A new species of *Tyttocharax* (Characiformes: Characidae: Stevardiinae) from the Güejar River, Orinoco River Basin, Colombia

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A new *Tyttocharax* species from the Güejar River system, near the Macarena Mountains in Colombia is described. This is the first record for the genus from the Orinoco basin. The combination of the following characters distinguish *Tyttocharax metae* from its congeners: presence of bony hooks on the pectoral and caudal-fin rays; bony hooks on the anal-fin rays larger than those on the pelvic-fin rays; pectoral-fin rays i,5-6,i; presence of three unbranched dorsal-fin rays; absence of an adipose fin; four scales rows between the anal-fin origin and the lateral line; and four scale rows between the pelvic-fin and the lateral line. Ecological characteristics of the habitat of the new species are also presented.

Una nueva especie de *Tyttocharax* se describe para la cuenca del río Güejar, Serranía de La Macarena en Colombia. *Tyttocharax metae* es un nuevo registro del género para la cuenca del río Orinoco. La combinación de los siguientes caracteres distingue a *Tyttocharax metae* de sus congéneres: presencia de ganchos óseos en los radios de las aletas pectorales y caudal; ganchos óseos en los radios de la aleta anal de mayor tamaño que los de las aletas pélvicas; radios de las aletas pectorales i,5-6,i; tres radios simples en la aleta dorsal; ausencia de una aleta adiposa; cuatro escamas entre la línea lateral y el origen de la aleta anal, y cuatro escamas entre la línea lateral y las aletas pélvicas. Se incluyen datos ecológicos del hábitat propio del nuevo taxón.

Key words: Geographic distribution, Neotropical fish, Osteology, Scales, Teeth.

Introduction

The subfamily Stevardiinae *sensu* Mirande (2010) comprises several characid genera previously listed as *incertae sedis* in Characidae by Lima *et al.* (2003), as well as all members of the inseminating characids of the subfamilies Stevardiinae and Glandulocaudinae *sensu* Weitzman *et al.* (2005). Among the inseminating stevardiines, *Argopleura, Iotabrycon, Scopaeocharax, Tyttocharax*, and *Xenurobrycon* have been proposed to belong to a single tribe by Weitzman & Fink (1985), the Xenurobryconini. Latter, the tribe was expanded to include *Chrysobrycon* and *Ptychocharax* (Weitzman & Menezes, 1998; Weitzman *et al.*, 1994).

Fishes of the xenurobryconin are sexually dimorphic in a variety of features (Weitzman & Ortega, 1995; Weitzman & Menezes, 1998). The great majority of inseminating fishes, including all known *Tyttocharax* species, exhibit sperm and testis modifications that appear to be adaptations related to this unusual reproductive habit (Burns & Weitzman, 2005; Pecio *et al.*, 2005).

Weitzman & Fink (1985) described five synapomorphies that diagnose *Tyttocharax*: (1) in sexually mature males bony hooks are confined to the posterior six to eight anal-fin rays. These hooks are relatively large and arranged in a vertically elongate cluster. (2) In sexually mature males the posterior three to five proximal anal-fin radials are expanded into flattened plates that serve as the origin for very robust anal-fin erector and depressor muscles. (3) Mature males and females have about 25 to 40 conical teeth, arranged in four to seven diagonal rows in each premaxilla. (4) Mature males and females have four to eight rows of dentary teeth, all but the innermost diagonal, with a total of 50 to 80 or more teeth on each mandible, and with many of the teeth projecting anteriorly or laterally. (5) The dorso-lateral lamellar process of the angulo-articular bone is absent. Currently, three valid species are recognized in *Tyttocharax*, all originally described from the Amazon River basin: *T. madeirae* Fowler, 1913, *T. cochui* (Ladiges, 1950), and *T. tambopatensis* Weitzman & Ortega, 1995.

In this paper we describe a new species of *Tyttocharax*, providing morphometrics, pigmentation, and osteological

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characters for both sexes, to distinguish it from all congeners. It is the first record of the genus from the Orinoco River basin, thus greatly expanding the known range to include the region around the La Macarena mountain range of the Guaviare River drainage in Colombia.

Material and Methods

Measurements were made with digital calipers to 0.1 mm precision, and expressed as percentages of standard length (SL) or head length (HL). Measurements and counts were taken on the left side, except when that side was damaged, and recorded following Fink & Weitzman (1974: 1-2) and Weitzman et al. (1994:48). Counts for the holotype are indicated with an asterisk (*). We performed 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. 2001). We used Principal Component Analysis (PCA) to examine variation in body shape.

Examined specimens are from Auburn University Natural History Museum, Auburn, U.S.A. (AUM); Instituto de Investigaciones de Recursos Biológicos “Alexander von Humboldt”, Villa de Leyva, Boyacá, Colombia (IAVH); Instituto de Ciencias Naturales, Museo de Historia Natural-Unidad de Ictiología, Universidad Nacional de Colombia, Bogotá, Colombia (ICNMHN); Laboratorio de Ictiología, Departamento de Biología, Universidad del Quindío, Armenia, Colombia (IUQ); Museo Javeriano de Historia Natural-Laboratorio de Ictiología, Departamento de Biología, Pontificia Universidad Javeriana, Bogotá, Colombia (MPUJ); and Museo de Historia Natural, Departamento de Ictiología, Universidad Nacional Mayor de San Marcos, Lima, Perú (MUSM).

_Tyttocharax metae_, new species

Figs. 1-6

**Holotype.** IUQ 2581, 15.3 mm SL, adult male, Colombia, Meta, Vista Hermosa near Palestina, río Orinoco basin, río Güejar system, arroyo Pringamosal, tributary of arroyo Blanco 500 m below Palestina School, 03°05'22"N 73°49'27"W, 240 m a.s.l., 9 Jan 2009, C. Román-Valencia, C. García-Alzate & R. Ruiz-C.


**Diagnosis.** _Tyttocharax metae_ can be distinguished from all congeners by having bony hooks on the pectoral and caudal-fin rays (vs. absent). Differs from _T. madeireae_ and _T. cochui_ by the absence of adipose fin (vs. adipose fin present), in having larger bony hooks on the anal fin than on the rays of the pelvic fins (vs. bony hooks of the same size on the rays of those fins). Differs from _T. cochui_ in having 1,5-6 pectoral-fin rays (vs. 1,7). _Tyttocharax metae_ can be distinguished from _T. tambopatensis_ by absence of a sexually dimorphic color pattern in life (vs. presence of sexually dimorphic color pattern, males have bright orange abdomens), by the number of scales rows between anal-fin origin and lateral line (4 vs. 6), by the number of scale rows between pelvic-fin and lateral line (4 vs. 6), by the number of branched pectoral-fin rays (5-6 vs. 7); by the number of unbranched dorsal-fin rays (iii vs. ii) and distance between the dorsal and anal-fin origins (22.3 to 32.2% SL vs. 38.0-41.0% SL).

**Description.** Morphometric and meristic data for holotype and paratypes in Table 1. Body deepest between verticals through pelvic-fin and dorsal-fin origins in females; deepest between verticals through posterior margin of dorsal-fin base and middle part of anal-fin base in males. Predorsal profile of body generally convex in both sexes. Body profile slightly elevated at dorsal-fin origin then slightly concave from dorsal-fin origin to posterior caudal-fin rays; slightly convex near tips of depressed dorsal-fin rays in males. Origin of dorsal fin nearer caudal-fin base than snout. Dorsal-fin origin at vertical through anal fin in females; anterior to vertical through anal-fin origin in males. Tips of pelvic-fin rays reach anal-fin origin in both sexes. Ventral profile of body convex from tip of lower jaw to pelvic-fin insertion. Ventral body profile convex along anal-fin base in males, concave in females. Ventral profile of caudal peduncle convex in females, concave in sexually dimorphic males (Figs. 1 and 2). Lower jaw prominent,
Morphometric data of holotype (male) and paratypes (A, adult males including the holotype and B, adult females and juveniles) of *Tyttocharax metae*. Values in parentheses = mean. SD = Standard deviation.

<table>
<thead>
<tr>
<th>Morphometric</th>
<th>Holotype</th>
<th>A n = 12</th>
<th>SD</th>
<th>B n = 16</th>
<th>SD</th>
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<tr>
<td>Standard length (mm)</td>
<td>15.3</td>
<td>12.6-15.8(13.9)</td>
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<td>Total length (mm)</td>
<td>19.7</td>
<td>16.8-20.7(18.0)</td>
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<td>16.2-20.2(18.1)</td>
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<td>Body depth</td>
<td>26.6</td>
<td>20.2-30.1(25.7)</td>
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<td>20.8-27.1(24.4)</td>
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<td>Snout-dorsal fin distance</td>
<td>64.0</td>
<td>58.7-67.0(62.3)</td>
<td>1.5</td>
<td>55.5-63.3(60.6)</td>
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<tr>
<td>Snout-pectoral fin distance</td>
<td>29.9</td>
<td>21.1-33.0(27.1)</td>
<td>2.4</td>
<td>23.2-29.9(26.7)</td>
<td>2.7</td>
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<td>Snout-pelvic fin distance</td>
<td>42.6</td>
<td>39.3-48.2(43.2)</td>
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<td>Dorsal-pectoral fin distance</td>
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<td>36.5-45.4(41.8)</td>
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<td>Snout-anal fin distance</td>
<td>66.6</td>
<td>57.9-66.7(63.3)</td>
<td>2.8</td>
<td>60.3-64.4(62.8)</td>
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<td>41.1-47.8(42.3)</td>
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<td>39.3-44.7(41.3)</td>
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<td>Dorsal-anal fin distance</td>
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<td>22.3-32.2(27.2)</td>
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<td>22.1-29.3(25.8)</td>
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<td>17.4-26.8(21.1)</td>
<td>1.8</td>
<td>15.8-24.3(19.7)</td>
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<td>Pectoral-fin length</td>
<td>23.0</td>
<td>16.0-25.3(20.1)</td>
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<td>Pelvic-fin length</td>
<td>23.1</td>
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<td>Anal-fin length</td>
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<td>12.2</td>
<td>11.3-15.5(12.7)</td>
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<td>7.1-12.1(10.1)</td>
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<td>7.5-12.7(9.9)</td>
<td>1.8</td>
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<td>Head length</td>
<td>29.3</td>
<td>22.5-29.4(26.3)</td>
<td>2.2</td>
<td>21.6-26.4(24.1)</td>
<td>2.6</td>
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<td>Percentages of head length</td>
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<td>Snout length</td>
<td>32.2</td>
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<td>22.7-35.6(29.7)</td>
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<td>Orbital diameter</td>
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<td>37.7-49.3(42.7)</td>
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<td>41.4-54.4(47.8)</td>
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<td>22.1-35.8(29.8)</td>
<td>4.0</td>
<td>31.1-39.9(35.5)</td>
<td>4.9</td>
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<td>Maxilla length</td>
<td>16.6</td>
<td>15.6-34.7(21.7)</td>
<td>4.6</td>
<td>15.6-28.2(21.8)</td>
<td>4.3</td>
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<tr>
<td>Interorbital distance</td>
<td>33.9</td>
<td>33.4-44.4(38.4)</td>
<td>4.6</td>
<td>35.7-47.1(42.5)</td>
<td>4.9</td>
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<tr>
<td>Upper jaw length</td>
<td>23.1</td>
<td>21.4-33.7(28.2)</td>
<td>3.0</td>
<td>26.0-32.8(29.6)</td>
<td>3.7</td>
</tr>
</tbody>
</table>
A new species of *Tytocharax* from the Güejar River

Nasal bone present. Basihyal cartilaginous not divided. Pharyngeal curved, an elongated plate, with thick cartilage at dorsal and ventral ends. Sixteen gill rakers on first branchial arch; 4-5 gill rakers on ceratobranchial and 11-12 gill rakers on epibranchial. Pectoral girdle with pointed dorsal process on cleithrum. Cleithrum elongated with straight posterior border; located under ventral edge of operculum. Anterior border of scapula straight. Postcleithrum 1 and 2 absent, postcleithrum 3 elongated and curved covering more than half of cleithrum. Proximal pterygiophore rays of dorsal fin inserted between neural spines 10 and 16; 17th proximal pterygiophore of anal fin inserted between hemal spines 11 and 12.

**Color in alcohol.** See Figs. 1 and 2 for pigment patterns in preserved males and females. Body light yellow, dark brown on dorsum with dark spot at base of caudal peduncle. Sides of body with dark stripe that starts posterior to operculum and extends to caudal spot and widens at level of vertical through posterior tip of ventral-fin rays. Posterior margins of scales located on upper sides anterior to dorsal fin dark. Pectoral, pelvic and anal fins hyaline. Dorsal area of head dark. Humeral spot visible.

**Color in life.** Dorsum of body, head and post ventral area greenish yellow, with an evident absence of dark pigment. Sides of body with blue stripe, caused by presence of iridophores that generate an iridescent bluish aspect known as Rayleigh scattering. The iridophores are limited on sides

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**Fig. 1.** *Tytocharax metae*, Colombia, Meta. **a)*** holotype, IUQ 2581, adult male, 15.3 mm SL; **b)*** paratype, IUQ 2343; adult female, 15.5 mm SL. Scale bar = 1 cm.

**Fig. 2.** *Tytocharax metae*, paratype, IUQ 2343, adult male, 18.4 mm SL. Caudal peduncle and fin, left lateral view.
to just dorsal margin of coelomic cavity. From there they extend posteriorly to the caudal peduncle. Lateral surface of coelomic cavity covered with leucophores that color this part of fish white. Bases of middle caudal-fin rays covered with narrow band of melanophores, more concentrated on dorsal lobe of caudal fin, and forming caudal spot. Posterior border of opercle covered by shiny blue iridophores. Humeral spot horizontally elongated and formed by disperse melanophores in area along dorsal margin of coelomic cavity, overlaing iridophores. Anal-fin rays with dispersed melanophores along their bases. All the fins hyaline. Color pattern identical in males and females.

Sexual dimorphism. Neither the principal component analysis among species of *Tyttocharax* nor regressions comparing males and females produced significant results. In males, teeth are found along entire length of anterior margin of maxilla, which is less sharply pointed on its ventral tip than in females. In both sexes maxillary teeth diminish gradually in size (Fig. 3). Posterior pterygiophores (last two or three including terminal piece) of anal fin in males of *Tyttocharax metae* are swollen, but in females are vestigial. Five or six penultimate anal-fin rays each have a pair of bony hooks (Fig. 3) present at distal extremity. Fin-ray segment dorsal to one with hook thickened in last rays with hooks (Fig. 4).

Pelvic fin of *T. metae* with i,3-6,i rays as in *T. tambopatensis*, but distribution of hooks is different: four hooks are present on simple ray and last branched ray, with one pair at terminus of each segment on their distal margins; five hooks are found on first and penultimate branched rays (Fig. 5). Three or four bony hooks are present on middle portion of caudal-fin rays. Principal caudal-fin ray count 10/7. Eleventh principal caudal-fin ray (as identified in females) is transformed in males into an accessory structure coupled to caudal scale (Fig. 6). Anterior anal-fin lobe larger in males (18.9% SL) than in females (15.1% SL).

Distribution. This species is known from the río Güejar system in Meta State, La Macarena Mountains, Orinoco basin, Colombia (Fig. 7).

Etymology. The specific epithet refers to the Meta State, in eastern Colombia, where the new species was collected.

Ecological notes. This new species was captured in streams characterized by relatively rapid water current, running

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Fig. 3. *Tyttocharax metae*, paratypes, IUQ 2493, 18.4 mm SL. Maxilla, premaxilla and dentary, left lateral view. a) female; b) male; scale bar = 1 mm.

Fig. 4. *Tyttocharax metae*, paratype, IUQ 2343, adult male, 18.4 mm SL. Posterior eight anal-fin rays and supporting pterygiophores left lateral view. Posterior ray split to its base with anterior half bearing bony hooks. Scale bar = 1 mm.
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over rocky and sandy bottoms at altitudes between 264-282 m a.s.l. Water depth was from 0.5 to 3 m and stream width between 1 to 4 m. Riparian vegetation was grass and trees. The transparency of the tea colored water was usually high, dissolved oxygen was also relatively high (5.7-7.1 mg/l), pH was usually around neutral (7.1-7.6). Fish species collected with *T. metae* are *Aphyocharax alburnus*, *Astyanax* sp., *Bujurquina* sp., *Bryconamericus cismontanus*, *Charax metae*, *Creagrutus calai*, *Farlowella vittata*, *Hemigrammus marginatus*, *Hoplias malabaricus*, *Hyphessobrycon metae*, *Moenkhausia lepidura* group, and *Pyrrhulina brevis*.

**Remarks.** The shape of the last anal-fin pterygiophore is reported to have an undulated margin in *T. madeirae* (Weitzman & Fink, 1985) and an obvious notch in *T. tambopatensis* (Weitzman & Ortega, 1995). In *T. metae* the margin of the last anal-fin pterygiophore is concave and half-moon shaped.

The distal extremity of principal caudal-fin ray 11 is leaf-shaped in *T. metae* with a straight but inclined dorsal margin and arched, protruding ventral margin vs. shaped as an elongate, thickened tubercle in *T. madeirae*. Three hooks on principal caudal-fin ray 7 and two on principal caudal-fin ray 8. The uroneural is subdivided in *T. metae* vs. uroneural continuous in *T. madeirae*.

Four of the five synapomorphies described for *Tyttocharax* (Weitzman & Fink, 1985) are present in *T. metae*, except for the smaller number of dentary teeth in *T. metae* (fewer than 50 teeth in each jaw, Fig. 3, instead of a total of 50 to 80 or more teeth on each mandible). It is possible that this difference results from the difference in size of the fishes studied by us and by Weitzman & Fink (1985).

**Comparative material.** *Tyttocharax madeirae*: all from Colombia, Amazonas, Amazon Basin: ICNMHN 6325, 33, 10.4-13.9 mm SL, km 95 Leticia-Tarapacá road, arroyo La Arenosa; ICNMHN 10329, 6, 14.9-16.6 mm SL, Leticia, tributary of Amazon River, km 6.5, Tarapacá road, arroyo Tacana; ICNMHN 10045, 2, 15.8-17.8 mm SL, Leticia, tributary of Amazon River, arroyo Tacana; IAvH 8301, 13, 12.9-17.7 mm SL, Leticia, Matamata Creek, 03°48’23’S 70°15’59”W; IAvH 8302, 4 (c&s), 16.3-20.3 mm SL, Leticia, tributary of Amazon River; IAvH 11171, 5, 13.0-18.4 mm SL, Leticia, arroyo Sufragio, El Zafire biological station; IAvH 11170, 23, 11.6-15.9 mm SL, Leticia, arroyo Sufragio at El Zafire biological station; IAvH 11168, 5, 16.0-20.2 mm SL, Leticia, arroyo Gravilla at El Zafire biological station; IAvH 11169, 8 (c&s), 15.9-18.5 mm SL, Leticia, arroyo Sufragio at El Zafire biological station. MPUJ 3461, 4, 16.6-20.0 mm SL, Leticia. *Tyttocharax tambopatensis*: MUSM 5087, 7 of 13 paratypes, 11.6-14.3 mm SL, Peru, Madre de Dios, Tambopata, Tambopata Reserve, río Tambopata, creek water stream at km 3, Tapir trail.

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Literature Cited


