Zootaxa 5563 (1): 084–095
https://www.mapress.com/zt/

Article

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

https://doi.org/10.11646/zootaxa.5563.1.9
http://zoobank.org/urn:lsid:zoobank.org:pub:7077DBB2-A020-4E72-9A5B-7A21DD5112F9

New genus and species of short-tailed whipscorpion (Schizomida: Hubbardiidae) from the Venezuelan Amazon

PÍO A. COLMENARES[1,2*], JAIRO A. MORENO-GONZÁLEZ[1], OSVALDO VILLARREAL[2,3] & LORENZO PRENDINI[1]

[1]*Arachnology Lab, Division of Invertebrate Zoology, American Museum of Natural History, Central Park West at 79th Street, New York, NY 10024-5192, U.S.A.*
jmorenogonzalez@amnh.org; https://orcid.org/0000-0001-5980-1417
lorenzo@amnh.org; https://orcid.org/0000-0001-8727-7106

[2]*Instituto y Museo del Instituto de Zoología Agrícola, Facultad de Agronomía, Universidad Central de Venezuela, Maracay, Aragua, Venezuela*

[3]*Centro de Ecología, Instituto Venezolano de Investigaciones Científicas, km 11 carretera Panamericana, Altos de Pipe, Miranda 1204-A, Venezuela*
osvaldovillarreal@gmail.com; https://orcid.org/0000-0001-5355-3723

**Corresponding author: pcolmenares@amnh.org; https://orcid.org/0000-0002-9568-7217*

Abstract

A new genus and species of short-tailed whipscorpion (Schizomida: Hubbardiidae Cook, 1899) is described based on specimens collected in the Venezuelan state of Amazonas. The new genus differs from other Neotropical genera in the presence of six setae on opisthosomal tergite II, the absence of seta Dm_4 on the flagellum in both sexes, the female flagellum comprising four segments, and the median lobes of the spermatheca being four times longer than the lateral lobes. *Jipai longevus* gen. *et* sp. nov. increases the count of South American schizomid genera to fourteen and the count of species to 57. The type locality of the new taxon is situated in the Guiana region of Amazonia *s. l.*, where three other hubbardiid genera have also been recorded. This discovery contributes to the understanding of Amazonian schizomid diversity and highlights the need for further sampling in this diverse, vulnerable and poorly explored area.

Key words: Amazonia, Hubbardiinae, Neotropics, South America, morphology, taxonomy

Introduction

The arachnid order Schizomida Petrunkevitch, 1945 is composed of small (total length less than 30 mm), eyeless whipscorpions characterized by vertically oriented, raptorial pedipalps, a three-segmented prosoma (comprising a propeltidium, mesopeltidium, and metapeltidium), terminal repugnatorial gland openings on the opisthosoma, and a sexually dimorphic pygidial flagellum (Reddell & Cokendolpher 1995). Although circumtropical in distribution, schizomids, also known as short-tailed whipscorpions, are microhabitat specialists with low vagility. Most species are short-range endemics, with an extent of occurrence less than 10,000 km^2, and many are known only from a single locality (Harvey 2002; Harvey *et al.* 2011).

The order currently comprises two families (Protoschizomidae Rowland, 1975; Hubbardiidae Cook, 1899), 71 extant genera, and 376 extant species (WSC 2024). Thirteen genera and 56 species occur in South America, predominantly in Brazil, Colombia and Venezuela (WSC 2024). The schizomid fauna of Venezuela is the third most diverse in the region, with six genera and ten species recorded (WSC 2024). As in other taxa, recent sampling of South American schizomids focused mostly on the Andean region (Armas & Delgado-Santa 2012, 2013; Moreno-González & Villarreal 2012; Delgado-Santa & Armas 2013; Moreno-González *et al.* 2014; Villarreal *et al.* 2016; Moreno-González & Villarreal 2017). Although the Amazon is the World's largest tropical rainforest and occupies ca. 40% of the South American continent (Rocha & Kaefer 2019), relatively few studies have been conducted on Amazonian schizomids (Pinto-da-Rocha *et al.* 2016; Ruiz & Valente 2017, 2019; Salvatierra 2018). Notwithstanding

 Accepted by A. Pérez-González: 4 Dec. 2024; published: 3 Jan. 2025

that some of the first studies of schizomid behavior (Kraus & Beck 1967) and phenology (Adis *et al.* 1999, 2001) were conducted in the Amazon, only eight genera and 25 valid species, most of which (14 species) belong to the genus *Surazomus* Reddell & Cokendolpher, 1995, have been recorded from Amazonia *s. l.* (*sensu* Eva *et al.* 2005).

The present contribution describes a new genus and species of hubbardiid, based on specimens collected in the Venezuelan state of Amazonas. The new genus differs from other Neotropical genera in the presence of six setae on opisthosomal tergite II, the absence of seta Dm_4 on the flagellum in both sexes, the female flagellum comprising four segments, and the median lobes of the spermatheca being four times longer than the lateral lobes. *Jipai longevus* gen. *et* sp. nov. increases the count of South American schizomid genera to 14 (Fig. 1) and the count of species to 57. The type locality of the new taxon is situated in the Guiana region of Amazonia *s. l.*, where three other hubbardiid genera have also been recorded. This discovery contributes to the understanding of Amazonian schizomid diversity and highlights the need for further sampling in this diverse, vulnerable and poorly explored area.

Materials and Methods

The material examined is deposited in the Museo del Instituto de Zoología Agrícola (MIZA), Maracay, Venezuela, and the Invertebrate Zoology Collection of the American Museum of Natural History (AMNH), New York, U.S.A.

General morphological nomenclature follows Reddell & Cokendolpher (1995); cheliceral setation follows Lawrence (1969), modified by Villarreal *et al.* (2016); pedipalp setation follows Monjaraz-Ruedas & Francke (2016);

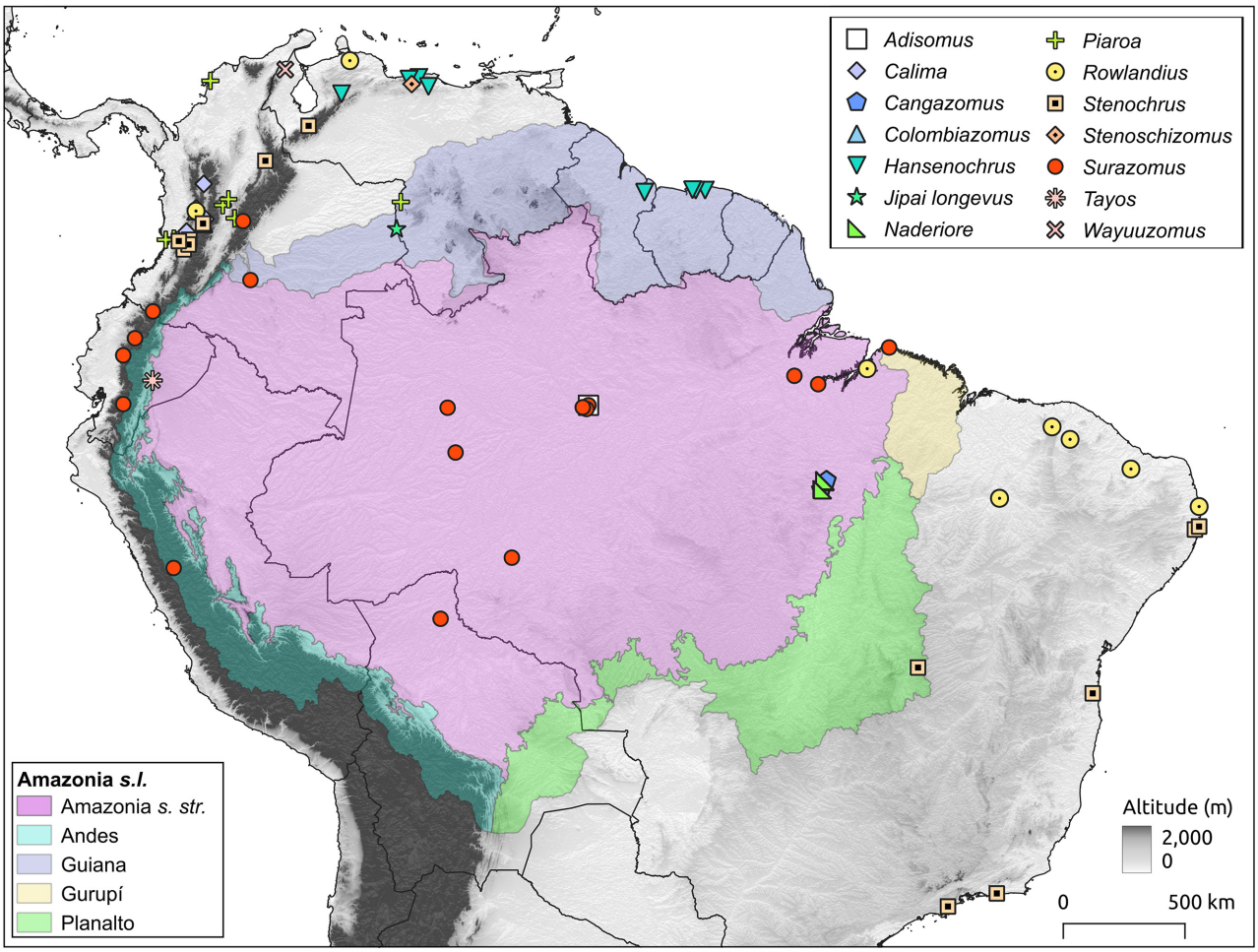

FIGURE 1. Known distributions of South American schizomid genera: *Adisomus* Cokendolpher & Reddell, 2000; *Calima* Moreno-González & Villarreal, 2012; *Cangazomus* Pinto-da-Rocha *et al.*, 2016; *Colombiazomus* Armas & Delgado-Santa, 2012; *Hansenochrus* Reddell & Cokendolpher, 1995; *Jipai* gen. nov.; *Naderiore* Pinto-da-Rocha *et al.*, 2016; *Piaroa* Villarreal *et al.*, 2008; *Rowlandius* Reddell & Cokendolpher, 1995; *Stenochrus* Chamberlin, 1922; *Stenoschizomus* Gonzalez-Sponga, 1997; *Surazomus* Reddell & Cokendolpher, 1995; *Tayos* Reddell & Cokendolpher, 1995; *Wayuuzomus* Armas & Colmenares, 2006. Amazonian boundaries after Eva *et al.* (2005).

opisthosomal setation follows Villarreal *et al*. (2016); flagellar setation follows Monjaraz-Ruedas *et al*. (2016); spermathecal structure follows Moreno-González *et al.* (2014); and male genitalia follows Ruiz & Valente (2023). The following abbreviations are used: chelicera: guard tooth (GT), cheliceral setal groups 1–5 ($G_{1–5}$); pedipalp setae: femur: dorsal (*Fd*), ectal (*Fe*), medial (*Fm*), ventral (*Fv*); patella: ectal (*Pe*), medial (*Pm*); tibia: external row (*Ter*), internal row (*Tir*), medial row (*Tmr*), ventral (*Tv*); male genitalia: medium septum (MS), pterapophysis (Pt); female genitalia: anterior branch (AB), chitinized arch (ChA), duct opening (DO), internal angle (IA), lateral lobe (LL), median lobe (ML), lateral tip (LT), posterior branch (PB); other setae: dorsolateral (*Dl*), dorsomedian (*Dm*), microsetae patch (*msP*), ventrolateral (*Vl*), ventromedian (*Vm*).

Photographs were taken with a Nikon DS-Qi2 camera, attached to a Nikon SMZ18 stereo microscope. Image stacking was conducted with Nikon NIS-Elements (https://www.microscope.healthcare.nikon.com/products/software/nis-elements). Vector illustrations of the chelicera and spermatheca were prepared using Inkscape 1.3.2. (https://inkscape.org) from photographs taken using an Amscope MU series 18 mp camera fitted to an Amscope CL-T720 trinocular compound microscope and stacked using ZereneStacker (https://zerenesystems.com).

A distribution map was prepared with QGIS 3.30 (http://www.qgis.org) using a digital elevation model, the raster Hillshade conversion (with layers on azimuths 45° and 145°) and a single band rendering (i.e., BrBg). The Amazonian boundaries proposed by Eva *et al.* (2005) were applied, using a shapefile from the European Commission (https://forobs.jrc.ec.europa.eu/amazon).

Taxonomy

Family Hubbardiidae Cook, 1899

Subfamily Hubbardiinae Cook, 1899

***Jipai* gen. nov.**
urn:lsid:zoobank.org:act:A1E64DE6-BB52-43E6-A8F8-41C88952D9EF

Type species. *Jipai longevus* sp. nov., by monotypy.

Diagnosis. In common with the following eleven Neotropical hubbardiid genera, *Jipai* gen. nov. possesses a female flagellum comprising four flagellomeres and three annuli (Figs. 5D–F, 6D–F): *Adisomus* Cokendolpher & Reddell, 2000; *Calima* Moreno-González & Villarreal, 2012; *Cangazomus* Pinto-da-Rocha *et al*. 2016; *Colombiazomus* Armas & Delgado-Santa, 2012; *Hansenochrus* Reddell & Cokendolpher, 1995; *Mayazomus* Reddell & Cokendolpher, 1995; *Naderiore* Pinto-da-Rocha *et al*. 2016; *Piaroa* Villarreal *et al*. 2008; *Rowlandius* Reddell & Cokendolpher, 1995; *Tayos* Reddell & Cokendolpher, 1995; *Wayuuzomus* Armas & Colmenares, 2006. However, these genera may be separated as follows. The presence of two pairs of lobes, median lobes (ML) and lateral lobes (LL), in the spermatheca (Fig. 4E) separates *Jipai* gen. nov. from *Adisomus*, *Calima*, *Piaroa*, and *Tayos*, each of which possess a single pair (LL), whereas the ML being significantly longer than the LL separates *Jipai* gen. nov. (Fig. 4E) from some species of *Hansenochrus*, *Rowlandius*, and *Wayuuzomus*, in which the ML are similar in length to the LL, and from *Cangazomus*, *Colombiazomus*, *Naderiore* and some species of *Hansenochrus* and *Rowlandius*, in which the ML are shorter than the LL. Additionally, the presence of more than one pair of setae on opisthosomal tergite II separates *Jipai* gen. nov. (Fig. 4A) from all the abovementioned genera, except some species of *Mayazomus*, which only possess a single pair.

Jipai gen. nov. most closely resembles *Mayazomus*, from which it can be distinguished by the linear ML of the spermatheca (Fig. 4E), six setae (*Dm*, Dl_1, and Dl_2) on opisthosomal tergite II (Fig. 4A), and the male pedipalp with a slender femur lacking setiferous tubercles distally, the patella not curved ventrally, and a ventral apophysis absent on the tibia (Fig. 3A). In *Mayazomus*, the ML of the spermatheca are curved, four (rarely five) setae (*Dm* and Dl_1) are present on tergite II, and the male pedipalp exhibits a robust femur with setiferous tubercles distally, the patella markedly curved ventrally, and a ventral apophysis present on the tibia.

Etymology. The generic name, masculine in gender, is a noun for soil or ground in Kurripako, a language of the Arawak linguistic family, spoken in parts of the Amazon in Brazil, Colombia and Venezuela. It refers to the substrate in which schizomids are commonly found.

***Jipai longevus* sp. nov.**
urn:lsid:zoobank.org:act:1684F0AB-0696-46E1-A7CB-DCAD73704447
Figures 1–6, Table 1

Diagnosis. As for genus.

Type material. Holotype ♂, paratype ♀ (MIZA), ♂, ♀ paratypes (AMNH), **Venezuela:** *Amazonas*: Municipio Atabapo: Comunidad Castillito, 83 m, 16.vii.2022, P.A. Colmenares, Q. Arias, E. Infante & O. Villarreal.

Etymology. The specific epithet recognizes the long career of Cuban arachnologist and zoologist Luis F. de Armas, who has worked on the Neotropical arachnid fauna for over five decades, producing numerous taxonomic contributions while mentoring generations of Latin American arachnologists.

Description. Based on the holotype ♂ (MIZA) and paratype ♀ (AMNH). Female as for male, except where noted otherwise. Measurements in Table 1.

Coloration: Prosoma dark yellowish brown; opisthosomal tergites and legs light yellowish brown; chelicerae and pedipalps medium yellowish brown (Fig. 2A–C).

TABLE 1. *Jipai longevus* gen. *et* sp. nov., measurements (mm) of holotype and paratype, respectively deposited in the in Museo del Instituto de Zoología Agrícola, Maracay, Venezuela, and the American Museum of Natural History, New York, U.S.A.

			Holotype ♂	**Paratype ♀**
Pro- + opisthosoma		total length	3.35	3.37
Prosoma		length	1.42	1.46
	propeltidium	length	1.06	1.11
		width	0.55	0.63
Opisthosoma		length	1.93	1.91
Flagellum		length	0.33	0.28
		width	0.26	0.06
		height	0.33	0.05
Pedipalp		total length	2.61	2.01
	trochanter	length	0.41	0.38
	femur	length	0.66	0.46
	patella	length	0.74	0.48
	tibia	length	0.48	0.40
	tarsus	length	0.21	0.19
	claw	length	0.11	0.10
Leg I		total length	4.11	4.01
	trochanter	length	0.31	0.29
	femur	length	1.04	1.01
	patella	length	1.21	1.17
	tibia	length	0.88	0.86
	basitarsus	length	0.27	0.27
	telotarsus	length	0.40	0.40
Leg IV		total length	3.24	3.54
	trochanter	length	0.23	0.30
	femur	length	0.99	1.03
	patella	length	0.44	0.43
	tibia	length	0.63	0.86
	basitarsus	length	0.57	0.55
	telotarsus	length	0.39	0.37

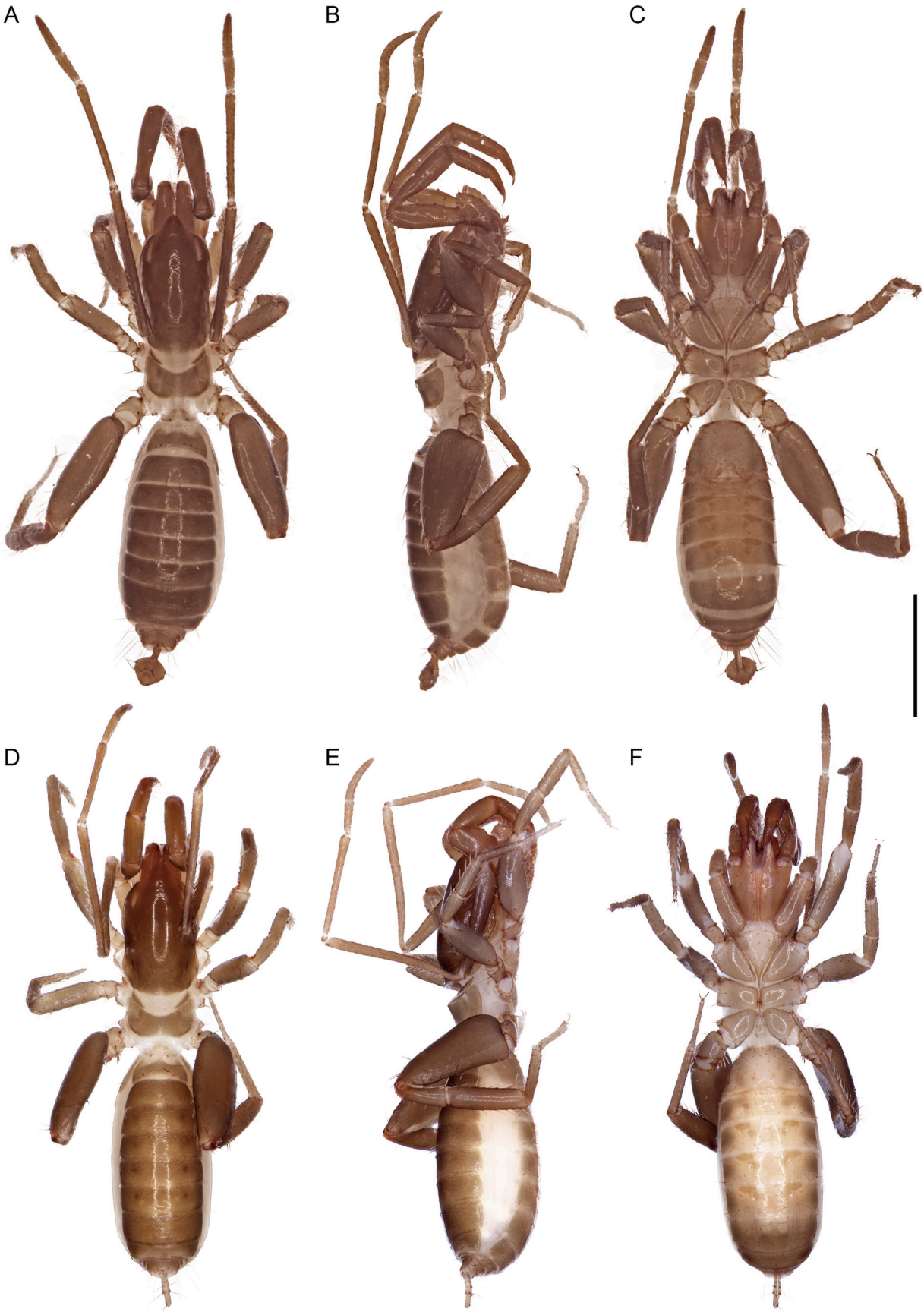

FIGURE 2. *Jipai longevus* gen. *et* sp. nov., habitus, dorsal (**A, D**), lateral (**B, E**) and ventral (**C, F**) aspects. **A–C.** Holotype ♂ (MIZA). **D–F.** Paratype ♀ (AMNH). Scale bar: 1 mm.

FIGURE 3. *Jipai longevus* gen. *et* sp. nov., pedipalps, retrolateral aspect. **A.** Holotype ♂ (MIZA). **B.** Paratype ♀ (AMNH). Scale bars: 0.1 mm.

Prosoma: Propeltidium anterior process with two setae, one posterior to the other, and three pairs of dorsosubmedian setae, posterior pair larger (Fig. 2A–C). Eyespot slender, elongated. Metapeltidium undivided. Anterior sternum with nine setae, plus three sternophysial setae; posterior sternum with six setae.

Chelicerae: Movable finger sharp and curved distally; serrula, composed of seventeen hyaline teeth, increasing in length distally; guard tooth and lamella present (Fig. 4B, C); rounded accessory teeth present on lamella, posterior to guard tooth. Fixed finger with three teeth of similar length between two larger teeth; distal tooth simple with basal tooth vestigial and proximal tooth bifid. G_1 (setal group 1) comprising three spatulate setae, one (dorsalmost) with basal surface almost smooth, other two with basal surface covered by four longitudinal rows of spicules; G_2 comprising five plumose setae, subequal and longer than movable finger; G_3 comprising four subequal setae, each with dorsal surfaces plumose and ventral surfaces serrate; G_4 comprising two short, stout, acuminate setae with smooth surfaces; G_{5A} comprising seven subequal setae, longer than fixed finger and plumose apically; G_{5B} comprising nine setae, longer than G_{5A} setae and plumose apically; G_6 comprising one smooth seta, more than half the length of movable finger; G_7 comprising six setae, plumose medially to apically, and decreasing in length distally. Setal group formula (G_1–G_2–G_3–G_4–G_{5A}–G_{5B}–G_6–G_7): 3–5–4–2–7–9–1–6.

Pedipalps: Sexually dimorphic, pedipalp of male longer than female, without armature (Figs. 2B, F, 3A, B); 2.5 x (♂) or 1.8 x (♀) longer than propeltidium. Trochanter with apical process subconical; prolateral spur present. Femur slender, slightly swollen distally, 3.2 x (♂) or 1.4 x (♀) longer than high; retroventral surface with Fe_1, Fev_1 and Fev_2 setae acuminate; prolateral surface with Fmv_1 seta basal and $Fmv_{2–3}$ setae more distal. Patella slender, 4.2 x (♂) or 2.7 x (♀) longer than high; ventral surface with acuminate Pe_1 setae basal, and $Pe_{2–5}$ and $Pm_{1–5}$ setae in distal half. Tibia cylindrical, 3.5 x (♂) or 2.9 (♀) longer than high; ventral surface with *Ter* comprising four acuminate setae, and *Tmr* and *Tir* each comprising four apically plumose setae. Tarsus slightly conical, about one third the length of tibia; ventroapical spurs similar in length; tarsal claw sharp, curved.

Legs: Leg IV femur 2.1 x (♂) or 2.4 x (♀) longer than high (Fig. 2B, E).

Tergites: Tergite I divided, with two anterior pairs of microsetae and one posterior pair of *Dm* setae (Fig. 4A); II with three anterior pairs of microsetae and three posterior pairs of *Dm*, Dl_1 *and* Dl_2 setae; III–VII each with one pair of *Dm* setae; VIII with one pair of *Dm* setae; IX with Dl_1 and Dl_2 setae.

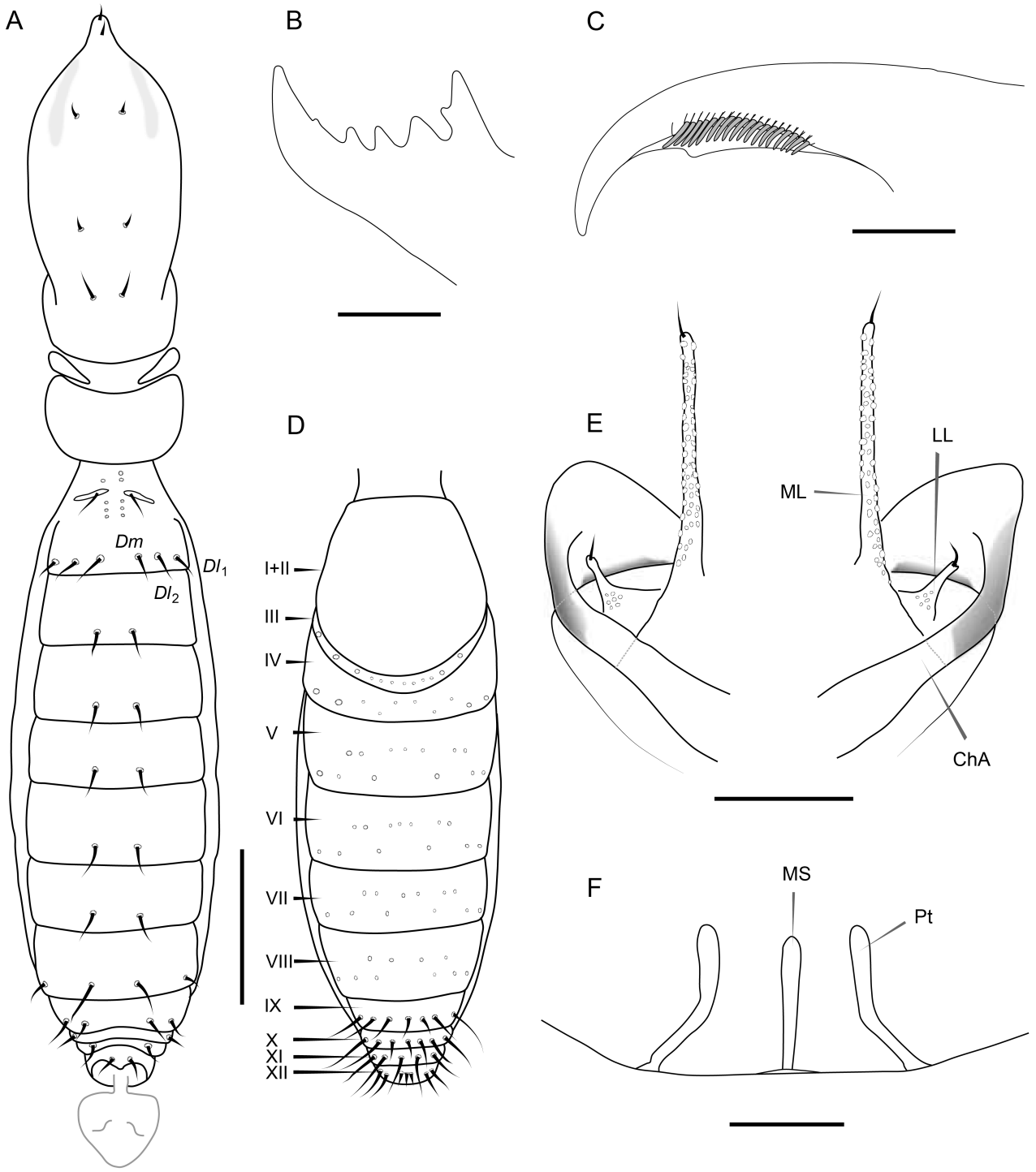

FIGURE 4. *Jipai longevus* gen. *et* sp. nov., holotype ♂ (MIZA) (**A–D, F**) and paratype ♀ (AMNH) (**E**). **A.** Prosomal and opisthosomal setation, dorsal aspect. **B.** Cheliceral fixed finger, retrolateral aspect. **C.** Cheliceral movable finger, ventral aspect illustrating serrula. **D.** Opisthosomal setation, ventral aspect. **E.** Spermatheca, dorsal aspect. **F.** Male genitalia, ventral aspect. Abbreviations: ChA, chitinized arch; *Dm*, dorsomedian setae; *Dl*, dorsolateral setae; LL, lateral lobe; ML, median lobe; MS, median septum; Pt, pterapophysis. Scale bars: 0.5 mm (**A, D**); 0.1 mm (**B, C, F**); 0.05 mm (**E**).

Sternites: Sternites I–III each with rows of scattered microsetae (Fig. 4D); IV–VIII each with Vm_2, Vl_1, and Vl_2 setae; IX and X each with Vm_1, Vm_2, Vl_1, and Vl_2 setae; XI with Vm_1, Dl_1, Vm_2, and Vl_1 setae; XII with *Dm*, Dl_1, Dl_2, Vm_2, Vl_{1A}, Vl_{1B}, *and* Vl_2 setae, and without posterodorsal abdominal process. Respiratory spiracles large, oval, and slightly sclerotized.

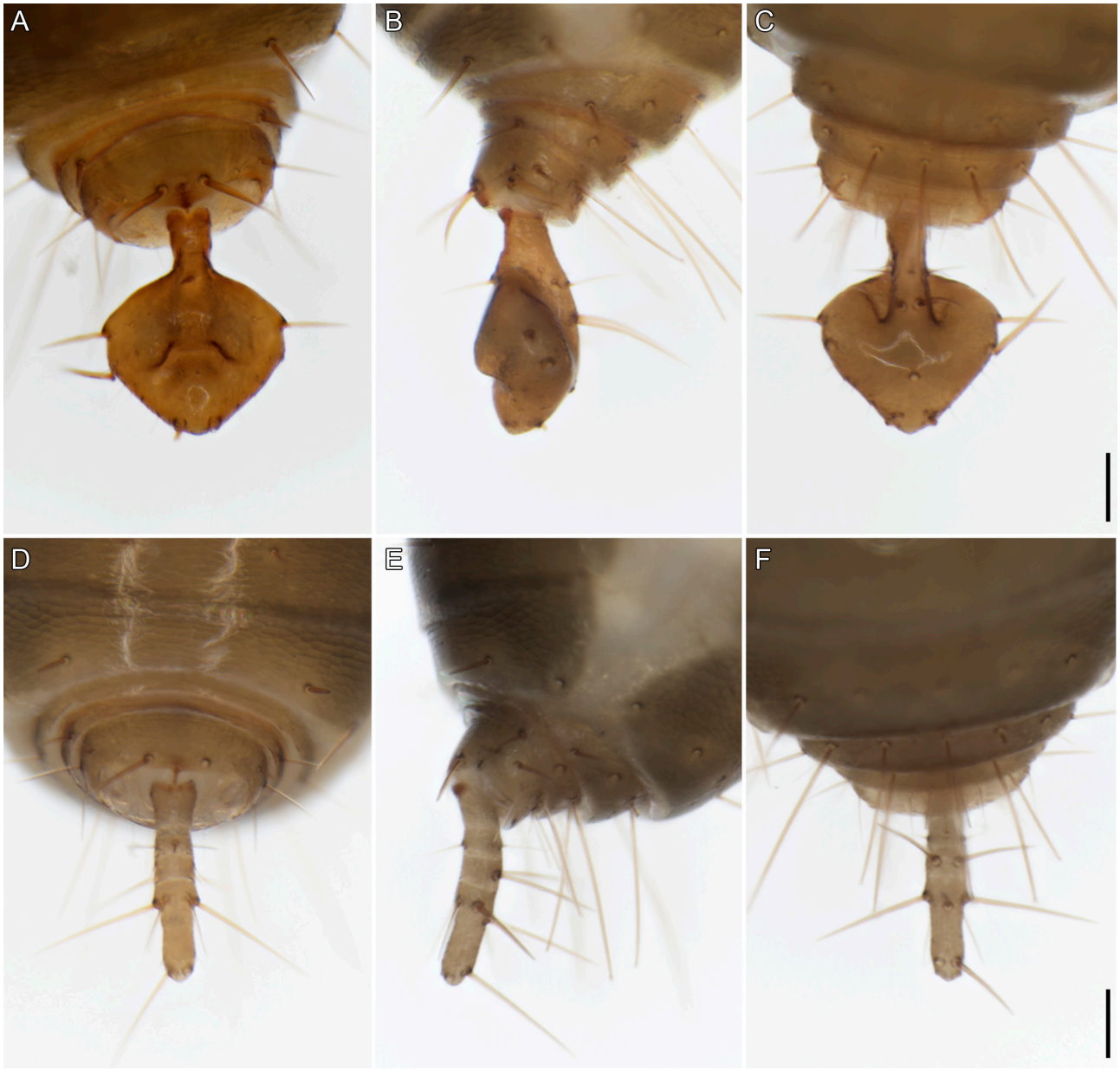

FIGURE 5. *Jipai longevus* gen. *et* sp. nov., flagellum, dorsal (**A, D**), lateral (**B, E**) and ventral (**C, F**) aspects. **A–C.** Holotype ♂ (MIZA). **D–F.** Paratype ♀ (AMNH). Scale bars: 0.1 mm.

Male genitalia: Gonosternite ca. 0.3 x opisthosomal length, with rows of anterior macrosetae and scattered posterior microsetae (Fig. 4F). Pterapophysis (Pt) angular, concave, bent at angle of ca. 40° medially, and slightly wider apically. Median septum slightly shorter than Pt, also wider apically.

Spermathecae: Two pairs of lobes, LL stalk short, narrow, and straight with some basal DOs and apical opening where microtubule inserted (Fig. 4E); ML stalk long, 4 x longer than LL, and linear, covered with sclerotized DOs, and with apical opening where microtubule inserted; all lobe stalks wider basally, terminal circular receptacula absent. Chitinized arch with AB and PB open medially, PB sclerotized anteriorly, narrowing posteriorly; LT wide, projected, with rounded IA. Gonopod absent.

Flagellum: Male flagellum kite-shaped (rhomboidal) in dorsal view, approximately as wide as long (Figs. 5A–C, 6A–C); pair of rounded, dorsosubmedian eminences and ventromedian eminence distally, all separated by depression; Dm_1 seta and Vm_1 seta subaligned where pedicel connects flagellar bulb; Vm_1 and Vm_2 setae aligned; Vm_3 setae large, distal to Vm_1 and Vm_2 setae and proximal to Vl_1 setae; Dl_2 setae proximal to Vl_1 setae; Vm_5 seta closer to Vl_1 setae than to Vl_2 setae in lateral aspect; Dl_3 setae subapical, aligned with Vl_2 setae; Dm_4 seta absent; one pair

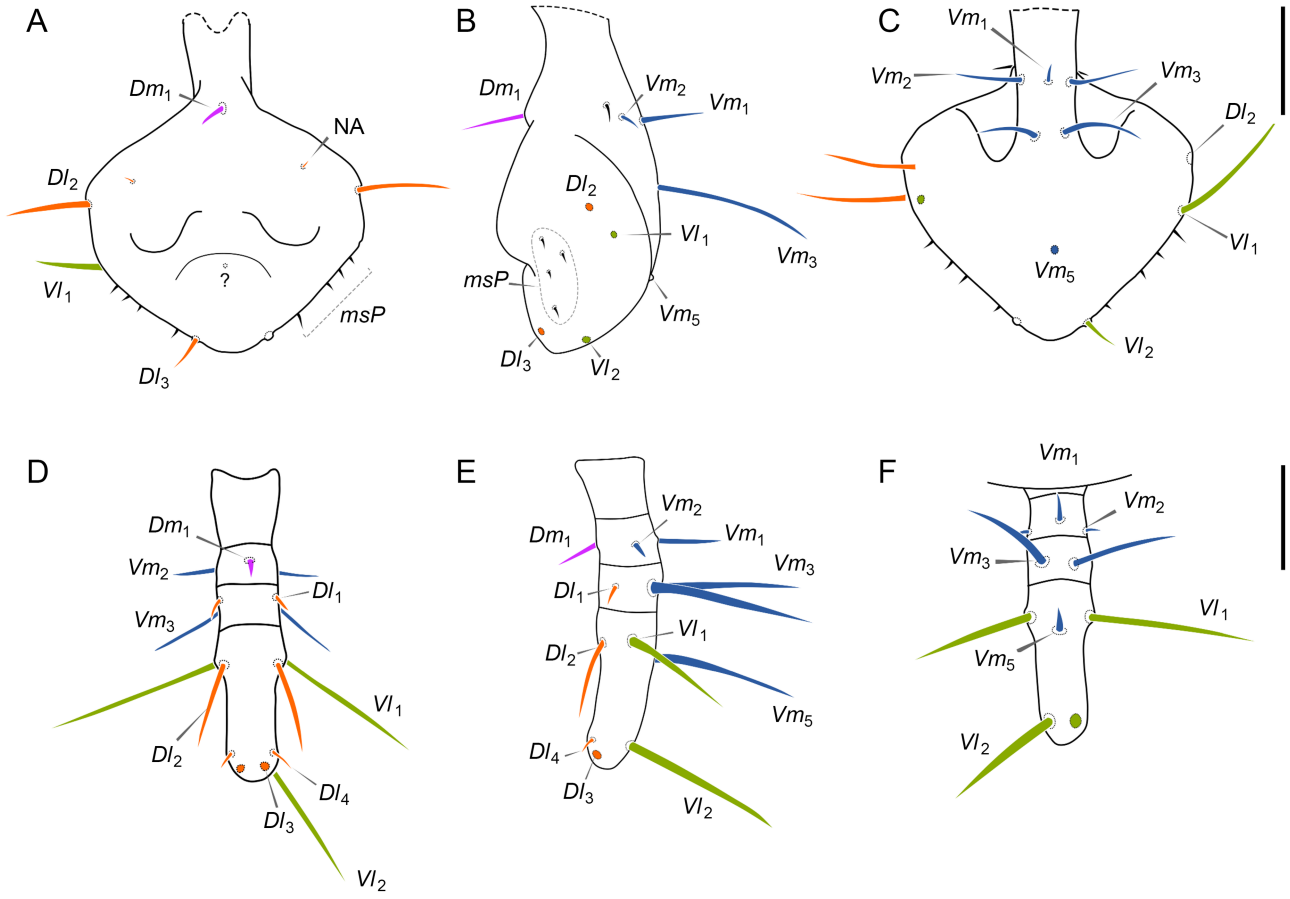

FIGURE 6. *Jipai longevus* gen. *et* sp. nov., flagellum, dorsal (**A, D**), lateral (**B, E**) and ventral (**C, F**) aspects with setal terminology. **A–C.** Holotype ♂ (MIZA). **D–F.** Paratype ♀ (AMNH). Abbreviations: *Dl*, dorsolateral; *Dm*, dorsomedian; *msP*, microsetae patch; NA, not assigned; *Vl*, ventrolateral; *Vm*, ventromedian. Scale bars: 0.1 mm.

of dorsal microsetae situated proximally on eminences, between Dm_1 and Dl_2 setae, and another pair of microsetae dorsal to Vm_2 setae; *msP* comprising four setae, second seta situated more ventrally than others, between Dl_2 and Dl_3 setae. Female flagellum comprising four flagellomeres and three annuli (Figs. 5D–F, 6D–F); flagellomere I asetose; II with Dm_1, Vm_1 and Vm_2 setae; III with pair of Dl_1 setae and pair of large Vm_3 setae; IV with Dl_2 and Vl_1 setae aligned; Vm_5 seta distal to Vl_1 setae; Dl_4 setae proximal to Dl_3 setae; Vl_2 and Dl_4 setae aligned; Dm_4 seta absent.

Distribution. Known only from the type locality in the state of Amazonas, Venezuela (Fig. 1).

Natural History. All specimens of the type series were taken from a single tree stump next to a group of rural houses atop a hill on the banks of the Orinoco River. The surrounding area was flooded as it was during the rainy season.

Remarks. Multiple pairs of setae on the dorsal surface of opisthosomal tergite II have only been reported in five hubbardiine genera, in addition to *Jipai* gen. nov. (Venezuela), which has six setae: *Antillostenochrus* Armas & Teruel, 2002 (Cuba, Dominican Republic, Haiti, and Puerto Rico), which has four to eight setae; *Clavizomus* Reddell & Cokendolpher, 1995 (Malaysia and Singapore), which has four to seven posterior setae; *Mayazomus* (Mexico), which has two to five setae; *Pinero* Teruel, 2018 (Cuba), which has four setae; and *Draculoides* Harvey, 1992 (Australia), which has two or three setae. Although the presence of multiple pairs of setae was considered synapomorphic for *Mayazomus* by Monjaraz-Ruedas & Francke (2016), this hypothesis remains to be tested by a phylogenetic analysis in which the other genera are included.

The absence of seta Dm_4 is rare among Hubbardiinae, having only been reported in *Jipai longevus* gen. nov. *et* sp. nov., *Reddellzomus cubensis* Armas, 2002, and *Bamazomus siamensis* Zheng *et al.*, 2024, and is assumed to be autapomorphic for each of these species.

Discussion

Significant Linnean (species) and Wallacean (geographical distribution) shortfalls (Hortal *et al.* 2015) limit current understanding of the global diversity and distribution of schizomids. Whereas some progress has been made in addressing these shortfalls in the Andes, many other areas, such as Amazonia, remain largely unexplored. These global shortfalls may explain why more than 40% of the extant genera (28 out of 69) of Hubbardiidae are monotypic (WSC 2024). Another possible explanation may be associated with the low vagility, specialized microhabitat preferences, and short generation times of schizomids. These characteristics suggest that, following colonization events, schizomid populations may become restricted to small areas of suitable habitat and rapidly differentiate genetically from other populations separated by just a few kilometers (Clouse *et al.* 2017). Given their low vagility and short generation times, localized schizomid populations could rapidly diverge by drift or selection, speciating regardless of whether environmental pressures differ from one location to the next.

Although the distinctive morphology of *Jipai* gen. nov. sets it apart from all other known Neotropical genera, suggesting it could represent a relictual lineage, the new genus appears to be most closely related to the Mexican genus, *Mayazomus*. A phylogenetic relationship between these genera is plausible, considering what is known about the origins and dispersal patterns of schizomids in the Americas (Clouse *et al.* 2017; Monjaraz-Ruedas *et al.* 2020), but this hypothesis awaits further testing.

Acknowledgements

Fieldwork was funded by National Geographic Explorers grant WW-214R-17 to PAC and LP. JAM was supported by grant DEB 2003382 from the U.S. National Science Foundation (NSF) to LP and a Theodore Roosevelt Postdoctoral Fellowship from the Richard Gilder Graduate School of the AMNH. The authors thank Quintin Arias (MIZA) and Edwin Infante (Universidad del Zulia, Maracaibo, Venezuela) for assistance in the field; José Clavijo (MIZA) for providing the framework for inter-institutional collaboration between the AMNH and MIZA; Steve Thurston for processing the images and design of the plates; Abel Pérez González for organizing and editing this special volume; and two anonymous reviewers for constructive comments on a previous draft of the manuscript.

References

Adis, J.U., Cokendolpher, J.C., Reddell, J.R. & Rodrigues, J.M.G. (2001) Abundance and phenology of Schizomida (Arachnida) from a secondary upland forest in central Amazonia. *Revue Suisse de Zoologie*, 108, 879–889. https://doi.org/10.5962/bhl.part.80166

Adis, J.U., Reddell, J.R., Cokendolpher, J.C. & Morais, J.W. de (1999) Abundance and phenology of Schizomida (Arachnida) from a primary upland forest in central Amazonia. *Journal of Arachnology*, 27, 205–210.

Arbeláez-Cortés, E. (2013) Knowledge of Colombian biodiversity: Published and indexed. *Biodiversity and Conservation* 22, 2875–2906. https://doi.org/10.1007/s10531-013-0560-y

Armas, L.F. de (2002) Dos géneros nuevos de Hubbardiidae (Arachnida: Schizomida) de Cuba. *Revista Ibérica de Aracnología*, 5, 3–9.

Armas, L.F. de (2010) Schizomida de Sudamérica (Chelicerata: Arachnida). *Boletín de la Sociedad Entomológica Aragonesa*, 46, 203–234.

Armas, L.F. de & Colmenares, P.A. (2006) Nuevo género de Hubbardiidae (Arachnida: Schizomida) del Zulia, Venezuela. *Boletín de la Sociedad Entomológica Aragonesa*, 39, 27–30.

Armas, L.F. de & Delgado-Santa, L. (2012) Nuevo género de Hubbardiidae (Arachnida: Schizomida) de la cordillera occidental de los Andes, Colombia. *Revista Ibérica de Aracnología*, 21, 139–143.

Armas, L.F. de & Teruel, R. (2002) "Un género nuevo de Hubbardiidae (Arachnida: Schizomida) de las Antilles Mayores". *Revista Ibérica de Aracnología*, 6, 45–52.

Chamberlin, R.V. (1922) Two new American arachnids of the order Pedipalpida. *Proceedings of the Biological Society of Washington* 35, 11–22.

Cook, O.F. (1899) *Hubbardia*, a new genus of Pedipalpi. *Proceedings of the Entomological Society of Washington*, 4, 249–262.

Clouse, R.M., Branstetter, M.G., Buenavente, P., Crowley, L.M., Czekanski-Moir, J., General, D.E.M., Giribet, G., Harvey, M.S., Janies, D.A., Mohagan, A.B., Mohagan, D.P., Sharma, P.P. & Wheeler, W.C. (2017) First global molecular phylogeny

and biogeographical analysis of two arachnid orders (Schizomida and Uropygi) supports a tropical Pangean origin and mid-Cretaceous diversification. *Journal of Biogeography*, 44, 2660–2672.
https://doi.org/10.1111/jbi.13076

Cokendolpher, J.C. & Reddell, J.R. (2000) New and rare Schizomida (Arachnida: Hubbardiidae) from South America. *Amazoniana*, 16, 187–212.

Delgado-Santa, L. & Armas, L.F. de (2013) Tres nuevos Hubbardiinae (Schizomida: Hubbardiidae) de Colombia. *Revista Ibérica de Aracnología*, 22, 37–45.

Eva, H.D., Huber, O., Achard, F., Balslev, H., Beck, S., Behling, H., Belward, A.S., Beuchle, R., Cleef, A., Colchester, M., Duivenvoorden, J., Hoogmoed, M., Junk, W., Kabat, P., Kruijt, B., Malhi, Y., Müller, J.M., Pereira, J.M., Peres, C., Prance, G.T., Roberts, J. & Salo, J. (2005) *A proposal for defining the geographical boundaries of Amazonia*. Office for Official Publications of the European Communities, Luxembourg (Luxembourg). Available from: http://bookshop.europa.eu/en/a-proposal-for-defining-the-geographical-boundaries-of-amazonia-pbLBNA21808 (accessed 21 August 2024)

González-Sponga, M.A. (1997) Arácnidos de Venezuela. Un nuevo género y dos nuevas especies de Schizomidae y redescripción de *Schizomus simoni* Hansen y Sorensen, 1905 del Sistema Montañoso de La Costa (Schizomida). *Acta Biologica Venezuelica*, 17 (2), 1–10.

Harvey, M.S. (1992) The Schizomida (Chelicerata) of Australia. *Invertebrate Taxonomy*, 6, 77–129.

Harvey, M.S. (2002) Nomenclatural notes on Solifugae, Amblypygi, Uropygi and Araneae (Arachnida). *Records of the Western Australian Museum*, 20, 449–459.

Harvey, M.S., Rix, M.G., Framenau, V.W., Hamilton, Z.R., Johnson, M.S., Teale, R.J., Humphreys, G. & Humphreys, W.F. (2011) Protecting the innocent: Studying short-range endemic taxa enhances conservation outcomes. *Invertebrate Systematics*, 25, 1–10.
https://doi.org/10.1071/IS11011

Hortal, J., Bello, F. de, Diniz-Filho, J.A.F., Lewinsohn, T.M., Lobo, J.M. & Ladle, R.J. (2015) Seven shortfalls that beset large-scale knowledge of biodiversity. *Annual Review of Ecology*, *Evolution*, *and Systematics*, 46, 523–549.
https://doi.org/10.1146/annurev-ecolsys-112414-054400

Kraus, O. & Beck, L. (1967) Taxonomie und Biologie von *Trithyreus brasiliensis* n. sp. (Arach.: Pedipalpi: Schizopeltidia). *Senckenbergiana Biologica*, 48, 401–405.

Lawrence, R.F. (1969) The trichoid structures on the chelicerae of the short-tailed whip-scorpions (Schizomida; Arachnida). *Transactions of the Royal Society of South Africa*, 38, 123–132.
https://doi.org/10.1080/00359196909519080

Monjaraz-Ruedas, R. & Francke, O.F. (2016) Systematics of the genus *Mayazomus* (Arachnida: Schizomida): The relevance of using continuous characters and pedipalp setae patterns to schizomid phylogenetics. *Zoological Journal of the Linnean Society*, 176, 781–805.
https://doi.org/10.1111/zoj.12337

Monjaraz-Ruedas, R., Francke, O.F., Cruz-López, J.A. & Santibáñez-López, C.E. (2016) Annuli and setal patterns in the flagellum of female micro-whipscorpions (Arachnida: Schizomida): Hypotheses of homology across an order. *Zoologischer Anzeiger*, 263, 118–134.
https://doi.org/10.1016/j.jcz.2016.05.003

Monjaraz-Ruedas, R., Prendini, L. & Francke, O.F. (2020) First species of *Surazomus* (Schizomida: Hubbardiidae) from North America illuminate biogeography of short-tailed whipscorpions in the New World. *Arthropod Systematics & Phylogeny*, 78, 245–263.

Moreno-González, J.A., Delgado-Santa, L. & Armas, L.F. de (2014) Two new species of *Piaroa* (Arachnida: Schizomida, Hubbardiidae) from Colombia, with comments on the genus taxonomy and the flagellar setae pattern of Hubbardiinae. *Zootaxa*, 3852 (2), 227–251.
https://doi.org/10.11646/zootaxa.3852.2.4

Moreno-González, J.A. & Villarreal, O.M. (2012) A new genus of Hubbardiidae (Arachnida: Schizomida) from the Colombian Andes, with some taxonomic comments. *Zootaxa*, 3560 (1), 61–78.
https://doi.org/10.11646/zootaxa.3560.1.4

Moreno-González, J.A. & Villarreal, O.M. (2017) Two new species of *Calima* Moreno-González and Villarreal, 2012 (Arachnida: Schizomida: Hubbardiidae) from the Colombian Andes, with a discussion on the male flagellar microsetae of Hubbardiinae. *Journal of Natural History*, 51, 2681–2700.
https://doi.org/10.1080/00222933.2017.1397226

Petrunkevitch, A. (1945) *Calcitro fisheri.* A new fossil arachnid. *American Journal of Science*, 243, 320–329.
https://doi.org/10.2475/ajs.243.6.320

Pinto-da-Rocha, R., Andrade, R. & Moreno-González, J.A. (2016) Two new cave-dwelling genera of short-tailed whip-scorpions from Brazil (Arachnida: Schizomida: Hubbardiidae). *Zoologia* (*Curitiba*), 33, e20150195. [9 pp.]
https://doi.org/10.1590/S1984-4689zool-20150195

Reddell, J.R. & Cokendolpher, J.C. (1995) Catalogue, bibliography, and generic revision of the order Schizomida (Arachnida). *Texas Memorial Museum*, *Speleological Monographs*, 4, 1–170.

Rocha, D.G. da & Kaefer, I.L. (2019) What has become of the refugia hypothesis to explain biological diversity in Amazonia? *Ecology and Evolution*, 9, 4302–4309.

https://doi.org/10.1002/ece3.5051
Ruiz, G.R.S. & Valente, R.M. (2017) The first schizomid from a dry forest in South America (Arachnida: Schizomida). *Zootaxa*, 4311 (1), 81–95.
https://doi.org/10.11646/zootaxa.4311.1.5
Ruiz, G.R.S. & Valente, R.M. (2019) Description of a new species of *Surazomus* (Arachnida: Schizomida), with comments on homology of male flagellum and mating march anchorage in the genus. *PLoS One*, 14, e0213268. [18 pp.]
https://doi.org/10.1371/journal.pone.0213268
Ruiz, G.R.S. & Valente, R.M. (2023) First description of the male genitalia in a short-tailed whipscorpion (Arachnida: Schizomida), description of the female, and comments on pygidial glands and cuticular ultrastructure of *Surazomus algodoal* Ruiz & Valente, 2017. *PLoS One*, 18, e0289370. [35 pp.]
https://doi.org/10.1371/journal.pone.0289370
Salvatierra, L. (2018) A new species of *Surazomus* Reddell and Cokendolpher, 1995 (Arachnida: Schizomida) from Rondônia, Brazil. *Turkish Journal of Zoology*, 42, 107–112.
https://doi.org/10.3906/zoo-1708-38
Teruel, R. (2018) Two new genera and a new species of schizomids (Arachnida: Schizomida) from Isla de Pinos, Cuba. *Ecologica Montenegrina*, 19, 33–49.
https://doi.org/10.37828/em.2018.19.4
Villarreal, O.M., Giupponi, A.P. de L. & Tourinho, A.L. (2008) New Venezuelan genus of Hubbardiidae (Arachnida: Schizomida). *Zootaxa*, 1860 (1), 60–68.
https://doi.org/10.11646/zootaxa.1860.1.5
Villarreal, O.M., Miranda, G.S. de & Giupponi, A.P. de L. (2016) New proposal of setal homology in Schizomida and revision of *Surazomus* (Hubbardiidae) from Ecuador. *PLoS One*, 11, e0147012. [29 pp.]
https://doi.org/10.1371/journal.pone.0147012
WSC (World Schizomida Catalog) (2024) *In*: *World Arachnid Catalog.* Natural History Museum Bern, Bern. Available from: http://wac.nmbe.ch (accessed 21 August 2024)
Zheng, T., Gong, J. & Zhang, F. (2024) Two new species of *Bamazomus* Harvey, 1992 from southern China (Schizomida, Hubbardiidae). *ZooKeys*, 1204, 337–353.
https://doi.org/10.3897/zookeys.1204.121754