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Apistogramma aguarico sp. n.: A new species of geophagine cichlid fish (Teleostei: Perciformes) from the Ecuadorian and Peruvian río Napo system

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Abstract

A new species of *Apistogramma*, *Apistogramma aguarico* sp. n., is described from Ecuador, based on a total of 9 specimens collected from an oxbow lake (appr. 09°47′ S / 75°57′ W) connected to the Rio Lagartococha, an affluent of the Rio Aguarico, which is part of the Rio Napo system in the north east of Ecuador close to the border with Peru. *Apistogramma aguarico* sp. n. is distinguished from all other *Apistogramma* species by the combination (in adult males) of: truncate unmarked caudal fin with streamer-like extensions to both upper and lower lobes in large individuals; four irregular abdominal lines formed by series of highly variable spots; serrate dorsal fin with membranes clearly prolonged past tips of spines; and ivory spot surrounding and including pectoral-fin base. The species is thought to be a representative of the *Apistogramma eunotus* complex within the *Apistogramma regani* lineage.

Resumen

Una nueva especies de *Apistogramma*, *Apistogramma aguarico sp. n.*, ha sido descrita en base de 9 especímenes, encontrada en un brazo muerto del Rio Lagartococha, un proveniente del Rio Aguarico en el sistema del Rio Napo cerca de El Pozo, Distrito de Santa María, Provincia Mariscal Ramón Castilla, Departamento Loreto, Ecuador (aproximadamente 09°47′ Sur y 75°57′ Oeste). *Apistogramma aguarico* sp. n. es distinta de otras especies de *Apistogramma* por su combinación de (en machos adultos): la aleta caudal, que (en machos) es truncada y no marcada (con una punta arriba y abajo en individuos grandes), los cuadro rayas abajo de cuerpo, que son evidentes aunque formadas por manchas irregulares, de la aleta dorsal serrada, que tiene membranas prolongadas arriba, y por una mancha del color marfil localizada en la base de la aleta pectoral. *Apistogramma aguarico* sp. n. es clasificada como representante del *Apistogramma-eunotus*-complejo dentro de la *Apistogramma-regani*-línea.

Kurzfassung

Apistogramma aguarico sp. n. wird auf Basis von 9 Exemplaren beschrieben, die aus einem Altarm des Rio Lagartococha (etwa 09°47′ S / 75°57′ W), einem Zufluss des zum Rio Napo gehörenden Rio Aguarico aus dem nordöstlichen Grenzgebiet Ecuadors zu Peru stammen. Die Art ist von allen anderen *Apistogramma*-Arten durch die Kombination von bei Männchen gestutzter zeichnungsloser Schwanzflosse, die bei großen Individuen zwei zipfelige Verlängerungen im oberen und unteren Lappen entwickelt, vier deutlichen unregelmäßigen aus ungleichmäßig geformten Flecken gebildeten Unterkörperstreifen, gesägter Dorsale mit deutlich über die Hartstacheln verlängerten Membranen und elfenbeinfarbenem Fleck um die Basis der Pectorale gekennzeichnet. *Apistogramma aguarico* sp. n. wird als Vertreter des *Apistogramma-eunotus*-Komplexes innerhalb der *Apistogramma-regani*-Linie eingestuft.

Key words

Cichlidae, ecology, freshwater, ichthyology, Neotropics, new taxa, systematics.

Prefatory Remarks

In recent years several new *Apistogramma* species have been discovered in Peru (Ortega & Vari 1998; Ortega *et al*. 2011, 2012; Römer *et al*., 2013), in clear contrast to the situation in neighbouring Ecuador. Recent studies in the context of the multi-national project Laboratoire Mixte International (LMI) have brought to light evidence that several undetermined (local) morphs of some of these species will need to undergo careful taxonomic revision (Römer *et al*. 2011, 2012, 2013). Some of them are known from Ecuador as well as from Peru. In the past decade species related to *Apistogramma eunotus* have gained far less attention than species of other phylogenetic groups within the genus from this region. Specimens of two undescribed species were accidentally discovered by UR, accompanied by Mike Wise and David P. Soares, during a visit to the FMNH in Chicago in 2006, when they had the opportunity to check some specimens of Neotropical dwarf cichlids in the museum's collection. Part of this material formed the type series of *Apistogramma playayacu*, recently described by Römer *et al*. (2011). The purpose of this work is to provide a formal description of the second undescribed species discovered during the visit at the FMNH, to facilitate nomenclature during further research activities, especially ecological studies and environmental planning processes, as well as research to resolve the question of whether the two species are native solely to Ecuador or also distributed in the Peruvian part of the Napo system.

Material and Methods

Methods for preservation, counts, and measurements are given in detail in Römer (2006a), Römer & Hahn (2008), and Römer *et al*. (2003, 2004, 2006, 2010, 2011, 2012) except where otherwise stated. For museum acronyms see Leviton *et al*. (1985). GPS data were extracted and combined from ONC Flight Navigation Charts (Ministry of Defence, UK) and Google Earth. The description of preserved specimens is based on the holotype, generally supplemented by observations on the paratypes. Photographs of all specimens were taken under standardised conditions specified in Römer *et al*. (2011). Gill rakers and pharyngeal elements have been excluded from this study, as these are the subject of further investigations still in progress. The description of live coloration is restricted to a few diagnostic features of known appearance taken from photographs. Additional description of live coloration and its variation have had to be postponed until sufficient live specimens are available for detailed behavioural and reproductive studies in the laboratory. Römer (2000, 2006 a, b, c) and Römer *et al*. (2003, 2004, 2006) have explained the reasons for giving detailed descriptions of live coloration in *Apistogramma* species. All type specimens were (as was usual in the 1980s) originally preserved in formalin solution and transferred into 70% ethanol later on. DNA samples have nevertheless been taken, fixed, and stored under conditions described by Römer *et al*. (2010) for future examination.

Apistogramma aguarico sp. n.

Holotype. FMNH 101588 (fig. 1), male, 49.4 mm SL; South America, Ecuador, río Napo system, laguna (approx. 09°47 ′ S / 75°57 ′ W) connected to río Lagartococha, about 25 km upstream from confluence with río Aguarico, field station DJS83-63, coll. 01. Nov. 1983 by D. Steward, M. Ibarra and R. Barriga.

Paratypes. 8 specimens: FMNH 117725, 1 male, 30.7 mm SL, 2 females, 16.3 – 17.7 mm SL; same collection data as for holotype. FMNH 117726, 2 males, 31.4 – 28.3 mm SL, 2 females, 13.3 – 15.9 mm SL; MTD F 32379, 1 male, 43.2 mm SL; same collection data as for holotype.

Comparative material

As listed in Römer (1994, 1997, 2006 a), Römer & Hahn (2008), Römer & Warzel (1998), and Römer *et al*. (2003, 2004, 2006 a, 2011, 2012).

Diagnosis. *Apistogramma aguarico* sp. n. is distinguished from all other *Apistogramma* species known to date on the basis of the combination of the following characters: adult males with basically truncate transparent caudal fin without markings, both lobes with filamentous streamers in largest specimens; first membranes of dorsal fin pointed and prolonged to nearly double length of spine, creating serrated impression; base of pectoral fin whitish to ivory without any dark markings in all specimens examined, creating distinct contrast with overall yellowish-brown body; broad lateral band on L+1-scale row, ending on upper third of caudal peduncle at vertical bar 7, separated from rectangular spot on centre of caudal base, centre of spot light brown creating impression of divided spot; two to three fragmentary rows of distinct oval abdominal spots, more intense in caudalmost part above anal fin; gill cover significantly darker than rest of body below lateral band; distinct preorbital, postorbital, and cheek stripes; no black markings on ventral surface of head or body apart from short narrow grey pre-anal stripe, occasionally visible in very large specimens only.

Description. Morphological characters: (n = 9, 13.3 to 49.4 mm SL); (for biometric data see Tables 1 – 3, for meristic data see Table 4).

Habitus (Fig. 1). Body moderately elongate and (especially in larger specimens) fairly deep (31.2 to 38.9 % SL,

Fig. 1. *Apistogramma aguarico* sp. n., holotype, FMNH 101588, male, 49.4 mm SL; 28 years after preservation (all figures U. Römer unless otherwise stated).

mean 35.3 % SL), clearly compressed laterally, usually barely twice, in adult males more than twice, as deep as wide, head long (33.1 to 40.2 % SL, mean 36.5 % SL), overall creating fairly robust appearance. Only few statistically significant differences in proportions between sexes: adult males usually nearly twice as large as females, with relatively larger head and predorsal lengths, deeper body, relatively wider head, larger eye, longer snout, upper jaw, dorsal-fin base, last dorsal spine, and pectoral fin. Upper head profile regularly convex; lower head profile only slightly convex in large males, almost straight from lip to posterior margin of lower jaw in smaller specimens. Mouth terminal and rounded, jaws not enlarged; lips thick and fleshy, not hypertrophied; maxillary extending roughly to vertical below anterior margin of pupil; eye relatively large for species of this phylogenetic group (diameter 10.7 to 13.8 % SL); cheek largely naked anteriorly, scale pattern as given for *Apistogramma urteagai* in Kullander (1986, Fig. 51); 5 dentary and 4 infraorbital pores. Ventral [V I.5 (n = 9)] pointed, slightly prolonged in smaller individuals, when folded extending to posterior half of caudal fin in adult males. Pectoral [11 (n = 1), 12 (n = 8] rounded, when folded extending to above base of second anal-fin spine. Dorsal [D. XV.4 (n = 1), XV.6 (n = 2), XV.7 (n = 5), XVI.6 (n = 1)], spines increasing in length from D1 to last, but significantly less from D5 or D6, last dorsal spine normally longest; in adult males membranes pointed, significantly prolonged past tips of spines, extensions of membranes D2 to D5 about twice of length of spines; lappets in adult females short, usually rounded, in some cases truncated; soft dorsal fin rounded in females, noticeably pointed in males with 3rd and / or 4th ray longest, in largest males tip extending significantly beyond posterior margin of caudal fin. Anal [A. III.5 (n = 3), III.6 (n = 5), IV.6 (n = 1)] pointed in adult males, soft portion extending to posterior edge of caudal fin when folded; rounded in females and smaller males, when folded extending barely to first third of caudal fin. Caudal with 16 (n = 8), 17 (n = 1) principal soft rays; with rounded posterior edge in all preserved specimens examined except two largest males (but note that lower part of fin in holotype had obviously been clipped off previously); in both sexes scaled for up to first third. Caudal peduncle in adult specimens about 25 % to 40 % deeper than long, scale pattern as given for *Apistogramma cruzi* in Kullander (1986), 16 scales around caudal peduncle (n = 9). Abdominal scales in median longitudinal row 20 to 22 [20 (n = 1), 21 (n = 3), 22 (n = 4), 1 damaged].

Coloration of preserved specimens. (after about 30 years in 75% ethanol) Basic colour of body predominantly brownish, somewhat paler in some smaller specimens, margins of body scales with darker edgings. Lower lip, lower jaw, unscaled parts of cheek, chin, central parts of branchiostegal membrane, and chest light yellowish brown. Mid-ventral region pale greyish in males, whitish in females, in large specimens of both sexes occasionally with narrow dark greyish anal stripe. Abdomen at base of pectoral fin porcelain whitish to ivory without any black pigmentation. Upper lip basically greyish brown. No distinct interorbital stripe. Operculum dark brownish, forming distinct contrast with significantly paler subopercular. Cheek stripe blackish, in both sexes about as wide as pupil, beginning between foramina 1 and 2 of posterior orbital of suborbital series (for terminology see Kullander, 1987), running backwards in straight line between lateral canal foramina (LCF) 10 and 11 across posterior half of cheek to lower posterior margin of preopercular and to posterior tip of interoperculum. Blackish-grey snout stripe straight, about half as wide as cheek stripe in all specimens. Forehead from interorbital to dorsum below first dorsal spine dark brownish. Distinct dorsal spots basal to dorsal fin in larger specimens, in smaller only faint blackish stripe below dorsal-

Fig. 2. Specimen provisionally identified as *Apistogramma aguarico* sp. n., non type, male, live coloration in the aquarium, adult subdominant, aggressive. Photo: D. Bork.

Fig. 3. Same individual as shown in Fig. 2; dominant, aggressive. Photo: D. Bork.

fin base. Iris dark bluish grey. Seven vertical bars, not split, about twice as wide as intervals, only partially visible in larger specimens, completely in smallest individuals. All specimens with two to four more or less distinct abdominal stripes consisting of horizontal rows of roughly rectangular to squarish blackish or brownish spots; stripes about two thirds of height of L-1 to L-4 scale rows respectively, such that each only around half as wide as that above; in large males coloration of caudalmost part of stripes much more intense than anterior portion. Lateral band straight, one scale high and occupying L+1 scale row in anterior third, widening by at least 33% in posterior part, extending from rear edge of orbital to barely to the upper posterior end of caudal peduncle.

Fig. 4. Specimen provisionally identified as *Apistogramma aguarico* sp. n., non type, female, live coloration in the aquarium, adult subdominant, neutral mode. Photo: D. Bork.

Fig. 5. Same individual as shown in Fig. 4; dominant, brood-care coloration. Photo: D. Bork.

In small number of smaller females lateral band widened at intersections with vertical bars, giving impression of row of five lateral spots. No separate lateral spot. Distinct caudal-peduncle spot roundish to rectangular, about half as high as caudal peduncle, in most male and few female specimens divided horizontally by light brownish zone, giving impression of double spot. All unpaired fins pale brown to dusky grey yellowish, pectorals hyaline whitish, ventrals whitish grey. Under microscope all fins with regular pattern of small light greyish chromatophores. Mature males with narrow irregular blackish pigmentation along membranes of caudal fin, more intense close to base of fin. Pectoral membranes transparent, with few small spots of brownish pigment along fin-rays. Ventral

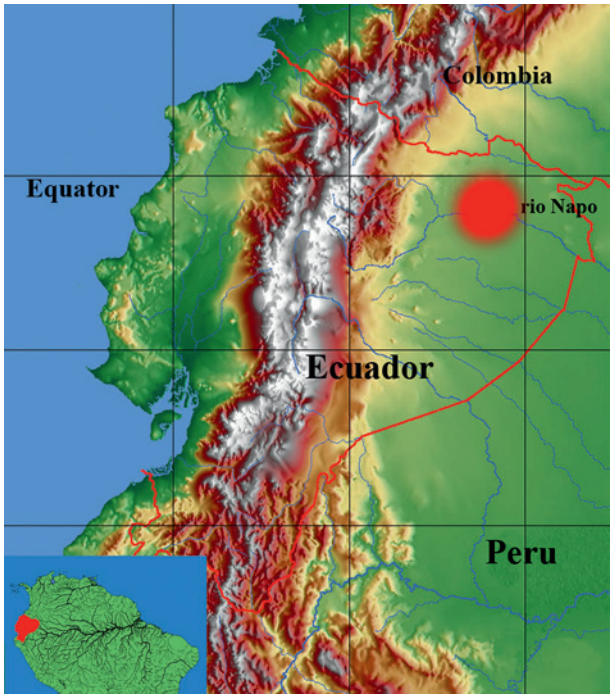

Fig. 6. Putative distribution of *Apistogramma aguarico* sp. n. in Ecuador. The type locality is indicated by a red dot.

fins in males without conspicuous dark markings, in females anterior part along spine and adjacent two to three membranes densely speckled with dark black-brown spots, giving about anterior third of fin blackish appearance. Anal fin in males with blackish spots on basal third, absent in females. In both sexes coloration of dorsal fin uniform, without marginal or other bands or other distinctive markings except dark spots on basal fifth of each membrane and sooty anterior membranes: in males first two and distal half of third, in females first three, exceptionally four, blackish. Soft portion of dorsal fin without rows of hyaline spots.

Coloration of live specimens. Little is known about the live coloration of *Apistogramma aguarico* sp. n.. Two specimens possibly belonging to this species were imported alive to FRG as a bycatch; subsequently UR had the opportunity to check another four specimens that had been collected by Sergio Llanos near Cabo Pontoja close to the Ecuadorian border in Peru. These six specimens, the first two of which we have seen only in photographs by Dieter Bork, may perhaps be the same species as the specimens we have examined for this description. But this provisional identification must be treated with due caution. All these live specimens were clearly sexually dimorphic and dichromatic, as is the case with the type material. However, the lack of properly authenticated living specimens means that detailed description of live coloration must be postponed until adequate live material of the species becomes available.

Systematic relationships. *Apistogramma aguarico* sp. n. is apparently a member of the *Apistogramma regani* lineage but *incertae sedis* within it (for nomenclature see Römer, 2006c). Some traits of the species seem to place it closer to *Apistogramma cruzi* Kullander, 1986, others to *A. eunotus* Kullander, 1981 itself. Closer studies of the phylogenetic position of the new species within the genus are required, ideally based on freshly collected material from the type locality.

Distribution and ecology. The species is known from only a single collecting site in the Ecuadorian río Napo system. *Apistogramma aguarico* sp. n. was collected 30 years ago in the drainage of the río Lagartococha, which is part of the río Aguarico system. The area is nowadays part of the Cuyabeno National Park. Another species new to science, *Apistogramma playayacu* Römer *et al*., 2011, has recently been reported from this river system. But there is nevertheless no indication of whether the two species are actually syntopic, as the museum specimens were stored in separate lots. Hence future field studies should not only focus on the distribution of the two species, but also investigate any possible socio-ecological relationships in detail.

In 2012 a few specimens of *Apistogramma* that accorded well with the putative live appearance of the preserved *Apistogramma aguarico* sp. n. were collected by local fishermen in the wider vicinity of the settlement of Cabo Pontoya. Some of these were transferred to the multinational Biodiversity in *Apistogramma* research project within the Laboratoire Mixte International (LMI-EDIA) and exported alive by UR to the laboratory in the FRG. The collection area for this live material was roughly 130 km downriver from the type locality of *Apistogramma aguarico* sp. n., and although we were unable to verify the identity of the new material with that species, information on its possible distribution in this area is of considerable interest given that it may also be present and more widespread in Peruvian parts of the río Napo system further downriver.

As the distribution and ecology of *Apistogramma aguarico* sp. n. are at present virtually unknown (no reports on biology, ecology or behaviour are as yet available), further studies in the field are urgently required.

Etymology. The specific name *aguarico* is a noun in apposition and refers to the type locality being situated in the río Aguarico system.

Discussion

Apistogramma aguarico sp. n. is the 83rd species of *Apistogramma* to be formally described.

The new species can be readily distinguished from all members of the *Apistogramma agassizii* lineage (nomenclature following Römer 2006 a, c) by a completely

Table 1. Biometric data of *Apistogramma aguarico sp. n.* type specimens (as % of SL; SL in mm).

		all specimens						males						females				abbreviations
	HT	**(n)**	**mean**	**min.**	**max.**	**st.dev.**		**(n)**	**mean**	**Min.**	**max.**	**st.dev.**		**n)**	**mean**	**min.**	**max.**	**St.dev.**	HT = Holotype / PT = Paratype
SL	49.4	9	27.4	13.3	49.4	12.79		5	36.6	28.3	49.4	9.19		4	15.8	13.3	17.7	1.88	standard length
TL	68.5	9	136.8	131.1	141.0	3.08		5	135.6	131.1	139.1	3.46		4	138.3	136.7	141.0	2.02	total length
TLS	71.4	9	137.5	131.1	144.6	4.01		5	136.8	131.1	144.6	5.29		4	138.3	136.7	141.0	2.02	total length plus streamer
HL	19.6	9	36.5	33.1	40.2	2.75		5	35.0	33.1	39.6	2.64		4	38.3	36.3	40.2	1.77	head length
HD	15.8	9	27.9	26.0	32.0	1.95		5	28.0	26.3	32.0	2.27		4	27.7	26.0	30.2	1.80	head depth
BD	19.2	9	35.3	31.2	38.9	2.92		5	35.0	31.2	38.9	2.80		4	35.8	32.5	38.8	3.43	body depth
HW	9.5	9	18.5	16.0	20.5	1.60		5	17.7	16.0	19.2	1.38		4	19.5	17.5	20.5	1.35	head width
PDL	17.6	9	37.4	35.1	40.8	2.00		5	36.0	35.1	37.3	0.94		4	39.2	37.4	40.8	1.40	pre-dorsal length
TDL	44.9	9	89.1	86.9	92.1	1.80		5	88.6	87.1	90.8	1.40		4	89.8	86.9	92.1	2.22	trans-dorsal length
PVL	21.0	9	40.1	38.4	42.5	1.45		5	40.0	38.4	42.4	1.52		4	40.3	39.0	42.5	1.57	pre-pelvic length
PAL	33.9	9	74.7	70.1	77.6	2.54		5	73.7	70.1	77.1	2.65		4	75.8	73.1	77.6	2.18	pre-anal length
TAL	42.9	9	86.3	83.0	88.8	2.16		5	85.7	83.6	87.4	1.60		4	87.1	83.0	88.8	2.74	trans-anal length
Eye	6.1	9	12.2	10.7	13.8	1.15		5	11.4	10.7	12.4	0.69		4	13.3	12.9	13.8	0.47	eye diameter
SNL	4.5	9	6.9	6.0	9.2	1.04		5	7.0	6.0	9.2	1.32		4	6.7	6.0	7.6	0.70	snout length
CHD	4.7	9	7.2	6.2	9.6	1.07		5	7.6	6.4	9.6	1.31		4	6.7	6.2	7.2	0.41	cheek depth
POD	2.1	9	2.9	2.0	4.2	0.61		5	3.3	2.8	4.2	0.57		4	2.5	2.0	2.8	0.34	pre-orbital depth
IOW	4.6	9	7.7	6.6	9.4	0.85		5	8.0	7.3	9.4	0.78		4	7.3	6.6	8.5	0.83	inter-orbital width
UJL	6.4	9	9.6	6.7	13.0	1.72		5	10.7	9.6	13.0	1.39		4	8.4	6.7	9.4	1.22	upper-jaw length
LJL	7.7	9	13.7	11.6	15.8	1.52		5	13.9	11.6	15.5	1.53		4	13.6	11.9	15.8	1.73	lower-jaw length
CPD	9.0	9	15.5	12.5	18.2	1.59		5	15.7	14.7	18.2	1.43		4	15.2	12.5	16.8	1.96	caudal-peduncle depth
CPL	6.7	9	12.3	9.7	16.2	2.00		5	12.5	10.8	13.5	1.20		4	12.0	9.7	16.2	2.93	caudal-peduncle length
DFB	29.9	9	57.3	53.2	62.7	2.96		5	59.3	56.7	62.7	2.47		4	54.9	53.2	55.7	1.17	dorsal-fin base length
AFB	10.1	9	19.6	17.6	21.1	1.03		5	19.8	17.6	21.1	1.31		4	19.3	18.4	19.7	0.62	anal-fin base length
PecL	15.9	9	27.6	22.0	32.3	3.34		5	29.8	27.2	32.3	1.91		4	24.8	22.0	27.6	2.49	pectoral-fin length
PelL	21.1	9	33.3	28.2	42.7	5.10		5	36.3	30.4	42.7	5.11		4	29.6	28.2	31.0	1.23	pelvic-fin length
PelSL	7.7	9	15.4	13.4	17.9	1.49		5	15.1	13.4	16.6	1.29		4	15.7	13.5	17.9	1.87	pelvic-fin spine length
LDS	11.7	9	17.4	15.0	23.7	3.07		5	19.0	15.1	23.7	3.42		4	15.5	15.0	16.8	0.85	last dorsal spine length
LAS	9.4	9	17.6	15.4	19.1	1.32		5	18.0	16.0	19.1	1.26		4	17.0	15.4	18.7	1.34	last anal spine length

Table 2. Biometric data of *Apistogramma aguarico sp. n*. type specimens (in mm; for abbreviations see table 1).

		all specimens						males						females				
	HT	**(n)**	**mean**	**min.**	**max.**	**st.dev.**		**(n)**	**mean**	**min.**	**max.**	**st.dev.**		**n)**	**mean**	**min.**	**max.**	**st.dev.**
SL	49.4	9	27.4	13.3	49.4	12.79		5	36.6	28.3	49.4	9.19		4	15.8	13.3	17.7	1.88
TL	68.5	9	37.4	18.4	68.5	17.53		5	49.8	37.1	68.5	13.27		4	21.9	18.4	25.0	2.74
TLS	71.4	9	37.7	18.4	71.4	18.20		5	50.4	37.1	71.4	14.33		4	21.9	18.4	25.0	2.74
HL	19.6	9	9.9	5.3	19.6	4.70		5	13.0	9.4	19.6	4.15		4	6.0	5.3	7.0	0.68
HD	15.8	9	7.7	4.0	15.8	3.96		5	10.4	7.6	15.8	3.35		4	4.4	4.0	4.9	0.40
BD	19.2	9	9.7	5.1	19.2	4.92		5	13.0	8.8	19.2	4.26		4	5.7	5.1	6.9	0.83
HW	9.5	9	5.0	2.7	9.5	2.24		5	6.5	4.7	9.5	1.86		4	3.1	2.7	3.5	0.37
PDL	17.6	9	10.0	5.4	17.6	4.30		5	13.1	10.4	17.6	3.14		4	6.2	5.4	6.9	0.62
TDL	44.9	9	24.4	11.5	44.9	11.40		5	32.5	25.0	44.9	8.49		4	14.2	11.5	16.3	2.00
PVL	21.0	9	11.0	5.3	21.0	5.27		5	14.7	11.1	21.0	4.07		4	6.4	5.3	7.5	0.90
PAL	33.9	9	18.5	8.8	33.9	8.45		5	24.5	18.8	33.9	6.19		4	10.9	8.8	12.1	1.45
TAL	42.9	9	23.6	11.0	42.9	10.89		5	31.4	23.9	42.9	7.93		4	13.8	11.0	15.6	1.98
Eye	6.1	9	3.3	1.8	6.1	1.40		5	4.2	3.2	6.1	1.22		4	2.1	1.8	2.3	0.21
SNL	4.5	9	2.0	0.8	4.5	1.20		5	2.7	1.8	4.5	1.20		4	1.1	0.8	1.3	0.23
CHD	4.7	9	2.1	0.9	4.7	1.30		5	2.9	1.9	4.7	1.24		4	1.1	0.9	1.3	0.17
POD	2.1	9	0.9	0.3	2.1	0.58		5	1.2	0.8	2.1	0.53		4	0.4	0.3	0.5	0.07
IOW	4.6	9	2.2	0.9	4.6	1.22		5	3.0	2.1	4.6	1.04		4	1.2	0.9	1.5	0.24
UJL	6.4	9	2.8	1.1	6.4	1.79		5	4.0	2.9	6.4	1.55		4	1.3	1.1	1.7	0.25
LJL	7.7	9	3.8	1.9	7.7	2.04		5	5.2	3.6	7.7	1.78		4	2.1	1.9	2.5	0.24
CPD	9.0	9	4.3	2.0	9.0	2.32		5	5.8	4.2	9.0	2.01		4	2.4	2.0	2.9	0.38
CPL	6.7	9	3.4	1.6	6.7	1.75		5	4.6	3.1	6.7	1.36		4	1.9	1.6	2.7	0.52
DFB	29.9	9	16.0	7.0	29.9	8.24		5	21.8	16.2	29.9	6.23		4	8.7	7.0	9.9	1.19
AFB	10.1	9	5.4	2.6	10.1	2.71		5	7.3	5.5	10.1	2.15		4	3.0	2.6	3.3	0.30
PecL	15.9	9	7.9	3.5	15.9	4.50		5	11.1	7.7	15.9	3.46		4	3.9	3.5	4.9	0.66
PelL	21.1	9	9.6	4.0	21.1	5.90		5	13.6	9.0	21.1	5.06		4	4.7	4.0	5.5	0.62
PelSL	7.7	9	4.2	2.1	7.7	1.88		5	5.5	4.1	7.7	1.35		4	2.5	2.1	3.2	0.48
LDS	11.7	9	5.1	2.0	11.7	3.25		5	7.1	4.3	11.7	2.98		4	2.5	2.0	3.0	0.40
LAS	9.4	9	4.9	2.3	9.4	2.50		5	6.6	5.0	9.4	1.93		4	2.7	2.3	3.3	0.43

different body shape (deep and massive *versus* long and slender in the *Apistogramma agassizii* lineage).

Species of the *Apistogramma steindachneri* lineage (including all species more closely related to *Apistogramma cacatuoides* Hoedeman, 1951) are distinguished from *Apistogramma aguarico* sp. n. by having a different head and mouth structure (significantly enlarged with massive jaws), reduced number of infraorbital pores (3 *versus* 4 in the new species), in many cases by caudal fin either banded or with broad coloured margin, as well as by otherwise completely different coloration including large lateral spots or bands as in species related to *Apistogramma nijsseni* Kullander, 1979.

Having thus eliminated around 60 % of known *Apistogramma* species, only a number of species of the *Apistogramma regani* lineage remain to be differentiated from the new species described here. Only a few of these exhibit diagnostic features comparable to those found in *Apistogramma aguarico* sp. n.. Several of these species can be eliminated by virtue of their pattern of black dots or lines on the body above the lateral band; they include *Apistogramma guttata* Antonio *et al*., 1990, *Apistogramma playayacu* Römer *et al*. 2011, *Apistogramma rubrolineata* Hein *et al*., 2002, *Apistogramma tucurui* Staeck, 2003, and the as yet undetermined forms *Apistogramma* sp. "Peixoto" (Römer 2006), *A*. sp. "Jabuti" (Koslowski in Stawikowski 2005), and *A*. sp. "Vielflecken" (Römer 2006). Several other species can be differentiated from *Apistogramma aguarico* sp. n. by lacking the distinctive abdominal stripes of this species, in particular *Apistogramma acrensis* Staeck, 2003, *A*. *cinilabra* Römer *et al*. 2011, *A*. *eunotus* Kullander, 1981, *A*. *moae* Kullander, 1980, and *A*. *resticulosa* Kullander, 1980. Most of these species are additionally distinguished by the different size and shape of the spot on the caudal base. Only *Apistogramma cruzi* Kullander, 1986 shares that basic feature, but is readily distinguished from *Apistogramma aguarico* sp. n. by differences in shape of dorsal fin (rounded and not produced in *A*. *cruzi*), in abdominal stripes (narrower and more regular in *A*. *cruzi*), in cheek stripe (significantly broader in *A*. *cruzi*), and in coloration of pectoral-fin base (covered with greyish chromatophores in *A*. *cruzi*).

It is unclear whether or not the paratype material of *Apistogramma cruzi* collected in the Colombian Rio Putumayo system is conspecific with *Apistogramma aguarico* sp. n.. The photographs given in Kullander (1986) show some overall similarity, but we have not

Table 3. Biometric data of *Apistogramma aguarico sp. n*. type specimens (raw data given in mm; for abbreviations see table 1).

Coll.No.	Status	Sex	SL	TL	TLS	HL	HD	BD	HW	PDL	TDL	PPL	PAL	TAL	Eye	SNL	CHD	POD	IOW	UJL	LJL	CPD	CPL	DFB	AFB	PecL	PelL	PelSL	LDS	LAS
FMNH 101588	HT	m	49.4	68.5	71.4	19.6	15.8	19.2	9.5	17.6	44.9	21.0	33.9	42.9	6.1	4.5	4.7	2.1	4.6	6.4	7.7	9.0	6.7	29.9	10.1	15.9	21.1	7.7	11.7	9.4
MTD F 32379	PT	m	43.2	58.8	58.8	14.4	11.4	15.5	6.9	15.2	37.6	16.6	27.5	36.1	4.6	3.2	3.6	1.4	3.4	4.7	6.4	6.7	5.1	27.1	9.1	13.4	16.1	5.8	8.4	7.8
FMNH 117726	PT	m	31.4	41.9	41.9	10.8	8.6	10.6	5.8	11.7	27.9	12.6	22.0	27.5	3.4	1.9	2.3	1.0	2.4	3.0	3.6	4.8	4.2	18.6	5.5	9.1	9.6	5.2	5.1	5.0
FMNH 117725	PT	m	30.7	42.7	42.7	10.6	8.5	10.8	5.6	10.8	26.9	12.2	20.4	26.4	3.6	1.8	2.0	0.9	2.4	3.0	4.1	4.6	4.1	17.4	6.2	9.1	12.0	4.9	6.3	5.9
FMNH 117726	PT	m	28.3	37.1	37.1	9.4	7.6	8.8	4.7	10.4	25.0	11.1	18.8	23.9	3.2	1.8	1.9	0.8	2.1	2.9	4.0	4.2	3.1	16.2	5.6	7.7	9.0	4.1	4.3	5.0
FMNH 117725	PT	f	17.7	25.0	25.0	7.0	4.9	6.9	3.6	6.9	16.3	7.5	12.1	15.6	2.3	1.3	1.3	0.5	1.5	1.7	2.5	2.9	1.8	9.9	3.3	4.9	5.5	3.2	3.0	3.3
FMNH 117725	PT	f	16.3	22.3	22.3	5.9	4.3	5.3	2.9	6.1	14.6	6.4	11.5	14.5	2.1	1.0	1.1	0.3	1.1	1.1	2.1	2.0	2.7	9.1	3.2	3.6	4.6	2.5	2.5	2.5
FMNH 117726	PT	f	15.9	21.8	21.8	6.0	4.3	5.3	3.2	6.3	14.5	6.3	11.2	14.1	2.2	1.1	1.0	0.4	1.1	1.3	1.9	2.4	1.6	8.8	3.1	3.8	4.6	2.2	2.4	2.7
FMNH 117726	PT	f	13.3	18.4	18.4	5.3	4.0	5.1	2.7	5.4	11.5	5.4	8.8	11.0	1.8	0.8	0.9	0.4	0.9	1.2	2.1	2.2	1.6	7.1	2.6	3.5	4.0	2.2	2.0	2.3

Table 4. Meristric data of *Apistogramma aguarico sp. n*. type specimens (SL in mm; for abbreviations see last column of table).

Coll.No.	Status	Sex	SL	DF (h)	DF (s)	DF (i)	AF (h)	AF (s)	PF (h)	PF (s)	PecF	CF	abbreviations
FMNH 101588	HT	m	49.4	15	7	0	3	6	1	5	12	16	**AF** = anal fin
MTD F 32379	PT	m	43.2	16	5	1	4	6	1	5	11	16	**CF** = caudal fin
FMNH 117726	PT	m	31.4	15	7	0	3	6	1	5	12	16	**DF** = dorsal fin
FMNH 117725	PT	m	30.7	15	6	1	3	6	1	5	12	17	**PecF** = pectoral fin
FMNH 117726	PT	m	28.3	15	7	0	3	6	1	5	12	16	**PF** = pelvic fin
FMNH 117725	PT	f	17.7	15	7	0	3	6	1	5	12	16	**(h)** = hard rays (spines)
FMNH 117725	PT	f	16.3	15	6	0	3	5	1	5	12	16	**(s)** = soft rays
FMNH 117726	PT	f	15.9	15	4	0	3	5	1	5	12	16	**(i)** = minor soft rays
FMNH 117726	PT	f	13.3	15	6	0	3	5	1	5	12	16	

examined the specimens in question. This is, however, of minor relevance here. Following Römer *et al*. (2011, 2012), we assume the type material of *A*. *cruzi* to be polytypic, and hence this discussion is restricted to the holotype of that species. The holotype of *A*. *cruzi* was collected at the mouth of the Rio Mazan and can be clearly differentiated from *Apistogramma aguarico* sp. n. as discussed above. The sampling point (type locality) for *Apistogramma aguarico* sp. n. is roughly 600 km upstream of that for *A*. *cruzi* on the river.

Apistogramma alacrina Kullander, 2004, which originates from the same geographical area as *Apistogramma aguarico* sp. n, is easily distinguished from the latter by a distinct large black spot at the base of the pectoral fin, which is very different to the pattern in the new species.

Thus no other known species of *Apistogramma* can be mistaken for *Apistogramma aguarico* sp. n., as the combination of its morphological and colour characters is unique within the genus.

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