de las demás especies por presentar el extremo de la cabeza aplanado, seis o siete pequeños dientes unicúspides en el dentario y una banda lateral oscura que se extiende desde el extremo posterior de la mancha humeral hasta la base media de la aleta caudal que se ensancha en su parte posterior detrás del nivel del origen de la aleta dorsal, y por presentar cinco supraneurales sin cartílago en sus extremos superior e inferior. Se incluyen claves para la determinación de las especies conocidas de *Bryconamericus* en Venezuela. *Bryconamericus motatanensis* se ubica como sinónimo de *B. alpha*. Citas previas de *B. breviceps* y *B. heteresthes* de Venezuela son identificaciones erróneas, y aquí se considera como *B. cinarucoense*, u otra especie aún no descrita.

Palabras claves: *B. cinarucoense* sp. n., *B. singularis* sp. n., Pez tropical, Taxonomía, Osteología, Dientes.

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Introduction

Species of the genus *Bryconamericus* Eigenmann (including *Knodus* Eigenmann) are predominantly small to medium-sized (usually 30–50 mm maximum SL), silvery fishes with a humeral spot and a dark lateral body stripe, silvery in life, that often extends onto the middle caudal rays (Géry, 1977; Román-Valencia, 2002a, 2002b, 2003a, 2003b). *Bryconamericus* is complex genus of the family Characidae, with about fifty described species (Lima et al., 2003) widely distributed in a variety of freshwater ecosystems in both the lowlands and highlands of South and Middle America (Vari & Siebert, 1990; Jiménez et al., 1998; Román-Valencia, 2001, 2002a, 2002b, 2003a, 2003b, 2003c, 2003d, 2005). Species of the genus are abundant in small brooks as well as along the banks of larger rivers, with high concentrations of dissolved oxygen (ca. 8 mg/l) and almost neutral pH (Jiménez et al., 1998; Román-Valencia, 1998, 2000, 2002a; Román-Valencia & Muñoz, 2001). *Bryconamericus* species are known from all major drainages in Venezuela (Román-Valencia, 2003a) but have frequently been misidentified.

In recent studies by Lima & Zuanon (2004), Weitzman et al. (2005), Ferreira & Lima (2006), and Ferreira & Carvajal (2007), the genus *Knodus* was considered valid, although this was mainly for convenience and based on the character of a scaled caudal fin. However, there are no characters that would allow us to confidently separate *Bryconamericus* from *Knodus*; as pointed out by Román-Valencia (2000, 2003a, 2005). In one key to Characidae, Planquette et al. (1996) attempt to differentiate *Bryconamericus* and *Knodus* from *Hemibrycon* by its fewer than six teeth on the maxilla; they furthermore state that the only difference between *Bryconamericus* and *Knodus* is the presence of scales on the caudal fin in the latter. There seems to be a consensus that the genus *Bryconamericus*, as currently defined, is not monophyletic (Vari & Siebert, 1990; Malabarba & Malabarba, 1994; Silva & Malabarba, 1996; Malabarba & Weitzman, 2003; Silva, 2004). However, there is still no published evidence that might indicate that some groups of *Bryconamericus* species are more closely related to any other taxa (Vari & Siebert, 1990; Malabarba & Kindel, 1995), nor proposals of any new phylogenies. The difficulty in diagnosing *Bryconamericus* and related genera was evident when Malabarba & Malabarba (1994) described *Hypobrycon maromba*, but commented that it might be better to locate it in *Bryconamericus*. Serra & Langeani (2006) redescribed the type species of *Bryconamericus* (= *B. exodon*) and augmented the number of characters available for its diagnosis, but commented that many of them may not represent characters uniquely defining *Bryconamericus*.

Malabarba y Weitzman (2003) presented a hypothesis, placing *Bryconamericus* as a member of a clade named "Clade A", supported by two synapomorphies: four teeth in the innter premaxillary row, and ii,8 dorsal-fin rays. Using molecular characters

Calcagnotto et al. (2005: fig. 6) found further support for the monophyly of *Bryconamericus* and indicate that *Knodus* is its sister taxon, and that both are closely related to *Creagrutus* and *Hemibrycon*. Also using molecular characters, Román-Valencia & Vanegas-Ríos (in press) recently proposed that the genus *Bryconamericus* is a monophyletic group, at least for the species from Central America. This was also proposed by Fink (1976). Furthermore, both groups (Fink, 1976; Román-Valencia & Vanegas-Ríos, in press) present evidence that indicates the diversification of *Bryconamericus* in Central America can be explained by dispersion from northwestern South America. However, Lima et al. (2003) lists *Bryconamericus* as *insertae sedis* in Characidae.

Taxonomically, *Bryconamericus* species from Central America have now been clearly resolved (Román-Valencia, 2002a), but the South American species are still poorly understood; for most countries, for example Colombia (Magdalena drainage), Peru, Ecuador (Pacífico and Amazon drainages) and Bolivia, the available keys and species descriptions are of little use to determine the nominal species reported. We consider twelve species as valid records from Venezuela in this report, including six from the Orinoco Basin. The description of two new species of *Bryconamericus* from the Cinaruco River in Venezuela adds to the first author's ongoing revision of the species in northern South America, and is further proof of the as-yet undocumented biodiversity of the genus. We provide keys to aid identification of all Venezuelan species for the following regions: Maracaibo Basin, Caribbean coastal drainages, Orinoco Basin, and the Rio Negro drainage in Amazonas state.

Material and methods

Twenty-one measurements were taken with digital calipers, recorded to hundredths of millimeters and expressed in most cases as percentages of standard or head length (table 1). Nine counts were made using a stereoscope with a dissection needle to extend the fins. Counts and measurements were taken from the left side of specimens when possible, basically following the guidelines in Vari & Siebert (1990).

Observations of bones and cartilage were made on cleared and stained specimens prepared according to techniques outlined in Taylor & Van Dyke (1985) and Song & Parenti (1995). Bone nomenclature follows Weitzman (1962), Vari (1995), Ruiz-C. & Román-Valencia (2006). Specimens are deposited in the Auburn University Museum Fish Collection, Auburn, Alabama (AUM), the Museo de Biología, Instituto de Zoología Tropical, Universidad Central de Venezuela, Caracas (MBUCV), Museo de Historia Natural La Salle, Caracas (MHNLS), the Museo de Ciencias Naturales de la UNELLEZ-Guanare, Venezuela (MCNG), the Ichthyology Laboratory at the Universidad del Quindío, Armenia, Colombia (IUQ) and in the Instituto de

Table 1. Morphometric and meristic data of *Bryconamericus singularis* n.sp. and *B. cinarucense* n. sp. (Standard and total length in mm, averages in parenthesis.)

Tabla 1. Datos morfométricos y merísticos de *Bryconamericus singularis* sp. n. y *B. cinarucense* sp. n. (Longitud estándar y total en mm, medias entre paréntesis)

	<i>B. singularis</i>		<i>B. cinarucense</i>	
	Holotipo	Paratipos	Paratipos	Holotipo
Standard length	33.41	27.31–33.57 (30.50)	19.75–33.57 (26.81)	28.98
Total length	41.07	35.40–41.55 (38.82)	23.62–42.88 (32.96)	36.76
Percentages of SL				
Body depth	19.47	19.47–25.99 (23.58)	16.97–25.94 (20.61)	19.43
Snout–dorsal fin distance	52.05	47.19–52.29 (49.71)	40.94–56.78 (50.41)	53.00
Snout–pectoral fin distance	26.58	21.99–30.07 (26.33)	19.44–29.45 (24.76)	25.85
Snout–pelvic fin distance	49.75	42.25–52.10 (47.84)	39.94–53.56 (46.75)	46.69
Dorsal–pectoral fin distance	36.55	33.78–40.62 (37.09)	29.91–40.97 (36.51)	32.15
Snout–anal fin distance	66.96	63.33–68.98 (65.65)	48.46–65.62 (59.77)	60.08
Dorsal fin–hypural distance	46.96	46.85–56.23 (51.46)	35.03–54.10 (47.85)	47.70
Dorsal–anal fin distance	27.49	21.48–37.31 (25.09)	16.54–44.70 (22.23)	19.57
Dorsal–fin length	21.88	18.66–28.38 (25.59)	14.4–26.60 (20.65)	19.60
Pectoral–fin length	19.84	17.72–28.01 (22.85)	15.63–26.0 (20.8)	23.50
Pelvic–fin length	16.55	13.85–22.56 (18.45)	10.68–20.10 (15.24)	14.84
Anal–fin length	18.26	17.45–20.18 (18.63)	13.11–21.06 (16.49)	18.77
Caudal peduncle depth	8.8	7.88–10.55 (9.28)	6.05–9.54 (8.22)	8.45
Caudal peduncle length	10.72	8.64–16.80 (11.77)	8.3–22.81 (14.68)	14.53
Head length	21.59	21.59–27.38 (24.06)	18.77–30.85 (24.42)	23.78
Percentages of HL				
Snouth length	21.63	21.63–29.52 (25.35)	18.49–34.55 (25.71)	26.27
Orbital diameter	53.09	39.59–53.09 (46.79)	35.76–54.74 (44.79)	45.28
Postorbital distance	29.17	29.17–37.50 (33.15)	27.72–49.64 (36.31)	30.19
Maxilla length	32.93	18.27–32.93 (27.30)	21.34–37.54 (29.75)	21.80
Interorbital distance	28.40	28.40–38.05 (33.87)	25.57–39.46 (32.63)	32.51
Mandible superior superior	19.87	19.87–31.06 (25.60)	19.20–30.70 (25.03)	20.14
Lateral–line scales	31	30–32	35–37	36
Scale row between dorsal–fin origin and lateral line				
	5	5–6	4–5	5
Scale rows between anal–fin origin and lateral line				
	4	4	3–4	4
Scale rows between pelvic–fin and lateral line				
	4	4	3–4	4
Predorsal median scales	10	10	10–11	10
Dorsal–fin rays	ii,8	iii–iv,8	i–iii,7–8	iii,7
Anal–fin rays	iii,17	iii,17–18	iii–iv,18–21	iii,20
Pelvic–fin rays	ii,8	ii,6	ii,6	ii,6
Pectoral–fin rays	ii,10	ii,10–11	ii,10–11	ii,11

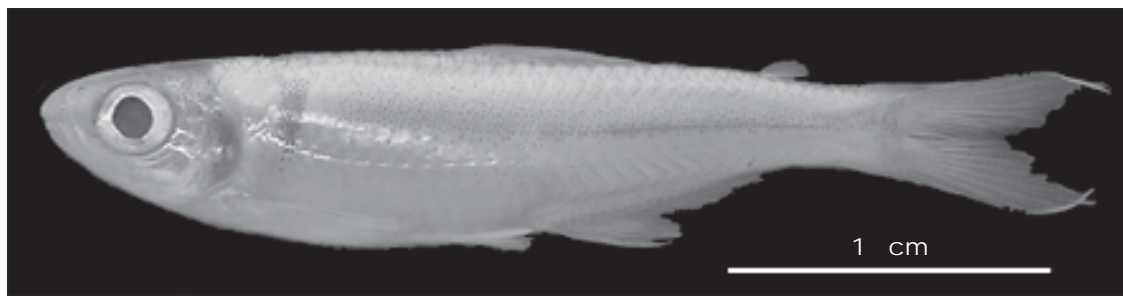


Fig. 1. *Bryconamericus cinarucoense* n. sp.: holotype, MCNG 52002, 28.98 mm SL.

Fig. 1. *Bryconamericus cinarucoense* sp. n.: holotipo, MCNG 52002, 28,98 mm LE.

Investigaciones Biológicas "Alexander Von Humboldt", Villa de Leyva, Boyacá (laVH).

In the lists of paratypes, the number of individuals is given in parentheses immediately after the catalog number, which is followed by the range of Standard Length (SL) in mm for that lot; for example: MCNG 53000 (23 ex.) 19.34–25.44, indicates 23 individuals in lot MCNG 53000, with the smallest fish 19.34 mm SL and the largest 25.44 mm SL. All collections were made in Venezuela. If no measurements are presented, the paratypes were not measured.

Comparative material (all from Venezuela)

Bryconamericus alpha Eigenmann, Henn and Wilson 1914 (see Román–Valencia, 2003a)

Bryconamericus breviceps Eigenmann 1908 (see Román–Valencia, 2003d)

Bryconamericus heteresthes Eigenmann 1908 (see Román–Valencia, 2003a)

Bryconamericus orinocoense Román–Valencia Román–Valencia 2003d

Holotype: MBUCV 29464, 28.1 mm SL; Amazonas State, Río Orinoco 0.5 km upstream from Esmeraldas (aprox. 2° 53' 06" N, 64° 58' 06" W); 12 III 1987.

Paratypes: collected with holotype: IUQ 433 (9 ex.) MBUCV 25834 (26); MBUCV 6055 (1 ex.) Amazonas, La Esmeralda, Caño Cadabaudi, 23 XI 1969. MBUCV 19395 (3 ex.); Amazonas, Río Mavacá near base camp; MBUCV 21658 (3 ex.), Amazonas, Río Cataniapo, 10 XI 1989.

Results

Bryconamericus cinarucoense n. sp. (fig. 1, table 1)

Holotype: MCNG 52002, 28.98 mm SL: Venezuela, Orinoco River basin, Cinaruco River, Apure State, Pedro Camejo County, sand beach, 6° 32' 55" N; 67° 24' 58" O, 21 V 1999 A. Arrington, C. García.

Paratypes: all from Venezuela, Orinoco River basin, Apure State, Cinaruco River: MCNG 34679 (6 ex.), 17.44–34.26 mm SL, beach in front of Laguna Larga, Apr 1997, coll. David Jepsen, Douglas Rodríguez; MCNG 34705 (31 ex.) 12.80–20.08, beach near Laguna Larga, 4 IV 97, coll. David Jepsen and Douglas Rodríguez; MCNG 39174 (2 ex.), 31.66–33.62, beach above Laguna Larga, 11 VI 99, A. and J. Arrington; MCNG 39248 (27 ex.) 30.11–36.87, beach below Laguna Larga, 11 VI 99, coll. A. & J. Arrington; MCNG 41277 (88 ex.) 17.53–35.63, beach, 19 IV 1999, coll. A. & J. Arrington; MCNG 41292 (26 ex.) 23.27–32.64, beach, 19 VI 1999, coll. A. & J. Arrington; MCNG 41638 (247 ex.), 18.86–37.26, IUQ 526 (16 ex.), IUQ 527 (3 ex.) (C & S), 25.2–28.4 collected with holotype; MCNG 41677 (13 ex.) 18.06–32.81, beach 7, 21 V 1999, coll. A. Arrington & C. García; MCNG 44438 (10 ex.) 30.94–36.79, beach upstream from Laguna Larga, 20 VI 2001, coll. C. Layman; MCNG 44496 (27 ex.) 29.67–35.61, beach upstream from Laguna Larga, C. Layman.

Non-type material examined

From Venezuela, Orinoco River basin, Apure State, Cinaruco River: MCNG 39175 (4 ex.), above Laguna Larga, 11 VI 1999, coll. A. & J. Arrington; MCNG 39221 (1 ex.), in front of Laguna Larga, 11 VI 1999, coll. A. & J. Arrington; MCNG 40549 (178 ex.), Laguna Espinar, 18 Mar 1999, coll. A. & J. Arrington; MCNG 40842 (64 ex.), Cinaruco River 24 III 1999, coll. A. & J. Arrington; MCNG 41147 (5 ex.), beach 4, 15 IV 1999, coll. A. & J. Arrington; MCNG 41575 (14 ex.), beach 2, 21 V 1999, coll. A. Arrington & C. García; MCNG 45013 (1 ex.), 17 V 1999, coll. A. Arrington & C. García; MCNG 45014 (1 ex.), downriver from Laguna Larga, 11 VI 1999, coll. A. & J. Arrington.

From Guyana Essequibo River basin: AUM 38844 (54 ex.), Takuku River 3.77 km SSW Lethem Rupununi, latitude 03.35500, 1 XI 2003, coll. J. W. Armbruster et al.; AUM 39017 (34 ex.), Essequibo river at Yukanopito Falis, 44.5 km SW mouth of Kuyuwini River, latitude 01.91461, 9 XI 2003, coll. J. W. Armbruster et al.; AUM 44686 (4 ex.), Pirara

River, at Pirara Ranch, latitude 03.62517, 26 XI 2005, coll. L. S. de Souza et al.; AUM 38952 (18 ex.), Araquai Creek 77.3 km SSE Lethem Rupununi, latitude 02.76261, coll. J. W. Armbruster et al., 15 XI 2003; AUM 44948 (30 ex.), Guyana, Ireng River, 6.9 km WSW Karasabal, latitude 04.01957, 1 XI 2002, coll. J. W. Armbruster; AUM 38104 (5 ex.), Creek and Kuyuwini River 28.0 km E Kuyuwini Landing Rupununi, latitude 02.04747, 5 XI 2003, coll. J. W. Armbruster et al.

Diagnosis

Bryconamericus cinarucoense n. sp. is distinguished from congeners by having the upper jaw extending beyond lower, maxilla short with one or two teeth, cartilaginous rhinosphenoid extending to anterior part of prevomer, pelvic bone with cartilage along anterior edge, and lateral line pores in a straight line. It differs from *B. subtilisform* Román–Valencia (Román–Valencia, 2003b), the most similar Venezuelan species, in having fewer pored lateral line scales (35–37 vs. 38–39), more scales below lateral line to origin of pelvic-fin (4–5 vs. 2–3), more branched anal-fin rays (20–21 vs. 17–18), and pelvic-fin rays usually ii,6 vs. i,7 in *B. subtilisform* [see also: table 1 (this paper), and table 1 (Román–Valencia, 2003b), and keys included below].

Description

Body slender and elongate (mean maximum body depth about 20% SL). Area above orbits flat. Dorsal profile of head and body oblique from the supraoccipital to dorsal origin and from the last dorsal-fin ray to the base of the caudal fin. Ventral profile of body convex from the snout to the base of anal fin. Caudal peduncle laterally compressed. Head and snout short, mandibles not equal, the upper longer than the lower; mouth terminal, lips soft and flexible and not covering the outer row of premaxillary teeth; ventral border of the upper mandible straight; posterior edge of the maxilla reaching anterior edge of orbit; opening of posterior nostrils vertically ovoid; opening of anterior nostrils with a membranous flap. Dorsal surface of mesethmoid covered with cartilage, which extends all along the sensorial canal.

Four or five infraorbitals with latero–sensorial canal present; first infraorbital thin and narrow, extending between the dorsal edge of maxilla and lateral ethmoid, second infraorbital short and wide, not completely covering the dorsal part of the angulo-articular, anterior part squared off and exposed to surface. Third infraorbital the widest and longest, its ventral border in contact with the preopercle; fourth and fifth infraorbitals short and narrow, covering the hyomandibular. Supraorbital present. Premaxilla with ascending lateral process and two rows of teeth; external row with six tricuspid teeth arranged in a straight line except for the first proximal tooth which is a little out of line; internal row with four teeth, each with three to five cusps, the central cusp largest. Maxilla short, the posterior edge not reaching ante-

rior edge of the second or third infraorbital. Maxilla with one or two teeth with three or four cusps each. Dentary with four large pentacuspoid teeth with the central cusp largest, followed by six or seven small teeth, the first tricuspid and the last two unicuspid. Rhinosphenoid osseous, with cartilaginous border and attached to orbitosphenoid by cartilage and extending to anterior edge of prevomer. Orbitosphenoid wide, short and united to pterosphenoid by a band of cartilage. Palatine united with parasphenoid by cartilage.

Dorsal fin with oblique dorsal edge, the second ray simple and the first two branched rays the longest. Radial and proximal pterygiophores of all rays of the dorsal fin inserted between the neural spines 11–18. Four to six supraneurals present between the head and the anterior part of the dorsal fin, with cartilage on the upper and lower edges. Pterygiophores of the anal fin completely cartilaginous, with just a small ossification of the three proximal anterior pterygiophores.

Pectoral girdle with a pointed dorsal process above the cleithrum that surpasses the entire supracleithrum, which is joined to the posttemporal. Cartilage present at the union of scapular with the internal surface of the supracleithrum. Four proximal radials. Pelvic bone short, straight, blunt and with cartilage at the anterior tip, its posterior projection extending between the junction of the two rows of pelvic rays.

Pelvic fin long, but not reaching the origin of the anal fin. Caudal fin not scaled, forked with short pointed lobes, 9–10/9–10 principal caudal rays. Cartilage present at the basal part of the last caudal vertebra and the urostyle. Lateral line with 35–36 pored scales that extend in a straight line from the supracleithrum to the hypurals. Total vertebra 35. No sexual dimorphism was observed.

Distribution

This species is known from the Cinaruco River of southern Apure State (fig. 3) and from the Essequibo River Basin of Guyana, and probably extends into similar rivers throughout the Orinoco Basin in Venezuela and Colombia.

Etymology

Bryconamericus cinarucoense n. sp. is named for the Cinaruco River of southern Apure State, where the type series was collected.

Habitat

Bryconamericus cinarucoense n. sp. was collected along shore over sandy substrates in the main-stream of rivers, as well as tributaries with flow. The transparency of the tea-colored water is usually moderate to high, total dissolved solids and conductivity are very low, and pH is usually slightly acidic.

Bryconamericus singularis n. sp. (fig. 2, table 1)

Holotype: MCNG 54500, 33.41 mm SL, Venezuela, Apure state, Orinoco River basin, Cinaruco River,

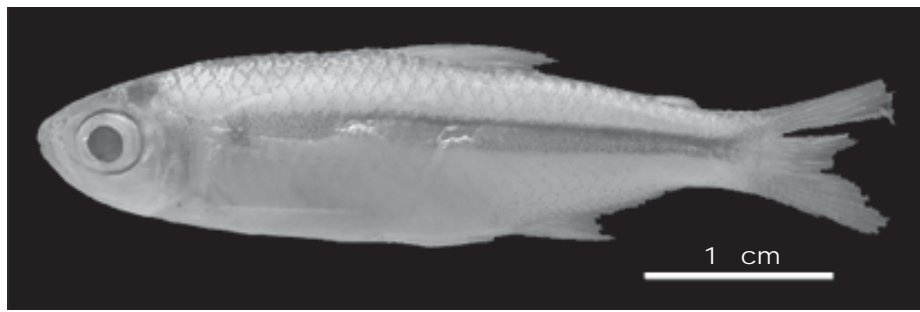


Fig. 2. *Bryconamericus singularis* n. sp.: holotype, MCNG 33.41 mm SL.

Fig. 2. *Bryconamericus singularis* sp. n.: holotipo: MCNG 33,41 mm LE.

beach (6° 32.33' N – 67° 25.35' W), 20 II 1999, coll. D. A. Arrington.

Paratypes: All from Venezuela, Apure State, Cinaruco River. Taken with holotype: IUQ 541 (3 ex. cleared and stained), MCNG 39659 (137 ex.); MCNG 39177 (14 ex.) 28.19–32.41, beach upstream from Laguna Larga (6° 33.15' N – 67° 25.45' W), 11 I 1999; MCNG 39194 (6 ex.) 25.76–33.60, beach upstream from Laguna Larga (6° 32' 20" N – 67° 24' 81" W), 11 VI 1999; MCNG 39232 (3 ex.) 29.44–30.69, beach downstream from Laguna Larga (6° 32.52' N – 67° 24.52' W), 11 VI 1999; MCNG 39245 (8 ex.) 27.73–32.78, beach downstream from Laguna Larga (6° 32.50' N – 67° 24.08' W), 11 I 1999; MCNG 39440 (10 ex.) 25.26–31.13, beach downstream from Laguna Larga (6° 33.37' N – 67° 2.55' W), 6 VI 1999; MCNG 40060 (28 ex.) 20.30–23.36, & MBUCV 33029, 22.23–25.45, Río Cinaruco, Laguna Espiñer, Dto. Pedro Camejo, Edo. Apure, 17 II 1999; MCNG 40149 (15 ex.) 23.93–34.03, beach (6° 36.32' N – 67° 14.87' W), 1 II 1999; MCNG 40374 (12 ex.) 26.24–30.83, Laguna Estrechura (6° 32.25' N – 67° 16.95' W), 16 III 1999; MCNG 40932 (2 ex.) 29.39–29.83, Laguna Espiñer, 12 VI 1999; MCNG 41014, (6 ex.) 26.62–32.01, Laguna Estrechura, 13 VI 1999; MCNG 41640 (18 ex.) 29.02–37.85, beach 5 (6° 32.92' N – 67° 24.97' W), 21 VI 1999; MCNG 41657 (17 ex.) 29.44–38.62, beach 6 (6° 32.52' N – 67° 24.52' W), 21 V 1999.

Non-type material examined

All from Venezuela, Apure State, Cinaruco River: MCNG 39149 (1 ex.) beach upstream from Laguna Larga (6° 38.05' N – 67° 26.05' W), 11 VI 1999; MCNG 39562 (2 ex.) beach, (6° 32.92' N – 7° 24.97' W) 2 X 1999; MCNG 39565 (4 ex.) beach (6° 32.50' N – 67° 24.97' W), 10 II 1999; MCNG 39686 (5 ex.) beach (6° 33.05' N – 67° 26.62' W), 2 II 1999; MCNG 39721 (36 ex.) beach (6° 32.92' N – 67° 24.97' W), 20 II 1999; MCNG 39770 (19 ex.) beach (6° 32.52' N – 67° 24.52' W), 18 II 1999; MCNG 39801 (42 ex.) beach (6° 32.50' N –

67° 24.08' W), 18 II 1999; MCNG 39902 (17 ex.) beach (6° 33.37' N – 67° 22.55' W), 16 II 1999; MCNG 39946 (4 ex.) Laguna Espiñer (6° 32.80' N – 67° 25.90' W), 16 II 1999; MCNG 40284 (7 ex.), beach (6° 33.32' N – 67° 14.87' W), 15 III 1999; MCNG 40312 (16 ex.) Laguna Guayaba (6° 34' 83" N – 67° 13' 84" W), 16 III 1999; MCNG 40403 (35 ex.) Laguna Estrechura (6° 32.32' N – 67° 14.87' W), 16 III 1999; MCNG 40578 (1 ex.) beach (6° 32.92' N – 67° 24.97' W), 18 III 1999; MCNG 40588 (1 ex.) beach (6° 32.92' N – 67° 24.97' W), 18 III 1999; MCNG 40769 (1 ex.) beach (6° 32.53' N – 67° 24.82' W), 24 III 1999; MCNG 40792 (88 ex.) beach (6° 32.33' N – 67° 25.35' W), 24 III 1999; MCNG 40809 (40 ex.) beach (6° 32.33' N – 62° 25.35' W), 24 III 1999; MCNG 40829 (1 ex.) beach (6° 32.33' N – 62° 25.35' W), 24 III 1999; MCNG 41455 (3 ex.) beach (6° 32.50' N – 67° 24.08' W), 17 VI 1999; MCNG 41459 (1 ex.) beach (6° 32.50' N – 67° 24.08' W), 17 V 1999; MCNG 41562 (1 ex.) beach (6° 32.53' N – 67° 24.28' W), 21 VI 1999; MCNG 41572 (1 ex.) playa 2 (6° 32.53' N – 67° 25.45' W), 21 V 1999.

Diagnosis

Bryconamericus singularis n. sp. differs from congeners in having the top of the head flat, the dentary with six or seven slight unicuspid teeth; a dark lateral band extending from posterior edge of the usually diffuse humeral spot to the base of caudal fin, and that widens and strengthens in intensity posteriorly at point beneath dorsal fin origin; five supraneural bones without cartilage on either upper or lower edges and without cartilage on all structures.

Description

Body elongate, dorsal profile of head and anterior body rising from snout to dorsal-fin origin, inclined downwards from last dorsal-fin ray base to base of caudal fin. Ventral profile of body straight from snout to base of anal fin. Head and snout short;

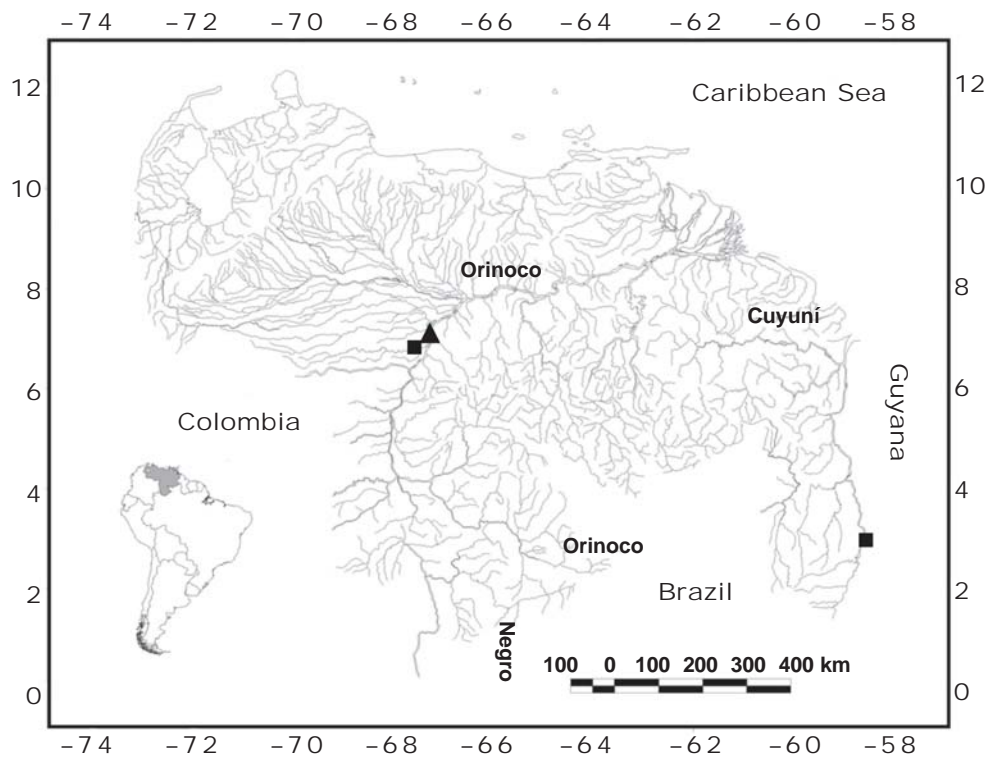


Fig. 3. Geographic distribution of *B. cinarukoense* n. sp. (■) and *B. singularis* n. sp. (▲) in Venezuela.

Fig. 3. Distribución geográfica de *B. cinarukoense* sp. n. (■) y de *B. singularis* sp. n. (▲) en Venezuela.

jaws equal in length; mouth terminal; lips soft and flexible, not covering the external row of premaxillary teeth; premaxilla with one ascendent processes that articulate with mesethmoid and a lateral process that supports the teeth and articulates laterally with the ascendent process of the maxilla; posterior end of maxilla extends beyond anterior edge of orbit. Five infraorbitals with sensory canal present; first infraorbital thin, extending between the dorsal border of maxilla and lateral ethmoid, the second long, covering the dorsal portion of angulo-articular and anterior part of quadrate, third infraorbital wider, its postero-ventral border in contact with preopercle, fourth and fifth infraorbitals short and narrow, covering the hyomandibular. Supraorbital absent. Premaxilla with two rows of teeth; the outer row with four tricuspid teeth with bases arranged in straight line. Internal row with five tri- to pentacuspoid teeth, with the central cusp much longer than rest. Maxilla with one or two tricuspid teeth. Dentary with four large front teeth, those at middle pentacuspoid, those on sides tricuspid, all with central cusp much the larger, followed by six or seven small uncuspoid teeth.

Along the ventral portion of the supraoccipital process there are one or two foramina above the supraoccipital canal that communicate with the neural

complex; dorsal-most portion of neural complex extending as two small apophyses that continue ventrally as a canal. Rhinosphenoid osseous united to orbitosphenoid by a thin osseous plate. Osseous rhinosphenoid united to orbitosphenoid by thin laminar bone. First two branched dorsal-fin rays longer than rest. Proximal dorsal pterygiophores inserted between neural spines 9–10 and 16–17. Five supraneurals present, lower and upper ends without cartilage.

Cartilage absent from the union between scapula with the internal surface of the cleithrum, and in general from all its structures. Pectoral girdle articulated postero-laterally with cranium by fusion with the supracleithrum and ventral end of posttemporal bone; united to dorsal edge of cleithrum. Cleithrum located beneath ventral edge of opercle, three postcleithrals present above posterior edge of pectoral girdle, first postcleithral posterior to union of postcleithrum and posttemporal, second and third postcleithrals united below with cleithrum which extends over the pectoral rays. Three or four proximal radials. Pelvic fin short, its tip not reaching anal origin. Pelvic bone long and straight, its lateral edge convex, internal concave, and located parallel to central axis of body; ischial process with a short, straight pointed apophysis.

Caudal fin forked with long pointed lobes. Principal caudal rays 10/10, no scales at base. 30–32 pored scales in the lateral line, which ends on the caudal fin. Pores of the lateral line forming a gentle curve from first to seventh scales, the rest in straight line. Total vertebrae 33. No sexual dimorphism observed.

Color in alcohol

Body light yellow, darker on dorsum. Lateral portion of body with a dark band behind humeral spot that extends to the base of the caudal fin, and that widens at point beneath dorsal fin origin. Guanine present dorsally and laterally and on opercle in many specimens. Humeral spot present but usually diffuse, about same height as pupil of eye and not usually extending dorsally beyond lateral stripe. Exposed edges of scales on dorsum and upper sides edged with black. Tips of caudal lobes dark, light yellow color of body extending onto central caudal rays, forming light spot at base of caudal fin that is bordered above and below by black. Dorsal, anal, pectoral and pelvic fins hyaline. Anal fin lightly pigmented at tips of rays, body above anterior

portion of anal fin base with concentration of melanophores, some specimens with melanophores outlining the muscle bundles, forming chevrons. Head dark and countershaded.

Distribution

Known from the Cinaruco River, Orinoco Basin, Apure State, Venezuela (fig. 3).

Diet

It is omnivorous, feeding on aquatic insects, snails, seeds and aquatic plants. Stomach contents of five fish included: Hemiptera: Vellidae: Microbelia (5.8% by Number, 33.3% by Frequency of Occurrence and 5.41% Volume) insect parts (100% F, 32.4% V), Mollusca: Bivalvia (47% N, 100% F & 4.05% V), seeds (41.1% N, 100% F & 4.05% V), plant stems (5.8% N, 33.3% F & 1.35% V) and vegetable matter (66.6% F & 32.4% V).

Etymology

The name refers to the singular and striking aspect of this new species.

Key to the species of *Bryconamericus* from the Cinaruco River.

Clave para las especies de Bryconamericus del río Cinaruco.

1	Sides of body with a well-defined, dark, lateral stripe; humeral spot absent or only weakly developed (diffuse) and not usually vertically elongated; lateral scales 33 or fewer	2
	Sides without wide, dark, lateral stripe; humeral spot strongly developed, vertically elongate; lateral scales 35 or more	<i>Bryconamericus cinarucoense</i>
2	Unbranched dorsal fin rays usually ii; unbranched anal-fin rays usually iv; length of maxilla 32–39% of head length, mean 35%; body short and stocky, its greatest depth 25–30% of standard length, mean 27%	<i>Bryconamericus orinocoense</i>
	Unbranched dorsal fin rays usually iii–iv; unbranched anal-fin rays usually iii; length of maxilla in head length 18–32%, mean 27%; body long and slender, its greatest depth 19–26% standard length, mean 24%	<i>Bryconamericus singularis</i>

Key to the species of *Bryconamericus* from tributaries of the Gulf of Paria.

Clave para las especies de Bryconamericus de los afluentes del golfo de Paria.

1	Lateral scales 35–36; total anal-fin rays 30–31; maxilla with 3–4 teeth	<i>Bryconamericus lassorum</i>
	Lateral scales 39–42; total anal-fin rays 26–29; maxilla with 5–8 teeth	<i>Bryconamericus yokiae</i>

Key to the species of *Bryconamericus* of the Apure and Arauca drainages.

Clave para las especies de Bryconamericus de las vertientes de Apure y Arauca.

1	Sides without dark lateral stripe that continues onto central caudal-fin rays; caudal fin usually with a vertically oriented, crescent-shaped dark blotch at base	<i>Bryconamericus cinarucoense</i>
	Sides with a dark lateral stripe that continues onto central caudal-fin rays	2
2	Five or more small teeth behind main series on dentary; body elongate (maximum body depth 26.6% SL); no small red or yellow dot on upper caudal peduncle	<i>Bryconamericus loisae</i>
	Four or fewer small teeth behind main series on dentary; body not as elongate (maximum body depth 27–3% SL), small red or yellow dot on caudal peduncle present or absent	3
3	Branched anal-fin rays 20 or more; no red or yellow dot on caudal peduncle	<i>Bryconamericus alpha</i>
	Branched anal-fin rays 17 or fewer; small red or yellow dot on upper caudal peduncle present	<i>Bryconamericus cismontanus</i>

Key to the species of *Bryconamericus* from the Caribbean Coastal drainages.

Clave para las especies de Bryconamericus de las vertientes de la costa caribeña.

1	Total anal rays (simple plus branched) fewer than 21; small red or yellow dot present on upper caudal peduncle	<i>Bryconamericus cismontanus</i> (Caribbean drainages of Falcon, Lara, Yaracuy and other states)
	Total anal rays more than 20	2
2	Lateral scales fewer than 35; teeth on maxilla multicuspid with all cusps of equal length	<i>Bryconamericus charalae</i> (endemic to Rio Aroa drainage, Lara)
	Lateral scales more than 34; teeth on maxilla multicuspid with central cusp longer than others	3
3	More than four small teeth behind major series of large teeth on dentary; three to four unbranched anal-fin rays; body elongate (greatest body depth 26.6% SL)	<i>Bryconamericus loisae</i> (Zulia, Falcón, Lara, Carabobo, Yaracuy)
	Fewer than three small teeth behind major series of large teeth on dentary; more than four unbranched anal-fin rays; body shorter and higher (greatest body depth 30.1% SL)	<i>Bryconamericus alpha</i> (Aragua, Miranda, Anzoátegui)

Key to the species of *Bryconamericus* from the Lake Maracaibo drainage.

Clave para las especies de Bryconamericus de las vertientes del lago Maracaibo.

1	Anal fin rays iii,13 to iii,16; scales from lateral line to anal fin base 2–3	<i>Bryconamericus meridae</i>
	Anal fin rays iii–v, 18–30; scales from lateral line to anal fin base 4 or more	2
2	Anal fin rays v, 18–23; lateral scales 32–38; body shorter and stocky, its greatest body depth 30.07% SL	<i>Bryconamericus alpha</i>
	Anal fin rays iii, 24–30; lateral scales 38–41; body long and slender, its greatest body depth 26.64% SL	<i>Bryconamericus cf loisae</i>

Key to the species of *Bryconamericus* from the Guyana Shield.

Clave para las especies de Bryconamericus del Macizo de Guyana.

1	Fewer than 34 lateral scales	2
	More than 33 lateral scales	3
2	Unbranched dorsal fin rays usually ii; unbranched anal-fin rays usually iv; length of maxilla 32–39% of head length, mean 35%; body short and stocky, its greatest body depth 25–30% standard length, mean 27%	<i>Bryconamericus orinocoense</i>
	Unbranched dorsal fin rays usually iii–iv; unbranched anal-fin rays usually iii; length of maxilla in head length 18–32%, mean 27%; body elongate and slender, its greatest body depth 19–26% standard length, mean 24%	<i>Bryconamericus singularis</i>
3	Central caudal-fin rays with a black stripe, or with a dark spot on their bases	4
	Central caudal-fin rays without black stripe, a vertically oriented, crescent-shaped blotch at base (sometimes diffuse) usually present	<i>Bryconamericus cinarucoense</i>
4	More than 19 branched anal-fin rays	<i>Bryconamericus alpha</i>
	Fewer than 20 branched anal-fin rays	5
5	Lateral scales 40–41; caudal fin overall dusky, with darker spot on base of central caudal rays, and whitish spot at base of upper lobe, and sometimes a at base of lower lobe as well	<i>Bryconamericus macrophthalmus</i>
	Lateral scales 32–39; caudal fin not pigmented as above	6
6	Caudal peduncle with small red or yellow dot; maxilla with 1–2 teeth with cusps of equal length; lateral scales 32–38; branched anal-fin rays 13–18	<i>Bryconamericus cismontanus</i>
	Caudal peduncle lacks red or yellow dot; maxilla with 4–6 teeth, with central cusp longer than others; lateral scales 38–39; branched anal-fin rays 17–18	<i>Bryconamericus subtiliform</i>

Discussion

A comprehensive discussion of the relationships of *Bryconamericus* species from South America is not possible at this time due to our poor knowledge of the taxonomy and systematics of the genus. No synapomorphies presently define *Bryconamericus* as a monophyletic unit. However, in a recent study with molecular characters Román-Valencia & Vanegas-Ríos (in press) propose the first hypothesis for the monophyly of the Central American species of this genus. We include species assigned to the genus *Knodus* because we do not consider a lack of scales on the caudal fin as sufficient to warrant generic recognition. Work in progress will hopefully uncover osteological characters that may be useful for generic diagnosis, but at this time the boundaries between *Astyanax* Baird and Girard, *Bryconamericus* Eigenmann, *Hemibrycon* Günther, *Hemigrammus* Gill, *Hyphessobrycon* Durbin, and *Moenkhausia* Eigenmann, remain tenuous and arbitrary.

Bryconamericus singularis n. sp. is similar to *Bryconamericus orinocoense* (Román-Valencia, 2003d, table 1), but can be distinguished by the longer maxillary bone (18.3–32.9% in *B. singularis* vs. 12.8–31.4%), and the shape of the opercle, which has a straight posterior edge vs. strong notch present in upper part of opercle. It also differs in the lower number of vertebrae (33 in *B. singularis* vs. 35–36), is longer and less deep bodied: maximum body depth (19.5–25.9% in *B. singularis* vs. 26.8–31.5%), and has a longer distance separating the dorsal fin and the hypurals (46.9–56.2% in *B. singularis* vs. 36.4–39.9%). The upper jaw is also longer: (19.9–31.1% in *B. singularis* vs. 11.7–17.8%); and the shape of the posterior edge of the opercle is concave and lacks a notch in *B. singularis*.

The presence of six to seven small unicuspid teeth in *B. singularis* coincides with the five to seven small teeth reported in *B. turiuba* Langeani et al. (Upper Río Paraná system) by Langeani et al. (2005) but that species has tricuspid as well as unicuspid teeth in this series.

While preparing the descriptions of *B. singularis* (in this work) and *B. orinocoense* (Román–Valencia, 2003d) we noted that we could place them in the genus *Moenkhausia* according to some character states (Eigenmann, 1918). For example, both have the teeth in the outer row of the premaxilla in a straight row and five teeth in the inner row. However, both species lack scales on the base of the caudal fin, as would be the case if they were *Moenkhausia* (some *Bryconamericus*, however, also have a scaled caudal, and some authors place them in the genus *Knodus* because of this). The second infraorbital is not in contact with the preopercle in *Moenkhausia* species but is in contact in *B. singularis* and *B. orinocoense*. This situation simply lends further credence to the paraphyly of both *Bryconamericus* and *Moenkhausia* as currently conformed, and points out the need for a broad revision and redefinition of these, and most other characid genera.

Based on the results and analysis of this study (for example, the re-identification of specimens from the localities where records of *B. breviceps* y *B. heteresthes* were previously purported to occur, and the characters presented in the keys) we consider previous reports of *B. breviceps* and *B. heteresthes* from Venezuela (Román–Valencia, 2005) to be misidentifications, and they are here considered as either *B. cinarucoense*, or another, as yet undescribed species.

On comparing data obtained during this study with previous reports (Román–Valencia, 2003d, 2005) we can find no differences to substantiate the recognition of *B. alpha* and *B. motatanensis* as separate species. In only one character: distance from dorsal-fin origin to anal-fin origin, is there a small difference: (35.8–36.1% in *B. alpha* vs. 37.0–48.1% in *B. motatanensis*) which we consider insufficient. Thus, based on the International Code of Zoological Nomenclature (1999), the valid name is *B. alpha*, and *B. motatanensis* (described as *B. beta motatanensis*) is considered a synonym.

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References

- Calcagnotto, D., Shaefer, S. A. & DeSalle, R., 2005. Relationships among characiform fishes inferred from analysis of nuclear and mitochondrial gene sequences. *Molecular Phylogenetics and Evolution*, 36: 135–153.
- Eigenmann, C., 1918. The American Characidae. *Memoirs of Museum of Comparative Zoology*, XLIII (2): 114.
- Ferreria, K. M. & Carvajal, F. M., 2007. *Knodus shinahota* (Characiformes: Characidae) a new species from the río Shinahota, río Chapare basin (Mamoré system), Bolivia. *Neotropical Ichthyology*, 5(1): 31–36.
- Ferreira, K. M. & Lima, F. C. T., 2006. A new species of *Knodus* (Characiformes: Characidae) from the Rio Tiquié upper Rio Negro system, Brazil. *Copeia*, 2006(4): 630–639.
- Fink, W. L., 1976. A new genus and species of characid fish from the Bayano river basin, Panamá (Pisces: Cypriniformes). *Proceedings of the Biological Society of Washington*, 88: 331–344.
- Géry, J., 1977. *Characoids of the World*, T. F. H. publications, Inc., Neptune, USA.
- International Commission on Zoological Nomenclature., 1999. *International code of zoological nomenclature*, 4th edition. International Truch for Zoological Nomenclature, London y University of California Press, Berkeley, Los Angeles.
- Jiménez J., Román–Valencia, C. & Cardona, M., 1998. Distribución y constancia de las comunidades de peces en la quebrada San Pablo, cuenca del río La Paila, Alto Cauca, Colombia. *Actualidades Biológicas*, 20: 21–27.
- Langeani, F., De Lucena, Z. M. S., Lima, P. J. & Tarelho–Pereira J., 2005. *Bryconamericus turiuba*, a new species from the Upper Río Paraná system (Ostariophysi: Characiformes). *Copeia*, 2005: 386–392.
- Lima, C. T. F., Malabarba, L. R., Buckup, P. A., Pezzi da Silva, J. F., Vari, R. P., Harold, A., Benine, R., Oyakawa, O. T., Pavanelli, C. S., Menezes, N. A., Lucena, C. A. S., Malabarba, M. C. S. L., De Lucena, Z. M. S., Reis, R. E., Langeani, F., Cassati, L., Bertaco, V. A., Moreira, C. & Lucinda P. H. F., 2003. Genera incertae sedis in Characidae p. 106–169. In Reis, R., Kullander, S. O., Ferraris Jr., C., (Eds.), 2003. *Check list of the freshwater fishes of South and Central America*, Edipucrs Porto Alegre, Brazil.
- Lima, F. C. T. & Zuanon, J., 2004. A new species of *Astyanax* (Characiformes: Characidae) from the rapids of the lower rio Xingu, Brazil. *Neotropical Ichthyology*, 2: 117–122.
- Malabarba, L. R. & Kindel, A., 1995. A new species of the genus *Bryconamericus* Eigenmann, 1907

- from southern Brazil (Ostariophysi: Characidae). *Proceedings of the Biological Society of Washington*, 108: 679–686.
- Malabarba, L. R. & Weitzman, S. H., 2003. Description of 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, Porto Alegre*, 16: 67–151.
- Malabarba, M. C. S. L. & Malabarba, L. R., 1994. *Hypobrycon maromba*, a new genus and species of characiform fish from the upper rio Uruguay, Brazil (Ostariophysi: Characidae). *Ichthyological Exploration of Freshwaters*, 5: 19–24.
- Planquette, P., Keith, P. & Le Bail, P.-Y., 1996. *Atlas des poissons d'eau douce de Guyane*. Muséum National D'Histoire Naturelle, Sepanguy, Paris.
- Román-Valencia, C., 1998. Descripción de una nueva especie de *Bryconamericus* (Characiformes, Characidae) para la cuenca alta de los ríos Ariari y Meta, Colombia. *Actualidades Biológicas*, 20: 21–27.
- 2000. Tres nuevas especies de *Bryconamericus* (Ostariophysi, Characidae) de Colombia y diagnóstico del género. *Revista de Biología Tropical*, 48(2–3): 449–464.
- 2001. Descripción de una nueva especie de *Bryconamericus* (Ostariophysi, Characidae) del alto río Suárez, cuenca del Magdalena, Colombia. *Bollettino del Museo Regionale di Scienze Naturali di Torino*, 18(2): 469–476.
- 2002a. Revisión sistemática de las especies del género *Bryconamericus* (Teleostei: Characidae) de Centroamérica. *Revista de Biología Tropical*, 50: 173–192.
- 2002b. Description of a new species of *Bryconamericus* (Teleostei, Characidae) from the basin of the Golfo de Paria, northeastern, Venezuela. *Revista Museo Argentino de Ciencias Naturales, n.s.*, 4: 209–214.
- 2003a. Sistemática de las especies Colombianas de *Bryconamericus* (Characiformes, Characidae). *Dahlia (Revista de la Asociación Colombiana de Ictiólogos)*, 6: 17–58.
- 2003b. Description of a new species of *Bryconamericus* (Teleostei: Characidae) from the Amazon. *Bollettino del Museo Regionale di Scienze Naturali di Torino*, 20: 477–486.
- 2003c. Una nueva especie de *Bryconamericus* (Pisces: Ostariophysi: Characidae) para el nororiente de Venezuela. *Memoria de la Fundación La Salle de Ciencias Naturales*, 155: 21–30.
- 2003d. Three new species of the genus *Bryconamericus* (Teleostei: Characidae) from Venezuela. *Dahlia (Revista de la Asociación Colombiana de Ictiólogos)*, 6: 7–15.
- 2005. Sinopsis comentada de las especies del género *Bryconamericus* (Teleostei: Characidae) de Venezuela y norte del Ecuador, con la descripción de una nueva especie para Venezuela. *Memoria de la Fundación La Salle de Ciencias Naturales*, 163: 27–52.
- Román-Valencia, C. & Muñoz, A., 2001. Ecología trófica y reproductiva de *Bryconamericus caucanus* (Pisces: Characidae). *Bollettino del Museo Regionale di Scienze Naturali di Torino*, 18(2): 459–467.
- Román-Valencia, C. & Vanegas-Ríos, J. A. (in press). Análisis filogenético y biogeográfico de las especies del género *Bryconamericus* (Characiformes, Characidae) para América Central. *Caldasia*, 29.
- Ruiz-C., R. I. & Román-Valencia, C., 2006. Osteología de *Astyanax aurocaudatus* Eigenmann, 1913 (Pisces: Characidae), con notas sobre la validez de *Carlastyanax* Géry, 1972. *Animal Biodiversity and Conservation*, 29(1): 49–64.
- Serra, P. J. & Langeani, F., 2006. Redescricção e osteologia de *Bryconamericus exodon* Eigenmann, 1907 (Ostariophysi, Characiformes, Characidae). *Biota Neotropica*, 6: 1–14.
- Silva, J. F. P., 2004. Two new species of *Bryconamericus* Eigenmann (Characiformes: Characidae) from southern Brazil. *Neotropical Ichthyology*, 2(2): 55–60.
- Silva, J. F. P. & Malabarba, L. R., 1996. Description of a new species of *Hypobrycon* from the upper rio Uruguai, Brazil (Ostariophysi: Characidae). *Comunicações do Museu de Ciências e Tecnologia da PUCRS, Série Zoologia, Porto Alegre*, 9: 45–53.
- Song, J. & Parenti, L. R., 1995. Clearing and staining whole fish specimens for simultaneous demonstration of bone, cartilage and nerves. *Copeia*, 1995: 114–118.
- Taylor, W. R. & Van Dyke, G. C., 1985. Revised procedures for staining and clearing small fishes and other vertebrates for bone and cartilage study. *Cybio*, 9: 107–119.
- Vari, R. P., 1995. The Neotropical fish family Ctenoluciidae (Teleostei: Ostariophysi: Characiformes): supra and intrafamilial phylogenetic relationship, with a revisionary study. *Smithsonian Contributions to Zoology*, 564: 1–96.
- Vari, R. P. & Siebert, D. J., 1990. A new unusually sexually dimorphic species of *Bryconamericus* (Pisces: Ostariophysi: Characidae) from the Peruvian amazon. *Proceeding Biological Society*, 103: 516–524.
- Weitzman, S. H., 1962. The osteology of *Brycon meeki*, a generalized characid fish, with an osteological definition of the family. *Stanford Ichthyological Bulletin*, 8: 1–77.
- Weitzman, S. H., Menezes, N. A., Evers, H. G. & Burns, J. R., 2005. Putative relationships among inseminating and externally fertilizing characids, with a description of a new genus and species of Brazilian inseminating fish bearing an anal–fin gland in males (Characiformes: Characidae). *Neotropical Ichthyology*, 3: 329–360.