

BULLETIN ZOOLOGISCH MUSEUM



Vol. 7 No. 16 1980

DESCRIPTION OF A NEW SPECIES OF *APISTOGRAMMA* FROM THE RIO MADEIRA SYSTEM IN BRAZIL (TELEOSTEI, CICHLIDAE)

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ABSTRACT

Apistogramma resticulosa sp.n. is described on the basis of six specimens, 12.8–26.5 mm standard length, from near Humaitá, Brazil. It belongs to the *A. regani* species-group and is distinguished by the vertical dash-marking of the abdominal sides.

INTRODUCTION

A major part of the South American cichlid genus *Apistogramma* Regan, 1913, was recently revised (Kullander, 1979, 1980a), but several species remain to be described. Some of these are represented by poorly preserved material, but recent collections from previously unexplored areas also contain new forms. Many of these appear to belong to the *A. regani* group, with six species described from the Amazônia in Brazil and Guyana. In these species, the sexes are rather isomorph, the males lacking the spectacular secondary sex

characteristics, such as produced dorsal fin lappets or caudal fin streamers, which are among the most useful taxonomic characters in the genus. Colour pattern must therefore be heavily relied upon for identification. The new species described below on the basis of fine, recently collected material, is notable for its distinctive abdominal side markings, and is also of interest because it comes from an ichthyologically little known part of Amazônia.

Methods are as explained in Kullander (1980a, b). Abbreviations employed include CP (caudal peduncle), LP (lower pharyngeal tooth-plate),

SL (standard length), TL (total length), NRM (Swedish Museum of Natural History), and ZMA (Zoölogisch Museum Amsterdam). In the text, frequency is given in parentheses following each count.

Apistogramma resticulosa sp.n.

(Fig. 1)

Material.-

Holotype: ZMA 116.177, adult ♂, 26.5 mm SL, 37.3 mm TL. Brasil, Estado do Amazonas, R. Madeira drainage system, Igarapé Xicanga, about 5 km W of Humaitá (07° 31'S 63° 04'W). 24 August 1976. leg. H.R. Axelrod, J. Géry, and others. Paratypes: ZMA 114.270, adult ♀, 25.6 mm, 2 juvs., 12.8, 15.6 mm, NRM 11320, young ♂, 20.5 mm SL. Collected together with the holotype; ZMA 114.277, adult ♂, 24.8 mm SL. Brasil, Estado do Amazonas, R. Madeira drainage system, drying pool 18 km W of Humaitá (c. 07° 31'S 63° 08'W). 24 August 1976. leg. H.R. Axelrod, J. Géry, and others.

The type-series consists of ethanol-preserved material in fine condition except for the somewhat faded ZMA 114.277 paratype.

Diagnosis.-

Head length 32.0-35.2 %, body depth 32.7-37.4% of SL. CP length 68.9-80.0% of CP depth. D. XV.6-7, XVI.6. A. III.5.i-7. Squ. long. 22-23. Rakers 2-3. Preoperculum entire. Dorsal fin without produced lappets. Caudal fin rounded. No lateral spot, but spot in Bar 2 in young, absent adults; pectoral spot, bars and caudal spot present. Short dark vertical stripes at bases of scales on abdominal sides, but no abdominal stripes, chest blotch or midventral stripe. Dorsal fin dark anteriorly. Caudal fin with vertical stripes of spots. (Six specimens, 12.8-26.5 mm SL.) A species of the *A. regani* group, distinguished by the abdominal side markings. Related species either have horizontal rows of spots or lack abdominal side markings.

Description.-

Qualitative data from the holotype except where noted otherwise. Quantitative data from all specimens; refer also to Table I.

Body moderately elongate, broadest and deepest just behind gill cover. Dorsal contour continuous with predorsal contour, nearly straight, slightly ascending to below third to fourth dorsal spine, horizontal to below sixth spine, from which straight sloping. Chest contour straight, sloping; abdominal contour straight, deeper caudally, anal base contour about straight, sloping upwards. Dorsal contour of caudal peduncle straight, horizontal; ventral contour sloping. Head moderately elongate, longer than deep; shorter than or about equal to body depth (87.2-104.7%, \bar{x} = 96.1% of body depth). Predorsal contour straight ascending to nape, posteriorly gradually less inclined, angle of slope about 40°; preventral contour almost straight, angle of slope about 20-30°. Snout rather rounded, contours about equal, straight or dorsal slightly convex. Ascending processes of premaxillae extend back as far as anterior margin or orbit. Angle of maxilla c. 58°; aboral tip exposed, reaching just past anterior edge of orbit. Lower jaw distinctly longer than upper, but equal anteriorly. Orbit in dorsal and rostral halves of head, tangential to predorsal contour; diameter 35.2-43.2% (\bar{x} = 40.1% of head length).

The largest scales anteriorly on flanks, gradually decreasing in size towards side margins, to about two-thirds on caudal peduncle. Predorsal scales cycloid ventrally to an anteriorly curved line between dorsal tip of preoperculum and origin of dorsal fin. Chest not naked anteriorly; preventral scales cycloid. Cheek completely scaled except for rostroventral corner; scales in three series, cycloid except for the posteriormost. Opercular and some subopercular scales ctenoid, interopercular scales cycloid. Squ.tr. 7+1+1, squ.ped. 16 in all specimens. Lateral lines in holotype with 11+2p+4pb/4p+3+pc (right side) and 11+3p+4pb/4p+3 (left side) scales (p = pores; pb = subserial pores; pc = pore on caudal fin). Upper line extends to below penultimate dorsal spine; lower to above first anal ray. In the entire material one to four subserial pores in the 11 intact lines; a caudal pore in the holotype only. Dorsal and anal fins naked. In the holotype, proximal fourth of caudal fin covered by ctenoid scales. In the others, one sixth to one-fourth

of caudal fin scaled, distal scales occasionally cycloid.

Dorsal spines increase in length up to the fifth, from which onwards they are subequal. Lappets rounded, reaching slightly beyond spine tips, but not produced. Soft part pointed; second and third rays form a point reaching to about middle of caudal fin. In the entire material the soft fin pointed, not produced; in juveniles reaching to only slightly beyond caudal fin base. Soft anal fin similar but shorter. D. XV. 6 (1), XV.7 (4, including holotype), XVI.6 (1). A. III.5.i (holotype), III.6 (3), III.6.i (1), III.7 (1). Pectoral fin rounded; fourth ray longest; two dorsal marginal and four ventral marginal simple, middle rays with two branches; reaching in holotype to above second anal spine, in the others to above second or third anal spine; P. 11 (2), 12 (4). Ventral fin acuminate; outermost ray in holotype and ZMA 114.277 produced, to first anal ray, in smaller specimens not produced, to first or second anal spines, inner rays gradually shorter. Caudal fin elongately rounded; two marginal rays in each lobe simple, inner rays with two branches; 16 principal rays in all specimens.

Teeth of jaws in three series anteriorly, the outer continued laterally, the middle series only a short distance laterally; pointed, simple, slightly recurved apically; in outer series increasing in size anteriorwards; inner smaller than outer. 21/24 in holotype, 20/25 in 25.6 mm specimen, 22/21 in 24.8 mm specimen, in outer series on one side of upper/lower jaw (\bar{x} = 21.0/23.3).

Vertebrae 12+12 (4), supraneural 1 (4). Lower pharyngeal tooth-plate examined in one specimen only; shape and dentition as shown in Fig. 2. The teeth are relatively scattered, most close-set in the caudal edge series. The majority, particularly the median and mediocaudal, have an elongate, rostrocaudally extended base and are laterally compressed, narrower apically, and with strong, somewhat rostrad curved cusp. Rostral and caudolateral teeth much smaller and narrower, unicuspid with rostral saddle near apex.

Colour in alcohol. Holotype: Ground colour yellowish white, appearing white only on abdomen, chest and throat. Markings dark brown, vertical

bars faint brown.

Vertical bars indistinct, including superopercular bar and six bars reaching downwards to lateral band (Bars 2 to 4) or ventral body edge (Bars 5 to 7). Narrowly darkened along the base of the dorsal fin and dorsal edge of caudal peduncle. The narrow postorbital stripe is continued by a lateral band about one-half to one scale wide, to Bar 6, above lower lateral line, more intensely pigmented anteriorly but not spotted. No lateral spot.

Suborbital stripe indistinctly separated from the dark forehead colour, to about median line of nape; suborbital stripe of about pupil width to union of sub- and interopercula. Operculum dusky; chin darkened just below lower lip. Distinct pectoral spot; no midventral stripe. No abdominal stripes, but scale bases below lateral band each have a narrow dark vertical stripe, except on midline of abdomen and on chest.

Dorsal fin semitransparent, smoky, anterior two membranes and spines black; a weak dark spot on base between each spine and ray; soft fin with three vertical rows of spots on clear ground. Caudal fin basally faintly yellowish, distally clear, edge slightly smoky; about six irregular rows of spots over middle part; mid-base semilunar caudal spot. Anal fin smoky, a dark spot on the base of each membrane; soft portion with three short terminal spot-stripes on clear ground. Ventral fins clear, outer membrane blackish.

Paratypes (ZMA 114.270 and NRM 11320): Female similar but vertical bars slightly more distinct, caudal fin spots less distinct, ventral fins darker, no midventral stripe. Male with rather spotted lateral band, the spot in Bar 2 most distinct. In the 15.6 mm juvenile the suborbital stripe extends only over the cheek. The lateral band is rather faint, intensified where crossing the distinct but faint bars, to Bar 7. Vertical stripes on abdomen are present only in Bars 2, 3 and 4, below and close to the lateral band. There is no lateral spot, but an intense small spot in the lateral band where crossed by Bar 2. The smallest specimen is similar but the flank spot is not so intense. The caudal fin stripes become fewer and less distinct, the caudal spot more ovate with decreasing size. There is no apparent sexual dichromatism except that the

female has slightly more pronounced dark markings, darker ventral fins, and fainter, less distinct, caudal fin stripes than the males.

Distribution and ecology.-

Known only from the type-series, from near Humaitá in Brazil (Rio Madeira system). Axelrod (1977) has given a popular account of the journey during which this material was collected but made no mention of *Apistogramma*.

Etymology.-

The name *resticulosa* is an adjective from the Latin *restis*, diminutive *resticula*, in the meaning of thin string or line, and refers to the abdominal side markings.

DISCUSSION

Relationships.-

Apistogramma resticulosa is apparently a species of the *A. regani* group, characterized by slight sexual dimorphism, dark anterior dorsal fin, distinct vertical bars, lateral band, head stripes, no chest or lateral spot, jaw teeth in three to four series, canals in the lower lateral line, generally one to four gill-rakers on the first ceratobranchial, scaled throat, rounded caudal fin and no produced dorsal fin lappets in males, and comparatively deep body (Kullander, 1980a). At least some of these characteristics, like the sexual dimorphism, number of gill-rakers, number of teeth-series, and scaled throat, are probably not apomorph character states or shared with other *Apistogramma* species. Although the group cannot yet, by characters, be demonstrated to represent a distinct phyletic lineage, it may be practical to distinguish this assemblage of "generalized" species within a large genus, most other species of which can be assigned to better defined species groups.

In addition to *A. resticulosa*, the *A. regani* group comprises, as recently described (Kullander, 1980a), six species: *A. ortmanni* (Eigenmann) in Guyana, *A. geisleri* Meinken, *A. regani* Kullander, and *A. moae* Kullander in the Amazonas basin, and *A. piauiensis* Kullander and *A. caetei*

Kullander in northeastern Brazil.

To these may also be added a form from the Rio Autaz, discussed below. Reexamination and a radiograph of the holotype of *A. taeniata* (Günther) indicate that any aberrant characteristics of this poorly preserved specimen may well be accounted for by its bad condition. It may be included in the *regani* group without affecting the characterization of the latter, although its sexual dimorphism, squamation and details of the colour pattern remain unknown (cf. Kullander, 1980a).

Distinguishing characters.-

From all other *Apistogramma* species except *A. brevis* Kullander, *A. resticulosa* differs in the colour pattern of the abdominal sides. In *regani* group species, these are plain in *A. geisleri*, *A. moae*, *A. piauiensis* and *A. caetei*, whilst *A. regani*, *A. ortmanni*, and *A. taeniata* have horizontal stripes or rows of spots on the lower sides (Kullander, 1980a; new information for *A. taeniata*, based on remnants of the coloration of the flank under the pectoral fin).

Of the Central Amazonian *regani* group species, *A. regani* (vicinity of Manaus) is further characterized by rather prominent vertical bars. The head is narrower than that of *A. resticulosa* (head width 14.4-17.9%, \bar{x} = 16.1% of SL), and the body is deeper (depth 32.2-41.0%, \bar{x} = 36.3% of SL). *Apistogramma geisleri* (Obidos) has shorter fins (pectoral fin 28.4-32.8%, \bar{x} = 30.2%; last dorsal spine 13.9-17.4%, \bar{x} = 15.7%; last anal spine 17.0-19.8%, \bar{x} = 18.0% of SL). *Apistogramma taeniata* (Rio Cuparf) has a longer head (33.5% of SL), deeper cheek (9.0% of SL) and a very long last dorsal spine (24.7% of SL) compared to *A. resticulosa*. (Data from Kullander, 1980a.)

Apistogramma brevis (Tiquié and Uaupés river systems), with dark abdominal side scale rims, is otherwise very distinct in the colour pattern, e.g. in having a lateral spot (Kullander, 1980a). *Apistogramma pulchra* Kullander (vicinity of Pôrto Velho), the second *Apistogramma* species in the upper Madeira system, is a slender species of the *A. pertensis* group, easily separated from *A. resticulosa* by e.g. the not darkened anterior part of the dorsal fin.

Five specimens of *Apistogramma*, NRM 11270, 13.7-22.7 mm SL, from Curaruzinho, Rio Autaz

(leg. A. Roman, 1 October 1914), agree in most respects with the type-material of *A. resticulosa*, but have significantly shorter snouts (snout length 3.5-4.8% of SL). They may represent a species closely related to *A. resticulosa*.

Unfortunately, the long period of preservation has apparently altered the coloration and although there appears to have been some kind of abdominal side markings, they may have been very different from those of *A. resticulosa*. Otherwise, the remaining colour pattern suggests *A. resticulosa* more than any other species.

Intraspecific variation.-

The sexual dimorphism in *A. resticulosa* is but slight, as in the other species of the *regani* group (Kullander, 1980a). The only available female is somewhat darker than the males in overall appearance, but the caudal fin coloration is weaker. This female also has slightly shorter last dorsal and anal spines and caudal fin, but there is no apparent differentiation in the length of the ventral fin.

Although the material is somewhat limited for observations on size allometry, the information in Table I nevertheless strongly indicates a positive size allometry for body depth, ventral fin length and last dorsal spine length measurements as compared to the standard length. There is no similarly clear negative allometry, but such is indicated in the postorbital head length and head length measurements. The orbit diameter rather increases with increasing head length.

The 24.8 mm specimen is exceptional in several measurements. It is more slender and has a larger head and shorter snout than the others; this is also apparent from direct observation. It is probably a starved specimen (cf. habitat, "drying pool").

The number of preventral and caudal fin scales clearly increases with increasing size, and the pores of the lateral lines are gradually replaced by canals.

Juveniles (unsexed) and adults differ but gradually in colour pattern. Of interest is to note the spot in Bar 2 in young. A similar spot is a characteristic of *A. regani*, and it may be present in combination with a lateral spot (in Bar 3) in *A. elizabethae* Kullander, *A. brevis*, *A. meinkenii* Kullander, and *A. uaupesi* Kullander

(Kullander, 1980a). It is difficult to interpret this character due to the limited material available, but it may be reasonable to assume that the spot is homologous in at least the otherwise similar *A. resticulosa* and *A. regani*.

The cichlids of the Rio Madeira.-

The Rio Madeira is a white-water river, rich in suspended matter, in the tropical watershed of the Amazonas basin (Marlier, 1973). For most of its course it flows through Tertiary sediments, but the uppermost course is over Archaic rocks and is characterized by a series of falls extending upstream from near Pôrto Velho to Guajará-Mirim on the tributary Rio Mamoré and to Cachuela Esperanza on the Rio Beni (e.g. Pearson, 1937). The major rivers of Bolivian Amazônia are the principal tributaries of the Rio Madeira, but many tributaries also join along the Brazilian course, including several from the Brazilian shield.

The falls probably act to some extent as barriers to fish dispersal. The fish fauna of Bolivian waters appears to be distinct from that of Central Amazônia (cf. Pearson, 1937; pers. obs.), but the fauna of the Madeira is still largely unknown, especially as regards cichlids.

Apistogramma resticulosa is the sixth cichlid species to be recorded for the upper regions of the Rio Madeira system in Brazil. The others are *A. pulchra* (Kullander, 1980a: Rio Preto, left bank tributary of the Rio Candeias, 25 km from Pôrto Velho, only known locality for this species); *Aequidens madeirae* Fowler (1913: Igarapé de Candelaria, a tributary of the upper Rio Madeira, only known locality for this species, probably not distinct from the Guyanan and Amazonian *Crenicara punctulata* (Günther) (Kullander, 1978)); *Ae. stollei* Ribeiro (1918: Rio Jamarí, a right bank affluent of the Rio Madeira, only known locality for this species), *Acaronia nassa* (Heckel) (Borba; Lago Guajará on the bank of the Rio Madeira, Borba (Travassos & Pinto, 1959), a widespread species in the Amazonas and Orinoco basins and in the Guianas); and *Geophagus jurupari* Heckel (Igarapé das Milagres, Pôrto Velho (Gosse, 1976); a widespread species like *A. nassa*).

These records are inconclusive and cannot be compared with the much better data on Bolivian

cichlids (cf. e.g. Haseman, 1911, Pearson, 1937, Kullander, 1976). It may be noted, however, that the widespread species, with the exception of *Crenicara punctulata* if *Aequidens madeirae* is a synonym, are also found in Bolivian Amazônia, and that the others have been found only in single localities or within a restricted area. Considering how little collecting has been done in the Amazonas basin other than near the Rio Solimões and Amazonas itself, those circumstances are not surprising.

ACKNOWLEDGEMENTS

I am indebted to Dr. Han Nijssen (Zoölogisch Museum, Amsterdam) for placing the studied material at my disposal, to Miss Britt-Marie Lindkvist for typing assistance, and to Miss Frances Van Sant for correcting my English.

RESUMEN

Se describe una nueva especie de cíclido de la sistema del río Madera en Brasil, *Apistogramma resticulosa*. Los seis especímenes típicos colectados cerca de Humaitá son de 12.8 a 26.5 mm de largo estándar. La nueva especie pertenece al grupo *A. regani* y se distingue en las líneas verticales cortas de los lados abdominales.

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received : 8.V.1980.
mailing date : 10.X.1980.

Table I. Measurements (in mm; range and mean as per cent of SL) and counts of the type series of *Apistogramma reticulosa*.

Measurements							Range	\bar{x}
SL	12.8	15.6	20.5	24.8	25.6	26.5		
Caudal fin length	5.3	6.2	7.8	10.3	9.6	10.8	37.5 - 41.5	39.8
Head length	4.5	5.4	6.7	8.1	8.2	8.8	32.0 - 35.2	33.4
Head depth	3.4	4.3	5.5	6.7	7.3	7.6	26.6 - 28.7	27.5
Body depth	4.3	5.4	7.0	8.1	9.4	9.9	32.7 - 37.4	34.9
Predorsal length	5.3	6.1	7.5	9.4	9.5	10.1	36.6 - 41.4	38.4
Preventral length	5.3	6.4	8.4	9.7	10.2	11.1	39.1 - 41.9	40.7
Orbit diameter	1.7	1.9	2.8	3.5	3.4	3.6	12.2 - 14.1	13.4
Snout length	0.6	0.8	1.1	1.2	1.4	1.5	4.7 - 5.7	5.2
Cheek depth	0.7	0.9	1.2	1.5	1.6	1.7	5.5 - 6.4	6.0
Head width	2.3	2.8	3.7	4.3	4.6	4.6	17.3 - 18.0	17.8
Interorbital width	1.0	1.2	1.6	1.8	2.1	2.1	7.3 - 8.2	7.8
Preorbital depth	0.3	0.4	0.5	0.7	0.7	0.7	2.3 - 2.8	2.6
Upper jaw length	1.2	1.4	1.9	2.5	2.5	2.7	9.0 - 10.2	9.6
Lower jaw length	1.7	2.0	2.7	3.5	3.6	3.8	12.8 - 14.9	13.6
Postorbital head length	2.0	2.5	2.9	3.6	3.6	3.8	14.1 - 16.0	14.8
CP depth	2.0	2.6	3.0	4.0	4.2	4.5	14.6 - 17.0	16.1
CP length	1.5	2.0	2.4	3.0	3.1	3.1	11.7 - 12.8	12.0
Dorsal base length	6.8	8.6	11.2	14.7	14.8	15.6	53.1 - 59.3	56.5
Anal base length	2.5	3.2	4.1	5.0	5.1	5.2	19.5 - 20.5	20.0
Pectoral fin length	4.4	5.2	7.0	8.4	8.6	8.9	33.3 - 34.4	33.8
Ventral spine length	2.1	2.5	3.8	4.4	4.5	4.4	16.0 - 17.7	17.1
Ventral fin length	3.6	4.7	6.2	7.9	8.8	9.2	28.1 - 34.7	31.6
Last D spine length	1.8	2.5	4.0	5.0	4.7	5.4	14.1 - 20.4	18.1
Last A spine length	2.2	2.9	4.3	5.6	5.0	5.5	17.2 - 22.6	20.0
Counts								
Squ.l.	22	22	22	23	23	22	22 - 23	22.3
LL ₁ (c)	4	7	10	12	9	11	4 - 12	8.8
LL ₁ (cp)	14	13	14	15	14	13	13 - 15	12.2
Ll ₂ (c)	0	0	2	4	2	3	0 - 4	1.8
LL ₂ (cp)	7	7	7	-	7	7	7	7.0
Cheek scale series	3	3	3	3	3	3	3	3.0
Squ.op.	-	12	12	-	-	12	12	12.0
Squ.sop.	5	5	4	-	4	5	4 - 5	4.6
Squ.iop.	3	3	3	3	3	3	3	3.0
Squ.caud.	3	3	5	4	4	5	3 - 5	4.0
Squ.prd.	11	9	10	9	9	10	9 - 11	9.7
Squ.prv.	8	8	9	13	11	12	8 - 13	10.2
D spines	16	15	15	15	15	15	15 - 16	15.2
D tot	22	22	21	22	22	22	21 - 22	21.8
A tot	10	9	9	10	9	9	9 - 10	9.3
Rakers	2	3	3	2	3	3	2 - 3	2.7
LP rakers	9	11	12	10	9	11	9 - 12	10.3

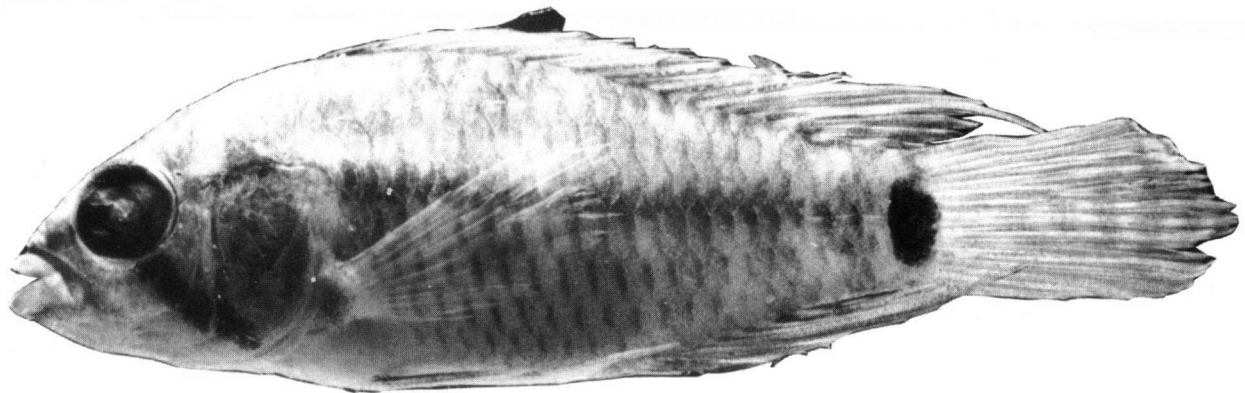


Fig. 1. Holotype of *Apistogramma resticulosa* sp.n.

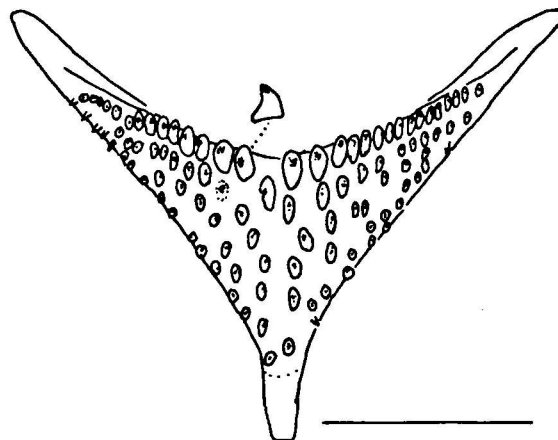


Fig. 2. Lower pharyngeal tooth-plate of *Apistogramma resticulosa* sp.n. Occlusal view; scale = 1 mm
From specimen ZMA 114.270, 25.6 mm SL.

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This periodical may be quoted in abbreviation as Bull. zool. Mus. Univ. Amsterdam.