Two new species of *Hemibrycon* (Characiformes, Characidae) from the Magdalena River, Colombia

C. Román–Valencia & D. K. Arcila–Mesa

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Abstract

Two new species of Hemibrycon *(Characiformes, Characidae) from the Magdalena River, Colombia*.— *Hemibrycon brevispini* n. sp. can be distinguished from other species of the genus by the presence of hooks on all fins, and by an elongate projection on the fourth ventral neural arc near the first neural post–zygotic apophysis. *Hemibrycon cairoense* n. sp. can be distinguished from congeners by having nine proximal pteryigiophores in the dorsal fins including the terminal piece (*vs*. > 10). It can be distinguished from *Hemibrycon* species in the Upper and Middle Cauca Rivers by the number of pored lateral–line scales (43–46 *vs*. > 46 o < 43; $F = 13.67$; $p < 0.000$). Ecological data concerning the aquatic habitat of the taxa are presented.

Key words: *Hemibrycon*, Tropical fish, South America.

Resumen

Dos nuevas especies de Hemibrycon *(Characiformes, Characidae) de la cuenca del río Magdalena, Colombia*.— *Hemibrycon brevispini* sp. n. se diferencia de sus congéneres por la presencia de ganchos reducidos en todas las aletas y por una proyección alargada sobre el cuarto arco neural ventral más cercana a la primera apófisis post–cigótica neural. *Hemibrycon cairoense* sp. n. se distingue de sus congéneres por la presencia de nueve pterigióforos proximales en la aleta dorsal (incluye la pieza terminal) (*vs*. > 10). Se separa de las especies de *Hemibrycon* del Alto y Medio Magdalena por el número de escamas con poros en la línea lateral (43 a 46 *vs*. > 46 o < 43; $F = 13,67$; $p < 0,000$). Se incluyen datos ecológicos del hábitat propio de los táxones.

Palabras claves: *Hemibrycon*, Pez tropical, América del Sur.

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Introduction

The different species of *Hemibrycon* are characterized by allopatric distribution patterns that are influenced by Miocene tectonics, the uplifting of the Andes, the genesis of the Amazon River and subsequent changes in Orinoco and Magdalena River drainage (Román–Valencia, 2001, 2004; Román–Valencia et al., 2006a, 2007, 2009; Román–Valencia & Ruiz–C., 2007; Bertaco et al., 2007, Arcila–Mesa et al., submitted).

One genus inhabits the crystalline waters of secondary type creeks at between 41 and 1,910 m a.s.l. The substrates is composed of stones, rocks, sand, or leaf litter in decomposition, with high dissolved oxygen (mean 8 ppm). Their diet consists primarily of aquatic and terrestrial insects of autochthonous and allochthonous origin (Román–Valencia & Botero, 2006; Román–Valencia et al., 2008).

The main difficulties encountered in the description of new species and appreciation of the diversity in *Hemibrycon* has been the lack of unique characters that would allow adequate diagnosis. Faced with this dilemma, Dahl (1971) and Schultz (1944) described subspecies from the upper Cauca and Lake Maracaibo Basins. The purpose of the present paper is to describe two new species of *Hemibrycon* from Colombia and provide morphometric, osteological and sexual dimorphism characters to distinguish them from their congeners, as a further contribution to the ongoing revision of the genus.

Material and methods

Fishes were captured using a seine, preserved with 10% formalin and later stored in 70% ethanol. Measurements were made with digital calipers to 0.01 mm precision, and are expressed as percentages of standard (SL) and head lengths (HL) (table 1). Measurements and counts were taken on the left side, except when that side was damaged, and were recorded following the methodology described in Vari & Siebert (1990). We performed Principal Component Analysis (PCA) on the covariance matrix of morphometric characters to compensate for allometric growth. All measurements were log–transformed before statistical analyses and the Burnaby method (Burnaby, 1966) was used to adjust size to reduce process errors due to size discrepancies. For meristic characters we used the Mann–Whitney non–parametric rank–sum test; for the measurements that were most significant in the PCA we applied an analysis of variance (ANDEVA) with a 0.05 significance level, and a Tukey test to corroborate the presence of statistically significant interspecific differences.

Observations of cartilage and bone were made on two cleared and stained specimens (C. and S.) following Song and Parenti's modifications (1995) of the method outlined in Taylor & Van Dyke (1985). Bone nomenclature follows Weitzman (1962), Vari (1995) and Ruiz–C. & Román–Valencia (2006). Institutional abbreviations follow standard ASIH abbreviations listed at http://www.asih.org, with the addition of the following institutions: Instituto de Investigaciones Biológicas "Alexander Von Humboldt", Villa de Leyva, Boyacá, Colombia (IAvH); Laboratorio de Ictiología, Universidad del Quindío, Armenia,Colombia (IUQ); Museo de Zoología, Departamento de Ciencias Biológicas, Escuela Politécnica Nacional de Quito,Ecuador (MEPN); Museo de Historia Natural, Universidad Nacional Mayor de San Marcos, Lima, Peru (MNH–UNMSM); Fundación La Salle de Ciencias Naturales–Museo de Historia Natural, Caracas, Venezuela (MHNLS). In the material examined and comparative sections the number of specimens is given in parentheses after the catalog number, for example: IUQ 754 (104).

Comparative material

Hemibrycon boquiae
IUQ 301a (3) (C. and S.), Colombia, Quindío, Boquia Creek (4° 38' 35" N, 75° 75' 11" W) 1,819 m a.s.l. IUQ 754 (104), Colombia, Quindío, Boquia Creek (4° 38' 35" N, 75° 75' 11" W) 1,819 m a.s.l. IUQ 871 (15), Colombia, Quindío, Boquia Creek (4° 38' 35" N, 75° 75' 11" W) 1,819 m a.s.l.

Hemibrycon colombianus
IAvH 3130 (28); Colombia, Santander, Moniquira and Suárez Rivers.

Hemibrycon jelskii
IUQ 1141 (2) (C. and S.), Divino River, 1,600 m before Chontayacu. USNM 361171 (3), Perú Cusco, the Convención, Echarate, Peruanita, Igoripato Creek.

Hemibrycon dariensis
USNM 260697 (1), Colombia, Creek Bernal, tributary of Negua River, 17 III 1967. USNM 293218 (2), Panamá, locality of Kuna Yala, Madinga River between Pingandi and Mandinga Rivers (Atlántico) (09° 28' N; 70° 06' W). USNM 293234 (1), Panamá, Darién, Pirre River ca 1/2 km above el Real (Tuira River), Pacifico. USNM 293245 (28), Panamá, Darién, río Tuira, Darién Province, Pucuro River about 3–4 km above the confluence of the Tuira River. IUQ 523 (26), Colombia, Antioquia, Zungo River highway, León River system. IUQ 524 (2), Colombia, Antioquia, Creek km 25 road Mutatá–Chigorodo. IUQ 525 (26), Colombia, Antioquia, León River drainage, Villarteaga River.

Hemibrycon metae
IAvH 3122 (10), Colombia, Casanare, Aguazul, Cachiza River, Chichaca Creek; III 1995.

Hemibrycon taeniurus
MHNLS 8046 (2), Venezuela, Monagas, Punceres River, to 15 km of Quiriquire (63º 53' N, 63º 9' W). MHNLS 8070 (119), Venezuela, Monagas River, Aragua (bridge on the Becerros Creek), Maturin–Quiriquire road, ca. 10 km Aragua–Maturin (63º 55' N, 63º 25' W) 100 m a.s.l. MHNLS 8091 (72), Vene-

Table 1. Morphometric and meristic data of *Hemibrycon brevispini* n. sp. and *H. cairoense* n. sp. Standard and total length in mm, mean in parenthesis: H. Holotype; P. Paratypes.

Tabla 1. Datos morfométricos y merísticos de Hemibrycon brevispini *sp. n. y* H. cairoense *sp. n. Las longitudes estándar y total se dan en mm y las medias entre paréntesis: H. Holotipos; P. Paratipos.*

	Hemibrycon brevispini n. sp.		*Hemibrycon cairoense* n. sp.	
Morphometric characters	P (n = 56)	H	P (n = 26)	H
Standard length (mm)	47.25–89.86 (66.58)	88.62	54.76–85.44 (70.94)	80.93
Total length	18.53–106.73 (79.23)	106.51	68.23–106.27 (87.17)	98.73
Percentages of SL				
Body depth	26.96–31.93 (29.52)	28.99	24.35–29.15 (27.23)	25.15
Snout–dorsal fin origin distance	48.32–53.00 (50.93)	51.48	48.02–52.89 (50.69)	51.58
Snout–pectoral fin insertion distance	20.71–24.53 (22.81)	22.42	20.82–23.40 (22.16)	21.70
Snout–pelvic fin insertion distance	40.77–47.38 (44.56)	41.95	41.53–46.42 (43.76)	41.75
Dorsal–fin origin–pectoral–fin distance	37.90–42.76 (40.25)	39.92	35.70–41.24 (38.31)	38.29
Snout–anal fin origin distance	55.09–61.45 (57.51)	56.67	55.94–59.24 (57.62)	57.09
Dorsal fin origin–hypurals plate length	50.11–56.16 (53.46)	50.65	51.09–57.03 (53.79)	54.65
Dorsal fin origin–anal fin origin length	28.87–32.50 (30.38)	29.42	24.72–30.01 (27.49)	26.45
Dorsal fin length	17.06–23.86 (21.53)	21.99	18.88–22.29 (20.56)	20.30
Pectoral fin length	17.87–22.30 (20.31)	19.49	12.72–21.71 (19.61)	18.44
Pelvic fin length	12.24–13.31 (12.78)	12.82	11.62–13.71 (12.58)	12.16
Anal fin length	12.62–16.38 (14.48)	14.13	12.96–14.75 (13.81)	13.16
Caudal peduncle depth	7.91–16.08 (10.32)	10.64	10.38–11.96 (11.11)	10.89
Caudal peduncle length	10.82–18.54 (11.90)	12.22	8.91–20.14 (11.47)	11.79
Head length	18.55–22.57 (20.44)	19.93	18.16–21.38 (20.03)	20.33
Percentages of HL				
Snout length	20.22–31.40 (26.05)	25.42	22.31–28.07 (24.48)	25.59
Orbital diameter	35.80–47.49 (40.71)	35.60	35.47–48.32 (41.29)	35.48
Postorbital distance	33.80–44.36 (38.83)	36.01	28.45–38.27 (35.98)	35.44
Maxilla length	27.37–38.35 (32.68)	27.73	27.42–35.34 (31.33)	27.52
Interorbital distance	35.02–44.96 (38.71)	36.86	37.02–45.50 (39.29)	38.72
Upper jaw length	28.35–39.01 (32.86)	29.56	29.10–36.19 (32.34)	29.30
Meristic				
Lateral line scales	41–43	43	43–46	43
Scales rows between dorsal–fin origin and lateral line	6–7	6	6–7	7
Scales rows between anal–fin origin and lateral line	5–6	6	6–7	6
Scales rows between pelvic–fin insertion and lateral line	5–6	6	6–7	6
Predorsal median scales	12–14	13	12–15	13
Dorsal–fin rays	iii,7	iii,7	ii,8	ii,8
Anal–fin rays	iii–iv,23–28	iii,28	iii–iv,23–28	iii,25
Pelvic–fin rays	ii,6	ii,6	ii,6	ii,6
Pectoral–fin rays	ii,9–11	ii,10	ii,10–11	ii,11

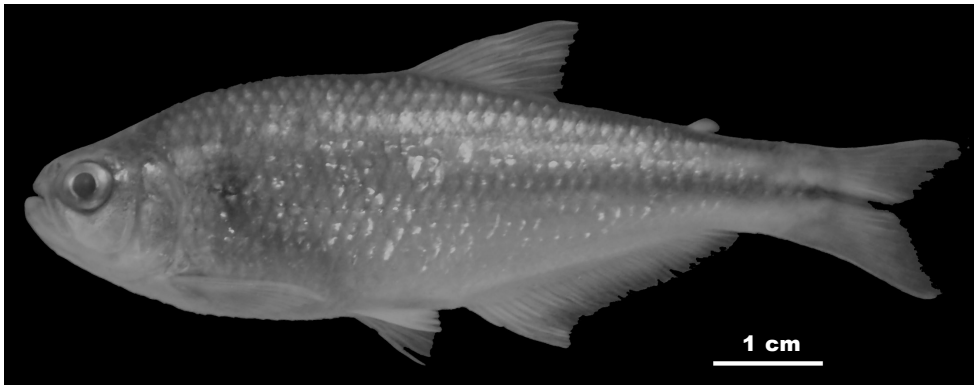

Fig. 1. *Hemibrycon brevispini* n. sp. Holotype IUQ 2008, Colombia, Quindío, Calarcá, Alto Cauca, Quindio River system, La Venada Creek.

Fig. 1. Hemibrycon brevispini *sp. n. Holotipo IUQ 2008, Colombia, Quindío, Calarcá, Alto Cauca, sistema fluvial del Quindío, arroyo La Venada.*

zuela, Monagas, Aragua River (bridge on the Becerros Creek, Maturin–Quiriquire road, ca. 10 km Aragua–Maturin (63º 55' N, 63º 25' W) 100 m a.s.l. MHNLS 8157 (52), Venezuela, Sucre, Parare River, at road to 5 km of Grande River, Quiriquire–Cariaco road (10º 19' N, 63º 17' W). MHNLS 8888 (191), Venezuela, Monagas, Aragua River (bridge on the Becerros Creek), Maturin–Quiriquire road, ca. 10 km Aragua–Maturin (63º 55' N, 63º 25' W) 100 m a.s.l. MHNLS 8891 (6), Venezuela, Monagas, Aragua River (bridge on the Becerros Creek), Maturin–Quiriquire road, ca. 10 km Aragua–Maturin (63º 55' N, 63º 25' W) 100 m a.s.l.

Hemibrycon jabonero
EBRG 4324 (20), Venezuela, Aragua Limón River on Pozo 350 m, profauna, El Limón. EBRG 4324 (2) (C. and S.), Venezuela, Aragua Limón River on Pozo 350 m, profauna, the Limón.

Hemibrycon microformaa
IUQ 512 (1 paratype) (C. and S.), Colombia, Atrato River Basin, Chintado River, 100 m bridge on the road Yuto–Certegui. IUQ 1204 (1 paratype) (C. and S.), Atrato River Basin, Chintado River, 100 m bridge on the road Yuto–Certegui.

Hemibrycon pautensis
IUQ 533 (2 paratypes) (C. and S.), Ecuador, Paute River, at the mouth of the Namangoza River.

Hemibrycon polyodon
IUQ 1142 (2) (C. and S.), Ecuador, Antonio–Guadalupe Creek.

Hemibrycon guppyi
USNM 290406 (1) (C. and S.), Trinidad and Tobago, Trinidad, Matura River. USNM 290406 (7), Trinidad and Tobago, Trinidad, Matura River.

Hemibrycon orcesi
MEPN 001538 (17), Ecuador, Morona–Santiago River Tayusa, afl. Upano River, on bridge road Méndez–Sucua. MEPN 001538 (4) (C. and S.), Ecuador, Morona–Santiago, Tayusa River, afl. Upano River, on bridge road Méndez–Sucua.

Results

Hemibrycon brevispini n. sp. (table 1, figs. 1–3)

Holotype: IUQ 2008, Colombia, Quindío, Alto Cauca, río Quindío, Venada Creek, afl. Santo Domingo River, 200 m. road to Quebrada Negra locality (4º 26' 47'' N, 75º 41' 02'' W) 1,278 to 1,304 m a.s.l.

Paratypes: Colombia, Quindío. IUQ 542 (40), collected with holotype. IUQ 883 (6), Colombia, Quindío, Venada Creek, afl. Santo Domingo River, road Quebrada Negra, Calarcá (4° 26' 52'' N, 75° 41' 02'' W) 1,278 to 1,304 m a.s.l. IUQ 1453 (5) (C. and S.), Colombia, Quindío, Quebrada Negra, Alto Cauca, Quindío River Basin, La Vieja River system, Venada Creek, drainage of Santo Domingo River, 200 m road Quebrada Negra after the bridge of the Santo Domingo River.

Diagnosis
The new taxon can be distinguished from all congeners by the elongate projection on fourth ventral neural arc near the first neural postzygoapophysis (fig. 2) and by the presence of very reduced hooks on all fins and the posterior end of dorsal lobe of the caudal–fin (fig. 3).

Description
Morphometric and meristic data in table 1. Body elongate, head robust, dorsal profile of head convex; area above orbits convex. Dorsal profile of body

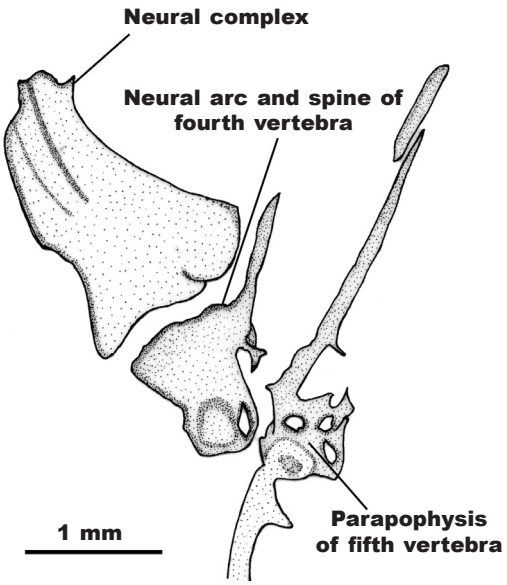

Fig. 2. Elongate projection on fourth ventral neural arc nearest first neural post–zigotic apophysis in *H. brevispini* n. sp.

Fig. 2. Proyección alargada del cuarto arco neural ventral más próximo a la primera apófisis post–cigótica neural de H. brevispini *sp. n.*

from supraoccipital to dorsal–fin origin, and from last dorsal–fin ray to caudal–fin base oblique. Ventral profile of body convex from snout to anal–fin base, convexity more pronounced beyond posterior portion of pectoral fins. Caudal peduncle laterally compressed in all specimens. Head and snout short; jaws equal, mouth terminal; lips soft and flexible, not covering external tooth row of premaxilla; ventral border of upper jaw slightly concave; maxilla ending at vertical through anterior border of orbit. Opening of posterior nostrils vertically ovoid; opening of anterior nostrils with posterior membranous flap.

Six infraorbitals present, all with laterosensory canal; third infraorbital long, wide, with ventral and posterior borders in contact with preopercle. Supraorbital absent. Premaxilla with long lateral process, and two rows of teeth; outer row with 2–5 tricuspid teeth arranged in straight line. Inner row with 4 tricuspid teeth with central cusp longer. Maxilla long with posterior tip reaching anterior border of second infraorbital. Maxilla with 8 to 10 teeth, with 1 to 3 cusps, along anterior ventral margin. Dentary with 3 to 4 long teeth with 2 to 3 cusps followed by 8 to 10 teeth with 1 to 3 cusps.

Rhinosphenoid ossified separated posteriorly from orbitosphenoid by mesethmoid cartilage. Orbitosphenoid small and without apophysis. Parasphenoid elongate and undivided posteriorly and with antero lateral aphophysis. Anterior portion of parasphenoid covering posterodorsal surface of vomer ossified. Eight supraneurals between head and anterior dorsal fin. Four branchiosegal rays. One to two epurals. 32–36 epineural, 23–24 epipleural, 11–13/9–13 procurrent rays. Dorsal–fin margin oblique, second ray unbranched and first two branched rays longest.

Pectoral girdle with sharp dorsal process on cleithrum reaching 1/2 length of supracleithrum. Pelvic–fin short, with tip of fin falling short of anal–fin origin. Pelvic bone elongates with straight lateral margin and anterior end and postero lateral margin cartilaginous; ischiatic process curved, with two apophysis dorsal

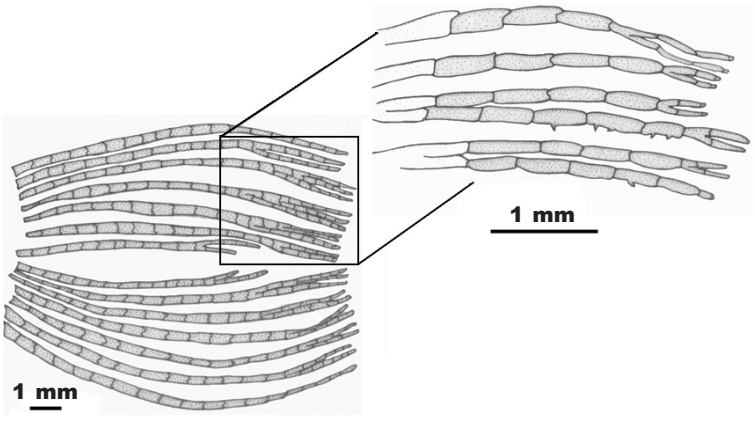

Fig. 3. Males of *Hemibrycon brevispini* n. sp. with tiny hooks on the caudal–fin localized on posterior end of dorsal lobe and medial part, 2 to 6 hooks on each ray.

Fig. 3. Presencia en los machos de Hemibrycon brevispini sp. n. de diminutos ganchos en la aleta caudal, localizados en el extremo posterior del lóbulo dorsal y la parte media, de 2 a 6 ganchos en cada hilera.

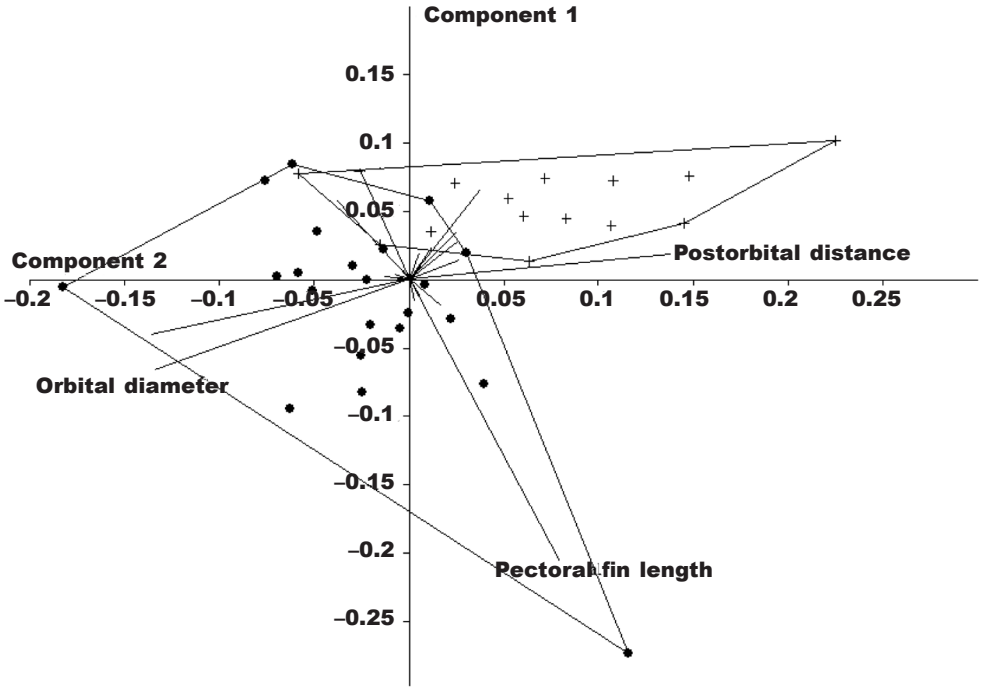

Fig. 4. Principal components analyses (PCA) (component 1 on the X axis, component 2 on the Y axis) of morphometric data in *Hemibrycon brevispini* n. sp. (+) and *H. cairoense* n. sp. (●).

Fig. 4. Análisis de componentes principales (PCA) (la componente 1 en el eje X y la componente 2 en el eje Y) de los datos morfométricos de Hemibrycon brevispini sp. *n. (+) y* H. cairoense *sp. n. (●).*

and ventral. Caudal–fin unscaled bifurcated with short lobes and pointed tips. Caudal–fin rays 8–10/9–10. Pored lateral–line scales 41–43, extending from supracleithrum to hypural joint. Lateral line pores forming slight curve in ventral direction between first and eighth scale with rest in straight line. Total vertebrae 39–41.

Color in alcohol
Body brown. Lateral body stripe gray and broad. Dark humeral spot vertically elongate centered on third to fifth scale row just dorsal to lateral line. Distal border of anal and dorsal fins dark. Pectoral and pelvic fins without pigment. Chromatophores on middle of caudal–fin more intense.

Color in life
Dorsal region dark greenish, lateral surface silvery, more so ventrally below greenish–yellow lateral. Pectoral and anal fins greenish–yellow, caudal–fins lobes red, dorsal, and pelvic fins dark greenish. Humeral spot obscure, dark and rounded. Middle caudal–fin rays with narrow dark pigmentation, a red spot on ventral portion of caudal–fin base.

Sexual dimorphism
The males of *Hemibrycon brevispini* n. sp. have very reduced hooks located at posterior end of anal, pelvic, pectoral, dorsal and caudal–fins rays. On the anal fin they are present from the fourth to last simple rays, with eight or nine hooks on each ray; pelvic, pectoral and dorsal fins have hooks on all rays, with eight to ten on each pelvic fin ray, five to six on each pectoral fin ray and six to seven on each dorsal fin tay. On the caudal–fin the hooks are on the posterior end of the dorsal lobe and the medial part has two to six hooks on each ray (fig. 3).

Distribution
La Venada Creek, Quindío–Santo Domingo River system, Upper Cauca, Colombia.

Habitat
The average dissolved oxygen (5–8 mg/l) and relative humidity (71–100%) values were high, conductivity was 301–367 us/cm, surface temperature 18.5–24.5°C, pH 5.8–8.0 (Romàn–Valencia et al., 2006b).

Etymology
The specific epithet refers to a combination of Latin *brevi* (meaning short or reduced) and *spini* (meaning hook), allusive to the presence of tiny hooks on all fins.

Comments
Principal components analysis (PCA) (fig. 4) indicates

Table 2. Eigenvalues of PCA (Principal Component Analysis) using 21 morphometric characters of *Hemibrycon brevispini* n. sp. and *H. cairoense* n. sp.

Tabla 2. Valores propios del ACP (Análisis de Componentes Principales) utilizando 21 caracteres morfométricos de Hemibrycon brevispini *sp. n. y* H. cairoense *sp. n.*

PC	Eigenvalue	% Variance
1	0.00598381	30.723
2	0.00518177	26.605
3	0.00241671	12.408

that *Hemibrycon brevispini* n. sp. is distinguished from *H. cairoense* n. sp., on axis 1 by pectoral fin length and axis 2 by postorbital distance and orbital diameter. Osteological characters and sexual dimorphism also distinguish *H. brevispini* n. sp. and *H. cairoense* n. sp. from all other species of *Hemibrycon*. Estimation of accumulated variability for these species is 30.72%, 57.32%, 69.72%, 78.78% (tables 2–3).

A phylogenetic analysis of *Hemibrycon* species supports the descripriptions of these new species from Colombia (Magdalena River) and others from Amazonian Ecuador using the autapomorphies and diagnostic characters presented here, but we also found that the traditional characters of number of teeth on the maxilla is not a useful taxonomic or systematic character for *Hemibrycon* (Arcila–Mesa et al., submitted).

Table 3. Eigenvector of PCA (Principal Component Analysis) using 21 morphometric characters of *Hemibrycon brevispini* n. sp. and *H. cairoense* n. sp.

Tabla 3. Vector propio del ACP (Análisis de Componentes Principales) utilizando 21 caracteres morfométricos de Hemibrycon brevispini *sp. n. y* H. cairoense *sp. n.*

	Eigenvector		
Morphometric characters	PC 1	PC 2	PC 3
Standard length (mm)	–0.001462	0.01447	–0.03861
Total length	–0.004459	0.01951	–0.0302
Body depth	–0.0475	–0.003583	–0.07415
Snout–dorsal fin origin distance	–0.03224	0.01458	–0.05311
Snout–pectoral fin insertion distance	–0.05229	0.007115	–0.08852
Snout–pelvic fin insertion distance	–0.01463	0.02564	–0.05965
Dorsal–fin origin–pectoral–fin distance	–0.01341	0.00117	–0.06103
Snout–anal fin origin distance	0.04412	0.08966	–0.1224
Dorsal fin origin–hypurals plate length	0.01936	0.07437	–0.03122
Dorsal fin origin–anal fin origin length	0.06355	–0.07647	–0.1309
Dorsal fin length	0.3032	–0.7861	0.07479
Pectoral fin length	–0.1119	0.3406	–0.2932
Pelvic fin length	0.09544	0.1323	–0.06522
Anal fin length	0.09982	0.05224	–0.09185
Caudal peduncle depth	0.09616	0.1073	0.06268
Caudal peduncle length	0.02126	–0.04836	–0.05775
Head length	0.02418	0.0358	–0.1157
Snout length	0.527	0.06912	–0.2288
Orbital diameter	0.1425	0.2503	0.6647
Postorbital distance	0.009588	–0.06223	–0.01235
Maxilla length	–0.5129	–0.2547	–0.3821
Interorbital distance	–0.5198	–0.1541	0.4166
Upper jaw length	–0.1486	0.2232	–0.04731

Fig. 5. *Hemibrycon cairoense* n. sp. Holotype IUQ 2009, Colombia, Risaralda, Quinchia, locality El Cairo, Upper Cauca River system, Los Ramirez Creek.

Fig. 5. Hemibrycon brevispini *sp. n. Holotipo IUQ 2009, Colombia, Risaralda, Quinchia, localidad de El Cairo, sistema fluvial del Alto Cauca, arroyo Los Ramírez.*

Hemibrycon cairoense n. sp. (table 1, figs. 5–6)

Holotype: IUQ 2009, Colombia, Risaralda, Quinchia, El Cairo locality, System Upper Cauca River, Ramirez Creek, afl. Italica Creek, Quinchia road to El Cairo 200 m. as next to the bridge (5º 21' 43" N, 75º 43' 43" W) 1,842 m a.s.l.

Paratypes: IUQ 534 (63) collected with holotype. IUQ 537 (2) (C. and S.), Colombia, Risaralda, El Cairo locality, Los Ramirez Creek, afl. La Italia Creek, road Quinchia to El Cairo, 200 m beside the bridge. IUQ 537 (2) (C. and S.), Los Ramirez Creek, afl. La Italia Creek, El Cairo locality, road Quinchia to El Cairo, 200 m beside the bridge.

Diagnosis

Hemibrycon cairoense n. sp. can be distinguished from congeners by having dorsal fin with nine proximal pteryigiophores (including the terminal piece) (*vs*. > 10) (fig. 5). It can be distinguished from *Hemibrycon* species from the Upper and Middle Cauca rivers by the number of pored lateral–line scales (43 a 46 *vs*. > 46 o < 43; $F = 13.67$; $p < 0.000$).

Description

Morphometric and meristic data in table 1. Body elongate, head robust, dorsal profile of head convex; area above orbits convex. Dorsal profile of body from supraoccipital to dorsal–fin origin, and from last dorsal–fin ray to caudal–fin base oblique. Ventral profile of body convex from snout to anal–fin base, convexity more pronounced beyond posterior portion of pectoral fins. Caudal peduncle laterally compressed in all specimens. Head and snout short; jaws equal, mouth terminal; lips soft and flexible, not covering external tooth row of premaxilla; ventral border of upper jaw slightly concave. Opening of posterior nostrils vertically ovoid, opening of anterior nostrils with posterior membranous flap.

Six infraorbitals present, all with laterosensory canal; third infraorbital long, wide, with ventral and posterior borders in contact with preopercle. Orbital margin cartilaginous. Supraorbital absent. Premaxilla with long lateral process that covers more than half of the nasal, and with two rows of teeth; outer row with 2 to 6 tricuspid teeth not arranged in straight line. Inner row with 3–5 cuspid teeth with central cusp longest. Maxilla long with posterior tip reaching anterior border of second infraorbital. Maxilla with 8 to 11 teeth, with 1 to 3 cusps, along anterior ventral margin. Dentary with 3 to 4 long teeth with 3 to 4 cusps followed by 7 to 10 teeth with 1 to 3 cusps.

Rhinosphenoid ossified separated posteriorly from orbitosphenoid by mesethmoid cartilage. Orbitosphenoid small and with apophysis. Postero–dorsal margin of parasphenoid concave. Postero–ventral margin of antorbital with two small apophyses that projected on to the first infraorbital. Eight supraneurals between head and anterior dorsal fin. Four branchiosegal rays. One to two epurals, 23–24 epipleural, 10–13/10–13 procurrent rays. Dorsal–fin margin oblique, second ray unbranched and first two branched rays longest.

Dorsal process of cleithrum reaching 1/2 length of supracleithrum. Cleithrum short. Pelvic–fin short, with tip of fin falling short of anal–fin origin. Pelvic bone elongate, straight and pointed with postero–lateral end with cartilage; ischiatic process short, curved, without foramen in upper part and with two apophyses, dorsal and ventral, with cartilaginous dorsal margin. Caudal–fin unscaled, bifurcated with short lobes with pointed tips. Caudal–fin rays 9–10/9–10.

Pored lateral–line scales 43–46, extending from supracleithrum to hypural joint. Lateral line pores forming slight curve in ventral direction between first and eight–ninth scale with rest in straight line.

Total vertebrae 39–40.

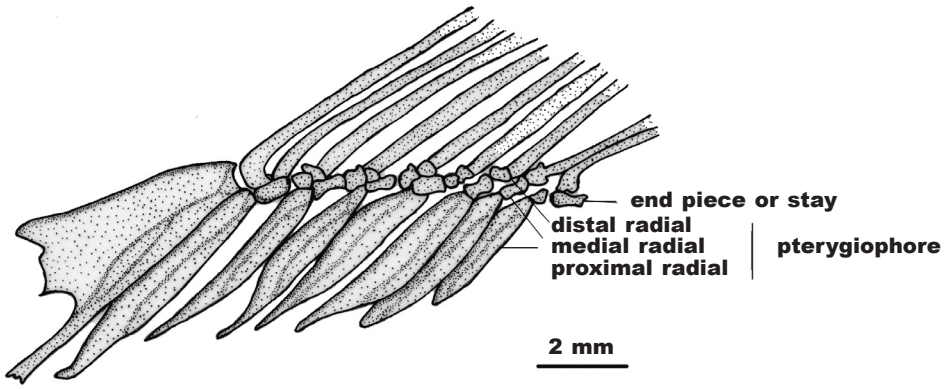

Fig. 6. Proximal dorsal fin pteryigiophores (included terminal piece) in *H. cairoense* n. sp.

Fig. 6. Pterigióforos proximales de la aleta dorsal (incluyendo el segmento terminal) de H. cairoense *sp. n.*

Color in alcohol
Body brown. Lateral body stripe gray and broad. Dark humeral spot vertically elongate centered on fourth to sixth of scale row just dorsal to lateral line. Distal borders of anal and dorsal fins dark. Pectoral and pelvic fins without pigment. Chromatophores on middle on caudal–fin more intense.

Color in life
Dorsal region greenish–brown, lateral surface silvery, more so ventrally. Pectoral, pelvic, anal and dorsal–fins light yellow, caudal lobes pink on base and yellow on posterior end. Humeral spot obscure, dark and rounded. Middle caudal–fin rays with narrow dark pigmentation, a red spot on ventral portion of caudal–fin base.

Sexual dimorphism
The males of *H. cairoense* n. sp. have small hooks, located on the anal, pelvic, pectoral and posterior portions of dorsal fin rays. On the anal fin they are present from the fourth or fifth ray until the last branched ray, with six to eight hooks on each ray; pelvic, dorsal and pectoral fins have hooks on all rays, with five to six on each pelvic–fin ray, six to seven on each pectoral–fin ray and four to five on each ray of dorsal fin.

Distribution
Los Ramirez and Italica Creeks in the Risaralda River system, Upper Cauca, Colombia.

Habitat
Surface temperature 18.3–20.3°C, air temperature 19.1–21.2°C, dissolved oxygen 7.6–9.7 mg/l and 104–127% saturation, pH 8, width 2–4 m, substrate stone and sand, water color brown.

Etymology
The specific epithet refers to locality El Cairo in the state of Risaralda, Colombia where the new species was collected.

Discussion

Problems with the diagnostic characters used to distinguish *Hemibrycon* species in the Magdalena River system were discussed by Dahl (1971). Ignorance of their autopomorphies has been a limiting factor to recognize the diversity of many characid species such as those in the genus *Hemibrycon*. The increase in number of described *Hemibrycon* species from Magdalena River system, most of which exist in allopatry (Román–Valencia & Arcila–Mesa, 2008; Román–Valencia et al., 2009; Arcila–Mesa et al., submitted) suggests an interesting model for diversification of this genus in the Andes. The morphological evolution of structures is determined by the variability caused by mutations, adaptation to living conditions and genetic changes (Ives et al., 2007) that generate phylogenetic divergence events or reflect direct effects of environmental factors between different species. In the case of *Hemibrycon* species from the Magdalena River system, Román–Valencia et al. (2009, in press) has determined that traditional morphometric characters are not very useful to distinguish *Hemibrycon* species.

There are two autopomorphies for *Hemibrycon brevispini* n. sp.: a distinctive modification of the fourth vertebra are of the Weberian apparatus and the arrangement of hooks on the fins, a sexual dimorphism seen in males (figs. 2–3). The presence of hooks on the rays of the male´s fins is a synapomorphy discussed by Malabarba & Weitzman (2003) for several genera of Characidae. The presence of hooks on the ray of all fins in males, except the caudal–fin, has been recorded for the following *Hemibrycon* species: *H. divisorensis* (Bertaco et al., 2007), *H. rafaelense* and *H. boquiae* (Roman–Valencia & Arcila–Mesa, 2008; Román–Valencia et al., 2009). However, the presence of hooks on rays of all fins including the caudal–fin was unknown (Arcila–Mesa et al., submitted). For *Hemibrycon cairoense* n. sp.

the number of proximal pteryigiophores of the dorsal fin (including the terminal piece) is an autapomorphy. The reduction in the number of pteryigiophores of dorsal fin is a novelty shared among *Hemibrycon* species (fig. 6) and several other species of characid fish such as: *Bryconamericus caucanus*, *Creagrutus brevipinnis*, *Microgenys minuta*, *Astyanax siapae* and *A. aurocaudatus*.

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