

The tadpole of *Scinax cosenzai* (Anura: Hylidae)

CARLA SILVA GUIMARÃES, MARCO ANTÔNIO A. PEIXOTO, JOÃO VÍCTOR ANDRADE LACERDA
& RENATO NEVES FEIO

Universidade Federal de Viçosa, Departamento de Biologia Animal, Museu de Zoologia João Moojen. Vila Gianetti 32.
CEP 36570-000. Viçosa, MG, Brazil

Corresponding author: CARLA SILVA GUIMARÃES, email: sguimaraes.carla@gmail.com

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Abstract. The bromeligenic *Scinax perpusillus* group is currently composed of 13 species endemic to the Atlantic rainforest, occurring north from the Brazilian state of Espírito Santo to Santa Catarina in the south. *Scinax cosenzai* was recently described from the state of Minas Gerais. It is the species with the most inland record of the group. As its original description lacks information on its larvae, we herein describe the tadpole of *S. cosenzai* and provide a comparison to the other known tadpoles of the group. Thirty-one tadpoles were collected from bromeliads at the Parque Estadual da Serra do Brigadeiro, then analysed and compared to information on tadpoles of the *S. perpusillus* group available in the literature. The tadpole of *S. cosenzai* may be diagnosed by the following set of characters: 1) lack of any yellow or golden marks; 2) a total length of 19.9–31.1 mm (stages 25–38); 3) lateral sections of mouth with labial papillae arranged in 3–4 rows; 4) anterior portion of mouth with a single row of labial papillae; 5) dorsal and ventral fins equal in height.

Key words. Amphibia, bromeliad, larvae, taxonomy, Serra do Brigadeiro, Minas Gerais

Introduction

The hylid genus *Scinax* WAGLER, 1830, is currently composed of 111 species of treefrogs, occurring south from Argentina and Uruguay north to Mexico (FROST 2013). PEIXOTO (1987) was the first to propose the existence of a *Scinax perpusillus* group, currently characterized by species of *Scinax* with bromeligenic habits, interdigital webbing absent between toes I and II, and absent or vestigial between II and III (FAIVOVICH 2002). Although the monophyly of the *Scinax perpusillus* group has not as yet been adequately tested it is continued to be recognized. Its assumed monophyly was also supported by POMBAL & BASTOS (2003) and ALVES-SILVA & SILVA (2009) with vocalization data and reproductive behaviour characteristics, respectively.

The group is currently composed of 13 species: *Scinax alcatraz* (LUTZ, 1973), *S. arduous* PEIXOTO, 2002, *S. atratus* (PEIXOTO, 1989), *S. belloni* FAIVOVICH, GASPARINI & HADDAD, 2010, *S. cosenzai* LACERDA, PEIXOTO & FEIO, 2012, *S. faivovichii* BRASILEIRO, OYAMAGUCHI & HADDAD, 2007, *S. insperatus* SILVA & ALVES-SILVA, 2011, *S. littoreus* (PEIXOTO, 1988a), *S. melloi* (PEIXOTO, 1989), *S. perpusillus* (LUTZ & LUTZ, 1939), *S. peixotoi* BRASILEIRO, HADDAD, SAWAYA & MARTINS, 2007, *S. tupinamba* SILVA & ALVES-SILVA, 2008, and *S. v-signatus* (LUTZ 1968). These species are all endemic to the Brazilian Atlantic tropical coastal forest, distributed north from the state of Espírito Santo south to

the state of Santa Catarina (ALVES-SILVA & SILVA 2009), inhabiting bromeliads in both mountain regions and coastal areas (SILVA-SOARES et al. 2010).

Scinax cosenzai was recently described from the Parque Estadual da Serra do Brigadeiro situated in the municipalities of Araponga and Ervália, state of Minas Gerais, being the most inland record of the group (LACERDA et al. 2012). Herein we describe the tadpole of *S. cosenzai* and provide a detailed comparison to the other known tadpoles of the *S. perpusillus* group.

Material and methods

Tadpoles of *Scinax cosenzai* were collected from bromeliads in the municipality of Araponga, in January of 2008 (20°43'13" S and 42°28'48" W; MZUFV 252), and in the municipality of Ervália, in January of 2012 (20°51'52" S and 42°31'17" W; MZUFV 253), both sites are located within the Parque Estadual da Serra do Brigadeiro, the type locality of the species.

All tadpoles were preserved in formalin 10% and deposited in the herpetological collection of the Museu de Zoologia João Moojen (MZUFV), Universidade Federal de Viçosa, municipality of Viçosa, state of Minas Gerais, southeastern Brazil. The species identity was confirmed by our raising in the laboratory one specimen to metamorph

stage (Fig. 1). This individual exhibited the same dorsal pattern and morphology as observed in *Scinax cosenzai* (see LACERDA 2012).

Fourteen measurements were taken from 31 specimens at stages 24–40 sensu GOSNER (1960): total length (TL), body length (BL), tail length (TAL), tail height (TH), inter-narial distance (IND), interorbital distance (IOD), and tail muscle height (TMH) – all following ALTIG & MCDIARMID (1999); body width (BW), body height (BH), eye–nostril distance (END), eye diameter (ED), and oral disc width (ODW) – all following LAVILLA & SCROCCHO (1986); and spiracle length (SL) and cloacal tube length (CTL). TL and TAL were taken using analogue callipers to the nearest 0.1 mm, while the other measurements were taken using a stereomicroscope with a micrometric ocular (Olympus SZ61).

Our comparison to the other described tadpoles of the *Scinax perpusillus* group was based on literature information: *S. arduous* (PEIXOTO 2002), *S. belloni* (SILVA-SOARES et al. 2010), *S. insperatus* (SILVA & ALVES-SILVA 2011), *S. littoreus* (PEIXOTO 1987), *S. melloi* (PEIXOTO 1988b), *S. perpusillus* (PEIXOTO 1987), *S. tupinamba* (SILVA & ALVES-SILVA 2008), and *S. v-signatus* (PEIXOTO 1987).

Results

Description. All 14 measurements from each tadpole of *Scinax cosenzai* are presented in Table 1. Body dorsoventrally compressed (BW > BH), oval in dorsal view (Fig. 2A) and slightly longer than wide, with rounded ends. These ends may have a width difference between them, with the anterior end being less wide than the posterior counterpart. Some tadpoles that were raised in an aquarium and analysed at an advanced stage (near 39) had a piriformous body shape in dorsal view with the posterior end of the body being much wider than the anterior portion (Fig. 2D).



Figure 1. Juvenile of *Scinax cosenzai* metamorphosed in the laboratory (MZUFV 253, SVL 10 mm).

Snout rounded in lateral and dorsal views. Eyes dorso-laterally located. Nostrils rounded and dorsally positioned. Spiracle sinistral with a posterodorsal opening. Terminal portion of spiracle tube with a free end. The arrangement of the intestinal tube is circular and spiralled in the centre of the abdomen during the early stages and shifted laterally (to the right in ventral view) at stages around 37. Dextral ventral tube with a free end a little above the bottom margin of the ventral fin.

Tail height corresponding to 92.7% of the body height (68.0–113.4%, sd = 10.7, n = 31) with a rounded or obtuse (intermediate between rounded and pointed) termination (Figs. 2C and 2E). Tail musculature height corresponding to 49.9% of the tail height (31.8–62.0%, sd = 7.8, n = 31). Dorsal fin from slightly convex to rectilinear, starting in the posterior third of the body with the insertion of the tail. Ventral fin slightly convex, starting at the level of the ventral tube. Dorsal and ventral fins equal in height.

Mouth ventrally located, without emarginations. The anterior portion is surrounded by one row of papillae with a large gap in the centre, 1–3 rows in the posterior section, and 3–4 rows laterally (Fig. 3). Labial tooth row formula 2(2)/3: two anterior rows of labial teeth, the second one with a small gap; three rows of labial teeth in the posterior portion. Jaw sheaths with moderate keratinisation, upper jaw v-shaped (cusped) and serrated, and lower jaw also serrated.

Colouration in life. Body with translucent skin, allowing to see the internal organs through it. Body loosely speckled with some darker pigment, more concentrated in the anterior third. The fins are also transparent with scattered darker pigment, likewise more concentrated in the anterior portion. The tail musculature is light beige in colour. Some individuals exhibited black blotches on the tail (fins and musculature), varying in density (Fig. 2F).

Colouration in formalin. The body skin turns a little darker, but remains translucent. The fins become less transparent, and take on a light beige colour, emphasizing the dark speckling.

Discussion

Prior to the present study, eight of the 13 described species belonging to the *Scinax perpusillus* group had their tadpoles described; missing were descriptions of those of *S. alcatraz*, *S. atratus*, *S. cosenzai*, *S. faivovichii* and *S. peixotoi*. Although the known tadpoles of the members of the *S. perpusillus* group are evidently very similar to each other, they may differ in the shape of lower jaw, numbers of rows of labial papillae, size of fins, height of tail, height of body, shape of tail termination, or whether the caudal muscles reach the end of the tail (SILVA-SOARES et al. 2010). Herein, we raise the number of species with described tadpoles within the group to nine by describing the tadpole of *S. cosenzai*, which can be distinguished from the other

Table 1. Fourteen measurements to the nearest of 0.1 mm of 31 tadpoles of *Scinax cosenzai*. Staging follows GOSNER (1960); total length (TL), body length (BL), body width (BW), body height (BH), tail length (TAL), tail height (TH), tail muscle height (TMH), eye diameter (ED), interorbital distance (IOD), eye–nostril distance (END), internarial distance (IND), oral disc width (ODW), spiracle length (SL), and cloacal tube length (CTL). Repeated stages represent the number of specimens measured at that stage.

Stage	TL	BL	BW	BH	TAL	TH	TMH	ED	IOD	END	IND	ODW	SL	CTL
24	22.1	8.5	5.0	3.5	13.6	3.5	1.9	0.7	2.5	1.2	1.9	2.1	0.7	1.0
25	23.0	9.3	6.4	4.8	13.7	3.8	2.3	1.0	3.6	1.5	1.9	2.0	0.8	1.0
25	23.7	9.9	7.3	5.8	13.8	5.9	2.5	1.1	4.6	1.9	2.3	2.7	1.2	1.3
26	24.9	9.6	6.7	4.8	15.3	4.0	2.1	1.0	3.7	1.8	2.1	1.7	0.8	1.1
26	22.1	8.5	6.4	4.7	13.6	3.2	1.7	0.9	3.5	1.6	1.9	2.0	0.1	1.1
26	23.8	9.1	5.7	4.5	14.7	4.5	1.9	0.9	3.4	1.5	2.3	2.0	0.8	0.9
26	19.9	8.3	5.7	4.2	11.6	4.4	1.4	0.9	3.3	1.6	1.9	1.6	0.9	0.9
27	22.0	8.0	5.0	4.9	14.0	4.9	2.1	1.0	3.2	1.4	1.8	1.8	1.1	0.6
27	23.4	9.1	5.7	4.9	14.3	4.0	1.4	0.7	3.4	1.4	2.0	2.1	1.1	0.8
28	24.6	8.8	6.0	5.2	15.8	5.9	1.9	1.0	3.8	1.7	2.0	2.4	0.7	1.4
29	21.6	8.4	5.6	4.2	13.2	3.8	1.7	0.9	3.5	1.5	1.9	1.8	0.6	0.9
34	24.5	8.9	6.1	4.5	15.6	4.1	2.4	1.2	3.5	1.7	1.9	2.0	0.8	1.2
34	22.4	9.1	5.6	4.4	13.3	3.9	1.8	0.9	3.4	1.5	1.8	2.2	0.9	1.1
36	23.4	8.9	6.5	4.4	14.5	3.7	2.2	1.2	3.9	1.7	2.1	2.7	1.3	1.1
36	24.5	10.4	7.3	5.9	14.1	5.0	2.4	1.2	3.8	1.9	2.0	2.3	1.3	0.8
36	28.1	10.5	7.8	4.7	17.6	4.9	3.0	1.4	4.2	1.9	2.2	2.3	0.9	1.5
36	30.9	10.7	8.0	5.8	20.2	5.9	2.8	1.4	4.4	2.2	2.2	2.7	0.9	2.1
37	27.1	10.5	7.2	5.3	16.6	5.3	2.5	1.5	4.5	1.8	2.1	2.3	1.5	2.1
37	27.3	10.5	7.2	5.5	16.8	4.7	2.5	1.3	4.2	1.8	2.2	2.4	1.3	1.2
37	27.4	10.5	7.4	5.9	16.9	6.1	2.8	1.5	4.3	2.1	1.9	2.2	1.3	1.9
37	31.1	10.8	8.2	5.2	20.3	5.0	3.1	1.5	4.7	2.0	2.3	2.7	1.2	2.2
38	26.7	10.6	8.9	6.4	16.1	5.5	2.9	1.4	4.4	2.1	2.2	2.7	0.8	0.9
38	29.1	10.6	8.1	5.6	18.5	5.4	2.7	1.5	4.3	2.0	2.3	2.7	1.1	1.0
38	30.8	11.0	7.9	5.6	19.8	5.4	2.4	1.4	4.5	2.1	2.2	2.5	0.5	2.0
39	24.8	10.0	6.8	4.9	14.8	5.5	2.8	1.3	4.5	2.0	2.2	3.1	1.5	1.6
39	27.8	10.5	7.5	6.5	17.3	4.7	2.5	1.3	4.2	1.9	2.2	2.4	1.7	1.1
39	29.7	10.5	8.4	6.1	19.2	5.7	3.2	1.4	4.2	2.2	2.2	2.9	0.4	1.5
40	28.0	11.3	8.2	5.7	17.7	5.5	2.6	1.4	4.5	2.0	2.2	2.5	1.0	0.9
40	28.6	9.9	7.5	5.3	18.7	4.8	2.6	1.5	4.1	2.1	2.1	2.1	1.0	1.5
40	28.6	10.5	7.3	5.6	18.1	4.6	2.3	1.4	4.4	1.9	2.2	2.5	1.2	1.3
40	29.9	11.0	8.3	5.7	18.9	4.9	2.8	1.4	4.5	2.0	2.1	2.6	0.6	1.9

known tadpoles of the group by the combination of the following characters:

The discrete colouration of the tadpoles of *Scinax cosenzai* readily distinguishes it from those of *S. belloni* and *S. insperatus*. The tadpole of *S. tupinamba* has a bright yellow stripe between the eyes and nostrils that differentiates it from all other known tadpoles of the group (SILVA & ALVES-SILVA 2008). The tadpole of *S. belloni* has a golden pigmentation throughout the body and a dark band along the dorsal and ventral fins (SILVA-SOARES et al. 2010). *Scinax insperatus* differs from all other known tadpoles of the group by having fins with yellow spots at the later stages of its development (SILVA & ALVES-SILVA 2011). The tadpole of *S. cosenzai* furthermore differs from *S. belloni* and *S. insperatus* by having only 3–4 rows of lateral labial papillae (4–6 in *S. belloni* and *S. insperatus*).

The tadpoles of *Scinax arduous*, *S. littoreus*, *S. melloi*, *S. perpusillus* and *S. v-signatus* are similar to *S. cosenzai* in that they lack any trace of yellow or golden markings. However, tadpoles of *S. cosenzai* may have dark pigmentation on the tail (as does *S. tupinamba*) and they are larger than those of *S. arduous* and *S. littoreus* described by PEIXOTO (1988a, 2002): TL of 16.7–23.0 mm ($x = 19.9$, $n = 13$, stages 26–37) in *S. arduous*, and 19.9–31.1 mm ($x = 24.9$, $sd = 3.1$, $n = 18$, stages 26–37) in *S. cosenzai*; TL of 16.0–19.9 mm (stages 25–38) in *S. littoreus* and 19.9–31.1 mm ($x = 25.3$, $sd = 3.1$, $n = 23$, stages 25–38) in *S. cosenzai*.

Regarding colour pattern and total length, the tadpole of *Scinax cosenzai* is most similar to those of *S. melloi*, *S. perpusillus* and *S. v-signatus*. Having a tail with dorsal and ventral fins of equal heights differentiates *S. cosenzai* from all these species (dorsal fin higher than ventral fin

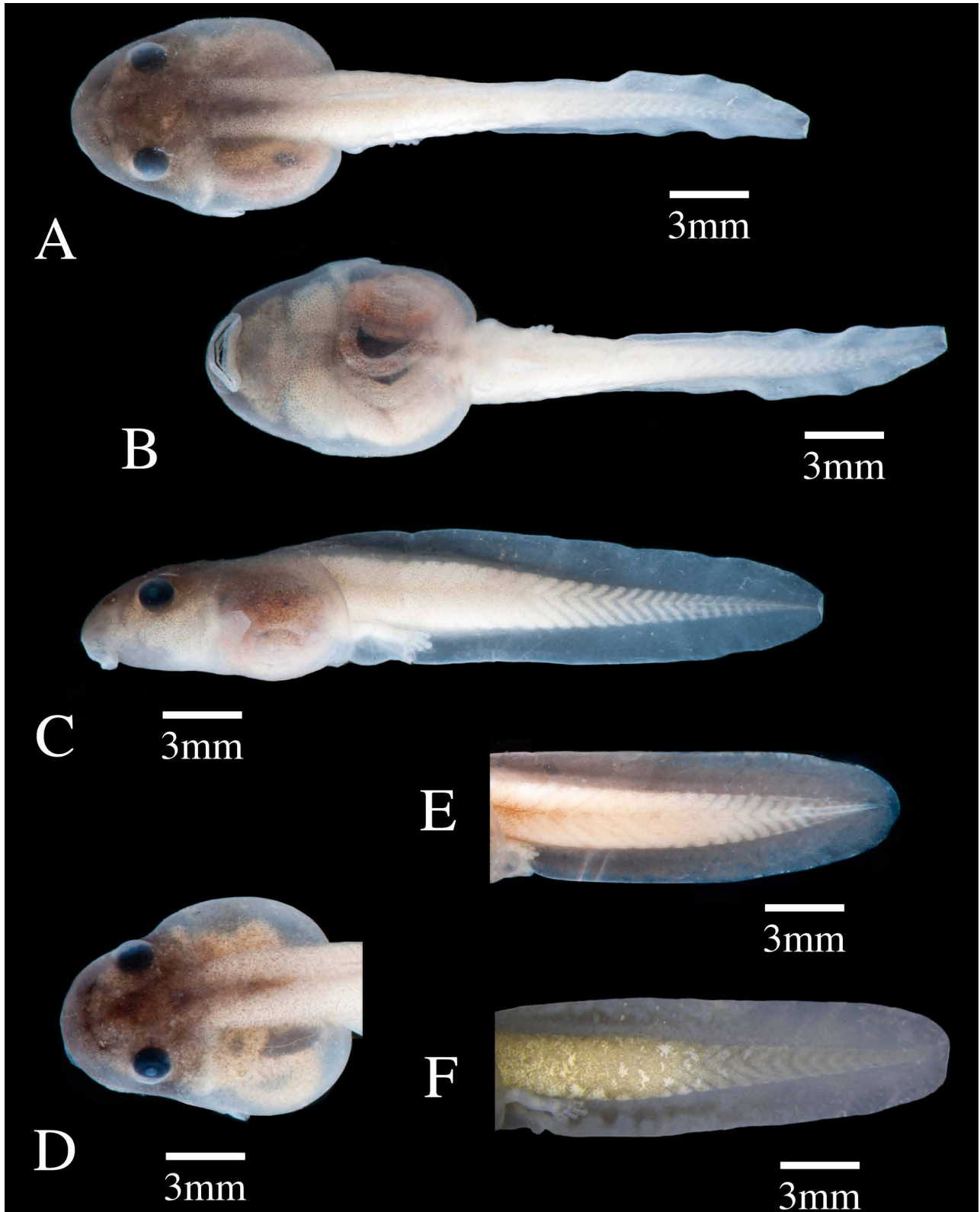


Figure 2. Tadpole of *Scinax cosenzai*: A) Dorsal view with emphasis on the ovoid body shape (stage 36); B) Ventral view (stage 36); C) Lateral view with emphasis on the obtuse tail ending (stage 36); D) Body dorsal view with emphasis on the piriform body shape (stage 38); E) Tail lateral view with emphasis on the rounded tail ending (stage 34); and F) Tail lateral view with black blotches (stage 38).

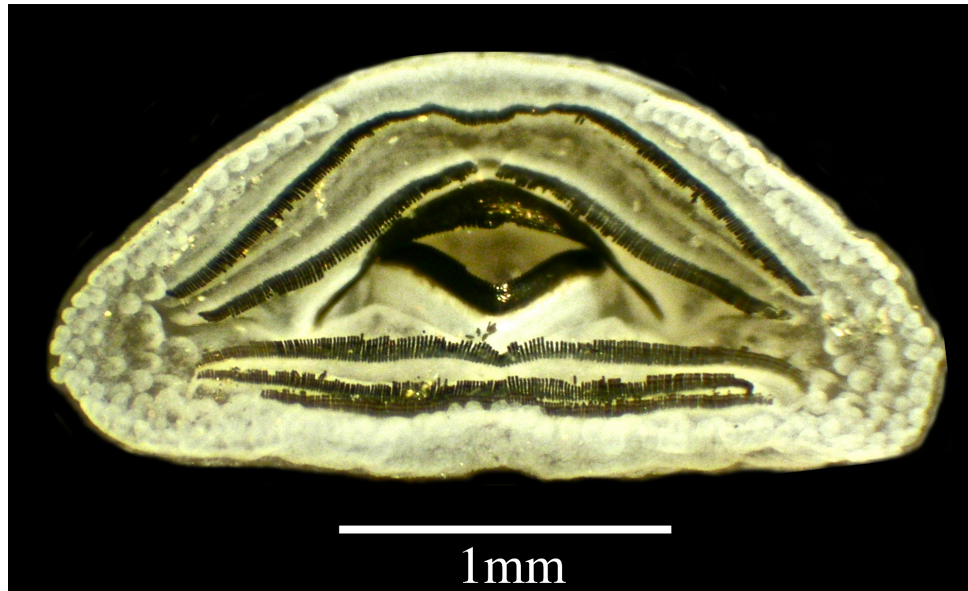


Figure 3. Detail of mouth of tadpole of *Scinax cosenzai* at Stage 36.

in *S. melloi*, *S. perpusillus* and *S. v-signatus*; PEIXOTO 1987, 1988b), though. The tadpole herein analysed furthermore differs from *S. perpusillus* in having its labial papillae arranged in a single row on the anterior margin of the mouth (two rows in *S. perpusillus*) and from *S. v-signatus* in having fewer lateral rows of labial papillae (four or more rows in *S. v-signatus* versus three or four rows in *S. cosenzai*).

Morphological studies on tadpoles may contribute to the ecology, taxonomy, phylogeny, and other studies on the evolution of anurans (CONTE et al. 2007, KOLENC et al. 2008). Recently, tadpole features have come to play an important role in the *Scinax perpusillus* group taxonomy, especially after the descriptions of *S. belloni*, *S. insperatus* and *S. tupinamba*, which have synapomorphies associated to their larvae. Nevertheless, comparisons between morphological characteristics of their larvae are still very difficult to perform within the group, in particular due to the lack of important information such as detailed morphometric data morphological nomenclature standardization, and detailed photographs. Thus, detailed descriptions and identification keys may greatly improve the knowledge on the taxonomy of the *S. perpusillus* group.

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