

Vaejovis montanus (Scorpiones: Vaejovidae), a new species from the Sierra Madre Occidental of Mexico

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Abstract. A new species of montane scorpion is described from the Sierra Madre Occidental of Mexico. The species is morphologically similar to scorpions distributed throughout the “sky island” region of the southwestern United States and northwestern Mexico and is a member of the “vorhiesi” subgroup of the *Vaejovis* “mexicanus” group. The morphology of the new species is compared to that of “vorhiesi” subgroup taxa, and biogeographic hypotheses about the diversification of this group are provided.

Keywords: Scorpion, “mexicanus” group, “vorhiesi” subgroup, taxonomy

The *Vaejovis* “mexicanus” group is a heterogeneous mix of scorpions comprised mostly of small, mountain-dwelling species that prefer similar habitat (Sissom 2000; Graham 2007). The group is relatively widespread in North America, occurring from as far south as the Mexican state of Chiapas, north to southern Utah, and east to North Carolina in the United States. Several of these scorpions are morphologically similar (and presumably closely related) and occur in geographic proximity, together comprising the “vorhiesi” subgroup (Soleglad & Fet 2008). Species in this subgroup (*V. cashi*, *V. deboerae*, *V. feti*, *V. paysonensis*, and *V. vorhiesi*) are disjunctly distributed throughout the mountain isolates of southern Arizona and New Mexico and northwestern Mexico in a region referred to as the “sky islands.”

Strikingly rich in biodiversity (Warshall 1995), the sky island region forms an archipelago of mesic mountain habitat flanked by vast expanses of desert and grassland plains. The sky islands provide a link between the northern Sierra Madre Occidental and the southern Rocky Mountains, effectively acting as a stepping stone of montane ecosystems (Holycross & Douglas 2007). Interestingly, however, the “mexicanus” group has never been documented in the well-studied Rocky Mountains, suggesting that these generally abundant and accessible scorpions likely do not occur there at all. Given that the “mexicanus” group is widespread in Mexico and conspicuously lacking from the Rocky Mountains, it is plausible that the ancestral stock of the “vorhiesi” subgroup came from the Sierra Madre Occidental. This has led to the suggestion that explorations of the Sierra Madre Occidental mountain ecosystems would reveal undescribed “mexicanus” group species (Sissom 2000).

As predicted, while searching under rocks, logs, and pine-oak forest litter during herpetofaunal surveys in the Sierra Madre Occidental, we discovered a new species of scorpion belonging to the “vorhiesi” subgroup of the “mexicanus” group. Presented herein is a description of the new species, with comments on the biogeographic implications of this discovery.

METHODS

Measurements are as described by Stahnke (1970), trichobothrial patterns are as in Vachon (1974) and Soleglad & Fet (2003), pedipalp finger dentition follows Soleglad & Sissom

(2001), and hemispermatophore terminology is from Soleglad & Fet (2008). Ventral submedian setal counts on metasomal segments I to IV are presented as the number of pairs of setae on each metasomal segment between the anterior and posterior margins, beginning with segment I, with counts for each segment separated by a semicolon. For measurements, the words “length”, “width”, and “depth” are abbreviated as L, W, and D. Total lengths were measured from the anterior margin of the carapace to the aculeus tip with the telson fully extended.

Acronyms of depositories.—CAS, California Academy of Sciences, San Francisco, California, USA; UANL, Universidad Autónoma de Nuevo León, Mexico; MRG, personal collection of Matthew R. Graham, Las Vegas, Nevada, USA.

Material examined (other than types).—*Pseudouroctonus apacheanus* (Gertsch & Soleglad 1972): MEXICO: Sonora: 14.2 km E of Yécora on Hwy 16, 5.3 km S on dirt road E of kilometer marker 294, 28.3384°N, 108.8331°W, 1772 m, 25 August 2007, M.R. Graham & R.W. Bryson, Jr., 2 ♀ (CAS); El Horquetudo, ca 16 km S Yécora, 28.2663°N, 108.8907°W, 1920 m, 10 July 2008, R.W. Bryson, Jr., 1 ♀ (MRG).

Vaejovis cashi Graham 2007: USA: Arizona: Herb Martyr Canyon, Chiricahua Mountains, Cochise County, 31.8901°N, 109.1686°W, 1530 m, 15 March 2008, R.W. Bryson, Jr., 8 ♀ (MRG).

Vaejovis feti Graham 2007: USA: New Mexico: Meadow Creek, Grant County, 6 July 1978, M. Muma, 1 ♂, 1 ♀ (MRG).

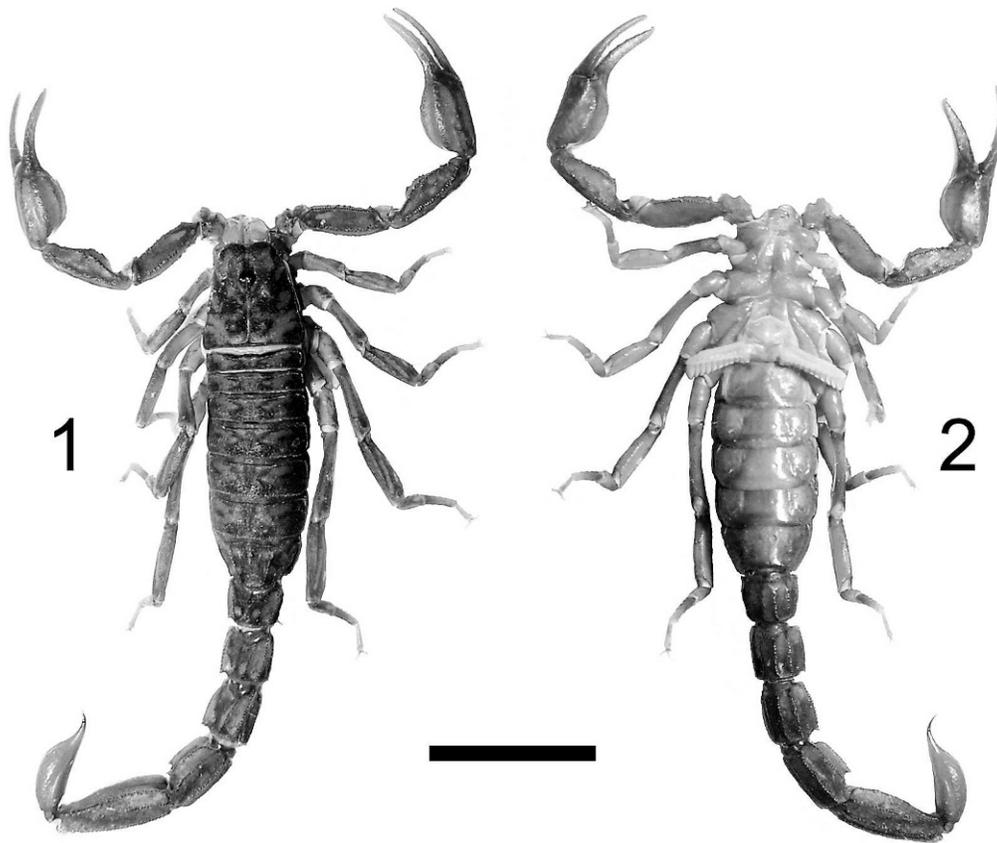
Vaejovis franckei Sissom 1989: MEXICO: Oaxaca: Cerro Corral del Piedra, 17.1696°N, 96.6571°W, 3270 m, 18 June 2007, R.W. Bryson, Jr. & F. Mendoza-Quijano, 1 ♂, 6 ♀ (CAS).

Vaejovis granulatus Pocock 1898: MEXICO: Morelos: W of Huitzilac, 19.0284°N, 99.2775°W, 2705 m, 4 June 2007, R.W. Bryson, Jr. & J. Jones, 3 ♀ (CAS).

Vaejovis paysonensis Soleglad 1973: USA: Arizona: Payson, Gila County, 2001, D. Vernier, 1 ♀ (MRG).

Vaejovis vaquero Gertsch & Soleglad 1972: MEXICO: Chihuahua: Sierra del Nido, 29.506111°N, 106.748556°W, 2731 m, 27 July 2007, R.W. Bryson, Jr., 2 ♀ (CAS).

Vaejovis vorhiesi Stahnke 1940: USA: Arizona: Cave Creek Canyon, Santa Rita Mountains, Santa Cruz County, 31.7130°N, 110.8241°W, 1890 m, 20 March 2008, R.W. Bryson, Jr., 1 ♂, 3 ♀ (MRG).



Figures 1–2.—*Vaejovis montanus* new species, male holotype (CAS). 1. Dorsal aspect. 2. Ventral aspect. Scale bar represents 5 mm.

TAXONOMY

Family Vaejovidae Thorell 1876
 Subfamily Vaejovinae Thorell 1876
 Genus *Vaejovis* Koch 1836

Vaejovis Koch 1836:51.

Type species.—*Vaejovis mexicanus* Koch 1836, by monotypy.

Vaejovis montanus new species
 (Figs. 1–6, 8–24)

Type material.—MEXICO: *Chihuahua*: male holotype, Sierra Madre Occidental southeast of Zorillo, a small ejido ca 5 km SW Guadalupe y Calvo, 26.0398°N, 106.9396°W, 2625 m, 14 July 2008, R.W. Bryson, Jr., M. Torocco, & F. Mendoza-Quijano (CAS Type No. 18488). Paratypes: 5 females, collected with holotype (CAS); 1 male, 5 females, collected with holotype (UANL).

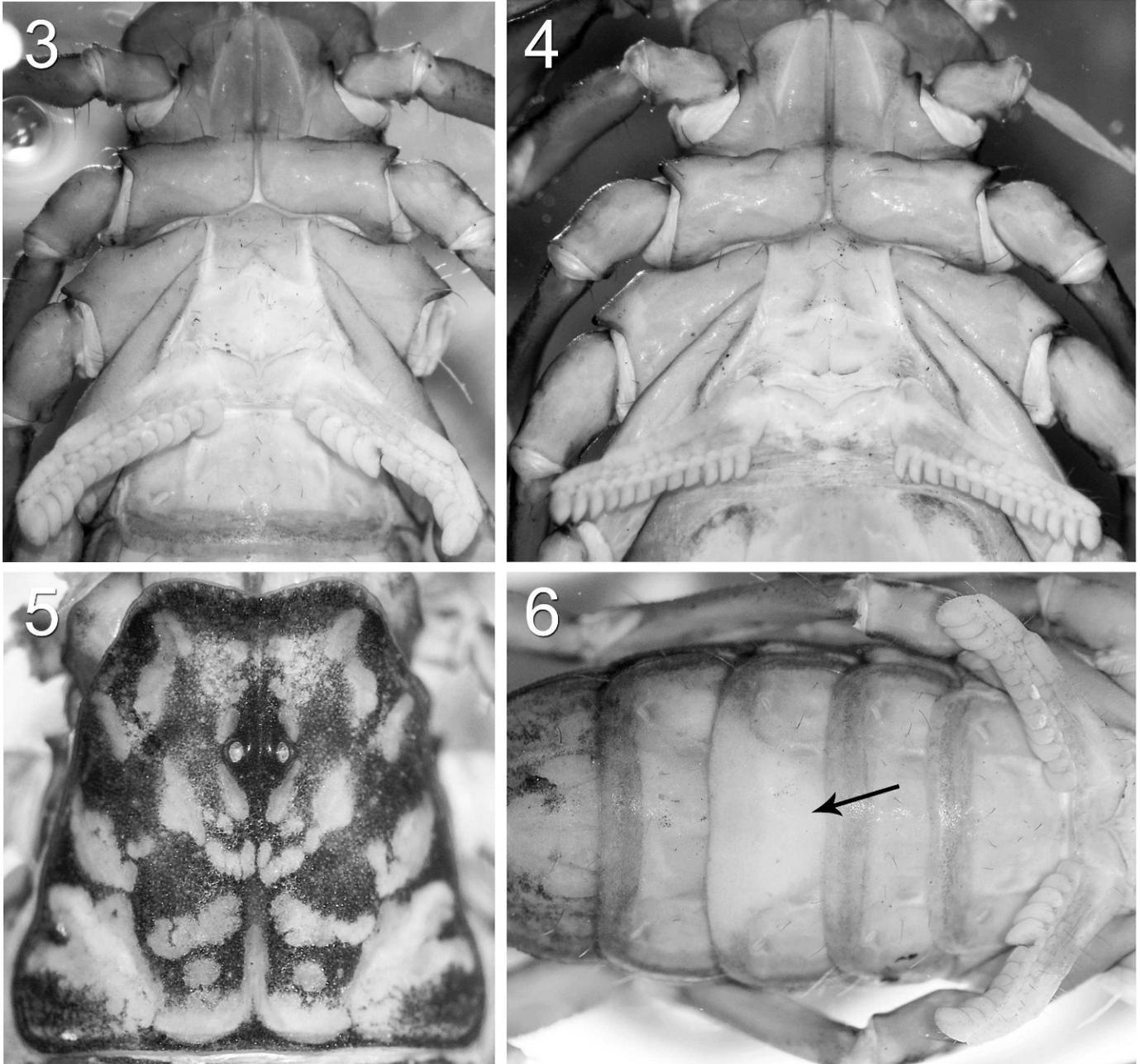
Other material examined.—MEXICO: *Sonora*: 2 females, El Horquetudo, ca 16 km S Yécora, 28.2663°N, 108.8907°W, 1920 m, 10 July 2008, R.W. Bryson, Jr. (CAS).

Etymology.—The specific epithet is the Latinized form of “montane,” referring to high-elevation habitats in the Sierra Madre Occidental where the species was discovered.

Diagnosis.—Small, with females slightly larger than males (up to approximately 34.2 mm for females). Brown base color with darker mottling on the carapace, legs, tergites, and metasoma (Figs. 1, 2, 5). Males with an area of reduced pigmentation on sternite V, herein referred to as the ‘white

patch’ (Fig. 6). Hemispermatothores lamelliform with well developed distal lamina and distinct distal crest about 1/3 length of lamina (Figs. 16, 17). Possesses following criteria of the “mexicanus” group (Soleglad 1973): genital operculum of females divided on posterior 1/5; fixed finger equal or longer than palm width; inner ventral carina of chelal palm variable, from obsolete to well developed; chelal trichobothria *ib* and *it* are located proximally on the fixed finger, not on palm; anterior margin of carapace concave but not deeply bilobed. Further distinguishable from all other vaejovids in the following combination of characters: pectine count 11–13 (Figs. 3, 4); 7 ID denticles on the pedipalp movable finger (Fig. 15) and 6 on the fixed finger. This species is a member of the “vorhiesi” subgroup, all of which are small (total L of 33 mm or less), inhabit montane forests, have single pair of distal spinules on ventral surface of leg tarsus, and have trichobothrium *Db* ventral to *Dl* carinae on chelal palm (Graham 2007; Ayrey 2009; Soleglad & Fet 2008).

It appears that *V. montanus* is also closely related to *V. vaquero* (Fig. 7), a montane species endemic to the Sierra del Nido Mountains in north-central Chihuahua (Sissom & Hendrixson 2005) that should also be considered a member of the “vorhiesi” subgroup. In fact, *V. montanus* is morphologically most similar to *V. vaquero*, since both share ID denticle counts, have similar femur and patella L/W ratios, and overlap in pectine tooth counts. However, *V. montanus* can be distinguished from *V. vaquero* and all other known sky island *Vaejovis* species by the following combination of characters: large adult size (26.7–34.2),



Figures 3–6.—*Vaejovis montanus* new species. 3. Pectines and sternum, male holotype. 4. Pectines and sternum, female paratype. 5. Carapace, male holotype. 6. White patch (arrow), an area of reduced pigmentation, on sternite V, male holotype.

more robust femur (L/W ratio 2.58–2.92) and pedipalp (L/W ratio 2.25–2.83), 7 ID denticles on the pedipalp movable finger and 6 on the fixed finger, pectine count 11–13, 6–7 middle lamellae, and darker coloration with strong mottling. A comparison of taxonomically important characters is provided in Table 1.

Vaejovis montanus can be further distinguished from other sky island *Vaejovis* species by possessing a more horizontally aligned external median (*em*) trichbothria series on the pedipalp patella (Figs. 8–13), and by differences in the white patch on sternite V in adult males. In *V. montanus*, the white patch is large and V-shaped, comprising about 50% of the

surface area of the sternite, whereas in both *V. deboerae* and *V. feti* the white patch is restricted to the posterior 1/3 of the sternite and not nearly as pronounced. Unfortunately, adult male specimens of the other sky island *Vaejovis* species are lacking, so the presence or absence of the white patch in those species remains unknown.

Superficially, *V. paysonensis* from central Arizona could also be confused with *V. montanus*. However, this species has more elongated chelae, less robust pedipalp patellae, faded mottling, and a lighter coloration. Another species, *V. pequeno* (currently *incertae sedis*) is similar in general morphology and has been found at mid-elevations in central and southeast

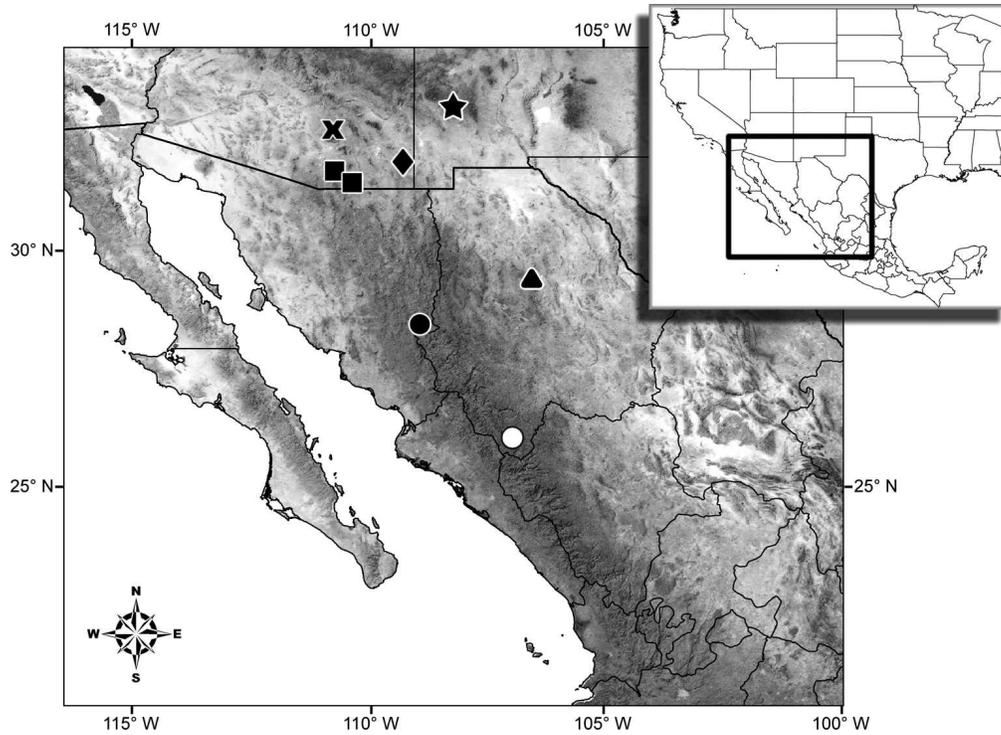
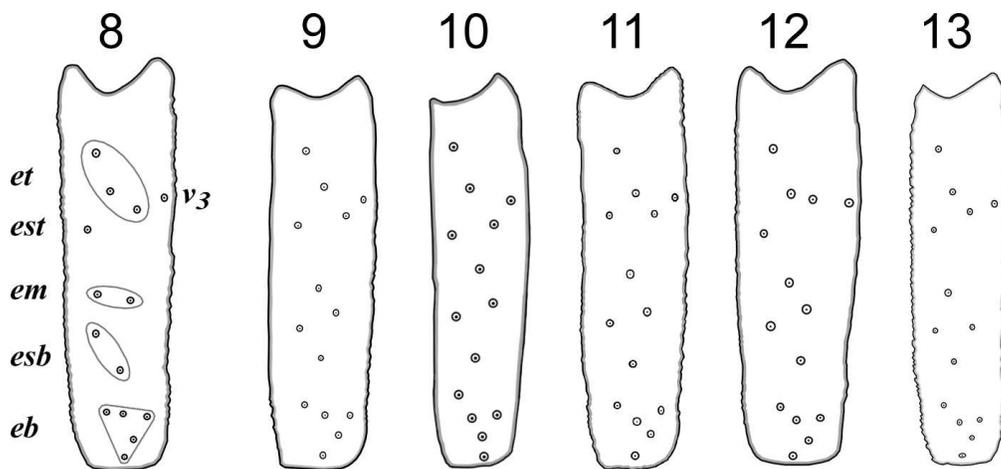


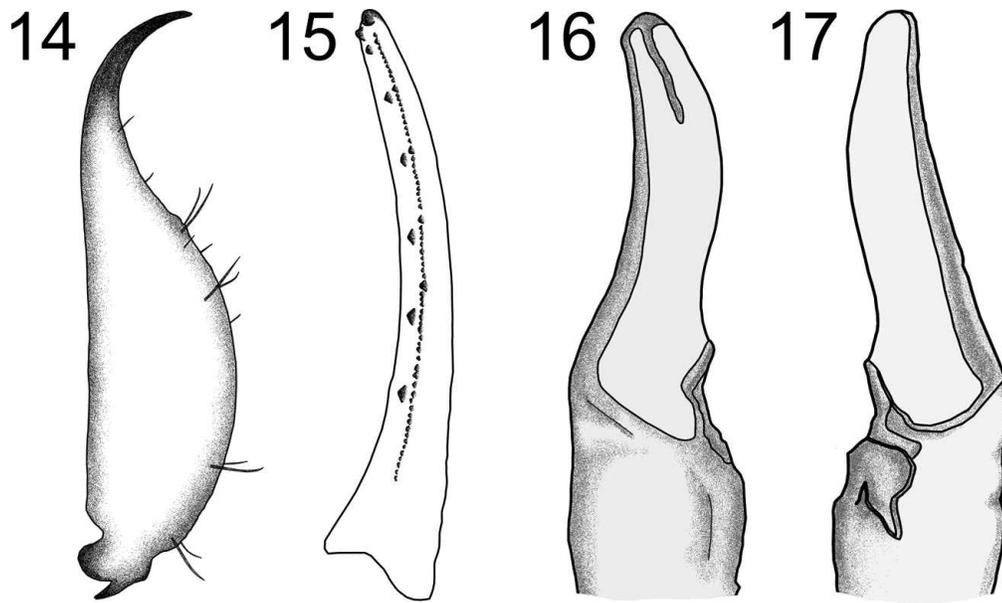
Figure 7.—Distribution of *Vaejovis montanus* new species (circles) and four closely related “mexicanus” group species: *V. cashi* Graham (diamond), *V. deboerae* Ayrey (X), *V. feti* Graham (star), *V. vaquero* Gertsch & Soleglad (triangle), and *V. vorhiesi* Stahnke (squares). The white circle depicts the type locality of *V. montanus*.

Sonora (Hendrixson 2001). This species, however, can readily be distinguished from *V. montanus* by its smaller adult size (adults up to 19.85 mm in *V. pequeno*) and position of trichobothria *ib* and *it* just basal to sixth inner accessory denticles (positioned at the base of the fixed finger in *V. montanus*). Furthermore, *V. montanus* is located in high elevation pine-oak forests in the Sierra Madre Occidental and is not known to be sympatric with any other “mexicanus” group species.

Description of holotype.—*Color:* Carapace, tergites, femur, patella, legs, and metasoma with a yellow-brown base color and mottled with dark brown to black markings dorsally. Pedipalp chela also mottled but with a reddish-brown base color. Chelicerae yellow-brown with mottling on distal 1/2. Telson reddish-brown with two light colored stripes ventrally. Pectines and genital operculum light yellow to light orange, and there is a white patch (area of reduced pigmentation) on sternite V in males.



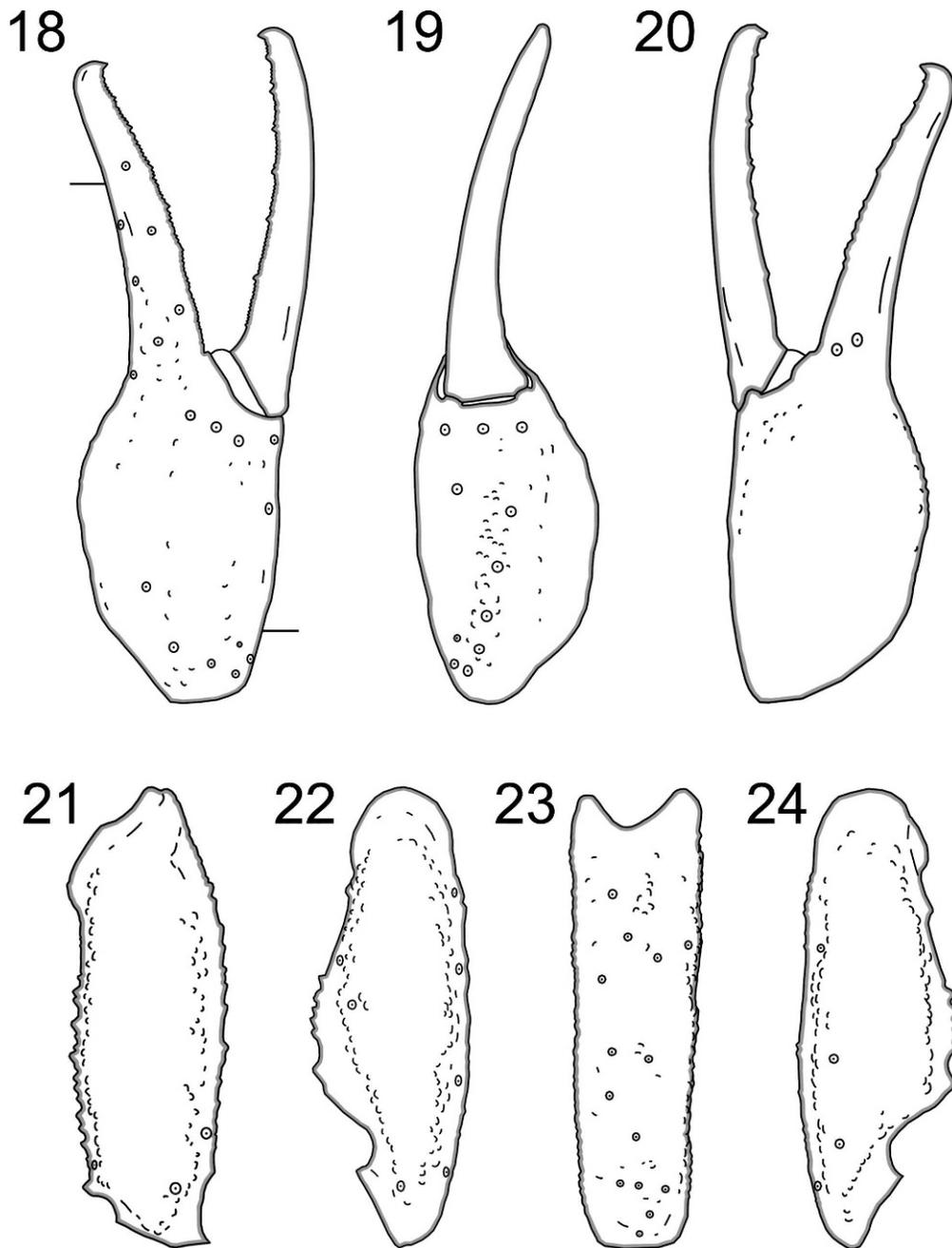
Figures 8–13.—Trichobothrial patterns of pedipalp patellae (external view) of “sky island” *Vaejovis* species. 8. *V. montanus* new species, holotype male. 9. *V. cashi*, holotype female. 10. *V. deboerae*, holotype female, adapted from Ayrey (2009). 11. *V. feti*, holotype male. 12. *V. vaquero*, female. 13. *V. vorhiesi*, holotype female. Trichobothrial abbreviations: eb = external basal; esb = external suprabasal; em = external median; est = external subterminal; et = external terminal; v3 = ventral trichobothrium number 3.



Figures 14–17.—*Vaejovis montanus* new species, male holotype. 14. Telson, lateral view. 15. Movable finger of right pedipalp. 16. Right hemispermatophore, dorsointernal view. 17. Right hemispermatophore, ventral view.

Morphology: Carapace: anterior margin slightly emarginate, with three lateral eyes on each side; moderately convex dorsolaterally; finely granular with scattered small granules; median furrow slight and traversing length of carapace, excluding the median eyes; ratio of median eyes location (distance from anterior edge)/carapace L = 0.35; carapace L/W at median eyes = 1.37. Tergites: coarsely granular with weak median carinae from distal 1/2 of tergite I to proximal half of VII; strong granular dorsolateral and lateral suprmedian carina on posterior 4/5s of VII; pretergites very finely granular. Sternites: III–VI smooth to very finely granular and without carinae; VII with granular ventral lateral carinae on posterior 1/5 to posterior 3/5s. Spiracles: ovoid with median side rotated 35° away from posterior sternite margin. Genital Operculum: sclerites separated on posterior 1/5 with genital papillae protruding well beyond posterior of operculum plates. Pectines: tooth count 11/12; middle lamellae 7/7; sensorial areas present on all pectine teeth (sensorial areas present on all teeth in females, but slightly reduced on the most basal tooth). Metasoma: ratio of segment I L/W 0.80; segment II L/W 0.88; segment III L/W 1.06; segment IV L/W 1.46; segment V L/W 2.22. Segments I–IV: dorsolateral carinae strong and serrate with distal denticle of II–IV enlarged and spinoid; of segment I only slightly enlarged and spinoid with serration of carina less pronounced; lateral suprmedian carinae I–III with serrated granules and enlarged spinoid distal denticle; carinae of segment IV less pronounced, crenulate to serrate, and flared on distal terminus; space between dorsolateral and suprmedian carinae of segments I–III with several scattered granules; lateral infrmedian carinae serrulate to finely crenulate on length of segment I, posterior 1/4 of II, 1/5 of III, and absent on IV; ventrolateral carinae I weak and crenulate to serrulate; on II–III serrulate to serrate; on IV serrate; ventral submedian carinae granular to serrulate on I and serrate to crenate on II–IV; dorsal and lateral intercarinal spaces very finely granular; ventral submedian setae pairs 3:3:3:3. Segment V: dorsolateral

carinae moderate, distally crenulate, basally granular to serrate; lateromedian carinae moderate and granular on basal 2/3, obsolete on distal 1/3; ventrolateral and ventromedian carinae moderate and serrate; ventromedian carinae continuous and straight for full length of segment, not posteriorly bifurcated; intercarinal spaces finely granular; ventrolateral setae pairs 5. Telson: smooth to slightly granular with very small bump in place of a subaculear tubercule; LAS denticles (Fet et al. 2006) lacking. Chelicerae: dorsal edge of movable cheliceral finger with two subdistal (sd) denticles; ventral edge smooth with well developed serrula comprised of approximately 20 times on distal half. Pedipalps: trichobothrial pattern type C (Figs. 18–24); ratio of chela L/W = 3.85; femur L/W = 2.84; patella L/W = 2.83; fixed finger L/carapace L = 0.73. Chela: carinae weak and smooth except for a few weak to moderate granules on D4 and D5; median (MD) denticles of fixed finger aligned and divided into six sub rows by five outer (OD) denticles; flanked by six inner (ID) denticles; movable finger with six sub rows, five OD denticles and seven ID denticles; movable finger shorter than both the carapace and metasomal segment V. Femur: dorsoexternal, dorsointernal, and ventrointernal carinae crenulate, ventroexternal with several strong serrations; internal surface with scattered granules on the proximal 3/4s. Patella: internal carinae oblique and granulose; all other carinae strong and crenulate. Legs: ventral surface of tarsus with single median row of spinules terminating distally with one spinule pair. Hemispermatophore (Figs. 16, 17): Lamelliform type with well developed distal lamina with a distinct distal crest about 1/3 the length of the lamina; truncal flexure present but not conspicuous. Slight basal constriction located just proximal of lamina midpoint where it terminates in well-developed intact (not bifurcated or grooved) lamellar hook. Lamellar hook is moderately elongated and about 1/4 the lamina length. A sclerotized mating (= sperm) plug was not found in either hemispermatophore.



Figures 18–24.—Trichobothrial patterns of *Vaejovis montanus* new species, based on male holotype. 18. Right pedipalp chela, external. 19. Right pedipalp chela, ventral. 20. Right pedipalp chela, internal. 21. Right pedipalp femur, dorsal. 22. Right pedipalp patella, dorsal. 23. Right pedipalp patella, external. 24. Right pedipalp patella, ventral.

Mensuration (mm): Male holotype: total L = 28.16; carapace L = 3.39; mesosoma L = 7.35; metasoma L = 10.22 (excluding telson); Metasoma: segment I L/W = 1.41/1.77; segment II L/W = 1.55/1.77; segment III L/W = 1.77/1.67; segment IV L/W = 2.33/1.60; segment V L/W = 3.39/1.53. Telson: L = 3.60; vesicle L/W/D = 2.31/1.29/1.06; aculeus L = 1.29. Pedipalps: total L = 10.87; femur L/W = 2.73/0.96; patella L/W = 3.06/1.08; chela L = 5.08; palm L/W/D = 2.47/1.32/1.62; movable finger L = 3.06; fixed finger L = 2.47. Female allotype: total L = 31.73; carapace L = 3.93; mesosoma L = 11.55; metasoma L = 12.05 (excluding telson);

Metasoma: segment I L/W/D = 1.57/2.26/1.81; segment II L/W/D = 1.86/2.14/1.79; segment III L/W/D = 1.90/2.10/1.81; segment IV L/W/D = 2.62/2.05/1.79; segment V L/W/D = 4.10/1.86/1.57. Telson: L = 4.21; vesicle L/W/D = 2.67/1.57/1.21; aculeus L = 1.55. Pedipalps: total L = 12.38; femur L/W = 3.19/1.19; patella L/W = 3.38/1.36; chela L = 5.81; palm L/W/D = 2.62/1.52/1.83; movable finger L = 3.60; fixed finger L = 2.81. Female (El Horquetudo locality): total L = 26.74; carapace L = 3.26; mesosoma L = 10.24; metasoma L = 10.05 (without telson); Metasoma: segment I L/W/D = 1.31/1.88/1.57; segment II L/W/D = 1.52/1.79/1.52; segment III L/W/D

Table 1.—Distribution of selected characters in *Vaejovis montanus* new species, and related “mexicanus” group species. Average values are presented with minimum and maximum values in brackets. One-way ANOVA used to compare means of all female total lengths and morphometric ratios, and Student’s t-test was used to compare the female character means of each species to that of *V. montanus*. Data on *V. deboerae* are from Ayrey (2009). Significantly different means indicated by asterisks (* $P < 0.05$; ** $P < 0.001$).

	Females						Males			
	<i>montanus</i>	<i>cashi</i>	<i>deboerae</i>	<i>feti</i>	<i>vaquero</i>	<i>vorhiesi</i>	<i>montanus</i>	<i>deboerae</i>	<i>feti</i>	<i>vorhiesi</i>
<i>n</i> =	12	7	2	3	3	4	2	1	3	1
Total length	30.6	21.77**	32.65*	22.19**	25.67*	26.15*	27.15	25.47	17.4	19.5
($F = 24.2$, $P < 0.001$)	[26.74–34.2]	[20–24.6]	[32.2–33.1]	[21.8–22.4]	[23.8–28]	[24.28–28.5]	[26.7–27.6]		[16.8–18]	
Pedipalp femur L/W	2.75	2.89*	2.82	2.92*	2.74	3.06**	2.89	2.89	3.03	3.17
($F = 9.6$, $P < 0.001$)	[2.58–2.92]	[2.74–3.03]	[2.74–2.89]	[2.89–2.97]	[2.72–2.77]	[3–3.13]	[2.84–2.93]		[2.92–3.15]	
Pedipalp patella L/W	2.64	2.84*	3.00	2.77*	2.53	2.9*	2.81	2.95	2.98	3
($F = 12.45$, $P < 0.001$)	[2.55–2.71]	[2.67–3]	[2.91–3.09]	[2.74–2.82]	[2.48–2.58]	[2.82–2.98]	[2.80–2.83]		[2.93–3.04]	
Pedipalp palm L/W	1.67	1.89**	1.97	1.72	1.53*	1.82*	1.75	1.87	1.66	2.07
($F = 24.64$, $P < 0.001$)	[1.6–1.73]	[1.79–2]	[1.91–2.03]	[1.68–1.78]	[1.49–1.57]	[1.69–1.9]	[1.62–1.87]		[1.62–1.71]	
Carapace L/Palm L	1.51	1.68**	1.50	1.67	1.54	1.64**	1.38	1.41	1.66	1.74
($F = 5.98$, $P < 0.01$)	[1.45–1.68]	[1.61–1.73]	[1.36–1.63]	[1.56–1.84]	[1.52–1.55]	[1.62–1.68]	[1.37–1.38]		[1.64–1.67]	
Carapace L/Palm W	2.52	3.18**	2.88	2.88	2.51	2.99**	2.41	2.63	2.76	3.6
($F = 17.18$, $P < 0.001$)	[2.35–2.82]	[3.05–3.4]	[2.77–3.11]	[2.76–3.09]	[2.26–2.85]	[2.85–3.15]	[2.24–2.57]		[2.7–2.86]	
Carapace L/Patella L	1.14	1.13	1.05	1.22	1.13	1.11	1.10	0.99	1.65	1.8
($F = 5.68$, $P = 0.01$)	[1.11–1.19]	[1.11–1.15]	[1.03–1.06]	[1.15–1.35]	[1.12–1.14]	[1.06–1.16]	[1.08–1.11]		[1.62–1.69]	
Pectine teeth	12.0	11.0	11.75	10 [10]	13.33	13	12.25	14	11.67	14.5
	[11–13]	[10–12]	[11–13]		[11–15]	[12–14]	[11–13]		[11–12]	[14–15]
Middle lamellae	6.86	6.5	7	6 [6]	8	7.29	7	7	6	8
	[6–7]	[6–7]				[7–8]				
Movable finger ID	7	6	6	6	7	6	7	6	6	6
Denticles										
Fixed finger ID	6	5	5	5.33 [5–6]	6	5.5	6	5	5.33	5
denticles						[5–6]			[5–6]	

= 1.67/1.74/1.55; segment IV L/W/D = 2.21/1.67/1.5; segment V L/W/D = 3.33/1.67/1.43. Telson: L = 3.19; vesicle L/W/D = 2.00/1.19/0.93; aculeus L = 1.19. Pedipalps: total L = 10.19; femur L/W = 2.62/1.05; patella L/W = 2.86/1.10; chela L = 4.71; palm L/W/D = 2.02/1.12/1.33; movable finger L = 2.76; fixed finger L = 2.17.

Variability.—There appears to be little variation between the two known populations of *V. montanus*, with only differences in size of pedipalp chelae noted. Female specimens from Zorillo have slightly larger pedipalp chelae (palm L/carapace L = 0.66–0.69) than that of the two females from El Horquetudo in the north (palm L/carapace L = 0.59–0.63). The shape of the chelae (L/W ratio), however, does not differ between the two populations.

Sexual dimorphism in *V. montanus*, as in most vaejovids, is strong. Males appear to be much smaller in total length and possess smaller and more elongated pedipalps (Table 1). Pectine tooth counts between the sexes are the same, but pectine teeth of adult males are larger. As characteristic of the subfamily Vaejovinae, the sclerites of the genital operculum of females operate as a single unit and are separated on the posterior 1/3 (Soleglad & Fet 2008).

Distribution.—Known only from the type locality in southern Chihuahua and from El Horquetudo near Yécora, Sonora, Mexico (Fig. 7). This species probably occurs throughout much of the intervening Sierra Madre Occidental as well.

Ecology.—This species was found primarily under rocks and logs in small exposed clearings on or adjacent to hillsides within high-elevation mesic pine-oak forests (Fig. 25). We observed *V. montanus* syntopically with two other scorpion species: an unidentified *Centruroides* sp. and *Pseudouroctonus apacheanus*. The latter was only observed at the El Horquetudo locality, representing the first record of this species in Mexico and extending the known range more than 300 km south of other records from mountains in southern Arizona, New Mexico, and Texas (Gertsch & Soleglad 1972).

Biogeography.—The topographic complexity of the Sierra Madre Occidental has profoundly influenced the evolutionary history of highland taxa. The main bulk of the range extends from northern Chihuahua and Sonora south across Durango. To the north and to a lesser degree the south, the sierra is broken up into ‘sky island’ isolates. Extensive post-Pleistocene development of grasslands and desert has increasingly separated these forested peaks from each other and the main



Figure 25.—High-elevation pine-oak forest habitat at the type locality of *Vaejovis montanus* new species, near Zorillo, Chihuahua. Several specimens of *V. montanus* were found under the rocks in the foreground.

sierra, and mountaintop isolation has likely driven evolutionary diversification of “vorhiesi” subgroup species.

Vaejovis montanus probably occurs throughout the Madrean pine-oak woodlands within the main Sierra Madre Occidental south to at least the type locality near Guadalupe y Calvo in southern Chihuahua. In this region, a series of deep east-west canyons (‘barrancas’) dissect the mountains and seemingly form a filter barrier for montane taxa (Smith et al. 1997). Several highland-adapted amphibians and reptiles, for example, are taxonomically subdivided north and south of this putative break (Barker 1992; Smith et al. 1997; Duellman 2001). Additional collecting in Durango would verify if the range of *V. montanus* is continuous across this break, or if an undescribed “mexicanus” group scorpion inhabits the mountains of this state.

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