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Identification Key

Morphological characterization and taxonomic key for tadpoles of Brazilian Cerrado

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Abstract: Currently, amphibians are recognized as the most threatened vertebrate group worldwide. In this context, studies that offer tools for amphibian conservation are strategic to reduce the threats to this group. The absence of detailed descriptions and morphological variation of the anuran larval stage and the lack of identification tools increase the difficulty of anuran larval stage identification by non-specialists. Here we present the morphological characterization of tadpoles of 49 anuran species that occur in the Cerrado biome and transitional areas. Also, we compared our characterization with available descriptions of the tadpole and provided comments about the morphological variation found in our samples. Finally, we produced a taxonomic key as a tool for species identification using the anuran larval stage.
Keywords: *larval stage; morphology; phenotypic plasticity; taxonomy.*

Caracterização morfológica e chave taxonômica para girinos do Cerrado Brasileiro

Resumo: Atualmente, os anfíbios são considerados como o grupo de vertebrado mais ameaçado no mundo. Nesse contexto, estudos que disponibilizem ferramentas para ajudar nos esforços de conservação dos anfíbios são estratégicos para se reduzir as ameaças ao grupo. A falta de descrições detalhadas da variação morfológica das larvas de anuros e a falta de ferramentas de identificação para este estágio de desenvolvimento dificultam a atribuição correta dos táxons por não-especialistas. Nós apresentamos neste manuscrito a caracterização morfológica das larvas de 49 espécies de anuros que ocorrem no Cerrado e áreas de transição. Nós também comparamos nossa caracterização com as descrições disponíveis de girinos e discutimos sobre a variação morfológica encontrada entre os trabalhos e nossa amostra. Por fim, também aapresentamos uma chave taxonômica para uma ferramenta para a identificação de espécies de anuros utilizando o estágio larval.
Palavras-chave: *fase larval; morfologia; plasticidade fenotípica; taxonomia.*

Introduction

Amphibian populations are declining worldwide (Blaustein 2002), with almost 41% of the known species at risk of extinction (Pimm et al. 2014). Public agencies for environment management have proposed conservation programs for several species in different countries in an effort to revert the threatened status of amphibians (Mushet et al. 2012; see also the Brazilian Ministry of Environment resolutions n° 25/2012 and n° 293/2018 for example of conservation action plans for amphibians). However, the lack of basic information about species' natural history or distribution adds an extra layer of difficulty to planning conservation strategies (see a review in Brito 2010). For example, the correct identification of specimens used in several types of scientific research, from surveys to ecological experiments, is an activity that has its importance underestimated (Bortolus 2008). Errors in species identification can have unpredictable consequences for research outcomes, and the correct use of taxonomy is necessary for the estimation of species richness (e.g., Gotelli 2004, Bortolus 2008, Trindade-Filho et al. 2012, Melo et al. 2013, Rossa-Feres et al. 2015).

The negative effect of the knowledge gap in taxonomy for anuran conservation is a concern for regions such as the Brazilian savannah, due to the high rate of degradation and environmental modification, associated with high levels of endemism and diversity of amphibians (Myers et al. 2000, Bini et al. 2006, Trindade-Filho et al. 2012, Melo et al. 2014). The Brazilian Savanna, also known as "Cerrado", is the second largest Brazilian biome, being considered the largest savanna region in South America and the most diversified savanna in the world (Ab'Saber 1977, Silva & Bates 2002). Currently, about 220 species are known to this biome, with ~52% of these species considered endemic (Valdujo et al. 2012, Azevedo et al. 2016). However, this richness is probably underestimated since many new species have been described each year (e.g., Andrade et al. 2018, Pinheiro et al. 2018, Vaz Silva et al. 2018).

For most anuran species, the larval stage, denominated tadpoles, are the easiest developmental stage to encounter and to collect, since they remain in the aquatic environment for a longer period than adults, which makes them a fundamental component for biodiversity surveys (Lips & Savage 1996, Altig & McDiarmid 1999, Rossa-Feres & Nomura 2006, Andrade et al. 2007, Alves-Ferreira et al. 2021). Also, the importance of the larval traits for reconstruction of the phylogenetic relationships (e.g., Haas 2003, Frost et al. 2006) and ecological processes modelling has been increasingly recognized (see a discussion in Rossa-Feres et al. 2015). For example, morphological variation has been used for taxonomy (e.g., Rossa-Feres & Nomura 2006, Channing et al. 2016, Arifin et al. 2018, Dubeux et al. 2020, Montilla et al. 2023), ecotoxicology (e.g., Costa & Nomura 2016, Costa et al. 2017), and investigating ecological process at the community level (e.g., Marques & Nomura 2015; Marques et al. 2018; Annibale et al. 2020). However, we need to better understand the natural morphological variation of tadpoles, resulted from interaction with predators and competitors or from inter- and intrapopulation variation, to differentiate it from the impact on anurans of changes in land use, land cover, climate change, or other man-induced environmental modifications (Rossa-Feres et al. 2015). Without knowing the normal variation in each population, the association of morphological changes to anthropogenic disturbance is more challenging (Costa & Nomura 2016, Costa et al. 2017, Annibale et al. 2020). This is particularly important when we consider the actual conservation status of the Cerrado biome and its rate of habitat modification and land-use conversion, and the threats to the herpetofauna (Klink & Machado 2005, Colli et al. 2020).

Despite the growing importance of tadpoles in different branches of science, the difficulties in the correct identification of species still represents a major obstacle to include anuran larvae in management and conservation studies, mainly due to the high intraspecific morphological variation in tadpoles (Andrade et al. 2007). Also, the misleading identification of tadpoles could result in an artificial morphological variation, as variation in tadpole morphology could be a consequence of the difficulty in identifying cryptic species (Santos et al. 2018). Without an understanding of the species morphological variation throughout its area of occurrence, the interpretation of the variation among populations will remain unclear (Gehara et al. 2014). Thus, investment in the training of taxonomists, incentives for collaboration between researchers, for example, in addition to tools to increase accuracy in species identification are important actions to reduce this knowledge gap (Bortolus 2008).

One valuable tool for accessing correct species identification of anuran larvae is the use of taxonomic keys, while not the sole, taxonomic keys are highly useful and easily accessible (Gotelli 2004). Additionally, they offer a more cost-effective solution compared to other techniques (Stein et al. 2014). Despite the importance of this tool and the high anuran diversity in Brazil, only seven identification keys for tadpoles are known up-to-date: one for the region of Central Amazonia (Hero 1990), one for species occurring in the northwestern region of São Paulo state (Rossa Feres & Nomura 2006), one for the Rio Grande do Sul state (Machado & Maltchik 2007), one for species with occurrence in municipalities of Alvorada de Minas, Conceição do Mato Dentro and Dom Joaquim, Minas Gerais state (Pimenta et al. 2014), one for the southward portion of Ilha Grande, municipality of Angra dos Reis, Rio de Janeiro state (Fatorelli et al. 2018), and more recently one key for tadpoles of the northern region of the Atlantic Forest (Dubeux et al. 2020) and another for the Iron Quadrangle, Southeastern Brazil (Pezzuti et al. 2021). Here we present a characterization of the external morphology and an identification key for tadpoles of 49 species with occurrence in areas of Brazilian Cerrado (following the species inventories for the Biome presented in Valdujo et al. 2012 and Azevedo et al. 2016).

Material and Methods

1. Study area

Geographically, the Cerrado biome occupies a central position in South America and shares contact zones with the two largest rainforest blocks of the Neotropics (Amazonia and Atlantic Forest biomes) as well as with two dry regions (Caatinga and Chaco biomes) (Ab'Saber 1977, Silva & Bates 2002). The Cerrado is characterized by a complex landscape with high horizontal heterogeneity along its distribution, from open and savanic vegetation to forested habitats (Ribeiro & Walter 1998). The savanna formations include the "*campo rupestre*" (*sensu* Silveira et al. 2016) and "*cerrado sensu stricto*" vegetational types, also known as the typical *cerrado* (Ribeiro & Walter 1998). The forest formations are constituted of "*cerradão*" (i.e., transition between semi-deciduous forests and typical *cerrado* areas), semi-deciduous forests, "*veredas*", riparian and gallery forests (Ribeiro & Walter 1998). The grasslands formations are made up of wet grasslands, dry grasslands and "*rupestre"* fields (Campos & Lage 2013). The Cerrado biome has a strongly seasonal climate, with a wet and warm season that lasts from October to April, and a dry and cold season that lasts from May to September (Klink & Machado 2005). In this study, we used the official limits of Cerrado biome defined by the Instituto Brasileiro de Geografia e Estatística (IBGE) (available in https://www.ibge.gov.br/geociencias/informacoes-ambientais).

Valdujo et al. (2012) found that the diversity of anuran species in the Cerrado was influenced by the proximity to the surrounding domains, like the Caatinga or the Amazon. For example, they state that shared species between the Cerrado and the Amazon are less likely to co-occur with species from the Cerrado-Atlantic Forest border (Valdujo et al. 2012). The same occur for the dry diagonal (Chaco-Cerrado-Caatinga, Valdujo et al. 2012). More important, Valdujo et al. (2012) highlight the importance of transitional areas to the composition of anuran species pool in the Cerrado, especially in the transition of the Cerrado and Atlantic Forest. Thus, we included five species that occurs in transitional areas between Cerrado and Atlantic Forest, which are *Rhinella ornata x Rhinella crucifer* Thomé, Zamudio, Haddad & Alexandrino 2012, *Thoropa miliaris* (Spix 1824), *Scinax longilineus* (Lutz 1968), *Proceratophrys boiei* (Wied 1825), and *Odontophrynus* cf. *juquinha* (Baldissera et al. 2004, Valdujo *et al.* 2012, Pimenta et al. 2014, Matavelli et al. 2018, Eterovick et al. 2020). We are following Thomé et al. (2012) and citing the previous known populations of *R. pombali* Baldissera, Caramaschi & Haddad 2004 included in our samples as *Rhinella ornata x Rhinella crucifer*, once *R. pombali* is currently considered a hybrid formed by *R. crucifer* and *R. ornata* parents (Thomé et al. 2012; but see also the discussion in Pereyra et al. 2021).

2. *Data collection*

All tadpoles were obtained from the Coleção Zoológica da Universidade Federal de Goiás (ZUFG), municipality of Goiânia, Goiás state, Brazil (Appendix 1), collected from different localities from the Brazilian Cerrado (Figure 1). To be more concise, we present information about the collection locations along with the description of external morphology in the "Results" section. We defined the tadpole's identity using known morphological diagnostic traits with the help of ZUFG collection curators (NM Maciel, RP Bastos, and FN - one of the authors) or by consulting external experts at the time of the tadpole's collection and inclusion in the ZUFG collection (DC Rossa-Feres, W Vaz-Silva, NYN Dias – particularly for tadpoles from *Scinax*, NM Maciel – for *Rhinella*). When necessary, we also compared the morphology of tadpoles in our samples with available descriptions (indicated in the "Results" section - Comments) or by using taxonomic keys (Rossa-Feres and Nomura 2006). Following the best practices proposed by Vink et al. (2012), when we were not confident to attribute a nominal taxon for a given tadpole morphotype, but we found a consistently morphological variation that differentiates it from other species in our sample, we used "aff.", "cf.", "gr.", or "sp." as appropriate.

For the morphological characterization and elaboration of the taxonomic key, we examined two to 15 individuals between stages 30 to 40 (*sensu* Gosner 1960). For the genus *Bokermannohyla* Faivovich, Haddad, Garcia, Frost, Campbell & Wheeler, 2005, with species reproducing in lotic environments and that have longer larval period (Patterson & McLachlan 1989), we used individuals at Gosner's stage 25. Whenever possible, we included individuals from more than one population to evaluate inter-populational variation in the morphological traits. Nomenclature of morphological characteristics (Figures 2–4) followed Altig & Johnston (1986; 1989), and McDiarmid & Altig (1999). When, in the description, we were referring to the oral disc, we use "A" to describe the teeth rows that were positioned anterior to the oral aperture, and "P" to describe the teeth rows that were positioned posterior to the oral aperture. Each letter was followed by a number that represents the position of a given row of ones in relation to the oral disc, and the "A" rows follow a distal-proximal ascending order, while the "P" rows follow a proximal-distal ascending order, in relation to the oral opening, as shown in Figure 3.6 in McDiarmid & Altig (1999).

Measurements follow Altig & McDiarmid (1999) for total length (TL), body length (BL), tail muscle height (TMH), tail muscle width (TMW), spiracle length (SL), spiracle width (SW); Lavilla & Scrocchi (1986) for body height (BH), body width (BW), eye diameter (ED), nares diameter (ND), nares distance (NED); and Grosjean (2005) for dorsal fin height (DFH) and ventral fin height (VFH). All morphometric measurements shown are in millimeters. Additional measurements included the dorsal fin insertion angle, measured as acute (bellow 45-degree angle) and obtuse (equal or above 45-degree angle), and the marginal and submarginal papillae length, measured as short (when wider than longer) or long (when longer than wider).

The size classes of body shape in lateral view, nares, eye, spiracle, tail muscle, and fin height were determined by the following ratios, respectively: body width/body height (compressed $\leq 1 <$ depressed), nares size/eye diameter (small $\leq 0.14 <$ medium $< 0.38 \leq$ large $\leq 0.50 <$ very large), eye diameter/body height (small $\leq 0.17 <$ medium $< 0.29 \leq$ large), tail muscle width/body width (narrow $\leq 0.29 <$ medium $< 0.49 \leq$ wide), dorsal fin height/tail muscle height (low $\leq 0.49 <$ medium $< 1.01 \leq$ high), ventral fin height/tail muscle height (low $\leq 0.43 <$ medium $< 0.97 \leq$ high), spiracle length/body length (short $\leq 0.06 <$ medium $< 0.19 \leq$ long), and spiracle width/body height (narrow $\leq 0.09 <$ medium $< 0.25 \leq$ wide). The size classes of the above-mentioned measurements were defining as "small $\leq$ -1 SD $<$ mean $<$ +1 SD $\leq$ large" for all measurements, except for nares diameter, that was defined as "small $\leq$ -1 SD $<$ mean $<$ +1 SD $\leq$ large $\leq$ +2 SD $<$ very large", and body shape. The standard deviations for the definition of size classes were calculated considering a sample of 322 anuran Brazilian species, collected during the project "SISBIOTA Girinos do Brasil" (DC Rossa-Feres, unpublished data).

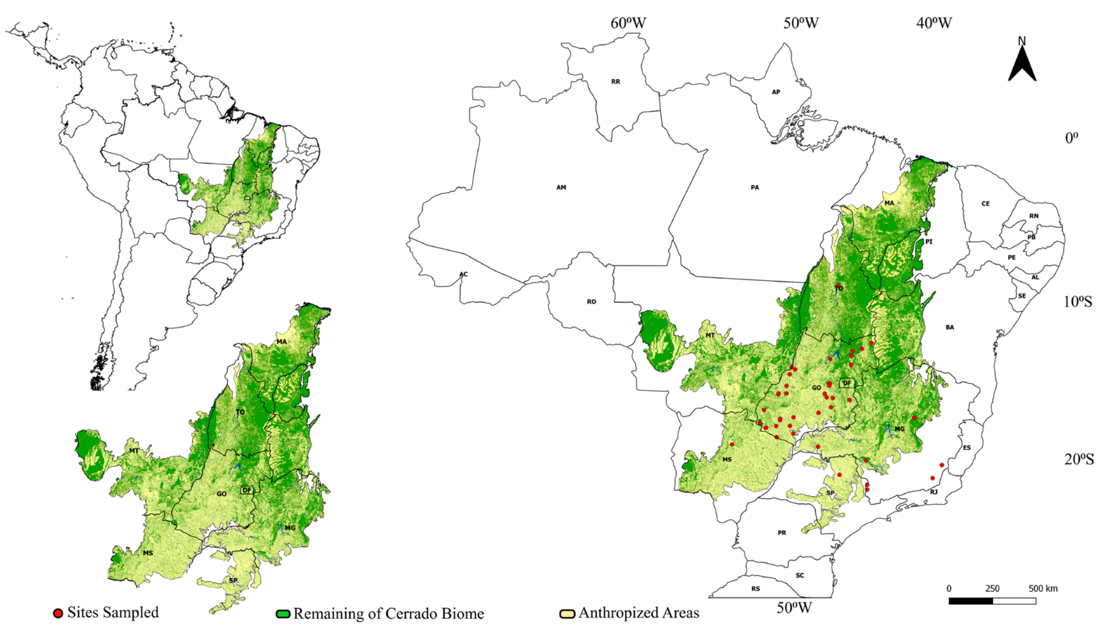

Figure 1. Map of remaining of Cerrado biome. Red circles represent the localities of the tadpoles used in the present study. Inset map: South America.

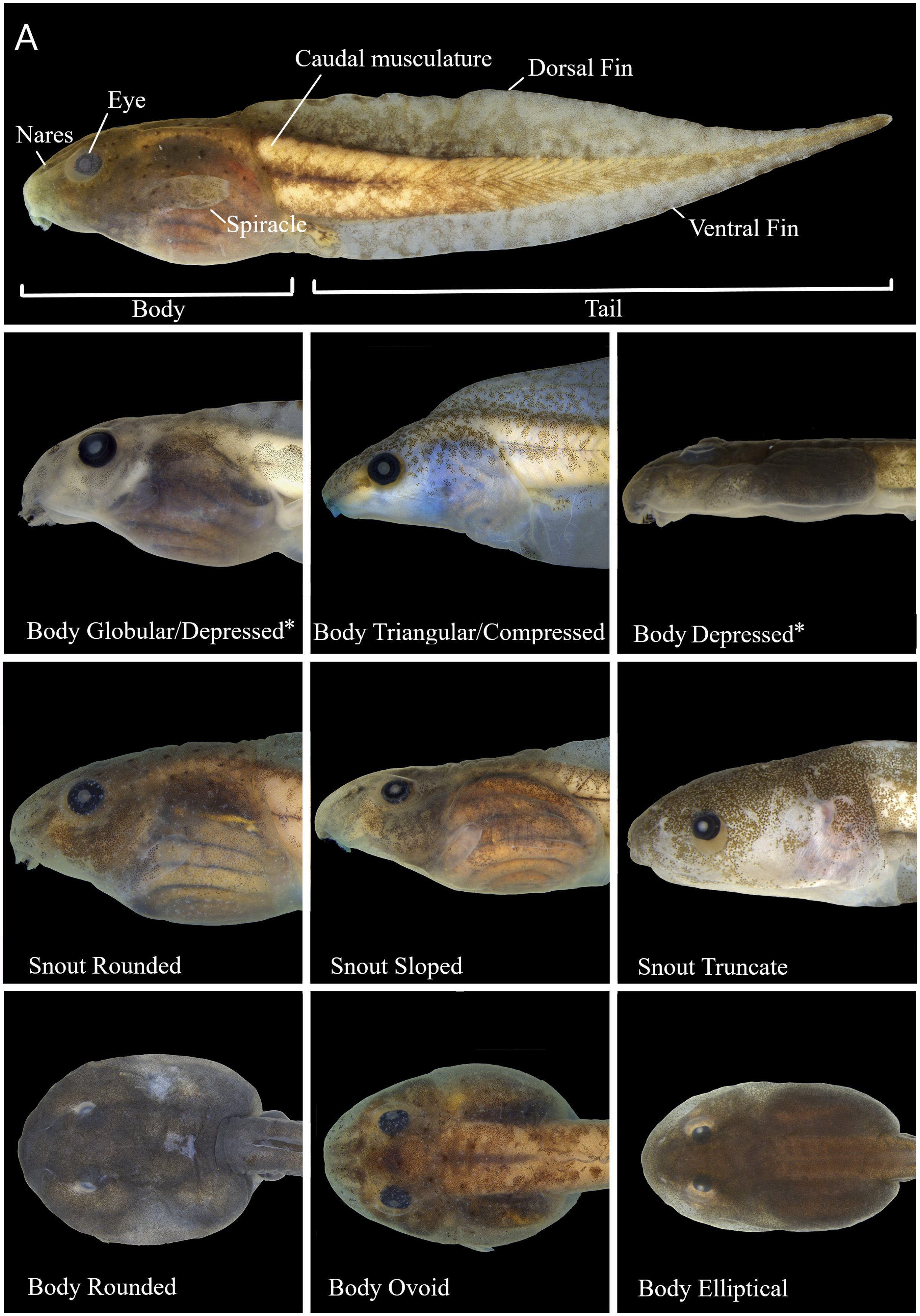

Figure 2. Morphological characteristics used to larval characterizations and in the taxonomic key. Details of a typical tadpole in lateral view, and body shape in dorsal and lateral view.

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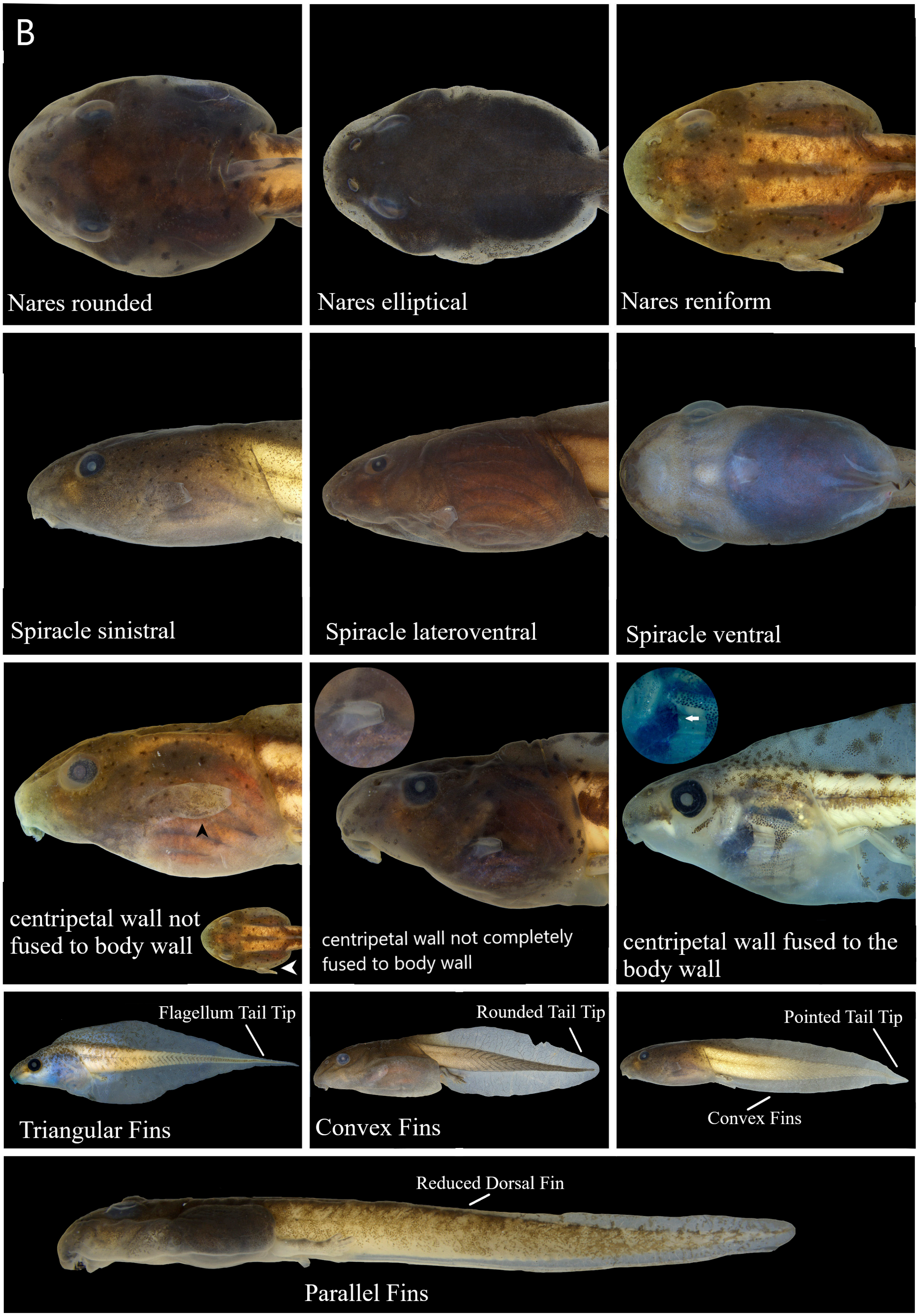

Figure 3. Morphological characteristics used to larval characterizations and in the taxonomic key. Details of the nares, spiracle, fins, and tail tips.

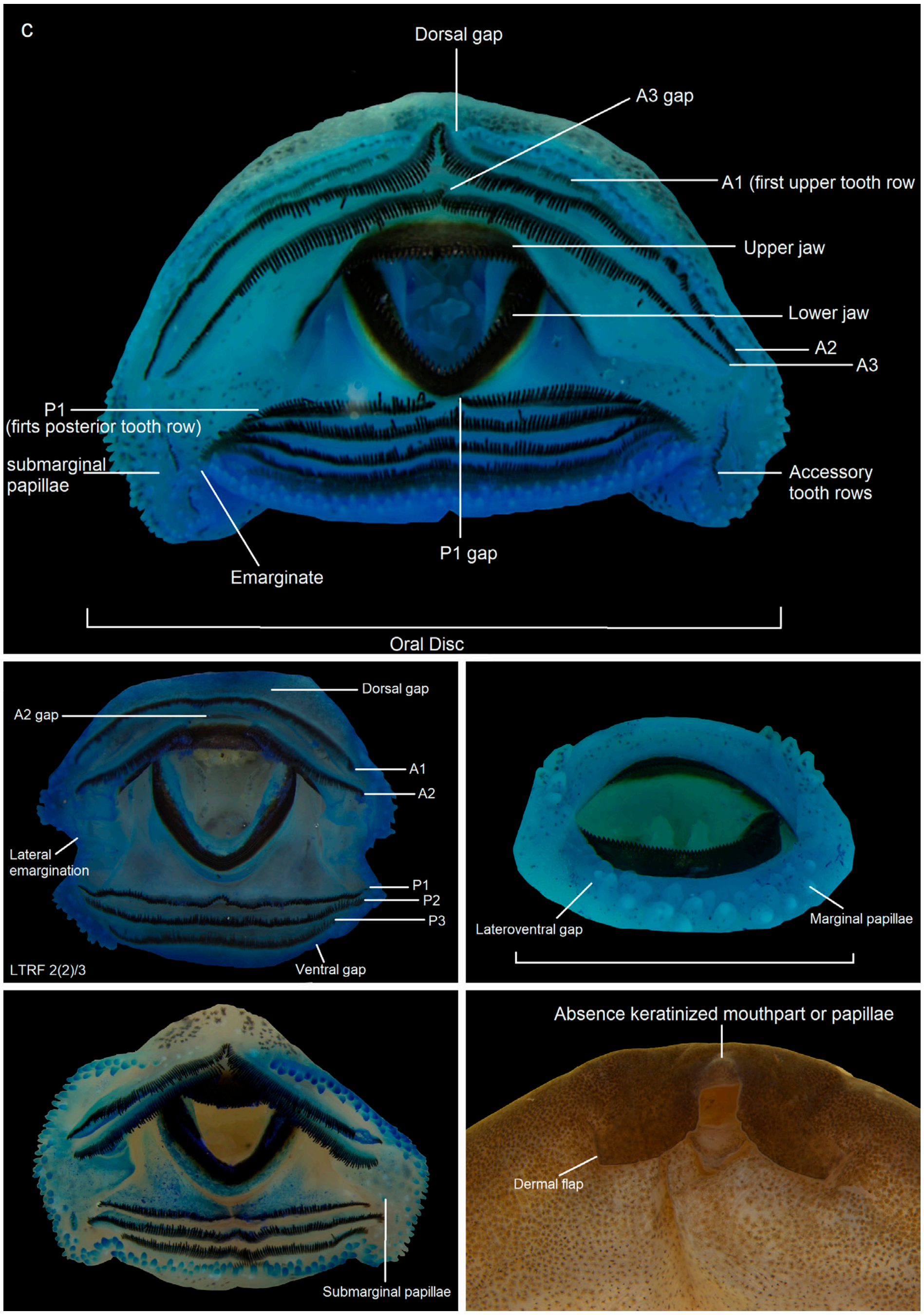

Figure 4. Morphological characteristics used to larval characterizations and in the taxonomic key. Details of the oral disc.

For body shape, we considered the body compressed when body height is higher than body width, and depressed when body width is higher than body height. Morphometric traits were reported in the characterization of each tadpole as mean ± standard deviation for total length and (range) for all other measurements. The complete morphometric information can be seen in Table 1. We considered lateral lines evident when the lateral lines were easily observed at stereomicroscopic.

All morphometric traits were measured from digital photographs, obtained with a M205A Leica® stereomicroscopic with a DFC550 camera, using the software ImageJ (1.51i). Each tadpole was placed in a petri dish and positioned in lateral or dorsal view using a water-based gel for image capture. To illustrate the external morphology, once tadpoles were larger than the visual field of the stereomicroscopic, we had taken from three to six digital images from one tadpole and combined they in an image editor software. To illustrate the oral disc, one tadpole in our series was dissected and mounted on a paraffin block, positioned with entomological pins to keep the mouth open, and submerged in distilled water for image capturing. We used a commercial 1% methylene blue solution to highlight oral disc parts, spiracle, or vent tube of tadpoles, as necessary.

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Table 1. Measurements (mm) of the tadpoles characterized in this study and on which the descriptions are based on. Character abbreviations: total length (TL), body length (BL), tail muscle height (TMW), tail muscle width (TMW); body height (BH), body width (BW), eye diameter (ED), nare diameter (ND), nare-eye distance (NED); dorsal fin height (DFH), ventral fin height (VFH), spiracle length (SL), spiracle width (SW), and dorsal fin insertion angle (DFA).

Species	N		TL	BL	BH	BW	ND	ED	NED	SL	SW	DFH	VFH	TMH	TMW	DFA
Bufonidae																
Rhinella cerradensis	4	Mean	27.63	12.2	6.19	8.03	0.34	0.96	2.27	0.45	0.5	2.41	2.05	1.92	1.43	11.5
		SD	2.24	0.65	0.49	0.46	0.06	0.11	0.26	0.1	0.07	0.21	0.25	0.21	0.12	1.52
		Min	24.8	11.53	5.64	7.56	0.26	0.87	1.91	0.35	0.43	2.28	1.72	1.65	1.34	10.24
		Max	30.12	12.91	6.84	8.52	0.41	1.1	2.51	0.56	0.6	2.72	2.33	2.14	1.59	13.41
Rhinella diptycha	11	Mean	20.81	9.66	4.7	5.71	0.32	0.8	2.09	0.67	0.39	1.59	1.28	1.65	1.1	10.42
		SD	2.09	0.42	0.56	0.68	0.04	0.1	0.22	0.14	0.07	0.24	0.2	0.13	0.12	2.48
		Min	17.08	9.08	3.71	4.58	0.23	0.68	1.7	0.5	0.32	1.1	0.89	1.5	0.9	7.43
		Max	23.87	10.34	5.61	6.8	0.39	1.03	2.37	1.03	0.53	1.88	1.63	1.9	1.4	15.27
Rhinella ornata x Rhinella crucifer	4	Mean	27.97	11.63	6.6	8.29	0.29	0.93	2.29	1.07	0.76	1.78	1.55	2.18	1.73	8.13
		SD	1.86	0.89	0.53	0.49	0.06	0.03	0.1	0.11	0.07	0.44	0.35	0.1	0.12	1.31
		Min	26.32	10.77	6.02	7.65	0.2	0.91	2.18	0.97	0.68	1.28	1.11	2.03	1.55	6.72
		Max	30	12.5	7.31	8.7	0.36	0.99	2.41	1.23	0.85	2.32	1.86	2.28	1.82	9.39
Cycloramphidae																
Thoropa megatympanum	6	Mean	23.74	7.11	2.76	4.51	0.16	0.96	1.45	1.1	0.79	0.47	0.43	1.49	1.41	6.47
		SD	3.48	1.01	0.43	0.76	0.02	0.13	0.21	0.29	0.09	0.1	0.08	0.26	0.22	0.56
		Min	20.27	5.9	2.3	3.8	0.13	0.75	1.2	0.68	0.63	0.31	0.32	1.12	1.17	5.46
		Max	29.5	8.57	3.25	5.65	0.18	1.1	1.79	1.5	0.87	0.58	0.53	1.9	1.78	7.12
Thoropa miliaris	5	Mean	24.08	7.22	2.64	4.21	0.15	0.91	1.55	0.83	0.69	0.12	0.21	1.42	1.33	4.99
		SD	0.7	0.27	0.39	0.32	0.03	0.11	0.18	0.14	0.11	0.04	0.04	0.09	0.08	1.04
		Min	23.1	6.9	2.35	3.77	0.12	0.8	1.36	0.68	0.56	0.06	0.15	1.33	1.23	3.48
		Max	25.1	7.5	3.32	4.64	0.18	1.07	1.79	1.06	0.81	0.19	0.26	1.58	1.42	6.4
Dendrobatidae																
Adelphobates galactonotus	5	Mean	39.19	14.53	6.89	10.69	0.5	0.71	2.29	1.47	1.46	2	1.8	3.6	3.67	15.32
		SD	2.06	0.44	0.19	1.5	0.1	0.17	0.02	0.29	0.26	0.33	0.17	0.38	0.29	3.42
		Min	35.95	14.15	6.61	8.4	0.38	0.45	2.26	1.19	1.25	1.5	1.65	2.92	3.28	10.44
		Max	41.68	15.15	7.14	12.15	0.63	0.88	2.33	1.88	1.87	2.35	2.04	3.84	4.03	18.94
Ameerega flavopicta	5	Mean	27.06	10.99	4.88	6.55	0.17	1.05	2.22	1.09	0.85	1.59	1.11	2.56	2.61	17.15
		SD	2.84	1.12	0.21	0.66	0.01	0.13	0.13	0.18	0.17	0.21	0.24	0.38	0.3	2.08
		Min	24.47	10.21	4.58	6.07	0.16	0.9	2.03	0.95	0.67	1.41	0.89	2.37	2.31	14.72
		Max	29.95	12.57	5.06	7.54	0.18	1.21	2.32	1.37	1	1.91	1.45	3.14	2.97	19.65
Hylidae																
Boana albopunctata	15	Mean	43.93	14.39	8.5	9.87	0.58	1.66	3.46	2.1	0.98	3.06	1.86	4.43	4.38	18.23
		SD	8.04	2.03	1.5	1.64	0.1	0.26	0.58	0.57	0.2	0.58	0.41	0.96	0.91	4.42
		Min	31.6	10.55	5.75	7.13	0.41	1.22	2.73	1.3	0.68	2.22	1.14	2.87	3.02	11.01
		Max	58.98	19.35	11.7	12.82	0.71	2.15	4.39	3.28	1.42	3.79	2.48	6.1	6.17	26.56
Boana lundii	5	Mean	59.47	19.64	10.34	11.53	0.73	1.8	3.85	1.84	1.31	3.34	2.79	5.69	6.06	11.98
		SD	8.98	1.77	0.92	0.71	0.08	0.17	0.75	0.2	0.31	0.29	0.52	0.67	0.34	3.45
		Min	51.57	17.75	9	10.54	0.64	1.67	2.97	1.67	0.87	2.91	1.95	4.75	5.54	8.83
		Max	72.56	22.36	11.53	12.47	0.88	2.1	5	2.12	1.67	3.62	3.34	6.62	6.44	16.6
Boana raniceps	14	Mean	57.54	19.93	11.6	12.9	0.83	2.38	4.26	2.08	1.42	4.98	2.69	6.05	5.87	36.77
		SD	9.53	3.04	2.3	2.63	0.11	0.4	0.43	0.53	0.36	1	0.53	1	1.16	8.51
		Min	42.77	15.99	8.22	9.42	0.66	1.8	3.64	1.15	0.83	3.85	2.04	4.33	4.42	27.1
		Max	77.68	24.82	15.49	16.58	1.11	3.3	4.9	2.91	2.08	6.83	3.75	7.25	7.85	52.23

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Species	N		TL	BL	BH	BW	ND	ED	NED	SL	SW	DFH	VFH	TMH	TMW	DFA
Boana cf. *crepitans*	8	Mean	62.31	21.39	13.45	15.24	0.73	2.57	5.4	1.87	1.49	4.51	2.67	7	6.25	16.66
		SD	4.96	2.18	1.54	1.96	0.1	0.3	0.57	0.38	0.21	0.68	0.66	1.3	1.16	4.26
		Min	53.11	18.3	11.09	12.6	0.58	2.08	4.3	1.42	1.19	3.31	1.56	4.84	4.09	9.23
		Max	70.01	25	15.33	18.08	0.88	3.06	6	2.39	1.78	5.26	3.6	8.95	7.65	22.95
Bokermannohyla alvarengai	15	Mean	51.1	18.22	9.06	12.63	0.74	1.7	4.83	2.27	1.37	3.13	2.37	5.61	5.32	18.79
		SD	5.69	1.55	0.96	1.31	0.1	0.26	0.72	0.35	0.15	0.51	0.33	0.63	0.88	2.56
		Min	42.5	14.96	7.33	10.19	0.62	1.29	3.69	1.31	1.25	2.15	1.78	4.29	3.24	14
		Max	60.09	20.91	10.88	16.1	0.93	2.21	6	2.75	1.68	3.78	2.9	6.75	6.77	23.19
Bokermannohyla pseudopseudis	10	Mean	42.95	15	8.14	9.24	0.64	1.55	3.1	1.56	1.28	3.31	2.33	4.84	4.37	19.09
		SD	4.31	1.61	0.95	0.98	0.09	0.24	0.47	0.34	0.2	0.36	0.25	0.53	0.62	4.27
		Min	37.89	12.19	6.94	7.79	0.5	1.26	2.5	1.25	1	2.86	1.96	4.1	3.67	14
		Max	52.53	17.96	9.91	10.49	0.87	1.97	3.76	2.37	1.56	3.97	2.79	5.91	5.82	27.14
Bokermannohyla sapiranga	9	Mean	59.51	20.88	10.53	12.44	0.69	1.67	3.72	1.89	1.4	4.06	3.34	6.95	7.04	14.48
		SD	15.31	4.39	2.71	3.01	0.18	0.6	0.5	0.46	0.33	0.94	0.68	2.95	2.93	2.57
		Min	40.76	14.08	7.06	8.11	0.43	1	3.09	1.31	1.18	2.34	1.93	3.63	3.68	10.49
		Max	81.92	27.22	15.65	18.63	1	2.82	4.55	2.81	2.25	5.37	4	13.19	12.9	18.66
Dendropsophus minutus	13	Mean	34.63	11.39	6.18	6.24	0.41	1.99	3.47	0.33	0.37	3.57	4.52	3.86	3.65	28.46
		SD	5.16	1.3	0.68	0.56	0.06	0.23	0.3	0.09	0.06	0.49	0.6	0.41	0.51	7.24
		Min	27.72	9.99	5.63	5.39	0.37	1.87	2.92	0.2	0.29	2.65	3.78	3.3	3.11	16.97
		Max	42.93	13.31	7.64	6.61	0.5	2.3	4.15	0.48	0.51	4.22	5.34	4.66	3.89	42
Dendropsophus soaresi	10	Mean	36.88	11.66	6.07	6.6	0.34	1.83	3.75	0.53	0.6	3.26	3.05	4.25	3.58	23.26
		SD	1.93	0.53	0.67	0.66	0.05	0.24	0.3	0.08	0.08	0.52	0.57	0.35	0.41	5.41
		Min	32.46	10.95	5.07	5.44	0.25	1.46	3.18	0.42	0.48	2.2	2.24	3.77	3.08	15.3
		Max	39.69	12.58	6.93	7.44	0.43	2.15	4.1	0.69	0.77	3.85	3.94	4.93	4.29	33.05
Scinax fuscomarginatus	11	Mean	30.71	10.39	5.12	5.91	0.45	1.56	2.56	1.69	1.09	2.44	2.17	2.64	2.73	17.93
		SD	1.68	0.44	0.57	0.52	0.05	0.12	0.21	0.21	0.19	0.29	0.23	0.27	0.29	2.43
		Min	27.3	9.71	4.4	5.15	0.37	1.33	2.19	1.37	0.87	1.92	1.68	2.22	2.4	14.38
		Max	33.63	11.09	6.1	6.7	0.5	1.79	2.88	2	1.56	2.93	2.42	3.13	3.44	21.81
Scinax fuscovarius	12	Mean	42.13	13.85	9.35	8.59	0.68	2.38	3.79	2.07	1.44	4.14	3.32	4.8	4.52	31.29
		SD	3.76	1.18	0.83	0.72	0.07	0.23	0.32	0.29	0.32	0.62	0.9	0.69	0.54	5.36
		Min	34.89	11.04	8.49	7.49	0.56	2.09	3.38	1.62	0.75	3.33	2.51	3.97	3.86	22.22
		Max	50.7	15.42	11.07	9.92	0.81	2.73	4.38	2.5	2	5.45	5.8	6.28	5.68	38.91
Scinax longilineus	11	Mean	38.49	13.35	9.46	9.84	0.39	1.8	3.3	1.35	1.09	3.53	2.68	4.79	4.59	20.57
		SD	4.91	0.81	0.65	0.94	0.06	0.22	0.61	0.32	0.16	0.4	0.34	0.56	0.73	4.31
		Min	31.94	11.93	8.36	7.99	0.25	1.24	2.42	0.87	0.81	2.93	2.15	3.99	3.61	12.49
		Max	47.09	14.63	10.52	11.3	0.5	2.09	4.49	1.81	1.31	4.1	3.39	5.68	5.52	25.51
Scinax pombali	10	Mean	46.06	16.12	9.68	11.42	0.46	2.25	3.7	1.44	0.82	2.99	2.21	6.25	6.15	15.6
		SD	3.19	1.28	0.87	0.95	0.11	0.23	0.39	0.15	0.12	0.51	0.31	0.35	0.53	3.63
		Min	40.47	14.03	8.52	9.97	0.3	1.84	2.98	1.15	0.66	2.14	1.66	5.85	5.5	11
		Max	51.48	18.33	11.33	12.69	0.61	2.65	4.27	1.69	1.01	3.85	2.75	6.94	7.06	20.9
Scinax rupestris	11	Mean	32.04	13.91	8.81	8.82	0.22	1.97	2.45	1.44	1.26	2.79	1.89	3.49	3	15.86
		SD	3.59	1.22	0.86	0.7	0.06	0.23	0.17	0.31	0.16	0.7	0.31	0.52	0.29	2.77
		Min	24.86	12.02	7.31	7.78	0.14	1.66	2.24	0.93	0.93	1.41	1.36	2.63	2.47	12.77
		Max	37.75	16.47	9.72	9.89	0.36	2.38	2.72	1.96	1.62	3.55	2.32	4.29	3.65	19.72

Continue...

...Continuation

Species	N		TL	BL	BH	BW	ND	ED	NED	SL	SW	DFH	VFH	TMH	TMW	DFA
Scinax similis	9	Mean	30.11	10.09	6.48	6.02	0.45	1.9	2.43	1.53	0.94	3.02	2.37	3.09	3.11	24.58
		SD	2.01	1.06	0.5	0.43	0.11	0.11	0.42	0.49	0.13	0.55	0.29	0.47	0.16	8.1
		Min	27.21	9.32	5.54	5.25	0.37	1.74	1.76	1.12	0.75	2.18	1.91	2.57	2.89	15.1
		Max	33.43	12.63	7.12	6.46	0.68	2.05	3.01	2.75	1.18	3.65	2.81	4.21	3.31	36
Scinax gr. *ruber*	4	Mean	29.92	9.18	5.91	5.42	0.35	1.44	2.47	1.15	0.77	2.9	2.25	3.02	2.33	28.07
		SD	3.35	1.37	1.02	0.71	0.03	0.26	0.34	0.08	0.1	0.38	0.42	0.38	0.38	2.32
		Min	25.43	7.2	4.58	4.4	0.31	1.23	2.11	1.06	0.68	2.47	1.73	2.55	1.8	25.25
		Max	33.04	10.35	6.99	5.93	0.37	1.82	2.94	1.25	0.93	3.29	2.64	3.55	2.66	30.94
Scinax squalirostris	6	Mean	22.58	8.69	5.08	5.17	0.37	1.31	2.18	1.62	1.29	2.57	2.27	2.2	2.11	17.4
		SD	1.05	0.47	0.46	0.24	0.05	0.1	0.24	0.31	0.15	0.21	0.18	0.15	0.29	1.19
		Min	20.87	8.05	4.5	4.9	0.31	1.2	1.82	1.43	1.12	2.4	2.02	2.06	1.63	15.41
		Max	23.99	9.22	5.7	5.5	0.43	1.5	2.5	2.25	1.5	2.97	2.5	2.45	2.45	19.17
Trachycephalus typhonius	15	Mean	36.45	14.12	8.13	8.21	0.36	1.51	2.54	2.17	1.34	2.44	2.22	2.96	2.78	17.44
		SD	4.02	1.44	1.04	1	0.09	0.19	0.36	0.58	0.32	0.29	0.25	0.35	0.32	2.66
		Min	29.82	11.93	6.76	6.65	0.23	1.16	1.94	1.61	0.93	1.94	1.8	2.55	2.11	12.98
		Max	43.57	17.39	10.51	10.06	0.53	1.89	3.2	3.61	2.15	2.94	2.56	3.62	3.4	22.56
Leptodactylidae																
Leptodactylus fuscus	5	Mean	31.18	11.85	6.83	7.68	0.44	1.17	1.93	1.82	1.17	1.32	1.28	3.16	2.96	14.3
		SD	4.59	1.57	1.3	1.11	0.08	0.22	0.28	0.49	0.26	0.21	0.21	0.62	0.8	1.14
		Min	24.54	9.66	4.9	6.23	0.31	0.85	1.54	0.93	0.62	1.05	0.94	2.18	1.71	13.5
		Max	37.45	13.64	8.35	9.15	0.56	1.43	2.33	2.5	1.43	1.65	1.57	3.87	3.78	16.26
Leptodactylus labyrinthicus	15	Mean	58.71	16.94	9.99	11.69	0.56	1.65	3.46	3.14	3.25	2.24	2.16	5.68	5.36	10.21
		SD	5.13	0.98	0.54	0.78	0.04	0.22	0.41	0.51	0.34	0.34	0.26	0.4	0.42	2.15
		Min	45.83	15.79	9.23	10.62	0.5	1.32	2.69	2.06	2.7	1.69	1.79	5	4.88	6.75
		Max	65.12	19.09	11.25	13.36	0.68	1.92	4.15	4.06	3.9	2.94	2.66	6.6	6.17	13.2
Leptodactylus luctator	12	Mean	45.29	17.97	8.8	8.86	0.43	1	3.39	2.66	1.83	2.33	2.26	3.96	3.27	11.96
		SD	7.72	2.39	1.53	1.68	0.08	0.24	0.44	0.44	0.42	0.56	0.64	0.83	0.92	2.27
		Min	36.36	14.42	6.89	6.72	0.31	0.76	2.78	2.06	1.37	1.7	1.55	3.02	2.15	8.6
		Max	62.15	22.26	11.56	12.4	0.62	1.48	4.49	3.43	3	3.71	4	5.84	5.15	14.99
Leptodactylus podicipinus	3	Mean	24.02	10.26	4.85	5.7	0.33	0.7	1.95	1.18	0.89	1.58	1.35	2.19	1.91	15.61
		SD	1.08	0.39	0.07	0.18	0.03	0.14	0.1	0.28	0.24	0.16	0.09	0.15	0.17	1.64
		Min	22.83	9.88	4.77	5.51	0.31	0.55	1.85	0.87	0.75	1.39	1.27	2.09	1.79	14.3
		Max	24.95	10.66	4.92	5.87	0.37	0.83	2.06	1.43	1.18	1.69	1.46	2.38	2.11	17.45
Leptodactylus troglodytes	6	Mean	35.77	14.15	7.91	9.51	0.48	1.12	2.86	2.09	1.49	1.92	1.74	3.15	3.08	15.74
		SD	3.23	0.77	0.77	0.78	0.1	0.1	0.52	0.27	0.31	0.35	0.28	0.24	0.32	2.43
		Min	30.89	13.07	6.94	8.71	0.31	0.94	1.97	1.87	1.12	1.32	1.45	2.82	2.74	12.97
		Max	39.98	15.17	9.17	10.59	0.62	1.24	3.34	2.5	2	2.4	2.18	3.42	3.42	20.11
Physalaemus centralis	10	Mean	23.19	8.37	4.49	5.16	0.32	0.97	1.62	1.24	1.24	1.4	0.91	2.38	2.02	21.36
		SD	1.89	0.8	0.66	0.62	0.06	0.16	0.23	0.48	0.18	0.33	0.22	0.32	0.28	4.66
		Min	20.08	7.04	3.54	4.37	0.25	0.77	1.2	0.5	1	0.81	0.45	1.95	1.54	15.79
		Max	26	9.55	5.51	6.01	0.43	1.2	2	2.37	1.5	1.82	1.21	2.88	2.41	29.26

Continue...

...Continuation

Species	N		TL	BL	BH	BW	ND	ED	NED	SL	SW	DFH	VFH	TMH	TMW	DFA
Physalaemus cuvieri	15	Mean	20.85	7.84	4.3	5.04	0.62	0.79	1.56	1.77	0.95	1.26	0.91	2	1.65	19.29
		SD	2.53	1.33	0.88	0.67	0.1	0.1	0.26	0.36	0.17	0.28	0.23	0.23	0.2	4.97
		Min	16.78	5.96	3.28	4.19	0.43	0.54	1.17	1.12	0.62	0.86	0.54	1.71	1.38	9.34
		Max	26.41	10.45	6.22	6.65	0.81	0.95	2.06	2.5	1.25	1.84	1.31	2.51	2.2	25.78
Physalaemus marmoratus	6	Mean	23.76	9.08	4.86	5.69	0.46	0.87	1.6	1.55	1.04	1.51	1.11	2.48	1.97	14.94
		SD	1.47	1.11	0.56	0.68	0.11	0.15	0.21	0.4	0.15	0.26	0.09	0.26	0.14	3.91
		Min	21.68	7.4	4.37	4.91	0.31	0.66	1.34	1.12	0.87	1.15	1	2.22	1.82	9
		Max	25.71	10.38	5.7	6.6	0.62	1.11	1.89	2.18	1.25	1.8	1.23	2.93	2.15	20.55
Physalaemus nattereri	13	Mean	33.84	12.68	6.9	7.96	0.44	1.14	2.16	2.22	1.2	1.96	1.34	3.3	2.55	19.09
		SD	3.1	1.19	0.74	0.82	0.11	0.19	0.55	0.48	0.18	0.38	0.29	0.4	0.43	3.27
		Min	29.9	10.64	5.35	6.51	0.31	0.75	1.15	1.25	0.81	1.33	0.74	2.53	2.01	15.18
		Max	39.95	14.17	7.99	9.47	0.7	1.42	3.15	3.06	1.56	2.57	1.68	3.86	3.4	23.86
Microhylidae																
Chiasmocleis albopunctata	6	Mean	20.25	8.5	4.93	5.34	–	1.12	1.94	1.27	1.3	1.87	1.78	1.93	1.73	19.27
		SD	2.65	0.85	0.54	0.3	–	0.14	0.11	0.22	0.33	0.48	0.5	0.33	0.35	2.58
		Min	17.52	7.79	4.18	4.99	–	0.93	1.82	0.92	1	0.97	1.18	1.92	1.35	15.88
		Max	24.14	9.82	5.82	5.89	–	1.3	2.15	1.53	1.76	2.29	2.58	2.83	2.21	23
Dermatonotus muelleri	15	Mean	36.44	15.68	8.7	11.16	–	1.47	3.8	4.02	0.82	3.13	3.13	4.3	3.47	22.18
		SD	3.61	1.37	0.92	0.94	–	0.16	0.54	0.9	0.15	0.54	0.62	0.48	0.48	4.12
		Min	29.63	13.62	7.57	10	–	1.22	2.84	2.96	0.54	2.23	2.23	3.46	2.81	15.98
		Max	41.55	17.65	10.15	12.31	–	1.85	4.93	5.02	1.04	3.57	4	4.74	4.42	29.99
Elachistocleis cesarii	15	Mean	26.94	9.04	4.59	6.39	–	0.83	2.65	1.58	0.81	1.37	1.21	2.61	2.01	25.79
		SD	4.26	0.81	0.6	0.72	–	0.1	0.31	0.28	0.17	0.15	0.3	0.34	0.34	5.04
		Min	20.81	7.83	3.75	5.45	–	0.64	2.08	1.09	0.45	1.14	0.64	2.14	1.51	18.43
		Max	36.72	10.84	5.96	8.46	–	0.95	3.24	2.1	1.05	1.59	1.7	3.36	2.87	35
Odontophrynidae																
Odontophrynus cf. *juquinha*	3	Mean	41.43	17.78	10.2	11.81	0.49	1.19	4.59	1.55	0.99	4.28	2.76	4.43	3.79	13.01
		SD	6.85	1.07	1.77	1.95	0.04	0.3	0.67	0.19	0.18	0.25	0.4	0.46	0.4	4.9
		Min	35.11	16.75	9.33	10.37	0.47	0.85	3.93	1.34	0.81	4.11	2.36	3.93	3.33	9.61
		Max	48.72	18.89	10.68	14.04	0.55	1.45	5.27	1.7	1.18	4.58	3.17	4.85	4.08	18.63
Odontophrynus cultripes	5	Mean	34.87	14.86	5.45	8.01	0.35	1.26	4.12	0.91	0.62	2.14	1.62	3.6	3.04	11.45
		SD	2.23	1.59	0.3	0.61	0.04	0.11	0.45	0.12	0.13	0.21	0.13	0.31	0.33	3.09
		Min	32.11	13.02	5.05	7.41	0.31	1.13	3.59	0.77	0.41	1.92	1.45	3.13	2.64	7.16
		Max	38.01	16.82	5.82	8.8	0.41	1.42	4.6	1.07	0.76	2.47	1.8	4.02	3.52	14.24
Odontophrynus sp.	4	Mean	53.51	22.96	14.99	16.73	0.29	2.34	5.36	2.19	1.36	5.64	4.41	5.98	5.42	10.4
		SD	2.84	1.19	1.18	0.82	0.04	0.16	0.34	0.18	0.18	0.9	0.59	0.54	0.22	1.78
		Min	50.87	21.8	13.58	15.54	0.25	2.16	4.93	1.99	1.24	4.38	3.67	5.38	5.09	8.55
		Max	57.26	24.19	16.41	17.41	0.35	2.5	5.75	2.38	1.63	6.48	5.09	6.67	5.58	12.32
Proceratophrys boiei	3	Mean	32.38	13.18	7.64	8.2	0.49	1.2	2.32	1.24	0.72	2.71	2.01	2.78	2.53	15.9
		SD	0.54	0.36	0.34	0.44	0.04	0.1	0.13	0.03	0.11	0.14	0.04	0.02	0.13	3.15
		Min	31.93	12.93	7.39	7.77	0.46	1.12	2.17	1.21	0.59	2.62	1.96	2.75	2.43	12.27
		Max	32.99	13.6	8.04	8.65	0.55	1.32	2.41	1.27	0.82	2.88	2.04	2.8	2.69	17.81

Continue...

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...Continuation

Species	N		TL	BL	BH	BW	ND	ED	NED	SL	SW	DFH	VFH	TMH	TMW	DFA
Proceratophrys cururu	15	Mean	33.09	12.98	6.43	8.99	0.27	1.36	3.58	0.97	0.68	1.97	1.41	3.45	2.85	15.69
		SD	6.69	2.12	1.05	1.47	0.04	0.16	0.56	0.34	0.19	0.38	0.5	0.54	0.57	4.42
		Min	18.89	8.61	4.58	6.39	0.17	1.12	2.51	0.44	0.25	1.3	0.78	2.17	1.57	7.71
		Max	44.29	15.51	8.08	11.46	0.35	1.68	4.56	1.96	0.88	2.66	2.83	4.02	3.57	23
Proceratophrys dibernardoi	3	Mean	29.75	11.14	5.08	7.69	0.17	1.06	3.06	0.56	0.42	1.71	1.31	3.21	2.9	13.7
		SD	1.52	0.78	0.42	0.49	0.02	0.05	0.46	0.2	0.16	0.08	0.04	0.1	0.21	4.51
		Min	28.82	10.32	4.69	7.14	0.15	1	2.76	0.36	0.24	1.66	1.27	3.12	2.66	9.03
		Max	31.52	11.89	5.53	8.1	0.2	1.11	3.59	0.76	0.54	1.81	1.36	3.33	3.04	18.04
Proceratophrys salvatori	6	Mean	29.83	12.79	6.73	8.29	0.25	1.36	2.54	0.72	0.51	2.57	1.43	2.96	2.6	8.19
		SD	1.9	0.47	0.63	0.87	0.04	0.15	0.39	0.2	0.15	0.25	0.21	0.25	0.18	1.49
		Min	27.67	11.94	5.89	6.78	0.2	1.16	1.94	0.51	0.33	2.17	1.14	2.61	2.27	6.43
		Max	32.62	13.26	7.73	9.19	0.32	1.57	2.92	1.09	0.77	2.86	1.62	3.33	2.77	10.08
Proceratophrys cf. *goyana*	11	Mean	35.55	14.17	7.14	8.14	0.41	1.35	2.51	0.83	0.6	2.51	1.52	3.66	3.81	12.02
		SD	3.83	1.2	0.88	0.69	0.06	0.18	0.35	0.12	0.12	0.33	0.22	0.48	0.41	4.39
		Min	30.95	12.56	5.79	7.08	0.32	1.09	2	0.64	0.43	1.74	1.22	2.9	3.15	6.65
		Max	43.79	16.34	8.72	9	0.54	1.68	3.02	0.98	0.82	2.87	1.89	4.55	4.45	20.04
Proceratophrys sp.	5	Mean	27.54	10.19	4.57	5.43	0.61	0.77	1.7	1.38	0.97	1.74	1.27	2.4	2.09	22.57
		SD	4.99	1.78	0.95	1.32	0.11	0.11	0.27	0.19	0.14	0.25	0.25	0.59	0.78	3.43
		Min	20.34	7.8	3.26	3.98	0.5	0.62	1.46	1.12	0.81	1.37	1.03	1.69	1.37	19
		Max	32.77	11.71	5.62	7.01	0.81	0.91	2.1	1.56	1.12	2.09	1.63	3.09	2.98	27.94
Phyllomedusidae																
Pithecopus azureus	15	Mean	48.78	15.48	8.66	8.03	0.44	2.4	2.91	1.04	1.21	1.43	3.2	4.66	4.07	12.82
		SD	4.97	1.5	0.82	0.95	0.14	0.3	0.25	0.21	0.17	0.48	0.59	0.56	0.6	2.05
		Min	39.38	12.42	7.4	6.15	0.16	1.91	2.45	0.74	0.93	1.03	2.11	3.68	3.05	9.21
		Max	57.13	17.87	10.39	9.66	0.66	3.15	3.5	1.54	1.67	2.5	4.25	5.84	4.91	16.68
Pithecopus oreades	8	Mean	48.71	15.85	9.29	9.13	0.62	2.35	3.5	1.26	1.22	2.02	3.3	4.91	4.36	12.28
		SD	2.31	0.79	0.73	0.39	0.07	0.12	0.32	0.25	0.2	0.18	0.47	0.39	0.35	3.15
		Min	46.68	15.08	8.25	8.76	0.5	2.16	3.1	0.82	0.9	1.66	2.46	4.29	3.97	9.35
		Max	53.93	17.12	10.14	9.95	0.66	2.54	3.99	1.62	1.5	2.22	3.9	5.59	5.04	19.19
Pithecopus sp.	2	Mean	42.1	15.63	7.9	7.01	0.33	2.53	2.92	0.85	1.02	1.09	2.06	5.06	4.11	6.93
		SD	0.79	0.39	0.54	1.14	0	0.18	0.09	0.1	0.21	0.08	0.31	0.72	0.87	1.32
		Min	41.54	15.35	7.52	6.2	0.2	2.4	2.86	0.78	0.87	1.03	1.84	4.55	3.49	6
		Max	42.66	15.91	8.29	7.82	0.2	2.66	2.99	0.93	1.18	1.15	2.28	5.57	4.73	7.87

Results

In this study, we present the morphological characterization for tadpoles of 49 anuran species, with about 600 specimens analyzed, from the families Bufonidae (*Rhinella cerradensis*, *R. diptycha*, *R. ornata* x *R. crucifer*), Cycloramphidae (*Thoropa megatympanum, T. miliaris*), Dendrobatidae (*Adelphobates galactonotus, Ameerega flavopicta*), Hylidae (*Boana albopunctata, Boa. lundii, Boa. raniceps, Boa.* cf. *crepitans, Bokermannohyla alvarengai, Bok. pseudopseudis, Bok. sapiranga, Dendropsophus minutus, D. soaresi, Scinax fuscomarginatus, S. fuscovarius, S. longilineus, S. pombali, S. rupestris, S. similis, Scinax* sp.*, S. squalirostris, Trachycephalus typhonius*), Leptodactylidae (*Leptodactylus fuscus, L. labyrinthicus, L. luctator, L. podicipinus, L. troglodytes, Physalaemus centralis, P. cuvieri, P. marmoratus, P. nattereri*), Microhylidae (*Chiasmocleis albopunctata, Dermatonotus muelleri, Elachistocleis cesarii*), Odontophrynidae (*Odontophrynus americanus, O. cultripes, Odontophrynus* sp.*, Proceratophrys boiei, P. cururu, P. dibernardoi, P. salvatori, P.* cf. *goyana, Proceratophrys* sp.), and Phyllomedusidae (*Pithecopus azureus, P. oreades, Pithecopus* sp.), which represents about 22% of the known anuran species for the Cerrado biome. We organized this morphological information in a taxonomic key and produced a tool to help in anuran surveys and management studies in the Cerrado biome.

1. Bufonidae Gray 1825
Rhinella cerradensis Maciel, Brandão, Campos & Sebben 2007
First Description of the tadpole: Brasília – DF, Brazil (Maciel et al. 2007).
Other characterizations: Not available.
Specimens Examined: Brazil, Goiás State, municipality of Cristianópolis (ZUFG 1769). Description based on four tadpoles between Gosner Stages 36 and 37.
Characterization. Total length 27.63 ± 2.24 mm (Table 1, Figure 5). The body shape is ovoid in dorsal view and globular-depressed in lateral view (BW/BH = 1.24–1.34). The snout is sloped in lateral view. The oral disc is ventral, laterally emarginate, with a uniseriate row of elongated marginal papillae, interrupted by dorsal and ventral gaps; few submarginal papillae scattered laterally, smaller than the marginal papillae. Labial teeth row formula (LTRF) is 2(2)/3(1), with row A1 = A2, P1 = P2 and P3 slightly smaller than P2 in length. The upper jaw sheath is narrow, arc-shaped, and the lower jaw sheath is narrow, U-shaped; the upper jaw sheath is slightly wider than the lower jaw sheath. Nares medium (ND/ED = 0.30–0.37), elliptical, with a small projection on the marginal rim, dorsally positioned. Eyes small (ED/BH = 0.15–0.16), dorsally positioned. Spiracle sinistral, short (SL/BL = 0.03–0.04), narrow (SW/BH = 0.08–0.09), with opening at the middle third of the body, directed posterodorsally, with the centripetal wall fused to the body wall. Vent tube medial, fused with the ventral fin. The caudal musculature width is narrow (TMW/BW = 0.18–0.19). The dorsal fin is high (DFH/TMH = 1.27–1.38), originating at the body-tail junction with acute slope, and convex margin; ventral fin is high (VFH/TMH = 1.04–1.09) with convex margin; the tail tip is rounded. Lateral lines are evident.
Comments. According to Maciel et al. (2007) the tadpoles of *R. cerradensis* can be differentiated from tadpoles of other *Rhinella* species by body proportions (in relation to tail and total length), spiracle position, and the "absence of an external spiracular tube'', with the opening in the body wall. *Rhinella cerradensis* tadpoles analyzed in this study closely resemble the individual described by Maciel et al. (2007), but presented an external spiracular tube, like other *Rhinella* species. We examined the tadpoles used in the description of *R. cerradensis* (CHUNB 49574) and the absence of an external spiracular tube (Maciel et al. 2007) represents a difference in the interpretation of the authors and not a morphological variation.

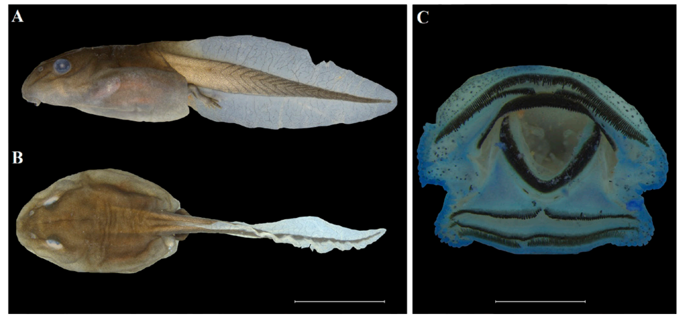

Figure 5. Tadpoles of *Rhinella cerradensis* at Stage 37 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc at Stage 34 (scale 2 mm).

Rhinella diptycha (Werner 1894)
First Description of the tadpole: Jaboticabal – SP, Brazil (Rosa, 1965).
Other characterizations: São José do Rio Preto – SP, Brazil (Vizotto 1967); Argentina (Cei 1980); Nova Itapirema – SP, Brazil (Rossa-Feres & Nomura 2006); Eastern Region of the Meridional Espinhaço Range – MG, Brazil (Pimenta et al. 2014); Bahia State, Brazil (Mercês et al. 2009); Fernando de Noronha – PE, Brazil (Tolledo & Toledo 2010); northern region of the Atlantic Forest (Dubeux et al. 2020).
Specimens Examined: Brazil, Goiás State, municipalities of Aparecida do Rio Doce (ZUFG 1770), Aporé (ZUFG 1030), Portelândia (ZUFG 120), São Domingos (ZUFG 1771). Description based on 11 tadpoles between Gosner Stages 35 and 39.
Characterization. Total length 20.82 ± 2.10 mm (Table 1, Figure 6). The body shape is elliptical in dorsal view and globular-depressed in lateral view (BW/BH = 1.21–1.23). The snout is rounded in lateral view. The oral disc is ventral, laterally emarginate, with a uniseriate row of conical marginal papillae, interrupted by dorsal and ventral gap; few submarginal papillae scattered laterally, smaller than the marginal papillae. LTRF is 2(2)/3, with row A1 = A2, P1 = P2 and P3 slightly smaller than P2. The upper jaw sheath is narrow, arc-shaped, and the lower jaw sheath is narrow, U-shaped; the upper jaw sheath is slightly wider than the lower jaw sheath. Nares medium to large (ND/ED = 0.34–0.38), elliptical, with a small projection on the marginal rim, dorsally positioned. Eyes medium (ED/BH = 0.18–0.18), dorsally positioned. Spiracle sinistral, with medium length (SL/BL = 0.06–0.10), narrow (SW/BW = 0.09–0.09), opening at the middle third of the body, directed posterodorsally, with the centripetal wall completely fused to the body wall. Vent tube medial, fused with the ventral fin. The caudal musculature width is narrow (TMH/BW = 0.20–0.21). The dorsal fin has medium height (DFH/TMH = 0.73–0.99), originating at the anterior third of the tail with an acute slope, and with convex margin; ventral fin has medium height (VFH/TMH = 0.59–0.86) with convex margin; the tail tip is rounded. Lateral line not evident.

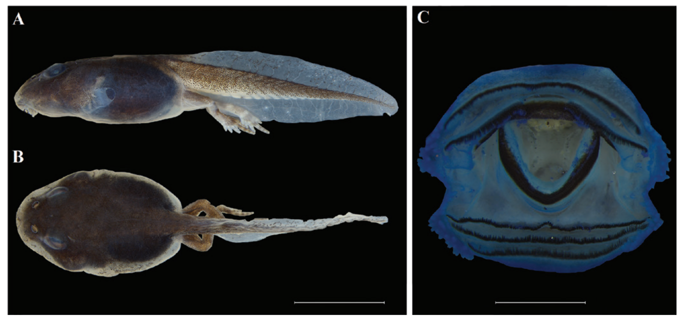

Figure 6. Tadpoles of *Rhinella diptycha* at Stage 40 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc (scale 2 mm).

Comments. Tadpoles from populations currently associated with Rhinella diptycha were described by Rosa (1965), Vizotto (1967), Cei (1980) (as *Bufo paracnemis*), Mercês et al. (2009), Tolledo & Toledo (2010) and Dubeux et al. (2020) (as *Rhinella jimi*). Tadpoles described by Cei (1980) were larger than those used in our description. In Stage 37 the Argentinean populations presented total length of 35 mm, while the analyzed in this study at the same stage presented total length of 23.87 mm, like those described by Vizotto (1967) that presented 23.50 mm, and by Rossa-Feres & Nomura (2006) with 24.31 mm. The LTRF 2(2)/3 was the mostly common observed by us and is the same as reported by

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Rossa-Feres & Nomura (2006), Mercês et al. (2009), Tolledo & Toledo (2010) and Dubeux et al. (2020), differing from the LTRF 2(2)/3(1) described by Rosa (1965), Vizotto (1967) and Cei (1980). Both Rosa (1965) and Rossa-Feres & Nomura (2006) suggests that the interrupted P1 could be caused by manipulation of the tadpoles, but this seems instead morphological variation. From the eleven tadpoles analyzed, two presented the P2 slightly wider than P1, two individuals from different locations presented the LTRF 2(2)/3(1) and the submarginal papillae with the same size of the marginal papillae. *Rhinella diptycha* seems to have variable spiracle position among the different populations studied. In Rossa-Feres & Nomura (2006), the position of the spiracle is in the posterior third of the body, while in Cei (1980) and Tolledo & Toledo (2010) the spiracle is described as positioned at the midbody, while Mercês et al. (2009) described it as positioned in the anterior half of the body. Dubeux et al. (2020) do not provide a description for *R. diptycha* but informs its general aspects together with other *Rhinella* tadpoles included in their study. In our samples, five individuals in both lots analyzed had the spiracle positioned at the posterior third of the body. Tadpoles of *R. diptycha* can be distinguished from *R. cerradensis* by having the body elliptical in dorsal view, depressed body, dorsal fin originating at the anterior third of the tail, LTRF 2(2)/3, mainly by snout rounded in lateral view, and by the presence of unpigmented longitudinal stripe along the ventral edge of the tail musculature.

Rhinella ornata x Rhinella crucifer Thomé, Zamudio, Haddad & Alexandrino 2012

First Description of the tadpole: Catas Altas – MG, Brazil (Lourenço et al. 2010).

Other characterizations: Eastern Region of the Meridional Espinhaço Ridge – MG, Brazil (Pimenta et al. 2014); Iron Quadrangle region (Pezzuti et al. 2021).

Specimens Examined: Brazil, Minas Gerais State, municipality of Cataguases (ZUFG 2352). Description based on four tadpoles at Gosner Stage 40.

Characterization. Total length 27.97 ± 1.87 mm (Table 1, Figure 7). The body shape is ovoid in dorsal view and globular-depressed in lateral view (BW/BH = 1.19–1.27). The snout is rounded in lateral view. The oral disc is ventral, laterally emarginate, with a uniseriate row of conical marginal papillae, interrupted by dorsal and ventral gap; few submarginal papillae laterally, forming a row on the inner side of the lateral emargination, with the same size as the marginal papillae. LTRF is 2(2)/3, A1 = A2, P1 = P2 and P3 slightly smaller than P-2; the upper jaw sheath is narrow, arc-shaped, and the lower jaw sheath is narrow, U-shaped; the upper jaw sheath slightly wider than the lower jaw sheath. Nares medium (ND/ED = 0.22–0.36), elliptical, with a small projection on marginal rim, dorsally positioned. Eyes small (ED/BH = 0.14–0.15), dorsally positioned. Spiracle sinistral, with medium length (SL/BL = 0.09–0.10) and medium width (SW/BH = 0.11–0.12), opening at the middle third of the body, directed posterodorsally, with the centripetal wall completely fused to the body wall. Vent tube medial, fused with the ventral fin. The caudal musculature width is narrow (TMW/BW = 0.20–0.21). The dorsal fin has medium to high height (DFH/TMH = 0.63–1.02), originating at the body-tail junction with acute slope, and convex margin; ventral fin has medium height (VFH/TMH = 0.55–0.82) with convex margin; the tail tip is rounded. Lateral line not evident.

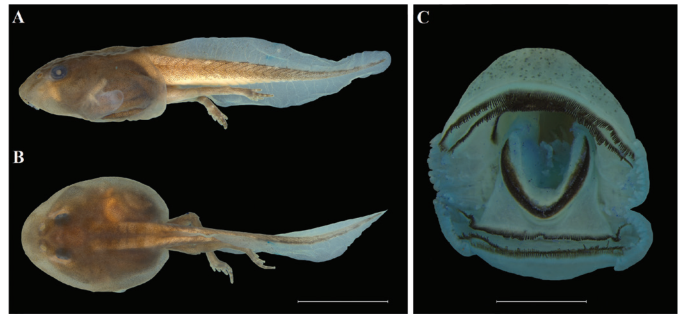

Figure 7. Tadpoles of *Rhinella ornata x Rhinella crucifer* at Stage 40 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc (scale 2 mm).

Comments. *Rhinella pombali*, treated as a species by Baldissera et al. (2004), is currently considered a hybrid formed by *R. crucifer* and *R. ornata* parents (Thomé et al. 2012; but see also the discussion in Pereyra et al. 2021). Thus, we used previous descriptions of tadpoles treated as *R. pombali* to compare with our description. The populations analyzed by Pimenta et al. (2014), treated as *Rhinella crucifer* were compared to our description. The populations described by Lourenço et al. (2010) were smaller (total length = 21.50 mm) than the populations that we studied, but this difference could be explained by the difference in the developmental stages of the tadpoles analyzed [stages 35–38 in Lourenço et al. (2010), stage 40 in our sampled population]. In addition, the tadpoles describe by Lourenço et al. (2010) have the oral disc not emarginate, but the figure shows that the oral disc is emarginate laterally. We found intrapopulation variation in teeth row formula, with one individual with LTRF 2(2)/3(1), and in submarginal papillae, with one individual without submarginal papillae. Tadpoles of (formerly known as) *R. pombali* can be distinguished from tadpoles of *R. cerradensis* by the rounded snout, and LTRF 2(2)/3, and from tadpoles of *R. diptycha* by the ovoid body shape, larger body proportions, eyes dorsolaterally directed, and spiracle opening at the posterior third of the body.

2. Cycloramphidae Bonaparte 1850

Thoropa megatympanum Caramaschi & Sazima 1984

First Description of the tadpole: Serra do Cipó – MG, Brazil (Caramaschi & Sazima, 1984).

Other characterizations: Eastern Region of the Meridional Espinhaço Ridge – MG, Brazil (Pimenta et al. 2014); Iron Quadrangle region (Pezzuti et al. 2021).

Specimens examined: Brazil, Minas Gerais State, Parque Nacional de Sempre Vivas (ZUFG 927). Description based on six tadpoles between Gosner Stages 35 and 37.

Characterization. Total length 23.70 ± 3.48 mm (Table 1, Figure 8). The body shape is ovoid in dorsal view and oval-depressed in lateral view (BW/BH = 1.65–1.73). The snout is rounded in lateral view. The oral disc is ventral, lateroventrally emarginate, with a uniseriate row of marginal papillae, elongated laterally and short ventrally, interrupted by a dorsal gap; submarginal papillae absent. The LTRF is 2(2)/3, A1 = A2, P1 = P2 and P3 slightly smaller than P-2. The upper jaw sheath is narrow, arc-shaped, and the lower jaw sheath is wide, U-shaped; the lower jaw sheath is wider than the upper jaw sheath. Nares medium (DMN/DMO = 0.16–0.17), elliptical, laterally positioned. Eyes

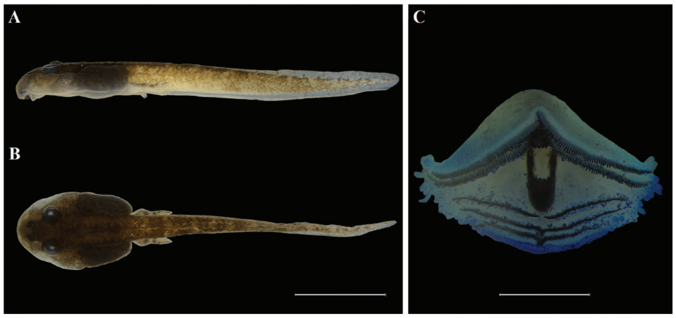

Figure 8. Tadpoles of *Thoropa megatympanum* at Stage 36 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc (scale 2 mm).

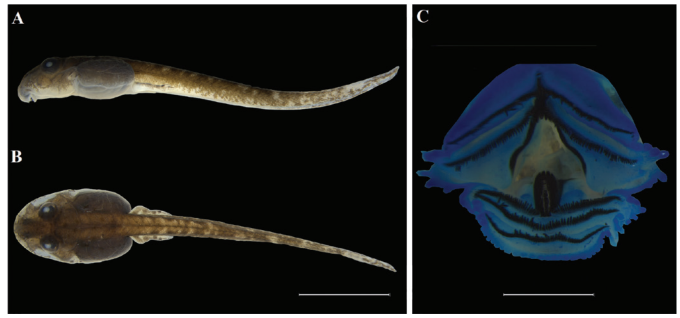

Figure 9. Tadpoles of *Thoropa miliaris* at Stage 36 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc (scale 2 mm).

large (ED/BH = 0.33–0.34), dorsally positioned. Spiracle sinistral, lateroventral, with medium length (SL/BL = 0.12–0.18), wide (SW/BH = 0.27–0.27), opening at the middle third of the body, directed posterodorsally, with the centripetal wall completely fused to the body wall. Vent tube medial, with free distal edge. The caudal musculature width is medium (TMW/BW = 0.31–0.32). The dorsal fin is low (DFH/TMH = 0.27–0.30), originating at the middle third of the tail with acute slope, and parallel margin; ventral fin is low (VFH/TMH = 0.27–0.28) with margin parallel to the caudal musculature; the tail tip is rounded. Lateral line not evident.

Comments. The tadpoles from Sempre Vivas National Park were like those described by Caramaschi & Sazima (1984), but the populations described by Pimenta et al. (2014) and Pezzuti et al. (2021) differ due to the vent tube fused to the ventral fin. From the total of analyzed individuals, two have the A1 slightly smaller than A2, two presented LTRF 2(1,2)/3(1), and one LTRF 2(2)/3(1).

Thoropa miliaris (Spix 1824)

First Description of the tadpole: Cubatão – SP, Brazil (Bokermann, 1965).

Other characterizations: Iron Quadrangle region (Pezzuti et al. 2021).

Specimens Examined: Brazil, Minas Gerais State: Cataguases (ZUFG 2342). Description based on five tadpoles at Gosner Stage 39.

Characterization. Total length 24.09 ± 0.71 mm (Table 1, Figure 9). The body shape is elliptical in dorsal view and oval-depressed in lateral view (BW/BH = 1.30–1.60). The snout is rounded in lateral view. The oral disc is ventral, ventrally emarginate, with a uniseriate row of marginal papillae, elongated laterally and short ventrally, interrupted by dorsal gap; submarginal papillae absent. LTRF is 2(2)/3(1), A1 = A2, P1 = P2 > P3. The upper jaw sheath is wide, arc-shaped, and the lower jaw sheath is wide, U-shaped; the upper and lower jaw sheath of the same width. Nares medium (ND/ED = 0.15–0.17), elliptical, laterally positioned. Eyes large (ED/BH = 0.32–0.34), dorsally positioned. Spiracle lateroventral, with medium length (SL/BL = 0.10–0.14) and width (SW/BH = 0.24–0.24), with opening at the middle third of the body, directed posterodorsally, with the centripetal wall completely fused to the body wall. Vent tube medial, with free distal edge. The caudal musculature width is medium (TMW/BW = 0.31–0.31). The dorsal fin is low (DFH/TMH = 0.05–0.12), originating at the posterior third of the tail with acute slope, and margin parallel to the caudal musculature; ventral fin is low (VFH/TMH = 0.11–0.16) with margin parallel to the caudal musculature; the tail tip is rounded. Lateral line not evident.

Comments. Tadpoles analyzed in this study are like the description of Bokermann (1965) and Pezzuti et al. (2021), and just one individual in our sample had a different LTRF of 2(1,2)/3(1). Pezzuti et al. (2021) described the tadpoles with the oral disc lateroventrally emarginate, while we considered the emargination ventral, with a small nostril, while we considered the nares medium sized, and with a short spiracle, while we considered it medium sized. Tadpoles of *T. miliaris* can be distinguished from tadpoles of *T. megatympanum* by the elliptical body in dorsal view, lower dorsal fin, and larger vent tube (LT/LMC = 1.72 mm in *T. miliaris*, and LT/LMC = 1.27 mm in *T. megatympanum*). However, regarding this last trait, we suspected that the vent tube in our *T. miliaris* sample were damaged during collecting and the validity of this difference should be evaluated in future studies.

3. Dendrobatidae Cope 1865

Adelphobates galactonotus (Steindachner 1864)

First Description of the tadpole: Araguaína – TO, Brazil (Santos et al. 2018).

Other characterizations: Not available.

Specimens Examined: Brazil, Tocantins State, municipality of Araguaína (ZUFG 2508).

Characterization. The following information is complementary to the description available in Santos et al. (2018). Total length 39.19 ± 2.07 mm (Table 1, Figure 10). The body shape is globular-depressed in lateral view (BW/BH = 1.27–1.70), nares very large (ND/ED = 0.72–0.84), eyes small (ED/BH = 0.07–0.12), spiracle medium-sized (SL/BL = 0.08–0.12) and medium width (SW/BH = 0.19–0.26). The caudal musculature width is medium (TMW/BW = 0.33–0.39), and the dorsal (DFH/TMH = 0.51–0.61) and ventral (VFH/TMH = 0.53–0.57) fins have medium height.

Comments. A discussion about the importance of larval morphology for systematic of the Dendrobatoidea and their relatives was provided by Santos et al. (2018).

Ameerega flavopicta (A. Lutz 1925)

First Description of the tadpole: Santana do Riacho – MG, Brazil (Haddad et al. 1994).

Other characterizations: Serra de Caldas State Park – GO, Brazil (Costa et al. 2006); Jaboticatubas– MG, Brazil (Dias et al. 2018); Iron Quadrangle region (Pezzuti et al. 2021).

Specimens Examined: Brazil, Goiás State, municipalities of Alto Paraíso (ZUFG 1166), São João d'Aliança (ZUFG 1094, ZUFG

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Figure 10. Tadpoles of *Adelphobates galactonotus* at Stage 37 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc at Stage 34(scale 2 mm).

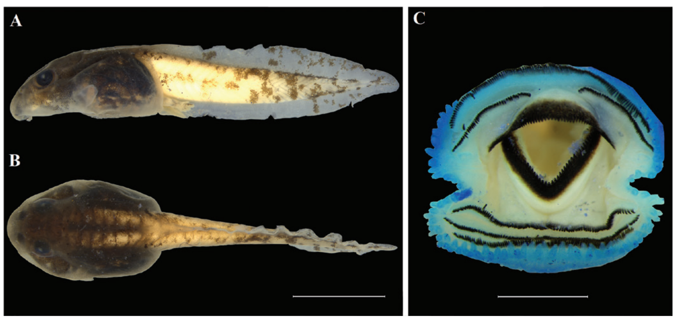

Figure 11. Tadpoles of *Ameerega flavopicta* at Stage 35 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc (scale 2 mm).

1110). Description based on four tadpoles between Gosner Stages 35 and 39.

Characterization. Total length 27.06 ± 2.85 mm (Table 1, Figure 11). The body shape is elliptical in dorsal view and globular-depressed in lateral view (BW/BH = 1.38– 1.49). The snout is rounded in lateral view. The oral disc is ventral, laterally emarginate, with a uniseriate row of elongated marginal papillae, interrupted by a dorsal gap; few submarginal papillae scattered laterally, of the same length as the marginal papillae. LTRF is 2(2)/3(1), A1<A2, P1<P2>P3. The upper jaw sheath is narrow, arc-shaped, and the lower jaw sheath is narrow, V-shaped; the upper jaw sheath is wider than the lower jaw sheath. Nares medium (ND/ED = 0.18–0.15), elliptical, with a small projection on marginal rim, dorsolaterally positioned. Eyes medium (ED/BH = 0.20–0.24), dorsally positioned. Spiracle sinistral, with medium length (SL/BL = 0.09–0.11) and wide width (SW/BH = 0.15–0.20), opening at the middle third of the body, directed posterodorsally, with the centripetal wall completely fused to the body wall. Vent tube dextral, fused with the ventral fin. The caudal musculature width is medium (TMW/BW = 0.38–0.39). The dorsal fin has medium height (DFH/TMH = 0.59–0.61), originating at the body-tail junction with an acute slope, and convex margin; ventral fin has low to medium height (VFH/TMH = 0.38–0.46) with margin parallel to the caudal musculature; the tail tip is pointed. Lateral line not evident.

Comments. Tadpoles analyzed by Dias et al. (2018) closely resemble those described herein. Tadpoles described by Pezzuti et al. (2021) differ by the spiracle length, that they considered short while we considered it medium sized. One individual in our sample presented marginal and submarginal papillae conical in the upper labium.

4. Hylidae Rafinesque 1815

Boana albopunctata (Spix 1824)

First Description of the tadpole: locality not mentioned (De Sá 1995).

Other characterizations: Boracéia – SP, Brazil (Heyer et al. 1990); Nova Itapirema, Engenheiro Schmidt and Vitória Brasil - SP, Brazil (Rossa-Feres & Nomura 2006); Eastern Region of the Meridional Espinhaço Ridge – MG, Brazil (Pimenta et al. 2014); Iron Quadrangle region (Pezzuti et al. 2021).

Specimens Examined: Brazil, Goiás State, municipalities of Aparecida do Rio Doce (ZUFG 1812, ZUFG 1822), Cachoeira Alta (ZUFG 1945), Caiapônia (ZUFG 1963), Pirenópolis (ZUFG 07, ZUFG 13), Rio Verde (ZUFG 57). Description based on 15 tadpoles between Gosner Stages 35 and 38.

Characterization. Total length 43.93 ± 8.05 mm (Table 1, Figure 12). The body shape is ovoid in dorsal view and globular-depressed in anterolateral view (BW/BH = 1.09–1.24). The snout is rounded in lateral view. The oral disc is ventral, ventrally emarginate, with a uniseriate row of conical marginal papillae, interrupted by a dorsal gap; submarginal papillae absent. LTRF is 2(2)/3(1), A1 = A2; P1 = P2 and P3 with half the length of P2. The upper jaw sheath is narrow, arc-shaped, and the lower jaw sheath is narrow, V-shaped; the upper jaw sheath is wider than the lower. Nares medium (ND/ED = 0.33–0.34), reniform, with a large projection on the marginal rim, dorsally positioned. Eyes medium (ED/BH = 0.18–0.21), dorsally positioned. Spiracle sinistral, with medium length (SL/BL = 0.12–0.17) and medium width (SW/BH = 0.12–0.12), opening on the posterior third of the body, directed posteriorly, with the centripetal wall not fused to body wall. Vent tube dextral, fused to the ventral fin. The caudal musculature width is medium (TMW/BW = 0.42–0.48). The dorsal fin has medium height (DFH/TMH = 0.62–0.77), originating at the body-tail junction with a median slope, and convex margin; ventral fin is low (VFH/TMHW = 0.40–0.41) with margin parallel to the caudal musculature; the tail tip is pointed. Lateral line evident.

Comments. Tadpoles of *B. albopunctata* are found in a diversity of habitats, as temporary streams, swamps, or permanent ponds. Morphological variation of tadpoles related to the environmental changes were described by Rossa-Feres & Nomura (2006). The tadpoles analyzed by Pimenta *et al.* (2014) and Pezzuti et al. (2021) have an oral disc emarginate lateroventral. Tadpoles described by de Sá (1995) differ from our sample by the presence of submarginal papillae and by the teeth row length (P1<P2). The LTRF 2(2)/3(1) observed in our samples also differ from the LTRF observed by Rossa-Feres & Nomura (2006), Pimenta et al. (2014) and Pezzuti et al. (2021), reported as 2(1,2)/3(1).

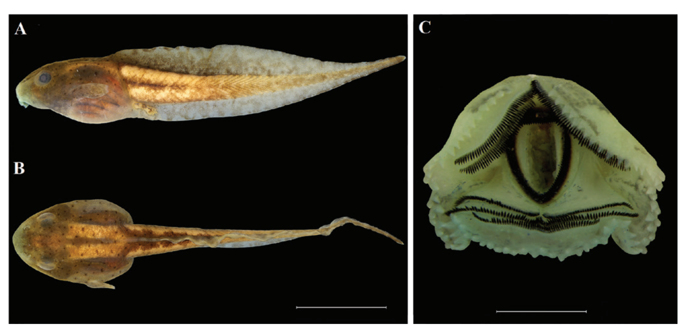

Figure 12. Tadpoles of *Boana albopunctata* at Stage 36 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc (scale 2 mm).

However, we found the LTRF 2(1,2)/3(1) in our sample, although with a small frequency (2/15), the same of the LTRF 2(2)/3, while the LTRF 2(2)/3(1) was the most common (11/15). In two specimens, the length of the P1 was smaller than the P2, in three, the P1 was longer than the P2, six specimens had the upper jaw sheath M-shaped and in seven tadpoles, the spiracle was posterodorsally directed.

Boana lundii (Burmeister 1856)
First Description of the tadpole: Serra do Cipó – MG, Brazil (Bokermann & Sazima 1973).
Other characterizations: Mirassol – SP, Brazil (Rossa-Feres & Nomura 2006); Eastern Region of the Meridional Espinhaço Ridge – MG, Brazil (Pimenta et al. 2014); Iron Quadrangle region (Pezzuti et al. 2021).
Specimens Examined: Brazil, Goiás State, municipality of Iporá (ZUFG 2264, ZUFG 2266). Description based on five tadpoles between Gosner Stages 36 and 38.
Characterization. Total length 59.47 ± 8.98 mm (Table 1, Figure 13). The body shape is elliptical in dorsal view and globular-depressed in lateral view (BW/BH = 1.08–1.17). The snout is rounded in lateral view. The oral disc is ventral, ventrally emarginate, with a uniseriate row of elongated marginal papillae dorsally, but in alternated disposition only lateroventrally, interrupted by a dorsal gap; submarginal papillae scattered laterally, smaller than the marginal papillae. Accessory teeth row present laterally in the oral disc (*sensu* Sanchez 2010). LTRF is 2(2)/4(1), A1 = A2, P1<P2>P3>P4. The upper jaw sheath is narrow to medium, arc-shaped, and the lower jaw sheath is narrow, V-shaped; the upper jaw sheath is wider than the lower jaw sheath. Nares large (ND/ED = 0.38–0.42), reniform, dorsally positioned. Eyes medium (ED/BH = 0.18–0.19), dorsally positioned. Spiracle sinistral, with medium length (SL/BL = 0.09–0.09) and medium width (SW/BH = 0.10–0.14), with opening on the posterior third of the body, directed posterodorsally, with centripetal wall not fused to body wall. Vent tube dextral, fused to the ventral fin. The caudal musculature width is wide (TMW/BW = 0.52–0.53). The dorsal fin has medium height (DFH/TMH = 0.55–0.61), originating at the body-tail junction with acute slope, and convex margin; ventral fin has low to medium height (VFH/TMH = 0.41–0.50) with margin parallel to the caudal musculature; the tail tip is pointed. Lateral line evident.
Comments. Tadpoles described by Bokermann & Sazima (1973) differ analyzed in our study by the ovoid body shape and by the LTRF 2(2)/3(1), although the illustration shows a LTRF 2(2)/4(1), as observed by Rossa-Feres & Nomura (2006). Considering the total length, tadpoles analyzed by Bokermann & Sazima (1973) are larger tadpoles [66 mm, Stage 37), and the described by Rossa-Feres & Nomura (2006) are smaller (45.78 mm, Stages 35–39). Tadpoles described by Rossa-Feres & Nomura (2006) also differ by the row of biseriate marginal papillae (uniseriate in our sample). The tadpoles analyzed by Pimenta et al. (2014) and by Pezzuti et al. (2021) had an oral disc emarginate lateroventrally. Pezzuti et al. (2021) described the spiracle as being short, while we considered it medium sized. Tadpoles of *B. lundii* are easily differentiated from those of *B. albopunctata* by LTRF 2(2)/4(1) (LTRF = 2(2)/3(1), 2(2)/3, or 2(1,2)/3(1) in *B. albopunctata*), marginal rim less prominent, presence of submarginal papillae (absent in *B. albopunctata*), and by the shorter spiracle.

Boana raniceps Cope 1862
First Description of the tadpole: Ibirá – SP, Brazil (Vizotto 1967).
Other characterizations: Argentina (Cei 1980); Nova Itapirema – SP, Brazil (Rossa-Feres & Nomura 2006); Argentina (Kolenc 2008); Bolívia (Schulze et al. 2015).
Specimens Examined: Brazil, Goiás State, municipality of Iporá (ZUFG 879, ZUFG 1028, ZUFG 2256). Description based on 14 tadpoles between Gosner Stages 34 and 38.
Characterization. Total length 57.54 ± 9.54 mm (Table 1, Figure 14). The body shape is ovoid in dorsal view and globular-depressed in lateral view (BW/BH = 1.07–1.14). The snout is rounded in lateral view. The oral disc is ventral, ventrally emarginate, with a uniseriate row of conical marginal papillae, short, interrupted by a dorsal gap; one to three submarginal papillae scattered laterally, smaller than the marginal papillae. LTRF is 2(1,2)/3(1), A1 = A2, P1<P2>P3. The upper jaw sheath is narrow, arc-shaped, and the lower jaw sheath is narrow, V-shaped; the upper and lower jaw sheath had the same width. Nares medium (ND/ED = 0.34–0.37), reniform, with a large projection on the marginal rim, dorsally positioned. Eyes medium (ED/BH = 0.21–0.22), dorsally positioned. Spiracle sinistral, with medium length (SL/BL = 0.07–0.12) and medium width (SW/BH = 0.10–0.13), opening on the posterior third of the body, posterodorsally directed, with centripetal wall not fused to body wall. Vent tube medial with dextral opening, fused to the ventral fin. The caudal musculature width is medium (TMW/BW = 0.47–0.47). The dorsal fin has medium height (DFH/TMH = 0.89–0.94), originating at the body with high slope, and triangular margin; ventral fin has medium height (VFH/TMH = 0.47–0.52) with margin parallel to the caudal musculature; the tail tip is pointed. Lateral line evident.
Comments. Tadpoles described by Cei (1980) differ from those studied herein by a dextral vent tube and by the LTRF 2/3 or 2/3(1). Kolenc (2008) reports for tadpoles from Argentina presence of a very short

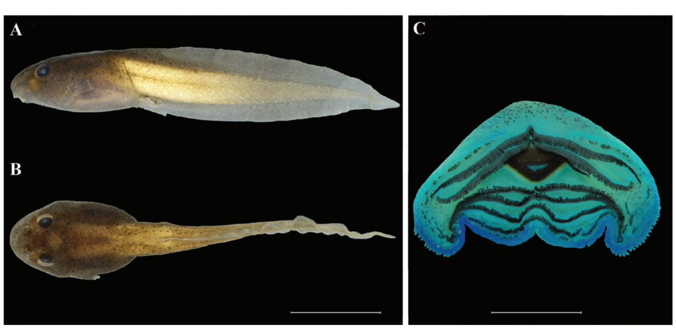

Figure 13. Tadpoles of *Boana lundii* at Stage 36 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc (scale 2 mm).

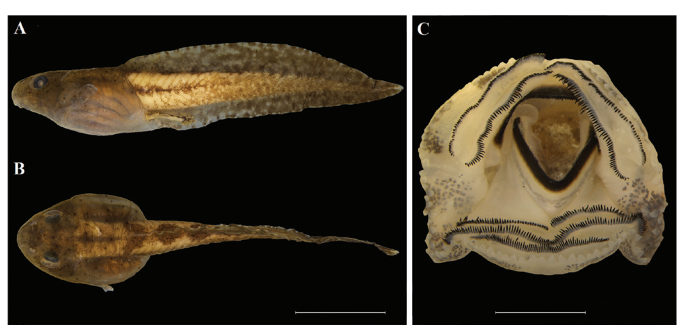

Figure 14. Tadpoles of *Boana raniceps* at Stage 38 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc at Stage 37 (scale 2 mm).

ventral gap in the marginal papillae, but in one specimen, and a short P4 row in another one. Disregarding these variations, the tadpoles are similar when compared to our sample. The populations analyzed by Schulze et al. (2015) were smaller (total length = 53.4 mm in stages 35 at 41 and our sample = 57.54 in stages 34 at 38). From the total of analyzed individuals, six individuals do not have submarginal papillae, in four, the A2 teeth row was larger than the A1, three have the A1 at the same length of the A2, four have the spiracle posteriorly directed and in two, the lateral line was not evident. *Boana raniceps* tadpoles can be easily distinguished from the tadpoles of *B. albopunctata* and *B. lundii* by the shape of dorsal fin (triangular margin in *B. raniceps*), the LTRF 2(1,2)/3(1) [LTRF 2(2)/3(1) in *B. albopunctata* and 2(2)/4(1) in *B. lundii*], and the presence of conical marginal papillae in *B. raniceps*.

Boana cf. *crepitans*

First Description of the tadpole: not available.

Other characterizations: not available.

Specimens Examined: Brazil, Goiás State, municipality of Nova Roma (ZUFG 2044). Description based on eight tadpoles between Gosner Stages 36 and 39.

Characterization. Total length 62.32 ± 4.96 mm (Table 1, Figure 15). The body shape is ovoid in dorsal view and globular-depressed in lateral view (BW/BH = 1.13–1.17). The snout is rounded in lateral view. The oral disc is ventral, ventrally emarginate, with a uniseriate row of elongated marginal papillae, in alternated disposition, interrupted by a dorsal gap; few submarginal papillae scattered laterally, smaller than the marginal papillae. LTRF is 2(2)/3(1), A1 = A2, P1 = P2 > P3. The upper jaw sheath is narrow, M-shaped, and the lower jaw sheath is narrow, U-shaped; the upper jaw sheath is wider than the lower jaw sheath. Nares are medium (ND/ED = 0.28–0.29), reniform, with a small projection, dorsally positioned. Eyes medium (ED/BH = 0.19–0.20), dorsally positioned. Spiracle sinistral, with medium length (SL/BL = 0.08–0.10) and medium width (SW/BH = 0.11–0.12), opening on the middle third of body, directed posterodorsally, with the centripetal wall fused to the body wall, with distal margin free. Vent tube medial with dextral opening, fused to the ventral fin. The caudal musculature width is medium (TMW/BW = 0.32–0.42). The dorsal fin has medium height (DFH/TMH = 0.59–0.68), originating at the body with median slope, and convex margin; ventral fin is low (VFH/TMH = 0.32–0.40) with margin parallel to the caudal musculature; the tail tip is rounded. Lateral line not evident.

Comments. We opt to use the name *Boana* cf. *crepitans* once our tadpoles are notably larger than the available descriptions of *Boana crepitans* tadpoles (53.8 mm of total length for tadpoles from the Iron Quadrangle, Pezzuti et al. 2021; 43.4 mm of total length for tadpole from Serra de São José, Casal & Juncá 2008; 62.3 mm in our study). These tadpoles differ from tadpoles of *B. lundii* by the larger body (BW = 15.24 mm in *B. crepitans* and 11.53 mm in *B. lundii*), ovoid body shape in dorsal view, higher body, wider spiracle, and deeper fins. From the total of analyzed individuals, one does not show submarginal papillae, one individual presented the upper jaw sheath arc-shaped and one the spiracle posteriorly directed, two have accessory teeth rows, and three have the P2 slightly longer than the P1.

Bokermannohyla alvarengai (Bokermann 1956)

First Description of the tadpole: Serra do Cipó – MG, Brazil (Sazima & Bokermann 1977).

Other characterizations: Eastern Region of the Meridional Espinhaço Ridge – MG, Brazil (Pimenta et al. 2014); Iron Quadrangle region (Pezzuti et al. 2021).

Specimens Examined: Brazil, Minas Gerais State, Parque Nacional de Sempre Vivas (ZUFG 974, ZUFG 981). Description based on 15 tadpoles between Gosner Stages 35 and 37.

Characterization. Total length 51.10 ± 5.70 mm (Table 1, Figure 16). The body shape is elliptical in dorsal view and globular-depressed in lateral view (BW/BH = 1.39– 1.49). The snout is rounded in lateral view. The oral disc is ventral, ventrally emarginate, with a uniseriate row of elongated marginal papillae, interrupted by a dorsal gap; submarginal papillae scattered lateroventrally, smaller than the marginal papillae; accessory teeth rows absent. LTRF is 2(2)/5(1), A1 = A2, P1 < P2 = P3 > P4 > P5. The upper jaw sheath is wide, arc-shaped, and the lower jaw sheath is wide, V-shaped; the upper jaw sheath is wider than the lower jaw sheath. Nares large (ND/ED = 0.42–0.48), elliptical, dorsolaterally positioned. Eyes medium (ED/BH = 0.18–0.20), dorsal positioned. Spiracle sinistral, with medium length (SL/BL = 0.09–0.13) and medium width (SW/BH = 0.15–0.17), opening at the middle third of the body, directed posterodorsally; centripetal wall partially fused to the body wall with a free distal edge. Vent tube dextral, fused to the ventral fin. The caudal musculature width is medium (TMW/BW = 0.32–0.42). The dorsal fin has medium height (DFH/TMH = 0.50–0.56), originating at the body with median slope, and convex margin; ventral fin is low (VFH/TMW = 0.41–0.43) with convex margin; the tail tip is pointed. Lateral line not evident.

Comments. Tadpoles described by Sazima & Bokermann (1977) differ from those analyzed herein by having ovoid body shape, and larger total length. In Stage 40, the tadpoles analyzed by Sazima & Bokermann (1977)

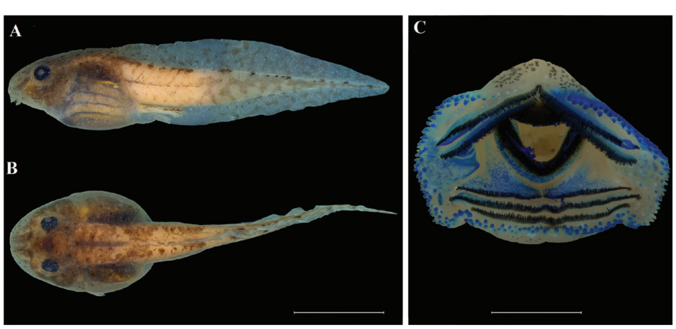

Figure 15. Tadpoles of *Boana* cf. *crepitans* at Stage 39 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc (scale 2 mm).

Figure 16. Tadpoles of *Bokermannohyla alvarengai* at Stage 35 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc (scale 2 mm).

presented 53 mm, while the tadpoles in our sample, Stages 35–39, had about 51.10 mm. Tadpoles described by Pezzuti et al. (2021) also were larger (56.1 mm) than the tadpoles that we described, and had medium sized nares, while we considered it larger. The oral disc of the tadpoles from the Iron Quadrangle also had lateroventrally emargination and marginal papillae with alternate disposition (Pezzuti et al. 2021). Although the illustration presented by Sazima & Bokermann (1977) show the LTRF 2(1,2)/5(1), the authors describe it as 2(2)/5(1), the same observed by Pimenta et al. (2014) and in our sample.

Bokermannohyla pseudopseudis (Miranda-Ribeiro 1937)
First Description of the tadpole: Alto Paraíso de Goias – GO, Brazil (Lins et al. 2018).
Other characterizations: Not available.
Specimens Examined: Brazil, Goiás State, municipality of Cavalcante (ZUFG 2426, ZUFG 2427). Description based on ten tadpoles between Gosner Stages 31 and 37.
Characterization. Total length 42.95 ± 4.32 mm (Table 1, Figure 17). The body shape is elliptical in dorsal view and globular-depressed in lateral view (BW/BH = 1.05–1.12). The snout is rounded in lateral view. The oral disc is ventral, emarginate ventrally, with a uniseriate row of elongated marginal papillae, in alternated disposition, interrupted by a dorsal gap; submarginal papillae scattered laterally, smaller than the marginal papillae, accessory teeth rows present laterally in the oral disc. LTRF is 3(1,3)/6(1), A1 slightly smaller than A2 and A3 slightly smaller than A2; P1 = P2 = P3 = P4 = P5 > P6. The upper jaw sheath is narrow, arc-shaped, and the lower jaw sheath is wide, V-shaped; the upper jaw sheath is wider than the lower jaw sheath. Nares large (ND/ED = 0.38–0.40), elliptical, with a small projection on the marginal rim, dorsally positioned. Eyes medium (ED/BH = 0.18–0.20), dorsally positioned. Spiracle sinistral, with medium length (SL/BL = 0.10–0.13) and medium width (SW/BH = 0.14–0.15), opening at the middle third of the body, directed posterodorsally, with the centripetal wall fused to the body wall, with a free distal edge. Vent tube dextral, fused to the ventral fin. The caudal musculature width is medium to wide (TMW/BW = 0.47– 0.55). The dorsal fin has medium height (DFH/TMH = 0.67–0.70), originating at the body with a median slope, and convex margin; ventral fin has medium height (VFH/TMHW = 0.47–0.48) with margin parallel to the caudal musculature; the tail tip is pointed. Lateral lines evident.
Comments. A previous description of *B. pseudopseudis* tadpoles was provided by Eterovick & Brandão (2001) but was based on a mixed series of both *B. pseudopseudis* and *B. sapiranga* tadpoles (Brandão et al. 2012; Lins et al. 2018). Thus, we considered the first formal description of the tadpole the report by Lins et al. (2018), once only *B. pseudopseudis* tadpoles were used in the characterization. The tadpole described by Lins et al. (2018) were larger (TL = 65.04 mm in stage 25) than those described herein (TL = 42.95 mm) and had a different LTRF: 3(1, 2)/6(1). From the total of analyzed individuals, two presented fewer submarginal papillae scattered laterally in the oral disc; two individuals presented a small ventral gap in the marginal papillae, with the space of one papilla; and three individuals presented LTRF 2(2)/6(1). Accessory tooth rows are "*short tooth rows in the lateral areas of the oral disc and beside the jaw sheaths*" (Sánchez 2010) and was reported frequently for tadpoles with high number of tooth rows [at least 2/4, *Boana balzani* and *B. palaestes* (Duellman *et al.* 1997), *B. riojana* (Kolenc *et al.* 2008), *Hyloscirtus* tadpoles (Sánchez, 2010), *Bokermannohyla pseudopseudis* group (Eterovick and Brandão, 2001; Faivovich *et al.* 2005), *Trachycephalus typhonius*, Nomura per. obs.], but was already observed for tadpoles with fewer tooth rows [no more than 2/3, *B. cordobae* (Kolenc *et al.* 2008)].

Bokermannohyla sapiranga Brandão, Magalhães, Garda, Campos, Sebben & Maciel 2012
First Description of the tadpole: Brasília– DF, Brazil (Lins et al. 2018).
Other characterization: Not available.
Specimens Examined: Brazil, Goiás State, municipality of Pirenópolis (ZUFG 217, ZUFG 218, ZUFG 2430). Description based on five tadpoles between Gosner Stages 25 and 28.
Characterization. Total length 59.51 ± 15.30 mm (Table 1, Figure 18). The body shape is elliptical in dorsal view and globular-depressed in lateral view (BW/BH = 1.14–1.19). The snout is rounded in lateral view. The oral disc is ventral, emarginate ventrally, with a uniseriate row of elongated marginal papillae, biseriate laterally, interrupted by a dorsal gap; submarginal papillae scattered laterally, smaller than the marginal papillae; accessory teeth row present laterally in the oral disc. LTRF is 2(2)/5(1), A1 = A2; P1 = P2 = P3 = P4 > P5. The upper jaw sheath is narrow, arc-shaped, and the lower jaw sheath is narrow, V- shaped; the upper jaw sheath is wider than the lower jaw sheath. Nares medium to large (ND/ED = 0.35–0.43), elliptical, with a projection on marginal rim, dorsally positioned. Eyes small (ED/BH = 0.14–0.18), dorsally positioned. Spiracle sinistral, with medium length (SL/BL = 0.09–0.10) and medium width (SW/BH = 0.14–0.17), opening at the middle third of the body, directed posterodorsally, with the centripetal wall fused to the body wall and with a free distal edge. Vent tube dextral, fused to the ventral fin. The caudal musculature width is medium to wide

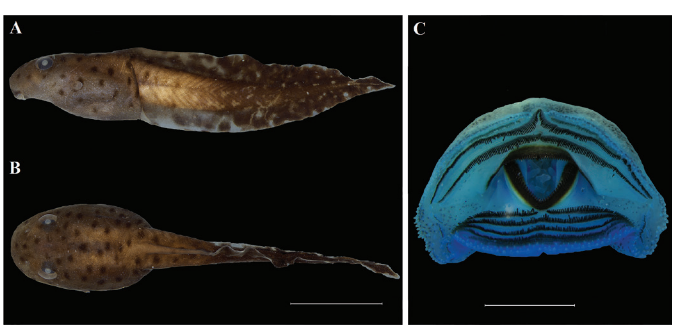

Figure 17. Tadpoles of *Bokermannohyla pseudopseudis* at Stage 25 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc (scale 2 mm).

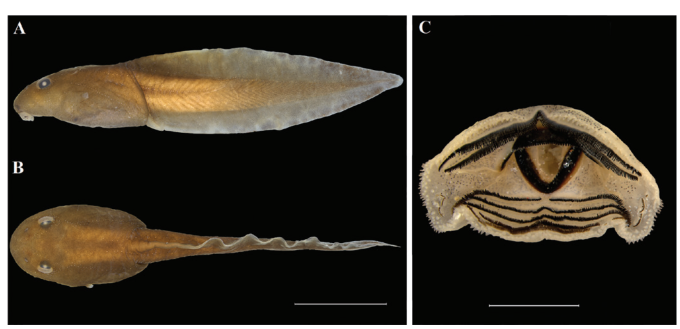

Figure 18. Tadpoles of *Bokermannohyla sapiranga* at Stage 25 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc (scale 2 mm).

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(TMW/BW = 0.45–0.69). The dorsal fin has low to medium height (DFH/TMH = 0.41–0.64), originating at the body with an acute slope, and margin convex to the caudal musculature; ventral fin has low to medium height (DFH/TMH = 0.30–0.53) with parallel margin; the tail tip is pointed. Lateral line evident.

Comments. From the total of analyzed individuals, four presented alternated marginal papillae, three had accessory teeth rows laterally, one presented marginal papilla in the upper labium, and three presented P1<P2. Tadpoles analyzed by Lins et al. (2018) closely resemble those presented herein, with the exception that the accessory teeth rows were absent in their populations and described as a variation presented in only one individual. Tadpoles of *B. sapiranga* can be distinguished of the *B. alvarengai* and *B. pseudopseudis* by the larger total length: *Bokermannohyla alvarengai* = 51.10 mm, Stages 35–37; *B. pseudopseudis* = 42.95 mm, Stages 31–37; *B. sapiranga* = 59.51 mm, Stages 25–28. Also, tadpoles of *B. sapiranga* differ from *B. alvarengai* larvae by the uniseriate marginal papillae laterally and from *B. pseudopseudis* by the LTRF. The presence of accessory teeth rows laterally in the oral disc was observed only in *B. pseudopseudis* and in *B. sapiranga*, and this trait is considered a synapomorphy for the *B. pseudopseudis* group [Eterovick & Brandão 2001; Faivovich et al. 2005; however, see a discussion in Sánchez (2010) for the phylogenetic importance of this trait].

Dendropsophus minutus (Peters 1872)

First Description of the tadpole: Campo Grande – SP, Brazil (Bokermann 1963). Wrongly attributed to the municipality of Campo Grande in the state of Mato Grosso do Sul, Brazil, by Rossa-Feres & Nomura (2006). Other characterizations: Northwestern Region of São Paulo State, Brazil (Vizotto 1967); Trinidad and Tobago (Kenny 1969); Santa Cecília – Ecuador (Duellman 1978); Argentina (Cei 1980); Boracéia – SP, Brazil (Heyer et al. 1990); Venezuela (Duellman 1997); Nova Itapirema – SP, Brazil (Rossa-Feres & Nomura 2006); Eastern Region of the Meridional Espinhaço Ridge – MG, Brazil (Pimenta et al. 2014); Bolivia (Schulze et al. 2015); Iron Quadrangle region (Pezzuti et al. 2021). Although lacking a formal characterization, some larval traits can be found in available taxonomic keys for the tadpoles from the Amazonas (Hero 1990) and Colombia (Lynch & Mayorga 2011).

Specimens Examined: Brazil, Goiás State, municipalities of Aruanã (ZUFG 610), Bonfinópolis (ZUFG 1952), Jataí (ZUFG 714), Pirenópolis (ZUFG 196), Portelândia (ZUFG 738), Serranópolis (ZUFG 216), and Minas Gerais State, municipality of Campina Verde (ZUFG 1953). Description based on 15 tadpoles between Gosner Stages 34 and 39.

Characterization. Total length 34.63 ± 5.17 mm (Table 1, Figure 19). The body shape is elliptical elongated in dorsal view and triangular-compressed in lateral view (BW/BH = 0.86–0.95). The snout is rounded in lateral view. The oral disc anteroventral, not emarginate, with a uniseriate row of elongated marginal papillae, biseriate ventrally, interrupted by a dorsal gap; submarginal papillae absent. LTRF varies among 0/0, 0/1, 0/2, 1/1 and 1/2. The upper jaw sheath is wide, arc-shaped, and the lower jaw sheath is wide, U-shaped; the upper jaw sheath is slightly wider than the lower. Nares medium (ND/ED = 0.20–0.22), rounded, laterally positioned. Eyes large (ED/BH = 0.30–0.33), laterally positioned. Spiracle sinistral, short (SL/BL = 0.02–0.04), narrow (SW/BH = 0.05–0.07), with opening at the middle third of the body, directed posteriorly, with the centripetal wall completely fused to the body wall.

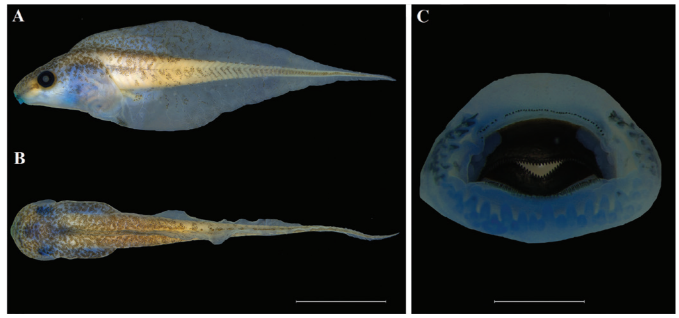

Figure 19. Tadpoles of *Dendropsophus minutus* at Stage 37 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc (scale 2 mm).

Vent tube dextral, fused to the ventral fin. The caudal musculature width is wide (TMW/BW = 0.58–0.59), with the anterior third of the tail muscle and adjacent fins with a sheath of thick connective tissue. The dorsal fin has medium height (DFH/TMH = 0.80–0.91), originating at the posterior third of the body with a median slope, and triangular margin; ventral fin is high (VFH/TMH = 1.15–1.15) with a triangular margin; the tail tip ends in a flagellum. Lateral line not evident.

Comments. Variations in some morphological characteristics, as body shape [cited as ovoid by Vizotto (1967) and Duellman (1978), and elliptical by Heyer (1990) and Rossa-Feres & Nomura (2006)] and eyes position [cited as dorsolaterally by Heyer (1990)], represent a terminology difference among the descriptions. Our sampled populations are like those described from Campo Grande (Bokermann 1963), but are smaller, with marginal papillae uniseriate laterally, have a different labial teeth row formula and spiracle directed posteriorly. However, the total length of the tadpoles of *D. minutus* is highly variable throughout its distribution [our sample = 34.63 mm, Stages 34–39; Iron Quadrangle = 35.4, stage 30 (Pezzuti et al. 2021); Northwestern Region of São Paulo State = 36.5 mm, Stage 36 (Vizotto 1967); Nova Itapirema and Macaúbas = 37.52 mm, Stages 37–40 (Rossa-Feres & Nomura 2006); San Sebastián = 37.60 mm, Stages 36–41 (Schulze et al. 2015); Campo Grande = 30 mm, probably Stage 39 (Bokermann 1963); Trinidad and Tobago = 40 mm, Stages 31–39 (Kenny 1965); Ecuador = 41.7 mm, Stage 41 (Duellman 1978); Venezuela = 39.35, Stage 37 (Duellman 1997) and Los Lagos = 36.9 mm, Stages 37 (Schulze et al. 2015)]. In relation to marginal papillae, the tadpoles analyzed in this study resemble those described by Rossa-Feres & Nomura (2006), presenting marginal papillae row uniseriate laterally and biseriate ventrally, but differ in the shape of papillae, which was considered long and triangular by the authors. However, this trait was also highly variable. The marginal papillae of *D. minutus* could be biseriate ventrally and uniseriate laterally (Bokermann 1963, although the illustration show a biseriate papillae also laterally; Vizotto 1967, Rossa-Feres & Nomura 2006, our sample), biseriate ventrally and in alternate disposition laterally (*D. minutus* A, Schulze et al. 2015); biseriate ventrally and laterally (Duellman 1978, Heyer 1990); or uniseriate ventrally and laterally (Kenny 1969; *D. minutus* B, Schulze et al. 2015; Pezzuti et al. 2021, but with alternate disposition). Despite the LTRF 0/1 was the most common in this study, observed in six of the 15 individuals [variation also registered by Rossa-Feres & Nomura (2006) and Pimenta et al. (2014)], this trait varied among 0/0 [two individuals, variation also registered by Rossa-Feres & Nomura (2006)], 0/2 [three individuals, variation also registered by Duellman, (1978)], 1/2 [three individuals, variation also registered by Vizotto (1967), Cei (1980), Heyer (1990), Rossa-Feres & Nomura (2006), and Pezzuti et al. (2021)], and 1/1 (one individual, registered for the first time). When the P2 is present, it is much smaller than P1 (Vizotto 1967, Heyer 1990, Schulze et al. 2015, Pezzuti et al. 2021, our sample), being the P1 = P2 a rare state (Rossa-Feres & Nomura 2006). In our sample, ten tadpoles presented the spiracle posteriorly directed, similar to those observed in the illustration presented by Bokermann (1967) and Kenny (1969), and description provided by Heyer (1990), but three tadpoles had the spiracle directed porsterodorsally, as the descriptions presented by Vizotto (1967), by Duellman (1978), by Rossa-Feres & Nomura (2006), by Schulze et al. (2015), and Pezzuti et al. (2021). From the total of analyzed individuals, seven presented nares elliptical. Gehara et al. (2014) defined *D. minutus* as a species complex, as noted by Duellman (1997). We do not test this hypothesis using tadpoles' traits, but we did not find any association between the observed variations and the divergent evolutionary lineage proposed by Gehara et al. (2014).

Dendropsophus soaresi (Caramaschi & Jim 1983)
First Description of the tadpole: Jandaíra – BA, Brazil (Gomes & Peixoto 1991).
Other characterization: Not available.
Specimens Examined: Brazil, Goiás State, municipalities of Barro Alto (ZUFG 811, ZUFG 862) and Jataí (ZUFG 773). Description based on ten tadpoles between Gosner Stages 35 and 39.
Characterization. Total length 36.88 ± 1.93 mm (Table 1, Figure 20). The body shape is elliptical elongated in dorsal view and triangular-compressed in lateral view (BW/BH = 1.07–1.07). The snout is sloped in lateral view. The oral disc anteroventral, not emarginate, with a biseriate row of rounded marginal papillae (varying between four to eight marginal papillae laterally), interrupted by a dorsal and lateroventral gap; submarginal papillae absent. LTRF is 0/1, with the P1 teeth row located close to the lower jaw sheath. The upper jaw sheath is narrow to medium, arc-shaped, and the lower jaw sheath is wide, U-shaped; the lower jaw sheath is wider than the upper jaw sheath. Nares medium (ND/ED = 0.17–0.20), rounded, anteriorly positioned. Eyes large (ED/BH = 0.29–0.31), laterally positioned. Spiracle sinistral, short (SL/BL = 0.04–0.05), with medium width (SW/BH = 0.09–0.11), opening at the middle third of the body, directed posteriorly, with centripetal wall completely fused to the body wall. Vent tube dextral, fused to the ventral fin. The caudal musculature width is wide (TMW/BW = 0.57–0.58). The dorsal fin has medium height (DFH/TMH = 0.58–0.78), originating on the posterior third of the body with a median slope, and convex margin; ventral fin has medium height (VFH/TMH = 0.59–0.80) and with convex margin; the tail tip end in a flagellum. Lateral line not evident.
Comments. Our sample of *D. soaresi* tadpoles closely resemble those described by Gomes & Peixoto (1991) but are larger [our sample = 36.88 mm of total length, Stages 35–38; Jandaíra = 29.5 mm, Stages 34–38, (Gomes & Peixoto 1991). The population described from Jandaíra, also have longer marginal papillae. From the ten individuals observed in our sample, three presented elliptical nares, and one had a small projection on the nares marginal rim. The spiracle direction also varied, with one specimen presenting spiracle ventrally directed and three posterodorsally directed. Tadpoles of *D. minutus* are commonly mistaken by tadpoles of *D. soaresi*, but tadpoles of *D. soaresi* can be identified by the presence of lateroventral gaps in the row of marginal papillae, the lower jaw sheath wider and straighter than in *D. minutus,* and the absence of blackish band between the snout and eyes, common in *D. minutus.*

Scinax fuscomarginatus (Lutz 1925)
First Description of the tadpole: Nova Itapirema – SP, Brazil (Vizotto 1967).
Other characterizations: Nova Itapirema – SP, Brazil (Rossa-Feres & Nomura 2006); Eastern Region of the Meridional Espinhaço Ridge – MG, Brazil (Pimenta et al. 2014).
Specimens Examined: Brazil, Goiás State, municipality of Niquelândia (ZUFG 915). Description based on ten tadpoles between Gosner Stages 34 and 39.
Characterization. Total length 30.72 ± 1.68 mm (Table 1, Figure 21). The body shape is elliptical in dorsal view and triangular-depressed in lateral view (BW/BH = 1.09–1.17). The snout is rounded in lateral view. The oral disc is ventral, folded ventrally, with a uniseriate row of elongated marginal papillae, in alternated disposition only laterally, interrupted by a dorsal gap; submarginal papillae aggregate laterally, smaller than the marginal papillae. LTRF is 2(2)/3(1), A1 = A2, P1 = P2 = P3. The upper jaw sheath is narrow, arc-shaped, and the lower jaw sheath is narrow, U-shaped; the lower jaw sheath is slightly wider than the upper jaw sheath. Nares medium (ND/ED = 0.28–0.28), rounded, dorsally positioned. Eyes large (ED/BH = 0.29–0.30), laterally positioned. Spiracle sinistral, with medium length (SL/BL = 0.14–0.18) and medium to wide width (SW/BH = 0.20–0.26), opening on the posterior third of the body, posterodorsally directed, with the centripetal wall fused to body wall. Vent tube dextral, fused to the ventral fin. The caudal musculature width is medium to wide (TMW/BW = 0.47–0.51).

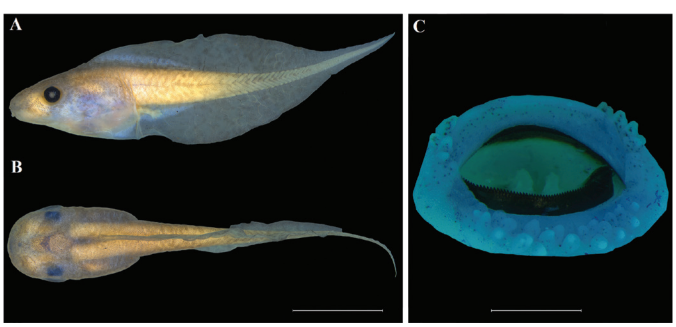

Figure 20. Tadpoles of *Dendropsophus soaresi* at Stage 37 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc (scale 2 mm).

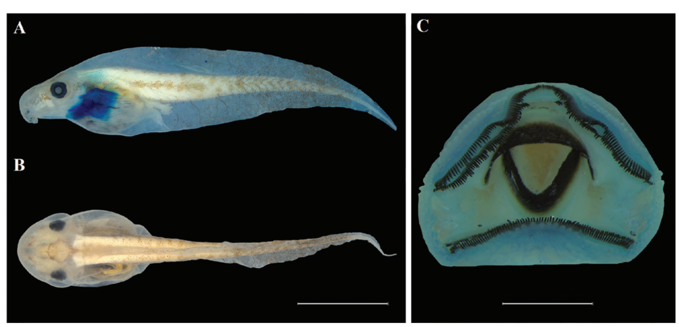

Figure 21. Tadpoles of *Scinax fuscomarginatus* at Stage 35 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc (scale 2 mm).

The dorsal fin has medium height (DFH/TMH = 0.86–0.94), originating at the body with median slope, and convex margin; ventral fin has medium height (VFH/TMH = 0.76–0.77) with a convex margin; the tail tip end in a flagellum. Lateral line not evident.

Comments. Tadpoles described by Vizotto (1967) differ from our sample by the LTRF 2(2)/3, however the author reports that the LTRF 2(2)/3(1) was also observed. Tadpoles described by Vizotto (1967) also have the P1 teeth row with the same length of the P2 and the P3 with about half the length of P1 and P2. Tadpoles described by Rossa-Feres & Nomura (2006) have the P1 teeth row smaller than the P2 and the P3 (P1>P2>P3 in our sample). From the total of analyzed individuals, one had fewer number of submarginal papillae that formed a row on the sides of the oral disc, one individual has the A1 teeth row with the same length than the A2 and one the upper jaw sheath M-shaped.

Scinax fuscovarius (Lutz 1925)

First Description of the tadpole: Northwestern region of São Paulo State, Brazil (Vizotto 1967).

Other characterizations: Argentina (Cei 1980, Fabrezi & Vera 1997); Nova Itapirema – SP, Brazil (Rossa-Feres & Nomura 2006); Eastern Region of the Meridional Espinhaço Ridge – MG, Brazil (Pimenta et al. 2014); Bolívia (Schulze et al. 2015).

Specimens Examined: Brazil, Goiás State, municipalities of Iporá (ZUFG 2091, ZUFG 2099, ZUFG 2103), Niquelândia (ZUFG 2061), Silvânia (ZUFG 1274) and Parque Nacional das Emas (ZUFG 1317). Description based on ten tadpoles between Gosner Stages 34 and 39.

Characterization. Total length 42.14 ± 3.76 mm (Table 1, Figure 22). The body shape is elliptical in dorsal view and triangular-compressed in lateral view (BW/BH = 0.88–0.89). The snout is sloped in lateral view. The oral disc is anteroventral, folded ventrally, with a uniseriate row of elongated marginal papillae, interrupted by a dorsal gap; submarginal papillae at commissures, smaller than the marginal papillae. LTRF is 2(2)/3(1), A1 = A2, P1 = P2 > P3. The upper jaw sheath is wide, arc-shaped, and the lower jaw sheath is wide, U-shaped; the upper jaw sheath is slightly wider than the lower jaw sheath. Nares medium (ND/ED = 0.27–0.30), rounded, dorsolaterally positioned. Eye medium (ED/BH = 0.25–0.25), laterally positioned. Spiracle sinistral, with medium length (SL/BL = 0.15–0.16) and medium width (SW/BH = 0.09–0.18), opening on the posterior third of the body, posterodorsally directed, with the centripetal wall fused to body wall. Vent tube dextral, fused to the ventral fin. The caudal musculature width is wide (TMW/BW = 0.52–0.57). The dorsal fin has medium height (DFH/TMH = 0.84–0.87), originating at the body with high slope, and convex margin; ventral fin has medium height (VFH/TMH = 0.63–0.92) with convex margin; the tail end with a flagellum. Lateral line evident.

Comments. Our tadpoles are like those described by Vizotto (1967) and Cei (1980), differing only by the disposition of submarginal papillae, with 4 to 6 rows laterally in the oral disc in these tadpoles. Tadpoles described by Rossa-Feres & Nomura (2006) differ from our samples by the upper jaw sheath M-shaped and nares elliptical. The populations described by Schulze et al. (2015) had the upper jaw-sheath M-shaped, oral disc emarginated laterally and were smaller (total length = 32.32 mm, Stages 32–38) than our tadpoles (TL = 42.13 mm, Stages 35–39). One individual in our sample presented the upper jaw sheath M-shaped and the spiracle posteriorly directed. Tadpoles of *S. fuscovarius* can be distinguished of those of *S. fuscomarginatus* by the sloped snout shape in lateral view (rounded in *S. fuscomarginatus*), deeper body and higher fins.

Scinax longilineus (Lutz 1968)

First Description of the tadpole: Poços de Caldas – MG, Brazil (Andrade & Cardoso 1991).

Other characterizations: not available.

Specimens Examined: Brazil, Minas Gerais State: Poços de Caldas (ZUFG 2494, ZUFG 2495, ZUFG 2496). Description based on 11 tadpoles between Gosner Stages 35 and 40.

Characterization. Total length 38.49 ± 4.91 mm (Table 1, Figure 23). The body shape is rounded in dorsal view and globular-depressed in lateral view (BW/BH = 0.95–1.00). The snout is rounded in lateral view. The oral disc is anteroventral, not emarginate, with a uniseriate row of conical marginal papillae, in alternated disposition, biseriate laterally, interrupted by a dorsal gap; submarginal papillae aggregated laterally, smaller than the marginal papillae. LTRF is 2(2)/3, A1 = A2, P1 = P2 = P3. The upper jaw sheath is narrow, M-shaped, and the lower jaw sheath is narrow, U-shaped; the upper jaw sheath is slightly wider than the lower jaw sheath. Nares medium (ND/ED = 0.20–0.24), rounded, dorsally positioned. Eyes small to medium (ED/BH = 0.15–0.20), dorsally positioned. Spiracle sinistral, with medium length (SL/BL = 0.07–0.12) and medium width (SW/BH = 0.10–0.12), opening on the posterior third of the body, posterodorsally directed, with centripetal wall fused to body wall. Vent tube dextral, fused to the ventral fin. The caudal musculature width is medium to wide (TMW/BW = 0.45–0.49). The dorsal fin has medium height (DFH/TMH = 0.72–0.73), originating at the body with acute slope, and convex margin; ventral fin has medium height (VFH/TMW = 0.54–0.60) with margin parallel to the caudal musculature; the tail tip is rounded. Lateral line evident.

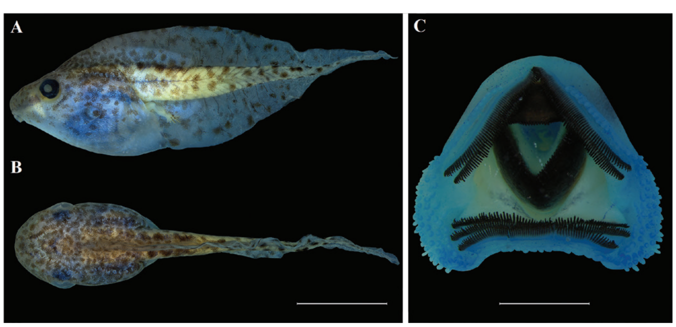

Figure 22. Tadpoles of *Scinax fuscovarius* at Stage 38 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc (scale 2 mm).

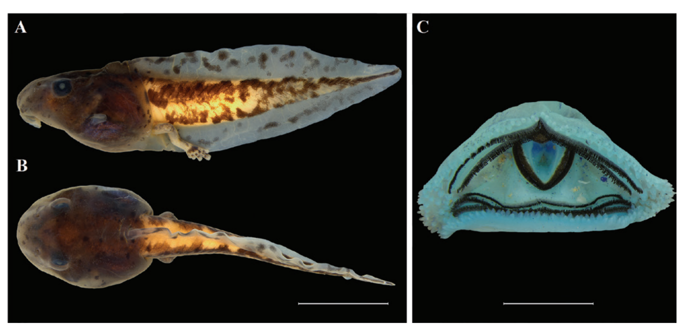

Figure 23. Tadpoles of *Scinax longilineus* at Stage 36 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc (scale 2 mm).

Comments. Tadpoles analyzed in this study were collected in the type locality of the species and differ from the original description by the body rounded in dorsal view, and nares dorsally positioned (body elliptical and nares dorsolaterally positioned in Andrade & Cardoso 1991). From the 11 analyzed individuals in our sample, one presented body elliptical and the A1 teeth row longer than the A2. Tadpoles of *S. longilineus* have an oral disc with a concave posterior margin when closed, a shared trait for tadpoles in the *S. catharinae* group, differing from the other species of *Scinax*. This trait allows an easy differentiation of *S. longilineus* tadpoles from *S. fuscomarginatus*, and *S. fuscovarius* tadpoles.

Scinax pombali Lourenço, Carvalho, Baêta, Pezzuti & Leite 2013
First Description of the tadpole: Capitólio – MG, Brazil (Lourenço et al. 2013).
Other characterization: Not available.
Specimens Examined: Brazil, Minas Gerais State, Parque Nacional da Serra da Canastra (ZUFG 2493, 2899). Description based on ten tadpoles between Gosner Stages 36 and 40.
Characterization. Total length 46.07 ± 3.19 mm (Table 1, Figure 24). The body shape is rounded in dorsal view and globular-depressed in lateral view (BW/BH = 1.12–1.17). The snout is rounded in lateral view. The oral disc is ventral, folded ventrally and ventrolaterally, with a biseriate row of mixed conical and elongated marginal papillae, without dorsal gap; presence of submarginal papillae aggregated lateroventrally, mixing small and large submarginal papillae, also mixing submarginal papillae that were smaller and larger than marginal papillae; submarginal papillae when larger than marginal papillae could have lateral projection, forming a T-shape. LTRF is 2(2)/3, A1 = A2, P1 = P2 = P3. The upper jaw sheath is narrow to medium sized, M-shaped, the lower jaw sheath is narrow, V-shaped; the upper jaw sheath is wider than the lower jaw sheath. Nares medium (ND/ED = 0.16–0.23), rounded, dorsally positioned. Eyes medium (ED/BH = 0.22–0.23), dorsally positioned. Spiracle sinistral, with medium length (SL/BL = 0.08–0.09), narrow width (SW/BH = 0.08–0.09), with opening on the posterior third of the body, posterodorsally directed, with centripetal wall not fused to body wall. Vent tube dextral, fused to the ventral fin. The caudal musculature width is wide (TMW/BW = 0.55–0.56). The dorsal fin has low to medium height (DFH/TMH = 0.37–0.55), originating at the body with a median slope, and convex margin; ventral fin low (VFH/TMW = 0.28–0.40) with convex margin; the tail tip is pointed. Lateral line not evident.

Comments. Tadpoles described by Lourenço et al. (2013) present snout sloped or truncated in lateral view (rounded in our samples). The large oral disc, continuous row of marginal papillae, without a dorsal gap, and the amount and shape of the submarginal papillae are useful traits that help to distinguish the tadpoles of *Scinax pombali* from the tadpoles of other species of *Scinax* included in our study. In our sample, one individual presented the marginal papillae uniseriate in alternate disposition and biseriate laterally, and another individual had A2 slightly smaller than A1.

Scinax rupestris Araújo-Vieira, Brandão & Faria 2015
First Description of the tadpole: Chapada dos Veadeiros National Park – GO, Brazil (Araujo-Vieira et al. 2015).
Other characterization: not available.
Specimens Examined: Brazil, Goiás State, Parque Nacional da Chapada dos Veadeiros (ZUFG 1970, ZUFG 2243, ZUFG 2251, ZUFG 2276). Description based on 11 tadpoles between Gosner Stages 31 and 37.
Characterization. Total length 32.04 ± 3.59 mm (Table 1, Figure 25). The body shape is elliptical in dorsal view and globular-depressed in lateral view (BW/BH = 1.01–1.06). The snout is rounded in lateral view. The oral disc is anteroventral, not emarginate, with a uniseriate row of conical marginal papillae, interrupted by a dorsal gap; submarginal papillae aggregated laterally, and smaller than the marginal papillae. LTRF is 2(2)/3 or 2(2)/3(1), A1 = A2, P1 = P2 and P3 slightly smaller than P1 and P2; the upper jaw sheath is wide, M-shaped, and the lower jaw sheath is wide, V-shaped; the upper jaw sheath is wider than the lower. Nares small to medium (ND/ED = 0.08–0.15) rounded, dorsally positioned. Eyes medium (ED/BH = 0.23–0.24), dorsally positioned. Spiracle sinistral, with medium length (SL/BL = 0.08–0.12) and medium width (SW/BH = 0.13–0.17), opening at the middle third of the body, posterodorsally directed, with centripetal wall fused to the body wall. Vent tube dextral, fused to the ventral fin. The caudal musculature width is medium (TMW/BW = 0.32–0.37). The dorsal fin has medium height (DFH/TMH = 0.54–0.83), originating at the body with median slope, and convex margin; ventral fin has medium height (VFH/TMW = 0.52–0.54) with convex margin; the tail tip is pointed. Lateral line not evident.
Comments. Tadpoles analyzed in this study closely resemble those described by Araujo-Vieira et al. (2015), differing only by the length of teeth rows and the shape of the upper jaw sheath (A1 > A2, P1 = P2 = P3, and upper jaw arc-shaped), although the figure of the oral disc in the original description shows an M-shaped upper jaw sheath. *Scinax rupestris* tadpoles can be distinguished from the tadpoles of

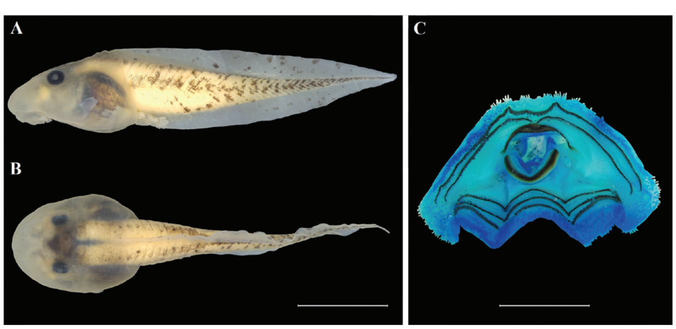

Figure 24. Tadpoles of *Scinax pombali* at Stage 36 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc (scale 2 mm).

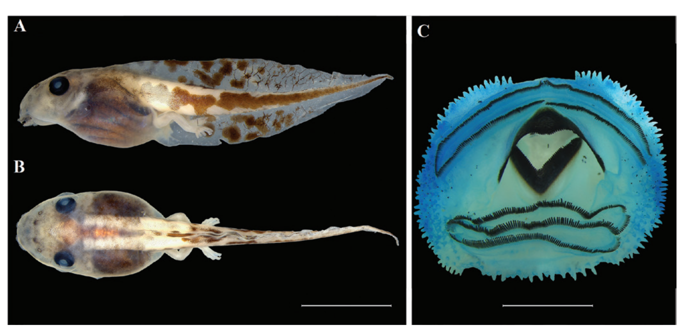

Figure 25. Tadpoles of *Scinax rupestris* at Stage 40 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc at Stage 30 (scale 2 mm).

S. fuscomarginatus and *S. fuscovarius* by oral disc not emarginated (oral disc ventrally emarginated in *S. fuscomarginatus* and *S. fuscovarius*), and upper jaw sheath in M-shaped differ of *S. fuscomarginatus* (arc-shaped). The body shape elliptical in dorsal view and oral disc without a concave posterior differ *S. rupestris* of *S. longilineus* (body shape rounded and oral disc with a concave posterior margin when closed). The LTRF 2(2)/3(1), the most common in our sample, is described as a variation in the original description (Araujo-Vieira et al. 2015). We also observed a variation in the density of pigmentation in the body coloration, as reported by Araujo-Vieira *et al.* (2015). Two individuals from our sample had the body ovoid in dorsal view, two showed an evident lateral line, two had the LTRF 2(2)/3, three had fewer submarginal papillae, scattered lateroventrally, and three had the A1 teeth row of the same length than the A2.

Scinax similis (Cochran 1952)
First Description of the tadpole: Rio de Janeiro – RJ, Brazil (Alves & Carvalho-e-Silva 1999).
Other characterizations: Not available.
Specimens Examined: Brazil, Goiás State, municipalities of Mineiros (ZUFG 70), Niquelândia (ZUFG 645) and Parque Nacional da Chapada dos Veadeiros (ZUFG 2124). Description based on ten tadpoles between Gosner Stages 31 and 37.
Characterization. Total length 30.12 ± 2.01 mm (Table 1, Figure 26). The body shape is elliptical in dorsal view and triangular-compressed in lateral view (BW/BH = 0.90–0.94). The snout is rounded in lateral view. The oral disc is anteroventral, ventrally emarginate, with a uniseriate row of conical marginal papillae, in alternate disposition, interrupted by a dorsal gap; submarginal papillae aggregate laterally, of the same size as the marginal papillae. LTRF is 2(2)/3(1), A1 = A2, P1 > P2 > P3. The upper jaw sheath is narrow, M-shaped, and the lower jaw sheath is narrow, V-shaped; the lower jaw sheath is slightly wider than the upper jaw sheath. Nares medium (ND/ED = 0.21–0.33), rounded, dorsolaterally positioned. Eyes large (ED/BH = 0.29–0.31), laterally positioned. Spiracle sinistral, medium to long (SL/BL = 0.12–0.21), with medium width (SW/BH = 0.14–0.17), opening on the posterior third of the body, posterodorsally directed, with centripetal wall fused to body wall. Vent tube dextral, fused to the ventral fin. The caudal musculature width is wide (TMW/BW = 0.51–0.55). The dorsal fin has medium height (DFH/TMHW = 0.85–0.87), originating at the body with acute slope, and convex margin; ventral fin has medium height (VFH/TMW = 0.67–0.74) with convex margin; the tail end with a flagellum. Lateral line evident.

Comments. Tadpoles described by Alves & Carvalho-e-Silva (1999) had arc-shaped upper jaw sheath and fewer submarginal papillae scattered laterally. Otherwise, our sample closely resemble those tadpoles. In our sample, two individuals had the upper jaw sheath arc-shaped, which indicates that this variation would be common within and among *S. similis* population. Tadpoles of *S. similis* are smaller and the dorsal fin origin is closer to the eyes than in *S. fuscovarius*. Tadpoles of *S. similis* can also be distinguished from *S. fuscovarius* by the snout rounded, narrower jaw sheath and smaller total length. Also, *S. similis* can be distinguished from *S. fuscomarginatus* by the wider lower jaw sheath and the P3 teeth row being slightly smaller than the P1 and P2 teeth rows. Easily distinguished from *S. rupestris* due to the oral disc ventrally emarginated.

Scinax gr. *ruber*
First Description of the tadpole: Species uncertain.
Other characterizations: Not available.
Specimens Examined: Brazil, Goiás State, municipality of Nova Roma (ZUFG: 1881). Description based on four tadpoles between Gosner Stages 31 and 40.
Total length 29.92 ± 3.35 mm (Table 1, Figure 27). The body shape is ovoid in dorsal view and triangular-compressed in lateral view (BW/BH = 0.84–0.96). The snout is sloped in lateral view. The oral disc is anteroventral, ventrally emarginate, with a uniseriate row of elongate marginal papillae, in alternate disposition, interrupted by a dorsal gap; submarginal papillae aggregate laterally, smaller than the marginal papillae. LTRF is 2(2)/3(1), A1 = A2, P1 = P2 > P3. The upper jaw sheath is narrow, M-shaped, and the lower jaw sheath is narrow, V-shaped; the lower jaw sheath is slightly wider than the upper jaw sheath. Nares medium (ND/ED = 0.20–0.25), rounded, laterally positioned. Eyes medium (ED/BH = 0.26–0.27), laterally positioned. Spiracle sinistral, with medium length (SL/BL = 0.12–0.15) and medium width (SW/BH = 0.13–0.15), opening on the middle third of the body, posterodorsally directed, with centripetal wall fused to body wall. Vent tube dextral, fused to the ventral fin. The caudal musculature width is medium (TMW/BW = 0.41–0.45). The dorsal fin has medium height (DFH/TMH = 0.93–0.97), originating at the body with median slope, and convex margin; ventral fin has medium height (VFH/TMH = 0.68–0.74) with convex margin; the tail tip the tail end with a flagellum is pointed. Lateral line not evident.
Comments. We were unable to associate these tadpoles to *S. fuscovarius*, once these tadpoles are smaller and had smaller fins, to *Scinax similis*,

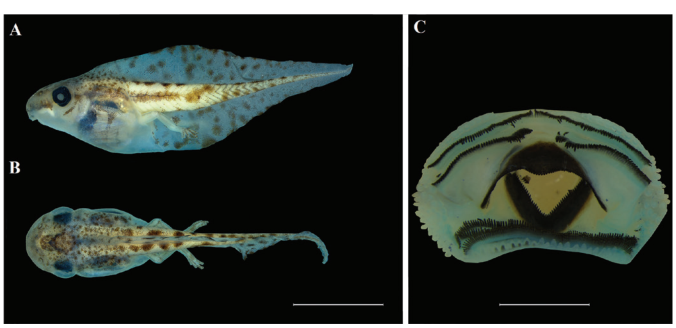

Figure 26. Tadpoles of *Scinax similis* at Stage 39 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc (scale 2 mm).

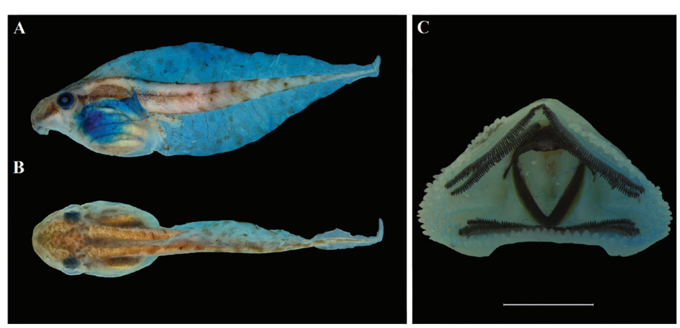

Figure 27. Tadpoles of *Scinax* gr. *ruber* at Stage 37 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc (scale 2 mm).

due to the snout sloped in lateral view, nares with opening laterally directed (anterolaterally directed in *S. similis*), and to *S. fuscomarginatus* due to the position of fin origin, away from the eyes position, and deeper fins. They also are distinguished from *S. rupestris* by the oral disc ventrally emarginated.

Scinax squalirostris (Lutz 1925)
First Description of the tadpole: Paranapiacaba – SP, Brazil (Bokermann 1967).
Other characterizations: Jaboticatubas – MG, Brazil (Cei 1980), Eastern Region of the Meridional Espinhaço Ridge – MG, Brazil (Pimenta et al. 2014).
Specimens Examined: Brazil, Minas Gerais State, Parque Nacional da Serra da Canastra (ZUFG 2497, ZUFG 2498). Description based on six tadpoles between Gosner Stages 31 and 36.
Characterization. Total length 22.58 ± 1.05 mm (Table 1, Figure 28). The body shape is elliptical in dorsal view and triangular-compressed in lateral view (BW/BH = 0.96–1.08). The snout is rounded in lateral view. The oral disc is anteroventral, ventrally emarginate, with a uniseriate row of conical marginal papillae, interrupted by dorsal gap; submarginal papillae aggregate laterally, smaller than the marginal papillae. LTRF is 2(2)/3(1), A1 = A2, P1 = P2>P3; the upper jaw sheath is wide, M-shaped, and the lower jaw sheath is wide, V-shaped; the upper jaw sheath is slightly wider than the lower jaw sheath. Nares medium (ND/ED = 0.26–0.29), rounded, dorsally positioned. Eyes medium (ED/BH = 0.26–0.27), laterally positioned. Spiracle sinistral, medium to long (SL/BL = 0.18–0.24), wide (SW/BH = 0.25–0.26), opening at the posterior third of the body, posterodorsally directed, with centripetal wall fused to the body wall. Vent tube dextral, fused to the ventral fin. The caudal musculature width is medium (TMW/BW = 0.33–0.45). The dorsal fin is high (DFH/TMHW = 1.17–1.21), originating at the body with median slope, and convex margin; ventral fin is high (VFH/TMH = 0.98–1.02), with convex margin; the tail tip is pointed. Lateral line not evident.
Comments. Tadpoles analyzed in our study closely resemble those described by Cei (1980) and Pimenta et al. (2014), differing only by the elliptical body shape in dorsal view from those tadpoles described by Cei (1980), which was described as ovoid, but this difference represents a difference in terminology use. Tadpoles described by Bokermann (1967) had a different LTRF [2(1,2)/3(1)]. In our sample, one of the tadpoles had the A2 teeth row longer than the A1. Tadpoles of *S. squalirostris* were distinguished from tadpoles of *S. fuscovarius* because they were slender, had a rounded snout, and the origin of the dorsal fin is closer to the eyes. In addition, *S. squalirostris* could be distinguished from the tadpoles of *S. fuscomarginatus* by higher body and deeper dorsal and ventral fins. The snout rounded in lateral view differ *S. squalirostris* from *S. rupestris* and *Scinax* sp., and the oral disc ventrally emarginated differ *S. squalirostris* from *S. rupestris.* Tadpoles of *S. squalirostris* are smaller and had the P3 smaller when compared to *S. similis.*

Trachycephalus typhonius (Linnaeus 1758)
First Description of the tadpole: Vera Cruz – México (Pyburn 1967).
Other characterizations: Colômbia (Duellman 1970, 2005); Argentina (Cei 1980); Pará and Roraima, Brazil (Schiesari et al. 1996); Nova Itapirema – SP, Brazil (Rossa-Feres & Nomura 2006); Bolivia (Schulze et al. 2015). Although lacking a formal characterization, some larval traits can be found in available taxonomic keys for the tadpoles from the Amazonas (Hero 1990) and Colombia (Lynch 2006).
Specimens Examined: Brazil, Goiás State, municipalities of Cidade de Goiás (ZUFG 1916, ZUFG 1927), Serranópolis (ZUFG 1371). Description based on 15 tadpoles between Gosner Stages 36 and 40.
Characterization. Total length 36.46 ± 4.02 mm (Table 1, Figure 29). The body shape is elliptical in dorsal view and triangular-compressed in lateral view (BW/BH = 0.95–0.98). The snout is sloped in lateral view. The oral disc is anteroventral, lateroventrally emarginate, with a biseriate row of elongated marginal papillae, interrupted by a dorsal gap; submarginal papillae aggregate laterally, smaller than the marginal papillae. LTRF is 4(1,3)/5(1), A1 = A2 = A3 = A4, P1 = P2 = P3 = P4 > P5 with the A4 row rather fragmented; accessory teeth rows presented laterally on the oral disc. The upper jaw sheath is narrow, arc-shaped, and the lower jaw sheath is narrow, U-shaped; the upper jaw sheath is wider than the lower jaw sheath. Nares medium (ND/ED = 0.20–0.28), rounded, dorsally positioned. Eyes medium (ED/BH = 0.17–0.18), laterally positioned. Spiracle sinistral, lateroventral, medium to long (SL/BL = 0.13–0.21), with medium width (SW/BH = 0.14–0.20), opening on the posterior third of the body, posterodorsally directed, with centripetal wall fused to the body wall. Vent tube medial, fused to the ventral fin. The caudal musculature width is medium (TMW/BW = 0.32–0.34). The dorsal fin has medium height (DFH/TMH = 0.76–0.81), originating at the body with median slope, and convex margin; ventral fin has medium height (VFH/TMH = 0.71–0.71) with convex margin; the tail tip is pointed. Lateral line not evident.
Comments. Tadpoles described by Schiesari et al. (1996) were larger (TL = 59.9 mm, Stages 39) than those in our sample. Tadpoles described by Duellman (2005) do not have submarginal papillae, but the author report the presence of small papillae positioned in the lateral folder, which could be a reference to the accessory teeth rows or o the

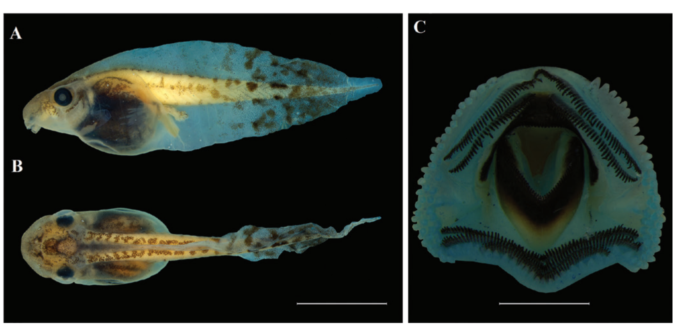

Figure 28. Tadpoles of *Scinax squalirostris* at Stage 35 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc (scale 2 mm).

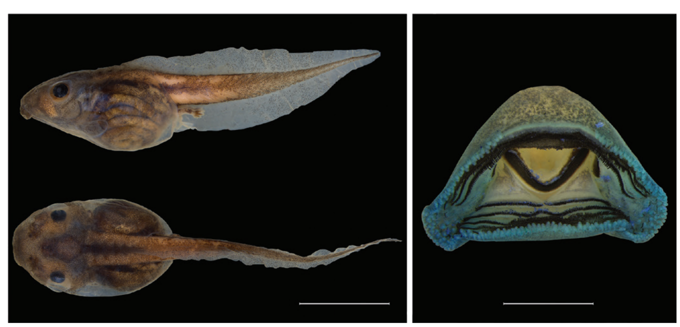

Figure 29. Tadpoles of *Trachycephalus typhonius* at Stage 36 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc (scale 2 mm).

submarginal papillae. Cei (1980) reports for the tadpoles of Argentina a LTRF 2(2)/5(1), eventually with an additional P6, but generally, the P5 and P6 were highly fragmented whenever present. For Duellman (1970) and Rossa-Feres & Nomura (2006), the P6 teeth row was more common and the interruptions in the teeth rows had a different pattern, resulting in a LTRF of 4(1,2,4)/6(1,6). Schiesari et al. (1996) already described the variation in the number of teeth rows, suggesting that this variation could be related to the developmental stages, finding until nine posterior labial teeth rows in tadpoles of *T. typhonius*. In our sample, the LTRF showed large variation, with LTRF 4(1,3)/5(1) found in eight of the tadpoles, followed by the LTRF 3(1,3)/6(1), found in five of the tadpoles, and the LTRF 3(1)/5(1), found in one of the tadpoles. Whenever present, the row P6 was shorter than the other rows of labial teeth and fragmented and, as seen by Schiesari et al. (1996), was positioned next to the row of marginal papillae. Navarro-Acosta et al. (2017) studied the teeth row development of four tadpoles of anuran species from the *Boana pulchella* group and *B. faber* and found that rows were added distally in both labia. The same pattern was reported by Sánchez (2010) for Colombian *Hiloscirtus* species. Thus, despite lack of developmental studies of the oral disc in *Trachycephalus*, we suggest that is very likely that the formation of supernumerary rows follow the same patterns of development described by Navarro Acosta et al. (2017) and Sánchez (2010). The lateral line was evident in six individuals.

5. Leptodactylidae Werner 1896 (1838)

Leptodactylus fuscus (Schneider 1799)

First Description of the tadpole: French Guiana – SR (Lescure 1973).
Other characterizations: Nova Itapirema – SP, Brazil (Rossa-Feres & Nomura 2006); Eastern Region of the Meridional Espinhaço Ridge – MG, Brazil (Pimenta et al. 2014); Bolivia (Schulze et al. 2015).
Specimens Examined: Brazil, Goiás State, municipality of São Miguel do Araguaia (ZUFG 1967). Description based on five tadpoles between Gosner Stages 36 and 37.
Characterization. Total length 29.32 ± 3.10 mm (Table 1, Figure 30). The body shape is ovoid in dorsal view and globular-depressed in lateral view (BW/BH = 1.27–1.09). The snout is rounded in lateral view. The oral disc is anteroventral, not emarginate, with a uniseriate row of elongate marginal papillae, in alternate disposition, interrupted by a dorsal gap; submarginal papillae absent. LTRF is 2(2)/3, A1 slightly smaller than A2, P1 = P2 and P3 slightly smaller than P2. The upper jaw sheath is narrow to medium, arc-shaped, and the lower jaw sheath is narrow, V-shaped; the upper jaw sheath is wider than the lower jaw sheath. Nares medium to large (ND/ED = 0.36–0.39), elliptical, dorsally positioned. Eyes medium (ED/BH = 0.17–0.17), dorsally positioned. Spiracle sinistral, with medium length (SL/BL = 0.10–0.18) and medium width (SW/BH = 0.13–0.17), opening on the middle third of the body, posterodorsally directed, with centripetal wall fused to the body wall. Vent tube medial, fused to the ventral fin. The caudal musculature width is medium (TMW/BW = 0.27–0.41). The dorsal fin is low (DFH/TMH = 0.43–0.48), originating at the tail-body junction with acute slope, and convex margin; ventral fin is low (DFH/TMH = 0.41–0.43) with convex margin to the caudal musculature; the tail tip is pointed. Lateral line not evident.
Comments. Tadpoles described by Lescure (1973) have a biseriate row of marginal papillae (uniseriate in our sample), while the tadpoles analyzed by Rossa-Feres & Nomura (2006) had LTRF 2(2)/3(1). The absence of projection on the marginal rim and LTRF 2(2)/3 in our sample, resemble the populations analyzed by Pimenta et al. (2014). The populations described by Schulze et al. (2015), present a biseriate marginal papillae ventrally and LTRF 2(2)/3(1). In our sample, one individual presented the A1 teeth row with the same length than A2.

Leptodactylus labyrinthicus (Spix 1824)

First Description of the tadpole: Guapiaçu – SP, Brazil (Vizotto 1967).
Other characterizations: São José do Rio Preto – SP, Brazil (Rossa-Feres & Nomura 2006); Eastern Region of the Meridional Espinhaço Ridge – MG, Brazil (Pimenta et al. 2014).
Specimens Examined: Brazil, Goiás State, municipalities of Caiapônia (ZUFG 2028), Rio Verde (ZUFG 664). Description based on eight tadpoles between Gosner Stages 35 and 40.
Characterization. Total length 58.72 ± 5.13 mm (Table 1, Figure 31). The body shape is ovoid in dorsal view and globular-depressed in lateral view (BW/BH = 1.15–1.18). The snout is rounded in lateral view. The oral disc is anteroventral, not emarginate, with a uniseriate row of short and rounded marginal papillae, alternated ventrally, interrupted by a dorsal gap; submarginal papillae absent. LTRF is 1/2(1), P1 slightly smaller than P2; the upper jaw sheath is narrow to medium, arc-shaped, and the lower jaw sheath is narrow, V-shaped; the upper and lower jaw sheath have the same width. Nares medium to large (ND/ED = 0.35–0.38), elliptical, dorsally positioned. Eyes small to medium (ED/BH = 0.14–0.17), dorsally positioned. Spiracle sinistral, medium to long (SL/BL = 0.13–0.21), wide width (SW/BH = 0.29–0.35), opening on the middle third of the body, posterodorsally directed, with the centripetal wall fused to body wall. Vent tube medial, fused to the ventral fin. The caudal musculature width is medium (TMW/BW = 0.46–0.46).

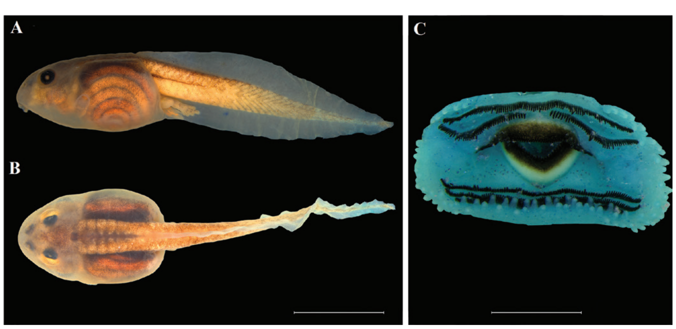

Figure 30. Tadpoles of *Leptodactylus fuscus* at Stage 36 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc (scale 2 mm).

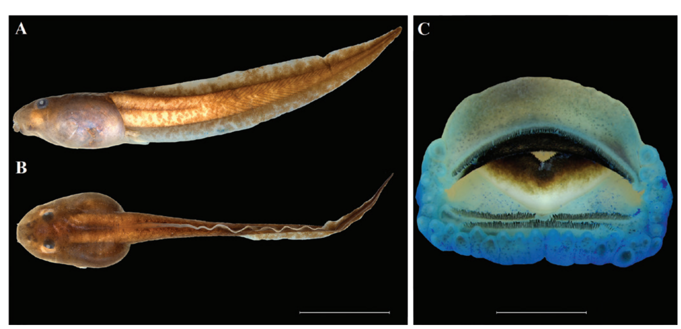

Figure 31. Tadpoles of *Leptodactylus labyrinthicus* at Stage 36 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc (scale 2 mm).

The dorsal fin is low (DFH/TMH = 0.34–0.45), originating on the posterior third of the body with acute slope, and margin parallel to the caudal musculature; ventral fin is low (VFH/TMH = 0.36–0.40) with margin parallel to the caudal musculature; the tail tip is pointed; tail very long, with almost four to five times the body length. Lateral line evident.
Comments. Tadpoles analyzed by Vizotto (1967) were larger (TL = 75 mm, Stages 39, TL = 58.72 mm, Stages 35–40, in our sample), and the tadpoles described by Rossa-Feres & Nomura (2006) were smaller (TL = 48.10 mm, Stages 36–39). Tadpoles analyzed by Rossa-Feres & Nomura (2006) also had the oral disc emarginate ventrally and with uniseriate marginal papillae. From the total of analyzed individuals, four individuals had uniseriate marginal papillae, one had the oral disc ventrally directed. Tadpoles of *L. labyrinthicus* were easily differentiated from those of *L. fuscus* by the larger total length (TL = 29.32 mm, Stages 36–37, in *L. fuscus*; TL = 58.72 mm, Stages 35–40, in *L. labyrinthicus*), smaller body when compared to the tail length and teeth row formula 1/2(1) in *L. labyrinthicus* and 2(2)/3 in *L. fuscus*.

Leptodactylus luctator (Hudson 1892)
First Description of the tadpole: Argentina (Fernandez & Fernandez, 1921).
Other characterizations: São Paulo, Brazil (Rosa, 1965); Argentina (Cei, 1980); Nova Itapirema – SP, Brazil (Rossa-Feres & Nomura, 2006); Eastern Region of the Meridional Espinhaço Ridge – MG, Brazil (Pimenta et al. 2014). Although lacking a formal characterization, some larval traits can be found in available taxonomic key for the tadpoles from the Amazonas (Hero 1990).
Specimens Examined: Brazil, Goiás State, municipalities of Cidade de Goiás (ZUFG 1915), Cristalina (ZUFG 1410), Jataí (ZUFG 1228), Rio Verde (ZUFG 165). Description based on 13 tadpoles between Gosner Stages 35 and 40.
Characterization. Total length 45.30 ± 7.73 mm (Table 1, Figure 32). The body shape is elliptical in dorsal view and globular-depressed in lateral view (BW/BH = 0.46–1.07). The snout is rounded in lateral view. The oral disc is anteroventral, ventrally folded, with a biseriate row of elongate marginal papillae ventrally and triseriate laterally, interrupted by a dorsal gap; submarginal papillae absent. LTRF is 2/3, A1 = A2, P1 = P2, P3 slightly smaller than P2. The upper jaw sheath is narrow to medium, arc-shaped, and the lower jaw sheath is narrow, V-shaped; the upper and lower jaw sheaths were of the same width. Nares large (ND/ED = 0.41–0.42), elliptical, with a small projection on marginal rim, dorsolaterally positioned. Eyes small (ED/BH = 0.11–0.13), dorsally positioned. Spiracle sinistral, lateroventral, with median length (SL/BL = 0.14–0.15), medium to wide (SW/BH = 0.20–0.26), opening at the middle third of the body, posterodorsally directed, with the centripetal wall fused to body wall. Vent tube medial, fused to the ventral fin. The caudal musculature width is medium (TMW/BW = 0.32–0.42). The dorsal fin has medium height (DFH/TMHW = 0.56–0.64), originating at the tail-body junction with acute slope, and convex margin; ventral fin has medium height (VFH/TMH = 0.51–0.68) with convex margin; the tail tip is rounded. Lateral line evident.
Comments. Recently, Magalhães et al. (2020) revised the taxonomy of *L. latrans* species group, defining the *L. latrans* species as endemic of Atlantic Forest, attributing the name *L. luctator* to the lineages of (formerly known as) *L. latrans* in the Cerrado, southern Brazil, southeastern Paraguay, Argentina, and Uruguay. Tadpoles from our sampled population were smaller than the tadpoles described by Fernandez & Fernandez (1921) (TL = 73 mm, probably Stages 39), and Rosa (1965) (TL = 90 mm) but were of similar size when compared to the tadpoles described by Rossa-Feres & Nomura (2006). From the total of analyzed individuals, two presented a snout sloped in lateral view, one had P1 = P2, one individual had the marginal papillae uniseriate ventrally, and another individual had the marginal papillae biseriate. The teeth row formula, larger total length, elongated body shape in dorsal view, and the marginal papillae biseriate ventrally and triseriate laterally in *L. luctator*, differ *L. luctator* tadpoles of *L. fuscus* and *L. labyrinthicus.*

Leptodactylus podicipinus (Cope 1862)
First Description of the tadpole: Ibirá – SP, Brazil (Vizotto 1967).
Other characterizations: Trinidad and Tobago (Kenny 1969); Nova Itapirema – SP, Brazil (Rossa-Feres & Nomura 2006); Bolívia (Schulze et al. 2015).
Specimens Examined: Brazil, Goiás State, municipality of Iporá (ZUFG 2268). Description based on three tadpoles between Gosner Stages 31 and 37.
Characterization. Total length 24.03 ± 1.09 mm (Table 1, Figure 33). The body shape is elliptical in dorsal view and globular-depressed in lateral view (BW/BH = 1.15–1.19). The snout is sloped in lateral view. The oral disc is anteroventral, ventrally folded, with a uniseriate row of elongated marginal papillae laterally, biseriate lateroventrally, interrupted by dorsal gap; three submarginal papillae laterally. LTRF is 2/3, A1 = A2, P1 = P2, P3 slightly smaller than P2. The upper jaw sheath is narrow to medium, arc-shaped, and the lower jaw sheath is narrow, V-shaped; the upper jaw sheath is wider than the lower jaw sheath. Nares large to very large (ND/ED = 0.45–0.56), elliptical,

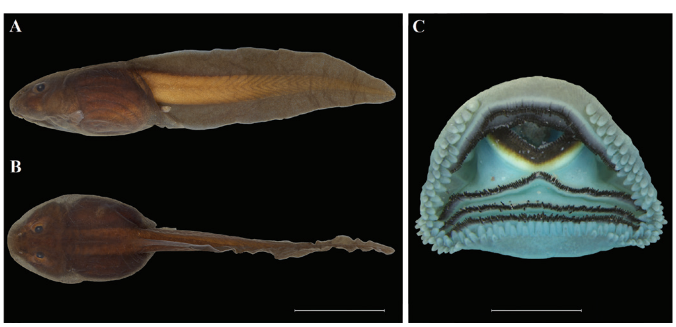

Figure 32. Tadpoles of *Leptodactylus latrans* at Stage 34 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc at Stage 39 (scale 2 mm).

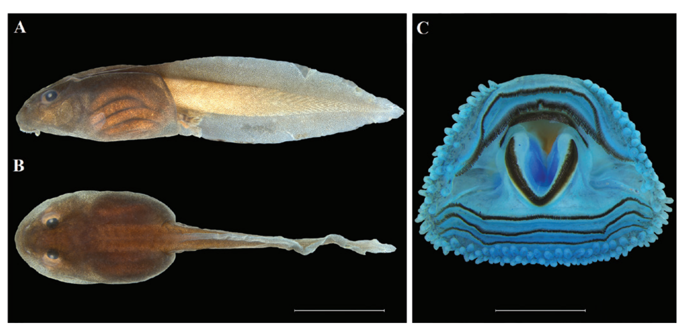

Figure 33. Tadpoles of *Leptodactylus podicipinus* at Stage 36 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc (scale 2 mm).

dorsally positioned. Eyes small to medium (ED/BH = 0.12–0.17), dorsally positioned. Spiracle sinistral, with medium length (SL/BL = 0.09–0.13) and medium width (SW/BH = 0.16–0.24), opening on the middle third of the body, posterodorsally directed, with the centripetal wall fused to the body wall. Vent tube medial, fused to the ventral fin. The caudal musculature width is medium (TMW/BW = 0.32–0.36). The dorsal fin has medium height (DFH/TMH = 0.67–0.71), originating on the posterior third of the body with a median slope, with convex margin; ventral fin has medium height (VFH/TMH = 0.61–0.61) with convex margin; the tail tip is rounded. Lateral line not evident.

Comments. Tadpoles in our sample (TL = 24.03 mm, Stages 31–37) were smaller than the tadpoles described by Vizotto (1967) (TL = 30 mm, Stage 39) and by Kenny (1969) (TL = 35 mm, about Stage 30), but larger than the tadpoles described by Rossa-Feres & Nomura (2006) (TL = 25.03 mm, Stage 37) and Schulze *et al.* (2015) (TL = 23.70 mm, Stage 36). Tadpoles described by Kenny (1965) also differ by the presence of a ventral gap on the row of marginal papillae, and by having the ventral marginal papillae shorter than the lateral marginal papillae. The populations analyzed by Rossa-Feres & Nomura (2006) have the marginal papillae triseriate laterally. Tadpoles described by Schulze *et al.* (2015) differ from our samples by oral disc described as not emarginated, LTRF 2(2)/3, marginal papillae biseriate laterally, and biseriate to triseriate ventrally, and A1 slightly shorter than A2. From the total of analyzed individuals, one individual has snout slightly sloped and one individual does not have submarginal papillae. Tadpoles of *L. podicipinus* can be distinguished of those of *L. fuscus*, *L. luctator*, e *L. labyrinthicus*, by lower total length (24.03 mm in *L. podicipinus*, stages 31 and 37, 29.32 mm in *L. fuscus*, stages 36 and 37, 45.30 mm in and *L. luctator*, stages 35 and 40, 58.72 mm in *L. labyrinthicus*, stages 35 and 40), and by the teeth row formula (LTRF 2/3 in *L. podicipinus*, 2(2)/3 in *L. fuscus* and *L. labyrinthicus*).

Leptodactylus troglodytes Lutz 1926

First Description of the tadpole: Cabeceiras – PB, Brazil (Cascon & Peixoto 1985).

Other characterizations: Not available.

Specimens Examined: Brazil, Tocantins State, Parque Estadual do Lajeado (ZUFG 2947). Description based on three tadpoles between Gosner Stages 31 and 37.

Characterization. Total length 35.77 ± 3.23 mm (Table 1, Figure 34). The body shape is ovoid in dorsal view and globular-depressed in lateral view (BW/BH = 1.15–1.25). The snout is sloped in lateral view. The oral disc is ventral, not emarginate, with a uniseriate row of elongated marginal papillae, with alternated disposition, interrupted by dorsal gap; submarginal papillae absent. LTRF is 2(2)/3, A1 slightly smaller than A2, P1 = P2, P2 slightly smaller than P3. The upper jaw sheath is narrow to medium, arc-shaped, and the lower jaw sheath is narrow, V-shaped; the upper jaw sheath is wider than the lower. Nares medium to large (ND/ED = 0.33–0.50), elliptical, dorsolaterally positioned. Eyes small (ED/BH = 0.14–0.14), dorsally positioned. Spiracle sinistral, lateroventral, with medium length (SL/BL = 0.14–0.16) and medium width (SW/BH = 0.16–0.22), opening on the posterior third of the body, posterodorsally directed, centripetal wall fused to body wall. Vent tube medial, fused to the ventral fin. The caudal musculature width is medium (TMH/BW = 0.31–0.32). The dorsal fin is low to medium (DFH/TMH = 0.47–0.70), originating on the posterior third of the body with a median slope, and margin parallel to the caudal musculature; ventral fin has medium height (VFH/TMH = 0.51–0.64) with margin parallel to the caudal musculature; the tail tip is rounded. Lateral line not evident.

Comments. Tadpoles described by Cascon & Peixoto (1985) were larger (TL = 43 mm, Stage 36) than the tadpoles included in our sample. In our sample, one individual had the A1 with the same length of the A2. Tadpoles of *L. troglodytes* (TL = 35.77 mm, Stages 34–38) were smaller than the tadpoles of *L. labyrinthicus* (TL = 58.72 mm, Stages 35–40) and *L. luctator* (TL = 45.30 mm, Stages 35–40), but larger than tadpoles of *L. podicipinus* (TL = 24.03 mm, Stages 31–37). The teeth row formula of *L. troglodytes* [2(2)/3] also differ from the LTRF of *L. luctator* (2/3) and the sloped snout in lateral view differ from the snout of *L. fuscus*.

Physalaemus centralis Bokermann 1962

First Description of the tadpole: Nova Aliança – SP, Brazil (Rossa-Feres & Jim 1993).

Other characterizations: Nova Itapirema – SP, Brazil (Rossa-Feres & Nomura 2006); Bolívia (Schulze et al. 2015). Although lacking a formal characterization, some larval traits can be found in Ruggeri & Weber (2012).

Specimens Examined: Brazil, Goiás State, municipality of Aruanã (ZUFG 571, ZUFG 582). Description based on ten tadpoles between Gosner Stages 37 and 40.

Characterization. Total length 23.18 ± 1.89 mm (Table 1, Figure 35). The body shape is ovoid in dorsal view and globular-depressed in lateral view (BW/BH = 1.09–1.23). The snout is rounded in lateral view. The oral disc is ventral, laterally emarginate, with a uniseriate row of elongated marginal papillae, interrupted by one dorsal and two lateroventral gaps (type C1 *sensu* Vera Candioti *et al.* 2011); submarginal papillae absent. LTRF is 2(2)/2, with A1 = A2, P1 slightly smaller than P2. The upper

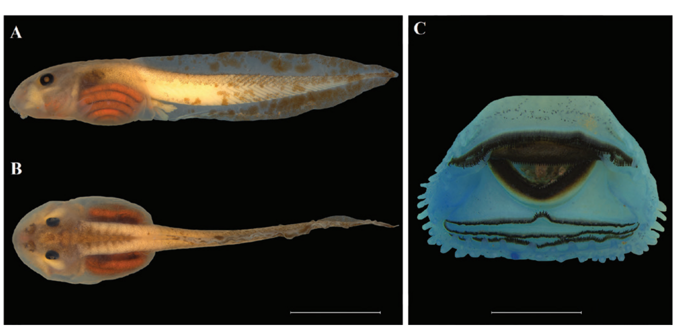

Figure 34. Tadpoles of *Leptodactylus troglodytes* at Stage 37 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc (scale 2 mm).

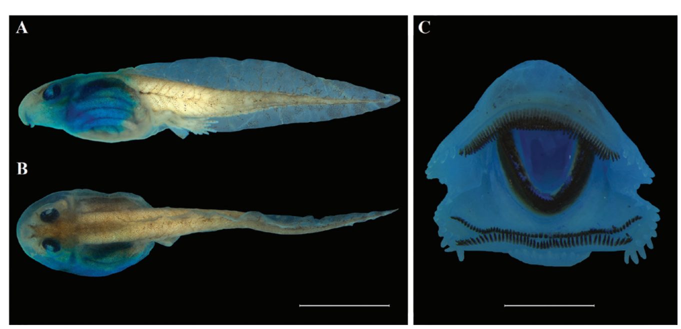

Figure 35. Tadpoles of *Physalaemus centralis* at Stage 39 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc at Stage 38 (scale 2 mm).

jaw sheath is narrow to medium, arc-shaped, and the lower jaw sheath is narrow, U-shaped; the lower jaw sheath is wider than the upper jaw sheath. Nares medium (ND/ED = 0.32–0.36), elliptical, with a small projection on marginal rim, dorsally positioned. Eyes medium (ED/BH = 0.22–0.22), dorsally positioned. Spiracle sinistral, lateroventral, medium to long (SL/BL = 0.07–0.25), wide (SW/BH = 0.27–0.28), opening on the middle third of the body, ventrally directed, with the centripetal wall totally fused to body wall. Vent tube medial, with free distal edge. The caudal musculature width is medium (TMW/BW = 0.35–0.40). The dorsal fin has low to medium height (DFH/TMH = 0.42–0.63), originating on the posterior third of the body with median slope, and convex margin; ventral fin is low (VFH/TMH = 0.23–0.42) with margin parallel to the caudal musculature; the tail tip is pointed. Lateral line not evident.

Comments. Tadpoles described by Rossa-Feres & Jim (1993), Rossa-Feres & Nomura (2006) (TL = 20.20 mm, Stage 37) and the morphotype *P. centralis* A described by Schulze et al. (2015) (TL = 15 mm, Stages 26-27) were smaller than our tadpoles (TL = 23.18 mm, Stages 37–40). The *P. centralis* A morphotype (Schulze et al. 2015) also differ from our tadpoles by having a ventral emargination, LTRF 2(2)/3(1), nares with a prominent projection on the marginal rim, and spiracle not fused to body and directed posteriorly. The presence of lateroventral gap in the oral disc (C1 type *sensu* Vera Candioti et al. 2011) and the total length of 21.40 mm, in Stage 39, makes the *P. centralis* B morphotype (Schulze et al. 2015) like those tadpoles previously described, being little smaller than tadpoles analyzed in our study, but differ by the LTRF 2(2)/3(1), spiracle not fused to body and directed posterodorsally. From the total of analyzed individuals, one individual had submarginal papillae scattered lateroventrally, two had the upper jaw sheath in M- shaped, and one individual had one ventral gap.

Physalaemus cuvieri Fitzinger, 1826

First Description of the tadpole: São Paulo, Brazil (Bokermann, 1962). Other characterizations: Argentina (Cei, 1980); Boracéia – SP, Brazil (Heyer et al. 1990); Nova Itapirema – SP, Brazil (Rossa-Feres & Nomura, 2006); Eastern Region of the Meridional Espinhaço Ridge – MG, Brazil (Pimenta et al. 2014). Although lacking a formal characterization, some larval traits can be found in available in Ruggeri & Weber (2012).

Specimens Examined: Brazil, Goiás State, municipality of Alto Paraíso (ZUFG 1121), Aparecida do Rio Doce (ZUFG 1842), Cocalzinho (ZUFG 174), Corumbá (ZUFG 47), Serranópolis (ZUFG 92), and Tocantins State, Parque Estadual do Lajeado (ZUFG 2519). Description based on 15 tadpoles between Gosner Stages 34 and 38.

Characterization. Total lengths 20.85 ± 2.54 mm (Table 1, Figure 36). The body shape is ovoid in dorsal view and globular-depressed in lateral view (BW/BH = 1.06–1.27). The snout is rounded in lateral view. The oral disc is ventral, laterally emarginate, with a uniseriate row of elongated marginal papillae, interrupted by one dorsal, one ventral and two lateroventral ventral gaps (C4 type *sensu* Vera Candioti et al. 2011), submarginal papillae absent. LTRF is 2(2)/3(1), with the A1 slightly smaller than the A2, P1>P2 and P3 with a third the length of the P2. The upper jaw sheath is narrow to medium, arc-shaped, and the lower jaw sheath is narrow, U-shaped; the lower jaw sheath is wider than the upper jaw sheath. Nares very large (ND/ED = 0.80–0.85), elliptical, with a small projection on marginal rim, dorsally positioned. Eyes small

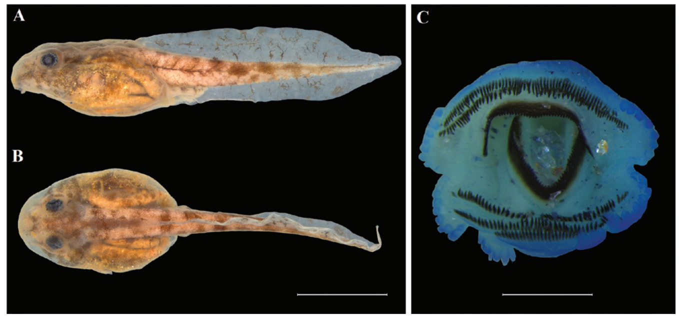

Figure 36. Tadpoles of *Physalaemus cuvieri* at Stage 37 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc (scale 2 mm).

(ED/BH = 0.15–0.16), dorsally positioned. Spiracle sinistral, medium to long (SL/BL = 0.19–0.24), with medium width (SW/BH = 0.19–0.20), with opening on the posterior third of the body, posterodorsally directed, with the centripetal wall fused to body wall. Vent tube medial, fused to the ventral fin. The caudal musculature width is medium (TMW/BW = 0.33–0.33). The dorsal fin has medium height (DFH/TMH = 0.50–0.73), originating on the posterior third of the body with median slope, and convex margin; ventral fin has medium height (VFH/TMH = 0.32–0.52) with margin parallel to the caudal musculature; the tail tip is pointed. Lateral line not evident.

Comments. Tadpoles described by Bokermann (1962) and Cei (1980) differ from those studied herein by the LTRF 2/3(1). Tadpoles in our sample were larger than those analyzed by Heyer (1990) (TL = 23.30 mm, Stage 34) and Rossa-Feres & Nomura (2006) (23.49 mm, Stages 34–39). From the total of analyzed individuals, three had the LTRF 2/3(1), four had the A1 with the same length than the A2, five had one or two submarginal papillae laterally (from which one had accessory teeth row), and six individuals had the upper jaw sheath M-shaped. The presence of marginal rim also varies, with three tadpoles with a small projection on the marginal rim, and three tadpoles presented the marginal rim in only one nare. Tadpoles of *P. cuvieri* are easily differentiated from those of *P. centralis* by the LTRF 2(2)/3(1), larger nares (average of 1.01 mm in diameter for *P. cuvieri*, and 0.53 mm for *P. centralis*), and by the spiracle posterodorsally directed.

Physalaemus marmoratus (Reinhardt & Lütken 1862)

First Description of the tadpole: Argentina (Cei 1980).

Other characterizations: Nova Itapirema – SP, Brazil (Nomura et al. 2003), Nova Itapirema – SP, Brazil (Rossa-Feres & Nomura 2006); Bolívia (Schulze et al. 2015).

Specimens Examined: Brazil, Goiás State, municipalities of Aparecida do Rio Doce (ZUFG 2521), Aruanã (ZUFG 600), Barro Alto (ZUFG 847). Description based on eight tadpoles between Gosner Stages 35 and 40.

Characterization. Total lengths 23.76 ± 1.47 mm (Table 1, Figure 37). The body shape is ovoid in dorsal view and globular-depressed in lateral view (BW/BH = 1.12–1.15). The snout is rounded in lateral view. The oral disc is ventral, laterally emarginate, with a uniseriate row of elongated marginal papillae, interrupted by one dorsal gap (C2 type *sensu* Vera Candioti et al. 2011); submarginal papillae absent. LTRF is 2(2)/2(1), A1 is slightly smaller than A2, P1 is slightly wider than P2. The upper jaw sheath is narrow to medium, M-shaped, and the lower jaw sheath is narrow, V-shaped; the upper

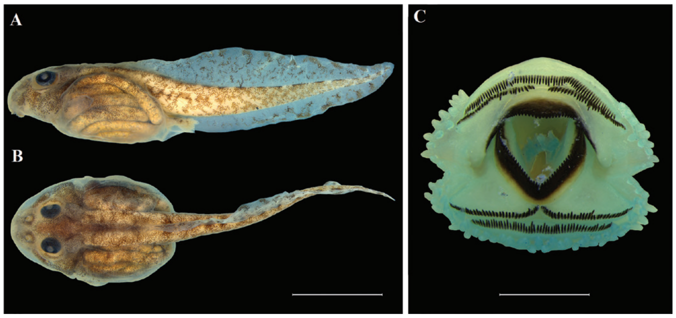

Figure 37. Tadpoles of *Physalaemus marmoratus* at Stage 35 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc (scale 2 mm).

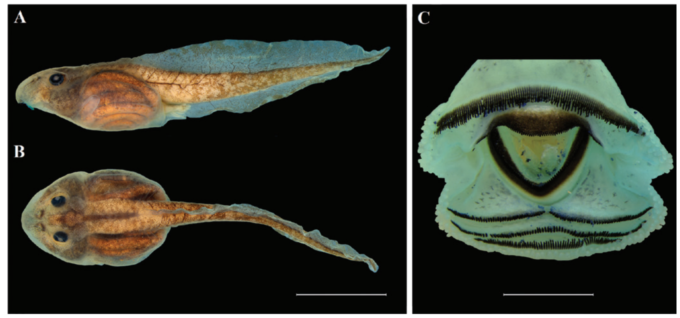

Figure 38. Tadpoles of *Physalaemus nattereri* at Stage 36 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc (scale 2 mm).

jaw sheath is wider than the lower jaw sheath. Nares large to very large (ND/ED = 0.47–0.56), rounded, with a very small projection on the marginal rim, dorsally positioned. Eyes small to medium (ED/BH = 0.15–0.19), dorsally positioned. Spiracle sinistral, medium to long (SL/BL = 0.15–0.21), with medium width (SW/BH = 0.20–0.22), with opening on the middle third of the body, posterodorsally directed, centripetal wall fused to body wall. Vent tube medial fused to the ventral fin. The caudal musculature width is medium (TMW/BW = 0.33–0.37). The dorsal fin has medium height (DFH/TMH = 0.52–0.61), originating on the posterior third of the body with acute slope, and convex margin; ventral has low to medium height (VFH/TMH = 0.42–0.45) with margin parallel to the caudal musculature; the tail tip is pointed. Lateral line not evident.

Comments. Tadpoles analyzed by Rossa-Feres & Nomura (2006) differ from those in our sample by the uniseriate marginal papillae and smaller size (TL = 32.64 mm, Stages 35–39, Rossa-Feres & Nomura 2006; TL = 33.84 mm, Stages 34–37, our sample). Tadpoles were described by Rossa-Feres & Nomura (2006) as having the P2 teeth row slightly longer than the P1 and the P3, but figure shows the P1 teeth row and the P2 of similar sizes, and both longer than the P3. The populations described by Schulze et al. (2015) were smaller (TL = 31.3 mm in Stages 37–41), had a uniseriate marginal papilla, and the P1 teeth row slightly smaller than the P2 and the P3. Three individuals in our sample had the uniseriate marginal papillae in alternated disposition laterally, two individuals had the marginal papillae uniseriate lateroventrally, and one individual had the marginal papillae biseriate laterally. In one individual, the A1 teeth row had the same length than the A-2 and five individuals presented the upper jaw sheath M-shaped. Tadpoles of *P. marmoratus* were easily differentiated from those of *P. centralis* and *P. cuvieri*, by the absence of a ventral gap. The spiracle posterodorsally directed differentiates *P. marmoratus* from *P. centralis* (ventrally directed).

Physalaemus nattereri (Steindachner 1863)

First Description of the tadpole: São José do Rio Preto – SP, Brazil (Vizotto 1967).

Other characterizations: Argentina (Cei 1980); Nova Itapirema – SP, Brazil (Rossa-Feres & Nomura 2006); Bolívia (Schulze et al. 2015).

Specimens Examined: Brazil, Goiás State, municipalities of Aparecida do Rio Doce (ZUFG 1817, ZUFG: 1839), Chapadão do Céu (ZUFG: 1347, ZUFG: 1958), Cidade de Goiás (ZUFG: 1921). Description based on 13 tadpoles between Gosner Stages 34 and 37.

Characterization. Total length 33.84 ± 3.10 mm (Table 1, Figure 38). The body shape is ovoid in dorsal view and globular-depressed in lateral view (BW/BH = 1.18–1.21). The snout is sloped in lateral view. The oral disc is anteroventral, laterally emarginate, with uniseriate row of elongated marginal papillae ventrally, in alternated disposition, biseriate lateroventrally, interrupted by a dorsal gap; submarginal papillae absent. LTRF is 2(2)/3(1), with A1 teeth row slightly longer than A2, P1 slightly longer than P2 and P3 slightly shorter than P2. The upper jaw sheath is wide, arc-shaped, and the lower jaw sheath is narrow, V-shaped; the upper and lower jaw sheath had the same width. Nares large (ND/ED = 0.41–0.49), rounded, dorsally positioned. Eyes small to medium (ED/BH = 0.14–0.18), dorsally positioned. Spiracle sinistral, medium to long (SL/BL = 0.12–0.22), with medium width (SW/BH = 0.15–0.20), opening on the posterior third of the body, posterodorsally directed, with the centripetal wall fused to body wall. Vent tube dextral, fused to the ventral fin. The caudal musculature width is medium (TMW/BW = 0.31–0.36). The dorsal fin has medium height (DFH/TMH = 0.53–0.67), originating on the posterior third of the body with a median slope, with a convex margin; ventral fin has low to medium height (VFH/TMH = 0.29–0.44) with margin parallel to the caudal musculature; the tail tip is pointed. Lateral line not evident.

Comments. Tadpoles analyzed by Rossa-Feres & Nomura (2006) differ from those in our sample by the uniseriate marginal papillae and smaller size (TL = 32.64 mm, Stages 35–39, Rossa-Feres & Nomura 2006; TL = 33.84 mm, Stages 34–37, our sample). Tadpoles were described by Rossa-Feres & Nomura (2006) as having the P2 teeth row slightly longer than the P1 and the P3, but figure shows the P1 teeth row and the P2 of similar sizes, and both longer than the P3. The populations described by Schulze et al. (2015) were smaller (TL = 31.3 mm in Stages 37–41), had a uniseriate marginal papilla, and the P1 teeth row slightly smaller than the P2 and the P3. Three individuals in our sample had the uniseriate marginal papillae in alternated disposition laterally, two individuals had the marginal papillae uniseriate lateroventrally, and one individual had the marginal papillae biseriate laterally. In one individual, the A1 teeth row had the same length than the A-2 and five individuals presented the upper jaw sheath M-shaped. Tadpoles of *P. nattereri* were easily differentiated from those of *P. centralis*, *P. cuvieri*, and *P. marmoratus* by the absence of a ventral gap.

6. Microhylidae Günther 1858

Chiasmocleis albopunctata (Boettger 1885)

First Description of the tadpole: Uberlândia – MG, Brazil (Oliveira-Filho & Giaretta 2006).

Other characterizations: Bolivia (Schulze et al. 2015).

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Specimens Examined: Brazil, Goiás State, Parque nacional da Chapada dos Veadeiros National (ZUFG 2294, ZUFG 2948). Description based on six tadpoles between Gosner Stages 35 and 40.

Characterization. Total length 20.25 ± 2.65 mm (Table 1, Figure 39). The body shape is rounded in dorsal view and triangular-depressed in lateral view (BW/BH = 1.01–1.19). The snout is truncate in lateral view. Oral disc without keratinized mouthparts or papillae; presence of a dermal flap suspended in front of oral cavity. Nares not perforated. Eyes medium (ED/BH = 0.22–0.22), laterally positioned. Spiracle ventral, with medium length (SL/BL = 0.12–0.16), medium to wide (SW/BH = 0.24–0.30), opening on the posterior third of the body, covering the vent tube in three of six tadpoles but anterior to the vent tube in three of six tadpoles, posteriorly directed, with the centripetal wall not fused to the body wall. Vent tube medial, fused to the ventral fin. The caudal musculature width is medium (TMW/BW = 0.27–0.38), with the anterior third of the tail muscle and adjacent fins with a sheath of thick connective tissue. The dorsal fin has medium height (DFH/TMH = 0.51–0.81), originating on the posterior third of the body with median slope, with a convex margin; ventral fin has medium height (VFH/TMH = 0.61–0.91) with a convex margin; the tail tip end with a flagellum. Lateral line evident.

Comments. Tadpoles analyzed by Schulze et al. (2015) were smaller (TL = 17.7 mm, Stages 35–39), and were described as having a rounded snout. In three of six individuals in our sample, the spiracle was not long enough to cover the vent tube and in one of six individuals, the vent tube was dextral.

Dermatonotus muelleri (Boettger 1885)

First Description of the tadpole: Santa Fé do Sul – SP (Vizotto 1967).

Other characterizations: Argentina (Cei 1980, Lavilla 1992); Vitória Brasil – SP, Brazil (Rossa-Feres & Nomura 2006); Bolivia (Schulze et al. 2015). Information about the larval development for populations from Argentina were presented by Fabrezi et al. (2012).

Specimens Examined: Brazil, Goiás State, municipalities of Britânia (ZUFG 1940), Pontalina (ZUFG 1283, ZUFG 1304), Nova Roma (ZUFG: 1955), and Mato Grosso do Sul State, municipality of São Gabriel do Oeste (ZUFG 1956). Description based on 15 tadpoles between Gosner Stages 31 and 37.

Characterization. Total length 36.45 ± 3.62 mm (Table 1, Figure 40). The body shape is rounded in dorsal view and triangular-depressed in lateral view (BW/BH = 1.21–1.32). The snout is rounded in lateral view. Oral disc modified without keratinized mouthparts or papillae; presence of a dermal flap suspended in front of oral cavity. Nares not perforated. Eyes medium (ED/BH = 0.16–0.18), laterally positioned. Spiracle ventral, long (SL/BL = 0.22–0.28), narrow to medium (SW/BH = 0.07–0.10), opening on the posterior third of the body, covering the vent tube, posteriorly directed, with the centripetal wall not fused with the body wall. Vent tube medial, fused to the ventral fin. The caudal musculature width is medium (TMW/BW = 0.28–0.36), with the anterior third of the tail muscle and adjacent fins with a sheath of thick connective tissue. The dorsal fin has medium height (DFH/TMH = 0.64–0.75), originating at the body-tail junction with acute slope, and convex margin; ventral fin has medium height (VFH/TMH = 0.64–0.84) with convex margin; the tail tip is pointed. Lateral line evident.

Comments. Vizotto (1967) considered the tadpoles to have large eyes while Cei (1980) and Lavilla (1992) described the eyes of the tadpoles as small. Tadpoles in our sample are like those described by Rossa-Feres & Nomura (2006). In two individuals in our sample, the spiracle was not long enough to cover the vent tube. Tadpoles of *D. muelleri* were easily differentiated from those of *C. albopunctatus* by the larger total length and the rounded snout in lateral view.

Elachistocleis cesarii (Miranda-Ribeiro 1920)

First Description of the tadpole: Mirassol – SP, Brazil (Rossa-Feres & Nomura 2006).

Other characterizations: Macaíba – SP, Brazil (Magalhães et al. 2012)

Specimens Examined: Brazil, Goiás State, municipalities of Barro Alto (ZUFG 891, ZUFG 892), Britânia (ZUFG 1939), Cidade de Goiás (ZUFG: 1920), São João d'Aliança (ZUFG 1098, ZUFG 1101), São Miguel do Araguaia (ZUFG 1886). Description based on 14 tadpoles between Gosner Stages 35 and 38.

Characterization. Total length 26.94 ± 4.27 mm (Table 1, Figure 41). The body shape is rounded in dorsal view and triangular-depressed in lateral view (BW/BH = 1.41–1.72). The snout is truncate in lateral view. Oral disc modified without keratinized mouthparts or papillae; presence of paired dermal flaps suspended in front of oral cavity; dermal flaps with irregular edges. Nares not perforated. Eyes small (ED/BH = 0.16–0.17), laterally positioned. Spiracle ventral, with medium length (SL/BL = 0.14–0.19) and medium width (SW/BH = 0.12–0.17), opening on the posterior to the body, covering the vent tube, posteriorly directed, with the centripetal wall not fused with the body wall. Vent tube medial with sinistral opening, fused to the ventral fin. The caudal musculature

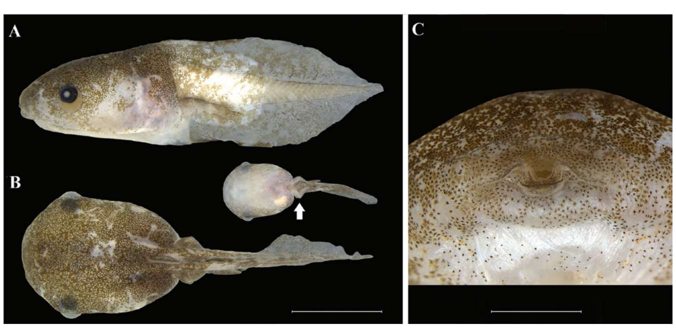

Figure 39. Tadpoles of *Chiasmocleis albopunctata* at Stage 39 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc (scale 2 mm). The arrow indicates the spiracle position.

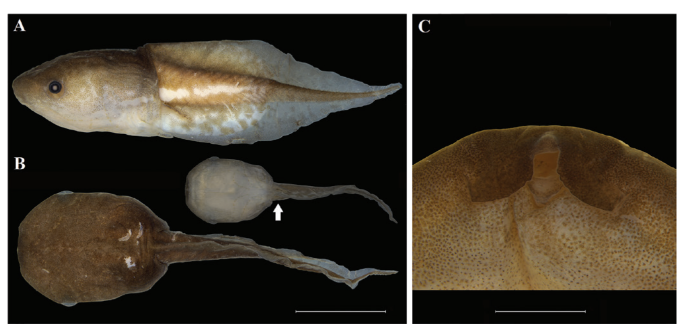

Figure 40. Tadpoles of *Dermatonotus muelleri* at Stage 39 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc (scale 2 mm). The arrow indicates the spiracle position.

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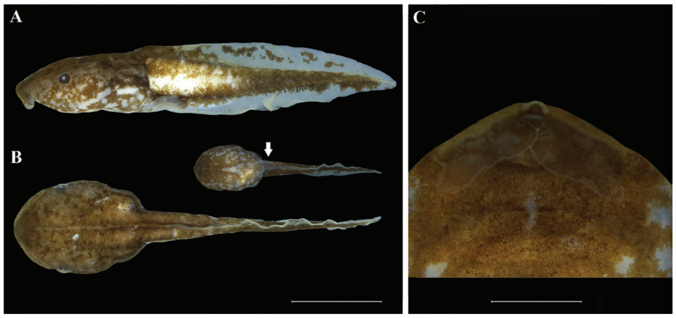

Figure 41. Tadpoles of *Elachistocleis cesarii* at Stage 38 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc (scale 2 mm). The arrow indicates the spiracle position.

width is medium (TMW/BW = 0.28–0.34). The dorsal fin has medium height (DFH/TMH = 0.47–0.53), originating at the posterior third of the body with median slope, with convex margin; ventral fin has low to medium height (VFH/TMH = 0.30–0.51) with convex margin; the tail tip is rounded. Lateral line not evident.

Comments. The populations analyzed by Rossa-Feres & Nomura (2006) were like the tadpoles in our descriptions. The populations analyzed by Magalhães et al. (2012) differ from those in our sample herein by the vent tube with medial opening. The vent tube with sinistral opening and the presence of two labial flaps differ *E. cesarii* from *C. albopunctatus* and *D. muelleri*.

7. Odontophrynidae Lynch 1969

Odontophrynus cf. *juquinha*

First Description of the tadpole: species uncertain.

Other characterizations: not available.

Specimens Examined: Brazil, Minas Gerais State, municipality of Andradas (ZUFG 908). Description based on three tadpoles at Gosner Stage 37.

Characterization. Total length 41.43 ± 6.86 mm (Table 1, Figure 42). The body shape is elliptical in dorsal view and globular-depressed in lateral view (BW/BH = 1.11–1.31). The snout is rounded in lateral view. The oral disc is anteroventral, laterally emarginate, with a uniseriate row of conical marginal papillae, interrupted by a dorsal gap; submarginal papillae scattered laterally, smaller than the marginal papillae. LTRF is 2(2)/3(1), A1 = A2; P1 = P2 > P3. The upper jaw sheath is wide, arc-shaped, and the lower jaw sheath is wide, U-shaped; the upper jaw sheath is wider than the lower jaw sheath. Nares large to very large (ND/ED = 0.38–0.55), elliptical, with a small projection on the marginal rim, dorsally positioned. Eyes small (ED/BH = 0.09–0.14), dorsally positioned. Spiracle sinistral, with medium length (SL/BL = 0.08–0.09), narrow to medium (SW/BH = 0.09–0.11), opening on the middle third of the body, posterodorsally directed, with the centripetal wall fused to body wall and free distal edge. Vent tube with dextral opening, fused to the ventral fin. The caudal musculature width is narrow to medium (TMW/BW = 0.29–0.32). The dorsal fin is medium to high (DFH/TMH = 0.94–1.05), originating on the posterior third of the body with an acute slope, and convex margin; ventral fin has medium height (VFH/TMH = 0.60–0.65) with margin parallel to the caudal musculature; the tail tip is rounded. Lateral line evident.

Comments. After Martino *et al.* (2019), the *O. americanus* species was restricted to southern Brazil, but these authors did not define a possible name for populations outside this distribution. As our sampled populations were geographically close to the *O. juquinha* (Rocha *et al.* 2017), we suspected that this species could have a larger geographical distribution. Our sample is like those described by Rocha *et al.* (2017) but our tadpoles have a larger total length.

Odontophrynus cultripes (Reinhardt & Lütken 1862)

First Description of the tadpole: Belo Horizonte – MG, Brazil (Savage & Cei 1965).

Other characterizations: Argentina (Cei 1980); Eastern Region of the Meridional Espinhaço Ridge – MG, Brazil (Pimenta et al. 2014).

Specimens Examined: Brazil, Goiás State, municipality of Teresópolis (ZUFG 533). Description based on 14 tadpoles between Gosner Stages 35 and 38.

Characterization. Total length 34.87 ± 2.23 mm (Table 1, Figure 43). The body shape is elliptical in dorsal view and globular-depressed in lateral view (BW/BH = 1.46–1.51). The snout is rounded in lateral view. The oral disc is ventral, laterally emarginate, with a uniseriate row of conical marginal papillae, interrupted by a dorsal gap; submarginal papillae scattered lateroventrally, smaller than the marginal papillae. LTRF is 2(2)/3(1), A1<A2, P1>P2>P3. The upper jaw sheath is wide, arc-shaped, and the lower jaw sheath is wide, U-shaped; the upper jaw sheath is wider than the lower jaw sheath. Nares medium (ND/ED = 0.27–0.29), elliptical, with a projection on marginal rim, dorsally positioned. Eyes medium (ED/BH = 0.22–0.24), dorsally positioned. Spiracle sinistral, short (SL/BL = 0.06–0.06), narrow to medium (SW/BH = 0.08–0.13), opening on the middle third of the body, posterodorsally directed, with the centripetal wall fused to body wall and free distal edge. Vent tube

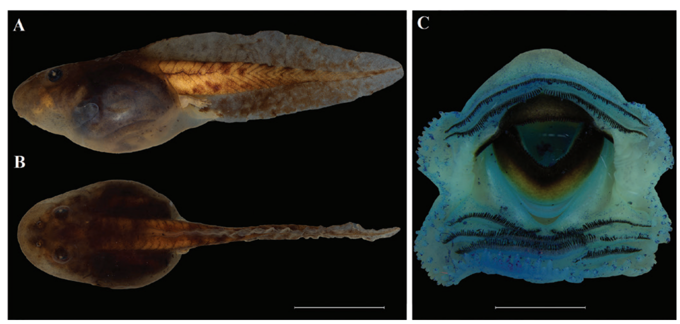

Figure 42. Tadpoles of *Odontophrynus* sp. (cf. *juquinha*) at Stage 38 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc (scale 2 mm).

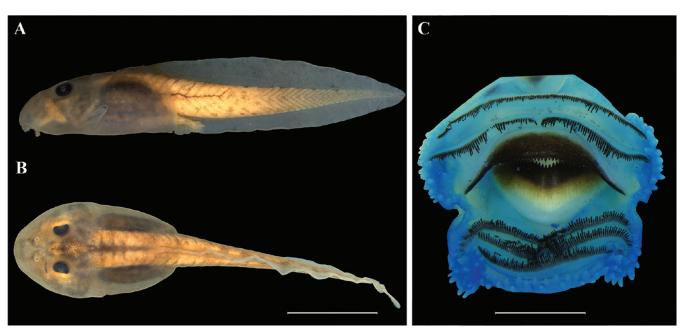

Figure 43. Tadpoles of *Odontophrynus cultripes* at Stage 36 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc (scale 2 mm).

medial, with dextral opening, fused to the ventral fin. The caudal musculature width is medium (TMW/BW = 0.36–0.40). The dorsal fin has medium height (DFH/TMH = 0.61–0.61), originating at the body with an acute slope, with convex margin; ventral fin has medium height (VFH/TMH = 0.45–0.46) with margin parallel to the caudal musculature; the tail tip is rounded. Lateral line not evident.
Comments. Tadpoles described by Savage & Cei (1965) were smaller (TL = 14 mm, Stage 37) than the tadpoles in our samples (TL = 38.01 mm, Stages 35–38). Tadpoles of *O. cultripes* can be distinguished from tadpoles of *O. americanus* by being smaller and the elliptical body shape in dorsal view.

Odontophrynus sp.
First Description of the tadpole: Not applicable.
Other characterizations: not available.
Specimens Examined: Brazil, Goiás State, municipality of Alto Paraíso (ZUFG 1892). Description based on four tadpoles between Gosner Stages 31 and 40.
Characterization. Total length 53.51 ± 2.84 mm (Table 1, Figure 44). The body shape is ovoid in dorsal view and globular-depressed in lateral view (BW/BH = 1.06–1.14). The snout is rounded in lateral view. The oral disc is anteroventral, laterally emarginate, with a uniseriate row of conical marginal papillae, interrupted by a dorsal gap; submarginal papillae absent. LTRF is 2(2)/3(1), A1 = A2, P1 = P2>P3; The upper jaw sheath is wide, M-shaped, and the lower jaw sheath is wide, U-shaped; the upper jaw sheath is wider than the lower jaw sheath. Nares small (ND/ED = 0.12–0.14), elliptical, with a small projection on the marginal rim, dorsally positioned. Eyes small (ED/BH = 0.15–0.16), dorsally positioned. Spiracle sinistral, with medium length (SL/BL = 0.09–0.10), narrow to medium (SW/BH = 0.09–0.10), opening on the middle third of the body, posterodorsally directed, with the centripetal wall fused to the body wall and free distal edge. Vent tube medial with dextral opening, fused to the ventral fin. The caudal musculature width is medium (TMW/BW = 0.32–0.32). The dorsal fin has medium height (DFH/TMH = 0.81–0.97), originating at the posterior third of the body with acute slope, with convex margin; ventral fin has medium height (VFH/TMH = 0.68–0.76) with convex margin; the tail tip is rounded. Lateral line not evident.
Comments. We are unable to associate this morphotype to other *Odontophrynus* species. Tadpoles of *Odontophrynus* sp. differ from the *O.* cf. *juquinha*, and *O. cultripes* by the upper jaw sheath M-shaped and larger total length. One individual presented one submarginal papilla on each side of the oral disc.

Proceratophrys boiei (Wied 1825)
First Description of the tadpole: Teresópolis – RJ, Brazil (Izeckson et al. 1979).
Other characterizations: Eastern Region of the Meridional Espinhaço Ridge – MG, Brazil (Pimenta et al. 2014).
Specimens Examined: Brazil, Minas Gerais State, municipality of Divino (ZUFG 2337). Description based on three tadpoles at Gosner Stage 31.
Characterization. Total length 32.39 ± 0.55 mm (Table 1, Figure 45). The body shape is ovoid in dorsal view and globular-depressed in lateral view (BW/BH = 1.05–1.07). The snout is rounded in lateral view. The oral disc is ventral, laterally emarginate, with a uniseriate row of conical marginal papillae, interrupted by a dorsal gap; submarginal papillae distributed laterally, forming rows, and smaller than the marginal papillae. LTRF is 2(2)/3(1), A1 = A2, P1 slightly smaller than P2 and P2>P3. The upper jaw sheath is narrow, arc-shaped, and the lower jaw sheath is narrow, U-shaped; the lower jaw sheath is wider than the upper jaw sheath. Nares large (ND/ED = 0.41–0.42), elliptical, with a projection on the marginal rim, dorsally positioned. Eyes small (ED/BH = 0.15–0.16), dorsally positioned. Spiracle sinistral, with medium length (SL/BL = 0.09–0.09), narrow to medium (SW/BH = 0.08–0.10), opening on the middle third of the body, posterodorsally directed, with the centripetal wall fused to the body wall and free distal edge. Vent tube dextral, fused to the ventral fin. The caudal musculature width is medium (TMW/BW = 0.31–0.31). The dorsal fin is medium to high (DFH/TMH = 0.95–1.03), emerging at the tail-body junction with median slope, and convex margin; ventral fin has medium height (VFH/TMH = 0.71–0.73) with margin parallel to the caudal musculature; the tail tip acute. Lateral line evident.
Comments. Tadpoles treated as *Stombus boiei* by Miranda-Ribeiro (1937) but the tadpoles presented in the Figure 5 is not representatives of the species (Izeckson et al. 1979). Tadpoles described by Izeckson et al. (1979) were like those in our sample but lacks the folds in the lower labium. From the total of analyzed individuals, one presented an elliptical body shape in dorsal view, and one individual had the A2 slightly longer than A1.

Proceratophrys cururu Eterovick & Sazima, 1998
First Description of the tadpole: Serra do Cipó – MG, Brazil (Eterovick & Sazima 1998).
Other characterizations: not available.
Specimens Examined: Brazil, Minas Gerais State, Parque Nacional de Sempre Vivas (ZUFG 931, ZUFG 937, ZUFG 984, ZUFG 991, ZUFG

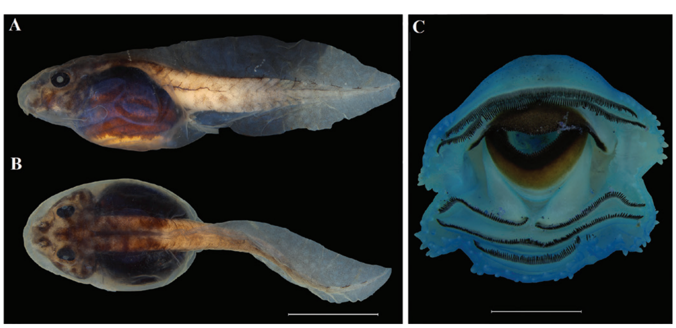

Figure 44. Tadpoles of *Odontophrynus* sp. at Stage 32 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc (scale 2 mm).

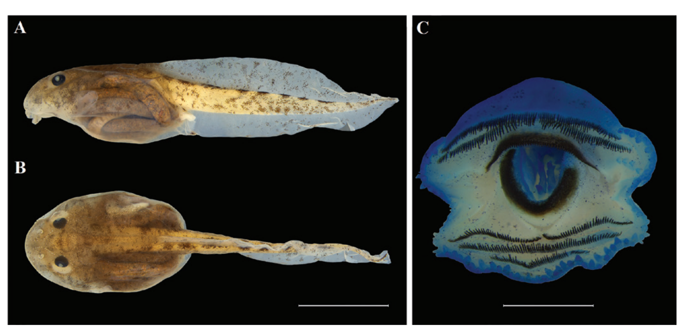

Figure 45. Tadpoles of *Proceratophrys boiei* at Stage 32 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc (scale 2 mm).

1007). Description based on 15 tadpoles between Gosner Stages 35 and 39.

Characterization. Total length 32.67 ± 4.61 mm (Table 1, Figure 46). The body shape is ovoid in dorsal view and globular-depressed in lateral view (BW/BH = 1.39–1.41). The snout is rounded in lateral view. The oral disc is ventral, laterally and lateroventrally emarginate, with a uniseriate row of conical marginal papillae, interrupted by a dorsal gap; submarginal papillae aggregated laterally, and smaller than the marginal papillae. LTRF is 2/3(1), A1 < A2, P1 = P2 > P3. The upper jaw sheath is narrow, arc-shaped, and the lower jaw sheath is narrow, V-shaped; the upper jaw sheath is wider than the lower. Nares medium (ND/ED = 0.15–0.21), elliptical, with a small projection on the marginal rim, dorsally positioned. Eyes medium (ED/BH = 0.21–0.24), dorsal positioned. Spiracle sinistral, short to medium (SL/BL = 0.05–0.13), narrow to medium (SW/BH = 0.05–0.11), opening on the middle third of the body, posterodorsally directed, with the centripetal wall fused to the body wall and free distal edge. Vent tube medial, fused to the ventral fin. The caudal musculature width is narrow to medium (TMW/BW = 0.25–0.31). The dorsal fin has medium height (DFH/TMH = 0.60–0.66) originating at the posterior third of the body with a median slope, with convex margin; ventral fin is low to medium (VFH/TMH = 0.36–0.70) with margin parallel to the caudal musculature; the tail tip is rounded. Lateral line not evident.

Comments. The tadpole presented in Eterovick & Sazima (1998) was described with the spiracle dorsally directed and without lateral emargination and folds on the lower labium. The tadpoles in our sample had lateral emargination and two folds in the lower labium, although not as prominent as seems in *P. boiei* and *P. dibernardoi*. The presence of lateral emargination and two folds in the lower labium were reported in tadpoles of *P. cururu* by Provete et al. (2013). Tadpoles of *P. cururu* differ from tadpoles of *P. boiei* by larger body proportions, less prominent folds in the lower labium and the greater number of submarginal papillae aggregated in the lateral of the oral disc, and the rounded tail tip.

Proceratophrys dibernardoi Brandão, Caramaschi, Vaz-Silva & Campos 2013

First Description of the tadpole: Jataí – GO, Brazil (Santos et al. 2017).

Other characterizations: not available.

Specimens Examined: Brazil, Goiás State, municipality of Jataí (ZUFG: 717).

Characterization. The following information is complementary to the description available in Santos et al. (2017). Total length 29.75 ± 1.52 mm

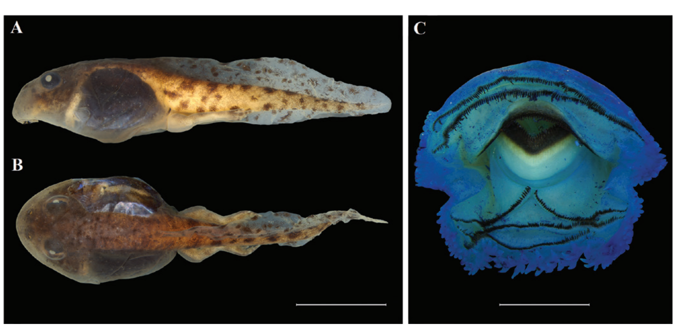

Figure 46. Tadpoles of *Proceratophrys cururu* at Stage 39 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc (scale 2 mm).

(Table 1, Figure 47). The body shape is globular-depressed in lateral view (BW/BH = 1.46–1.52). Nares middle (ND/ED = 0.15–0.18) and eyes medium (ED/BH = 0.20–0.21). Spiracle short (SL/BL = 0.03–0.06) and narrow to medium width (SW/BH = 0.05–0.10). The caudal musculature width is medium (TMW/BW = 0.37–0.38), the dorsal fin has medium height (DFH/TMH = 0.53–0.54) and the ventral fin is low (DFH/TMH = 0.41–0.41).

Comments. Santos et al. (2017) provided comparison with other species of the *P. cristiceps* group. Tadpoles of *P. dibernardoi* differ from tadpoles of *P. boiei* and *P. cururu* by the spiracle with centripetal wall completely fused to the body wall, lower body height, and wider marginal rim, especially when compared to *P. cururu*.

Proceratophrys salvatori Caramaschi 1996

First Description of the tadpole: Alto Paraíso – GO, Brazil (Brandão & Batista 2000).

Other characterizations: not available.

Specimens Examined: Brazil, Goiás, Parque Nacional da Chapada dos Veadeiros National (ZUFG 1886). Description based on six tadpoles between Gosner Stages 38 and 40.

Characterization. Total length 29.84 ± 1.91 mm (Table 1, Figure 48). The body shape is elliptical in dorsal view and globular-depressed in lateral view (BW/BH = 1.15–1.18). The snout is rounded in lateral view. The oral disc is ventral, laterally emarginate, with a uniseriate row of elongated marginal papillae, interrupted by a dorsal gap; submarginal papillae absent. LTRF is 2(2)/3(1), A1 < A2, P1 = P2 > P3. The upper jaw sheath is wide, arc-shaped, and the lower jaw sheath is wide, V-shaped; the upper jaw sheath is wider than the lower jaw sheath. Nares medium (ND/ED = 0.17–0.20), rounded, with a small projection on the marginal

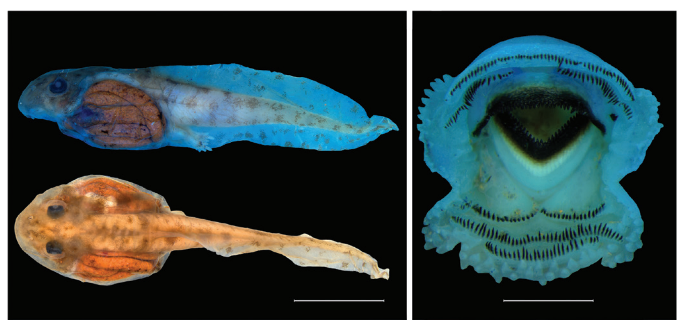

Figure 47. Tadpoles of *Proceratophrys dibernardoi* at Stage 37 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc at Stage 30 (scale 2 mm).

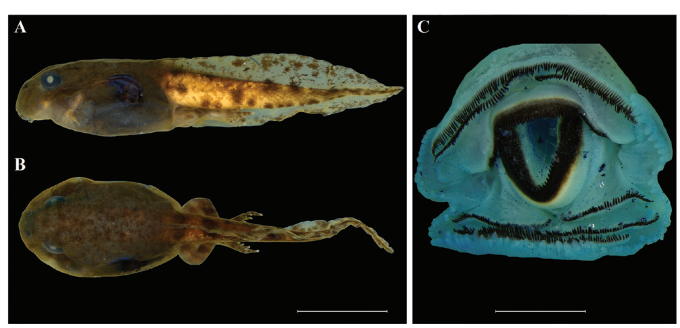

Figure 48. Tadpoles of *Proceratophrys salvatori* at Stage 40 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc at Stage 39 (scale 2 mm).

rim, dorsally positioned. Eyes medium (ED/BH = 0.20–0.20), dorsally positioned. Spiracle sinistral, short to medium (SL/BL = 0.04–0.08), narrow to medium (SW/BH = 0.06–0.10), opening on the middle third of the body, posterodorsally directed, with the centripetal wall fused to body wall and free distal edge. Vent tube medial with dextral opening, fused to the ventral fin. The caudal musculature width is medium (TMW/BW = 0.30–0.33). The dorsal fin has medium height (DFH/TMH = 0.83–0.86), originating at the body-tail junction with an acute slope, and convex margin; ventral fin has medium height (VFH/TMH = 0.44–0.49) with margin parallel to the caudal musculature; the tail tip is pointed. Lateral line not evident.

Comments. *Proceratophrys salvatori* was initially allocated in the genus *Odontophrynus*, and more recently transferred to the *Proceratophrys* genus (Magalhães et al. 2020). Tadpoles of *P. salvatori* can be distinguished from other *Proceratophrys* tadpoles included in our work by the nares with opening anterolaterally directed. Also, the pointed tail tip differentiates *Proceratophrys* cf. *goyana* from *P. cururu.*

Proceratophrys cf. *goyana*

First Description of the tadpole: not applicable.

Other characterizations: not available.

Specimens Examined: Brazil, Goiás State, municipality of Iporá (ZUFG 2269, ZUFG 2270, ZUFG 2271, ZUFG 2272, ZUFG 2273). Description based on ten tadpoles between Gosner Stages 31 and 37.

Characterization. Total length 35.56 ± 3.83 mm (Table 1, Figure 49). The body shape is elliptical in dorsal view and globular-depressed in lateral view (BW/BH = 1.03–1.22). The snout is rounded in lateral view. The oral disc is ventral, laterally emarginate, with a uniseriate row of conical marginal papillae, interrupted by a dorsal gap; submarginal papillae scattered laterally, with the same length of the marginal papillae. LTRF is 2(2)/3(1), A1 slightly smaller than A2, P1>P2>P3. The upper jaw sheath is narrow, arc-shaped, and the lower jaw sheath is narrow, U-shaped; the lower jaw sheath is wider than the upper jaw sheath. Nares medium (ND/ED = 0.29–0.32), elliptical, with a projection on the marginal rim, dorsally positioned. Eyes medium (ED/BH = 0.19–0.19), dorsally positioned. Spiracle sinistral, short (SL/BL = 0.05–0.06), narrow (SW/BH = 0.07–0.09), with opening on the middle third of the body, posterodorsally directed, with the centripetal wall fused to body wall. Vent tube dextral, fused to the ventral fin. The caudal musculature width is medium to wide (TMW/BW = 0.44–0.49). The dorsal fin has medium height (DFH/TMH = 0.60–0.63), originating at the tail-body junction with acute slope, with convex margin; ventral fin is low (VFH/TMH = 0.42–0.42) with margin parallel to the caudal musculature; the tail tip is pointed. Lateral line not evident.

Comments. We are using the name *Proceratophrys* cf. *goyana* to these tadpoles once they were collected in the same pond were only adults of *P. goyana* were found and because a formal description of these tadpoles is lacking. The number of marginal papillae and the quantity and position of submarginal papillae presented variation among individuals in our sample. One individual has a uniseriate marginal papilla, two have submarginal papillae only laterally, two only ventrally, two does not have submarginal papillae and one have submarginal papillae larger than marginal papillae. Three individuals had the A2 teeth row slightly longer than the A1, and four individuals had the A1 with same size that the A2. Tadpoles of *Proceratophrys* cf. *goyana* can be distinguished from *P. boiei* by having larger body and the oral disc with only lateral emargination. Tadpoles of *Proceratophrys* cf. *goyana* differ from *P. dibernardoi* by the spiracle with a free distal margin, greater number of submarginal papillae, oral disc without folds ventrally in the lower labium, and dorsal fin originating on the the tail-body junction. Also, the absence of folds ventrally in the lower labium differentiate *Proceratophrys* cf. *goyana* from *P. cururu.*

Proceratophrys sp.

First Description of the tadpole: not applicable.

Other characterizations: not available.

Specimens Examined: Brazil, Goiás State, municipality of São Domingos (ZUFG 1043, ZUFG 1051). Description based on five tadpoles between Gosner Stages 31 and 39.

Characterization. Total length 27.55 ± 4.99 mm (Table 1, Figure 50). The body shape is elliptical in dorsal view and globular-depressed in lateral view (BW/BH = 1.22–1.24). The snout is sloped in lateral view. The oral disc is ventral, laterally emarginate, with a uniseriate row of conical marginal papillae, interrupted by a dorsal gap; submarginal papillae absent. LTRF is 2(2)/3(1), A1 slightly smaller than A2, P1 = P2 and P3 slightly smaller than P2. The upper jaw sheath is narrow to medium, arc-shaped, and the lower jaw sheath is narrow, U-shaped; the lower jaw sheath is wider than the upper jaw sheath. Nares very large (ND/ED = 0.81–0.89), elliptical, with a projection on the marginal rim, dorsolaterally positioned. Eyes small to medium (ED/BH = 0.16–0.19), dorsal positioned. Spiracle sinistral, with medium lenght (SL/BL = 0.13–0.14), medium to wide (SW/BH = 0.20–0.25), opening on the middle third of the body, posterodorsally directed, with the centripetal

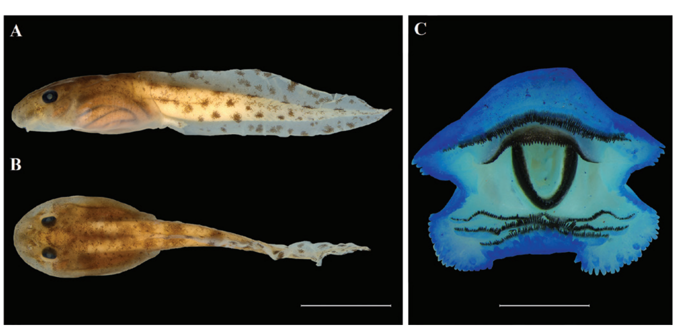

Figure 49. Tadpoles of a *Proceratophrys* cf. *goyana* at Stage 36 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc (scale 2 mm).

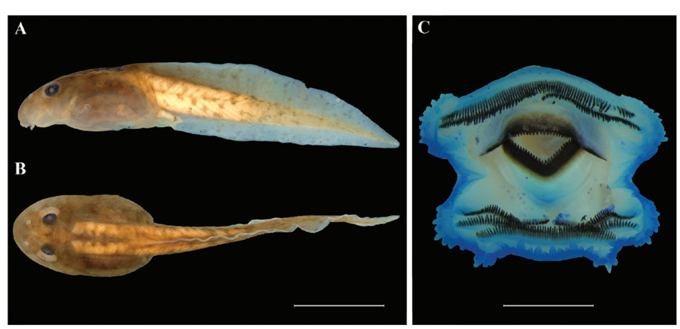

Figure 50. Tadpoles of a *Proceratophrys* sp. at Stage 36 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc at Stage 33 (scale 2 mm).

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wall fused to body wall. Vent tube dextral, fused to the ventral fin. The caudal musculature width is medium (TMW/BW = 0.34–0.43). The dorsal fin has medium height (DFH/TMH = 0.68–0.81), originating at the body with median slope, and convex margin; ventral fin has medium height (VFH/TMH = 0.53–0.61) with margin parallel to the caudal musculature; the tail tip is rounded. Lateral line evident.

Comments. We were unable to associate this morphotype to the other known species of *Proceratophrys*. Tadpoles of *Proceratophrys* sp. differ from tadpoles of *P.* cf. *goyana*, *P. boiei* and *P. dibernardoi* by the sloped snout shape in lateral view and nares size. In addition, these tadpoles differ from *Proceratophrys* cf. *goyana* by the oral disc emarginate ventrally with two folds in the lower labium, and from *P. dibernardoi* by the spiracle with a free distal margin.

8. Phyllomedusidae Günther 1858

Pithecopus azureus Cope 1862

First Description of the tadpole: Argentina (Cei 1980).

Other characterizations: Populations from Salta and Formosa, Argentina, treated as *P. hypochondrialis*, had the oral disc described by Vera Candioti (2007); Bolívia (Schulze et al. 2015); Barro Alto, Cocalzinho, Mineiros and Jataí - GO, Brazil (Santos et al. 2018).

Specimens Examined: Brazil, Goiás State, municipalities of Barro Alto (ZUFG 819, ZUFG 838), Jataí (ZUFG 2350), Mineiros (ZUFG 746). Description based on 15 tadpoles between Gosner Stages 35 and 38.

Characterization. Total length 48.76 ± 4.97 mm (Table 1, Figure 51). The body shape is elliptical-elongated in dorsal view and triangular-compressed in lateral view (BW/BH = 0.83–0.92). The snout is truncated in lateral view. Oral disc anteroventral, ventrally emarginate, with a uniseriate row of elongated marginal papillae, in alternated disposition, interrupted by a dorsal gap; submarginal papillae scattered laterally, and smaller than the marginal papillae. LTRF is 2(2)/3(1), A1 slightly smaller than A2, P1 = P2 and P3 with about a third of the P2 length. The upper jaw sheath is narrow to medium, M-shaped, and the lower jaw sheath is narrow, V-shaped; the upper jaw sheath is wider than the lower jaw sheath. Nares small to medium (ND/ED = 0.08–0.21), elliptical, laterally positioned. Eyes medium (ED/BH = 0.26–0.30), laterally positioned. Spiracle ventral, short to medium (SL/BL = 0.06–0.09), with medium width (SW/BH = 0.13–0.16), opening at the middle third of the body, posteriorly directed, with the centripetal wall fused to the body wall. Vent tube medial with dextral opening, fused to the ventral fin. The caudal musculature width is wide (TMW/BW = 0.50–0.51). The dorsal fin is low (DFH/TMH = 0.28–0.43), originating at the tail-body junction with acute slope, with margin parallel to the caudal musculature; ventral fin has medium height (VFH/TMH = 0.57–0.73) with convex margin; the tail tip end with a flagellum. Lateral line evident.

Comments. Tadpoles described by Cei (1980) differed from the tadpoles in our sample by the LTRF 2(2)/2(1) and the dextral vent tube. The populations analyzed by Vera Candioti (2007) had uniseriate marginal papillae. Two morphotypes were presented by Schulze et al. (2015), from Bolivia, the "*P. azureus* A" and "*P. azureus* B" (treated as *Phyllomedusa azurea*). The morphotype B (Schulze et al. 2015) was described with a sloped snout in lateral view, arc-shaped upper jaw sheath, V-shaped lower jaw sheath, marginal papillae biseriate laterally and uniseriate in alternated disposition ventrally, and without submarginal papillae. The morphotype A (Schulze et al. 2015) also had a sloped snout in lateral view, but the marginal papillae were biseriate lateral and ventrally, and the submarginal papillae were absent. The morphotype A presented a narrow ventral gap, variation that we observed in seven tadpoles in our sample. Two individuals had ventral emargination in the oral disc, and one individual had a biseriate marginal papillae. The lateroventrally spiracle described by Schulze et al. (2015) represent a difference in terminology use, but the position is the same. We prefer the use of ventral spiracle, once the spiracle can be only seen in ventral position, although it is not positioned in the sagittal line.

Pithecopus oreades (Brandão, 2002)

First Description of the tadpole: Goiás – Brasil (Brandão, 2002).

Other characterizations: not available.

Specimens Examined: Brazil, Goiás State, Parque Nacional da Chapada dos Veadeiros (ZUFG 1976). Description based on eight tadpoles between Gosner Stages 36 and 38.

Characterization. Total length 48.72 ± 2.31 mm (Table 1, Figure 52). The body shape is elliptical-elongated in dorsal view and triangular-compressed in lateral view (BW/BH = 0.98–1.00). The snout is rounded to sloped in lateral view. The oral disc is anteroventral, ventrally emarginate, with a uniseriate row of elongated marginal papillae, in alternated disposition, interrupted by a dorsal and a small ventral gap; submarginal papillae scattered laterally, smaller than the marginal papillae. LTRF is 2(2)/3, A1 = A2, P1 = P2 > P3. The upper jaw sheath is narrow to medium, M-shaped, and the lower jaw sheath is narrow, V-shaped; the upper jaw sheath is wider than the lower jaw sheath. Nares medium (ND/ED = 0.23–0.26), elliptical, with a projection on the marginal rim, laterally positioned. Eyes medium (ED/BH =

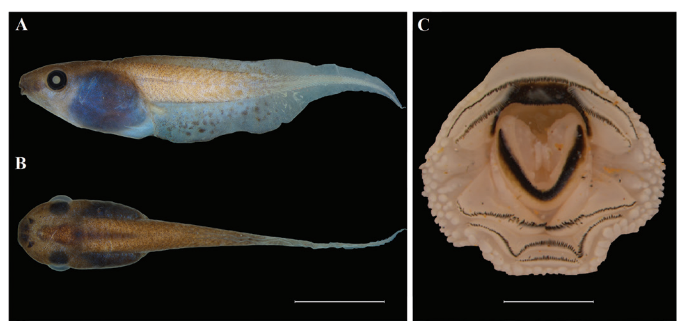

Figure 51. Tadpoles of *Pithecopus azureus* at Stage 35 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc (scale 2 mm).

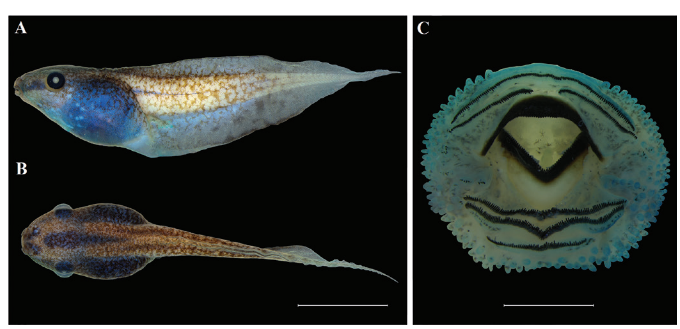

Figure 52. Tadpoles of *Pithecopus oreades* at Stage 36 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc (scale 2 mm).

0.25–0.26), laterally positioned. Spiracle ventral, short to medium (SL/BL = 0.05–0.09), with medium width (SW/BH = 0.11–0.15), opening at the middle third of the body, posteriorly directed, displaced to the left, with the centripetal wall fused to the body wall. Vent tube medial with dextral opening, fused to the ventral fin. The caudal musculature width is medium to wide (TMW/BW = 0.45–0.51). The dorsal fin is low (DFW/TMW = 0.39–0.40), originating at the tail-body junction with acute slope, with margin parallel to the caudal musculature; ventral fin has medium height (VFH/TMH = 0.57–0.70) with convex margin; the tail end with a flagellum. Lateral line evident.
Comments. Our tadpoles are like those described by Brandão (2002), but the presence of a narrow ventral gap was not reported in the original description. Tadpoles of *P. oreades* can be distinguished from tadpoles of *P. azurea* by the P3 teeth row slightly smaller than P2 and P1, labial teeth row formula 2(2)/3, and spiracle opening oriented to the left.

Pithecopus sp.
First Description of the tadpole: not applicable.
Other characterizations: not available.
Specimens Examined: Brazil, Goiás State, municipality of Pontalina (ZUFG 1294). Description based on two tadpoles at Gosner Stage 34.
Characterization. Total length 42.10 ± 0.79 mm (Table 1, Figure 53). The body shape is elliptical-elongated in dorsal view and triangular-compressed in lateral view (BW/BH = 0.82–0.94). The snout is truncated in lateral view. The oral disc is anteroventral, ventrally emarginate, with a uniseriate row of elongated marginal papillae, in alternated disposition, interrupted by a dorsal gap; submarginal papillae scattered laterally, smaller than the marginal papillae. LTRF is 2(2)/3(1), A1 = A2, P1 > P2 > P3. The upper jaw sheath is narrow to medium, M-shaped, and the lower jaw sheath is narrow, V-shaped; the upper jaw sheath is wider than the lower jaw sheath. Nares small (ND/ED = 0.08–0.08), elliptical, with a projection on the marginal rim, laterally positioned. Eyes large (ED/BH = 0.32–0.32), laterally positioned. Spiracle ventral, short (SL/BL = 0.05–0.06), with medium width (SW/BH = 0.12–0.14), opening at the middle third of the body, posteriorly directed, with centripetal wall fused to the body wall. Vent tube medial with dextral opening, fused to the ventral fin. The caudal musculature width is wide (TMW/BW = 0.56–0.60). The dorsal fin is low (DFH/TMH = 0.21–0.23), originating at the tail-body junction with acute slope, with margin parallel to the caudal musculature; ventral fin is low (VFH/TMH = 0.40–0.41) with convex margin. Lateral line evident.

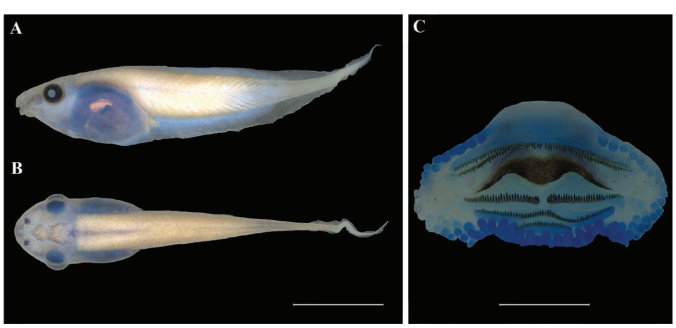

Figure 53. Tadpoles of *Pithecopus* sp. at Stage 34 (Gosner 1960): (A) lateral, and (B) dorsal view (scale 10 mm), (C) oral disc (scale 2 mm).

Comments. We were unable to associate this morphotype to the other known species of *Pithecopus*. Tadpoles of *Pithecopus* sp. differ from tadpoles of *P. azurea* and *P. oreades* by the taller caudal musculature, lower dorsal fin, and smaller total length. In one individual, we observed a narrow ventral gap.

Discussion

Most larval studies in Brazil are related to descriptive studies, like the description of the external morphology (Andrade *et al.* 2007), which allow the inclusion of larval morphology as functional or ecological traits in hypothesis test (e.g., Arifin et al. 2021). However, we still need to understand the extent of variation in morphological traits to increase the accuracy of taxonomic studies, and its usefulness in ecological studies. In the characterizations that we provided in this article, we found variation in the body or oral features even for species that we do not have a larger sample, which highlight the need to not underestimate the amount of intra- or interpopulation morphological variation and the impact of such variation in defining morphotypes for taxonomic studies (Grosjean 2005) or evaluating the effect of environmental modifications (e.g., Costa & Nomura 2016, Costa et al. 2017), for example. Moreover, tadpoles are known to exhibit phenotypic plasticity and morphological variation in tadpoles is expected throughout its area of occurrence, due to changes in local environmental conditions or the presence of predators and competitors (Marques & Nomura 2018). In general, morphological characterization of the external morphology of tadpoles does not receive much attention from researchers or journals, with several journals indicating that tadpole morphological characterization should be published as Short Notes or Correspondence (e.g., Santos et al. 2018, Tolledo & Toledo 2010, Verdade et al. 2023). Certainly, we can have many arguments for a given report to be published as a summarized version, but this decision ideally should be done case by case, once this type of publication reduces the opportunity for discussion of the results and for comparisons. Also, when a given tadpole morphology is already formally described, the interest to report other characterization of the same tadpole with samples from different localities is reduced, unless the original description is not very detailed, have a low sample of individuals, or is based on individuals in early developmental stages (i.e., below Gosner's Stage 34). Such constraint in reporting morphological variation, despite its result from the interest of researchers for novelty or journal editorial decisions, implies a generalization of the tadpole morphology based on the first description for the entire range of the species distribution and restricts the morphological sampling throughout the geographical range of the species. Although the effect of availability is not restricted to the reports of tadpoles' morphology, it is an issue to be considered, nevertheless. One of the possibilities to overcome this effect is to produce descriptive reports with broader geographical samples and to use more diverse and comparative analytical methods. However, in a continental size country like Brazil, this sampling and analytical decisions can result in greater logistical costs, which could be prohibitive, once financial resource is an important constraint of biodiversity research in developing countries (Young 2005). The increase of independent and geographically restricted reports of tadpoles' morphology would help to reduce several opportunities costs and increase the open collaboration in biodiversity research, aligned to the principles and practices of the open science initiative (UNESCO 2021).

The ontogenetic variation can lead to erroneous determination of diagnostic traits (see Gosner 1960, Grosjean 2005, and Navarro Acosta & Vera Candioti 2017 for a discussion about morphological variation regarding developmental allometry). To avoid this problem, the use of tadpoles between Stages 32 and 40 was suggested by Grosjean (2005), once it is more likely that any variation in these developmental stages reflect interspecific variation than ontogenetic changes. It would be ideal if all anuran species had a known developmental table for the larval stage, but we are far from this reality. Even if we consider that the ontogenetic changes in the larval stage among anuran species is relatively uniform, and then could be illustrated by the Gosner's (1960) developmental table, we do not have enough information about populational variation to define which are the most reliable traits for taxonomic comparisons.

The shape of the snout, the body or fins or the size of eyes and nares had great variation in tadpoles' descriptions. The use of morphological traits as nominal variables increases the risk of subjective interpretation of such traits. Although the variability in the reports of the external morphology could represent a natural variation in a continuous shape scale, and the use of nominal descriptors in the characterization is also useful to describe tadpole morphology, the use of quantitative morphometric definitions for such shapes would increase reliability in tadpoles' descriptions. An attempt to provide morphological definitions was made by Altig (1970), modified posteriorly by Altig & McDiarmind (1986, 1999). Despite being widely used, in many descriptions several traits are lacking, or the traits are not used as proposed. Together with the terminology problem, the use of ratios to describe tadpole morphology limits the utility of the descriptions. Although ratios are helpful to establish a size proportion of the morphological trait, we cannot access the raw information from ratios. Conversely, the use of new technologies in image capture and processing allowed an increase in the quality of pictures in recent descriptions of tadpoles' external morphology (e.g., *Chiasmocleis schubarti*, Santos et al. 2015; *Crossodactylus aeneus*, Silva-Soares et al. 2015; *Dendropsophus branneri*, Abreu et al. 2015), and the use of quantitative morphometric analytical approaches, as geometric morphometric (e.g., Pezzuti et al. 2016).

We detected large variation in external morphological traits of tadpoles from several anuran species, with no reference in other available descriptions of such variation. Evaluation if these variations represent some level of phenotypic plasticity or a clue for taxonomic use, like a complex of cryptic species, is hard to define once data about morphological traits from populations throughout a geographic gradient is lacking.

1. How to use this taxonomic key

We think this taxonomic key would be helpful to anyone interested in describing the anuran biodiversity using larval stage information, but the users should be aware of its limitations. First, the distribution of anuran species in the Cerrado Biome is compartmentalized, thus many species that occur in the Cerrado-Atlantic Forest border are not expected to be found in the Cerrado-Amazon border, and vice-versa (Valdujo et al. 2012). The user should know the expected species pool for the sampled area to avoid misidentification. Second, we should expect variation in tadpole morphology; thus, the user should compare the tadpole morphology with the larval description before associating a larval morphology with a species name. This taxonomic key includes about 22% of the species known to occur in the Cerrado biome, and for many anurans' species larval stage is currently unknown. For example, for the 114 anurans species that occur in the Goiás State, central Brazil, 35 does not have their larval stage described (Vaz-Silva et al. 2020). Thus, the user should be aware that this taxonomic key can be useful to indicate which species the larva belongs to or exclude other species to which the larva does not belong. Finally, we invite other researchers with samples of tadpoles' larvae of species not included to modify this taxonomic key to improve its accuracy and species coverage.

Identification key

1. Nares unperforated 2

1'. Nares perforated 4

2. Double dermal flap covering the mouth, vent tube with sinistral opening .... *Elachistocleis cesarii*

2'. A single continuous dermal flap covering the mouth, vent tube with medial opening 3

3. Total length above 30 mm in stage 37, snout rounded in lateral view, dorsal fin originating at the body-tail junction …............................ ....*Dermatonotus muelleri*

3'. Total length below 25 mm in stage 37, snout truncate in lateral view, dorsal fin originating at the posterior third of the body ………..……................................ *Chiasmocleis albopunctata*

4. Accessory teeth row present laterally in the oral disc ..…….……. 5

4'. Accessory teeth row absent laterally in the oral disc …..……..… 8

5. Small anterior gap in the marginal papillae, snout rounded in lateral view, nares with projection on the marginal rim ……………………. 6

5'. Wide anterior gap in the marginal papillae, snout sloped in lateral view, nares without projection on the marginal rim …………. …..……. *Trachycephalus typhonius*

6. Spiracle with the centripetal wall fused to body wall and free distal edge, vent tube short 7

6'. Spiracle with centripetal wall not fused to the body wall and longer than external wall, vent tube long …...... *Boana lundii*

7. Presence of dark rounded blotches scattered on the dorsum of the body, two labial teeth row anterior, labial teeth row formula (LTRF) 2(2)/5(1) .... *Bokermannohyla sapiranga*

7'. Absence of dark rounded blotches scattered on the dorsum of the body, three labial teeth row anterior, LTRF 3(1,3)/6(1) ……….....……………………. *Bokermannohyla pseudopseudis*

8. Dorsal and ventral fins margin parallel to the caudal musculature …. 9

8'. Dorsal and ventral fins not as above ……………………….... 13

9. Oral disc not emarginated ………...…………………………... 10

9'. Oral disc emarginated ………………………………...…. 11

10. Oral disc anteroventral, snout rounded in lateral view, marginal papillae short and rounded, labial teeth row 1/2(1), total length 58.72 mm …………......…………..... *Leptodactylus labyrinthicus*

10'. Oral disc ventral, snout sloped in lateral view, marginal papillae elongated, labial teeth row 2(2)/3, total length 35.77 mm ………..................................……… *Leptodactylus troglodytes*

11. Body rounded in dorsal view, globular in lateral view, oral disc anteroventral, laterally emarginated, papillae absent at the emargination …................................ *Adelphobates galactonotus*

11'. Body in dorsal view globular or elliptic, depressed in lateral view, oral disc ventral, ventrally emarginate, papillae present at the emargination ………...................…………………...... 12

12. Body ovoid in dorsal view, nares anterodorsally directed, dorsal fin originating at the middle third of the tail ...... *Thoropa megatympanum*

12'. Body elliptical in dorsal view, nares dorsolaterally directed, dorsal fin originating at the posterior third the tail ………………………...…………………...…. *Thoropa miliaris*

13. Spiracle ventral 14

13'. Spiracle sinistral …………………...…………….......….. 16

14. Labial teeth row 2(2)/3, spiracle displaced to the left side of the belly …………………………………………. *Pithecopus oreades*

14'. Labial teeth row 2(2)/3(1), spiracle positioned near the sagittal line ....……… 15

15. Nares with a projection on the marginal rim, total length with average of 42.10 mm and ventral fin with about 1.09 mm ………………. ..…...…………………... *Pithecopus* sp.

15'. Nares without a projection on the marginal rim, total length with average of 48.76 mm and ventral fin with about 1.44 mm ……………………...................…….... *Pithecopus azureus*

16. Body rounded in dorsal view, nares rounded, oral discs not emarginated, with posterior margin concave when closed …......17

16'. Body not rounded, nares elliptical or reniform, oral disc emarginated, not forming a concave shape when closed …......18

17. Large oral disc, without dorsal gap, submarginal papillae aggregated lateroventrally, T-shaped papillae present, upper jaw sheat arc-shaped …...……......................................…..…. *Scinax pombali*

17'. Smaller oral disc with dorsal gap, submarginal papillae aggregated laterally, T-shaped papillae absent, upper jaw sheath M-shaped ……......................……………... *Scinax longilineus*

18. Upper labial teeth rows absent or with only one row ……..…... 19

18'. Two or more upper labial teeth rows ……………….…..….. 20

19. Oral disc interrupted by lateroventral gaps, margin of fins convex, upper jaw sheath U-Shaped ...……………..… *Dendropsophus soaresi*

19'. Oral disc not interrupted by lateroventral gaps, fins high and triangular, upper jaw sheath arc-shaped ……………… ....… *Dendropsophus minutus*

20. Eyes dorsal, body globular in lateral view ……….......……… 21

20'. Eyes lateral, body triangular in lateral view ……….……. 45

21. Marginal papillae interrupted by ventral gap ……………....…… 22

21'. Marginal papillae not interrupted by ventral gap …………… 28

22. Oral disc with two rows of posterior labial teeth ……...……... 23

22'. Oral disc with three rows of posterior teeth …………… 24

23. Spiracle positioned bellow the body midline in lateral view, ventrally directed, nares medium, absence of a medial gap in P1 ...……….......…….................………… *Physalaemus centralis*

23'. Spiracle positioned at the body midline in lateral view, posterodorsally directed, nares large to very large, presence of a medial gap in P1……........... *Physalaemus marmoratus*

24. P3 longer than half the length of the P2, nares medium to large ……………...…..... 25

24'. P3 shorter than one third the length of the P2, nares very large ……......................................………... *Physalaemus cuvieri*

25. Rounded tail tip, caudal musculature not reaching the tail tip, spiracle with centripetal wall longer than the external wall, wide ventral gap ……………………………………………...…. 26

25'. Pointed tail tip, caudal musculature almost reaching the tail tip, spiracle with centripetal wall with the same length of the external wall, without ventral gap ………...….... *Physalaemus nattereri*

26. Unpigmented longitudinal stripe along the ventral edge of the tail musculature ….. 27

26'. Unpigmented longitudinal stripe along the ventral edge of the tail musculature absent …………………. *Rhinella cerradensis*

27. Spiracle opening on the midbody, eyes laterally directed ……. ....….. *Rhinella diptycha*

27'. Spiracle opening on the posterior third of the body, eyes dorsolaterally directed ……….... *Rhinella crucifer* x *R. ornata*

28. Nares large, with a large projection on marginal rim, spiracle long, centripetal wall not fused to body wall and with the same length of the external wall …...…......................................…...…… 29

28'. Nares small, without projection on marginal rim, spiracle short, centripetal wall fused to the body wall and longer than the external wall ……………...….................………….... 30

29. Marginal papillae triangular, submarginal papillae present, dorsal fin triangular …………………..……………….. *Boana raniceps*

29'. Marginal papillae conical, submarginal papillae absent, dorsal fin convex ………………………… *Boana albopunctata*

30. Oral disc not emarginate ……….……………………………... 31

30'. Oral disc emarginate ……………....………………………… 34

31. Vent tube long, medial, upper jaw sheath arc-shaped, submarginal papillae absent ……………...………………………………… 32

31'. Vent tube short, dextral, upper jaw sheath M-shaped, submarginal papillae shorter, laterally aggregate on the oral disc ……...……………………….........…… *Scinax rupestris*

32. Total length below 40 mm, marginal papillae not biseriate ventrally and not triseriate laterally, spiracle at the midline of the body at lateral view, pointed tail tip ……………...................................… 33

32'. Total length above 45 mm, marginal papillae biseriate ventrally and triseriate laterally, spiracle bellow the midline of the body at lateral view, rounded tail tip …………… *Leptodactylus latrans*

33. A2 teeth row without a medial gap, marginal papillae biseriate ventrally, snout rounded in lateral view …………… …...………................………………... *Leptodactylus podicipinus*

33'. A2 teeth row with a medial gap, marginal papillae uniseriate in alternate disposition, snout sloped in lateral view ……….. ……..… *Leptodactylus fuscus*

34. Oral disc emarginate ventrally ……….................................….... 35

 34’. Oral disc emarginate laterally ……….....…...…........….…... 36

35. Body elliptical in dorsal view, nares without projection on the marginal rim, five posterior rows of labial teeth …………………... .... *Bokermannohyla alvarengai*

 35’. Body ovoid in dorsal view, nares with a large projection on the marginal rim, four posterior rows of labial teeth ………………………....….….........…... *Boana* cf. *crepitans*

36. Intestinal tube switchback point located at to the center of abdominal region …... 37

 36’. Intestinal tube switchback point located at to the left of abdominal region ……………………... *Ameerega flavopicta*

37. Rounded tail tip 38

 37’. Pointed tail tip 41

38. Total length less than 50 mm, upper jaw sheath arc-shaped, submarginal papillae present …………......……………………... 39

 38’. Total length above 50 mm, upper jaw sheath M-shaped, submarginal papillae absent …………....…. *Odontophrynus* sp.

39. Presence of medial gap in the A2 teeth row ……......………... 40

 39’. Labial teeth row A2 not interrupted …… *Proceratophrys cururu*

40. Body elliptical in dorsal view, depressed in lateral view, maximum total length of 38 mm and lower dorsal fin ………………. .... *Odontophrynus cultripes*

 40’. Body ovoid in dorsal view, globular in lateral view, maximum total length of 48 mm and higher dorsal fin …...… ………..…........………… *Odontophrynus* sp. (cf. *juquinha*)

41. Nares closer to snout tip than eyes, directed anterolaterally, large gap in P1 teeth row .... *Proceratophrys salvatori*

 41’. Nares at equal distance from eyes and snout tip, not directed anterolaterally, small gap in P1 teeth row 42

42. Spiracle conspicuous, with centripetal wall not fused to the body wall, or with the distal margin free 43

 42’. Spiracle inconspicuous, with centripetal wall completely fused to the body wall ……..……… *Proceratophrys dibernardoi*

43. Spiracle positioned below body midline ………........….…... 44

 43’. Spiracle positioned above body midline ………………… ....… *Proceratophrys boiei*

44. Nares medium, folds on the lower labium absent, spiracle short .... *Proceratophrys* cf. *goyana*

 44’. Nares very large, two folds on the lower labium, spiracle medium .... *Proceratophrys* sp.

45. Posterior third of the tail not pigmented …...………...…..… 46

 45’. Posterior third of the tail heavily pigmented …………......... ....… *Scinax squalirostris*

46. Dorsal fin emerging closer to the eye ……………….........….... 47

 46’. Dorsal fin emerging posteriorly to the eye ………………..... 48

47. Snout rounded in lateral view, eyes large, jaw sheaths narrow .... *Scinax fuscomarginatus*

 47’. Snout sloped in lateral view, eyes medium, jaw sheaths wide .... *Scinax fuscovarius*

48. Spiracle conspicuous, nares with opening directed laterally, upper jaw sheath arc-shaped ……………...……………... *Scinax* gr. *ruber*

 48’. Spiracle inconspicuous, nares with opening directed anterolaterally, upper jaw sheath M-shaped …... *Scinax similis*

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Authors Contributions

Danusy Lopes Santos: Substantial contribution in the concept and design of the study; contribution to data collection; contribution to data analyses and interpretation; contribution to manuscript preparation; contribution to critical revision; adding intellectual content.

Renato Neves Feio: Contribution to data collection; contribution to data analyses and interpretation; contribution to critical revision; adding intellectual content.

Fausto Nomura: Substantial contribution in the concept and design of the study; contribution to data collection; contribution to data analyses and interpretation; contribution to manuscript preparation; contribution to critical revision; adding intellectual content.

Conflict of Interests

The authors declares that they have no conflict of interest related to the publication of this manuscript.

Data Availability

The morphometric raw data can be accessed at https://doi.org/10.48331/scielodata.HI0HTL

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