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A new species of cave catfish, genus *Trichomycterus* (Siluriformes: Trichomycteridae), from the Magdalena River system, Cordillera Oriental, Colombia

Una nueva especie de bagre de caverna, género *Trichomycterus* (Siluriformes: Trichomycteridae), del sistema río Magdalena, cordillera Oriental, Colombia

César A. Castellanos-Morales

Abstract

A new species of troglomorphic catfish is described from de Gedania Cave, located in the middle Suárez River drainage, Magdalena River system, Colombia. The new species can be distinguished from its congeners by the combination of the following characters: reduction or loss of the cornea, reduction of eyes and skin pigmentation, very long nasal and maxillary barbels (maximum of 160% and 135% of HL, respectively), nine branched pectoral-fin rays, first unbranched ray of the pectoral fin prolonged as a long filament, reaching 80% of pectoral-fin length, anterior cranial fontanel connected with the posterior fontanel through an opening of variable length and width, first dorsal-fin pterygiophore inserted between neural spines of free vertebra 13-14 and free vertebrae 33-34. The presence of troglomorphisms such as regression of the eyes, reduction of skin pigmentation and long barbels suggest the troglobitic status of this species. A comparative analysis with other species of *Trichomycterus* from epigeal and hypogean environments is presented.

Keywords. Andean region. Subterranean habitat. Systematics. Taxonomy. Troglobite.

Resumen

Una nueva especie de bagre troglomorfo es descrito de la cueva de Gedania, cuenca media del río Suárez, sistema río Magdalena, Colombia. La nueva especie puede distinguirse de sus congéneres por la combinación de los caracteres de reducción o pérdida de la córnea, reducción de ojos y pigmentación de la piel, barbillas nasales y maxilares muy largas (máximo 160 % y 135 % de LC respectivamente), nueve radios ramificados de la aleta pectoral, primer radio simple de la aleta pectoral prolongado como un filamento largo, alcanzando 80 % de la longitud de la aleta pectoral, fontanela craneal anterior conectada con la fontanela posterior por una apertura de amplitud y longitud variable, primer pterigioforo de la aleta dorsal insertado entre la espina neural de la vértebra libre 13-14 y 33-34 vertebras libres. La presencia de características troglomorfas como la regresión de ojos y reducción de la pigmentación, así como barbillas largas sugieren el estatus troglobítico de la especie. Se presenta un análisis comparativo con otras especies de *Trichomycterus* de ambientes epigeos e hipogeos.

Palabras clave. Hábitat subterráneo. Región andina. Sistemática. Taxonomía. Troglobio.

Introduction

Trichomycteridae is a family of Neotropical freshwater catfishes widely distributed in Central and South America, on both sides of the Andes mountain range from sea level to 4500 m a.s.l (de Pinna & Wosiacki, 2003). Currently, the family represents one of the most species-rich groups of Siluriformes with at least 300 valid species and 41 valid genera (Eschmeyer *et al.*, 2017). Its monophyly is well corroborated and its most conspicuous synapomorphies are based on its highly specialized opercular-interopercular apparatus (de Pinna, 1998; Datovo & Bockmann, 2010). The genus *Trichomycterus* is the most diverse within the Trichomycteridae, containing over 170 valid species (Eschmeyer *et al.*, 2017). In Colombia, the genus is represented by 41 species, of which eight have been recently described: *Trichomycterus steindachneri* (DoNascimento *et al.*, 2014), *T. nietoi* (Ardila-Rodríguez, 2014), *T. tetuanensis* (García-Melo *et al.*, 2016) and *T. arhuaco*, *T. garciamarquezii*, *T. kankuamo*, *T. manauensis*, *T. montesi* (Ardila-Rodríguez, 2016). Trans-Andean drainages (Magdalena, Cauca, San Juan, and Sinú basins) have the largest number of species (Castellanos-Morales & Galvis, 2012).

Trichomycterid catfishes are among the most successful colonizers of subterranean habitats (Castellanos-Morales, 2008), with troglobitic and troglomorphic populations (Mattox *et al.*, 2008), including several troglobitic species in 4 genera, *Silvinichthys* (Argentina), *Glaphyropoma* (Brazil), *Ituglanis* (Brazil), and *Trichomycterus* (Bolivia, Brazil, Colombia and Venezuela) (Proudlove, 2010). Currently 14 hypogean species of *Trichomycterus* have been reported in South America; Colombia has the largest number with 6 species: *T. sandovali* Ardila-Rodríguez, 2006 (Don Juan cave), *T. santanderensis* Castellanos-Morales, 2007 (El Puente Cave), *T. sketi* Castellanos-Morales, 2010 (Del Indio Cave), and *T. uisae* Castellanos-Morales, 2008 (El Misterio Cave), and at least 2 additional undescribed species (Castellanos-Morales *et al.*, 2011, Castellanos-Morales & Galvis, 2012); Brazil has 3 species: *T. itacarambiensis* Trajano and de Pinna, 1996 (Olhos d'Água Cave),

T. dali Rizzato, Costa-Jr, Trajano and Bichuette, 2011 (Saracura y Buraco das Abelhas Caves), and *T. rubbioli* Bichuette y Rizzato, 2012 (Lapa dos Peixes Cave), and 2 undescribed forms (Bichuette & Rizzato, 2012); 2 species are known from Venezuela: *T. spelaeus* DoNascimento, Villarreal & Provenzano, 2001 (Punto Fijo Cave) and 1 undescribed species from El Guácharo Cave, a species previously considered to be a hypogean population of *T. conradi* (DoNascimento, 2005); finally 1 species is found in Bolivia: *Trichomycterus chaberti* Durand, 1968 (Umayalanta Cave). These species (except *T. sketi*) show troglomorphic characteristics (e.g. reduced eyes or not visible externally and, pigmentation reduction), indicating a troglobitic condition. This paper describes a new subterranean, troglomorphic *Trichomycterus* species from the middle Suárez River drainage, Magdalena Basin, La Paz municipality, southwestern Santander Department, in the Andean region of Colombia.

Materials and methods

Measurements were taken point-to-point with dial calipers from the left side of each specimen with the aid of a stereomicroscope. Methodology and terminology for measurements and counts follow de Pinna (1992), with the addition of length of first and second pectoral-fin rays, eye diameter and interopercular patch length. Measurements are presented in percentage of standard length (SL) and head length (HL). Osteological data and number of branchiostegal and procurent rays, vertebrae, ribs, fin rays, number and position of supporting elements of dorsal and anal fins, and other osteological features were obtained from two paratypes cleared and double-stained (C&S) for bone and cartilage following the method of Taylor & Van Dyke (1985). Osteological nomenclature follows Bockmann *et al.* (2004). Vertebral counts include only the free vertebrae (posterior to the Weberian complex), and the compound caudal centrum (PU1+U1) was counted as one element (Lundberg &

Baskin, 1969). The presence or absence of the cornea was determined by direct observation throughout light stereo microscope. Color was determined according to the Munsell soil color chart (M) (1994). Morphological data for other species are based on personal observations, literature and available images at the Image

Base website from the All Catfish Species Inventory (Morris *et al.*, 2006) and the Illustrated and online catalog of type specimens from the *Instituto de Investigación de Recursos Biológicos Alexander von Humboldt* (DoNascimento *et al.*, 2016). Institutional abbreviations follow Sabaj (2016).

Results

Trichomycterus donascimentoi, new species



Figure 1. *Trichomycterus donascimentoi*, CAC-CDMB 224, holotype, 78.0 mm SL, Colombia, Santander department, La Paz municipality, Gedania Cave, Suárez River basin, Magdalena River system. Lateral view of the right side. Scale bar = 1 cm.

Holotype. CAC-CDMB 224, 78.0 mm SL, Colombia, Departamento de Santander, Municipio La Paz, vereda Casas Blancas, cueva de Gedania, 6 km South of town (06°08'07.9" N 73°35'50.4" W, elevation 1871 m), near quebrada La Gran Curí, middle Suárez River drainage, Magdalena River

system, César A. Castellanos-M., Fabián Moreno-R & Liliana Toro-M, 15 Dec 2014.

Paratypes. Collected with the holotype. CAC-CDMB 225 (4, 55–76.5 mm SL), CAR 780 (2, 34.2 – 66.5), IAvH-P 16143 (2, 48.8–68.4 mm SL), ICN-

MHN 21744, (2, 46.4–79.9 mm SL), MLS 1578 (1, 66.4 mm SL) UIS-T-2294 (1, 59.1 mm SL).

Diagnosis. *Trichomycterus donascimientoi* is readily distinguished from hypogean congeners by the presence of 33–34 free vertebrae (vs. 35–36 in *T. itacarambiensis*, *T. sandovali* and *T. santanderensis*; 35 in *T. dali* and *sketi*; 31–32 in *T. rubbioli* and *T. uisae*). *Trichomycterus donascimientoi* can be distinguished from epigean and most hypogean species of the genus by the following combination of characters: reduced skin body pigmentation (except *T. gorgona* and hypogean congeners *T. chaberti*, *T. itacarambiensis*, *T. sandovali*, *T. santanderensis*, *T. spelaeus* and *T. uisae*); reduced eyes, (vs. eyes well developed in all epigean species, except *T. gorgona*, and the hypogean species, *T. chaberti*, *T. itacarambiensis*, *T. rubbioli*, *T. santanderensis*, *T. sketi* and *T. uisae*) reduction or loss of the cornea (vs. well-developed cornea in all epigean species); long nasal and maxillary barbels (reaching a maximum of 160% and 135% of HL, respectively), except for species with well-developed barbels mostly restricted to subterranean habitats: *T. dali*, *T. rubbioli*, *T. sandovali*, *T. santanderensis*, *T. spelaeus*, *T. sketi* and *T. uisae* and, epigean *T. longibarbus*. *Trichomycterus donascimientoi* is further distinguished from almost all congeners (except epigean *T. hualco* and *T. roigi* and the cave restricted *T. dali*, *T. rubbioli*, *T. sandovali* and *T. sketi*) by pectoral-fin ray count reaching 9 branched rays (vs. 6–8); and the first ray of the pectoral fin prolonged as a long filament, except all hypogean *Trichomycterus* (vs. first pectoral fin ray not prolonged or variably extended in all epigean species). *Trichomycterus donascimientoi* can be diagnosed from almost all congeners, excluding *T. sketi* and *T. uisae* by the caudal fin obliquely rounded, with upper portion of caudal fin slightly longer than lower portion (vs. rounded or truncate in the remaining trans-Andean species from Colombia); coloration from homogeneous light-red to pale rose, similar to that reported for troglomorphic species from Colombian cave environments (vs. variably pigmented in epigean trans- Andean species from Colombia and the hypogean *T. sketi* and *T. itacarambiensis*); anterior

cranial fontanel connected to the posterior fontanel by an opening of variable length and width except *T. uisae* (vs. fontanel separated by epiphyseal in almost all epigean species).

Trichomycterus donascimientoi can also be differentiated from the only other species described from the same geographic area (La Paz, Santander), *T. sketi*, by the origin of pelvic fin slightly posterior to vertical through the dorsal fin origin (vs. anterior to dorsal-fin origin). *T. donascimientoi* has its first dorsal-fin pterygiophore inserted between the neural spines of free vertebra 13–14, in *T. sketi* it is inserted in free vertebra 17–18, and first anal-fin pterygiophore is inserted between hemal spines of free vertebrae 18–19 (vs. free vertebra 20–21). Also, *Trichomycterus donascimientoi* differs from *T. sketi* by having 24–26 dorsal procurent caudal-fin rays (vs. 16–18), reduction or loss of the cornea (vs. cornea present) and well-developed troglomorphisms (vs. not developed).

According to Castellanos-Morales *et al.* (2011), the following species of *Trichomycterus* inhabit the Suárez River basin, in the department of Santander, Colombia: *T. bogotensis*, *T. latistriatus*, *T. sandovali* and *T. straminius*. *Trichomycterus donascimientoi* differs from *T. bogotensis*, *T. latistriatus* and *T. straminius* by well-developed troglomorphisms (vs. not developed) and nine pectoral-fin branched rays (vs. six to eight). Also, *T. straminius* has a rounded caudal-fin edge (vs. obliquely rounded in *T. donascimientoi*). *Trichomycterus bogotensis* and *T. latistriatus* differ from *T. donascimientoi* by the dorsal-fin origin anterior to origin of pelvic fin, (vs. at the same level or slightly anterior to the origin of the pelvic-fin). *Trichomycterus donascimientoi* differs from *T. sandovali* by the presence of eyes (vs. absence), 33–34 free vertebra (vs. 35–36) and dorsal-fin origin after the midpoint of the standard length (before the midpoint of the standard length).

Description. Morphometric data presented in Table 1. Body elongated, deeper than wide, gradually deeper from pectoral region to pelvic-fin

insertion; dorsal profile convex from nape to origin of dorsal fin; ventral profile slightly straight, dorsal and ventral profile of caudal peduncle slightly convex. Thick and pale integument. Head wide, depressed and triangular in dorsal view; dorsal profile of head straight, ventral and lateral profile convex; jaw muscles not particularly developed.

Eyes positioned dorsally on anterior half of head, variably reduced in size from well-developed to visible externally as small black spots and slightly covered by integument continuous with head skin. Reduction or loss of the cornea, from well-developed in young specimens to absent in large specimens (66 mm SL or more).

Table 1. Morphometric data for holotype (H) and 12 paratypes of *Trichomycterus donascimientoi*. Standard length (SL) expressed in mm. Measurements 2-10 expressed as percents of SL; Measurements 11 - 19 expressed as percent of head length (HL). M: mean; R: range.

Standard length	H	M	R
	78.0	-	34.2 - 80.0
Percentage of standard length			
Total length	116.7	117.8	115.8 - 121.0
Body depth	16.7	16.9	15.5 - 19.5
Predorsal length	56.9	56.9	54.7 - 59.7
Prepelvic length	55.4	57.4	55.9 - 60.5
Preanal length	69.0	70.5	67.6 - 73.5
Caudal peduncle length	22.0	22.2	20.7 - 23.9
Caudal peduncle depth	13.5	13.8	13.3 - 14.6
Dorsal-fin base length	10.6	10.7	9.8 - 12.1
Pelvic-fin base length	2.8	2.7	2.2 - 3.0
Head length	19.3	20.2	19.0 - 22.2
Percentage of head length			
Head width	105.5	100.9	93.0 - 108.2
Head depth	61.0	58.7	56.0 - 63.2
Mouth width	47.1	39.1	31.7 - 47.1
Eye diameter	1.9	6.7	1.9 - 11.7
Interorbital width	35.6	33.8	31.6 - 36.3
Nasal barbel length	105.5	124.3	104.6 - 160.2
Maxillary barbel length	102.7	107.7	88.5 - 134.9
Rictal barbel length	72.5	73.0	60.7 - 83.8
Interopercular patch length	15.3	17.0	14.6 - 19.4

Mouth subterminal, with corners oriented backwards. Lower lip with conspicuous fleshy lateral lobes. Anterior nostril ovoid and slightly smaller than posterior one, surrounded by slightly raised thick integument, continuous with nasal barbel. Posterior nostril rounded, oriented transversally, surrounded anteriorly by laterally-folded flap of integument. Teeth conical, slightly straight but curved at the tip, arranged in 3-4 irregular rows on upper jaw and three rows on lower jaw (Figure 2).

Nasal and maxillary barbels surpassing base of pectoral fin. Nasal barbel longer than maxillary barbel. Interopercular patch of odontodes well developed, with 25-29 conical and elongated odontodes, arranged in 4 irregular rows, with large interopercular odontodes on the posterior edge. Opercular patch of odontodes small, with 9-11 conical odontodes arranged in 3 irregular rows.

Neurocranium with elongate mesethmoid T-shaped. Anterior fontanel small, triangular in shape, located between frontals at level of infraorbital canal exit. Posterior fontanel long and connected with anterior fontanel through opening of variable length and width. Anterior one-third of posterior fontanel situated between frontal bones

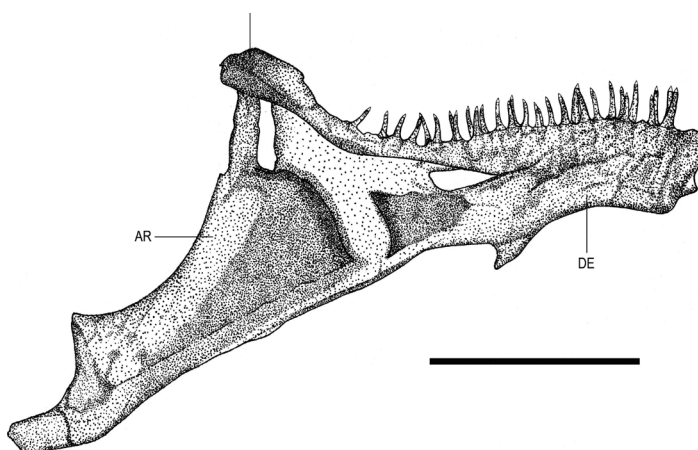


Figure 2. Left lower jaw in medial view of *Trichomycterus donascimientoi*, CAC-CDMB 225, 59.1 mm SL. Abbreviations: AR: anguloarticular ; CP, coronoid process; DE, dentary. Scale bar = 1 mm.

and, anterior portion of parieto-supraoccipital bone (Figure 3). Thickened branchial membranes, united to isthmus anteromedially and forming free fold across isthmus. Gill opening wide. Branchiostegal rays seven (Figure 4), ray 5 with enlarged distal tip, ray 6 surpasses posteriorly ray 5, with distal portion located under ray 5 and covered by interopercle, ray 7 with a medial portion of the ray located under rays 6 and 5, reaching ventral margin of opercular patch of

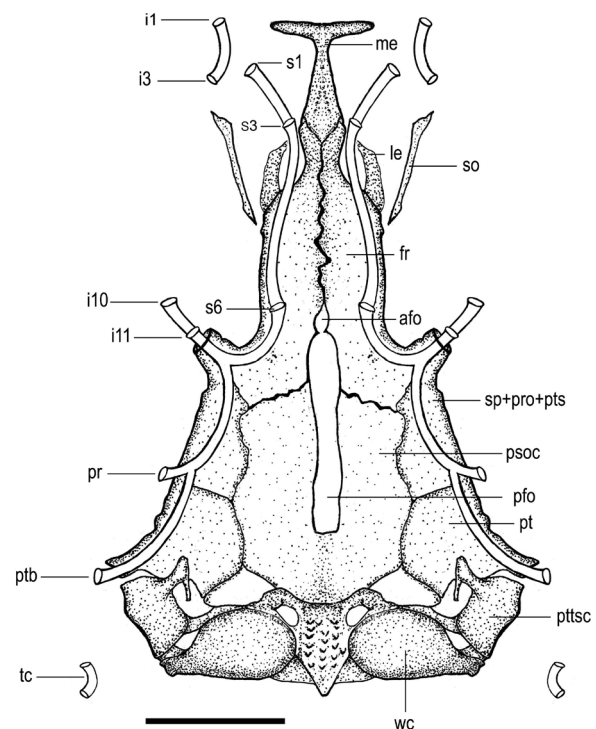


Figure 3. Dorsal view of the neurocranium of *Trichomycterus donascimientoi*. CAC-CDMB 225, 59.1 mm SL. afo, anterior fontanel; i1, infraorbital sensory pore 1; i3, infraorbital sensory pore 3; i10, infraorbital sensory pore 10; i11, infraorbital sensory pore 11; le, lateral ethmoid; me, mesethmoid; pfo, posterior fontanel; pr, preopercular sensory pore; psoc, parieto-supraoccipital; pt, pterotic; ptb, pterotic branch; pttsc, posttemporo-supracleithrum; s1, supraorbital sensory pore 1; s3, supraorbital sensory pore 3; s6, supraorbital sensory pore 6; so, supraorbital tendon bone; sp+pro+pts, sphenotic-prootic-pterosphenoid complex bone; tc, trunk canale; wc, weberian capsule. Scale bar = 2 mm.

odontodes. Urohyal with long, very narrow posterior process, broad convex posterior margin, lateral process with distal margins chipped, hypobranchial foramen slightly ovoid. Hypohyal with depression to which articulates anterior process of urohyal. Head sensory canals with simple tubes. Sensory pore s1 medially adjacent to anterior nostril. s3 medial to posterior nostril. s6 at level of posterior eye. Infraorbital sensory canal with 2 segments, anterior with 2 branches and pores (i1 and i3) and posterior segment with 2 branches and pores (i10 and i11). Preopercular canal short, pore above origin of opercular patch of odontodes. Postotic canal with pore above opercular patch of odontodes.

Pectoral-fin margin rounded with i,9 rays. First ray thin and fragile, prolonged as a long filament. Scapulocoracoid with long anteriorly directed process, located close to first pectoral-fin ray base. Dorsal fin rounded, located slightly anterior to pelvic-fin origin, with ii,6 rays. First dorsal-fin pterygiophore inserted between neural spines of free vertebra 13-14. Pelvic-fin rays i,4, with a lateral splint. Pelvic-fin origin slightly posterior to vertical through dorsal-fin origin and its edge surpasses

urogenital opening. Inner margins of pelvic-fin bases slightly separated. Basipterygium with two long anterior processes narrowing from base to distal tip, one or two medial processes and one short posterior process. Anal fin similar to dorsal fin, but smaller, with ii,6 rays, its origin at level of last dorsal-fin ray. First anal-fin pterygiophore inserted between hemal spines of vertebrae 18-19. Caudal-fin edge obliquely rounded. Principal caudal-fin rays 14. Caudal skeleton with neural spine of preural centrum 2 well developed. Hypurals 1 and 2 fused to parhypural, associated with two unbranched rays and seven branched rays; hypural 3 fused to hypural 4, articulating with three branched rays; hypural 5 narrowly separated from hypurals 3+4 for entire length, associated with one unbranched ray and one branched ray (Figure 5). Uroneural with slightly rounded distal tip, not fused to hypural 5. Neural spine 1 of preural centrum reduced to almost 25% of uroneural length, rounded tip projected upward. Dorsal procurent caudal-fin rays 24-26, and 14-16 ventral procurent rays. Free vertebrae 33-34. Ribs 11-12. Anal and urogenital openings closer to anal-fin origin than to pelvic-fin base, totally covered when pelvic fin extended.

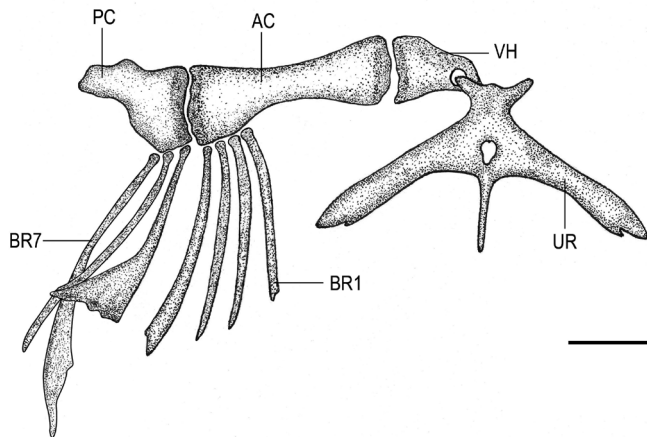


Figure 4. Left hyoid arch of *Trichomycterus donascimientoi* CAC-CDMB 225 59.1 mm SL. Ventral view. Abbreviations: AC, anterior ceratohyal; BR 1 to 7, branchiostegal rays; PC, posterior ceratohyal; UR, urohyal; VH, ventral hypohyal. Scale bar = 1 mm.

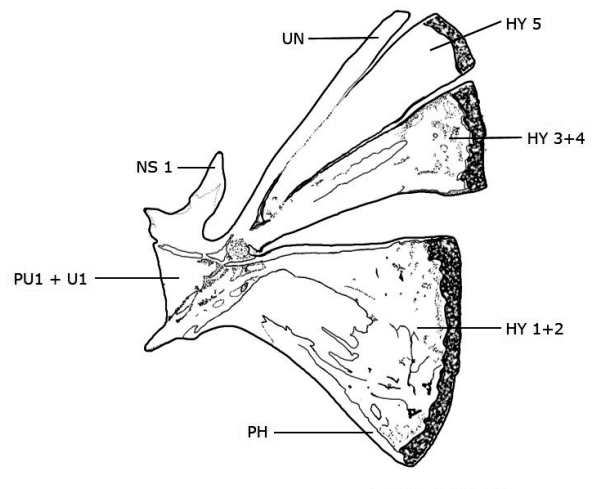


Figure 5. Caudal skeleton of *Trichomycterus donascimientoi*, CACCDMB 225, 57 mm SL. HY: hypurals 1-5; NS 1: neural spines of preural centrum; PH: parhypural; PU1+U1: complex preural centrum 1+ urocentrum 1; UN: uroneural. Scale bar = 1 mm.

Coloration in live specimens. Body color light-brown (M 10YR - 5/6). Base of all fins yellow (M 5YR - 6/8 to M 2.5Y - 7/6).

Coloration in alcohol. All specimens with ground color pale yellow (M 5Y - 8/4). Base of all fins yellow (M 2.5Y - 7/6).

Distribution. *Trichomycterus donascimientoi* is known exclusively from the hipogean environment of the de Gedania Cave, near to Gran Curí River,

in the Magdalena River system, Department of Santander, Colombia.

Ecological data. The de Gedania Cave (also known as del Puya Cave) is located at approximately 6.2 km South from the municipality of La Paz - Santander (Figure 6). This region is on the western flank of the Andean Cordillera Oriental, with lithostratigraphic sedimentary units from the Cretaceous period grouped in different geologic formations as Rosablanca, Paja, Tablazo, Simit,

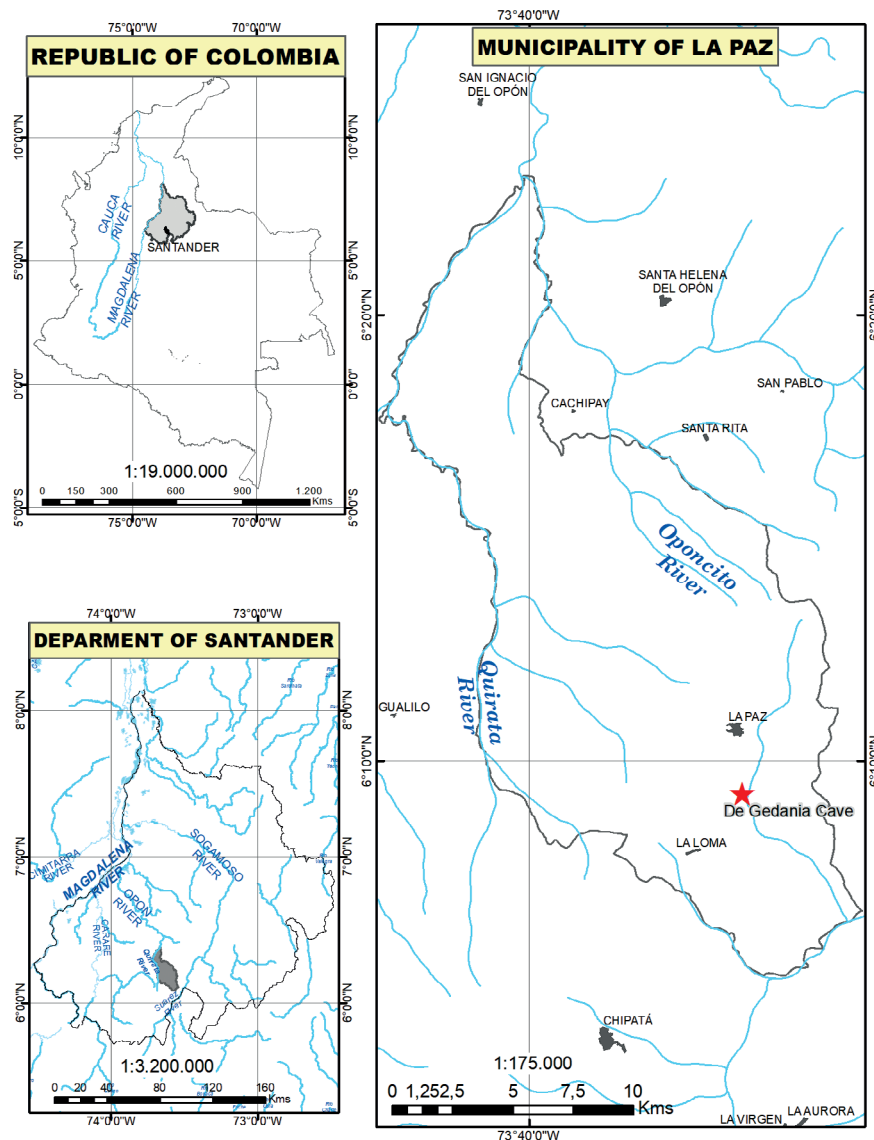


Figure 6. Map of La Paz, northeastern region of Colombia, showing the geographic position of the de Gedania Cave in the town of Casas Blancas. This is the type locality of *Trichomycterus donascimientoi*.

and Luna (Castellanos *et al.*, 2015). The entrance of the cave is oriented horizontally 60° NW, and has a small flow of water that in the period of low rainfalls remains completely dry (Figure 7). The de Gedania cave has three main sections: the first section, here named *Tunnel A*, has a length of 156 m. The height vary inside the tunnel from 0.8 m to up to 3.1 m high and 1.2 to 3.1 m wide. Small wells are interconnected by reduced descending channels along the tunnel. The bottom of each well is rocky and contains abundant fine sediment. The second section has a small gallery called *Gallery A* with an average height of 7 m and 8 m wide. The third section, called *Gallery B*, starts with a waterfall formed by the infiltration process with 50 m high, from which the last gallery, with about 90 m long and up to 20 m high is connected. Specimens of the new species were collected in the first and second sections of the cave, where the water temperature was 17.9°C, cave temperature 18.1°C, and water pH was 6.7. Neither stalagmites nor stalactites, or any kind of incrustation, was recorded inside the cave, (Comisión Polaca, 1977; pers. obs.). The population densities of *Trichomycterus donascimientoi* recorded in three different expeditions were extremely low. The cave is located in an area with livestock and

agricultural production such as sugar cane, cocoa, corn and coffee, which use agrochemicals to grow the crops. The deteriorating environmental conditions near the de Gedania Cave, water bodies inside the cave by infiltration process and the low population number of *T. donascimientoi* provide some criteria to consider this species at risk of extinction and a priority in conservation programs. Also, should the species should be included in the Red Data Book for Colombian freshwater fishes. The de Gedania Cave was first explored by the Polish Commission 1975, who named it in honor to the Polish city Gdansk (Comisión Polaca, 1977). Other species that inhabit the interior of the cave include bats (*Carollia perspicillata*), crabs (*Neostrengeria charalensis*), crickets (Phalangopsidae: Phalangopsinae) and aquatic insects (Gerridae, Hemiptera, Heteroptera, Veliidae and Opiliones (cf. Stygnidae) (pers. obs.)).

Etymology. The specific epithet is in honor of Carlos DoNascimento for his invaluable orientation in my research about the genus *Trichomycterus*. The name is used as an adjective genitive masculine singular.

Common name: Lauchas.

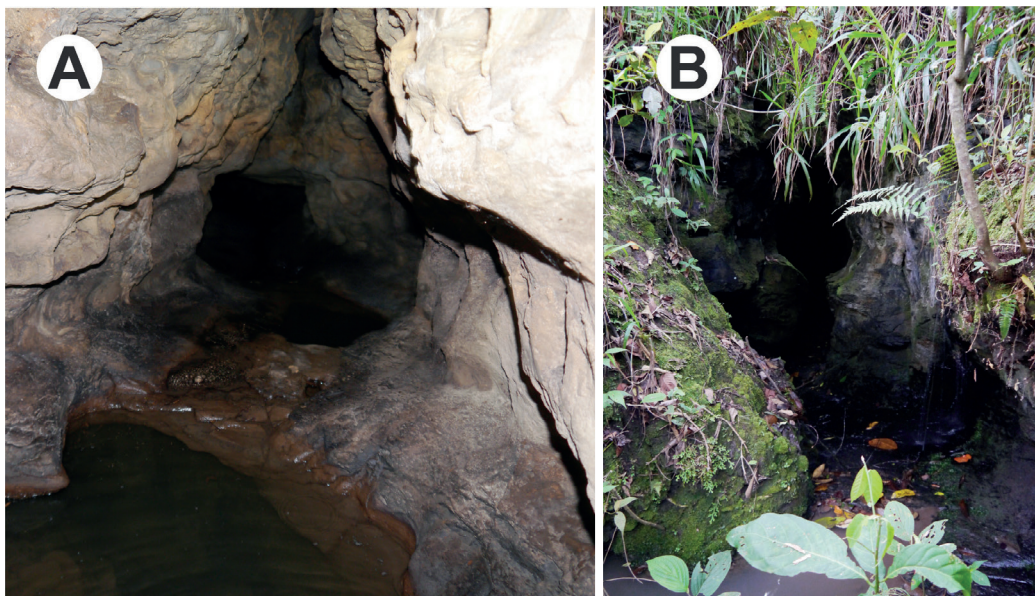


Figure 7. Type locality of *Trichomycterus donascimientoi*. A. inside the de Gedania Cave. B. outside of the de Gedania Cave, middle Suárez River basin, Santander, Colombia.

Discussion

Troglophic species are restricted to subterranean environments and exhibit, in variable degrees, the following characters: reduction of eyes, reduced skin pigmentation, and relatively long barbels (Romero & Paulson, 2001; Trajano, 2005; Bichuette & Trajano, 2008; Bichuette & Rizzato, 2012). These characters are very distinctive and well developed in *Trichomycterus donascimientoi*. Three species of *Trichomycterus* restricted to subterranean environments share the above mentioned features with *Trichomycterus donascimientoi*: *T. rubioli*, *T. santanderensis*, and *T. uisae*. Moreover, *T. dali*, *T. sandovali*, and *T. spelaeus* are species that share the last two characters cited above; however, these species differ from *T. donascimientoi* because they lack eyes.

Trichomycterus donascimientoi exhibits an additional feature that could be related to hypogean life: the extension of the first pectoral fin ray as a long filament which widely surpasses the edge of the pectoral fin (reaching 80% of pectoral-fin length). This condition is also present in all restricted cave fishes of *Trichomycterus*. In all species of the genus the extension of the filament can vary in length from 50% to 95% of the pectoral-fin length of *T. santanderensis* (Castellanos-Morales, 2007). A more comprehensive analysis focusing on this condition in both epigean and hypogean species of *Trichomycterus* should be developed in future studies.

Evolution of troglomorphic characters may be associated with selective pressures which may differ from cave to cave (Culver *et al.*, 1995). In addition to reduction or loss of some structures, many troglomorphic organisms exhibit enhancement of others, particularly those associated with chemical and mechanical sensory systems which are essential for foraging, mating, etc., in the absence of vision (Romero & Green, 2005). Some species from the genera *Trichomycterus* and *Ituglanis* are exclusively hypogean and have elongated barbels that are more developed than those observed in epigean congeners. The enlargement

of appendages bearing sensorial structures is broadly recognized as the most common trait characterizing troglobites (Hüppop, 2000; Trajano, 2001). According to Romero & Green (2005) the degree of development of some characters (e.g., barbel elongation in hypogean fishes from families in which barbels are a common characteristic) is conditioned by their phylogenetic history. The new species *Trichomycterus donascimientoi* has very long barbels, especially the nasal and maxillary barbels, which is a remarkable character that can distinguish the species from its epigean congeners and other troglomorphic cave catfishes such as *T. chaberti* and *T. itacarambiensis*, where nasal and maxillary barbel length is shorter than 80% and 90% of HL, respectively.

According to Bockmann & Sazima (2004) the number of pectoral-fin rays has been considered conservative within Trichomycteridae: Trichomycterinae. In this sense, García-Melo *et al.* (2016) showed that the pectoral-fin ray count is a character homoplastically distributed in trichomycterines, *Bullockia* and *Hatcheria* as well as many *Trichomycterus* species have similar number of branched pectoral-fin rays. For this reason, these authors do not discard the potential of this character as informative for several subgroups of Trichomycteridae, including the *Trichomycterus sensu stricto* clade. In *T. donascimientoi* count of pectoral-fin rays reaches i,9, which has been considered by Bichuette & Rizzato (2012) as a rare condition for the genus. Only three cave species (*T. sandovali*, *T. sketi* and *T. dali*) and one epigean species (*T. hualco*) share this condition with *T. donascimientoi*. Most *Trichomycterus* species have i,7 pectoral-fin rays, and less commonly i,6 to i,8 pectoral-fin rays.

The cornea is the anterior, transparent window in the collagenous scleral coat of the eyes that contributes to the structural support of the globe, protects the inner eyes from organismal invasion and unwanted environment changes, and helps control intra and extra ocular pressures (Collirt

& Collin, 2001). Although the cornea allows the formation of a sharp image of the external environment that is displayed on the retina, in an aquatic environment the contribution of the cornea to refraction is minimal and does not have an optical use (Land, 1991). In *Trichomycterus donascimientoi* it is observed that eyes have a variable reduction of the cornea from visible and well developed in young specimens to absent in large specimens. When the cornea is absent, eyes are completely sunken in and slightly covered by a continuous integument from head skin. Similar observations have been made in other cave catfishes such as *Rhamdia laticauda*. In adult specimens, the eyes of this species are not visible externally since epidermal parts of the cornea have separated and lost their tight contact. Due to this fact, the eyes are completely sunken beneath the body surface (Wilkens, 2001). Another similar report was made by Castellanos-Morales (2007), in which a cave fish from Colombia, *T. santanderensis*, was observed to have eyes reduced or imperceptible due to covering by thick integument. Reduction in eyes development is a further character associated with troglomorphic species that are restricted to subterranean environments. In this sense, genetic studies conducted by Jeffery (2009) suggest that eye loss is very likely to be adaptive to hypogean environments, due to the energetic cost of maintaining eyes in an environment where they lack utility.

Trichomycterus donascimientoi is an endemic species from La Paz, Santander, Colombia, the same area reported for *T. sketi*. According to Castellanos-Morales (2010), *Trichomycterus sketi* was described from a subterranean population with not well developed troglomorphic characters. For this reason, the author considered *T. sketi* as an hypogean but not troglobitic species. The colonization of the hypogean environments (de Gedania and del Indio Caves) in the karst area of La Paz, occurred independently for each of these species; the presence of well-developed troglomorphic characters in *T. donascimientoi* is an evidence of the early colonization of subterranean environment of the de Gedania Cave. (vs. late in del Indio Cave).

Comparative material. *Trichomycterus bogotensis*, MLS 25, 3, Colombia: Cundinamarca: Guasca. *Trichomycterus cachiraensis*, CAR 468, 1, Colombia: Norte de Santander. *Trichomycterus latistriatus*, MLS 850, 1, Colombia: Cundinamarca: Machetá. *Trichomycterus sandovali*, CAR 115 paratype, 1, Colombia: Santander. *Trichomycterus santanderensis*, CAC-CDMB 35, holotype, Colombia: upper Lebrija river basin: El Puente Cave. *Trichomycterus sketi*, CAC-CDMB 104, holotype, Colombia: Santander: upper Opón River basin: La Paz: vereda Casas Blancas: Cueva del Indio. *Trichomycterus straminus*, IAvH-P 440, 3, Colombia: Santander: Suárez River basin. *Trichomycterus striatus*, CAC-CDMB 111, 4, Colombia: Santander: Sogamoso River basin: río Chicamocha. *Trichomycterus uisae*, CAC-CDMB 072, holotype, Colombia: upper Sogamoso River basin: El Misterio Cave.

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