



Research paper

The tadpoles of the neotropical *Scinax catharinae* group (Anura, Hylidae): Ecomorphology and descriptions of two new forms

Tiago Leite Pezzuti^{a,*}, Igor Rodrigues Fernandes^a, Felipe Sá Fortes Leite^b,
Carlos Eduardo De Sousa^c, Paulo Christiano Anchieta Garcia^a, Denise Rossa-Feres^c

^a Laboratório de Herpetologia, Departamento de Zoologia, Instituto de Ciências Biológicas, Universidade Federal de Minas Gerais, Belo Horizonte, Minas Gerais, Brazil

^b Universidade Federal de Viçosa, Campus Florestal, Florestal, Minas Gerais, Brazil

^c Departamento de Zoologia e Botânica, Instituto de Biociências, Letras e Ciências Exatas, Universidade Estadual de São Paulo, Campus São José do Rio Preto, São José do Rio Preto, São Paulo, Brazil

ARTICLE INFO

Article history:

Received 26 August 2015

Received in revised form 4 February 2016

Accepted 16 February 2016

Available online 20 February 2016

Corresponding Editor: Alexander Kupfer.

Keywords:

Taxonomy

Dendropsophini

Larvae

Geometric morphometrics

Scinax carnevallii

Scinax canastrensis

ABSTRACT

Herein we provide novel data on the external morphological features and natural history of the tadpoles of *Scinax canastrensis* and *Scinax carnevallii*, two poorly known tree frog species occurring in southeastern Brazil. Both species share characteristics with all other species of the *Scinax catharinae* group, including oral discs not emarginated with the posterior margin concave when closed, many submarginal papillae laterally, circular nostrils, and vent tubes reaching the ventral fin margin. Landmark-based geometric morphometrics applied to 16 species of the *S. catharinae* group indicate that their tadpoles have substantial variation in body shape, yet with some overlap among species. Although the lentic/lotic habitat categorization was not sufficient for explaining the complex patterns of morphospace occupancy by tadpoles of *S. catharinae* group, some well-established ecomorphological relationships were recovered, such as that for suctorial and pond-type guilds. Moreover, the morphological diversity in shape may also reflect interspecific variation in microhabitat use, other contemporary factors (e.g., other abiotic habitat components and/or biological interactions) and evolutionary relationships.

© 2016 Elsevier GmbH. All rights reserved.

1. Introduction

Hylid tree frogs of the genus *Scinax* Wagler, 1830, are common constituents of Neotropical anurofauna, occurring from eastern and southern Mexico, Trinidad and Tobago, and St. Lucia to Argentina and Uruguay (Frost, 2015). Faivovich et al. (2005) recognized two monophyletic groups within the genus: the *Scinax catharinae* and the *Scinax ruber* clades. The *S. catharinae* clade comprises two monophyletic species groups, the *S. catharinae* and the *Scinax perpusillus* groups. Thirty-three species are recognized as belonging to the former (Lourenço et al., 2014), occurring predominantly in the Brazilian Atlantic Forest, from northeastern to southern Brazil.

* Corresponding author at: Laboratório de Herpetologia, Departamento de Zoologia, Instituto de Ciências Biológicas, Universidade Federal de Minas Gerais, 6627, Pampulha 31270-901, Belo Horizonte, Minas Gerais, Brazil.

E-mail addresses: tpezzuti@gmail.com (T.L. Pezzuti), rodriguesigor@yahoo.com.br (I.R. Fernandes), fsfleite@gmail.com (F.S.F. Leite), csousa@ibilce.unesp.br (C.E. De Sousa), pcgarcia@gmail.com (P.C.A. Garcia), deferes@gmail.com (D. Rossa-Feres).

Some species occupy gallery forests and open areas of the Cerrado domain (e.g., Lourenço et al., 2013; Pombal and Bastos, 1996; Pombal et al., 2010), and two species reach temperate areas of Uruguay and central-eastern Argentina (Faivovich, 2002, 2005; Pereyra et al., 2012). In general, species of the *S. catharinae* group are nocturnal and breed in a wide variety of habitats, from streams to ponds inside the forest, and more rarely in open formations (e.g., Carvalho-e-Silva and Carvalho-e-Silva, 2008; De-Sá et al., 1997; Faivovich, 2002; Hartmann et al., 2010; Kolenc et al., 2007; Lourenço et al., 2013; Rico et al., 2004; Teixeira and Röder, 2007).

Studies on the morphological and ecological diversity of tadpoles of the *S. catharinae* group are scarce. Despite advances in the taxonomy of the group (e.g., six new species described from 2005 to 2014; Frost, 2015) accurate and complete descriptions of the external morphology of the tadpoles of many species are still lacking, and tadpoles of nine species remain completely unknown (Abreu et al., 2015; Lourenço et al., 2013). This lack of information notwithstanding, larval characters of the *S. catharinae* clade have been included in phylogenetic studies of the genus (Faivovich, 2002), and are potentially informative regarding phylogenetic relation-

ships and taxonomy (e.g., [Carvalho-e-Silva and Carvalho-e-Silva, 1994](#); [Conte et al., 2007](#); [Kolenc et al., 2007](#)). Putative larval morphological synapomorphies have already been suggested for some groups of *Scinax* ([Alcalde et al., 2011](#); [Faivovich, 2002](#); [Faivovich et al., 2005](#); [Kolenc et al., 2003](#)[2004]).

Most of the available information on the natural history and ecology of *Scinax* tadpoles comes from natural history notes included in original species and/or tadpole descriptions (e.g., [Carvalho-e-Silva and Carvalho-e-Silva, 1994, 1998](#); [Haddad and Pombal, 1987](#); [Kolenc et al., 2007](#)). Other studies addressing more general ecological issues have included tadpoles of the *S. catharinae* group (e.g., [Eterovick and Barros, 2003](#); [Eterovick et al., 2008](#)).

At first glance, larvae of the *S. catharinae* group exhibit extensive variation in body shape, oral disc size and configuration, color, and behavior, which are poorly understood from adaptive and phylogenetic perspectives, mainly due to gaps in the basic information available and the absence of a comprehensive phylogenetic framework. Two species, *Scinax ariadne* ([Bokermann, 1967](#)) and *Scinax pombali* ([Lourenço et al., 2013](#)); possess features presumably evolved to live in fast flowing water, such as large ventral oral discs with adherent structures ([Bokermann, 1967](#); [Lourenço et al., 2013](#)). Some tadpoles, such as *Scinax aromothyella* ([Faivovich, 2005](#)); *Scinax machadoi* ([Bokermann and Sazima, 1973](#)) and *Scinax berthae* ([Barrio, 1962](#)), have higher tail fins and globular bodies ([Bokermann and Sazima, 1973](#); [De-Sá et al., 1997](#); [Kolenc et al., 2007](#)), whereas other species such as *Scinax littoralis* ([Pombal and Gordo, 1991](#)) and *Scinax luizotavioi* ([Caramaschi and Kistumacher, 1989](#)), possess a generalized benthic/lentic morphology ([Bertoluci et al., 2007](#); [Pombal and Gordo, 1991](#)). An exploratory analysis suggested that the similarity of some external characters (i.e., position of nostrils, number of rows marginal papillae, presence of an anterior gap, jaw sheath width, LTRF, and presence of a tail flagellum) among the tadpoles of this group could be related to habitat use and/or vegetation ([Conte et al., 2007](#)). However, variation in external shape and its relationship to ecological factors and phylogenetic relationships have yet to be investigated.

Geometric morphometrics has been shown to be a valuable approach to exploring variation in the morphological shape of tadpoles of many anuran lineages (e.g., [Baldo et al., 2014](#); [Haad et al., 2011](#); [Vera Candiotti, 2007, 2008](#)). Because these methods can document precise shape differences among species, the evolutionary relationships between morphology and ecology can be explored at many phylogenetic levels ([Baldo et al., 2014](#); [Haad et al., 2011](#); [Marques and Nomura, 2015](#); [Van Buskirk, 2009](#); [Vera Candiotti, 2008](#)).

The present paper has two primary goals. The first goal is to fill-in gaps in knowledge of larval morphology of the *S. catharinae* group by describing the tadpoles of *Scinax canastrensis* ([Cardoso and Haddad, 1982](#)) and *Scinax carnevallii* ([Caramaschi and Kistumacher, 1989](#)), including data on their natural history, and performing a qualitative comparison of the morphology of all 24 known tadpoles of the group. The second goal is to analyze the diversity in external shape among the majority of described tadpoles of the *S. catharinae* group. We were interested determining the extent to which these tadpoles differ morphologically from one another, and if this morphological variation is related to the environment in which they develop. Since the tadpole morphology of several anuran lineages is recurrently related to lentic and lotic water bodies (e.g., [Baldo et al., 2014](#); [Haad et al., 2011](#); [Van Buskirk, 2009](#)), we expect to find a similar ecomorphological pattern for the tadpoles of the *S. catharinae* group. In spite of the absence of an understanding of the phylogenetic relationships among species of the group and refined environmental data on the habitat used by tadpoles of all species, this inaugural approach aims to shed light on their morphological variation.

2. Material and methods

2.1. Tadpole collection and description

Tadpoles of *S. canastrensis* were collected in the municipalities of São Roque de Minas (type locality; 46°28'21"W, 20°19'50"S, 807 m a.s.l.; collected on October 09, 2012–DZSJRP1353.1), Sacramento (about 80 km west of the type locality; 47°10'36"W, 19°51'25"S, 991 m a.s.l.; collected on October 15, 2014–UFMG1668-9), and Tapiraí (about 55 km northeast of the type locality; 46°07'07"W, 19°55'02"S, 801 m a.s.l.; collected on October 17, 2014–UFMG1670), all localities were in the region of Serra da Canastra in the state of Minas Gerais in southeastern Brazil. Tadpoles of *S. carnevallii* were collected in the southeastern portion of the Serra do Espinhaço in the municipality of Conceição do Mato Dentro in the state of Minas Gerais in southeastern Brazil (about 100 km east of the type locality; 43°26'02"W, 18°56'23"S, 671 m a. s. l.; collected on July 28, 2008–UFMG604). Adults of these species were the only anurans reproducing in the environments where the larvae were found. Moreover, in the Serra da Canastra region, another species of *S. catharinae* group (*S. machadoi*) was also recorded, but not syntopic with *S. canastrensis*. Furthermore, the tadpoles of *S. machadoi* are quite different from those of *S. canastrensis* ([Bokermann and Sazima, 1973](#); TLP personal observation).

Tadpoles were euthanized in 5% lidocaine solution and preserved in 10% formalin. For *S. canastrensis*, the description of the external morphology was based on two tadpoles from the type locality in stages 38–39 ([Gosner, 1960](#); lot DZSJRP1353.1), whereas measurements were taken from 18 specimens between stages 30 and 39 (lots DZSJRP1353.1, UFMG1668-9, UFMG1670; [Table 1](#)). For *S. carnevallii*, the description of the external morphology was based on five tadpoles in stages 29–32 (lot UFMG 604a), and the measurements were taken from 12 specimens between stages 27 and 32 (lots UFMG 604a,b; [Table 1](#)). Throughout the descriptions the ratios between measurements are expressed as ranges.

Measurements and terminology follow [Altig and McDiarmid \(1999\)](#) for total length (TL), body length (BL), tail length (TAL), maximum tail height (MTH), internarial distance (IND), interorbital distance (IOD), tail muscle width (TMW), and tail muscle height (TMH); [Lavilla and Scrocchi \(1986\)](#) for body width (BW), body width at narial level (BWN), body width at eye level (BWE), body height (BH), eye-snout distance (ESD), eye-nostril distance (END), nostril-snout distance (NSD), eye diameter (ED), narial diameter (ND), snout-spiracular distance (SSD), and oral disc width (ODW); and [Grosjean \(2005\)](#) for dorsal fin height (DFH) and ventral fin height (VFH). Additional measurements taken were spiracle length (distance between the anterior insertion of the spiracle and its distal margin; SL), and spiracular-venter distance (perpendicular distance between the distal margin of the spiracle and the ventral surface of the tadpole; SVD). Classes of nostril, eye and oral disc size, height of the dorsal fin, and tail muscle robustness were determined using the following ratios, respectively: ND/BL (small $\leq 0.025 < \text{middle} < 0.035 \leq \text{large}$; [Conte et al., 2007](#)), ED/BWE (small $< 0.23 \leq \text{large}$), ODW/BW (small $\leq 0.45 < \text{middle} < 0.70 \leq \text{large}$), DFH/TMH (low $\leq 1.0 < \text{high}$; [Conte et al., 2007](#)), and TMH/BH (slender $\leq 0.45 < \text{slightly robust} < 0.50 \leq \text{robust}$). All measurements were taken to the nearest 0.1 mm with the aid of ImageTool version 3.00 ([Wilcox et al., 1996](#)). To obtain high quality photos we used an adjustable platform to support tadpoles immersed in water ([Schacht and McBayer, 2009](#)). Lateral line descriptions and terminology is that of [Lannoo \(1987\)](#). For detailed morphological examination, especially characters of the oral disc, lateral line system, spiracle, narial opening and vent tube, preserved tadpoles were stained with methylene blue and analyzed using multifocal photographs, which were taken with a Leica M205 stereomicroscope.

Download English Version:

<https://daneshyari.com/en/article/2790485>

Download Persian Version:

<https://daneshyari.com/article/2790485>

[Daneshyari.com](https://daneshyari.com)