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A new species of lizard genus *Gymnodactylus* Spix, 1825 (Squamata: Gekkota: Phyllodactylidae) from Serra do Sincorá, northeastern Brazil, and the status of *G. carvalhoi* Vanzolini, 2005

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Abstract

A new species of gekkonid lizard genus *Gymnodactylus* Spix, 1825 is described on the basis of material collected in the "campos rupestres" (open rocky communities) of Mucugê municipality, northeastern Brazil. *G. vanzolinii* **sp. nov.** differs from its congeners in the number of transverse and longitudinal rows of dorsal tubercles and color pattern. It is thought to be closer to *G. guttulatus* which also occurs and is restricted to the rocky communities from highland open areas in the Espinhaço mountain range. The discovery leads to a reevaluation of the taxonomic status of *G. carvalhoi* Vanzolini, 2005, which is here considered a synonym of *G. amarali* Barbour, 1925.

Key words: Squamata; Gekkota; Phyllodactylidae; *Gymnodactylus vanzolinii* **sp. nov.**; New species; *Gymnodactylus carvalhoi*; *Gymnodactylus amarali*; Synonymy; Meadow fields; Serra do Sincorá; Mucugê municipality; Northeastern Brazil

Resumo

Uma nova espécie de lagarto geconídeo do gênero *Gymnodactylus* Spix, 1825 é descrita com base em material coletado nos campos rupestres dos arredores do município de Mucugê, estado da Bahia, nordeste do Brasil. *G. vanzolinii* **sp. nov.** difere de seus congêneres no número de fileiras transversais e longitudinais de tubérculos dorsais e no padrão de colorido. A nova espécie parece estar mais relacionada a *G. guttulatus*, que também ocorre e está restrita aos campos rupestres das áreas abertas da porção sul da Cadeia do Espinhaço. Esta nova espécie nos leva a reavaliar o status taxonômico de *G. carvalhoi* Vanzolini, 2005, aqui considerada sinônimo de *G. amarali* Barbour, 1925.

Palavras-chave: Squamata; Gekkota; Phyllodactylidae; *Gymnodactylus vanzolinii* **sp. nov.**; espécie nova; *Gymnodactylus carvalhoi*; *G. amarali*; *G. guttulatus*; sinonímia; campos rupestres; Serra do Sincorá; Município de Mucugê; Nordeste do Brasil

Introduction

Neotropical lizards of genus *Gymnodactylus* Spix, 1825 are endemic to South America, occurring throughout Cerrado, Caatinga, and Atlantic Rain Forest biomes in Brazil (Kluge 1993; Vanzolini 1953a, b; 1982; 2004; 2005). Although their presence has been reported in Trinidad (Caramaschi *et al.* 2004; Murphy 1997), the record was not confirmed by additional specimens. Presently, the genus includes five species. *G. amarali* Barbour, 1925, is known only from two specimens: the holotype from Engenheiro Dodt, state of Piauí and a juvenile from Alto Parnaíba, state of Maranhão. Both localities are in the Cerrado and are separated by the Rio

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Parnaíba which defines the borderline between Piauí and Maranhão states. The other four species are well represented in collections: *G. carvalhoi* Vanzolini, 2005, is widespread in the Cerrado of central Brazil; *G. darwinii* (Gray 1845), is restricted to Atlantic Rain Forest, from northeastern São Paulo state to the northern limits of the Atlantic Rain Forest in Rio Grande do Norte state; *G. geckoides* Spix, 1825, is endemic to Caatinga in northeastern Brazil, but occurs in sympatry with *G. darwinii* in a sand dune environment in the city of Natal, Rio Grande do Norte state (Freire 1998); and *G. guttulatus* Vanzolini, 1982, is known only from the "campos rupestres", or rocky meadows, of the southern portion of Serra do Espinhaço, a mountain range running through parts of Minas Gerais and Bahia states (Vanzolini 1982; 2004; 2005).

As currently understood, *Gymnodactylus* is characterized by gymnodactily, or the presence of free fingers without dilations, bearing wide, undivided subdigital lamellae; distal phalanges elevated above the basal ones; nail placed between two scales, the ventral scale indented; straight, vertical pupils, and an heterogeneous dorsal lepidosis, with granules and tubercles (Vanzolini 1968a; 1982). Except for the absence of bent fingers, *Homonota* is the only South American gekkonid sharing with *Gymnodactylus* all external characters mentioned above. Cacciali *et al.* (2007) erroneously considered *Homonota* as the only South American genus presenting fingers without dilations, overlooking its occurrence in *Gymnodactylus* and *Garthia*, as well as in some sphaerodactyls. Nevertheless, *Gymnodactylus* can be distinguished promptly from *Homonota* by having digits more angulated with large and distended proximal subdigital lamellae, by having a much larger mental, enlarged postmentals, and some myological and osteological differences in the skull and pectoral girdle (Abdala & Moro 1996; Kluge 1964). *Garthia*, on the other hand, presents an homogeneous dorsal lepidosis, lobate pupil (Vanzolini 1968a; Vanzolini & Donoso-Barros 1966), and double frontal bone (Abdala 1996). Other South American gekkonid genera with gymnodactily are *Coleodactylus*, *Gonatodes*, *Lepidoblepharis* and *Pseudogonatodes* that are presently included in a different tribe (Sphaerodactylini, according to Kluge 1967; 1987), or subfamily (Sphaerodactylinae, Underwood 1954; 1955), or family (Sphaerodactylidae, Gamble et. 2008). Externally they can be immediately separated from *Gymnodactylus* by presenting round pupils and homogeneous dorsal scales (Parker 1926; Vanzolini 1967; 1968a). *Coleodactylus*, *Lepidoblepharis* and *Pseudogonatodes* have a claw surrounded by four or more scales (Avila-Pires 1995; Kluge 1964; Vanzolini 1967; 1968a).

A detailed historical review of the literature on *Gymnodactylus* was recently presented by Vanzolini (2004) who in 1953 (a) also performed the first revision of the genus. Subsequently he published several important works leading to the present generic taxonomic scheme (Vanzolini 1953b; 1968a, b; 1982; 2004; 2005). An extensive study of geographic variation along the coast of Brazil, using morphological characters, was conducted by Freire (1998). She recognized the existence of geographic variation, but did not recognize distinctive species throughout this area. In the same line, Pellegrino *et al.* (2005) studying the molecular and chromosomal variation of *G. darwinii* along the same area, concluded, without formal description, that there were at least two forms diagnosable by chromosomal and molecular traits under this name in the Atlantic Rain Forest. Aside from these comprehensive studies on geographical variation involving *G. carvalhoi* and *G. geckoides* (Vanzolini 2004; 2005) only ecological studies or short communications have been published recently on *Gymnodactylus* species (Ariani *et al.* 2006; Carvalho & Araújo 2007; Carvalho *et al.* 2007; Colli *et al.* 2003; Teixeira 2002; Vanzolini 2003; Vitt *et al.* 2007).

Recent analyses based on molecular data recovered a strongly supported sister relationship between part of the Kluge's (1983) South American gekkonini (*Homonota*, *Phyllodactylus*, *Phyllopezus*, *Thecadactylus*) and some Old World geckos (*Asaccus*, *Haemodracon*, *Ptyodactylus*, *Tarentola*) (Gamble *et al.* 2008). This clade, sister to all other Gekkonidae was recognized as a new trans-Atlantic family, the Phyllodactylidae. Although *Gymnodactylus*, as well as *Bogertia* and *Garthia*, were not included in the analysis, their position in the new clade was predicted (Gamble *et al.* 2008).

In the early 1980's, one of us (MTR) conducted extensive collecting in the high altitude "campos rupestres" of Serra do Espinhaço in eastern Brazil. One of the first samples of *Gymnodactylus* obtained was col-

lected at Guinda, Diamantina municipality, in the southern portion of this mountain range, and described by Paulo Emílio Vanzolini as *G. guttulatus* (Vanzolini 1982). On a later trip, at Mucugê municipality, Serra do Sincorá, about 620 km further north, specimens of *Gymnodactylus*, clearly different from all other species of the genus were obtained but remained undescribed. These specimens were examined by Vanzolini (2004) when investigating the geographic differentiation of *G. geckoides* in northeastern Brazil. He recognized these specimens as the southernmost sample of *G. geckoides* and called attention to their marked divergence from all other samples of *G. geckoides* in all characters studied. Even admitting the possibility that these specimens could represent a new species, he preferred to maintain them under *G. geckoides*.

The senior author, in the course of a systematic revision of the genus *Gymnodactylus* based on morphological and molecular characters, obtained additional specimens of the same species at Mucugê. These new specimens, as well as the study of all material of the genus deposited in the collections of MZUSP, confirms the distinctness of the Mucugê specimens, and, contrary to Vanzolini's (2004) suggestion, the new species seems clearly to be more related to *G. guttulatus* than to *G. geckoides*. Molecular studies presently being conducted (unpublished data), confirm our hypothesis.

Herein, we describe this new *Gymnodactylus* and reevaluate the taxonomic status of *G. carvalhoi*, described recently by Vanzolini (2005).

Material and methods

Field work was conducted at Mucugê municipality, Serra do Sincorá, in December 1980, September 1987, October 1990, and March 2003. Coordinates for most localities were obtained using a GPS Magellan MAP-330 in March 2003. Specimens were examined for 44 morphological characters and measurements (Tables 1–2), and compared to all other recognized species of the genus *Gymnodactylus* housed in the herpetological collection of Museu de Zoologia da Universidade de São Paulo (MZUSP) (Table 3), either by direct examination (see Appendix 1) or, in the case of *G. amarali*, by comparison with their original description (see Barbour 1925). In the absence of type specimens (see Appendix 1) or that of a precise type locality we selected comparative material as close as possible from type localities in order to minimize the influence of geographical distance during comparisons.

Measurements were taken with a Mitutoyo caliper and recorded to the nearest 0.1 mm. Only intact tails were examined. Sex was determined by dissection, or by the presence of everted hemipenes. We collected most character data using the methods of Avila-Pires (1995) and Vanzolini (2004; 2005), although we altered our data collection protocol in the following instances. When scale counts were taken on both sides of the specimen, the left side is given first. We counted the number of longitudinal tubercles in a paramedian row, between anterior level of forelimbs and posterior level of hindlimbs. This differs from the counts obtained by Vanzolini (1953a; 2004; 2005) who counted tubercules between the anterior ones to the posterior level of hind limbs. As the position of anteriormost tubercles in the paramedian row vary among specimens, our character restriction renders data more comparable. In counting sub-digital lamellae, only those that were seen to be on the ventral surface of the finger or toe were counted.

Gymnodactylus vanzolinii sp. nov.

(Figs. 1–2)

Holotype: MZUSP 68286 (adult female), field number 80.6069 (SVL 52.3 mm, TL 70 mm), from Serra do Sincorá, Chapada Diamantina, Mucugê municipality (13°09'S, 41°24'W), ca. 1,000 m elevation, State of Bahia, Brazil, collected 27–28 September 1987 by M. T. Rodrigues.

TABLE 1. Codes for Sex, morphological characters and measurements taken in this study.

No.	Character description
1	Sex: ♂ = male, ♀ = female, J = juvenile
2	Number of post-nasals
3	Internasals in contact (+) or no (–)
4	Number of granules between internasals
5	Number of supralabials
6	Number of infralabials
7	Number of granules in contact with supralabials, from first to fifth
8	Number of scales in contact with rostral
9	Number of interorbitals
10	Shape of granules in loreal region: flattened (F), conical (C), rounded (R)
11	Number of scales between postmentals and cloaca
12	Number of granules in contact with mental
13	Number of granules in contact of postmentals
14	Number of ventral granules between ears
15	Shape of gular scales: flattened (F), conical (C), rounded (R)
16	Number of color bands on head, nape, body, and tail
17	Number of scales between eye and ear (left side only)
18	Number of scales surrounding a dorsal tubercle (randomly counted for 5 tubercles)
19	Number of granules between the two middorsal paravertebrals tubercle rows counted at midbody
20	Number of granules between two transverse and adjacent rows of tubercles counted in paravertebral row at mid-body
21	Number of granules between paravertebral and the immediately adjacent longitudinal row of tubercles, counted at midbody
22	Number of longitudinal rows of tubercles
23	Number of paramedian tubercles
24	Number of transverse rows of ventral scales at midbody
25	Number of subdigital lamellae on fourth finger
26	Number of subdigital lamellae on fourth toe
27	Number of subdigital lamellae on fifth toe
28	Number of subcaudals
29	Snout-vent length (SVL)
30	Distance between posterior level of arm and anterior margin of tight
31	Trunk length (TrunkL)
32	Tail length (TailL)
33	Head length (HeadL)
34	Head width (HeadW)
35	Head height (HeadH)
36	Orbital diameter (OrbL)
37	Ear length (EarL)
38	Internarial distance (InterNar)
39	Snout to eye distance (SnEye)
40	Nares to eye distance (EyeEar)
41	Eye to ear distance (EyeEar)
42	Interorbital distance (IntraOrb)
43	Forearm length (ArmL)
44	Tibia Length (CrusL)

TABLE 2. Sex, scale counts and measurements (in millimeters) for *Gymnodactylus vanzolinii* **sp. nov.** from Serra do Sincorá, Bahia state, Brazil. See text and Table 1 for character descriptions. * = holotype; NA = not available.

Specimen	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
MZUSP 56290	♀	2–2	+	0	7/7	5/5	14/12	4	24	R	130	2	6/6	86	R	5/2/8/NA	22
MZUSP 56291	♀	2–2	+	0	6/7	5/5	16/16	4	23	R	124	4	6/6	87	R	5/2/9/NA	23
MZUSP 68285	♀	2–2	–	1	7/7	5/5	12/15	5	21	R	120	2	6/6	84	R	5/2/8/NA	24
MZUSP 68286*	♀	3–3	–	1	7/7	6/6	16/13	5	24	R	130	2	5/4	80	R	5/2/9/17	24
MZUSP 73926	J	2–2	–	1	7/7	5/5	13/14	5	23	R	NA	2	6/5	82	R	5/2/8/NA	23
MZUSP 73927	J	2–2	+	0	7/7	5/5	13/12	4	22	R	NA	4	5/4	82	R	5/2/8/NA	23
MZUSP 73928	♂	2–2	–	1	7/7	6/6	13/12	5	24	R	135	3	6/5	86	R	5/1/8/NA	24
MZUSP 98245	♀	2–2	–	1	7/7	5/5	15/13	5	25	R	136	4	5/5	81	R	5/2/8/16	25
MZUSP 98246	♀	2–2	+	0	7/7	5/5	14/13	4	20	R	NA	3	6/6	83	R	5/2/8/17	26
MZUSP 98247	♀	2–2	–	1	7/7	5/6	13/14	5	22	R	122	5	5/4	78	R	5/1/8/16	25
MZUSP 98248	♀	2–2	–	1	7/7	5/5	12/13	5	23	R	NA	3	6/6	NA	R	5/NA/8/NA	21
MZUSP 98249	♀	NA	NA	NA	NA	NA	NA	NA	NA	R	NA	5	5/5	NA	R	NA	22
MZUSP 98250	♀	2–2	–	1	8/8	6/6	13/13	5	23	R	NA	3	5/5	NA	R	5/2/NA/NA	27
MZUSP 98251	♂	2–2	+	0	8/8	5/5	11/14	4	20	R	NA	3	6/4	NA	R	5/2/8/NA	26
MZUSP 98252	♀	2–2	–	1	7/7	6/5	15/15	5	22	R	119	3	7/6	83	R	5/1/9/NA	26
MZUSP 98253	♂	2–2	–	1	7/7	5/6	15/14	5	24	R	126	2	6/6	80	R	5/2/8/NA	25
MZUSP 98254	♂	2–2	+	0	7/5	5/5	13/14	4	23	R	124	3	5/5	84	R	5/2/9/NA	26

continued.

Specimen	18	19	20	21	22	23	24	25	26	27	28	29
MZUSP 56290	13–15	10	6	8	6/5	27/29	22	17/15	19/19	20/20	NA	40.6
MZUSP 56291	14	9	5	7	5/6	26/25	18	17/17	19/19	19/20	NA	50.7
MZUSP 68285	13–15	10	6	6	5/5	29/25	21	16/17	19/19	20/20	NA	48.1
MZUSP 68286*	12–14	12	6	6	5/5	28/29	21	15/15	19/19	19/19	7 + 63	52.3
MZUSP 73926	13–14	10	6	6	6/5	24/28	NA	16/16	20/20	18/19	NA	31.4
MZUSP 73927	13–15	11	6	7	5/5	24/25	NA	16/17	20/19	19/20	NA	36.9
MZUSP 73928	13–15	12	6	7	5/5	NA/25	NA	16/16	18/18	19/18	NA	41.7
MZUSP 98245	13–14	12	7	7	5/5	24/22	20	17/18	21/20	20/20	8 + 67	48.0
MZUSP 98246	13–14	12	5	7	NA	NA	NA	16/17	19/19	20/19	7 + 59	42.9
MZUSP 98247	14–15	12	6	6	5/6	23/24	21	16/16	19/18	19/20	8 + 66	41.1
MZUSP 98248	14–15	10	6	7	5/5	NA	19	17/16	21/21	21/20	NA	50.1
MZUSP 98249	NA	NA	NA	NA	NA	NA	NA	17/16	21/20	20/20	NA	52.2
MZUSP 98250	13	NA	NA	NA	NA	NA	NA	18/18	NA/21	NA/20	NA	41.4
MZUSP 98251	12–14	12	7	7	NA/5	NA/27	19	16/17	NA/20	19/20	8 + 74	50.5
MZUSP 98252	13–15	10	6	8	5/5	24/24	21	15/17	20/19	18/19	NA	39.6
MZUSP 98253	12–14	12	7	5	5/5	22/25	20	15/16	20/20	20/20	NA	49.7
MZUSP 98254	14–16	10	6	7	6/6	22/22	21	17/17	20/21	21/21	NA	50.8

continued.

Specimen	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
MZUSP 56290	18.8	24.5	NA	10.7	7.8	5.4	3.0	1.6	1.6	4.6	3.4	3.1	3.8	5.3	6.7
MZUSP 56291	23.9	30.5	NA	12.3	9.2	6.6	3.3	1.6	1.8	4.9	3.9	3.8	4.2	6.9	8.3
MZUSP 68285	22.1	29.4	NA	11.6	8.9	6.3	3.1	1.3	1.8	4.8	3.5	4.1	3.9	6.8	8.2
MZUSP 68286*	25.4	33.8	70.6	12.9	9.3	6.8	3.0	1.5	1.9	5.2	4.3	4.1	4.2	6.9	8.3
MZUSP 73926	12.2	17.6	NA	8.2	5.6	3.6	2.3	1.0	1.2	3.3	2.5	2.5	2.6	4.1	5.0
MZUSP 73927	16.5	20.9	NA	9.4	6.7	4.2	2.4	1.2	1.4	3.9	2.9	3.2	3.0	5.0	6.2
MZUSP 73928	20.9	27.4	NA	12.1	8.7	5.6	3.1	1.2	1.8	4.9	3.9	3.9	3.8	6.7	8.1
MZUSP 98245	21.9	28.9	65.6	12.0	8.2	5.4	3.1	1.3	1.7	5.0	3.8	3.7	4.0	6.8	7.9
MZUSP 98246	18.2	25.3	61.0	10.8	7.9	4.9	2.7	1.2	1.5	4.4	3.5	3.4	3.3	6.0	6.7
MZUSP 98247	17.3	23.7	59.4	10.1	7.5	4.4	2.7	1.3	1.5	4.2	3.2	3.2	3.5	5.6	7.0
MZUSP 98248	22.5	30.2	NA	12.1	8.8	5.5	3.0	1.2	1.7	4.9	3.8	4.1	4.0	6.8	8.3
MZUSP 98249	23.3	32.1	NA	12.4	NA	NA	NA	1.2	NA	NA	NA	4.1	NA	7.4	8.7
MZUSP 98250	17.7	24.0	NA	10.1	7.6	4.7	2.8	1.2	1.5	4.2	3.2	3.2	3.3	5.0	5.9
MZUSP 98251	21.4	28.9	NA	12.2	8.9	5.5	3.2	1.4	1.8	5.0	4.1	3.6	3.8	7.2	8.5
MZUSP 98252	16.7	22.0	NA	10.1	7.2	4.8	2.7	1.2	1.5	3.9	3.2	2.9	3.3	5.3	7.0
MZUSP 98253	19.2	28.1	NA	12.9	9.3	5.6	3.3	1.7	1.8	5.0	4.1	4.1	3.4	7.2	8.5
MZUSP 98254	22.7	31.4	NA	12.6	9.4	5.6	3.1	1.5	1.8	5.1	4.1	3.7	4.2	7.1	8.8

TABLE 3. Comparative morphological data for *Gymnodactylus vanzolinii* **sp. nov.**, and currently recognized species of the genus *Gymnodactylus*. Mean, standard deviation, range and sample size (n) are presented for each species. Data were taken from examined specimens (Appendix 1). * = estimated value.

Character	*Gymnodactylus*					
	vanzolinii **sp. nov.**	*guttulatus*	*amarali*	*carvalhoi*	*geckoides*	*darwinii*
Snout-vent Length	45.2 ± 6.18 (31.4–52.3; n = 17)	38.36 ± 8.73 (27.9–49.6; n = 7)	34.2	42.02 ± 7.27 (24.1–51.3; n = 13)	40.95 ± 2.18 (33.0–44.5; n = 30)	47.68 ± 4.45 (39.8–53.6); n = 16
Tail length	64.19 ± 5.03 (59.4–70.6; n = 4)	44,05 ± 5.16 (40.4–47.7; n = 2)	NA	42.5 ± 21.63 (27.2–57.8; n = 2)	45.35 ± 3.18 (43.1–47.6; n = 2)	55.3 ± 6.62 (46.7–66.8); n = 6
Head length	11.35 ± 1.36 (8.2–12.9; n = 17)	9.79 ± 1.65 (7.7–12.1; n = 7)	8.5	10.7 ± 1.63 (7.0–13.0; n = 13)	10.3 ± 0.57 (8.2–11.0; n = 30)	11.99 ± 0.88 (10.7–13.7); n = 16
Head width	8.225 ± 1.08 (5.6–9.4; n = 16)	7.19 ± 1.86 (4.0–9.1; n = 7)	6.7	8.32 ± 1.34 (5.5–10.7; n = 13)	7.62 ± 0.40 (6.3–8.2; n = 30)	8.79 ± 0.86 (7.4–10.4); n = 16
Head height	5.33 0.86 (3.6–6.8; n = 16)	4.85 ± 1.07 (3.4–6.1; n = 7)	3,95	5.24 ± 1.06 (3.7–7.3; n = 13	4.89 ± 0.36 (4.1–5.6; n = 30)	5.77 ± 0.68 (4.7–7.1)
Supralabial scales	7 ± 0.63 (5–8; n = 16)	6.14 ± 0.38 (6–7; n = 7)	5/6	5.92 ± 0.28 (5–6; n = 13)	6.13 ± 0.57 (5–7; n = 30)	6.44 ± 0.51 (6–7; n = 16)
Subdigital lamellae 4th finger	16.52 ± 0.87 (16–18; n = 17)	16.14 ± 0.90 (15–18; n =7)	13/12	12.61 ± 0.77 (11–14; n = 13)	13.70 ± 0.70 (13–15; n = 30)	18.44 ± 0.93 (17–20; n = 16
4th toe	19.52 ± 0.94 (18–21; n = 15)	19.86 ± 1.07 (18–21; n = 7)	15/14	16 ± 0.74 (15–17; n = 12)	17.5 ± 0.93 (15–19; n = 30)	21.94 ± 0.68 (21–23; n = 16)
Tubercles rows	10.43 ± 0.65 (10–12; n = 14)	12.4 ± 1.14 (11–14; n = 5)	14	14 ± 0 (14; n = 13)	12.06 ± 0.37 (12–14; n = 29)	14 ± 0 (14; n = 16)
Tubercles in a paramedian row	25.38 ± 2.29 (22–29; n = 13)	21.5 ± 1.64 (19–24; n = 6)	38*	31.75 ± 3.44 (27–38; n = 12)	34.48 ± 2.98 (27–40; n = 23)	51.53 ± 3.29 (47–59; n = 15)
Ventrals	20.27 ± 1.19 (18–22; n = 11)	23 ± 1.83 (20–26; n = 7)	19	21.08 ± 1.38 (19–24; n = 13)	21.07 ± 0.99 (19–24; n = 27)	18.75 ± 3.27 (15–24; n = 16)

FIGURE 1. *Gymnodactylus vanzolinii* **sp. nov.**, adult male paratype (MZUSP 98247); Serra do Sincorá, municipality of Mucugê, State of Bahia, Brazil. Photo by Felipe S. F. Leite.

Paratypes (N = 16): MZUSP 56290 (adult female) and MZUSP 56291 (adult female), 13°09'S, 41°24'W, 1000 m, collected on 6 December 1980 by M. T. Rodrigues, field numbers 80.1885 and 80.1886 respectively. MZUSP 68285 (adult female), collected 27–28 September 1987, by M.T. Rodrigues, field number 80.6020. MZUSP 73926, MZUSP 73927 (juveniles) and MZUSP 73928 (adult male) collected on 1 October 1990, by M.T. Rodrigues, field numbers 90.6026, 90.6027 and 90.6028 respectively. MZUSP 98245 (adult female), 13°01'06"S, 41°21'57"W, 1017 m, collected on 06 March 2005 by J. Cassimiro, F.S.F. Leite & L.E. Lopes, field number JC 1207. MZUSP 98246 (adult female), collected on 10 March 2005 by J. Cassimiro, field number JC 1209. MZUSP 98247 (adult female), 13°00'03"S, 41°21'57"W, 997 m, 12 March 2005 by J. Cassimiro, field number JC 1223. MZUSP 98248 (adult female), 13°00'02"S, 41°21'59W", 1004 m, 13 March 2005 by J. Cassimiro, field number JC 1230. MZUSP 98249 (adult female), 13°00'03"S 41°21'58W", 1010 m, by F.S.F. Leite & J. Cassimiro, field number JC 1235. MZUSP 98250 (adult female), 98251 (adult male), collected on 18 March 2005 by J. Cassimiro & F.S.F. Leite, field numbers JC 1238–9 respectively. MZUSP 98252 (adult female), 98253–4 (adult males), collected on 27 March 2005 by J. Cassimiro, field numbers JC 1280–2 respectively. All specimens collected in the same municipality as the holotype, in Mucugê, Chapada Diamantina, Bahia state, Brazil.

Etymology: The specific name is a homage to Dr. Paulo Emílio Vanzolini one of the most distinguished Brazilian zoologists. About Vanzolini see Heyer (2004).

Diagnosis: A small *Gymnodactylus* with a slender body, head distinct from neck, and tail longer than body. *G. vanzolinii* **sp. nov.** can be distinguished from all other species of the genus by the following combina-

tion of characters: 10–12 (n = 14) longitudinal rows of dorsal tubercles; 22–29 (n = 13) tubercles in a paramedian row; 18–22 (n = 11) transverse ventrals at midbody; 16–18 (n = 17) subdigital lamellae under fourth finger; 18–21 (n = 15) subdigital lamellae under fourth toe; color pattern with transverse dark bands along the dorsum.

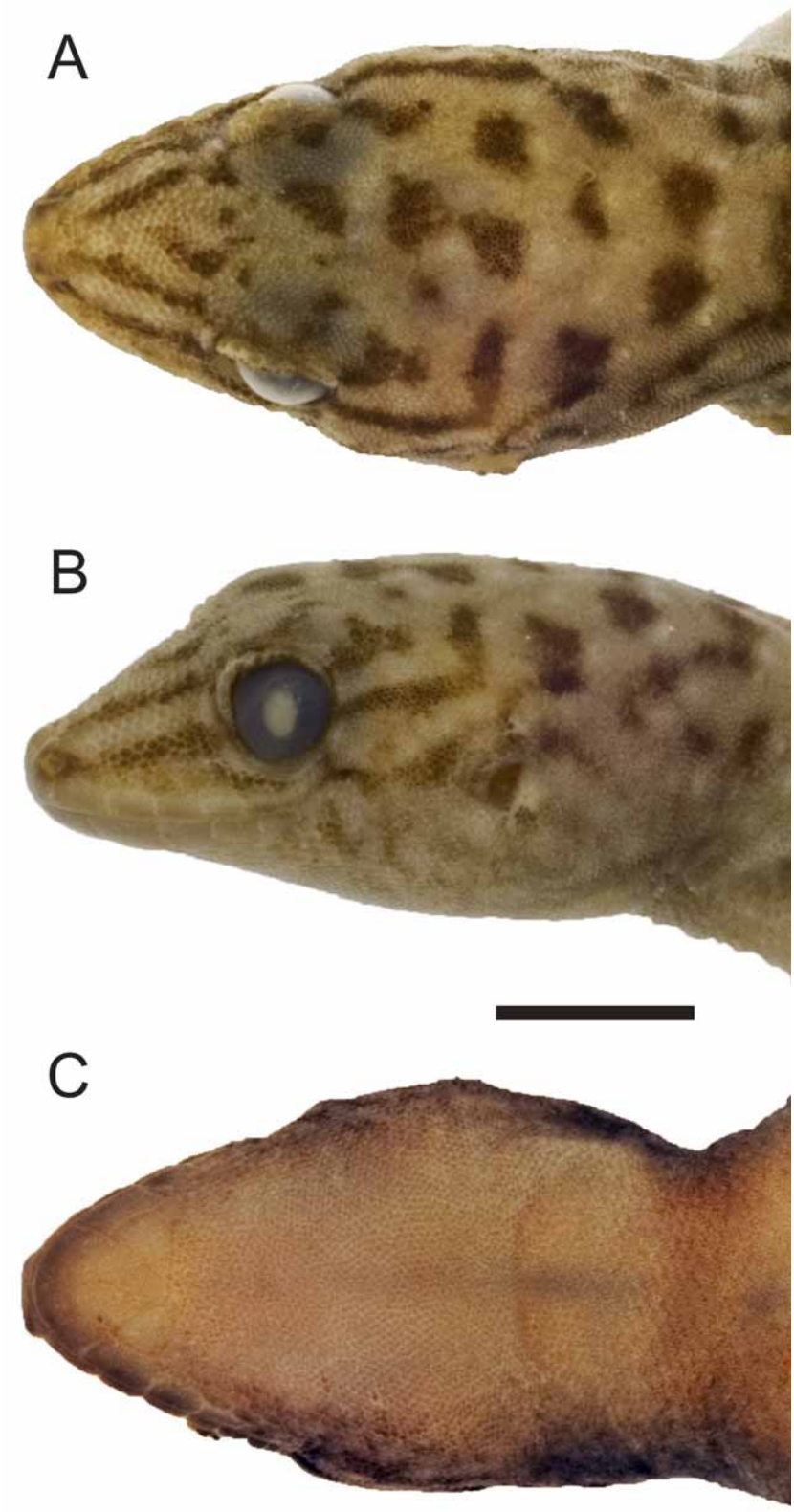

FIGURE 2. Holotype of *Gymnodactylus vanzolinii* **sp. nov.** (MZUSP 68286). Dorsal (A), lateral (B), and ventral (C) views of the head (scale bar = 5 mm).

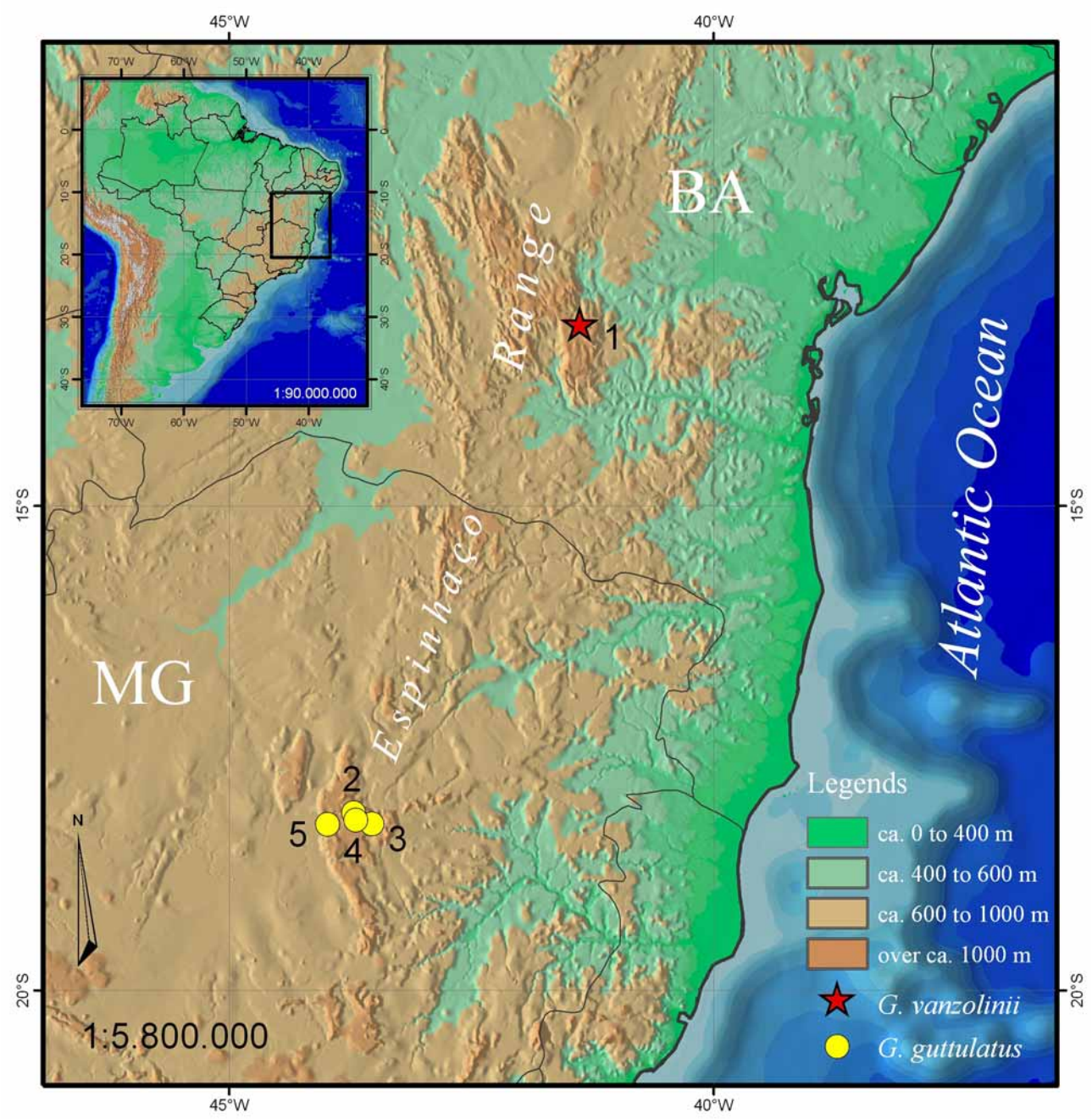

FIGURE 3. Type-locality of *Gymnodactylus vanzolinii* **sp. nov.**, Mucugê municipality, State of Bahia (BA), Brazil, and distribution of *G. guttulatus* along the Espinhaço mountain range. Localities: 1. Mucugê; 2. Sopa, Diamantina, Minas Gerais (MG); 3. Extração, Diamantina (MG); 4. Guinda, Diamantina (MG); 5. Conselheiro Mata, Diamantina (MG).

Description of holotype: Adult female, SVL 52.3 mm, TL 70.6 mm, HL 12.9 mm, HW 9.3 mm, HH 6.8 mm. Head large, distinct from neck; covered with small granules and irregularly disposed, enlarged and scattered tubercles among them in parietal and occipital regions. Rostral scale of moderate size, 1.7 times wider than high, visible from above, indented and slightly concave dorso-medially. Supranasals wider than long, enlarged separated on midline by a granular scale and posteriorly bordered by three small granules, the exterior one larger and contacting the nostril. Snout sub-elliptical in dorsal view, rounded laterally. Top of snout, from rostral to level of anterior margin of orbit, covered with enlarged granules of different sizes, rounded, juxtaposed, slightly keeled or smooth, decreasing in size towards labial border and posterior part of head. Central and posterior part of head with slightly rounded, conic, juxtaposed granules much smaller than those

from snout. A cluster of enlarged granules on top of head posterior to eyes. Superciliary region with a series of enlarged imbricate and smooth scales; anterior ones much larger, becoming progressively smaller and granular posteriorly. Loreal region with enlarged and juxtaposed granules similar to those on top of snout, those closer to labials longer than wide and flat. Temporal granules small, conical, juxtaposed, some keeled, similar to those on top of head. Enlarged, conical, and juxtaposed granules on the superior an anterior margin of ear opening, those posterior to ear opening smaller. External ear opening oblique, about half the size of the eye. Tympanum highly recessed. Nostril small and protruding, bordered by rostral, internasal, two enlarged postnasals, and two small granules separating nostril from first supralabial. Fourteen to 15 loreal granules in an imaginary row between postnasals and anterior margin of the orbit. Eye large, pupil vertical. About 22 interorbital granular scales. Seven to eight enlarged supralabials, fifth to seventh below center of eye, followed by small granules; two irregularly arranged rows of slightly enlarged flat scales between supralabials and eye. Mental sub-triangular, as long as broad, followed laterally by a pair of enlarged but much smaller sub-triangular postmentals. Postmentals in contact with first supralabials, broadly separated in the midline; in posterior contact with gular granules, the external ones larger. Six infralabials decreasing progressively in size posteriorly, first largest. A series of enlarged sublabials between gular scales and infralabials, longer than wider. Gular scales rounded, cycloid, increasing gradually in size posteriorly; those closer to sublabials slightly enlarged.

Neck granules conical, imbricate, juxtaposed, smaller dorsally, slightly enlarged laterally.

Dorsal and lateral parts of body covered with granules as small as or smaller than those on top of head. On each side five relatively regular longitudinal rows of enlarged and widely separated blunt conical tubercles. Twenty three paravertebral tubercles. Ventral scales large, much larger than the enlarged isolated dorsal tubercles, rounded, flat, subimbricate, cycloid, forming irregular longitudinal rows, 33 on the midline between the level of posterior edge of arm and anterior edge of thigh. Cloacal opening a straight transverse cleft, surrounded by granular scales.

Fore-limbs with enlarged, keeled, and imbricate scales dorsally; ventrally much smaller, almost granular and flat scales. Antero-dorsal and ventral parts of thigh with large, imbricate, cycloid scales those contacting scales of posterior part of thigh slightly keeled. Postero-dorsal part of thigh with much smaller, juxtaposed, conical granules, decreasing ventrally in size. Dorsal parts of tibia with enlarged juxtaposed slightly keeled granules. Ventral parts of tibia with cycloid, smooth, imbricate, flat scales, smaller than those on ventral part of thigh.

Palmar and plantar surfaces with juxtaposed rounded granules; an enlarged external and conspicuous palmar tubercle. Digits long, angulated distally, slightly compressed; claws relatively long, curve, protruding much beyond claw sheath; subdigital lamellae quadrangular, gradually decreasing in size distally, some, in the distal half, eventually substituted by a pair of granules. Fifteen infradigital lamellae under fourth finger; 19 under fourth toe.

Tail cylindrical, its dorsal scalation near the base identical to that present on dorsal parts of body. Distal part of the dorsal surface of the tail with enlarged, imbricate, slightly keeled or smooth scales that are as wide as long, gradually increasing in size and becoming elongated towards the tip of the tail. In the first third of dorsal part of tail, a pair of distinctive enlarged scales characterizes a series of regular whorls that become inconspicuous distally. Ventral part of base of tail with smooth, imbricate scales, similar to those of ventral part of body. Posterior part of ventral surface of tail with smooth, strongly imbricate scales; those from mid-ventral area distinctly enlarged, at least twice as wide as long, laterally contacting much smaller scales.

Color in preservative (ca. 70% alcohol): Background color of dorsal and lateral parts of body light olive-brown. Head with a series of irregular dark brown spots, extending from the level of eyes to neck. A conspicuous dark brown stripe extending from nostril to eye is present both in loreal and canthal regions; these stripes extend behind the eyes on temporal region but become irregular on nuchal region. A series of nine irregular transverse dark brown bands, fading toward venter, extend from the level of arms to the level of legs. Ventral

surface of body cream, immaculate. Three to four irregularly arranged melanophores on each gular scale. Dorsal parts of tail with dark brown irregular bands similar to those of dorsum, ventral parts immaculate anteriorly, becoming progressively dark-brown towards the extremity.

Color in life: Similar to colors observed in preserved condition, although more brightly colored.

Variation: Maximum snout-vent length in males 50.8 mm (N = 4); maximum snout-vent length in females 52.3 mm (N = 11); tail length 59.4–70.6 (N = 4); head length 8.2–12.9 (N = 17); head width 5.6–9.4 (N = 16); head height 3.6–6.8 (N = 16); number of longitudinal rows of tubercles 10–12 (N = 13); paravertebral tubercles 22–29 (N = 13); supralabial scales 5–8 (N = 16); internasals 0–1 (N = 16); ventrals 18–22 (N = 11); subdigital lamellae under finger IV 16–18 (N = 17); subdigital lamellae under toe IV 18–21 (N = 15).

The status of *G. carvalhoi* Vanzolini, 2005 and *G. amarali* Barbour, 1925: *Gymnodactylus amarali* was described by Barbour in 1925 on the basis of a specimen from Engenheiro Dodt, state of Piauí (Barbour 1925). In the course of a recent revisionary study Vanzolini (2005) described *G. carvalhoi*, including under this name all specimens of *Gymnodactylus* from the Central Brazilian Cerrado currently attributed to *Gymnodactylus geckoides amarali*. Although Vanzolini did not examine the holotype of Barbour (1925), he redefined and redescribed *G. amarali* based on a single juvenile specimen he collected at Alto Parnaíba, state of Maranhão, in the surroundings of the type locality. Recognizing this specimen as the only other example of *G. amarali* he decided to allocate all other specimens from the Cerrado previously assigned to *G. geckoides amarali*, in his new species. We think that Vanzolini was in error and that *G. carvalhoi* is not a valid species.

Barbour was very clear when he said in the original description that the holotype of *G. amarali*, (MCZ 20682) had "about 15 longitudinal series" of "rows along the sides of the body" (Barbour 1925). Later, the same specimen also was examined by Benjamin Shreve who found 14 rows of tubercles (In: Vanzolini 1953a). We do not understand why Vanzolini (2005) ignored this information, because he redefined *G. amarali* based on the presence of 10 longitudinal rows of dorsal scales in the juvenile specimen from Alto Parnaíba (Vanzolini 2005). We re-examined this specimen (MZUSP 93075) and verified that its dorsal skin is partially damaged, probably leading Vanzolini to mistakenly count its scales. Actually the specimen has 14 longitudinal rows of dorsal scales instead of the 10 reported by Vanzolini (2005). The only species of *Gymnodactylus* with such a low number of longitudinal rows of dorsal tubercules are *G. guttulatus* and *G. vanzolinii* **sp. nov.**, with values varying between 10 to 12 in both species (see Table 3). Vanzolini (2005) also admitted that the most important diagnostic characteristic of his new species was the color pattern, which was characterized by the presence of conspicuous and vivid ocelli with their centers situated on dorsal tubercles. He considered this ocellate pattern sufficient to separate *G. amarali* from all other samples he studied from the Cerrado. We disagree. Specimens from other areas in the Cerrado we examine exhibit a similar pattern of coloration. Live animals, particularly juveniles, show that "conspicuous and vivid" coloration described by him and Barbour. The "large tubercle that forms the center for each of the dorsal white spots" reported as diagnostic for *G. amarali*, is found in several specimens from the Cerrado examined and varies greatly in all samples. When Barbour described *G. amarali* he diagnosed his new species from *G. geckoides* found in the adjacent semi-arid Caatinga and emphasized color differences. In fact, color differences between *G. geckoides* and *G. amarali* are markedly contrasting: *G. geckoides* presenting commonly a less conspicuous color pattern, usually without ocelli, almost inconspicuous when compared with the vivid pattern of the Cerrado animals, especially in life or recently collected.

Vanzolini (2005) also estimated the number of tubercles in the paramedian row of his juvenile of "*amarali*" to be 66 tubercles. Using a similar method we estimate the number of tubercules in the damaged part of skin and counted those present in the remaining intact part, and the total number does not pass 40. This value is within the range for the samples of *Gymnodactylu*s from the Cerrado biome (Table 3) examined by us.

Other characteristics pointed out by Vanzolini (2005) as diagnostic between the two species refers to the shape of the canthus rostralis and loreal, size and organization of the tubercles, shape of ear opening, and presence or absence of preanal patch. All these characteristics mentioned by him are highly variable and most of

them are subjective, like "the dorsal tubercles of *amarali* are weaker and much less well organized". Variation in the referred characters is so extensive in specimens from the Cerrado and in all other species of *Gymnodactylus*, that they are useless for diagnostical purposes.

Based on the considerations above, we consider that *G. carvalhoi* is identical to *G. amarali* and should be considered a synonym of that last name.

Comparison to other species: *G. vanzolinii* **sp. nov.** can be immediately distinguished from all other congeners by the presence of irregular transversal dark bands along the dorsum, absent or incomplete and interrupted in all other species. The most similar species seems to be *G. guttulatus* that also has irregular transverse band along the dorsum but they are incomplete and interrupted. *G. guttulatus* presents white dots scattered on the dorsum that are absent or faded in *G. vanzolinii*. In color pattern *G. vanzolinii* differs from *G. darwinii* in the absence of a nuchal dark collar (present in *G. darwinii*), from *G. amarali* by the absence of light dorsal body ocelli, present in almost all individuals of *G. amarali* examined, and from *G. geckoides* by the absence of dark marblings or, less commonly, by the presence of diffuse, irregular and incomplete ocelli, forming incomplete transverse bands on the dorsum in *G. geckoides* (variation in *G. geckoides* is also extensive). *G. vanzolinii* can be distinguished from *G. amarali*, *G. darwinii*, and *G. geckoides*, by having frequently 10 (rarely 11 or 12) rows of longitudinal dorsal tubercles (mean = 10.43 ± 0.65; n = 14), instead of 12 or more in the other three species (see Table 3). The number of rows of longitudinal dorsal tubercles in *G. guttulatus* ranges from 11–14 (mean 12.4 ± 1.14, n = 5). Overlap in the number of rows of longitudinal dorsal tubercles with *G. vanzolinii* is slight but in these cases color pattern separates the two species. *G. vanzolinii* can be additionally distinguished from *G. amarali* and *G. geckoides* by having a 4th finger with 16–18 (n = 17) subdigital lamellae [11–14 (n = 14) in *G. amarali*, and 13–15 (n = 30) in *G. geckoides*]. *G. vanzolinii* can be distinguished from *G. darwinii* by having less tubercles in a paramedian row [22–29 (n = 13) against 47–59 (n = 15) in *G. darwinii*]. Finally, *G. vanzolinii* is distinctly larger than *G. geckoides* in body size (Table 3).

Distribution and ecology: *G. vanzolinii* **sp. nov.** is presently known only from, and thought to be endemic to, the mountains of Serra do Sincorá, in the Chapada Diamantina, an area situated in the northern portion of Espinhaço mountain range (Fig. 3). Situated in Bahia and Minas Gerais states between latitudes 10°–20°35'S and longitudes 40°10'–44°30'W, this high altitude phytogeographic province, reaches elevations of more than 2,000 m in some places. The area is characterized by a mosaic of vegetation types, of which "campos rupestres" [rocky fields in Magalhães's (1966) connotation], a dominant open-rock pioneer vegetation with rock-dwelling plants, are most common. Nevertheless, various types of environments occur in the area, like marshes, gallery forests, "cerrado" (savanna-like), montane forests and semi-deciduous to deciduous forests (Giulietti & Pirani 1988).

All specimens of *G. vanzolinii* were collected on rock outcrops in the proximity of the Mucugê municipality, Serra do Sincorá, Chapada Diamantina. Some were collected under solitary rocks or in rock crevices. Seven individuals were found inactive under rocks during the day. Active specimens were only observed at night, from early evening to about midnight. As most active specimens observed were foraging in deep fissures on large rocks we think that their apparently scarcity might be due to this microhabitat preference. Several active specimens observed under these circumstances were not collected because there were deeply inserted in the rock crevices.

Phyllopezus pollicaris and *Hemidactylus brasilianus* were collected syntopically with *G. vanzolinii* on the rocks, although they were also obtained in other microhabitats in the area. Other lizards recorded at Mucugê area [unpublished data, and Freitas & Silva (2007)] were: *Hemidactylus mabouia* (Gekkonidae), *Acratosaura mentalis*, *Acratosaura* sp., *Heterodactylus* sp., *Micrablepharus maximiliani*, *Psilophthalmus* sp. (Gymnophthalmidae), *Enyalius erythroceneus* (Leiosauridae), *Polychrus acutirostris* (Polychrotidae), *Mabuya heathi*, *Mabuya* sp. (Scincidae), *Ameiva ameiva*, *Cnemidophorus* sp., *Tupinambis merianae* (Teiidae), *Eurolophosaurus* sp., *Tropidurus hispidus*, *Tropidurus mucujensis*, and *Tropidurus semitaeniatus* (Tropiduridae).

Discussion

The Espinhaço mountain range in eastern Brazil is well known for its high level of plant and animal endemism. Recently, several new species have been described, or still have to be described from this area (examples: Bokermann & Sazima 1978; Caramaschi & Sazima 1984; 1985; Cassimiro *et al.* 2008; Eterovick & Sazima 1998; Giulietti & Pirani 1988; Lugli & Haddad 2006a, b; Mott *et al.* 2008; Napoli & Juncá 2006; Pinna 1992; Pugliese *et al.* 2004; Rodrigues 1987; Rodrigues *et al.* 2006; Sazima & Caramaschi 1988). As the surrounding areas were relatively well inventoried and *G. vanzolinii* **sp. nov.** was not detected there (Freitas & Silva 2007; Juncá 2005) it is reasonable to consider this species as another endemic from this area. Although *G. amarali*, *G. darwinii* and *G. geckoides* occur geographically closer to *G. vanzolinii* (Vanzolini 1953a, 2004, 2005), in habitat requirements and general similarity *G. vanzolinii* seems to be more related to *G. guttulatus*. The latter is also restricted to the Espinhaço range, being endemic to high elevations in the southern portion of this mountain range, its northern record being about 620 km from the type locality of *G. vanzolinii*. Both species live in rock crevices associated with the characteristic open vegetation of the rocky meadows of these highlands, like other species endemic to this region (Rodrigues 1987). The other species of *Gymnodactylus* are mainly associated with different habitats at lower altitudes: *G. darwinii* with the Atlantic forest, *G. geckoides* with the Caatinga, and *G. amarali* with the Cerrado (Vanzolini 2004; 2005; Vanzolini *et al.* 1980). We hope that an explicit phylogenetic scheme, which is presently under way, will clarify the relationships, as well as the history and timing of differentiation of this interesting lizard genus.

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Appendix 1. Specimens examined.

Gymnodactylus amarali. Brazil: Maranhão state: Alto Parnaíba municipality: MZUSP 93075.

Gymnodactylus carvalhoi. Brazil: Tocantins state: Ipueiras municipality: MZUSP 91187 (holotype); MZUSP 91183–6 (paratypes); Gurupí municipality: MZUSP 57017 (paratype); Porto Nacional municipality: MZUSP 78244 (paratype); Palmas municipality: MZUSP 87119–21 (paratypes); Peixe municipality: MZUSP 91509–11 (paratypes).

Gymnodactylus darwinii. Brazil: Bahia state: Salvador municipality: MZUSP 89697–8, 89707, 89736, 89744–5, 89748, 89759, 89763, 89765, 89768, 89779–80, 89785, 89789, 89794.

Gymnodactylus geckoides [Spix's type was lost according to Hoogmoed & Gruber (1983)] Brazil: Bahia state: Senhor do Bonfim municipality (formerly Villa Nova): MZUSP 408 [holotype of *Gymnodactylus conspicuus* (Amaral 1932 "1933") synonymized with *G. geckoides* Spix, 1825 by Vanzolini (1953a)]; MZUSP 457, 658, 12299, 12301 (paratypes of *G. conspicuus*). Pernambuco state: Exu municipality: MZUSP 49683–6, 49688–9, 49691–4, 49696–9, 49702, 49708, 49711–2, 49714, 49716, 49718–22.

Gymnodactylus guttulatus. Brazil: Minas Gerais state: Diamantina municipality: Vila de Guinda: MZUSP 56372 (holotype); MZUSP 55527–8, 56370–1 (paratypes); Diamantina municipality: Extração: MZUSP 56337–8.