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Characidium xanthopterum (Ostariophysi: Characiformes: Crenuchidae): a new species from the Central Brazilian Plateau

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Characidium xanthopterum is described from tributaries of the upper rio Paraná and upper rio Tocantins basins, in the Central Brazilian Plateau, Goiás State, Brazil. The new species is diagnosed among congeners by the absence of dark bars on the sides of the body in adult specimens, and by the deep yellow coloration in all fins. Ontogenetic change of color pattern is recorded for the first time for *Characidium* species. Specimens smaller than 32 mm SL possess dark bars on body. These bars disappear with growth between 32 and 35 mm SL, and are always absent in individuals larger than 35 mm SL.

Characidium xanthopterum é descrita de tributários das bacias do alto Paraná e do alto Tocantins, no Planalto Central do Brasil, Estado de Goiás, Brasil. Entre as congêneres, a nova espécie é diagnosticada pela ausência de barras escuras nas porções laterais do corpo em exemplares adultos, e pela presença de todas as nadadeiras fortemente amareladas, sem marcas ou manchas. Exemplares menores de 32 mm CP apresentam barras escuras no corpo. Estas barras desaparecem com o crescimento entre 32 e 35 mm CP, e estão sempre ausentes em indivíduos maiores do que 35 mm CP.

Key words: Characidiinae, South American darters, Upper rio Paraná, Upper rio Tocantins, Taxonomy, Sexual fin-hooks.

Introduction

The genus *Characidium* Reinhardt contains 51 valid species of small (smaller than 10 cm SL) fishes distributed in most freshwater drainages from eastern Panama to Argentina (Buckup, 2003). The alpha-taxonomy of the genus is still poorly known, and several species have been described in the last few years (e.g., Buckup & Reis, 1997; Buckup & Hahn, 2000; Zarske & Géry, 2001; Melo & Buckup, 2002; Taphorn *et al*., 2006; Graça *et al*., in press). Buckup (1993b) provisionally diagnosed *Characidium* (in a phylogenetic sense) by the presence of a black spot near the base of the middle caudal-fin rays.

Melo & Buckup (2002) described *Characidium stigmosum* from the rio Paranã drainage (rio Tocantins basin), remarking that it was the first species of *Characidium* described from northern areas of the Brazilian State of Goiás, which is located in the Central Brazilian Plateau, an area drained by headwater tributaries of three major South American river basins (Paraná, São Francisco, and Tocantins). An additional species of *Characidium* from the Central Brazilian Plateau is described herein. It has been collected in tributaries of the upper Paraná and upper Tocantins river basins in the Brazilian State of Goiás. Currently, only four species of *Characidium* have been formally referred to the upper rio Paraná drainage outside of the Central Brazilian Plateau, *Characidium fasciatum* Reinhardt, *C. gomesi* Travassos, *C. oiticicai* Travassos, and *C. schubarti* Travassos (Buckup, 2007). Except for *C. stigmosum*, no other species of *Characidium* has been formally described from the Tocantins drainage.

Materials and Methods

All measurements were taken with a digital caliper to the nearest 0.01 mm under a stereomicroscope. Definitions of measurements, counts and the descriptive protocol follow Buckup (1993a). Measurements and counts of bilateral structures were obtained on the left side of the specimens. Counts in the text are followed by their frequency in parentheses, and an asterisk indicates values for the holotype. The sex of some

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specimens was confirmed by dissection. Specimens were cleared and stained according to procedures of Taylor & Van Dyke (1985). Skeletal and tooth counts were taken from cleared and stained (cs) specimens only. Counts or osteological characters from cleared and stained specimens refer to left/right side, respectively. Morphometric data are presented only for specimens larger than 25 mm standard length (SL). The dissection protocol follows Weitzman (1974), except for the ceratohyals, hypohyals and associated branchiostegal rays, which were left attached to the branchial apparatus. Institutional abbreviations are listed in Leviton *et al*. (1985), with the exception of DZSJRP (Coleção de Peixes do Departamento de Zoologia e Botânica de São José do Rio Preto), and NUP (Coleção Ictiológica do Núcleo de Pesquisas em Limnologia, Ictiologia e Aqüicultura, Universidade Estadual de Maringá). The abbreviation "mun." stands for the Brazilian Portuguese word município (municipality).

***Characidium xanthopterum*, new species**

Figs. 1-3

Characidium sp. Pavanelli *et al*., 2007:60 [Brazil, Goiás, rio Corumbá basin; check list].

Holotype. DZSJRP 10474, 47.3 mm SL, Brazil, Goiás, Mun. Caldas Novas, riacho outside of Parque Estadual de Caldas Novas, 17°46'9"S 48°39'19"W, 8 Jun 2007, team from Laboratório de Ictiologia, Departamento de Zoologia e Botânica, IBILCE/UNESP.

Paratypes. All from Brazil, Goiás. Upper rio Paraná basin, rio Paranaíba drainage: Mun. Bela Vista de Goiás: DZSJRP 6491, 4, 34.7-36.2 mm SL, rio Corumbá, Arapuca farm, 17º4'6"S 48º43'49"W, 29 Apr 2004, D. O. Tavares *et al*.; DZSJRP 6508, 1, 42.2 mm SL, unnamed córrego tributary to rio Arapuca, Arapuca farm, 17º05'32"S 48º43'47"W, 29 Apr 2004, D. O. Tavares *et al*.; DZSJRP 6853, 2, 38.8-42.0 mm SL, rio Corumbá, Arapuca farm, 17º5'32"S 48º43'47"W, 13 Jul 2004, D. O. Tavares *et al*.; DZSJRP 6980, 6 + 1 cs, 32.2-44.5 mm SL, rio Corumbá, 17º5'34"S 48º43'49"W, 2 Nov 2004, D. O. Tavares *et al*.; DZSJRP 7041, 1, 35.2 mm SL, rio Corumbá, GO-020 highway, Km 78, 17º4'7"S 48º43'59"W, 6 Feb 2005, D. O. Tavares *et al*.; DZSJRP 7060, 4 + 1 cs, 30.4-36.1 mm SL, rio Corumbá, GO-020 highway, Km 78, 17º5'33"S 48º43'47"W, 7 Feb 2005, D. O. Tavares *et al*. Mun. Caldas Novas: DZSJRP 10797, 1, 44.9 mm SL, collected with the holotype. [Mun. Coromandel]: MNRJ 11481, 20, 19.6-33.1 mm SL, unnamed córrego tributary to rio Verde, on the downhill road towards the rio Verde (mouth of rio Verde is located at 18º3'33"S 47º16'59"W), 28 Apr 1986, G. W. Nunan & D. F. Moraes Jr. Mun. Catalão: MNRJ 19729, 1, 45.1 mm SL, córrego Taquari, a left bank tributary to rio São Marcos, 17º43'5"S 47º34'25"W, 25 Sep 1999, C. A. Figueiredo *et al*.; MNRJ 19842, 2, 38.6-47.1 mm SL, córrego Prata, a right bank tributary to rio São Marcos, 17º47'24"S 47º35'46"W, 21 Sep 1999, F. A. Bockmann *et al*. Mun. Mineiros: MNRJ 20256, 7, 28.7-33.1 mm SL, and MNRJ 20257, 6, 36.1-39.1 mm SL, córrego Coqueiros, BR-364, 17º30'25"S 52º32'18"W, 12 Nov 2000, F. A. G. Melo *et al*. Mun. Corumbaíba: NUP 4414, 15, 32.8-40.4 mm SL, and NUP 4415, 2 cs, 37.6-42.0 mm SL, córrego Gameleira, tributary to left margin of rio Corumbá, 17º59'S 48º29'W, 12 Oct 1996, Nupélia.

Additional examined specimens. All from Brazil, Goiás, upper Tocantins basin: Mun. Niquelândia: MNRJ 11540, 21, 27.4-35.6 mm SL, riacho do Padre, right bank tributary to rio Tocantinzinho, 14º8'30"S 48º05'W, 11 Oct 1985; MNRJ 11542, 3, 26.0-30.7 mm SL, 14º18'S 48º7'30"W, 11 Oct 1985. Mun. São João do Castelão: MNRJ 13288, 35, 13.1-24.0 mm SL, calcareous sink (dolina) of a tributary to rio Castelo Grande, a right bank tributary to rio Maranhão, 11 Oct 1985. Mun. Minaçu: MZUSP 53404, 20, 30.5-39.9 mm SL, unnamed córrego tributary to rio Tocantinzinho, 14º2'12"S 48º13'22"W, 19 Dec 1995. MZUSP 53422, 3, 37.4-43.1 mm SL, tributary to rio Tocantinzinho, 14º2'27"S 48º12'22"W, 20 Dec 1995.

Diagnosis. *Characidium xanthopterum* is diagnosed among congeners by the bright yellow fin coloration, and by the absence of conspicuous dark bars along the sides of body in individuals larger than 35 mm SL (*vs* dark bars or marks present on the sides of the body in specimens of all sizes in the remaining species of *Characidium*).

Description. Based on specimens from upper rio Paraná basin. Morphometric data in Table 1. A medium-sized *Characidium*, largest specimen examined 47.3 mm SL. Body

Fig. 1. *Characidium xanthopterum*, holotype, DZSJRP 10474, 47.3 mm SL, freshly preserved specimen.

compressed. Dorsal profile convex between anterior tip of snout and dorsal-fin origin, except for small concavity at supraoccipital process, almost straight between bases of dorsal and caudal fins. Ventral profile convex from lower lip to pelvic-fin insertion, straight between pelvic-fin insertion and anal-fin origin, slightly concave from anal-fin origin to caudal-fin base.

Snout rounded in dorsal view, its tip aligned with ventral margin of orbit. Mouth small, terminal; maxilla moderately elongate, reaching vertical line through anterior third of orbit. Orbit slightly larger than snout length. Cheek shallow, its depth about half of orbit diameter. Nares distinctly separated; posterior naris closer to eye than to anterior naris; margin of anterior naris raised, forming circular rim, without dermal flaps; posterior naris directed backwards, with rim raised and not forming dermal flaps.

At least 1-2 medial lower-jaw teeth tricuspid. Dentary teeth in single series, 8/8(1), 9/9(1) or 10/8(1), decreasing gradually in size from symphysis towards lateral posterior portion of dentary. Premaxillary teeth 6/6(1), 7/7(1) or 8/8(1), mostly unicuspid, occasionally with very small lateral cusps on medialmost teeth, decreasing gradually in size from symphysis towards lateral posterior portion of premaxillary. Maxillary teeth absent. Ectopterygoid conical teeth in a single series of 11/11, 10/13 or 14/14. Mesopterygoid teeth absent.

Branchiostegal rays 4/4(2) or 4/5(1); 3 or 4 at anterior ceratohyal, 1 at posterior ceratohyal. Supraorbital present, somewhat triangular in dorsal view, with anterior margin wider than posterior one; medial margin slightly concave, abutting frontal. Parietal branch of supraorbital canal present, extending through almost two thirds of parietal. Parietal fontanel limited anteriorly by frontals.

Orbitosphenoid slightly rectangular in lateral view, connected anteriorly to rhinosphenoid, with free posterior-ventral margin concave. Pterosphenoid foramen for ophthalmic nerve relatively small, formed by tunnel crossing pterosphenoid diagonally, bordered ventrally by bony crest that conceals the brain cavity from lateral view.

Scales cycloid; about 10-12 radii on posterior field of scale located immediately below 10th scale of lateral line. Lateral line complete, with 32(15), 33(7), 34(38*), 35(2) or 36(4) perforated scales. Scale rows above lateral line 3(51), 4(14*); scale rows below lateral line 3(63*). Scale rows around caudal peduncle 10(5), 12(59*). Scales in regular predorsal series 8(2), 9(20), 10(23*), 11(10). Scales from base of dorsal fin to origin of adipose fin 7(6), 8(15*), 9(29), 10(7). Isthmus completely covered with scales. Pseudotympanum present, represented by muscle hiatus at vertical through anterior portion of swim bladder between first and second pleural ribs.

Dorsal-fin rays ii,8(4), ii,9(36*) or ii,10(22). Adipose fin present. Pectoral-fin rays iii,8(31), iii,9(33*) or iii,10(1), in some specimens reaching pelvic-fin origin. Pelvic-fin i,8(65*), in some specimens reaching anal-fin origin. Anal-fin rays, ii,6(54*) or ii,7(9); fin elements (i.e., adnate rays) on last pterygiophore 2(58*), counted as single ray in total count. Principal caudal-fin rays 9(3), 10(42*), 11(1) on dorsal lobe, 9(42*) on ventral lobe. Mature males with at least five well-developed sexual hooks on dorsal surface of first five branched and unbranched pectoral and pelvic fin-rays; some with hooks only on pelvic fins. Only one hook per ray-segment, usually absent on the first proximal identifiable segment.

Total number of vertebrae 32(1), 33(2). Swim bladder well developed, extending through entire length of visceral cavity. Supraneural bones 5(2), 6(1), anterior to neural spine of fifth or sixth centrum. Epural bones 2(2), 3(1). Single pair of uroneural bones present (3).

Color in alcohol. Ground color of head and body brown-purple. Opercular bones and pectoral girdle pale yellow. Chromatophores distributed over entire surface of head, sparse at gular area; dorsal portion of head and body dark, lighter ventrally. All scales, except ventral ones, with chromatophores concentrated at their posterior margin, forming checkered pattern. Adult specimens with brown, dark and pale yellow pigmentation, uniformly checkered, except for inconspicuous midlateral longitudinal stripe, positioned slightly above lateral line. Dark humeral blotch usually conspicuous, vertically elongate. Dark, oblique stripe extending from upper lip to anterior margin of orbit. Black spot slightly vertically expanded near base of middle caudal-fin rays inconspicuous or absent. All fins pale yellow. Specimens smaller than 32 mm SL with eight to 11 vertical bars on sides of body, shaped as inverted isosceles triangles, darker on dorsal portion; humeral blotch partially merged into first bar; black, thin stripe present; dark spot present at base of middle caudal-fin rays. Fins hyaline, with scattered chromatophores along rays (Fig. 2).

Color in freshly preserved specimens. Body almost entirely brown-reddish; cheek, opercular region, and lateral portion of pectoral girdle yellow; fin rays bright yellow. Dorsal portion of head, opercle, and humeral blotch conspicuously dark. Inconspicuous, narrow midlateral longitudinal stripe, running slightly above lateral line, from humeral blotch to caudal peduncle.

Sexual dimorphism. Mature males with sexual hooks on unbranched and branched rays of pectoral and pelvic fins (most evident in MNRJ 11481). Small, inconspicuous hooks observed on pelvic-fin rays of immature males.

Geographic variation. The description above is based on specimens from the upper rio Paraná basin. To provide comparative morphometric data, specimens from the upper rio Tocantins basin were also measured (Additional examined specimens; Table 1). These specimens differ in the number of scale rows around the caudal peduncle (12 or 14, mode=14 *vs* 10 or 12, mode=12 in specimens from the upper Paraná basin) and deeper cheek (7.1-10.1, mean= 8.3 *vs* 10.4-19.8, mean=15.1% of head length in specimens from the upper rio Paraná basin). Due to the overlap and individual variation of meristic data between the samples from these two river drainages, the upper Tocantins

population is not considered a different species.

Distribution and habitat. *Characidium xanthopterum* is known from tributaries of the rio Paranaíba drainage, upper rio Paraná basin, and tributaries to the upper rio Tocantins basin in the State of Goiás, Brazil (Fig. 3). Most specimens were collected in habitats with riffles, rocky bed with pebbles, and sand deposits.

Etymology. From the Greek *xanthos* (yellow) and *pteron* (fin) meaning yellow fin, in a reference to the bright yellow fins of living specimens. An adjective.

Discussion

Most species of *Characidium* have eigth to 11 dark lateral vertical bars on the body (e.g., *C. fasciatum*, *C. gomesi*, *C. vestigipinne*, *C. zebra*). Psammophilic species present more than 13 vertical bars (*C. heinianum*, *C. longum*, *C. pellucidum*, *C. pteroides*), and other species have distinct types of markings on the body (*C. lauroi* species group, *C. serrano*, *C. stigmosum*). In contrast, dark vertical bars or marks are always absent in individuals of *C. xanthopterum* larger than 35 mm SL. Individuals smaller than 32 mm SL possess a color pattern similar to *C. zebra*, *i.e.* transverse bars along body

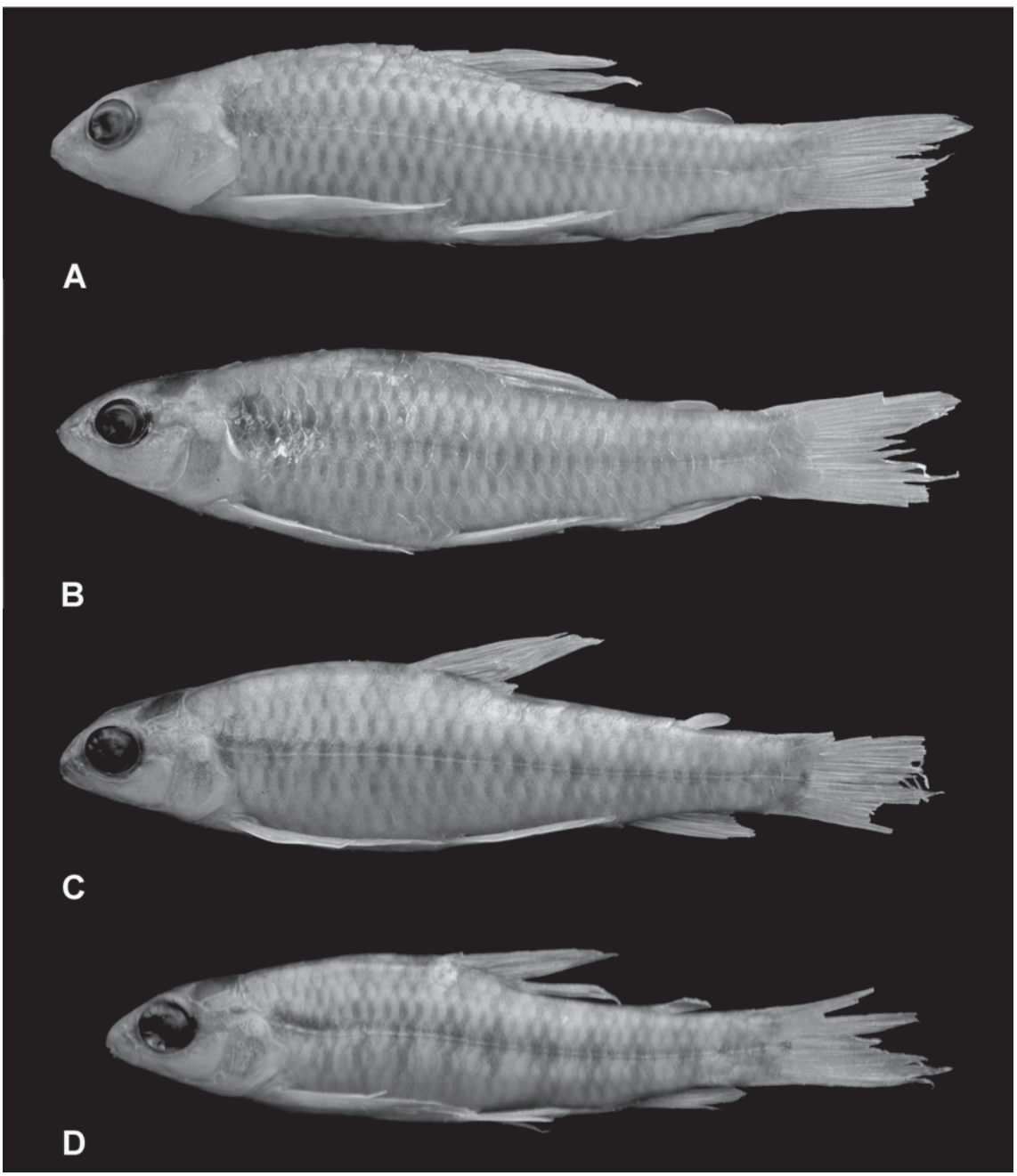

Fig. 2. *Characidium xanthopterum*, paratypes, MNRJ 11481, (A) 34.8 mm SL, (B) 32.1 mm SL, (C) 30.6 mm SL, and (D) 22.5 mm SL.

Table 1. Morphometric data of *Characidium xanthopterum* samples from the upper rio Paraná basin based on DZSJRP 6491 (n=3), DZSJRP 6508 (n=1), DZSJRP 6853 (n=2), DZSJRP 6980 (n=6), DZSJRP 7041 (n=1), DZSJRP 7060 (n=4), DZSJRP 10474 (holotype), DZSJRP 10797 (n=1), MNRJ 11481 (n=17), MNRJ 19729 (n=1), MNRJ 19842 (n=2), MNRJ 20256 (n=5), MNRJ 20257 (n=6), and NUP 4414 (n=15) and samples from the upper rio Tocantins basin based on MNRJ 11431 (n=18). N is number of specimens.

Character	Upper rio Paraná					Upper rio Tocantins			
	Holotype	Range	Mean	Standard Deviation	N	Range	Mean	Standard Deviation	N
Standard length (mm)	47.3	26.4-47.3	34.4	4.8	62	25.6-38.0	32.0	3.8	18
Percents of standard length									
Prepectoral distance	23.4	23.4-27.9	25.7	1.1	61	25.2-29.9	26.8	1.2	18
Predorsal distance	49.5	49.2-53.8	51.3	1.1	60	51.1-56.7	52.8	1.4	18
Prepelvic distance	51.5	51.5-56.9	54.6	1.2	61	55.2-59.2	56.9	1.2	18
Preanal distance	75.5	75.5-83.1	79.7	1.4	59	74.1-84.1	81.8	2.2	18
Anal to apex distance	94.7	94.1-102.1	97.7	1.9	58	99.2-103.6	101.5	1.3	18
Body width	12.6	11.1-15.1	12.8	0.8	62	12.2-14.3	12.9	0.6	18
Body depth at dorsal-fin origin	25.1	23.1-29.0	25.3	1.2	60	22.6-27.0	25.3	1.1	18
Body depth at anal-fin origin	18.1	13.8-19.3	16.7	1.2	61	15.2-18.3	17.1	0.8	18
Body depth at caudal peduncle	11.3	9.7-12.6	11.0	0.7	62	11.2-13.6	12.6	0.7	18
Head length	23.2	23.2-27.6	25.5	1.0	61	25.2-29.9	26.8	1.2	18
Dorsal-fin base length	15.8	13.7-18.6	15.7	1.1	61	13.9-16.4	15.3	0.7	18
Anal-fin base length	8.7	6.3-10.8	8.3	0.9	62	8.0-9.8	8.8	0.6	18
Pelvic-fin length	23.0	21.6-27.4	23.8	1.4	59	22.9-26.6	24.4	1.0	18
Pectoral-fin length	24.7	24.7-33.2	28.6	2.0	59	27.5-32.6	30.5	1.4	18
Dorsal-fin length	26.9	24.9-32.2	28.4	1.7	62	26.1-29.2	27.7	0.8	18
Anal-fin length	19.9	16.6-22.1	18.8	1.1	62	17.7-22.3	21.0	1.2	18
Caudal-peduncle length	27.4	22.1-29.5	25.7	1.9	44	24.3-28.6	27.4	1.1	17
Percents of head length									
Snout length	27.7	22.5-29.4	25.6	1.6	59	24.7-27.5	25.6	0.7	18
Snout to maxillary tip	28.0	24.3-33.0	27.7	2.2	58	25.3-28.7	27.1	1.0	18
Anterior naris to orbit	15.3	10.5-15.3	12.7	1.1	59	11.5-14.3	12.9	0.8	18
Posterior naris to orbit	9.6	4.4-9.6	6.7	1.1	62	5.7-8.4	7.2	0.8	18
Cheek depth	10.5	10.4-19.8	15.1	3.0	55	7.1-10.1	8.3	0.8	18
Orbital diameter	25.6	25.6-33.4	28.7	2.0	60	25.7-31.8	28.5	1.8	18
Interorbital distance	32.1	27.1-35.1	31.3	2.0	59	27.9-33.5	30.8	1.7	18

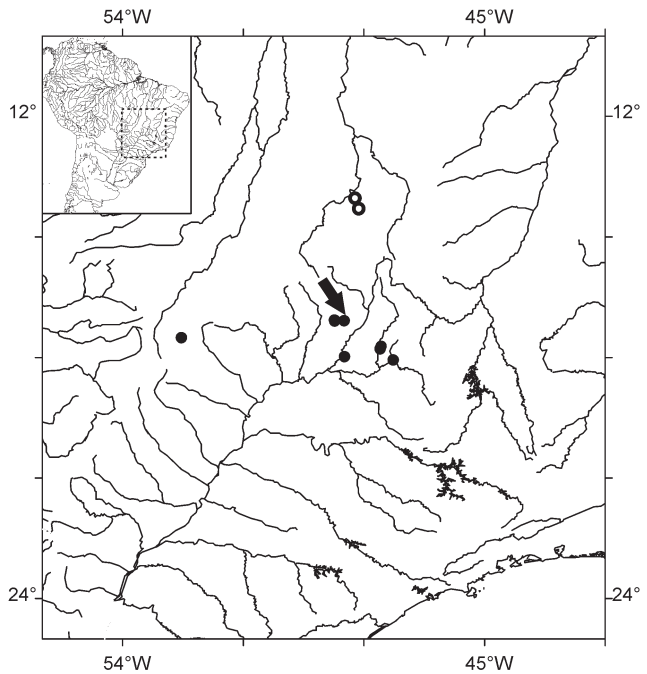

Fig. 3. Map of central Brazil, showing distribution of *Characidium xanthopterum*. Arrow indicates type-locality (Caldas Novas, Goiás State, upper rio Paraná basin), complete circles represent localities in the upper rio Paraná basin, and open circles represent localities in the upper rio Tocantins basin. Symbols may represent more than one lot or locality.

sides and a black spot near the base of the middle caudal-fin rays, but the bars and basicaudal spot disappear with growth between 32 and 35 mm SL. During ontogeny, the bars and basicaudal spot also become progressively fainter, until disappearing completely. In the upper rio Paraná basin, the juvenile pattern of lateral body bars is also present in *Characidium* sp. *cf. C. zebra*. Juveniles of *C. xanthopterum* can be distinguished from juveniles of *Characidium* sp. *cf. C. zebra* (smaller than 32 mm SL – MZUSP 40503, MZUSP 40515, MNRJ 19842 and MNRJ 21342) by the larger pectoral-fin length (24.7-33.2, mean = 28.6 *vs* 18.4-30.7, mean = 26.5% SL), a deeper cheek (10.4-19.8, mean = 15.1 *vs* 5.7-12.0, mean = 7.7% HL), and a smaller orbital diameter (25.6-33.4, mean = 28.7 *vs* 28.5-37.9, mean = 34.0% HL). Juvenile specimens from the remaining *Characidium* species occurring at the upper rio Paraná basin, such as *C. fasciatum* and *C. gomesi*, also possess a similar color pattern, but can be easily distinguished from *C. xanthopterum* by the lack of scales in the isthmus.

Adult males of *Characidium occidentale*, *C. orientale*, *C. rachovii*, and *C. vestigipinne* are reported as possessing bright orange or red-colored fins (Buckup & Hahn, 2000). In contrast, all fins of *Characidium xanthopterum* are deep yellow colored in males and females of all size classes. *Characidium xanthopterum*, however, also lacks the synapomorphy listed by Melo & Buckup (2002) for a putative monophyletic clade that includes those species and *C. stigmosum* (*i.e.*, black pigmentation of distal portion of anal and pelvic fins).

Recently, Pavanelli & Britski (1999) suggested that the rio

Paranaíba drainage corresponds to an area of endemism that harbors a fish fauna somewhat distinct from the remainder of the upper rio Paraná basin. This endemism was attributed to a series of rapids which represent barriers to fish dispersal between the upper and lower portions of the basin. Species that are considered endemic to the rio Paranaíba drainage include *Oligosarcus planaltinae* Menezes & Géry, *Phenacorhamdia unifasciata* Britski, *Steindachnerina corumbae* Pavanelli & Britski, *Planaltina myersi* Böhlke, and *Creagrutus varii* Ribeiro *et al*. The distribution of *Characidium xanthopterum* suggests that the rio Paranaíba area of endemism may actually extends northwards beyond the limits of the upper rio Paraná basin into the headwaters of the Tocantins basin. Future fieldwork, mainly in upper rio Tocantins basin, may help understand the relationships between fish species from headwaters of the upper Paraná and upper Tocantins river basins.

Material examined (all from Brazil, range of SL is given in millimeters). *Characidium fasciatum*: MNRJ 11479, 1, 45.7, Goiás, Catalão, córrego Taquari, a left bank tributary to rio São Marcos, 17º43'5"S 47º34'25"W. *Characidium gomesi*: DZSJRP 5653, 2, 43.8-48.3, Goiás, Montividiu, córrego Formosa, Km 77 road GO-174, between Amorinópolis and Montividiu, Paranaíba, 17º9'37"S 51º9'34"W; NUP 1092, 7, 40.0-52.1 Goiás, Caldas Novas, rio Corumbá tributary to rio Paranaíba, 17°34'24"S 48°29'50"W; NUP 3815, 1, 41.2, Goiás, Teresópolis, córrego Maria Paula, 16º28'14"S 49º06'14"W; NUP 3816, 2, 40.0-57.5, Goiás, Anápolis, córrego Cunha, 16º20'25"S 49º07'2"W. *Characidium* sp. *cf. C. zebra*: DZSJRP 6415, 1, 32.8, Goiás, Cristalina, unnamed creek tributary to left margin of rio Paineiras, Km 163.5, GO-020, 800 m of BR-050, Paranaíba; DZSJRP 10412, 1, 22.0, Goiás, Buriti Alegre, creek on road GO-210, entrance to Buriti Alegre, before ribeirão Desemboque, 18º7'42"S 49º13'28"W; DZSJRP 10530, 1, 52.7, Goiás, Corumbaíba, unnamed creek under bridge on road GO-406 (Ipameri-Corumbaíba), 18º6'36"S 48º30'13"W; MNRJ 21342, 6, 35.1-38.7, Minas Gerais, Unaí, unnamed creek, North of Unaí cross the road MG-188 to West (rio Preto basin); MNRJ 19842, 12, 19.0-24.2, Goiás, Catalão, córrego da Prata, tributary to right margin of rio São Marcos; MZUSP 40515, 68, 22.4-30.5, Goiás, Alvorada de Goiás, unnamed creek tributary to rio Corrente, road GO-236, 15 km of Alvorada de Goiás; MZUSP 40503, 6, 24.9-27.4, Goiás, Flores de Goiás, unnamed creek tributary to right margin of rio Santa Maria, road GO 236, 22 km of Flores de Goiás; NUP 1196, 100, 40.0-68.9, Goiás, Caldas Novas, rio Corumbá, tributary to rio Paranaíba, 17°34'24"S 48°29'50"W; NUP 1206, 54, 42.0-69.0, Goiás, Caldas Novas, córrego Gameleira tributary to rio Corumbá, 17°59'S 48°29'W; NUP 1384, 4, 53.0-75.8, Paraná, Jussara, rio Abelha tributary to rio Ivaí, 23°36'S 52°28'W; NUP 2302, 3, 52.0-65.0, Goiás, Mineiros, rio Formoso, Parque Nacional das Emas, 18º15'S 53º00'W.

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