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The smallest known solifuge: *Vempironiella aguilari*, new genus and species of sun-spider (Solifugae: Mummuciidae) from the coastal desert of Peru

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Abstract. A new genus and species in the South American sun-spider family Mummuciidae, *Vempironiella aguilari* gen. nov., sp. nov., is herein described from a series of specimens from the coastal desert of Punta Hermosa, Peru. *Vempironiella* can be readily distinguished from all other known mummuciid genera, by the absence of the cheliceral movable finger MM tooth and the presence of a diastema between the RFA and RFP teeth on the fixed finger. With this description, the number of valid species of mummuciids is 19, three of which have been described from Peru. Males of *V. aguilari* measure 3.90–5.85 mm in total body length making it the smallest solifuge species known to date. The cheliceral morphology of *V. aguilari* is discussed and some hypotheses on the function of morphology are provided.

Keywords: Solifuges, Punta Hermosa, Peruvian coastal desert.

The South American sun-spider family Mummuciidae Roewer, 1934 encompasses small to moderate-sized species of solifuges. Traditionally, eight genera have been included in the family, namely *Mummucia* Simon, 1879, *Gaucha* Mello-Leitão, 1924, *Metacleobis* Roewer, 1934, *Mummucina* Roewer, 1934, *Mummucipes* Roewer, 1934, *Gauchella* Mello-Leitão, 1937, *Cordobulgida* Mello-Leitão, 1938 and *Uspallata* Mello-Leitão, 1938 (Harvey 2003; Bird et al. 2015). Although the catalogue of Harvey (2003) listed ten genera in the family, two of them, i.e., *Mummuciona* Roewer, 1934 and *Sedna* Muma, 1971, had been transferred to Ammotrechidae by Maury (1982, 1987). Until recently, 20 species were recognized for Mummuciidae (Bird et al. 2015); however, two were discovered to belong to Ammotrechidae (Botero-Trujillo & Iuri 2015).

Mummuciid species have been described mostly from Brazil and Argentina, with six and four species respectively, followed by Paraguay, Chile and Peru, each with two species, and Bolivia and Ecuador, with a single species each (Maury 1998; Xavier & Rocha 2001; Martins et al. 2004; Rocha & Carvalho 2006; Carvalho et al. 2010; González-Reyes & Corronca 2013; Botero-Trujillo & Iuri 2015). These numbers are not accurate estimators of species diversity, however, and enormous areas across the geographical distribution of the family remain unsampled (e.g., Maury 1998: fig. 4). As summarized by Harvey (2003), a few species have been allegedly recorded for more than one country [e.g., *Mummucia variegata* (Gervais, 1849)]. Whilst some of those correspond to rather old records [e.g., Simon's mention of *M. variegata* for Peru (Simon 1879: 152)], determining the actual geographic range of species requires additional dedicated fieldwork and comprehensive efforts to delimit species.

Thus far the recognition of mummuciid genera is a challenging task, for these are poorly defined (Maury 1998; Botero-Trujillo 2014), rendering the validity of some questionable. Because of this, it is often easier to identify new species than it is to place them into a genus. As a consequence, some authors of newly-named species have opted for placing them into the type genus, *Mummucia*, as a conservative approach without taxonomic support (Xavier & Rocha 2001; Martins et al. 2004; Rocha & Carvalho 2006; Carvalho et al. 2010). Two genera with more than one species, *Mummucia* and *Mummucina*, have neither been revised nor had their monophyly yet demonstrated. Meanwhile, the other six genera remain monotypic. Due to this taxonomic confusion, only the study of the type species of the different genera can shed light on where a new species should be placed.

In the present contribution, *Vempironiella* gen. nov. is created to accommodate a remarkable new species, *Vempironiella aguilari* sp. nov., from the coastal desert of the district of Punta Hermosa, Peru. After direct comparison with the type species of the eight former genera of Mummuciidae, the new species proved to exhibit a unique morphology that does not fit into any of the currently recognized genera, all of which are more similar to one another than any is to the new genus. *Vempironiella aguilari* is the smallest known solifuge, with males measuring 3.90–5.85 mm in total body length, with the second smallest being the southern African melanoblossiid *Lawrencega minuta* Wharton, 1981 whose males measure 5–8 mm (Bird et al. 2015).

Vempironiella aguilari represents only the third mummuciid described from Peru, along with *Mummucina exlineae* Mello-Leitão, 1943 and *Mummucina masculina* Lawrence, 1954, and brings the known diversity of the family to 19 species.

METHODS

Terminology used for referring to cheliceral teeth and other cheliceral structures follows Bird et al. (2015). The term *fixed finger retrofondal diastema* (frfd) is here introduced to refer to a toothless diastema present between the RFP and RFA teeth. Abbreviations rlf_{1-4} are here used to identify a set of four individual *principal retrolateral finger* setae, as defined by Bird et al. (2015: 173). These *rlf* setae, which are common to all mummuciid species and are present in at least some other families (e.g., Daesiidae Kraepelin, 1899; see Bird et al. 2015: pl. 145), differ in position across mummuciid taxa (i.e., with respect to particular teeth) and bear some relevant taxonomic usefulness. Identification of individual teeth used the criteria of Bird et al. (2015: 83) for primary homology assessment of dentition. Leg segmentation terminology follows Shultz (1989). In line with Bird & Wharton (2015), the terms basi- and telotarsus are used for the pedipalp segments traditionally refered to as metatarsus and tarsus. The term 'spiniform setae' (equivalent to spine-like setae) refers to rigid, socketed macrosetae and is preferred over 'spines' (broadly used before by various authors), following recent works on solifuges (e.g., Botero-Trujillo 2014; Bird & Wharton 2015; Botero-Trujillo & Iuri 2015). The formula used to describe the pattern of spiniform setae on telotarsi of legs follows Iuri et al. (2014), where a dash line (-) stands for incomplete segmentation and a slash (/) for complete segmentation. Pedipalp setae terminology follows Cushing & Casto (2012).

The 'row of rigid hairs along the posterior margin of the post-spiracular sternite II' (4th post-genital sternite) is the same structure referred to as 'specialized setae' by Botero-Trujillo (2014) and as 'comb of rigid hairs' by Botero-Trujillo & Iuri (2015). Maury (1984) referred to it as "ctenidia in the form of a comb of rigid hairs". Here the term 'ctenidia' is used only for the long, single-tipped (non-bifid) and flexible seta-like structures that, in the new species, are present on the 3rd and 4th post-genital sternites. Unlike the rigid hairs which are arranged in a row, ctenidia are irregularly distributed in the sternites (Figs. 22, 23).

The "variation" section deals with observations performed on the cheliceral dental pattern formula and teeth (FSD, FSM) counts (no other significant variation was observed); dental pattern formula follows that proposed by Bird et al. (2015: 67).

Specimens were examined with Leica M165 C and Leica S8AP0 stereomicroscopes. Photographs were taken with a Leica DFC 290 digital camera mounted on the Leica M165 C stereomicroscope and the extended focal range images composed with Helicon Focus 6.2.2 Pro software (http://www.heliconsoft.com/heliconsoft-products/helicon-focus/). Illustrations of the chelicerae were prepared with CorelDRAW 12 by superimposing vectors on previously obtained micrographs. Images were edited with Adobe Photoshop CS3 (10.0). Measurements, in millimeters, were obtained using an ocular micrometer fitted to a Leitz Wetzlar stereomicroscope.

Some chelicerae were manipulated, after dissection, to allow full display of the dentition. Fine forceps were carefully placed between the finger mucra, as close as possible to the bases of FD and MSM teeth. The tips of the forceps were gradually separated by carefully inserting between them the tip of another set of forceps, while controlling the first forceps such that it opened only as desired, i.e., to prevent an abrupt opening that could damage the fingers. Chelicerae were opened enough to expose all the teeth, or until the muscle keeping the movable finger closed had detached. For scanning electron microscope (SEM) preparations, specimens were dissected, cleaned with a fine-bristle paintbrush followed by ultrasonication, dehydrated via 80% - 87% - 96% - 100% ethanol series, fixed to aluminum stubs, and gold-palladium coated in a VG Scientific SC 7620 mini sputter-coater. SEM micrographs were taken under high vacuum with a Philips FEI XL30 TMP.

Material examined.—Specimens used in the present work belong to the following institutions: American Museum of Natural History, New York, U.S.A. (AMNH); Museo Argentino de Ciencias Naturales "Bernardino Rivadavia", Buenos Aires, Argentina (MACN); Museo de Historia Natural, Universidad Nacional Mayor de San Marcos, Lima, Peru (MUSM); Museu de Ciências Naturais, Fundação Zoobotânica do Rio Grande do Sul, Porto Alegre, Brazil (MCN); Museu Nacional do Rio de Janeiro, Rio de Janeiro, Brazil (MNRJ); Museum National d'Histoire Naturelle, Paris, France (MNHN); Senckenberg Forschungsinstitut und Natur-Museum, Frankfurt, Germany (SMF).

Specimens of 17 of the other 18 species currently placed in Mummuciidae (all but *Mummucia dubia* Badcock, 1932) were examined, including type specimens of most of them. A list of material examined belonging to the type species of all other genera is provided below.

Cordobulgida bruchi Mello-Leitão, 1938: female holotype (MNRJ): Labels verbatim: "*Cordobulgida bruchi M. L. / Alta Gracia / Bruch leg. / 58160*". "*520 a-D / Leg.: Dr. C. Bruch / Alta Gracia (Cord.) / 14.xii.1934*". ARGENTINA: Córdoba, Alta Gracia, La Granja, under rocks, i.1939, C. Bruch, 2 juveniles (MACN-Ar); Córdoba, Alta Gracia, La Granja, i.1938, C. Bruch, 1 male, 1 female, 1 juvenile (MACN-Ar).

Gaucha fasciata Mello-Leitão, 1924: male holotype (MNRJ, currently at MCN): Label verbatim: "*Gaucha fasciata M. L. / Porto Alegre / Gliesch / 42682*". "*Laboratorio de Zoologia / Solifugos/Solpugidae / Gaucha fasciata / M. Leitão*". 1 male, 2 female paratypes (MNRJ; currently at MCN): Label verbatim: "*Laboratorio de Zoologia / Solifugos/Solpugidae / Gaucha fasciata / M. Leitão*". BRAZIL: Rio Grande do Sul, Porto Alegre, Jardim Botânico, granito, 46 m elev., 30°03′13.11″ S 51°10′35.18″ W, 19.xi.2012, 3 males, 1 female (MCN-Sol-020); 03.xii.2012, 2 males, 2 juveniles (MCN-Sol-021); xii.2014, R. Ott & R. Botero Trujillo, 1 male (96% ethanol, MCN).

Gauchella stoeckeli (Roewer, 1934): 2 males, 1 female syntypes (SMF): Label verbatim: "*Arachn. Coll. Roewer – Lfd. No. 2984 / Solifuga: / No. 73 / Gaucha stoeckeli n. sp. / 2♂, 1♀ / Bolivia, La Paz / Typus / Roewer det. 1933*".

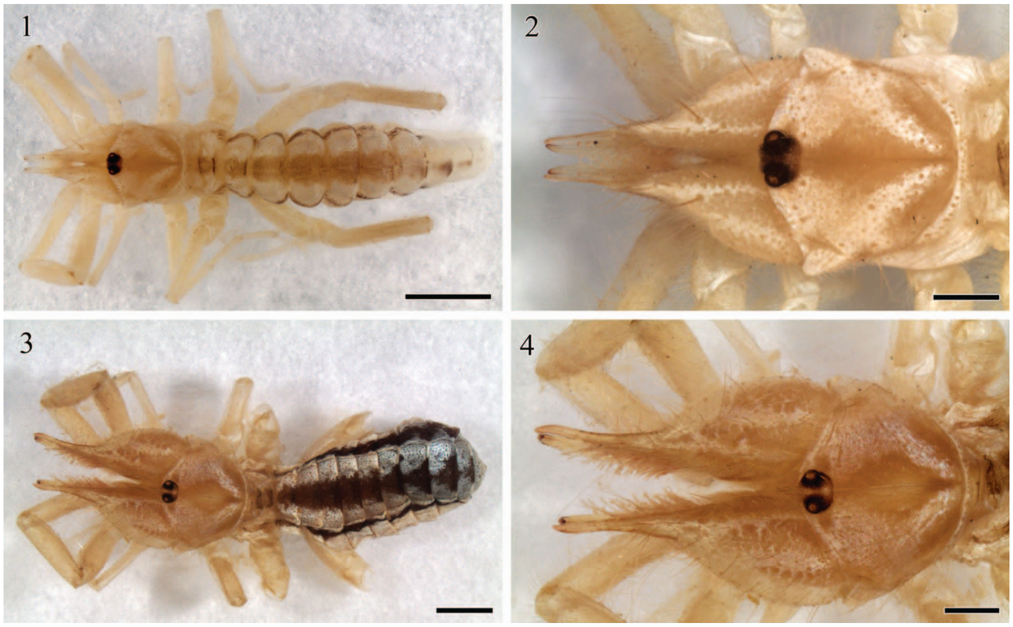
Metacleobis fulvipes Roewer, 1934: male holotype (SMF): Label verbatim: "*Arachn. Coll. Roewer – Lfd. No. 4556 / Solifuga: / No. 365 / Metacleobis fulvipes / 1♂ / n. g. n. sp. / Brasil: Matto Grosso, Cuyabo / Typus / Roewer det. 1933*". "*4756*".

Mummucia variegata (Gervais, 1849): 3 female syntypes (MNHN): Labels verbatim: "*I7849 / Mummucia varegata* [sic] */ Chili / Gervais / Vid. Kraep.*" "*59.*" CHILE: V Región, Valparaíso, Puente Las Bayicas, 24 km E of Algarrobo, 09.xi.1988, E. Maury, 15 males, 1 female, 2 juveniles (MACN-Ar).

Mummucina titschacki Roewer, 1934: ECUADOR: Chimborazo, Road 35th, 3 km N of Riobamba, 1 km before San Andrés, 100 m from "Cantera (quarry) San Andrés", 3000 m elev., 01°35′57″ S 78°41′50″ W, manual capture and pitfall traps (12:00 to 15:00 hs), 22–23.iii.2014; R. Botero Trujillo, 31 males, 3 females, 4 juveniles (MACN-Ar).

Mummucipes paraguayensis Roewer, 1934: 2 males, 1 female syntypes (SMF): Label verbatim: "*Arachn. Coll. Roewer – Lfd. No. 4753 / Solifuga: / No. 362 / Mummucipes paraguayensis / 2♂, 1♀ / n. g. n. sp. / Paraguay: Asuncion / Typus / Roewer det. 1933*". "*4753*".

Uspallata pulchra Mello-Leitão, 1938: ARGENTINA: Mendoza, Las Heras, 10 km N of Uspallata, 2014 m elev.,



Figures 1–4.—*Vempironiella aguilari* gen. nov., sp. nov. 1–2. Male holotype (MACN-Ar-35453); 1. Habitus, dorsal view; 2. Prosoma, dorsal view. 3–4. Adult female paratype (MACN-Ar-35454); 3. Habitus, dorsal view; 4. Prosoma, dorsal view. Scale bars: 1 mm (Figs. 1, 3); 0.3 mm (Fig. 2); 0.5 mm (Fig. 4).

32°32′30.8″ S 69°18′22.2″ W, manual capture, 22.i.2014; H.A. Iuri, R. Botero Trujillo, A.A. Ojanguren Affilastro, 1 female (96% ethanol, MACN-Ar).

NOTE: Mello-Leitão (1938) only reported one type specimen for *C. bruchi* which was thus far considered lost (Kury & Nogueira 1999). One specimen, accompanied by a label in Mello-Leitão's handwriting and with collection data matching that reported in the original description, was recently found in the collection of the MACN. Although the specimen is not accompanied by any label identifying it as a type, the morphology and wear pattern of its chelicerae (which is very particular) allowed the author to determine that it is, without a doubt, the same specimen illustrated by Mello-Leitão (1938: figs. 72, 73). Therefore, this specimen is considered to be the holotype of *C. bruchi*.

TAXONOMY

Family Mummuciidae Roewer, 1934

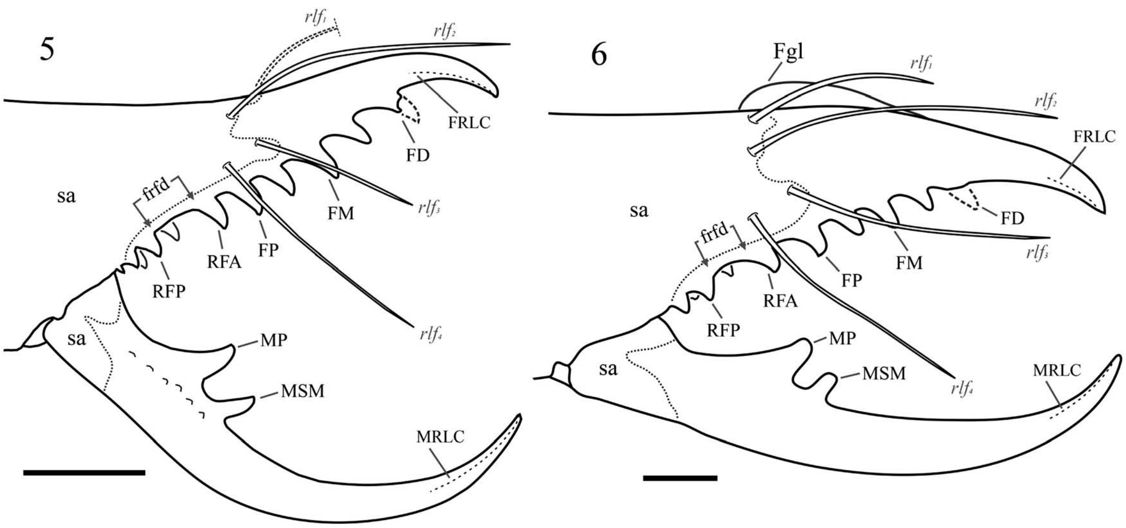
Vempironiella gen. nov.

Type species.—*Vempironiella aguilari* sp. nov.

Etymology.—The generic name is an arbitrary combination of letters that resembles the word "vampire" inspired by the shape of the cheliceral teeth which are reminiscent of the fangs of vampires. Feminine in gender.

Diagnosis.—A member of the family Mummuciidae because of having a three-dark-band pattern on the opisthosomal dorsal surface (Figs. 1, 3), a row of rigid hairs along the posterior margin of post-spiracular sternite II (4th post-genital sternite), lacking spiniform setae on pedipalps (Fig. 16), and the male flagellum of the composite type, retrolaterally compressed with ipsilateral opening, and immovably attached to the cheliceral fixed finger (Figs. 12, 13) (Maury 1984; Bird et al. 2015; Botero-Trujillo & Iuri 2015). The new genus differs from all other genera in the family in various aspects, mostly of its cheliceral morphology: *i)* Fixed finger with retrofondal diastema (frfd) between the RFA tooth and the RFP tooth (intermediate retrofondal teeth absent) (Figs. 5, 6). *ii)* Movable finger with MP and MSM teeth only, MM tooth absent (Figs. 7, 11). *iii)* Movable finger MSM tooth markedly pronounced and columnar (Figs. 7–11). *iv)* Movable finger of female aculeus-like, with very long and slender mucron, and teeth located in a noticeably basal position on the finger (Figs. 5, 7). *v)* Movable finger of female with mucron cylindrical, retrolateral carina obsolete (represented by shallow granules on the base of finger and edge carina on the apex), and gnathal edge carina identified only by a sclerotized line along the mucron dorsal margin (Figs. 5, 7). *vi)* Opisthosomal lateral pleural membranes, sub-dorsal dark bands with white marks surrounding the insertion socket of some setae, instead of similar but black marks on the sub-ventral whitish bands of the membrane.

Comparisons.—All other eight genera currently recognized in the family, most importantly their type species, differ substantially from the above description by: *i)* Cheliceral fixed finger retrofondal teeth series is uninterrupted, without diastema. *ii)* Movable finger with MP, MSM and MM teeth present. *iii)* Movable finger MSM tooth small to moderately pronounced and sub-triangular. *iv)* Movable finger mucron of female moderately long and more robust than that of *Vempironiella*, with teeth located in a sub-medial position on the finger. *v)* Movable finger of female with retrolateral carina moderately to densely granular and gnathal edge carina identified by pronounced angle formed by adjacent surfaces, which gives the appearance of a cutting edge along the mucron. *vi)* Opisthosomal lateral pleural membranes, sub-ventral whitish bands with black marks, and not the other way around, except for *Mummucina* in *stricto sensu* (i.e., *M.*



Figures 5–6.—*Vempironiella aguilari* gen. nov., sp. nov. Schematic representation of the cheliceral morphology in retrolateral aspect. 5. Female and juvenile morphology; 6; Male morphology. Abbreviations: RFP, RFA, FP, FM, FD, particular fixed finger teeth for reference; MP, MSM, movable finger teeth; *rlf*$_{1-4}$, set of four principal retrolateral finger setae; Fgl, flagellum; sa, setose areas; MRLC, movable finger retrolateral edge carina; FRLC, fixed finger retrolateral edge carina; frfd, fixed finger retrofondal diastema. Scale bars: 0.25 mm (Fig. 5); 0.1 mm (Fig. 6).

titschacki) which shares the pattern described above for *Vempironiella*.

Vempironiella aguilari sp. nov.

Figures 1–23; Table 1

Mummucia variegata (misidentification): Aguilar 1977: 91 [as "*Mummucia variegata* (?)"].

Type material.—*Holotype male:* PERU: Lima, Lima, Punta Hermosa, "40 km S of Lima", 03.xi.1974, P. Aguilar (MACN-Ar-35453). *Paratypes:* PERU: same data of holotype, 12 males, 2 females, 2 juveniles (MACN-Ar-35454), 1 male, 1 juvenile (AMNH), 1 male, 1 juvenile (MUSM). All specimens preserved in 80% ethanol.

Etymology.—The species is named after the prominent Peruvian Biologist, Dr. Pedro G. Aguilar Fernández (1926–2013). Doctor Aguilar Fernández was the collector of the type material and, in one of his 1977's publications, presented some information about the natural history of this species.

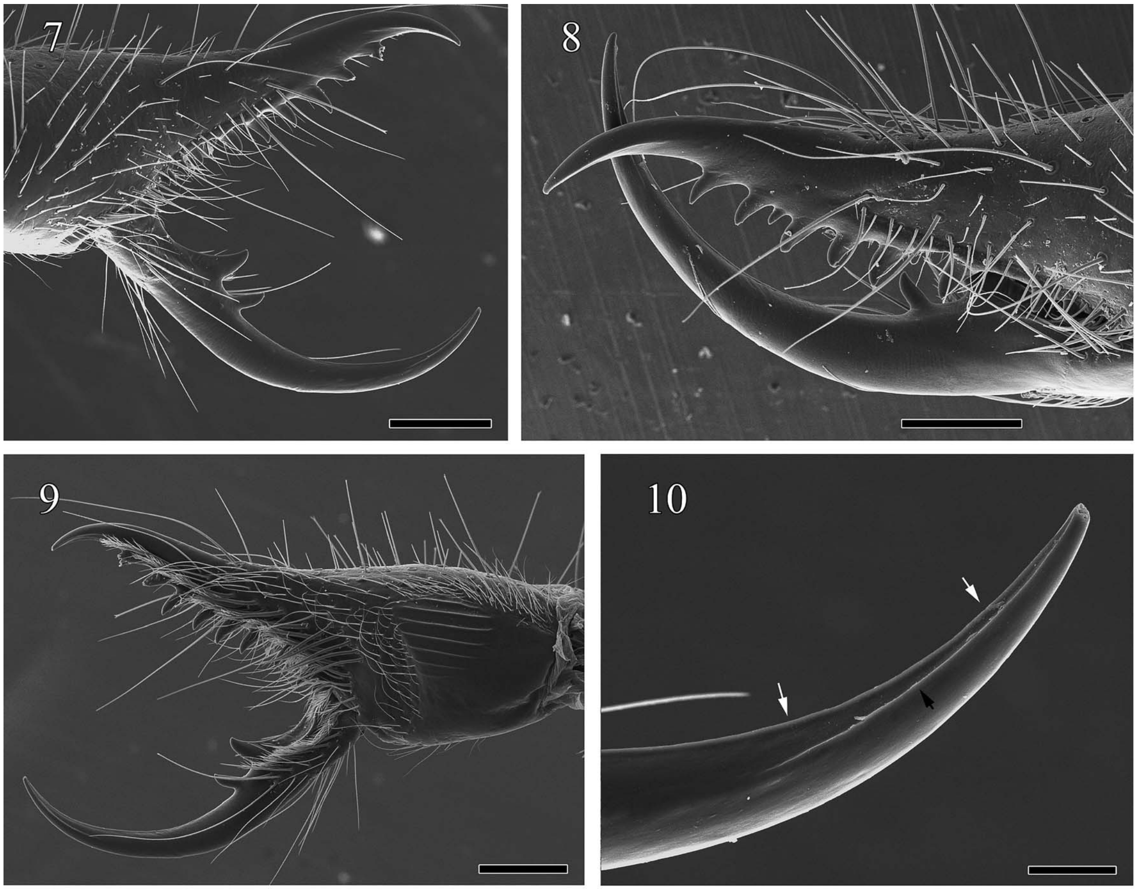
Diagnosis.—As for genus.

Description of male.—Meristic data in Table 1.

Color: (Figs. 1, 2). On 80% ethanol-preserved specimens. General coloration yellow with iridescent white areas. Propeltidium with yellow central area, longer than wide, and two yellow areas on posterior margin, all forming an arrow-like design that is surrounded by white pigment; ocular tubercle yellowish-brown, except for the border of the eyes which is black. Chelicerae manus yellow, ornamented with longitudinal white bands which fuse together on the distalmost region of the setose area; fingers yellow, translucent. Meso-, metapeltidium, and dorsal surface of opisthosoma with a three-dark-band design typical of the family: tergites with median, longitudinal light brown band, and paired lateral white bands; lateral pleural membranes with sub-dorsal dark-brown and sub-ventral white bands; dark bands of opisthosomal pleural membrane with white marks surrounding the insertion socket of some setae; sternites immaculately iridescent white. Ventral aspect of prosoma, legs and pedipalps uniformly yellow, with hint of iridescence; sternum lighter than coxae. Malleoli yellow, translucent.

Prosoma: (Fig. 2). Propeltidium wider than long; with bifurcated setae of variable size, the longest setae arranged in a bilaterally symmetrical distribution on propeltidium; anterior margin procurved, with ocular tubercle elevated; complete and shallow median longitudinal furrow present; anterolateral propeltidial lobes separated from the propeltidium principal shield by incomplete lateral groove. Meso- and metapeltidium wider than long, with bifurcated setae of variable size. Coxae densely covered with bifurcated setae; some of which are longer and exhibit a bilateral symmetrical distribution, and one or two other long single-tipped setae present at least on coxae III. Sternum glabrous.

Chelicera-dentition and processes: (Figs. 6, 11–15). Fixed finger with median teeth series comprising all primary teeth, i.e., FP, FM, FD, markedly pronounced and columnar; secondary teeth arranged in two (FSM and FSD) categories, similar to principal teeth but slightly shorter; retrofondal teeth series comprising RFA, RFP and RFSP teeth only, interrupted by retrofondal diastema (frfd) between the RFA and RFP teeth; RFA and RFP larger than RFSP, both similar to teeth of median series; profondal teeth series with three teeth (PFSP, PFP, PFM); PFM tooth visible in retrolateral aspect through the frfd. Movable finger with median teeth series comprising only two teeth, markedly pronounced and erect MP, and pronounced and columnar MSM, arranged as MP>>MSM; teeth placed in a sub-basal, rather than medial, position on the finger. Movable finger without any trace of MM tooth and without subproximal (MSP) or subterminal (MST) teeth; retrolateral carina incomplete and obsolete, consisting of one or two low granules basal to MP tooth, and keel-like section

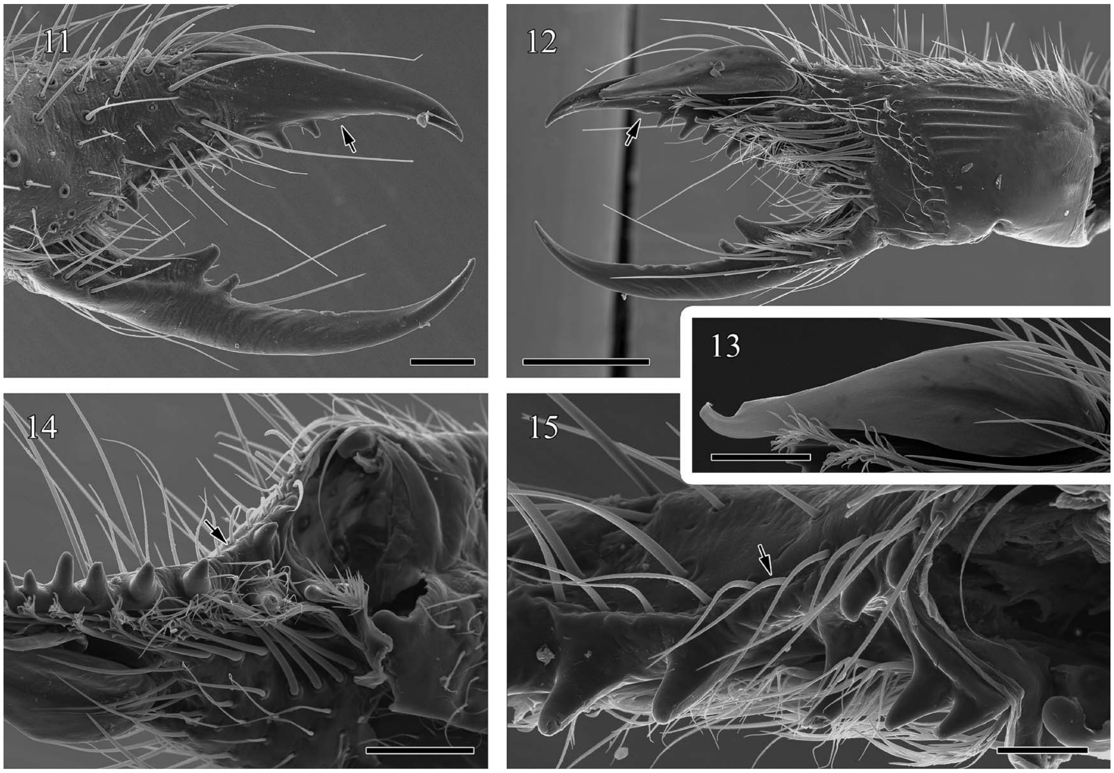


Figures 7–10.—*Vempironiella aguilari* gen. nov., sp. nov. SEM images. Juvenile (presumably subadult) and adult female paratypes (MACN-Ar-35454). 7. Juvenile, right chelicera, retrolateral aspect; 8. Adult female, left chelicera, retrolateral aspect; 9. Juvenile, right chelicera, prolateral aspect; 10. Juvenile, right chelicera, apex of movable finger mucron, retrolateral aspect (gnathal edge carina indicated by white arrows; retrolateral edge carina indicated by black arrow). Scale bars: 0.25 mm (Figs. 7–9); 50μm (Fig. 10).

(i.e., retrolateral edge carina) evident only on the apical region of the mucron. Closure of FP tooth distal to MP. Fixed finger with prodorsal carina complete (along the entire length of the asetose area), starting approximately at level of the attachment point of the flagellum and of RFA tooth, predominantly straight, without angular dorsal crest; proventral carina long, starting approximately at level of FM tooth and present in the entire mucron area; mucron long and slender, ventral margin gently curved, without subterminal flange (STF), apex (FT tooth) ventrally curved. Movable finger mucron very long and slender, with obsolete gnathal edge carina, identified by subtle angle formed by adjacent surfaces.

Chelicera-setose areas and stridulatory plate: (Figs. 6, 11–15). Retrolateral and dorsal surfaces with abundant bifurcated retrolateral manus (*rlm*) and retrolateral finger (*rlf*) setae, of different sizes; some of these setae are arranged in a bilaterally symmetrical pattern, including four evident principal retrolateral finger (*principal rlf*) setae, i.e., rlf_{1-4}, with distribution in the fixed finger as shown in Fig. 6. Prolateral surface with array of setal types, as follows: proventral distal (*pvd*) setae consisting of (apparently) two rows of plumose setae, the ventral reaching the level of the fondal interdigital articular membrane (*fiam*) and the dorsal reaching the prolateral interdigital condyle (*pic*); proventral subdistal setae made up of few thick and blunt setae (*pvsd* comb) at level of the stridulatory apparatus, and a few others, thinner, in more distal position (*pvsd*); carpet-like field of sparse barbed and bristle-like promedial (*pm*) setae, covering the distalmost quarter of manus. Stridulatory plate slightly longer than high, occupying most of manus, dorso-apically with a six-ridged stridulatory apparatus (variability in ridge number was not measured). Prolateral setose area of movable finger with setal insertions reaching the level of MP tooth; movable finger prodorsal (*mpd*) setal series consisting of plumose setae arranged in one staggered row or two rows, followed by sparse setae of different length and thickness corresponding to the movable finger promedial (*mpm*) and proventral (*mpv*) setal series, the distalmost setae of each of which is longer.

Flagellum: (Figs. 6, 11–14). A thin, translucent, membranous structure immovably attached prodorsally to the fixed finger; ipsilateral opening present. General aspect drop-like, moderately inflated and narrowing anteriorly; ventral margin sinuous. Visible (prolateral) surface almost smooth, with very sparse minute spicules, barely identifiable along regions of prodorsal margin; apex without visible spicules; apex of the flagellum reaching about midway between the apex of the mucron and FD tooth.



Figures 11–15.—*Vempironiella aguilari* gen. nov., sp. nov. SEM images. Male paratypes (MACN-Ar-35454). 11. Right chelicera, retrolateral aspect (broken FD tooth indicated by arrow); 12. Right chelicera, prolateral aspect (broken FD tooth indicated); 13. Right chelicera, flagellum, prolateral aspect; 14. Left chelicera, fixed finger, proventral aspect (retrofondal diastema indicated by arrow); 15. Ibid., retroventral aspect. Scale bars: 0.1 mm (Figs. 11, 13, 14); 0.25 mm (Fig. 12); 50 μm (Fig. 15).

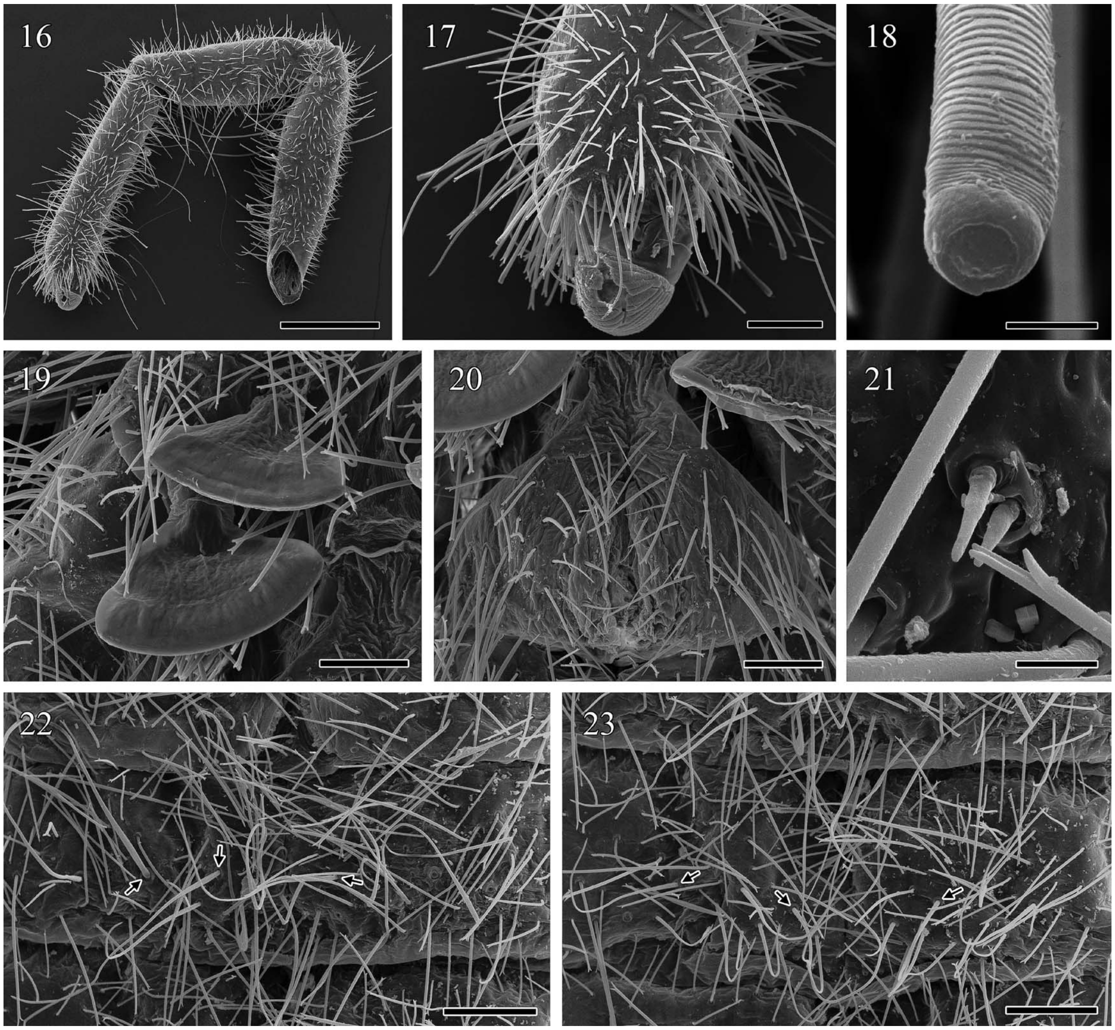
Pedipalp: (Figs. 16–18). Segments robust, all coated with bifurcated setae (*sensu* Cushing & Casto 2012) of different sizes; femur, basitarsus, and especially tibia with ventral set of very long setae, some of them longer than tibia; clubbed setae (*sensu* Cushing & Casto 2012) only present on basi- and telotarsus; spiniform setae absent. Randomly distributed slit sensilla present at least on tibia, basi- and telotarsus.

Leg I: (Fig. 1). Similar to pedipalp with respect to the types, density and distribution of setae; with neither claws nor spiniform setae. Slit sensilla, if present, could not be identified.

Walking legs: (Fig. 1). Covered with abundant small- to medium-sized bifurcated setae, and a few longer setae. Legs II and III: tibia and basitarsus with array of pro- and retroventral rows of spiniform setae; on basitarsus apparently a row of three proventral, row of three retroventral, and one distal subventral spiniform setae, in a 2.2.3 pattern; telotarsus bi-segmented with pro- and retroventral rows of spiniform setae, each apparently with five and three, respectively, in a 1.1.2/2.2 pattern. Leg IV: Tibia with row of three/four spiniform setae on proventral surface and single distal spiniform seta on retroventral surface; basitarsus apparently with row of four provental and one distal retroventral spiniform setae, in a 1.1.1.2 pattern; telotarsus bi-segmented with incomplete (ventral) segmentation on first (basal) tarsomere, with pro- and retroventral rows of six spiniform setae each, in a 2.2.2-2/2.2 pattern.

Opisthosoma: (Figs. 1, 20–23). Tergites with abundant bifurcated setae of variable size. Sternites with several bifurcated setae. Ctenidia present on 3rd and 4th post-genital sternites (post-spiracular sternites I and II); ctenidia filiform and setae-like, similar in thickness to the bifid setae, but distinguishable because ctenidia are longer, single-tipped (non-bifid), and flexible; ctenidia similar in the two sternites. Post-spiracular sternite II with row of rigid hairs along posterior margin. Two pairs of microsetae, of the same type reported by Iuri et al. (2014) and Botero-Trujillo (2014), present in the posterior half of the genital plate, 1st and 2nd post-genital sternites (spiracular sternites); one of these microsetae is also present on each side of post-spiracular sternite I (these could not be seen in other sternites due to dense setation).

Female.—Meristic data in Table 1. Figs. 3–5, 7–10. Similar to male but larger and more robust; propeltidium wider. Ctenidia present in the same sternites and similar to those of male. Chelicera without the sexual specializations of males. Fixed and movable fingers very sharp, with sharp teeth. Fixed finger dorsal surface more elevated than manus, evidently curved on lateral aspect and without dorsal crest; fixed finger highest elevation at level of mucron. Movable finger mucron aculeus-like, with teeth located in a noticeably basal position on the finger; mucron cylindrical; vestigial retrolateral carina present on basal third of finger (where granulose) and on the apex (i.e., retrolateral edge carina); gnathal edge carina



Figures 16–23.—*Vempironiella aguilari* gen. nov., sp. nov. SEM images. Male paratypes (MACN-Ar-35454). 16. Right pedipalp, prolateral aspect; 17. Ibid., detail of telotarsus; 18. Tip of clubbed seta on pedipalp telotarsus; 19. Leg IV malleoli; 20. Genital plate; 21. Pair of microsetae on genital plate; 22. Post-spiracular sternite I (arrows indicate some ctenidia); 23. Post-spiracular sternite II (arrows indicate some ctenidia). Scale bars: 0.5 mm (Fig. 16); 0.1 mm (Figs. 17, 19, 20, 22–23); 5 µm (Fig. 18); 10 µm (Fig. 21).

obsolete, not elevated and identified only by a sclerotized line along the mucron dorsal margin.

Variation.—Dental pattern formula: In females and juveniles: FD-(1-2)-FM-(1-2)-FP-(1RFA, 1RFP, 1RFSP); in males: FD-(1-2)-FM-(1)-FP-(1RFA, 1RFP, 1RFSP).

Number of teeth on the FSD secondary teeth category: Males: n (chelicerae) = 24; 21 with one, 3 with two FSD; females: n = 4; 4 with two FSD.

Number of teeth on the FSM secondary teeth category: Males: n (chelicerae) = 24; 24 with one FSM; females: n = 4; 2 with one, 2 with two FSM.

Notes.—Resulting from a year-round (1974–1975) ecological study of the arthropod fauna of the Tillandsial of Punta Hermosa, Aguilar (1977: 91) reported *V. aguilari* [as "*Mummucia variegata* (?)"] as the most abundant arachnid species. Aguilar (1977) did not mention if the specimens were to be deposited in a collection; however, he specified that some arachnid samples from his study had been sent to Dr. M. E. Galiano, formerly at the MACN where the material herein referred was found. The information contained in the label with the specimens accurately indicates that these are from Aguilar's survey of the spring of 1974 (September to November). According to Aguilar (1977: fig. 4), around 40 specimens of only that solifuge species were captured in that season, while other, about 190 specimens were captured during the rest of the year (mostly in summer). So far, only the specimens here referred are known to be deposited in a formal collection, the rest remain unlocated.

Even though *V. aguilari* appeared to be, back then, fairly abundant throughout the year, a two-day survey to the type locality conducted by the author in early March 2014, aimed at collecting additional material of this species, was unsuccessful. Whether the population density might have decreased, or which variables might be related to the species not having been found, cannot be determined at this time.

Habitat.—The coastal-desert area where *V. aguilari* was collected is characterized by the presence of the xerophyte *Tillandsia latifolia* (Bromeliaceae) (Aguilar 1977).

Table 1.—Meristic data for *Vempironiella aguilari* gen. nov., sp. nov. Measurements in millimeters for male and female. L = length; W = width; H = height. [1]Measured along medial axis, from the propeltidium anterior margin to the opisthosoma posterior margin. [2]Measured in dorsal view at widest point. [3]Measured in retrolateral view parallel to longitudinal axis of chelicera, from the fixed finger apex to anterolateral propeltidial lobe anterior margin. [4]Measured in retrolateral view, along vertical axis at widest part of manus. [5]Sum of individual segment lengths. [6]Measurement excludes claws. * Range for males (n = 15). ** Measurement unavailable (legs IV absent).

	Male holotype (MACN-Ar-35453)	*Female paratype (adult)* (MACN-Ar-35454)
Total body L:		
With chelicerae:	5.72 (holotype) [3.90 – 5.85] *	8.11
w/o chelicerae:[1]	4.66 (holotype) [3.19 – 4.79] *	5.72
Propeltidium:		
L:	0.90	1.57
W:[2]	1.00	2.10
Chelicera:		
L:[3]	1.23	2.83
W:[2]	0.43	0.97
H:[4]	0.37	0.97
Pedipalp total L:[5]	3.37	5.33
Femur L:	1.17	1.83
Tibia L:	1.00	1.67
Tibia W:[2]	0.23	0.42
Basitarsus + telotarsus L:	1.20	1.83
Leg I total L:[5]	2.70	4.11
Patella L:	0.90	1.17
Tibia L:	0.82	1.30
Basitarsus L:	0.58	0.97
Telotarsus L:	0.40	0.67
Leg IV total L (w/o claws):[5]	4.57	**
Patella L:	1.50	**
Tibia L:	1.37	**
Basitarsus L:	1.03	**
Telotarsus L: [6]	0.67	**

DISCUSSION

The cheliceral morphology of *Vempironiella aguilari* is challenging to interpret, especially that of the movable finger. Bird et al. (2015) consider in corollary 1 of their structural criterion of homology that secondary teeth are more likely to be absent than primary teeth. On the other hand, corollary 2 argues that teeth are more prone to be absent the more distal its position is on the finger (except within secondary teeth categories where the opposite can be true).

The chelicerae of *V. aguilari* bear only two teeth on the movable finger, the proximal of which is larger than the distal. In interpreting this dentition pattern in the light of the corollaries of Bird et al. (2015), it could be argued that it is the MSM tooth which is absent, the smallest tooth on the movable finger of this species corresponding to MM. Three things suggest, however, that this is not the case and that it is the MM tooth which is indeed absent. First, in all known mummuciid species, the MM tooth closes just slightly proximal to its serial homolog on the fixed finger, FM; therefore if MM is presumed to be present in *V. aguilari*, then its closure with respect to FM would deviate from that pattern considering that the two teeth would be well distant when the fingers are closed. In addition, the two teeth on the movable finger of *V. aguilari* are placed in a clearly basal position on the finger, while the finger mucron is very long. If compared with other species in the family, it is reasonable to consider that it was the absence of MM tooth, instead of the MSM, which makes the mucron of this species that long as compared to the whole finger length. The absence of MM tooth would also more easily explain why the teeth are placed in a basal instead of median position on the finger, the latter being more widely distributed across mummuciid taxa. Likewise, the anterior-most tooth on the movable finger of *V. aguilari* is considerably smaller than MP, as it most frequently happens with MSM and MP teeth, respectively, throughout the order (Bird et al. 2015). Although the former tooth is indeed much more developed compared to the MSM of other species in family Mummuciidae, it is similar in size to the secondary teeth of the fixed finger, and therefore the hypothesis that it is the MSM tooth remains feasible.

The frfd in the chelicerae of *V. aguilari* involves the absence of retrofondal teeth (including RFM). This diastema, which is present in adults of both sexes as well as in juveniles, is to our knowledge not shared with any other described solifuge. The frfd is unlikely to be homologous to the fondal notch of many male eremobatids, the later of which is situated immediately proximal to the FP tooth, whereas the frfd is proximal to RFA. The frfd is not either considered homologous to the medial notch of some other families (e.g., Solpugidae), since such diastema is situated between FM and FSM and does not involve the lack of teeth (Bird et al. 2015).

The shape of the chelicerae of solifuges has been proposed to be associated with dietary preferences and burrowing abilities (Van der Meijden et al. 2012; Bird et al. 2015). For instance, species with multidentate chelicerae are presumed to be especially successful at hunting small, fast-running prey, at the cost of lower force as compared to species with robust chelicerae (Bird et al. 2015). The chelicerae of *V. aguilari* are neither multidentate nor especially robust, and these might also be associated with feeding and burrowing adaptations. The long and delicate shape of the fingers of *V. aguilari* suggests that these solifuges are not especially adapted for burrowing or that they burrow in soft substrates (e.g., loose-sand removal instead of hard-substrate excavation). In contrast, it is possible that the long, sharp aculeus-like movable finger can serve as a “killing weapon” that easily penetrates soft-bodied animals or articular membranes. In addition, the large size of the MP tooth might grant these animals the ability to break small, hard-shelled preys (e.g., ants), or to prevent them from escaping, for instance, by crushing them or keeping them trapped against the frfd. These hypotheses, however, have not yet been confirmed with live animals and direct observations will be necessary.

The cheliceral morphology of *V. aguilari* is remarkable and very different from that of most species in the family. Interestingly, there is some resemblance between the chelicerae of this species and that of *M. mauryi* (see Xavier & Rocha 2001). In both, the chelicerae are slender with finger tips sharp, the movable finger mucron is long and delicate, and the fixed finger highest elevation in female is at level of the mucron. These resemblances probably result from independent adaptations in two distant taxa. As for the two other Peruvian species, *M. exlineae* and *M. masculina*, neither is assignable to the new genus and their systematic position remains to be determined.

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