

The genus *Vaejovis* in Sonora, Mexico (Scorpiones, Vaejovidae)

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Abstract

The genus *Vaejovis* C. L. Koch in the Mexican state of Sonora is reviewed, based on the examination of numerous specimens from United States collections. Four species are reported to occur there: *Vaejovis spinigerus* (Wood), *V. confusus* Stahnke, *V. sonorae* Williams, and *V. decipiens* Hoffmann. Distributional information for all four species is updated, and a key is provided to facilitate identification. The subspecies *V. spinigerus sonorensis* Hoffmann is synonymized with *V. spinigerus*. The record for *V. gravicaudus* Williams on Isla Tiburon (Williams 1980) is demonstrated to be a misidentification resulting from atypical variation in the closely related *V. spinigerus*, which is common on the island. A record for *V. waueri* Gertsch and Soleglad is considered the result of accidental introduction, because additional specimens have not been seen in the well-sampled Alamos area. It is suggested that the genus is probably more diverse than demonstrated here; several species from neighboring Arizona probably occur in Sonora, and new species may eventually be discovered in the poorly sampled interior.

Introduction

Scorpions of the genus *Vaejovis* from Sonora are very poorly known. Hoffmann (1931) reported only *Vaejovis spinigerus* (Wood) from that state in his monograph on Mexican scorpions and described a new subspecies, *V. spinigerus sonorensis* from Bacerac in northeastern Sonora. He indicated that both subspecies occurred in Sonora, but gave no specific locality information for the nominal form.

The next mention of the genus *Vaejovis* in Sonora was made by Williams and Hadley (1967) in describing the scorpiofauna of the Puerto Peñasco area. They listed *V. confusus* Stahnke from inland and coastal dune communities at that site. Two other species listed as *Vaejovis*, *V. baergi* Williams and Hadley and *V. mesaensis* (Stahnke), are now in the genus *Paruroctonus* (Williams 1972).

A few years later, two new species were reported to occur in Sonora: *V. sonorae* Williams and *V. waueri* Gertsch and Soleglad, both from the Alamos area in southeastern Sonora (Williams 1971; Gertsch and Soleglad 1972). The latter species is known mainly from Texas, U.S.A. and Nuevo León, Mexico, and has not been collected in Sonora since this mention; consequently, the Sonoran record

may be the result of accidental introduction by man. All of the preceding records were repeated by Díaz Nájera (1975) in his distributional study of Mexican scorpions. Williams (1980) added records for *V. spinigerus* from coastal Sonora and for *V. gravicaudus* Williams and *V. spinigerus* from Isla Tiburon. Another species he reported on that island, *V. harbisoni*, is now regarded a member of the recently revived genus *Serradigitus* Stahnke (Williams and Berke 1986, Sissom and Stockwell 1991). Finally, Sissom (1991) reported two localities in Sonora for *V. decipiens* Hoffmann, formerly known only from the Batopilas region in southwestern Chihuahua.

In the present paper, distributional information for these species is revised and some previous species records are discounted. Examination of considerable material from U.S. collections indicates that only four species of the genus *Vaejovis* have been found in Sonora thus far, although more species are likely occur there based on comparisons with the richer faunas of Baja California and Arizona. Synonymies for species discussed herein include only those references to original descriptions, redescriptions, or actual Sonoran specimens. Terminology for general morphology follows

Stahnke (1970), except as follows: pedipalpal and metasomal carinal terminology is after Francke (1977), trichobothrial designations are after Vachon (1974), and terminology for pedipalp chela finger dentition is after Williams (1980).

The genus *Vaejovis* C. L. Koch

As currently recognized, *Vaejovis* C. L. Koch is not a monophyletic assemblage (*sensu* Hennig) and consists of a number of species groups whose relationships to one another and to other vaejovid taxa remain fairly obscure. Although diagnosing a taxon of this type is difficult, it is necessary here at least to distinguish it from other existing vaejovid genera known from or potentially occurring in Sonora (i.e., *Paruroctonus*, *Serradigitus*, and *Uroctonus*). To serve this end, the following combination of characters found in *Vaejovis* will be helpful: (1) the ventral margin of the cheliceral movable finger is smooth (i.e., it does not bear teeth or crenulations); (2) the pedipalp chela fingers each bear a linear row of denticles, divided into 5-7 subrows by more or less regularly-spaced, enlarged denticles; (3) the pedipalp chela fingers do not terminate in conspicuously enlarged terminal denticles that overlap greatly when the chela fingers are closed, or if such a condition exists, then trichobothria *ib* and *it* of the chela fixed finger are located at the extreme base of the finger; (4) the pectinal teeth of the female are all approximately the same size and shape, and each bears peg sensilla; (5) the dorsolateral carinae of metasomal segments I-IV terminate distally in an enlarged, sharp denticle; (6) the tibiae and tarsi of the legs typically have the retrolateral setae irregularly spaced, rather than arranged into a distinct row of seven or more long recurved setae (if setal rows occur, then there are not more than five large setae on legs II and III); (7) the anterior carapacial margin is essentially straight or weakly, obtusely emarginate (not with moderate or deep rounded median notch); and (8) the ventral face of the chela bears a ventromedian carina, or if that carina is obsolete, then the ventral face is gently rounded (not distinctly flattened).

Vaejovis spinigerus (Wood) (Figs. 1-4)

Buthus spinigerus Wood 1863:110.
Vejovis spinigerus spinigerus, Hoffmann 1931:349.

Vejovis spinigerus sonorensis Hoffmann 1931:352.
NEW SYNONYMY.

Vaejovis spinigerus sonorensis, Díaz Nájera 1975:32. NEW SYNONYMY.

Vaejovis spinigerus, Williams 1980:69.

Vaejovis gravicaudus, Williams 1980:63 (Isla Tiburon record only).

Type data. The syntypes of *Buthus spinigerus* are housed in the U. S. National Museum and include two series: S-9, Jar 3 (2 males, 1 female) and S-10, Jar 3 (2 males); examined. The latter series gives the locality as "Texas" (Williams 1980). However, because the species has not been reported from Texas since its original description, it seems doubtful that the specimens originated from that state.

The type series of *Vaejovis spinigerus sonorensis* Hoffmann is housed in the American Museum of Natural History and was examined. The female labeled "#1" by Hoffmann should be considered the holotype; in addition to the holotype, there are six paratypes (one male, four females, and one juvenile female).

Distribution. Arizona, southern California, and western New Mexico in the United States and in northern Baja California del Norte and Sonora in Mexico.

Diagnosis. Adults to about 70 mm in length. Base color light yellow brown with variable underlying dusky markings on carapace and tergites; positions of ventrolateral and ventral submedian metasoma carinae indicated by black pigment. Pectinal tooth count 22-27 in males, 16-22 in females. Metasoma robust (Fig. 1), with segment V usually wider and deeper than III in adults. Ventrolateral metasomal carinae weak, smooth; ventral submedians obsolete. Pedipalp chela (Figs. 2-3): palm smooth, lacking noticeable keels; fixed finger (Fig. 4) with trichobothria *ib* and *it* flanking sixth inner accessory granule. Primary row of denticles on chela fixed finger divided into six subrows; on movable finger divided into seven subrows; proximal inner accessory granule of movable finger closely paired with adjacent enlarged denticle in primary row. Chela length/width 3.2-3.7; movable finger length/carapace length 0.8-0.9; movable finger length/palm width 2.0-2.3.

Comments. Specimens previously identified as *V. gravicaudus* Williams from Isla Tiburon (Williams

1980) are referable to *V. spinigerus*, as verified by examination of the specimens in question. The main differentiating character for these two taxa is derived from the dentition of the chela movable finger. In *V. spinigerus*, the basalmost inner accessory granule is closely paired with the basalmost enlarged primary row denticle, and the denticle row itself is divided into seven subrows; in *V. gravicaudus*, the basalmost enlarged primary row denticle is missing, leaving the corresponding inner accessory granule unpaired and the denticle row divided into six subrows. In some specimens of *V. spinigerus* on Isla Tiburon the enlarged primary row denticle is reduced in size and in others it is virtually absent. In a few cases, the granule is reduced or absent on one pedipalp movable finger, but present on the other. Finally, specimens from Agua Dulce Bay exhibit all three conditions in this character.

A second character used to characterize *V. gravicaudus* is the absence of dusky markings on the dorsum; in *V. spinigerus*, these markings are typically moderately to well developed in all instars, including the adult. Some specimens from Isla Tiburon have the dorsum unmarked or weakly marked; some specimens from other areas in Sonora are also weakly marked. There is no correlation between the color characteristic and the pedipalp chela finger dentition in these examples. With this information, it seems appropriate, then, to disregard the records of *V. gravicaudus* on Isla Tiburon and assign the specimens in question to *V. spinigerus*.

Examination of the type series of *V. spinigerus sonorensis* has revealed that this taxon is a synonym of *V. spinigerus*. Hoffmann (1931) demonstrated that these specimens were distinct from other *V. spinigerus* he examined. However, the characters he used to separate the taxa, based mainly on differences in granulation, are subject to considerable local variation in populations of *V. spinigerus* and are not important at the specific or subspecific level. I therefore propose the synonymy: *Vaejovis spinigerus sonorensis* Hoffmann, 1931 = *Vaejovis spinigerus* (Wood, 1863).

Specimens examined. MEXICO: Sonora: La Aduana, 24 Aug 1963 (no collector), 1 male (CSULB); Alamos (rocks), 30 Jan 1967 (no collector), 7 females, 5 juvs (CAS); Alamos (under rocks, rain), 29 Jan-2 Feb 1968 (no collector), 1 male, 2 females (CAS); Alamos, 1942 (C.M. Bogert), 1

female (AMNH); Alamos (rocks), 30 Jan 1967 (no collector), 1 male (CAS); Alamos, 7 mi SE Arroyo Cuchajaque, 21 Mar 1967 (no collector), 1 male, 1 female, 3 juvs. (CAS); 6.1 mi SE Alamos, on banks of Cuchajaque River (under rocks), 1 male, 1 female (CAS); on Alamos-Guirocoba road, ridge E of Rio Cuchajaque, 28 Dec 1961 (C. Parrish); 1 female, 1 juv. (CAS); near Alamos, Rio Cuchajaque, 1-5 Feb yr?? (Tim Walker), 2 males, 1 juv female (AMNH); E of Alamos, Rio Cuchajaque, 14 Jan 1968 (V. Roth), 2 females (AMNH); 0.5 mi SE Alamos, La Pilla (1300 ft, semi-arid rocky, sandy habitats) 13 Aug 1966 (H.L. Heringhi), 2 females (CAS); Alamos area, between Alamos and Navajoa, early Aug 1966 (H.L. Heringhi), 1 male, 1 female (CAS); 6-6.5 mi NW Alamos, along Alamos-Navajoa road (Johnny Clark's ranch), 30-31 Aug 1966 (H.L. Heringhi), 1 male, 2 females (CAS); 0.5-1.5 mi N Alamos (Johnny Clark's ranch), 22-26 Jan 1966 (M. Nickerson, C. Mays, B. Winokur), 4 males, 7 females, 4 juvs. (CAS); near Alamos, 7 Aug 1956 (V. Roth, W. Gertsch), 1 male (AMNH); 11 mi W Alamos (just off road), 23 Jan 1966 (M.A. Nickerson, C. Mays, R. Winokur), 1 male, 9 females (CAS); Arroyo de Alamos, 6 mi SE Alamos on Guirocoba road, 13 Aug 1966 (H. L. Heringhi), 2 females (CAS); 7 mi SE Alamos, 12 Aug 1960 (no collector), 1 female (CAS); 10 mi W Alamos, 19 July 1954 (W. J. Gertsch), 2 males, 2 females (AMNH); 8 mi W Alamos, 23 August 1965 (W. J. Gertsch, R. Hastings), 2 males, 3 females (AMNH); Sierra de Alamos, 15-30 Jan 1968 (V. Roth), 3 males, 12 females (AMNH); 15 mi SW Alamos, 25 Jan 1951 (LiRoss), 2 juvs (FMNH); Bacerac, no date (no collector), 1 male, 5 females, 1 juv. (types of *V. spinigerus sonorensis*)(AMNH); Bahia San Carlos (no date or collector), 1 female (CSULB); Bahia San Carlos, 4 July 1967 (no collector), 1 female (CAS); Bahia San Carlos, 12 Apr 1971 (Stahnke, Lutz, Johns), 4 females, 1 juv (CAS-HLS); Bahia San Carlos, 1 June 1968 (H. L. Stahnke), 1 male (CAS-HLS); Bahia San Carlos, Rancho Algodon, 24 Dec 1971 (J.D. Connors), 1 female (CAS); Bahia San Carlos, 7 Aug 1921 (no collector), 1 male, 1 juv female (AMNH); 5 mi E Bahia San Carlos, 25 Mar 1970 (Stahnke), 1 male, 1 female, 2 juvs (CAS-HLS); Bahia San Carlos/Guaymas area, 10-12 Apr 1986 (D. Due, G.A. Polis), 9 males, 4 females (WDS); Bahia San Carlos/Guaymas area, 8 Apr 1986 (D. Due, G.A. Polis), 8 males, 9 females, 5 juvs (WDS); hill N Bahia San Carlos boat harbor, 31 Dec 1961 (C.

Parrish), 1 male, 1 female, 1 juv (CAS); 1 mi NE Posada de San Carlos, Bahia San Carlos, 31 Dec 1966 (C. Parrish), 1 male (CAS); 1 mi E boat harbor, Bahia San Carlos, 31 Dec 1961 (C. Parrish), 2 females (CAS); approx. 3 mi NW Bahia San Carlos at S base Punta San Antonio (under tarp on ground), 14 Apr 1968 (L.T. Findley), 1 female (CAS); 3 mi W Baviácora, banks of Rio Sonora (18 Aug 1958 (B.A. Branson), 1 male (AMNH); 20 mi N Caborca (UV light, open desert), 18 Sept 1971 (D.E. Breedlove), 1 male, 1 female, 2 juvs (CAS); Cajon Bonita, 38 mi E Agua Prieta, 6 Aug 1975 (V. Roth), 1 male, 1 female (AMNH); 18 mi W Cananea, 19 Aug 1960 (Zweifel), 1 female (AMNH); 11 mi S Cumpas (30.00N:109.45W), 3 Oct 1966 (V. Roth, N. Bucknall), 1 female (AMNH); Guaymas (Bahia San Carlos)(brush and volcanic rock next to ocean), 6 Apr 1969 (Pape and Belze), 1 female (AMNH-OFF); Guaymas 30 Dec 1967 (R. Neueln), 10 juvs (AMNH-OFF); near Guaymas, 27 Feb ? (W. M Wheeler), 1 juv (MCZ); Guaymas, May 1894? (Eisen), 1 male, 1 female, 1 juv (MCZ); Guaymas, 27 Nov 1965 (T. Paca), 1 juv (CAS); Guaymas, 16 Jan 1957 (no collector), 1 juv female (CAS-HLS); Guaymas, campsite on bay S Punta San Antonio (W. Findley, A.C. Beonde), 1 juv (CAS); Guaymas, 29 June 1969 (S.C. Williams), 5 males, 4 females (CAS); Guaymas, 7-15 Apr 1921 (under stones, sea level to 100 ft)(V. Owen et. al), 1 male, 4 females (AMNH); 10 mi N Guaymas, near coast (under rocks, desert area), 13 Jan 1953 (D. Werner), 2 males, 2 females (CAS-HLS); 10 mi N Guaymas, 16 Jan 1953 (no collector), 1 male (CAS-HLS); 40 mi N Guaymas, Hwy 15 (under cow dung)(no collector), 24 Mar 1969 (CAS); Guirocoba, 28 Dec 1961 (village children), 2 males, 3 females, 9 juvs (CAS); 1/8 mi NW Guirocoba, 28 Dec 1968 (C. Parrish), 9 males, 16 females (CAS); Hermosillo (under cardboard, cow dung), 26 Jan 1963 (no collector), 1 female, 2 juvs (CAS); 29 mi E Hermosillo on road to Sahuaripa, Sierra San Juan de Dios (1580 ft), 25 Oct 1975 (J. L. Landye), 1 female (AMNH-OFF); 32 mi E Hermosillo, 20 Aug 1960 (Zweifel, Stahl), 1 male (AMNH); 29 mi N Hermosillo, 9 Aug 1960 (P.H. Arnaud, E.S. Ross, D.C. Rentz), 1 female (CAS); 8 mi S La Siesta Motel, Hermosillo, 27 Dec 1961 (C. Parrish), 1 male, 2 females (CAS); 28 mi E Hermosillo, 20 Aug 1960 (Zweifel, et al.), 1 male, 1 female (AMNH); Imuris, 17 July 1954 (W.J. Gertsch), 1 female (AMNH); 16 mi ENE Imuris, 8 Jan 1960 (R. Zweifel), 1 female (AMNH); Isla Tiburon, Agua Dulce Bay, 18 Mar 1962 (I.L. Wiggins, Belvedere Exp.), 2 females (CAS); Isla Tiburon, Agua Dulce Bay (under rocks), 23 Apr 1966 (K. Lucas), 5 males, 2 females (CAS); Isla Tiburon (south end, under rocks), 24 Apr 1966 (K. Lucas), 2 males, 2 females (CAS); Isla Tiburon (under rocks), 27 Apr 1966 (K. Lucas), 1 female (CAS); Kino Bay, 3-4 Apr 1986 (D. Due, G.A. Polis), 3 males, 3 females, 2 juvs (WDS); New Kino Bay (desert, sand dunes), 22-23 Mar 1970 (Stahnke, Stones, Kemps), 5 males (CAS-HLS); 13 mi E Mazatán, 20 Aug 1950 (Zweifel), 1 male (AMNH); Los Muchos (under rocks), 8 Sept 1964 (no collector), 1 male (AMNH); 5 mi S Naco, 5 July 1965 (no collector), 1 female (CSULB); 4 mi N Navajoa, 3 Dec 1969 (no collector), 2 juvs (CSULB); 6 mi E Navajoa, 20 July 1964 (W.J. Gertsch, J. Woods), 2 females (AMNH); 8.5 mi E Navajoa, 17 May 1963 (W.J. Gertsch, W. Ivie), 2 males (AMNH); 20 mi S Navajoa, 12 Sept 1966 (J. and W. Ivie), 1 male (AMNH); 50 mi S Navajoa, 24 Aug 1965 (W.J. Gertsch, R. Hastings), 1 male, 1 female (AMNH); 17 mi E Navajoa, 3 Apr 1968 (no collector), 1 male (CAS); El Oasis, nr. Hwy 15 (1500 ft)(between Santa Ana and Hermosillo), 7 Oct 1970 (D. Breedlove), 1 female (CAS); Pitiquito (1500 ft), 1 Apr 1949 (no collector), 1 female (AMNH); 8 mi S Pitiquito (under rock), 2 Feb 1968 (L.T. Findley), 1 female (AMNH); Rancho Los Banos (30.30N:110.40W), 9 May 1966 (V. Roth), 3 males, 2 females (AMNH); Rancho Naranja (27.13N:108.45W), 7-12 Feb yr? (V. Roth), 2 males, 1 female, 1 juv female (AMNH); San Luis (no date or collector), 1 female (AMNH); San Miguel de Horcasitas (29.30N:110.45W), 4 Oct 1966 (V. Roth), 1 male, 1 female (AMNH); San Pedro Bay, 7 July 1921 (no collector), 1 male (AMNH); San Pedro Bay, 3 Apr 1953 (P.A. Arnaud, T. Wall), 1 male, 1 female (AMNH); Sierra de los Ajos (31.00N:110.00W), 1 June 1971 (Roth, Halstead), 2 males, 3 females (AMNH); Sierra Magallanes (31.05N:109.55W), 1 June 1971 (Roth, Halstead), 2 males, 2 females (AMNH); Sonoyta (1200 ft), 2-3 Apr 1949 (G.M. Bradt), 2 females (AMNH); SW Sonoyta, Cerro Colorado, 28 Nov 1959 (Roth, Peterson), 1 male, 2 females (AMNH); Cerro Colorado, SW Sonoyta, 14 Feb 1960 (V. Roth), 1 female (AMNH); 2 mi SW Cerro Colorado, Pinacate Mts., 12 Feb 1960 (V. Roth), 1 female (AMNH); Lava Camp, Pinacate, 10 Apr 1970 (Stahnke, Lutz), 1 male (CAS-HLS); Sonoyta (bark of tree), 16 Oct 1962 (J. Russell), 1 male, 4 females (CAS-HLS); Sonoyta (under rock), 17 Feb 1963 (J. M. Russell),

1 female, 1 juv (CAS-HLS); 10 mi S Sonoyta, 5 Apr 1949 (G.M. Bradt), 1 female (AMNH); 15 mi S Sonoyta border station on Sonoyta-Caborca Road, 1 Jan 1962 (C. Parrish), 1 juv (CAS); 25 mi W Sonoyta, 29 Dec 1960 (V. Roth), 2 males (AMNH); 35 mi W Sonoyta, 28 Dec 1960 (V. Roth), 1 female (AMNH); Tejitas, 8 Apr 1966 (no collector), 1 female (AMNH); hills W Tepustete (under rock; riparian habitat, thorn forest), 7 Aug 1966 (H.L. Heringhi), 1 male (CAS); 4 mi SW Los Vidrios (E of Sonoyta), 11 Feb 1960 (V. Roth), 1 male (AMNH).

Vaejovis confusus Stahnke
(Figs. 5-10)

Vaejovis confusus Stahnke 1940:101.

Vaejovis confusus, Williams and Hadley 1967: 112.

Vaejovis confusus, Díaz Nájera 1975: 31; Williams 1980:57.

Type data. Syntypes of *Vaejovis confusus* from Coolidge, Mesa, Superior, Tucson, Wickenburg, and Casa Grande National Monument in Arizona. Permanently housed in the California Academy of Sciences (H. L. Stahnke collection); two female syntypes from Wickenburg collected 20 Apr 1938 (O. L. Corbin) were examined.

Distribution. Known from northern Baja California Norte and the northwestern half of Sonora in Mexico and the Colorado River drainage system in Arizona and southern California.

Diagnosis. Adults to 55 mm in length. Base color uniformly yellow to yellow brown, without contrasting dusky markings on dorsum. Pectinal tooth count 15-18 in males, 12-14 in females. Metasoma (Fig. 5) with ventrolateral carinae moderate, crenulate on I-IV; ventral submedian carinae on I smooth, on II smooth with weak posterior crenulations, on III smooth to crenulate, on IV irregularly crenulate. Pedipalp chela with slender palm (Figs. 6-7); keels weak, granular. Chela fixed finger with six subrows of denticles in primary row (Fig. 8), movable finger with six or seven subrows (Figs. 9-10). Trichobothria *ib* and *it* of fixed finger situated at the level of the sixth inner accessory granule (Fig. 8). Chela fingers elongate, movable finger length/carapace length 1.0-1.1; chela length/width 4.3-6.1; movable finger length/chela width 3.2-4.0;

chela width/patella width typically greater than 1.0.

Comments. Stahnke (1940) described *Vaejovis confusus* from several localities in south-central Arizona, and this species is known to be widespread across the southwestern United States. Williams and Hadley (1967) also reported this species from northern Sonora, specifically, the Puerto Peñasco area.

Williams (1970) described two related species from northern Baja California and the Colorado River drainage system of southeastern California: *Vaejovis waeringi* and *V. coloradensis*. Subsequently, he considered *V. coloradensis* to be a junior synonym of *V. waeringi* (Williams 1980). Morphometric characters and minor variation in metasomal carinal morphology now provide the means to distinguish *V. confusus* and *V. waeringi*. Although *V. waeringi* has not been reported from Sonora, there appear to be significant problems in separating *V. confusus* from *V. waeringi* because variation is great in the diagnostic characters, both within and between populations.

Specimens from the Kino Bay area and Isla Tiburon differ from the population in northern Sonora by having seven subrows of denticles on the pedipalp chela movable finger (i.e., the primary row is subdivided by six enlarged primary row denticles; Fig. 9). Specimens from northwestern Sonora have only six subrows (Fig. 10). The specimens also differ slightly in morphometrics; however, local populations of *V. confusus* tend to be distinct from one another in these characters. Although the dentition character and morphometrics are usually considered important species characters, I prefer not to describe the Kino Bay/Tiburon population as new based on these characters. To do so would further complicate the taxonomy of this problematic complex. Further, I have noticed that the basalmost enlarged primary row granule may be present (i.e., the movable finger has seven subrows) or absent (i.e., the movable finger has six subrows) even in the same population of *V. waeringi* (San Felipe, Baja California Sur). The same tendency was demonstrated above for *V. spinigerus*, another *eusthenura* group species. This observation is interesting because the character does not exhibit variation in other species groups and genera of the Vaejovidae, and consequently has great taxonomic value.

Specimens examined. MEXICO: Sonora: Cholla Bay, 15 Oct 1966 (S.C. Williams), 3 males, 1 female (CAS); Cholla Bay, 11-12 Nov 1966 (S. C. Williams), 7 males, 1 female (CAS); Cholla Bay, 10 July 1975 (H.L. and J.L. Stahnke), 1 female, 1 juv. female (CAS-HLS); Cholla Bay, 4 Nov 1967 (P.J. Pinter, S. Huntingdon), 1 male, 1 female (CAS-HLS); 5 mi N Cholla Bay, 15 Jan 1967 (S. C. Williams), 1 juv. male (CAS); Isla Tiburon, 4-5 Apr 1986 (D. Due, G. A. Polis), 1, 3 females, 9 juvs. (WDS); Kino Bay area, 7 Apr 1986 (D. Due, G. A. Polis), 2 females (WDS); New Kino Bay (sand dunes), 22 Mar 1970 (H. L. Stahnke, Stones, Kemps), 1 male, 1 juv. male (CAS); Pinacote (lava camp) 10 Apr 1970 (Stahnke, Lutz), 1 male, 2 females (CAS-HLS); 6 mi E. Puerto Peñasco (=Rocky Point), 21 Dec 1959 (Dale, Evans, Adams), 1 female (CAS); 6.5 mi N Puerto Peñasco (sand dunes), 3 June 1968 (M.A. Cazier, et al.), 7 males, 2 females, 1 juv. (CAS); 5 mi NE Puerto Peñasco (sand dunes), 15 Jan 1967 (S. C. Williams), 3 males, 1 female, 8 juvs. (CAS); San Luis (no date or collector), 1 juv. female (AMNH); Sonoyta (under rock), 17 Feb 1963 (J. M. Russell), 1 female, 1 juv. (CAS); SW Sonoyta (in bottom of Crater Elegante), 28 Nov 1959 (Roth, Peterson), 2 juv. females (AMNH); 30 mi S Sonyta (500'), 31 Mar 1949 (G. M. Bradt), 1 juv. female (AMNH); Sta. Clara del Golfo, El Golfo Fishing Resort (on sand), 12 VII 1969 (J. L. Bigelow), 1 juv. female (AMNH-OFF).

Vaejovis sonoreae Williams
(Figs. 11-14)

Vaejovis sonoreae Williams 1971: 57; Díaz Nájera 1975: 31.

Type data. Holotype male of *Vaejovis sonoreae* from 11.2 mi W Alamos, Sonora, Mexico on 23 January 1966 (R. Winokur, C. Mays, and M. A. Nickerson); not examined.

Distribution. Previously known from several localities in the Alamos region of Sonora; new records indicate that the species occurs as far north as Guaymas.

Diagnosis. Adults to about 30 mm in length. Base color yellow brown with variable dusky markings on carapace and tergites. Pectinal tooth count of males 14-16; of females 14-15. Metasoma very slender (Fig. 11), with segment V length/width

2.4-2.5; ventrolateral and ventral submedian carinae well developed, crenulate to serrate. Telson slender with long setae, a few of which are longer than the aculeus. Pedipalp chela robust (Figs. 12-13), with chela length/width 2.8-3.1 and movable finger length/chela width 1.6-1.7; fingers short, with movable finger length/carapace length around 0.8; fixed finger (Fig. 14) with primary row of denticles divided into five subrows, movable finger with six subrows; keels of palm well developed, granulose in male, granular in female; margins of chela fingers unscalloped without noticeable space between fingers when chela closed; fixed finger trichobothria *ib* and *it* both slightly basal to sixth inner accessory granule.

Specimens examined. MEXICO: Sonora: Alamos, 1942 (C. M. Bogert), 1 male (AMNH); 7 mi SE Alamos, 12 Aug 1960 (P. H. Arnaud, D. C. Hentz), 1 juv. male (paratype)(CAS); Bahia San Carlos, 12 Apr 1972 (Stahnke, Lutz, Johns), 1 male (CAS-HLS); Bahia San Carlos/Guaymas area, 8-12 Apr 1986 (D. Due, G.A. Polis), 1 male, 1 female (WDS); Ciudad Obregon, 10 July 1951 (no collector), 1 male (CAS-HLS); Guaymas (under boards), 9 Sept 1957 (H. M. Beller), 1 juv. male (CAS-HLS); Guisobaca, 28 Dec 1961 (village children), 1 female (CAS); 17 mi E Navajoa, 3 April 1968 (collector unknown), 1 female (CAS-HLS); Cerro Prieto Microwave, about 3 mi E Navajoa (Basalt mtn.), 25 Nov 1975 (J.J. Landye), 2 males (WDS).

Vaejovis decipiens (Hoffmann)
(Figs. 15-18)

Vaejovis mexicanus decipiens Hoffmann 1931:399.
Vaejovis decipiens, Sissom and Francke 1985:259;
Sissom 1991:24.

Type data. Holotype and paratype male of *Vaejovis mexicanus decipiens* from Batopilas, Chihuahua, Mexico (no date or collector). Deposited in the American Museum of Natural History (C. C. Hoffmann collection); examined.

Distribution. Known from the Batopilas region in southern Chihuahua and in the mountains of southern and central Sonora.

Diagnosis. Total length 50-60 mm. Base color dark brown to dark reddish brown with variable

underlying dusky markings. Pectinal tooth counts 22-25 in males, 21-22 in females. Metasoma (Fig. 15) with segments I-III (except sometimes I) longer than wide; V 2.2-2.5 times longer than wide. Ventral submedian carinae on I obsolete to weak, smooth; on II-IV weak, smooth with fine posterior serrations. Ventrolateral carinae of metasoma moderate, weakly granular. Pedipalp chela (Figs. 16-17) with digital carina of palm smooth; ventro-internal carina weakly granular; dorsointernal carina strong, with enlarged sharp granules; scalloping of chela fingers distinct in male. Chela fixed finger (Fig. 18) with primary row divided into six subrows, that of movable finger into seven subrows; trichobothria *ib* and *it* situated at extreme base of fixed finger. Chela slender with long fingers, chela length/width 4.3-4.8; movable finger length/carapace length 1.1-1.3; movable finger length/chela width 2.8-3.2.

Specimens examined. MEXICO: Sonora: Sierra de Alamos, 15-30 Jan 1968 (V. Roth), 1 juv female (AMNH); Rancho Los Banos (30.30N:110.40W), 9 May 1966 (V. Roth), 1 juv female (AMNH).

Key to the species of *Vaejovis* from Sonora, Mexico and adjacent areas

Species not yet reported for Sonora, but likely to occur there are indicated by an asterisk (*).

- 1. Trichobothria *ib* and *it* of pedipalp chela fixed finger situated at extreme base of finger (Fig. 18) 2
- 1'. Trichobothria *ib* and *it* displaced distally on the fixed finger at or near the level of the sixth inner accessory granule (Figs. 4, 8, 14) 3
- 2. Pectinal tooth count in both sexes greater than 16; adult body size in excess of 40 mm; later instar juveniles and adults with distinct, serrated dorsointernal carina on pedipalp chela *decipiens*
- 2'. Pectinal tooth count in both sexes less than 16; adult body size less than 30 mm; dorsointernal chela carina weak, smooth to feebly granular in all age groups *vorhiesi**

- 3. Pedipalp chela fixed finger with primary row of denticles divided into six subrows (Figs. 4, 8) 4
- 3'. Pedipalp chela fixed finger with primary row of denticles divided into five subrows (Fig. 14) .. 5
- 4. Pectinal tooth count 22-27 in males, 16-22 in females; ventral submedian carinae absent on segments I-IV, their positions indicated by blackish underlying pigment; ventrolateral carinae reduced, smooth on I-IV, also underlined with blackish pigment *spinigerus*
- 4'. Pectinal tooth count less than 20 in males and less than 16 in females; ventral submedian carinae present at least on metasomal segments III-IV; neither ventral submedian nor ventrolateral carinae of metasomal segments I-IV underlined in black pigment *confusus*
- 5. Pedipalp chelae strongly inflated in both sexes, with movable finger length/chela width distinctly less than 2.0 (Figs. 12, 13); chela fingers short, with movable finger length/carapace length less than 0.85; all chela carinae in both sexes well developed and granulose 6
- 5'. Pedipalp chelae slightly to moderately inflated (movable finger length/chela width 2.1-2.3 in males, 2.3-2.7 in females); fingers longer, with movable finger length/carapace length 0.89-0.94; chela carinae in male feebly to moderately granulose, reduced and almost smooth in female *russelli**
- 6. Telson vesicle ventrally with numerous long conspicuous setae, most longer than aculeus; metasomal segment V length/width greater than 3.0 *hirsuticauda**
- 6'. Telson vesicle sparsely setose, with a few longer setae (Fig. 11); metasomal segment V length/width distinctly less than 2.8 *sonorae*

Discussion

Gertsch and Soleglad (1972) reported two specimens of *Vaejovis waueri* from the Rio Cuchajahui area in southeastern Sonora. This species is widespread in western Texas and Nuevo León, Mexico, and the Sonoran locality represents a considerable disjunction. The specimens are virtually identical in morphology to specimens in Texas; the only noticeable difference is that the ventrolateral carinae of metasomal segment V in the Sonoran specimens are granular, whereas they tend to be smooth in Texan specimens. This difference is hardly great enough to be important at the specific level and is probably normal intra-

specific variation. Because there is no reason to doubt the accuracy of the collection data, it may be reasonable to assume that *V. waueri* has somehow been transported by man to Sonora, and that it does not occur there naturally. This is further supported by the fact that the Rio Cuchajaqui/Alamos region has been thoroughly sampled, and no additional specimens have been collected.

Our knowledge of the scorpions of Sonora remains sketchy at best, and a better understanding of the diversity and distribution of most species is badly needed. It is a certainty that more species of *Vaejovis* will be discovered in Sonora. Two species known from Cochise Co. in southeastern Arizona which probably (or possibly) occur in Sonora were conspicuously absent from the material examined: *V. vorhiesi* Stahnke and *V. russelli* Williams. Their occurrence in northeastern Sonora would certainly be expected. A third species, *V. hirsuticauda* (Banks), has been collected in Yuma Co., Arizona and is widespread in southern California and Baja California Norte (Williams 1980). It is probable that it may eventually be found in the extreme northwestern corner of Sonora.

Currently, we have a poor understanding of the distribution of all species except *V. spinigerus*. Collecting has been heavily biased towards the coastal areas (Puerto Peñasco, Kino Bay, Guaymas/San Carlos Bay) and the Alamos area. The limited sampling in the mountainous interior has been restricted to rock-rolling which typically produces inferior results for scorpions (Williams 1968); this method underestimates both the abundance and diversity of scorpions. Sampling of scorpion populations with the ultraviolet light technique (Williams 1968) is desperately needed not only in Sonora, but in all of mainland Mexico, and it is hoped that the present paper will stimulate new efforts to collect scorpions there.

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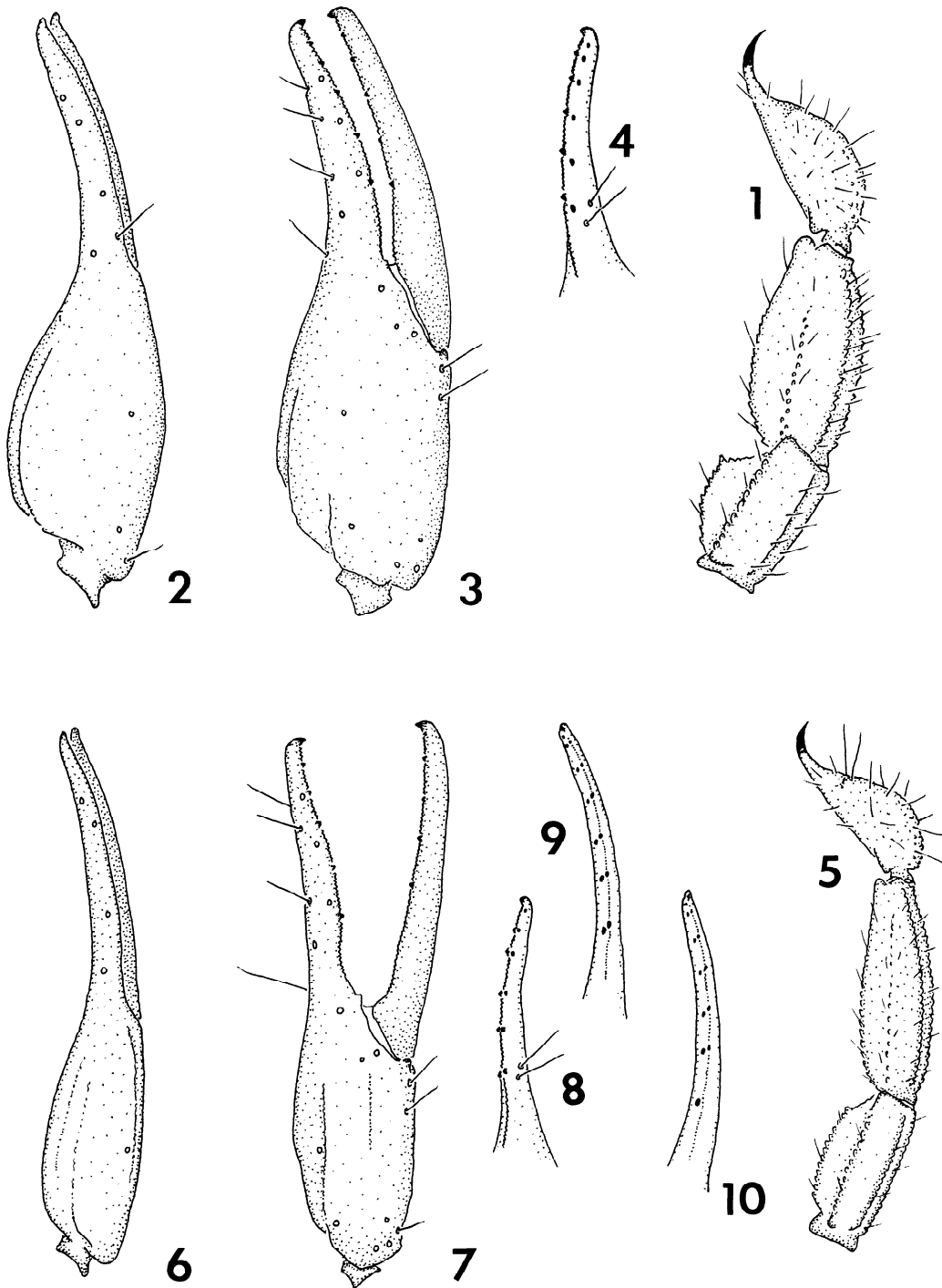
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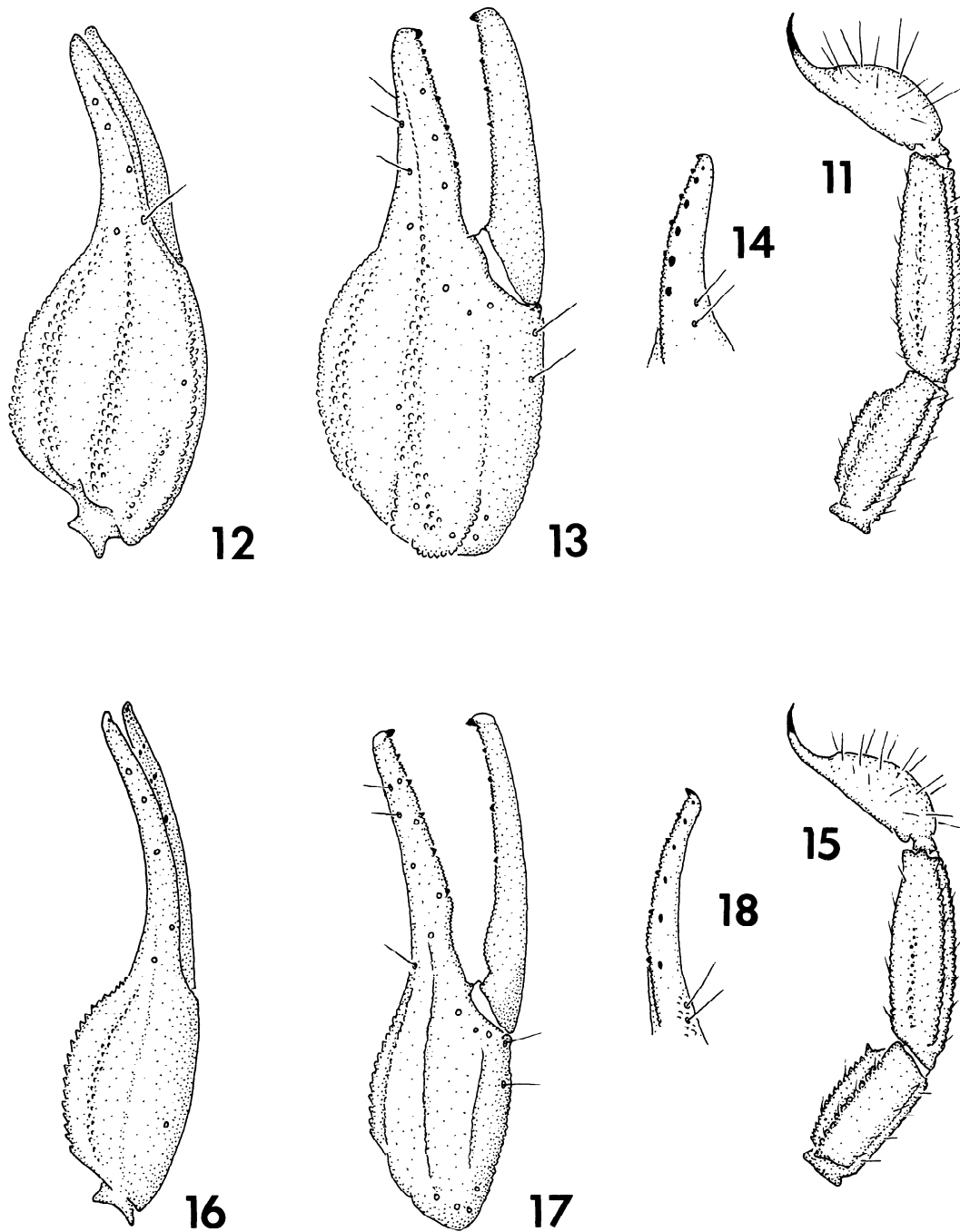
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Figures 1-10. Morphology of *Vaejovis* spp. from Sonora, Mexico. *Vaejovis spinigerus*: 1, lateral view of metasomal segments IV and V and telson; 2, dorsal view of right pedipalp chela; 3, lateral view of right pedipalp chela; 4, inner view of right pedipalp chela fixed finger. *Vaejovis confusus*: 5, lateral view of metasomal segments IV and V and telson; 6, dorsal view of right pedipalp chela; 7, lateral view of right pedipalp chela; 8, inner view of right pedipalp chela fixed finger; 9, inner view of right pedipalp chela movable finger (specimen from Kino Bay); 10, inner view of right pedipalp chela movable finger (specimen from Puerto Penasco).



Figures 11-18. Morphology of *Vaejovis* spp. from Sonora, Mexico. *Vaejovis sonoreae*: 11, lateral view of metasomal segments IV and V and telson; 12, dorsal view of right pedipalp chela; 13, lateral view of right pedipalp chela; 14, inner view of right pedipalp chela fixed finger. *Vaejovis decipiens*: 15, lateral view of metasomal segments IV and V and telson; 16, dorsal view of right pedipalp chela; 17, lateral view of right pedipalp chela; 18, inner view of right pedipalp chela fixed finger.