

BULLETIN OF THE CALIFORNIA INSECT SURVEY  
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OR STRATIOMYIDAE  
OF CALIFORNIA

BY

MARION T. JAMES

(Department of Zoology, State College of Washington, Pullman)

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TO THE MEMORY  
OF MY SON  
TED

# THE SOLDIER FLIES OR STRATIOMYIDAE OF CALIFORNIA

BY

MAURICE T. JAMES

To date, no publication has presented a comprehensive survey of the Stratiomyidae of the Pacific coast; the nearest approach to one is the study of the aquatic forms by Wirth and Stone (1956). Even this work falls a little short of its expected goal since two groups have had to be omitted. These are the Pachygastrinae and the *Euparyphus-Aochletus* complex which are being studied by Dr. Kenneth J. Kraft and Dr. John A. Quist. It is hoped that a supplement to this paper can include these two groups.

The Stratiomyidae are placed, together with the Tabanidae, Coenomyiidae, Pantophthalmidae, and Erinnidae, near the base of the Brachycera. In all these flies the empodia are pulvilliform; venation is of a relatively primitive type; and the antenna, although in some groups it may be aristate, has the basal complex distinctly annulated (Steyskal, 1953). In the Stratiomyidae venation is quite primitive although the veins are crowded toward the costal margin, and there is a strong tendency toward reduction, for example, in the weakening or loss of  $R_4$ ,  $M_1$ ,  $M_3$  and cross veins r-m and m-cu, and in the general weakening of the veins surrounding the discal cell. A venational character that distinguishes the Stratiomyidae from the Erinnidae and Coenomyiidae is the origin of the radial sector at or near the base of the discal cell rather than far before it. Among other characters, we might mention the frequently spinose condition of the scutellum (a character which suggested to Bauer the name *Notacantha* for the Stratiomyidae and their close relatives), and the lack of tibial spurs (except in some

forms extralimital to the California fauna).

Although of limited economic importance, the Stratiomyidae are more significant from the theoretical standpoint than is usually recognized. Indeed, if this family had become extinct in prehistoric times, some valuable links in the evolutionary development of Diptera would have been lost to science. Nowhere within a closely knit taxonomic group can be found a better example of evolutionary change involving a major structure than in the stratiomyid antenna, which we can trace from the relatively primitive, undifferentiated 1-segmented (e.g., *Cyphomyia*) and the somewhat reduced but still undifferentiated 7- to 8-segmented (e.g., *Stratiomys*), through the stylate (e.g., *Eulalia*, some *Adoxomyia*), attenuate-stylate (e.g., some *Adoxomyia*, *Nemotelus*), and terminally aristate (*Acrochaeta*), to the subterminally aristate form (e.g., *Sargus*). Much of that development can be seen within a single tribe, the Myxosargini (James, 1942). Though the final development of the dorsally aristate, pendant antenna, with its thoroughly consolidated basal flagellar complex comes later, this is certainly a marked development to take place in one family.

The sidewise, rather than direct, development of a characteristic venational pattern has obscured some phylogenetically more important wing developments. It is not the Beridinae and Chironomyzinae, commonly considered the most primitive subfamilies, which have the most primitive venation but, on the other hand, the Cyphomyiinae. From this subfamily, progressive reduction and weakening of venation can be traced in three directions, through the

Stratiomyinae, Potamidinae, and to a lesser extent, the Sarginae, culminating in such genera as *Oplodontha*, *Nemotelus*, and typical *Microchrysa*, respectively. An independent branch which, at least so far as venation is concerned, must have originated below the Cyphomyiinae, leads through the Chiromyzinae and Beridinae to the otherwise highly specialized Pachygastrinae.

Another bit of significant phylogenetic development that takes place within the family is the differentiation of the pre- and postabdomen. The whole process can be demonstrated in the Chiromyzinae and the Beridinae, where reduction and telescoping of segments VI through VIII takes place gradually.

Even some of the sidewise developments have interesting aspects aside from their own peculiarities. The vestigial mouth parts of the Chiromyzinae are, of course, adaptive, but a similar situation occurs independently in several groups of the higher Diptera. The development of the subscutellum (metascutellum), which Curran (1924) considered a phylogenetic link between the Stratiomyidae, Syrphidae, and Larvaevoridae, falls in the same category; likewise the spinose scutellum which is again encountered, for example, in the Diopsidae. However, a special significance of this character in the Stratiomyidae is that, once developed, the spines tend gradually to disappear (e.g., *Stratiomys* through various species of *Labostigmina*).

Larval habits and habitats are not as varied as might be expected. The Cyphomyiinae, so far as known, are scavengers in decaying plant materials, a habit that is carried through the Hermetiinae and the Sarginae although both these families tend strongly toward coprophagy and, possibly in part, predatism. The phytosaprophagous habit is found also in some Potamidinae, though this subfamily, as well as the Stratiomyinae, becomes essentially aquatic, where the saprophagous habit may be maintained or may change to phytophage or micro-predatism. The chiromyzine-beridine-pachygastrine stem also begins trophically in phytophagy and phytosaprophagy and continues, although some Pachygastrinae become predaceous on bark beetle larvae (and consequently somewhat beneficial to man). The aquatic habitat, though shared by many members of the family, seems to be a secondary development; nevertheless, it is significant that no habitat is very far removed ecologically from the aquatic.

The stratiomyid fauna of California seems to consist of three chief elements: the introduced (from Europe, South America, or Australia), the more widespread Nearctic species that have spread into the state, and the endemic. The introduced species are found exclusively in the Sarginae, Chiromyzinae, and Hermetiinae and are either sod feeders or scavengers, both easily spread by commerce. It is not easy to separate the endemic forms from the more widespread ones that have entered the state, but many cases are quite clear. A number of the latter category, it will be noticed, have just barely reached California.

The collecting data presented herein represent the accumulation of more than a quarter century, although records were relatively meager until the work of the California Insect Survey got under way. Many collections which have been examined during this period are not acknowledged here, but those from which specifically cited records have been drawn, with the pertinent abbreviations, are as follows:

Institutional collections: California Insect Survey, University of California, Berkeley (C.I.S.); University of California, Davis (U.C.D.); University of California, Los Angeles (U.C.L.A.); University of California, Riverside (U.C.R.); California Academy of Sciences (C.A.S.); California Department of Agriculture (C.D.A.); American Museum of Natural History (A.M.N.H.); United States National Museum (U.S.N.M.); Ohio State University (O.S.U.); University of Arizona (U.A.); Brigham Young University (B.Y.U.); University of Kansas (K.U.); State College of Washington (W.S.C.).

Individual collections: George E. Bohart (G.E.B.); Mont A. Cazier (M.A.C.); Gerald F. Kraft (G.F.K.); Joe Schuh (J.S.); R. M. Bohart (R.M.B.); Paul H. Arnaud (P.H.A.); Stanley W. Bromley (S.W.B.), now part of the United States National Museum collection; R. H. Painter (R.H.P.); Maurice T. James (M.T.J.).

I express my appreciation to the individuals and curators of the collections above mentioned and to others not acknowledged here, who have from time to time loaned me materials from which pertinent records have been taken. I also express my appreciation to Miss Patricia Packard who prepared the original illustrations, and to my son, Ted, who was helping me in the preparation of this manuscript when tragedy intervened.



In preparing the keys, particularly the one to subfamilies and genera, I have had in mind the California fauna in particular. Generalities have often been sacrificed to utility. Consequently, the generic key will fail to work for some of the extralimital species of genera included, even for the eastern United States, and for some extralimital genera of the subfamilies. On the other hand, I hope that the construction of these keys along these lines will lead to easier and more positive identification of the California forms and others that might be expected to occur within the limits of the state or in closely adjacent areas.

One North American subfamily, the Cyphomyiinae, is omitted. Members of this subfamily barely enter the Nearctic region in Florida, Texas, New Mexico, and Arizona. It is possible, though not likely, that the genus *Cyphomyia* may occur in California. This genus will run to couplet 5 of the generic key, where it may be separated on the basis of the 10-segmented, undifferentiated antenna (at most 8-segmented in the Stratiomyinae).

### Key to the Subfamilies and Genera of California Stratiomyidae

1. Abdomen consisting of five principal segments (that is, exclusive of the apical segments that are normally telescoped into the fifth); mouth parts well developed and functional; scutellum either unspined or with a single pair of terminal spines . . . 4  
Abdomen consisting of six to eight principal segments, or, if only five (*Exodontha*), the scutellum with three or four pairs of marginal spines, including the apical pair . . 2
2. Scutellum, in California genera, with three or four pairs of marginal spines; mouth parts functional; abdomen with six principal segments, the seventh and eighth telescoping into the sixth (subfamily Beridinae) . . . . . 3  
Scutellum unspined; mouth parts vestigial; abdomen with seven or eight principal segments, the eighth telescoping into the seventh in the male, free in the female (subfamily Chiromyzinae) . . . . . *Metoponia*
3. Abdomen with six principal segments; slender-bodied flies, the abdomen not much broader than the thorax; three veins

arising from the discal cell . . . . . *Beris* ×  
Abdomen with five principal segments; body robust, the abdomen conspicuously broader than the thorax; four strong veins arising from the discal cell . . . . . *Exodontha* ×

- 4.<sup>(1)</sup> Cross vein m-cu present, . . . . . 5  
Cross vein m-cu absent, part of vein Cu<sub>1</sub> consequently forming part of the lower margin of the discal cell . . . . . 12
5. Antenna with or without a more or less well-defined thickened style but without an arista (subfamily Stratiomyinae) . . . . 6  
Antenna with a distinct subterminal arista (subfamily Sarginae) . . . . . 11
6. Anal (second anal) vein slightly though distinctly sinuate (fig. 44); face distinctly produced downward (fig. 48); wing patterned; slender, *Sargus*-like flies, with an unpatterned abdomen . . . . . *Myxosargus* ✓  
Anal vein not at all sinuate; face often somewhat produced forward but never downward; wing not distinctly patterned; more robust flies, usually with a distinctly patterned abdomen . . . . . 7
7. Scutellum unspined; fourth segment of flagellum with a distinct oval depression on its under side; last two (fifth and sixth) segments of flagellum forming a short blunt style; veins r-m, M<sub>1</sub>, M<sub>2</sub>, and M<sub>3</sub> strong and distinct, M<sub>3</sub> somewhat abbreviated, however . . . . . *Anoplodonta*  
Scutellum with two spines which may, however, be very short and inconspicuous (*Labostigmina*); fourth segment of flagellum without a depression below . . . . . 8
8. Last two antennal segments (fifth and sixth of flagellum) modified into a distinct, though usually short and often blunt, style; venation somewhat reduced, with either r-m missing or M<sub>1</sub> and/or M<sub>3</sub> reduced to a stump or weak fold; ratio of first to second antennal segments not more than 1.5 to 1 . . . . . 9  
Antenna without a style; venation not reduced in California species; ratio of first to second antennal segment 2.5 to 1 or greater except in *Labostigmina* . . . . . 10
9. Cross vein r-m absent, veins M<sub>1</sub>, M<sub>2</sub>, and M<sub>3</sub> present; face either receding or tuberculate below base of antennae, wholly green or yellow between the antennae and the oral margin except for a pair of small black dots in some species . . . . . *Hedriodiscus*

+ *Actina* *Metoponia*

+ *Prognathus* O.S.

- Cross vein r-m present, vein  $M_3$  wanting or greatly reduced, vein  $M_1$  also often more or less reduced; face often with extensive black areas or wholly black . . . . . *Eulalia*
10. Face receding; scutellar spines strong, situated on the outer corners and outside the median third; ratio of first to second antennal segments from 2.5 to 1, to 5 to 1 . . . . . *Stratiomys*  
Face produced into a rounded tubercle, the antennae inserted on the upper part of the tuberculate area; ratio of first to second antennal segments less than 2 to 1; scutellar spines very weak, almost evanescent . . . . . *Labostigmina*
11. Anal cell much narrower than the combined basal cells (fig. 37); veins  $M_1$  and  $M_3$  strong and well developed at least almost to the wing margin; in California species, eyes separated distinctly in both sexes and front of female with either a whitish transverse band or two small whitish spots (very small and widely separated in *viridis*) above the bases of the antennae . . . . . *Sargus* X  
Anal cell about as broad as the combined width of the basal cells (fig. 43); veins  $M_1$  and  $M_3$  in California species, feeble, represented by elongated stumps and folds; eyes contiguous in the male; front in both sexes without whitish spots or bands above the bases of the antennae . *Microchrysa*
12. (4) Discal cell large, bounded by feeble veins and emitting three veins, vein  $M_3$  being absent; California species small, black, with unpatterned abdomen and aristate antenna . . . . . subfamily Pachygastrinae  
Discal cell of small size, as usual, and emitting four veins, vein  $M_3$  developed at least as a fold and stump; antenna with a style or terminally undifferentiated, never aristate . . . . . 13
13. Terminal segment of flagellum developed into a vanelike style which is almost to fully as long as the rest of the antenna combined; large, elongated, wasplike flies. Subfamily Hermetiinae . . . . . *Hermetia*  
Antennal style undifferentiated or, if present, not elongated and vanelike; smaller, more robust flies. Subfamily Potamidinae . . . . . 14
14. Face produced forward conelike (figs. 49, 50); scutellum unspined; small predominantly black (sometimes reddish) flies . . . . . *Nemotelus*  
Face not produced into a cone; scutellum two-spined . . . . . 15
15. Antennal flagellum inflated, distinctly broader than the basal segments, the style always well differentiated and the segments composing it cylindrical; abdomen black, not patterned . . . . . 16  
Antennal flagellum elongated and slender, scarcely broader than the basal segments; style either undifferentiated or the segments composing it flattened; abdomen patterned, black and yellow or yellowish red . . . . *Euparyphus*, including *Aochletus*
16. Eyes distinctly pilose; front without polished calli . . . . . *Adoxomyia*  
Eyes bare; front with a pair of large polished calli which are virtually contiguous in the male . . . . . *Dieuryneura* ✓

### Subfamily CHIROMYZINAE

#### Genus *Metoponia* Macquart

#### *Metoponia rubriceps* Macquart (Pl. 10, figs. 45, 47)

*Metoponia rubriceps* Macquart, 1847, Dipteres Exotiques, suppl. 2, p. 28 (original pagination). Type ♀, "New Holland"; in the Muséum National d'Histoire Naturelle, Paris.  
Geographical range: Australia, California.  
Occurrence in California:

This species was taken in considerable numbers emerging from lawns on the campus of the University of San Francisco, by Edward L. Kessel. Though it is spreading, it seems still to be confined to San Francisco County.

#### Discussion:

This species is easily recognized by the blackish or blackish-brown body with the contrasting swollen reddish or reddish-yellow head of the female, the chiromyzine type of abdomen, with its seven principal segments and, in the female, its strongly tapering form, and by the vestigial mouth parts. There is considerable sexual dimorphism; the male is much smaller than the female and the eyes are contiguous, the head consequently lacking the swollen appearance and not contrasting in color with the body. The bionomics and immature stages of this species are described in



detail by Irwin-Smith (1920). It is widespread and common in Australia, in some areas being considered a pest of maize and lawn grasses.

### Subfamily BERIDINAE

#### Genus *Hermetia* Latreille

Specimens of *Beris* are rare in collections. Three North American species belong here; of these, only one can be referred to the California list with certainty.

Adults are usually swept from low-growing vegetation along small streams. The immature stages of the American species are unknown; but in Europe larvae breed in decaying leaves and other vegetable matter in the vicinity of streams.

### Key to the California Species of *Beris*

1. Antennal flagellum slender, its base but little broader than the apex of the second antennal segment; last tergite of male truncated, not produced laterally into spines; head and mesonotum clothed with bushy pile which is predominantly black; thorax dark green, almost black . . . . . *californica*
- Antennal flagellum distinctly broader at its base than the apex of the second antennal segment; last tergite of male prolonged on each side into a curved spur which extends under the cerci; head and mesonotum clothed with relatively short, usually yellow pile; thorax bright green or bluish green . . . . . *annulifera*

#### *Beris californica* James

*Beris californica* James, 1939, Ann. Ent. Soc. Amer., 32:546. Type ♂, Del Norte Co., California; in Deutsches Entomologisches Institut.

Geographical range: Washington, Oregon, California (map 1).

Occurrence in California:

Del Norte Co.: Type series.

Los Angeles Co.: Crystal Lake, VI-29-50 (W. C. Bentick, C.I.S.). Camp Baldy, VII-8-50 (W. C. Bentinck, C.I.S.).

Mariposa Co.: Yosemite, VI-25-21 (Van Dyke, C.A.S.).

Mono Co.: Sardine Creek, VII-12-51 (A. T. McClay, U.C.D.).

Nevada Co.: Sagehen, nr. Hobart Mills, VI-25-54 (S. E. Booras, U.C.D.); VII-21-54 (R. H. Goodwin, C.I.S.).

Sierra Co.: Independence Lake, VII-17-54 (R. H. Goodwin, C.I.S.).

Santa Cruz Co.: Soquel, on car radiator, VII-2-54 (M. T. James, M. T. J.).

#### *Beris annulifera* (Bigot)

(Pl. 10; fig. 42)

*Oplacantha annulifera* Bigot, Ann. Soc. Ent. France (6) 7: 21. Type, ♀, Georgia; in Bigot Collection.

Geographical range: Newfoundland to Yukon Territory and Alaska, southward to the Great Lakes region, along the Alleghenies to Georgia, through the Great Plains and Rocky Mountains to Kansas and New Mexico, and along the coast states into the Sierra Nevada (map 1).

Occurrence in California:

Mono Co.: Tioga Pass, VII-3-33 (G.E.B.).

Discussion:

The California record for this species may belong properly to *californica*. The determination was made before I recognized the identity of that species. However, *annulifera* does occur in Washington, so it should at least be on the hypothetical list.

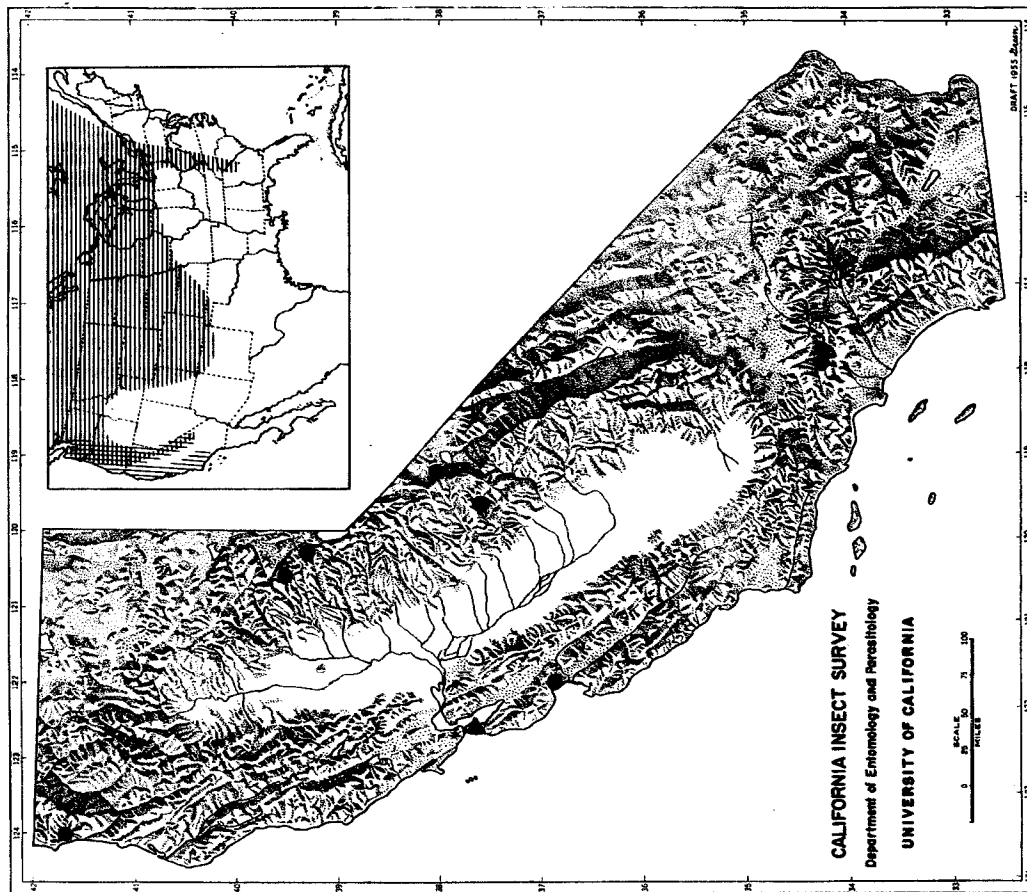
#### Genus *Exodontha* Rondani

The rare *Exodontha grandis* (James), known only from Oregon, is placed on the hypothetical list of California species.

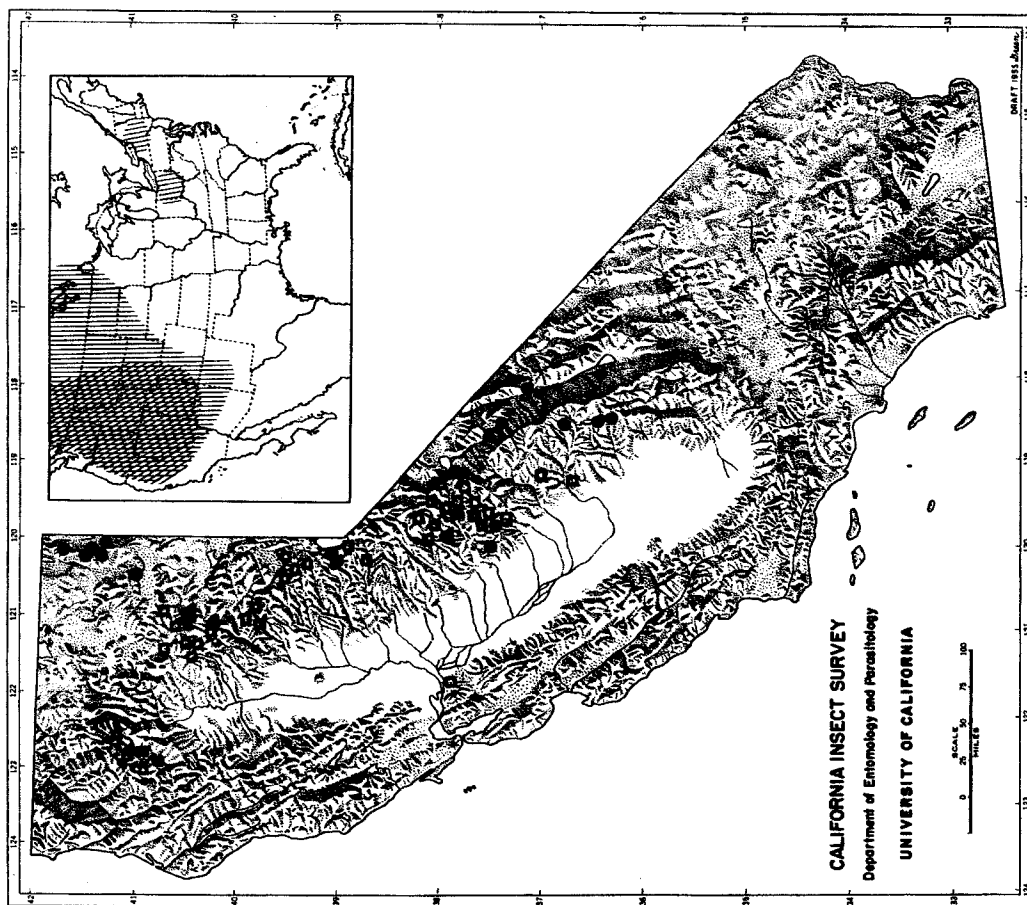
### Subfamily STRATIOMYINAE

#### Genus *Stratiomys* Geoffroy

From the standpoint of geographical distribution, the species of *Stratiomys* that occur in the Pacific coast states can be divided into two groups: the truly western species, and the species which have entered the mountain areas of the west by way of a northern transcontinental bridge. So far as my records go, only one of the latter group, namely *S. obesa* Loew,



Map 1. Distribution in California of *Beris annulifera* (Bigot), open circles; *Beris californica* James, solid circles; and *Metoponia rubriceps* Macquart, triangles. Inset: Distribution in the United States of *B. annulifera*, horizontal lines, and *B. californica*, vertical lines.



Map 2. Distribution in California of *Stratiomys laticeps* Loew, solid circles; *Stratiomys melastoma* Loew, open squares; and *Stratiomys barbata* Loew, solid triangles. Inset: Distribution in the United States of *S. laticeps*, vertical lines, and *S. melastoma*, oblique lines. The distribution of *barbata* is similar to that of *laticeps* as it occurs west of the Mississippi.

has reached California (and only as a rarity), although *S. adelpha* Steyskal (= *discaelis* Auctt. not Loew), *S. badia* Walker, and the polytypic *S. normula* Loew with three of its subspecies, *n. normula* Loew, *n. unilimbata* Loew, and *n. angulicincta* James, are found in the Pacific Northwest, and should therefore be included in the hypothetical list of California species. The only species of the western group that extends east of the Mississippi, namely, *S. laticeps* Loew, does so only rarely. The genus as it occurs in California, therefore, represents a distinctly western element of the family.

The adults commonly frequent such flowers as willows, composites, and umbellifers. The immature stages are not sufficiently well known to permit broad generalizations, but they live in water which contains large amounts of organic debris, such as the sluggish water shaded by cattails near the banks of rivers. The larvae feed on decaying vegetation and on microorganisms. Some species live in highly thermal or highly saline waters, and their ability to withstand desiccation is remarkable.

The genus has been reviewed by James and Steyskal (1952), although one species and one subspecies, both belonging to the California fauna, have been described more recently by James.

### Key to the California Species of *Stratiomys*

(Modified from

James and Steyskal, 1952)

1. Antenna short, the first segment not more than three times as long as the second, the flagellum at least twice as long as the first segment; abdomen flattened . . . . . 2  
Antenna longer, the first segment normally four or more times as long as the second, the flagellum less than twice as long as the first segment; abdomen more highly arched . . . . . 4
2. Eyes of male with distinct, though short, hair, except when abraded; mesonotum of female before the suture with dense pale pile which effectively conceals the underlying short black hairs; venter prominently banded with black; length usually 13 mm. or more . . . . . *laticeps*  
Eyes of male bare; mesonotum of female usually with less conspicuous pale pile, the black hairs usually showing through it in patches; length usually 11 mm. or less . 3
3. Venter wholly pale or virtually so; femora of female yellow on basal half . . . . . *currani currani*  
Venter distinctly cross-banded with black; femora of both sexes, except extreme apices, black . . . . . *currani boharti*
4. Fourth abdominal tergite with an oblique black mark interrupting the lateral yellow spot on each side; eyes pilose in both sexes . . . . . *maculosa*  
Fourth abdominal tergite not so colored; eyes bare, except in the male of *badia* . 5
5. Posterior ocular orbit broader below than above and broadly yellow at least on its lower part; in the female yellow throughout or at most black on its upper fourth, bare except for short inconspicuous hairs, and broad throughout, its minimal breadth at least equal to the length of the second antennal segment; in the male, distinctly broadened in the lower part; facial orbits broadly yellow (except in some high altitude males\* of *barbata*); sternites with posterior yellow part approximately equally developed on all segments, or at most only slightly more so on the anterior segments . . . . . 6  
Posterior ocular orbit not much broader in the lower part, narrow throughout in the male, relatively so in the female, its minimal breadth usually distinctly less than length of the second antennal segment; yellow color of posterior orbit usually narrow or lacking, if relatively wide or somewhat broadened and yellow on lower half or more, posterior orbit clothed in part with conspicuous tomentum; eyes bare in both sexes . . . . . 10
6. Posterior pale margin of fourth tergite continuous and distinctly produced forward in the form of a median bar; eyes of male pilose. Transcontinental, eastern United States to Washington and Idaho . . . *badia*  
Posterior pale margin of fourth tergite, if continuous, not produced forward medially; eyes bare in both sexes . . . . . 7
7. Pale marking of fifth tergite consisting of a median apical triangle which is widest posteriorly; posterior pale marking of fourth tergite usually interrupted, at least

- in the males; femora, except knees, black; face of male usually largely black . . . . 8
- Pale markings of fifth tergite either a parallel-sided medial longitudinal bar, sometimes somewhat expanded at each end, or a pentagon that is widest anteriorly; posterior pale marking of fourth tergite continuous; face largely pale; sternites usually predominantly yellow, each with a black anterior transverse band which is broadest in the middle . . . . . 9
8. Metapleural and usually (always in the male) extensive areas of mesopleural pile black; facial pile of male black; each sternite at least half black, the black part forming a parallel-sided anterior transverse band . . . . . *barbata*
- Metapleural and mesonotal pile pale; facial pile of male white; first and second sternites predominantly yellow . . . *tularensis*
9. Fifth tergite with at least a small yellow lateral mark on each anterior corner and with a median parallel-sided bar which is sometimes expanded at each end, its anterior end sometimes fused with the lateral spots; oral margin of female at least in part, usually largely yellowish; femora of female yellowish, sometimes piceous apically; posterior orbit of female about as wide at its minimum as length of second antennal segment . *obesa*
- Fifth tergite black at sides but with a conspicuous median pentagonal marking which is usually distinctly broader anteriorly; oral margin black; femora, except knees, black, rarely largely yellowish in the female . . . . . *melastoma*
10. Metapleural pile largely to wholly brown or black; venter largely black or with conspicuous crossbands on all segments (sometimes interrupted on the second); all femora black except narrow bases and apices; third and fourth tergites without complete crossbands . . . . . 11
- Metapleural pile chiefly pale. Eastern species extending into Idaho, Washington, and British Columbia . . . . . 13
11. Predominantly black species, the abdominal tergites normally wholly black, sometimes narrowly yellow laterally on the anterior tergites and with suggestions of a median line on the fifth, the sternites also black except for narrow posterior margins which are rarely extended . . . . . *nevadae*
- Abdominal tergites with conspicuous broad markings on at least the second segment; sternites with conspicuous yellow areas . . . . . 12
12. Abdomen no broader than thorax, rather strongly convex in transverse section; mesonotal pile cinereous; third tergite without transverse apical markings . . *griseata*
- Abdomen distinctly broader than thorax, only moderately convex; mesonotal pile pale to deep yellowish; third tergite sometimes with transverse apical or even broad lateral markings . . . . . *discaoides*
13. Second and third sternites largely pale and contrasting to those posterior to them, which are almost wholly black; the third sternite typically with a black triangle in each posterior corner, but the black may be somewhat extended; base of hind femur broadly yellowish or brownish. Great Lakes area westward to Washington, Idaho, and Oregon . . . . . *adelpha*
- Third sternite conspicuously black, the ventral pattern on segments II to V consisting of rather equally developed yellow posterior margins which may broaden somewhat medially and which may be more pronounced on the second sternite; hind femur black, with at most a very narrow pale base . . 14
14. Fourth abdominal tergite with a continuous pale posterior margin . . . . . 15
- Fourth abdominal tergite with (sometimes without) short, pale transverse bars and sometimes with a small separated median triangle, but without a continuous posterior margin. Northeastern states to British Columbia and Idaho . . . . . *normula normula*
15. Third tergite with a continuous pale posterior margin. Colorado, Utah, New Mexico, Idaho . . . . . *normula angulicincta*
- Third tergite with only lateral transverse bars. Great Lakes area westward to Idaho . . . . . *normula unilimbata*

### *Stratiomys laticeps* Loew

(Pl. 6, fig. 2)

*Stratiomyia laticeps* Loew, 1866, Berliner Ent. Zeit., 10: 12 (Centuria VII, 20). Type, ♀, "Hudson's Bay Territory"; in Museum of Comparative Zoölogy.

Geographical range: Manitoba and Saskatchewan,

westward and southward to British Columbia, New Mexico, and California; also in scattered localities in Ohio and New York (see map 2).  
Occurrence in California:

Apparently restricted to the Sierra Nevada and eastward. At higher elevations I have records from Tioga Pass, VII-3-33, 9,941 ft. (G. E. Bohart, G.E.B.) and Inyo County (no locality), 9,700 ft., VII-7-38 (G. E. Bohart, G.E.B.). Seasonal distribution is June and July, with a few records in early August.

### *Stratiomys currani* James

(Pl. 6, fig. 4; pl. 8, fig. 25)

*Stratiomys currani* James, 1932, Amer. Mus. Novitates, no. 571, p. 5. Type ♀, Electra Lake, Colorado; in American Museum of Natural History.

*Stratiomys currani boharti* James, 1955, Jour. Kansas Ent. Soc., 28:47. Type ♀, Sierraville, Sierra Co., California; in California Academy of Sciences.

Geographical range: (Typical form) Colorado northward to Alberta and British Columbia, then southward to lower elevations in the California Sierra; (*boharti*) Utah northward to Alberta, thence into the higher Sierra of California; (intergrades) Utah, through Wyoming, Idaho, and Oregon, into California.

Occurrence in California:

Throughout the Sierra Nevada, late May through July (see map 3).

Discussion:

The two subspecies, at their extremes, are quite distinct. The unicolorous pale venter of *currani currani* is striking and is unusual for a *Stratiomys*; *currani boharti*, on the other hand, resembles a small *laticeps* except for the bare eyes of the male. Where the two occupy the same geographical area, *currani currani* seems to occur more at the lower and *currani boharti* at higher elevations, but a broad zone with various degrees of intergradation extends from California, by a northern bridge, into Utah.

### *Stratiomys maculosa* Loew

(Pl. 6, fig. 1)

*Stratiomys maculosa* Loew, 1866, Berliner Ent. Zeit., 10:12 (Centuria VII, 19). Type, California; in Museum of Comparative Zoölogy.  
Geographical range: British Columbia, Wash-

ington, Oregon, Idaho, Utah, Nevada, California (see map 4).

Occurrence in California:

Throughout the state, but apparently present in the inland valleys and deserts only in favorable local habitats. I have records from March 2 to August 18; seasonal distribution is, with rare exceptions, from March to May at lower elevations and May and June, with a few July dates, in the higher mountains. Adults have been taken on flowers of *Eriogonum* at Riverside, IV-23-24 (Timberlake, U.C.R.); on *Ceanothus* at Riverside (Timberlake, U.C.R.); on *Baccharis viminea* at Riverside, IV-9-39 (Timberlake, U.C.R.); on *Salix lasiolepis* at Riverside, III-2-40 (Timberlake, U.C.R.); on *Baeria aristata* at Riverside, IV-9-17 (Timberlake, U.C.R.); on *Lomatium dasycarpum* at Gavilan, IV-10-46 (Timberlake, U.C.R.); on *Layia platyglossa* at Gavilan, IV-14-40 (Timberlake, U.C.R.); on willow, Mission Valley, V-6-49 (J. Ulics, C.I.S.); and on willow, Redlands, III-30-28 (Ingles, C.I.S.).

### *Stratiomys barbata* Loew

(Pl. 6, fig. 5)

*Stratiomys barbata* Loew, 1865, Berliner Ent. Zeit., 9:133 (Centuria VI, 9). Type, ♂, California; in Museum of Comparative Zoölogy.  
Geographical range: Alaska to California, eastward to Manitoba, South Dakota, and New Mexico (see map 2).

Occurrence in California:

This common Rocky Mountain species becomes rare in California. I have only the following records:

Lassen Co.: Mt. Lassen, 8 mi. E., VII-8-55 (J. W. MacSwain, C.I.S.); Mt. Lassen, 3 mi. S.E., VII-8-55 (A. J. Mueller, U.C.D.).

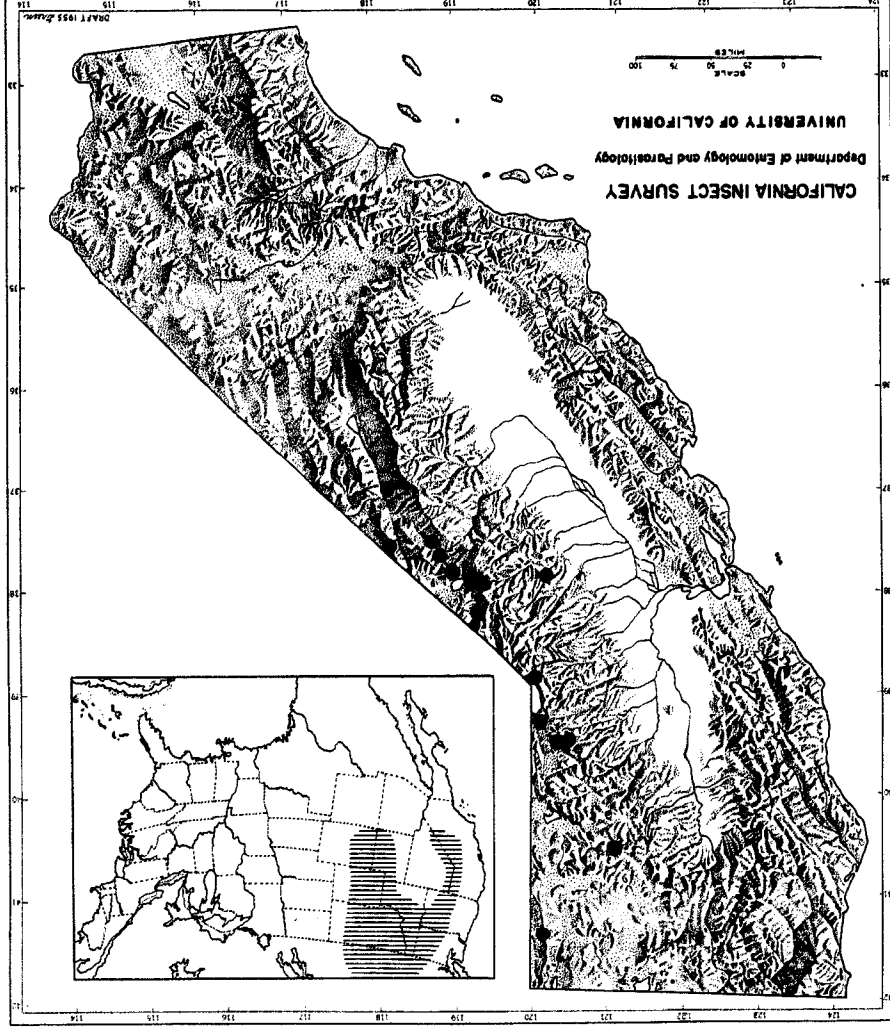
Tuolumne Co.: Elizabeth Lake, VIII-16-47 (L. L. Jensen, C.I.S.).

### *Stratiomys tularensis* James

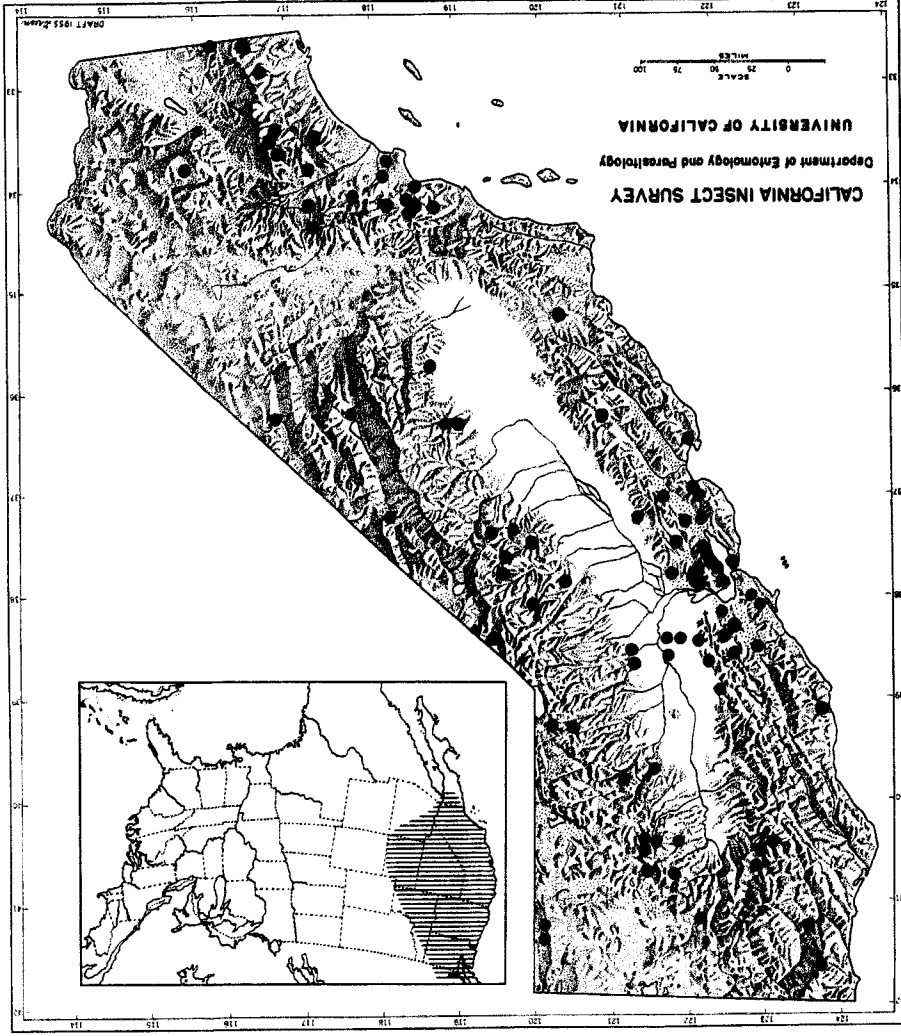
*Stratiomys tularensis* James, 1957, Pan-Pac. Ent., 33:43. Type ♀, two miles south of Forster Pass, Tulare Co., California; in California Academy of Sciences.

Geographical range: California. Known only from the type locality.

Map 3. Distribution in California and (inset) in the United States of *Stratiomys curranii* James. The two subspecies of *curranii* are not mapped separately.



Map 4. Distribution in California and in the United States of *Stratiomys maculosa* Loew.





*Stratiomys obesa* Loew

*Stratiomyia obesa* Loew, 1865, Berliner Ent. Zeit., 9:134 (Centuria VI, 11). Type ♀, Illinois; in Museum of Comparative Zoölogy.

Geographical range: Widespread, northeastern states westward to Nebraska and Saskatchewan, rare westward and southward to Washington, California, and New Mexico.

Occurrence in California:

Plumas Co.: Meadow Valley, VI-1934 (M. A. Cazier, M.A.C.).

? County: Summit, Sierra Nevada (Henry Edwards, A.M.N.H.).

*Stratiomys melastoma* Loew

(Pl. 6, fig. 3)

*Stratiomyia melastoma* Loew, 1865, Berliner Ent. Zeit., 9:134 (Centuria VI, 10). Type, ♂, California; in Museum of Comparative Zoölogy.

Geographical range: Alberta and British Columbia to California, Utah, and western Colorado (see map 2).

Occurrence in California:

The mountains of northern California and the middle Sierra, up to at least 10,000 ft. A somewhat anomalous record is that of a male, Antioch, Contra Costa Co., VI-3-36 (H. R. Mead, M.A.C.). Seasonal occurrence, May 20 to August 1; most common in June and July.

*Stratiomys nevadae* Bigot

*Stratiomys nevadae* Bigot, 1887, Ann. Soc. Ent. France, (6) 7:24. Type, ♂, Nevada; in Bigot Collection.

Geographical range: North Dakota and Alberta to British Columbia, Colorado, and California (see map 5).

Occurrence in California:

Mono Co.: Sardine Creek, 8,500 ft., VI-27-57 (J. W. MacSwain, C.I.S.); VII-11-51 (A. T. McClay, U.C.D.).

Nevada Co.: Sagehen, near Hobart Mills, VI-25-54 (R. M. Bohart, R. C. Blaylock, U.C.D.; R. H. Goodwin, C.I.S.) and VII-2-54 (G. Schaeffer, C.I.S.). Truckee, 7 mi. S.E., VI-24-54 (R. M. Bohart, U.C.D., C.I.S.).

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

Discussion:

The wholly or almost wholly black abdomen

makes most members of this species easy to recognize. Occasionally, however, a greater amount of pale coloration occurs, as in the series of four males from Sardine Creek. Two of these males have the abdomen virtually all black, except for very narrow crossbands on the venter; the other two have distinct ventral crossbands and distinct, though narrow, lateral spots on tergites 2 and 3. The markings suggest an intergradation, possibly hybridization, with *griseata*, one male of which was taken at the same locality.

*Stratiomys griseata* Curran

*Stratiomyia griseata* Curran, 1923, Canad. Ent., 55:74, new name for *velutina* Curran, not Bigot. Type (of *velutina*), ♂, Aspen Grove, B. C., in Museum of Comparative Zoölogy.

Geographical range: British Columbia eastward to Montana, southward to California and Utah.

Occurrence in California:

Mono Co.: Sardine Creek, 8,500 ft., VI-28-51 (C. A. Downey, U.C.D.).

*Stratiomys discaloides* Curran

(Pl. 6, fig. 6; pl. 8, fig. 22)

*Stratiomyia discaloides* Curran, 1922, Canad. Ent., 54:281. Type, ♂, Chilcotin, B.C.; in Museum of Comparative Zoölogy.

Geographical range: British Columbia eastward to Montana, thence southward to California and New Mexico (see map 5).

Occurrence in California:

A high mountain, early summer species.

Inyo Co.: Deep Spring, VI-17-53 (N. Malley, U.C.D.).

Mono Co.: Blanco's Corral, 10,000 ft., VI-1924 to VII-8-53 (H. Washburn, U.C.L.A.; J. T. Brooks, C.I.S.; J. W. MacSwain, C.I.S.; W. D. McLellan, U.C.D.).

Nevada Co.: Truckee, 7 mi. S.E., V-24-54 (R. M. Bohart, U.C.D.).

Placer Co.: Carnelian Bay, Lake Tahoe, VI-24-54 (R. M. Bohart, U.C.D.).

Tuolumne Co.: Sonora Pass, VI-18-48 (C.I.S.).

Discussion:

The mesonotal pile varies from almost white to a deep reddish yellow, the tendency in California specimens, particularly the females, being toward the latter color.

Genus *Labostigmina* Enderlein*Labostigminia similis* (Johnson)

*Odontomyia similis* Johnson, 1895, Trans. Amer. Ent. Soc., 22:267. Type, ♀, Colorado; in Museum of Comparative Zoölogy.

Geographical range: Alberta, Montana, Wyoming, Colorado, Utah, California.

Occurrence in California:

I have not seen specimens from the state, but Wirth and Stone (1956) have recorded it from Lake Tahoe.

Discussion:

*Labostigminia* is a neotropical and warm temperate genus represented in the United States by seventeen species. Most of these occur in the southeast and westward to Texas; one, however, *megantica* (Curran), occurs in Michigan and eastern Canada, and another, *similis*, belongs to the area of the high Rockies, where it is rare. The California record is very interesting but, in light of the known spotty distribution of the species, quite plausible.

Genus *Eulalia* Meigen

The characteristically California representation of this genus consists of eight species endemic to the state or to the West. Two of these, *americana* (Day) and *inaequalis* (Loew), are rare; four, namely *arcuata* (Loew), *pilosa* (Day), *hirtocculata* (James), and *colei* (James) seem, from distributional data, to be confined to the state or to have spread out from a point of origin within it; whereas two others, *alticola* (James) and *tumida* (Banks), though distinctly western, are more widespread and probably belong more to the Rocky Mountain and Great Basin faunas than to that of the coast.

A second group consists of three species of broad distribution which are represented commonly in at least parts of California. These are *cincta* (Latreille), *communis* (James), and *hoodiana* (Bigot). Three additional species of wide distribution, namely *pilimana* (Loew), *pubescens* (Day), and *virgo* (Wiedemann), seem to reach the limit of their distribution in California, occurring there as rarities. Finally, another widely distributed species, *hydroleonoides* (Johnson), is placed on the hypothetical list, since I have records of it from Oregon.

The habits of the adults are similar to those of *Stratiomys*. Likewise, the larvae are aquatic, but they tend more to live in well-aerated

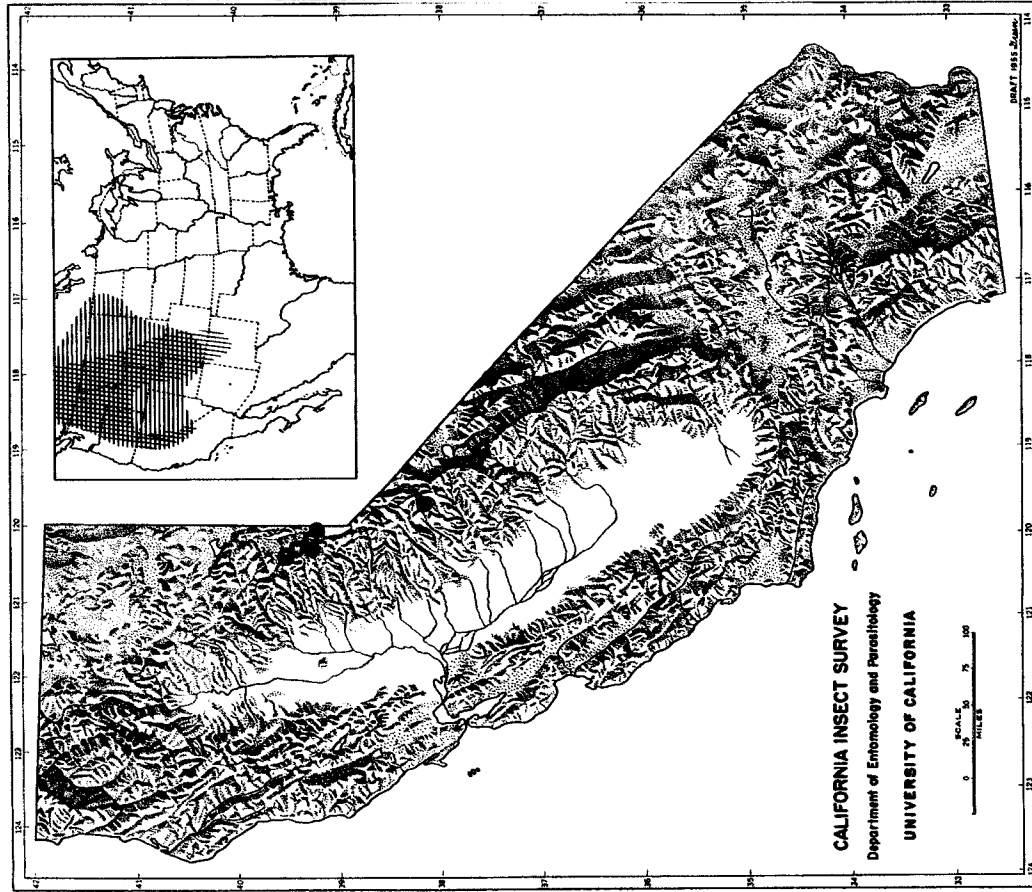
water, being more commonly found among emergent or floating vegetation, where they feed on parts of aquatic plants and small organisms including at times smaller individuals of their own species. Like *Stratiomys*, *Eulalia* larvae are highly tolerant of adverse conditions, being able to withstand desiccation and, at least in certain species, high salinity.

The most recent comprehensive treatment of the Nearctic species is that of James (1936), but this work should be used in connection with the papers of James (1939) and James and Steyskal (1952).

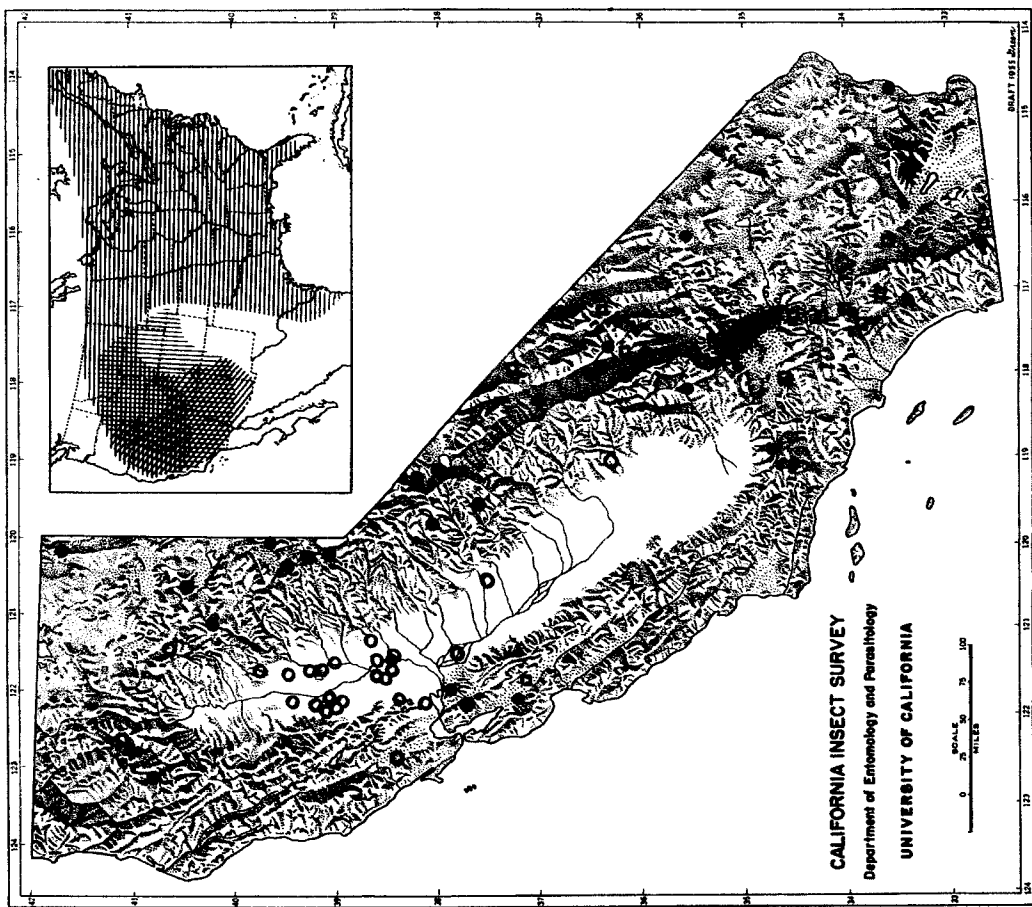
Key to the California Species  
of *Eulalia*

1. Eyes clothed with conspicuous pile . . . . . *hirtocculata*  
Eyes bare . . . . . 2
2. Femora black, at most the bases and apices pale; abdomen broad, the terga black with transverse linear or triangular yellow or green markings at the apical corners of the segments, these markings only rarely simulating broad lateral margins (fig. 16); supra-alar callus always black . . . . . 3  
Femora yellow; abdomen as described above only in *pubescens*, although an occasional *arcuata* or *inaequalis* may have the black so expanded as to simulate such a pattern . . . . . 5
3. Vein  $R_4$  present; either the front of the female marked with yellow, or the oral margin largely or wholly yellow in both sexes . . . . . 4  
Vein  $R_4$  absent; front and oral margin wholly black in both sexes . . . *hoodiana*
4. Face and consequently the head unusually wide (fig. 33); oral margin yellow; strong veins yellowish brown . . . . . *pilosa*  
Face and head of usual width; oral margin black; strong veins dark brown . . . *colei*
5. Mesonotum with broad lateral margins running from each humerus to the postalar callus, and including both areas, yellow or green . . . . . *cincta*  
Mesonotum black on at least a considerable part of the lateral margin . . . . . 6

6. Face and oral margin black or, if tending to reddish (some *hydroleonoides*) or only partly yellow (*americana*), the oral margin and face not strongly contrasting in color; abdomen dorsally either black with transverse pale markings at the apical corners of the terga (*pubescens*) or yellow to green with a median longitudinal stripe which is not interrupted at the incisures . . . . . 7  
 Oral margin yellow or green; face either concolorous or, if partly or wholly black, the black strongly contrasting with the pale colors; abdomen dorsally basally green or yellow, characteristically with black transverse basal bands, although these bands may, on the one hand, be so expanded in the female that the pattern secondarily becomes similar to that of *pubescens*, or, on the other, may in the male be narrowed and connected with one another so as to form a median longitudinal stripe . . . . . 11
7. Abdomen black, with yellow apicolateral triangles which are only rarely expanded so as to suggest a broad lateral margin; first antennal segment distinctly longer than the second; face keeled, *pubescens*  
 Abdomen yellow or green with a median longitudinal band which may be expanded laterally on the apical terga; first and second antennal segments subequal; face either receding or tuberculate, not keeled . . . . . 8
8. Front basitarsus fringed below with pile which (unless abraded) is distinctly longer in the male and almost as long in the female as the diameter of the basitarsus; front of female with a pale spot (sometimes with a second, or with a long linear area resulting from the fusion of the two) on each side of the mid-frontal suture; antennal style acute . . . *pilimana*  
 Front basitarsus with only short pile below; front of female either wholly reddish or almost so (*hydroleonoides*) or wholly black . . . . . 9
9. Terminal segment of antennal style distinctly longer than wide and either acute or not noticeably blunt . . . . . 10  
 Terminal segment of antennal style no longer than wide and distinctly blunt; front of female and oral margin wholly black . . . . . *virgo*
10. Oral margin partly yellow; front wholly black . . . . . *americana*  
 Oral margin wholly black; front of female reddish or reddish yellow, this color sometimes extending somewhat onto the face (northeastern states, westward to Oregon) . . . . . *hydroleonoides*
11. Lower ocular orbits divergent (figs. 34, 35), the sides of the face in the female, as well as in the male, likewise divergent; face entirely yellow except sometimes two small spots above the tentorial pits; abdominal terga with black transverse basal bands, strongly biarcuate posteriorly, in both sexes, those of the male connected on a median line with those of adjacent segments . . . . *tumida*  
 Lower ocular orbits, along and just above the oral margin, parallel (figs. 31, 32); sides of face of female approximately parallel; face often marked with black or wholly black . . . . . 12
12. Face wholly black or with a black vitta along the median line which usually broadens just above the oral margin . . . . 13  
 Face wholly yellow or, partly black, the markings other than on the median line 14
13. Black transverse abdominal bands taking in all but the narrow apices of the terga, always broadly connected with those of adjacent terga in the female and frequently so also in the male; bands of intermediate segments not narrowed in the male . . . . . *inaequalis*  
 Black transverse abdominal bands discretely separated from one another in the female and forming in the male a continuous longitudinal vitta which, on the second and third terga, is confined to the median third . . . . . *communis*
14. Face yellow; scutellum wholly yellow in the female; abdomen of female with transverse black crossbands which are always well separated from those of adjacent segments and attenuated laterally, the posterior margin of each band forming a simple arc; abdomen of male with a longitudinal vitta which is distinctly narrowed on the third segment, without trace of side spots . . . . . *alticola*  
 Face sometimes marked with black; scutellum black at base in both sexes; abdomen of female with black crossbands which



Map 5. Distribution in California of *Stratiomys nevadae* Bigot, open circles; *Stratiomys discaloides* Curran, solid circles; and *Stratiomys griseata* Curran, open triangles. Inset: Distribution in the United States of *S. discaloides*, vertical lines, and *S. nevadae*, horizontal lines.



Map 6. Distribution in California of *Eulalia arcuata* (Loew), solid circles; *E. cincta* (Latreille), open circles; and *E. albicola* (James), open squares. Inset: Distribution in the United States of *E. cincta*, horizontal lines; *E. albicola*, vertical lines; and *E. arcuata*, oblique lines.

are usually little, if any, attenuated laterally and which may fuse with those of adjacent segments; abdomen of male as in *alticola* but usually with at least traces of side spots, sometimes with lateral extensions to form a crossband, on the third segment . . . . . *arcuata*

### Subgenus *Eulalia* Meigen

#### *Eulalia hirtocculata* (James)

(Pl. 7, figs. 10, 11; pl. 8, fig. 26)

*Odontomyia hirtocculata* James, 1936, Ann. Ent. Soc. Amer., 29: 540; n.n. for *O. pacifica* Curran not Macquart. Type (*pacifica*), ♀, Stanford University, California; in Canadian National Collection.

Geographical range: California (see map 7)

Occurrence in California:

Fairly common in the coastal area, from Sonoma County southward to the Mexican border. I have seen one specimen, however, from Hope Valley, Alpine Co., IX-11-38 (M. A. Cazier, M.A.C.). Seasonal occurrence, June to October but mostly late August and September. This species has been taken on the flowers of *Baccharis douglasii*, Stanford University, IX-3-57 (Paul H. Arnaud, Jr., C.D.A.) and on the flowers of *Mentha spicata*, Stanford University, VII-24-57 (Paul H. Arnaud, Jr., C.D.A.)

Discussion:

Specimens with abraded hair on the eyes may be misdetermined as *arcuata*. Undoubtedly some records of *arcuata* in the literature pertain to this species.

#### *Eulalia cincta* (Latreille)

(Pl. 7, figs. 14, 15)

*Odontomyia cincta* Latreille, in Olivier, 1811, Encyclopedie Methodique, 8, p. 432. Type, ♂, Carolina; Museum National d'Histoire Naturelle, Paris.

Geographical range: The most widely distributed Nearctic *Eulalia*; New Brunswick to Florida, westward to about the 100th meridian; Utah, Idaho, Oregon, Nevada, and California. The Montana-Wyoming bridge shown in map 6 is still hypothetical.

Occurrence in California:

A very common species in the Sacramento Valley but of limited occurrence elsewhere; I

have seen specimens from Carrville, Trinity Co., 2,400 to 2,500 ft., V-15-34 (M.A.C.) and Hat Creek P.O., Shasta Co., VI-27-55 (J. W. MacSwain, C.I.S.). Seasonal occurrence, late April through August. It has been swept from rice fields, both clean and weedy, in the Sacramento Valley on several occasions.

#### *Eulalia tumida* (Banks)

(Pl. 7, fig. 13; pl. 9, figs. 34, 35)

*Odontomyia tumida* Banks, 1926, Psyche, 33:42.

Type not stated, presumably a female; locality not stated but written into separates as Gazelle, Calif.; in Museum of Comparative Zoology.

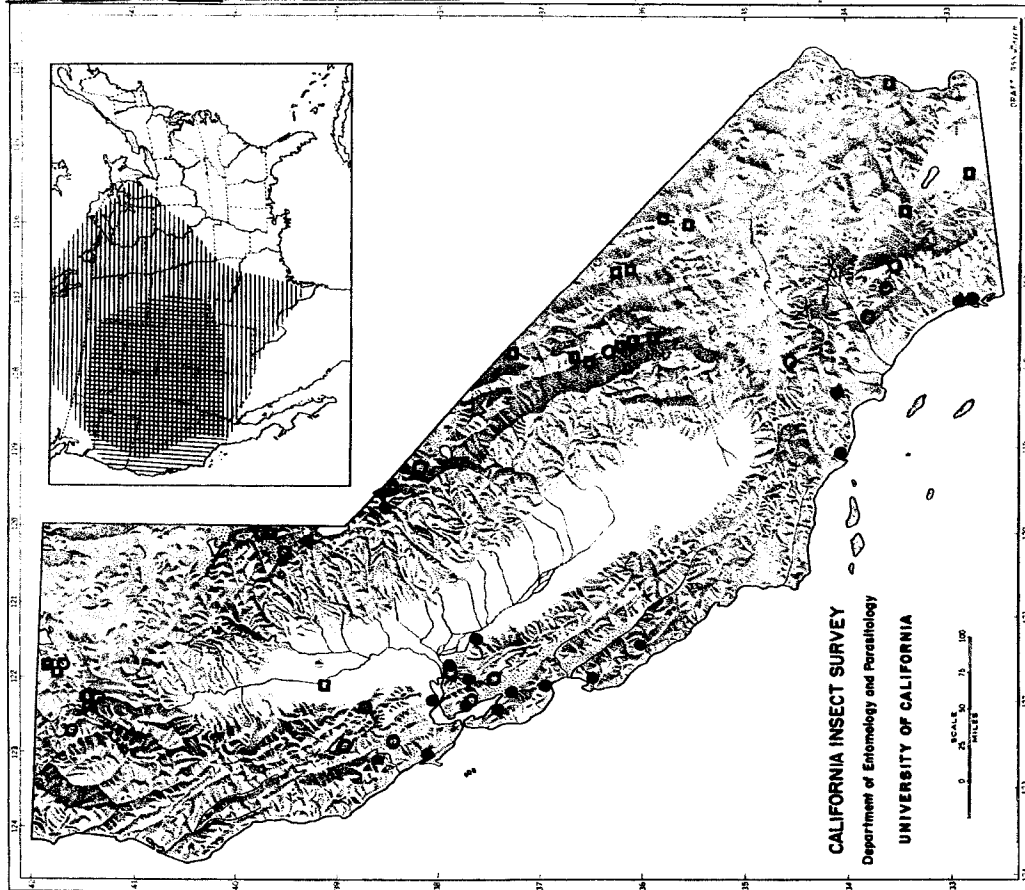
Geographical range: Montana to New Mexico, eastward to western Kansas and Nebraska and westward to Washington and California (map 7).

Occurrence in California:

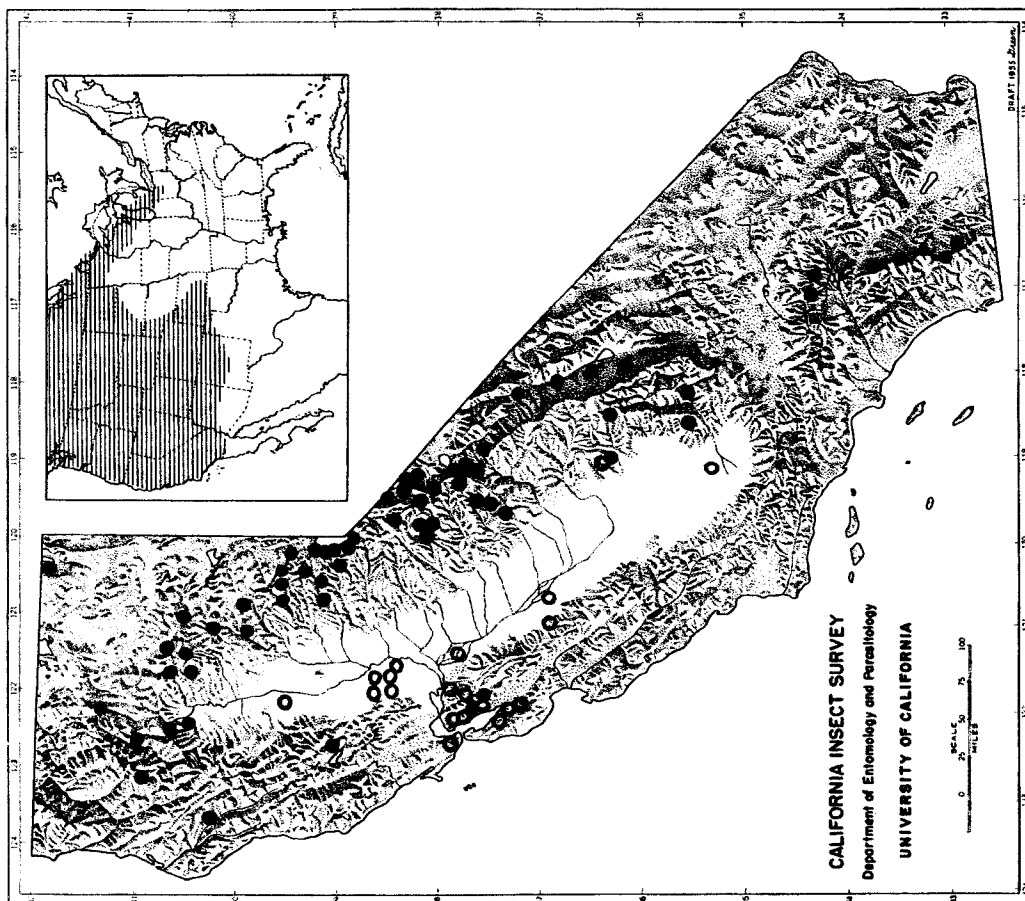
Widespread in lower mountain areas throughout the state and locally common. Seasonal occurrence, mid-August to mid- or late October. It has been taken on the flowers of *Bassharia emoryi*, Riverside, Riverside Co., IX-25-26 and X-21-34 (Timberlake, U.C.R.); on *Isocoma vernonoides*, Riverside, IX-17 to X-2 (Timberlake, U.C.R.); on *Isocoma acradenia*, Riverside, X-5-34 (Timberlake, U.C.R.); on *Gutierrezia sarothrae*, Riverside, IX-17-24 (Timberlake, U.C.R.); on *Gutierrezia lucida*, Morongo, San Bernardino Co., IX-25 to X-5, and Yucca Valley, San Bernardino Co., IX-28-44 and IX-30-44 (Timberlake, U.C.R.); on *Solidago occidentalis*, Victorville, San Bernardino Co., IX-28-38 (Timberlake, U.C.R.); on *Ericameria palmeri*, Riverside, X-16-25 (Timberlake, U.C.R.); on *Ericameria arborescens*, Konocti Bay, Lake Co., IX-9-57 (Paul J. Arnaud, Jr., C.D.A.); on *Chrysothamnus nauseosus*, Macdoel, Siskiyou Co., VIII-21-54 (Joe Schuh, J.S.); and on *Chrysothamnus nauseosus consimilis*, Hallelujah Junction, Lassen Co., IX-6-57 (E. G. Lindsey, C.I.S.).

#### *Eulalia inaequalis* (Loew)

*Odontomyia inaequalis* Loew, 1865, Berliner Ent. Zeit., 9: 143 (Centuria VI, 24). Types, ♀, ♂, near Fort Resolution, Hudson Bay territory; in Museum of Comparative Zoology.



Map 7. Distribution, in California of *Eulalia hirtoculata* (James), solid circles; *E. tumida* (Banks), open circles; *E. communis* (James), open squares; and *E. inaequalis* (Loew), solid triangles. Inset: distribution in the United States of *E. communis*, horizontal lines, and *E. tumida*, vertical lines.



Map 8. Distribution in California of *Eulalia hoodiana* (Bigot), solid circles, and *E. colei* (James), open circles. Inset: Distribution in the United States of *E. hoodiana*.



Geographical range: Manitoba, Oregon, California, Utah, Colorado, western Nebraska, Mexico (Morelos, D.F.); at high elevations in the southern part of its range (map 7).

Occurrence in California:

Mono Co.: Topaz Lake, V-13-51 (T. R. Haig, U.C.D.)

Nevada Co.: Sagehen Creek, nr. Hobart Mills, VII-10-33 (John D. Lattin, G.F.K.).

*Eulalia communis* (James)

(Pl. 7, fig. 12; pl. 9, figs. 31, 32)

*Odontomyia communis* James, 1939, Bull. Brooklyn Ent. Soc., 34:220. Type, ♀, Fort Collins, Colorado; in collection of Colorado State University.

Geographical range: Michigan and Manitoba to Washington and southward to the Texas coast and southern California (map 7).

Occurrence in California:

Widespread in the deserts and in the dry valleys west of the Sierra and in the north. I have no records from the San Joaquin Valley and but one, Colusa, Colusa Co., VIII-3-55 (W. H. Lange, U.C.D.), from the Sacramento Valley. Seasonal occurrence, May to September, but mostly July. This species has been taken on flowers of *Lippia nodiflora* at Blythe, Riverside Co., VII-16-38 (Timberlake, U.C.R.), and on flowers of *Heliotropium curassavicum* at Mecca, Riverside Co., VI-23-36 (M. Wasbauer, C.I.S.). It has been reared from larvae taken from 5 per cent saline water at Badwater, Death Valley, by Dr. Deane Furman.

Discussion:

This is a highly variable species. Characteristically, the abdominal pattern of the female consists of a series of discretely separated crossbands, whereas that of the male forms a longitudinal strip extending from the base of the abdomen well onto the fifth tergite. In the adult female sent to me by Dr. Furman as a result of his rearing, the abdominal pattern assumes much the *pubescens* type of pattern, though the black is not as extensive as in *inaequalis*. There are some desert specimens that I am unable to place; the coloration in these goes to the other extreme, the abdomen very pallid in both sexes. The black median marking of the face is quite characteristic in the female; usually the face of the male is wholly black, though it may be much as in the female.

*Eulalia alticola* (James)

(Pl. 7, figs. 17, 18)

*Odontomyia alticola* James, 1932, Jour. N. Y. Ent. Soc., 40: 437. Type, ♀, Fort Collins, Colorado; in collection of Colorado State University.

Geographical range: Montana to western Nebraska and eastern Oregon, south to northern New Mexico, Arizona, and southern California (see map 6).

Occurrence in California:

The mountains of the southern half of the state, both in the Coast Range and the southern Sierra Nevada; also at lower elevations early and late in the season. Seasonal occurrence, mostly July, but as early as April 11 and as late as October 21. This species has been taken at Riverside, Riverside Co., IX-1-41, on *Schinus molle*; at Oro Grande, San Bernardino Co., X-21-51, on *Chrysothamnus nauseosus*; at Yucca Valley, San Bernardino Co., VIII-20-26, on *Croton californicus* and IX-30-44, on *Gutierrezia lucida*; and at Cushenbury Springs, IX-1-36, on *Lepidospartum squamatum* (all Timberlake, U.C.R.).

Discussion:

The seasonal distribution of the lower elevation form of this species and of *arcuata* suggest the possibility of two generations a year, a phenomenon which, to my knowledge, has not been demonstrated in the aquatic Stratiomyidae. A second and more likely possibility is that there is an overlap of broods, with adult emergence occurring both early and late in areas where the normal developmental season is long. This explanation is more in keeping with the known facts concerning the bionomics of the aquatic forms.

*Eulalia arcuata* (Loew)

*Odontomyia arcuata* Loew, 1872, Berliner Ent. Zeit., 16: 52 (Centuria IX, 4). Type, ♀, California; in Museum of Comparative Zoology.

Geographical range: Oregon, southwestern Idaho, California, Nevada, Utah, extreme southwestern Colorado, northwestern New Mexico (see map 6).

Occurrence in California:

Throughout the state, but not common. Seasonal occurrence, mostly June and July; it has

been taken as early as April 23 at Saratoga Springs, Death Valley (Belkin and McDonald, U.C.L.A.), and I have several records for September, all in warm, dry areas.

**Discussion:**

The *arcuata* complex, involving *occidentalis* (James), *inaequalis* (Loew), *idahoensis* (James), *flava* (Day), and *communis* (James), needs intensive study before the exact status and limits of the taxa involved can be determined. At present, it looks as if either a single polytypic species or a superspecies may be involved, but any positive statement at this time would be premature.

**Subgenus *Catatasina* Enderlein**

***Eulalia hoodiana* (Bigot)**

(Pl. 7, fig. 16; pl. 8, fig. 23)

*Odontomyia hoodiana* Bigot, 1887, Ann. Soc. Ent. France (6) 7: 25. Type, ♂, Mt. Hood, Oregon; in Bigot Collection.

Geographical range: British Columbia to Manitoba and Minnesota, eastward as a rarity to Ohio, southward and westward to Kansas, New Mexico, Arizona, and California (see map 8).

**Occurrence in California:**

Widespread throughout the mountain areas of the state; very common in the Sierra, uncommon in the Coast Range. Seasonal occurrence, March through July, most common mid-May to mid-July. This species has been taken on the flowers of *Arctostaphylos glauca* at Cedar Crest, San Jacinto Mts., Riverside Co., III-16-40 (Timberlake, U.C.R.) and on the flowers of *Horkelia* at Sequoia Lake, Tulare Co., VI-12-25 (U.C.R.).

***Eulalia pilosa* (Day)**

(Pl. 9, fig. 33)

*Odontomyia pilosa* Day, 1882, Proc. Acad. Nat. Sci. Philadelphia, 1882: 76. Type, ♂, California; in Snow Entomological Collection, University of Kansas.

Geographical range: Washington, Oregon, California, Arizona, Utah (map 9).

**Occurrence in California:**

Widespread and moderately common west of the Sierra Nevada. Seasonal occurrence, February to early June; most common from mid-March to early May. It has been taken on *En-*

*celia farinosa* at Palm Canyon, Riverside Co., IV-15-38 (R. M. and G. E. Bohart, G.E.B.); on *Ranunculus californicus* at Rancheria, near Boonville, Mendocino Co., IV-30-49 (Claude I. Smith, C.I.S.); on *Rhamnus crocea* at Tujunga Wash, Los Angeles Co., IV-17-27 (P. H. Timberlake, U.C.R.); and on *Cryptantha intermedia* at Camp Pendleton, 16 miles northwest of Ocean-side, San Diego Co., IV-22-46 (Timberlake, U.C.R.).

***Eulalia colei* James**

(Pl. 6, fig. 8; pl. 8, fig. 27)

*Odontomyia colei* James, 1936, Ann. Ent. Soc. Amer., 29:532. Type, ♂, Panoche Creek, California; in California Academy of Sciences.

Geographical range: Idaho, California (see map 8).

**Occurrence in California:**

Apparently restricted to the San Joaquin and Sacramento valleys and the San Francisco Bay area, where it is fairly common. It has been taken on the flowers of *Layia platyglossa* at Antioch, Contra Costa Co., VI-18-37 (Van Dyke, C.A.S.). Seasonal occurrence, April to early August; apparently most common in late April and May.

***Eulalia pubescens* (Day)**

*Odontomyia pubescens* (Day), 1882, Proc. Acad. Nat. Sci. Philadelphia, 1882: 72. Cotypes, ♀, New York, and ♂, California; in Snow Entomological Collection, University of Kansas.

Geographical range: southern Canada and the northern half of the United States, coast to coast, and extending into the western mountains southward to New Mexico and California.

**Occurrence in California:**

The only California record known to me is that of the male cotype.

**Subgenus *Odontomyiina* Enderlein**

***Eulalia pilimana* (Loew)**

(Pl. 8, figs. 19, 29)

*Odontomyia pilimana* Loew, 1865, Berliner Ent. Zeit., 9: 146 (Centuria VI, 27). Types, ♂.

♀, Illinois; in Museum of Comparative Zoölogy.

Geographical range: Southeastern Canada and the eastern United States south to Virginia and Kansas; Colorado, Utah, Idaho, Oregon, and extreme northern California (see map 9).

Occurrence in California:

Modoc Co.: Cedarville, VII-9-46 (P. D. Hurd, Ray F. Smith, C.I.S.). Lake City, VII-9-46 (Smith, C.I.S.).

Siskiyou Co.: Yreka, VII-4-50 (H. E. Cott, U.C.D.).

### *Eulalia virgo* (Wiedemann)

(Pl. 8, figs. 20, 24)

*Stratiomys virgo* Wiedemann, 1830, Aussereurop. Zweifl. Insekten, 2: 69. Type, ♂, Savannah, Georgia; in Wiedemann collection, Zoological Museum of Vienna.

Geographical range: Southern Canada and the northern two thirds of the United States, also southward on the Atlantic seaboard to Florida. (See map 9.)

Occurrence in California:

Though widespread in the Northwest, this species seems to reach the limit of its range in northern California. I have but one record:

Shasta Co.: Lake Britton, VI-29-47 (T. F. Leigh, C.I.S.).

### *Eulalia americana* (Day)

*Odontomyia americana* Day, 1882, Proc. Acad. Nat. Sci. Philadelphia, 1882: 77. Type, ♂, California; in Snow Entomological Collection, University of Kansas.

Geographical range: Oregon, California.

Occurrence in California:

San Diego Co.: Boulevard, VI-27-52 (Knull and Knull, O.S.U.).

### Genus *Anoplodonta* James

The only known species of this genus, *Anoplodonta nigrirostris* (Loew), is placed on the hypothetical list of California species, although it probably does not occur in the state. The known geographical range is from Alberta eastward to Michigan, then southward through the West Central and Rocky Mountain states, into Mexico (Colima, Nuevo Leon). It reaches

its western-known limit in southern Idaho, Utah, and eastern Arizona.

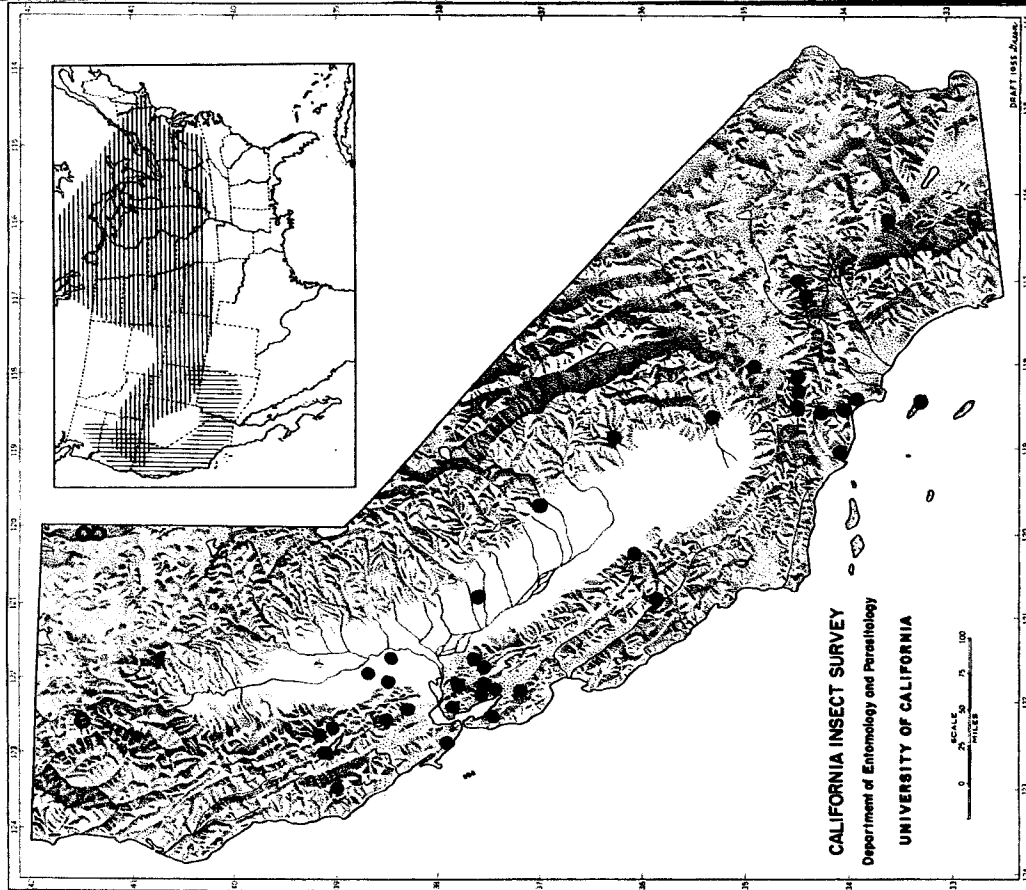
### Genus *Hedriodiscus* Enderlein

This is essentially a neotropical genus, several members of which have become adapted quite successfully to the warmer parts of temperate North America. Four species are known to occur in California; a fifth, *varipes* (Loew), occurs as close as Utah and Arizona and is, consequently, placed on the hypothetical list.

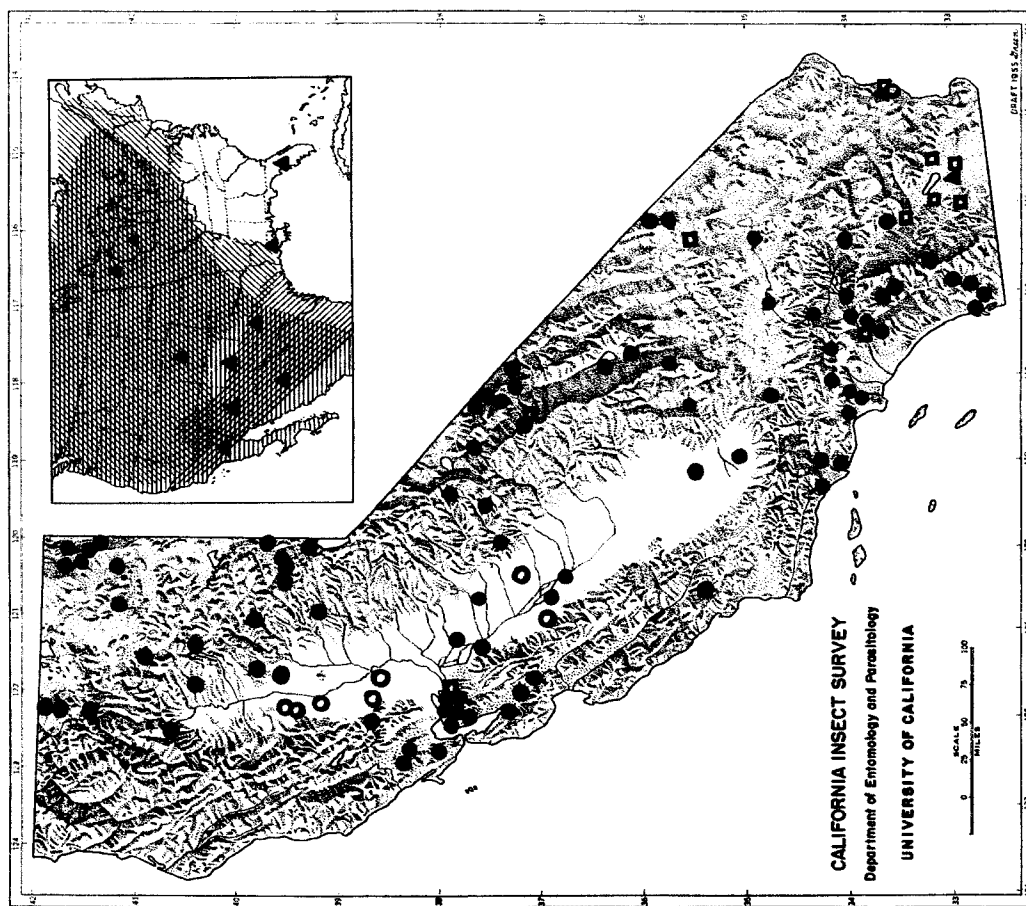
The larvae are aquatic. The bionomics of *H. vertebratus* are relatively well known; the larvae live among floating vegetation in small streams, where they feed on microorganisms, algae, and the soft parts of plants. Like *Eulalia* and *Stratiomys*, they withstand desiccation remarkably well. The larvae of *truquii* seem to inhabit similar situations.

### Key to the California Species of *Hedriodiscus*

1. Face in lateral profile tuberculate, the tubercle extending forward almost as far as the apex of the first antennal segment (fig. 30); face of female with a small black spot on each side; branches of media represented by distinct though weak folds, indistinguishable in color from the membrane; length usually less than 10 mm . . . . . 2.  
Face in lateral profile receding (fig. 28); that of the female wholly yellow; branches of media pigmented on at least part of their course and consequently well differentiated from the membrane . . . . . 3
2. Oral margin yellow; sides of mesonotum yellow or yellowish brown, at least behind the suture; mesonotum of female with dorsocentral pale stripes which are usually quite prominent . . . . . *trivittatus*  
Oral margin black in the male, usually marked with black in the female; sides of mesonotum wholly black in the male; mesonotum without dorsocentral pale stripes in either sex . . . . . *vertebratus*
3. Black of fourth tergum reaching the lateral margin in both sexes; tibiae and usually front femur blackened on apical fourth, rarely, in some pallid specimens, not so; mesonotum never with dorsocentral pale



Map 9. Distribution in California of *Eulalia pilosa* (Day), solid circles; *E. pilimana* (Loew), open circles; *E. virgo* (Wiedemann), solid triangles; and *E. americana* (Day), open squares. Inset: Distribution in the United States of *E. pilimana*, horizontal lines, and *E. pilosa*, vertical lines.



Map 10. Distribution in California of *Hedriodiscus truquii* (Bellardi), solid circles; *H. vertebratus* (Say), open circles; *H. currani* (James), open squares; and *H. trivittatus* (Say), solid triangles. Inset: Distribution in the United States of *H. truquii*, horizontal lines; *H. vertebratus*, oblique lines directed downward and left; *H. currani*, oblique lines directed downward and right; and *H. trivittatus*, state and national records only indicated by solid triangles.

stripes or vittae; scutellum wholly yellow (♀) or with a black spot at the base (♂), but never with abundant erect black hairs (Great Lakes area to Alberta, southward through the mountains to Arizona) . . . . . *varipes*  
Black of fourth tergum reaching lateral margin in female only, although the male may have disconnected spot on each margin; femora yellow, tibiae at most blackish at the apex, although femora and tibiae may be partly castaneous . . . . . 4

4. Scutellum of male black at base, with very dense, erect black pile on the black area; that of female wholly yellow, or at most very narrowly black at base, but with abundant erect black pile; dorsocentral spots absent . . . . . *currani*  
Scutellum of male black at base but without conspicuous erect black hairs; that of female with yellow pile only; dorsocentral pale spots, sometimes expanded into longitudinal vittae, often present, especially in the female . . . . . *truquii*

### *Hedriodiscus trivittatus* (Say)

(Pl. 8, fig. 30; pl. 9, fig. 41)

*Stratiomys trivittatus* Say, 1829, Jour. Acad. Nat. Sci. Philadelphia, 6: 160 (Complete Works, 2, 356). Type, sex not stated but obviously ♀, Mexico; lost.

Geographical range: California to Florida, southward to Central America, northward through Colorado to Minnesota and Wisconsin. The northward arm of the range (see map 10) is an interesting phenomenon.

Occurrence in California:

Imperial Co.: No locality, V-29-12 (J. C. Bridwell, U.S.N.M.). Laguna Lake, VII-21 to 22-52 (J. N. Belkin, U.C.L.A.) (form *leucogaster*).

Riverside Co.: Blythe, V-17-47 (J. W. MacSwain, C.I.S.) and VI-26-46 (W. F. Barr, C.I.S.).

#### Discussion:

*Odontomyia leucogaster* James seems to be merely a form with a wholly pale abdomen. The distributional pattern may warrant its consideration as a subspecies of *trivittatus*, although this is somewhat doubtful.

### *Hedriodiscus vertebratus* (Say)

(Pl. 8, fig. 21; pl. 9, fig. 36)

*Odontomyia vertebrata* Say, 1824, Long's Second Expedition, p. 369 (Complete Works, I, p. 251). Type, ♂, Northwest Territory; lost. Geographical range: General, southern Canada and northern United States, southward to Virginia, Louisiana, Texas, and California (map 10).

Occurrence in California:

Colusa Co.: Colusa, VIII-3-55 (R. E. Darby, U.C.D.) and VII-5-55 (W. H. Lange, U.C.D.).

Glenn Co.: Artois, V-16-54, on *Foeniculum vulgare* (M. Wasbauer, C.I.S.); VII-10-52 (J. W. MacSwain, C.I.S.); VII-11-52 (H. L. Hanson, C.I.S.).

Merced Co.: Los Banos, V-22-18 (E. P. Van Duzee, C.A.S.).

Riverside Co.: Blythe, VII-15-38, on *Lippia nodifera* (P. H. Timberlake, U.C.R.).

Yolo Co.: Woodland, VIII-14-55, VIII-15 to 16-53 (A. T. McClay, U.C.D.); VIII-25-55, on *Sagittaria* (H. R. Moffitt, U.C.D.); VIII-25-55, sweeping rice (E. A. Kurtz, U.C.D.).

### *Hedriodiscus currani* (James)

*Odontomyia truquii currani* James, 1932, Amer. Mus. Novitates, 571: 6. Type, ♂, Baboquivari Mts., Arizona; in American Museum of Natural History.

Geographical range: California, Nevada, Arizona, New Mexico, Texas, Mexico (map 10).

Occurrence in California:

Contra Costa Co.: Antioch, VII-19-41 (G. E. Bohart, G.E.B.).

Imperial Co.: No locality, V-29-12 (J. C. Bridwell, U.S.N.M.). Brawley, V-10-52 (I. Hannon, U.A.). Hot Mineral Springs, IV-25-53 (J. Belkin, K. Newman, U.C.L.A.). Laguna Lake, VII-21 to 22-53 (J. Belkin, U.C.L.A.).

Inyo Co.: Big Pine, 6,000 ft., VI-16-42 (R. Bohart, R.M.B.).

Los Angeles Co.: Azusa, V-11-25 (S.W.B.).

Riverside Co.: Blythe, on flowers of *Lippia nodiflora*, VII-5-38 (P. H. Timberlake, U.C.R.). Mecca, 4 mi. E., VII-16-56, on *Croton californicus* (M. Wasbauer, C.I.S.). Salton Sea, VII-22-48 (A. T. McClay, U.C.D.).

San Bernardino Co.: Saratoga Springs, Death Valley, V-30-53 (A. Fukushima, U.C.L.A.).

*Hedriodiscus truquii* (Bellardi)

(Pl. 6, figs. 7, 9; pl. 8, fig. 28)

*Odontomyia truquii* Bellardi, 1859, Saggio di Ditterologia Messicana, I, p. 34. Type, sex not stated but obviously ♀, Cuernavaca, Mexico; in Bellardi Collection, Turin, Italy.

Geographical range: Ontario, New York, and Ohio westward to the Pacific Coast, southward into Mexico (map 10).

## Occurrence in California:

The wide geographical distribution of this species is mirrored in its broad range within the state. Records include all parts of California except the northern coast and range in elevation from below sea level in Death Valley to about 11,000 ft. at Big Pine Creek, Inyo County. The seasonal range is from late April to mid-October, but mostly June through September. P. H. Timberlake (U.C.R.) has taken it at Riverside on flowers of *Encelia farinosa*, *Isocoma vernonioides*, *Eriogonum fasciculatum*, *Salix gooddingii*, *Gutierrezia lucida*, *Baccharis emoryi*, *Cryptantha intermedia*, *Gutierrezia sarothrae*, *Maytenus boaria*, and mint. Other food plants, as indicated by the Timberlake collection, are *Eriogonum plumatella*, *Solidago confinis*, *Eriogonum nodosum*, and *Petalonyx thurberi* at Morongo Valley; *Croton californica* at San Felipe Creek and Yucca Valley; *Frasera parryi* and *Eriogonum elongatum* at Warner Springs; *Hemizonia fasciculata* at Oceanside; and *Solidago occidentalis* at Victorville. It has also been collected on *Chrysothamnus nauseosus mohavensis* at Rosamond, Kern Co., IX-8-56 (P. D. Hurd, C.I.S.).

## Discussion:

Curran has distinguished as variety *innotata* that form in which the dorsocentral spots are wanting. However, this form does not follow distributional pattern of a subspecies, and it is much more common in the male than in the female; there is, therefore, no advantage in maintaining it. In the west, males referable to *innotata* commonly have the mesonotum black laterally before the suture, whereas in the type of *innotata*, as in typical *truquii*, the mesonotum is yellow laterally in both sexes.

Genus *Myxosargus* Brauer*Myxosargus knowltoni* Curran

(Pl. 10, figs. 44, 48)

*Myxosargus knowltoni* Curran, 1929, Amer. Mus. Novitates, 378, p. 2. Type, ♂, Clearfield, Utah; in American Museum of Natural History.

Geographical range: Utah, Idaho, Oregon, California (map 11).

## Occurrence in California:

Inyo Co.: Big Pine, VI-17-29 (E. P. Van Duzee, C.A.S.). Deep Springs, VII-16-53 (E. I. Schlinger, U.C.D.). Lone Pine, VI-1-37 (N. W. Frazier, G.R.B.) and VI-8-29 (E. P. Van Duzee, C.A.S.). Cartago, 2 mi. N., VII-11-53 (R. M. Bohart, U.C.D.).

Kern Co.: Onyx, VII-23-40 (D. E. Hardy, K.U.).

Los Angeles Co.: Los Angeles, VIII-3-16 (O.S.U.).

San Bernardino Co.: Saratoga Springs, Death Valley, V-27 to 29-55 (J. N. Belkin, U.C.D.).

San Luis Obispo Co.: Black Lake Canyon, VII-16-52 (R. M. Bohart, U.C.D.); VII-22-48 (W. W. Wirth, C.I.S.). Oceano Beach, VIII-20-48 (W. W. Wirth, C.I.S.).

San Mateo Co.: Redwood City, VI-1952 (P. H. Arnaud, Jr., P.H.A.).

Santa Clara Co.: Stanford University, XI-22-50 (P. H. Arnaud, Jr., P.H.A.).

Shasta Co.: Anderson, IV to VII-1955 (Joe Willis, U.C.D.).

## Discussion:

This species apparently extends, in its range, from Utah, where it is very common at lower elevations, across southern Idaho and Oregon into California. Its occurrence in Nevada is hypothetical. Another member of the genus, *M. pilosus* James, occurs in Arizona but probably does not extend into California, *M. knowltoni* may readily be distinguished from *pilosus* by its wholly black antenna, that of *pilosus* being yellow on the basal two segments.

## Subfamily POTAMIDINAE

Genus *Dieuryneura* James*Dieuryneura obscura* Coquillett

(Pl. 9, fig. 39)

*Aochletus obscurus* Coquillett, 1902, Proc. U.S. Nat. Mus., 25: 98. Types, ♂♂, Los Angeles



Co., California, and Sulphur Springs Valley, Arizona; in United States National Museum. Geographical range: Davis Mountains of Texas, New Mexico, Arizona, California, northern Mexico (map 11).

Occurrence in California:

Los Angeles Co.: Los Angeles, VII-27-35 (Roger C. Smith, R.H.P.). Glendale, VII-28-49 (E. I. Schlinger, U.C.D.); VII-5-49 (E. I. Schlinger, C.I.S.). Palmdale, VII-6-33 (R. H. Beamer, K.U.).

Riverside Co.: Piñon Flat, San Jacinto Mts., V-27-39, VI-4-39 (M. A. Cazier, A.M.N.H.).

Santa Barbara Co.: Sunset Valley, VI-1939 (B. White, M.A.C.).

### Genus *Adoxomyia* Kertész

Five of the ten known Nearctic species occur in California. Little is known of the bionomics of this genus. Adults occur on vegetation, but seem to visit flowers only very rarely. The immature stages of the Nearctic species and their habits are unknown, but they are probably scavengers in decaying vegetation. The Indian *Euclitellaria heminopla* (Wiedemann), a member of a closely related genus, breeds in rotting papaya stems, plantains, and melons.

### Key to the California Species of *Adoxomyia*

(Modified from James, 1943)

1. Tarsi reddish yellow in large part, contrasting with the black tibiae; flagellum with basal segments reddish; pile of face entirely silvery . . . . . *argentata*  
Legs, including tarsi, wholly black, or black except for the kees . . . . . 2
2. Antennal flagellum reddish, at least on the basal segments . . . . . 3  
Antennal flagellum entirely black . . . . . 4
3. Pleura predominantly black-pilose; mesonotum of male with abundant, erect, black pile; venter black-pilose (reddish brown, in certain lights) on the basal segments . . . *lata*  
Thorax entirely pale-pilose; pile of mesonotum, in both sexes, appressed; venter entirely pale-pilose . . . . . *appressa*
4. Pleura and face of female black-pilose (male unknown) . . . . . *nigribarba*

Pleura of both sexes and face of female pale-pilose . . . . . *rustica*

### *Adoxomyia argentata* (Williston)

*Clitellaria argentata* Williston, 1885, Canad Ent., 17:127. Type, ♂, California, no locality; in Snow Entomological Collection, University of Kansas.

Geographical range: California, Arizona, New Mexico.

Occurrence in California:

No records other than the type.

### *Adoxomyia lata* (Loew)

(Pl. 9, figs: 38, 40)

*Clitellaria lata* Loew, 1872, Berliner Ent. Zeit., 16:55 (Centuria X, 9). Types, ♂, ♀, California, no locality; in Museum of Comparative Zoology.

Geographical range: Washington, Oregon, California, Arizona (map 12).

Occurrence in California:

Widespread, coastal areas and lower mountains up to 4,000 ft.; apparently absent in the Sacramento and San Joaquin valleys and in the southern deserts. Seasonal distribution, March 14 to June 25; mostly in May and June.

### *Adoxomyia appressa* James

*Adoxomyia appressa* James, 1935, Pan-Pac. Ent., 9:63. Type, ♂, Cloudcroft, N.M.; in Snow Entomological Collection, University of Kansas.

Geographical range: California, Arizona, New Mexico (map 12).

Occurrence in California:

Fresno Co.: Coalinga, V-14-38 (M. A. Cazier, M.A.)

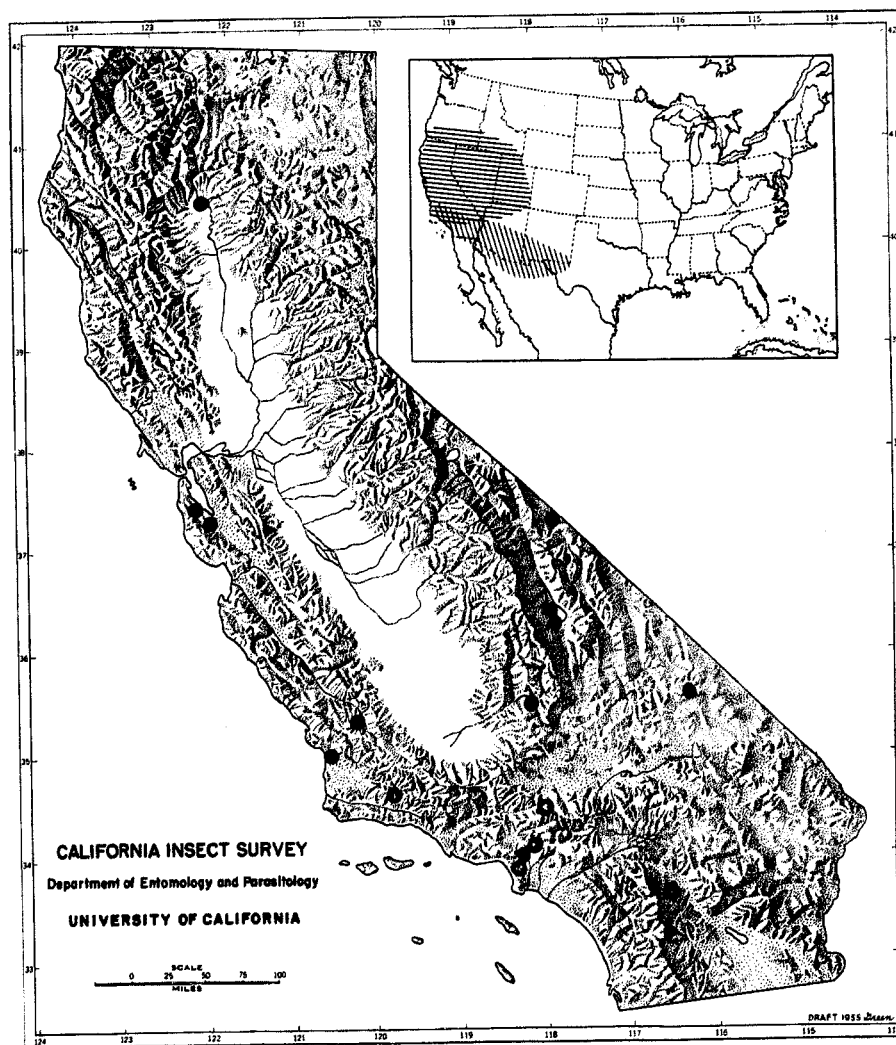
Mariposa Co.: El Portal, V-18-38 (M. A. Cazier, M.A.C.)

### *Adoxomyia nigribarba* James

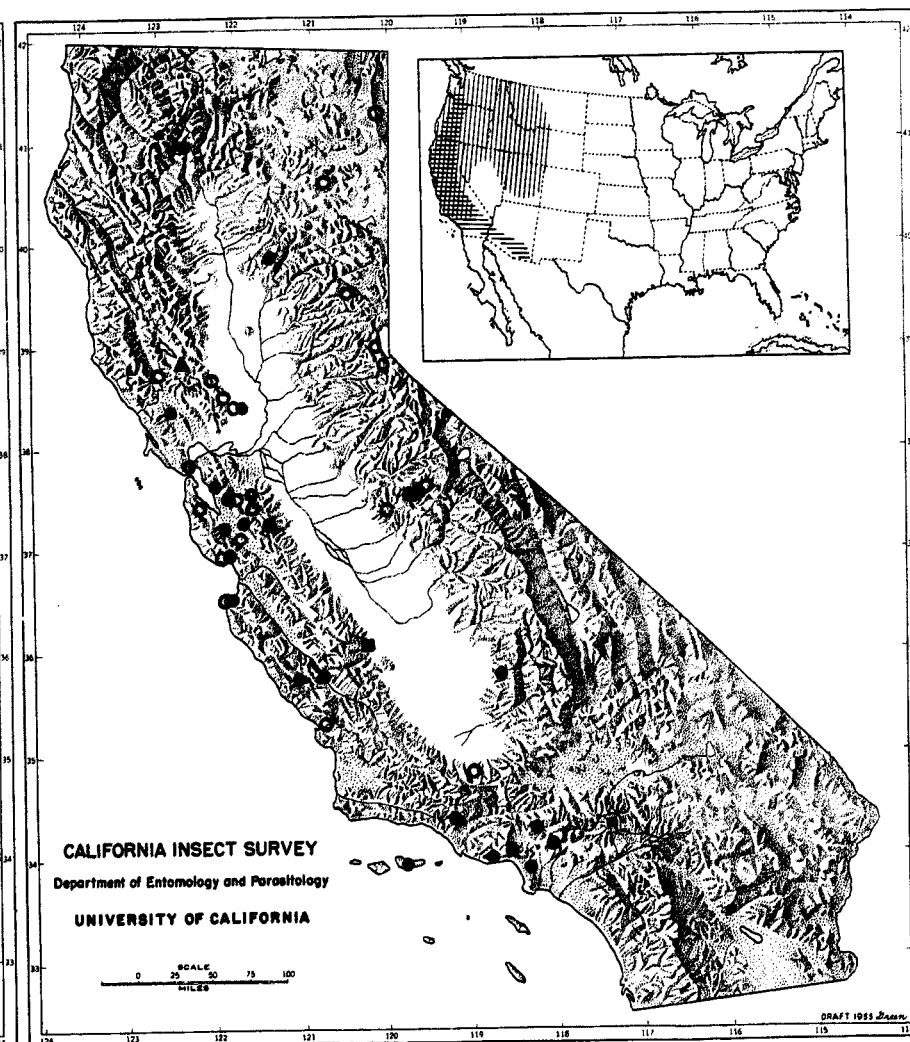
*Adoxomyia nigribarba* James, 1943, Proc. Ent. Soc. Wash., 45:168. Type, ♀, Klamath Lake, Oregon; in California Academy of Sciences.

Geographical range: California, Oregon.

Occurrence in California:



Map 11. Distribution in California of *Myxosargus knowltoni* Curran, solid circles, and *Dieuryneura obscura* (Coquillett), open circles. Inset: Distribution in the United States of *M. knowltoni*, horizontal lines, and *D. obscura*, oblique lines.



Map 12. Distribution in California of *Adoxomyia lata* (Loew), solid circles; *A. rustica* (Osten Sacken), open circles; *A. appressa* James, solid squares; and *A. nigribarba*, solid triangles. Inset: Distribution in the United States of *A. lata*, horizontal lines, and *A. rustica*, vertical lines.

Lake Co.: North fork Cache Creek, Highway 20, IV-19-54 (R. C. Bechtel, U.C.D.).

### *Adoxomyia rustica* (Osten Sacken)

*Clitellaria rustica* Osten Sacken, 1877, Geol. and Geog. Survey, Bull. 3, No. 2, p. 213. Types, ♂, ♀, The Geysers, California (first locality in cotype series); in Museum of Comparative Zoölogy.

Geographical range: Washington, Oregon, Montana, California, Utah (map 12).

Occurrence in California:

The coastal and lower mountain areas of northern and central California. Seasonal distribution, April 2 to July 14; most records are for May. It has been taken on *Anthemis cotula* at Atascadero, 8 mi. W., San Luis Obispo Co., VII-3-56 (E. G. Linsley, C.I.S.).

### Genus *Nemotelus* Geoffroy

Thirteen species of this genus, three belonging to the typical subgenus and the remaining ten being *Melanonemotelus*, are known to occur in California; a fourteenth species, *N. (M.) communis* Hanson, which has been recorded from Arizona, Idaho, and Oregon, is placed on the hypothetical list. Some species are fairly well localized in general distribution; others enjoy quite wide distribution; and one, *nigrinus* Fallén, spreads broadly over a large part of the Holarctic region. Adults often emerge in great numbers and in rather spasmodic occurrences; consequently a species which is considered rather rare may be well represented by a limited number of separate catches, whereas on the other hand relatively common species may be absent from collections. This fact, together with the failure of most collectors to recognize these flies as Stratiomyidae, has produced a somewhat spotty distributional pattern in mapping the species.

Adults frequent flowers, especially umbellifers and such composites as goldenrod, often in enormous numbers. They may also rest quietly in grass in or near moist places until disturbed, at such times occasionally rising in dense clouds. The larvae so far as known are aquatic; rearing records (entirely in species of the typical subgenus) indicate a preference for saline or brackish waters or soil wet with such water, and collecting records of adults of other

species suggest that such larval habitats may be common.

The records given below for the subgenus *Melanonemotelus* have had to be chosen with care, in light of the recent revision of this group by Hanson (1958) and the confusion that existed previously. Hanson had to make determinations in many cases on the basis of male genitalia, structures which had not previously been studied in any detail. My records for this subgenus, therefore, are not nearly as complete as they are for other flies treated in this work, and this fact must be taken into consideration in judging distributional data and maps.

### Key to the California Species of *Nemotelus*

(Adapted from James, 1936a, and  
Hanson, 1958)

1. Vein  $R_4$  present; abdomen of male largely or wholly white, that of female black or reddish marked with white to creamy triangular spots at the median apices of the terga (subgenus *Nemotelus*) . . . . . 2
- Vein  $R_4$  absent; abdomen black in both sexes, sometimes marked with white but not in the above pattern (subgenus *Melanonemotelus*) . . . . . 4
2. Lower sections of proboscis shorter than head, more or less thickened, either straight or upturned (fig. 50) . . . . . 3
- Lower sections of proboscis at least as long as head, slender, rigid and arcuate, the labella inconspicuous (fig. 49); humeri white; abdomen of female variably black to reddish except for the white apical triangles . . . . . *knowltoni*
3. Humeri entirely white; tibiae entirely pale; comparatively slender species; abdomen of female red, marked with white . . . . . *rufoabdominalis*
- Humeri each with a small yellow spot; tibiae largely black; more robust species; abdomen of female black, marked with white . . . . . *montanus*
4. Humeral callus with at least the anterior half black . . . . . 6
- Humeral callus with less than the anterior half black, usually wholly yellowish white . . . . . 5

5. Abdomen wholly black . . . . . *tenuistylus*  
Abdomen with apices of abdominal terga  
five and six creamy white; length of  
facial prominence at least one third width  
of eye . . . . . *albimarginatus*
6. Frons with two creamy white or buff spots,  
contiguous in the male . . . . . 7  
Frons immaculate, sometimes with dark  
brown spots . . . . . 14
7. Hind tibiae mostly yellowish, with only a  
narrow black band around each mesally;  
abdomen with a thin, pale yellow lateral  
line on each side; relatively large species  
(4-5 mm.) . . . . . *canadensis*  
Hind tibiae black, at most with the bases  
and apices yellowish; abdomen without a  
pale yellow lateral line on each side . . 8
8. All tibiae entirely black except for brown-  
ish extremities; body color shining black  
. . . . . *tristis*  
Fore and middle tibiae yellowish; body  
color black, usually with bluish or green-  
ish iridescence . . . . . 9
9. Pile of mesonotum long over entire surface  
. . . . . 10  
Pile of mesonotum mesally very short and  
inconspicuous, much longer near margins  
of mesonotum . . . . . 12
10. Male: Pile on mesonotum very fine, long  
but inconspicuous, erect or nearly so,  
whitish; posterior half of humeral callus  
creamy white as seen from dorsal aspect;  
gonostyli curved with blunt apices. Ari-  
zona, Idaho, and Oregon eastward to  
Indiana . . . . . *communis*<sup>1</sup>  
Male: Pile on mesonotum shining and con-  
spicuous, sometimes giving it a "shaggy"  
appearance, often with a buff tinge; hum-  
eral callus usually mostly black; gono-  
styli either curved and with sharp apices,  
or straight with blunt apices . . . . . 11
11. Gonostyli strongly curved, apices pointed  
. . . . . *politus*<sup>1</sup>  
Gonostyli straight or only slightly curved,  
apices rounded, blunt . . . . . *arator*<sup>1</sup>
12. Male: Gonocoxites with basal lamellae  
absent or only slightly evident (fig. 53)  
. . . . . *politus*<sup>1</sup>  
Male: Gonocoxites with basal lamellae  
complete (figs. 51, 52) . . . . . 13
13. Penis valves black, pincerlike, sclerotized  
(fig. 55) . . . . . *jamesi*<sup>1</sup>  
Penis valves transparent, membranous, nar-  
row and inconspicuous (fig. 56) . . . . .  
. . . . . *variabilis*<sup>1</sup>
14. Mesonotum with pubescence over entire  
surface; the pubescence often very short  
and inconspicuous mesally in the female,  
but at least a few clearly evident hairs  
immediately anterior to the scutellum . 15  
Mesonotum bare mesally, sometimes with a  
few very short hairs anteriorly but never  
immediately anterior to the scutellum;  
facial prominence usually intermediate in  
length between *beameri* and *variabilis*,  
although some females of *beameri* may key  
out here . . . . . *nigrinus*
15. Facial prominence very long, its length in  
the male half width of eye viewed lateral-  
ly, its length in female about equal to  
width of eye; frons never with spots . .  
. . . . . *beameri*  
Facial prominence not noticeably long and  
tapering, its length in the male less than  
half the width of eye viewed laterally, its  
length in the female less than width of  
eye; frons with or without brown spots . .  
. . . . . *variabilis*

### Subgenus *Nemotelus* Geoffroy

#### *Nemotelus knowltoni* James

(Pl. 10, fig. 49)

*Nemotelus knowltoni* James, 1936, Bull. Brook-  
lyn Ent. Soc., 31: 89. Type, ♂, St. George,  
Utah; in United States National Museum.

Geographical range: Western Texas and southern  
New Mexico to southern Utah, southern  
Nevada, and southern California (map 13).

Occurrence in California:

Inyo Co.: Surprise Canyon, Panamint Mts.,  
IV-24-57, on *Encelia farinosa*, and IV-28-53 (P.  
D. Hurd, C.I.S.).

#### *Nemotelus rufoabdominalis* Cole

(Pl. 10, fig. 50)

*Nemotelus rufoabdominalis* Cole, 1923, Proc.  
Calif. Acad. Sci., (4) 12: 459. Type, ♀, Te-

<sup>1</sup> It is virtually impossible to separate unassociated females of these species.

poca Bay, Sonora, Mexico; in California Academy of Sciences.

Geographical range: New Mexico, Arizona, California, Mexico (Sonora, Baja California) (map 13).

Occurrence in California:

Imperial Co.: Brawley, 8 mi. E., V-20-56 (T. R. Haig, U.C.D.). Calexico, V-2-49, flowers of *Salix exigua* (R. A. Fleck, U.C.R.); flowers of *Pluchea sericea*, V-2-49 (Fleck, U.C.R.); V-27-57 and IV-10-57 (E. I. Schlinger, U.C.D.). Heber, 12 mi. E., V-15-56 (T. R. Haig, U.C.D.). Hot Mineral Springs, IV-25-53 (U.C.L.A.). Niland, on *Heliotropium oculatum*, V-1-49 (P. H. Timberlake, U.C.R.). Travertine Rocks, 2 mi. S., III-29-36, flowers of mesquite (F. R. Platt, U.C.R.).

Inyo Co.: Furnace Creek, Death Valley, IV-27-56 (R. M. Bohart, U.C.D.).

Riverside Co.: Blythe, VIII-19-46 (P. D. Hurd, C.I.S.). Hunter's Spring, IV-25-53 (U.C.L.A.). Mecca, on *Heliotropium curassavicum*, IV-13-34 (Timberlake, U.C.R.). Palo Verde, 5 mi. N., on *Prosopis glandulosa* (R. C. Dickson, U.C.R.). Thousand Palms, on *Pluchea sericea*, IV-25-36 (Timberlake, U.C.R.). Thermal, 2 mi. S., IV-10-57 (E. I. Schlinger, U.C.D.). Ripley, on *Heliotropium oculatum*, IV-30-52 (Timberlake, U.C.R.).

San Diego Co.: Desert edge, IV-6-15 (M. C. Van Duzee, C.A.S.).

*Nemotelus montanus* James

*Nemotelus montanus* James, 1936, Bull. Brooklyn Ent. Soc., 31:90. Type, ♀, Alma, Colorado; in Colorado State University Collection.

Geographical range: Colorado, Utah, Oregon, California, Yukon Territory (map 13).

Occurrence in California:

Inyo Co.: Owens Valley, VIII-2-36 (R. M. Bohart, U.C.L.A.).

Mono Co.: Leavitt Meadow, VII-6-51 (E. L. Silver, U.C.L.A.); VI-28-51 (A. T. McClay, U.C.D.). Sardine Creek, 8,500 ft., VII-11 to 28-51 (A. T. McClay, R. W. Morgan, U.C.D.).

Nevada Co.: Sagehen, nr. Hobart Mills, VI-9-54 (R. H. Goodwin, C.I.S.; R. M. Bohart, U.C.D.). Hobart Mills, 4 mi. N.W., VII-5-51 (E. I. Schlinger, U.C.D.).

Subgenus *Melanonemotelus* Pleske

*Nemotelus tenuistylus* Hanson

*Nemotelus tenuistylus* Hanson, 1958, Univ. Kansas Sci. Bull., 38 (pt. 2): 1379. Type, ♂, Las Cruces, New Mexico; in United States National Museum.

Geographical range: Idaho, Nevada, California, New Mexico, Kansas (map 14).

Occurrence in California:

Inyo Co.: Furnace Creek, Death Valley, III-31-53 (J. W. MacSwain, C.I.S.). Surprise Canyon, Panamint Mts., IV-24-57, on *Eriogonum inflatum* (P. D. Hurd, C.I.S.).

San Bernardino Co.: Needles, IV-3-51 (J. W. MacSwain, C.I.S.).

*Nemotelus albimarginatus* James

*Nemotelus albimarginatus* James, 1936, Bull. Brooklyn Ent. Soc., 31:86. Type, ♂, Kingston, Utah; in United States National Museum.

Geographical range: British Columbia to South Dakota, Utah, and California (map 14).

Occurrence in California:

Fresno Co.: Panoche Creek (recorded by Hanson as "Panocho" Creek.)

Inyo Co.: Big Pine, 4,500 ft., VI-13-42 (R. M. Bohart, R.M.B.). Lone Pine, VI-6-39 (R. M. Bohart, R. M. B.); VI-13-37 (E. C. Van Dyke, C.A.S.).

Mono Co.: Benton, VII-10-50 (H. A. Hunt, U.C.D.).

Tulare Co.: Wood Lake, rotary trap, V-24-47 (Norman R. Frazier, C.I.S.).

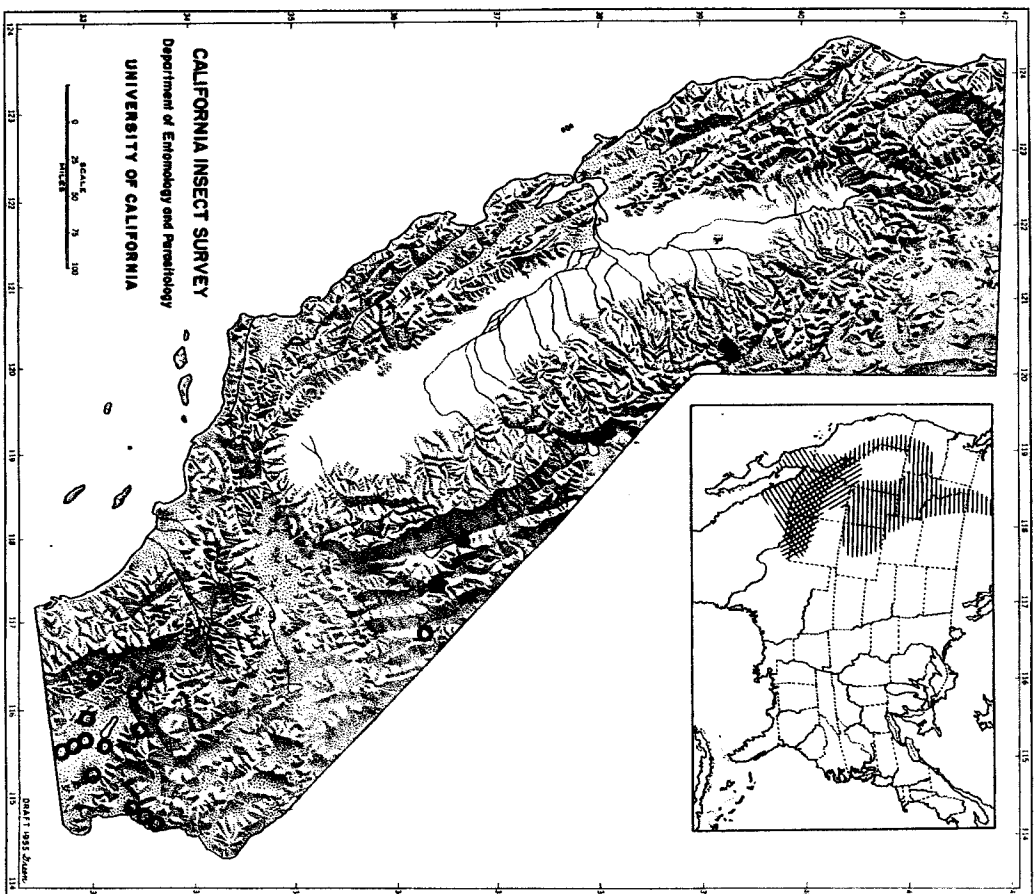
*Nemotelus canadensis* Loew

*Nemotelus canadensis* Loew, 1863, Berliner Ent. Zeit., 7: 7 (Centuria III, 12). Types, ♂, ♀, Fort Resolution, Hudson Bay territory; in Museum of Comparative Zoölogy.

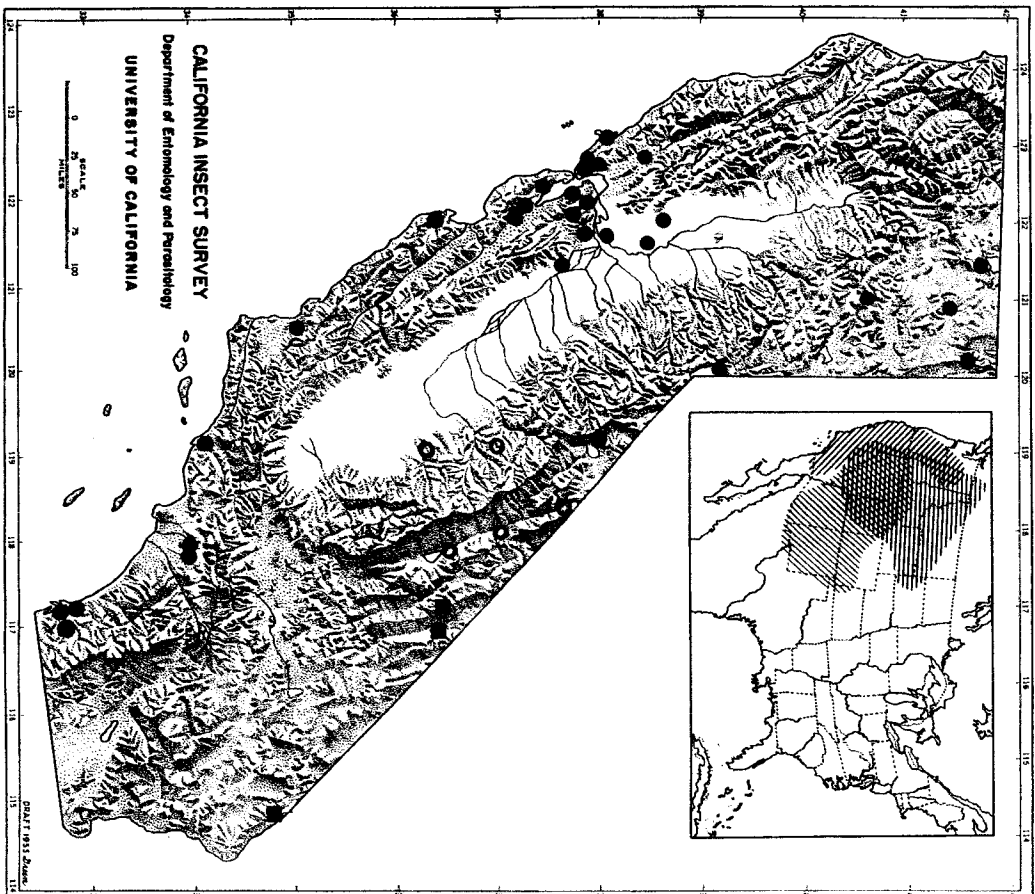
Geographical range: Hudson Bay to Alaska, southward to Colorado, Utah, Nevada, and northeastern California (map 15).

Occurrence in California:

Lassen Co.: Summit Camp, VI-28-49 (W.S.C.). Hallelujah Junction, VI-27-49 (W. F. Ehrhardt, W.S.C.). Spalding, VI-27-49 (P. D. Hurd, C.I.S.).



Map 13. Distribution in California of *Nemotelus knowltoni* James, solid squares; *N. montanus* James, solid circles; and *N. rufocaudominalis* Cole, open circles. Inset: Distribution in the United States of *N. montanus*, horizontal lines; *N. knowltoni*, oblique lines directed downward and right; and *N. rufocaudominalis*, oblique lines directed downward and left.



Map 14. Distribution in California of *Nemotelus arator* Melander, solid circles; *N. albimarginatus* James, solid squares; and *N. tenuistylus* Hanson, solid squares. Inset: Distribution in the United States of *N. albimarginatus*, horizontal lines; *N. arator*, oblique lines directed downward and right; and *N. tenuistylus*, oblique lines directed downward and left.



*Nemotelus tristis* Bigot

*Nemotelus tristis* Bigot, 1887, Ann. Soc. Ent. France (6) 7: 30. Types, ♀, ♂, "Californie"; in Bigot Collection.

Geographical range: Central California, east of the Sierra (map 15).

Occurrence in California:

Alameda Co.: Tilden Park, Berkeley Hills, IV-12-57 (J. A. Chemsak, C.I.S.).

Fresno Co.: Panoche Creek (recorded by Hanson).

Kern Co.: Woody, III-30-57 (P.D. Hurd, C.I.S.).

Madera Co.: Oakhurst (recorded by Hanson).

San Joaquin Exp. R., III-25-53, on *Baeria* (H. E. Childs, C.I.S.).

Santa Clara Co.: Mt. Hamilton, IV-15-47 (G. E. Bohart, C.I.S.). San Antonio Valley, IV-20-48 (Ray F. Smith, C.I.S.).

Yolo Co.: Davis; Putah Canyon (recorded by Hanson).

*Nemotelus politus* Hanson

(Pl. 10, fig. 53)

*Nemotelus politus* Hanson, 1958, Univ. Kansas Sci. Bull. 38 (pt. 2): 1364. Type, ♂, Midvale, Utah; in Snow Entomological Collection, University of Kansas.

Geographical range: Montana, Washington, Oregon, Idaho, Utah, Nevada, California (map 15).

Occurrence in California:

Inyo Co.: Deep Spring, VII-16-53 (J. W. MacSwain, C.I.S.). Westgard Pass, V-26-53 (J. W. MacSwain, C.I.S.).

Kern Co.: No locality (S.W. Williston, M.T.J.).

Lassen Co.: Hallelujah Jct., VII-4-49 (J. W. MacSwain, C.I.S.).

Mono Co.: Sardine Creek, 8,500 ft., VI-28-51 (J. W. MacSwain, C.I.S.).

Monterey Co.: Paradise Springs (recorded by Hanson).

San Bernardino Co.: Victorville, V-1-53 (G. O. Marsh, L. O. Schuster, C.I.S.).

*Nemotelus arator* Melander

(Pl. 10, fig. 54)

*Nemotelus arator* Melander, 1903, Psyche, 10: 179. Types, ♂ ♀, San Diego Co., California; in Melander Collection, Riverside, California.

Geographical range: Washington, Oregon, California (map 14).

Occurrence in California:

Widespread in the northern half of the state and along the Coast Range and adjacent lowlands at least southward to the Mexican border. This is the most common *Nemotelus* in California, according to our records. Seasonal distribution, March through August.

*Nemotelus jamesi* Hanson

(Pl. 10, figs. 51, 55)

*Nemotelus jamesi* Hanson, 1958, Univ. Kansas Sci. Bull. 38 (pt. 2): 1367. Type, ♂, Prosser, Washington; in State College of Washington Collection.

Geographical range: California, Idaho, Washington, Utah, Nebraska (map 16).

Occurrence in California:

Lassen Co.: Hallelujah Jct., VI-27-49 (Claude L. Smith, C.I.S.).

San Diego Co.: Escondido (recorded by Hanson).

*Nemotelus variabilis* Hanson

(Pl. 10, figs. 52, 56)

*Nemotelus variabilis* Hanson, 1958, Univ. Kansas Sci. Bull. 38 (pt. 2): 1368. Type, ♂, Hibernia, Florida; in Snow Entomological Collection, University of Kansas.

Geographical range: California and Nevada to Texas and along the Gulf strip to Florida (map 15).

Occurrence in California:

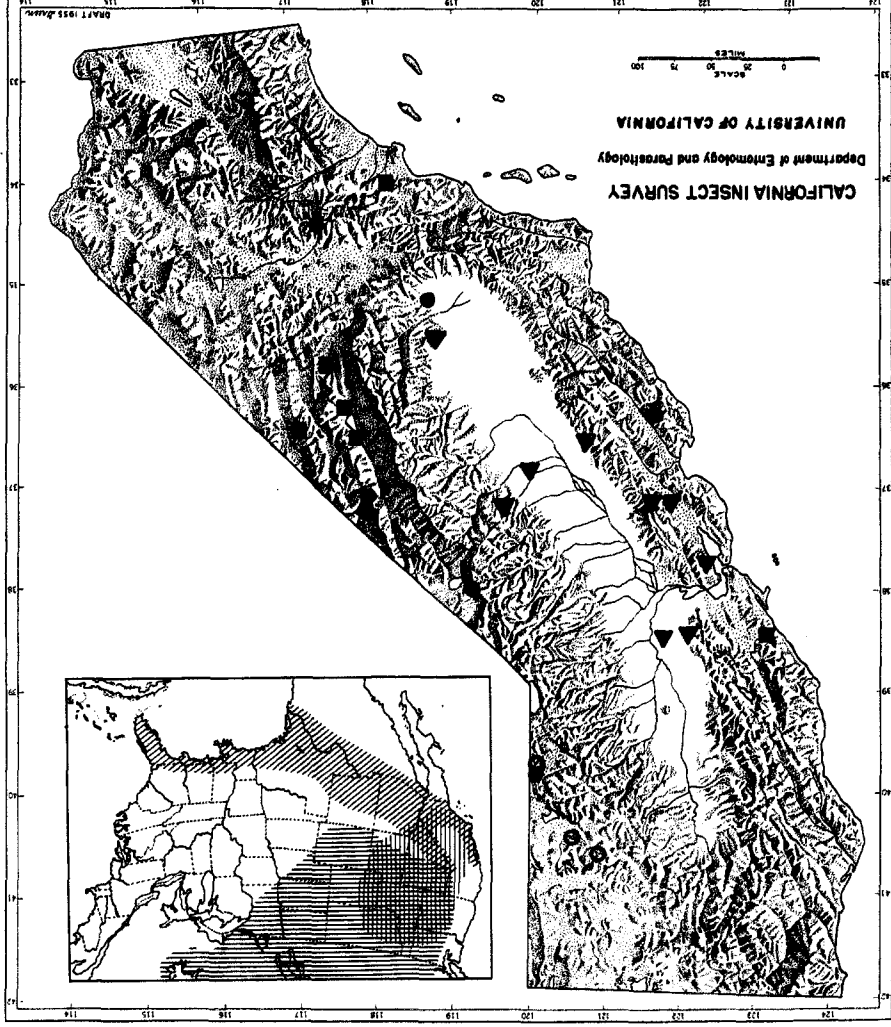
• This species has been recorded by Hanson from "Arroyo R.; Cazadero; Lone Pine, Inyo Co.; Little Lake, Inyo Co.; Los Angeles; Olanche, Inyo Co.; Panamint Mountains, Inyo Co." I have not seen specimens. Hanson gives the range of flight records as "March 27 (southern Texas) to August 8 (California)."

*Nemotelus beameri* James

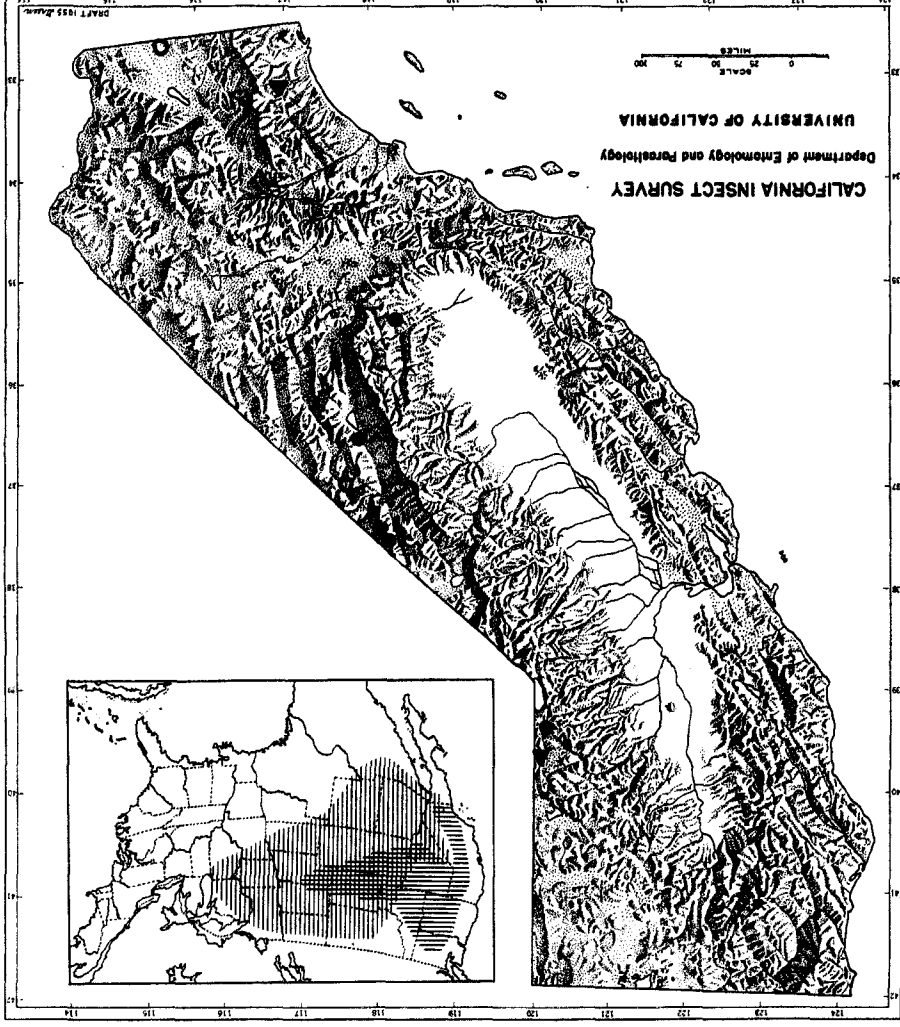
*Nemotelus beameri* James, 1933, Jour. Kansas Ent. Soc., 6: 70. Type, ♀, Northgate, Colorado; in Snow Entomological Collection, University of Kansas.

Geographical range: Illinois westward to Mon-

Map 15. Distribution in California of *Nemotelus politus* Hanson, solid circles; *N. canadensis* Loew, open circles; *N. tristis* Bigot, solid triangles; and *N. variabilis* Hanson, solid squares. Insert: *N. canadensis*, horizontal lines; *N. politus*, vertical lines; *N. variabilis*, oblique lines.



Map 16. Distribution in California of *Nemotelus nigrinus* Fallen, solid circles; *N. beameri* James, open circles; and *N. jamesi* Hanson, solid triangles. Insert: Distribution in the United States of *N. jamesi*, horizontal lines, and *N. beameri*, vertical lines. The general distribution of *N. nigrinus* is omitted because it would cover most of the map north of the Mexican border.



tana, southward to New Mexico and California (map 16).

Occurrence in California:

Imperial Co.: Calexico, IV-10-57 (E. I. Schlinger, C.I.S.).

Inyo Co.: Surprise Canyon, Panamint Mts., IV-24-57 (J. Powell, C.I.S.).

*Nemotelus nigrinus* Fallén

*Nemotelus nigrinus* Fallén, 1817, Diptera Sueciae, 6: 3. Information concerning type not available.

Geographical range: Europe; Alaska, Yukon Territory and Northwest Territories through most of Canada and the United States and into the highlands of Mexico (map 16).

Occurrence in California:

Inyo Co.: Lone Pine (recorded by Hanson).

Kern Co.: Tejon Canyon (recorded by Hanson).

Mono Co.: Blanco's Corral, White Mountains, 10,000 ft., VII-20-53 (J. W. MacSwain, C.I.S.). Crooked Creek, White Mountains, 9,000 ft., VI-20-53 (J. W. MacSwain, C.I.S.).

Nevada Co.: Sagehen, nr. Hobart Mills, VII-21-54 (R. H. Goodwin, C.I.S.).

Discussion:

This species has apparently spread to all inhabitable parts of temperate North America and has become differentiated into several forms which, according to Hanson, have identical male genitalia. Hanson has synonymized *carneus* Walker, *crassus* Loew, *carbonarius* Loew, and *unicolor* Loew with *nigrinus*, and some records relating to those nominal species certainly belong to *nigrinus*. On the other hand, some records of *nigrinus* and *unicolor* in the literature most probably refer to some of the similar, wholly black *Nemotelus* which Hanson has described in his recent treatment of the genus.

Subfamily HERMETIINAE

Genus *Hermetia* Latreille

The genus *Hermetia* is represented in the United States by the extremely widespread *H. illucens* (Linnaeus) and by six other species of rather localized distribution. The genus is essentially a tropical and warm temperate one, being well represented in both hemispheres

but particularly in South America. Three species are known to occur in California. It is possible that a fourth, *H. comstocki* Williston, from the mountains of northern Mexico, southern New Mexico, and southeastern Arizona may extend into the state, though this is not probable. *H. comstocki* is a yellowish species with wholly yellow legs, pilose eyes, and a conical, inflated abdomen. It admirably mimics wasps of the genus *Polistes*.

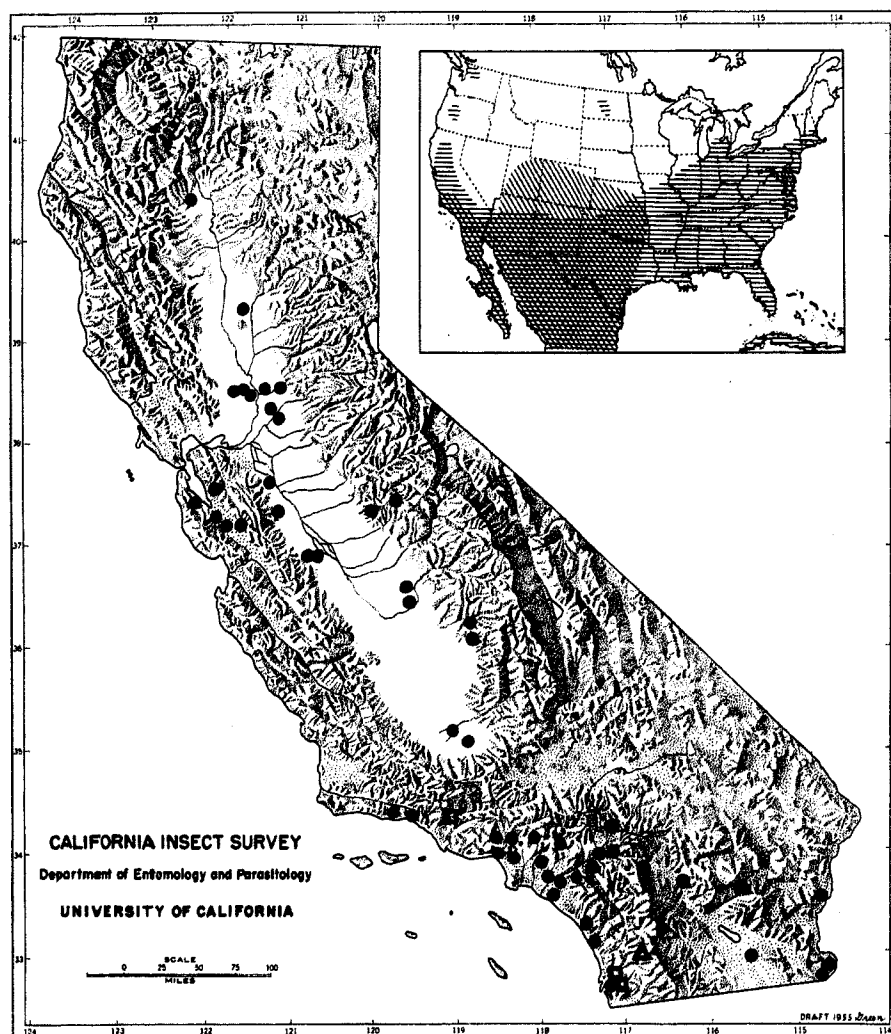
Key to the California Species of  
*Hermetia*

1. Eyes bare; body predominantly black, with black femora and predominantly black tibiae; abdomen black, sometimes reddish toward apex or even in large part, especially in the male, but with two large, well-defined yellow or even translucent spots on the second tergum . . . . . *illucens*  
Eyes pilose; legs with at most hind tibia partly black, the tibiae otherwise yellow or reddish; abdomen without well-defined yellow or translucent spots on the second tergum . . . . . 2
2. Face produced conically downward in front of oral margin, the projection best visible from lateral aspect; abdomen reddish yellow, flattened, with only very inconspicuous pile, and usually with a series of median black markings which form an interrupted longitudinal vitta . . . . *concinna*  
Face evenly rounded below, not produced conically in front of the oral margin; abdomen variable, black to red, but without a median vitta; abdomen inflated, conspicuously yellow to golden pilose . . . *aurata*

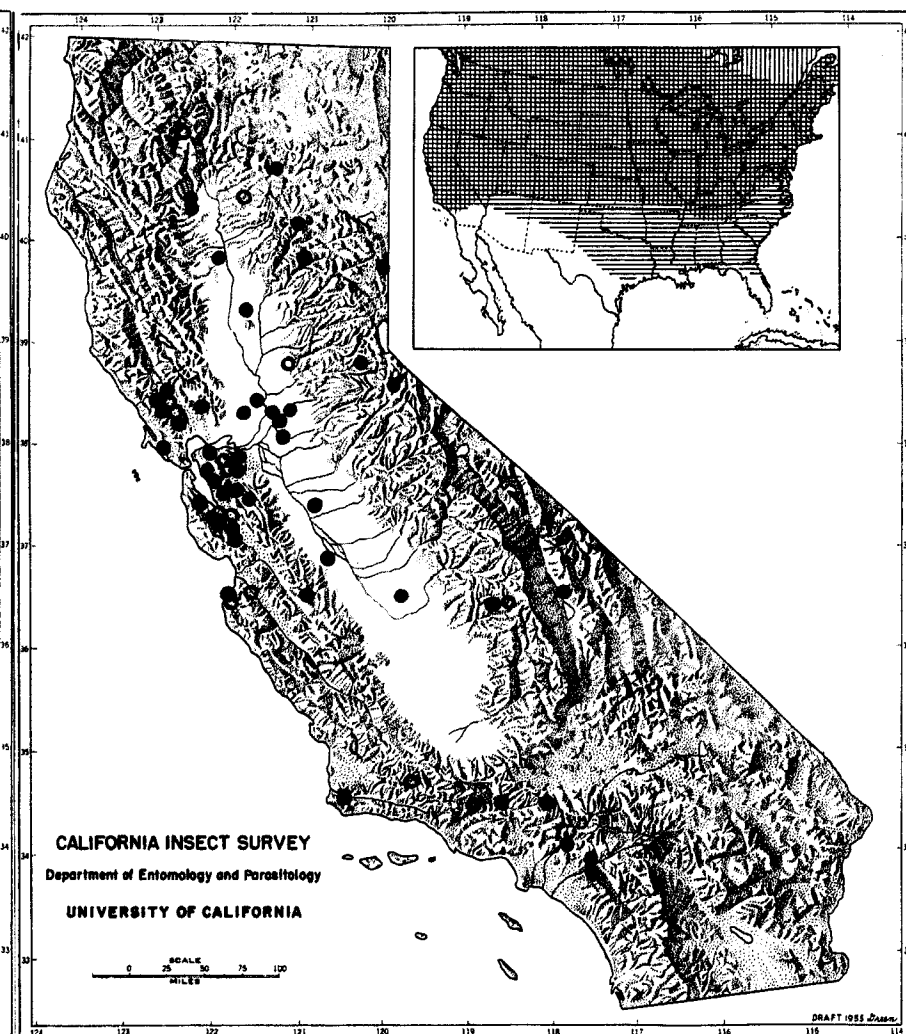
*Hermetia illucens* (Linnaeus)

*Musca illucens* Linnaeus, 1758, Systema Naturae, 10th ed., p. 589. Type, sex not indicated, South America; location uncertain, but stated by Linnaeus as in the collection of De Geer.

Geographical range: Massachusetts and California southward through most of tropical America; introduced into Africa, Hawaii, Micronesia, the Solomon Islands, Samoa, Europe, and elsewhere. Records from Washington, Oregon, and North Dakota probably



Map 17. Distribution in California of *Hermetia illucens* (Linnaeus), solid circles; *H. aurata eiseni* Townsend, open squares; and *H. concinna* Williston, open triangles. Inset: Distribution in the United States of *H. illucens*, horizontal lines, and *H. aurata eiseni*, oblique lines; *H. aurata eiseni* occupies approximately that part of the *aurata* distribution west of the southward extension of the Utah-Nevada line to the Gulf of California.



Map 18. Distribution in California of *Sargus decorus* Say, open circles, and *S. cuprarius* (Linnaeus), solid circles. Inset: *S. decorus*, horizontal lines, and *S. cuprarius*, vertical lines.

represent temporary local introductions (map 17).

#### Occurrence in California:

The southern part of the state, through the low coastal mountains and valleys, to the San Francisco Bay area, and throughout the San Joaquin and Sacramento valleys. Records from Ash Mountain, Sequoia National Park, X-5-40 (P. H. Arnaud Jr., P.H.A.) and Yosemite, 3,880 ft. to 4,000 ft., V-19-31(M.A.C.) may represent introductions into those areas by vacationers; such introductions are frequent because of the breeding habits of the fly and are responsible for its wide distribution into distant areas. Seasonal distribution, mainly May through October, with generally common occurrence throughout the summer months; I have California records, however, for every month except January.

#### Discussion:

This species is a privy fly in much of its range. It breeds in a variety of media involving decaying or putrifying vegetable matter, including human excrement; there is evidence, however, that in such media it may at times be a predator on other fly larvae, including those of the house fly. I have records of its occurrence in decomposing wet rice, soy beans, fruits and vegetables, catsup, animal cadavers, and waste materials found in bee hives, and it has been recorded in intestinal myiasis in man.

The adults are sluggish until once induced to fly. They may enter houses and buildings and may be attracted to light, but they do not seem to molest human food. In the open they visit excrement but usually not flowers; however, I have one record on *Polygonum auberti* at Davis, VII-8-51 (A. T. McClay, U.C.D.).

#### *Hermetia aurata eiseni* Townsend

*Hermetia eiseni* Townsend, 1895, Proc. Calif. Acad. Sci., 4(2):594. Types, sex not stated, El Toste and San José del Cabo, Baja California; in California Academy of Sciences. Geographical range: California, Baja California, Arizona (map 17).

#### Occurrence in California:

San Diego Co.: San Diego, VIII-6-21 and VIII-22-21 (C.I.S.); Sweetwater Valley, \*10/6/23\* (Armitage, C.I.S.).

Ventura Co.: Fillmore, VI-27-37 (B. E. White, M.A.C.).

#### Discussion:

This seems to be but a western subspecies of typical *H. aurata* Bellardi, from which it differs chiefly in the much less conspicuous pale abdominal pile; in *aurata* the abdomen is mostly bright yellow pilose whereas in *eiseni* the pale pile on the terga is limited chiefly to the apices.

#### *Hermetia concinna* Williston

*Hermetia concinna* Williston, 1900, Biol. Centrali-Americana, I, p.241. Type series, ♂ ♀, Arizona and New Mexico; in Snow collection, University of Kansas.

Geographical range: California, Arizona, New Mexico, Mexico (Chihuahua) (map 17).

#### Occurrence in California:

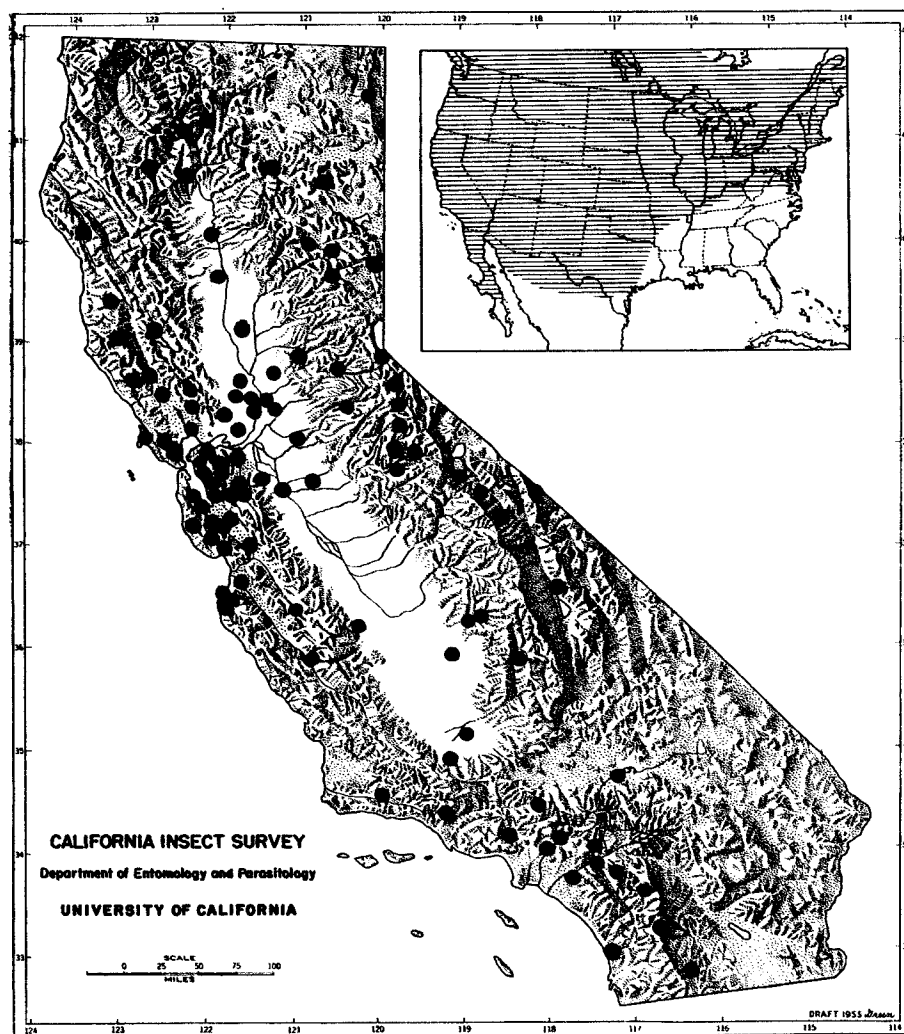
San Diego Co.: no locality, VII-1931 (Beck and Call, B.Y.U.).

### Subfamily SARGINAE

#### Genus *Sargus* Fabricius

Some confusion has arisen as to the proper name to be applied to this genus. The name *Sargus* Fabricius 1898 was antedated by *Sargus* Klein but, as has been pointed out to me by C. W. Sabrosky, the latter was simply a publication by Walbaum in 1792 of a pre-Linnaean name and, as such, has no nomenclatorial standing, according to Opinion 21 of the International Commission on Zoological Nomenclature. *Geosargus* Bezzi 1907, proposed to replace *Sargus* Fabricius not Klein, was unnecessary, and *Pedicella* Bigot 1856, used by some authors in the sense of *Sargus* Fabricius, is quite a different genus, as has been shown by Aldrich (1933) and James (1935).

The genus, in its broader sense, is widely distributed throughout the world, though it is nowhere numerous in species. Europe seems to be the center of distribution, and one of our species, *S. cuprarius* (Linnaeus), the genotype, is an introduction from that continent. Two other species, *decorus* Say and *viridis* Say, are known to occur in California, and a fourth, the European *bipunctatus* (Scopoli), has been introduced into Washington and Oregon. All known species that occur in the Pacific coast states are slender flies of medium size and more or less metallic green or blue-green coloration,



Map 19. Distribution in California and in the United States of *Sargus viridis* Say.

particularly on the thorax. They will not be confused with other members of the family except the rarely occurring *Beris*, which has quite a different venation, and *Microchrysa*, for which undersized specimens of *Sargus viridis* might be mistaken.

The adults are commonly found flying over or resting on the leaves of bushes and low trees, particularly in the sunshine. They are occasionally attracted to flowers. The larvae breed in decaying vegetation, such as decaying leaves or turnip roots, or in excrement of cattle, horses, rabbits, and doubtless other mammals.

## Key to the California Species of *Sargus*

1. Legs entirely yellow, or at most the tarsal segments partly darkened. . . . . 2  
     Legs largely or entirely black or metallic green, at most the narrow apices or bases of the segments black . . . . . 3
2. Frons with bushy black pile which is distinctly longer than combined first and second antennal segments; vein  $R_{2+3}$  lying very close to  $R_{4+5}$  on its basal two fifths, then strongly diverging; abdomen of female distinctly bicolored, orange and largely metallic blue to purple, the pattern variable but the terga always extensively orange basally and the color areas distinctly separated; face of male, at oral margin, almost one third as wide as head; male genital capsule mostly black and black-haired (Europe; Washington, Oregon) . . . . . *bipunctatus*  
     Frons with yellow pile or, if black, not bushy and shorter than combined first and second antennal segments; vein  $R_{2+3}$  gradually diverging from  $R_{4+5}$ ; abdomen of female usually bicolored but the paler areas usually at the sides, bases, and apices of the terga and not clearly defined; face of male, at oral margin, about one fourth as wide as head; male genital capsule mostly yellow and yellow-haired . . . . . *decorus*
3. Head, thorax, abdomen, femora in large part, and areas on tibiae bright metallic green or blue-green; wing uniformly subfuscous; abdomen of male almost parallel-sided on intermediate segments . . . . . *viridis*  
     Abdomen coppery to purplish, femora and tibia black with at most greenish reflections; wing distinctly clouded across discal cell; abdomen in both sexes distinctly broadening to a maximum width on the fourth segment . . . . . *cuprarius*

### *Sargus decorus* Say

*Sargus decorus* Say, 1824, Long's Second Expedition, p. 376 (Complete Works, 1, 257). Types, sex not stated "Pennsylvania and East Florida"; lost.

Geographical range: Alaska, throughout southern Canada, to Florida, Texas, and California (see map 18).

#### Occurrence in California:

Contra Costa Co.: Danville, X-11-51 (F. X. Williams, C.A.S.). Mt. Diablo, IV-22-33 (G.E.B.). Los Angeles Co.: No locality or date (C. B. Philips, N.U.).

Monterey Co.: Carmel, IV-12-26, IV-25-32 (L. S. Slevin, C.A.S.). Spreckels, VIII-20-04 (E. G. Titus, C.I.S.).

Placer Co.: Loomis, IV-11-51 (R. C. Bechtel, U.C.D.).

Santa Barbara Co.: San Rafael Mts., IV-24-51 (R. M. Bohart, U.C.D.).

Santa Clara Co.: University of California Ranch, San Jose, IV-11-43 (Paul H. Arnaud, Jr., P.H.A.). Stanford University, IV-27-20, V-12-21 (C.I.S.).

Shasta Co.: Shingletown, VI-2-41 (E. G. Linsley, C.I.S.).

Sonoma Co.: Alexander Valley, IV-28-33 (G.E.B.). No locality, VII-4-26 (E. H. Nest, C.A.S.); III-28-37 (C.I.S.).

Trinity Co.: Carrville, V-17-34 (G.E.B.).

Tulare Co.: Sequoia National Park, 3,000 to 5,000 ft., V-18-29 (E. C. Van Dyke, C.A.S.).

### *Sargus viridis* Say

*Sargus viridis* Say, 1823, Jour. Acad. Nat. Sci. Philadelphia, 3: 87 (Complete Works, 2, 77).

Type, no sex or locality given; lost.

Geographical range: Alaska, throughout southern Canada, to Maryland, Texas, and Baja California (see map 19).

#### Occurrence in California:

Widespread and common throughout the state except in the more extreme desert areas, altitudinal range, from sea level to 9,700 ft. in Mono Co. (no locality given). Seasonal occur-



rence, March to June at lower elevations, May to July in the higher mountains. It rarely visits flowers, but it has been collected at Riverside, Riverside Co., on *Isocoma vernonoides*, X-13-28 (an extraordinarily unique seasonal record!) and on flowers of *Sedum*, IV-3-35, by P. H. Timberlake (U.C.R.).

*Sargus cuprarius* (Linnaeus)

(Pl. 8, fig. 37; pl. 11, fig. 46)

*Musca cupraria* Linnaeus, 1758, Systema Naturae, 10th ed., p. 598. Type, sex not stated, from Europe; in Linnean Society of London. Geographical range: Europe, Asia; throughout southern Canada, southward to Tennessee, New Mexico, and California (see map 18).

Occurrence in California:

Widespread, except in the desert, and moderately common at low or moderate elevations (up to 4,000 ft.). Seasonal range, late March to October, mostly April through July. It has been taken at Riverside, Riverside Co., on *Sambucus coerulea*, III-30-41 (P. H. Timberlake, U.C.R.). It is attracted to light and light traps.

Genus *Microchrysa* Loew

This genus, members of which resemble a small, rather robust *Sargus*, is represented by two species, both imported from Europe and both distributed broadly across the northern United States and southern Canada but reaching the limit of their range in California. Adults may be found on the leaves of shrubs, particularly in sunny places; they visit flowers only rarely, if at all. The larvae breed in cow or horse dung or other excrement or decomposing matter.

Key to the California Species of  
*Microchrysa*

1. Mesopleuron with a whitish or yellowish upper margin that reaches from the humerus to the wing base; antennae and legs predominantly yellow, the black of the legs usually limited to the median part of the middle and hind femora . . . . . *flavicornis*  
Mesopleuron without a pale upper margin; antennae and legs predominantly black, all femora and usually at least the middle and hind tibiae chiefly black . . . . . *polita*

*Microchrysa flavicornis* (Meigen)

*Sargus flavicornis* Meigen, 1822, System. Beschreib. Bekann. Europ. Zweifl. Insekten, 3:112. Type, ♀, England; location uncertain. Geographical range: Europe; throughout southern Canada and the northern half of the United States.

Occurrence in California:

Sacramento Co.: Carmichael, VI-29-56, light trap (Jack Fowler, U.C.D.).

*Microchrysa polita* (Linnaeus)

(Pl. 11, fig. 43)

*Musca polita* Linnaeus, 1758, Systema Naturae, 10th ed., p. 598. Type, sex not stated, Europe, in Linnean Society of London. Geographical range: Europe; throughout southern Canada and the northern half of the United States.

Occurrence in California:

Marin Co.: Bolinas, V-18-55 (A. D. Telford, U.C.D.).

## LITERATURE CITED

- CURRAN, C. H.  
 1924. Concerning the availability of certain taxonomic characters and their significance. *Psyche*, 31:167-169.
- HANSON, WILFORD J.  
 1958. A revision of the subgenus *Melanone-motelus* of America north of Mexico (Diptera, Stratiomyidae). *Univ. Kansas Sci. Bull.*, 38 (2): 1351-1391.
- IRWIN-SMITH, VERA  
 1920. Studies of life-histories of Australian Diptera Brachycera. Part I. Stratiomyidae. No. 1. *Metoponia rubriceps* Macquart. *Proc. Linn. Soc. New South Wales*, 45:505-531.
- JAMES, MAURICE T.  
 1936a. The genus *Odontomyia* in America north of Mexico (Diptera, Stratiomyidae) *Ann. Ent. Soc. Amer.*, 29: 517-550.  
 1936b. Notes on *Nemotelus* (Diptera, Stratiomyidae). *Bull. Brooklyn Ent. Soc.*, 31: 86-91.
1939. Notes on my monograph of *Odontomyia* (Diptera, Stratiomyidae). *Bull. Brooklyn Ent. Soc.*, 34: 220-221-  
 1942. A review of the Myxosargini (Diptera, Stratiomyidae). *Pan-Pac. Ent.*, 18:49-60.  
 1943. A revision of the Nearctic species of *Adoxomyia* (Diptera, Stratiomyidae). *Proc. Ent. Soc. Washington*, 45:163-171.
- JAMES, MAURICE T., and GEORGE STEYSKAL  
 1952. A review of the Nearctic Stratiomyini (Diptera, Stratiomyidae). *Ann. Ent. Soc. Amer.*, 45:385-412.
- STEYSKAL, GEORGE C.  
 1953. A suggested classification of the lower brachycerous Diptera. *Ann. Ent. Soc. Amer.*, 46: 237-242.
- WIRTH, WILLIS W., and ALAN STONE  
 1956. Aquatic Diptera. In *Usinger, et al.*, *Aquatic Insects of California*. Univ. Calif. Press. 508 pp.



## PLATES

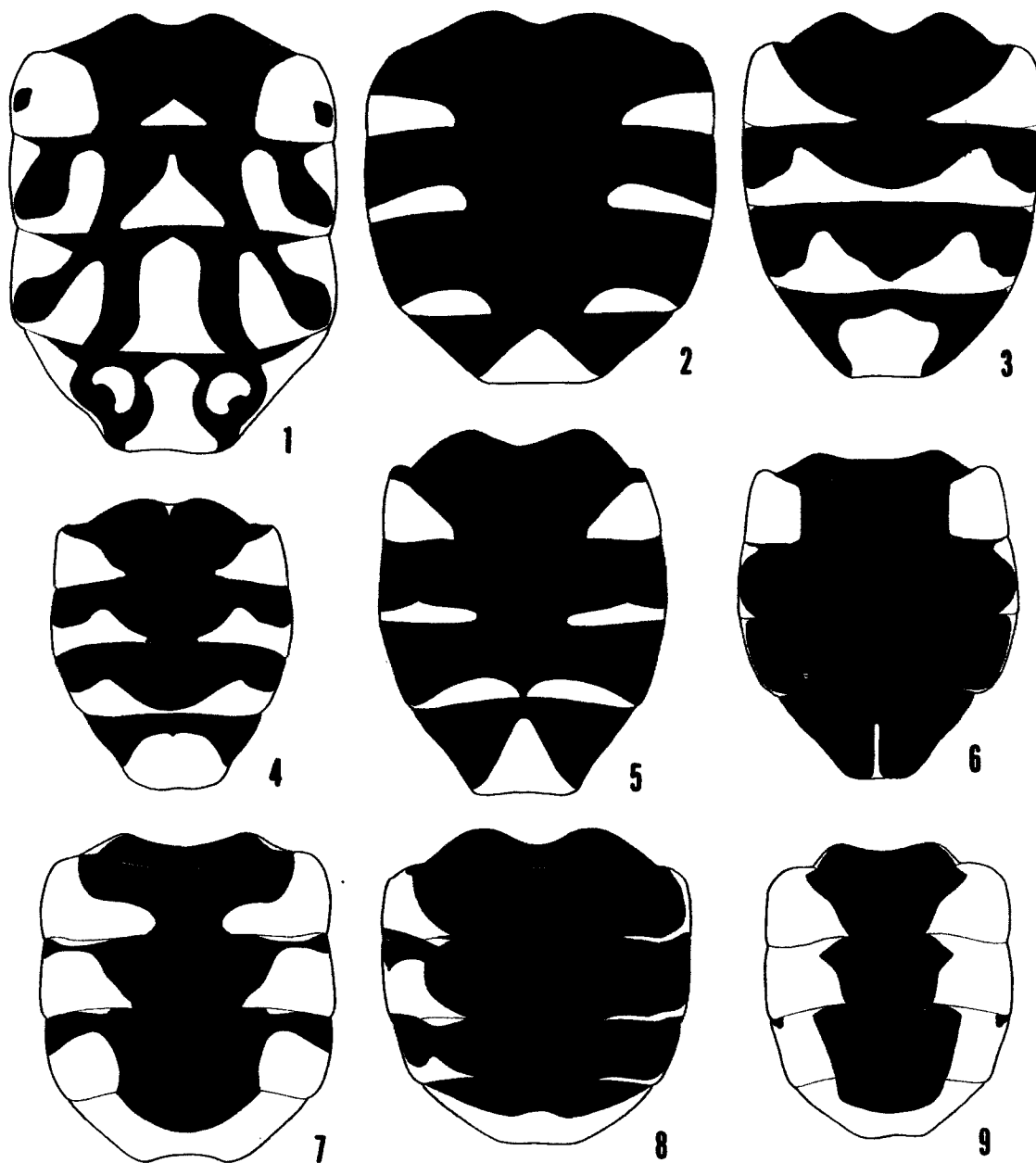


Plate 6. Abdominal patterns.

Fig. 1. *Stratiomys maculosa* Loew, female. Fig. 2. *Stratiomys laticeps* Loew, female. Fig. 3. *Stratiomys melastoma* Loew, female. Fig. 4. *Stratiomys currani* James, female. Fig. 5. *Stratiomys barbata* Loew, female. Fig. 6. *Stratiomys discaloides* Curran, female. Fig. 7. *Hedriodiscus truquii* (Bellardi), female. Fig. 8. *Eulalia colei* (James), male. Fig. 9. *Hedriodiscus truquii* (Bellardi), male. Drawings by Patricia Packard.

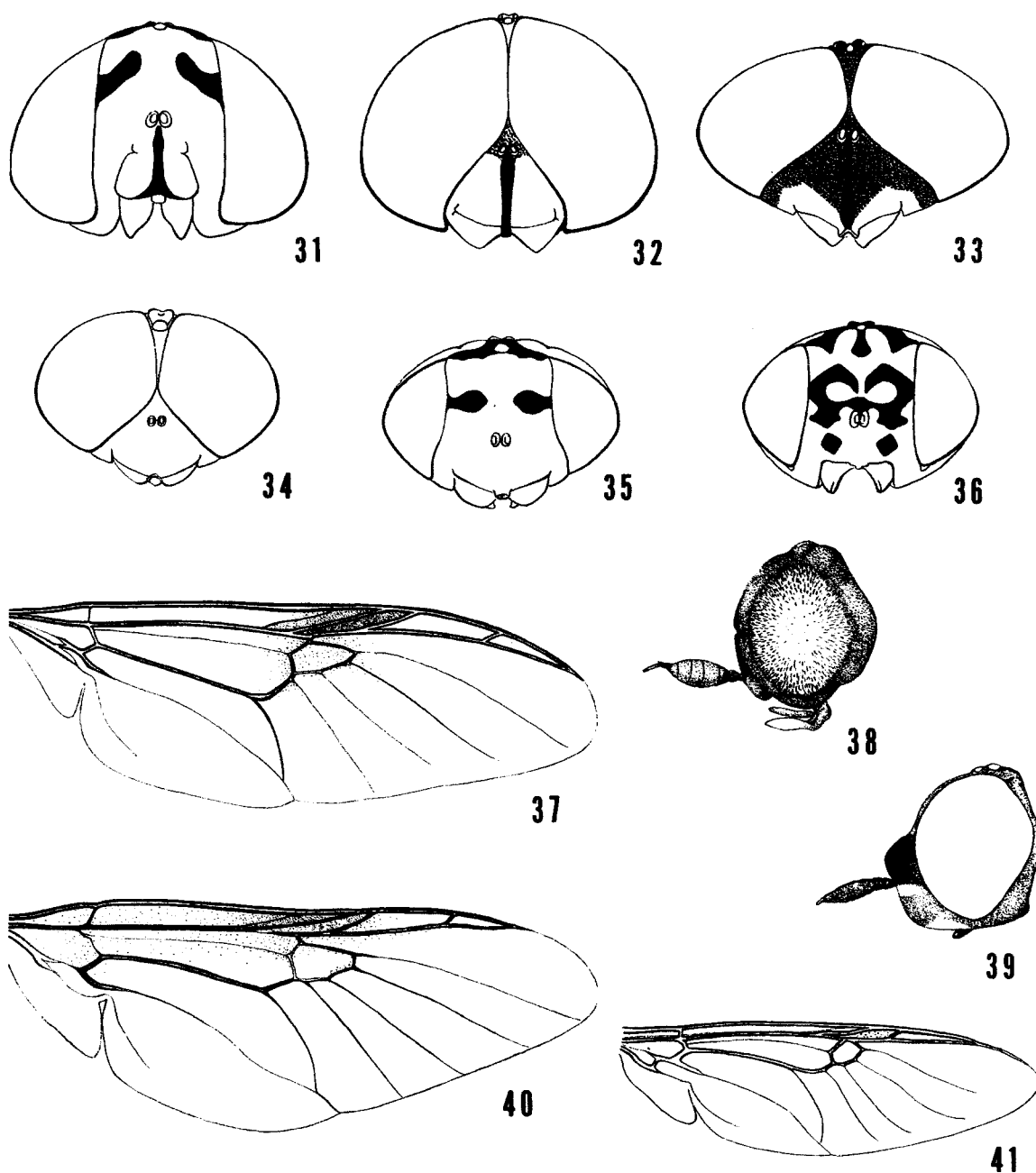


Plate 9. All pilosity, except that of eyes, omitted.

Fig. 31. *Eulalia communis* (James), female. Front view of head. Fig. 32. *Eulalia communis* (James), male. Front view of head. Fig. 33. *Eulalia pilosa* (Day), male. Front view of head. Fig. 34. *Eulalia tumida* (Banks), male. Front view of head. Fig. 35. *Eulalia tumida* (Banks), female. Front view of head. Fig. 36. *Hedriodiscus vertebratus* (Say), female. Front view of head. Fig. 37. *Sargus cuprarius* (Linnaeus), wing. Fig. 38. *Adoxomyia lata* (Loew), female. Head, side view. Fig. 39. *Dieuryneura obscura* (Coquillett), female. Head, side view. Fig. 40. *Adoxomyia lata* (Loew), wing. Fig. 41. *Hedriodiscus trivittatus* (Say), wing. Drawings by Patricia Packard.

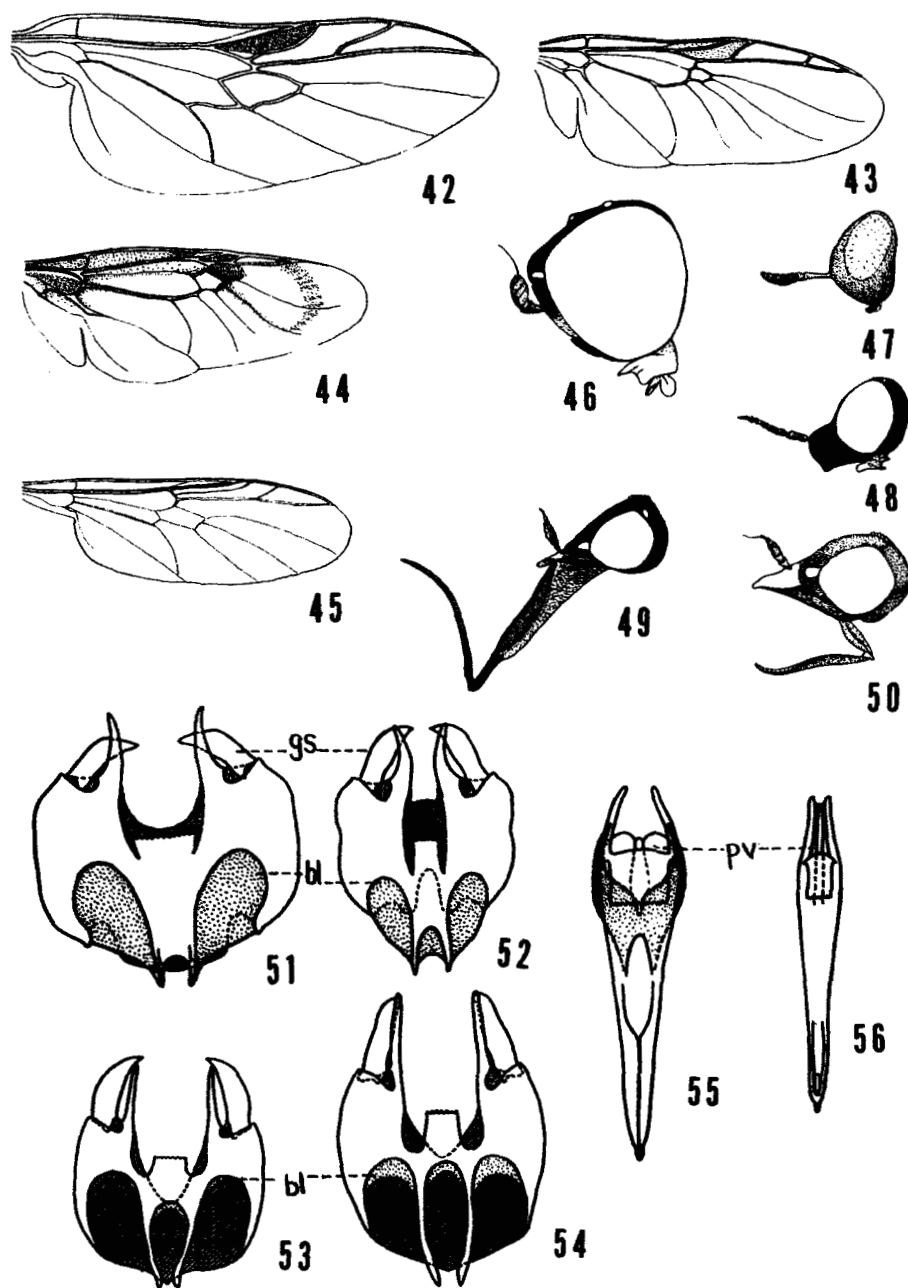


Plate 10. Pilosity of heads omitted, except that of eyes.

Fig. 42. *Beris annulifera* Bigot, wing. Fig. 43. *Microchrysa polita* (Linnaeus), wing. Fig. 44. *Myxosargus knowltoni* Curran, wing. Fig. 45. *Metoponia rubriceps* Macquart, wing. Fig. 46. *Sargus cuprarius* (Linnaeus), female. Head, side view. Fig. 47. *Metoponia rubriceps* Macquart, female. Head, side view. Fig. 48. *Myxosargus knowltoni* Curran, female. Head, side view. Fig. 49. *Nemotelus knowltoni* James, female. Head, side view. Fig. 50. *Nemotelus rufo-abdominalis* Cole, female. Head, side view. Fig. 51. *Nemotelus jamesi* Hanson, male genitalia. bl, basal lamella of gonocoxite; gs, gonostylus. Fig. 52. *Nemotelus variabilis* Hanson, male genitalia. Fig. 53. *Nemotelus politus* Hanson, male genitalia. Fig. 54. *Nemotelus arator* Melander, male genitalia. Fig. 55. *Nemotelus jamesi* Hanson, aedeagus. pv, penis valve. Fig. 56. *Nemotelus variabilis* Hanson, aedeagus. Figs. 42-50 drawn by Patricia Packard; figs. 51-56 after Han.