

A new species of *Hemibrycon* (Teleostei: Characiformes: Characidae) from the Roble River, Alto Cauca, Colombia, with a key to species known from the Magdalena – Cauca River Basin

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> Abstract

A new species, *Hemibrycon palomae*, is described from the La Paloma and La Siria Creek, río Roble drainage, of the upper Cauca River Basin, Colombia. It differs from congeners in meristic characters. It also has two reddish spots located on both the dorsal and ventral margins of the caudal peduncle (vs. only one reddish spot on the ventral margin of the caudal peduncle). Ecological habitat data and an updated key to all *Hemibrycon* species known from the Magdalena-Cauca River Basin are also presented.

> Resumen

Se investiga a *Hemibrycon palomae*, nueva especie, proveniente de las quebradas La Paloma y La Siria, afluentes del río Roble, cuenca del Alto Cauca, Colombia. Esta especie se distingue de sus congeneres en caracteres merísticos. También por presentar dos manchas rojizas tanto en el borde dorsal y ventral del pedunculo caudal (vs. sólo una mancha rojiza sobre el borde ventral del pedunculo caudal). Se reportan datos ecológicos del hábitat propio de la especie y también una clave práctica de todas las especies conocidas de la cuenca del Río Magdalena-Cauca.

> Kurzfassung

Hemibrycon palomae, new species, vom La Paloma und La Siria Creek, río Roble system, oberes río Cauca Becken, Kolumbien wurde untersucht. Die neue Art unterscheidet sich von den Verwandten in der Gattung *Hemibrycon* durch ihre meristischen Merkmale. Sie besitzt außerdem zwei rötliche Flecke am dorsalen und ventralen Ende des Schwanzstiels (vs. nur ein rötlicher Fleck am ventralen Ende des Schwanzstiels). Ökologische Daten und ein aktueller Bestimmungsschlüssel aller, aus dem Einzugsgebiet des Magdalena-Cauca bekannter *Hemibrycon*-Arten wird präsentiert.

> Key words

Fish, tropical, creek, freshwater, scales, teeth, new species, *Hemibrycon*.

Introduction

The character traditionally used to define *Hemibrycon* is: maxilla with teeth along the greater part of its length (GÜNTHER, 1864; EIGENMANN, 1927) but that trait is considered to be homoplastic and variable among species of *Hemibrycon* (ARCILA-MESA, 2008). Other genera

that have teeth along most of the maxillary border are *Henochilus* and *Hollandichthys* (EIGENMANN, 1927; CASTRO *et al.*, 2004). EIGENMANN (1927) recorded between three and eleven teeth in species of *Hemibrycon*; GÉRY (1962) stating that the number varied depends on

the age from five to fifteen. Even so, *Hemibrycon* has traditionally been distinguished from *Bryconamericus* by only this character (ROMÁN-VALENCIA, 2001) and recently this character was also used by MALABARBA & WEITZMAN (2003) to distinguish *Hemibrycon* from *Cyanocharax*. ARCILA-MESA (2008) found *Bryconamericus* to be the sister genus to *Hemibrycon* based on three synapomorphies: modifications of the jaws and suspensorium and the shape of the scales of the caudal fin. The genus *Hemibrycon* GÜNTHER has been shown to be monophyletic based on four synapomorphies: presence of ectopterygoids with widened ventral anterior projection, four to six times wider than posterior part; a red spot present in life on ventral margin of caudal peduncle; a postero-ventral projection on the pterotic and first infraorbitals gradually decreasing in width from posterior tip and located near posterior part of antorbital (ARCILA-MESA, 2008); its taxonomy is fairly well known (ROMÁN-VALENCIA *et al.*, 2006; 2007; 2009a; b; c; 2010a; b; ROMÁN-VALENCIA & RUIZ-C., 2007; BERTACO *et al.*, 2007; ROMÁN-VALENCIA & ARCILA-MESA, 2008; 2009; 2010; ZARSKÉ, 2008). *H. dentatus* from upper Cauca River and *H. decurrens* from the lower Magdalena River have been shown to be synonyms of *B. caucanus* (ROMÁN-VALENCIA *et al.*, 2009a).

The purpose of this paper is to describe a new species of *Hemibrycon* from Alto Cauca, Colombia, as a further contribution from the first author's ongoing revision of *Hemibrycon* species in South America, and is proof of the as yet undocumented biodiversity of the genus.

Materials and Methods

Measurements were taken with digital calipers, recorded to 0.1 mm precision and usually expressed as percentages of standard or head length (Table 1). 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 and in general were taken according to guidelines in VARI & SIEBERT (1990).

Observations of bones and cartilage were made on cleared and stained specimens (C&S) prepared according to techniques outlined in TAYLOR & VAN DYKE (1985) and SONG & PARENTI (1995). Bone nomenclature follows WEITZMAN (1962), VARI (1995), and RUIZ-C. & ROMÁN-VALENCIA (2006). Museum acronyms follow the ASIH list (<http://asih.org/curation>), except for the Laboratorio de Ictología de la Universidad del Quindío, Armenia, Colombia (IUQ). Specimens are deposited in The Auburn University Museum Fish Collection, Auburn, Alabama (AUM), and the Ichthyology Lab at the Universidad del Quindío, Armenia, Colombia (IUQ).

In the list of paratypes, the number of individuals is given immediately after the catalog number, which is followed by the range of Standard Length in mm for that lot; for example: IUQ 2300, 6, 46.36–65.43 mm SL indicates six individuals in lot IUQ 2300, with the smallest fish 46.36 mm SL and the largest 65.43 mm SL. All collections were made in Colombia, from the Alto Cauca-Roble River drainage, in La Paloma Creek. We do not translate locality information because key information from original labels is often lost by inaccurate translation.

The 21 morphometric characters analyzed in this study (Table 1) were evaluated by Principal Component Analysis (PCA) using the Burnaby method to eliminate the influence of size with the PAST program, version 1.81 for Windows (HAMMER *et al.*, 2008).

Material examined

See ROMÁN-VALENCIA, 2001; ROMÁN-VALENCIA *et al.*, 2006; 2007; 2009a; b; c; 2010a; b; ROMÁN-VALENCIA & RUIZ-C., 2007; ROMÁN-VALENCIA & ARCILA-MESA, 2008; 2009; 2010 for additional lists of comparative material examined of *Hemibrycon* species that we compared with this new species.

Results

Hemibrycon palomae new species

Figures 1 and 2; Table 1

Holotype. IUQ 2727, male, 65.9 mm SL, Colombia, Quindío, Quimbaya, Mountain El Ocaso natural reserve, Cauca-Magdalena River Basin, Roble River drainage, La Paloma Creek, 4°35'08"N, 75°51'06"W, 1103 m.a.s.l., 18 Aug. 2009.

Paratypes. (all from Colombia, Cauca-Magdalena River Basin, Quindío, Quimbaya, El Ocaso natural reserve, Cauca-Magdalena River Basin, Roble River drainage, La Paloma Creek): IUQ 2300, 6, 46.4–65.4 mm SL, 15 May 2008. IUQ 2301, 1, 77.2 mm SL 5 Jan. 1997. IUQ 2728, 7, 39.4–88.8 mm SL. 25 Jul. 2009. IUQ 2729, 19, 39.7–76.4 mm SL, 18 Aug. 2009. IUQ 2802, 23, 23.3–80.2 mm SL, Colombia, Quindío, Municipality of Circasia, La Siria village, 400 m from the road Circasia to Montenegro, Cauca-Magdalena River Basin, Roble River drainage, La Siria Creek, 4°35'19"N, 75°42'39"W, 1470 m.a.s.l., 23 Jan. 2010. IUQ 2846, 23, 39.9–76.5 mm SL, 25 Jul. 2009. AUM 50793, 3 collected with holotype.

Diagnosis. *Hemibrycon palomae* is distinguished from congeners in having a higher number of lateral-line



Fig. 1. *Hemibrycon palomae* sp. n., holotype: IUQ 2727, male, 65.9 mm SL, Colombia, Quindío, Quimbaya, Mountain El Ocaso natural reserve, Cauca–Magdalena River Basin, Roble River drainage, La Paloma Creek. Scale = 1 cm.

scales (44–51 vs. 34–44, except *H. colombianus* with 45–54 and *H. cairoense* with 43–46). It also has a higher number of scales: between the lateral line and the anal-fin origin (5–9 vs. 4–5, except *H. paez* with 6–7, *H. colombianus* with 7–9, *H. polyodon* with 6–7, *H. orcesi* with 4–7, *H. huambonicus* with 8–9 and *H. coxei* with 7); and also more scales between the lateral line and the insertion of the pelvic fin 5–6 vs. more than 6, except in *H. yacopiae* with 4–6, *H. polyodon* with 5–6, and *H. orcesi* with 4–6). *Hemibrycon palomae* also has fewer circumpeduncular scales 13–14 (vs. 18–20). It also differs in having a reddish spot present on both the dorsal and ventral margins of the caudal peduncle instead of just on the ventral margin as is the case for all other *Hemibrycon* species.

Description. Body slender and elongate (mean maximum body depth about 27.1 % SL). Area above orbits convex. 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 snout to base of anal-fin. Caudal peduncle laterally compressed. Head and snout short, mandibles equal, mouth terminal, lips soft and flexible, and not covering the outer row of premaxilla teeth; ventral border of the upper jaw straight; posterior edge of the maxilla reaching anterior edge of orbit.

Premaxilla with teeth in two rows. Four to six teeth of outer row tricuspid with central cusp larger. Internal row with four tricuspid teeth. Maxilla long, posterior margin straight, with eighth to ten teeth, each with one to three cusps. Dentary with three large tricuspid teeth with the central cusp largest, followed by eleven or twelve smaller teeth with one to three cusps.

Scales cycloid, small. Lateral line complete, perforated scales 44–51 (44* mean = 44.46, n = 34). Scale rows between dorsal-fin origin and lateral line 6–8

(6*, mean = 6.34, n = 34); scale rows between lateral line and anal-fin origin 5–9 (5* mean = 5.46, n = 34); scale rows between lateral line and pelvic-fin insertion 5–6, (5*, mean = 5.62, n = 34). Predorsal scales 12–15, arranged in regular series (13*, mean = 13, n = 34). Dorsal-fin rays ii–iii, 7–8 (n = 34); first unbranched ray approximately one-half length of second ray, its tip reaching first bifurcation of first branched ray. Dorsal-fin origin located near middle of body and posterior to vertical through pelvic-fin origin.

Anal-fin rays iii–v, 24–27 (iv, 26*; n = 34). Anal-fin origin posterior to vertical through base of first dorsal-fin ray. Pectoral-fin rays ii, 10 (n = 34). Pelvic-fin rays ii, 6 (ii, 6*, n = 34). Pelvic-fin origin anterior to vertical through dorsal-fin origin. Caudal fin not covered with scales, forked with short pointed lobes, principal caudal rays 1/17/1 (n = 34). Dorsal procurent rays 12 (n = 34). Ventral procurent rays 12 (n = 34). Adipose fin present. Total number of vertebra 40–41. Five infraorbitals present, the first thin and narrow, extending between the dorsal edge of maxilla and lateral ethmoid, with sensorial canal. Second infraorbital short and wide, covering the dorsal part of the angulo-articular, anterior part of second infraorbital overlaying anterior part of first infraorbital and with a foramen that extends towards the dorsal margin of the first infraorbital; its posterior margin extends below the third infraorbital. Third infraorbital the widest and longest, its ventral border in contact with the sensorial canal of preopercle. Fourth and fifth infraorbitals short and narrow, covering the posterior margin of the hyomandibular. Supraorbital absent. Seven supraneurals present between the head and the anterior part of the dorsal fin, without cartilage on the upper and lower edges, and with medial sensorial canal.

Secondary sexual dimorphism. Males have a row of very short hooks, on all branched and one

Tab. 1. Morphometric of *Hemibrycon palomae* sp. n. standard and total length in mm, mean in parentheses.

| | Holotype | Paratypes |
|---|----------|-------------------|
| Standard length (mm) | 65.8 | 39.3–88.8 (55.0) |
| Total length | 82.8 | 48.8–107.3 (67.7) |
| Percentages of SL: | | |
| 1. Body depth | 28.4 | 23.6–29.6 (27.0) |
| 2. Snout–dorsal fin origin distance | 52.8 | 49.2–53.8 (51.5) |
| 3. Snout–pectoral fin insertion distance | 23.0 | 21.3–24.9 (22.7) |
| 4. Snout–pelvic fin insertion distance | 43.8 | 40.5–47.0 (43.1) |
| 5. Dorsal–fin origin–pectoral–fin distance | 39.5 | 37.2–41.1 (39.1) |
| 6. Snout–anal fin origin distance | 57.0 | 53.6–58.8 (56.7) |
| 7. Dorsal fin origin–hypurals plate length | 50.9 | 48.6–54.1 (51.5) |
| 8. Dorsal fin origin–anal fin origin length | 29.8 | 25.4–31.0 (28.4) |
| 9. Dorsal fin length | 22.4 | 18.9–23.8 (21.8) |
| 10. Pectoral fin length | 21.1 | 17.7–21.6 (20.0) |
| 11. Pelvic fin length | 9.7 | 9.4–15.2 (12.7) |
| 12. Anal fin length | 14.4 | 13.3–17.8 (15.3) |
| 13. Caudal peduncle depth | 11.1 | 8.8–11.1 (10.2) |
| 14. Caudal peduncle length | 12.1 | 8.2–12.6 (10.8) |
| 15. Head length | 20.6 | 17.7–21.6 (20.0) |
| Percentages of HL: | | |
| 16. Snout length | 28.6 | 22.7–31.5 (25.8) |
| 17. Orbital diameter | 37.8 | 34.2–44.1 (39.8) |
| 18. Postorbital distance | 38.8 | 32.4–40.3 (36.0) |
| 19. Maxilla length | 35.3 | 30.1–38.4 (33.5) |
| 20. Interorbital distance | 40.1 | 33.1–42.5 (37.3) |
| 21. Upper jaw length | 31.9 | 26.2–34.1 (30.7) |

simple anal-fin ray, each ray has 3–11 hooks, located on the posterior-most branch. There are also 12–14 small hooks on the branched rays of the pelvic fin, located on both branches of the rays, extending onto the anterior-most part, also in the pectoral fin with 2 to 4 hooks on the distal end of the spokes. There are 4–10 hooks on the distal end of dorsal fin.

Life colors. Dorsum dark blue, sides of body silvery-yellow, ventrum silvery-white. Humeral spot dark and rounded. Purple opercular spot visible only in live fish. Dark stripe on caudal peduncle extends onto middle caudal-fin rays. Posterior portion of caudal peduncle with reddish blotch; dorsal margin of caudal peduncle with two reddish spots. Dark horizontal stripe on central caudal-fin rays bordered above and below by yellow stripes. Pectoral, pelvic and anal fins yellowish, dorsal fin dark red.

Distribution. This species is so far known from the Paloma and La Siria Creek, Roble River drainage in Quindío state, Alto Cauca, Magdalena River system in Colombia.

Habitat. *Hemibrycon palomae* sp.n. was collected along shore over sandy substrates in the mainstream of La Paloma Creek. The pH is around neutral (7.7), oxygen concentration was low from 4.8–5.3 mg/l, as was the percent oxygen saturation (60–65.9 %), temperature air 22.5–23.5 °C and surface water temperature was 21.2–21.4 °C, conductivity 118–128 µs/cm The new taxon is syntopic with other characid fish: *Astyanax fasciatus*, *A. aurocaudatus*, *Brycon henni* and *Bryconamericus caucanus*. Data from La Siria Creek are in ROMÁN-VALENCIA & RUIZ-C. (2005).

Discussion

Principal component analysis of all species produced no significant results, however, it did indicate that *H. palomae* can be distinguished from de *H. colombianus*, from Magdalena river, by eye diameter vs. maxilla length in the first component, by the length of the caudal peduncle vs. snout length in the second component and

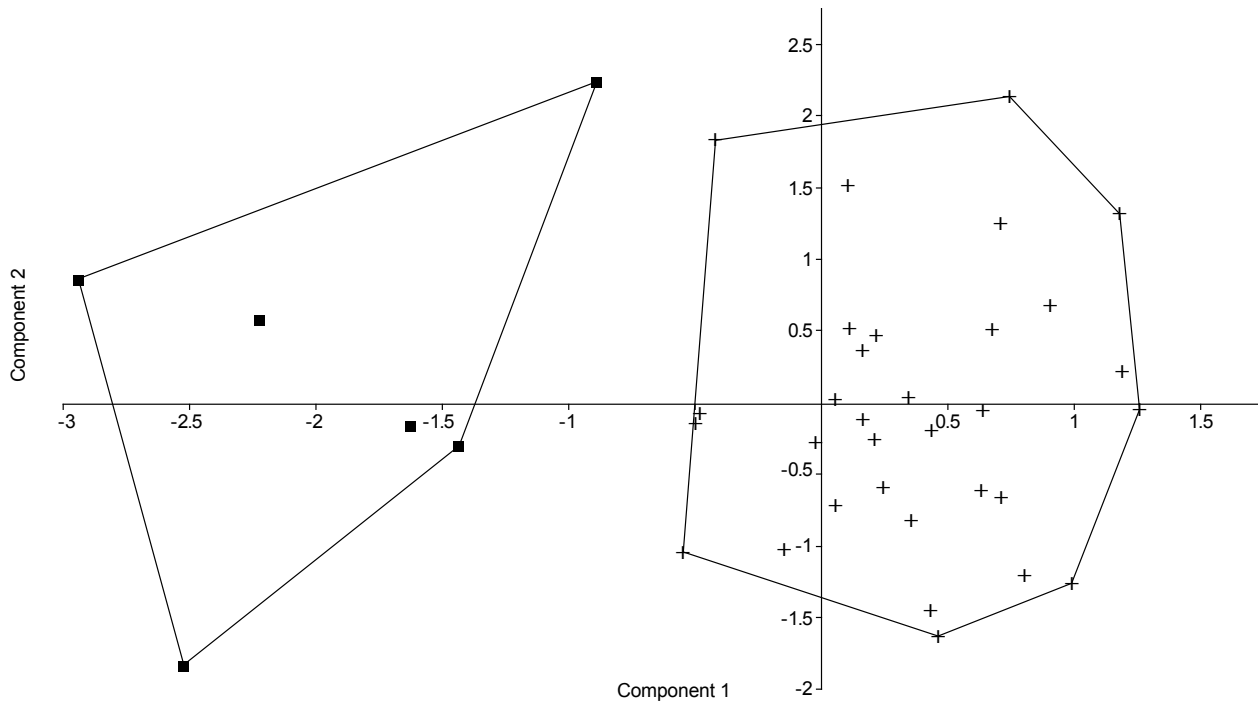


Fig. 2. Representation of the first two principal components (component 1 is the X axis, component 2 is the Y axis) from morphometric data of *Hemibrycon palomae* sp. n. (+) and *H. colombianus* (■).

by caudal peduncle depth vs. postorbital head length in the third component. The first component explained 32.41 % of the total variation, while the second component of the 18.17 % of the variation between the first and third component explains 60.56 %.

The genus *Hemibrycon* was found to be monophyletic based on osteological and other characters (ARCILA-MESA, 2008). *Hemibrycon palomae* sp. n. has all of the synapomorphies observed in other *Hemibrycon*.

A common requirement for the description of a new species is to compare the new taxon with all other known species in the genus. However, we do not share that idea, not because technically it has no truth, but when dealing with large genera such as *Bryconamericus*, *Creagrutus*, *Hyphessobrycon*, *Hemigrammus*, *Astyanax* or *Hemibrycon*, it is not feasible, nor in our opinion, necessary. In the modern sense of our thinking, we would not expect there to be any species in common between the Magdalena/Cauca Basin of northern Colombia and the drainages of southern Brazil or Argentina. Instead, we provide a practical key to the species present locally, as has been done for other genera of Characidae (VARI & HAROLD, 2001; (ROMÁN-VALENCIA *et al.*, 2008a; b; 2009b; c; 2010b; ROMÁN-VALENCIA & ARCILA-MESA, 2008).

Etymology. *Hemibrycon palomae* sp.n. is named after the La Paloma Creek, Rio Roble, La Vieja River Basin, Alto Cauca, Colombia, where the type series was collected.

Key to the species of *Hemibrycon* from the Cauca-Magdalena River system

- 1. Pored lateral-line scales 44–54 2
- 1.1. Fewer than 44 pored lateral-line scales 3
- 2. 5–6 scales between lateral line and pelvic fin insertion; dorsal-fin rays iii, 7; reddish spots present on both dorsal and ventral margins of caudal peduncle *H. palomae* sp. n.
- 2.1. 6–9 scales between lateral line and pelvic-fin insertion; dorsal fin rays ii, 8–9; reddish spot present only on ventral margin of caudal peduncle *H. colombianus*
- 3. Predorsal scales 10–12 *H. rafaelse*
- 3.1. Predorsal scales 12–16 4
- 4. Dentary with 6–9 large teeth on each side *H. boquiae*
- 4.1. Dentary with 3–4 large teeth on each side 5
- 5. Males with hooks on caudal-fin rays *H. brevispinni*
- 5.1. Males without hooks on caudal-fin rays 6
- 6. Males without hooks on rays of dorsal fin 7
- 6.1. Males with hooks on rays of dorsal fin 8
- 7. Scales between lateral line and pelvic-fin insertion 6–7; 20–23 branched anal-fin rays; pectoral fin length 17–22 % SL; humeral and peduncular spots horizontally elongate *H. virolinica*
- 7.1. Scales between lateral line and pelvic-fin insertion 7–8; 23–28 branched anal-fin rays;

- pectoral fin length 22–24 % SL; humeral and peduncular spots rounded *H. raqueliae*
8. Males with rounded cartilaginous protuberances on all branched anal-fin rays; 4–5 scales between lateral line and pelvic-fin insertion *H. quindos*
- 8.1. Breeding protuberances not present on anal-fin rays in males; more than 5 scales present between lateral line and pelvic-fin insertions 9
9. Dorsal fin with 3 simple rays; humeral spot elongate *H. yacopiae*
- 9.1. Dorsal fin with 2 simple rays; humeral spot rounded 10
10. Pored lateral-line scales 39–42; caudal peduncle spot rounded *H. paez*
- 10.1. Pored lateral-line scales 43–46; caudal peduncle spot horizontally elongate *H. cairoense*

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