

**Conspecificity of *Liolaemus isabelae* Navarro & Núñez, 1993 and *Liolaemus nigroventrolateralis* Ortiz, 1994 (Iguania: Tropicuridae: Liolaeminae) from Northern Chile**

**Daniel Pincheira-Donoso<sup>1</sup> and Herman Núñez<sup>2</sup>**

<sup>1</sup>Centre for Ecology and Conservation, Department of Biological Sciences, University of Exeter, United Kingdom

<sup>2</sup>Sección Zoología, Museo Nacional de Historia Natural, Santiago, Chile

The conspecificity of the Chilean Liolaeminae lizards *Liolaemus isabelae* Navarro & Núñez, 1993 and *Liolaemus nigroventrolateralis* Ortiz, 1994 is discussed. A careful comparison of the holotype and paratypes of *L. nigroventrolateralis* with the type series and additional topotype specimens of *L. isabelae* indicate the conspecificity of the two forms. Furthermore, the characters studied by Ortiz (1994) to diagnose *L. nigroventrolateralis* do not distinguish this species from *L. isabelae*. There are no distributional or ecological differences between the two species. Therefore, we consider that *L. nigroventrolateralis* is a synonym of *L. isabelae*.

*Key words:* conspecificity, distribution, ecology, *Liolaemus*

Ortiz (1994) described *Liolaemus nigroventrolateralis* based on material from the Salar de Pedernales, at 3425 m (26°15'S, 69°10'W), Chañaral Province, Third Administrative Region of Chile (Fourth Administrative Region *vide* Ortiz, 1994, *in errore*). In the main discussion provided by Ortiz (1994) to support the status of the new taxon, there are detailed comparisons with five congeneric species living in the same area: *Liolaemus nigriceps* Philippi, *L. montanus* Koslowsky, *L. rosenmanni* Núñez & Navarro, "*L. eleodori*" from Chile (= *L. rosenmanni*, see Pincheira-Donoso & Núñez, 2005) and *L. melanopleura* (sic) Philippi. However, Ortiz (1994) apparently ignored several previously published studies in which the *Liolaemus* species characterized by the combination of traits observed in *L. nigroventrolateralis* were placed as members of the subgenus *Liolaemus* (*sensu stricto*), and those taxa showing a different series of traits were recognized under the subgenus *Eulaemus* (e.g. Laurent, 1992; Cei, 1993). Because *L. nigriceps*, *L. montanus* and *L. rosenmanni* belong to the *Eulaemus* clade (see Schulte et

al., 2000; Pincheira-Donoso & Núñez, 2005), Ortiz (1994) focused on the comparison of species that are actually not phylogenetically related. Therefore, the specific differences found by Ortiz (1994) may be an artefact of early divergent phylogenetic histories (e.g. Felsenstein, 1985; Harvey & Purvis, 1991). On the other hand, the comparison performed by Ortiz (1994) between the new taxon and *L. melanopleurus* appears to be a matter for discussion, because *L. melanopleurus* is an enigmatic taxon. Indeed, it not only is known on the basis of two specimens, but the type locality also still remains a mystery (Pincheira-Donoso & Núñez, 2005). Finally, and perhaps more importantly, Ortiz (1994) did not compare *L. nigroventrolateralis* with the very similar species *Liolaemus isabelae*, previously described (Navarro & Núñez, 1993) based on material from "El Cerrito", 12 km northwest of La Ola settlement, Salar de Pedernales, 3350 m, Chañaral Province, Third Administrative Region (see Appendix). Curiously, in some later general systematic accounts for the genus *Liolaemus*, Etheridge (1995) and Etheridge & Espinoza (2000) did not refer to the species described by Ortiz (1994).

Although Ortiz (1994) failed to provide a formal diagnosis for *L. nigroventrolateralis*, he did indicate, in the abstract, that it has a "dorsal color pattern with a mid dorsal yellow band spotted with black dots, and a strong melanism running from the axilla to the groin, gut area, gular region, ventral surface of forelegs, hind legs and tail, low number of precloacal pores (2) and a moderate number of midbody scales", the same diagnostic traits previously described for *L. isabelae* by Navarro & Núñez (1993).

A comparative analysis of the holotype and paratypes of *L. nigroventrolateralis* with the type sample and topotypes of *L. isabelae* indicates the two species are conspecific. We performed comparisons on different traits, including morphometric, meristic and chromatic characters. The variables body size and scales around midbody were analysed using two-tailed Student *t*-tests.

The body size observed in both species is similar. The snout–vent length measured for the type series of *L. nigroventrolateralis* is 71.81±6.38 mm (range 61.22–77.84 mm), and 72.13±7.27 mm (range 59.6–83.5 mm) for *L. isabelae*. The statistical comparison of those variables showed non-significant differences (*t*-test,  $t_{(0.05, 16)} = 2.120$ ,  $P = 0.933$ ,  $n = 18$ ). Also, in both *L. nigroventrolateralis* and *L. isabelae*, the head-length/head-width ratio ranges between 1.19 and 1.20.

The cephalic lepidosis of *L. nigroventrolateralis* is identical to that of *L. isabelae*. Both exhibit smooth anterior scales anterior to the frontal, and somewhat more wrinkled scales in the posterior areas of the head, although there are in both series individual specimens in which all the head scales are almost smooth. In both species the rostral scale is 2–3 times wider than high and the nasal contacts the rostral shield. In shape, size, number and distribution, the nasal scales, frontonasals, unpaired scales of the snout, frontal, prefrontals, postfrontals, in-

**Table 1.** Comparative measurements (mm) of the holotypes of *L. nigroventrolateralis* and *L. isabelae*. In the first column: snout–vent length (SVL); axilla–groin length (A–GL); hind-limb length (H–LL); fore-limb length (F–LL); head length (HL); head width (HW) and tail length (TL). For *L. nigroventrolateralis*, “x”=appendix presents a regenerated portion.

Measurements	<i>L. nigroventrolateralis</i> (MZUC 19008)	<i>L. isabelae</i> (MNHN 2359)
Sex	Male	Male
SVL	77.8	78.9
A–GL	37.5	38.4
H–LL	49.4	44.0
F–LL	29.4	29.8
HL	16.9	17.2
HW	13.9	14.4
TL	111.0+x	133.0

terparietal and parietals are indistinguishable in *L. nigroventrolateralis* and *L. isabelae*. The presence and disposition of the lentiform sensory organs are invariable in both taxa, being found on the frontonasal scales and unpaired scales of the snout, not reaching the frontals. In the holotype of *L. nigroventrolateralis* there are four supraocular scales on each side, whereas in the holotype of *L. isabelae* there are five on each side. Nevertheless, in both samples studied there may be four or five of them.

The canthus rostralis, loreals, superciliaries, preoculars, suboculars and the ciliar sides are the same in both species. In the holotypes of *L. nigroventrolateralis* and *L. isabelae* there are five supralabial scales, the fourth one longest and curved upward posteriorly. Some individuals of both species have six supralabials with the fifth the longest. The temporal scales of the *L. nigroventrolateralis* holotype are smooth, whereas in the holotype of *L. isabelae* they are moderately keeled; however, this character is variable in both species. The size, disposition, depth and lateral bordering scales of the external auditory meatus are identical in the holotypes and the paratypes of both species, even in the number, shape and size of tympanic scales (see Donoso-Barros, 1966; Pincheira-Donoso & Núñez, 2005).

The holotype of *L. nigroventrolateralis* has four infralabials on the right side and five on the left, whereas that of *L. isabelae* has five infralabials on each side, but in both species the number of infralabials is five on each side. The mental is wider than the rostral, and in contact with four scales, the first pair of infralabials and postmentals, but never in contact with the sublabials. The gular region is covered with smooth, round and imbricated scales in both species. The presence of a laterocervical fold open behind the auditory meatus, and terminating in an antehumeral fold to form a deep “pocket” (see Ceï, 1986, 1993), both of them covered with

**Table 2.** Comparisons between the type series of *L. nigroventrolateralis* and *L. isabelae*. Type locality (Type loc), latitudinal range (LAR), longitudinal range (LOR), altitudinal range (ALR), snout–vent length (SVL), scales around midbody (SAMB). Values of SVL and SAMB are mean±standard deviation (range). *P* values from Student *t*-tests.

	<i>L. nigroventrolateralis</i>	<i>L. isabelae</i>	<i>P</i> value (df=16)
<i>n</i>	5	18	
Type loc	Salar de Pedernales	Salar de Pedernales	
LAR	26°15'–26°15' S	26°14'–26°26' S	
LOR	69°10'–69°13' W	69°12'–69°37' W	
ALR (m)	3320–3425	2850–3500	
SVL (mm)	71.81±6.38 (61.22–77.84)	72.13±7.27 (59.6–83.5)	0.933
SAMB	58.60±2.87 (55–62)	59.15±3.35 55–64	>0.7

smooth and granular scales, is a character identical in both species.

In both taxa, dorsal body scales are keeled, non-mucronate, imbricate to subimbricate, becoming granular towards the axilla and groin. Anterior limb scalation is identical in both species in shape, number and disposition. In the holotype of *L. nigroventrolateralis* there are 19 lamellae under the fourth finger of the right hand, whereas in the holotype of *L. isabelae* there are 18. Nevertheless, both samples vary from 18 to 20.

The lepidosis of hind legs is identical in both species in shape, size and disposition. In the holotype of *L. nigroventrolateralis* the fourth toe shows 24 lamellae, while the holotype of *L. isabelae* has 25; the range for both samples is 23–25. While the holotype of *L. nigroventrolateralis* has two precloacal pores, the holotype of *L. isabelae* has three, but the range observed was 2–3 in all of the males. The number of scales around midbody measured in both type series showed almost identical values (for *L. nigroventrolateralis*: 58.6±2.87, range 55–62; for *L. isabelae*: 59.15±3.35, range 55–64), which do not differ significantly ( $t_{(0.05, 16)}=2.12, P>0.7, n=18$ ; see Tables 1 and 2).

The diagnostic characters given in the abstract and in the description of Ortiz (1994) for *L. nigroventrolateralis* do not provide sufficient evidence for distinguishing it from *L. isabelae*. The dorsal pattern of a medium dorsal yellow band, spotted with black dots and a bold melanism between axilla and groin, the abdomen, gular region and ventral surface of the limbs and tail, are present in all known specimens of *L. isabelae*. In this species, and in *L. nigroventrolateralis*, the sides are strongly melanic, bordering a yellow band on the middle of the back, with scattered, irregular black spots, sometimes forming a vertebral line, and also showing a predominance of melanism on the dorsum and head. Both *L. nigroventrolateralis* and *L. isabelae* are sexually dichromatic, with males hav-

ing bolder yellow spots, and the throat and ventral surface of limbs and tail more melanic than in females, which may lack ventral melanism entirely.

In addition, no ecological differences (H. Núñez, field observations) appear to exist between these species, and their geographical distributions are absolutely continuous and overlapping (see Pincheira-Donoso & Núñez, 2005). Therefore, we conclude that *L. nigroventrolateralis* Ortiz, 1994 should be recognized as a synonym of *L. isabelae* Navarro & Núñez, 1993.

## ACKNOWLEDGEMENTS

We thank Jorge N. Artigas, Elvira Solar and Minerva Contreras, Zoology Museum, Facultad de Ciencias Naturales y Oceanográficas of the Universidad de Concepción, for giving us permission to examine the type sample of *Liolaemus nigroventrolateralis*. Two anonymous reviewers made essential comments to improve the original structure of this manuscript. D.P.-D. thanks Universities UK for financial support through an Overseas Research Student Award and the University of Exeter for an Exeter Overseas Research Student Award and a School of Biological and Chemical Sciences PhD scholarship.

## REFERENCES

- Cei, J.M. (1986). *Reptiles del Centro, Centro-oeste y Sur de la Argentina. Herpetofauna de las Zonas Áridas y Semiáridas*. Monograph 4. Torino: Museo Regionale di Scienze Naturali di Torino.
- Cei, J.M. (1993). *Reptiles del Noroeste, Nordeste y Este de la Argentina. Herpetofauna de las Selvas Subtropicales, Puna y Pampas*. Monograph 14. Torino: Museo Regionale di Scienze Naturali di Torino.
- Donoso-Barros, R. (1966). *Reptiles de Chile*. Santiago: Ediciones de la Universidad de Chile.
- Etheridge, R. (1995). Redescription of *Ctenoblepharys adpersa* Tschudi, 1845, and the taxonomy of Liolaeminae (Reptilia: Squamata: Tropicuridae). *American Museum Novitates* 3142, 1–34.
- Etheridge, R. & Espinoza, R. (2000). Taxonomy of the Liolaeminae (Squamata: Iguania: Tropicuridae) and a semi-annotated bibliography. *Smithsonian Herpetological Information Service* 126, 1–64.
- Felsenstein, J. (1985). Phylogenies and the comparative method. *American Naturalist* 125, 1–15.
- Harvey, P.H. & Purvis, A. (1991). Comparative methods for explaining adaptations. *Nature* 351, 619–624.
- Laurent, R.F. (1992). On some overlooked species of the genus *Liolaemus* Wiegmann (Reptilia Tropicuridae) from Perú. *Breviora* 494, 1–33.
- Navarro, J. & Núñez, H. (1993). *Liolaemus patriciaturrae* y *Liolaemus isabelae*, dos nuevas especies de lagartijas

para el norte de Chile. Aspectos biogeográficos y citotaxonómicos (Squamata, Tropicuridae). *Boletín del Museo Nacional de Historia Natural de Chile* 44, 99–113.

- Ortiz, J.C. (1994). Una nueva especie de lagarto altoandino del género *Liolaemus* (Sauria, Tropicuridae). *Boletín de la Sociedad de Biología de Concepción* 65, 191–195.
- Pincheira-Donoso, D. & Núñez, H. (2005). *Las Especies Chilenas del Género Liolaemus (Iguania, Tropicuridae, Liolaeminae)*. *Taxonomía, Sistemática y Evolución*. Publicación Ocasional del Museo Nacional de Historia Natural de Chile. Santiago: Museo de Historia Natural de Chile.
- Schulte, J.A., Macey, J.R., Espinoza, R.E. & Larson, A. (2000). Phylogenetic relationships in the iguanid lizard genus *Liolaemus*: multiple origins of viviparous reproduction and evidence for recurring Andean vicariance and dispersal. *Biological Journal of the Linnean Society* 69, 75–102.

Accepted: 26 October 2006

## APPENDIX

### Studied material

*Liolaemus nigroventrolateralis*: MZUC 19007–19011, type series, Museo de Zoología, Facultad de Ciencias Naturales y Oceanográficas, Universidad de Concepción, Chile, Salar de Pedernales (26°15'S, 69°10'W; 26°15'S, 69°13'W), 3425 m, Tercera Region, Chile.

*Liolaemus isabelae*: MNHN 2359–2362; 2697–2698; 3312–3314, Museo Nacional de Historia Natural de Chile, “El Cerrito”, 12 km NW campamento La Ola, Salar de Pedernales, 3350 m (26°14'S, 69°37'W), Tercera Región, Chile; MNHN 2713–2715, Mina “El Hueso”, Potrerillos, 2850 m (26°26'S, 69°28'W), Tercera Región, Chile; MNHN 2735–2736, Quebrada de Pedernales, cerca del Salar de Pedernales, 3672 m (26°22'S, 69°17'W), Tercera Región, Chile; DBCGUCh 1916, 1919, Departamento de Biología Celular y Genética, Facultad de Medicina sede Norte, Universidad de Chile, “El Cerrito”, 12 km NW campamento La Ola, Salar de Pedernales, 3350 m (26°14'S, 69°37'W), Tercera Región, Chile; CHDPD 723–724, herpetological collection of Daniel Pincheira-Donoso, Salar de Pedernales, 3500 m (26°14'S, 69°12'W), Tercera Región, Chile.