Dicrossus gladicauda sp. n. – a new species of crenicarine dwarf cichlids (Teleostei: Perciformes: Cichlidae) from Colombia, South-America

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> Abstract

Dicrossus gladicauda sp. n. is described from the drainage of the lower río Atababo in Colombia. It can be distinguished from all other *Dicrossus* species by the asymmetrical shape of the caudal fin of adult males which develop a long filamentous streamer by the extension of their caudal-fin rays D3 and D4.

> Resumen

Se describe una nueva especie de cíclido, *Dicrossus gladicauda*, de la cuenca del río Atababo en Colombia. La nueva especie se distingue de todas las demás especies del género *Dicrossus* por la forma asimétrica de la aleta caudal de los machos adultos con una extensión filamentosa de los raios D3 y D4.

> Resumo

Dicrossus gladicauda, espécie nova, é descrita da drenagem do rio Atababo em Colombia. *Dicrossus gladicauda* é distinta das demais espécies do gênero *Dicrossus* pela forma asimétrica da nadadeira caudal e pela presença de raios filamentos D3 e D4 na nadadeira caudal em machos adultos.

> Kurzfassung

Dicrossus gladicauda sp. n. wird aus dem Einzugsgebiet des unteren río Atabapo in Kolumbien beschrieben. Die neue Art unterscheidet sich von allen anderen *Dicrossus*-Arten durch die asymmetrische Schwanzflosse, deren obere Hälfte bei adulten Männchen in einer fadenförmigen Verlängerung der Flossenstrahlen D3 und D4 endet.

> Key words

Systematics, ichthyology, ecology, reproductive behaviour, Cichlidae, Crenicarini, new species, Colombia.

Introduction

The South American cichlid genus *Dicrossus* was first established as a monotypic genus for *Dicrossus maculatus* by Steindachner (1875). Later Regan (1905) regarded *Dicrossus* as a synonym of *Crenicara*, a view followed by other authors (Ahl, 1936, Ladiges, 1959, Kullander, 1978). In 1990 Kullander briefly discussed the taxonomic status of *Dicrossus*. He pointed out that *Dicrossus* and *Crenicara* are distinct enough to be treated as separate taxa and consequently revalidated it.

Kullander (1998) thought *Dicrossus* a genus of the tribus Crenicarini (also including *Biotoecus* Steindachner, *Crenicara* Steindachner and *Mazarunia* Kullander). But this group (including *Biotoecus*) was not verified as monophyletic in the cladistic analysis of geophagine Cichlids by López-Fernández *et al*. (2005). In both studies, however, *Dicrossus* and *Crenicara* are recognized as sister taxa sharing a serrated posterior margin of the preopercle. This is a conspicuous, relatively rare character state within South-American cichlids (Kullander, 1990).

At present the genus includes two valid species (Kullander, 1990; 2003), viz. *Dicrossus maculatus*

Fig. 1. *Dicrossus gladicauda* sp. n., holotype, ten weeks after fixation, MTD F 31312.

STEINDACHNER, 1875 and *Dicrossus filamentosus* (LADIGES, 1958), redescribed by KULLANDER in 1978. Both are dwarf cichlids (max. SL approx. 45 mm), which are distributed in the Amazon River basin (rio Negro, rio Tapajós, rio Maués) in Brazil and in the río Orinoco drainages in Venezuela and Colombia (KULLANDER, 1990, 2003). In addition at least three undescribed species have been known for some time (KULLANDER, 1990, STAWIKOWSKI & WERNER, 2004). The purpose of the present paper is to give a formal description of one of these species, which has been known for several years in the aquarium hobby and was provisionally referred to as *Dicrossus* sp. "Obenschwert" in the aquarium literature (BORK, 2002; STAWIKOWSKI & WERNER, 2004).

Materials and Methods

Some type specimens were fixed in ethanol, others in formalin and later transferred into 75 % ethanol. The holotype and paratypes are deposited in the fish collection of the Museum für Tierkunde Dresden (MTD F). Data from KULLANDER (1978, 1990), KULLANDER & STAECK (1990), STAWIKOWSKI & WERNER (2004) and STEINDACHNER (1875) were used for comparison.

The techniques for taking measurements and meristic data follow those described in KULLANDER (1986, 1990) and KULLANDER & NIJSSEN (1989). Measurements were made with an electronic digital caliper reading to the nearest 0.1 mm. Numbers in brackets after counts indicate the number of specimens examined with that condition. Terminology and methods of measurements of jaws and teeth follow CASCIOTTA & ARRATIA (1993). Scale rows are numbered as described in KULLANDER (1990). Principal caudal-fin rays are numbered from 1 to 8 in each lobe, beginning with the admedian one (KULLANDER, 1986).

Abbreviations: AL = ascending arm length of premaxilla; D1–8 = first to eighth principal caudal-fin ray of upper (dorsal) lobe; DL = dentigerous arm length of premaxilla; E1 = row of scales in the horizontal series directly above the longitudinal row including the lower lateral line; HL = head length; MTD F = Staatliche Naturhistorische Sammlungen Dresden, Museum für Tierkunde, Fischsammlung; SL = standard length; TL = total length; V1–8 = first to eighth principal caudal-fin ray of lower (ventral) lobe.

Dicrossus gladicauda sp. n.

(Figs. 1–4, Table 1)

Holotype. MTD F 31312, male, 38.6 mm SL, Caño Jigua (3° 47' N, 67° 38' W), western tributary to the lower río Atabapo south of San Fernando de Atabapo, *leg*. February 2006 by W. STAECK.

Paratypes. MTD F 31313–18, 4 males, 37.5–42.4 mm SL, 2 females, 30.7–37.1 mm SL, collecting data like holotype; one female, 32.4 mm SL, dissected, not catalogued.

Diagnosis. A small crenicarine cichlid with a marked secondary sexual dimorphism. It differs from all the other species in the genus by the conspicuously asymmetrical caudal fin characterized by the long filamentous streamer of its dorsal lobe in adult males. The new species is most similar to *Dicrossus filamentosus*, which differs in having a lyreate caudal fin (i. e. both the marginal rays of the dorsal and the ventral part of caudal fin are distally produced into a filamentous streamer).

Description. Based on all type-specimens. Osteological characters from one dissected paratype (female, 32.4 mm SL). See Figs. 1–3 for general appearance and colour pattern. Body elongate (depth up to 26% of SL in males, up to 29% in females), moderately

Tab 1. Morphometry of of *Dicrossus gladicauda*. Measurements of holotype and seven paratypes (MTD F 31312, MTD F 31313–18) in percent of SL (SL in mm); min = lowest value, max = highest value, mean = arithmetric mean.

	males (n=5)			females (n=3)		
	min	max	mean	min	max	mean
Standard length	37.5	42.4	39.7	30.7	37.1	33.4
Head length	29.1	29.9	29.43	29.9	32.3	31.27
Postorbital length	11.1	12.5	11.82	11.3	13.4	12.49
Snout length	5.9	6.5	6.17	6.2	6.7	6.40
Body depth	23.6	25.8	24.50	28.7	29.1	28.83
Eye diameter	10.6	11.7	11.08	11.7	13.0	12.47
Interorbital width	7.5	8.7	7.99	8.1	9.1	8.72
Preorbital depth	3.4	3.8	3.57	3.4	3.6	3.50
Caudal peduncle depth	11.4	12.5	12.13	12.6	12.9	12.77
Caudal peduncle length	14.5	15.4	14.96	14.0	15.4	14.57
Length of pectoral fin	19.8	23.3	20.88	20.5	22.8	21.79
Length of pelvic fin	25.9	34.5	28.29	22.4	24.4	23.63
Length of dorsal-fin base	53.3	55.7	54.08	52.8	53.1	53.00
Length of anal-fin base	16.9	20.8	18.51	17.6	18.9	18.12
Length of caudal fin	28.7	40.7	32.32	27.0	29.1	27.87
Predorsal length	32.6	33.1	32.90	32.9	38.4	36.02
Preventral length	34.5	35.7	35.17	35.8	36.2	36.04
Preanal length	63.4	66.3	64.68	66.6	68.7	67.79

compressed laterally. Predorsal- and preventral contour about equally arched. Abdominal contour in females slightly convex, in males more or less straight. Caudal peduncle longer than deep. Head elongate (HL 29–31% of SL), narrowing to snout tip. Snout round in dorsal and lateral view.

Mouth subterminal, rather narrow. Jaws equal, or upper jaw slightly prognathous (in males more conspicuous than in females). Posterior margin of ascending limb of preopercle (Fig. 4) serrated, with 13–29 denticuli (mean value 21.5). Supracleithrum with 2–4 (mode 3) irregularly arranged denticuli, posttemporal with 3-5 denticuli. Gill-cover margin round.

Lachrymal bone longer than deep (length/depth ≈ 2.3). Neurocranium flat, with foreshortened vomer (length/depth = 1.2, length/width = 1.6). Supraoccipital crest narrow, only slightly higher than interorbital region. Pharyngeal apophysis of parasphenoid narrow, not particularly developed.

Scales in E1 row 24 (1) or 25 (7). Lateral lines not overlapping. Upper lateral line with 13 to 17 scales, reaching to below last dorsal spine. Lower lateral line with 5 to 7 scales. Fins naked, except caudal fin which is scaled on about one fourth or one third of its principal length (measured without filamentous streamer). Dorsal fin origin above posterior edge of operculum or slightly behind. Anterior five (or six) spines of dorsal fin increasing rapidly in length (length of first spine about one fourth of the fifth spine), then slightly decreasing in length to about the 9th or 10th, from there about equal in size. Soft portion of dorsal fin pointed (not filamentous) in males, round in females. Caudal fin asymmetrical in adult males: Dorsal lobe of caudal fin distally with conspicuous filamentous streamer, medial part truncate or slightly concave, ventral lobe rounded. Caudal streamer of upper lope produced by elongation of rays D3 and D4; rays V3 to V8 form a roundish or subtruncate margin. In females and young specimens caudal fin round to slightly truncate. Each lobe of caudal fin with 8 principal rays. Anal fin pointed in males, rounded in females. Pelvic fins pointed, filamentous in males (reaching soft part of anal fin). Pectoral fin rounded, 10 (6) or 11 (2) rays, fifth ray usually longest. Dorsal fin rays XIV.8 (2) or XV.8 (6). Anal fin rays III.6 (1) or III.7 (7).

Teeth in three series in both jaws (outer series dominating inner ones), caniniform, straight or moderately recurved. Length of dentigerous arm of premaxilla shorter than length of ascending arm (AL/DL = 1.7); width of the ascending arm about 17% of its length. Angle formed by confluence of both arms about 83°. Ventral margin of dentigerous arm slightly concave. Anterior four or five teeth of outer row of premaxilla erected, conspicuously longer than posterior ones. Outer hemiseries of upper jaw with 20/23

Fig. 2. Live adult male of *Dicrossus gladicauda* sp. n., photographed in aquarium.

Fig. 3. Live topotypic adult female of *Dicrossus gladicauda* sp. n., photographed in aquarium.

(left/right) teeth along entire arm. Lower jaw long and comparatively low (anguloarticular depth about 52% of length). Coulter area wider than deep, without bony mandibular canal. Anterior teeth on dentary procumbent; outer hemiseries with 19/22 teeth along entire arm. Lower pharyngeal tooth plate triangular in dorsal aspect (width/length ≈ 1.2), with 12 teeth in posterior row and 14 in median row. Anterior teeth pointed, uniscuspid, rather scattered. Posterior inner teeth regularly arranged; a few of the innermost teeth laterally compressed and biscupid. First caretobranchial with 4 or 5 (n=4) external gill rakers.

Colouration in life. Body of males with yellowish ground colour, upper portion usually tan or greyish, ventral region white. Two longitudinal series of alternating squarish or rectangular black spots along middle of flanks (flank spots) and in dorsal region (dorsal spots). Six or seven flank spots of variable shape (longer than deep, shorter than deep or squarish) between operculum and caudal fin. Seven dorsal spots between nape and dorsal edge of caudal peduncle, last two very narrow. Frequently a few black scales irregularly spread over the ventral region. With broad preorbital stripe from orbit to snout tip; postorbital stripe

pale. No suborbital or superorbital stripe. Dorsal fin in males clear, with red spots in posterior and red streaks in anterior portion; with narrow red margin and blue submarginal band. Caudal fin in males bluish, in its central portion with tiny red spots arranged in about 7 wavy vertical cross-lines. Caudal streamer with narrow red margin and bright blue submarginal band. Anal fin bluish or violet with small red spots in posterior and red streaks in anterior part. Ventral fins with blue and red longitudinal markings. Pectoral fins colourless and hyaline. Colouration of females similar, but fins hyaline, without any red or blue markings.

Colouration in alcohol. Ground colour yellowish or whitish, duskier above upper lateral line. A series of six (two specimen) or seven dark, squarish or rectangular blotches along middle of flanks. First covering the anterior two or three scales of row 0 and adjacent parts of row E1 and row H1; second above belly; third (most prominent) above anterior part of anal fin; fourth above soft part of anal fin; fifth and sixth on caudal peduncle (less intense, without well defined edges, often ventrally extended on H2 scale row). Seventh blotch (if present) on posterior end of caudal peduncle and anterior part of caudal fin (intensely blackish, quadratic or ventrally slightly extended). Arrangement and position of the fourth to seventh blotch somewhat variable.

A second series of seven or (rarely) six dark squarish or rectangular blotches along back and on dorsal edge of caudal peduncle. Blotches on caudal peduncle not well defined, often fused with each other. Head whitish below eye, above dark grey. With prominent dark preorbital stripe; postorbital stripe short; no suborbital stripe. Dorsal fin of males with mottled pattern of irregularly arranged dark dots and short oblique streaks. In females dorsal fin with an indistinct dusky intramarginal band. Anal fin of males dusky or clear, posterior soft part with distinct dark spots. In females anterior and distal part of anal fin dusky. Caudal fin of males dusky (dorsal lobe darker than ventral lobe), with small dark spots arranged in six to eight cross lines (anterior series more distinct than distal ones). In females anterior central part dusky with a few spots (more prominent in dorsal lobe). Ventral fin of males dusky, without or only tiny blackish spots at fin base. Females with a distinct black spot at fin base, extending along anterior margin. Pectoral fins hyaline in both sexes.

Discussion

The new species shares all the diagnostic characters of *Dicrossus* described by Steindachner (1875) and Kullander (1990), viz. small size, elongate shape, laterally only moderately compressed body, serrated preoperculum, supracleithrum and posttemporal, elongated anguloarticular without bony enclosed mandibular sensory canal, two series of dark blotches arranged in the pattern of a checkerboard on the body sides and lack of both suborbital stripe and prominent dark lateral stripe in preserved specimens.

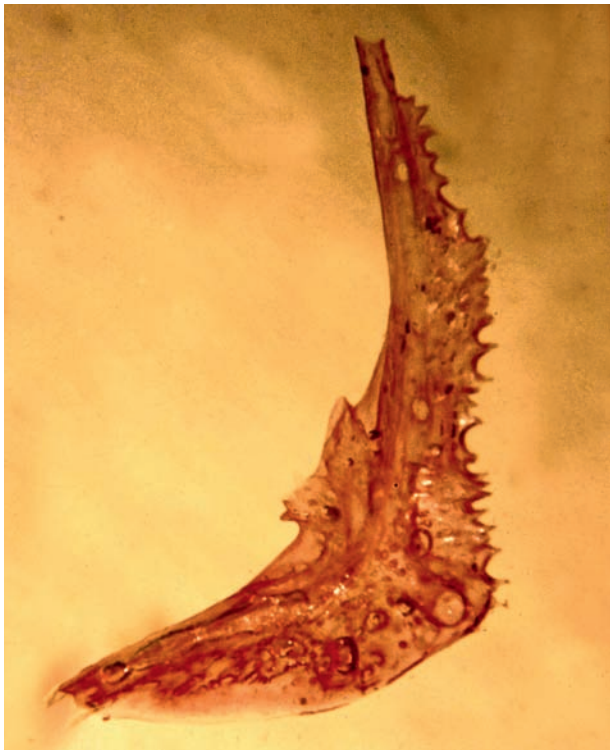

Fig. 4. Preopercle bone of *Dicrossus gladicauda* (serrated posterior edge on the right).

Dicrossus gladicauda is most closely related to *Dicrossus filamentosus*. Both species are very similar and cannot be separated by proportional or meristic characters, but differ significantly in the shape and colour pattern of the caudal fin of adult males. In *Dicrossus filamentosus* the caudal fin of males is lyreate and distally produced into two filamentous streamers, while in adult males of *Dicrossus gladicauda* the fin is asymmetrical, for only its upper lobe has a filamentous prolongation while the lower lobe is rounded. The reduction of the length of V3 and V4 in the ventral part of the caudal fin in *Dicrossus gladicauda* correlates with the lack of the dark margin and the submarginal bluish stripe of the caudal streamers characteristic of the male *Dicrossus filamentosus*.

Dicrossus gladicauda is distinguished from *Dicrossus maculatus* by the shape of the caudal fin in adult males (upper lobe with streamer versus lanceolate) and the shape of the dark blotches on the body sides (squarish or rectangular versus more rounded; cf. Staeck & Linke, 2006; Stawikowski & Werner, 2004).

Fig. 5. Type locality of *Dicrossus gladicauda* sp. n. at the Caño Jigua, a western tributary to the lower Río Atabapo.

Dicrossus gladicauda differs from the undescribed *Dicrossus* sp. "Rio Negro" (*Dicrossus* sp. A in KULLANDER, 1990) and *Dicrossus* sp. "Rio Tapajos" (*Dicrossus* sp. B in KULLANDER, 1990) by the shape of the caudal fin in adult males (asymmetrical, upper lobe with streamer versus oval) and the pattern of dark markings on the body sides (squarish or rectangular blotches versus two series of several small double spots in *Dicrossus* sp. "Rio Negro" and two series of several short lines in *Dicrossus* sp. "Rio Tapajos"; cf. STAECK & LINKE, 2006; STAWIKOWSKI & WERNER, 2004).

An asymmetrical caudal fin with a rounded lower lobe and a prolongation of the upper lobe ending in a filamentous streamer is a unique feature among South American cichlids. In spite of the overall similarity between *Dicrossus gladicauda* and *Dicrossus filamentosus,* we describe the new form as a separate species and refrain from using a subspecific category for we agree with KULLANDER (1999, 2004) that every single diagnosable form deserves its own specific treatment

Geographical distribution. At present *Dicrossus gladicauda* is known only from the type locality in the drainage of the lower río Atabapo in Colombia. The species, however, is said to be exported for the aquarium hobby from the río Reita in the vicinity of the village Cumaribo in Colombia (BORK, 2002). This small river is a tributary to the río Tomo, a western tributary to the río Orinoco.

Ecological notes. The type locality of *Dicrossus gladicauda* is a typical blackwater habitat with clear, acid and very soft tea-coloured water (pH 4.4; electrical conductivity 10 μS/cm; total and temporary hardness < 1 °dH; water temperature 24.4 °Celsius). The fish were collected along the banks of the small rivulet in zones of extremely shallow water, i.e. in a water depth between approx. 10 and 50 cm, where they were found either in a layer of dead leaves covering the bottom of the bank side or among the submerged terrestrial vegetation.
Field observations under water indicated that in this microhabitat the associated fish fauna includes several small characid species, e. g. *Hemigrammus bleheri, Hyphessobrycon stictus, Nannostomus eques, Paracheirodon axelrodi, Copella meinkeni* and the dwarf cichlid *Apistogramma uaupesi*. In the adjacent deeper water the cichlids *Mesonauta insignis* and *Biotodoma wavrini* were observed.

Reproductive behaviour. Observations under aquarium conditions revealed *Dicrossus gladicauda* to be a polygynous substrate spawner and that the male defends a territory containing several potential spawning sites. Each of them may serve as the focus of a smaller territory occupied by a female. Like most other open brooders these dwarf cichlids place their eggs on a horizontal surface. The preferred spawning site is a stout plant leaf or drift wood.
At 27 °C hatching occurs about three days postspawning, and the fry attempt swimming six days thereafter. After spawning the female drives the male energetically from the close proximity of the spawning site. Parental care is exclusively maternal in this species, although the male may indirectly assist by defending the territory against predators.

Etymology. The specific epithet is a noun in apposition derived from the Latin *gladius* (= sword) and *cauda* (= tail). It is an allusion to the sword-like streamer of the dorsal lobe of the caudal fin in adult males.

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