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## The Scorpions of the *Vejovis boreus* Group (Subgenus *Paruroctonus*) in North America (Scorpionida, Vejovidae)

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The scorpion fauna of the Nearctic Region has been treated in superficial fashion by arachnologists, and much still remains to be done before we can have a clear picture of our species. One of the earliest listings of those from the United States was that of Banks (1900) as part of a series entitled "Synopsis of North American invertebrates." This contribution consists mainly of a key to 23 species of scorpions reputed to belong to our fauna. Three of these were new species established on the basis of brief mention in the key. Unfortunately, many of Banks's records were based on incorrectly labeled specimens from the Marx collection in the United States National Museum and on misidentifications of various Mexican species. The garbled data associated with specimens in the Marx collection and gross errors resulting from their acceptance by spider students were discussed by Gertsch (1961, pp. 366-367).

Ten of the 23 species credited by Banks to our fauna should be stricken from the list. *Broteas alleni* Wood and *Vejovis punctipalpus* Wood are known to occur only in the southern part of Baja California (Gertsch, 1958). Records from Florida of *Opisthacanthus elatus* Gervais and *Centrurus margaritatus* Gervais, both basically Central American, and of the West Indian *Diplocentrus lesueuri* Gervais and *Centrurus testaceus* De Geer are

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clearly spurious. *Tityus floridanus* Banks is known to be from Central America. *Uroplectes mexicanus* Banks is a species of doubtful position and probably is of African origin. *Vejovis mexicanus* Koch is largely limited to the high plateau country of central Mexico and does not reach Texas. *Centrurus nigrescens* Pocock is unknown outside of southern Guerrero, even in Mexico. It is very doubtful that any of the above-named species will ever be recorded from within the United States except possibly as casual introductions.

Some of the records of California scorpions by Banks (1910) are similarly tainted, being based on spuriously labeled material. *Tityus tenuimanus* Banks, reputedly from Buena Vista Lake, California, undoubtedly came from the American tropics. And finally, Borelli's record of the Mexican *Vejovis subcristatus* Pocock from Tuscon, Arizona, probably should be referred to *Vejovis confusus* Stahnke. Most of the above dozen species represent elements quite extraneous to the Nearctic fauna. Until more comprehensive studies are available, the student has available only the general work of Comstock ["1912" (1913)] and that of Ewing (1928).

The present paper is concerned with a series of ground scorpions, the *Vejovis boreus* group, which has its center of occurrence in the western United States and adjacent Mexico. The first member of the group was taken by Howard Stansbury in the valley of the Great Salt Lake of Utah during the course of an expedition to that then little-known region. It was named *Scorpio boreus* by Girard in 1854, and the species was later transferred to the exclusively American genus *Vejovis*. In the new combination, *Vejovis boreus* (Girard) has become rather well known for its wide distribution in the western United States and for its range northward into the southern parts of the adjacent Canadian provinces. Other species of similar facies, some described in the genus *Paruroctonus*, in this paper are regarded as typical members of the *boreus* group. This new placement was suggested by Gertsch and Allred (1965, p. 4). The *boreus* group, as herein defined, includes a dozen closely related species that share a combination of basic features which set them apart as a section of the genus *Vejovis*. They can be regarded as a subgenus or even a genus, in which case the name *Paruroctonus* is available. In the latter case, a consequence would be the elevation of other groups now within *Vejovis* to generic rank. We prefer to identify the series as the *boreus* group of *Vejovis* and hold *Paruroctonus* to be only a subgenus.

#### ACKNOWLEDGMENTS

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#### GENUS *VEJOVIS* KOCH

*Vaejovis* KOCH, 1836, p. 51. POCOCK, 1902, p. 8. Ewing, 1928, p. 9.

*Vejovis* THORELL, 1876, p. 10. KRAEPELIN, 1894, p. 198; 1899, p. 183. COMSTOCK, "1912" [1913], p. 31; 1940, p. 31. HOFFMANN, 1931, p. 346. GERTSCH AND ALLRED, 1965, p. 346.

*Uroctonoides* HOFFMANN, 1931, p. 405 (not *Uroctonoides* Chamberlin, 1920).

*Paruroctonus* WERNER, 1934, p. 283.

*Hoffmanniellus* MELLO-LEITÃO, 1934, p. 80.

Carapace about as broad as long, with front margin typically straight, rarely produced to slight tubercle or lightly emarginated. Median eyes of medium to large size, set on low tubercles slightly in advance of middle of carapace; diad of median eyes varying from about one-fifth to one-third of width of carapace at that point; side eyes three, of which posterior one is smallest. Chelicera without enlarged, dark tooth on lower margin of movable finger, either smooth or variously dissected into trivial, pale denticles or distinct dark teeth. Chelae with fingers armed with a single, essentially straight line of denticles, rather indistinctly separated into six series, and flanked typically by six or seven larger teeth, but in some cases with more. Pectines with lamellae consisting of numerous, usually more than eight, subequal pieces similar in size to fulcra. Cauda with pair of inferior median keels or their vestiges.

TYPE OF GENUS: *Vejovis mexicanus* Koch.

The first comprehensive treatment of *Vejovis* was that of Kraepelin

(1899, p. 183) who characterized, and tentatively assigned, the known and doubtful taxa. Pocock (1902, p. 8) reviewed the Central American and Mexican representatives and made bare mention of some species ranging into the United States. The most detailed study was that of Hoffmann (1931, p. 346), who gave excellent descriptions and good keys to 18 taxa which he assigned to eight species. This excellent work suffers only from conservatism, since it is becoming clear that all or most of his subspecies should be given full specific status. Such would seem also to be the conclusion of Nájera (1964, pp. 15–30).

Hoffmann followed his predecessors in dividing *Vejovis* into groups based on the special character and armature of the keels on the ventral surface of the cauda. The more generalized condition is the presence of all these keels as distinct carinae armed with variously shaped teeth or granules. The loss of granules and eventual obliteration of the keels are presumed to represent a derivative condition. Unfortunately, there are intermediate stages in the loss of these keels which sometimes make the assignment to group inexact.

The *Vejovis boreus* group is tentatively assigned to the first section of Hoffmann in which the inferior median keels of caudal segments I–IV are largely lacking. In some of our species, the keels on segments III and IV are, to some extent, developed, and also provided with granules. The development and granulation of the inferior lateral keels are also variable in the group, being obsolete in some and quite prominently developed in others.

Some of the features used to separate the species of the complex are the following: the development of the keels on the chelae of the pedipalps; the proportions of the hand and fingers of the chelae; the development of the keels on the cauda and the proportions and setal covering of the various segments; the size and structure of the combs and numbers of teeth and other elements; and the general coloration and color pattern. The *boreus* group has as relatives the striped species of the *spinigerus* complex and those with unmarked preabdomens related to *nitidulus*.

The species of the *boreus* group are all nocturnal ground forms. They live under rocks and ground litter in a wide range of situations, according to the species and the latitude, from below sea level up to about 8000 feet in the mountains. Eight of the species live in the hot desert and foothill country of southeastern California and adjacent Arizona. Some of the species (notably *mesaensis*) burrow actively in sand and may be largely limited to this habitat. Brief mention of the bionomics of *Vejovis boreus* and *becki* was given by Gertsch and Allred (1965).

The measurements used in the present paper are, for the most part,

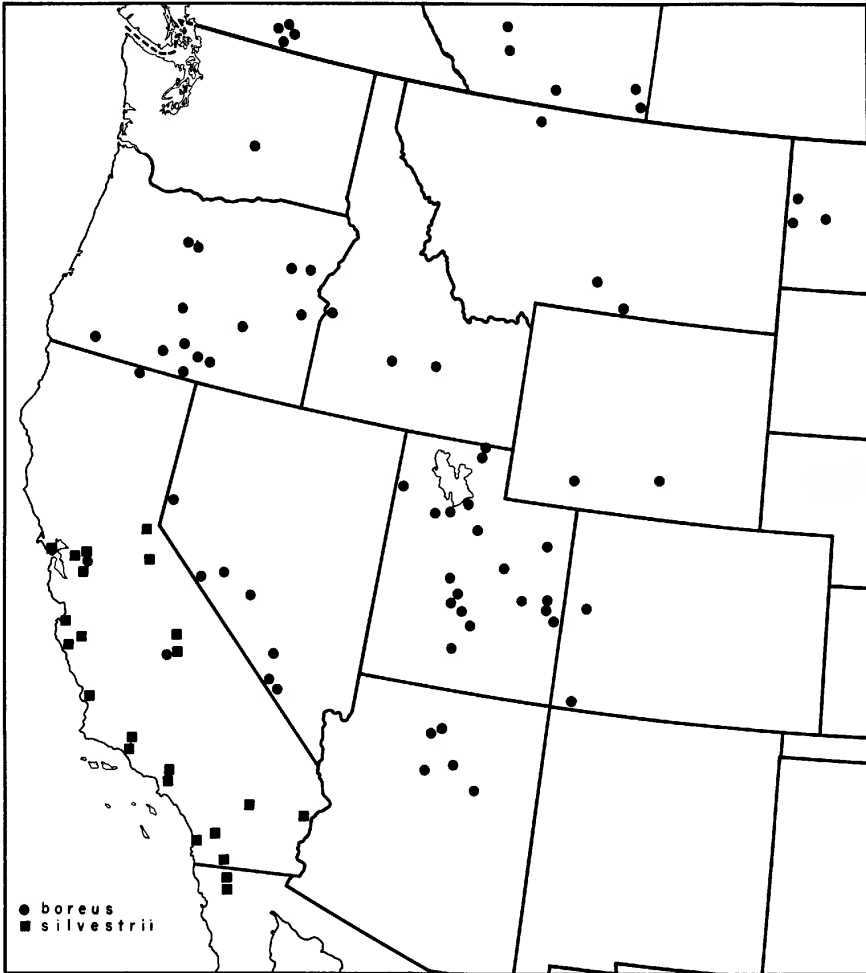


FIG. 1. Distribution map of *Vejovis boreus* and *silvestrii*.

the conventional ones for scorpion systematics. The total length is the sum of the lengths of carapace, preabdomen, and cauda, and excludes the telson. The length of the cauda is the sum of the dorsal lengths of the five segments measured separately. The length of the chela is arbitrarily taken as the lengths of the palm and of its fixed finger. Some of the points of measurement are arbitrarily chosen ones and subject to some inexactness. The length of the spine on the telson is not fixed by exact limits. The number of middle lamellae includes only those forming a

single row above the fulcra and excludes others in the middle area. The nomenclature for the teeth on the chelicerae is that of Vachon (1963).

KEY TO SPECIES OF *boreus* GROUP

1. Fixed finger of chela longer than length of palm . . . . . 2  
Fixed finger of chela at most as long as, usually much shorter than, length of palm . . . . . 3
2. Fixed finger much longer than palm in ratio 7.2/5.3 in female; inner margins of fingers deeply scalloped (fig. 32) . . . . . *xanthus*, new species  
Fixed finger longer than palm in ratio 4.6/4.3 in female, 4.5/3.7 in male; inner margins of fingers lightly scalloped . . . . . *becki* Gertsch and Allred
3. Distal external tooth of movable finger of chelicera smaller, not closely opposed to distal internal tooth (figs. 35-41) . . . . . 4  
Distal teeth of movable finger of chelicera subequal in size (figs. 42-54) . . . . . 5
4. Preabdomen with dark pattern (fig. 21); front margin of carapace with short projection (fig. 18); pectinal teeth of females 18-20, of males 25-29. . . . . *gracilior* (Hoffmann)  
Preabdomen clear or with faint dusky shadings; front margin of carapace essentially straight; pectinal teeth of females 14-15, of males 20-23 . . . . . *stahnkei*, new species
5. Preabdomen with dark pattern . . . . . 6  
Preabdomen without dark pattern . . . . . 9
6. Tergites of preabdomen with pale band along posterior margins (fig. 8) . . 7  
Tergites of preabdomen with dark pattern continuous to posterior margin (fig. 9) . . . . . 8
7. Inferior lateral keels of caudal segments distinct and granulate on all segments; inferior median keels distinct and irregularly granulate on segment III and heavily granulate on segment IV . . . . . *bantai*, new species  
Inferior lateral and median keels essentially obsolete and not granulate on segments I-IV . . . . . *boreus* (Girard)
8. Inferior lateral and median keels essentially obsolete and not granular on segments I-IV; pectinal teeth of male 25-29, of female 18-22 . . . . . *silvestrii* Borelli  
Inferior lateral and median keels more distinct and to some extent granular on segments I-IV; pectinal teeth of male 33-36, of female 23-27 . . . . . *vachoni* (Stahnke)
9. Pectinal teeth of male 16-19, of female 11-15; chela of pedipalps with short, narrow palm and short fingers (fig. 30) . . . . . *luteolus*, new species  
Pectinal teeth of male 28 or more, of female 19 or more; chela of pedipalps with thickened palm . . . . . 10
10. Eyes smaller: diad of median eyes at most one-fourth of width of carapace at that point; caudal segments I-IV with at most 3-4-5-5 pairs of setae on inferior median keels . . . . . 11  
Eyes larger: diad of median eyes about one-third of width of carapace; caudal segments with numerous setae, paired and irregularly placed on area of inferior median keels . . . . . *mesaensis* (Stahnke)
11. Pectines of male four times as long as greatest width; pectinal teeth shorter

- than length of median piece; caudal segment I of female broader than long.....*auratus*, new species  
 Pectines of male three times as long as greatest width; pectinal teeth longer than median piece; caudal segment I of female slightly longer than wide.....*aquilonalis* Stahnke

*Vejois boreus* (Girard)

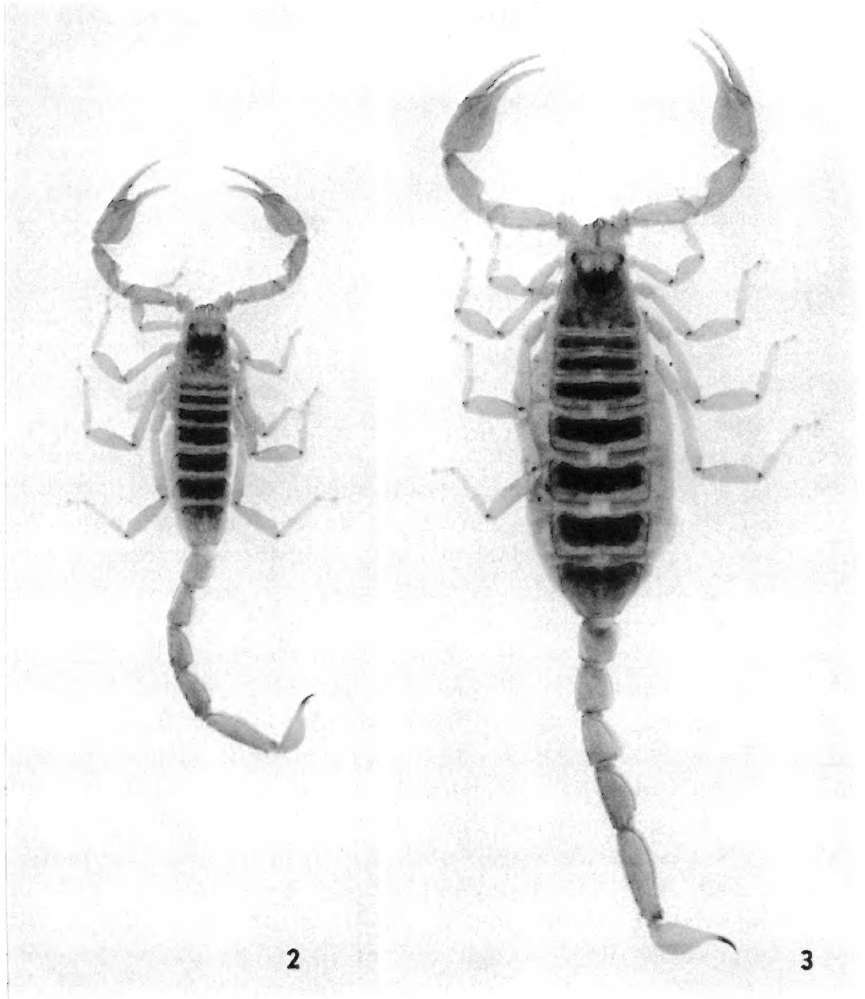
Figures 1-3, 6, 8, 10, 11, 16-17, 24-25, 31, 46-48, 57

*Scorpio (Telegonus) boreus* GIRARD, 1854, p. 257.

*Vejois boreus*: BANKS, 1900, p. 424; 1910, p. 189. COMSTOCK, "1912" [1913], p. 31; 1940, p. 31. WEBSTER, 1923, p. 248. CHAMBERLIN, 1924, p. 64. EWING, 1928, p. 12. KURATA, 1930, p. 28. STAHNKE, 1940, p. 101. GERTSCH, 1958, p. 6 (part). GERTSCH AND ALLRED, 1965, p. 9, figs. 8, 20.

DIAGNOSIS: Medium-sized, with conventional yellow base color of group that is marked with black pattern. V-shaped black marking centered on median eyes and, in many, dusky side streaks on thoracic portion of carapace. Tergites of preabdomen bearing dusky transverse bands except for a narrow, yellow band along margins. Median eyes average in size, set on two connate tubercles forming a low, oval eminence. Width of diad of median eye at most one-fourth of width of carapace at that point. Setae on ventral aspect of cauda relatively few, 2-3-3-4 pairs on segments I-IV. Chelae very heavy, with heavily granulated carinae in both sexes. Habitus of male and female shown in figures 2 and 3.

COLORATION: Base color pale yellow to orange-brown in alcoholic specimens of both sexes and with more or less developed dusky or black pattern on carapace and preabdomen as shown in figures 6 and 8. Eyes and eye tubercles black. Carapace with dark, V-shaped patch at median eyes and with dusky bands running to side eyes. Anterior portion of interocular triangle usually pale. Rest of carapace either pale or with few radiating dusky lines and side patches. Immature specimens, especially young males, often strongly marked with black, approaching pattern of *silvestrii*. Specimens from Oregon (fig. 57) and Washington with much darker pattern than those from Great Basin Region and Rocky Mountain states (figs. 2, 3). Tergites I-VI of preabdomen with transverse dusky bands as shown in figure 8, each enclosing pair of yellow ovoid spots near middle and irregular series of yellow spots running to side margins; behind dark bands of these tergites a transverse pale stripe along hind margins. Tergite VII paler than others, with more variable markings. Under side of carapace and sternites of preabdomen usually clear yellow to orange-brown. Cauda with yellow base color, usually unmarked above but below with series of four dusky lines (fig. 17) running from first to fourth segment and marking positions of obsolete carinae; these markings



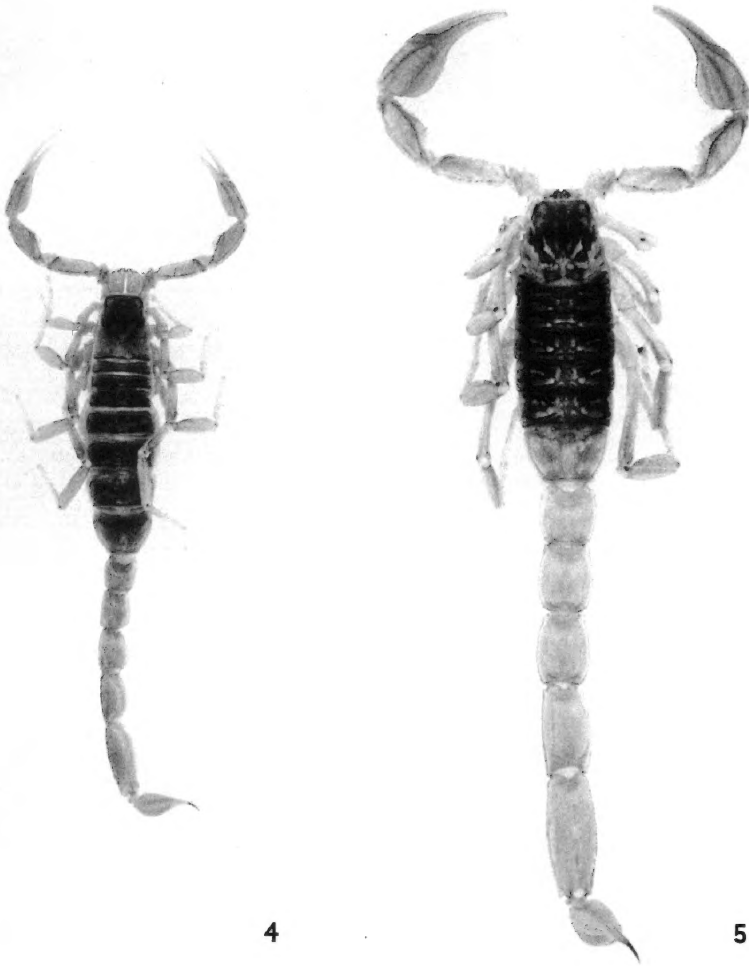
FIGS. 2, 3. *Vejovis boreus* (Girard). 2. Male. 3. Female. Both  $\times 2$ .

variable, more distinct in younger specimens, in some scarcely visible. Legs and pectines pale yellow. Sting red.

**STRUCTURE:** Typical of subgenus and similar in both sexes except as indicated. Male smaller than female, with somewhat thinner cauda. Measurements given in table 1.

**Carapace:** Shape of carapace of female from Green River, Utah, as shown in figure 6. Anterior margin essentially straight, set with six suberect bristles, rather sharply angled around side eyes; sides essentially straight,





FIGS. 4, 5. *Vejois silvestrii* Borelli. 4. Male. 5. Female. Both  $\times 2$ .

broadly rounded at posterior corners; breadth behind nearly equal to length. Median eyes of average size, set on low tubercle; width of median diad about one-fourth of width of carapace at that point (23/100). Three eyes in each side group, of which hind one smallest. Interocular tubercle smooth, but rest of carapace finely to coarsely granulose over much of surface. Interocular triangle quite smooth, but with heavier granules on pigmented areas. Median groove distinct from median eyes to posterior margins, with flanking elevations liberally set with coarse

granules. Carapace of male with heavier, more conspicuous granules than that of female.

Preabdomen: Traces of weakly granulated median keel on tergites I-VII still persistent. Tergites appearing quite smooth in both sexes but under low magnification seen to be finely granulose throughout; lateral and posterior margins lined with rounded granules; tergite VII with more numerous larger granules and additional heavily granulated lateral keel flanking indistinct median one. All sternites smooth. Stigmata short, elongated slits.

Cauda: Dorsal and ventral surfaces of segments I-IV as shown in figures 16 and 17. Dorsal and superior lateral keels prominent, surmounted with rows of serrate to rounded granules of quite regular size, without noticeable development of granules at end of each series. Inferior median keels essentially obsolete on segments I-III, but indicated by presence of diffuse, brown bands; these keels feebly represented on segment IV, but largely smooth. Inferior lateral keels weak and smooth on segments I-IV, also dusted to form bands. Inferior lateral keels of segment V serrate to granulate; single median keel with double line of granules; intercarinal spaces with numerous granules. Segment V somewhat longer than carapace in females, considerably longer in males. All segments with scattered setae, but those on ventral surface in regular rows on or near carinae; segments I-IV with 2-3-3-4 pairs of setae on obsolete, inferior median keels.

Telson: See figure 31. Sting moderately curved, two-thirds as long as vesicle. Subaculear nodule inconspicuous. Vesicle about as wide as segment V of cauda.

Pectines: Those of female (fig. 10) of average size, three times as long as breadth of much broader than long median piece; middle lamellae consisting of 15-20 small, round or ovoid pieces and second indistinct series of five to 10 in basal area; fulcra small, subtriangular or rounded pieces, one fewer than pectinal teeth; pectinal teeth of medium length and stoutness, 18-23 in number. Those of male (fig. 11) much larger; median piece as broad as long; middle lamellae consisting of about 30 small pieces in single row and additional ones in basal area; pectinal teeth varying from 25 to 31, about twice as long as those of female.

Genital operculum: In female (fig. 10) consisting of two sclerotized, rounded valves separated by deep fissure but free only in posterior fourth. In male (fig. 11) valves narrower, more pointed behind, free for most of length; genital papillae two fleshy fingers, usually somewhat exposed.

Chelicerae: Similar in both sexes, as illustrated in figures 46 to 48. Basal segment of median size, with thin brush of hairs on inner side

TABLE 1  
MEASUREMENTS (IN MILLIMETERS) OF *Vejovis boreus*

	Female Nevada	Female Oregon	Male Utah	Male Nevada
Total length	38.2	42.9	46.1	41.8
Carapace				
Length	5.5	6.5	5.5	5.1
Width at lateral eyes	3.3	3.9	3.3	3.0
Width at caudal edge	5.2	6.1	5.2	4.7
Preabdomen, length	14.5	13.5	12.0	10.3
Postabdomen, length	18.2	22.9	28.6	26.4
Caudal segment I				
Length	2.5	3.2	3.0	2.7
Width	2.8	3.6	3.0	2.8
Caudal segment II				
Length	2.7	3.6	3.4	3.2
Width	2.5	3.4	2.9	2.7
Caudal segment III				
Length	3.0	3.8	3.8	3.5
Width	2.5	3.6	2.8	2.6
Caudal segment IV				
Length	4.0	4.7	4.5	4.3
Width	2.5	3.1	2.6	2.4
Caudal segment V				
Length	6.0	7.6	7.2	6.5
Width	2.5	4.7	2.7	2.2
Telson, length	6.3	7.1	6.7	6.2
Vesicle				
Length	4.5	4.7	4.5	4.0
Width	2.6	3.3	2.6	2.2
Depth	2.3	4.8	2.0	2.0
Spine, length	2.3	2.4	2.2	2.2
Pedipalp, length	17.3	19.2	18.1	16.6
Femur				
Length	4.3	5.5	4.8	4.3
Depth	1.4	2.0	1.5	1.4
Tibia				
Length	4.8	5.5	4.8	4.3
Depth	1.7	2.4	1.9	1.7
Chela, length	8.2	8.2	8.5	8.0
Palm length	4.2	4.4	4.4	4.3
Palm width	3.0	3.5	3.3	3.3
Palm depth	3.0	2.4	2.7	2.8
Fixed finger, length	3.8	3.6	4.1	3.6
Movable finger, length	5.3	5.0	5.2	5.0
Pectines				
Teeth	19/19	19/19	27/27	27/27
Middle lamellae	15	15	22	21

near front edge above. Fixed finger with four stout teeth on upper margin of which basal pair forms compound tooth; lower margin essentially obsolete, usually bearing traces of two weak, dusky nodules or teeth. Movable finger with five strong teeth on upper (external) margin; lower margin with stout distal tooth, bearing distinct keel, with edge rarely smooth, usually variously dissected to form pale crenulations or more distinct, rounded, dark teeth. Distal teeth of both margins (fig. 47) subequal in size and length.

**Pedipalps:** In both sexes short, with heavy hands and short fingers as shown in figures 24 and 25. Femur in lateral view two and one-half times as long as wide, with strongly angled carinae coarsely granulated. Tibia about twice as long as broad, inflated behind middle and produced below to sharp angle bearing two setae on heavy granules; all carinae well developed and coarsely granulated. Chela greatly incrasated, with following well-developed carinae: inner and outer carinae strongly developed and set with several rows of coarse granules; superior and inner accessory carinae of dorsal surface rounded and coarsely granulated but outer accessory carina shorter and less distinctly granulated; corresponding carinae of ventral surface all strongly developed and coarsely granulated. Inner keel of fixed finger scalloped as shown in figures, typically more so in male. Small granules on inner keel of fixed finger forming a quite regular, little-curved line, broken into six files by five large teeth and with six supernumerary teeth adjacent to them. Inner keel of movable finger similarly armed with six large teeth in file series and seven adjacent to them.

**Walking legs:** All segments with few scattered setae. Protarsi with somewhat irregular series of long setae on dorsal surfaces.

**TYPE DATA:** Type specimen of uncertain sex from the valley of the Great Salt Lake, Utah, collected by Howard Stansbury, presumed still to be in the United States National Museum (Marx, 1888).

**DISTRIBUTION:** This common, widespread species (see fig. 1) occurs in the northwestern United States and reaches the southern portions of Alberta and British Columbia in Canada. It ranges in the Rocky Mountain states, eastward into Colorado, south into northern Arizona, and westward into Nevada and eastern California. It is the only pale scorpion of Oregon and Washington. Its probable range includes parts of New Mexico and northern California, but we have few records of such occurrence. The recent records of *boreus* for California and Baja California (Gertsch, 1958) should be assigned to *Vejois silvestrii* Borelli. Ewing (1928, p. 12) expressed doubt that *boreus* was native to Alberta, but it is clear that western Canada represents its natural northern

limits. Kurata (1930) found numerous specimens in crevices and under rocks at a cliff near Summerland, British Columbia, and predicted that these arachnids would be found in similar situations a few miles east of Kamloops.

RECORDS: *British Columbia*: Keremeos, Okanagan District (Anderson, 1901); Vaseau Lake, Oliver, May 19, 1959 (R. E. Leech), female; Oliver, August 22 (E. R. Buckell), four specimens; May 20, 1953 (J. R. McGillis), male; Summerland, July 3-24, 1928 (T. B. Kurata, E. B. S. Logier), many specimens; west slope of Richter Pass, March 29, 1941 (H. B. Leech), female. *Alberta*: Medicine Hat (Chamberlin, 1924), June 6, 1936 (O. Bryant), female; June, 1923 (J. M. Gouldie), one specimen; July 16, 1956 (O. Peck), two females; (J. M. Gouldie), three specimens (Kurata, 1930). Turner Valley, 35 miles southwest of Calgary, 1925 (G. Hume) (Kurata, 1930). Cypress Hills (R. Leech). Lethbridge (R. Leech). Little Sandhill, Red Deer (C. M. Sternberg), one specimen (Kurata, 1930). Near Iddlesleigh, Red Deer River, August 25, 1919 (V. R. Summerhayes), one specimen (Kurata, 1930). *Washington*: Kittitas County; Whiskey Dick Canyon, 5 miles north of Vantage, June, July, 1953 (R. Crabtree), two females. *Oregon*: Jefferson County: Willowdale, June 14, 1946 (B. Malkin, M. S. Sargent), immature male; 10 miles north of Hay Creek, June 15, 1946 (B. Malkin), female; Gateway, July 13, 1938 (Schuh and Gray), two females. Jackson County: Gold Hill (Webster, 1923). Baker County: Highway 86, 13 miles east of Baker, June 27, 1952 (B. Malkin), female; Sumpter, June 24, 1935 (D. Mote). Klamath County: Sprague River, near Bly, June 22, 1952 (B. Malkin), female. Lake County: Paisley, June 28-29, 1951 (B. Malkin), female; Fort Rock, July 9, 1953 (R. Lauderdale), female; Albert Lake; June 16, 1938 (Schuh and Gray), eight females, male, June 23, 1952 (B. Malkin), three females; Lakeview, June 27-28, 1951 (B. Malkin), female; Hart Mountain, June 17, 1938 (Schuh and Gray), female. Harney County: Harney Lake, Hot Springs, May 28, 1957 (B. Malkin), female. Malheur County: Harper, June 22, 1947 (B. Malkin), immature male. *California*: Siskiyou County: West side of Tule Lake, 9 miles southwest of Tulelake, August 15, 1965 (J. and W. Ivie), two females. Tulare County: Cedar Grove, King's Canyon National Park, July 5, 1956 (W. J. Gertsch, V. Roth), male. Contra Costa County: Mt. Diablo, May 7, 1945 (G. Linsley, R. F. Smith), male, two females. *Idaho*: Butte County: Craters of the Moon National Monument, July 2, 1952 (B. Malkin), female. Camas County: Soldier (Webster, 1923). Payette County: Payette, June 20, 1953 (W. Ivie), female. *Montana*: Carbon County: Como Tit, August 4, 1965 (P. Parks), male, female; Square Butte, March 7, 1922 (D. M. Thomas),

female. Toole County: T. 35 N., R. 1 W., April, 1922, three specimens. Stillwater County: Sect. 21, T. 2 S., R. 20 E., 1 mile west of Columbus, (E. G. Robinson), one specimen. *North Dakota*: McKenzie County; Alexander (P. C. Arildson), December, 1921 (Webster, 1923), three specimens. Dunn County: Oakdale, spring, 1922 (Webster, 1923), one specimen. Golden Valley County: Trotters, November, 1922 (Webster, 1923), one specimen. *Nevada*: Nye County: Nevada test site, north of Mercury (Gertsch and Allred, 1965), many males and females; near Tonopah, 3000 feet, July 29, 1961 (F. E. Russell), male. Washoe County: Galena Creek, June 25, 1955 (M. A. Cazier), female; Reno, October 4, 1941 (I. La Rivers), male, four females. Mineral County: Thirteen miles east along Highway 31, from California-Nevada state line, August 19, 1959 (R. E. Graham), males, females; 15 miles northeast of Mina, June 11, 1960 (E. S. Ross), two immature females. *Colorado*: Mesa County: Palisade (L. Anderson), male, female. Montezuma County: Mesa Verde National Park, August 20, 1952 (B. Malkin), two males; Mesa Verde, July 23, 1941 (C. and M. Goodnight), male. *Utah*: Salt Lake County: Salt Lake (Webster, 1923), June 2, 1930 (J. Rowe), male, two females. Emery County: Green River, April 7, 1946 (G. F. Knowlton), two females; May 7, 1946 (G. F. Knowlton), female; 3 miles south of Green River, September 6, 1943 (H. E. Vokes), male, five females, Cache County: Blacksmith Fork Canyon, between Logan, Utah, and Preston, Idaho, July 9, 1935 (J. A. Rowe and C. F. Smith), female; Logan, August 26, 1936 (F. Harmston), female. Tooele County: Skull Valley, April 19, 1939 (G. F. Knowlton), female; Desert Range Research Station, September 9, 1950 (D. E. Beck), two females. Utah County: Four miles east of Provo. Uintah County: Ouray, female. Carbon County: Price, June 7, 1951 (D. E. Beck). Millard County: Scipio, April 16, 1935, female. Sevier County: Richfield, June 19, 1947 (D. E. Beck), female, May 15, 1940 (W. J. Gertsch), male, five females. Sevier Canyon, July 19, 1940 (W. J. Gertsch), female; 2 miles east of Glenwood, June 30, 1940 (W. J. Gertsch, L. Hook), immature female; Fish Lake, June 22, 1930 (W. J. Gertsch), male. Grand County: Arches National Monument, May 12, 1948 (D. Allred), female. Wayne County: Fruita, July 17, 1931 (W. J. Gertsch), two females. *Wyoming*: Sweetwater County: Green River, 6100 feet, July 2, 1920, male. Carbon County: Fort Steeb (Webster, 1923). *Arizona*: Coconino County: Grand Canyon (rim), 7000 feet, May 25, 1905 (W. M. Wheeler); Williams, May 25, July 9-15; Bright Angel, August 10; Wupatki National Monument, 7000 feet. Navajo County: Winslow, July 31. Yavapai County: Prescott, June 20, 1901.

*Vejois silvestrii* Borelli

Figures 1, 4, 5, 7, 9, 27, 28

*Vejois silvestrii* BORELLI, 1908, pp. 225-227. EWING, 1928, p. 14.*Vejois boreus*: GERTSCH, 1958, p. 6 (part).

DIAGNOSIS: Distinct species (figs. 4, 5) resembling *boreus* in general appearance but differing in following features: carapace heavily mottled with black pattern and tergites of preabdomen having transverse black bands continuous to posterior margins. Females attaining larger size, having shorter and stouter cauda with heavier telsons, and longer and less granulose hands on chelae. Sexual dimorphism more pronounced, and considerably smaller males having more slender cauda and quite thin, weak hands. Ventral surfaces of cauda bearing one more pair of setae on each segment. Eyes of medium size and somewhat smaller than those of *boreus*.

COLORATION: Similar to that of *boreus* in both sexes but more boldly marked in black. Base color yellow to dull orange or tan, with well-marked black pattern as shown in figures 7 and 9. Eyes and eye tubercles black. Carapace typically bright yellow, with intricate pattern of black bands and stripes radiating from pale midline. Tergites I-VI of preabdomen with transverse black bands covering most of surface, dark to posterior margins; each tergite enclosing pair of oval yellow markings near center and irregular series of spots on each side. Tergite VII much paler than tergites in front, without pronounced pattern. Cauda yellow to orange, unmarked above, but with series of four dusky lines below on segments I-IV as in *boreus*; these markings in some cases faint or lacking, but well indicated in many females and broader and darker in many males.

STRUCTURE: Similar to that of *boreus* except as indicated below. Males much smaller than females, with proportionately thinner cauda. Measurements given in table 2.

Carapace: Shape of carapace of female from northeast of Lucia, Monterey County, California: Anterior margin straight, set with six suberect bristles; width at side eyes four-sevenths of width at posterior margin; length and breadth about equal. Median eyes of average size situated just forward of midpoint of carapace; width of median diad about one-fifth of width of carapace at that point (22/110). Surface polished in spite of numerous granules situated chiefly on dark pattern areas and seemingly coarser and more conspicuous than corresponding granules of *boreus*; carapace of male more coarsely granulate than that of females.

Preabdomen: With typical sculpturing of *boreus*.

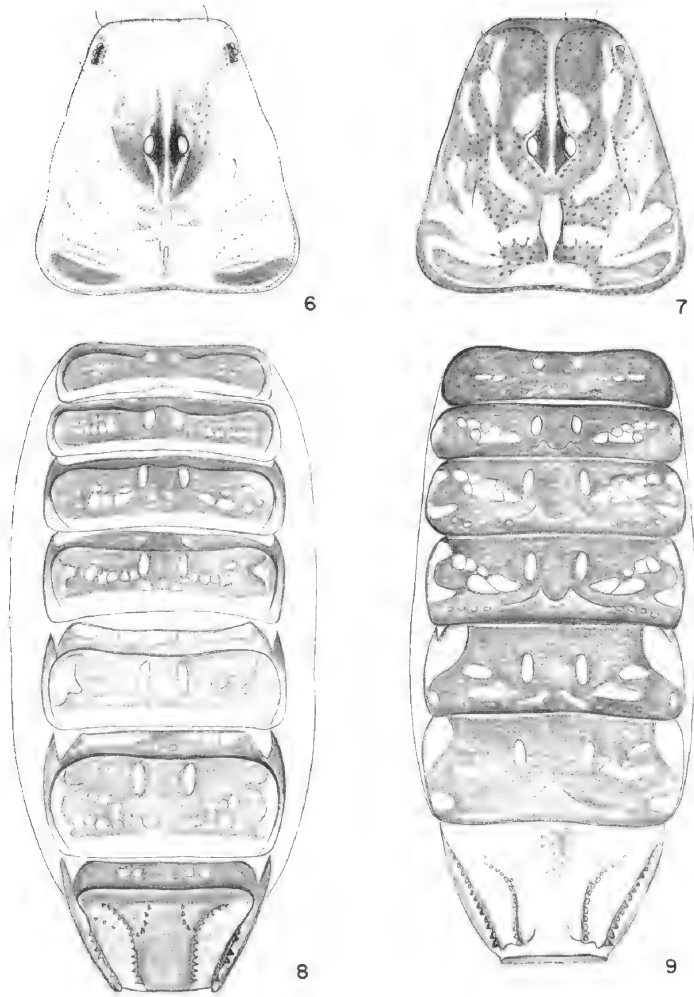


FIG. 6. *Vejovis boreus* (Girard), carapace of female.

FIG. 7. *Vejovis silvestrii* Borelli, carapace of female.

FIG. 8. *Vejovis boreus* (Girard), preabdomen of female.

FIG. 9. *Vejovis silvestrii* Borelli, preabdomen of female.

Cauda: Similar to that of *boreus* (figs. 16, 17) on all surfaces. Obsolete inferior median keels of segments I-IV with 3-4-4-5 pairs of setae.

Telson: Essentially smooth: vesicle globular, somewhat less slender than that of *boreus*; sting gradually curved, half as long as vesicle.

Pectines: Pectinal teeth of female 18-22, of male 25-29.



Chelicerae: Similar in both sexes and differing little from those of *boreus* (figs. 46-48). Lower margin of fixed fingers usually with two distinct, dusky nodules at base. Lower margin of movable finger with keel dissected into four to seven distinct, irregularly formed teeth.

Pedipalps: Those of female of medium length, with heavy hands and fingers as shown in figure 28. Basal segments with all carinae coarsely granulated. Chelae greatly incrassated, with all eight carinae distinct as in *boreus* but somewhat smoother and less granulose. Inner keels of fingers rather smooth, weakly scalloped, and armed as in *boreus*. Pedipalp of male far more slender than that of female as shown in figure 27, with carinae rather weak and weakly granulated as compared with those of female.

Walking legs: With setation essentially as in *boreus*, but protarsi with fewer and quite irregularly spaced setae.

TYPE DATA: Female type from Sierra Madre, Los Angeles (County), California, in the Museo Zoologico, Turin, Italy.

DISTRIBUTION: California and Baja California (fig. 1).

Records: *California*: Modoc County: Adin Summit, September 18, 1961 (W. Ivie, W. J. Gertsch), one immature. El Dorado County: Ranger Station, 12 miles east of Kyburz, October 9, 1945 (G. Linsley, J. W. MacSwain, R. F. Smith), female. Marin County: Mt. Tamalpais, May 13, 1934, female. San Joaquin County: One and one-quarter miles east of Atomic Energy Commission Explosive Test Site, Corral Hollow Valley, July 31, 1965 (K. Hom), pit trap, two females. Contra Costa County: Four miles south of Antioch, April 9, 1945 (R. F. Smith), two males, six females; Antioch, sand dunes, March 16, 1951 (E. I. Schlinger), male. Alameda County: Corral Hollow, 5 miles west of Tracy; April 19, 1945 (R. F. Smith, O. Bacon), two immature females, March 8, 1945 (R. F. Smith, A. E. Michelbacher), female. Corral Hollow, October 1, 1945 (J. W. MacSwain), female. Canyon north of Mitchell Ravine, August 26, 1965 (K. Hom), pit trap, male. Tuolumne County: Four miles west of Pinecrest, July 8 and 16, 1961 (J. Rozen), two males, female; Reservoir Canyon, San Luis Obispo, August 15, 1959 (V. Roth, W. J. Gertsch), male. San Benito County: Four miles east of Panoche, July 28, 1965 (K. Hom, V. Lee), female. Fresno County: Cedar Grove, Kings River Canyon, 4633 feet, July 16, 1952 (W. J. Gertsch), female. Monterey County: Indian Creek, King City-Memorial Park Road, January 16, 1956 (H. B. Leech), under stones, male. Junipera Serra Peak, 5800 feet, Santa Lucia Mountains, August 9, 1956 (L. Salanave), male, August 14, 1956 (B. Hargis), male, August 15-16, 1956 (H. B. Leech), under stones, male, two females; Seaside, behind beach dunes, June 24, 1957 (T. J.

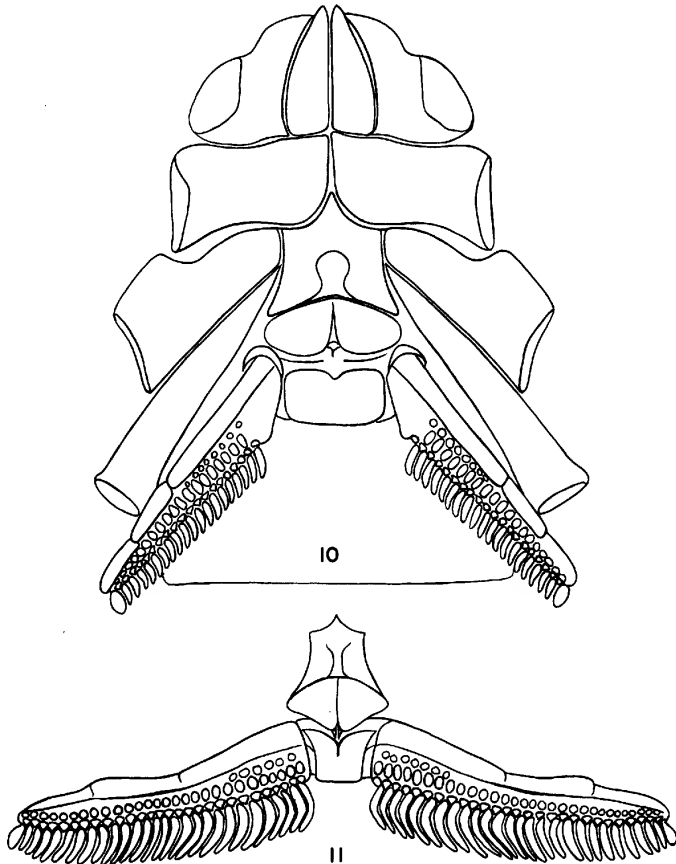


FIG. 10. *Vejovis boreus* (Girard), venter of cephalothorax and base of preabdomen of female.

FIG. 11. *Vejovis boreus* (Girard), pectines of male.

Cohn), female with *boreus* pattern; Cone Peak Trail, 4100–5100 feet, 3.5 air miles northeast of Lucia, August 18, 1957 (T. J. Cohn), male, four females. Tulare County: Near Ash Mountain, Sequoia National Park, July 9, 1958 (W. J. Gertsch, V. Roth), immature female. Ventura County: Wheeler Springs, July 2, 1958 (W. J. Gertsch, V. Roth), three immature females; 10 miles north of Wheeler Springs, July 2, 1958 (V. Roth), female; Mt. Pinos, July 31, 1961 (V. and B. Roth), male, two females. Los Angeles County: Los Angeles; July 30, 1948 (C. and P. Vaurie), immature female, March, 1922 (G. Grant), male, immature, November–December, 1912 (D. D. R. Ruthling), male; Lower Shake Camp, Pine Canyon, July 6, 1954 (W. A. McDonald), female; Crystal Lake, San Gabriel Mountains, September 29, 1965 (J. and W. Ivie),

TABLE 2  
MEASUREMENTS (IN MILLIMETERS) OF *Vejovis bantai* AND *silvestrii*

	Female <i>bantai</i>	Male <i>bantai</i>	Female <i>silvestrii</i>	Male <i>silvestrii</i>
Total length	42.4	38.9	41.7	39.1
Carapace				
Length	5.8	5.5	5.9	5.1
Width at lateral eyes	3.3	3.2	3.6	3.2
Width at caudal edge	5.5	5.0	5.9	4.6
Preabdomen, length	16.5	11.7	14.6	11.9
Postabdomen, length	20.1	21.7	21.2	22.1
Caudal segment I				
Length	2.7	2.8	2.8	3.0
Width	3.2	3.0	3.3	2.8
Caudal segment II				
Length	3.2	3.5	3.5	3.6
Caudal segment III				
Length	3.4	3.7	3.6	3.8
Width	3.0	2.8	3.1	2.6
Caudal segment IV				
Length	4.3	4.7	4.6	4.8
Width	2.8	2.7	2.8	2.5
Caudal segment V				
Length	6.5	7.0	6.7	6.9
Width	2.7	2.5	2.7	2.4
Telson, length	6.5	6.5	7.1	5.9
Vesicle				
Length	4.0	4.0	5.1	4.3
Width	2.8	2.5	2.9	2.2
Depth	2.2	2.2	2.4	1.7
Spine, length	2.0	2.0	2.0	1.6
Pedipalp, length	18.5	18.7	19.5	16.7
Femur				
Length	4.7	4.7	4.9	4.6
Depth	1.7	1.6	1.7	1.3
Tibia				
Length	5.0	5.0	5.5	4.3
Depth	2.0	2.0	2.4	1.8
Chela, length	8.8	9.0	10.5	7.3
Palm length	5.0	5.2	5.4	3.5
Palm width	4.2	4.7	3.3	2.0
Palm depth	3.3	3.5	2.5	2.0
Fixed finger, length	4.0	3.6	4.7	3.5
Movable finger, length	5.8	5.8	6.3	4.5
Pectines				
Teeth	17/17	23/23	20/20	25/24
Middle lamellae	15	17	15	20

two females. Orange County: Santa Ana Canyon, 12 miles east of Capistrano, March 30, 1960 (W. J. Gertsch), male. Riverside County: Riverside, 500–800 feet, July 14, 1907, female; Keen Camp area, San Jacinto Mountains, April 26, 1961 (W. J. Gertsch), male. San Diego County: Mt. Palomar State Park, July 13, 1953 (W. J. and J. W. Gertsch), immature females; Del Mar, April 1, 1956 (J. A. Comstock), female; 6 miles northwest of Campo, on Hauser Creek, October 1, 1961 (W. J. Gertsch, W. Ivie, V. Roth), female, immature female. *Baja California Norte*: La Rumarosa; 43 miles west of Mexicali, October 7, 1961 (O. Clarke), female, October 1, 1961 (V. Roth), immature; 10–15 miles south of La Rumarosa, July 14, 1961 (V. Roth), female; Ensenada, March 10, 1946 (B. Malkin), immature female; 17 miles north of Colonia Guerrero, April 29, 1961 (W. J. Gertsch, V. Roth), male.

### ***Vejovis bantai*, new species**

Figures 12, 22, 29

**DIAGNOSIS:** Near relative of *boreus*, readily distinguishable by following features: Pedipalps with thicker hands and shorter fingers. Cauda somewhat heavier in both sexes, and inferior median keels of fourth segment set with heavy granules for full length.

**COLORATION:** Available specimens hardened and presumably bleached by improper preservation, but pattern (fig. 12) similar in both sexes to that of *boreus*, except as noted. Base color pale yellow, with dusky pattern as follows: eyes and eye tubercles black; median eyes with small, W-shaped, black maculation little larger than area of tubercles, and with indistinct dusky shading running back in median groove; tergites I–VI of preabdomen with transverse dusky bands even less extensive than those of *boreus*, leaving wide pale stripe along posterior margins and along side margins; tergite VII with small dusky patch at base; cauda without contrasting markings above or below. Tip of sting red.

**STRUCTURE:** Similar to that of *boreus* in both sexes except as noted below. Males slightly smaller than females. Measurements given in table 2.

**Carapace:** Anterior margin essentially straight, lightly rounded in some specimens, with usual six rather long setae; breadth behind slightly less than length. Median eyes of average size, set on inconspicuous tubercles; width of median diad about one-fourth of width of carapace at that point (22/84). Granulation like that of *boreus*, with heavier and more numerous granules in males.

**Preabdomen:** Smooth except for rows of pale granules along side and posterior margins.



FIG. 12. *Vejovis bantai*, new species, male.  $\times 2$ .

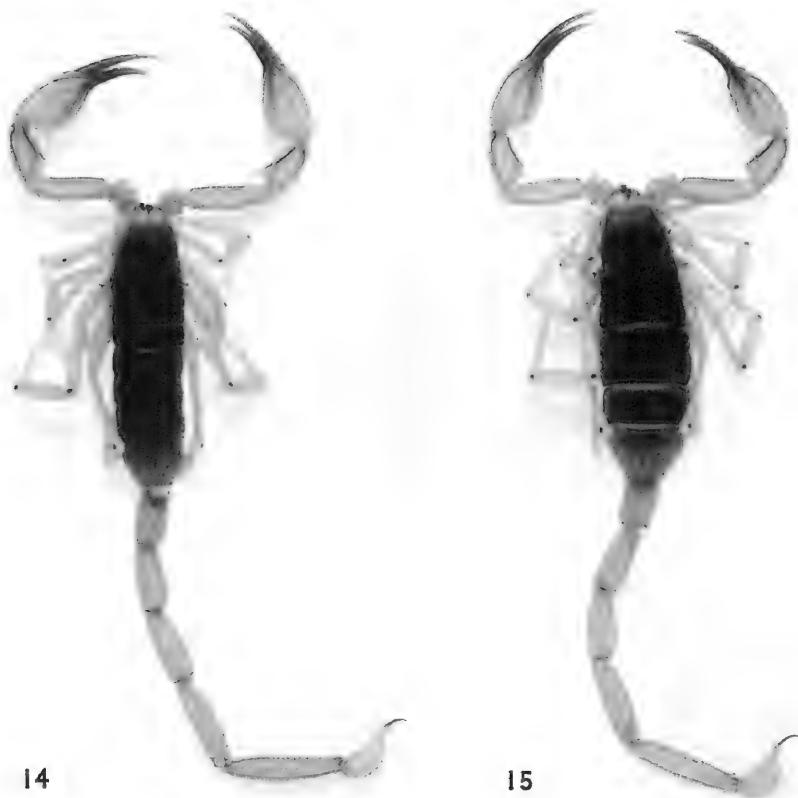
FIG. 13. *Vejovis gracilior* (Hoffmann), male.  $\times 2$ .

**Cauda:** Sculpturing of dorsal surface like that of *boreus*. Inferior lateral keels distinct and granulate on all segments, but those of sixth segment with fewer, larger granules than in *boreus*. Inferior median keels essentially obsolete on segments I and II, distinct and irregularly granulate on segment III, and heavily granulate on segment IV. Segment I-IV with 3-3-3-3 pairs of setae on inferior median keels. Segment V slightly longer than carapace in both sexes.

**Telson:** Somewhat stouter than that of *boreus*, with spine moderately curved and somewhat more than half as long as smooth vesicle.

**Pectines:** Similar to those of *boreus* in both sexes. Pectinal teeth of females 17, of males 23.

**Chelicerae:** Similar to those of *boreus* in both sexes. Keel on lower margin of movable finger crenulate, with four or five distinct rounded



FIGS. 14, 15. *Vejovis vachoni* (Stahnke). 14. Male. 15. Female. Both  $\times 1$ .

teeth. Lower margin usually with only one distinct tooth on weak lower margin.

Pedipalps: In both sexes short, with very heavy chelae and short fingers as shown in figure 29. Chela very heavy, with hand nearly as wide as long, as wide as length of fixed finger, and with all eight carinae distinct and granulated as in *boreus*. Inner keels of fingers lightly scalloped in females, more deeply scalloped at base in males.

Walking legs: Protarsi of third legs with row of six or seven long setae.

TYPE DATA: Female holotype from Warm Springs Road, Station 94, Saline Valley, Inyo County, California, May 8, 1960 (B. Banta), from pit trap; in the California Academy of Sciences.

DISTRIBUTION: Known only from type locality (fig. 22).

RECORDS: *California*: Warm Spring Road, Stations 90, 93-97, Saline

Valley, Inyo County, April 3 to September 16, 1960 (B. Banta), four males, three females, from pit traps.

*Vejovis vachoni* (Stahnke)

Figures 14, 15, 22, 49-51, 64, 66

*Paruroctonus vachoni* STAHNKE, 1961, p. 206.

DIAGNOSIS: Giant species of *boreus* group, in some cases attaining 90 mm. in total length, in our fauna exceeded in size only by species of *Hadrurus*. Carapace and preabdomen heavily marked with dark pattern. Median eyes enlarged, set on a conspicuous tubercle, and diad somewhat less than one-third of width of carapace at that point. Greatly incrasated chelae bearing distinct carinae armed with regular rows of quite large granules. Ventral surface of cauda with numerous short setae in somewhat irregular rows. Male and female as shown in figures 14 and 15.

COLORATION: Base color yellow to orange-brown, with pattern of brown or black pigment essentially that of *silvestrii*. Carapace (fig. 64) heavily mottled with dark patches, and pale areas reticulated with dusky lines. Eyes and median eye tubercle black. Preabdomen with dark pigment on segments I-VI except for pairs of pale spots, near middle, and pale spots on sides and margins as shown for *silvestrii* (see fig. 9); dark coloration continuous to posterior margins of segments. Segment VII of preabdomen much paler, with faint pattern of pale spots near base. Cauda dull yellow to orange brown, without contrasting markings. Tip of sting dull red. Legs mostly clear yellow. Pedipalps clear yellow to dark brown; chelae with carinae and fingers reddish.

STRUCTURE: Similar in both sexes to that of *boreus* except as noted below. Shape of carapace of medium-sized female from Mule Mountains, Imperial County, California, as shown in figure 64. Anterior margin with slight to distinct rounded emargination, bearing six quite conspicuous setae and with usual seta behind lateral eye group. Width of carapace at side eyes about four-sevenths of width at posterior margin; sides essentially straight; total length usually clearly greater than width behind (8/7). Median eyes large, set on conspicuous eminence, separated by full diameter; width of median diad somewhat less than third of width at that point (37/120). Interocular region finely roughened, with scattered granules. Ridges flanking median groove with rows of coarse granules. Carapace of male more coarsely granulose than that of female, with more numerous, larger, dark granules on elevated areas.

Preabdomen: Of females and small males: dark tergites quite smooth and shining, with rows of granules along posterior edges inconspicuous. Of larger males: tergites coarsely roughened along posterior margins.

TABLE 3  
MEASUREMENTS (IN MILLIMETERS) OF *Vejois gracilior* AND *vachoni*

	Female <i>gracilior</i>	Male <i>gracilior</i>	Female <i>vachoni</i>	Male <i>vachoni</i>
Total length	35.3	39.7	85.5	70.3
Carapace				
Length	5.3	5.5	11.0	8.8
Width at lateral eyes	4.1	3.9	7.0	5.5
Width at caudal edge	5.5	5.1	10.7	8.2
Preabdomen, length	10.1	12.0	24.0	17.5
Postabdomen, length	19.1	22.2	50.5	44.0
Caudal segment I				
Length	2.8	2.8	6.7	5.5
Width	2.4	2.5	4.7	3.7
Caudal segment II				
Length	3.1	3.5	8.5	7.8
Width	2.1	2.4	4.3	3.3
Caudal segment III				
Length	3.5	3.9	9.3	8.0
Width	2.0	2.2	4.0	3.2
Caudal segment IV				
Length	4.2	4.8	11.7	10.0
Width	1.9	2.0	3.6	3.0
Caudal segment V				
Length	6.3	7.2	14.3	12.7
Width	1.8	2.0	3.2	2.6
Telson, length	6.0	6.1	12.5	9.8
Vesicle				
Length	3.5	3.6	7.7	6.3
Width	1.9	1.7	4.3	3.5
Depth	1.7	1.6	4.3	3.3
Spine, length	2.5	2.5	4.0	3.3
Pedipalp, length	16.2	17.7	39.5	34.8
Femur				
Length	3.9	4.5	10.0	8.5
Depth	1.6	1.6	3.2	2.4
Tibia				
Length	4.2	4.5	9.5	8.5
Depth	1.9	2.0	4.5	3.3
Chela, length	8.1	8.7	20.0	17.8
Palm length	3.9	4.3	10.5	9.5
Palm width	3.2	3.7	7.7	6.7
Palm depth	2.3	2.7	5.7	4.5
Fixed finger, length	3.1	3.5	8.7	7.7
Movable finger, length	4.7	5.3	11.5	11.0
Pectines				
Teeth	18/18	29/29	26/26	33/33
Middle lamellae	13	21	20	25



**Cauda:** All segments very slender in both sexes, with basic features of *mesaensis* but showing differences, as follows: Inferior lateral keels of smaller specimens well developed on all segments, smooth on segment I, lightly granulose on segment II, progressively more granulose to segment V; all these keels distinctly granular in larger females and males. Inferior median keels of smaller specimens not prominent on segment I, more distinct and lightly to coarsely granulose on succeeding segments; all these keels more distinct and more granulose on larger males and females. Intercarinal spaces mostly smooth. All segments with scattered reddish setae above, quite hirsute on ventral surfaces; areas of median keels of segments I-IV rather thickly lined with short setae in quite regular rows; these stouter and less numerous than those of *mesaensis*.

**Telson:** Essentially smooth, with vesicle globose, not fully twice as long as deep, sparsely set with long setae, and moderately curved sting about half as long as vesicle.

**Pectines:** Those of medium-sized female as shown in figure 66. Middle piece wider than broad, with narrow groove in front half. Pectine about four times length of median piece; middle lamellae consisting of about 23 ovoid pieces; pectinal teeth of medium length, 23-27 in number. Those of males much longer, with 33-36 pectinal teeth.

**Chelicerae:** Robust, similar in both sexes, as shown in figures 49-51, differing little from those of *boreus* and *mesaensis*. Dark denticles on lower margin of fixed finger usually present. Keel on lower margin of movable finger usually dissected into several rounded, pale teeth; distal teeth on this finger subequal in size.

**Pedipalps:** In both sexes of medium length, with greatly incrassated hands and stout fingers. All eight carinae on chelae developed and granulated. Inner and outer keels round, armed with two rows of heavy granules. Superior and inner accessory keels well elevated, armed with single line of heavy granules. Outer accessory keel rather weakly developed, with scattered granules. Inner keels of fingers lightly scalloped in females and small males; in large males, produced into deep concavities and basal humps on both fingers.

**Walking legs:** Protarsi long, thinner than those of *mesaensis*, with irregular series of dorsal bristles.

**TYPE DATA:** Female holotype from Sheep Creek Springs, 37 miles north of Baker, San Bernardino County, California, in collection of Arizona State University.

**DISTRIBUTION:** Nevada and southern California (fig. 22).

**RECORDS:** *Nevada:* Clark County: Boulder City, September 9, 1955 (D. L. Wallace), female. *California:* Imperial County: Trona, September

16, 1954 (W. C. Vogt), female; Mule Mountains, near Riverside, November 19, 1961 (D. Richman), under rock, female; Chocolate Mountains, north of Inspection Station, December 24, 1959, female; 3 miles north of Winterhaven, April 2, 1960, female; Glamis, July 13, 1963, female; Salton Sea, December 26, 1964, male, female (all V. Roth). Inyo County: Saline Valley, March 6, 1959, to September 17, 1960 (B. Banta), numerous males, females; Wildrose Canyon, 3500 feet, Death Valley National Monument, October, 1948 (A. Pipkin), two females. San Bernardino County: Sheep Creek Springs, 1800 feet, 37 miles north of Baker, December 4, 1960, female holotype; November 21, 1960, male; June, July, 1953, two females (all R. L. Sweet).

*Vejovis gracilior* (Hoffmann)

Figures 13, 18, 21, 23, 33-35

*Uroctonoides gracilior* HOFFMANN, 1931, p. 406, figs. 42, 43.

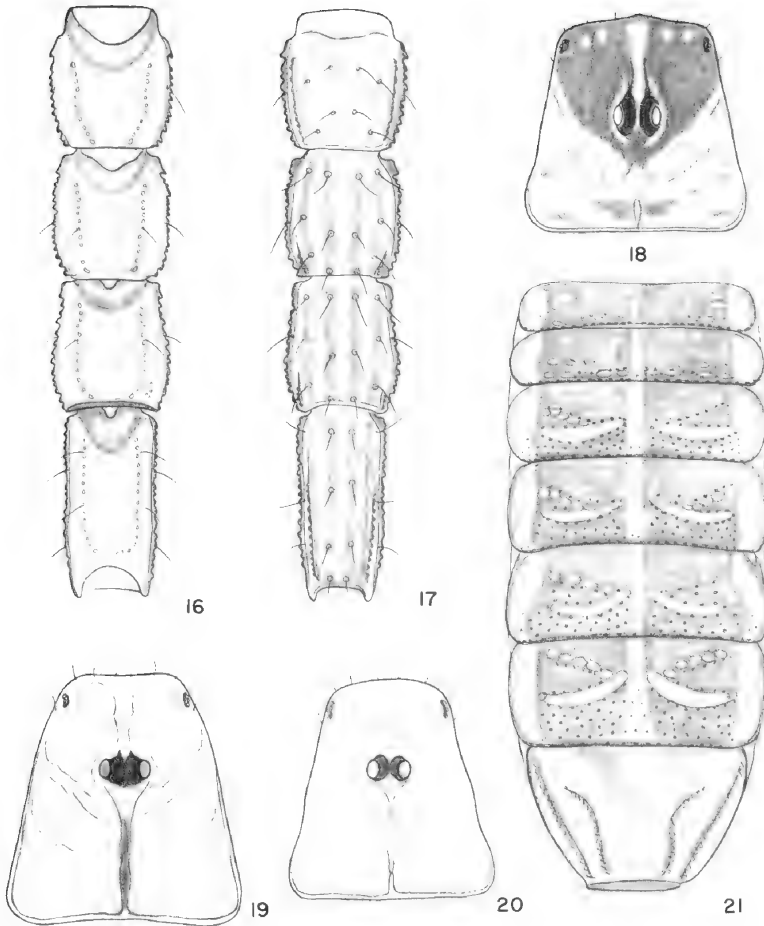
*Paruroctonus gracilior*: WERNER, 1934 (January), p. 283, fig. 363. STAHNKE, 1957, p. 253; 1961, p. 206.

*Hoffmanniellus gracilior*: MELLO-LEITÃO, 1934 (June 30), p. 75.

*Vejovis gracilior*: GERTSCH AND ALLRED, 1965, p. 9.

DIAGNOSIS: Very distinct species (fig. 13), readily identified by following combination of characters: Carapace proportionately broader than in other species, produced in front into distinct angle at middle, and having entire interocular area marked with dark pattern to front margin. Tergites of preabdomen having dark pattern except for pale stripe along each side and indistinct median pale line or stripe running length. Chelicerae larger than those of other species of series and distinctive in following features: fixed finger lacking any trace of basal teeth or nodules on weak ventral keel; apical tooth on upper margin of movable finger relatively small and widely separated from enlarged apical tooth of lower margin; teeth on lower margin of movable finger quite variable in size and differing in almost every specimen.

COLORATION: Base color pale yellow to dusky yellowish brown, with dark pattern as follows: Eyes and eye tubercles black. Carapace (fig. 18) with brown or dusky maculation of triangular shape beginning behind median eyes and enclosing most of pars cephalica except for paler front margin and narrow ring around median eyes. Thoracic portion of carapace pale except for dusky streaks mostly near posterior margin. Tergites I-VI of preabdomen (fig. 21) with transverse dusky or brown bands enclosing a series of paler spots on each side; dark bands covering entire segments except for pale stripe along each side margin and indistinct pale median stripe running full length. Tergite VII mostly pale, with



FIGS. 16, 17. *Vejovis boreus* (Girard). 16. Basal segments of cauda of female, dorsal view. 17. Ventral view.

FIG. 18. *Vejovis gracilior* (Hoffmann), carapace of female.

FIG. 19. *Vejovis xanthus*, new species, carapace of female.

FIG. 20. *Vejovis aquilonalis* Stahnke, carapace of female.

FIG. 21. *Vejovis gracilior* (Hoffmann), preabdomen of male.

dusky shadings. Under side of carapace and sternites of preabdomen dull yellow. Cauda dull yellow to yellowish brown, with faint dusky shadings of ventral keels in some individuals. Legs pale yellow, with dusky shadings on upper surfaces. Chelae yellowish brown, lightly mottled with black, and with keels dusky in some. Sting red.

STRUCTURE: Typical of subgenus and similar in both sexes to that of

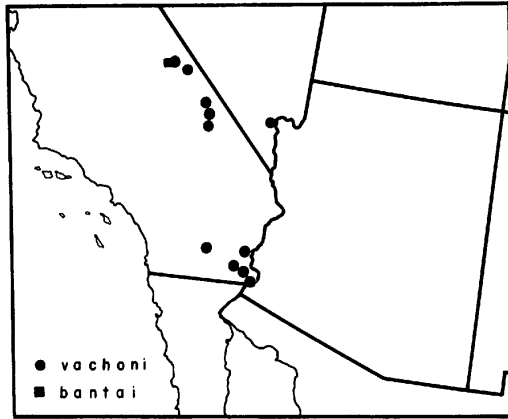


FIG. 22. Distribution map of *Vejovis vachoni* and *bantai*.

*boreus* except as noted below. Male smaller than female. Measurements given in table 3.

Carapace: Shape of carapace of female from Hope, New Mexico, as shown in figure 18. Anterior margin lightly produced at middle to slight rounded projection, occasionally essentially straight, set with six suberect setae; sides essentially straight to broadly rounded at caudal angle; length and breadth subequal, proportionately broader than in other species. Median eyes somewhat enlarged from average, set on low tubercles connate along inner edges; width of median diad about one-fourth of

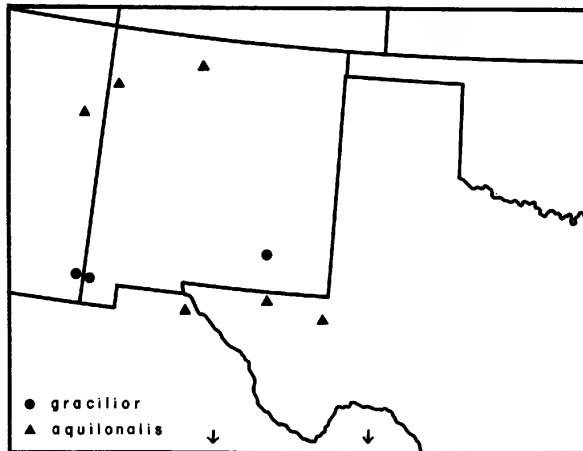


FIG. 23. Distribution map of *Vejovis gracilior* and *aquilonalis*.

width of carapace at that point (26/96). Carapace of male granulate over most of surface, with many coarse, black granules forming conspicuous rows on dark pattern; granulation of female less developed.

Preabdomen: Tergites dull, quite rough, with many conspicuous granules forming transverse rows in posterior portion of each.

Cauda: Dorsal and superior lateral keels all distinct but not sharply angled, crenulate, set with many small, rounded granules. Inferior median keels essentially obsolete on segments I-III, weak and irregularly crenulate on segment IV. Inferior lateral keels weak and mostly smooth on segments I-IV. Inferior lateral keels of segment V roundly angled, with heavy granules. Segment V much longer than carapace in both sexes. Segments I-IV with 4-5-5-6 pairs of setae on obsolete inferior median keels.

Telson: Vesicle quite slender, about twice as long as slightly curved sting, smooth. Subaculear nodule inconspicuous. Vesicle about as wide as segment V of cauda.

Pectines: Similar to those of *boreus* in both sexes. Those of females of medium width and length; middle lamellae consisting of about 16 ovoid pieces; pectinal teeth numbering from 18 to 20. Those of male much larger and broader; middle lamellae about 25 small ovoid pieces; pectinal teeth long, curved, 25-29 in number.

Chelicerae: Similar in both sexes (figs. 33-35) and larger than those of other species. Fixed finger a thin blade with long distal tooth, without trace of basal nodules on obsolete ventral keel. Movable finger a long, flat blade, with five strong teeth, on upper margin of which distal tooth is of medium size and quite remote from long apical tooth of lower margin (fig. 34); carina of lower margin dissected in middle or basal portion into four or more quite large teeth of irregular size and shape.

Pedipalps: In both sexes short, with heavy hands and short fingers, with sculpturing essentially like that of *boreus*. Chelae with all carinae well developed and coarsely granulated. Inner keels of fingers weakly scalloped.

Walking legs: Protarsi with irregular series of six to eight principal bristles.

TYPE DATA: Three male cotypes from Tepezala, Aguascalientes, Mexico (of which specimen labeled number 1 is herein designated as lectotype), in the American Museum of Natural History.

DISTRIBUTION: Eastern Arizona and New Mexico, south to Coahuila and Aguascalientes in Mexico (fig. 23).

RECORDS: *Arizona*: Cochise County: Portal, July 1 to September 4, 1965 (R. M. Hastings, W. J. Gertsch, V. Roth), 27 males, four females. *New Mexico*: Hidalgo County: Rodeo, August 29, 1964 (R. Hastings),

male. Eddy County: Hope, September 23, 1950 (W. J. Gertsch), female. *Coahuila*: Twenty miles east of Saltillo, July 16, 1965 (W. J. Gertsch, V. Roth), male. *Agascalientes*: Tepezala (C. C. Hoffmann), three male cotypes.

***Vejovis stahnkei*, new species**

Figures 36-38, 56

**DIAGNOSIS:** Small, pale species, readily differentiated from *boreus* by following features: Preabdomen essentially unmarked by dark pattern, and dark lines not present beneath cauda. Distal tooth on upper margin of movable finger of chelicera reduced in size and far smaller than corresponding tooth of lower margin. Number of teeth in combs much smaller, 14-15 in females and 20-23 in males.

**COLORATION:** Entire body pale yellow except as follows: eyes and eye tubercles black; V-shaped dusky patch centered at median eyes more or less evident; preabdomen either unmarked or showing very faint pattern similar to that of *boreus*; tip of sting red.

**STRUCTURE:** Similar to that of *boreus* in both sexes except as indicated below. Male differing little from female in size and appearance. Measurements given in table 4.

**Carapace:** Anterior margin gently rounded, essentially straight, set with six fine setae. Length greater than width at caudal margin. Median eyes of average size, set on low tubercles; width of median diad somewhat more than one-fourth of width of carapace at that point (9/33). Granulation less conspicuous than that of *boreus* but similar in distribution.

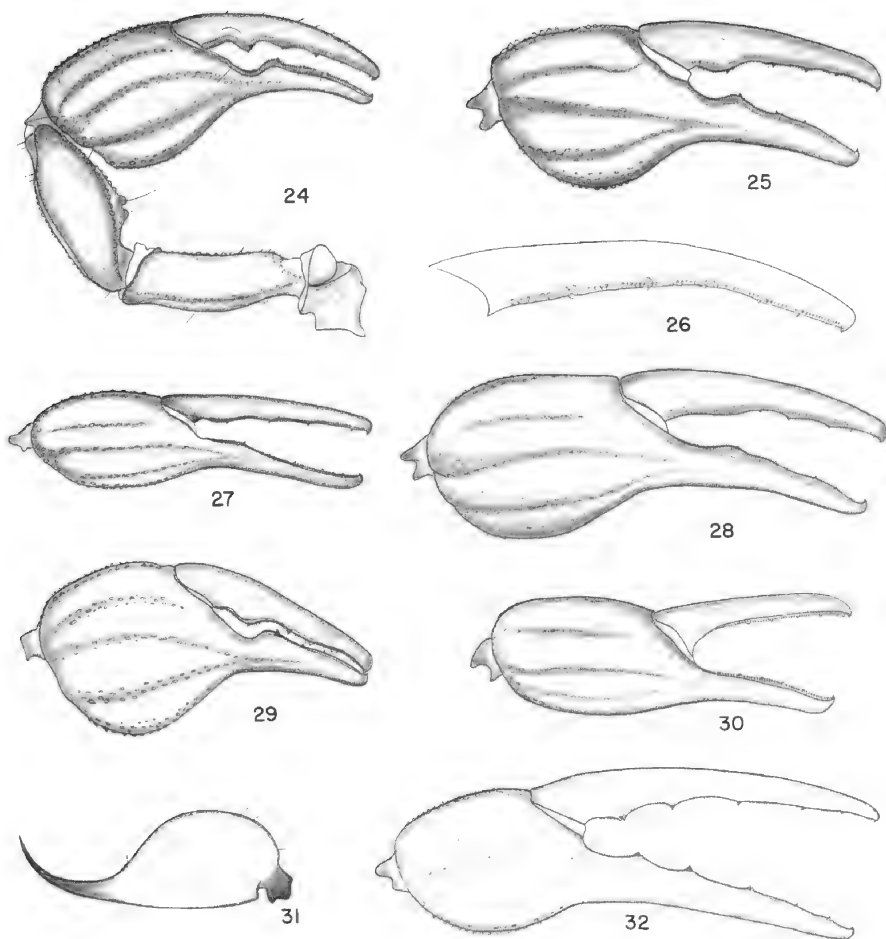
**Preabdomen:** Tergites generally quite smooth except for weak granules on posterior margins.

**Cauda:** Sculpturing essentially as in *boreus*. Dorsal and superior lateral keels of segments I-IV in male less strongly crenulate, with individual granules small and regularly spaced; these keels of female quite smooth, with fewer granules. Inferior lateral keels of female obsolete on segments I and II, faintly visible but smooth on segment III, more developed and crenulate in caudal half of segment IV. Inferior median keels of female obsolete on basal segments, faintly visible and weakly crenulate on segment IV. All inferior keels of male finely granulated. All segments with scattered setae, but those on ventral surface in regular rows; segments I-IV with 3-4-5-5 pairs of setae on obsolete inferior median keels.

**Telson:** Slender, with long, slightly curved sting half as long as vesicle.

**Pectines:** Pectinal teeth of females 14-15, of males 20-23.

**Chelicerae:** Similar in both sexes (figs. 36-38) and showing important differences from those of *boreus*. Lower margin of fixed finger without



FIGS. 24, 25. *Vejovis boreus* (Girard). 24. Pedipalp of male. 25. Hand of female.  
 FIG. 26. *Vejovis mesaensis* (Stahnke), movable finger of hand of female.  
 FIGS. 27, 28. *Vejovis silvestrii* Borelli. 27. Hand of male. 28. Hand of female.  
 FIG. 29. *Vejovis bantai*, new species, hand of male.  
 FIG. 30. *Vejovis luteolus*, new species, hand of female.  
 FIG. 31. *Vejovis boreus* (Girard), telson of female, lateral view.  
 FIG. 32. *Vejovis xanthus*, new species, hand of female.

distinct nodules at base. Movable finger a quite large, flat blade bearing on upper margin five teeth, of which distal one is quite small, well separated from enlarged apical tooth of lower margin (fig. 37); carina of lower margin faintly dissected into weak denticles.

Pedipalps: Those of female of medium length, with chelae of medium

TABLE 4  
MEASUREMENTS (IN MILLIMETERS) OF *Vejovis stahnkei* AND *luteolus*

	Female <i>stahnkei</i>	Male <i>stahnkei</i>	Female <i>luteolus</i>	Male <i>luteolus</i>
Total length	25.2	24.7	32.5	27.6
Carapace				
Length	4.0	3.5	4.0	3.2
Width at lateral eyes	2.7	2.5	2.4	1.8
Width at caudal edge	3.5	3.3	3.8	2.8
Preabdomen, length	9.3	7.7	11.0	7.7
Postabdomen, length	11.9	13.5	17.5	16.7
Caudal segment I				
Length	1.6	1.7	2.0	1.8
Width	1.8	1.7	2.0	1.7
Caudal segment II				
Length	1.8	2.2	2.1	2.1
Width	1.7	1.5	1.8	1.7
Caudal segment III				
Length	2.0	2.3	2.4	2.4
Width	1.4	1.4	1.7	1.5
Caudal segment IV				
Length	2.5	3.0	2.9	2.9
Width	1.3	1.3	1.5	1.3
Caudal segment V				
Length	4.0	4.3	4.3	3.9
Width	1.3	1.3	1.6	1.3
Telson, length	3.7	4.0	3.8	3.6
Vesicle				
Length	2.5	2.5	2.2	2.2
Width	1.3	1.3	1.3	1.2
Depth	1.0	1.0	1.2	1.0
Spine, length	1.5	1.3	1.6	1.4
Pedipalp, length	12.2	11.9	10.7	9.7
Femur				
Length	3.0	3.0	2.8	2.6
Depth	1.0	0.9	0.9	0.9
Tibia				
Length	3.2	3.2	3.2	2.9
Depth	1.3	1.3	1.3	1.0
Chela, length	6.0	5.7	4.7	3.9
Palm length	3.3	3.5	2.8	2.2
Palm width	1.8	2.1	1.6	1.1
Palm depth	1.5	1.7	1.4	1.0
Fixed finger, length	2.5	2.5	2.0	1.5
Movable finger, length	3.5	3.3	2.8	2.0
Pectines				
Teeth	14/14	20/20	12/13	19/18
Middle lamellae	11	14	10	14



TABLE 5  
MEASUREMENTS (IN MILLIMETERS) OF *Vejois xanthus* AND *mesaensis*

	Female <i>xanthus</i>	Female <i>mesaensis</i>	Female <i>mesaensis</i>	Male <i>mesaensis</i>
Total length	52.0	65.2	55.8	63.9
Carapace				
Length	6.8	8.7	7.5	7.8
Width at lateral eyes	3.2	5.0	4.3	4.5
Width at caudal edge	6.6	7.9	6.8	7.1
Preabdomen, length	19.5	19.7	19.1	16.8
Postabdomen, length	25.7	36.8	29.2	39.3
Caudal segment I				
Length	3.5	5.0	3.9	5.2
Width	3.4	3.6	3.1	3.7
Caudal segment II				
Length	4.1	6.1	5.1	6.9
Width	3.3	3.3	2.8	3.2
Caudal segment III				
Length	4.5	6.7	5.5	7.3
Width	3.0	3.1	2.6	3.1
Caudal segment IV				
Length	5.6	8.2	6.6	8.9
Width	2.7	2.8	2.3	2.9
Caudal segment V				
Length	8.0	10.8	8.4	11.0
Width	2.5	2.9	2.3	2.8
Telson, length	8.0	9.7	7.9	8.7
Vesicle				
Length	4.7	5.9	4.5	5.5
Width	2.3	2.8	2.2	2.5
Depth	2.0	2.5	2.0	2.2
Spine, length	3.5	3.8	3.4	3.2
Pedipalp, length	24.7	30.1	25.0	28.8
Femur				
Length	6.1	6.5	6.2	7.5
Depth	1.7	2.0	1.7	2.4
Tibia				
Length	6.5	7.0	6.3	7.2
Depth	2.3	2.6	2.5	2.9
Chela, length	12.1	14.0	13.0	15.0
Palm length	5.3	7.0	6.5	7.3
Palm width	3.6	4.5	4.0	4.7
Palm depth	2.8	3.5	3.1	3.4
Fixed finger, length	7.2	6.7	6.0	6.7
Movable finger, length	9.0	8.5	7.8	8.8
Pectines				
Teeth	23/21	25/26	23/23	35/35
Middle lamellae	17	21	18	30

stoutness. Basal segments with all carinae quite uniformly granulated. Chelae moderately thickened, with all carinae distinct but relatively smooth and weakly granulose. Inner keels of fingers weakly scalloped, armed as in *boreus*. Pedipalp of male heavier than that of female, with conspicuous carinae set with numerous rounded granules.

Walking legs: Setation essentially as in *boreus*; protarsi of second and third legs with row of six or seven long setae.

TYPE DATA: Male holotype from Sentinel, Maricopa County, Arizona, October 9, 1959 (V. Roth).

DISTRIBUTION: Southern Arizona (fig. 56).

RECORDS: *Arizona*: Maricopa County: Buckeye, April 24, 1961 (J. Rozen, R. Schrammel), female. Sunshine Acres Childrens Home, 5 miles northeast of Mesa, October 11 to December 27, 1959, four males, female; November, 1960, male (M. E. Soleglad, R. Dingman). Pima County: Four miles northeast of Arivaca, October 3, 1953, male (V. Roth).

### *Vejovis xanthus*, new species

Figures 19, 32, 55, 71

DIAGNOSIS: Pale scorpion resembling *auratus* and *mesaensis* in appearance and sharing features of both. Median eyes of medium size and set well in advance of center of carapace. Cauda stout and bearing only up to five pairs of setae on inferior median keels. Telson long and slender and bearing a long, lightly curved sting. Pedipalps resembling those of *mesaensis*, but stout fingers proportionately longer and more deeply scalloped.

COLORATION: Entire body pale yellow to golden orange, without contrasting markings except as follows: Lateral eyes and small tubercles black. Median eyes and most of tubercles black. Articulation spots on appendages red. Tip of sting red. Dark setae on appendages with reddish tinge.

STRUCTURE: Similar to that of *boreus* except as noted below. Measurements given in table 5.

Carapace: Anterior margin essentially straight (fig. 19), set with six short setae; sides gently scalloped; width at rounded caudal margin equal to length. Median eyes well in front of middle of carapace, of medium size, set on small elevated tubercles; width of median diad about one-fourth of width of carapace at that point (23/96). Granulation inconspicuous because of pale color but heavier than that of *boreus*.

Preabdomen: Smooth, shining, with quite typical armature of granules as in *boreus*.

Cauda: Stoutier than that of *boreus* but sculptured essentially as in that

species. Dorsal and superior lateral keels prominent, crenulate, with rounded or pointed granules. Inferior lateral keels distinct on all segments, weakly denticulate on segment I, nearly smooth, with scattered denticles, on segment II, smooth, with more numerous denticles, on segment III, quite regularly denticulate on segment IV, and evenly set with pointed granules on segment V. Inferior median keels of segments I-III distinct but smooth, of segment IV with granules in distal fifth of length; single median keel of segment V with closeset series of sharp granules. Segments I-IV with 3-4-4-5 pairs of setae on median keels.

Telson: Details as shown in figure 71. Vesicle slender, quite smooth, set with fine bristles; sting long, moderately curved; subaculear nodule of medium development.

Pectines: Similar to those of *boreus*. Pectinal teeth 21/22.

Chelicerae: Similar to those of *boreus*. Lower margin of fixed finger with two nodules near base. Lower margin of movable finger with keel dissected into six or seven irregularly formed denticles. Apical tooth on lower margin of movable finger stout, nearly equal to opposing apical tooth.

Pedipalps: Similar to those of *mesaensis*, with smaller and stout, long fingers as shown in figure 32. All carinae conspicuous and set with quite coarse, pale granules. Inner keels of fingers quite deeply scalloped.

Walking legs: First to third protarsi with regular series of nine to 12 long, stout bristles on dorsal surface; fourth protarsus with five scattered bristles.

TYPE DATA: Female holotype from 13 miles west of Winterhaven, Imperial County, California; June 13, 1958 (V. Roth).

DISTRIBUTION: Known only from type specimen (fig. 55).

*Vejovis mesaensis* (Stahnke)

Figures 26, 42-45, 55, 61, 62, 67, 70, 72

*Paruroctonus mesaensis* STAHNKE, 1957, pp. 253-259, fig. 1; 1961, p. 207. GERTSCH, 1958, p. 15. GERTSCH AND ALLRED, 1965, p. 9.

DIAGNOSIS: Many attaining 80 mm. in length, exceeded in size only by *vachoni*. Body pale except for small, dark mark across median eyes. Median eyes enlarged, set on conspicuous tubercle, diad of these eyes about one-third of width of carapace. Chelae very heavy and armed with coarsely granulated carinae in both sexes. Ventral surface of cauda thickly set with numerous short setae in irregular rows. Female and male shown in figures 61 and 62.

COLORATION: Entire body uniform pale yellow to clear yellow or orange except as follows: eyes black and eye tubercles crossed with black

bar or crescent (fig. 67); reddish articulation spots at ends of leg segments; tip of sting red.

**STRUCTURE:** Similar to that of *boreus* except as indicated below. Males more slender, with thinner cauda and somewhat smaller than females. Measurements given in table 5.

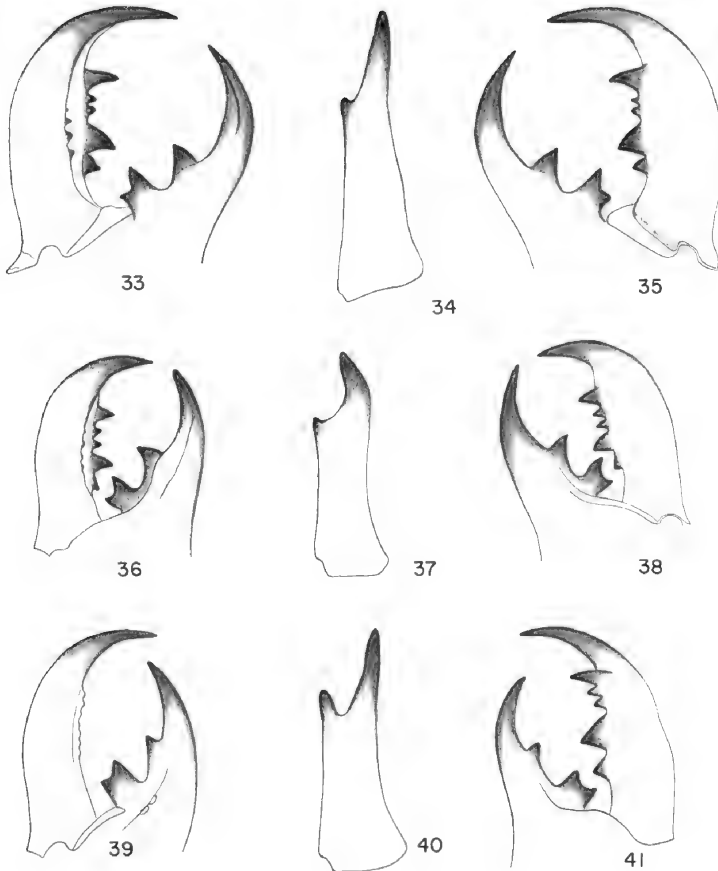
**Carapace:** Shape of carapace of small female from Borrego Valley, California, as shown in figure 67. Anterior margin essentially straight, in some cases with trivial emargination at center, set with six suberect bristles; width at side eyes two-thirds of width at posterior margin; length usually clearly longer than greatest width (10/9). Median eyes large, set on quite conspicuous tubercles connate on inner margins; eyes separated by full diameter; width of median diad about one-third of width of carapace at that point. Interocular triangle roughened, sparsely set with large pale granules. Ridges flanking median groove behind median eyes thickly set with heavy pale granules, forming quite regular rows. Median groove a deep furrow behind, a shallow groove over ocular tubercle, and a broad, less distinct furrow fading to anterior margin. Carapace of male as usual somewhat more granulose than that of female.

**Preabdomen:** Tergites of all segments finely granulated, seemingly quite smooth except along sides, with marginal row of granules; caudal half of each tergite with two distinct rows and scattered granules of medium size.

**Cauda:** With basic features of *boreus* but showing differences as follows: Dorsal and superior lateral keels of segments I-IV distinct and quite evenly granulated. Dorsal keel of segment V rounded, lightly granulose in female, more heavily granulose in male; superior lateral keel distinct only near base and lightly granulose. Inferior lateral keels distinct on all segments, lightly granulate on segment I, essentially smooth on segment II, lightly granulose on segment III, and heavily granulose on segments IV and V. Inferior median keels essentially obsolete on segment I, distinct but smooth on segments II and III, and quite heavily granulated on segments IV and V. Intercarinal spaces mostly smooth. All segments with scattered setae above, quite hirsute on ventral surfaces; areas of inferior median keels of segments I-IV thickly lined with numerous short setae in irregular rows.

**Telson:** Of female: essentially smooth, with vesicle more than twice as long as deep and slightly curved spine half as long as vesicle, set with a few long setae; of male: proportionately longer and thinner than that of female.

**Pectines:** Those of female quite long and slender as shown for *vachoni*



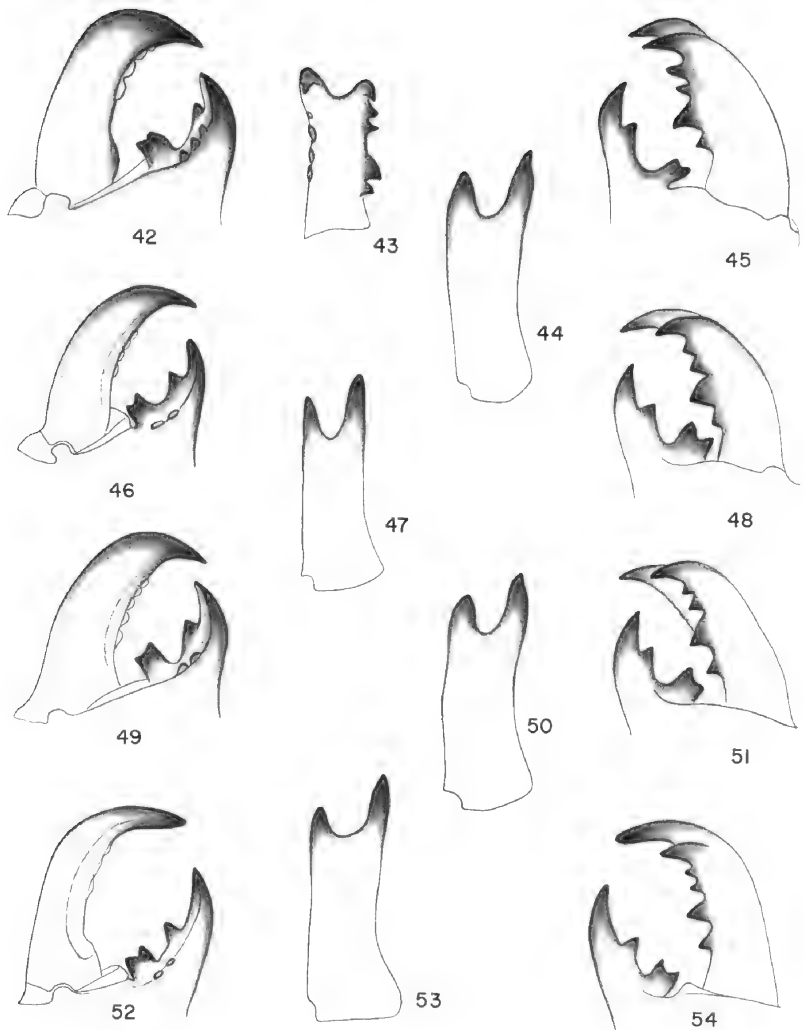
FIGS. 33-35. *Vejovis gracilior* (Hoffmann), right chelicera of female. 33. Ventral view. 34. Outer view of movable finger. 35. Dorsal view.

FIGS. 36-38. *Vejovis stahnkei*, new species, right chelicera of female. 36. Ventral view. 37. Outer view of movable finger. 38. Dorsal view.

FIGS. 39-41. *Vejovis becki* Gertsch and Allred, right chelicera of female. 39. Ventral view. 40. Outer view of movable finger. 41. Dorsal view.

(see fig. 66), about four times as long as median piece; middle lamellae consisting of about 20 ovoid pieces in principal row; pectinal teeth of medium length, 21-27 in number. Those of male much larger, like those of *boreus*, but with more numerous teeth—31-39.

Chelicerae: Robust, similar in both sexes as shown in figures 42-45, similar to those of *boreus*. Fixed finger short, quite stout, bearing four teeth on upper margin, of which basal pair is compound, and with dis-



FIGS. 42-45. *Vejovis mesaensis* (Stahnke), right chelicera of female. 42. Ventral view. 43. Inner view of movable finger. 44. Outer view of movable finger. 45. Dorsal view.

FIGS. 46-48. *Vejovis boreus* (Girard), right chelicera of female. 46. Ventral view. 47. Outer view of movable finger. 48. Dorsal view.

FIGS. 49-51. *Vejovis vachoni* (Stahnke), right chelicera of female. 49. Ventral view. 50. Outer view of movable finger. 51. Dorsal view.

FIGS. 52-54. *Vejovis luteolus*, new species, right chelicera of female. 52. Ventral view. 53. Outer view of movable finger. 54. Dorsal view.

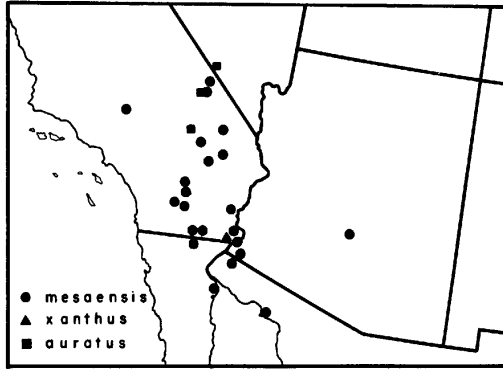


FIG. 55. Distribution map of *Vejovis mesaensis*, *xanthus*, and *auratus*.

tinct lower margin bearing three large, often dark teeth. Movable finger with typical five teeth on dorsal margin; lower margin bearing distinct keel dissected to form four or five large, rounded, pale teeth; distal teeth of both margins (figs. 43, 44) subequal in size and length.

**Pedipalps:** In both sexes of medium length, with heavy hands and stout fingers. Carinae on basal segments distinct and granular. Chelae greatly incrassated, essentially as in *boreus*, with all eight carinae conspicuous and armed with quite coarse granules. Inner keels of fingers lightly scalloped in females, armed with six principal files of denticles as shown in figure 26; inner keels of males more deeply scalloped.

**Walking legs:** First to third protarsi with regular series of six to nine long, stout bristles on dorsal surfaces; fourth protarsus with about six scattered bristles.

**TYPE DATA:** Female holotype from northwest of Mesa, Arizona, in collection of Arizona State University.

**DISTRIBUTION:** Southern Arizona and California, and adjacent states of Mexico (fig. 55).

**RECORDS:** *Arizona:* Yuma County; Wellton, May 6, 1959, immature female; Fortuna Mine, May 13, 1957 (V. Roth), male. Maricopa County: City dump, northwest of Mesa, March 13, 1947 (F. Parrat, I. F. Nichols), female holotype; September 14, 1939 (H. L. Stahnke), male allotype. *California:* San Bernadino County: Sheep Creek Spring, 37 miles north of Baker, Death Valley National Monument, July, 1953 (R. L. Sweet), two females; Saratoga Springs, Death Valley National Monument, April 23, 1955 (R. X. Schick), two males, female; Pisgah Crater, July 26 to September 2, 1961–1962 (Norris, Heath), 13 males; Amboy Crater, July 11, 1956 (J. F. Lawrence), female; Twenty-nine Palms, July–August,

1945 (J. F. Branch), nine males, two females; 10 miles south of Kelso, April 15, 1961 (V. Roth), one immature. Riverside County: Coachella Valley, May, 1953 (R. X. Schick), female; Coon Hollow, Mule Mountains, near Riverside, November 19, 1961 (D. Richman), female; Indian Wells, near Palm Springs, January 5, 1964 (R. Hennessey), in dunes, male, female. Kern County: Mojave (F. Russell), male. San Diego County: Borrego Valley, April 28, 1951 (J. Rozen, D. Schrammel), sand dunes, male, four females (immature); 2 miles east of Anza-Borrego State Park, Highway 78, April 22, 1960 (W. J. Gertsch), male. Imperial County: Winterhaven, June 13, 1958 (V. Roth), female; Pilot's Knob, November 2, 1957 (V. Roth), male; 14 miles north of Winterhaven, February 7, 1965 (V. Roth), female; Midway Wells (F. Green, T. S. Briggs), female; 5 miles west of Seely, September 30, 1961 (V. Roth), female. *Sonora*: Punta Penasco, July 30, 1956 (M. Cazier), two males; Tiburon Island, June, 1960 (B. Douglass), immature male; Laguna Prieta, 20 miles southeast of San Luis, June 6, 1959 (V. Roth), immature. *Baja California Norte*: Southeast of Cocopa Mountains, April 16, 1958 (V. Roth), female; San Felipe, June 15, 1952 (W. J. Gertsch), female.

***Vejovis luteolus*, new species**

Figures 30, 52-54, 56, 63, 68, 69

**DIAGNOSIS:** Very distinct species (fig. 63), probably smallest of group, with females not exceeding 30 mm. in length. Pedipalps having small hands with short fingers and carinae quite smooth in females. Pectinal tooth count quite low, 11-14 in females and about 17 in males.

**COLORATION:** Entire body yellow to bright orange-brown, except for black eyes and tubercles and red tip of sting; black color of eye tubercles usually forming transverse bar between eyes (fig. 68).

**STRUCTURE:** Similar to that of *boreus* and relatives in both sexes except as noted below. Males considerably smaller than females in available material. Measurements given in table 4.

**Carapace:** Shape of carapace of female from 2 miles east of Anza-Borrego State Park, California, as shown in figure 68. Carapace essentially straight, at most with gentle forward curvature, with six short bristles on margin; sides straight to broadly rounded at posterior corners; length and breadth behind subequal. Median eyes set on low, smooth tubercles; width of median diad one-fourth of width of carapace at that point. Carapace of female smooth and shining, without conspicuous granules visible under low power; of male, dull, rough, with quite heavy granules on elevated areas.



Preabdomen: Tergites quite smooth and shining in female, with weak granulation; duller and rougher in male, with numerous weak granules.

Cauda: Dorsal and superior lateral keels of female not prominent, clear and smooth, with edges slightly and somewhat irregularly serrulate. Inferior lateral keels largely obsolete on segments I and II, visible and weakly crenulate in posterior third of segment III, more distinct and with weak granules in posterior half of segment IV. Inferior median keels obsolete on basal segments, faintly visible and weakly crenulate on segment IV.

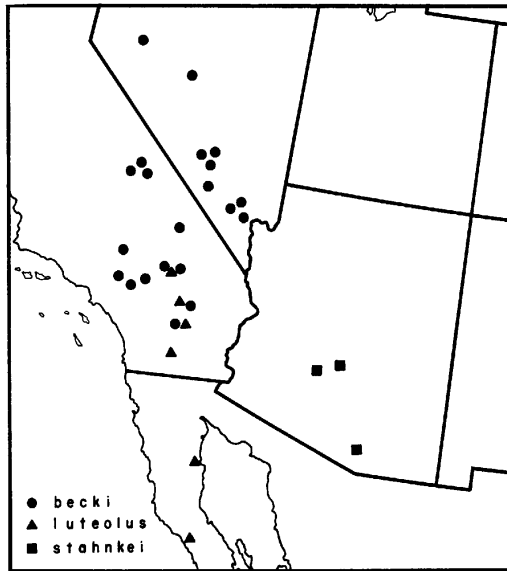


FIG. 56. Distribution map of *Vejovis becki*, *luteolus*, and *stahnkei*.

Segments I-IV with 3-4-4-5 pairs of setae on obsolete, inferior, median keels. Segment V only slightly longer than carapace; dorsum unevenly covered with round granules; intercarinal spaces on ventral surface covered with granules. Keels of males more prominent and with heavier granules.

Telson: In both sexes slender, with slightly curved sting half as long as granulated vesicle.

Pectines: Those of female as shown in figure 69, rather small, only twice as long as wide median piece; middle lamellae inconspicuous, consisting of about 12 or 13 round pieces; pectinal teeth short, 11-15 in number. Those of male much larger and broader; median piece about as long as broad; middle lamellae consisting of 13-15 round pieces; pectinal teeth

twice as long as those of female, distinctly angled at middle, 16–19 in number.

Genital operculum: Of female as shown in figure 69.

Chelicerae: Similar in both sexes (figs. 52–54), quite similar to those of *boreus*. Lower margin of fixed finger weakly developed, with traces of two weak nodules. Movable finger with five strong teeth, on upper margin of which distal tooth is well developed; lower margin with very stout distal tooth and keel lightly crenulated.

Pedipalps: Those of female of medium length, with chelae short with short fingers (fig. 30). Carinae on basal segment rounded, weakly granulated. Chela with all eight carinae visible, mostly quite smooth, with light granulation at angles. Those of male with proportions of those of female, but carinae more developed and quite heavily granulated. Inner keels of fingers essentially straight, dentate as in *boreus*.

Walking legs: Protarsi of second and third legs with six to eight long setae.

TYPE DATA: Female holotype from 2 miles east of Anza-Borrego State Park on Highway 78, San Diego County, California, April 22, 1960 (W. J. Gertsch).

DISTRIBUTION: So far known only from desert areas of southern California and two localities in Baja California (fig. 56).

RECORDS: *California*: San Bernardino County: Twenty-nine Palms, March–April, 1945 (J. H. Branch), male, female; Pisgah Crater, May 6 to October 7, 1961–1962 (Norris and Heath), 20 males, three females. San Diego County: Two miles east of Anza-Borrego State Park, April 22, 1960 (W. J. Gertsch), female. Riverside County: Indio, April 3, 1959 (W. J. Gertsch), female. *Baja California Norte*: Twenty-five miles north of Punta Prieta, January 13, 1965 (V. and B. Roth), female; San Felipe, February 19, 1954 (P. Arnaud), female.

*Vejovis aquilonalis* Stahnke

Figures 20, 23

*Vejovis aquilonalis* STAHNKE, 1940, p. 101.

DIAGNOSIS: Close relative of *boreus*, distinguished mainly by lack of dark pattern on carapace and preabdomen. Carapace slightly rounded on front margin and set with more numerous granules in males.

COLORATION: Entire body pale yellow to bright orange-brown except for black eyes and eye tubercles (fig. 20). Sting tipped with red. Specimen from Wide Ruin, Arizona, with faint dusky pattern on carapace and preabdomen like that of *boreus* and very faint dusky lines beneath cauda.

STRUCTURE: Similar to that of *boreus* in both sexes except as indicated

TABLE 6

MEASUREMENTS (IN MILLIMETERS) OF *Vejoavis auratus* AND *aquilonalis*

	Female <i>auratus</i>	Male <i>auratus</i>	Female <i>aquilonalis</i>	Male <i>aquilonalis</i>
Total length	54.0	34.4	40.3	37.0
Carapace				
Length	7.3	5.0	5.8	5.0
Width	4.3	2.8	3.3	2.8
Width at caudal edge	7.0	4.5	5.5	4.6
Preabdomen, length	21.5	13.0	15.5	12.0
Postabdomen, length	25.2	16.4	19.0	20.0
Caudal segment I				
Length	3.5	2.5	2.8	2.6
Width	3.8	2.5	2.7	2.6
Caudal segment II				
Length	3.8	2.5	3.0	3.2
Width	3.6	2.5	2.8	2.7
Caudal segment III				
Length	4.2	2.7	3.0	3.3
Width	3.5	2.3	2.6	2.5
Caudal segment IV				
Length	5.2	3.2	4.0	4.5
Width	3.3	2.2	2.4	2.3
Caudal segment V				
Length	8.5	5.5	6.2	6.4
Width	3.4	2.2	2.3	2.2
Telson, length	8.3	5.2	6.5	6.0
Vesicle				
Length	5.2	3.2	3.7	3.7
Width	3.6	2.1	2.2	1.9
Depth	3.0	1.7	2.0	1.7
Spine, length	2.7	1.7	2.5	2.3
Pedipalp, length	16.7	16.0	16.9	16.6
Femur				
Length	6.0	3.9	4.0	4.0
Depth	2.0	1.4	1.5	1.3
Tibia				
Length	6.0	4.4	4.7	4.5
Depth	2.5	1.7	2.1	2.0
Chela, length	10.7	7.7	8.2	8.0
Palm length	6.0	4.0	4.2	4.4
Palm width	4.7	2.7	3.0	3.8
Palm depth	3.5	2.0	2.2	2.4
Fixed finger, length	4.8	3.5	3.7	3.2
Movable finger, length	6.8	4.6	5.0	4.7
Pectines				
Teeth	20/20	29/29	19/19	28/28
Middle lamellae	15	24	14	23

below. Measurements given in table 6.

**Carapace:** Shape of carapace of female from Ojito de Los Gatos Canyon, New Mexico, as shown in figure 20. Anterior margin gently rounded in front, essentially straight, set with six suberect bristles; sides quite straight; length greater than width at caudal margin. Median eyes of average size, set on low tubercles bearing granules along inner margins; width of median diad about one-fourth of width of carapace at that point. Granulation heavier in both sexes than found in *boreus*.

**Cauda:** Sculpturing essentially as in *boreus*. Segments I-IV with 3-3-4-4 pairs of setae on obsolete, inferior, median keels.

**Telson:** Quite slender, with slightly curved sting not fully half as long as vesicle.

**Pectines:** Of subadult female: small, about twice as long as, and equal to, length of median piece; pectinal teeth 19; of males: short and broad, three times as long as greatest width; pectinal teeth 28-34.

**Chelicerae:** Similar in both sexes and showing no important differences from those of *boreus* (figs. 46-48). Lower margin of fixed finger without distinct granules at base. Lower margin of movable finger variable, dissected into series of weak crenulations or small teeth.

**Pedipalps:** Similar to those of *boreus* in both sexes. Chelae heavy, with all carinae distinct and quite coarsely granulated. Inner keels of fingers weakly scalloped.

**Walking legs:** Setation like that of *boreus*; protarsi of second and third legs with row of eight or nine long setae; second protarsus of male more than twice as long as deep (18/7).

**TYPE DATA:** Male type from 37 miles south of the Grand Canyon on Highway 64 (H. L. Stahnke), in the collection of Arizona State University.

**DISTRIBUTION:** Arizona and New Mexico to west Texas and Chihuahua.

**RECORDS:** *Arizona:* Apache County: Wide Ruin, July 22, 1950 (M. A. Cazier), male. *New Mexico:* McKinley County: Six miles north of Tohatchi, July 14, 1965 (W. J. Gertsch, V. Roth), four males. Rio Arriba County: Ojito de los Gatos Canyon, May 7, 1964 (W. Shear), under rock, female. *Texas:* Culberson County: Two miles east of Nickel Creek Station, September 2, 1952 (B. Malkin), male. Ward County: Monahans Sand Hills State Park, April 17, 1961 (J. Rozen, R. Schrammel), immature female. *Chihuahua:* Samalayuca, June 25, 1947 (W. J. Gertsch), immature female.

***Vejovis auratus*, new species**

Figures 55, 58

**DIAGNOSIS:** Differing from *boreus* in general pale golden coloration and



FIG. 57. *Vejovis boreus* (Girard), female from Oregon.  $\times 2$ .

FIG. 58. *Vejovis auratus*, new species, female.  $\times 2$ .

lack of dark pattern on preabdomen and cauda. Cauda somewhat stouter, and telson, especially that of female, heavier and armed with shorter sting. More closely related to *aquilonalis*, from which it differs in thinner pectines and longer legs.

**COLORATION:** Entire body pale yellow to golden orange, without contrasting markings except as follows: Eyes black, and median eye tubercles dusky only around eyes. Articulation spots on appendages dull red. Tip of sting red. Carinae on cauda somewhat paler because of narrow yellow bands beneath integument.

**STRUCTURE:** Similar to that of *boreus* in both sexes except as noted below. Male considerably smaller than female. Measurements given in table 6.

**Carapace:** Anterior margin essentially straight, set with six quite long setae; sides essentially straight; width at rounded caudal margins about equal to length. Median eyes of average size, separated only by their diameter, placed just in front of middle of shield, set on low, oval, connate tubercles bearing few granules along inner margins; width of median diad about one-fourth of width of carapace at that point (5/23). Granulation heavier in both sexes than that of *boreus*, most conspicuous in elevated areas.

**Preabdomen:** Smooth, shining, with fine granules along side and posterior margins as in *boreus*.

**Cauda:** Stoutier than in typical *boreus* but sculptured essentially as in that species. Dorsal and superior lateral keels prominent, more or less strongly crenulate, with granules rounded. Inferior lateral keel distinct on all segments, weak on segment I, smooth on segments II and III, smooth except for a few granules on posterior fifth of segment IV. Inferior lateral keels of segment V serrate to granulate; single median keel with irregular row of granules; intercarinal spaces with scattered, small granules. Segment V somewhat longer than carapace in both sexes. Segments I-IV with 3-3-4-4 pairs of setae on obsolete median keels of female; with 3-4-5-5 in two males.

**Telson:** Of female: with vesicle subglobose, quite smooth, and short; moderately curved sting about half as long as vesicle; subaculear nodule inconspicuous; of male: with thinner vesicle and longer sting; subaculear nodule a small, rounded elevation.

**Pectines:** Pectinal teeth of female 18-20, of male 25-29.

**Chelicerae:** Similar to those of *boreus* in both sexes. Lower margin of fixed finger with three nodules at base in female, only two in male. Lower margin of movable finger with keel dissected into five or six irregularly formed denticles.

**Pedipalps:** Those of female with very heavy hands and short fingers as in *boreus*. All carinae quite prominent, with inner and outer ones coarsely granulated, but superior and inner accessory carinae of both surfaces smoother, with more scattered granules. Inner keels of fingers

scalloped in basal half, armed with small granules and larger teeth as in *boreus*. Pedipalps of male thinner than those of female.

Walking legs: Second and third protarsi with six or seven long setae; second protarsus of male four times as long as deep (21/5).

TYPE DATA: Female holotype from Saratoga Springs, Death Valley, California, April 23–24, 1955.

DISTRIBUTION: Southern California and Nevada (fig. 55).

RECORDS: *Nevada*: Nye County: Ash Meadow, June 5, 1954 (M. A. Cazier), male. *California*: San Bernardino County: Saratoga Springs, February 19, 1955 (W. McDonald), female, 18 teeth in comb; Pisgah Crater, February 25, 1961 (Norris and Heath), male, 25 teeth.

*Vejovis becki* Gertsch and Allred

Figures 39–41, 56, 59, 60, 65

*Vejovis becki* GERTSCH AND ALLRED, 1965, p. 9, figs. 1, 2, 4, 7, 10, 20, table 2.

DIAGNOSIS: Resembling *mesaensis* in lacking dark pattern on preabdomen and in having eyes of quite large size. Quite slender hands and long fingers readily separating it from that and most species in series. Chelicerae large and having distal tooth on upper margin of movable finger of medium size, widely separated from large apical tooth of lower margin. Male and female as shown in figures 59 and 60.

COLORATION: Base color in both sexes yellow to bright orange-brown, but legs and pectines pale yellow. Carapace (fig. 65) typically with dark pattern as follows: Eyes and eye tubercles black; dark central dusky patch enclosing median eyes and from it inconspicuous dusky shadings radiating toward side eyes; central patch in some cases limited to median eyes, with rest of carapace pale. Preabdomen and cauda unmarked above or below; tip of sting dark red.

STRUCTURE: Similar to that of *boreus* in both sexes except as noted below. Males smaller and more slender than females. Measurements given in table 7.

Carapace: Shape of carapace of female from Nevada test site as shown in figure 65. Anterior margin essentially straight, more rarely with gentle curvature, set with six suberect setae. Granulation as in *boreus*, most distinct in males. Median eyes large, on conspicuous suboval tubercles; width of median diad about one-third of width of carapace at this point, somewhat less in a few specimens.

Cauda: Sculpturing essentially as in *boreus*. Segments I–IV with 4-5-5-5 pairs of setae on obsolete, inferior, median keels.

Telson: Sting moderately curved, shorter than quite smooth vesicle.



FIGS. 59, 60. *Vejovis becki* Gertsch and Allred. 59. Male from Nevada. 60. Female from California. Both  $\times 2$ .

Subaculear nodule inconspicuous. Vesicle about as wide as segment V of cauda.

Pectines: Similar to those of *boreus* in both sexes. Those of female of median width and length; middle lamellae consisting of about 20 small oval pieces; pectinal teeth numbering from 17 to 21. Those of male much





FIGS. 61, 62. *Vejovis mesaensis* (Stahnke). 61. Female. 62. Male. Both  $\times 1.5$ .  
 FIG. 63. *Vejovis luteolus*, new species, female.  $\times 1.5$ .

larger and broader; middle lamellae about 30 small ovoid pieces; pectinal teeth long, curved, numbering 24 to 29.

Chelicerae: Similar in both sexes (figs. 39-41) and most closely resembling those of *stahnkei* and *gracilior*. Fixed finger with typical dentition, with long, thin, apical spur, with faint indication of, or completely lacking, rounded nodules on nearly obsolete lower margin. Movable finger a very

TABLE 7  
MEASUREMENTS (IN MILLIMETERS) OF *Vejovis becki*

	Female Nevada	Male Nevada	Female California	Male California
Total length	39.2	32.9	39.4	37.1
Carapace				
Length	5.7	4.4	6.0	4.8
Width at lateral eyes	3.5	2.7	3.7	2.7
Width at caudal edge	5.0	3.9	5.5	4.0
Preabdomen, length	13.7	10.0	11.0	12.5
Postabdomen, length	19.8	18.5	22.4	19.8
Caudal segment I				
Length	2.7	2.5	3.0	2.7
Width	2.7	2.1	3.0	2.2
Caudal segment II				
Length	3.0	3.1	3.7	3.3
Width	2.4	2.0	2.1	2.0
Caudal segment III				
Length	3.3	3.2	3.9	3.5
Width	2.3	2.0	2.6	1.8
Caudal segment IV				
Length	4.3	4.0	4.8	4.3
Width	2.1	1.8	2.4	1.8
Caudal segment V				
Length	6.5	5.7	7.0	6.0
Width	2.3	1.8	2.4	1.8
Telson, length	6.7	5.0	7.5	5.7
Vesicle				
Length	4.3	3.4	4.8	3.5
Width	2.5	1.7	2.6	1.8
Depth	2.2	1.3	2.2	1.4
Spine, length	2.3	1.6	2.5	2.0
Pedipalp, length	17.2	14.4	19.5	16.5
Femur				
Length	4.5	3.9	5.2	4.5
Depth	1.3	1.2	1.5	1.2
Tibia				
Length	4.5	4.1	5.3	4.5
Depth	1.7	1.4	1.9	1.3
Chela, length	9.2	7.5	9.0	7.5
Palm length	4.3	3.7	4.3	3.7
Palm width	2.4	2.3	2.3	1.8
Palm depth	1.8	1.8	1.8	1.5
Fixed finger, length	4.6	3.7	4.3	3.7
Movable finger, length	5.7	4.5	5.6	4.7
Pectines				
Teeth	21/21	25/27	20/20	26/27
Middle lamellae	18	20	17	20

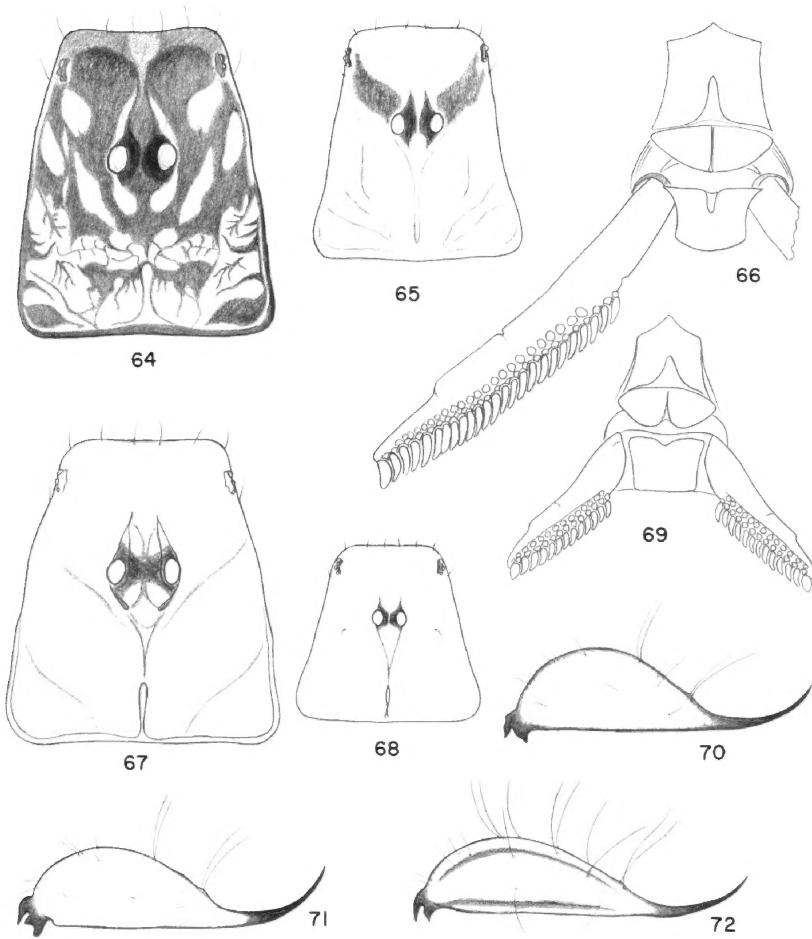


FIG. 64. *Vejovis vachoni* (Stahnke), carapace of female.

FIG. 65. *Vejovis becki* Gertsch and Allred, carapace of female.

FIG. 66. *Vejovis vachoni* (Stahnke), pectines of female.

FIG. 67. *Vejovis mesaensis* (Stahnke), carapace of female.

FIGS. 68, 69. *Vejovis luteolus*, new species. 68. Carapace of female. 69. Pectines of female.

FIG. 70. *Vejovis mesaensis* (Stahnke), telson.

FIG. 71. *Vejovis xanthus*, new species, telson.

FIG. 72. *Vejovis mesaensis* (Stahnke), telson.

long, flat blade, bearing on upper margin five teeth of which distal one is of medium size, well separated from enlarged apical tooth of lower margin (fig. 40); carina of lower margin crenulate, dissected into series of six to 12 pale teeth.

**Pedipalps:** In both sexes quite long, with hands of medium size and long fingers. Femur about three times as long as broad, with all carinae distinct and granulated. Tibia not fully three times as long as broad, narrowed at base, inflated at center, with all carinae granulated. Chela with all eight carinae low and set with small granules. Inner keels essentially straight to lightly scalloped, with small granules and teeth arranged as in *boreus*.

**Walking legs:** Protarsi of third legs with series of about seven long setae.

**TYPE DATA:** Male holotype from the Nevada test site, approximately 34 miles due north of Mercury, Nye County, Nevada, July 21, 1961, in the American Museum of Natural History.

**DISTRIBUTION:** Southern Nevada and southern California (fig. 56).

**RECORDS:** *California:* Riverside County: Indio, April 3, 1959 (W. J. Gertsch), female. Los Angeles County: Pearblossom, May 2, 1960 (W. J. Gertsch), male. San Bernardino County: Saratoga Springs, Death Valley, February 9, 1955 (W. McDonald), female; Phelan, April 19, 1960 (W. J. Gertsch), female; Pisgah Crater, February 11 to July 12, 1961-1962 (Norris and Heath), two males, 11 females; Victorville, April 2, 1922 (E. Seton), three females. Kern County: Two miles south of Mojave, June 29, 1960 (T. S. Briggs), male. Inyo County: Lee Flat, on Saline Valley road, 6.7 miles southwest of Grapevine Canyon, south of Saline Valley, August 27, 1965 (T. S. Briggs, K. Hom), under yucca, male; Grapevine Canyon, south of Saline Valley, August 27, 1965 (V. Lee, K. Hom), exposed at night by LIV lamp, female, two immature; Olancha, July 18, 1952 (W. J. Gertsch), male. *Nevada:* Clarke County: Eight miles northeast of junction of Deer Creed road and Highway 52, near Charleston Mountain, August 18, 1965 (K. Hom), two females; Las Vegas, February-June, 1965 (D. J. Zinn), male, two females. Nye County: Nevada test site, north of Mercury (Gertsch and Allred, 1965), many males and females; Lathrop Wells, August 28, 1965 (K. Hom), under boards, three immature; Round Mountain, June 28, 1961 (F. E. Russell), immature male. Churchill County: Soda Lake, near Fallon, July 23, 1965 (K. Hom), two males, female, two immature.

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