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NEW AND REDEFINED SPECIES BELONGING TO THE *PARUROCTONUS BORREGOENSIS* GROUP (SCORPIONES, VAEJOVIDAE)

Richard M. Haradon

9 High Street
Stoneham, Massachusetts 02180

ABSTRACT

The borregoensis group of the nominate subgenus *Paruroctonus* Werner, 1934, of North America, is differentiated by the combination of: basitarsus II without a mid-retrosuperior seta, pectinal teeth usually 22 or fewer in males and 16 or fewer in females, pedipalp palm with carinae of female weak and smooth, pedipalp primary denticles in rows 1-5 usually 36 or fewer on movable finger and 28 or fewer on fixed finger. Nine essentially allopatric, arenicolous species constituting the borregoensis group are defined or redefined, and keyed: *P. luteolus* (Gertsch and Soleglad, 1966), Mojave and Colorado Deserts; *P. pseudopumilis* (Williams, 1970), southern Vizcaino Desert; *P. borregoensis* Williams, 1972), Colorado Desert; *P. borregoensis actites*, ssp., northeastern coastal Baja California Norte; *P. bajae* Williams, 1972, eastern coastal Baja California Norte; *P. ventosus* Williams, 1972, western coastal Baja California Norte; *P. surensis* Williams and Haradon, 1980, northwestern Vizcaino Desert; *P. ammonastes*, n. sp., southeastern Mojave Desert; *P. hirsutipes*, n. sp., southeastern Colorado Desert; *P. nitidus*, n. sp., southern Baja California Norte.

INTRODUCTION

The borregoensis group of the nominate subgenus *Paruroctonus* Werner, 1934 (see Haradon 1983), contains nine small, arenicolous species distributed more or less allopatrically from the northern Mojave Desert to the southern Vizcaino Desert in Western North America. In this report, which is part of an ongoing generic revision (see Haradon 1984), the borregoensis group is defined, three new species and one new subspecies are described, and six other member species are redefined.

METHODS

New diagnostic characters involving pedipalpal and tarsal macrosetae are discussed in detail by Haradon (1984). The tarsal terminology is that of Couzijn (1976), except that I use the terms prolateral and retrolateral instead of anterior and posterior. Terms referring to specific macrosetae on the pedipalp humerus and brachium are explained in Figures 1-4. Terms referring to specific basitarsal and telotarsal setae are explained in Figures 5-12 and Figures 13-16 respectively.

The number of large superior setae on each basitarsus is given as two counts (distal row + proximal row), or as a single count when two separate rows are indistinct. Metasomal seta counts are given for segments I-IV for the dorsals, dorsolaterals and ventrals, and for segments I-V for the laterals and ventrolaterals. Primary denticle counts on the pedipalp fingers are given for all six rows (distal to proximal), or as the sum of rows 1-5. Primary denticle and tarsal seta counts for the holotype and allotype are given for each side (left-right), or as one number when both sides are the same.

Measurements involving the chelicerae are defined by Francke (1975:109); all other measurements used herein are defined by Stahnke (1970). Statistical data in the text include the observed range (sample mean ± one standard deviation, n = sample size). Acronyms of specimen depositories are explained in the acknowledgments below.

BORREGOENSIS GROUP

Diagnosis.—A species group of nominate subgenus *Paruroctonus* (subgenus diagnosed by absence of short intercarinal setae ventrally on metasomal segments I-IV) differentiated by the combination of: pectinal teeth in males 13-22 (except 26-27 in *Paruroctonus hirsutipes*, n. sp., and to 23 in *Paruroctonus borregoensis actites*, n. ssp.), females 8-16 (except 17-18 in *Paruroctonus nitidus*, n. sp.); pedipalp movable finger length/palm length ratio in adult males 0.8-1.0 [except in about 2% of *Paruroctonus luteolus* (Gertsch and Soleglad, 1966)]; carapace length/pectine length ratio in adult females 1.5-2.2; basitarsus II without mid-retrosuperior (mrs) seta; pedipalp primary denticles in rows 1-5 total on fixed finger 17-28 (except less than 2% of *P. luteolus* with up to 30), movable finger 22-36 (except less than 2% of *P. luteolus* with up to 38); pedipalp palm with carinae granular in adult males, weak and smooth in adult females, intercarinal surfaces in both sexes flat or subtly concave to convex (see *P. luteolus* in Soleglad 1973:fig. 8).

Comparisons: Species in the partly sympatric *Paruroctonus baergi* (Williams and Hadley, 1967) group (see Haradon, 1984) differ in having: pectinal teeth in males 23-29 (except one population of *P. baergi* with low of 20), females 17-22 (except certain populations of *P. baergi* with lows of 13-15); pedipalp movable finger length/palm length ratio in adult males 1.1-1.2; carapace length/pectine length ratio in adult females 1.2-1.4; pedipalp primary denticles in rows 1-5 total on fixed finger 28-44, movable finger 36-57; pedipalp palm in both sexes with carinae well developed, granular, intercarinal surfaces concave.

Paruroctonus xanthus (Gertsch and Soleglad, 1966), from the southeastern part of the Colorado Desert, differs primarily in having: pectinal teeth in males 28-32, females 19-23; pedipalp primary denticles on movable finger in seven (not six) rows; pedipalp primary denticles total in rows 1-5 on fixed finger more than 80, in rows 1-6 on movable finger more than 90; pedipalp movable finger length/palm length ratio in adults of both sexes 1.5-1.6.

All other species in the subgenus *Paruroctonus*, and representing several species groups, have a distinctly differentiated mrs seta on basitarsus II.

Group description.—Total adult length 24 to 41 mm (rarely longer); adult carapace length in males 3.3-4.5 mm (rarely longer), females 3.5-5.2 mm (rarely longer); pedipalp movable finger length/palm length ratio in adult females 1.0-1.1; carapace length/pectine length ratio in adult males 0.9-1.0, pectines extend to about 1/3 length of trochanter IV, pectines in adult female usually do not extend to trochanter IV; carapacial, mesosomal, metasomal and pedipalpal cuticular surfaces generally granular in adult males, smooth and

glossy in juvenile males (see Williams 1980: fig. 43) and juvenile and adult females; carapace length/cheliceral fixed digit length ratio 6.8-8.6; pedipalp humerus with two inframedial macrosetae on proximal 3/5 of internal surface (except inconspicuous or absent in *P. hirsutipes*, n. sp.); pedipalp fingers with six rows of primary denticles [except rows indistinct in *Paruroctonus pseudopumilis* (Williams, 1970b)]; pedipalp fingers of adult males scalloped, closed fingers form proximal gap (except in *P. pseudopumilis*); basitarsi I-III, especially in females, moderately to strongly compressed laterally; distinctly differentiated mrs seta absent on basitarsi I-II, present on III-IV; telotarsi II-IV with two retroinferior terminal setae.

Distribution.–Sandy soils, primarily dunes, from southern Nevada and northern Mojave Desert, southward through the Colorado Desert into the Vizcaino Desert.

Species included.–*Paruroctonus luteolus* (Gertsch and Soleglad, 1966); *Paruroctonus pseudopumilis* (Williams, 1970b); *Paruroctonus borregoensis* Williams, 1972; *Paruroctonus borregoensis actites*, n. ssp.; *Paruroctonus bajae* Williams, 1972; *Paruroctonus ventosus* Williams, 1972; *Paruroctonus surensis* Williams and Haradon, in Williams 1980; *Paruroctonus ammonastes*, n. sp.; *Paruroctonus hirsutipes*, n. sp.; *Paruroctonus nitidus*, n. sp.

Remarks.–This species group is named after *P. borregoensis*, one of the group's more widely distributed and morphologically typical species.

Paravaejovis Williams, 1980, represented only by *Paravaejovis pumilis* (Williams, 1970a) from the Magdalena Plain in Baja California Sur, is differentiated from other vaejovines by having 34 trichobothria on the pedipalp chela. However, species deviating from the typical vaejovine count of 26 chelal trichobothria are now known in *Uroctonus* Thorell, 1876, and from the typical 14 external trichobothria on the brachium in *Vaejovis* Koch, 1836, and *Paruroctonus* (see *P. ammonastes*, n. sp., below). Thus, the phylogenetic significance of the deviation exhibited by *Paravaejovis* from other vaejovines is open to doubt. Before any taxonomic importance was attached to the trichobothrial count in *Paravaejovis*, Stahnke (1974:138), who made no mention of that characteristic, placed this taxon in *Paruroctonus*, for reasons not explicitly stated. The structure of the carapace, metasoma, pectines, pedipalps and legs, and the sexual dimorphism shown by *Paravaejovis*, indicate to me that this taxon is most closely related, if not subordinate, to the borregoensis group. This problem, however, is not yet resolved.

Paruroctonus borregoensis Williams
Figs. 1-2, 5-8, 14, 17-18, 27

Vejovis (Paruroctonus) luteolus Gertsch and Soleglad 1966:42, fig. 56 (in part, female from San Felipe, Baja California Norte, Mexico).

Paruroctonus borregoensis Williams 1972:3, 5-6, 7, fig. 2, tbl. 2, 1976:2, 1980:33, 34-35, 41, 117, figs. 35D, 36B, 37C, 41, tbls, 5, 6; Soleglad 1972:74, 1973:355, tbl. 2; not Polis and Farley 1979a:38, 41, 1979b:526 (= *P. luteolus*); not Polis 1980:27 (= *P. luteolus*); not Polis et al. 1981: 310, 311, 317 (= *P. luteolus*).

Vaejovis luteolus: Diaz-Nájera 1975:10 (in part, repeats misidentification of Gertsch and Soleglad 1966:42).

Paruroctonus luteolus: Williams 1980:36, fig. 41 (in part, records from San Felipe and Persebu, Baja California Norte, Mexico).

Type.–*Paruroctonus borregoensis:* Holotype male (adult) from U.S.A., California, San Diego County, 13 miles NE Borrego Springs (500 ft.), 7 October 1967 (M. A. Cazier et al.). Depository: CAS, Type No. 11336.

Diagnosis.—A species in the borregoensis group of subgenus *Paruroctonus* differentiated by combination of: telotarsus III with three retrosuperior setae (Fig. 14); basitarsus III with seven (5 + 2) superior setae (Figs. 7-8); dorsal and dorsolateral metasomal setae I-IV inconspicuous in adult male; brachium with dsm and dim internal setae (Fig. 1) and chelal internal setae inconspicuous in adult male.

Comparisons.—Table 2. Differs further from *P. ammonastes* in having always 14 trichobothria on external surface of brachium. Differs further from *P. bajae* in having less developed inferior denticles on cheliceral fixed digit; two external medial macrosetae on distal 3/5 of humerus (Fig. 2); primarily granular ventral and ventrolateral metasomal carinae I-IV in male. Differs further from *P. luteolus* in having two retroinferior terminal setae on telotarsus I; two external medial macrosetae on distal 3/5 of humerus; lacking msm internal macroseta on brachium.

Distribution.—Fig. 27. Colorado Desert region.

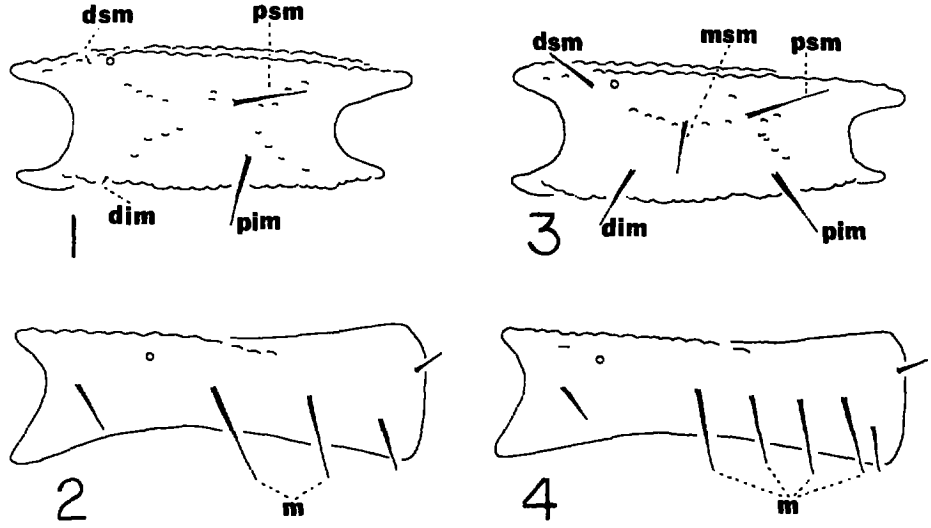
Remarks.—Two subspecies are distinguished by different numbers of pectinal teeth in both sexes.

Specimens examined.—See subspecies below.

Paruroctonus borregoensis borregoensis Williams
Figs. 1-2, 5-8, 14, 17-18, 27

Paruroctonus borregoensis Williams 1972:3, 5-6, 7, fig. 2, tbl. 2, 1976:2, 1980:33, 34-35, 41, 117, figs. 35D, 36B, 37C, 41, tbls. 5, 6; Soleglad 1972:74, 1973:355, tbl. 2; not Polis and Farley 1979a:38, 41, 1979b:526 (= *P. luteolus*); not Polis 1980:27 (= *P. luteolus*); not Polis et al. 1981: 310, 311, 317 (= *P. luteolus*).

Diagnosis.—A subspecies of *P. borregoensis* differentiated by: 13-19 pectinal teeth in males, 8-12 in females; metasomal segment V with eight to 11 (usually eight) pairs of ventrolateral setae.



Figs. 1-4.—Right pedipalpal segments. 1-2, *P. borregoensis:* 1, brachium, internal view; 2, humerus, external view. 3-4, *P. luteolus:* 3, brachium internal view; 4, humerus, external view. Key: dim = distal inframedial; dsm = distal supramedial; m = medial; msm = mid-supramedial; pim = proximal inframedial; psm = proximal supramedial; circle = trichobothrium.

Comparisons: *P. borregoensis actites* has 20-23 pectinal teeth in males, 13-15 in females; usually seven pairs of ventrolateral setae on metasomal segment V.

Variation.–Pectinal teeth numbered fewer than 19 in 96% of the males, and fewer than 12 in 92% of the females.

Distribution.–Fig. 27. Extreme southern San Bernardino County, California, southward (excluding the Coachella Valley) along Colorado River into Yuma County, Arizona, and northwestern Sonora; Borrego Desert, California, southward into extreme northeastern Baja California Norte.

Specimens examined.–U.S.A.: CALIFORNIA; *San Bernardino County,* Clarks Pass, 27 mi. E Twentynine Palms, 3 September 1972 (R. M. Haradon, J. L. Marks), 21 males, 1 female (CAS), Clarks Pass, April 1972 (R. M. Haradon, J. L. Marks), 2 males (CAS); *Riverside County,* approx. 26.9 mi. N Desert Center, 6 May 1972 (R. M. Haradon, J. L. Marks), 1 male, 1 female (CAS), 8.2 mi. N Desert Center, 29 April 1973 (R. M. Haradon, J. L. Marks), 1 male, 1 female (CAS); *Imperial County,* Paloverde, 23 July 1967 (M. A. Cazier, J. Davidson), 2 females (CAS), Paloverde, 16 March 1976 (M. A. Cazier, O. F. Francke), 4 females (OFF), 8 mi. E Bonds Corner, 6 October 1967 (M. A. Cazier et al.), 2 males, 3 females (CAS), 9 mi. E Bonds Corner, 6 October 1967 (M. A. Cazier et al.), 1 male (CAS), 10 mi. W Glamis, 1 May 1976 (J. Bigelow), 1 female (OFF), 8 mi. W Glamis, 14 October 1967 (M. A. Cazier et al.), 1 male, 4 females (CAS), 13 mi. W Winterhaven, 18 March 1976 (M. A. Cazier, O. F. Francke), 1 female (OFF); *San Diego County,* Borrego Valley, N. end Digiorgio Rd., 4 May 1968 (M. A. Cazier, R. Smoot), 8 males, 7 females (CAS), Borrego State Park, 19 April 1969 (R. R. Pinger, M. Wasbauer), 1 male, 1 female (CAS), Borrego Valley, Borrego Springs dump, 5 May 1968 (M. Cazier, R. Smoot), 2 males, 1 female (CAS), Borrego Valley, 2 mi. W Pegleg Mon., 4 May 1968 (M. A. Cazier, R. Smoot), 1 male (CAS), E Borrego Springs along Pegleg Rd., 21 April 1973 (R. M. Haradon, J. L. Marks), 13 males, 17 females (CAS), E Borrego Springs along Salton Seaway at jct. Font's Point Wash, 21 April 1973 (R. M. Haradon, J. L. Marks), 11 males, 28 females (CAS), E Borrego Springs between dump and Pegleg Smith Mon., 31 October 1980 (S. C. Williams), 1 male, 2 females (CAS), 6 mi. E Borrego Springs, 7 October 1967 (M. A. Cazier et al.), 7 males, 7 females (CAS), 6 mi. NE Borrego Springs, 7 October 1967 (M. A. Cazier et al.), 14 males, 1 female (CAS), 13 mi. NE Borrego Springs, 7 October 1967 (M. A. Cazier et al.), 19 males, 5 females (CAS): ARIZONA; *Yuma County,* San Luis, 22 July 1967 (M. A. Cazier et al.), 2 females (CAS), 3 mi. E Imperial Dam, 14 July 1969 (D. Johnson, J. Bigelow), 1 female (OFF), 10 mi. E Yuma, 31 July 1967 (M. A. Cazier, J. Davidson), 2 females (OFF), 6 mi. E Tacna, Mohawk Sand Dunes, 24 September 1970 (W. Fox, J. Bigelow), 3 females (OFF), 4 mi. SW Mohawk Hwy., 11 July 1970 (W. K. Fox), 3 males, 3 females (OFF). **MEXICO:** SONORA; 6.5 mi. N Puerto Peñasco, 3 June 1968 (M. A. Cazier et al.), 1 male, 1 female (CAS), 5 mi. N El Golfo, 5 June 1968 (M. A. Cazier), 1 male (CAS), Cholla Bay, near Puerto Peñasco, 11 November 1966 (S. C. Williams), 1 male (CAS); BAJA CALIFORNIA NORTE; N end Laguna Salada, 31 March 1969 (S. C. Williams), 1 male (CAS).

Paruroctonus borregoensis actites, new subspecies
Fig. 27

Vejovis (Paruroctonus) luteolus Gertsch and Soleglad 1966:42, fig. 56 (in part, female from San Felipe, Baja California Norte, Mexico).

Vaejovis luteolus: Diaz-Nájera 1975:7, (in part, repeats misidentification of Gertsch and Soleglad 1966:42).

Paruroctonus luteolus: Williams 1980:36, fig. 41 (in part, records from San Felipe and Persebu, Baja California Norte, Mexico).

Type.–*Paruroctonus borregoensis actites:* Holotype female (adult) from Mexico, Baja California Norte, 1 mile N San Felipe, 6 June 1968 (M. A. Cazier). Depository: CAS, Type No. 15058.

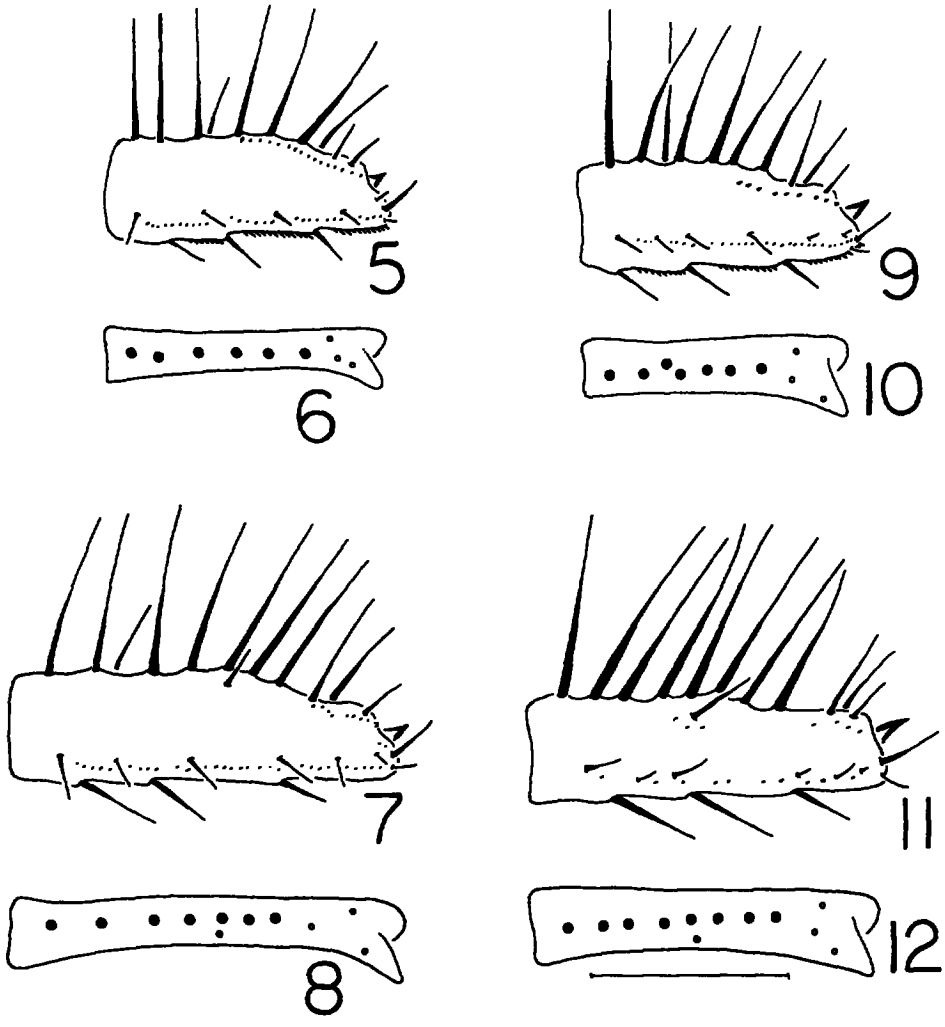
Diagnosis.–A subspecies of *P. borregoensis* differentiated by: pectinal teeth in males 20-23, in females 13-15; metasomal segment V with seven to eight pairs of ventrolateral setae (eighth seta, when present, occurs between and is offset from third and fourth setae in normal series).

Comparisons: *P. borregoensis borregoensis* has 13-19 pectinal teeth in males, 8-12 in females; usually eight evenly developed pairs of ventrolateral setae on metasomal segment V.

Description of female holotype (adult male unknown).–Measurements: Table 1. Metasomal setae: well developed, long; dorsals 0,1,1,2; dorsolaterals 0,0,1,2-3; laterals 0,0,0,0,2; ventrolaterals 2,3,3,3,7; ventrals 3,3-4,4,4-5. Primary denticles on pedipalp fixed fingers 2-3,4,5,6-7,5,12-11, movable fingers 4-3,5,6-7,5-8,7-8,6-7.

Etymology.–The name "actites" refers to the coastal region in which this subspecies occurs.

Distribution.–Fig. 27. Northeastern coastal region of Baja California Norte.



Figs. 5-12.–Right basitarsi II and III. 5-8. *P. borregoensis:* 5, II, retrolateral view; 6, II, superior view; 7, III, retrolateral view; 8, III, superior view. 9-12, *P. ammonastes:* 9, II, retrolateral view; 10, II, superior view; 11, III, retrolateral view; 12, III, superior view. Key: large circles = diagnostic superior setae; small solid circle = mid-retrosuperior (mrs) seta; small open circles = prosuperior and retrosuperior landmark setae. Scale = 1.0 mm.

Table 1.–Measurements (in millimeters) of the holotypes,and one allotype, of new species and subspecies belonging to the *Paruroctonus borregoensis* group. L = length, W = width, D = depth.

	P. borregoensis actites	*P. ammonastes*		*P. hirsutipes*	*P. nitidus*
	Holotype ♀	Holotype ♂	Allotype ♀	Holotype ♀	Holotype ♀
Total L	35.8	32.4	32.8	27.6	32.4
Carapace L	4.5	3.8	4.3	3.8	4.3
Mid-length W	3.5	3.0	3.6	3.0	3.2
Posterior W	4.2	3.4	3.8	3.6	3.6
Median eyes W	0.9	0.8	0.8	0.8	0.8
Mesosoma L	10.8	8.2	9.8	7.2	10.2
Metasoma I L/W	2.2/2.2	2.2/1.8	2.0/2.0	2.0/2.0	2.0/2.0
II L/W	2.6/2.0	2.6/1.8	2.3/1.9	2.5/1.7	2.4/1.8
III L/W	2.8/2.0	2.8/1.8	2.4/1.8	2.6/1.6	2.5/ —
IV L/W	3.4/1.8	3.5/1.6	3.0/1.6	3.0/1.4	2.9/1.4
V L/W	4.9/1.7	4.9/1.5	4.6/1.8	3.5/1.4	4.2/1.6
Telson L/W	4.6/1.6	4.3/1.5	4.4/1.6	3.1/1.0	4.1/1.4
Ampulla L/D	2.4/1.4	2.6/1.2	2.6/1.4	1.8/1.0	2.4/1.2
Chelicera palm L/W	1.2/1.0	1.2/0.9	1.3/1.0	1.2/1.0	1.2/1.0
Fixed digit L	0.6	0.5	0.6	0.5	0.7
Movable digit L	1.2	1.0	1.1	1.0	1.4
Humerus L/W	3.0/1.2	3.2/1.0	3.0/1.1	2.6/1.0	2.8/1.1
Brachium L/W	3.4/1.6	3.0/1.4	3.4/1.4	3.0/1.2	3.2/1.6
Pedipalp palm L/W	3.0/1.6	3.3/2.6	3.3/2.0	2.5/1.5	2.9/1.6
Fixed finger L	2.1	2.1	2.3	2.0	1.9
Movable finger L	3.0	3.0	3.2	2.8	2.6
Pectine dentate L	2.0	3.4	2.1	1.6	2.1
Anterior L	2.5	3.8	2.8	2.4	2.6
Pecitinal teeth	15/15	20/19	15/15	14/15	18/17

Specimens examined.–Paratypes. **MEXICO:** BAJA CALIFORNIA NORTE; 1 mi. N San Felipe, 6 June 1968 (M. A. Cazier), 1 male (CAS), San Felipe, 19 February 1954 (P. H. Arnaud), 1 female (AMNH), Persebu, 23 June 1973 (S. C. Williams, K. B. Blair), 1 male, 1 female (CAS).

Paruroctonus luteolus (Gertsch and Soleglad)
Figs. 3-4, 13, 21-22, 42-46

Vejovis (Paruroctonus) luteolus Gertsch and Soleglad 1966:6, 40-42, figs. 30, 52-54, 56, 63, 68, 69, tbl. 4 (in part, not records from San Felipe (= *P. borregoensis actites*) or 25 mi. N Punta Prieta (= *P. nitidus*), Baja California Norte, Mexico).

Paruroctonus luteolus: Williams 1972:3, 5, 1976:2, 1980: 33, 34, 36, 117, figs. 36A, 37A, 37B, 41, 43, tbls. 5, 6, (in part, not records from San Felipe or Persebu (= *P. borregoensis actites*), or Oakie Landing and Bahia San Luis Gonzaga (= *P. bajae*), Baja California Norte, Mexico); Soleglad 1972:74, 1973:355, tbl. 2, fig. 8; Stahnke 1974:138; Polis and Farley 1979b:526 (erratum, "*luteolis*"); Polis et al. 1981:310, 311, 316, 317.

Paruroctonus borregoensis: Polis and Farley 1979a:38, 41, 1979b:526; Polis 1980:27, tbl. 1; Polis et al. 1981:310, 311, 317.

not *Vaejovis luteolus:* Diaz-Nájera 1975:7, 10 (repeats misidentification of Gertsch and Soleglad 1966:42).

Type.–*Vejovis luteolus:* Holotype female (adult) from U.S.A., California, San Diego County, 2 miles E Anza-Borrego Desert State Park on Hwy. 78, 22 April 1960 (W. J. Gertsch). Depository: AMNH.

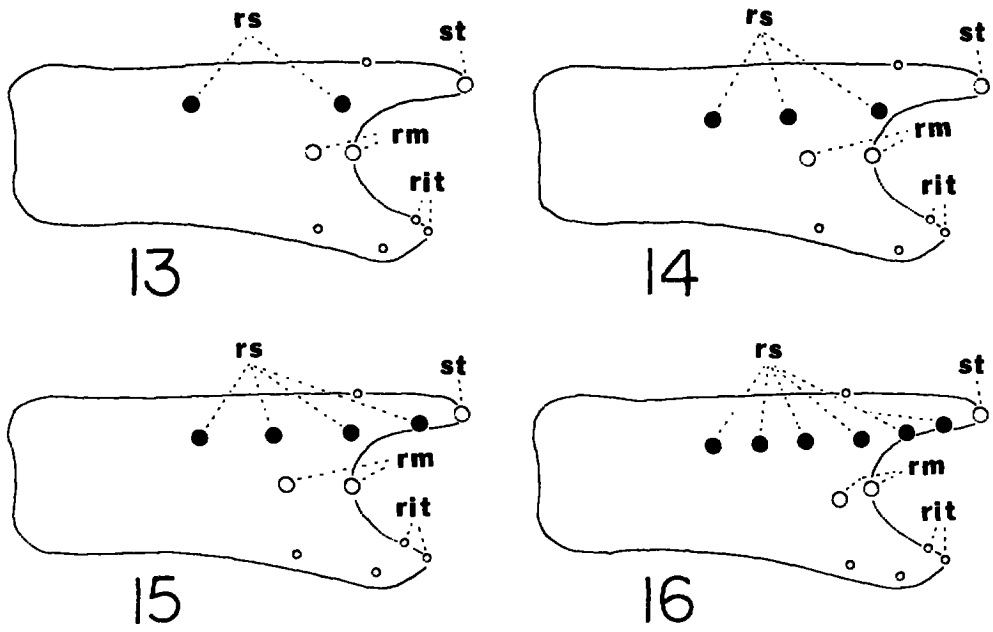
Diagnosis.—A species in the borregoensis group of subgenus *Paruroctonus* differentiated by: telotarsus III with two retrosuperior setae (Fig. 13); basitarsus III with six (4 + 2); superior setae (Figs. 44-45), moderately large extraneous setae often present; brachium with five internal macrosetae, including msm (Fig. 3); telotarsus I with one retroinferior terminal setae.

Comparisons: Table 2. Differs further from *P. borregoensis* and *P. bajae* in having more deeply scalloped pedipalp fingers in adult male (Fig. 21). Differs further from *P. borregoensis* in having four external medial macrosetae on distal 3/5 of humerus (Fig. 4); long dorsal and dorsolateral metasomal setae I-IV in both sexes; four internal macrosetae on pedipalp palm, two on fixed finger, in both sexes. Differs further from *P. bajae* in having granular ventrolateral and ventral metasomal carinae I-IV in male.

Variation.—Two relatively distinct populations are characterized as follows.

Population I. Distribution: Colorado Desert, primarily northwest and west of the Salton Sea. Description: adult carapace length in adult males 3.0-5.0 mm (4.23 ± 0.38 mm, n = 56), females 4.0-6.6 mm (4.42 ± 0.33 mm, n = 77); carapace length/pedipalp palm width ratio in adult males 1.6-1.8 (1.77 ± 0.05, n = 55), females 2.2-2.7 (2.49 ± 0.11, n = 81); pectinal teeth in males 16-22 (18.83 ± 1.30, n = 162), females 10-16 (13.17 ± 1.05, n = 228), 81.6% of females with 13 or more.

Population II. Distribution: Mojave Desert and southern Nevada. Description: adult carapace length in males 2.8-3.8 mm (3.20 ± 0.18 mm, n = 49), females 3.2-4.8 mm (3.52 ± 0.31 mm, n = 29); carapace length/pedipalp palm width ratio in adult males 1.9-2.3 (2.04 ± 0.11, n = 50), females 2.5-2.9 (2.71 ± 0.14, n = 30); pectinal teeth in males 16-19 (17.46 ± 0.96, n = 108), females 10-13 (11.60 ± 0.76, n = 86), 88.4% of females with 12 or fewer.



Figs. 13-16.—Right telotarsus III, retrolateral views. 13, *P. luteolus*. 14, *P. borregoensis*. 15, *P. ammonastes*. 16, *P. hirsutipes*. Key: large closed circles = diagnostic setae; large open circles = large landmark setae; small open circles = small landmark setae; rit = retroinferior terminal; rm = retromedial; rs = retrosuperior; st = superoterminal.

Distribution.–Fig. 46. Mojave Desert and southern Nevada, southward into Yuma County, Arizona, and extreme northeastern Baja California Norte.

Remarks.–More than in other species of the borregoensis group, *P. luteolus* often has one to three moderately large extraneous setae on the superior surface of the basitarsi. The most common of such setae occurs along the prosuperior border just proximal to but offset from the distal row in the diagnostic series. In all the specimens that were studied, however, the basic pattern of 4 + 2 superior setae on basitarsi II and III remained detectable.

A total of 157 males and 168 females (AMNH, CAS, OFF, WDS) of *P. luteolus*, representing 59 separate records, was examined. Many of the records are geographically repetitive, and only representative records at least ten kilometers apart are listed below.

Specimens examined.–Population I. **U.S.A.**: CALIFORNIA; *Riverside County*, Snow Creek Campground, 12 km NW Palm Springs 1980 (S. J. McCormick), 12 males, 8 females (WDS), North Palm Springs, 13 May 1972 (R. M. Haradon), 7 males, 13 females (CAS), 0.7 mi. NW Thousand Palms, 20 April 1973 (R. M. Haradon, J. L. Marks), 2 females (CAS), several mi. NW Indio, 8 April 1974 (R. M. Haradon, W. E. Savary), 3 males, 4 females (CAS), 1 mi. E Mecca (-189 feet), 29 September 1967 (M. A. Cazier et al.), 4 males, 2 females (CAS); *San Diego County*, 3 mi. NW Borrego Springs, 7 October 1967 (M. A. Cazier et al.), 36 males, 15 females (CAS), 7.2 mi. S Borrego Springs on State Rt. 78, 22 December 1965 (K. Hom), 1 male (CAS), Ocotillo Wells, 7 October 1967 (M. A. Cazier et al.), 1 male, 2 females (CAS); *Imperial County*, 19 mi. W Calexico, 6 July 1969 (S. C. Williams, V. Lee, 1 male, 1 female (CAS): ARIZONA; *Yuma County*, Dateland, sand dunes (500 feet), 13 October 1967 (M. A. Cazier et al.), 1 male (OFF). **MEXICO**: BAJA CALIFORNIA NORTE; W side Laguna Salada, February 1963 (J. L. Barr), 1 male (CAS).

Population II. **U.S.A.**: NEVADA; *Lincoln County*, 10 mi. S. Lower Pahranagat Lake, 31 August 1973 (J. Landy), 1 male (OFF): CALIFORNIA; *Inyo County*, Panamint Valley, sand dunes, 13 September 1972 (D. Giuliani), 1 female (CAS), Death Valley Natl. Mon., Bennetts Wells, 14 April 1968 (G. Lytle, B. Nevelyn), 2 females (CAS); *San Bernardino County*, Death Valley Natl. Mon., Saratoga Springs, 11 June 1970 (M. A. Cazier et al.), 4 males, 6 females (CAS, OFF), 7 mi. W Ludlow, 26 March 1972 (H. B. Leech), 1 female (CAS), 3 mi. W Amboy, 11 May 1968 (M. A. Cazier), 1 male, 3 females (CAS), 8 mi. S Amboy, 11 May 1968 (M. A. Cazier et al.), 1 female (CAS), Pisgah Crater, 11 August 1974 (R. M. Haradon, W. E. Savary), 36 males, 16 females (CAS), 3 mi. W Adelanto, 4 September 1972 (R. M. Haradon, J. L. Marks), 2 males, 9 females (CAS), Twentynine Palms, 28 May 1973 (R. M. Haradon, J. L. Marks), 2 males, 3 females (CAS).

Paruroctonus ammonastes, new species
Figs. 9-12, 15, 19-20, 25-26, 27

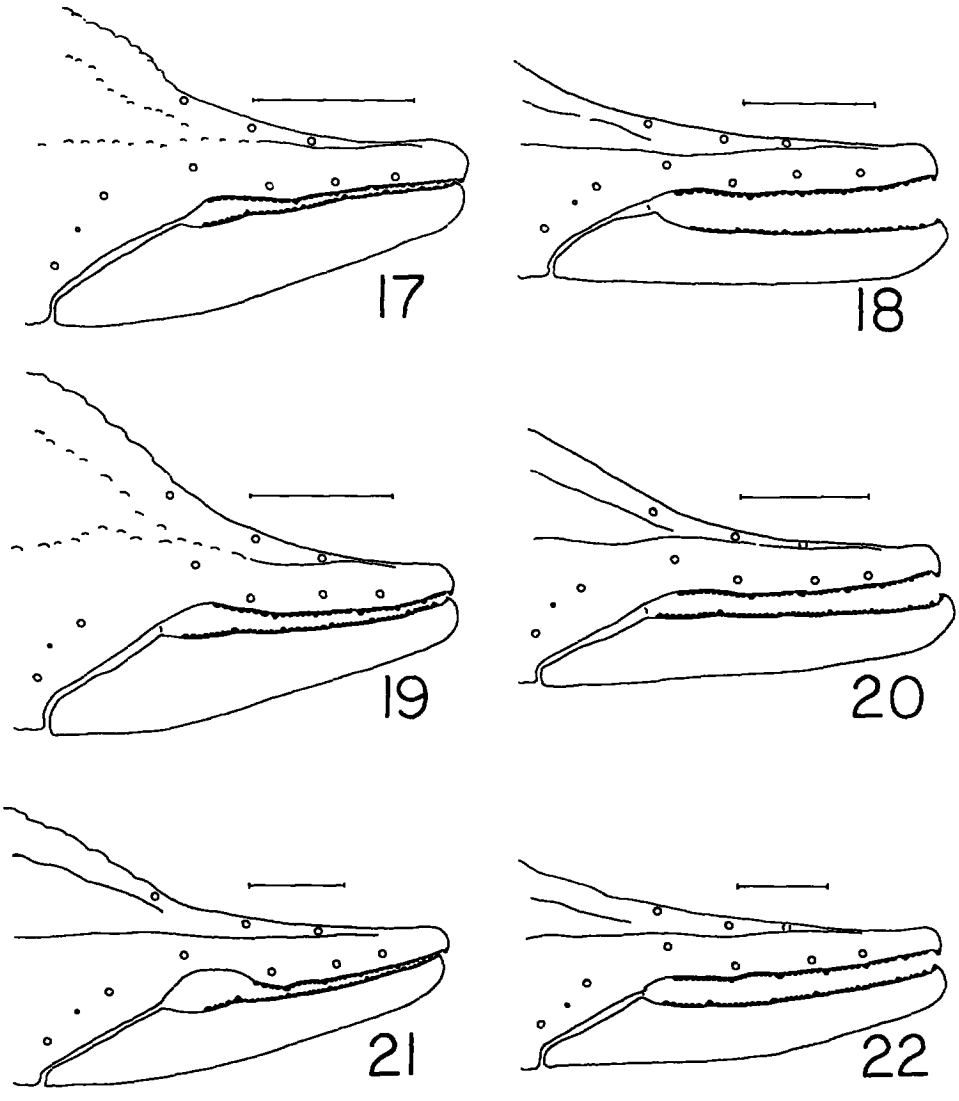
Type.–*Paruroctonus ammonastes:* Holotype male (adult) from U.S.A., Arizona, Mohave County, 2 miles N Lake Havasu, 17 February 1972 (collector unknown). Depository: CAS, Type No. 15054.

Diagnosis.–A species in the borregoensis group of subgenus *Paruroctonus* differentiated by combination of: telotarsus III with four retrosuperior setae (Fig. 15); basitarsus III with eight (6 + 2) superior setae (Figs. 11-12); denticles on inferior border of cheliceral fixed digit distinct, unpigmented; metasomal setae I-IV long in both sexes; pectinal teeth in females 12-16; high incidence of 15 external trichobothria on brachium (Figs. 25-26).

Comparisons: Table 2. Differs further from *P. borregoensis* in having dsm and dim internal brachial and internal chelal macrosetae well developed in both sexes.

Description of male holotype (allotype).–Measurements: Table 1. Coloration: uniformly pale yellow. Carapace: anterior margin indented slightly medially; surface granular; furrows and carinae weakly developed. Tergites: I-VII anterior elevated area smooth,

posterior area finely granular with scattered larger granules (tergites entirely smooth); median carina I-II obsolete, III-VII very weak, lightly granular (smooth); VII with two pairs granular lateral carinae. Sternites: III-VI smooth; VII granular (lightly granular) posteriorly, one pair moderately (weakly) developed lateral carinae. Metasomal carinae: dorsals I-IV moderately developed, dentate (crenulate); dorsolaterals I-IV dentate (crenulate), V granular (lightly granular); laterals I granular (crenulate), II-III marked by few granules posteriorly, V with scattered granules anterior 2/5; ventrolaterals well developed (I-III weakly developed), I granular (smooth), II smooth with few posterior granules (smooth), III granular posterior 1/2 (smooth), IV weakly to moderately granular (smooth



Figs. 17-22.—Right pedipalp fingers, adult state, external views. 17-18, *P. borregoensis:* 17, male; 18, female. 19-20, *P. ammonastes:* 19, male; 20, female. 21-22, *P. luteolus:* 21, male; 22, female. Scale = 1.0 mm.

to granular posteriorly), V dentate; ventrals I-II weak, smooth (obsolete), III weak, few posterior granules (smooth), IV granular (smooth to granular posteriorly), V dentate; intercarinal surfaces finely granular except V with scattered larger granules ventrally. Metasomal setae: long, well developed; dorsals 0,1,1,2; dorsolaterals 1,1,2,3; laterals 1,0,0,0,2; ventrolaterals 3,3,3,4-5,8; ventrals 3,4,4,6. Telson: smooth, except few flattened tubercles ventroanteriorly; 11 pairs long lateral and ventral setae. Pectines: extend to 2/3 length (to proximal margin) of trochanter IV. Chelicera: fixed digit with three to four weak unpigmented denticles on inferior border; movable digit with four to five denticles or crenulations on inferior border. Humerus: all carinae well (moderately) developed, granular; intercarinal surfaces lightly granular; macrosetae include two internal inframedials proximally, four superiors, two external medials. Brachium: all carinae well developed, granular (internal carinae moderately developed, granular, external carinae smooth with few scattered flattened granules); intercarinal surfaces lightly (finely) granular; four internal macrosetae; 15 trichobothria on external surface. Chela: dorsal carina moderately developed, others weakly to moderately developed,granular (all weak to moderate; ventral, ventroexternal and dorsointernal weakly granular proximally); intercarinal surfaces lightly granular (smooth); internal macrosetae include four on palm, distal seta along ventrointernal carina very small, one on movable finger; primary denticles on fixed fingers 4-3,4-5,5,5,5-6,11-12, movable fingers 5,7-6,7,6,7,9-7. Basitarsi I-III: laterally compressed; mrs seta on III moderately developed, set well away from superior setae; superior setae 5-6,5+2,6+2. Telotarsal setae I-IV: proinferiors 1,2,2,2; promedials 2,2,2,1; prosuperiors 2,2,2,2; retrosuperiors 2,3,4,3; retromedials 2,2,2,2; retroinferiors 2,1,2,3; retroinferior terminals 2,2,2,2. Ungues I-IV: about 3/5 as long as telotarsus.

Variation.–Adult carapace length in females 4.0-4.8 mm; total adult length 38-48 mm. Pedipalpal primary denticles in rows 1-5 total on fixed finger 23-28 (24.92 ± 1.50, n = 25), movable finger 30-36 (32.72 ± 1.67, n = 25). In the topotypic sample (n = 11) one specimen had only 14 trichobothria on the external surface of each brachium; two specimens from the same general area but constituting a separate sample both had only 14 trichobothria. The distribution of the external trichobothria on the brachium varied considerably; two examples are shown in Figures 25-26.

Etymology.–The name "ammonastes" refers to the sandy habitat to which this species is well adapted.

Distribution.–Fig. 27. Along the Colorado River in central western Arizona.

Specimens examined.–Paratypes **U.S.A.**: ARIZONA; *Mohave County*, 2 mi. N Lake Havasu, 17 February 1972 (collector unknown), 1 male, 10 females (includes allotype) (CAS), 3 mi. N Topock, campground, 11 April 1969 (A. Hulse), 2 females (OFF).

Paruroctonus hirsutipes, new species
Figs. 16, 23-24, 27, 28-31

Type.–*Paruroctonus hirsutipes:* Holotype female (adult) from U.S.A., California, Imperial County, 14 miles W Winterhaven, 25 July 1967 (M. A. Cazier). Depository: CAS, Type No. 15060.

Diagnosis.–A species in the borregoensis group of subgenus *Paruroctonus* differentiated by any one of the following: telotarsi I-III with 4, 5,5-6 (usually six on III) retrosuperior setae (Fig. 16); basitarsus III with nine to 10 superior setae (Figs. 30-31); basitarsi I-III strongly compressed laterally, superior setae on each segment in single file (Figs. 28-31); humeral macrosetae inconspicuous or absent on internal surface, three on dorsal

Table 2.—Diagnostic character states of the species in the *Paruroctonus borregoensis* group. Sexually dimorphic characters are indicated in the manner, male/female. Meristic data reported as a range of values may be followed by modal or bimodal counts in parentheses.

Characters	*borrego-ensis*	*luteo-lus*	*ammo-nastes*	*hirsuti-pes*	*bajae*	*nitidus*	*vento-sus*	*suren-sis*	*pseudo-pumilis*
Chelicerae									
Fixed digit, inferior denticles: (A) inconspicuous or absent; (B) weak, unpigmented; (C) distinct, pigmented	B-C	C	B	C	C	A-B	A	A	A
Pedipalps									
Finger scalloping, adult male: (A) not scalloped; (B) weak; (C) moderate; (D) deep	C/A	D/A	C/A	?/A	C/?	?/A	D/B	C/A	A
Chelal palm carinae, adult female: (A) weakly granular proximally; (B) weak, but distinct and smooth; (C) very weak to obsolete	B	B	A	B	B	C	B	A	B
Supernumerary denticles, 6th on fixed and 7th on movable fingers: (A) distinct; (B) inconspicuous or absent	A	A	A	A-B	A	A	B	A	B
Humeral macrosetae: External medial count	2	4	2-3(2)	2	4	4	4	2-3(2)	2
Internal: (A) long; (B) inconspicuous or absent	A	A	A	B	A	A	A	A	A
Superior count	4	4	4	3	4	4	4	4	4
Brachial macrosetae: Internal count	2/4	5	4	3	4	4	4	2/4	4
Internal dsm: (A) long; (B) inconspicuous	B/A	A	A	B	A	A	A	B/A	A
Internal dim: (A) long; (B) inconspicuous	B/A	A	A	A	A	A	A	B/A	A
Brachial tricobothria, external count	14	14	14-15(15)	14	14	14	14	14	14
Chelal macrosetae, internal: (A) long; (B) inconspicuous or absent	B/A	A	A	B	A	A	A	B/A	A
Palm count	2	4	4	0	4	4	4	4	4
Fixed finger count	0	2	0-1	0	0	0	0	0	0
Movable finger count	1	1	1	0	1	1	1	1	1
Chelal trichobothria, ventral count	5	5	5	4	5	5	5	5	5
Pectines									
Male count	18-23	16-22	19-21	26-27	20-22	?	15-18	17-19	17-18
Female count	8-15	10-16	12-16	13-15	14	17-18	11-13	9	9-10

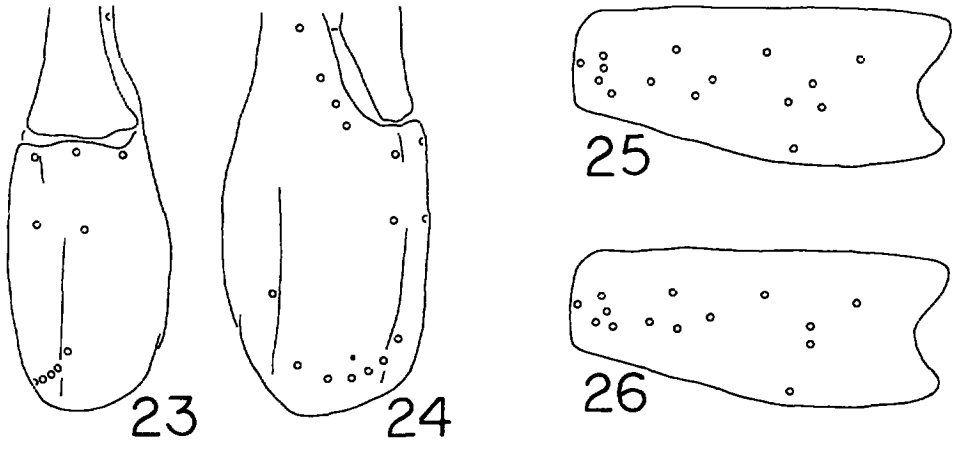
Table 2 continued.

Characters		*borrego-ensis*	*luteo-lus*	*ammo-nastes*	*hirsuti-pes*	*bajae*	*nitidus*	*vento-sus*	*suren-sis*	*pseudo-pumilis*
Legs										
Telotarsal setae: Retrosuperior I-III count		2,2-3,3	2,2,2	2-3,3-4,4	4,5,5-6(6)	2-3,2-3,3	2,2,3	2,3-4,4	2,2-3,4	2,2,2
Retroinferior terminal I count		2	1	2	1	2	2	2	2	2
Superoterminal I-IV: (A) long; (B) absent or inconspicuous		A	A	A	A	A	A	B	A	A
Basitarsal setae: Superior I-III: (A)	I	A	A	A	C	A	A	A	A	A
set irregularly/ (B) in distal +	II	B	B	B	C	B	B	B	B	B
proximal rows; (C) in single file	III	B	B	B	C	B	B	B	B	B
Superior I-III count	I	4-5(5)	4-5	5	4-6	4-5	5	4	5	3-5
	II	3+2,4+2	4+2	4+2,5+2	5-7	4+2	4+2	5+2	5+2	4+2
	III	5+2	4+2	6+2	9-10	4+2	4+2	6+2,7+2	6+2	4+2,5+2
Mrs on III: (A) set well apart from, or (B) set very close to, superior setae		A	A	A	A	A	A	A	B	B
Mrs size: (A) long, stout; (B) short, fine		B	A	A	B	A	A	A	A	A
Metasoma										
Ventrolateral carinae I-IV: (A) entirely	I	A-B/D	A/D	A-B/D	?/D	C	?/D	D	D	C/D
granular; (B) granular posterior 1/3	II	A-B/D	A/D	A-B/D	?/C-D	C	?/D	C-D/D	C-D/D	C/D
to 1/2; (C) weak, few posterior	III	A/C	A/C	A/C	?/C-D	C	?/D	C-D/D	C-D/D	C/D
granules; (D) very weak to obsolete	IV	A/B	A/B	A/B	?/C	B	?/D	C/D	BC	C
Ventral carinae I-IV: (A) entirely	I	A/D	A-B/D	A/D	?/B-C	D	?/D	D	D	D
granular; (B) granular posterior 1/3	II	B/D	A-B/D	A/D	?/D	D	?/D	D	D	D
to 1/2; (C) weak, few posterior	III	B/D	A/D	A/D	?/D	C	?/D	D	C/D	D
granules; (D) very weak to obsolete	IV	A/B	A/C	A/B	?/A	B-C	?/D	D	B/C	C/D
Dorsal setae I-IV: (A) well developed; (B) inconspicuous		B/A	A	A	B	A	?/A	A	B/A	A
Dorsal setae I-IV count		0,1,1,2	0,1,1,2	0,1,1,2	0,1,1,1	0,1,1,2	0,1,1,2	1,1,1,2	0,1,1,2	0,1,1,2
Ventral setae I-IV: (A) well developed; (B) inconspicuous		A	A	A	A	A	?/A	A	B/A	A
Ventrolateral setae V count		7-9(8)	7-8(7)	8	8-10	8-11	10	8-14(9-10)	7-9(8)	8

surface (proximal absent); chelal internal setae absent; chela with four (of 26) trichobothria on ventral palm (Figs. 23-24); dorsal metasomal setae I-IV inconspicuous in both sexes, 0,1,1,1 pairs: pectinal teeth in males 26-27.

Comparisons: Table 2. Differs further from *P. borregoensis* in having one retroinferior terminal seta on telotarsus I.

Description of female holotype (adult male unknown).–Measurements: Table 1. Coloration: pale yellow with very weak fuscous markings on carapace and tergites. Carapace: anterior margin very subtly concave; surface very finely granular; furrows and carinae weakly developed except posterior median furrow moderately developed posteriorly. Tergites: I-VI uniformly extremely finely granular, posterior margins with very weak granules; VII finely granular; median carina I-IV obsolete, V-VI barely discernible, VII smooth, weak; VII paired lateral carinae weakly developed, weakly granular. Sternites: III-VI smooth to very finely granular; VII lightly granular, one pair moderately developed granular lateral carinae. Metasomal carinae: dorsals I-IV weak, crenulate, dorsal furrow I-III shallow, IV very shallow; dorsolaterals I-IV very weakly granular, V obsolete, smooth; laterals I weakly granular, II-IV obsolete, V marked by few weak granules anteriorly; ventrolaterals I-III weak, smooth, IV weakly granular, V granular to dentate; ventrals I obsolete, II-III weak, smooth, IV weakly granular, V dentate; intercarinal surfaces very finely granular except V sparsely granular ventrally. Metasomal setae: short to moderately long, very fine; dorsals 0,1,1,1; dorsolaterals inconspicuous or absent; laterals 0,0,0,0,2-3; ventrolaterals 2,3,3,4,10; ventrals 2,3,4,4. Telson: smooth; eight pairs long lateral and ventral setae. Pectines: do not quite reach distal margin of coxa IV. Chelicera: fixed digit with one or two pigmented denticles on inferior border; movable digit with four or five crenulations on inferior border. Humerus: all carinae moderately developed, lightly to moderately granular; intercarinal surfaces very finely granular; macrosetae include three dorsals, proximal absent, and two external medials; internal surface without macrosetae. Brachium: internal carinae weakly granular, external carinae obsolete to smooth; intercarinal surfaces smooth; four internal macrosetae, dim short and fine. Chela: all carinae weak, smooth, except ventroexternal and ventral lightly granular



Figs. 23-26.–Trichobothrial patterns. 23-24, *P. hirsutipes*, pedipalp palm: 23, ventral view; 24, external view. 25-26, *P. ammonastes* brachium, external views: 25, pattern with 15 trichobothria; 26, pattern with 14 trichobothria.

proximally; intercarinal surfaces smooth; internal macrosetae inconspicuous or absent; primary denticles on fixed fingers 3,4,5-6,5,5-4,6-5, movable fingers 6-5,6,6,6-7,6-4,3-4. Basitarsi I-III: strongly compressed laterally; mrs seta on III short, fine, set well away from superior setae; superior setae 6-5,8,10. Telotarsal setae I-IV: proinferiors 1,1,1,1, distal inconspicuous or absent on each segment; promedials 2,2,2,1; prosuperiors 3,3,3,3, proximal distinctly smallest on each; retrosuperiors 4,5,5-6,4, proximal reduced on IV; retromedials 1,2,2,2; retroinferiors 0,1,2,2, distal inconspicuous or absent on each segment III-IV; retroinferior terminals 1,2,2,2, most superior of two inconspicuous or very fine. Ungues I-IV: about 3/4 as long as, or same length as, telotarsus.

Variation.–Weak fuscous markings more evident in immatures. Ventral metasomal setae varied 2,3,3-4,4; laterals on V varied from 0 to 3. Pectines in juvenile male extend to 1/2 length of trochanter IV. Primary denticles in rows 1-5 total on pedipalp fixed finger 22, movable finger 27-32.

Etymology.–The name "hirsutipes" refers to the relatively numerous tarsal setae characterizing this species.

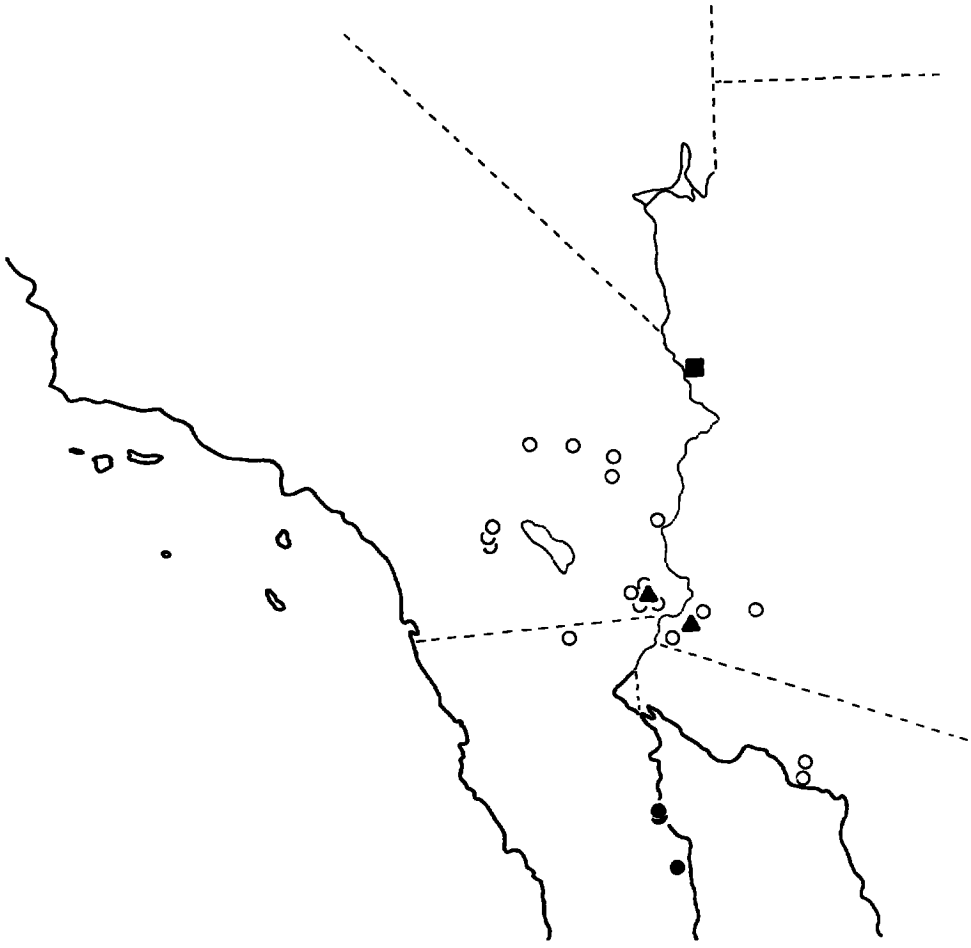


Fig. 27.–Southern California and adjacent areas. Key: *P. ammonastes* (square); *P. hirsutipes* (triangles); *P. borregoensis borregoensis* (open circles); *P. borregoensis actites* (closed circles).

Remarks.—This species and *P. xanthus* represent the most conspicuously modified arenicolous species in the genus *Paruroctonus*. Both species appear to be restricted to the extensive sand dunes at the northern end of the Gulf of California.

Distribution.—Fig. 27. Extreme southeastern California and adjacent Yuma County, Arizona.

Specimens examined.—Paratypes. U.S.A.: CALIFORNIA; *Imperial County*, 13 mi. W Winterhaven, 18 March 1976 (M. A. Cazier, O. F. Francke), 1 male, 1 female (OFF): ARIZONA; *Yuma County*, 1 mi. W Somerton, 19 March 1976 (M. A. Cazier, O. F. Francke), 1 female (OFF).

Paruroctonus bajae Williams
Fig. 36

Paruroctonus bajae Williams 1972:3, 6-7, fig. 3, tbl. 3, 1980:36; Soleglad 1972:74, 1973:355, tbl. 2; Diaz-Nájera 1975:5, 9.

Paruroctonus luteolus: Williams 1980:36, fig. 41 (in part, records from Oakie Landing and 13 km N Bahia San Luis Gonzaga, Baja California Norte, Mexico).

Type.—*Paruroctonus bajae:* Holotype male (adult) from Mexico, Baja California Norte, 8 miles N Bahia San Luis Gonzaga, 13 June 1968 (S. C. Williams, M. A. Cazier, et al.). Depository: CAS, Type No. 11335.

Diagnosis.—Adult female unknown. A species of the borregoensis group of subgenus *Paruroctonus* differentiated by the combination of: telotarsus III with three retrosuperior setae; basitarsus III with six (4 + 2) superior setae; cheliceral fixed digit with denticles on inferior border well developed, pigmented; ventrolateral carinae IV posteriorly crenulate in both sexes; females with 14-15 pectinal teeth.

Comparisons: Table 2. Differs further from *P. nitidus* in having weak but distinct carinae on pedipalp palm of female. Differs further from *P. borregoensis* in having dsm and dim internal setae on brachium and internal macrosetae on pedipalp palm well developed in both sexes; dorsal metasomal setae I-IV well developed in both sexes; four external medial setae on distal 3/5 of humerus. Differs further from *P. luteolus* in having two retroinferior terminal setae on telotarsus I; no msm internal macrosetae on brachium; less deeply scalloped pedipalp fingers in adult male (Fig. 36).

Distribution.—Eastern central coastal region of Baja California Norte.

Specimens examined.—MEXICO: BAJA CALIFORNIA NORTE; approx. 8 mi. N Bahia San Luis Gonzaga, 13 June 1968 (S. C. Williams, M. A. Cazier), 3 males (CAS), Oakies Landing, 27 mi. S Puertecitos, 12 June 1968 (S. C. Williams, M. A. Cazier), 1 female (CAS).

Paruroctonus nitidus, new species

Vejovis (Paruroctonus) luteolus Gertsch and Soleglad 1966:42, fig. 56 (in part, female from 25 mi. N Punta Prieta, Baja California Norte, Mexico).

Vaejovis luteolus: Diaz-Nájera 1975:10 (in part, repeats misidentification of Gertsch and Soleglad 1966:42).

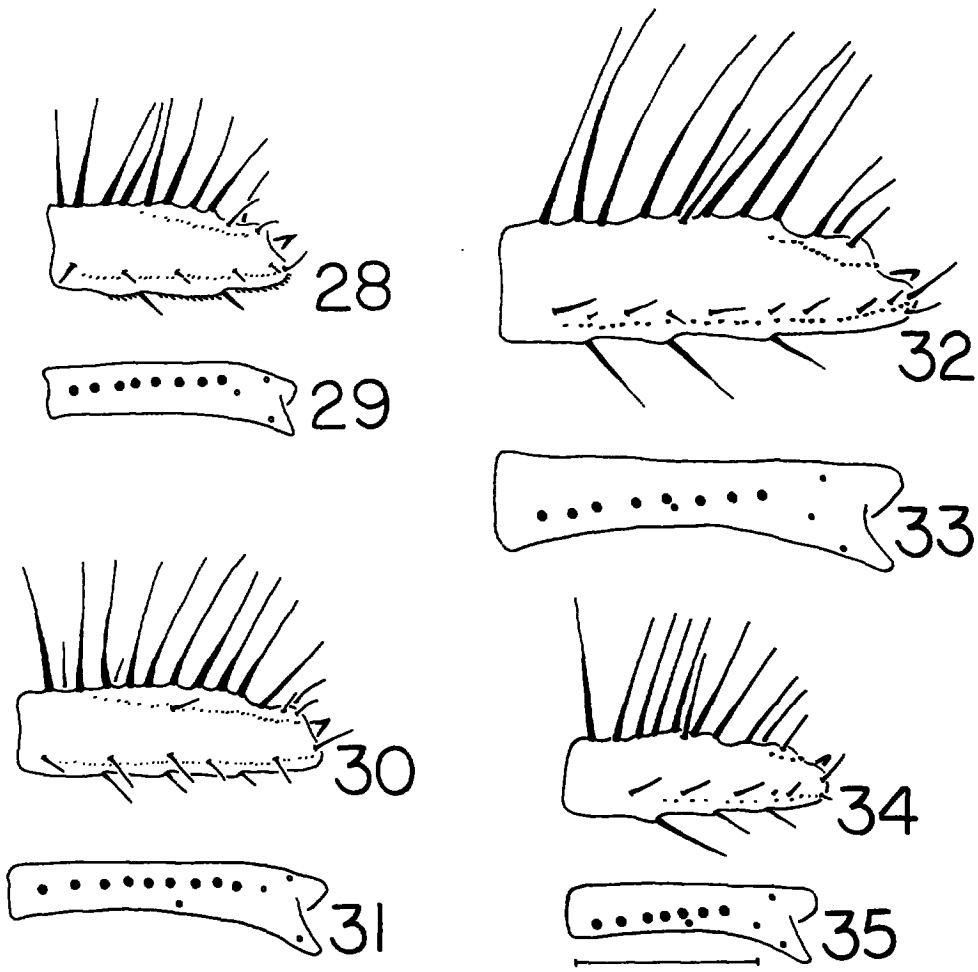
Type.—*Paruroctonus nitidus:* Holotype female (adult) from Mexico, Baja California Norte, 25 miles N Punta Prieta (on desert), 13 January 1965 (V. and B. Roth). Depository: AMNH.

Diagnosis.—Male unknown. A species of the borregoensis group of subgenus *Paruroctonus* differentiated by combination of: telotarsus III with three retrosuperior setae; basitarsus III with six (4 +2) superior setae; cheliceral fixed digit with inconspicuous

denticles on inferior border; ventrolateral carinae IV obsolete in female; pectinal teeth in female 17-18.

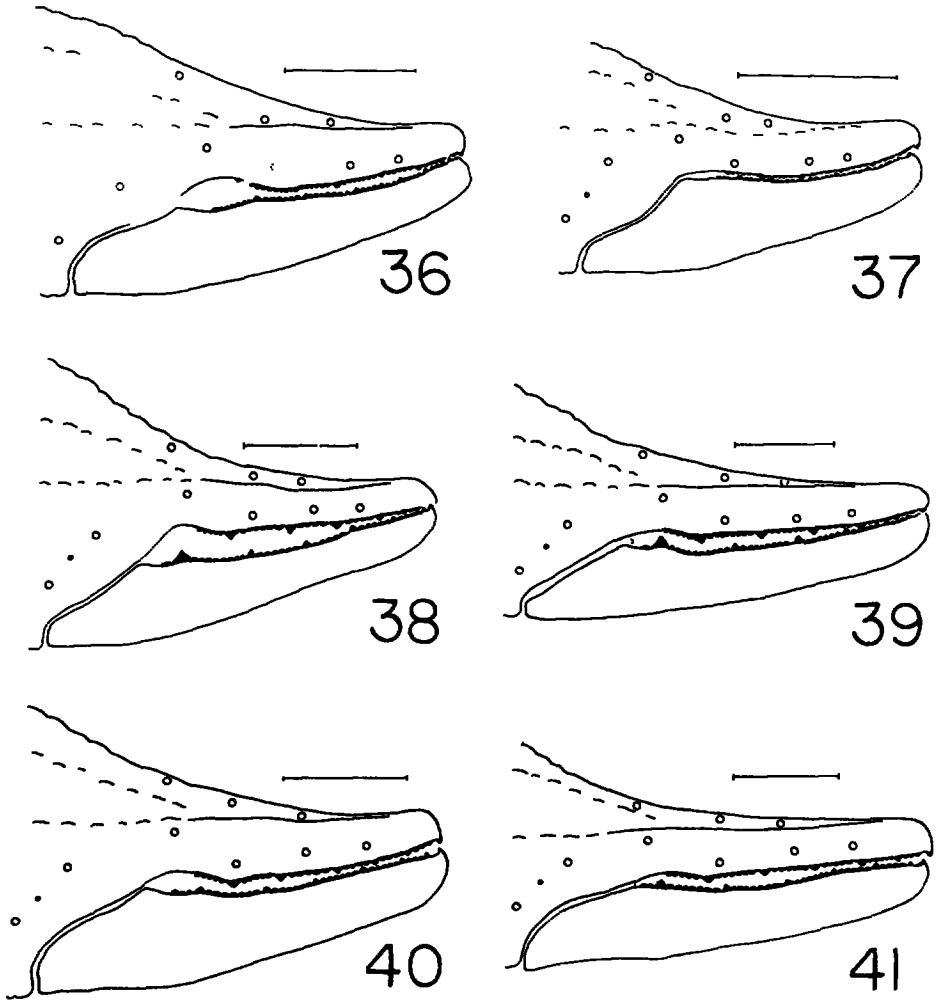
Comparisons: Table 2. Differs further from *P. bajae* in having obsolete to very weak carinae on pedipalp palm of female. Differs further from *P. ventosus* in having long superoterminal seta on telotarsi I-IV; sixth and seventh supernumerary denticles on pedipalp fixed and movable fingers respectively distinct; pedipalp fingers in adult female unscalloped.

Description of female holotype (male unknown).–Measurements: Table 1. Coloration: uniformly golden yellow, except very weak fuscous markings near median ocular tubercle. Carapace: anterior margin protrudes medially; surface smooth, glossy, with few weak granules; furrows and carinae weak. Tergites: I-VII smooth; median carina I obsolete, II-VII weak, smooth; VII paired lateral carinae weakly granular. Sternites: III-VII smooth, glossy; VII with one pair very weak carinae. Metasomal carinae: dorsals I-IV moderately



Figs. 28-35.–Right basitarsi II and III, 28-31, *P. hirsutipes:* II, retrolateral view; 29, II, superior view; 30, III, retrolateral view; 31, III, superior view. 32-33, *P. surensis:* 32, III, retrolateral view; 33, III, superior view. 34-35, *P. pseudopumilis:* 34, III, retrolateral view; 35, III, superior view. Key: see legend to Figs. 5-12.

developed, crenulate; dorsolaterals I-IV moderately developed, crenulate, V obsolete; laterals I weak, smooth, II-III marked by few weak posterior granules, IV-V obsolete; ventrolaterals I-IV obsolete, V moderately granular; ventrals I-IV obsolete, V weak, marked by small scattered granules; intercarinal surfaces smooth except ventral surface of V with fine scattered granules. Metasomal setae: all long; dorsals 0,1,1,2; dorsolaterals indefinite; laterals 1,0,0,0,3; ventrolaterals 2,3,3,4-5,10; ventrals 3,4,4,4. Telson: smooth; about eight pairs long ventral and lateral setae. Pectines: barely extend to distal margin of coxa IV. Chelicera: fixed digit with two to three very weak denticles on inferior border; movable digit with four very weak crenulations on inferior border. Humerus: all carinae weak, smooth; intercarinal surfaces smooth, glossy; macrosetae include two internal inframedials proximally, four dorsals, four external medials on distal 3/5. Brachium: internal carinae weak, smooth; external carinae obsolete to weak, smooth; intercarinal



Figs. 36-41.—Right pedipalp fingers, adult state, external views. 36, *P. bajae*, male. 37, *P. pseudopumilis*, male. 38-39, *P. ventosus:* 38, male; 39, female. 40-41, *P. surensis:* 40, male; 41, female. Scale = 1.0 mm.

surfaces smooth, glossy; four internal macrosetae. Chela: all carinae obsolete to very weak, smooth; intercarinal surfaces smooth, glossy; internal macrosetae include four on palm, one on movable finger; primary denticles on fixed fingers 2,4-3,4-5,4-5,3,6-7, movable fingers 4-2,4-5,6,4-5,4-5,4-5. Basitarsi I-III: laterally compressed; mrs seta on III moderately developed, set well away from superior setae; superior setae 5,4+2,4+2. Telotarsal setae I-IV: proinferiors 1,2,2,2; promedials 2,2,2,2; prosuperiors 2,2,2,2; retrosuperiors 2,3,3,3; retromedials 2,2,2,2; retroinferiors 1,1,2,2; retroinferior terminals 2,2,2,2. Ungues I-IV: about 3/5 as long as telotarsus.

Etymology.—The name "nitidus" refers to the glossy appearance of the female of this species.

Distribution.—Southern Baja California Norte.

Specimens examined.—Known only from holotype.

Paruroctonus ventosus Williams
Figs. 38-39

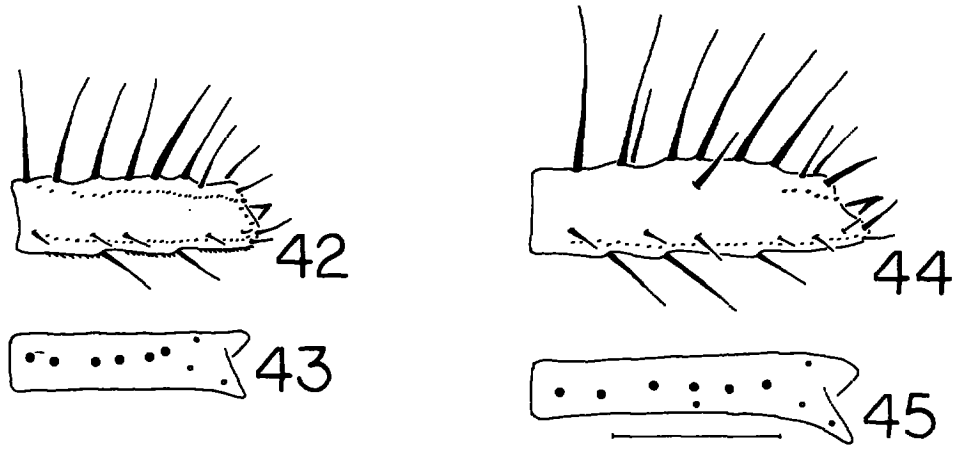
Paruroctonus ventosus Williams 1972:3, 8-9, fig. 4, tbl. 4, 1980:34, 45-46, figs. 41, 48, tbl. 5; Soleglad 1972:74, 1973:355, tbl. 2; Diaz-Nájera 1975:5, 9.

Type.—*Paruroctonus ventosus:* Holotype male (adult) from Mexico, Baja California Norte, Socorro Sand Dunes (200 feet), 12 July 1969 (S. C. Williams, V. F. Lee). Depository: CAS, Type No. 11337.

Diagnosis.—A species in the borregoensis group of subgenus *Paruroctonus* differentiated by combination of: telotarsus III with four retrosuperior setae; basitarsus III with eight (6 + 2) superior setae; sixth and seventh supernumerary denticles on pedipalp fixed and movable fingers respectively inconspicuous or absent; telotarsi I-IV with superoterminal seta inconspicuous or absent; proximal enlarged denticle on pedipalp movable finger three to four times longer than adjacent primary denticles (Figs. 38-39).

Comparisons: Table 2. Differs further from *P. surensis* in having long metasomal setae I-IV in both sexes; females with 11-13 pectinal teeth.

Distribution.—Western coastal region of Baja California Norte.



Figs. 42-45.—Right basitarsi II and III, *P. luteolus:* 42, II, retrolateral view; 43, II, superior view; 44, III, retrolateral view; 45, III, superior view. Key: see legend to Figs. 5-12.

Specimens examined.–MEXICO: BAJA CALIFORNIA NORTE; Socorro Sand Dunes (200 feet), 12 July 1969 (S. C. Williams, V. F. Lee), 2 males, 5 females (CAS), Socorro Sand Dunes, 17 July 1974 (R. M. Haradon et al.), 2 males, 2 females (CAS), 3 mi. N Santa Maria (100 feet), 12 July 1969 (S. C. Williams, V. Lee), 3 females (CAS), NE side San Quintin Bay, 9 September 1963 (B. Seavey, D. Banks), 1 female (CAS).

Paruroctonus surensis Williams and Haradon
Figs. 32-33, 40-41

Paruroctonus surensis Williams and Haradon, in Williams 1980:33, 41, 45, figs. 41, 47, tbls. 1, 2, 5.

Type.–*Paruroctonus surensis:* Holotype male (adult) from Mexico, Baja California Sur, 12 km SE Guerrero Negro, 18 August 1974 (R. M. Haradon, V. F. Lee, W. E. Savary). Depository: CAS, Type No. 12249.

Diagnosis.–A species in the borregoensis group of subgenus *Paruroctonus* differentiated by combination of: telotarsus III with four retrosuperior setae (distal in series

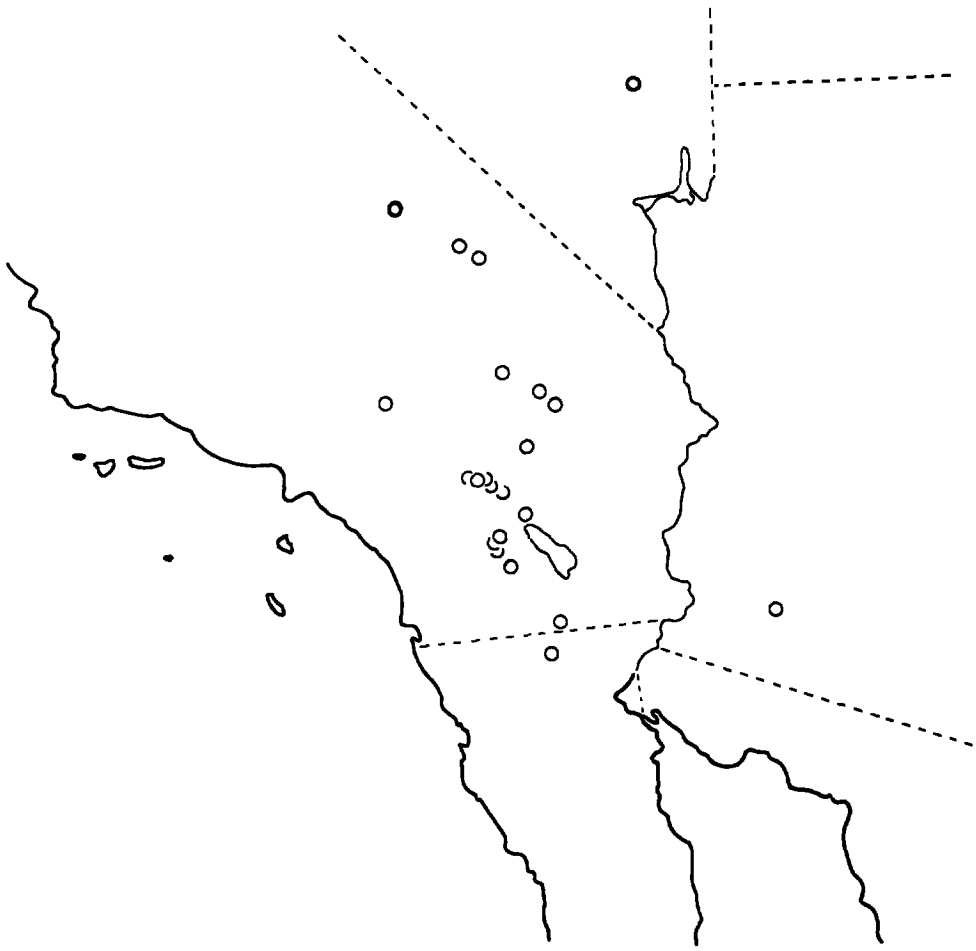


Fig. 46.–Southern California and adjacent areas, showing distribution of *P. luteolus.*

may be slightly smaller than others); basitarsus III with eight (6 + 2) superior setae (Figs. 32-33); mrs seta on basitarsus III set very close to superior setae, all metasomal setae I-IV extremely short, inconspicuous in adult male; pectinal teeth in female 9; pedipalp fingers of adult male moderately scalloped (Fig. 40).

Comparisons: Table 2. Differs further from *P. pseudopumilis* and *P. ventosus* in having sixth and seventh supernumerary denticles on fixed and movable fingers respectively moderately developed, distinct. Differs further from *P. ventosus* in having superoterminal seta on telotarsi I-IV long, well developed; two to three (usually two) external medial macrosetae on distal 3/5 of humerus; proximal enlarged denticle on movable finger about twice as long as adjacent primary denticles.

Distribution.–Northwestern Vizcaino Desert, Baja California Sur.

Specimens examined.–MEXICO: BAJA CALIFORNIA SUR; 7.8 mi. SW Guerrero Negro, 8 August 1974 (R. M. Haradon et al.), 3 males, 1 female (CAS), 7.8 mi. SW Guerrero Negro, 18 July 1974 (R. M. Haradon et al.), 1 female (CAS).

Paruroctonus pseudopumilis (Williams)
Figs. 34-35, 37

Vejovis pseudopumilis Williams 1970b:181-183, figs. 1-2, tbl. 1.
Paruroctonus pseudopumilis: Stahnke 1974:138 (erratum, "*pseudopumilus*"); Williams 1980:34, 38, 39, 41, 115, fig. 45, tbl. 5 (in part, not record from 13 km N San Raymundo, Baja California Sur, Mexico [= *Paravaejovis pumilis* (Williams, 1970a)].
Vaejovis pseudopumilis: Diaz-Nájera 1975:7, 15.

Type.–*Vejovis pseudopumilis:* Holotype male (adult) from Mexico, Baja California Sur, San Angel, 13 miles W San Ignacio, 28 June 1968 (S. C. Williams, M. A. Cazier, et al.). Depository: CAS, Type No. 10424.

Diagnosis.–A species in the borregoensis group of subgenus *Paruroctonus* differentiated by combination of: telotarsus III with two retrosuperior setae; basitarsus III with six (4 + 2) or seven (5 + 2) superior setae (Figs. 34-35); mrs seta on basitarsus III set very close to superior setae; pedipalp fingers of adult male essentially unscalloped (Fig. 37); sixth and seventh supernumerary denticles on pedipalp fixed and movable fingers respectively inconspicuous or absent; pedipalpal primary denticle rows poorly delimited.

Comparisons: Table 2. Differs further from *P. surensis* in having moderately long metasomal setae I-IV in both sexes.

Distribution.–Southern Vizcaino Desert, Baja California Sur.

Specimens examined.–MEXICO: BAJA CALIFORNIA SUR; 26 mi. S El Arco (800 feet), 17 April 1968 (S. C. Williams), 1 male, 2 females (CAS).

KEY TO THE SPECIES AND SUBSPECIES OF THE *PARUROCTONUS BORREGOENSIS* GROUP

1. Telotarsus III with two retrosuperior setae (Fig. 13). 2
   Telotarsus III with three to six retrosuperior setae (Figs. 14-16) 3

2. Brachium with five (including msm) macrosetae on internal surface (Fig. 3); mrs seta on basitarsus III set well away from superior setae (Figs. 44-45). . . . . *luteolus*
   Brachium with four macrosetae on internal surface (msm absent); mrs seta on basitarsus III set very close to superior setae (Figs. 34-35) . . . . . *pseudopumilis*

3. Telotarsus III with three retrosuperior setae (Fig. 14). 4
   Telotarsus III with four to six retrosuperior setae 7

4. Basitarsus III with seven (5 + 2) superior setae (Figs. 7-8) . . . . . *borregoensis* 5
   Basitarsus III with six (4 + 2) superior setae 6

5. Pectinal teeth in males 13-19, females 8-12. . . . . *borregoensis borregoensis*
   Pectinal teeth in males 20-23, females 13-15. . . . . *borregoensis actites*, n. ssp.

6. Cheliceral fixed digit with distinct, pigmented denticles on inferior border; pectinal teeth in females 14 . . . . . *bajae*
   Cheliceral fixed digit with inconspicuous denticles on inferior border; pectinal teeth in females 17-18 . . . . . *nitidus*, n. sp.

7. Telotarsus III with five or six retrosuperior setae (Fig. 16). . . . . *hirsutipes*, n. sp.
   Telotarsus III with four retrosuperior setae (Fig. 15) 8

8. Superoterminal seta on telotarsi I-IV inconspicuous or absent; sixth and seventh supernumerary denticles on pedipalp fixed and movable fingers respectively inconspicuous or absent . . . . . *ventosus*
   Superoterminal seta on telotarsi I-IV long, well developed; sixth and seventh supernumerary denticles on pedipalp fixed and movable fingers respectively well developed, distinct 9

9. Basitarsus III mrs seta set well away from superior setae (Figs. 11-12); metasomal setae I-IV in adult males long; pectinal teeth in females 12-16 . . . . . *ammonastes*, n. sp.
   Basitarsus III mrs seta set very close to superior setae (Figs. 32-33); metasomal setae I-IV in adult male very short, inconspicuous; pectinal teeth in females 9 . . . . *surensis*

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