*Zootaxa* 2493: 49–58 (2010)
www.mapress.com/zootaxa/


**Article**

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

# A new species of the *Vaejovis eusthenura* group in Oaxaca, Mexico (Scorpiones: Vaejovidae)

CARLOS SANTIBAÑEZ LÓPEZ[1] & W. DAVID SISSOM[2]

[1]*Colección Nacional de Arácnidos, Instituto de Biología, Departamento de Zoología, Universidad Nacional Autónoma de México, Tercer Circuito Exterior sin número, Cuidad Universitaria, Apartado Postal 70-153, Mexico D. F., 04510. Mexico.*
*E-mail: ironc81@hotmail.com*
[2]*Dept. of Life, Earth, & Environmental Sciences, West Texas A&M University, WTAMU Box 60808, Canyon, TX 79016. USA.*
*E-mail: dsissom@wtamu.edu*

## Abstract

*Vaejovis oaxaca*, a new species of the *Vaejovis eusthenura* group is described from the Mexican state of Oaxaca. It is found in lowlands ranging from the Mitla area in central Oaxaca southeast into the Isthmus of Tehuantepec and the eastern edge of Chiapas.

**Key words:** new species, Oaxaca, setal counts, systematics.

## Introduction

The genus *Vaejovis* C. L. Koch, 1836 is the most diverse element of the North American scorpiofauna (Sissom 2000), with over 70 described species. For many years, the genus was subdivided into a number of species groups and a small number of unassigned species. Recently, the species groups were given generic status by Soleglad & Fet (2008), but these authors provided no cladistic tests of monophyly for the proposed new genera, and their previous efforts at cladistic analysis were demonstrated to be greatly flawed (Prendini & Wheeler 2005). Consequently, we prefer to retain the genus *Vaejovis* in its previous state, most recently summarized by Sissom (2000) and Prendini & Wheeler (2005), pending the production of a valid cladistic analysis.

The *eusthenura* group of *Vaejovis* currently consists of 18 species distributed in the southwestern USA, Baja California, and most of mainland Mexico into the Isthmus of Tehuantepec. It is the purpose here to describe one new species in this group from the Mexican state of Oaxaca and adjacent Chiapas. Oaxaca has been promoted as the state with the highest biodiversity in all of Mexico (García-Mendoza, *et al.* 2004), and is proving to be a region of high scorpion diversity (Francke 1977, 1978). The species described herein represents part of an assemblage of species collected as a result of recent inventory work in the Northern Mountain Range (also known as the Sierra de Juarez) by the senior author.

## Material and methods

Nomenclature and mensuration follows Stahnke (1970), except for trichobotrial terminology after Vachon (1974), carinal terminology modified after Francke (1977), hemispermatophore terminology after Sissom (1991), and pedipalpal setal terminology after Haradon (1983, 1984a, 1984b, 1985). Taxonomy follows Prendini & Wheeler (2005). Measurements were taken using an ocular micrometer calibrated at 10X from a Nikon SMZ-1500 microscope and are given in millimeters. Drawings were obtained with a camera lucida supported on the same stereoscope and were edited with Adobe Photoshop C3. Additional methodological issues are discussed below.

*Accepted by L. Prendini: 8 Apr. 2010; published: 3 Jun. 2010*

**Metasomal Setal counts**. Setal counts have provided useful taxonomic characters in vaejovid taxonomy for many years (e.g., Haradon 1983, 1984a, 1984b, 1985; Yahia & Sissom 1996). The members of the *eusthenura* group pose interesting problems for taking setal counts because they are polytrichous and exhibit a considerable amount of intraspecific variation (Yahia & Sissom, 1996). In particular, the position, size, and pairing of the setae associated with the ventral submedian carinae of metasomal segments I–IV are commonly irregular. Setae associated with other carinae are less problematical, but offer inconsistencies as well. To ensure higher consistency in the setal counts, setal maps were generated showing the exact placement of the setae with respect to the individual carinae, as well as the relative sizes of the setae (or their sockets). Major and minor setae, but not microsetae (defined by Vachon, 1952 p. 50 as very small, nonpigmented setae) were counted. Counts were taken from the left side carinae as follows, except as noted:

Dorsolateral carinae. For segments I–V, setae along the carinal ridge (either among the carinal granules or directly adjacent to them) were counted.

Lateral supramedian carinae. Setae on and below the carinal ridge were counted.

Lateral inframedian carinae. Setae among the carinal granules on I–III were counted; on segment IV (which lacks inframedian carinae) setae corresponding in position to setae on I–III were counted. The setae of the lateromedian carina of segment V was counted in similar fashion.

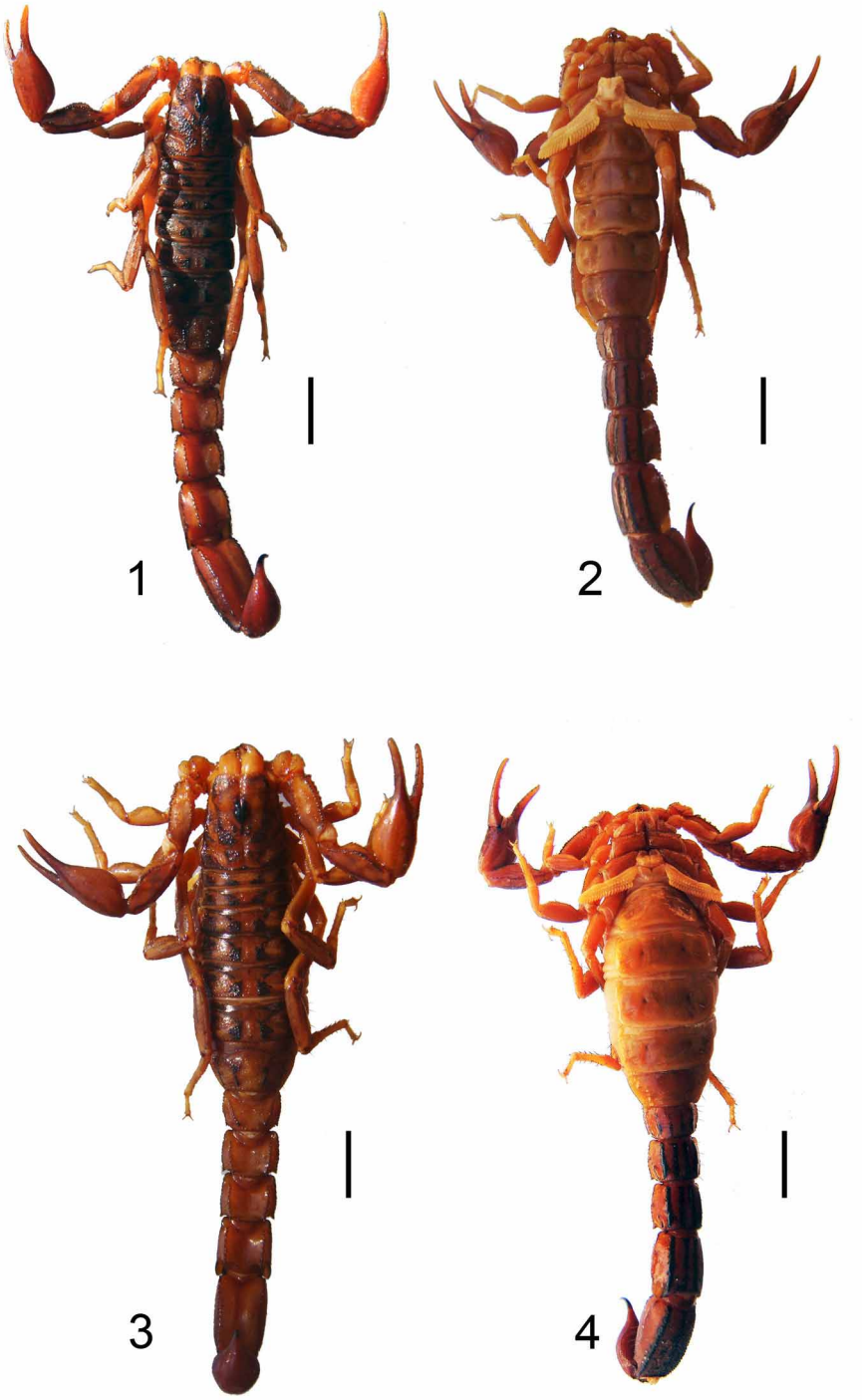
Ventrolateral carinae. On segments I–IV, setae immediately above the carina or among the carinal granules were counted. Setae on the ventral aspect of the segment lying adjacent to the ventrolateral carina are not included; these are regarded as ventrolateral accessory setae. This same procedure was followed for the ventrolateral carina of segment V.

Ventral submedian carinae. As on other carinae, major paired setae occur along these keels. Because the carinae are in such close proximity, separated by a narrow intercarinal space, these setae are often reported as pairs in taxonomic works on vaejovids (e.g., Gertsch & Soleglad 1966; Sissom & Francke 1985; Haradon 1984a, 1984b, 1985). However, variation in the setal pattern of these carinae is great, and the pairing of the setae is often distorted. In almost all specimens, major setal pairs occur in basal, medial, and distal positions on segments I–IV. On segments II–IV there is also a tendency for subbasal and subdistal pairs to occur, but these are inconsistent in several ways: (1) one of the members of the pair may be missing; (2) one or both members of the pair may be shifted in position, often to the medial edges of the carinae and even into the medial or ventrolateral intercarinal spaces (in the median space, it is often subjective to consider whether a particular seta is a member of a pair or if it should be regarded as an accessory seta); and (3) the setae (and their setal pits) exhibit considerable variation in size, forcing a subjective decision on whether to include them in the count, particularly when the seta is missing. Given these problems, it was decided to give a total count of the setae associated with the ventral submedian carinae (to include both carinae and the intercarinal space). Although this count is different than the counts given for other carinae, we suggest that it is the most practical and objective method available.

Ventromedian carina of segment V. Paired and unpaired setae occur immediately adjacent to the ventromedian carina; as with other carinae, only the setae on the left side of the carina are counted. The paired larger setae that are somewhat offset laterally from the carina are incorporated in an additive formula: a count of “5+2” indicates five setae along the carina, and two offset setae.

**Granulation**. Granulation patterns are difficult to study with accuracy when specimens are viewed in alcohol. In fact, in alcohol, surfaces with dense, minute granulation are virtually indistinguishable from shagreened and smooth surfaces. The following descriptions of granulation patterns are based on dry surfaces of specimens removed from alcohol.

**Pedipalp chela finger dentition**. Counts of the denticle subrows of the pedipalp chela fingers are derived by considering the enlarged primary denticle at the base of each subrow as a member of that subrow. This avoids an issue regarding the apical subrow on the movable finger in which the smaller apical primary row denticle is sometimes missing (a common occurrence in this species assemblage). Because the enlarged primary denticle is always present (barring aberrations of the finger), the apical subrow is always included in the count.




**FIGURES 1–4.** Habitus of *Vaejovis oaxaca* **sp. nov.** 1. Dorsal view, holotype male. 2. Ventral view, holotype male. 3. Dorsal view, paratype female. 4. Ventral view, paratype female.

## Taxonomy

***Vaejovis oaxaca*, new species**
(Figs.1–17)

**Type data.** Holotype male (Figs. 1–2) taken from 4 km N Totolapam, Oaxaca, Mexico (N 16°41'45.9", W 96°18'52.1", elevation 1078 m) on 1 November 2004 by O. Francke, R. Paredes & G. Villegas. Deposited in

the Colección Nacional de Áracnidos (CNAN-T0376), Departamento de Zoología, Instituto de Biología, Universidad Nacional Autónoma de México.

**Etymology.** The specific epithet is derived from the Mexican state of Oaxaca, which encompasses most of the geographical range of the species.

**Distribution.** Known from central Oaxaca southeast into southern part of the Isthmus of Tehuantepec and the eastern edge of Chiapas (Fig. 5).

**Diagnosis.** *Vaejovis oaxaca* is most similar to *V. punctatus* Karsch, 1879, *V. variegatus* Pocock, 1898, *V. subcristatus* Pocock, 1898, and *V. occidentalis* Hoffmann, 1931 (although *occidentalis* and *subcristatus* currently reside in the *intrepidus* group). The possession of six subrows of denticles on the cutting edge of the chela fixed finger readily distinguishes the new species from *V. punctatus* and *V. subcristatus*, which have five subrows. Its larger body size, more reddish coloration, different hemispermatophore structure, and higher metasomal setation counts further distinguish it from *V. punctatus*. The absence of ventral submedian carinae on metasomal segments I–III (and with weak, smooth carinae on IV) distinguishes *V. oaxaca* from *V. subcristatus*, which has developed carinae on at least II–IV, with the posterior carinae usually bearing crenulations or serrations.

From *V. variegatus*, *V. oaxaca* may be distinguished by coloration (*V. variegatus* is typically darker reddish brown, and the median dark stripe on the tergites includes dark posteromedian patches) and lower setal counts on the metasoma (e.g., *variegatus* typically has 6–8 [mode = 7] dorsolateral and 7–10 [mode = 7] ventrolateral setae on metasoma V). In *V. variegatus*, the ventral submedian carinae are entirely absent on I–IV and the ventromedian carina is absent basally on V.

From *V. occidentalis*, *V. oaxaca* may be distinguished by the absence of ventral submedian carinae on metasomal segments II–III (and with only weak, smooth carinae on IV); the former has developed carinae on at least II–IV, with the posterior carinae bearing crenulations or serrations. The ventrolateral metasomal carinae are smooth in *V. oaxaca*, but bear crenulations on segments II–IV in *V. occidentalis*. *Vaejovis oaxaca* has weaker scalloping in the chela fingers: the basal lobe on the chela movable finger is noticeably smaller and the corresponding notch in the fixed finger is less pronounced. The metasomal intercarinal spaces are sparsely granular in *V. oaxaca*, but are densely coarsely granular in *V. occidentalis*. Finally, the color pattern of the tergites is different in the two species: in *V. oaxaca* there are dusky markings connecting the medial and lateral dusky patches, whereas in *V. occidentalis*, the area between these is almost devoid of markings (i.e., it is uniformly pale).

**Description of holotype male.** Coloration. (Figures 1–2). Carapace, tergites, and metasomal segments I–IV light yellow brown to orange brown; ventrolateral and ventral submedian carinae underlined with strong dusky pigment. Mesosomal tergites with paired submedian and lateral fuscous patches, producing a distinct striping pattern. Metasoma V and telson darker orange brown. Telson yellow brown to light orange brown; aculeus dark brown. Pedipalps: femur and patella yellow brown to orange brown with dusky markings; chela orange brown, darker at base of fingers, with yellowish fingertips; denticles of finger dentate margins brown. Legs yellow brown with some faint dusky markings; tarsi yellowish. Venter: coxosternal region light orange brown; pectines yellowish white; sternites light orange brown; sternite V with whitish patch along posteromedial margin.

Prosoma. Carapace approximately as long as posterior width. Median ocular prominence moderately raised above carapacial surface. Anterior margin nearly straight, lacking median notch; with 11 setae. Entire carapacial surface a densely minutely granular field arrayed with coarser granulation.

Mesosoma. Tergites I–IV: median carina on I obsolete, on II–VI weak, granular. Submedian carinae on I–II vestigial; on III–V weak, granular; on VI moderate, granular. Tergite VII: median carina represented by a rounded, granular raised area, present on anterior two-thirds; submedian and lateral carinae strong, granulose. Genital opercula without median longitudinal membranous connection, genital papillae well developed. Pectinal tooth count 19–20. Sternites III–VI smooth to shagreened medially, densely minutely granular laterally; sparsely setose. Sternite VII with pair of very weak, smooth lateral carinae.

Metasoma. Segment I 0.77 times as long as wide, II 0.93 times as long as wide, III 1.10 times longer than wide, IV 1.52 times longer than wide, V 2.10 times longer than wide. Segments I–IV: Carination: Dorsolateral

carinae on I–IV strong, serrate; distalmost denticles on I–IV distinctly enlarged, spinoid. Lateral supramedian carinae on I–II strong, crenulate; on III strong, irregularly crenulate; on IV moderate, granular; distalmost denticles distinctly enlarged, spinoid on I–III; widely flared on IV. Lateral inframedian carinae on I complete, strong, crenulate; on II present only on posterior one-third, moderate granular; on III present on posterior one-fourth, weak, granular; on IV absent. Ventrolateral carinae weak, smooth. Ventral submedian carinae on I–IV obsolete. Dorsal intercarinal spaces densely minutely granular with a few larger granules, lustrous; lateral and ventral spaces smooth, lustrous. Setation (Figs. 6–8): dorsolaterals, 0/0:2/2:3/3:3/3; lateral supramedians, 0/0:3/3:4/4:4/4; lateral inframedians, 2/2:1/1:1/1:0/0; ventrolaterals, 4/4:4/4:5/5:5/5; ventrolateral accessories 0/0:1/1:1/1:1/1; ventral submedians (total) 6:8:10:12. Segment V: Dorsolateral carinae strong basally, granular, weakening distally. Lateromedian carinae present on anterior three-fourths, weak, smooth. Ventrolateral and ventromedian carinae strong, serrate. Intercarinal spaces smooth, lustrous; dorsal, dorsolateral, and ventral faces with sparse coarse granulation. Segment V setation (Figs. 6–8): dorsolaterals, 9/9; lateromedians, 6/6; ventrolaterals, 12/12; ventrolateral accessories 5/5; ventromedians, 7+2/6+2.

Telson. All surfaces smooth, lustrous. Vesicle with about 26 pairs of setae; aculeus with a few setae on base. Subaculear tubercle lacking. Aculeus 32% of telson length.

Pedipalp. Femur (Fig. 9) tetracarinate. Dorsointernal, dorsoexternal, and ventrointernal carinae strong, granulose. Ventroexternal carina strong, with irregularly spaced, large rounded granules. Internal face densely minutely granular, with about 12 medium-sized and large, subconical granules; dorsal face densely, minutely granular with medium-sized to large granules in medial area; ventral and external faces densely, minutely granular with sparse coarse granulation. Trichobothrial pattern Type C, orthobothriotaxic (Vachon 1974). Setation: internal face with 3/3 supramedial setae, 6/5 inframedial setae; external face with 5/5 medial setae.

Patella (Figs. 10–11) tetracarinate. Dorsointernal and ventrointernal carinae moderate, granulose. Dorsoexternal carina moderate, smooth. Ventroexternal carina moderate, smooth. Internomedian carina strong, with several larger granules, terminating just distal to *i* trichobothrium. Intercarinal spaces densely, finely granular. Trichobothrial pattern Type C, orthobothriotaxic (Vachon 1974). Setation: internal face with 4/3 supramedial setae, 5/5 inframedial setae.

Chela (Figs. 12–15): Essentially acarinate, with positions of keels indicated in cross section by faint, rounded elevations. Dentate margin of fixed finger (Fig. 14) with primary row divided into six subrows by five larger granules; six inner accessory granules (right side) with the distalmost paired with the terminal denticle and the others with enlarged primary row granules (five on left side, each paired with an enlarged primary row denticle). Dentate margin of movable finger (Fig. 15) with primary row broken up into seven subrows by six enlarged granules; seven inner accessory granules, with the distal granule paired with the terminal denticle and the others with enlarged primary row granules. Chela length/width ratio 3.57; fixed finger length/carapace length ratio, 0.55; fixed finger length 39% of total chela length. Trichobothrial pattern Type C, orthobothriotaxic (Vachon 1974).

Legs. Basitarsus on legs I–II with two ventrosubmedian and one retrolateral rows of spinules; spinule rows interrupted at irregular intervals by large, stiff setae. Leg III with submedian row on prolateral side absent, on retrolateral side vestigial; retrolateral spinule row present, with coarser spinules. Leg IV with only sparse retrolateral spinule row.

Telotarsus on all legs with single ventromedian row of spinules, procurved basally, terminating distally between three to four pairs of spinules.

**Measurements** (mm, L = length, W = width, D = depth) – *Holotype male:* Total L, 41.5, carapace L, 5.3, mesosoma L, 11.6; metasoma L, 19; telson L, 5.6. Metasomal segments: I L/W, 2.4/3.1; II L/W, 2.8/3.0; III L/W, 3.2/2.9; IV L/W, 4.1/2.7; V L/W, 6.5/3.1. Telson: vesicle L/W/D, 3.8/2.3/1.9; aculeus L, 1.8. Pedipalps: total L, 16.3; femur L/W, 4.1/1.1; patella L/W, 4.7/1.1; chela L/W/D, 7.5/2.1/2.6; fixed finger L, 2.9; movable finger L, 4.4.

*Paratype female*: Total L, 50.9; carapace L, 6.5; mesosoma L, 16.1; metasoma L, 21.0; telson L, 7.3. Metasomal segments: I L/W, 2.8/4.0; II L/W, 3.3/3.9; III L/W, 3.7/3.8; IV L/W, 4.9/3.1; V L/W, 6.3/3.3. Telson: vesicle L/W/D, 4.8/3.4/2.6; aculeus L, 2.5. Pedipalps: total L, 19.7; femur L/W, 4.7/1.2; patella L/W, 5.6/1.2; chela L/W/D, 9.4/2.5/3.0; fixed finger L, 3.8; movable finger L, 5.7 (left).

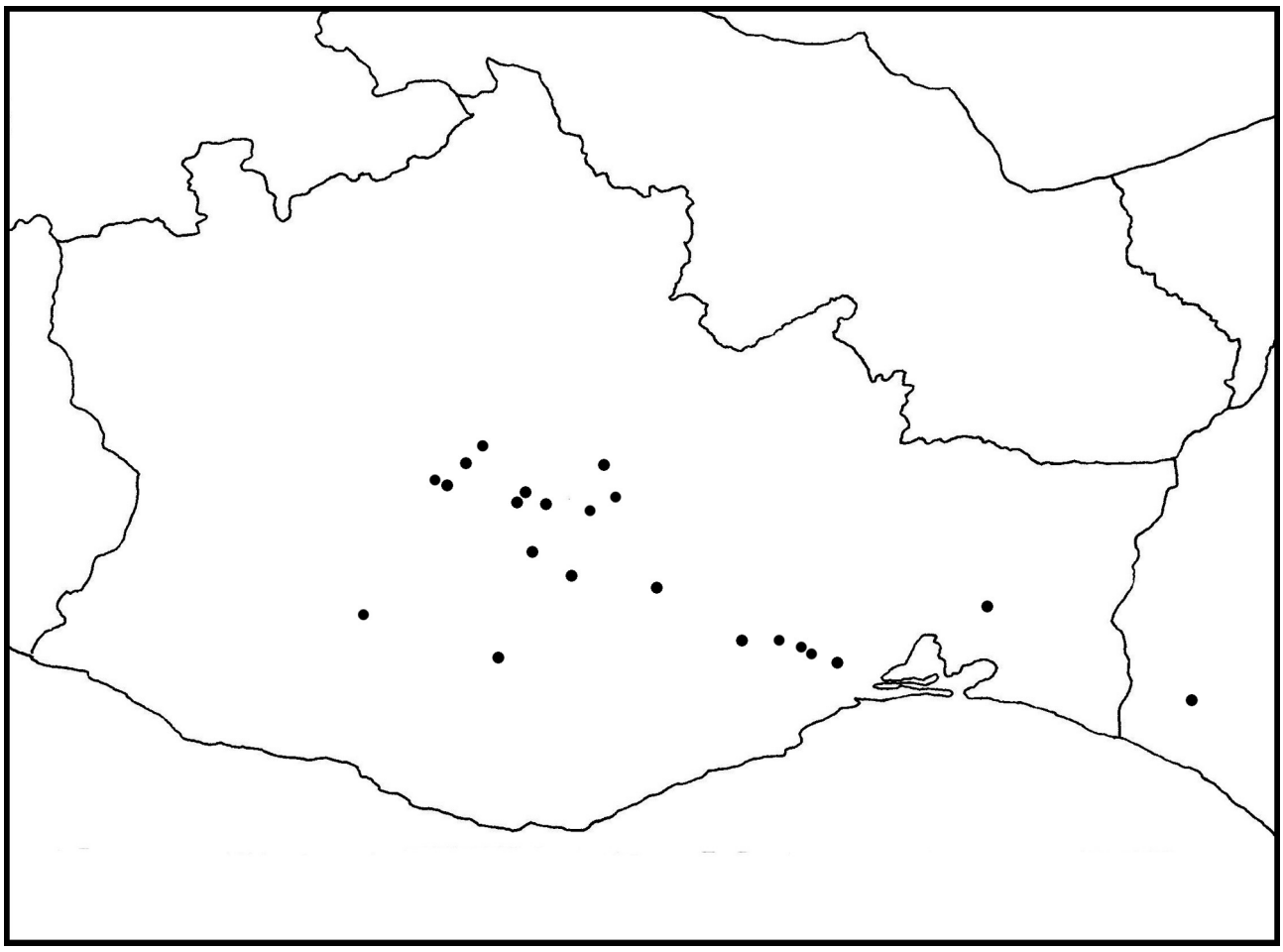
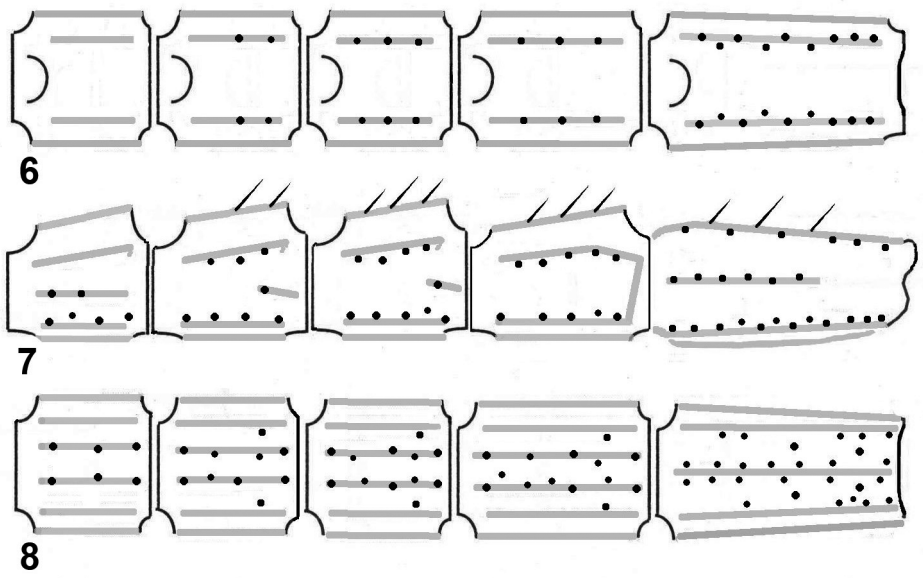


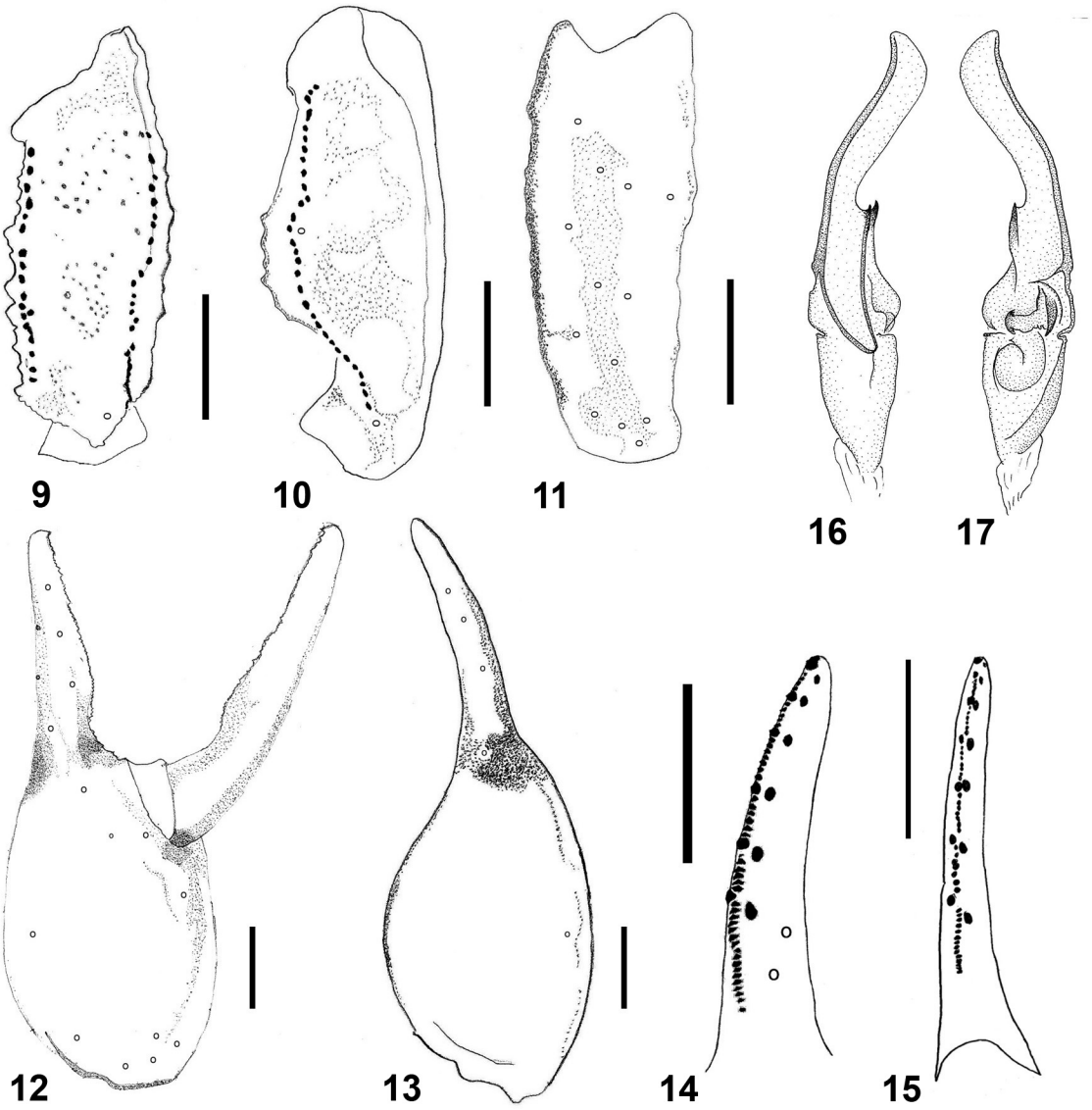
**FIGURE 5.** Map showing distribution of *Vaejovis oaxaca* **sp. nov.**




**FIGURES 6–8.** Metasoma of *Vaejovis oaxaca* **sp. nov.** 6. Setation on metasomal segments, dorsal view. 7. Setation on metasomal segments, lateral view. 8. Setation on metasomal segments, ventral view.

**Hemispermatophore** (dissected from paratopotype male; Figs. 16–17). Hemispermatophore as in other *eusthenura* group species (Sissom 1991), i.e., with broad flange on ectal edge of distal lamina, lamellar

"hooks" displaced distally from its base, and spines in the sperm plug; distance from tip of ectal flange to base of dorsal trough 54% of length from tip of flange to base of trunk; capsular region as in Fig. 18; sperm plug of capsular region with 15 spines on ectal process.




**FIGURES 9–17.** *Vaejovis oaxaca* **sp. nov.** holotype male. 9. Femur, dosal view. 10. Patella, dorsal view. 11. Patella, external view. 12. Chela, dorsoexternal view. 13. Chela, dorsal view. 14. Fixed finger. 15. Movable finger. 16. Hemispermatophore ental view. 17. Hemispermatophore dorsal view.

**Intraspecific Variation**. Variation in pectinal tooth counts is as follows: males (n = 30 specimens, or 60 combs): 12 combs with 19 teeth, 18 combs with 20, 14 combs with 21, 11 combs with 22 and three combs with 23 (two combs were damaged); females (n = 73 specimens, or 146 combs): one comb with 17 teeth, 44 combs with 18, 82 combs with 19, 17 combs with 20 (two combs were damaged).

Modes and ranges in setal counts for 25 specimens are given in Table 1. This species has high setal counts on both the metasoma and pedipalps, and each carina exhibits considerable variation.

Pedipalp chela finger dentition varied as follows (left side, n = 25): for the fixed finger, 24 fingers had six subrows of denticles and one had five (the specimen with five had an aberrant finger, with the second and third rows fused); 24 fingers had six inner accessory denticles and one had five. For the right movable finger, 20 fingers had seven subrows and five had six (one of the five exhibited a damaged distal end on the finger, with the loss of the distal subrow); 22 fingers had seven inner accessory denticles, two had six, and one had nine.

**Table 1.** Variation in setal count in *V. oaxaca*. Setal counts of metasomal segments I-IV are separated by "/".

| Setal group | *n*=25 | |
|---|---|---|
| | **modal counts** | **range** |
| *Metasomal Segments I-IV:* | | |
| dorsolateral | 0/3/3/5 | 0-2/2-3/3-4/3-5 |
| lateral supramedian | 1/3/4/5 | 0-1/2-5/3-6/3-6 |
| lateral inframedian | 2/1/1/1 | 2-3/0-2/1-2/0-2 |
| ventrolateral | 4/4/4/5,6 | 3-4/4-5/3-5/4-7 |
| ventrolateral accessory | 0/1/1/1 | 0-2/1-2/1-2/1-3 |
| ventral submedian (total) | 6/9/10/12 | 6-8/8-12/8-13/10-14 |
| *Metasomal Segment V:* | | |
| dorsolateral | 12, 13 | 8-16 |
| lateromedian | 6, 7 | 5-7 |
| ventrolateral | 12 | 9-14 |
| ventrolateral accessory | 4 | 3-6 |
| ventromedian | 6+2 | 5-8+2-3 |
| *Pedipalp Femur:* | | |
| prolateral supramedian | 3 | 3-4 |
| prolateral inframedian | 5 | 4-6 |
| retrolateral median | 5 | 5-6 |
| *Pedipalp Patella:* | | |
| prolateral supramedian | 3 | 3-5 |

Morphometric variation is as follows: Males (n = 10): Chela length/width 3.26–3.87, patella length/width 3.00–3.75, fixed finger length/carapace length 0.47–0.63, segment III length/width 0.97–1.06, segment V length/width 1.73–2.03, fixed finger length/chela length 0.36–0.42, carapace length/segment V length 0.81–0.92. Females (n = 10): Chela length/width 3.23–3.77, patella length/width 3.06–3.44, fixed finger length/carapace length 0.57–0.63, segment III length/width 0.95–1.06, segment V length/width 1.62–2.06, fixed finger length/chela length 0.41–0.47, carapace length/segment V length 0.86–0.99.

**Comments.** Beutelspacher (2000: 103, map 85) listed several records of "*Vaejovis punctatus*" from Oaxaca within the range of this species, including Mixtequilla, Ixtlan de Juarez, and Salina Cruz. We were able to locate the Ixtlan de Juarez specimen in the CNAN collection, and it is referable to an undescribed species in the *mexicanus* group; specimens upon which the other records were based could not be located.

**Paratypes**. MEXICO: Chiapas: Arriaga, "4-8-75" (H. L. Stahnke), juvenile (CAS); Municipio Arriaga, 4 km NE Arriaga, 16º15.59' N: 93º51.96' W, 1 Sept 2005 (O. F. Francke, M. Cordova, A. Jaimes, H. Montaño), 1 male, 1 female (CNAN); Arriaga, near edge of town at Hwy intersection (sandy soil, field burned, UV light), "4-8-75" (H. L. Stahnke), 1 male (CAS). Oaxaca: Caballo Blanco (under rocks), 12 July 1963 (G. Sluder), 1 male, 2 females (AMNH); 1.5 mi S Carrizal (9500 ft), 25 July 1963 (G. Sluder), 1 female, 1 juvenile (AMNH); 3 mi E Chichicapan (Distrito de Ocotlan, 5400 ft), 23 Aug 1966 (C. M. Bogert), 1 male, 2 juveniles (AMNH); 4.5 mi S El Punto (8500 ft), 7 July 1966 (C. M. Bogert, P. Peckham), females (AMNH); 2 mi E Ixtlan de Juarez (7600 ft), 20 July 1963 (G. Sluder), 2 females (AMNH); Juan Garcia, 16° 18.6' N: 95° 28.2' W, 1 Sept 1964 (J. & W. Ivie), 1 male, 1 female (AMNH); NW of Juchitan, 3 Apr 1969 (W. Peck), 1 male, 1 female (CAS); 4 km E Miahuatlan, 16° 19.503' N: 96° 32.4606' W, 23 June 2006 (O. F. Francke, G. Villegas, H. Montano, A. Valdez, C. Santibanez), 1 male, 4 subadult males, 2 females, 1 subadult female, 1 juv male (CNAN); 6 males, 2 juveniles (AMNH); 4 males, 1 female (CAS) ; 8 mi N Miahuatlan, 3 Sept 1962 (M. Bogert), 2 females, 1 subadult female, 2 juvs. (AMNH); Mitla, 1962 (W. Miller), 2 juv. female (AMNH); ca. 6 mi E Mitla (above, to the NE of Xaaga, between 6000 & 7500 ft), 3 Sept 1965 (M. R. & C. W. Bogert), 1

male, 1 female, 2 juveniles (AMNH); 15 km E Mitla, 13-VIII-1988 (Stockwell), 1 female (UCB), 17 Aug 1988 (Stockwell), 1 subadult male, 2 females (UCB); 15 km E Mitla, 16° 66.606' N: 96° 17.114' W, elevation 2081 m); 18 July 2007; (O. Francke, A. Ballesteros, H. Montaño, C. Santibañez, A. Valdez), 3 males, 4 females; 14.5 km E Mitla, 12 July 2002 (O. Francke, E. Gonzalez, L. Prendini & J. Ponce), 1 female (AMNH); 14.5 km E Mitla, 17º 15.642' N: 96° 17.112' W, 23 July 2002 (L. Prendini, O. Francke, E. Gonzalez, J. Ponce), 1 female (AMNH-ARA 00001146); 3 mi NE Mitla (under rocks, 5800 ft), 13 July 1966 (P. Peckham, C. Bogert), 3 females (AMNH); 5 mi NE Mitla (on ridge, ca. 6800–7200 ft), near ruins called "El Crucero", 27 Aug 1963 (M. Bogert, G. Sluder, N. Bucknell), 3 males, 3 females, 1 juv. female (AMNH); about 6 mi N Mitla (6200 ft), 1 Sept 1962 (M. R. Bogert),1 female, 1 juv. female (AMNH); Nueve Puntas (under stones), 13 July 1963 (G. Sluder), 3 females (AMNH); 2 mi SE Niltepec, 16° 19.2' N: 94° 19.8' W, 16 Aug 1966 (J. & W. Ivie), 1 female, 1 juv. male (AMNH); Oaxaca de Juarez, 21–22 Aug 1965 (C. M. Bogert), 1 female, 1 juv. male (AMNH); 17 km SE Oaxaca nr. Dainzu Ruins, 11 Aug 1988 (Stockwell), 1 juv male (UCB); Portillo Nejapa (4200 ft, under rocks in pine-oak habitat), 20 July 1966 (C. M. Bogert), 2 females (AMNH); Summit, SE Nejapa, 16° 20.4' N: 95° 33.6' W, 29 Aug 1967 (J. & W. Ivie), 1 female, 1 juvenile (AMNH); San Juan del Rio, SE of Mitla (4100 ft, in river bottom), Aug 1961 (C. M. & M. R. Bogert), 1 female (AMNH); Tehuantepec, 27 Dec 1947 (T. MacDougall), juvenile (AMNH); 8 mi W Tehuantepec, 16° 13.2' N: 95° 13.2'W, 29 Aug 1966 (J. & W. Ivie), 6 females, 3 males, 1 juv. male, 1 juvenile (AMNH); 12 mi WNW Tehuantepec, 16° 13.3' N: 95° 13.3'W, 1 Sept 1964 (J. & W. Ivie), 1 male, 1 female, 1 juv. female (AMNH); 20 mi W Tehuantepec along Hwy 190 (4450 ft, dry acacia area), 23 June 1970 (Riechert, Reeder), 1 juv. male (AMNH); 3 km down dirt road to Santo Domingo Tepuxtepec (between Ayutla and Tepuxtepec), Mixes District, 16° 58.044' N: 96° 08.626' W, elevation 1805 m, 18 July 2007 (O. Francke, A. Ballesteros, H. Montaño, C. Santibañez, A. Valdez), 1 juvenile (CNAN); 5 mi W Tequisistlan, 16° 15' N: 95° 2.4'W, 1 Sept 1964 (J. & W. Ivie), 1 juvenile (AMNH); Tlacolula, 16 July 1955 (J. & P. Vaurie),1 female, 1 male (AMNH); Totolapam, "9-2-66" (R. Hubbard), 1 female (CAS); 2 km NNW Totolapam (3200'), 12 Aug 1988 (T. Doyen), 1 male, 2 females, 2 juvs. (UCB); 4 km N Totolapam, 16° 41.765' N: 96° 18.8683' W, elevation 1078 m, 1 November 2004 (O. Francke, R. Paredes & G. Villegas), 2 males, 4 females, 1 juv male (CNAN-T0377/ AMNH-ARA 00002012), 2 males, 4 females, 2 juv. males, 1 juv. female (AMNH/AMNH-ARA 000011511); 1 male, 2 females, 2 juvs. (CAS/AMNH-ARA 00001850); nr. Yagul, ca. 30 km SE Oaxaca, 13 Aug 1988 (S. Stockwell), 1 subadult male, 2 females (UCB); 14 Aug 1988 (S. Stockwell, T. Doyen), 3 females (UCB); Yahuiche (mesa east of Yagúl), 30 Aug 1962 (M. R. Bogert), 1 female (AMNH); Magdalena Mixtepec, 16° 52.824' N: 96° 51.0558' W, 19 Jun 2006 (O. Francke, G. Villegas, H. Montaño, C. Santibáñez & A. Valdez), 1 female, 1 juvenile (AMNH), 1 female, 3 juveniles (CNAN), 1 female (CAS); 1 km N San Lorenzo Mixtepec, 16° 17.5206' N: 96° 19.983' W, elevation 1925 m, 22 Jun 2006 (O. Francke, G. Villegas, H. Montaño, C. Santibáñez & A. Valdez), 1 male, 2 females, 4 juveniles (AMNH), 3 females, 1 subadult male, 5 juveniles (CNAN), 1 female, 2 juveniles (CAS); 1 km E Yagul, 16° 57.297' N: 96° 26.4606' W, elevation 1662 m, 14 Nov 2005 (O. Francke, M. Córdova, A. Jaimes, G. Montiel & C. Santibáñez), 1 male, 1 juvenile female (AMNH).

**Acknowledgments**

We would like to thank Charles Griswold (California Academy of Sciences), Norman I. Platnick and Lorenzo Prendini (American Museum of Natural History), Oscar Francke (Instituto de Biología, UNAM), Scott Stockwell (formally University of California, Berkeley) and Ernst G. Burmeister for the loan of the specimens studied here. The senior author would like to thank Oscar Francke, Alejandro Valdez, Hector Montaño, Gabriel Villegas and Ricardo Paredes for their help during the field work; he would also like to thank Alejandro Valdez and Mayra Patricia for their help editing the figures; to the Biological science graduate program of UNAM, to CONACYT and the Program for graduate studies support of UNAM (PAEP) for financial support during the senior's visit to West Texas A&M University at Amarillo, Texas on October, 2008. Field work for this project was supported in part by NSF BIO-DEB 0413453 grant to Lorenzo Prendini.

The junior author is especially grateful to Oscar F. Francke for his hospitality, generosity, and cooperation during several visits to Mexico City in recent years to study the scorpion collection at UNAM. Funding for these visits was provided by Tila Maria Pérez of the Instituto de Biología, the Arachnological Research Fund of the American Arachnological Society, and by NSF BIO-DEB 0413453 grant to Lorenzo Prendini.

## References

Beutelspacher, C.R. (2000) *Catálogo de los alacranes de México*. Universidad Michoacana de San Nicolás Hidalgo, Morelia, Michoacán. 175 pp.

Francke, O.F. (1975) A new species of *Diplocentrus* from New Mexico and Arizona (Scorpionida: Diplocentridae). *Journal of Arachnology*, 2, 107–118.

Francke, O.F. (1977) Scorpions of the genus *Diplocentrus* from Oaxaca, Mexico. *Journal of Arachnology*, 4, 145–200.

Francke, O.F. (1978) New troglobite scorpion of genus *Diplocentrus* (Scorpionida: Diplocentridae). *Entomological News*, 89(1–2), 39–45.

García-Mendoza, A., Ordóñez, M.J. & Briones-Salas, M. (eds). (2004) *Biodiversidad de Oaxaca*. Instituto de Biología, UNAM- Fondo Oaxaqueño para la Conservación de la Naturaleza- World Wildlife Fund. México. 605 p.

Gertsch, W.J. & Soleglad, M.E. (1966) Scorpions of the *Vejovis boreus* group (subgenus Paruroctonus) in North America. *American Museum Novitates*, 2278, 1–54.

Haradon, R.M. (1983) *Smeringurus*, a new subgenus of *Paruroctonus* Werner (Scorpiones, Vaejovidae). *Journal of Arachnology*, 11(2), 251–270.

Haradon, R.M. (1984a) New and redefined species belonging to the *Paruroctonus baergi* group (Scorpiones, Vaejovidae). *Journal of Arachnology*, 12, 205–221.

Haradon, R.M. (1984b) New and redefined species belonging to the *Paruroctonus borregoensis* group (Scorpiones, Vaejovidae). *Journal of Arachnology*, 12, 317–339.

Haradon, R.M. (1985) New groups and species belonging to the nominate subgenus *Paruroctonus* (Scorpiones, Vaejovidae). *Journal of Arachnology*, 13, 19–42.

Prendini, L. & Wheeler, W. (2005) Scorpion higher phylogeny and classification, taxonomic anarchy, and standards for peer review in online publishing. *Cladistics*, 21, 446–494.

Sissom, W.D. (1991) Systematic studies on the *nitidulus* group of the genus *Vaejovis*, with descriptions of seven new species (Scorpiones, Vaejovidae). *Journal of Arachnology*, 19, 4–28.

Sissom, W.D. (2000) Family Vaejovidae Thorell 1876. *In* Fet, V., W. D. Sissom, G. Lowe, & M. Braunwalder. *Catalog of the Scorpions of the World (1758-1998)*. New York Entomological Society, New York, pp. 503–553.

Sissom, W.D. & Francke, O.F. (1985) Redescriptions of some poorly known species of the nitidulus group of the genus *Vaejovis* (Scorpiones, Vaejovidae). *Journal of Arachnology*, 13 (2), 243–266.

Soleglad, M.E. & Fet, V. (2008) Contributions to scorpion systematics. III. Subfamilies Smeringurinae and Syntropinae (Scorpiones: Vaejovidae). *Euscorpius*, 71, 1–115.

Stahnke, H.L. (1970) Scorpion nomenclature and mensuration. *Entomological News*, 81,297–316.

Vachon, M. (1952) *Etudes sur les Scorpions*. Institut Pasteur d'Algérie. Algerie, 482 pp.

Vachon, M. (1974) Étude des caractères utilisés pour classer les familles et les genres de Scorpions (Arachnides). 1. La trichobothriotaxie en Arachnologie, Sigles trichobothriaux et types de trichobothriotaxie chez les Scorpions. *Bulletin du Muséum National d'Histoire Naturelle*, Paris, (3), 140 (Zool. 104), 857–958.

Yahia, N. & Sissom, W.D. (1996) Studies on the systematics and distribution of the scorpion *Vaejovis bilineatus* Pocock (Vaejovidae). *Journal of Arachnology*, 24, 81–88.