

A new species of *Vaejovis* (Scorpiones: Vaejovidae) from Coahuila and Nuevo León, and a key to the vaejovid species from northeastern and north-central México

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Abstract

Vaejovis glabrimanus **sp. nov.**, a member of the *Vaejovis eusthenura* group, is described from the southern parts of the states of Coahuila and Nuevo León in México. Comparisons are provided to distinguish the species from related and similar forms in the region, including *V. coahuilae*, *V. globosus*, and *V. russelli*. In addition, a key to the vaejovid scorpion fauna of northeastern and north-central México (i.e., eastern Chihuahua, northeastern Durango, Coahuila, Nuevo León, and Tamaulipas) is provided.

Key words: Scorpion, taxonomic key

Introduction

Hoffmann (1931) produced the first monograph on the scorpions of México. In that work, only four vaejovid species were suggested to occur in northeastern and north-central México, a large geographical area considered herein to include the states of Coahuila, Nuevo León, and Tamaulipas, as well as the Chihuahuan Desert regions in eastern Chihuahua and northeastern Durango. Only *Vaejovis intermedius* Borelli was actually seen by Hoffmann, based on a record from Nombre de Dios, Durango; two other species (*V. crassimanus* Pocock and *V. globosus* Borelli) were listed solely on the basis of Borelli's old records from Dinamita, Durango (Borelli 1915). The presence of a fourth species in the area, *Vaejovis bilineatus* Pocock, could be inferred because it was originally described from San Diego, Texas (now known to be an erroneous locality) and then reported by Hoffmann (1931) from Aguascalientes.

Several decades later, an intensive study of the Cuatrociénegas area of Coahuila was produced by Williams (1968); in that paper he described five new species of vaejovids, two of which are now synonyms. This was followed by descriptions of a number of new vaejovid taxa now assigned to the genera *Serradigitus* (Soleglad 1974), *Paruroctonus* (Haradon 1985), and *Vaejovis* (Sissom 1989, 1990, 1991; Sissom & Francke 1985). Other papers presented new records of previously described species (Gertsch & Soleglad 1966; Francke 1977a; Yahia & Sissom 1996).

In general, the scorpion fauna of this area remains incompletely known (Sissom & Hendrixson 2005). Currently, 27 species have been reported, and 16 of these (61.5%) are vaejovids. The Vaejovidae is the largest North American scorpion family, with 146 described species on the continent. One hundred seven species (some polytypic) are known to occur throughout México.

Many of the vaejovid species reported from northeastern and north-central México are documented from only one or a few records. However, most of these are well known from southern Texas, New Mexico, and southeastern Arizona in the USA. There are no taxonomic keys available for the scorpions of this region, and workers must rely on scattered taxonomic descriptions in order to identify specimens. One of the purposes here is to provide a key for the identification of known vaejovid species of the area.

Among miscellaneous scorpion material from northern México received by the first author, a new species of *Vaejovis* was identified and is described below. It clearly belongs to the *eusthenura* group, which is characterized by: the possession of smooth pedipalp chelae, polytrichous metasomal carinae, trichobothria *ib* and *it* positioned distally at the level of the 6th inner accessory denticle of the chela fixed finger denticle row, the hemispermatophore with an ectal flange and a sperm plug armed with hooklets, the telotarsi of the legs with five or six distal spinules flanking the ventromedian spinule row, and the cheliceral serrula weak or absent. Additional characters for the group are provided by Williams (1970, 1980).

Only four other *eusthenura* group species occur within the considered area: *V. coahuilae* Williams, *V. globosus* (= *V. gilvus* Williams), *V. waueri* Gertsch & Soleglad, and *V. bilineatus*. In size and morphology, *Vaejovis coahuilae* and *V. globosus* appear to represent the closest relatives of the new species. *Vaejovis coahuilae* ranges from central Coahuila, Chihuahua, and eastern Durango into western Texas, New Mexico, and southeastern Arizona. *Vaejovis globosus* is known from isolated localities in Texas along the Rio Grande, at Cuatrociénegas in Coahuila, at Dinamita in Durango, and in northern Zacatecas. The new species is from the southern parts of Coahuila and Nuevo León, an area that (combined with the adjacent part of Tamaulipas) has a distinct scorpion fauna. Unique species found here include *Diplocentrus ferrugineus* Fritts & Sissom, *V. sprousei* Sissom, *V. rossmani* Sissom, and *V. platnicki* Sissom (Fritts & Sissom 1994; Sissom 1989, 1990, 1991). In addition, *V. bilineatus* replaces the more northern *V. waueri* (Yahia & Sissom 1996).

Methods

Nomenclature and mensuration follow that of Stahnke (1970), except for carinal terminology that follows Francke (1977b) and trichobothrial terminology that follows Vachon (1974); the fourth pedipalpal segment is considered the patella rather than the tibia, adhering to Stahnke's (1970) nomenclature. Hemispermatophore preparation follows Sissom *et al.* (1990). All measurements were taken with the aid of an ocular micrometer calibrated at 20x (± 0.05 accuracy), and are recorded in millimeters. The measurement of telson vesicle length includes the pedicel. Figures were illustrated by using a 10x10 ocular grid. Abbreviations for measurements are as follows: L = length, W = width, D = depth; also, l = left and r = right.

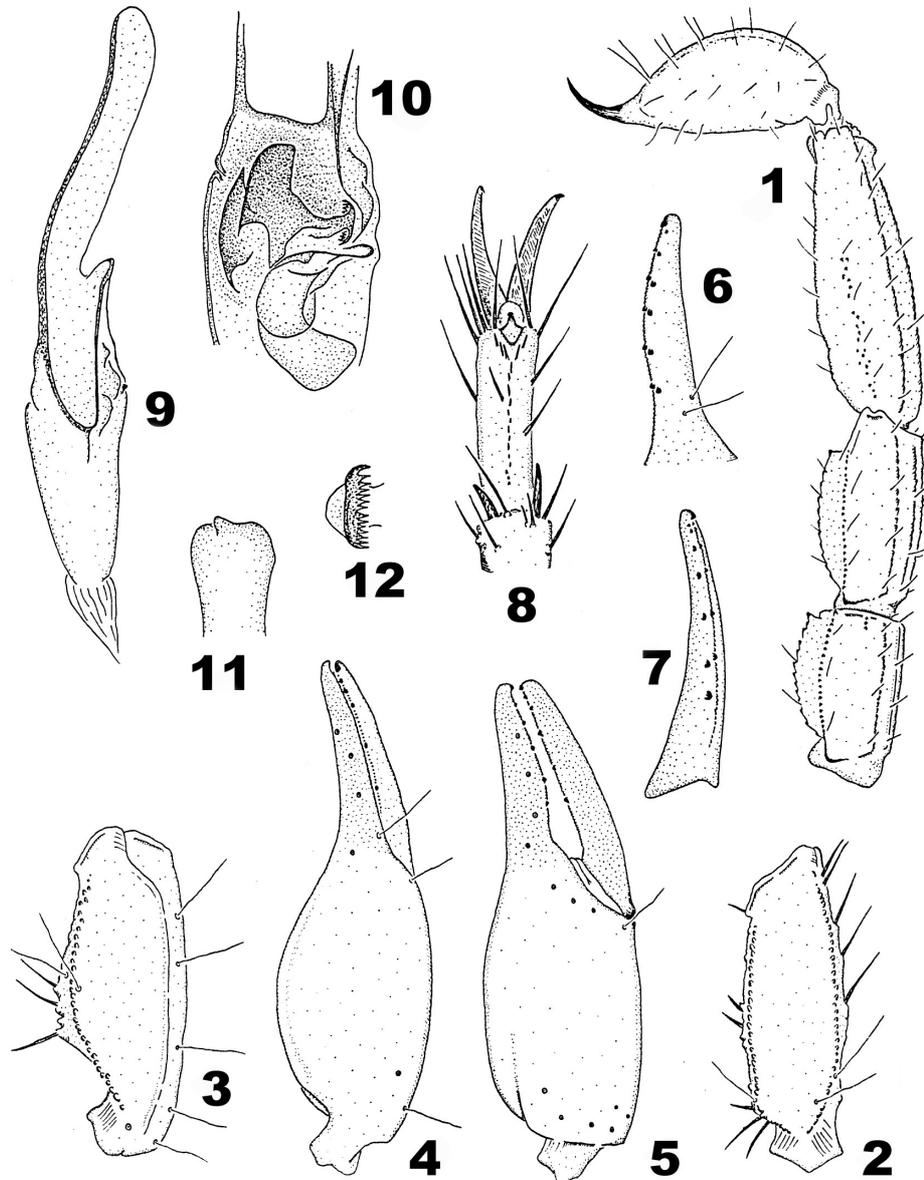
Taxonomy

Vaejovis glabrimanus, new species

(Figs. 1–12)

Type data.—Adult male holotype taken from 4.9 mi N La Ascension, Nuevo León, México (24°19' N, 99°54' W) on 18 July 1972 by E.A. Liner, R.M. Johnson, and A.H. Chaney; deposited in the Florida State Collection of Arthropods, Gainesville, Florida. Paratype male taken from 10.8 mi S, 0.1 mi E Arteaga at Los Pinos, Coahuila, México (25°17' N, 100°50' W) on 17 July 1975 by E.A. Liner *et al.*; also deposited in the Florida State Collection of Arthropods.

Diagnosis.—In possessing a setose metasoma and essentially acarinate pedipalp chelae, *Vaejovis glabrimanus* **sp. nov.** is most similar to *V. coahuilae* and *V. globosus*. It may be distinguished from *V. coahuilae* by (1) the presence of six, rather than five, subrows of denticles on the cutting margin of the pedipalp chela fixed finger; (2) the absence of an elaborate dusky pattern on the carapace, dorsum, metasoma, and appendages; (3) the lack of carinae on sternite VII (in *V. coahuilae*, granular lateral carinae are present); and (4) larger body size, with adult males reaching approximately 40–42 mm in length (adult males of *V. coahuilae* are rarely about 35 mm in length). It may be distinguished from *V. globosus* by (1) the presence of six, rather than five, subrows of denticles on the pedipalp chela fixed finger; (2) the presence of prominent scalloping in the chela fingers in the male; (3) the absence of dusky markings on the dorsum and metasoma; (4) more swollen pedipalp chelae in the male (chela length/width ratios: *V. glabrimanus*, 2.94–3.06; *V. globosus*, 3.29–3.79); and (5) its larger body size (males of *V. globosus* range only to about 25–30 mm).



FIGURES 1–12. External morphology of *Vaejovis glabrimanus* **sp. nov.** 1, metasomal segments III–V and telson, lateral aspect; 2, pedipalp femur, dorsal aspect; 3, pedipalp patella, dorsal aspect; 4, pedipalp chela, dorsal aspect; 5, pedipalp chela, external aspect; 6, pedipalp chela fixed finger, showing dentition and trichobothrial pattern; 7, pedipalp chela movable finger, showing dentition; 8, tarsomere II on right leg III, ventral aspect, showing arrangement of spinules; 9, morphology of hemispermatophore, dorsal aspect; 10, structure of hemispermatophore capsular area (ventral aspect); 11, ectal view of laminar flange; 12, barbed end of "sperm plug".

In body size and coloration, the new species is also superficially similar to *V. russelli* Williams. As is typical of the *punctipalpi* group, males of *V. russelli* have distinctly carinate, often granular pedipalp chelae and fewer metasomal setae (e.g., segment V in *V. russelli* typically has only 4–7 setae on the metasomal dorsolateral and ventrolateral carinae, whereas *V. globosus* has 7–10 on the dorsolaterals and 10 on the ventrolaterals). Additional characters for the *punctipalpi* group are provided by Williams (1971b, 1980).

Description.—The following description is based on the holotype male; some meristic and morphometric characters of the paratype male are provided in parentheses. *Coloration.* Base color light yellow-brown, almost immaculate. Tergites with paired vestigial dusky patches along posterior margin. Metasomal segments with carinae yellow-orange. Telson yellowish; aculeus dark reddish-brown. Pedipalps: femur and tibia yellow, lighter than body; chela manus yellow, fingers orange-red with underlying dusky pigment; denticles of dentate margin dark brown. Legs pale yellow with some faint dusky markings; tarsi yellowish. Venter: coxosternal region yellowish; pectines yellowish-white; sternites light yellow. *Prosoma.* Carapace approximately as long as wide. Anterior margin essentially straight, with six conspicuous setae; median notch faint, shallow. Entire carapacial surface densely granular. *Mesosoma.* Tergites I–IV: Median carina on I–II faint, on II–VI weak, smooth to granular; lateral carinae present posteriorly on II–VI, weak, granular. Tergite VII: Median carina weak, smooth, present on anterior one-third; submedian and lateral carinae strong, granulate. Pectinal tooth count (l/r) 15/? (17/17). Sternites III–VI smooth, moderately setose. Sternite VII acarinate. *Metasoma* (Fig. 1). Segment I slightly wider than long, II–III slightly longer than wide, V 2.37 (2.40) times longer than wide. Segments I–IV: Dorsolateral carinae on I–III strong, serrate; on IV strong, crenulate; terminal denticles on I–III distinctly enlarged, spiniform. Lateral suprmedian carinae on I–III strong, irregularly serrate; on IV moderate, irregularly serrate; terminal denticles distinctly enlarged, spiniform on I–III. Lateral inframedian carinae on I complete, strong, irregularly serrate; on II present only on posterior third, crenulate to serrate; on III represented by only three or four medium-sized granules; on IV absent. Ventrolateral carinae on I moderate, irregularly crenulate; on II–IV moderate to strong, crenulate. Ventral submedian carinae on I–III weak, smooth; on IV weak, smooth anteriorly, serrate posteriorly. Intercarinal spaces mostly smooth, lustrous. Segment V: Dorsolateral carinae moderate, granular on anterior half of segment. Lateromedian carinae present on anterior third, weak, granular. Ventrolateral and ventromedian carinae moderate, crenulate. Intercarinal spaces mostly smooth, lustrous. Metasomal I–IV carinal setation (l/r): dorsolaterals, 0/0:2/2:2/2:4/4; lateral suprmedians, 1/1:3/3:3/3:4/4; lateral inframedians, 2/2:0/0:0/0:0/0; ventrolaterals, 2/3:4/4:4/4:4/4; ventral submedians, 3/3:3/3:4/3:4/5 (segment III with unpaired seta offset medially from carina; segment IV with left seta of pair 2 offset medially from carina). Setation of metasomal segment V: dorsolaterals, 7/7; lateromedians, 4/5; ventrolaterals, 10/10. *Telson* (Fig. 1). Dorsal surface flattened, smooth; ventral surface almost smooth, without a subaculear tubercle;

aculeus much shorter than vesicle. *Pedipalps*. Orthobothriotaxic, Type C (Vachon 1974). Femur (Fig. 2) tetracarinate. Dorsointernal, dorsoexternal, and ventrointernal carinae strong, granulose. Ventroexternal carina moderate, with irregularly spaced, large rounded granules. Internal face with large conical granules; dorsal face shagreened. Ratio of femur length/width, 2.55 (2.52). Patella (Fig. 3) tetracarinate. Dorsointernal carina strong, granulose. Ventrointernal carina moderate, granulose. Dorsoexternal carina weak to moderate, smooth. Ventroexternal carina weak, smooth. Internal face with moderate basal tubercle and longitudinal series of 6–7 large granules. Surfaces smooth. Ratio of patella length/width, 2.47 (2.41). Chela (Figs. 4–7): carinae of palm (Figs. 4–5) obsolete or at most, vestigial and smooth. Dentate margin of fixed finger (Fig. 6) with primary row of denticles divided into six subrows by five larger granules; six inner accessory granules of which all but distal-most paired with larger granule in primary row; trichobothrium *it* slightly basal to sixth inner accessory granule. Dentate margin of movable finger on right pedipalp chela (Fig. 7) with primary denticle row broken up into six subrows by five enlarged granules; apical row consisting of one small granule; seven inner accessory granules, of which distal granule not paired with larger granule in primary row; basal inner accessory granule distinctly basal to corresponding granule in primary row. Dentate margin of movable finger on left pedipalp chela anomalous, with primary row broken into four subrows by three enlarged granules; distalmost subrows fused; only three inner accessory granules. Slight recess indicated on both fingers such that a distinct gap is visible proximally when the fingers are closed (Fig. 5). Ratio of chela length/width 2.94 (3.06); of movable finger length/chela width 1.60 (1.64); of fixed finger length/carapace length ratio 0.56 (0.53). *Legs*. Tarsomere I on legs I–II with one retrolateral and two ventrolateral rows of spinules; ventral rows complete, interrupted at irregular intervals by large, dark, stiff setae. Retrolateral row present on distal one-half, interrupted by one or two spines. Tarsomere I spinule rows rudimentary on legs III–IV, but with stiff setae present. Tarsomere II on all legs with single ventromedian row of spinules, procurved basally, terminating distally between with 2–3 pairs of medium-sized spines (Fig. 8). *Hemispermaphore* (Figs. 9–12). Hemispermaphore with broad flange on ectal edge of distal lamina (Figs. 9, 11); capsular region as in Fig. 10; "sperm plug" of capsular region with 14 spines (Fig. 12).

Measurements of Male Holotype (mm): Total L, 40.85; carapace L, 5.00; mesosoma L, 10.50; metasoma L, 19.10; telson L, 6.25. Metasomal segments: I L/W/D, 2.55/2.70/2.15; II L/W/D, 3.05/2.65/2.15; III L/W/D, 3.25/2.65/2.15; IV L/W/D, 4.10/2.55/2.05; V L/W/D, 6.15/2.60/1.90. Telson: vesicle L/W/D, 4.45/2.45/2.10; aculeus L, 1.80. Pedipalps: femur L/W, 3.70/1.45; patella L/W, 4.20/1.70; chela L/W/D, 7.05/2.40/2.45; fixed finger L, 2.80; movable finger L, 3.85.

Measurements of Male Paratype (mm): Total L, 42.00 (estimated, due to broken aculeus); carapace L, 5.20; mesosoma L, 11.00; metasoma L, 19.65; telson L, ??. Metasomal segments: I L/W/D, 2.60/3.00/2.30; II L/W/D, 3.10/2.80/2.30; III L/W/D,

3.30/2.70/2.30; IV L/W/D, 4.30/2.60/2.20; V L/W/D, 6.35/2.65/2.05. Telson: vesicle L/W/D, 4.60/2.55/2.10; aculeus L, ?. Pedipalps: femur L/W, 3.65/1.45; patella L/W, 4.10/1.70; chela L/W/D, 7.20/2.35/2.45; fixed finger L, 2.75; movable finger L, 3.85.

Variation. The paratype male did not differ significantly from the holotype in any of the above-mentioned characters. The setation of the carinae of metasomal segments I–IV (l/r) in the paratype is as follows: dorsolaterals, 2/2:2/2:4/4:5/5; lateral supramedians, 1/2:3/4:4/4:4/4; lateral inframedians, 3/2:1/2:1/1:1/1; ventrolaterals, 3/3:4/4:4/4:4/4; ventral submedians, 3/3:4/3:4/3:5/5 (segments II and III each with unpaired seta slightly offset from the ventral submedian carinae; segment IV with setal pairs 2 and 4 slightly offset medially from the ventral submedian carinae). For metasomal segment V (l/r), the setation of the paratype is: dorsolaterals, 9/10; lateromedians, 4/5; ventrolaterals, 10/10.

Distribution.—Known only from the two localities in southern Nuevo León and Coahuila, México.

Etymology.—The specific epithet is Latin for "smooth hand" and refers to the lack of distinct carinae on the pedipalp chelae.

Key to the Vaejovid Scorpion Species of Northeastern México

The following key is intended for use with *adult* scorpions in the Mexican states of Coahuila, Nuevo León, Tamaulipas, and the Chihuahuan Desert region in eastern Chihuahua and northeastern Durango. Species from adjacent regions that probably occur in these states are also keyed; these are indicated by an asterisk (*).

1. Dorsolateral carinae of metasoma more or less evenly denticulate throughout (i.e., without an enlarged terminal denticle); legs I–III with distinct retrolateral setal combs 2
 Dorsolateral carinae of metasoma (at least on segments I–III) with an enlarged terminal denticle; legs I–III with irregular setation (except in *V. globosus*, which has setal combs, – but has the enlarged terminal denticle on the metasoma) 5
2. Anterior margin of carapace distinctly convex; fixed cheliceral finger with ventral keel restricted to tip of finger..... *Paruroctonus gracilior* (= *pallidus*)
 Anterior margin of carapace almost straight; fixed cheliceral finger with ventral keel extending from tip to bicuspid area..... 3
3. Pectinal tooth counts above 24 in males and 17 in females; basitarsus of leg II without *mrs* seta (Haradon 1985; Sissom & Henson 1998); pedipalp chela fixed finger with more than 30 primary denticles (excluding those of proximal row) 4
 Pectinal tooth counts less than 24 in males and 17 in females; basitarsus of leg II with *mrs* seta; pedipalp chela fixed finger with 25–28 primary denticles (excluding proximal row) *Paruroctonus coahuilanus*
4. Pedipalp femur with four external medial setae; with 1, 1, 1–2, 2 pairs of setae on dor-

- solateral carinae of metasoma I–IV; with 0, 2, 2, 3 pairs of setae on the lateral supra-medians; with 2 pairs of setae on lateral inframedians of metasomal segment I; with 2, 3, 4, 5 pairs of setae on the ventrolaterals of metasoma I–IV. Boquillas Canyon, Big Bend National Park, Texas..... *Paruroctonus boquillas**
- Pedipalp femur with two or three external medial setae; with 0, 1, 1, 2 pairs of setae on dorsolateral carinae of metasoma I–IV; with 0, 1, 1, 2 pairs of setae on the lateral supra-medians; with 1 pair of setae on lateral inframedians of metasomal segment I; with 2, 3, 3, 4 pairs of setae on the ventrolateral carinae of I–IV. Samalayuca Dunes, Chihuahua *Paruroctonus utahensis*
5. Trichobothria *ib* and *it* situated at base of chela fixed finger 6
 Trichobothria *ib* and *it* situated more distally, at the level of the sixth inner accessory denticle or beyond 14
6. Pectinal tooth 9–13 in males, 8–11 in females; pedipalp chela with ventral face flattened and without ventromedian carina; adults are small reddish brown scorpions.....
 *Pseudouroctonus apacheanus**
- Pectinal tooth counts greater than 14 in males, greater than 11 in females; pedipalp chela with ventral face rounded, with or without ventromedian carina; chela movable finger length/ chela palm width ratio greater than 1.8; adults variable in size and color 7
7. Cheliceral fixed finger with a carina bearing denticles along the ventral margin..... 8
 Cheliceral movable finger with ventral margin smooth..... 9
8. Pectinal tooth counts less than 20 in both sexes; cheliceral movable finger with distinct denticles along ventral margin; adults dark reddish brown in color
 *Pseudouroctonus reddelli*
- Pectinal tooth counts greater than 25 in both sexes; cheliceral movable finger with ventral margin smooth; adults yellowish with reddish chela fingers *Vaejovis minckleyi*
9. Pedipalp patella with 3 *esb* trichobothria 10
 Pedipalp patella with 2 *esb* trichobothria 11
10. Small scorpions, with adult females less than 30 mm in length; ventral submedian carinae on metasomal segments I–IV obsolete; pectinal tooth counts less than 20.....
 *Vaejovis platnicki*
- Larger scorpions, with adults 45–60 mm in length; ventral submedian carinae on metasomal segments I–IV developed, granular to crenulate; pectinal tooth counts greater than 23..... *Vaejovis rubrimanus*
11. Ventral submedian carinae obsolete; underside of metasoma hirsute, with numerous setae in intercarinal spaces; pectinal tooth counts greater than 20 in males, greater than 17 in females *Vaejovis intermedius*
- Ventral submedian carinae present (usually weak on I–II, stronger on III–IV); metasoma with paired setae (on segments I–IV, usually 3–6 pairs) and no more than one or two setae in the intercarinal spaces; pectinal tooth counts less than 20 in males, less

- than 18 in females 12
12. Body color medium to dark brown, immaculate; adult body length of males above 45 mm, of females above 50 mm *Vaejovis norteno*
Body color light yellow brown to brown (if brown, with distinct mottling); adult body length less than 35 mm in both sexes 13
13. Pectinal tooth counts 10–13 in females, 12–14 in males; pedipalp chela length/width 3.10–3.90; smaller scorpions, with adult females reaching no more than 26 mm in length *Vaejovis rossmani*
Pectinal tooth counts 14–18 in females, 17–18 in males; pedipalp chela length/width greater than 4.0; larger scorpions, both adult males and females over 27 mm in length 14
14. Coloration light yellow brown, with diffuse or weak dusky markings. *Vaejovis chisos**
Coloration brown to reddish brown, with distinct dusky markings ... *Vaejovis sprousei*
15. Trichobothria *ib* and *it* situated between the fourth and fifth inner accessory denticle of the pedipalp chela fixed finger; dentate margins of chela fingers serrated in lateral view *Serradigitus calidus*
Trichobothria *ib* and *it* situated at or near the sixth inner accessory denticle; dentate margins of chela fingers not serrated in lateral view 16
16. Ventral submedian carinae of metasoma I–IV obsolete 17
Ventral submedian carinae of metasoma developed and usually granular, at least on segments III and IV 18
17. Pedipalp chelae and fifth metasomal segment distinctly darkened; pectinal tooth counts 12–15 in males (mode = 14), 11–15 (mode = 12) in females; smaller species, adult males under 21 mm and females under 25 mm in length *Vaejovis waueri*
Pedipalp chela similar in color to other pedipalpal segments; fifth metasomal segment only slightly darkened; pectinal tooth count 15–19 (mode = 17) in males, 14–16 (mode = 15 in females); larger species, adult males 22–27 mm and females up to 27–31 mm in length *Vaejovis bilineatus*
18. Metasoma setose (e.g., metasoma V ventrolateral carinae with 9–12 setae); pedipalp chelae of adult male acarinate or at most feebly carinate 19
Metasoma with fewer setae (e.g., metasoma V ventrolateral carinae with no more than 7 setae); pedipalp chela of adult male with distinct, granular carinae 21
19. Cutting margin of pedipalp chela fixed finger with 6 subrows of denticles; underside of metasoma uniformly yellowish *Vaejovis glabrimanus* **sp. nov.**
Cutting margin of pedipalp chela fixed finger with 5 subrows of denticles; ventral carinae of metasoma infusate (sometimes weakly so in *V. globosus*) 20
20. Pedipalp chela of male somewhat inflated, with ratio of length/width 2.89–3.28; with distinct scalloping in the chela finger margins (when viewed laterally); telson of female with vesicle length/width ratio of 2.38–2.50; carapace densely fuscous
..... *Vaejovis coahuilae*

- Pedipalp chela of male not inflated, with ratio of length/width 3.29–3.79; without scalloping in the chela finger margins; telson of female swollen, with telson length/width ratio of 2.05–2.25; carapace moderately fuscous, with a pair of lateral dusky lines anteriorly *Vaejovis globosus*
21. Male chelae with distinct scalloping in the fingers (less so in female, but present); chela of male with dorsal carinae moderately granulate, that of female present and smooth; almost always with five subrows of denticles on the chela fixed finger *Vaejovis russelli**
- Male and female chelae with margins of chela fingers straight in lateral view; chelae of adult male and female with carinae granulate; typically with six subrows of denticles on the chela fixed finger (but sometimes with five rows) 22
22. Telson vesicle conspicuously hirsute, with approximately 20–30 pairs of setae *Vaejovis cazieri*
- Telson vesicle with fewer than 20 pairs of setae *Vaejovis crassimanus*

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