



A new species of *Liolaemus* (Reptilia: Squamata: Liolaemini) from southern Mendoza province, Argentina

LUCIANO JAVIER AVILA¹, MARIANA MORANDO¹, CRISTIAN HERNAN FULVIO PEREZ² & JACK W. SITES, JR.³

¹Centro Nacional Patagónico – Consejo Nacional de Investigaciones Científicas y Técnicas, Boulevard Almirante Brown 2825, 9120, Puerto Madryn, Chubut, Argentina. E-mail: avila@cenpat.edu.ar

²Los Copihues s/n, 8300, Chimpay, Río Negro, Argentina. E-mail: liolaemu@criba.edu.ar

³Department of Integrative Biology and M. L. Bean Life Science Museum, Brigham Young University, 401 WIDB, 84602, Provo, Utah, United States of America. E-mail: jack_sites@byu.edu

Abstract

A new species of lizard of the genus *Liolaemus* from southern Mendoza Province, western Argentina, is described. The new species is a member of the *Liolaemus donosobarrosi* group, and molecular data show it as sister taxon of *L. josei* differing in size, squamation, coloration, and sexual dimorphism. *Liolaemus* sp. nov. is terrestrial, dwelling on sandy soil in a shrubby piedmont of small hills, and seems to have low population density.

Key words: Argentina, Iguanidae, Liolaemini, *Liolaemus puelche* sp. nov., Mendoza province, new species, northern Patagonia

Resumen

Una nueva especie de lagartija del género *Liolaemus* del sur de la Provincia de Mendoza, oeste de Argentina, es descrita. La nueva especie es un miembro del grupo *Liolaemus donosobarrosi*, y datos moleculares la muestran como el taxón hermano de *L. josei*, diferenciándose en tamaño, escamación, coloración y en dimorfismo sexual. *Liolaemus* sp. nov. es terrestre, vive en suelo arenoso en un piedemonte arbustivo de colinas bajas, y parece tener baja densidad poblacional.

Palabras claves: Argentina, Iguanidae, Liolaemini, *Liolaemus puelche* sp. nov., Provincia de Mendoza, nueva especie, Patagonia norte

Introduction

The lizard fauna of northwestern Patagonia and adjacent areas is poorly known despite extensive field work over the last four decades. In the 1970s and 1980s several new species were described, all with restricted distributions or locally endemic to this region (e.g. *Liolaemus austromendocinus* Cei; *L. donosobarrosi* (Cei); *L. duellmani* Cei; *L. rabinoi* (Cei); *Phymaturus payunia* (Cei and Castro); *P. nevadoi* (Cei and Roig)). In the last ten years new field surveys in southern Mendoza and northern Neuquén provinces revealed additional new species of *Liolaemus* and *Phymaturus* (*L. thermarum*, Videla and Cei 1996; *L. grosseorum*, Etheridge 2001; *L. gununakuna* Avila et al. 2004; *L. flavipiceus* Cei and Videla 2003; *L. josei* Abdala 2005; *Phymaturus verdugo* Cei and Videla, 2003; *Phymaturus dorsimaculatus* Lobo and Quinteros, 2005). Further, other species of liz-

ards were re-validated (e.g., *Pristidactylus araucanus* [Cei *et al.* 2004]), and new surveys in poorly known areas, coupled with the application of molecular techniques, revealed that several additional species of *Liolaemus* remain undescribed (Avila *et al.* 2006; Morando *et al.* 2003, 2004, 2007).

The genus *Liolaemus* predominates the lizard fauna in the austral part of South America, and ranges from northern central Perú southward through Bolivia, Paraguay, Chile, and Argentina, and up to the Atlantic coast of Uruguay and southeastern Brazil. Within this large geographic area, the genus occupies habitats extending from sea level to over 4500 m, and they range in body size from 45 to > 100 mm snout-vent length, with body masses from three to nearly 200 g. *Liolaemus* may be insectivorous or herbivorous, but the majority of species appear to be omnivores; half of the species are oviparous, whereas the remaining species deposit eggs in varying stages of embryonic development (Donoso Barros 1966; Cei 1986, 1993; Etheridge and Espinoza 2000). About 180 species are known, but more than 40 new species were described in the last ten years and new species descriptions are published at a rate of four or five per year. One detailed study of a single species complex suggested that the total number of actual species might be approximately double the number now recognized (Morando *et al.* 2003). Two main clades are recognized for all these species, *Liolaemus* and *Eulaemus* (Schulte *et al.* 2000). *Eulaemus* encompasses several clades (Morando, 2004), including a group of several species distributed mainly along inland dunes areas of the Monte Desert in western Argentina. A recent study (Avila *et al.* 2006) referred to this clade as the *donosobarrosi* group, which includes *L. cuyanus*, *L. donosobarrosi*, *L. josei*, and several undescribed species or very distinct populations. Abdala (2002) described *L. mapuche* as a likely close relative of *L. cuyanus*, implying that this species could be a member of this species complex.

Here we describe a new species of *Liolaemus* from southern Mendoza Province that shows morphological, chromatic, and genetic differences from all other described species of *Liolaemus*, and we show phylogenetically that this species belongs to the *donosobarrosi* species group as was defined by Avila *et al.* (2006) and Morando (2004).

TABLE 1. Morphometric, meristic, and chromatic characteristics in species of the *Liolaemus donosobarrosi* group, *L. mapuche* data are from Abdala (2002).

Species	Maximum SVL (in mm)	Midbody scales (range)	Dorsal scales (range)	Precloacal pores (males)	Scapular marks	Ventral melanism	Sexual dichromatism
<i>L. puelche</i> (n = 4)	89	67–76	74–80	6–9	No	No	Weak
<i>L. cuyanus</i> (n = 30)	92.5	58–76	53–82	7–10	Yes	No	Weak
<i>L. donosobarrosi</i> (n = 9)	63	71–87	82–101	5–7	No	No	Weak
<i>L. josei</i> (n = 55)	73.1	62–76	67–81	4–10	No	Yes	Strong
<i>L. mapuche</i> (n = 30)	82.7	65–76	70–86	6–9	Yes	Yes	Strong

Material and methods

Specimens were collected by hand or noose, sacrificed by a pericardiac injection of sodium penthotal Abbot®, fixed in 10-20% formalin and later transferred to 70% ethanol. Measurements were taken with a digital caliper to the nearest 0.1 mm. Some character states were observed with the aid of a binocular stereomicroscope. Scale terminology follows Smith (1946), and recent treatments of related species by Etheridge and Christie (2003). Where numbers of paired scales are provided they are given as left-right, and terminology of lateral neck folds follows Frost (1992). Descriptions of color in life are based on notes taken in the field and color photographs of recently captured animals. We examined sample series of related species of the *donoso-*

barrosi complex (Morando, 2004, Avila *et al.* 2006; Table 1, Appendix 1) from the herpetological collections of Fundación Miguel Lillo (FML), Argentina; Monte L. Bean Museum, Brigham Young University (BYU); Museo de La Plata, Universidad Nacional de La Plata (MLP.S/R); Museum of Vertebrate Zoology, University of California – Berkeley (MVZ); Museo Argentino de Ciencias Naturales Bernardino Rivadavia, Buenos Aires (MACN), and the field collection of L. J. Avila and M. Morando (LJAMM), now housed in the Centro Nacional Patagónico, Puerto Madryn, Argentina (CENPAT–CONICET). Morphological data for *Liolaemus mapuche* were taken from Abdala (2002).

Results

Liolaemus puelche sp. nov.

(Figure 1)

Type Material. Holotype: MACN 38992, adult male collected along the south side of Ruta Nacional 40, 3 km N Ranquil Norte (36° 38' S, 69° 49' W, 1600 m), Malargüe Department, Mendoza province, Argentina, 9 March 2000, by L. J. Avila, and M. Morando.

Paratypes: MLPR 5063, adult male; MLPR 5064, subadult male; MACN 38991, subadult female. All collected on marginal slopes on southern edge of Ruta Nacional 40, 3 km N Ranquil Norte (36° 38' S, 69° 49' W, 1600 m), Malargüe Department, Mendoza Province, Argentina, 7 February 2003, by L. J. Avila, K. Dittmar, M. Morando, and C. H. F. Perez.

Diagnosis. *Liolaemus puelche* is a robust and medium size member of the clade of *Liolaemus* lizards referred to as the *boulengeri* group by Etheridge (1995) and is a member of the *Liolaemus donosobarrosi* group, that includes *L. cuyanus*, *L. donosobarrosi*, *L. josei*, and several other potential species still undescribed (Avila *et al.*, 2006; Morando *et al.*, 2004). *Liolaemus cuyanus* has a light brown dorsal coloration crossed by well defined transversal brown bands with posterior white-borders, a conspicuous brown to black antehumeral band from throat to shoulder, and white ventral areas; these characteristics are not present in *L. puelche*. *Liolaemus mapuche* has a very different dorsal coloration characterized by a light blue head and scattered blue scales on a light green-blue background, a black antehumeral arch, four series of gray paravertebral and lateral spots, and scattered yellow and blue scales in the lateral area of the body (Abdala, 2002); these characteristics are never present in *L. puelche*. *Liolaemus donosobarrosi* is a smaller species (maximum SVL = 64 vs 89 mm in *L. puelche*), and has a dorsal pattern consisting of transverse series of well-marked four half-moon spots surrounding white spots, with a background coloration orange brown or orange tan, sometimes very bright, more scales around midbody (71–87 vs 67–76 in *L. puelche*), and more scales between the occiput and rump (82–101 vs 74–80 in *L. puelche*). *Liolaemus josei* is a smaller species (maximum SVL = 73.1 vs 89 mm in *L. puelche*), with a marked sexual dichromatism not present in *L. puelche*; *L. josei* males have gular melanism, two series of well marked paravertebral black spots, and a dorsal background of white/light blue speckles and a light-blue sheen, characters never present in males of *L. puelche*.

Description of the holotype. Adult male 85.5 mm (SVL), regenerated tail 62.0 mm (46.0 mm regenerated portion). Axilla-groin distance 37.4 mm. Head length 17.1 mm; head width 14.9 mm; head depth 10.6 mm; snout length 6.2 mm, horizontal diameter of the orbit 5.0 mm. Arm length 23.2 mm; tibial length 15.9 mm; foot length 23.5 mm.

Upper head scales smooth, convex, bulged, pitted with scale organs, in postrostral, internasals, frontonasals, and prefrontals. Rostral pentagonal, twice as wide as high (2.9 x 1.3 mm). Two postrostrals, wider than high, with four conspicuous scale organs each; together with anterior supralabials separate nasal scales from rostral. Nasal scales subpentagonal in shape (1.6 x 1.6 mm). Nostril roughly rhomboidal in shape, occupying almost two thirds of the nasal scale. Nasal scales in contact with seven scales on each side. Internasal scales

convex. Six internasal, two median, almost quadrangular; four lateral in tandem, a smaller one in front and a long and narrow scale in back. Two frontonasals rows in front, two paired scales in wider contact in medial position, two smaller lateral scales in contact with nasals. Along the back, a row of five scales, three about equal in size and subpentagonal in medial position; lateral frontonasals rhomboidal equal in size each other, and in wide contact with second canthal. Nine prefrontals, anterior three regularly arranged, with a small medial and two lateral more that three times larger; a second row of three scales with a medial scale larger than laterals; a third row with two scales in tandem in the left side, and a single scale in the right side. Frontal scale irregular, slightly larger that last prefrontals. Seven frontoparietals irregular in shape, smaller that frontal and parietal. Interparietal pentagonal with a large and conspicuous white cream “eye” in the middle.



FIGURE 1. *Liolaemus puelche*, holotype adult male (MACN 38992), from south side of Ruta Nacional 40, 3 km N Ranquil Norte, Malargüe Department, Mendoza province, Argentina.

A lateral parietal on each side, irregular, equal or slightly smaller than interparietal. Four larger parietals in back, very irregular. Circumorbitals: 11–11. Supraoculars 8–7, laterally expanded. Three rows of irregular, small scales between supraoculars and supercilliaris, 26 on each side. A small scale between nasal and first canthal. First canthal higher than wide. Posterior canthal longer than wide, with a well marked but blunt ridge. Posterior canthal overlap only a small part of first superciliary. Supercilliaris 8–7 (left-right), strongly overlapped. Loreal irregular in size and shape, 9-5; together with preocular and anterior subocular forming a slight concavity. Upper ciliary scales in two rows, those of inner rows flat and quadrangular, those of outer row rectangular, compressed, and moderately projecting. Lower and upper ciliaris similar in size and shape. Palpebral scales small, irregulars, flat. One preocular, longer than wide; one elongate subocular (5.6 x 0.9 mm), one small postocular; a very evident keel in subocular and postocular, less marked in preocular. Lorilabials convex, 7-7, except the first, roughly quadrangular, higher than supralabials pitted with conspicuous and numerous scale organs. Supralabials 9-8, flat. Temporal scales smooth, swollen, juxtaposed, with a scale organ in the tip. Auditory meatus higher than wide (3.2 x 1.0 mm) surrounded by granular scales. Mental pentagonal, wider than high (3.3 x 1.9); in contact with anterior infralabial and postmental but not in contact with anterior sublabials. Infralabials 6-6. Chinshields 7-7, transversally expanded, separated from infralabials by series of 2–3 elongated but smaller sublabials. Larger sublabials with several conspicuous scale organs each, less numerous to absent in smaller scales. Only a few scale organs present in supralabials and infralabials. Gular scales smooth, flat, imbricate, rhomboidal, immediately after postmental, gradually becoming rounded posteriorly and with a distinct posterior apical notch. Lateral neck folds (longitudinal, oblique, antegular, gular, antehumeral and post auricular) distinct to well developed.



FIGURE 2. Dorsal and ventral color variation in the type series of *Liolaemus puelche*.

Dorsal body scales subtriangular to obovate, moderately imbricated. Twenty three to 25 longitudinal rows with scales with distinct but blunt keels, a few with an apical scale organ. At midbody, dorsal scales grade laterally into smaller scales, smooth, imbricate, many with an apical notch. Scales anterior to, above, and posterior to forelimb and hind limb insertions, small, smooth, non-overlapping, becoming granular close to the insertions. Ventral body scales smooth, flat, imbricate, with an apical notch; subtriangular to obovate, same size or smaller than dorsal body scales. Scales around midbody 71; scales between occiput an anterior margin

of hind-limb articulations 80. Scales of cloacal apron slightly smaller in size than ventral body scales. Precloacal pores 8.

TABLE 2. Morphometric and meristic variation in *Liolaemus puelche* type series.

	MACN 38992	MACN 38991	MLP.R 5063	MLP.R 5064
sex	Male	Female	Male	Male
SVL	85.5	74.0	89	69
Axilla-groin distance	37.4	35.1	40.1	30.5
Head length	17.1	14.7	17.7	14.6
Head width	14.9	12.4	15.3	11.9
Head high	10.6	9.1	10.9	8.7
Foot length	24.0	20.5	24.2	20.5
Tibial length	16.4	14.5	18.3	14.9
Arm length	23.4	21.5	24.1	19.6
Midbody scales	71	69	76	67
Dorsal scales	80	75	78	74
Ventral scales	115	103	106	100
Fourth toe lamellae	34	28	30	29
Supralabial scales	9	10	9	9
Infralabial scales	6	6	6	6
Cloacal pores	8	2	6	9
Scales in contact with mental	4	4	6	4

Suprabrachials smooth, rhomboidal, imbricated, with a small notch in the tip. Infrabrachials small, convex, and not overlapping. Supra-antibrachials smooth, imbricate, rhomboidal to obovate, some with a small notch in the tip, others larger than suprabrachials. Infra-antibrachials smooth, granular to progressively rhomboidal distally, becoming with one to three small but distinct keel and spines near the hand insertion. Supracarpals smooth, strongly imbricate. Infracarpals strongly keeled, imbricate. Supradigital lamellae smooth, imbricate. Subdigital lamellae tricarinate, imbricate, numbering: I: 14, II: 22, III: 22, IV: 16, V: 10.

Suprafemorals smooth, imbricate, rhomboidal to rounded, few with an apical scale organ or a blunt keel. Infracemorals smooth, imbricate, rhomboidal. Supratibials smooth to slightly keeled, imbricate, becoming rounded distally. Twenty to 25 spinose scales in a postfemoral patch. Infratibials smooth, imbricate. Supratarsals, smooth, imbricate, a few with a apical notch. Infratarsals strongly imbricate, with a conspicuous keel. Supradigital smooth, imbricate. Infradigital bi- to tri-carinate, numbering I: 13, II: 18, III: 25, IV: 33, V: 19. Caudal scales smooth, a few slightly keeled, imbricated.

Coloration. In life, general dorsal background color tan. Dorsal head surface dark brown, grading to light tan in azygous and nuchal areas. Between occiput and rump, twelve irregular, transversal bands formed by four dark brown spots. Paravertebral spots more-or-less round, with a concave or notched posterior margin, distinctly outlined with white scales, the anterior margins indistinct. Lateral spots irregularly rectangular, bordered with white or light tan scales, sometimes partially fused ventrally. Paravertebral spots are smaller but more marked than quadrangular lateral spots. Spots become less evident and apparently fused on neck and rump areas. On the tail, paravertebral spots become rounded and progressively fused, disappearing on the regenerated portion; lateral spots become rounded and lighter, and disappear in the first portion of the tail. On dorsal limbs areas an irregular pattern of rounded, irregular, sometimes fused dark spots on a light tan back-

ground. Ventral surfaces uniformly bluish gray. Immediately after capture, central body area with a light bright yellow dorsal coloration that disappeared after a few hours. Light yellow coloration on ventral areas of hindlimbs and cloacal apron faded after a few weeks in preservative. After several years in preservative, all coloration became faded.

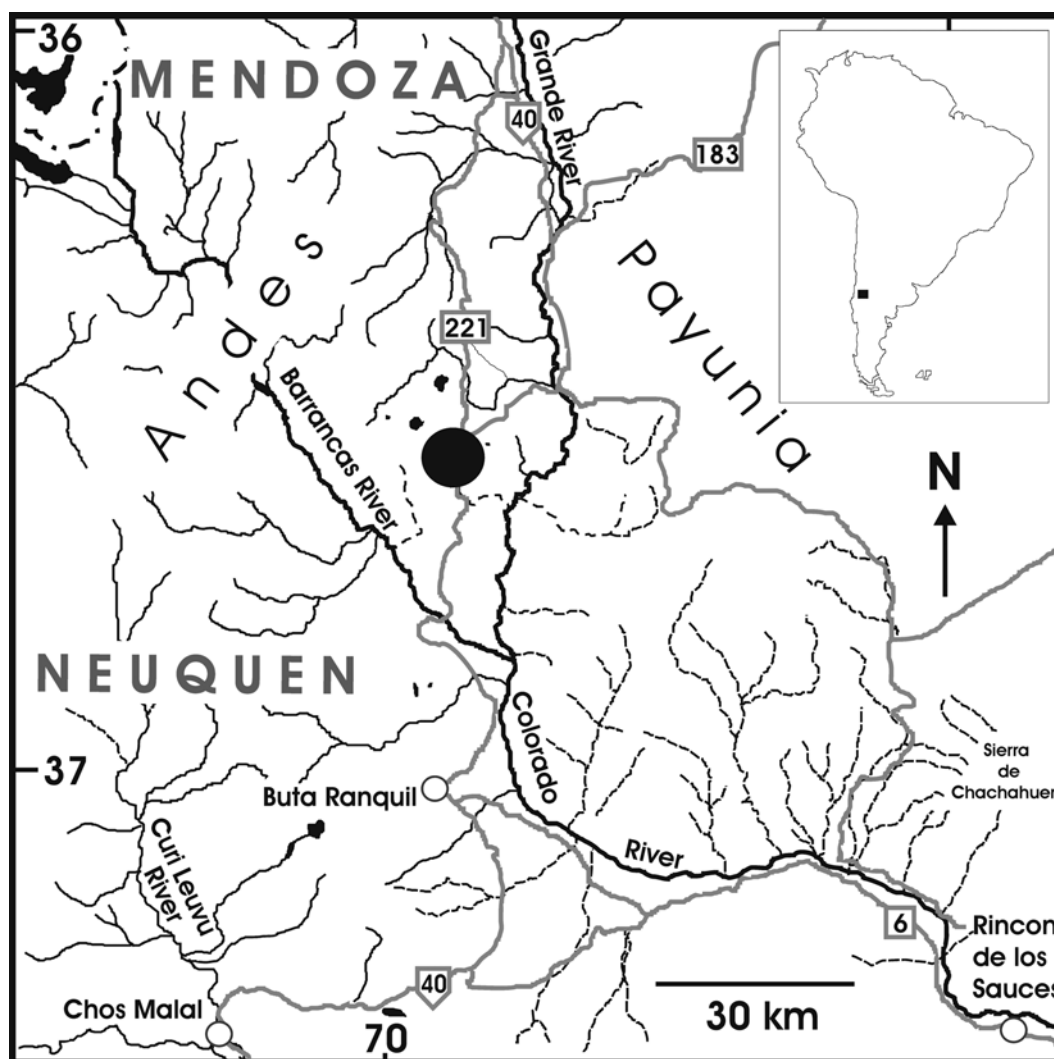


FIGURE 3. Type locality of *Liolaemus puelche* (black dot). Grey lines show main national and provincial roads, and open circles identify main towns in the region. Insert: the area in Argentina.

Variation. Based on the paratypes (Table 2, Figure 2); in subadult–adult males: SVL 69–89 mm. Axilla groin distance 30.5–40.1 mm. Foot length 20.5–24.2 mm. Tibial length 14.9–18.3 mm. Arm length 19.6–24.1 mm. Head length 14.6–17.7 mm. Head width 11.9–15.3 mm. Head depth 8.7–10.9 mm. Midbody scales 67–76. Dorsal scales between occiput to rump 74–78. Ventral scales 100–106. Supralabials 9. Infralabials 6. Fourth toe lamellae 29–30. Preloacal pores 6–9. In one subadult female: SVL 74.0 mm. Axilla-groin distance 35.1 mm. Foot length 21.5 mm. Tibial length 14.5 mm. Arm length 21.5 mm. Head length 14.7 mm. Head width 12.4 mm. Head depth 9.1 mm. Midbody scales 69. Dorsal scales between occiput to rump 75. Ventral scales 103. Supralabials 8. Infralabials 6. Fourth toe lamellae 28. Two small preloacal pores. Dorsal head scales variable in size, some irregular in shape, most convex but a few almost flat. Cloacal apron larger in males than in females. Scales of the cloacal apron slightly smaller than ventral scales in males, same size or slightly smaller in females. Postfemoral patch not present in females and variable in size in males between 18–25 scales. Only in a single lizard were 6 scales observed in contact with the mental scale; all others have 4

scales.

Dorsal background color brown to tan, recently captured adult males have a yellowish-green sheen. Dorsal head scales with brown, tan and white speckles. Most individuals boldly marked with holotype pattern, maintaining the pattern of transversal bands with variations in spots shape and distinctiveness. Variation more frequent on dorsal neck area by fusion of spots. Ventral surfaces of subadults tinged with gray, throat with light gray spots and light gray variegations.



FIGURE 4. General view of the type locality of *Liolaemus puelche* from a northern perspective. Lizard activity was more intense under the large shrubs of *Schinus johnstonii*.

Etymology. The specific name *puelche*, comes from the name of a group of aboriginal people that inhabited the mountain slopes and piedmont between the Barrancas and Diamante rivers, in southern Mendoza Province. Puelche culture apparently started to disappear two centuries ago when they mixed with other tribes invading from actual Chile.

Geographic distribution. *Liolaemus puelche* was collected only in an isolated locality along the National Road 40, north to the locality of Ranquil Norte, Malargüe Department, Mendoza Province, in western Argentina (Figure 3, 4).

Natural history. The holotype and the paratypes were found by active search, basking in the edges of spine shrubs (*Schinus johnstonii*); the first lizard collected was found running from one shrub to another, but the others were usually found motionless in the bare ground below the vegetation branches where they blend in with patterns of light and shadows on the soil. When pursued they run to mammal burrows (*Ctenomys* sp.) which are common beneath scattered bushes and shrubs of the area. Population density of this species in the area appears to be very low because no more than four individuals collected were found in two collecting trips, while other sympatric lizards were commonly found at the same time. Apparently suitable habitats for this species are scarce in the small area that is accessible by motorized vehicle. This species shares its habitat

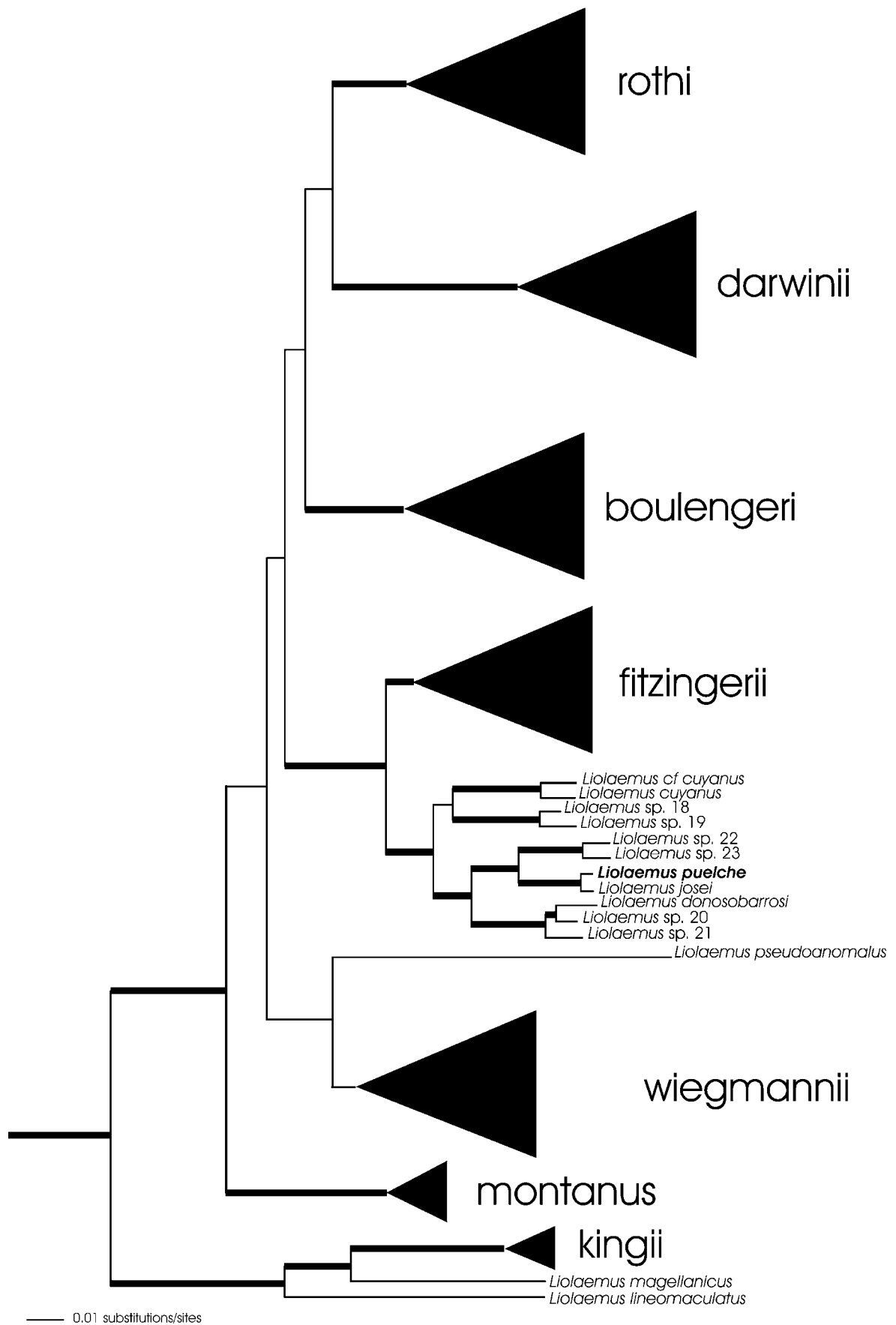


FIGURE 5. Phylogenetic relationships of *Liolaemus puelche* with other members of the *donosobarrosi* group. Thick black lines in the *donosobarrosi* group clade represent posterior probabilities >0.95. Redrawn from Morando (2004).

with other *Liolaemus* species (*L. austromendocinus*, *L. bibronii*, *L. darwini*) and usually occupies the microhabitat below the spiny shrubs that grow as scattered “island clumps” of 5–10 m² separated by an open, loose sand substrate, while the other species were found in rocky patches or in the rocky-gravel accumulations of the road edges. Only a male of *L. darwini* was observed sharing the same microhabitat of *L. puelche*. No data about reproduction or diet area available, but as in other related species, *L. puelche* is probably oviparous and feeds mainly in arthropods and some plant matter.

Remarks. A combined phylogenetic analysis using Maximum Parsimony, Maximum Likelihood and Bayesian Analyses of 141 species of Liolaemini with three mitochondrial (cytb, ND4, 12S = 2536bp) and two nuclear genes (GAPDH, C-mos = 834bp), recovered *L. puelche* as nested inside an arenicolous group of the *donosobarrosi* group (Morando, 2004). Here we reproduce the topology of the *donosobarrosi* group, where *L. puelche* (*L.* sp. 25, Fig. 5.2; Morando 2004) was recovered as the sister taxon of *L. josei* (*L.* sp. 24, Fig. 5.2; Morando 2004). This topology suggests that the group is still poorly known, and has at least six more “candidate species” (Morando *et al.*, 2003), including two in the *cuyanus* complex, two related to *L. josei* and *L. puelche*, and another two closely related to *L. donosobarrosi*. Although we do not have molecular data for *L. mapuche*, Abdala (2002) suggested that it is closely related to *L. cuyanus*; if true, then, the *donosobarrosi* group includes five described and possibly seven undescribed species. These are under study by our research group and a detailed analysis of this group will be published elsewhere.

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Appendix 1. Specimens examined

- Liolaemus cuyanus* (30).—ARGENTINA: CATAMARCA: Tinogasta Department: 10 km N Medanitos, road to Tatón: BYU 47316, LJAMM 2324, 2327; Ruta Nacional 40, Km 1298, and La Puerta River: LJAMM 2316–9; Ruta Nacional 60, 11.8 km N Tinogasta: LJAMM 4173; Ruta Provincial 34, 16 km S Palo Blanco: LJAMM 2340. MENDOZA: La Paz Department: Ruta Nacional 146, Km 276: LJAMM 4023. LA RIOJA: Arauco Department: Aimogasta: LJAMM 4321. Castro Barros Department: Ruta Provincial 7, 9 km E Anillaco: LJAMM 1272; Ruta Provincial 7, 10 km E Anillaco: LJAMM 2254–5. Famatina Department: Road to Antinaco, 2.4 km E Ruta Nacional 40: LJAMM 5830–5; Road to Antinaco, 3.8 km E Ruta Nacional 40: LJAMM 4094; Ruta Nacional 40, Km 657, 9 km E Pituil: LJAMM 4156. General Lamadrid Department: Ruta Nacional 76, 3 km N Villa Castelli: LJAMM 4094. Rosario Vera Peñaloza Department: Ruta Nacional 141, 7.6 km W Mascasin, east edge of Mascasin salt depression: LJAMM 5740–1, 5743, 5778–9. Felipe Varela Department: Ruta Nacional 76, Km 158, 18 km S Pagancillo: LJAMM 4136. SAN JUAN: Ullúm Department: Ruta Nacional 40, Matagusanos: BYU 47315.
- Liolaemus donosobarrosi* (9).—ARGENTINA: MENDOZA: Malargüe Department: Ruta Provincial 180, 15 km S La Cortadera: LJAMM 5051–2, 5058, 5076–7; Ruta Provincial 180, 12.4 km S La Mantancilla: LJAMM 5153; Ruta Provincial . NEUQUEN: Zapala Department: unpaved road 6 km S Covunco Centro: LJAMM 3070–3
- Liolaemus josei* (4).—ARGENTINA: MENDOZA: Malargüe Department: Ruta Nacional 40, Puente El Zampal. LJAMM 5760–3.