

Description of the tadpole of *Scinax luizotavioi* from the Atlantic rainforest of southeastern Brazil

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We describe and figure for the first time the tadpoles of the hylid frog *Scinax luizotavioi* from stream backwaters and associated puddles of the Atlantic rainforest of southeastern Brazil. External morphology, colour in life and detailed morphometric data are presented. Diagnostic characteristics that help to distinguish *S. luizotavioi* tadpoles from other species within the *S. catharinae* group include labial tooth row formula, disposition of oral papillae and colour in life.

Key words: Anura, diagnostic characters, Hylidae, morphology, *Scinax catharinae* group, tadpole description

INTRODUCTION

Scinax luizotavioi (Caramaschi & Kisteumacher, 1989) is a treefrog of small size (snout–vent length of males 21.8–24.3 mm, females 27.5 mm) described from the Caraça National Park in the state of Minas Gerais, southeastern Brazil (Caramaschi & Kisteumacher, 1989). The type locality is covered by semideciduous montane Atlantic forest and cerrado vegetation in its lower parts; at higher altitudes montane meadows (“campo rupestre”) and misty forest occur. *Scinax luizotavioi* belongs to the *S. catharinae* group and is known only from some areas in the southern portion of the Espinhaço range, southeastern Brazil, occurring in gallery forests in the cerrado and on the edge of the Atlantic forest. Males call at night from low vegetation near water bodies such as ponds or streams (Caramaschi & Kisteumacher, 1989; pers. obs.). This species has already been allocated to the *S. rizibilis* group, whose species were included in the *S. catharinae* group (Pombal et al., 1995). The taxonomy of the *S. catharinae* species group is unclear (Pombal & Bastos, 1996).

Faivovich (2002) recognized two major clades within the genus *Scinax* Wagler, 1830: the *S. catharinae* clade, including the *S. catharinae* and *S. perpusillus* species groups, and the *S. ruber* clade. The monophyly of the *S. catharinae* clade seems well supported, although it cannot yet be tested for the *S. perpusillus* group (Faivovich, 2002; Faivovich et al., 2005). According to Faivovich et al. (2005) the following species are included in the *S. catharinae* group: *Scinax agilis* (Cruz & Peixoto, 1983), *S. albicans* (Bokermann, 1967), *S. angrensis* (B. Lutz, 1973), *S. argyreornatus* (Miranda-Ribeiro, 1926), *S. ariadne* (Bokermann, 1967), *S. aromothyella* Faivovich, 2005, *S. berthae* (Barrio, 1962), *S. brienti* (Witte, 1930), *S. canastrensis* (Cardoso & Haddad, 1982), *S. carnevallii* (Caramaschi & Kisteumacher, 1989), *S. catharinae*

(Boulenger, 1888), *S. centralis* Pombal & Bastos, 1996, *S. flavoguttatus* (A. Lutz & B. Lutz, 1939), *S. heyeri* (Peixoto & Weygoldt, 1986), *S. hiemalis* (Haddad & Pombal, 1987), *S. humilis* (B. Lutz, 1954), *S. jureia* (Pombal & Gordo, 1991), *S. kautskyi* (Carvalho e Silva & Peixoto, 1991), *S. littoralis* (Pombal & Gordo, 1991), *S. longilineus* (B. Lutz, 1968), *S. luizotavioi* (Caramaschi & Kisteumacher, 1989), *S. machadoi* (Bokermann & Sazima, 1973), *S. obtriangulatus* (B. Lutz, 1973), *S. ranki* (Andrade & Cardoso, 1987), *S. rizibilis* (Bokermann, 1964), *S. strigilatus* (Spix, 1824) and *S. trapicheiroi* (B. Lutz, 1954).

Only fifteen species in this group have tadpole descriptions: *S. berthae* (de Sá et al., 1997), *S. albicans* and *S. trapicheiroi* (Carvalho e Silva & Carvalho e Silva, 1994), *S. flavoguttatus* (Carvalho e Silva & Carnaval, 1997), *S. argyreornatus* and *S. humilis* (Carvalho e Silva & Carvalho e Silva, 1998), *S. ariadne* (Bokermann, 1967), *S. ranki* (Andrade & Cardoso, 1987), *S. littoralis* (Pombal & Gordo, 1991), *S. machadoi* (Bokermann & Sazima, 1973), *S. hiemalis* (Haddad & Pombal, 1987), *S. longilineus* (Andrade & Cardoso, 1991), *S. rizibilis* (Bokermann, 1964) and *S. angrensis* and *S. kautskyi* (Carvalho e Silva et al., 1995).

Here we describe and figure the tadpoles of *S. luizotavioi* based on 45 individuals belonging to several developmental stages collected in the Estação Ambiental de Peti, an Atlantic rainforest remnant located in the municipality of São Gonçalo do Rio Abaixo, state of Minas Gerais, southeastern Brazil (19°54'S, 43°22'W). This is the locality where some of the paratypes were collected (Caramaschi & Kisteumacher, 1989).

MATERIALS AND METHODS

Collections were made on 27–28 September 2002 at two small forest streams in the study site. Tadpoles were collected with a dip net and preserved in a mixture of equal

parts of 6% formaldehyde and 70% ethanol upon capture (Schiesari & Moreira, 1996). Larvae used in the description were at stage 37 of Gosner (1960). Measurements were taken with a hand calliper (total, body and tail lengths) or under a stereomicroscope with an ocular micrometer (other measures) to the nearest 0.1 mm. Drawings were made with the aid of a camera lucida. Terminology and labial tooth row formula (LTRF) follow Altig (1970) and Grillitsch et al. (1993) and developmental stages are according to Gosner (1960). Tadpole colour was described based on stereoscopic microscope examination, both in life and in preservative. Characters used for species comparisons were taken from original descriptions of tadpoles. Some tadpoles were reared through metamorphosis to confirm species identity, but these individuals were not used in the tadpole description. Voucher specimens were deposited in the herpetological collection of the Laboratório de Zoologia de Vertebrados, Escola Superior de Agricultura Luiz de Queiroz, Universidade de São Paulo, Brazil (VESALQ 1001).

RESULTS

Tadpole description (Fig. 1)

The following description is based on six tadpoles at stage 37 belonging to the population of Estação Ambiental de Peti (Table 1). Body and total length for all available developmental stages and detailed morphometric data for selected developmental stages can be found in Table 1.

Body slightly flattened dorsoventrally, ovoid in dorsal view. Total length 2.7–3.1 times body length ($n=5$); body 1.6–1.8 times longer than wide ($n=6$), 1.9–2.3 times longer than high ($n=6$), and slightly wider than high. Snout rounded in lateral and dorsal views. Nares rounded and located slightly nearer the eyes than snout tip; nostril rims slightly protuberant, whitish with a few dark chromatophores sparsely distributed. Eyes dorsolateral, their diameter 0.2–0.3 times body width ($n=6$) and 0.3 times body height ($n=6$); interorbital distance 0.6–0.9 times body width ($n=6$) and 2.9–4.0 times eye diameter ($n=6$). Oral disc anteroventral, about 0.4 times body width; lateral margins and posterior end of the oral disc continuous; posterior margin of the folded oral disc concave; oral disc surrounded by a single row of marginal papillae interrupted in the middle of the anterior labium by a small gap; consecutive papillae in this margin oppositely oriented; one or two rows of lateral submarginal papillae. LTRF 2(2)/3; third posterior row of keratodonts contained within the margins of the oral disc. Upper jaw sheath concave, lower jaw sheath V-shaped, both jaw sheath margins finely serrated and dark pigmented; lower jaw sheath with a pair of keratinized spurs located at ends of arch. Spiracular tube sinistral, its inner wall free from body; spiracle opening directed posteriorly and located beyond half of body (about 0.6 times body length). Vent tube dextral, reaching the free margin of the lower fin; left wall of vent tube adhered to right lateral surface of ventral fin. Tail length about 0.6–0.7 times total length ($n=5$); tail musculature well developed; dorsal fin slightly deeper

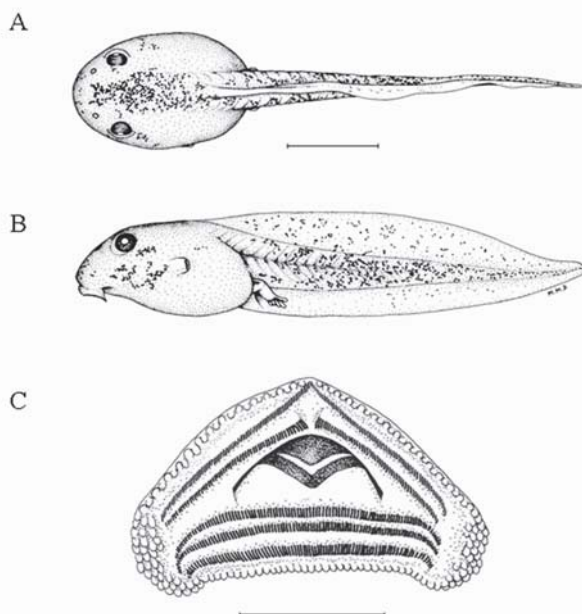


Fig. 1. Tadpole of *Scinax luizotavioi* from Estação Ambiental de Peti, Minas Gerais state, southeastern Brazil (Stage 37 of Gosner, 1960). A) Dorsal and B) right lateral views; C) oral disc. Bars equal to 5 mm (A and B) and 1 mm (C).

than ventral fin, both with outline slightly convex; tail tapering smoothly.

Body proportions do not change in any defined direction through development but can vary slightly among individuals. Variation in morphometric data can be found in Table 1. A few individuals showed variation in LTRF: of 43 individuals analysed, three presented the 2(2)/3(2) and one the 2(1,2)/3 formula.

Colour

In life. Body yellowish light brown; tail translucent yellowish, with irregular dark dots; spiracle translucent and poorly pigmented, with few elongated dark chromatophores; belly transparent, with small whitish chromatophores, revealing the dark gut and the reddish gills. Fins transparent with small elongate black chromatophores. Eyes with two concentric copper circles on black ground with many golden flecks. Depending on the habitat, tadpole body may present a much darker brownish coloration.

In preservative. Body dark brown, except for the caudal portion of the tail musculature (visible by transparency), which is yellowish cream; spiracle unpigmented; belly transparent with small light brown chromatophores more densely grouped in its cranial half, posterior to oral disc; intestinal coiled mass entirely visible by transparency. Tail musculature yellowish cream with many small, light brown, regularly distributed chromatophores. Fins transparent with a few small, dark brown chromatophores that are more densely grouped in dorsal fin. Eyes black with white rounded pupils.

Habitats and ecology

The tadpoles are benthonic and inhabit stream backwaters inside the forest. Twenty-six tadpoles were collected

Table 1. Morphometric data [mean±standard deviation (range)] in mm for *Scinax luizotavioi* tadpoles from Estação Ambiental de Peti, São Gonçalo do Rio Abaixo, Minas Gerais state, southeastern Brazil, for all available developmental stages (Gosner, 1960). Detailed measurements are presented only for stages 34–37. BL: body length; TL: total length; TAL: tail length; MTH: maximum tail height; UF: maximum height of upper tail fin; LF: maximum height of lower tail fin; RN: rostronarial distance; NP: naropupillar distance; IND: internarial distance; IOD: interorbital distance; ED: maximum diameter of eye; BW: maximum body width; BH: maximum body height; TMH: tail muscle height.

Stage	n	BL	TL	TAL	MTH	UF	LF	RN	NP	IND	IOD	ED	BW	BH	TMH	
25	7	6.7±0.5 (6.1–7.5)	18.1±2.3 (15.0–21.5)													
26	2	6.5±0.2 (6.3–6.7)	17.0±0.14 (16.9–17.1)													
27	1	6.0	17.0													
28	4	7.5±0.7 (6.6–8.1)	20.3±2.8 (17.3–22.8) ^a													
29	1	7.5	19.1													
30	1	8.6	21.3													
31	4	8.6±0.5 (8.2–9.4)	21.7±1.6 (19.9–23.9)													
32	1	7.3	18.4													
34	2	8.9±0.1 (8.8–8.9)	23.6±0.4 (23.3–23.9)	14.8±0.5 (14.4–15.1)	4.9±0.6 (4.5–5.3)	1.9±0.1 (1.8–2.0)	1.6±0.1 (1.5–1.7)	2.1±0.4 (1.8–2.3)	1.3±0.1 (1.2–1.4)	1.8±0.1 (1.7–1.9)	3.4±0.1 (3.3–3.5)	1.2±0.2 (1.0–1.3)	4.7±0.1 (4.6–4.7)	4.0±0.1 (3.9–4.1)	2.2±0.4 (1.9–2.4)	
35	7	8.5±0.8 (7.3–9.5)	23.9±2.2 ^b (21.4–26.5)	15.3±1.8 (12.6–17.3) ^b	4.6±0.4 (4.0–5.3)	1.9±0.2 (1.6–2.2)	1.5±0.2 (1.1–1.7)	1.7±0.2 (1.4–2.0)	1.3±0.1 (1.1–1.5)	2.1±0.3 (1.8–2.5)	3.3±0.4 (2.9–3.9)	1.1±0.1 (1.0–1.2)	4.8±0.5 (4.4–5.6)	3.9±0.3 (3.3–4.2)	2.1±0.2 (2.0–2.3)	
36	2	8.6±1.0 (7.9–9.3)	23.3 ^c	15.4 ^c	4.6±0.6 (4.2–5.0)	1.8±0.4 (1.5–2.0)	1.4±0.3 (1.2–1.6)	2.0±0.0	1.4±0.0	1.9±0.1 (1.8–2.0)	3.4±0.6 (3.0–3.8)	1.1±0.0	5.1±0.9 (4.4–5.7)	4.0±0.4 (3.7–4.2)	2.1±0.1 (2.0–2.1)	
37	6	9.7±1.0 (8.7–11.4)	28.8±2.2 ^d (27.0–31.6)	19.0±1.5 (12.6–17.3) ^d	5.2±0.6 (4.3–5.8)	2.0±0.2 (1.8–2.3)	1.6±0.3 (1.3–2.0)	1.8±0.5 (1.2–2.4)	1.5±0.3 (1.1–1.9)	2.3±0.2 (2.1–2.6)	4.2±0.6 (3.5–4.9)	1.3±0.1 (1.1–1.5)	5.8±0.7 (5.1–7.0)	4.6±0.4 (4.1–5.0)	2.5±0.5 (1.8–3.2)	
38	1	8.7	25.9													
39	2	9.6±0.1 (9.5–9.7)	28.2±0.5 (27.8–28.6)													
41	2	10.6±1.6 (9.6–11.8)	30.6±3.4 (28.1–33.0)													

^an=3, ^bn=6, ^cn=1, ^dn=5 (one tadpole with tail damaged in each sample).

in a stream puddle bordered by *Heliconia* (Heliconiaceae) and exotic *Impatiens* (Balsaminaceae) at the forest edge. Tadpoles certainly also develop in ponds and swamps in addition to streams, since we recorded calling males almost every month between April 2002 and June 2004 in several water bodies at the study site (unpublished data).

DISCUSSION

The labial tooth row formula 2(2)/3 distinguishes *S. luizotavioi* from *S. ariadne*, *S. argyreornatus*, *S. machadoi* and *S. rizibilis*, which exhibit LTRF 2/3, 2(1-2)/3, 2(2)/3(1) and 2(2)/3(3) respectively.

Scinax luizotavioi differs from *S. albicans*, *S. angrensis*, *S. ariadne*, *S. flavoguttatus*, *S. machadoi* and *S. rizibilis* in the presence of a gap on the middle of the papillary border of the anterior labium, which is absent in the other species. This narrow gap also distinguishes *S. luizotavioi* tadpoles from *S. argyreornatus*, *S. berthae*, *S. hiemalis*, *S. humilis*, *S. littoralis* and *S. ranki* tadpoles, which have a larger gap.

The presence of a single row of marginal papillae around the oral disc distinguishes *S. luizotavioi* from *S. albicans*, *S. angrensis*, *S. ariadne*, *S. flavoguttatus*, *S. hiemalis*, *S. kautskyi* and *S. machadoi*, which present complementary submarginal papillae on the papillary border besides lateral submarginal papillae.

The presence of golden lunules or golden and black dorsal transversal stripes can be observed in *S. albicans*, *S. angrensis*, *S. ariadne*, *S. flavoguttatus*, *S. kautskyi*, *S. machadoi* and *S. trapicheiroi*, whereas *S. luizotavioi* and the other known tadpoles of the *S. catharinae* group show life colours in tones of yellow and brown. It should be emphasized that although useful, colour in life is a plastic character that can easily change according to substrate type and time of day, as observed by Carvalho e Silva & Carnaval (1997) for *S. flavoguttatus* tadpoles.

S. luizotavioi and *S. longilineus* can occur in syntopy, as observed at the Estação Ecológica de Fechos, municipality of Nova Lima, Minas Gerais state (20°04'S, 43°57'W), a second locality where we collected *S. luizotavioi* tadpoles. *Scinax luizotavioi* preferentially inhabits stream backwaters, but also occurs in ponds and swamps, whereas *S. longilineus* is usually found in stream backwaters. Both species show quite similar oral morphology. At stage 37 *Scinax luizotavioi* differs from *S. longilineus* in the ratio IOD/ED (about 3.2 and about 2.1, respectively; Andrade & Cardoso, 1991). These two tadpoles also differ in size (total length 8.7–11.4 vs 13.6 mm and body length 27.0–31.6 vs 43.8 mm, respectively; Andrade & Cardoso, 1991). Tadpole size may be greatly influenced by environmental constraints, which makes it a bad diagnostic character. Although we did not check for overlapping, the *S. longilineus* tadpoles seem to reach a bigger size at metamorphosis than *S. luizotavioi* tadpoles. Although these tadpoles might be distinguishable by morphological and morphometrical comparison, a study should be done focusing particularly on the differences between them.

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