

## A new species of the *Bokermannohyla circumdata* group (Amphibia: Anura: Hylidae) from Chapada Diamantina, State of Bahia, Brazil

MARCELO FELGUEIRAS NAPOLI<sup>1</sup> & FLORA ACUÑA JUNCA<sup>2</sup>

<sup>1</sup>Museu de Zoologia, Departamento de Zoologia, Instituto de Biologia, Universidade Federal da Bahia, Campus Universitário, Rua Barão de Geremoabo, Ondina, 40170-290 Salvador, Bahia, Brazil. Associate Researcher; Departamento de Vertebrados, Museu Nacional/Universidade Federal do Rio de Janeiro, Quinta da Boa Vista, São Cristóvão, 20940-040 Rio de Janeiro, Rio de Janeiro, Brazil. E-mail: napoli@ufba.br

<sup>2</sup>Departamento de Ciências Biológicas, Universidade Estadual de Feira de Santana, Campus Universitário, Avenida Universitária, 44031-060 Feira de Santana, Bahia, Brazil. E-mail: fjunca@libra.uefs.br

### Abstract

A new species of the *Bokermannohyla circumdata* group, *B. diamantina* **sp. nov.**, is described from Serra dos Barbados, Municipality of Abaíra, State of Bahia, Brazil. This locality belongs to Chapada Diamantina, a semiarid region in central Bahia. This is the first record of a species of the *B. circumdata* group from the Brazilian semiarid. *Bokermannohyla diamantina* is diagnosed by the medium size (snout-vent length 47.0–51.7 mm in adult specimens); head length 2.8–2.9 times smaller than snout-vent length; tympanum medium-sized, its diameter 1.3–1.5 times smaller than eye diameter (tympanum diameter/snout-vent length 0.07); thigh and tibia lengths 0.48–0.52 and 0.49–0.51 of snout-vent length, respectively; dorsum medium to blackish brown, with weak transverse dark brown bars; flanks, anterior, and posterior surfaces of thighs with dark transverse brown stripes, lacking additional thin stripes between them; distinct vocal slits in adult males; advertisement call with 2–4 notes, and dominant frequency from 0.39–0.56 kHz.

**Key words:** Chapada Diamantina; *Bokermannohyla diamantina* **sp. nov.**; *Bokermannohyla circumdata* species group; advertisement call; Northeastern Brazil

**Resumo:** Uma nova espécie do grupo de *Bokermannohyla circumdata*, *B. diamantina* **sp. nov.**, é descrita para a Serra dos Barbados, Município de Abaíra, Estado da Bahia, Brasil. Esta localidade pertence à Chapada Diamantina, região semi-árida localizada na porção central da Bahia. Esta é a primeira ocorrência de uma espécie do grupo de *B. circumdata* no semi-árido brasileiro. *Bokermannohyla diamantina* é diagnosticada pelo tamanho médio (comprimento rostro-cloacal 47,0–51,7 mm em espécimes adultos); comprimento da cabeça 2,8–2,9 vezes menor que o

comprimento rostro-cloacal; tímpano de tamanho médio, seu diâmetro 1,2–1,5 vezes menor que o diâmetro do olho (diâmetro do tímpano/comprimento rostro-cloacal 0,07–0,08); comprimentos da coxa e tíbia 0,48–0,52 e 0,48–0,51 do comprimento rostro-cloacal, respectivamente; dorso castanho médio a enegrecido, com faixas transversais castanho escuro pouco distintas; flancos e superfícies anterior e posterior das coxas com faixas transversais castanho escuro, sem faixas finas adicionais entre elas; fendas vocais distintas em machos adultos; canto de anúncio com 2–4 notas e frequência dominante entre 0,39–0,56 kHz.

**Palavras-chave:** Chapada Diamantina; *Bokermannohyla diamantina* **sp. nov.**; espécie do grupo de *Bokermannohyla circumdata*; canto de anúncio; Nordeste do Brasil

## Introduction

The *Bokermannohyla circumdata* species group comprises 15 species distributed mainly over Brazilian mountain stream habitats in Atlantic Tropical Forests. The species currently included in the group are the following (Napoli and Caramaschi 2004; Napoli 2005): *B. ahenea* (Napoli and Caramaschi, 2004); *B. astartea* (Bokermann, 1967); *B. caramaschii* (Napoli, 2005); *B. carvalhoi* (Peixoto, 1981); *B. circumdata* (Cope, 1870); *B. feioi* (Napoli and Caramaschi, 2004); *B. gouveai* (Peixoto and Cruz, 1992); *B. hylax* (Heyer, 1985); *B. ibitipoca* (Caramaschi and Feio, 1990); *B. izecksohni* (Jim and Caramaschi, 1979); *B. lucianae* (Napoli and Pimenta, 2003); *B. luctuosa* (Pombal and Haddad, 1993); *B. nanuzae* (Bokermann and Sazima, 1973); *B. ravida* (Caramaschi, Napoli and Bernardes, 2001); *B. sazimai* (Cardoso and Andrade, 1982). These species share the following characters: dorsum brown (live and preserved specimens), simple (not dichotomized) transverse bands on the posterior surface of thighs, single (not bifid) large and sharp prepollex, and hypertrophied forearm in adult males.

During the project “Chapada Diamantina: Biodiversidade” (Projeto de Conservação e Utilização Sustentável da Diversidade Biológica Brasileira–PROBIO/Ministério do Meio Ambiente–MMA) the second author surveyed for anurans in Serra dos Barbados, one of the mountain ranges comprised in a semiarid region known as Chapada Diamantina, located in the Municipality of Abaíra, State of Bahia, Brazil, and found a new species belonging to the *B. circumdata* group, described herein.

## Material and Methods

The specimens used in the description are housed in (acronyms in parenthesis): Coleção Herpetológica do Museu de Zoologia da Universidade Estadual de Feira de Santana (MZUEFS), and Museu de Zoologia da Universidade Federal da Bahia (UFBA). For additional specimens examined see Caramaschi et al. (2001), Napoli and Pimenta (2003), Napoli and Caramaschi (2004), and Napoli (2005).

The fifteen morphometric characters used in the account followed Napoli (2005), and are in millimeters: SVL (snout-vent length), HL (head length), HW (head width), ED (eye diameter), UEW (upper eyelid width), IOD (interorbital distance), IND (internarial distance), END (eye-nostril distance), NSD (nostril to tip of snout distance), TD (tympanum diameter), THL (thigh length), TL (tibia length), FL (foot length), 3FD (third finger disk diameter), and 4TD (fourth toe disk diameter). Measurements were taken with the help of an ocular micrometer in an Olympus stereomicroscope, except for SVL, HL, HW, THL, TL, and FL, which were measured with a vernier caliper. Drawings were made using a Leica MZ6 stereomicroscope with a drawing tube. Webbing formula notation follows Savage and Heyer (1967), as modified by Myers and Duellman (1982).

Advertisement calls of three males were recorded in Serra dos Barbados, Chapada Diamantina, Bahia, Brazil (MZUEFS 1785, 14 February 2004; MZUEFS 1799, 15 February 2004; a third specimen, not captured, 14 February 2004). The distance between the first and the third male was approximately 2–3 meters. The vocalizations were recorded with a SONY WM-D6 Digital Audio Track (DAT) with a directional microphone. Advertisement calls were analyzed using Canary 1.2.4 software. The vocalizations were digitalized with a sampling frequency of 44.1 kHz and a sample size of 16 bits. The audiospectrograms were made using Fast Fourier Transform length (FFT) of 1024 points and window hamming. The terminology used for the description of the advertisement call follows Duellman and Trueb (1986).

***Bokermannohyla diamantina* Napoli and Juncá, sp. nov.**

(Figs. 1–3)

Holotype. MZUEFS 1784, adult male, from Riacho do Tijuquinha, Serra dos Barbados, District of Catolés de Cima, Municipality of Abaíra (13°16'08"S; 41°54'39"W; 1700 m altitude), State of Bahia, Brazil, collected by Flora Acuña Juncá, on 14–15 February 2004.

Paratopotypes. Adult males: MZUEFS 1785 and UFBA 5053, collected with holotype; UFBA 5054, on 12 February 2004; MZUEFS 1781, on 14 February 2004; UFBA 5055, on 15 February 2004. Adult female: MZUEFS 1798, on 14–15 February 2004. All collected by Flora Acuña Juncá.

*Diagnosis*

Species characterized by the following combination of traits: medium size (SVL 46.7–51.7 mm in adult specimens); head length 2.8–2.9 times smaller than SVL; tympanum medium-sized, its diameter 1.3–1.5 times smaller than eye diameter (TD/SVL 0.07–0.08); thigh and tibia lengths 0.48–0.52 and 0.49–0.51 of SVL, respectively; dorsum medium to blackish brown, with weak transverse dark brown bars; flanks, anterior, and posterior surfaces of thighs with dark transverse brown stripes, without additional thin stripes between them; vocal slits in adult males; advertisement call with 2–4 notes, and dominant frequencies from 0.39–0.56 kHz.



**FIGURE 1.** Holotype of *Bokermannohyla diamantina* sp. nov., MZUEFS 1784, adult male, SVL 51.7 mm.

#### *Comparison with other species*

*Bokermannohyla diamantina* (SVL 46.7–51.7 mm) is larger than *B. astartea*, *B. feioi*, *B. ibitipoca*, *B. nanuzae*, *B. sazimai* (combined species SVL 30.2–44.1 mm), and *B. ravida* (SVL 30.1–47.6 mm), but smaller than *B. caramaschii*, *B. carvalhoi*, *B. circumdata*, *B. gouveai*, *B. luctuosa* (combined species SVL 55.2–71.6 mm), and *B. hylax* (SVL 51.4–59.6 mm). The tympanum diameter of *B. diamantina* (TD/SVL 0.07–0.08) is smaller than in *B. caramaschii* and *B. luctuosa* (combined species TD/SVL 0.08–0.10), but larger than in *B. astartea*, *B. sazimai*, *B. ahenea*, *B. carvalhoi*, *B. feioi*, *B. lucianae* (combined species TD/SVL 0.04–0.06), *B. nanuzae*, *B. hylax*, and *B. ibitipoca* (combined species TD/SVL 0.05–0.07). The shorter head distinguishes *B. diamantina* (SVL/HL 2.8–2.9) from males of *B. astartea*, *B. hylax*, *B. izecksohni*, *B. lucianae*, and *B. ravida* (combined species SVL/HL 2.4–2.7). The narrower head distinguishes *B. diamantina* (SVL/HW 2.7–2.9) from males of *B. ravida* (SVL/HW 2.5–2.7). The shorter thigh and tibia lengths distinguish *B. diamantina* (THL/SVL 0.48–0.52; TL/SVL 0.49–0.51, respectively) from males of *B. izecksohni* (THL/SVL 0.53–0.55; TL/SVL 0.52–0.55, respectively). Dorsum blackish brown or with weak transverse dark brown stripes in *B. diamantina*, cream color in *B. ibitipoca* and *B. sazima*, the latter with reticulated thin brown stripes and random

brown dots over it; also, *B. gouveai*, *B. carvalhoi*, *B. ahenea*, and *B. astartea* have immaculate dorsa (the two latter with dorsal surfaces golden brown), and *B. nanuzae* lacks distinct transverse brown bars over it. A dorsolateral blackish brown stripe from tip of snout to inguinal region distinguishes *B. feioi* from *B. diamantina*, which lacks such stripe. Flanks, anterior, and posterior surfaces of thighs with dark transverse brown stripes in *B. diamantina*, they are immaculate in *B. nanuzae*, *B. feioi*, and *B. lucianae*, with thin and fragmented stripes in *B. carvalhoi*, and with thin brown stripes intercalated with transverse brown bars in *B. hylax*. The presence of vocal slits in adult males distinguishes *B. diamantina* from *B. caramaschii* and *B. izecksohni*, which lack such structures. The advertisement call distinguishes *B. diamantina* from all other species of the *B. circumdata* group for which such data is available (see below).

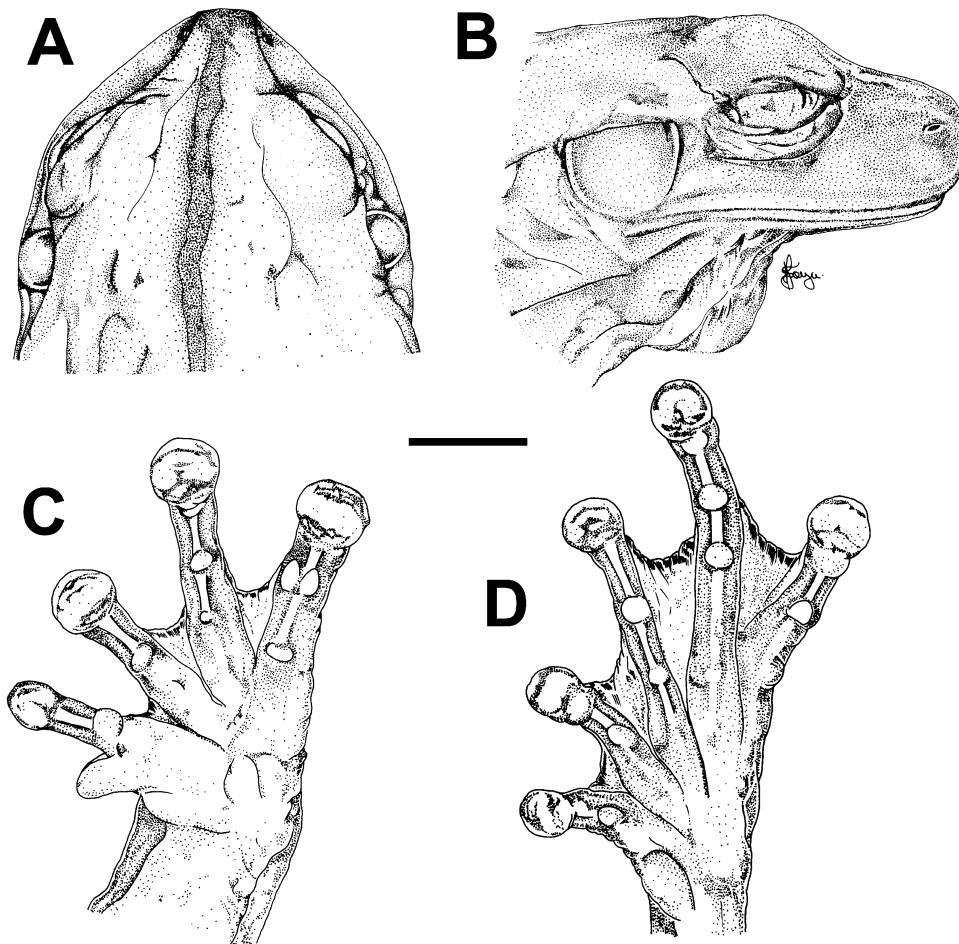


**FIGURE 2.** Living specimen of *Bokermannohyla diamantina* **sp. nov.**, an adult male from the type series (not identified). Photograph by F. A. Juncá.

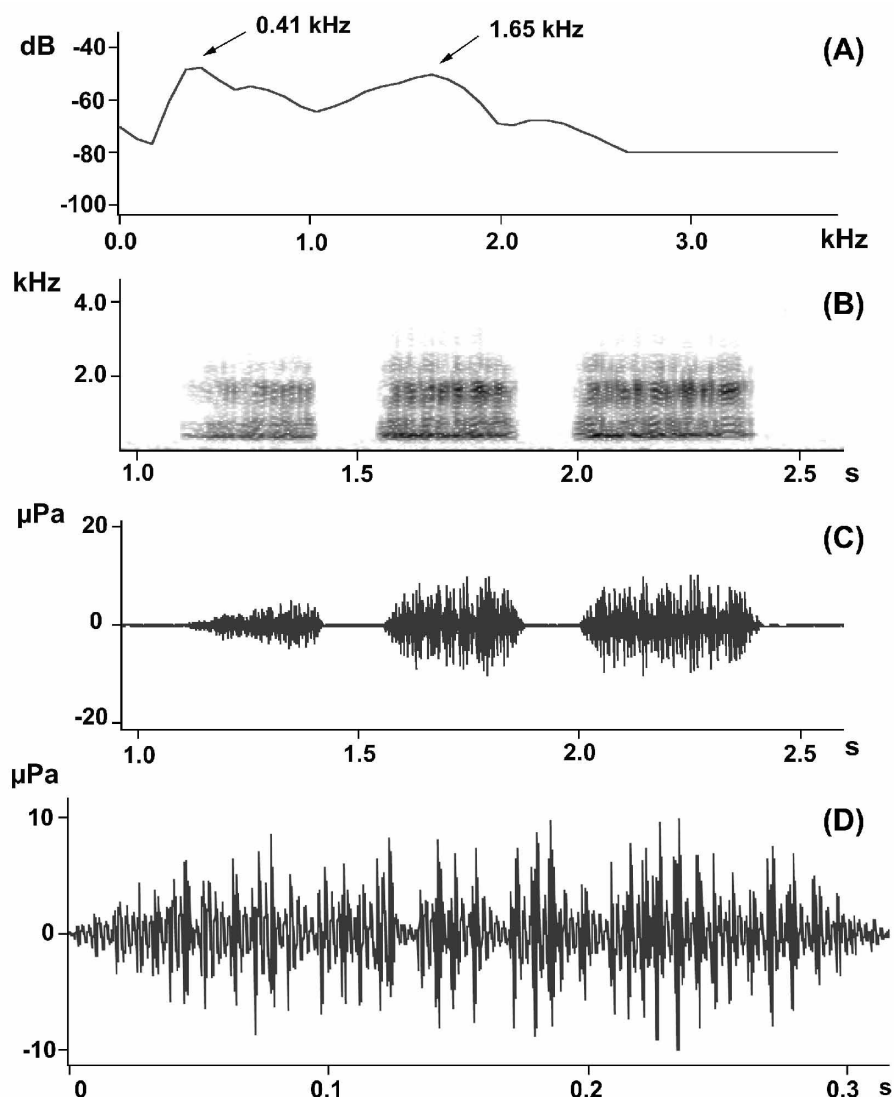
#### *Description of adult specimens*

Descriptive statistics in Table 1. Medium sized species (SVL 46.7–51.7 mm). Head wider than long, its width and length 2.7–2.9 times smaller than snout-vent length. Internarial distance smaller than eye-nostril distance and eye diameter, the latter larger than eye-nostril distance. Snout slightly truncate in dorsal outline, and rounded in lateral outline. Canthus rostralis rounded. Loreal region slightly concave. Tympanum medium-sized, nearly circular, its width 1.28–1.50 times smaller than eye diameter. Supratympanic

fold distinct, covering partially the tympanum. Nostrils directed laterally. Internarial region slightly furrowed. Vomerine teeth present in two angular patches between choanae. Tongue cordiform. Vocal sac single, subgular. Vocal slits distinct. Forearm hypertrophied, with a weak dermal fringe. Third finger disc diameter equal or larger than fourth toe disk. Subarticular tubercles rounded. Distal tubercle of fourth finger bifid. Supernumerary tubercles present. Palmar tubercle divided. Prepollex large, curved, single (not bifid), and with protruding prepollical spine. Modal webbing formulae notation, I  $2\frac{3}{4}$ – $2\frac{3}{4}$  II 2–3 III  $2\frac{1}{2}$ –2 IV. Thigh length larger than tibia length, their sum larger than snout-vent length (with exception of the holotype, in which thigh length is smaller than tibia length, and their sum is smaller than snout-vent length). Subarticular tubercles rounded. Supernumerary tubercles distinct. Inner metatarsal tubercle ovoid. Modal webbing formulae notation, I 2–2 II 1–2  $\frac{1}{2}$  III  $1^+$ – $2\frac{1}{2}$  IV 2–1 V. Dorsal and ventral surfaces of arms smooth. Belly, throat, chest, and ventral surfaces of thighs glandular.



**FIGURE 3.** *Bokermannohyla diamantina* sp. nov., MZUEFS 1784, holotype, adult male. (A) Dorsal and (B) lateral views of head; (C) hand, and (D) foot. Horizontal line equals 5 mm.



**FIGURE 4.** (A) Power spectrum, (B) audiospectrogram, (C) oscillogram of the advertisement call, and (D) oscillogram of the second note figured of the advertisement call of *Bokermannohyla diamantina* **sp. nov.** from the Municipality of Abaíra, State of Bahia, Brazil. Air temperature 22°C.

#### *Color in life*

Dorsal surfaces dark brown to blackish brown (Fig. 2), with weak transverse dark brown bars on dorsum, flanks, arms, thighs, shanks, tarsus, and feet. Belly and ventral surfaces of chest, throat, and thighs vivid yellow; ventral surfaces of arms, hands, shanks, tarsus, feet, and anterior and posterior surfaces of thighs purple.

#### *Color in preservative*

Dorsal surfaces medium to blackish brown, with weak transverse dark brown bars on

dorsum, flanks, arms, thighs, shanks, tarsus, and feet. A weak brown vertebral stripe might be present from the tip of snout to the middle of dorsum. Canthus rostralis delimited by a weak subcanthal dark brown stripe. Flanks pale cream with transverse dark brown bars; anterior and posterior faces of thighs medium brown; ventral surfaces pale cream.

**TABLE 1.** Descriptive statistics of adult males and a female of *Bokermannohyla diamantina* **sp. nov.** from the Municipality of Abaíra, State of Bahia, Brazil.  $n$  = number of specimens;  $\bar{X}$  = mean; Min = minimum; Max = maximum; SD = standard deviation. Values in millimeters.

	$\bar{X}$	Males ( $n = 6$ )			Female ( $n = 1$ )
		Min	Max	SD	
SVL	48.28	46.7	51.7	1.95	49.4
HL	17.03	16.6	17.7	0.43	16.9
HW	17.18	16.0	18.7	0.92	17.2
ED	4.97	4.8	5.5	0.29	4.8
END	4.15	3.9	4.3	0.15	3.9
TD	3.77	3.3	4.3	0.33	3.9
UEW	3.80	3.7	4.0	0.12	4.0
IOD	5.55	5.2	6.0	0.36	5.4
IND	3.30	3.1	3.4	0.13	3.3
NSD	2.77	2.4	3.0	0.24	2.7
THL	24.58	23.2	25.3	0.79	24.4
TL	24.31	23.2	25.5	0.78	23.8
FL	35.50	32.4	35.8	1.21	32.6
3FD	2.22	2.1	2.5	0.17	2.2
4TD	2.07	1.9	2.2	0.11	1.8
SVL/HW	2.81	2.72	2.93	0.08	2.87
SVL/HL	2.83	2.78	2.92	0.04	2.92
HL/SVL	0.35	0.34	0.35	0.00	0.34
ED/TD	1.32	1.27	1.50	0.08	1.23
TD/SVL	0.07	0.07	0.08	0.00	0.07
ED/SVL	0.10	0.09	0.11	0.00	0.09
THL/SVL	0.50	0.48	0.52	0.01	0.49
TL/SVL	0.50	0.49	0.51	0.00	0.48
THL+TL	48.90	47.1	50.8	1.43	48.2

*Measurements of holotype*

SVL 51.7, HL 17.7, HW 18.7, ED 4.8, END 4.3, TD 3.7, UEW 3.7, IOD 6.0, IND 3.4, NSD 2.8, THL 25.3, TL 25.5, FL 35.8, 3FD 2.5, 4TD 2.2.



**TABLE 2.** Temporal measurements of the advertisement call of *Bokermannohyla diamantina* sp. nov. Values are presented as mean  $\pm$  standard deviation, and minimum-maximum in parentheses. Note duration in milliseconds.

	(not captured)	Specimens	
		MZUEFS 1785 (CRC 47.00 mm)	MZUEFS 1799 (CRC 46.80 mm)
Number of calls	21	13	17
Number of notes	3	2.85 $\pm$ 0.55 (2–4)	3.41 $\pm$ 0.50 (3–4)
Note 1 duration	221.20 $\pm$ 34.90 (148.32–296.63)	199.31 $\pm$ 38.79 (150.04–262.90)	276.66 $\pm$ 37.65 (210.23–322.23)
Note 2 duration	267.57 $\pm$ 20.30 (228.83–307.50)	261.26 $\pm$ 41.37 (187.55–350.53)	302.52 $\pm$ 27.17 (271.09–381.73)
Note 3 duration	277.06 $\pm$ 19.56 (235.98–321.80)	262.37 $\pm$ 39.89 (175.05–326.71)	360.96 $\pm$ 38.19 (309.67–409.40)
Note 4 duration	-	328.62	385.48 $\pm$ 17.22
Notes per second	4.16 $\pm$ 0.24 (3.70–4.61)	4.25 $\pm$ 0.89 (2.77–6.13)	3.28 $\pm$ 0.38 (2.77–3.90)

#### *Sexual dimorphism*

Adult males of *Bokermannohyla diamantina* have hypertrophied forearms, enlarged prepollices, and vocal slits, characteristics absent in females.

#### *Advertisement call*

The following description is based on advertisement calls from three recorded males. Social interactions among males were not noticed. The call (Fig. 4A–D) is composed of 2–4 pulsed notes, usually three notes, and the first note always with lower intensity than the others. The pulses are very close to each other and present side bands, which prevented the accurate count of the pulse number of each note. Therefore, we counted only the pulses with more intensity in the notes (Fig. 4D). In this sense, the pulse number of one note varied from 21–110 pulses ( $\bar{x}$  = 48.08, n = 59 notes, SD = 23.16). The call duration is 0.63–1.85 s ( $\bar{x}$  = 1.16, n = 51, SD = 0.29). The interval between calls is 65.45–3.79 s ( $\bar{x}$  = 8.89, n = 48, SD = 9.81). Note duration between 0.14–0.40 s, with trend to increase the duration from the first to the last note, and note rate between 2.77–6.13 notes per second (Table 2). Two main energetic bandwidths are clearly distinguishable in the audiospectrogram (Fig. 4B), and two peaks of intensity can be observed on the power spectrum (Fig. 4A). Low frequency is 0.22–0.29 kHz ( $\bar{x}$  = 0.26, n = 51, SD = 0.02) and high frequency 2.08–2.75 kHz ( $\bar{x}$  = 2.45, n = 51 SD = 0.23). The dominant frequency is 0.39–0.56 kHz ( $\bar{x}$  = 0.40, n = 49, SD = 0.03), but in one specimen (MZUEFS 1799), two,

of a total of 17 calls analyzed, displayed the dominant frequency in the upper bandwidth (1.59 and 1.63 kHz). This alteration in the dominant frequency may correspond to a change between the two peaks of intensity observed in all calls analyzed.

The advertisement call of *Bokermannohyla diamantina* is distinguished from the calls of the other species of the *B. circumdata* group by the general singular structure and by the lowest dominant frequency (0.39–0.56 kHz; 1.25–2.80 kHz; respectively).

#### *Natural history*

*Bokermannohyla diamantina* occurs in gallery forests along creeks surrounded by rocky mountain fields called “Campo Rupestre”, a biome typical in Chapada Diamantina (for description of “Campo Rupestre” see Rizzini 1979). The three males heard were calling from the central axis of an epiphytic bromeliad, a cavity under a rock on the side of a stream, and on the ground in an open field near the stream, respectively. Two individuals were collected in a gallery forest, and four in the “Campo Rupestre” near a stream, all at night. Only one individual was collected during the day, resting inside the gallery forest.

#### *Etymology*

The specific name, a noun in apposition, refers to the Chapada Diamantina, the region in the State of Bahia in which is located the type locality of the new species.

#### *Geographic distribution*

*Bokermannohyla diamantina* is only known from the type locality (13°16'08"S; 41°54'39"W; 1700 m altitude), Municipality of Abaíra, in Serra dos Barbados. The Serra dos Barbados is a mountain range with altitude varying from 600 to 2033 m, being the highest point of the State of Bahia, and is comprised in the Brazilian semiarid. The mountain scenery contains ecosystems like Caatinga, Cerrado, Campo Rupestre (“rock fields”), Deciduous and Semi-Deciduous Mountain Forests, and gallery forests. This mountain range belongs to the “Área de Proteção Ambiental Serra dos Barbados”, that is a protected area with sustainable management.

#### *Comments*

The species of the *Bokermannohyla circumdata* group mainly inhabit large forested areas of the Tropical Atlantic Domain near the Brazilian Atlantic coast (see Ab'Sáber 1977 for description of Brazilian morphoclimatic domains). However, species of this group have been encountered far from the Atlantic coast, occurring in Cerrado and Caatinga domains, and also at high elevation fields in the Tropical Atlantic Domain (e.g., *B. diamantina*, *B. circumdata*, *B. feioi*, *B. ibitipoca*, *B. nanuzae*, *B. ravida*, and *B. sazimai*), but always associated to gallery forests. This pattern of distribution suggests that the occurrence of species of the *B. circumdata* group in Cerrado and Caatinga domains is due to the presence of gallery forests, which provide, in some degree, environmental

conditions similar to the Atlantic Tropical forests from coastal Brazil, and therefore these species should not be considered as characteristic taxa of Cerrado and Caatinga biomes.

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### References

- Ab'Sáber, A.N. (1977) Os domínios morfoclimáticos na América do Sul. Primeira aproximação. *Geomorfologia*, 52, 1–23.
- Bokermann, W.C.A. (1967) *Hyla astartea*, nova espécie da Serra do Mar em São Paulo (Amphibia, Hylidae). *Revista Brasileira de Biologia*, 27(2), 157–158.
- Bokermann, W.C.A. & Sazima, I. (1973) Anfíbios da Serra do Cipó, Minas Gerais, Brasil. 1-Espécies novas de “*Hyla*” (Anura, Hylidae). *Revista Brasileira de Biologia*, 33(3), 329–336.
- Caramaschi, U. & Feio, R.N. (1990) A new species of *Hyla* (Anura, Hylidae) from southern Minas Gerais, Brazil. *Copeia*, 1990, (2), 542–546.
- Caramaschi, U., Napoli, M.F. & Bernardes, A.T. (2001) Nova espécie do grupo de *Hyla circumdata* (Cope, 1870) do Estado de Minas Gerais, Brasil (Amphibia, Anura, Hylidae). *Boletim do Museu Nacional, Nova Série, Zoologia*, (457), 1–11.
- Cardoso, A.J. & Andrade, G.V. (1982) Nova espécie de *Hyla* do Parque Nacional Serra da Canastra (Anura, Hylidae). *Revista Brasileira de Biologia*, 42(3), 589–593.
- Cope, E.D. (1870) Eighth contribution to the herpetology of tropical America. *Proceedings of the American Philosophical Society*, 11, 555.
- Duellman, W.E. & Trueb, L. (1986) *Biology of Amphibians*. McGraw-Hill Inc., New York, 670 pp.
- Heyer, W.R. (1985) New species of frogs from Boracéia, São Paulo, Brazil. *Proceedings of the Biological Society of Washington*, 98, 657–671.
- Jim, J. & Caramaschi, U. (1979) Uma nova espécie de *Hyla* da região de Botucatu, São Paulo, Brasil (Amphibia, Anura). *Revista Brasileira de Biologia*, 39(3), 717–719.
- Myers, C.W. & Duellman, W.E. (1982) A new species of *Hyla* from Cerro Colorado, and other tree frog records and geographical notes from Western Panama. *American Museum Novitates*, (2752), 1–32.
- Napoli, M.F. (2005) A new species allied to *Hyla circumdata* (Anura: Hylidae) from Serra da Mantiqueira, Southeastern Brazil. *Herpetologica*, 61(1), 63–69.
- Napoli, M.F. & Caramaschi, U. (2004) Two new species of the *Hyla circumdata* group from Serra do Mar and Serra da Mantiqueira, Southeastern Brazil, with description of the advertisement call of *H. ibitipoca* (Anura, Hylidae). *Copeia*, 2004, (3), 534–545.
- Napoli, M.F. & Pimenta, B.V.S. (2003) Nova espécie do grupo de *Hyla circumdata* (Cope, 1870) do Sul da Bahia, Brasil (Amphibia, Anura, Hylidae). *Arquivos do Museu Nacional, Rio de Jan-*

- eiro*, 61(3), 189–194.
- Peixoto, O.L. (1981) Nova espécie de *Hyla* da Serra dos Órgãos, Estado do Rio de Janeiro, Brasil (Amphibia, Anura, Hylidae). *Revista Brasileira de Biologia*, 41(3), 515–520.
- Peixoto, O.L. & Cruz, C.A.G. (1992) Nova espécie de *Hyla* da Serra da Mantiqueira, Itatiaia, Estado do Rio de Janeiro (Amphibia, Anura, Hylidae). *Memórias do Instituto Oswaldo Cruz*, 87, Suplemento I, 197–200.
- Pombal, J.P. & Haddad, C.F.B. (1993) *Hyla luctuosa*, a new treefrog from Southeastern Brazil (Amphibia, Hylidae). *Herpetologica*, 49(1), 16–21.
- Rizzini, C.T. (1979) *Tratado de Fitogeografia do Brasil. Aspectos sociológicos e florísticos*. E DUSP/HUCITEC, São Paulo, 374 pp.
- Savage, J.M. & Heyer, W.R. (1967). Variation and distribution in the tree-frog genus *Phyllomedusa* in Costa Rica, Central America. *Beiträge zur Neotropischen Fauna*, 5, 111–131.