

*Physocephala burgessi* (Williston). Courtesy E. S. Ross.

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**THE CONOPID FLIES OF CALIFORNIA**  
**(DIPTERA)**

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# THE CONOPID FLIES OF CALIFORNIA

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By

Sidney Camras and Paul D. Hurd, Jr.

## INTRODUCTION

The conopid flies are characterized by the closed or narrowed first posterior cell of the wing (fig. 2) and in all the Nearctic forms by the elongated proboscis. These flies, especially the members of the subfamily Conopinae which have the base of the abdomen narrowed and somewhat thread-waisted, superficially resemble some of the wasps and certain asilids, bombyliids, syrphids, and tachinids. They are found frequently around flowers.

To date, thirty-nine species of six genera are definitely known from California. Nine others have been included in the present report because it seems likely that they will be eventually found to occur here. One other species has been included, but the record of its occurrence in California is open to question.

In matters of identification, the great variability of many of the species and the frequent occurrence of atypical and intermediate specimens must be considered. Therefore, the keys cannot cover all the aberrant individuals. The latest work covering the North American Conopidae is that of Parsons (1948) and should be consulted for a more complete synonymical bibliography.

Kröber (1919) has provided a very convenient summary of the knowledge pertaining to the family from a world viewpoint.

The present study includes all of the species known from Alberta, Arizona, British Columbia, California, Idaho, Lower California, Montana, Nevada, Oregon, and Washington.

Mrs. Celeste Green, Scientific Illustrator, Department of Entomology and Parasitology, University of California, Berkeley, has prepared the illustrations which accompany this study.

The material which has formed the basis of this paper and which we have been privileged to study was made available by the institutions listed below. To the individuals in charge of these collections as well as those acknowledged elsewhere in the present paper we would like to express our gratitude: Drs. G. E. Bohart, U.S. Legume Seed Research Laboratory, U.S. Department of Agriculture, Logan, Utah (G.E.B.); W. L. Brown, Jr., and P. J. Darlington, Jr., Museum of Comparative

Zoölogy, Harvard College (M.C.Z.); California Insect Survey, Department of Entomology and Parasitology, University of California (C.I.S.); Mont A. Cazier, American Museum of Natural History (A.M.N.H.); H. Dietrich, Department of Entomology, Cornell University (C.U.); H. J. Dybas, Chicago Museum of Natural History, (C.M.N.H.); G. F. Knowlton, Utah State Agricultural College (U.S.A.C.); A. T. McClay, Department of Entomology and Parasitology, University of California, Davis (U.C.D.); J. A. G. Rehn, Academy of Natural Sciences of Philadelphia (A.N.S.P.); E. S. Ross, California Academy of Sciences (C.A.S.); Curtis Sabrosky, U.S. National Museum (U.S.N.M.); and P. H. Timberlake, Citrus Experiment Station, University of California, Riverside (U.C.R.). Much additional material is in the private collection of Sidney Camras (S.C.).

## BIOLOGY

The conopid flies are all solitary, internal parasites of Hymenoptera (especially wasps and bees), Orthoptera (one reared from the genus *Oedipoda*), and Isoptera (a single record of a larva described by Silvestri, 1926, from the head of the Philippine *Termes gilvus* Hagen).

Brauer (1883) and Meijere (1903, 1912) are fundamental to any ethological study of the family. Their investigations not only embody a synthesis of the literature pertaining to the immature stages and biology, but more importantly contain much original information. Townsend (1935) has summarized the high lights of the conopid ethological studies since that time and has provided certain data on the immature stages of *Physocephala sagittaria* (Say).

The most informative biological study made on an American conopid, *Physocephala affinis* (= *texana*), is that by Bohart and MacSwain (1939). Although this investigation was conducted as an adjunct to an ethological study of its host, *Epibembex occidentalis*, the data obtained and presented more fully by Bohart (1941a) were suf-

ficiently informative to demonstrate the usefulness of biological criteria in the interpretation of the species problem in this genus. A more detailed consideration of these works is presented in the discussion of the genus *Physocephala*. There have been a few additional biological studies dealing with the American conopids, but since most of these are concerned with host relationships, they are considered or cited elsewhere in the present study.

complicated by the female pouncing upon the host during flight and inserting the ovipositor briefly between the abdominal segments. Prolonged contact has been observed, but more often the encounter between the ovipositing fly and its host is of short duration. There seems to be no evident effect upon the host following oviposition or during the subsequent development of at least the early larval instars of the parasite. Apparently otherwise normal bees containing third instar conopid



Fig. 1. Puparium of *Physocephala texana* (Williston) within abdominal cavity of its dead host, *Epibembix occidentalis beutenmuelleri* (Fox). Courtesy E. S. Ross.

There is reason to believe that a certain degree of developmental host specificity is manifest by at least some species of conopids. This is particularly evident in the paper of MacSwain and Bohart (1947) where these authors found *Myopa rubida* ovipositing in three species of *Andrena*, but apparently unsuccessfully on at least one of the species.

Oviposition in the majority of our species is ac-

complished by the female pouncing upon the host during flight and inserting the ovipositor briefly between the abdominal segments. Prolonged contact has been observed, but more often the encounter between the ovipositing fly and its host is of short duration. There seems to be no evident effect upon the host following oviposition or during the subsequent development of at least the early larval instars of the parasite. Apparently otherwise normal bees containing third instar conopid

larvae are observed visiting flowers in the search for nectar and pollen. The feeding activities of the parasitic larva are restricted to the abdominal cavity since there has been no indication in any of the studies that the larva attempts to gain access to the thorax.

Shortly before pupation the host dies, and the conopid completes its development within the abdominal cavity. Emergence of the adult fly from the

abdomen of the dead host seems always to occur between the segments and may be either dorsal or ventral.

There is but one generation produced a year in all the species studied thus far; however, there is reason to believe that some of the species may be multivoltine as are their hosts.

Much additional information is needed before it will be possible to provide biological criteria for the definition of our species and genera.

The distributional maps accompanying this study show the known localities of occurrence in California (indicated by various forms of circles) for each species, and the geographic range (various overlays) of the species in the smaller inset maps. Where there is not sufficient distributional information on a California species to warrant interpretation by a map, the California records are cited in full.

The following key includes in addition to those genera known from California, the genera *Robertsonomyia* and *Stylogaster*, both of which probably occur in the state.

Key to the Subfamilies and Genera of California Conopidae

- 1. Antennae with terminal style (Conopinae) 2  
Antennae with dorsal arista . . . . . 3
- 2(1). Anterior cross vein (r-m) near middle of discal cell (1st M<sub>2</sub>) (fig. 2c); hind femur uniformly thickened. . . . . *Physoconops* (p. 21)  
Anterior cross vein (r-m) well beyond middle of discal cell (1st M<sub>2</sub>) (fig. 2b); hind femur irregularly thickened at base . . . . . *Physocephala* (p. 25)
- 3(1). Anal cell (Cu) much longer than second basal (M) (Myopinae) (fig. 2a) . . . . . 4  
Anal cell (Cu) about equal to second basal (M) . . . . . 7
- 4(3). Proboscis not geniculate at middle . . . . . 5  
Proboscis geniculate at middle . . . . . 6
- 5(4). First posterior cell (R<sub>5</sub>) open or with short petiole (fig. 2); femora without thorns on apical half ventrally . . . *Zodion* (p. 29)  
First posterior cell (R<sub>5</sub>) usually with long petiole; femora with thorns on apical half ventrally . . . *Robertsonomyia* (p. 35)
- 6(4). Cheeks as wide as eye height . . . . .  
. . . . . *Myopa* (p. 35)  
Cheeks narrower than eye height . . . . .  
. . . . . *Occemyia* (p. 43)

- 7(3). Tibiae unarmed at apices (Dalmanninae). . . . . *Dalmannia* (p. 45)  
Tibiae with apical spur (Stylogasterinae) . . . . . *Stylogaster* (p. 47)

Genus *Physoconops* Szilady

The majority of the New World species included in this genus were described in the genus *Conops*. Our species are very similar in their wasplike habitus to the genus *Physocephala*.

The New World *Physoconops* have recently been reviewed by Camras (1955). In that study the genus has been divided into six subgenera, three of which are represented in California and may be separated by means of the following key.

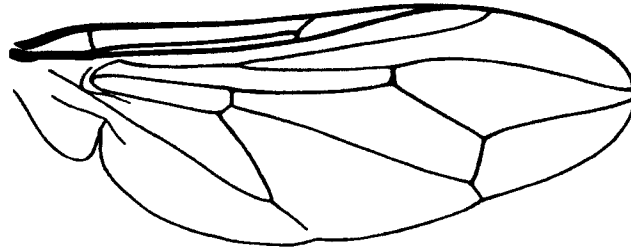
Key to the California Subgenera of *Physoconops*

- 1. Third antennal segment more than two-thirds as long as second; front shorter than wide . . . . . 2  
Third antennal segment less than two-thirds as long as second; front generally longer than wide . . . . . *Physoconops*
- 2. Vertex small, much shorter than front . . . . . *Pachyconops*  
Vertex large, as long as front *Gyroconops*

The subgenus *Gyroconops* includes three species of which only one, *Physoconops sylvorus* (Williston) the type of the subgenus, is known from California. This subgenus may be recognized by the large vertical swelling which extends halfway from the occiput to the base of the antennae.

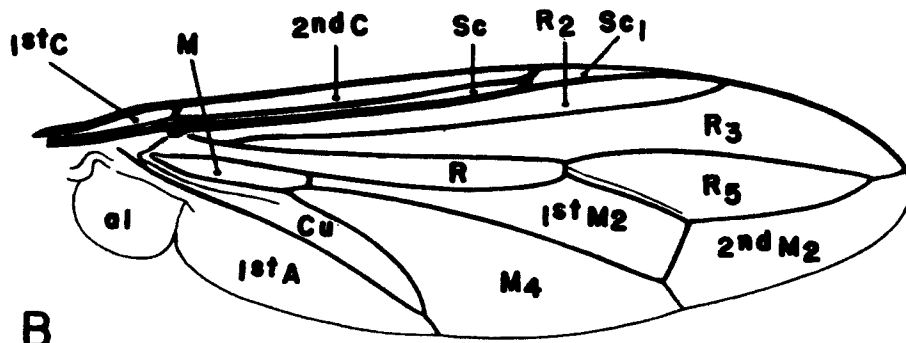
The subgenus *Pachyconops* is represented in California by two species, *Physoconops gracilis* (Williston) and *P. townsendi* Camras. *Pachyconops* is similar to the nominate subgenus, but differs in having the front shorter than wide, and in having the third antennal segment about equal to the second. This subgenus to which twenty-five species have been assigned appears to contain several diverse groups, but their recognition as subgenera at this time seems unwise.

The nominate subgenus which includes seventeen species, only one of which, *Physoconops fronto* (Williston), is definitely known to occur in California, may be represented in California by three species. The type of the subgenus, *Physoconops obscuripennis* (Williston), and *P. discalis* (Williston) are not now known from California, but it is anticipated that future collecting will demonstrate their presence here. The subgenus *Physo-*



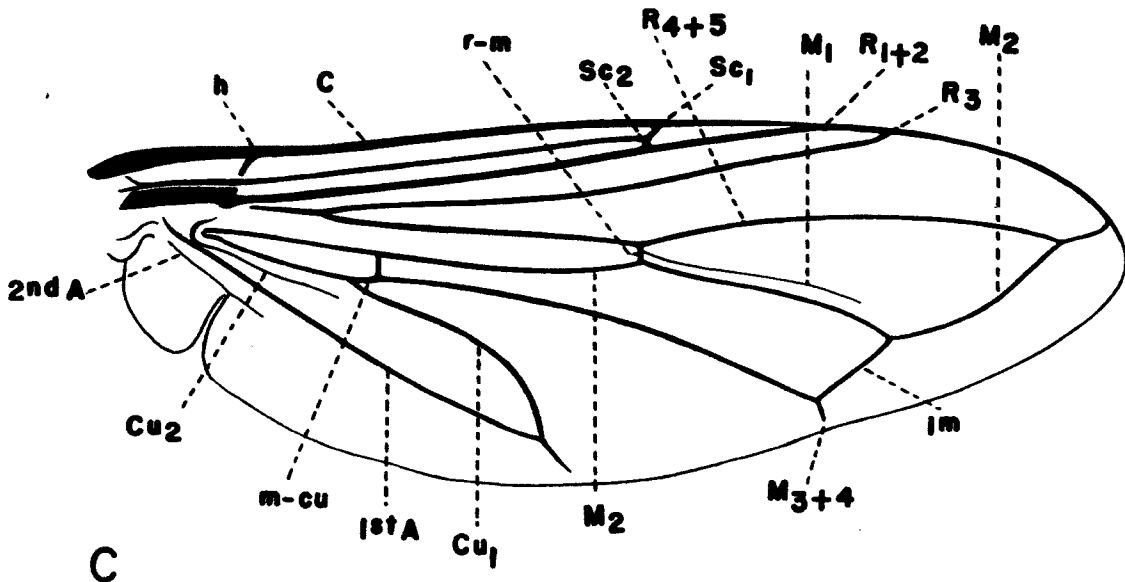
A

*Zodion obliquefasciatum*



B

*Physocephala texana*



C

*Physoconops fronto*

Fig. 2. Wing venation of A, *Zodion obliquefasciatum* Macquart; B, *Physocephala texana* (Williston); and C, *Physoconops fronto* (Williston).



*conops* is easily recognized by the narrow front, the short third antennal segment, and the relatively prominent triangular mark on the posterior margin of the eye.

The California species of the genus *Physoconops* may be separated by means of the following key.

Key to the California Species of  
*Physoconops*

- 1. Front yellow . . . . . 2  
Front black . . . . . 4
- 2(1). First posterior cell (R<sub>5</sub>) entirely hyaline . .  
. . . . . *fronto* (p. 25)  
First posterior cell (R<sub>5</sub>) partly patterned . .  
. . . . . 3
- 3(2). Cheeks reddish, face yellow . . . . .  
. . . . . *townsendi* (p. 23)  
Cheeks yellow, same as face . . . . .  
. . . . . *gracilis* (p. 23)
- 4(1). Dark wing pattern with transverse hyaline  
stripe . . . . . *sylosus* (p. 23)  
Dark wing pattern uninterrupted . . . . . 5
- 5(4). Wing pattern sharply limited by third vein .  
. . . . . *discalis* (p. 25)  
Wing pattern diffuse, extending beyond third  
vein . . . . . *obscuripennis* (p. 25)

*Physoconops* (*Pachyconops*) *gracilis* (Williston)

*Conops gracilis* Williston, 1885, Trans. Conn. Acad. Arts and Science, 6:377. Type ♂, Arizona (Snow Entomological Collections, Lawrence, Kansas).

Geographic range: Arizona, California, Colombia, Colorado, Lower California, Mexico, and New Mexico.

California records:

Imperial Co.: Experimental Farm, V-31-12, VI-6-12 (J. C. Bridwell, U.S.N.M.).

Riverside Co.: Blythe, VIII-3-46, flowers *Tamarix gallica* (P. D. Hurd, Jr., C.I.S.); VII-20-47, same flower (J. W. MacSwain, C.I.S.).

Discussion:

In addition to the key characters of this predominantly reddish species, the second and third antennal segments are subequal, the genital plate of the female is short, and there is no distinct postvertical pollinose stripe. The front is sometimes darkened in the center, and the facial grooves sometimes have dark marks at the oral keel, thus showing variation toward the eastern *P. brachyrhynchus* which it replaces in the western United States.

*Physoconops* (*Pachyconops*) *townsendi* Camras

*Conops auratus* Townsend, 1901, Trans. Amer. Ent. Soc., 27:161-163. Four cotypes ♂, ♀, LaCueva, 5,300 ft., Organ Mts., New Mexico. One cotype in British Museum (location of others unknown). (Preoccupied by *Conops aurata* Walker, 1871.)

*Physoconops* (*Pachyconops*) *townsendi* Camras, 1955, Proc. U.S. Nat. Mus., 105 (3355):170-171.

Geographic range: Arizona, California, New Mexico, and Texas.

California records:

Imperial Co.: Bard, VI-15-20 (H. R. Reed, U.S.N.M.).

Riverside Co.: Blythe, VI-19-47 (J. W. MacSwain, C.I.S., Camras Coll.). Hemet, VI-18-45, flowers alfalfa (C.I.S.).

Discussion:

In addition to the key characters of this predominantly reddish species, there is a distinct golden pollinose postvertical stripe connecting the pollinose postorbital stripes. The female genital plate is very large, and the second and third antennal segments are subequal.

There has been some confusion about the name of this species since Kröber misapplied the name *auratus*, using it for *connectens*, and using the name *gracilis* for this species. However, Camras (1955:171) has remarked that recognition of *connectens* and the distinction of *townsendi* (= *auratus*) from *rufus* should clear up the confusion of names.

*Physoconops* (*Gyroconops*) *sylosus* (Williston)

*Conops sylosus* Williston, 1882, Trans. Conn. Acad. Arts and Sci., 4:329-330. Three cotypes ♂, Massachusetts, Connecticut, New England (Snow Entomological Collections, Lawrence, Kansas).

Synonym: *Conops arizonicus* Banks, 1916.

Geographic range: Massachusetts to Florida, west to Arizona, California, Colorado, Lower California, Mexico, Nebraska, Nevada, New Mexico, and Texas.

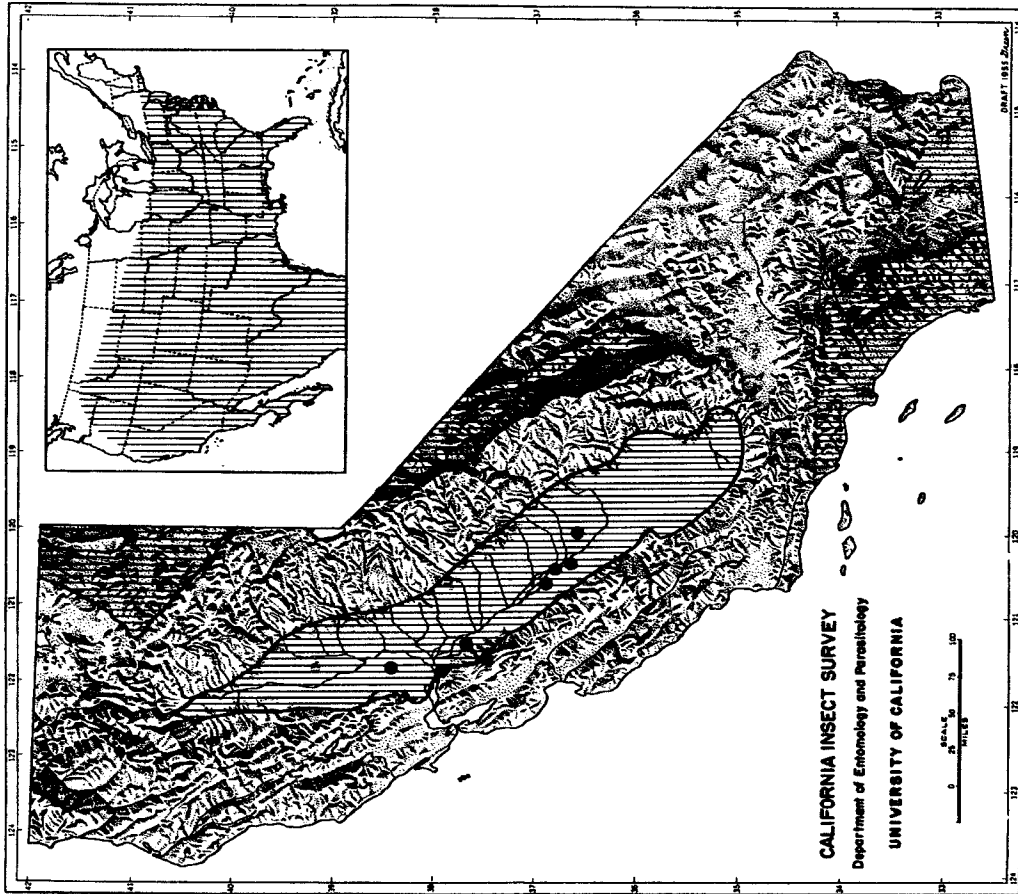
California records:

Los Angeles Co.: Castaic Jct., IX-11-50, flowers *Lepidospartum* (P. H. Timberlake, U.C.R.); Mohave Desert, Highway 138, 3,600 ft., VI-28-27, (P. H. Timberlake, U.C.R.).

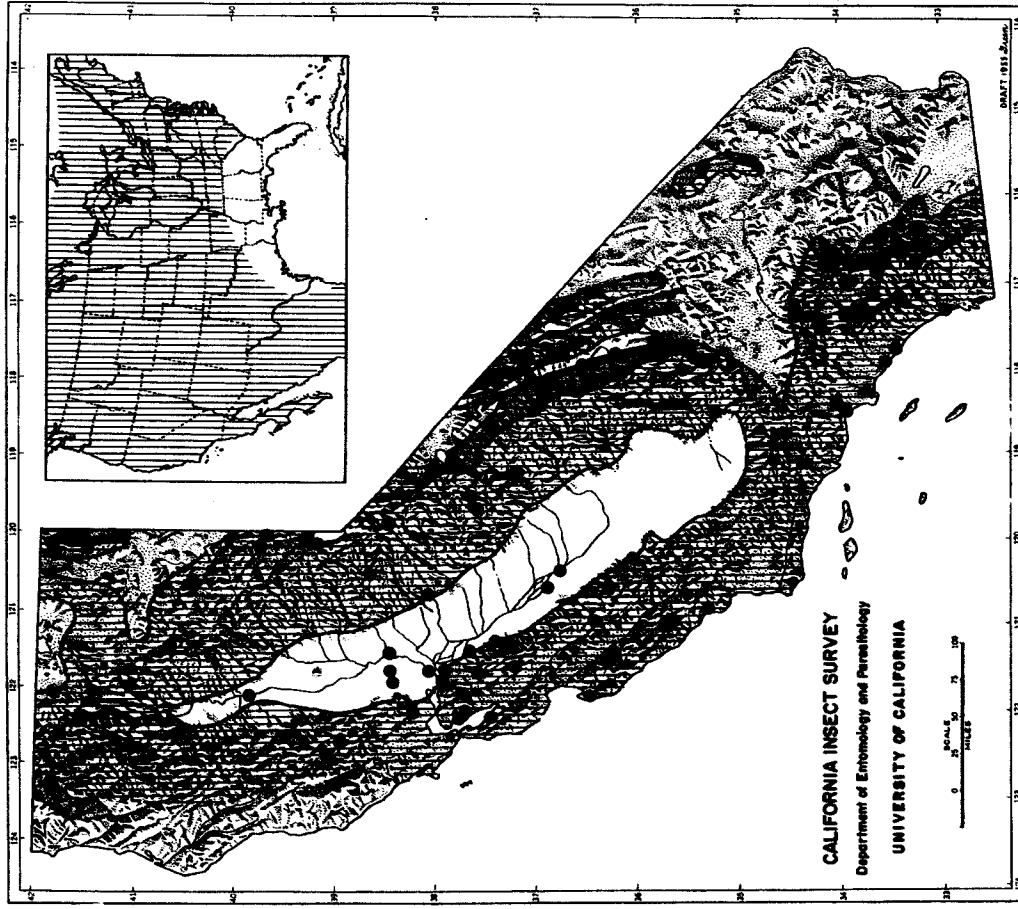
Mono Co.: Rock Creek near Toms Place, VIII-20-56 (C. D. MacNeill, C.I.S.).

San Bernardino Co.: Mountain Home, San Bernardino Mountains, IX-12-53, (J. C. Hall, U.C.D.); Redlands, X-1913 (F. R. Cole, U.S.N.M.).

San Diego Co.: Warner Springs, 9 mi. S., VII-4-56 (R. M. Bohart, U.C.D.).



Map 1. Distribution of *Physoconops fronto*  
(Williston).



Map 2. Distribution of *Physocephala texana*  
(Williston).

## Discussion:

This predominantly blackish species is immediately distinguishable by the interrupted wing pattern. The second and third antennal segments are subequal, and the female genital plate is moderately long. The vertex of this species is produced anteriorly at the expense of the front, and consequently is nearly as long as that structure. It is the only California species of the subgenus *Gyroconops*.

*Physoconops (Physoconops) fronto* (Williston)

*Conops fronto* Williston, 1885, Trans. Conn. Acad. Arts and Sci., 6:378-379. Three cotypes ♂, ♀, western Kansas (Snow Entomological Collections, Lawrence, Kansas).

Synonyms: *Conops striatifrons* Kröber, 1915; *C. pulchellus* Kröber, 1915; *C. argentifacies* Van Duzee, 1927; *C. fraterculus* Van Duzee, 1927; *C. rubicundulus* Van Duzee, 1927.

Geographic range: Massachusetts to Florida, west to California (see map 1), Washington, and Mexico.

## Discussion:

In addition to the key characters, this predominantly reddish species has the third antennal segment much shorter than the second. The triangular smooth area on the posterior margin of the eye was first discovered in this species, but it also occurs in other members of this genus and in *Physocephala*.

Camras (1955:177) has found that this species shows considerable geographic variation, and western specimens have the front averaging narrower and usually entirely bright yellow; eastern specimens frequently have an indistinct dark midline on the front, and the hyaline areas of the wing may be so brownish as to resemble superficially *P. obscuripennis*.

Bohart and MacSwain (1940:91) have recorded this species as a parasite of *Megachile peribirta* Cockerell.

*Physoconops (Physoconops) discalis* (Williston)

*Conops discalis* Williston, 1892, Biolog. Centr.-Amer., Dipt. 3:79-80. Cotypes (no.?). ♂, ♀, Guerrero, Tabasco, Mexico (A.M.N.H.)

Synonyms: *Conops formosus* Kröber, 1915; *Conops brachyrhynchus* var. *semifuscus* Banks, 1916.

Geographic range: Argentina, Arizona, Bolivia, Brazil, Costa Rica, Guatemala, Mexico, New Mexico, Paraguay, Texas, and Utah.

## Discussion:

This predominantly blackish species has not been found in California, but may occur in the southeastern part of the state. The synonymy is based on a series of specimens from Mexico showing complete intergradation between the yellow-cheeked form *semifuscus* and the black-cheeked form *discalis* (Camras, 1955:181). Some individuals from Mexico (*formosus*) have the face entirely black except for the facial grooves.

*Physoconops (Physoconops) obscuripennis* (Williston)

*Conops obscuripennis* Williston, 1882, Trans. Conn. Acad. Arts and Sci., 4:328-329. Five cotypes ♂, Virginia, South Carolina, Georgia, Massachusetts (Snow Entomological Collections, Lawrence, Kansas).

Synonym: *Conops foxi* Van Duzee, 1927.

Geographic range: Massachusetts to Florida, west to Alberta, British Columbia, Colorado, Texas, and Washington.

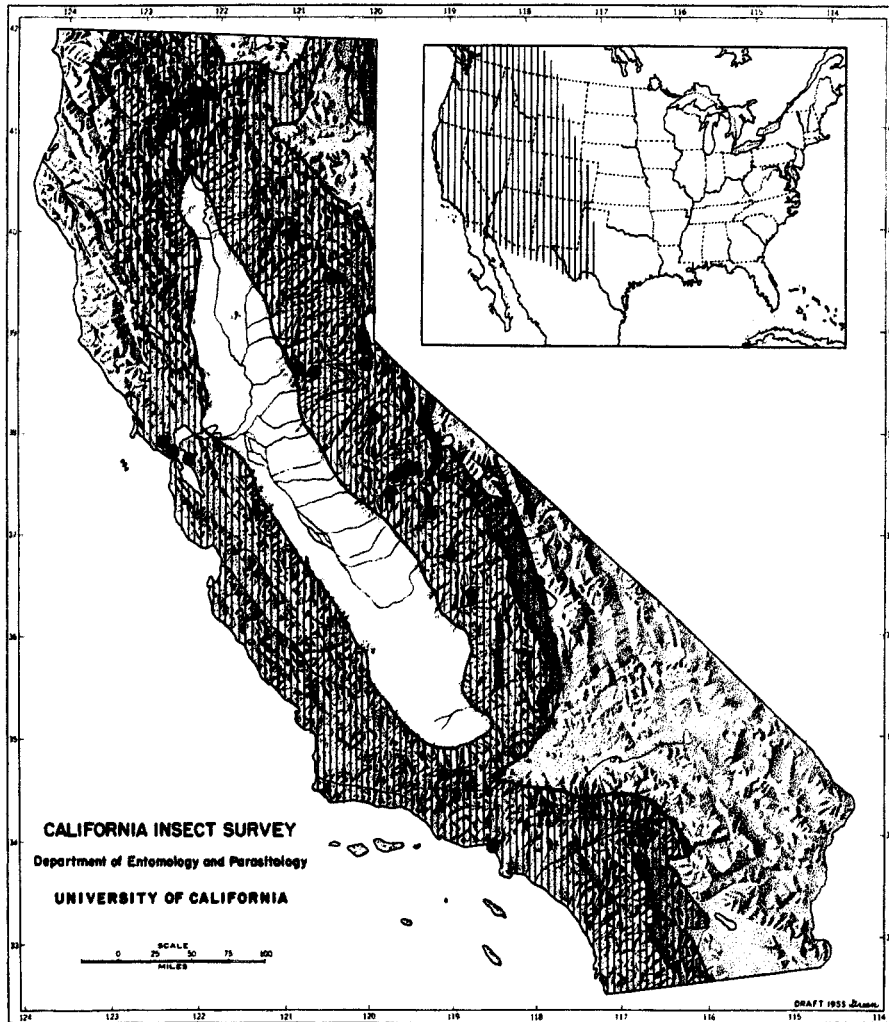
## Discussion:

This species has not been found in California as yet, but should occur at least in the northeastern part of the state. The western form (*foxi*) differs from the eastern in that the posterior margin of the wing is nearly hyaline, and there is a difference in the shade of the wing pattern behind the third vein. This suggests variation toward *discalis*, and intermediates will probably be found in the region between the range of *obscuripennis* and *discalis*.

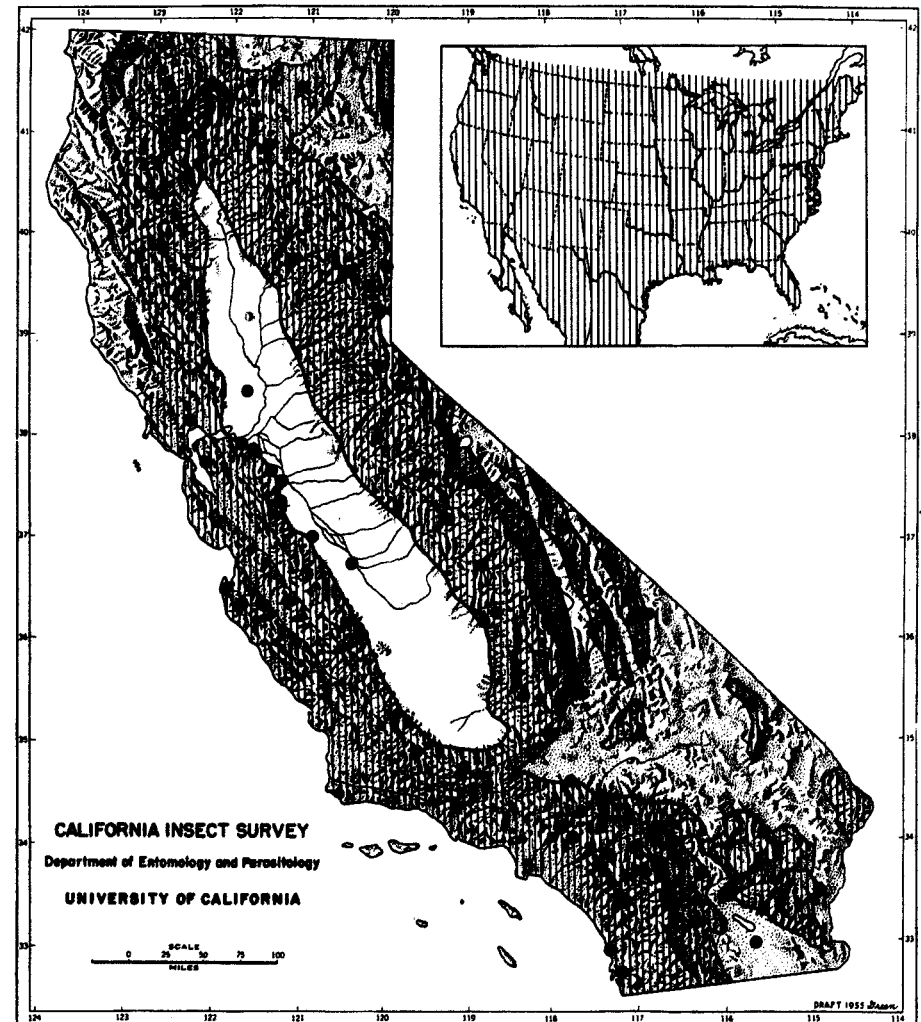
Genus *Physocephala* Schiner

Superficially the species of *Physocephala* resemble those of the genus *Physoconops*, but may be readily separated from that genus by the position of the anterior cross vein (r-m) in relation to the discal cell (1st M<sub>2</sub>) (fig. 2). An additional character of value is the irregularly thickened base of the hind femur present in the species of *Physocephala*. In *Physoconops* the hind femur is uniformly thickened.

Important biological studies, conducted at Antioch, California, on *Physocephala texana* (Williston) by Bohart and MacSwain (1939:84-97) and Bohart (1941:141-144), have provided biological criteria for the interpretation of color and morphological variation within a single species. The extent of variation as expressed in a series of more than one hundred specimens (Bohart, 1941) bred from a single colony of the bembicid sand



Map 3. Distribution of *Physocephala burgesi* (Williston).



Map 4. Distribution of *Zodion fulvifrons* Say.

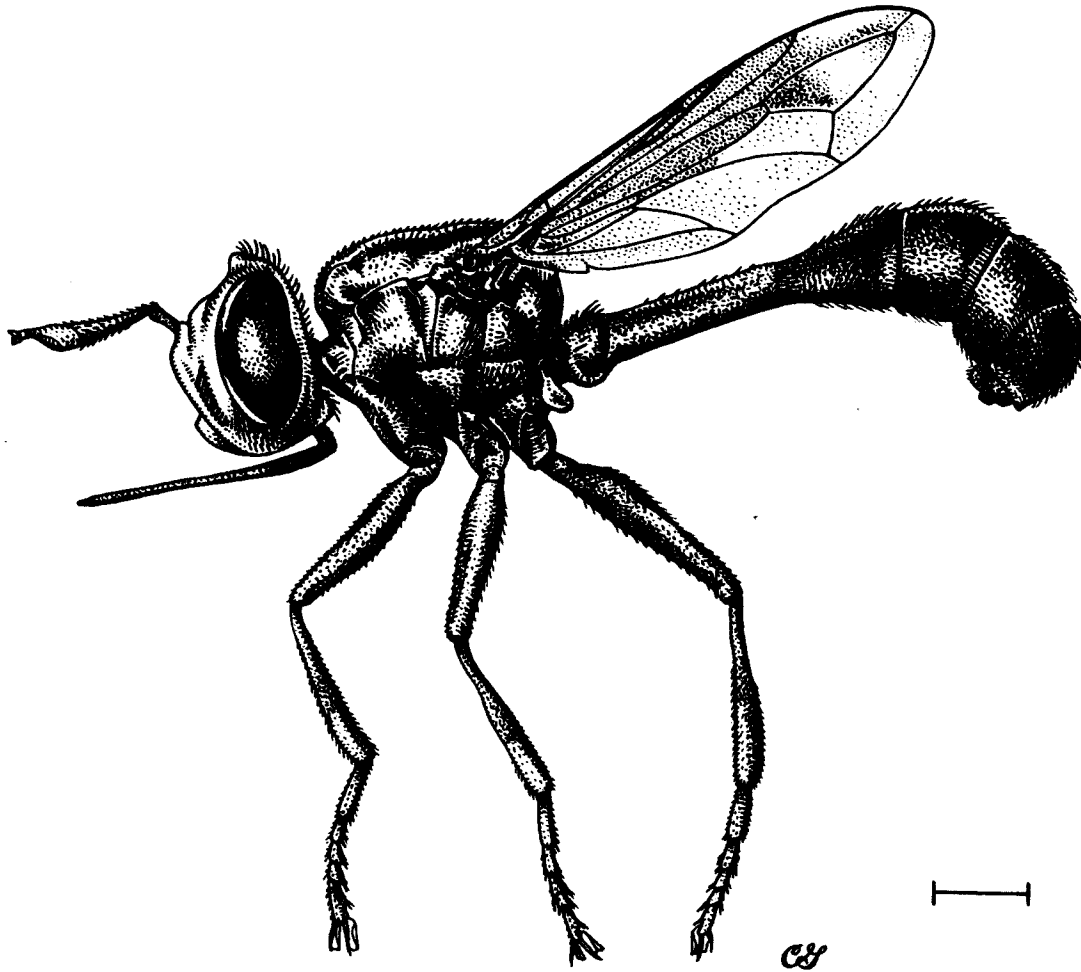


Fig. 3. *Physocephala texana* (Williston).

wasp, *Epibembex occidentalis beutenmuelleri* (Fox), was sufficient to demonstrate that the characters which had been used to establish several species and subspecies by Van Duzee (1927, 1934) were evident in this single population rearing.

Plath (1934:60) has recorded an eastern United States species, *Physocephala tibialis* (Say), as parasitizing chiefly the workers of *Bombus bimaculatus* Cresson. Ryckman (1953:144-146) has reported rearing an unidentified California species of *Physocephala* from *Bombus sonorus* Say. Drs. H. L. Hansen and Ray F. Smith have found brachypterous teneral adults of *Physocephala burgessi* (Williston) actively running about in the exhumed nests of *Bombus sonorus* Say near Orland, Glenn County, California.

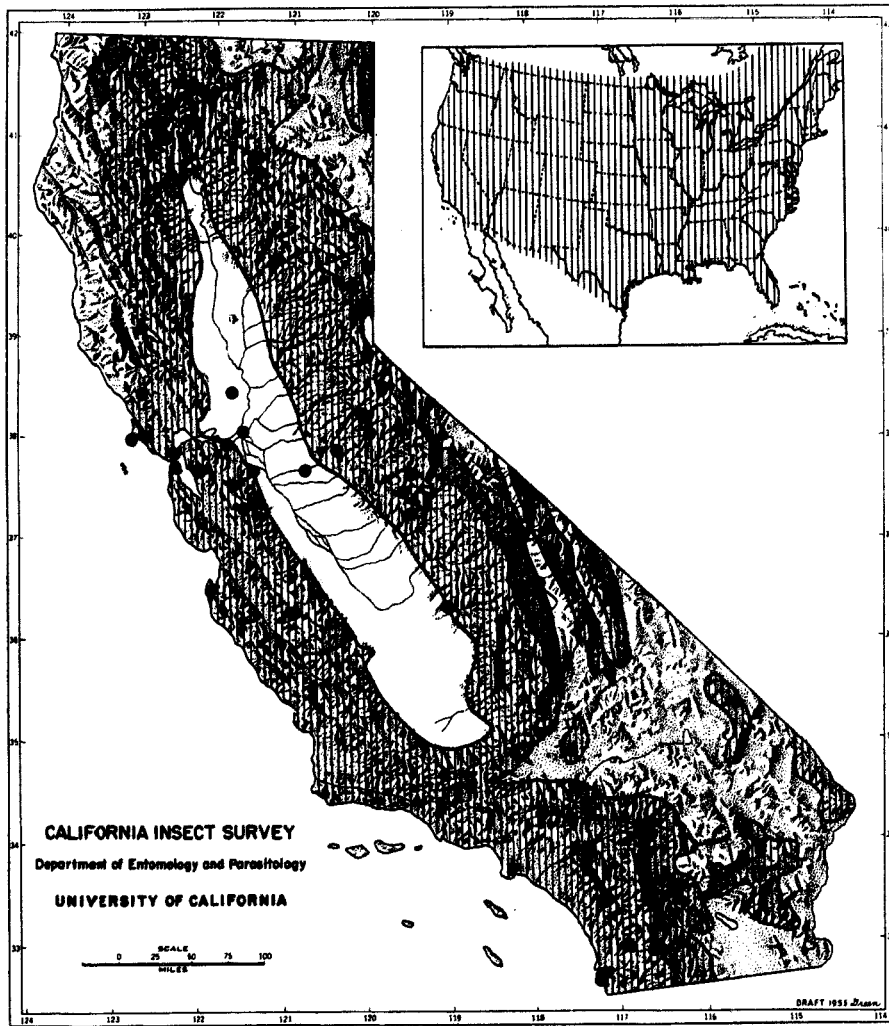
Townsend (1935) has presented a summary of the *Bombus* hosts for the eastern United States *Physocephala sagittaria* (Say), together with a description of the mature larva and puparium of that species. Keys were also prepared to separate the larvae of *Physocephala* from *Zodion* and *Sicus*.

Key to the California Species of  
*Physocephala*

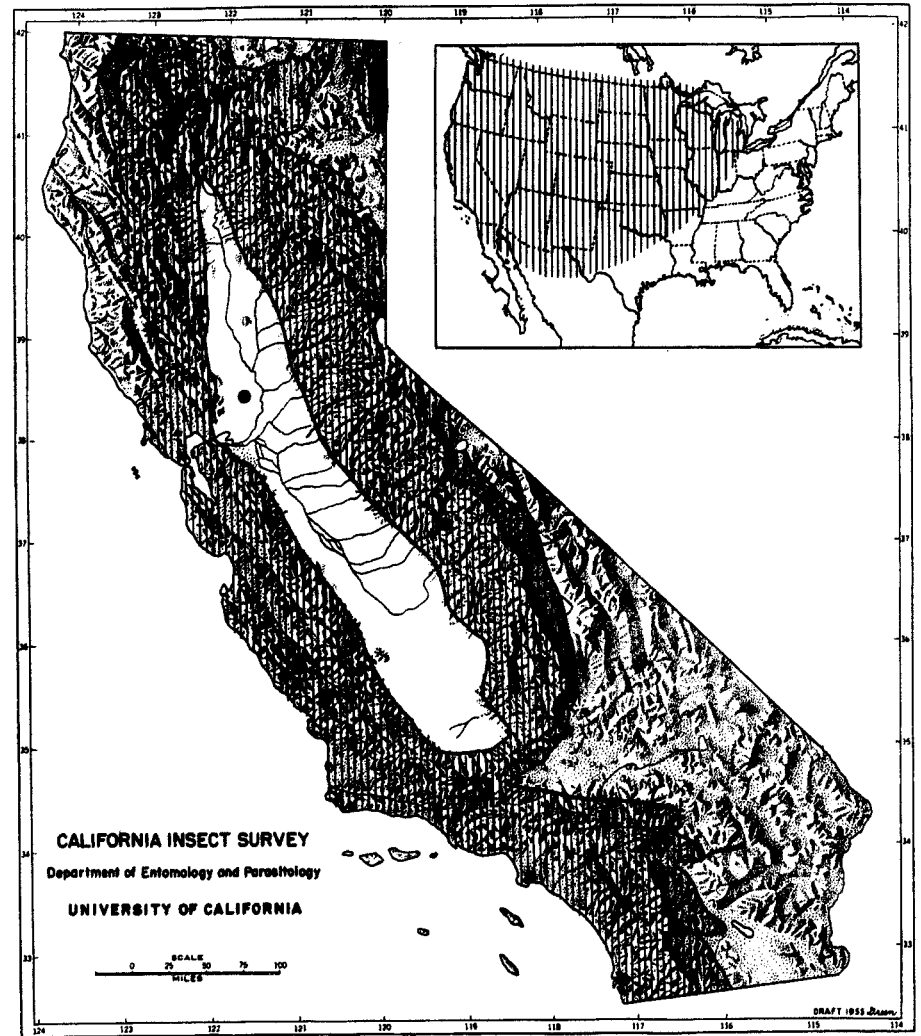
- 1. Facial grooves dark. . . . . *marginata* (p. 29)
- Facial grooves yellow. . . . . 2
- 2(1). Cheeks black . . . . . *furcillata* (p. 29)
- Cheeks reddish, yellowish, or both . . . . 3
- 3(2). Dark cheek marking at most, paler in the center; anterior coxae black; dark mark on dorsum of thorax usually confined to a stripe in the center; antennal proportions about 1:4:2½ . . . . . *burgessi* (p. 29)
- Dark cheek marking usually interrupted by yellow, and may be entirely absent; anterior coxae usually yellow; dorsum of thorax usually predominantly black; antennal proportions about 1:3:1½ . . . . . *texana* (p. 27)

*Physocephala texana* (Williston)

*Conops texanus* Williston, 1882, Trans. Conn. Acad.



Map 5. Distribution of *Zodion intermedium* Banks.



Map 6. Distribution of *Zodion cinereiventre* Van Duzee.

Arts and Sci., 4:338. Type ♂, Waco, Texas (U.S. National Museum).

Synonyms: *Conops affinus* Williston, 1882; *C. ochreiceps* Bigot, 1887; *Physocephala humeralis* Van Duzee, 1927; *P. humeralis simulans* Van Duzee, 1927; *P. aurifacies* Van Duzee, 1927; *P. buccalis* Van Duzee, 1927; *P. rubida* Van Duzee, 1934.

Geographic range: Alberta, Arizona, British Columbia, California (see map 2) Colorado, Georgia, Idaho, Indiana, Kansas, Lower California, Manitoba, Mexico, Michigan, Minnesota, Montana, Nevada, New Mexico, New York, Ontario, Oregon, Quebec, South Dakota, Texas, Utah, Washington, Wisconsin, and Wyoming.

Hosts: *Epibembex occidentalis beutenmuelleri* (Fox), Bohart and MacSwain, 1939:93; *Bembix comata* Parker, Bohart and MacSwain, 1940:16.

#### Discussion:

This species is extremely variable, and many names have been applied to the various forms. Occasional individuals have aberrant antennal proportions, as do other Conopidae.

The color of the head varies from a very dark T on the front and entirely dark reddish cheeks, to complete absence of any dark pattern on the front and face. In the eastern species of *Physocephala* on the other hand, the color of the face is relatively constant and often specific. Some individuals have some darkening in the facial grooves and it is sometimes difficult to decide whether they belong here or to *marginata*. Specimens of *texana* that resemble *burgessi* practically always have reddish anterior coxae.

#### *Physocephala marginata* (Say)

*Conops marginata* Say, 1823, Journ. Acad. Nat. Sci. Phila., 3:82-83. Type, Missouri (lost).

Synonyms: *Physocephala dakotensis* Van Duzee, 1934; *P. stylifer* Van Duzee, 1934.

Geographic range: New Hampshire to Tennessee, west to California and Washington.

#### California records:

Yolo Co.: Putah Canyon, University of California campus, Davis, V-1950 (J. C. Hall, U.C.D.).

Host: *Apis mellifera* Linnaeus (Van Duzee, 1934:315).

#### Discussion:

This species is relatively uncommon in the West. The reddish form which was described as *dakotensis* closely resembles *texana*. Individuals in which the black facial groove is not as distinct as usual may be difficult to distinguish from *texana*.

#### *Physocephala burgessi* (Williston)

*Conops burgessi* Williston, 1882, Trans. Conn.

Acad. Arts and Sci., 4:337-338. 16 cotypes ♂, ♀, Colorado; Mendocino, California (Snow Entomological Collections, Lawrence, Kansas; Museum of Comparative Zoölogy, Cambridge, Massachusetts; location of others unknown).

Synonym: *Physocephala brevis* Van Duzee, 1927.

Geographic range: Alberta to Texas, west to British Columbia and California (see map 3).

Host: *Bombus sonorus* Say (new record).

#### Discussion:

Most individuals are quite uniform and are readily distinguishable from *texana*. The majority of the questionable specimens have yellow coxae and prove to be aberrant *texana*. The shade of reddish is darker in *burgessi* and distinguishes most of the specimens at a glance.

#### *Physocephala furcillata* (Williston)

*Conops furcillatus* Williston, 1882, Trans. Conn. Acad. Arts & Sci., 4:336-337. Three cotypes ♂, ♀, Jefferson, New Hampshire, "White Mts." Museum of Comparative Zoölogy, Cambridge, Massachusetts (Snow Entomological Collections, Lawrence, Kans.).

Synonyms: *Physocephala sorocula* Williston, 1892; *P. lucida* Van Duzee, 1931.

Geographic range: Alberta, California, Maine, Manitoba, Massachusetts, Mexico, Michigan, Minnesota, New Brunswick, New Hampshire, New York, Nova Scotia, Ontario, Pennsylvania, Quebec, Vermont, and Wisconsin.

#### Discussion:

Parsons (1948:232) included *sorocula* from Mexico in this species, and records it from California (2 specimens, Colton, San Bernardino Co. Eddy Collection, M.C.Z.). These have been examined and are typical *furcillata*, but P. J. Darlington, Curator of Insects at the Museum of Comparative Zoölogy, informs us that Eddy occasionally mislabeled his specimens. Since this species has not been collected in the surrounding states, it probably will not be found in California.

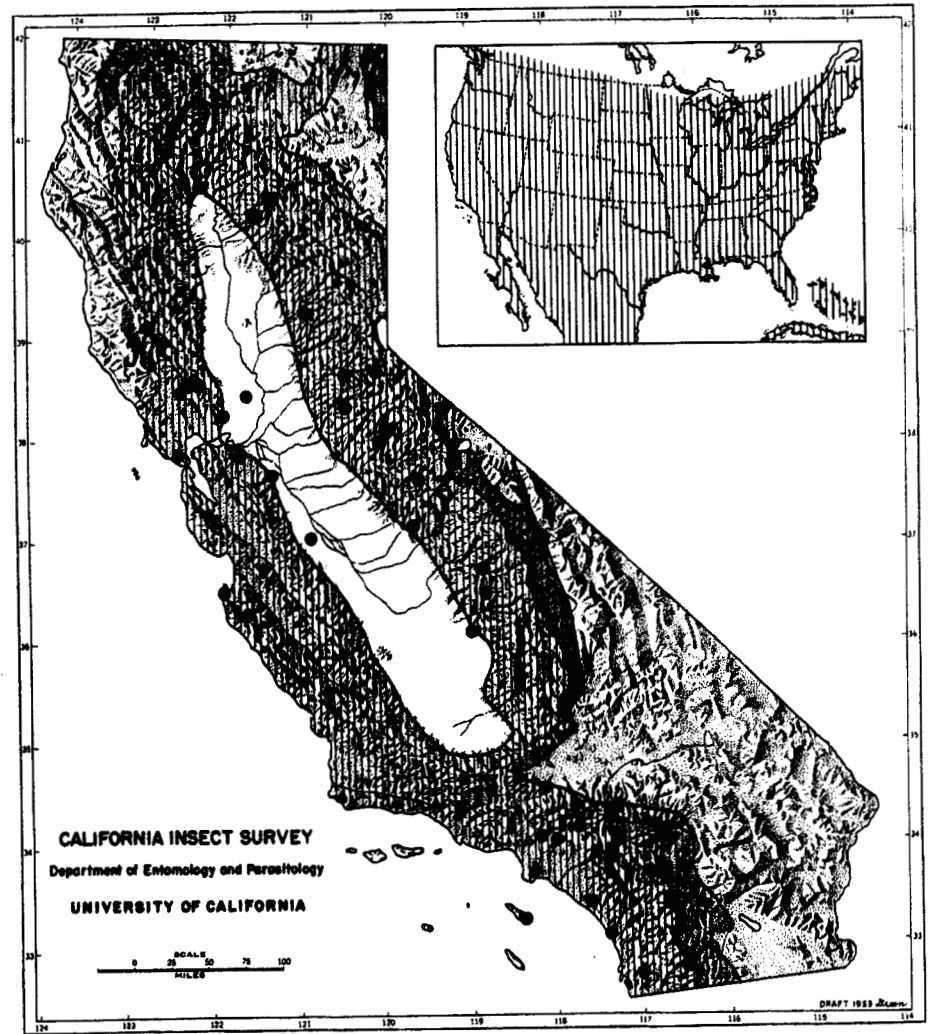
#### Genus *Zodion* Latreille

This genus may be readily recognized by the characters presented in the key. The species included herein were recently revised by Camras (1943:187-191; 1944:121-128; 1945:31) with a key to the North American species presented in the second paper.

The majority of the species occur in the West and many of them in California. Two additional species, *Zodion albonotatum* and *Z. pictulum*, of the described North American species of the genus probably occur in California.



Map 7. Distribution of *Zodion nigrifrons* Kröber.



Map 8. Distribution of *Zodion americanum* Wiedemann.



Key to the California Species of *Zodion*

- 1. Thorax with narrow dark stripes or unmarked . . . . . 2  
 Thorax with light stripes, or spotted, or abdomen with golden pollen or oblique pattern . . . . . 8
- 2(1). Dark markings of thorax and abdomen very distinct from the bluish or greenish pollinose ground color (rarely, dark markings are absent) . . . *americanum* (p. 33)  
 Dark pattern less distinct from ground color . . . . . 3
- 3(2). Antennae black; front frequently entirely black; fourth vein usually ending before attaining wing margin . . . *nigrifrons* (p. 33)  
 Antennae in part rufous; front with some yellow; fourth vein complete . . . . . 4
- 4(3). Size 5½ mm. or less; abdomen without reddish coloration . . . . . 5  
 Size more than 5½ mm. . . . . 6
- 5(4). Theca short, first posterior cell (R<sub>5</sub>) open . . . . . *cinereiventre* (p. 31)  
 Theca long, first posterior cell (R<sub>5</sub>) usually closed . . . . . *triste* (p. 33)
- 6(4). Third abdominal segment of female as long as second, distinctly longer than wide (known definitely only in the female) . . . . . *perlongum* (p. 31)  
 Third abdominal segment shorter than second, not much longer than wide . . . . . 7
- 7(6). Male abdomen without reddish; female genital plate elongated . . . . . *intermedium* (p. 31)  
 Male abdomen with reddish; female genital plate short . . . . . *fulvifrons* (p. 31)
- 8(1). Thorax with spots . . . . . *pictulum*<sup>a</sup>  
 Thorax with stripes . . . . . 9
- 9(8). Abdomen with golden pollen . . . *albonotatum*<sup>a</sup>  
 Abdomen with grayish pollen . . . . . 10
- 10(9). Dark species without rufous . . . . . *californicum* (p. 33)  
 Light species with considerable rufous . . . . . *obliquefasciatum* (p. 33)

*Zodion fulvifrons* Say

*Zodion fulvifrons* Say, 1823, Journ. Acad. Nat. Sci. Phila., 3:83-84. Cotypes, Maryland and Pennsylvania (lost).

<sup>a</sup>Not known to occur in California, but anticipated.

Synonyms: *Zodion abdominale* Say, 1823; *Myopa rubrifrons* Robineau-Desvoidy 1830; *Zodion flavipenne* Bigot, 1887; *Z. lativentre* Graenicher, 1910; *Z. sayi* Banks 1916; *Z. obscurum* Banks, 1916; *Z. reclusum* Banks, 1916. *Z. bilineata* Van Duzee, 1927, may also be a synonym.

Geographic range: Nova Scotia to Florida, west to Washington, California (see map 4), and Mexico.

Host: *Apis mellifera* Linnaeus (Severin, 1937:243).

Discussion:

The species is extremely variable, but there is gradual and complete intergradation between the various forms. The dorsum of the thorax varies from bluish-gray pollinose with the stripes limited to two faintly visible sublateral lines, to brownish with all five lines very distinct. The abdomen varies from entirely rufous to just a trace on the sides of the second segment.

*Zodion intermedium* Banks

*Zodion intermedium* Banks, 1916, Ann. Ent. Soc. Amer., 9:193-194. Type ♀, Pocono Lake, Pa. (MCZ).

Synonyms: *Zodion occidentale* Banks, 1916; *Z. basalis* Van Duzee, 1927.

Geographic range: Prince Edward Island to Florida, west to Washington and California (see map 5).

Discussion:

The species differs from *fulvifrons* in the long female genital plate and in the absence of reddish on the abdomen. Most individuals have the thorax brownish-gray pollinose with all five lines, but occasionally the thorax is bluish-gray pollinose and only two or three lines are present. Very occasionally the first posterior cell (R<sub>5</sub>) is closed.

*Zodion perlongum* Coquillett

*Zodion perlongum* Coquillett, 1902, Canad. Ent., 34:199. Cotypes ♀, Colorado, New Mexico, and Mexico (U.S.N.M.).

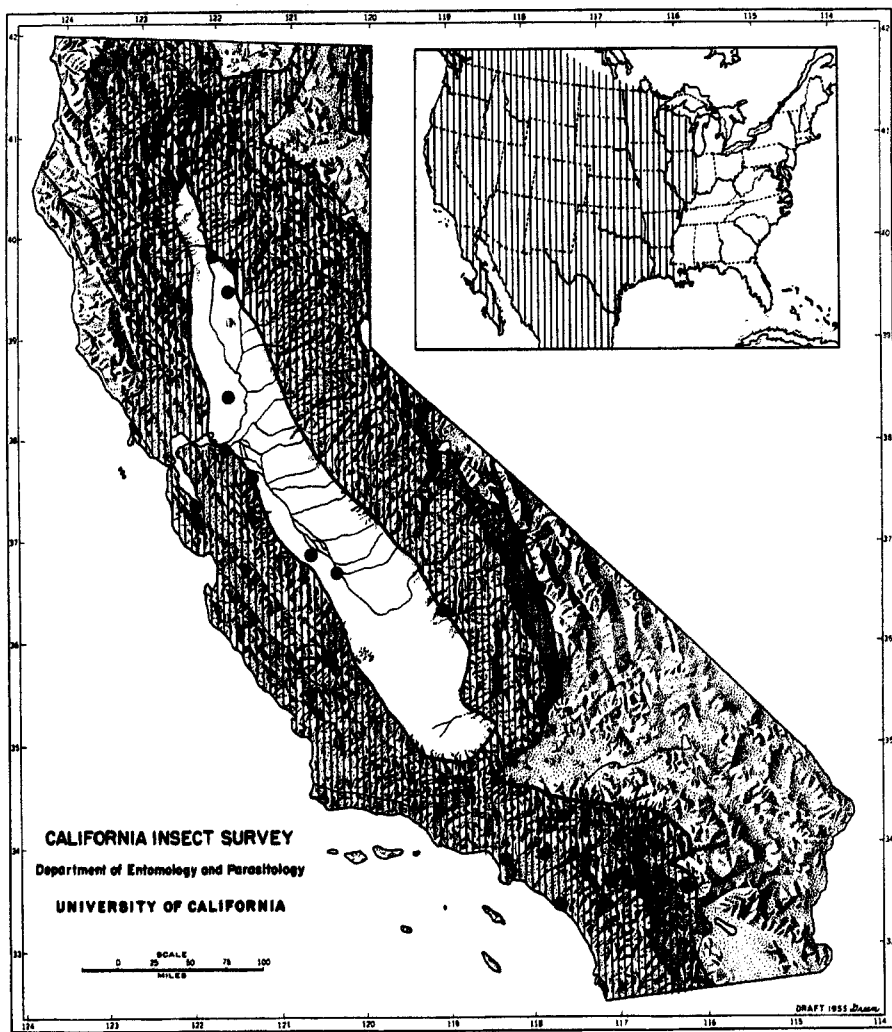
Geographic range: Maine to North Carolina, west to Wyoming and California, Mexico.

Discussion:

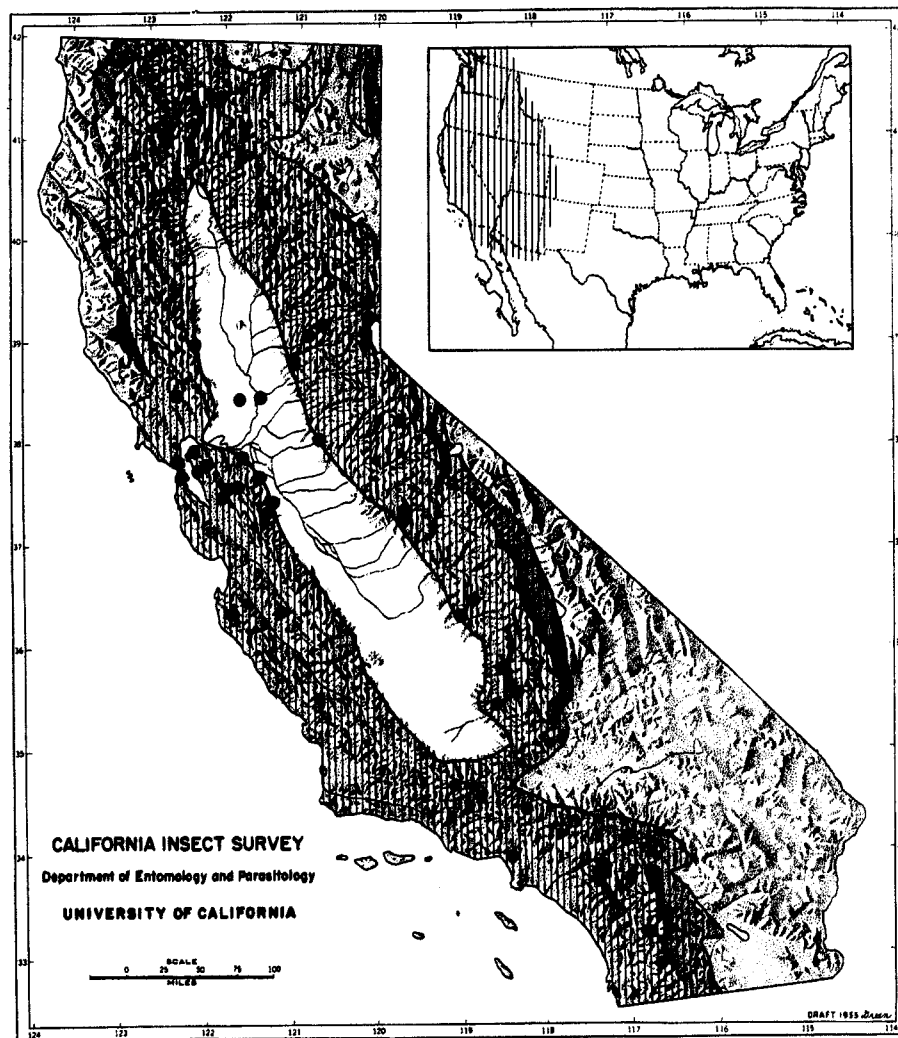
This species is known definitely only from the female. The males may be large examples of *fulvifrons* with an elongate abdomen.

*Zodion cinereiventre* Van Duzee

*Zodion cinereiventris* Van Duzee, 1927, Proc. Calif. Acad. Sci., 16:585. Type ♀, Huntington Lake, Fresno County, California (Calif. Acad. Sci.).



Map 9. Distribution of *Zodion oblique fasciatum* Macquart.



Map 10. Distribution of *Myopa curticornis* Kröber.

Geographic range: Illinois and Michigan, west to California (see map 6) and Oregon.

Discussion:

The first posterior cell ( $R_5$ ) of this species is normally open, but some individuals may have it closed. Such specimens may be referred here but only if they are females with a short genital plate.

*Zodion triste* Bigot

*Zodion triste* Bigot, 1887, Ann. Soc. Ent. Fr., 7:203-204. Type ♂, California (J. E. Collin Collection, Newmarket, England)

Geographic range: California and Idaho.

California records:

Plumas Co.: Graeagle, ♀, VI-12-49 (E. I. Schlinger, U.C.D.).

San Diego Co.: San Diego, ♂, IV-5-91 (F. E. Blaisdell, A.N.S.P.); ♂, ♀, III-11-97 (A.M.N.H.).

Yolo Co.: Davis, V-12-49 (R. M. Bohart, S.C.C.).

Discussion:

*Zodion triste* is regarded as a valid species, although an examination of the type may show that it is the species now called *cinereiventre* (Camras, 1944:124).

This species has the long thin female genital plate of *intermedium*, and usually a closed first posterior cell ( $R_5$ ); it is otherwise indistinguishable from *cinereiventre*.

*Zodion nigrifrons* Kröber

*Zodion nigrifrons* Kröber, 1915, Arch. Nat. (1915) div. A, vol. 7:97. Type ♀, California (Bezzi Coll., Mus. Civ. Stor. Nat., Milan).

Synonym: *Zodion hirtipes* Van Duzee, 1927.

Geographic range: California (see map 7) and Oregon.

Host: *Panurginus melanocephalus* Cockerell (MacSwain and Bohart, 1947:30).

Discussion:

Contrary to the name, this species usually has some yellow on the lower part of the front. Occasional specimens have been found with the venation complete in one or both wings. The first posterior cell ( $R_5$ ) is then closed and with a long petiole, resembling the wing of *Robertsonomyia*.

*Zodion americanum* Wiedemann

*Zodion americana* Wiedemann, 1830, Auss. Zw. Insecten, 2:242. Type ♂, Montevideo, Uruguay (Wiedemann Coll., Vienna Mus.).

Synonyms: *Zodion albifacies* Van Duzee, 1927; *Zodion nanellum* Loew, 1886; *Z. pygmaeum*

Williston, 1885. *Zodion occidentalis* Walker, 1849, is possibly a synonym.

Geographic range: Nova Scotia to Florida, west to Washington and California (see map 8), West Indies and Mexico to Uruguay.

Discussion:

The first posterior cell ( $R_5$ ) is practically always open, but exceptions have been found. Some individuals in rare cases may lack the dark abdominal markings completely. The type of *albifacies* has been examined and found to be indistinguishable from *Zodion americanum*.

*Zodion obliquefasciatum* (Macquart)

*Myopa obliquefasciatum* Macquart, 1845, Dipt. Exot., Suppl I, p. 141. Type ♂, Galveston, Texas (Mus. Hist. Nat., Lille, France).

Synonyms: *Zodion splendens* Jaenicke, 1867; *Z. leucostoma* Williston, 1885.

Geographic range: Wisconsin to Louisiana, west to Alberta, Washington, California (see map 9), and Mexico.

Discussion:

In the pollinose phase, individuals may resemble *fulvifrons* very closely as the thorax may have only the two dark sublateral lines. Three color phases (melanistic, pollinose, and rufous) are evident in this species. For details concerning this variation and its relation to geography, reference should be made to the work of Camras (1943:190).

*Zodion californicum* Camras

*Zodion californicum* Camras, 1954, Pan-Pac. Ent., 30:165-166. Type ♀, Ripley, Riverside County, California (Calif. Acad. Sci.).

Geographic range: California.

California records:

Riverside Co.: Blythe, VI-22-46, sweeping alfalfa (W. F. Barr, C.I.S.); Ripley, VI-26-46, sweeping alfalfa (W. F. Barr, C.I.S.).

San Diego Co.: Barrett Springs, IV-20-50 (J. W. MacSwain, C.I.S.).

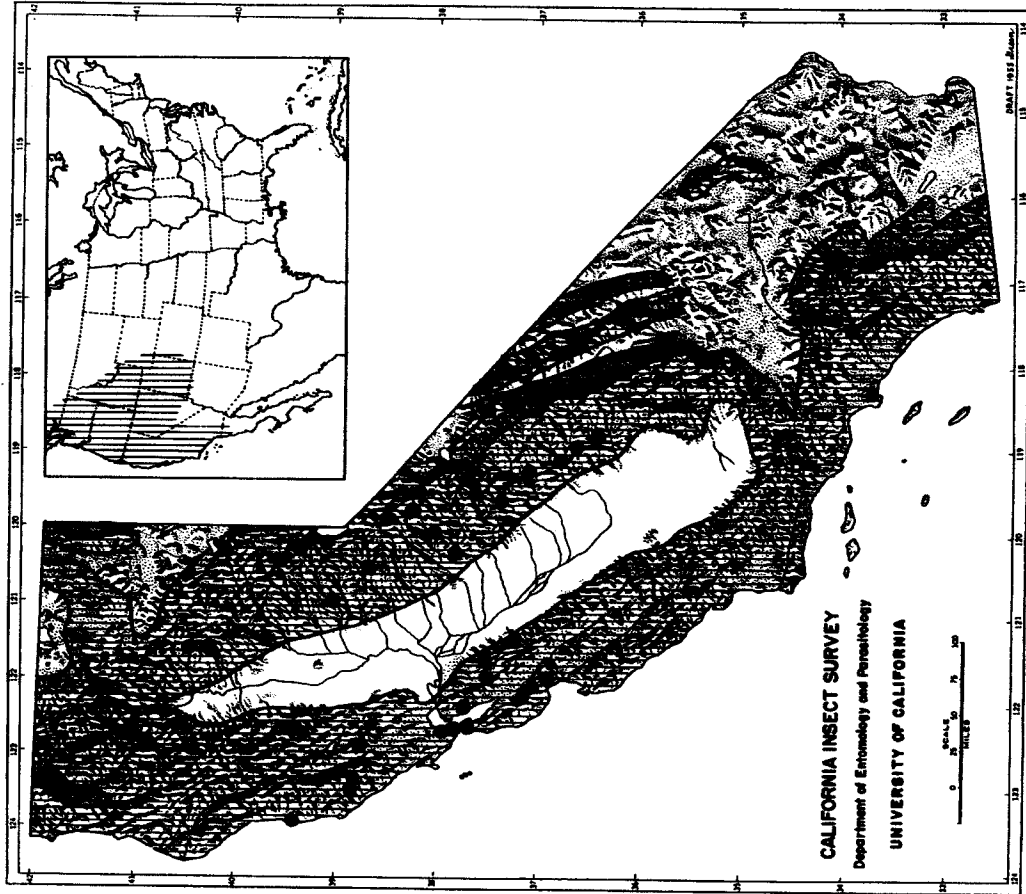
Yolo Co.: Davis, VII-24-54 (J. C. Downey, U.C.D.).

Discussion:

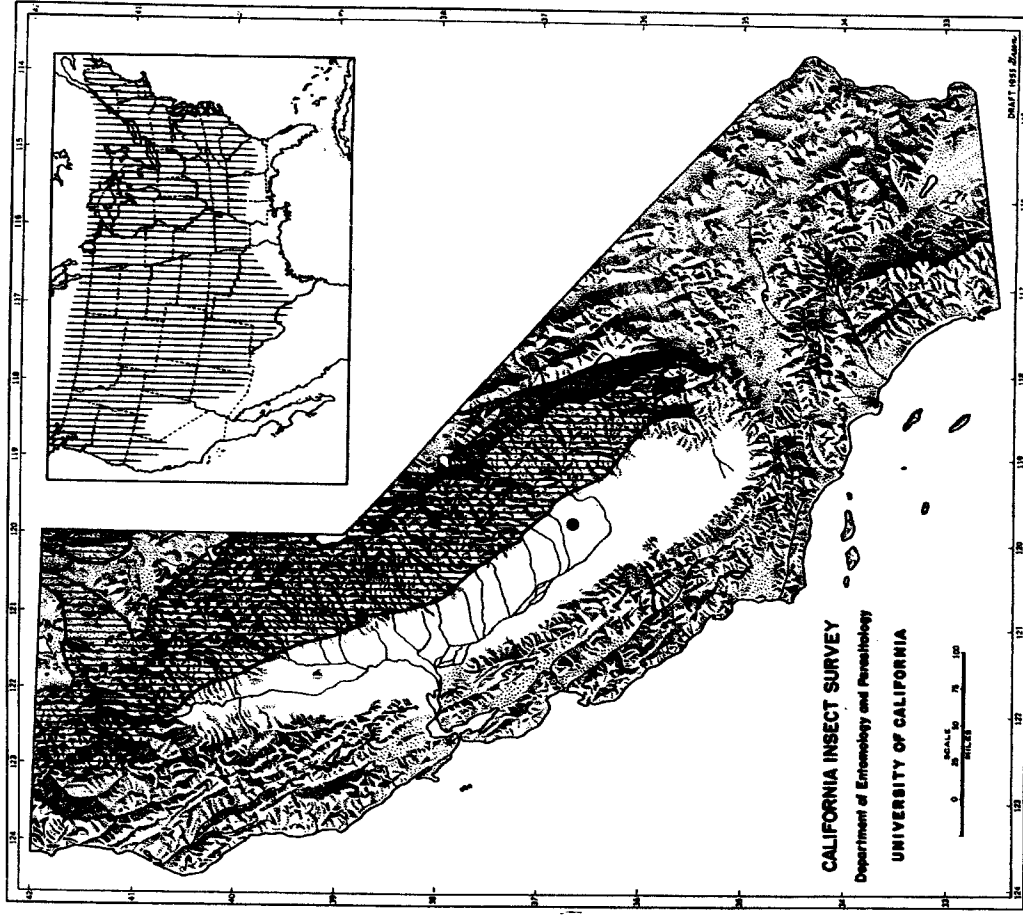
This species probably replaces *obliquefasciatum* in the Great Valley and the extreme southern part of the state. Although appearing very distinct, it is very closely related to *obliquefasciatum*.

*Zodion albonotatum* Townsend

*Zodion albonotatum* Townsend, 1897, Jour. N.Y.



Map 11. Distribution of *Myopa rubida* (Bigot).



Map 12. Distribution of *Myopa clausa* Loew.

Ent. Soc., 5:175. Cotypes 2 ♂?, Brownsville and Fort Brown, Texas (location of type unknown).

Geographic range: Arizona, Colorado, Lower California, and Guatemala.

Discussion:

Although not recorded as yet, this species should occur in the southeastern part of the state.

*Zodion pictulum* Williston

*Zodion pictulum* Williston, 1885, Trans., Conn. Acad. Arts and Sci., 6:379-380. Two cotypes, ♂, ♀, New Mexico (Snow Entomological Collection, Lawrence, Kans.).

Geographic Range: Arizona, New Mexico.

Discussion:

Like *Z. albonotatum* it is anticipated that this species will be found in the southeastern part of California.

Genus *Robertsonomyia* Malloch

This genus was at one time included in the genus *Zodion* (Camras, 1944), but as the work of Parsons (1948:242) has shown, it should be considered as distinct from that genus. There are but two species of *Robertsonomyia* known from America north of Mexico, neither of which has been found in California. However, it seems very likely that future collecting will substantiate their occurrence in California.

Key to the Species of *Robertsonomyia*

1. Palpi clavate on lateral aspect; abdomen of male reddish; size larger, 5 mm . . . . . *palpalis* (p. 35)
- Palpi not clavate; abdomen of male entirely dark. Size smaller, 3½ mm . . . . . *parva* (p. 35)

*Robertsonomyia parva* (Adams)

*Zodion parvis* Adams, 1903, Sci. Bull. Univ. Kans., 2:34-35. Two cotypes ♂, Arizona (Snow Collections, Lawrence, Kans.).

*Zodion lovetti* Van Duzee, 1934, Ann. Ent. Soc. Amer., 27:323. Type ♀, Fort Collins, Colorado (Calif. Acad. Sci.). New synonymy.

Geographic range: Arizona, Colorado, Utah, Wyoming.

Discussion:

Sufficient material has been seen to substantiate the synonymy indicated above. In particular, the

variation as exhibited by the palpi clearly shows that *lovetti* is a nonsegregable variant of *parva*.

*Robertsonomyia palpalis* (Robertson)

*Zodion palpalis* Robertson, 1901, Canad. Ent., 33:284. Ten cotypes ♂, ♀, Carlinville, Illinois (Ill. Nat. Hist. Surv., Urbana, Ill.).

Synonyms: *Sicus brevirostris* Coquillett, 1902; *Zodion scapularis* Adams, 1903.

Geographic range: Arizona, Colorado, Illinois, Mexico (Chihuahua), Nebraska, New Mexico, North Carolina, Virginia, and Wyoming.

Discussion:

Although *scapularis* had been previously maintained as distinct, studies by one of us (Camras) have since demonstrated enough variation in the palpi to show that it represents a nonsegregable variant of *palpalis*. This is in accordance with the conclusions of Parsons (1948:243). The position of the palpi is frequently deceptive and a clavate palpus appears nonclavate if viewed from above or below.

Genus *Myopa* Fabricius

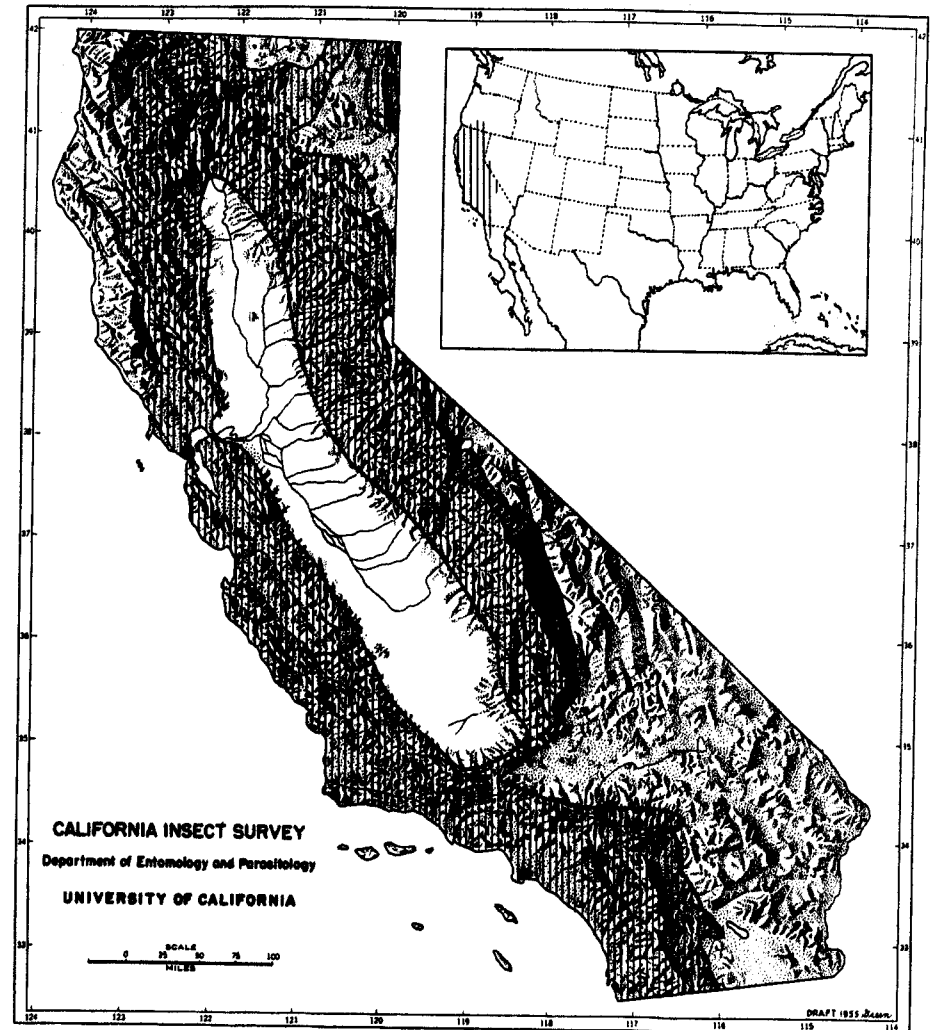
The genus *Myopa* is composed of medium-sized, often brightly colored and pollinose species which in some forms have the wings patterned or at least clouded at the cross veins. The North American species of *Myopa* have been recently revised by Camras (1953). The genus is Holarctic in distribution, and its species in North America seem to be associated with the principal cordilleran systems. In California none of the species are known to occur in the arid austral districts. One additional species, *Myopa plebeia* Williston, is anticipated from California and is therefore included in the accompanying key.

Key to the California Species of *Myopa*

1. Wing unmarked; or if patterned, first posterior cell (R<sub>5</sub>) closed . . . . . 2
- Wing patterned, at least clouded at cross veins; first posterior cell (R<sub>5</sub>) open . . . . . 12
- 2(1). Anterior cross vein (r-m) not thickened; costal "stigma" if present, dark . . . . . 3
- Anterior cross vein (r-m) thickened; costal stigma yellowish . . . . . 11
- 3(2). Abdominal hair black . . . . . 4
- Abdominal hair white or yellowish . . . . . 10
- 4(3). Abdomen predominantly reddish . . . . . 5
- Abdomen predominantly black . . . . . 8



Map 13. Distribution of *Myopa perplexa* Camras.



Map 14. Distribution of *Myopa castanea* (Bigot).

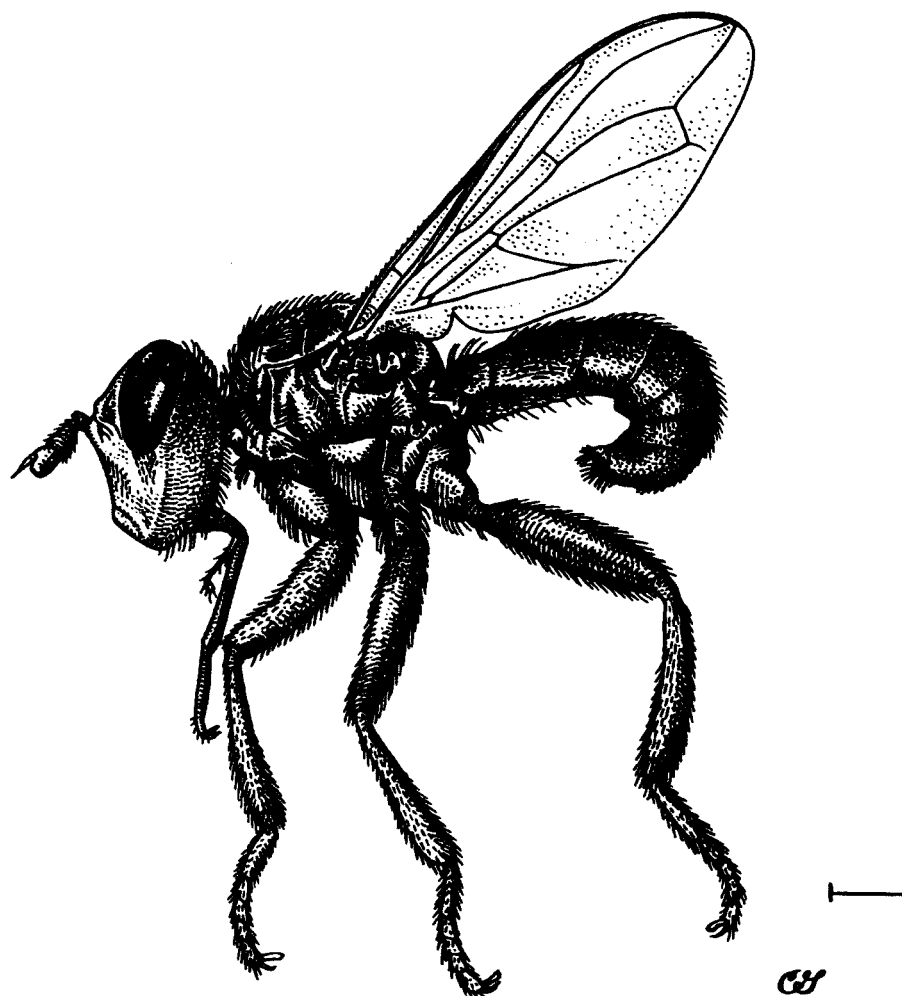
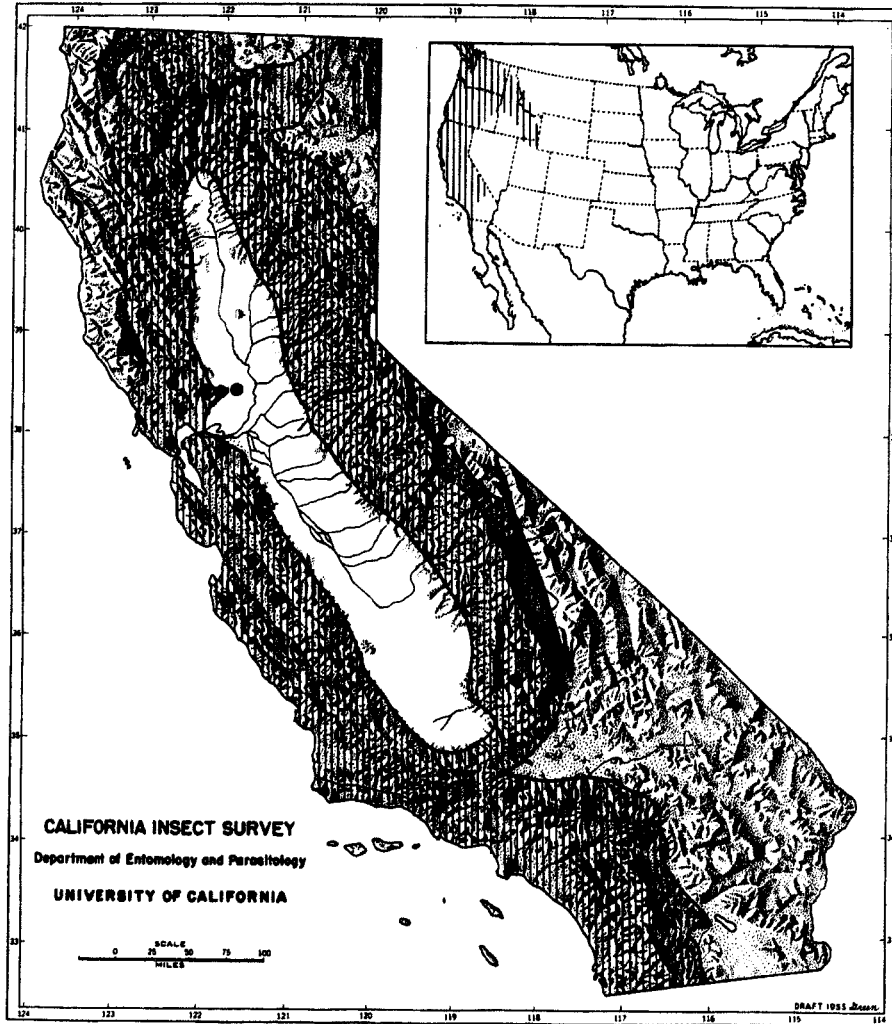
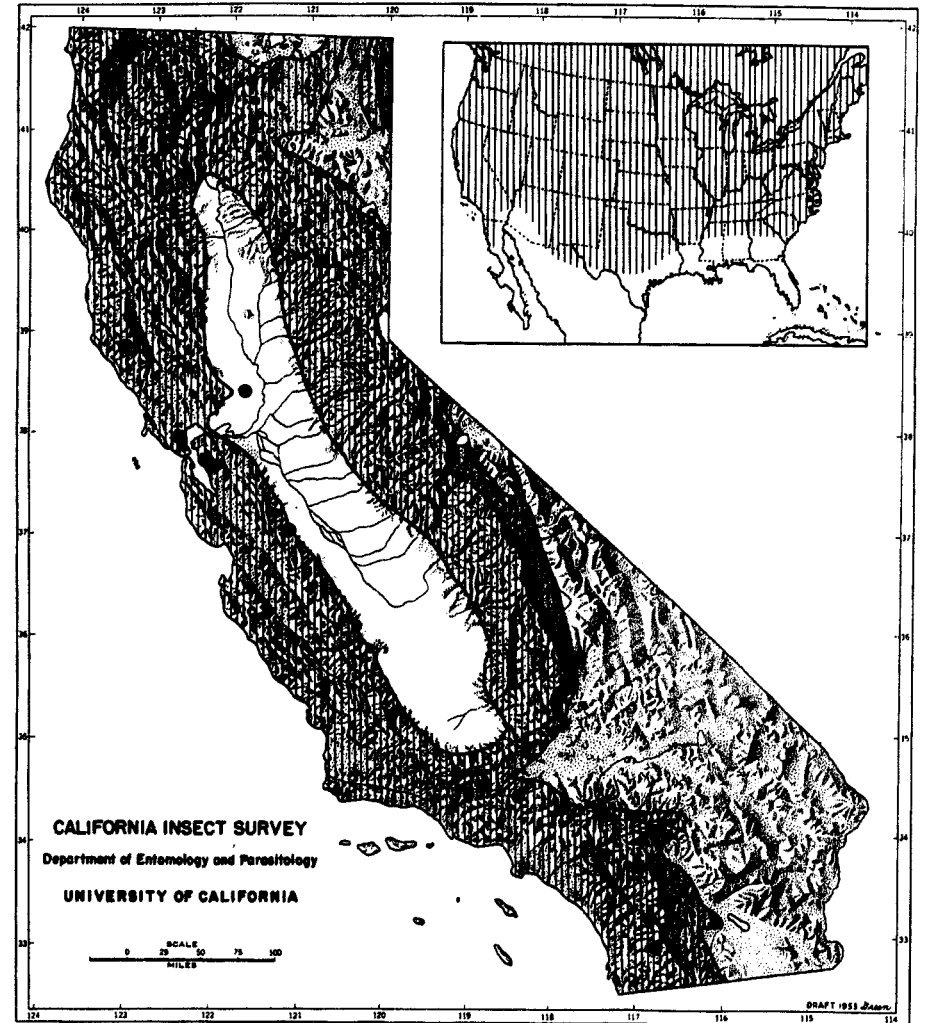


Fig. 4. *Myopa rubida* (Bigot).

- |  |   |
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| <p>5(4). Male abdomen less pollinose, especially on fifth segment; female genital plate short . . . . . 6<br/>                 Male abdomen more pollinose, especially on fifth segment; female genital plate long . . . . . <i>perplexa</i> (p. 39)</p> <p>6(5) Abdominal pollinose markings less distinct; abdomen of male more circular . . . . . 7<br/>                 Abdominal pollinose markings distinct (occasionally nearly absent); abdomen long and cylindrical, especially in the male . . . . . <i>clausa</i> (p. 39)</p> <p>7(6). Abdomen moderately pollinose, less shiny; hairs moderately long and dense; first posterior cell (<math>R_5</math>) closed, but sometimes open; size smaller, 6 to 8 mm . . . . . <i>curticornis</i> (p. 39)<br/>                 Abdomen with almost no pollen, shiny, hairs short and sparse; first posterior cell (<math>R_5</math>) almost always open; size larger, 7-10 mm. . . . . <i>rubida</i> (p. 39)</p> | <p>8(4). Abdominal pollen grayish-white . . . . . 9<br/>                 Abdominal pollen golden-yellow . . . . .<br/>                 . . . . . <i>plebeia</i> (p. 41)</p> <p>9(8). Abdominal hair short . . . . . <i>castanea</i> (p. 39)<br/>                 Abdominal hair long. . . . . <i>longipilis</i> (p. 39)</p> <p>10(3). Abdomen reddish, usually rufous . . . . .<br/>                 . . . . . <i>flavopilosa</i> (p. 41)<br/>                 Abdomen black (if reddish, it is dark) . . . . .<br/>                 . . . . . <i>vesiculosa</i> (p. 41)</p> <p>11(2). First posterior cell (<math>R_5</math>) hyaline or slightly darkened; abdomen with longitudinal pollinose stripe . . . . . <i>bobartorum</i> (p. 41)<br/>                 First posterior cell (<math>R_5</math>) with dark spot; abdomen with stripe confined to terminal segments . . . . . <i>melanderi</i> (p. 41)</p> <p>12(1). Wing hyaline except for dark clouds at cross veins . . . . . <i>vicaria</i> (p. 41)<br/>                 Wings heavily marked with spots . . . . .<br/>                 . . . . . <i>willistoni</i> (p. 41)</p> |
|--|---|



Map 15. Distribution of *Myopa melanderi* Banks.



Map 16. Distribution of *Myopa vicaria* Walker.



*Myopa curticornis* Kröber

*Myopa curticornis* Kröber, 1916, Arch. Naturgesch. (1915) div. A, vol. 7:32. Six cotypes ♀, ♂, Colorado and California. (Bezzi Coll., Mus. Civ. Stor. Nat., Milan).

Geographic range: Arizona, California (see map 10), Colorado, Idaho, Oregon, Utah, Washington, and Wyoming.

## Discussion:

This species is rather variable and merges with *Myopa clausa*, *M. perplexa*, and *M. rubida*; however, specimens of *M. curticornis* average smaller. Characteristic specimens of this species have the abdomen moderately haired and pollinose with the first posterior cell closed and the female with a short genital plate.

The distinguishing characteristics of the *Myopa curticornis* complex have been more fully discussed in a separate paper (Camras, 1953:100, 102). *M. curticornis* is considered as the basic species from which the others in this complex (*M. rubida*, *M. clausa*, and *M. perplexa*) are derived.

*Myopa rubida* (Bigot)

*Glossigona rubida* Bigot, 1887, Ann. Soc. Ent. Fr., 7:206. Cotypes ♂, ♀, California and Washington (J. E. Collin Collection, Newmarket, England).

Synonyms: *Myopa clausa* var. *aperta* Röder, 1889. *M. seminuda* Banks, 1916. Ann. Ent. Soc. Amer., 9:198. Cotypes, Corvallis, Oregon, Base of Mary's Peak, Oregon (Ore. Agr. Coll. and M.C.Z.).

Geographic range: California (see map 11), Colorado, Idaho, Nevada, Oregon, Utah, Washington, and Wyoming.

Hosts: *Andrena complexa* Viereck (Bohart, 1941:95); *Andrena pallidiscopa* Viereck (Bohart, 1941:95); *Andrena vierecki* Cockerell (MacSwain and Bohart, 1947:30); *Andrena chalybioides* Viereck (MacSwain and Bohart, 1947:30). Some of these may apply to *Myopa perplexa* Camras rather than this species.

## Discussion:

Typical specimens are very distinct, having the abdomen shiny red with sparse short hairs and almost no pollen, the first posterior cell open, and the female theca short. The second antennal segment is usually elongate compared with the previous species.

*Myopa clausa* Loew

*Myopa clausa* Loew, 1866, Centuria VII, No. 72, p. 101. Type ? Maine (M.C.Z.).

Geographic range: Maine to Georgia, west to Washington and California (see map 12).

## Discussion:

This species is characterized by the elongate cylindrical abdomen. Specimens from the western states may have the pollen on the abdomen nearly absent and the first posterior cell occasionally open, thus showing variation toward *rubida*.

*Myopa perplexa* Camras

*Myopa perplexa* Camras, 1953, Wasmann Jour. Biol., 11:103. Type ♀, Antioch, Contra Costa County, California (Calif. Acad. Sci.).

Geographic range: Arizona, California (see map 13), Idaho, Oregon, and Washington.

## Discussion:

This species differs from *M. clausa* by the long genital plate of the female. Otherwise the species typically has the first posterior cell ( $R_5$ ) long and petiolate, the abdominal hairs long, the pollen relatively extensive, and the second antennal segment short. Atypical males can not be distinguished from *curticornis*.

*Myopa castanea* (Bigot)

*Gonirhynchus castaneus* Bigot, 1887, Ann. Soc. Ent. Fr., 7:207-208. Two cotypes ♂, ♀, Nevada (J. E. Collin Collection, Newmarket, Eng.).

Geographic range: California (see map 14) Nevada. Discussion:

*Myopa castanea* is characterized by the short black abdominal hairs, dark abdomen, and the long genital plate of the female. The hairs average longer in the female, and must be taken into consideration in distinguishing them from *longipilis*.

*Myopa longipilis* Banks

*Myopa longipilis* Banks, 1916, Ann. Ent. Soc. Amer., 9:197. Type (♂ ?) Pullman, Washington (M.C.Z.).

Geographic range: California, Idaho, Oregon, Utah, and Washington.

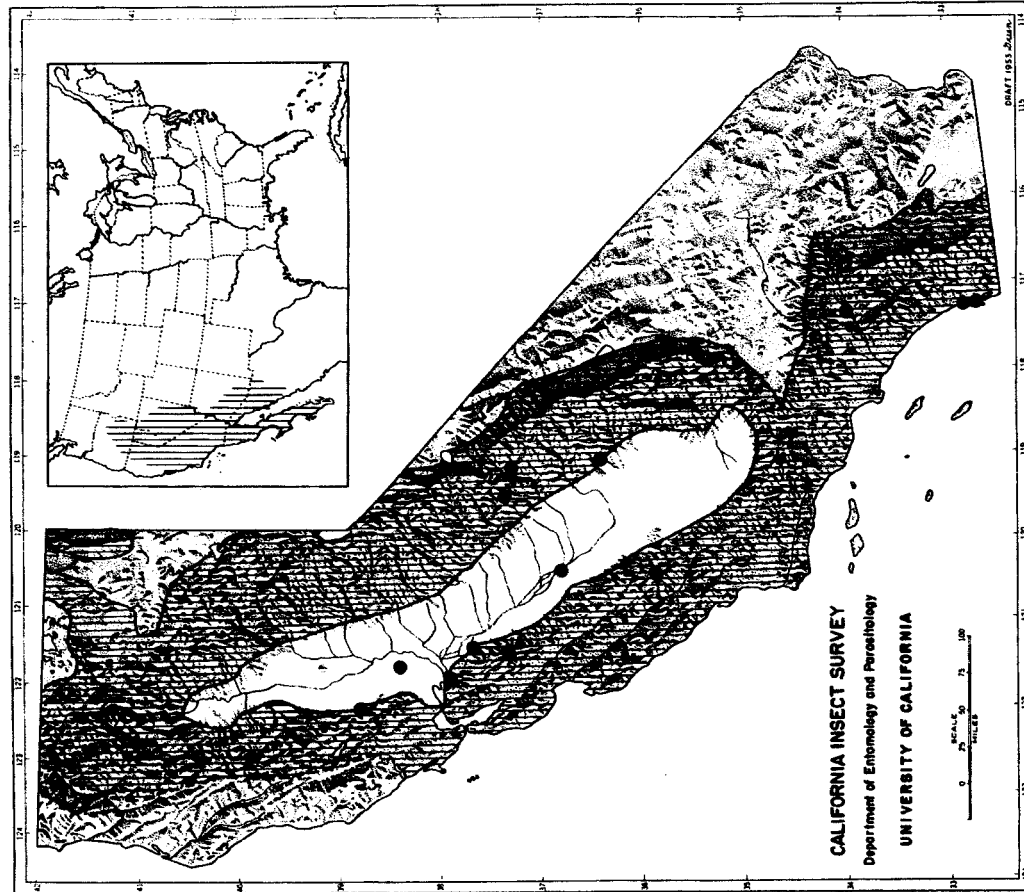
## California records:

Lassen Co.: Mountains west of Nubieber, VI-4-38 (E. C. Van Dyke, C.A.S.).

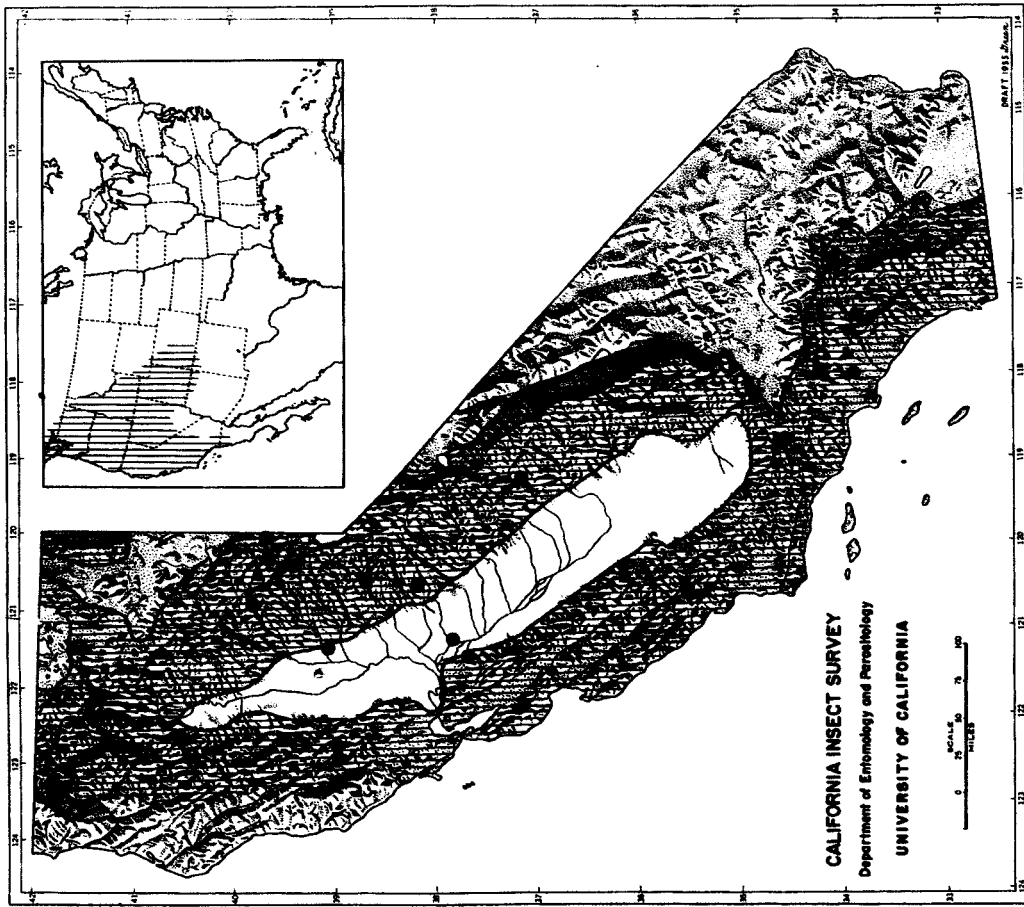
Los Angeles Co.: Acton, IV-1-37, flowers *Salix* (E. G. Linsley, C.A.S.).

## Discussion:

This species is very close to *castanea*, differing only in the longer hair of the abdomen. Some individuals are intermediate and difficult to identify.



Map 17. Distribution of *Myopa willistoni* Banks.



Map 18. Distribution of *Occemyia luteipes* Camras.

*Myopa plebeia* Williston

*Myopa plebeia* Williston, 1885, Trans. Conn. Acad. Arts and Sci., 6:384-385. Three cotypes ♂, ♀, Arizona (Snow Entomological Collections, Lawrence, Kansas).

Geographic range: Arizona.

## Discussion:

This species is characterized by the golden pollen on the abdomen, but otherwise is close to *castanea* with which it has been confused. It will probably be found in southeastern California.

*Myopa flavopilosa* Kröber

*Myopa flavopilosa* Kröber, 1916, Arch. Naturgesch. (1915) Abt. A, H. 7., pp. 30-31. Two cotypes ♀, ♂, southern Colorado (Vienna Mus.).

Geographic range: Alberta, California, Colorado, Montana, Nebraska, Utah.

## California records:

Los Angeles Co.: Acton, IV-1-37, flowers *Salix* (E. G. Linsley, C.I.S., C.A.S.).

## Discussion:

This species and the following one are the only species with light-colored hairs. The abdomen is rufous and the hairs almost always yellowish.

*Myopa vesiculosa* Say

*Myopa vesiculosa* Say, 1823, Journ. Acad. Nat. Sci. Phila., 3:80. Cotypes ♂, ♀, Pennsylvania (lost).

Synonyms: *Myopa apicalis* Walker, 1849; *M. bistris* Walker, 1849; *M. conjuncta* Thomson, 1868; and *Glossigona maculifrons* Bigot, 1887.

Geographic range: Quebec to Florida, west to Washington and California.

## California records:

Los Angeles Co.: Acton, IV-1-37, flowers *Salix* (E. G. Linsley, C.A.S.).

Mono Co.: Mono Lake, VI-4-17 (C. L. Fox, C.A.S.).

Riverside Co.: Riverside, I-28-34, II-3-35, II-5-33, III-19-32, flowers *Salix*; III-25-34, flowers *Salix*; IV-28-40 (P. H. Timberlake, U.C.R.).

San Diego Co.: Cuyumaca Lake, IV-19-50, flowers *Gilia* (E. G. Linsley, C.I.S.).

## Discussion:

There is considerable variation in size of specimens from the western United States. However, those from the East are almost uniformly small. The hairs of this species are usually whitish but may vary to yellow.

*Myopa bohartorum* Camras

*Myopa bohartorum* Camras, 1953. Wasmann Journ. Biol., 11(1):107-109, ♂, ♀. Type ♂, Napa, California (Calif. Acad. Sci.).

Geographic range: California.

## California records:

Santa Clara Co.: San Antonio Valley, IV-8-47, IV-20-48 (R. F. Smith, C.I.S.).

Solano Co.: Napa, IV-3-37 (G. E. and R. M. Bohart, U.C.D.).

Tuolumne Co.: Jamestown, IV-26-51 (P. D. Hurd, Jr., C.I.S.); Strawberry, IV-1933 (G. E. Bohart).

Yolo Co.: Davis, IV-12 to 28-1936-1937 (R. M. Bohart, U.C.D.); IV-1-48 (R. M. Bohart, S.C.C., U.C.D.); IV-12-51 (A. T. MacClay, U.C.D.).

## Discussion:

Although superficially resembling the *castanea* group, this species is related to *melanderi*. The trace of darkness in the first posterior cell may be quite prominent.

*Myopa melanderi* Banks

*Myopa melanderi* Banks, 1916, Ann. Ent. Soc. Amer., 9:197. Type ♂ ? Pullman, Washington (M.C.Z.).

Geographic range: California (see map 15), Idaho, Oregon, Washington.

## Discussion:

This species is characterized by the spot in the first posterior cell. With *bohartorum* it differs from the other species by having a thickened anterior cross vein, and the costal stigma yellow.

*Myopa vicaria* Walker

*Myopa vicaria* Walker, 1849, List Dipt. Brit. Mus., 3:679. Type ? Nova Scotia (Brit. Mus.).

Synonym: *Myopa pilosa* Williston, 1885.

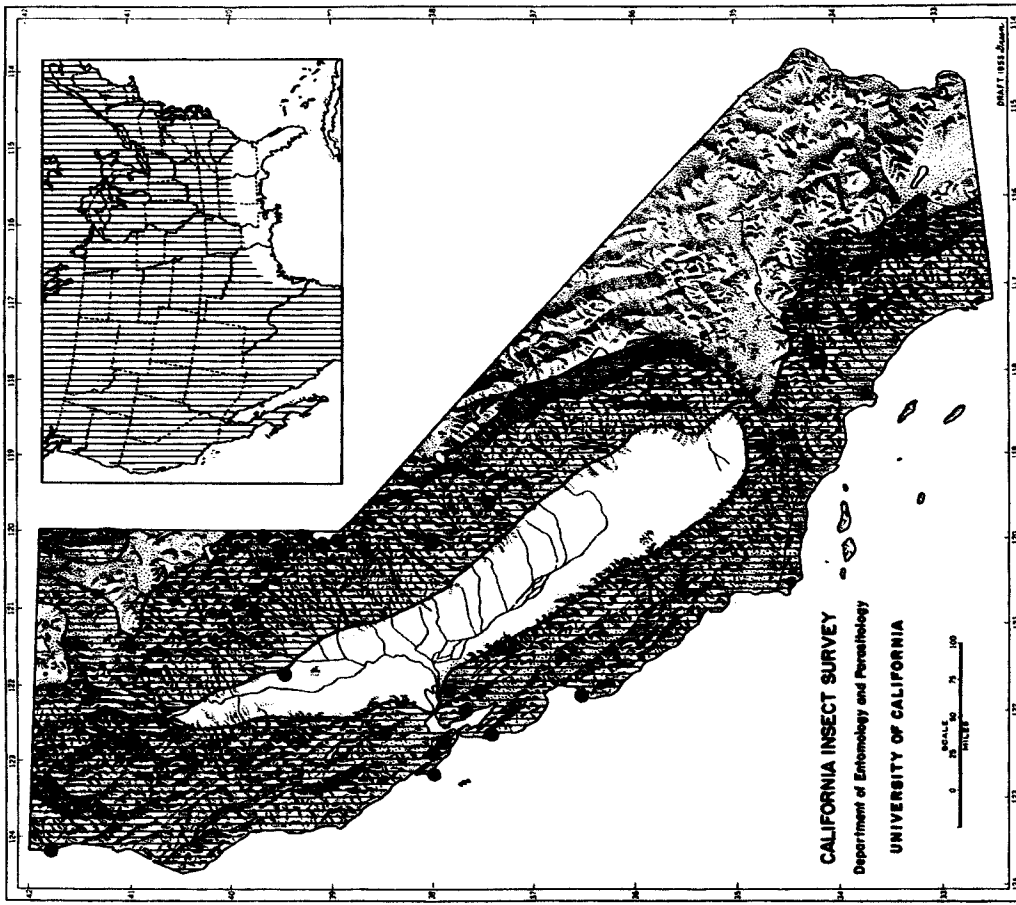
Geographic range: Nova Scotia to Georgia, west to Alaska and California (see map 16).

## Discussion:

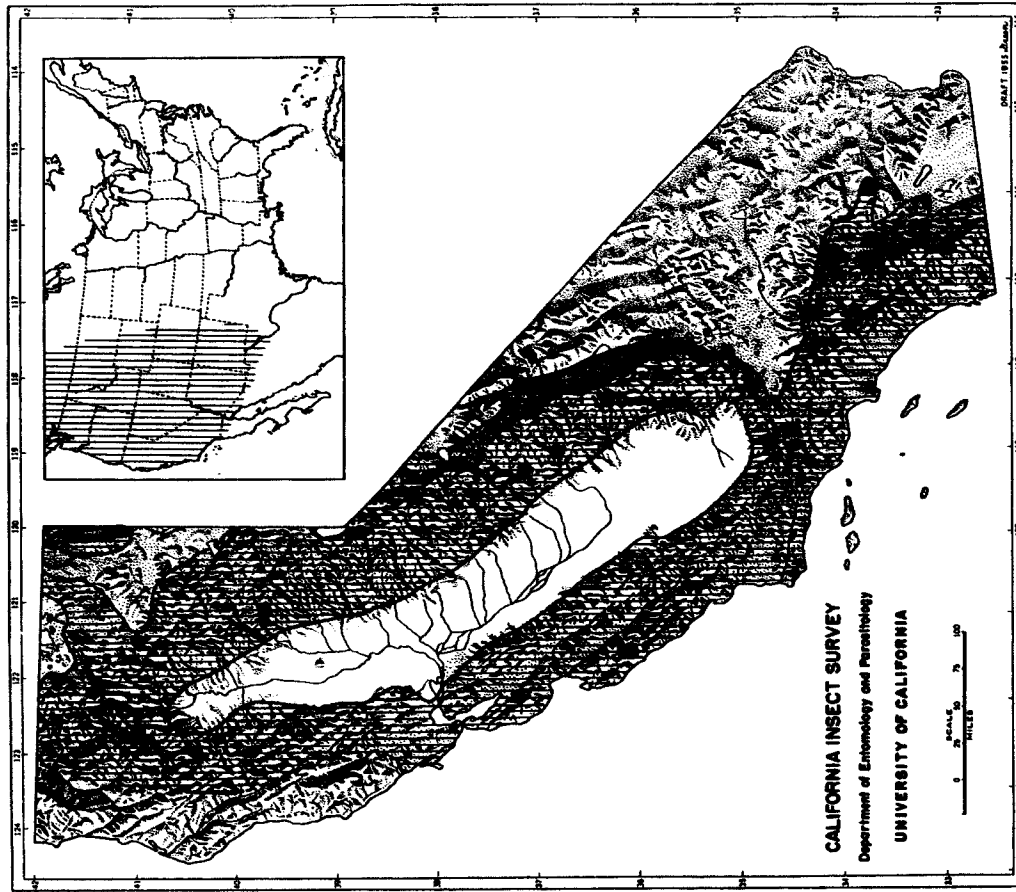
Characteristically this species is predominantly rufous, though some melanistic specimens are known. Some of these melanistic specimens may, however, represent another species. For a fuller account of the variation noted in this species and its putative occurrence in the Old World, the earlier work of Camras (1953:110-112) should be consulted.

*Myopa willistoni* Banks

*Myopa willistoni* Banks, 1916, Ann. Ent. Soc. Amer., 9:197. Five cotypes ♀, California and



Map 20. Distribution of *Occemyia loraria* (Loew).



Map 19. Distribution of *Occemyia modesta* (Williston).

Arizona (M.C.Z., Snow Entomological Collections, Lawrence, Kansas).

Synonym: *Myopa pictipennis* Williston, 1885, preoccupied.

Geographic range: Arizona, California (see map 17), Mexico, Oregon.

Discussion:

This species, which superficially resembles *melanderi*, is immediately distinguishable from the other species of the genus by the presence of spots in both the first and second posterior cells.

Genus *Occemyia* Robineau-Desvoidy

The definitions of the species in this genus appear to be somewhat artificial. However, no better characters have thus far been found. It is not uncommon for specimens of this genus with the third segment of the proboscis broken off or folded closely against the second segment to be referred to the genus *Zodion*. *Zodion*, however, never has the elongate antennae and abdomen and relatively thin head. Further, the species are never nearly black as is characteristic of *Occemyia*. The North American species of this genus were last revised by Camras (1945:216-222).

Key to the California Species of *Occemyia*

- 1. Hind femur entirely to four-fifths black; female genital plate long; abdomen of male with white or yellowish hairs . . . . . *propinqua* (p. 45)
- Hind femur yellow on basal one-fifth or more; female genital plate not elongate; abdominal hairs mostly black . . . . . 2
- 2(1). Hind femur with yellow on the basal one-fifth to one-third . . . . . 3
- Hind femur with yellow on more than basal one-third . . . . . 4
- 3(2). Small species, 3½ to 5½ mm. long . . . . . *nigripes* (p. 45)
- Large species, 6½ to 8 mm. long . . . . . *nigra* (p. 45)
- 4(2). Hind femur one-third to two-thirds yellow. 5
- Hind femur more than two-thirds yellow . 6
- 5(4). Size medium, 3½ to 6 mm. . *loraria* (p. 43)
- Size larger, more than 6 mm. . . . . *longicornis* (p. 43)
- 6(4). Large species, more than 6 mm. . . . . *modesta* (p. 43)
- Small species, 3½ to 5½ mm. . . . . *luteipes* (p. 43)

*Occemyia luteipes* Camras

*Occemyia luteipes* Camras, 1945, Ann. Ent. Soc. Amer., 38:220-221. Type ♀, Pullman, Washington (Calif. Acad. Sci.).

Geographic range: California (see map 18), Colorado, Idaho, Nevada, Utah, Washington.

*Occemyia modesta* (Williston)

*Oncomyia modesta* Williston, 1883, Trans. Conn. Acad. Arts and Sci., 6:96. Eight cotypes ♂, ♀, California and Washington (Snow Entomological Collections, Lawrence, Kansas).

Geographic range: Arizona, California (see map 19), Colorado, Idaho, Nevada, New Mexico, Oregon, Saskatchewan, Utah, Washington, Wyoming.

Discussion:

This large species is rather distinctive but intergrades with *luteipes*, and *longicornis* are known to occur.

*Occemyia longicornis* (Say)

*Myopa longicornis* Say, 1823, Journ. Acad. Nat. Sci. Phila., 3:83. Types "Missouri" (lost).

Synonym: *Oncomyia infuscipes* Van Duzee, 1927.

Geographic range: Quebec to Georgia, west to Alberta, Arizona, California, Colorado, Montana, New Mexico, and Utah.

California records:

Nevada Co.: Boca, VI-28-54, flowers *Eriogonum* (R. M. Bohart, U.C.D.)

Sierra Co.: Sagehen nr. Hobart Mills, VI-25-54 (R. M. Bohart, U.C.D., P. D. Hurd, C.I.S.).

Discussion:

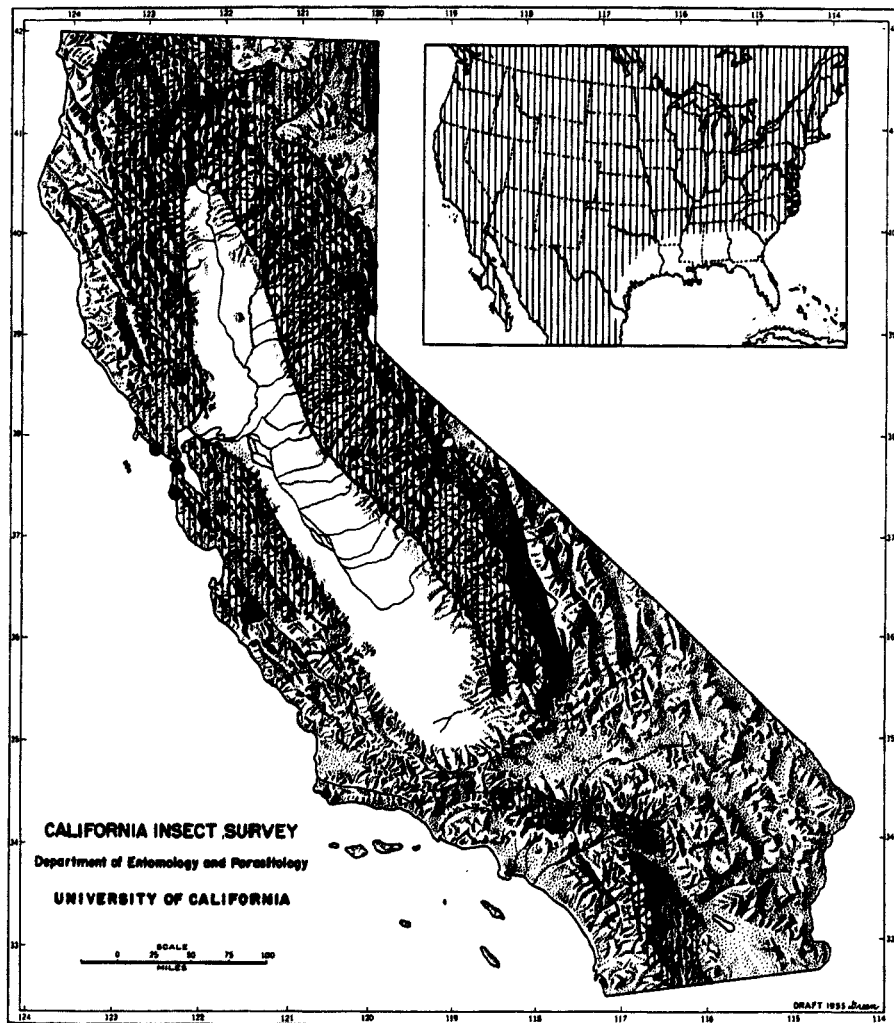
This species is intermediate between *modesta* and *loraria* and is relatively uncommon in the West. In the eastern United States, specimens are larger and more typical

*Occemyia loraria* (Loew)

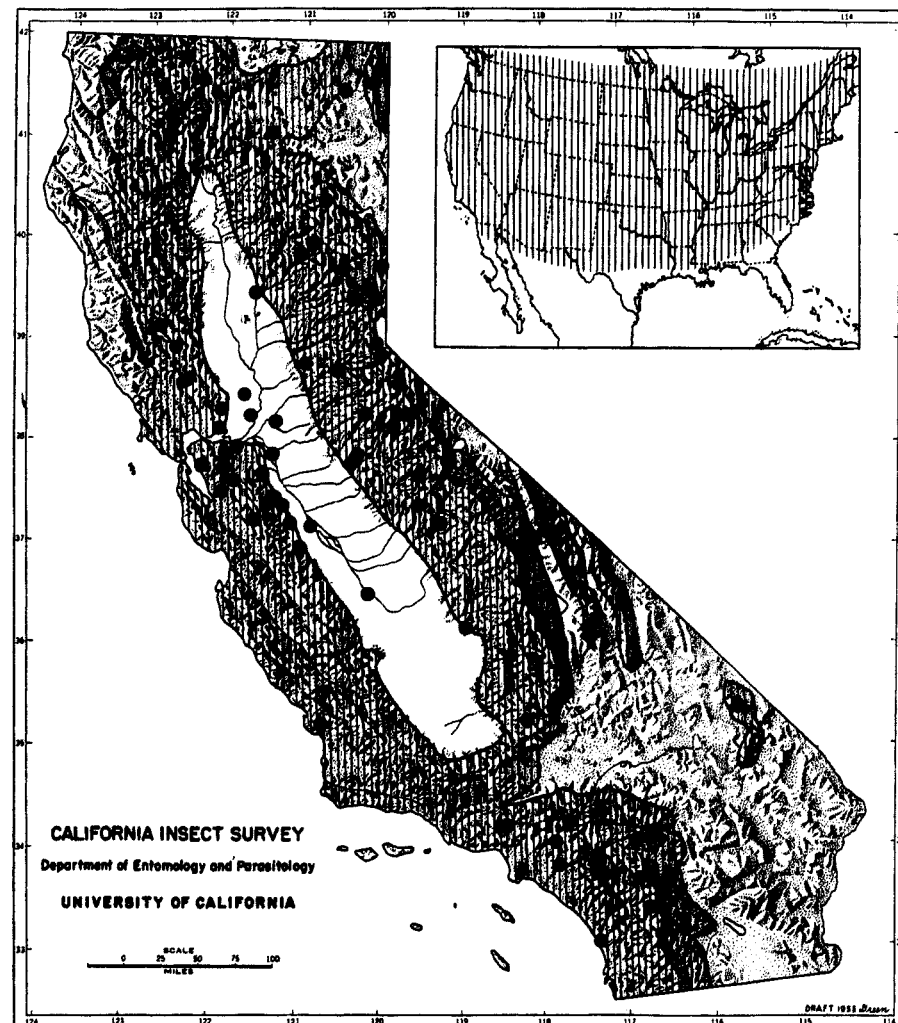
*Oncomyia loraria* Loew, 1866, Centuria VII, No. 74, pp. 101-102. Cotypes ♂, ♀, New Hampshire (M.C.Z.).

Synonyms: *Oncomyia baroni* Williston, 1883; *O. brevisrostris* Van Duzee, 1927; *O. aequalis* Var. Duzee, 1927; *O. terminalis* Van Duzee, 1927; *Zodion bimaculata* Curran, 1933; *Oncomyia frontalis* Van Duzee, 1934.

Geographic range: Quebec to Georgia, west to British Columbia and California (see map 20) and Mexico.



Map 21. Distribution of *Occemyia nigripes* Camras.



Map 22. Distribution of *Occemyia propinqua* (Adams).

Discussion:

The variation exhibited by this species suggests that more than one species may be included. However, in certain characters *O. loraria* merges with *O. luteipes*, *O. longicornis* and *O. nigripes*.

*Occemyia nigripes* Camras

*Occemyia nigripes* Camras, 1945, Ann. Ent. Soc. Amer., 38:218-219. Type ♀, Thunder Bay Beach, Ontario (Chicago Natural History Museum).

Geographic range: Nova Scotia to Georgia, west to British Columbia, California (see map 21) and Guatemala.

Discussion:

This species resembles *propinqua*, but is easily distinguishable by the dark hairs of the male, and the short genital plate of the female. It shows intergradation with *loraria*.

*Occemyia nigra* (Van Duzee)

*Oncomyia nigra* Van Duzee, 1927, Proc. Calif. Acad. Sci., 16:596. Type ♀, Corvallis, Oregon (Calif. Acad. Sci.).

Geographic range: California, Maine, Oregon, and Washington

California records:

Contra Costa Co.: Mt. Diablo, VII-11-26 (E. P. Van Duzee, C.A.S.).

Marin Co.: Tomales Bay nr. Marshalls, VIII-14-38 (E. C. Van Dyke, C.A.S.).

Santa Clara Co.: San Antonio Valley, VII-30-49 (J. E. Gillaspay, C.I.S.).

Yolo Co.: Davis, V-30-54 (R. C. Bechtel, U.C.D.).

Discussion:

Although related to *O. longicornis* and *O. nigripes*, no intermediates have been seen.

*Occemyia propinqua* (Adams)

*Oncomyia propinqua* Adams, 1903, Sci. Bull. Univ. Kansas, 2:32. Type ♂, unknown locality (Snow Entomological Collections, Lawrence, Kansas).

*Zodion angusticornis* Van Duzee, 1927, Proc. Calif. Acad. Sci. 16:589. Type ♀, Los Banos, California (Calif. Acad. Sci.) New synonymy.

Synonym: *Oncomyia longipalpis* Van Duzee, 1934.

Geographic range: Nova Scotia to Alabama, west to Washington and California (see map 22).

Discussion:

The long genital plate of the female and whitish hairs of the abdomen in the male are characteristic of this species. The hind femur is almost always entirely black.

The type of *Zodion angusticornis* has been examined and belongs here. As indicated in the discussion of the genus, it is not uncommon that a specimen belonging to the genus *Occemyia* may erroneously be referred to the genus *Zodion* unless a careful examination of the proboscis is made.

Genus *Dalmannia* Robineau-Desvoidy

The genus *Dalmannia* is Holarctic in distribution with six species known from North America, five of which are known to occur in California. A synopsis of the North American species was last prepared by G. Bohart (1938).

The species of this genus are shining black forms brightly maculated with yellow, the anal cell (Cu) is scarcely longer than the second basal cell (M), and the antennae are provided with a distinctly dorsal arista.

One of the species, *Dalmannia picta* Williston, has been reported by Bohart (1938:133) from Mojave, California, where there were great numbers of *Andrena* (*Diandrena*) nesting and collecting pollen.

Key to the California Species of *Dalmannia*

1. Scutellum and humeri black; small species, 4 mm. . . . . *vitiosa* (p. 47)
- Scutellum and humeri partly yellow; large species, at least 6 mm . . . . . 2
- 2(1). Thoracic pile relatively short; shorter than arista . . . . . 3
- Thoracic pile relatively long; as long as arista . . . . . 4
- 3(2). Pile of dorsum of thorax predominantly pale . . . . . *picta* (p. 45)
- Pile of dorsum of thorax predominantly black in the center, yellow anteriorly . . . . . *blaisdelli* (p. 47)
- 4(2). Black bands of tergites continuous; abdominal hairs white except for apex; hind tibiae of female without apical process . . . . . *heterotricha* (p. 47)
- Black bands of tergites usually interrupted; abdominal hairs with considerable black; hind tibiae of female with apical process . . . . . *pacifica* (p. 47)

*Dalmannia picta* Williston

*Dalmannia picta* Williston, 1883, Trans. Conn. Acad. Arts and Sci., 6:94. Type ♀, New Mexico (Snow Entomological Collections, Lawrence, Kansas).



Map 23. Distribution of *Dalmannia picta* Williston.



Map 24. Distribution of *Dalmannia blaisdelli* Cresson.



Geographic range: Arizona, California (see map 23), Colorado, Idaho, New Mexico, Utah, and Washington.

Discussion:

This species is more variable than previously considered and intergrades completely with *blaisdelli*. Intermediates will probably also be found with *heterotricha* and *nigriceps* of the eastern United States. The hair of the thorax and abdomen may be quite yellowish, or there may be a considerable number of black hairs in the center of the thoracic dorsum. There is occasionally some black hair on the apical segments of the abdomen. The wings are never smoky.

*Dalmannia blaisdelli* Cresson

*Dalmannia blaisdelli* Cresson, 1919, Proc. Acad. Nat. Sci. Phila., 71:190. Type ♂, Colorado (Phila. Acad. Nat. Sci.).

Geographic range: California (see map 24), Colorado, Idaho, Oregon, and Wyoming.

Discussion:

Typical specimens are very distinctive, having smoky wings and black hair on the third and fourth tergites. However, more individuals are closer to *picta* and will have clear wings and predominantly white or yellow pile on the abdomen. The anterior pile of the thorax is always yellow if not golden in color.

*Dalmannia heterotricha* G. Bohart

*Dalmannia heterotricha* G. Bohart, 1938, Pan-Pac. Ent., 14:134-135. Type ♀, Pt. Reyes Peninsula, Marin County, California (Calif. Acad. Sci.).

Geographic range: California.

Discussion:

This relatively rare species is as yet known only from the original type and paratype. It is possible that *heterotricha* is a link between *picta* and *pacifica*.

*Dalmannia pacifica* Banks

*Dalmannia pacifica* Banks, 1916, Ann. Ent. Soc. Amer., 9:199-200. Cotypes ♂, ♀, Corvallis, Oregon (M.C.Z. and Ore. Agr. Coll.).

Synonym: *Dalmannia hirsuta* Van Duzee.

Geographic range: California and Oregon.

California records:

Alameda Co.: Berkeley, March to May (Bohart, 1938:134).

Contra Costa Co.: Antioch, IV-29-50 (P. D. Hurd, Jr., C.I.S.). Clayton, IV-26-42, R. F. Smith, C.I.S.); Mt. Diablo, IV-26-42 (J. W. Tilden, C.A.S.); Russellman Park, Mt. Diablo, IV-26-42 (E. C. Van Dyke, C.A.S.).

Marin Co.: Paradise Cove, IV-12-47 (E. L. Kessel, C.A.S.).

San Benito Co.: Panoche Hills, IV-10-38 (E. C. Van Dyke, C.A.S.).

Yolo Co.: Davis, IV-12-47 (E. C. Carlson, U.C.D.); V-13-48 (R. M. Bohart, S.C.C., U.C.D.).

Discussion:

The predominantly yellow individuals are very distinctive, but dark specimens (usually females) may resemble *picta*. The peculiar hind femora and metatarsi are characteristic of the female.

*Dalmannia vitiosa* Coquillett

*Dalmannia vitiosa* Coquillett, 1892, Ent. News, 3:150-151. Type ♂, Los Angeles County, California (U.S.N.M.).

Geographic range: Arizona, California (see map 25), Georgia, Kansas, Nevada, New York, and Virginia.

Discussion:

This small distinctive species lacks the cross vein (r-m) between the second basal (M) and discal cells (1st M<sub>2</sub>). A specimen from the eastern United States has been seen that has some yellow on the scutellum.

Genus *Stylogaster* Macquart

Members of this genus are thought to be parasitic upon ants of the genus *Eciton*, several species of which occur in California. However, neither the *Stylogaster* nor its suspected host relationship have been confirmed for California as yet. The following species which is a small, slender, and somewhat delicate conopid may very well occur in California.

*Stylogaster neglecta* Williston

*Stylogaster neglecta* Williston, 1883, Trans. Conn. Acad. Arts and Sci., 6:91-92, Three cotypes ♂, ♀, Connecticut and Pennsylvania (Snow Entomological Collections, Lawrence, Kansas).

Geographic range: Massachusetts to Georgia, west to Arizona, Iowa, and Kansas.

Discussion:

Although not recorded from California as yet, this species may occur in the southeastern part of the state. The long third antennal segment immediately distinguishes this species from *biannulata*, which is known only as far west as Texas.



Map 25. Distribution of *Dalmannia vitiosa* Coquillett.

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