

***Australoheros capixaba*, a new species of *Australoheros* from south-eastern Brazil (Labroidei: Cichlidae: Cichlasomatinae)**

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> Abstract

Australoheros capixaba, new species, is distributed along the rio Itaúnas, rio Barra Seca, rio São Mateus and the lower rio Doce basins. The new species is distinguished from its congeners in the rio Paraná-Uruguay system and Laguna dos Patos system by having 12 caudal vertebrae (vs. 13–15). *Australoheros capixaba* differs from the other species of *Australoheros* from south-eastern Brazil by its coloration in life (a reddish chest, large spots on the dorsal region of the trunk and a green iridescence on the pelvic fins). It also differs from some of its congeners by having a longer caudal peduncle, a longer anal-fin spine, fewer dorsal-fin spines and fewer anal-fin rays. *Australoheros capixaba* sp. n. is the first species from the genus described for the Estado do Espírito Santo, south-eastern Brazil. The phylogenetic placement of the species in the genus cannot be discussed, because there is no phylogenetic work about the *Australoheros* species from south-eastern Brazil.

> Resumo

Australoheros capixaba, nova espécie, se distribui ao longo das bacias do rio Itaúnas, rio Barra Seca, rio São Mateus e baixo rio Doce. A nova espécie difere de das espécies do gênero dos sistemas rio Paraná-Uruguay system e Laguna dos Patos por possuir 12 vértebras caudais (vs. 13–15). *Australoheros capixaba* difere das outras espécies do gênero do sudeste do Brasil por alguns caracteres relacionados ao padrão de colorido em vida (peito avermelhado, pintas vermelhas grandes na região dorsal do corpo e nadadeira pélvica com iridescência verde). Também difere de algumas espécies do sudeste do Brasil por possuir pedúnculo caudal mais longo, último espinho da nadadeira anal mais longo, menos espinhos na nadadeira dorsal e menos raios na nadadeira anal. *Australoheros capixaba* sp. n. é a primeira espécie do gênero descrita para o Estado do Espírito Santo, sudeste do Brasil. Não foi possível realizar discussões sobre sistemática, já que não existem trabalhos sobre filogenia das espécies do sudeste do Brasil.

> Key words

Australoheros facetus, coastal basins, Estado do Espírito Santo, Heroíni, Linhares, rio Barra Seca, rio Doce, rio Itaúnas, rio São Mateus, South American cichlids, taxonomy.

Introduction

Australoheros RÍCAN & KULLANDER is a South American cichlid genus characterized by having a unique breeding coloration (body bars 5–7 interrupted in their middorsal part) and juveniles with distinct xanthophore dots on caudal-fin base (RÍCAN & KULLANDER, 2006). The genus includes about 18 species distributed in the rio Paraná-Paraguay and rio Uruguay basins, extending to the foothills of the Andes in western Argentina and to the east in the Atlantic coastal drainages of Argentina, Uruguay and Brazil up to Bahia,

including the São Francisco drainage (CASCIOTTA *et al.*, 1995, 2006; RÍCAN & KULLANDER, 2008; OTTONI & COSTA, 2008). According to RÍCAN & KULLANDER (2003, 2006), *Australoheros* is included in the tribe Heroíni, subfamily Cichlasomatinae, closely related to the Mesoamerican and Antillean heroines.

The first described species of the genus is *A. facetus* (JENYNS, 1842), collected in the coastal plains of Uruguay during the voyage of CHARLES DARWIN, as *Chromys facetus*. More recently, before the creation of

the genus *Australoheros*, “*Cichlasoma*” *tembe* CASCIOTTA, GÓMEZ & TORESANI, 1995 and “*Cichlasoma*” *scitulum* RÍCAN & KULLANDER, 2003 were described. The first one from the arroyo Uruguay drainage in the río Paraná basins, Argentina (CASCIOTTA *et al.*, 1995), and the second from the rio Rosario drainage in the rio de La Plata region of Uruguay and from the lower rio Uruguay tributaries in Argentina, Uruguay and Brazil (RÍCAN & KULLANDER, 2003).

After RÍCAN & KULLANDER (2006) erected *Australoheros*, several other new species were described from the rio Uruguay and rio Paraná drainages: *A. kaaygua* CASCIOTTA, ALMIRÓN & GÓMEZ, 2006; *A. forquilha* RÍCAN & KULLANDER, 2008; *A. guarani* RÍCAN & KULLANDER, 2008; *A. minuano* RÍCAN & KULLANDER, 2008, and *A. charrua* RÍCAN & KULLANDER, 2008. *Australoheros ribeirae* OTTONI *et al.*, 2008 is the first species described from south-eastern Brazil. This species is endemic to the rio Ribeira do Iguape basin (OTTONI *et al.*, 2008). Later on OTTONI & COSTA (2008) described nine new species from the southeastern of Brazil: *Australoheros austrani* OTTONI & COSTA, 2008, *A. barbosa* OTTONI & COSTA, 2008, *A. ipatinguensis* OTTONI & COSTA, 2008, *A. macacuensis* OTTONI & COSTA, 2008, *A. macaensis* OTTONI & COSTA, 2008, *A. muriae* OTTONI & COSTA, 2008, *A. paraibae* OTTONI & COSTA, 2008, *A. robustus* OTTONI & COSTA, 2008 and *A. saquarema* OTTONI & COSTA, 2008.

OTTONI & CHEFFE (2009) described *Australoheros taura*, endemic from the upper rio das Antas basin. Another new species of *Australoheros* is herein described from the rio São Mateus basin, rio Itaúnas basin, rio Barra Seca basin and lower rio Doce basin (south-eastern Brazil).

Materials and Methods

Materials are deposited in CIMC, divisão de Fauna, Grupo Especial de Estudo e Proteção do Ambiente Aquático do Rio Grande do Sul, Rio Grande do Sul; in MCP, Museu de ciências e tecnologia da Pontifícia Universidade Católica do Rio Grande do Sul, Pontifícia Universidade Católica do Rio Grande do Sul, Rio Grande do Sul; MNRJ, Museu Nacional do Rio de Janeiro, Universidade Federal do Rio de Janeiro, Rio de Janeiro; MTD F, Senckenberg Naturhistorische Sammlungen, Museum für Tierkunde Dresden Fish Collection, Dresden, Germany; MZUSP, Museu de Zoologia, Universidade de São Paulo, São Paulo; and in UFRJ, Instituto de Biologia, Universidade Federal do Rio de Janeiro, Rio de Janeiro.

Measurements and counts follow OTTONI & COSTA (2008), with addition of the longitudinal scale counts

(E0, E1 and E2) (KULLANDER, 1990), teeth on posterior margin of ceratobranchial 5, teeth on transversal series of ceratobranchial 5 (KULLANDER, 1986), transversal series of scales from the end of upper lateral line to the dorsal-fin base and peduncle series, a transversal scale count on the caudal peduncle (only from the left side). Measurements are presented as percentages of standard length (SL), except for those related to head morphology, which are expressed as percentages of head length (HL). Measurements were taken on the left side of each specimen with digital calipers under a binocular microscope. Osteological studies were made on cleared and counterstained (C&S) specimens prepared according to TAYLOR & VAN DYKE (1985), and the osteological nomenclature follows COSTA (2006). Vertical bars are grouped into trunk bars and head bars, numbered from the caudal-fin to the snout. Spots are similarly numbered.

The method of species delimitation follows DAVIS & NIXON (1992).

Comparison with *A. tembe*, *A. kaaygua*, *A. charrua* and *A. guarani* has been based on literature. Comparison with *A. facetus*, *A. forquilha*, *A. minuano*, *A. ribeirae*, *A. scitulus*, *A. austrani*, *A. barbosa*, *A. ipatinguensis*, *A. macacuensis*, *A. macaensis*, *A. muriae*, *A. paraibae*, *A. robustus* and *A. saquarema* has been based on examined material and literature. Comparative material is listed in OTTONI & COSTA (2008) and OTTONI & CHEFFE (2009).

Australoheros capixaba, new species

Fig. 1

Holotype. UFRJ 7725, 57.4 mm SL; Brazil: Estado do Espírito Santo: stream under a bridge in a ES street, between Município de Jaguaré and Município de São Mateus (S 18°34.953' e WO 4026.115''); F.P. OTTONI & J.L.O. MATTOS, 08. Jul. 2009.

Paratypes. Brazil: Estado do Espírito Santo: UFRJ 7749, 1 C&S, 33.3 mm SL; collected with holotype; MNRJ 17275, 2, 27.3–52.0 mm SL; córrego Floresta (rio Itaúnas basin); L.R. TEIXEIRA & D. BLANK, 06. Nov. 1997; MNRJ 25749, 3, 40.8–101.8 mm SL; Município de Linhares, Reserva Florestal CURD; C.A.G. CRUZ & E. IZECKSON, 14. Oct. 1979; MNRJ 27141, 1, 77.2 mm SL; rio Piraquêçu, near the bridge on the ES 257 street; M. BRITTO & R. CAMPOS-DA-PAZ, 27. May 2004; MNRJ 22288, 1, 37.0 mm SL; rio Itaúnas, BR 101 street, south of Pedro Canário; P.A. BUCKUP, A.T. ARANDA & P.A. MELO, 24. Aug. 2001; MCP 18141, 6 (2 C&S), 29.0–52.7 mm SL; stream tributary from rio Itaúnas, crossing the street Nanuque-Montanha, about 14 km south of Nanuque (S 17° 57' 46" WO 40°23'21"); R. REIS, W. SAUL & E. PEREIRA, 26. Jan. 1995; MCP 18139, 6 (1 C&S), 20.7–69.8 mm SL; rio Cricaré (rio São Mateus basin), about 1 km north from Nova Venécia (S18° 42'02" WO 040° 24' 58"); R. REIS, W. SAUL & E. PEREIRA, 26. Jan. 1995; MZUSP 498, 2, 59.8–74.0 mm SL; rio Doce; E. GARBE; and MZUSP 2580, 7, 53.4–69.6 mm SL; rio Doce; E. GARBE, 1906.



Fig. 1. *Australoheros capixaba*, sp. n.; Holotype, UFRJ 7725, 57.4 mm SL; Brazil: Estado do Espírito Santo: rio Barra Seca basin.

Diagnosis

Australoheros capixaba is distinguished from *A. facetus*, *A. kaaygua*, *A. tembe*, *A. forquilha*, *A. guarani*, *A. minuano*, *A. scitulus*, *A. charrua* and *A. taura* by having fewer caudal vertebrae (12 in *A. capixaba* vs. 13–15 in the other species). *Australoheros capixaba* differs from *A. saquarema*, *A. muriae*, *A. robustus*, *A. barbosa*, *A. macacuensis*, *A. ipatinguensis*, *A. paraibae* and *A. ribeirae* by having a longer caudal peduncle (9.6–11.4 % SL in *A. capixaba* vs. 5.1–9.2 % SL in the other species); from *A. autrani*, *A. barbosa*, *A. ipatinguensis*, *A. muriae* and *A. saquarema* by having fewer anal-fin rays (8 in *A. capixaba* vs. 9–10 in the other species); from *A. macacuensis*, *A. macaensis*, *A. ribeirae* and *A. saquarema* by having large red spots on the dorsal portion of the trunk (vs. absence); from *A. autrani*, *A. macacuensis*, *A. macaensis* and *A. saquarema* by having a reddish chest (vs. chest not reddish, i.e. a coloration similar to the entire trunk); from *A. macaensis* and *A. saquarema* by not having a detached snout, with a depression on the snout (vs. detached snout, with depression on head in specimens above 30.0 mm SL); from *A. robustus* by fewer dorsal-fin spines (15–16 vs. 17) and more dorsal-fin rays (10–11 vs. 8–9); from *A. macacuensis* by having both arms of trunk bar 7 with the same width (vs. postero-dorsal arm of trunk bar 7 wider than anterior one) and pelvic fins with green and yellow iridescence (vs. black or dark brown); and from *A. paraibae* by having a longer last anal-fin spine (last anal-fin spine length 14.0–17.2 % SL vs. 12.2–13.3 % SL).

Description

Morphometric data are summarized in Table 1, meristic data in Table 2. Body elongated and laterally compressed. Dorsal profile slightly convex from snout to caudal peduncle origin. Dorsal-fin base slightly curved, progressively descending from origin to end. Ventral profile slightly curved from snout to caudal peduncle origin. Caudal peduncle approximately straight ventrally and dorsally. Head profile between tip of snout and orbit slightly curved. Nostrils in the middle between the tip of snout and anterior margin of orbit. Mouth terminal, distal tip of maxilla not reaching vertical tangent to anterior margin of orbit. Lower lip fold covering distal portion of upper lip. Lower jaw slightly shorter than upper one. Jaw teeth caniniform, slightly curved to mouth. Teeth hyaline, red at tip. Outer row teeth increasing in size symphysiad, upper jaw anterior teeth longest, lower jaw anterior teeth subequal. Opercle not serrated.

Trunk and caudal peduncle covered with ctenoid scales. Chest scales also ctenoid. Sides of head (opercle, preopercle, subopercle and interopercle) covered with cycloid scales. Scales on head and chest not distinctly smaller than on flanks. Two scale rows between the lateral lines.

Dorsal fin origin placed at level of posterior margin of opercle. Dorsal fin rounded, pointed on posterior region. Tip of dorsal fin reaching vertical through half of caudal fin. Dorsal fin scaled from about dorsal-fin spine 12 to end. Anal fin rounded anteriorly, pointed posteriorly. Anal-fin base scaled from about anal-fin spine 6. Tip of anal fin reaching vertical through half

Tab. 1. Morphometric data of *Australoheros capixaba*. H=holotype, R=range, M=mean and SD=standard deviation.

	H	R n=14	M	SD
Standard length (mm)	57.4	37.0–101.8	61.7	16.7
Percents, standard length (SL)				
Body depth	47.4	42.6–50.3	46.0	2.0
Predorsal length	44.4	41.4–47.6	43.9	1.9
Prepelvic length	43.6	42.2–46.2	44.2	1.0
Caudal peduncle depth	17.8	15.9–18.5	17.1	0.8
Caudal peduncle length	9.9	9.6–11.4	10.6	0.6
Dorsal-fin base length	56.1	53.2–59.6	56.8	1.9
Anal-fin base length	27.0	24.3–29.8	27.3	1.7
Pelvic-fin spine length	16.0	14.43–17.6	16.1	1.1
Pelvic-fin length	34.3	27.5–44.9	33.6	5.0
Last dorsal-fin spine length	14.5	13.0–18.1	15.5	1.4
Last anal-fin spine length	15.0	14.0–17.2	15.5	0.9
Pectoral-fin length	29.8	19.9–32.8	29.2	3.4
Caudal-fin length	31.5	29.9–33.3	31.5	1.0
Head depth	33.1	31.1–39.1	34.2	2.0
Orbital diameter	11.7	9.1–12.9	11.4	1.0
Snout length	12.1	12.2–14.5	13.5	0.8
Head width	19.9	17.4–20.7	19.0	0.8
Interorbital width	16.6	14.2–17.2	15.5	0.8
Preorbital depth	21.4	20.6–26.0	22.7	1.7
Upper jaw length	10.5	10.3–12.2	11.0	0.5
Lower jaw length	7.1	6.4–8.3	7.5	0.7
Head length (mm)	20.9	14.6–36.6	23.1	5.8
Percents, head length (HL)				
Head depth	90.9	81.9–103.4	91.2	6.7
Orbital diameter	32.1	25.4–33.0	30.3	2.3
Snout length	33.5	31.7–39.3	36.0	2.4
Head width	54.5	48.4–54.8	50.7	2.3
Interorbital width	45.5	38.9–45.5	41.3	2.2
Preorbital depth	58.9	54.1–68.8	60.4	5.2
Upper jaw length	28.7	26.0–33.9	29.4	1.9
Lower jaw length	19.6	16.8–22.2	20.0	2.2

of caudal fin. Dorsal and anal fins with ctenoid scales on basal third. Caudal fin long with distal margin curved. Caudal fin with smaller ctenoid scales covering about a third of the fin. Pectoral fin with a rounded tip, extending to about first anal-fin spine or vertical trunk bar 4. Pectoral-fin base on vertical through trunk bar 4. Pelvic fin pointed. Pelvic-fin base on vertical through third or fourth spine of dorsal fin. Tip of pelvic fin reaching vertical through second spine of anal fin.

A wide ectopterygoid (OTTONI & COSTA, 2008: fig. 3b). Arm of epibranchial 1 long and epibranchial 2 with two long processes (OTTONI & COSTA, 2008: fig. 4a and 4c). Microbranchiospines present only on external side of ceratobranchial 4. Ceratobranchial 5 partly sutured medially and relatively robust, with 6₍₁₎–7₍₂₎ teeth along midline and 23₍₁₎–24₍₂₎ teeth along posterior margin. Posterior teeth tend to be laterally

more compressed. Posterior and medial teeth larger than lateral and anterior teeth. Posterior teeth unicuspid, curved forward. Large laterally compressed teeth bicuspid.

Coloration in alcohol. Side of body light brown with seven dark brown trunk bars (bars 1–5 continuous, 6–7 interrupted above longitudinal stripe) between caudal peduncle and posterior margin of opercle. Trunk bars usually not forked ventrally. Trunk bars 2–4 dorsally inclined posteriorly. Trunk bar 5 unforked dorsally and connected to trunk bar 6, above upper lateral line. Trunk bar 6 interrupted between longitudinal stripe and upper lateral line. Trunk bar 7 forked dorsally and interrupted above longitudinal stripe. Posterior arm of trunk bar 7 with same width as the anterior one. Trunk bar 1 somewhat arched. Three dark spots: first spot on caudal-fin peduncle and on lower lateral line

Tab. 2. Meristic variation data of *Australoheros capixaba*. Pc = procurent rays.

	Holotype	Range
Dorsal-fin spines	16	15 ₍₆₎ –16 ₍₈₎
Dorsal-fin rays	10	10 ₍₁₁₎ –11 ₍₃₎
Anal-fin spines	7	6 ₍₂₎ –7 ₍₁₂₎
Anal-fin rays	8	8 ₍₁₄₎
Pelvic-fin spines	1	1 ₍₁₄₎
Pelvic-fin rays	5	5 ₍₁₄₎
Caudal-fin rays	–	3 + 8 + 8 + 3 ₍₄₎
Pectoral-fin rays	–	14 ₍₃₎
Gill-rakers on first ceratobranchial	–	12 ₍₂₎ –15 ₍₁₎ + 3 ₍₁₎ –4 ₍₁₎ –5 ₍₁₎
Total vertebrae	–	26 ₍₄₎
Rib pairs	–	10 ₍₃₎ –11 ₍₁₎
Precaudal vertebrae	–	14 ₍₄₎
Caudal vertebrae	–	12 ₍₄₎
Scales of upper lateral line serie	16	16 ₍₇₎ –17 ₍₄₎ –18 ₍₃₎
Scales of lower lateral line serie	9	8 ₍₂₎ –9 ₍₃₎ –10 ₍₈₎ –11 ₍₁₎
E0 serie	25	25 ₍₉₎ –26 ₍₅₎
E1 serie	26	26 ₍₇₎ –27 ₍₄₎ –28 ₍₃₎
E2 serie	22	21 ₍₅₎ –22 ₍₈₎ –23 ₍₁₎
Scales of dorsal fin origin serie	4	4 ₍₁₄₎
Scales of the end of superior, lateral line to dorsal fin serie	3	3 ₍₁₄₎
Scales of anal fin origin serie	8	8 ₍₁₄₎
Scales between lateral lines	2	2 ₍₁₄₎
Scales of peduncle depth	7	7 ₍₁₄₎
Proximal radial on dorsal-fin base	–	23 ₍₁₎ –24 ₍₁₎ –25 ₍₁₎
Proximal radial on anal-fin base	–	12 ₍₂₎ –13 ₍₂₎

(a well developed round spot); second spot on junction between longitudinal stripe and trunk bar 4; and a third spot on posterior margin of opercle and longitudinal stripe. An interrupted brown longitudinal stripe running from trunk bar 1 to preopercle, lighter and inconspicuous between trunk bars 1–4, darker between trunk bar 4 and vertical head bar 1.

Side of head with three brown bars, all continuous: head bar 1 on post-orbital region close to the eye; head bars 2–3 on supra-orbital zone between the eyes, head bar 2 on posterior orbital margin touching head bar 1 just above preopercle; head bar 3 curved and directed to snout. Head darker than trunk, especially on dorsal part between head bars 2–3.

Dorsal fin light brown, slightly invaded by dark brown trunk bars. Anal fin color pattern similar to dorsal fin. Caudal fin light brown, darker near the caudal peduncle. Pectoral fin light brown, pelvic fin somewhat darker.

Coloration in life (Fig. 1). Side of body light brown, occasionally changing to dark brown or yellowish brown. Seven dark brown bars often changing from light brown to green, or to black. Three black spots with green iridescence. Chest reddish, and dorsal portion of trunk with large red spots. Green iridescence

on entire trunk, more concentrated near longitudinal stripe. The dorsal, anal and caudal fins also show a green iridescence. Usually bars lighter than longitudinal stripe. Spot intensity not or slightly changing.

Side of head with same coloration of trunk. Eye not crossed by longitudinal stripe and bars, with yellow iris.

Dorsal fin light brown, invaded by trunk bars and with large red spots on base. Dorsal fin with green iridescence on posterior portion. Anal fin with same coloration as dorsal fin, lightly invaded by trunk bars. Caudal fin with green iridescence. Pelvic fin with green iridescence on spine, and yellow iridescence on rays. Pectoral fin yellowish.

Distribution. Rio São Mateus basin, rio Itaúnas basin, rio Barra Seca basin and lower rio Doce basin, all in south-eastern Brazil (Fig. 2).

Etymology. From the Brazilian idiomatic expression *capixaba*, meaning people who were born in the Estado de Espírito Santo.

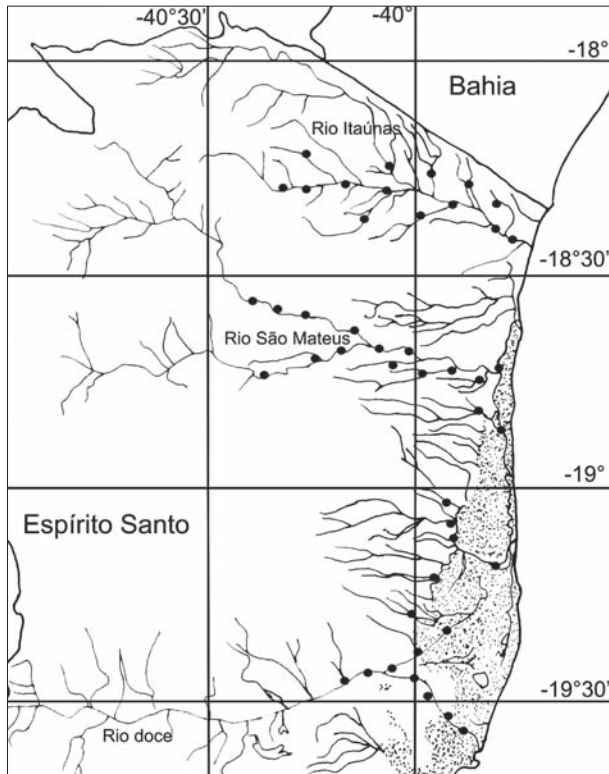


Fig. 2. Distribution map of *Australoheros capixaba*, sp. n.
● *Australoheros capixaba* sp. n.

Discussion

Australoheros capixaba is described from the rio Itaúnas, rio Barra Seca, rio São Mateus and lower rio Doce basins (Fig. 2). This is the first species of the genus described from the Estado do Espírito Santo, Brazil, and it is allopatric with its congeners. *Australoheros capixaba* has a color pattern similar to that described for *A. ribeirae*, characterized by having seven trunk bars, trunk bar seven dorsally forked and trunk bar 5 not dorsally forked (OTTONI *et al.*, 2008).

The *Australoheros* species from south-eastern Brazil (*Australoheros autrani*, *A. barbosae*, *A. ipatinguensis*, *A. macacuensis*, *A. macaensis*, *A. capixaba* sp. n., *A. muriae*, *A. paraibae*, *A. robustus*, *A. ribeirae* and *A. saquarema*) share two apomorphic characters that distinguish them from the described species from rio Paraná-Paraguai-Uruguai basins and Laguna dos Patos system: fewer caudal vertebrae (12 *vs.* 13–15) (OTTONI & COSTA, 2008) and more precaudal vertebrae (14 *vs.* 12–13). All the species from south-eastern Brazil are distinguished from the Forquilha, Facetus and Kaaygua group by having always three abdominal trunk bar, both in juveniles and adults (*vs.* always four abdominal trunk bars in juveniles and 50% of the adults). Furthermore they are distinguished from the Forquilha group by having four scales between the upper lateral line and the origin of dorsal fin (*vs.* three),

a well developed longitudinal stripe (*vs.* longitudinal stripe weakly developed) and a well developed caudal-fin base spot (*vs.* absence). They differ from the Scitululus group and *A. kaaygua* by having a well developed caudal-fin base spot (*vs.* weakly developed caudal-fin base spot) and the longitudinal stripe not wide (*vs.* widest longitudinal stripe). They also differ from the Kaaygua group by having 13 or more pectoral-fin rays (usually 14 *vs.* 12) and usually more than 24 scales on row E0 (*A. autrani*, *A. saquarema*, *A. paraibae* e *A. ipatinguensis* rarely have 24 scales) (*vs.* always 24 scales). At last the south-eastern Brazil species differ from the Facetus group and *A. minuano* by having the longitudinal stripe well developed (*vs.* weakly developed) and usually more than 24 scales on row E0 (*A. autrani*, *A. saquarema*, *A. paraibae* and *A. ipatinguensis* rarely have 24 scales) (*vs.* always 24 scales).

An undescribed species (*A. sp. jacui*) is proposed by RÍCAN & KULLANDER (2006). *Australoheros capixaba* is distinguished from this undescribed species and *A. cf. facetus* by having fewer caudal vertebrae (12 *vs.* 13), as well as from all its congeners in the rio Paraguay-Paraná-Uruguai system.

The phylogenetic tree proposed by RÍCAN & KULLANDER (2006, 2008) does not include the taxa from south-eastern Brazil, so a new phylogeny including all the known species is necessary to become an insight of the cladogenesis within the genus.

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