

Sissom, W. D. and O. F. Francke. 1985. Redescriptions of some poorly known species of the *nitidulus* group of the genus *Vaejovis* (Scorpiones, Vaejovidae). J. Arachnol., 13:243-266.

**REDESCRIPTIONS OF SOME POORLY KNOWN SPECIES
OF THE *NITIDULUS* GROUP OF THE GENUS *VAEJOVIS*
(SCORPIONES, VAEJOVIDAE)**

W. David Sissom

Department of General Biology, Vanderbilt University
Nashville, Tennessee 37235

and

Oscar F. Francke

Department of Biological Sciences, Texas Tech University
Lubbock, Texas 79409

ABSTRACT

The *nitidulus* group of *Vaejovis* is defined on the basis of pedipalp chela morphology and dentition, trichobothrial patterns, and carinal structure of the pedipalp chela and the metasoma. Five species are treated herein: *V. mexicanus decipiens* Hoffmann is elevated to specific status and transferred to the *nitidulus* group; *V. intermedius* Borelli, *V. nigrescens* Pocock, and *V. nitidulus* C. L. Koch are all considered valid species and redescribed; and *V. minckleyi* Williams is transferred to the group and a revised diagnosis given.

INTRODUCTION

Vaejovis C. L. Koch, 1836, with over 90 described species and subspecies, is the largest and most widespread genus of scorpions in North America. Through the years, a number of distinct species groups have been established, largely through the efforts of Williams (1970a, 1970b, 1971, 1980) and Sologlad (1972, 1973). Several of these groups are now recognized as valid genera (i.e., *Paruroctonus* Werner and *Paravaejovis* Williams; Williams 1970c, 1972). Currently, four species groups remain in the genus: the *eusthenura*, *mexicanus* (with the *minus* subgroup), *punctipalpi*, and *wupatkiensis* groups. The purpose here is to provide a preliminary definition of a fifth group, the *nitidulus* group, and to clarify the status of five poorly understood taxa within it.

The most important features of the *nitidulus* group are: (1) the pedipalps are long and slender with chela length/palm width ratios greater than 3.3 (in most species, greater than 4.0); (2) the pedipalp chela fingers are long and tenuous, and

each terminates in an enlarged clawlike denticle bearing distally a distinct white patch; (3) chela trichobothria *ib* and *it* are located at the base of the fixed finger; (4) the pectinal teeth of the female are subequal in size, never with the proximal teeth enlarged; (5) the primary row of denticles on the chela fixed finger is divided into five, six or seven distinct subrows; (6) the dorsointernal carina of the pedipalp chela is the strongest and usually bears enlarged, sharp granules; and (7) the ventral submedian carinae of the metasoma are usually obsolete (but in some species are weak to moderate). The following described species are referable to the *nitidulus* group: *V. carolinianus* (Beauvois), *V. decipiens* Hoffmann (n. comb.), *V. gracilis* Gertsch and Soleglad, *V. intermedius* Borelli, *V. janssi* Williams, *V. jonesi* Stahnke, *V. minckleyi* Williams, *V. nigrescens* Pocock, *V. nitidulus* C. L. Koch, *V. peninsularis* Williams, and *V. spicatus* Haradon. A complete revision of this species group, with descriptions of new species, is in preparation by the senior author.

The status of three of these species, *V. nitidulus*, *V. nigrescens*, and *V. intermedius*, has been particularly confusing. Until now, each has been considered a subspecies of *V. nitidulus*; with the nominal subspecies in Oaxaca, *V. nitidulus nigrescens* in central and eastern Mexico, and *V. nitidulus intermedius* in northwestern Mexico (Hoffmann 1931). Examination of the primary types of these species and considerable material from pertinent areas indicates that all three taxa are distinct species, and that *V. nitidulus* has been continuously misidentified since its original description in 1843. A second source of confusion in the identification of these taxa is the occurrence in central and southern Mexico of the aforementioned new taxa. Some of these have almost certainly been called *V. nitidulus* or *V. nigrescens* in the past (e.g., Díaz Nájera 1964, 1975). Unfortunately, our attempts to obtain specimens from Mexican collections have failed, and we can neither confirm nor deny many of the old records for these species. To clarify the identity and taxonomic status of the three taxa, complete redescriptions are provided below.

Two other species are dealt with here. *Vaejovis mexicanus decipiens* Hoffmann is elevated to specific status and redescribed as a valid species of the *nitidulus* group based on examination of the types. *Vaejovis minckleyi* Williams, which has lately been considered a member of the genus *Paruroctonus* (Stahnke 1974), is returned to *Vaejovis* and placed in the *nitidulus* group. Because Williams' original description (1968) is largely adequate and the species is very distinctive, only a revised diagnosis and some comments are given below, emphasizing new characters of taxonomic importance.

Vaejovis nitidulus C. L. Koch
(Figs. 1-13)

Vaejovis nitidulus C. L. Koch 1843: 4, fig. 758; Peters 1861: 510; Karsch 1879: 135; *nec* Pocock 1902: 12; Borelli 1915: 7; Moritz & Fischer 1980: 320.

Vejovis nitidus (sic), Thorell 1876: 186.

Vejovis spinigerus, Kraepelin 1894: 202 (part).

Vejovis nitidulus, *nec* Kraepelin 1899: 186; Bücherl 1959: 271 (?), 1971: 329; Stahnke 1974: 135.

Vaejovis nitidulus nitidulus, *nec* Hoffmann 1931: 371, *nec* 1937: 204, *nec* 1939: 318; *nec* Gertsch 1958:5; Díaz Nájera 1964: 20 (part?), 1975: 7 (part?)

Type data.—Of four syntypes of *Vaejovis nitidulus* used by Koch (1843) in his original description, only two remain (Moritz and Fischer 1980). Both are adult females, and represent two different taxa. Koch's description is too general to determine whether he based it on either specimen or all four; likewise, his measurements cannot be assigned with certainty to either specimen (Although his measurements, which are few and general, are similar to those of the smaller female, it is not certain that they indeed belong to that female; it is equally possible that the measurements refer to one of the missing syntypes).

We hereby select the larger female from Mexico (Deppe, coll.), bearing the label ZMB 10a, as the lectotype for *V. nitidulus*. We have identified conspecific material from Hidalgo and eastern Querétaro, Mexico, and the coloration of these specimens match very well the description by Koch and his color plate (Koch 1843: fig. 758).

The lectotype, originally a dry, pinned specimen, is in very poor condition. The pedipalps, metasoma, and most of the legs are detached from the body; some of the legs themselves are broken into separate segments, as is one pedipalp. Some damage by dermestid beetles is evident. The carapace is also detached from the body, and the specimen is strongly discolored. However, in spite of its poor condition, no body parts are missing and taxonomic characters are readily observable.

The identity of specimen ZMB 10 is unknown. It is definitely not referable to *V. nitidulus*, and we have not yet seen any material which is conspecific with it. In the vial containing this specimen is a label written by H. L. Stahnke, selecting this specimen as lectotype. Dr. Stahnke has never published this designation, and therefore, it is not valid according to the International Code of Zoological Nomenclature, Art. 74(a)(i). The reference to Stahnke's invalid lectotype by Moritz & Fischer (1980) also does not constitute proper designation, as it was not intended as such [ICZN 74(c)]. Stahnke's paralectotype label in the vial containing ZMB 10a should likewise be disregarded.

Both specimens are deposited in the Zoologisches Museum of Humboldt Universität in Berlin.

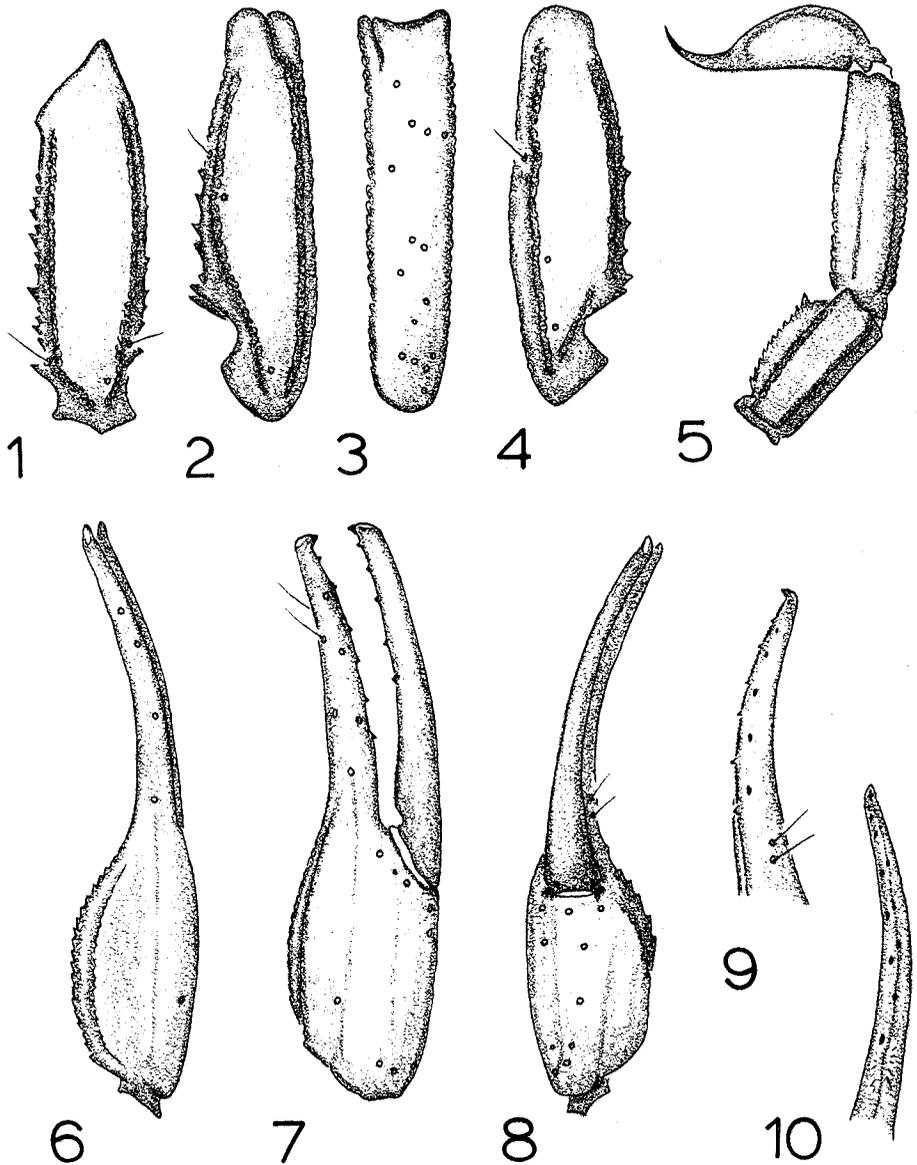
Distribution.—Known from Hidalgo, and eastern Querétaro, Mexico.

Diagnosis.—Adults 45-65 mm in length. Base color yellow brown, without conspicuous underlying markings. Sternite VII with lateral keels weak, granular. Metasoma with ventral submedian carinae obsolete on I-IV; ventrolateral carinae moderate to weak, smooth; distalmost granules of dorsolateral and lateral supramedian carinae enlarged, spinoid. Pedipalp: tibia with 15 trichobothria (3 *et*, 1 *est*, 2 *em*, 3 *esb*, 5 *eb*, 1 *v*) on external face; fixed finger with primary row divided into seven subrows by six larger granules; keels of chela developed. Pectinal tooth count 24-28 in males, 21-27 in females.

Vaejovis nitidulus, in possessing an extra *esb* trichobothrium on the tibia and high pectinal tooth counts, is most similar to *V. minckleyi*. It is easily distinguished from that species by possessing seven subrows of denticles on the pedipalp chela fixed finger (instead of six subrows), by having smooth or obsolete keels on the dorsal and external surfaces of the pedipalp chela (instead of granulose keels), by having obsolete ventral submedian keels on the metasoma (rather than weak, granular keels), and by having metasomal segments I-II wider than long (instead of longer than wide).

Redescription.—The following redescription is based on adults. Parenthetical statements refer to females. Measurements of the female lectotype and an adult male appear in Table 1.

Coloration (in alcohol). Carapace and tergites yellow brown. Metasomal segments I-III yellow brown to light orange brown, IV-V orange brown to reddish brown. Telson yellow brown to light orange brown; aculeus dark brown.



Figs. 1-10—*Vaejovis nitidulus* Koch, male from Hidalgo, Mexico: 1, dorsal aspect of pedipalp femur; 2, dorsal aspect of pedipalp tibia; 3, external aspect of pedipalp tibia; 4, ventral aspect of pedipalp tibia; 5, lateral aspect of metasomal segments IV and V, and telson; 6, dorsal aspect of pedipalp chela; 7, external aspect of pedipalp chela; 8, ventral aspect of pedipalp chela; 9, dentition pattern on fixed finger of pedipalp chela; 10, dentition pattern on movable finger of pedipalp chela.

Pedipalps: femur and tibia yellow, lighter than body; chela orange brown, darker at base of fingers with yellowish fingertips; denticles of dentate margin brown. Legs yellow with some faint dusky markings; tarsi yellowish. Venter: coxosternal region yellow brown; pectines yellowish white; sternites light yellow brown; third sternite in male with whitish patch along posteromedial margin (absent).

Prosoma. Carapace approximately as long as wide. Median ocular prominence moderately raised above carapacial surface. Three pairs of lateral eyes. Anterior carapacial margin obtusely emarginate; median notch shallow, narrow. Median longitudinal furrow deep, wide at anterior margin; deep, narrow posteriorly. Posterior lateral furrow curved, deep, wide. Entire carapacial surface densely granular.

Mesosoma. Tergites I-VI: median carina on I obsolete, on II-VI weak, granular; submedian carinae vestigial. Tergite VII: median carina weak, finely granular, present on anterior one-third to one-half; submedian and lateral carinae strong, serratocrenulate. Genital operculi distinctly lobed posteriorly; without median longitudinal membranous connection (with short basal connection, one-half length of genital operculum). Genital papillae well developed (absent). Pectinal teeth numbering 24-28 (21-27). Sternites III-VI smooth, stigmata about three times longer than wide. Sternite VII with median pair of carinae obsolete; lateral carinae weak, granular.

Metasoma. Segments I-IV: Segments I-II, occasionally III, wider than long, others longer than wide. Dorsolateral carinae on I-III strong, serrate; on IV strong, irregularly crenulate to serrate; distalmost denticle distinctly enlarged, spinoid (Fig. 5). Lateral suprmedian carinae on I strong, serrate; on II-III strong, finely crenulate to finely serrate; on IV moderate, smooth to finely serrate; distalmost denticle distinctly enlarged, spinoid on I-III; flared and winglike on IV (Fig. 5). Lateral inframedian carinae on I complete, strong, crenulate to serrate; on II present only on posterior one-third, crenulate to serrate; on III present on posterior one-fourth, granular to crenulate; on IV absent. Ventrolateral carinae on I moderate, smooth, sometimes with few posterior serrations; on II-IV weak, smooth, posterior serrations sometimes present. Ventral submedian carinae on I-IV obsolete. Intercarinal spaces irregularly granular, lustrous. Segment V (Fig. 5): slightly more than twice as long as wide. Dorsolateral carinae weak, granular. Lateral median carinae present on anterior three-fourths, weak, granular. Ventrolateral and ventromedian carinae moderate, finely serrate. Intercarinal spaces irregularly granular, lustrous.

Telson (Fig. 5.). Dorsal surface flattened, smooth; ventral surface with irregularly spaced granules and punctations.

Chelicera. Movable finger internally with well developed serrula.

Pedipalp. Femur (Fig. 1) tetracarinate. Dorsointernal, dorsoexternal, and ventrointernal carinae strong, crenulate. Ventroexternal carina strong, with irregularly spaced, large rounded granules. Internal face with large, conical granules; dorsal face coarsely granular; ventral and external faces with granulation on basal portion. Orthobothriotaxia C (Vachon 1974).

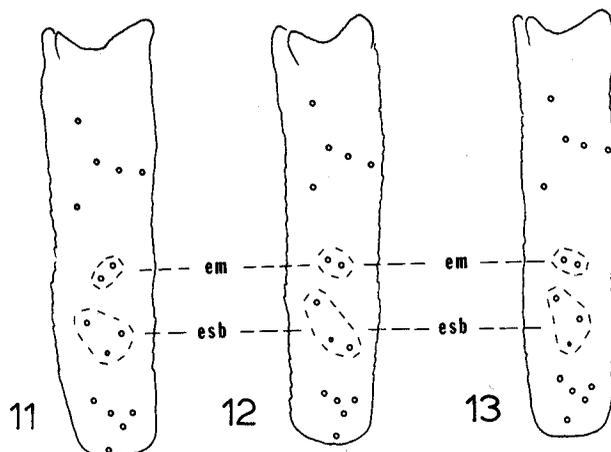
Tibia (Figs 2-4) tetracarinate. Dorsointernal and ventrointernal carinae strong, crenulate. Dorsoexternal carina moderate, granular to crenulate. Ventroexternal carina moderate, crenulate. Internal face with moderate basal tubercle and large, sharp granules. Dorsal face smooth; ventral face with few scattered, coarse

granules; external face with weakly granular, longitudinal series of granules. Neobothriotaxia C (Vachon 1974), with three *esb* trichobothria; *esb*₂ petite (Fig. 3). Positions of *em*₁ and *em*₂ variable (see Figs. 11-13).

Chela (Figs. 6-10): Dorsal marginal carina weak, granular. Dorsal secondary and digital carinae weak, smooth. External secondary carina obsolete. Ventroexternal and ventromedian carinae weak, smooth. Ventrointernal carina weak, granular. Dorsointernal carina moderate, with large sharp granules. Dentate margin of fixed finger with primary row broken up into seven subrows by six larger granules; six internal accessory granules of which all but distal one paired with larger granule in primary row (Fig. 9). Dentate margin of movable finger with primary row broken up into seven subrows by six enlarged granules; apical row consisting of one or two small granules; seven internal accessory granules of which distal granule not paired with larger granule of primary row, basalmost granule distinctly basal to corresponding granule in primary row (Fig. 10). Both fingers terminating in large, sharp, claw-like tooth bearing distally an oblong elongate whitish cap. Orthobothriotaxia C (Vachon 1974).

Legs. Tarsomere I on legs I-II with one retrolateral and two ventrolateral rows of spinules; ventral rows complete, interrupted at irregular intervals by large spines. Retrolateral row present on distal one-half, interrupted by one or two spines. Tarsomere I spinule rows rudimentary on legs III-IV, with spines well developed. Tarsomere II on all legs with single ventromedian row of spinules, procurved basally, terminating distally between single pair of medium-sized spines. Spinule rows flanked by pairs of setae as in Soleglad (1975: Fig. 17); seta formula given in Table 3.

Variation.—Although only a small number of specimens have been located and examined, pectinal tooth counts varied as follows: among males, 5 combs with 24 teeth, 3 combs with 25 teeth, 3 combs with 26 teeth, 2 combs with 27 teeth, and 3 combs with 28 teeth; among females, 2 combs with 21 teeth, 3 combs with 22 teeth, 4 combs with 23 teeth, 4 combs with 24 teeth, 4 combs with 25 teeth, 3 combs with 26 teeth, and 2 combs with 27 teeth. As is typical of the group, adult males have relatively shorter, wider chelae than females and slightly longer and narrower metasomal segments. No other significant variation was observed.



Figs. 11-13.—*Vaejovis nitidulus* Koch, males from Hidalgo, Mexico: external aspect of pedipalp tibia showing variability in position of *em* and *esb* trichobothria.

Remarks.—*V. nitidulus* and its relationship to other species in the group have been poorly understood since the original description. Hoffmann (1931), in his treatment of the scorpions of Mexico, considered *V. nitidulus* to be polytypic, containing three subspecies: *V. n. nitidulus*, *V. n. intermedius*, and *V. n. nigrescens*. The new characters established by examination of the types of the three nominal taxa (i.e., number of subrows in the dentate margin of the chela fingers, structure of pedipalp chela keels, trichobothrial pattern of the tibia, pectinal tooth counts, and morphometrics) show conclusively that each is a good species. Problems in identifying these taxa were compounded by the fact that Hoffmann (1931) misidentified *V. nitidulus*. We have examined some of Hoffmann's specimens from Cuicatlán, Oaxaca, and they are not referable to *V. nitidulus* (actually they represent a new species being described by the senior author). All records of *V. nitidulus* from Guanajuato and western Querétaro (Díaz Nájera 1975) need to be confirmed.

Specimens examined.—MEXICO: no specific locality or date (Deppe), 1 lectotype female (ZMB) *Hidalgo*: Jacala (east side), W99.11: N21.01, 27 July 1966 (J. & W. Ivie), 1 female (AMNH), 1 juv (AMNH); 18 July 1963 (R. E. Woodruff) (under cow dung), 1 female (FSCA); Jacala, W99.12: N21.01, 20 April 1963 (W. J. Gertsch & W. Ivie), 1 female (AMNH); Taxquillo (Tzindejeh), W99.19: N20.33, 29 July 1966 (J. & W. Ivie), 1 male (AMNH), 1 juv (AMNH); 1 mi SE Danghu (3 mi S Taxquillo), 22 Aug 1984 (W. D. Sissom, C. Myers, L. Born) (N slope of rocky hillside, UV light), 5 males, 2 females (WDS), 1 male, 1 female (OFF); *Querétaro*: Mountains near San Joaquin, July 1976 (S. Minton), 1 female (SAM); Mission Bucareli, 31 Dec 1981 (S. Minton), 1 female (SAM), 1 juv female (MEB).

Vaejovis nigrescens Pocock
(Figs. 14-23)

Vaejovis nigrescens Pocock 1898:396.

Vaejovis nitidulus, Kraepelin 1899: 186 (part); 1901: 274 (part).

Vaejovis nitidulus, Pocock 1902: 12.

Vaejovis nitidulus nigrescens, Hoffmann 1931: 365, 1937: 204, 1939: 318; Gertsch 1958: 5.

Vaejovis nitidulus nigrescens, Díaz Nájera 1964:20, 24, 25, 29; 1975: 7, 22, 25, 26, 30, 34.

Type data.—Adult female holotype from Mexico (no date or collector); deposited in the British Museum (Natural History); examined. The holotype, formerly a pinned specimen, is in poor condition: metasomal segments II-V and the telson are detached from the body and held together with a pin; the right pedipalp, its movable finger, and most of the legs are also detached; the pectines are shriveled and broken; and the specimen is strongly discolored.

Distribution.—The specimens we have examined are from the central Mexican states of Aguascalientes, Distrito Federal, and Guanajuato. Hoffmann (1931, 1937) and Díaz Nájera (1964, 1975) record *V. nigrescens* additionally from Hidalgo, Querétaro, and adjacent parts of Jalisco, Michoacan, San Luis Potosí, and Zacatecas. As in the case of *V. intermedius*, these records need to be verified. We have also examined a series of specimens from Dinamita, Durango collected by Duges; this record is far outside the range of *nigrescens* (including the records of Hoffmann and Díaz Nájera) and may possibly be the result of a labeling error.

Diagnosis.—Adults 42-68 mm in length. Base color orange brown to reddish brown with variable faint underlying dusky markings. Sternite VII with submedian keels obsolete; lateral keels weak to moderate, granular. Metasomal

segments I-II wider than long, III as long as wide, V less than twice as long as wide; ventrolateral carinae of I-IV weak, smooth to finely granular; ventral submedian carinae obsolete. Pedipalp: tibia with 14 trichobothria (3 *et*, 1 *est*, 2 *em*, 2 *esb*, 5 *eb*, 1 *v*) on external face; fixed finger of chela with primary row of denticles broken into six subrows by five enlarged denticles; femur as long as carapace; dorsointernal carina of chela with weak to moderate, rounded granules. Pectinal tooth count 19-21 in males; 17-21 in females.

Vaejovis nigrescens is most similar to *V. intermedius*. For comparisons between these two species, see the diagnosis of the latter species.

Redescription.—The following redescription is based on adult males and females. Parenthetical statements refer to females. Measurements of the female holotype and an adult male appear in Table 1.

Coloration. Base color of carapace and tergites orange brown to reddish brown, with faint underlying dusky markings. Venter yellow brown to orange brown; third sternite in males with whitish patch along posteriomedial margin (absent). Metasomal segments I-III orange brown to reddish brown, IV-V dark reddish brown. Telson reddish brown, with dark brown aculeus. Chelicerae yellow brown at base, mottled with brown distally; teeth brown. Pedipalps: Femur and tibia yellow brown to orange brown with carinae somewhat darkened; chela manus reddish brown to dark orange brown; fingers dark brown basally, reddish brown to dark orange brown distally. Legs yellow to orange brown, usually lighter than body. Pectines whitish.

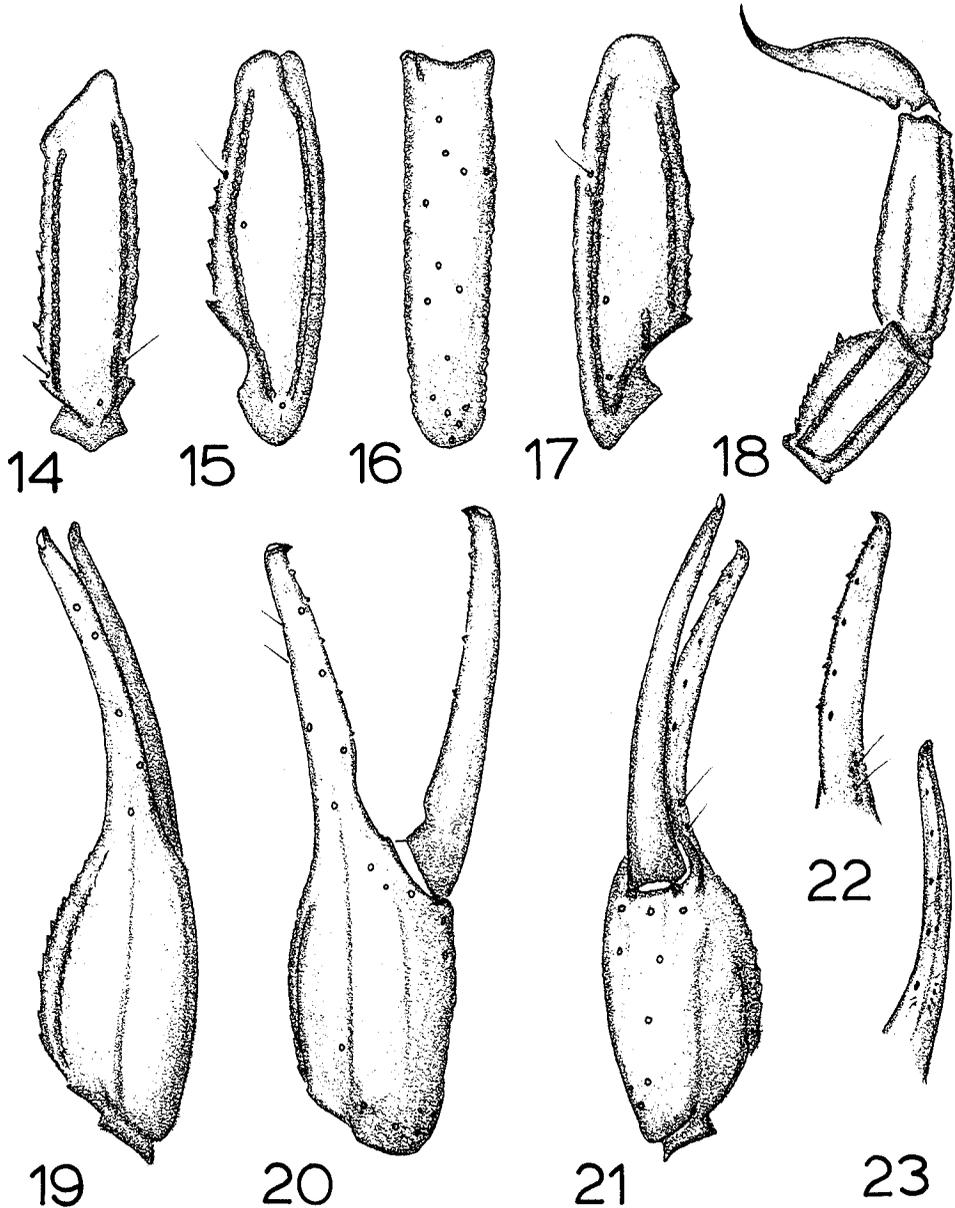
Prosoma. Carapace slightly longer than wide. Median ocular prominence only slightly raised above carapacial surface. Three pairs of lateral eyes, diameter of

Table 1. Measurements in mm and meristic characters of *Vaejovis nigrescens* Pocock and *Vaejovis nitidulus* C. L. Koch.

Character	<i>V. nitidulus</i>		<i>V. nigrescens</i>	
	lectotype ♀	adult ♂ (AMNH, Taxquillo)	holotype ♀	adult ♂ (MNHN, RS-0671)
Total length	64.8	50.4	61.8	49.5
Carapace length	7.7	5.8	7.4	5.9
Mesosoma length	20.8	14.8	20.6	14.4
Metasoma length	27.5	23.1	25.9	22.0
I length/width	3.6/4.8	3.0/3.6	3.4/4.4	2.8/3.8
II length/width	4.0/4.8	3.6/3.5	3.9/4.5	3.4/3.8
III length/width	4.5/4.8	3.9/3.5	4.3/4.4	3.8/3.8
IV length/width	6.2/4.6	5.1/3.4	6.0/4.4	5.0/3.9
V length/width	9.2/4.6	7.5/3.4	8.3/4.4	7.0/3.8
Telson length	8.8	6.7	7.9	7.2
Vesicle length/width/depth	5.8/3.4/2.8	4.3/2.4/1.9	5.1/3.4/2.6	4.7/2.8/2.2
Aculeus length	3.0	2.4	2.8	2.5
Pedipalp length	26.7	22.2	27.3	21.3
Femur length/width	7.2/2.2	6.0/1.6	7.2/2.0	5.6/1.6
Tibia length/width	7.5/2.3	6.2/1.5	7.5/2.2	6.0/1.7
Chela length/width/depth	12.0/2.6/3.0	10.0/2.2/2.8	12.6/2.8/3.2	9.7/2.9/2.9
Movable finger length	8.0	6.6	8.6	6.0
Fixed finger length	6.5	5.5	7.1	4.7
No. primary rows (FF/MF)	7/7	7/7	6/6	6/6
Int. accessory granules (FF/MF)	6/7	6/7	6/7	6/7
Pectinal teeth (l/r)	27-26	26-24	18-19*	24-23

*as reported by Pocock (1898).

posteriormost pair approximately one-half the diameter of the preceding pairs. Anterior carapacial margin obtusely emarginate, median notch distinct, shallow, wide. Median longitudinal furrow deep, wide at anterior margin; deep, narrow posteriorly. Posterior lateral furrows curved, deep, wide. Entire carapacial surface coarsely granular.



Figs. 14-23.—*Vaejovis nigrescens* Pocock, male from Guanajuato, Mexico: 14, dorsal aspect of pedipalp femur; 15 dorsal aspect of pedipalp tibia; 16, external aspect of pedipalp tibia; 17, ventral aspect of pedipalp tibia; 18, lateral aspect of metasomal segments IV and V, and telson; 19, dorsal aspect of pedipalp chela; 20, external aspect of pedipalp chela; 21, ventral aspect of pedipalp chela; 22, dentition pattern on fixed finger of pedipalp chela; 23, dentition pattern on movable finger of pedipalp chela.

Mesosoma. Tergites I-VI: Median carina on I obsolete, on II-VI weak, granular; submedian carinae vestigial. Tergite VII: median carina weak, granular, present on anterior one-half to two-thirds; submedian and lateral carinae strong, crenulate. Genital operculi distinctly lobed posteriorly, without median longitudinal membranous connection (with basal connection two-thirds length of genital operculum); genital papillae well developed (absent). Pectinal teeth numbering 19-21, mode = 21 (17-21, mode = 18). Sternites III-VI smooth, with slit-like stigmata. Sternite VII with one pair of lateral carinae, these weak to moderate, granular.

Metasoma. Segments I-IV: Segments I-II shorter than wide, III as long as or longer than wide, IV longer than wide. Dorsolateral carinae on I-III strong, crenulate; on IV strong, irregularly crenulate; distalmost denticle on I-IV distinctly enlarged, spinoid (Fig. 18). Lateral supramedian carinae on I-III strong, crenulate to finely crenulate; on IV strong, granular to finely crenulate; distalmost denticle on I-III distinctly enlarged, spinoid, on IV widely flared (Fig. 18). Lateral inframedian carinae on I complete, strong, crenulate; on II present on posterior one-half, strong, crenulate; on III present on posterior one-third, moderate, crenulate; on IV absent. Ventrolateral carinae on I weak, finely granular; on II-IV weak, smooth to finely granular. Ventral submedian carinae obsolete. Intercarinal spaces dorsally and laterally with scattered, coarse granules. Segment V (Fig. 18): Averaging 1.95 (1.84) times as long as wide. Dorsolateral carinae weak to moderate, granular. Lateromedian carinae weak, finely granular. Ventrolateral and ventromedian carinae weak, finely serrate. Intercarinal spaces with scattered coarse granules.

Telson (Fig. 18). Dorsal surface smooth, flattened; ventral surface with irregularly spaced granules and punctations; subtle subaculear tubercle sometimes present.

Chelicera. Dentition typical of genus, with well developed serrula on ventral margin of movable finger.

Pedipalp. Femur (Fig. 14) tetracarinate: Dorsointernal, ventrointernal, and dorsoexternal carinae strong, granulose. Ventroexternal carina strong, composed of large irregularly spaced, sharp granules. Internal face with about 15 large, subconical granules; dorsal face with scattered coarse granules; ventral face with coarse granulation proximally. Femur as long as or slightly longer than carapace. *Orthobothriotaxia* C (Vachon 1974).

Tibia (Figs. 15-77): Dorsointernal and ventrointernal carinae strong, granulose. Dorsoexternal carina moderate, granular. Ventroexternal carina moderate, somewhat crenulate. Internal face with about 10 large, sharp, subconical granules; dorsal and ventral faces with scattered coarse granules; external face with vestigial, granular external keel. *Orthobothriotaxia* C (Vachon 1974); trichobothrium *em*₂ consistently basal to *em*₁ (Fig. 16).

Chela (Figs. 19-23): Dorsal marginal carina moderate, granular. Dorsal secondary keel weak, smooth. Digital carina weak basally, moderate distally, smooth. External secondary and ventromedian carinae weak, smooth. Ventrointernal carina weak, finely granular. Dorsointernal carina weak to moderate, with medium-sized granules more rounded than sharp. Dentate margin of fixed finger with primary row divided into six subrows by five larger denticles; six internal accessory granules, of which distalmost not paired with larger granule

in primary row (Fig. 22). Dentate margin of movable finger with primary row divided into six subrows by five larger granules; apical subrow with only one or two granules; seven internal accessory granules, of which distalmost and basalmost not paired with larger granule in primary row (Fig. 23). Both chela fingers terminating in large, sharp, clawlike tooth bearing distally an oblong whitish cap. Fingers of male with weak scalloping. Orthobothriotaxia C (Vachon 1974).

Legs. Arrangement of setae, spines, and spinules as in *V. nitidulus*; seta formula given in Table 3.

Variation.—Male pectinal tooth counts varied as follows: 6 combs with 19 teeth, 11 combs with 20 teeth, and 12 combs with 21 teeth. Female pectinal tooth counts varied as follows: 12 combs with 17 teeth, 22 combs with 18 teeth, 7 combs with 19 teeth, 3 combs with 20 teeth, and 1 comb with 21 teeth. Pectinal tooth counts of males and females are statistically different ($F_{1,75} = 71.0$, $p < 0.001$).

Sexual dimorphism occurs in body size and morphometrics of the pedipalp chela and metasoma (see Table 4). Adult males range from 42-52 mm in length; adult females from 46-68 mm.

Specimens examined.—MEXICO: no specific locality, date, or collector, 1 holotype female (BM); no specific locality, date or collector, 1 female (MCZ), 3 males, 1 female (MCZ); no date, 1 female (AMNH); *Aguascalientes*: Rio de Pirules (no date or collector), 1 female (AMNH); *Mexico, D.F.*: Mexico City, no date (Bononseal), 4 males, 2 females (Sc516, ex. 617) (TOR); *Durango*: Dinamite (no date or collector), 3 males, 1 female (Sc 517, ex. 656) (TOR); *Guanajuato*: Guanajuato, no date (Duges), 4 females (RS-0668) (MNHN), 2 females (RS-0678) (MNHN), 1 female (RS-0684) (MNHN), 1 male, 5 females, 7 first instars (RS-0671) (MNHN), 1 female (BM); Guanajuato, no date (Duges) (in houses) 3 males, 4 females (Sc 515, ex. 616) (TOR), 2 females (BM), 1 female (BM), Guanajuato, June 1963 (S. A. Minton), 1 female (SAM).

Vaejovis intermedius Borelli
(Figs. 24-33)

Vaejovis intermedius Borelli 1915: 6.

Vaejovis nitidulus intermedius, Hoffmann 1931: 368, 1937: 204, 1939:318; Gertsch 1958: 5.

Vaejovis nitidulus intermedius, Díaz Nájera 1964: 20, 24, 25; 1975: 7, 22, 25, 26.

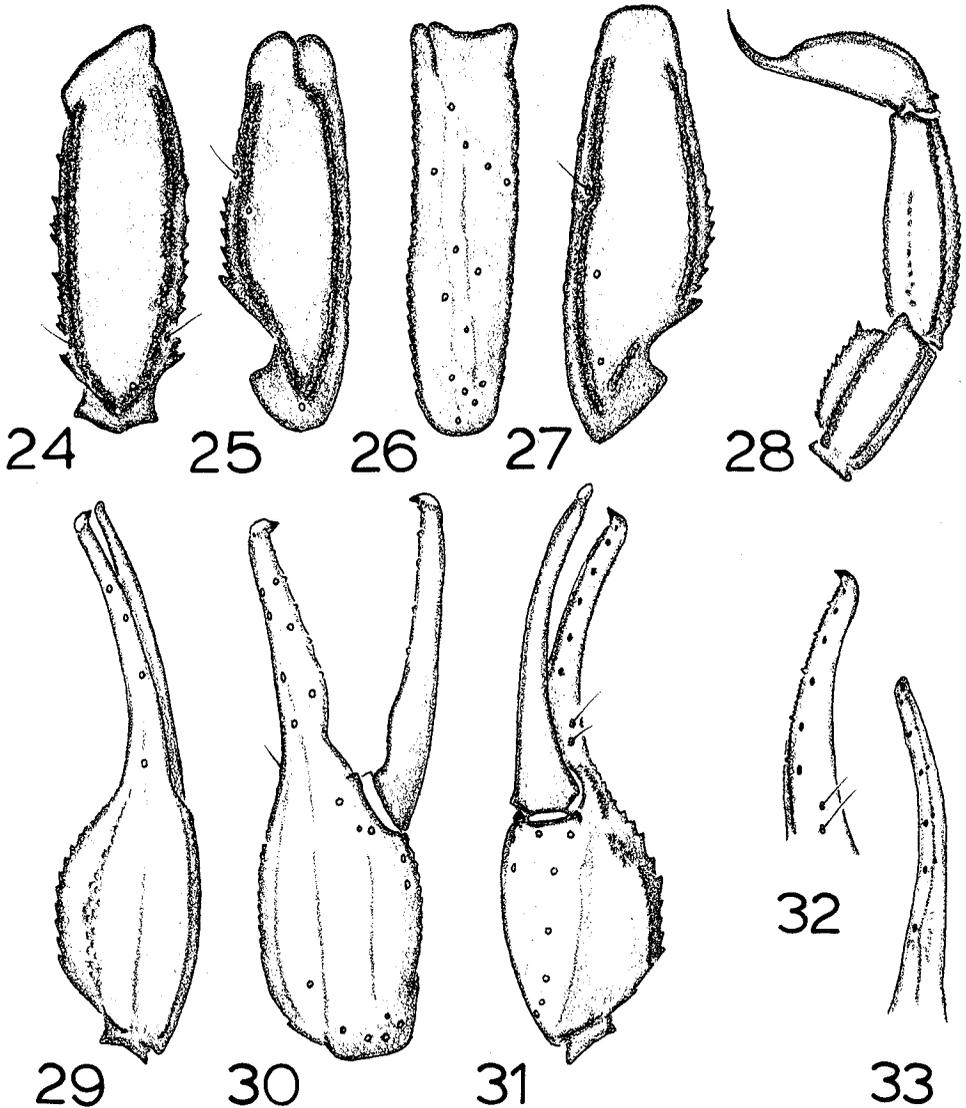
Type data.—The type series consists of three adult males and three adult females taken from Dinamita, Durango, Mexico (collector and date unknown). From this type series we designate one adult male, clearly labeled as lectotype and the remaining specimens as paralectotypes. One of the female syntypes has been labeled as a lectotype by H. L. Stahnke; however, this designation is not valid as it has never been published [International Code of Zoological Nomenclature, Art. 74 (a) (i)]. We have chosen to select the male as lectotype because it is intact; the female is broken into three parts.

The lectotype and five paralectotypes are permanently deposited in the Museo ed Istituto di Zoologia Sistemática della Università di Torino; Torino, Italy (cat. no. Sc 508, ex. 799).

Distribution.—*Vaejovis intermedius* is known from southwestern Texas (Brewster, Crockett, Presidio, Terrell, and Val Verde Counties), U.S.A. and the state of Durango in Mexico. Hoffmann (1931) reports the species also occurs in the Sierra de Guadalupe, Distrito Federal, Mexico. Díaz Nájera (1964, 1975)

reports additional records from Hidalgo and Jalisco. We have been unable to obtain these specimens, and, in light of the confusion previously surrounding the species of the *nitidulus* group, we must consider these records as tentative.

Diagnosis.—Adults 40-57 mm in length. Base color yellowish to reddish brown; pedipalps and metasoma dark reddish brown distally. Sternite VII with submedian keels obsolete; lateral keels moderate, smooth to crenulate. Metasoma: segments I-II wider than long, III as wide as long; IV-V longer than wide; ventrolateral carinae moderate, smooth to finely granular; ventral submedian



Figs. 24-33.—*Vaejovis intermedius* Borelli, lectotype male from Durango, Mexico: 24, dorsal aspect of pedipalp femur; 25, dorsal aspect of pedipalp tibia; 26, external aspect of pedipalp tibia; 27, ventral aspect of pedipalp tibia; 28, lateral aspect of metasomal segments IV and V, and telson; 29, dorsal aspect of pedipalp chela; 30, external aspect of pedipalp chela; 31, ventral aspect of pedipalp chela; 32, dentition pattern on fixed finger of pedipalp chela; 33, dentition pattern on movable finger of pedipalp chela.

carinae on I-IV obsolete; distalmost denticle of dorsolateral and lateral supramedian carinae of I-IV distinctly enlarged, spinoid. Pedipalp: tibia with 14 trichobothria (3 *et*, 1 *est*, 2 *em*, 2 *esb*, 3 *eb*, 1 *v*) on external face; fixed finger of chela with primary row of denticles broken into six subrows by five enlarged denticles; pedipalp femur distinctly shorter than carapace; keels of dorsal and external faces of chela faint to weak, smooth. Pectinal tooth count 21-26 in males, 19-23 in females.

Vaejovis intermedius is most similar to *V. nigrescens* Pocock from central Mexico. The most significant differences between the two are as follows: (1) male pectinal tooth counts range from 21-26 (mode = 23, 24) in *V. intermedius*, 19-24 (mode = 21) in *V. nigrescens*; (2) female pectinal tooth counts range from 19-23 (mode = 21) in *V. intermedius*, 17-22 (mode = 18) in *V. nigrescens*; (3) the pedipalp chela is proportionately wider and deeper in *V. intermedius*, with shorter fingers (see Table 4); (4) the dorsointernal carina of the pedipalp chela possesses strong, sharp granules in *V. intermedius*, but weak, more rounded granules in *V. nigrescens*; and (5) metasomal segment V length/width is distinctly greater in both males and females of *V. intermedius* than in *V. nigrescens* (Table 4).

Redescription.—The following redescription is based on adult males and females. Parenthetical statements refer to females and indicate sexual differences. Measurements of the lectotype male and a paralectotype female appear in Table 2.

Coloration. Base color of carapace and tergites yellowish to orange brown, with variable underlying dusky markings; in some specimens, dusky markings appear as faint submedian stripes on tergites. Venter yellow to yellow brown; third sternite in males with whitish patch along posteriomedial margin (absent).

Table 2.—Measurements in mm and meristic characters of *Vaejovis decipiens* Hoffmann and *Vaejovis intermedius* Borelli.

Character	<i>V. intermedius</i>		<i>V. decipiens</i>
	lectotype ♂	paralectotype ♀	holotype
Total length	46.3	51.6	53.7
Carapace length	5.5	6.5	6.4
Mesosoma length	12.7	16.0	14.9
Metasoma length	21.7	22.3	25.1
I length/width	2.9/3.4	3.1/3.8	3.5/3.6
II length/width	3.4/3.4	3.4/3.7	4.0/3.5
III length/width	3.6/3.3	3.8/3.6	4.3/3.6
IV length/width	4.8/3.2	5.0/3.5	5.6/3.4
V length/width	7.0/3.1	7.0/3.5	7.7/3.4
Telson length	6.4	6.8	7.3
Vesicle length/width/depth	4.1/2.4/1.8	4.4/2.8/2.1	4.8/2.6/2.0
Aculeus length	2.3	2.4	2.5
Pedipalp length	18.9	21.1	24.9
Femur length/width	5.0/1.6	5.7/1.9	6.7/1.7
Tibia length/width	5.2/1.7	5.8/2.1	7.0/1.8
Chela length/width/depth	8.7/2.5/2.7	9.6/2.4/2.6	11.2/2.6/3.2
Movable finger length	5.5	6.1	7.2
Fixed finger length	4.5	5.1	6.1
No. primary rows (FF/MF)	6/6	6/6	6/6
Int. accessory granules (FF/MF)	6/7	6/7	6/7
Pectinal teeth	25-25	21-21	24-24

Pectines whitish. Metasomal segments I-III (sometimes IV) yellowish brown; IV-V dark reddish brown; ventral submedian and ventrolateral carinae usually with faint underlying dusky pigment. Telson reddish brown; aculeus dark reddish brown. Chelicerae yellowish brown; teeth dark reddish brown. Pedipalps: femur yellowish brown; tibia yellowish brown, often reddish brown distally; chela reddish brown, with palm somewhat lighter than fingers. Legs yellow brown.

Prosoma. Carapace slightly longer than wide. Median ocular prominence only slightly raised above carapacial surface. Three pairs of lateral eyes, diameter of posteriormost pair approximately one-half the diameter of preceding pairs. Anterior carapacial margin obtusely emarginate; median notch distinct, shallow, narrow. Median longitudinal furrow deep, wide at anterior margin; deep, narrow posteriorly. Posterior lateral furrow curved, deep, wide. Entire surface of carapace moderately granular, shagreened (less granular, lustrous).

Mesosoma. Tergites I-VI: Median carina on I obsolete, on II-VI weak, granular; lateral carinae vestigial. Tergite VII pentacarinata: median carina weak, granular, present on anterior one-third to one-half; submedian and lateral carinae strong, serrate. Genital operculi distinctly lobed posteriorly; without median longitudinal membranous connection (with short basal connection, one-half length of genital operculum); genital papillae well developed (absent). Pectinal teeth numbering 21-26, mode = 23, 24 (19-23, mode = 21). Sternites III-VI smooth, agranular; stigmata approximately three times longer than wide. Sternite V with submedian carinae obsolete; lateral carinae moderate, smooth to crenulate (smooth).

Metasoma. Segments I-II (occasionally III) wider than long, III-IV longer than wide. Dorsolateral carinae strong, serrate; distalmost denticle on I-IV distinctly enlarged, spinoid (Fig. 28). Lateral suprmedian carina on I-II strong, serrate; on III strong, finely serrate (finely crenulate); on IV moderate, granular (granular to finely crenulate); distalmost denticle distinctly enlarged, spinoid on I-III, flared and winglike on IV (Fig. 28). Lateral inframedian carinae on I complete, moderate, irregularly serrate (crenulate); on II-III present on posterior one-half, moderate, crenulate; on IV absent. Ventrolateral carinae moderate; on I-II smooth anteriorly, finely granular posteriorly; on III-IV smooth to finely serrate. Ventral submedian carinae obsolete. Intercarinal spaces dorsally and ventrally with faint luster, all faces with scattered small granules. Segment V (Fig. 28): Dorsolateral carinae moderate, anteriorly serrate, posteriorly granular. Lateral median carinae present on anterior three-fifths, weak, smooth to granular. Ventrolateral carinae moderate, finely serrate (crenulate). Ventromedian carina moderate, finely crenulate to finely serrate. Intercarinal spaces as on I-IV.

Telson (Fig. 28). Dorsal surface smooth, flattened; ventral surface with irregularly spaced punctations. Subtle subaculear tubercle present.

Chelicera. Dentition typical of genus, with well developed serrula on ventral margin of movable finger.

Pedipalp. Femur (Fig. 24) tetracarinata: Dorsointernal and ventrointernal carinae strong, serratocrenulate. Dorsoexternal carina strong, serrate. Ventroexternal carina strong, with irregularly spaced, large serrate granules. Internal face with numerous, large conical granules; dorsal and ventral faces granular; external face with few proximal granules. Orthobothriotaxia C (Vachon 1974).

Tibia (Figs. 25-27) tetracarinate: Dorsointernal carina strong, serratocrenulate. Ventrointernal carina serratocrenulate to serrate. Dorsoexternal carina moderate, granular (smooth). Ventroexternal carina moderate, granular to crenulate. Internal face with moderate basal tubercle and short row of enlarged conical granules; external face granular; dorsal and ventral faces smooth. Orthobothriotaxia C (Vachon 1974). Trichobothrium *em*₂ consistently basal to *em*₁.

Chela (Figs. 29-33): Dorsal marginal carina moderate, with medium sized sharp granules. Dorsointernal carina strong, composed of large, serrate granules. Ventrointernal carina weak to moderate, granular. Ventroexternal carina weak, granular (smooth). Ventromedian carina weak, smooth. Other carinae faint, smooth. Dentate margin of movable finger with primary row divided into six subrows by five larger granules; six internal accessory granules, of which distalmost not paired with larger granule in primary row (Fig. 32). Dentate margin of movable finger with primary row divided into six subrows by five larger granules; distal subrow with only one or two granules; seven internal accessory granules, of which distalmost and basal most not paired with larger granules in primary row (Fig. 33). Chela fingers moderately (weakly) scalloped. Both chela fingers terminating distally in large, clawlike tooth bearing distally an oblong whitish cap. Orthobothriotaxia C (Vachon 1974).

Legs. Arrangement of setae, spines, and spinules as in *V. nitidulus*; seta formula given in Table 3.

Variation.—Male pectinal tooth counts varied as follows: 1 comb with 21 teeth, 8 combs with 22 teeth, 25 combs with 23 teeth, 25 combs with 24 teeth, 9 combs with 25 teeth, and 4 combs with 26 teeth. Female pectinal tooth counts varied as follows: 2 combs with 19 teeth, 12 combs with 20 teeth, 68 combs with 21 teeth, 37 combs with 22 teeth, and 4 combs with 23 teeth. Pectinal tooth counts of males and females are statistically different ($F_{1,193} = 340.3, p < 0.001$).

Coloration varies with age. Juveniles (including subadults) tend to be light yellow with more prominent dusky markings on the body. The distal segments

Table 3.—Seta formulae and variation in setal counts of the ventral surface of the tarsi of legs I-IV in *Vaejovis* spp. The numerator of the fractions indicates the number of setae in the prolateral row; the denominator indicates the number in the retrolateral row. The number outside the parentheses is the mode (=most common observation); the numbers within parentheses indicate the range.

SPECIES	I		II		III		IV	
	left	right	left	right	left	right	left	right
<i>nitidulus</i>	$\frac{2(1-2)}{1(0-1)}$	$\frac{2(1-2)}{1(0-1)}$	$\frac{4}{2(2-3)}$	$\frac{4(3-4)}{2(2-3)}$	$\frac{4(4-5)}{3}$	$\frac{4(4-5)}{3(3-4)}$	$\frac{5(4-5)}{4(3-4)}$	$\frac{5(4-5)}{4(3-4)}$
<i>nigrescens</i>	$\frac{3(2-4)}{1}$	$\frac{3(2-4)}{1(1-2)}$	$\frac{4}{3}$	$\frac{4}{3(3-4)}$	$\frac{4(4-5)}{3-4}$	$\frac{4(4-5)}{3(3-4)}$	$\frac{5(4-5)}{4(3-5)}$	$\frac{5(4-5)}{4(3-5)}$
<i>intermedius</i>	$\frac{2(1-2)}{1(1-2)}$	$\frac{2}{1(1-2)}$	$\frac{4(3-4)}{2(2-3)}$	$\frac{4(3-4)}{2(2-3)}$	$\frac{4(4-5)}{3(3-4)}$	$\frac{4(4-5)}{3}$	$\frac{5(4-5)}{4(3-5)}$	$\frac{5(4-5)}{4(3-4)}$
<i>decipiens</i> *	$\frac{2}{1}$	$\frac{2}{1-2}$	$\frac{3-4}{2-4}$	$\frac{3-4}{2}$	$\frac{4}{3-4}$	$\frac{4-5}{3-4}$	$\frac{4-5}{4}$	$\frac{4-5}{3-4}$
<i>minckleyi</i> *	$\frac{2}{1}$	$\frac{2}{1}$	$\frac{3}{2}$	$\frac{3}{2}$	$\frac{3}{3}$	$\frac{3-4}{3}$	$\frac{4}{3}$	$\frac{4}{3}$

*Only the range of observations is given due to the small sample sizes (i.e., $n < 10$).

Table 4.—Morphometric and meristic characteristics (mean and standard deviation) of *Vaejovis intermedius* Borelli and *V. nigrescens* Pocock. For *V. intermedius*, morphometrics are based on 20 ♂♂ and 20 ♀♀; for *V. nigrescens*, 8 ♂♂ and 13 ♀♀. Pectinal tooth counts are taken from 36 ♂♂ and 62 ♀♀ *V. intermedius*; and 4 ♂♂ and 23 ♀♀ of *V. nigrescens*.

Character		<i>V. intermedius</i>		<i>V. nigrescens</i>	
		males	females	males	females
Slenderness of pedipalp chela					
1. chela length/width	\bar{x}	3.78	4.35	3.94	4.54
	s	0.20	0.25	0.31	0.29
2. chela length/depth	\bar{x}	3.10	3.70	3.70	4.04
	s	0.21	0.16	0.32	0.31
Relative length of pedipalp					
3. fixed finger length/carapace length	\bar{x}	0.79	0.81	0.84	0.88
	s	0.02	0.03	0.01	0.04
4. femur length/carapace length	\bar{x}	0.91	0.88	1.02	0.99
	s	0.02	0.03	0.03	0.03
Slenderness of metasoma					
5. I length/width	\bar{x}	0.81	0.76	0.81	0.75
	s	0.03	0.02	0.04	0.03
6. III length/width	\bar{x}	1.05	1.00	1.03	0.98
	s	0.03	0.04	0.05	0.04
7. V length/width	\bar{x}	2.05	2.00	1.95	1.89
	s	0.09	0.07	0.08	0.05
Relative length of metasoma					
8. carapace length/met V length	\bar{x}	0.88	0.90	0.84	0.90
	s	0.03	0.03	0.04	0.03
Meristics					
9. Pectinal tooth counts	mode	23,24	21	21	18
	range	21-26	19-23	19-21	17-21

of the pedipalps and metasoma are light orange brown, rather than dark reddish brown as in adults.

Sexual dimorphism also occurs in body size and morphometrics of the pedipalp chela and metasoma (see Table 4). Adult males range from 40-48 mm in length; adult females from 50-57 mm.

Specimens examined.—MEXICO: *Durango*: Dinamita (no date or collector), 1 lectotype male, 2 paralectotype males, 3 paralectotype females (Sc. 508, Ex. 799) (TOR). USA: *Texas*: *Brewster Co.*: NE rim of Chisos Basin, Chisos Mts., Big Bend National Park (5600'), 6 Sept 1969 (Cazier, Bigelow), 1 male, 1 female (OFF); Chisos Mts., Juniper Canyon, Big Bend National Park, July 1921 (no collector), 1 female (AMNH); Chisos Mts., The Basin, Big Bend National Park, 1-10 Aug 1937 (K. P. Schmidt), 1 female (FMNH); Chisos Mts., The Basin, Big Bend National Park, 6 Aug 1937 (K. P. Schmidt), 1 female (FMNH); *Crockett Co.*: 14.3 mi E Sheffield, 11 October 1972 (T. R. VanDevender), 1 female (FSCA); *Presidio Co.*: no specific locality, 2 Dec 1978 (under rock) (W. W. Dalquest), 1 female (OFF); 9 mi E Bandera Mesa, 11 Mar 1975 (W. W. Dalquest), 1 female (OFF); *Terrel Co.*: 5 mi N Sanderson, 15 June 1974 (L. Draper, M. A. Cazier, O. F. Francke), 2 females (OFF); *Val Verde Co.*: 1 mi SSE Langtry, 7 June 1974 (L. Draper, M. A. Cazier, O. F. Francke), 1 female (OFF); 0.5 mi S Langtry, 14 June 1974 (L. Draper, M. A. Cazier, O. F. Francke), 18 males, 19 females (OFF); Langtry, 21 Apr 1973 (no collector), 1 female (OFF); 10 mi W Comstock, E side of Pecos River Bridge on US Highway 90 (among large rocks), 2 Sept 1983 (W. D. and J. C. Sissom), 1 female (WDS); Amistad Reservoir, railroad cuts off US Highway 90 (1000'), 6 Sept 1969 (Cazier, Bigelow), 12 males, 26 females (OFF); Amistad Reservoir, 11 June 1974 (L. Draper, M. A. Cazier, O. F. Francke), 3 males, 5 females (OFF).

Vaejovis decipiens Hoffmann
(Figs. 34-43)

Vaejovis mexicanus decipiens Hoffmann 1931: 349, 399-401; 1939: 318.

Vaejovis mexicanus decipiens, Díaz Nájera 1975: 7, 19; *nec* Vásquez 1960: 219-221; Williams 1980: 105-107.

Type data.—Hoffmann's (1931) original description was based on nine specimens: three males, four females, and two juveniles from Batopilas, Chihuahua, Mexico (no date or collector). We have been able to locate and examine only two males permanently deposited in the American Museum of Natural History. One of these, carrying Hoffmann's label, "#1, ♂ type", is considered to be the holotype, and the other a paratype.

Both the holotype and paratype are in good condition. However, the holotype has the left pedipalp loosely articulated at the femur-tibia joint, and leg II loose at the coxa-trochanter joint. The paratype has the right pedipalp loosely articulated at the tibia-chela joint, right leg I loose at the trochanter-femur joint, right leg II loose at the patella-tibia joint, left leg III loose at the coxa-trochanter joint, and left leg IV completely detached.

Distribution.—Known only from the type locality.

Diagnosis.—Adults 50-60 mm in length. Base color dark brown to dark reddish brown with variable underlying dusky markings. Sternite VII with submedian keels obsolete; lateral keels strong, granular to crenulate. Metasoma with ventral submedian carinae on I obsolete or weak, smooth; on II-IV weak, smooth with fine posterior granulation. Pedipalp: tibia with 14 trichobothria (3 *et*, 1 *est*, 2 *em*, 2 *esb*, 5 *eb*, 1 *v*) on external face; fixed finger of chela with primary row of denticles broken into six subrows by five enlarged denticles. Pectinal tooth count 22-25 in males, 21-22 in females.

V. decipiens is most similar to *Vaejovis janssi* Williams from Isla Socorro (Revillagigedo Islands). It may be distinguished from *V. janssi* by pectinal tooth counts of 22-25 in males and 21-22 in females, rather than 21-22 in males and 18-21 in females; and by having the ventral submedian carinae on metasomal segments II-IV smooth with fine posterior granulation, rather than crenulate. Morphometric differences cited by Williams (1980) apparently based on Hoffmann's (1931) measurements of *V. decipiens*, are not consistent or cannot be evaluated due to lack of adult females of *V. decipiens*.

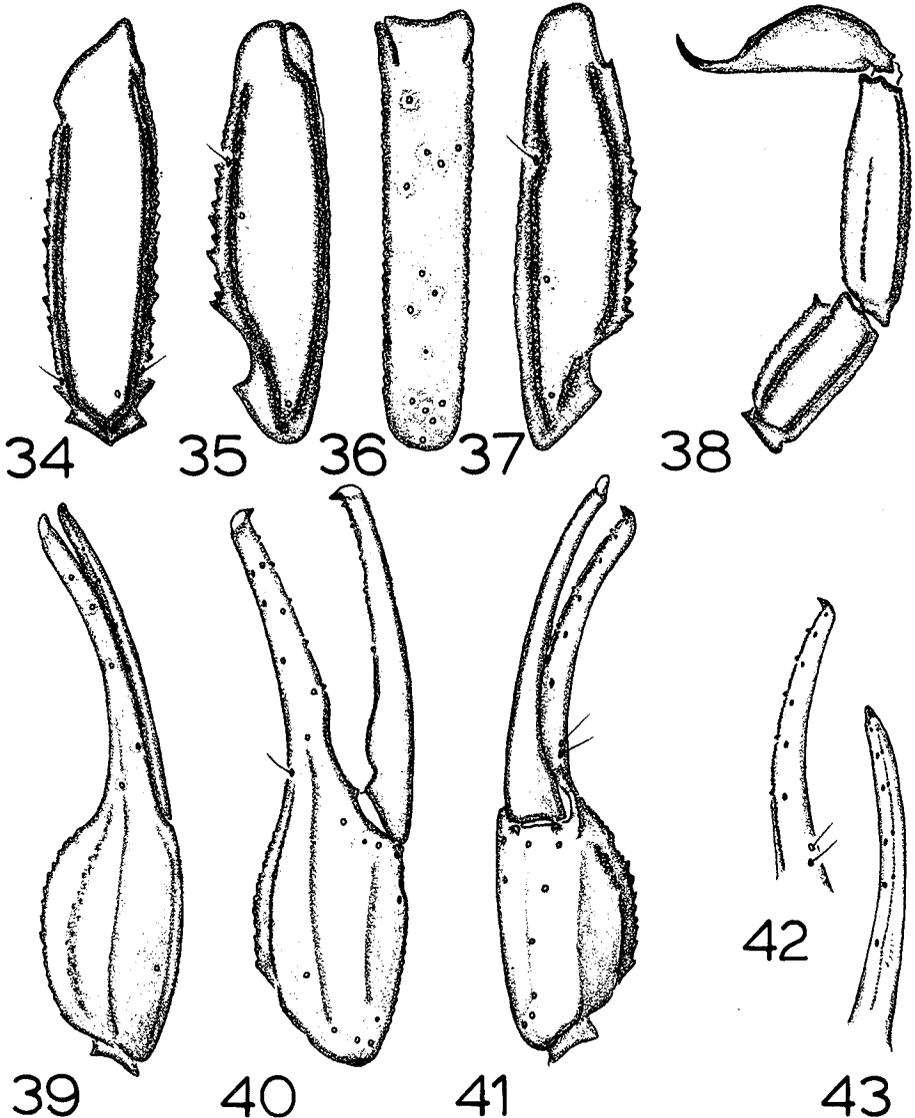
Redescription.—The following redescription is based on adult males. Measurements of the holotype appear in Table 2.

Coloration. Carapace, tergites, and metasoma brown to dark reddish brown with variable underlying dusky markings. Pedipalp femur and tibia same color as body; chela dark reddish brown, usually lighter than body, with yellow brown fingertips. Chelicerae yellow brown with teeth dark brown. Legs yellow brown to brown with variable underlying dusky markings. Venter light brown to medium brown with dusky markings; third sternite with conspicuous yellowish white patch posteromedially. Pectines yellowish white.

Prosoma. Carapace slightly longer than wide. Median ocular prominence slightly raised above surface of carapace. Three pairs of lateral eyes, diameter of posteriormost pair approximately one-half the diameter of preceding pairs.

Anterior carapacial margin obtusely emarginate; median notch distinct, shallow, narrow. Median longitudinal furrow deep, wide at anterior margin; deep, narrow posteriorly. Posterior lateral furrow curved, deep, wide. Entire carapacial surface coarsely granular.

Mesosoma. Tergites I-VI with median carina weak, granular; lateral carinae vestigial. Tergite VII pentacarinat: median carina weak, granular, present on anterior one-third; submedian and lateral carinae strong, serrate. Genital operculi distinctly lobed posteriorly; without median longitudinal membranous connection.



Figs. 34-43.—*Vaejovis decipiens* Hoffmann, holotype male from Chihuahua, Mexico: 34, dorsal aspect of pedipalp femur; 35, dorsal aspect of pedipalp tibia; 36, external aspect of pedipalp tibia; 37, ventral aspect of pedipalp tibia; 38, lateral aspect of metasomal segments IV and V, and telson; 39, dorsal aspect of pedipalp chela; 40, external aspect of pedipalp chela; 41, ventral aspect of pedipalp chela; 42, dentition pattern on fixed finger of pedipalp chela; 43, dentition pattern on movable finger of pedipalp chela.

Genital papillae well developed. Pectinal teeth numbering 22-25. Sternites III-VI smooth, agranular; stigmata approximately 2.5 to 3 times longer than wide. Sternite VII with submedian carinae obsolete; lateral carinae strong, granular to crenulate.

Metasoma. Segments I-IV longer than wide (except sometimes I). Dorsolateral carinae strong, serrate; distalmost denticle distinctly enlarged and spinoid (Fig. 38). Lateral suprmedian carinae on I strong, serrate; on II-III strong, serrate to finely serrate; on IV strong, granular to finely serrate; distalmost denticle distinctly enlarged and spinoid on I-III, flared and winglike on IV (Fig. 38). Lateral inframedian carinae on I complete, strong, serrate; on II present on posterior one-third, strong, serrate; on III present on posterior one-fourth, strong, crenulate to serrate; on IV absent. Ventrolateral carinae on I-III strong, finely serrate; on IV strong, finely crenulate to finely serrate. Ventral submedian carinae on I obsolete or weak, smooth; on II-IV weak, smooth, usually with fine serrations on posterior portion. Intercarinal spaces with scattered coarse granules, primarily on dorsal surfaces. Segment V (Fig. 38): Dorsolateral carinae strong, granular. Lateromedian carinae present on anterior three-fourths of segment, strong, granular to finely serrate. Ventrolateral carinae strong, finely serrate (sometimes finely crenulate posteriorly). Ventromedian carina strong, finely crenulate to finely serrate. Intercarinal spaces essentially agranular.

Telson (Fig. 38). Dorsal surface smooth, flattened; ventral surface with irregularly spaced fine granules and punctations.

Chelicera. Dentition typical of genus, with well developed serrula on ventral margin of movable finger.

Pedipalp. Femur (Fig. 34) tetracarinate: Dorsointernal and ventrointernal carinae strong, serratocrenulate. Dorsoexternal carina strong, serrate. Ventroexternal carina strong, composed of large, irregularly spaced sharp granules. Internal face with large, scattered, conical granules; ventral face with moderate granulation basally; dorsal face smooth. Orthobothriotaxia C (Vachon 1974).

Tibia (Figs. 35-37) tetracarinate: All keels strong, crenulate to serratocrenulate. Internal face with moderate basal tubercle plus series of large, conical granules; external face granular; dorsal and ventral faces smooth. Orthobothriotaxia C (Vachon 1974). Trichobothrium em_2 basal to or in juxtaposition with em_1 .

Chela (Figs. 39-43). Dorsal marginal carina strong, granular. Dorsal secondary carina weak, smooth to finely granular. Digital carina moderate, smooth to finely granular. External secondary carina weak, smooth to finely granular. Ventroexternal carina moderate, granular. Ventromedian carina weak, smooth. Ventrointernal carina weak to moderate, finely granular. Dorsointernal carina strong, composed of large, sharp granules. Dentate margin of fixed finger with primary row divided into six subrows by five larger granules; six internal accessory granules, of which distalmost not paired with larger granule in primary row (Fig. 42). Dentate margin of movable finger with primary row divided into six subrows by five larger granules; distal subrow with only one or two granules; seven internal accessory granules, of which distalmost and basalmost not paired with larger granule in primary row (Fig. 43). Both chela fingers terminating in large, sharp, clawlike tooth bearing distally an oblong whitish cap. Orthobothriotaxia C (Vachon 1984).

Legs. Arrangement of setae, spines, and spinules as in *V. nitidulus*; seta formula given in Table 3.

Variation.—Male pectinal tooth counts varied as follows: 1 comb with 22 teeth; 3 combs with 23 teeth; 3 combs with 24 teeth; 1 comb with 25 teeth. Only a single female (a juvenile) was available for study; its pectinal tooth count is 21-21. Hoffmann (1931) reported pectinal tooth counts of 22 for the females he studied.

Juveniles differ from adults in general coloration. In juveniles the body is yellow brown with dusky underlying markings: the tibia and chela of the pedipalp are orange brown; the metasoma is yellow brown basally (segments I-III) and gradually becomes orange brown distally (segments IV-V); the telson is orange brown.

Remarks.—Hoffmann (1931), in his original description, noticed the similarity between *V. decipiens* and the *V. nitidulus* group, but was reluctant to group it with those taxa because its ventral submedian keels were distinctly developed (not obsolete). As a result, he considered it to be a subspecies of *V. mexicanus*. In possessing the enlarged terminal denticles on the pedipalp chela fingers (each with a distinct whitish cap), it is clear that *V. decipiens* is a member of the *nitidulus* group and not a subspecies of *V. mexicanus*.

Specimens examined.—MEXICO: *Chihuahua*: Batopilas (no date or collector), 1 male holotype (labeled "#1, male type" by Hoffmann), 1 male paratype (AMNH); Barranca de Rio Batopilas, 120 km S Creel (approx. 1000 m), 26 Feb. 1966 (W. Bell, J. Reddell), 2 males, 3 juvs. (AMNH).

Vaejovis minckleyi Williams
(Figs. 44-53)

Vaejovis minckleyi Williams 1968: 21-24, figs. 11-12; Soleglad 1972: 180, 1973:357.

Paruroctonus minckleyi, Stahnke 1974: 138.

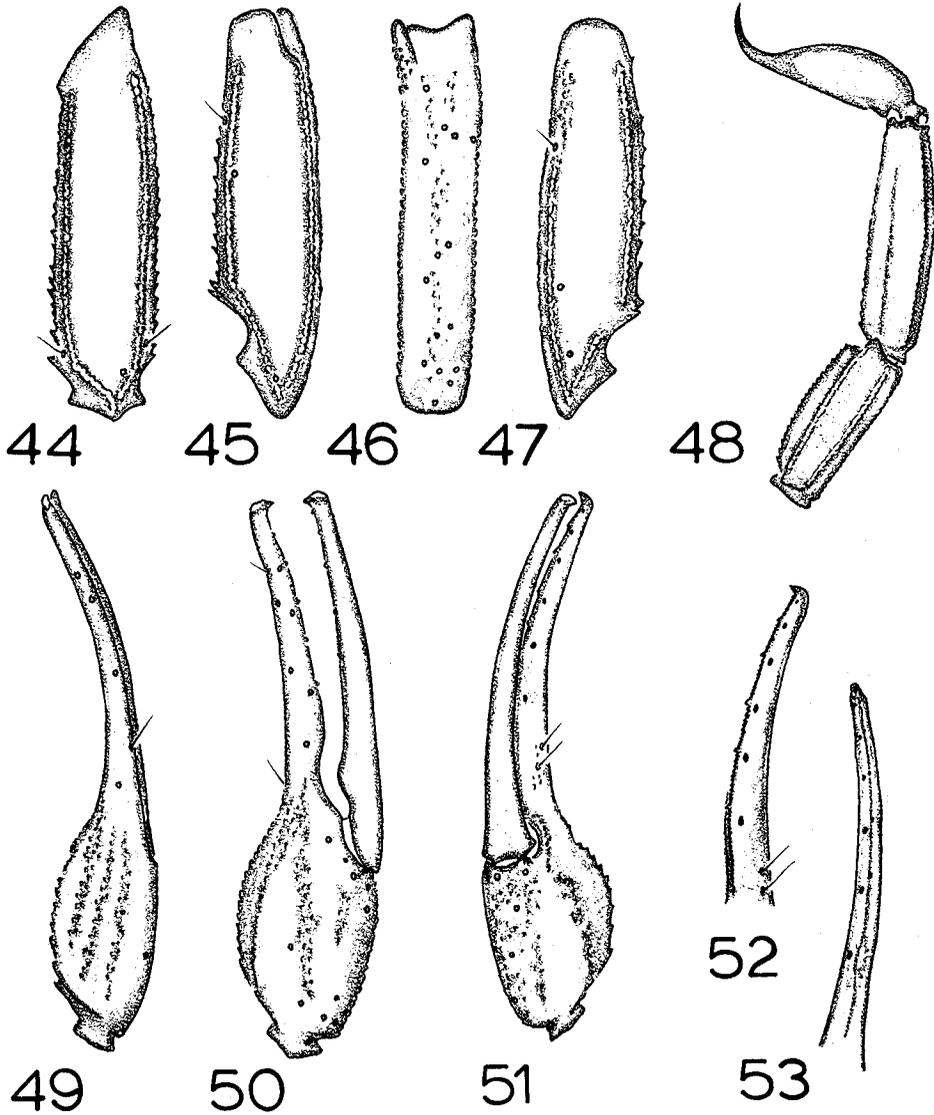
Type data.—Holotype male from 5.3 km NW Cuatro Ciénegas, Coahuila, Mexico, 3 January 1965 (W. S. Parker). Paratype male from second canyon from the eastern tip of San Marcos Mountain, 12 km SW Cuatro Ciénegas, 3 January 1965 (W. L. Minckley, W. S. Parker, and W. K. Taylor). Deposited in the California Academy of Sciences; not examined.

Distribution.—*Vaejovis minckleyi* is apparently endemic to the Cuatro Ciénegas Basin, Coahuila, Mexico. This remarkable intermontane valley in the Sierra Madre Oriental contains a highly diversified biota with a conspicuous percentage of endemic taxa, a considerable portion of which are Pleistocene relicts or older (Minckley 1969).

Diagnosis.—Adults 60-70 mm in length. Base color yellow; pedipalp chelae yellow orange with reddish brown fingers. Sternite VII tetracarinate: submedian keels faint, smooth; lateral keels strong, crenulate. Metasoma: all segments distinctly longer than wide; ventrolateral carinae on I-IV strong, serrate; ventral submedian carinae on I-III weak to vestigial, smooth, on IV weak, granular. Distalmost denticle of dorsolateral carinae of I-IV not distinctly larger than others or spinoid (Fig. 48). Pedipalp (Figs. 44-47; 49-53): tibia with 15 trichobothria (3 *et*, 1 *est*, 2 *em*, 3 *esb*, 5 *eb*, 1 *v*) on external face (Fig. 46): fixed finger of chela with primary row of denticles broken into six subrows by five enlarged denticles (Fig. 52); fixed finger distinctly longer than carapace; keels of

dorsal and external surfaces of chela strong in males (moderate in females), granulose (Figs. 49-51). Pectinal tooth count 31-32 in males, 28-29 in females.

Vaejovis minckleyi is a very distinctive member of the *nitidulus* group. In pectinal tooth counts and tibial trichobothrial pattern, it most closely resembles *V. nitidulus*. However, it may be easily distinguished from that species by having six subrows of granules on the chela fingers rather than seven subrows; by having distinct ventral submedian carinae on metasomal segments I-IV, rather than



Figs. 44-53.—*Vaejovis minckleyi* Williams, male from Coahuila, Mexico: 44, dorsal aspect of pedipalp femur; 45, dorsal aspect of pedipalp tibia; 46, external aspect of pedipalp tibia; 47, ventral aspect of pedipalp tibia; 48, lateral aspect of metasomal segments IV and V, and telson; 49, dorsal aspect of pedipalp chela; 50, external aspect of pedipalp chela; 51, ventral aspect of pedipalp chela; 52, dentition pattern on fixed finger of pedipalp chela; 53, dentition pattern on movable finger of pedipalp chela.

obsolete carinae; by having all metasomal segments longer than wide; and by having granulose carinae on the dorsal and external surfaces of the chela, rather than weak, smooth carinae.

Variation.—Only one male and one female (both topotypes) were studied.

Remarks.—Stahnke (1974) considered *V. minckleyi* to be a member of the genus *Paruroctonus*, apparently because the distalmost denticles of the dorsolateral carinae of metasomal segments I-IV are not enlarged and spinoid (Fig. 48). We interpret this condition to result from the elongation of the metasomal segments (as seen in other *nitidulus* group species and also in *Syntropis*), and it does not indicate phylogenetic affinity with *Paruroctonus*. In addition, *V. minckleyi* lacks denticles or scallops on the inferior margin of the movable cheliceral finger and has the anterior margin of the carapace distinctly notched. Both of these characteristics exclude it from *Paruroctonus*. The structure of the pedipalp chelae and the trichobothrial pattern of the tibia and chela, however, indicate that *V. minckleyi* is a member of the *nitidulus* group of *Vaejovis*.

Specimens examined.—MEXICO: *Coahuila*; Cuatro Ciénegas Basin, large canyon ½mi E of W tip of Sierra San Marcos, 12 May 1968 (S. C. Williams, M. Bentzien), 1 male, 1 female (OFF).

ACKNOWLEDGMENTS

Numerous curators and institutions provided assistance during the course of this study, either through loans of specimens or by searching through their collections for pertinent material.

for the loan of type specimens, we are deeply grateful to the following: the types of *V. intermedius*, O. Elter, Museo ed Istituto di Zoologia Sistemática della Università di Torino, Torino, Italy (TOR); the types of *V. nitidulus*, M. Moritz, Zoologisches Museum, Humboldt Universität, Berlin (ZMB); the types of *V. mexicanus decipiens*, Normal I. Platnick, the American Museum of Natural History, New York (AMNH); and the types of *V. nigrescens*, F. R. Wanless and P. D. Hillyard, The British Museum (Natural History), London (BM). These curators and institutions also gave needed extensions of the loans, and for this, we are also grateful.

Drs. Elter (TOR), Platnick (AMNH), and Wanless and Hillyard (BM) allowed us to examine other *nitidulus* group material used in this study. Others providing such assistance were Larry Watrous, J. B. Kethley, and D. A. Summers, the Field Museum of Natural History, Chicago (FMNH); G. B. Edwards, Florida State Collection of Arthropods, Gainesville (FSCA); H. W. Levi, Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts (MCZ); Max Vachon and Wilson R. Lourenço, Muséum National d'Histoire Naturelle, Paris (MNHN); Sherman A. Minton, Indiana University School of Medicine (SAM); and Matt E. Braunwald (MEB). We thank them for their courtesy and assistance.

We also wish to thank several individuals who responded to our requests for specimens, although their respective collections did not have any pertinent material: V. F. Lee, W. J. Pulawski, and S. C. Williams, the California Academy of Sciences, San Francisco; C. E. Griswold, the Division of Entomology and

Parasitology, University of California, Berkeley; W. H. Hutchinson, University of Mississippi Medical Center, Jackson, for information about the collection of the late H. L. Keegan; James R. Reddell, Texas Memorial Museum, the University of Texas, Austin; C. Carlton, University of Arkansas Agricultural Experiment Station; and M. Alvarez del Toro, Instituto de Historia Natural, Tuxtla Gutierrez, Chiapas, Mexico.

For correspondence and cooperation during the course of this study, we wish to acknowledge Max Vachon and M. E. Soleglad. James C. Cokendolpher provided stimulating taxonomic discussions for the senior author, and his comments are sincerely appreciated. For reviewing the manuscript we are grateful to M. E. Soleglad and S. C. Williams. To the friends and colleagues who assisted in the field, we express our warmest appreciation: Mont A. Cazier, Linda Draper (nééWelch), Joe Bigelow, Neal McReynolds, Chris Colwell, Chris Myers, Lynne Born, and John Sissom.

REFERENCES CITED

- Borelli, A. 1915. Scorpioni nuovi o poco noti del Messico. *Boll. Mus. Zool. Anat. Comp. Univ. Torino*, 30(703): 1-7.
- Bücherl, W. 1959. Escorpiõese escorpionismo no Brasil. X. Catálogo da coleção escorpionica do Instituto Butantan. *Mem. Inst. Butantan*, 29: 255-275.
- Bücherl, W. 1971. Classification, biology, and venom extraction of scorpions. Pp. 317-347 *In* *Venomous animals and their venom*. III. (W. Bücherl and E. E. Buckley, eds.). Academic Press, New York.
- Díaz Nájera, A. 1964. Alacranes de la Republica Mexicana: Identificación de ejemplares capturados en 235 localidades. *Rev. Inst. Salubr. Enferm. Trop., México*, 24: 12-30.
- Díaz Nájera, A. 1975. Listas y datos de distribución geografica de los alacranes de Mexico (Scorpionida). *Rev. Inst. Salubr. Enferm. Trop., México*, 35: 1-36.
- Gertsch, W. J. 1958. Results of the Puritan-American Museum expedition to western Mexico. 4. The scorpions. *Amer. Mus. Notitates*, No. 1903, pp. 1-20.
- Hoffmann, C. C. 1931. Los Scorpiones de México. Primera parte: Diplocentridae, Chactidae, Vejovidae. *An. Inst. Biol., México*, 2:291-408.
- Hoffmann, C. C. 1937. Nota acerca de los alacranes del Valle del Mezquital, Hgo. *An. Inst. Biol., México*, 8: 201-206.
- Hoffmann, C. C. 1939. Nuevas consideraciones acerca de los alacranes de México. *An. Inst. Biol., México*, 9: 317-337.
- Koch, C. L. 1843. *Die Arachniden*. X. Nürnberg.
- Kraepelin, K. 1894. Revision der Scorpione. II. Scorpionidae und Bothriuridae. *Jahrb. Hamburgischen Wiss. Anst.*, 11: 1-248.
- Kraepelin, K. 1899. Scorpiones und Pedipalpi. *Das Tierreich*, 8:1-265.
- Kraepelin, K. 1901. Catalogue des scorpions des collections du Museum d'Histoire Naturelle de Paris. *Bull. Mus. Paris*, 7: 265-274.
- Minkley, W. L. 1969. Environments of the Bolson of Cuatro Ciénegas, Coahuila, Mexico, with special reference to the aquatic biota. *Univ. Texas El Paso Sci. Ser.*, 2:1-65.
- Moritz, M. and S. Fischer. 1980. Die Typen der Arachniden-Sammlung des Zoologischen Museum Berlin. III. Scorpiones. *Mitt. zool. Mus. Berlin*, 56:309-326.
- Peters, W. 1861. Über eine neue Eintheilung der Skorpione. *Monber. Ak. Berlin*, 1861: 507-516.
- Pocock, R. I. 1898. The scorpions of the genus *Vaejovis* contained in the collection of the British Museum. *Ann. Mag. Nat. Hist.*, ser. 7, 1: 394-400.
- Pocock, R. I. 1902. Arachnida: Scorpiones, Pedipalpi, and Solifugae. *Biologia Centrali-Americana*. Francis and Taylor, London. 72 pp.

- Soleglad, M. E. 1972. Two new scorpions of the *wupatkiensis* group of the genus *Vejovis* (Scorpionida: Vejovidae). *Wasmann J. Biol.*, 30: 179-195.
- Soleglad, M. E. 1973. Scorpions of the *mexicanus* group of the genus *Vejovis* (Scorpionida, Vejovidae). *Wasmann J. Biol.*, 31:351-372.
- Soleglad, M. E. 1975. A redescription of *Vaejovis gracilis* Gertsch & Soleglad based on the adult (Scorpionida, Vejovidae). *Wasmann J. Biol.*, 33:107-120.
- Stahnke, H. L. 1974. Revision and keys to the higher categories of Vejovidae (Scorpionida). *J. Arachnol.*, 1: 107-141.
- Thorell, T. 1876. Etudes scorpologiques. *Atti Soc. Italiana Sci. Nat.*, 19: 75-272.
- Vachon, M. 1974. Étude des caractères utilisés pour classer les familles et les genres de Scorpions (Arachnides). I. La trichobothriotaxie en Arachnologie. Sigle trichobothriaux et types de trichobothriotaxie chez les Scorpions. *Bull. Mus. Nat. Hist. Nat., Paris, 3e Ser., No. 140, Zool.*, 104:857-958.
- Vásquez, G. L. 1960. La Isla Socorro, Archipiélago de Las Revillagigedo. 10. Observaciones sobre los Artrópodos. *Monogr. Inst. Geofísica, Univ. Nac. Autónoma México*, 2: 219-221.
- Williams, S. C. 1968. Scorpions from northern Mexico: Five new species of *Vejovis* from Coahuila, Mexico. *Occas. Pap. California Acad. Sci.*, 68:1-24.
- Williams, S. C. 1970a. Scorpion fauna of Baja California, Mexico: Eleven new species of *Vejovis* (Scorpionida: Vejovidae). *Proc. California Acad. Sci.*, 37:275-331.
- Williams, S. C. 1970b. New scorpions belonging to the Eusthenura Group of *Vejovis* from Baja California, Mexico (Scorpionida: Vejovidae). *Proc. California Acad. Sci.*, 37:395-418.
- Williams, S. C. 1971. New and little known scorpions belonging to the Punctipalpi Group of the genus *Vaejovis* from Baja California, Mexico, and adjacent areas (Scorpionida: Vaejovidae). *Wasmann J. Biol.*, 29:37-63.
- Williams, S. C. 1972. Four new scorpion species belonging to the genus *Paruroctonus* (Scorpionida: Vaejovidae). *Occas. Pap. California Acad. Sci.*, 94: 1-16.
- Williams, S. C. 1980. Scorpions of Baja California, Mexico, and adjacent islands. *Occas. Pap. California Acad. Sci.*, 135: 1-127.

Manuscript received June 1984, revised November 1984.