Rumikiru, n. gen. (Scorpiones: Bothriuridae), a New Scorpion Genus from the Atacama Desert

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Rumikiru, n. gen. (Scorpiones: Bothriuridae), a New Scorpion Genus from the Atacama Desert

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JOSÉ A. OCHOA,[3, 4] AND LORENZO PRENDINI[5]

ABSTRACT

Rumikiru, n. gen., a new bothriurid scorpion genus from the coastal Atacama Desert, Chile, is described. This is the first scorpion genus endemic to northern Chile. It is most closely related to *Pachakutej* Ochoa, 2004, from the inter-Andean valleys of Peru. *Orobothriurus lourencoi* Ojanguren-Affilastro, 2003, is transferred to the new genus and redescribed, creating *Rumikiru lourencoi* (Ojanguren-Affilastro, 2003), n. comb., and a second species of the genus, *Rumikiru atacama*, n. sp., is described.

KEYWORDS: Scorpiones, Bothriuridae, Chile, systematics, taxonomy, phylogeny.

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INTRODUCTION

The scorpion fauna of Chile is largely isolated from that of the rest of South America by the high altitudes of the Andes to the south and the extreme desert of the Pacific coast to the north. This isolation has created a high level of endemism in the country, especially in southern Chile, where there are three endemic scorpion genera in the family Bothriuridae Simon, 1880: *Centromachetes* Lönnberg, 1897, *Phoniocercus* Pocock, 1893, and *Tehuankea* Cekalovic, 1973. These genera occur almost exclusively in the cold to temperate forests of the area, and are related to the endemic Australian bothriurid genus *Cercophonius* Peters, 1861 (Prendini, 2000, 2003). Another endemic Chilean scorpion genus, *Caraboctonus* Pocock, 1893 (family Iuridae Thorell, 1876), has a widespread distribution in the central part of the country (Lourenço, 1995; Agusto et al., 2006). Until now, however, the scorpion fauna in the arid zone of northern Chile appeared to be similar in generic composition to that in the arid zone of southern Peru, and also to the Andean scorpion fauna, no endemic genera having been recorded there (Maury, 1975; Ochoa and Acosta, 2002; Ochoa, 2005; Ochoa and Ojanguren-Affilastro, 2007; Ojanguren-Affilastro and Ramírez, 2009; Ochoa and Prendini, 2010).

The absence from Chile of indigenous scorpions in the family Buthidae C.L. Koch, 1837, which occur in all other Neotropical countries, is of particular interest. The high altitudes of the Andes, together with the aridity of the Atacama Desert, apparently form an effective barrier to the family at these latitudes. A buthid, *Tityus chilensis* Lourenço, 2005, was described from the northeastern extreme of Chile (an area above 4000 m, in the Andes Altiplano Region), based on old material from the Museum National d'Histoire Naturelle, Paris, ambiguously labelled "Bolivia, West of Charaña" (Lourenço, 2005) and apparently originating from an area disputed by Bolivia, Chile, and Peru since the Pacific War (1879–1883). We have extensively surveyed this area, however, and confirm that no buthids occur either in the Altiplano or the high Andes of Bolivia and Chile, an area of exceptional aridity. The highest record for *Tityus* C.L. Koch, 1836, that we know of in this region is 3170 m, on the eastern slopes of the Andes (pers. obs.). The material described by Lourenço (2005) probably originates from the more humid, eastern slopes of the Andes in Bolivia.

We conducted several expeditions to Chile during the past decade, resulting in the collection and description of various new bothriurid taxa, especially from the northern part of the country (Ojanguren-Affilastro, 2003b, 2004; Mattoni and Acosta, 2006; Ojanguren-Affilastro and Mattoni, 2006; Ojanguren-Affilastro et al., 2007a, 2007b). Among these was *Orobothriurus lourencoi* Ojanguren-Affilastro, 2003, from the Atacama Desert of Chile, a distinctive species, possessing several morphological characters unique among Bothriuridae. At the time of its description, the systematics of *Orobothriurus* Maury, 1976, was poorly understood, and it was divided into two species groups, the *alticola* group and the *inca* group (Maury, 1976; Acosta and Ochoa, 2000, 2001). Based on the definition of *Orobothriurus* at the time, and without the support of phylogenetic analysis, *O. lourencoi* was placed in *Orobothriurus* and tentatively assigned to the *inca* group, although Ojanguren-Affilastro (2003a: 118, 119) noted that it possessed several characters that did not fit the diagnosis.

Ochoa (2004) revised *Orobothriurus* and created a new genus, *Pachakutej* Ochoa, 2004, to accommodate the species of the *inca* group of *Orobothriurus*. Ochoa (2004) did not include *O. lourencoi* in his study, however, so this species remained in *Orobothriurus* by default. A recent revision of *Orobothriurus* (Ochoa et al., 2011), together with a reanalysis of the phylogeny of *Orobothriurus* and *Pachakutej* (Mattoni et al., in press), and the discovery of a new species, sister to *O. lourencoi*, demonstrated that the two species do not belong in either genus, and required the creation of a new genus, *Rumikiru*, n. gen., to accommodate them. *Orobothriurus lourencoi* and its sister species exhibit several synapomorphies with *Pachakutej*, but also several unique synapomorphies (fig. 1, appendix 1, and Diagnosis and Relationships below) that justify their placement in a new genus.

Rumikiru, n. gen., is the first bothriurid genus endemic to northern Chile (fig. 2). It is most closely related to *Pachakutej* from the inter-Andean valleys of Peru (fig. 3). The presence of a new genus in this area together with the discovery of additional new species from the Coquimbo Region, which probably belong to another new genus (Mattoni et al., in prep.), suggest higher levels of diversity and endemism in the scorpion fauna of northern Chile than previously recognized. In the present contribution, we describe *Rumikiru*, n. gen., transfer *O. lourencoi* to it, creating *Rumikiru lourencoi* (Ojanguren-Affilastro, 2003), n. comb., and describe a second species of the genus, *Rumikiru atacama*, n. sp.

METHODS

Personally collected material reported here was located and captured manually by ultraviolet (UV) light detection at night using UV LEDs inserted into Maglite® 3D flashlights, and pitfall traps. Abbreviations for collections are as follows: AMNH: American Museum of Natural History, New York, U.S.A.; FKPC: František Kovařík Private Collection, Prague, Czech Republic; LBRE: Laboratorio de Biología Reproductiva y Evolución, Universidad Nacional de Córdoba, Argentina; MACN: Museo Argentino de Ciencias Naturales "Bernardino Rivadavia," Buenos Aires, Argentina; MHNC: Museo de Historia Natural, Universidad Nacional de San Antonio Abad, Cusco, Peru; MNHNS: Museo Nacional de Historia Natural de Santiago, Chile.

Measurements, taken using an ocular micrometer, were recorded in millimeters. Descriptive terminology follows Mattoni and Acosta (2005) for hemispermatophores; Vachon (1974) for trichobothria; Ochoa et al. (2010) for metasomal carinae, abbreviated as follows: DL: dorsolateral; LIM: lateral inframedian; LM: lateral median; LSM: lateral supramedian; VL: ventral lateral; VM: ventral median; VSM: ventral submedian; and Prendini (2000) for pedipalp carinae, abbreviated as follows: D: digital; DE: dorsal external; DI: dorsal internal; DM: dorsal marginal; DS: dorsal secondary; E: external; EM: external median; IM: internal median; V: ventral; VE: ventral external; VI: ventral internal; VM: ventral median.

Illustrations were produced using a Leica M165C stereomicroscope and camera lucida. Digital images of pigmentation pattern and habitus were taken under visible light, images of external morphology under UV light, using a digital camera (Leica DFC290 or Nikon DS-Fi1)

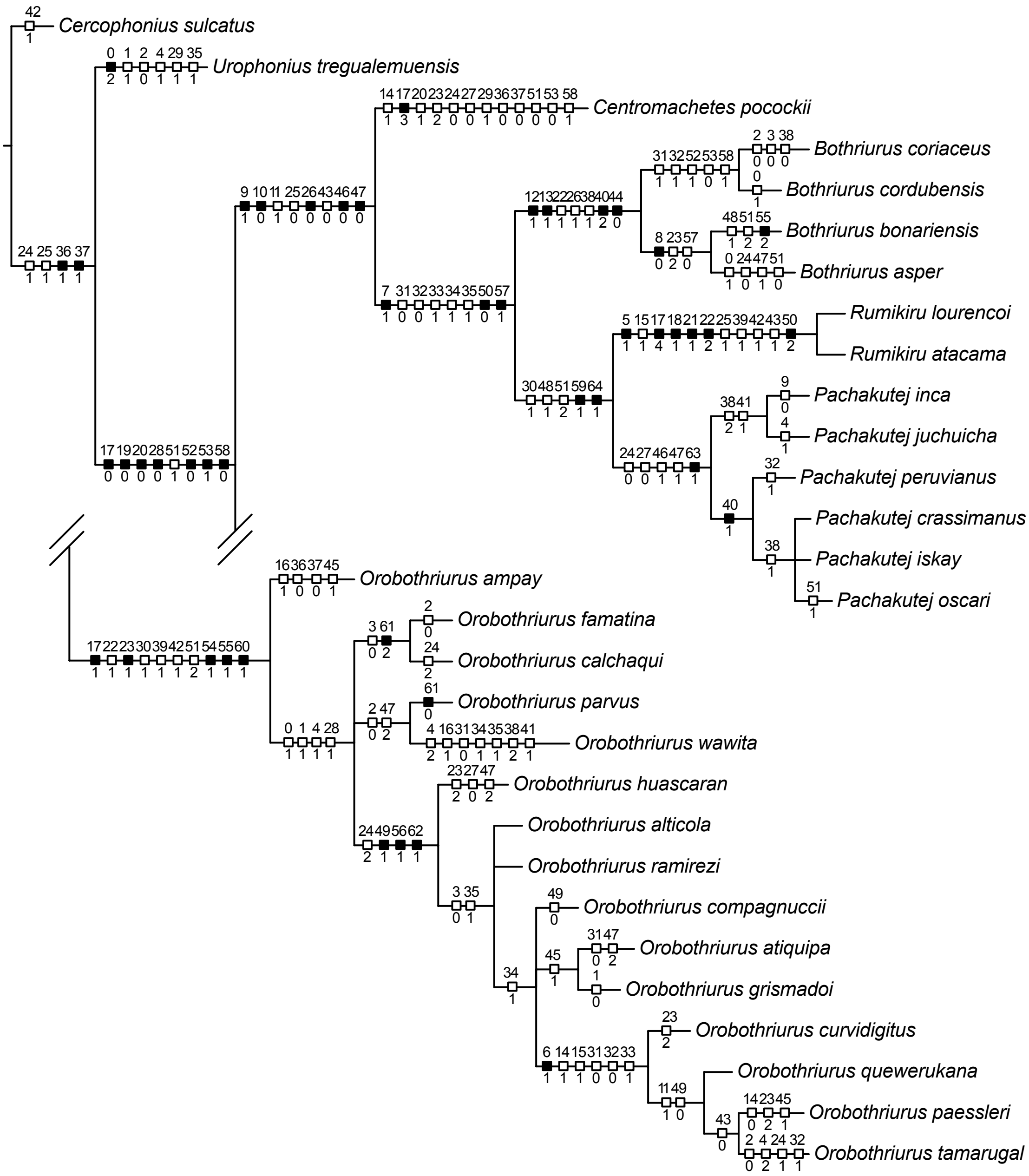

FIGURE 1. Most parsimonious tree (length = 167; CI: 0.479; RI: 0.813), obtained by cladistic analysis of 65 morphological characters (appendix 1) scored for 30 species of Bothriuridae Simon, 1880, with the implied weighting regime that maximized average support (Mattoni et al., in press), showing the position of *Rumikiru*, n. gen., in the family. Synapomorphies optimized with accelerated transformation indicated with bars. Black bars indicate uniquely derived apomorphic states, white bars indicate parallel derivations of apomorphic states. Numbers above bars indicate characters, numbers below indicate states.

attached to a stereomicroscope (Leica M165C or Nikon SMZ1500), and the focal planes fused with Helicon Focus 3.10.3 (http://helicon.com.usa/heliconfocus/). Scanning electron micrographs (SEM) were taken with a Philips XL30 TMP SEM at the MACN. Samples for SEM were dehydrated and coated with gold-palladium in a Thermo VG Scientific SC 7620 sputter coater.

Point locality records were georeferenced in the field with portable global positioning system devices (Garmin® GPS II Plus, Etrex, Etrex Vista, and Etrex Vista C) or retroactively using the GeoNet Names Server (http://earth-info.nga.mil/gns/html/). Retroactive georeferences are indicated in square brackets in the list of materials examined. A distribution map was generated using ArcMap 9.0 (©Environmental Systems Research Institute, Redlands, California), by superimposing the point locality records on a spatial dataset depicting the political boundaries and topography of Argentina and Chile. The topographic coverage (as a shaded relief) was generated using digital elevation model files (ca. 90 m resolution) from the CGIAR-CSI Consortium website (http://srtm.csi.cgiar.org/).

SYSTEMATICS

Family Bothriuridae Simon, 1880

Rumikiru, n. gen.

Figures 1–28; table 1

Orobothriurus Ojanguren-Affilastro, 2003a: 117–122 (part); Ojanguren-Affilastro, 2004: 72 (part); Ochoa, 2004: 44 (part); Agusto et al., 2006: 415–419 (part); Rein, 2007: 5 (part); Pizarro-Araya et al., 2008: 270, 271 (part); Vrech et al., 2011: 465, 467, 470, 475, 482 (part).

Type Species: *Orobothriurus lourencoi* Ojanguren-Affilastro, 2003 [= *Rumikiru lourencoi* (Ojanguren-Affilastro, 2003), n. comb.].

Etymology: The indigenous peoples of the Chilean Atacama originally spoke Kakan or Kunza, depending on the region and, after the Inca invasion, added Quechua and Aymara to their languages. *Rumikiru* is formed from two Quechua words, *rumi* meaning "stone" and *kiru* meaning "tooth," and refers to the large denticles on the movable fingers of the pedipalp chelae in this genus, unique in the family Bothriuridae, and to the habitat of its two species, both of which appear to be restricted to rocky slopes.

Diagnosis: Species of *Rumikiru*, n. gen., are easily recognized by the enlarged basal denticle of the median denticle row of the pedipalp chela movable finger (figs. 18A, 19A, 24C, 25A, C), which is approximately three times larger than and replaces the first five or six median denticles. Such a hypertrophied basal denticle is unique among bothriurids. An enlarged basal denticle on the movable finger is exhibited by some bothriurids, e.g., *Brachistosternus ehrenbergii* (Gervais, 1841), but replaces no more than two or three denticles (Ochoa and Ojanguren-Affilastro, 2007). The submedial position of the apophysis on the internal surface of the pedipalp chela manus in the adult male of *Rumikiru*, n. gen. (figs. 18C, D, 22A, C, D, 24A, B, 25A, B), is also unique in the family. The apophysis is situated in the distal third of the surface in all other bothriurid taxa in which it occurs, and is absent from the pedipalp chela manus of basal bothriurids, e.g., *Lisposoma* Lawrence, 1928, and *Thestylus* Simon, 1880 (Prendini, 2000, 2003). The shape of the apophysis and the position of trichobothium *ib* distal to it are also

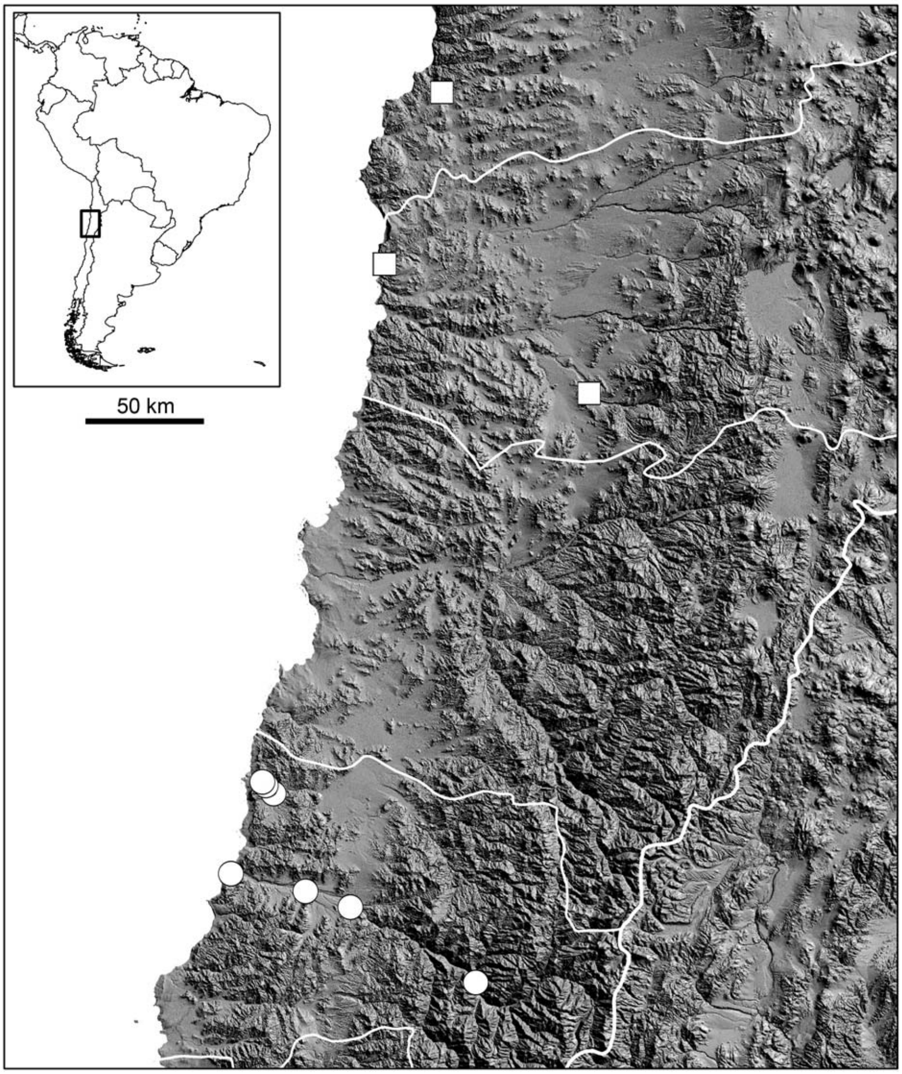

FIGURE 2. Map of central Chile, plotting known locality records of *Rumikiru atacama,* n. sp. (circles), and *Rumikiru lourencoi* (Ojanguren-Affilastro, 2003), n. comb. (squares).

unique to *Rumikiru*, n. gen. The new genus may be further separated by a twist in the medial to distal third of the dentate margin of the pedipalp chela fingers, which abruptly alters the orientation of the median denticle row (more conspicuously on the movable finger), in the male (figs. 18A, 22A), that is absent in other bothriurid genera. Additionally, the carapace of *Rumikiru*, n. gen., is dorsoventrally compressed (fig. 12C, D), unlike many other bothriurids, in which it is more convex.

Rumikiru, n. gen., is most closely related to *Pachakutej*, based mainly on characters of the hemispermatophore (fig. 10). The two genera share the presence of one sclerotized apophysis on the internal fold of the internal lobe, and a papillose fold in the basal lobe (figs. 10C, H). Species

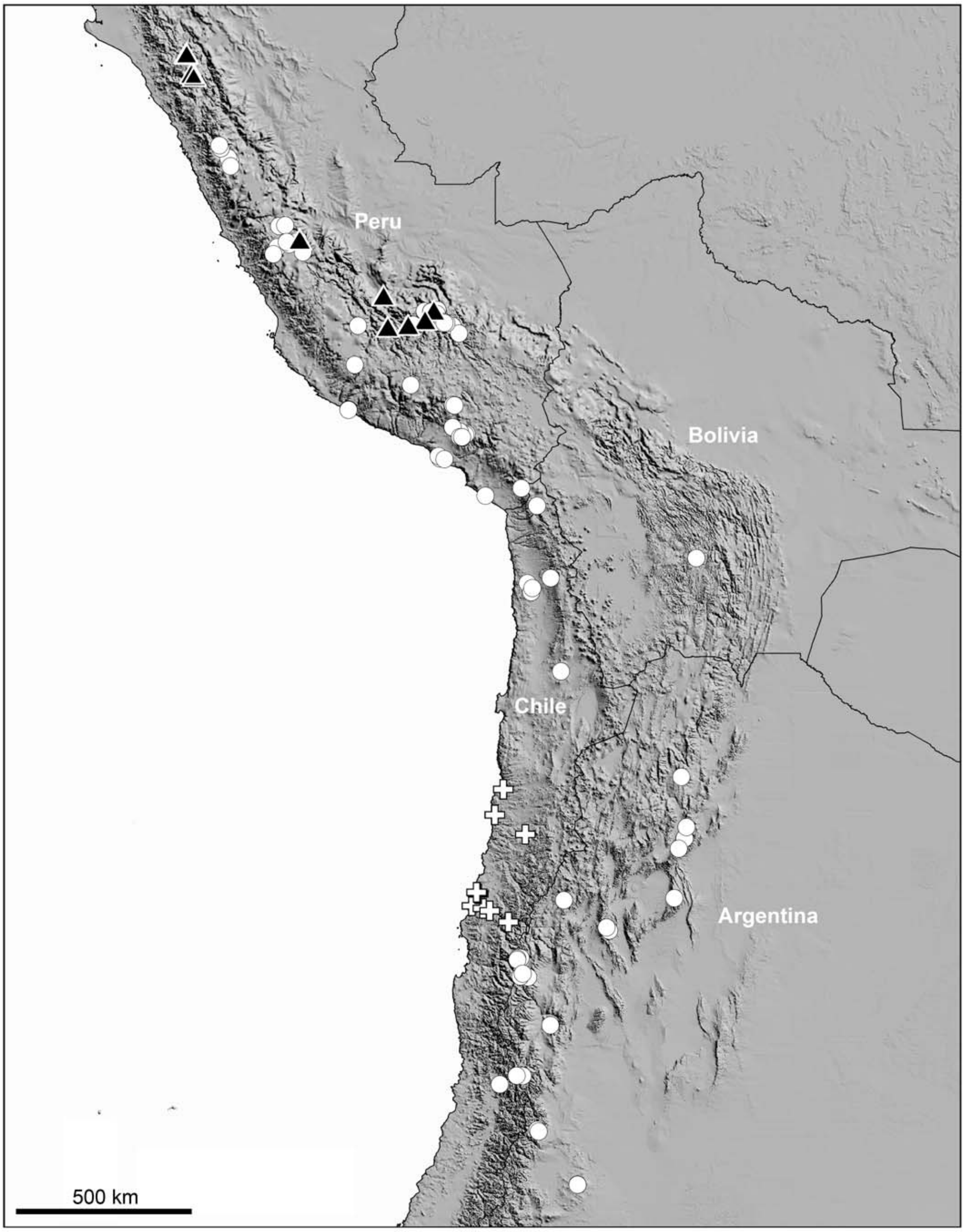

FIGURE 3. Map of central-western South America, plotting known locality records of *Orobothriurus* Maury, 1976 (circles), *Pachakutej* Ochoa, 2004 (triangles), and *Rumikiru,* n. gen. (crosses).

FIGURE 4. *Rumikiru atacama*, n. sp., habitat and habitus. **A.** Type locality, Llanos de Challe National Park, Chile. **B.** ♂ (LBRE), displaying characteristic defense posture.

FIGURE 5. *Rumikiru*, n. gen., habitus in life. **A.** *Rumikiru lourencoi* (Ojanguren-Affilastro, 2003), n. comb., paratype ♂ (AMNH), from Pan de Azucar National Park, Chile. **B.** *Rumikiru atacama*, n. sp., gravid ♀ paratype (AMNH), from Llanos de Challe National Park, Chile.

FIGURE 6. *Rumikiru*, n. gen., chela, dorsoexternal aspect, showing pigmentation pattern. **A.** *Rumikiru atacama*, n. sp., ♂ (MACN-Ar). **B.** *Rumikiru lourencoi* (Ojanguren-Affilastro, 2003), n. comb., ♂ (MACN-Ar). Scale bars = 1 mm.

of *Pachakutej*, however, possess a unique synapomorphy, a spatulate terminal process on the basal lobe of the hemispermatophore (Ochoa, 2004) that is absent in *Rumikiru*, n. gen., and are markedly more pigmented. The pedipalp carinae are more pronounced, especially on the femur and patella, in *Rumikiru*, n. gen. (figs. 16, 17, 20, 21), than in *Pachakutej*. The two genera may also be separated by the trichobothrial pattern of the pedipalp chela manus. Trichobothrium V_2 is situated in the same axis as V_1 and V_3 in *Rumikiru*, n. gen. (figs. 18C, 19C, 22C, 23C), but not in the same axis, forming an angle less than 180°, in *Pachakutej*, and *Db* is equidistant between *Dt* and Eb_3 in *Rumikiru*, n. gen. (figs. 18B, 19B, 22B, 23B), but close to *Dt* in *Pachakutej*. Finally, the VSM carinae of metasomal segment V are subparallel and situated close to the VL carinae in *Rumikiru*, n. gen. (fig. 27), whereas the VSM carinae are slightly inclined toward the external margin in the posterior third of the segment, or absent, in *Pachakutej*.

Included Species: This genus contains two species: *Rumikiru atacama*, n. sp., and *Rumikiru lourencoi* (Ojanguren-Affilastro, 2003), n. comb.

Distribution: *Rumikiru*, n. gen., is endemic to the Atacama Desert of northern Chile (figs. 2, 3, 4A). All known records are located in the Antofagasta Province of Region II (Antofagasta) and the Chañaral and Huasco provinces of Region III (Atacama). The distribution of

FIGURE 7. *Rumikiru*, n. gen., telson, lateral aspect, showing pigmentation pattern. **A.** *Rumikiru atacama*, n. sp., ♂ (MACN-Ar). **B.** *Rumikiru lourencoi* (Ojanguren-Affilastro, 2003), n. comb., ♂ (MACN-Ar). Scale bars = 1 mm.

this genus is allopatric with that of its sister genus, *Pachakutej*, from the inter-Andean valleys of Peru (fig. 3).

Ecology. In addition to its unusual morphology, *Rumikiru*, n. gen., occupies an unusual habitat among bothriurid scorpions. Most bothriurids are fossorial, requiring exposed soil to construct burrows. However, all personally collected specimens of *Rumikiru*, n. gen., were found in rocky habitats, with almost no exposed soil. At Pan de Azúcar National Park, the type locality of *R. lourencoi*, n. comb., several specimens were captured on vegetationless scree slopes comprising piles of sharp, loose stones accumulated below steep cliff faces. At Llanos de Challe National Park, specimens of *R. atacama*, n. sp., were collected in a slightly more vegetated environment, but this species was common only on scree slopes, cliff faces, and exposed rocky outcrops (fig. 4A).

The environment inhabited by *Rumikiru*, n. gen., differs markedly from that of its sister genus, *Pachakutej*, which occurs under stones in more humid habitats, in inter-Andean valleys and montane rainforests on the eastern slopes of the Andes in Peru (Ochoa, 2004).

Rumikiru, n. gen., displays an unusual defensive behavior, not reported among other scorpions, which typically curve the metasoma and strike out with the aculeus and, in some species, the pedipalp chelae, when threatened: males spread the pedipalps wide open, making short pulses or vibrations with them, without curving the metasoma (fig. 4B).

Rumikiru atacama, n. sp.

Figures 1, 2, 3, 4A, B, 5A, B, 6A, 7A, 8, 10B, F, G, H, I, 11, 12A, C, 13, 15, 16, 17, 18, 19, 24, 26B, C, D, 27A, C, 28A, C, E, G; table 1

Type Material: **CHILE: Region III (Atacama):** *Huasco Province*: Holotype ♂ (MNHNS), Llanos de Challe National Park: administration building, hills nearby, 28°09′39.8″S 71°03′20″W, 205 m, 25.i.2005, C.I. Mattoni and A.A. Ojanguren-Affilastro, UV detection, full moon. Paratypes: Llanos de Challe National Park: administration building, hills nearby, 28°09′38.16″S 71°03′20.13″W, 100 m, 10.xi.2003, L. Prendini, C.I. Mattoni, and J.A. Ochoa, UV detection on cool, breezy night, almost full moon, collecting conducted behind ridge in shadow, specimens common on scree slope and earthen banks, 4 ♂, 9 ♀ (AMNH), 3 ♂, 1 ♀ (LBRE), 2 ♂, 1 ♀ (MHNC), 1 ♀, 1 subad. ♀ (AMNH [LP 2427]); near administration building, 28°09′39.8″S 71°03′20″W, 205 m, 25.i.2005, C.I. Mattoni and A.A. Ojanguren-Affilastro, UV detection, full

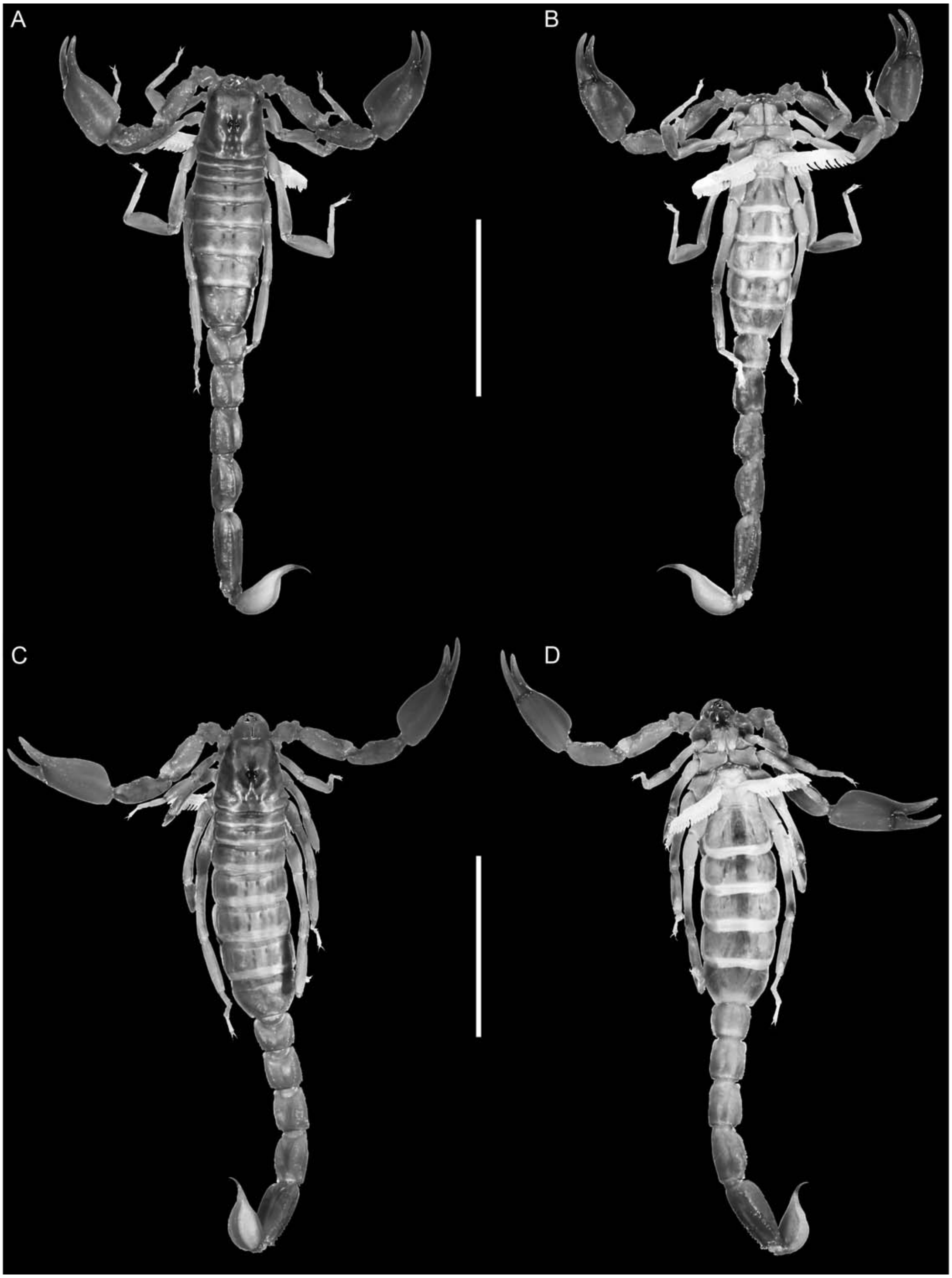

FIGURE 8. *Rumikiru atacama*, n. sp., habitus. **A, B.** Holotype ♂ (MNHNS). **C, D.** Paratype ♀ (MACN-Ar). **A, C.** Dorsal aspect. **B, D.** Ventral aspect. Scale bars = 10 mm.

FIGURE 9. *Rumikiru lourencoi* (Ojanguren-Affilastro, 2003), n. comb., habitus. **A, B.** Holotype ♂ (MACN-Ar). **C, D.** Paratype ♀ (MACN-Ar). **A, C.** Dorsal aspect. **B, D.** Ventral aspect. Scale bars = 10 mm.

FIGURE 10. *Rumikiru*, n. gen., sinistral hemispermatophore. **A, C, D, E.** *Rumikiru lourencoi* (Ojanguren-Affilastro, 2003), n. comb., ♂ (MACN-Ar). **B, F, G, H, I.** *Rumikiru atacama*, n. sp., ♂ (MACN-Ar). **A, B.** Distal lamina, ectal aspect, under UV light. **C, H.** Lobe region. **E, G.** Sinistral hemispermatophore ectal aspect. **F.** Sinistral hemispermatophore ental aspect. **D, I.** Basal lobe, internal fold, close-up. Scale bars = 1 mm (**A, B, E–G**), 0.3 mm (**C, H**), 0.2 mm (**D, I**).

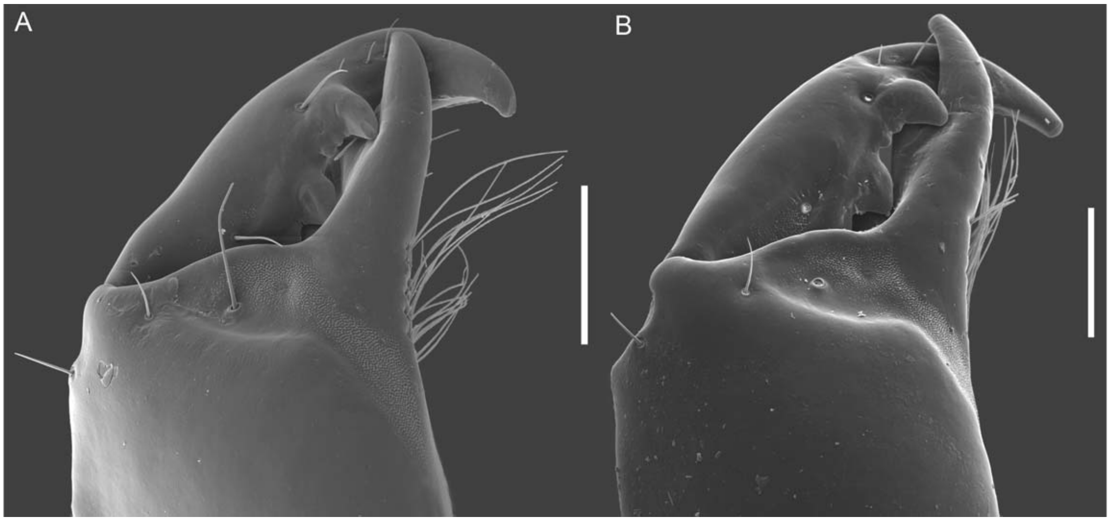

FIGURE 11. *Rumikiru atacama*, n. sp., sinistral chelicera, dorsal aspect. **A.** ♂ (MACN-Ar). **B.** ♀ (MACN-Ar). Scale bars = 0.3 mm.

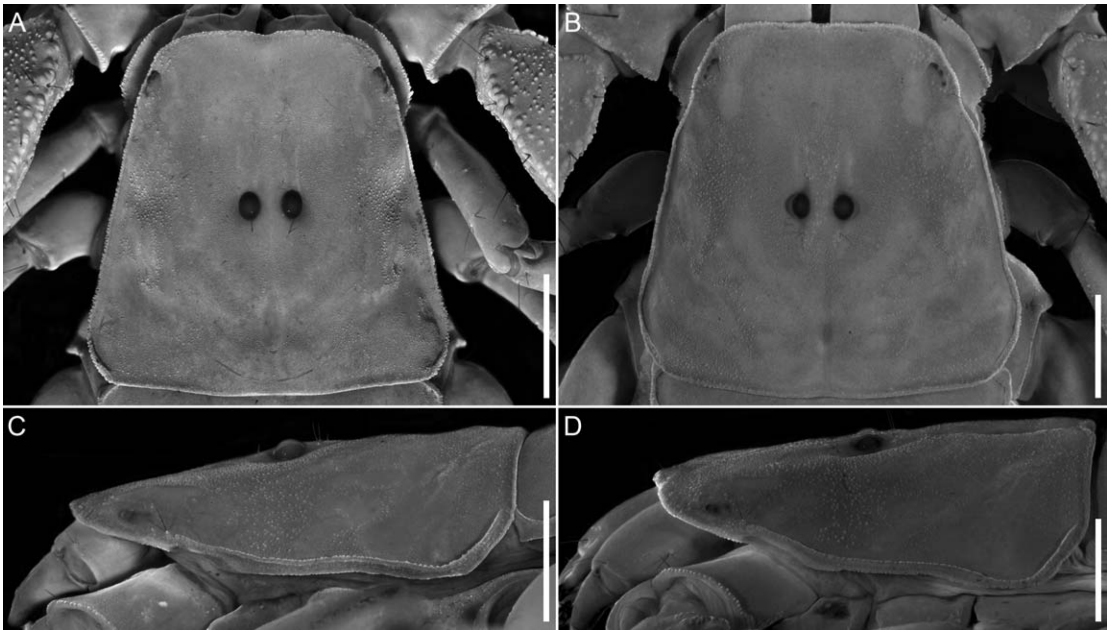

FIGURE 12. *Rumikiru*, n. gen., carapace. **A, C.** *Rumikiru atacama*, n. sp., ♂ (MACN-Ar). **B, D.** *Rumikiru lourencoi* (Ojanguren-Affilastro, 2003), n. comb., ♂ (MACN-Ar). **A, B.** Dorsal aspect. **C, D.** Lateral aspect. Scale bars = 1 mm.

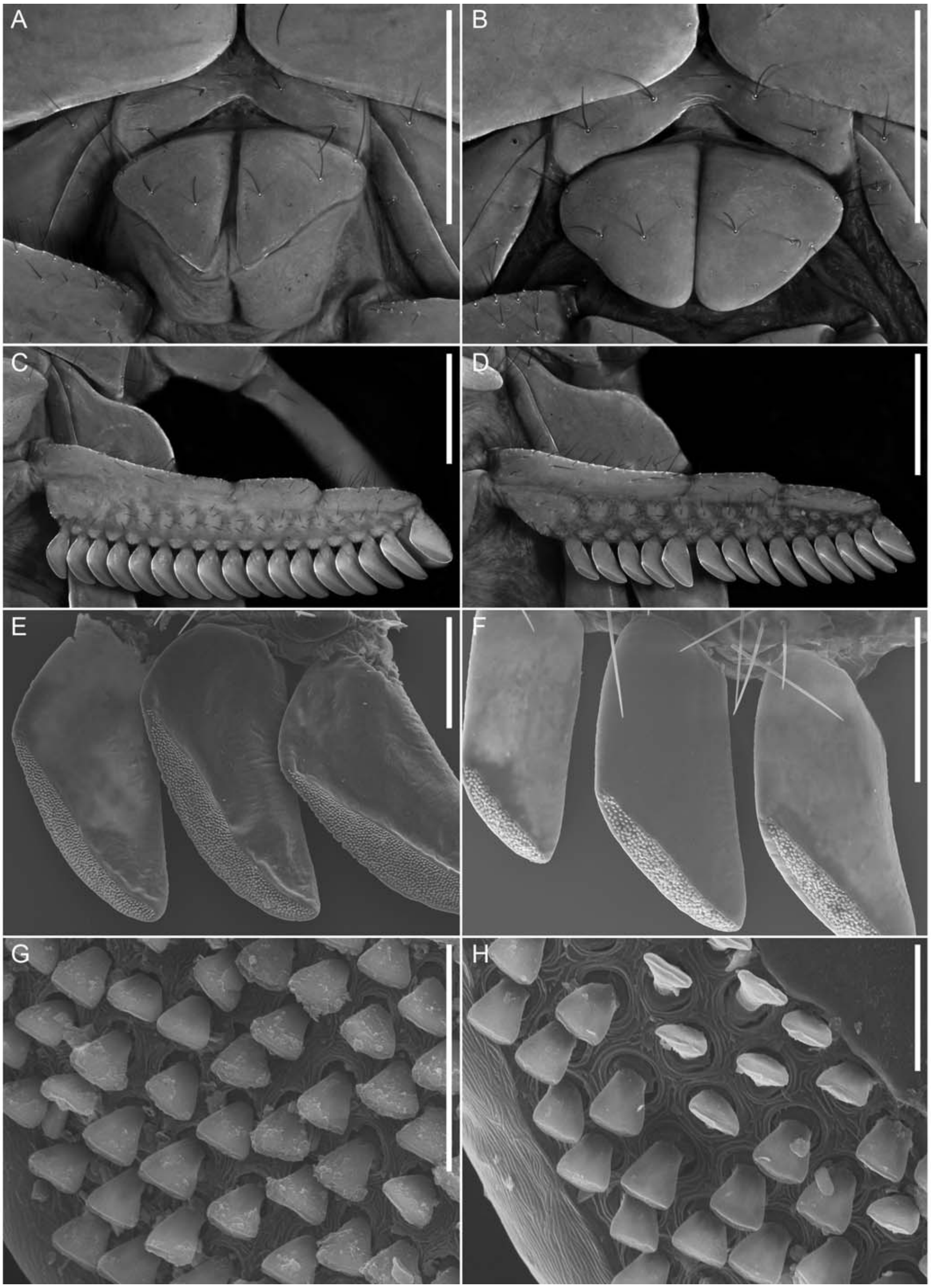

FIGURE 13. *Rumikiru atacama*, n. sp., sternum, genital opercula and pectines. **A, B.** Sternum and genital opercula, ventral aspect. **C, D.** Sinistral pecten, ventral aspect. **A, C, E, G.** ♂ (MACN-Ar). **B, D, F, H.** ♀ (MACN-Ar). **E, F.** Pectinal teeth, close-up. **G, H.** Pectinal peg sensilla, close-up. Scale bars = 1 mm (**A–D**), 0.2 mm (**E, F**), 0.02 mm (**G**), 0.01 mm (**H**).

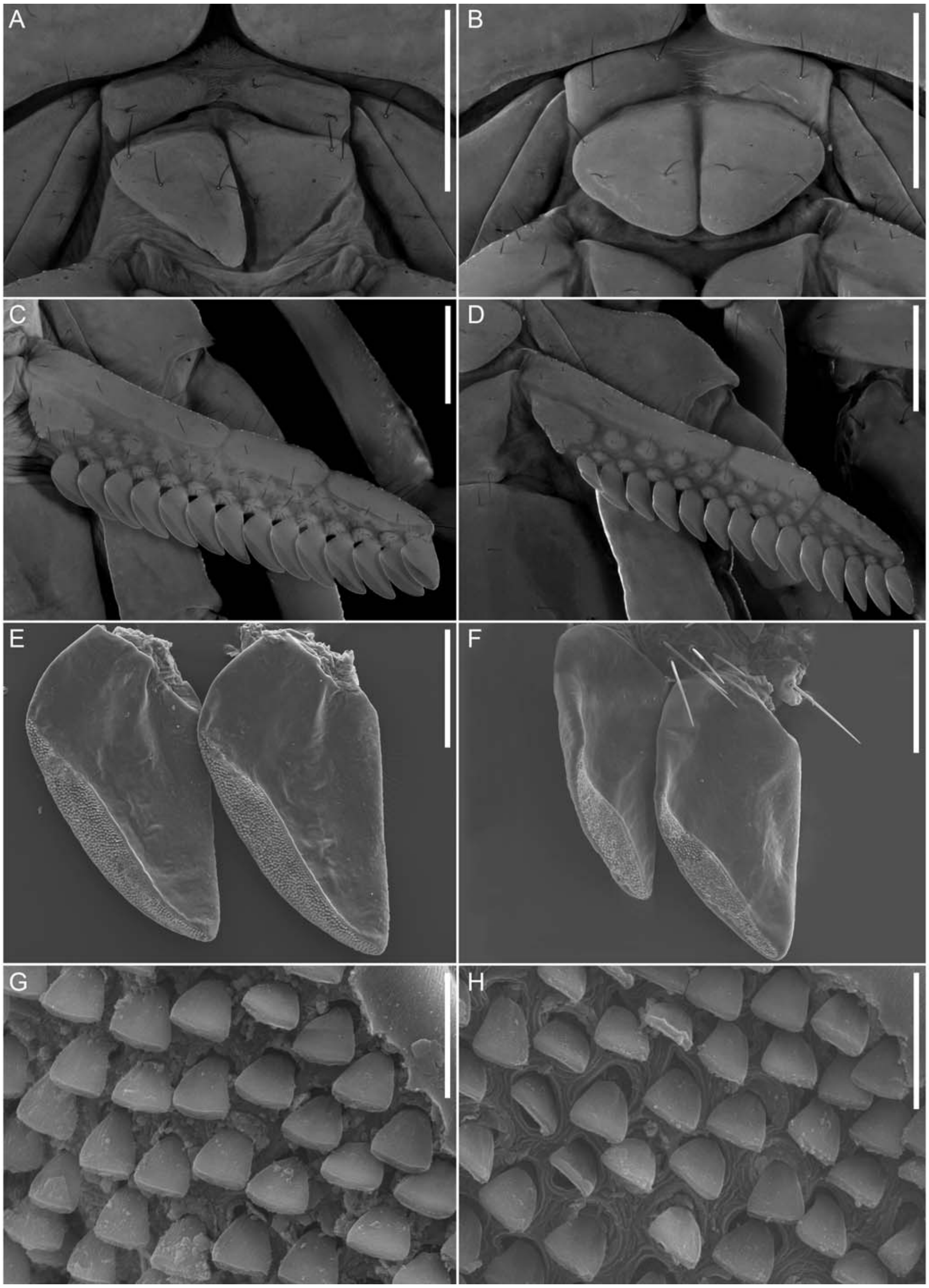

FIGURE 14. *Rumikiru lourencoi* (Ojanguren-Affilastro, 2003), n. comb. **A, B.** Sternum and genital opercula, ventral aspect. **C, D.** Sinistral pecten, ventral aspect. **A, C, E, G.** ♂ (MACN-Ar). **B, D, F, H.** ♀ (MACN-Ar). **E, F.** Pectinal teeth, close-up. **G, H.** Pectinal peg sensilla, close-up. Scale bars = 1 mm (**A–D**), 0.2 mm (**E, F**), 0.02 mm (**G**), 0.01 mm (**H**).

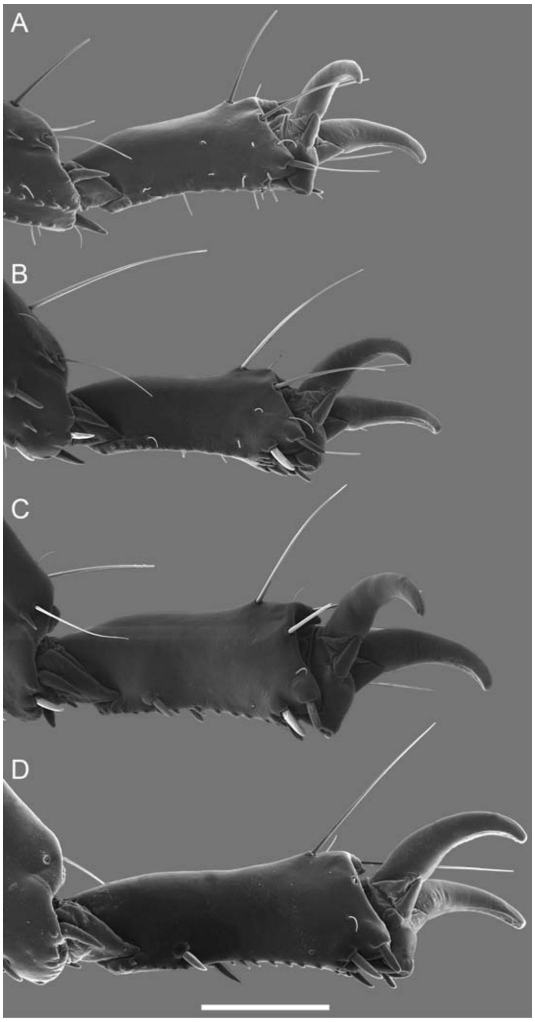

FIGURE 15. *Rumikiru atacama*, n. sp., ♂ (MACN-Ar), sinistral telotarsi, prolateral aspect. **A–D.** Legs I–IV. Scale bar = 0.3 mm.

moon, 4 ♂, 2 ♀ (AMNH), 4 ♂, 2 ♀ (MACN-Ar), 1 ♂, 1 juv. (LBRE), 1 ♀ (MNHNS); near administration, 28°10′10.8″S 71°03′40.2″W, 32 m, 17–18.viii.2009, C. Grismado, A.A. Ojanguren-Affilastro, J. Pizarro-Araya, and F. Alfaro-Kong, UV detection, 3 juv. (MACN-Ar); 5.5 km from administration building to Carrizal Bajo, 28°07′38.34″S 71°05′0.54″W, 88 m, 10.xi.2003, L. Prendini, C.I. Mattoni, and J.A. Ochoa, UV detection on cool, breezy night, moon rising, steep, rocky slope, lots of scree on slope, cacti and sparsely distributed bushes, specimens common on scree and at top of ridge, 1 ♂, 2 ♀, 3 juv. (LBRE), 2 subad. ♂, 1 subad. ♀ (AMNH [LP 2426]); 7.5 km from administration building to Carrizal Bajo, 28°07′05.3″S 71°05′57.3″W, 65 m, 10.xi.2003, L. Prendini, C.I. Mattoni, and J.A. Ochoa, UV detection on cool, breezy night, moon not yet risen, on steep scree slope with cacti and bushes, 3 ♂, 3 ♀ (AMNH), 1 ♀, 1 subad. ♂ (AMNH [LP 2425]); near administration building, 28°10′10.8″S 71°03′40.2″W, 32 m, 17.viii.2009, A.A. Ojanguren-Affilastro, C. Grismado, J. Pizarro-Araya, F. Alfaro-Kong, UV detection, 1 ♀, 2 juv. (MACN-Ar).

Additional Material: **CHILE: Region III (Atacama):** *Huasco Province*: “Atama” [probably “Atacama”], x.1980, L. Peña, 1 juv. ♂ (AMNH); El Tránsito to Pinte [28″53′S 70°17′W], 1100/1600 m, 25–27.x.1980, L. Peña, 1 subad. ♂, 2 juv. ♀ (AMNH); N of Huasco [28°28′08″S 71°13′11″W], 12.x.1980, L. Peña, 1 subad. ♂ (AMNH); Juntas, on Huasco River, 1600 m, 3.x.1980, L. Peña, 1 ♀ (AMNH); Quebrada Maitencillo [28°28′23.69″S 70°49′05.80″W], NW of Vallenar, 11.x.1980, L. Peña, 1 subad. ♀ (AMNH); Quebrada Talinay [28°08″S 71°13′11″W], large canyon S of Huasco, 13.x.1980, L. Peña, 2 subad. ♂ (AMNH); Vallenar, 2–3 km S [28°34′24″S 70°45′31″W], 460 m.

Etymology: The specific epithet, *atacama*, is a noun in apposition, referring to the Chilean Region III, to which this species appears to be endemic. This region forms part of the Atacama Desert, which extends from southern Peru to northern Chile.

Diagnosis: *Rumikiru atacama*, n. sp., can be separated from the only other known species of the genus, *R. lourencoi*, n. comb., by several morphological characters. The distal lamina of the hemispermatophore of *R. atacama*, n. sp. (fig. 10B, F, G), has a shorter apex and a longer frontal crest than that of *R. lourencoi*, n. comb. (fig. 10A, E); the distal crest is curved in *R. atacama*, n. sp. (fig. 10B, F), whereas it is almost straight in its apical two-thirds in *R. lourencoi*, n. comb. (fig. 10A, E); and the papillose fold of the basal lobe is less pronounced, less granular, and bears smaller papillae (spicules) in *R. atacama*, n. sp. (fig. 10H, I), than in *R. lourencoi*, n. comb. (fig. 10C, D). Metasomal segment V is less granular in *R. atacama*, n. sp. (fig. 27A, C), than in *R. lourencoi*, n. comb. (fig. 27 B, D). The telson is less granular and the vesicle of the male more globose in *R. atacama*, n. sp. (fig. 28A, C), than in *R. lourencoi*, n. comb. (fig. 28B, D). The IM carina of the pedipalp patella is often well developed along its entire length in males of *R. atacama*, n. sp. (fig. 17D), but absent or reduced to a few scattered granules in males of *R. lourencoi*, n. comb. (fig. 21D). There are also differences in the pigmentation pattern: *R. atacama*, n. sp., is less pigmented, the ventral surface of the telson vesicle (fig. 7A) and the pedipalp chela manus largely unpigmented (fig. 6A), compared with *R. lourencoi*, n. comb., in which the telson vesicle is completely covered by faint pigmentation (fig. 7B) and the pedipalp chela manus bears pigmentation stripes along each carina (fig. 6B).

Description: Based on the holotype ♂ (MNHNS) and paratypes (AMNH, LBRE, MACN-Ar, MHNC, MNHNS).

Total length: 24.6–39 mm (n = 10; mean = 31.1) in ♂; 25.4–33.3 mm (n = 7; mean = 29.1) in ♀.

Color: Base color yellowish, with brown reticulate pigmentation on some segments (figs. 4B, 5A, B, 6A, 7A, 8). Cheliceral manus, external surface with faint reticulate pigmentation; fingers more densely pigmented distally. Carapace, anterior margin pigmented medially; two broad, dark stripes extending from anterior margin to anterior part of posteromedian longitudinal sulcus, surrounding median ocular tubercle; lateral margins densely pigmented; median ocular tubercle and area around lateral ocelli dark brown to black; posterior third with reticulate pigmentation and two faint spots posterolaterally; posterior margin with dark narrow stripe. Tergites I–VI each with faint, paired spots laterally, posterior margin with dark narrow stripe, more developed on anterior than posterior segments; VII with faint brown spot posteromedially. Sternum, sternites, genital opercula, and pectines unpigmented. Metasomal segment I, dorsal surface with faint triangular spots medially and at posterior margin; DL carinae with pigmented granules; lateral margins with faint triangular spot between LM and LIM carinae; faint vestigial VL and VM stripes, reduced to dark pigmentation at posterior margin of segment. Metasomal segments II and III as for I, except more densely pigmented; dorsal surface with dark triangular spot medially, posterior margin with dark spot medially; DL, LM and LIM carinae with pigmented granules; lateral margins with triangular spot between LM and LIM carinae; VL and VM stripes well developed, extending entire length of segment, contiguous at posterior margin, VL stripes narrow, reduced to lateral margins, VM stripe broad, occupying most of surface. Metasomal segment IV, dorsal surface with elongated spot medially, not reaching posterior margin of segment; DL carinae pigmented; lateral margins with elongated dark spot; ventral surface as for segment III. Metasomal segment V, dorsal surface unpigmented medially; DL margins densely pigmented; lateral margins with reticulate pigmentation; VM and paired VL stripes contiguous at posterior margin of segment, VL stripes broad, occupying most of surface, VM stripe very narrow, restricted to carina. Telson vesicle conspicuous light yellow color, lateral surfaces with faint vestigial pigment; aculeus unpigmented basally, apex dark brown (fig. 7A). Pedipalps, coxa unpigmented; trochanter faintly pigmented at articulation with femur; femur with well-developed stripe at posterior margin and faint reticulate pigmentation near articulation with patella; patella with four complete stripes along DI, EM, VI, and VE carinae, dorsal margin with reticulate pigmentation; chela almost unpigmented (fig. 6A), faintly pigmented along E carinae and near external articulation with patella and movable finger. Legs, coxa, and trochanter unpigmented; femur, internal surface densely pigmented, external surface densely pigmented near articulation with patella; patella, internal surface densely pigmented, external surface pigmented near articulations and along ventral margin; tibia, internal surface pigmented at articulation with patella; basitarsi and telotarsi unpigmented.

Carapace: Carapace dorsoventrally compressed (fig. 12C); anterior margin almost straight (fig. 12A). Surface finely granular medially, more densely granular laterally, less so in ♀. Anteromedian longitudinal and interocular sulci absent or obsolete; posteromedian longitudinal and posterolateral sulci well developed. Median ocular tubercle shallow, ocelli situated in depression, only median part of ocular tubercle protruding above carapace in lateral profile (fig. 12C); median ocelli small, approximately two diameters apart, with two pairs of longitudinally aligned microsetae anteriorly and one pair of macrosetae posteriorly (fig. 12A, C). Three pairs of small lateral ocelli on each side of carapace (fig. 12A), anterior ocellus noticeably larger than other ocelli; anterior and median ocelli situated very close together, in same horizontal axis, posterior ocellus smaller and situated slightly dorsal to others.

Chelicerae: Movable finger, distal internal tooth well developed, strongly curved, forming angle of almost 90° with rest of finger in ♂ (fig. 11A), less curved in ♀ (fig. 11B); distal external tooth well developed, protruding dorsally from surface of finger; two vestigial subdistal teeth, barely visible in some specimens.

Pedipalps: Femur, dorsal, internal and ventral surfaces densely granular (fig. 16), especially along internal margin, with external surface less granular (♂), or dorsal and external surfaces with scattered granules only, internal and ventral surfaces smooth (♀); DE and VI carinae well developed, extending entire length of segment; DI carina reduced to scattered granules along margin of segment; IM carina barely discernible among coarse surface granulation (♂; fig. 16D) or comprising scattered granules (♀). Patella, intercarinal surfaces densely granular (♂) or smooth (♀); DI, VI, and VE carinae granular, extending entire length of segment, DI carina especially pronounced and coarsely granular (♂; figs. 17A, D) or obsolete, reduced to few scattered granules (♀); external margin undulated (fig. 17C), DE and EM carinae obsolete, reduced to few granules (♂; fig. 17A, B) or DE carina absent, EM carina obsolete, reduced to slight curvature of surface along entire length of segment (♀); IM carina granular, well developed along entire length in some ♂ (fig. 17D) but reduced to scattered granules in others, and absent in ♀. Chela manus prism shaped, more robust in ♂ (figs. 18, 19, 24), length/width ratio 2.35–2.78 in ♂ (n = 10; median = 2.55), 2.83–3.18 in ♀

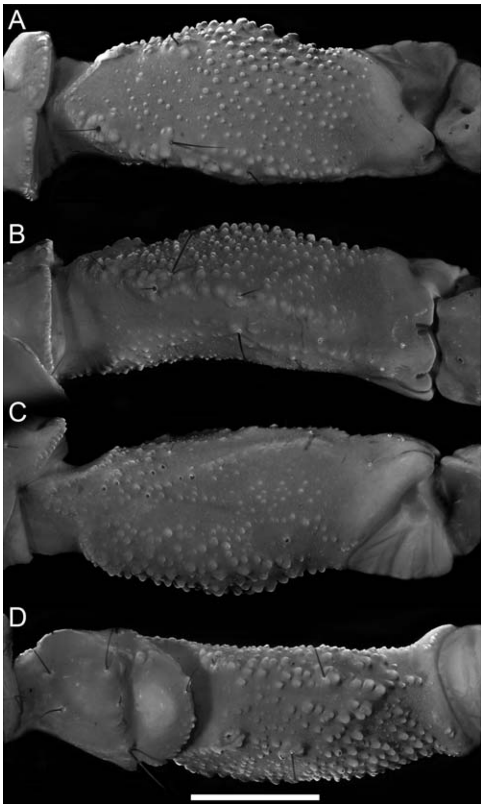

FIGURE 16. *Rumikiru atacama*, n. sp., ♂ (MACN-Ar), dextral pedipalp femur. **A.** Dorsal aspect. **B.** External aspect. **C.** Ventral aspect. **D.** Internal aspect. Scale bar = 1 mm.

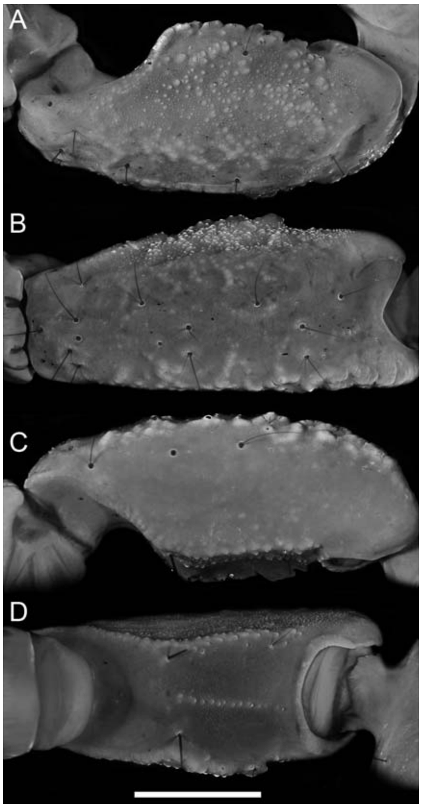

FIGURE 17. *Rumikiru atacama*, n. sp., ♂ (MACN-Ar), dextral pedipalp patella. **A.** Dorsal aspect. **B.** External aspect. **C.** Ventral aspect. **D.** Internal aspect. Scale bar = 1 mm.

(*n* = 7; median = 3.01); length/height ratio 2.16–2.45 in ♂ (*n* = 10; median = 2.3), 2.53–2.92 in ♀ (*n* = 7; median = 2.69); internal surface with small conical apophysis, situated almost medially, in ♂ (figs. 18C, D, 24A, B), absent in ♀ (figs. 19C, D, 24C, D); carinae of ♀ absent, except for DS and VI carinae each evident as subtle lobe near articulation with patella; carinae of ♂ as follows: DM carina finely granular, obsolete, extending entire length of segment (fig. 18A); DS and D carinae each finely granular, obsolete, reduced to slight curvature of surface and lobe near articulation with patella (fig. 18B); E carina obsolete, reduced to scattered macrosetae; VE, VM, and VI carinae obsolete, reduced to slight curvature of surface along entire length of manus; IM carina obsolete, reduced to well-developed lobe reaching conical apophysis; fixed and movable fingers short and stout, each with single median denticle row and five pairs of internal and external accessory denticles; basal denticle of median denticle row on movable finger approximately three times larger than and replacing first five or six median denticles (figs. 18A, B, D, 19A, D, 24A, C); distal third of fingers twisted, abruptly altering orientation of median denticle row (more conspicuously on movable fin-

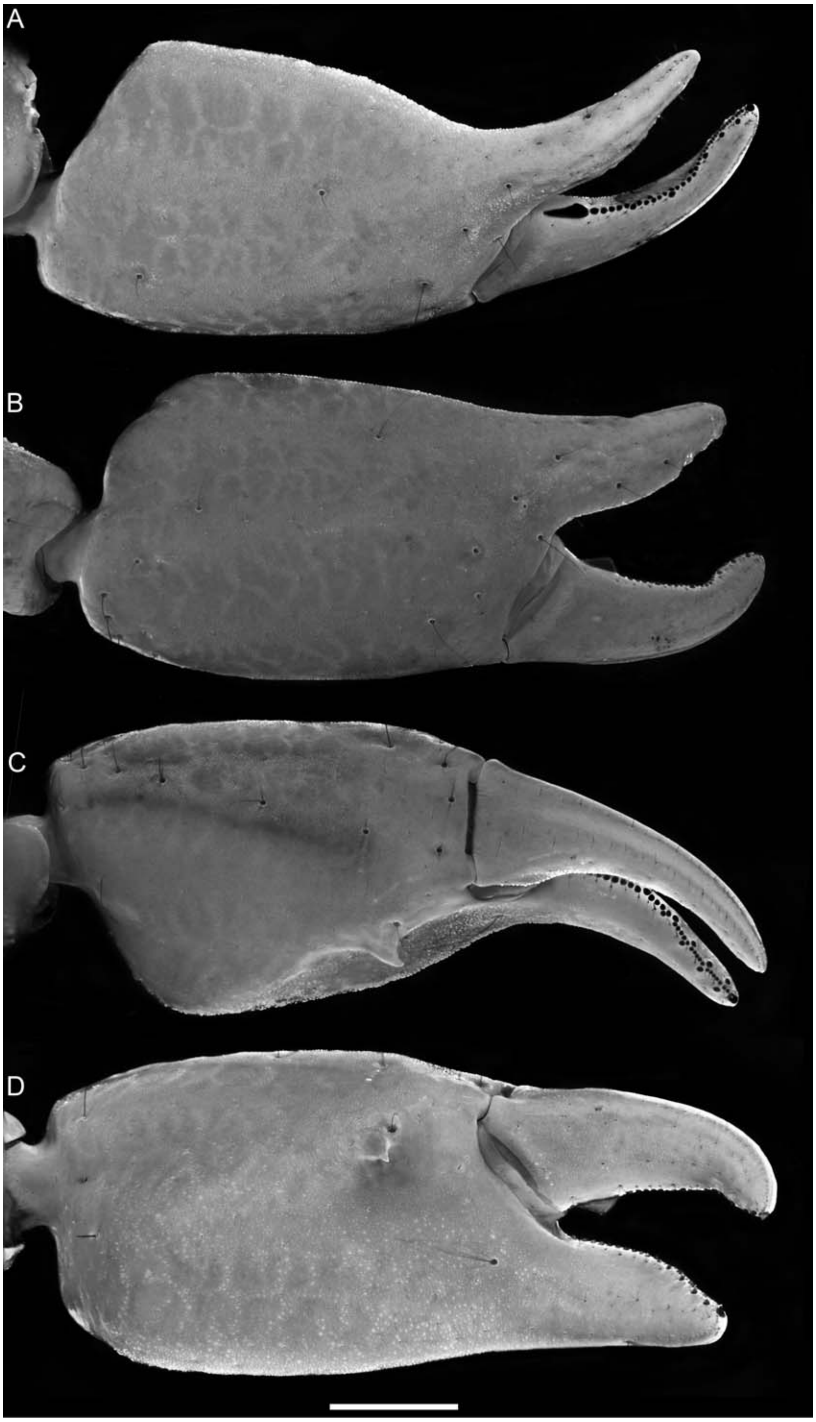

FIGURE 18. *Rumikiru atacama*, n. sp., ♂ (MACN-Ar), dextral pedipalp chela. **A.** Dorsal aspect. **B.** External aspect. **C.** Ventral aspect. **D.** Internal aspect. Scale bar = 1 mm.

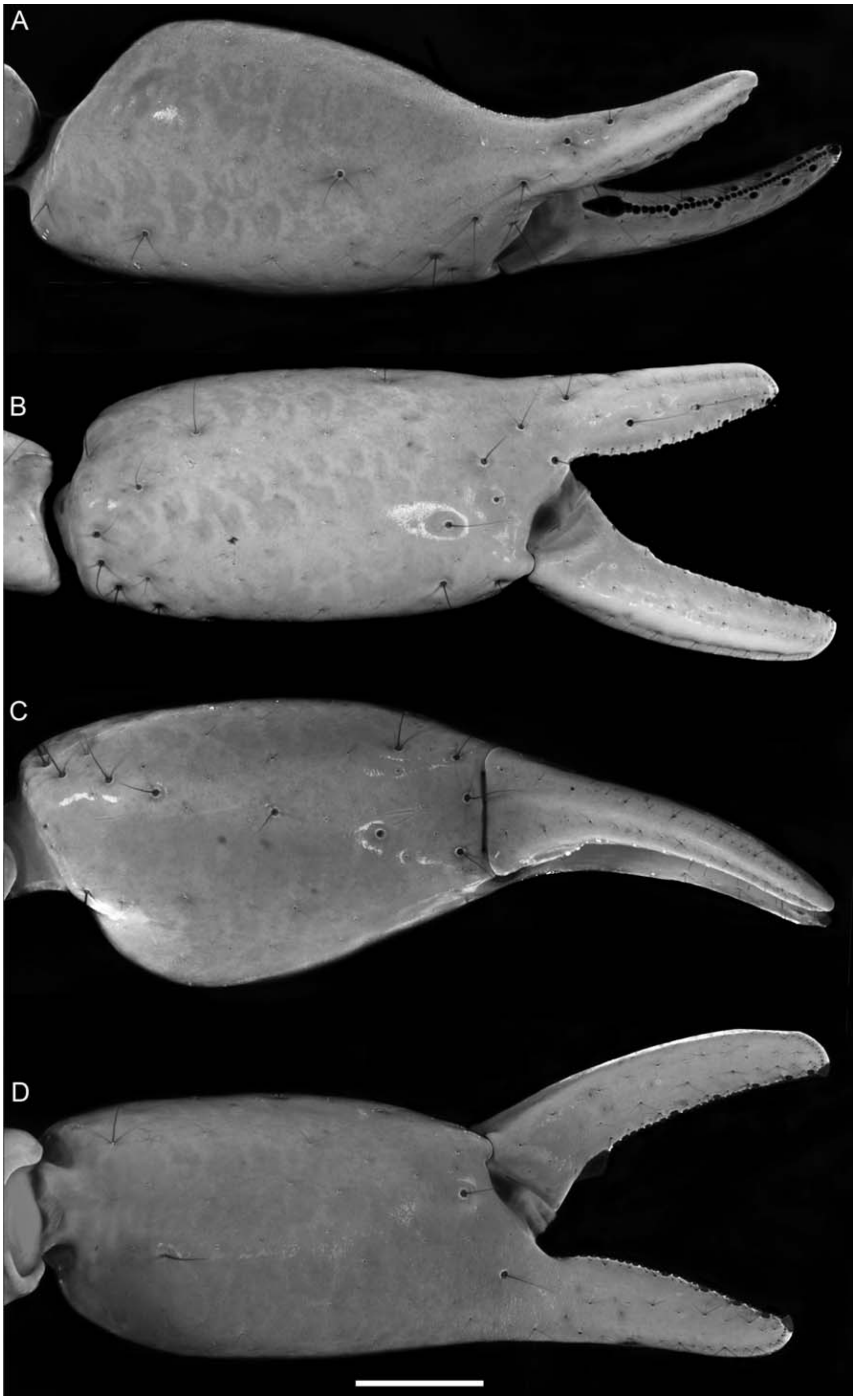

FIGURE 19. *Rumikiru atacama*, n. sp., ♀ (MACN-Ar), dextral pedipalp chela. **A.** Dorsal aspect. **B.** External aspect. **C.** Ventral aspect. **D.** Internal aspect. Scale bar = 1 mm.

ger), in ♂ (fig. 18A). Trichobothrial pattern neobothriotaxic major Type C, with one accessory trichobothrium in *V* series of chela (figs. 18, 19, 24); femur (fig. 16) with three trichobothria (*d*, *i,* and *e*), one macroseta (M_1) associated with *d* and *i*, *e* situated in same axis as or slightly proximal to M_1 (fig. 16A); patella (fig. 17) with 19 trichobothria (2 *d*, *i*, 3 *et*, *est*, 2 *em*, 2 *esb*, 5 *eb*, 3 *v*); chela (figs. 18, 19, 24) with 27 trichobothria (*Dt*, *Db*, 5 *Et*, *Est*, *Esb*, 3 *Eb*, *dt*, *dst*, *dsb*, *db*, *et*, *est*, *esb*, *eb*, *ib*, *it*, 5 *V*), *Esb* forming triangle with Eb_1 and Eb_2.

Legs: Femur and patella, surfaces slightly granular, other segments smooth. Basitarsi each with two well-developed, equal-length pedal spurs (fig. 15). Telotarsi elongated, shallow, each with ventromedian row of small spinules, and pro- and retroventral rows of short, stout spiniform macrosetae, with following counts on leg I: 1/1, II: 2/2, III and IV: 3/3 (fig. 15). Ungues curved, equal in length.

Sternum: Shape markedly compressed anteriorly to posteriorly, but not divided into two separated plates (figs. 13A, B).

Genital opercula: Sclerites subtriangular, more elongated in ♂ (fig. 13A, B).

Pectines: Single row of median lamellae; first median lamella more elongated in ♀ (figs. 13C, D). Fulcra present, small (fig. 13C, D). Pectinal teeth small, triangular; tooth count: 16–18 in ♂ (*n* = 24; median = 16), 13–16 in ♀ (*n* = 18; median = 14); retrolateral margins covered posteriorly with peg sensilla, sensilla field more extensive (fig. 13E, F) with sensilla apparently more acute basally (fig. 13. G, H), in ♂.

Tergites: Tergites I–VI, surfaces smooth to finely granular (♀) or entirely finely granular, more coarsely so near posterior and lateral margins (♂); VII with paired submedian carinae, restricted to posterior third of segment, and lateral carinae, restricted to posterior half, intercarinal surfaces with scattered medium-sized granules, finely granular elsewhere.

Sternites: Sternites III–VII, surfaces entirely smooth (♀) or smooth to finely granular (♂); III–VI each with small, elliptical spiracles.

Metasoma: Metasomal segment I, dorsal surface finely granular; DL and LM carinae granular, extending entire length of segment, LM carinae weakly developed medially; one pair of LM macrosetae posteriorly; LSM and LIM carinae granular, restricted to posterior half of segment (fig. 26B); one pair of LIM macrosetae anteriorly; surfaces between LSM and LIM carinae sparsely granular; lateral margins and ventral surfaces smooth, acarinate; two pairs of VL and VSM macrosetae. Segment II as for I, but carinae less granular; LIM carinae absent or reduced to few granules at posterior margin of segment (fig. 26B). Segment III as for II but less granular, carinae less developed; LSM carina reduced to few granules near posterior margin of segment; LIM carinae absent (fig. 26C). Segment IV slightly more elongated than preceding segments; DL carinae granular, extending entire length of segment (fig. 26C); one pair of DL macrosetae medially; LM carinae restricted to anterior and posterior thirds of segment, almost smooth medially; one pair of LM macrosetae in posterior third of segment; LIM carinae absent, represented only by pair of LIM macrosetae (fig. 26C); ventral surface smooth, acarinate; two pairs of VSM and VL macrosetae. Segment V elongated; dorsal and lateral surfaces smooth or finely granular (fig. 26D);

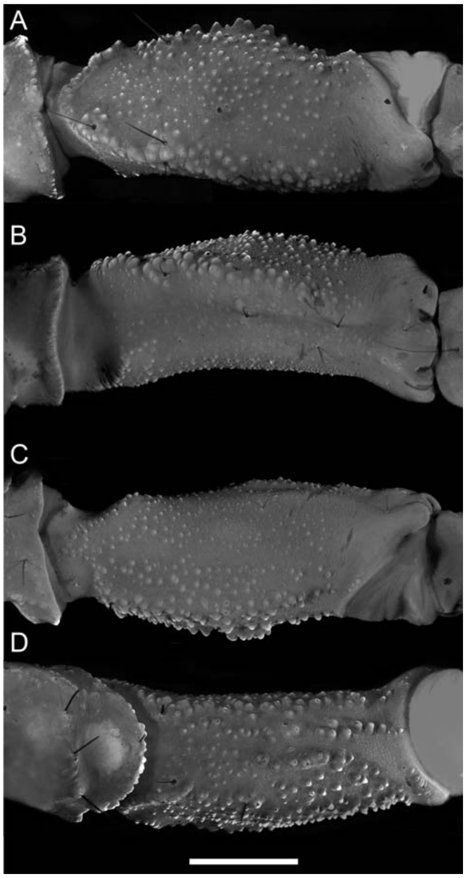

FIGURE 20. *Rumikiru lourencoi* (Ojanguren-Affilastro, 2003), n. comb., ♂ (MACN-Ar), dextral pedipalp femur. **A.** Dorsal aspect. **B.** External aspect. **C.** Ventral aspect. **D.** Internal aspect. Scale bar = 1 mm.

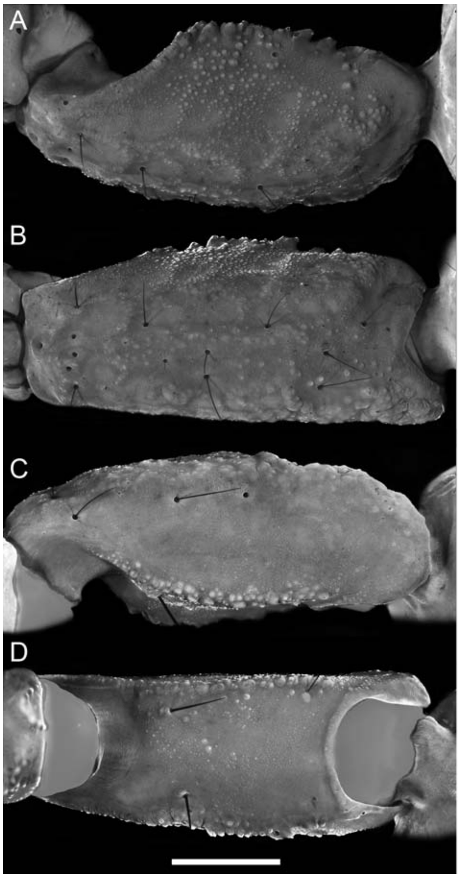

FIGURE 21. *Rumikiru lourencoi* (Ojanguren-Affilastro, 2003), n. comb., ♂ (MACN-Ar), dextral pedipalp patella. **A.** Dorsal aspect. **B.** External aspect. **C.** Ventral aspect. **D.** Internal aspect. Scale bar = 1 mm.

DL carina finely granular, extending entire length of segment; one pair of DL macrosetae; lateral surfaces acarinate, smooth or sparsely granular; LM carinae represented only by two pairs of LM macrosetae in posterior third of segment, LIM carinae by one pair of LIM macrosetae in anterior third (fig. 26D); VL carinae granular, extending almost entire length of segment, comprising larger granules near posterior margin (fig. 27A, C); VSM carinae subparallel to VL carinae, restricted to posterior two-thirds of segment, contiguous with VL carinae at margins; VM carina granular, extending entire length of segment, with two accessory granules separated from it in anterior part of posterior third (fig. 27A, C); other surfaces sparsely granular, slightly more densely granular in ♂; three pairs of VL macrosetae and four pairs of VSM macrosetae, one pair of each at posterior margin of segment.

Telson: Vesicle shallow in ♂ (fig. 28C), more globose in ♀ (fig. 28A); length/height ratio 3.2–3.84 in ♂ (n = 9; median = 3.43), 2.68–3.04 in ♀ (n = 7; median = 2.93); dorsal surface

FIGURE 22. *Rumikiru lourencoi* (Ojanguren-Affilastro, 2003), n. comb., ♂ (MACN-Ar), dextral pedipalp chela. **A.** Dorsal aspect. **B.** External aspect. **C.** Ventral aspect. **D.** Internal aspect. Scale bar = 1 mm.

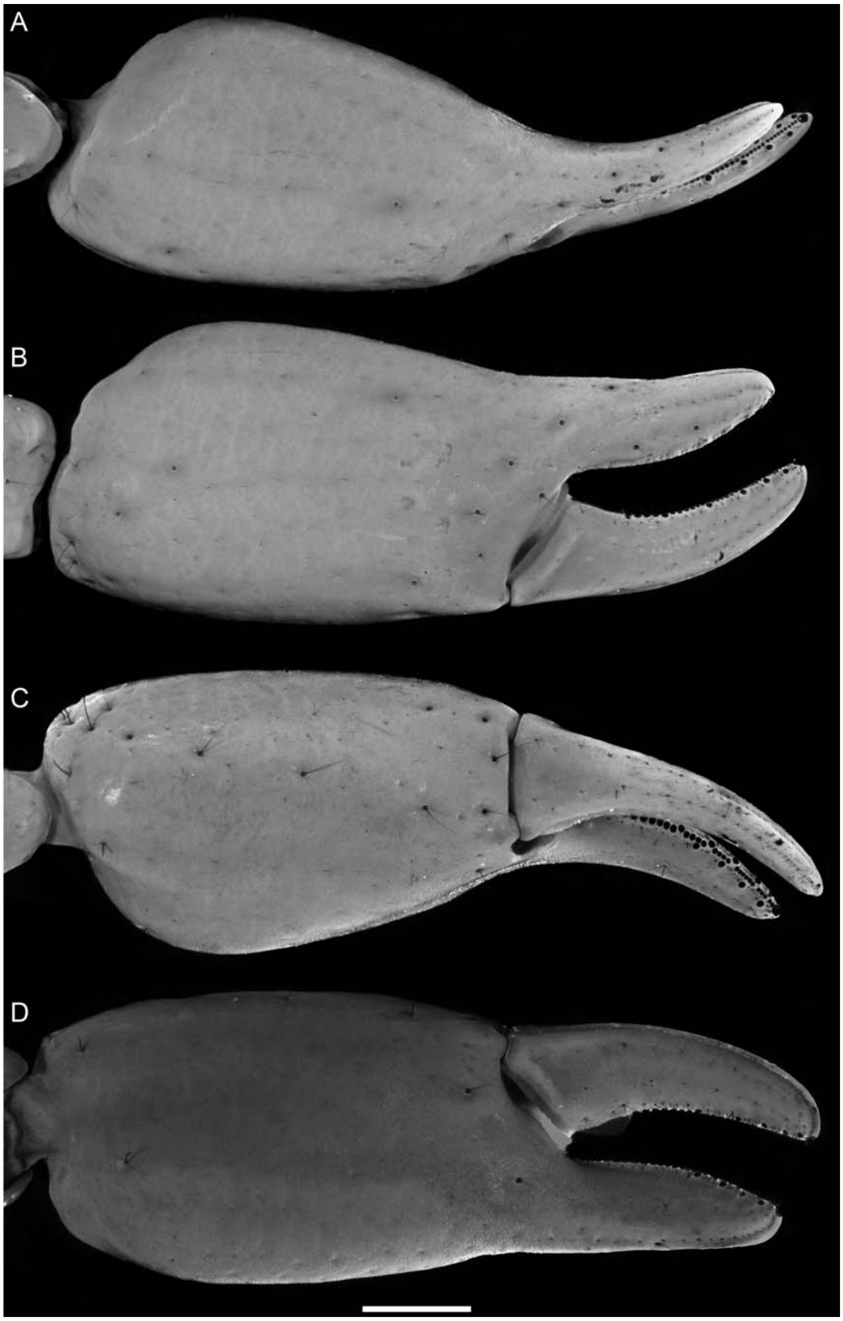

FIGURE 23. *Rumikiru lourencoi* (Ojanguren-Affilastro, 2003), n. comb., ♀ (MACN-Ar), dextral pedipalp chela. **A.** Dorsal aspect. **B.** External aspect. **C.** Ventral aspect. **D.** Internal aspect. Scale bar = 1 mm.

FIGURE 24. *Rumikiru atacama*, n. sp., dextral pedipalp chela. **A, B.** ♂ (MACN-Ar). **C, D.** ♀ (MACN-Ar). **A, C.** Internal aspect. **B, D.** Ventral aspect. Scale bar = 1 mm.

FIGURE 25. *Rumikiru lourencoi* (Ojanguren-Affilastro, 2003), n. comb., dextral pedipalp chela. **A, B.** ♂ (MACN-Ar). **C, D.** ♀ (MACN-Ar). **A, C.** Internal aspect. **B, D.** Ventral aspect. Scale bar = 1 mm.

smooth, telson gland not apparent, but with small depression, containing abundant pores in cuticle, at posterodorsal margin (fig. 28G); ventral surface granular, especially in ♂, with conspicuous granule medially at posterior margin (fig. 28E); three pairs of VL and VSM macrosetae. Aculeus elongated, shallowly curved (fig. 28A, C).

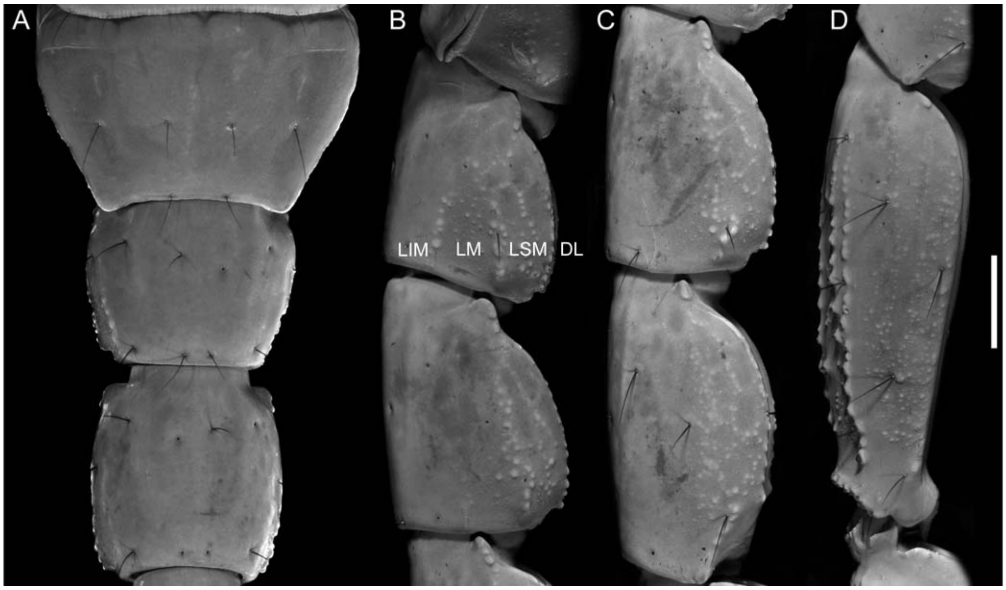

FIGURE 26. *Rumikiru*, n. gen., sternite VII and metasomal segments. **A.** *Rumikiru lourencoi* (Ojanguren-Affilastro, 2003), n. comb., ♀ (MACN-Ar), sternite VII and metasomal segments I and II, ventral aspect. **B–D.** *Rumikiru atacama*, n. sp., ♂ (MACN-Ar). **B.** Metasomal segments I and II, lateral aspect. **C.** Metasomal segments III and IV, lateral aspect. **D.** Metasomal segment V, lateral aspect. Annotations: DL: dorsolateral carina; LSM: lateral supramedian carina; LM: lateral median carina; LIM: lateral inframedian carina. Scale bar = 1 mm.

Hemispermatophore: Basal portion well developed (fig. 10F, G). Distal lamina well developed, similar in length to basal portion (fig. 10B, F, G); apical half forming well-developed apex; distal crest slightly undulated in distal third, convex in basal two-thirds (fig. 10B, F, G); frontal crest (distal posterior flexure) well developed, almost straight, occupying basal half of distal lamina. Lobe region well developed (fig. 10H); basal lobe well developed, with small projection, internal fold covered by tiny, scattered papillae (spicules) (fig. 10I).

Distribution: All known records of *R. atacama*, n. sp., occur within a small part of Huasco Province, in the southern part of Region III (Atacama), northern Chile (figs. 2, 3), to which this species is probably endemic.

Ecology: The area in which this species was collected falls within the "Desierto Costero del Huasco" subregion of the "Desierto" botanical region (Gajardo, 1993). This area is extremely arid, with sparse shrubs and cacti, except in areas with greater exposure to sea fog, where a "Lomas" habitat, comprising more abundant vegetation, occurs. *Rumikiru atacama*, n. sp., has been collected close the seashore but not in "Lomas" habitat. Most personally collected specimens were taken from scree slopes, cliff faces, and exposed rocky outcrops, in areas with little or no vegetation (fig. 4A).

This species occurs in sympatry with the iurid *Caraboctonus keyserlingi* Pocock, 1893, and three other bothriurids, *Bothriurus dumayi* Cekalovic, 1974, *Brachistosternus kamanchaca* Ojanguren-Affilastro et al., 2007, and *Brachistosternus roigalsinai* Ojanguren-Affilastro, 2002. None of these species shares the same microhabitat as *R. atacama*, n. sp., however.

Rumikiru lourencoi (Ojanguren-Affilastro, 2003), n. comb.
Figures 1, 2, 3, 6B, 7B, 9, 10A, C, D, E, 12B, D, 14,
20, 21, 22, 23, 25, 26A, 27B, D, 28B, D, F, H; table 1

Orobothriurus lourencoi Ojanguren-Affilastro, 2003a: 118–121, figs. 1–14; 2004: 72; Ochoa, 2004: 44; Agusto et al., 2006: 415–419; Rein, 2007: 5; Pizarro-Araya et al., 2008: 270, 271; Vrech et al., 2011: 465, 467, 470, 475, 482.

Type Material: **CHILE: Region III (Atacama):** *Chañaral Province*: Holotype ♂ (MACN-Ar 10308), Pan de Azúcar National Park: Quebrada Pan de Azúcar, 8 km from coast, 28°09′00″S 70°30′00″W, UV detection, 7–8.ii.2003, A.A. Ojanguren-Affilastro and P. Korob. Paratypes: same data, 3 ♂, 2 ♀ (MACN-Ar 10309), 1 ♂ (AMNH), 1 ♂ (MHNC).

New Records: **CHILE: Region II (Antofagasta):** *Antofagasta Province*: Taltal, 10 km E [25°29′15″S 70°24′45″W], ii.1996, Z. Janeba, 1 juv. (FKPC). **Region III (Atacama):** *Chañaral Province*: Finca de Chañaral, Inca de Oro [26°38′09″S 69°51′02″W], 1800 m, 7–8.x.1980, L. Peña, 2 subad. ♀ (AMNH); Pan de Azúcar National Park, near Chañaral: Agua Salada, in Quebrada Pan de Azúcar, 26°08′32.4″S 70°37′49.8″W, 82 m, 9.xi.2003, L. Prendini, C.I. Mattoni, and J.A. Ochoa, UV detection on cool, still night, moon completely obscured by clouds, Atacama desert with steep scree slopes and alluvial flats at the base, specimens on rocks at base of slope, 4 ♂ (AMNH), 1 subad. (AMNH [LP 2417]); Quebrada Pan de Azúcar, 8 km from coast, 26°06′47.8″S 70°34′08.7″W, 229 m, 9.xi.2003, L. Prendini, C.I. Mattoni, and J.A. Ochoa, UV detection on cool, still night, moon partly obscured by clouds, Atacama desert with steep scree slopes and alluvial flats at the base, specimens on scree slopes, 3 ♂ (AMNH); Quebrada Pan de Azúcar, 5–9 km from coast, 26°06′46.2″S 70°34′00.9″W, 250 m, 23.i.2005, C.I. Mattoni and A.A. Ojanguren-Affilastro, 4 ♀, 1 juv. ♀ (AMNH).

Diagnosis: *Rumikiru lourencoi*, n. comb., can be separated from the only other known species of the genus, *R. atacama*, n. sp., by several morphological characters. The distal lamina of the hemispermatophore of *R. lourencoi*, n. comb. (fig. 10A, E), has a longer apex and a shorter frontal crest than that of *R. atacama*, n. sp. (fig. 10B, F, G); the distal crest is almost straight in its apical two-thirds in *R. lourencoi*, n. comb. (fig. 10A, E), whereas it is curved in *R. atacama*, n. sp. (fig. 10B, G); and the papillose fold of the basal lobe is more pronounced, more granular, and bears larger papillae (spicules) in *R. lourencoi*, n. comb. (fig. 10C, D), than in *R. atacama*, n. sp. (fig. 10H, I). Metasomal segment V is more densely granular in *R. lourencoi*, n. comb. (fig. 27B, D), than in *R. atacama*, n. sp. (fig. 27A, C). The telson is more granular and the vesicle of the male more slender in *R. lourencoi*, n. comb. (fig. 28B, D), than in *R. atacama*, n. sp. (fig. 28A, C). The IM carina of the pedipalp patella is absent or reduced to a few scattered granules in males of *R. lourencoi*, n. comb. (fig. 21D), but often well developed along its entire length in males of *R. atacama*, n. sp. (fig. 17D). There are also differences in the pigmentation pattern: *R. lourencoi*, n. comb., is more densely pigmented, the ventral surface of the telson vesicle completely covered by faint pigmentation (fig. 7B) and the pedipalp chela manus bearing pigmentation stripes along each carina (fig. 6B), compared with *R. atacama*, n. sp., in which the telson vesicle (fig. 7A) and pedipalp chela manus (fig. 6A) are largely unpigmented.

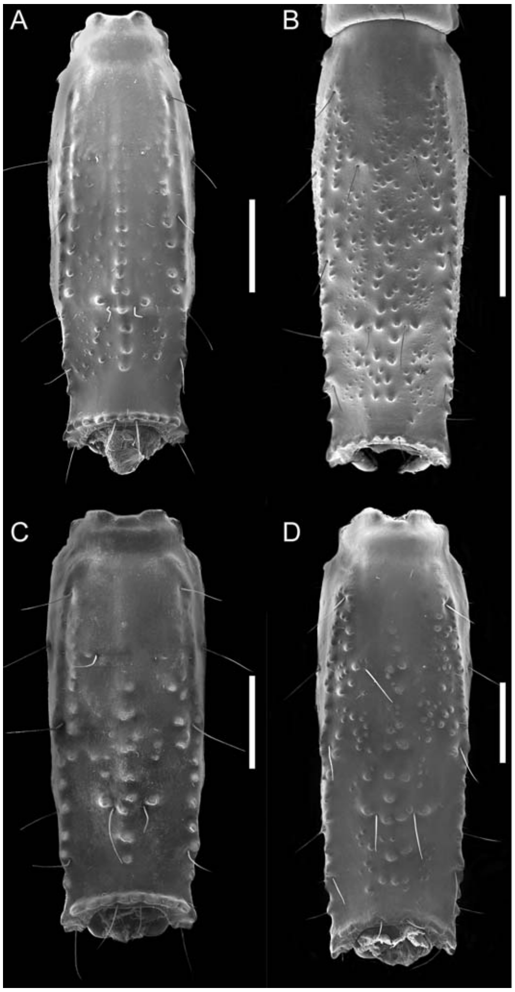

FIGURE 27. *Rumikiru*, n. gen., metasomal segment V, ventral aspect. **A, C.** *Rumikiru atacama*, n. sp. **B, D.** *Rumikiru lourencoi* (Ojanguren-Affilastro, 2003), n. comb. **A, B.** ♂ (MACN-Ar). **C, D.** ♀ (MACN-Ar). Scale bars = 1 mm.

Redescription: Based on holotype ♂ (MACN-Ar) and paratypes (AMNH, MACN-Ar, MHNC).

Total length: 34–41 mm (n = 9; mean = 37.6) in ♂; 37.5 mm and 39.12 mm in two ♀.

Color: Base color light brown, with dark brown reticulate pigmentation on some segments (figs. 6B, 7B, 9). Cheliceral manus, external surface with faint reticulate pigmentation; fingers densely pigmented distally. Carapace, anterior margin pigmented; two broad, dark stripes extending from anterior margin to postocular sulcus, surrounding median ocular tubercle; lateral margins densely pigmented; median ocular tubercle and area around lateral ocelli dark brown to black; posterior third with reticulate pigmentation and two dark spots posterolaterally; posterior margin with dark narrow stripe. Tergites I–VII each with faint, paired spots posterolaterally, posterior margin with dark narrow stripe. Sternum, sternites, genital opercula, and pectines unpigmented. Metasomal segment I, dorsal surface with faint triangular spot medially, reaching DL carinae and posterior margin; DL, LM, and LIM carinae with pigmented granules; lateral margins with faint triangular spot between LM and LIM carinae; faint VL and VM stripes, contiguous in posterior third of segment. Metasomal segments II–IV as for I, except more densely pigmented; VL and VM stripes well developed, extending entire length of segment, contiguous in posterior third, VL stripes narrow, reduced to lateral margins, VM stripe broad, occupying most of surface. Metasomal segment V, dorsal surface unpigmented medially; DL margins densely pigmented; lateral margins with reticulate pigmentation; VM and paired VL stripes contiguous in posterior third of the segment, VL stripes broad, occupying most of surface, VM stripe narrow, restricted to carina. Telson vesicle, ventral surface and dorsolateral margins faintly pigmented, other surfaces unpigmented; aculeus unpigmented basally, apex dark reddish brown (fig. 7B). Pedipalps, coxa unpigmented; trochanter with reticulate pigmentation, more densely pigmented at articulation with femur; femur almost completely covered by reddish-brown pigmentation, more densely pigmented in granular areas, at posterior margin, and near articulation with patella; patella with four complete stripes along DI, EM, VI, and VE carinae,

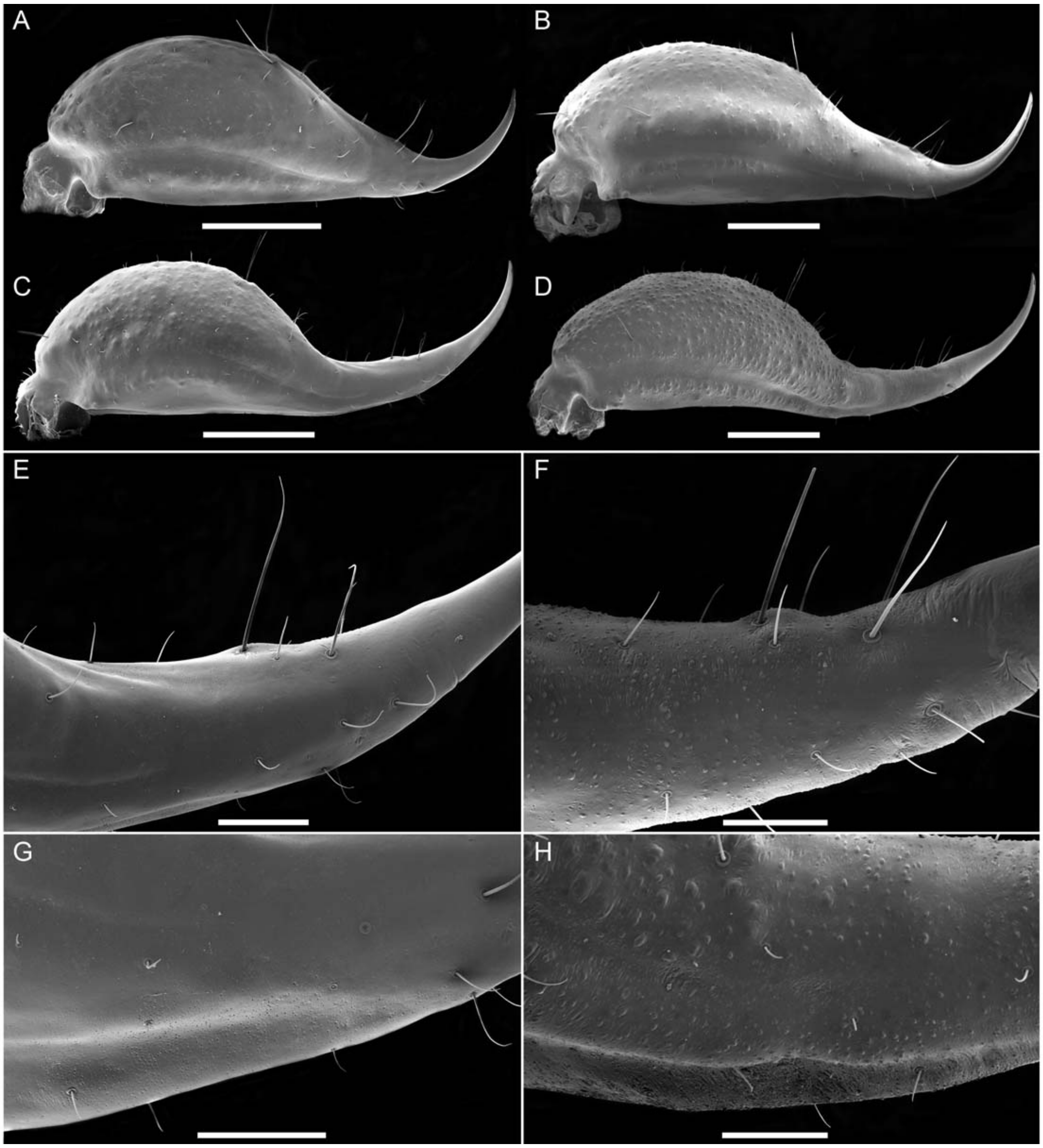

FIGURE 28. *Rumikiru*, n. gen., telson, lateral aspect (**A–D**), with close-up of posterior median ventral granule (**E, F**) and posterior median dorsal concavity (**G, H**). **A, C, E, G.** *Rumikiru atacama*, n. sp. **B, D, F, H.** *Rumikiru lourencoi* (Ojanguren-Affilastro, 2003), n. comb. **A, B.** ♀ (MACN-Ar). **C–H.** ♂ (MACN-Ar). Scale bars = 1 mm (**A–D**), 0.5 mm (**E**), 0.2 mm (**F, H**), 0.25 mm (**G**).

dorsal margin with reticulate pigmentation; chela with faint stripes along carinae, faintly pigmented near external articulation with patella, more densely pigmented at articulation with movable finger, and on fingers (fig. 6B). Legs, coxa, and trochanter unpigmented; femur, internal surface densely pigmented, external surface densely pigmented near articulation with patella; patella, internal surface densely pigmented, external surface pigmented near articulations and

TABLE 1. Measurements (mm) of *Rumikiru atacama*, n. sp., and *Rumikiru lourencoi* (Ojanguren-Affilastro, 2003), n. comb.

	R. atacama, n. sp.		*R. lourencoi,* n. comb.	
SPECIMEN				
Type	Holotype	Paratype	Holotype	Paratype
Sex	♂	♀	♂	♀
Collection	MNHNS	MACN-Ar	MACN-Ar	MACN-Ar
CARAPACE				
Length	3.73	3.80	4.53	4.77
Anterior width	2.33	2.40	2.83	2.99
Posterior width	3.93	4.00	4.69	4.93
CHELA				
Length	5.73	5.47	7.51	7.99
Width	2.37	1.83	2.91	2.83
Height	2.63	2.13	3.23	3.23
Movable finger length	2.70	2.50	3.07	3.64
PATELLA				
Length	3.17	2.90	4.04	4.28
Width	1.40	1.23	1.69	1.62
FEMUR				
Length	3.03	2.77	4.04	4.12
Width	1.40	1.17	1.69	1.69
MESOSOMA				
Length	10.24	12.24	9.29	10.92
METASOMA I				
Length	2.00	1.77	2.59	2.59
Width	2.17	2.20	2.67	2.75
Height	1.73	1.70	2.02	2.18
METASOMA II				
Length	2.30	2.00	3.07	2.99
Width	2.03	2.00	2.42	2.51
Height	1.70	1.67	2.02	2.18
METASOMA III				
Length	2.33	2.17	3.23	3.15
Width	1.93	2.00	2.34	2.51
Height	1.67	1.67	1.86	2.10
METASOMA IV				
Length	2.67	2.33	3.88	3.79
Width	1.83	1.83	2.10	2.26
Height	1.67	1.67	1.88	2.10
METASOMA V				
Length	4.07	3.67	5.82	5.66
Width	1.71	1.70	2.10	2.11
Height	1.47	1.47	1.62	1.69
METASOMA				
Total length	13.37	11.94	18.59	18.18
TELSON				
Total length	4.93	3.93	5.74	5.25
Vesicle length	2.93	2.80	3.72	3.15
Vesicle width	1.80	1.73	2.10	2.18
Vesicle height	1.53	1.33	1.62	1.69
Aculeus length	2.00	1.13	2.02	1.29
TOTAL LENGTH	32.27	31.91	38.15	39.12

along ventral margin; tibia, internal surface pigmented at articulation with patella; basitarsi and telotarsi unpigmented.

Carapace: Carapace dorsoventrally compressed (fig. 12D); anterior margin almost straight (fig. 12B). Surface finely granular medially, more densely granular laterally, less granular in ♀. Anteromedian longitudinal sulcus absent or obsolete; interocular sulcus obsolete; posteromedian longitudinal and posterolateral sulci well developed. Median ocular tubercle shallow, ocelli situated in depression, only median part of ocular tubercle protruding above carapace in lateral profile (fig. 12D); median ocelli small, approximately two diameters apart, with one pair of microsetae situated anteriorly and one pair of macrosetae situated posteriorly. Three pairs of small lateral ocelli on each side of carapace (fig. 12B), anterior ocellus noticeably larger than other ocelli; anterior and median ocelli situated very close together, in same horizontal axis, posterior ocellus smaller and situated slightly dorsal to others.

Chelicerae: Movable finger, distal internal tooth very well developed, strongly curved, forming angle of almost 90° with rest of finger in ♂, less curved in ♀; distal external tooth well developed, protruding dorsally from surface of finger; two vestigial subdistal teeth, barely visible in some specimens.

Pedipalps: Femur, surfaces densely granular (fig. 20), especially along internal margin, in ♂, less so in ♀; DE and VI carinae well developed, extending entire length of segment (fig. 20D); DI carina reduced to scattered granules along margin of segment; IM carina distinct and well developed (fig. 20D). Patella intercarinal surfaces densely granular (♂) or smooth (♀); DI and VI carinae granular, extending entire length of segment, DI carina especially pronounced and coarsely granular (fig. 21A, D); VE carina granular, extending entire length of segment (♂) or obsolete, reduced to slight curvature of surface (♀); external margin undulated (fig. 21B), DE and EM carinae well developed, granular (♂; fig. 21B) or DE carina absent, EM carina obsolete, reduced to slight curvature of surface along entire length of segment (♀); IM carina obsolete, reduced to scattered fine granules (♂; fig. 21D) or absent (♂, ♀). Chela manus prism shaped, more robust in ♂ (figs. 22, 23, 25), length/width ratio 2.35–2.58 in ♂ (n = 9; median = 2.47), 2.77 and 2.82 in two ♀; length/height ratio 2.16–2.32 in ♂ (n = 9; median = 2.23), 2.39 and 2.47 in two ♀; internal surface with small conical apophysis, situated almost medially, in ♂ (figs. 22A, C, D, 25A, B), absent in ♀ (figs. 23A, C, D, 25C, D); carinae of ♀ absent, except for DS and VI carinae, each evident as subtle lobe near articulation with patella (figs. 23, 25C, D); carinae of ♂ as follows: DM carina obsolete, finely granular, extending entire length of segment (fig. 22A); DS and D carinae finely granular, obsolete, reduced to slight curvature of surface and lobe near articulation with patella (fig. 22B); E carina absent, reduced to scattered macrosetae; VE, VM, and VI carinae obsolete, reduced to slight curvature of surface along entire length of manus (figs. 22C, 25B); IM carina obsolete, reduced to well-developed lobe reaching conical apophysis (figs. 22C, 25B); fixed and movable fingers short and stout, each with single median denticle row and five pairs of internal and external accessory denticles; basal denticle of median denticle row on movable finger approximately three times larger than and replacing first five or six median denticles (figs. 22A, B, D, 25A, C); median third of fingers twisted, abruptly altering orientation of median denticle row (more conspicuously on movable finger), in ♂ (fig. 22A). Trichobothrial pattern neobothriotaxic major Type C, with one accessory trichobothrium in *V* series of chela (figs. 22, 23, 25); femur (fig. 20) with three trichobothria (*d*, *i,* and *e*), one macroseta (M_1) associated with *d* and *i*, *e* situated in same axis as or slightly proximal to M_1 (fig. 20A); patella (fig. 21) with 19 trichobothria (2 *d*, *i*, 3 *et*, *est*, 2 *em*, 2 *esb*, 5 *eb*, 3 *v*); chela (figs. 22, 23, 25) with 27 trichobothria (*Dt*, *Db*, 5 *Et*, *Est*, *Esb*, 3 *Eb*, *dt*, *dst*, *dsb*, *db*, *et*, *est*, *esb*, *eb*, *ib*, *it*, 5 *V*), *Esb* forming triangle with Eb_1 and Eb_2.

Legs: Femur and patella, surfaces finely granular, other segments smooth. Basitarsi each with two well-developed, equal-length pedal spurs. Telotarsi elongated, shallow, each with ventromedian row of small spinules, and pro- and retroventral rows of short, stout spiniform macrosetae, with following counts on leg I: 1/1, II: 2/2, III and IV: 3/3. Ungues curved, equal in length.

Sternum: Shape slightly compressed anteriorly to posteriorly, but not divided into two separated plates (fig. 14A, B).

Genital opercula: Sclerites subtriangular, more elongated in ♂ (fig. 14 A, B).

Pectines: Single row of median lamellae; first median lamella more elongated in ♀ (fig. 14C, D). Fulcra present, small (fig. 14C, D). Pectinal teeth small, subtriangular; tooth count: 15–17 in ♂ (n = 18; median = 15), 12/13 and 13/14 in two ♀; retrolateral margins covered posteriorly with peg sensilla, sensilla field more extensive (fig. 14E, F) with sensilla apparently more acute basally (fig. 14G, H), in ♂.

Tergites: Tergites I–VI, surfaces smooth to finely granular (♀) or finely granular anteriorly, more coarsely so at lateral margins and in posterior third (♂); VII with paired submedian carinae, restricted to posterior third of segment, and lateral carinae, restricted to posterior half, intercarinal surfaces with scattered medium-sized granules, finely granular elsewhere.

Sternites: Sternites III–VII, surfaces entirely smooth (♀) or smooth to finely granular (♂); III–VI each with small, elliptical spiracles.

Metasoma: Metasomal segment I, dorsal surface finely granular; DL and LM carinae granular, extending entire length of segment; LM carinae weakly developed medially; one pair of LM macrosetae posteriorly; LSM carinae restricted to posterior half of segment; LIM carinae granular, extending entire length of segment; one pair of LIM macrosetae anteriorly; surfaces between LSM and LIM carinae granular; lateral margins and ventral surfaces smooth, acarinate (fig. 26A), except for traces of VL carinae, reduced to sparse fine granules ventrolaterally, in ♂; two pairs of VL and VSM macrosetae. Segments II and III as for I, but carinae slightly less granular; LIM carinae restricted to posterior third of segment; ventral surfaces smooth. Segment IV slightly more elongated than preceding segments; DL carinae granular, extending entire length of segment; one pair of DL macrosetae medially; LM carinae extending entire length of segment, more developed in anterior and posterior thirds; one pair of LM macrosetae in posterior third of segment; LIM carinae reduced to few scattered granules in posterior third and pair of LIM macrosetae anteriorly; ventral surface smooth, acarinate; two pairs of VSM and VL macrosetae. Segment V elongated; dorsal surface smooth; DL carina finely granular, extending entire length of segment; one pair of DL macrosetae; lateral surfaces acarinate, granular; LM carinae represented only by two pairs of LM macrosetae in posterior half of segment, LIM carinae by one pair of LIM macrosetae in anterior third; ventral surface granular (fig. 27B, D); VL carinae granular, extending entire length of segment, comprising larger granules near posterior margin; VSM carinae subparallel to VL carinae, restricted to posterior two-thirds of segment, contiguous with VL carinae at margins; VM carina granular, extending entire length of segment, with two to six accessory granules separated from it in anterior part of posterior third; other surfaces granular; three pairs of VL macrosetae and four pairs of VSM macrosetae, one pair of each at posterior margin of segment.

Telson: Vesicle shallow in ♂ (fig. 28D), more globose in ♀ (fig. 28B); length/height ratio 3.52–3.65 in ♂ (n = 7; median = 3.58), 2.95 mm and 3.07 in two ♀; dorsal surface smooth, telson gland not apparent, but with small depression, containing abundant pores in cuticle, at posterodorsal margin (fig. 28H); ventral surface granular, especially in ♂, with conspicuous granule medially at posterior margin (fig. 28F); three pairs of VL and VSM macrosetae. Aculeus elongated, shallowly curved (fig. 28B, D).

Hemispermatophore: Basal portion well developed (fig. 10E). Distal lamina well developed, similar in length to basal portion; apical half forming well-developed apex; distal crest almost straight in apical two-thirds (fig. 10A, E); frontal crest (distal posterior flexure) short, almost straight, occupying basal third of distal lamina. Lobe region well developed (fig. 10C); basal lobe well developed, with small projection, internal fold covered by abundant, well-developed papillae (spicules), especially near tip (fig. 10C, D).

Distribution: All known records of *R. lourencoi*, n. comb., occur within Antofagasta Province, in the southern part of Region II (Antofagasta), and Chañaral Province, in the northern part of Region III (Atacama), northern Chile (figs. 2, 3). The species is probably endemic to this area.

Ecology: The area where this species was collected falls within the "Desierto Costero de Tal-Tal" subregion of the "Desierto" botanical region (Gajardo, 1993). This area is extremely arid, with sparse shrubs and cacti, except in areas with greater exposure to sea fog, where a "Lomas" habitat, comprising more abundant vegetation, occurs. This species was collected in the rocky scree slopes of the "Quebrada Pan de Azucar," 8–10 km inland from the coast, in areas with almost no vegetation.

This species occurs in sympatry with five other bothriurid species, *Bothriurus dumayi*, *Brachistosternus ochoai* Ojanguren-Affilastro, 2004, *Brachistosternus roigalsinai*, *Brachistosternus sciosciae* Ojanguren-Affilastro, 2002, and *Brachistosternus kamanchaca*. None of these species shares the same microhabitat as *R. lourencoi*, n. comb., however.

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Appendix 1

Character list

List of 65 characters scored for cladistic analysis of 30 bothriurid scorpion species, including all species of *Orobothriurus* Maury, 1976, *Pachakutej* Ochoa, 2004, and *Rumikiru*, n. gen., from Mattoni et al. (in press). Character states are scored 0–3, unknown (?) and inapplicable (-). Characters from previous analyses that correspond partially or entirely to those in the present matrix are as follows: O2004 = Ochoa (2004); OA&R2009 = Ojanguren-Affilastro and Ramírez (2009); P2003 = Prendini (2003).

Pigmentation pattern

0. Tergites I–IV, pigmentation: entirely pigmented (0); paired spots sublaterally, unpigmented area medially (1) [O2004: 0; OA&R2009: 1].
1. Tergite VII, pigmentation: entirely pigmented (0); paired spots sublaterally, unpigmented area medially (1); inapplicable (-).
2. Metasomal segments II and III, dorsal surfaces, pigmentation: absent, unpigmented (0); subtriangular spot medially, may be divided by unpigmented line medially (1).
3. Metasomal segments I–III, dorsal surfaces, pigmentation along DL carinae: absent, unpigmented (0); reticulate lines (1).
4. Metasomal segments IV and V, ventral surfaces, VM stripe: contiguous with VL stripe posteriorly (0); not contiguous with VL stripe posteriorly (1); absent (2). [OA&R2009: 5].
5. Telson vesicle, ventral and lateral surfaces, coloration (♂): similar to ♀, pigmented (0); different from ♀, unpigmented, with glandular, light yellow coloration (1).

Carapace

6. Anterior margin, shape: sublinear or with shallow median notch (0); with weak median projection (epistome) (1). [OA&R2009: 7].
7. Anteromedian longitudinal sulcus, length (♂): complete (0); vestigial (1). [P2003: 4; O2004: 1; OA&R2009: 8].

Chelicera

8. Movable finger, subdistal teeth, number: one (0); two (1). [P2003: 9; O2004: 2; OA&R2009: 6].

Pedipalps

9. Femur, length (♂): greater than three times width (0); less than three times width (1). [O2004: 3; OA&R2009: 75].
10. Femur, dorsal surface, shape: slightly convex, DE and DI carinae situated in different axes (0); flat, DE and DI carinae situated in same axis (1). [O2004: 4].

11. Chela, shape: similar in both sexes or narrower (length/width ratio of pedipalp chela smaller) in ♂ than ♀ (0); more robust (length/width ratio of pedipalp chela greater) in ♂ than ♀ (1). [O2004: 5; OA&R2009: 60].
12. Chela manus, external surfaces, shape (♂): prismatic (0) flat (1). [O2004: 6].
13. Chela manus, surfaces adjacent to DMA carinae, shape (♂): D–DMA–DI carinae forming angle greater than 90° (0); D–DMA–DI carinae forming angle less than 90°. [O2004: 7].
14. Chela manus, DMA, DI and VM carinae, granulation (♂): absent, smooth (0); present, finely and densely granular (1).
15. Chela movable finger, shape (♂): straight (0); curved (1). [O2004: 8].
16. Chela manus, secondary sexual apophysis (♂): present (0); absent (1). [O2004: 9].
17. Chela manus, secondary sexual apophysis, shape (♂): conical (0); spiniform (1); lobate (2); conical-truncate (3); hornlike (4); inapplicable (-). [P2003: 25; O2004: 10; OA&R2009: 61].
18. Chela manus, secondary sexual apophysis, position (♂): close to base of fixed finger, distal to trichobothrium *ib* (0); in distal third of manus, proximal to trichobothrium *ib* (1).
19. Chela fixed finger, group of granules at base (♂): absent (0); present (1). [P2003: 26; O2004: 11; OA&R2009: 62].
20. Chela fingers, median denticle rows, number: single row (0); multiple rows (1). [P2003: 27; O2004: 12; OA&R2009: 64].
21. Chela movable finger, median denticle row, relative denticle size: all denticles equal in size (0); basal denticle greatly enlarged, approximately five times larger than other denticles (1).

Trichobothria

22. Chela manus, trichobothrium *ib*, position (♂): situated at base of ventral side of secondary sexual apophysis, visible in ventral view (0); situated at base of internal side of apophysis, not visible in ventral view (1); situated more distal to apophysis, visible in ventral view (2). [O2004: 13].
23. Chela manus, trichobothrium *Esb*, position: intermediate between Eb_1 and Eb_2 (0); dorsal to Eb_2 (1); intermediate between Eb_2 and Eb_3 (2). [O2004: 14; OA&R2009: 53].
24. Chela manus, trichobothrium Et_3, position: distal to *Est* (0); in same axis as *Est* (1); proximal to *Est* (2). [O2004: 15; OA&R2009: 54].
25. Chela manus, trichobothrium V_2, position: forming obtuse angle (< 180°) with V_1 and V_3 (0); in same axis as V_1 and V_3 (1). [O2004: 16].
26. Chela fixed finger, trichobothrium *dst*, position: in same axis as *est* (0); proximal to *est* (1). [O2004: 17].
27. Chela manus, trichobothrium *Db*, position: close to *Dt* (0); equidistant between *Dt* and Eb_3 (1). [O2004: 18].
28. Chela manus, trichobothrium Et_5, position: forming acute angle (< 90°) with *eb* and Et_4 (0); forming obtuse angle (< 180°) with *eb* and Et_4 (1). [O2004: 19].

Legs

29. Legs III and IV, telotarsi, ventrosubmedian spiniform macrosetae, number of pairs: three (0); more than five (1). [O2004: 20; OA&R2009: 39].

Genital operculum

30. Genital sclerites, shape (♀): rhomboid (0); posteriorly elongated, anterior edge slightly rounded (1).

Sternites and Metasoma

31. Sternite VII, carinae: absent (0); VL and/or VSM carinae present (1). [O2004: 21; OA&R2009: 81].

32. Metasomal segment I, VSM carinae (♀): absent (0); present (1). [O2004: 22; OA&R2009: 91].
33. Metasomal segment II, VSM carinae (♀): present (0); absent (1). [O2004: 23; OA&R2009: 92].
34. Metasomal segment II, VSM carinae (♂): present (0); absent (1). [O2004: 24].
35. Metasomal segment III, VSM carinae (♀): present (0); absent (1). [O2004: 25].
36. Metasomal segment IV, VSM carinae (♀): present (0); absent (1). [O2004: 26; OA&R2009: 97].
37. Metasomal segment IV, VSM carinae (♂): present (0); absent (1). [O2004: 27].
38. Metasomal segment V, VL carinae (♂): present in more than half of segment (0); restricted to posterior third (1); absent or reduced to few granules posteriorly (2). [O2004: 28; OA&R2009: 104].
39. Metasomal segment V, VL and VSM carinae, relative orientation: well separated, diverging (0); adjacent, subparallel (1); inapplicable (-). [O2004: 29].
40. Metasomal segment V, VSM carinae, orientation in posterior third: subparallel, not diverging (0); diverging slightly (1), diverging strongly, forming arc (2). [P2003: 82; O2004: 30; OA&R2009: 101; additive].
41. Metasomal segment V, VM carina: present, well developed (0), vestigial or absent (1). [O2004: 31].
42. Metasomal segment III, length (♂): less than or equal to width (0); greater than width (1). [O2004: 32; OA&R2009: 105].
43. Metasomal segment V, length (♂): less than or equal to twice width (0); greater than twice width (1). [O2004: 33; OA&R2009: 106].

Macrosetae

44. Pedipalp femur, dorsal macroseta (M_1) situated near *d* trichobothrium: present (0), absent (1). [O2004: 34].
45. Metasomal segment I, VSM macrosetae, number of pairs: two (0); three (1). [O2004: 35; OA&R2009: 83].
46. Metasomal segment III, VSM setae, number of pairs: two (0); three (1). [O2004: 36].
47. Metasomal segment IV, VSM setae, number of pairs: two (0); three (1); four (2). [O2004: 37; OA&R2009: 87; additive].

Hemispermatophore

48. Apex of lamina, shape of distal margin: subtriangular (0); rounded or subquadrangular (1). [O2004: 38].
49. Apex of lamina, length: greater than length of frontal crest (0); less than length of frontal crest (1); inapplicable (-).
50. Distal crest, shape: curved with respect to ventral border (0); parallel to ventral border (1); straight and diagonal to ventral border (2). [O2004: 40].
51. Semicircular depression at base of lamina, development: well developed, extended to basal portion (0); slightly developed (1); obsolete (2). [O2004: 41; additive].
52. Posterodistal fold: absent (0); present (1). [O2004: 42].
53. Frontal crest: absent (0); present (1). [O2004: 43; OA&R2009: 35].
54. Frontal crest, incision in distal border: absent (0); present (1); inapplicable (-). [O2004: 44].
55. Frontal crest, shape: undivided, with continuous, smooth borders, without undulations (0); divided in two parts, proximal oblique part with two lateral folds, distal part straight usually parallel to ventral margin of lamina, with lateral projections on each side (1); divided in two parts, distal part sinuous with strong undulation in dorsal border (2).; inapplicable (-). [O2004: 45].

56. Frontal crest, lateral projections of distal part, shape: reduced, length of projections less than length of proximal oblique part (0); elongated, length of distal part greater than proximal oblique part (1); inapplicable (-). [O2004: 47].
57. Capsule, internal lobe, development: similarly developed to external lobe (0); considerably more developed than external lobe (1). [O2004: 49].
58. Capsule, internal lobe, spiniform apophysis on external surface: absent (0); present (1). [O2004: 50].
59. Capsule, internal lobe, sclerotized apophysis on internal fold: absent (0); present (1). [O2004: 51].
60. Capsule, basal lobe, tortuous stem, subdistal spoonlike dilation ending in terminal process: absent (0); present (1). [O2004: 52].
61. Capsule, basal lobe, subdistal dilation, shape: widened (0); oval (1); elongated (2); inapplicable (-). [O2004: 53].
62. Capsule, basal lobe, terminal process, shape: short (0); elongated (1); inapplicable (-). [O2004: 54].
63. Capsule, basal lobe, spatulate terminal process: absent (0); present (1). [O2004: 55].
64. Capsule, basal lobe, papillose fold: absent (0); present (1). [O2004: 56].