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## Hidden in the cracks, a new species of Scorpion from Michoacan, Mexico (Scorpiones: Vaejovidae)

### Escondido en las grietas, una nueva especie de alacrán de Michoacán, México (Scorpiones: Vaejovidae)

Gerardo A. Contreras Félix<sup>1,\*</sup> and José L. Navarrete Heredia<sup>1</sup>

<sup>1</sup> Centro de Estudios en Zoología (CZUG), Centro Universitario de Ciencias Biológicas y Agropecuarias (CUC-BA), Universidad de Guadalajara (UdG), Zapopan, Jalisco. \*contrerasfelixga@gmail.com

#### ABSTRACT

A new species of *Vaejovis* is described for Michoacan, Mexico belonging to the *nigrescens/nitidulus* group, the less diverse group of species from the genus. This species has a preference for synanthropic environments and inhabits rock walls within the city limits. Additionally, the pictures of the hemispermatochore are presented and characters are named according to new terminology. This species is named honoring Dr. Gabriela Castaño Meneses for her great contributions to arthropods research in Mexico and the world.

**Key words:** diversity, endemism, sympatry, lithophilous.

#### RESUMEN

Se describe una nueva especie de *Vaejovis* de Michoacán, México la cual pertenece al grupo *nigrescens/nitidulus*, el grupo con menor diversidad del género. Esta especie tiene una preferencia por ambientes sinantrópicos y habita en paredes de piedra dentro de la ciudad. Adicionalmente se presentan fotografías del hemispermatochore y las características se nombran de acuerdo con la nueva terminología. Esta especie es nombrada en honor a la Dra. Gabriela Castaño Meneses, por su gran contribución a la investigación en artrópodos de México y el mundo.

**Palabras clave:** diversidad, endemismo, simpatria, litófilo.

Scorpions are one of the most adaptable species of animals, as they can inhabit different types of areas. Although most of the species can be found living under rocks, stumps or other litter in the floor; others inhabit the fallen leaves, the vegetation or even caves; but some species are specialized in inhabiting rock crevices.

The genus *Vaejovis* C.L. Koch, 1836 is the most diverse of the family with more than 70 species, all of them distributed between Mexico and the United States. The great diversity of this genus traditionally is divided in groups. Nowadays only three groups remain: *mexicanus* (36 spp.), *nigrescens/nitidulus* (13 spp.) and *vorhiesi* (26 spp.) (Contreras-Félix and Francke, 2019) (Table. 1). Only the *mexicanus* group has been revised recently (Contreras-Félix and Francke 2019), whereas the *vorhiesi* group has 9 species described on the last 10 years (Table 1); this left the *nigrescens/nitidulus* group neglected for almost 20 years since its last description of species and more than 30 years since its last revision (Sissom and Francke, 1985; Sissom, 1991; Zárate-Gálvez y Francke, 2009); although Soleglad and Fet (2005) split this group into the genus *Franckeus* and the group *nigrescens*, this separation must be proven with further research.

The *nigrescens/nitidulus* group can be distinguish for the following characters: smooth ventral medial carina on

metasomal segment I-V, the presence of a sclerotized mating plug, the long pedipalp chela and fingers (Sissom and Francke, 1985; Contreras-Félix and Francke, 2019) and finally the glandular white tips on each fingertip of pedipalp chela. Although, it has not been properly reviewed in almost 40 years, it remains a group with well-set characters that provide enough evidence to clearly incorporate new species, provide them resemble such characters. Here is described the newest species to be included in the *nigrescens/nitidulus* group, from Michoacan, Mexico.

#### MATERIAL AND METHODS

Nomenclature mensuration follows Stahnke (1970); trichobothrial, metasomal and pedipalps carinae terminology follows González-Santillán and Prendini (2013); lateral ocelli terminology follows Loria and Prendini (2014). Variation metasomal segment carina follows Santibáñez-López and Sissom (2010), leg telotarsi setae follows Contreras-Félix *et al.*, (2015). The hemispermatochore was dissected following Vachon (1952) and cleaned by hand with two entomological needles; terminology follows Chávez-Samayoa *et al.* (2022). Surfaces of the carapace, metasoma, and pedipalp were observed and photographed under UV light as described in Prendini (2003) and Volschenk (2005). Higher-level taxonomy of scorpions fol-

lows Santibáñez-López *et al.*, (2019). Measurements were taken with an ocular micrometer calibrated at 10X and are given in millimeters. Measurements and proportion are given inside parenthesis.

Abbreviations for depositories are as follows: CZUG—Centro de Estudios en Zoología, Universidad de Guadalajara and with codes according given according to the database of the collection (CZUG-Holotypes Arachnida “HA”-XXXX or Sco-XXXX); CNAN—Colección Nacional de Arácnidos, Instituto de Biología, Universidad Nacional Autónoma de México (UNAM). Other abbreviations used: L=length, W=width, D=Depth, C= carapace, MSI= metasomal segment I, MSV= metasomal segment V, V= vesicle, CG= caudal gland, F= pedipalp femur, P= pedipalp patella, CM= chela manus, FF= fixed finger. Proportions given in round brackets and variation ranges for females, if presents, are given after a hyphen -(2-2.1).

## RESULTS

**Scorpiones Linnaeus, 1752**

**Vaejovoidea Thorell, 1876**

**Vaejovidae Thorell, 1876**

**Vaejovinae Thorell, 1876**

**Vaejovis C.L. Koch, 1836**

***Vaejovis castanoae* sp. nov.**

Figures: 1 a-d; 2 a-d; 3 a-d; 4 a-d; 5 a-d; 6 a-d; 7 a-d; 8 a-c; 9 a-c; 10; table 2-4

<http://zoobank.org/2D433823-AC3B-48D1-BEF4-3387FC6C3F9F>

**Etymology:** The species epithet is a patronym named after Dr. Gabriela Castaño Meneses, one of the most prominent scientists in Mexico working on Arthropods communities in different environments.

**Holotype.** MEXICO, Michoacan, *Mpio:* Marcos Castellanos, perimetral wall of the local graveyard (N 19.99129, W 103.02834, 1965 masl.). October 20th, 2020. Collectors: J. Vargas and G. Contreras. 1 male, CZUG Types #CZUG-HA-0004. Paratypes: Same data as the holotype. 5 females (CZUG-HA-0005), 2 females (CNAN). Other material examined: MEXICO, Michoacan, *Mpio:* Marcos Castellanos, perimetral wall of the local graveyard (N 19.99129, W 103.02834, 1965 masl.). September 16th, 2020. Collectors: O. del-Pozo and G. Contreras, 4 females (Sco-00304). *Vaejovis nigrescens:* MEXICO, Michoacán, *Mpio:* Morelia, Colonia Obrera (19.710306, -101.182561, 1919 masl.). 3 males, 1 female. *V. intermedius:* MEXICO, Durango, *Mpio:* Mezquital, “La Joya” resort, on the way to aldea de los Pigmeos (23.46611, -104.36805, 1480 masl.). 3 males, 3 females. *V. janssi:* MEXICO, Socorro Island, Revillagigedo achipelago (18.79797, -110.97545, 922 masl.). 1 male, 5 females. *V. mitchelli:* MEXICO, Querétaro, *Mpio:* Jalpan de Serra, Concá river bank (21.45976, -99.6446, 571 masl.). 2 males, 2 females. *V. pococki:* MEXICO, Querétaro, *Mpio:* San Juan del Río, 2 km. south from Galindo (20.37671, -100.07878, 1959 masl.). 3 males, 3 females

**Diagnosis:** *Vaejovis castanoae* sp. nov. can be distin-

guished from *V. nigrescens* by the trochanter, femur, patella, and chela manus noticeable infuscate, whereas on *V. castanoae* sp. nov. those four segments are feebly infuscate to immaculate: *V. castanoae* sp. nov. presents shorter chela fingers compared with the chela manus length (fixed finger: 1-1.1; movable finger: 1.2-1.3), whereas on *V. nigrescens* fingers are larger (fixed finger: 1.2; movable finger: 1.5); basal lateral trough on *Vaejovis nigrescens* is broad and rounded, whereas on *V. castanoae* sp. nov. Blt is narrow and noticeable pointed, nearly on an angle of 45°. Other species geographically and morphologically close to *V. castanoae* sp. nov. is *V. intermedius*, but they can be differentiated by the infuscation on the carapace and tergites in *V. castanoae* sp. nov., whereas on *V. intermedius* if this coloration is present it is reduced to the margins of each part and the rest of the segments are immaculate; mesosomal sternite VII on *V. intermedius* presents more than 40 macrosetae, whereas *V. castanoae* always presents less than 20 macrosetae; lamina equal or longer than the 60% total length of hemispermatophore on *V. intermedius*, whereas on *V. castanoae* sp. nov. lamina is equal, never longer than the 50% of the hemispermatophore total length. *V. janssi* is another species closer to *V. castanoae* sp. nov. but can be differentiated by the presence of crenulate ventral median carinae on metasomal segment I on *V. janssi*, whereas on *V. castanoae* sp. nov. these carinae are obsolete; additionally, *V. janssi* presents a ventral retrolateral, ventral median and prolateral ventral carinae on chela manus complete and granular, whereas on *V. castanoae* sp. nov. these carinae are smooth to crenulate. *V. mitchelli* is another geographically and morphologically close species to *V. castanoae* sp. nov. but can be differentiated by the pectinal counts, *V. castanoae* sp. nov. has 21-21 in males and 18-20 in females, whereas *V. mitchelli* has 27-28 in males and 25-26 in females; the metasomal segment III is as long as wide in *V. castanoae* sp. nov, whereas on *V. mitchelli* is longer than wide (metasomal segment III L/W ratio in *V. castanoae* sp. nov. is 1-0.9 and in *V. mitchelli* is 1.10-1.13): fixed and movable fingers also differ between these two species, as *V. castanoae* sp. nov. does has 6 subrows of denticles on fixed finger and seven in movable finger, whereas *V. mitchelli* has 7 subrows of denticles on fixed finger and eight in movable finger. Finally, *V. pococki* is the last species close geographically and morphologically to *V. castanoae* sp. nov. but they differ as follows. Sternite VII with lateral carinae faint to obsolete on *V. pococki*, whereas on *V. castanoae* sp. nov. these carinae are evidently granular to crenulated; metasomal segment V is shorter, never twice longer than wide, in *V. castanoae* (ratio L/W 1.9-1.7), whereas on *V. pococki* is twice longer than wide (ratio L/W 2-2.1); additionally, metasomal segment V has all carinae weak to obsolete in *V. pococki*, whereas *V. castanoae* sp. nov. has all carinae granular.

**Description:** The following description is based on the type series including one male and five females adults of both sexes and additional material examined (4 females)

(Fig: 1).

*Color and infuscations:* Body base color yellowish (maintained on alcohol). Cheliceral manus dorsal surface densely infuscate on the anterior edge, becoming diffuse and reticular pigment on the two posterior thirds. Carapace densely infuscate on the margins, becoming diffuse toward the posterior third (Fig. 1). Pedipalp femur, dorsal prolateral carina densely infuscate, the rest of the carinae feebly infuscate; patella carinae faintly infuscate, except for the posterior third of the dorsal prolateral carina, which is densely infuscate; chela carinae noticeable infuscate in females, whereas on males they are faintly infuscate, base of the fixed and movable fingers densely infuscate. Coxosternal region, genital operculum and pectines immaculate (Fig: 1b). Legs noticeable infuscate. Mesosomal tergites infuscated, except for an immaculate line, running longitudinally just at the middle; sternites immaculate, except for the lateral carinae and the posterior edge of the tergite VII. Metasomal segments I-IV, dorsal lateral and lateral median carinae, faintly infuscate, lateral inframedian carina noticeable infuscate; ventral lateral and ventral submedian carinae completely infuscate; metasomal segment I, dorsal lateral and the two anterior thirds of the ventral face weakly infuscate, whereas on the posterior third is densely infuscate; segments II-IV, dorsal face, weakly infuscate, lateral faces densely infuscate and ventral face infuscate completely; segment V dark, completely infuscate. Telson vesicle base color yellowish to reddish, ventral and dorsal surfaces faintly infuscate.

*Chelicerae:* Manus dorsal surface smooth, with one macrosetae located on medially on anterior flat plate of manus (Fig. 2A). Movable finger ventral surface with serrula, comprising 23-25 tines in distal fifth.

*Carapace* (Fig: 2a): Length equal or slightly shorter than posterior width (0.96), carapace length equal to slightly shorter than the metasomal segment V length (0.95) and equal to shorter than femur length (0.96). Surface granular, except for the anterior ocular area, which is smooth to feebly granular. Anterior margin concave and straight and three macrosetae on each side (Fig: 2a). Lateral ocelli conform type 3A, PDMi small, almost vestigial, PLMA and MLMA subequal in size. Median tubercle prominent, situated in anterior half of carapace, superciliary carinae granular to crenulated. Median ocelli approximately two times the size of the anterolateral ocelli. Anteromedian and posteromedian sulcus deep and narrow, posterolateral sulcus shallow, and posterior transverse sulcus shallow.

*Coxosternal region* (Fig: 2b): Sternum subequilateral pentagonal, anterior width slightly greater than length (1.33-1.25). Median sulcus deep, ventral surfaces smooth with three pairs of macrosetae (Fig: 2b). Coxae ventral surface entirely smooth. Coxa II, prolateral proximal margin smooth, subproximally with two pairs of macrosetae on each side. Coxa IV length 1.5 the length of coxa II (1.5).

*Pedipalps:* Femur length more than three times greater than width (3.6) (Table 2); intercarinal surfaces shagreened to granular; dorsal prolateral, dorsal retrolateral and ventral

prolateral carinae complete granular (Fig: 3 a-d); ventral median and retrolateral ventral carinae complete granular; ventral retrosubmedian carina granular, on the proximal half of the segment; retrolateral dorsosubmedian carina partial, present only on the median part of the segment, comprising 10 to 14 granules; prolateral ventral and prolateral ventrosubmedian carinae vestigial, reduced to three to four conical granules with one macrosetae (Fig: 3d). Patella (Fig: 4 a-d) length more than three times greater than the width (3.4-3.3) and slightly wider than the femur (1.1); intercarinal surfaces shagreened; dorsal prolateral, dorsal retrolateral, ventral prolateral and ventral retrosubmedian carinae granular and complete; ventral median carina granular, present on the proximal third of the segment; prolateral ventral carina obsolete, only present by one or two macrosetae; prolateral process developed, prolateral median carina complete and granular, comprised by a line of isolated granules; retrolateral median carina weak and partial, comprising a broken row of granules; retrolateral dorsosubmedian carina vestigial, barely recognized by some granules on the middle of the segment. Chela length (1.8-1.7) times greater than patella length, (1.8-1.9) times greater than femur length; width (1.3-1.1) times greater than patella width, (1.5-1.3) times greater than the femur width. Manus tubular (Fig: 5 a-d); all intercarinal surfaces shagreened to minutely granular, with smaller granules than femur and patella; dorsal retrolateral, dorsal median and retrolateral median carinae complete, crenulate to costate, may present by unordered rows of faint granules; prolateral dorsal, dorsal prosubmedian and dorsal prolateral carinae fused, granular; prolateral median and prolateral ventrosubmedian carinae fused and noticeable granular; ventral prolateral and prolateral ventral carinae fused crenulated, becoming granular on the posterior half of the manus; ventral retrolateral and ventral retrosubmedian carinae partial, only present on the median half of the manus, comprised of an irregular row of granules; retrolateral median carina partial, granular, comprising three irregular rows of small granules; other carinae obsolete (Fig: 5 a-d). Fixed and movable fingers dentate margin linear, notches and lobes absent; fixed finger median denticle row comprising six denticle subrows flanked by six prolateral and retrolateral denticles, retrolateral denticles aligned with subrows; movable finger denticle row six denticle subrows, flanked by seven prolateral and six retrolateral denticles, terminal subrow usually comprising one single denticle; retrolateral denticles proximal to the prolateral denticles.

Trichobothrial pattern orthobothriotaxic type C; chela trichobothrium *Db* situated under dorsal retrolateral carina, in proximal fifth of manus; *Dt* situated in proximal half of manus above dorsal retrolateral carina (Fig: 5a); *ib* and *it* situated on the base of the fixed finger (Fig: 5d).

*Legs:* Basitarsi, prolateral ventral spinule rows on leg I-II complete, extending the whole length of the leg, incomplete in III absent on IV; retrolateral ventral spinule row on legs I-II partial, incomplete on III and absent on IV; ret-

rolateral dorsal spinule row on leg I, partial, only present on the posterior fifth, on leg II-III incomplete, absent on leg IV. Telotarsi, macrosetal count on I-IV, prointernal and retrointernal side: 1/0:2/1:2/1:3/2 (males), 1/0:1/1:2/1:3/2 (females). Two pairs of ventrodiscal spinules (Fig: 6 a-d).

*Genital operculum*: genital operculum (2-1.9) times wider than long with two to three macrosetae on the lateral half of each sclerite and several minor macrosetae on the near the median part of the sclerite; sclerites free longitudinally on anterior third, fused distally (male) or longitudinally (females); genital papillae present, protruding posteriorly (males) (Fig: 2b) or absent (females) (Fig: 2d).

*Hemispermaphore* (Fig: 7a-b): laminar measurements (mm), lamina length equal to the stem (1); Blt<sub>AL</sub>, 1.2; Clt<sub>AL</sub>, 0.6; Lcdc absent. Laminar antero-distal process vestigial, almost straight; laminar hooks bilobated. Capsular distal carina vestigial, never protruding from de lamina; basal lateral trough deep; capsular basal carina straight, without hooklets; clasper rounded and not evident. Stem axial carina prominent, slightly perpendicular to the posterior margin. Hemimating plug developed from the inner lobe; distal barb margin straight.

*Pectines*: basal piece with two pairs of macrosetae, eventually three pairs can be found. Marginal lamella comprising three sclerites (Fig: 2b, d). Medial lamella proximal four to five sclerites fused, thirteen (males and females). Fulcra, 20/20 (males) or 18/19 (females). Pectinal tooth count: 21 (males), 18-20 (females, n=10).

*Tergites*: tergites I-VII intercarinal surfaces pretergites and margin of anterior pretergites shagreened; tergite I granular on the posterior edge, tergite II-IV, postergite granular; dorsal median carina obsolete on I-II, weak on III and strong on IV-VII, dorsal lateral carina obsolete on I-VI. *Sternites*: sternites III-VI surfaces smooth, slit-like, minute spiracles minute more than three times longer than wide; sternite V, with a noticeable semicircular white glandular area, semicircular, present on the posterior margin (males); sternite VII intercarinal median surface smooth, shagreened to feebly granular laterally, 19 setae including one pair on posterior margin (Fig: 2c); ventral submedian carina well-developed, crenulated to granular, never reaching anterior or posterior edges on males, whereas females present it closer to posterior margin. Posterior margin of sternite VII slightly elevated at the middle.

*Metasoma* (Fig 8 a-c): length (1.6 -1.2) times greater than mesosoma length. Segment I-V length (0.8), (1-0.9), (1-0.9), (1.2-1.1), (1.7-1.9) times greater than width respectively; ventral intercarinal surfaces completely smooth, lateral and dorsal surfaces shagreened, with some scattered granules dispersed along each face mostly smooth; dorsal lateral carinae complete granular terminating in enlarged spiniform granules posteriorly on segments I-IV, on V comprising several unordered rows of rounded granules; lateral median carinae complete, granular terminating in enlarged spiniform granules posteriorly on I-III, lobate posteriorly on IV, partial, granular on the anterior four fifths on V; lat-

eral inframedian carinae complete, granular on I, partial restricted to posterior third, granular on II-III, absent on IV; ventral lateral carinae complete, granular (males), granular to crenulated (females) on I-V; ventral submedian carinae complete, smooth (males), smooth to obsolete (females) on I-IV; ventral median carina complete granular on V (Fig. 8c). Macrosetal count on carinae segments I-V, respectively: dorsal lateral 0/1/1/2/6; lateral median, 0-1/1/2/4/3; lateral inframedian, 3-2/2/2-1/1; ventral lateral, 3/3/3/3/6; ventral lateral, 2/3/3/3/5; full variation is presented on table 3.

*Telson* (Fig: 9 a-c): vesicle elongated, length (2.3-2.1) greater than width, (4.7-4.3) times greater than aculeus length. Dorsal surface smooth, except for the lateral edges that are crenulated, without hyaline glandular area, flat. Ventral surface finely granular; subaculear tubercle obsolete. Aculeus laterobasal microserration absent.

*Natural history*: The adults of this species were collected past the rain season at the beginning of the fall and is sympatric with *Centruroides ornatus* Pocock, 1902, as both species are occupying the same habitat, although *C. ornatus* is more abundant than *V. catanae* sp. nov.

*Habitat*: *Vaejovis castanae* sp. nov. is a species that inhabits exclusively on the crevices of rock wall. It was collected during the night, with the aid of UV lights. This species was only located on the wall of the town graveyard. *Distribution*: This species is only known from the type locality. Although further collections were made on the surrounding areas, but these collections were unsuccessful (Fig: 10).

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Table 1. List of species of the three recognized groups of the genus *Vaejovis* C.L. Koch, 1836.

Species of <i>Vaejovis</i> and the group where they are affiliated		
“mexicanus” group	“nigrescens/nitidulus” group	“vorhiesi” group
<i>V. aguazarca</i> Díaz-Plascencia & González-Santillán, 2022	<i>V. carolinianus</i> (Beauvois, 1805)	<i>V. baggins</i> Azzinnari, Bryson, Graham, Solís-Rojas & Sissom, 2021
<i>V. aquascalentensis</i> Chávez-Samayoa & González-Santillán, 2022	<i>V. curvidigitus</i> Sissom, 1991	<i>V. bandido</i> Graham, Ayrey & Bryson, 2012
<i>V. ceboruco</i> Contreras-Félix & Francke, 2019	<i>V. davidi</i> Soleglad & Fet, 2005	<i>V. bigelowi</i> Sissom, 2011
<i>V. chiapas</i> Sissom, 1989	<i>V. decipiens</i> Hoffmann, 1931	<i>V. cashi</i> Graham, 2007
<i>V. coalcoman</i> Contreras-Félix & Francke, 2014	<i>V. gracilis</i> Gertsch & Soleglad, 1972	<i>V. chisos</i> Sissom, 1990
<i>V. darwini</i> Santibáñez-López & Francke, 2010	<i>V. intermedius</i> Borelli, 1915	<i>V. crumpi</i> Ayrey & Soleglad, 2011
<i>V. dugesi</i> Pocock, 1902	<i>V. janssi</i> Williams, 1980	<i>V. deboerae</i> Ayrey, 2009
<i>V. dzahui</i> Santibáñez-López & Francke, 2010	<i>V. jonesi</i> Stahnke, 1940	<i>V. electrum</i> Huges, 2011
<i>V. franckei</i> Sissom, 1989	<i>V. mauryi</i> Capes, 2001	<i>V. elii</i> Ayrey, 2020
<i>V. granulatus</i> Pocock, 1898	<i>V. mitchelli</i> Sissom, 1991	<i>V. feti</i> Graham, 2007
<i>V. maculosus</i> Sissom, 1989	<i>V. nigrescens</i> Pocock, 1898	<i>V. grahami</i> Ayrey & Soleglad, 2014
<i>V. macwesti</i> Sissom, Graham, Donaldson & Bryson Jr., 2016	<i>V. ocotensis</i> Zárate-Gálvez & Francke, 2009	<i>V. grayae</i> Ayrey, 2014
<i>V. mendozai</i> Contreras-Félix & Francke, 2021	<i>V. pococki</i> Sissom, 1991	<i>V. halli</i> Ayrey, 2012
<i>V. mexicanus</i> C.L. Koch, 1836	<i>V. solegladi</i> Sissom, 1991	<i>V. islaserrano</i> Barrales-Alcalá, Francke, Van Devender & Contreras Félix, 2018
<i>V. montanus</i> Graham & Bryson Jr., 2010		<i>V. lapidicola</i> Stahnke, 1940
<i>V. monticola</i> Sissom, 1989		<i>V. miscionei</i> Mayers & Ayrey, 2021
<i>V. morelia</i> Miranda-López, Ponce-Saavedra & Francke, 2012		<i>V. patagonia</i> Ayrey, 2018
<i>V. nanchititla</i> Contreras-Félix & Francke, 2019		<i>V. paysonensis</i> Soleglad, 1973
<i>V. nigrofemoratus</i> Hendrixson & Sissom, 2001		<i>V. pequeno</i> Hendrixson, 2001
<i>V. norteno</i> Sissom, González-Santillán & Pérez, 2004		<i>V. stetsoni</i> Ayrey & Mayers, 2019
<i>V. prendinii</i> Santibáñez-López & Francke, 2010		<i>V. tenuipalpus</i> Sissom, Hughes, Bryson Jr. & Prendini, 2012
<i>V. pusillus</i> Pocock, 1898		<i>V. trinityae</i> Ayrey, 2013
<i>V. rossmani</i> Sissom, 1989		<i>V. troupi</i> Ayrey & Soleglad, 2015
<i>V. santibagnezi</i> Contreras-Félix & Francke, 2019		<i>V. vaquero</i> Gertsch & Soleglad, 1972
<i>V. setosus</i> Sissom, 1989		<i>V. vorhiesi</i> Stahnke, 1940
<i>V. sierrae</i> Sissom, Graham, Donaldson & Bryson Jr., 2016		
<i>V. smithi</i> Pocock, 1902		
<i>V. sprousei</i> Sissom, 1990		
<i>V. tenamaztlei</i> Contreras-Félix, Francke & Bryson Jr., 2015		
<i>V. tessellatus</i> Hendrixson & Sissom, 2001		
<i>V. talpa</i> Contreras-Félix & Francke, 2019		
<i>V. tapalpa</i> Contreras-Félix & Francke, 2019		
<i>V. tilae</i> Contreras-Félix, del-Pozo & Navarrete-Heredia, 2023		
<i>V. trespicos</i> Zárate-Gálvez & Francke, 2009		
<i>V. zapoteca</i> Santibáñez-López & Francke, 2010		

Table 2. Measurements of the type series of *V. castanoae* sp. nov.

	<b>Holotype</b> ♂ CZUG- HA-0004	Sco-0304 ♀	Sco-0304 ♀	Sco-0304 ♀	Sco-0304 ♀	CZUG- HA-0005 ♀	CZUG- HA-0005 ♀	CZUG- HA-0005 ♀	CZUG- HA-0005 ♀
Total L	39	46.6	45.2	45.9	38.6	42.5	43.4	45.5	43.4
Carapace L	4.7	5.8	5.5	5.3	5	5.2	5.2	5.3	5.3
Carapace W	2	3.1	3	3.2	2.7	2.9	3	3.3	3.1
Carapace posterior W	4.8	6	5.9	5.7	5	5.5	5.5	5.5	5.7
Mesosoma L	11	14.9	15.2	15.3	12.7	14.3	14	15.1	13.9
MSI L	2.6	2.8	2.6	2.7	2.3	2.5	2.4	2.7	2.7
MSII L	2.9	3.1	2.9	3	2.5	2.8	2.9	3	3
MSIII L	3.2	3.4	3.2	3.3	2.6	3	3.2	3.3	3.2
MSIV L	3.6	4	3.9	4	3.2	3.5	3.8	3.9	3.8
MSV L	5.3	6.2	5.8	5.9	5.1	5.2	5.7	5.9	5.4
Metasoma total L	17.6	19.5	18.4	18.9	15.7	17	18	18.8	18.1
SM I/V W	3/2.8	2.7/2.7	3.6/3.5	3.5/3.4	2.9/2.8	3.5/3.5	3.5/3.4	3.5/3.5	3.4/3.3
SM I deepht	2.4/2.3	3/2.9	2.7/2.6	2.8/2.7	2.8/2.3	2.8/2.8	2.8/2.8	2.8/2.7	2.8/2.6
Telson to- tal L	5.7	6.4	6.1	6.4	5.2	6	6.2	6.3	6.1
Vesicle L/W/D	4.7/2/1.7	5.3/2.7/2	5/2.5/2	5.1/2.4/1.8	4.2/2.1/1.5	5/2.3/1.8	5/2.3/1.8	5.1/2.5/1.9	5/2.4/1.8
Femur L/W/D	5/1.3/0.8	5.9/1.7/1	5.6/1.6/1	5.6/1.5/0.9	5/1.3/0.8	5.5/1.4/0.9	5.4/1.6/1	5.6/1.5/0.9	5.5/1.5/0.9
Patella L/W/D	5.2/1.5/1	6.3/1.9/1.4	5.9/1.8/1.2	5.8/1.8/1.1	5.2/1.5/1.1	5.8/1.7/1.2	5.8/1.6/1.1	5.9/1.8/1.2	5.9/1.7/1.2
Chela manus L/W/D	4.2/2/1.9	4.8/2.1/2.2	4.5/2/2	4.5/2/2	4/1.7/1.7	4.4/2/2.1	4.4/2/2	4.4/2/2.1	4.4/2/2.1
Fixed finger length	4.3	5	4.5	4.8	3.9	4.3	4.5	5	4.7
Movable finger length	5.2	6.1	6	6	5	5.8	5.8	6.2	6.1
Pectinal tooth count	21-21	18-19	18-18	18-20	18-18	19-20	18-18	18-19	18-18



Table 3. Telotarsal macrosetal counts of the type series of *V. castanoae* sp. nov.

Metasomal carinae	Holotype ♂				
	CZUG-HA-0004	Sco-0304	Sco-0304	Sco-0304	Sco-0304
DL	0/1/1/2/6	0/1/1/3/6	0/1/1/3/6	0/1/1/2/7	0/1/1/2/7
LM	0-1/1/2/4/3	0/2/2/3-4/3-4	0/2/2/4/4	0/2/2/3-4/3-4	0/2/2/4/4
LI	3-2/2/2-1/1	2/1/1/2-1	1/2/2/1	2/2-1/2°	2-3/2/2/1
VL	3/3/3/3/6	2/3/3/3/5-6	3/3/3/4/6	2/3/3/3-4/6	3/3/3/5/7
VS/M	2/3/3/3/5	3/3/3/3/4	3/3/3/3/5	2/3/3/3/6	3/3/3/3/6
Segment 7		14	13	18	19
					16
Metasomal carinae	CZUG-HA-0005				
	CZUG-HA-0005	CZUG-HA-0005	CZUG-HA-0005	CZUG-HA-0005	CZUG-HA-0005
DL	0/1/2/3/6	0/1/1/2/6-7	0/1/1-2/3/5	0/1/1/2-3/7	0/1/1/2/6-7
LM	0/2/2/4/3-4	0/2/2/4/4	0/1-2/2/4/3	0/2/2.3/4-5/3	0/2/2/3-4/3
LI	3-2/2/2/2-1	3/2/2/2-1	2/2/1-2/1	3-2/2/2/1	2/2/2/1
VL	3-2/3/4-3/4-3/7	3/3/3/4/7	3/3/3/4/5	3/3/3/5/7	3/3/3/3/6
VS/M	2/3/3/3/6-5	2/3/3/3/6	2/3/3/3/6-4	2/3/3/4/5	3/3/3/3/6
Segment 7		17	17	17	19



Figure 1. Habitus of *V. castanoae* sp. nov. a- Holotype male, dorsal view; b- holotype male, ventral view; c- female paratype, dorsal view; d- female paratype, ventral view. Scale 1 cm.

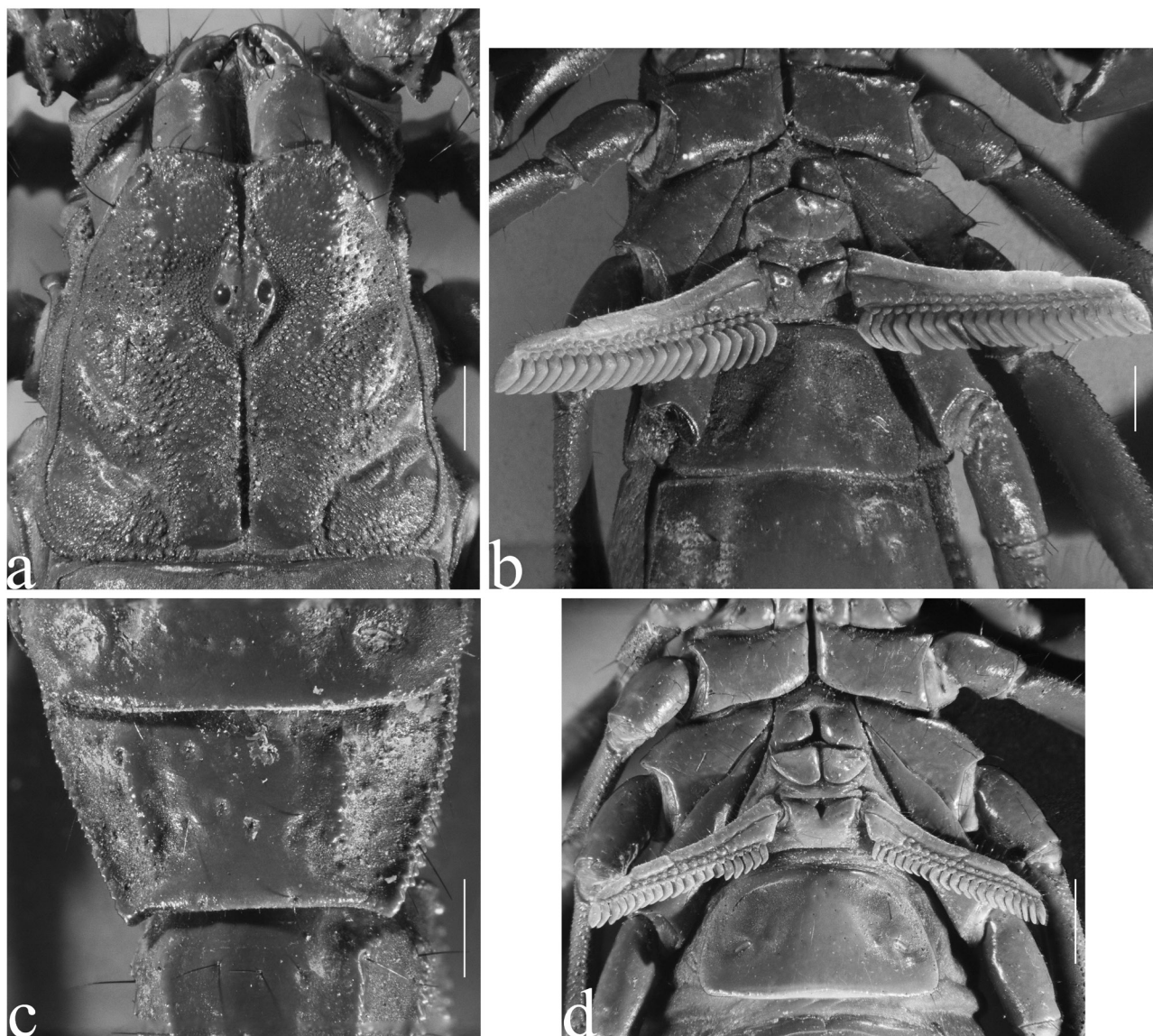


Figure 2. Different characters of *V. castanoae* sp. nov. a- Carapace holotype male, dorsal view; b- pectens, holotype, male, ventral view; c- mesosomal segment VII, holotype male, ventral view; c- pectens, paratype female, ventral view. Scale 1 mm.

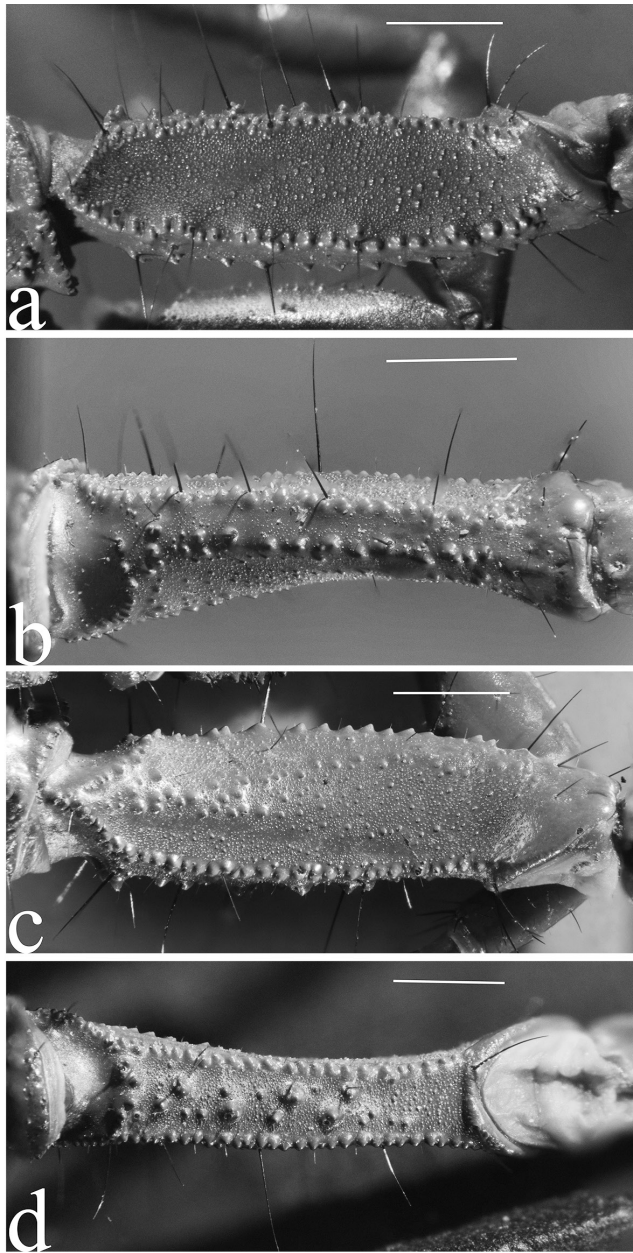


Figure 3. Femur, holotype male. a- Dorsal view; b- retrolateral view; c- ventral view; d- prolateral view. Scale 1 mm.

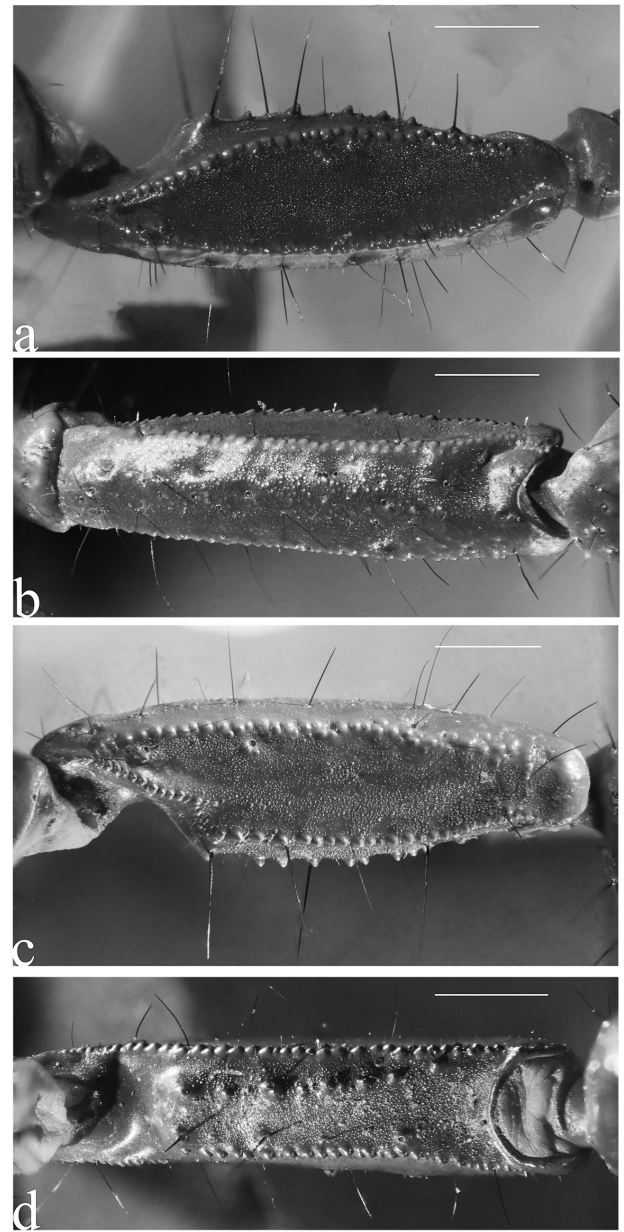


Figure 4. Patella, holotype male. a- Dorsal view; b- retrolateral view; c- ventral view; d- prolateral view. Scale 1 mm.

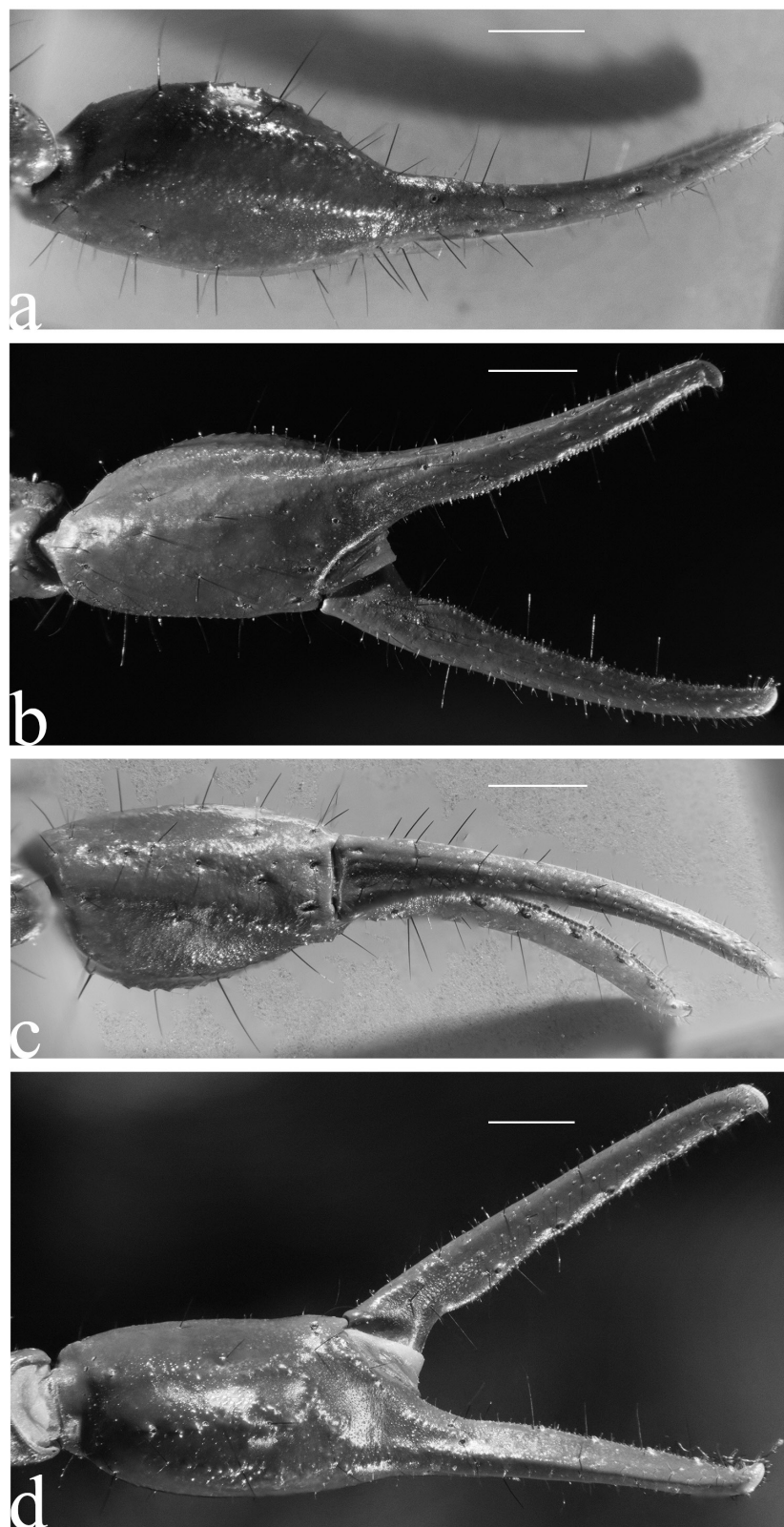


Figure 5. Chela, holotype male. a- Dorsal view; b- retrolateral view; c- ventral view; d- prolateral view. Scale 1 mm.

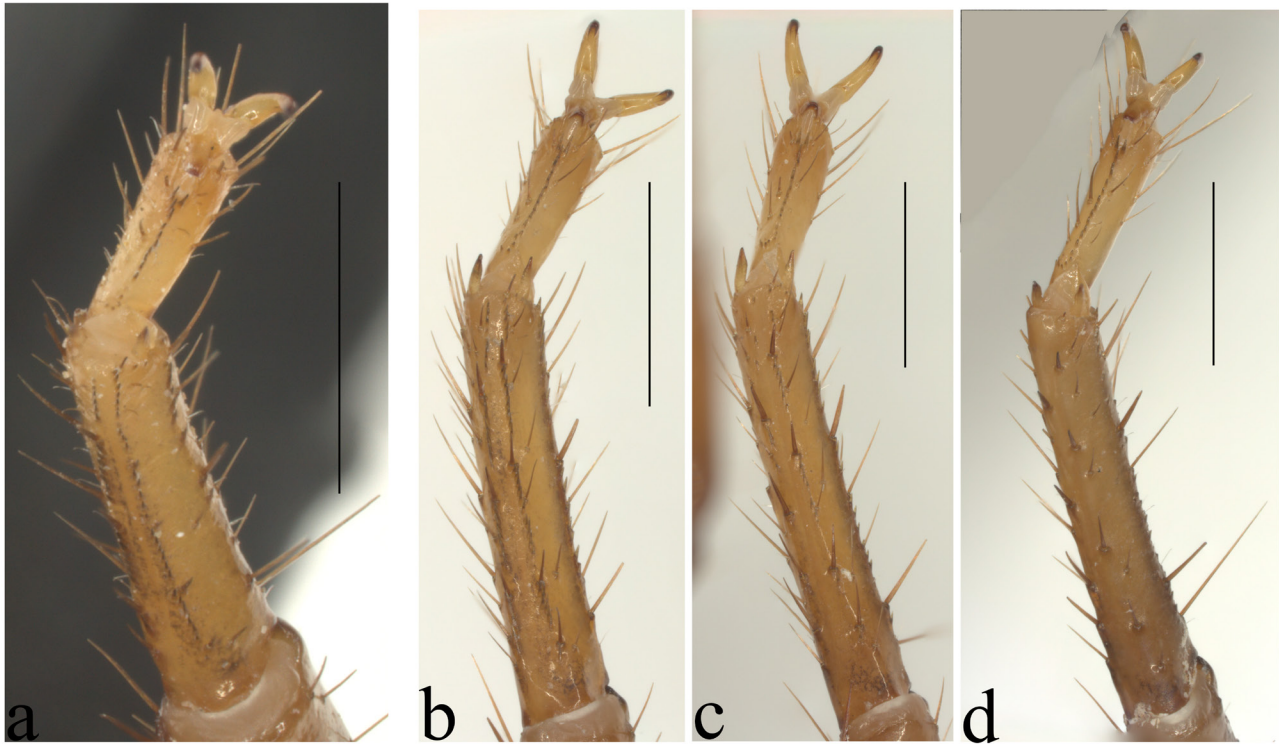


Figure 6. Legs, holotype male. a- leg I, ventral view; b- leg II, ventral view; c- leg III, ventral view; d- leg IV, ventral view. Scale 1 mm.

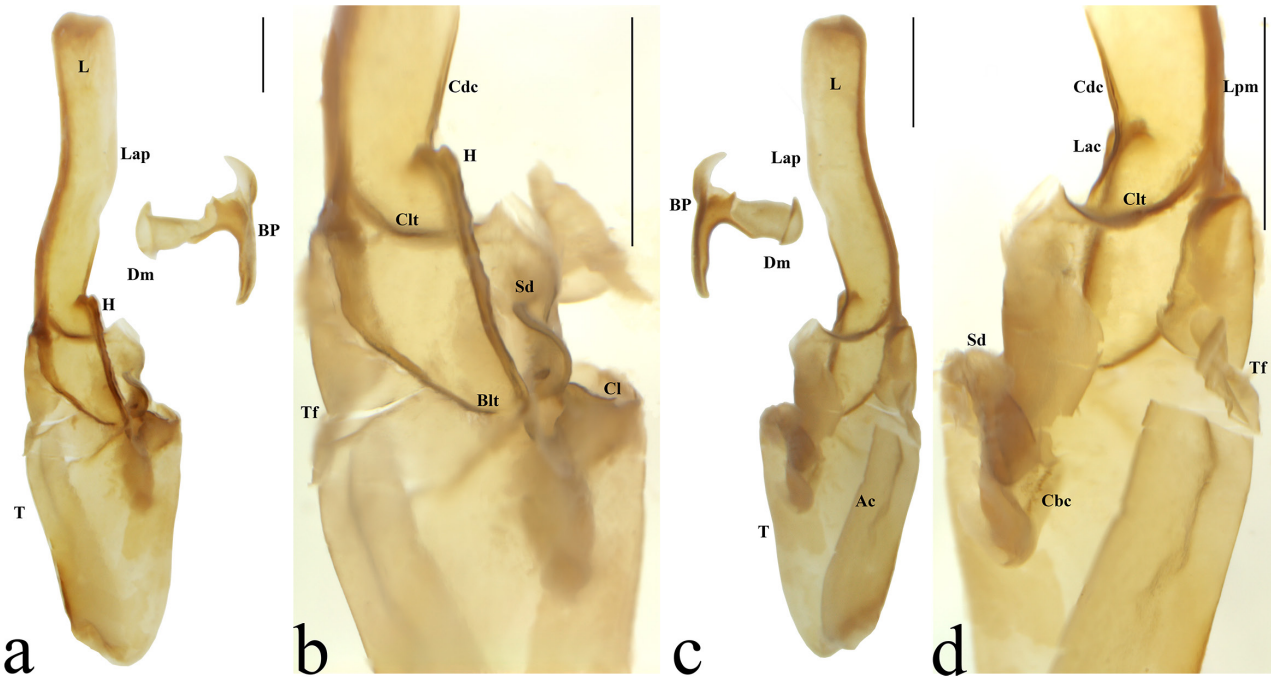


Figure 7. Hemispermatophore holotype male. a- Hemispermatophore and hemimating plug, ectal view; b- close up to the hemispermatophore, ectal view; c- hemispermatophore and hemimating plug, ental view; d- close up to the hemispermatophore, ental view. Scale 1 mm. Abbreviations: **Ac**, axial carina. **Bp**, basal plate. **Blt**, basal lateral trough. **Cbc**, capsular basal carina. **Cdc**, capsular distal carina. **Cl**, clasper. **Clt**, contralateral trough. **Dm**, distal margin. **H**, laminar hooks. **L**, lamina. **Lap**, laminar antero-distal process. **Lpm**, laminar posterior margin. **Sd**, sperm duct. **T**, trunk. **Tf**, truncal flexure.

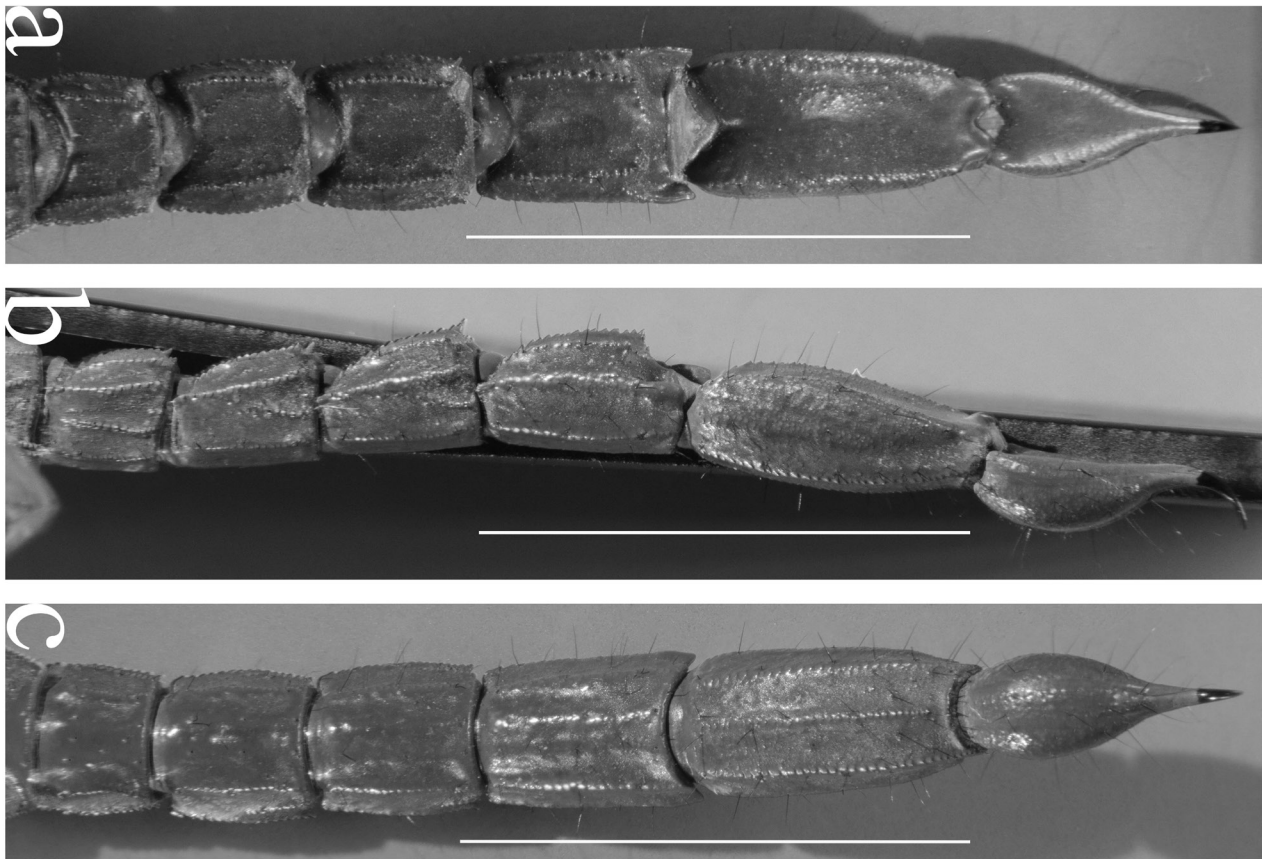


Figure 8. Metasoma, holotype male. a- Dorsal view; b- lateral view; c- ventral view. Scale 1 cm.

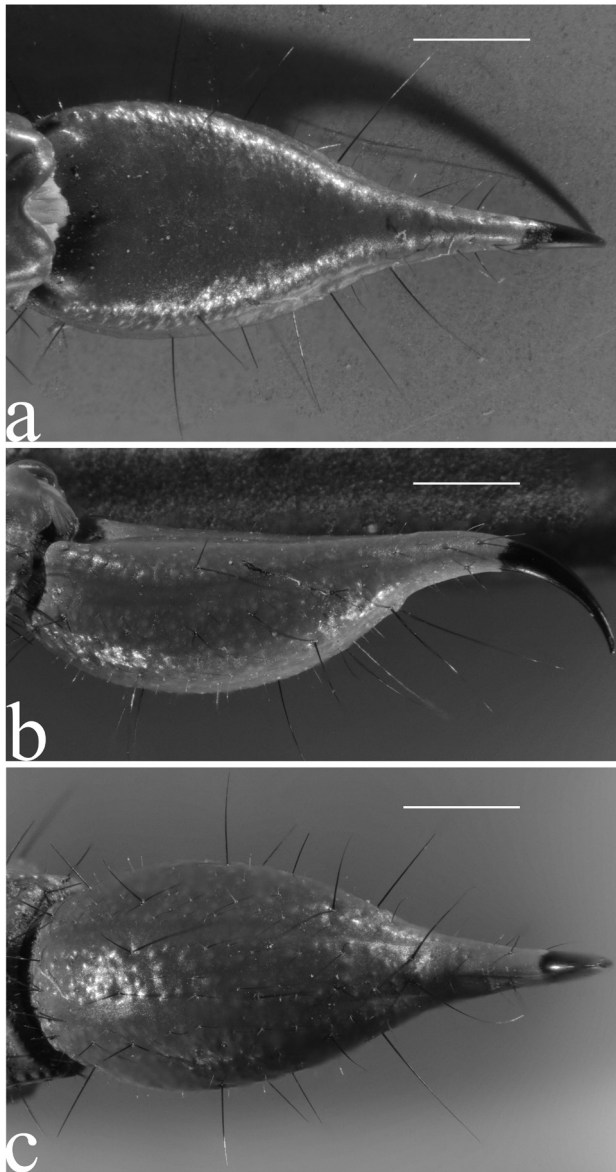


Figure 9. Telson, holotype male. a- Dorsal view; b- lateral view; c- ventral view. Scale 1 cm.

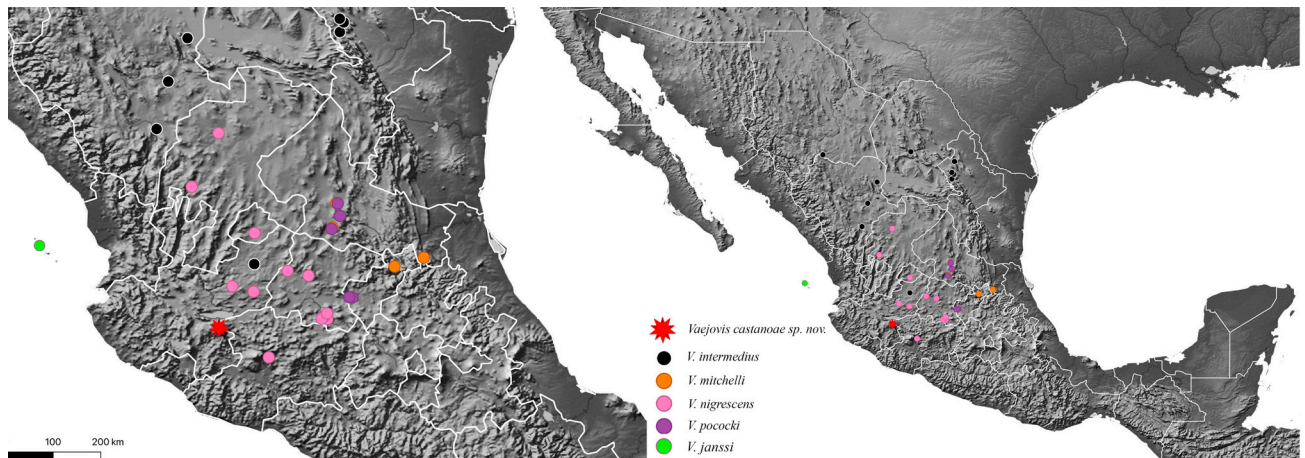


Figure 10. Map with the known distribution on *V. castanoae* sp. nov.