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A NEW SPECIES OF *LIOLAEMUS* FROM SOUTHERN BRAZIL (IGUANIA: TROPIDURIDAE)

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ABSTRACT: We describe a new species of the genus *Liolaemus* from Rio Grande do Sul, Brazil. The morphology of the new species, *L. arambarensis* sp. nov, is compared to other species of *Liolaemus* of the "*wiegmannii*" group. The new species is distinguished from others members of this group by a dorsal color pattern with a medium dorsal white stripe and two dorsolateral stripes, two rows of juxtaposed brown marks resembling triangles, delimited by a white bar; nasal scales oriented dorsally; a complete row of dorsally oriented lorilabial scales between the subocular and supralabial scales; a moderate number of scales around the mid-body; flat temporal scales; flat head scales; and a transversely divided frontal. *Liolaemus arambarensis* sp. nov. is omnivorous, oviparous, and exhibits sexual dimorphism in color and size.

Key words: Brazil; Karyotype; *Liolaemus*; Lizard; New species; Restinga habitat; Tropiduridae

LIZARDS of the genus *Liolaemus* (Tropiduridae) include 150 recognized species of small to moderate size (Etheridge, 1995, 2000). They live in a variety of habitats from sea level to over 5000 m (Etheridge, 2000; Etheridge and de Queiroz, 1988); in extensive areas of aeolean sand, including the sandy beaches of Chile, Argentina, Uruguay, and southeastern Brazil; and the sand flats and dune systems scattered throughout much of the inte-

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rior of Argentina and Chile (Etheridge, 1993).

The *wiegmannii* group is characterized by the presence of lorilabial scales, which are smaller than the supralabial scales, and usually by the presence of two rows of supralabial scales between the subocular and the supralabial scales. The supralabial scales are narrow, but the posterior ones are elongated. The sublabial scales are in contact with the mental scale, which is wider posteriorly. The infralabial scales vary from flat to concave (Etheridge, 1995, 2000).

According to Etheridge (1995, 2000), this group includes nine predominantly psammophilous species: *L. occipitalis,* which occurs in the southern region of Brazil and southern Santa Catarina state (de Lema, 1994; Peters and Donoso-Barros, 1970); *L. lutzae* from the coast of Rio de Janeiro, Brazil (Rocha, 1985); and *L. wiegmannii,* which is widely distributed in Argentina (Cei, 1986) and Uruguay (Gudynas, 1981*a,b,c*). Other species assigned to this group also occur in Argentina: *L. scapularis* in the arid plains of the provinces of Catamarca and Tucumán; *L. multimaculatus* from the coastal region of Buenos Aires and Río Negro; *L. rabinoi* from San Rafael Department, Mendoza; *L. riojanus* from La Rioja and San Juan; and *L. salinicola* from Catamarca (Cei, 1986). Lastly, *L. cranwelli* occurs in Santa Cruz de la Sierra, Bolivia (Donoso-Barros, 1973). Etheridge (2000), in his recent paper on the *wiegmannii* group, considers *L. cranwelli* a synonym to *L. wiegmannii.*

Peters and Donoso-Barros (1970), Müller (1979), and de Lema (1994) recorded *L. occipitalis* and *L. wiegmannii* from Rio Grande do Sul (southernmost state of Brazil). During field work conducted at the margins of the Laguna dos Patos in Rio Grande do Sul, Brazil, lizards formerly considered *L. wiegmannii* by Peters and Donoso-Barros (1970) and de Lema (1994) were captured. After detailed examination of their dorsal color pattern and lepidosis, these specimens were judged to represent a new species of the *wiegmannii* group (sensu Etheridge 1995, 2000).

Chile was incorrectly registered as the type locality of *L. wiegmannii* by Duméril and Bibron (1837). Bell (1843) lists the presence of this species in Bahía Blanca, Río Negro, Argentina, and Maldonado, Uruguay, as part of the sample collected in that region by Charles Darwin. These localities were confirmed by Gallardo (1966). The distribution of *L. wiegmannii,* according to Cei (1979*a,* 1986), Laurent and Teran (1981), Cabrera and Bee de Speroni (1986), and Tedesco et al. (1992), is broad and includes Argentina (Entre Ríos, Buenos Aires, Bahía Blanca, La Pampa, Corrientes, San Luis, Mendoza, Tucumán, and Jujuy), Uruguay, and southern Brazil. *Liolaemus wiegmannii* is an omnivorous species with oviparous reproduction (Cei, 1986; Donoso-Barros, 1973).

We were unable to assign the species described here to *L. wiegmannii,* or any other species of *Liolaemus.* Thus, we here describe this new species based on material collected in southern Brazil and analyzed at the Herpetology Laboratory of the Federal University of Rio Grande do Sul.

Materials and Methods

Meristic and Morphometric Analysis

The samples examined in this study included 91 specimens of *Liolaemus* sp. nov., 59 of *L. occipitalis,* 32 of *L. wiegmannii,* and 9 of *L. lutzae.* The mass (g) of each individual of *L. arambarensis* sp. nov. was recorded, and the lizards were immediately sacrificed with 3% Citanest anesthetic. Specimens were then fixed in 10% formalin, transferred to 70% ethanol after 72 h, and deposited at the Laboratório de Herpetologia, Universidade Federal do Rio Grande do Sul (UFRGS).

Meristic data were taken under stereomicroscope, and nomenclature follows Smith (1946). The following variables were taken for morphometric analysis: SVL (snout–vent length), HL (head length), HW (head width), AX–GR (axilla groin distance), FL (foreleg length), HLL (hind leg length), and TL (tail length). All measurements were taken with a 0.1-mm precision caliper. The presence (and number) or absence of precloacal pores was also recorded.

Data for the remaining species of the *wiegmannii* group (*L. cranwelli, L. scapularis, L. multimaculatus, L. rabinoi, L. riojanus,* and *L. salinicola*) were obtained from the literature (Boulenger, 1885; Cei, 1979*b,* 1986; Donoso-Barros, 1973; Dumeril and Bibron, 1837; Laurent, 1982, 1986; Etheridge, 2000).

Cytogenetic Analysis

Material for cytological preparations was obtained from the bone marrow, spleen (males and females), and testes of 10 specimens. The analyses were performed after Giemsa staining. The C-banding patterns were obtained according to Sumner (1972), and the silver staining of nucleolus organizer regions (Ag–NORs) followed Howell and Black (1980).

Natural History

We examined the gonads and stomach contents from all 91 specimens of *L. arambarensis.* The gonads were measured, and their anatomical stage was verified by determining the presence of eggs in the oviducts. For observation of the reproductive stages, histological sections were prepared, using the hematoxilin and osin technique; histological preparations were observed under a microscope (25–10× and 64–10×). In males, the presence of spermatozoa in the seminiferous tubules and in the epididymis was observed in specimens collected throughout the year, as was presence of mature and vitelogenic follicles in females.

The digestive tract was examined under stereomicroscope for the presence of prey items. Arthropod prey items were identified to Order. Frequency of occurrence and volume of each food item was calculated according to Rocha (1989). Plant material was identified as vegetative parts, fruits, and flowers.

Results and Discussion

Liolaemus ***arambarensis*** sp. nov.

Holotype.—UFRGS 2902, an adult male collected by L. Veronese 14 December 1996 in a restinga at the municipality of Arambaré, State of Rio Grande do Sul, Brazil (30° 55′ S, 51° 30′ W).

FIG. 1.—Adult specimens of *Liolaemus arambarensis* from Arambaré, Rio Grande do Sul, Brazil (left female, UFRGS 2951, SVL = 55.85 mm; right male, UFRGS 2902, SVL = 59.84 mm = holotype).

Paratypes.—All specimens from the type locality: males: UFRGS 2903–07; females: UFRGS 2908–13, collected by L. Veronese on 14 December 1996; males: UFRGS 2946, 2950, 3044, 3112–13, 3115, 3118; females: UFRGS 2945, 2947, 2951, 3114, 3116, 3120, collected by L. Verrastro on 25 January 1997; UFRGS 3044 females collected by C. Bujes on 26 April, 1997; UFRGS 3112–20 females collected by C. Bujes on 30 July 1997.

Diagnosis.—*Liolaemus arambarensis* has the following diagnostic characters: nasals oriented dorsally; a complete row of lorilabial scales between subocular and supralabial scales; temporal and head scales smooth; frontal usually divided transversely; dorsal color pattern consisting of a middorsal white stripe and two dorsolateral stripes, with two series of paravertebral brown marks resembling triangles bordered by white bar (Figs. 1, 2).

Liolaemus arambarensis is referrable to

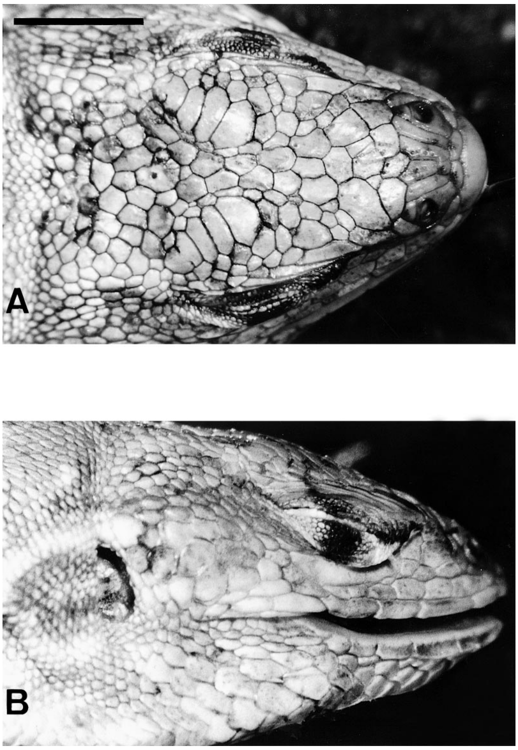

FIG. 2.—(A) Dorsal and (B) lateral view of the head of adult male *Liolaemus arambarensis* (UFRGS 2902; holotype). Scale = 5 mm.

the "*wiegmannii*" group based on the presence of lorilabial scales smaller than supralabial scales and narrow (longer than wide) supralabial scales, the posterior ones being wider; the mental scale is in contact with the sublabial scales and is posteriorly wide; infralabial scales are concave.

Liolaemus arambarensis is distinguished from all other species of the *wiegmannii* group by their distinct pattern of dorsal and ventral color and, except for *L. lutzae,* by having a single row of lorilabial scales between the subocular and the supralabial scales. The new species is distinguished from *L. wiegmannii,* which has laterally oriented nostrils, by having dorsally oriented nostrils; the new species has head and lateral body scales that are smooth, in contrast with the keeled or rugose scales of *L. wiegmannii.* The frontal scale is present and transversally divided, while it is not divided in *L. wiegmannii* and is absent in *L. occipitalis* and *L. lutzae.* The dorsal scales are markedly keeled and imbricate in the new species, similar to *L. cranwelli, L. lutzae, L. occipitalis, L. riojanus, L. scapularis,* and *L. wiegmannii,* but different from other species (i.e., *L. multimaculatus, L. rabinoi,* and *L. salinicola*), which have smooth or slightly crenate dorsal texture. Lateral scales in the new species are similar to those of *L. lutzae, L. occipitalis,* and *L. wiegmannii,* having a common pattern with distinct dorsal and ventral regions, while in other species of the group this pattern is not observed (Donosos-Barros, 1973; Boulenger, 1885; Cei, 1979*a,* 1986; Laurent, 1982, 1986).

The comparison of scale counts (Table 1) and biometric variables (Table 2) among the species of the *wiegmannii* group indicates that *L. arambarensis* is a small species like *L. scapularis* and *L. wiegmannii.* The statistical comparison between the new species and the three most geographically proximate species (*L. lutzae, L. occipitalis,* and *L. wiegmannii*) revealed significant differences between the means of all variables. These species are easily distinguished by their the dorsal color pattern (Boulenger, 1885; Mertens, 1938; Cei, 1986; Fig. 1).

Description of holotype.—Adult male. SVL 59.8 mm; HL 13.7 mm; HW 10.8 mm; TL 64.0 mm. Dorsal head scales smooth. Width of rostral scale approximately twice its length. Rostral length delimited posteriorly by four postrostrals, half the lateral pair overlapping the supralabials. Nasals oriented dorsally; nostrils in posterior half of nasal scale, in distinct dorsal position separated by two pairs of internasals; 10 frontonasal scales relatively small, situated between the posterior canthals; supraorbital semicircles distinct, formed by irregular scales with intermediate contact, anterior region in contact with transversally divided frontal scale. Interparietal polygonal, with distinct opalescent, parietal eye in contact anteriorly with supraorbital semicircle; parietal eye separated from suborbital semicircle by single scale, which is limited posteriorly by three irregular, smaller parietal scales. Mid-supraocular large, longer than wide, medially separated from the supraorbital semicircle

TABLE 1.—Scale counts in species of the *Liolaemus* "*wiegmannii*" group.

	Dorsal scales	Scales around the body	Longitudinal rows of dorsal scales	Ventral scales	Pre-cloacal pores		Infradigital scales in the fourth anterior and posterior finger		Origin
					f	m	ant	post	
L. arambarensis	57–64	60–66	15–18	51–60	3–4	4–7	14–19	20–25	Arambaré/RS. 82 specimens examined in this study
L. cranwelli	57	—	—	—	—	—	23	—	Donoso-Barros, 1973
L. lutzae	66–72	58–68	22–30	61–68	0	6	18–21	24–29	Rio de Janeiro/RJ. 9 specimens examined in this study
L. multimaculatus	—	72–74	—	26–28	0	8	0	—	Boulenger, 1885; Cei, 1979*a*
L. occipitalis	75–86	67–79	21–26	61–78	0	7–10	18–22	21–25	Jardim Edem/RS. 59 specimens examined in this study
L. rabinoi	—	74–78	—	—	0	6–7	24	—	Cei, 1974
L. riojanus	—	75	—	—	0	10	22–23	—	Cei, 1979*a*
L. salinicola	75	65	—	89	0	10	18	23	Laurent, 1986
L. scapularis	26–34	54–60	—	23–30	2–6	6–10	18–21	22–26	Laurent, 1982
L. wiegmannii (Argentina)	50–52	52–63	15–18	52–60	3–5	5–6	14–19	18–25	Córdoba/Argentina. 16 specimens examined in this study
L.wiegmannii (Uruguay)	47–53	47–57	13–15	53–63	3–4	5	13–16	20–22	Colonia-Montevideo/Uruguay. 16 specimens examined in this study

TABLE 2.—Morphometric measurements for species of the *Liolaemus "wiegmannii"* group. SVL = snout–vent length; TL = tail length; HL = head length; HW = head width; FL = foreleg length; HiL = hind leg length; A–G = axilla–groin distance.

	SVL	TL	HL	HW	FL	HiL	A–G	Origin
L. arambarensis	50.21	54.60	10.92	8.21	27.12	18.83	22.95	Arambaré/RS. 69 specimens
L. cranwelli	57.5		13.0		15.0	27.2		Donoso-Barros, 1973
L. lutzae	63.44	79.27	14.89	10.77	37.71	24.64	29.32	Rio de Janeiro/RJ. 9 specimens
L. multimaculatus	52.0	68.0	16.0	13.0	25.0	39.0		Boulenger, 1885; Cei 1979*a*
L. occipitalis	56.67	63.35	12.59	9.80	21.53	32.24	26.76	Jardim do Edem/RS. 59 specimens
L. rabinoi								Cei, 1974
L. riojanus	61.5	72.0	14.5	12.5	22.0	36.0	28.0	Cei, 1979*a*
L. salinicola	73.0	98.0	14.5			28.0	33.0	Laurent, 1986
L. scapularis								Laurent, 1982
L. wiegmannii (Argentina)	48.93	57.73	11.78	8.81	27.12	18.2	24.32	Córdoba/Argentina. 16 specimens
L. wiegmannii (Uruguay)	49.03	61.2	12.13	8.81	29.02	18.99	23.4	Colonia-Montevideo/Uruguay. 16 specimens

by complete arching row of circumorbitals, laterally separated from supraciliaries by three rows of small supraoculars. Two canthals, posterior canthal larger and longer then anterior canthal. Orbit bordered superiorly by four elongate, obliquely overlapping superciliary scales, followed by two short overlapping scales in the opposite direction. One preocular single, equal in height and length, preceded by a curved preocular. Subocular elongated, bordered superiorly by short postocular, both scales with sharp keel along superior margins. Small eyelids situated immediately below zone of small ciliaries under the eyelid, particularly in the medial portion. Internal ciliaries granular; external ciliaries slightly projected: 3, 4 loreals. Seven lorilabials in complete rows separate anteriorly supralabials from loreals and posteriorly separating the supralabials from suboculars. Lorilabials separated from subocular by two small scales. Anterior lorilabials high, shorter than underlying supralabials, which are narrower posteriorly. All four supralabials longer than high, with straight edges not covering anterior infralabials; posterior supralabial more elongated than others, preceded by two postlabials, the anterior one longer, forming curved suture with posterior supralabial. Temporals smooth, anteriorly juxtaposed, and sub-imbricate posteriorly. The opening of the external auditory meatus higher than wide, bordered anteriorly by single series of small, projecting, convex auricular scales. Mental wider than rostral (2.4 mm wide × 1.2 mm long), delimited posteriorly by two postmentals, and laterally by the infralabials. Five infralabials, the second, third, and fourth with distinctively concave external surfaces, and with keel on edge of the suture bordering the anterior sublabials, in inferior contact with sublabials 2, 3; anterior sublabials and post-mentals not in contact. Three pairs of chin shields separated anteriorly by three small scales diverging posteriorly. Nine overlapping posterior gular scales between antehumeral folds, flat, smooth; 55 ventral scales, each longer than wide, and larger than smooth, overlapping dorsal scales. Dorsal scales in 18 longitudinal rows. Anterodorsal nuchals smooth; dorsal scales of the body distinctly keeled; lateral scales longer than wide overlapping. Dorsal nuchals in 19 longitudinal rows. Nine posterior gulars among the antehumerals folds. Sixty-three scales around the body. Lateral superior scales keeled; inferior lateral scales smooth, situated posteriorly in V-shape. Dorsal scales of the limbs keeled similarly to body scales, becoming granular at base of limb and frontal portion, larger, smooth, overlapping ventrally; infratarsal scales with blunt keels, sub-imbricate, and obovate. Eighteen infradigital scales on the fourth right finger and 22 in the fourth right toe; subdigital lamellae on feet, with pointed keels and spines (mucrons) strongly projected, resulting in a spiny aspect. Four pre-cloacal pores.

Color in life.—Head predominantly brown with some marbled orange scales. Two white stripes originating dorsally on the supraocular scales and extending laterally, diverging and interrupted near the neck. Two brown lines (width 1.5–2 scales), originating on the posterior border of each orbit delimiting the area of dorsal stripes. Two circular, dark brown spots, similar to ocelli, situated on each side of the interparietal. Two distinct, dorsolateral stripes (width 3.5–4 scales) beginning on the neck and extending to tip of tail. A distinct mid-dorsal stripe (width 1.5–2 scales) extending from neck to tip of tail, where it gradually joins the two dorsolateral stripes. A series of 9–10 brown lateral marks arranged paravertebrally along mid-dorsal stripe. The mid-dorsal stripe is delimited posteriorly by a band of white scales distributed along the mid-dorsal stripe, resembling triangles, with the hypotenuse lying on the mid-dorsal stripe. From the base to the tip of the tail, seven paraverteral marks become nearly fused, but remain separated by the mid-dorsal stripe, which is reduced to a thin line. Dorsal background coloration is dark ferruginous orange. Lateral coloration marbled with brown lines bordering cyan-blue spots on an orange background. Coloration is more intense near the dorsolateral stripes and progressively fades ventrally, where white replaces the orange coloration. The lateral portion of the body and infrafemoral area is bright orange. Precloacal pores bright orange. Immaculate white ventrally.

Color in preservative.—Specimens fixed in 10% formalin and stored in 70% ethanol lost color within 30 d. Blue areas became gray; the orange of the pores and lateral and dorsal portions of the body disappeared; and the brown stripes and body lost their intensity; white areas remained unchanged.

Variation.—Maximum adult size for males and females is 60 mm and 56 mm, respectively (Table 3). Dorsal nuchals smooth anteriorly; dorsal scales of the body distinctly keeled; lateral scales larger in length than in width and overlapping;

TABLE 3.—Morphometric measurements taken from *Liolaemus arambarensis*; SVL = snout–vent length; TL = tail length; HL = head length; HW = head width; FL = foreleg length; HiL = hind leg length; A–G = axilla–groin distance; min = minimum; $\bar{x}$ = mean; max = maximum; SD = standard deviation; *n* = number of individuals.

Measurements	Min	$\bar{x}$	Max	SD	*n*
SVL	40.70	50.21	60.00	4.69	41
TL	33.20	58.25	79.80	8.37	35
HL	6.80	10.92	13.30	1.13	41
HW	4.40	8.21	10.50	1.14	41
FL	9.70	18.83	22.30	2.13	41
HiL	15.60	27.12	33.60	3.02	41
A–G	17.96	22.95	28.10	2.44	41

60–66 scales around the body; 57–64 dorsal scales; 51–60 ventral scales; dorsal scales of the body with 15–18 longitudinal rows; 14–19 infradigital scales in the fourth finger and 20–25 in the fourth toe. Precloacal pores orange, 4–7 in males and 3–4 in females (Table 4). Only male specimens have orange coloration along the sides of the body and in the infrafemoral area, and blue marks along the body sides. In both adult females and males, the color pattern is similar to that of recently hatched specimens. *Liolaemus arambarensis* is sexually dimorphic, with males being larger than females, possessing more cloacal pores, and exhibiting differences in color pattern (Tables 5, 6).

Etymology.—The name *arambarensis* refers to the type locality: Arambaré, state of Rio Grande do Sul, Brazil.

Distribution and ecology.—*Liolaemus arambarensis* sp. nov. is known only from the restinga habitats associated with Holocene sandbanks of the Coastal Plain at the margin of the Laguna dos Patos, from Itapuã (district of the city of Viamão) to the city of Arambaré (type locality), Rio Grande do Sul, Brazil.

The type locality, Arambaré County (30° 55′ S, 51° 30′ W) in Rio Grande do Sul, Brazil, is near the mouth of Arroio Velhaco, on the margins of the Laguna dos Patos. The climate of Rio Grande do Sul is humid subtropical (type Cfa in Köppen's classification). Annual rainfall ranges 1100–1300 mm, and annual temperature is 16–18 C (Moreno, 1961). The predom-

TABLE 4.—Scale count and pre-cloacal pores in paratypes of *Liolaemus arambarensis*.

	Dorsal scales	Scales around the body	Longitudinal rows of dorsal scales	Ventral scales	Pre-cloacal pores	Infradigital scales in the fourth anterior and posterior finger: ant	post
Males							
2902	60	63	19	55	4	18	22
2903	63	64	19	53	4	16	24
2905	60	63	18	54	5	17	24
2906	57	60	18	57	6	17	23
2907	60	63	18	52	5	17	24
2946	64	65	17	56	4	18	22
2950	62	63	16	56	6	18	25
3044	60	60	19	51	6	19	22
3112	58	64	19	52	7	18	25
3117	61	66	17	53	4	17	21
Females							
2908	61	61	17	60	4	18	22
2909	58	61	15	58	3	18	20
2910	59	60	18	59	4	16	20
2911	62	60	16	57	4	16	24
2912	61	60	16	54	3	17	22
2913	60	61	16	58	3	16	22
2945	60	61	16	60	4	17	20
2947	62	60	15	57	4	16	22
2951	63	61	16	60	4	17	23
3120	62	61	18	59	4	14	22

inant direction of the winds is northeast, which is related to the subtropical anticyclone of the South Atlantic. The speed of the winds rarely exceeds 40 km/h; the constant effect gives an anemomorphic aspect to the trees and shrubs. Actually, the top of the trees become unilaterally distorted (Waechter, 1985).

The relief is basically plain, made of holocenic sites of the Coast Plain. The soils are mostly sandy and well drained with grains between 1–2 mm of diameter, sometimes reaching 5 mm. The vegetation gradually varies in size and density according to the distance from the margins of the lagoon (where *L. arambarensis* occurs); there are almost no plants in the first 5 m. Between 5–10 m, about 65% of the area is a sandy surface and the other 35% is covered by herbaceous vegetation and sparse scrubs. The most abundant plant species are from the family Gramineae (*Panicum racemosum, Rhynchelytrum repens, Paspalum notatum, Cynodon dactylon*), followed by species from other families like *Eryngium nudicaule, Euphorbia peploides, Oenothera* sp., *Polygala* sp., and *Petunia integrifolia*. The most frequent

TABLE 5.—Morphometric data for male and female adults of *Liolaemus arambarensis* (in mm). Means, standard deviation (SD), sample size (n) and the t values of Student's t-test are presented for SVL (snout–vent length), HL (head length), HW (head width), and TBW (tail–base width). Asterisks indicate significant sex differences ($P < 0.01$).

Variable	Females (n = 30) Mean ± SD	Males (n = 30) Mean ± SD	t
SVL	49.67 ± 5.084	54.57 ± 4.261	3.64*
HL	10.66 ± 0.877	12.07 ± 0.840	5.55*
HW	8.06 ± 0.705	9.30 ± 0.667	6.15*
TBW	5.16 ± 0.685	6.93 ± 0.765	8.44*

TABLE 6.—Percentages of blue area in the dorso-lateral region, yellow area in the infrafemural region, orange area in lateral region, and number of pores for both sexes of *Liolaemus arambarensis* (n = 60).

Age/Sex	Blue (%)	Yellow (%)	Orange (%)	Number of pores
Juvenile male	28.2	50	50	4
Adult male	83.3	100	100	5
Juvenile female	0	0	0	3
Adult female	25	0	0	3

shrubs are *Dodonaea viscosa* and *Cordia verbenacea.* Between 10–20 m from the margin of the lagoon, almost the same herbaceous community is present, with a slight increase of the abundance of shrubs. At 20 m from the margin, the vegetation is patchy, with a combination of herbaceous and shrubby vegetation, and several woody insular vegetation clusters ("matorrais" and Sandbank Low Forest) and sandy grasslands. The Sandbank Low Forest is 1.5–6 m high, surrounded by herbaceous species such as *Polypodium lepidopterys, Aechmea recurvata, Peperomia peresquifolia, Rumora* sp., and shrubs like *Hexachlamis edulis, Lantana camara, Cereus hildemanianus, Opuntia monacantha,* and *Eupatorium* sp. The epiphyte *Smilax campestris* is also common. The most common trees are *Myrciaria cuspidata, Lithreaea brasiliensis, Gomidesia palustris, Butia capitata,* and *Myrsine umbellata* (Fig. 3).

Cytogenetic data.—The karyotype of *L. arambarensis* (Fig. 4) indicates a diploid number of 2N = 34. The karyotype has 12 metacentric macrochromosomes and 22 microchromosomes. The first pair of microchromosomes is distinctly larger than the others. Analysis of chromosomes in metaphase, stained with silver, indicated that NORs are located in the secondary constrictions of the long arm of Pair 2. The known diploid number for *Liolaemus* species varies between 2N = 30 and 2N = 44 (Gorman, 1973). Among the species of the *wiegmannii* group, there are chromosomal data for *L. salinicola* (2N = 32), *L. scapularis* (2N = 34; Navarro, 1992), *L. occipitalis, L. lutzae,* and *L. wiegmannii* (2N = 34; Bertolotto et al., 1996), all with 12 macrochromosomes and 20 or 22 microchromosomes. Thus, the karyotype obtained for *L. arambarensis* seems to be conservative with respect to other species of *Liolaemus,* but an analysis of chromosome morphologies and banding patterns is necessary to characterize species karyotypes and contribute to the understanding of the relationship among Liolaeminae species.

Natural History

Individuals of *L. arambarensis* appear to mimic the substrate with their cryptic color pattern and can easily dig holes with the head and forelimbs to burrow themselves. The pattern used for digging the substrate and hiding corresponds to that in the second digging model described by Halloy et al. (1998). We include in this group the lizards that twist their body when burrowing in the sand with the help of the tail movements. The species is able to move under the substrate (sand and litter) and change position without being noticed by the observer.

Construction of holes in the sand was not observed for this species in contrast to the observations made of *L. occipitalis* (Verrastro and Bujes, 1998), possibly because the restinga habitat provides more cover for escaping from predators and refuge for resting.

Liolaemus arambarensis is oviparous and the reproductive season is late August–March. The presence of spermatozoa was observed in the seminiferous tubules from late August–late December, after which males become reproductively inactive. The size of testes varies during the year, being larger in the months of spermatozoa production. The smallest male examined with spermatozoa in the seminiferous tubules and in the epididymis during the reproductive season measured 45.8 mm (SVL). The smallest female with eggs in the oviducts measured 45.3 mm (SVL). Average clutch size was two eggs. From histological analysis of the gonads, follicles were present in the ovaries September–March, and the presence of eggs in the oviduct was observed October–January. Non-reproductive females (without vittelogenic follicles or eggs in the oviducts) were observed in March and October; non-ovigerous reproductive females (with vittelogenic follicles, but without eggs in the oviduct) were found throughout the year, except in January, April, August, and December. Ovigerous reproductive females (with eggs in at least one of the oviducts) were found in spring and summer months (December–February). Field observations revealed the presence of recently hatched individuals January–late March. The reproductive cycle of *L. arambarensis* is similar to that of other spe-

FIG. 3.—Habitat at the type locality of *Liolaemus arambarensis* at Arambaré, RS, Brazil; note the sandy soil.

cies of the *wiegmannii* group. *Liolaemus occipitalis* (Verrastro, 1991; Verrastro and Krause, 1994), *L. lutzae* (Rocha, 1989), and L. *wiegmannii* (Pinilla, 1991) are also oviparous and have seasonal reproductive cycles with only one reproductive season each year. *Liolaemus multimaculatus* (Gallardo, 1966), *L. riojanus* (Cei, 1986), and *L. wiegmannii* (Gallardo, 1966) are also oviparous species. The diet of *L. arambarensis* consisted predominantly of insects, but is characterized as omnivorous because of the presence of plant material in the stomachs. The main prey items and their respective percent frequency of occurrence and relative volume were: Hymenoptera, 87.0%, 16.8%; Aranae, 80.1%, 13.2%; and Coleoptera, 68.5%, 9.6%. Plant material included mainly flowers and leaves, which collectively corresponded to a frequency of 31.5% and relative volume of 16.9%. The species of the "*wiegmannii*" group are usually mentioned as insectivorous, but there are few detailed studies in this respect. According to Rocha (1989, 1991), *L. lutzae* presents an ontogenetic shift in diet, with young specimens being insectivorous and adults being herbivorous. Another species, *L. occipitalis,* has a diet exclusively composed of arthropods, with no plant material (Verrastro, 1991).

Phylogenetic Relationships

A phylogeny for the *L. wiegmannii* group has been recently proposed by Etheridge (2000) and used herein to hypothesize the phylogenetic relationships of *L. arambarensis.* Among the characters analyzed, Etheridge included several meristic and morphometric multistate characters, not discussed herein.

Liolaemus arambarensis appears to belong to the *L. wiegmannii* group, defined by Etheridge (2000, his figure 9), by sharing the following characters with all species in his Branch 19 of his cladogram (numbers correspond to character list given by Etheridge, 2000): Lorilabial scales small, more than seven between the posterior canthals (Character 4: State 1); supralabials narrow (Character 6: State 1); no contact between postmentals and the

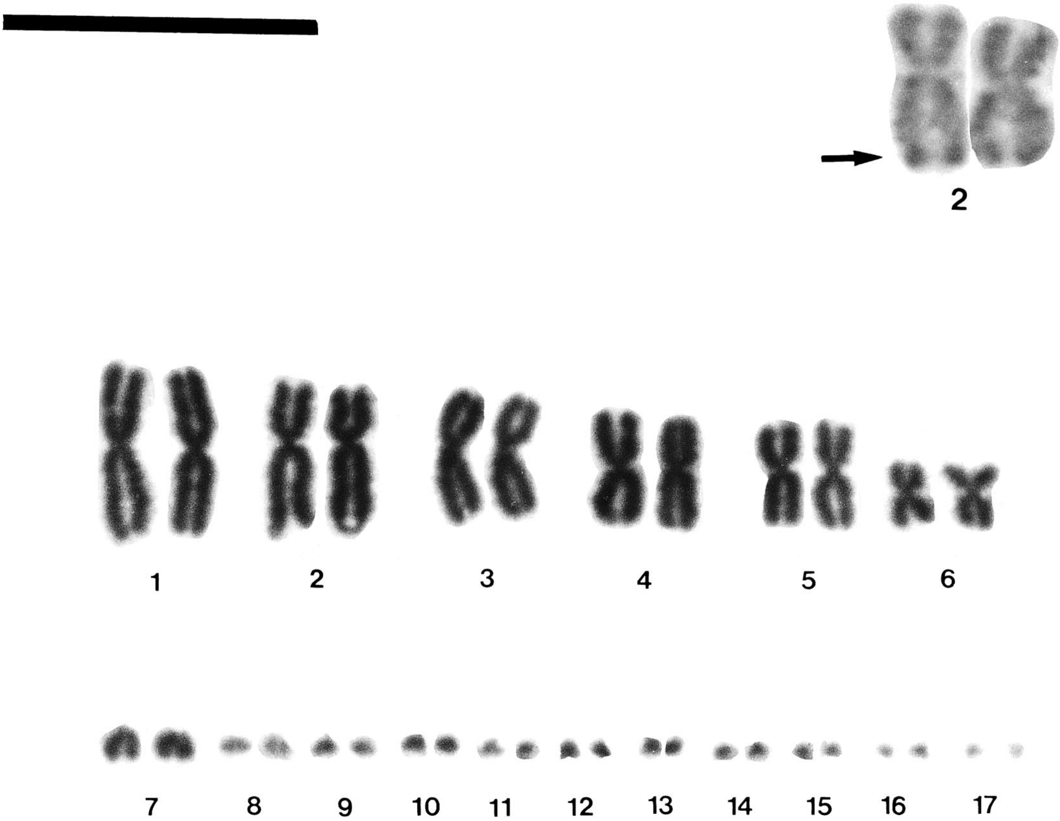

FIG. 4.—Karyotype and site of active NORs in *Liolaemus arambarensis* (UFRGS 2369, male) from Arambaré, Rio Grande do Sul, Brazil. 2N = 34 (12 M + 22 m). Scale = 10 μm.

infralabials (Character 11: State 1); snout profile flat (Character 32: State 1); and diurnal escape behavior includes rapid burial under sand (Character 36: State 1).

Among the species in the *L. wiegmanni* group, *L. arambarensis* appears to be referable to the "sand lizards" group (sensu Etheridge, 2000, his figure 9, Branch 20) by sharing the following characters: dorsal position of the nasal scale (Character 2: State 1); proximal prebranchial scales with distal granules below the apex, which causes the scales to project outward from the surface to form a tridentate margin (Character 15: State 1); and gravid female coloration absent (Character 30: State 1).

Liolaemus arambarensis differs from the species in Branch 20 given in Etheridge (2000, his figure 9) by the presence of a different state for Character 28. Although State 2 (adult male coloration finely checkered dark gray on throat and abdomen) is assigned as a synapomorphy of Branch 20 and State 4 as a synapomorphy of Branch 21, *L. arambarensis* has a different pattern, herein considered as autapomorphic of this species (State 3: adult male ventral surfaces immaculate, or nearly so).

Liolaemus arambarensis appears referable to Branch 21 by sharing the following characters with those species: upper temporal scales smooth (Character 1: State 0); outer surface of second, third, and fourth infralabial scales concave with a keel where they suture with adjacent sublabial scales (Character 9: State 2); subdigital lamellae of pes with blunt keels, without strongly projecting mucrons (Character 21: State 1).

Branch 22 of the cladogram from Etheridge (2000, his figure 9) is defined by

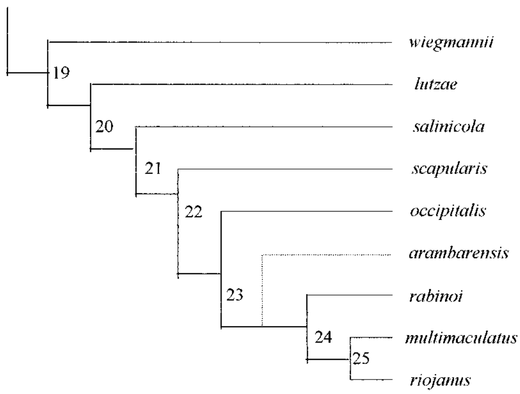

FIG. 5.—Phylogenetic hypothesis proposed by Etheridge (2000) for the "*wiegmannii*" group, which suggests *Liolaemus arambarensis* as sister group for *Liolaemus* Branch 24; future studies will be required to confirm this hypothesis.

four polymorphic characters, not analyzed herein. *Liolaemus arambarensis,* however, appears referable to Branch 23 by sharing the following synapomorphies: frontonasal scales small (more than seven between the posterior canthals; Character 3: State 1), although these scales are not as small as in *L. occipitalis,* there are more than seven present; infratarsal scales surface smooth (Character 17: State 2); infratarsal scales sub-imbricate (Character 19: State 2); shape infratarsal scales of obovate (Character 20: State 1).

All the characters discussed above include *L. arambarensis* in a clade formed by this species and *L. occiptalis, L. rabinoi, L. multimaculatus,* and *L. riojanus.* Relationships of the new species to the species of this clade must be further investigated. *Liolaemus arambarensis,* however, does not possess any of the autapomorphies described by Etheridge for these known species. *Liolaemus arambarensis* also does not possess the synapomorphies defining Branch 25, which includes *L. multimaculatus* and *L. riojanus.* Among the synapomorphies described for Branch 24 (Fig. 5), *L. arambarensis* possesses two: Character 13: State 1, almost all posterior gulars without an apical notch and scale sensory organ; and Character 26: State 1, most blue scales in clumps on sides of body. It lacks, however, synapomorphies Character 8: State 1 (inferior margin of anterior supralabial scales distinctively concave, all together forming a scalloped lower border that overlaps anterior infralabial scales) and Character 25: State 1 (iridescent blue scales present in both fixed males and females) that also defines this branch. All the information given above suggests that *L. arambarensis* is a sister group for Branch 24 (*L. rabinoi, L. multimaculatus,* and *L. riojanus*), but further investigation is needed to better support such a hypothesis.

After our analysis and with consideration of Peters and Donoso-Barros (1970), Müller (1979), and de Lema (1994), who cite *L. wiegmannii* for southern Rio Grande do Sul (specifically for Tapes), we conclude that all these populations correspond to *L. arambarensis* and that there is no record of *L. wiegmannii* in Brazil.

RESUMO

Uma nova espécie do gênero *Liolaemus* do Rio Grande do Sul, Brazil é descrita neste trabalho. A morfologia da nova espécie, *L. arambarensis* sp. nov, é comparada às espécies de *Liolaemus* do grupo "*wiegmannii.*" A nova espécie se distingue dos demais membros desse grupo pelo padrão de coloração dorsal com uma faixa branca médio dorsal e duas faixas dorsolaterais, duas fileiras justapostas de marcas marrons lembrando triângulos, limitadas por uma barra branca; escamas nasais orientadas dorsalmente; um linha completa de escamas lorilabiais entre as escamas subocular e supralabial orientada dorsalmente; um número moderado de escamas ao redor do corpo escamas temporais planas; escamas da cabeça planas; e, frontal dividida transversalmente. *Liolaemus arambarensis* sp. nov. é omnívoro, ovíparo e com marcante dimorfismo sexual em cor e tamanho.

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APPENDIX I

Specimens Examined

Liolaemus wiegmanni, Rio Cuarto, Argentina (ZV-UNRC) Males: 3325, 3327, 3336, 3338, 3346, 3366, 3369, 3378; Females: 3324, 3328, 3330, 3348, 3367, 3375, 3377, 3380. Colonia, Uruguay (UFRGS) Males: 3182, 3300–01, 3322–26; Female: 3183. Montevideo, Uruguay (MNHN) Males: 154, 196; Females: 137, 266, 3306, 3310, 3316, 5838.

Liolaemus arambarensis, Arambaré, Rio Grande do Sul, Brasil (UFRGS) Males: 2369, 2682, 2694–95, 2728, 2799, 2748, 2750, 2769–72, 2774, 2776, 2778, 2781, 2785, 2788–89, 2799, 2817, 2819–20, 2822–25, 2902–03, 2905–07, 2946–48, 2950–51, 3044, 3112–13, 3117–19, 2369, 2695, 2728–29, 2748–49, 3186, 3221, 3267; Females: 2750–51, 2773, 2775, 2779, 2782–84, 2786–87, 2790, 2794, 2796, 2800, 2802, 2818, 2821, 2826–32, 2908–13, 2945, 2947, 2951, 3114, 3120, 3268. Arambaré, Rio Grande do Sul, Brasil (MCTPUCRS) 4475, 4525, 4652–54. Barra do Ribeiro, Rio Grande do Sul, Brasil (UFRGS) Male: 3184. Females: 3185, 3222. Tapes, Fz. Formosa, Rio Grande do Sul, Brasil (MCTPUCRS) 5121, 5362–65.

Liolaemus occipitalis, Cidreira, Rio Grande do Sul, Brasil (UFRGS) Males: 2497, 2504–05, 2513, 2519, 2522, 2524, 2540, 2545–46, 2556, 2559–61, 2564–65, 2567, 2628, 2630, 2632–33, 2635, 2637–38, 2753, 2755, 2760, 2765–67; Females: 2498–2501, 2503, 2510–12, 2514, 2521, 2541–44, 2548, 2555, 2557–58, 2562–63, 2566, 2619, 2623–24, 2629, 2754, 2757, 2764, 2768.

Liolaemus lutzae, Restinga do Maricá, Rio de Janeiro, Brasil (UFRGS) Males: 227–28, 825; Females: 203–04. Praia de Grumari, Rio de Janeiro, Brasil (UFRGS) Male: 2482; Females: 2483, 2487–88.