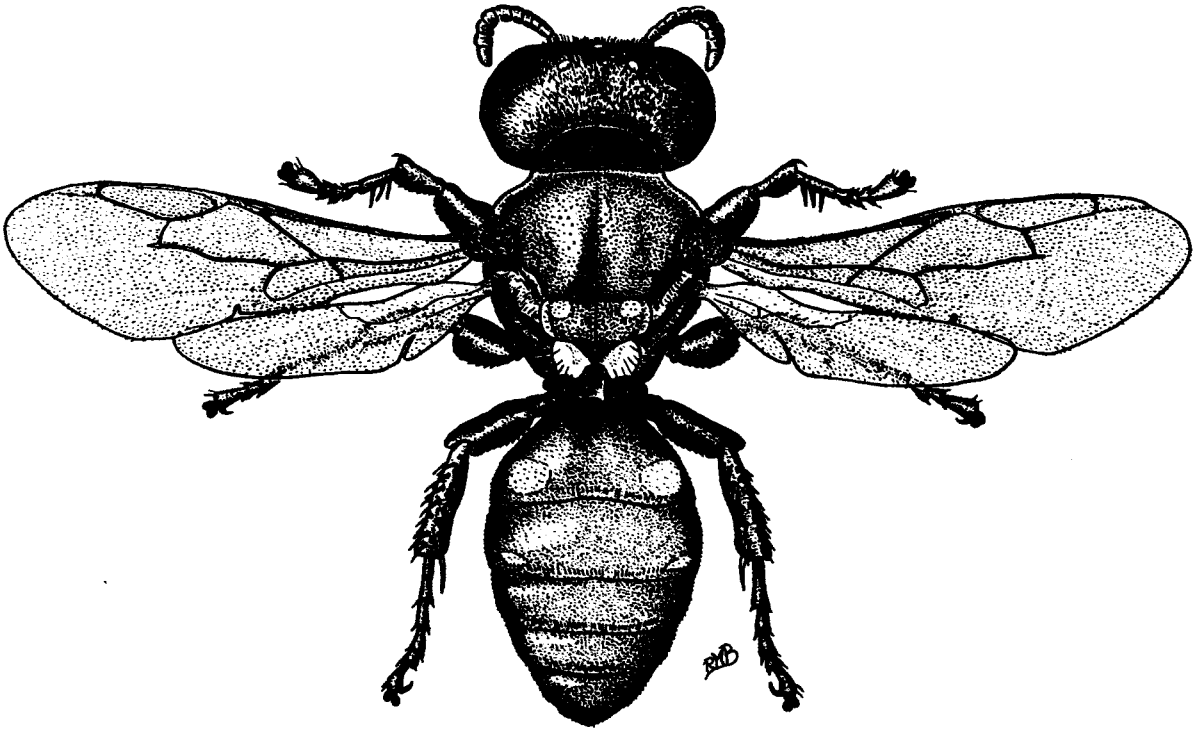
[redacted]



Dorsal view of *Oxybelus californicum* Bohart and Schlinger, female.

BULLETIN OF THE CALIFORNIA INSECT SURVEY

VOLUME 4, NO. 4

CALIFORNIA WASPS OF THE GENUS OXYBELUS

(Hymenoptera: Sphecidae, Crabroninae)

BY

RICHARD M. BOHART and EVERT I. SCHLINGER

(Department of Entomology and Parasitology, University of California, Davis)

UNIVERSITY OF CALIFORNIA PRESS
BERKELEY AND LOS ANGELES
1957

BULLETIN OF THE CALIFORNIA INSECT SURVEY

Editors: E. G. Linsley, S. B. Freeborn, P. D. Hurd, R. L. Usinger
Volume 4, No. 4, pp. 103-142, plates 9-16, 23 maps, frontis.
Submitted by Editors, May 29, 1956
Issued April 11, 1957
Price, 75 cents

UNIVERSITY OF CALIFORNIA PRESS
BERKELEY AND LOS ANGELES
CALIFORNIA

CAMBRIDGE UNIVERSITY PRESS
LONDON, ENGLAND

PRINTED BY OFFSET IN THE UNITED STATES OF AMERICA

CALIFORNIA WASPS OF THE GENUS OXYBELUS

(Hymenoptera, Sphecidae, Crabroninae)

By
Richard M. Bohart and Evert I. Schlinger

INTRODUCTION

The winglike expansions of the postscutellum and the spear-shaped median spine of the propodeum in species of the genus *Oxybelus* have always seemed remarkable to entomologists who have observed them. It is surprising that with about 50 species known from this continent, only seventeen workers have published taxonomic studies other than catalogues on the North American members since Thomas Say described the first species in 1824. Those who followed Say, listed in approximate chronological order, were E. T. Cresson, A. S. Packard, Abbé Provancher, C. H. Robertson, P. Cameron, W. J. Fox, T. D. A. Cockerell, C. F. Baker, H. L. Viereck, H. S. Smith, S. A. Rohwer, C. E. Mickel, N. Banks, V. S. L. Pate, K. V. Krombein, and the writers. Of the early papers those of Robertson were outstanding. His key (1889) to the known species was expanded by Smith (1908) and by Mickel (1918), but all three keys were fragmentary in the light of the presently known fauna.

The only important contributions at the generic level were those of Pate (1937, 1940) who added a third genus, *Enchemicrum*, to our fauna, and who discussed relationships of the Oxybelini from a world standpoint.

Burks (1951) was the first since Dalla Torre (1897) to assemble a check list which incorporated previously published synonymy. In this list of 65 species and subspecies from America north of Mexico, only 9 species were recorded from California. One of these, *laetum* Say, was based on a misidentification. Subsequent to Burks' list, further synonymy was added by Krombein (1955) and an extensively revised synonymic list was given by Bohart and Schlinger (1956*c*). In the latter list 50 of the 96 names pertaining to species and subspecies of *Oxybelus* in North America were retained as valid. In the present study we have attempted to differentiate 42 species and subspecies which we have been able to recognize from United States and Mexico. Included are 24 from California, and 5 of these—*cocopa, krombeini, linsleyi, macswaini,* and *timberlakei*—appear to be endemic forms.

Generally speaking, the species of *Oxybelus* can be considered rare. That is to say, they are often local, most of them are small, their habits are inconspicuous, and ordinary collecting methods yield only occasional specimens. We have seen entire collections from twenty-five of the major entomological museums in the country, and some of these contained only a dozen or so specimens. The material examined has totaled about 5,000 specimens of which some 2,000 are in collections of the University of California. At least one-half of the total has involved the 3 relatively common species, *emarginatum, uniglumis quadrinotatum,* and *californicum.* From the standpoint of distribution records, at least, there is a great need for further collecting of these insects in all parts of North America.

BIOLOGY

For the large number of known Oxybeline species, our biological information is scarce. To our knowledge no complete biology of any species has been published, although numerous notes are available dating from the early nineteenth century. Many European authors have contributed to our knowledge of these wasps, and for an account of the bibliographical and prey records of the European species, see Berland (1925). Among North American writers, Peckham (1898), Parker (1915), and Williams (1936) have recorded most of the data, all of which pertains to one subspecies, *Oxybelus uniglumis quadrinotatum.*

The *Oxybelus* wasps are solitary, each female constructing and provisioning her own nest or nests, usually in sandy areas. The nest is short, straight, and consists of one or rarely, two cells. It is not lined with foreign material but is simply dug out of the sand by the forelegs of the female. The cell is terminal, provisioned with several flies whose number depends on the size of the individual prey, and the egg is laid on the first prey member of the cell. The larva emerges in about a day, devours its stored food, grows and

pupates in ten to fifteen days, and emerges some two to three weeks later. There are one or two generations each year, possibly even three in a very favorable environment. The female of *quadrinotatum* impales her prey on her sting and carries it in this manner while flying. This also frees her legs for walking. The prey is held head first, sometimes upside down, so that most of it extends beyond the abdomen of the wasp. This subspecies reopens her nest on each arrival with prey and closes it before each excursion. The European species, *O. quattuordecimnotatum* Olivier, differs somewhat in its biology in that the prey is held under the body by the hind pair of legs rather than on the sting.

Only 2 of the 5 genera of Oxybelines have known prey records; *Oxybelus*, which use flies, and *Belomicrus*, which use flower beetles and mirids. Flies of the following families and genera have been recorded as prey of our North American *Oxybelus:* Anthomyidae (*Hylemyia*), Calliphoridae (*Lucilia*), Chloropidae (*Thaumatomyia*), Lonchaeidae (*Lonchaea*), Muscidae (*Musca*), Sarcophagidae (*Sarcophaga*), Stratiomyidae (*Microchrysa*), Syrphidae (*Allograpta*), and Therevidae (*Thereva*). The European species of *Oxybelus* have been cited also as using most of the above families, and in addition various genera of Dolichopodidae, Ephydridae, Lauxanidae, Sapromyzidae, Scopeumatidae, and Tachinidae have been observed.

Many of the flies recorded as prey are of economic concern, such as *Musca domestica* L., *M. crassirostris* Stein, and species of the root maggot genus, *Hylemyia*. Bequaert, as noted by Pate (1937:375), explained that adults of *Oxybelus pyrura* (Rohwer) are called "policias" by natives of Guatemala because of their beneficial attack on adults of *Simulium* species, some of which are vectors of onchocerciasis. Also, several authors have recorded *Oxybelus rufipes* Taschenberg as a predator on tsetse flies in Africa. Therefore it seems that some economic benefit may result from *Oxybelus* species near places of habitation as well as in agricultural areas.

During our studies on *Oxybelus*, numerous flower (nectar) hosts have been encountered through observations, specimen data, and the literature. Apparently the species are not directly associated with the flower hosts involved, but are rather found feeding from whatever attractive plants happen to be in flower. Thus, the importance of botanical records seems questionable.

DISTRIBUTION

The genus *Oxybelus* is cosmopolitan except for Australasia, where it is represented by a single species in the Society Islands. In North America about 50 species and subspecies are known to occur. The majority of these are found west of the Mississippi River, and many of them have a distribution extending from the Great Plains west into California and south into northern Mexico. We recognize 24 species as Californian, and of these, 19 range more or less broadly to the East. On the other hand, this leaves 5, or the respectable figure of 20.8 per cent, as apparently endemic forms. In addition to the 24, 5 other species have been collected as far west as Arizona and may eventually be found in California. These are *crandalli, paracochise, sparideum, subcornutum,* and *taenigaster.*

It appears likely that the American species may have evolved from some member of the *uniglumis* group, which is dominant in Europe. However, if our *Oxybelus* entered by the traditional Northwest Passage, they were able to adapt themselves to the arid regions of the West and developed into a number of species groups. These are quite distinct from any found elsewhere, and all but one are represented in California. Because of the predominance of species of the *emarginatum* group in Central and South America, it is possible that these developed from early isolations and remigrated north into the United States in relatively recent geological times.

At present there appears to be only a single truly Holarctic species, *uniglumis*. The other one occurring on both continents, *bipunctatum*, was supposedly introduced into eastern United States about 1935 according to Pate (1943).

The whole genus shows a predilection for dry areas, and the majority of North American species are essentially creatures of the Austral life zone. In California, 18 of the known species are primarily Sonoran (Austral) in distribution, 4 are principally Transition, and 2 are rather extensively Austro-boreal.

Distribution maps show the known localities (by the use of dots) and the probable geographic distribution (by the use of overlays) for all the California species. The range of each species, as indicated by the overlay, is limited by a solid line where enough information is available, and by a dashed line where the range is somewhat doubtful.

Besides the actual locality records of the specimens, the following works were consulted in determining the distributional limits of our species: Merriam's *Life Zones* (1898), Dice's *Biotic Provinces* (1943), *Map of the Faunal Zones of America North of Mexico*, in Muesebeck *et al.* (1951), and Hurd's and Michener's *Megachiline Bees of California* (1955:4).

Several of the species have similar geographic ranges in California as shown on the accompanying maps. For example, *linsleyi* and *timberlakei* are confined to the southern montane areas; *krombeini* and *macswaini* seem to be restricted to the Great Valley; *abdominale, argenteopilosum, argypheum, parvum, pitanta,* and *ventrale* appear to inhabit the arid regions east of the Sierra Nevada; and the Mohave Desert apparently acts as a barrier to the three most common forms, *californicum, emarginatum,* and *uniglumis quadrinotatum.* The caption under each map explains the geographic position of each species.

ACKNOWLEDGMENTS

To the many who have helped in the preparation of this manuscript we express our appreciation. Most of the individuals who furnished us material are indicated in the collection records later in the paper.

Special help was given by K. V. Krombein of the U. S. National Museum (U.S.N.M.) who volunteered much original information and patiently compared specimens for us. Similarly, this study could not have been completed without the help of L. W. Quate, who made possible the examination of type material at the University of Nebraska.

Other individuals and institutions who generously loaned specimens were: Y. U. Amrein Pomona College (P.C.); W. E. Barr, University of Idaho (U.I.); G. E. Bohart, U. S. Department of Agriculture, Logan, Utah (G.E.B.); W. L. Brown, Jr., Museum of Comparative Zoölogy, Harvard College (M.C.Z.); R. R. Dreisbach, Midland, Michigan; H. E. Evans, Cornell University (C.U.); Harold Grant, Jr., Academy of Natural Sciences, Philadelphia; C. F. Harbison, San Diego Natural History Museum (S.D.); H. F. Howden, University of Tennessee; P. D. Hurd, Jr., University of California, California Insect Survey, Berkeley (C.I.S.); M. T. James, Washington State College; G. F. Knowlton, Utah State Agricultural College; W. E. LaBerge, University of Kansas (U.K); J. L. Laffoon, University of Iowa; W. A. MacDonald, University of California at Los Angeles (U.C.L.A.); A. T. McClay, University of California, Davis (U.C.D.); J. T. Medler, University of Wisconsin; H. J. Reinhard, Texas Agricultural and Mechanical College; E. S. Ross, California Academy of Sciences (C.A.S.); H. F. Schwarz, American Museum of Natural History (A.M.N.H.); H. A. Scullen, Oregon State College; J. A. Sealander, University of Arkansas; P. H. Timberlake, University of California at Riverside (U.C.R.); H. V. Weems, Jr., and R. A. Morse, State Plant Board of Florida, Gainesville; F. G. Werner and G. D. Butler, University of Arizona; and D. L. Wray, North Carolina State College.

In addition we wish to thank P. M. F. Verhoeff of the Netherlands and J. de Beaumont of Switzerland for giving us the opportunity of examining representative collections of Palearctic species.

SYSTEMATICS

The tribe Oxybelini is one of several in the subfamily Crabroninae. Characteristic of the tribe is the winglike development of the postscutellar integument into squamae. Even more striking in appearance is the mucro, a median spine or broadened projection of the propodeum arising just below the postscutellum. Three genera are represented in the American fauna: *Oxybelus* Latreille, *Belomicrus* A. Costa, and *Enchemicrum* Pate. The first two contain many species in various parts of the world, and *Enchemicrum* is known from a single North American species, *australe* Pate, which ranges as far west as Arizona. *Belomicrus* is well represented in California by about 25 species. The 3 genera can be separated in the following key.

Key to the Genera of Oxybelini in North America

1. Abdominal tergites sharply bent under laterally, venter flat; marginal cell of forewing acute at apex; female with a row of long hairs (psammophore) along temporal angle . . . . . *Belomicrus*
   Third and following abdominal tergites not sharply bent under laterally; marginal cell of forewing nearly truncate apically; female without a temporal row of hairs 2
2. Pleuron with a vertical carina in front of and separate from mid-coxal cavity as well as a short carina associated with front margin of cavity; scutellum and postscutellum with a median longitudinal carina . . . . . *Oxybelus*
   Pleuron with a carina associated with front margin of mid-coxal cavity but without one in front of it; scutellum and postscutellum not longitudinally carinate . . . . . *Enchemicrum*

Genus *Oxybelus* Latreille

Type species, *Vespa uniglumis* Linnaeus.

The name of the genus was apparently based on the propodeal spine or mucro, and was derived from the Greek *Oxy-* (= sharp) and *belos* (= dart or spear). Although several authors have treated the gender as masculine, it must be neuter, as pointed out by Pate (1937).

The genus has not been satisfactorily separated into subgenera. Some of the American species with emarginate mucro were originally described in *Notoglossa* Dahlbom. However, this characteristic is not entirely a natural one, and there is doubt that *Notoglossa* would apply to the American species in any case. Instead of using subgenera, we have divided the North American fauna into species groups. The groups are numbered from I to VII in order of their supposed development. On the basis of our studies we have assumed that the more important derived characters are: (1) a broadening and emargination of the mucro; (2) presence of a shiny tubercle on the vertex; (3) a broadening of the postscutellum and its squamae; (4) reduction or partial obliteration of the pronotal carina; (5) presence of appressed pubescence on the propodeum laterally; and (6) development of lateral tergal teeth in the male.

In the groups outlined below, the first has a Holarctic distribution. All the others appear to be endemic to the New World.

I. *Uniglumis* Group. Mucro slender, not emarginate, essentially parallel sided; pronotal carina strong; squama distinctly curved inward, point stronger than submedian lobe, if any; male clypeus ordinarily tridentate; most species without strong lateral tergal teeth in the male. Included species: *bipunctatum* Olivier, *cressonii* Robertson, *exclamans* Viereck, *laetum* Say, *macswaini* Bohart and Schlinger, *nigrum* Robertson, *packardii* Robertson, *rancocas* Pate, *rejectum* Baker, *sericeum* Robertson, *uniglumis* (Linnaeus), and *xerophilum* Bohart and Schlinger.

II. *Cornutum* Group. Mucro slender, entire or nearly so, usually spiniform; vertex with a smooth median tubercle; squamal point strong, exceeding submedian lobe, if any; lateral teeth developed on some tergites in the male. Included species: *cochise* Pate, *cornutum* Robertson, *hurdi* Bohart and Schlinger, *paracochise* Bohart and Schlinger, and *subcornutum* Cockerell.

III. *Subulatum* Group. Mucro slender, entire, tapering toward apex; pronotal angles rounded off; general sculpture rather rough; generally with a large basolateral polished spot on clypeus. Included species: *linsleyi* Bohart and Schlinger, *majus* Mickel, *subulatum* Robertson, and *ventrale* Fox.

IV. *Robertsonii* Group. Mucro usually short and rather broad, truncate or weakly emarginate distally; squamae broadened, of even height and texture across whole breadth, not evenly incurved posteriorly; propodeal sculpture fine on posterior vertical surface. Included species: *argypheum* Bohart and Schlinger, *robertsonii* Baker, *simile* Cresson, *taenigaster* (Viereck), and *timberlakei* Bohart and Schlinger.

V. *Emarginatum* Group. Mucro emarginate distally; squamae broadened, submedian squamal lobe often well developed. Included species: *abdominale* Baker, *anale* Cresson, *argenteopilosum* Cameron, *aztecum* Cameron, *bugabense* Cameron, *californicum* Bohart and Schlinger, *canalis* Bohart and Schlinger, *cocopa* Pate, *decorosum* (Mickel), *emarginatum* Say, *fossor* Rohwer and Cockerell, *frontale* Robertson, *inornatum* (Robertson), *krombeini* Bohart and Schlinger, *longispina* Cameron, *mexicanum* Robertson, *paenemarginatum* (Viereck), *parvum* Cresson, *pitanta* Pate, *pyrura* (Rohwer), and *sparideum* Cockerell.

VI. *Crandalli* Group. Mucro broadened; postscutellum short and broad, squama without submedian lobe; propodeum with abundant appressed pubescence on lateral surface. Included species: *crandalli* Bohart and Schlinger. [1]

SPECIFIC CHARACTERS

In contrast to the group characters there seem to be some which are found in distantly related species. These are: (1) a tendency toward reduction and localization of the setae on the wing membrane, particularly those in the median cell of the forewing; (2) formation of dense pubescence on the horizontal surface of the propodeum; (3) brown instead of gray eye color; (4) presence of red coloration on the abdomen toward the base as well as the apex; (5) development of a strong distal keel on the hind femur; and (6) an enlargement of the male last tergite together with loss of a defined pygidial area.

Extreme examples of (1) above are *subcornutum* in group II and *parvum* in group V. The propodeal pubescence of (2) occurs in *exclamans* of group I; *timberlakei, argypheum,* and *robertsonii* of group

[1]This species was based on a single female from Arizona with an imperfect mucro. We have seen a male from Lewisville, Arkansas, June 2, 1919 (J. C. Bradley, C.U.) which agrees in all important characteristics. The mucro is similar to that of *parvum* as illustrated in fig. 66.

IV; and *crandalli* of group VI. Brown eyes (3) are found in *exclamans, sericeum,* and *xerophilum* of group I; *paracochise* of group II; *ventrale* and *linsleyi* of group III; *argypheum, taenigaster,* and *timberlakei* of group IV; and *anale* of group V. Examples of red basal markings (4) are *abdominale, pitanta, cocopa,* and *fossor,* all in group V; of apical red coloration are *xerophilum* of group I and *timberlakei* of group IV. Keeled hind femora (5) are outstanding in *burdi* of group II and somewhat less developed in several species in other groups, notably *emarginatum* of group V. The only species with truly hoodlike apical tergite (6) are *timberlakei* in group IV and *fossor* in group V.

Probably the most characteristic specific structures are the squamae and the mucro. Ordinarily, the female has the mucro shorter, but it may be narrower or broader than in the male. In groups I, II, and III it is usually narrower in the female, but in groups IV, V, and VI it is usually broader. Although these structures are surprisingly uniform, there is a certain amount of variation and asymmetry to be expected, more in some species than in others.

Generally speaking, specimens of *Oxybelus* are small wasps usually 5 to 9 mm. in length. There is considerable size variation within a single species, however, no doubt dependent on the amount of provisioned food. For example, the smallest *Oxybelus* we have seen were females of *parvum* with a length of 3.5 mm. The average of this species is about 4.5 mm. and large specimens measure 5.5 mm. The largest species of *Oxybelus* in this country is *majus* with a length of 12 to 13 mm.

Key to the Species of *Oxybelus* in America and Northern Mexico[2]

1. Vertex with a shiny median tubercle . . . 2
   Vertex without a shiny median tubercle 6

2(1). Median cell of forewing nearly asetose; mucro mostly whitish-opaque, slightly flaring and barely emarginate at tip; thorax and abdomen shining; pile of ocellar and upper frons region quite erect (figs. 19, 20) . . . . . *subcornutum* Cockerell (p. 106)

   Median cell of forewing setose and otherwise not as above. 3

3(2). Hind ocellus with shiny swelling inside and adjacent to it 4
   Hind ocellus with small punctured swelling inside and adjacent to it 5

4(3). Mucro narrow, entire; distal projection of hind femur about as long as one ocellus diameter; tegula red, pronotal red marks usually present in female, sometimes in male (figs. 6, 13, 14) . . . . . *cornutum* Robertson (p. 115)
   Mucro stout, emarginate at apex; distal projection of hind femur longer than 2 ocellus diameters; tegula brown, pronotum all dark (figs. 1, 10, 22, 23) *burdi* Bohart and Schlinger (p. 106)

5(3). Small species, 3–5 mm.; median cell rather sparsely setose on posterior one-half; antenna abruptly dark on apical segment; legs with tibiae mostly bright yellow on outer side; male penult tergite black or rarely brown (fig. 15) . . . . . *cochise* Pate (p. 115)
   Large species, usually 6-8 mm.; median cell rather setose on posterior one-half, these setae stronger than those along anterior margin; antenna nearly evenly colored; legs with the fore tibia red, mid and hind tibia black, rarely with small white basal spot; male penult tergite red (figs. 4, 16, 17) *paracochise* Bohart and Schlinger (p. 106)

6(1). First abdominal tergite with reddish ground color 7
   First abdominal tergite with black or brownish ground color, sometimes with a little reddish subapically 10

7(6). With smooth shining swellings inside and adjacent to hind ocellus; male with lateral projections on tergites V–VI (figs. 62, 63) . . . . . *fossor* Rohwer and Cockerell (p. 129)
   Without smooth shining swellings adjacent to hind ocellus; male usually with lateral projections on tergites III–VI 8

8(7). Clypeus and antenna yellow; mesopleural silvery vestiture so dense as to obscure puncturation (figs. 86, 87) . . . . . *cocopa* Pate (p. 127)
   Clypeus and antenna not yellow; mesopleural silvery vestiture not entirely obscuring puncturation 9

9(8). Squama with a prominent, rounded, inner lobe; temporal angle with a long dis-

[2]A summary of the synonymy of North American species and information on the distribution of out-of-state forms can be found in Bohart and Schlinger (1956*c*).

tinct carina (figs. 78, 79) . . . . . *abdominale* Baker(p. 123)

Squama with inner apical margin oblique and nearly straight; temporal angle not carinate or only fairly so at base (figs. 64, 65) . . . . . *pitanta* Pate(p. 129)

10(6). Propodeum in dorsal view with dense silvery pubescence which largely obscures the sculpture 11

Propodeum in dorsal view without dense silvery pubescence 15

11(10). Squama with submedian lobe undeveloped 12

Squama with submedian lobe well developed; mucro truncate to slightly emarginate 13

12(11). Lateral surface of propodeum covered with appressed silvery pubescence; mucro narrow basally, broad and emarginate distally (fig. 21) . . . . . *crandalli* Bohart and Schlinger (p. 106)

Lateral surface of propodeum not pubescent; mucro slender, gently rounded distally; male with abdomen usually mostly reddish and mesopleuron with large, polished, impunctate area (figs. 44, 45) . . . *exclamans* Viereck (p. 113)

13(11). Median cell of forewing rather densely and somewhat unevenly setose; male last tergite enlarged, lateral punctured area not enclosed toward base above by carina (figs. 5, 52, 53) . . . . . *timberlakei* Bohart and Schlinger (p. 119)

Median cell of forewing with rather scanty setation on posterior one-half . . . 14

14(13). Eyes brown; median cell of forewing with rather pale-colored and sparse setae, about as in fig. 90; abdominal tergite V with an apical band of silvery pubescence in the male (fig. 57) . . . . . *argypheum* Bohart and Schlinger (p. 119)

Eyes black; median cell of forewing with rather dark-colored and more numerous setae, about as in fig. 91; abdominal tergite V with dark apical pubescence in male (figs. 48, 49) . . . . . *robertsonii* Baker (p. 119)

15(10). Mucro nearly parallel-sided or tapering toward apex which is usually not emarginate, or if slightly flaring, the squama rather evenly incurved from its point to near middle of postscutellum . . 16

Mucro flaring toward apex which is often emarginate; squama with an uneven inner (or posterior) margin, the point often lateral, much depressed, or abruptly angled near apex 28

16(15). Pronotal carina distinctly broken at humeral angle, which is somewhat rounded off 17

Pronotal carina sharp, hardly if at all interrupted, not rounded off at pronotal angle. 20

17(16). Median cell of forewing evenly and fairly densely setose in broad central area. 18

Median cell of forewing sparsely setose in broad central area 19

18(17). Large species, 10–14 mm.; mucro short, narrow, tapering to a point at apex; squama evenly incurved from its point to mid-line; male without lateral abdominal teeth (figs. 34, 35) . . . . . *majus* Mickel (p. 106)

Smaller species, 7–10 mm.; mucro parallel-sided, angled to point at tip in male, gently coming to point in female; squama abruptly angled inside lateral point, the posterior inner margin somewhat uneven; male with lateral abdominal teeth on tergites III–VI (figs. 12, 28, 29 . . . . . *linsleyi* Bohart and Schlinger (p. 117)

19(17). Eyes grayish (figs. 30, 31) . . . . . *subulatum* Robertson (p. 106)

Eyes yellowish or brownish; male with thoracic sterna, coxae, and clypeus often white-marked (figs. 32, 33) . . . . . .*ventrale* Fox(p. 117)

20(16). Median cell of forewing rather evenly setose 21

Median cell of forewing very sparsely or rather unevenly setose 23

21(20). Median carina of postscutellum projecting into a keel which is higher than long at base; squama stoutly sickle-shaped, more than twice as long as basal breadth; male only known (fig. 18) . . . . . *rancocas* Pate (p. 106)

Median carina of postscutellum moderately developed; squama not sickle-shaped, less than twice as long as basal breadth 22

22(21). Clypeus densely silvery pubescent in front view; last 2 or 3 tergites reddish; male clypeus with 5 rather equally developed teeth on margin (subspecies *crocatum* Krombein with abdominal

markings orange rather than yellow) (figs. 7, 46, 47) . . . . . *sericeum* Robertson (p. 113)

Clypeus not densely silvery pubescent; last 2 or 3 tergites dark brown to black; male clypeus with 3 teeth on margin (figs. 9, 24, 25) . . . . . *uniglumis quadrinotatum* Say (p. 111)

23(20). Temporal ridge present, originating at inferior angle of mandible base . . . 24

Temporal ridge undeveloped 26

24(23). Submedian lobe of squama well developed; penultimate tergite without reddish ground color; tergal spots well separated (figs. 26, 27) . . . . . *bipunctatum* Olivier (p. 106)

Submedian lobe of squama undeveloped; last 2 or 3 tergites with red ground color; 4 tergal yellow bands complete or nearly so 25

25(24). Distance between squamal points about one-half the postscutellar breadth; eyes of both sexes gray; setation of median cell of forewing as in fig. 91 (figs. 8, 42, 43, 91) . . . . . *macswaini* Bohart and Schlinger (p. 115)

Distance between squamal points about three-fifths the postscutellar breadth; eyes of male brown (female unknown); setation of median cell of forewing about as in fig. 90 (fig. 56) . . . . . *xerophilum* Bohart and Schlinger (p. 115)

26(23). Thorax and abdomen entirely black, dorsum of abdomen becoming polished toward middle where punctures are very fine and sparse (figs. 40, 41) . . . . . *nigrum* Robertson (p. 106)

Thorax and abdomen somewhat maculated 27

27(26). Tergite II in female polished toward middle and finely punctured; clypeal apex in male with mid-tooth depressed and not protruding farther than submedian tooth (subspecies *fulvipes* Robertson with orange rather than yellow and brown) (figs. 38, 39) . . . . . *laetum* Say (p. 106)

Tergite II in female well covered with large punctures toward middle; clypeal apex in male with mid-tooth raised and protruding farther than submedian tooth (figs. 36, 37) . . . . . *packardii* Robertson (p. 113)

28(15). Postscutellum including squama more than 3 times as broad as its greatest length; mandible and scape black to reddish brown, abdominal markings whitish (figs. 54, 55) . . . . . *simile* Cresson (p. 121)

Postscutellum including squama not more than 3 times as broad as its greatest length 29

29(28). Last 3 tergites in male and last 2 in female all red; male mid-tibia with a whitish basal spot; setation of median cell of forewing irregular and sparse in posterior one-half (figs. 58, 59) . . . . . *taenigaster* (Viereck) (p. 106)

At most with last tergite and apex of penult red; male mid-tibia extensively pale 30

30(29). Median cell of forewing at most sparsely setose in posterior one-half 31

Median cell fairly extensively setose in posterior one-half 35

31(30). Median cell of forewing almost completely bare of setae; lateral point of squama strong, surpassing submedian lobe, if any; mesonotal groove moderate, of rather even depth 32

Median cell setose in anterior one-half 34

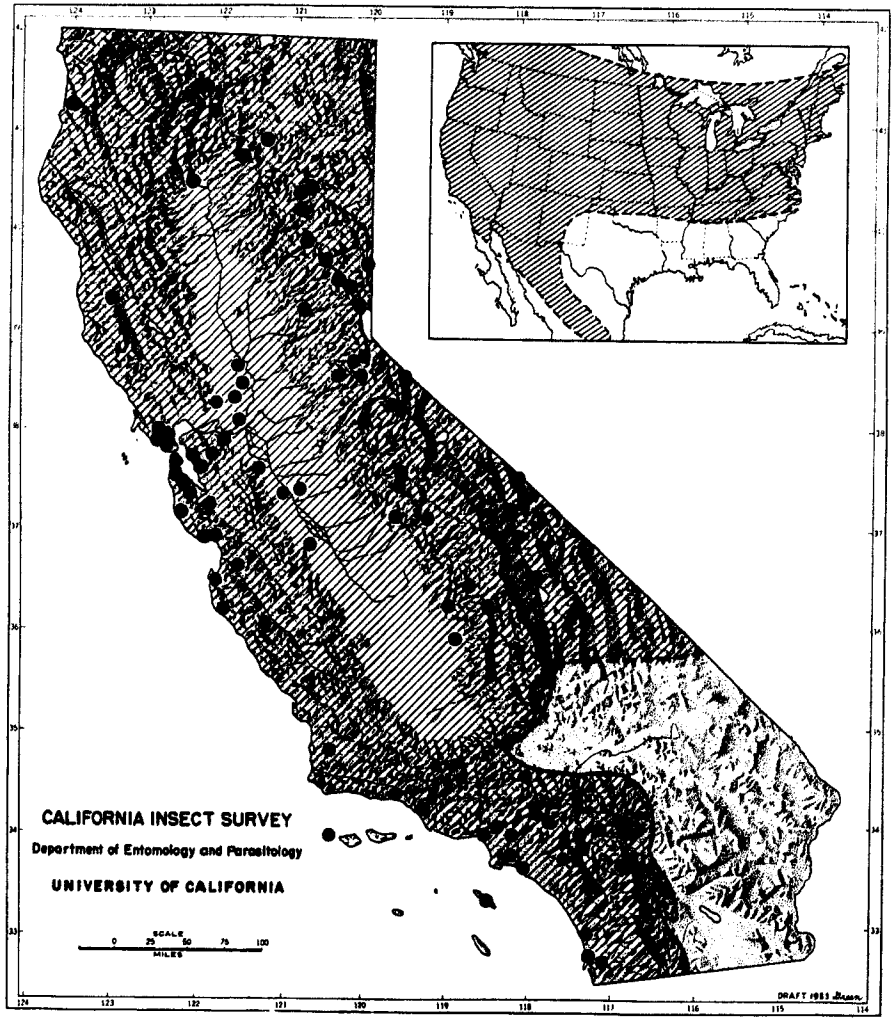
32(31). Face below ocelli shagreened, without large, distinct punctures; no smooth tubercles inside lateral ocelli; female antenna entirely bright yellow, and face with yellowish-tinted pubescence; male abdomen all black (figs. 50, 51) . . . . . *cressonii* Robertson (p. 106)

Face below ocelli with large, distinct punctures; smooth tubercles present inside lateral ocelli; female antenna dark toward base, not bright yellow, face silvery pubescent 33

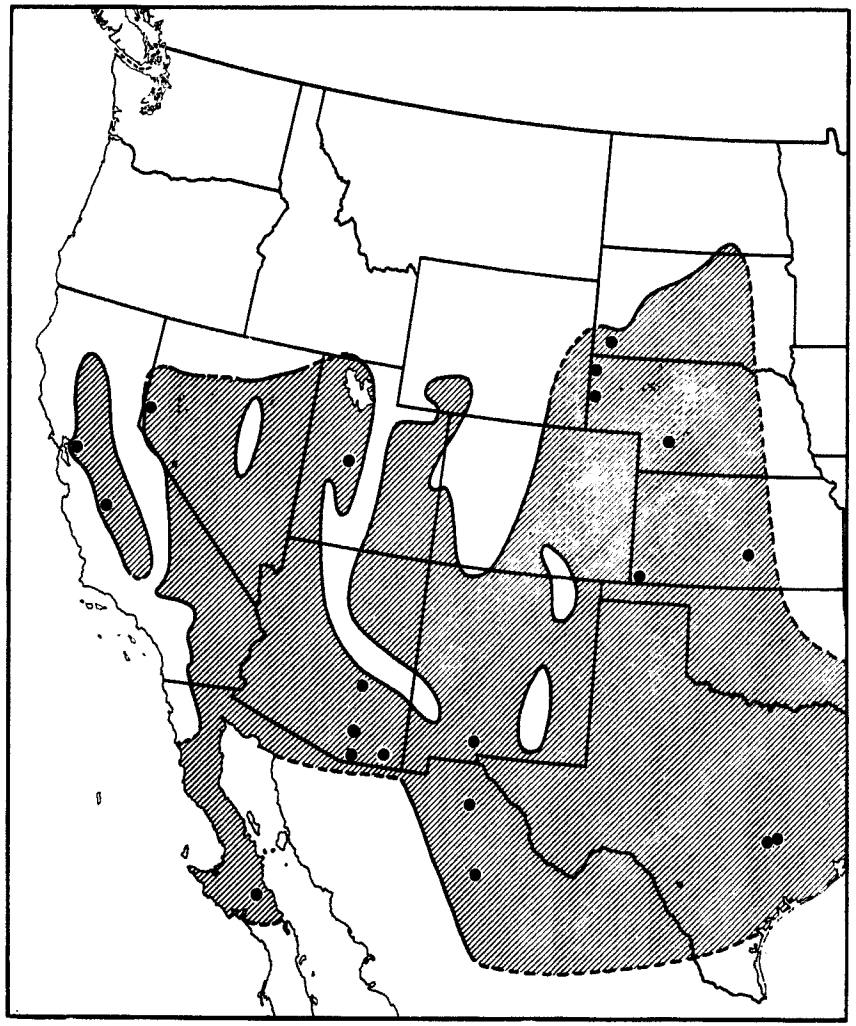
33(32). Abdomen with yellow markings, at least on first tergite; setae of female pygidium light reddish (figs. 66, 67, 88) . . . . . *parvum* Cresson (p. 127)

Abdomen without yellow markings, setae of female pygidium nearly black (figs. 70, 71) . . . . . *inornatum* (Robertson) (p. 106)

34(31). Mesonotal groove deeply channeled; submedian lobe of squama weakly developed and plainly surpassed by strong lateral tooth (figs. 11, 68, 69,



Map 1. California distribution of *Oxybelus uniglumis quadrinotatum* Say. Inset map shows range in United States.



Map 2. Distribution of *Oxybelus exclamans* Viereck. (This species is also recorded from Alabama and Georgia.)

89) . . . . . *canalis* Bohart and Schlinger (p. 127)

Mesonotal groove shallow; submedian lobe of squama moderately developed, usually equaling lateral tooth (figs. 84, 85, 90) . . . . . *argenteopilosum* Cameron (p. 123)

35(30). Lateral point of squama strong, plainly surpassing rather weakly developed submedian lobe; dorsum of abdomen evenly and rather densely punctured 36

Lateral point of squama plainly equaled or surpassed by strongly developed submedian lobe 37

36(35). Mesonotum with a shallow median depression; tergites with lateral spots only; female facial pubescence scanty and somewhat tawny (figs. 60, 61) . . . . . *decorosum* (Mickel)(p. 106)

Mesonotum with a median groove from pronotum almost to scutellum; tergites with complete or nearly complete yellow bands at least on II–IV; female facial pubescence plentiful and silvery (figs. 82, 83) . . . . . *krombeini* Bohart and Schlinger (p. 123)

37(35). Mucro with a distinct median ridge, forking Y-shaped distally (figs. 76, 77) . . . . . *sparideum* Cockerell (p. 106)

Mucro without a long Y-shaped ridge 38

38(37). Frons at its narrowest point more than one-third the head breadth, with a raised V-shaped ridge below ocelli; male with distinct lateral teeth on tergites II–IV; female and male mucro usually about twice as long as broad (figs. 74, 75) . . . . . *frontale* Robertson (p. 106)

Frons at its narrowest point about one-third the head breadth, no V-shaped frontal ridge 39

39(38). Dorsum of abdomen in both sexes, but particularly in female, more finely punctured toward mid-line and somewhat shiny; median cell of forewing evenly and densely setose; mucro usually with sides nearly parallel and 1.5–2.0 times as long as broad (frontis., figs. 2, 80, 81, 93) . . . . . *californicum* Bohart and Schlinger (p. 121)

Dorsum of abdomen in both sexes well punctured and rather dull; median cell of forewing more sparsely setose along posterior marginal one-fourth; mucro usually with very convex or divergent sides and less than 1.5 times as long as broad (figs. 3, 72, 73, 92) . . . . . *emarginatum* Say (p. 121)

GROUP I, UNIGLUMIS GROUP

Oxybelus uniglumis quadrinotatum Say
(Pl. 9, fig. 9; pl. 11, figs. 24, 25)

Oxybelus quadrinotatus Say, 1824, in Keating, Narrat. Long's second Exped., v. 2, appendix, p. 338 (no sex given), Pennsylvania. Type destroyed.

Geographic range: United States, southern Canada, and Mexico (see map 1, inset).

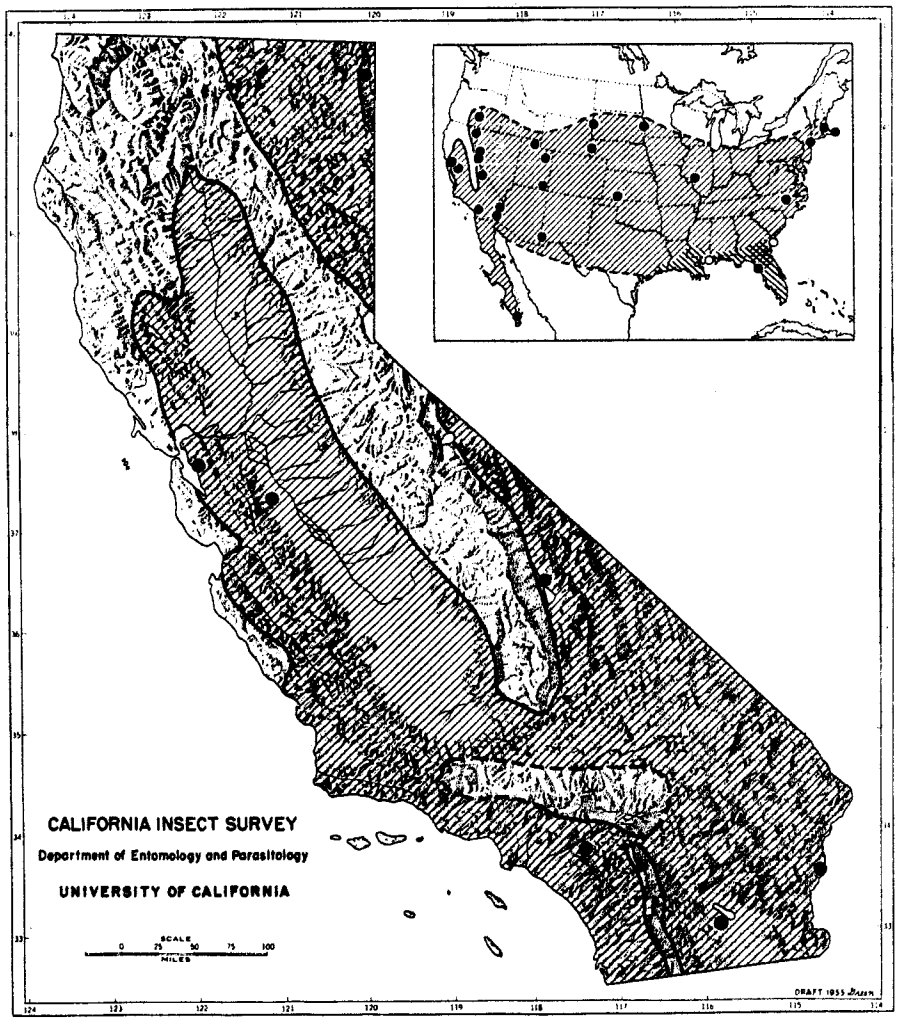
California records: Widespread (see map 1).

Discussion:

Twelve North American species belong in the *uniglumis* group which contains many European members. We have examined 8 of the latter. The sharp and continuous pronotal carina together with the rather evenly incurved squama and rather narrow, nonemarginate mucro characterize the group. Most of the species have the male clypeus strongly tridentate. Specimens of *quadrinotatum* are usually recognized at a glance in the female by the broad, somewhat shiny, evenly and finely punctured, nonconstricted abdomen; and in the male by the strongly beaked clypeus, the finely punctured tergites which are not toothed laterally, and the dark pygidium. As in some others of the group, the setation of the median cell of the forewing is even and dense (about as in fig. 93).

This widespread form is the most common North American *Oxybelus* and is the oldest named representative of the genus in this country. As suggested by P. M. F. Verhoeff (in a letter, 1955) *quadrinotatum* is conspecific with *uniglumis* (Linnaeus), the type species of the genus. The material which we have seen from Switzerland and Holland indicates that the typical subspecies differs only by the more orange-colored legs. According to Verhoeff, it is confined to Europe, including western Russia. Our subspecies occurs in southern Canada, throughout the United States except in the Austroriparian faunal zone, and south along the Sierra Madre mountains of Mexico to Huanchinango, Puebla. Its habitat covers a range of faunal areas from Upper Sonoran through Canadian. As an indication of its abundance in California we have examined a total of 326 males and 216 females.

Map 3. California distribution of *Oxybelus packardii* Robertson. Inset map shows range in United States.



Map 4. California distribution of *Oxybelus sericeum* Robertson. Inset map shows the subspecies *sericeum* (solid circles), and the subspecies *crocatum* (open circles) in United States.

Oxybelus exclamans Viereck,
(Pl. 12, figs. 43, 44)

Oxybelus exclamans Viereck, 1906, Trans. Amer. Ent. Soc., 32:215, ♀. Type ♀, Morton Co., Kansas.

Geographic range: North America from Nebraska to northern Mexico (see map 2).

Contra Costa Co.: Antioch, 1 ♀, VIII-30-36 (E. C. Van Dyke, C.A.S.).

Fresno Co.: Mendota, 1 ♂, IX-14-48 (V. M. Stern, C.I.S.).

Discussion:

This handsome species is primarily black in the male, the tergal fasciae whitish tinged with reddish. The female usually has the abdomen extensively red except at the base. Both sexes have the pygidium red. The dense silvery pile of the face, notum, and the area around the wing base, including the propodeum above, nearly obscures the sculpture. The eyes of dried specimens are light brown. The setation of the median cell of the forewing resembles that figured for *argenteopilosum* (fig. 90). It is widely distributed over North America in the Austral Zone but is rarely collected. Out-of-state records are from Arizona (Globe, Huachuca Mts., Tucson, Elfrida), Alabama (no definite locality), Georgia (Spring Creek), Kansas (Pottawatomie Co., Reno Co., Morton Co., 10 miles south of Jetmore), Mexico (Canyon de Santa Clara and Ahumada in Chihuahua, and San Ignacio in Baja California), Nebraska (Harrison, Mitchell, Wallace), Nevada (Reno Sky Ranch), New Mexico (Las Cruces), South Dakota (Hot Springs), Texas (Lee Co., McDade), and Utah (Topaz).

Oxybelus packardii Robertson
(Pl. 12, figs. 36, 37)

Oxybelus packardii Robertson, 1889, Trans. Amer. Ent. Soc., 16:80, ♂, ♀. Cotypes, Illinois.

Geographic range: United States, mostly south of 42° latitude (see map 3).

California records:

Inyo Co.: Deep Springs, 1♂, VII-16-53 (E. I. Schlinger, U.C.D.); 1 ♂, VII-17-53 (J. T. Brooks, U.C.D.); Mazourka Canyon, 1 ♂, VII-2-53 (J. W. MacSwain, C.I.S.).

Los Angeles Co.: Claremont, 1♀ (C. F. Baker, P. C.).

Riverside Co.: Coachella, 1♀, IX-22-31 (A. Williamson, U.S.N.M.); Blythe, 1♂, VI-24-45 (U.S.N.M.).

San Bernardino Co.: Baldy Mesa, 1♀, VII-21-36 (P.H. Timberlake, U.C.R.).

Discussion:

The California specimens which we have studied are somewhat atypical in that the clypeal teeth of the male are sharper and the female usually has the pygidial setae yellow to silvery rather than rust-red. Arizona specimens appear to be intermediate, however, and much more material will have to be studied before the exact status of the western forms can be determined. The setation of the median cell of the forewing is about as in figure 90.

The species is widespread in North America where we have seen out-of-state specimens from Arizona (Globe, San Simon, Pearce, Tuba City, Tucson), Florida (Alachua Co.), Iowa (Ledges State Park), Kansas (Douglas Co., Pottawatomie Co., Stafford Co., Blackjack Cr., Manhattan, Medicine Lodge, Minneapolis), Missouri (Kansas City, Buffalo), Nebraska (Glen, Bridgeport, Rulo, Omaha, Mitchell, Harrison), New Mexico (Grant), North Carolina (Raleigh, Bryson City, Wise), Ohio (Summit Co.), Texas (Giddings, Edna, Fedor, Goliad, Roanoke, Austin), Utah (Dugway), and Virginia (Falls Church, Farmville).

Oxybelus sericeum sericeum Robertson
(Pl. 9, fig. 7; pl. 12, figs. 46, 47)

Oxybelus sericeus Robertson, 1889, Trans. Amer. Ent. Soc., 16:81, ♀. Type ♀, Carlinville, Illinois (Acad. Nat. Sci. Phila.).

Geographic range: United States and Baja California, Mexico (see map 4). (*O. sericeum crocatum* Krombein is known from Mississippi and Georgia.)

California records:

Alameda Co.: Oakland, 1♀, VI-19-36 (E. S. Ross, C.A.S.).

Imperial Co.: San Felipe Creek, 1♀, VII-8-33 H. S. Gentry, U.C.D.).

Inyo Co.: Lone Pine, 1♀, VII-28-40 (R. H. Beamer, U.K.); Owens River, 1♂, VIII-5-15 (C. H. Kennedy, U.C.D.).

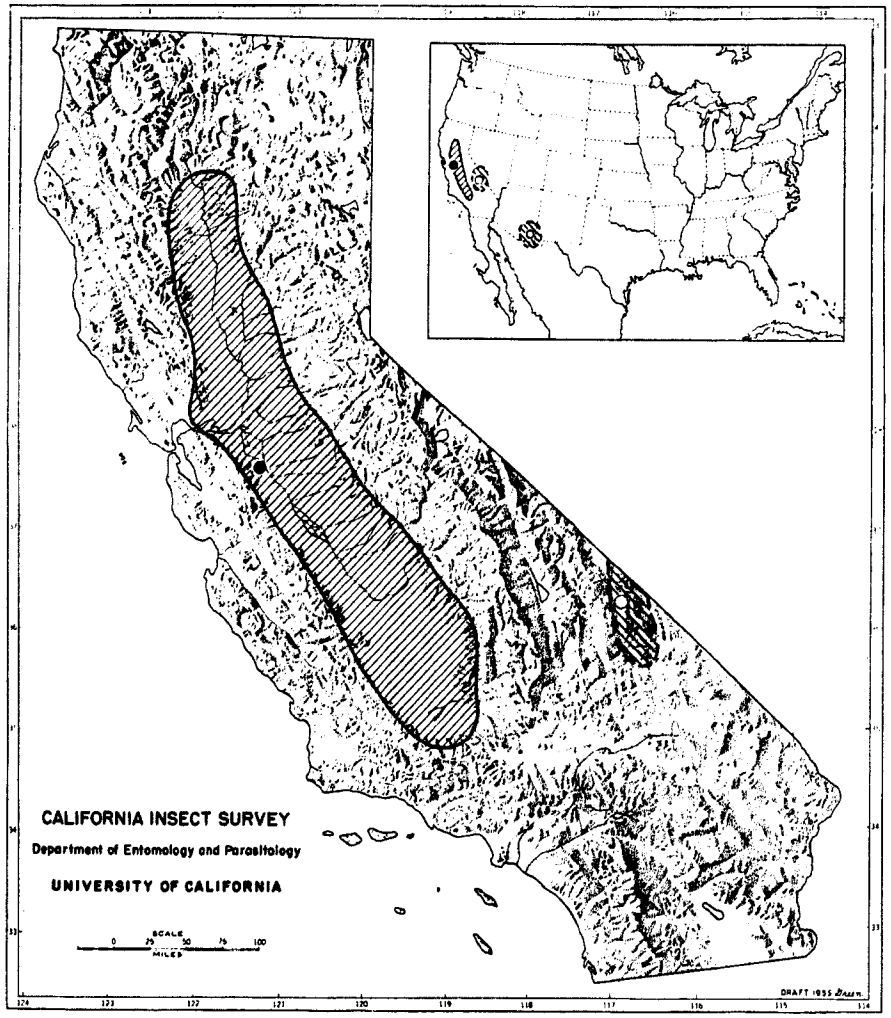
Modoc Co.: Lake City, 1♂, VII-30-22 (C. L. Fox, C.A.S.).

Riverside Co.: Blythe, 1♀, VI-24-45 (E. G. Linsley, C.I.S.); Riverside, 1♀, IX-1-35 (P. H. Timberlake, U.S.N.M.).

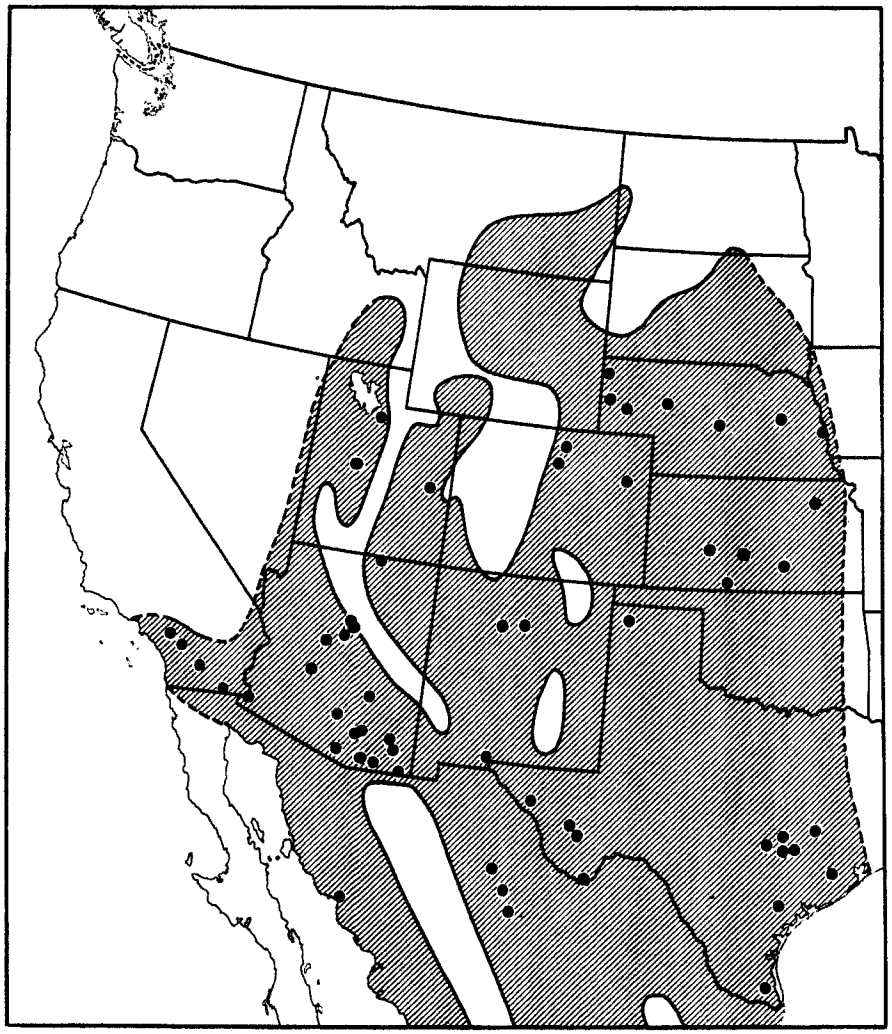
Stanislaus Co.: Patterson, 1♂, VI-21-49 (T. F. Leigh, C.I.S.).

Discussion:

In most characteristics this species agrees with others in the *uniglumis* group. The quinquedentate margin of the male clypeus is a departure, however.



Map 5. Distribution of *Oxybelus macswaini* Bohart and Schlinger (solid circle) and *Oxybelus xerophilum* Bohart and Schlinger (open circle). Inset map shows distribution of *macswaini*, and *xerophilum* range in United States.



Map 6. Distribution of *Oxybelus cornutum* Robertson.

It is one of the most pubescent species in this country. The setae of the median cell of the forewing are about as in figure 93, but a little less dense. As in many *Oxybelus* the females are more brightly colored than the males. For instance, in our female specimens the scutellum and squamae are yellow-marked instead of black, and the tergal spots are much larger than in the male. In California it occurs in dry regions the length of the state, but it is rare. Out-of-state records are: Arizona (Elfrida, Wilcox, Wickenberg), Florida (Cedar Keys), Illinois (Chicago, Carlinville), Kansas (Meade Co.), Massachusetts (Nantasket, Saxonville), Mexico (several localities in Baja California as far south as La Paz), Nevada (Lyon Co., Pyramid Lake), New Mexico (Rodeo), New York (Long Island, Gardiners Island), North Carolina (Penn Island), Oregon (Summer Lake), South Dakota (Belle Fourche, Lake Poinsett), and Utah (Roosevelt, Utah Lake, Bluff).

Oxybelus macswaini Bohart and Schlinger
(Pl. 9, fig. 8; pl. 12, figs. 42, 43; pl. 16, fig. 91)

Oxybelus macswaini Bohart and Schlinger, 1956, Pan-Pac. Ent., 32:153 ♂♀. Type ♂, Tracy, San Joaquin County, California (Calif. Acad. Sci.).

Geographic range: California (see map 5).

California records:

San Joaquin Co.: Tracy, 2♂, 2♀, VII-29-49 (J. W. MacSwain, C.A.S., C.I.S., U.S.N.M., U.C.D.); 1♀, VIII-1-48 (J. W. MacSwain, C.I.S.); 1♀, VI-21-49 (R. F. Smith, U.C.D.).

Discussion:

This species is closely related to *xerophilum* but differs as indicated in the key. Although known only from the type locality, its distribution should include much of the Sacramento-San Joaquin Valley.

Oxybelus xerophilum Bohart and Schlinger
(Pl. 13, fig. 56)

Oxybelus xerophilum Bohart and Schlinger, 1956, Pan-Pac. Ent., 32:154; ♂. Type ♂, Stovepipe Wells, Death Valley, Inyo County, California (Calif. Acad. Sci.).

Geographic range: California, Arizona (see map 5).

California records:

Inyo Co.: Stovepipe Wells, Death Valley, 1♂, III-30-53 (J. W. MacSwain, C.A.S).

Discussion:

Although closely related to *macswaini*, the brown eye color, more scanty wing setation, and more broadly separated squamae are sufficient for separation in the male. The female is unknown. Other species with brownish eyes and with several posterior tergites red are *sericeum* and *exclamans*, also in group I, and *argypheum*, *taenigaster*, and *timberlakei* in group IV.

Out-of-state records of *xerophilum* include 2 males from Willcox, Arizona.

GROUP II, CORNUTUM GROUP

Oxybelus cornutum Robertson
(Pl. 9, fig. 8; pl. 10, figs. 13, 14)

Oxybelus cornutus Robertson, 1889, Trans. Amer. Ent. Soc., 16:80, ♂. Cotype ♂♂, Montana (Acad. Nat. Sci. Phila.).

Geographic range: Arizona, California, Colorado, Kansas, Mexico (as far south as Guadalajara), Nebraska, New Mexico, Texas, and Utah (see map 6).

California records:

Imperial Co.: Holtville, 1♂, 1♀, VIII-11-17 (J. Bequaert, U.C.D.).

Riverside Co.: Riverside, 3♂, 5♀, V to IX-1931-36, IX-1-35 (P. H. Timberlake, U.C.R., U.C.D.); Hemet, VIII-13-49, VIII-24-46, VII-5-50 (J. W. MacSwain, E. G. Linsley, C.I.S., U.C.D).

San Diego Co.: Borego, 2♂, V-2-52 (J. G. Rozen, C.I.S.).

Discussion:

The red-marked mesonotum of the females and some males is peculiar to the species. The setae of the median cell of the forewing are larger and somewhat more dense than in figure 90. Although it is one of the largest and showiest of the California species it has been taken only rarely in the state. In North America it occurs west of the Mississippi River Basin, chiefly in the Sonoran zone.

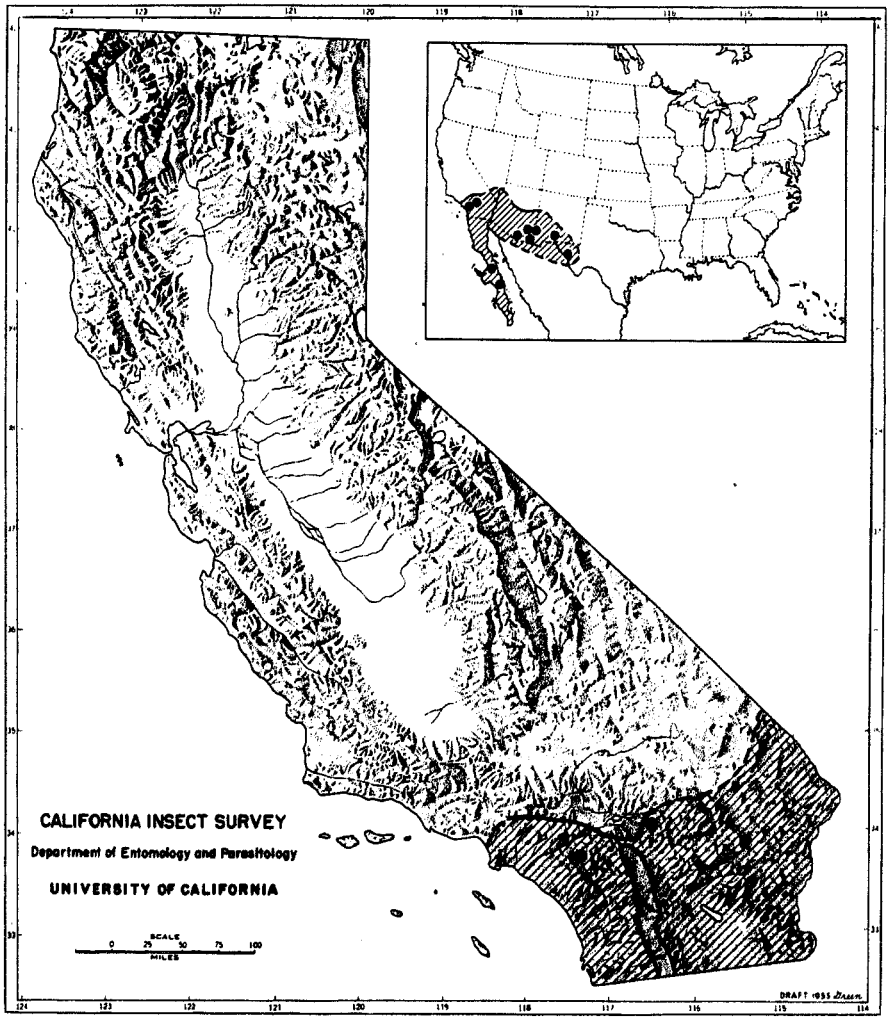
Oxybelus cochise Pate
(Pl. 10, fig. 15)

Oxybelus cochise Pate, 1943, Bull. Brooklyn Ent. Soc., 38:93, ♂♀. Type ♂, Steins, Hidalgo Co., New Mexico (Pate Coll.?).

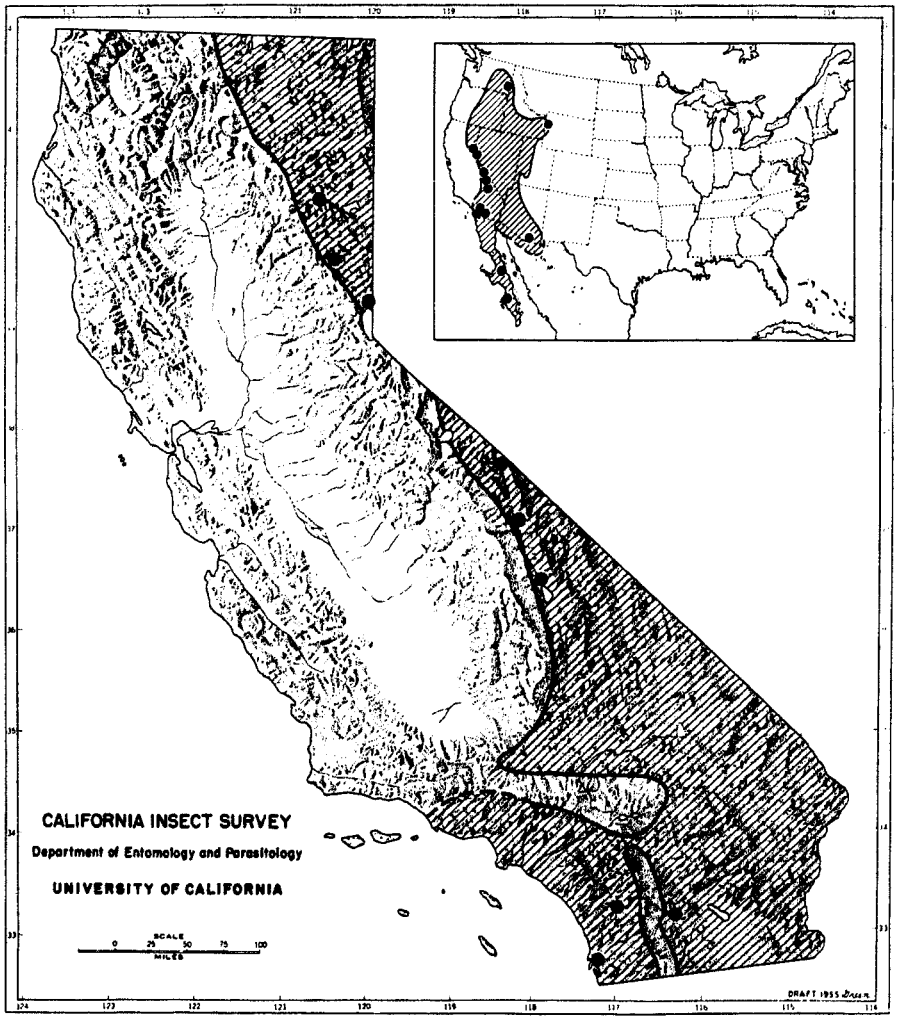
Geographic range: Arizona, California, Mexico (Baja California), New Mexico, Texas (see map 7).

California records:

Riverside Co.: Riverside, 1♂, VII-26-38 (P. H. Timberlake, U.C.R.).



Map 7. California distribution of *Oxybelus cochise* Pate. Inset map shows range in United States.



Map 8. California distribution of *Oxybelus ventrale* Fox. Inset map shows range in United States.

San Bernardino Co.: Morongo Valley, 1♂, IX-3-41 (P. H. Timberlake, U.C.R.).

Discussion:

Apparently this species has been collected only twice in California. In addition to the key characters it differs from *cornutum* by its unbroken pronotal carina and the quinquedentate rather than tridentate clypeal margin in the male. The median cell of the forewing is about as in figure 90. The male is similar to *burdi* in having the last antennal segment much darker than the preceding ones (see fig. 10). Out-of-state records are: Arizona (25 mi. E. Pierce, Fort Grant, Elfrida, Dragoon, Portal, Tucson), Baja California (near San Ignacio and Concepcion Bay), New Mexico (Steins, Rodeo, Las Cruces), and Texas (McNary, Sierra Blanca).

GROUP III, SUBULATUM GROUP

Oxybelus ventrale Fox
(Pl. 11, figs. 32, 33)

Oxybelus ventralis Fox, 1894. Proc. Calif. Acad. Sci., (2)4:107, ♀. Type, ♀, San Jose del Cabo, Baja California (Calif. Acad. Sci.).

Geographic range: United States west of the Rocky Mountains and Baja California (see map 8).

California records:

Inyo Co.: Big Pine, 1 ♀, VI-18-28 (E. P. Van Duzee, C.A.S.); 1♂, VI-8-37 (M. A. Cazier, A.M.N.H.).

Lassen Co.: Bridge Creek Camp, 1♂, VII-9-49 (W. F. Ehrhardt, U.S.N.M.).

Mono Co.: Benton's Crossing, 1♂, IX-9-35 (M. A. Cazier, C.I.S.).

Nevada Co.: Boca, 1 ♀, VI-28-54 (R. M. Bohart, U.C.D.).

Plumas Co.: Portola, 1♀, VII-4-52 (R. C. Bechtel, U.S.N.M.).

Riverside Co.: Anza, 1♀, VII-5-56 (R. C. Bechtel, U.C.D.).

San Diego Co.: Old Town, 3♂, 1♀, VIII-27-21 (U.C.D., S.D.); Oak Grove, 1♀, VI-6-40 (C. D. Michener, C.I.S.); Borego, 1♀, IV-27-54 (M. Wasbauer, C.I.S.)

Sierra Co.: Sierraville, 1 ♂, VII-24-56 (R. M. Bohart, U.C.D.).

Discussion:

The *subulatum* group is particularly characterized by the rounded-off pronotal angles. Also, except in *linsleyi*, the clypeus has a large basolateral polished spot. Represented in the western fauna are *ventrale, linsleyi, subulatum,* and *majus.* The first two of these occur in California. In *ventrale* the females tend to have white markings varying in extent on the thoracic sterna, coxae, clypeus, mandibles, and abdominal venter. Those seen from Baja California have the clypeus all white in the female and the mandibles basally white in the male. The brownish eyes occur also in *linsleyi* but not in *majus* nor in *subulatum.* The setation of the median cell of the forewing is a little less dense than in figure 90, and there is a clear strip along the anterior margin.

It is an uncommon species as indicated by the fact that we have seen only 20 specimens, 14 from California. Out-of-state records are: Arizona (Huachuca Mts.), Baja California (20 miles south of El Arco and San Domingo), Nevada (Washoe Lake), Washington (Pullman), and Wyoming (Grand Teton National Park).

Oxybelus linsleyi Bohart and Schlinger
(Pl. 9, fig. 12; pl. 11, figs. 28, 29)

Oxybelus linsleyi Bohart and Schlinger, 1956, Pan-Pac. Ent., 32:151, ♂♀. Type ♂, Keen Camp, San Jacinto Mts., Riverside Co., California (Calif. Acad. Sci.).

Geographic range: California (see map 9).

California records:

Los Angeles Co.: Mt. Wilson, 1♂, VI-22-46 (R. M. Bohart, U.C.D.); Tanbark Flat, 1♀, VI-27-50 F. X. Williams, C.A.S.), 2♀, VI-19-56 (R. C. Bechtel, U.C.D.); 1♂, VI-23-50 (R. Schuster, C.I.S.); Claremont, 1♂ (C. F. Baker, U.S.N.M.).

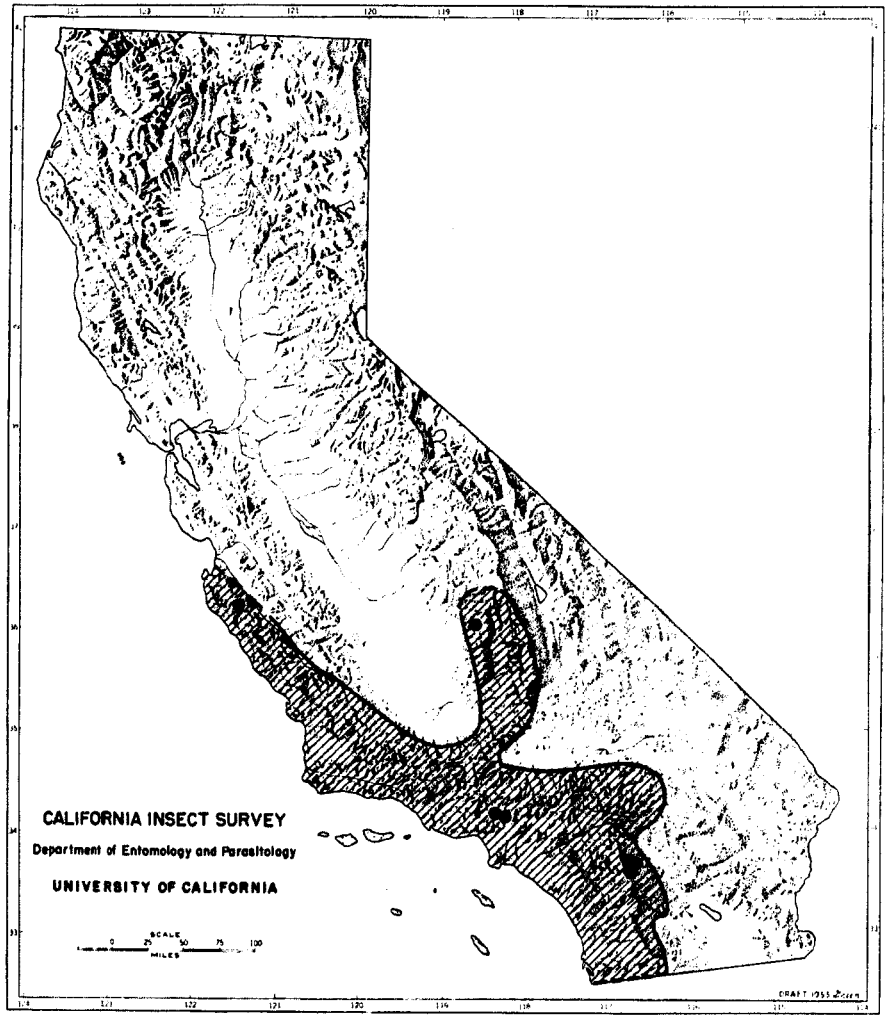
Monterey Co.: Paraiso Springs, 1♂, V-26-50 (R. M. Bohart, U.C.D.); Arroyo Seco Camp, 2♂, 4♀, V-27-56 (R. C. Bechtel, U.C.D.); 22♂, 14♀, VI-6-56 (R. M. Bohart, R. C. Bechtel, U.C.D.).

Riverside Co.: Keen Camp, San Jacinto Mts., 1♂, V-31-39 (E. G. Linsley, C.A.S.); Idyllwild, 1♂, IV-19-51 (G. C. Bechtel, U.C.D.); 1♀, VII-14-12 F. H. Timberlake, U.C.R.); Taquitz Lodge, San Jacinto Mts., 1♂, V-13-37 (E. P. Van Duzee, C.A.S.); Piñon Flat, San Jacinto Mts., 1♀, V-24-39 (E. S. Ross, C.A.S.), 2♂, V-21-40 (C. D. Michener, C.I.S.).

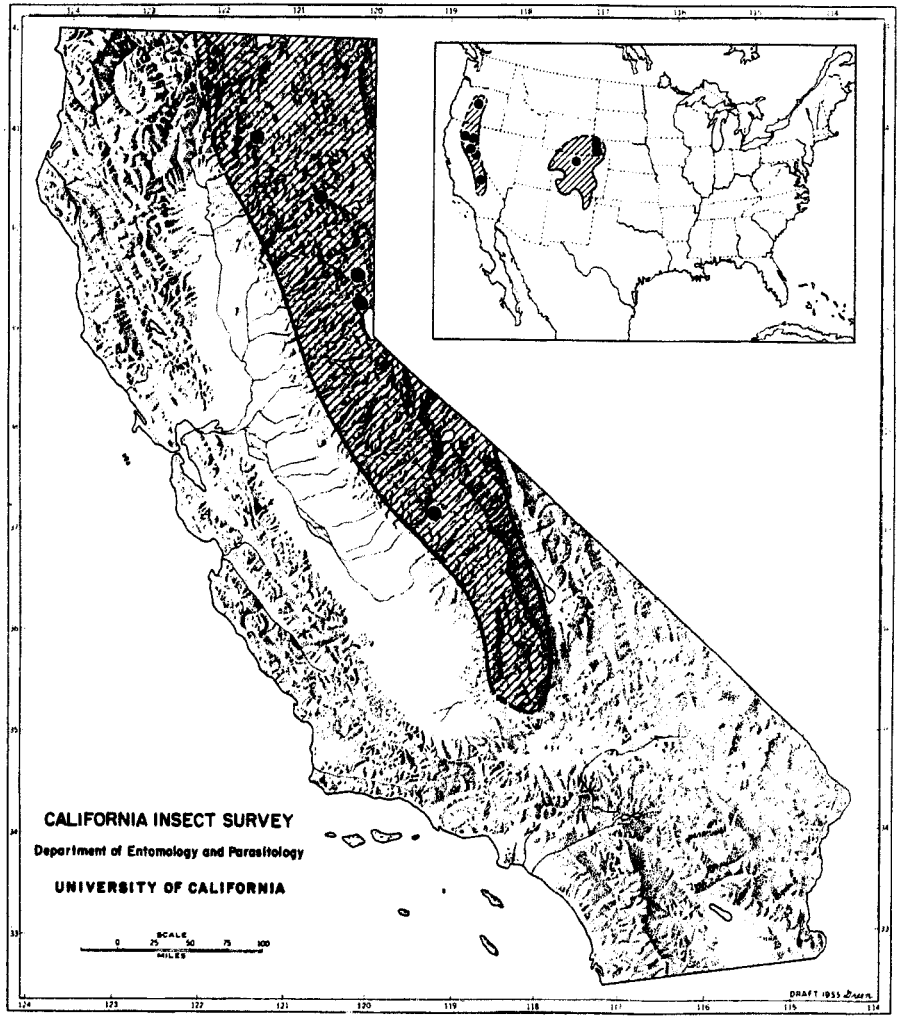
Tulare Co.: Camp Nelson, 1♂, VIII-3-13 (R. L. Beardsley, M.C.Z.).

Discussion:

Linsleyi differs from other members of the group, in having the clypeus punctate laterally, in having a broader mucro, and a more transverse squama. In addition the female is the only one of the group with a shaggy, silvery pubescence on the lower mesopleuron, and two large macrosetae on fore tarsal segments III and IV. The setae of the median cell of the forewing are distributed about as in



Map 9. Distribution of *Oxybelus linsleyi* Bohart and Schlinger.



Map 10. California distribution of *Oxybelus robertsonii* Baker. Inset map shows range in United States.

figure 90. With the possible exception of the Claremont record, its distribution is Transition, occurring from the cismontane regions of southern California north along the coast to Monterey County, and in the Sierra to Tulare County.

GROUP IV, ROBERTSONII GROUP

Oxybelus robertsonii Baker
(Pl. 13, figs. 48, 49)

Oxybelus robertsonii Baker, 1896, Ent. News, 7:156, ♂. Type ♂, Fort Collins, Colorado (U.S. Nat. Mus.).

Geographic range: California, Colorado, Nebraska, Nevada, Oregon (see map 10).

California records:

Fresno Co.: Huntington Lake, 1♂, VII-21-19 (E. P. Van Duzee, U.S.N.M.).

Lassen Co.: Bridge Creek Camp, 2♀, VII-9-49 (J. W. MacSwain, C.I.S.); 1♂, 1♀, VII-9-49 (W. F. Ehrhardt, U.C.D.).

Nevada Co.: Sagehen nr. Hobart Mills, 1♂, VI-25-54 (R. M. Bohart, U.C.D.).

Sierra Co.: Sierraville, 12 mi. S.E., 1♀, VIII-4-53 (R. M. Bohart, U.C.D.).

Shasta Co.: McCoy Flat, 1♀, VII-8-49 (J. W. MacSwain, C.I.S.).

Discussion:

Although the difference in eye color is diagnostic, there is a close relationship with *argypheum*. Among other characters, both have a broad, short postscutellum with a well-developed submedian lobe, and have the propodeum strongly pubescent above. However, the setation of the median cell of the forewing is about as in figure 91 in *robertsonii* and figure 90 in *argypheum*. The ranges of the two are different, however, with *robertsonii* mostly inhabiting the Transition zone and *argypheum* the Sonoran zone. It is a widespread but uncommon species of which we have seen only 9 males and 7 females. Our out-of-state localities include Colorado (Fort Collins), Nevada (Daggett Pass in Douglas Co.), Nebraska (Warbonnet Canyon), and Oregon (Tumalo Reservoir near Bend).

Oxybelus argypheum Bohart and Schlinger
(Pl. 13, fig. 57)

Oxybelus argypheum Bohart and Schlinger, 1956, Proc. Biol. Soc. Wash., 69:38, ♀. Type ♀, Borego, San Diego County, California (Calif. Acad. Sci.).

Geographic range: California, Arizona, Colorado (see map 11, inset).

California records:

Inyo Co.: Lone Pine, 1♂, V-2-37 (E. C. Van Dyke, C.A.S.).

Riverside Co.: Indio, 6 mi. W., 1♀, IV-30-49 (Linsley, MacSwain, Smith, C.I.S.); Murrieta, 1 mi. N., 1♂, IV-18-50 (E. G. Linsley, C.I.S.).

San Bernardino Co.: Twentynine Palms, 1♀, IV-13-35 (P. H. Timberlake, U.C.R.); Needles, 2♂, IV-1 and 6-18 (J. C. Bradley, U.C.D., C.U.).

San Diego Co.: Borego, 2♀, IV-27 and 30-54 (M. Wasbauer, C.I.S.); 1♂, 1♀, IV-24-55 (P. D. Hurd, C.I.S., U.C.D.); 1♂, 1♀, IV-27-55 (R. O. Schuster, C.I.S.).

Discussion:

The pubescent upper surface of the propodeum relate this species to *robertsonii* and *timberlakei*. From both of these the generally dense, silvery pubescence and the silvery fifth tergal band in the female are separating characters. However, it is unquestionably close to *robertsonii* as discussed under that species. The distribution is Sonoran in the desert regions of southeastern California, northern Arizona, and southern Colorado. Our out-of-state records are: 1 male from Arizona (Kaibab Forest) and 2 males from Colorado (Great Sand Dunes in Alamosa Co.).

Oxybelus timberlakei Bohart and Schlinger
(Pl. 9, fig. 5; pl. 13, figs. 52, 53)

Oxybelus timberlakei Bohart and Schlinger, 1956, Pan-Pac. Ent., 32:150, ♂♀. Type ♂, Herkey Creek, San Jacinto Mts., Riverside Co., California (Calif. Acad. Sci.).

Geographic range: California (see map 12).

California records:

Kern Co.: Glenville, 1♂, IV-22-50 (R. M. Bohart, U.C.D.); Isabella, 1♀, V-6-31 (E. C. Van Dyke, C.A.S.).

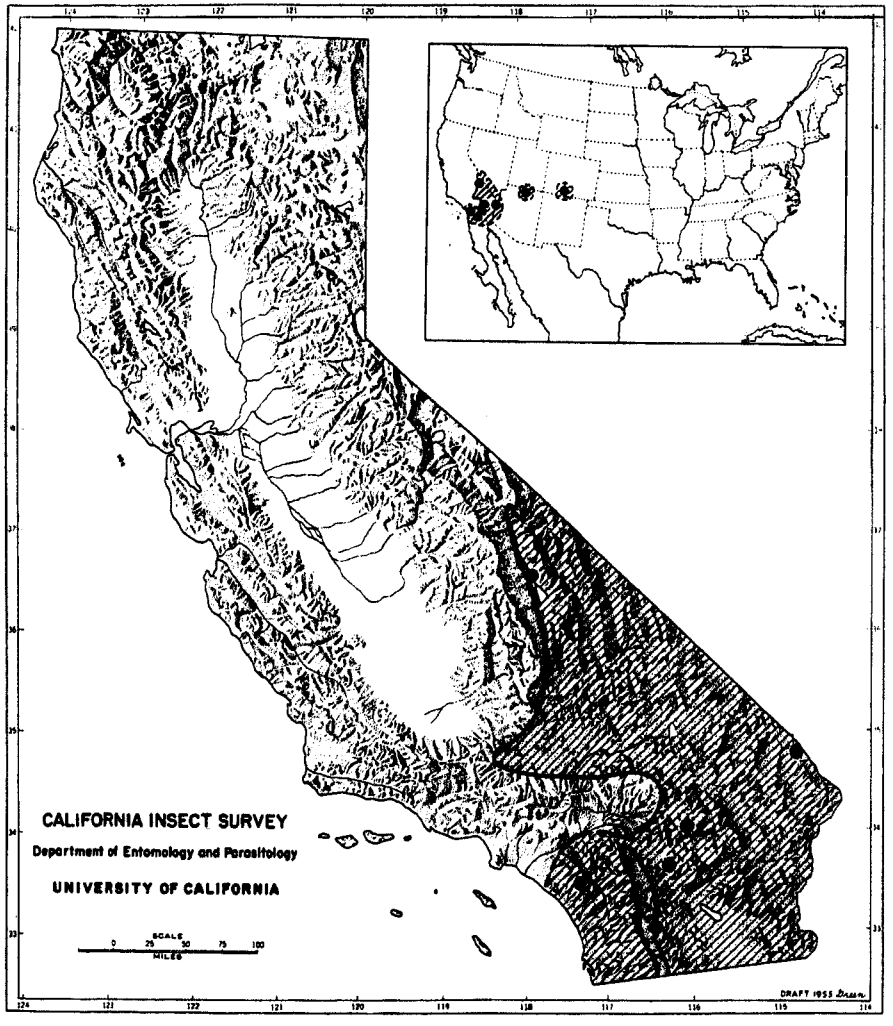
Monterey Co.: Bryson, 1♂, V-20-20 (E. P. Van Duzee, C.A.S.).

Riverside Co.: Herkey Creek, San Jacinto Mts., 1♂, VI-8-37 (P. H. Timberlake, C.A.S.); Palm Springs, 1♂, V-23-17 (E. P. Van Duzee, C.A.S.); Banning, 1♂, V-28-28 (E. C. Van Dyke, C.A.S.); Riverside, 1♀, VI-23-38 (P. H. Timberlake, U.C.R.).

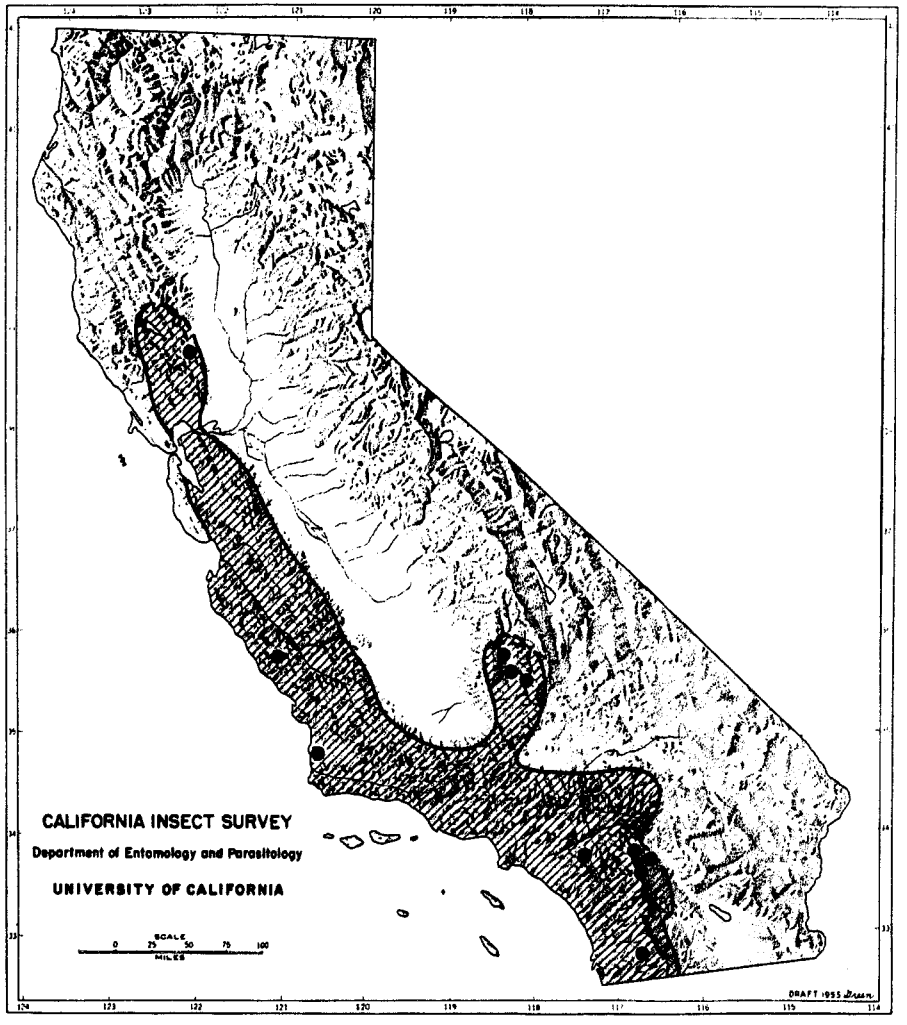
Santa Barbara Co.: Santa Maria, 14 mi. E., 1♂, VI-20-52 (R. H. & L. D. Beamer, U. K.).

San Diego Co.: Pine Valley, 1♀, VIII-2-26 (F. W. Kelsey, U.C.D.).

Tulare Co.: California Hot Springs, 1♂, VI-3-39 (E. C. Van Dyke, C.A.S.).



Map 11. California distribution of *Oxybelus argypheum* Bohart and Schlinger. Inset map shows range in United States.



Map 12. Distribution of *Oxybelus timberlakei* Bohart and Schlinger.

Yolo Co.: Rumsey, 1♂, IV-7-56 (E. A. Kurtz, U.C.D.).

Discussion:

The silvery pubescence of the propodeum above, together with the form of the squamae and mucro, relate this species to *robertsonii*. The more setose median cell (about as in fig. 92) and the hoodlike last abdominal tergite of the male (fig. 5) are distinctive. It appears to range over both Sonoran and Transition zones of California as far north as Yolo County, but it is rare.

Oxybelus simile Cresson
(Pl. 13, figs. 54, 55)

Oxybelus similis Cresson, 1865. Proc. Ent. Soc. Phila., 4:476, ♀. Type ♀, Colorado Territory (Acad. Nat. Sci. Phila.).

Geographic range: Arizona, California, Colorado, Nevada, Wyoming (see map 13).

California records:

Inyo Co.; Westgaard Pass, 1 ♀, VI-3-37 (U.C.D.).

Kern Co.: Glenville, 1♂, 1♀, IV-22-50 (R. M. Bohart, U.C.D.).

Los Angeles Co.: Claremont, 13♂, 6♀, (C. F. Baker, P.C., U.C.D.).

Madera Co.: Bass Lake, 3,000'; 1, ♂ V-27-38 (R. M. Bohart, U.C.D.).

Monterey Co.: Bryson, 1♀, V-19-20 (E. P. Van Duzee, C.A.S.).

Riverside Co.: Riverside, 1♂, V-30-39 (P. H. Timberlake, U.C.R.); Herkey Creek, 1♂, VI-3-39 (P. H. Timberlake, U.C.D.); Murrieta, 1 mi. N., 1♀, IV-18-50 (E. G. Linsley, C.I.S.); The Gavilan, 1♂, 1♀, IV-20-50, IV-6-30 (P. H. Timberlake, U.C.R.).

San Bernardino Co.: Verdemont, 1♂, V-1-46 (P. H. Timberlake, U.C.R.).

San Luis Obispo Co.: Atascadero, 1♂, IV-26-19 (E. P. Van Duzee, C.A.S.).

Shasta Co.: Old Station, 1♀, VI-16-41 (U.C.D.).

Tulare Co.: Woodlake, 2♂, 3♀, IV-12 to V-2-47 (N. W. Frazier, C.I.S., U.C.D.).

Discussion:

The broad, short postscutellum and mucro are peculiar. In addition to characters given in the key, the hind femur has a strong distal keel, and the male has the last tergite somewhat hoodlike with the pygidium defined only toward the apex. This last feature suggests a relationship with *timberlakei*. The setation of the median cell of the forewing is intermediate between figures 91 and 92. In California it appears to range through the Upper Sonoran and Transition zones. Out-of-state records are: Arizona (Tucson), Colorado (Colorado Territory), Idaho (Craters of the Moon), Nevada (Emigrant Pass), and Wyoming (Newcastle).

GROUP V, EMARGINATUM GROUP

Oxybelus emarginatum Say
(Pl. 9, fig. 3; pl. 15, figs. 72, 73; pl. 16, fig. 92)

Oxybelus emarginatus Say, 1837, Boston Jour. Nat. Hist., 1:375, ♂. Type ♂, Indiana (destroyed).

Geographic range: U.S., southern Canada, and Mexico (see map 14, inset).

California records: Widespread (see map 14).

Discussion:

The short, broadly flaring mucro (figs. 72, 73) and the extensive setation of the median cell (fig. 92) separate this species from other black and yellow members of the group. In the United States it is one of the two commonest species of *Oxybelus*, the other being *uniglumis quadrinotatum*. A third species, *californicum*, is almost equally abundant in California, but whereas the first two are essentially sympatric, *californicum* is rarely found in the higher elevations. Of the specimens studied, 214 males and 55 females of *emarginatum* were collected in California.

Oxybelus californicum Bohart and Schlinger
(Frontis.; pl. 9, fig. 2; pl. 15, figs. 80, 81; pl. 16, fig. 93)

Oxybelus californicum Bohart and Schlinger, 1956, Pan-Pac. Ent., 32: 147, ♂, ♀. Type ♂, Davis, Yolo County, California (Calif. Acad. Sci.).

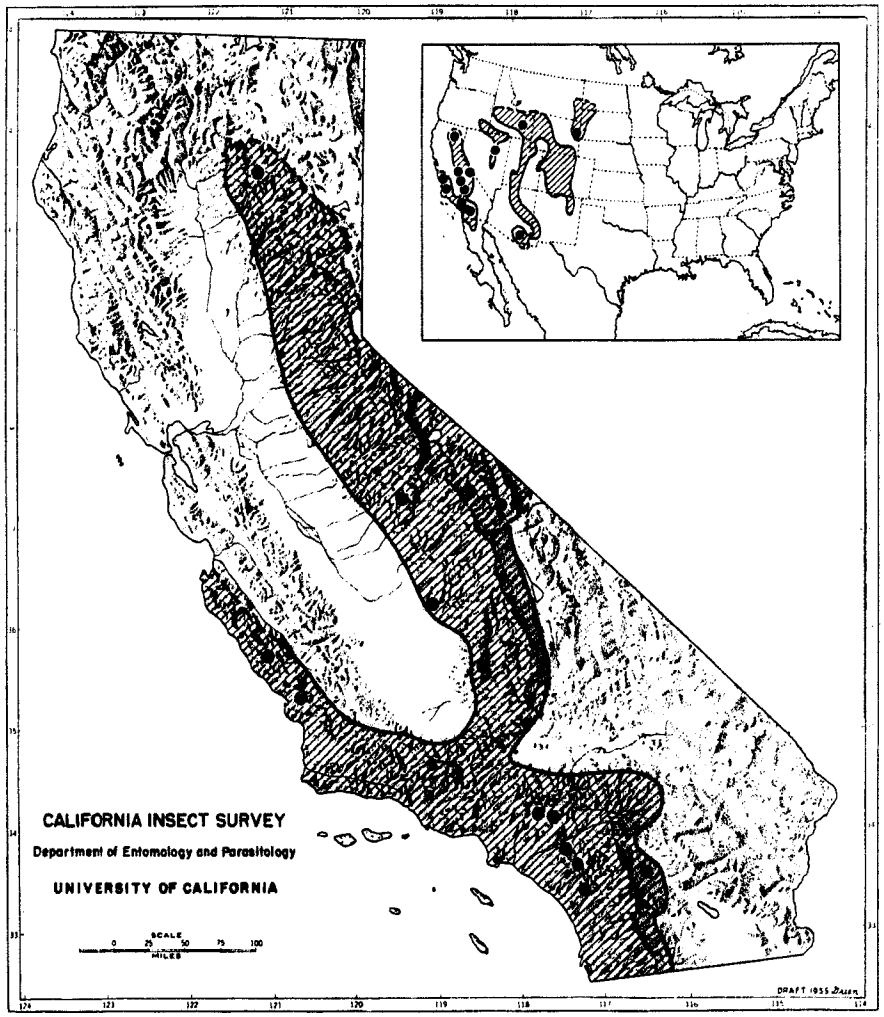
Geographic range: United States west of the Rocky Mountains and Mexico in the Sierra Madre range (see map 15, inset).

California records: Widespread (see map 15).

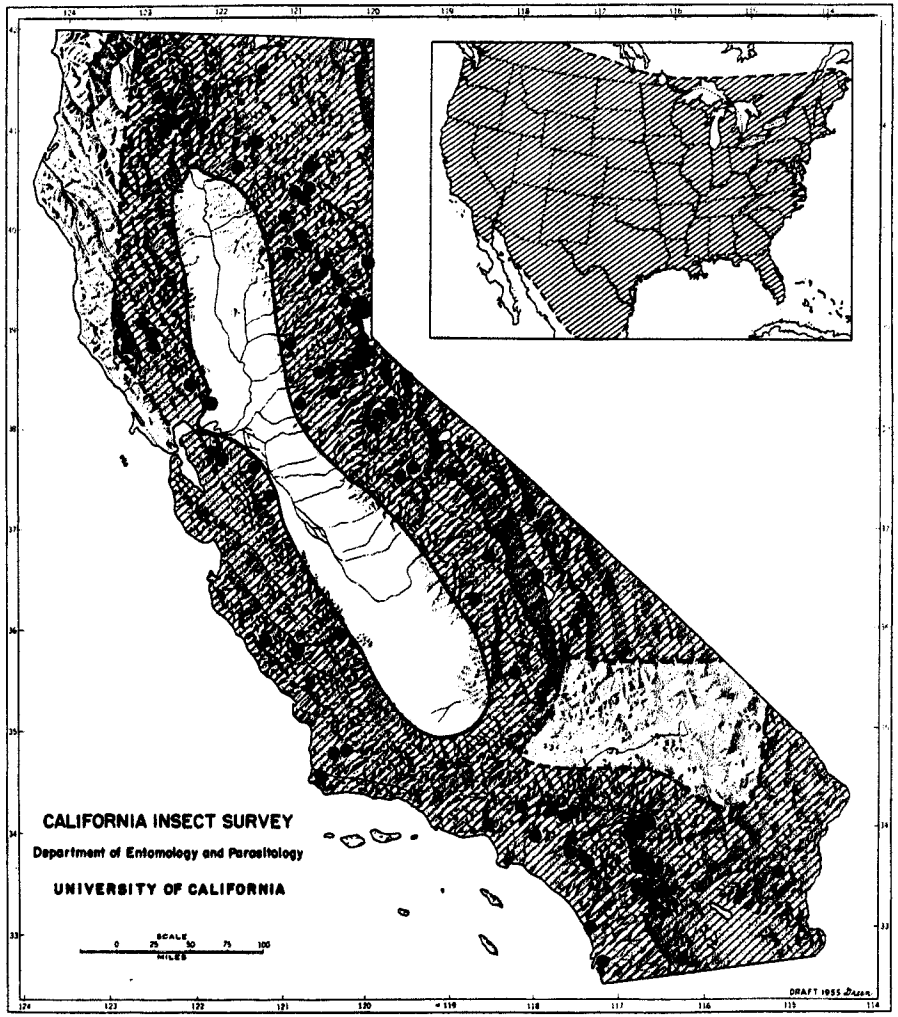
Discussion:

The short, nearly parallel-sided mucro distinguishes this species from others in the *emarginatum* group. Also characteristic are the evenly setose median cell and the stained wing membrane. The mesonotal groove is not so deep as that in *canalis* but more nearly reaches the pronotum.

We have observed this species attacking anthomyid flies in Davis. It is the commonest species of the genus in California where it is widespread in the Sonoran and lower Transition zones. As an index to its abundance, we have examined a total of 382 males and 169 females from California. Our out-of-state records include numerous ex-



Map 13. California distribution of *Oxybelus simile* Cresson. Inset map shows range in United States.



Map 14. California distribution of *Oxybelus emarginatum* Say. Inset map shows range in United States.

amples from Arizona, Colorado (Great Sand Dunes in Alamosa Co.), Idaho, Nevada, New Mexico (Albuquerque, Las Cruces, Hot Springs), Mexico (Descanso in Baja California and Nombre de Dios in Durango), Oregon, Utah, and Washington (Yakima, Copalis).

Oxybelus krombeini Bohart and Schlinger (Pl. 15, figs. 82, 83)

Oxybelus krombeini Bohart and Schlinger, 1956, Pan-Pac. Ent., 32:149, ♂, ♀. Type ♂, Three Rivers, Tulare County, Calif. (Calif. Acad. Sci.).

Geographic range: California (see map 16).

California records:

Stanislaus Co.: Turlock, 1♂, VI-22-52 (R. R. Snelling, U.C.D.).

Tulare Co.: Woodlake, 1♂, 1♀, VI-12-47 (N. W. Frazier, C.A.S., C.I.S.); Three Rivers, 2♂, VIII-5-40 (L. C. Kuitert, U.K.).

Discussion:

In wing setation and general body form *krombeini* appears to be related to *californicum*. However, in addition to being much more highly colored and densely punctured, the squamae are of different form and the mucro is larger (compare figs. 80, 81 with 82, 83). The rarity of the species is indicated by the fact that only 5 specimens are known from three localities, all in the San Joaquin Valley.

Oxybelus abdominale Baker (Pl. 15, figs. 78, 79)

Oxybelus abdominalis Baker, 1896, Ent. News, 7:158, ♂. Type ♂, Fort Collins, Colorado (U.S. Nat. Mus.).

Geographic range: United States from the prairie states of the Midwest to the Sierra Nevada (see map 17).

California records:

Inyo Co.: Olancha, 3 mi. S., 1♂, 1♀, VIII-6-48 (J. W. MacSwain, C.I.S.); Westgaard Pass, 1♂, VI-16-42 (R. M. Bohart, U.C.D.).

Discussion:

Apart from the markings, *abdominale* appears closely related to *emarginatum*, differing mainly in the absence of a distal keel on the hind femur and the reduced wing setation (median cell of forewing about as in fig. 90). The red ground color of the abdominal tergites may be restricted to the first and last tergites as we have observed in two specimens from Medora, Kansas. On the other hand the abdominal ground color may be entirely red, or more commonly with tergites III and IV dark-brown to black.

California localities are only in the western fringe of the Great Basin. Our out-of-state records are: Arizona (25 mi. E. Gila Bend, Willcox), Colorado (Artesia, White River, White Ranch, Great Sand Dunes in Alamosa Co.), Idaho (Preston, Acequia), Kansas (Douglas County, Morton Co., Pottawatomie Co., Stafford Co., Kearny Co., Kingsley, Medora), Nebraska (Harrison, Dunning), New Mexico (Lordsburg, Nogal, Las Cruces, Estancia), North Dakota (Hamar), Texas (Hudspeth Co., Conlen, Palestine, El Paso, Raymondsville, San Manuel), and Utah (Jensen, Delta, Utah Lake, Jericho).

Oxybelus argenteopilosum Cameron (Pl. 16, figs. 84, 85, 90)

Oxybelus argenteopilosus Cameron, 1891, Biol. Cent. Amer., Ins. Hymen., 2:158. Type (no sex given), Guerrero, Mexico.

Geographic range: Western North America, Oregon south to Tehuantepec, Mexico (see map 18).

California records:

Inyo Co.: Furnace Creek, Death Valley, 1♂, IV-8-39 (P. H. Timberlake, U.C.R.); 1♂, 2♀, IV-23-35 (A. L. Melander, M.C.Z.); Resting Springs, 1♂, V-29-55 (J. N. Belkin, U.C.L.A.).

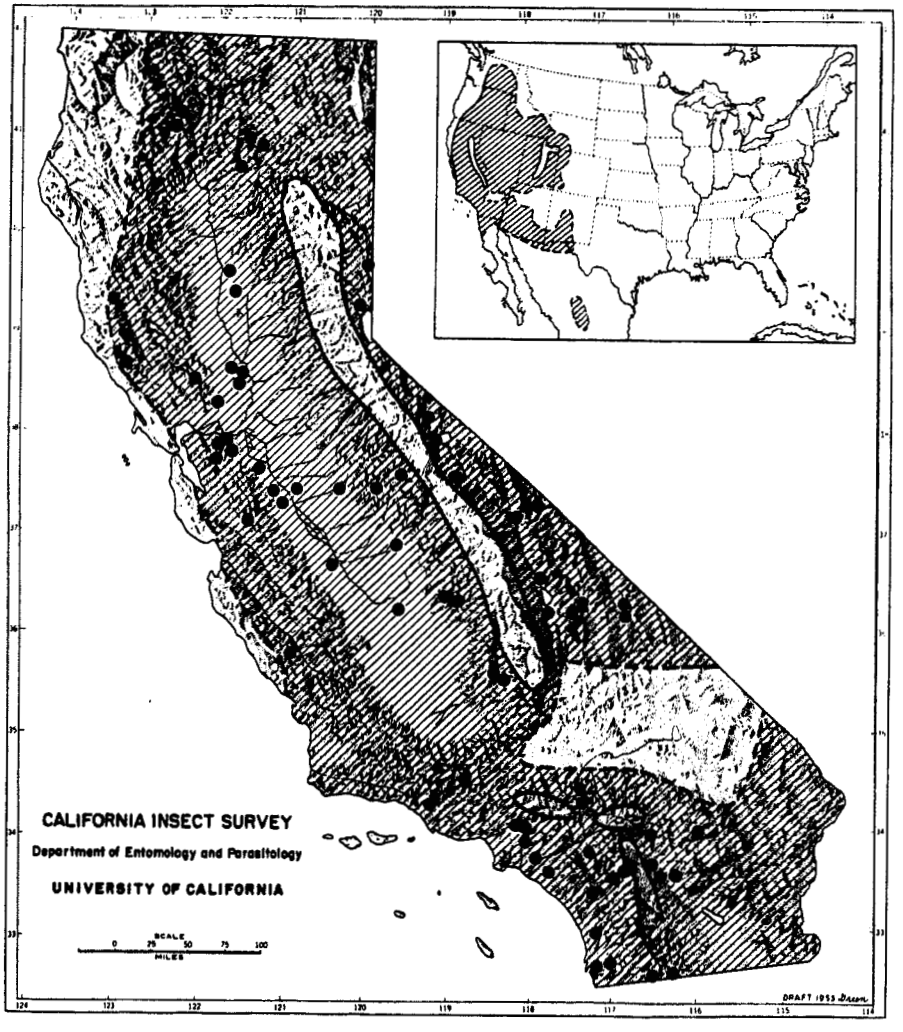
Riverside Co.: Riverside, 34♂, 9♀, VIII-5-40 to X-8-53 (P. H. Timberlake, U.C.R., U.C.D.); Palm Springs, 1♂, VI-24-40 (P. H. Timberlake, U.C.R.); Winchester, 3♂, VII-25-46 (J. W. MacSwain, C.I.S.); The Gavilan, 1♀, V-18-51 (E. I. Schlinger, U.C.D.); Hot Mineral, 1♂, IV-30-52 (U.C.L.A.); Palm Canyon, 2♀, VIII-17-27 (J. C. Bradley, C.U.).

San Bernardino Co.: Morongo Valley, 1♂, IX-3-41 (P. H. Timberlake, U.C.R.); Upper Santa Ana River, 1♂, IX-14-46 (G. and J. L. Sperry, U.K.).

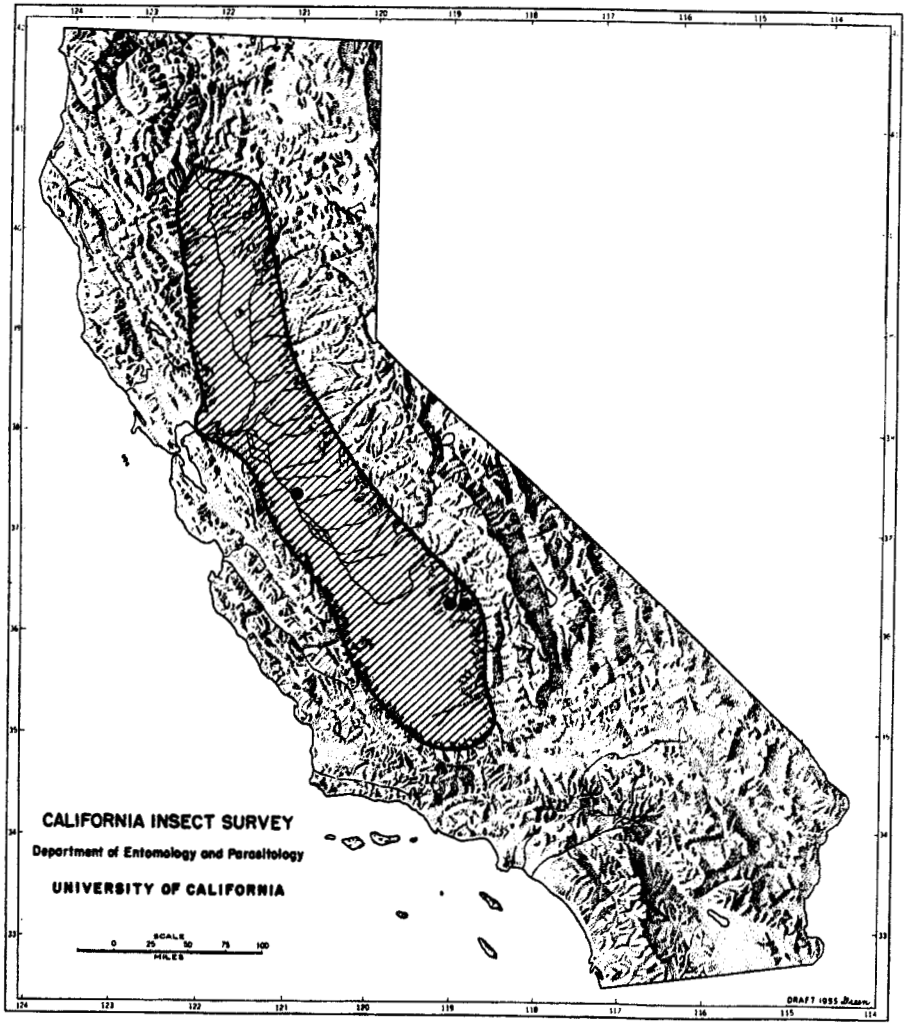
San Diego Co.: Borego, 1♂, V-2-52 (J. G. Rosen, C.I.S.); 1♂, IV-30-54 (M. Wasbauer, C.I.S.); Carlsbad, 3♂, VI-1-54 (J. C. Hall, U.C.D.).

Discussion:

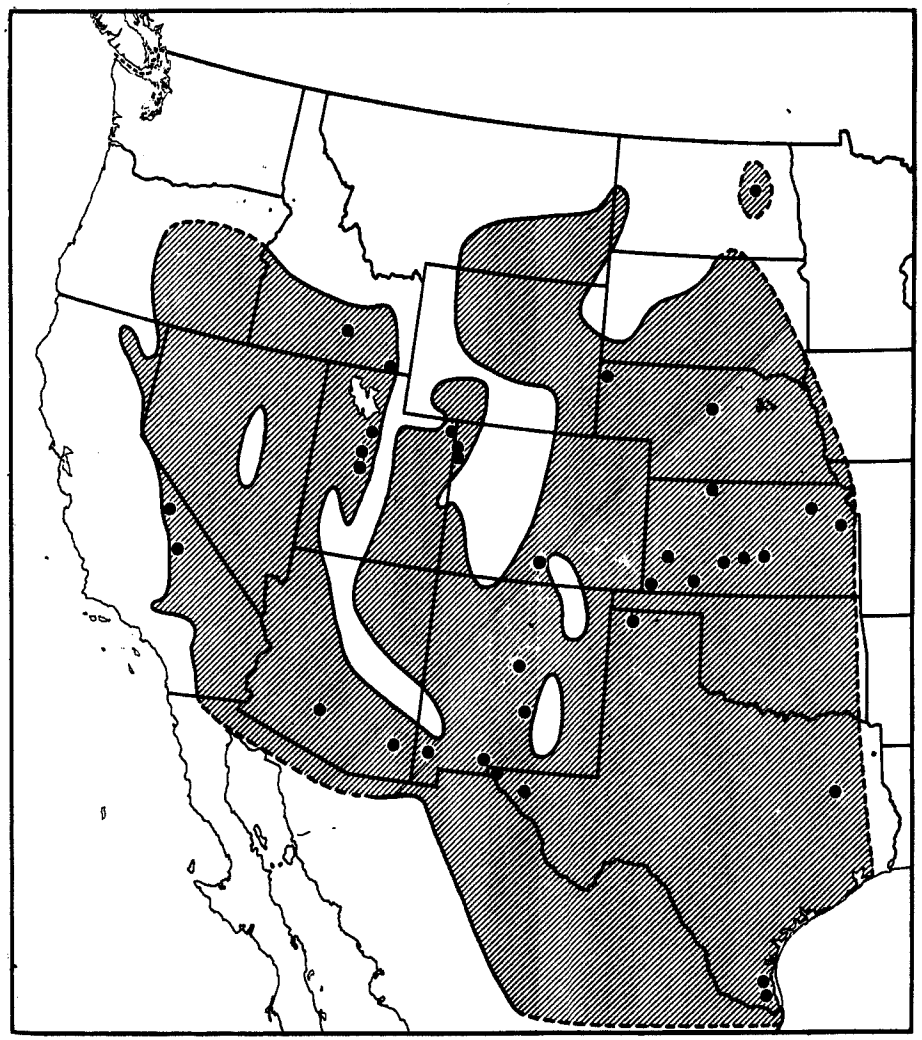
We have seen a long series of this species collected by P. D. Hurd near Teotihuacan Pyramids as well as specimens from Guerrero, the type locality. Considerable variation has been noted in the squamae and mucro. The squama typically has a strong lateral point as illustrated in figures 84 and 85, but it may vary in this characteristic almost to the condition shown in figure 80. The mucro of the female is usually smaller in Mexican material than in Californian as exemplified by figure 85. Specimens from intermediate areas such as Texas are usually intermediate in the size of



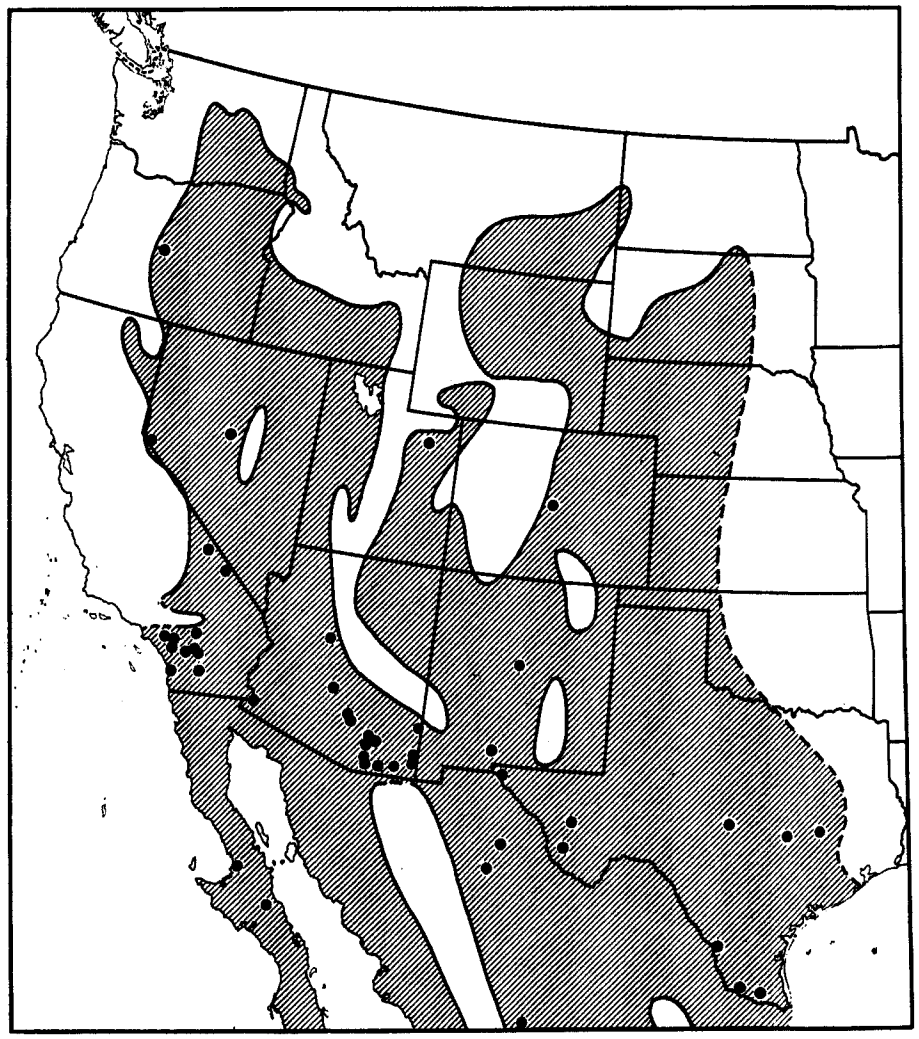
Map 15. California distribution of *Oxybelus californicum* Bohart and Schlinger. Inset map shows range in United States.



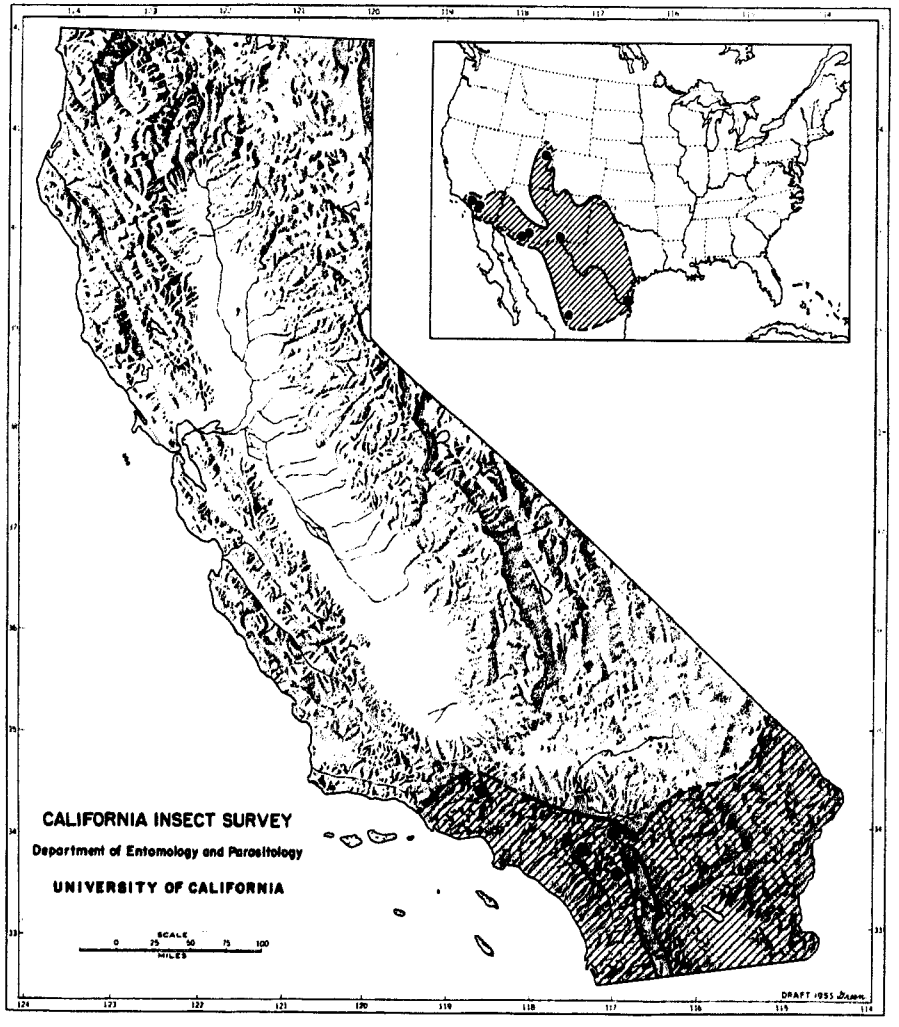
Map 16. Distribution of *Oxybelus krombeini* Bohart and Schlinger.



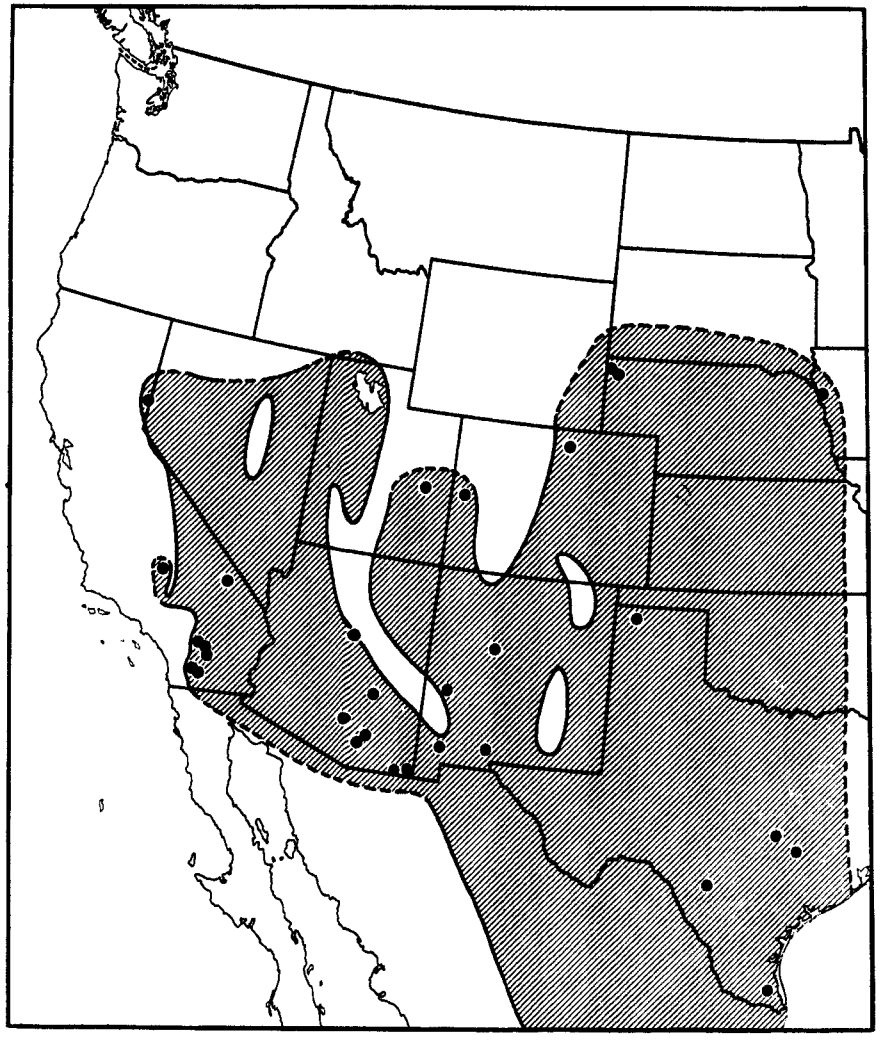
Map 17. Distribution of *Oxybelus abdominale* Baker.



Map 18. Distribution of *Oxybelus argenteopilosum* Cameron.



Map 19. California distribution of *Oxybelus canalis* Bohart and Schlinger. Inset map shows range in United States.



Map 20. Distribution of *Oxybelus parvum* Cresson.

the mucro. The single most characteristic feature of the species is the "half-setose" median cell of the forewing (fig. 90).

It is widespread in the Austral zone of North America and is particularly common in Mexico. In California it is presently known only from the southern desert areas. Our out-of-state records are: Arizona (many localities), Colorado (Wilkerson Pass), Mexico (many localities in Baja California, Chihuahua, Durango, Guerrero, Jalisco, Mexico D. F., Nayarit, Oaxaca, Puebla, and Zacatecas), Nevada (Austin, Walley Hot Springs), New Mexico (Tajique, Las Cruces, Alamagordo, High Rolls, Nogal), Oregon (Brothers), Texas (many localities) and Utah (Roosevelt).

Oxybelus canalis Bohart and Schlinger
(Pl. 9, fig. 11; pl. 14, figs. 68, 69; pl. 16, fig. 89)

Oxybelus canalis Bohart and Schlinger, 1956, Pan-Pac. Ent., 32:149, ♂, ♀. Type ♂, Riverside, (Riverside County, Calif. (Calif. Acad. Sci.).

Geographic range: Southwestern United States and Mexico (see map 19). California records:

Los Angeles Co.: Castaic Junction, 1♀, IX-11-50 (P. H. Timberlake, U.C.D.).

Riverside Co.: Riverside, 7♂, 3♀, VI-6-43, VIII-42, IX-1-41, IX-19-41, X-8-42 (P. H. Timberlake, U.C.R., C.A.S., U.C.D.); 1♀, VIII-2-15 (F. C. Bishopp, U.S.N.M.); Redlands, 1♀, 1913 (F. R. Cole, U.S.N.M.); Hemet, 3♀, VIII-11-46 (C. Grainger, C.I.S., U.C.D.).

Discussion:

The sharp mesonotal groove is of equal depth throughout, ending abruptly short of the pronotum. Also characteristic are the narrow, acutely emarginate mucro, the absence of a submedian squamal lobe, the coarse, sparse punctation, and the shiny black aspect of the notum. In addition it is one of the smallest species in the *emarginatum* group.

It ranges throughout the Sonoran zone. Our out-of-state records are: Arizona (Tucson, Continental, Sabino Canyon, Tanque Verde), New Mexico (Las Cruces), Mexico (Nombre de Dios in Durango), Utah (Roosevelt), and Texas (Brownsville). At present the species appears to be rare since it is known from only 33 specimens.

Oxybelus parvum Cresson
(Pl. 14, figs. 66, 67; pl. 16, fig. 88)

Oxybelus parvus Cresson, 1865. Proc. Ent. Soc. Phila., 4:476. Type ♀, Colorado Territory (Acad. Nat. Sci. Phila.).

Geographic range: United States from the prairie states westward, mostly south of the 45th parallel (see map 20).

California records:

Kern Co.: Kernville, 3♂, VII-24-40 (R. H. Beamer, U.K.).

Lassen Co.: Hallelujah Junction, 1♂, VII-12-54 (R. C. Blaylock, U.C.D.).

Riverside Co.: Indio, 6 mi. W., 8♂, IV-30-49 (Linsley, MacSwain, Smith, C.I.S., U.C.D.); Whitewater Canyon, 1♂, V-4-54 (J. C. Hall, U.C.D.); Palm Springs, 1♂, VI-24-32 (P. H. Timberlake, U.C.R.).

San Bernardino Co.: Sheep Creek Springs, Death Valley (U.C.L.A.).

San Diego Co.: Anza State Park, 3♂, IV-23-51 (E. I. Schlinger, R. C. Bechtel, U.C.D.); Borego, 6♂, V-2-52 (P. D. Hurd, J. G. Rosen, G. A. Marsh, C.I.S.); 31♂, 1♀, IV-2 to 25-54 J. G. Rosen, P. D. Hurd, M. Wasbauer, C.I.S., U.C.D.); 5♂, 1♀, IV-25 to 30-54 (P. H. Timberlake, U.C.R.); 36♂, 2♀, IV-26 to 29-55 (P. D. Hurd, R. O. Schuster, M. Wasbauer, C.I.S., U.C.D.).

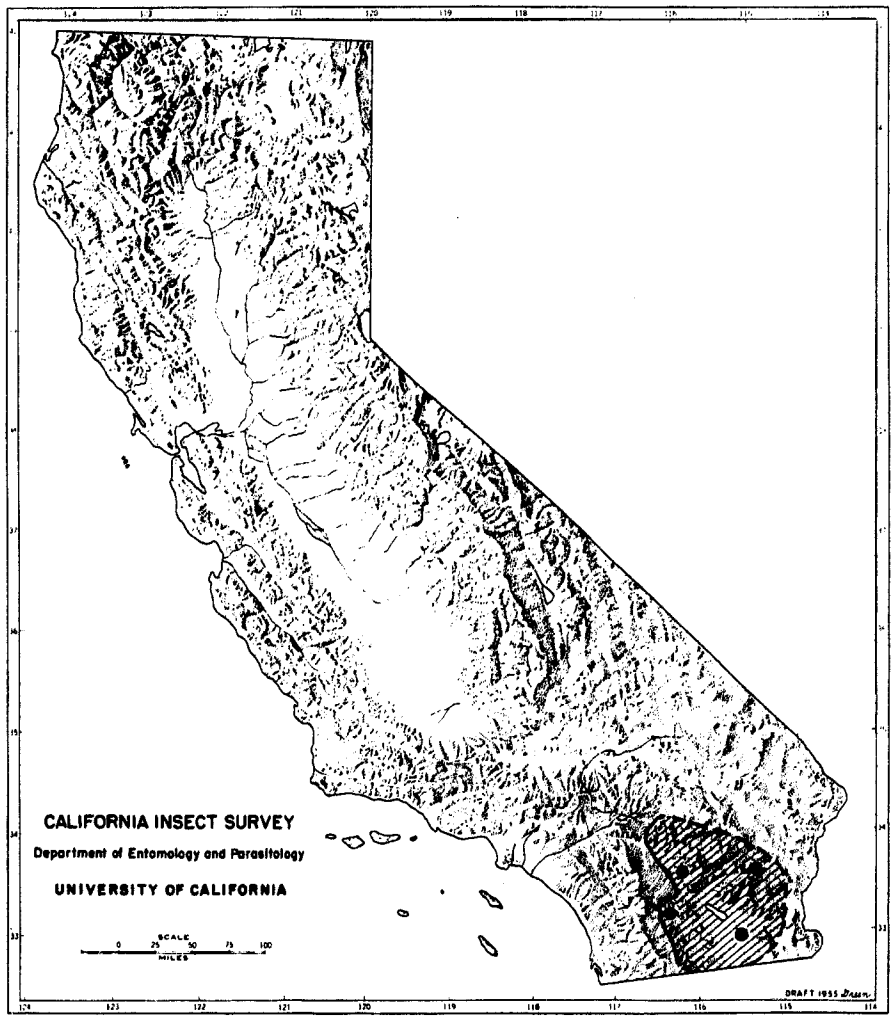
Discussion:

Of the small black and yellow species, this is the only one in which the median cell of the forewing is nearly asetose. The deep mesonotal groove indicates a relationship with *canalis*. It differs from all its close relatives except *decorosum* in having the female frons broader at its narrowest point than the compound eye. As in *californicum* the larger females tend to have bright yellow markings on the pronotum and scutellum.

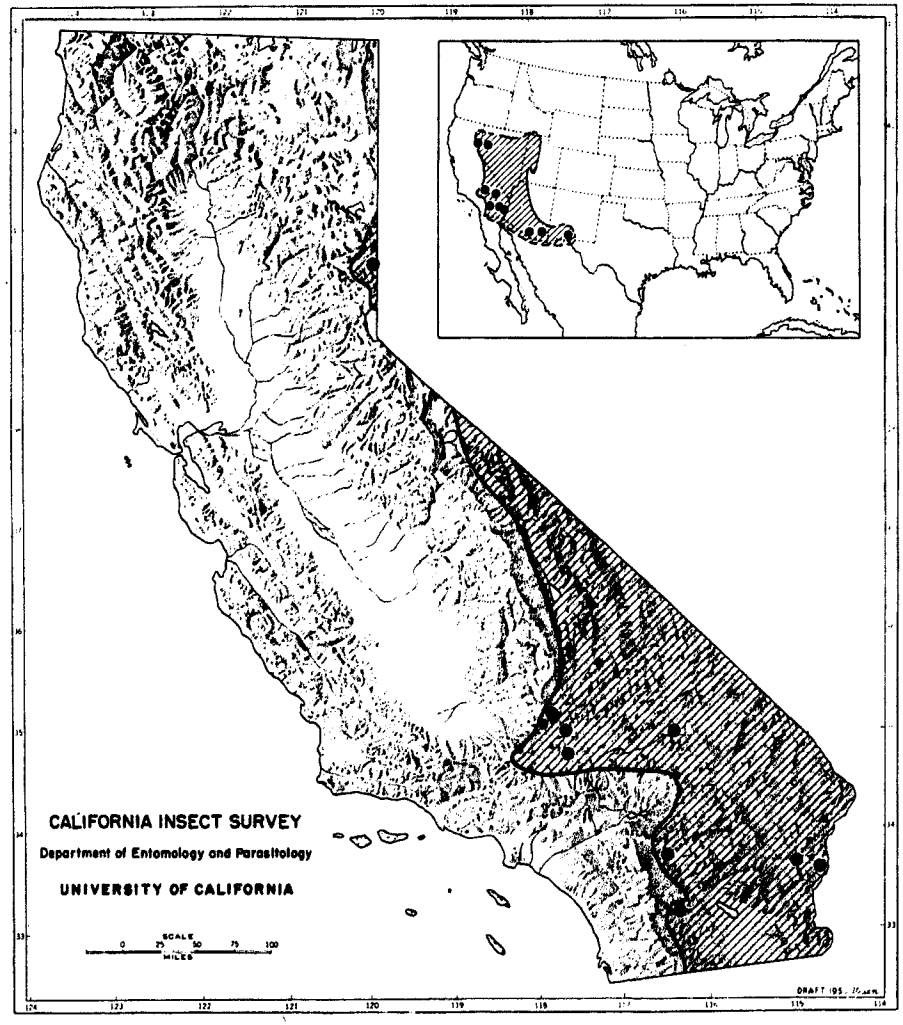
In the West it is confined largely to the sagebrush and creosote bush Sonoran desert areas. Our out-of-state records are: Arizona (Toltec, Whitewater, White Mountains, Continental, Tucson, Sabino Canyon, Sahuarita, Pearce, Globe, Douglas, Sedona, Chiricahua Mountains), Colorado (Grand Junction, Fort Collins), Mexico (Villa Ahumada in Chihuahua, Nombre de Dios and San Juan del Rio in Durango, Lagos de Moreno in Jalisco), Nebraska (Glen), New Mexico (Las Cruces, Rio Puerco, Omega), Texas (Conlen, Round Rock, Giddings, Raymondsville, Uvalde), and Utah (Elgin).

Oxybelus cocopa Pate
(Pl. 16, figs. 86, 87)

Oxybelus cocopa Pate, 1943, Pan-Pac. Ent., 19:121, ♂. Type ♂, Thompson Ranch, Imperial Co., California (U.S. Nat. Mus.).



Map 21. Distribution of *Oxybelus cocopa* Pate.



Map 22. California distribution of *Oxybelus pitanta* Pate. Inset map shows range in United States.

Geographic range: Southern California (see map 21).
California records:

Imperial Co.: Thompson Ranch, 1♂, VI-4-11 (J. C. Bridwell, U.S.N.M.) (Pate 1943*b*:121).

Riverside Co.: Desert Center, 5 mi. E., 1♂, V-22-39 (E. P. Van Duzee, C.A.S.); Indio, 6 mi. W., 1♀, IV-30-49 (MacSwain, Smith, C.I.S.).

San Diego Co.: Borego, 3♂, 2♀, IV-27-54 (M. Wasbauer, C.I.S.).

Discussion:

In the material we have seen, the abdomen is all red with yellow bands on the first 4 or 5 tergites. The scutellum and postscutellum are yellow-marked, and the head and thorax are mostly covered with dense silvery pubescence. The pale setae of the median cell of the forewing are distributed about as in figure 89 but a little more numerous.

We have seen only 4 males and 3 females of this rare California, Lower Sonoran species, previously known from the 2 type males collected by J. C. Bridwell in 1911. The female agrees with the male in all essential features.

Oxybelus pitanta Pate
(Pl. 14, figs. 64, 65)

Oxybelus pitanta Pate, 1943, Pan-Pac. Ent., 19:123, ♂. Type ♂, Cronise, San Bernardino Co., California (Pate Coll.?).

Geographic range: Southwestern United States (see map 22).

California records:

Kern Co.: Saltdale, 2♂, VI-23-48 (A. T. McClay, U.C.D.).

Lassen Co.: Hallelujah Junction, 1♀, VII-4-49 (P. D. Hurd, C.I.S.).

Riverside Co.: Blythe, 18 mi. W., 1♂, IX-29-52 (P. H. Timberlake, U.C.R.); Palm Springs, 3 mi. S., 1♂, VII-13-40 (P. H. Timberlake, U.C.R.); Hopkins Well, 3♂, IV-29-52 (P. D. Hurd, C.I.S., U.C.D.).

San Bernardino Co.: Cronise, 3♂, VII-9-38 (P. H. Timberlake) (Pate, 1943*b*:123); Atolia, 1♂, VII-9-50 (R. M. Bohart, U.C.D.); Desert Springs, 7 mi. S., 1♂, VIII-25-53 (J. C. Hall, U.C.D.); Kramer, 15 mi. E., 1♀, V-30-50 (C. D. MacNeill, C.I.S.).

San Diego Co.: Borego, 9♂, IV-24-54 (J. G. Rosen, P. D. Hurd, M. Wasbauer, C.I.S., U.C.D.); 1♂, 1♀, V-26-54 (F. X. Williams, C.A.S.); 2♂, 1♀, IV-25-54 (P. H. Timberlake, U.C.R.); 8♂, IV-27 to 28-55 (P. D. Hurd, M. Wasbauer, R. O. Schuster, C.I.S., U.C.D.).

Discussion:

Superficially, this species resembles *abdominale* closely. However, the indistinct temporal carina and differently formed mucro and squama indicate a closer relationship to *canalis*. The mesonotal depression of the latter is, of course, distinctive. The median cell of the forewing has setation intermediate between figures 89 and 90.

The species appears to be essentially part of the Lower Sonoran fauna. The type material consisted of 3 male specimens from Cronise, San Bernardino County. We have examined a total of 41 males and 11 females including out-of-state records as follows: Arizona (Sahuarita, Pearce), Nevada (Nixon), and New Mexico (Las Cruces). The female appears to agree with the male in essential features of color, puncturation, and pubescence.

Oxybelus fossor Rohwer and Cockerell
(Pl. 14, figs. 62, 63)

Oxybelus fossor Rohwer and Cockerell, 1908, Ent. News, 10:179, ♀. Type ♀, Mesilla Park, New Mexico (U.S. Nat. Mus.).

Geographic range: United States west of the 100th meridian, north to Nebraska and south to Baja California, Mexico (see map 23).

California records:

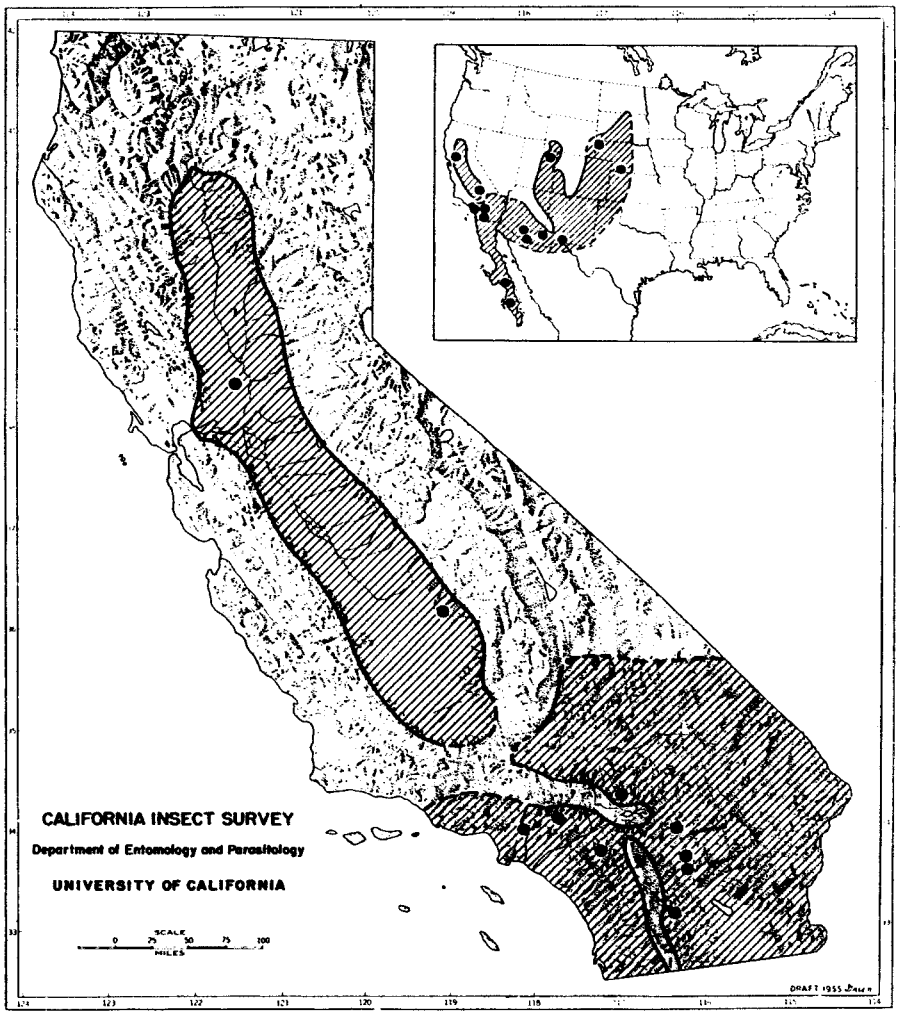
Los Angeles Co.: Claremont, 4♂, 1♀ (C. F. Baker, P.C., U.C.D.); Whittier, 1♀, VIII-11-20 (P. H. Timberlake) (Pate, 1943*b*:128).

Riverside Co.: Riverside, 10♂, 3♀, VIII-29-26, V-25-28, X-9-29, IX-24-31, VII-9-33, IX-25-41, VIII-5-50, IX-5-53 (P. H. Timberlake, U.C.R., U.C.D.); Palm Springs, 1♂, V-23-17 (E. P. Van Duzee, C.A.S.); Indio, 6 mi. W., 1♂, IV-30-49 (Linsley, MacSwain, Smith, U.S.N.M.).

San Bernardino Co.: Morongo Valley, 1♂, IX-3-41 (P. H. Timberlake, U.C.R.); Cushenbury Springs, 1♂, IX-1-36 (P. H. Timberlake). (Pate, 1943*b*:128).

San Diego Co.: Borego, 1♂, IV-27-50 (C. D. MacNeill, C.I.S.); 4♂, V-2-52 (P. D. Hurd, J. G. Rosen, C.I.S.); 6♂, 2♀, IV-24 to 27-54 (J. G. Rosen, C.I.S.); 1♂, IV-25-54 (M. Wasbauer, C.I.S.); 1♂, V-26-54 (F. X. Williams, C.A.S.); 1♂, IV-25-54 (P. H. Timberlake, U.C.R.); 1♀, 9 mi. S. Warner Springs, VII-4-56 (R. M. Bohart, U.C.D.); 1♂, 2 mi. N. Warner Springs, VII-4-56 (A. G. Bartel, U.C.D.).

Yolo Co.: Davis, 1♀, VIII-28-52 (A. A. Grigarick, U.C.D.).



Map 23. California distribution of *Oxybelus fossor* Rohwer and Cockerell. Inset map shows range in United States.

Discussion:

The shiny abdominal tergites are an important part of the facies of this species. Typical specimens have the abdomen nearly or all bright red often marked with yellow. Specimens from the Midwest and Baja California tend to have varying amounts of brown. The male has the last tergite hoodlike, curved under, directed forward, and with the pygidium poorly defined. The setation of the median cell of the forewing is about as in figure 89.

We have studied a total of 43 males and 14 females. Our out-of-state records are: Arizona (Duncan, Toltec, Continental, Gila Bend), Mexico (San Domingo and San Ignacio in Baja California), Nebraska (Hastings, Culbertson), New Mexico (Las Cruces), and Utah (Myton).

LITERATURE CITED

BAKER, C. F.

1896. Notes on *Oxybelus* with descriptions of new species—I. Ent. News, 7:59-62.

BERLAND, L.

1925. Faune de France 10, Hyménoptères vespiformes. I. 364 pp., 663 figs. Paris: Paul Lechevalier.

BOHART, R. M., and E. I. SCHLINGER

1956a. Descriptions of two new western *Oxybelus*. Proc. Biol. Soc. Wash., 69:37-40.

1956b. New species of *Oxybelus* from Western North America. Pan-Pac. Ent.,32:147-156.

1956c. An annotated synonymical list of North American *Oxybelus*. Pan-Pac. Ent., 32: 157:165.

BURKS, B. D.

1951. Tribe Oxybelini. In Muesebeck, C. F. W., *et al.*, Hymenoptera of America north of Mexico. Synoptic Catalogue. U. S. Dept. Agr. Mono., 2:1029-1034.

CRÈVECOEUR, A.

1931. Note sur la biologie de l'*Oxybelus bipunctatus* Oliv. Soc. Ent. de Belgique, Bull. et Ann., 71:187-192.

DALLA TORRE, C. G. de

1897. Catalogus Hymenopterorum hucusque decriptorum systematicus et synonymicus. 8, Fossores, pp. 638-649. Lipsiae.

DICE, L. R.

1943. The biotic provinces of North America. Univ. Michigan Press, 78 pp., 1 map.

HURD, P. D., JR., and C. D. MICHENER

1955. The Megachiline bees of California. Bull. Calif. Ins. Surv., 3:1-247, 24 plates, 112 maps.

KROMBEIN, K. V.

1955. Synonymical notes on North American sphecoid wasps. IV. Some synonymy in *Oxybelus* and descriptions of a new subspecies. Bull. Brooklyn Ent. Soc., 50:70-74.

MERRIAM, C. H.

1898. Life zones and crop zones of the United States. Bull. U.S. Dept. Agric., 10:1-79, 1 map.

MICKEL, C. E.

1918. A synopsis of the Sphecoidea of Nebraska. Univ. Studies (Nebraska) for 1917, 17:342-456, 2 figs.

MUESEBECK, C. F. W., *et al.*

1951. Hymenoptera of America North of Mexico. Synoptic Catalogue. U.S. Dept. Agr. Mono. 2, 1420 pp., frontispiece.

PARKER, J. B.

1915. Notes on the nesting habits of some solitary wasps. Proc. Ent. Soc. Wash., 17:70-77, 9 figs.

PATE, V. S. L.

1937. The Oxybeline wasps of the Philippines, with a synonymical catalogue of the Oriental species. Phil. Jour. Sci., 64:373-396, 12 figs.

1940a. The taxonomy of the Oxybeline wasps, I. A review of the genera *Belomicroides*, *Brimocelus*, and *Belomicrus* with particular reference to the Nearctic species. Trans. Amer. Ent. Soc., 66:1-99, 55 figs.

1940b. The taxonomy of the Oxybeline wasps, II. The classification of the genera *Belomicrus* and *Enchemicrum*. Trans. Amer. Ent. Soc., 66:209-264, 5 text figs.

1943a. On some Holarctic sphecoid wasps. Bull. Brooklyn Ent. Soc., 38:14-16.

1943b. Three new *Oxybelus* from southern California. Pan-Pac. Ent., 19:121-128.

PECKHAM, G. W., and E. G. PECKHAM

1898. On the instincts and habits of the solitary wasps. Bull. Wisc. Geol. Nat. Hist. Survey, scientific series (1), 2:3-245, 12 plates.

ROBERTSON, C.

1889. Synopsis of North American species of the genus *Oxybelus*. Trans. Amer. Ent. Soc., 16:77-85.

1901. Some new aculeate Hymenoptera from Illinois and Florida. Trans. Amer. Ent. Soc., 27:195-204.

SMITH, H. S.

1908. The Sphegoidea of Nebraska. Univ. Studies (Nebraska), 2:1-88, 1 plate.

WILLIAMS, F. X.

1936. Notes on two oxybelid wasps in San Francisco, California. Pan-Pac. Ent., 12:1-6, 2 figs.

SOURCE OF ILLUSTRATIONS

Frontis., *O. californicum* Bohart and Schlinger, paratype, Davis, Yolo Co., California.
Fig. 1, *O. burdi* Bohart and Schlinger, holotype, Ahuacatlan, Nayarit, Mexico.
Fig. 2, *O. californicum* Bohart and Schlinger, holotype, Davis, Yolo Co., California.
Fig. 3, *O. emarginatum* Say, Vacaville, Solano Co., California.
Fig. 4, *O. paracochise* Bohart and Schlinger, holotype, Sonoita, Santa Cruz Co., Arizona.
Fig. 5, *O. timberlakei* Bohart and Schlinger, paratype, Bryson, Monterey Co., California.
Fig. 6, *O. cornutum* Robertson, Tucson, Pima Co., Arizona.
Fig. 7, *O. sericeum* Robertson, Hot Springs, Lyon Co., Nevada.
Fig. 8, *O. macswaini* Bohart and Schlinger, holotype, Tracy, San Joaquin Co., California.
Fig. 9, *O. uniglumis quadrinotatum* Say, Mineral King, Tulare Co., California.
Fig. 10, *O. burdi* Bohart and Schlinger, holotype, Ahuacatlan, Nayarit, Mexico.
Fig. 11, *O. canalis* Bohart and Schlinger, holotype, Riverside Co., California.
Fig. 12, *O. linsleyi* Bohart and Schlinger, paratype, Idyllwild, Riverside Co., California.
Fig. 13, *O. cornutum* Robertson, Hemet, Riverside Co., California.
Fig. 14, *O. cornutum* Robertson, Riverside, Riverside Co., California.
Fig. 15, *O. cochise* Pate, Morongo Valley, Riverside Co., California.
Fig. 16, *O. paracochise* Bohart and Schlinger, holotype, Sonoita, Santa Cruz Co., Arizona.
Fig. 17, *O. paracochise* Bohart and Schlinger, paratype, Douglas, Cochise Co., Arizona.
Fig. 18, *O. rancocas* Pate, paratype, Camden Co., New Jersey.
Fig. 19, *O. subcornutum* Cockerell, Mt. Graham, Graham Co., Arizona.
Fig. 20, *O. subcornutum* Cockerell, Aberdeen, Moore Co., North Carolina.
Fig. 21, *O. crandalli* Bohart and Schlinger, holotype, Tucson, Pima Co., Arizona.
Fig. 22, *O. burdi* Bohart and Schlinger, holotype, Ahuacatlan, Nayarit, Mexico.
Fig. 23, *O. burdi* Bohart and Schlinger, paratype, Ahuacatlan, Nayarit, Mexico.
Fig. 24, *O. uniglumis quadrinotatum* Say, Bolinas, Marin Co., California.
Fig. 25, *O. uniglumis quadrinotatum* Say, Bolinas, Marin Co., California.
Fig. 26, *O. bipunctatum* Olivier, Valais, Switzerland.
Fig. 27, *O. bipunctatum* Olivier, Valais, Switzerland.
Fig. 28, *O. linsleyi* Bohart and Schlinger, paratype, Mt. San Jacinto, Riverside Co., California.
Fig. 29, *O. linsleyi* Bohart and Schlinger, paratype, Mt. San Jacinto, Riverside Co., California.
Fig. 30, *O. subulatum* Robertson, Devil's Lake, Ramsey Co., North Dakota.
Fig. 31, *O. subulatum* Robertson, Holliston, Middlesex Co., Massachusetts.
Fig. 32, *O. ventrale* Fox, San Diego, San Diego Co., California.
Fig. 33, *O. ventrale* Fox, El Arco, Baja California, Mexico.
Fig. 34, *O. majus* Mickel, Llano Co., Texas.
Fig. 35, *O. majus* Mickel, Otsego Co., Michigan.
Fig. 36, *O. packardii* Robertson, Deep Springs, Inyo Co., California.
Fig. 37, *O. packardii* Robertson, Baldy Mesa, Los Angeles Co., California.
Fig. 38, *O. laetum* Say, Iosco Co., Michigan.
Fig. 39, *O. laetum* Say, Williamsburg, York Co., Virginia.
Fig. 40, *O. nigrum* Robertson, Keweenaw Co., Michigan.
Fig. 41, *O. nigrum* Robertson, Winona, Winona Co., Minnesota.
Fig. 42, *O. macswaini* Bohart and Schlinger, holotype, Tracy, San Joaquin Co., California.
Fig. 43, *O. macswaini* Bohart and Schlinger, paratype, Tracy, San Joaquin Co., California.
Fig. 44, *O. exclamans* Viereck, Mendota, Fresno Co., California.
Fig. 45, *O. exclamans* Viereck, Antioch, Contra Costa Co., California.
Fig. 46, *O. sericeum* Robertson, Pyramid Lake, Washoe Co., Nevada.
Fig. 47, *O. sericeum* Robertson, Blythe, Riverside Co., California.
Fig. 48, *O. robertsonii* Baker, Bridge Creek Camp, Lassen Co., California.
Fig. 49, *O. robertsonii* Baker, Bridge Creek Camp, Lassen Co., California.
Fig. 50, *O. cressonii* Robertson, Arlington, Arlington Co., Virginia.
Fig. 51, *O. cressonii* Robertson, Arlington, Arlington Co., Virginia.
Fig. 52, *O. timberlakei* Bohart and Schlinger, holotype, Mt. San Jacinto, Riverside Co., California.
Fig. 53, *O. timberlakei* Bohart and Schlinger, paratype, Isabella, Kern Co., California.
Fig. 54, *O. simile* Cresson, Glenville, Kern Co., California.
Fig. 55, *O. simile* Cresson, Kernville, Kern Co., California.
Fig. 56, *O. xerophilum* Bohart and Schlinger, holotype, Death Valley, Inyo Co., California.

Fig. 57, *O. argypheum* Bohart and Schlinger, holotype, Borego, San Diego Co., California.

Fig. 58, *O. taenigaster* (Viereck), *Nogal*, Lincoln Co., New Mexico.

Fig. 59, *O. taenigaster* (Viereck), Dalhart, Dallam Co., Texas.

Fig. 60, *O. decorosum* Mickel, Barberton, Summit Co., Ohio.

Fig. 61, *O. decorosum* Mickel, holotype, Omaha, Douglas Co., Nebraska.

Fig. 62, *O. fossor* Rohwer and Cockerell, Riverside, Riverside Co., California.

Fig. 63, *O. fossor* Rohwer and Cockerell, Riverside, Riverside Co., California.

Fig. 64, *O. pitanta* Pate, Borego, San Diego Co., California.

Fig. 65, *O. pitanta* Pate, Saltdale, Kern Co., California.

Fig. 66, *O. parvum* Cresson, Borego, San Diego Co., California.

Fig. 67, *O. parvum* Cresson, Borego, San Diego Co., California.

Fig. 68, *O. canalis* Bohart and Schlinger, holotype, Riverside, Riverside Co., California.

Fig. 69, *O. canalis* Bohart and Schlinger, paratype, Riverside, Riverside Co., California.

Fig. 70, *O. inornatum* (Robertson), Midland Co., Michigan.

Fig. 71, *O. inornatum* (Robertson), Arlington, Arlington Co., Virginia.

Fig. 72, *O. emarginatum* Say, Mt. Montgomery, Mineral Co., Nevada.

Fig. 73, *O. emarginatum* Say, Cheboygan Co., Michigan.

Fig. 74, *O. frontale* Robertson, Hastings, Adams Co., Nebraska.

Fig. 75, *O. frontale* Robertson, Hutchison, Reno Co., Kansas.

Fig. 76, *O. sparideum* Cockerell, Sahuarita, Pima Co., Arizona.

Fig. 77, *O. sparideum* Cockerell, Santa Rita Mts., Santa Cruz Co., Arizona.

Fig. 78, *O. abdominale* Baker, near Olancha, Inyo Co., California.

Fig. 79, *O. abdominale* Baker, near Olancha, Inyo Co., California.

Fig. 80, *O. californicum* Bohart and Schlinger, holotype, Davis, Yolo Co., California.

Fig. 81, *O. californicum* Bohart and Schlinger, paratype, Davis, Yolo Co., California.

Fig. 82, *O. krombeini* Bohart and Schlinger, holotype, Woodlake, Tulare Co., California.

Fig. 83, *O. krombeini* Bohart and Schlinger, paratype, Woodlake, Tulare Co., California.

Fig. 84, *O. argenteopilosum* Cameron, Winchester, Riverside Co., California.

Fig. 85, *O. argenteopilosum* Cameron, Hemet, Riverside Co., California.

Fig. 86, *O. cocopa* Pate, Borego, San Diego Co., California.

Fig. 87, *O. cocopa* Pate, Borego, San Diego Co., California.

Fig. 88, *O. parvum* Cresson, near Indio, Riverside Co., California.

Fig. 89, *O. canalis* Bohart and Schlinger, paratype, Riverside, Riverside Co., California.

Fig. 90, *O. argenteopilosum* Cameron, Riverside, Riverside Co., California.

Fig. 91, *O. macswaini* Bohart and Schlinger, holotype, Tracy, San Joaquin Co., California.

Fig. 92, *O. emarginatum* Say, Barberton, Summit Co., Ohio.

Fig. 93, *O. californicum* Bohart and Schlinger, holotype, Davis, Yolo Co., California.

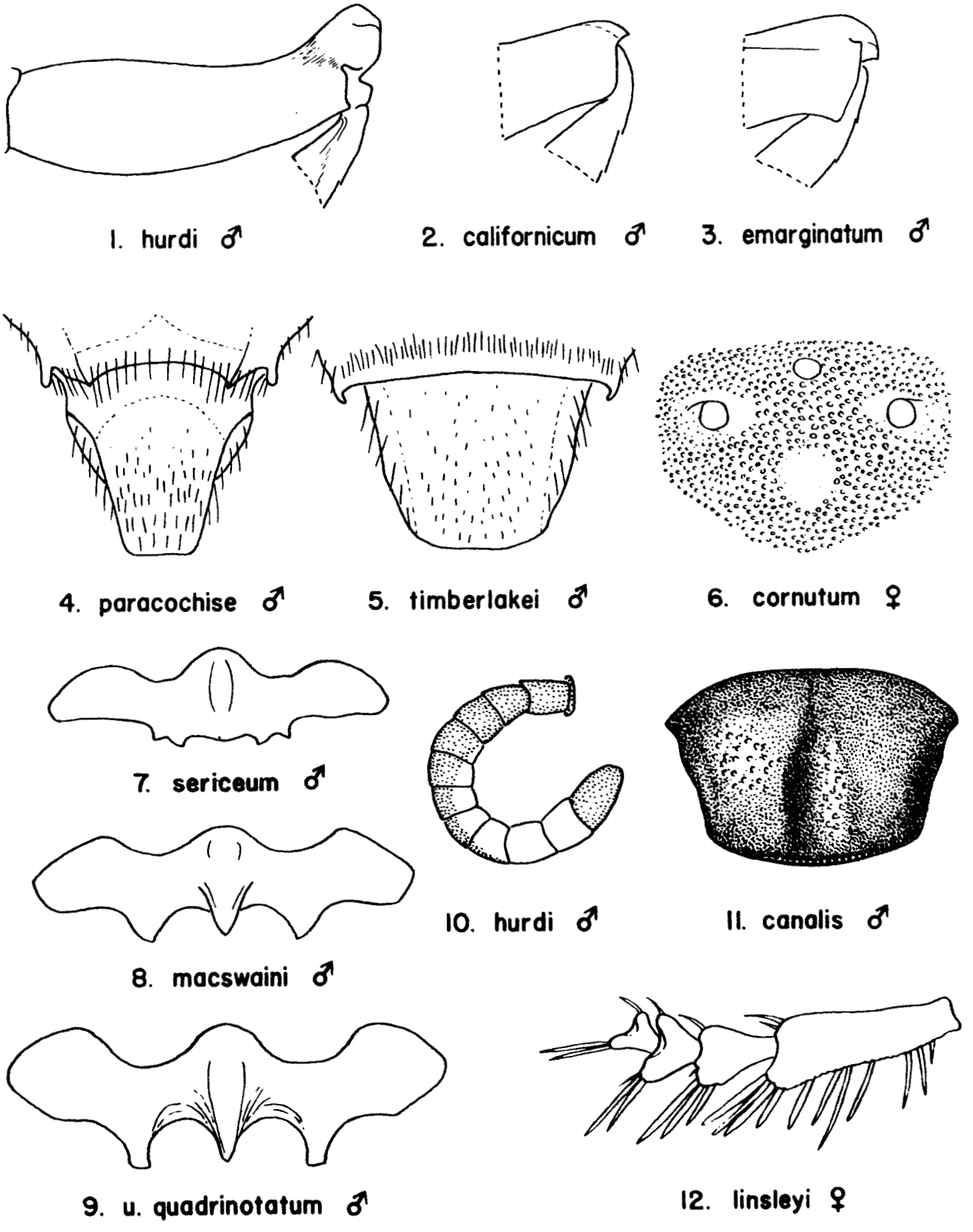


Plate 9.

Figs. 1–3, lateral, inner view of hind femur. Figs. 4–5, dorsal view of tergite VII and apex of VI. Fig. 6, view of vertex from above showing vertex tubercle behind ocelli. Figs. 7–9, clypeus. Fig. 10, front view of left antenna. Fig. 11, mesonotum. Fig. 12, fore tarsal segments I–IV showing structure of psammophore.

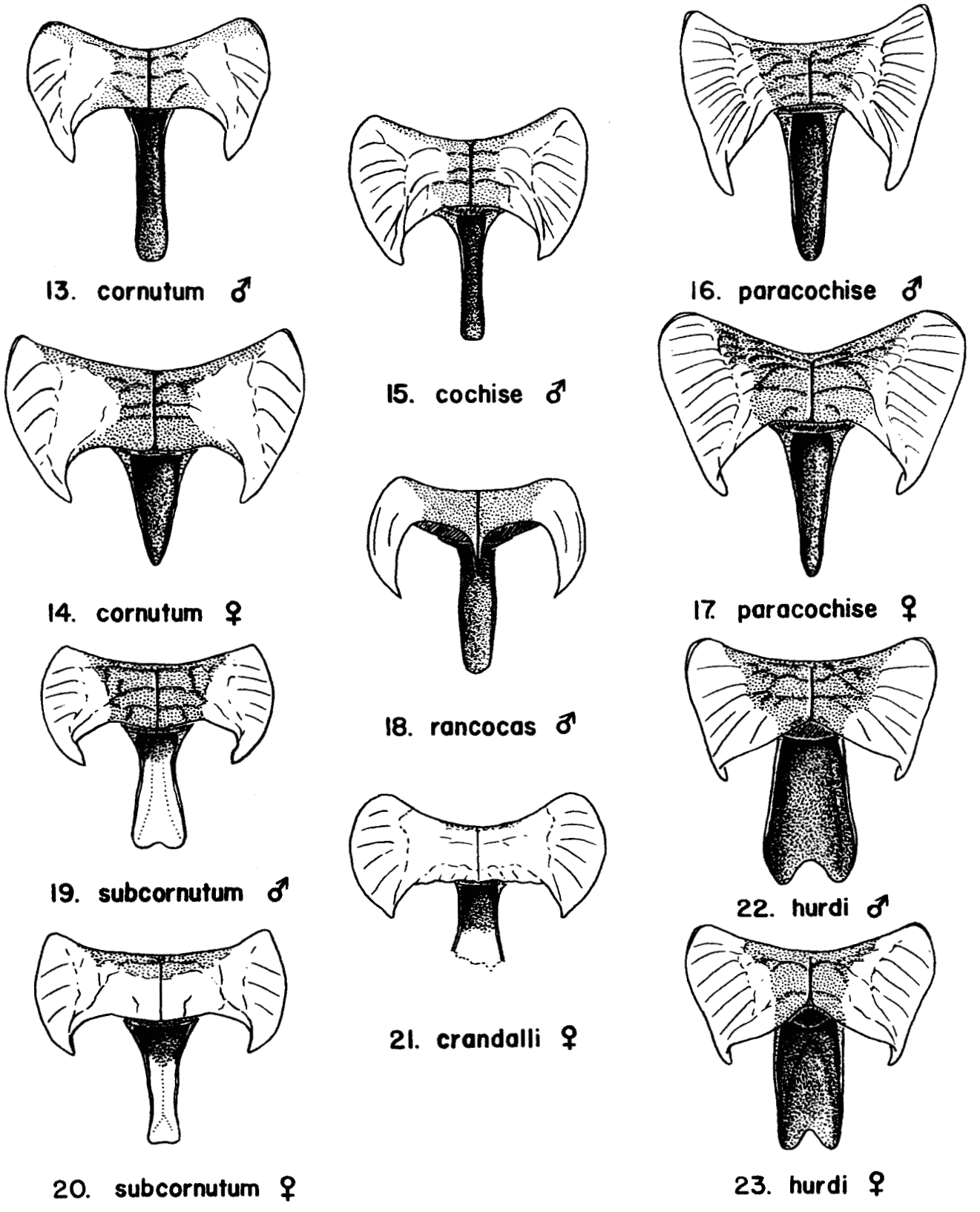


Plate 10.

Figs. 13–23, postscutellum (with lateral squamae) and propodeal spine (mucro).

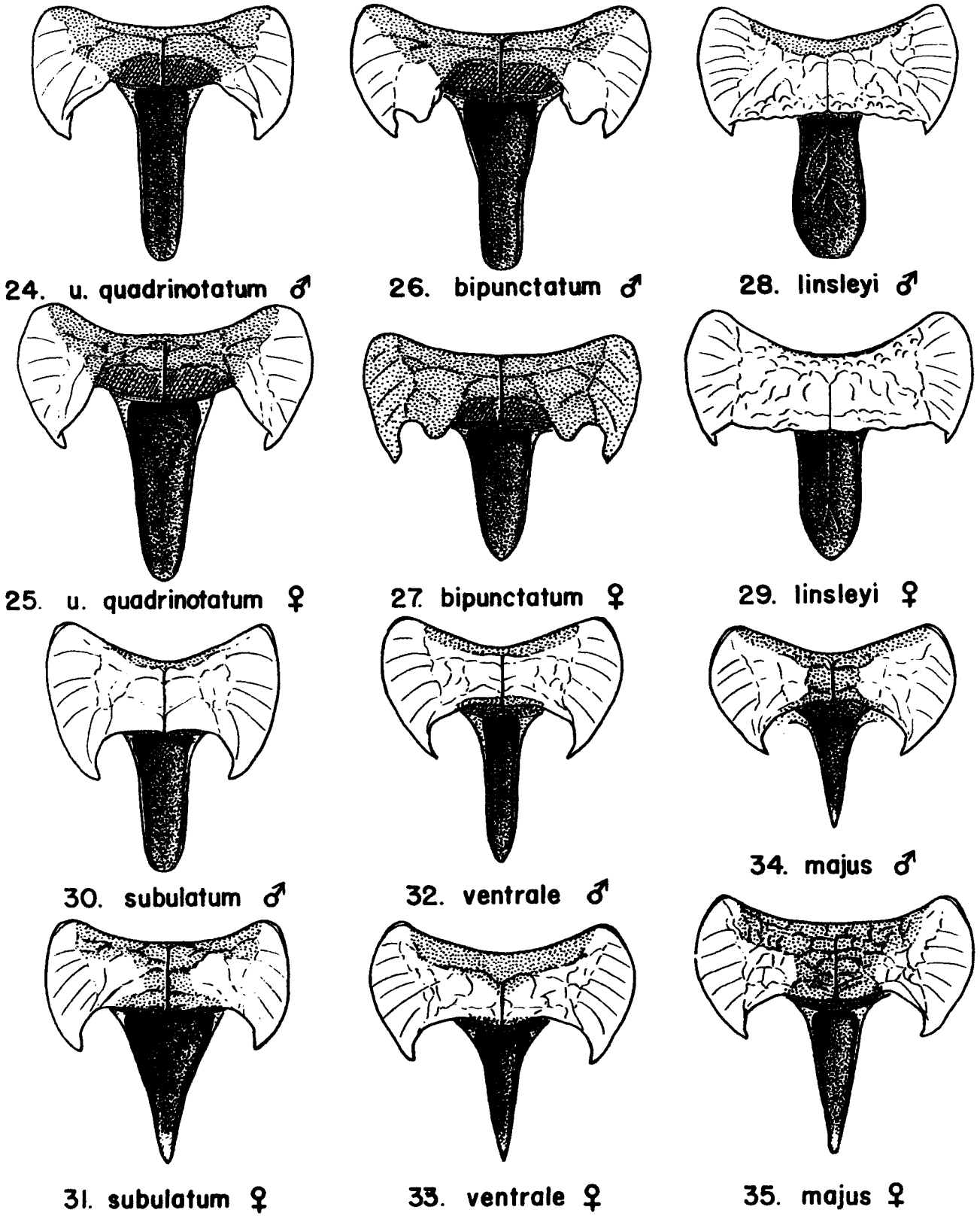
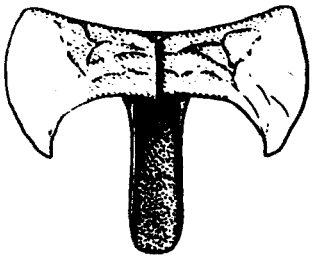
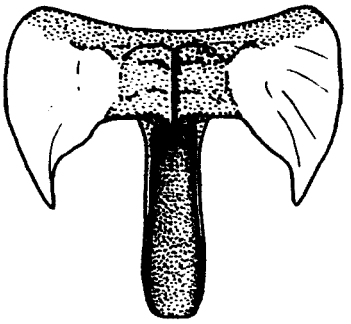


Plate 11.

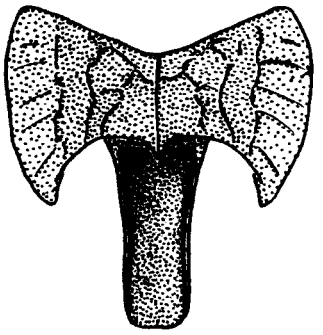
Figs. 24–35, postscutellum (with lateral squamae) and propodeal spine (mucro).



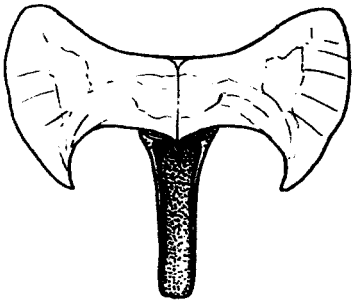
36. packardi ♂



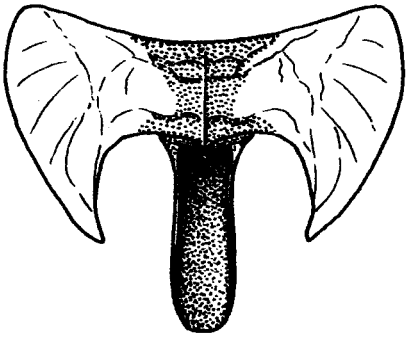
38. laetum ♂



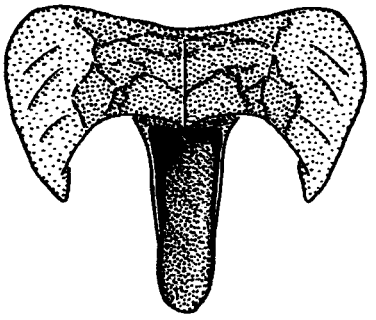
40. nigrum ♂



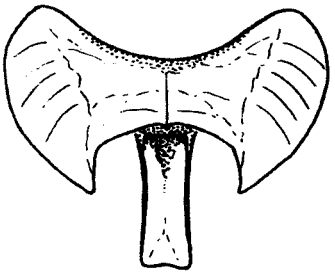
37. packardi ♀



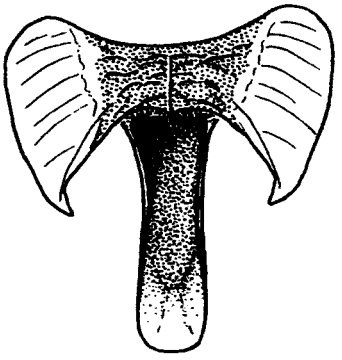
39. laetum ♀



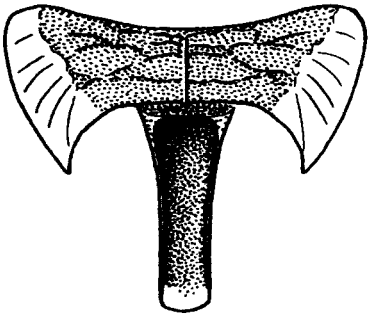
41. nigrum ♀



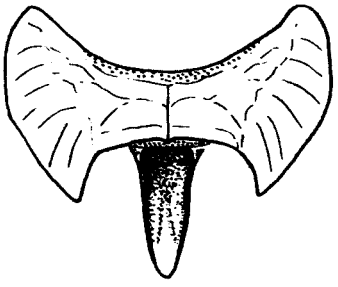
42. macswaini ♂



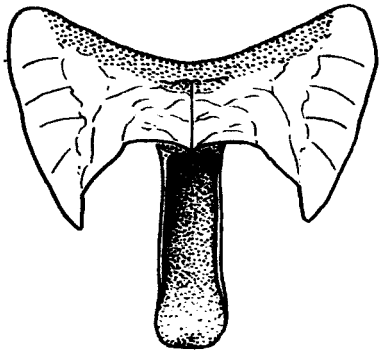
44. exclamans ♂



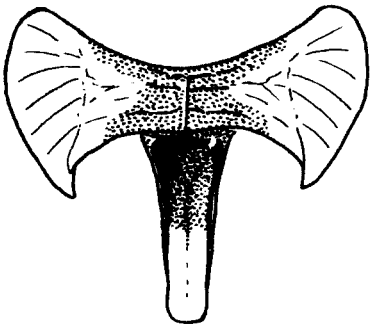
46. sericeum ♂



43. macswaini ♀



45. exclamans ♀



47. sericeum ♀

Plate 12.

Figs. 36–47, postscutellum (with lateral squamae) and propodeal spine (mucro).

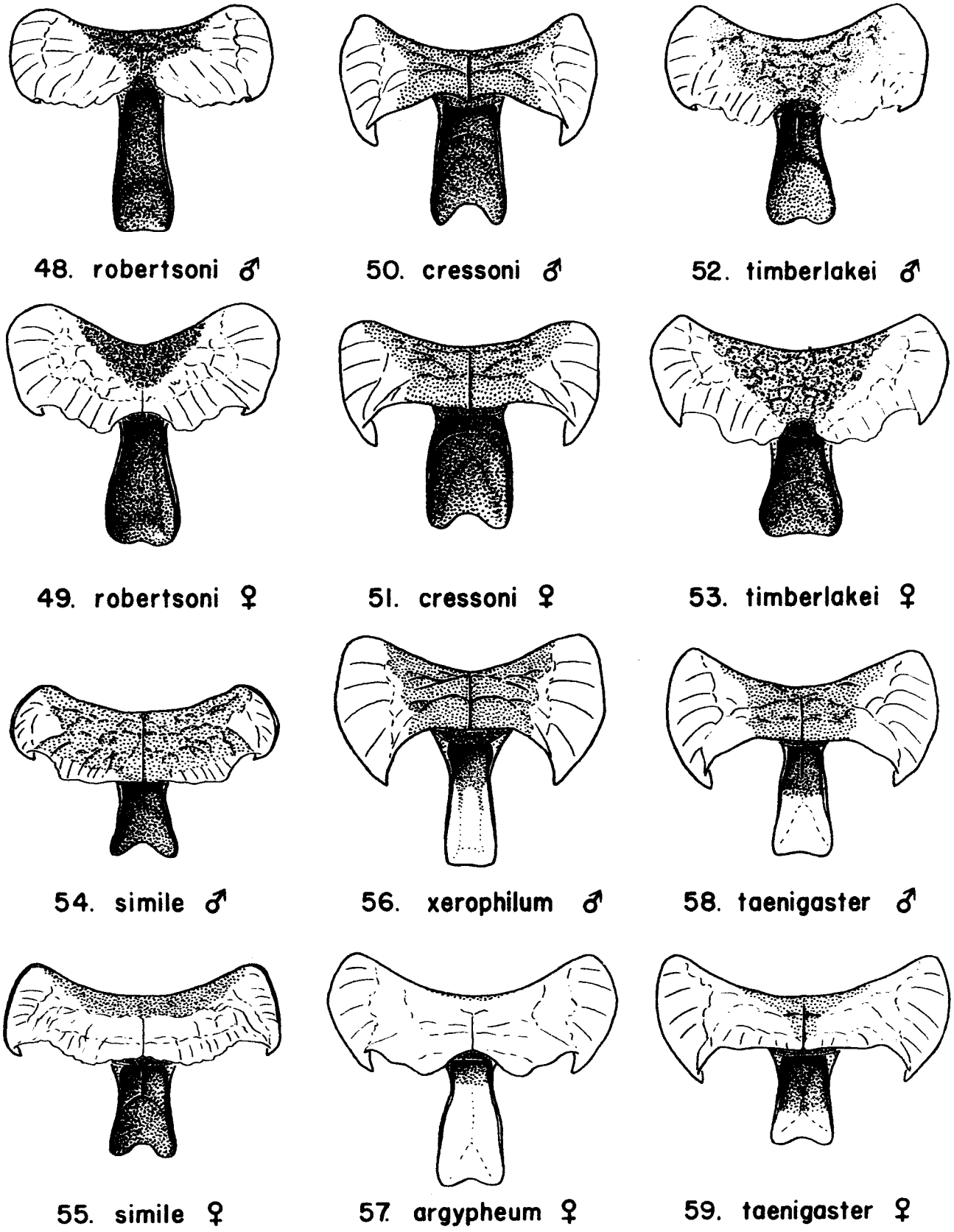


Plate 13.

Figs. 48-59, postscutellum (with lateral squamae) and propodeal spine (mucro).

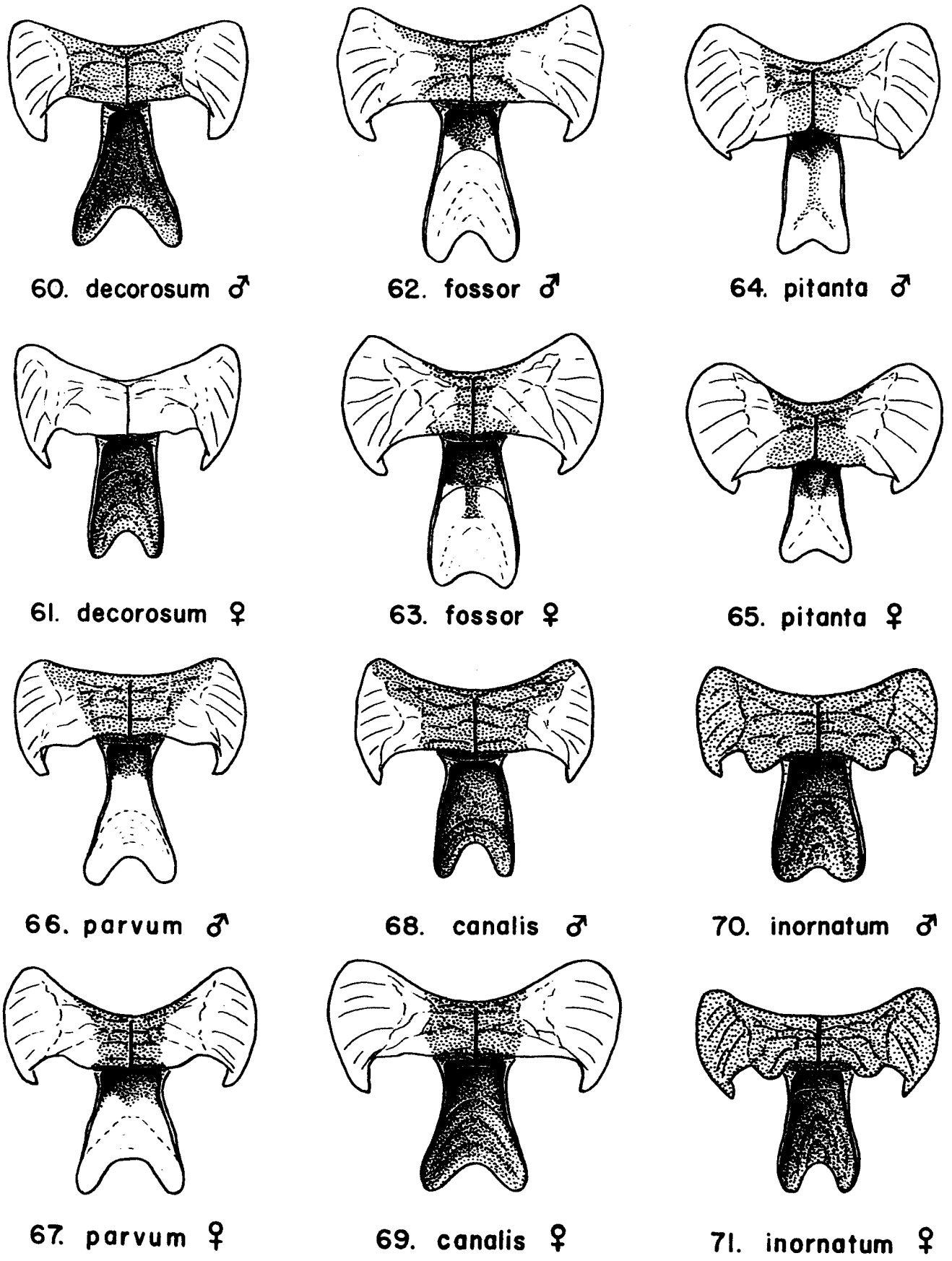
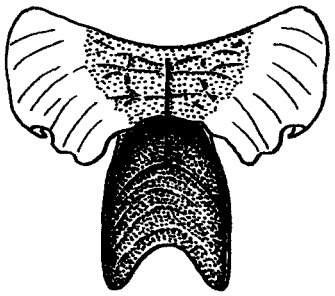
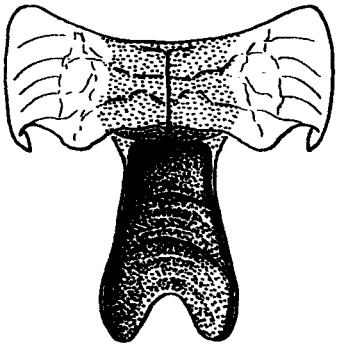


Plate 14.

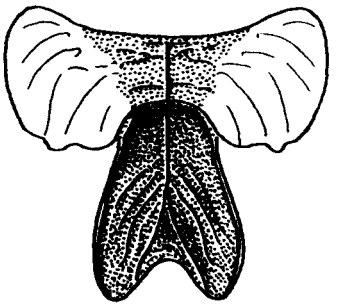
Figs. 60–71, postscutellum (with lateral squamae) and propodeal spine (mucro).



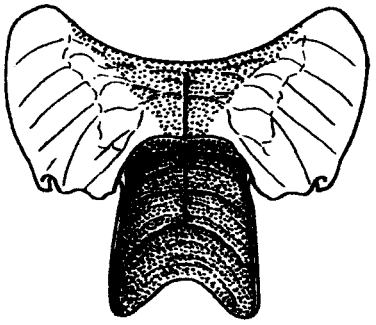
72. emarginatum ♂



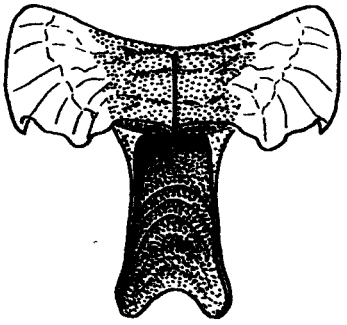
74. frontale ♂



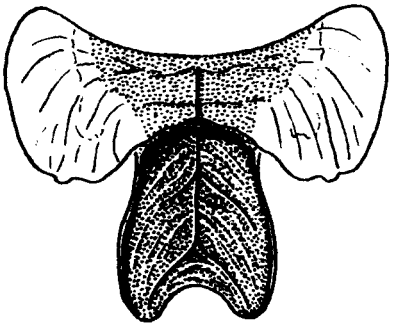
76. sparideum ♂



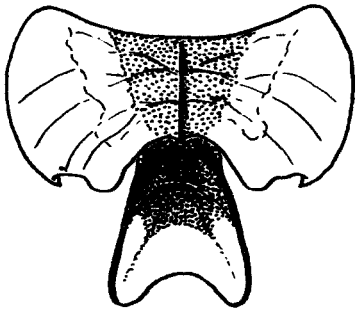
73. emarginatum ♀



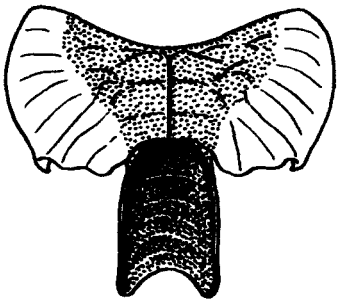
75. frontale ♀



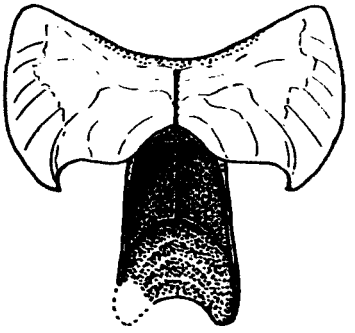
77. sparideum ♀



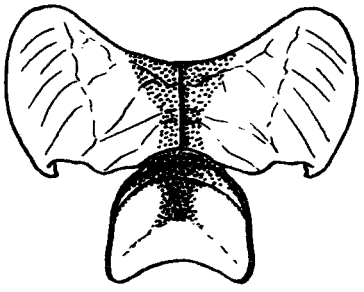
78. abdominale ♂



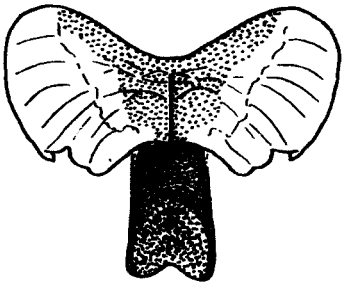
80. californicum ♂



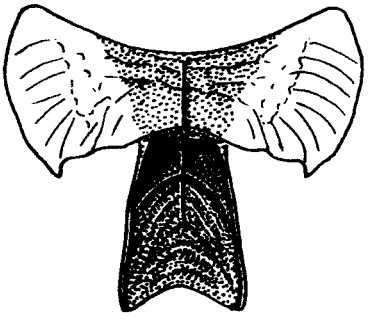
82. krombeini ♂



79. abdominale ♀



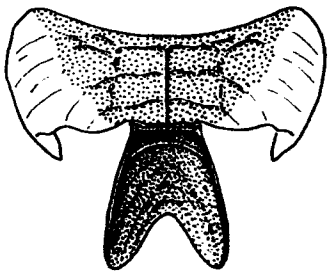
81. californicum ♀



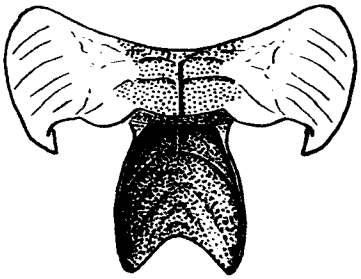
83. krombeini ♀

Plate 15.

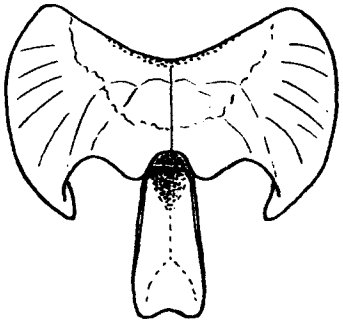
Figs. 72–83, postscutellum (with lateral squamae) and propodeal spine (mucro).



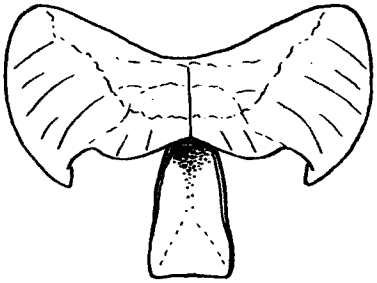
84. argenteopilosum ♂



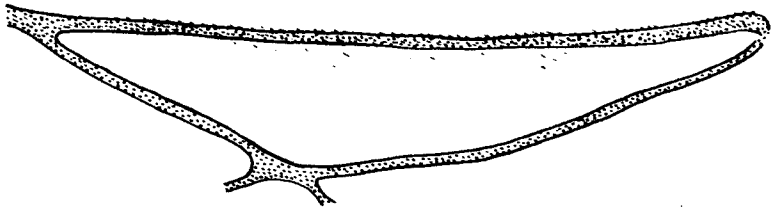
85. argenteopilosum ♀



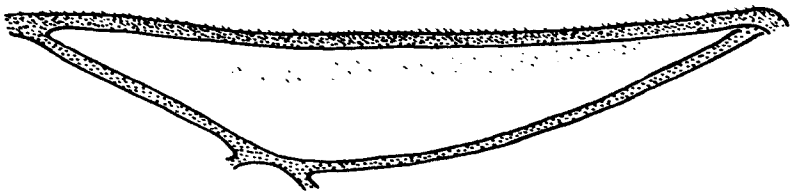
86. cocopa ♂



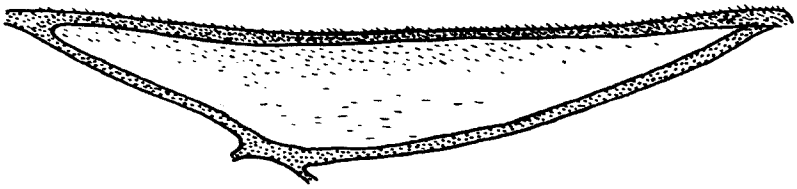
87. cocopa ♀



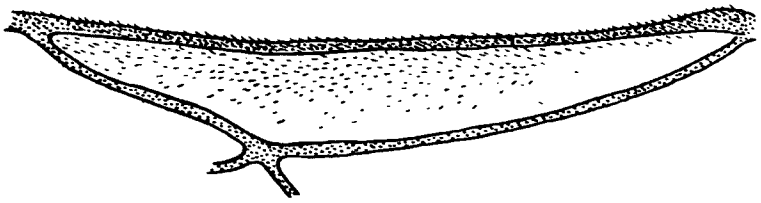
88. parvum



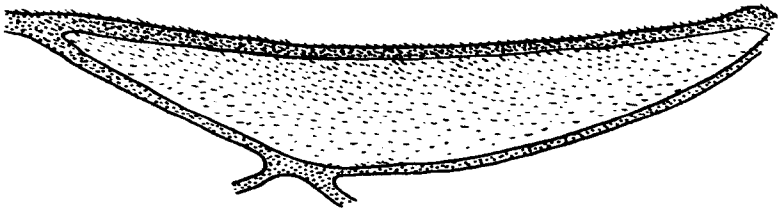
89. canalis



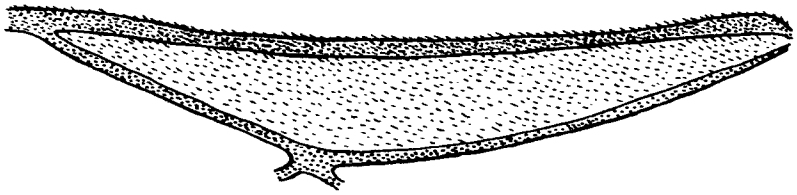
90. argenteopilosum



91. macswaini



92. emarginatum



93. californicum

Plate 16.

Figs. 84–87, postscutellum (with lateral squamae) and propodeal spine (mucro). Figs. 88–93, median cell of left forewing of male, showing different types of setation.

INDEX TO OXYBELINI