A new species of *Bufo* Laurenti (Anura, Bufonidae) from northeastern Brazil

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ABSTRACT. A new species of bufonid toad, *Bufo jimi* **sp. nov.**, is described from Maracás and Itagibá, State of Bahia, Brazil. This species shows close relationships to *B. paracnemis* Lutz, 1925 by sharing the presence of tibial glands and the paratoid glands shape. The new species is a member of the *Bufo marinus*-group, and is characterized by having well-defined glands in most part of dorsal face of the forearms, in the extern side of the feet and in both sides of cloacal region.
KEY WORDS. Amphibia, Anura, Bufonidae, *Bufo jimi* **sp. nov.**, *anuran, taxonomy*

The genus Bufo Laurenti, 1768 is a group of toads with extensive distribution in the New World, Eurasia and Africa (GRAYBEAL & CANNNATELLA 1995). The *marinus*-group of this genus has a typical Neotropical distribution, from southern Texas in North America to southern Argentina (north of the Chubut River), extending from east of the Andes to the Atlantic coast (GALLARDO 1962; 1965a, b; CEI 1968, 1972; BLAIR 1972; REIG 1972; HOOGMOED 1990; DUELLMAN & SCHULTE 1992).

The *marinus*-group is composed by six species: *Bufo arenarum* Hensel, 1867, *B. ictericus* Spix, 1824, *B. marinus* Linnaeus, 1758, *B. paracnemis* Lutz, 1925, *B. poeppigii* Tschudi, 1845 e *B. rufus* Garmann, 1877 (DUELLMAN & SCHULTE 1992). *Bufo paracnemis* is an inhabitant of open formations of South America, from the dry Caatinga in northeastern Brazil to the Chaco region in Argentina, across the steps of Central Brazil (CEI 1972). In the Atlantic rain forests of southeastern Brazil, from Rio de Janeiro to Uruguay, there is another species of this group, *B. ictericus* (BLAIR 1972; CEI 1972; MARTIN 1972).

A new member of this group, distributed in northeastern Brazil, is described here and can contribute to a better understanding of the evolution of the *marinus*-group.

MATERIAL AND METHODS

The specimens examined are housed in JJ (Jorge Jim Collection, deposited in the Universidade Estadual Paulista, Botucatu, São Paulo, Brazil) and from the MZUSP (Museu de Zoologia, Universidade de São Paulo, São Paulo, Brazil).

A total of 25 measurements were taken in mm (by using of the 0,2mm of precision instruments) from external feature. Abbreviations are as follows: SVL (snout-vent length), HW (head width), HL (head length), ED (eye diameter), TD (tympanum diameter), IOD^f (fore inter-orbital distance), IOD^m (medial inter-orbital

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distance), IOD^p (posterior interorbital distance), IND (inter-nostril distance), NSD (nostril-snout distance), END (eye-nostril distance), ETD (eye-tympanum distance), PL (parotoid gland length), PW (parotoid gland width), AL (arm length), FAL (fore-arm length), HaL (hand length), ThL (thigh length), TbL (tibia length), FL (foot length), STCL (supra-tympanic crest length), EL (eyelid length), MFL (metatarsal fold length), POCL (pre-orbital crest length), and OTCL (orbit-tympanic crest length).

Morphological data were taken from comparative analysis of samples of *B. paracnemis* of the MZUSP and the JJ.

Bufo jimi sp. nov.

Holotype. JJ 7628 adult male from BRAZIL, *Bahia*: Maracás (40°26'W, 13°26'S, Fazenda Cana Brava), 10/I/1975, J. Jim, L.A. Toledo, C.M. Carvalho, S.A. Mioni & U. Caramaschi *leg.*

Paratypes. BRAZIL, *Bahia*: Itagibá (39°51'W, 14°24'S, Fazenda Pedra Branca), 04 a 07/II/1974, JJ–7536-40 (males); 7541-42; 7543-44 and 7545-48 (females), J. Jim & U. Caramaschi *leg.*; 16-24/I/1975, 7643-46, 7650-52, 7654-56, 7668-72 (males), 7647-49, 7653, 7657-60, 7661-67, 7673-77, 7678-83 (females), J. Jim, U. Caramaschi, C.M. Carvalho & S.A. Mioni *leg.*; Maracás (Fazenda Cana Brava), 10-12/I/1975, JJ-7629 (male), 7624, 7625, 7630-31, 7632-34, 7635-37, 7638 (females), J. Jim, L.A. Toledo, C.M. Carvalho, S.A. Mioni & U. Caramaschi *leg.*; Maracás (Fazenda Três Barras), 13/I/1975, JJ-7639-42 (females), J. Jim, L.A. Toledo, C.M. Carvalho, S.A. Mioni & U. Caramaschi *leg.*

Holotype and paratypes are housed in Jorge Jim Collection (JJ), deposited in the Universidade Estadual Paulista, Botucatu, São Paulo, Brazil.

Description of the holotype. A stout, large and weighty toad species (Fig. 1 a-b). Head (Fig. 2 a-f in female paratype) wider than long, snout rounded in profile and drawing a semicircle in ventral view. Skull very broad and concave. All cranial crests present, thick. Crest on snout thick and moderately projected. Supra-lip arcs short and thick. Canthus rostralis distinct, loreal region slightly concave; nostrils slightly protuberant and directed backwards and upwards. Eyelids thick, with edges projected and covered by several keratinized spines. Tympanum rounded, median and distinct, with scattered keratinized points at margin. Parotoid glands (Fig. 2 a-f) follow the supra-tympanic crests, broad anteriorly, slender posteriorly. Behind each gland is a line of elongated tubercles reaching the median inguinal region. No vomerine or maxillary teeth, but vomerine odontoids present. Arms moderately strong in males, slim in females; well defined forearm glands dorsally (Fig. 2a, d and indicated by arrows in figure 3a from holotype). Finger length: II< I< IV< III. No webbing. Subarticular tubercles double or divided. Inner metacarpal tubercle rounded, nearly elliptical. Outer metacarpal tubercle large, nearly rounded, followed by a line of small tubercles, slightly keratinized on ventral face of fore-arms. Legs robust and short. Tibiae glands irregular and scarcely defined (Fig. 1a, 3b, e). Metatarsal fold low, but thick and covered by a continuous line of keratinized points. Feet (Fig. 1 c) with elliptical inner metatarsal tubercle, longer than wide; subarticular tubercles small, single and rounded. Lateral surface of feet with an anterior, main, well-defined gland reaching the to toe V, and a smaller, more scarcely defined gland

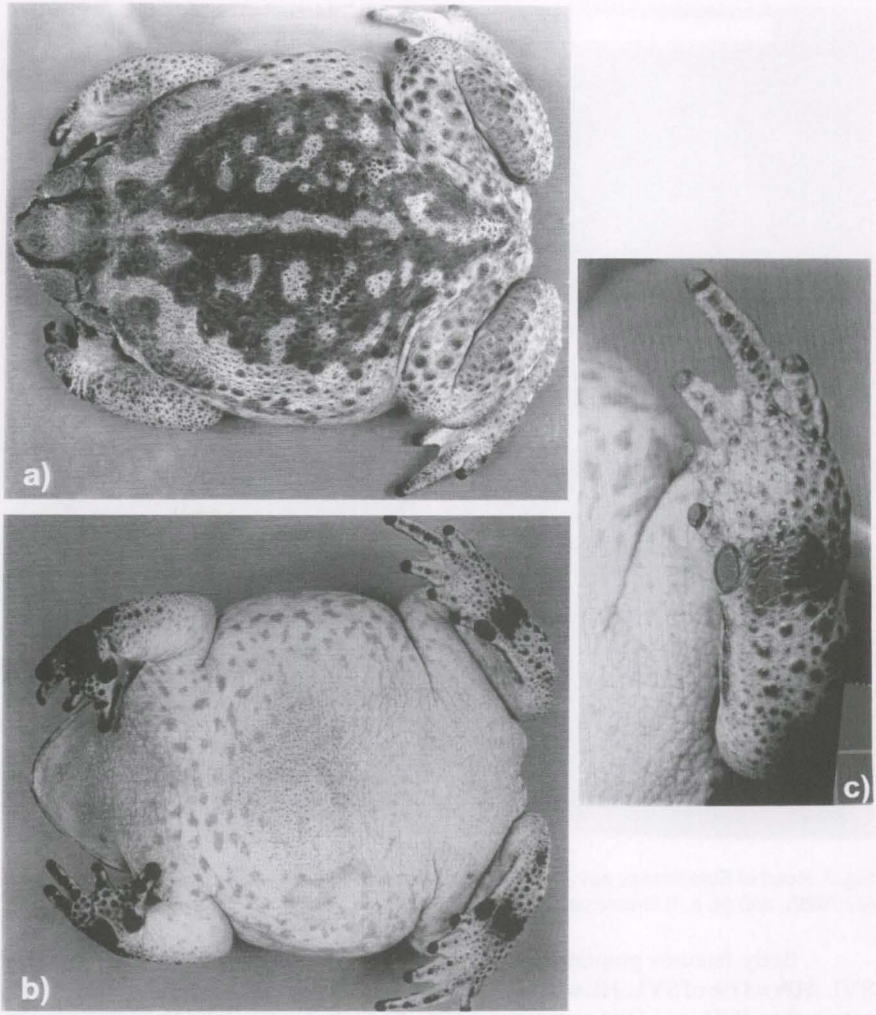

Fig. 1. Male holotype of *Bufo jimi* **sp. nov.** (JJ 7628): (a) dorsal view, (b) ventral view, and (c) ventral view of foot.

in metatarsal region (indicated by arrows in figure 3b, d). Toes webbed proximally and fringed distally. Toes length: I< II< V< III< IV. Two evident aggregates of glands symmetrically located at both side of cloaca (Fig. 1 a, b, and indicated by arrows in Fig. 3c, e), with no defined shape, but always present.

Measurements from holotypes (in mm): SVL = 171; HW = 67,25; HL = 42,10; ED = 13,54; TD = 11,60; IOD^f = 23,46; IOD^m = 23,57; IOD^p = 28,31; IND = 10,57; NSD = 5,63; END = 11,16; ETD = 6,60; PL = 44,78; PW = 21,40; AL = 47,63; FAL = 39,38; HaL = 25,63; ThL = 69,60; TbL = 60,50; FL = 90,43; STCL = 10,76; EL = 11,57; MFL = 18,40; OTCL = 15,84; POCL = 14,62.

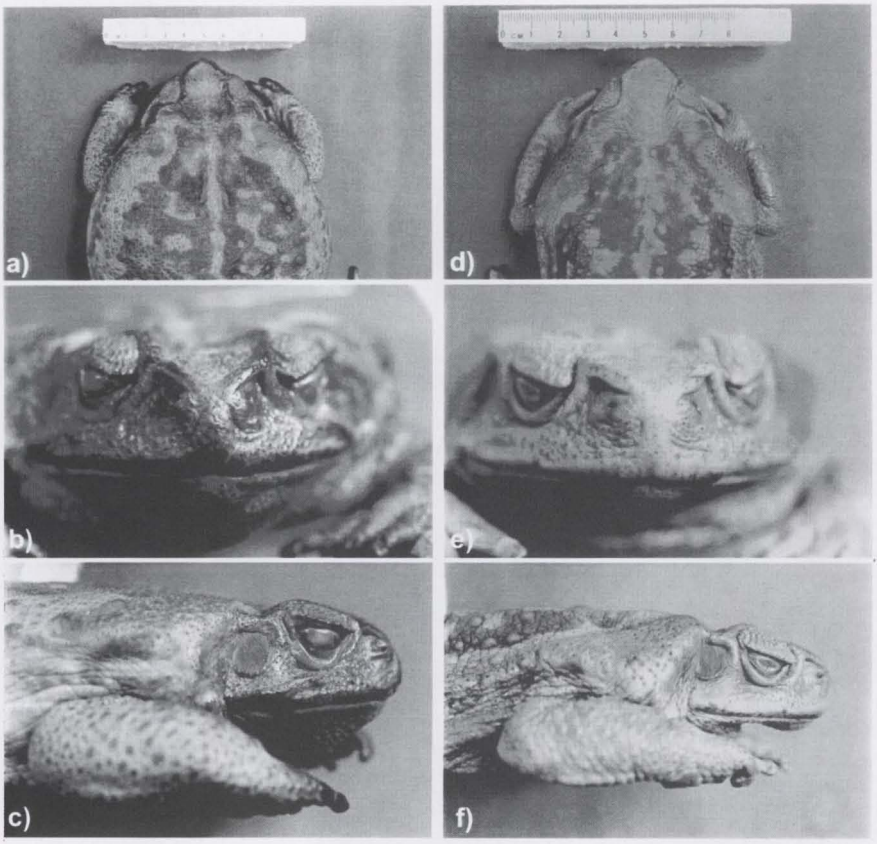

Fig. 2. Head of *Bufo jimi* **sp. nov.** in dorsal, frontal, and profile views: (a, b, c) of male holotypes (JJ 7628), and (d, e, f) female paratype (JJ 7631).

Body features proportions (Tab. I, for morphometric media). HL = 25% of SVL, HW=37% of SVL. HL = 67% of HW. OTCL >STCL >POCL >EL. END slightly longer than IND, and IND near twice ETD. IND = twice NSD. ETD slightly greater than NSD. TD = 62% of ED, and = 41% from IOD^m. ED = 76% of IOD^m. HaL = 67% of AL, and = 89% of FAL. ThL = 73% of FL; TbL = 67% of FL. MFL = 24% of FL.

Color of holotype in preservative. Dorsum is grayish beige, mottled with dark brown spots nearly symmetrically distributed, from anterior end of parotoid glands to posterior region, in both sides of the body. The parotoid glands show a slightly distinct color, more orangeish. Ventrally beige is lighter than in dorsum. Head region is very dark, from brown to nearly black. Spots brown are smokiest more concentrated at the scapular region and scarcely to back.

Skin texture. Dorsum skin is covered by many tubercles of variable sizes. On dorsum, flanks, and upper surface of arms and legs, keratinized spines are present, as well as on skin, and on tubercles. These points have small spines, giving a sandpaper appearance at touch (in females these spines are absent, the skin is smoother at touch).

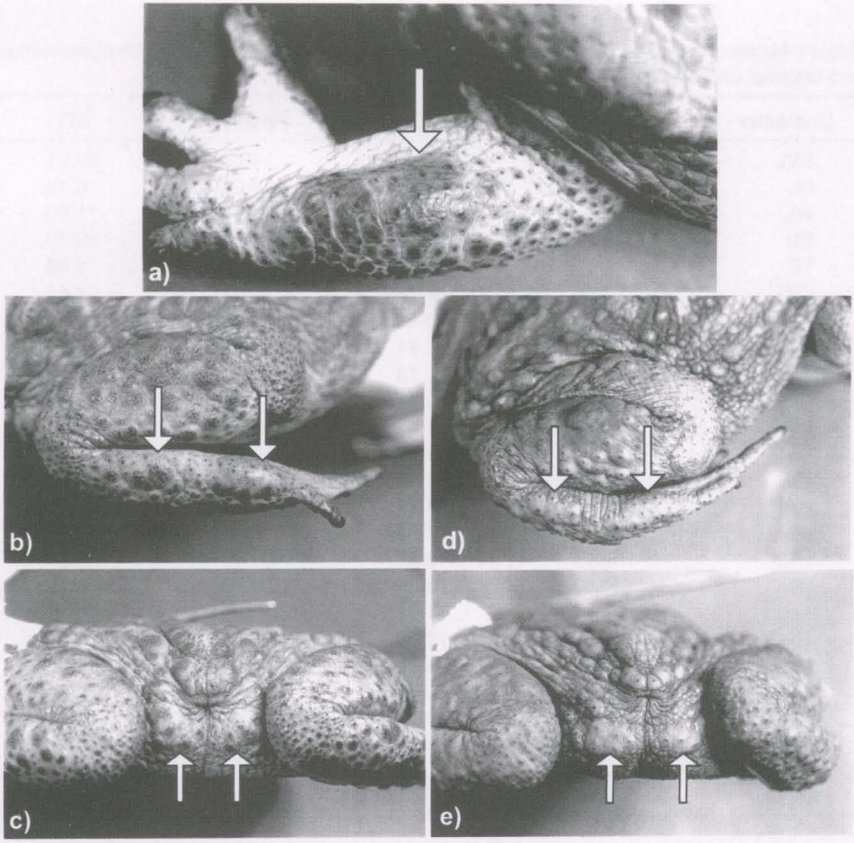

Fig. 3. Diagnostic features of *Bufo jimi* **sp. nov.**: glands on forearm, on foot, and on both sides of cloaca from (a, b, c) male holotypes (JJ 7628), and (d, e) female paratype. (JJ 7631).

Diagnosis and comparison with other species. It seems quite probable that *Bufo paracnemis* in its traditional sense represents a species complex. This species presents large distribution in the open formations of the South America (Fig. 4). *Bufo jimi* **sp. nov.** corresponds to the set of populations identified to date as *B. paracnemis* in the Brazilian northeastern region (Fig. 4) and clearly represents a different species. *Bufo jimi* **sp. nov.** shows close relationships to *B. paracnemis*, as indicate the presence of tibial glands and the parotoid gland shape. *Bufo jimi* **sp. nov.** differs from *B. paracnemis* on the following diagnostic features: presence of forearm gland, an external gland in the feet, and gland conglomerates on both sides of the cloaca. Additionally, in *B. jimi* **sp. nov.** the eyelid length is slightly shorter than in *B. paracnemis*. CSTL/EL proportions is 1,0 in *B. jimi* **sp. nov.**, while in different localities *B. paracnemis* specimens this proportion is about 0,9 (SD = 0.04). The eye diameter in *B. jimi* **sp. nov.** is 76% of the interorbital distance, while in *B. paracnemis* is 81% (SD = 4%). Hands are 89% of forearm length, smaller than in *B. paracnemis* (M = 93%, SD = 2%). The metatarsal fold length is 24% of the foot length, slightly larger than in *B. paracnemis* (M = 22%, SD = 0,47%).

Table I. Media of measurements of samples of *Bufo* jimi **sp. n.** (mm) (N = 60). For abbreviations see Material and Methods.

Character	Males	SD	Females	SD
SVL	147.48	16.34	133.8	29.71
HL	36.63	3.79	32.94	6.45
WL	54.12	11.18	48.63	11.90
ED	14.85	1.59	13.34	2.43
TD	9.10	0.92	8.29	1.48
IOD ^{f}	20.60	2.72	18.04	4.44
IOD ^{m}	19.63	2.81	17.46	4.60
IOD ^{p}	23.07	1.91	20.60	4.88
IND	9.13	1.13	8.10	1.88
NSD	4.37	0.73	4.29	1.10
END	9.61	1.25	8.73	1.87
ETD	5.01	0.93	4.36	1.30
PL	35.90	4.45	33.19	9.63
PW	22.65	3.94	19.17	7.20
AL	48.11	7.35	4.05	10.58
FAL	36.01	5.51	30.80	8.24
HaL	31.67	3.80	28.10	6.22
ThL	54.82	7.61	47.98	12.40
TbL	49.53	10.00	45.37	11.39
FL	74.96	8.91	66.32	14.92
STCL	9.69	1.70	8.48	2.99
EL	8.57	0.91	8.14	1.81
MFL	17.16	3.21	16.34	4.46
POCL	10.68	1.46	9.74	2.36
OTCL	9.49	1.44	8.21	2.05

Bufo ictericus, from the Atlantic forests in southeastern Brazil (Fig. 4), would be slightly more distant from *B. jimi* **sp. nov.** The tibial glands represent a synapomorphy joining *B. jimi* **sp. nov.** and *B. paracnemis*. *Bufo ictericus* joins this pair of species in an immediately higher level, as suggested by osteological (MARTIN 1972), reproductive (BLAIR 1972), and morphological features (CEI 1972). On the other hand, *B. marinus* and *B. poeppigii* seem to constitute a more basal clade in the *marinus*-group. BLAIR's (1972) interpretation of experimental hibridization and testes proportion showed that a pair of species composed of *B. arenarum* and *B. rufus* would joined *B. paracnemis*, *B. jimi* **sp. nov.**, and *B. ictericus*. The closest relationship between *B. arenarum* and *B. rufus*, sometimes referred as the *arenarum*-group (CEI 1972), is suggested by the smaller and more elongated parotoid glands and the proportions of the skull.

Geographic distribution. *Bufo jimi* **sp. nov.** is distributed in the entire northeastern region of Brazil, from State of Maranhão to State of Bahia at low altitudes, from sea level to nearly by 400-500 m. No local specialization was detected between the populations examined. The distribution area of *B. jimi* **sp. nov.** includes the northern spots of rain forest along the Atlantic coast, the open formation of caatinga in Maracás (Bahia) and the dry area of Cabaceiras in State of Paraíba.

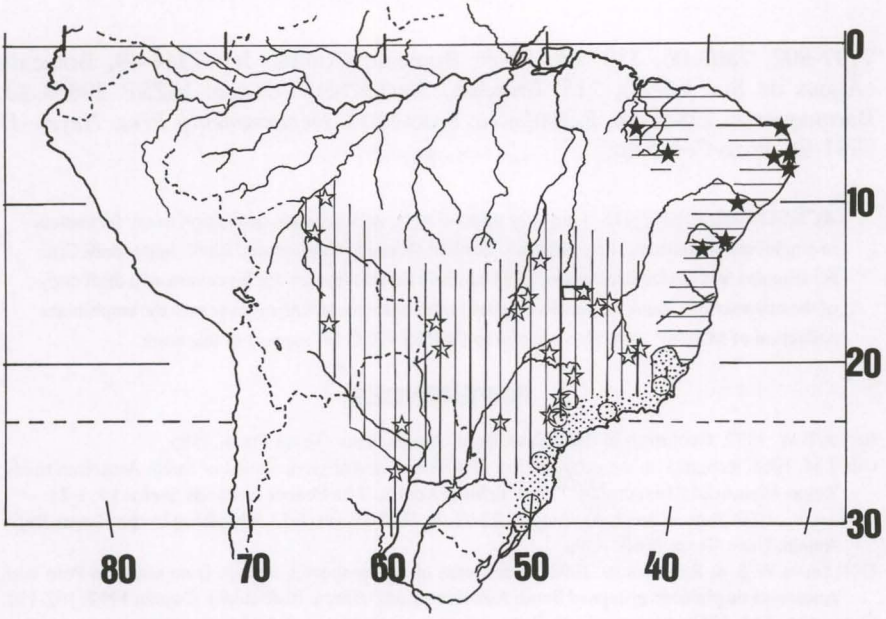

Fig. 4. Approximate area of distribution of three species: *Bufo jimi* **sp. nov.** (horizontal lines), *B. paracnemis* (vertical lines) and *B. ictericus* (spots). The circles points localities for *Bufo ictericus*, and stars points localities with specimens considered *Bufo paracnemis* (black stars = *B. jimi*, and white stars = *B. paracnemis* in this work).

Etymology. The specific name of this species is given after Dr. Jorge Jim for his contribution to the knowledge of the Brazilian herpetology.

Additional material examined. Specimens recognized as *Bufo jimi* **sp. nov.**: BRAZIL, *Alagoas*: MZSP 11901-09, Mangabeiras; *Bahia*: MZSP 10750-70, Salvador; 38054-60, Jeremoabo; *Maranhão*: MZSP 21236, Aldeia do Ponto; 21237-38, Barra do Corda; 21239, Tabacoal; 212748, São Luiz; *Paraíba*: MZSP 22909-21, Mamanguape; 62992-96, Gurinhém; *Pernambuco*: MZSP 24321-22, Ponta de Pedras; 55504, Recife; *Piauí*: JJ (unregistred) Picos; *Rio Grande do Norte*: MZSP 29408, Ponta Negra; *Sergipe*: MZSP 55488-03, Santo Amaro das Brotas; Arquipélago Fernando de Noronha: MZSP 20962-70.

Specimens recognized as *B. paracnemis*: *Goiás*: MZSP 29514-28, Jataí, 29532-35, Rio Verde, 29572-80, Santa Isabel do Morro, 71727-45, Serra da Mesa; *Distrito Federal*: JJ 7787-88, Brasília (Lago Paranoá); *Mato Grosso*: MZSP 22393-07, Xavantina; 29434-40, Três Lagoas; 29758-64, Mato Verde; *Mato Grosso do Sul*: MZSP 15791-96, Aquidauana; 29470-71, Serra do Urucum; *Minas Gerais*: MZSP 20509-18, Santana do Araçuaí; 29581-88, Arinos, 29605-08, Lagoa Santa, 29648-51, Uberlândia, 29663-71, Unaí; *Paraná*: MZSP 29774-84, Guairá; *Rondônia*: MZSP 20420-30, Porto Velho; 29791-96, Príncipe da Beira; JJ 7684-85; 7686-88 and 7689-93, Guajará Mirim; *São Paulo*: MZSP 11234-62, Emas; 11901-09, Herculânia; 29673-81, Borborema; JJ 7771, Angatuba; 214, Anhembi; 743; 7455; 7458; 7465; 7549-50; 7551; 7552, Botucatu (Faz. Lageado); 7343; 7456-57;

7797-802; 7803-06; 7807-08; 7809; Botucatu (Rubião Jr); 7344-49, Botucatu (Águas de Sta. Lúcia); 215, Conchas. ARGENTINA, *Chaco*: MZSP 29864-80, Barranqueras; 29881-88, Resistência. PARAGUAI, *Departamento Pres. Heyes*: JJ 7791-96, Pozo Colorado.

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