

Scientific Results of the Peru-Bolivia Expedition Dr. K. H. Lüling 1966

*Apistogramma luelingi* sp. nov., a new  
Cichlid Fish from Bolivia (Teleostei: Cichlidae)

By

SVEN O. KULLANDER, Umeå

During an expedition to Peru and Bolivia in 1966, Dr. K. H. Lüling (Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn) collected fishes in the vicinity of Todos Santos, not far from Cochabamba in Bolivia.

Part of the material was later determined by Dr. H. Meinken, Bremen, as *Apistogramma borelli* (Regan) (15 specimens) and *A. ramirezi* Myers & Harry (1 specimen). Both of these identifications were suspect immediately after publication (Meinken 1967, 1969), since *A. borelli* was till then reliably reported only from the Paraguay basin and *A. ramirezi* recorded only from the Orinoco basin. Despite the uniqueness of these records and their implications on zoogeography, Meinken nowhere published any data supporting either identification.

Through the kindness of Dr. Lüling who generously lent the specimens identified as *A. borelli*, I am now able to give a more detailed description of the specimens and to present a more correct determination.

The results presented here are preliminary as a full evaluation of the relationships and intraspecific variation is not possible before all members of the genus *Apistogramma* have been reviewed. A revision of the genus is in preparation.

#### Methods and abbreviations

All measurements were obtained with vernier callipers, counts taken under a binocular microscope.

The standard length (S. L.) includes the upper lip.

The caudal peduncle length is the length of the ventral edge of the peduncle. The caudal peduncle depth is measured over the middle of the peduncle.

The snout length is the snout length in linear projection.

The cheek scale count is the number of longitudinal rows crossing an imaginary line down from the center of the orbit.



Fig. 1: *Apistogramma luelingi*

The transverse row scale count expresses the number of scales in the row from above the first anal spine forwards and upwards.

The longitudinal row scale count is obtained by counting the scales in the row above the lower lateral line.

The gill-raker count includes ceratobranchial rakers only.

ZFMK = Zoologisches Forschungsinstitut und Museum Alexander Koenig.

*Apistogramma luelingi* sp. nov.

*Apistogramma borelli*, Meinken 1969: 425 [Ecology]; Lüling 1969 a: 117 [Ecology]; Lüling 1969 b: 72, 78, 81 [Ecology]; Lüling 1973: 46, Abb. 35 [Ecology].

**H o l o t y p e**: ZFMK (I) 66/2283. ♂, 26.4 mm S. L. Loc. Kleine Quebrada unterhalb Todos Santos (Bolivien). Date 1966. 10. 03.

**P a r a t y p e s**: ZFMK (I) 66/2284—2291. 8 specimens. 3 ♂, 23.7, 18.7 and 18.2 mm S. L., 5 ♀, 29.0, 26.6, 20.5, 20.5 and 20.4 mm S. L. Same data as holotype.

Other specimens: ZFMK (I) 66/2303. 1 specimen, 24.7 mm S. L., sex indeterminate. Loc. Bach zwischen Río Chaparé und Río Chimoré. Date 1966. 10. 09.

ZFMK (I) 66/2311—2314. 4 specimens. 2 ♂, 19.7 and 19.7 mm S. L., 1 ♀, 20.9 mm S. L., 1 possible ♀, 14.8 mm S. L. Loc. „Hoffmann Lagune“, Río Chaparé, unterhalb Todos Santos (Bolivien). Date 1966. 10. 07.

ZFMK (I) 66/2316. 1 specimen, ♀, 25.8 mm S. L. Loc. Kleine Quebrada mit Restwasser, 4 km unterhalb Todos Santos (Bolivien) TS 3. Date 1966. 09. 30.

All specimens were collected by Dr. K. H. Lüling and Mr. Arnim Meyer during the „Peru-Bolivien-Expedition Dr. K. H. Lüling 1966“.

Condition generally poor, from drought or too strong fixative (alcohol). The coloration is faint, in some specimens almost absent on one or both sides.

**Diagnosis**

Moderately elongate, depth 33.1—37.6 %, head length 33.4—37.8 % of S. L. Dorsal and caudal fin not modified in males up to 26 mm; last dorsal spine length 11.7—15.5 % of S. L.

D. XV. 5—6 or XVI. 5—6; A. III. 5. i or IV. 5—6, normally 4 spines. 1—2 gill-rakers. Lateral line rudimentary.

A longitudinal dark lateral band, 2 (or 3) series of spots longitudinally on abdominal side, no midventral stripe.

### Description

All specimens listed above are included in the description.

Principal measurements are presented in Table I.

Moderately elongate, deepest just anterior to origin of ventral fins. Dorsal contour gently arched anteriorly, straight sloping from below about middle of spinous dorsal fin. Caudal peduncle decreasing in depth distally, the ventral contour always oblique; medially deeper than long, the length 58.3—81.0 % ( $\bar{x}$  = 68.1 %) of the depth. Ventral contour of body straight horizontal between ventral fins and anal fin, anal fin base line straight slanting, chest contour arched or straight.

Head moderately short, its dorsal contour somewhat steeper than the ventral, arched from the first dorsal spine.

Snout blunt, dorsal and ventral contours equally steep, straight. Length less than orbit diameter (5 specimens) or equal to or greater (10), variation 41.7—65.6 % ( $\bar{x}$  = 52.0 %) of diameter of orbit.

Mouth moderate or small, moderately wide. Angle of maxilla at more than 45° to the horizontal, the tip visible, reaching to the vertical from 1/5 to 1/4 of the orbit diameter.

Lips moderate in size, the upper lip sometimes proceeding under the lacrimal in smaller specimens.

Orbit circular, tangented by the forehead contour, part ascending the posterior half of the head; lower rim at level of lower edge of upper lip.

Squamation typical for the genus. Cheek scales cycloid, rather small. Upper opercular scales at least in larger specimens ctenoid, sometimes also the upper subopercular scales.

Scale rows on cheek 2—4 (mode 2), total number of scales on operculum 0—19 (mode 14; incomplete in some, specimens, not included in search for modal number), total number on suboperculum 2—10 (mode 7), 3 interopercular scales.

Scales in the longitudinal row 19—23 (mode 21,  $\bar{x}$  = 21.3), in the transverse row 7+1+1, around the caudal peduncle 16. Predorsal scales irregular, 7—10.

Upper lateral line extending over 6—16 scales (mode 12,  $\bar{x}$  = 12.2), comprising 2—11 tubes (mode 10,  $\bar{x}$  = 7.7), 0—10 pores (mode 2—3,  $\bar{x}$  = 4.4).

Lower lateral line extending over 2—9 scales (mode 6,  $\bar{x}$  = 5.9), comprising 0—4 tubes (mode 0,  $\bar{x}$  = 0.6), 1—8 pores (mode 7,  $\bar{x}$  = 5.4).

Proximal squamation on caudal fin extending to 1/3 of fin in the largest specimens, hind edge of scaled area vertical. All caudal scales ctenoid, the distal ones very small with few denticles.

Table 1. Principal measurements obtained from 15 specimens of *Apistogramma luelingi* expressed as per cent of S. L. (Variation,  $\bar{x}$ ), and calculated for variance ( $s^2$ ), standard deviation (s) and standard error (SE). n = number of specimens for which data are presented.

Measurement	Variation	n	$\bar{x}$	$s^2$	s	SE
Head length .....	33.4—37.8	15	35.5	1.39	1.18	0.30
Depth of body .....	33.1—37.6	15	35.4	1.23	1.11	0.29
Diameter of orbit....	11.6—13.4	15	12.5	0.26	0.51	0.13
Snout length .....	5.41—7.95	15	6.47	0.47	0.68	0.18
Depth of cheek .....	4.73—7.95	15	6.26	0.94	0.97	0.25
Interorbital width ..	8.11—10.2	15	9.16	0.33	0.57	0.15
Depth of preorbital ..	2.11—3.03	15	2.52	0.05	0.22	0.06
Caudal peduncle depth .....	15.4—17.6	15	16.7	0.36	0.60	0.15
Caudal peduncle length .....	10.2—13.8	15	11.3	0.82	0.91	0.23
Dorsal base length ..	54.7—63.4	15	60.2	5.19	2.28	0.59
Pectoral fin length ..	25.2—30.1	13	27.9	2.06	1.44	0.40

D. XV.? (1) XV. 5 (1), XV. 6 (2), XVI. 5 (3), XVI. 5. i. (2), XVI. 6 (6); total number of elements 20 (1), 21 (5), 22 (8); spine numbers XV (4), XVI (11). Shape similar in both sexes, without prolonged lappets. Moderately high, spines subequal in length from about the 5<sup>th</sup>, the last longest.

A. III. 5. i (1), IV.? (1), IV. 5 (3), IV. 5. i (3), IV. 6 (7); total number of elements 9 (4) or 10 (10); spine numbers III (1) or IV (14). The three-spined individual is the single specimen from the stream (ZFMK (I) 66/2303). Anal fin spines increasing in length to the last, the soft part rounded or producing a blunt point reaching at most to 1/4 of the caudal fin, always shorter than corresponding point in the dorsal fin, reaching at most to 1/3 of caudal fin.

P. 11—14 rays, of which 3—8 unbranched; variation 11 (4), 12 (8), 13 (1), 14 (1). Asymmetrical, distal edge rounded. Reaches to above vent.

V. I. 5. First ray longest, with a short filament in the larger specimens, extending to first anal spine or shorter.

C. 16 rays counted in 12 specimens, 11 of which have the formula ii.6.6.ii. Rounded in both sexes.

Gill-rakers 1 (3) or 2 (11).

Dentition. Teeth unicuspid, curved inwards distally, the outer anterior slightly stronger in both jaws. 3 series in both jaws with formulae (outer series/middle/inner): Upper jaw 21—25/4—6/9—10, lower jaw 18—25/2—6/12—17.

The outer series extends laterally, the middle and inner series confined to the anterior portion of the jaw, the middle series much the shortest.



**Coloration.** Life colors unknown. In alcohol pale brownish to yellowish, markings brown.

A dark lateral band, from the eye broadening to a lateral spot, continued to the caudal fin base on and above the lower lateral line.

A dark lateral spot in the lateral band and the second cross-bar behind the head, above distal half of the pectoral fin.

6 indistinct cross-bars from dorsal base to opercle edge (1<sup>st</sup>), a little below dorsal base (2<sup>nd</sup>) or lateral band (3<sup>rd</sup>–6<sup>th</sup>). A 7<sup>th</sup> cross-bar faint across the caudal peduncle.

Sub-, pre-, and superorbital bands radiating from the eye.

A small spot dorsally on the pectoral fin base.

Two parallel dotted lines on abdominal sides originating behind upper and lower edge of pectoral fin base respectively, and fading to extinction on caudal peduncle or before, occasionally an indistinct 3<sup>rd</sup> line below.

No midventral stripe.

The two anterior dorsal fin membranes dark, the rest of the fin dusky or colorless. Anal fin colorless to dusky, sometimes with 3 cross-bars over the terminal rays.

Caudal fin not always with a median roundish or oval base-spot. In larger specimens 5–6 dark cross-bars of spots distally, generally faint. Otherwise colorless.

Pectoral fin colorless or dusky.

Ventral fin in males colorless, in the holotype light brown distally, in females the two outer membranes dark. This was the only secondary sex difference observed besides the difference in the shape of the genital papilla.

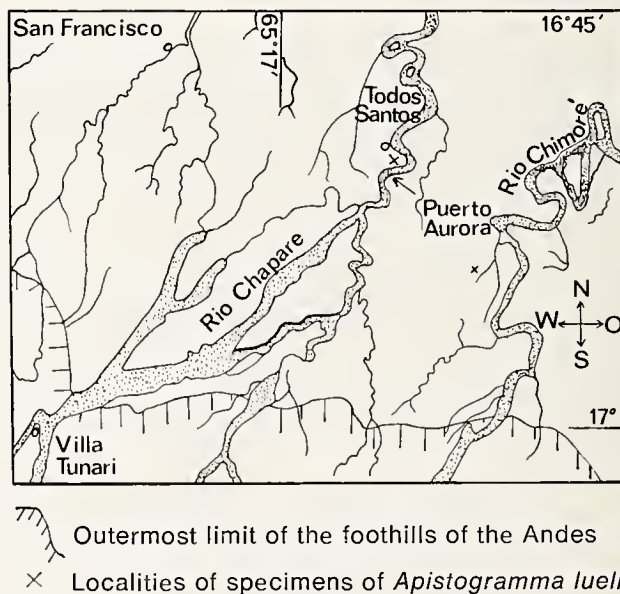


Fig. 2: Todos Santos, Bolivia, and adjacent rivers.  
Map prepared by Dr. K. H. Lüling.

### Ecology

The collecting localities all lie within the vicinity of Todos Santos, close to the Río Chaparé, an affluent of the R. Moré in central Bolivia (Fig. 2). Collections were made on September 30, October 3, 7 and 9, during low water season.

Descriptions of the localities have already been published by Lüling (1969 a, 1969 b, 1973) and Meinken (1969). Additional information on the streams was kindly supplied by Dr. Lüling. The following is a summary of the information from these sources.

ZFMK (I) 66/2303: A single specimen was procured from a stream of moderate flow located between R. Chaparé and R. Chimoré. The stream flows largely through rain forest, partly over marshy areas. Its bottom is covered by light mud at the place of collecting, the water dark grey-brown. pH 5.9—6.0, hardness 26.7 ppm. Fishes caught here also included *Astyanax bimaculatus*, *Gymnocorymbus thayeri* and *Ctenopoma huxwellianus* (Characidae), *Pyrrhulina vittata* (Lebiasinidae), *Carnegiella myersi* (Gasteropelecidae), *Pimelodella* sp. cf. *P. cristata* (Pimelodidae), *Ancistrus* sp. and *Loricariichthys* sp. (Loricariidae), *Potamorhaphis* sp. (Belontiidae), *Crenicichla saxatilis*, *Aequidens tetramerus* and *Ae. portalegrensis* (Cichlidae).

ZFMK (I) 66/2311—2314. These four specimens were caught in a broad strip of water cut off from the R. Chaparé. Aquaphile plants occupied the northern part, the west part offered some open water surface, partly shadowed by terrestrial vegetation. The south part was very shallow and covered by a mat of *Azolla filiculoides* (Salvinicaceae). pH 6.0, hardness 116 ppm. Temperature one day 26.5° C (in the air 32° C in the shadow). The fishes found here were also *Rivulichthys luelingi* (Cyprinodontidae), taken in the *Azolla* vegetation, *Synbranchus marmoratus* (Synbranchidae), *Plectrochilus* sp. cf. *P. sanguinea* (Trichomycteridae), and, taken outside vegetation together with *A. luelingi*, *Hoplosternum thoracatum* (Callichthyidae) and *Cichlasoma bimaculatum* (Cichlidae).

ZFMK (I) 66/2316. A stagnant water of 5—6 m width but rather long, mostly less than 0.5 m deep (Fig. 3). The water was clear to weakly turbid, slightly brownish in color. pH 6.4, hardness 80 ppm, temperature 26—27° C (in the air in the shadow 28° C), dissolved oxygen 5 ppm. Bottom muddy. This pool was probably in contact with the R. Chaparé at times of high water. It lay deeply embedded in the rain forest, bordered by *Heliconia* (Heliconiaceae). *Paspalum repens* and *Echinochloa polystachia* (Poaceae) entered the water. The water surface was partly covered by *Pistia* sp. (Araceae) and undetermined Nymphaeaceae. Branches and trunks of trees were lying in the water, believed to contain amounts of allochthonous matter. The fish community included also *Hoplias malabaricus* and *Hoplerethrinus unitaeniatus* (Erythrinidae), *Acestrorhynchus* sp. aff. *A. lacustris* (Characidae), *Gymnotus carapo* and *G.* sp. cf. *G. anguillararis* (Gymnotidae), *Eigenmannia virescens* (Rhamphichthyidae), *Rivulichthys luelingi* (Cyprinodontidae), *Callichthys callichthys* and *Hoplosternum littorale* (Callichthyidae), „*Apistogramma*“ *ramirezi* and *Aequidens portalegrensis* (Cichlidae).

I have no description of the type-locality, but it should be expected to be similar to the just described locality.

No information is at hand as regards food, behavior or reproduction.



Fig. 3: The locality at which specimen ZFMK (I) 66/2316 was collected. Photo Dr. K. H. Lüling.

No other fishes besides *A. luelingi*, were determined by me. The *Acestrorhynchus* sp. was identified by Dr. J. Gery (Lüling 1969 b), *Rivulichthys luelingi* by Dr. H. Meinken (Meinken 1969). The fish figured by Lüling (1969 a: 117) as *Ae. portalegrensis* is definitely not that species. The record of *A. ramirezi* should be tested.

### Discussion

A full analysis of relationships must await the description of all members of the genus.

*A. luelingi* is not to be confused with *A. borellii* (Regan), which is a Paraguay basin species very different in coloration and body shape. Meinken's (1967, 1969) determination is probably a consequence of his previous (1961) misidentification of a species identical with or closely related to *A. cacatuoides* Hoedeman, but which he calls *A. borellii*. This species is similar to *A. luelingi* in some respects, having a moderately elongate body and similar general color pattern, including 2—3 lines on



the abdominal sides. But it has a very different head shape and details in the coloration are very different. The stripes along the abdominal sides are composed of v-markings, not slightly elongated spots as in *A. luelingi*. It also frequently has a midventral stripe and very rarely 4 anal spines. Adult males show strongly developed finnage.

From the description it is evident that *A. luelingi* in at least one respect is different from all other members of the genus as presently known, i. e. in the number of anal spines.

The anal spine number is one of the central characters in neotropical cichlid systematics, the basis for division of this branch of the family in two groups, one characterized by 3 anal spines (*Aequidens* — *Geophagus* type), the other containing species with more than 3 anal spines (up to 12) (*Cichlasoma* type).

A discussion on the utility and value of this system is beyond the scope of this paper. Anyway, I see for the moment no reason to regard *A. luelingi* as a *Cichlasoma* type species or even to separate it generically. It has all other essential characteristics of an *Apistogramma*.

Individuals of other species of *Apistogramma*, viz. *A. cacatuoides* and *A. pleurotaenia* are known with 4 anal spines, although the normal number in these species is probably 3. Another, new species with 6 anal spines is known to me from a single specimen from R. Guaporé. Meinken has erected the genus *Apistogrammoides* for a species from Peru with 8 anal spines, but seemingly related to *Apistogramma*.

My only conclusion regarding these aberrations is, at the time being, that in the genus *Apistogramma* the normal or plesiomorph number of anal spines is 3, but that there is a varying tendency or frequency to develop 4 anal spines. The species with 6 and 8 anal spines need further consideration. The existence of 3-spined individuals of *A. luelingi* supports this interpretation.

In the specimens of *A. luelingi* here presented, sexual dimorphism was found only in the different coloration of the ventral fins. It cannot, however, be concluded that sexual dimorphism is restricted to this feature, shared by most *Apistogramma* spp., because we know neither life colors nor maximum size of *A. luelingi*. The specimens may not have attained the length at which differentiation occurs.

### Acknowledgements

I wish to thank Dr. Lüling for sending me his specimens for study, and I am also indebted to him for information on the collecting localities and for two of the figures accompanying this paper.

Dr. Gunnar Bertmar kindly placed working facilities at my disposal at the Department of Biology, University of Umeå.



### Summary

*Apistogramma luelingi* sp. nov., is described from the vicinity of Todos Santos on Rio Chaparé, central Bolivia. The new species is characterized by a normally 4-spined anal fin. In specimens up to about 25 mm, sex dimorphism is restricted to different coloration of the ventral fin.

### Zusammenfassung

Eine neue Art der Gattung *Apistogramma*, *A. luelingi* sp. nov., wird aus der Umgebung von Todos Santos am Río Chaparé in Bolivien beschrieben. Diese Art ist durch normalerweise 4 Analstacheln gekennzeichnet. Sexualdimorphismus scheint in Individuen von etwa 25 mm Länge auf verschiedene Färbung der Ventralen beschränkt zu sein.

Aufgrund der 15 untersuchten Exemplare wird die folgende Diagnose gegeben: Mäßig langgestreckt, Körperhöhe 33.1—37.6 %, Kopflänge 33.4—37.8 % der S. L. Rücken- und Schwanzflosse bei dem größten Männchen von 26 mm Länge ohne ausgezogene Strahlen oder Flossenmembranen. Letzter Rückenflossenstachel 11.7 bis 15.5 % der S. L.

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The author's address: Department of Biology, Section of Ecological Zoology, University of Umeå, S 901 87 Umeå, Sweden.