Mauryius n.gen. (Scorpiones: Bothriuridae), a new neotropical scorpion genus

ANDRÉS A. OJANGUREN-AFFILASTRO[1] & CAMILO I. MATTONI *,[2]

[1] Museo Argentino de Ciencias Naturales "Bernardino Rivadavia" (MACN, CONICET), Avenida Ángel Gallardo 470, CP: 1405DJR, CABA, Buenos Aires, Argentina; Andrés A. Ojanguren-Affilastro [ojanguren@macn.gov.ar, andres.ojanguren@gmail.com] — [2] Laboratorio de Biología Reproductiva y Evolución, Instituto de Diversidad y Ecología Animal (IDEA, CONICET – UNC), Facultad de Ciencias Exactas, Físicas y Naturales, Universidad Nacional de Córdoba, Av. Vélez Sársfield 299, 5000, Córdoba, Argentina; Camilo I. Mattoni [camilomattoni@gmail.com] — * Corresponding author

Abstract

Mauryius n.gen., a new bothriurid scorpion genus from the Argentinean Precordillera, is described, and its phylogenetic position is discussed based on a phylogenetic analysis of morphological data. *Mauryius* n.gen. is the first scorpion genus endemic to the Argentinean Precordillera. It is most closely related to *Pachakutej* Ochoa, 2004 from the inter-Andean valleys of Peru and to *Rumikiru* Ojanguren-Affilastro, Mattoni, Ochoa & Prendini, 2012 from the Atacama Desert in Chile. *Mauryius cuyanus* n.sp., the only known species of the genus, is described. Biogeographical implications of *Mauryius* relationships are discussed.

Key words

Andes, Argentinean Precordillera, Bothriuridae, Scorpiones, new genus.

1. Introduction

The Argentinean Precordillera is a relatively small mountain range placed approximately between 29º and 32º southern latitude in eastern Argentina (Fig. 2), which includes some peaks that can reach more than 4000 m asl. It is situated east of the Andes, from which it is separated by valleys with an average altitude of 1000 m. The Precordillera has a different geological origin from the Andes, and corresponds to an old piece of land (Cuyania) originally related to Laurasia, which collided with Gondwana about 400 MYA, long before the raising of the Andes (about 50 MYA) (LAMB & DAVIS 2003; FINNEY 2007).

The scorpion fauna of the Argentinean Precordillera has never been studied in depth. It has only been briefly considered as a part of regional studies or in taxonomic descriptions (ROIG-JUÑENT et al. 2003; OJANGUREN-AFFILASTRO 2005; OJANGUREN-AFFILASTRO et al. 2009; OJANGUREN-AFFILASTRO et al. 2015). Up to now, the scorpion fauna of the area was considered to be continuous with the Andean fauna, with some impoverishment in endemic species due to its lower general altitude. Only recently, ACOSTA (2005) studied part of the scorpion fauna of the area when he redescribed *Orobothriurus bivittatus* (Thorell, 1877) from El Tontal Mountain, in San Juan Province, Argentina. Shortly after, this species was synonymized with *Orobothrius alticola* (Pocock, 1899) on the basis of more material collected in the same area by the first author (OJANGUREN-AFFILASTRO et al. 2009). In the same area (Figs. 1A, 2) and on the same collection trip in which we collected the specimens of *O. alticola*

Fig. 1. A: Habitat of *Mauryius cuyanus* n.gen. et n.sp. in Sierra del Tontal, San Juan Province, Argentina. **B**: Habitus in life of *Mauryius cuyanus* n.gen. et n.sp., male.

from El Tontal, we also collected a small number of specimens of an enigmatic scorpion (Figs. 1B, 4) that could not be assigned to any known genus of the family.

In this contribution, we describe this entity as *Mauryius* n.gen. and *Mauryius cuyanus* n.sp. We also present a phylogenetic analysis based on morphological data, in which we clearly establish the taxonomic position of the genus. *Mauryius* n.gen. is most closely related to *Rumikiru* Ojanguren-Affilastro, Mattoni, Ochoa &

Prendini, 2012, from the Atacama Desert in Chile, and to *Pachakutej* Ochoa, 2004, from the inter-Andean valleys of southern and central Peru. *Mauryius* n.gen. is the first known endemic scorpion genus from the Argentinean Precordillera. The taxonomic position of *Mauryius* n.gen. and the kind of environment and microhabitat where this genus and its closest relatives occur, allow us to presume a wider distribution of its ancestors in a much lower pre-Andean landscape.
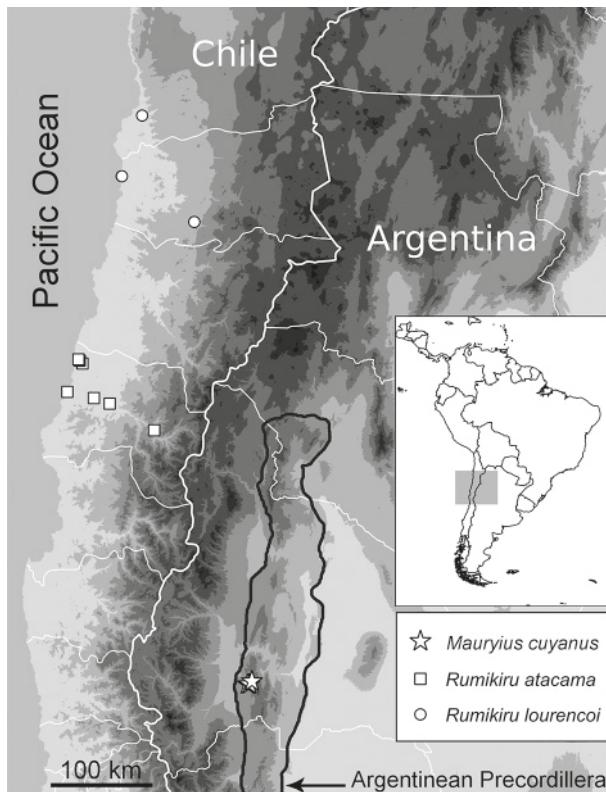
Fig. 2. Map of central Argentina and Chile (contour interval 1000 m), plotting known locality records of *Mauryius cuyanus* n.gen. et n.sp. (stars), *Rumikiru lourencoi* (Ojanguren-Affilastro, 2003) (circles) and *Rumikiru atacama* Ojanguren-Affilastro, Mattoni, Ochoa & Prendini, 2012 (squares). Thick white line: country limit; thin white line: province limits; black thick line: aproximate contour of Argentinean Precordillera.

2. Methods

2.1. Cladistic analysis

Taxa. We added the new species to a previously developed matrix of Andean bothriurids (MATTONI et al. 2012), that includes 15 species of *Orobothriurus* Maury, six of *Pachakutej*, four *Bothriurus*, and three exemplar species of other, more distantly related bothriurid genera: *Centromachetes pocockii* (Kraepelin, 1894), *Cercophonius sulcatus* Kraepelin, 1908 and *Urophonius tregualemuensis* Cekalovic, 1981. The matrix comprises a total of 31 species. The tree was rooted on *C. sulcatus*, based on previous evidence for the relationships among bothriurid genera (PRENDINI 2000, 2003a).

Materials. Specimens examined (complete list in MATTONI et al. 2012: Electronic Supplement Appendix S1) are deposited in the following collections: American Museum of Natural History, New York, U.S.A.; Cátedra de Diversidad Animal I, Universidad Nacional de Córdoba, Argentina; Field Museum of Natural History, Chicago,

U.S.A.; Instituto Miguel Lillo, Tucumán, Argentina; Laboratorio de Biología Reproductiva y Evolución, Universidad Nacional de Córdoba, Argentina; Museo Argentino de Ciencias Naturales "Bernardino Rivadavia," Buenos Aires, Argentina; Museo Nacional de Historia Natural, Santiago, Chile; Museo de Historia Natural, Universidad Nacional de San Antonio Abad del Cusco, Perú; Museo de Historia Natural, Universidad Nacional Mayor de San Marcos, Lima, Perú; Museo de Zoología, Universidad de Concepción, Chile; Museu de Zoologia, Universidade de São Paulo, Brazil; Museu Nacional, Rio de Janeiro, Brasil.

Characters. We used the same matrix as MATTONI et al. (2012), adding a new character (char. 8), for a total of 66, and modifying two (chars. 1 and 6). The complete list of characters and the matrix are available in the Electronic Supplement (Appendix S1 and Table S1 respectively).

Analyses. Analyses were conducted using TNT 1.5beta (GOLOBOFF et al. 2008). Heuristic search strategies were performed using traditional search with 100 random addition sequences (Wagner trees) followed by tree bisection-reconnection branch swapping (TBR), keeping up to 10 trees per replication (command sequence: "hold 1000; mult=tbr replic 100 hold 10;"). The resulting trees were used as starting points for a round of TBR branch swapping (command: "bbreak=TBR"). All trees found during searches were collapsed under "rule 1" (minimum possible length is zero; SWOFFORD & BEGLE 1993; CODDINGTON & SCHARFF 1994). The data matrix was analyzed under equal weights (EW) and implied weights (IW) (GOLOBOFF 1993). The sensitivity of results (*sensu* WHEELER 1995) was assessed by treating all characters unordered, and varying values of the concavity constant in the IW analyses ($k=1-20$; command: "Piwe=N", where "N" is the k value). Twenty-eight analyses were conducted in total, 14 (one EW and 13 IW analyses) with characters 41, 48 and 52 ordered, and 14 in which these characters were unordered. Results of the sensitivity analysis were summarized by means of a 50% majority rule tree (command: "majority=50"), whereas different optimal trees obtained from each analysis were summarized by means of strict consensus trees (command: "nelsen"). Adjusted homoplasy (or distortion) in IW analyses, measured with a convex increasing function (GOLOBOFF 1993, 1997), was calculated in TNT (command: "fit"). Character optimization was conducted using accelerated transformation (ACCTRAN) (FARRIS 1970; SWOFFORD & MADDISON 1987, 1992) in WINCLADA 1.00.08 (NIXON 1999–2002). Unambiguous optimizations were produced using TNT (command: "apo-"). The consistency index (CI; KLUGE & FARRIS 1969) and retention index (RI; FARRIS 1989) of the trees were calculated with TNT using the macro script "stats.run". Support values for each node were estimated using group frequencies under jackknifing (Jackknife support, JS; reviewed by GOLOBOFF et al. 2003), with a probability of alteration, P=0.36, by performing 1000 pseudoreplicates of ten random ad-

Table 1. Summary of statistical differences among most parsimonious trees (MPTs) obtained by analyses of 31 bothriurid scorpion species, including *Mauryius cuyanus* n.gen. et n.sp., all species of *Orobothriurus* Maury, 1976, *Pachakutej* Ochoa, 2004 and *Rumikiru* Ojanguren-Affilastro et al., 2012, with equal weights (EW) and implied weights (IW) with thirteen values for the concavity constant (*k*). Values presented for analyses with three characters (41, 48 and 52) ordered (additive) or unordered (non-additive). Length=number of steps under equal weights; MPTs=number of most parsimonious trees; CI=consistency index; RI=retention index; AH=adjusted homoplasy under concave weighting function of IW analyses; Av. JS=average support using Jackknife resampling (highest value in bold).

	Length	MPTs	CI	RI	AH	Av. JS
EW	182 / 179	18 / 18	0.456 / 0.464	0.801 / 0.804	–	24.5 / 29.7
IW k = 1	189 / 186	3 / 3	0.439 / 0.446	0.787 / 0.789	30.098 / 28.371	31.7 / 33.9
IW k = 2	183 – 185 / 181 – 182	26 / 4	0.449 – 0.454 / 0.456 – 0.459	0.795 – 0.799 / 0.798 – 0.8	22.731 / 21.55	29.7 / 32.9
IW k = 3	182 / 179	1 / 1	0.456 / 0.464	0.801 / 0.804	18.277 / 17.402	29.8 / 32.8
IW k = 4	182 / 179	1 / 1	0.456 / 0.464	0.801 / 0.804	15.327 / 14.625	29.4 / 32.8
IW k = 5	182 / 179	1 / 1	0.456 / 0.464	0.801 / 0.804	13.216 / 12.633	29.5 / 32.7
IW k = 6	182 / 179	1 / 1	0.456 / 0.464	0.801 / 0.804	11.626 / 11.128	29.3 / 32.6
IW k = 7	182 / 179	1 / 1	0.456 / 0.464	0.801 / 0.804	10.383 / 9.949	29.3 / 32.6
IW k = 8	182 / 179	1 / 1	0.456 / 0.464	0.801 / 0.804	9.383 / 9	29.3 / 32.5
IW k = 9	182 / 179	1 / 1	0.456 / 0.464	0.801 / 0.804	8.561 / 8.218	29.1 / 32.5
IW k = 10	182 / 179	1 / 1	0.456 / 0.464	0.801 / 0.804	7.881 / 7.562	29.2 / 32.4
IW k = 12	182 / 179	1 / 1	0.456 / 0.464	0.801 / 0.804	6.783 / 6.524	28.8 / 30.6
IW k = 15	182 / 179	1 / 1	0.456 / 0.464	0.801 / 0.804	5.62 / 5.412	30.6 / **34.1**
IW k = 20	182 / 179	1 / 1	0.456 / 0.464	0.801 / 0.804	4.374 / 4.217	30.5 / 32.3

dition sequences, each followed by TBR swapping, keeping up to ten trees (command sequence: "mult: noratchet repl 10 tbr hold 10; resample jak frequency repl 1000;"). The average JS of each phylogenetic hypothesis was calculated with TNT, and used as a criterion for choosing among alternative trees (Källersjö et al. 1999).

2.2. Systematics

All new material reported here was collected by the authors; most of it was collected at night by UV detection, using a 32 UV LED lamp inserted into Maglite® 3D flashlights, as well as hand-made 152 UV LED lamps connected to 12 V batteries. Some material was also collected in the daytime under stones. Abbreviations for collections are as follows: LBRE: Laboratorio de Biología Reproductiva y Evolución, Universidad Nacional de Córdoba, Argentina; MACN-Ar: Museo Argentino de Ciencias Naturales "Bernardino Rivadavia", Buenos Aires, Argentina; AMNH: American Museum of Natural History, New York, USA; AMCC: Ambrose Monell Collection for Molecular and Microbial Research, New York, USA.

Measurements, taken using an ocular micrometer, were recorded in mm. Descriptive terminology follows Mattoni & Acosta (2005) for hemispermatophores; Vachon (1974) for trichobothria; Francke (1977) for metasomal carinae, abbreviated as follows: DL: dorsolateral; LIM: lateral inframedian; LSM: lateral supramedian; LM: lateral median; VSM: ventral submedian; VL: ventrolateral; VM: ventromedian; and Prendini (2000) for pedipalp carinae, abbreviated as follows: DI: dorsal internal; DE: dorsal external; VI: ventral internal; VE: ventral external; D: digital; E: external; IM: internomedian; EM:

externomedian; V: ventral; VM: ventral median; DM: dorsal marginal; DS: dorsal secondary.

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) 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/).

Point locality records were georeferenced in the field with portable Global Positioning System devices (Garmin® Etrex Vista and Etrex Vista C). The distribution map was generated using QGIS 2.0.1 (QGIS Development Team, 2013), by superimposing the point locality records of species on coverages depicting the political boundaries and topography of Argentina and Chile. The topographic coverage was generated from a digital elevation model file (30-arc seconds resolution) obtained from the Global Multi-resolution Terrain Elevation Data 2010 (GMTED2010, U.S. Geological Survey (USGS) and the National Geospatial-Intelligence Agency (NGA)), available at http://earthexplorer.usgs.gov/.

3. Results

3.1. Cladistic analyses

In the analyses with equal weights (EW), 18 most parsimonious trees (MPT) were found, considering all characters unordered (length=179) or with three of them ordered (length=182) (Table 1). When using implied
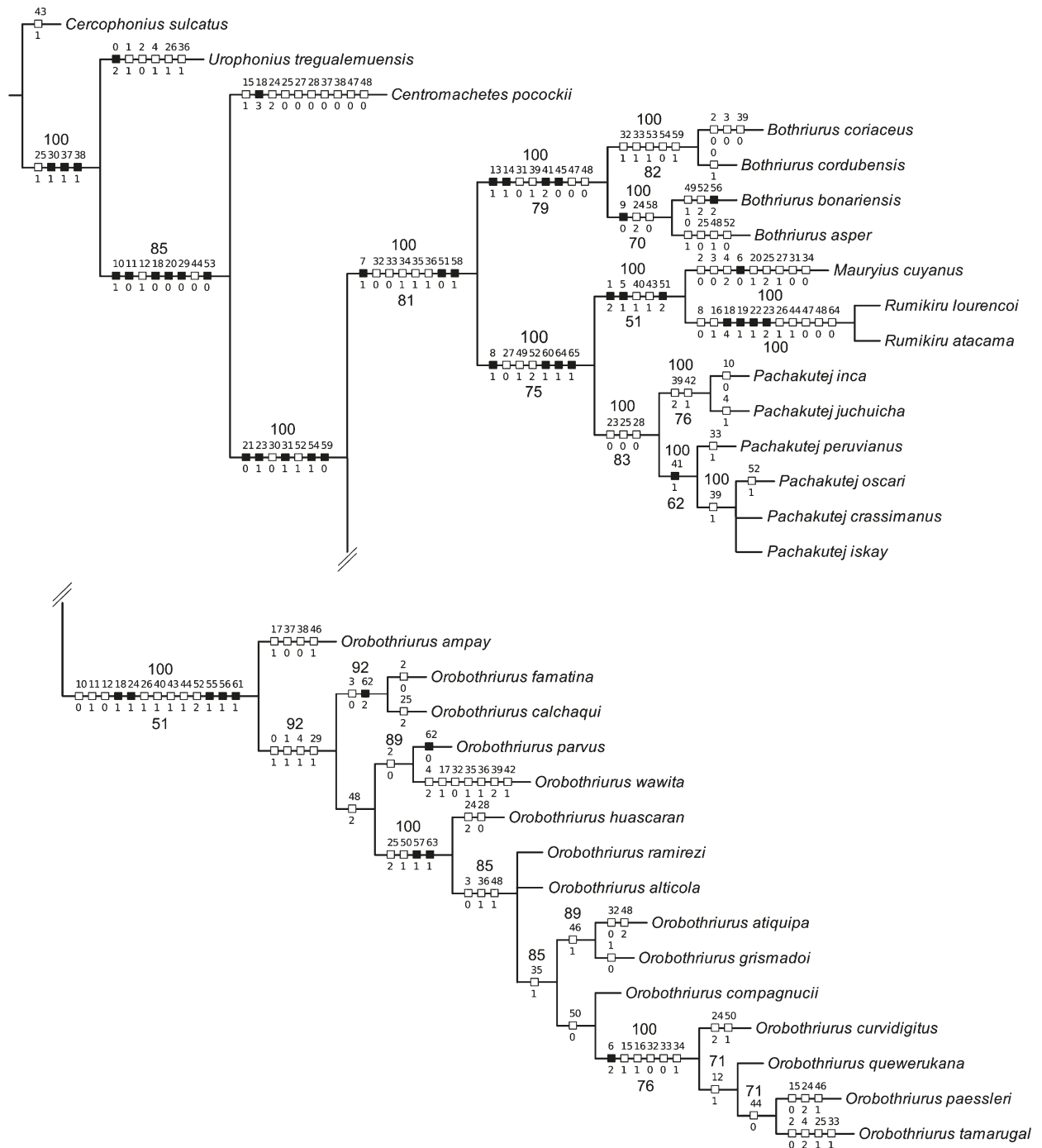
Fig. 3. Single most parsimonious tree obtained in cladistic analysis of 31 bothriurid scorpion species, including *Mauryius cuyanus* n.gen. et n.sp., all species of *Orobothriurus* Maury, 1976, *Pachakutej* Ochoa, 2004 and *Rumikiru* Ojanguren-Affilastro et al., 2012, under implied weights ($k = 15$, adjusted homoplasy $= 5.412$, length $= 179$, all characters unordered). Characters optimized with accelerated transformation. Homoplasious and non homoplasious transformations respectively indicated by white and black squares along branches, with character numbers above and character states below each. Zero length branches collapsed under "rule 1". Jackknife percentages indicated below branches. Percentage of recovery of each node in all 28 analyses indicated above branches.

weighting (IW), fewer MPTs were found in most analyses (mostly a single tree), except when the concavity constant (k) was strong ($k = 1, 2$). In that case, more trees (three to 26) were retrieved, longer than the ones from the EW analyses (length $= 183 – 189$ with ordered characters, $181 – 186$ with unordered characters) (Table 1). All the other analyses with IW found a single MPT each, of the

same length as the ones from EW analyses. The average support increased in all the analyses with IW. The maximum average support was obtained in the analysis using $k = 15$, with all the characters unordered (Table 1), and this tree was selected as our preferred hypothesis (Fig. 3). Topological variations between all the MPT trees were minimal (see a majority consensus tree in Fig. 3 and in

Electronic Supplement Fig. S1). In all 28 analyses, using EW and IW, *Mauryius cuyanus* was placed as the sister group to *Rumikiru* species, but with low support (JS = 51 with *k* = 15; Fig. 3). Five unambiguous synapomorphies support this relationship (character states 1-2, 5-1, 40-1, 43-1, and 51-2). *Mauryius cuyanus* and *Rumikiru* are closely related to *Pachakutej* species, a relationship that was recovered in all the analyses, with good support (JS = 75 with *k* = 15). Three unambiguous synapomorphies support this relationship (character states 49-1, 60-1, and 65-1).

3.2.   Systematics

Family Bothriuridae Simon, 1880

Mauryius n.gen.
Figs. 1B, 4–9; Table 2

Type species. *Mauryius cuyanus* n.sp.

Etymology. The name of this genus is masculine in gender and derives from the surname of the Argentinean arachnologist Dr. Emilio Maury (1940–1998), who was the director of the MACN arachnology laboratory up to his death in 1998, and who has been the most important researcher in scorpion systematics from Argentina.

Diagnosis and comparisons. *Mauryius* n.gen. can be recognized by a combination of characters that is not present in any other genus of the family.

Mauryius presents a median notch on the anterior margin of the carapace; this represents an unambiguous autapomorphy of *Mauryius* (Fig. 5C,D) (Char. 6).

The overall external morphology as well as the shape of the hemispermatophore relates *Mauryius* most closely to *Rumikiru* and *Pachakutej*. *Mauryius* presents a small spatular projection in the basal lobe of the hemispermatophore (Fig. 9B,C), (Char. 64), like *Rumikiru* and *Pachakutej*. However in *Mauryius*, this spatular projection is different from the other genera, with a slightly but clearly narrower base, and two distal lobes. In *Rumikiru*, the narrower base is hardly discernible and there is only one distal lobe (OJANGUREN-AFFILASTRO et al. 2012), whereas in *Pachakutej* the base is noticeably narrower and presents two well-developed distal lobes (OCHOA 2004). *Mauryius* presents an internal fold in the basal lobe covered with very small papillae (Char. 65), a character also present, but much more developed, only in *Rumikiru* and *Pachakutej*. *Mauryius* can be easily separated from *Rumikiru*, because *Mauryius* lacks the hypertrophied basal tooth of the movable finger of pedipalp chela that is present in *Rumikiru* (Char. 22) (OJANGUREN-AFFILASTRO et al. 2012: fig. 25c); in that place, *Mauryius* presents denticles of normal size, or a denticle slightly more developed than the rest, which seems to be formed by two fused teeth. Additionally, the internal apophysis of the male pedipalp

chela of *Rumikiru* is conical and placed almost medially in the chela (OJANGUREN-AFFILASTRO et al. 2012: fig. 22c), whereas in *Mauryius* and *Pachakutej* it is subtriangular and placed on the base of the fingers (Fig. 6A,B,C) (OCHOA 2004; OJANGUREN-AFFILASTRO 2003; KOVARIK & OJANGUREN-AFFILASTRO 2013) (Char. 19).

The sternum of *Mauryius* is subpentagonal (Fig. 8A,B), a character which in Bothriuridae has only been observed in the Chilean endemic genus *Tehuankea* Cekalovic, 1973 and the African genera *Lisposoma* Lawrence, 1928 and *Brandbergia* Prendini, 2003. Both South American genera can be separated because *Mauryius* presents a single median row of denticles on the internal surface of the pedipalp fingers, whereas *Tehuankea* presents two or three median rows (Char. 21). Males of *Mauryius* present a very well-developed internal apophysis on the internal margin of the pedipalp chela (Chars. 17, 18), a character shared by most genera of Bothriuridae but not by *Lisposoma* and most probably nor by *Brandbergia* (the male of which is still unknown) (PRENDINI 2003a,b). *Mauryius* presents a very well-developed IM carina on its pedipalp chela, which is more developed in males (Figs. 6A, 7A), and a densely granular internal pedipalp surface connecting IM carina to DM and VI carinae, both characters that are more developed than in any other genus of the family.

Males of *Mauryius* present some internal granules on the basal internal margin of the fixed finger of the pedipalp chela (Char. 20). This character is shared only with males of *Urophonius*, *Cercophonius* and *Phoniocercus*. However, in these four genera this character is slightly different, since in *Mauryius* these granules are in a single line that are a clear continuum with the median row of granules of the internal margin of the pedipalp fixed finger (Fig. 6B), whereas in the other genera they tend to form a scattered group of granules more or less separated from the median row of granules of the pedipalp fixed fingers.

The anterior-external margin of the movable finger of chelicerae of males of *Mauryius* presents a conspicuous median constriction and an anterior hump (Fig. 5B) that is present only in males of *Pachakutej* (but less developed) and is absent in the rest of the family (Char. 8). *Mauryius* presents a very well sclerotized apophysis on the internal fold of the capsule of the hemispermatophore (Fig. 9B,C), which otherwise in the family is present only in *Rumikru* and *Pachakutej*; however, in these genera it is less developed than in *Mauryius*.

Included species. This genus contains only one species: *Mauryius cuyanus* n.sp.

Mauryius cuyanus n.sp.
Figs. 1B, 4–9; Table 2

Type material. *Argentina*, *San Juan Province*: Holotype male (MACN), "El Tontal" mountain chain, beside the dirt road leading to Communication Antennas placed at the top of the mountain; 17 km west from route 412 (S31º37′31.94″ W69º16′31.08″);
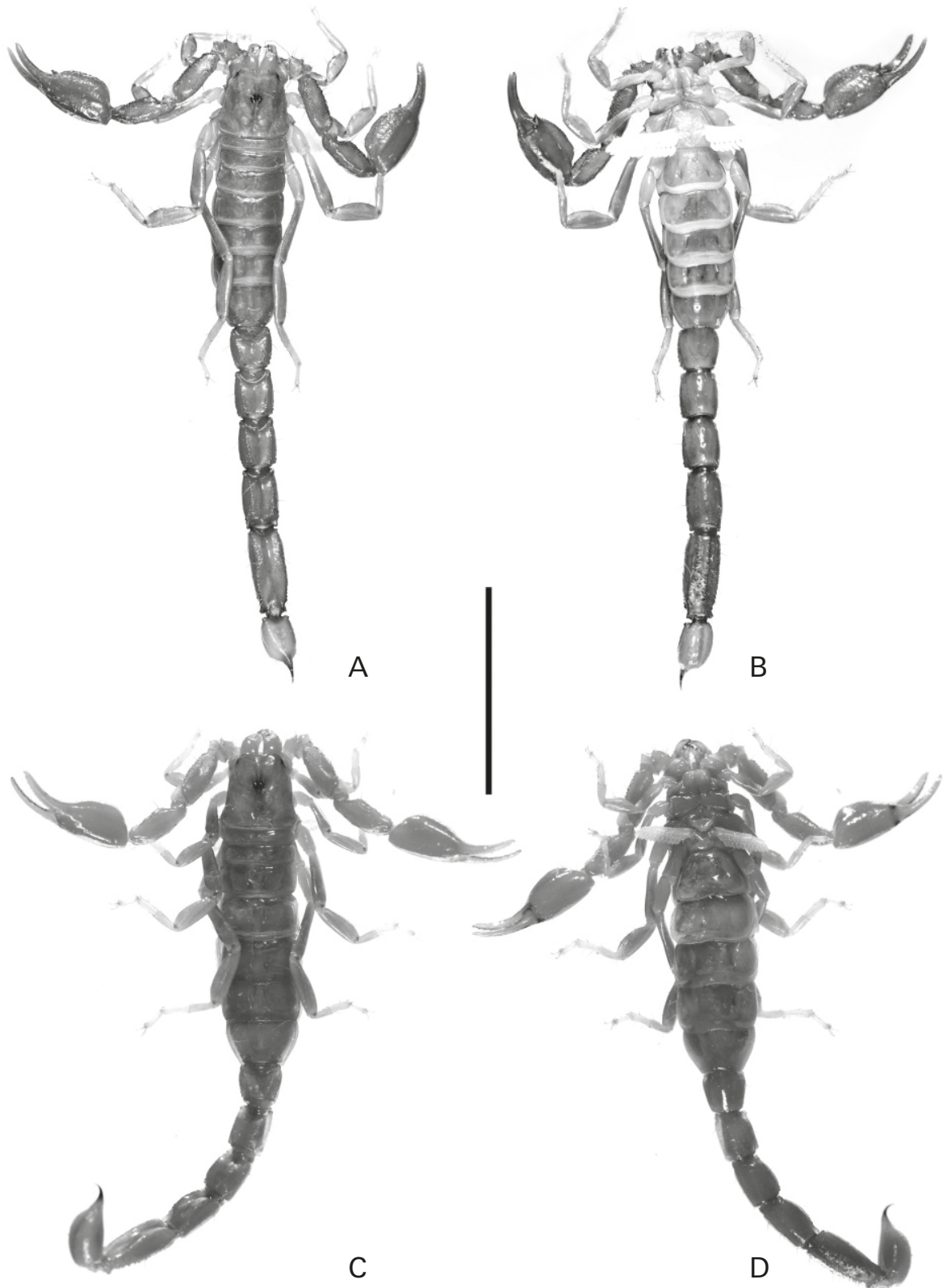
Fig. 4. *Mauryius cuyanus* n.gen. et n.sp. **A**,**B**: Holotype male. **C**,**D**: Paratype female. **A**,**C**: Dorsal aspect. **B**,**D**: Ventral aspect. (Scale bar = 10 mm)

2560 m asl, 17–19 December 2014; C.I. Mattoni, L. Piacentini & A.A. Ojanguren-Affilastro leg., UV detection. Paratypes: same data as holotype: 1 male, 1 female, 4 juveniles (MACN); 1 male, 1 juv. (LBRE); 1 male (AMNH); "El Tontal" mountain chain, beside the unpaved road leading to Communication Antennas placed at the top of the mountain, 21 km west from route 412 (S31º37′26.11″ W69º15′16.06″); 2682 m asl, 25 January 2006, 2 juveniles, one with left pedipalp removed (MACN), pedipalp (AMCC); collected under stones, L. Compagnucci, L. Piacentini & A.A. Ojanguren-Affilastro leg.
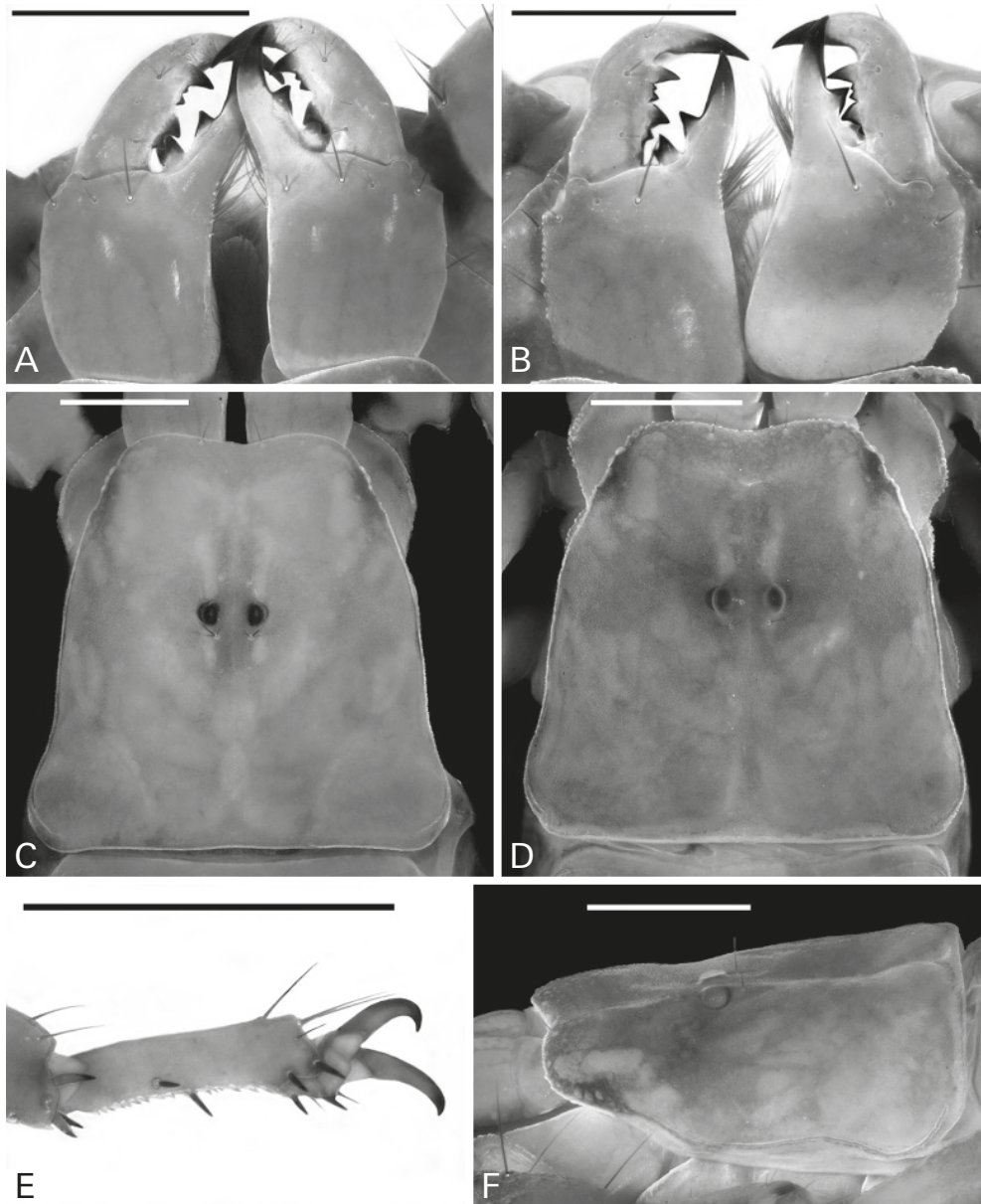
Fig. 5. *Mauryius cuyanus* n.gen. et n.sp. **A**: Chelicerae, female, dorsal aspect. **B**: Chelicerae, male, dorsal aspect. **C**: Carapace, female, dorsal aspect. **D**: Carapace, male, dorsal aspect. **E**: Telotarsus of leg III. **F**: Carapace, male, latero-dorsal aspect. (Scale bars: 1 mm)

Other studied material. *Argentina*, *San Juan Province*: 19 km west from route 412 (S31º35′31.38″ W69º13′43.72″); 2971 m asl, November 2013, UV detection, 2 juveniles (MACN); C.I. Mattoni, R. Botero-Trujillo, C. Grismado & A.A. Ojanguren-Affilastro leg.

Etymology. The specific epithet "*cuyanus*" is a noun in apposition, referring to the Argentinean area denominated "Cuyo" which includes three central Argentinean provinces: Mendoza, San Luis, and San Juan (to which *M. cuyanus* is endemic).

Diagnosis. As for the genus.

Description. Based on the holotype male (MACN) and paratypes (AMNH, LBRE, MACN).

Total length: 25–28.45 mm (*n*=4; mean=26.77) in adult males; 30.36 mm in the only known adult female.

Color: Base color yellowish, with faint brown pattern on chelicerae, carapace, tergites and legs. Pedipalps, sternites, pectines, metasoma and telson unpigmented except for the apex of the aculeus that is reddish dark brown. Some specimens tend to be more brownish, and others are yellowish almost devoid of pigment (Figs. 1B, 4A–D).

Carapace: Dorsoventrally compressed (Fig. 5F); anterior margin with a conspicuous broad median notch that divides the anterior margin into two lobes (Fig. 5C,D). Surface finely granular on males (Fig. 5D), smooth on females (Fig. 5C), more densely granular on the lateral margins. Anteromedian longitudinal sulcus obsolete, interocular sulcus poorly marked; posteromedian longitudinal and posterolateral sulci present and conspicuous, but not very deep. Median ocular tubercle shallow, situated in a depression, only median part of each ocellus slightly protruding above carapace in lateral profile; me-
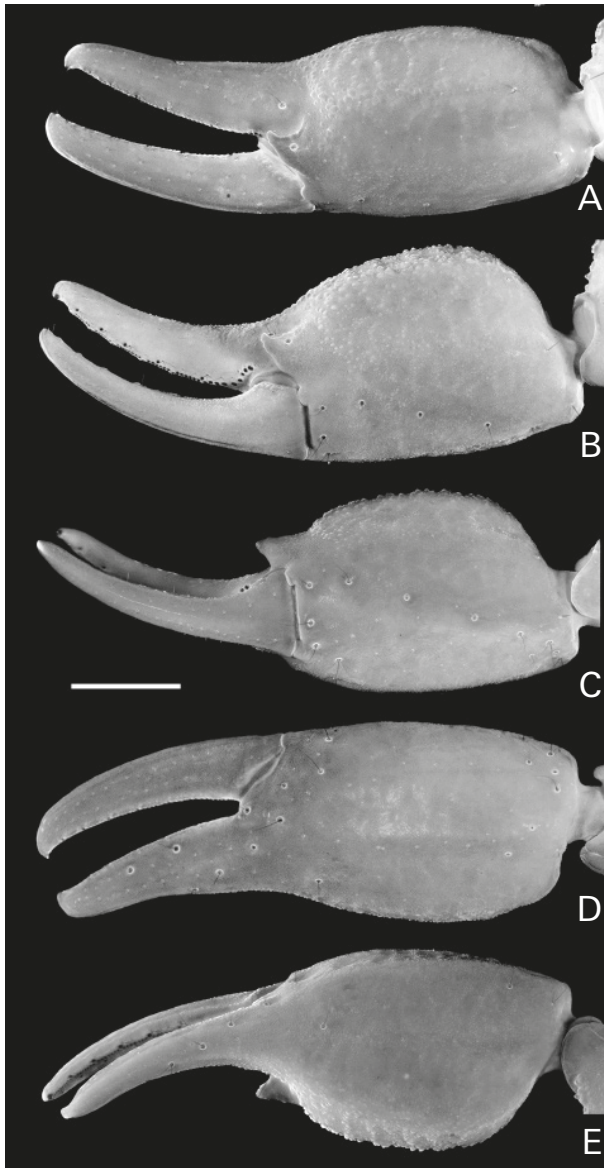
Fig. 6. *Mauryius cuyanus* n.gen. et n.sp., right pedipalp chela, male. **A**: Internal aspect. **B**: Ventro-internal aspect. **C**: Ventral aspect. **D**: External aspect. **E**: Dorsal aspect. (Scale bar: 1 mm)

Fig. 7. *Mauryius cuyanus* n.gen. et n.sp. **A,B**: Right pedipalp chela, female, internal aspect (A) and ventral aspect (B). **C,D**: Left pedipalp patella, male, external aspect (C) and ventral aspect (D). **E**: Left pedipalp femur, male, dorsal aspect. (Scale bars: 1 mm)

dian ocelli small, approximately one diameter apart, with one pair of microsetae anteriorly and one pair of macrosetae posteriorly. Three pairs of small lateral ocelli on each side of carapace, 2 larger anterior ocelli in the same horizontal axis, and a smaller posterior ocellus situated slightly dorsal to the others, lateral ocelly pattern type 3A (Loria & Prendini 2014).

Chelicerae: Movable finger, distal internal tooth well developed, strongly curved, forming an angle of almost 90° with the rest of the finger, and slightly displaced ventrally respect to the line formed by the other teeth; with two well-developed subdistal teeth (Fig. 5A). In males, the anterior-external margin of the movable finger with a conspicuous median constriction and an anterior hump (Fig. 5B).

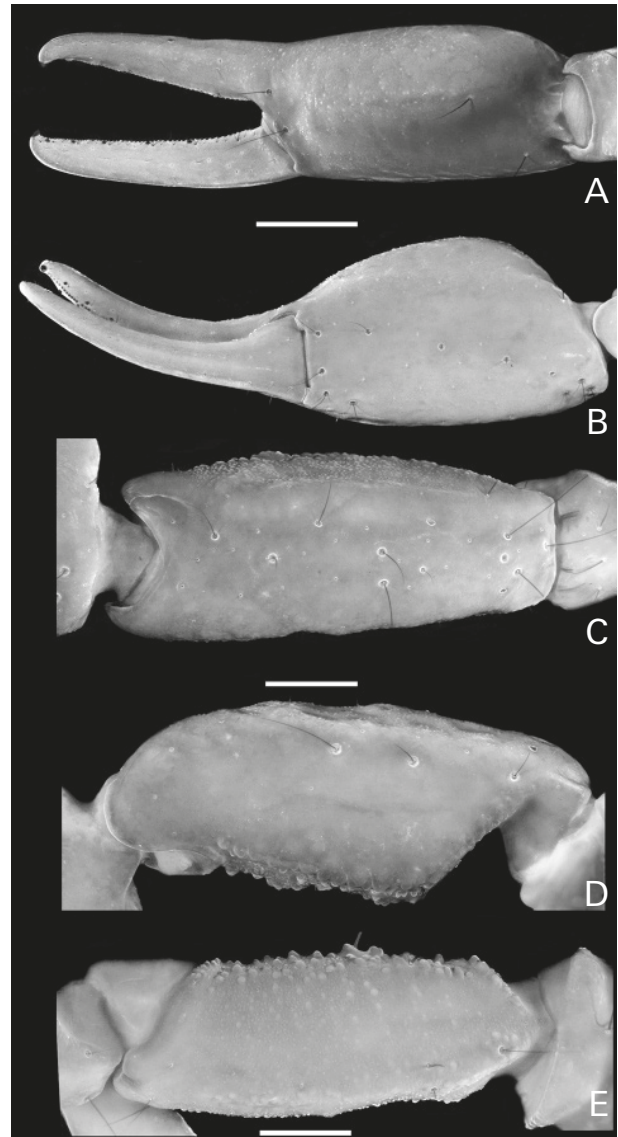*Pedipalps*: Femur, surface sparsely granular (males) (Fig. 7E), less so in females, with some smooth areas;

VE carina absent; DE, DI and VI carinae granular and well-developed, extending the entire length of the segment (males); less developed in females, the DE and DI being poorly developed. Patella (Fig. 7C,D), intercarinal surfaces sparsely granular (males) or smooth (females); DI, VI, and VE carinae granular, extending the entire length of the segment, DE carina also present but less developed (males); in females DI and VI are represented by some scattered granules, DE and VE carinae absent; EM carina obsolete, reduced to slight curvature of surface along entire length of segment; IM carina absent. Chela manus globose, more robust in males, length/width ratio 2.67 – 2.79 in males ($n=4$; mean$=2.74$), 3.16 in the only known adult female; length/height ratio 2.66 – 2.97 in males ($n=4$; mean$=2.81$), 3.29 in the only known adult female; males with a small subtriangular apophysis near the base of the movable finger (Fig. 6A – C), which is ab-
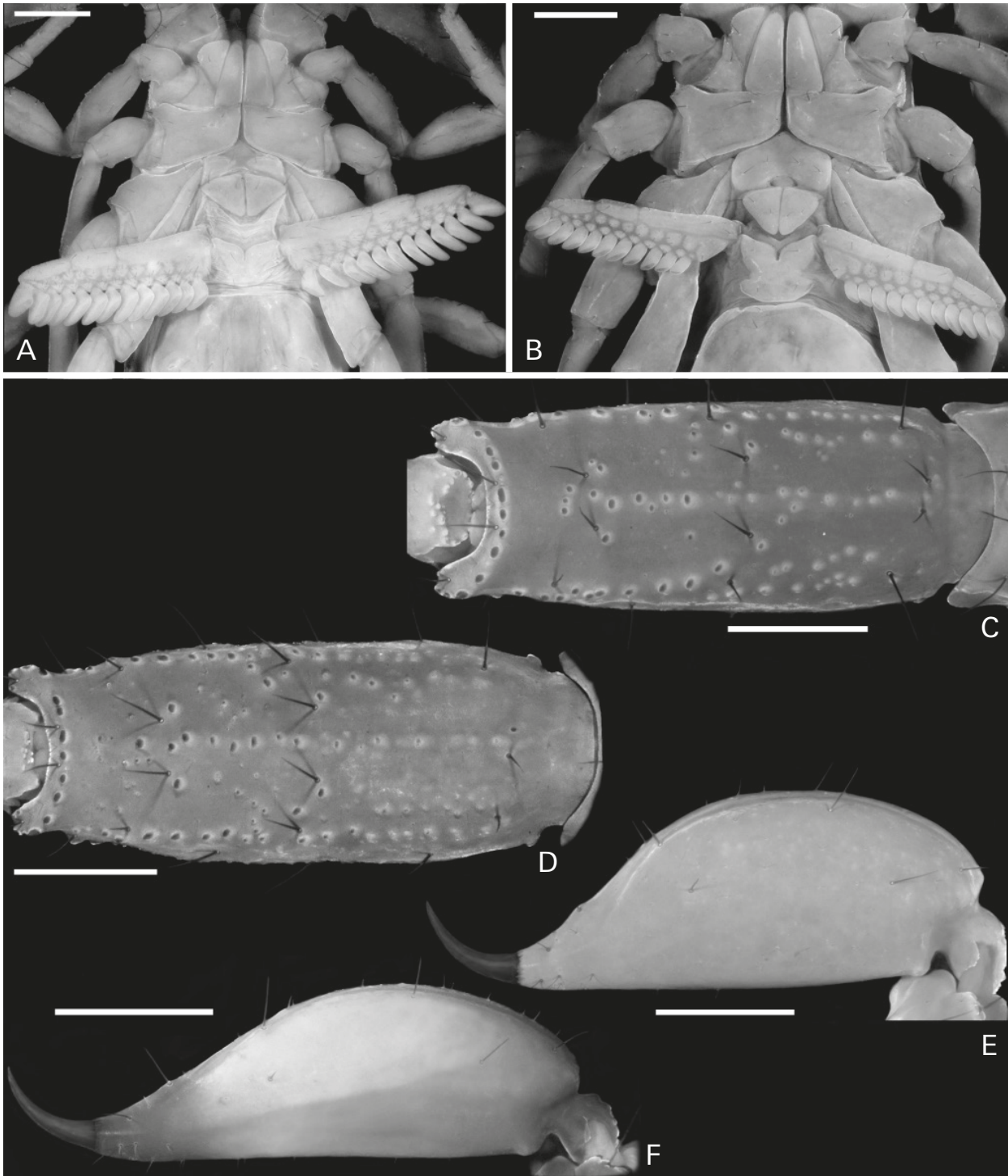
Fig. 8. *Mauryius cuyanus* n.gen. et n.sp. **A,B**: Prosoma, sternum, genital operculum and pectines of male (A) and female (B), ventral aspect. **C,D**: Metasomal segment V of male (C) and female (D), ventral aspect. **E,F**: Telson of female (E) and male (F), lateral aspect. (Scale bars: 1 mm)

sent in females (Fig. 7A,B); this internal apophysis of males is slightly curved dorsally, and partially surrounds an internal smooth depression (Fig. 6A); carinae of females poorly developed or absent, IM carina complete, well developed, and formed by tiny granules (Fig. 7A), VI complete and represented by an elevation of the tegument (Fig. 7B), DS evident as subtle lobe near articulation with patella, rest of carinae obsolete or absent; cari-

nae of males as follows: DM, IM, and VI carinae finely granular, extending entire length of segment (Fig. 6E), the IM carinae densely granular and connecting to DM and VI carinae by several granules (Fig. 6A); DS, D, ES and VM carinae extending the entire length of the manus (Fig. 6D), and represented by a well-developed elevation of the tegument; rest of carinae obsolete or absent; fixed and movable fingers medium-sized and slightly curved,

each with 1 median denticle row and 4–6 pairs of internal and external accessory denticles, the basal external accessory granule forming part of the median row; first 2 basal denticles of median denticle row of movable finger can be partially fused to each other; basal denticles of fixed finger of males not restricted to the internal margin of the finger, with four or five denticles following the internal curve of the base of the finger (Fig. 6B), but not forming a group of isolated denticles. Trichobothrial pattern neobothriotaxic major Type C, with one accessory trichobothrium in *V* series of chela; femur with 3 trichobothria (*d*, *i*, *e*), one macroseta (M1) associated with *d* and *i* (Fig. 7E), *e* situated in same axis as, or slightly proximal to M1; patella, with 19 trichobothria (2 *d*, *i*, 3 *et*, *est*, 2 *em*, 2 *esb*, 5 *eb*, 3 *V*), esb_1 petit (Fig. 7C); chela with 27 trichobothria (*Dt*, *Db*, 5 *Et*, *Est*, *Esb*, 3 *Eb*, *dt*, *dst*, *dsb*, *db*, *et*, *est*, *esb*, *eb*, *ib*, *it*, 5 *V*), Et_4 petit (Fig. 6D), *Esb* forming triangle with Eb_1 and Eb_2 (Fig. 7B).

Legs: surfaces smooth, except for ventral and dorsal margins of femur and patella of males that are slightly granular. Basitarsi each with 2 well-developed, equal-length pedal spurs. Telotarsi elongated, shallow, each with a ventromedian row of small spinules, and pro- and retrolateral rows of short spiniform macrosetae, with following counts, on leg I: 1/1, II: 2/2, III and IV: 3/3; basal pair of spiniform macrosetae of legs III and IV not in the same transversal line with respect to the axis of the segment. Ungues well-developed, equal in length and curved (Fig. 5E).

Sternum: Subpentagonal, with 2 well-developed lateral lobes connected to each other medially (Fig. 8A,B).

Genital opercula: Sclerites subtriangular, similar in males and females but slightly more elongated laterally in males (Fig. 8A) than in females (Fig. 8B).

Pectines: With one row of median lamellae; first lamella conspicuously more elongated in females (Fig. 8B). Fulcra present, small. Pectinal teeth medium-sized; tooth count: 13-13 in males (*n*=4; median=13), 11-11 in the only known adult female; retrolateral margins covered posteriorly with peg sensillae; sensillae field more developed in males.

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

Sternites: Sternites III–VII, surfaces entirely smooth; III–VI each with small, elliptical spiracles.

Metasoma: Metasomal segment I: dorsal surface finely granular (males), or smooth (females); DL and LM carinae granular, extending entire length of segment, LSM carina restricted to some scattered posterior granules; LIM carinae granular, restricted to posterior half of segment; one pair of LIM macrosetae anteriorly; all carinae less developed in females, LIM carina ob-

solete; surface between LSM and LIM carinae sparsely granular on males, or smooth on females; lateral margins and ventral surfaces smooth, acarinate; two pairs of VL and VSM macrosetae. Segment II as for I, but carinae less granular, LSM carinae reduced to some intermediate granules in the lateral margin of segment (males), or absent (females); LM carina extending the entire length of segment (males), or reduced to a couple of anterior and posterior granules (females); LIM carina reduced to posterior third of segment (males), or absent (females); ventral surface smooth, acarinate, with three pairs of VSM and VL macrosetae. Segment III as for II but less granular, with carinae less developed; DL carinae complete, LSM carina reduced to a few intermediate granules (males), or absent (females); LM carina represented by some well-developed anterior and posterior granules, and poorly developed granules medially (males), or reduced to some poorly developed anterior and posterior granules (females); LIM carina restricted to a slight elevation of the tegument near the posterior margin (males) or absent (females), ventral surface as on segment II. Segment IV slightly more elongated than preceding segments; DL carinae granular, extending entire length of segment; one pair of DL macrosetae medially; LSM carina reduced to few intermediate granules (males) or absent (females); LM carina restricted to anterior and posterior thirds of segment, almost smooth medially; LIM carina absent, ventral surface as on segment III. Segment V elongated; dorsal surface smooth except for some granules near dorsolateral margin; DL carina granular, extending the entire length of the segment; one pair of DL macrosetae; lateral surfaces acarinate, sparsely granular near superior and inferior surfaces; LM carinae represented only by two pairs of LM macrosetae on median part of the segment; ventral surface sparsely granular (Fig. 8C,D), slightly more densely granular on males; with three pairs of VL macrosetae and three pairs of VSM macrosetae, plus one pair of each at posterior margin of segment; VL carinae granular, extending almost the entire length of the segment, VSM carinae subparallel to VL carinae, poorly developed and barely discernible, restricted to median part of the segment and contiguous with VL carinae at margins; VM carina granular, extending the entire length of segment.

Telson: Vesicle shallow in males (Fig. 8F), more globose in females (Fig. 8E); length/height ratio 3.00–3.16 in males (*n*=4; mean=3.04), 2.81 in the only known adult female; dorsal surface smooth, telson gland not very conspicuous, but represented by an elongated depression, containing abundant pores on cuticle; ventral surface slightly granular; three pairs of VL and four pairs of VSM macrosetae. Aculeus short, moderately curved.

Hemispermatophore: Basal portion well developed. Distal lamina well developed, slightly longer than basal portion (Fig. 9A); apex well-developed, occupying more than the distal half of the distal lamina; distal crest slightly convex, forming a concave surface on apical third limited by a small transversal keel; frontal crest well developed, almost straight, occupying slightly less than the
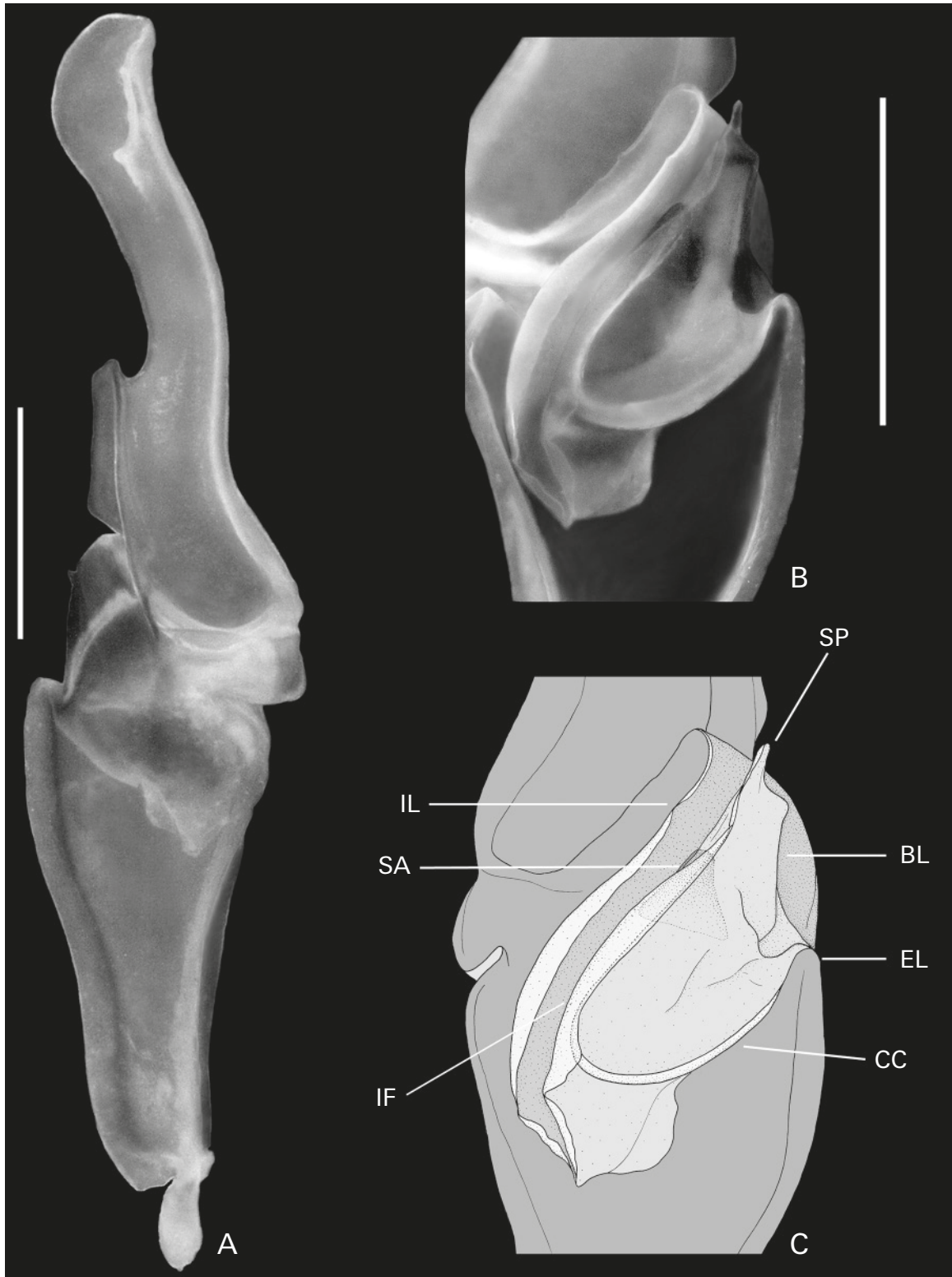
Fig. 9. *Mauryius cuyanus* n.gen. et n.sp., left hemispermatophore. **A**: Ectal aspect under UV light. **B**: Ental aspect, detail of lobe region, under UV light. **C**: Schematic figure of lobe region. — ***Annotations***: Internal Lobe (IL); Sclerotized Apophysis (SA); Internal Fold (IF); Capsular Concavity (CC); External Lobe (EL); Basal Lobe (BL); Spatular Process (SP). (Scale bars: 1 mm)

basal half of distal lamina. Lobe region well developed (Fig. 9B,C); basal lobe (BL) well-developed, with a distal spatular projection (SP) which presents a slightly, but clearly, narrower base, and two distal lobes, one distal lobe more acute, and one basal lobe broader and less developed (shallower); internal lobe (IL) with an internal fold (IF) bearing some barely visible scattered papillae; with a very well developed capsular concavity (CC); sclerotized apophysis (SA) subtriangular, very well developed.

Table 2. Measurements (mm) of *Mauryius cuyanus* n.gen. et n.sp. (holotype and paratype, MACN).

Specimen:	*Mauryius cuyanus*	
Type	Holotype	Paratype
Sex	♂	♀
Collection	**MACN**	**MACN**
Carapace:		
length	3.20	3.56
anterior width	2.00	2.28
posterior width	3.20	3.52
Chela:		
length	5.60	6.06
width	2.02	1.92
height	2.02	1.84
Patella:		
length	3.00	3.12
width	1.20	1.24
Femur:		
length	3.00	3.00
width	1.08	1.20
Mesosoma:		
length	8.89	10.60
Metasomal segment I:		
length	1.80	1.96
width	1.92	2.08
height	1.48	1.64
Metasomal segment II:		
length	2.00	2.04
width	1.80	1.80
height	1.52	1.60
Metasomal segment III:		
length	2.20	2.00
width	1.76	1.72
height	1.56	1.56
Metasomal segment IV:		
length	2.52	2.40
width	1.72	1.64
height	1.48	1,48
Metasomal segment V:		
length	3.72	3.64
width	1.66	1.60
height	1.44	1.40
Metasoma:		
total length	12.24	12.04
Telson:		
total length	3.92	4.16
vesicle width	1.52	1.84
vesicle height	1.24	1.48
Total length:	28.25	30.36

Distribution and habitat. *Mauryius cuyanus* n.sp. has been collected only at "El Tontal" mountain chain, in San Juan Province (Fig. 2), Argentina. This is a mountain range belonging to the Argentinean Precordillera. This species has been collected at intermediate altitudes between 2500 and 3000 m asl, in an area that could be assigned to the Prepuna vegetational formation, or to an ecotone between Monte and Prepuna vegetational formations. This species does not reach the upper level of the mountain (above 3000 m asl) which belongs to a clear Altoandina vegetational formation. *Mauryius cuyanus* is a litophilous species, which seems to prefer rocky reliefs (Fig. 1A). Most of the active specimens, captured at night under UV light, were collected on vegetationless scree slopes, comprising piles of stones accumulated below steep cliff faces. Most usually, specimens were hiding under these stones with little or no parts of the body exposed. Some specimens, however, were found walking over stones. Specimens collected during the day were always found under stones, and we did not detect any kind of burrow in the soil under these rocks. This microhabitat preference is quite uncommon in Bothriuridae and is shared only with the close genus *Rumikiru* (OJANGUREN-AFFILASTRO et al. 2012), from rocky reliefs in the Atacama Desert, Chile. Most species of Bothriuridae are fossorial, digging their burrows on exposed soils, or occasionally, under rocks. *Mauryius cuyanus* occurs in sympatry with *Bothriurus olaen* Acosta, 1997, *Brachistosternus montanus* Roig Alsina, 1977, and *Orobothriurus alticola* (Pocock, 1899). However, none of these species actually occurs in exactly the same microhabitat occupied by *Mauryius*.

4. Discussion

All the phylogenetic analyses placed *Mauryius cuyanus* as a sister species to *Rumikiru atacama* and *R. lourencoi*. This clade shares characters from the pigmentation pattern, all being completely unpigmented on tergite V (character state 1-2), and the males showing an unpigmented telson (character state 5-1), with glandular, light-yellow coloration, different from females (OJANGUREN-AFFILASTRO et al. 2012). The carinal configuration on the ventral side of metasomal segment V (character state 40-1) is the same in *Rumikiru* species and *Mauryius cuyanus*, and the proportion (length/width) of metasomal segment III similar (character state 43-1). Finally, the three species share a similar shape of the distal crest of the hemispermatophore, which is straight and diagonal to the ventral border (character state 51-2). Both genera also present a very similar overall aspect, with a comparatively depressed body shape, as well as strong chelae and short fingers, all of which could be related to the particular environment they inhabit. *Mauryius cuyanus* and *Rumikiru* species are also closely related to *Pachakutej* species, sharing at least three characters states (49-1, 60-1 and 65-1), all of them from the hemispermatophore; however, its external aspect and microhabitat preferences are clearly different (OCHOA 2004).

Another interesting similarity between *Mauryius* and *Rumikiru* is their restricted distribution, since both genera inhabit very small areas. This is particularly noticeable in *Mauryius*, whose distribution is restricted to a very narrow ecotone area of intermediate altitude in the small mountain range of the Argentinean Precordillera. This genus is apparently absent in the neighboring

Andes, since periodic surveys have been carried out in this area in the last 40 years (Roig-Alsina 1977; Ochoa et al. 2011; Fernandez-Campon et al. 2014; Ojanguren-Affilastro et al. 2009) and no representatives of this genus have ever been collected. The similar morphology and microhabitat preferences of *Mauryius* and *Rumikiru*, as well as their present restricted distribution on both sides of the Andes almost at the same latitude, suggest that their ancestors distribution predates the latest uplift of this mountain chain 10 – 5 MYA. At this period the Andes elevated about 3000 m to their current height in only 5 MY (Ghosh et al. 2006; Garzione et al. 2008), completely isolating both genera.

In turn, the common ancestor of *Mauryius* and *Rumikiru*, together with *Pachakutej*, must be even older, showing perhaps a wide distribution over the pre-Andean landscape on the western side of southern and central South America, from Peru to central Chile and Argentina. Before 10 MYA, the Andes had a much lower average altitude and the region had a less extreme climate than nowadays; therefore, at that period, this low mountain chain probably acted as a corridor for the ancient scorpion fauna, and not as a barrier, as it does nowadays. This is supported by the distribution of several scorpion genera such as *Orobothriurus* and *Brachistosternus* (Bothriuridae), and the species of *Tityus* of the *bolivianus* group (Buthidae) (Lourenco & Maury 1985; Ochoa 2004; Mattoni et al. 2012; Ojanguren-Affilastro et al. 2015; Ceccarelli et al. 2016).

Finally, we would like to point out the remarkably low number of specimens collected of *Mauryius* after three collection campaigns to the type locality. All campaigns were carried out at the end of spring, when most bothriurids have their peak of activity at this latitude; however, the low activity of *Mauryius* at this period, mostly males and juveniles, suggests that this genus was only beginning its period of activity at this season of the year. Most probably the peak of activity of this genus takes place after the heavy seasonal rainfalls that occur in central-western Argentina during the summer; however, we could not check this because the mountain path to access the type locality becomes impassable after these summer rainfalls due to the increase of the levels of the rivers in the area.

5. Acknowledgements

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Electronic Supplement File

at http://www.senckenberg.de/arthropod-systematics

File 1: ojanguren&mattoni-mauryius-asp2017-electronicsupplement-1.doc. – **Appendix S1**: Character list. – **Table S1**: Character matrix.

Zoobank registrations

at http://zoobank.org

Present article: http://zoobank.org/urn:lsid:zoobank.org:pub:0ECFEEE4-6274-41AE-B745-258FA23D0222

***Mauryius* Ojanguren-Affilastro & Mattoni, 2017:** http://zoobank.org/urn:lsid:zoobank.org:act:28BDABF4-3A97-45C5-BB05-70025C016955

***Mauryius cuyanus* Ojanguren-Affilastro & Mattoni, 2017:** http://zoobank.org/urn:lsid:zoobank.org:act:68326248-CF82-4898-879D-4C5E62D5E852