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## New species of the *Rhinella crucifer* group (Anura, Bufonidae) from the Brazilian Cerrado

WILIAN VAZ-SILVA<sup>1,2,5</sup>, PAULA HANNA VALDUJO<sup>3</sup> & JOSÉ P. POMBAL JR.<sup>4</sup>

<sup>1</sup> Departamento de Ciências Biológicas, Centro Universitário de Goiás – Uni-Anhanguera, Rua Professor Lázaro Costa, 456, CEP: 74.415-450 Goiânia, GO, Brazil.

<sup>2</sup> Laboratório de Genética e Biodiversidade, Departamento de Biologia, Instituto de Ciências Biológicas, Universidade Federal de Goiás, Campus Samambaia, Cx. Postal 131 CEP: 74.001-970, Goiânia, GO, Brazil.

<sup>3</sup> Departamento de Ecologia, Universidade de São Paulo. Rua do Matão, travessa 14. CEP: 05508-900, São Paulo, SP, Brazil.

<sup>4</sup> Universidade Federal do Rio de Janeiro, Departamento de Vertebrados, Museu Nacional, Quinta da Boa Vista, CEP: 20940-040, Rio de Janeiro, RJ, Brazil.

<sup>5</sup> Corresponding author: E-mail: herpetovaz@gmail.com

### Abstract

A new species of *Rhinella* of Central Brazil from the *Rhinella crucifer* group is described. *Rhinella inopina* sp. nov. is restricted to the disjunct Seasonal Tropical Dry Forests enclaves in the western Cerrado biome. The new species is characterized mainly by head wider than long, shape of parotoid gland, and oblique arrangement of the parotoid gland. Data on natural history and distribution are also presented.

**Key words:** *Rhinella crucifer* group, Seasonally Dry Forest, Cerrado, Central Brazil

### Introduction

The cosmopolitan Bufonidae family (true toads) presented currently 528 species. The second most diverse genus of Bufonidae, *Rhinella* Fitzinger 1826, comprises 77 species, distributed in the Neotropics and some species were introduced in several world locations (Frost 2011). Although the taxonomy and phylogeny of the family Bufonidae, had several changes in the past few years (e.g. Frost *et al.* 2006; Chaparro *et al.* 2007), composition of major phenetic groups of *Rhinella* have remained largely unchanged (Pramuk 2006; Maciel *et al.* 2007; Narvaes & Rodrigues 2009).

Duellman and Schulte (1992) and Baldissera *et al.* (2004) defined morphologically the *Rhinella crucifer* species group based on osteological and external morphological characters. *Rhinella crucifer* was considered a species complex with an extensive geographical distribution (Haddad & Sazima 1992), since the end of century XIX, when many formerly recognized species were synonymized with *R. crucifer*. Baldissera *et al.* (2004) revised the *Rhinella crucifer* species group and redefined the group consisting of five species: *Rhinella crucifer* (Wied-Neuwied 1821), *Rhinella ornata* (Spix 1824), *Rhinella henseli* (A. Lutz 1934), *Rhinella abei* (Baldissera, Caramaschi & Haddad 2004) and *Rhinella pombali* (Baldissera, Caramaschi & Haddad 2004). The *Rhinella crucifer* species group is distributed throughout the Atlantic Rain Forest from State of Ceará to the State of Rio Grande do Sul and extending west to the states of Minas Gerais and São Paulo, Brazil, as well as to northeastern Argentina (Baldissera *et al.* 2004; Frost 2011).

Herein we describe a new species of *Rhinella* assigned to the *Rhinella crucifer* species group based on evidence of external morphological characters such as head wider than long, shape of parotoid gland, and oblique arrangement of the parotoid gland. The new species has the inland most distribution in the group. We also provide remarks on natural history, distribution, and conservation of the species.

## Material and methods

Specimens examined for description and comparisons are deposited in Museu Nacional, Rio de Janeiro, Brazil (MNRJ) and Coleção Herpetológica da Universidade de Brasília, Brasília, Brazil (CHUNB). Twenty-three external morphologic characters were measured followed Baldissera *et al.* (2004): snout to vent length (SVL); head length (HL); head width (HW); inter-nostril distance (IND); eye to nostril distance (END); eye diameter (ED); upper eyelid width (UEW); interorbital distance (IOD); eye border to upper maxilla distance (EMD); canthal ridge length (CRL); supratympanic ridge length (STR); eye to tympanum distance (ETD); tympanum diameter (TD); tympanum height (TH); inter-parotoid distance (IPD); forearm length (FAR); upper arm length (UAR); inner carpal tubercle length (ICTL); inner carpal tubercle width (ICTW); hand length (HAL); armpit-groin distance (AGD); thigh length (THL); tibia length (TBL); tarsal length (TAL - distance between the articulation of tarsus with tibia and the base of the external metatarsal tubercle). We also measured the distances between parotoid glands both anteriorly (ANP) and posteriorly (POP). The measurements were conducted by using a digital caliper to the nearest 0.1mm. For comparison with other species, we use the species diagnoses of the *Rhinella crucifer*, provided by Duellman and Schulte (1992) and Baldissera *et al.* (2004). Cranial crests standardization follows Narvaes & Rodrigues (2009).

## Results

### *Rhinella inopina* sp. nov.

(Figs. 1–2)

*Rhinella* cf. *pombali* - Valdujo *et al.* 2009: 905.

**Holotype.** Brazil, State of Goiás, São Domingos municipality (13°23'S; 46°20'W), MNRJ 75231, adult male, S. P. Andrade and E. P. Vitor col., on 2 August 2010.

**Paratypes.** Brazil, State of Goiás, São Domingos municipality (13°23'S; 46°20'W), MNRJ 53069, juvenile, F. F. Gontijo col., 28 January 2007; MNRJ 63752, adult female, R. M. F. Rodrigues col., 29 July 2009; MNRJ 67272, juvenile, S. P. Andrade and E. P. Vitor col., 09 May 2010; MNRJ 67273, juvenile, S. P. Andrade and E. P. Vitor col., 10 May 2010; MNRJ 75232, juvenile, S. P. Andrade and E. P. Vitor col., 20 July 2010; MNRJ 75234 and MNRJ 75236, adult males, MNRJ 75235, adult female, MNRJ 75233, juvenile, S. P. Andrade and E. P. Vitor col., 25 July 2010.

**Diagnosis.** A member of *Rhinella crucifer* species group based on the combination of morphological characters proposed by Duellman and Schulte (1992) and Baldissera *et al.* (2004) such as: presence of a row of glandular keratinized tubercles at the corners of mouth; absence of the pre-ocular ridge in the smaller specimens, but always present and strongly elevated in the larger ones; a row of glandular keratinized tubercles following the lateral edges of the body, with the first tubercle united or not to the parotoid gland; parotoid gland elliptical in dorsal view, triangular in lateral view and elongate; tympanum visible, covered by a tegumentary fold on posterior region; snout rounded to mucronate in dorsal view; and, dorsal integument varying from extremely granular to smooth. *Rhinella inopina* sp. nov. is characterized by the following combination of features: 1) largest size for the group (SVL 102.6 mm in males and 136.1 mm in females); 2) head wider than long (Fig. 2A); 3) snout rounded to mucronate in dorsal view (Fig. 2A); 4) snout rounded and elongated in lateral view (Fig. 2B); 5) parotoid glands overhanging the lateral edges of body dorsally (Fig. 3); 6) in life and preservative yellow spots on flanks from posterior surface on parotoid gland to inguinal region, posterior surface of thighs and near the cloacae; 7) vertebral line absent or very thin (Fig. 3); 8) a conspicuous fringe on the ventral surface of the tarsus; 9) parotoid gland elongated (Fig. 3); 10) oblique arrangement of the parotoid gland in relation the midline of the body (Fig. 1).

**Comparisons with other species of the *Rhinella crucifer* species group.** The new species is distinguished from *Rhinella ornata* and *Rhinella abei* by the presence of yellow marks on flanks (in some specimens), around the cloacae and on the posterior surface of thighs (vs. absence), parotoid glands overhanging the lateral edges of body dorsally (vs. not overhanging), elongate parotoid gland in lateral view (vs. rounded), and presence of a fringe on the ventral surface of tarsus (vs. a row of small tubercles); from *Rhinella henseli* by the parotoid glands overhanging the lateral edges of body dorsally (vs. not overhanging), and presence of a fringe on the ventral surface of tarsus

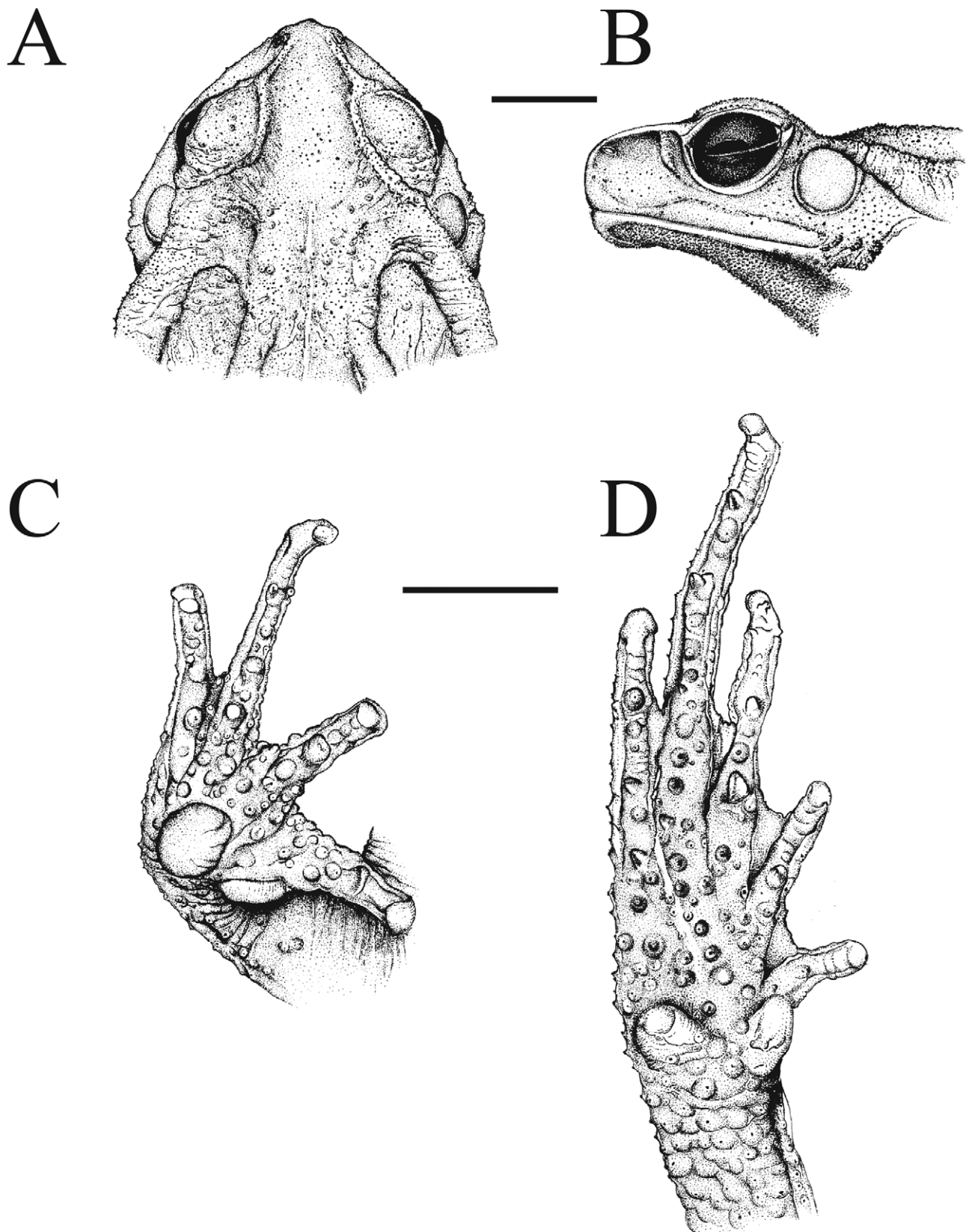
(vs. a row of small tubercles); from *Rhinella pombali* by elongated snout in lateral view (vs. short snout), and elongate parotoid gland in lateral view (vs. rounded); from *Rhinella crucifer* by the presence of yellow marks on flanks, around the cloacae and on the posterior surface of thighs (vs. only around the cloaca and thighs), and elongate parotoid gland in lateral view (vs. rounded). *Rhinella inopina* sp. nov. differs from the all other species of *R. crucifer* group by having an oblique arrangement of the parotoid gland in relation to midline of the body (ANP/POP: *R. inopina* = 0.72; *R. ornata* = 0.68; *R. abei* = 0.67; *R. henseli* = 0.59; *R. pombali* = 0.66; *R. crucifer* = 0.67).



**FIGURE 1.** *Rhinella inopina* sp. nov.. Dorsal (A) and ventral (B) views of the holotype, MNRJ 75231, adult male, SVL 92.5 mm. Photograph by I. Nunes.

**Description of holotype.** An adult male (Fig. 1A–B, Fig. 2A–D) with body robust; head wider than long; head width 37% of SVL; snout rounded in dorsal and lateral views; *canthus rostralis* well defined by canthal crest, almost straight; loreal region slightly concave; nostrils lateral, protuberant, slightly directed backwards, near to the snout tip; inter-nostril distance smaller than the eye-to-nostril distance (IND/END = 0.90); eye diameter and upper eyelid width larger than the tympanum diameter (ED/TD = 1.23; UEW/TD = 1.07); eye-to-nostril distance smaller than eye diameter (END/ED = 0.78), upper eyelid width (END/UEW = 0.89), and tympanum diameter (END/TD = 0.96); eye diameter larger than the upper eyelid width (ED/UEW = 1.14) and tympanum diameter (ED/TD = 1.23); upper eyelid width 51% of interorbital distance; preorbital and supraorbital crests developed; parietal crest absent; postorbital crest weakly developed; tympanum large, vertically elliptical, with a distinct annulus; horizontal diameter of tympanum 90% of the vertical diameter; parotoid glands, in dorsal view, medium size, elliptical (on right side more elongated), in lateral view triangular connected with the postorbital crest; parotoid gland length larger than the postorbital crest length; small V-shaped incision on maxilar symphysis; vocal sac not visible externally; vocal slits, sideways to the tongue; choane oval, small, lateral, widely separated; tongue large, two times long as wide, free and not notched behind. Forearms robust, arms slender; hand with long and slender fingers, not webbed, in crescent order of size, II  $\approx$  IV < I < III; lateral fringes poorly developed, formed by a line of spinulose tubercles, absence on inner surface of finger I; finger tips slightly expanded; palmar tubercle large, nearly ovoid, smooth; the nar tubercle approximately one third of the palmar tubercle, ovoid, smooth; subarticular tubercles developed, protruding, single, except by divided distal tubercle on the III finger; numerous supernumerary tubercles varied in size, distinct, rounded, irregularly distributed on the ventral surfaces of hand and fingers; keratinous small spicules on the upper surfaces of the finger I and part of finger II. Legs moderately robust; thigh length slightly smaller than tibia length (THL/TBL = 0.95); sum of tibia and thigh lengths 84% of SVL; tarsus-foot length larger than the tibia





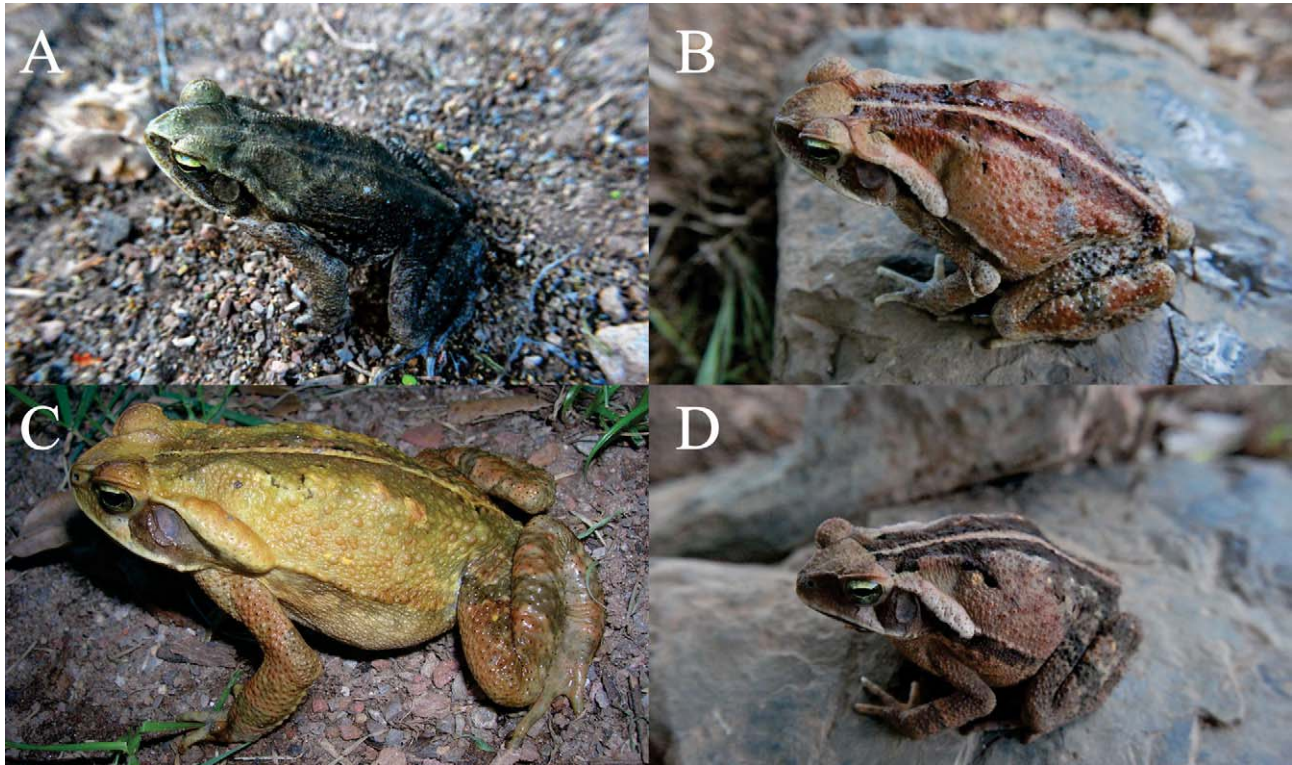
**FIGURE 2.** *Rhinella inopina* sp. nov.. Dorsal (A) and lateral (B) views of the head (scale bar =15 mm), palmar (C) plantar views (D) (scale bar =10 mm) of the holotype (MNRJ 75231).

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and thigh lengths, 58% of SVL; outer metatarsal tubercle small, rounded; inner metatarsal tubercle small, elliptical, with the external border free; foot medium-size, with robust toes; toes in increasing order of size, I<II<III  $\approx$  V<IV; webbing moderately developed, plantar formula I<sup>2</sup>-2II1-3III2<sup>+</sup>-4IV4-2<sup>+</sup>V; small rounded bulbs toe tips, smooth, posteriorly delimited on ventral surfaces by a groove; subarticular tubercles small, conical, unique; supranumerary tubercles distinct, rounded or conical, unequal in size, irregularly distributed on the ventral surfaces of foot and toes. Skin on dorsum, flanks, and limbs with many irregularly distributed round warts; ventral surfaces finely granulose; warts of dorsum, limbs and granules on throat with many keratinized tips.



**FIGURE 3.** *Rhinella inopina* sp. nov. in life from type-locality. (A) Holotype (MNRJ75231, SVL = 92.5mm), an adult male; (B) adult female (MNRJ75233, SVL = 67.0mm); (C) juvenile (MNRJ53069, SVL = 73.3mm); (D) juvenile (MNRJ75232, SVL = 63.5mm). Photographs by S. P. Andrade (A, B and D) and by W. Vaz-Silva (C).

**Color of holotype in preservative.** General color of body grayish light olive; a tiny vertebral light gray line; a light gray bar on tarsus; some light olive small elongated blotches and spots on the thighs; keratinized spicules on brown warts, tympanum light brown; iris silver. Under surfaces cream olive, throat slightly darker than belly; tubercles on hand palms and sole of feet brown.

**Measurements of holotype (in mm).** Snout-vent length 92.5; head length 26.3; head width 34.3; inter-narial distance 5.5.; eye to nostril distance 6.1; eye diameter 7.8; upper eyelid width 6.8; interorbital distance 13.2; eye border to upper maxilla distance 3.2; canthal ridge length 7.8; supratympanic ridge length 5.6; eye to tympanum distance 2.2; tympanum diameter 6.3; tympanum height 7.0; inter-parotoid distance 24.2; forearm length 22.0; upper arm length 28.7; inner carpal tubercle length 4.2; inner carpal tubercle width 2.5; hand length 11.3; armpit-groin distance 33.3; thigh length 38.0; tibia length 40.0; tarsal length 21.1.

**Variation.** The variations in measurements are summarized in Table 1. *Rhinella inopina* has typical color polymorphism found in the species of the *Rhinella crucifer* group (e.g. Baldissera *et al.* 2004). In life, color pattern varies from uniform yellowish-cream to brown, with sparse dark spots adjacent to vertebral line, which may be absent. Females have more numerous yellowish flank blotches than males. Males usually have uniform color pattern, whereas juveniles tend to be blotchy. Discontinuous dark stripes on the internal surface of thighs more frequent in juveniles (Fig. 3). Color in preservative is similar to color in life, except the yellow color is replaced with cream.

**Etymology.** Inopinus, an adjective, is a Latin word, meaning unexpected. The name is appropriate because is the most inland species of the *Rhinella crucifer* species group. The other species known of the *Rhinella crucifer* species group are found in Atlantic Forest Biome, except for *R. pombali* which is distributed in the domains of the Central Brazilian Plateau, in the transition from the Atlantic Rain Forest to the Cerrado (Baldissera *et al.* 2004).



TABLE 1. Measurements (in millimeters) of *Rhinella inopina* sp. nov. (n=10).

Character	X	Range Male (n=6)	SD	X	Range Female (n=4)	SD
SVL	88.5	84.2–102.6	8.4	113.1	97.1–136.1	18.5
HL	25.3	23.7–30.9	3.4	33.9	30.3–40.2	5.8
HW	31.3	28.7–36.6	3.6	41.9	37.4–47.9	6.3
IND	5.2	4.1–6.4	0.9	6.8	5.7–8.1	1.4
END	5.6	4.5–5.6	0.9	7.4	6.4–9.2	1.3
ED	6.6	5.7–8.0	1.1	7.2	7.1–7.9	0.4
UEW	6.2	5.1–6.6	0.7	7.6	6.6–8.8	1.2
IOD	11.8	11.4–13.4	1.2	15.2	13.5–18.4	2.5
EMD	3.8	3.6–4.7	0.6	4.7	4.1–5.5	0.8
CRL	7.1	5.7–7.9	0.9	8.9	8.2–9.5	0.6
STR	5.6	5.5–6.5	0.6	7.4	5.9–8.7	1.3
ETD	2.5	2.4–3.0	0.3	3.4	3.4–3.9	0.5
TD	5.2	4.8–6.4	0.9	7.2	6.2–7.3	1.0
TH	6.2	5.3–7.8	1.0	7.9	7.1–9.1	0.9
IPD	22.5	19.3–23.8	2.1	27.5	22.7–31.0	4.0
FAR	20.3	18.2–24.2	2.4	24.9	21.3–27.6	2.9
UAR	27.7	25.8–30.9	1.9	33.4	26.8–40.3	5.6
ICTW	2.5	2.4–3.1	0.4	3.6	2.8–4.5	0.9
ICTL	4.1	3.8–5.3	0.7	5.3	4.7–6.1	0.7
HAL	9.8	8.6–10.8	1.1	12.0	12.0–13.1	1.2
AGD	32.0	34.4–37.5	4.8	46.3	41.2–62.2	12.5
THL	37.3	35.1–44.4	3.8	44.7	37.9–49.7	5.8
TBL	37.9	35.0–43.7	3.3	45.1	40.3–50.2	4.7
TAL	19.9	19.0–22.7	1.7	24.2	21.9–28.0	3.0

**Natural History.** Adult males were found calling during a rainy night, after 0h00, in November 2008. It was one of the first heavy rains of the rainy season. The toads were found in the water very close to the margins of a temporary pond next to São Desidério river, in a valley between two calcareous rock outcrops, a location known as Pedra do Santo, municipality of São Desidério, State of Bahia. One amplexed couple was found during the same night and another female was found four days before during a drier night in the same location. Other species calling from the same pond were *Hypsiboas crepitans* (Wied-Neuwied 1824), *Dendropsophus nanus* (Boulenger 1889), *Leptodactylus mystaceus* (Spix 1824), and *Leptodactylus* cf. *chaquensis* Cei 1950. At Sítio d'Abadia juvenile specimens were captured close to Corrente river in pitfall traps in deciduous forest dominated by *Acacia farnesiana* (L.) Willd., a tree species typical of Caatinga biome. At São Domingos adult specimens were collected in areas of gallery forest of the São Domingos and Galheiros rivers, and Dry Forest with calcareous rock outcrop (Fig. 4). During the dry season specimens were found inside caves.

**Geographic Distribution.** *Rhinella inopina* has been found in São Domingos municipality (type locality) and Sítio d'Abadia municipality, in Goiás State, Combinado municipality and Aurora do Tocantins municipality, in Tocantins State and São Desidério municipality, in Bahia State (Fig. 5).

**Remarks.** The Cerrado Biome covers about 2 million km<sup>2</sup>, representing 22% of Brazil, and small areas in eastern Bolivia and northwestern Paraguay. It extends from the southern borders of the Amazonian forest to areas in the southern States of São Paulo and Paraná. The distribution of the Cerrado is coincident with the plateau of central Brazil (Oliveira-Filho & Ratter 2002). *Rhinella inopina* occurs in the Cerrado biome, having the most inland distribution within the *R. crucifer* group, and it is apparently restricted to the disjunct Seasonal Tropical Dry Forests enclaves in western Cerrado.



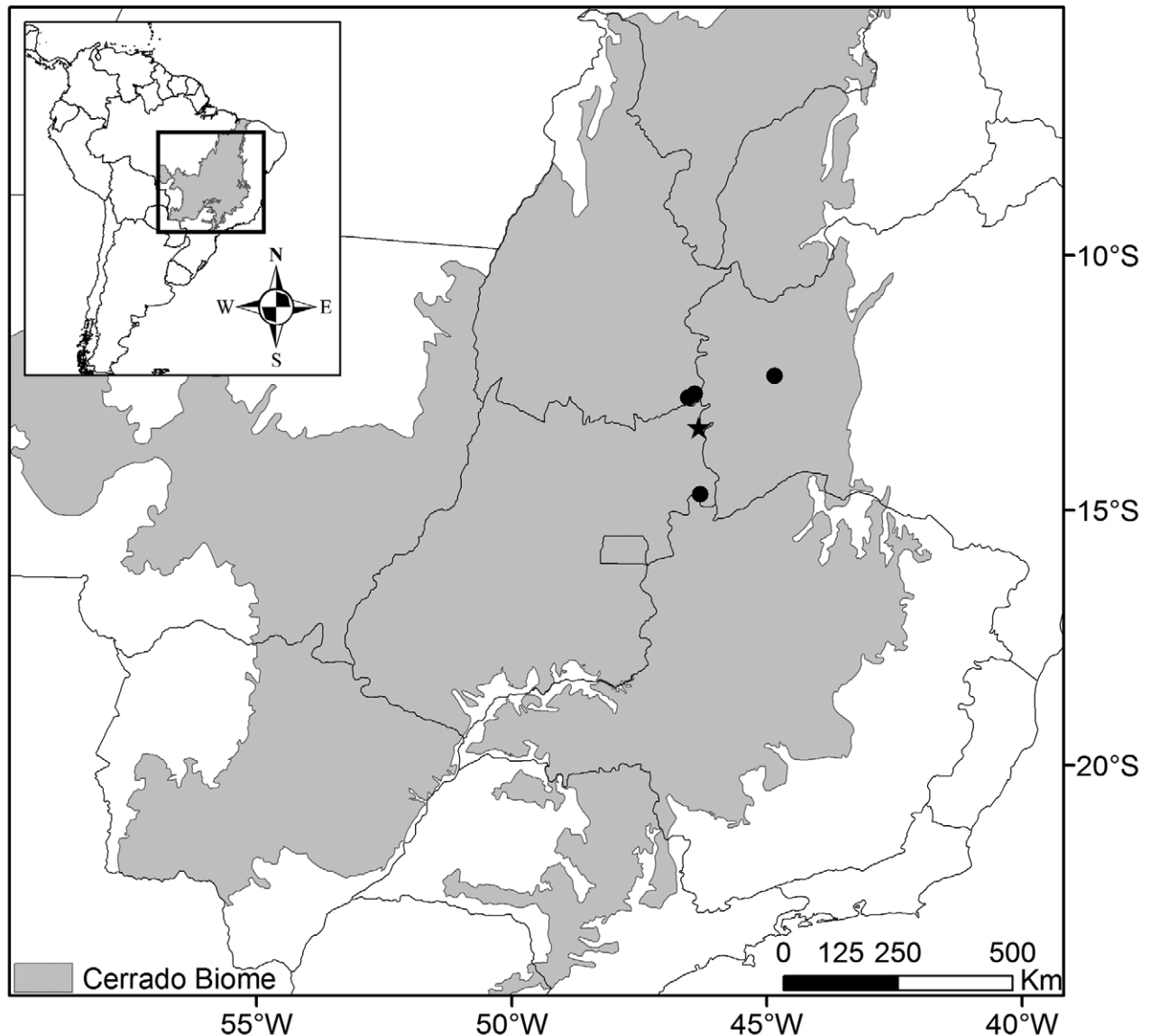
**FIGURE 4.** Dry Forest with calcareous rock outcrop in the São Domingos municipality, state of Goiás, type-locality of *Rhinella inopina* sp. nov.. Photograph by D. Sampaio.

The *Rhinella crucifer* species group is widely distributed in Atlantic Forest. Only *R. pombali*, *R. crucifer*, and *R. inopina* are known to occur in the transition zones or within the Cerrado biome (Baldissera *et al.* 2004; Thomé *et al.* 2010). *Rhinella inopina* is allopatric to all other species in the group, and its distribution is associated with forest vegetation types in eastern Cerrado, such as seasonal tropical dry forest, semideciduous forest and gallery forest in karstic relief and limestone areas, all in the transition between Cerrado and Caatinga biomes. So far, we have detected five populations of this species that depend upon the conservation of forest vegetation in eastern Cerrado to persist.

### Acknowledgements

We are grateful to S. P. Andrade and E. Vitor that collected specimens of type-series and CTE Fauna Team assisted in fieldwork. We thank N. M. Maciel, M. Vences, and W. R. Heyer for comments on the manuscript. G.R. Colli (CHUNB) loaned specimens under his care; P.R. Nascimento for the line drawings; R. L. Silveira and N. Maciel for help in plates. Centro Tecnológico de Engenharia – CTE, in charge of the Faunal Monitoring Program and Environmental Programs of the PCH São Domingos II and PCH Galheiros in the São Domingos municipality, provided some additional specimens. We thank Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq), Fundação Carlos Chagas de Amparo à Pesquisa do Estado do Rio de Janeiro (FAPERJ), Fundação de Amparo à Pesquisa do Estado de Goiás (FAPEG), and Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP, 06/58011-4) for financial support. Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio) issued collecting permits.





**FIGURE 5.** Map with known geographic distribution (black circles) of *Rhinella inopina* sp. nov.. Black star represents São Domingos municipality (type locality).

## References

- Baldissera Jr., F.A.B., Caramaschi, U. & Haddad, C.F.B. (2004) Review of the *Bufo crucifer* species group, with descriptions of two new related species (Amphibia, Anura, Bufonidae). *Arquivos do Museu Nacional*, 62, 255–282.
- Chaparro, J.C., Pramuk, J.B. & Gluesenkamp, A.G. (2007) A new species of arboreal *Rhinella* (Anura: Bufonidae) from cloud forest of southeastern Peru. *Herpetologica*, 63, 203–212.
- Duellman, W.E. & Schulte, R. (1992) Description of a new species of *Bufo* from Northern Peru with comments on phenetic groups of South American toads (Anura: Bufonidae). *Copeia*, 1992, 162–172.
- Frost, D., Grant, T., Faivovich, J., Bain, R., Haas, A., Haddad, C.F.B., De Sá, R.O., Channing, A., Wilkinson, M., Donnellan, S.C., Raxworthy, C.J., Campbell, J.A., Blotto, B.L., Moler, P., Drewes, R.C., Nussbaum, R.A., Lynch, J.D., Green, D.M. & Wheeler, W.C. (2006) The amphibian tree of life. *Bulletin of the American Museum of Natural History*, 297, 1–370.
- Frost, D.R. (2011) *Amphibian Species of the World: an Online Reference*. V.5.4 (08 April 2010). American Museum of Natural History, New York. Available from: <http://research.amnh.org/herpetology/amphibia/index.html>. (accessed 20 April 2011).
- Haddad, C.F.B. & Sazima, I. (1992) Anfíbios anuros da Serra do Japi. In: Morellato, L.P.C. (Org.). *História Natural da Serra do Japi: Ecologia e Preservação de uma Área Florestal no Sudeste do Brasil*. Campinas: Editora da UNICAMP, pp. 188–211.

- Oliveira-Filho, A.T. & Ratter, J.A. (2002) Vegetation physiognomies and woody flora of the Cerrado Biome. In: Oliveira, P.S. and Marquis, R.J. (Eds.). *The Cerrados of Brazil: Ecology and Natural History of a Neotropical Savanna*. Columbia University Press, New York, USA, pp. 91–120.
- Maciel, N.M., Brandão, R.A., Campos, L.A. & Sebben, A. (2007) A large new species of *Rhinella* (Anura: Bufonidae) from Cerrado of Brazil. *Zootaxa*, 1627, 23–39.
- Narvaes, P. & Rodrigues, M.T. (2009) Taxonomic revision of *Rhinella granulosa* species group (Amphibia, Anura, Bufonidae), with a description of a new species. *Arquivos de Zoologia*, 40, 1–73.
- Pramuk, J.B. (2006) Phylogeny of South American *Bufo* (Anura: Bufonidae) inferred from combined evidence. *Zoological Journal of the Linnean Society*, 146, 407–452.
- Thomé, M.T.C., Zamudio, K.R., Giovanelli, J.G.R., Haddad, C.F.B., Baldissera Jr., F.A. & Alexandrino, J. (2010) Phylogeography of endemic toads and post-Pliocene persistence of the Brazilian Atlantic Forest. *Molecular Phylogenetics and Evolution* 55, 1018–1031.
- Valdujo, P.H., Recorder, R.S., Vasconcellos, M.M. & Portella, A.S. (2009) Amphibia, Anura, São Desidério western Bahia uplands, northeastern Brazil. *Check List*, 5, 903–911.

### Appendix 1. Specimens examined

- Rhinella inopina* – BRAZIL: GOIÁS: Sítio d'Abadia (MNRJ 51741, MNRJ 23067–68). BAHIA: São Desidério (CHUNB 51110–11, CHUNB 51117).
- Rhinella pombali* – BRAZIL: MINAS GERAIS: Faria Lemos (MNRJ 41608–13, MNRJ 43631–33); Catas Altas, Caraça (MNRJ 38328–29, MNRJ 49689–95); Paraíso, Espera Feliz (MNRJ 43466–67); Carangola (MNRJ 41552).
- Rhinella crucifer* – BRAZIL: BAHIA: Salvador (MNRJ 45464); Juçari (MNRJ 43833–34); Prado (MNRJ 21927); Trancoso (MNRJ 45785); Porto Seguro (MNRJ 38920–21); Nova Viçosa (MNRJ 22327–28); Ilhéus (MNRJ 21899). ESPÍRITO SANTO: Santa Teresa (MNRJ 30099). SERGIPE: Itaporanga D'Ajuda (MNRJ 46757–58). ALAGOAS: Passo de Camaragibe (MNRJ 9876).
- Rhinella henseli* – BRAZIL: RIO GRANDE DO SUL: Mato Castelhana (MNRJ 32998–33012).
- Rhinella ornata* – BRAZIL: RIO DE JANEIRO: Tanguá (MNRJ 51251–52, MNRJ 51255, MNRJ 51260–61, MNRJ 51264); Nova Friburgo (MNRJ 61991–92, MNRJ 61995–96, MNRJ 61998–99, MNRJ 62002, MNRJ 62005–07); Duque de Caxias (MNRJ 65341–44).
- Rhinella abei* – BRAZIL: SANTA CATARINA: Florianópolis (MNRJ 24963 (holotype), MNRJ24964–67 (paratypes)); Brusque (MNRJ 44332–33); Guatambú (MNRJ 48399). PARANÁ: Guaraqueçaba (MNRJ 22243–46); Tijucas do Sul (MNRJ 31262).