

**CYNOLEBIAS GILBERTOI, A NEW SPECIES OF ANNUAL FISH
(CYPRINODONTIFORMES: RIVULIDAE) FROM
THE RIO SÃO FRANCISCO BASIN, NORTHEASTERN BRAZIL**

by

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ABSTRACT. - *Cynolebias gilbertoi* n. sp. is described from a temporary pond near the rio São Francisco, in Estado da Bahia, northeastern Brazil. It is considered to be a member of the *Cynolebias porosus* species-complex by having the tip of the interarcual cartilage displaced to posterior portion of second pharyngobranchial, a distinct ossification ventral to basibranchial cartilage, two distinct transverse rows of neuromasts above opercular region, and a distal portion of anal fin of males pale blue on fin membrane and red on rays. The new species differs from all other species of that complex by having many teeth on vomer, fewer vertebrae and scales in longitudinal series, and the pelvic fins separated by a wide interspace. It is hypothesized to be most closely related to *C. perforatus* and *C. leptocephalus*, its only congeners also possessing teeth on vomer and numerous neuromasts on the ventral part of opercular region.

RÉSUMÉ. - *Cynolebias gilbertoi*, une nouvelle espèce de poisson annuel (Cyprinodontiformes: Rivulidae) du bassin du Rio São Francisco, nord-est du Brésil.

Cynolebias gilbertoi n. sp. est décrite d'une mare temporaire située près du Rio São Francisco dans l'état de Bahia, au nord-est du Brésil. Elle appartient au complexe *Cynolebias porosus* car elle possède les caractères suivants: extrémité du cartilage interarcual déplacée vers la partie postérieure du second pharyngobranchial; cartilage basibranchial présentant une ossification ventrale; présence de deux rangées transverses, bien distinctes, de neuromastes au-dessus de la région operculaire; chez les mâles, la membrane et les rayons de la partie distale de la nageoire anale sont respectivement bleu pâle et rouges. La nouvelle espèce diffère de toutes les autres espèces de ce complexe par la présence de nombreuses dents sur le vomer, un nombre plus réduit de vertèbres et d'écaillés en rangées longitudinales, et par ses nageoires pelviennes qui sont largement séparées. Il est suggéré que cette nouvelle espèce présente des affinités étroites avec *C. perforatus* et *C. leptocephalus*, seules espèces du complexe à posséder également des dents vomériennes et de nombreux neuromastes sur la partie ventrale de la région operculaire.

Key-words. - Rivulidae, *Cynolebias gilbertoi*, Brazil, Rio São Francisco basin, Taxonomy, New species.

The genus *Cynolebias* Steindachner constitutes a diverse and widespread assemblage of neotropical annual fishes. It occurs between northeastern Brazil (4°S) and northeastern Argentina (37°S), in several habitats, including the Caatinga (semi-arid region of northeastern Brazil), Cerrado (savannas of central Brazil), the Chaco (semi-arid region of Paraguay and northern Argentina) and the Pampas (grassy plains of southern Brazil, Uruguay and northeastern Argentina).

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Species of *Cynolebias* from central Brazil (*C. griseus* Costa, Lacerda & Brasil) and northeastern Brazil (the *C. porosus* species-complex, comprising *C. porosus* Steindachner, *C. microphthalmus* Costa & Brasil, *C. albipunctatus* Costa & Brasil, *C. leptcephalus* Costa & Brasil, and *C. perforatus* Costa & Brasil) have been hypothesized to form a monophyletic group (Costa, 1995), which was confirmed in a recent phylogenetic study (Costa, in press). The new species herein described shares some unique derived features with species of that assemblage, but also exhibiting some very distinctive morphological conditions.

MATERIAL AND METHODS

Methods for taking measurements and counts follow Costa (1988). Measurements are presented as percentages of standard length (SL), except for subunits of the head, which are presented as percentages of head length. The compound caudal centrum was counted as a single element in vertebrae numbers, which were taken only from the cleared and stained material, prepared according to Taylor and Van Dyke (1985). Nomenclature for frontal squamation follows Hoedeman (1956), and that for cephalic neuromasts follows Gosline's (1949) nomenclature for head sensory canals. Supraorbital neuromasts counts do not include transverse neuromasts over rostral region. Institutional acronyms are: MZUSP, Museu de Zoologia da Universidade de São Paulo, and UFRJ, Universidade Federal do Rio de Janeiro, Rio de Janeiro.

CYNOLEBIAS GILBERTOI N. SP.

(Fig. 1, Table I)

Holotype. - MZUSP 52304, male, 46.2 mm SL; Brazil: Estado da Bahia, temporary pond about 30 km South of Bom Jesus da Lapa, near rio São Francisco; G.C. Brasil, 30 April 1994.

Paratypes. - MZUSP 52305, one female, 34.1 mm SL; UFRJ 4470, one male, 40.0 mm SL, and two females, 34.3 and 37.1 mm SL; UFRJ 4471, two females (cleared and stained for bone and cartilage), 32.9 and 35.9 mm SL; all collected with the holotype.

Diagnosis

The new species is similar to members of the *Cynolebias porosus* species-group and distinct from all other cynolebiatins by the possession of four synapomorphies: 1) tip of the interarcual cartilage displaced to posterior portion of second pharyngobranchial (vs. tip of the interarcual cartilage attached to the upper portion of second pharyngobranchial); 2) a distinct ossification ventral to basibranchial cartilage (vs. ossification absent); 3) two distinct transverse rows of neuromasts above opercular region (vs. no transverse rows above opercular region); and, 4) distal portion of anal fin of males pale blue on fin membrane and red on rays (vs. never presenting this color pattern). It is immediately distinguished from all other species of this complex by having 10-13 teeth on vomer (vs. usually teeth absent, rarely one or two), 31 or 32 vertebrae (vs. 34-36), 31 or 32 scales on the longitudinal series (vs. 36-50), and pelvic fins separated by a broad interspace, wider than one pelvic-fin base (vs. shorter than one pelvic-fin base).

griseus Costa, Lacerda & Brasil) and x, comprising *C. porosus* Steindachipunctatus Costa & Brasil, *C. lep-* & Brasil) have been hypothesized to s confirmed in a recent phylogenetic described shares some unique derived exhibiting some very distinctive mor-

METHODS

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Cynolebias porosus species-group session of four synapomorphies: 1) portion of second pharyngobranchial er portion of second pharyngobran- chial cartilage (vs. ossification ab- ove opercular region (vs. no trans- tion of anal fin of males pale blue on his color pattern). It is immediately y having 10-13 teeth on vomer (vs. ebrae (vs. 34-36), 31 or 32 scales on arated by a broad interspace, wider (fin base).

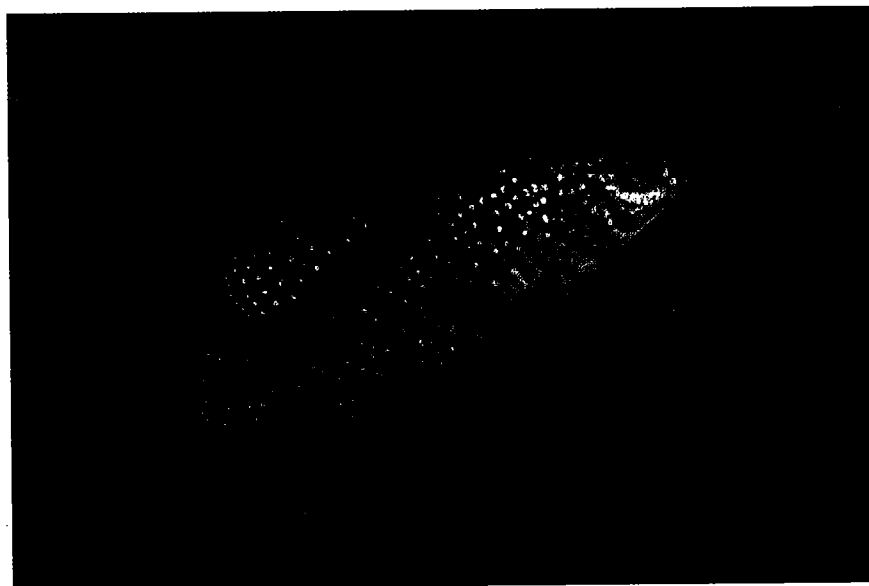


Fig. 1. - *Cynolebias gilbertoi* n. sp., male, about 50 mm SL, one week after collection; not preserved.

Description

Morphometric data are given in table I. Dorsal profile approximately straight on head, convex on nape, and nearly straight to posterior dorsal-fin base, where it is concave, becoming straight to caudal-fin base. Ventral profile nearly straight on head, convex between branchial aperture and posterior anal-fin base, and gently concave on caudal peduncle.

Table I. - Morphometric data of *Cynolebias gilbertoi* n. sp. H: holotype; P: paratypes.

	Males		Females		
	H	P	P	P	P
	MZUSP 52304	UFRJ 4470	UFRJ 4470	UFRJ 4470	MZUSP 52305
SL (mm)	46.2	40.0	37.1	34.3	34.1
In percents of standard length					
Body depth	30.3	30.0	34.9	33.4	34.9
Depth of caudal peduncle	14.6	14.5	15.1	14.8	15.4
Predorsal length	59.9	57.6	63.4	63.8	65.7
Prepelvic length	49.3	52.0	54.9	56.3	56.5
Length of dorsal-fin base	28.6	27.9	24.4	23.1	23.2
Length of anal-fin base	30.5	32.0	23.6	23.1	23.5
Head length	27.9	28.0	29.7	30.8	31.1
In percents of head length					
Head depth	99.7	93.8	93.6	88.6	96.3
Head width	72.9	71.0	72.3	70.0	72.1
Eye diameter	30.0	30.8	32.4	34.2	33.0

Tip of dorsal and anal fins approximately rounded in both sexes; in males, short filamentous rays on the dorsal fin reaching a vertical through the basal portion of caudal fin, and somewhat elongate filamentous rays in the anal fin reaching a vertical through the central portion of caudal fin. Caudal fin rounded. Pectoral fin elliptical. Tip of the pectoral fin reaches a vertical between base of second and third anal-fin rays in males, and a vertical through anus in females. Tip of the pelvic fin reaches the base of third anal-fin ray in males, and between base of first and second anal-fin rays in females. Dorsal-fin origin in a vertical through base of the third or fourth anal-fin ray in males, and base of second anal-fin ray in females. Dorsal-fin rays 16-17 in males, 14-16 in females; anal-fin rays 18 in males, 16-18 in females; total caudal-fin rays 28, principal rays 14; pectoral-fin rays 12-13; pelvic-fin rays 6. Total vertebrae 31-32, precaudal 12-13, caudal 19.

Total neuromasts on the supraorbital series 23-32, 13-16 on the anterior portion, 10-16 on the posterior portion. Two transverse rows of neuromasts above opercular region. A double row of neuromasts on lateral portion of lower jaw. Six to nine neuromasts on the ventral part of opercular region. Scales of the longitudinal series 31-32, scales of the transverse series 10-12, series of scales around caudal peduncle 16-18. Frontal squamation E-patterned, scales irregularly arranged.

Ten to 13 teeth on the anteromedian portion of vomer. No teeth on second pharyngobranchial; interarcual cartilage attached to the posterior portion of second pharyngobranchial; a distinct ossification ventral to basibranchial cartilage. Gill rakers 2+8.

Colouration in life

Males. - Sides of body pale brown with rows of golden dots arranged over narrow, bluish gray vertical bars. Dorsum pale brown. Belly white. Sides of head golden, with vermiculate spots on posterodorsal region. Iris pale orange; a faint reddish brown vertical bar crossing the eye. Dorsal fin orangish brown, becoming dark gray on borders, with golden dots. Basal half of anal fin orangish brown, with a row of pale blue dots along fin base, and pale golden dots scattered over posterior portion of the fin; distal half of anal fin light blue, with red rays, which become black on tips. Caudal fin orangish brown on base, dark gray on the remaining parts, with pale golden dots on the anterior half of the fin. Pelvic fin orangish brown. Pectoral fin hyaline.

Females. - Sides of body pale brown, with slightly darker brown irregular spots on anterior portion, and six vertical bars of the same color in the posterior portion of body; two black spots on the anteroventral region of body. Sides of head pale brown, with golden reflections on opercular region; irregular small dark brown spots on the posterodorsal region. Iris yellow; a faint brown vertical bar crossing the eye. Unpaired fins hyaline, with small dark gray spots. Paired fins hyaline.

Distribution

Known only from the type locality, in the middle rio São Francisco region, northeastern Brazil.

Etymology

Name in honor of Gilberto Campello Brasil, who made several expeditions alone to collect annual fishes in the semi-arid areas of northeastern Brazil, discovering this and many other species unknown to the science.

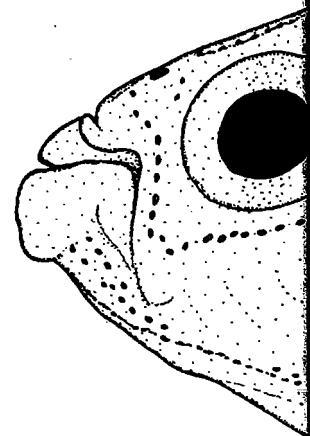


Fig. 2. - Diagrammatic representation of the head of *Cynolebias gilbertoi* (MZUSP 52304).

Relationships

Cynolebias gilbertoi shares characteristics with other species of the *C. porosus* complex: a displaced interarcual cartilage on the lower jaw (Fig. 2), and dark spots scattered on the lateral portion of lower jaw and no black spots on the opercle, whereas those spots of *C. gilbertoi* are black.

Within this assemblage, *C. porosus* is distinguished from other species of the *C. porosus* complex, by the common interarcual cartilage displaced to the posterior portion of the lower jaw, the ossification ventral to basibranchial cartilage, the arrangement of neuromasts above opercular region (black on membrane and red on rays), the arrangement of interarcual cartilage and posteroventral basibranchial cartilage, and the arrangement of neuromasts on the lateral portion of lower jaw. Species of *Cynolebias* also have an elaborate arrangement of neuromasts above opercle. Although some species of *Cynolebias* have red on anal-fin rays, and no other red on fins (e.g., *S. fulminantis* Costa, 1979), this is not a synapomorphy of the clade.

Among species of the *C. porosus* complex, the most closely related to *C. perforatus* is *C. porosus*, a species of the genus also having teeth and neuromasts, except for *Simpson* (1979).

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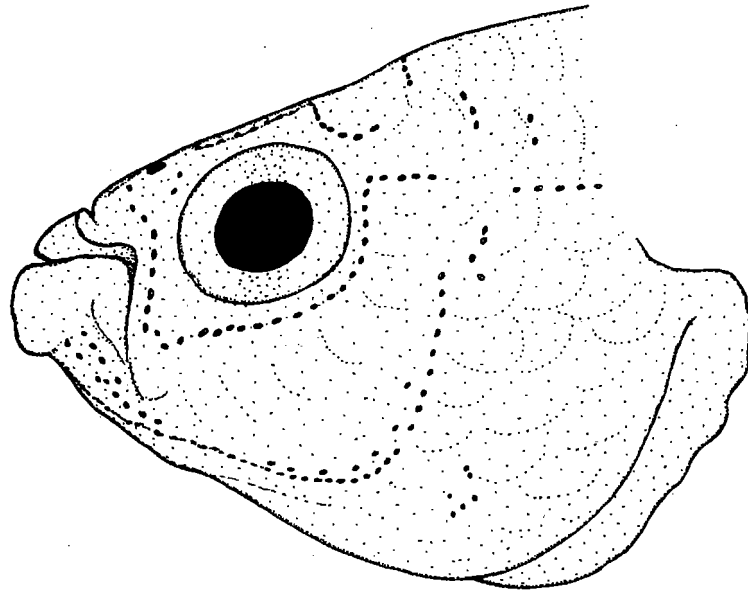


Fig. 2. - Diagrammatic representation of the head of *Cynolebias gilbertoi*, lateral view; holotype, male, MZUSP 52304.

Relationships

Cynolebias gilbertoi shares two apomorphic conditions with *C. griseus* and species of the *C. porosus* complex: a double row of neuromasts on the lateral portion of lower jaw (Fig. 2), and dark spots scattered over dorsolateral portion of head (Fig. 1). All other species of *Cynolebias* and closely related taxa have a single row of neuromasts on the lateral portion of lower jaw and no spots on the dorsolateral portion of head. However, whereas those spots of *C. gilbertoi* are red crimson, in all other species they are brown to black.

Within this assemblage, *C. gilbertoi* seems to be closer related to species of the *C. porosus* complex, by the common possession of four apomorphic features: tip of the interarcual cartilage displaced to posterior portion of second pharyngobranchial (Fig. 3), ossification ventral to basibranchial cartilage (Fig. 4), two distinct transverse rows of neuromasts above opercular region (Fig. 2), and distal portion of anal fin of males pale blue on membrane and red on rays. Both posterior displacement of the interarcual cartilage and posteroventral basibranchial ossification are unique among rivulids. Other species of *Cynolebias* also have an elaborated neuromast pattern, but never those transverse rows above opercle. Although some species of *Symponichthys* may have red pigmentation on fins (e.g., *S. fulminantis* Costa & Brasil), no other species of *Cynolebias* present red on anal-fin rays, and no other rivulids have the color pattern described for the above clade.

Among species of the *C. porosus* complex, *C. gilbertoi* is hypothesized to be most closely related to *C. perforatus* and *C. leptocephalus*, which are the only other species of the genus also having teeth in vomer. Vomerine teeth are absent in all other cynolebiatins, except for *Simpsonichthys whitei* (Myers), which usually has a single

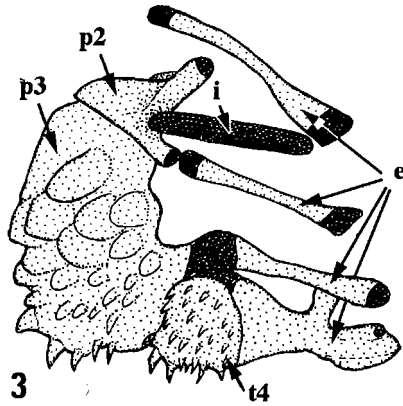


Fig. 3. - Ventral view of left dorsal gill arch of *Cynolebias leptocephalus*. e: epibranchials 1-4; i: interarcual cartilage; p2-3: pharyngobranchials 2-3; t4: tooth plate pharyngobranchial 4. Dots indicate bone, and circles cartilage.

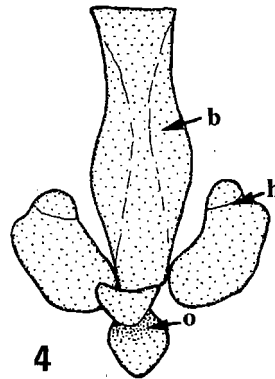


Fig. 4. - Ventral view of posteromedian portion of ventral gill arches of *Cynolebias gilbertoi* n. sp. b: basibranchial 3; h: hypobranchials 3; o: basibranchial ossification. Cartilages not represented.

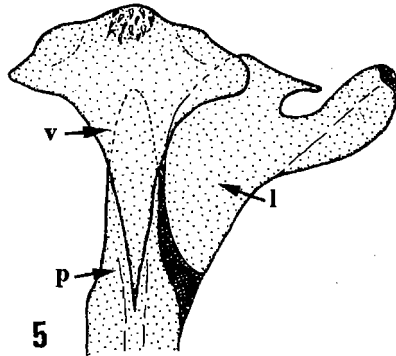


Fig. 5. - Ventral view of ethmoidal region of *Cynolebias gilbertoi* n. sp. l: lateral ethmoid; p: parasphenoid; v: vomer. Dots indicate bone, and circles cartilage.

tooth (Costa, 1996). Therefore, absence of teeth in vomer is considered a plesiomorphic condition for *Cynolebias*. However, *C. perforatus* and *C. leptocephalus* usually have no vomerine teeth, but sometimes may present one or two teeth. *Cynolebias gilbertoi* presents ten or more teeth (Fig. 5), a unique condition among cynolebiatins, since the presence of one or two vomerine teeth also occurs in basal cynolebiatins clades (e.g., plesiolebiatins). In addition, *C. perforatus*, *C. leptocephalus* and *C. gilbertoi* share an increased number of neuromasts on the ventral part of the opercular region: four to six in the former two species, and six to nine neuromasts in *C. gilbertoi* (Fig. 2), in contrast to only two or three in closely related groups.

On the other hand, both *C. griseus* and species of the *C. porosus* complex are among the largest of annual rivulid fishes, males reaching between 70 and 100 mm SL. In contrast, *C. gilbertoi* does not seem to reach such a size. The holotype, the single paratype, and a not preserved specimen illustrated in figure 1, did not surpass 50 mm SL, but presented sexually dimorphic characters, such as filamentous rays in the dorsal and

anal fin of males, completely developed. Nevertheless, in other species of that genus, specimens larger than 50 mm SL. For condition similar to that of most other species, suggesting that *C. gilbertoi* may have these apparent plesiomorphies (reduced or interpreted as reversals, in view of above, and thus arguing for the inclusion in the complex.

Besides the uniqueness of morphological feature of *C. gilbertoi*, the combination among cynolebiatins, constituting an

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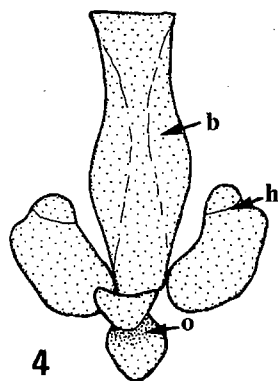


Fig. 4. - Ventral view of ethmoidal region of *Cynolebias gilbertoi* n. sp. l: lateral ethmoid; p: parasphenoid; v: vomer. Dots indicate bone, and circles cartilage.

Fig. 5. - Ventral view of ethmoidal region of *Cynolebias gilbertoi* n. sp. l: lateral ethmoid; p: parasphenoid; v: vomer. Dots indicate bone, and circles cartilage.

The vomer is considered a plesiomorphic character for *C. leptocephalus* and *C. gilbertoi* usually have no teeth. *Cynolebias gilbertoi* presents a unique character among cynolebiatins, since the presence of two teeth in the basal cynolebiatins clades (e.g., *C. leptocephalus* and *C. gilbertoi* share an unique character of the opercular region: four to six in *C. leptocephalus* and *C. gilbertoi* (Fig. 2), in contrast to

Species of the *C. porosus* complex are reaching between 70 and 100 mm SL. In such a size. The holotype, the single specimen in figure 1, did not surpass 50 mm SL, and has filamentous rays in the dorsal and

anal fin of males, completely developed, even in the smaller specimen (40 mm SL). Nevertheless, in other species of that group, these filaments are fully developed only in specimens larger than 50 mm SL. Furthermore, *C. gilbertoi* has 31 or 32 vertebrae, a condition similar to that of most other cynolebiatins, but contrasting with the apomorphic higher counts for vertebrae (33-36) of *C. griseus* and species of the *C. porosus* complex, suggesting that *C. gilbertoi* may not be a representative of this clade. However, these apparent plesiomorphies (reduced size and lower vertebra counts) are parsimoniously interpreted as reversals, in view of the several conflicting characters discussed above, and thus arguing for the inclusion of *C. gilbertoi* in the *C. porosus* species-complex.

Besides the uniqueness of multiple vomerine teeth as discussed above, another diagnostic feature of *C. gilbertoi*, the wide interspace between the pelvic fins is unique among cynolebiatins, constituting an autapomorphic condition.

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