

ORIGINAL ARTICLE

A new species of *Brachistosternus* from Chilean central Andes (Scorpiones: Bothriuridae)

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Abstract

Brachistosternus (Leptosternus) perettii sp. n., from Chilean central Andes is described. *Brachistosternus (L.) perettii* is thought to be closely related to species from the plains of central Chile because its telson glands are divided into two separated halves. A key for the Andean species of subgenus *Leptosternus* is presented herein.

Resumen

Se describe a *Brachistosternus (Leptosternus) perettii* sp. n.; *Brachistosternus (L.) perettii* se encuentra relacionada con las especies de llanura del centro de Chile, ya que la glándula del telson de encuentra dividida en dos mitades separadas. Se brinda una clave para las especies andinas del subgénero *Leptosternus*.

Keywords: *Brachistosternus perettii* sp. n., Scorpiones, Bothriuridae, Chile, Neotropics

Introduction

The genus *Brachistosternus*, Pocock 1893 is the most diversified genus of Bothriuridae in arid plains from South America, and in the southern Andes of Argentina, Chile, Bolivia and Peru.

In recent years, the knowledge of the scorpion fauna of the southern Andes has had a great deal of improvement, and several new species of the genus *Brachistosternus* have been described (Ojanguren Affilastro, 2002a, 2002b, 2003; Ochoa, 2004, Ochoa & Acosta, 2002). Ojanguren Affilastro (2003) included all the known Andean species of high altitudes (from 2500 to 4500 m a.s.l.) of the subgenus *Leptosternus* Maury 1973 in a separate group; all these species are very similar, and most of them can only be separated by subtle differences in morphometric ratios, the number of setae, and pigmentation patterns. In some circumstances, species of other species groups can reach intermediate altitudes of up to 2500 m (Ojanguren Affilastro, 2003; Roig Alsina & Maury, 1981), but until now, no species from any of the other groups has been reported from high altitudes.

While revising part of the scorpion collection from the Entomology Laboratory of La Serena University (Chile), we have recognized an undescribed species of *Brachistosternus*, from high altitudes in the Doña Ana mountain chain, *Brachistosternus (Leptosternus) perettii* sp. n. This species does not belong to the Andean species group previously mentioned, but to another group of species which until now was only known from plains and coastal localities from northern and central Chile.

The Doña Ana mountain chain is a markedly steep region with strong elevation gradients. The hills and mountains exceed 3500 m, with their highest peak being the Cerro Las Tórtolas (6280 m). This chain runs northwest to southeast, where it unites with the Andes, and is crossed by numerous rivers and streams. The climate at 3750 m shows temperatures ranging from -17°C , in the winter, to more than 24°C in the summer, but temperatures below zero are possible throughout the year (Cepeda-Pizarro, 2004). Precipitation occurs mainly during the winter months in the form of snow, accumulating up to eight meters in some areas (Cepeda-Pizarro, 2004). The vegetation corresponds to a steppe with diverse

altitudinal levels: shrub steppe (or sub-Andean floor) between 2700 and 3500 m, sub-shrub steppe between 3500 and 4250 m, and the high-Andean steppe from 4250 to 4450 m, after which the vegetation disappears (Squeo et al., 1994; Cepeda-Pizarro, 2004). This vegetation, typical of the desert Andes of Chile, shows a high degree of endemism (Squeo et al., 1994), which is further increased by the presence of wet lowland ecosystems termed “vega” or “humedal” (Squeo et al., 1994; Cepeda-Pizarro, 2004). These areas are characterized by an accumulation of water resulting in permanently flooded floors.

Brachistosternus perettii is sympatric with another undescribed species of the same subgenus, which is closely related to *Brachistosternus (Leptosternus) montanus* Roig Alsina, 1977. Unfortunately, due to the scarcity of specimens, we cannot describe this species here.

Materials and methods

The terminology used for the hemispermaphore structures follows Maury (1974). Trichobothrial terminology follows Vachon (1974). Terminology of the *androvestigia* follows Cekalovic (1973). Terminology of the telson gland follows Roig Alsina and Maury (1981). Terminology of the metasomal carinae follows Stahnke (1970), abbreviated as follows: DL = dorsal lateral; LSM = lateral supramedian; LIM = lateral inframedian; VL = ventral lateral; VM = ventral median. Abbreviations of studied collections (and curators) are as follows: MACN-Ar: Museo Argentino de Ciencias Naturales “Bernardino Rivadavia”, National Arachnological Collection, Argentina (Cristina Scioscia); MZUC-UCCC: Universidad de Concepción Colecciones Científicas, Chile (Jorge Artigas); AMNH: American Museum of Natural History, New York, USA (Lorenzo Prendini); LEULS: Laboratorio de Entomología, Universidad de La Serena, Chile (Jorge Cepeda, Jaime Pizarro); CDA: Cátedra de Diversidad Animal I, Universidad Nacional de Córdoba, Argentina (Luis Acosta). All measurements are given in mm, and were taken using an ocular micrometer. Illustrations were produced using a stereomicroscope and camera lucida. The hemispermaphores were dissected from surrounding tissues and observed in 80% ethanol.

Results

Brachistosternus (L.) perettii sp. n.
(Figures 1–14, Table I)

Type material

Chile: Coquimbo Region: Elqui Province: Holotype male, Pastos Largos, “El Indio” Mine, 3600 m, 29°

49' S 70° 03' W, pitfall, I/1993, H. Vasquez C. coll., MZUC-UCCC 28634. Paratypes: 1 male and 5 juveniles, same data as the holotype, LEULS 049; 1 male, same data as the holotype, LEULS 048; 1 male, Cancha Sky, “El Indio” Mine, 3300 m, 29° 51' S 70° 03' W, under stone, II.1992, H. Vasquez C. coll., AMNH; 1 juvenile, Mil Curvas, 3 km before entrance to “El Indio” Mine 2850 m, UV detection, 26.II.2004, J. Ochoa, C. Mattoni, J. Pizarro coll., CDA 000.380; 1 juvenile, Cancha Sky, “El Indio” Mine, 3300 m, UV detection, 29° 51' S 70° 03' W, 6.XI.2003, C. Mattoni, J. Ochoa, L. Prendini coll., CDA 000.381; 1 juvenile, “airport”, plain over Cancha Sky, “El Indio” Mine, 3600 m, UV detection, 6.XI.2003, C. Mattoni, J. Ochoa, L. Prendini, coll., AMNH; 2 juveniles, same data as the holotype, except I/1992, LEULS 047. Near Juntas, Coquimbo, 30° 16' 14.5" S 69° 58' 27.9" W, C. Mattoni, A. Ojanguren coll. 1 male, 1 female (MACN-Ar 10522); 1 male, same data, (CDA).

Etymology

This species is named after the Argentinean biologist Dr. Alfredo Peretti in honour of his contributions to the understanding of scorpion behaviour and reproduction.

Distribution

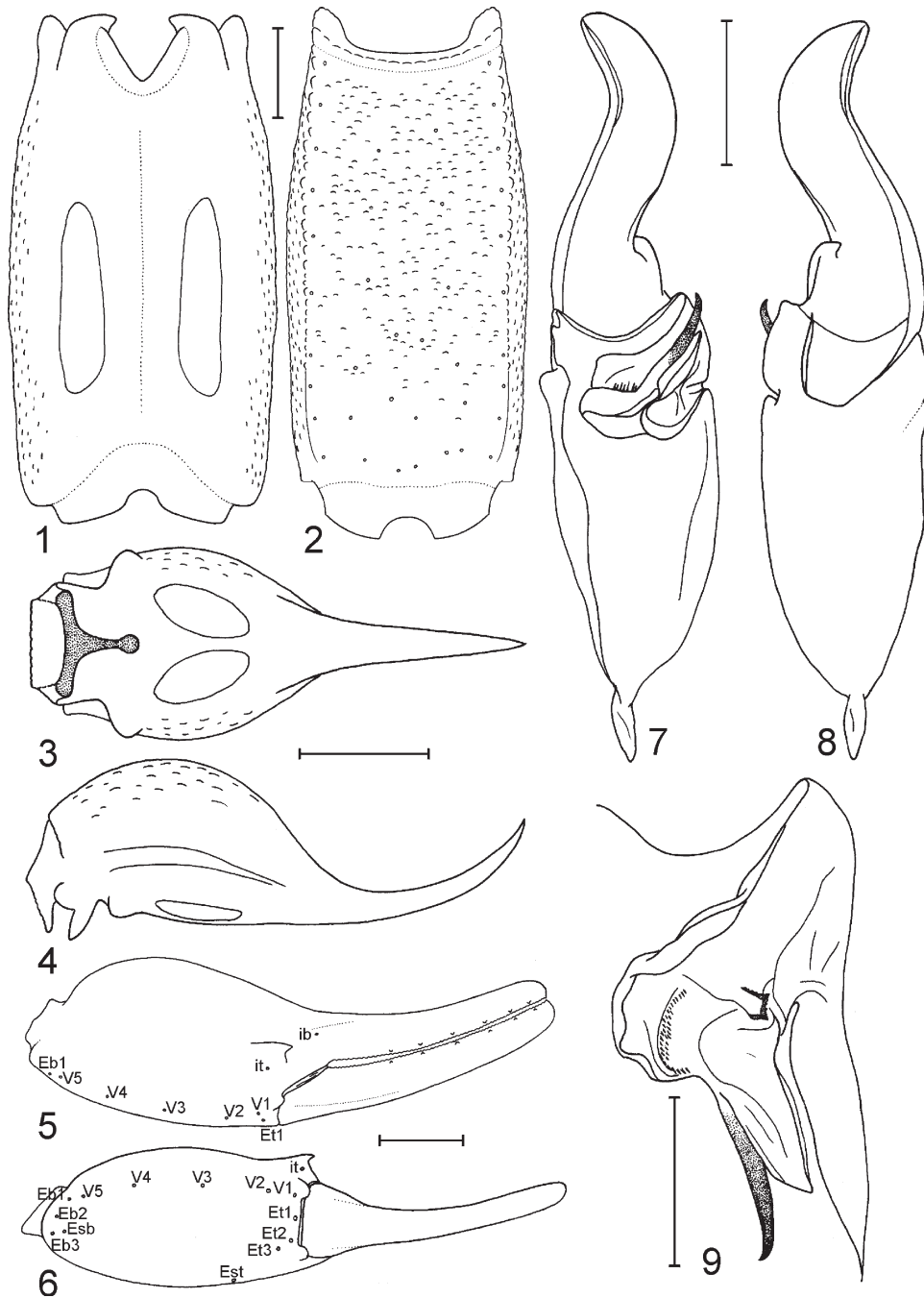
This species appears to be common between 3000 and 3600 m on the Doña Ana mountain chain (Figure 10). Several juveniles were collected by Lorenzo Prendini, José Ochoa and the junior author, at night with UV light sampling on November 2003, with a low temperature (below 5°C), on several localities of “El Indio” Mine. All the specimens were located over rocks, walking or waiting on open ground.

Diagnosis

Brachistosternus (Leptosternus) perettii can be distinguished from all other Andean species of the genus, because the dorsal gland of the telson is divided into two separated halves (Figure 3), whereas in the rest of the Andean species there is only one telson gland. *Brachistosternus (L.) perettii* is related to *Brachistosternus (L.) negrei* Cekalovic 1975, and some undescribed species from plains of central Chile, which have a telson gland divided into two halves.

Description

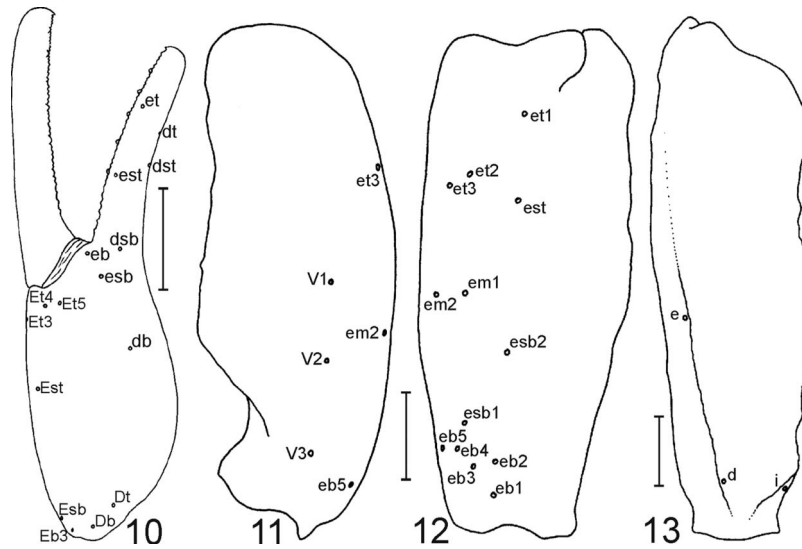
Colour. General colour dark yellow, with a dense dusky pattern. Carapace: oculo tubercle black, all the area from the postocular furrow to the lateral ocelli



Figures 1–9. *Brachistosternus* (*L.*) *perettii* sp. n., male. 1, fifth metasomal segment, dorsal aspect; 2, fifth metasomal segment, ventral aspect; 3, telson, dorsal aspect; 4, telson, lateral aspect; 5, left pedipalp chela, internal aspect; 6, left pedipalp chela, ventral aspect; 7, left hemispermatophore, ventral aspect; 8, left hemispermatophore, dorsal aspect; 9, left hemispermatophore, detail of the lobe region. Scale bars = 1 mm.

densely pigmented; two lateral dark spots and two posterolateral dark spots; the rest with reticulate pigment. Chelicerae: with reticulate pigment, and with a dark spot at the base of the fingers. Tergites I–VI: with a dark spot on the anterior two-thirds, not reaching the lateral margins; tergite VII: with five spots, one median triangular spot, and four lateral spots, two on each side, the rest with reticulate pigmentation. Sternites: depigmented. Metasoma:

dorsal surface: with two posterolateral dark spots, the rest with abundant reticulated pigmentation. Lateral surface: with abundant reticulated pigmentation. Ventral surface: with three dark stripes joining in the second half of the segment; in segment I the median stripe is faint and in some cases can be absent; in segments I–IV the median stripe is very thick and the lateroventral stripes are narrow in the first half, thickening in the second half; in segment V the



Figures 10–13. *Brachistosternus (L.) perettii* sp. n. 10, left pedipalp chela, male, external aspect; 11, left pedipalp patella, male, ventral aspect; 12, left pedipalp patella, male, external aspect; 13, left pedipalp femur, male, dorsal aspect. Scale bars = 1 mm.

median stripe is narrow in the first half, thickening in the second half, and the lateroventral stripes are very thick. Telson: vesicle faintly spotted; aculeus dark brown. Legs: femur and patella densely pigmented. Pedipalps: femur and patella densely pigmented; chela with abundant reticulated pigmentation.

Morphology

Measurements of male holotype and female paratype are given in Table I. Carapace: anterior edge with a slight median bulge; tegument smooth near the ocular tubercle, the rest densely granular; anterior and posterior longitudinal sulcus, lateral sulcus and postocular furrow deeply marked; ocular tubercle elongated, in the middle of the carapace, with a slight interocular sulcus, eyes two diameters apart with a seta behind each eye. Chelicerae with two vestigial subdistal teeth. Tergites I–VI finely granular, with some bigger granules near the posterior margin; tergite VII smooth in the middle, the rest densely granular, without carinae. Sternites with coarse granulation, spiracles narrow and well developed. Metasoma: segment I: ventral and lateral surface densely granular, dorsal surface finely granular, LSM and LIM carinae only present on the distal 2/3 of the segment, DL carinae extend the entire length of the segment; segment II: ventral and lateral surface smooth, LIM carinae slightly marked on the distal third, LSM carinae only present on the second half of the segment, DL carinae complete, dorsal surface finely granular; segment III: similar to segment II but less granular and with less developed carinae; segment IV: DL carinae complete, LSM carinae represented by a slight tegumentary elevation near

Table I. Measurements (mm) of *Brachistosternus perettii* sp. n., male holotype and female paratype.

	<i>Brachistosternus perettii</i> sp. n.	
	Male holotype	Female paratype
Total length	62.33	67.28
Carapace, length	7.19	7.35
Carapace, anterior width	5.25	5.23
Carapace, posterior width	7.67	7.59
Mesosoma, total length	17.11	24.12
Metasoma, total length	29.15	27.14
Metasomal segment I, length	4.6	4.28
Metasomal segment I, width	4.44	4.77
Metasomal segment I, height	3.88	3.96
Metasomal segment II, length	5.17	4.93
Metasomal segment II, width	4.28	4.36
Metasomal segment II, height	3.79	3.88
Metasomal segment III, length	5.49	5.09
Metasomal segment III, width	4.04	3.96
Metasomal segment III, height	3.63	3.88
Metasomal segment IV, length	6.62	6.14
Metasomal segment IV, width	3.88	3.8
Metasomal segment IV, height	3.47	3.47

(continued)

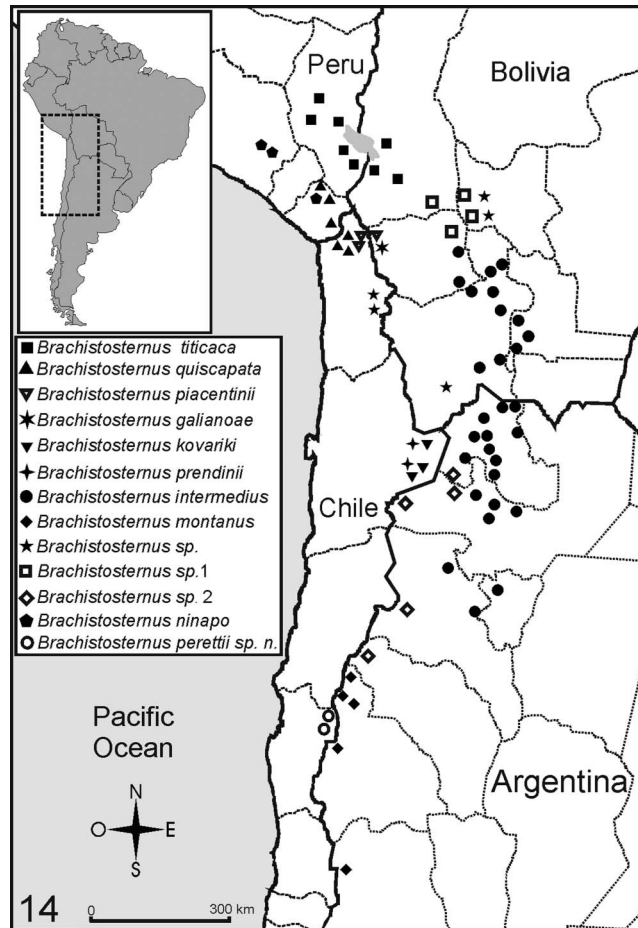


Figure 14. Map with the distribution of the Andean species of *Brachistosternus* (*Leptosternus*).

the anterior and posterior margins, ventral surface smooth, with a large number of scattered setae, each one in a depression; segment V: ventral surface irregularly granular, specially in the second half of the segment; ventral setae usually comprising six or seven rows of two to six setae (Figure 2); VL carinae extend the entire length of the segment, VM carina absent, but in some specimens there is a slight tegumentary elevation in the posterior third of the segment; lateral surface densely granular; dorsal surface finely granular or smooth; in males the androvestigia are long and well developed, occupying almost a 50% of the dorsal surface (Figure 1). The juveniles and females of the species are less granular than adult males. Telson densely granular (Figure 4); vesicle with rounded ventral surface; aculeus slightly curved, of the same length as the vesicle; in males the telson gland is divided into two halves, with an elliptic shape (Figure 3). Pedipalps: trichobothrial pattern of subgenus *Leptosternus*, neobothriotaxic major type C (Figures 5, 6, 10–13), adding one trichobotria on ventral series of chela; femur with three trichobotria: 1 *d*, 1 *i* and 1 *e*; patella with 19 trichobotria: 3 *V*, 2 *d*, 1 *i*, 3 *et*, 1 *est*, 2 *em*, 2 *esb*, and 5

eb; chela with 27 trichobotria: 1 *Est*, 5 *Et*, 5 *V*, 1 *Esb*, 3 *Eb*, 1 *Dt*, 1 *Db*, 1 *et*, 1 *est*, 1 *esb*, 1 *eb*, 1 *dt*, 1 *dst*, 1 *dsb*, 1 *db*, 1 *ib*, 1 *it*. Femur: anterior margin granular, ventrointernal, dorsoexternal, and dorsointernal carinae well developed; patella: scarcely granular, dorsointernal carinae well developed; chela stout with long fingers, smooth tegument, (Figures 5 and 6); in males the internal apophysis is well developed; movable finger with a central row of granules and five or six internal and external granules. Legs: finely granular; telotarsi I and II with the inner unguis 5–10% shorter than the external one. *Hemispermatochore*: distal lamina thick, slightly curved, approximately of the same size as the basal portion (Figures 7 and 8); cylindrical apophysis well developed, longer than the laminar apophysis; basal triangle of medium size, formed by two or three crests (Figure 9); internal spines absent; basal spines well developed; row of spines well developed.

Variability

Total length in males: 52–63 mm ($N=6$; mean = 57.80); 67.2 mm in the only studied female.

Key for the Andean species of *Brachistosternus* (*Leptosternus*)

1.	Hemispermatochore without internal spines	2
–	Hemispermatochore with internal spines.....	3
2.	Telson with four better developed granules on the ventral surface of the vesicle.....	
	.....<i>Brachistosternus</i> (<i>L.</i>) <i>weijenberghi</i> (Thorell, 1876).	
–	Telson without four better developed granules on the ventral surface of the vesicle	
	.....<i>Brachistosternus</i> (<i>L.</i>) <i>pentheri</i> Mello-Leitão, 1931.	
3.	Fifth metasomal segment with 18 to 26 ventral setae.....	4
–	Fifth metasomal segment with 17 or less ventral setae.....	5
4.	Telson gland divided into two separated halves.....	
	.....<i>Brachistosternus</i> (<i>L.</i>) <i>perettii</i> sp. n.	
–	Telson gland not divided into two separated halves.....	
	.....<i>Brachistosternus</i> (<i>L.</i>) <i>prendinii</i> Ojanguren Affilastro, 2003.	
5.	Distal lamina of hemispermatochore very curved, longer than the basal portion; basal spines of the hemispermatochore absent or poorly developed; <i>androvestigia</i> very small, occupying less than the 20% of the dorsal surface of the fifth metasomal segment	
	..... <i>Brachistosternus</i> (<i>L.</i>) <i>galianoae</i> Ojanguren Affilastro, 2001.	
–	Distal lamina of hemispermatochore straight or slightly curved, usually shorter or similar to the basal portion, but if it is longer than it is straight; basal spines of hemispermatochore always present and very well developed; <i>androvestigia</i> small to medium, occupying from 25–50% of the dorsal surface of fifth metasomal segment	6
6.	Distal lamina of hemispermatochore straight, slightly longer than the basal portion; general colour yellow, without brown spots	
	.....<i>Brachistosternus</i> (<i>L.</i>) <i>zambrunoi</i> Ojanguren Affilastro, 2001.	
–	Distal lamina of the hemispermatochore of the same length or shorter than the basal portion; general colour dark yellow, with brown spots.....	7
7.	Metasomal ventral dark stripes joining in the second half of all the segments.....	
	.....<i>Brachistosternus</i> (<i>L.</i>) <i>quiscapata</i> Ochoa & Acosta, 2002.	
–	Metasomal ventral dark stripes, never joining in the second half of segment I.....	8
8.	Metasomal ventral dark stripes, joining in the second half of segments II–V.....	
	.....<i>Brachistosternus</i> (<i>L.</i>) <i>ninapo</i> Ochoa 2004.	
–	Metasomal ventral dark stripes, never joining in the second half of segments II–III.....	9
9.	Fifth metasomal segment length/width ratio: 1.50–1.65.....	10
–	Fifth metasomal segment length/width ratio: 1.70–1.95.....	11
10.	Metasomal ventral dark stripes joining on the second half of segment V, in very pigmented specimens also joining on segment IV; telotarsus III with seven or eight dorsal setae.....	
	.....<i>Brachistosternus</i> (<i>L.</i>) <i>titicaca</i> Ochoa & Acosta, 2002.	
–	Metasomal ventral dark stripes, not joining on the second half of any segment, only in some very pigmented specimens of northern Argentina, they can join in segment IV and V; telotarsus III with nine or ten dorsal setae.....	
	.....<i>Brachistosternus</i> (<i>L.</i>) <i>intermedius</i> Lönnberg, 1902.	
11.	Pedipalp chela length/width ratio in males: 4.00–4.30.....	
	.....<i>Brachistosternus</i> (<i>L.</i>) <i>montanus</i> Roig Alsina, 1977.	
–	Pedipalp chela length/width ratio in males: 3.46–3.88.....	12
12.	Fifth metasomal segment length/width ratio: 1.70–1.80; <i>androvestigia</i> occupying less than a third of the dorsal surface of segment V; distal lamina of hemispermatochore thick, shorter than the basal portion; VM carinae of metasomal segment V only present in the second half of the segment	
	..... <i>Brachistosternus</i> (<i>L.</i>) <i>piacentinii</i> Ojanguren Affilastro, 2003.	
–	Fifth metasomal segment length/width ratio: 1.80–1.95; <i>androvestigia</i> occupying almost half the dorsal surface of segment V; distal lamina of hemispermatochore narrow, of the same length as the basal portion; VM carinae of metasomal segment V extending the entire length of the segment.....	
	..... <i>Brachistosternus</i> (<i>L.</i>) <i>kovariki</i> Ojanguren Affilastro, 2003.	

Number of pectinal teeth in males: 30–35 ($N=6$; median = 33); 29 in the only studied female. Fifth metasomal segment length/width ratio: 1.75–1.82 ($N=7$; mean = 1.77). Fifth metasomal segment with 8 or 9 lateroventral setae ($N=10$; median = 8), and with 18–22 ventral setae ($N=10$; median = 21). Telotarsus III with 9 or 10 dorsal setae ($N=10$; median = 10), 4–6 ventrointernal setae ($N=10$; median = 6); and 3 or 4 ventroexternal setae ($N=10$; median = 4). Basitarsus III with 6 or 7 dorsal setae ($N=10$; median = 6). Length/height ratio of the pedipalp chela in males: 2.98–3.4 ($N=6$; mean = 3.2); 3.53 in the only studied female. Length/width ratio of the pedipalp chela in males: 3.47–4.25 ($N=6$; mean = 3.9); 4,29 in the only studied female.

Discussion

Most of the Andean species of subgenus *Leptosternus* belong to a well-defined group of species with very similar external morphology (Ojanguren Affilastro, 2003; Ochoa, 2004), and only small differences in their hemispermatochores. All of these species are small to medium size; densely pigmented, except *Brachistosternus* (*L.*) *zambrunoi* Ojanguren Affilastro, 2002; with caudal glands or *androvestigia* always present, but not very developed, and with telson glands always present but never divided into two halves; the hemispermatochore does not carry internal spines, and the basal triangle is usually poorly developed. All of these species are distributed from

central Argentina to southern Peru, from 2500 m to 4500 m, except *B. zambrunoi* (Ojanguren Affilastro, 2002b) which inhabits a small area of sandy plains in north-eastern Argentina, from 1500 to 2000 m.

Brachistosternus perettii belongs to another species group that is particularly diverse in the plains of central Chile, and includes *B. negrei*, *Brachistosternus (L.) artigasi* Cekalovic, 1974, and other undescribed species. This latter group shares most of its characteristics with the Andean species, but it can be easily separated based on the complete or partial division of the telson gland into two halves. This group is more closely related to the Andean group than to the rest of the species from the plains of northern Chile, southern Peru and Argentina. However, other types of analysis (e.g., cladistic) will be necessary to elucidate the relationships among the different species groups of the subgenus *Leptosternus*.

Apparently the highest peaks of the Andes are an efficient barrier to most of the Andean species of *Brachistosternus*. Until now, the only species of this genus that has been collected on both sides of the Andes was *Brachistosternus (Leptosternus) piacentinii* Ojanguren Affilastro, 2003, from central west Bolivia and northern Chile (Ojanguren Affilastro, 2003).

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