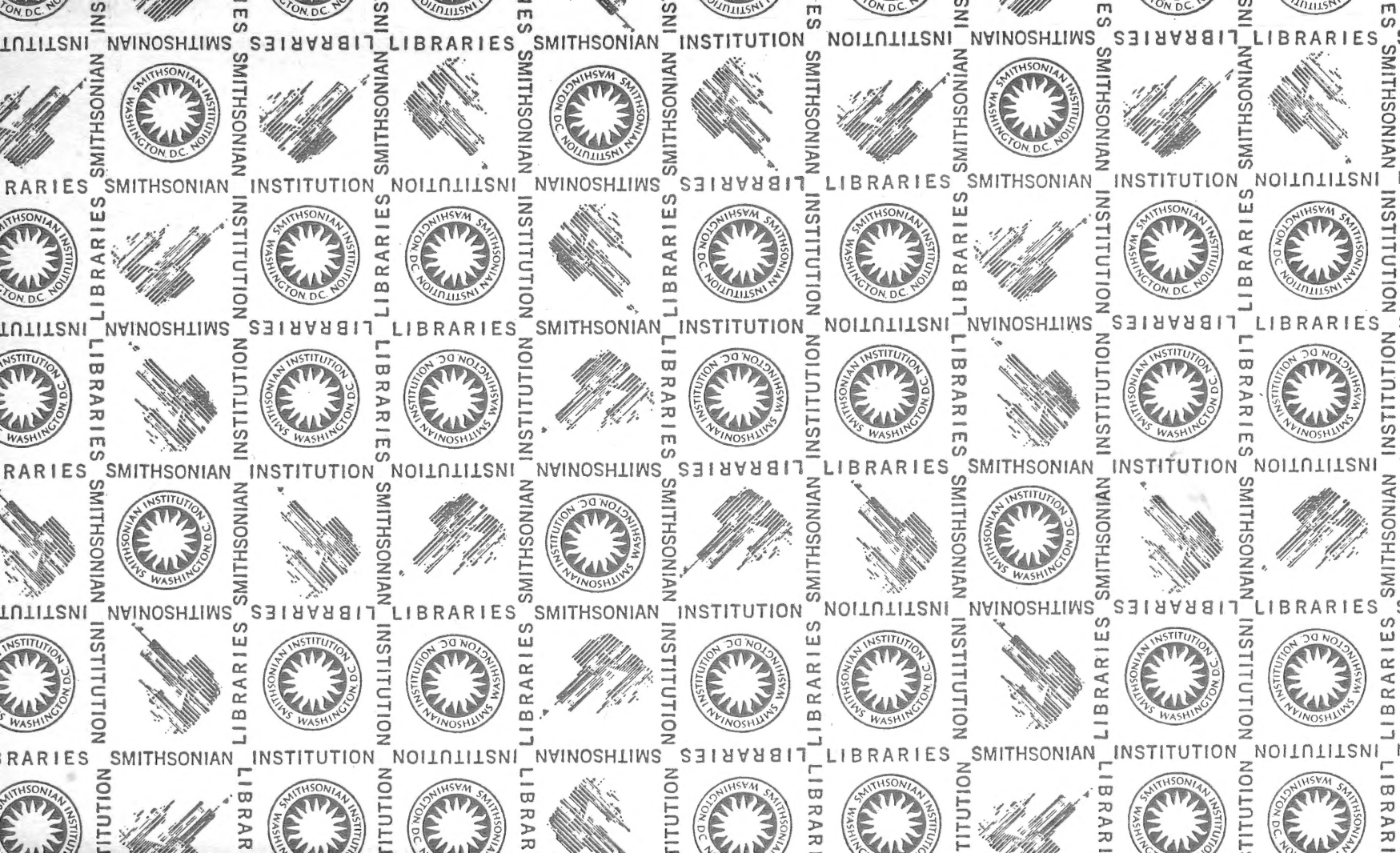
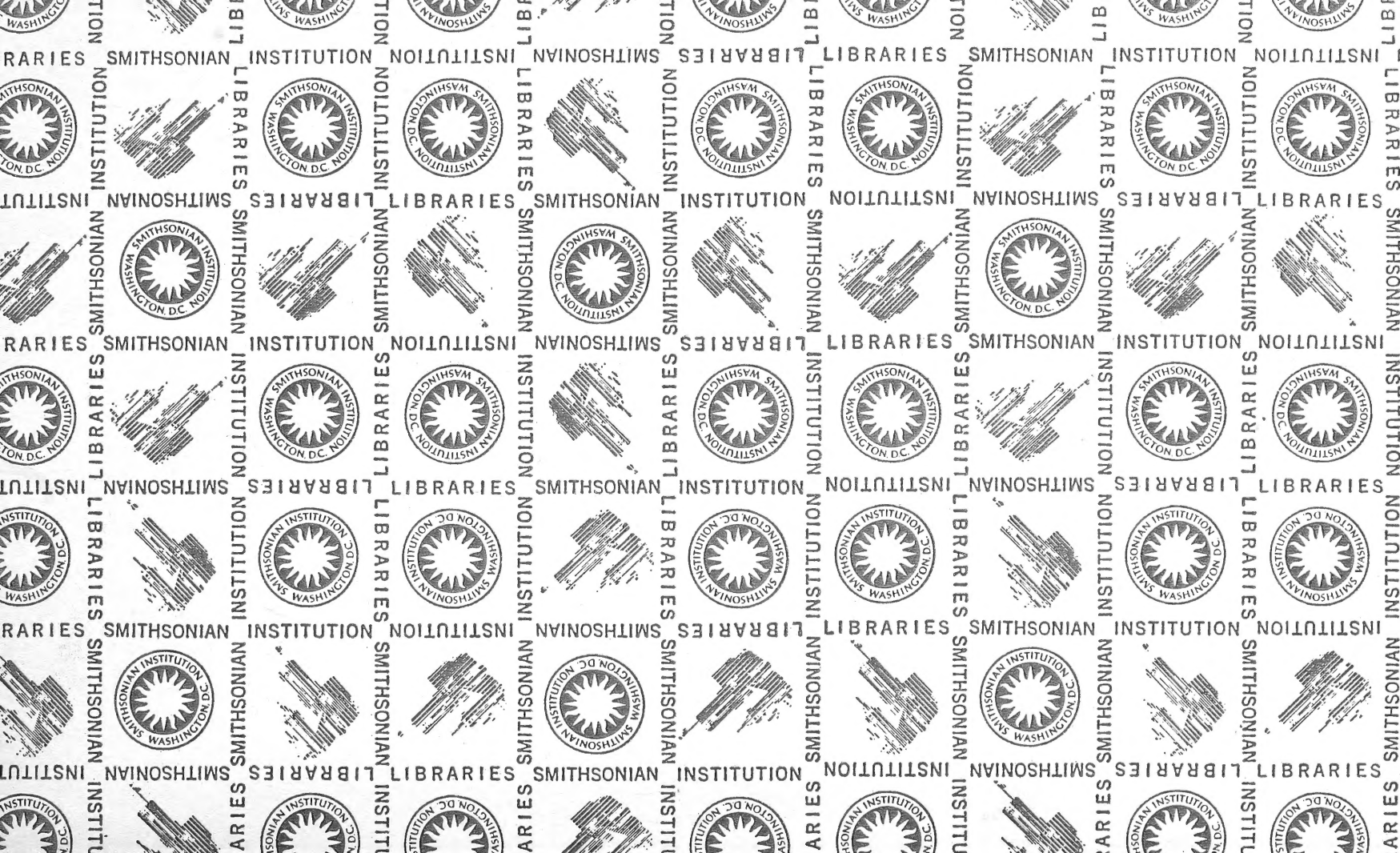

SMITHSONIAN INSTITUTION LIBRARIES


SMITHSONIAN INSTITUTION LIBRARIES
SMITHSONIAN INSTITUTION LIBRARIES
SMITHSONIAN INSTITUTION LIBRARIES
SMITHSONIAN INSTITUTION LIBRARIES
SMITHSONIAN INSTITUTION LIBRARIES
SMITHSONIAN INSTITUTION LIBRARIES
SMITHSONIAN INSTITUTION LIBRARIES
SMITHSONIAN INSTITUTION LIBRARIES
SMITHSONIAN INSTITUTION LIBRARIES
SMITHSONIAN INSTITUTION LIBRARIES
SMITHSONIAN INSTITUTION LIBRARIES
SMITHSONIAN INSTITUTION LIBRARIES
SMITHSONIAN INSTITUTION LIBRARIES
SMITHSONIAN INSTITUTION LIBRARIES
SMITHSONIAN INSTITUTION LIBRARIES
SMITHSONIAN INSTITUTION LIBRARIES

COMMITTEE ON PUBLICATION

Dr. George E. Lindsay, *Chairman*

Dr. Edward L. Kessel, *Editor*

Dr. Leo G. Hertlein

OCCASIONAL PAPERS

OF THE

California Academy of Sciences

No. 92, 59 pages, 52 figures, 3 tables.

SCORPIONS OF THE NORTHERN CALIFORNIA COAST RANGES (Arachnida: Scorpionida)

By

John T. Hjelle

SAN FRANCISCO

PUBLISHED BY THE ACADEMY

January 26, 1972

COMMITTEE ON PUBLICATION

Dr. George E. Lindsay, Chairman
Dr. Edward L. Kessel, Editor Dr. Leo G. Hertlein

OCCASIONAL PAPERS

OF THE

California Academy of Sciences

No. 92, 59 pages, 52 figures, 3 tables.

SCORPIONS OF THE NORTHERN CALIFORNIA COAST RANGES (Arachnida: Scorpionida)

By

John T. Hjelle
California Academy of Sciences

INTRODUCTION

Until recently, the scorpion fauna of the Nearctic region was given very little attention by arachnologists, the scorpions of northern California having been almost completely ignored. One of the earliest references to the scorpions of these areas is that by Wood (1863), in which he described several new species of North American scorpions. In 1894, Pocock listed the various genera of scorpions to be found in each of the zoogeographical regions of the world. Many of his observations have since proved to have been in error. For example, the northern limit of scorpions in North America is closer to the 50th parallel rather than between the 35th and 40th parallels. Also, the genus Uroctonus is now known to extend south into Baja California, Mexico.

In 1900, Banks published a key to 23 species of North American scorpions, and later, in 1910, published a key to 14 species of California scorpions. Gertsch (1966) gives a critical discussion of the species included in both of these keys.

A work of major significance is Pocock's (1902) synopsis of the scorpion fauna of North and Central America. Although for many years a prominent work, the synopsis by Ewing (1928) of the scorpions of the western United States has been outdated by both synonomy and the discovery of many new species. Hoffmann (1931) gave detailed descriptions of the scorpions of Mexico. Werner (1935) reviewed the order Scorpionida on a global basis. Gertsch (1958) reviewed the scorpion fauna of northwestern Mexico and Baja California, describing three new species from these areas. The more recent papers by

Gertsch and Allred (1965), on the scorpions of the Nevada Test Site, and by Gertsch and Soleglad (1966), on the Boreus group of scorpions, have contributed greatly to our understanding of the scorpion fauna of North America.

Williams (1968b, 1968d, 1970a, 1970b, 1970c, 1970d, 1970e) and Williams and Hadley (1967) have described many new species of North American scorpions. By his recent revision of the genus Hadrurus, Williams (1970e) has made a prominent contribution to North American scorpion systematics. Most recently, Gertsch and Soleglad (personal communication, 1970) have in press a revision of the genus Uroctonus, and Williams (1971) has corrected the spelling of the genus Vejovis to its original form, Vaejovis (likewise Vejovidae to Vaejovidae), and also the spelling of the genus Broteas to Brotheas.

Because of the lack of collections and knowledge of the scorpion fauna of the northern California Coast Ranges, and the uncertain status of many specimens held by various individuals and institutions, it seemed worthwhile to undertake a study of the scorpions of this area. The main purposes of this study were to sample the scorpion fauna of the northern Coast Ranges of California by selective field work, and to prepare for publication a comprehensive paper including taxonomic keys, new species descriptions, differential diagnoses of all species, distributional maps, species illustrations, and whatever other bionomical information could be gathered.

It should be mentioned that there are three new species, authored by Gertsch and Soleglad, known from the northern California Coast Ranges in addition to those discussed below. However, since the descriptions of these species are now in press, they have been omitted from this paper, although they are in my unpublished master's thesis on which this paper is based and which is on file at San Francisco State College.

ACKNOWLEDGMENTS

This study is based on scorpions collected by the author over the past two years and on specimens deposited in numerous other institutions. I take this opportunity to express my thanks to the following individuals and institutions for making available important study material: Franklin Ennik, Bureau of Vector Control, Department of Public Health, Berkeley, California; Saul Frommer, University of California, Riverside, California; William E. Ferguson and R. E. Main, San Jose State College, San Jose, California; Charles L. Hogue, Los Angeles Museum of Natural History, Los Angeles, California; Charles R. Smith, Bureau of Vector Control, Department of Public Health, Redding, California; Robbin W. Thorp, University of California, Davis, California; Marius S. Wasbauer, Bureau of Entomology, Department of Agriculture, Sacramento, California; Thomas S. Briggs, Galileo High School, San Francisco, California; Paul H. Arnaud, Jr., California Academy of Sciences, San Francisco, California; and Mont A. Cazier and Joe Bigelow, Arizona State University, Tempe,

Arizona. I would especially like to thank Torbjörn Kronestedt of the Naturhistoriska Riksmuseet, Stockholm, Sweden, and M. Moritz of the Zoologisches Museum der Humboldt-Universität, East Berlin, Germany, for arranging the loan of very important type specimens. Special thanks go to Stanley C. Williams for his guidance and encouragement throughout this study, to James R. Sweeney and Joel F. Gustafson for their reading of the manuscript and for their suggestions and criticisms, to Robert D. Beeman for his help in the taking of macrophotographs, and to Willis J. Gertsch and Michael Soleglad who kindly made descriptions of species recently described by them available to me prior to publication. Much appreciation is due Frank H. Koehler, Jr. for making several of the drawings which illustrate important taxonomic characters. The following are gratefully acknowledged for their assistance in the field: Thomas M. Glimme, Benjamin E. Proeres, Frank H. Koehler, Jr., Carl S. Koehler, Mel Bolander, and Vincent F. Lee. Finally, I would like to thank my wife, Martha, for clerical assistance and for her help and encouragement throughout the term of this study. This study was partially supported by the National Science Foundation through Research Grants GB-7679 and GB-23674.

MATERIALS AND METHODS

This study is based on an examination of about 2000 specimens of immature to adult scorpions, mainly from the northern California Coast Ranges. Most collecting was done at night with the aid of an ultra-violet light, although some specimens were collected by rock-rolling during the day.

Each specimen was fixed and preserved by the methods recommended by Williams (1968a), that is, injection with Dietrich's fixative and preservation in 70 percent ethyl alcohol.

All measurements are in millimeters and were taken with the use of a dissecting microscope equipped with an ocular micrometer. The measurements used in the paper are, for the most part, the conventional ones for scorpion systematics as detailed by Williams (1968b), with the following exceptions: the width of the palm is taken at its widest point dorsally between the lateral and inner dorsal keels (or where these keels would be if absent) (fig. 1); the depth of the palm is taken at its widest point between the median dorsal and ventral keels while looking at the inferior median surface (fig. 2).

Macrophotographs were taken on a Wild dissecting microscope equipped with a standard 35 mm. film box, using KB14 film. Illustrations and photographs are based on one specimen, those of type specimens being indicated separately with each figure. Type specimens are deposited, along with all other material, in the California Academy of Sciences.

RESULTS

For the purpose of this study, the northern California Coast Ranges are designated as those ranges present in the area bounded by the southern Monterey County line to the south, the Klamath Mountains to the north, and the Central Valley to the east. In addition, records from both the Klamath and Cascade mountains are included.

The general framework of the Coast Ranges was probably established about 20 million years ago, although it was not until about one million years ago, at the beginning of the Quaternary, that the Coast Ranges region was uplifted and the sea receded from the Central Valley (Durrenberger, 1968).

The area under study is heterogeneous in many respects. The northern Coast Ranges are composed largely of sandstones, shales, and limestones laid down in the Jurassic. In the more northern areas, particularly in the Klamaths and Cascades, Mesozoic-Paleozoic metamorphic and granitic rocks are the major geologic units. The central portion of the study area is most diverse, with combinations of Cretaceous, Tertiary, and Quaternary sedimentary rocks and some areas with the more typically northern granitic rock complex.

The flora of this area is also quite diverse, falling into the Oregonian, Californian, and Nevadan (in part) Biotic Provinces of Munz and Keck (1965), or into the Pacific Maritime, Sierra Nevadan (Trinitian District), and Californian Biotic Provinces of Schick (1965). Within these provinces, the major plant communities associated with the scorpion fauna of this area are: Northern Coastal Scrub, Coastal Sage Scrub, North Coastal Coniferous Forest, Closed-cone Pine Forest, Redwood Forest, Douglas-Fir Forest, Yellow-Pine Forest, Mixed Evergreen Forest, Northern Oak Woodland, Foothill Woodland, Chaparral, and Coastal Prairie.

Life zones from Lower Sonoran to Boreal are represented in various areas. The climate is also variable. Along the coast, it is cool, without extreme temperature fluctuations, while along the eastern slopes there is a greater range in temperature, being modified locally by topography. Also, the occurrence of fog is an important climatic factor along the coast and foothills.

Because of the diversity of geologic, floral, and climatic conditions, one would expect, and indeed finds, considerable diversity in the faunal elements.

SCORPION FAUNA

The scorpion fauna of the northern California Coast Ranges includes representatives from two families, the Chactidae and the Vaejovidae. The Family Chactidae includes one genus and a single species, while the Family Vaejovidae predominates with four genera, nine species, and three subspecies. The following is a key to the scorpion taxa now known to occur in the northern Coast Ranges of California and peripheral areas.

Key to the Species of Scorpions of the Northern California Coast Ranges

1. 2 lateral eyes on each side of carapace; principal teeth of pedipalp fingers arranged in oblique, discontinuous rows (family Chactidae) . . . *Superstitionia donensis* Stahnke
   Not with 2 lateral eyes on each side, but with 3 or 4 lateral eyes on each side; principal teeth of pedipalp fingers arranged in a single continuous row (fig. 4) (family Vaejovidae) 2

2. Four lateral eyes on each side (fig. 5); male with swollen bulb on basal part of aculeus (fig. 6) (genus *Anuroctonus*) . . . . . *Anuroctonus phaiodactylus* (Wood)
   Three lateral eyes on each side; male without swollen bulb on basal part of aculeus 3

3. With single enlarged dark tooth on inferior margin of movable cheliceral finger (genus *Hadrurus*) . . . . . *Hadrurus obscurus* Williams
   Inferior margin of movable cheliceral finger without such a tooth, this margin toothless or with a series of small denticles (fig. 8) . . . 4

4. Ratio of palm width/palm depth 1.05 or greater; genital operculum of female not completely fused longitudinally, free distally up to 1/4 length; 9 or fewer middle lamellae (fig. 3) (genus *Uroctonus*) 5
   Ratio of palm width/palm depth usually 1.00 or less (if greater, either genital operculum of female completely fused longitudinally, or male and female with 10 or more middle lamellae, or fixed finger of chela more than twice palm width (genus *Vaejovis*) 7

5. Inferior median keel of metasoma V unbranched distally . . . . . *Uroctonus glimmei* Hjelle, new species
   Inferior median keel of metasoma V branched distally 6

6. Supernumerary teeth number 7 and 8 on fixed and movable fingers of chela, respectively . . . . . *Uroctonus mordax mordax* Thorell
   Supernumerary teeth number 8 and 9 on fixed and movable fingers of chela, respectively . . . . . *Uroctonus mordax pluridens* Hjelle, new subspecies

7. Fixed finger of chela twice or more as long as palm width; both fingers of chela with elongate distal tooth (fig. 45); two distinct dark lateral longitudinal stripes on mesosoma; pectine teeth 13 to 16 in male, 11 to 14 in female . . . . Vaejovis gertschi striatus Hjelle, new subspecies

Fixed finger of chela less than twice as long as palm width, both fingers without elongate distal tooth; pectine teeth 18 or more in female, 20 or more in male 8

8. Terga of mesosoma with pale band along posterior margins; teeth of chela strongly scalloped, more so in male . . . . . Vaejovis boreus (Girard)

Terga of mesosoma with dark pattern continuous to posterior margin over most of range (in areas detailed in text, color variable, some individuals resembling V. boreus); teeth of chela lightly scalloped in both sexes . . . . . Vaejovis silvestrii Borelli

Family CHACTIDAE

Genus SUPERSTITIONIA Stahnke

Superstitionia donensis Stahnke.
(Figures 12, 13, 14, 52.)

Superstitionia donensis Stahnke, 1940, p. 102; 1949, p. 243.
Gertsch & Allred, 1965, pp. 2, 7, 13, 14.
Diplops desertorum Mulaik and Higgins, 1944, p. 238.

DIAGNOSIS. Small species, base color yellow to orange-brown, with an overlying black pattern as follows: Carapace with irregular dark markings over most of surface; mesosoma and metasoma dorsally with three distinct black stripes, a single median stripe running the full length to the aculeus, and one on each side laterally, somewhat broken on the metasoma; metasoma ventrally with a single dark median line extending the full length and onto the posterior half of the last segment of the mesosoma. Metasoma without keels, with heavy granules only on posterior portion of segment V. Segments I, II, and III of metasoma broader than long. Pedipalps with short fingers; fingers of male with large gap when fingertips touching. Subdistal teeth of chelicerae usually minute, two in number; characteristic patch of long, whitish hairs ventrally along middle of movable cheliceral finger. Usually six pectinal teeth; genital operculum of female completely fused longitudinally; genital papillae of male visible externally.

TYPE DATA. Syntypes of Superstitionia donensis from the

Superstition Mountains, Arizona. Depository: Arizona State University (Stahnke collection). Holotype of Diplops desertorum from 16 miles east of Tucson, Arizona. Depository: University of Utah.

DISTRIBUTION. Known from Arizona, New Mexico, Sonora, Baja California, Nevada, southern and central California.

RECORDS. CALIFORNIA: San Benito County: 3.5 miles west of the Fresno County line on Road J-1 between Mendota and Panoche, 14 August 1969 (S. C. Williams, M. M. Bentzien, V. F. Lee), 2 males.

REMARKS. This record from San Benito County, California, extends the range of this species northward by about 100 miles. This species is much less common than any others of the coast ranges.

Family VAEJOVIDAE

Genus ANUROCTONUS Pocock

This genus is represented by a single species which is easily identified by the presence of four lateral eyes on each side of the carapace and by the swollen bulb on the aculeus of mature males.

Anuroctonus phaiodactylus (Wood).
(Figures 5, 6, 15, 16, 49, 52.)

Centrurus phaiodactylus Wood, 1863a, p. 111; 1863b, p. 372.
Uroctonus phaeodactylus Karsch, 1879, p. 102. Kraepelin, 1894, pp. 196-198.
Uroctonus phaiodactylus Banks, 1900, p. 424; 1904, p. 365.
Oncocentrus phaeodactylus Thorell, 1894, p. 375.
Anuroctonus phaiodactylus Banks, 1910, p. 188. Ewing, 1938, pp. 14-15.
Anuroctonus phaeodactylus Pocock, 1893, p. 309. Kraepelin, 1899, p. 14. Moles, 1921, p. 13. Hoffman, 1931, pp. 404-405. Werner, 1935, p. 284. Gertsch, 1958, p. 14; 1965, pp. 11-12. Diaz Najera, 1970, p. 116.

DIAGNOSIS. Medium to large size; base color yellowish brown to brown. Anterior portion of carapace elevated; four lateral eyes per group. Inferior median keels of metasoma distinctly granular on all but segment IV, where obsolete. Vesicle of telson large; aculeus of male with bulbous swelling at base. Inferior margin of movable cheliceral finger bears up to four denticles. Genital operculum of male large and unlike Vaejovis in that the genital papillae may protrude ventrally as well as posteriorly. Pectine teeth number 5 to 8 in females, 7 to 10 in males.

TYPE DATA. Male type of Centrurus phaiodactylus Wood from "Utah" (from original description, "Utah Territory, M. McCarthy, Esq."). Depository: United States National Museum, S-4, jar 2.

DISTRIBUTION. Known from Nevada, Utah, Baja California,

southern and central California.

RECORDS. CALIFORNIA: Ventura County: Casitas Spring, 1956 (via Ventura Health Department), 1 male; Quatal Canyon, Cuyama Badlands, 9 April 1966 (R. R. Montanucci), 2 males. San Luis Obispo County: 1.3 miles west of Highway 101 on West Cuesta Road, elevation 2400 feet, 4 April 1970 (J. T. Hjelle, F. H. Koehler, Jr., B. E. Proeres), 1 female; 2 miles east of San Luis Obispo, 26 December 1966 (K. Hom), 1 male, 1 female. San Benito County: 3 miles east of Pinnacles National Monument, elevation 1100 feet, 5 May 1968 (S. C. Williams), 1 male, 3 females; 1 mile north of Pinnacles National Monument, 4 May 1968 (B. Butterworth), 1 male, 3 females; Pinnacles National Monument, elevation 1200 feet, 4 May 1968 (S. C. Williams, V. F. Lee), 5 females.

REMARKS. In 1863, H. C. Wood described Centrurus phaiodactylus as a new species of North American scorpion (Wood, 1863a). Later, in 1879, F. Karsch amended the spelling of "phaiodactylus" to "phaeodactylus" without stating his reasons for doing this (Karsch, 1879). In studying Wood's original description, and a description appearing in another journal later in the same year (Wood, 1863b), it is clear that he definitely intended to use the spelling "phaiodactylus," as the specific name is spelled this way uniformly in the text. Therefore, Karsch's emendation must be considered as an unjustified emendation according to Articles 32 and 33 of the International Code of Zoological Nomenclature. As such, Karsch's "phaeodactylus" must be considered as a junior objective synonym of Wood's "phaiodactylus." The new records listed above extend the range of this species northward by about 100 miles. This species is an obligate burrower, with only one scorpion in a burrow. The burrows can be readily identified by their characteristic shape (fig. 16). The females probably spend their complete pre-adult and adult life in and around one burrow, while the male, upon reaching maturity, appears to leave his burrow in search of a female. A discussion of the burrowing activities of Anuroctonus phaiodactylus is given by Williams (1966).

Genus HADRURUS Thorell

A genus of large hirsute scorpions which may be easily identified by the presence of a single, large, dark, conspicuous tooth on the inferior margin of the movable cheliceral finger. Only one species of Hadrurus has been reported from the northern California Coast Range.

Hadrurus obscurus Williams.
(Figures 17, 18, 52.)

Hadrurus obscurus Williams, 1970e, pp. 28-30, 61-62.

DIAGNOSIS. Large, hirsute scorpion, base color pale

yellow with dark pigmentation on carapace and mesosoma; anterior region of carapace light yellow; females with carapace longer than metasoma V, and with metasoma I broader than long; inferior median keels of metasomal segments I to III densely covered with stout bristles; total length averages about 71 millimeters in males, females averaging about 67 millimeters; pectine tooth counts 34 to 37 in males, 24 to 30 in females. Sexual dimorphism exhibited by the following characters: male carapace shorter than movable finger of pedipalp; carapace longer than metasoma V in males, shorter in females; movable finger of pedipalp longer than metasoma V in female, subequal in male.

TYPE DATA. Holotype male and allotype female from 3.5 miles west of the Fresno County line along Road J-1 between Panoche and Mendota, San Benito County, California, 14 August 1969 and 18 May 1968, respectively (S. C. Williams and parties). Depository: California Academy of Sciences.

DISTRIBUTION. Found in California along the southeastern base of the Sierra Nevada, across the southern Central Valley.

RECORDS. CALIFORNIA: San Benito County: 3.5 miles west of the Fresno County line, along Road J-1 between Panoche and Mendota, 18 May 1968 (S. C. Williams, J. R. Gabel, K. C. Schroen), allotype and 2 paratopotypes, and 14 August 1969 (S. C. Williams, V. F. Lee, M. M Bentzien), holotype and 20 paratopotypes (9 males, 11 females).

Genus UROCTONUS Thorell

This genus can be distinguished from most vaejovids in that the genital operculum of the female is not completely fused longitudinally. In addition, the hand is heavy, flattened, and wide, the ratio of palm width/palm depth is usually greater than 1.05 (can be as high as 1.45), and there are nine or fewer middle lamellae.

Uroctonus glimmei Hjelle, new species.
(Figures 10, 25-29, 31, 49, 52.)

DIAGNOSIS. Medium-sized species of Uroctonus closely related to Uroctonus mordax subspecies. Base color of cuticle reddish brown to brown with few contrasting markings. Carapace with shallow anterior median emargination; carapace lightly granular; median eyes slightly anterior to middle of carapace. Inferior median and inferior lateral keels of metasoma all distinctly granular; first metasomal segment broader than long, succeeding segments longer than broad. Pectinal teeth 10 to 12 in males, 9 to 11 in females; chelicerae with inferior border of movable finger smooth. Tarsi each with a median row of at least fifteen spinules on the inferior surface.

May be distinguished from U. mordax in the following ways: distinctly smaller size; the lack of dark markings on

most body regions; presence of keels on inferior median surface of palm (fig. 31); presence of ventral keel on palm (fig. 31); inferior median keels of metasoma not smooth or obsolete on segments I and II; inferior median keel of metasomal segment V not branched posteriorly; dorsal and dorsolateral keels end posteriorly in a sharp point.

HOLOTYPE. Male. Coloration: Base color of carapace, pedipalps, and metasoma light reddish brown; mesosoma and telson lighter yellowish brown to brown; walking legs lighter yellow to yellowish brown; carapace with lighter brown areas posterolaterally and anterior to median eyes; dark contrasting markings on mesosoma absent or very pale, more obvious in juveniles; metasoma without dark contrasting markings; pectines yellowish white; tips of pretarsal claws light reddish brown.

Carapace: Anterior margin with shallow median emargination, with three pairs erect reddish bristles; lateral eyes three per group, anterior two eyes about equal size, posterior eye smaller; median eyes situated 0.7 mm. anterior to middle of carapace, each eye 0.2 mm. in diameter, separated from each other by 0.2 mm.; low median ocular tubercle, raised 0.1 mm. from carapace (taken from most elevated point); most of carapace finely granular, agranular just behind anterior margin.

Mesosoma: Terga 1-6 finely granular, essentially bare, without obvious dark markings; on some specimens a hint of a lighter median longitudinal band; tergum 7 with two pairs of distinct, granular lateral keels, the inner keel projecting laterally, joining the outer keel anteriorly; intercarinal spaces finely granular. Sterna agranular except sternum 7 with one pair distinct granular keels and a few scattered granules; each sternum set with row of reddish bristles on posterior margin; stigma short, slit-like.

Metasoma: All dorsal and dorsolateral keels granular except dorsal keels of segment V absent; dorsal keels I to IV each end posteriorly in sharp upturned point; dorsolateral keels I to IV each begin anteriorly as distinctly broadened wing (quite enlarged in some) and end posteriorly in sharp point; lateral keels granular on full length of segment I posterior 1/4 segment II, posterior 1/6 segment III, absent on segment IV, granular on anterior 2/3 segment V; inferior lateral and inferior median keels distinct, granular on segments I to V; single inferior median keel of segment V distinct, granular, unbranched posteriorly; inferior median keels on segments I, II, III, and IV are set with 2, 3, 3, 3 erect, reddish bristles, respectively; intercarinal spaces essentially agranular, except segment V with two groups granules on either side of inferior median keel, each group set with one erect, reddish bristle.

Telson: Ventral aspect of vesicle irregular, granular along darker longitudinal bands; this surface with six pairs of reddish bristles; very subtle subaculear tubercle; aculeus deeply curved with one pair of reddish bristles ventrally.

Pectines: 12/12 pectinal teeth; fulcra triangular; middle lamellae with six subequal pieces distal to basal piece; anterior lamellae hirsute; middle lamellae, fulcra, and

pectinal teeth hairless or with a few hairs, mainly on basal area. Sternite between pectines deeply concave anteriorly, 2/3 as broad as long, set with several stout, reddish bristles.

Genital operculum: Completely divided longitudinally; genital papillae visible externally.

Chelicerae: Superior margin of movable finger with five strong teeth, distal tooth elongate; inferior margin of movable finger smooth, without denticles, with one strong, elongate, distal tooth. Superior margin of fixed finger with four strong teeth, proximal two forming compound tooth, distal tooth elongate; inferior margin rounded, toothless. Basal segment covered ventrally with fine whitish hairs, these hairs extending onto inferior margins of movable and fixed fingers; basal segment dorsally without dark markings.

Pedipalps: Humerus almost three times as long as broad, anterior surface with several sharp granules along 3/4 of its length; brachium almost three times as long as broad; all keels of humerus and brachium granular; hands moderately heavy and thickened, with various keels developed as follows: ventral keel lightly granular, directed slightly inward distally (fig. 31); ventrolateral keel distinctly granular, extending distally straight toward superior margin of movable finger (fig. 31); lateral, dorsolateral, and median dorsal keels distinct, raised, lightly granular; inner dorsal keel raised, granular; inferior median surface with two raised granular keels, forming a shallow groove between them - this surface otherwise agranular or with very fine granules. Inferior margin of fixed finger with six supernumerary teeth; principal teeth of fixed finger divided into six groups by enlarged teeth; inferior margin of movable finger with seven supernumerary teeth; principal teeth of movable finger divided into seven groups by enlarged teeth.

Walking legs: Femora I to IV with double row of granules extending length of inferior face of each femur, all rows equally distinct; all tarsi with median claw, immediately behind which are a pair of spinules followed by a single row of approximately 15 or more similar spinules, this row flanked by two pairs of light spines on each side (fig. 10).

Standard measurements: Table 1.

ALLOTYPE. Female. Essentially the same as holotype in color and morphology with the following exceptions: slightly greater in total body length and most other body proportions; pectines with fewer teeth (10/11 instead of 12/12); genital papillae absent; genital operculum divided longitudinally only along distal 1/4.

Standard measurements: Table 1.

PARATYPE VARIATION. Paratypes showed little significant variation from the descriptions of the holotype and allotype. Adult males varied in carapace length from 5.2 to 5.6 millimeters, while females varied from 5.6 to 6.2 millimeters. Samples contained adult and juvenile instars, the juveniles being generally lighter in color and with more contrasting markings. Little sexual dimorphism occurs. Males and females have overlapping pectine tooth counts, males varying from 10 to 12 (predominantly 11) and females varying from 9

to 11 (predominantly 10 and 11). Males can be distinguished by externally visible genital papillae and a genital operculum which is completely divided longitudinally.

TYPE DATA AND ETYMOLOGY. The holotype, allotype, and 10 paratopotypes were collected 5 miles north of Rayhouse Road, at the junction of Davis and Cache creeks, Lake County, California, 15 June 1969 (J. T. Hjelle, M. Bolander). All specimens were collected at night under ultraviolet light along a dirt roadbank with both eastern and western exposures. The area is characterized by chaparral vegetation and is hot and dry during the summer months. The holotype and allotype are permanently deposited in the California Academy of Sciences. The species is named "glimmei" for my good friend, Thomas M. Glimme, in appreciation for valuable help in the field.

DISTRIBUTION. Known from coastal Monterey County and north along the slopes of the inner coast ranges into Mendocino County.

RECORDS. In addition to the holotype, allotype, and 10 paratopotypes, an additional seven paratypes were studied. Paratypes were collected from the following localities in California. Mendocino County: 13 miles east of Covelo on Mendocino Pass Road, 30 August 1969 (J. T. Hjelle, B. E. Proeres), 1 male; 3 miles up Robinson Creek Road (off Highway 253), elevation 1000 feet, 28 August 1969 (J. T. Hjelle, B. E. Proeres), 1 male. Lake County: 5 miles north of Rayhouse Road, at the junction of Davis and Cache creeks, 9 August 1969 (J. T. Hjelle, T. Farris), 1 male, 1 female, 1 subadult. Napa County: 1/4 mile southwest of the Lake County line on Butts Canyon Road, elevation 750 feet, 11 September 1969 (J. T. Hjelle, T. M. Glimme), 1 male. Stanislaus County: Frank Raines Park, 18 miles west of Patterson, 27 September 1969 (S. C. Williams, J. T. Hjelle, M. M. Bentzien, W. E. Azevedo), 1 female.

REMARKS. This species occurs in the drier inland areas of the northern California Coast Ranges along with Vaejovis gertschi striatus. Most of the specimens were collected at night along road cuts or areas with little or no grass cover but with brush cover nearby.

Uroctonus mordax mordax Thorell.
(Figures 1-3, 7-9, 30, 32-36, 50, 52.)

Uroctonus mordax Thorell, 1876, p. 11 (original description); 1876-77, pp. 196-198. Mann, 1876, p. 212. Karsch, 1879, pp. 102-103. Kraepelin, 1894, p. 194; 1899, p. 182. Pocock, 1902, p. 309. Banks, 1900, p. 424; 1904, p. 365; 1910, pp. 186, 188. Borelli, 1908-09, p. 224. Moles, 1921, p. 13. Ewing, 1928, pp. 7, 15. Hoffman, 1931, pp. 402-403. Werner, 1935, pp. 283-284. Mello-Leitao, 1945, p. 128. Henry, 1949, pp. 120-125. Gertsch & Allred, 1965, p. 4. Gertsch & Soleglad, 1971, in press (personal communication). Parrish, 1966, pp. 12-13. Diaz Najera, 1970, p. 116.

In the years which have elapsed since Thorell first described Uroctonus mordax, all dark scorpions from the northern California Coast Ranges that bore some resemblance to U. mordax have been identified as that species. Thorell's original description (1876) was limited to a few sentences both in English and Latin, but later in the same year, he published a more extensive description of U. mordax. The measurements given in the later paper (none were included in the original description) were made in an obsolete style and did not seem wholly reliable. Also, the sex of the holotype was not mentioned in either the original or later description.

DIAGNOSIS. Medium-sized, robust, dark scorpion with thick, swollen pedipalps. Base color of cuticle dark reddish brown to brown, with contrasting patterning on most body regions; carapace with deep anterior median emarginate notch; carapace heavily granulated; median eyes slightly anterior to middle of carapace; first metasomal segment broader than long, succeeding ones longer than broad; inferior lateral and inferior median keels of metasoma granular, variable in appearance; pectine teeth 8/9; lower margin of movable finger of chelicerae with four and five denticles on right and left chelicerae, respectively.

RESESCRIPTION OF FEMALE LECTOTYPE. Coloration: Generally dark reddish brown with intricate contrasting markings on carapace, mesosoma, metasoma, and telson. Pedipalps, anterior 3/4 carapace, and metasoma dark reddish brown, darkest along keels and areas of heavy granulation; chelicerae with dark markings on dorsal basal segment; carapace with darker markings radiating in a pattern anterolaterally from median groove, base color lighter on posterior 1/4; mesosoma brown with essentially same lighter pattern on each segment (except segment 7), consisting of a pair of oval spots along midline and a series of spots and elongate areas extending laterally; metasomal segments I to IV with dorsal "arrowhead-like" markings, the point facing posteriorly; sterna of mesosoma, the pectines, and genital operculum pale brownish yellow; telson light reddish brown with darker longitudinal bands, one on each side of ventral midline, one on each lateral side, and one median dorsal band.

Carapace: Anterior margin with deep median emargination, with two pairs of erect reddish bristles (others probably lost); median ocular tubercle high, 0.2 mm. above surface of carapace (taken from most elevated point); median eyes situated 0.6 mm. anterior to middle of carapace, each eye 0.25 mm. diameter, separated from each other by 0.4 mm.; lateral eyes three per group, anterior two equal in size, posterior eye smallest; entire carapace finely to coarsely granular, coarser granules in pattern from middle of carapace outward to lateral eyes.

Mesosoma: Terga finely granular, essentially bare, with a few erect bristles along posterior margins; tergum 7 with two pairs of granular lateral keels posteriorly. Sterna smooth, with erect reddish bristles on each segment laterally, finer whitish bristles in rows across each segment on anterior margin, middle of segment, and posterior margin; one pair fine granular keels posterolaterally on sternum 7.

Metasoma: Dorsal and dorsolateral keels granular, dentate to serrate in appearance, on segments I to IV; dorsal keels absent on segment V; dorsolateral keels granular on segment V; lateral keels weakly granular on posterior 1/2 of I, as row of granules on posterior 1/6 of II, as two or three granules on posterior end of III, absent or up to four granules on IV, showing as irregularly spaced granules on anterior 1/2 of V, most prominent along anterior 1/6; inferior lateral keels obvious on all segments, raised to crenulate on I, crenulate on II and III, granular on IV and V, appearing serrate to dentate; inferior median keels weakly crenulate, but not obvious, on segments I and II, crenulate on III, crenulate to granular on IV, single median keel granular on V, this keel branching laterally at distal end. Segments I, IV, and V widest in middle, segments II and III widest slightly posterior to middle; metasomal segment I broader than long, segments II to V longer than broad.

Telson: Aculeus with moderate curve, 1/2 vesicle in length; vesicle wider than metasoma V, equals metasoma IV in width; slightly concave above, ventral surface irregularly covered with small granules, granules darker, larger, and more conspicuous at basal end. Subtle subaculear tubercle; ventral surface of vesicle with seven pairs of reddish bristles; aculeus with one pair of hairs ventrally.

Pectines: 8/9 pectinal teeth; length of sternum between pectines slightly more than twice its breadth, shallowly concave; anterior lamellae of three segments, basal sclerite longest; middle lamellae composed of basal sclerite and six rounded sclerites, each rounded sclerite with one erect, reddish bristle, a few sclerites also with one smaller bristle; fulcra subtriangular, each with one or two erect, reddish bristles.

Genital operculum: Divided longitudinally along distal 1/4; genital papillae absent; each valve with two elongate, reddish bristles along lateral margin, one shorter bristle on posterior margin, and one short bristle on medial margin.

Chelicerae: Superior margin of right movable finger with five strong teeth, distal tooth elongate; inferior margin with elongate distal tooth and bearing four small, evenly spaced denticles. Superior margin of right fixed finger with four strong teeth, the proximal two forming compound tooth, distal tooth elongate; inferior margin rounded, toothless. Left chelicera the same, with the following exceptions: first subdistal tooth of superior margin of movable finger appearing as a small extra tooth on the elongate distal tooth (fig. 7); inferior margin movable finger with five small denticles (fig. 8). Basal segment and both fingers covered entirely with brush of fine, whitish hairs on ventral surface.

Pedipalps: Humerus slightly more than twice as long as broad, anterior surface with 5 to 6 sharp granules; brachium about twice as long as broad(including projecting spurs);chela heavy and thickened, with various keels developed as follows: ventral keel absent; ventrolateral keel pronounced and granular, curved inward distally; (fig. 32) lateral keel obsolete or indicated by faint dusky markings or fine scattered granules; dorsolateral keel solidly raised, smooth; median dorsal

keel raised only very slightly, with occasional granules, indicated primarily by dusky markings; inner dorsal keel raised and granular; inferior median surface with one obsolete keel, indicated only by faint dusky markings, this surface irregularly covered with granules. Inferior margin of fixed finger with seven supernumerary teeth; principal teeth of fixed finger separated into seven groups by enlarged teeth; inferior margin of movable finger with eight supernumerary teeth; principal teeth of movable finger separated into eight groups by enlarged teeth; principal teeth of each finger aligned in single continuous row.

Walking legs: Femora I, II, and III with double row of granules extending the length of inferior face of each femur, the more inferior row being larger and most obvious; femora IV showing only a short row of granules along distal 1/4; all tarsi with median claw, immediately behind which are a pair of spinules, followed by a row of five to seven similar spinules (fig. 9).

Standard measurements: Table 2.

TYPE DATA. Female lectotype presumably from "San Francisco, California." Depository: Naturhistoriska Riksmuseet, Stockholm, Sweden (vial number 59b). Information on the original label reads as follows: "Uroctonus mordax Thor., Scorpio, Amer. sept., Eisen, S. Francisco, Californ., M. Th." There are two males in the same vial, one subadult, the other a young juvenile. The question of whether or not Eisen actually collected these specimens in San Francisco is still open to speculation, although Banks (1904) lists another San Francisco record. At the present time, it seems unlikely that U. mordax mordax or U. m. pluridens are now to be found in the northern end of the peninsula, since recent efforts to collect here have been unsuccessful.

In a second vial (59a), there are four adult females. The original label reads as follows: "Uroctonus mordax Thor., America: Guatemala, Eisen." Research on Eisen showed that he arrived in the United States from Sweden in 1873 and did not travel to Guatemala until 1882, several years after Thorell's description of U. mordax. Being that the specimens in this vial definitely belong to U. mordax mordax, and that this subspecies does not extend south of California, it seems most likely that Eisen mistakenly gave Thorell the wrong locality data, resulting in this spurious Guatemalan record.

DISTRIBUTION. Northern California and Oregon (figs. 50, 52).

RECORDS. OREGON: Lane County: 3.5 miles east of Oakridge, 25 April 1970 (R. M. Winokur), 4 females. Wasco County: 8 miles west of Rowena along U. S. Highway 80N, 16 June 1968 (J. Davidson), 2 males, 1 female. CALIFORNIA: Del Norte County: Junction of Dunn Creek and the East Fork of the Illinois River, 9 June 1960 (T. R. Haig) 2 males. Siskiyou County: Yreka, 2 May 1969 (J. R. Grisham), 1 male; 12.7 miles north-northeast of Happy Camp, elevation 2000 feet, 7-8 June 1969 (R. A. & R. R. Snelling), 1 male, 3 females. Humboldt County: Willow Creek, 25 August (year not given), (N. Elmore), 1 male; Williams Grove, 3 July 1948 (S. F. Wood), 1 female; 1 mile northeast of Willow Creek, elevation 590 feet,

28 April 1968 (W. Strickland), 1 female; Orleans, Hoopa, Willow Creek Area, 1969 (W. Strickland), 2 males, 15 females; 8 miles south of Honeydew, 28 September 1969 (P. Wilson), 1 female. Trinity County: Junction of Mumbo Creek and Trinity River (East Fork near Clair Engle Lake), 30 May 1965 (G. Brooks), 1 male; 8 miles south of Highway 36 on Van Duzen Road, elevation 3000 feet, 29 August 1969 (J. T. Hjelle, B. E. Proeres), 2 females; 5 miles northeast of Zenia on Zenia Road, elevation 4000 feet, 29 August 1969 (J. T. Hjelle, B. E. Proeres), 1 male, 3 females. Shasta County: Hat Creek Ranger Station, 17 May 1965 (R. R. Pinger), 1 female; Burney, 25 May 1967 (collector unknown), 1 male; 2 miles north, 7 miles east of Shingletown, elevation 4000 feet, 26 April 1968 (Smith and Hazeleur), 3 males. Tehama County: 32 miles east of Covelo on Mendocino Pass Road (toward Paskenta), elevation 5200 feet, 30 August 1969 (J. T. Hjelle, B. E. Proeres), 1 female; Mill Creek, 7 July 1970 (R. Dietz, P. Rudd), 1 male. Mendocino County: Albion Ridge Road, 9 miles south of Albion Road, 18 June 1969 (F. J. Radovsky), 2 females; Ukiah, 24 January 1962 (T. S. Briggs), 2 females; 12 miles northwest of Cloverdale on Highway 128, elevation 400 feet, 28 August 1969 (J. T. Hjelle, B. E. Proeres), 1 male, 1 female; 13 miles east of Covelo on Mendocino Pass Road, elevation 4000 feet, 30 August 1969 (J. T. Hjelle, B. E. Proeres), 12 males, 10 females; Riley Ridge, Hopland Field Station, elevation 1900 feet, 8 May 1970 (M. M. Bentzien), 5 males, 2 females; Mendocino Woodlands Camp, 15 November 1970 (J. R. Gabel), 1 male. Lake County: 3.15 miles north of Soda Creek Camp, Mendocino National Forest, 9 July (K. Hom, V. F. Lee), 2 females; 1/2 mile north Glen Eden School, Scott Valley, 17 July 1965 (K. Hom), 1 female; 5 miles north of Rayhouse Road, at junction of Davis and Cache creeks, elevation 900 feet, 15 June 1969 (J. T. Hjelle, M. Bolander), 2 males, 3 females; about 5 miles east of Bear Creek Ranger Station on Bear Creek Road, elevation 3500 feet, 31 August 1969 (J. T. Hjelle, B. E. Proeres), 6 males, 5 females; 2 miles east of Bear Creek Ranger Station on Bear Creek Road, elevation 2300 feet, 31 August 1969 (J. T. Hjelle, B. E. Proeres), 1 female; 1800 to 2400 feet up Mt. Konocti on Konocti Road, 9 September 1969 (J. T. Hjelle, T. M. Glimme), 4 males, 2 females; on Highland Springs Road, 5 miles southwest of intersection with Bell Hill Road, elevation 1600 feet, 9 August 1969 (J. T. Hjelle, T. M. Glimme), 2 females; 1/4 mile southeast of Highway 175 on Adams Springs Road, elevation 2600 feet, 11 August 1969 (J. T. Hjelle, T. M. Glimme), 1 female; 1/4 mile south Highway 175 on Anderson Springs Road, elevation 1300 feet, 11 August 1969 (J. T. Hjelle, T. M. Glimme), 1 male, 3 females; 1 mile east of Loch Lomond on Siegler Canyon Road, elevation 3000 feet, 11 August 1969 (J. T. Hjelle, T. M. Glimme), 1 male, 5 females; Rattlesnake Island, Clear Lake, elevation 1350 feet, 12 August 1969 (J. T. Hjelle, T. M. Glimme), 6 males, 12 females. Colusa County: from 2 to 5 miles along unnamed road connecting Letts Valley Road and Twin Valley Road, elevation 4000 feet, 31 August 1969 (J. T. Hjelle, B. E. Proeres), 7 males, 7 females. Sonoma County: in "Larkin Woods," between Forestville and Guerneville, 30 November 1968

(S. Bridge), 1 female; Summerhome Park, Russian River, 13 August 1969 (L. Lagomarsino), 1 female; 1/2 mile off Highway 116 on road connecting Highway 116 with River Road (approx. 1.8 miles southwest of Rio Nido), 11 October 1969 (J. T. Hjelle, B. E. Proeres), 2 males, 2 females. Napa County: 1/4 mile southwest of the Lake-Napa County line on Butts Canyon Road, elevation 750 feet, 11 September 1969 (J. T. Hjelle, T. M. Glimme), 2 males. Yolo County: Monticello Dam Spillway, 10 November 1967 (F. Ennik), 1 male. Marin County: near entrance to Muir Woods, 10 January 1964 (V. D. Roth, P. R. Craig), 1 male; Novato, 11 December 1964 (H. Mathis), 1 female cast skin; White's Estate, 3 March 1965 (K. Hom), 1 male; along Bolinas Road, 13 April 1965 (T. S. Briggs), 3 males, 1 female; 2 1/2 miles west of Alpine Dam, 7 July 1965 (K. Hom), 1 male; near Tiburon, 11 December 1965 (K. Hom, T. S. Briggs), 2 males, 3 females; 1/4 mile north of Laurel Dell, Mt. Tamalpais, 8 September 1969 (M. M. Bentzien), 1 male; 1 mile south of Fairfax on Bolinas Road, elevation 200 feet, 16 September 1969 (J. T. Hjelle, T. M. Glimme), 3 males, 8 females; 5 miles south of Fairfax on Bolinas Road, elevation 600 feet, 16 September 1969 (J. T. Hjelle, T. M. Glimme), 4 males, 13 females; along fire trail to Kent Lake, elevation 50 feet, 18 September 1969 (J. T. Hjelle, F. H. & C. S. Koehler), 25 males, 26 females; Lily Lake, north of Alpine Reservoir, 1 December 1969 (J. Mackey), 1 female; near Lily Lake (just north of Alpine Lake), 18 April 1970 (M. M. Bentzien), 2 males, 3 females; Phoenix Lake, north shore, 2 May 1970 (J. Collins), 1 female; San Rafael, 21 May 1970 (W. L. Blackwell), 1 female; 1/4 mile north of Lake Lagunitas, 17 September 1970 (A. D. Bacon), 1 female; south shore of Phoenix Lake, 1 October 1970 (J. T. Hjelle), 1 male, 5 females. Solano County: 2.2 miles south of Cordelia (Cerada Ranch), 28 March 1961 (R. E. Doty), 1 male, 3 females; 1.5 miles south of Cordelia, 3 May 1961 (R. E. Doty), 2 males; on Cordelia Road, 0.9 miles north of junction with Pittman Road, 9 February 1964 (D. L. Dailey, P. R. Craig), 1 female; 5 miles southwest of Winters, 19 July 1964 (collector unknown), 1 male. Contra Costa County: Castle Rock Park, 5 miles west of Mt. Diablo, no date (F. Ennik), 3 males, 4 females; Lafayette, May 1958 (R. F. Peters), 1 female; El Cerrito, November 1959 (W. Anderson), 1 female. Alameda County: Oakland, May 1957 (G. Salter), 1 female; Skyline Boulevard, 0.1 mile south of intersection with Colton Road and Snake Road, 6 October 1962(P. R. Craig, D. L. Dailey), 1 male; Berkeley Hills, Marlborough Terrace below Grizzly Peak Blvd., 24 February 1963 (P. R. Craig, D. L. Dailey), 1 female; near Niles, 3 January 1964 (V. D. Roth), 1 female; Oakland, 1 April 1963 (W. J. Hoff), 1 male; Sunol Regional Park, 23 January 1965 (K. Hom, T. S. Briggs), 1 male, 1 female; Sunol Regional Park, 7 August 1965 (K. Hom), 1 female; Oakland, 30 August 1965 (W. W. Sampson), 1 female with 29 first-instar young; Berkeley Hills, Strawberry Canyon, 17 April 1966 (P. R. Craig), 2 females; north side of Albany Hill, Albany, 29 March 1968 (F. Ennik), 8 males, 3 females;

Montclair Area, Oakland, 20 September 1968 (D. Pomerantz), 1 male. Santa Clara County: Gilroy Hot Springs, 13 February 1966 (R. W. Cahill), 2 males; Uvas Canyon County Park, 26 February 1966 (K. Hom), 1 female; Arroyo Mocho, Mt. Hamilton, 28 April 1968 (collector unknown), 1 female; Alum Rock Park, 8 May 1968 (R. Pisciotto), 1 female; Alum Rock Park, 30 January 1969 (J. Smith), 1 male. San Mateo County: Redwood City, 12 August 1958 (D. W. Ozenbaugh), 1 female.

REMARKS. Other specimens which were examined showed little significant variation in most characters. As a subspecies, U. mordax mordax ranges from 20 feet to over 7000 feet above sea level. In the past, arachnologists tended to associate this species primarily with the redwood communities. However, as would be expected from its extensive range, U. m. mordax is found in other plant communities as well - from coastal scrub to predominantly pine areas, to the more unlikely inner coastal chaparral areas. Their relative abundance in the latter areas seems, from collection records available, to be much lower than in the other areas mentioned.

A certain degree of genetic isolation appears to manifest itself in three characters, these being color, the relative numbers of pectinal teeth of both sexes, and the number of denticles on the inferior margin of the movable cheliceral finger.

Various populations, particularly from the inner coastal areas east of Covelo, Mendocino County, have a predominance of individuals of a lighter color than is normally the case in U. m.mordax. Lighter individuals are present in most other populations also, but are a minority. The inner coastal ranges at the edge of the central valley represent the fringes of U. mordax distribution, thus these lighter populations may be a result of habitat differences or of some degree of ecological isolation.

In the case of pectine tooth counts, as a subspecies, those of the female vary from 16 to 23, while those of the male vary from 22 to 29. Generally, these counts seem to form a mode at about 20 in the female and at about 25 or 26 in the male. However, within these ranges, various populations have different modal tendencies - toward either high or low modes, or toward single, double, or even triple modes. For example, in an area in Glenn County, California (fig. 35a), females ranged from 17 to 21 with two modes, one at 18, the other at 20 (based on 21 specimens), while males ranged from 22 to 27, also with two modes, one at 24, the other at 26 (based on 19 specimens). At Bootjack Camp, Marin County, California (fig. 35b), females ranged from 17 to 23 with a single mode at 19 (based on 41 specimens), while males ranged from 24 to 28 with a large mode at 24 and a smaller mode at 26 (based on 40 specimens). In a population from Sonoma County, California (fig. 35c), females ranged from 18 to 22 with modes at 18, 20 and 22 (based on 45 specimens), while males ranged from 23 to 27 with a single mode at 26 (based on 30 specimens). Finally, from Kent Lake, Marin County, California (fig. 35d), females ranged from 16 to 21 with a single mode at 18 (based on 26 specimens), while males ranged from 24 to 27 with a single mode at 25 (based on 23 specimens).

These data tend to show that, though there is a genetic continuum which maintains the range of variation for this species character, there is sufficient geographic or ecological isolation between the populations to allow the formation of distinctly different subpopulation tendencies.

The third character under consideration is that of the number of denticles present on the inferior margin of the movable cheliceral finger. For many years, U. mordax, as a species, was diagnosed as having five denticles on this surface. However, this character is variable within any one local population and is even more variable for the subspecies, U. m. mordax, as a whole. The range of variation for this character, based on analysis of several hundred specimens from the entire range, was 0 to 7 denticles with a mean of 4.2. Most populations showed values that clustered around this over-all mean, for example: in the Fairfax Area of Marin County (fig. 36a), the range was 2 to 6 with a mean of 4.1, and in the Bear Creek Area of Lake County (fig. 36b), the range was 3 to 6 with a mean of 4.3. However, various populations showed quite different tendencies, for example: 13 miles east of Covelo, Mendocino County (fig. 36c), the range was from 0 to 4 denticles with a mean of 2.0 (this again may be due to habitat differences or ecological isolation along the periphery of the distribution), and on Rattlesnake Island, Clear Lake, Lake County (fig. 36d), the range was from 0 to 5 with a mean of 3.3. There were few scorpions on the island, so the main factor involved in altering the typical mode would appear to be genetic drift in a small population. Geographic isolation may also be a factor, since the island has been isolated from the mainland for several thousand years.

Uroctonus mordax pluridens Hjelle, new subspecies.
(Figures 37-40, 50, 52.)

In examining various specimens of Uroctonus from coastal northern California areas, it was noticed that several specimens differed from typical U. mordax in the presence of a greater number of supernumerary teeth on the fixed and movable fingers of the chela. Because of the homogeneity of this important and otherwise nonvariable character in large clearly defined geographic areas, I consider this group a subspecies of U. mordax.

DIAGNOSIS. Essentially the same as U. m. mordax except for the following differences: mesosoma more of a solid dark brown, the characteristic U. m. mordax pattern of lighter spots less obvious; metasomal segments I to IV with dorsal "arrowhead-like" markings less distinct than on U. m. mordax, absent on some individuals (on the allotype these are faintly marked on segments I and II, absent on III and IV); length of humerus much greater than twice its width; length of brachium much less than twice its width; 8 and 9 supernumerary teeth on the fixed and movable fingers of the chela, respectively.

Standard measurements: Table 3.

TYPE DATA. Holotype male from near Corralitos, Santa Cruz County, California, 8 March 1969 (J. Smith). Allotype female from Scotts Valley, Santa Cruz County, California, 5 October 1968 (G. Bianconi). Depository: California Academy of Sciences.

DISTRIBUTION. Santa Clara and Santa Cruz counties, California.

RECORDS. California: Santa Clara County: Near Loma Prieta Weather Station, 10 November 1968 (J. Smith), 1 female; Summit above Los Gatos, 4 March 1969 (J. Smith), 3 males, 2 females; Alum Rock Park, 8 March 1969 (J. Smith), 1 male, 1 female; Uvas Meadows, near Sveadahl, 15 March 1969 (J. Smith), 1 male, 1 female; Summit above Los Gatos, just off Summit Road, 20 March 1969 (J. Smith), 1 female; Mt. Charlie Road, 13 April 1969 (R. McGehee), 1 male; Loma Prieta, 9 November 1969 (J. Smith), 2 females. Santa Cruz County: 10 miles south of Holy City, 10 April 1968 (A. R. Gillogly), 1 female; Big Basin State Park, 28 April 1968 (R. C. Shellman), 1 female; 10 miles southwest of Saratoga on Highway 9, 27 March 1969 (Bob Agnoletti), 2 females; Camp Loma, 23 November 1969 (J. Smith), 1 male, 1 female.

Uroctonus mordax (mordax x pluridens hybrids).

In the Alum Rock Park area of Santa Clara County, California, U. mordax mordax appears to hybridize with U. mordax pluridens. These individuals may be recognized by the presence of 7 and 9 supernumerary teeth on the fixed and movable fingers of the chela, respectively.

RECORDS. Santa Clara County: Alum Rock Park, 3 March 1970 (R. P. Swartzell), 1 female.

Genus VAEJOVIS Koch

This genus can be distinguished from other genera of the family Vaejovidae through the following combinations of characters: the genital operculum of the female of most species is completely fused longitudinally; the inferior margin of the movable cheliceral finger is completely smooth, or crenulate, or with several small denticles; there are three lateral eyes per group; the ratio of palm width/palm depth is usually 1.00 or less (if greater, either the males and females each have 10 or more middle lamellae, or the fixed finger of the chela is more than twice the palm width).

Vaejovis gertschi striatus Hjelle, new subspecies. (Figures 41-45, 49.)

DIAGNOSIS. Differs from Vaejovis gertschi gertschi

Williams in the following characters: females less than 30 millimeters in total length; pectine teeth 13 to 16 in males, 11 to 14 in females (rather than 16 to 18 in males, 14 to 16 in females); subtle subaculear tubercle in the male; two distinct dark lateral longitudinal stripes on mesosoma. Base color of cuticle brownish yellow with contrasting dark markings on most body regions. Carapace with median emarginate notch; inferior median and inferior lateral keels of metasoma all distinctly developed, these serrate, crenulate, or intermediate. Chela elongate, palm with lightly crenulate keels medially and smooth keels dorsally and laterally (fig. 45); fixed finger longer than palm, at least twice palm width, terminal tooth on each finger elongate. Chelicerae with inferior border of movable finger smooth.

TYPE DATA AND ETYMOLOGY. The holotype, allotype, and 59 paratopotypes were collected at Frank Raines Park, 18 miles west of Patterson, Stanislaus County, California, 27 September 1969 (S. C. Williams, J. T. Hjelle, M. M. Bentzien, W. E. Azevedo). All specimens were collected at night under ultraviolet light along a dirt roadbank and on a hillside with a northwest exposure and light grass cover. The holotype and allotype are permanently deposited in the California Academy of Sciences. The subspecies is named "striatus" because of its characteristic dark lateral stripes.

PARATYPE VARIATION. Paratypes showed little significant variation from the descriptions of the holotype and allotype. Males varied in total length from 11.8 to 22.1 millimeters while females varied from 12.5 to 30.0 millimeters. Males varied in carapace length from 2.1 to 2.9 millimeters while females varied from 2.6 to 4.0 millimeters. Samples contained both adult and subadult instars but younger instars were totally lacking. Little sexual dimorphism occurs. Males and females have overlapping pectine tooth counts. Males can be distinguished by the presence of genital papillae and by having the genital operculum completely divided longitudinally.

DISTRIBUTION. Known from the slopes of the inner (eastern) coast ranges from San Benito County to Mendocino County.

RECORDS. In addition to the holotype, allotype, and 59 paratopotypes, an additional 104 paratypes were studied. Paratypes were collected from the following localities in California. Mendocino County: 3 miles north of Highway 253 along Robinson Creek Road, elevation 1000 feet, 28 August 1969 (J. T. Hjelle, B. E. Proeres), 2 males, 1 female. Lake County: 4 miles east of Kelseyville on Konocti Road, Mt. Konocti, elevation 2800 feet, 9 September 1969(J. T. Hjelle, T. M. Glimme), 1 male; Kugelman Ranch Road, Lower Lake, elevation 1200 feet, 1 September 1969 and 7 September 1970(J. T. Hjelle, T. M. Glimme), 17 males, 3 females, and 8 males, 1 female, respectively; 6 miles north of Upper Lake (Witter Springs), 2 February 1970 (T. Toren), 1 female; Bachelor Valley, 12 December 1970 (T. Toren), 3 females; approximately 5 miles north of Rayhouse Road, at junction of Davis and Cache creeks, 15 June 1969 (J. T. Hjelle, M. Bolander), 8 males, 17 females, and 9 August 1969 (J. T. Hjelle, T. Farris), 13 males, 10 females. Napa County: 1/4 mile southwest of the Lake

County line on Butts Canyon Road, elevation 750 feet, 11 September 1969 (J. T. Hjelle, T. M. Glimme), 9 males, 6 females; 3 miles south of junction of road to Pope Valley on west side of Lake Berryessa, elevation 550 feet, 11 November 1969 (V. F. Lee), 1 female. Stanislaus County: Del Puerto Canyon, 4 April 1970 (W. E. Azevedo), 1 female, 2 subadults. Additional specimens have been recorded from the following localities: Solano County: Vacaville, 29 October 1964 (A. Mendes), 2 females. Contra Costa County: Walnut Creek, 4 June 1956 (Leo Farr), 1 male; Concord Area, 30 August 1965 (F. Ennik), 1 male; Mt. Diablo, 17 April 1965 (R. R. Pinger, R. W. Pinger), 1 male. San Joaquin County: Stockton, 9 April 1970 (Walt Bauer), 1 female. Stanislaus County: La Grange, 31 July 1969 (R. P. Allen), 1 female; 1/4 mile east of Frank Raines Park, elevation 1000 feet, 3 April 1970 (A. Dean Bacon), 1 female. San Mateo County: San Carlos (burned chaparral hillside), 20 December 1970 (C. Rees), 1 male. San Benito County: Pinnacles National Monument, 25 August 1968 (F. Ennik), 1 male.

REMARKS. This subspecies appears to be relatively common in the drier areas of the northern California Coast Ranges, particularly on the slopes of the inner ranges. Most of the specimens were collected at night along road cuts and in areas with light grass cover. Several specimens have been collected in houses.

Vaejovis boreus (Girard).
(Figures 46, 51.)

Scorpio (Telegonus) boreus Girard, 1854, p. 257.
Vejovis boreus Banks, 1900, p. 424; 1910, pp. 187, 189. Comstock, "1912" (1913), p. 31; 1940, p. 31. Webster, 1923, p. 248. Chamberlin, 1924, p. 64. Kurata, 1930, p. 28. Werner, 1935, p. 282. Stahnke, 1940, p. 101. Gertsch, 1958, p. 6. Gertsch & Allred, 1965, p. 9. Gertsch & Soleglad, 1966, pp. 6-14.
Vaejovis boreus Ewing, 1928, pp. 10, 12.

DIAGNOSIS. Medium-sized scorpion with base color pale yellow to orange-brown. Carapace with V-shaped patch at median eyes, with dark bands running to lateral eyes; anterior portion of interocular triangle pale. Mesosomal terga 1 to 6 darkly colored, each with a series of yellow spots extending laterally and each with a transverse pale stripe along the posterior margin. Carapace finely to coarsely granular. Metasoma I to III with inferior median keels essentially obsolete, indicated by diffuse, brown stripes; metasoma V longer than carapace in both sexes. Pectine teeth 18 to 23 in females, 25 to 31 in males; middle lamellae with two rows of sclerites, the anterior row somewhat indistinct. Genital operculum of female not completely fused longitudinally, usually free over distal 1/4. Superior margin of movable cheliceral finger with five stout teeth, the inferior margin with pale crenulations or more distinct,

dark teeth. Pedipalps with inner keel of fixed finger strongly scalloped, more so in male; fixed and movable fingers with six and seven supernumerary teeth, respectively.

TYPE DATA. Type specimen from the valley of the Great Salt Lake, Utah, collected by Howard Stansbury. Depository: United States National Museum.

DISTRIBUTION. This is a common widespread species occurring in the southern parts of Alberta and British Columbia in Canada, the northwestern United States, the Rocky Mountain States, northern Arizona, Nevada, and eastern California.

RECORDS. IDAHO: Butte County: 10 miles east of Arco, 31 July 1966 (E. Slansky), 1 male. OREGON: Harney County: 2 miles northwest of Crane, elevation 4200 feet, 11 June 1967 (R. R. Snelling), 1 female. CALIFORNIA: Modoc County: Lava Beds National Monument, 28 August 1966 (R. C. Gardner & S. E. Harrison), 1 female. Siskiyou County: 3 miles northeast of Bray, 26 July 1967 (collector unknown), 1 male. Alpine County: Pleasant V.(?), 18 October 1962 (W. R. Bauer), 1 male. Inyo County: Westgard Pass, 1961 (R. Hock), 2 males; dry wash of the North Fork of Crooked Creek, opposite Bucks Peak, Ancient Bristlecone Pine Area, Inyo National Forest, elevation 9270 feet, 10 September 1968 (C. R. Smith, F. Ennik), 1 female. Mono County: McGee Creek, 29 June 1938 (Fleshner), 1 male, 1 female; near Hot Springs east of de Chambeau Ranch, northwest end of Mono Lake, 26 June 1965 (K. Hom), 2 males, 4 females. Riverside County: Mt. San Jacinto, 23 August 1938 (W. Warren), 1 male.

REMARKS. This species has the northernmost distribution of all North American scorpions. Of all the specimens from the Coast Ranges which I have seen, those identified as V. boreus have actually been specimens of V. silvestrii of either its typical form or its lightly colored racial form. Not having seen all of the specimens from this area recorded as V. boreus, I cannot make a positive statement, but from the records available, it appears that V. boreus occurs only to the east of the Sierra Nevada and does not occur in the Coast Ranges. I have retained this species in the key because of this uncertainty.

Vaejovis silvestrii Borelli.
(Figures 11, 47, 48, 51.)

Vaejovis silvestrii Borelli, 1908-1909, pp. 225-227 (original description). Ewing, 1928, p. 14.
Vejovis boreus Gertsch, 1958, p. 6.
Vejovis silvestrii Gertsch & Soleglad, 1966, pp. 15-20.

DIAGNOSIS. Scorpion of moderate size resembling V. boreus in general appearance. Base color yellow to tan; carapace yellow with pattern of black stripes radiating from midline; preocular area dark; mesosoma with dark coloration continuous to posterior margin on segments 1 to 6, each tergum with pair of oval spots near the midline and a series of spots radiating outward laterally on each side. Local color races

variable in color, from typical coloration to almost complete absence of dark coloration, some individuals strongly resembling V. boreus (fig. 48). Inferior median keels of metasoma I to IV obsolete, indicated by dusky lines of varying intensity. Pectine teeth of female 18 to 24, of male 25 to 29; middle lamellae with two rows of sclerites. Genital operculum of female not completely fused longitudinally, free distally up to 1/4 length. Inferior margin of movable cheliceral finger with several irregularly formed teeth. Pedipalps with inner keel of fixed finger more weakly scalloped than in V. boreus.

TYPE DATA. Female type from Sierra Madre, Los Angeles County, California. Depository: Museo Zoologico, Turin, Italy.

DISTRIBUTION. Baja California and California.

RECORDS. CALIFORNIA: Los Angeles County: Tanbark Flat, 20 June 1950 (J. W. MacSwain), 1 male. San Luis Obispo County: Morro Bay, 24 September 1969 (T. L. Richards), 2 males, 1 female; 1.3 miles west of Highway 101 on West Cuesta Road, elevation 2400 feet, 4 April 1970 (J. T. Hjelle, F. H. Koehler, B. E. Proeres), 8 males, 10 females. Monterey County: Arroyo Seco Campgrounds, 21 May 1968 (P. Cammer), 1 female; Los Padres National Forest, 4 miles southeast of Nacimiento Summit Campground, 8 August 1970 (W. E. Azevedo, V. F. Lee), 9 males, 8 females; Los Padres National Forest, 0.5 mile south of Nacimiento Summit Campground, 8 August 1970 (W. E. Azevedo, V. F. Lee), 8 males, 3 females; Los Padres National Forest, 2 miles southeast of Nacimiento Summit Campground, 8 August 1970 (W. E. Azevedo, V. F. Lee), 16 males, 5 females. San Benito County: Pinnacles National Monument, 25 August 1968 (collector unknown), 1 female. Stanislaus County: Adobe Creek, 26 February 1956 (D. Burdick), 1 male; 1.3 miles east of the Atomic Energy Commission Explosive Test Site, 12 April 1965 (K. Hom), 1 female; Carnegie Site, Corral Hollow, 8 May 1965 (V. F. Lee), 1 male; 1 1/4 miles east of the Atomic Energy Commission Explosive Test Site, Corral Hollow Valley, 31 July 1965 (T. Briggs), 2 males; along County Road J-Z, 1.5 miles east of LRL (3 miles east of San Joaquin-Alameda County line), 21 April 1970 (F. Ennik), 1 male, 4 females. Santa Clara County: Santa Teresa County Park, 26 February 1966 (T. S. Briggs), 1 female. Alameda County: Corral Hollow, 30 May 1960 (T. S. Briggs), 2 females; in canyon north of Mitchell Ravine, Corral Hollow, 8 May 1965 (V. F. Lee, G. Wong), 1 male, 1 female; Sunol Regional Park, 7 August 1965 (K. Hom), 1 female; 8 miles north of Corral Hollow Creek, 3 October 1965 (collector unknown), 1 male; 11 miles southeast of Livermore on Wagnor Ranch, County Road J-2, 30 July 1968 (C. R. Smith, F. Ennik), 8 males, 3 females; behind quarantine coops on Kimber Farms Chicken Ranch, Niles district of Fremont, elevation 250 feet, 1 November 1970 (J. T. Hjelle, T. M. Glimme, F. H. Koehler, F. Salazar), 3 females; Berkeley, 4 August 1966 (S. Jeffery), 1 male. Contra Costa County: Antioch, 5 April 1956 (M. Wasbauer), 1 male, 1 female; Castle Rock Park, 5 miles west of Mt. Diablo, no date (F. Ennik), 6 males, 3 females. Yolo County: Putah Creek, near Zoological Field Station,

University of California, Davis, 1 November 1966 (R. R. Montanucci), 1 female. Marin County: Carson Ridge, 2 January 1958 (D. D. Linsdale), 2 males; hillside directly behind Boot Jack Camp, 1/2 mile up Matt Trail, Mt. Tamalpais, 11 May 1968 (B. Butterworth), 1 female; 5 miles south of Fairfax on Bolinas Road, elevation 600 feet, 16 September 1969 (J. T. Hjelle, T. M. Glimme), 3 females. Colusa County: from 2 to 5 miles along unnamed road connecting Letts Valley Road and Twin Valley Road, elevation 4000 feet, 31 August 1969 (J. T. Hjelle, B. E. Proeres), 3 females; Century Ranch, 1 June 1970 (Lottle & Wickey), 1 female. Napa County: 1/4 mile southwest of the Lake County line along Butts Canyon Road, elevation 750 feet, 11 September 1969 (J. T. Hjelle, T. M. Glimme), 16 males, 43 females. Lake County: approximately 5 miles north of Rayhouse Road at junction of Davis and Cache creeks, elevation 900 feet, 15 June 1969 (J. T. Hjelle, M. Bolander), 20 males, 18 females, and 9 August 1969 (J. T. Hjelle, T. Farris), 17 males, 12 females; from 3 1/2 to 7 miles east of Bear Creek Ranger Station, elevation 3700 to 4500 feet, 31 August 1969 (J. T. Hjelle, B. E. Proeres), 7 males, 14 females; along Clearlake Park Estates Road, Clearlake Park, elevation 1400 feet, 8 September 1969 and 6 September 1970 (J. T. Hjelle, T. M. Glimme), 11 males, 40 females, and 3 females, respectively; Konocti Road, Mt. Konocti, elevation 1800 to 2800 feet, 9 September 1969 (J. T. Hjelle, T. M. Glimme), 2 males, 4 females; 1/4 mile southeast of Highway 175 on Adam's Springs Road, elevation 2600 feet, 11 September 1969 (J. T. Hjelle, T. M. Glimme), 4 males, 7 females; 1 mile east of Loch Lomond on Siegler Canyon Road, elevation 3000 feet, 11 September 1969 (J. T. Hjelle, T. M. Glimme), 1 male, 1 female.

REMARKS. The above records extend the range of V. silvestrii northward about 100 miles, from Marin County to Lake County. In the area around Panoche Pass, San Benito County, California, there occurs a nearly nonmelanic race of V. silvestrii (fig. 48). These scorpions are essentially the same as the typical V. silvestrii except for this color variation. In an extensive area around this locality are found scorpions with varying degrees of dark coloration, from the typical V. silvestrii patterning, to patterning much like that of V. boreus, ultimately to the nearly colorless forms. Most of these variants show a dark V-shaped marking which connects the median eyes with each lateral group of eyes. Records of this race of V. silvestrii are as follows: San Benito County: Panoche Pass, 3.5 miles west of Fresno County line on road between Panoche and Mendota, 14 August 1969 (S. C. Williams, V. F. Lee, M. M. Bentzien), 77 males, 139 females; Pinnacles National Monument, 4 May 1968 (S. C. Williams & party), 22 males, 32 females; Panoche area, 3.9 miles southeast of junction of Road J-1 with road to Idria, on J-1, 18 May 1968 (S. C. Williams, K. C. Schroen, J. R. Gabel), 76 males, 171 females. Stanislaus County: Frank Raines Park, approximately 18 miles west of Patterson, 27 September 1969 (S. C. Williams, J. T. Hjelle, W. E. Azevedo, V. F. Lee), 13 males, 26 females. Fresno County: Panoche Canyon, 24 March 1967 (R. Snelling), 1 male. Monterey County: Los Padres National

Forest, Wagon Cave Campground (25 miles south of Arroyo Seco Campground), 9 August 1970 (W. E. Azevedo, V. F. Lee), 22 males, 4 females.

DISCUSSION AND CONCLUSIONS

In separating the genus Uroctonus from the genus Vaejovis, I believe that there are two characters of primary importance: 1) the ratio of palm width/palm depth. In Uroctonus, this ratio is always more than 1.05, reaching a probable maximum of 1.50 (actually, in the more than 200 individuals of several different species measured, the range of this ratio went from 1.08 to 1.45 with a mean of 1.28). Most species of Vaejovis show this ratio as 1.00 or less. In particular, in the Eusthenura Group, this ratio ranged from 0.82 to 1.08 with a mean of 0.96; in the subgenus Paruroctonus, this ratio ranged from 0.87 to 1.00 with a mean of 0.97; and in the Punctipalpus Group, this ratio ranged from 0.94 to 1.10 with a mean of 1.02. In remaining groups, and in species of the above-mentioned groups, where this ratio extends into the range of Uroctonus, other important characters, which are mentioned in the key, serve to distinguish Uroctonus from Vaejovis. 2) the incomplete fusion of the genital operculum in the female, the valves remaining free distally up to 1/4 of their length. All species of Uroctonus which I have had the opportunity to examine have shown this condition, so this appears to be a stable and important character of this genus. Among the related vaejovids, only the subgenus Paruroctonus exhibits this character. However, this subgenus may be distinguished by its greater numbers of middle lamellae (in some, two rows of sclerites) and by the low palm width/palm depth ratio. One must use these taxonomic characters in combination, since no single character is useful in determining all species. However, these two characters appear much more stable and reliable than those others previously considered.

The scorpion fauna of the northern California Coast Range, as a whole, cannot be considered particularly rich in the number of species present. Nine species and three subspecies from two families were found to occur in an area of approximately 30,000 square miles. Gertsch and Allred (1965) reported a North American record of nine species from two families collected in the Nevada Test Site (an area of about 1000 square miles). Williams and Hadley reported five species from two families from the Puerto Penasco area of Sonora, Mexico in an area only 5 miles in diameter. However, if the study area is broken up into two parts, with a San Francisco-Oakland line dividing them, the picture changes somewhat. In the northern area (about 24,000 square miles), four species and 2 subspecies from one family are found, while in the southern area, six species and three subspecies from two families are found. To look even closer, in an area from Alameda County to San Benito County (about 2500 square miles), six species and three subspecies from two families may again be found. This compares more favorably

with the above-mentioned record reported by Gertsch and Allred. These figures appear to correspond with the fact that the geology, floral elements, and climatic conditions are more diverse in the southern area. The spider fauna of the coast ranges seems to be more diverse than the scorpion fauna. Schick (1965) reported 59 species and 4 subspecies of thomisid spiders from the northern California Coast Range are (although his Idrian biotic district includes approximately 6500 more square miles).

In the study area north of San Francisco, the generally predominant scorpions were Uroctonus mordax mordax and Vaejovis silvestrii, both found in various situations ranging from rather dry, inland chaparral areas to moist, foggy, forested areas. Vaejovis silvestrii is generally more common in drier areas. Vaejovis gertschi striatus was fairly common along the inner coastal ranges, tolerating areas of little or no brush cover. Uroctonus glimmei appears to follow the same distributional paths as V. g. striatus, but is less common. In the study area south of San Francisco, Uroctonus mordax pluridens predominates in the western coastal ranges of Santa Cruz and Santa Clara counties. Vaejovis silvestrii is most closely associated with the chaparral and woodland-grass areas south of Santa Cruz County and inland up through the East Bay counties. Superstitionia donensis, Anuroctonus phaiodactylus, and Hadrurus obscurus are restricted to San Benito County in the warmer drier Lower Sonoran areas around Panoche and Pinnacles National Monument. Anuroctonus phaiodactylus is common in localized areas, while S. donensis and H. obscurus are much less common in the Coast Ranges, being more closely associated with the southern Central Valley desert regions.

The comparative distribution of various species of scorpions with different species of spiders suggests similar zoogeographical distribution patterns. For example, the distribution of U. m. mordax along with U. m. pluridens is very similar to that of Xysticus gosiutus Gertsch (Araneida: Thomisidae) (Schick, 1965). Also, the distributions of V. silvestrii and the V. gertschi group are similar to that of Misumenops aikoae Schick (Araneida: Thomisidae) (Schick, 1965).

In addition to the descriptions of a new species, Uroctonus glimmei, and two new subspecies, Uroctonus mordax pluridens and Vaejovis gertschi striatus, samples yielded significant northern range extensions for three other species, Superstitionia donensis, Anuroctonus phaiodactylus, and Vaejovis silvestrii.

Different groups exhibited varying degrees of genetic isolation. Uroctonus m. mordax demonstrated, through various characters, tendencies toward the formation of distinctly different subpopulations. Also, V. silvestrii showed these same tendencies in the formation of localized nonmelanic races. These unique tendencies toward subpopulation formation may arise from such factors as habitat differences, genetic drift in small populations, ecological and geographic isolation.

Several species of scorpion have been reported from

California which I consider to be spurious records. Banks (1900, 1904, 1910) reported the following: Hadrurus hirsutus (Wood), Vaejovis punctipalpus (Wood), and Brotheas alleni (Wood) are all known only from southern Baja California; Uroplectes mexicanus Banks is mentioned by Gertsch (1966) as probably being of African origin; Opisthacanthus lepturus (Palisot de Beauvois), Diplocentrus keyserlingi Karsch, D. whitei (Gervais), Tityus tenuimanus Banks, and Isometrus maculatus (DeGeer) are all tropical species and probably do not extend into California unless as accidentals by transport with food or other materials; finally, that Centruroides californicus (Wood) occurs in Lake County, as reported by Banks (1910), is doubtful, since Lake County has been intensively sampled, and no evidence of the occurrence of this species (or genus) could be confirmed.

In his monograph, "Ueber Scorpione," Karsch (1879) described a new species of Uroctonus from "California" which he named Uroctonus privus. Kraepelin (1894) later called "privus" a junior synonym of U. mordax. Since that time, all other scorpion workers have accepted Kraepelin's placement. However, characters deemed unimportant by Kraepelin now appear to have special significance. The type was, therefore, borrowed from the Zoology Museum of Humboldt University, Berlin, Germany. Close examination of the specimen (figs. 19-24) indicated that Kraepelin was mistaken in regarding it as a synonym of U. mordax.

The original description was brief, not including some important characters, and including no measurements. The holotype examined agreed with the original description except in the following ways: metasoma V shorter than metasoma III and IV together; three denticles on the inferior margin of the movable cheliceral finger. Karsch did not define the sex which is clearly a juvenile female.

The characters which exclude this specimen from the genus Uroctonus are: 1) the circular shape of the booklung openings (stigma) (fig. 21); and 2) the presence of pectinal teeth on only the distal 3/4 of the pectines (fig. 22). These characters are not found on any known species of Uroctonus. Except for the presence of three lateral eyes per group, this specimen appears closely related to Brotheas alleni (Wood) (Scorpionida: Chactidae). In addition to the characters mentioned above, the structure of the pedipalps, the relative lengths of the metasomal segments, and the general coloration are very similar to that of B. alleni. Because the data needed for exact placement of this individual are unavailable at this time, I will only tentatively suggest that this species may have its closest relationship with the species now known as Brotheas alleni (Wood), from Baja California Sur, Mexico. I consider the California record to be spurious, this individual most probably being from Baja California, Mexico.

Type data. Holotype female, "California" (there appears to have been another word above "California" which could not be made out). Depository: Zoologisches Museum der Humboldt-Universität, East Berlin, Germany (Graber collection). Type

specimen poorly preserved, segment 7 of mesosoma transparent, third right walking leg missing, metasoma detached, one chelicera missing.

The scorpion fauna of other areas of California is still relatively unknown. Data from the Modoc Plateau area, much of the Sierra Nevada, and the southern coast ranges are particularly lacking. A complete picture of the scorpion fauna of California is not only of scientific interest. From the numbers of scorpions to be seen during much of the year, they are obviously important predators of other arthropods, both insect and arachnid. Also, there is a public health interest in that almost nothing is known about the toxicity of the venom of most of the species now known from California. These and other topics, such as population and behavioral studies, are only a few examples of needed future research.

REFERENCES

BANKS, N.
1900. Synopses of North American invertebrates. IX. The scorpions, solpugids and pedipalpi. The American Naturalist, vol. 34, pp. 421-427.
1904. Some arachnida from California. Proceedings of the California Academy of Sciences, 3rd series, vol. 3, no. 13, p. 365.
1910. The scorpions of California. Pomona College Journal of Entomology, vol. 2, no. 2, pp. 185-190.

BORELLI, A.
1908-1909. Scorpioni raccolti dal Prof. F. Silvestri nell' America settentrionale e alle isole Hawaii. Bollettino del Laboratorio di zoologica generale e agraria della R. Scuola superiore d'agricoltura, Portici, vol. 3, pp. 222-227.

CHAMBERLIN, R.V.
1923. The northern range of the scorpion. Science, vol. 59: p. 64.

COMSTOCK, J. H.
"1912"(1913). The Spider Book. Doubleday, Doran and Co., Inc. New York. 721 pp.
1940. The Spider Book, revised and edited by W. J. Gertsch. Doubleday, Doran and Co., Inc. New York. 729 pp.

DIAZ-NAJERA, A.
1970. Contribucion al conocimiento de los alacranes de Mexico (Scorpionida). Revista de Investigation en Salud Publica, vol. 30, no. 2, pp. 111-122.

DURRENBERGER, R. W.
1968. Patterns on the land. National Press Books. Palo Alto, California. 109 pp.

EWING, H.
1928. The scorpions of the western part of the United States with notes on those occurring in northern Mexico. Proceedings of the United States National Museum, vol. 73, no. 9, pp. 1-24.

GERTSCH, W. J.
1958. Results of the Puritan-American Museum Expedition to western Mexico. 4. The scorpions. American Museum Novitates, no. 1903, pp. 1-20.

GERTSCH, W. J., and D. ALLRED
1965. Scorpions of the Nevada Test Site. Brigham Young University Science Bulletin, Biological Series, vol. 6, no. 4, pp. 1-15.

GERTSCH, W. J., and M. SOLEGLAD
1966. The scorpions of the Vejovis boreus group (subgenus Paruroctonus) in North America (Scorpionida: Vejovidae). American Museum Novitates, no. 2278, pp. 1-54.

GIRARD, C.
1854. In Marcy's exploration of the Red River of Louisiana in 1852. 33rd Congress, 1st session, Senate Executive Document, pp. 251-259.

HENRY, L. M.
1949. The nervous system and the segmentation of the head in a scorpion (Arachnida). Microentomology, vol. 14, no. 4, pp. 120-125.

HOFFMAN, C. C.
1931. Monografias para la entomologia medica de Mexico. Monografia num. 2, los scorpiones de Mexico. Primera parte: Diplocentridae, Chactidae, Vejovidae. Anales del Instituto de Biologica, Universidad de Mexico, vol. 2, no. 4, pp. 291-408.

JENKINS, O. P. (director)
1951. Geologic Handbook of the San Francisco Bay Counties. California Department of Natural Resources, Division of Mines, Bulletin 154. 392 pp.

KARSCH, F.
1879. Scorpionologische Beiträge. Ueber scorpione. Mittheilungen des Münchener Entomologischen Vereins, vol. 3, pp. 97-136.

KOCH, C. L.
1836. Die Arachniden. Nürnberg. Vol. 3, pp. 50-57.

KRAEPELIN, K.
1894. Revision der skorpione. II. Scorpionidae und Bothriuridae. Jahrbuch der Hamburgischen Wissenschaftlichen Anstalten, vol. 11, pp. 1-248.
1899. Scorpiones und Pedipalpi. Das Tierreich, vol. 8, p. 182.

KURATA, T. B.
1930. Notes on the northern scorpion, Vaejovis boreus Girard, in British Columbia. Canadian Field-Naturalist, vol. 54, pp. 28-30.

MANN, B. P. (editor)
1876. Synoptical tables for determining North American insects. Scorpiones. Psyche, vol. 1, no. 31, pp. 209-214.

MELLO-LEITAO, C.
1945. Escorpioes Sul-Americanos. Arquivos do Museu Nacional, vol. 40, p. 128.

MOLES, M.
1921. A list of California Arachnida: (III. Cox, F. A.: The Scorpionida). Journal of Entomology and Zoology, vol. 13, no. 2, pp. 12-13.
MULAIK, S., and H. G. HIGGINS
1944. A new genus of scorpions in the southwest. Entomological News, vol. 55, no. 9, pp. 237-240.
MUNZ, P. A., and D. D. KECK
1965. A California Flora. University of California Press, 1681 pp.
POCOCK, R.I.
1893. On the classification of scorpions. Annals and Magazine of Natural History, 6th series, vol. 12, no. 10, p. 309.
1894. Scorpions and their geographical distribution. Natural Science, vol. 4, no. 24, pp. 253-364.
1902. Arachnida, Scorpiones, Pedipalpi and Solfugae. Biologia Centrali-Americana. 71 pp., 12 plates.
SCHICK, R. X.
1965. The crab spiders of California (Araneida: Thomisidae). Bulletin of the American Museum of Natural History, vol. 129, no. 1, pp. 1-180.
STAHNKE, H.L.
1940. The scorpions of Arizona. Iowa State College Journal of Science, vol. 15, pp. 101-103.
1949. Diplops desertorum a scorpion synonym. Entomological News, vol. 60, no. 9, p. 243.
1966. Some aspects of scorpion behavior. Bulletin of the Southern California Academy of Sciences, vol. 65, no. 2, p. 69.
THORELL, T. T. T.
1876. On the classification of scorpions. Annals and Magazine of Natural History, 4th series, vol. 17, no. 97, pp. 1-15.
1876-1877. Etudes scorpiologiques. Atti della Societa italiana di scienze naturali, e del Museo civile di storia naturale, Milano, vol. 19, no. 1, pp. 75-80; vol. 19, no. 2, pp. 81-272.
1893. Scorpiones exotici. Bollettino della Societa Entomologica Italiana, vol. 25, pp. 356-387.
VACHON, M.
1963. De l'utilite, en systematique, d'une nomenclature des dents des chiliceres chez les scorpions. Bulletin du Museum National d'Histoire Naturelle, Paris, ser. 2, vol. 35, no. 2, pp. 161-166.
WEBSTER, R. L.
1923. Scorpions in North Dakota. Science, vol. 58, p. 248.
WERNER, F.
1935. Scorpions und Pedipalpi. In Bronn, H. G., Klassen und Ordnungen des Tierreichs, Leipzig, bd. 5, abt. 4, buch 8, lief. 3, pp. 1-316.
WILLIAMS, S. C.
1966. Burrowing activities of the scorpion Anuroctonus phaeodactylus (Wood) (Scorpionida: Vejovidae). Proceedings of the California Academy of Sciences, 4th series, vol. 34, no. 8, pp. 419-428.

WILLIAMS, S. C. (continued)
1968a. Scorpion preservation for taxonomic and morphological studies. Wasmann Journal of Biology, vol. 26, no. 1, pp. 133-136.
1968b. Scorpions from northern Mexico: Five new species of Vejovis from Coahuila, Mexico. Occasional Papers of the California Academy of Sciences, no. 68, pp. 1-24.
1968c. Methods of sampling scorpion populations. Proceedings of the California Academy of Sciences, 4th series, vol. 36, no. 8, pp. 221-230.
1968d. Two new scorpions from western North America. Pan-Pacific Entomologist, vol. 44, no. 4, pp. 313-321.
1970a. Three new species of Vejovis from Death Valley, California. Pan-Pacific Entomologist, vol. 46, no. 1, pp. 1-11.
1970b. Scorpion fauna of Baja California, Mexico: Eleven new species of Vejovis (Scorpionida: Vejovidae). Proceedings of the California Academy of Sciences, 4th series, vol. 37, no. 8, pp. 275-332.
1970c. New scorpions belonging to the Eusthenura group of Vejovis from Baja California, Mexico (Scorpionida: Vejovidae). Proceedings of the California Academy of Sciences, 4th series, vol. 37, no. 12, pp. 395-418.
1970d. A new species of scorpion belonging to the pumilis group of genus Vejovis (Scorpionida: Vejovidae). Pan-Pacific Entomologist, vol. 46, no. 3, pp. 181-183.
1970e. A systematic revision of the giant hairy-scorpion genus Hadrurus (Scorpionida: Vejovidae). Occasional Papers of the California Academy of Sciences, no. 87, pp. 1-62.
1971. Clarifications in the nomenclature of some North American scorpionida. Pan-Pacific Entomologist, vol. 47, no. 1, pp. 78-79.

WILLIAMS, S. C., and N. F. HADLEY
1967. Scorpions of the Puerto Penasco Area (Cholla Bay), Sonora, Mexico, with description of Vejovis baergi, new species. Proceedings of the California Academy of Sciences, 4th series, vol. 35, no. 5, pp. 103-116.

WOOD, H. C.
1863a. Descriptions of new species of North American pedipalpi. Proceedings of the Academy of Natural Sciences of Philadelphia 1863, pp. 107-112.
1863b. On the pedipalpi of North America. Journal of the Academy of Natural Sciences of Philadelphia, 2nd series, vol. 5, pp. 357-376.

TABLE 1. Measurements (in millimeters) of Uroctonus glimmei Hjelle, new species, holotype and allotype.

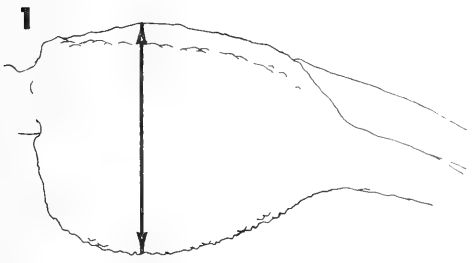
	Holotype (male)	Allotype (female)
Total length	34.8	40.2
Carapace, length	4.2	5.2
width (at median eyes)	3.0	3.8
Mesosoma, length	10.0	11.4
Metasoma, length	15.8	17.8
segment I (length/width)	2.1/2.3	2.4/2.7
segment II (length/width)	2.5/2.2	2.7/2.6
segment III (length/width)	2.6/2.2	3.0/2.5
segment IV (length/width)	3.4/2.1	3.7/2.4
segment V (length/width)	5.2/2.0	6.0/2.3
Telson, length	4.8	5.8
Vesicle (length/width)	3.3/2.1	4.0/2.3
depth	1.6	1.9
Aculeus, length	1.5	1.8
Pedipalp		
Humerus (length/width)	3.6/1.3	4.4/1.6
Brachium (length/width)	4.0/1.4	4.7/1.8
Chela (length/width)	6.8/2.6	8.4/3.0
depth	2.3	2.6
movable finger, length	3.6	4.2
fixed finger, length	2.7	3.4
Pectines		
teeth (left/right)	12/12	10/11

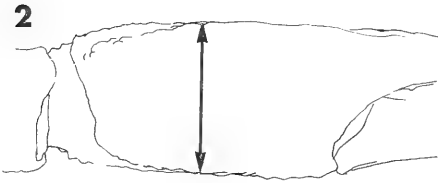
TABLE 2. Measurements (in millimeters) of Uroctonus mordax mordax Thorell, lectotype.

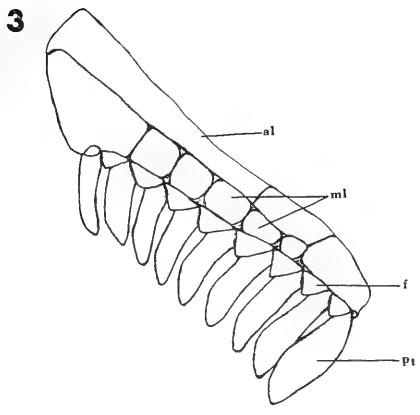
	Lectotype (female)
Total length	53.1
Carapace, length	6.4
width (at median eyes)	5.6
Mesosoma, length	20.5
Metasoma, length	19.4
segment I (length/width)	2.6/3.2
segment II (length/width)	3.2/2.8
segment III (length/width)	3.4/2.6
segment IV (length/width)	3.8/2.4
segment V (length/width)	6.4/2.2
Telson, length	6.8
Vesicle (length/width)	4.5/2.4
depth	2.2
Aculeus, length	2.3
Pedipalp	
Humerus (length/width)	5.1/2.4
Brachium (length/width)	5.5/2.8
Chela (length/width)	10.8/4.2
depth	3.0
movable finger, length	5.8
fixed finger, length	4.3
Pectines	
teeth (left/right)	8/9

TABLE 3. Measurements (in millimeters) of Uroctonus mordax pluridens Hjelle, new subspecies, holotype and allotype.

	Holotype (male)	Allotype (female)
Total length	55.5	57.0
Carapace, length	7.0	7.6
width (at median eyes)	5.9	6.5
Mesosoma,length	16.8	21.1
Metasoma, length	23.7	21.6
segment I (length/width)	3.2/3.8	3.0/3.4
segment II (length/width)	3.8/3.3	3.4/3.0
segment III (length/width)	4.1/3.1	3.8/2.8
segment IV (length/width)	4.8/2.8	4.2/2.6
segment V (length/width)	7.8/2.6	7.2/2.4
Telson, length	8.0	6.7
Vesicle (length/width)	5.8/3.3	4.5/2.6
depth	2.8	2.2
Aculeus, length	2.2	2.2
Pedipalp		
Humerus (length/width)	6.0/2.5	6.0/2.6
Brachium (length/width)	5.9/3.0	6.0/3.3
Chela (length/width)	12.4/4.8	12.7/4.8
depth	3.9	3.6
movable finger, length	6.4	6.8
fixed finger, length	5.1	5.3
Pectines		
teeth (left/right)	13/13	11/11







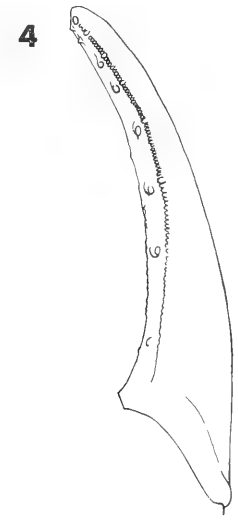
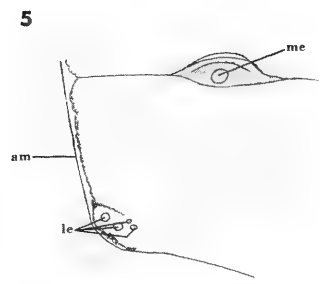


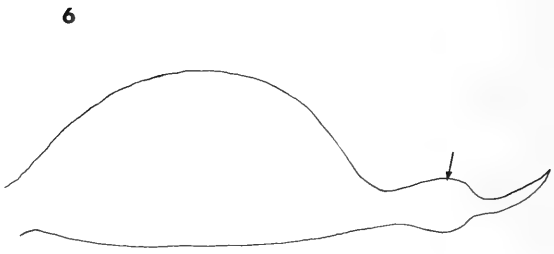
FIGURE 1. Dorsal view of left chela of Uroctonus mordax mordax Thorell, showing method of measurement of palm width.

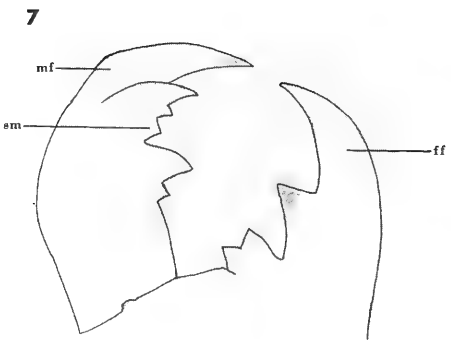
FIGURE 2. Inferior median view of left chela of Uroctonus mordax mordax Thorell, showing method of measurement of palm depth.

FIGURE 3. Generalized view of left pectine of Uroctonus mordax mordax Thorell. Structures shown: al - anterior lamella; ml - middle lamellae; f - fulcra; pt - pectinal teeth.

FIGURE 4. Dorsal view of right movable pedipalp finger of Uroctonus mordax mordax Thorell.







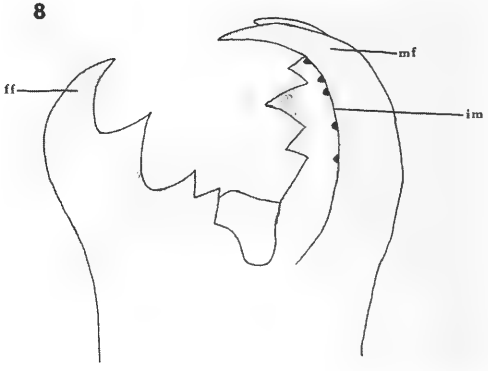
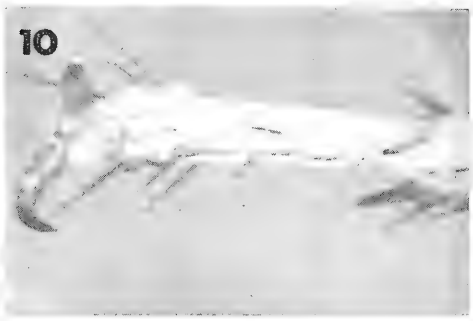


FIGURE 5. Dorso-lateral view of left half of carapace of Anuroctonus phaiodactylus (Wood). Structures shown: am - anterior margin; le - lateral eyes (4); me - median eye.

FIGURE 6. Lateral view of telson of male Anuroctonus phaiodactylus (Wood). Arrow indicates swollen bulb of aculeus.

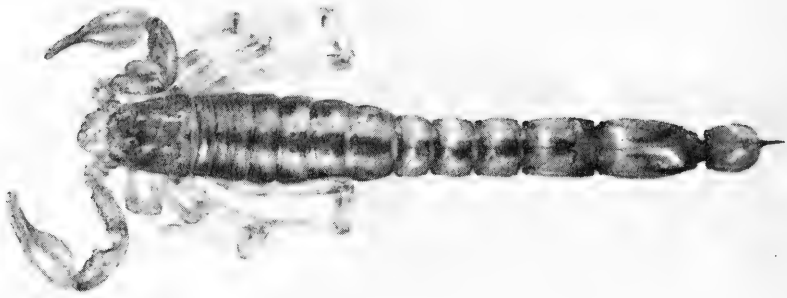
FIGURE 7. Left chelicera of type specimen of Uroctonus mordax Thorell. Dorsal view, showing: mf - movable finger; sm - superior margin of movable finger; ff - fixed finger.

FIGURE 8. Left chelicera of type specimen of Uroctonus mordax Thorell. Ventral view, showing: mf - movable finger; im - inferior margin of movable finger, with denticles; ff - fixed finger.

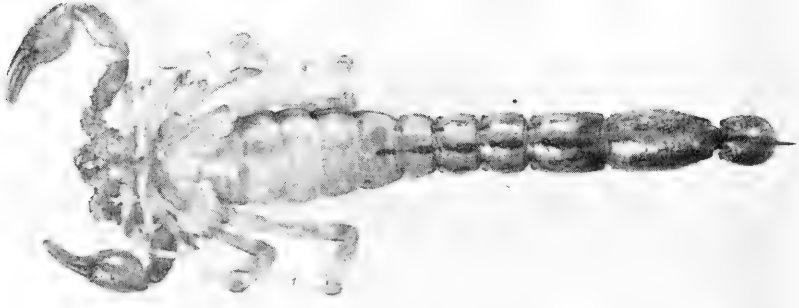


FIGURES 9 to 12. Ventral views of hind tarsi showing characteristic spinule pattern. FIGURE 9. Uroctonus mordax mordax Thorell. FIGURE 10. Uroctonus glimmei Hjelle, new species. FIGURE 11. Vaejovis silvestrii Borelli. FIGURE 12. Superstitionia donensis Stahnke.

13



14



FIGURES 13 and 14. Superstitionia donensis Stahnke, male. FIGURE 13. Dorsal view. FIGURE 14. Ventral view.

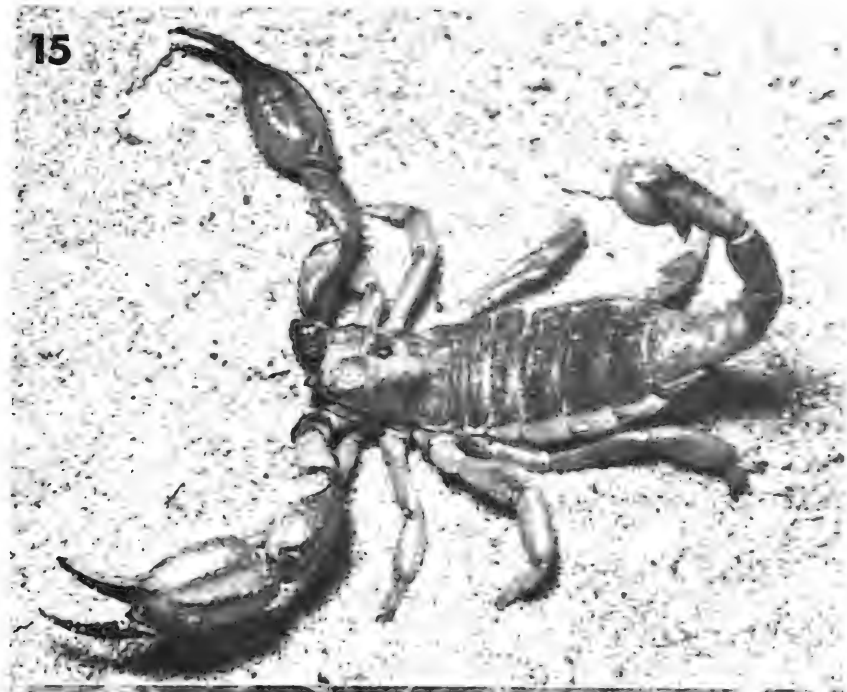
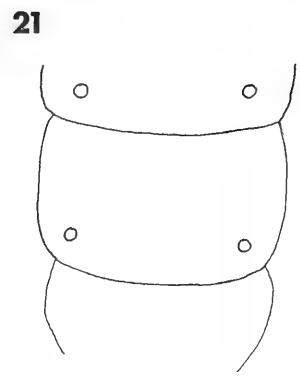


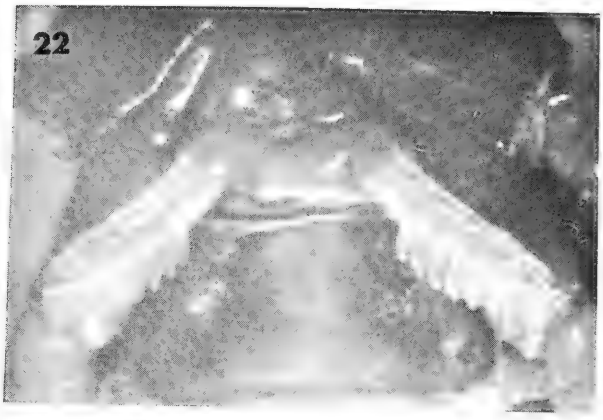
FIGURE 15. Dorsal view of Anuroctonus phaiodactylus (Wood), male.

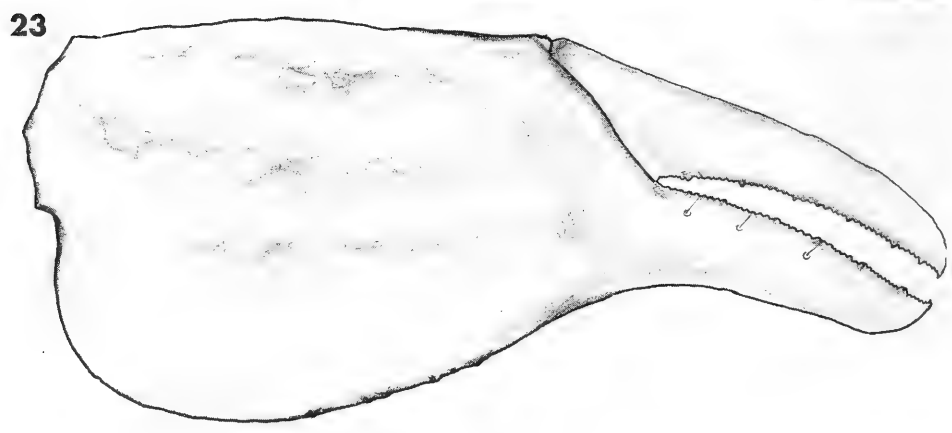
FIGURE 16. Typical burrow entrance of Anuroctonus phaiodactylus (Wood).

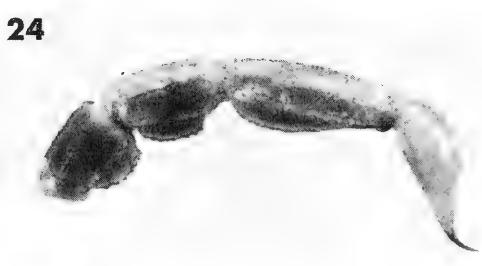
FIGURES 17 and 18. Hadrurus obscurus Williams, holotype male. FIGURE 17. Dorsal view. FIGURE 18. Ventral view.

FIGURES 19 and 20. Uroctonus privus Karsch, holotype female. FIGURE 19. Dorsal view. FIGURE 20. Ventral view.









FIGURES 21 to 24. Uroctonus privus Karsch, holotype female. FIGURE 21. Representation of ventral surface of mesosoma showing circular booklung openings. FIGURE 22. Pectine structure. FIGURE 23. Exterior lateral view of chela. FIGURE 24. Lateral view of metasoma III, IV, and V, and telson.

25

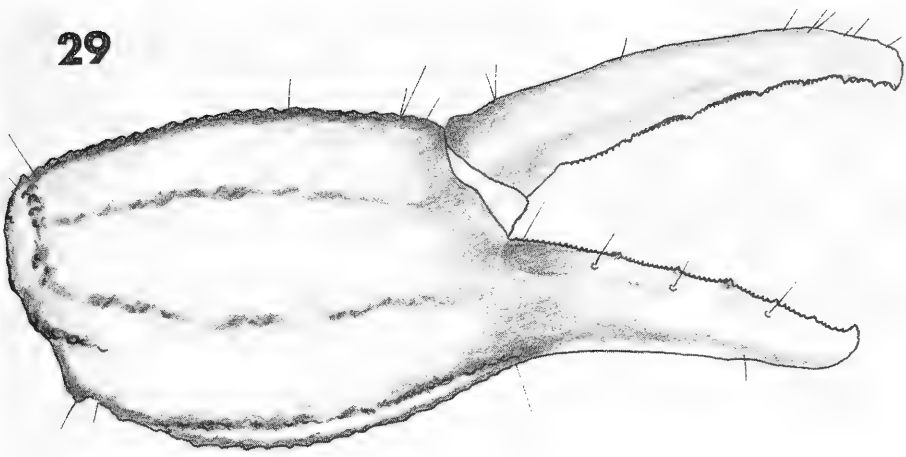
26

FIGURES 25 and 26. Uroctonus glimmei Hjelle, new species, holotype male. FIGURE 25. Dorsal view. FIGURE 26. Ventral view.

27

28

FIGURES 27 and 28. Uroctonus glimmei Hjelle, new species, allotype female. FIGURE 27. Dorsal view. FIGURE 28. Ventral view.



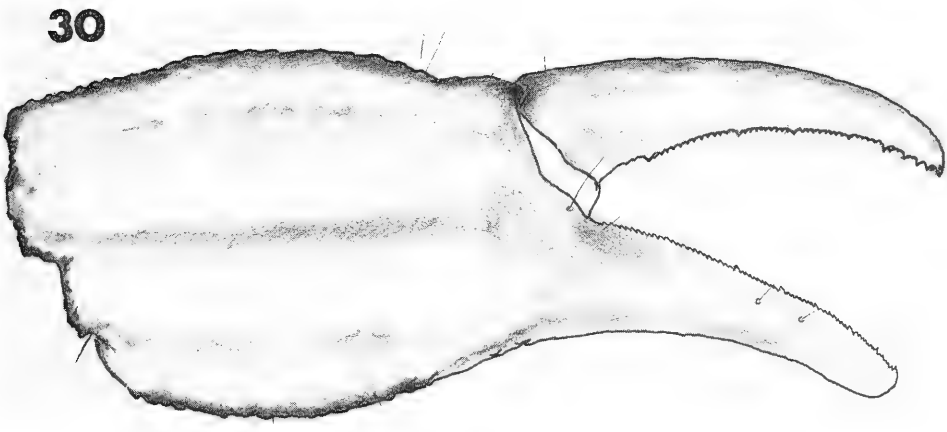
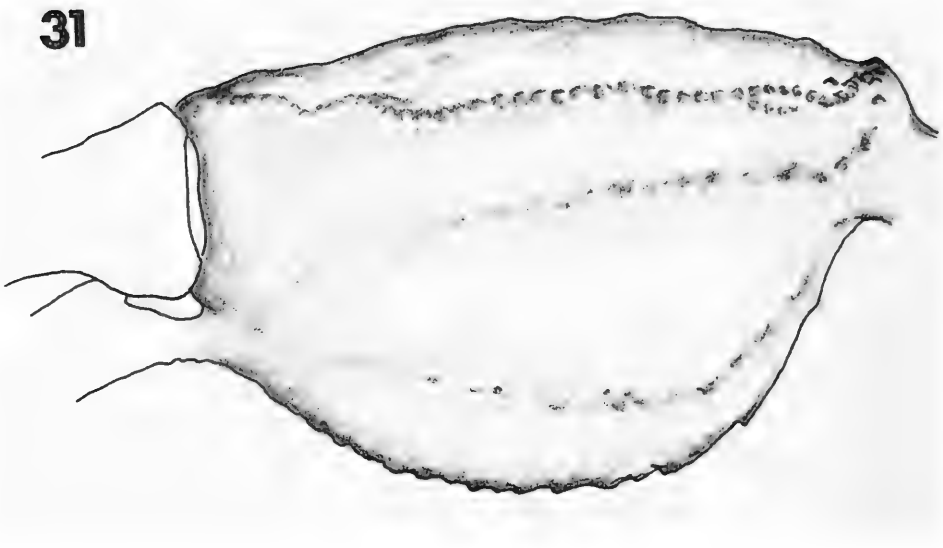


FIGURE 29. Exterior lateral view of left chela of Uroctonus glimmei Hjelle, new species, holotype male.

FIGURE 30. Exterior lateral view of left chela of Uroctonus mordax Thorell, lectotype female.



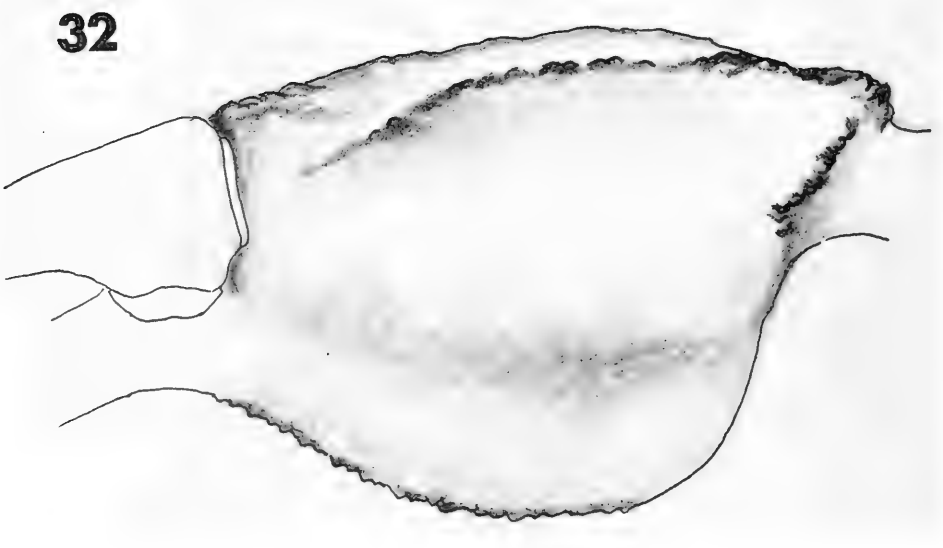


FIGURE 31. Ventral view of chela of Uroctonus glimmei Hjelle, new species, holotype male, showing characteristic carination.

FIGURE 32. Ventral view of chela of Uroctonus mordax Thorell, lectotype female, showing characteristic carination.

33

34

FIGURES 33 and 34. Lectotype female of Uroctonus mordax Thorell. FIGURE 33. Dorsal view. FIGURE 34. Ventral view.

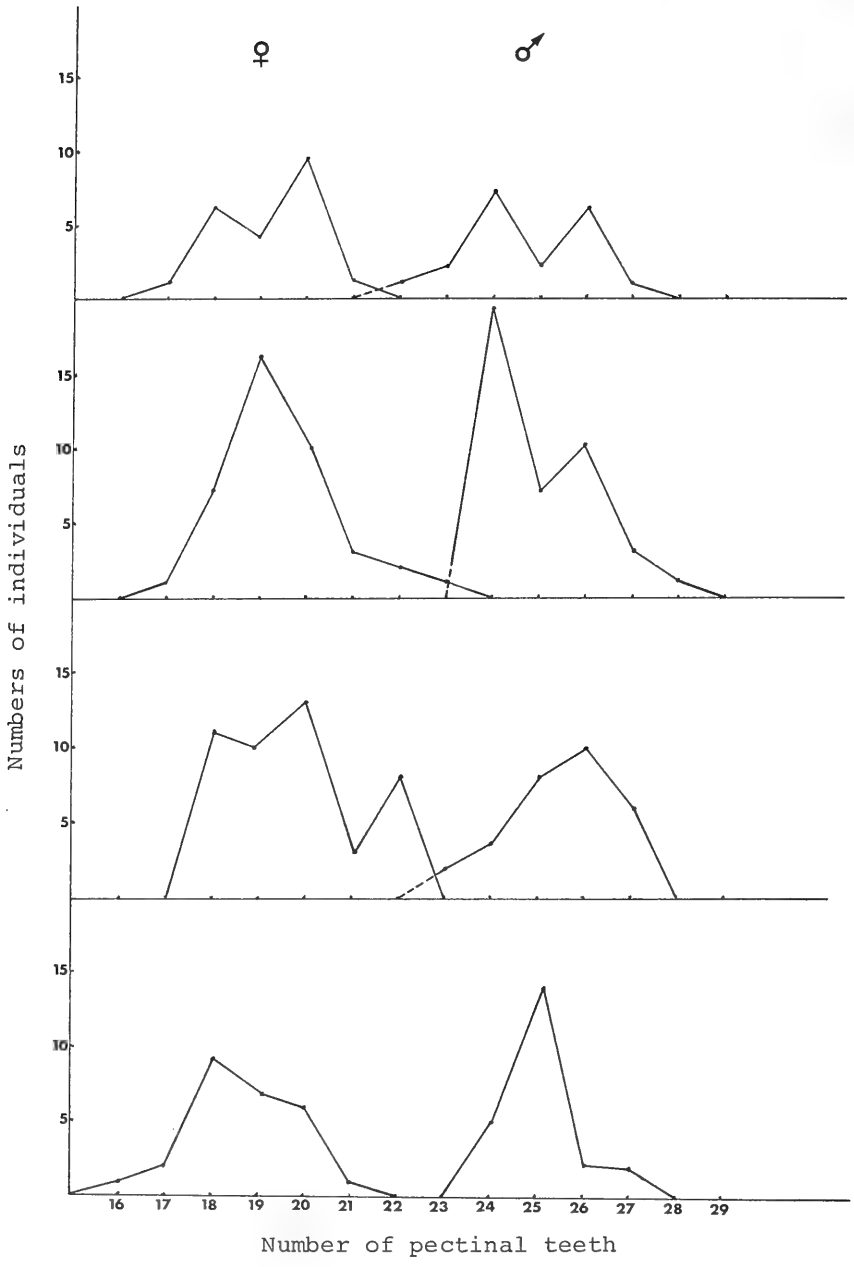


FIGURE 35. Differences in pectine tooth count modes between four different populations of Uroctonus mordax mordax Thorell. a) Glenn County, California. b) Bootjack Camp, Marin County, California. c) Sonoma County, California. d) Kent Lake, Marin County, California.

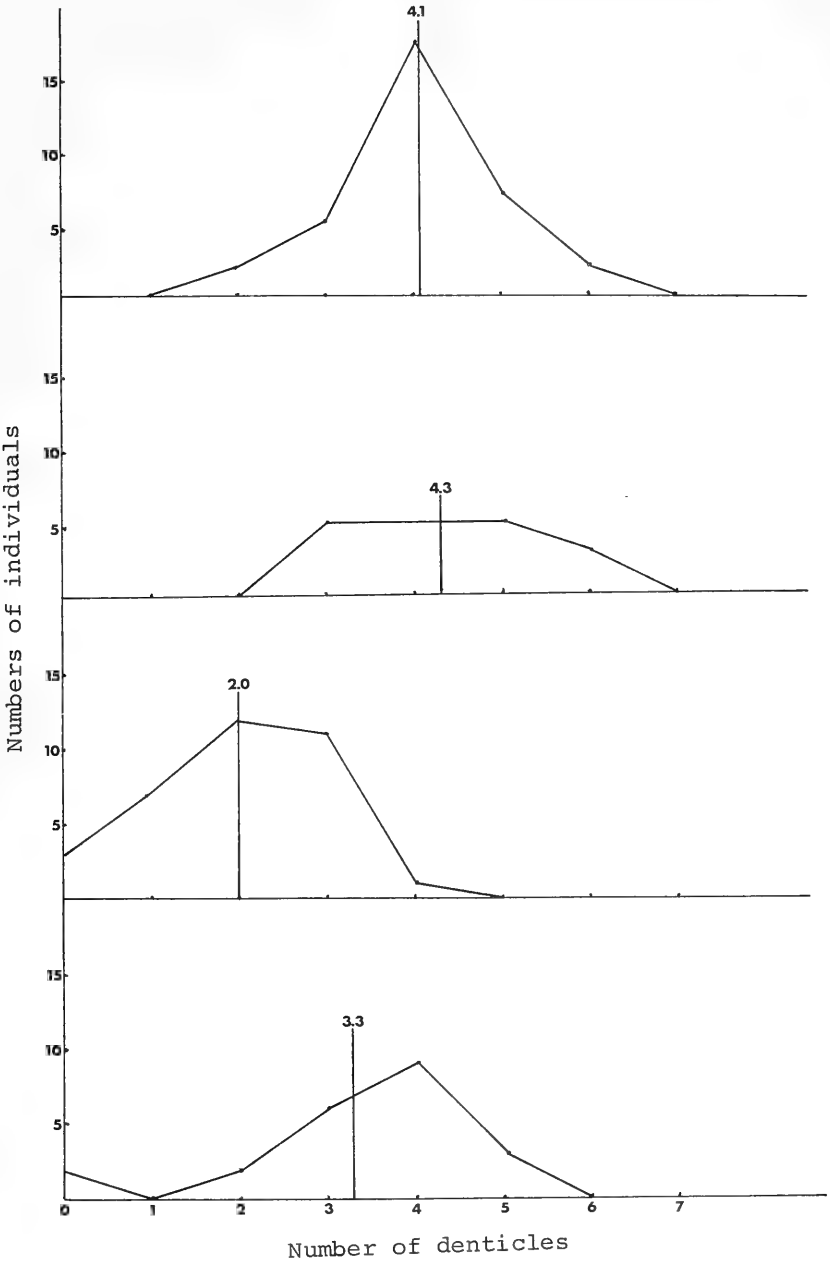
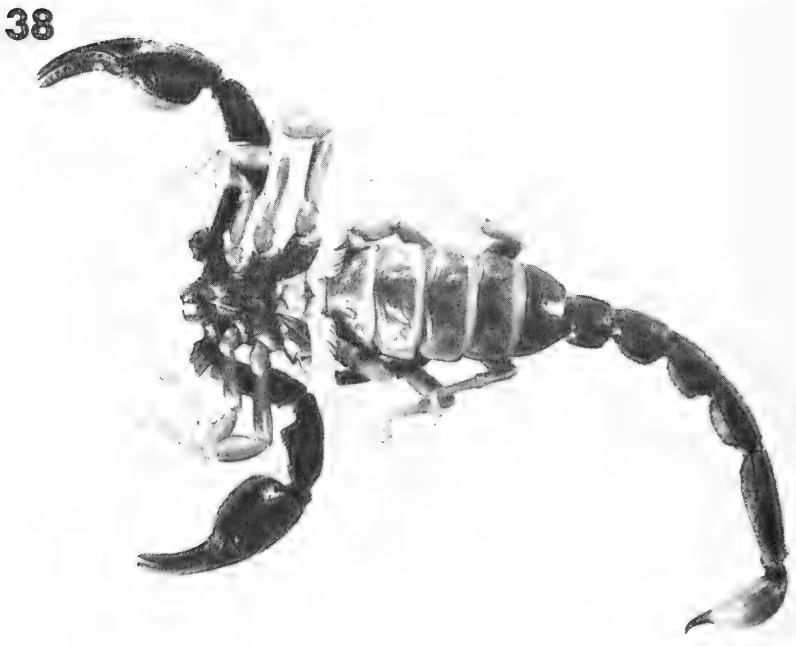
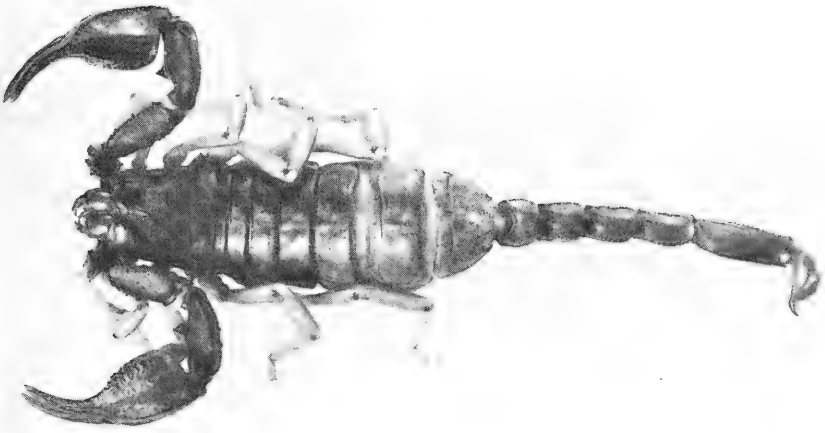


FIGURE 36. Differences in modes of counts of denticles on inferior margin of movable cheliceral finger between four different populations of Uroctonus mordax mordax Thorell. a) Fairfax Area of Marin County, California. b) Bear Creek Area of Lake County, California. c) 13 miles east of Covelo, Mendocino County, California. d) Rattlesnake Island, Clear Lake, Lake County, California.

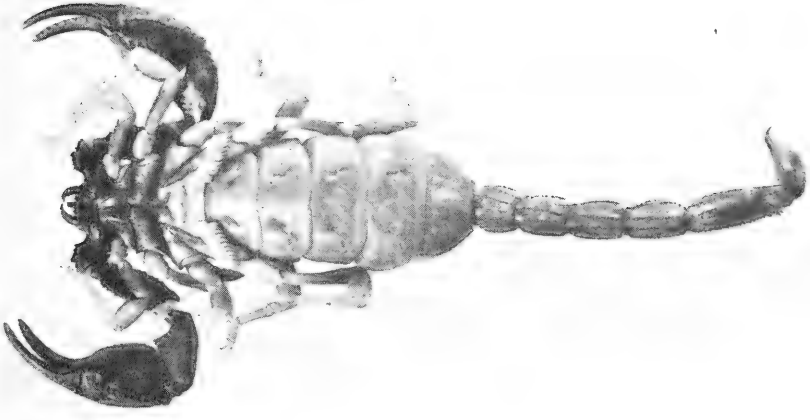


FIGURES 37 and 38. Uroctonus mordax pluridens Hjelle, new subspecies, holotype male. FIGURE 37. Dorsal view. FIGURE 38. Ventral view.

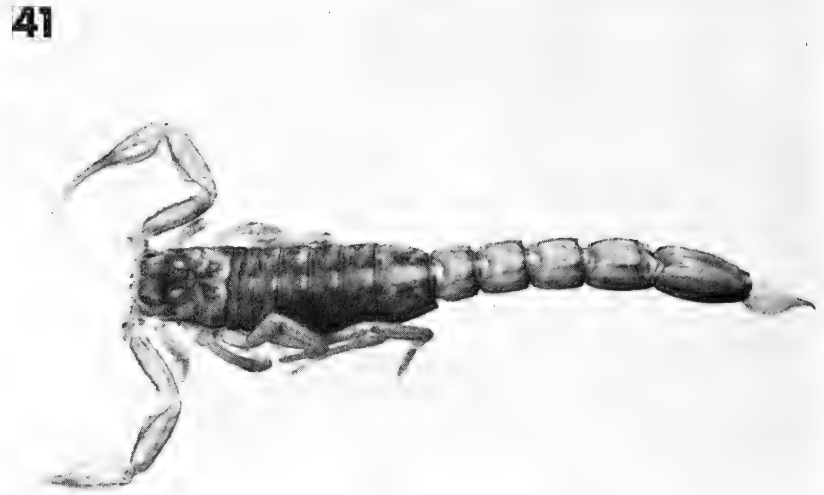
39

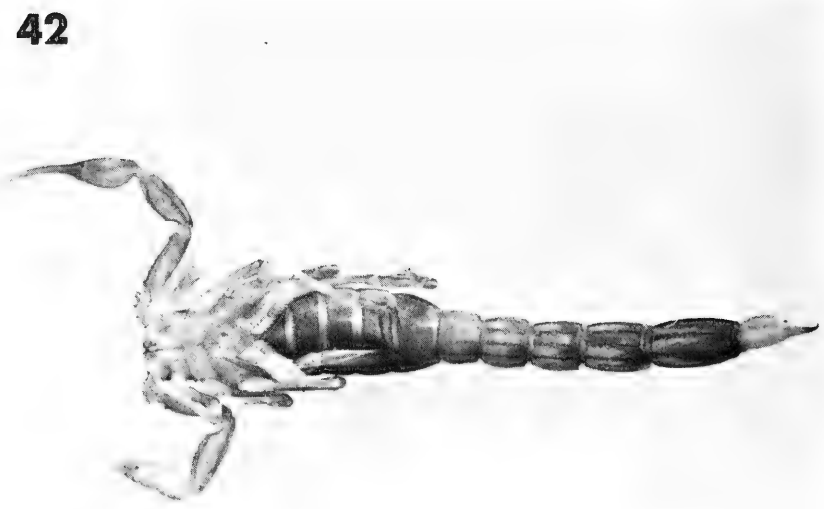


40



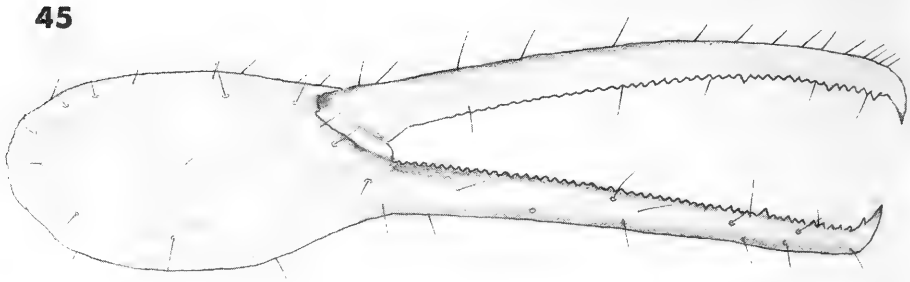
FIGURES 39 and 40. Uroctonus mordax pluridens Hjelle, new subspecies, allotype female. FIGURE 39. Dorsal view. FIGURE 40. Ventral view.





FIGURES 41 and 42. Vaejovis gertschi striatus Hjelle, new subspecies, holotype male. FIGURE 41. Dorsal view. FIGURE 42. Ventral view.

FIGURES 43 and 44. Vaejovis gertschi striatus Hjelle, new subspecies, allotype female. FIGURE 43. Dorsal view. FIGURE 44. Ventral view.



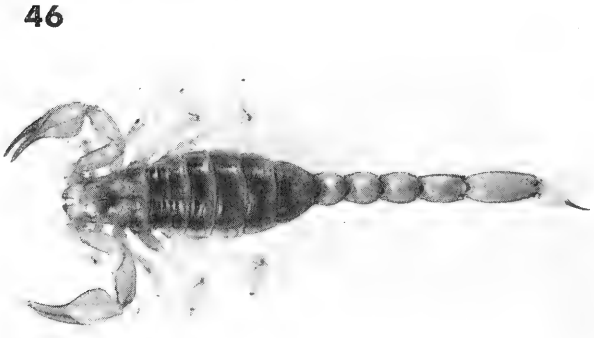
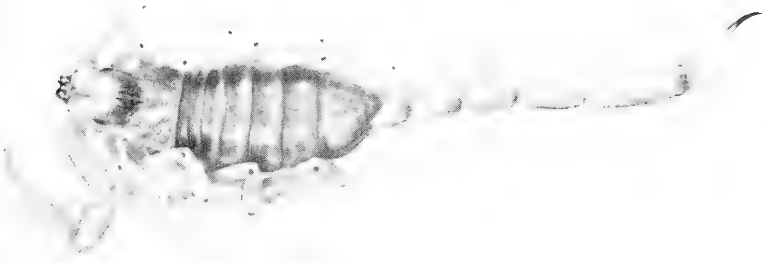


FIGURE 45. Exterior lateral view of chela of Vaejovis gertschi striatus Hjelle, new subspecies.
FIGURE 46. Dorsal view of Vaejovis boreus (Girard).

47

48



FIGURES 47 and 48. Vaejovis silvestrii Borelli. FIGURE 47. Typical color form. FIGURE 48. Lightly colored racial form.

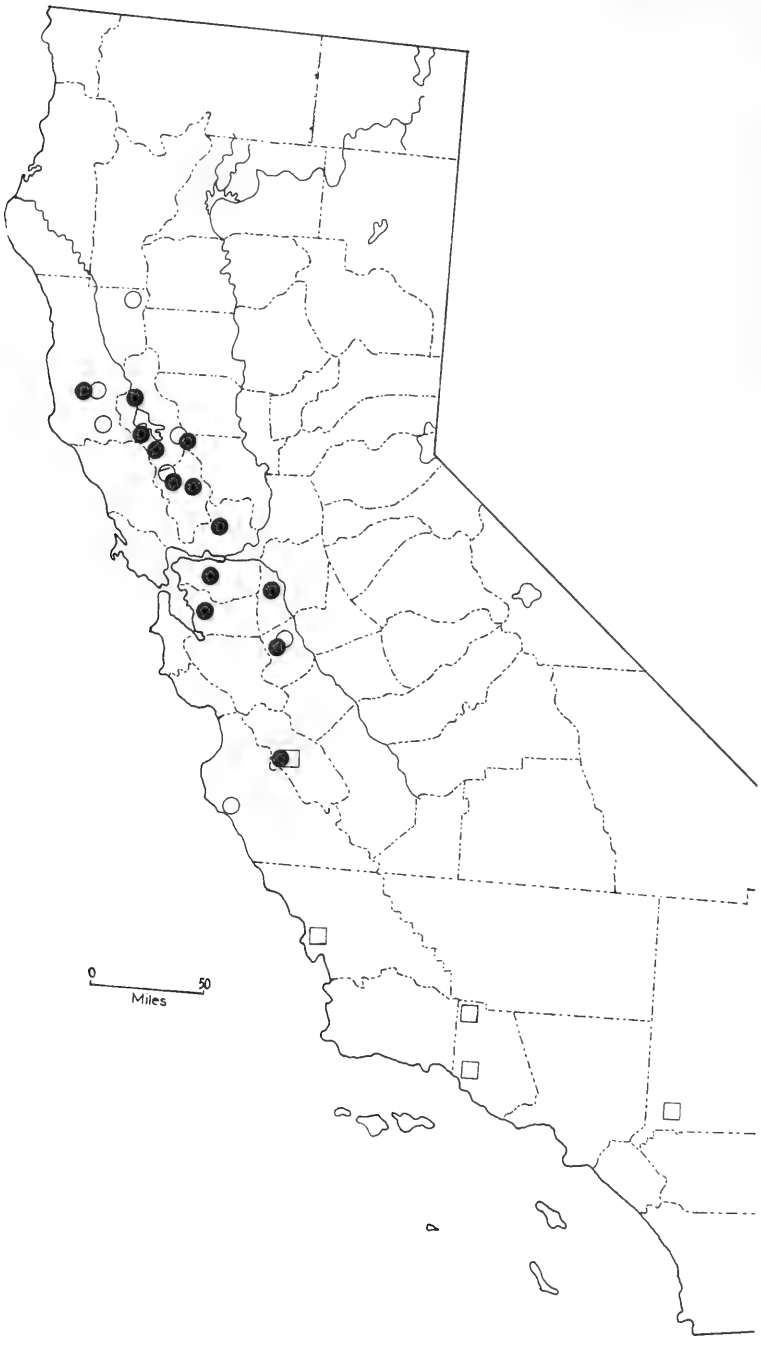


FIGURE 49. Distribution of Uroctonus glimmei Hjelle, new species (○), Vaejovis gertschi striatus Hjelle, new subspecies (●), and Anuroctonus phaiodactylus (Wood) (□).

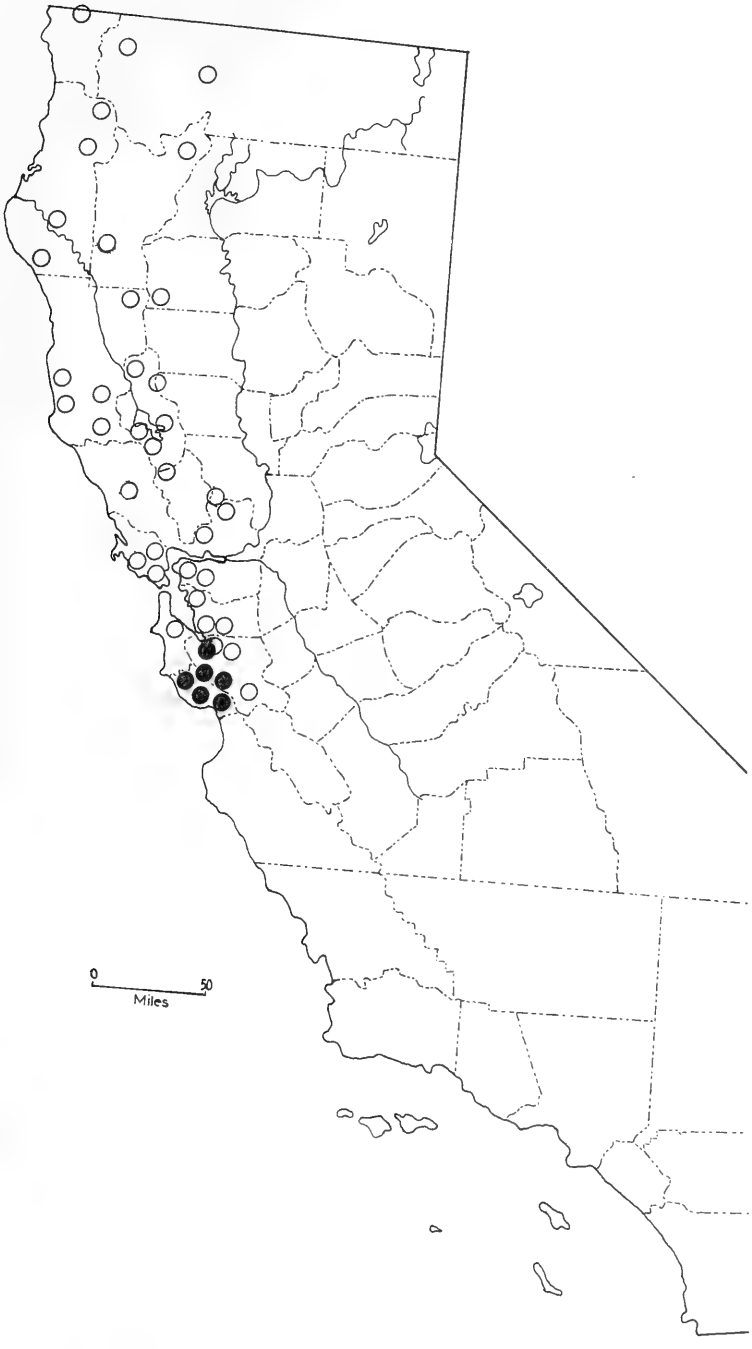


FIGURE 50. Distribution of Uroctonus mordax mordax Thorell (○) and Uroctonus mordax pluridens Hjelle, new subspecies (●).

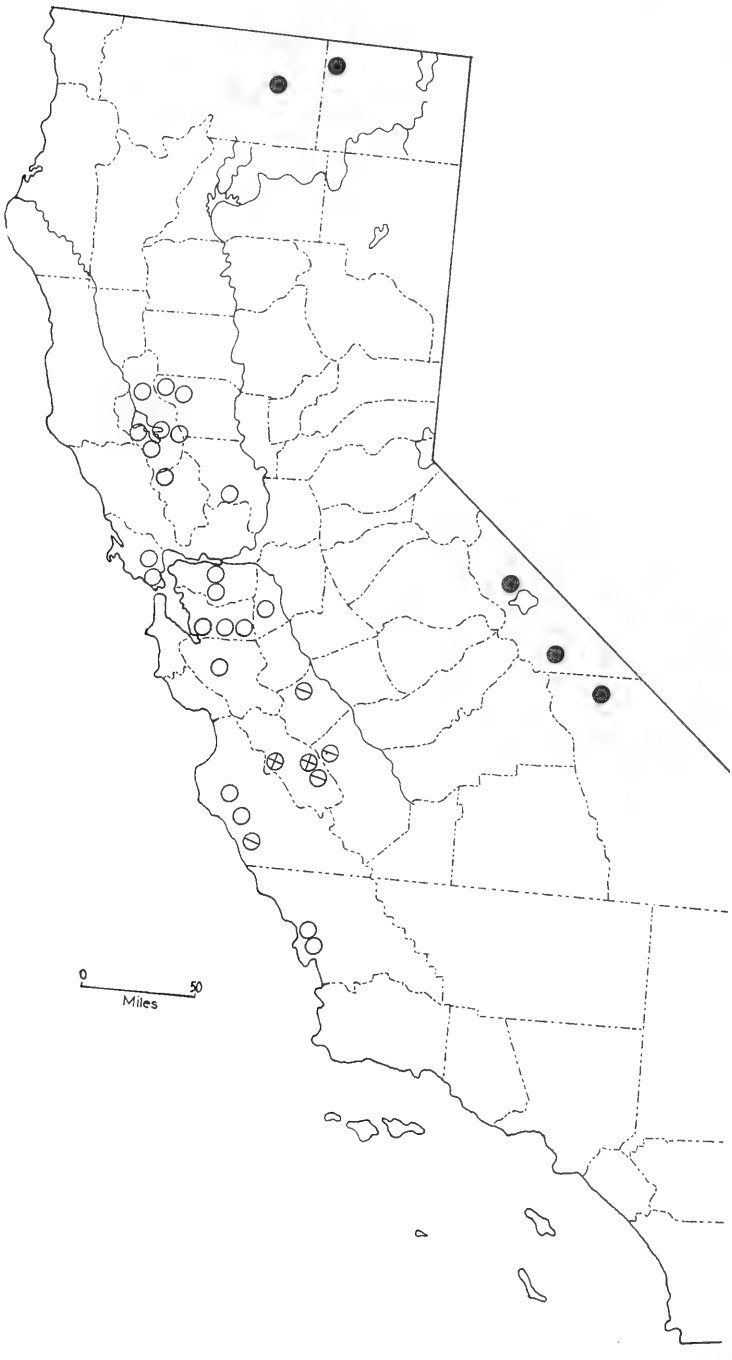


FIGURE 51. Distribution of Vaejovis boreus (Girard) (●), and Vaejovis silvestrii Borelli, typical color form (○), lightly colored racial form (⊗), and intergrades (⊘).

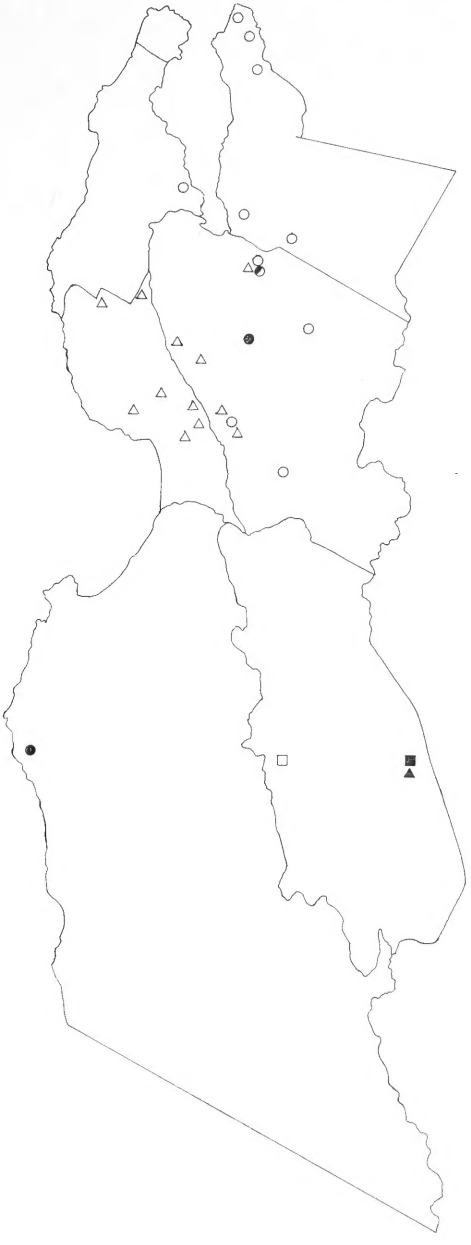


FIGURE 52. Distribution of the following scorpions in the East and South Bay counties: Uroctonus mordax mordax Thorell (○), Uroctonus mordax pluridens Hjelle, new subspecies (△), Uroctonus mordax (mordax X pluridens intergrades) (◐), Uroctonus glimmei Hjelle, new species (●), Anuroctonus phaiodactylus (Wood) (□), Superstitionia donensis Stahnke (▲), and Hadrurus obscurus Williams (■).