A new *Vaejovis* (Scorpiones: Vaejovidae) with a subaculear tooth from Michoacan, Mexico

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Abstract:

*Vaejovis kuarapu* sp. n., from Municipio Paracuaro, Michoacan is described and illustrated, including the hemispermatophore. This is the fifth species of *Vaejovis* from Mexico, fourth from the mainland, with a well developed subaculear tooth. *Vaejovis zihuatanjensis* Baldazo-Monsivais, 2003, is synonymized under *Vaejovis acapulco* Armas & Martin-Frias, 2001.

Key words: Scorpiones, Vaejovidae, systematics, Michoacan, Mexico.


Un nuevo *Vaejovis* (Scorpiones: Vaejovidae) con espina subaculear de Michoacán, México.

Resumen:


Palabras clave: Scorpiones, Vaejovidae, sistemática, Michoacán, México.


Introduction

Seven species of *Vaejovis* Koch, 1836 with a well developed subaculear tooth have been described: (1) *Vaejovis spicatus* Haradon, 1974, from southern California, U.S.A.; (2) *Vaejovis pattersoni* Williams & Haradon, 1980 (in Williams, 1980), from Baja California Sur, Mexico; (3) *Vaejovis chamelaensis* Williams, 1986, from Jalisco, Mexico; (4) *Vaejovis mumai* Sissom, 1993, from Arizona, U.S.A.; (5) *Vaejovis acapulco* Armas & Martin-Frias, 2001, from Guerrero, Mexico; (6) *Vaejovis nayarit* Armas & Martin-Frias, 2001, from Nayarit, Mexico; and (7) *Vaejovis zihuatanjensis* Baldazo-Monsivais, 2003, also from Guerrero. The objectives of this contribution are to describe another species with a subaculear tooth; and secondarily to synonymize *V. zihuatanjensis*.

Materials and methods

Nomenclature and mensuration for the most part follow that of Stahnke (1970), with the following exceptions: metasomal carinal terminology after Francke (1977), and trichobothrial terminology after Vachon (1974). Hemispermatophore preparation follows Sissom et al. (1990). The description largely follows in organization and details of that recently published by Sissom and Gonzalez-Santillan (2004); except that the diagnosis for the new species enumerates only characters considered most useful in identifying the species, and comparisons with taxa considered its closest relatives are provided in a separate section.
Obsolete is used when a structure is absent; vestigial when it is very weakly developed; weak, moderate and strong are relative degrees of development of a given structure.

The holotype and paratypes of *V. acapulco* deposited at CNAN, IBUNAM were studied; the holotype of *V. zihuatanejensis* could not be located and attempts to contact the author received no response.

**Fig. 1** *Vaejovis kuarapu* sp. n. Holotype male.

*Vaejovis kuarapu*, sp. n.
Figs. 1-7, 9, 14-15

**TYPE MATERIAL:** Holotype male from La Batea, 19° 07’ 54” N – 102° 07’ 48” W, 360 m, Municipio de Paracuaro, Michoacán, México, 21 Octubre 2000 (J. Ponce, et al., under rocks). Deposited in the Colección Nacional de Arácnidos (CNAN), Instituto de Biología, UNAM. Paratypes: one adult male (AMNH) and two adult female (CNAN; Univ. de Michoacan), same data as holotype.

**ETYMOLOGY:** The specific name *kuarapu* is the term given scorpions by the native inhabitants of Michoacán, the Purhepecha ethnic group, and is a noun in apposition.

**DIAGNOSIS:** Adults about 20 mm long, carapace 2.7-2.9 mm long. Base color yellow brown with metasoma darkening distally to reddish brown; body with variegated fuscosity throughout (Fig. 1), except prosoma and mesosoma ventrally yellow and without markings. **COLOR:** Base color dorsally yellow brown, with metasoma darkening distally to reddish brown; body with variegated fuscosity throughout (Fig. 1), except prosoma and mesosoma ventrally yellow and without markings. **PROSOMA:** Carapace conspicuously convex, about 1.3 times longer than wide; anterior margin straight, with three pairs of setae; median eyes located on anterior one-third (Fig. 2); surface shagreened to minutely granulose throughout. **MESOSOMA:** Tergites minutely granulose; VII with four moderately strongly, serrated carinae. Stermites II-VI lustrous; VII shagreened, without carinae. **Hemispermatophore** (Figs. 3 and 4) lamelliform, about 2.6 mm long; lamella 2.3 mm long (from distal tip to truncal flexure), 0.26 mm wide; dorsal hooks paired, almost halfway along ectal edge of lamella; capsule poorly sclerotized, without spines, spicules or hooks with well developed subacicular tooth; vesicle about onehalf as wide as segment V. Pedipalps orthobothriotaxia “C”; chela ib-it located at base of fixed finger. Fixed finger with primary denticle row divided into six subrows by five enlarged denticles; with six inner accessory denticles, the distal most unpaired. Movable finger with primary denticle row divided into six subrows by five enlarged denticles; with seven inner accessory denticles, the basal and distal ones unpaired. Pectinal tooth counts 12-13 in males, 12 in females.

**Fig. 2. Vaejovis kuarapu** sp. n. Carapace.

**DESCRIPTION** Based on the holotype:

**COLOR:** Base color dorsally yellow brown, with metasoma darkening distally to reddish brown; body with variegated fuscosity throughout (Fig. 1), except prosoma and mesosoma ventrally yellow and without markings. **PROSOMA:** Carapace conspicuously convex, about 1.3 times longer than wide; anterior margin straight, with three pairs of setae; median eyes located on anterior one-third (Fig. 2); surface shagreened to minutely granulose throughout. **STERNA:** Pentagonal, with three pairs of setae (one anterior submedian, one middle submedially and one middle laterally). **MESOSOMA:** Tergites minutely granulose; VII with four moderately strongly, serrated carinae. Stermites II-VI lustrous; VII shagreened, without carinae. **Hemispermatophore** (Figs. 3 and 4) lamelliform, about 2.6 mm long; lamella 2.3 mm long (from distal tip to truncal flexure), 0.26 mm wide; dorsal hooks paired, almost halfway along ectal edge of lamella; capsule poorly sclerotized, without spines, spicules or hooks with well developed subacicular tooth; vesicle about onehalf as wide as segment V. Pedipalps orthobothriotaxia “C”; chela ib-it located at base of fixed finger. Fixed finger with primary denticle row divided into six subrows by five enlarged denticles; with six inner accessory denticles, the distal most unpaired. Movable finger with primary denticle row divided into six subrows by five enlarged denticles; with seven inner accessory denticles, the basal and distal ones unpaired. Pectinal tooth counts 12-13 in males, 12 in females.
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around sperm duct, mating plug without hooklets on distal barb. **METASOMA:** with carinae faintly infuscate, segments progressively wider distally. Ventral submedial carinae on I-IV obsolete. Ventrolateral carinae on I-II weak, III-IV moderate, granulose. Lateral inframedian carinae on I moderate, complete, granulose; on II weak, on distal third only, granulose; on III weak, on distal fourth only, granulose; on IV obsolete. Lateral supramedian and dorsolateral carinae on I-IV moderate, serrate-granulose. Segment V: ventromedian carina obsolete; ventrolateral carinae on distal half only, weak, granulose; lateral carinae indicated by a few granules basally; dorsolateral carinae weak, granulose, with five pairs of setae. All intercarinal spaces densely, minutely granulose.


**TELSON** narrower than segment V; vesicle ventrally weakly granulose, with one large tooth pointing towards the tip of the aculeus, and one smaller tooth basal to it (Fig. 9).

**CHELICERA** pale yellow to cream without fuscosity, teeth on both fingers medium brown. Movable finger with a well developed serrula ventrally.

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**Figs. 3-4. Vaejovis kuarapu sp. n.** 3: dorsal aspect of right hemispermatophore. 4: enlarged ectal aspect of right hemispermatophore. Scale=0.5 mm.

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**Figs. 5-7. Vaejovis kuarapu n. sp.** 5: external aspect of male pedipalp chela. 6. dorsal aspect of male pedipalp chela. 7. dorsal aspect of female pedipalp chela.
Figs. 8-11. Lateral aspect of metasomal segment V and telson (all drawn at the same magnification; scale=0.5 mm). 8: Vaejovis nayarit Armas & Martin-Frias. 9: Vaejovis kuarapu, sp. n. 10: Vaejovis chamelaensis Williams. 11: Vaejovis acapulco Armas & Martin-Frias.

PEDIPALPS: Orthobotheriotaxia “C”. Femur three times longer than wide; carinae moderately infuscated, dorsal, anterior and posterior faces uniformly but faintly infuscated, shagreened; dorsointernal and dorsoexternal carinae moderate, granulose. Patella 3.1 times longer than wide, faintly infuscate; internal median carina weak, granulose, complete; dorsointernal carina very weak, granulose; dorsoexternal carina obsolete; ventroexternal and ventrointernal carinae weak, granulose. CHELA (Figs. 5 and 6) yellow, fingers moderately infuscate; palm moderately swollen, without carinae; fingers edges slightly curved, leaving a distinct gap when closed; fixed finger (Fig. 14) with primary denticle row divided into six subrows by five enlarged primary row denticles, and with seven inner accessory denticles; movable finger (Fig. 15) with primary denticle row divided into six subrows by five enlarged primary row denticles, and with seven inner accessory denticles.

LEGS with moderate, variegated fuscosity; tarsomere II distally with one pair of ventral spinules. Measurements of holotype (in mm; L=length, W=width, D=depth). Total L 19.30. Carapace L/W 2.70/1.85. Mesosoma L 5.75. Metasoma L 8.55 : I L/W 1.10/1.60, II L/W 1.35/1.60, III L/W 1.50/1.60, IV L/W 2.00/1.65, V L/W 2.60/1.70. Telson L 2.30; vesicle W/D 1.05/0.85. Pedipalp L 8.50: femur L/W 2.25/0.75, patella L/W 2.50/0.80, chela L/W/D 3.75/1.20/1.00, movable finger L 2.25. 13 teeth.

INTRASPECIFIC VARIABILITY: Sexual dimorphism is evident in three characters: (a) females are slightly larger than males; (b) the female integument is lustrous rather than shagreened as in the males; and (c) the pedipalp chela is not swollen in the females (Fig. 7).

Pectinal tooth counts among the 2 males studied varied as follows: 1 comb with 12 teeth, 3 combs with 13 teeth. The pectinal tooth count on the two known females is 12-12

Metasomal setal variation (n=8, four specimens, two sides each): ventral submedians none; ventrolaterals on I six with two setae, two with three; ventrolaterals on III seven with three setae, one with four; lateral inframedians none; lateral supramedians on I seven without setae, one with one; dorsolaterals on V six with five setae and two with six.

COMPARISONS: Among the described species with a subaculear tooth, V. kuarapu can be separated as follows:

1—V. spicatus is brownish-yellow with no contrasting markings, whereas V. kuarapu is densely infuscate throughout; it has a globose vesicle as wide or wider than metasomal segment V, whereas on V. kuarapu the vesicle is about one-half as wide as segment V; and has 7 subrows of primary denticles on the movable finger, whereas V. kuarapu has only six.

2—V. mumai is yellow to golden brown without any dusky markings, also has a globose vesicle, and has only 5 subrows of primary denticles on the fixed finger.

3—V. pattersoni has well developed ventral carinae on metasomal segment V, with the median carina distinctly granular and the laterals crenulate to serrate; whereas on V. kuarapu the ventromedian carina is obsolete, and the ventrolaterals are weak and granulose and present only
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Figs. 12-19. Granulation of pedipalp chela fingers (all drawn at the same magnification; scale =0.5 mm). 12-13: Vaejovis chamelaensis Williams. 14-15: Vaejovis kuarapu, sp. n. 16-17: Vaejovis nayarit Armas & Martín-Frías. 18-19: Vaejovis acapulco Armas & Martin-Frias. 12, 14, 16, 18: fixed finger. 13, 15, 17, 19: movable finger.

in the distal one-half.

4—V. chamelaensis is considerably smaller with carapace lengths of 1.8-2.0 mm in adults, whereas on V. kuarapu it measures 2.7-2.9 mm; has a lower pectinal tooth count, with 10-11 in males and 10 in females, whereas in V. kuarapu males have 12-13 and females 12; the ventral carinae on metasomal segment V are strong, serrate; and the subaculear tooth is small (Fig. 10), whereas on V. kuarapu the carinae are weak to obsolete and the tooth rather large (Fig. 9); and both the fixed and movable fingers of the pedipalp chela have the primary denticle row divided into five subrows by four enlarged denticles (Figs. 12 and 13), whereas on V. kuarapu there are five and six subrows, respectively.

5—V. acapulco essentially lacks carinae on metasomal segment V (Fig. 11), whereas the dorsolaterals are weak and granulose on V. kuarapu; and this species has six enlarged granules on the primary denticle subrows on both the fixed and the movable finger (Figs. 18 and 19), compared to the five subrows present in the new species. In the original description of this species, Armas & Martin-Frias (2001) reported specimens not only from Acapulco, but also from Zihuatanejo, Guerrero. The subsequent description of V. zihuatanejensis (apparently prepared in 1994 but not published until 2003) makes no mention of V. acapulco, and it is obvious that they are one and the same; therefore, here we formally propose that Vaejovis zihuatanejensis Baldazo-Monsivais, 2003 = Vaejovis acapulco, new synonymy.

6—Finally, V. nayarit has the carinae on metasomal segment V strong and coarsely crenulate (Fig. 8), and has pedipalp finger dentition (Figs. 16 and 17) similar to that of V. kuarapu.

DISCUSSION: In the description of the first Vaejovis with a subaculear tooth, Haradon (1974) compared V. spicatus to Serradigitus joshuaensis (Soleglad, 1972), another species of the family Vaejovidae with a subaculear tooth, and made no mention of its phylogenetic relationships or its placement in the then recognized species groups of the genus Vaejovis. Subsequently, Williams & Haradon (1980) described V. pattersoni and placed it in the eusthenura group without additional comments; and when Williams (1986) described V. chamelaensis he also placed it in the eusthenura group, but did not mention the similarity between this species and the former. Sissom (1993) described V. mumai and compared it to V. spicatus, and after a thorough discussion on their affinities to other genera and the species groups of Vaejovis left them unplaced; and he did not mention V. pattersoni or V. chamelaensis in his publication. Likewise, Armas & Martin-Frias (2001) in their descriptions of V. acapulco and V. nayarit failed to relate them to the other Mexican species with a subaculear tooth.

Although our knowledge of the species with a subaculear tooth is still incomplete, partly because of the paucity of specimens known, some interesting observations follow. The two northern species, V. spicatus and V. mumai appear to be more closely related to each other in that they share a globose telson, the subaculear tooth is conical in shape, and they lack fuscous markings on the body. The five Mexican species also appear to be more closely related to each other than to the northern species in that they share a non-globose telson, the subaculear tooth is spinoid and slightly compressed.
laterally, and their bodies are heavily infuscate. The difference in the shape (conical versus spinoid) suggest that the subaculear tooth in the northern species is not homologous to that of the Mexican species. The genus Vaejovis is known not to be monophyletic (Sissom, 2000), as are most likely some of the species groups (see Sissom, 2000) currently recognized, and thus the relationships of the taxa with a subacicular tooth to other members of the genus remains unresolved.

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Bibliography


