

Systematic Revision of the North American Syntropine Vaejovid Scorpion Genera Balsateres, Kuarapu, and Thorellius, With Descriptions of three New Species

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SYSTEMATIC REVISION OF THE
NORTH AMERICAN SYNTROPINE VAEJOVID
SCORPION GENERA *BALSATERES*, *KUARAPU*, AND
THORELLIUS, WITH DESCRIPTIONS OF THREE
NEW SPECIES

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ABSTRACT

Four genera formed a monophyletic group, referred to as the *Kochius* clade, in the phylogeny of the North American vaejovid scorpion subfamily Syntropinae Kraepelin, 1905: *Balsateres* González-Santillán and Prendini, 2013; *Kochius* Soleglad and Fet, 2008; *Kuarapu* Francke and Ponce-Saavedra, 2010; and *Thorellius* Soleglad and Fet, 2008. In the present contribution, all except *Kochius*, treated elsewhere, are revised. The monotypic *Balsateres* and *Kuarapu* are redescribed. *Thorellius cristimanus* (Pocock, 1898) and *Thorellius intrepidus* (Thorell, 1876) are redescribed and their type localities discussed and clarified. Three new species of *Thorellius* are described: *Thorellius tekuanii*; *Thorellius wixarika*; and *Thorellius yuyuawii*. *Vaejovis intrepidus atrox* Hoffmann, 1931, is newly synonymized with *T. cristimanus* based on examination of the type material. A key to identification of the species of *Thorellius* is presented, and new locality records and updated distribution maps provided for all species covered.

INTRODUCTION

Four genera formed a monophyletic group, referred to as the *Kochius* clade, in the phylogeny of the North American vaejovid scorpion subfamily Syntropinae Kraepelin, 1905, presented by González-Santillán and Prendini (2015a): *Balsateres* González-Santillán and Prendini, 2013; *Kochius* Soleglad and Fet, 2008; *Kuarapu* Francke and Ponce-Saavedra, 2010; and *Thorellius* Soleglad and Fet, 2008 (fig. 1). Members of this clade are united by low setal counts on the dorsolateral and ventrosubmedian carinae of metasomal segment IV and the granular condition of the pro- and retrolateral carinae of the pedipalp femur, the ventral median carina of the patella, and the median and retrolateral carinae of the chela (González-Santillán and Prendini, 2015a: 403, appendix 9). These characters distinguish the four genera from all other genera in the subfamily.

Whereas *Balsateres* and *Kuarapu* are monotypic, *Kochius* and *Thorellius* are mesodiverse. Species of *Kochius* inhabit desert to semidesert habitats from the Baja California Peninsula and the Mexican state of Sonora to the states of Arizona, California, and Nevada (González-Santillán and Prendini, 2015a). In contrast, species of *Balsateres*, *Kuarapu*, and *Thorellius* are endemic to Mexico and inhabit tropical deciduous forest throughout the Balsas Basin, and along the Pacific coast from the states of Nayarit to Guerrero, southern Aguascalientes and Estado de

México, western Guanajuato, and southern Zacatecas (figs. 2–4). *Balsateres* and *Kuarapu* are relatively stenotopic. *Balsateres cisnerosi* Ponce-Saavedra and Sissom, 2004, which burrows in sandy river beds (Ponce-Saavedra and Sissom, 2004), is semipsammophilous, possessing a pale and glabrous integument without metasomal carinae, but lacks setal combs on the leg tarsi, a psammophilous characteristic (Prendini, 2001). *Kuarapu purhepecha* Francke and Ponce-Saavedra, 2010, usually found actively foraging on the surfaces of road cuts at night or resting in rock piles by day, is lithophilous, with slender pedipalps and a somewhat dorsoventrally compressed soma. *Thorellius* species are eurytopic and predominantly lapidicolous. Although often sheltering under stones, logs or other available debris, where they may excavate shallow burrows, *Thorellius* also inhabits the cracks and crevices of rocks. *Thorellius* includes the largest species in family Vaejovidae Thorell, 1876, with females attaining a length of 94 mm (Sissom, 2000).

In the present contribution, all except *Kochius*, to be treated elsewhere, are revised in accordance with the classification, terminology, and homology assessment proposed by González-Santillán and Prendini (2013, 2015a, 2015b). The monotypic *Balsateres* and *Kuarapu* are redescribed. *Thorellius cristimanus* (Pocock, 1898) and *Thorellius intrepidus* (Thorell, 1876) are redescribed and their type localities discussed and clarified. Three new species of *Thorellius* are described: *Thorellius tekuanii*, sp. nov.; *Thorellius wixarika*,



FIGURE 1. Habitus in life. **A.** *Balsateres cisnerosi* (Ponce-Saavedra and Sissom, 2004), ♀; **B.** *Kuarapu purhepecha* Francke and Ponce-Saavedra, 2010, ♀; **C.** *Thorellius cristimanus* (Pocock, 1898), ♂; and **D.** *Thorellius intrepidus* (Thorell, 1876), ♀.

sp. nov.; *Thorellius yuyuawi*, sp. nov. *Vaejovis intrepidus atrox* Hoffmann, 1931, is newly synonymized with *T. cristimanus* based on examination of the type material. A key to identification of the species of *Thorellius* is presented, and new locality records and updated distribution maps provided for all species covered.

TAXONOMIC HISTORY

Two species presently accommodated in *Thorellius*, including the type species of the genus, *T. intrepidus*, were originally placed in the “catchall” genus *Vaejovis* C.L. Koch, 1836. Thorell (1876a, 1876b, 1877) mistakenly regarded *Vaejovis intrepidus* Thorell, 1876, rather than *Vaejovis mexicanus* C.L. Koch, 1836, as the type species of *Vaejovis*. Whereas Kraepelin (1894, 1899) followed Thorell’s (1876a, 1876b, 1877) opinion, Pocock (1902: 13) disagreed:

In face of Thorell’s description, I find it impossible to adopt this opinion [Kraepelin’s (1894, 1899) recognition of *Vaejovis intrepidus* as type species of the genus]. The measurements given show that *V. intrepidus* is about twice the size of the average *V. mexicanus*, the length being 84, the carapace 11.5, and the tail 52.5 mm. Moreover, the third caudal segment is one-third longer than wide (9:6) and the second as long as wide. Lastly, the inferior caudal keels, although well expressed, are described as subgranular, except the median keels on segment 1, 2, and 3, which are smooth, those on the third being subgranular only posteriorly. So far as these keels are concerned, as well as in color and certain other characters, *V. intrepidus*, apart from its much greater size, most nearly approaches *V. cristimanus*...

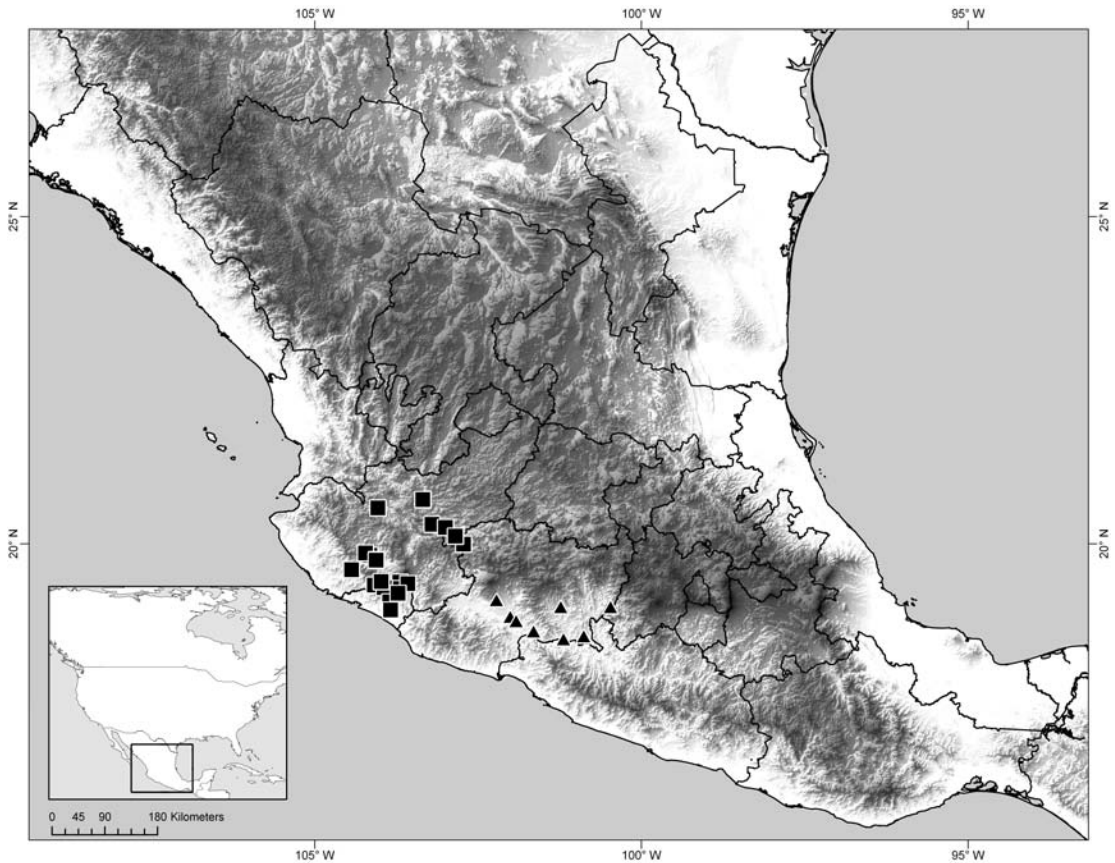


FIGURE 2. Map of central Mexico, plotting known locality records for the vaejovid scorpion species, *Balsateres cisnerosi* (Ponce-Saavedra and Sissom, 2004) (triangles) and *Thorellius cristimanus* (Pocock, 1898) (squares), based on data collected in the present study.

Hoffmann (1931) divided *Vaejovis* into three “sections” and recognized the differences between *V. intrepidus* and *V. mexicanus* noted by Pocock (1902). Hoffmann’s (1931) “second section” was the precursor of the *intrepidus* group of *Vaejovis* (Sissom, 1989) to which the name *Thorellius* was later assigned (Soleglad and Fet, 2008) whereas Hoffmann’s (1931) “third section” became the *mexicanus* group (Soleglad, 1973), currently what remains of *Vaejovis*, in the nominotypical subfamily Vaejovinae Thorell, 1876 (Soleglad and Fet, 2008).

Hoffmann (1931) recognized three “forms” within *V. intrepidus*: the nominotypical form; *Vaejovis intrepidus atrox* Hoffmann, 1931; and

Vaejovis cristimanus Pocock, 1898, demoted to subspecies, establishing *Vaejovis intrepidus cristimanus* Pocock, 1898. Despite noting “he reunido tres formas que por sí sola cada una puede pasar por especie propia” (I reunited three forms that each can be recognized as a proper species), Hoffmann (1931: 374) considered differences in the trichobothrial counts among these “forms” to represent intraspecific variation, associated with differences in habitat and climate.

In addition to *V. intrepidus* and its subspecies, Hoffmann’s (1931) second section of *Vaejovis* included the nominotypical form of *Vaejovis subcristatus* Pocock, 1902, and *V. subcristatus*

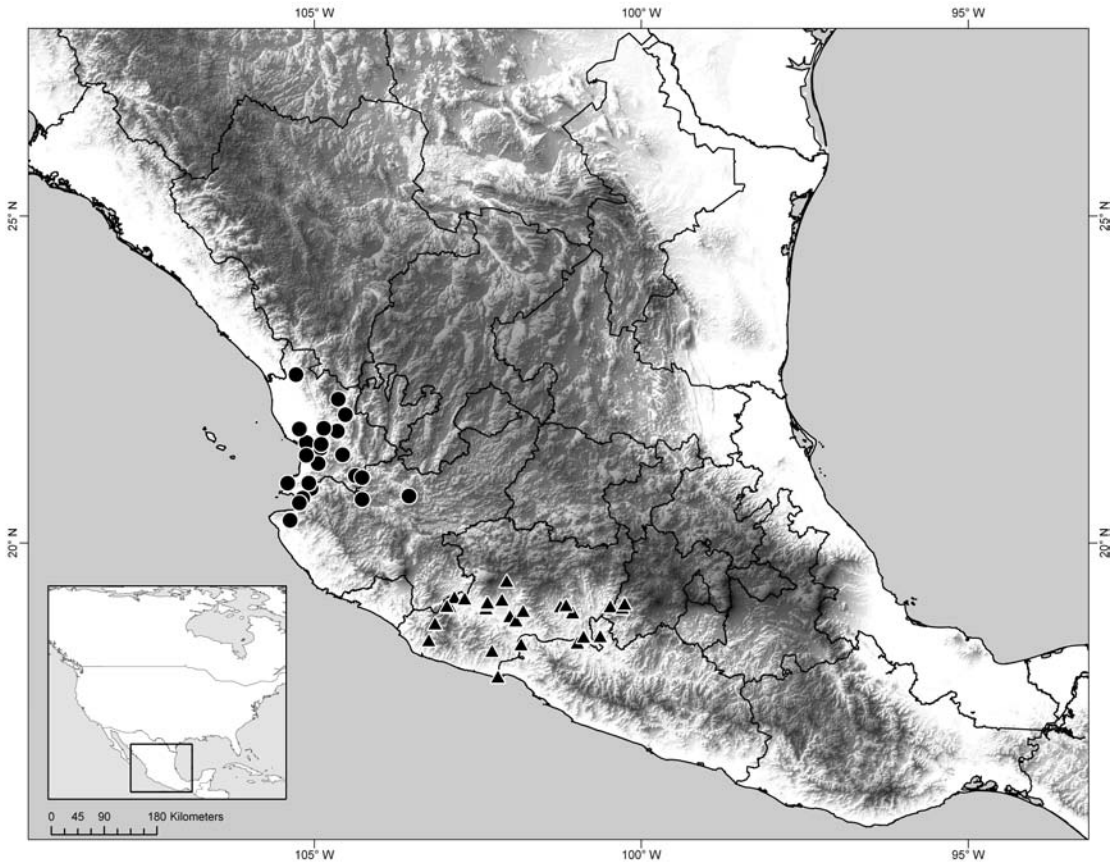


FIGURE 3. Map of central Mexico, plotting known locality records for the vaejovid scorpion species, *Thorellius tekuni*, sp. nov. (triangles), and *Thorellius wixarika*, sp. nov. (circles), based on data collected in the present study.

occidentalis Hoffmann, 1931. Sissom (1989) later elevated *V. occidentalis* to the rank of species and suggested a possible link between the former *intrepidus* group of *Vaejovis* and the former *punctipalpi* group, created by Williams (1971), to which the name, *Kochius*, was later assigned (Soleglad and Fet, 2008).

Vaejovis intrepidus and its subspecies, along with *V. occidentalis* and *V. subcristatus*, remained in the *intrepidus* group for several decades (Loureço and Sissom, 2000; Sissom, 2000) until Soleglad and Fet (2008) presented their revised classification of Vaejovidae. Soleglad and Fet (2008) formalized the relationship between the *intrepidus* and *punctipalpi* groups, suggested earlier by Sissom (1989), renamed them *Thorellius*

and *Kochius*, respectively, and transferred *Thorellius* to subtribe Thorelliina Soleglad and Fet, 2008, of tribe Syntropini Kraepelin, 1905. In addition to renaming the *intrepidus* group *Thorellius*, Soleglad and Fet (2008) elevated the two subspecies of *T. intrepidus* to the rank of species, creating *Thorellius atrox* (Hoffmann, 1931) and *T. cristimanus*, and transferred *Vaejovis cisnerosi* Ponce-Saavedra and Sissom, 2004, to *Thorellius*. In the original description of *V. cisnerosi*, Ponce-Saavedra and Sissom (2004: 540) refrained from assigning it to any of the species groups recognized at that time due to its unique character combination:

Vaejovis cisnerosi is unlike all other species of *Vaejovis* in that the carinae of the

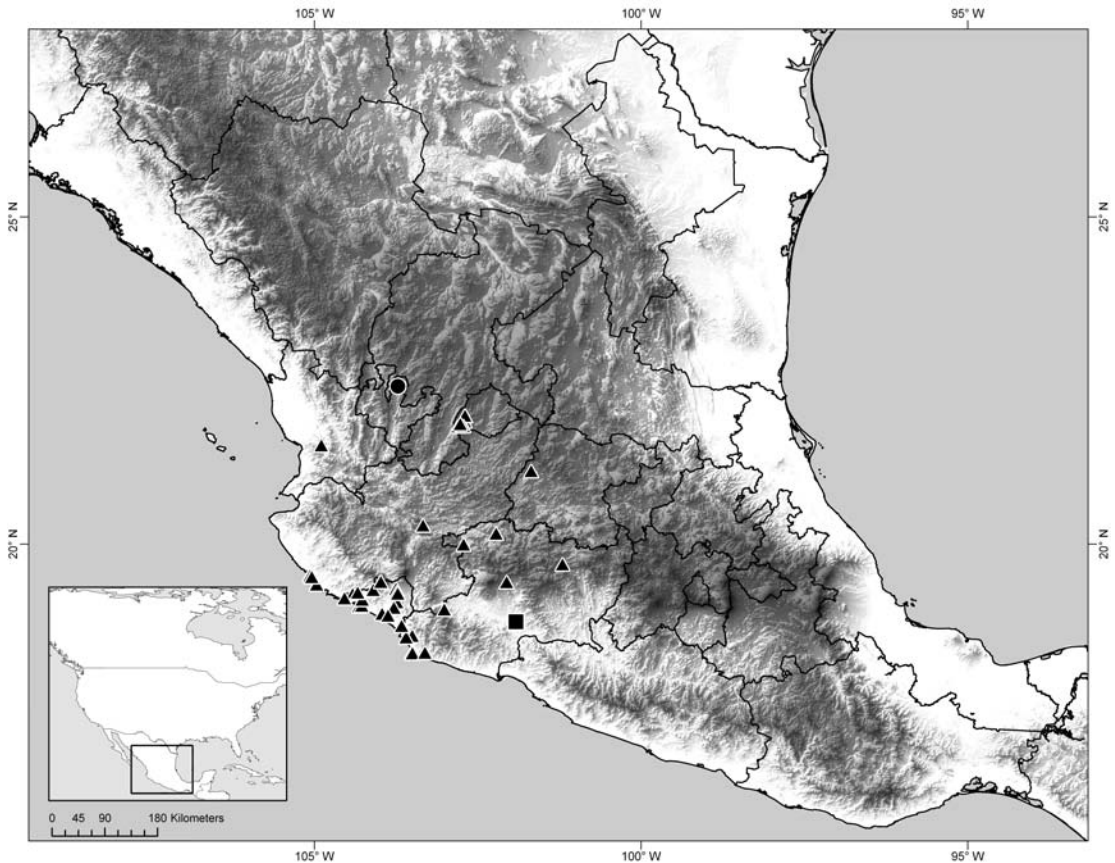


FIGURE 4. Map of central Mexico, plotting known locality records for the vaejovid scorpion species, *Kuarapu purhepecha* Francke and Ponce-Saavedra, 2010 (square), *Thorellius intrepidus* (Thorell, 1876) (triangles) and *Thorellius yuyuawi*, sp. nov. (circle), based on data collected in the present study.

dorsal and lateral surfaces of the metasoma are greatly reduced in strength (mostly obsolete) and completely smooth. In addition, the metasomal setation is highly reduced ... giving it the lowest setal counts of any species in the genus. These features are autapomorphic.... The hemispermaphore of *V. cisnerosi* is quite similar to those of the species of the *V. eusthenura*, *V. intrepidus* and *V. punctipalpi* species groups. There is a broad flange along the ental margin of the distal lamina [fused margin of dorsal and ventral troughs], and the ental process of the inner capsular lobe bears a series of hook-

lets (Sissom, 1991) [spinose distal barb margin]. The position of trichobothria *ib* and *it* on the pedipalp chela fixed finger (displaced to near the 6th inner accessory denticle of the primary denticle row) and the possession of only five subrows of denticles on the chela fixed finger also suggest relationship with those groups. Finally, the ventromedian spinule row of the leg tarsi are flanked distally by two or more pairs of larger spinules, as in the aforementioned groups. The reduction of the carinae of the pedipalps and the absence of ventral carinae on the metasoma place the species closer to the *eusthenura* group

(e.g., in southern Mexico, this would include *Vaejovis punctatus* Karsch, 1879 [currently *Mesomexovis punctatus* (Karsch, 1879)] and its relatives); on the other hand, the reduction of the metasomal setation and the dorsoventral compression of the metasoma are similar to the conditions seen in the *intrepidus* species group.

Soleglad and Fet (2008: 95) justified the transfer of *V. cisnerosi* to *Thorellius*, despite the uncertainty regarding its phylogenetic placement (Ponce-Saavedra and Sissom, 2004), and without testing that placement in a quantitative analysis, as follows:

Clearly the hemispermaphore, with its well developed lamellar hook [fused margin of dorsal and ventral troughs], the mating plug with its toothed barb [spinose distal barb margin], and the multiple pairs of ventral distal spinules of the leg tarsus imply this species is a member of tribe Syntropini. The chelal and metasomal carination of this species is unique... where the former exhibits vestigial to smooth carinae and the ventral carinae of the latter are obsolete. The existence of carinae on the chelae, though smooth, and the somewhat robust chelae imply this species is a member of subtribe Thorelliina. The carapace in *T. cisnerosi* lacks the anterior emargination extending to the lateral ocelli as seen in *Kochius* and the placement of chelal trichobothrium *Dt* is well distal of the palm midpoint, indications of genus *Thorellius*... Finally, of somewhat less importance, the large size of this species, its large pectinal tooth count (20–22 for males and 20–21 for females), and its geographical distribution also indicates genus *Thorellius*.

As discussed by González-Santillán and Prendini (2013), most of the new taxa proposed in the classification presented by Soleglad and Fet (2008) were demonstrably paraphyletic or polyphyletic

when tested by a quantitative phylogenetic analysis based on morphological characters and DNA sequences from the nuclear and mitochondrial genomes (González-Santillán and Prendini, 2015a). *Thorellius*, as defined by Soleglad and Fet (2008), was consistently polyphyletic, and the group comprising *T. atrox*, *T. cristimanus*, and *T. intrepidus* consistently monophyletic. In consequence, *Thorellius* was restricted to these species, and the other species transferred to different genera by González-Santillán and Prendini (2013). *Balsateres* was created to account for the phylogenetic position and unique diagnostic character combination of *V. cisnerosi*, creating *B. cisnerosi*, whereas *V. occidentalis* and *V. subcristatus* were transferred to *Mesomexovis*, creating *Mesomexovis occidentalis* (Hoffmann, 1931) and *Mesomexovis subcristatus* (Pocock, 1902).

Francke and Ponce-Saavedra (2010) discussed the placement of *Kuarapu* in the context of Soleglad and Fet's (2008) classification, and offered two alternatives: placement within Syntropini, based on the spinose distal barb margin of the hemimating plug of the male hemispermaphore, peg sensillae on the basal pectinal teeth of the female, and five ventral spinules on the telotarsus of leg III; or within Stahnkeini Soleglad and Fet, 2008, based on the shared serrate cutting edge of the pedipalp chela fingers and the medial position of trichobothria *ib* and *it* on the pedipalp chela fixed finger. The analyses of González-Santillán and Prendini (2015a) confirmed the first hypothesis, based on the spinose distal barb margin of the hemimating plug, uniquely synapomorphic for Syntropinae, and consistently recovered *Kuarapu* as the basal member the *Kochius* clade.

MATERIAL AND METHODS

Scorpion specimens were collected mostly by ultraviolet (UV) light detection at night using portable UV lamps, comprising mercury vapor tubes attached to a chromium reflector, and powered by a 12V, 7 amp/hour battery, or Maglite flashlights modified with UV light-emitting

diode (LED) attachments. Some specimens were collected during the day by turning rocks and other objects on the ground.

Material examined is deposited in the following collections: American Museum of Natural History, New York (AMNH), including tissue samples stored in the Ambrose Monell Cryocollection (AMCC); Natural History Museum, London (BMNH); Colección Nacional de Arácnidos (CNAN), Instituto de Biología, Universidad Nacional Autónoma de México (IBUNAM), Mexico City; Instituto Nacional de Diagnóstico y Referencia Epidemiológicos, Mexico City (INDRE); Naturhistoriska Riksmuseet, Stockholm, Sweden (NRS); Universidad Michoacana de San Nicolás de Hidalgo, Morelia, Mexico (UMSNH). Specimens at the AMNH and CNAN bearing ARA (Arachnida) numbers were collected during a U.S. National Science Foundation-funded "Revisionary Syntheses in Systematics" grant.

The sex and life stage of specimens were determined by pectinal tooth counts, the presence or absence of genital papillae, secondary sexual characters, and the presence of hemispermatophores or mature ovariuteri. Morphological terminology follows González-Santillán and Prendini (2013). Hemispermatophores were cleared by hand or with clove oil. Measurements (mm), following Sissom et al. (1990), were taken with an ocular micrometer and illustrations of external morphology produced using a Nikon SMZ 1000 or 1500 stereomicroscope with a camera lucida. Morphometric ratios, expressed as means, are given separately for adult males and females. Digital images were taken under visible and UV light using a Microptics ML1000 digital imaging system. Photographs and illustrations were edited using Adobe Photoshop CS5.

Collection localities were georeferenced in the field with portable GPS devices (Garmin® V Plus) or retroactively using GEOLocate (Rios and Bart, 2010) and Google Earth version 6.1.0.5001. Distribution maps were generated using ArcMap 9.3.1 (Environmental Systems Research Institute, Redlands, California), by superimposing point locality records on layers depicting the topography of

North America, generated from digital elevation model files with 1 arc degree of resolution, obtained from the United States Geological Survey.

SYSTEMATICS

FAMILY VAEJOVIDAE THORELL, 1876

Subfamily Syntropinae Kraepelin, 1905

Balsateres González-Santillán and Prendini, 2013

Figures 5, 8, 9–15; table 8

Vaejovis cisnerosi Ponce-Saavedra and Sissom, 2004 [= *Balsateres cisnerosi* (Ponce-Saavedra and Sissom, 2004)], type species by monotypy.

Vaejovis incertae sedis Ponce-Saavedra and Sissom, 2004: 541.

Thorellius: Soleglad and Fet, 2008: 53, 58, 67, 77, 94, 95, tables 4, 9.

Balsateres González-Santillán and Prendini, 2013: 3, 6, 7, 18, 24, 53, 59, table 1, figs. 3; 2015a: 349, 351, 352, 355, 356, 360, 362, 363, 367, 372, 403, fig., table 5, 6; Quijano-Ravel and Ponce-Saavedra, 2014: 17, 18, table 2; 2016: 50; Santibáñez-López et al., 2015: 7; Dupré, 2017: 9.

DIAGNOSIS: *Balsateres* may be distinguished from other genera of Syntropinae by the smooth dorsal lateral and lateral median carinae of metasomal segments I–V. The carinae and intercarinal surfaces of the carapace, pedipalp chela and patella, tergites, metasoma, and telson are smooth (figs. 5A, 9A, 10A, 11A, 17, 18, 19) unlike other syntropine genera, in which they are granular. Counts of macrosetae on the carinae of metasomal segments I–IV are also greatly reduced in *Balsateres*, compared with other syntropine genera as follows: dl, 0/0/0/0/0/1/1:4/4; lm, 0/0/0/0/0/0/0/2/2; vl and vsm, 1/1:1/1:1/1:1/1:3/3. Two or more macrosetae are present on these carinae in other syntropine genera, including *Thorellius*, which also presents low setal counts, e.g., the following counts on seg-

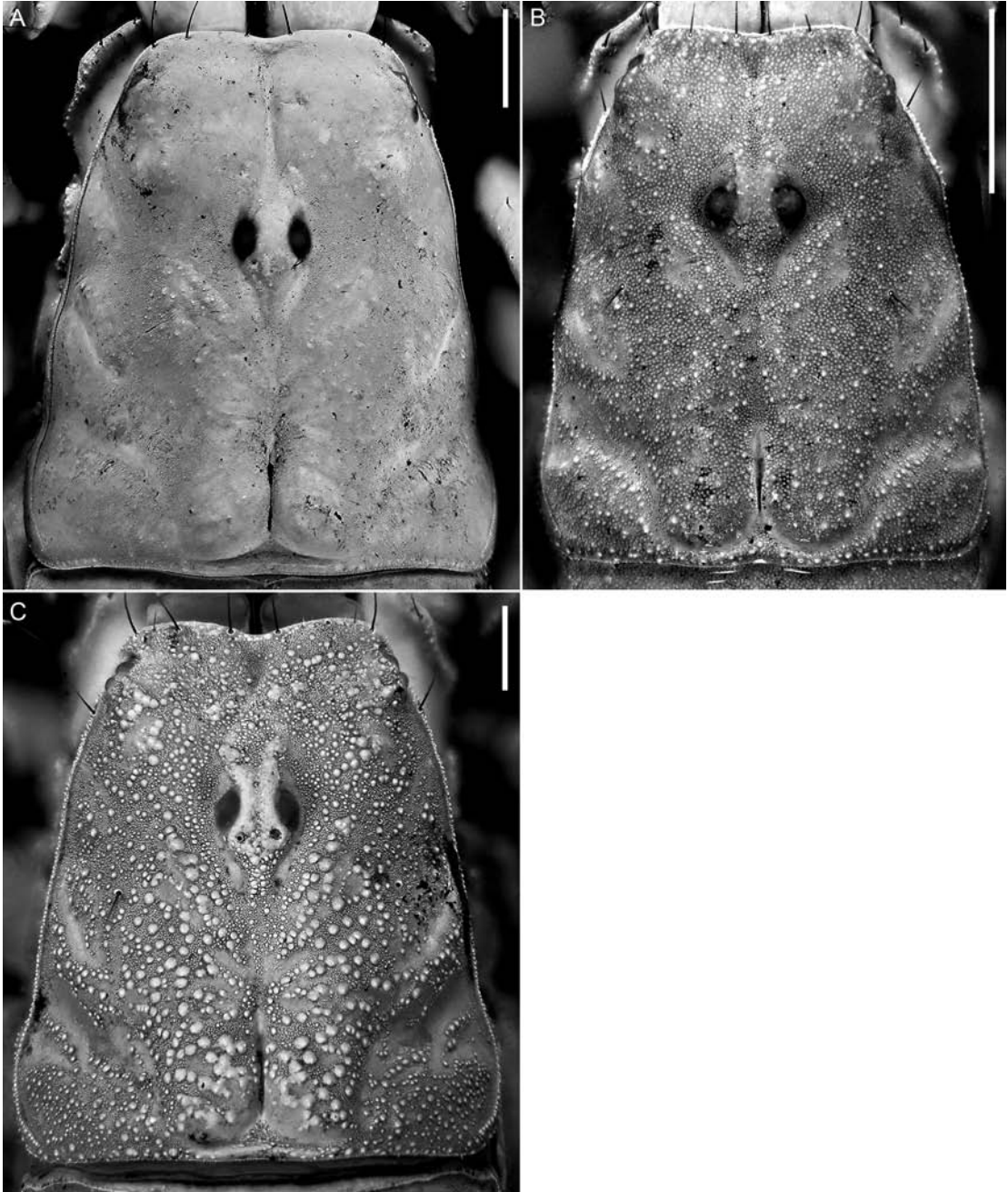


FIGURE 5. *Balsateres* González-Santillán and Prendini, 2013, *Kuarapu* Francke and Ponce-Saavedra, 2010, and *Thorellius* Soleglad and Fet, 2008, carapaces. A. *Balsateres cisnerosi* (Ponce-Saavedra and Sissom, 2004), ♂ (CNAN SC2441). B. *Kuarapu purhepecha* Francke and Ponce-Saavedra, 2010, paratype ♂ (AMNH). C. *Thorellius cristimanus* (Pocock, 1898), ♂ (AMNH). Scale bars = 1 mm



FIGURE 6. *Thorellius* Soleglad and Fet, 2008, carapaces. A. *Thorellius intrepidus* (Thorell, 1876), ♂ (AMNH). B. *Thorellius tekuni*, sp. nov., holotype ♂ (CNAN T01250). C. *Thorellius wixarika*, sp. nov., holotype ♂ (CNAN T01251). D. *Thorellius yuyuawi*, sp. nov., holotype ♂ (CNAN T01252). Scale bars = 1 mm.

ments I–V in *T. cristimanus*: dl, 2/2:3/3:3/3:3/7/6; lm, 1/1:3/3:3/3:4/4:4/4; vl, 2/2:3/3:3/3:3/7/7; vsm, 3/3:3/3:3/3:3/5/5.

Balsateres is most closely related to *Thorellius*, with which it shares broad pedipalpal and metasomal carinae, but all carinae are smooth in *Balsateres*, instead of moderately to densely granular, as in *Thorellius*. The pedipalp chela fingers of *Balsateres* are sublinear, without a distinct proximal gap, when closed, unlike *Thorellius*, in which a distinct proximal gap is evident in both sexes. The two genera also differ in base coloration and infuscation. *Balsateres* is yellowish and almost immaculate, except for the ocular tubercle, which is infuscate, whereas most *Thorellius* species are darker and reddish in color, with infuscation on the carapace and tergites. Only *T. intrepidus* is paler and mostly immaculate. *Balsateres* also shares with *T. intrepidus* a pair of prolateral denticles at the seventh position on the pedipalp chela movable finger, whereas other species of *Thorellius* possess a single denticle at the seventh position.

Balsateres resembles species of *Mesomexovis* in possessing obsolete ventral carinae on metasomal segments I–IV, but *Mesomexovis* are more setose and infuscate.

INCLUDED SPECIES: *Balsateres cisnerosi* (Ponce-Saavedra and Sissom, 2004).

DISTRIBUTION: *Balsateres cisnerosi* is endemic to the Balsas Depression in the Mexican states of Michoacán and Estado de México (fig. 2).

Balsateres cisnerosi

(Ponce-Saavedra and Sissom, 2004)

Figures 1A, 2, 5A, 7A, 8A, 9A 10A, 11A, 12A–C, 14A, 15A–C, 16–18; tables 1, 8

Vaejovis cisnerosi Ponce-Saavedra and Sissom, 2004: 540, figs 1–4, table 1.

Thorellius cisnerosi: Soleglad and Fet, 2008: 26, 31, 53, 58, 67, 73, 77, 94, 95, tables 4, 9; Baldazo-Monsivaiz et al., 2012: 146, table 1; 2013: 101, table 1; Ponce-Saavedra and Francke, 2013: 77, table 2.

Balsateres cisnerosi: González-Santillán and Prendini, 2013: 3, 6, 7, 18, 21, 24, 28, 37, 53, 55, 57, 59, table 1, figs. 3, 16A, 20A, 28A; 2015a: 351–353, 357, 363, 376, 380, 382, 387, 399, figs. 3–5, 6; Quijano-Ravel and Ponce-Saavedra, 2014: 17, 18, 20, table 2; 2016: 50; Dupré, 2017: 9.

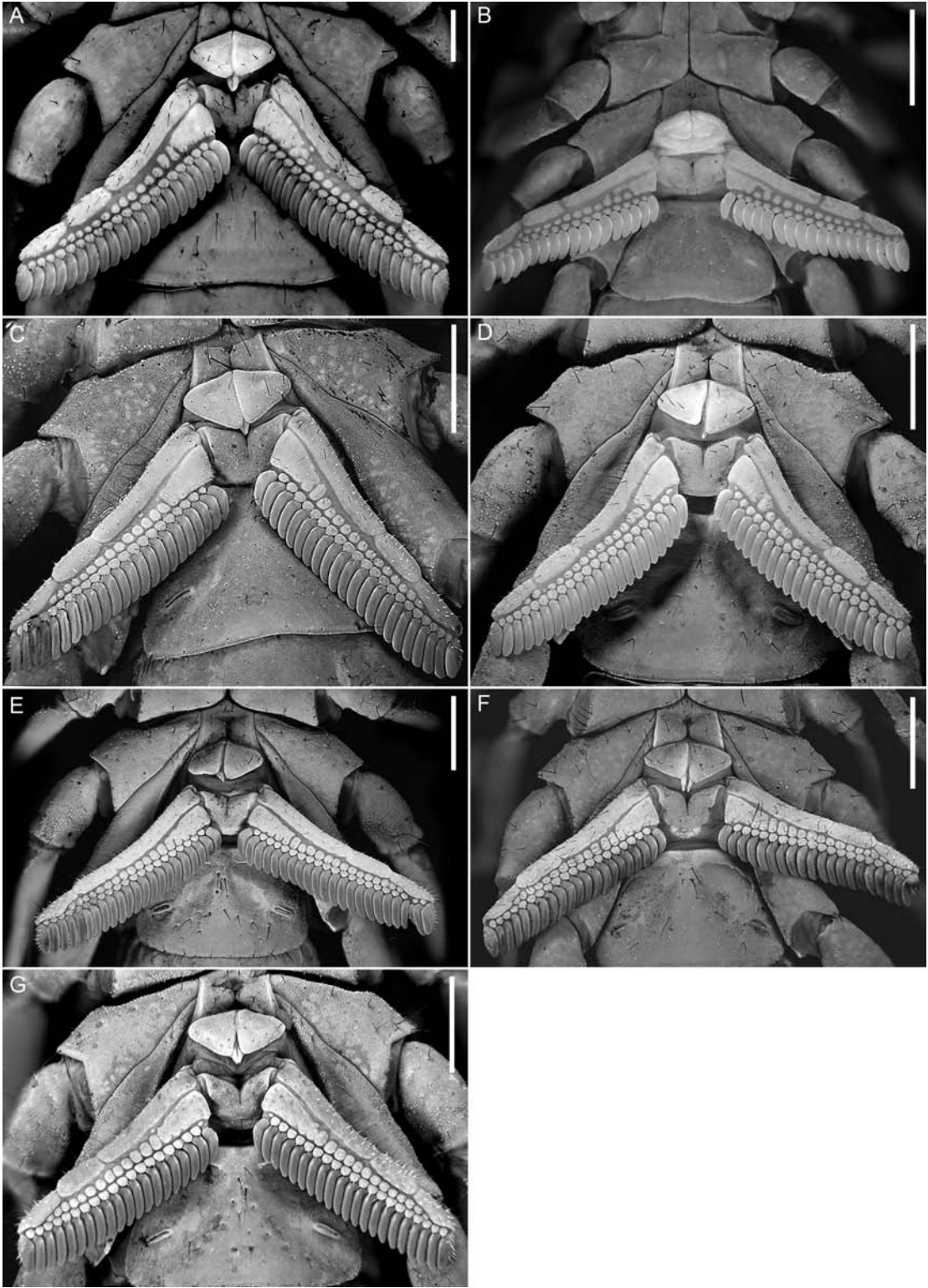
TYPE MATERIAL: **MEXICO: Michoacán:** *Municipio de Churumuco*: Holotype ♂ (UMSNH) [lost], Churumuco, 18°40'15"N 101°38'39"W, 7.i.2000, J. Ponce. Paratypes: Churumuco, 18°40'15"N 101°38'39"W, 1 ♀ (UMSNH) [lost], 9.ix.2000, J. Ponce, 1 ♂, 1 subad. ♂, 1 juv. ♂ (UMSNH) [lost], 11.xi.2000, R. Moreno, 1 ♂, 1 ♀ (UMSNH) [lost]; Cerro de Turitzio, 18°31'41"N 100°55'27"W, 1 ♀ (UMSNH) [lost]. *Municipio de Arúa*: Huetamo, 9.ix.2000, R. Moreno and R. Cancino, 1 ♀ (UMSNH) [lost]. *Municipio de Carácuaro*: El Carrizal, 19°09'00"N 101°06'19"W, vii.2000, E. Miranda, 1 ex. (UMSNH) [lost]. Neotype ♂ (CNAN T01249), Churumuco de Morelos, 18°40'15"N 101°38'39"W, 217 m, 1.vii.2000, J. Ponce-Saavedra. The holotype and paratypes are apparently lost (J. Ponce-Saavedra and G. Montiel-Parra, personal commun.) and a neotype is hereby designated.

DIAGNOSIS: As for genus.

DESCRIPTION: The following redescription, which is based on topotypes and additional material examined, supplements the original description by Ponce-Saavedra and Sissom (2004).

Color and infuscation: Chelicerae, carapace, pedipalps, legs, tergites, sternites, metasoma, and

FIGURE 7. *Balsateres* González-Santillán and Prendini, 2013, *Kuarapu* Francke and Ponce-Saavedra, 2010, and *Thorellius* Soleglad and Fet, 2008, sternum, genital operculum and pectines. **A.** *Balsateres cisnerosi* (Ponce-Saavedra and Sissom, 2004), ♂ (CNAN SC2441). **B.** *Kuarapu purhepecha* Francke and Ponce-Saavedra, 2010, paratype ♂ (AMNH). **C.** *Thorellius intrepidus* (Thorell, 1876), ♂ (AMNH). **D.** *Thorellius tekuanii*, sp. nov., holotype ♂ (CNAN T01250). **E.** *Thorellius wixarika*, sp. nov., holotype ♂ (CNAN T01251). **F.** *Thorellius yuyuawii*, sp. nov., holotype ♂ (CNAN T01252). **G.** *Thorellius cristimanus* (Pocock, 1898), ♂ (AMNH). Scale bars = 1 mm.



telson base color uniformly yellow, mostly immaculate, except as follows. Carapace and tergites faintly infuscate. Coxosternal region, genital operculum, basal piece, and pectines pale whitish. Pedipalp chela fingers slightly orange to reddish proximally, darker than manus. Telson aculeus dark reddish posteriorly.

Chelicerae: Manus dorsal surface smooth, distal margin with two pairs of setae. Movable finger, ventral surface with serrula, comprising 14/14 tines, in distal half.

Carapace: Length 1.09/1.08 $\times$ greater than posterior width (table 1). Anterior margin slightly emarginate, with shallow median notch, with three pairs of major macrosetae (fig. 5A). Three pairs of lateral ocelli, anterolateral and median lateral pairs equal in size, posterolateral pair approximately half the size. Median ocular tubercle slightly raised, situated in anterior half of carapace, superciliary carinae obsolete, lower than median ocelli. Median ocelli approximately twice the size of anterolateral ocelli. Anteromedian and posteromedian sulci moderate to deep, posterolateral and posterior transverse sulci shallow. Interocular surface glabrous, anterolateral surfaces with scattered granules, other surfaces mostly smooth (fig. 5A).

Coxosternal region: Sternum subequilateral pentagonal (fig. 7A); width 1.09/1.11 $\times$ greater than length (table 1); median sulcus deep; surfaces smooth, with three pairs of macrosetae, anteriorly, medially and posteriorly on lobes. Coxae surfaces smooth; coxa II subproximal margin with three oblique slitlike structures, adjacent to smooth protuberance; coxal endite II proximal margin with moderate depression, medial margin smooth. Coxa IV 2 $\times$ longer than coxa II (table 1).

Pedipalps: Femur, intercarinal surfaces glabrous and smooth (figs. 16, 17A); dorsal prolateral, dorsal retrolateral, and ventral prolateral carinae complete, granular (fig. 17A); retrolateral dorsosubmedian carina obsolete, mostly smooth, with few large granules proximally, and two macrosetae; prolateral ventrosobmedian carinae vestigial, reduced to proximal tubercle, six granules,

and two macrosetae medially; prolateral ventral carina vestigial, reduced to low tubercle proximally, and three macrosetae in proximal half; retrolateral ventral, ventromedian, and ventral retrosobmedian carinae vestigial, each reduced to few granules proximally. Patella slightly wider than femur (table 1); intercarinal surfaces smooth and glabrous (fig. 17B–E); dorsal prolateral and ventral prolateral carinae complete, finely granular, becoming smooth distally; dorsal retrolateral and ventral retrosobmedian carinae complete, costate; ventral median carina vestigial, reduced to row of low granules proximally; retrolateral dorsosobmedian and retrolateral median carinae absent; prolateral process well developed; prolateral median carina partial, comprising proximal tubercle, two or three low granules, and two macrosetae, proximal larger than distal; prolateral ventral carina vestigial, reduced to low tubercle proximally, and two macrosetae, proximal larger than the distal. Chela 1.6 $\times$ longer than patella and 1.7 $\times$ longer than femur (table 1). Manus incrassate (fig. 18), 1.4 $\times$ wider than patella, 1.6 $\times$ wider than femur (table 1); intercarinal surfaces smooth and glabrous; prolateral dorsal, dorsal prosobmedian, and dorsal prolateral carinae fused into broad smooth costa; dorsal median, dorsal retrolateral, retrolateral median, ventral retrolateral, ventral median, ventral prolateral, and prolateral median carinae complete, broad, costate; dorsal retrosobmedian accessory carina vestigial, costate; other carinae absent. Fixed and movable fingers, dentate margins very shallowly emarginate, notches and lobes obsolete (σ), or sublinear, notches and lobes absent (φ), fitting together evenly such that no gap evident when closed (fig. 18B, D); fixed finger, median denticle row comprising five denticle subrows flanked by six prolateral and five retrolateral denticles; movable finger, median denticle row comprising six denticle subrows, flanked by eight prolateral and six retrolateral denticles, proximal two prolateral denticles adjacent, terminal subrow comprising single denticle. Trichobothrial pattern type C, orthobothriotaxic; chela trichobothrium *Db* situated on dorsal

TABLE 1

Measurements (mm) of adult *Balsateres cisnerosi* (Ponce-Saavedra and Sissom, 2004)

Specimens deposited in Colección Nacional de Arácnidos (CNAN), Instituto de Biología, Universidad Nacional Autónoma de México.

Collection		CNAN							CNAN						
Number		1249	2442				2663	3930	2441		2662	2663	2665	3930	
Type		Neo.													
Sex		♂	♂	♂	♂	♂	♂	♂	♀	♀	♀	♀	♀	♀	
Carapace	length	6.1	6.6	6.4	6.4	6.0	6.1	6.7	7.3	7.4	7.2	5.6	7.9	6.8	
	ant. width	3.4	3.6	3.4	3.4	3.4	3.4	4.0	4.0	4.2	4.0	4.5	4.4	3.9	
	post. width	5.5	5.9	5.8	5.9	5.6	5.4	6.2	6.8	6.6	6.8	5.2	7.4	6.4	
Femur	length	5.1	5.4	5.2	5.4	4.9	5.0	5.6	5.7	6.0	5.6	6.4	6.2	5.4	
	width	1.7	1.8	1.8	1.8	1.8	1.5	1.9	2.0	2.0	2.0	2.4	2.1	1.6	
Patella	length	5.5	5.7	5.6	5.6	5.3	5.4	6.0	6.2	6.4	5.9	7.0	6.7	5.8	
	width	2.0	2.0	2.0	2.1	2.0	1.9	2.1	2.2	2.3	2.2	2.5	2.4	2.0	
Chela	length	9.5	9.3	9.2	9.0	8.4	8.7	9.7	9.9	10.3	9.8	11.5	10.8	9.1	
Manus	width	3.3	3.0	3.0	3.1	2.8	2.8	3.3	3.2	3.3	3.0	3.7	3.8	2.1	
Manus	height	3.0	3.2	3.2	3.4	2.9	2.9	3.4	3.5	3.5	3.2	4.2	3.8	2.3	
Manus	length	5.2	5.4	5.4	5.2	5.0	5.0	5.6	5.6	5.8	5.5	6.3	6.1	4.7	
Fixed finger	length	4.3	3.9	3.8	3.8	3.4	3.7	4.0	4.3	4.4	4.3	5.2	4.7	4.4	
Mov. finger	length	5.7	5.6	5.5	5.5	5.0	5.0	6.0	6.0	6.4	6.1	7.0	6.6	5.8	
Coxa II	length	2.4	2.6	2.6	2.6	2.5	2.4	2.8	3.0	3.0	2.8	3.3	3.2	2.8	
Coxa IV	length	4.8	5.2	5.2	5.2	5.0	5.0	5.4	5.9	6.0	5.7	6.5	6.2	5.5	
Sternum	length	1.5	1.1	1.1	1.0	1.1	1.2	1.3	1.3	1.2	1.1	1.4	1.3	1.2	
	width	1.3	1.3	1.2	1.3	1.3	1.1	1.3	1.5	1.4	1.3	1.5	1.5	1.3	
Mesosoma	length	13.1	14.1	13.9	14.3	12.3	12.9	14.5	17.8	18.0	16.1	20.0	18.1	15.1	
Metasoma	length	22.4	23.5	22.4	23.7	21.7	22.2	24.6	24.1	24.2	22.9	27.8	27.0	21.8	
Segment I	length	3.0	3.0	2.8	3.2	2.8	3.0	3.2	3.1	3.2	3.0	3.6	3.4	3.0	
	width	3.7	3.9	3.8	4.0	3.9	3.7	4.0	4.4	4.3	4.3	5.1	4.6	4.0	
	height	2.4	3.0	3.0	2.9	3.1	2.6	3.2	3.4	3.4	3.2	3.9	3.8	3.0	
Segment II	length	3.6	3.7	3.5	3.8	3.4	3.6	3.8	3.8	3.8	3.7	4.4	4.3	3.5	
	width	3.6	3.8	3.4	4.0	3.8	3.6	4.0	4.2	4.3	4.2	5.0	4.6	3.9	
	height	2.3	3.0	3.0	2.9	3.0	2.8	3.0	3.4	3.4	3.2	3.8	3.8	2.8	
Segment III	length	4.0	4.0	3.9	4.1	3.8	3.9	4.4	4.2	4.2	4.0	4.8	4.7	3.8	
	width	3.6	3.8	3.6	4.0	3.8	3.6	4.0	4.2	4.2	4.1	4.8	4.5	3.8	
	height	2.3	2.9	3.0	2.9	3.0	2.8	3.0	3.4	3.4	3.2	3.8	3.8	2.8	
Segment IV	length	5.3	5.6	5.2	5.6	5.2	5.2	6.0	5.7	5.6	5.4	6.6	6.4	5.2	
	width	3.5	3.7	3.6	3.8	3.7	3.4	3.9	4.0	4.0	4.0	4.6	4.3	3.7	
	height	2.3	3.0	3.0	3.0	3.0	2.8	3.2	3.4	3.4	3.1	3.9	3.8	2.8	
Segment V	length	6.5	7.2	7.0	7.1	6.5	6.6	7.2	7.3	7.5	6.8	8.5	8.2	6.4	
	width	3.3	3.4	3.4	3.6	3.4	3.3	3.8	3.8	3.8	3.8	4.5	4.1	3.3	
	height	2.3	2.8	2.8	2.8	2.8	2.6	3.0	3.2	3.2	3.0	3.6	3.6	2.7	
Telson	length	6.4	7.2	6.5	7.0	6.3	6.4	7.3	7.4	7.4	7.4	8.2	8.2	6.6	
Vesicle	length	4.0	4.7	4.2	4.6	4.0	4.1	4.9	4.8	5.0	4.8	5.4	5.4	4.1	
	width	2.5	2.7	2.6	2.8	2.6	2.6	3.0	3.0	3.2	3.0	3.4	3.2	2.6	
	height	2.1	2.4	2.1	2.4	2.1	2.0	2.6	2.7	2.7	2.6	2.9	2.8	2.4	
Aculeus	length	2.4	2.5	2.4	2.4	2.4	2.4	2.5	2.6	2.4	2.7	2.8	2.8	2.6	
Total	length	47.0	51.4	49.1	51.4	46.3	47.6	53.1	56.5	57.0	53.6	61.6	61.2	50.4	

retrolateral carina, in proximal fifth of manus; *Dt* situated at midpoint of manus; *db-dt* and *eb-et* distributed along entire length of fixed finger with *db* situated proximal and *eb* subproximal; *ib* situated between sixth prolateral denticle and seta demarcating position of seventh denticle, which is absent; *it* aligned with sixth prolateral denticle (fig. 18D).

Legs: Basitarsi retrolateral dorsal spinule row complete on I and II, vestigial, reduced to few distal spinules on III and IV; retrolateral median spinule row absent on I–IV; prolateral ventral spinule row vestigial, reduced to few distal spinules on I–IV; retrolateral ventral spinule row complete on I–III, vestigial, reduced to few distal spinules on IV; macrosetal counts on legs I–IV, respectively: dorsal, 3:3:3:3; retrolateral dorsal, 4:4:4:4, prolateral ventral, 3:5:5:5, distal spinules small and delicate; retrolateral ventral, 4:8:9:9; dorsal and retrolateral dorsal macrosetae arranged into two separate rows on I–IV. Telo-tarsi I–IV, each with single ventromedian row of spinules, curved proximally, and two or three pairs of ventrodistal spinules (fig. 11A).

Genital operculum: Width greater than length (fig. 7A), with three pairs of macrosetae. Sclerites separated, but unable to open more than 45° (♂) or fused longitudinally (♀). Genital papillae present, protruding posteriorly (♂) or absent (♀).

Hemispermaphore: Lamina 1.2× longer than trunk (table 8). Median lobe, ental terminus prominent, rounded (fig. 12A–C). Dorsal trough margin long, narrow, curving proximally, well separated from ventral trough (fig. 12C). Dorsal and ventral trough margins, terminal spinelike processes fused into prominent, bifurcate hook, situated distally on lamina dorsal margin (fig. 12A, B). Basal plate of inner lobe well separated from ventral trough (fig. 14A); spine of inner lobe long and markedly sclerotized. Hemimating plug developed from inner lobe; distal barb 0.4× longer than basal plate (fig. 15A–C); distal barb margin with 25 elongated spinules; secondary spine on ventromedian side of distal barb moderately developed.

Pectines: Basal piece with three pairs of major macrosetae. Marginal lamella comprising three sclerites. Medial lamella proximal sclerites fused, 15 distal sclerites separate (fig. 7A). Fulcra, 21–22 (♂), 19–20 (♀). Pectinal teeth, 20–23 (♂), 20–21 (♀). Pectines relatively long, midpoint (♂) or distal margin (♀) of medial sclerite of marginal lamella aligned with distal margin of coxa VI.

Tergites: Pretergites I–VII, surfaces smooth. Posttergites I–VI, intercarinal surfaces smooth medially, finely granular posterolaterally, dorsal median and dorsal lateral carinae obsolete, reduced to few, low granules; VII, intercarinal surfaces finely granular, dorsal median carina vestigial, restricted to anterior third, costate-granular; dorsal submedian carinae vestigial, each reduced to anterior granule, dorsal lateral and lateral median carinae costate to costate-granular, converging anteromedially, posterior granules slightly larger, spiniform.

Sternites: Sternites III–VII, surfaces acarinate, smooth; III–VI, spiracles elongate, slitlike, 4× longer than wide; V, posteromedian hyaline glandular area moderately developed (♂) or obsolete (♀).

Metasoma: Metasoma 1.5× longer than mesosoma (table 1). Segments I–V, respectively 1.3/1.4, 1.1, 1.0, 0.7, 0.5× wider than long; V, 1.3× wider than telson vesicle. Segments I–V, intercarinal surfaces smooth (figs. 8A, 9A); dorsal lateral carinae complete, costate, terminating in enlarged spiniform granules posteriorly on I–IV, obsolete on V; lateral median carinae vestigial, costate, terminating in enlarged spiniform granules posteriorly on I–III, lobate posteriorly on IV, vestigial, costate on V; lateral inframedian, ventral lateral, and ventral submedian carinae obsolete on I–V, except ventral lateral carinae granular on posterior third of V. Macrosetal counts on carinae of segments I–V, respectively: dorsal lateral carinae, 0:0:1:1:4; lateral median carinae, 0:1:1:1:2; lateral inframedian carinae, 0:0:0:0:0; ventral lateral carinae, 1:1:1:1:3; ventral submedian carinae, 1:1:1:1:3; ventral sublateral carinae, 0:0:0:0:2.

Telson: Vesicle globose, length 2.5× greater than width (table 1); ventral and dorsal surfaces

smooth; ventral carinae each with two pairs of macrosetae. Subaculear tubercle vestigial, comprising low broad granule (fig. 10A). Aculeus, laterobasal microsemination comprising 4–6 spinules.

DISTRIBUTION: As for genus.

ECOLOGY: *Balsateres cisnerosi* inhabits tropical deciduous forest at altitudes ranging from 195 to 672 m. Specimens have been observed at night, doorkeeping at the entrances of their burrows in open, sandy areas, and excavated from the burrows, approximately 15–20 cm deep with a circular entrance (Ponce-Saavedra and Sissom, 2004). The habitat and habitus are consistent with the psammophilous ecomorphotype (Prendini, 2001) although the leg setation, in which the dorsal and retrolateral dorsal macrosetae are arranged into two separate rows, not forming a setal comb, is atypical. *Balsateres cisnerosi* was collected in sympatry with the following species: the buthids *Centruroides balsasensis* Ponce-Saavedra and Francke, 2004 (observed preying on *B. cisnerosi*) and *Centruroides limpidus* (Karsch, 1879); the diplocentrids *Diplocentrus churumuco* Francke and Ponce Saavedra, 2005, and *Kolotl poncei* (Francke and Quijano-Ravell, 2009); and the vaejovids *Konetontli* aff. *kuarapu*; *Kuarapu purhepecha*, *Mesomexovis* sp., and *Thorellius tekuanii*, sp. nov. (J. Ponce-Saavedra and A. Quijano-Ravel, personal commun.). Although sympatric, *B. cisnerosi* was collected in open, sandy areas, whereas *K. purhepecha* was collected on road cuts and under rock piles.

REMARKS: Due to the unique morphology of *V. cisnerosi*, Ponce-Saavedra and Sissom (2004) refrained from assigning it to one of the five species groups of *Vaejovis* recognized at the time. Soleglad and Fet (2008) transferred it to *Thorellius*, the name devised for Hoffmann's (1931) "second section" of *Vaejovis*, later termed the *intrepidus* group by Sissom (1989), without quantitatively testing its placement. Santibáñez-López and Sissom (2010) also referred this species to the *intrepidus* group. González-Santillán and Prendini (2013) justified the creation of *Balsateres* based on its unique diagnostic character combination.

ADDITIONAL MATERIAL EXAMINED: MEXICO: Estado de México: Municipio de Luvianus: Pungarancho, 3 km E, 19°01.775'N 100°28.406'W, 16.iv.2002, E. González, O. Francke and S. Reynaud, tropical dry forest, 1 ♀ (CNAN SC2662). **Michoacán: Municipio de Carácuaro:** La Berea, 19°08.173'N 102°13.195'W, 445 m, 11.vii.2005, O. Francke, J. Ponce, M. Córdova, A. Jaimes, G. Francke and V. Capovilla, 1 juv. ♀ (AMCC [LP 5320]); Las Cocinas, Hwy Nocupetaro–Carácuaro, 19°01.880'N 101°14.067'W, 672 m, 14.vii.2005, O. Francke, J. Ponce, M. Córdova, A. Jaimes, G. Francke, and V. Capovilla, 1 subad. ♂ (AMCC [LP 5269]), [18°39.393'N 101°39.124'W], 8.ix.2001, J. Ponce, 1 ♂ (CNAN SC2665), 1 ♀ (AMCC [LP 2019]), R. Cancino, 1 ♂ (AMCC [LP 2018]). **Municipio de Huetamo:** Arua [18°35'N 100°53'W], 9.ix.2000, R. Cancino, 2 ♀ (CNAN SC2663), 23.viii.2001, 1 ♂ (CNAN SC2661). **Municipio de La Huacana:** El Chauz [18°52'50.14"N 102°00'27.55"W], 20.ii.2004 R. Lanoy Cardenas, 1 juv. (CNAN SC3030); El Vado, 18°48.908'N 101°54.976'W, 198 m, 20.v.2007, O. Francke, J. Ponce, M. Villaseñor, and A. Quijano, 1 ♂, 2 ♀ (AMNH), 1 ♂, 2 ♀ (CNAN), 18°48'51.34"N 101°55'10.31"W, 248 m, 30.viii.2008, O. Francke, H. Montaña, J. Ponce, and A. Quijano, 2 ♂, 2 ♀, 2 subad. ♂ (CNAN SC2441). **Municipio de Parácuaro:** La Berea, 19°08.173'N 102°13.195'W, 445 m, 11.vii.2005, O. Francke, J. Ponce, M. Córdova, A. Jaimes, G. Francke, and V. Capovilla, 1 juv. (AMCC [LP 5320]). **Municipio de Zingangio:** Las Juntas Ranch, 24 km W of Capeo, 18°32.270'N 101°11.603'W, 195 m, 8.iv.2012, O. Francke et al., 5 ♂, 1 subad. ♂ (CNAN SC2442).

Kuarapu Francke and Ponce-Saavedra, 2010

Figures 5, 7–12, 14, 15; table 8

Kuarapu purhepecha Francke and Ponce-Saavedra, 2010, type species, by monotypy.

Kuarapu Francke and Ponce-Saavedra, 2010:

1–27, 52, table 1; González-Santillán and

Prendini, 2013: 3, 6, 8, 11, 18, 21, 24, 28, 43,

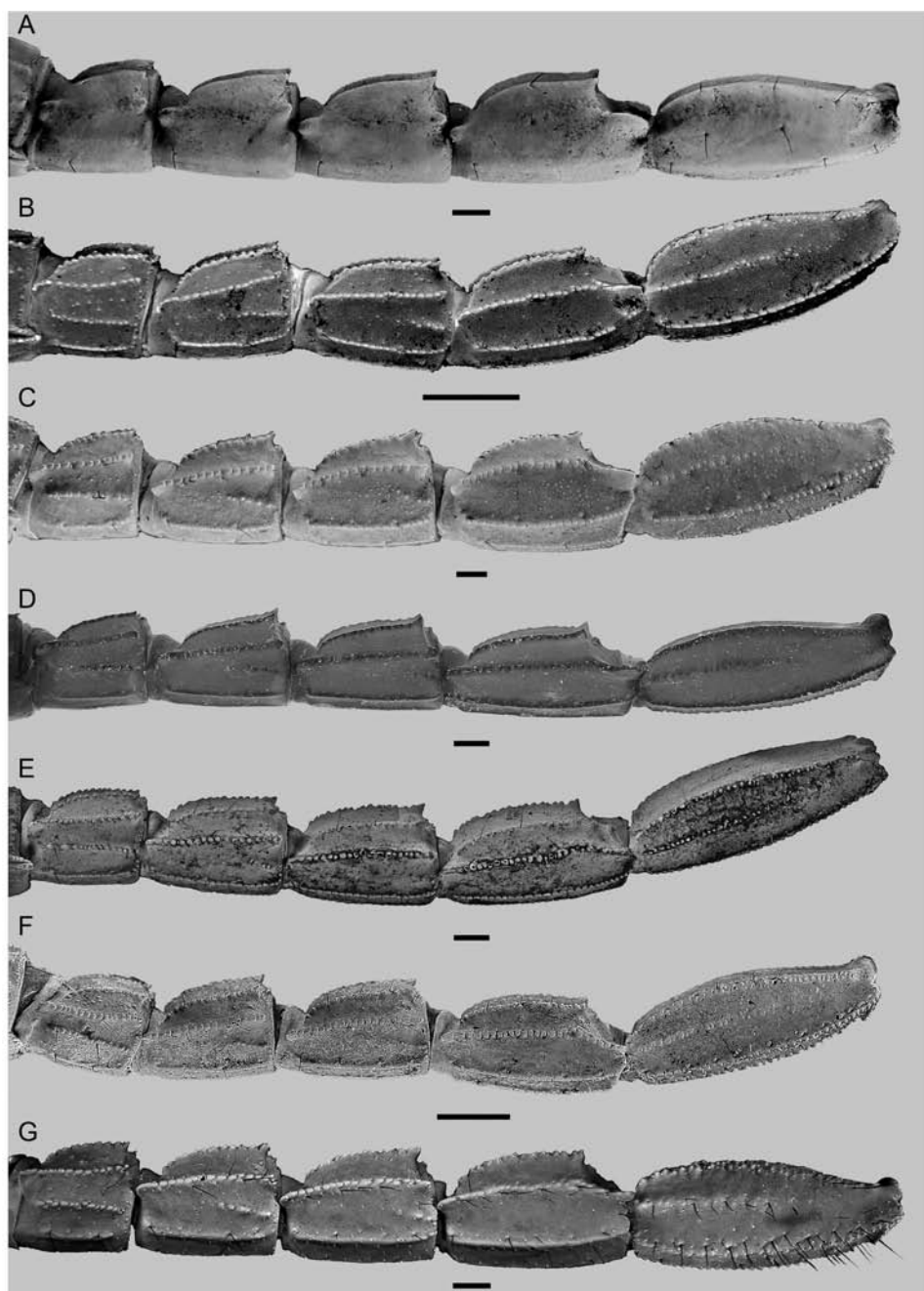


FIGURE 8. *Balsateres* González-Santillán and Prendini, 2013, *Kuarapu* Francke and Ponce-Saavedra, 2010, and *Thorellius* Soleglad and Fet, 2008, metasomal segments I–V, lateral aspect. **A.** *Balsateres cisnerosi* (Ponce-Saavedra and Sissom, 2004), ♂ (CNAN SC2441). **B.** *Kuarapu purhepecha* Francke and Ponce-Saavedra, 2010, paratype ♂ (AMNH). **C.** *Thorellius cristimanus* (Pocock, 1898), ♂ (AMNH). **D.** *Thorellius intrepidus* (Thorell, 1876), ♂ (AMNH). **E.** *Thorellius tekuanii*, sp. nov., holotype ♂ (CNAN T01250). **F.** *Thorellius wixarika*, sp. nov., holotype ♂ (CNAN T01251). **G.** *Thorellius yuyuwawi*, sp. nov., holotype ♂ (CNAN T01252). Scale bars = 1 mm.

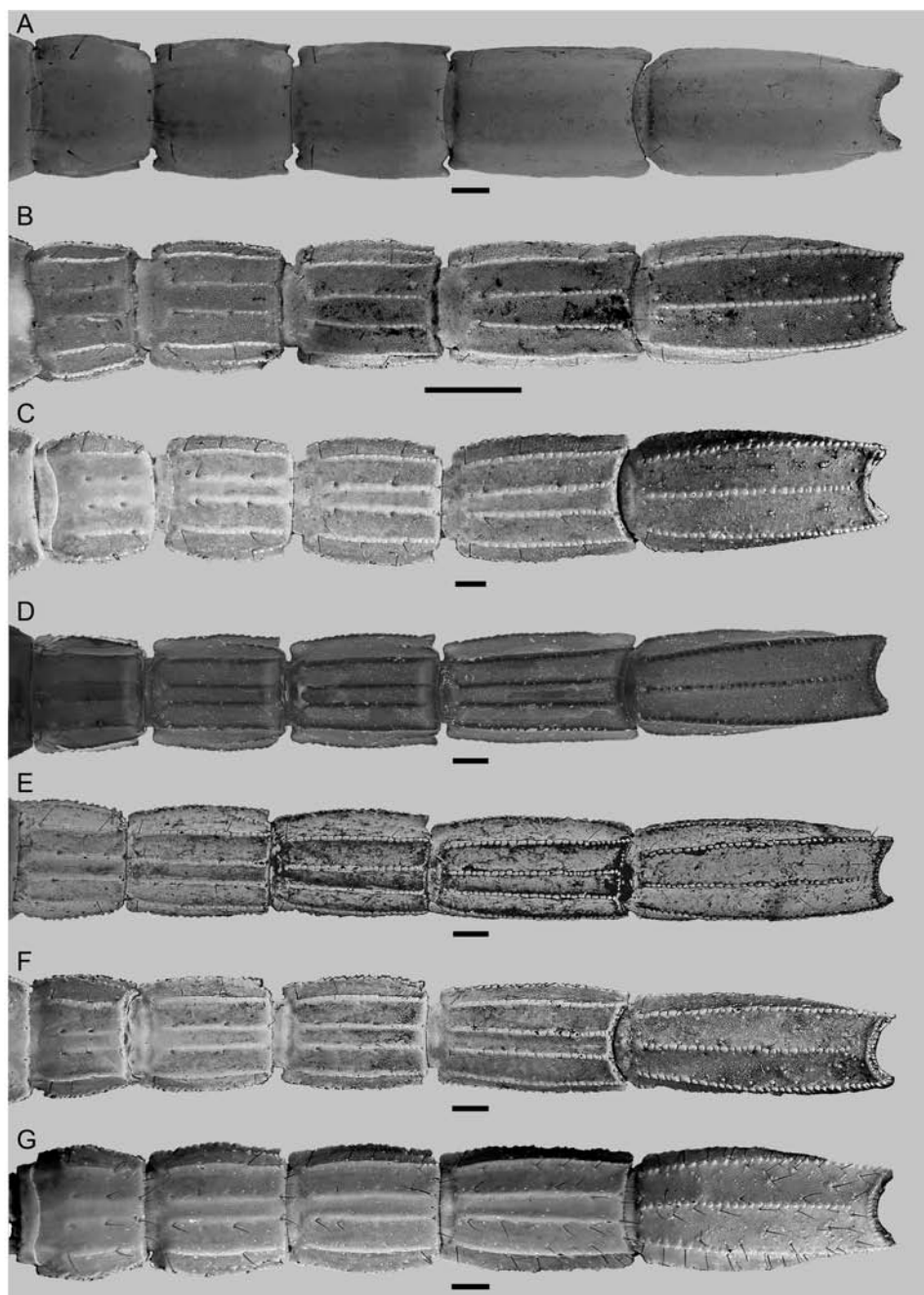
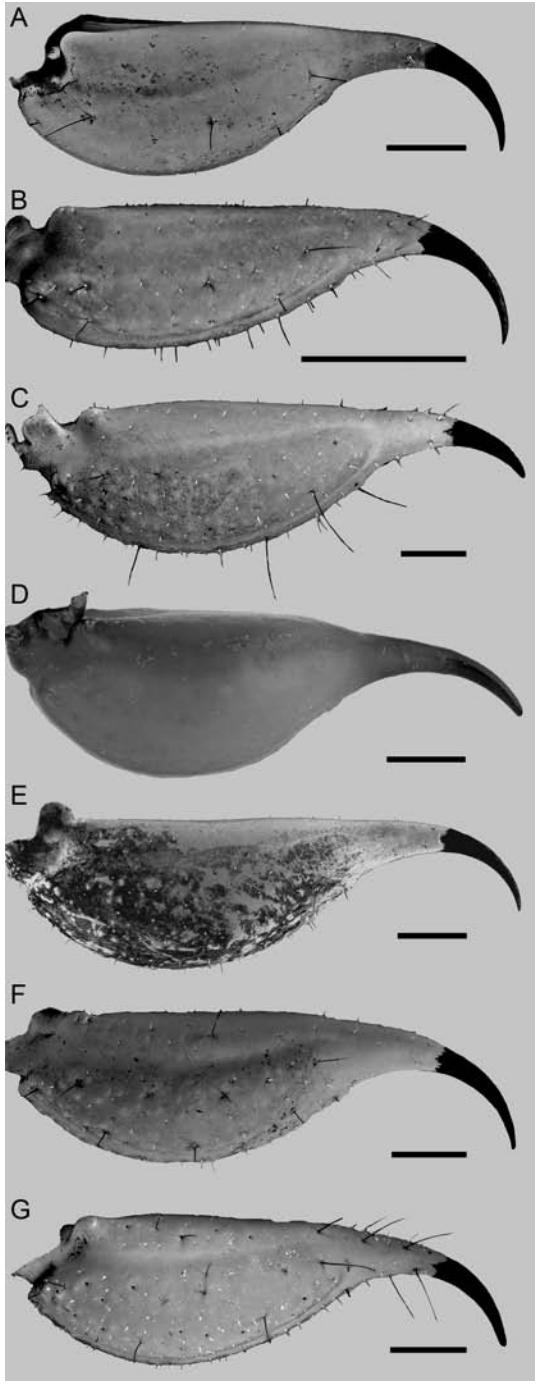


FIGURE 9. *Balsateres* González-Santillán and Prendini, 2013, *Kuarapu* Francke and Ponce-Saavedra, 2010, and *Thorellius* Soleglad and Fet, 2008, metasomal segments I–V, ventral aspect. **A.** *Balsateres cisnerosi* (Ponce-Saavedra and Sissom, 2004), ♂ (CNAN SC2441). **B.** *Kuarapu purhepecha* Francke and Ponce-Saavedra, 2010, paratype ♂ (AMNH). **C.** *Thorellius cristimanus* (Pocock, 1898), ♂ (AMNH). **D.** *Thorellius intrepidus* (Thorell, 1876), ♂ (AMNH). **E.** *Thorellius tekواني*, sp. nov., holotype ♂ (CNAN T01250). **F.** *Thorellius wixarika*, sp. nov., holotype ♂ (CNAN T01251). **G.** *Thorellius yuyuawi*, sp. nov., holotype ♂ (CNAN T01252). Scale bars = 1 mm.



45, 51, 52, 56, 59, table 1, figs. 4; 2015a: 344, 349, 352, 356, 360, 362, 363, 364, 367, 403, tables 5, 6; Ponce-Saavedra and Francke, 2013: 78, table 2; Quijano-Ravel and Ponce-Saavedra, 2014: 17, 18, 20, figs. 1–3, table 2; 2016: 50; Santibañez-López et al., 2015: 7; González-Santillán and Prendini, 2016: 16, 36, 37, 60; Dupré, 2017: 11.

DIAGNOSIS: *Kuarapu* may be separated from other genera of the *Kochius* clade as follows. The dorsal surface of the cheliceral manus, the dorsal median carinae of the tergites, the dorsal and ventral surfaces of the metasoma, and the ventral surface of the telson are densely infusate in *Kuarapu* (figs. 20, 21), whereas in *Balsateres* and most *Kochius* and *Thorellius* species, these surfaces and carinae are faintly infusate or immaculate. The carapace anterior margin is sublinear, with a vestigial median notch, in *Kuarapu* (fig. 5B), whereas in the other genera it is emarginate, with a shallow median notch in *Balsateres* and *Thorellius*, and a deep median notch in *Kochius*. The carinae of the pedipalp chela manus are absent or obsolete in *Kuarapu* but distinct in the other three genera, costate in *Balsateres* and granular or costate-granular in *Kochius* and *Thorellius*. The median denticle row of the pedipalp chela movable finger comprises five primary subrows of median denticles and five retrolateral denticles in *Kuarapu*, but six primary subrows of median denticles and six retrolateral denticles in *Balsateres* and *Thorellius*. The terminal denticle of the fixed and movable fingers is considerably

FIGURE 10. *Balsateres* González-Santillán and Prendini, 2013, *Kuarapu* Francke and Ponce-Saavedra, 2010, and *Thorellius* Soleglad and Fet, 2008, telson, lateral aspect. **A.** *Balsateres cisnerosi* (Ponce-Saavedra and Sissom, 2004), ♂ (CNAN SC2441). **B.** *Kuarapu purhepecha* Francke and Ponce-Saavedra, 2010, paratype ♂ (AMNH). **C.** *Thorellius cristimanus* (Pocock, 1898), ♂ (AMNH). **D.** *Thorellius intrepidus* (Thorell, 1876), ♂ (AMNH). **E.** *Thorellius tekuanii*, sp. nov., holotype ♂ (CNAN T01250). **F.** *Thorellius wixarika*, sp. nov., holotype ♂ (CNAN T01251). **G.** *Thorellius yuyuawi*, sp. nov., holotype ♂ (CNAN T01252). Scale bars = 1 mm.

larger and sharper than the preceding denticles in *Kuarapu* (fig. 21D), but only slightly larger than the preceding denticles and blunt in *Balsateres*, *Kochius*, and *Thorellius*.

As in *Kochius* and *Thorellius*, trichobothrium *Dt* is situated medially on the pedipalp chela manus in *Kuarapu*, which further resembles *Kochius* in the presence of a raised, whitish boss, restricted to the posteromedian third of mesosomal sternite VII, and finely granular ventral submedian and ventral lateral carinae of metasomal segments I–IV. *Kuarapu* is gracile with attenuate and largely acarinate pedipalp chelae (fig. 19, 21) whereas *Kochius* and *Thorellius* are robust with incrassate and markedly carinate pedipalp chelae.

Kuarapu possesses a secondary hook on the hemispermatophore, created by an extension of the axial carina of the distal lamina that forms a pronounced bifurcation with the primary hook (fig. 21D–F), a structure also observed in *Kone-tontli* González-Santillán and Prendini, 2013, *Maaykuyak* González-Santillán and Prendini, 2013, *Syntropis* Kraepelin, 1900, *Vizcaino*, *Chihuahuanus bilineatus* (Pocock, 1898), *Chihuahuanus coahuilae* (Williams, 1968), *T. cristimanus*, and *T. yuyuawi*, sp. nov. A pronounced bifurcation is absent in *Balsateres*, *Kochius*, and most species of *Thorellius*.

INCLUDED SPECIES: *Kuarapu purhepecha* Francke and Ponce-Saavedra, 2010.

DISTRIBUTION: *Kuarapu purhepecha* is endemic to the Balsas Depression in the Mexican state of Michoacán, Mexico. It is presently known from only two localities in the La Huacana and Parácuaro municipalities (fig. 4).

Kuarapu purhepecha

Francke and Ponce-Saavedra, 2010

Figures 1B, 4, 5B, 7B, 8B, 9B, 10B, 11B, 12D–F, 14B, 15D, E, 19–21; tables 2, 8

Kuarapu purhepecha Francke and Ponce-Saavedra, 2010: 52; Ayrey, 2011: 1; González-Santillán and Prendini, 2013: 3, 6, 8, 11, 18, 21,

24, 28, 33, 43, 45, 51, 52, 56, 59, figs. 4, 18C, D, 24B, table 1; 2015a: 344, 345, 349, 351–354, 356, 357, 360, 362–364, 367, 373, 377, 380, 384, 388 400, 403, fig. 4–6, tables 5, 6; Ponce-Saavedra and Francke, 2013: 77, table 2; Quijano-Ravel and Ponce-Saavedra, 2014: 17, 18, 20, figs. 1–3, table 2; 2016: 50; Dupré, 2017: 11.

TYPE MATERIAL: **MEXICO: Michoacán: Municipio de la Huacana:** Holotype ♂ (CNAN T-0411), “El Vado” [seasonal drainage underpass], km 17 [road marker], road from Zicuarán to Churumuco, 18.814°N 101.916°W, 248 m, 30.vii.2008, O. Francke, H. Montaña, J. Ponce, and A. Quijano. Paratypes: 2 ♂, 2 ♀ (CNAN T-0412), 1 ♂, 1 ♀ (AMNH), same data as holotype; 1 ♀ (CNAN T-0413), same locality as holotype, 20.v.2007, O. Francke, J. Ballesteros, J. Ponce, A. Quijano, and M. Villaseñor.

DIAGNOSIS: As for genus.

DESCRIPTION: The following redescription, which is based on the type material and additional material examined, supplements the original description by Francke and Ponce-Saavedra (2010).

Color and infuscation: Chelicerae, carapace, pedipalps, legs, tergites, sternites, metasoma, and telson base color pale yellow to orange. Chelicer al manus, dorsal surface with reticulate infuscation. Carapace and tergites with variegated infuscation. Coxosternal region, genital operculum, basal piece, and pectines pale whitish. Pedipalp femur, patella, and chela dorsal, prolateral, and retrolateral intercarinal surfaces faintly infusate; carinae densely infusate; chela fingers infusate proximally. Legs prolateral surfaces partially infusate. Sternites mostly immaculate, lateral margins faintly infusate. Metasoma with variegated infuscation, more densely so on segments III–V. Telson vesicle dorsal surface entirely infusate; ventral surface with three broad, longitudinal bands of infuscation, one median and two lateral; aculeus reddish to brownish.

Chelicerae: Manus dorsal surface smooth, with three macrosetae distally, decreasing in size

TABLE 2

Measurements (mm) of adult *Kuarapu purhepecha* Francke and Ponce-Saavedra, 2010

Specimens deposited in American Museum of Natural History (AMNH) and Colección Nacional de Arácnidos (CNAN), Instituto de Biología, Universidad Nacional Autónoma de México.

Collection		CNAN			AMNH		CNAN			AMNH
Number		T0411	T0412				1234	T0412	T0413	
Type		Holo.	Para.					Para.		
Sex		♂	♂	♂	♂	♀	♀	♀	♀	♀
Carapace	length	3.2	3.2	3.0	3.0	4.1	4.3	4.0	3.9	3.8
	ant. width	1.5	1.5	1.6	1.6	2.2	2.2	2.0	1.9	2.1
	post. width	2.7	2.7	2.5	2.5	3.8	4.0	2.5	3.5	3.3
Femur	length	2.6	2.7	2.6	2.5	3.5	3.6	3.3	3.2	3.2
	width	0.9	0.8	0.8	0.8	1.2	1.2	1.1	1.1	1.1
Patella	length	3.1	3.1	3.0	2.9	4.0	4.1	3.9	3.8	3.9
	width	1.0	0.9	0.9	1.0	1.3	1.4	1.3	1.2	1.2
Chela	length	4.6	4.7	4.1	4.4	5.7	5.8	5.2	5.2	5.5
Manus	width	1.1	1.1	1.0	1.1	1.3	1.3	1.2	1.2	1.1
Manus	height	1.1	1.0	1.0	1.0	1.1	1.2	1.2	1.1	0.9
Manus	length	2.4	2.5	2.2	2.3	2.8	3.0	2.7	2.6	2.8
Fixed finger	length	2.2	2.2	2.0	2.1	2.9	2.8	2.5	2.6	2.8
Mov. finger	length	2.7	2.8	2.5	2.7	3.5	3.6	3.3	3.2	3.5
Coxa II	length	1.3	1.2	1.3	1.2	1.6	1.8	1.6	1.6	1.5
Coxa IV	length	2.5	2.5	2.3	2.1	3.3	3.6	3.1	3.2	3.0
Sternum	length	0.6	0.7	0.6	0.7	0.8	0.9	0.7	0.8	0.9
	width	0.7	0.7	0.8	0.7	0.9	0.9	0.9	0.9	1.0
Mesosoma	length	7.1	6.6	6.8	5.7	6.3	10.4	9.5	9.1	6.8
Metasoma	length	10.8	9.4	9.9	9.9	13.1	13.1	11.9	11.9	12.0
Segment I	length	1.4	1.4	1.3	1.3	1.8	1.8	1.7	1.6	1.6
	width	1.8	1.7	1.7	1.6	2.4	2.4	2.2	2.2	2.2
	height	1.5	1.5	1.3	1.2	2.1	2.0	1.8	1.9	1.5
Segment II	length	1.7	1.6	1.5	1.5	2.1	2.0	1.7	1.9	1.9
	width	1.8	1.7	1.6	1.6	2.3	2.3	2.2	2.1	2.1
	height	1.4	1.4	1.3	1.2	2.0	1.9	1.7	1.8	1.5
Segment III	length	1.8	1.7	1.7	1.7	2.2	2.2	2.0	1.9	2.0
	width	1.7	1.6	1.6	1.0	2.2	2.3	2.2	2.0	2.1
	height	1.4	1.4	1.3	1.5	2.0	1.9	1.8	1.8	1.5
Segment IV	length	2.5	2.4	2.3	2.3	3.0	3.0	2.7	2.7	2.7
	width	1.7	1.6	1.6	1.0	2.2	2.2	2.1	2.0	2.0
	height	1.4	1.4	1.3	1.5	2.0	1.9	1.8	1.8	1.4
Segment V	length	3.6	2.2	3.1	3.3	4.1	4.3	3.9	3.9	3.9
	width	1.6	1.6	1.6	1.2	2.1	2.1	2.0	1.9	1.9
	height	1.4	1.3	1.3	1.5	1.9	1.8	1.7	1.7	1.4
Telson	length	3.1	3.0	2.7	2.9	3.7	4.0	3.7	3.8	3.6
Vesicle	length	2.1	2.0	1.8	1.9	2.4	2.6	2.3	2.3	2.2
	width	1.2	1.2	1.1	0.9	1.5	1.6	1.5	1.5	1.5
	height	1.0	1.0	0.9	1.1	1.3	1.4	1.2	1.2	1.1
Aculeus	length	1.1	1.0	0.9	1.1	1.4	1.4	1.4	1.5	1.5
Total	length	24.3	22.2	22.5	21.4	27.2	31.7	29.1	28.6	26.2

from dorsomedian to prolateral surface. Movable finger, ventral surface with serrula, comprising 14/14 times, in distal half.

Carapace: Length 1.18/1.16 $\times$ greater than posterior width (table 2). Anterior margin sublinear, with vestigial median notch, and three pairs of major macrosetae (fig. 5B). Three pairs of lateral ocelli, anterolateral and median pairs equal in size, posterolateral pair half the size. Median ocular tubercle shallow, situated in anterior half of carapace, superciliary carinae smooth, lower than median ocelli. Median ocelli more than twice the size of anterolateral ocelli. Anteromedian, posteromedian, and posterolateral sulci moderate, posterior transverse sulci obsolete. Surfaces matte (δ) or shagreened, covered with minute rounded granules (φ).

Coxosternal region: Sternum subequilateral pentagonal (fig. 7B); length 0.89/0.88 $\times$ longer than wide (table 2); median sulcus deep; surfaces matte, with four pairs of macrosetae. Coxae surfaces matte, smooth in places; coxa II subproximal margin with two oblique slitlike structures, adjacent to small, smooth protuberance; coxal endite II proximal margin with shallow depression, medial margin smooth. Coxa IV 1.92/2.04 $\times$ longer than coxa II (table 2).

Pedipalps: Femur intercarinal surfaces matte (fig. 20A); dorsal prolateral, dorsal retrolateral, and ventral prolateral carinae complete, granular to costate-granular; retrolateral dorsosubmedian carina complete, serrate, with proximal tubercle and two major macrosetae medially; prolateral ventrosubmedian carina partial, reduced to row of conical granules and two minor macrosetae medially; prolateral ventral carina vestigial, reduced to proximal and distal tubercles and three conical granules, one bicuspid, medially, each with macroseta; ventral median and retrolateral ventral carinae vestigial, reduced to scattered serrate granules; ventral retrosubmedian carina obsolete. Patella 1.16/1.14 $\times$ wider than femur (table 2); intercarinal surfaces matte (fig. 20B–E); dorsal prolateral, dorsal retrolateral, and ventral prolateral carinae complete, finely granular; ventral retrosubmedian carina vestigial,

reduced to proximal spiniform granules; ventral median carina vestigial, reduced to few low granules; retrolateral dorsosubmedian and retrolateral median carinae obsolete; prolateral process moderately developed; prolateral median carina complete, comprising tubercle with macroseta proximally, row of serrate granules medially, and tubercle with minor macroseta distally; prolateral ventral carina vestigial, comprising proximal and distal granules, each with major macroseta, and minor macrosetae medially. Chela 1.46/1.40 $\times$ longer than patella, 1.69/1.62 $\times$ longer than femur (table 2). Manus elongate and slender (fig. 21), 1.12/0.95 $\times$ wider than patella, 1.30/1.08 $\times$ wider than femur; intercarinal surfaces matte; acarinate. Fixed and movable fingers, dentate margins emarginate, fixed finger with shallow proximal notch and median lobe (fig. 21B, D), movable finger with shallow proximal lobe, fitting together unevenly such that moderate proximal gap evident when closed (δ) or dentate margins sublinear, notches and lobes absent, fitting together evenly such that no gap evident when closed (φ); fixed finger, median denticle row comprising five denticle subrows flanked by six prolateral and five retrolateral serrate denticles, prolateral and retrolateral denticles equal in size; movable finger, median denticle row comprising five denticle subrows, flanked by seven prolateral denticles and five retrolateral denticles, subpaired, terminal subrow comprising single denticle; terminal retrolateral denticle of fixed and movable fingers considerably larger and sharper than preceding denticles. Trichobothrial pattern type C, orthobothriotaxic; chela trichobothrium *Db* situated on dorsal retrolateral carina; *Dt* situated dorsal to dorsal retrolateral carina, near midpoint of manus, but slightly toward distal half; *db–dt* and *eb–et* distributed along entire length of fixed finger with *db* situated proximal and *eb* subproximal; *ib* aligned with sixth prolateral denticle (fig. 21D); *it* situated between fifth and sixth prolateral denticles.

Legs: Basitarsi retrolateral dorsal, prolateral ventral, and retrolateral ventral spinule rows complete on I and II, retrolateral dorsal spinule

row partial, restricted to distal half of III and IV, prolateral ventral spinule row vestigial, reduced to few distal spinules on III, absent on IV; retrolateral ventral spinule row complete on III, absent on IV; retrolateral median spinule row vestigial, reduced to few distal spinules on I–IV; macrosetal counts on legs I–IV, respectively: dorsal, 3:3:3:3; retrolateral dorsal, 2:3:3:3; prolateral ventral, 3:3:5:5; retrolateral ventral, 3:5:6:6; dorsal and retrolateral dorsal macrosetae arranged in two separate rows on I–IV. Telotarsi I–IV, each with single ventromedian row of spinules, curved proximally, with two pairs of ventrodistal spinules (fig. 11B).

Genital operculum: Width greater than length (fig. 7B), with three pairs of macrosetae. Sclerites separated, but unable to open more than 45° (♂) or fused longitudinally (♀). Genital papillae present, protruding posteriorly (♂) or absent (♀).

Hemispermatophore: Lamina 1.76× longer than trunk (table 8). Median lobe, ental terminus moderately developed, rounded (fig. 12D, F). Dorsal trough margin long, narrow, curving proximally, well separated from ventral trough (fig. 12F). Dorsal and ventral trough margins, terminal spinelike processes fused into prominent, bifurcate hook, situated distally on lamina dorsal margin (fig. 12E, F). Basal plate of inner lobe situated proximal to ventral trough (fig. 14B); spine of inner lobe moderately developed. Hemimating plug developed from inner lobe; distal barb 0.6× longer than basal plate; distal barb margin with 9 elongated spinules; secondary spine on ventromedian side of distal barb moderately developed (fig. 15D, E).

Pectines: Basal piece with two pairs of minor macrosetae. Marginal lamella comprising three sclerites. Medial lamella proximal sclerites fused, 11–13 distal sclerites separate (fig. 5D). Fulcra, 16–17 (♂), 15–16 (♀). Pectinal teeth, 17–18 (♂), 16–17 (♀). Pectines relatively long, midpoint (♂) or distal margin (♀) of medial sclerite of marginal lamella aligned with distal margin of coxa VI.

Tergites: Pretergites I–VII, surfaces matte. Posttergites I–VI, intercarinal surfaces matte, except

posterolateral surfaces more coarsely granular, dorsal median and dorsal lateral carinae obsolete, granular, restricted to posterior half; VII, intercarinal surfaces matte, except posterolateral surfaces more coarsely granular, dorsal median carina partial, restricted to anterior half, costate, dorsal submedian carinae vestigial, each reduced to anterior tubercle; dorsal lateral and lateral median carinae granular, converging anteromedially, posterior granules larger, spiniform.

Sternites: Sternites III–VI, surfaces acarinate, matte; spiracles elongate, slitlike, ca. 2× longer than wide; V, posteromedian hyaline glandular area protruding slightly from adjacent surfaces (♂) or obsolete (♀); VII, posteromedian hyaline glandular area rounded, protruding moderately, ventral submedian carinae obsolete, each with three macrosetae, ventral lateral carinae weakly costate-granular.

Metasoma: Metasoma 1.59/1.48× longer than mesosoma (table 2). Segments I–V, respectively 1.25/1.35, 1.06/1.16, 0.87/1.04, 0.61/0.74, 0.48/0.49× wider than long; V, 1.03/1.07× wider than telson vesicle. Segments I–V, all intercarinal surfaces matte (figs. 9B, 10B); dorsal lateral carinae serrate, terminating in conical spiniform granules posteriorly on I–IV, serrate in anterior half, becoming finely granular posteriorly on V; lateral median carinae serrate, terminating in conical spiniform granules posteriorly on I–III, lobate on IV, partial, restricted to posterior two-thirds, serrate anteriorly, becoming costate posteriorly on V; lateral inframedian carinae complete, serrate on I, partial, obsolete anteriorly, granular in posterior half on II, partial, serrate, restricted to posterior third on III, absent on IV; ventral lateral carinae finely serrate on I–V; ventral submedian carinae costate on I and II, costate in anterior two-thirds, finely serrate in posterior third, on III, finely serrate on IV; ventral median carina finely serrate on V. Macrosetal counts on carinae of segments I–V, respectively: dorsal lateral carinae, 0:0:1:1:4 (♂), 1:2:3:3:9 (♀); lateral median carinae, 1:1:1:2:2 (♂), 1:2:3:4:5 (♀); lateral inframedian carinae, 1:1:1:0:0 (♂), 3:2:1:0:0 (♀); ventral lateral carinae, 2:2:2:3:5 (♂), 3:3:3:4:12 (♀); ventral submedian carinae,

FIGURE 11. *Balsateres* González-Santillán and Prendini, 2013, *Kuarapu* Francke and Ponce-Saavedra, 2010, and *Thorellius* Sologlad and Fet, 2008, dextral leg III, basitarsus and telotarsus, ventral aspect. **A.** *Balsateres cisnerosi* (Ponce-Saavedra and Sissom, 2004), ♂ (CNAN SC2441). **B.** *Kuarapu purhepecha* Francke and Ponce-Saavedra, 2010, paratype ♂ (AMNH). **C.** *Thorellius cristimanus* (Pocock, 1898), ♂ (AMNH). **D.** *Thorellius intrepidus* (Thorell, 1876), ♂ (AMNH). **E.** *Thorellius tekuanii*, sp. nov., holotype ♂ (CNAN T01250). **F.** *Thorellius wixarika*, sp. nov., holotype ♂ (CNAN T01251). **G.** *Thorellius yuyuawi*, sp. nov., holotype ♂ (CNAN T01252). Scale bars = 1 mm.

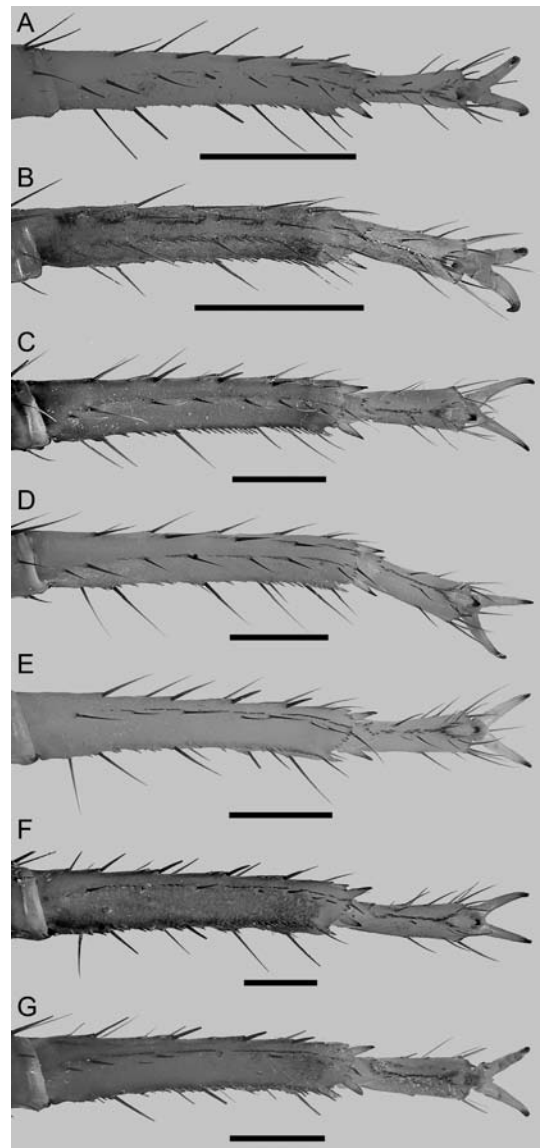
3:3:3:3 (♂), 3:3:4:3:0 (♀); ventral sublateral carinae, 0:0:0:0:3 (♂), 0:0:0:0:3 (♀); ventral median carinae, 0:0:0:0:4 (♂), 0:0:0:0:6 (♀); segments II–IV each with three accessory macrosetae on ventral median surface (♀).

Telson: Vesicle relatively elongate (fig. 10B); length 2.73/2.52× greater than width (table 2). Ventral and dorsal surfaces smooth, relatively hirsute; ventral carinae each with three (♂) or five to six (♀) macrosetae posteriorly. Subaculear tubercle vestigial, comprising low, broad tubercle, protruding weakly from adjacent surface. Aculeus, laterobasal microsementation comprising seven sharp spinules.

DISTRIBUTION: As for genus.

ECOLOGY: *Kuarapu purhepecha* inhabits tropical deciduous forest at an altitude of approximately 250 m. It has been collected with UV light detection at night on the surfaces of road cuts (Francke and Ponce-Saavedra, 2010) and during the day from rock piles at the base of talus slopes covered with vegetation and leaf litter. The habitat and habitus of *Kuarapu* are consistent with the lithophilous ecomorphotype (Prendini, 2001). *Kuarapu purhepecha* has been collected in sympatry with *Balsateres cisnerosi*, *Centruroides balsasensis* Ponce-Saavedra and Francke, 2004, *Kolotl ponceti* (Francke and Quijano-Ravell, 2009), *Konetontli* sp., *Mesomexovis* sp., and *Thorellius tekuanii* at the type locality (J. Ponce-Saavedra and A. Quijano-Ravel, personal commun.).

REMARKS: Two adult specimens from El Valle labeled as paratypes were not listed as such in the original description.



ADDITIONAL MATERIAL EXAMINED: MEXICO: Michoacán: Municipio de La Huacana: El Vado, 18°48'51"N 101°54'57"W, 248 m, 30. vii.2008, O. Francke, H. Montaña, J. Ponce, and A. Quijano, 2 juv. (AMCC [LP 9517]). **Municipio de Parácuaro:** El Valle [ca. 5 km S of Parácuaro, 19°06'12.41"N 102°13'09.73"W], 21.x.2000, J. Ponce et al., 1 ♂ (AMNH), 1 ♀ (CNAN).

Thorellius Soleglad and Fet, 2008

Figures 5–15, table 8

- Vejovis intrepidus* Thorell, 1876 [= *Thorellius intrepidus* (Thorell, 1876)], type species, by original designation.
- Vejovis* second section (part): Hoffmann, 1931: 373.
- Vaejovis* second section (part): Francke and González-Santillán, 2007: 590.
- Vaejovis intrepidus* group (part): Sissom, 1989: 180; 1991a: 24, 26; 1991b: 24, 26; 1993: 68; Stockwell, 1992: 408, 409; Lourenço and Sissom, 2000: 135; Sissom, 2000: 537, 551; Armas and Martín-Frías, 2001: 8; Hendrixson, 2001: 47; González-Santillán, 2004: 30, 31; Ponce-Saavedra and Sissom, 2004: 539, 541; Graham and Fet, 2006: 7; Soleglad and Fet, 2008: 1, 95, 102; McWest, 2009: 66, 69, 70, 100–102, table 1; Santibáñez-López and Sissom, 2010: 52; Miranda-López et al., 2012: 966; González-Santillán and Prendini, 2013: 7, 9, 11, 14, 24, 44, 55, table 3; 2016: 8.
- Vaejovis punctipalpi* group (part): Fet et al., 2006: 9, table 1; Soleglad and Fet, 2006: 6.
- Thorellius* (part): Soleglad and Fet, 2008: 1, 95, 102; Baldazo-Monsivaiz et al., 2012: 144; 2013: 100, 101, table 1
- Thorellius*: González-Santillán and Prendini, 2013: 3, 6, 7, 16, 17, 18, 21, 24, 30, 35, 38, 39, 43, 44, 51–53, 55, 56, 59, figs. 1E, 5, 17, 20, 21, tables 1, 3; Ponce-Saavedra and Francke, 2013: 77, table 2; Quijano-Ravel and Ponce Saavedra, 2014: 17, 18, 20, table 2; Loria and Prendini, 2014: 26, table 5; Ayrey and Soleglad, 2015: 5; Santibáñez-López et al., 2015: 7; González-Santillán and Prendini, 2016: 8, 36; Dupré, 2017: 14.

DIAGNOSIS: *Thorellius* may be separated from other genera of Syntropinae by the presence of nine retrolateral ventral major macrosetae on the basitarsus of leg III (fig. 11C–G). Most other syn-

tropine genera bear six or seven retrolateral ventral major or minor macrosetae, whereas *Syntropis* bears more than 10. The dorsal surface of the pedipalp femur is finely and sparsely granular in all species of *Thorellius*, whereas in other syntropine genera the dorsal surface is smooth, matte, or granular. The pedipalp patellar retrolateral dorsosubmedian and retrolateral median carinae are smooth and weakly developed in most species of *Thorellius*, except *T. wixarika*, sp. nov., in which the carinae are granular, whereas in other syntropine genera these carinae are absent or granular, as in *Kochius*.

Thorellius is most closely related to *Balsateres*, with which it shares broad pedipalpal and metasomal carinae, but the carinae are moderately to densely granular in *Thorellius*, instead of smooth, as in *Balsateres*. A distinct proximal gap between the pedipalp chela fingers, when closed, is evident in both sexes of *Thorellius*, unlike *Balsateres*, in which the fingers are sublinear, without a distinct proximal gap. The two genera also differ in base coloration and infuscation. *Thorellius* are dark and reddish in color, with infuscation on the carapace and tergites, whereas *Balsateres* is yellow and almost immaculate, except for the ocular tubercle, which is infuscate. *Thorellius intrepidus* shares with *Balsateres* a pair of prolateral denticles at the seventh position on the pedipalp chela movable finger, whereas other species of *Thorellius* possess a single denticle at the seventh position. However, *T. intrepidus* may be separated from *Balsateres* by the densely granular carinae and intercarinal surfaces, which are smooth in *Balsateres*.

Species of *Thorellius* superficially resemble *Kochius*, in which the pedipalp chelae are relatively incrassate. However, *Thorellius* may be distinguished by the broad, raised pedipalp carinae, comprising clustered granules, unlike *Kochius*, in which the carinal granulation is moniliform. The two genera also differ in the macrosculpture of the ventral submedian carinae of metasomal segments I–III, which are costate to weakly denticulate in *Thorellius* but granular in *Kochius*.

Thorellius contains the largest and most robust scorpions in subfamily Syntropinae. The holotype of *T. intrepidus* is 94 mm in length (Sissom, 2000). *Syntropis*, the only genus with adults similar in total length, is comparatively slender, with narrow, elongated pedipalps, legs, and metasoma.

INCLUDED SPECIES: *Thorellius intrepidus* (Thorell, 1876); *T. cristimanus* (Pocock, 1898); *T. tekuaní*, sp. nov.; *T. wixarika*, sp. nov.; and *T. yuyuawi*, sp. nov.

DISTRIBUTION: *Thorellius* is endemic to central-western Mexico and distributed from the interior to the Pacific coast. It has been recorded from the states of Aguascalientes, Colima, Estado de México, Guanajuato, Guerrero, Jalisco, Michoacán, and Nayarit, and probably also occurs in Sinaloa (figs. 1–3). Hoffmann's (1931) records of *T. intrepidus* from Veracruz (Catemaco) on the eastern coast of Mexico are probably erroneous; extensive fieldwork has not yielded new collections from this area (González-Santillán and Prendini, 2013) and the specimens were probably mislabeled.

ECOLOGY: Species of *Thorellius* inhabit subtropical deciduous forest from sea level to 1760 m and have been collected on the surface at night with UV light detection or by turning stones during the day. *Thorellius* species are active only during the rainy season and estivate during the dry season. Although González-Santillán (2004) suggested that *T. intrepidus* is pelophilous, the absence of fossorial adaptations suggests otherwise. The habitat and habitus of *Thorellius* are consistent with the lapidicolous ecomorphotype (Prendini, 2001).

REMARKS: As redefined by González-Santillán and Prendini (2013), *Thorellius* accommodates a subset of species previously assigned to Hoffmann's (1931) "second section" of *Vaejovis*, later termed the *intrepidus* group by Sissom (1989), for which Soleglad and Fet (2008) devised the name *Thorellius*, without quantitatively testing its monophyly or composition. As defined by Soleglad and Fet (2008), *Thorellius* was consistently poly-

phyletic in the phylogenetic analyses presented by González-Santillán and Prendini (2013, 2015a), necessitating its relimitation and redefinition.

KEY TO IDENTIFICATION OF THE SPECIES OF *THORELLIUS*

1. Pedipalp chela carinae granular and immaculate to faintly infusate; fixed and movable fingers, proximal notch deep; fixed finger, medial lobe pronounced2
- Pedipalp chela carinae smooth and densely infusate; fixed and movable fingers, proximal notch shallow; fixed finger, medial lobe weak*T. yuyuawi*, sp. nov.
2. Pedipalp chela manus ventral retrolateral, ventral retrolateral, ventral median, and ventral prosubmedian carinae sparsely granular to smooth; patella retrolateral dorso-submedian and retrolateral median carinae vestigial, comprising few scattered fine or coarse granules3
- Pedipalp chela manus ventral retrolateral, ventral retrolateral, ventral median, and ventral prosubmedian carinae densely granular; patella retrolateral dorsosubmedian and retrolateral median carinae partially developed, densely granular.....*T. wixarika*, sp. nov.
3. Metasomal segments I and II, ventral submedian carinae granular; segments I–V, dorsal and ventral intercarinal surfaces immaculate*T. tekuaní*, sp. nov.
- Metasomal segments I and II, ventral submedian carinae smooth; segments I–V, dorsal and ventral intercarinal surfaces faintly infusate4
4. Pedipalp chelae markedly incrassate; carinae broad and irregularly granular; movable finger with a pair of prolateral denticles at seventh position *T. intrepidus*
- Pedipalp chelae slightly incrassate; carinae slender and mostly moniliform, movable finger with a single prolateral denticle at seventh position*T. cristimanus*

Thorellius cristimanus (Pocock, 1898)

Figures 2, 5C, 7G, 8C, 9C, 10C, 11C, 12G–I
14C, 15F–H, 22–24; tables 3, 8

Vaejovis cristimanus Pocock, 1898: 397; 1902: 11,
fig. 1a–d.

Vejovis cristimanus: Kraepelin, 1899: 184, 186;
1901: 274; Pavlovsky, 1925: 198; Bücherl,
1964: 61; 1971: 328.

Vejovis intrepidus cristimanus: Hoffmann, 1931:
378–381, figs. 33, 34; 1938: 318.

Vejovis intrepidus atrox Hoffmann, 1931: 382–
385, fig. 35; syn. nov.

Vejovis nitidulus intermedius: Díaz-Nájera, 1964:
25 (misidentification).

Vaejovis intrepidus cristimanus: Díaz-Nájera,
1975: 7, 8, 26; Kovařík, 1998: 147; Beutel-
spacher, 2000: 92, 136, 140, 141, 145, map
68; Sissom, 2000: 538; Ponce-Saavedra and
Beutelspacher, 2001: 46, 48, 49, 76, 101, map
21; Soleglad and Fet, 2003: 8, 16, figs. 8, 17,
38, 68, 59, table 2; González-Santillán, 2004:
26, table 2; Kamenz et al., 2005: 102, 105,
table 1; Kamenz and Prendini, 2008: 6, table
1; Volschenk and Prendini, 2008: 655, table
1; McWest, 2009: 20, tables 1, 69, 70, 119,
figs. 209–213; Ponce-Saavedra and Francke,
2011: 466, table 1.

Vaejovis intrepidus atrox: Díaz-Nájera, 1975: 7,
21; Kovařík, 1998: 147; Beutelspacher, 2000:
92, 139, 143, 153, map 68 (part); Ponce-Saa-
vedra and Beutelspacher, 2001: 46, 48, 49,
76, 101, map 20; Sissom, 2000: 538;
González-Santillán, 2004: 26, table 2;
McWest, 2009: 20, 66, 68–70, figs. 204, 208,
119, table 1; Ponce-Saavedra and Francke,
2011: 466, table 1.

Thorellius cristimanus: Soleglad and Fet, 2008: 1,
5, 23, 26, 28, 29, 32, 37, 45, 50, 53, 55, 57,
58, 61, 67, 73, 77, 94, 95, figs. 24, 35, 74, 75,
104, 135, 158, 176, tables 1, 3, 4, 9;
González-Santillán and Prendini, 2013: 24,
35, 38, 39, 52, 55, 56; Ponce-Saavedra and
Francke, 2013: 77, table 2; Quijano-Ravel

and Ponce-Saavedra, 2014: 18, 20, table 2;
González-Santillán and Prendini, 2016: 16,
37, 61; Dupré, 2017: 14.

Thorellius atrox: Soleglad and Fet, 2008: 1, 4, 23,
28, 45, 46, 53, 55–58, 61, 67, 73, 77, 95, figs.
25, 108, 134, 145, 159, 176, tables 1, 4, 9;
González-Santillán and Prendini, 2013: 55;
Ponce-Saavedra and Francke, 2013: 77, table
2; Quijano-Ravel and Ponce Saavedra, 2014:
18, table 2; Dupré, 2017: 14.

TYPE MATERIAL: *Vaejovis cristimanus*: **MEX-ICO: Zacatecas**: Holotype ♀ (BMNH 85.40), Zacatecas. *Vejovis intrepidus atrox*: **MEXICO: Colima**: Lectotype ♀, subad. ♀ paralectotype (AMNH), Colima, in houses. Hoffmann (1931: 382–385) described *V. intrepidus atrox* from three females and three juveniles, but failed to clearly identify the holotype. The AMNH collection contains two specimens: an adult female with a handwritten label (presumably C.C. Hoffmann's) that reads: "Colección de Alacranes Mexicanos. *Vaejovis intrepidus atrox* Hoffmann. Localidad: Colima, Col. en casas. Notas: ♀ grande = tipo, el resto paratipos. Clasificó Carlos C. Hoffmann" [Mexican Scorpion Collection. *Vaejovis intrepidus atrox* Hoffmann. Locality: Colima, Col., within houses. Notes: large ♀ = type, others paratypes. Classified Carlos C. Hoffmann]; and a subadult female with a typed label that reads: "*Vaejovis intrepidus atrox* Hoffmann, Colima, Colima, in house. Paratipos." No other type specimens were located in the collections of the AMNH or the CNAN. Following ICZN Article 73.2, Sissom (2000) regarded the specimens as syntypes. The adult female and subadult female are hereby designated lectotype and paralectotype, respectively, of *V. intrepidus atrox*.

DIAGNOSIS: *Thorellius cristimanus* may be distinguished from other *Thorellius* species as follows. The terminal spinelike processes of the hemispermatophore dorsal and ventral trough margins are fused into a prominent, bifurcate hook in *T. cristimanus*, rather than a nonbifurcate hook, as in the other species. Metasomal segments I and II are robust, slightly wider, and

shorter in *T. cristimanus*, but relatively elongated in *T. intrepidus*, *T. tekuni*, and *T. wixarika*, (tables 3, 4, 5). The notch and lobes of the pedipalp chela fingers are moderately to weakly developed in *T. cristimanus*, but markedly developed in *T. intrepidus*. The movable finger bears a single denticle at the seventh position in *T. cristimanus*, but a pair of prolateral denticles in *T. intrepidus*. *Thorellius cristimanus* is reddish brown in color with some infuscation on the carapace and tergites, unlike *T. tekuni*, which is light yellow and immaculate. The ventral submedian carinae of metasomal segments I and II are smooth in *T. cristimanus*, but finely granular in *T. tekuni*. The retrolateral dorsosubmedian and retrolateral median carinae of the pedipalp patella are vestigial, comprising a few scattered fine granules in *T. cristimanus*, but partially developed and densely granular in *T. wixarika*. The ventral retrolateral, ventral retrosubmedian, ventral median, and ventral prosubmedian carinae of the pedipalp chela manus are smooth to moderately granular in *T. cristimanus*, but irregularly and densely granular in *T. wixarika*. The carapace interocular surface is shagreened in *T. cristimanus*, but relatively smooth in *T. yuyuawi*. All carinae of the pedipalp chela manus are partially or entirely granular in *T. cristimanus*, but smooth in *T. yuyuawi*. The ventral lateral and ventral submedian carinae of metasomal segments II–IV are finely granular in *T. cristimanus*, but smooth in *T. yuyuawi*. The dorsal lateral and ventral lateral carinae of metasomal segment V each bear seven or eight macrosetae, respectively, in *T. cristimanus*, but 14 and 23 macrosetae, respectively, in *T. yuyuawi*.

DESCRIPTION: The following redescription supplements Pocock's (1898) original description and Hoffmann's (1931) redescription and is based on the types and additional material examined.

Color and infuscation: Cheliceral manus dorsal surface base color yellow to orange, fingers darker, reddish. Carapace, pedipalps, tergites, sternites, metasoma, and telson base color yellowish to reddish-brown. Carapace, tergites, and legs faintly infuscate. Coxosternal region slightly

darker than carapace and tergites. Pedipalp carinae reddish, darker than intercarinal surfaces. Legs yellow to orange. Genital operculum and pectines pale whitish to yellowish, immaculate. Sternites immaculate. Metasomal segments ventral lateral and ventral submedian carinae reddish, darker than intercarinal surfaces, faintly infuscate. Telson aculeus reddish to brownish.

Chelicerae: Manus dorsal surface smooth, with broad, finely granular carinae subdistally and one macroseta medially. Fixed and movable fingers smooth; movable finger, ventral surface with serula, comprising 22/25 times, in distal half.

Carapace: Length 1.07/0.98× greater than posterior width (table 3). Anterior margin emarginate, with moderate to shallow median notch, with three or four pairs of major macrosetae (fig. 5C). Three pairs of lateral ocelli, anterolateral and median lateral pairs equal in size, posterolateral pair approximately half the size. Median ocular tubercle slightly raised, situated in anterior half of carapace, superciliary carinae smooth, higher than median ocelli. Median ocelli approximately twice the size of anterolateral ocelli. Anteromedian and posteromedian sulci deep; posterolateral and posterior transverse sulci shallow. Surfaces shagreened, covered with fine and coarse, rounded granules.

Coxosternal region: Sternum subequilateral pentagonal (fig. 7G); 0.91/0.97× longer than wide (table 3); median sulcus deep; surfaces matte, with five pairs of macrosetae, two pairs anteriorly, one pair medially, and two pairs posteriorly on lobes. Coxae surfaces matte, smooth in places; coxa II subproximal margin with three oblique slitlike structures, adjacent to moderately granular, triangular protuberance; coxal endite II proximal margin with deep depression, medial margin finely granular, becoming smooth distally. Coxa IV 2.1/1.93× longer than coxa II (table 3).

Pedipalps: Femur, dorsal and ventral intercarinal surfaces granular medially, prolateral and retrolateral intercarinal surfaces matte (fig. 23A); dorsal prolateral, dorsal retrolateral, and ventral prolateral carinae complete, granular; retrolateral

TABLE 3

Measurements (mm) of selected specimens of *Thorellius cristimanus* (Pocock, 1898)

Specimens deposited in American Museum of Natural History (AMNH) and Colección Nacional de Arácnidos (CNAN), Instituto de Biología, Universidad Nacional Autónoma de México.

Collection		AMNH			CNAN	AMNH				
Number/Type					3929	Lecto.				
Sex		♂	♂	♂	♂	♀	♀	♀	♀	♀
Carapace	length	6.7	6.6	5.8	7.4	9.1	8.5	6.5	8.5	8.2
	ant. width	3.7	3.8	3.4	4.0	5.2	5.0	3.8	5.0	4.9
	post. width	6.2	6.2	5.6	6.7	9.0	8.7	6.5	8.6	8.8
Femur	length	6.0	5.7	5.1	6.2	7.5	7.1	5.5	7.0	7.0
	width	2.1	2.0	1.8	2.0	2.1	2.5	1.9	2.5	2.1
Patella	length	6.6	6.1	6.0	6.5	8.0	7.5	5.8	7.6	7.8
	width	2.4	2.1	2.1	2.4	3.1	3.0	2.3	2.9	3.0
Chela	length	10.0	9.9	8.9	10.5	13.0	12.5	9.6	12.5	12.0
Manus	width	3.2	3.1	2.6	3.4	3.8	3.6	2.8	3.8	3.8
Manus	height	3.4	3.4	2.8	3.7	4.1	3.9	2.7	4.1	4.4
Manus	length	5.8	5.7	5.1	6.0	7.1	7.0	5.4	7.0	6.5
Fixed finger	length	4.2	4.2	3.8	4.4	5.9	5.5	4.2	5.5	5.5
Mov. finger	length	5.9	6.1	5.0	6.5	8.0	7.6	5.7	7.5	7.6
Coxa II	length	3.0	2.8	2.6	1.4	3.8	3.6	2.8	3.7	3.7
Coxa IV	length	5.8	5.8	5.4	3.2	8.0	7.5	6.0	5.0	7.5
Sternum	length	1.3	1.3	1.3	6.2	2.0	1.9	1.3	1.1	1.7
	width	1.5	1.5	1.4	1.3	1.9	2.0	1.5	1.2	1.7
Mesosoma	length	14.5	14.5	13.8	15.8	20.1	20.5	15.8	21.1	19.3
Metasoma	length	25.9	25.4	22.7	24.7	31.1	29.5	22.8	29.3	29.4
Segment I	length	3.3	3.3	2.9	3.2	4.0	3.6	2.9	3.7	3.8
	width	4.2	4.0	3.6	4.2	5.3	5.2	3.7	5.1	5.2
	height	3.0	3.4	2.8	3.4	4.4	4.1	3.1	4.1	3.7
Segment II	length	4.0	3.9	3.6	4.6	4.8	4.5	3.5	4.5	4.4
	width	4.3	4.0	3.6	4.2	5.4	5.1	3.8	5.0	5.0
	height	3.2	3.3	2.8	3.4	4.4	4.1	3.0	4.2	3.8
Segment III	length	4.4	4.4	3.8	4.7	5.3	5.0	3.9	5.0	5.0
	width	4.3	3.9	3.6	4.2	5.3	5.0	3.8	5.0	4.9
	height	3.4	3.4	3.0	3.5	4.4	4.3	3.0	4.1	4.0
Segment IV	length	5.9	5.9	5.2	6.3	7.0	6.9	5.2	6.7	6.8
	width	4.2	4.0	3.6	4.2	5.1	5.0	3.7	4.9	4.8
	height	3.6	3.5	3.2	3.6	4.6	4.2	3.2	4.3	4.2
Segment V	length	8.3	8.0	7.2	8.8	10.0	9.5	7.3	9.5	9.5
	width	4.0	3.7	3.4	4.0	5.0	4.8	3.4	4.8	4.6
	height	3.2	3.1	2.8	3.6	4.1	4.0	3.0	4.2	4.0
Telson	length	7.5	7.8	6.6	8.6	9.5	9.2	7.3	9.2	9.0
Vesicle	length	4.8	4.9	4.2	5.8	6.4	6.2	4.7	6.0	6.0
	width	3.0	2.6	2.4	3.3	3.6	3.5	2.8	3.7	3.6
	height	2.4	2.4	2.1	2.9	3.3	3.0	2.4	3.2	3.0
Aculeus	length	2.7	2.9	2.4	2.8	3.1	3.0	2.6	3.2	3.0
Total	length	54.5	54.2	48.8	56.4	69.8	67.7	52.3	68.1	65.8

TABLE 4

Measurements (mm) of adult *Thorellius intrepidus* (Thorell, 1976)

Specimens deposited in American Museum of Natural History (AMNH) and Colección Nacional de Arácnidos (CNAN), Instituto de Biología, Universidad Nacional Autónoma de México.

Collection		AMNH					CNAN				
Number											
Sex		♂	♂	♂	♂	♂	♀	♀	♀	♀	♀
Carapace	length	9.1	9.0	8.3	9.2	9.3	9.0	10.4	10.1	9.6	8.2
	ant. width	5.3	5.0	4.7	5.1	5.2	4.7	5.6	5.6	5.5	4.0
	post. width	8.4	8.4	7.6	8.6	8.7	8.8	10.0	9.8	9.0	7.5
Femur	length	7.8	7.2	7.2	7.8	8.0	7.3	8.7	8.4	8.0	6.7
	width	2.7	2.7	2.3	2.6	2.7	2.5	3.0	2.8	2.7	2.4
Patella	length	8.0	7.7	7.6	8.3	8.2	7.8	8.9	8.7	8.5	7.0
	width	2.8	2.9	2.7	2.8	2.9	2.8	3.2	3.1	2.9	2.5
Chela	length	13.9	12.3	12.2	13.0	13.5	12.7	14.5	14.2	13.6	11.9
Manus	width	4.7	4.7	4.0	4.8	5.0	4.1	5.2	5.5	4.8	3.9
Manus	height	6.4	5.4	4.6	5.7	5.8	5.0	6.0	6.2	5.4	4.4
Manus	length	7.6	7.1	7.0	7.7	7.8	7.2	8.1	8.0	7.5	6.7
Fixed finger	length	6.3	5.2	5.2	5.3	5.7	5.5	6.4	6.2	6.1	5.2
Mov. finger	length	9.0	8.2	8.1	8.3	9.0	7.7	9.6	9.2	9.0	7.5
Coxa II	length	3.9	3.6	3.6	4.0	3.9	3.7	4.4	4.3	3.9	3.4
Coxa IV	length	7.8	7.1	4.7	7.7	7.6	5.0	8.5	8.7	8.0	6.7
Sternum	length	1.5	1.4	1.4	1.4	1.5	1.5	1.9	2.0	1.6	1.4
	width	1.6	1.7	1.7	1.7	1.8	1.8	2.1	2.0	1.7	1.6
Mesosoma	length	19.4	18.8	18.2	18.0	19.0	22.2	25.6	25.4	20.0	19.4
Metasoma	length	34.2	26.1	31.8	34.8	36.0	32.5	35.8	36.6	33.1	26.1
Segment I	length	4.5	4.2	4.2	4.7	4.8	4.2	4.6	4.8	4.3	3.7
	width	4.8	5.0	4.4	5.0	5.1	5.0	5.5	5.5	5.0	4.0
	height	3.8	3.9	3.7	4.0	4.2	3.7	4.4	4.4	4.0	3.1
Segment II	length	5.2	5.2	5.1	5.7	5.7	5.3	5.5	5.9	5.2	4.6
	width	4.9	4.9	4.4	5.0	5.1	5.0	5.5	5.5	5.1	4.1
	height	3.8	3.7	3.5	3.8	4.1	3.8	4.2	4.3	4.0	3.1
Segment III	length	6.0	5.8	5.5	6.1	6.4	5.6	6.3	6.4	5.8	5.1
	width	4.8	4.8	4.2	5.0	5.0	5.0	5.4	5.4	5.1	4.0
	height	3.7	3.9	3.4	3.7	4.1	3.9	4.2	4.4	3.8	3.1
Segment IV	length	8.1	7.8	7.5	8.3	8.2	7.7	8.5	8.5	7.8	6.7
	width	4.6	4.8	4.2	4.8	4.9	5.0	5.3	5.2	4.8	4.0
	height	3.7	3.9	3.4	3.7	4.1	4.2	4.2	4.4	3.6	3.4
Segment V	length	10.4	10.5	9.5	10.0	10.9	9.7	10.9	11.0	10.0	9.0
	width	4.4	4.4	4.0	4.5	4.7	4.7	5.0	5.1	4.5	3.7
	height	3.5	3.8	3.5	3.5	4.0	3.9	4.1	4.3	3.7	3.1
Telson	length	9.5	9.1	9.0	9.6	9.7	8.8	10.3	10.5	9.6	8.0
Vesicle	length	6.0	5.7	5.5	5.8	6.1	5.5	6.5	6.4	5.8	5.0
	width	3.8	3.8	3.4	3.8	3.9	3.8	4.4	4.5	4.0	3.2
	height	3.4	3.3	3.1	3.4	3.5	3.3	3.9	3.8	3.1	2.8
Aculeus	length	3.5	3.4	3.5	3.8	3.6	3.3	3.8	4.1	3.8	3.0
Total	length	72.2	63.0	67.3	71.6	74.0	72.5	82.1	82.6	72.3	61.7

TABLE 5

Measurements (mm) of adult *Thorellius tekuni*, sp. nov.

Specimens deposited in American Museum of Natural History (AMNH) and Colección Nacional de Arácnidos (CNAN), Instituto de Biología, Universidad Nacional Autónoma de México.

Collection		CNAN	AMNH						
Number		1249							
Type		Holo.	Para.						
Sex		♂	♂	♂	♂	♀	♀	♀	♀
Carapace	length	6.7	6.4	6.2	5.5	9.4	8.2	8.5	8.2
	ant. width	3.3	3.7	3.6	3.0	5.3	4.7	4.5	4.4
	post. width	6.0	5.6	5.7	5.0	8.3	7.6	7.6	7.2
Femur	length	6.0	5.4	5.0	4.6	7.9	7.0	7.1	6.5
	width	1.9	1.9	1.8	1.6	2.7	2.3	2.4	2.3
Patella	length	6.4	5.6	5.4	5.0	8.0	7.4	7.4	7.1
	width	2.0	2.0	1.9	1.7	2.3	2.4	2.8	2.6
Chela	length	9.9	9.1	8.9	7.5	13.7	12.1	12.0	12.4
Manus	width	3.4	3.0	2.9	2.6	4.3	3.5	3.6	3.5
Manus	height	3.4	3.2	3.0	2.8	5.0	4.0	4.1	3.9
Manus	length	5.7	5.2	5.2	4.3	7.2	6.2	6.5	7.1
Fixed finger	length	4.2	3.8	3.7	3.2	6.5	5.9	5.5	5.3
Mov. finger	length	6.0	5.5	5.4	4.7	9.0	8.0	7.6	7.4
Coxa II	length	2.8	2.7	2.5	2.2	3.8	3.3	3.4	3.2
Coxa IV	length	5.8	5.2	5.0	4.4	7.9	6.9	7.1	6.7
Sternum	length	1.3	1.1	0.9	0.9	1.5	1.4	1.4	1.6
	width	1.3	1.3	1.3	1.2	1.9	1.7	1.5	1.6
Mesosoma	length	14.3	14.1	13.8	11.7	21.0	19.3	20.7	17.8
Metasoma	length	24.3	21.8	22.5	20.2	32.4	29.5	29.9	29.0
Segment I	length	3.6	3.2	3.0	2.7	4.3	3.8	3.9	3.8
	width	3.7	3.6	3.8	3.3	4.8	4.2	4.4	4.3
	height	3.0	2.6	3.0	2.7	4.0	3.5	3.3	3.4
Segment II	length	4.4	3.9	3.6	3.2	5.1	4.5	4.7	4.6
	width	3.6	3.4	3.6	3.2	4.8	4.2	4.2	4.2
	height	3.0	2.8	3.0	2.8	4.0	3.5	3.2	3.6
Segment III	length	4.7	4.3	3.9	3.6	5.4	4.9	5.1	4.8
	width	3.5	3.4	3.6	3.2	4.7	4.1	4.1	4.1
	height	3.0	2.8	3.0	2.8	4.0	3.4	3.4	3.5
Segment IV	length	6.2	5.4	5.4	4.7	7.6	6.6	7.0	6.5
	width	3.4	3.4	3.6	3.2	4.4	4.0	4.0	4.0
	height	2.9	2.8	3.0	2.8	3.8	3.4	3.3	3.6
Segment V	length	8.1	5.1	6.7	6.1	10.0	9.7	9.2	9.3
	width	3.2	3.1	3.3	3.0	4.0	3.7	3.5	3.7
	height	2.7	2.5	2.8	2.6	3.7	3.2	3.0	3.2
Telson	length	7.4	7.0	6.6	5.8	9.6	8.5	8.2	8.6
Vesicle	length	4.9	4.6	4.2	3.7	5.8	5.2	5.5	5.4
	width	2.5	2.6	2.5	2.2	3.4	3.1	3.2	3.4
	height	2.3	2.0	2.2	1.9	3.2	2.8	2.8	3.0
Aculeus	length	2.5	2.4	2.4	2.1	3.8	3.3	2.8	3.3
Total	length	52.7	49.3	49.1	43.1	72.4	65.5	67.3	63.7

dorsosubmedian carina complete, serrate, with six or seven macrosetae, decreasing in size distally; prolateral ventrosubmedian carina vestigial, reduced to two bicuspid tubercles, each with macroseta, proximally and distally, and five or six spiniform granules medially; prolateral ventral carina vestigial, reduced to two tubercles, each with macroseta proximally, and two or three additional tubercles medially; retrolateral ventral, ventral median, and ventral retrosubmedian carinae vestigial, each reduced to row of serrate granules proximally. Patella 1.13/1.28× wider than femur (table 3); intercarinal surfaces matte (fig. 23B–E); dorsal prolateral and dorsal retrolateral carinae complete, granular; ventral prolateral and ventral retrosubmedian carinae complete, costate-granular; ventral median carina vestigial, reduced to row of minute granules proximally, occasionally extending to proximal two-thirds; retrolateral dorsosubmedian and retrolateral median carinae vestigial, granular; prolateral process well developed; prolateral median carina vestigial, reduced to proximal tubercle with macroseta, four to six serrate granules decreasing in size distally, and distal granule with macroseta; prolateral ventral carina vestigial, comprising proximal, median and distal granules, each with a macroseta. Chela 1.56/1.62× longer than patella, 1.71/1.75× longer than femur (table 3). Manus relatively incrassate (fig. 24), 1.36/1.24× wider than patella, 1.53/1.59× wider than femur (table 3); intercarinal surfaces matte; dorsal prolateral, dorsal median, dorsal retrolateral, and retrolateral median carinae complete, granular; dorsal retrosubmedian accessory carina vestigial, granular; dorsal prosubmedian and prolateral dorsal carinae vestigial, crenulate, flanking dorsal prolateral carina; retrolateral subventral accessory and retrolateral subventral carinae vestigial, each reduced to short granular row distally; retrolateral ventral carina vestigial, reduced to proximal tubercles; ventral retrolateral and ventral retrosubmedian carinae partial, becoming costate-granular distally (fig. 24C); ventral prosubmedian and ventral median carinae complete, crenulate; ventral prolateral and

prolateral ventral carinae vestigial, each reduced to short row of granules proximally; prolateral median and prolateral ventrosubmedian carinae complete, costate-granular. Fixed and movable fingers, dentate margins emarginate, fixed finger with moderate (♀) to well developed (♂) proximal notch and median lobe (fig. 24B, D), movable finger with shallow (♀) to moderate (♂) proximal lobe, fitting together unevenly such that proximal gap evident when closed; fixed finger median denticle row comprising five denticle subrows flanked by six prolateral and five retrolateral subserrate denticles, retrolateral denticles comparatively smaller than prolateral denticles, proximal retrolateral denticle situated in median half of finger; movable finger median denticle row comprising six denticle subrows, flanked by seven prolateral and six retrolateral denticles, subpaired, proximal retrolateral denticle situated in median half of finger, terminal subrow comprising single denticle. Trichobothrial pattern type C, orthobothriotaxic; chela trichobothria *Db* and *Dt* situated dorsal to dorsal retrolateral carina, *Dt* at midpoint of manus, *Db* suproximal on manus; *db–dt* and *eb–et* series distributed along entire length of fixed finger with *db* situated proximal and *eb* subproximal; *ib* and *it* situated in median third of fixed finger (fig. 24D), *ib* between sixth and seventh prolateral denticles, but closer to the sixth, *it* between fifth and sixth prolateral denticles, also closer to the sixth.

Legs: Basitarsi retrolateral dorsal, prolateral ventral, and retrolateral ventral spinule rows complete on I and II, retrolateral dorsal spinule row partial, restricted to distal two-thirds of III and IV, prolateral ventral spinule row partial, restricted to distal two-thirds of III, absent on IV, retrolateral ventral spinule row complete on III, absent on VI; retrolateral median row vestigial, reduced to few distal spinules on I–IV; macrosetal counts on legs I–IV, respectively: dorsal, 4:4:4:4; retrolateral dorsal, 3:3:4:4; prolateral ventral, 4:5:5:6, distal three spinules on II and distal four on IV stout; retrolateral ventral, 5:8:9:9, with major and minor macrosetae interspersed; dorsal and retrolateral dorsal macrosetae arranged into two separate rows on I–IV.

Telotarsi I–IV, each with single ventromedian row of spinules, curved proximally, and two or three pairs of ventrodistal spinules (fig. 11C).

Genital operculum: Width greater than length (fig. 7G), with three pairs of macrosetae. Sclerites separated, but unable to open more than 45° (♂) or fused longitudinally (♀). Genital papillae present, protruding posteriorly (♂) or absent (♀).

Hemispermaphore: Lamina 1.84× longer than trunk (table 8). Median lobe, ental terminus well developed, rounded (fig. 12G, I). Dorsal trough margin long, narrow, curving proximally, well separated from ventral trough. Dorsal and ventral trough margins, terminal spinelike processes fused into prominent, bifurcate hook, situated distally on lamina dorsal margin (fig. 12H, I). Basal plate of inner lobe adjacent to ventral trough; spine of inner lobe long and markedly sclerotized (fig. 14C). Hemimating plug developed from inner lobe; distal barb 0.43× longer than basal plate (table 8); distal barb margin with 15 elongated spinules; secondary spine on ventromedian side of distal barb moderately developed, triangular (figs. 14C, 15F–H).

Pectines: Basal piece with four pairs of major macrosetae. Marginal lamella comprising three sclerites. Medial lamella proximal sclerites fused, 13 distal sclerites separate (fig. 7G). Fulcra, 20–23 (♂), 17–19 (♀). Pectinal teeth, 21–24 (♂), 18–20 (♀). Pectines relatively long, midpoint (♂) or distal margin (♀) of medial sclerite of marginal lamella aligned with distal margin of coxa VI.

Tergites: Pretergites I–VII, surfaces matte. Posttergites I–VI, intercarinal surfaces shagreened, sparsely covered with fine and coarse granules, dorsal median and dorsal lateral carinae partial, restricted to posterior half, granular; VII, intercarinal surfaces moderately granular; dorsal median carina partial, restricted to anterior third, costate-granular, dorsal submedian carinae vestigial, costate to serrate anteriorly, dorsal lateral and lateral median costate to serrate, converging anteromedially, posterior granules larger, spiniform.

Sternites: Sternites III–VII, surfaces acarinate and matte (♂) or finely punctate (♀); III–VI, spiracles elongate, slitlike, ca. 4× longer than wide; V, posteromedian hyaline glandular area weakly developed, protruding slightly from adjacent surfaces and paler than surrounding surfaces (♂) or obsolete (♀); VII, posteromedian hyaline glandular area absent, ventral submedian carinae obsolete, each with three pairs of macrosetae, ventral lateral carinae weakly granular.

Metasoma: Metasoma 1.68/1.47× longer than mesosoma (table 3). Segments I–V, respectively 1.26/1.36, 1.00/1.12, 0.93/0.99, 0.68/0.72, 0.47/0.49× wider than long; V, 1.35× wider than telson vesicle. Segments I–V, all intercarinal surfaces matte with scattered granules (figs. 9C, 10C); dorsal lateral carinae serrate, terminating in conical spiniform granules posteriorly on I–IV, serrate in anterior half, becoming finely granular posteriorly on V; lateral median carinae serrate, terminating in conical spiniform granules posteriorly on I–III, lobate, forming rounded triangular projection, posteriorly on IV, partial, restricted to posterior two-thirds, serrate anteriorly, becoming granular posteriorly on V; lateral inframedian carinae complete, serrate on I, partial, serrate in posterior third on II, partial, granular in posterior quarter on III, absent on IV; ventral lateral carinae costate-granular on I and II, granular on III and IV, finely serrate on V; ventral submedian carinae obsolete on I, costate in anterior half, becoming granular in posterior half on II and III, finely granular on IV; ventral lateral and ventral median carinae finely serrate on V. Macrosetal counts on carinae of segments I–V, respectively: dorsal lateral carinae, 1:3:3:3:7; lateral median carinae, 1:3:3:4:4; lateral inframedian carinae, 2:1:1:0:0; ventral lateral carinae, 2:2:2:4:8; ventral submedian carinae, 3:3:3:3:3; ventral sublateral carinae, 0:0:0:0:2.

Telson: Vesicle relatively elongate (fig. 10C), length 1.84/1.98× greater than aculeus length (table 3). Dorsal surface smooth. Ventral surface, anterior third moderately granular, smooth posteriorly; ventral carinae each with three or four macrosetae. Subaculear tubercle vestigial, com-

prising two minute granules longitudinally. Aculeus, laterobasal microserration comprising 5–6 sharp spinules.

DISTRIBUTION: *Thorellius cristimanus* is endemic to Mexico and has been recorded from Colima, southern and central Jalisco, and north-eastern Michoacán (fig. 2). The type locality of *T. cristimanus* was indefinitely located in Zacatecas (Pocock, 1898). The distribution of *T. cristimanus* remained ambiguous until Hoffmann (1931) identified specimens from Aguascalientes, Guanajuato, Jalisco, and Michoacán. This distribution persisted, largely unsupported by precise records, in subsequent taxonomic works (Lourenço and Sissom, 2000; Sissom, 2000). Although Pocock's (1898) holotype from Zacatecas might be spurious, Zacatecas is an extensive state and further fieldwork may reveal the presence of *T. cristimanus*, especially near its southern border with Jalisco. Although Hoffmann's (1931) specimens from Calvillo, Aguascalientes, could not be located during the present investigation, material from that locality, deposited in INDRE, as well as material from Guanajuato and Michoacán, deposited in CNAN, was found to be conspecific with *T. intrepidus*. Hoffmann's (1931) specimens from Ocotlán, Jalisco, were also unavailable for study, but the locality may be valid as it is situated fewer than 50 km east of Chapala and Guadalajara, both known localities of *T. cristimanus*, and the habitat is similar.

Beutelspacher's (2000: 140, 141) catalog of Mexican scorpions incorrectly listed *V. cristimanus* and *V. intrepidus cristimanus* as separate taxa for the states of Guanajuato, Hidalgo and Jalisco. Even if Beutelspacher (2000) intended to recognize *V. cristimanus* as a subspecies of *Thorellius intrepidus*, several records are erroneously cited. Beutelspacher's (2000: 141, 145) records of *V. intrepidus atrox* and *V. i. cristimanus* from San Luis Potosí, and of *V. i. cristimanus* from Hidalgo are based on misidentifications (W.D. Sissom, personal commun.). Beutelspacher's (2000: 92, 143) records from Michoacán and Nayarit probably correspond to *T. tekuani* and *T. wixarika*, respectively, whereas a record of *V. intrepidus*

atrox [= *T. cristimanus*] from Nayarit is a misidentification.

ECOLOGY: *Thorellius cristimanus* inhabits tropical deciduous forest from 50 to 1550 m altitude. Most specimens have been collected under stones during the day and with UV detection at night. One was collected inside a cave in Coquimatlán, Colima. Hoffmann's (1931) report of *V. intrepidus atrox* from houses within the city of Colima suggests the species may be synanthropic. The habitat and habitus of *T. cristimanus* are consistent with the lapidicolous ecomorphotype (Prendini, 2001).

REMARKS: Soleglad and Fet (2008) supported Hoffmann's (1931) distinction between *V. intrepidus atrox* and the nominotypical form and elevated the former to the rank of species. However, the diagnostic characters proposed by these authors do not justify the distinction between *T. atrox* and *T. cristimanus*. Soleglad and Fet (2008) examined a single female of *T. atrox* from Colima and two pairs of males and females of *T. cristimanus* from Autlan, Jalisco. Whereas Soleglad and Fet (2008: 95) suggested that the pedipalp chela manus of *T. atrox* is narrower than that of *T. cristimanus*, "comparing the length to the palm depth, we see a ratio of 2.882 in *T. atrox* versus 2.379 in *T. cristimanus*, a 21.1 % difference," a larger sample size indicated that the manus of large males is usually more markedly incrassate than that of small males (table 3; figs. 23, 25). Soleglad and Fet (2008: 95) also argued that "*T. atrox* is a very dark scorpion, almost black, while *T. intrepidus* and *T. cristimanus* are much lighter," but a larger sample size revealed that the color varies in accordance with the substrate. For example, specimens from El Limón and El Grullo, Jalisco, examined during the present investigation, were as pale as *T. intrepidus*, matching the granitic soils at these localities, whereas specimens from Colima City were darker and more infusate, matching the volcanic soils associated with Volcan de Fuego. Based on examination of the type material and extensive additional material, and augmented by genetic analyses, which revealed minimal diver-

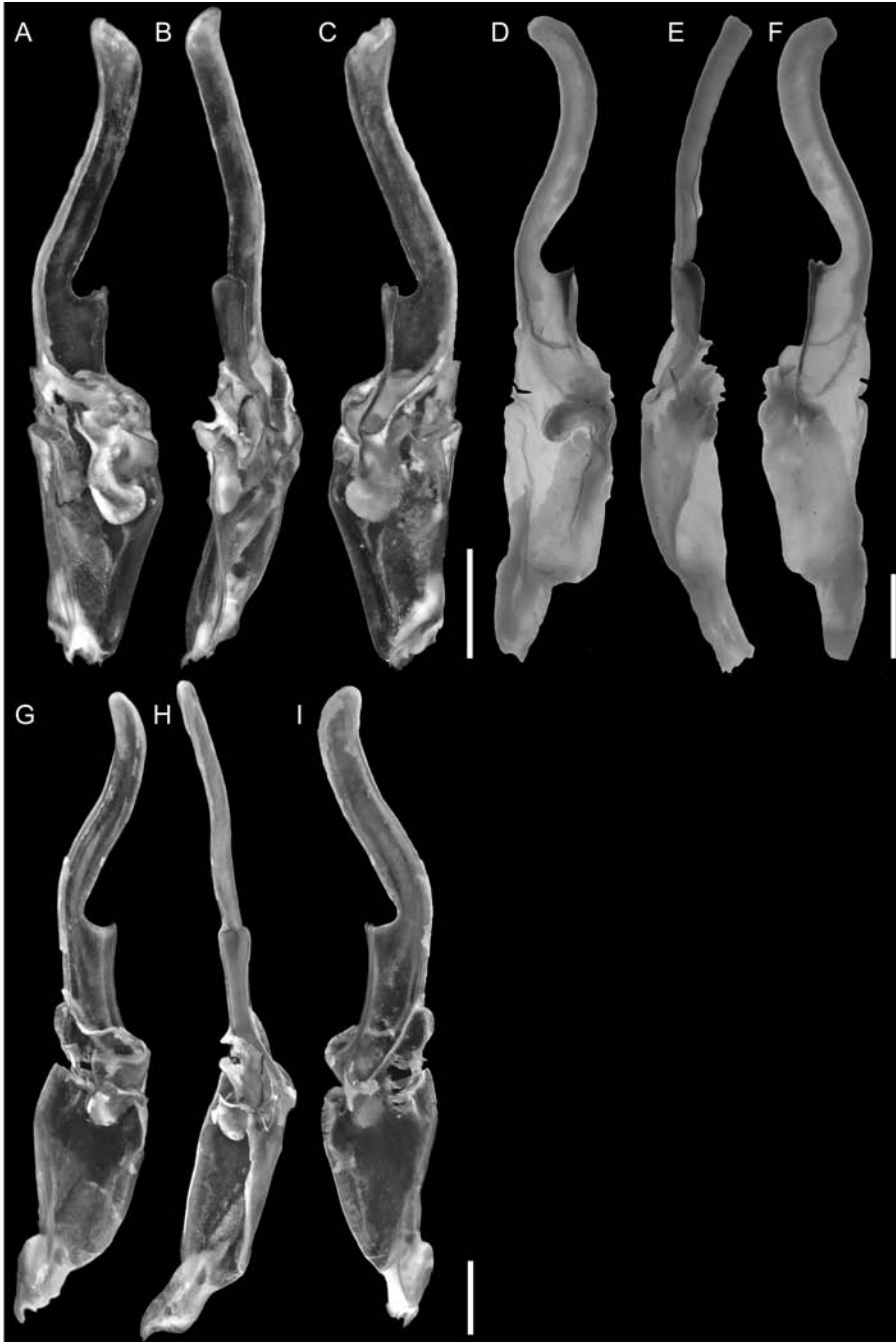


FIGURE 12. *Balsateres* González-Santillán and Prendini, 2013, *Kuarapu* Francke and Ponce-Saavedra, 2010, and *Thorellius* Soleglad and Fet, 2008, dextral hemispermaphores, ventral aspect (A, D, G), ental aspect (B, E, H), and dorsal aspect (C, F, I). A–C. *Balsateres cisnerosi* (Ponce-Saavedra and Sissom, 2004), ♂ (CNAN SC2441). D–F. *Kuarapu purhepecha* Francke and Ponce-Saavedra, 2010, paratype ♂ (AMNH). G–I. *Thorellius cristimanus* (Pocock, 1898), ♂ (AMNH), Scale bars = 1 mm (A–C, G–I), 0.5 mm (D–F).



FIGURE 13. *Thorellius* Soleglad and Fet, 2008, dextral hemispermaphores, ventral aspect (A, C, F, I), dorsal aspect (B, E, H, K), and ental aspect (D, G, J). A, B. *Thorellius intrepidus* (Thorell, 1876), ♂ (AMNH). C–E. *Thorellius wixarika*, sp. nov., holotype ♂ (CNAN T01251). F–H. *Thorellius tekuaní*, sp. nov., holotype ♂ (CNAN T01250). I–K. *Thorellius yuyuawí*, sp. nov., holotype ♂ (CNAN T01252), Scale bars = 1 mm.

gence among four samples from across the range of these taxa (González-Santillán and Prendini, 2015a: 17, fig. 6), the distinction between them is rejected and the following synonym proposed: *Vejovis intrepidus atrox* Hoffmann, 1931 = *Thorellius cristimanus* (Pocock, 1898).

ADDITIONAL MATERIAL EXAMINED: MEXICO: Colima: *Municipio de Colima:* Colima, 21.i.1943, 2 juv. (CNAN SC2650), 30.i.1963, staff, 1 ♂ (CNAN SC2646), 19°14'37"N 103°43'51"W, 500 m, viii.2000, R. Ayala, 1 ♂, 3 ♀ (CNAN SC2932); Colima, in house, 1 ♀ (AMNH); Hacienda San Juan Antonio, 20 km N Colima, 19°14'35"N 103°43'50"W, 500 m, viii.2000, R. Ayala, 2 ♀, 1 juv. (CNAN SC2928); Cofradía de Suchitlan, 19°24.795'N 103°41.815'W, 1344 m, 26.v.2006, O. Francke, A. Valdez, H. Montaña, and J. Ballesteros, forest, under rock, 2 juv. (AMNH). *Municipio de Comala:* Comala [19°19'N 103°45'W], 21.iii.1978, 1 ♀, 56 juv. (CNAN SC2653), A. Montaudon, 2.iii.2004, 1 ♂ (CNAN SC2657), P. Berea, 9.iv.2004, 1 subad. ♂ (CNAN SC2651), W. López-Forment, 30. viii.1996, 1 juv. (CNAN SC2649); El Jabalí Ranch [19°19'N 103°45'W], 27–28.v.1992, W. López-Forment, 1 juv. (CNAN SC2654). *Municipio de Coquimatlán:* Cave, 8 km S Coquimatlán, 19°09.108'N 103°50.152'W, 280 m, 29–30. viii.2011, O. Francke, H. Montaña, A. Valdez, C. Santibáñez, and A. Ballesteros, outside cave, 1 subad. ♀, 2 juv. (CNAN SC2927), 1 ♀ (AMNH), inside cave, 1 juv. ♂ (AMCC [LP 7671]), 19°09.061'N 103°50.080'W, 277 m, 29.viii.2007, O. Francke, H. Montaña, N. Perez, and A. Valdez, 1 ♂, 1 ♀ (CNAN SC2927); Road to Coquimatlán, marker km 71, 19°06.775'N 103°51.185'W, 336 m, 26.v.2006, O. Francke, A. Valdez, H. Montaña, and A. Ballesteros, tropical deciduous forest, under rock, 3 juv. (AMNH, AMCC [LP 6551], CNAN SC2933). *Municipio de Minatitlán:* Balneario 'El Salto,' Minatitlán, 19°22.087'N 104°5.128'W, 650 m, 26.v.2006, O. Francke, A. Valdez, H. Montaña, and J. Ballesteros, forest, in burrows, 2 ♀ (AMNH); road to Minatitlán, junction to Saus, 19°25.379'N 103°58.999'W, 1006 m, 26.v.2006, O. Francke, A.

Valdez, H. Montaña, and J. Ballesteros, forest, under rock, 1 ♀ (AMNH). *Municipio de Tecolapa:* Tecolapa, 18°59'14"N 103°50'18"W, 94 m, 13.ix.1971, 1 ♀ (CNAN SC2931). *Municipio de Tonila:* Tonila, 3.2 km S [19°23.375'N 103°34.444'W], 28.viii.1965, W.J. Gertsch and R. Hastings, 3 ♂, 3 ♀ (AMNH). *Municipio de Villa de Álvarez:* El Mixcuate, 1 km N, 19°19.674'N 103°56.306'W, 590 m, 30.viii.2011, O. Francke, H. Montaña, A. Valdés, C. Santibáñez, and A. Ballesteros, 3 juv. (CNAN SC2449). **Jalisco:** *Municipio de Ameca:* Ameca [20°33'N 104°2'W], Laboratorios Mand NSA, 1 ♂ (CNAN SC2648). *Municipio de Atoyac:* Atoyac, 5 km S, 19°56'43.15"N 103°31'2.21"W, 1360 m, 25.x.2016, G. Montiel, D. Guerrero, and G. Contreras, 1 ♂, 5 ♀, 1 juv. (CNAN SC3929). *Municipio de Chapala:* Chapala [20°17'58.32"N 103°12'16.52"W], 20 m, 17.viii.2001, 1 ♂ (CNAN SC2644); Lago de Chapala, S side [20°15'N 103°00'W], 28.vii.1954, W.J. Gertsch, 1 ♀ (AMNH). *Municipio de El Grullo:* Puerta de Barro, 2 km N of El Grullo, 19°51.509'N 104°13.420'W, 1059 m, 9.vii.2005, O. Francke, J. Ponce, M. Córdova, A. Jaimes, G. Francke, and V. Capovilla, 3 ♂, 3 ♀, 1 subad. ♀ (AMNH), 2 ♂, 3 ♀ (CNAN SC2930), 1 ♂ (AMCC [LP 5323]), 1 juv. (AMCC [LP 5328]). *Municipio de El Limón:* 7.5 km from El Grullo, 19°49'24"N 104°09'18"W, 840 m, 7.ii.1997, F. Álvarez and J.L. Castelo, 1 subad. ♀ (CNAN SC2444), 31.iii.1997, F. Álvarez and J.L. Castelo, 2 subad. ♀ (CNAN SC2445); El Limón, 19°49'26"N 104°09'22"W, 3.iii.1997, F. Álvarez and J.L. Castelo, 1 ♂, 1 ♀, 1 subad. ♂, 3 subad. ♀, 7 juv. (CNAN SC2447); Los Yesos [19°49'31.29"N 104°09'18.73"W], 4.xii.1996, F. Álvarez and J.L. Castelo, 1 ♀, 3 juv. (CNAN SC2659); San Buenaventura, 19°45.617'N 104°03.317'W, 840 m, 1.xii.1996, F. Álvarez and J.L. Castelo, 1 ♂ (CNAN SC2647), 6.xii.1996, F. Álvarez and J.L. Castelo, 2 juv. (CNAN SC2645); San Buenaventura, 6.6 km SW, 19°45.006'N 104°03.555'W, 840 m, 2.ix.2001, F. Álvarez and J.L. Castelo, 2 ♂, 2 ♀, 1 subad. ♀ (CNAN SC2934). *Municipio de Guadalajara:* Guadalajara, 10 km NW, 20°40'35"N 103°20'46"W, 1550

m, 24.ix.1973, A. Flores and P. Reandes, 1 ♀ (CNAN SC2631). **Michoacán:** *Municipio de Alvaro Obregón:* Alvaro Obregón, 19°02.310'N 102°58.405'W, 462 m, 11.vii.2005, O. Francke, J. Ponce, M. Córdova, A. Jaimes, G. Francke, and V. Capovilla, 4 juv. (AMCC [LP 5325]). *Municipio de Cojumatlán de Régules:* Cojumatlán, 8 km E [20°07.034'N 102°50.7813'W], 2.viii.1954, W.J. Gertsch, 1 ♂ (AMNH). *Municipio de Jiquilpán:* Jiquilpán [19°59'38.52"N 102°43'16.94"W], I. García, 5 ♂, 2 ♀, 2 juv. (CNAN SC2929).

Thorellius intrepidus (Thorell, 1876)

Figures 1C, 4, 6A, 7C, 8D, 9D, 10D, 11D, 13A, B, 15I, J, 25–27; tables 4, 8

Vejovis intrepidus Thorell, 1876a: 10; 1876b: 183; Bücherl, 1971: 329.

Vaejovis mexicanus: Kraepelin, 1894: 199; 1899: 185 (part).

Vaejovis intrepidus: Pocock, 1902: 13; Due and Polis, 1986: 464; Kovařík, 1998: 147; Beutelspacher, 2000: 89, 139, 140, 142, 143, 153, map 68; Sissom, 2000: 537; Ponce-Saavedra and Sissom, 2004: 539, 541; Soleglad and Fet, 2005: 5; Ross, 2009: 530, table 1; Quintero-Hernández, et al., 2015: 1, 3–7, 9–12, fig. 1–3.

Vejovis intrepidus intrepidus: Hoffmann, 1931: 374–378, figs. 30–32; Williams and Hadley, 1967: 112.

Vaejovis intrepidus intrepidus: Díaz-Nájera, 1975: 7, 21, 33; Ponce-Saavedra and Beutelspacher, 2001: 46, 48, 49, 100, map 19; Sissom, 2000: 538; González-Santillán, 2004: 25, 26, table 2; Kamenz and Prendini, 2008: 6, table 1; McWest, 2009: 20, 68, 119, figs. 197–203, tables 1, 53, 66; Ponce-Saavedra and Francke, 2011: 466, table 1.

Vaejovis increpidus increpidus: Williams, 1986: 355, 358 (lapsus).

Thorellius intrepidus: Soleglad and Fet, 2008: 5, 23, 26, 33, 50, 51, 53, 56–58, 67, 73, 77, 94, 95, figs. 12, 23, 49, 144, 157, tables 3, 4, 9;

González-Santillán and Prendini, 2013: 24, 32, 42, 44, 53, 55, figs. 17C, D, 20B, 21B; Ponce-Saavedra and Francke, 2013: 77, table 2; Quijano-Ravel and Ponce Saavedra, 2014: 18, 20, table 2; Loria and Prendini, 2014: 15, 16, fig. 5K; Santibáñez-López et al., 2015: 10, 11, table 2; Dupré, 2017: 14.

TYPE MATERIAL: MEXICO: Holotype ♀ (NRS), Mexico [not examined].

DIAGNOSIS: *Thorellius intrepidus* may be distinguished from other species of *Thorellius* by the larger size of the adults. Although in some populations small males of *T. intrepidus* can measure 60 mm, adult males and females usually measure 75 and 80 mm, respectively, whereas adults of the other species usually measure less than 70 mm in both sexes (tables 3–7). Additionally, the carinae of the pedipalp chela manus are markedly developed and irregularly granular in *T. intrepidus*, but moderately developed, granular to smooth in the other species; the notch and lobes of the pedipalp chela fingers are markedly developed in *T. intrepidus*, but moderately to weakly developed in the other species; and the chela movable finger bears a pair of prolateral denticles at the seventh position in *T. intrepidus*, but a single denticle in the other species. Metasomal segments I and II are relatively elongated in *T. intrepidus*, but robust and slightly wider than long in *T. cristimanus* and *T. yuyuawi* (tables 3, 4, 7). The terminal spinelike processes of the hemispermatophore dorsal and ventral trough margins are fused into a prominent, nonbifurcate hook in *T. intrepidus*, instead of a bifurcate hook as in *T. cristimanus* and *T. yuyuawi* (figs. 13H, 14A, B, G, J). *Thorellius intrepidus* is reddish yellow in color with faint infuscation on the carapace and tergites, whereas *T. tekuanii* is yellow and immaculate. The ventral submedian carinae of metasomal segments I and II are smooth in *T. intrepidus* but finely granular in *T. tekuanii*. The ventral retrolateral, ventral retrosubmedian, ventral median, and ventral prosubmedian carinae of the pedipalp chela manus are smooth to moderately granular in *T. intrepidus* but densely and

TABLE 6

Measurements (mm) of adult *Thorellius wixarika*, sp. nov.

Specimens deposited in American Museum of Natural History (AMNH), New York, and Colección Nacional de Arácnidos (CNAN), Instituto de Biología, Universidad Nacional Autónoma de México.

Collection		CNAN	AMNH						
Number		1251							
Type		Holo.	Para.						
Sex		♂	♂	♂	♂	♀	♀	♀	♀
Carapace	length	6.6	6.4	7.0	7.2	9.1	7.4	8.7	7.7
	ant. width	3.4	3.5	3.9	3.7	5.1	4.4	5.0	4.2
	post. width	5.9	6.0	6.7	6.6	8.9	7.6	8.5	7.3
Femur	length	5.7	5.4	6.0	6.0	7.8	6.4	6.7	6.4
	width	1.9	1.9	2.2	2.0	2.7	2.1	2.5	2.4
Patella	length	6.4	6.0	6.6	6.5	8.1	7.4	7.6	7.0
	width	2.2	2.1	2.6	2.4	3.0	2.7	3.2	2.6
Chela	length	9.7	9.5	9.9	9.4	13.2	16.5	11.8	10.5
Manus	width	2.7	2.6	3.6	3.2	3.9	3.1	3.9	3.3
Manus	height	2.8	2.8	3.5	3.5	4.2	3.3	4.1	3.6
Manus	length	5.3	5.4	5.5	5.4	7.2	9.0	6.5	5.7
Fixed finger	length	4.4	4.2	4.4	4.0	6.0	7.5	5.3	4.8
Mov. finger	length	5.9	6.0	6.2	6.0	8.2	10.0	7.5	6.6
Coxa II	length	2.7	2.7	3.1	3.2	3.7	3.2	3.7	3.0
Coxa IV	length	5.7	5.0	6.0	6.0	7.9	6.6	7.5	6.4
Sternum	length	1.2	1.3	1.3	1.3	1.7	1.6	1.7	1.5
	width	1.5	1.5	1.5	1.5	2.0	1.9	1.8	1.5
Mesosoma	length	14.1	12.7	15.5	16.1	14.9	18.8	19.7	16.9
Metasoma	length	23.3	24.6	26.8	26.6	32.3	27.0	30.9	26.7
Segment I	length	3.4	3.0	3.4	3.4	4.2	3.3	3.9	3.4
	width	3.7	3.5	4.0	3.9	5.1	4.4	5.1	4.4
	height	3.0	2.8	3.2	3.4	4.0	3.0	3.8	3.5
Segment II	length	4.0	3.8	4.2	4.2	5.0	4.0	4.7	4.2
	width	3.6	3.6	4.0	3.8	5.0	4.3	4.8	4.4
	height	3.0	2.7	3.2	3.4	3.7	3.5	3.8	3.5
Segment III	length	4.5	4.2	4.5	4.5	5.5	4.5	5.1	4.6
	width	3.6	3.6	3.9	3.8	4.8	4.2	4.7	4.4
	height	3.0	2.8	3.4	3.4	4.0	3.6	3.9	3.6
Segment IV	length	6.0	5.7	6.2	6.2	7.5	6.2	7.2	6.2
	width	3.4	3.4	3.8	3.8	4.7	4.0	4.6	4.1
	height	3.0	2.9	3.4	3.4	4.0	3.6	4.0	3.7
Segment V	length	8.0	7.8	8.5	8.4	10.1	9.0	10.0	8.5
	width	3.2	3.2	3.6	3.6	4.4	3.9	4.4	3.9
	height	2.8	2.8	3.2	3.4	4.0	3.4	3.5	3.5
Telson	length	7.3	7.1	7.5	7.6	9.8	8.3	10.1	7.6
Vesicle	length	4.8	4.6	4.8	4.9	6.5	5.4	7.0	4.8
	width	2.7	2.7	2.9	2.9	3.0	3.3	4.0	3.4
	height	2.3	2.1	2.4	2.6	3.4	2.7	3.5	2.8
Aculeus	length	2.6	2.5	2.7	2.8	3.3	3.0	3.1	2.8
Total	length	51.3	50.8	56.8	57.5	66.1	61.6	69.4	58.9

TABLE 7

Measurements (mm) of adult *Thorellius yuyuawi*, sp. nov.

Specimens deposited in American Museum of Natural History (AMNH) and Colección Nacional de Arácnidos (CNAN), Instituto de Biología, Universidad Nacional Autónoma de México.

Collection		CNAN					AMNH	CNAN		AMNH
Number		1252	1253					1253		
Type		Holo.	Para.							
Sex		♂	♂	♂	♂	♂	♂	♀	♀	♀
Carapace	length	6.4	6.0	6.0	6.4	6.0	6.0	5.5	7.3	7.3
	ant. width	3.5	3.4	3.4	3.5	3.4	3.6	3.4	4.2	4.2
	post. width	6.2	5.5	5.5	6.2	5.9	6.4	5.6	7.4	7.1
Femur	length	5.4	5.0	5.2	5.4	5.3	5.3	4.7	5.9	6.0
	width	2.0	1.9	1.5	1.9	1.9	1.9	1.7	2.0	2.1
Patella	length	6.0	5.5	5.4	5.9	5.4	5.4	5.3	6.3	6.6
	width	2.1	2.0	2.0	2.1	2.1	2.1	1.9	2.4	2.2
Chela	length	9.2	8.8	8.1	8.6	8.9	8.6	7.4	9.0	10.0
Manus	width	2.8	2.5	2.6	2.8	3.0	2.7	1.7	2.5	2.8
Manus	height	3.4	2.6	2.7	3.1	2.8	3.0	1.9	2.9	3.0
Manus	length	5.2	4.8	4.6	5.0	4.8	4.6	4.0	4.5	5.4
Fixed finger	length	4.0	4.0	3.5	3.6	4.1	4.0	3.4	4.5	4.6
Mov. finger	length	5.7	5.2	5.4	5.3	5.7	5.4	4.6	6.0	6.2
Coxa II	length	2.8	2.4	2.6	2.8	2.6	2.6	2.4	3.0	3.1
Coxa IV	length	5.6	4.9	5.1	5.5	5.0	5.4	4.7	6.1	6.4
Sternum	length	1.1	0.9	0.9	1.1	0.9	0.9	1.1	1.4	1.1
	width	1.5	1.3	1.3	1.5	1.4	1.3	1.3	1.7	1.5
Mesosoma	length	14.3	12.3	11.3	13.9	13.6	14.4	13.5	15.2	17.2
Metasoma	length	22.2	22.5	23.2	24.2	23.7	24.1	19.3	24.7	25.4
Segment I	length	3.4	3.0	3.0	3.2	3.0	3.1	2.6	3.2	3.3
	width	4.0	3.4	3.5	3.9	3.8	3.8	3.4	4.0	4.3
	height	3.4	2.9	2.0	2.7	2.8	2.9	2.7	3.5	3.2
Segment II	length	3.9	3.6	3.7	3.8	3.8	3.8	3.0	3.9	4.0
	width	4.0	3.4	3.6	3.8	3.7	3.8	3.2	4.3	4.2
	height	3.4	2.6	2.0	3.0	2.8	2.7	2.6	3.5	3.1
Segment III	length	4.4	4.0	4.0	4.2	4.1	4.2	3.4	4.2	4.4
	width	3.8	3.3	3.5	3.7	3.6	3.6	3.2	4.2	4.1
	height	3.3	2.6	1.9	3.0	2.9	3.0	2.6	3.6	3.4
Segment IV	length	5.5	5.0	5.3	5.6	5.4	5.4	4.3	5.6	5.8
	width	3.8	3.2	3.4	3.6	3.6	3.6	3.0	3.8	4.0
	height	3.2	2.7	2.1	3.0	3.0	3.2	2.6	3.7	3.2
Segment V	length	7.7	7.0	7.3	7.5	7.5	7.6	6.0	7.8	8.0
	width	3.6	3.0	3.2	3.4	3.4	3.3	2.7	3.5	3.7
	height	3.1	2.6	1.9	2.8	2.8	2.9	2.3	3.1	3.2
Telson	length	7.2	6.3	6.4	7.1	6.6	7.0	3.4	7.4	8.0
Vesicle	length	4.8	4.1	4.4	4.7	4.3	4.5	3.4	4.9	5.1
	width	2.8	2.3	2.2	2.6	2.4	2.6	2.1	2.9	3.0
	height	2.5	1.9	1.9	2.1	1.9	1.9	1.9	2.4	2.4
Aculeus	length	2.4	2.2	2.1	2.4	2.3	2.6	2.7	2.5	3.0
Total	length	50.1	47.1	46.9	51.6	49.9	51.6	41.7	54.6	57.9

irregularly granular in *T. wixarika*. The retrolateral dorsosubmedian and retrolateral median carinae of the pedipalp patella are vestigial and weakly granular in *T. intrepidus* but partial and densely granular in *T. wixarika*. The carapace interocular surface is shagreened in *T. intrepidus* but relatively smooth in *T. yuyuawi*. The ventral lateral and ventral submedian carinae of metasomal segments II–IV are finely granular in *T. intrepidus* but smooth in *T. yuyuawi*. The dorsal lateral and ventral lateral carinae of metasomal segment V each bear three and four macrosetae, respectively, in *T. intrepidus* but 14 and 23 macrosetae, respectively, in *T. yuyuawi*.

DESCRIPTION: The following redescription supplements the original description and Hoffmann's (1931) redescription and is based on freshly collected material listed below.

Color and infuscation: Carapace, pedipalps, legs, tergites, sternites, metasoma, and telson base color yellowish to reddish brown, immaculate except as follows. Chelicerae, coxosternal region, and pedipalp chela fingers darker, reddish. Carapace, tergites, and legs moderately infusate. Pedipalp carinae reddish, darker than intercarinal surfaces. Genital operculum and pectines pale whitish to yellowish. Metasomal segments ventral lateral and ventral submedian carinae faintly infusate. Telson aculeus reddish to brownish.

Chelicerae: Manus dorsal surface smooth, with broad, finely granular carinae subdistally and one macroseta medially. Fixed and movable fingers smooth; movable finger, ventral surface with serrula, comprising 22/24 tines, in distal half.

Carapace: Length 1.08/1.05× greater than posterior width (table 4). Anterior margin emarginate, with moderate to shallow median notch, with three pairs of major macrosetae (fig. 6A). Three pairs of lateral ocelli, anterolateral and median lateral pairs equal in size, posterolateral pair approximately half the size. Median ocular tubercle slightly raised, situated in anterior half of carapace, superciliary carinae smooth to weakly granular, higher than median ocelli. Median ocelli approximately twice the size of anterolateral ocelli. Anteromedian and postero-

median sulci deep, posterolateral and posterior transverse sulci shallow. Surfaces shagreened, covered with fine and coarse, rounded granules.

Coxosternal region: Sternum subequilateral pentagonal (fig. 7C), 0.85/0.91× longer than wide (table 4); median sulcus deep; surfaces matte, with four pairs of setae, two pairs anteriorly, one pair medially, and one pair posteriorly on lobes. Coxae surfaces matte, smooth in places; coxa II subproximal margin with three oblique slitlike structures, adjacent to finely granular protuberance; coxal endite II proximal margin with moderate depression, medial margin finely granular, becoming smooth distally. Coxa IV 1.83/1.88× longer than coxa II (table 4).

Pedipalps: Femur, intercarinal surfaces matte or smooth with scattered granules (fig. 26A); dorsal prolateral, dorsal retrolateral, and ventral prolateral carinae complete, granular to costate-granular; retrolateral dorsosubmedian carina complete, serrate, with spiniform tubercle proximally and row of five major macrosetae; prolateral ventrosubmedian carinae complete, comprising proximal tubercle, row of enlarged spiniform granules, and two macrosetae medially; prolateral ventral carina vestigial, reduced to two proximal tubercles, each with macroseta, and two or three additional tubercles medially; retrolateral ventral, ventral median, and ventral retrosubmedian carinae vestigial, each reduced to few serrate granules. Patella width equal to femur width (table 4); retrolateral intercarinal surface smooth, other intercarinal surfaces matte (fig. 26B–E); dorsal prolateral, dorsal retrolateral, ventral prolateral, and ventral retrosubmedian carinae complete, granular; ventral median carina vestigial, reduced to row of minute granules proximally; retrolateral dorsosubmedian and retrolateral median carinae obsolete, costate; prolateral process well developed; prolateral median carina partial, reduced to proximal and distal tubercles, each with major macroseta, and four to six serrate granules decreasing in size distally; prolateral ventral carina vestigial, reduced to proximal and distal macrosetae. Chela 1.63/1.64× longer than patella, 1.71× longer than

femur (table 4). Manus markedly incrassate, $1.65/1.62\times$ wider than patella, $1.79/1.76\times$ wider than femur (table 4); intercarinal surfaces predominantly smooth (fig. 28); dorsal prolateral, dorsal median, dorsal retrolateral, prolateral ventrosubmedian, prolateral median, ventral prosubmedian, and ventral median carinae complete, costate-granular; dorsal retrosubmedian accessory carina vestigial, granular; dorsal prosubmedian and prolateral dorsal carinae vestigial, crenulate, flanking dorsal prolateral carina; retrolateral median carina partial, restricted to median third, finely granular; retrolateral subventral accessory and retrolateral subventral carinae vestigial, each reduced to short granular row distally; retrolateral ventral carina vestigial, reduced to proximal tubercle; ventral retrolateral and ventral retrosubmedian carinae partial, granular (fig. 27C, B); ventral prolateral and prolateral ventral carinae vestigial, each reduced to short row of granules proximally. Fixed and movable fingers, dentate margins emarginate, with well-developed proximal notch and median lobe (fig. 27B, D), fitting together unevenly such that distinct proximal gap evident when closed; fixed finger median denticle row comprising five denticle subrows flanked by six prolateral and five retrolateral subserrate denticles, retrolateral denticles comparatively smaller than prolateral denticles, proximal prolateral denticle situated in median median third of finger; movable finger median row comprising six denticle subrows, flanked by eight prolateral and six retrolateral denticles, subpaired, proximal two prolateral denticles adjacent, terminal subrow comprising single denticle. Trichobothrial pattern type C, orthobothriotaxic; chela trichobothria *Db* and *Dt* situated dorsal to dorsal retrolateral carina, *Dt* at midpoint of manus; *db-dt* and *eb-et* distributed along entire length of fixed finger with *db* situated proximal and *eb* subproximal; *ib* and *it* situated at midpoint of fixed finger (fig. 27D), *ib* aligned with sixth prolateral denticle, *it* situated between sixth and seventh prolateral denticles.

Legs: Basitarsi retrolateral dorsal, prolateral ventral, and retrolateral ventral spinule rows

complete on I–III; retrolateral dorsal spinule row partial, restricted to distal two-thirds of IV; prolateral ventral and retrolateral ventral spinule rows absent on VI; retrolateral median row vestigial, reduced to few distal spinules on I–IV; macrosetal counts on legs I–IV, respectively: dorsal, 3:4:4:4; retrolateral dorsal, 2:3:4:2; prolateral ventral, 5:5:5:5, distal three spinules on II and distal four on IV slightly stouter; retrolateral ventral, 4:8:9:9; dorsal and retrolateral dorsal macrosetae arranged into two separate rows on I–IV. Telotarsi I–IV, each with single ventromedian row of spinules, curved proximally, and two or three pairs of ventrodistal spinules (fig. 11D).

Genital operculum: Width greater than length (fig. 7C), with three pairs of macrosetae. Sclerites separated, but unable to open more than 45° (δ) or fused longitudinally (φ). Genital papillae present, protruding posteriorly (δ) or absent (φ).

Hemispermaphore: Lamina $1.89\times$ longer than trunk (table 8). Median lobe, ental terminus prominent, rounded (fig. 13A, B). Dorsal trough margin long, narrow, curving proximally, well separated from ventral trough. Dorsal and ventral trough margins, terminal spinelike processes fused into prominent hook, not bifurcate but with shallow notch, situated distally on lamina dorsal margin (fig. 13B). Basal plate of inner lobe adjacent to ventral trough; spine of inner lobe long and markedly sclerotized. Hemimating plug developed from inner lobe; distal barb $0.67\times$ longer than basal plate (table 8); distal barb margin with 15 elongated spinules; secondary spine on ventromedian side of distal barb prominent, short and rounded (fig. 15 I, J).

Pectines: Basal piece with four pairs of major macrosetae. Marginal lamella comprising three sclerites. Medial lamella proximal sclerites fused, 14–16 distal sclerites separate (fig. 7C). Fulcra, 22–24 (δ), 19–21 (φ). Pectinal teeth, 23–25 (δ), 20–22 (φ). Pectines relatively long, midpoint (δ) or distal margin (φ) of medial sclerite of marginal lamella aligned with distal margin of coxa VI.

Tergites: Pretergites I–VII, surfaces matte. Posttergites I–VI, intercarinal surfaces

shagreened, sparsely covered with fine and coarse granules, dorsal median and dorsal lateral carinae partial, restricted to posterior half, granular to costate-granular; VII, intercarinal surfaces smooth; dorsal median carina partial, restricted to anterior third, costate-granular, dorsal submedian carinae vestigial, each reduced to anterior tubercle; dorsal lateral and lateral median carinae granular, converging anteromedially, posterior granules larger, spiniform.

Sternites: Sternites III–VI, surfaces acarinate, finely punctate; spiracles elongate, slitlike, approximately 4× longer than wide; V, postero-median hyaline glandular area obsolete (♂) or absent (♀); VII, posteromedian hyaline glandular area absent, ventral submedian carinae obsolete, each with two pairs of macrosetae; ventral lateral carinae vestigial, weakly granular.

Metasoma: Metasoma 1.74/1.46× longer than mesosoma (table 4). Segments I–V, respectively 1.08/1.16, 0.90/0.95, 0.80/0.85, 0.58/0.62, 0.43/0.45× wider than long; V, 1.35× wider than telson vesicle. Segments I–V, all intercarinal surfaces predominantly smooth (figs. 9D, 10D); dorsal lateral carinae serrate, terminating in conical spiniform granules posteriorly on I–IV, serrate in anterior third, granular medially and posteriorly on V; lateral median carinae serrate, terminating in conical spiniform granules posteriorly on I–III, lobate, forming rounded triangular projection, posteriorly on IV, partial, serrate in anterior two-thirds, becoming granular posteriorly on V; lateral inframedian carinae complete, serrate on I, partial, serrate in posterior third on II, partial, granular in posterior quarter on III, absent on IV; ventral lateral carinae costate to costate-granular on I–III, serrate on IV and V; ventral submedian carinae costate on I–III, costate in anterior two-thirds, granular in posterior third on IV and V; ventral median carina finely serrate on V. Macrosetal counts on carinae of segments I–V, respectively: dorsal lateral carinae, 0:0:1:1:3; lateral median carinae, 0:1:1:2:2; lateral inframedian carinae, 1:0:0:0:0;

ventral lateral carinae, 2:2:2:2:4; ventral sublateral carinae, 0:0:0:0:2; ventral submedian carinae, 2:2:2:2:1.

Telson: Vesicle relatively globose (fig. 10D); length 1.64/1.62× greater than aculeus (table 4). Dorsal and ventral surfaces smooth; ventral carinae each with two or three macrosetae. Subaculear tubercle obsolete. Aculeus, laterobasal microsemination comprising 5–8 spinules.

DISTRIBUTION: *Thorellius intrepidus* is endemic to central-western Mexico and distributed from the interior to the Pacific coast (fig. 4). It has been recorded in the states of Aguascalientes, Colima, Guanajuato, Jalisco, Michoacán, and Nayarit, and probably also occurs in Sinaloa. The type locality of *T. intrepidus* was indefinitely located in Mexico (Thorell, 1876). The distribution of *T. intrepidus* remained ambiguous until Hoffmann (1931) identified specimens from Tecomán, Colima, and Jalapa, Veracruz, suggesting that the nominotypical form of *T. intrepidus* extended south to the coasts of Guerrero and Michoacán. Hoffmann (1931: 374) did not examine Thorell's (1876) types but relied on Pocock's (1902) redescription to identify the specimens, stating: "los ejemplares veracruzanos no difieren esencialmente de la forma de la costa del Pacífico" [the Veracruz exemplars do not differ essentially from the Pacific coast form]. However, Hoffmann (1931) did not establish whether the nominotypical form of *T. intrepidus* was distributed continuously across central Mexico, from Colima to Veracruz. Sissom (2000) later suggested that the distribution is disjunct and restricted the nominotypical form of *T. intrepidus* to Jalapa and Colima City. Although others accepted that assertion (Lourenço and Sissom, 2000; González-Santillán, 2004), the distribution of *T. intrepidus* remained controversial because the territory between these areas is very dissimilar in topography, vegetation, and climate. Based on multiple, unsuccessful attempts to collect more specimens from Jalapa, and the examination of extensive material from across the distribution, the record of *T. intrepidus* from Veracruz is considered spurious, perhaps the result of mis-

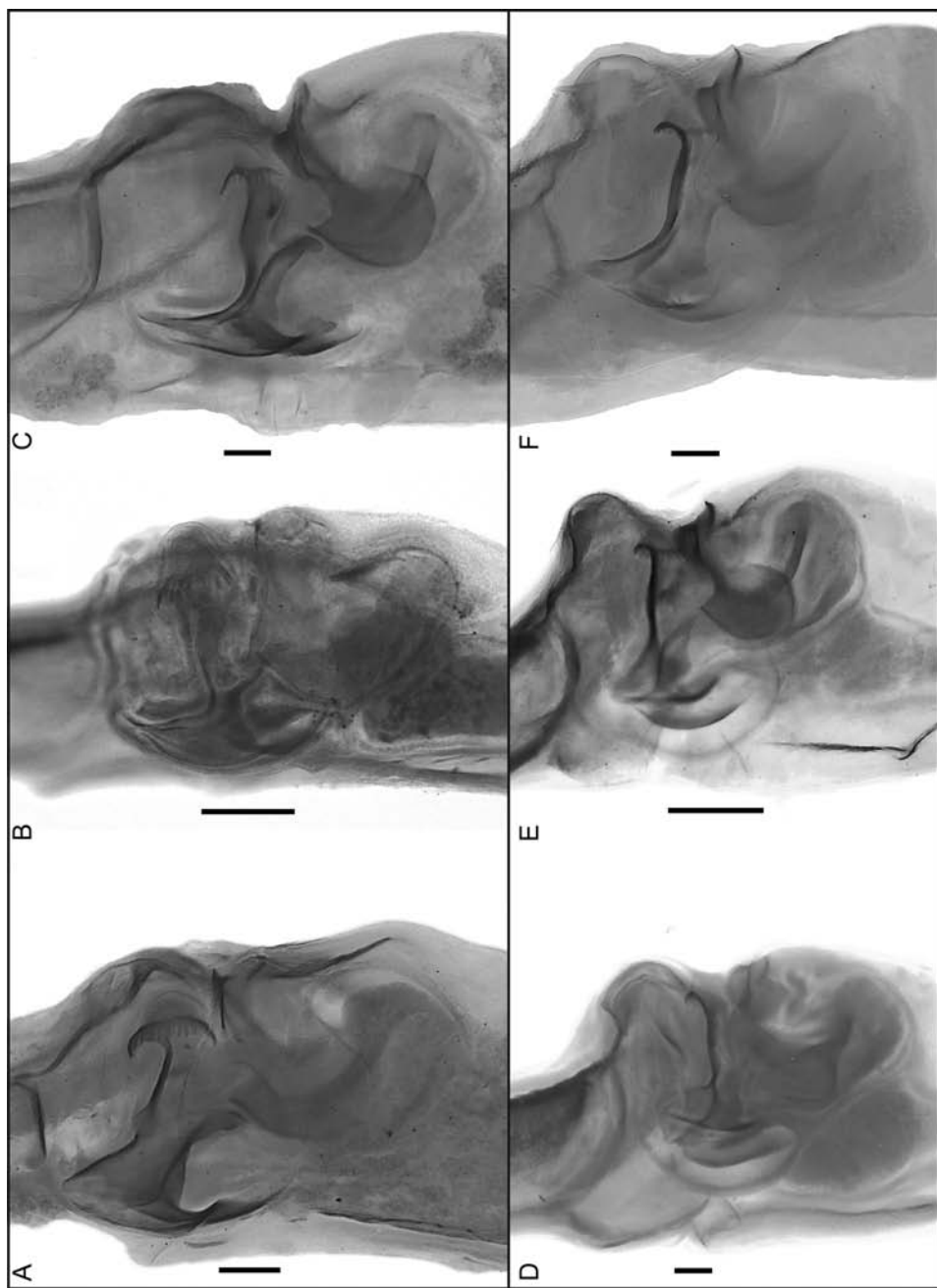


FIGURE 14. *Balsateres* González-Santillán and Prendini, 2013, *Kuarapu* Francke and Ponce-Saavedra, 2010, and *Thorellius* Soleglad and Fet, 2008, dextral hemispermatophores, detail of capsule prior dissection, ventral aspect. **A.** *Balsateres cisnerosi* (Ponce-Saavedra and Sissom, 2004), ♂ (CNAN). **B.** *Kuarapu purhepecha* Francke and Ponce-Saavedra, 2010, paratype ♂ (AMNH). **C.** *Thorellius cristimanus* (Pocock, 1898), ♂ (AMNH). **D.** *Thorellius tekuani*, sp. nov., holotype ♂ (CNAN T01250). **E.** *Thorellius wixarika*, sp. nov., holotype ♂ (CNAN T01251). **F.** *Thorellius yuyuwai*, sp. nov., holotype ♂ (CNAN T01252). Scale bars = 0.2 mm (A–C, E, F), 0.5 mm (D).

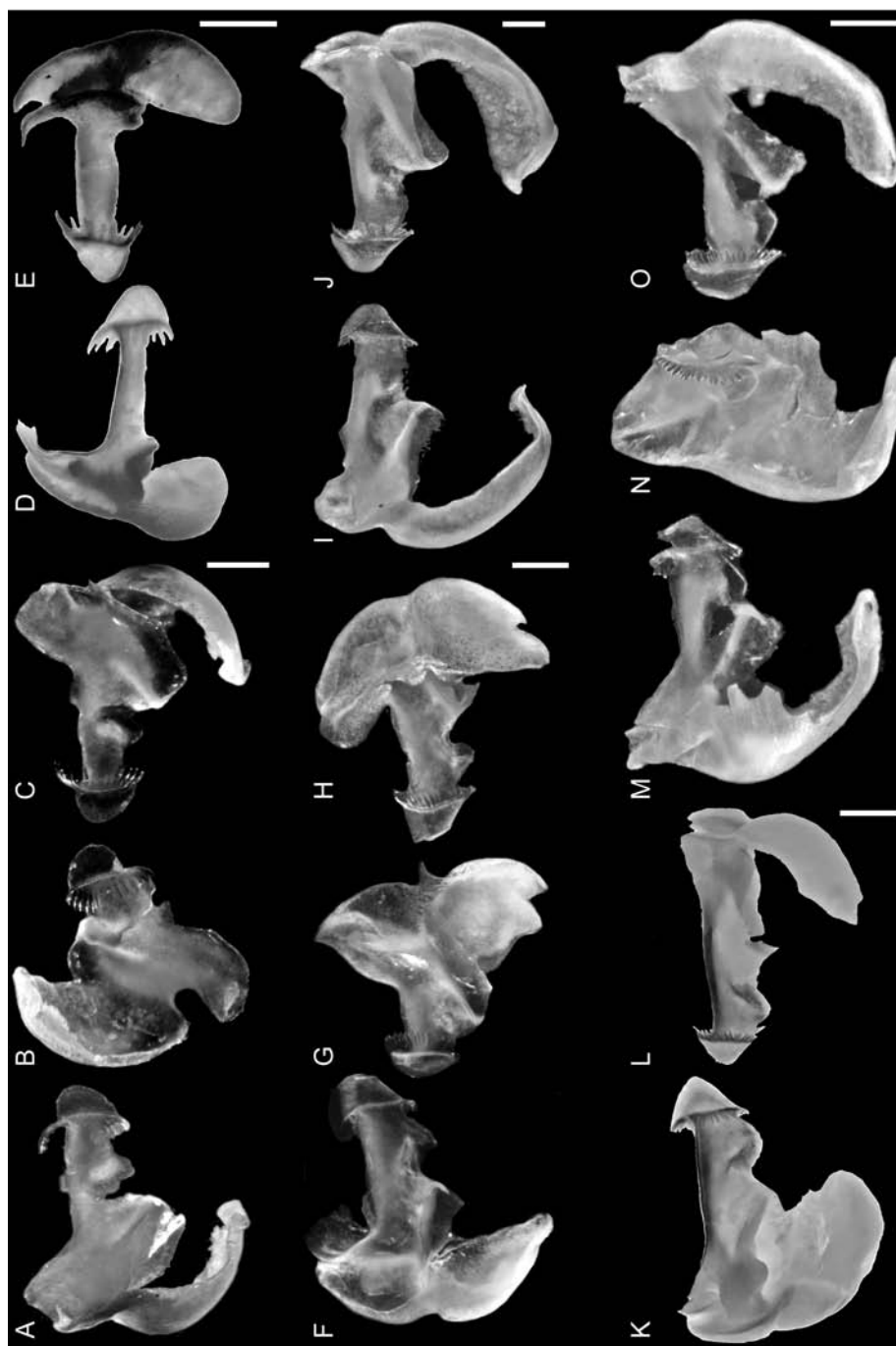


FIGURE 15. *Balsateres* González-Santillán and Prendini, 2013, *Kuarapu* Francke and Ponce-Saavedra, 2010, and *Thorellius* Soleglad and Fet, 2008, dextral hemimating plug, dorsal aspect (A, D, E, I, K, M), ental aspect (B, G, N), ventral aspect (C, E, H, J, L, O). A–C. *Balsateres cisnerosi* (Ponce-Saavedra and Sissom, 2004), ♂ (CNAN SC2441). D, E. *Kuarapu purhepecha* Francke and Ponce-Saavedra, 2010, paratype ♂ (AMNH). F–H. *Thorellius cristimanus* (Pocock, 1898), ♂ (AMNH). I, J. *Thorellius intrepidus* (Thorell, 1876), ♂ (AMNH). K, L. *Thorellius wixarika*, sp. nov., holotype ♂ (CNAN T01251). M–O. *Thorellius yuyuawai*, sp. nov., paratype ♂ (CNAN T01252). Scale bars = 0.2 mm (A–J, M–O), 0.5 mm (K, L).

labeled specimens. On the other hand, the record of *T. intrepidus* on the Pacific coast of Michoacán was corroborated with specimens from CNAN, and the records from Guerrero are probably referable to *T. tekuani*.

ECOLOGY: *Thorellius intrepidus* inhabits tropical dry forest, including deciduous and broadleaf forest, at altitudes ranging from 5 to 1760 m. Numerous specimens have been collected inside houses in Colima City (Hoffmann, 1931), suggesting that this species is synanthropic. *Thorellius intrepidus* has been recorded in sympatry with *Centruroides elegans* (Thorell, 1876), *Centruroides chamela* Ponce-Saavedra and Francke, 2011, *Konetontli chamelaensis* (Williams, 1986), and *Mesomexovis* sp. The habitat and habitus of this species are consistent with the lapidicolous ecomorphotype (Prendini, 2001).

REMARKS: In addition to the nominotypical form of *T. intrepidus*, Hoffmann (1931) recognized two additional “forms” based on morphometrics, development and granulation of the pedipalp chela manus, and the count of trichobothria on the retrolateral surface of the pedipalp patella. Hoffmann’s (1931) diagnostic characters were confirmed in the present investigation, with one exception. Whereas Hoffmann (1931: 347) cited trichobothrial counts of 14, 19, and 20 for *T. intrepidus*, *T. cristimanus*, and *T. atrox*, respectively, the count was constant and conformed to the typical orthobothriotaxic type C pattern for vaejovid scorpions, with 14 trichobothria (figs. 24C, 27C) among all specimens examined for the present investigation. Soleglad and Fet (2008) arrived at the same conclusion. However, the decision of these authors to recognize *T. atrox* as a distinct species is unsupported by the evidence.

ADDITIONAL MATERIAL EXAMINED: MEXICO: Aguascalientes: *Municipio de Calvillo:* Chiquihuetero, 21°52′27″N 102°42′09″W, 1680 m, 29.vi.2007, A. Valle Colis, 1 ♂ (INDRE); El Rodeo, 21°52′09″N 102°44′50″W, 1620 m, 25.vi.2007, A. Valle Colis, 1 ♀ (INDRE); La Labor, 21°57′43″N 102°41′46″W, 1740 m, 15–18.vi.2007, I. Escalante Piña, 1 ♂, 1 ♀ (INDRE);

Media Luna Ranch, 21°47′56″N 102°48′05″W, 1560 m, 9.xi.2008, I. Franchini, 1 ♀ (INDRE); Mesa Grande, 21°48′18″N 102°43′18″W, 1760 m, 24.vi.2003, G. Vargas, 1 ♀ (INDRE), 24.vi.2007, M. Sema, 1 ♂ (INDRE); Tepalcate de Arriba, 21°50.083′N 102°46′W, 24.vi.2007, R.C. Jorge, 1 ♂ (INDRE). **Colima:** *Municipio de Armería:* Armería, 18°56′03″N 103°57′52″W, 40 m, 2.i.2003, H. Rodríguez, 1 ♂, 1 ♀ (CNAN SC2628); Mina La Salada, NW Ixtlahuacán, at mine headquarters, 19°01.680′N 103°47.036′W, 275 m, 2005, mine staff, 11 ♀ (AMNH). *Municipio de Camotlán:* Punta de Agua, 19°09′N 104°16′W, 2.ix.2003, E. González, 1 ♀ (CNAN SC2242). *Municipio de Colima:* Colima [19°14.60′N 103°43.483′W], 30.xii.1927, J.C. Chamberlin, 1 ♂ (AMNH); Colima, 16 km S [19°14′37″N 103°43′51″W], 30.vii.1954, W.J. Gertsch, 1 ♂ (AMNH); Los Ortices, 19°06′46.8″N 103°44′22.6″W, 343 m, 9.iv.2004, P. Berea, 1 ♂ (AMCC [LP 6379]). *Municipio de Comala:* Comala [19°19′N 103°45′W], 9.iv.2004, P. Berea, 1 subad. ♀ (AMCC [LP 6377]). *Municipio de Coquimatlán:* near Coquimatlán [19°18′N 104°06′W], 2008, L.L. Valdez, 1 ♂ (CNAN SC2921). *Municipio de Manzanillo:* Los Parajes, 19°14′07″N 104°24′52″W, 230 m, 3.ii.2008, 1 ♂ (INDRE); Manzanillo [19°03′08″N 104°18′57″W], 5 m, 1 ♀ (INDRE), 17.i.1947, 2 ♂, 4 ♀, 1 subad. ♂ (CNAN SC2634); Manzanillo, 10 km of El Colomo [19°03′08″N 104°18′57″W], 16.iv.2008, P. Berea, 1 ♀ (CNAN SC2619); Manzanillo, Colonia Valle de Las Garzas, 19°03′08″N 104°18′57″W, 5 m, 29.ix.2008, 1 ♀ (INDRE); Manzanillo, Sector 7, 19°03′08″N 104°18′57″W, 5 m, 6.ii.2004, 1 ♂ (INDRE); Nuevo Petatero Ranch [19°03.649′N 104°16.602′W], 4.ii.2008, 1 ♀ (INDRE); Potrero Grande, 19°10′19″N 104°32′27″W, 6 m, 27.xi.2008, 1 ♀ (INDRE); Veladero de Otates, 19°15′38″N 104°20′14″W, 280 m, 4.ii.2008, 1 ♀ (INDRE). *Municipio de Minatitlán:* Junction to Saus, on way to Minatitlán, 19°25.379′N 103°58.999′W, 1006 m, 26.v.2006, O. Francke, A. Valdez, H. Montaña, and A. Ballesteros, 1 ♂ (AMCC [LP 6469]).

Municipio de Tecomán: Tecomán [18°54'30"N 103°52'28"W], 8.v.1961, E. López, 1 subad. ♀ (INDRE), iii.1992, R.G. Orozco, 1 ♂ (INDRE), 30 m, 9.iii.1992, R. Lezama, 3 ♂, 6 ♀ (CNAN SC2629), 17.iii.1992, E. López, around village, 1 ♀, 1 subad. ♂ (CNAN SC2611), 29.xi.1995, M. González, 1 ♀ (CNAN SC2605), 12.i.1996, H. Arredondo, 1 ♀ (CNAN SC2641), 18.ii.1996, H. Arredondo, 1 ♀ (INDRE), 19.vi.1996, H. Arredondo, 1 ♀ (INDRE). *Municipio de Villa de Álvarez*: Villa de Álvarez, 19°16'00"N 103°44'15"W, 530 m, 11.ii.1995, E. Polanco, 1 ♀ (CNAN SC2618). **Guanajuato**: *Municipio de León*: Hacienda de Arriba, NE of León, 2008, L. Olguín, in house, 2 ♀ (CNAN SC2922); León [21°07'N 101°41'W], 2.vi.2006, 1 ♂ (CNAN SC2612). **Jalisco**: *Municipio de Jocotepec*: San Juan Cosola, 1.6 km E [20°17.200'N 103°20.217'W], 10.vii.1959, C.M. Bogert, 1 ♀ (AMNH). *Municipio de La Huerta*: Ejido E. Zapata, 19°22'58"N 104°57'55"W, 10 m, 9.vii.1994, I. Ramirez, 1 ♀ (CNAN SC2606); Estación Biológica Chamela [19°29.875'N 105°02.608'W], 5.iv.1981, M.V. Julia, 1 ♀ (CNAN SC2244), 20 m, 19.v.1985, A. Pescador, 1 subad. ♀ (CNAN SC2607), 26.iv.1993, E. Ramírez, 1 ♂ (CNAN SC2614), 25.iii.1998, S.H. Bullock, 1 ♀ (CNAN SC2920), 14.ix.1999, A.M. Corona and R. Ayala, 1 ♀ (CNAN SC2621), 19.ix.1999, A.M. Corona, 1 ♀ (CNAN SC2622), 12.xi.2002, A. Rodríguez, 1 ♀ (CNAN), 19°29.875'N 105°02.608'W, 1.ix.2011, O. Francke, A. Valdez, H. Montaña, A. Balles-teros, and C. Santibáñez, 3 ♂, 1 ♀ (CNAN SC2245); Estación Biológica Chamela, Cutz-mala, 19°29.875'N 105°02.608'W, 97 m, 30.viii.2007, O. Francke et al., 1 juv. ♀ (AMCC [LP 7670]); Estación Biológica Chamela, El Tejon Trail, 19°29.836'N 105°02.491'W, 18.viii.2005, J.L. Castelo, UV detection at night, 1 juv. (AMCC [LP 5309]). **Michoacán**: *Municipio de Aquila*: Aquila, 18°35'57"N 103°30'15"W, 180 m, 21.ii.1992, R. Mares, 1 ♀ (CNAN SC2636); Arroyo de la Cruz, 5 km NE of Maquili, 18°34'33.5"N 103°35'47.8"W, 24.i.2004, 1 ♂, 2 ♀, 1 subad. ♂, 1 subad. ♀

(CNAN SC2992); El Faro de Bucerías [18°21'N 103°29'W], 13–14.i.2002, E. González, tropical dry forest, 1 ♀ (AMCC [LP 2022]); El Faro de Bucerías, near La Llorona [18°20'40.74"N 103°30'32.04"W], 17.i.2006, G. Suarez, 1 ♀ (CNAN SC2624); Pomaro, 18°20'28"N 103°18'29"W, 380 m, 18.ii.1992, R. Álvarez, 1 ♂ (CNAN SC2608). *Municipio de Coahuayana*: Coahuayana [18°45'N 103°40'W], 24.vi.1991, M.J. Nereida, 1 ♀ (CNAN SC2615). *Municipio de Jiquilpán*: Jiquilpán, 19°59'37"N 102°43'02"W, 1560 m, G. Ignacio, 1 ♂, 1 ♀ (CNAN SC2616); Universidad de Michoacán [19°41.466'N 101°12.163'W], 1 ♂ (CNAN SC2613). *Municipio de Uruapan*: Uruapan, 19°25'10"N 102°03'30"W, 1620 m, J. Julia, 1 ♂ (CNAN SC2610). **Nayarit**: *Municipio de Tepic*: Tepic, Motel La Loma [21°30.500'N 104°53.583'W], C.M. Bogert, 1 ♀ (AMNH).

Thorellius tekuni, sp. nov.

Figures 3, 6B, 7D, 8E, 9E, 10E, 11E, 13F–H, 28–30; tables 5, 8

Thorellius intrepidus intrepidus: Hoffmann, 1931: 374 (Guerrero records only); Beutelspacher, 2000: 92, map 68; Baldazo-Monsivaiz et al. 2016: 75, 77, 78, 79; table 1; fig. 3.

TYPE MATERIAL: MEXICO: Estado de México: *Municipio de Luvianos*: Holotype ♂ (CNAN T01250), Pungarancho, 3 km E, 19°01.775'N 100°28.406'W, 574 m, 1.xi.2002, E. González-Santillán, C. Durán and R. Paredes. Paratypes: Same locality as holotype, 1 ♀, 1 juv ♀ (AMNH). San Juan Acatitlán, 5 km E, 19°01.997'N 100°17.997'W, 925 m, 2.xi.2002, E. González-Santillán, C. Durán and R. Paredes, tropical deciduous forest, river bank, under rocks, 1 ♀ (CNAN T01254 old SC2942). **Guerrero**: *Municipio de Zirándaro de los Chávez*: Cupuán [18°24'31.42"N 101°22'3.29"W], 348 m, 19.vi.2000, Micaela, 1 ♂ (CNAN T01254 old SC2945). **Michoacán**: *Municipio de Parácuaro*: Ejido la Batea [19°07'53.54"N 102°07'48.96"W], 653 m, viii.1998, J. Orozco, 1 ♀ (CNAN T01254 old SC2944).

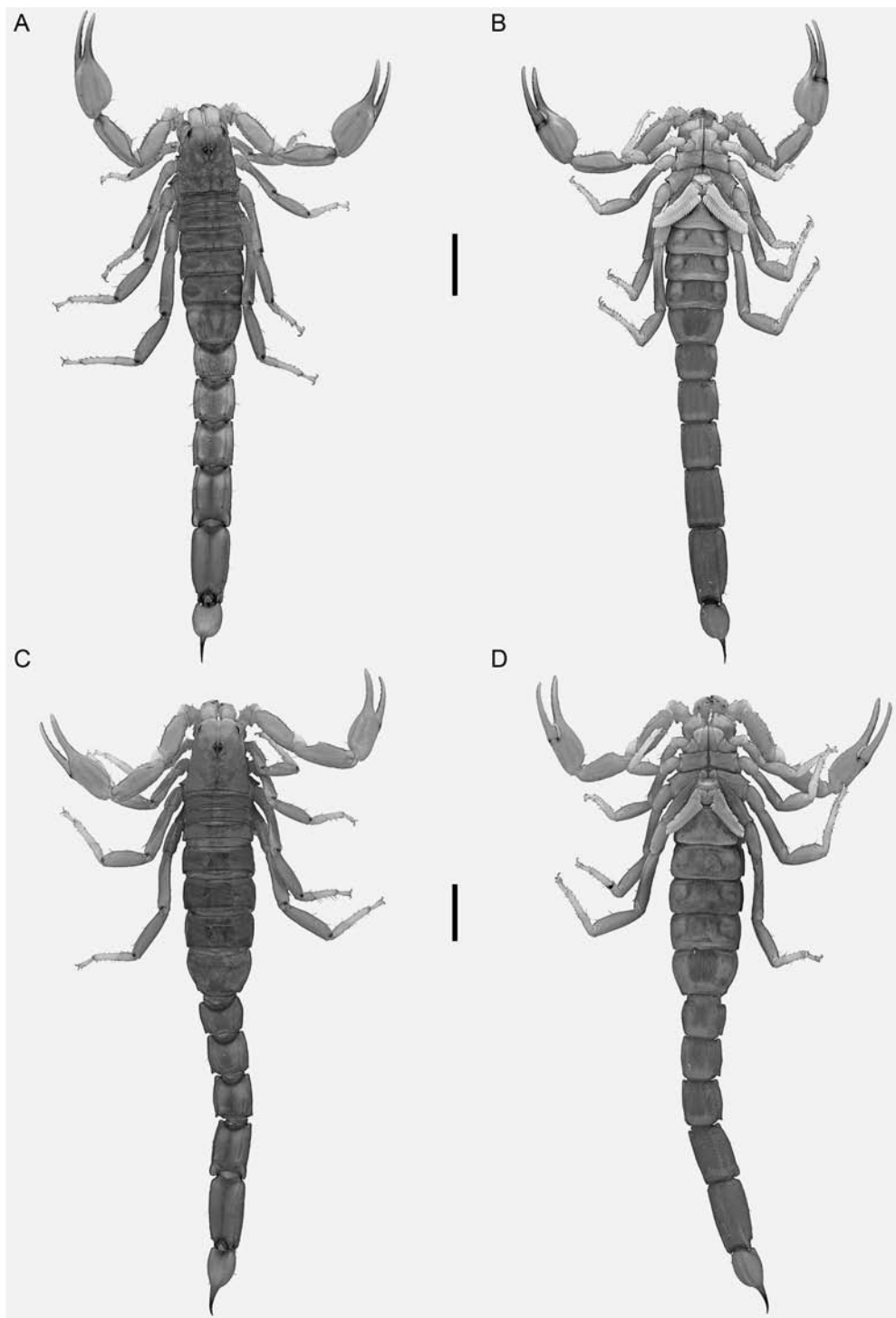
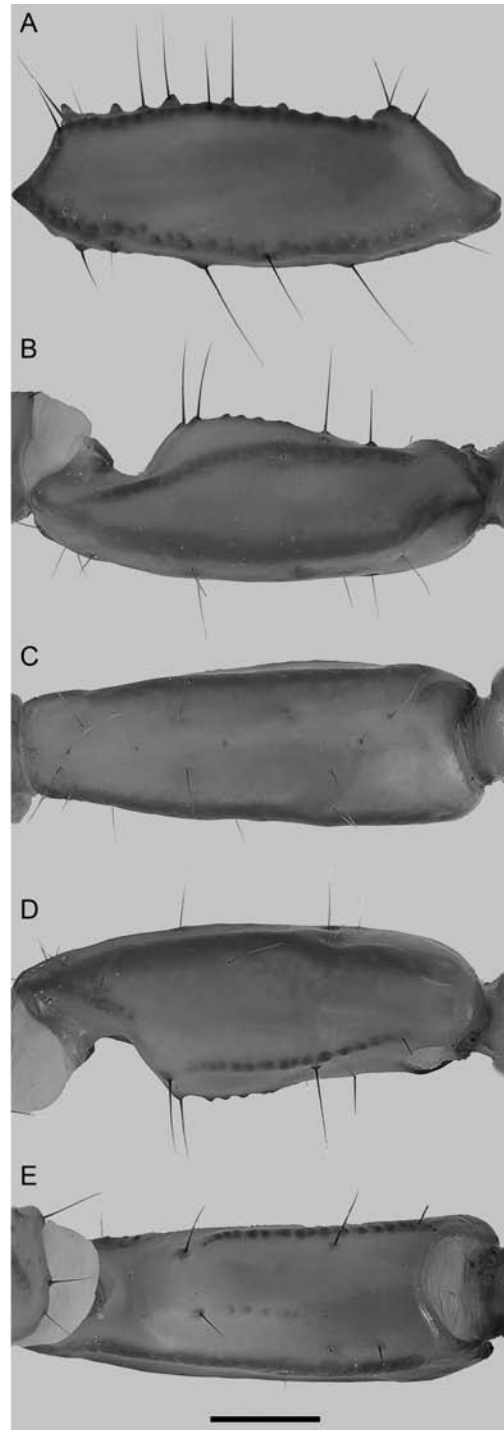


FIGURE 16. *Balsateres cisnerosi* (Ponce-Saavedra and Sissom, 2004), habitus, dorsal (A, C) and ventral (B, D) aspects. A, B. ♂ (CNAN SC2441). C, D. ♀ (CNAN SC2441). Scale bars = 5 mm.

FIGURE 17. *Balsateres cisnerosi* (Ponce-Saavedra and Sissom, 2004), ♂ (CNAN SC2441), dextral pedipalp femur (A) and patella (B–E). A, B. Dorsal aspect. C. Retrolateral aspect. D. Ventral aspect. E. Prolateral aspect. Scale bars = 1 mm.

ETYMOLOGY: The species name *tekuani* is an adjective for ferocious in the Nahuatl language, and refers to the impressive appearance of this large scorpion.

DIAGNOSIS: *Thorellius tekuani* may be distinguished from other species of *Thorellius* as follows. The color of *T. tekuani* is pale yellowish, rather than reddish to dark brown, as in the other species. The carinae of the pedipalp femur, patella, and chela are immaculate in *T. tekuani* (figs. 29, 30), faintly infusate in *T. cristimanus* and *T. intrepidus*, and densely infusate in *T. wixarika* and *T. yuyuawi*. The ventral submedian carinae of metasomal segments I and II are finely granular in *T. tekuani*, but smooth to partially granular in the other species. The notch and lobes of the pedipalp chela fingers are moderately developed in *T. tekuani*, markedly developed in *T. intrepidus*, and weakly developed in *T. yuyuawi*. Metasomal segments I and II are relatively elongate in *T. tekuani*, but more robust, slightly wider and shorter in *T. cristimanus* and *T. yuyuawi* (tables 3, 5, 7). *Thorellius tekuani* may be distinguished from *T. intrepidus* by the smaller adult size. Adult *T. tekuani* usually measure less than 70 mm whereas adult male and female *T. intrepidus* usually measure 75 and 80 mm, respectively (tables 4, 5). The ventral retrolateral, ventral retrosubmedian, ventral median, and ventral prosubmedian carinae of the pedipalp chela manus are smooth to moderately granular in *T. tekuani*, but markedly developed, broad, and irregularly granular in *T. intrepidus*, and densely and irregularly granular in *T. wixarika*. The retrolateral dorsosubmedian and retrolateral median carinae of the pedipalp patella are vestigial, comprising a few fine, scattered granules in *T. tekuani*, but partially developed and densely granular in *T. wixarika*. The carapace interocular surface is shagreened in *T. tekuani*, but relatively smooth in *T. yuyuawi* (fig. 6B, D). All carinae of



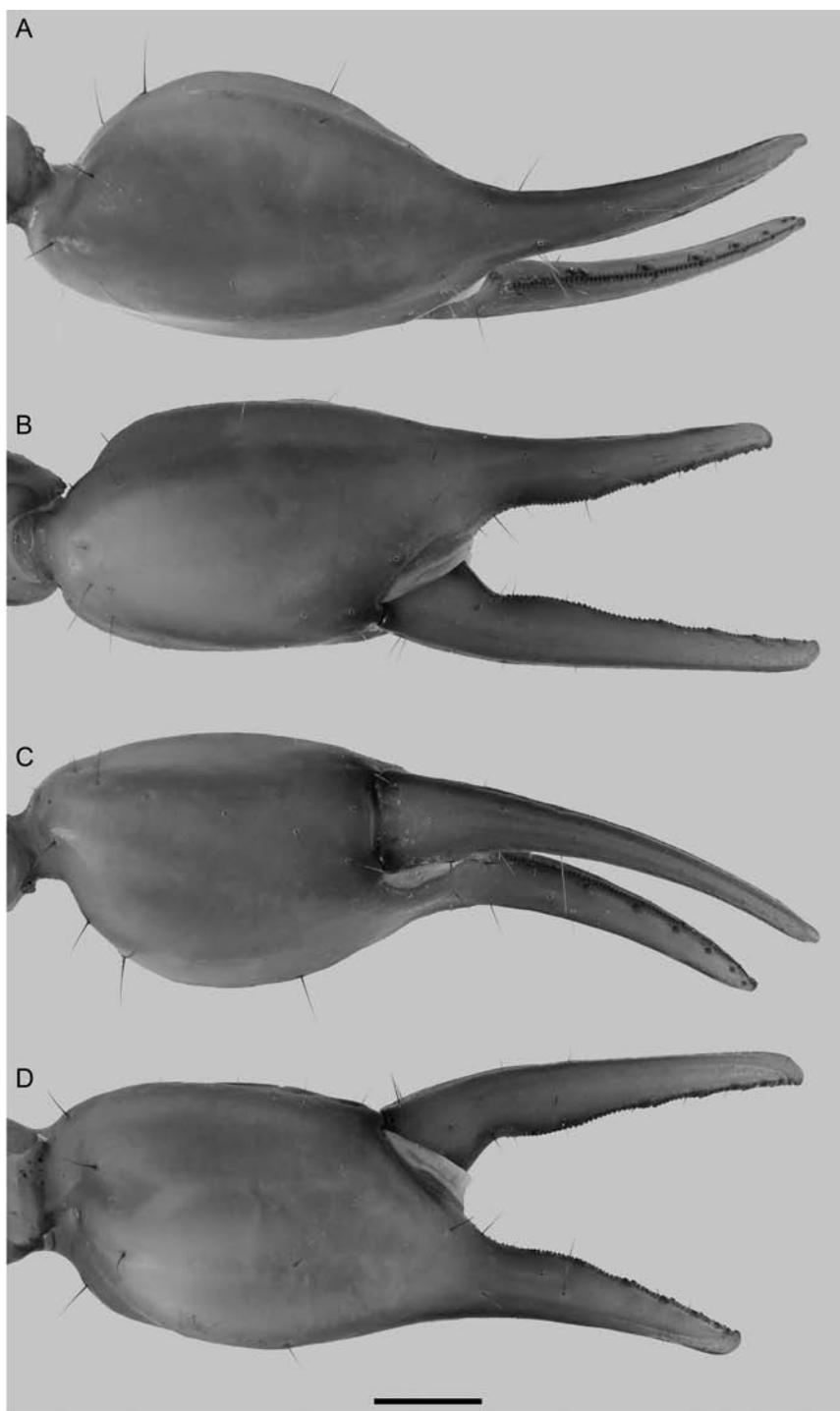


FIGURE 18. *Balsateres cisnerosi* (Ponce-Saavedra and Sissom, 2004), ♂ (CNAN SC2441), dextral pedipalp chela. A. Dorsal aspect. B. Retrolateral aspect. C. Ventral aspect. D. Prolateral aspect. Scale bars = 1 mm.

TABLE 8

Measurements (mm) of hemispermatoophores of *Balsateros cisnerosi* (Ponce-Saavedra and Sissom, 2004), *Kuarapu purhepecha* Francke and Ponce-Saavedra, 2010, and five species of *Thorellius* Sologlad and Fet, 2008
Specimens deposited in American Museum of Natural History (AMNH) and Colección Nacional de Arácnidos (CNAN), Instituto de Biología, Universidad Nacional Autónoma de México.

Species	<i>B. cisnerosi</i>	<i>K. purhepecha</i>	<i>T. cristimanus</i>	<i>T. intrepidus</i>	<i>T. tekuaní</i>	<i>T. wixarika</i>	<i>T. yuyuawí</i>
Collection	CNAN	CNAN	AMNH	CNAN	CNAN	CNAN	CNAN
Lamina length	3.33	2.33	5.10	5.10	4.80	4.80	4.20
Trunk length	2.67	1.32	2.76	2.70	2.70	3.00	2.40
Distal barb length	0.33	0.43	0.36	0.48	0.54	0.48	0.54
Basal plate length	0.76	0.73	0.84	0.72	0.78	0.72	0.72
Dorsal trough-laminar hooks	3.67	0.99	2.28	1.74	2.10	1.98	2.10
Ventral trough-laminar hooks	0.97	0.63	1.44	1.14	1.50	1.26	1.80

the pedipalp chela manus and the ventral lateral and ventral submedian carinae of metasomal segments II–IV are granular to finely serrate in *T. tekuaní*, but smooth in *T. yuyuawí*. The dorsal lateral and ventral lateral carinae of metasomal segment V each bear five and two macrosetae, respectively, in *T. tekuaní*, but 14 and 23, respectively, in *T. yuyuawí*.

DESCRIPTION: The following description is based on the types and additional material examined.

Color and infuscation: Chelicerae, carapace, pedipalps, legs, tergites, sternites, metasoma, and telson base color yellowish to pale orange. Chelicer al fingers darker than manus dorsal surface, reddish. Carapace, tergites, and legs faintly infuscate to immaculate. Coxosternal region slightly darker than carapace and tergites. Pedipalp carinae reddish, darker than intercarinal surfaces; chela fingers reddish, darker than manus intercarinal surfaces. Genital operculum and pectines pale whitish, immaculate. Metasomal segments ventral lateral and ventral submedian carinae reddish, darker than intercarinal surfaces. Telson aculeus reddish to brownish.

Chelicerae: Manus dorsal surface smooth, with broad, finely granular carinae subdistally and one macroseta medially. Fixed and movable fingers smooth; movable finger, ventral surface with serula, comprising 22/24 tines, in distal half.

Carapace: Length 1.11/1.12× greater than posterior width (table 5). Anterior margin emar-

ginate, with a moderate to shallow median notch, with three pairs of major macrosetae (fig. 6B). Three pairs of lateral ocelli, anterolateral and median lateral pairs equal in size, posterolateral pair approximately half the size. Median ocular tubercle slightly raised, situated in anterior half of carapace, superciliary carinae granular, higher than median ocelli. Median ocelli approximately twice the size of anterolateral ocelli. Anteromedian, posteromedian, and posterolateral sulci deep and narrow, posterior transverse sulci obsolete. Surface shagreened, covered with fine and coarse, rounded granules.

Coxosternal region: Sternum subequilateral pentagonal (fig. 7D); 0.83/0.88× longer than wide (table 5); median sulcus deep; surfaces matte, with three pairs of macrosetae, anteriorly, medially, and posteriorly on lobes. Coxae surfaces matte, smooth in places; coxa II subproximal margin with three oblique slitlike structures, adjacent to finely granular protuberance; coxal endite II proximal margin with moderate depression, medial margin finely granular, becoming smooth distally. Coxa IV 2.01/2.09× longer than coxa II (table 5).

Pedipalps: Femur dorsal and ventral intercarinal surfaces sparsely granular, other intercarinal surfaces matte (fig. 29A); dorsal prolateral, dorsal retrolateral, and ventral prolateral carinae complete, granular to costate-granular; retrolateral dorsosubmedian carinae complete, serrate, enlarged subproximal, median and distal gran-

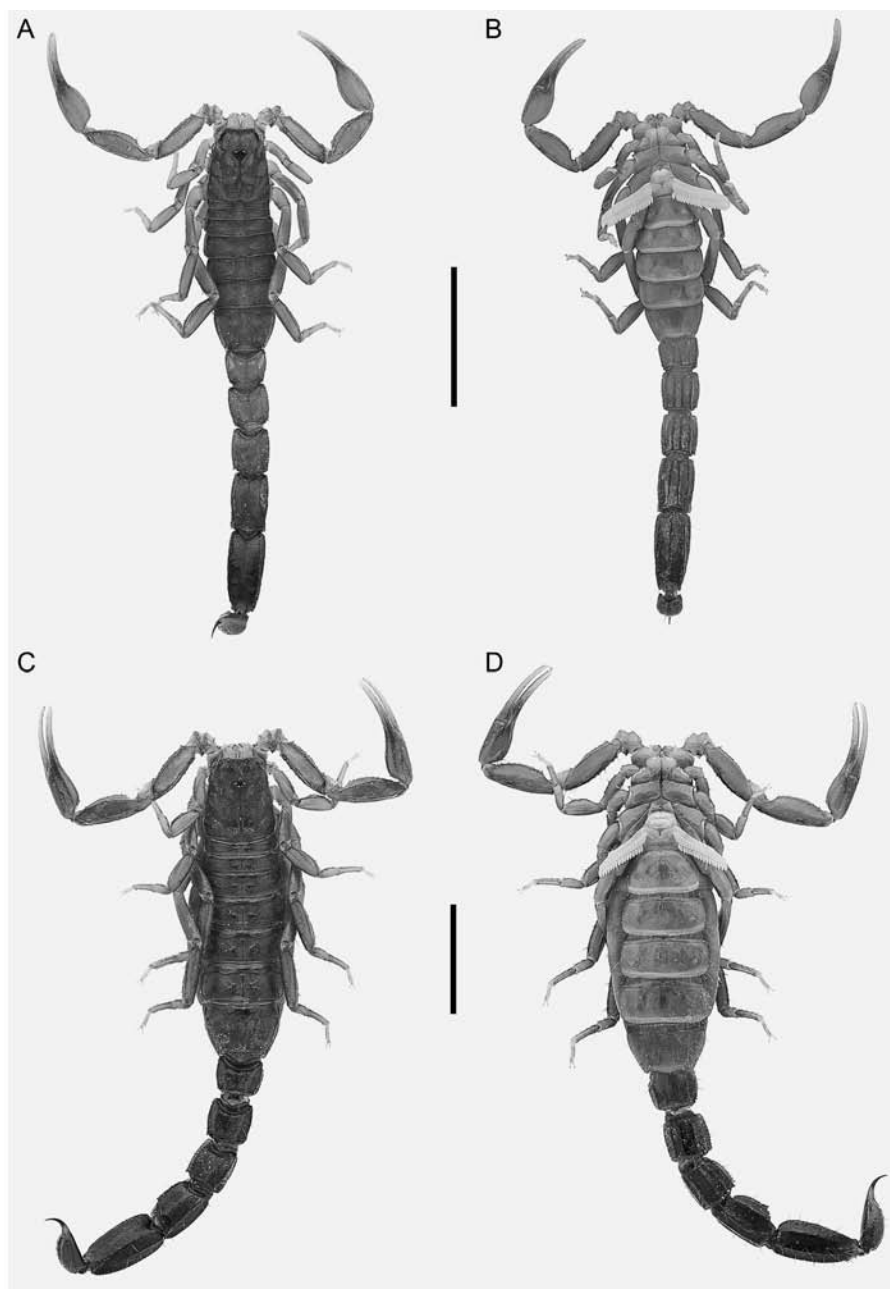


FIGURE 19. *Kuarapu purhepecha* Francke and Ponce-Saavedra, 2010, habitus, dorsal (A, C) and ventral (B, D) aspects. A, B. Paratype ♂ (AMNH). C, D. Paratype ♀ (AMNH). Scale bars = 1 mm.

ules each with major macroseta; prolateral ventrosubmedian carina complete, comprising proximal tubercle, row of enlarged spiniform granules, and two macrosetae; prolateral ventral carina vestigial, reduced to few scattered granules, two proximal tubercles or bicuspid granule with macroseta, subdistal and distal tubercles, each with macroseta; retrolateral ventral, ventral median, and ventral retrosubmedian carinae vestigial, each reduced to row of serrate granules proximally. Patella 1.06/1.04 $\times$ wider than femur (table 5); intercarinal surfaces matte (fig. 29B–E); dorsal prolateral, dorsal retrolateral, ventral prolateral, and ventral retrosubmedian carinae complete, granular; ventral median carina vestigial, reduced to row of granules proximally, occasionally extending to proximal third; retrolateral dorsosubmedian carina vestigial, crenulate; retrolateral median carina obsolete, costate medially; prolateral process well developed; prolateral median carina vestigial, reduced to proximal tubercle with major macroseta, row of serrate granules, and distal granule with macroseta; prolateral ventral carina vestigial, reduced to proximal and distal macrosetae, adjacent to ventral prolateral carina. Chela 1.58/1.68 $\times$ longer than patella, 1.68/1.76 $\times$ longer than femur (table 5). Manus incrassate, 1.53/1.48 $\times$ wider than patella, 1.63/1.54 $\times$ wider than femur (table 5); intercarinal surfaces predominantly smooth (fig. 30); dorsal prolateral, dorsal median, dorsal retrolateral, prolateral median, prolateral ventrosubmedian, ventral prosubmedian and ventral median carinae complete, crenulate; dorsal retrosubmedian accessory carina, vestigial, granular; dorsal prosubmedian and prolateral dorsal carinae vestigial, crenulate, flanking dorsal prolateral carina; retrolateral median carina partial, restricted to median two-thirds, costate-granular; retrolateral subventral accessory and retrolateral subventral carinae vestigial, each reduced to distal granules; retrolateral ventral carina vestigial, reduced to proximal tubercle; ventral retrolateral and ventral retrosubmedian carinae partial, crenulate; ventral prolateral and prolateral ventral carinae partial, crenulate. Fixed and

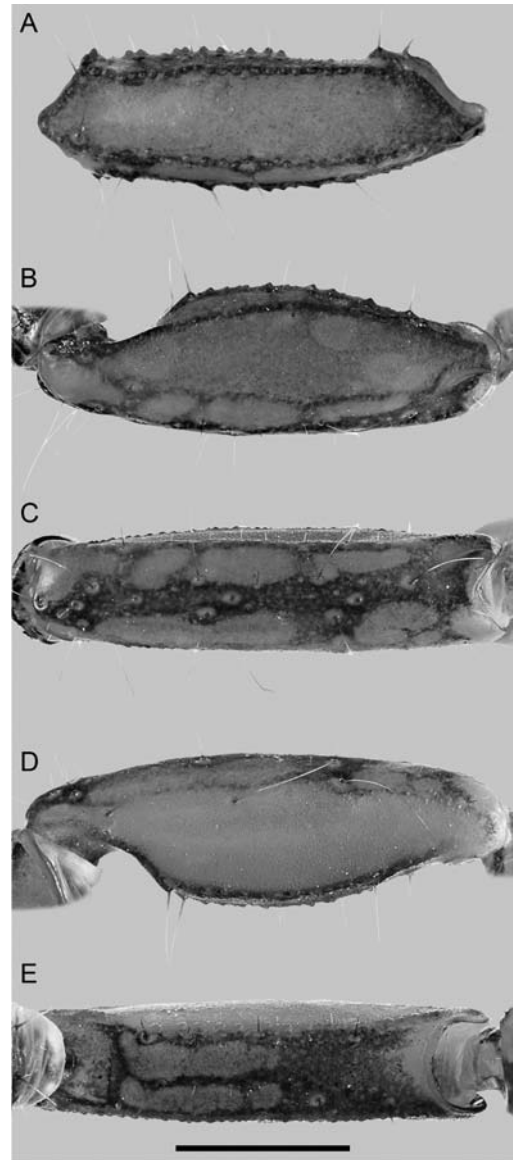


FIGURE 20. *Kuarapu purhepecha* Francke and Ponce-Saavedra, 2010, paratype ♂ (AMNH), dextral pedipalp femur (A) and patella (B–E). A, B. Dorsal aspect. C. Retrolateral aspect. D. Ventral aspect. E. Prolateral aspect. Scale bars = 1 mm.

movable fingers, dentate margins emarginate, fixed finger with moderate (♀) to well-developed (♂) proximal notch and median lobe (fig. 30B, D), movable finger with moderate proximal lobe, fitting together unevenly such that shallow (♀)



FIGURE 21. *Kuarapu purhepecha* Francke and Ponce-Saavedra, 2010, paratype ♂ (AMNH), dextral pedipalp chela. **A.** Dorsal aspect. **B.** Retrolateral aspect. **C.** Ventral aspect. **D.** Prolateral aspect. Scale bars = 1 mm.

to moderate (♂) proximal gap evident when closed; fixed finger median denticle row comprising five denticle subrows flanked by six prolateral and five retrolateral subserrate denticles, retrolateral denticles comparatively smaller than prolateral denticles, proximal prolateral denticle situated in median half of finger; movable finger median denticle row comprising six denticle sub-

rows, flanked by seven prolateral and six retrolateral denticles, subpaired, terminal subrow comprising single denticle. Trichobothrial pattern type C, orthobothriotaxic; chela trichobothrium *Db* situated on dorsal retrolateral carina, subproximal on manus; *Dt* situated dorsal to dorsal retrolateral carina, at midpoint of manus; *db-dt* and *eb-et* distributed along entire length

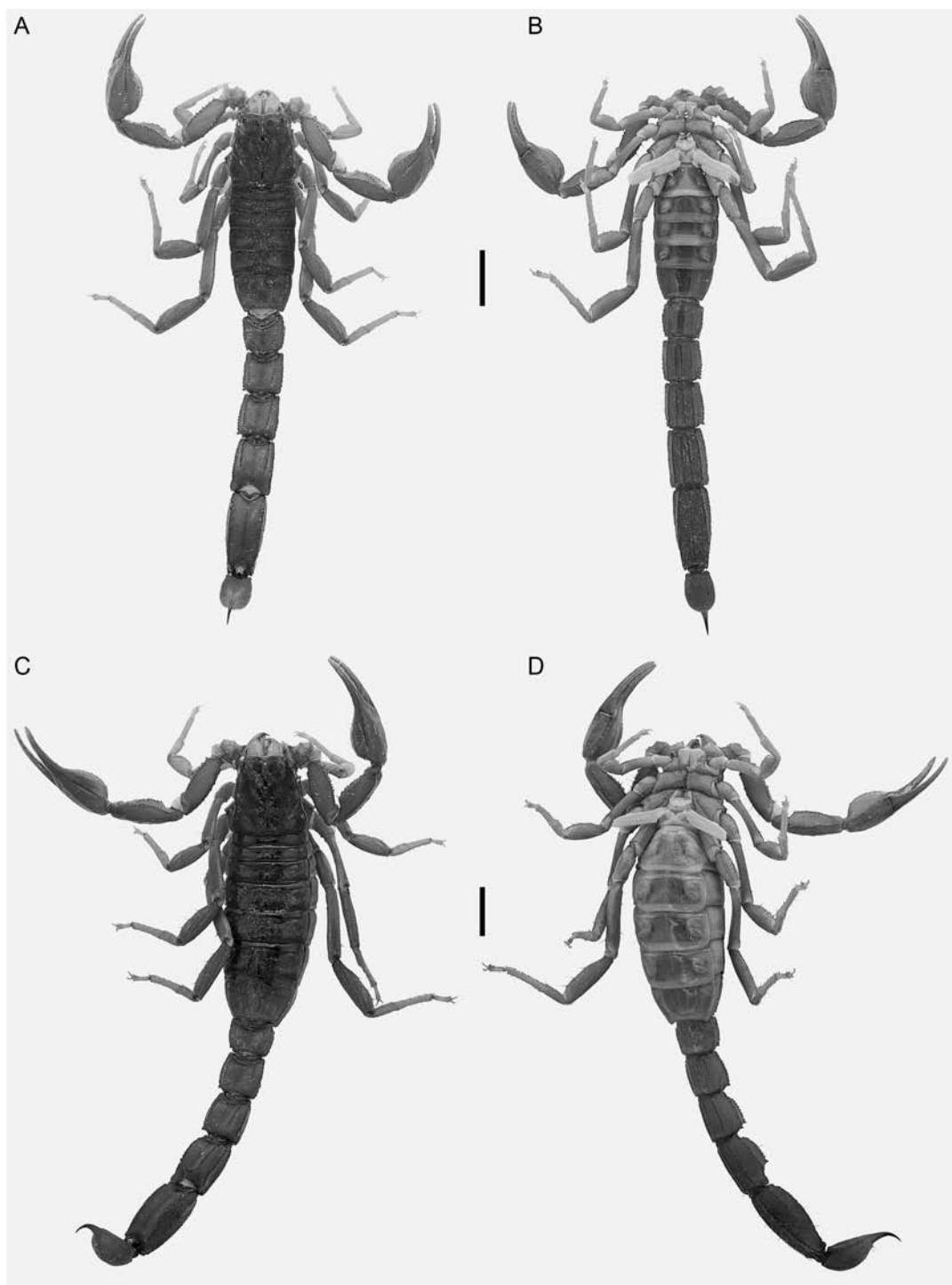


FIGURE 22. *Thorellius cristimanus* (Pocock, 1898), habitus, dorsal (A, C) and ventral (B, D) aspects. A, B. ♂ (AMNH). C, D. ♀ (AMNH). Scale bars = 5 mm.

of fixed finger with *db* situated proximal and *eb* subproximal; *ib* and *it* situated subproximal on fixed finger (fig. 30D), *ib* aligned with sixth prolateral denticle, *it* situated between fifth and sixth prolateral denticles, but closer to (♂) or well separated from (♀) sixth denticle.

Legs: Basitarsi retrolateral dorsal, prolateral ventral, and retrolateral ventral spinule rows complete on I and II, retrolateral dorsal spinule row partial, restricted to distal three-quarters of III and IV, prolateral ventral spinule row partial, restricted to distal two-thirds of III, absent on VI; retrolateral ventral spinule row complete on III, absent on VI; retrolateral median spinule row vestigial, reduced to few distal spinules on I–IV; macrosetal counts on legs I–IV, respectively: dorsal, 3:4:4:4, major or minor; retrolateral dorsal 3:3:3:4; prolateral ventral, 3:4:5:6, subdistal two spinules on II and subdistal three on IV stout; retrolateral ventral, 5:8:9:9, major and minor macrosetae interspersed; dorsal and retrolateral dorsal macrosetae arranged into two separate rows on I–IV. Telotarsi I–IV, each with single ventromedian row of spinules, curved proximally, and two or three pairs of ventrodistal spinules (fig. 11E).

Genital operculum: Width greater than length (fig. 7D), with three pairs of macrosetae. Sclerites separated, but unable to open more than 45° (♂) or fused longitudinally (♀). Genital papillae present, protruding posteriorly (♂) or absent (♀).

Hemispermaphore: Lamina 1.78× longer than trunk (table 8). Median lobe, ental terminus prominent, rounded, protruding slightly toward ental margin, with distal projection (fig. 14F, H). Dorsal trough margin long, narrow, straight, well separated from ventral trough (fig. 13H). Dorsal and ventral trough margins, terminal spinelike processes fused into prominent hook, not bifurcate but with shallow notch, situated distally on lamina dorsal margin (fig. 13F–H). Basal plate of inner lobe well separated from ventral trough; spine of inner lobe long and markedly sclerotized. Hemimating plug developed from inner lobe; distal barb 0.7× lon-

ger than basal plate (table 8); distal barb margin with 12 elongated spinules (14D).

Pectines: Basal piece with three pairs of major macrosetae. Marginal lamella comprising three sclerites. Medial lamella proximal sclerites fused, 12–15 distal sclerites separate (fig. 7D). Fulcra, 21 (♂) 18–19 (♀). Pectinal teeth, 22 (♂), 19–20 (♀). Pectines relatively long, midpoint (♂) or distal margin (♀) of medial sclerite of marginal lamella aligned with distal margin of coxa VI.

Tergites: Pretergites I–VII, surfaces matte. Posttergites I–VI, intercarinal surfaces shagreened, sparsely covered with fine and coarse granules, dorsal median and dorsal lateral carinae partial, restricted to posterior half, granular; VII, intercarinal surfaces moderately granular; dorsal median carina partial, restricted to anterior third, costate-granular, posterior granules larger, dorsal submedian carinae vestigial, costate anteriorly, dorsal lateral and lateral median carinae granular, converging anteromedially, posterior granules larger, spiniform.

Sternites: Sternites III–VI, surfaces acarinate, finely punctate medially, matte laterally; spiracles elongate, approximately 2× longer than wide, becoming wider on posterior sternites; V, posteromedian hyaline glandular area not protruding, but slightly paler than adjacent surfaces (♂) or obsolete (♀); VII, posteromedian hyaline glandular area vestigial, protruding shallowly, but not paler than adjacent surfaces (♂) or obsolete (♀), ventral submedian carinae obsolete, each with two pairs of macrosetae, ventral lateral intercarinal surfaces smooth, ventral lateral carinae moderately developed, granular.

Metasoma: Metasoma 1.65/1.53× longer than mesosoma (table 5). Segments I–V, respectively 1.15/1.12, 0.92, 0.83/0.84, 0.62/0.59, 0.48/0.39× wider than long; V, 1.28/1.35× wider than telson vesicle. Segments I–V, all intercarinal surfaces matte, dorsal surfaces sparsely and coarsely granular on I–III (figs. 9E, 10E); dorsal lateral carinae complete, serrate, terminating in conical spiniform granules posteriorly on I–IV, complete, serrate on V; lateral median carinae complete, serrate, terminating in conical spiniform gran-

ules posteriorly on I–III, lobate posteriorly on IV, serrate in anterior two-thirds, becoming finely granular posteriorly, and terminating in conical protuberance on V; lateral inframedian carinae complete, serrate on I, partial, serrate in posterior third on II, partial, granular in posterior quarter on III, absent on IV; ventral lateral and ventral submedian carinae serrate on I–IV; ventral median carina serrate on V. Macrosetal counts on carinae of segments I–V, respectively: dorsal lateral carinae, 2:2:2:3:5; lateral median carinae, 1:1:1:2:6; lateral inframedian carinae, 2:2:2:2:0; ventral lateral carinae, 2:3:3:3:2; ventral sublateral carinae, 0:0:0:0:2; ventral submedian carinae, 2:2:2:2:1.

Telson: Vesicle relatively elongate, length 1.86/1.66× greater than width (table 5). Dorsal surface smooth. Ventral surface with scattered low granules; ventral carinae each with two or three macrosetae. Subaculear tubercle vestigial, comprising minute granule (fig. 10E). Aculeus, latero-basal microserration comprising 3–5 spinules.

DISTRIBUTION: *Thorellius tekواني* is endemic to the Balsas Depression, in the states of Guerrero, Estado de México, and Michoacán, Mexico (fig. 3).

ECOLOGY: *Thorellius tekواني* inhabits tropical deciduous forest and tropical thorn forest from 10 to 1620 m altitude. The species has been collected under large, embedded rocks in the dry season, where it constructs burrows, apparently to estivate, and under smaller, loose rocks in the rainy season. The habitat and habitus of *T. tekواني* are consistent with the lapidicolous ecomorphotype (Prendini, 2001).

ADDITIONAL MATERIAL EXAMINED: MEXICO: Estado de México: *Municipio de Luvianos:* San Juan Acatitlán, 5 km E, 19°00'33"N 100°17'20"W, 925 m, 3.xi.2002, E. González, R. Paredes, and C. Durán, under rocks, 1 ♀ (CNAN SC2942); Puerto del Salitre, 3 km S, 21.vi.2002, E. González, 1 ♂ (AMCC [LP 2017]). *Municipio de Zacazonapan:* Zacazonapan, 3 km N, 19°04.198'N 100°15.329'W, 1360 m, 16.xii.2001 O. Francke, E. González, and M. and O. Martínez, 3 ♀ (CNAN SC2909). **Guerrero:** *Municipio de Copala:* Microondas Fogos, 16°33.992'N

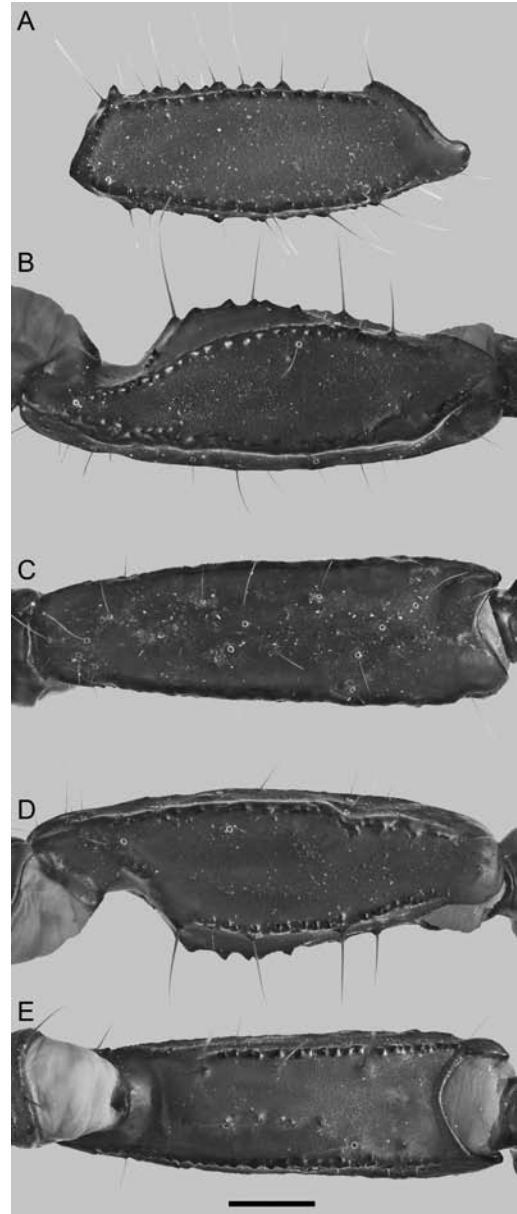


FIGURE 23. *Thorellius cristimanus* (Pocock, 1898), ♂ (AMNH), dextral pedipalp femur (A) and patella (B–E). A, B. Dorsal aspect. C. Retrolateral aspect. D. Ventral aspect. E. Prolateral aspect. Scale bars = 1 mm.

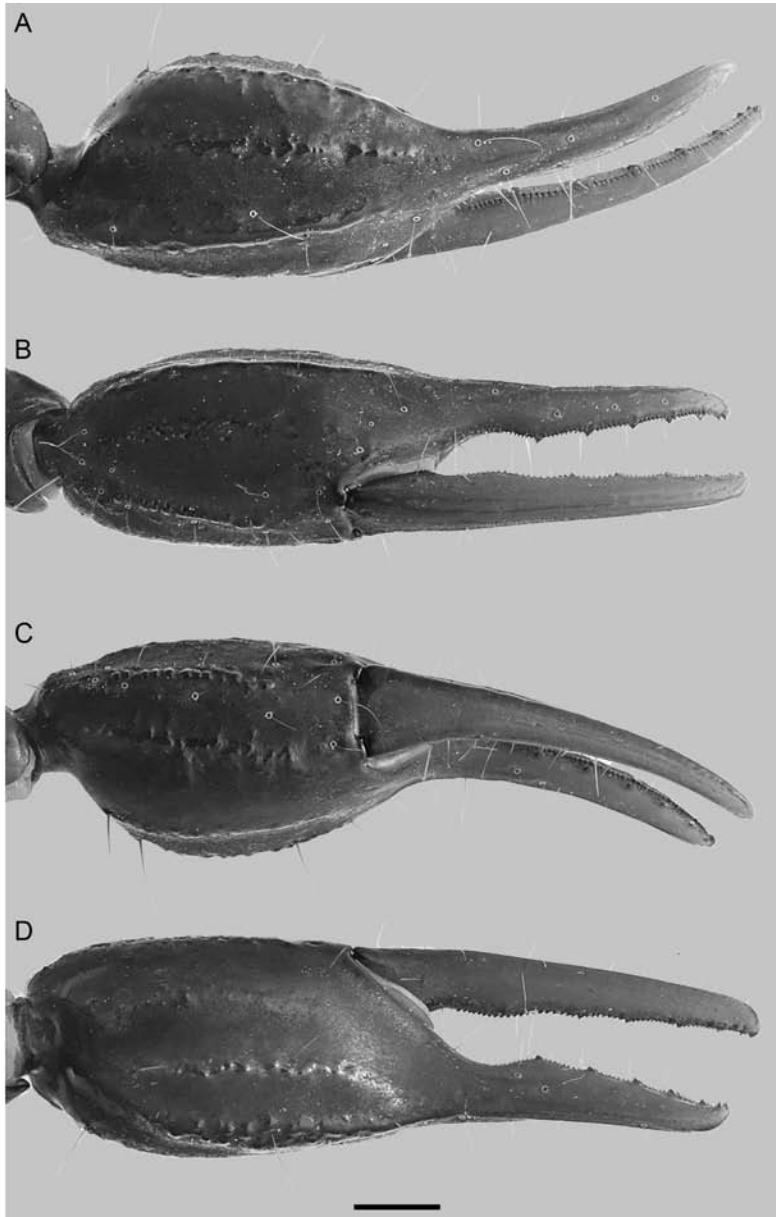


FIGURE 24. *Thorellius cristimanus* (Pocock, 1898), ♂ (AMNH), dextral pedipalp chela. **A.** Dorsal aspect. **B.** Retrolateral aspect. **C.** Ventral aspect. **D.** Prolateral aspect. Scale bars = 1 mm.

98°53.301'W, 103 m, 26.vi.2007, Francke et al., 1 juv. ♀ (AMCC [LP 7062]). *Municipio de Cutzamala de Pinzón*: Ixtapilla, 3 km N, 18°34.419'N 100°37.70'W, 297 m, 22.v.2006, O. Francke, A. Valdez, H. Montaña, and A. Ballesteros, forest, collected at night with UV light, 1 ♀ (AMCC

[LP 6609]), 1 juv. (AMNH). *Municipio de Coahuayutla*: Matamoros [18°27'01.61"N 101°50'12.86"W], 377 m, 13.v.2004, J. Baldazo, 1 ♀ (CNAN SC2995). *Michoacán*: *Municipio de Apatzingán*: Apatzingán de la Constitución, 19°05'19"N 102°21'03"W, 320 m, 21.iv.1947, M.

Cardenas and H. Correa, 1 ♀, 1 subad. ♀, 1 juv. (CNAN SC3936); Apatzingán, 19°05'19"N 102°21'03"W, 320 m, 2 ♀ (CNAN SC2643), 366 m, 30.viii.1941, H. Hoogstraal, 1 ♂ (AMNH); Escuela de Ciencias Agropecuarias, 19°04'59"N 102°22'18"W, 300 m, 20.i.2007, N.A. Avila and A. Aguirre, 1 ♂ (CNAN); El Tesorero, 19°00'03"N 102°22'31"W, 240 m, 26.viii.2002, A. Mingucha, 1 ♀ (CNAN SC3939); Los Cerritos, 19°05'19"N 102°21'03"W, 320 m, 10.viii.1994, 1 ♀ (CNAN SC3941), 19°04'09.1"N 102°20'31.2"W, 12.x.2006, J. Ponce, 1 ♀ (CNAN). *Municipio de Aquila*: La Peña, 18°30'51"N 103°14'58"W, 1500 m, 3.v.2004, 1 ♀ (CNAN). *Municipio de Arteaga*: Arteaga [18°21'00.59"N 102°17'25.70"W], 840 m, 15.iv.2006, 1 ♂ (CNAN SC3942). *Municipio de Carácuaro*: Hwy Carácuaro–Huetamo, marker km 125, 18°56.231'N 101°02.906'W, 724 m, 14.vii.2005, O. Francke, J. Ponce, M. Córdova, A. Jaimes, G. Francke, and V. Capovilla, 1 juv. (AMCC [LP 5322]); Las Cocinas, Hwy Nocupetaro–Carácuaro, 19°01.880'N 101°14.067'W, 672 m, 14.vii.2005, O. Francke, J. Ponce, M. Córdova, A. Jaimes, G. Francke, and V. Capovilla, 1 juv. (AMCC [LP 5331]); Nocupetaro [19°03'N 101°09'W], 24.ix.2004, 1 ♀ (CNAN). *Municipio de Huetamo*: Arua [18°34'57.12"N 100°53'01.23"W], 23.viii.2001, 1 ♂ (CNAN SC2661). *Municipio de la Huacana*: El Chauz [18°52'50.14"N 102°00'27.55"W], 19.xi.2004, R. Lanoy Cardenas, 5 juv. (CNAN SC2943); El Vado, 18°48.90'N 101°54.976'W, 198 m, 20.v.2007, O. Francke, J. Ponce, A. Quijano, M. Villaseñor, and A. Ballesteros, 1 ♀ (CNAN SC2946); La Huacana, 18°57'44"N 101°48'23"W, 480 m, 18.vi.1993, 1 ♀ (CNAN). *Municipio de Lázaro Cárdenas*: Lázaro Cárdenas, 17°57'22"N 102°11'32"W, 10 m, 11.xi.2002, F. Camacho, 1 ♀ (CNAN SC2947). *Municipio de Parácuaro*: Ejido La Batea, 19°07'54"N 102°07'49"W, 650 m, 2.viii.2002, J. Jesus Orozco, 1 ♀ (CNAN SC2944). *Municipio de Tepalcatepec*: El Taixtan, 1 km SW, 19°01.719'N 102°55.706'W, 980 m, 18–19.v.2007, O. Francke, J. Ponce, M. Villaseñor, A. Quijano, and A. Ballesteros, 1 ♂ (AMCC [LP 7069]), 1 ♂, 1 subad. ♀ (AMNH), 1 ♀ (CNAN SC2753);

Valle Verde Ranch [19°10'21.58"N 102°51'29.00"W], 270 m, 14.v.2005, A. Valdez, 5 ♂ (CNAN SC2642); Valle Verde Ranch, Las Colonias, road Apatzingán–La Ruana, 14.v.2005, C. Tena, 2 ♂ (CNAN SC3935). *Municipio de Tzitzandaro de los Chávez*: Cupuan [18°28'31.14"N 100°58'36.86"W], 20.vi.2004, Micaela, 1 ♂ (CNAN SC2945).

Thorellius wixarika, sp. nov.

Figures 1D, 3, 6C, 7C, 8F, 9F, 10F, 11F, 13C–E, 14E, 15K, L, 31–33; table 6, 8

TYPE MATERIAL: **MEXICO: Nayarit:** *Municipio de Tepic*: Holotype ♂ (CNAN T01251), Jesus María Corte, 4 km N, 2 km along gravel E of main paved road, ca. 30 km N of Tepic, 21°45.203'N 104°51.213'W, 126 m, 29.vii.2005, E. González, S. Reynaud, and R. Mercurio. Paratypes: *Municipio de Compostela*: Compostela, 21°13'40"N 104°51'00"W, 992 m, farmland forest, under rocks, 1.vii.2008, R.C. West, 1 ♀ (AMNH); 21°12'51"N 104°56'19"W, 955 m, cattle pasture, under rocks, 1.vii.2008, R.C. West, 1 subad. ♀ (AMNH). *Municipio de San Blas*: José María Mercado, El Infiernillo, 21°33'28.81"N 105°10'12.72"W, 330 m, 23.ii.2008, J. Ponce-Saavedra, 1 ♀ (CNAN T01257 old SC3010). **Jalisco:** *Municipio de Puerto Vallarta*: Las Palmas, 8 km E, 20°49'26.35"N 105°01'8.66"W, 350 m, tropical subdeciduous forest, under log, 1 ♂ (CNAN T01258 old SC3002); Puerto Vallarta, 8 km S, 20°20'48"N 105°22'05"W, 8.vii.1996, R.C. West, 2 ♀ (AMNH); road to La Palapa, 20°41'10.4"N 105°10'32.7"W, 128 m, 17.ii.2010, F. Cupul, tropical subdeciduous forest, 1 ♀ (CNAN T01259 old SC3000).

ETYMOLOGY: The species name *wixarika* is the Nahuatl self-denomination of the aboriginal Huichol people inhabiting the central and western Sierra Madre Occidental, in the Mexican states of Nayarit, Jalisco, Durango, and Zacatecas. The name refers to the distribution of the species in part of the territory inhabited by the Wixarika.

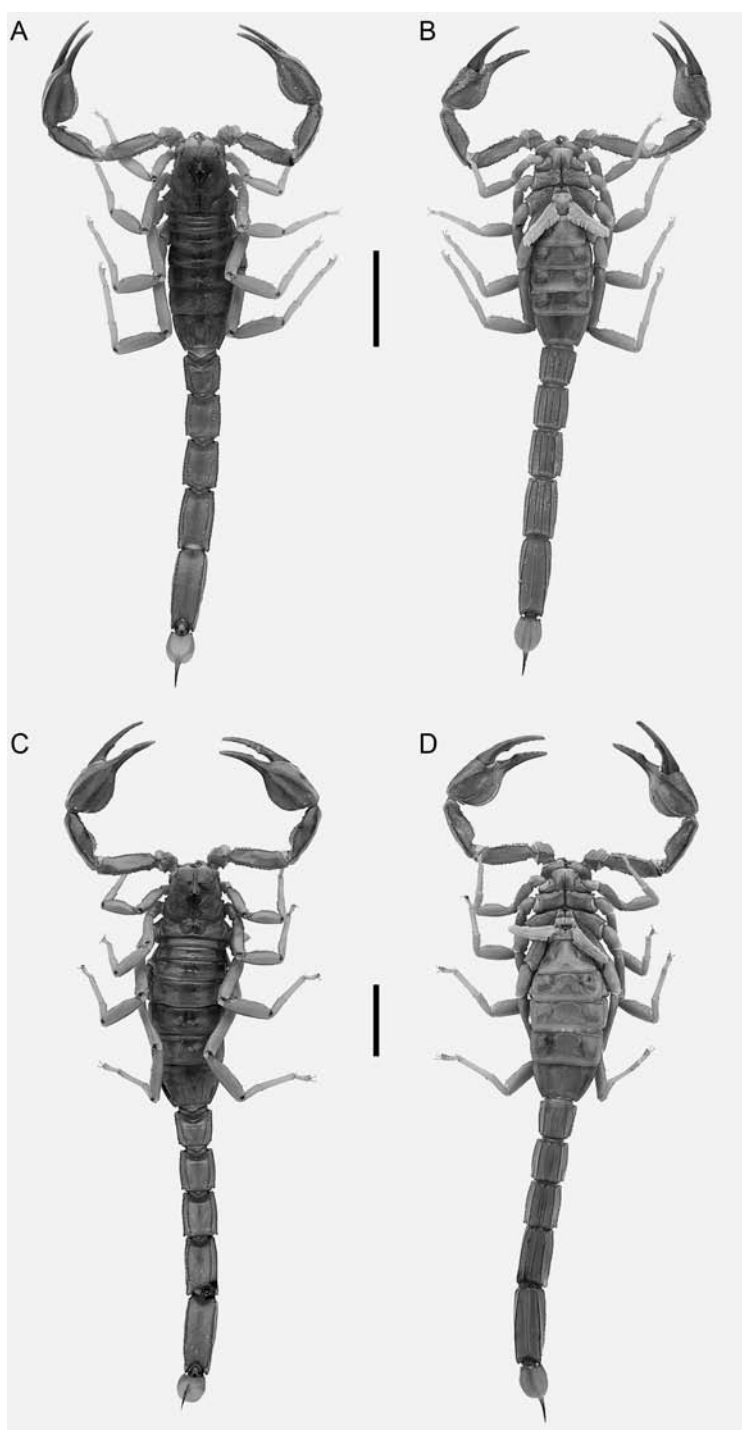


FIGURE 25. *Thorellius intrepidus* (Thorell, 1876), habitus, dorsal (A, C) and ventral (B, D) aspects. A, B. ♂ (AMNH). C, D. ♀ (AMNH). Scale bars = 10 mm.

DIAGNOSIS: *Thorellius wixarika* may be distinguished from other species of *Thorellius* by the pedipalp carination. The ventral retrolateral, ventral retrosubmedian, ventral median, and ventral prosubmedian carinae of the chela manus are densely and irregularly granular in *T. wixarika*, but smooth to moderately granular in the other species. The retrolateral dorsosubmedian and retrolateral median carinae of the patella are partially developed and densely granular in *T. wixarika*, but vestigial, comprising a few scattered fine granules in the other species. Metasomal segments I and II are relatively elongate in *T. wixarika*, but more robust, slightly wider, and shorter in *T. cristimanus* and *T. yuyuawi* (tables 3, 6, 7). *Thorellius wixarika* is dark brownish in color, unlike *T. intrepidus* and *T. tekuni*, which are pale yellowish to reddish. The terminal spine-like processes of the hemispermatophore dorsal and ventral trough margins are fused into a prominent, bifurcate hook in *T. wixarika* instead of a nonbifurcate hook as in *T. cristimanus* and *T. yuyuawi*. Adult *T. wixarika* usually measure less than 60 mm whereas adult male and female *T. intrepidus* usually measure 75 and 80 mm, respectively (tables 4, 6). The ventral retrolateral, ventral retrosubmedian, ventral median, and ventral prosubmedian carinae of the pedipalp chela manus are densely and irregularly granular in *T. wixarika*, but markedly developed, broad and irregularly granular in *T. intrepidus*. The notch and lobes of the pedipalp chela fingers are moderately to weakly developed in *T. wixarika*, but markedly developed in *T. intrepidus*. The chela movable finger bears a single denticle at the seventh position in *T. wixarika*, but a pair of prolateral denticles in *T. intrepidus*. The ventral submedian carinae of metasomal segments I and II are smooth to partially granular in *T. wixarika*, but finely granular in *T. tekuni*. The carapace interocular surface is shagreened in *T. wixarika*, but relatively smooth in *T. yuyuawi*. All carinae of the pedipalp chela manus and the ventral lateral and ventral submedian carinae of metasomal segments II–IV are granular to finely serrate in *T. wixarika*, but smooth in *T. yuyuawi*. The ret-

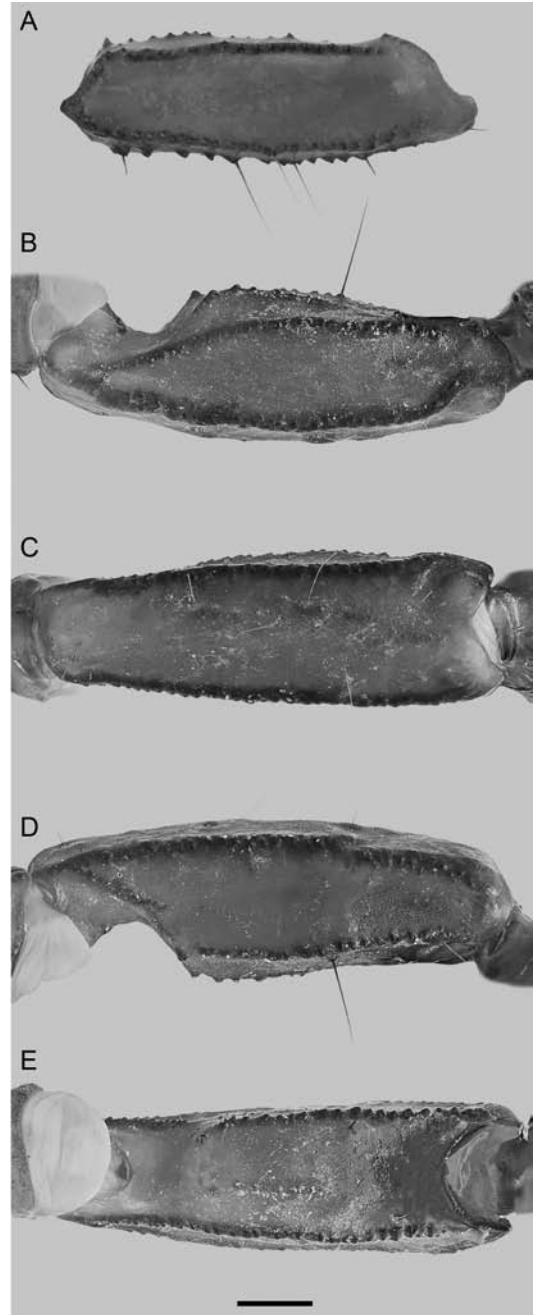


FIGURE 26. *Thorellius intrepidus* (Thorell, 1876), ♂ (AMNH), dextral pedipalp femur (A) and patella (B–E). A, B. Dorsal aspect. C. Retrolateral aspect. D. Ventral aspect. E. Prolateral aspect. Scale bars = 1 mm.

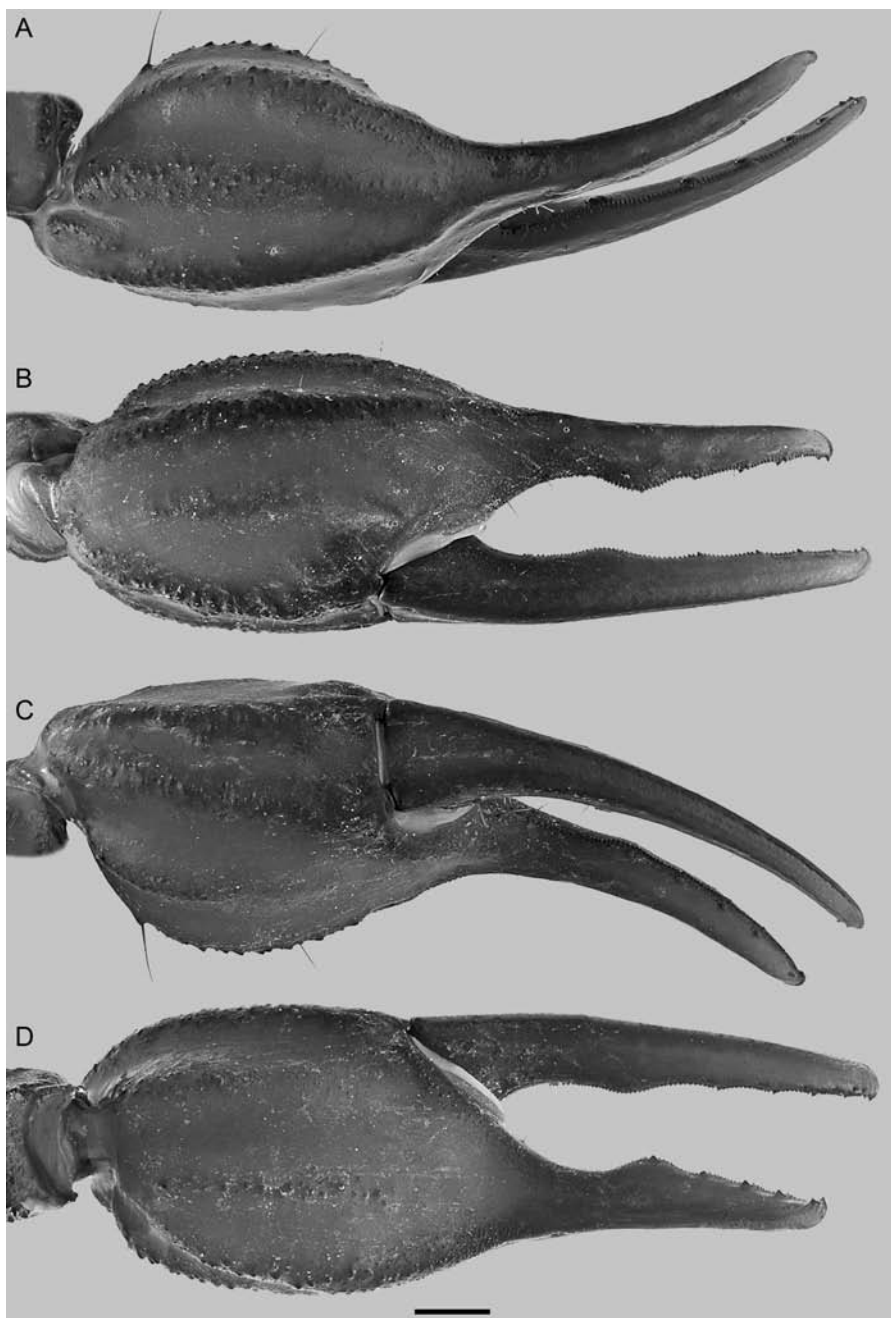


FIGURE 27. *Thorellius intrepidus* (Thorell, 1876), ♂ (AMNH), dextral pedipalp chela. **A.** Dorsal aspect. **B.** Retrolateral aspect. **C.** Ventral aspect. **D.** Prolateral aspect. Scale bars = 1 mm.

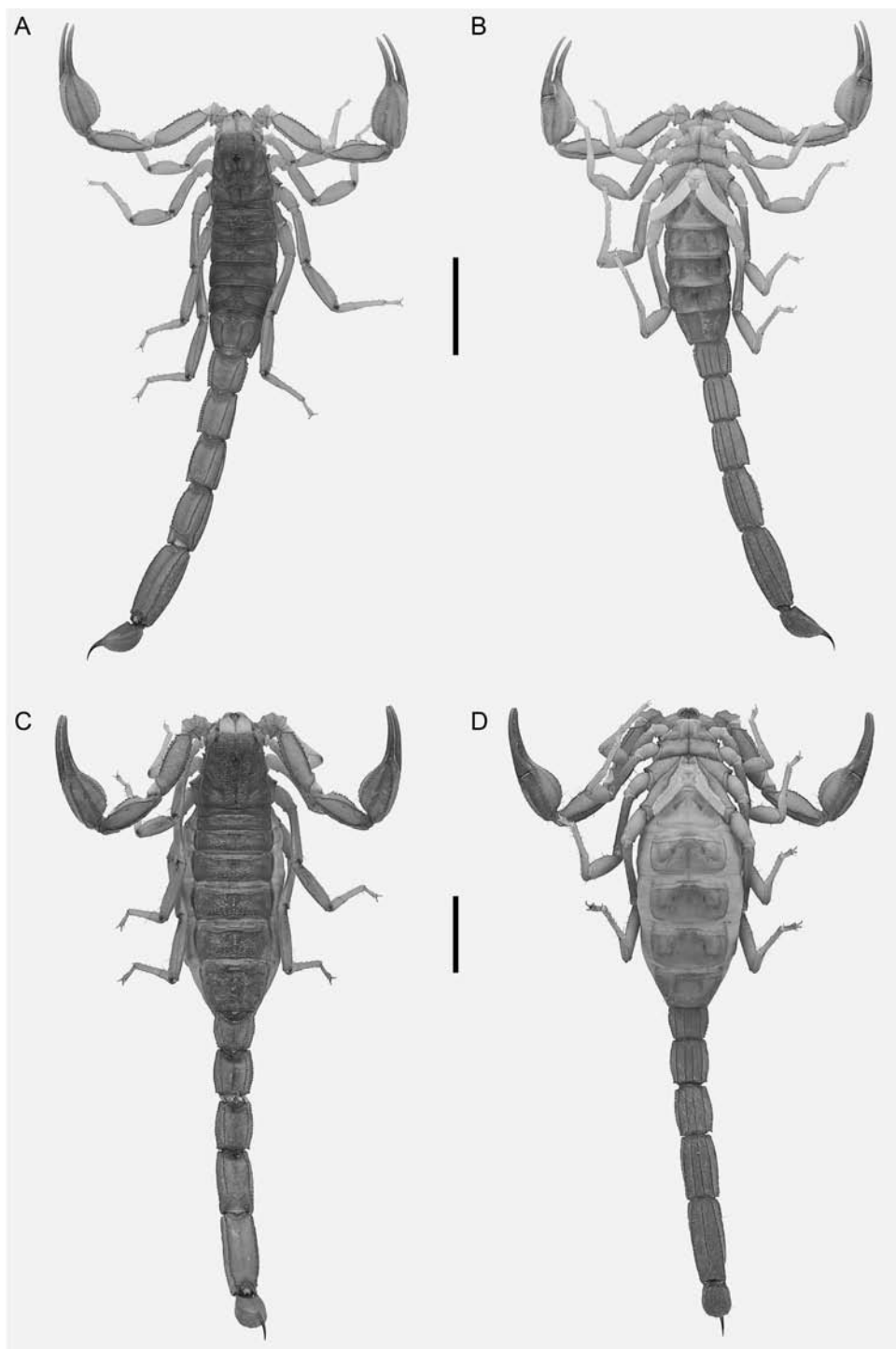


FIGURE 28. *Thorellius tekuni*, sp. nov., habitus, dorsal (A, C) and ventral (B, D) aspects. A, B. Holotype ♂ (CNAN T01250). C, D. Paratype ♀ (CNAN T01250). Scale bars = 5 mm.

rolateral dorsosubmedian and retrolateral median carinae of the pedipalp patella are partially and densely granular in *T. wixarika*, but smooth to obsolete in *T. yuyuawi*. The dorsal lateral and ventral lateral carinae of metasomal segment V each bear 6 and 13 macrosetae, respectively, in *T. wixarika*, but 14 and 23 macrosetae, respectively, in *T. yuyuawi*.

DESCRIPTION: The following description is based on the types and additional material examined.

Color and infuscation: Cheliceral manus dorsal surface base color yellowish orange, fingers darker, amber. Carapace, pedipalps, legs, tergites, sternites, and metasoma base color orange to dark brown, immaculate, except as follows. Carapace, tergites, and legs infusate. Coxosternal region slightly darker than carapace and tergites; sternum brown anteriorly, yellowish orange posteriorly. Pedipalps and legs orange-brown. Pedipalp and metasomal carinae brownish, darker than intercarinal surfaces. Genital operculum and pectines pale whitish. Telson reddish brown; aculeus dark reddish to brownish.

Chelicerae: Manus dorsal surface smooth, with broad, finely granular carinae subdistally and three macrosetae medially. Fixed and movable fingers smooth; movable finger, ventral surface with serrula, comprising 21/22 times, in distal half.

Carapace: Length 1.08/1.02× greater than posterior width (table 6). Anterior margin emarginate, with moderate to shallow median notch, with five pairs of major and minor macrosetae (fig. 6C). Three pairs of lateral ocelli, anterolateral and median lateral pairs equal in size, posterolateral pair approximately half the size. Median ocular tubercle slightly raised, situated in anterior half of carapace, superciliary carinae smooth to weakly granular anteriorly, higher than median ocelli. Median ocelli approximately twice the size of anterior lateral ocelli. Anteromedian, posteromedian, and posterolateral sulci deep and narrow, posterior transverse sulci shallow. Surfaces shagreened, covered with fine and coarse, rounded granules.

Coxosternal region: Sternum subequilateral pentagonal (fig. 7E); 0.88/0.89 longer than wide (table 6); median sulcus deep; surfaces matte, with four pairs of macrosetae, one pair anteriorly, two pairs medially, and one pair posteriorly on lobes. Coxae surfaces matte, smooth in places; coxa II subproximal margin with three oblique slitlike structures, adjacent to finely granular protuberance; coxal endite II proximal margin with deep depression, medial margin finely granular, becoming smooth distally. Coxa IV 1.96/2.10× longer than coxa II (table 6).

Pedipalps: Femur prolateral and ventral intercarinal surfaces sparsely granular, other intercarinal surfaces matte (fig. 32A); dorsal prolateral and dorsal retrolateral carinae complete, granular; ventral prolateral carina complete, costate-granular; retrolateral dorsosubmedian carina complete, serrate, with major macrosetae subproximally, medially and distally; prolateral ventrosubmedian carina partial, restricted to proximal half with row of spiniform granules and enlarged tubercle proximally; prolateral ventral carina vestigial, reduced to few scattered granules, two proximal, one subproximal and one distal tubercles, each with macroseta; retrolateral ventral, ventral median, and ventral retrosubmedian carinae vestigial, each reduced to row of serrate granules proximally. Patella 1.16/1.19× wider than femur (table 6); intercarinal surfaces matte (fig. 32B–E); dorsal prolateral, dorsal retrolateral, ventral prolateral, and ventral retrosubmedian carinae complete, granular; ventral median carina vestigial, reduced to row of minute granules proximally, occasionally extending to proximal half; retrolateral dorsosubmedian carina partial, reduced to row of granules in median third; retrolateral median carina complete, serrate; prolateral process well developed; prolateral median carina partial, comprising proximal tubercle with major macroseta, row of serrate granules, median macroseta, and distal granule; prolateral ventral carina vestigial, reduced to proximal and distal macrosetae, adjacent to ventral prolateral carina. Chela 1.51/1.73× longer than patella,

1.66/1.90× longer than femur (table 6). Manus incrassate, 1.29/1.23× wider than patella, 1.50/1.46× wider than femur (table 6); intercarnal surfaces matte (fig. 33); dorsal prolateral, dorsal median, dorsal retrolateral, prolateral ventrosubmedian, and prolateral median carinae complete, crenulate; dorsal retrosubmedian accessory carina, vestigial, crenulate; dorsal prosubmedian and prolateral dorsal carinae vestigial, crenulate, flanking dorsal prolateral carina; retrolateral median carina partial, restricted to proximal two-thirds, costate-granular; retrolateral subventral carina vestigial, crenulate; retrolateral subventral accessory carina partial, reduced to distal row of granules; retrolateral ventral carina vestigial, reduced to proximal tubercle; ventral retrolateral carina partial, granular; ventral retrosubmedian carina partial, crenulate; ventral prosubmedian and ventral median carinae complete, crenulate (fig. 33C); ventral prolateral and prolateral ventral carinae partial, crenulate. Fixed and movable fingers, dentate margins emarginate, fixed finger with moderate (♀) to well-developed (♂) proximal notch and median lobe (fig. 33B, D), movable finger with moderate proximal lobe, fitting together unevenly such that shallow (♀) to moderate (♂) proximal gap evident when closed; fixed finger median denticle row comprising five denticle subrows flanked by six prolateral and five retrolateral subserrate denticles, retrolateral denticles comparatively smaller than prolateral denticles, proximal prolateral denticle situated in median half of finger; movable finger median row comprising six denticle subrows, flanked by seven prolateral and six retrolateral denticles, subpaired, terminal subrow comprising single denticle. Trichobothrial pattern type C, orthobothriotaxic; chela trichobothrium *Db* situated on dorsal retrolateral carina, subproximal on manus; *Dt* situated dorsal to dorsal retrolateral carina, at midpoint of manus; *ib* and *it* situated subproximal on fixed finger (fig. 33D), *ib* aligned with sixth prolateral denticle, *it* situated between fifth and sixth prolateral denticles, but closer to sixth denticle.

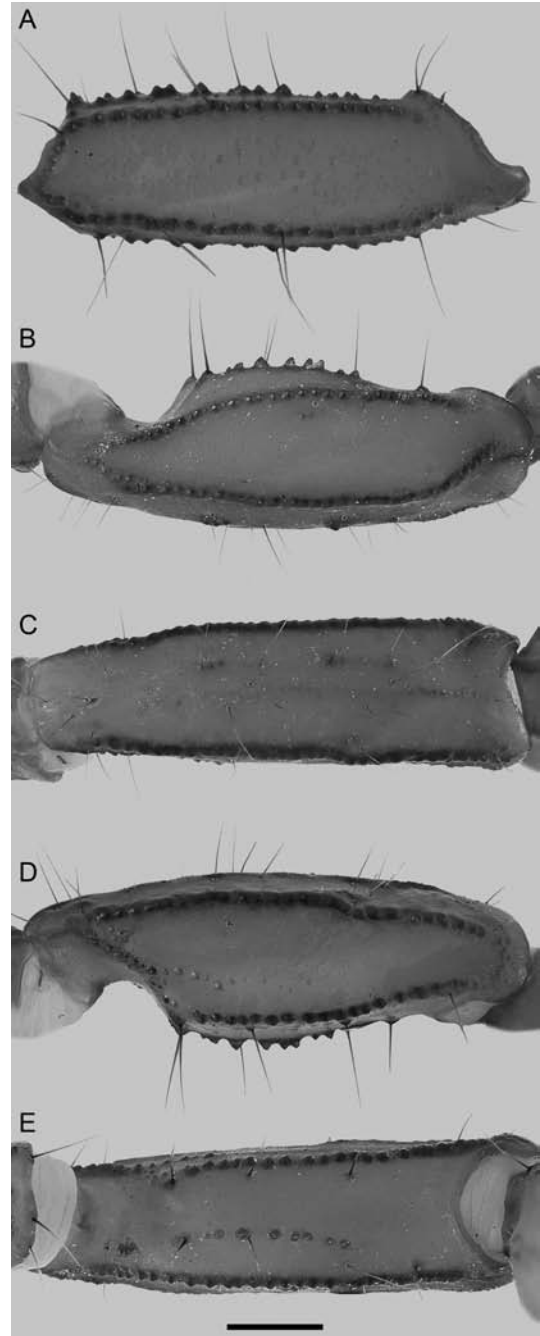


FIGURE 29. *Thorellius tekuni*, sp. nov., holotype ♂ (CNAN T01250), dextral pedipalp femur (A) and patella (B–E). A, B. Dorsal aspect. C. Retrolateral aspect. D. Ventral aspect. E. Prolateral aspect. Scale bars = 1 mm.

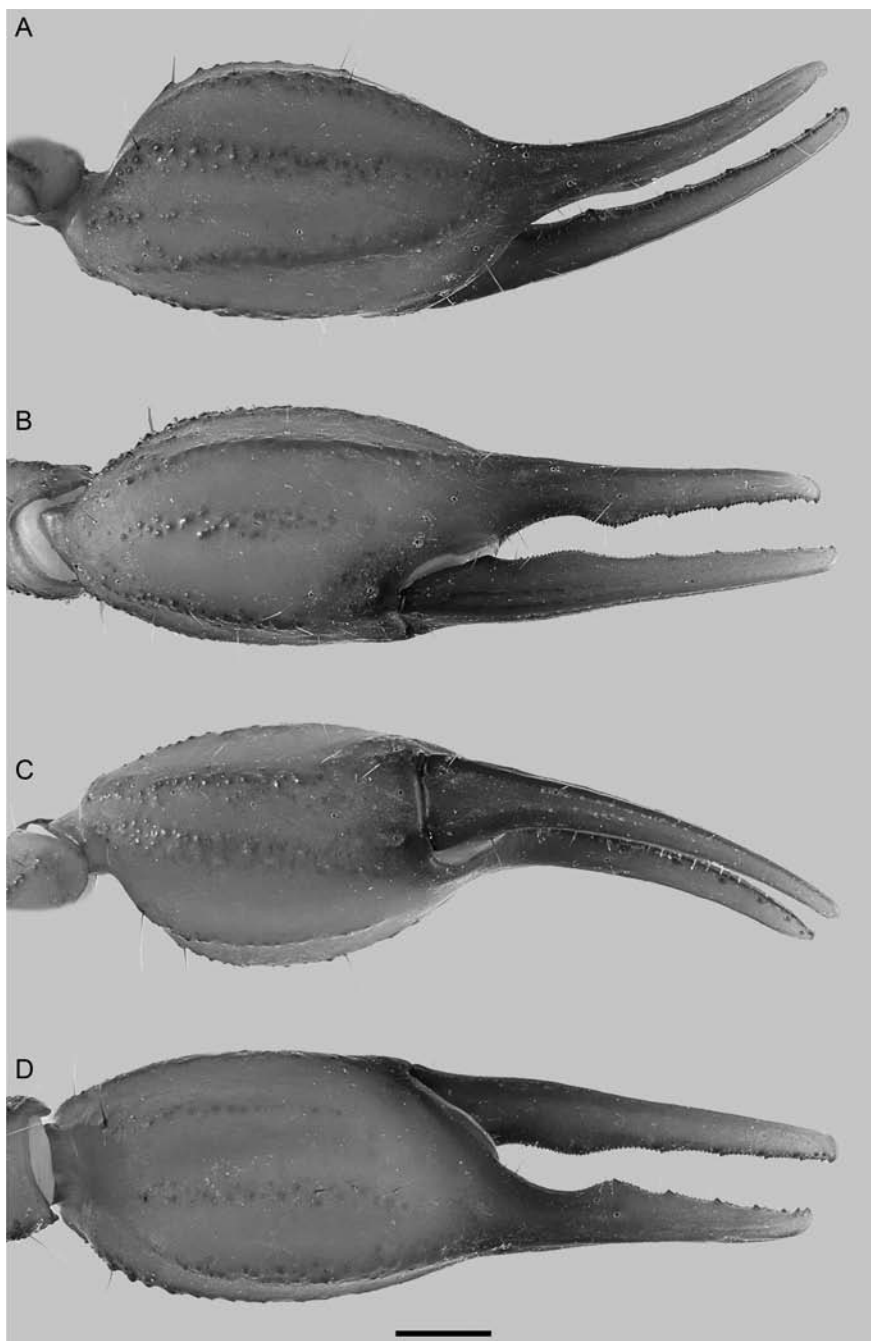


FIGURE 30. *Thorellius tekuni*, sp. nov., holotype ♂ (CNAN T01250), dextral pedipalp chela. A. Dorsal aspect. B. Retrolateral aspect. C. Ventral aspect. D. Prolateral aspect. Scale bars = 1 mm.

Legs: Basitarsi retrolateral dorsal, prolateral ventral, and retrolateral ventral spinule rows complete on I and II, retrolateral dorsal spinule row partial, restricted to distal three-quarters of III and IV, prolateral ventral spinule row partial, restricted to distal two-thirds of III, absent on VI, retrolateral ventral spinule row complete on III, absent on VI; retrolateral median spinule row vestigial, reduced to few distal spinules on I–IV; macrosetal counts on legs I–IV, respectively: dorsal, 4:4:4:4; retrolateral dorsal, 3:3:3:4; prolateral ventral, 3:5:5:6, subdistal two spinules on II and subdistal three on IV stout; retrolateral ventral, 4:8:9:9, major and minor macrosetae interspersed; dorsal and retrolateral dorsal macrosetae arranged into two separate rows on I–IV. Telotarsi I–IV, each with single ventromedian row of spinules, curved proximally, and two or three pairs of ventrodistal spinules (fig. 11F).

Genital operculum: Width greater than length (fig. 7E), with three pairs of macrosetae. Sclerites separated, but unable to open more than 45° (♂) or fused longitudinally (♀). Genital papillae present, protruding posteriorly (♂) or absent (♀).

Hemispermaphore: Lamina 1.6× longer than trunk (table 8); distal margin broad and curved, tapering distally to form conical caplike structure. Median lobe, ental terminus prominent, rounded, and protruding toward ental margin, two distal rims forming funnellike structure (figs. 13C, E, 14E). Dorsal trough margin long, narrow, curving proximally, well separated from ventral trough (fig. 13E). Dorsal and ventral trough margins, terminal spinelike processes fused into prominent hook, not bifurcate but with shallow notch, situated distally on lamina dorsal margin (fig. 13A, B). Basal plate of inner lobe well separated from ventral trough; spine of inner lobe long and markedly sclerotized. Hemimating plug developed from inner lobe; distal barb 0.66× longer than basal plate (table 8); distal barb margin with 18 elongated spinules; secondary spine on ventromedian side of distal barb short, broad, and rounded (fig. 15K, L).

Pectines: Basal piece with three pairs of major macrosetae. Marginal lamella comprising three sclerites. Medial lamella proximal sclerites fused, 14 distal sclerites separate (fig. 7E). Fulcra, 19–22 (♂), 19–20 (♀). Pectinal teeth, 20–23 (♂), 20–21 (♀). Pectines relatively long, midpoint (♂) or distal margin (♀) of medial sclerite of marginal lamella aligned with distal margin of coxa VI.

Tergites: Pretergites I–VII, surfaces matte. Posttergites I–VI, intercarinal surfaces shagreened, sparsely covered with fine and coarse granules, dorsal median and dorsal lateral carinae partial, restricted to posterior half, granular; VII, intercarinal surfaces moderately granular; dorsal median carina partial, restricted to anterior third, costate-granular, posterior granules larger, dorsal submedian carinae vestigial, costate anteriorly, dorsal lateral and lateral median carinae granular to costate-granular, converging anteromedially, posterior granules larger, spiniform.

Sternites: Sternites III–VI, surfaces acarinate, matte; spiracles elongate, slitlike, approximately 2–4× longer than wide, becoming wider on posterior sternites; IV, posteromedian hyaline glandular area vestigial, not protruding but slightly paler than adjacent surfaces; V, posteromedian glandular area longer and wider than on IV, not protruding but paler than adjacent surfaces (♂) or obsolete (♀); VII, posteromedian glandular area vestigial, protruding shallowly but not paler than adjacent surfaces (♂) or obsolete (♀), ventral submedian carinae obsolete, each with two pairs of macrosetae, ventral lateral intercarinal surfaces smooth, ventral lateral carinae moderately developed, granular.

Metasoma: Metasoma 1.73/1.66× longer than mesosoma (table 6). Segments I–V, respectively 1.14/1.30, 0.93/1.03, 0.84/0.92, 0.59/0.64, 0.42/0.44× wider than long; V, 1.22/1.35× wider than telson vesicle. Segments I–V, all intercarinal surfaces smooth to matte (figs. 9F, 10F); dorsal lateral carinae complete, serrate, terminating in conical spiniform granules posteriorly on I–IV, serrate in anterior third, becoming granular medially, terminating in moderately developed

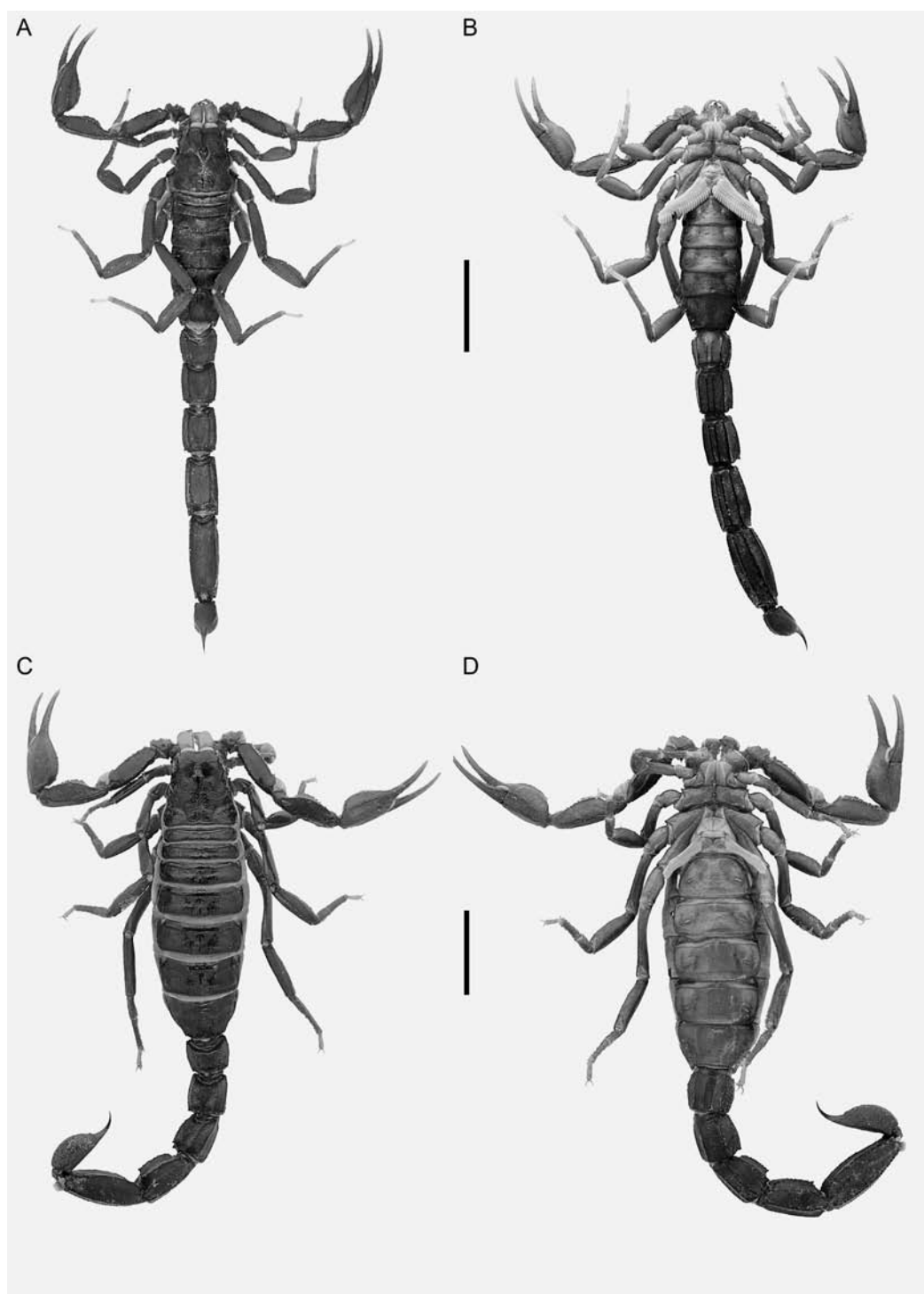


FIGURE 31. *Thorellius wixarika*, sp. nov., habitus, dorsal (A, C) and ventral (B, D) aspects. A, B. Holotype ♂ (CNAN T01251). C, D. Paratype ♀ (AMNH). Scale bars = 5 mm.

tubercle posteriorly on V; lateral median carinae serrate, terminating in conical spiniform granules posteriorly on I–III, lobate posteriorly on IV, serrate in anterior two-thirds, becoming granular posteriorly on V; lateral inframedian carinae complete, serrate on I, partial, serrate in posterior third on II, partial, granular in posterior quarter on III, absent on IV; ventral lateral carinae complete, costate in anterior two-thirds, granular in posterior third on I–III, granular on IV, complete, serrate on V; ventral submedian carinae complete, costate on I, complete, costate in anterior two-thirds, granular in posterior third on II and III, complete, granular on IV, serrate on V; ventral median carina moderately serrate on V. Macrosetal counts on carinae of segments I–V, respectively: dorsal lateral carinae, 1:2:3:3:6; lateral median carinae, 1:3:3:3:4; lateral inframedian carinae, 1:3:3:2:0, ventral lateral carinae, 3:4:4:4:13, with macrosetae on both sides of carinae; ventral sublateral carinae, 0:0:0:0:2; ventral submedian carinae, 3:3:3:4:4.

Telson: Vesicle relatively elongate; length 1.83/1.94× greater than width (table 6). Dorsal surface smooth. Ventral surface, anterior margin markedly granular, moderately granular posteriorly; ventral carinae each with three or four macrosetae. Subaculear tubercle moderate, comprising three or four minute granules (fig. 10F). Aculeus, laterobasal microsementation comprising 3–5 spinules.

DISTRIBUTION: *Thorellius wixarika* occurs in the lowlands along the Pacific coast between the Trans Mexican Volcanic Belt and the Sierra Madre Occidental, in the Mexican states of Jalisco, Nayarit, and probably Sinaloa (fig. 3).

ECOLOGY: *Thorellius wixarika* inhabits tropical deciduous forest at altitudes ranging from 126 to 977 m, where it has been collected under rocks during daytime, and on the surface, with UV light detection at night. The habitat and habitus are consistent with the lapidicolous ecomorphotype (Prendini, 2001).

ADDITIONAL MATERIAL EXAMINED: MEXICO: Jalisco: *Municipio de Puerto Vallarta:* Las Palmas, 8 km E [20°49'58.48"N 105°02'55.04"W],

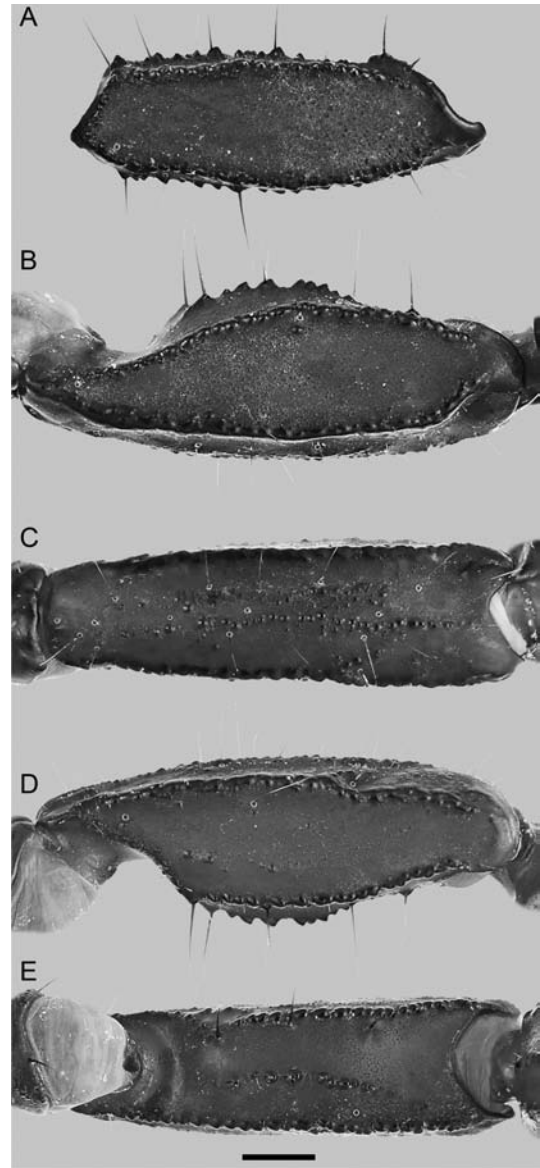


FIGURE 32. *Thorellius wixarika*, sp. nov., holotype ♂ (CNAN T01251), dextral pedipalp femur (A) and patella (B–E). A, B. Dorsal aspect. C. Retrolateral aspect. D. Ventral aspect. E. Prolateral aspect. Scale bars = 1 mm.

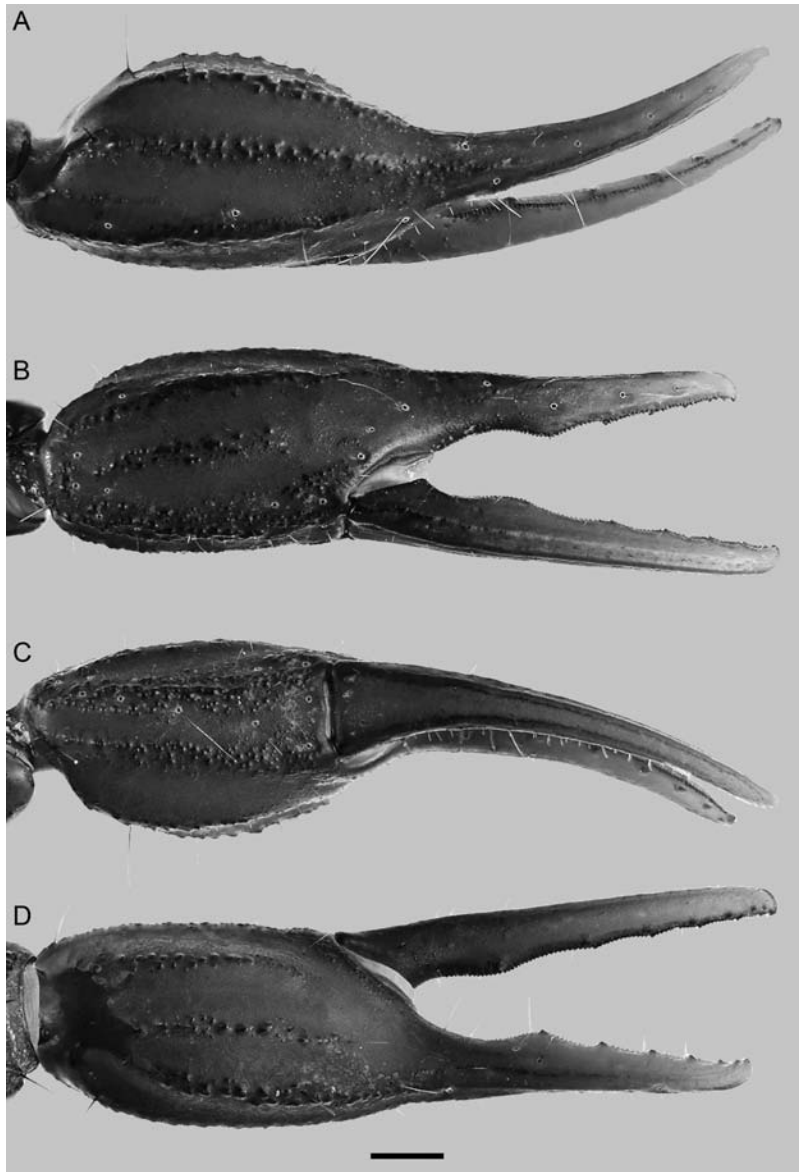


FIGURE 33. *Thorellius wixarika*, sp. nov., holotype ♂ (CNAN T01251), dextral pedipalp chela. A. Dorsal aspect. B. Retrolateral aspect. C. Ventral aspect. D. Prolateral aspect. Scale bars = 1 mm.

13.ix.2009, F. Cupul, tropical dry forest, 1 ♂ (CNAN SC3002); Puerto Vallarta, near La Palapa, 20°41.174'N 105°10.540'W, 173 m, 17.ii.2010, F. Cupul, 1 ♀ (CNAN SC3000); Puerto Vallarta, road to Veladero [20°36'47.67"N 105°13'34.77"W], 7.ii.2010, F. Cupul, under rocks, 1 subad. ♀ (CNAN SC2998); road to La Palapa [20°55'N

105°05'W], 16.ix.2004, F. Cupul, tropical dry forest, 2 juv. (CNAN SC3003). **Nayarit:** *Municipio de Compostela:* Compostela [21°14'16.53"N 104°54'2.74"W], 1.iv.1933, 1 juv. (AMNH); Compostela, 3.2 km N [21°12'51"N 104°56'19"W], 11.viii.1958, 1 ♀ (AMNH); Compostela, S of, 21°12'59.78"N 104°56'19.09"W, 3205 ft., 1.vii.2008,

R.C. West, under dry cow manure in pasture, 2 juv. (AMCC [LP 8678]). *Municipio de El Nayar*: La Mesa del Nayar [22°12'51.19"N 104°38'58.13"W], 16–21.vii.1955, B. Malkin, 1 ♀ (AMNH); Las Adjuntas, Río Santiago, 21°57'41"N 104°31'29"W, 245 m, 6.vi.1995, E. Barrera, 1 ♂ (CNAN SC3006), 22.xi.1995, E. Barrera, 1 subad. ♂ (CNAN SC3005). *Municipio de Ixtlán del Río*: Ixtlán del Río [21°01.8'N 104°22.2'W], 22.ix.1953, B. Malkin, 1 ♀ (AMNH). *Municipio de Jalisco*: Jalisco [21°27'N 104°54'W], 1956, Keef, 1 ♀ (AMNH). *Municipio de Nayarit*: Nayarit [21°44.633'N 105°13.7'W], 5.vi.1935, Maas, 5 juv. (AMNH). *Municipio de San Blas*: José María Mercado, El Infiernillo [22°34'33.74"N 105°16'39.23"W], 320 m, 23.ii.2008, J. Ponce, 1 ♀ (CNAN SC3010); Mecatán [21°32.136'N 105°07.1748'W], 244 m, 23.v.1949, G.M. Bradt, 1 ♂ (AMNH); San Blas [21°20.4'N 105°07.2'W], 6.viii.1964, C. and M. Goodnight, 1 ♀ (AMNH); San Blas, 8 km NE, 21°20.4'N 105°07.2'W, 14.v.1963, W.J. Gertsch and W. Ivie, 1 ♀ (AMNH). *Municipio de Santa María del Oro*: La Laguna [21°21'N 104°34'W], 20.viii.2002, P. Berea, 2 juv. (CNAN SC3001). *Municipio de Tepic*: El Colorado de La Mora, 21°42'39"N 104°38'51"W, 280 m, 29.xi.1995, E. Barrera, 1 subad. ♂, 1 subad. ♀ (CNAN SC3945), 25.viii.1991, W. López-Forment, 1 ♂ (CNAN SC3009); Jesus María Corte, 4 km N, 2 km along gravel road E of main paved road, ca. 30 km N of Tepic, 21°45.203'N 104°51.210'W, 126 m, 29.vii.2005, E. González, S. Reynaud, and R. Mercurio, tropical deciduous forest, UV detection at night, 2 subad. ♂ (AMCC [LP 4721]); Jesus María [20°40.000'N 104°16.002'W], 22–30.vi.1955, B. Malkin, 1 subad. ♀ (AMNH); Loma del Toro [21°00'N 104°16'W], 22.ix.1967, A. Villalobos, 1 ♀ (CNAN SC3944); Sierra de San Juan, km 22, El Izato–El Cora [20°54.804'N 105°24.282'W], 5.xii.1989, A. Cadena, 2 ♂ (CNAN SC3007); Tepic, 14.5 km S [21°30.50'N 104°53.583'W], 28.vii.1964, W.J. Gertsch and J. Woods, 1 ♀ (AMNH); Tepic, 24 km N [21°43'12.12"N 104°54'32.32"W], 25.vii.1954, W.J. Gertsch, 1 ♀ (AMNH); Tepic, 44 km S [21°5'39.41"N 104°52'55.73"W], 27.vii.1964, W.J. Gertsch and J. Woods, 1 ♂ (AMNH).

Thorellius yuyuawi, sp. nov.

Figures 4, 6D, 7E, 8G, 9G, 10G, 11G, 13I–K, 14F, I–K, 15M–O, 34–36; tables 7, 8

TYPE MATERIAL: **MEXICO: Jalisco:** *Municipio de Mezquitic*: Holotype ♂ (CNAN T01252), Mezquitic, 4 km N, 22°24.732'N 103°43.222'W, 1388 m, 6.vii.2005, O. Francke, J. Ponce, M. Córdova, A. Jaimes, G. Francke, and V. Capovilla. Paratypes: 4 ♂, 1 ♀, 3 juv. (AMNH [ARA 1172]), 1 subad. ♂, 1 subad. ♀, 1 juv. (AMNH [ARA 1849]), 3 ♂, 1 ♀, 1 subad. ♀, 3 juv. (CNAN T01253 [ARA 2009]), same data as holotype.

ETYMOLOGY: The species name *yuyuawi* is the word for grains of black maize in the language of the Wixarika people. The name refers to the smoothness and dark color of the integument, especially the chelae, of this species, which resembles kernels of black maize.

DIAGNOSIS: *Thorellius yuyuawi* may be distinguished from other species of *Thorellius* as follows. The carapace interocular surface of *T. yuyuawi* is relatively smooth, rather than shagreened as in the other species. All carinae of the pedipalp chela manus and the ventral lateral and ventral submedian carinae of metasomal segments II–IV are smooth in *T. yuyuawi* but partially or entirely granular in the other species. The dorsal lateral and ventral lateral carinae of metasomal segment V each bear 14 and 23 macrosetae, respectively, in *T. yuyuawi* but lower counts of macrosetae in the other species: 7 in *T. cristimanus*; 3 and 4, respectively, in *T. intrepidus*; 5 and 3, respectively, in *T. tekuaní*; and 6 and 13, respectively, in *T. wixarika*. Metasomal segments I and II are robust, and slightly wider than long in *T. yuyuawi* but relatively elongated in *T. intrepidus*, *T. tekuaní*, and *T. wixarika* (tables 4–7). *Thorellius yuyuawi* is dark brownish in color, unlike *T. intrepidus* and *T. tekuaní*, which are pale yellow to reddish. Adult *T. yuyuawi* usually measure less than 60 mm whereas adult male and female *T. intrepidus* usually measure 75 and 80 mm, respectively (tables 4, 7). The ventral retrolateral, ventral retrosubmedian, ventral median, and ventral prosubmedian carinae of the pedipalp chela manus are moderately devel-

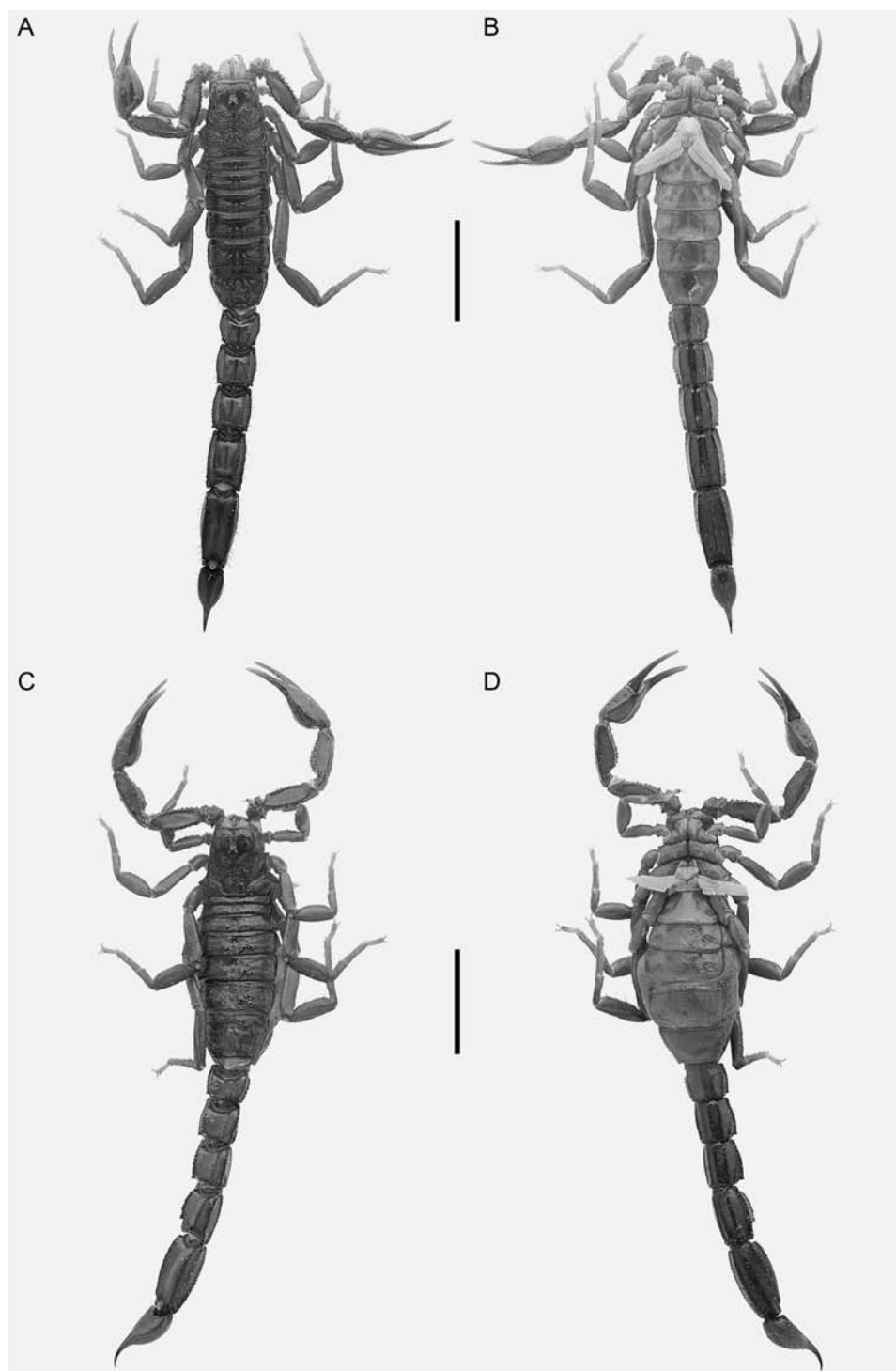


FIGURE 34. *Thorellius yuyuawi*, sp. nov., habitus, dorsal (A, C) and ventral (B, D) aspects. A, B. Holotype ♂ (CNAN T01252). C, D. Paratype ♀ (CNAN T01253 [ARA 2009]). Scale bars = 5 mm.

oped and smooth in *T. yuyuawi* but markedly developed, broad and irregularly granular in *T. intrepidus*. The notch and lobes of the pedipalp chela fingers are moderately to weakly developed in *T. yuyuawi* but markedly developed in *T. intrepidus*. The chela movable finger bears a single denticle at the seventh position in *T. yuyuawi* but a pair of prolateral denticles in *T. intrepidus*. All carinae of the pedipalp chela manus and the ventral lateral and ventral submedian carinae of metasomal segments II–IV are smooth in *T. yuyuawi* but granular to finely serrate in *T. wixarika*. The retrolateral dorsosubmedian and retrolateral median carinae of the pedipalp patella are smooth to obsolete in *T. yuyuawi* but partially or irregularly and densely granular in *T. wixarika*.

DESCRIPTION: The following description is based on the types and additional material examined.

Color and infuscation: Cheliceral manus dorsal surface base color yellowish orange, fingers darker, orange-brown, faintly infusate distally. Carapace, pedipalps, legs, tergites, sternites, and metasoma base color orange to dark brown. Carapace and tergites faintly infusate, more densely so along anterior and lateral margins. Coxosternal region slightly darker than carapace and tergites. Pedipalp femur and patella dorsal and retrolateral surfaces infusate, other surfaces immaculate; chela manus intercarinal surfaces immaculate; pedipalp carinae dark brownish, infusate, darker than intercarinal surfaces. Legs brownish orange, infusate. Genital operculum pale whitish to orange, immaculate. Pectines whitish to yellowish, immaculate. Metasoma intercarinal surfaces infusate, carinae darker, brownish, infusate. Telson vesicle reddish brown, dorsal surface completely infusate; ventral surface with three broad, longitudinal bands of infuscation, one median and two lateral; aculeus reddish to brownish.

Chelicerae: Manus dorsal surface smooth, with broad striate carinae subdistally and three macrosetae medially. Fixed and movable fingers smooth; movable finger, ventral surface with serrula, comprising 21/23 tines, in distal half.

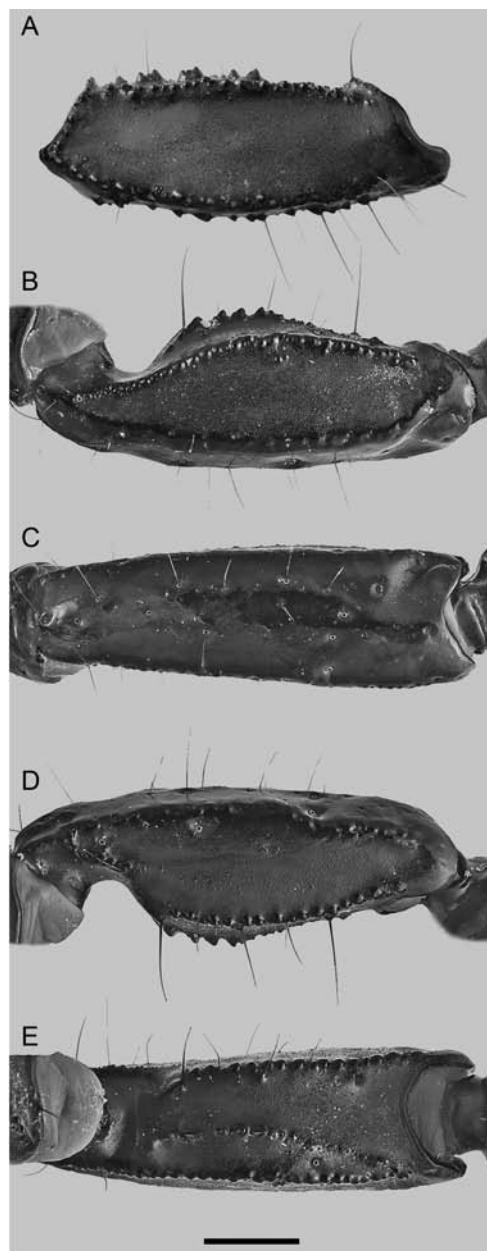


FIGURE 35. *Thorellius yuyuawi*, sp. nov., holotype ♂ (CNAN T01252), dextral pedipalp femur (A) and patella (B–E). A, B. Dorsal aspect. C. Retrolateral aspect. D. Ventral aspect. E. Prolateral aspect. Scale bars = 1 mm.

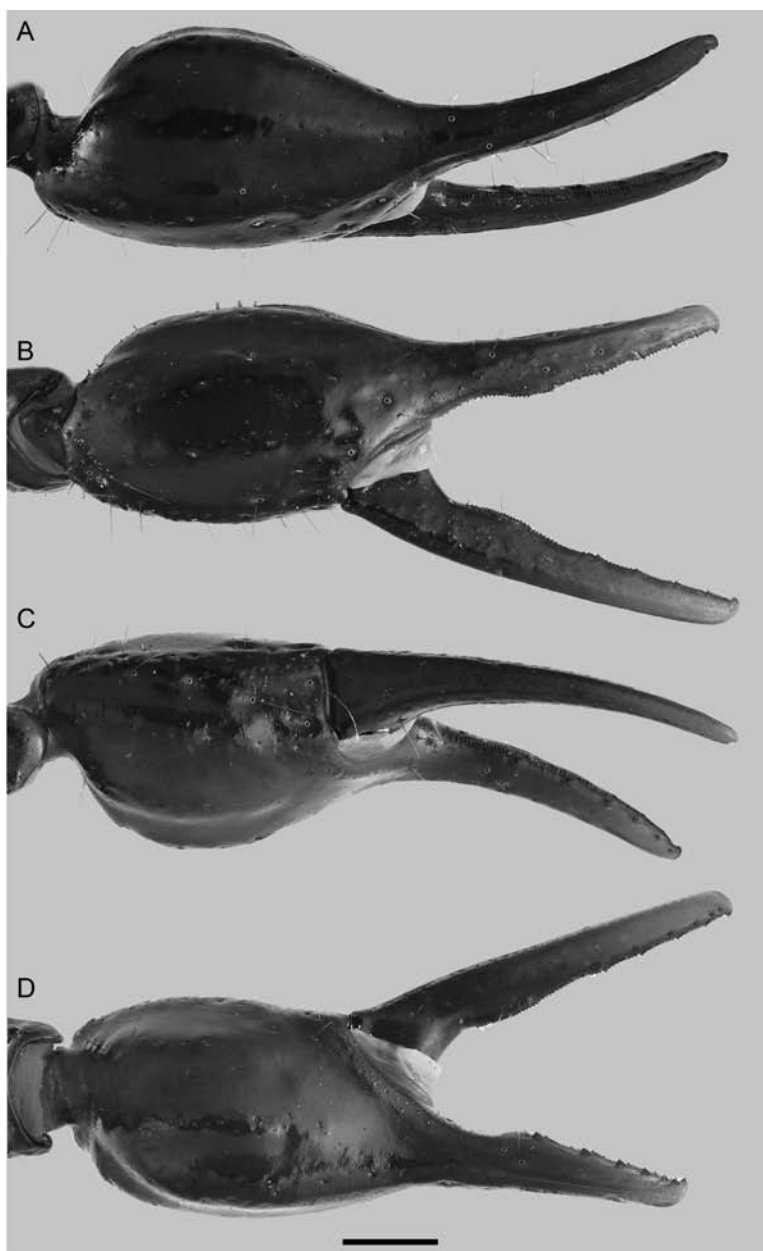


FIGURE 36. *Thorellius yuyuawi*, sp. nov., holotype ♂ (CNAN T01252), dextral pedipalp chela. A. Dorsal aspect. B. Retrolateral aspect. C. Ventral aspect. D. Prolateral aspect. Scale bars = 1 mm.

Carapace: Length 1.03/1.00× greater than posterior width (table 7). Anterior margin emarginate, with a moderate to shallow median notch, with five pairs of major and minor macrosetae (fig. 6D). Three pairs of lateral ocelli, anterolateral and median lateral pairs equal in size, posterolateral pair approximately half the size. Median ocular tubercle slightly raised, situated in anterior half of carapace, superciliary carinae smooth to weakly granular anteriorly, higher than median ocelli. Median ocelli approximately twice the size of anterior lateral ocelli. Anteromedian and posteromedian sulci deep and narrow, posterolateral and posterior transverse sulci shallow. Interocular surfaces smooth and matte, other surfaces shagreened, covered with fine and coarse, rounded granules (fig. 6D).

Coxosternal region: Sternum subequilateral pentagonal (fig. 7F); 0.71/0.79× longer than wide (table 7); median sulcus deep; surfaces matte, with four pairs of macrosetae, one pair anteriorly, two pairs medially, and one pair posteriorly on lobes. Coxae surfaces matte, smooth in places; coxa II subproximal margin with three oblique slitlike structures, adjacent to finely granular protuberance; coxal endite proximal margin with deep depression, medial margin finely granular, becoming smooth distally. Coxa IV 2.01/2.09× longer than coxa II (table 7).

Pedipalps: Femur intercarinal surfaces matte (fig. 35A); dorsal prolateral, dorsal retrolateral, and ventral prolateral carinae complete, granular; retrolateral dorsosubmedian carina partial, restricted to distal two-thirds, comprising row of serrate granules, becoming obsolete distally, with four major macrosetae; prolateral ventrosubmedian carina partial, comprising enlarged bicuspid tubercle proximally and row of five or six spiniform granules with three macrosetae; prolateral ventral carina partial, restricted to proximal half, comprising two bicuspid tubercles proximally and three large granules with macrosetae medially; retrolateral ventral, ventral median, and ventral retrosubmedian carinae vestigial, each reduced to short row of rounded or serrate gran-

ules proximally. Patella 1.10× wider than femur (table 7); retrolateral intercarinal surface smooth, other intercarinal surfaces matte (figs. 35B–D); dorsal prolateral and ventral prolateral carinae complete, granular; dorsal retrolateral and ventral retrosubmedian carinae complete, costate-granular; ventral median carina vestigial, reduced to row of granules proximally; retrolateral dorso-submedian and retrolateral median carinae obsolete, costate; prolateral process well developed; prolateral median carina partial, comprising proximal tubercle with major macroseta, row of serrate granules, medial macroseta, and distal granule; prolateral ventral carina vestigial, reduced to proximal and distal macrosetae, adjacent to ventral prolateral carina. Chela 1.56/1.45× longer than patella, 1.66/1.60× longer than femur (table 7). Manus slightly incrassate, 1.30/1.08× wider than patella, 1.45/1.20× wider than femur (table 7); intercarinal surfaces matte (fig. 36); dorsal prolateral, dorsal median, dorsal retrolateral, dorsal retrosubmedian accessory, prolateral median, ventral prolateral, and ventral retrosubmedian carinae vestigial, costate; retrolateral median carina obsolete, costate; ventral retrolateral carina partial, costate; other carinae absent. Fixed and movable fingers, dentate margins emarginate, fixed finger with shallow proximal notch and median lobe (fig. 36B, D), movable finger with shallow proximal lobe, fitting together unevenly such that moderate proximal gap evident when closed (♂) or dentate margins sublinear, notches and lobes obsolete, fitting together evenly such that almost no gap evident when closed (♀); fixed finger median denticle row comprising five denticle subrows flanked by six prolateral and six retrolateral subserrate denticles, retrolateral denticles comparatively smaller than prolateral denticles, proximal prolateral denticle situated in median half of finger; movable finger median row comprising six denticle subrows, flanked by seven prolateral and six retrolateral denticles, subpaired, terminal subrow comprising single denticle. Trichobothrial pattern type C, orthobothriotaxic; chela trichobothria *Db* and *Dt* situated dorsal to dorsal retrolateral

carina, *Db* subproximal on manus, *Dt* at mid-point of manus; *ib* and *it* situated subproximal on fixed finger (fig. 36D), *ib* between sixth prolateral denticle and seta demarcating position of seventh denticle, which is absent, *it* aligned with sixth prolateral denticle.

Legs: Basitarsi retrolateral dorsal, prolateral ventral, and retrolateral ventral spinule rows complete on I and II, retrolateral dorsal spinule row complete on III, partial, restricted to distal two-thirds of IV, prolateral ventral spinule row partial, restricted to distal third of III, absent on VI; retrolateral ventral spinule row complete on III, absent on VI; retrolateral median spinule row vestigial, reduced to few distal spinules on I–IV; macrosetal counts on legs I–IV, respectively: dorsal, 4:4:4:4; retrolateral dorsal, 2:3:4:4; prolateral ventral, 2:5:5:6, subdistal two spinules on II and subdistal three on IV stout; retrolateral ventral, 4:8:9:9, major and minor macrosetae interspersed; dorsal and retrolateral dorsal macrosetae arranged into two separate rows on I–IV. Telotarsi I–IV, each with single ventromedian row of spinules, curved proximally, and two or three pairs of ventrodistal spinules (fig. 11G).

Genital operculum: Width greater than length (fig. 7F), with six pairs of macrosetae. Sclerites separated, but unable to open more than 45° (♂) or fused longitudinally (♀). Genital papillae present, protruding posteriorly (♂) or absent (♀).

Hemispermaphore: Lamina 1.75× longer than trunk (table 8). Median lobe, ental terminus prominent, rounded, and protruding toward ental margin, two distal rims forming funnellike structure (figs. 13I, K, 14F). Dorsal trough margin long, narrow, curving proximally, well separated from ventral trough. Dorsal and ventral trough margins, terminal spinelike processes fused into prominent bifurcate hook, situated distally on lamina dorsal margin (fig. 13J, K). Basal plate of inner lobe well separated from ventral trough; spine of inner lobe short and moderately sclerotized. Hemimating plug developed from inner lobe; distal barb 0.75× longer than basal plate (table 8); distal barb margin with 18

short spinules; secondary spine on ventromedian side of distal barb long, with markedly sclerotized median stalk (fig. 15M–O).

Pectines: Basal piece with three pairs of major macrosetae. Marginal lamella comprising three sclerites. Medial lamella proximal sclerites fused, 14 distal sclerites separate (fig. 7F). Fulcra, 19–21 (♂), 17–19 (♀). Pectinal teeth, 20–22 (♂), 18–20 (♀). Pectines relatively long, midpoint (♂) or distal margin (♀) of medial sclerite of marginal lamella aligned with distal margin of coxa VI.

Tergites: Pretergites I–VII, surfaces matte. Posttergites I–VI, intercarinal surfaces shagreened, sparsely covered with fine and coarse granules, dorsal median and dorsal lateral carinae partial, restricted to posterior half, granular; VII, intercarinal surfaces moderately granular, dorsal median carina partial, restricted to anterior third, costate-granular, dorsal submedian carinae vestigial, costate anteriorly, dorsal lateral and lateral median carinae costate-granular, converging anteromedially, posterior granules larger, spiniform.

Sternites: Sternites III–VI, surfaces acarinate, matte; spiracles elongate, slitlike, approximately 2–4× longer than wide, becoming wider on posterior sternites; III with anteromedian triangular projection, bordered by pairs of macrosetae, protruding shallowly and paler than adjacent surfaces; V, posteromedian hyaline glandular area protruding shallowly and paler than adjacent surfaces (♂) or obsolete (♀); VII, posteromedian glandular area vestigial, protruding shallowly but not paler than adjacent surfaces (♂) or obsolete (♀); ventral submedian carinae obsolete, each with two pairs of macrosetae, ventral lateral intercarinal surfaces smooth, ventral lateral carinae weakly granular (♂) or obsolete (♀).

Metasoma: Metasoma 1.75/1.51× longer than mesosoma (table 7). Segments I–V, respectively 1.20/1.28, 0.99/1.07, 0.87/0.96, 0.66/0.69, 0.44/0.45× wider than telson vesicle; V, 1.4× wider than telson vesicle. Segments I–V, all intercarinal surfaces smooth (figs. 9G, 10G); dorsal lateral carinae complete, serrate, terminating in conical spiniform granules posteriorly on I–IV,

serrate in anterior third, becoming granular medially, terminating in moderately developed tubercle posteriorly on V; lateral median carinae complete, serrate, terminating in enlarged spiniform granules posteriorly on I–III, lobate posteriorly on IV, partial, serrate in anterior two-thirds, becoming granular posteriorly on V; lateral inframedian carinae complete, serrate on I, partial, serrate in posterior third on II, partial, granular in posterior quarter on III, absent on IV; ventral lateral carinae complete, costate on I–IV, serrate on V; ventral submedian carinae costate on I, costate-granular on II–IV, serrate on V; ventral median carina serrate on V. Macrosetal counts on carinae of segments I–V, respectively: dorsal lateral carinae, 2:3:5:7:14, with minor and major macrosetae interspersed on both sides of carina on V; lateral median carinae, 1:3:3:4:8; lateral inframedian carinae, 2:2:2:1:0; ventral lateral carinae, 3:4:5:6:23, with macrosetae on both sides of carinae; ventral sublateral carinae, 0:0:0:0:3; ventral submedian carinae, 3:5:5:5:4.

Telson: Vesicle relatively elongate; length 1.7× greater than width (table 7). Dorsal surface smooth. Ventral surface, anterior margin markedly granular, anterior third, moderately granular, smooth posteriorly; ventral carinae each with eight or nine macrosetae. Subaculear tubercle obsolete (fig. 10G). Aculeus, laterobasal microsemination comprising 3–5 spinules.

DISTRIBUTION: *Thorellius yuyuawi* is known only from the type locality in Jalisco, Mexico. It may also occur in Zacatecas, given the similar habitat and proximity of the type locality to the border of that state (fig. 4).

ECOLOGY: The type locality of *T. yuyuawi* is situated in a canyon that extends north to south between the Trans Mexican Volcanic Belt and the Sierra Madre Occidental. Unlike the distribution range of *T. wixarika*, however, which extends along the Pacific coast, this area extends along the interior side of the mountains. The only known specimens of *T. yuyuawi* were collected by UV light detection in tropical thorn forest at an altitude of 1388 m. The habitat and habitus of this species are con-

sistent with the lapidicolous ecomorphotype (Prendini, 2001).

ADDITIONAL MATERIAL EXAMINED: **MEXICO: Jalisco:** *Municipio de Mezquitic:* Mezquitic, 4 km N, 22°24.732'N 103°43.222'W, 1388 m, 6.vii.2005, O. Francke, J. Ponce, M. Córdova, A. Jaimes, G. Francke, and V. Capovilla, 1 ♀ (AMCC [LP 5266]).

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