

Redescription of *Kryptolebias ocellatus* (Hensel) and *K. caudomarginatus* (Seegers) (Teleostei: Cyprinodontiformes: Rivulidae), two killifishes from mangroves of south-eastern Brazil

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Abstract

Taxonomy of *Kryptolebias ocellatus* (Hensel) and *K. caudomarginatus* (Seegers) has been poorly defined and mostly based on a few specimens bred in aquaria. They are considered valid species and are redescribed based on recent collections in the type locality area, the mangroves of Rio de Janeiro state, south-eastern Brazil. Both species are considered closely related to *K. marmoratus* (Poey), with which they share the presence of four neuromasts on the posterior supraorbital series, a long anterior nostril, and a bony laminar ventral process on the fifth ceratobranchial; *K. ocellatus* is distinguished by a unique colour pattern in the hermaphrodite, more slender caudal peduncle, and a shorter pelvic fin, and *K. caudomarginatus* by possessing more vomerine teeth, longer dorsal fin base, and a unique male colour pattern. The type locality of *K. caudomarginatus* is corrected.

Resumo

A taxonomia de *Kryptolebias ocellatus* (Hensel) e *K. caudomarginatus* (Seegers) tem sido fracamente definida, principalmente com base em poucos espécimes criados em aquários. Elas são consideradas espécies válidas e são redescritas com base em coleções recentes na área da localidade tipo, os manguezais do estado do Rio de Janeiro, sudeste do Brasil. Ambas espécies são consideradas estreitamente aparentadas a *K. marmoratus* (Poey), com a qual elas compartilham a presença de quatro neuromastos na série supraorbital posterior, narina anterior longa, e processo ventral laminar ósseo em quinto ceratobranchial; *K. ocellatus* é distinguível por possuir um padrão de colorido exclusivo em hermafrodita, pedúnculo caudal mais esguio e nadadeira pélvica mais curta, e *K. caudomarginatus* por possuir mais dentes no vomer, base de nadadeira dorsal mais longa e padrões

de colorido exclusivos em macho. A localidade tipo de *K. caudomarginatus* é corrigida.

Zusammenfassung

Die systematische Stellung von *Kryptolebias ocellatus* (Hensel) und *K. caudomarginatus* (Seegers) wurde bisher nicht ausreichend begründet und ihre Beschreibung beruhte auf einigen wenigen Exemplaren aus Aquarien. Sie werden hier zu gültigen Arten erklärt und auf der Grundlage neuerer Fänge im Gebiet der Typuslokalität neu beschrieben, den Mangrovensümpfen der Region Rio de Janeiro, in SO-Brasilien. Die beiden Arten werden als nahe verwandt mit *K. marmoratus* (Poey) eingestuft; gemeinsame Merkmale sind vier Neuromasten in der hinteren supraorbitalen Reihe, ein langes vorderes Nasenloch und ein knochiger, blättchenhafter ventraler Fortsatz am fünften Ceratobranchiale; *K. ocellatus* unterscheidet sich durch ein unverkennbares Farbmuster ohne Geschlechtsunterschied, einen schlankeren Schwanzstiel und eine kürzere Bauchflosse, während *K. caudomarginatus* mehr Schlundzähne, eine längere Rückenflossenbasis und ein unverkennbares männliches Farbmuster besitzt. Die Typuslokalität von *K. caudomarginatus* wird korrekt abgegrenzt.

Résumé

La taxinomie des espèces *Kryptolebias ocellatus* (Hensel) et *K. caudomarginatus* (Seegers) a été peu spécifiée et basée surtout sur un petit nombre de spécimens élevés en aquarium. Elles sont considérées comme des espèces valides et sont redécrites sur base de collectes récentes dans la région de la localité-type, les mangroves de l'état de Rio de Janeiro, au sud-est du Brésil. Les deux espèces paraissent très proches de *K. marmoratus* (Poey), et, comme celle-ci, montrent la présence de quatre neuromastes sur la série postérieure supra-orbitale, une longue narine antérieure et une excroissance osseuse laminaire ventrale sur la cinquième cératobranchiale. *K. ocellatus* se distingue par une coloration unique du pédoncule caudal hermaphrodite, plus mince et une pelvienne plus courte, et

K. caudomarginatus, par un plus grand nombre de dents vomériennes, une plus longue base de la dorsale et un patron de coloration unique pour le mâle. La localité-type de *K. caudomarginatus* est correctement identifiée.

Sommario

La tassonomia di *Kryptolebias ocellatus* (Hensel) e *K. caudomarginatus* (Seegers) è poco definita e basata per lo più su pochi esemplari provenienti da accoppiamenti in acquario. Esse sono considerate specie valide e vengono qui descritte nuovamente sulla base di recenti catture nella località tipo, le mangrovie dello stato di Rio de Janeiro, Brasile sud-orientale. Entrambe sono considerate molto vicine a *K. marmoratus* (Poey), con cui condividono la presenza di quattro neuromasti sulla serie supraorbitale posteriore, una lunga narice anteriore e un processo laminare ventrale osseo sul quinto ceratobranchiale; *K. ocellatus* si distingue per una tipica colorazione nell'ermafrodita, un peduncolo caudale più sottile e le pinne pelviche più corte, mentre *K. caudomarginatus* si differenzia per possedere più denti vomerini, una pinna dorsale a base più lunga e una singolare colorazione nel maschio. La località tipo *K. caudomarginatus* è definita in modo corretto.

Introduction

Kryptolebias Costa was recently established to include some species previously placed in *Rivulus*: *K. brasiliensis* (Valenciennes), *K. caudomarginatus* (Seegers), and *K. ocellatus* (Hensel) from south-eastern Brazil; *K. campelloi* (Costa) from eastern Brazilian Amazon; *K. marmoratus* (Poey), recorded from a broad geographic range, including the south-eastern United States, Bahamas, Yucatan Peninsula, Cuba and other Caribbean islands, Venezuela and Guianas (Costa, 2004a, 2004b). Three poorly known nominal species, considered synonyms of *K. marmoratus* (e. g., Costa, 2003), were also included in *Kryptolebias*: *K. bonairensis* (Hoedeman) from Bonaire, Curaçao, and coastal Venezuela; *K. heyei* (Nichols) from Isla Saona, Dominican Republic; and, *K. garciai* (De la Cruz & Dubitsky) from Cuba (Costa, 2004a). Subsequently, Vermeulen & Hrbek (2005) described *K. sepia* from Surinam.

Kryptolebias has been hypothesized to be the sister group to a clade comprising all other rivulids on the basis of morphological and some molecular analyses (Hrbek & Larson, 1999; Costa, 2004a, 2004c; Vermeulen & Hrbek, 2005) or a basal clade within a monophyletic lineage including all rivulids except cynolebiatines according to other molecular analyses (Murphy *et al.*, 1999; Vermeulen & Hrbek, 2005). *Kryptolebias brasiliensis*, *K. campelloi*, and *K. sepia* are similar to most rivulids in inhabiting freshwater pools and streams (e. g., Costa, 2004a; Vermeulen & Hrbek, 2005), while *K. caudomarginatus*, *K. ocellatus*, and *K. marmoratus* live in brackish to salt water, usually in mangrove swamps (e. g., Taylor, 1988; the present paper). Both

morphological (Costa, 2004a) and molecular studies (Murphy *et al.*, 1999; Vermeulen & Hrbek, 2005) support monophyly of the latter assemblage. Among species of this assemblage, *K. ocellatus* and *K. marmoratus* are self-fertilizing hermaphroditic species, a condition unique among vertebrates (e. g., Harrington, 1961). Hermaphrodites are female-like individuals, exhibiting typical female colour patterns. Populations are mainly composed of hermaphrodites, while functional females are unknown, and males are uncommon or very rare (e. g., Davis *et al.*, 1990; Turner *et al.*, 1992). For example, Taylor (1990) collected over 250 specimens of *K. marmoratus* in Florida, but none of them was a male.

Although some species of *Kryptolebias* are among the oldest described species of the Rivulidae, their taxonomy is still confused. The best example is *K. ocellatus*, described by Hensel (1868) based on a single specimen collected in Rio de Janeiro. The identity of *K. ocellatus* was difficult to determine between 1906 and 1984, a period when *K. caudomarginatus*, another species from Rio de Janeiro and undescribed at that time, was usually identified as *Rivulus ocellatus* (= *K. ocellatus*). Seegers (1984) established the identity of *K. ocellatus* and first described *K. caudomarginatus* based upon aquarium bred specimens. Seegers also considered *K. marmoratus* conspecific to *K. ocellatus*, proposing the two names as subspecies of *K. ocellatus*, which would have chronological priority over *K. marmoratus*, described 12 years later (Poey, 1980). However, *K. marmoratus* is an important experimental fish for researches on carcinogenicity, mutagenesis, teratogenesis, and other scientific areas, in which the specific epithet *marmoratus* is consistently applied, whereas the specific epithet *ocellatus*, the putative senior synonym of *marmoratus*, was poorly known and never correctly applied for many decades. These were the basic arguments used by Lazara & Smith (1990) to propose suppression of the specific epithet *ocellatus* and conservation of the name *marmoratus*. However, Costa (1994) did not agree with such a proposal, which would be premature, since no rigorous taxonomic study was developed to check whether *ocellatus* and *marmoratus* were in fact the same species. The International Commission of Zoological Nomenclature (1995) then decided to give precedence to the name *marmoratus* over the name *ocellatus*, whenever the two names are considered to be synonyms. However, due to difficulties in collecting small fishes in a mangrove habitat, *K. ocellatus* and *K. caudomarginatus* have been insufficiently sampled in scientific collections, and consequently are still poorly known taxonomically. Both species are herein redescribed, based on recent collections made in their type locality areas.

Material and methods

All material was collected with dip nets. Measurements and counts follow Costa (1995). Measurements are pre-

sented as percentages of standard length (SL), except those related to head morphology, and are expressed as percentages of head length. Fin ray counts include all elements. Numbers of vertebrae, gill rakers, and pectoral, pelvic and caudal fin rays were recorded only from cleared and stained specimens. The compound caudal centrum was counted as a single element. Osteological preparations were made according to Taylor and Van Dyke (1985). Terminology for frontal squamation and the cephalic neuromast series follow Hoedeman (1958) and Costa (2001), respectively. The abbreviation "c&s" stands for specimens cleared and stained for bone and cartilage. Material is deposited in Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil (UFRJ). Other abbreviations for of institution names are: ZFMK, Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn, and ZMB, Zoologisches Museum, Humboldt-Universität, Berlin.

***Kryptolebias ocellatus* (Hensel)**

(Figs. 1-2; Table I)

Rivulus ocellatus Hensel, 1868: 365 (type locality: Rio de Janeiro; holotype: ZMB 7448).

Material examined

Brazil: Estado do Rio de Janeiro: UFRJ 1806, 3; mangrove swamp near Itaguaí; M. S. Melgaço, 25 Jul. 1991. UFRJ 6234, 4 (c&s); mangrove canal, near EMBRAPA, rio Piracão basin, a tributary to baía de Sepetiba, Guaratiba; W. J. E. M. Costa, C. P. Bove & B.B. Costa, 2004. UFRJ 6237, 3; *idem*; W. J. E. M. Costa, C. P. Bove & T. Litz, 19 Feb. 2005. UFRJ 6243, 3; *idem*; W. J. E. M. Costa, J. Barata, A. Moreira & J. P. Moreira, 14 Aug. 2005. UFRJ 6252, 9; *idem*; W. J. E. M. Costa, J.L. Mattos, L. Villa Verde, F. Ottoni & E. Mattos, 22 Oct. 2005. Material collected in mangrove swamp near Caxias, baía de Guanabara, was not preserved.

Diagnosis

Distinguished from all rivulids except *K. marmoratus* and *K. caudomarginatus* in having long anterior nostril, its tip extending beyond anterior profile of the head. Also similar to *K. marmoratus* and *K. caudomarginatus* by possessing numerous scales in the longitudinal series (44-48, vs. 30-32 *K. brasiliensis* and *K. campelloi*, and 38-40 in *K. sepiá*) and four neuromasts on the posterior supraorbital series (vs. three). It differs from *K. marmoratus* and *K. caudomarginatus* in having a vertical row of pale silver to pale gold dots on the dorsal portion of flank in the hermaphrodite (vs. pale silver spots over the whole flank in the hermaphrodite of *K. marmoratus* and in the female of *K. caudomarginatus*), more slender caudal peduncle (caudal peduncle depth 12.3-13.4 % SL, vs. 13.7-16.3 % SL), and shorter pelvic fin (pelvic fin length 6.0-7.8 % SL, vs. 8.5-10.7 % SL).

Description

The description is based on hermaphrodites only. Morphometric data appear in Table I. Largest specimen 49.8 mm SL. Dorsal profile approximately straight to slightly convex from snout to end of dorsal fin base, approximately straight on caudal peduncle. Ventral profile gently convex from lower jaw to end of anal fin base, about straight on caudal peduncle. Body slender, subcylindrical anteriorly, about as deep as wide, to compressed posteriorly. Greatest body depth at vertical just in front to pelvic fin base. Jaws short, snout blunt. Anterior naris cylindrical and long, extending beyond anterior profile of the head. Urogenital papilla pocket-shaped.

Tip of dorsal and anal fins rounded. Anal fin rays 4 and 5 longer than other anal fin rays. Caudal fin rounded. Pectoral fin short and rounded, posterior margin reaching vertical just posterior to midlength between pectoral fin and pelvic fin bases. Pelvic fin elliptical, tip reaching base of 1st anal fin ray. Pelvic fin bases medially separated by short interspace. Dorsal fin origin on vertical between base of 10th and 11th anal fin rays, and



Fig. 1. *Kryptolebias ocellatus*, hermaphrodite, UFRJ 6243, 46.8 mm SL; Brazil: Rio de Janeiro: Guaratiba. Photo by W. J. E. M. Costa.

Table I. Morphometric data of *Kryptolebias ocellatus* and *K. caudomarginatus*.

	<i>K. ocellatus</i> hermaphrodites (n = 10)	<i>K. caudomarginatus</i>	
		males (n = 10)	females (n = 10)
Standard length (mm)	27.2-48.3	28.3-48.5	27.7-36.3
Percent of standard length			
Body depth	17.5-19.7	19.2-23.4	19.4-23.3
Caudal peduncle depth	12.3-13.4	13.7-16.3	13.9-16.1
Predorsal length	73.5-77.2	72.5-76.3	72.1-78.0
Prepelvic length	56.9-59.9	56.9-59.4	57.6-61.5
Length of dorsal fin base	9.2-10.7	11.1-13.5	10.9-12.5
Length of anal fin base	14.1-15.6	15.1-17.4	14.4-16.5
Caudal fin length	27.9-31.4	29.2-34.4	30.2-32.8
Pectoral fin length	17.4-19.0	17.1-20.4	18.4-20.8
Pelvic fin length	6.0-7.8	8.7-9.5	8.5-10.7
Head length	24.0-26.0	24.8-27.7	24.8-27.8
Percent of head length			
Head depth	62.8-72.1	60.3-78.2	64.0-77.8
Head width	75.0-93.6	74.6-91.6	76.5-89.7
Snout length	13.5-15.7	13.5-15.5	14.0-15.9
Lower jaw length	20.2-25.0	18.4-25.7	19.1-24.1
Eye diameter	28.4-33.0	31.2-35.9	32.2-36.0



Fig. 2. *Kryptolebias ocellatus*, hermaphrodite, UFRJ 6237, 36.8 mm SL; Brazil: Rio de Janeiro: Guaratiba. Photo by W. J. E. M. Costa.

between neural spines of 18th and 20th vertebrae. Anal fin origin between pleural ribs of 14th and 15th vertebrae. Dorsal fin rays 8-9; anal fin rays 11-12; caudal fin rays 30-31; pectoral fin rays 13; pelvic fin rays 6.

Scales small, cycloid. Body and head entirely scaled, except anterior ventral surface of head. Body squamation extending over anterior 40 % of caudal fin base; no scales on dorsal and anal fin bases. Frontal squamation E-patterned; E-scales overlapping medially; scales arranged in regular circular pattern around A-scale without exposed margins. Longitudinal series of scales 47-48; transverse series of scales 13-14; scale rows around caudal peduncle 24-26. Contact organs absent.

Cephalic neuromasts: supraorbital 3 + 4, parietal 1-2, anterior rostral 1, posterior rostral 1, infraorbital 1 + 1 + 13-14 + 1, preorbital 3, otic 1, post-otic 2, supratemporal 1, median opercular 1, ventral opercular 2, preopercular 2 + 7-8, mandibular 4 + 2-3, lateral mandibular 4.

Interhyal ossified. Rostral cartilage longer than wide, width about 60% length. Basihyal subtriangular, width about 65 % length; basihyal cartilage about 10 % of basihyal length. Six branchiostegal rays. Second pharyngobranchial teeth 4-5. Gill rakers of first branchial arch 1 + 8. Vomerine teeth 1-4. Ventral process of post-temporal long. Total vertebrae 33-34.

Coloration in life: Side of body light brown with row of pale silver to pale golden dots on dorsal portion of flank; black humeral blotch with narrow anterior extension; round black spot with bright grey margin on dorsal end of caudal peduncle, sometimes other black spot below. Dorsum light brown. Venter white. Side of head light

brown on dorsal portion, pale silver with great concentration on melanophores ventrally. Lower jaw grey. Iris brown. Unpaired fins grey with hyaline small spots on basal portion; anal fin with pale yellow subdistal stripe, and distal grey stripe. Pelvic and pectoral fins hyaline.

Distribution and habitat

Kryptolebias ocellatus inhabits the shallow parts (about 10-40 cm deep) of mangrove swamps associated with Sepetiba and Guanabara bays (Fig. 3). It is always sympatric to *K. caudomarginatus*, which is conspicuously more abundant, and sometimes with two species of poeciliids, *Poecilia vivipara* Bloch & Schneider and *Phalloptychus januaris* (Hensel), an eleotridine gobiid, *Dormitator maculatus* (Bloch), and the callichthyid *Callichthys callichthys* (Linnaeus). It is never found in freshwater streams. The occurrence of this species has already been reported in Santos, São Paulo (Huber, 1992), but the material from this region was not examined in the present paper.

Remarks

All the material herein examined included only hermaphrodites. Three recent collecting trips were unsuccessful in collecting males. However, Notare (1988) provided a colour photo of a live male identified as "*Rivulus*



Fig. 3. Mangrove at Guaratiba, Rio de Janeiro, Brazil, habitat of *Kryptolebias ocellatus* and *K. caudomarginatus*. Photo by W. J. E. M. Costa.

caudomarginatus var. (?)" collected in Rio de Janeiro and Huber (1992) illustrated a similar live male, also from Rio de Janeiro, identified as "primary male of *ocellatus*". Notare's colour photo shows a fish in which the flank is light grey with dark red spots. There is a dark grey humeral spot and a grey caudal peduncle spot, and, the unpaired fins have a pale yellow subdistal zone and a dark grey to black distal zone. This material was not preserved for study, and its identification needs confirmation.

Kryptolebias caudomarginatus (Seegers)

(Figs. 4-7; Table I)

Rivulus caudomarginatus Seegers, 1984: 307 (type locality: Greta Funda [correctly Grota Funda, an equivocal type locality as discussed in "Remarks" below] near a technical centre of the Army, southern Rio de Janeiro [correctly near Technological Center of the Brazilian Army, Guaratiba, south-western Município do Rio de Janeiro, Estado do Rio de Janeiro, south-eastern Brazil, rio Piracão basin, a tributary to Baía de Sepetiba, 23°00'18.1"S 43°33'34.9"W, altitude 8 m]; holotype: ZFMK 12848).

Material examined

Brazil: Estado do Rio de Janeiro: UFRJ 1805, 32; mangrove near Itaguaí; M.S. Melgaço, 25 Jul. 1991. UFRJ 1047, 22; UFRJ 3583, 3 (c&s); Madeira, mangrove swamp or mangrove habitat near Itaguaí; M. S. Melgaço, 25 Jul. 1991. UFRJ 4316, 30; rio Iriri, a tributary to Baía de Guanabara, Barão de Iriri; W. J. E. M. Costa, F. Pupo, E. Araujo & F. Autran, 4 Dec. 1998. UFRJ 6235, 15; UFRJ 6236, 6 (c&s); mangrove canal, near EMBRAPA, rio Piracão basin, a tributary to Baía de Sepetiba, Guaratiba; W. J. E. M. Costa, C. P. Bove & B.B. Costa, 2004. UFRJ 6238, 4; *idem*; W. J. E. M. Costa, C. P. Bove & T. Litz, 19 Feb. 2005. UFRJ 6244, 12; *idem*; W. J. E. M. Costa, J. Barata, A. Moreira & J. P. Moreira, 14 Aug. 2005. UFRJ 6253, 4; *idem*; W. J. E. M. Costa, J. L. Mattos, L. Villa Verde, F. Ottoni & E. Mattos, 22 Oct. 2005. Material collected in mangrove habitat near Caxias, Baía de Guanabara, was not preserved.

Diagnosis

Distinguished from all rivulids except *K. marmoratus* and *K. ocellatus* in having long anterior nostril, its tip extending beyond anterior profile of the head. Also similar to *K. marmoratus* and *K. ocellatus* by possessing numerous scales in the longitudinal series (44-48, vs. 30-32 *K. brasiliensis* and *K. campelloi*, and 38-40 in *K. sepia* in other species of *Kryptolebias*) and four neuromasts on the posterior supraorbital series (vs. three). It differs from *K. marmoratus* and *K. ocellatus* in having more vomerine teeth (6-17, vs. 1-4), longer dorsal fin base (10.9-13.5 % SL, vs. 9.2-10.7 % SL), and a unique colour pattern of flank and caudal fin in male (flank with black oblique bars on its posterior half, vs. dark red



Fig. 4. *Kryptolebias caudomarginatus*, male, UFRJ 6235, 34.8 mm SL; Brazil: Rio de Janeiro: Guaratiba. Photo by W. J. E. M. Costa.



Fig. 5. *Kryptolebias caudomarginatus*, male, UFRJ 6238, 42.4 mm SL; Brazil: Rio de Janeiro: Guaratiba. Photo by W. J. E. M. Costa.

spots; caudal fin with a broad white to yellowish white subdistal zone, strongly contrasting with a broad black distal zone, vs. indistinct pale yellow subdistal zone bordered by narrow black distal zone).

Description

Morphometric data appear in Table I. Male larger than female, largest male 54.6 mm SL. Dorsal profile slightly convex from snout to end of dorsal fin base, approximately straight on caudal peduncle. Ventral profile gently convex from lower jaw to end of anal fin base, about straight on caudal peduncle. Body slender, subcylindrical anteriorly, about as deep as wide, to compressed posteriorly. Greatest body depth at vertical just in front of pelvic fin base. Jaws short, snout blunt. Anterior naris cylindrical and long, extending anteriorly beyond anterior profile of the head. Urogenital papilla globular in male, pocket-shaped in female.

Tip of dorsal and anal fins rounded. Anal fin rays 4 and 5 longer than other anal fin rays. Caudal fin rounded. Pectoral fin short and rounded, posterior margin reaching vertical just posterior to midlength between pectoral fin and pelvic fin bases. Pelvic fin elliptical, tip reaching between base of 2nd and 4th anal fin rays in male, and between base of 1st and 2nd anal-fin rays in female.

Pelvic fin bases medially separated by short interspace or in contact. Dorsal fin origin on vertical between base of 8th and 10th anal fin rays, and between neural spines of 17th and 19th vertebrae. Anal fin origin between pleural ribs of 13th and 15th vertebrae. Dorsal fin rays 8-10; anal fin rays 11-13; caudal fin rays 29-32; pectoral-fin rays 13; pelvic fin rays 5-6.

Scales small, cycloid. Body and head entirely scaled, except anterior ventral surface of head. Body squamation extending over anterior 40 % of caudal fin base; no scales on dorsal and anal fin bases. Frontal squamation E-patterned; E-scales overlapping medially; scales arranged in regular circular pattern around A-scale without exposed margins. Longitudinal series of scales 43-48; transverse series of scales 9-10; scale rows around caudal peduncle 20-22. Contact organs absent.

Cephalic neuromasts: supraorbital 3-4 + 4, parietal 2, anterior rostral 1, posterior rostral 1, infraorbital 1 + 2 + 12-13 + 1, preorbital 3, otic 1, postotic 2, supratemporal 1, median opercular 1, ventral opercular 2, preopercular 2 + 6-7, mandibular 5 + 2, lateral mandibular 3-5.

Interhyal ossified. Rostral cartilage longer than wide, width about 60 % length. Basihyal subtriangular, width about 50 % length; basihyal cartilage about 10 % basihyal length. Six branchiostegal rays. Second pharyngo-branchial teeth 3-5. Gill rakers of first branchial arch 1-2



Fig. 6. *Kryptolebias caudomarginatus*, female, UFRJ 6235, 31.9 mm SL; Brazil: Rio de Janeiro: Guaratiba. Photo by W. J. E. M. Costa.



Fig. 7. *Kryptolebias caudomarginatus*, female, UFRJ 6238, 36.3 mm SL; Brazil: Rio de Janeiro: Guaratiba. Photo by W. J. E. M. Costa.

+ 8-9. Vomerine teeth 6-17. Ventral process of post-temporal long. Total vertebrae 32-33.

Coloration in life: Male: Side of body pale bluish silver; black spots irregularly shaped and arranged on anterior half of flank and black oblique bars, usually zigzag shaped, sometimes broken, forming isolated black spots on posterior half of flank; approximately rectangular black humeral blotch; round black spot on dorsal end of caudal peduncle, sometimes other black spot below. Dorsum light brown, with green iridescence of laterodorsal scales. Venter white. Side of head light greenish brown on dorsal portion, pale silver with great concentration of melanophores ventrally. Lower jaw grey. Iris brown. Dorsal and anal fins light grey with small dark grey to black small spots, broad subdistal white stripe and narrow distal black stripe. Caudal fin dark grey, with broad white to yellowish-white subdistal zone and broad black distal zone; often dorsal and ventral margins and filaments dark orange. Pelvic fin hyaline with subdistal white line and black margin. Pectoral fin hyaline.

Female: Side of body light brown with pale silver spots; black humeral blotch; round black spot with bright grey margin on dorsal end of caudal peduncle, Caudal fin hyaline, with small faint grey spots on basal portion and pale grey margin. Pelvic and pectoral fins hyaline.

All described color patterns visible in preserved specimens, both in male and female.

Distribution and habitat

As described for *K. ocellatus*.

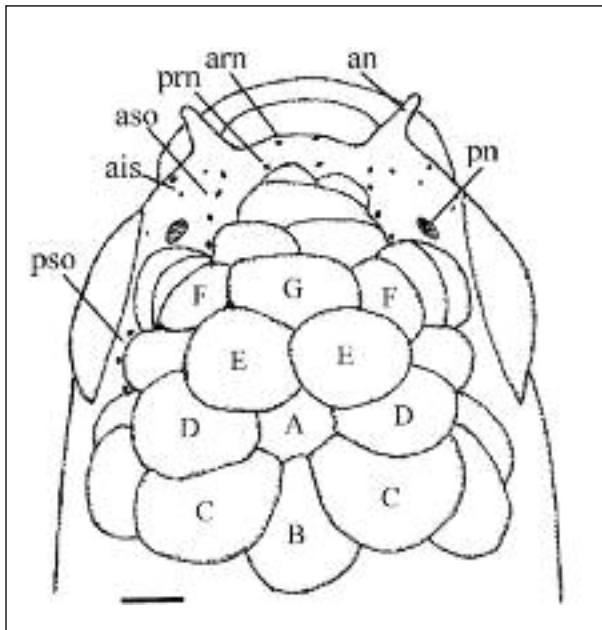


Fig. 8. Diagrammatic representation of the head, dorsal view, of *Kryptolebias caudomarginatus*, UFRJ 6253, male, 48.5 mm SL. Drawn by the author

Remarks

During the 1980's, several collections of *K. ocellatus* and *K. caudomarginatus* were made in a mangrove area near the Technological Center of the Brazilian Army, Guaratiba, south-western part of the metropolitan region of the Rio de Janeiro city, by aquarists. Seegers (1984) mentioned that the type specimens of *R. caudomarginatus* were the progeny of fish collected in "Greta Funda", a misspelling of Grota Funda, near a technical center of the Army. However, Grota Funda is situated about 4 km east of the Technological Center of the Brazilian Army, at a small coastal hill (Serra Geral de Guaratiba), at an altitude of 200-300 m. No habitat suitable to the occurrence of rivulids is present in Grota Funda, thus it is considered an equivocal type locality.

Discussion

Monophyly of the assemblage including *K. ocellatus*, *K. marmoratus* and *K. caudomarginatus* has been supported by different studies (e. g., Murphy *et al.*, 1999; Costa, 2004a; Vermeulen & Hrbek, 2005). New evidence corroborating this hypothesis is herein provided:

- 1) presence of four neuromasts on the posterior supraorbital series (Fig. 8), a condition not occurring in other species of *Kryptolebias* nor in members of other basal rivulid lineages, such as the genera *Prorivulus* Costa and *Rivulus* Poey, which have three neuromasts;
- 2) long anterior nostril (Fig. 8), a condition not found in other aplocheiloid fishes;
- 3) bony laminar ventral process close to the lateral

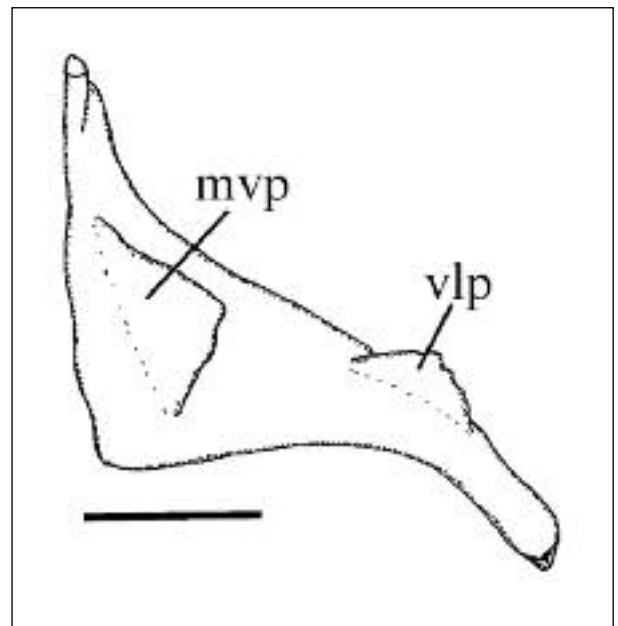


Fig. 9. Fifth ceratobranchial, ventral view, of *Kryptolebias caudomarginatus*, UFRJ 6236, male, 38.5 mm SL. Drawn by the author

edge of the fifth ceratobranchial (Fig. 9), not found elsewhere among aplocheiloid fishes.

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