

ORIGINAL ARTICLE

Systematics and distribution of three *Bothriurus* species (Scorpiones, Bothriuridae) from central and northern Chile

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Abstract

Bothriurus coriaceus Pocock and *B. keyserlingi* Pocock are redescribed, and the latter is restored as a valid species (formerly under synonymy of *B. coriaceus*). Though these species were erroneously mentioned from Argentina and Brazil, they are restricted to Chile: *B. coriaceus* distributed from Coquimbo to Santiago (type locality Coquimbo), and *B. keyserlingi* from the Región de Valparaíso and surroundings (type locality uncertain). The external morphology and the hemispermatophores of these species are very similar; they differ in their pigment patterns. The ranges of both species are updated. New records of the close relative, *B. dumayi*, are also provided, which enhance its known distribution.

Resumen

Se describen *Bothriurus coriaceus* Pocock y *B. keyserlingi* Pocock, y esta última es revalidada (anteriormente bajo la sinonimia de *B. coriaceus*). Aunque fueran erróneamente citadas para Argentina y Brasil, estas especies están limitadas a Chile: *B. coriaceus* desde Coquimbo a Santiago (localidad tipo, Coquimbo), y *B. keyserlingi* en la Región de Valparaíso y alrededores (localidad tipo incierta). La morfología externa y el hemiespermatóforo de estas especies son muy similares, difiriendo en sus patrones de pigmentación. Se actualizan las distribuciones de ambas especies. Se proporcionan también nuevos registros de la especie próxima *B. dumayi*, ampliando su distribución conocida.

Keywords: Bothriuridae, *Bothriurus coriaceus*, *Bothriurus dumayi*, *Bothriurus keyserlingi*, Chile, Scorpiones

Introduction

Two Chilean species of *Bothriurus* Peters, 1861, *B. coriaceus* and *B. keyserlingi*, were described in successive pages by Pocock (1893). The former was based on several specimens (three males and one female), while *B. keyserlingi* was described just upon a dry-preserved female (Pocock, 1893). This author differentiated these species through the presence of ventral carinae in sternite V and metasomal segment I in *B. keyserlingi*, a feature apparently absent in *B. coriaceus* (Pocock, 1893, p.95). This character, considered of little value by Bücherl (1963), because of being usually much more developed in females (see “Remarks” under *B. keyserlingi*), likely led him to place *B. keyserlingi* under the synonymy of *B. coriaceus*. We do not agree with this judgment, since Bücherl (1963) only based his conclusions on a few

materials available at the Museu Nacional (Rio de Janeiro) and in Pocock’s description, but without seeing the type material. The types, together with abundant materials of both species, were first revised by Emilio Maury, and according to his unpublished notes and to his opinion in some papers (e.g. Maury, 1968, 1973), he considered both species to be valid. However, he did not reflect this opinion in his genus catalog (Maury, 1981), where for reasons unknown to us, he repeated without comments the synonymy of Bücherl (1963). Accordingly, in the recent *Catalog of the scorpions of the world*, Lowe & Fet (2000) still listed *B. keyserlingi* as a junior synonym of *B. coriaceus*. This unclear taxonomic status also affected the current distributional knowledge of these species. The latest scorpion catalog of Chile (Cekalovic, 1983) gives an incredibly wide distribution for *B. coriaceus*: from the center of Brazil, to the

center of Argentina and Chile. Also *B. keyserlingi*, treated as valid by Cekalovic (1983), is attributed there to have a similarly immense range (Chile, Peru, Argentina and south Brazil). Lowe & Fet (2000) mention *B. coriaceus* for Argentina and Chile, but note that records for Brazil are erroneous.

We were able to examine the types of both nominal species, and large series of additional material as well, which allowed us to determine that *B. coriaceus* and *B. keyserlingi* are valid, separate species, geographically restricted to Chile. In this paper we redescribe both species. In addition, we provide new records of a close relative, *B. dumayi* Cekalovic, 1974, a species which was in turn the subject of some misunderstanding (it was incorrectly included in *Orobothriurus* Maury, 1976, and only recently restored in *Bothriurus*; Maury, 1976; Acosta & Ochoa, 2001).

Materials and methods

Terminology for general morphology follows Stahnke (1970), except for metasomal and pedipalpal carinae (Francke, 1977) and trichobothrial nomenclature (Vachon, 1974). The abbreviations of carinae of metasomal segments used are: DL, dorsal lateral; LSM, lateral supramedian; LM, lateral median; LI, lateral inframedian; VL, ventral lateral; VSM, ventral submedian; VM, ventral median. The abbreviations of hemispermaphore structures (based on San Martín, 1963) used are: L, lamina; c.d., distal crest of lamina; r.d.p., posterodistal fold; P.b., basal portion; l.i., internal lobe of capsule; l.b., basal lobe of capsule; l.e., external lobe of capsule.

Acronyms and curators of studied collections: AAOA, Andrés Ojanguren Affilastro personal collection; AMNH, American Museum of Natural History, New York (L. Prendini); BMNH, The Natural History Museum, London (J. Beccaloni); CDA: Cátedra de Diversidad Animal I, Facultad de Ciencias Exactas, Físicas y Naturales, Universidad Nacional de Córdoba (L. E. Acosta); MACN, Museo Argentino de Ciencias Naturales "Bernardino Rivadavia", Buenos Aires (C. Scioscia); MNHN, Museo Nacional de Historia Natural, Santiago de Chile (A. Camousseight); MNRJ, Museu Nacional do Rio de Janeiro (A. Kury); UCCC, Universidad de Concepción, Colecciones Científicas, Concepción (V. Jerez, J. Artigas).

Results

Bothriurus coriaceus Pocock, 1893 (Figures 2–15, Table I)

Bothriurus coriaceus Pocock, 1893, p. 95; Lowe & Fet, 2000, p. 30 (complete reference list, exclude *B. keyserlingi*).

Bothriurus chilensis: Mello-Leitão, 1945, p. 157 (misidentification).

Bothriurus (Andibothriurus) coriaceus: Bücherl et al., 1963, p. 220.

NEC: *Bothriurus coriaceus*: Prendini, 2000, p. 5 (with one subdistal tooth in the chelicera).

Type series

Chile: Región de Coquimbo: *Provincia Elqui*: Coquimbo, syntype ♂, H. M. S. [His Majesty's Ship] *Alert*, BMNH 81.109. Chile (no further detail): syntype ♂, T. Edmonds coll., BMNH 81.56. Pocock (1893, p. 95) mentions four specimens: "two [♂♂] being ticketed merely Chili, the others (1♂ and 1♀) Coquimbo"; but, as already noted by Maury (1981, p. 101), only the previously mentioned males remain (J. Beccaloni, *in litt.*). Lowe & Fet (2000, p. 30) mention four syntypes, but inverting the accession numbers: "Chile" for 81.109 ("2 ♂♂") and "Coquimbo, Chile" for 81.56 (1 ♂) and for a female (without number). The male, BMNH 81.109 from Coquimbo, is hereby designated as lectotype of *Bothriurus coriaceus*, and the remaining specimen (BMNH 81.56) as paralectotype (but see "Remarks"). We cannot be precise on the collection date of the lectotype (BMNH 81.109), but H. M. S. *Alert* was in Coquimbo three times: in 1879 from 19 May to 16 July and from 23 to 30 August, and in 1880 from 4 May to 14 June (Coppinger, 1885). Also, the most probable collector is R. W. Coppinger, since he was the only naturalist on the ship.

Diagnosis

Bothriurus coriaceus is related to *B. dumayi* and *B. keyserlingi*, sharing a similar morphology of the ventral carinae of the metasomal segment V, and a similar general habitus and appearance. The closest species concerning morphology is *B. keyserlingi*, differing from *B. coriaceus* in less development and density of granules in the pedipalps and the metasoma. Pigment patterns easily separate *B. coriaceus* from *B. keyserlingi*, the latter being more pigmented. In *B. coriaceus* the sternites either completely lack pigment or show at most weak lateral spots in the sternite V alone; in *B. keyserlingi* the pigment may cover all sternites, or may consist of sternite V completely covered and dark lateral spots on sternites I–IV. Also the pigmentation on tergites differs, since while they are totally pigmented in *B. keyserlingi* and in *B. coriaceus* the posterior half or one-third of each tergite is depigmented. In addition, the metasoma of *B. coriaceus* is usually much less pigmented than *B. keyserlingi*. The background coloration is different too, specimens of *B. coriaceus*

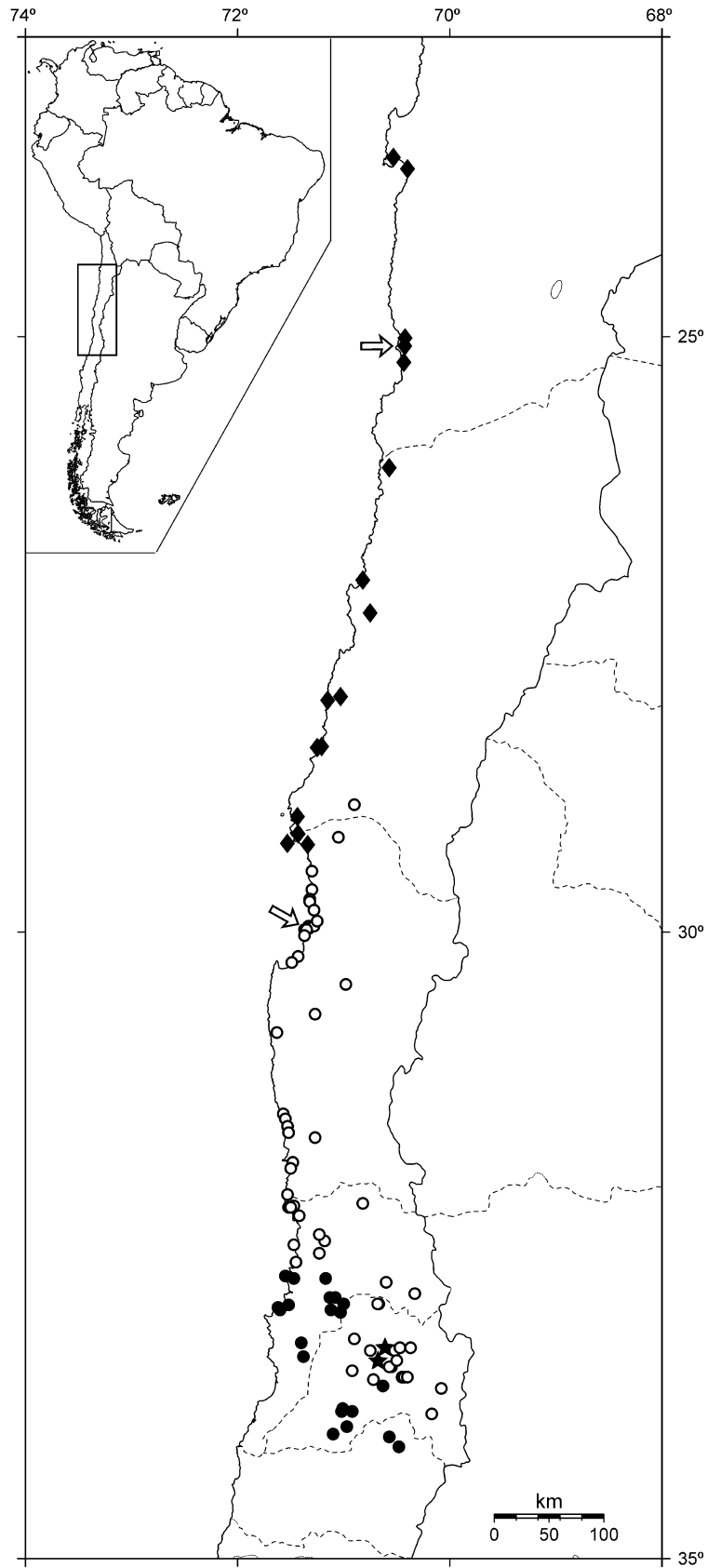
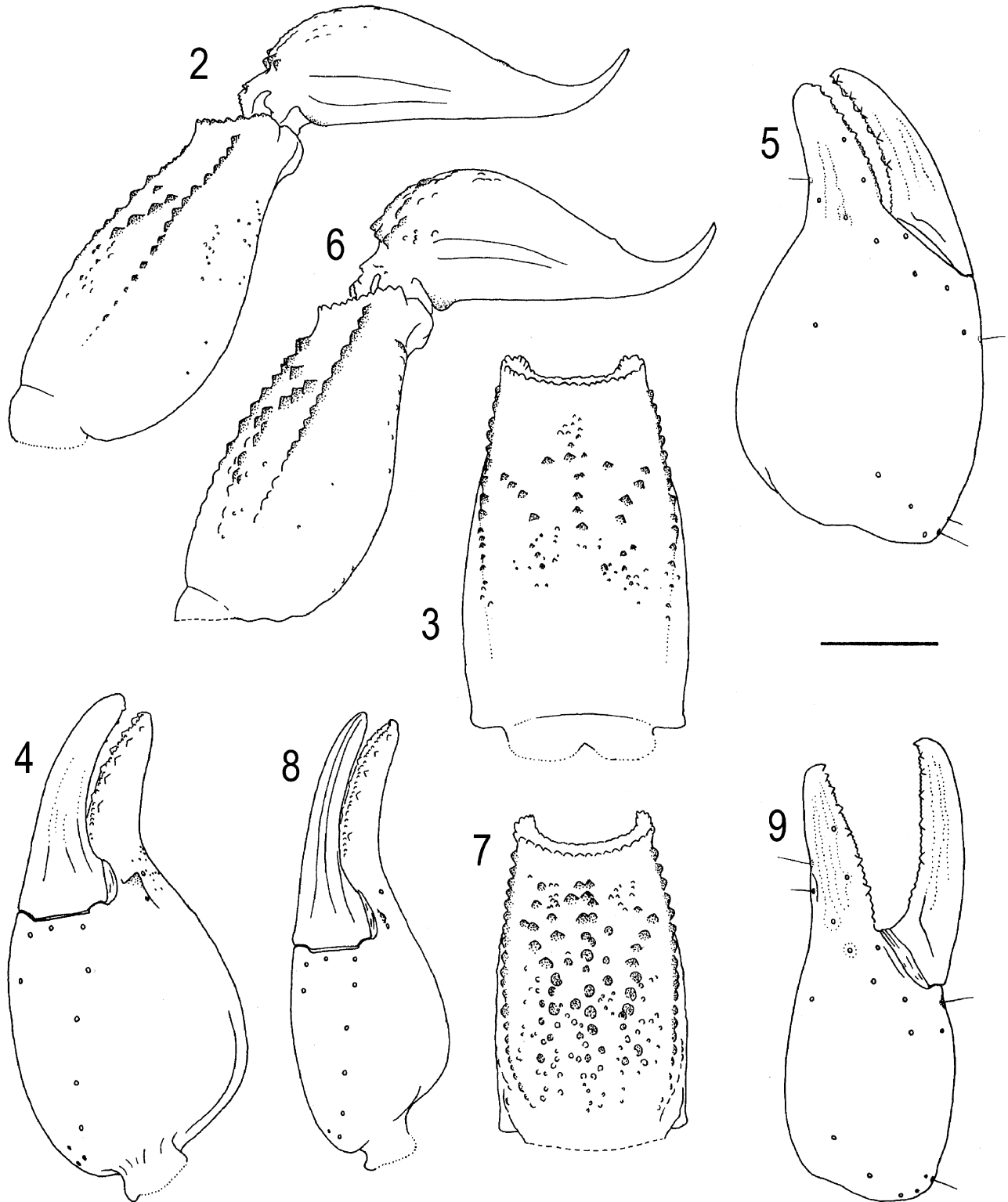
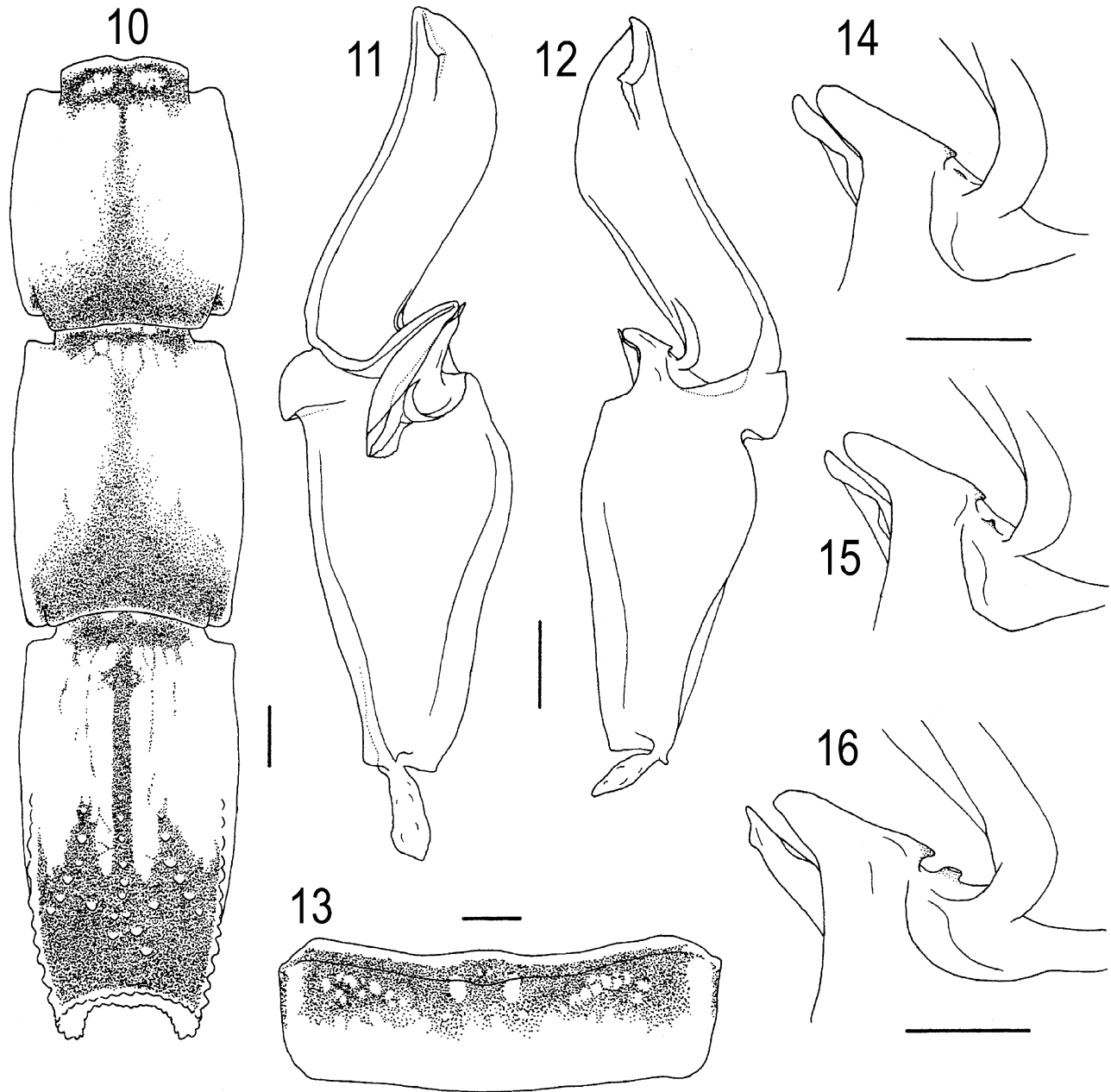


Figure 1. Records of *Bothriurus coriaceus* Pocock (white circles), *Bothriurus keyserlingi* Pocock (black circles) and *Bothriurus dumayi* Cekalovic (black diamonds). Black stars: localities with records of both *B. coriaceus* and *B. keyserlingi*. The arrows indicate the type localities. Solid line: international boundaries; dashed line: region or province limits.



Figures 2–9. *Bothriurus coriaceus* Pocock. (2–5) Lectotype ♂ (BMNH 81.109): (2) metasomal segment V and telson, lateral view; (3) metasomal segment V, ventral view; (4) right pedipalp chela, ventromedial view; (5) right pedipalp chela, lateral view. (6) ♀ from Quebrada a Playa Agua Dulce (MACN), metasomal segment V and telson, lateral view. (7) ♀ from 4 km N Los Vilos (AMNH), metasomal segment V, ventral view. (8, 9) ♀ from Playa Agua Dulce (MACN): (8) right pedipalp chela, ventromedial view; (9) right pedipalp chela, lateral view. Scale bars: 2 mm.



Figures 10–16. (10–15) *Bothriurus coriaceus* Pocock. (10, 11) ♂ from Quebrada a Playa Agua Dulce (MACN): (10) pigment pattern of metasomal segments III–V, ventral view; (11) left hemispermaphore, internal view. (12) Lectotype ♂ (BMNH 81.109), left hemispermaphore, external view. (13) ♀ from Quebrada a Playa Agua Dulce (MACN), pigment pattern of tergite IV. (14–16) Left hemispermaphores, detail of lobes area, external view: (14) ♂ from 30 km N Ovalle (MACN); (15) ♂ from Los Vilos (MNH); (16) *Bothriurus dumayi* Cekalovic, ♂ from 27 km E Vallenar (AMNH). Scale bars: 1 mm (9–11); 0.5 mm (12–15).

being reddish yellow to reddish brown, while *B. keyserlingi* are reddish brown to dark brown or almost black, darkest individuals are the most common. Concerning color, the most related species is *B. dumayi*, whose pigment pattern is closely similar to *B. coriaceus*. These species differ in their morphology: adult females of *B. coriaceus* bear well-developed ventral carinae on the sternite V and metasomal segment I, and the subaculear, ventral granule of the telson is simple and small; in contrast, those carinae are little developed or absent in

females of *B. dumayi*, and the subaculear granule is double and well developed. The hemispermaphore of *B. dumayi* has a large fold on the external side of the l.i. (between the external apophysis and the r.d.p.), whereas in *B. coriaceus* no structure or just a small granule is normally seen in this place.

Description

Coloration. General color reddish yellow to reddish brown, with pigment spots dark brown. Legs

Table I. Measurements (mm) of *Bothriurus coriaceus* Pocock (lectotype ♂ from Coquimbo, BMNH 1881.104; ♀ from Playa Agua Dulce, MACN) and *Bothriurus keyserlingi* Pocock (♂ from Valparaíso, MACN; holotype ♀ from "Chile").

	<i>Bothriurus coriaceus</i>		<i>Bothriurus keyserlingi</i>	
	Lectotype ♂	♀	♂	Holotype ♀
Total length	42.09	38.22	43.41	39.16
Carapace length/anterior width	5.54/3.13	5.34/3.47	5.67/3.40	5.49/3.35
Mesosoma length	10.57	10.34	10.78	8.48
Metasoma total length	25.98	22.54	26.96	25.19
Metasomal segment I, length/width	2.80/4.47	2.33/3.80	2.80/4.20	2.81/4.02
Metasomal segment II, length/width	3.34/4.13	2.80/3.60	2.93/4.07	3.15/3.75
Metasomal segment III, length/width	3.60/4.00	3.20/3.47	3.74/3.94	3.48/3.48
Metasomal segment IV, length/width	4.07/3.80	3.47/3.40	4.40/4.07	4.02/3.55
Metasomal segment V, length/width/height	5.53/3.74/2.93	4.74/3.34/2.73	5.87/3.80/3.27	5.23/3.42/2.81
Telson, length	6.64	6.00	7.22	6.50
Vesicle, length/width/height	4.51/2.73/2.00	4.27/2.67/2.07	4.89/2.93/2.13	4.62/2.88/2.08
Sting, length	2.13	1.73	2.33	1.88
Pedipalp, total length	16.21	14.76	16.47	15.26
Femur, length/width	3.87/1.80	3.60/1.60	4.00/1.73	3.69/1.68
Patella, length/width	4.34/1.87	3.94/1.60	4.34/1.80	4.09/1.68
Chela, length/width/height	8.00/3.47/4.27	7.22/2.40/2.73	8.13/3.20/3.94	7.48/2.48/2.81
Movable finger, length	3.80	4.13	4.47	4.36

yellowish, weakly spotted on the proteral side. Ventral side of coxae, sternum and genital operculum reddish yellow, without pigment. Pectines yellow, depigmented. Pedipalp femur and patella reddish yellow, with diffuse stains on the external side, chelae yellow to reddish brown with some diffuse spots on the external and dorsal side (mostly on the base of the fingers). Chelicerae yellow, with a small transverse stain on the base of the fingers, movable finger weakly spotted. Carapace reddish yellow with stains, with very dense pigment on the median eyes area, connected with lateral irregular spots and with the pigment on the lateral eyes area; front area depigmented or with a faint transverse spot near the anterior margin; posterior area with weak reticules on the posterolateral angles, posterior margin without spots. Tergites reddish yellow, the anterior half covered by dense pigment, the posterior half depigmented. Sternites light reddish yellow, I–IV without pigment, on sternite V two diffuse posterolateral stains may be present. Metasoma reddish yellow. Ventral face with dense spots of pigment on the posterior third, triangle-shaped; in juveniles and some adults there are three longitudinal stripes of diffuse pigment (one medial, two lateral) that join on the posterior third. Lateral sides of metasoma without pigment or with weak longitudinal stripes. Dorsal face depigmented, except for some examples where a transverse posterior stain of segments I–IV exists. Telson reddish yellow, depigmented or with one weak ventral stripe, dorsal side of the vesicle of the males with a wide yellow area.

Morphology. Carapace and tergites of males fine and evenly granulated, with matt appearance on all surfaces; carapace and tergites of females smooth. Carination in general more developed in males, except for the ventral carinae on sternite V, VSM and VL on metasomal segment I (absent in males), and the ventral carinae of metasomal segment V, all with larger granules in females. Carapace with front margin straight or slightly protruded; anterior median furrow extremely feeble; ocular mound noticeable, with no depression between the eyes, which are separated at 1.5–2 diameters; lateral ocular furrows weak, median central and posterior well marked, with a deep depression in between; posterior transversal and posterior lateral furrows marked. Tergites I–VI acarinate, VII with four short carinae in the posterior third, two paramedian and two lateral, with sparse granules in between (but smooth in the median sector). Sternites I–IV: tegument smooth, on sternite V of females and juveniles there are four vestigial carinae (two paramedian, two lateral) and small blunt granules scattered on the posterior one-quarter; in some specimens the carinae can be very weak and almost without accessory granulation. Metasoma. Carinae on segments I–IV: DL complete, with low and rounded granules, the caudal ones more developed; LSM limited to the posterior third or quarter (a little more extended on segment I); area between DL and LSM with a few, dispersed small granules; LI only present on the posterior third of segment I, it is vestigial on segments II–III, absent on segment IV; VL and VSM only present on segment I of females and

juveniles, straight and vestigial, with no granules (males with tegument smooth). Metasomal segment V (Figures 2, 3, 6, 7): DL feeble, with small sparse granules, more noticeable on the distal third; LM lacking; area between DL and VSM with no or a few small granules; VL, VSM and VM developed on the posterior two-thirds of the segment (see "Variability"), VSM subterminal, slightly oblique, VM posteriorly bifurcated, with two subterminal paramedian larger granules; intercarinal ventral areas without or with small to large granules. Telson (Figures 2 and 6) with elongated vesicle (a little shorter in females), ventral surface with blunt granules more developed on the anterior border, dorsal surface smooth (and a slight glandular depression in males). Chelicera with two subdistal teeth on the movable finger. Pedipalps. Femur with three carinae, dorsomedial limited to the basal third, dorsolateral reaching the proximal two-thirds, ventromedial with a proximal portion diagonal, well developed, and distal portion with small sparse granules; medial, dorsal and ventral sides with some scattered granules. Patella with two vestigial carinae, dorsomedial and ventromedial, with or without small granules. Chela with smooth tegument, without carinae or granules, vestigial remains of carinae are only seen on the fingers (a little more noticeable in females); male chela robust with short fingers (Figures 4 and 5); medially, near the base of the movable finger, a strong conic apophysis, tip slightly curved upwards, and a slight tegumentary depression above it; female chela less robust, with longer fingers (Figures 8 and 9) and a blunt granule in the position of the apophysis of the male. Trichobothriotaxy: type C, increasing neobothriotaxy, with the following total numbers: femur 3 (1 *d*; 1 *i*; 1 *e*), patella 19 (2 *d*; 1 *i*; 13 *e*; 3 *v*), chela 27 (21 in manus -5 *V*-; 6 in fixed finger). Number of pectinal teeth: males with 14–20 (lectotype with 18), females with 12–18 (variability in Table II). Hemispermatophore (Figures 10–12, 14, 15): L slender, slightly S-curved; c.d. parallel to the edge of L, divided by a transversal ridge, the distal part slightly curved, the proximal portion straight; l.b. laminar, with bifid end; l.i. with an external apophysis, it can bear a small granule or crest in the depression between the apophysis and the r.d.p. (see "Variability"); l.e. with a semicircular ridge; r.d.p. well developed.

Variability

Total length. Males 32.84–43.81 mm, females up to 50.78 mm.

Pigment. The adult specimens tend to be less pigmented, especially the ventral side of metasoma.

Some adults may recall the typical juvenile pigmentation; such an increase of the pigment density is more remarkable in specimens from the southernmost records, being evident in some geographical intergradations.

Ventral carinae on sternite V and metasomal segment I (females). Slightly variable, from well defined and strong in some cases, to only insinuated in other specimens. This variability also shows a slight geographical trend: females of the southern localities have these carinae more marked.

Ventral carinae on metasomal segment V. Highly variable, ranging from short carinae with few intermediate granules (most frequent), to more extended with many intermediate granules (Figures 3 and 7); this variability does not suggest any geographical pattern, and even specimens from the same locality may represent one of the ends of variation.

Hemispermatophore. Variability affects the external side of l.i. (Figures 11, 14, 15): out of 102 hemispermatophores studied (i.e. 51 individuals), 19 (18.63%) showed some structure in the depressed area between the apophysis and r.d.p.: a tiny granule (16) or a very small crest (three) (Figures 14 and 15); these structures can be present in both hemispermatophores of an individual (six specimens), or in only one hemispermatophore (four examples only on the right side, three on the left). In one specimen, both hemispermatophores showed c.d. divided by more than one transversal ridge (four ridges on the right, two ridges on the left).

Chelicerae. Small variability, in most cases probably attributable to natural erosion; in one remarkable case, a juvenile (El Canelo, Santiago, MNRJ) showed a single subdistal tooth in both chelicera, with no trace of the lacking tooth; a female of the same locality (UCCC) had a large subdistal tooth on the right chelicera, and two small teeth on the left one.

Remarks

The paralectotype (BMNH 81.56) may prove not be conspecific to the lectotype. Its general color is dark brown, with three ventral pigment stripes on the metasoma that join distally on each segment; this is not the most frequent state in adult *B. coriaceus*. Additionally, four ventral carinae are insinuated on sternite V, a state not observed in the studied males of *B. coriaceus*. Further, the development of ventral carinae on metasomal segment V of this specimen recalls the arrangement typical to *B. keyserlingi*, with

many granules between VSM and VM. Unfortunately, the poor condition of this individual (originally dry preserved) does not enable its identity to be determined with certainty.

Distribution and habitat

Bothriurus coriaceus was collected from southern Región de Atacama up to eastern Región de Santiago, in Chile (Figure 1). References for NE Brazil and central Argentina (e.g. Mello-Leitão, 1934, p. 91; Bücherl, 1959, p. 26; Borelli, 1901, p. 11) are misidentifications and were assigned to other species (Maury, 1982; Acosta, 1997). The range of *B. coriaceus* roughly matches the vegetation subregion known as “Matorral Estepario” (steppe scrub), in its “coastal”, “interior”, “woody” and “arborescent” formations, and a part of the “Matorral and Bosque Espinoso” Subregion (shrub and spiny forest), “spiny shrub of the hills” formation, both subregions belonging to the “Matorral and Bosque Esclerófilo” (shrub and sclerophyllous forest) region (Gajardo, 1995). In almost its entire range, *B. coriaceus* coexists with *Caraboctonus keyserlingi* Pocock (Iuridae), a species also reported to show some N–S morphological intergradations (Lourenço, 1995). In some sites, *B. coriaceus* is seemingly sympatric to other *Bothriurus* species: in Quebrada Guaquén (Pichicuy) it was found together with *Bothriurus pichicuy* Mattoni, 2002 (Mattoni, 2002c); in the surroundings of Santiago city (Manquehue and San Cristobal Mountains) it might have been collected together with *B. keyserlingi*, though these collections might have well originated at different altitudes (not specified in the labels).

Material examined

Chile: Región de Atacama: *Provincia Huasco*: 20 km N Domeyko, 19 September 1963 (W. Aravena), 1♀ (UCCC 235); Domeyko, 24 September 1963 (Instituto de Biología), 1♀ (MACN); 7 km S Incahuasi, 11 October 1975 (C. Carraro), 1 juv. (AMNH). Región de Coquimbo: *Provincia Elqui*: 6 km S Cruz Grande (beach, 20 m), 6 October 1992 (N. I. Platnick, K. Catley and P. Goloboff), 1 juv. (AMNH); 30 km N La Serena (beach), 2 November 1981 (N. I. Platnick and R. T. Schuh), 1♀ (AMNH); 20 km N La Serena (90 m, coastal scrub, under rocks and cactus), 6 January 1985 (N. I. Platnick and O. F. Francke), 1 juv. (AMNH); 19 km N La Serena (120 m, scrub), 7 February 1986 (N. I. Platnick and R. T. Schuh), 2 juv. (AMNH); same loc. (coastal scrub matorral) and coll., 4 November 1981, 1 juv. (AMNH); Punta Teatinos, 12 km N La Serena, February 1963 (Bonniart), 1♀ (UCCC 18);

11 km N La Serena (3 m, on beach with freshwater empoundment), 4 November 1981 (N. I. Platnick and R. T. Schuh), 1♂ (AMNH); La Serena, 14 May 1966 (A. Miranda), 1 juv. (UCCC 423); Lomas de Guayacán, 17 December 1963 (J. Stuardo), 1♂ (UCCC); 2 km S Coquimbo, 7 January 1985 (N. I. Platnick and O. F. Francke), 1♂, 1♀, 1 juv. (AMNH); same. loc. (coastal scrub matorral, pitfalls), 31 October and 4 November 1981 (N. I. Platnick and R. T. Schuh), 1♂ (AMNH); Lomas de Peñuelas (8 m, under rocks and dead cactus), 6 January 1985 (N. I. Platnick and O. F. Francke), 3♀♀ (AMNH); 10 km S Coquimbo, 1 May 1970 (R. D. Sage), 1 juv. (CDA); Guanaqueros, 10 January 1984 (E. Maury), 3 juv. (MACN); same loc. and coll., 2 November 1988, 1 juv. (MACN); Tongoy, 20 May 1973 (V. Riosaco), 1 juv. (UCCC). *Provincia Limari*: 30 km N Ovalle, 10 January 1984 (E. Maury), 1♂ (MACN); Guampulla, 30 September 1993 (L. E. Peña), 1♀, 1 juv. (AMNH); Talinay, eastern slope, 3 July 1975 (L. M. Gonzalez, P. Ferrari and E. Riguelme), 1♀ (AMNH); road from Ovalle to Camarico, 26 May 1964 (Ecología Animal), 1 juv. (UCCC 425). *Provincia Choapa*: Tunga, Illapel, 17 October 1965 (R. Calderón), 1♂ (MACN); Huentelauquén, 13 February 1982 (D. Jackson), 1♂, 1♀, 1 juv. (AMNH); same loc., 27 September 1980 (L. E. Peña), 2♂♂ (AMNH); same loc. and coll., 26 September 1980, 5♂♂, 8♀♀, 2 juv. (AMNH); 5 km S from Río Choapa (30 m), 16 December 1963 (T. Cekalovic), 2 juv. (UCCC 64); Playa Agua Dulce, 51 km N Los Vilos, 8 January 1984 (E. Maury), 1♂, 1♀ (MACN); Quebrada near Playa Agua Dulce, 46 km N Los Vilos, 5–6 November 1988 (E. Maury), 3♂♂, 1♀ (MACN); 4 km N Los Vilos, 5 January 1985 (N. I. Platnick and O. F. Francke), 1♂♂, 2♀♀, 2 juv. (AMNH); Los Vilos, 30 September 1983 (E. Maury), 2♂♂, 3 juv. (MACN); Bajos Chigualoco, Los Vilos, 7 November 1975 (O. Leon), 1♂ (MNHN); Hacienda Palo Colorado, Pichidangui, 20 February 1963 (L. E. Peña), 1♂ (AMNH); Pichidangui, 10 October 1976 (J. Manriquez, M. Carrasco and J. Linderman), 2♀♀ (AMNH); “Quebrada. Los Maitenes, N Amolanas, Coquimbo”, 27 September 1980 (L. E. Peña), 2♂♂, 1 juv. (AMNH). Región de Valparaíso: *Provincia Petorca*: Punta Molles, Los Molles, 2 August 1975 (S. Robles and M. Valdebenito), 1♀ (AMNH); same loc., 18 September 1964 (I. Moyano), 1 juv. (UCCC 214); Los Molles, Ruta. 5, km 188 (10 m), 27 January and 9 February 1994, pitfalls (N. I. Platnick, K. Catley, M. Ramírez and Allen), 2♂♂ (AMNH); same data, 1♂, 1 juv. (AMNH); Punta Molles, 18 September 1964 (I. Moyano), 2 juv. (UCCC 138); same data, 1♀ (UCCC 136); Quebrada del Chivito, Los Molles, 10 November 1987 (E. Maury), 1♂ (MACN); Chalaco, Río

Pedernal, 26 September 1984 (H. Niemeyert), 1♂, 3 juv. (AMNH); Quebrada Guaquén, Pichicuy, 7 January 1984 (E. Maury), 1♀ (MACN); same loc. (elev. 10 m), 2 October 1992 (N. Platnick, K. Catley and P. Goloboff), 1♂ (AMNH); same loc. and coll., 16 October 1992, 1♂ (AMNH); La Ligua, 27 September 1980 (L. E. Peña), 1♂, 1♀ (AMNH); 7 km E La Ligua (under rocks, dry roadside), 9 January 1985 (N. I. Platnick and O. F. Francke), 1♂, 1♀ (AMNH); 2 km N Zapallar (23 m, under rocks), 9 January 1985 (N. I. Platnick and O. F. Francke), 1 juv. (AMNH); same loc., 7 November 1981 (N. I. Platnick and R. T. Schuh), 1♀ (AMNH). *Provincia Valparaíso*: 1 km E Maitencillo (elev. 8 m, chaparral), 10 January 1985 (N. I. Platnick and O. F. Francke), 1 juv. (AMNH); *Provincia Quillota*: Cuesta El Melón (elev. 520 m, chaparral), 10 January 1985 (N. I. Platnick and O. F. Francke), 1♀, 3 juv. (AMNH). *Provincia Los Andes*: Los Andes, 30 September 1983 (E. Maury), 2 juv. (MACN); "Riecello" (Riecillos), km 28 (1200 m), 13 January 1974 (R. C. G.), 1♀, 1 juv. (AMNH); Juncal (1950 m), 5 January 1984 (E. Maury), 2♂♂, 2♀♀, 4 juv. (MACN); Cuesta de Chacabuco, N side (1235 m, dry mountainside, acacias), 14 January 1985 (N. I. Platnick and O. F. Francke), 2♂♂, 2♀♀, 1 juv. (AMNH); Cuesta de Chacabuco, 14 January 1985 (N. I. Platnick and O. F. Francke), 3♀♀, 1 juv. (AMNH). *Región de Santiago*: *Provincia Chacabuco*: Lampa, 19 September 1977 (L. Peña), 2♂♂ (MACN). *Provincia Santiago*: Cerro Manquehue, 25 November 1966 (W. Duarte), 1♂, 1♀ (UCCC 420); same data, 1♂ (UCCC 421); same loc., July 1979 (D. Jackson), 3 juv. (MACN); same loc. ("Agua de Palo"), date and coll., 1♂, 1♀ (UCCC 412); Cerro San Cristóbal, under stones, 1 October 1966 (D. Torres), 1 juv. (UCCC 402); same loc., 25 April 1966 (H. Rodriguez), 1 juv. (UCCC); Las Condes, 21 September 1965 (Sieweers), 1♂, 1 juv. (UCCC 372); Quilicura, October 1979 (L. Peña), 5♂♂, 4♀♀, 2 juv. (AMNH); Camino Farellones, Puente "Nilhua", April 1983, 3 juv. (AMNH); Santiago, 18 November 1977 (L.E. Peña), 1 juv. (AMNH); same loc. and coll., January 1970, 1 juv. (AMNH); same loc., August 1995 (A. Hinojosa), 1♀ (MNHN); same loc. and coll., November 1995, 1♂ (MNHN); same data, 1♂ (MNHN); Barrancas (just W of Santiago), January 1980 (L. E. Peña), 11 juv. (AMNH); near San Ramón, 10 km E Santiago (1500 m, under stones), 18 December 1930 (Schröder), 1♂, 1♀ (MACN); Quebrada Macul, 14 April 1979 (D. Jackson), 1 juv. (AMNH); same loc., March 1979 (J. E. Barriga Tuñón), 1♂, 1♀ (MACN); El Arrayán, August 1970 (J. Moravi), 1♀ (MNHN). *Provincia Cordillera*: El Canelo, no date (Stuardo), 2♂♂, 1♀, 2 juv. (MNRJ 42551); same loc., 17 November 1963 (Fetis), 1♂, 2♀♀, 1 juv.

(UCCC 40); same loc., 3 September 1967 (G. López), 1 juv. (UCCC 466); same loc., 800–100 m, 1980 (L. Peña), 10 juv. (AMNH); 1 km E El Canelo (850 m, streamside rocks), 16 January 1985 (N.I. Platnick and O. F. Francke), 1♂ (AMNH); El Manzano, August 1979 (D. Jackson), 5 juv. (AMNH); El Yeso, Cajón del Maipo, "7400 m" (probably 1400 m), 27 October 1981 (L. E. Peña), 1♂ (AMNH); Guayacán, 14 January 1984 (E. Maury), 1♂ (MACN); same data, 2♂♂, 2♀♀, 2 juv. (MACN). *Provincia Maipo*: La Rinconada, 17 km W Maipú (520 m, dry wooded valley, under rocks), 10 November 1981 (N. I. Platnick and R. T. Schuh), 1 juv. (AMNH); Quebrada de La Plata, near Maipú (580 m, streamside), 15 January 1985 (N. I. Platnick and O. F. Francke), 1♀, 4 juv. (AMNH); San Bernardo, 4 April 1966 (E. Aguirre), 1 juv. (UCCC 367). *Not located*: "Santiago, Cerro Blanco", October 1961 (Profra, Fracinee), 1 juv. (AMNH); "Santiago, El Tabo", August 1978 (D. Jackson), 4 juv. (AMNH); "Prov. Santiago, Cajón del Maipo", 25 April 1966 (H. Rodriguez), 1♀, 1 juv. (UCCC 4297); "Corral de Julio", 5 July 1975 (R. Bustemante, R. Duchi, S. M. Robles, M. Valdebenitos, E. Riguilme, P. Ferrari and L. M. Gonzalez), 1 juv. (AMNH).

Bothriurus keyserlingi Pocock, 1893, revalidated (Figures 17–28, Table I)

Bothriurus keyserlingi Pocock, 1893, p. 96; Maury, 1973, p. 359 (mentioned as valid).

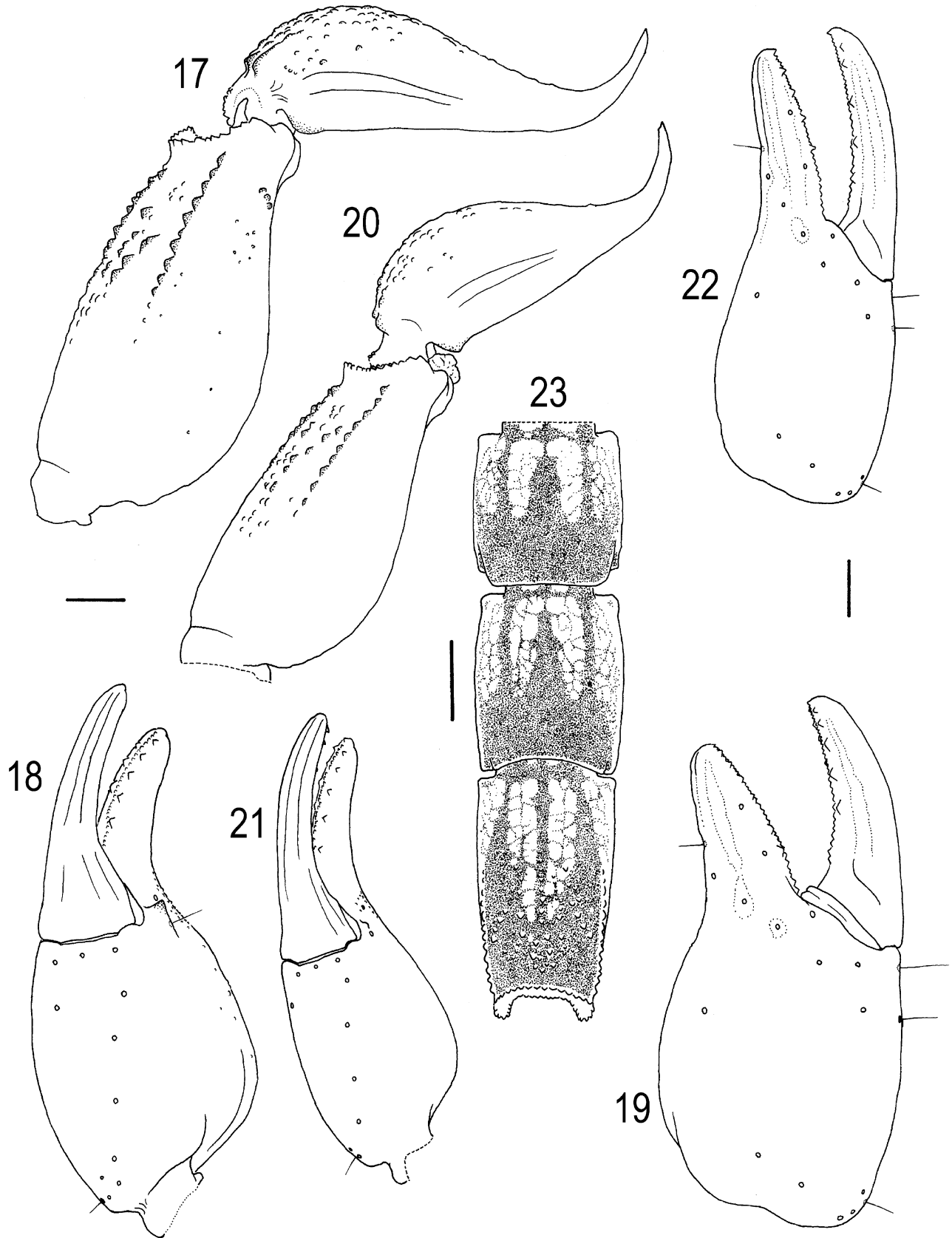
Bothriurus coriaceus: Bücherl, 1963, p. 200 (synonymy incorrect); Maury, 1981, p. 104 (repeats synonymy of Bücherl, 1963); Lowe & Fet, 2000, p. 30 (includes a complete reference list).

Type series

Holotype ♀ (BMNH), "Chili? or Peru?", Keyserling coll. The specimen is in poor condition, left pedipalp, pectines and left legs lacking. It was initially dry preserved (Pocock, 1893), then stored into alcohol (according to unpublished notes of E. Maury) and apparently recently it dried out again. Maury (1973, p. 359) suggests Valparaíso to be the presumable type locality; we agree with his suspicion, since its port was frequently visited by scientific expeditions of the 19th century.

Diagnosis

The nearest relative of *B. keyserlingi* is *B. coriaceus*, sharing the similar morphology of the metasomal ventral carinae, as well as of the hemispermatophore (including the polymorphism in one feature, as explained below). Differences from *B. coriaceus* consist of being in general more

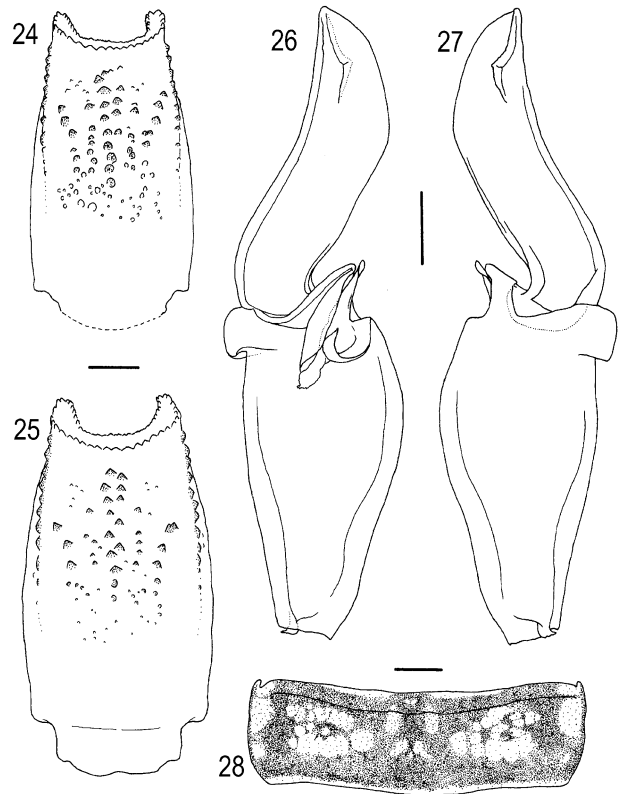


Figures 17–23. *Bothriurus keyserlingi* Pocock. (17–19) ♂ from Valparaiso (MACN): (17) metasomal segment V and telson, lateral view; (18) right pedipalp chela, ventromedial view; (19) right pedipalp chela, external view. (20–22) ♀ holotype (BMNH): (20) metasomal segment V and telson, lateral view; (21) right pedipalp chela, ventromedial view; (22) right pedipalp chela, external view. (23) ♀ from Palmas de Ocoa (MACN), pigment pattern of metasomal segments III–V, ventral view. Scale bars: 1 mm (16–21); 2 mm (22).

granular (especially the pedipalps and the metasomal segment V), the darker overall coloration and larger pigmented areas. In *B. keyserlingi* sternites are either all densely pigmented, or sternite V is completely covered and sternites I–IV have lateral spots; in contrast, all sternites are depigmented in *B. coriaceus*, at most with faint lateral spots only on sternite V. Tergites in *B. keyserlingi* are completely covered, while in *B. coriaceus* the posterior half or third of each tergite is free of pigment. Finally, the metasoma of *B. keyserlingi* shows normally much more pigment than *B. coriaceus*. While first describing *B. voyati* (from Sierra de La Ventana, Province of Buenos Aires, Argentina), Maury (1973) suggests the latter to be close to *B. keyserlingi*, supposedly sharing “morphology, coloration and structure of the paraxial organ”, but we do not agree with this view. Many *Bothriurus* species share this hemispermaphore type (Mattoni, 2003), and the dark, almost melanic coloration is also quite widespread. As for the ventral carinae of metasomal segment V, they are quite different, them all being shorter in *B. voyati* (they are limited to the distal half or third), and VL are little developed (Maury, 1973).

Description

Coloration. General color reddish brown to dark brown or black, with spots of dark pigment. Legs: reddish brown to dark brown, with large pigment spots both on pro- and retrolateral sides. Coxae, sternum, genital operculum and pectines reddish brown, with weak or no spots. Pedipalps: femur and patella dark reddish brown with large spots, except for their ventral side; chela with diffuse spots forming narrow longitudinal stripes from the base to the fingers. Chelicerae reddish brown, densely pigmented on the fingers and their base, and forming longitudinal stripes toward them. Carapace: dark reddish brown to black, densely spotted, ocular mound almost black; central and anterior areas with a sub-trapezoid spot, connected to irregular spots on the sides and the sector of the lateral eyes; posterior region with irregular spots on the angles, the posterior edge with faint spots. Tergites (Figure 28) densely pigmented, with small paramedian and lateral sectors lighter. Sternites: reddish yellow to reddish brown, on I–IV the pigment covers the whole sternite or is limited to faint lateral spots; sternite V completely covered. Metasoma: dark reddish brown; ventrally (Figure 23) three longitudinal pigment stripes, with reticules in between, joining at the posterior half on each segment; lateral and dorsal sides with longitudinal stripes that follow carinae LSM, LM and DL; dorsal



Figures 24–28. *Bothriurus keyserlingi* Pocock. (24) Holotype ♀ (BMNH), metasomal segment V, ventral view. (25–28) ♂ from Palmas de Ocoa (MACN): (25) metasomal segment V, ventral view; (26) left hemispermaphore, internal view; (27) left hemispermaphore, external view; (28) pigment pattern of tergite IV. Scale bars: 1 mm.

side with a triangular median spot on segments I–IV, diffuse spots on segment V; distal end of all segments with a transverse spot. Telson reddish brown, extensively spotted; in males, dorsal side of the vesicle yellow.

Morphology. Carinae more developed in males, except for VSM and VL on metasomal segment I and sternite V (lacking in males). Tegument of carapace and tergites smooth in females, finely granular in males. Carapace: front margin straight, anterior median furrow absent or very inconspicuous, ocular mound prominent and not sulcate, median eyes separated at 1.7–2 diameters; lateral ocular furrow weak, central median and posterior well defined, with a deep depression between them; posterior transverse furrows and lateral posterior defined. Tergites I–VI acarinate, VII slightly granulate and with four short carinae on the caudal third, two paramedian and two lateral, with sparse granulation in between. Sternites I–IV smooth, without granules or carinae, sternite V of females and juveniles with soft granules scattered towards the posterior end, and four vestigial carinae, two paramedian, two lateral. Metasoma. Carinae on

Table II. Variability of the number of the pectinal teeth in *Bothriurus coriaceus* Pocock, *Bothriurus keyserlingi* Pocock and *Bothriurus dumayi* Cekalovic.

	Sex	Number of pectinal teeth										n	
		12	13	14	15	16	17	18	19	20	21		22
<i>Bothriurus coriaceus</i>	♂			5	18	48	37	37	18	2			165
	♀	1	13	29	47	32	8	2					132
<i>Bothriurus keyserlingi</i>	♂				7	25	26	25	8	1			92
	♀	2	5	30	30	7							74
<i>Bothriurus dumayi</i>	♂						1	3	5	15	10	9	43
	♀			2	–	7	9	13	2	4			37

n: Total number of pectines examined.

segments I–IV: DL complete, of low and rounded granules, the posterior are larger; LSM present only on the posterior quarter of each segment (a little more developed on segment I); area between DL and LSM with a few, scattered small granules; LI weak, with no granules, only present on the distal third or quarter of segments I–III, lacking in IV; VL and VSM only present on segment I of females and juveniles, straight, vestigial (no granules), with a few blunt granules scattered in between (males with smooth tegument or slight elevation corresponding to the carina). Carinae of metasomal segment V (Figures 17, 20, 24, 25): DL poorly defined, with tiny disperse granules, more discernible on both ends; LM absent, area between DL and VSM with no or few small granules; VL, VSM and VM developed on the distal two-thirds of the segment, VSM subterminal, oblique, VM distally bifurcated, with two paramedian subterminal granules; area between ventral carinae with some small intermediate granules (most between VSM and VM). Telson (Figures 17 and 20) with elongated vesicle (less in females), ventral surface with granules more developed anteriorly; dorsal face smooth (slight glandular depression in males). Chelicera with two subdistal teeth on the movable finger. Pedipalps. Femur with three carinae, dorsomedial developed only on the basal third, dorsolateral reaching the basal two-thirds, ventromedial complete, with proximal portion diagonal; medial face with large scattered granules; dorsal side with some small sparse granules on the proximal part; ventral side with granules groups. Patella with two vestigial carinae, dorsomedial and ventromedial, very feeble and with no granules. Chela: tegument smooth on the ventral and lateral sides, some sparse granules on the medial face, and dorsally near the base of the fingers (more evident in males); carinae not marked, they are only vestigial in the fingers (a little more noticeable in females); male chela robust (Figures 18 and 19), with short fingers, medial side armed with a strong conic apophysis near the base of the movable finger, its tip slightly curved upwards; a slight

tegumentary depression above the apophysis; chela of female less robust (Figures 21 and 22), fingers proportionally longer, with a blunt granule equivalent to the apophysis of male. Trichobothriotaxy: type C, increased neobothriotaxy, with the following totals: femur 3 (1 *d*; 1 *i*; 1 *e*), patella 19 (2 *d*; 1 *i*; 13 *e*; 3 *v*) and chela 27 (21 on manus -5 *V*-; 6 on the fixed finger). Number of pectinal teeth: males 15–20, females 12–16 (holotype female with lost pectines); variability in Table II. Hemispermatophore (Figures 26, 27): L narrow, slightly S-curved; c.d. parallel to the edge of L, divided by a transverse ridge, the distal portion slightly curved, proximal part straight; l.b. lamellar, with bifid tip; l.i. with one apophysis on the external face, a small granule or crest can exist in the depression between this apophysis and r.d.p. (see “Variability”); l.e. with a semicircular ridge; r.d.p. well developed.

Variability

Total length. Males 32.04–46.98 mm; females up to 46.37.

Pigment patterns. Little variation was observed, though some juveniles are less dark than others, with no discernible geographic correlation.

Ventral carinae of metasoma. On segment V they vary slightly in their development and in the presence of intermediate granulations, occasionally the carinae are weaker and the granulation less developed. In some adult males the ventral carinae of segment I, though normally absent, can be insinuated as a slight cuticular convexity.

Hemispermatophore. Like in *B. coriaceus*, the hemispermatophore shows variations on the external face of l.i.: out of 62 hemispermatophores studied (32 specimens), 10 (16.13%) bore a small granule in the depression between the apophysis and r.d.p. (as in Figure 15); however, in *B. keyserlingi* no asymmetry was seen in this structure (if present, it appeared in both hemispermatophores of an individual).

Remarks

The holotype is poorly preserved and its patterns of pigmentation are no longer discernible. Based on personal notes of E. Maury (who studied the specimen in a better condition), the original pigment pattern of this specimen matched that observed in our sample. Bücherl (1963, p. 200) synonymized *B. keyserlingi* under *B. coriaceus*, arguing (with only the original description at sight) that the sole difference between them (presence/absence of ventral carinae on sternite V and the metasomal segment I; Pocock, 1893) is useless, since *B. coriaceus* was probably described on males alone (despite a female being mentioned among the types) while *B. keyserlingi* was based on a female. And as Bücherl (1963) pointed out, many other *Bothriurus* species share the referred character state (those carinae present in females, absent in males). We agree that this character alone is not enough, but the identity of *B. keyserlingi* is indeed supported by the differential pigment patterns, which justifies its revalidation.

Distribution and habitat

Records originate in the central and southern part of Región de Valparaíso, west of Región de Santiago and northern Región de Bernardo O'Higgins, in central Chile (Figure 1). This range seems restricted to the spiny scrub of the Coastal Cordillera ("Matorral and Bosque Espinoso" Subregion) and to the sclerophyllous coastal forest ("Bosque Esclerófilo" Subregion), within the "Matorral and Bosque esclerófilo" Region (Gajardo, 1995).

Material examined

Chile: Región de Valparaíso: *Provincia Valparaíso*: Quintero, 12 December 1980 (L. E. Peña), 1 juv. (AMNH); 11 km E Quintero (8 m, small mixed forest), 10 January 1985 (N. I. Platnick and O. F. Francke), 1♀, 1 juv. (AMNH); same data ("Berlese sample, oak litter"), 2 juv. (AMNH); dunes of Reñaca, 18 March 1961, 1 juv. (MNHN); Viña del Mar, 15 February 1970 (P. Toro D.), 1 juv. (MACN); Laboratorio Patología general Playa Ancha, Valparaíso, 26 December 1966 (M. Díaz), 1♂ (MACN); Playa Ancha, Valparaíso, 13 October 1965 (M. Díaz), 1♀ (MACN); Valparaíso, 5 March 1968 (Instituto de Biología), 1♂ (MACN); same loc., 8 March 1967 (J. C. Ortiz), 1 juv. (MACN); same loc., April 1966 (H. Lineros), 1♀ (MACN); Casablanca, 5 October 1995, 1♀ (MNHN); same loc., 6 October 1967 (J. Solervicens), 1♀ (MACN); 10 km S Casablanca, 13 January 1984 (E. Maury), 1 juv. (MACN). *Provincia Quillota*: Hijuelas, La Calera, 9 January 1964 (L. Marnef), 1 juv.

(UCCC 52); Cerro La Campana, 2 June 1966 (M. Chiaruttini), 1♂ (MACN); same loc., 12 October 1968 (L. Vasquéz), 1♀ (MACN); same loc. ("cerca de la 3♀ aguada, bajo piedra"), 15 October 1972 (R. Calderón), 1♀ (AMNH); La Campana, 16 June 1965 (R. Galleguillos), 1♂ (MACN); Palmas de Ocoa, Parque Nacional La Campana, 8–9 December 1987 (E. Maury), 2♂♂, 2♀♀, 1 juv. (MACN); same loc. and coll., 27–28 October 1988, 4♂♂, 2♀♀ (MACN); same loc. (475 m, riparian forest), 12 January 1985 (N. I. Platnick and O. F. Francke), 3♂♂, 2♀♀, 5 juv. (AMNH); same loc. (450 m, dry, rocky streamside), 5 February 1986 (N. I. Platnick and R. T. Schuh), 3 juv. (AMNH); same loc. (burned site, pitfall), 17 May 1985 (R. Calderón G.), 1 juv. (AMNH); same loc. (pitfall) and coll., 29 January 1985, 3 juv. (AMNH); same loc. (pitfall) and coll., 14 March 1985, 1 juv. (AMNH); same loc. (pitfall) and coll., 21 December 1984, 1 juv. (AMNH); same loc. (pitfall) and coll., 29 January 1985, 1♀ (AMNH); same loc. (pitfall) and coll., 30 October 1984, 1 juv. (AMNH); same loc. (pitfall) and coll., 14 March 1985, 3 juv. (AMNH); same data, 1 juv. (AMNH); same loc. (pitfall) and coll., 30 November 1984, 1 juv. (AMNH); same loc. (pitfall) and coll., 29 January 1985, 1 juv. (AMNH); same loc. (pitfall) and coll., 14 March 1985, 1 juv. (AMNH); same loc. (pitfall) and coll., 21 December 1984, 1 juv. (AMNH); same data, 1♂, 1♀, 3 juv. (AMNH); same loc. (unburned site, pitfall) and coll., 14 March 1985, 2 juv. (AMNH); same data, 1 juv. (AMNH); same data, 1 juv. (AMNH); same loc. (pitfall) and coll., 21 December 1984, 1 juv. (AMNH); same loc. (pitfall) and coll., 17 May 1985, 1 juv. (AMNH); same loc. (pitfall) and coll., 29 January 1985, 1 juv. (AMNH); same data, 1 juv. (AMNH); Caleu (1850 m, *Nothofagus* forest), 14 January 1985 (N. I. Platnick and O. F. Francke), 4 juv. (AMNH); Quebrada Alvarado, 12 April 1974 (S. Zunino), 1♂, 4♀♀, 2 juv. (AMNH); Cuesta de La Dormida, 610 m, under rocks (N. I. Platnick and O. F. Francke), 2 juv. (AMNH); same loc. (975 m), date and coll., 1♂, 5 juv. (AMNH). Región de Santiago: *Provincia Santiago*: Cerro Manquehue (Agua del Palo), 25 November 1966 (W. Duarte), 1♂ (UCCC 494); Cerro San Cristóbal, 25 April 1966 (H. Rodríguez), 1 juv. (UCCC); Santiago, November 1995 (A. Hinojosa), 1 juv. (MNHN). *Provincia Cordillera*: Clarillo, July 1983 (M. Lewin), 1♂, 1 juv. (AMNH). *Provincia Maipo*: Aculeo, January 1970 (L. E. Peña), 1♀, 1 juv. (AMNH); same loc. (Quebrada El Cepillo) and coll., 28 March 1981, 1 juv. (AMNH); same loc. (NE of Lago Aculeo) and coll., 17–18 December 1986, 1 juv. (AMNH); same loc. (El Patagual), 5–8 December 1983 (L. Irarrazabal), 3♂♂ (AMNH). *Provincia Melipilla*: Alhue, Cajón de

Lisboa, 20 December 1989 (L. E. Peña), 1♂, 2♀♀ (AMNH); Cerro Cantillana, 10–22 December 1983 (L. Irarrázabal), 1♂ (AMNH). Región de Bernardo O'Higgins: *Provincia Cachapoal*: Codegua, La Leonera, 13 February 1986 (L.mE. Peña), 1♂ (AMNH); Río Cipreses, Piedra del Indio, 12 January 1985 (F. Silva), 1♂, 1♀ (AMNH). *Not located or doubtful*: “Valparaíso Prov., Cerro Las Vizcachas, 1800–1200 m”, 1–12 December 1982, 1 juv. (AMNH); “Gómez Carreño, Valparaíso”, 12 September 1969 (P. Baez), 1 juv. (MACN); “Valdivia, Valdivia” (Valdivia from Paine?), 12 January 1966 (F. Silva), 1♀ (MACN); “Prov. Santiago, Cajón del Maipo”, 25 April 1966 (H. Rodríguez), 1♀ (UCCC 4297).

Bothriurus dumayi Cekalovic, 1974 (Figure 16)

Bothriurus dumayi Cekalovic, 1974, p. 210; Acosta & Ochoa, 2001, p. 203 (restored in *Bothriurus*).

Orobothriurus dumayi: Maury, 1976, p. 209 (new combination); Lowe & Fet, 2000, p. 36 (complete reference list).

Type series

Chile, Región de Antofagasta, *Provincia Antofagasta*, holotype female (UCCC 439), 1 paratype juv. (UCCC 655), 1 paratype juv. (UCCC 656), 2 paratypes juv. (UCCC 653, 654), 2 paratypes juv. (UCCC 657, 658), 1 paratype juv. (UCCC 651): Paposo, 25 August 1963, Ecología Animal Universidad Chile, INCO coll.; 1 paratype juv. (UCCC 662), 1 paratype juv. (UCCC 664): Cuesta Paposo, 15 February 1974, T. Cekalovic coll.

Diagnosis

Bothriurus dumayi is a close relative of *B. coriaceus*, with very similar pigmentation pattern. These species can be separated by the number of pectinal teeth, higher in *B. dumayi* (see Table II), by the presence of a pair of conspicuous subaculear granules in the latter (much less developed in *B. coriaceus*), by the absence of ventral carinae on sternite V and metasomal segment I in both sexes of *B. dumayi* (present in female *B. coriaceus*), and by the hemispermatophore, bearing in *B. dumayi* a strong crest with plicate end on the external side of l.i. (Figure 16), while in *B. coriaceus* this crest is absent or is represented by a very small granule.

Remarks

Not having studied the types, Maury (1976) included this species in *Orobothriurus* based on materials seemingly determined by Cekalovic as *B. dumayi*. Those specimens (from Termas de

Mamiña, Tarapacá, at more than 2300 m a.s.l., MACN) belong to *Orobothriurus*, although the lack of males does not allow the species to be determined.

Distribution and habitat

Extended from the middle of Región de Antofagasta up to northern Región de Coquimbo, always in localities near the coast (Figure 1). Its range corresponds to various coastal deserts: of Tocopilla (only the southern end), of Taltal and of Huasco, in the “Desierto Costero” Subregion (Gajardo, 1995). Most localities of *B. dumayi* have been reported as belonging to the plant formation known as “lomas”. These are patches of vegetal communities situated from 0 to 1100 m, which receive more humidity than the surrounding desert thanks to the interception of fog (“camanchacas”) originated in the ocean (Rundel et al., 1991).

Material examined

Chile: Región de Antofagasta: *Provincia Antofagasta*: Cerro Moreno, 18 April 1992 (H. Larrain), 1♀, 3 juv. (AMNH); La Chimba, 3 June 1964 (K. Lay), 1 juv. (UCCC); same loc., 10 July 1992 (H. Larrain), 2 juv. (AMNH); same loc., September 1979 (G. Hidalgo), 1♀ (MNHN); Quebrada “La Chimba”, 4 July 1967 (D. Lanfranco), 1 juv. (MACN); Paposo, 31 July 1997 (T. Mondaca), 1♀ (MNHN); 6 km E Paposo (480 m), 12 October 1992 (N. Platnick, K. Catley and P. Goloboff), 1♀ (AMNH); 24 km S Paposo (20–50 m), 11 October 1992 (N. Platnick, K. Catley and P. Goloboff), 1 juv. (AMNH); “Las Vertientes”, 12 June 1992 (L. E. Peña), 1♀, 1 juv. (AMNH). Región de Atacama: *Provincia Chañaral*: Parque Nacional Pan de Azúcar, 8 km from the coast in Quebrada Pan de Azúcar, 7–8 February 2003 (A. Ojanguren Affilastro and P. Korob), 1♂ (AAOA); Quebrada Chango Aracena, Parque Nacional Pan de Azúcar, 200 m, 13 October 1992 (N. Platnick, K. Catley and P. Goloboff), 1 juv. (AMNH). *Provincia Copiapó*: Caldera, 12 June 1968 (L. Peña), 1 juv. (UCCC). *Provincia Huasco*: Alto del Carrizal Bajo, 12 October 1965 (I. Moreau), 1♀ (MACN); Huasco, 14 October 1990 (L. E. Peña), 1♀ (AMNH); Lomas de Huasco, 18 December 1963 (T. Cekalovic), 1 juv. (UCCC 70); same loc., 18 December 1963 (Castro), 1♂ (UCCC 69); same loc., 24 July 1964 (Stuardo, Castro, Barrales), 1 juv. (UCCC 109); 27 km E Vallenar (105 m, under rocks in succulents), 7 January 1985 (N. I. Platnick and O. F. Francke), 1♂ (AMNH); S of Chañaral de Aceituna, 14 June 1968, 1 juv. (UCCC); “Hacienda Santa Isabel, Copiapó valley” [María Isabel?], 4 October 1980 (L. E. Peña), 2♀♀ (AMNH). Región de Coquimbo: *Provincia Elqui*:

Isla Choros, 7 August 1980 (L. E. Peña), 1♀, 1 juv. (AMNH); Carrizalillo to Choros Bajos, 1 November 1980 (L. E. Peña), 2 juv. (AMNH); E of Choros Bajos (300 m), 10–12 November 1981, 3 juv. (AMNH).

Zoogeographic comments

Separation of some specimens of *B. coriaceus* and *B. keyserlingi* becomes complicated regarding populations of *B. coriaceus* from the southern end of its range (Santiago valley), because these are more pigmented than elsewhere. In a first approach we even considered the possibility of recognizing these populations as a different entity, but the evident intergradations from the coast to the valley discarded this interpretation. On the contrary, differences between individuals of both species from geographically close localities are clear, leaving no doubt of their identity. This “penetration” of *B. coriaceus*, a species characteristic of coastal shrub of Coquimbo into the Santiago valley, is observed in other arachnids too, like the iurid scorpion *Caraboctonus keyserlingi* (Lourenço, 1995) and some gonyleptid harvestmen (L. E. Acosta, unpublished). The ranges of *B. coriaceus* and *B. keyserlingi* approximately match the Biogeographical Provinces of Coquimbo and Santiago, respectively, which belong to the Central Chile Subregion (Morrone, 2002). The latter area is deemed to be related to the Subantarctic Subregion (Morrone, 2002), which comprises the southern Andes from 37°S up to Cape Horn. Other authors, however, consider Central Chile more related with arid areas east of the Andes, like the Patagonia and the Monte scrub (Roig Juñent & Flores, 2001). Within genus *Bothriurus*, the species groups closest to *B. coriaceus*, *B. keyserlingi* and *B. dumayi* are the *burmeisteri*-group (northern Patagonia, Monte and central sierras in Argentina; Maury, 1979; Acosta & Maury, 1998), the *prospicius*-group (in the “peripampasic mountain arc”, from NW and central Argentina to southern Uruguay and southern Brazil; Acosta & Maury, 1998; Acosta & Peretti, 1998; Mattoni, 2003) and the *vittatus*-group (central and southern Chile; Mattoni, 2002a, 2002b, 2002c). With these facts, both proposed relationships of Central Chile (Subantarctic versus Patagonia+Monte) look plausible. In any case, a further subdivision of the biogeographical provinces proposed by Morrone (2002), differentiating coastal sectors and valleys from proper Cordilleran and Precordilleran areas, would reflect better the observed patterns.

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References

- Acosta LE. 1997. Descripción de *Bothriurus olaen*, nueva especie de escorpión de Argentina central (Scorpiones, Bothriuridae). *Rev Arachnol* 12(1):1–8.
- Acosta LE, Maury EA. 1998. Scorpiones. In: Morrone JJ, Coscarón S, editors. Biodiversidad de artrópodos argentinos. La Plata (Argentina): Ediciones Sur. p. 545–559.
- Acosta LE, Peretti AV. 1998. Complemento a la descripción de *Bothriurus cordubensis* (Scorpiones, Bothriuridae), con anotaciones sobre patrones evolutivos del género en Argentina. *Rev Arachnol* 12(10):95–108.
- Acosta LE, Ochoa JA. 2001. Two new species of *Orobthriurus* Maury, 1976 from Argentina and Peru, with comments on the systematics of the genus (Scorpiones: Bothriuridae). In: Fet V, Selden P, editors. Scorpions 2001. In memoriam Gary A. Polis. Burnham Beeches (UK): British Arachnological Society. p. 203–214.
- Borelli A. 1901. Scorpioni raccolti dal Dott. Filippo Silvestri nella Repubblica Argentina e regioni vicine. *Boll Mus Zool Anat Comp Torino* 16(403):1–12.
- Bücherl W. 1959. Escorpiões e escorpionismo no Brasil. VIII. Revisão das espécies do genero *Bothriurus* descritas da Argentina. *Mem Inst Butantan* 28:19–44.
- Bücherl W. 1963. Escorpiões e escorpionismo no Brasil. XI. Revisão dos Bothriurideos da coleção escorpionica do Museu Nacional do Rio de Janeiro. *Mem Inst Butantan* 30:187–206.
- Bücherl WP, San Martin M, Da Cunha Flores, Matthiesen F, Zimmer S, Bücherl I. 1963. Escorpiões e escorpionismo no Brasil. XII. Revisão sistemática e crítica dos escorpiões do genero *Bothriurus* Peters, 1861. *Mem Inst Butantan* 30: 207–226.
- Cekalovic TK. 1974. *Bothriurus dumayi* n. sp. de escorpión chileno (Scorpiones, Bothriuridae). *Bol Soc Biol Concepción* 48:209–216.
- Cekalovic TK. 1983. Catálogo de los escorpiones de Chile (Chelicerata, Scorpiones). *Bol Soc Biol Concepción* 54:43–70.
- Coppinger RW. 1885. Cruise of the “Alert”: four years in Patagonian, Polynesian and Mascarene waters (1878–82). London: W. Swan Sonnenschein and Co. 256 p.
- Francke OF. 1977. Scorpions of the genus *Diplocentrus* from Oaxaca, Mexico (Scorpionida, Diplocentridae). *J Arachnol* 4(3):145–200.
- Gajardo R. 1995. La vegetación natural de Chile. Clasificación y distribución geográfica. Santiago: Editorial Universitaria. 165 p.
- Lourenço WR. 1995. Considerations sur la morphologie, écologie et biogéographie de *Caraboctonus keyserlingi* Pocock (Scorpiones, Iuridae). *Bol Soc Biol Concepción* 66:63–69.
- Lowe G, Fet V. 2000. Family Bothriuridae Simon, 1880. In: Fet V, Lowe G, Sissom WD, Braunwalder ME, editors.

- Catalog of the scorpions of the world (1758–1998). New York: New York Entomological Society. p. 17–53.
- Mattoni CI. 2002a. *Bothriurus picunche* sp. nov., a new scorpion from Chile (Scorpiones, Bothriuridae). *Stud Neotrop Fauna Environ* 37(2):169–174.
- Mattoni CI. 2002b. La verdadera identidad de *Bothriurus vittatus* (Guérin Méneville, [1838]) (Scorpiones, Bothriuridae). *Rev Arachnol* 14(5):59–72.
- Mattoni CI. 2002c. *Bothriurus pichicuy* sp. nov., nuevo escorpión chileno del grupo *vittatus* (Scorpiones: Bothriuridae). *Iheringia Ser Zool* 92(4):81–87.
- Mattoni CI. 2003. Patrones evolutivos en el género *Bothriurus* (Scorpiones, Bothriuridae): análisis filogenético [PhD dissertation], Córdoba: Universidad Nacional de Córdoba. 249 p.
- Maury EA. 1968. Aportes al conocimiento de los escorpiones de la República Argentina. II. Algunas consideraciones sobre el género *Bothriurus* en la Patagonia y Tierra del Fuego con la descripción de una nueva especie (Bothriuridae). *Physis* 28(76):149–164.
- Maury EA. 1973. Los escorpiones de los sistemas serranos de la provincia de Buenos Aires. *Physis C* 32(85):351–371.
- Maury EA. 1976. Escorpiones y escorpionismo en el Perú. V. *Orobothriurus*, un nuevo género de escorpiones altoandino (Bothriuridae). *Rev Peru Entomol* 18(1):14–25.
- Maury EA. 1979. Apuntes para una zoogeografía de la escorpiofauna argentina. *Acta Zool Lill* 35:703–719.
- Maury EA. 1981. Estudio sobre el género *Bothriurus* (Scorpiones, Bothriuridae). I. Catálogo y comentarios sobre el material típico. *Rev Mus Argent Cien Nat “B. Rivadavia”* 4(4):95–111.
- Maury EA. 1982. Dos *Bothriurus* del Nordeste Brasileño (Scorpiones, Bothriuridae). *Rev Soc Entomol Argent* 41(1–4):253–265.
- Mello-Leitão C. 1934. Estudio monografico dos escorpiões da Republica Argentina. VIII Reun Soc Argent Pat Reg, 1–97.
- Mello-Leitão C. 1945. Escorpiões sul-americanos. *Arq Mus Nac* 40:1–468.
- Morrone JJ. 2002. Presentación sintética de un nuevo esquema biogeográfico de América Latina y el Caribe. In: Costa C, Vanin SA, Lobo JM, Melic A, editors. *PRIBES 2002. Volume 2, SEA. Zaragoza: Monografías Tercer Milenio.* p. 267–275.
- Pocock RI. 1893. A contribution to the study of Neotropical scorpions. *Ann Mag Nat Hist* 6(12/68):77–103.
- Prendini L. 2000. Phylogeny and classification of the superfamily Scorpionoidea Latreille 1802 (Chelicerata, Scorpiones): an exemplar approach. *Cladistics* 16:1–78.
- Roig Juñent S, Flores GE. 2001. Historia biogeográfica de las áreas áridas de América del Sur austral. In: Llorente Bousquets J, Morrone JJ, editors. *Introducción a la biogeografía en Latinoamérica: teorías, conceptos, métodos y aplicaciones.* Mexico: Las Prensas de Ciencias, Facultad de Ciencias, UNAM. 257–266.
- Rundel PW, Dillon MO, Palma B, Mooney HA, Gulmon SL, Ehleringer JR. 1991. The phytogeography and ecology of the coastal Atacama and Peruvian deserts. *Aliso* 13(1):1–50.
- San Martín PR. 1963. Una nueva especie de *Bothriurus* (Scorpiones, Bothriuridae) del Uruguay. *Bull Mus Natl Hist Nat (Ser 2)* 35:400–418.
- Stahnke HL. 1970. Scorpion nomenclature and mensuration. *Entomol News* 81:297–316.
- Vachon M. 1974. Étude des caractères utilisés pour classer les familles et les genres de scorpions (Arachnides). 1. La tricobothriotaxie en Arachnologie. Sigles trichobothriaux et types de tricobothriotaxie chez les scorpions. *Bull Mus Natl Hist Nat (Ser 3)* 104:857–958.