# BULLETIN OF THE CALIFORNIA INSECT SURVEY <br> VOLUME 3 

# THE MEGACHILINE BEES OF CALIFORNIA 

(Hymenoptera: Megachilidae)

BY
PAUL D. HURD, JR.
(Department of Entomology and Parasitology, University of California, Berkeley)
AND
CHARLES D. MICHENER
(Department of Entomology, University of Kansas, Lawrence)

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## Contents

Introduction ..... 1
Bionomics ..... 1
Floral relationships ..... 2
Distribution ..... 2
Acknowledgments ..... 3
Systematics . ..... 6
Family Megachilidae ..... 6
Phyletic relationships within the Megachilini ..... 8
Key to the Genera of Megachilini found in the Western Hemisphere ..... 10
Heriades ..... 11
Chelostoma ..... 24
Chelostomopsis ..... 37
Hoplitis ..... 44
Anthocopa ..... 94
Proteriades ..... 129
Ashmeadiella ..... 153
Diceratosmia ..... 215
Osmia ..... 217
Megachile ..... 219
Coelioxys ..... 222
Literature Cited. ..... 223
Index to the California Megachiline bees ..... 239
Index to the floral visitational records. ..... 243

## Introduction

This study is the result of an effort to provide usable keys, pertinent descriptive comments, and detailed data on distribution and floral visits of certain of the megachiline bees found in the state of California. The genera Antbocopa, A shmeadiella, Chelostoma, Chelostomopsis, Diceratosmia, Heriades, Hoplitis, Proteriades are treated in detail, but the genera Coelioxys, Megachile, and Osmia are considered only to the subgeneric level. The above mentioned genera are our representatives of the tribe Megachilini of the family Megachilidae.

The genera which are treated in detail have been the subject of special studies by one of us (Michener), who is largely responsible for the keys, discussions, and descriptive comments. The other author (Hurd) has assembled the distributional and floral data, prepared the maps, and supervised much of the preparation of the manuscript for the press.

The terminology is essentially that utilized by Michener (1944a) except that, in the light of newer studies of head structures in insects, the word frons is used instead of the complicated term, "supra-antennal area," and the segments of the metasoma ( $=$ second and following true abdominal segments) are numbered starting with one. Thus the segment behind the first morphological abdominal segment or propodeum is the first metasomal segment. As a result, the numbering of the segments corresponds to that most generally used in taxonomic works on the Hymenoptera.

## Bionomics

The bees of the genera discussed in this bulletin are all solitary, that is, each female constructs and provisions her own nest or nests; there is no worker caste. Each nest consists of one to several cylindrical cells. As usual in the megachilids, but unlike most other bees, the cell walls are built of foreign materials of various
sorts carried to the nest. These materials are quite constant for each species but vary considerably among the species and genera. Thus most Megachile use pieces of leaves, but some species use pebbles, mud, resin, and other materials in combination with leaves or without leaves. Most Hoplitis chew up the leaf fragments to make a pulp to form partitions between cells.

The cells may be placed in natural cavities or in burrows constructed by the female bee in advance of cell construction. They may be lined on all sides by the foreign material brought for this purpose, as is usual in Megachile, or only partitions between cells may be constructed of such material (as in Hoplitis), in which case the sides of the cell consist of the walls of the burrow.

Situations in which nests of these bees are likely to occur include holes (often made by beetles) in logs, pine cones, galls, and sticks; burrows in pithy stems such as those of Rubus and various weeds; and burrows or cavities in the soil. Sometimes they make use of abandoned nests of other bees or wasps and, especially in Europe, of abandoned snail shells.

Each cell is provisioned with a mass of pollen and honey occupying the lower end of the cell, and on top of this a single large, elongate, gently curved egg is laid. After hatching, the larva eats downward through the pollen mass, generally growing rapidly and reaching maturity in less than two weeks. It then spins a cocoon consisting of two or more layers of silk, at least one of which is impregnated with a solid brown material applied by the larva as a liquid. This substance fills the interstices in the silken sheet and probably makes the cocoon relatively airtight except for a small area of loose threads often projecting as a nipple at one end of the cocoon.

After the cocoon is complete the larva may go into a resting stage, often called the prepupa, in which it remains for many months. Among the
genera considered in this study, most of the species that have but one generation per year are in flight in the spring and reach the prepupal stage before midsummer and remain in this stage through the rest of summer, fall, and winter, emerging after a brief pupal stage in the spring. Other species (e.g., Megachile brevis Cresson) have as many as four generations per year so that the prepupal resting stage is very short except for the overwintering generation.

In many species males appear in flight before the females and disappear long before the females. Thus collections often consist entirely of one sex or another, and proper association of sexes is often a problem. A number of species are still known from only one sex. Mating usually occurs very soon after emergence of females.

The above generalizations on the biology of these bees are based on meager data concerning few species. We urgently need exhaustive ethological and ecological studies of several species in order to interpret better the comparative behavioral characteristics and in order to judge more intelligently the importance of these bees to man.

## Floral Relationships

Many of the megachiline bees are probably important pollinators of native plants. Only in a few known instances, for example Diceratosmia subfasciata, are they known to assume any role in the pollination of agriculturally importan crops. Even here, their role may be regarded as but incidental in relation to the principal economy of these bees. This is not especially surprising if we realize that the majority of megachiline bees are restricted in their pollen-collecting habits to certain types of flowers, and sometimes to the flowers of a particular family or even genus. It is probable that this floral selection by the bees is operative in restricting them to the native floras and, further, is responsible to a large degree for accentuating the differences among geographically differentiating faunas. It seems probable, because of the floral preferences, that this group of native bees is not likely to contain many representatives which will assume important roles in the pollination of agricultural crops of introduced origin. Conversely, it is evident that purposeful introductions of bees for the pollination of such crops, if made, should be done with floral relationship in mind.

A review of the floral records and a preliminary analysis of the distribution of this group of
native bees have enabled us to evaluate more properly the economy of these bees. As mentioned earlier, they are associated with the native floras; more particularly the majority are associated with the floras of the broad desert and chaparral or scrub areas of the state.

The pollination of floras of such areas is significant in connection with problems of range management, watershed, and soil conservation. As may be seen by reference to the floral listings, these native bees visit many of these economically important plants and therefore are likely to be responsible for much pollination of them. It is therefore advisable that in the planning and practice of the management programs, consideration be given to perpetuation of these bee faunas.

Considerable public interest has developed in the appreciation and preservation of wild flowers within California. It is our obligation to society to contribute tangibly to a knowledge of the ecology of these plants. It is apparent that among the flowers visited by this group of bees are many of the more aesthetically appreciated wild flower forms. As cross-pollination is often important in the reproduction of such plants, it is likely that these bees play a significant role in ensuring survival of these natural assets of the state.

## Distribution

Among the eight genera discussed in detail in this paper, 124 species ( 144 species and subspecies) are known or anticipated in California. A few additional species represented by one or a very few specimens occur within the state but have not yet been described. A total of 116 named species is recognized at present from California. This is a surprisingly large proportion of the 154 species of these genera known from the entire Western Hemisphere. This is partly owing to the fact that these genera are of northern distribution, several of them Holarctic; no species in the eight genera concerned occurs in South America and only one or two in the tropical regions of Central America. It is possibly also owing in part to the origin of certain genera in the Palearctic region, with only certain species groups reaching Norch America; these occur mostly along the Pacific Coast near the Alaskan area where they first reached this hemisphere.

Most important, however, in explaining the large percentage of the American species occur-
ring in California is the ecological diversity of this state and especially the presence of the extensive desert areas of eastern and southern California. As has been explained earlier (Michener, 1944b), several genera or subgenera are principally boreal in distribution. Examples are Alcidamea, Monumetha, and Atoposmia. These are the groups most closely related to Palearctic relatives. Presumably from these groups a variety of austral and even desert groups (e.g., Eremosmia, Dasyosmia) arose in California and other western states. Some of these, such as Asbmeadiella, have spread widely, but a surprising number are confined to, or at least most abundant in, the deserts immediately east of the principal mountains of central and southern California. As pointed out by Michener (1951b), this restriction of certain desert megachilines to the western deserts is less strict than was believed in 1944, since some have since been collected as far east as Texas, but it seems nonetheless to be a significant fact.

In order to study the distribution of the species within the state, use has been made of certain biotic areas outlined by Miller (1951) and shown in the accompanying diagram. The various boreal areas are stippled on this map whereas the austral ones are white. The boreal areas are those above the lower or southern limit of the principal coniferous trees. Even the most wideranging species is not known from all the areas, and many are restricted to particular areas. Many are entirely or principally boreal; others entirely or principally austral. Not only do some wide-ranging forms occur extensively in both boreal and austral regions, but some with apparently rather narrow ecological tolerances (e.g., Anthocopa triodonta) occur in a zone on either side of the line between the boreal and austral regions. For these reasons it has not been possible to place every species as an occupant of one or another biotic region, or even to classify all the species as boreal, austral, or wide ranging.

In table 1, however, we have indicated the number of species of each genus or subgenus occurring in each biotic area. Occasionally records are ignored if a form abundant in one area has been taken only once or twice near the margin of an adjacent area. From the table it can be clearly seen which genera or subgenera are wide ranging and which are ecologically restricted. It can also be seen that there are more species in the austral than in the boreal region in spite of austral groups being derived
from boreal. The great number of species in the Californian (chaparral, oak-grassland) area is significant, as is the small number in the Great Valley. The small number of species in the Great Basin Montane area may be owing to the small area concerned and to poor collecting, although the almost equally limited Southern Californian Montane has many more species. The North Coast area has relatively few species, probably largely because of its coolness and humidity.

In dealing with a group of insects dependent on flowers for food, many of them strictly limited to particular flowers for pollen sources (e.g., the species of Proteriades use only the pollen of Cryptantha), we are tempted to try to correlate plant and insect distributions. Unfortunately for this approach, we do not know of a single species of bee in this group which is distributionally coëxtensive with its food plant. Invariably the plant occurs in certain places where the bee seems to be absent, and sometimes, as in the case of Cryptantha and Proteriades, the plant ranges a thousand miles or more beyond the range of the bee. Since the bees are evidently limited by such factors as availability of nesting sites and climate, we must conclude that successful pollination by insects is usually owing to a complex of pollinators and not to any single pollinating agent.

The distributional maps accompanying this paper show first, the known localities of occurrence (indicated by various forms of circles) for each species and subspecies, and second, the probable geographic range (various overlays) as interpreted from these distributions in terms of the probable ecological requirements for each species and subspecies. In delimiting the geographic range of each species and subspecies, where there appears to be sufficient information, a solid line indicates the peripheral limits of geographic range, and where there is insufficient information a dashed line is used.

This study has tended to demonstrate that the actual distribution for any given species or subspecies is that place in the environment where the interbreeding population meets the requirements of its economy.

## Acknowledgments

It was at the suggestion of Professor E. G. Linsley that the present study was undertaken. To him we gratefully acknowledge the encouragement and inspirational interest he has shown in the project.


Boreal (stippled) and Austral (white) areas ot California showing biotic subdivisions occupied by the megachiline bees shown in table 1. Numbers indicate the number of species which are found in each district.

TABLE 1

Distribution Within California of Species of Certain Genera of Megachilini
（Numbers indicate the number of species in each area）

| Genera and Subgenera |  |  | Boreal（in Calif．） |  |  |  | Austral（in Calif．） |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | $\begin{aligned} & \text { प } \\ & 0 \\ & 0 \\ & 0 \\ & \text { B } \\ & \text { 프 } \\ & 0 \end{aligned}$ | 号 |  |  |  |  | $\begin{aligned} & \text { 士 } \\ & 0 \\ & 0 \\ & 0 \\ & 0 \\ & 0 \\ & 0 \\ & 0 \\ & 0 \\ & 0 \\ & 0 \end{aligned}$ | 号 |  |
| Heriades | 3 | 13 | 1 | 1 | 3 |  | 1 |  |  | 2 |  |
| Chelostoma | 8 | 8 | 1 | 3 | 5 |  |  |  |  | 5 |  |
| Chelostomopsis | 1 | 1 | 1 | 1 | 1 |  |  |  |  | 1 |  |
| Hoplitis |  |  |  |  |  |  |  |  |  |  |  |
| Formicapis | 1 | 1 |  | 1 |  |  |  |  |  |  |  |
| Robertsonella |  | 1 |  |  |  |  |  |  |  |  |  |
| Hoplitina | 6 | 6 |  |  |  |  | 3 | 3 | 1 | 3 |  |
| Acrosmia | 3 | 3 |  | 3 | 1 |  |  |  |  |  |  |
| Alcidamea | 7 | 9 | 2 | 3 | 3 | 2 | 1 |  | 2 | 5 | 1 |
| Ancronicus |  | 1 |  |  |  |  |  |  |  |  |  |
| Cyrtosmia | 1 | 1 | 1 | 1 | 1 |  |  | 1 |  | 1 |  |
| Dasyosmia | 2 | 2 |  |  |  |  | 2 | 1 | 1 |  |  |
| Monumetha | 3 | 4 | 2 | 3 | 2 |  |  |  |  | 2 |  |
| Anthocopa |  |  |  |  |  |  |  |  |  |  |  |
| Atoposmia | 8 | 9 | 1 | 7 | 3 | 3 |  |  |  | 2 |  |
| Eremosmia | 13 | 17 |  |  |  |  | 10 | 7 | 9 | 1 |  |
| Hexosmia | 2 | 2 | 1 | 1 | 1 | 1 |  | 1 | 1 | 2 |  |
| Proteriades | 22 | 22 | 2 | 6 | 5 | 3 | 5 | 5 | 5 | 9 |  |
| Ashmeadiella s．str． | 19 | 27 | 5 | 6 | 7 | 4 | 10 | 8 | 9 | 16 | 5 |
| Titusella | 1 | 3 |  | 1 |  |  | 1 | 1 |  | 1 |  |
| Arogochila | 11 | 15 | 1 | 4 | 2 | 1 | 5 | 4 | 2 | 4 |  |
| Corythochila | 2 | 2 |  |  |  |  | 2 | 1 | 2 |  |  |
| Chilosima | 1 | 2 |  |  |  |  | 1 | 1 | 1 |  |  |
| Cubitognatha | 1 | 1 |  |  |  |  | 1 | 1 | 1 |  |  |
| Diceratosmia | 1 | 4 |  |  |  |  | 1 |  | 1 |  |  |
| Totals | 116 | 154 | 18 | 41 | 34 | 14 | 43 | 34 | 35 | 54 | 6 |

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## Systematics

## Family Megachilidae

The Megachilidae is one of the large families of bees and is perhaps the least varied and hence most readily recognizable of all the families. Nonparasitic females may be easily identified by position of the pollen-collecting hairs, or scopa, which are on the undersurface of the metasoma. In other pollen-collecting bees, such hairs are largely on the posterior legs. All forms may be recognized by the shape of the labrum and the direction taken by the subantennal sutures, as detailed in the following diagnosis of the family.

Labrum longer than broad, broadened basally to form a long line of articulation with clypeus; subantennal areas absent; subantennal sutures directed toward outer margins of antennal sockets; lower sides of clypeus not bent backward parallel
to long axis of body; facial foveae absent; hypostoma free from tentorium; first flagellar segment much shorter than scape; stipites with or without combs; galeae short prepalpally, long postpalpally, without combs; submentum vshaped; mentum tapering basally; labial palpi with first two segments elongated and flattened, sheathlike, first segment usually shorter than second; glossa linear, with a flabellum; preepisternal suture and scrobal suture in front of mesepisternal scrobe absent; metanotum usually vertical, sometimes subhorizontal; middle coxae elongate, at least half, and usually much more than half, as long as distance from summits to hind wing bases; pterostigma small; submarginal cells two, second as long, or nearly as long, as first; marginal cell pointed or narrowly rounded at apex which is usually a little bent away from costal margin of wing and nearer to wing tip than to base of cell; basitibial plates absent; scopa


Plate 1. Lateral view of Chelostoma californicum, male, showing the principal morphological structures.
when present confined to metasomal sterna; pygidial plate usually absent; penis valves more or less fused to penis.

This is a large and morphologically rather
uniform group of bees.
The family Megachilidae is divisible into three major groups, as indicated in the following key:

## Key to the Subfamilies and Tribes of Megachilidae

1. Jugal lobe of posterior wing about three-fourths as long as vannal lobe; tibiae coarsely spiculate on outer surfaces; male with pygidial plate on seventh metasomal tergum, female with remnant thereof (in ours, a large flattened spine) on sixth tergum

Jugal lobe of posterior wing less than half as long as vannal lobe; tibiae not spiculate; pygidial area or plate absent (subfamily Megachilinae) .
2. Pterostigma small, inner margin from its base to base of radial vein not much if any longer than width of pterostigma; claws of female cleft or at least with an inner tooth

Pterostigma larger, inner margin from its base to base of radial vein usually much longer than width of ptero stigma; claws of female simple. . . . . . . . Tribe Megachilini

The tribe Megachilini is by far the largest of these groups and is the subject of the remainder of the present study. Superficially, most California species of Anthidiini can be immediately distinguished from any of the Megachilini by the presence of yellow or white integumental markings on the body. Such markings are not present in Megachilini. The Lithurginae are superficially very like some species of Megachile, however.

## Phyletic Relationships within the Megachilini

From evidence available it is not desirable to attempt to construct a phylogenetic tree for the genera of the entire Megachilini. However, some conclusions on relationships seem justifiable. As has been pointed out previously (e.g., by Michener, 1944a), a cylindrical thoracic shape is more primitive in bees than a spherical one. For this and several other reasons, for example the large size of the pterostigma (a primitive feature), the genera Heriades, Chelostoma, and Prochelostoma are regarded as the most primitive members of the tribe. In the characters mentioned above there is a gradual gradient from these primitive genera through Chelostomopsis, Hoplitis of the subgenera Formicapis and Robertsonella, other subgenera of Hoplitis, Proteriades, to forms such as Asbmeadiella, Anthocopa, and Osmia with a rather spherical thorax and much reduced pterostigmata. The generic characters concerned are discussed in detail by Michener (1941). The genera Megachile and Coelioxys also have the specialized characters mentioned above but are not closely related to Osmia and its allies as shown by a variety of characters including absence of arolia.
In the Hoplitis, Proteriades, Anthocopa, Ashmeadiella complex some knowledge of relationships has come to light since the most recent published accounts. In an unpublished work carried on at Kansas State College, Dr. Roland L. Fischer showed that Proteriades and Hoplitis (Hoplitina) have certain characters in common that had not previously been appreciated. For example, both groups have a fold or process on the sixth metasomal sternum of the male, ornamented with short specialized hairs. In the females both groups are somewhat unusual in lacking a flange at the apex of the sixth metasomal tergum of the female. They are so similar superficially as well as in other morphological characters that there can now be little doubt that Proteriades arose, largely by specialization of mouthparts in adaptation to the flowers of Cryptantha, from ancestors very like Hoplitina. Indeed, intergradations exist through forms like Proteriades incanescens and P. remotula, males of which nearly lack the strongly hooked hairs on the proboscis characteristic of other Proteriades. The subgenus Acrosmia also shares the abdominal characters mentioned above with Proteriades and Hoplitina and presumably belongs to the stock from which they arose.

From the statements made above, together with those which appear in earlier papers referred to under the various genera, we must conclude that two or more boreal stocks each of Hoplitis and Anthocopa arrived in North America and still persist as such largely boreal subgenera as Alcidamea, Monumetha, Atoposmia, and Hexosmia. The boreal groups of Hoplitis in the arid west gave rise to largely austral groups such as Dasyosmia, Hoplitina, and Proteriades, whereas the boreal groups of Anthocopa gave rise to the largely austral Eremosmia and Ashmeadiella.


Plate 2. Fig. 1, Osmia, dorsal view of left half of thorax showing parapsidal line. Fig. 2, Ashmeadiella, lateral view of thorax. Fig. 3, Anthocopa, dorsal view of left half of thorax showing parapsidal line. Fig. 4, Diceratosmia, ventral view of posterior coxa showing carinate condition. Fig. 5, Hoplitis, distal part of leg.

## Key to the Genera of Megachilini found in the Western Hemisphere

1. Arolia absent ..... 2
Arolia present (pl. 2, fig. 5) ..... 3
2(1). Eyes bare; axillae rounded ..... Megachile (p. 219)Eyes hairy in American species; axillae each produced to a conspicuous tooth.
Coelioxys (p. 222)
3(1). Parapsidal lines punctiform or at most about three times as long as broad (pl. 2, fig. 1); usually metallic forms ..... 4
Parapsidal lines linear (pl. 2, fig. 3); rarely metallic forms ..... 5
4(3). Posterior coxae each with longitudinal carina along inner ventral angle (pl. 2, fig. 4); parap- sidal lines slightly elongate . . . . . . . . . . . . . Diceratosmia (p. 215)
Posterior coxae not carinate; parapsidal lines punctiform ..... Osmia (p. 217)
5(3). Base of propodeum with narrow horizontal zone, set off by a carina from posterior surface and traversed by carinae breaking it into a series of large pits Heriades (p. 11)
Base of propodeum neither set off from posterior face by a carina nor pitted. ..... 6
6(5). Anterior face of each mesepisternum separated, at least below, from lateral face by weakcarina, in front of which surface is smooth and shining, behind which surface is stronglypunctate (pl. 2, fig. 2); sixth metasomal tergum of male quadridentate
Ashmeadiella (p. 153)
Anterior face of each mesepisternum not separated by a carina from posterior face, surfacesculpturing grading gradually from smooth anteriorly to strongly punctate laterally, sixthmetasomal tergum of male not quadridentate7
7(6). Maxillary galeae and first two segments of labial palpi covered with stiff hairs whose tipsare hooked or wavy; proboscis unusually short, in repose scarcely reaching beyondproboscidial fossaProteriades (p. 129)
Maxillary galeae and labial palpi without specialized hairs; proboscis usually longer and inrepose extending well behind proboscidial fossa.8
8(7). Shortest distance between tegulae equal to or less than length of mesoscutum ..... 9
Shortest distance between tegulae greater than length of mesoscutum . ..... 10
$9(8)$. Posterior coxae each with a longitudinal carina along inner ventral angle; third segment oflabial palpi flattened and connate with second. Chelostoma(p. 24)
Posterior coxae not carinate; third segment of labial palpi cylindrical and usually standingout at right angles to the secondFirst metasomal tergum with longitudinal sulcus on weakly concave, flat, or convex anteriorsurface; sculpturing of anterior surface merging with that of dorsal surface with no dis-tinct line between these surfaces except sometimes across summit of sulcus and for ashort distance laterally from it11First metasomal tergum with anterior surface broadly concave, smooth, without a longitudinalsulcus; a distinct line usually separating the scarcely punctate anterior surface from thedistinctly punctate dorsal surfaceAnthocopa(p. 94)

11(10). Posterior coxae each with longitudinal carina along inner ventral angle; male with but six exposed metasomal terga; mandibles of female long, slender, almost parallel-sided

Posterior coxae not carinate (occasionally in non-California species with a carina whose apex turns toward the outer rather than the inner side of the articulation with the trochanter); male with seven exposed terga; mandibles of female expanded to broad apices

[^0]
## Genus Heriades Spinola

This genus is readily recognized by its slender, parallel-sided, coarsely punctate body. The propodeum has a narrow transverse basal band which is horizontal and divided by longitudinal ridges into shining pits. The anterior face of the first metasomal tergum is concave and margined posteriorly by a carina far stronger than is that which margins the similarly concave region in Asbmeadiella and Anthocopa. As in Cbelostomopsis and Anthocopa subgenus Hexosmia, there are only six exposed metasomal terga in the male. The sixth tergum of the male is not dentate laterally. As in Cbelostoma and Prochelostoma, the thorax is slender, with the metanotum clearly a part of its dorsal, not its posterior, surface, and the pterostigma is rather large. The inner ventral angle of each posterior coxa is conspicuously carinate.

Heriades is widely distributed throughout the world except in the Australian region and South America. The southernmost known species in the Western Hemisphere occurs in Panama. Two subgenera are known in North America, but only one of these, Physostetha Michener, is recorded in California. Two species of the subgenus Neotrypetes Robertson, however, may be expected, one in the northeastern and the other in the southeastern part of the state. A total of eleven species is known in the Nearctic area. The American species of the genus were revised by Michener (1938a), and a new key to the American Neotrypetes was given by Michener (1954b).

The species of Heriades are polylectic so far as is known, and have rather long seasons of flight. They nest in small holes such as those made by emerging beetles in old logs, dead branches, and pine cones.

## Key to the American Subgenera of Heriades

1. Mandible of female with the two carinae of outer surface separated except apically; first metasomal sternum of male rounded or pointed apically (short and truncate in $H$. micheneri Timberlake from southern Arizona) . . . . . . . . . . . Neotrypetes (p. 11) Mandible of female with the two carinae of outer surface united basally; first metasomal sternum of male short and truncate apically . . . . . . . . Pbysostetha (p. 14)

## Subgenus Neotrypetes Robertson

Of the two American subgenera of Heriades, this one has the widest range, extending south to

Panama. It is poorly represented on the Pacific Coast, however, and the two species listed below have not yet been taken in California.

Key to the California Species of Neotrypetes

## Males

1. First sternum rounded apically; ocelli small, separated by over two ocellar diameters
. . . . . . . . . . . . . . . . . . . . . . . micropthalma (p. 14)

First sternum pointed apically; ocelli large, separated by little more than one ocellar diameter
variolosa (p. 14)

## Females

1. Ocelli small, separated by two or more ocellar diameters . . . . . micropthalma (p. 14)

Ocelli large, separated by little more than once ocellar diameter . . . variolosa (p. 14)


Plate 3. Lateral view of Heriades cressoni Michener, male.


Map 1. Distribution of Heriades variolosa (Cresson), the subspecies purpurascens indicated by open circles, the subspecies variolosa by solid circles.

Heriades variolosa variolosa (Cresson) (Pl. 12, figs. 6, 14)

Megachile variolosa Cresson, 1872, Trans. Amer. Ent. Soc., 4:270, ㅇ. Type 우, Texas (Acad. Nat. Sci. Phila.).
Synonyms: odontophora Schletterer, 1889; asteris Cockerell, 1897; barbatus Robertson, 1903, $\sigma^{2}$, not 个; productus Robertson, 1905.
Geographic range: Ontario to North Carolina, west to British Columbia. Oregon, Utah, New Mexico, and Texas. Another subspecies ( $H$. variolosa purpurascens Cockerell) ranges from Texas to Yucatan (see map 1).
Discussion:
There are no California records of this species, but it has been collected at Baker, Oregon (Michener, 1938:520) and at North Powder, and 13 miles east of Juntura, Oregon, and may, therefore, be expected to occur in northeastern California. At the latter two localities this bee has collected on Solidago.

This bee has been found to visit a variety of flowers. In Nebraska, where perhaps the majority of floral visitation records have been kept, we have the following information: At Carns, flowers Amorpha, Heliantbus, Heliopsis belianthoides, Malva silvestris, Mentha, Monarda, Ratibida, Vernonia, and thistle. At Glen, flowers Gutierrezia sarotbrae, Mentba canadensis, and Solidago. At Monroe Canyon, Sioux Co., flowers Solidago. Neligh, flowers thistle. At Nebraska City, flowers thistle. At Omaha, flowers Melilotus alba and

Solidago rigida. At Red Cloud, flowers Theles. perma gracile. At Warbonnet Canyon, Sioux Co., flowers Melilotus and Monarda. At Weeping Water, flowers thistle. At West Point, flowers choke cherry.

At Beach, North Dakota, variolosa has been taken at flowers of Grindelia. P. H. Timberlake has found it collecting pollen from Erigeron philadelphicus at Mengus Mills, Pennsylvania.

## Heriades micropthalma Michener

(Pl. 12, figs. 8, 12)
Heriades micropthalma Michener, 1954, Jour. Kansas Ent. Soc., 27:66, ㅇ, ${ }^{3}$, Type ㅇ, Williams, Arizona (Univ. of Kansas).
Geographic range: Texas to Arizona and Utah (see map 2).
Discussion:
This species has not yet been recorded from California, but it very likely occurs in eastern California since it has been found at Grand Canyon and Williams, Arizona.

## Subgenus Pbysostetha Michener

All the species of Heriades presently known from California belong to this subgenus. Certain of the species are very common.

Key to the American Species of Pbysostetha

## Males

1. Tubercle of first sternum more than two-thirds of distance from base to apex of sternum, in profile slender and directed posteriorly, from behind emarginate at summit (pl. 12, fig. 10).

Tubercle of first sternum less than two-thirds of distance from base to apex of sternum, in profile robust and not directed posteriorly, from behind not or scarcely emarginate. . 2
2(1). Tubercle of first sternum high so that its sides, if projected, would meet at an acute angle (pl. 12, fig. 9).
carinata (p. 18)
Tubercle of first sternum low so that its sides, if projected, would meet at an obtuse angle

3(2). Outer edge of mandible, seen from front, with subbasal low rounded projection . . . . 4
Outer edge of mandible, seen from front, evenly curved except at extreme base.


Map. 2. Distribution of Heriades microp thalma Michener.
4(3). Sixth sternum prolonged into a ligulate, recurved process . . . . . . gracilior (p. 18)
Sixth sternum with broadly rounded or feebly angulate apex . . . . . timberlakei (p. 18)

## Females

1. Labrum with two small basal tubercles; anterior margin of clypeus with rather broad median emargination
. cressoni(p. 16)
Labrum with one small basal tubercle; anterior margin of clypeus nearly straight medially, with a tubercle at each side
2(1) Tubercles of clypeal margin broad and rounded . . . . . . . . . . . . . . 3
Tubercles of clypeal margin narrow, rather acute 4

3(2). Distance from base of mandible to tubercle on outer side (point of union of mandibular carinae) about one third of distance from tubercle to apex of mandible .
occidentalis ( p . 22)
Distance from base of mandible to tubercle on outer side about one-half of distance from tubercle to apex of mandible . . . . . . . . . . . . . . . carinata (p. 18)

4(2). Punctures of disc of mesoscutum separated by about one-fourth a puncture width .
Punctures of disc of mesoscutum separated by about one-half a puncture width
$\cdot$
$\cdot$
$\cdot$

## Heriades cressoni Michener

(Pl. 12, figs. $10,11,13$ )
Heriades (Physostetha) cressoni Michener, 1938, Ann. Ent. Soc. Amer., 31:529, ठ', ㅇ. Type ㅇ, Bluff Lake, San Bernardino Mountains, California (Calif. Acad. Sci.).
Geographic range: Wyoming and western Nebraska to New Mexico, west to British Columbia, and California (see map 3).
California records:
Del Norte Co.: Siskiyou National Forest, 9 , VII-14-35 (R. H. Beamer, K. U.)

Fresno Co.: Florence Lake, VII-1931 (Michener, 1938:530). Huntington Lake, 7,000 ft., VII-8 (Michener, 1938:530). Indian Basin, Kings Canyon National Park, ${ }^{\prime}$, VIII-23-52 (J. C. Hall, J.C.D.).

Inyo Co.: Bishop, 9 , VII-14-35 (R. H. Beamer, K.U.) ; $\delta$, \&, IV-4-37 (G. E. and R. M. Bohart, U.S.A.C.). Glacier Lodge, 3 ㅇ, VII-30-53 (J. G. Rozen, C.I.S.). Lone Pine, $\delta$, ㅇ, VII-28-40 (R. H. Beamer, K.U.). Whitney Portal, $6 \delta, 10 \%$, VIII-6-48 (P. D. Hurd, Jr., and J. W. MacSwain, C.I.S., K.U.).

Lassen Co.: Susanville, VII-12-34 (Michener, 1938:531).

Los Angeles Co.: Big Pines Camp, ó, ㅇ, VII-13 to 17-27, flowers Erigeron foliosus var. stenopbyllus and Potentilla gracilis (Michener, 1938:531, U.C.R.).

Marin Co.: Tamalpais, $\bar{\sigma}$, VI-20-36, flowers Pbotinia arbutifolia (P. H. Timberlake, U.C.R.).

Mariposa Co.: Yosemite, $\delta^{\text {, }}$ VII-13-48 (H. M. G. and D. Townes, K.U.).

Placer Co.: Brockway, $2 \delta, 2$ 우, (2 pairs in copulo), VII-1 941 (G. E. Bohart, G.E.B.).

Plumas Co.: Quincy, $4 \mathrm{mi} . W^{2} ., ~ \delta, ~ V I I-2-49$ (P. D. Hurd, Jr., C.I.S.).

Riverside Co.: Idyllwild, San Jacinto Mountains, VII-7-28 (Michener, 1938:530); VIII-12-34, flowers Eriogonum nudum (Michener, 1938:530).

San Bernardino Co.: (all following localities are in the San Bernardino Mountains), Barton Flat, Y, VIII-23-52, flowers Solidago confinis (P. H. Timberlake, U.C.R.). Bear Valley, VIII-7, 9, 11, 13, flowers Aster canescens, A. parishii, Gayophytum ramosissimum, Geranium richardsonii, Helenium bigelovii, Solidago californica, S. confinis (Michener 1938:530, U.C.R:); VIII-1913 (Michener, 1938:530). Big Bear Valley (Lake), §, ㅇ, VIII-21-32 (Michener, 1938:530, U.C.R.). Bluff Lake, , VII-15-34 (Michener, 1938:530, C.I.S.). Clark Mountain, $6,000 \mathrm{ft} ., \mathrm{\delta}, \mathrm{VII}-8-38$, flowers Solidago petradoria (P. H. Timberlake, U.C.R.). Lake Arrowhead (above), VII-16-33, flowers Eriophyllum (Michener, 1938:530). Rathbon Creek, VIII-25-32 (Michener, 1938:530). South Fork Camp, 6,200 ft., 9, IX-2-46, flowers Gutierrezia californica (P. H. Timberlake,U.C.R.); 2 б, 9, IX-10-44, flowers Chrysothamnus pumilus, Gutierrezia californica, Solidago californica (P.


Map 3. Distribution of Heriades cressoni Michener.
H. Timberlake, U.C.R.); 2 §', 아, IX-11-44, flowers Chrysothamnus pumilus (P. H. Timberlake,U.C.R.) South Fork Camp, 6,300 ft., 2 Y, IX-9-47, flowers Aster canescens, Cbrysothamnus viridulus ( P . H. Timberlake, U.C.R.). Tetley Park, ㅇ, VIII-19-47, flowers Eriogonum elongatum (P. H. Timberlake, U.C.R.); 우, VIII-19-47, flowers Erigeron foliosus (P. H. Timberlake, U.C.R.); ㅇ, Solidago californica (P. H. Timberlake, U.C.R.). Santa Ana River, 6,300 ft., 3 ㅇ, VIII-23-52, flowers Solidago confinis (P. H. Timberlake, U.C.R.). Upper Santa Ana River, 11 o', 16 ㅇ, VII-2 to 26-46, flowers Senecio ionophyllus (G. H. and J. L. Sperry, C.A.S., U.C.R.).

San Diego Co.: San Diego, ơ, VII-21-29 (R. H. Beamer, K.U.). This locality is indicated on the map but is probably an error for a locality in the San Diego County Mountains.

Shasta Co.: Hat Creek Ranger Station, $\mathcal{f}$, VI-26-47 (T. F. Leigh, C.I.S.).

Tulare Co.: Peppermint Meadows, VI-29-35 (Michener, 1938:530). Tokopah Valley, Sequoia National Park, VII-20, 21-33 (Michener, 1938:530).

Tuolumne Co.: Eleanor Lake, $\mathrm{\delta}^{\prime}$, VII-2-51 (A. T. McClay, U.C.D.). Pinecrest, $14 \delta^{\sigma}, 35$ 우, VIII-4-48, flowers Solidago (P. D. Hurd, Jr., and J. W. MacSwain, C.I.S., K.U.). Pinecrest, 5,400 $\mathrm{ft} ., 4$ ठ, 3 ㅇ, VII-1-52, flowers Solidago californica (R. R. Snelling).
Discussion:
This is the commonest Heriades in many places in the mountains of California. It is also the most distinctive species of the subgenus Pbysostetha, as indicated by the characters listed in the key.
H. cressoni has been rather sporadically collected over the western United States, as the following records and an accompanying map indicate. In Arizona, it has been found at Prescott visiting the flowers of Haplopappus gracilis, Erigeron, and Gutierrezia (Michener, 1938:531). Other localities include: British Columbia (Lytton), Colorado (Meadows, Estes Park; near Monument Lake on flowers Cbrysopsis; and at Ouray), Nebraska (Glen; Monroe Canyon, Sioux County on flowers Solidago), Nevada (Kyle Canyon, Charleston Mountains, 7,500 ft., 9,000 ft.), New Mexico (Beulah; Cloudcroft; Highrolls; and Santa Fe on flowers Grindelia), Oregon (Corvallis; Crater Lake, 22 mi . W. on Medford Road, $3,750 \mathrm{ft}$. Pelican Bay; Prospect on flowers Solidago; and Sisters on flowers Cbrysothamnus), Utah (Bryce National Park on flowers Senecio), and Wyoming (Jenny Lake, Grand Teton National Park).

## Heriades gracilior Cockerell <br> (Pl. 12, fig. 17)

Heriades gracilior Cockerell, 1897, Ann. Mag.
Nat. Hist. (6) 20:138, 웅. Type 우, Soledad Canyon, Organ Mountains, New Mexico (U.S. Nat. Mus.).
Geographic range: Colorado, New Mexico, Arizona, Nevada, and California. (see map 4).
California records:
Riverside Co.: Piñon Flat, San Jacinto Mountains, V-30-39 (Michener, 1951:51); V-21-40, flowers Opuntia (Michener, 1951:51).
Discussion:
H. gracilior apparently is distributed throughout much of the southwestern United States but has not been found so abundantly in southern California as might be anticipated from the geographic range of the species. It has been found thus far visiting flowers of Opuntia in California and Convolulus arvensis in New Mexico (Las Cruces).

## Heriades timberlakei Michener

Heriades timberlakei Michener, 1938, Ann. Ent. Soc. Amer., 31:527, $\delta$, ㅇ. Type ${ }^{2}$, Prescott, Arizona (Timberlake collection, U.C.R.).
Geographic range: Arizona, Colorado, Nevada, and New Mexico. (see map 5).
Discussion:
This species is unknown in California but approaches eastern California in Arizona and Nevada. At White River, Arizona, it has been collected at the flowers of Euphorbia albomarginata. No other floral records are known to us.

## Heriades carinata Cresson

(P1. 12, figs. 9, 15)
Heriades carinatum Cresson, 1864, Proc. Ent. Soc. Phila., 2:383, ㅇ, $\delta$. Type $\mathcal{Y}$, Pennsylvania (Acad. Nat. Sci. Phila.).
Synonym: glomerans Schletterer, 1889.
Geographic range: Quebec to Georgia, west to British Columbia, Oregon, Utah, Arizona, and Texas. (see map 6).
Discussion:
Aithough there are no California records of this species, it has been taken at Pelican Bay, Klamath County, Oregon (Michener, 1938:524) and presumably occurs also in the northeastern part of California.


Map 4. Distribution of Heriades gracilior Cockerell.


Map 5. Distribution of Heriades timberlakei Michener.


Map. 6. Distribution of Heriades carinata Cresson.

A wide variety of flowers are visited, as the following enumeration suggests. In Nebraska it has been taken on flowers of Asclepias syriaca at Halsey; on flowers of Cleome serrulata at Glen; on flowers of Medicago sativa at Norfolk; on flowers of Melilotus at Carns and Warbonnet Canyon; on flowers Melilotus alba at Southbend and West Point; on flowers of Melilotus officinalis at Sowbelly Canyon, Sioux County; on flowers of Mentha canadensis at Glen; on flowers of Monarda at Carns and Warbonnet Canyon; on flowers of Parthenocissus quinquefolia at Omaha; on flowers of Penstemon at Warbonnet Canyon; on flowers of Petalostemon candidus at Carns; on flowers of Polygonum scaridens at Monroe Canyon; and on flowers of Solidago at Glen. In Utah it has been taken on flowers of Heliantbus and Vicia at Logan.

## Heriades occidentalis Michener

(Pl. 12, figs. 7, 16)
Heriades (Physostetha) occidentalis Michener, 1938, Ann. Ent. Soc. Amer., $31: 525, \sigma$, Type 9, Idyllwild, San Jacinto Mountains, California (Calif. Acad. Sci.).
Geographic range: Oregon, California. (see map 7). California records:

Alpine Co.: Alpine, ${ }^{\text {P, VII-19-41 (B. Hodgden, }}$ K.U.).

Los Angeles Co.: Altadena, VI-1-35, flowers Opuntia (Michener, 1938:526). Azusa, 41 (E. L. Todd, K.U.). Camp Baldy, 2 ठ, 2 ㅇ, VI-26-50 (H. L. Hansen, C.I.S.); P, same data (P. D. Hurd, Jr., C.I.S.); ㅇ, same data (A. T. McClay, U.C.D.); 6 ó, VII-11-50 (D. C. Blodget, U.C.D.. U.C.L.A.); 5 \%, same data (J. C. Hall, U.C.D.); $2 \delta$, same data (P. D. Hurd, Jr., C.I.S.); $2 \delta, 4$ ㅇ, same dara (A. T. and M. F. McClay, U.C.D.); $\delta^{\prime}$ VII-17-52 (A. T. McClay, U.C.D.). Eagle Rock, 9 , VII-1-36 (C. D. Michener, K.U.). Eagle Rock Hills, VI-22-33, VI-30-33, flowers Stephanomeria (Michener, 1938:526). Lone Pine Creek, San Gabriel Mountains, $5,500 \mathrm{ft} ., \delta^{\prime}$, , VI-16-28, flowers Eriodictyon trichocalyx (Michener, 1938: 526); $\delta, 3$ ㅇ, VII-4-33, flowers Lonicera interrupta (Michener, 1938:526). Lone Pine Canyon, San Gabriel Mountains, 6,000 ft., ${ }^{\text {P, VII }}$, 2136, flowers Tetradymia canescens (P. H. Timberlake, U.C.R.). Mt. Wilson, $\sigma^{\prime}$, August (K.U.). Mt. Wilson Road, б, 2 ㅇ, VII-24-39 (R. M. Bohart, U.C.D.). San Gabriel Mountains, 3,000 to 3,500 ft., V-28-10, VI-4 and 5-10, VII-2-10 (Michener, 1938:526). Sheep Creek, San Gabriel Mountains,

4 ठ, VI-3-28, flowers Eriodictyon trichocalyx (Michener, 1938:526). Switzer's Camp, San Gabriel Mountains, $\delta$, VII-27 (Michener, 1938: 526). Tanbark Flat, San Dimas Experimental Forest, ${ }^{\text {T, VI }}$ VI-20-50 (P. D. Hurd, Jr., C.I.S.); $f$, same data (K. G. Whitesell, U.C.D.); $\delta$, VII-22-50 (P. D. Hurd, Jr., K.U.); $\delta$, same data (J. C. Hall, U.C.D.); $\sigma^{2}$ VI-23-50 (H. L. Hansen, C.I.S.); $\sigma^{2}$, same data (M. J. Stebbins, U.C.D.); 6 ㅇ, VI-25-50 (W. C. Bentinck, C.I.S.); + , same data (P. D. Hurd, Jr., C.I.S.); $\delta$, same data (J. W. MacSwain, C.I.S.); ${ }^{\prime}$, same data (U.C.D.); $\delta$, same data (F. X. Williams, C.A.S.); ${ }^{\pi}$, VI-27-50 (W. O. Marshall, U.C.D.); 2 \&, same data (F. X. Williams, C.A.S.); $2 \delta$, VI-30-50, flowers Helianthus (P. D. Hurd, Jr., C.I.S.); $\delta$, VII-2-50, flowers Lotus (E. G. Linsley, C.I.S.); ס, ㅇ, VII-3-50 (P. D. Hurd, Jr., C.I.S.); Y, same data (F. X. Williams, C.A.S.). 2 9, VII-4-50 (D. C. Blodget, U.C.D., U.C.L.A.); 2 ठ', same data (P. D. Hurd, Jr., C.I.S., K.U.); $\sigma^{\top}$, same data (A. T. McClay, U.C.D.); ㅇ, VII-8-50 (A. T. McClay, U.C.D.); 2 , same data (F. X. Williams, C.A.S.); ㅇ, VII-10-50 (A. T. McClay, U.C.D.); d, VII-12-50 (P. D. Hurd, Jr., C.I.S.); 2 ㅇ, VII-13-50 (A. T. McClay, U.C.D.); ㅇ, VII-14-50 (P. D. Hurd, Jr., K.U.); $\sigma$, Y, VII-1 9-50 (A. T. McClay, U.C.D.); $\delta$, VI-17-52 (A. T. McClay, U.C.D.); , VII-5-52 (S. Miyagawa, U.C.D.); $3 \delta$, VII-11-52 (A. T. McClay, U.C.D.); す, VII-12-52 (R. L. Anderson, U.C.D.); $2 \delta$, + , same data (H. L. Mathis, U.C.D.); 2 , VII-13-52 (A. T. McClay, U.C.D.); , same data (S. Miyagawa, U.C.D.); 2 б, VII-1 5-52 (J. W. MacSwain, C.I.S.); $4 \delta^{\top}$; VII-16-52 (A. T. McClay, U.C.D.); ס, VII-1 7-52 (A. T. McClay, U.C.D.). West Hollywood Hills, ¢, VIII-21-49 (R. G. Howell, U.C.D.); 2 ס', VI-2450 (R. G. Howell, C.I.S.); 2 o, VI-25-50 (R. G. Howell).

Marin Co.: Tamalpais, $\sigma^{\prime}$, VI-20-26 (Michener, 1938:526, U.C.R.).

Napa Co.: Mt. St. Helena, $\delta$, V-6-36 (Michener, 1938:526, C.A.S.); $2 \delta, 2$ ¢, V-3-51, emerged from cones of Pinus attenuata (Green, Helfer, Leech, Van Dyke, C.A.S.). Samuel Spring, ${ }^{\prime}$, V-31-51 (J. C. Hall, U.C.D.).

Plumas Co.: Quincy, 4 mi . W., ס', VI-26-49 (J. W. MacSwain, C.I.S.).

Riverside Co.: Herkey Creek, San Jacinto Mountains, ${ }^{\text {f, VI-14-40 (C. D. Michener, K.U.). }}$ Idyllwild, $\delta$, VII-3-30, flowers Sidalcea malvaeflora (Michener, 1938:526); $\delta$, VII-2-36, flowers Angelica tomentosa (P. H. Timberlake, U.C.R.); $\delta^{*}$, VI-21-40 (C.I.S.). Piñon Flar, San Jacinto Mountains, $\sigma^{\pi}$, V-18-39 (B. Brookman, C.I.S.); ${ }^{\circ}$, V-20-39 (E. G. Linsley, K.U.); 2 б, ㅇ, V-27-36


Map 8. Distribution of Chelostoma californicum Cresson.
(E. S. Ross, C.I.S.); 2 오, VI-4-39, flowers Eriogonum (E. G. Linsley, C.I.S.); 3 ㅇ, VI-4-39, Eriogonum fasciculatum and Nolina parryi (P. H. Timberlake, U.C.R.); 2 ㅇ, V-21-40, flowers Eriogonum (H. T. Reynolds, C.I.S.); $\delta$, V-28-40, flowers Eriogonum (R. Husbands, C.I.S.); ठ, 2 ㅇ, V-28-40, flowers Eriogonum fasciculatum (C. D. Michener, C.I.S., K.U.); ס', 2 ㅇ, V-28-40, flowers Opuntia (H. T. Reynolds, C.I.S.). San Jacinto Mountains, VII-1912 (Michener, 1938:526). Strawberry Valley, San Jacinto Mountains, VII-25-12 (Michener, 1938:526).

San Bernardino Co.: Barton Flat (near), San Bernardino Mountains, 6,300 ft., 2 ㅇ, VIII-30-49, flowers Solidago californica (P. H. Timberlake, U.C.R.). Cajon Pass, + , VII-2-34, flowers white Pbacelia (I. McCracken, K.U.). Mountain Home Creek, San Bernardino Mountains, 4,300 ft., VIII-14-34, VII-4-35, flowers Eriogonum fasciculatum (Michener, 1938:526); $\widehat{3}, 4$ ㅇ, VIII-24-44, flowers Eriogonum fasciculatum (P. H. Timberlake, U.C.R.); 2 ㅇ, VIII-6-49, flowers Eriogonum fasciculatum (P. H. Timberlake, U.C.R.); 9, VIII-7-49, flowers Eriogonum fasciculatum (P. H. Timberlake). Seven Oaks, $\delta$, VI-14-50, flowers Cryptantha intermedia (P. H. Timberlake, U.C.R.).

San Diego Co.: Mt. Laguna, đó, VII-9-50 (D. Cox, C.I.S.). Oak Grove, $\delta^{\prime}$, VI-6-40 (C. D. Michener, C.I.S.). Warner Springs, 2 㱜, v-9-36, flowers Frasera parryi (Michener, 1938:526, U.C.R.).

Santa Clara Co.: Menlo Park, J, VII-1937 (Michener, 1938:526, U.C.R.).

Shasta Co.: Mt. Lassen, 7,000 ft., + , VII-30-47 (R. M. Bohart, G.E.B.).

Solano Co.: Vacaville, $\delta$ ', VI-1-32 (A. S. Harrison, CiI.S.). Discussion:

This species is closely allied to $H$. carinata. Since the two species are, so far as is known, allopatric, it seems likely that occidentalis is a subspecies of carinata. No intermediate specimens are known, however. In Oregon, H. occidentalis has been collected only at Corvallis, and it is possible that the record is based upon an unusual $H$. carinata.

## Genus Chelostoma Latreille

This genus conta ins slender black bees, which are much more finely punctate than those in Heriades. The thorax is the most elongate of any megachilid except Prochelostoma, the shortest distance between the tegulae being less than the length of the mesoscutum. The propodeum has a horizontal basal region about as long as the metanotum; this region is finely sculptured medially, although sometimes pitted laterally, and there is no sharp margin separating it from the posterior surface. The first metasomal tergum is convex seen in profile with no well-defined anterior face, but with a longitudinal median sulcus basally. The abdomen of the male is less telescoped than in most megachilines, there being seven exposed terga; the seventh in ours is strongly tridentate or quadridentate (pl. 13, figs. 18-23). As in Heriades, the pterostigma is rather large. The inner ventral angle of each posterior coxa bears a carina.

Chelostoma is widespread in the Palearctic region, but in North America occurs only in the Pacific coast area, whence eight species are known. All of them occur in California. It is replaced in eastern North America by the closely related, but in some respects more primitive genus, Prochelostoma. The latter could justifiably be regarded as a subgenus of Chelostoma. The American species of the genus were revised by Michener ( 1938 b).

Bees of this genus are active for the most part in spring and early summer. Our species visit principally flowers of the Hydrophyllaceae, especially the genera Pbacelia and Eriodictyon, and possibly collect their pollen exclusively from such flowers. Nothing is known of nesting habits of American species, but European forms, as well as the related Prochelostoma, nest in holes, such as those made by emerging beetles, in old logs and branches.

Key to the American Species of Cbelostoma

## Males

Apex of abdomen (seventh metasomal tergum) terminating in four teeth (pl. 13, figs. 20-23)
Apex of abdomen terminating in three teeth (pl. 13, figs. 18, 19) . . . . . . . . 5


Plate 4. Lateral view of Chelostoma californicum Cresson, male.

2(1). Second segment of labial palpus longer than eye; fringe of fifth stemum arising from broad,
shallow emargination in margin of sternum . . . . . . . . . cockerelli (p. 32)
Second segment of labial palpus shorter than eye; fifth sternum not emarginate, fringe aris-
ing from posteriormost part of sternum . . . . . . . . . . . . . . . . 3
$3(2)$. Fringe of fifth metasomal sternum consisting of amber-colored bristles which bear numerous side branches distally and are all directed posteriorly from margin of sternum, then bent ventrally, and then posteriorly again; fringe occupying middle third of sternal margin .

Fringe of fifth sternum consisting of bristles without conspicuous side branches, if amber colored and bent as in minutum, then fringe occupying entire width of sternal margin . . 4
4(3). Fringe of fifth sternum occupying the full width of sternum, consisting of amber-colored bristles, each of which is directed posteriorly from the margin of the sternum, then bent ventrally, and then posteriorly . . . . . . . . . . . . . incisulum (p. 36)
Fringe of fifth sternum occupying only median part of sternal margin, consisting of creamcolored bristles which are only weakly and somewhat irregularly bent as described above but are wavy apically
marginatum(p. 36)
S(1). Processes of seventh metasomal tergum short (pl. 13, fig. 18), lateral ones not as long as basal width; flagellar segments except the last broader than long or about as long as broad . . . . . . . . . . . . . . . . . . . . . californicum (p. 27)
Processes of seventh tergum longer (as in pl. 13, fig. 19), lateral ones longer than basal width; flagellar segments mostly longer than broad

6
6(5). Proboscis long, in repose reaching far behind head, second segment of labial palpus usually longer than eye; teeth of seventh tergum in nearly the same plane so that in profile lateral one is seen largely or entirely against middle one (pl. 13, fig. 19) . . phaceliae (p. 29)
Proboscis shorter, in repose not reaching much behind head, second segment of labial palpus much shorter than eye; median tooth of seventh tergum directed more ventrally than lateral ones, so that in profile apices of lateral ones are above middle one
$7(6)$. Fifth sternum with a fringe of hairs which is short medially and consists of long, laterally directed hairs at the sides . . . . . . . . . . . . . . . bernardinum (p. 29)
Fifth sternum with a fringe of long, posteriorly directed hairs medially . tetramerum (p. 29)

## Females

1. Posterior face of propodeum above median pit with large, smooth and shining area; length more than $61 / 2 \mathrm{~mm}$., usually about 8 mm. . . . . . . . . . californicum (p. 27)
Posterior face of propodeum above median pit finely roughened and dull; length usually less than $6 \mathrm{~mm} . \quad . \quad . \quad$. . . . . . . . . . . . . . . . . . . . . 2

2(1). Maxillary palpi four-segmented . . . . . . . . . . . . . . phaceliae (p. 29)
Maxillary palpi three-segmented 3

3(2). Anterior part of clypeus between tubercles minutely crenulate, several yellowish hairs as long as antennal scape arising beneath crenulate margin; extreme basolateral angles of labrum tuberculate. . . . . . . . . . . . . . . . . .bernardinum (p. 29)
Anterior part of clypeus between tubercles straight, hairs arising near margin much shorter than scape; basolateral angles of labrum not tuberculate
4(3). Second segment of labial palpus longer than eye . . . . . . . . cockerelli (p. 32)
Second segment of labial palpus shorter than eye . . . . . . . . . . . . . 5
5(4). Margins of metasomal terga scarcely brownish; head about as long as broad. minutum (p. 34) Margins of metasomal terga rather broadly brown; head longer than broad6

G（5）．Head more elongate，so that seen from front a line across summits of the two eyes passes in front of the median ocellus ．．．．．．．．．．．．．．marginatum（p．36）
Head less elongate so that a line across summits of the two eyes passes near anterior mar－ gin of median ocellus．
incisulum（p．36）

## Chelostoma californicum Cresson

（Pl．13，fig．18）
Chelostoma californicum Cresson，1878，Trans． Amer．Ent．Soc．，7：108，ס．Type ס，California （Acad．Nat．Sci．Phila．）
Synonyms：albicinctum（Provancher），1895；odon－ tura（Cockerell），1902；dolichosoma（Cockerell）， 1922.

Geographic range：California（see map 8）．
California records：
Alameda Co．：Livermore，$\uparrow$ ，V－12－40（M．A． Cazier，U．C．R．）．

Contra Costa Co．：Antioch， 3 ס，IV－18－36 （Michener，1938：38）；$\delta$ ， Layia platyglossa（E．C．Van Dyke，C．A．S．）； 9 ， V－8－37（G．E．and R．M．Bohart，U．C．D．）．Marsh Creek，Mt．Diablo，IV－26－37，flowers Pbacelia （Michener，1938：38）．Russelman Park，Mt．Diablo， 19 ठ＇， 6 Y，IV－8－38，flowers white Phacelia（E． C．Van Dyke，C．A．S．，K．U．）．Rock City，Mt． Diablo， 4 ठ́，V－24－40（E．G．Linsley，C．A．S．）． Mt．Diablo， $3 \sigma^{\prime}, 5$ ㅇ，IV－24－37（G．E．and R．M． Bohart，G．E．B．，U．C．D．，U．C．L．A．）； $5 \delta^{2}, 3$ ， IV－26－37，flowers Phacelia（C．D．Michener，K．U．）； ㅇ，V－10－38（M．A．Cazier，U．C．R．）； 10 ठ， 4 ㅇ， IV－28－39（M．A．Cazier，U．C．R．）； 9 ס，ㅇ，IV－29－39 （C．I．S．，K．U．）；$\delta^{7}$ ， ，IV－13－47（R．M．Bohart， U．C．D．）．Marsh Creek Spring， 6 ס， 3 \＆，IV－23－37 （E．C．Van Dyke，C．A．S．）．

Fresno Co．：Coalinga，$\delta$ ，V－14－38（M．A． Cazier，U．C．R．）．Coalinga， 12 mi ．W．，$\delta$ ，IV－8－51 （E．G．Linsley，C．I．S．）．Delpiedra， 3 o＇， 25－53，flowers Phacelia（H．L．Hansen，C．I．S．）． Kern Co．：Glennville，${ }^{\text {P，IV }} \mathrm{IV}$－26－50（E．I． Schlinger，U．C．D．）．McKittrick， 2 §，V－2－51（R． M．Bohart，U．C．D．）．

Los Angeles Co．：Westwood Hills， $7 \sigma^{\circ}$ ，IV－18－ 40 （R．M．Bohart，U．C．D．，U．C．L．A．）．Swartout Valley，ס＇，VI－3－28，flowers Phacelia davidsonii （Michener，1938：38，U．C．R．）．Rock Creek，grade above， $\mathrm{P}, \mathrm{V}-9-38$ ，flowers Salvia carnosa（P．H． Timberlake，U．C．R．）．Claremont，mountains near， 우（C．F．Baker，U．C．R．）．

Madera Co．：O＇Neals， $2 \delta^{\prime \prime}$ IV－26－47（A．T． McClay，K．U．）．San Joaquin Experimental Range， 5 ठ， 8 个，IV－18－53，flowers Phacelia platyloba （P．D．Hurd，Jr．，C．I．S．）．

Mariposa Co．：El Portal，ס＇，V－23－38（N．F． Hardman，C．I．S．）．

Riverside Co．：Riverside，V－15－38，flowers Phacelia distans（Michener，1938：38，U．C．R．）； ㅇ，V－15－33，flowers Pbacelia distans（P．H． Timberlake，U．C．R．）；ठ，V－7－50，flowers Pbacelia distans（P．H．Timberlake，U．C．R．）．Riverside， $3 \mathrm{mi} . W ., 5 \delta$, ㅇ，V－10－38，flowers Phacelia distans（P．H．Timberlake，U．C．R．）．Banning， $2 \sigma^{\pi}, 4$ 个，V－28－28（Michener，1938：38，C．A．S．）； $17{ }^{\circ}$ ，V－17－41（E．C．Van Dyke，C．A．S．，K．U．）． The Gavilan，$\delta$ ，IV－17－38，flowers Pbacelia distans（P．H．Timberlake，U．C．R．）；${ }^{\top}$ ，IV－18－37 （E．G．Linsley，C．I．S．）； 3 ठ，V－4－38，flowers Phacelia distans（P．H．Timberlake，U．C．R．）； ס＇，IV－16－50，flowers Pbacelia distans（P．H． Timberlake，U．C．R．）．Corona，$\delta, 3$ Y，V－1912． （C．I．S．）．Idyllwild，ס，V1－18－40（C．D．Michener， C．I．S．）．Temecula， ，IV－11－50（P．D．Hurd，Jr．， C．I．S．）．

San Benito Co．：Pinnacles National Monument， б＇，IV－24－48（P．D．Hurd，Jr．，C．I．S．）．

San Bernardino Co．：Tetley Park，San Bernar－ dino Mountains， $15 \delta, 23$ ，V，16－23，flowers Nemopbila Menziesii var．integrifolia（Michener， 1938：38，U．C．R．）； $3 \delta_{i}^{\prime} 3$ ㅇ，same data（Michener， 1938：38，K．U．）．Redlands，${ }^{*}$（Michener，1938：38）． Mouth of Deep Creek， $2 \sigma^{\sigma}$ ， 9, V－5－36，flowers Eriodictyon trichocalyx（Michener，1938：38， U．C．R．）．Deep Creek，${ }^{\prime}$ ，IV－26－36，flowers Erio－ dictyon californicum（E．G．Linsley，C．I．S．）；${ }^{\circ}$ ， ㅇ，V－5－36，same flower（E．G．Linsley，C．I．S．）． East Highlands， 0 ，V－4－45，flowers Phacelia distans（R．C．Dickson，U．C．R．）．Mill Creek，San Bernardino Mountains，$\delta$＇， 2 个，V－13－40，flowers Phacelia distans（P．H．Timberlake，U．C．R．）． Mill Creek，San Bernardino Mountains， 4,400 ft．， $7 \sigma^{2}, 5$ ㅇ，V－30－38，flowers Pbacelia distans（P． H．Timberlake，U．C．R．）．Mountain Home Creek， $4,500 \mathrm{ft} ., 7$ o＇， 2 ，VII－4－38，flowers Pbacelia distans（P．H．Timberlake，U．C．R．）； 9 ，VII－9－38， same flower（P．H．Timberlake，U．C．R．）．

Santa Clara Co．：Mt．Hamilton， 5 ס， 9, IV－1 5－ 47，flowers Phacelia（G．E．Bohart，C．I．S．）；${ }^{\sigma}$ ， V－18－52（P．D．Hurd，Jr．，C．I．S．）．

Stanislaus Co．：Adobe Creek， 2 ㅇ，V－11－48 （J．W．MacSwain and R．F．Smith，C．I．S．）； $9 \sigma^{6}$ ， 6 Y．IV－6－48，flowers Phacelia（J．W．MacSwain， C．I．S．）； $11 \delta^{\prime}, 2$ P，IV－20－48（R．F．Smith，C．I．S．）． Turlock， 2 O，V－10－52，flowers Phacelia（R．R． Snelling）．





Tulare Co.: Lemoncove, $2 \delta$, III-24-40, (R. P. Allen, C.A.S.); 15 ot, 1 오, IV-14-50, flowers Phacelia (E. G. Linsley, C.I.S., K.U.); $\delta$, III-29-51 (J. W. MacSwain, C.I.S.). Potwisha, Sequoia National Park, 2,000-5,000 ft., 2 f, V-15-29 (E. C. Van Dyke, C.A.S., C.I.S.). Pine Flat, $4 \delta^{\prime}$, V-3-47, flowers Phacelia hispida (P. H. Timberlake, U.C.R.). Three Rivers, $3 \mathrm{mi} . W ., 16 \delta^{\prime}$, IV-1-39, flowers Pbacelia distans (many specimens), Plagiobothrys nothofulvus (P. H. Timberlake, U.C.R.), Three Rivers, $4.5 \mathrm{mi} . \mathrm{S}^{2}$, $\delta$, IV-29-47, flowers Cryptantha flaccida (P. H. Timberlake, U.C.R.).
Discussion:
This is the largest American species of the genus and by size alone (length usually about 8 mm .) it can ordinarily be separated from its relatives.

It is noteworthy that the number of segments in the maxillary palpi varies from three to four. This suggests that the number of palpal segments may eventually prove useless for separation of species elsewhere in the genus, although none of our species are distinguished by this character alone. The three-segmented condition seems most common in southern California, although specimens with four segments predominate in central California.

The fringe of the fifth sternum in the male arises from a shallow emargination in the apical margin of the sternum. The fringe is narrow, occupying a tenth or less of the width of the sternum, and consists of only slightly curved hairs bearing numerous short side branches.

## Cbelostoma tetramerum Michener

Chelostoma tetramerum Michener, 1942, Ent. News, 53:47, đ'. Type ${ }^{\star}$, Shingletown, Shasta County, California (Calif. Acad. Sci.).
Geographic range: California (see map 9). California records:

Shasta Co.: Shingletown, ${ }^{\circ}$ ', V-23-41, flowers yellow Mimulus (Michener, 1942:47).
Discussion:
Only a few specimens of this species are known. Except for californicum, it is our largest species.

The fringe of the fifth sternum of the male does not arise from an emargination. It occupies about one third of the width of the sternum. Its brownish white hairs are quite long and are directed at first posteriorly, then ventrally, and then posteriorly, the curves being gradual. The
hairs themselves diverge somewhat apically and are provided with numerous side branches.

## Cbelostoma bernardinum Michener

Chelostoma bernardinum Michener, 1938, PanPacific Ent. 14:40, $\boldsymbol{\sigma}^{2}$, 우. Type ㅇ, Tetley Park, San Bernardino Mountains, California, flowers Nemophila (Calif. Acad. Sci.).
Geographic range: California (see map 10).
California records:
San Bernardino Co.: Tetley Park, San Bernardino Mountains, V-16 and V-23, 1936, flowers Nemophila Menziesii var. integrifolia and Pbacelia davidsonii (Michener, 1938:41, U.C.R.). Crestline, V-13-34, flowers Nemophila Menziesii var. integrifolia (Michener, 1938:41, U.C.R.). Miller Canyon, San Bernardino Mountains, 3,500 ft., + , V-19-41, flowers Nemophila Menziesii var. integrifolia (P. H. Timberlake, U.C.R.).
Discussion:
The fringe of the fifth metasomal sternum of the male makes this species unique among American Chelostoma. It occupies the full width of the sternum, which is not emarginate, and hangs down at right angles to the sternum instead of having its hairs directed posteriorly, at least near their bases, as in all our other species. The hairs slant strongly toward the sides and are longest at the sides, short medially.

## Chelostoma phaceliae Michener <br> (Pl. 13, fig. 19)

Chelostoma phaceliae Michener, 1938, PanPacific Ent., 14:38, © ', ㄱ. Type $\mathbf{\sigma}^{2}$, Altadena, California, flowers Phacelia tanacetifolia. (Calif. Acad. Sci.).
Geographic range: California, Nevada, Oregon, Washington (see map 11).
California records:
Alameda Co.: Berkeley Hills, 20 J, 4 f, VI- 4 and 16-33, flowers Pbacelia (Michener, 1938:40, U.C.R.).

Contra Costa Co.: Marsh Creek, Mr. Diablo, 7 O, 9 , V-12-37, flowers Phacelia (Michener, 1938:40, U.S.A.C.). Curry Creek, $\delta$, V-5-47, flowers Brodiaea laxa (G. E. Bohart, G.E.B.).

Inyo Co.: Big Pine Creek, $6,000 \mathrm{ft}$., + , VI-16-42 (R. M. Bohart, G.E.B.).

Kern Co.: Greenhorn Mountains, $\sigma^{2}$ V-7-31 (E. C. Van Dyke, C.A.S.).

Lake Co.: Cobb Mountain, 2 㱜, V-7-36 (Michener, 1938:40, G.E.B.).

Los Angeles Co.: Los Angeles, ${ }^{\pi}$, VI-16-34 flowers Pbacelia ramosissima (Michener, 1938: 39). Puente Hills, $\delta$, IV-12-25, flowers Pbacelia distans (P. H. Timberlake, U.C.R.); ס, Y, V-9 and 10-26, same flower (Michener, 1938:39). San Gabriel Canyon, 9, VI-25-33, flowers Lotus (Michener, 1938:39). Altadena, $2 \sigma^{*}$, IV-18-35, flowers Phacelia ramosissima (C. D. Michener, U.C.D., U.C.L.A.); ס', VI-11-33, flowers Phacelia (Michener, 1938:39). Arroyo Seco, San Gabriel Mountains, ㅇ, VII-6-22 (Michener, 1938:39); 3 ㅇ. VI-25-40 (J. W. MacSwain, C.I.S.). Big Pines Camp, San Gabriel Mountains, $Y$, VII-11-27, flowers Phacelia ramosissima (Michener, 1938: 39); 2 ㅇ, VII-13-27, flowers Pbacelia californica (Michener, 1938:39). Swartout Valley, 9, VI-3-28, flowers Phacelia californica (Michener, 1938:39). Pasadena, 9 , VII-2-26, flowers Nama parryi (C.I.S.). Crystal Lake Road., 4,700 ft., $\widehat{\sigma}$, VII-9-52 (J. K. Hester, U.C.D.). Tanbark Flat, San Dimas Experimental Forest, F , VI-21-50 (H. L. Hansen, C.I.S.); $P$, VI-22-50, flowers Eriogonum (H. F. Robinson, U.C.D.); 3 Y, VII-10-50 (F. X. Williams, C.A.S.); 3 Y, VII-13-52, flowers Phacelia (J. W. MacSwain, C.I.S.).

Madera Co.: Bass Lake, J, ㅇ, VI-6-38 (R. M. Bohart, U.C.D., G.E.B.).

Mariposa Co.: $\delta$, VII-2-33 (Michener, 1938:39, G.E.B.). El Portal, 2 ó, 2 Y, V-23-38 (R. M. Bohart, U.C.D., U.C.L.A., U.S.A.C.); $3 \delta^{\circ}$, same data (N. F. Hardman, C.I.S.).

Napa Co.: Putah Canyon, $\delta$, V-25-51 (E. I. Schlinger, U.C.D.).

Nevada Co.: Lake Spaulding, $\uparrow$, VI-1 938 (I. McCracken, C.A.S.).

Plumas Co.: Clio, 9, VII-9-16 (Michener, 1949:43). Nelson Point, 2 す, 7 9, VII-5-52 (E. I. Schlinger, U.C.D.); 2 q, same data (R. C. Bechtel, U.C.D.). Meadow Valley, 3,500-4,000 fr., $\delta, 2$, VI-1-24 (W. H. Nelson, C.I.S.). Quincy, 4 mi. W., 3 Y, VI-21-49, flowers Phacelia (P. D. Hurd, Jr. C.I.S.) 2 \&, same data (J. W. MacSwain, C.I.S.); 4 ㅇ, VI-22-49, flowers Pbacelia (P. D. Hurd, Jr., C.I.S.) ; Y, VI-24-49 (P. D. Hurd, Jr., C.I.S.); $q$, VI-25-49 (P. D. Hurd, Jr., C.I.S.); Y, same data (J. W. MacSwain, C.I.S.); 2 q, same data (W. R. Schreader, U.C.D.); 3 \&, VI-26-49 (W. F. Ehrhardt, U.C.D.) ; 3 \&, same data (E. I. Schlinger, U.C.D.); 2 Y. VI-30-49 (R. C. Bechtel, U.C.D.); 9 , same data (W. F. Ehrhardt, U.C.D.); 4 Y, same data (P. D. Hurd, Jr., C.I.S.); 3 Y, same data (J. W. MacSwain, C.I.S.); 3 \&, same data (E. I. Schlinger, U.C.D.); 2 个, VII-3-49 (J. E. Gillaspy, C.I.S.); 9, VII-7-49 (E. L. Atkinson, C.I.S.).

Riverside Co.: Riverside, IV-20-26, IV-26-27,

V-4-27, V-12-30, VI-4-30, IV-8-32, V-14-36, flowers Phacelia distans and $P$. ramosissima (Michener, 1938:39, U.C.R., K.U.); ㅇ, V-6-38, flowers Phacelia ramosissima (P. H. Timberlake, U.C.R.); $\delta$, IV-26-39, flowers Cryptantha intermedia (P. H. Timberlake, U.C.R.). Idyllwild, 9 , VI-28-28 (Michener, 1938:39, C.A.S.); $\delta$, VII-3-30, flowers Erigeron foliosus, var. stenophyllus (Michener, 1938:39, U.C.R.). San Jacinto River, $3,000 \mathrm{ft}$. , $\delta, ~ \mathrm{O}, \mathrm{V}-30-40$, flowers Phacelia (C. D. Michener, C.I.S.). The Gavilan, $\delta$, $9, \mathrm{~V}-4-38$, flowers Pbacelia distans (P. H. Timberlake, U.C.R.). Banning, $\delta$, V-28-28 (E. C. Van Dyke, C.A.S.).

Sacramento Co.: Folsom, 2 Q, V-18-52 (T. R. Haig, C.I.S.).

San Bernardino Co.: Tetley Park, San Bernardino Mountains, $\delta$, V-13-34, flowers Potentilla (Michener, 1938:39). Mountain Home, 7, VI-17-34, flowers Pbacelia ramosissima (Michener, 1938: 39); $\delta$, VII-4-35, flowers Erigeron (P. H. Timberlake, U.C.R.); 4 ㅇ, VII-17-34 (I. McCracken, C.A.S.). Mountain Home Creek, 4,500 ft., 4 f, VII-4-38, flowers Pbacelia distans (P. H. Timberlake, U.C.R.). Crestline, $\mathcal{Y}$, V-23-36, flowers Lotus (E. G. Linsley, C.I.S.). San Bernardino, $\sigma^{\sigma}$, V-28-36, flowers Cryptantha (E. G. Linsley, C.I.S.). Green Valley, $\delta$, VII-9-33, flowers Pbacelia (P. H. Timberlake, U.C.R.). Mill Creek, San Bernardino Mountains, $4,400 \mathrm{ft} ., 5$ Y, V-3038, flowers Phacelia distans (P. H. Timberlake, U.C.R.); $\delta$, $4,800 \mathrm{ft} ., \mathrm{V}-13-40$, flowers Gilia exilis (P. H. Timberlake, U.C.R.); 2 \&, 4,400 ft., VI-20-50, flowers Phacelia ramosissima (P. H. Timberlake, U.C.R.).

Santa Barbara Co.: Rincon Creek near Carpinteria, 9 , VII-16-28 (Michener, 1938:39, C.A.S.).

Santa Cruz Co.: Santa Cruz, ㅇ, VI-1-19 (E. P. Van Duzee, C.A.S.).

Shasta Co.: Burney, 5 mi. E. $\delta, 2$ ㅇ, VI-8-41, flowers Phacelia (C. D. Michener, C.I.S.); $\sigma^{\top}$, VI-9-41 (P. D. Hurd, Jr., C.I.S.).

Sonoma Co.: Green Valley, $\delta^{\alpha}$, VI-9-33, flowers Pbacelia (Michener, 1938:40).

Stanislaus Co.: Adobe Creek, 2 ठ', V-6-48, flowers Phacelia (R. F. Smith, C.I.S.).

Tulare Co.: California Hot Springs, f, (Michener, $1938: 39$ ). Coffee Camp, 0,3 , 3 , VI-8-25, flowers Phacelia (Michener, 1938:39, U.C.R.). General Grant National Park, ${ }^{\circ}$, VI-27-29, flowers Pbacelia (Michener, 1938:39, U.C.R.). Lemoncove, 9 , IV-14-50, flowers Phacelia (E. G. Linsley, C.I.S.). Mineralking, $\sigma$, VII-20-23 (C. L. Fox, C.A.S.). Pine Flat, $9, \mathrm{~V}-3-47$, flowers Phacelia bispida (P. H. Timberlake, U.C.R.).




Map 11. Distribution of Cbelostoma phaceliae Michener.

Tuolumne Co.: $\delta$, VI-9-38 (J. R. Warren, U.C.R.). Strawberry, Y, VI-22-51 (E. G. Linsley, C.I.S.); $\delta$, VII-15-53, flowers Mimulus (J. G. Rozen, C.I.S.). Tuolumne City, ㅇ, VI-22-53 (J. G. Rozen, C.I.S.).

Ventura Co.: Sespe Canyon, IV-22-34, flowers Pbacelia (Michener, 1938:39). Fillmore, VI-27-37 (Michener, 1938:39).
Discussion:
This is probably the commonest California Chelostoma. Its very long proboscis, in repose usually reaching beyond the front coxae, distinguishes this species from all except the considerably smaller C. cockerelli.

The posterior margin of the fifth metasomal sternum of the male is rather conspicuously emarginate medially. The emargination occupies about one-third of the sternal margin and bears a similarly broad fringe of but little bent hairs which converge apically so that the fringe usually comes to a point posteriorly. The hairs bear short, inconspicuous, side branches.

The distribution of phaceliae outside of California is little known, as the following records show. Nevada (Daggett Pass, Douglas Co.). Oregon (Eagle Ridge, Klamath Lake; Wildhorse Canyon, Andrews). Utah (Logan). Washington (Asotin; Walla Walla).

## Cbelostoma cockerelli Michener

(Pl. 13, fig. 20)
Chelostoma minutum cockerelli Michener, 1938, Pan-Pacific Ent., 14:43, $\delta^{\prime \prime}$, ㄱ. Type $\delta^{\prime \prime}$, Andreas Canyon, near Palm Springs, California, flowers Eriodictyon trichocalyx (Calif. Acad. Sci.). Geographic range: California (see map 12). California records:

Los Angeles Co.: Palmdale, 3 ơ, IV-11-36 (Michener, 1938:44, G.E.B., K.U.). Lancaster, IV-10-36 (Michener, 1938:44). Camp Baldy, 2 ס', 4 우, VI-26-50, flowers Eriodictyon (Michener, 1951:51, C.I.S., K.U.). Lone Pine Canyon, 5,900 ft., 2 ô, 4 ㅇ, VI-16-28, flowers Trichostema lanatum (P. H. Timberlake, U.C.R.); $2 \delta, 3$, VI-16-28, flowers Nama parryi (P. H. Timberlake, U.C.R.). Lone Pine Canyon, San Gabriel Mountains, $\sigma^{\prime}, 5$ ㅇ, VII-4-33, flowers Eriodictyon trichocalyx (P. H. Timberlake, K.U., U.C.R.). Sheep Creek, San Gabriel Mountains 2 ó, 9 , VI-3-28, flowers Eriodictyon trichocalyx (P. H. Timberlake, U.C.R.). Ridge Route, 3,000-4,000
ft., ठ', 4 ㅇ, VI-13-31 (H. A. Scullen, O.S.C.). Camp Baldy, 3 ס', 11 f, VI-26-50 (A. T. McClay, U.C.D.); $\delta$, $\mathcal{O}$, same data (K. G. Whitesell, U.C.D.); 9 , same data (T. R. Haig, K.U.).

Madera Co.: Bass Lake, 2,500 ft., VI-6-38 (N. F. Hardman, C.I.S.).

Riverside Co.: Andreas Canyon, Palm Springs, $2 \sigma^{\text {on }}$, ㅇ, IV-10-36, flowers Eriodictyon trichocalyx (Michener, 1938:44, C.A.S., C.I.S.); $\delta^{\pi}$ IV-10-32, flowers Phacelia distans (P. H. Timberlake, U.C.R.). Keen Camp, ó, VI-9-39, flowers Penstemon (E. S. Ross, C.I.S.). Keen Camp, 7 mi. W., $\delta^{\prime}$, V-17-39, flowers Penstemon (R. F. Smith, C.I.S.). Tahquitz, 2 o', 4 \&, IV-16-38, flowers Lotus (G. E. Bohart, G.E.B.).

San Bernardino Co.: Mouth of Deep Creek, $\delta$, 8 ㅇ, V-5-26, flowers Eriodictyon trichocalyx (P. H. Timberlake, U.C.R.). Deep Creek,, , V-16-36, flowers Eriodictyon (G. E. Bohart, G.E.B.). Vivian Creek Trail, San Bernardino Mountains, 6,500-6,600 ft., 3 个, VII-6-46, flowers Eriodictyon trichocalyx (P. H. Timberlake, U.C.R.). Upper Santa Ana River, 2 ㅇ, VIII-2-46, flowers Eriodictyon trichocalyx (G. H. and J. L. Sperry, K.U.). Cajon Pass, ㅇ, VII-2-34 (I. McCracken, C.A.S.). Mill Creek, San Bernardino Mountains, 4,400 ft., 5 ठ', 2 ㅇ, V-30-39, flowers Mimulus fremontii (many specimens), Gryptantha intermedia (P. H. Timberlake, U.C.R.); ơ, 4,800 ft., V-13-40, flowers Gilia exilis (P. H. Timberlake, U.C.R.). Discussion:

This form has been hitherto considered as a subspecies of minutum but it is abundantly distinct, as indicated by the following characters: Head of female conspicuously longer than broad; second segment of labial palpus longer than eye; brownish coloration on posterior margins of terga very inconspicuous; body and especially fifth sternum of male a little more coarsely punctate than in other members of the minutum group; posterior margin of fifth sternum of male with a broad emargination, from the straight median margin of which the fringe arises; the fringe occupies about one-fourth of width of sternum and consists of amber-colored bristles of stiff hairs, paler apically, directed at first posteriorly, then ventrally, then posteriorly again and bearing inconspicuous short side branches; median emargination of the seventh tergum of the male as deep as length of lateral spine of this tergum.
C. cockerelli visits chiefly flowers of Eriodictyon. Its range broadly overlaps that of $C$. marginatum and perhaps C. minutum.


Map 13. Distribution of Chelostoma minutum Crawford.

## Chelostoma minutum Crawford <br> (Pl. 13, fig. 22)

Cbelostoma minuta Crawford, 1916, Insecutor Inscitiae Menstruus, 4:102, ㅇ. Type ㅇ, Tuolumne Meadows, California (U.S.N.M.).
Geographic range: California, Idaho, Nevada, Oregon, Utah, Washington (see map 13).
California records:
Alpine Co.: Hope Valley, 2 万, VII-9-48 (J. W. MacSwain, C.I.S.).

Eldorado Co.: Tallac, Lake Tahoe, $\sigma^{\prime}$, VII-17-15 (Michener, 1938:43, C.I.S.). Strawberry, o', VII-1-50 (C. D. Michener, K.U.). Tahoe, Lake Tahoe, ${ }^{\text {§ }}$, VII-17-15 (E. P. Van Duzee, C.I.S.). Inyo Co.: Bishop Creek, north fork, $8,500 \mathrm{ft}$. , 4 o, VI-22-37, flowers Pbacelia (C. D. Michener, K.U.).

Lassen Co.: Summit Lake, Mt. Lossen, 6,700 ft., ${ }^{\circ}$, VII-21 to 22-37 (Michener, 1938:43, U.C.R.).

Los Angeles Co.: Swartout Valley, 3 ס', 7 , VI-3-28, flowers Phacelia davidsonii (Michener, 1938:43, K.U., U.C.R.); 8 ㅇ, VI-3-28, flowers Phacelia beteropbylla (Michener, 1938:43). Big Pines Camp, San Gabriel Mountains, 6 , VII-234, flowers Phacelia beterophylla (Michener, 1938:43, U.C.R.); ô, celia beterophylla (Michener, 1938:43, U.C.R.); VII-13-27, flowers Pbacelia californica (Michener, 1938:43, U.C.R.); + , VI-16-28, flowers Phacelia beterophylla (P. H. Timberlake, U.C.R.); ㅇ, VII-11-27, flowers Pbacelia ramosissima (P. H. Timberlake, U.C.R.); 9 , VII-16-27, flowers Pbacelia beteropbylla (P. H. Timberlake, U.C.R.). Lone Pine Canyon, San Gabriel Mountains, 9 , VII-4-33, flowers Eriodictyon trichocalyx (P. H. Timberlake, U.C.R.). Altadena, o, VI-1-35, flowers Cryptantha (C. D. Michener, C.I.S.).

Mariposa Co.: Ledge Trail, $1 / 4$ way up, Yosemite, 3 \&, VI-25-26, flowers Draperia systyla (Michener, 1938:43, U.C.R.). Pohono Trail above Yosemite, 9 , VI-26-26, flowers Pbacelia beterophylla (Michener, 1938:43, U.C.R.). Yosemite, ó, V-31-38 (N. F. Hardman, C.I.S.). Yosemite, 3,880-4,000 ft., ס', V-25-38, flowers Cryptantha (R. M. Bohart, G.E.B.).

Modoc Co.: Modoc National Forest, VI-1 6-33 (Michener, 1938:43, K.U.).

Mono Co.: Mammoth Lake, + , VII-27-36 (G. E. and R. M. Bohart, G.E.B.).

Plumas Co.: Bucks Lake, 4 ठ', VI-23-49 (Michener, 1951:51, C.I.S., K.U.).

San Bernardino Co.: Tetley Park, San Bernardino Mountains, ㅇ, V-15-37, flowers Pbacelia davidsonii (Michener, 1938:43, U.C.R.); $\delta$, V-16-

36, flowers Nemophila Menziesii var. integrifolia Michener, 1938:43, U.C.R.). Barton Flats, San Bernardino Mountains, 23 §, IV-14-50, flowers Erigeron divergens, Phacelia davidsonii, (P. H. Timberlake, U.C.R.). Miller Canyon, San Bernardino Mountains, 3,500 ft., $Y$, V-19-41, flowers Nemophila Menziesii var. integrifolia (P. H. Timberlake, U.C.R.). Mill Creek, San Bernardino Mountains, $4,400 \mathrm{ft}$., ${ }^{\top}$, V-30-38, flowers Mimulus fremontii (P. H. Timberlake, U.C.R.). Green Valley Lake, San Bernardino Mountains, ${ }^{\top}$, VII-15-50 (C. D. Michener, K.U.). Verdemont, $2 \delta^{\prime}$, V-1-46, flowers Pbacelia distans (P. H. Timberlake, U.C.R.).

Sierra Co.: Gold Lake, $\mathcal{Y}$, VII-10-21 (C. L. Fox, C.A.S.); む', VIII-4-21 (C. L. Fox, C.A.S.). Tulare Co.: Kaweah River near Ash Mountain, ㅇ, V-1 0-38 (F. T. Scott, U.C.R.).

Tuolumne Co.: Strawberry, 3 ó, VI-21-S1 (E. G. Linsley and J. W. MacSwain, C.I.S.), $\delta$, VI-22-51 (J. W. MacSwain, C.I.S.); 3 o, VI-23-51 (J. W. MacSwain, C.I.S.); 2 ס, 9 , VI-29-51 (J. W. MacSwain, K.U.); ס', VII-14-51 (J. W. MacSwain, C.I.S.); $\delta^{\prime}$, VII-9-53 (J. G. Rozen, C.I.S.); $\delta^{\prime}, 2$ f, VII-15-53, flowers Mimulus (J. G. Rozen, C.I.S.). Pinecrest, $5,400 \mathrm{ft} ., \delta, \mathrm{VI}-16-52$, flowers Nemophila (R. R. Snelling). Dardanelles, $9, V I I-13-51$ (W. H. Lange, U.C.D.).

## Discussion:

This species is distinguished from its three close relatives, cockerelli, marginatum, and incisulum, previously regarded as subspecies of minutum, by the following characters: Head of female about as long as broad; second segment of labial palpus shorter than eye; brownish coloration on posterior margins of terga very inconspicuous; posterior margin of fifth metasomal sternum straight, giving rise to a fringe that occupies fully one-third of width of sternum and consists of very coarse, amber-colored bristles which are directed posteriorly, then ventrally, then posteriorly, and bear numerous side branches; median emargination of seventh tergum of male deep, as in C. cockerelli.
C. minutum is principally montane in California, being found usually in the transition life zone and above. It apparently normally visits flowers of Phacelia. As may be seen by an accompanying map, its distribution in Idaho (Warren), Nevada (Lake Tahoe, flowers Phacelia), Oregon (Pamelia Lake, Mt. Jefferson; Eagle Ridge, Klamath Lake), Utah (Logan, flowers Pbacelia linearis), and Washington (Spokane) is scarcely known.


Map 14. Distribution of Cbelostoma incisulum Michener.


Map 15. Distribution of Chelostoma marginatum Michener, the subspecies incisuloides indicated by open circles, the subspecies marginatum by solid circles.

## Cbelostoma incisulum Michener

(Pl. 13, fig. 21)
Cbelostoma minutum incisulum Michener, 1938, Pan-Pacific Ent., 14:44, ठ. Type $\delta$ ', Marsh Creek, Mount Diablo, California, flowers Phacelia (Calif. Acad. Sci.).
Geographic range: California (see map 14).
California records:
Contra Costra Co.: Marsh Creek, Mt. Diablo, 6 б', Y, IV-26-37, flowers Phacelia (Michener, 1938:45, K.U.). Mt. Diablo, ㅇ, IV-24-37 (G. E. and R. M. Bohart, G.E.B.); $\delta$, IV-24-37 (Michener, 1938:45, C.I.S.).

Kern Co.: Glennville, $30^{\wedge}$, 오, IV-24-49, flowers Gilia (Michener, 1951:51, C.I.S., K.U.). Woody, 4 ó, 15 ㅇ, IV-24-49, flowers Pbacelia (Michener, 1951:51, C.I.S., K.U.).

Madera Co.: San Joaquin Experimental Range, 3 ó, III-24-53, flowers Gilia tricolor (H. E. Childs, C.I.S.); $\sigma, 6$ ㅇ, IV-18-53, flowers Phacelia platyloba (P. D. Hurd, Jr., C.I.S.).

San Benito Co.: Pinnacles National Monument, o', IV-24-48, flowers Phacelia (P. D. Hurd, Jr., C.I.S.).

Santa Clara Co.: Mt. Hamilton, $3 \delta^{\prime}, 2$ ㅇ, IV-15-47, flowers Pbacelia (G. E. Bohart, C.I.S., K.U.).

Stanislaus Co.: Adobe Creek, 2 б, $\uparrow$, IV-20-48 (R. F. Smith, C.I.S.); ס', V-6-48 (J. W. MacSwain, C.I.S.).

Tulare Co.: Three Rivers, 3 mi W., $\sigma^{\top}, 4$, IV-1-39, flowers Phacelia distans (P. H. Timberlake, U.C.R.). Discussion:

Chelostoma incisulum is distinguishable from its close relatives by the following characters: Head of female longer than broad; second segment of labial palpus shorter than eye; posterior margins of terga conspicuously and rather broadly brown; posterior margin of fifth metasomal ster-
num of male straight, its fringe occupying full width of sternum and consisting of amber-colored hairs or bristles, paler apically, which are directed posteriorly, then abruptly bent ventrally, then abruptly bent posteriorly, and which bear no side branches; median emargination of seventh sternum of male shallow, not more than half as deep as length of lateral spine of this tergum, that is, the median teeth of this tergum are fused nearly to their apices (pl. 13, fig. 21).

This species appears to inhabit the upper Sonoran life zone of central California, where it visits principally the flowers of Pbacelia.

## Cbelostoma marginatum Michener

(Pl. 13, fig. 23)
Cbelostoma minutum marginatum Michener, 1938,
Pan-Pacific Ent., 14:44, $\delta$, 우.
Geographic range: California (see map 15).
Discussion:
This species is conspicuously distinct from its close relatives by the following combination of characters: Head of female longer than broad; second segment of labial palpus shorter than eye; posterior margins of terga conspicuously and rather broadiy brown; posterior margin of fifth metasomal sternum of male straight or very broadly concave with pale yellowish fringe, twothirds as broad as sternum, with short hairs laterally; hairs of fringe with the curvature characteristic of incisulum and other species only weakly evident but hairs irregularly wavy apically, without side branches; median emargination of seventh sternum deeper than in incisulum in marginatum proper but shallow in the subspecies incisuloides.

This species seems to replace incisulum in southern California, although in central California, the two species occur together.

Key to the Subspecies of Cbelostoma marginatum
Males

1. Median teeth of ninth metasomal tergum separate . . . . . . . . marginatum (p. 37) Median teeth of ninth metasomal tergum fused almost to apices . . . .incisuloides (p. 37)

## Chelostoma marginatum marginatum Michener

Chelostoma minutum marginatum Michener, 1938, Pan-Pacific Ent., 14:44, J, 우. Type ơ, Puente Hills, Los Angeles County, California, on flowers of Pbacelia distans (Timberlake collection, U.C.R.).
Geographic range: California (see map 15).
California records:
Inyo Co.: Argus Mountains, ${ }^{\circ}$, V-22-37 (N. W. Frazier, K.U.).

Los Angeles Co.: Puente Hills, IV-12-25, III-14-26, III-21-26, V-9-26, flowers Phacelia distans (Michener, 1938:44, C.A.S., K.U., U.C.R.). Eagle Rock, IV-7-36, flowers Salvia mellifera (Michener, 1938:44). Eagle Rock Hills, IV-14-33, flowers Rhamnus crocea (Michener, 1938:44). Altadena, $\delta$, V-2-36, flowers Eriodictyon crassifolium (Michener, 1938:44, K.U.). Palmdale, ${ }^{\prime}$, IV-11-36 (G. E. and R. M. Bohart, C.I.S.). Lancaster, $\delta$, IV-10-36 (G. E. and R. M. Bohart, G.E.B.). Tanbark Flat, San Dimas Experimental Forest, ${ }^{\text {F, VI-20-50 (H. M. Graham, C.I.S.). }}$

Riverside Co.: Riverside, 2 , III-21-26, flowers Pbacelia distans (Michener, 1938:44, U.C.R.); $\delta$, IV-4-39, flowers Cryptantha intermedia (P. H. Timberlake, U.C.R.). The Gavilan, 5 o, III-19-36, flowers Rbus trilobata (P. H. Timberlake, U.C.R.); ס', IV-18-37, flowers Rhus trilobata (Michener, $1938: 44$ ); 万, IV-18-37 (P. H. Timberlake, U.C.R.); 3 ס', IV-18-37, flowers Phacelia (E. G. Linsley, C.I.S.); $\delta$, III-4-38, flowers Phacelia distans (P. H. Timberlake, U.C.R.); 2 Y, IV-4-38, flowers Phacelia distans, P. bispida (P. H. Timberlake, U.C.R.); ${ }^{2}$, IV-1738, flowers Cryptantha intermedia (P. H. Timberlake, U.C.R.); 9, IV-27-38, flowers Pbacelia minor (P. H. Timberlake, U.C.R.); 2 ©, 4 Y, V-438, flowers Phacelia distans (P. H. Timberlake, U.C.R.); + , V-4-38, flowers Phacelia bispida (P. H. Timberlake, U.C.R.); ㅇ, IV-18-40, flowers Salvia columbariae (P. H. Timberlake, U.C.R.); $\sigma^{\top}$, IV-30-40 (C. M. Dammers, U.C.R.; 3 ठ, IV-G50, flowers Cryptantha intermedia (P. H. Timberlake, U.C.R.); 2 ó, III-27-51, flowers Lomatium dasycarpum (P. H. Timberlake, U.C.R.).

## Cbelostoma marginatum incisuloides Michener

Chelostoma marginatum incisuloides Michener, 1954, Jour. Kansas Ent. Soc., 27:69, $\sigma^{\prime}$, Type $\delta$, San Joaquin Experimental Range (near O'Neals), Madera County, California, on flowers of Phacelia platyloba (Univ. of Kansas).

Geographic range: California (see map 15). California records:

Contra Costa Co.: Mt. Diablo, ס, IV-21-53, flowers Eriodictyon (Michener, 1954:70, C.I.S.).

Madera Co.: San Joaquin Experimental Range near O'Neals, $5 \delta^{\circ}$,, , IV-18-53, flowers Amsinckia, Cryptantha, and Pbacelia platyloba (Michener, 1954:70, C.I.S., K.U.).

Stanislaus Co.: Adobe Creek, ơ, V-6-48 (Michener, 1954:70, K.U.).

Tulare Co.: Pine Flat, $\delta, V-3-47$, flowers Nemophila pulchella (P. H. Timberlake, U.C.R.). Three Rivers, 5 mi . S., $9, \mathrm{~V}-1-47$, flowers Penstemon laetus (Michener, $1954: 70$, U.C.R.).

## Genus Chelostomopsis Cockerell

Included in this genus is a single, small black species which is sufficiently different from its relatives to justify its placement in a distinct genus. A distinctive, although perhaps superficial character, is the presence of a dorsoventrally flattened spatulate horn projecting from the anterior margin of the clypeus of the female (fig. 26). Chelostomopsis is but little more coarsely punctate than Chelostoma. The thorax is more robust than in that genus but the metanotum is clearly dorsal in position, although sloping posteriorly. The propodeum has a horizontal, rather coarsely rugose, basal area about as long as the metanotum. There is no carina separating this area from the posterior face of the propodeum. The first metasomal tergum is much higher; that is, its anterior surface is larger, than in Cbelostoma, and there is a rather distinct angle between the anterior and dorsal surfaces. The former is broadly concave, with a longitudinal sulcus in the concavity. There is an abrupt change in sculpturing between the two surfaces, the anterior being shining and sparsely punctured. In the male, there are but six exposed terga, the seventh being entirely hidden by the sixth. The inner ventral angle of each posterior coxa bears a carina.

## Chelostomopsis rubifloris (Cockerell)

(Pl. 13, fig. 26)
Chelynia rubifloris Cockerell, 1898, Canad. Ent., 30:50, ㅇ. Type ㅇ, Seattle, Washington (U.S. Nat. Mus.).
Synonyms: edwardsii (Cockerell), 1916; ceanothi (Cockerell), 1936.


Plate 5. Lateral view of Chelostomop sis rubifloris (Cockerell), male.


Map 16. Distribution of Cbelostomopsis rubifloris (Cockerell).

Geographic range: Arizona, California, Oregon, Washington (see map 16).
California records:
Alameda Co.: San Antonio Creek, ơ, V-14-22 (K.U.). Sunol, 9 , IV-1 0-51 (W. W. Middlekauff, C.I.S.). Tesla, 9 , IV-23-46, flowers Delpbinium (J. W. MacSwain, C.I.S.); O, , IV-27-50 (W. F. Ehrhardt, K.U.).

Butte Co.: Yankee Hill, Q , V-12-49 (P. D. Hurd, Jr., C.I.S.).

Calaveras Co.: Mokelumne Hill, ${ }^{( }$, (F. E. Blaisdell, C.A.S.).

Contra Costa Co.: Mt. Diablo, IV-26-37, flowers Pbacelia (Michener, 1938:128); IV-26-37, flowers Gilia (C. D. Michener, K.U.); 3 ô, 4 ㅇ, IV-26-37 (C. D. Michener, K.U.); 2 đ', IV-21-34 (G. E. and R. M. Bohart, G.E.B.); ס, IV-24-37 (G. E. and R. M. Bohart, G.E.B.); 3 \&, same data (M. A. Cazier, U.C.R.); 2 J, q, V-7-39 (C.I.S.); 3 9, VI-25-39 (E. C. Van Dyke, C.A.S., K.U.); $\delta$, VI-28-39 (E. C. Van Dyke, C.A.S.); 4 ¢, V-1 8-47 (P. D. Hurd, Jr., C.I.S.); 6 ס, IV-18-48, flowers Arctostapbylos (P. D. Hurd, Jr., C.I.S.); ${ }^{\text {J, }}$, Y, III-14-51 (H. L. Hansen, C.I.S.); ¢, III-24-51 (E. I. Schlinger, U.C.D.); ${ }^{\circ}$, V-30-51 (E. I. Schlinger, U.C.D.); ठ', IV-5-52 (R. O. Schuster, C.I.S.); Y, V-28-52 (F. X. Williams, C.A.S.); 9 J, IV-21-53, flowers Salvia (P. D. Hurd, Jr., C.I.S.); 2 ठ, VI-21-35, flowers Eriodictyon (P. D. Hurd, Jr., C.I.S.). 4 o', 2 ㅇ, IV-21-53 (P. D. Hurd, Jr., C.I.S.). Rock City, Mt. Diablo, 11 ㅇ, V-24-40 (E. G. Linsley, C.A.S.). Marsh Creek, 2 ס, 2 ¢, IV-24-37 (G. Ferguson, O.S.C.). Marsh Creek Springs, 2 ס', Y, IV-23-37 (E. C. Van Dyke, C.A.S.). Curry Creek, 9, V-547, flowers Collinsia bicolor (G. E. Bohart, G.E.B.). Antioch, $\delta, ~ V-8-50$ (P. D. Hurd, Jr., K.U.).

Eldorado Co.: Camino, 3 mi. S., $\mathrm{Y}, \mathrm{VI}-23-48$, flowers Phacelia (P. D. Hurd, Jr., C.I.S.). Placerville, 9, IV-6-39, flowers Nemophila (G. E. Bohart, G.E.B.). Pollock Pines, , VI, V22-48, flowers Chamaebatia foliolosa (K. W. Tucker, C.I.S.); ㅇ, VI-22-48 (J. W. MacSwain, C.I.S.). Snowline Camp, 2 ㅇ, VI-20-48, ㅇ, VI-27-48, ㅇ, VI-25-48 (J. W. MacSwain, C.I.S.).

Fresno Co.: Auberry, 3 , IV-13-49 (R. Craig, C.I.S.). Coalinga, 15 mi . W., $\delta^{\prime}$, IV-8-51, flowers Layia (E. G. Linsley, C.I.S.). Delpiedra, 5 mi. N., 3 \&, IV-25-53, flowers Trifolium tridentatum (H. L. Hansen, C.I.S.).

Humboldt Co.: Fort Seward, 9 , VI-3-35 (H. J. Rayner, G.E.B.).

Inyo Co.: Oak Creek Canyon, near Independence, V-28-37, flowers Penstemon breviflorus
(Michener, 1949:47). Alabama Hills, ㅇ, V-29-37 (K.U.). Big Creek, 6,000 ft., 2 ㅇ, VI-16-42 (R. M. Bohart, G.E.B.).

Kern Co.: Glennville, $2 \sigma^{\circ}$, IV-24-49, flowers Arctostaphylos (E. G. Linsley, J. W. MacSwa in, R. F. Smith, C.I.S., K.U.). Walker Pass, + , IV-26-49 (E. G. Linsley, J. W. MacSwain, R. F. Smith, C.I.S.).

Lake Co.: near Clear Lake, $9, \mathrm{~V}$-14-47 (R. M. Bohart, U.C.D.). Cobb Mountain, 9 , V-7-36 (Michener, 1938:128). Kelseyville, 9, VII-10-29 (E. C. Van Dyke, C.A.S.). Lower Lake, Y, V-1322 (E. P. Van Duzee, C.A.S.).

Lassen Co.: Bridge Creek Camp, 7, VII-9-49 (J. E. Gillaspy, C.I.S.).

Los Angeles Co.: Eagle Rock, $\delta$, 9 , IV-7-36, flowers Salvia mellifera (Michener, 1938:128). Swartout Valley, VI-3-25, flowers Pbacelia californica (Michener, 1938:128, U.C.R.). Eagle Rock Hills, ${ }^{\prime}$, IV-1 4-33, flowers Rbamnus crocea (Michener, $1938: 128$, K.U. ). Altadena, ㄱ, VI-1-35, flowers Lotus (Michener, 1938:128); ㅇ, V-2-36, flowers Lotus scoparius (C. D. Michener, K.U.). Crystal Lake, San Gabriel Mountains, ${ }^{\text {, }}$, VII-734, flowers Verbena prostrata (Michener, 1938: 128, K.U.). Rock Creek (grade above), 12 ㅇ, V-9-38, flowers Salvia carnosa (P. H. Timberlake, U.C.R.). Arroyo Seco. Y, VI-25-40, flowers Nama parryi (J. W. MacSwain, C.I.S.). Griffith Park, Los Angeles, 9 , IV-12-36, flowers Salvia columbariae (E. G. Linsley, C.I.S.). Camp Baldy, 2 f, VII-11-50 (A. T. and M. F. McClay, U.C.D.); 8 ㅇ, VI-26-50 (D. C. Blodget, U.C.D., U.C.L.A.). Tanbark Flat, San Dimas Experimental Forest, ㅇ, VI-1 9-50 (J. W. MacSwain, C.I.S.); 2 ㅇ, VI-20-50 (P. D. Hurd, Jr., C.I.S.); ㅇ, VI-21-50 (P. D. Hurd, Jr., C.I.S.); ㅇ, same data (J. D. Paschke, C.I.S.); Y, VI-22-50, flowers Compositae (T. R. Haig, C.I.S.); 2 9, VI-22-50, flowers Cryptantha (P. D. Hurd,' Jr., C.I.S., K.U.); 3 \&, VI-22-50 (F. X. Williams, C.A.S.); 4 , VI-25-50 (P. D. Hurd, Jr., C.I.S.); 8 , same data (J. W. MacSwain, C.I.S.); $q$, same data (F. X. Williams, C.A.S.); 2 ㅇ, VI-27-50, flowers Cryptantha (P. D. Hurd, Jr., C.I.S.); 4 q, VI-27-50 (F. X. Williams, C.A.S.); 6 , VI-30-50, flowers Helianthus (P. D. Hurd, Jr., C.I.S., K.U.); 2 ㅇ, VI-3050 (A. T. McClay, U.C.D.); ${ }^{\text {f, VI-3 }} 0-50$ (R. O. Schuster, C.I.S.); 3 Y, VII-2-50, (P. D. Hurd, Jr., C.I.S.); 2 \&, same data (A. T. McClay, U.C.D.);母, VII-3-50 (P. D. Hurd, Jr., C.I.S.); $\uparrow$, same data (F. X. Williams, C.A.S.) ; Y, VII-4-50 (K. G. Whitesell, U.C.D.); 2 ㅇ, VII-10-50 (A. T. McClay, U.C.D.); 9, VII-14-50 (P. D. Hurd, Jr., C.I.S.); ㅇ, VII-5-52 (J. F. Powers, U.C.D., U.C.L.A.);

ㅇ, VII-6-52 (Joan Linsley, C.I.S.); ㅇ, VII-1 5-52 (J. W. MacSwain, C.I.S.).
.Madera Co.: Bass Lake, 2 ㅇ, VI-6-38 (R. M. Bohart, U.C.D., G.E.B.); , VI-5-42 (C.I.S.). Oakhurst, $\uparrow$, V-14-42 (C.I.S.); 9, VI-8-42 (E. G. Linsley, C.I.S.); 3 ㅇ, VI-1-42 (C.I.S.); $\delta^{\prime}, 3$ ㅇ, V-1 9-42, flowers Lupinus (A. J. Walz, U.C.R.). San Joaquin Experimental Range, 2 Y, V-1 2-46 (P. D. Hurd, Jr., C.I.S.); Y, IV-18-53, flowers Nemophila maculata (P. D. Hurd, Jr., C.I.S.).

Marin Co.: Corte Madera Creek, $\delta$, III-22-15, flowers Arbutus menziesii (L.S., Jr., U.). Fairfax, 9, IV-12-21 (Michener, 1938:128, K.U.). Mill Valley, $\delta$, V-15-25 (H. H. Keifer, C.A.S.); 9 , V-24-25 (C. L. Fox, C.A.S.); + , VI-5-50 (F. X. Williams, C.A.S.).

Mariposa Co.: El Portal, 2 9, V-18-38 (R. M. Bohart, G.E.B.); 2 , same data (N. F. Hardman, C.I.S.). Miami Ranger Station, 2 Y, V-24-42 (E. G. Linsley, C.I.S.); 2 Y, VI-4-42 (E. G. Linsley, U.C.R.). Yosemite, $\sigma$, V-26-21 (E. C. Van Dyke, C.A.S.); $\delta$, V-22-38 (N. F. Hardman, C.I.S.); $\delta$, V-23-38 (K. B. Snyder, C.I.S.); 2 ㅇ, V-31-38 (F. M. Ferguson, K.U.); $\delta$, same data (N. F. Hardman, C.I.S.). Yosemite, 3,880-4,000 ft., $3 \delta^{\delta}$, 4 9, V-25-38, flowers Cryptantha (R. M. Bohart, G.E.B.) ; $\delta$, ㅇ, V-25-38 (J. R. Warren, U.C.R.). Wawona, $\delta^{\prime}$, V-21-38 (R. M. Bohart, G.E.B.).

Mendocino Co.: Ryan Creek, 2 ó, IV-9-39 (N. F. Hardman, C.I.S.); 9, V-30-49 (R. Craig, C.I.S.); ठ, IV-12-41 (N. F. Hardman, C.I.S.); 2 Y, IV-1 3-41 (N. F. Hardman, C.I.S.); Y, VI-1-52 (R. Craig, C.I.S.). Twin Rocks, 2 Y, VII-10-29 (E. C. Van Dyke, C.A.S., K.U.). Yorkville, 5 ㅇ, V-1-24 (Michener, 1 938:128).

Monterey Co.: Bryson, Y, V-18-20 (E. P. Van Duzee, C.A.S.). Hastings Natural History Reservation, near Jamesburg, ㅇ, V-28-38 (C. D. Michener, K.U.). Paraiso Springs, $\delta$, V-6-22 (L. S. Slevin, C.A.S.).

Napa Co.: Chiles Valley, 3 个, V-7-39 (E. C. Van Dyke, C.A.S.). Monticello, $\delta$, III-25-30 (C.I.S.). Mt. St. Helena, P, III-10-41 (A. T. Mc Clay, U.C.D.); 9, III-7-46, reared from cone of Pinus attenuata (A. T. McClay, U.C.D.); + , V-15-51 (E. I. Schlinger, U.C.D.); $6 \delta^{*}, 5$ ㅇ, III-15, 16, 17-51, emerged from cones of Pinus attenuata (J. W. Green, J. Helfer, H. B. Leech, C.A.S.). Napa, 2 ठ', IV-14-38 (M. Emburg, K.U.). Pope Valley,. ס', 2 ¢, III-24-51 (W. W. Middlekauff, C.I.S.).

Nevada Co.: Truckee, , VI-15-27 (E. P. Van Duzee, C.A.S.).

Placer Co.: Lake Tahoe, 2 ㅇ, VI-1 9-36 (R. M. Bohart, U.C.D., U.C.L.A.).

Plumas Co.: Meadow Valley, 5,000-6,000 ft.,

2 б', V-1 3-49 (P. D. Hurd, Jr., C.I.S.). Nelson Point, ${ }^{\text {f, VII-5-52 (E. I. Schlinger, U.C.D.). }}$ Quincy, 4 mi. W., VI-21-49(J. W. MacSwain, K.U.); †, VI-24-49 (P. D. Hurd, Jr., C.I.S.); 2 o', VI-2549 (J. W. MacSwain, C.I.S., K.U.); + , VII-2-49 (P. D. Hurd, Jr., C.I.S.). Tobin, ס', V-13-49 (W. W. Middlekauff, C.I.S.).

Riverside Co.: The Gavilan, 8 , III-19-36, flowers Rhus trilobata (Michener, 1938:128, U.C.R.). Banning, $P$, VI-19-41 (E. C. Van Dyke, C.A.S.). Santa Rosa Mountain, $7,500 \mathrm{ft}, \mathrm{J}^{\top}, \mathrm{V}-31-$ 40 (C. D. Michener, C.I.S.); $\delta$, VI-1-40 (C.I.S.); 9, VII-9-49 (J. E. Gillaspy, C.I.S.). Marion Mountain Camp, San Jacinto Mountains, $\uparrow$, VII-1-52 (J. W. MacSwain, C.I.S.). Stone Creek, San Jacinto Mountains, 2 ㅇ, flowers Cryptantba intermedia, Lotus davidsonii (P. H. Timberlake, U.C.R.). Herkey Creek, San Jacinto Mountains, $\mathrm{P}, \mathrm{VI}-4-40$ (C. D. Michener, C.I.S.); Y, VI-14-40, flowers Chorizanthe staticoides (C. D. Michener, C.I.S.). Dark Canyon, San Jacinto Mountains, ㅇ, VI-15-40 (C.I.S.). Piñon Flat, San Jacinto Mountains, $q$, V-1 8-39 (B. Brookman, C.I.S.). Poppet Flat, San Jacinto Mountains, 2 ¢, VI-1-40, flowers Cryptantha (C. D. Michener, C.I.S.). Ribbonwood, San Jacinto Mountains, 9, V-21-40, flowers Cryptantha (C. D. Michener, C.I.S.). Idyllwild, 9 , V-20-39 (E. G. Linsley, C.I.S.); 4 J, V-21-39, flowers Cryptantha (E. G. Linsley, C.I.S.); $9, \mathrm{~V}-23-40$ (C. D. Michener, C.I.S.); ㅇ, VI-9-40, flowers Lotus davidsonii (P. H. Timberlake, U.C.R.); Y, VI-19-40 (E. C. Van Dyke, C.A.S.). Keen Camp, San Jacinto Mountains, 9 , VI-6 to 12-17 (E. P. Van Duzee, C.A.S.); 2 §, V-16-39, flowers Ceanothus, Cryptantha (E. G. Linsley, C.I.S.); 2 F, V-31-39, flowers Penstemon (B. Brookman, C.I.S.); Y, V-31-39, flowers Penstemon (E. G. Linsley, K.U.); P, V-31-39 (R. F. Smith, C.I.S.); ㅇ, VI-1-39, flowers Penstemon(E. S. Ross, C.I.S.); 2 9, VI-9-39, flowers Penstemon (E. S. Ross, C.I.S.); 2 , VI-9-39 (C.I.S.); ㅇ, VI-1 0-3 9, flowers Penstemon (W. C. Bush, C.I.S.). Keen Camp, 8 mi. W., , V-17-39, flowers Penstemon (E. S. Ross, C.I.S.); Y, VI-1-39 (E. S. Ross, C.I.S.).

San Benito Co.: Pinnacles National Monument, 5 才, IV-24-48, flowers Cryptantha, Phacelia (P. D. Hurd, Jr., C.I.S.); 4 J, 2 , IV-24-48 (J. W. MacSwain, C.I.S.).

San Bernardino Co.: Tetley Park, San Bernardino Mountains, V-16-36, flowers Nemophila Menziesii var. integrifolia (Michener, 1938:128); ठ', V-15-37, flowers Nemophila Menziesii var. integrifolia (P. H. Timberlake, U.C.R.); $4 \delta, 4$ 우, V-8-40, flowers Nemophila Menziesii var. integrifolia (P. H. Timberlake, U.C.R.); Y, V-16-36, flowers Fragaria californica (P. H. Timberlake,
U.C.R.). Cajon Pass, IV-13-36 (Michener, 1938: 128). Crestline, V-23-36, flowers Lotus davidsonii (Michener, 1938:128). 2 9, V-23-36, same flower (E. G. Linsley, C.I.S.). Mill Creek, San Bernardino Mountains, V-30-36, flowers Pbacelia brachyloba (Michener, 1938:128); 5 ㅇ, V-30-38, flowers Cryptantha intermedia (P. H. Timberlake, U.C.R.). Mill Creek, 4,400 ft., $\delta^{\prime}, 5$ ㅇ, V-30-38, flowers Cryptantba intermedia (P. H. Timberlake, U.C.R.); $\mathrm{P}, \mathrm{V}-30-38$, flowers Mimulus fremontii (P. H. Timberlake, U.C.R.). Mill Creek, 4,800 ft., 2 ㅇ, V-13-40, flowers Gilia exilis (P. H. Timberlake, U.C.R.); ㅇ, V-13-40, flowers Phacelia davidsonii (P. H. Timberlake, U.C.R.). Mill Creek, 6,000 ft., $\bar{\delta}$, V-12-41, flowers Ribes roezlii (P. H. Timberlake, U.C.R.); $2 \delta$, VI-4-44, flowers Cryptantha lepida (P. H. Timberlake, U.C.R.); ô, VII-2-44, flowers Cryptantba lepida (P. H. Timberlake, U.C.R.); 6 ठ', IV-26-46, some on flowers Arctostaphylos patula, 1 it on Cercocarpus ledifolius (P. H. Timberlake, U.C.R.); ठ, ㅇ, V-20-46, flowers Arctostaphylos drupacea (P. H. Timberlake, U.C.R.); ${ }^{\text {d, }}$ V-23-48, flowers Arctostapbylos patula (P. H. Timberlake, U.C.R.); $\delta^{\prime}$, V-26-48, flowers Ribes roezlii (P. H. Timberlake, U.C.R.); $\delta$, V-25-50, flowers Phacelia davidsonii (P. H. Timberlake, U.C.R.); $\bar{\sigma}$, 9 , V-28-50, flowers Cryptantha lepida (P. H. Timberlake, U.C.R.); 3 ㅇ, VIII-27-51, flowers Cryptantha lepida (P. H. Timberlake, U.C.R.). Mill Creek, 6,200 ft., 3 ठ, V-22-38, flowers Arctostaphylos drupacea (P. H. Timberlake, U.C.R.); $\mathbf{\delta}^{\prime}$, Y, V-2938, same flowers (P. H. Timberlake, U.C.R.); $\sigma^{\text {t, }} \mathrm{V}$ -30-39, same flowers (P. H. Timberlake, U.C.R.); б', V-30-40, same flowers ( P . H. Timberlake, U.C.R.). Valley of the Falls, San Bernardino Mountains, V-25-35, flowers Phacelia davidsonii (Michener, 1938:129). Seven Oaks, San Bernardino Mountains, + , VI-14-50, flowers Radicula nastur-tium-aquaticum (P. H. Timberlake, U.C.R.). Lake Arrowhead, , VI-13-50 (G. P. Taylor, G.E.B.). Camp Baldy, + , VII-7-52 (R. M. Bohart, U.C.D.).

San Mateo Co.: Redwood City, ${ }^{\text {P, }}$ V-1 0-52 (J. I. Stage).

Santa Clara Co.: Alum Rock Park, ㅇ, IV-21-51 (J. W. MacSwain, C.I.S.). Mr. Hamilton, 9, V-2550, flowers Eriodictyon (E. G. Linsley, C.I.S.). Morgan Hill, , VI-16-22 (C.I.S.). San Antonio Ranger Station, 우, III-19-51, flowers Cryptantha (P. D. Hurd, Jr., C.I.S.); 4 ㅇ, VI-27-53( (G. A. Marsh, C.I.S.). San Antonio Valley, $\delta^{\prime}$, IV-20-48, (R. F. Smith, C.I.S.); + , VI-6-48 (J. W. MacSwain, C.I.S.). Stanford University campus, $\delta^{\prime}$, III-1 9-16, flowers Ceanothus cuneatus (R. Stinchfield, L.S., Jr., U.). Stevens Creek, 2 ㅇ, V-28-52 (D. Burdick).

Santa Cruz Co.: 1,500 ft., VI-8-17 (Michener, 1938:128, K.U.). Santa Cruz Mountains, ㅇ, VI-1522 (S. E. Flanders, C.I.S.).

Shasta Co.: Burney, Y, VI-9-41 (C. D. Michener, K.U.). Hat Creek, 6 ㅇ, VI-4-41, flowers Castilleia and Senecio (C. D. Michener, C.I.S.); 우, VI-4-41, flowers Ceanothus parvifolius (C.I.S.). Hat Creek, 4 mi. S., 2 ㅇ, VI-5-41, flowers Ceanothus and Wyethia (P. D. Hurd, Jr., C.I.S.). Hat Creek, 4 mi. S., 2 ㅇ, VI-5-41, flowers Pbacelia (P. D. Hurd, Jr., C.I.S.). Old Station, 우, VI-16-41 (C.I.S.). Rock Creek, ${ }^{2}$, VI-8-41 (C.I.S.). Manzanita Lake, $\delta^{2}$, VI-12-41, flowers Arctostaphylos nevadensis (C. D. Michener, C.I.S.). Shingletown, $90^{\circ}$, V-23-41, flowers Mimulus (C. D. Michener, C.I.S.); ㅇ, V-24-41, flowers Ranunculus (C. D. Michener, K.U.).

Siskiyou Co.: Hamburg, ${ }^{\text {+, }}$ V-14-51 (R. P. Allen, C.A.S.). Mt. Shasta, $2 \delta$, G. Rozen). Sawyers Bar, \&, VI-1937 (I. Mc Cracken, K.U.).

Sonoma Co.: Sonoma (s outh), ㅇ, VI-1 9-40 (J. A. Kusche, C.A.S.). Cazadero, ${ }^{\circ}$, III-29-35 (G. E. and R. M. Bohart, G.E.B.); 8 d, VI-25-33 (G. E. and R. M. Bohart, G.E.B.).

Stanislaus Co.: Adobe Creek, 3 아, IV-6-48, flowers Phacelia (J. W. MacSwain, C.I.S.); $2 \delta^{\circ}$, IV-20-48 (R. F. Smith, C.I.S.); 3 d, V-6-48, flowers Phacelia(J. W. MacSwain and R. F. Smith, C.I.S.); ㅇ, V-11-48, flowers Melilotus (R. F. Smith, C.I.S.); d, IV-6-49, flowers Arctostaphylos (R. F. Smith, C.I.S.); 2 ㅇ, IV-20-49, flowers Stenotopsis linearifolius (P. D. Hurd, Jr., C.I.S.). Del Puerto Canyon, $\delta, 2$ 우, V-11-48, flowers Eriodictyon (R. F. Smith, C.I.S.).

Trinity Co.: Carrville, 2,400-2,500 ft., 아, V-15-34 (Michener, 1938:128, U.C.D.); ㅇ, V-2234 (U.S.A.C.); ㅇ, VI-9-34 (B. J. Hall, U.C.R.); 우, VI-15-34 (B. J. Hall, U.C.R.); 2 ㅇ, VI-19-34 (E. C. Van Dyke, C.A.S.).

Tulare Co.: Ash Mountain, $\delta^{\top}$, ㅇ, IV-27-50 (L. W. Isaak, U.C.D.). California Hot Springs, 5 ㅇ, VI-2, 3-39 (E. C. Van Dyke, C.A.S.); 아, (E. R. Leach, U.C.R.). Coffee Camp, VI-11-25, flowers Lotus glaber (Michener, 1938:128). Kaweah River, 3 P, V-1 0-38, flowers Ceanothus integerrimus and Plagiobothrys nothofulvus ( P . H. Timberlake, U.C.R.). Pine Flat, 2 ㅇ, V-3-47, flowers Potentilla glandulosa (P. H. Timberlake, U.C.R.). Potwisha, Sequoia National Park, $P$, V-17-29, 우, V-18-29, 아, V-20-29, 2 아, VI-2-29 (E. C. Van Dyke, C.A.S.). Sequoia Lake, VI-1225, flowers Horkelia (Michener, 1938:1 29). Springville, 3 mi . E., 3 ㅇ, IV-30-47, flowers Eriodictyon californicum (P. H. Timberlake, U.C.R.). Three


Plate 6. Lateral view of Hoplitis producta gracilis (Michener), male.

Rivers, $5 \mathrm{mi} . \mathrm{S} .$, P, V-1-47 (P. H. Timberlake, U.C.R.).

Tuolumne Co.: Pinecrest, 5,400 ft., $2 \delta$ VI-16-52, flowers Nemophila (R. R. Snelling). Tuolumne City, 9 , VI-5-53, flowers Trifolium melananthum (J. G. Rozen, C.I.S.).
Discussion:
This is a common spring and early summer bee in coastal and montane California. Records in Oregon (Corvallis; Eagle Ridge, Klamath Lake; Elam, Griffith Creek, Jacks on Co.; Kane Creek, 5 mi. W. Gold Hill; Klamath Falls; Soda Springs, Benton Co.) and Washington (Seattle) are scarce, suggesting that the species may be much rarer there. Since the species is apparently absent from the California deserts (there is but a single collection east of the Sierra Nevada crest) and is unknown in the Rocky Mountains, its occurrence in the mountains of Arizona (Parker Creek, Workman Creek in the Sierra Ancha; Prescott and 32 miles $S$. Prescott) is most surprising. It has been reared from cones of Pinus attenuata which were collected at Mt. St. Helena, California.

## Genus Hoplitis Klug

This is one of the rather large genera of bees considered in this study. There is much diversity among the species which are therefore divided among numerous subgenera, nine of which occur in North America. Six of these were regarded as distinct genera for many years. Two so-called genera, Robertsonella and Formicapis, are here relegated to the level of subgenera for the first time. Each contains but a single species. The thorax in each subgenus is slightly but not much longer than in other Hoplitis. This is a minor difference compared to the many similarities.

Hoplitis consists of moderately robust to slender bees, usually black but sometimes brilliantly metallic, sometimes with the metasoma red. The basal area of the propodeum slants strongly to the rear and merges with the even more steeply slanting posterior part of the propodeum. The metanotum is dorsal in position in the subgenus Formicapis, slopes posteriorly in Robertsonella, and is distinctly on the posterior surface of the thorax in other forms. The anterior surface of the first metasomal tergum bears a longitudinal sulcus, and ordinarily the sculpturing of the anterior surface grades into that of the dorsal surface, there being a gradually rounded angle
between these two surfaces. There are seven exposed terga in the male, and the sixth usually is angulate or toothed laterally. The posterior coxae lack carinae along their inner ventral angles, unlike those of Diceratosmia (pl. 3, fig. 4).

Hoplitis is widespread throughout the entire Holarctic region. The southernmost records for North America are only a short distance south of the Mexican border. Among the nine Nearctic subgenera, six are known from California, and 23 species occur in this state. The American species of the genus (except for the subgenera Robertsonella and Formicapis) were revised by Michener (1947), and species of the subgenera Formicapis and Robertsonella were reviewed by the same author (1938c).

Species of Hoplitis fly for the most part in spring and early summer. Although most species are more or less polylectic, they are not as thoroughly so as some species of Heriades. Most Hoplitis collect pollen primarily from flowers with papilionaceous or tubular flowers, such as the Leguminosae, Scrophulariaceae, Labitaceae, Polemoniaceae, and Hydrophyllaceae. Even among these families, there are definite preferences, there being usually one or two species of flowers in each locality which seem to be preferred. As indicated under certain species, there are a few more strictly oligolectic forms. As with many bees, males are usually in flight some days before the females.

Something is known of the nesting habits of several American species of Hoplitis. As with a great many other solitary bees, each nest consists of a row of cells, one above a nother, in a tubular hole in a stem, in wood, or in the soil. Each cell is provided with a mass of semisolid pollen or bee bread on which an egg is laid. According to Graenicher (1905), the mass is conical in $H$, producta, and the egg is laid on the summit. After provisioning, the cell is sealed by the parent. The larva rapidly eats the pollen mass, then rests for a long period as a "prepupa." Overwintering occurs in this stage, within a thin but tough and paperlike cocoon spun by the larva. The cocoons of Hoplitis, so far as known, lack the nipplelike projection at one end, often present in megachilid cocoons. Pupation takes place in the spring, and the adult emerges soon thereafter.

In common with those of most Megachilidae, the cells are separated by partitions of various materials characteristic for the species, and often brought into the nest. In the following account emphasis is placed on those features of the nests which appear to differ among the species and subgenera.


Plate 7. Lateral view of Hoplitis albifrons maura (Cresson), male.

The species of the subgenus Alcidamea whose habits are known all nest in the pithy cores of dead stems or canes of various plants. Nests of Hoplitis (Alcidamea) producta producta have been described by several authors (Graenicher, 1905; Comstock, 1924; Hicks, 1926; Rau, 1928). This bee makes the partitions between cells of parts of leaves, chewed into a feltlike, pliable mass which dries to form a very firm, hard plug. Davidson (1896) described, under the name producta, nests which probably actually belonged to the closely related $H$. grinnelli grinnelli. The partitions are said to be made of pith and clay. $H$. brachyodonta (a probable synonym of grinnelli grinnelli) is reported by Hicks (1933) to use plant material apparently similar to that used by producta but sometimes supplemented by small pebbles. It may be that the use of soil material (clay or pebbles) is characteristic of grinnelli. It is also possible that the pith mentioned by Davidson was actually masticated and subsequently dried leaf material. Of $H$. producta gracilis and H. sambuci all that is known is that they nest in pithy stems. Nests of the former have been mentioned (as productus) by Linsley and MacSwain (1943); those of the latter, by Titus (1904) and Linsley and MacSwain (1943). H. sambuci has also been reared from stems collected by Michener in southern California.

Nests of the only known species of the subgenus Cyrtosmia, H. bypocrita, were described by Hicks (1926) and have been found by Michener in southern California. As in the subgenus Alcidamea, the nests are placed in dry pithy
stems. The partitions between the cells consist of loose, uncemented, coarse particles of pith, apparently from the stem in which the nest is built.

The only species of the subgenus Dasyosmia whose nesting is known is H. biscutellae. Linsley and MacSwain (1943) record this species nesting in a bank. It is our only Hoplitis known to nest in soil.

The nests of $H$. (Andronicus) cylindrica have been described by Hicks (1926). They are built in dry pithy stems, as with Alcidamea and Cyrtosmia, and the partitions between the cells appear to consist of fine particles of pith cemented together to make hard compact masses. A curious feature is that apparently the adults normally escape by cutting their way out through the stem walls instead of by emerging through the original nest entrance and working through the plugs and debris above them.

Two nests of Hoplitis (Monumetha) fulgida were described by Hicks (1926). One was in a hole, apparently made by a beetle, in a stump; the other was in a woody stem. Partitions between the cells consist of masticated plant material and pebbles. The cells are irregularly and widely spaced, as with certain other Hymenoptera which appropriate abandoned burrows of other insects.

Although H. albifrons is a common and widespread species, the nesting habits of this Montmetha are unknown. However, a female of $H$. albifrons maura has been collected, carrying a pulpy, green mass, apparently consisting of macerated leaf tissue.

Key to the American Subgenera of Hoplitis ${ }^{2}$

|  | Males |
| :---: | :---: |
| 1. |  |
| 2(1). | First and second metasomal sterna each with a median posterior spine or angle <br> . . . . . . . . . . . . . . . . . . . . . . . . Monumetha (p. 81) <br> First and second sterna without median posterior spines or angles, although first may have elevated blunt apical angulation |
| $3(2)$. | Last antennal segment expanded and produced to one side (as in pl. 15, fig. 40) <br> Acrosmia (p. 78) <br> Last antennal segment rounded or pointed, not expanded (as in pl. 14, figs.31,33,34,35) |

[^1]|  | Seventh metasomal tergum at least feebly and commonly deeply emarginate medially (as in pl. 16, fig. 45) (except rarely in Hoplitina which may be recognized by the largely red metasoma). |
| :---: | :---: |
|  | Seventh tergum rounded (pl. 16, fig. 48), truncate (pl. 16, fig. 46), or pointed (pl. 16, fig. 50 ), sometimes trifid (pl. 17, fig. 58) (metasoma not red). |
| 5(4) | Seventh metasomal tergum four-lobed, the median lobes rather close together and exceeding others; metasoma black . . . . . . . . . . . . . . . . Formicapis (p. 54) |
|  | Seventh tergum bilobed (as in pl. 16, figs. 42, 43) (rarely subtruncate); metasoma partly or largely red . . . . . . . . . . . . . . . . . . . . .Hoplitina (p. 48) |
| $6(4)$ | Seventh metasomal tergum simple, broadly rounded; antennae unmodified; clypeus densely clothed with short hairs . . . . . . . . . . . . . . . . . Robertsonella |
|  | Seventh tergum produced to a pointed or truncate apex; antennae modified, the scape often thickened, the last segment pointed or the middle flagellar segments thickened; clypeus with the usual long hairs |
|  | Third to fifth flagellar segments conspicuously broader than others; first metasomal sternum with median apical elevation |
|  | Third to fifth flagellar segments not broad; first metasomal sternum with margin simple (except H. biscutellae) |
|  | Antennal pedicel almost completely hidden in concavity at end of scape when antenna is in normal position (as in pl. 15, fig. 37); posterior coxae edentate . . . Alcidamea (p. 54) |
|  | ntennal pedicel exposed (as in pl. 14, fig. 35); posterior coxae each with broad ventral tooth . . . . . . . . . . . . . . . . . . . . . . Dasyosmia (p. 75) |

## Females

1. Mandibles clearly quadridentate or approaching the quinquedentate condition (as in pl. 18, fig. 61)

2
Mandibles tridentate, sometimes with a weak convexity between second and third teeth (as in pl. 18, fig. 63).

4
2(1). Clypeus low and broad with median apical snout; mandibles each with broad apical margin bearing two long lower teeth, above which is an undulate margin which may be regarded as forming either two or three low teeth . . . . . . . . . . Formicap is (p. 54)
Clypeus of normal shape, without snout; mandible clearly quadridentate (as in pl. 18, fig. 70)

3(2). Body brilliantly metallic or, if black, with at least some black hair; distance between apices of first and fourth mandibular teeth more than one and one-half times width of mandible at narrowest point
. Monumetha (p. 81)
Body black, with pubescence entirely pale; distance between apices of first and fourth mandibular teeth less than one and one-half times width of mandible at narrowest point

Andronicus
4(1). Median mandibular tooth almost twice as far from upper as from lower tooth; a weak convexity present between second and third teeth (pl. 18, fig. 63).

Cyrtosmia(p. 74)
Median mandibular tooth more nearly midway between upper and lower teeth (as in pl. 18, fig. 66)
5(4). Anterior median part of metanotum as high as convexity of mesoscutellum; sixth tergum nearly straight in profile if smooth projecting apical rim is ignored.

6
Metanotum on posterior face of thorax so that anterior median part is lower than convexity of mesoscutellum; punctate part of sixth tergum usually concave in profile
6(5). Metasoma black
Robertsonella
Metasoma partly or wholly red
Hoplitina (p. 48)

# 7(5). Mandibles slender, each distinctly narrower just beyond base than at base, width at narrowest point one-third the mandibular length or less . . . . . . Acrosmia (p. 78) Mandibles robust, not markedly narrowed near bases, width at narrowest point more than onethird the mandibular length . 8 

8(7). Apices of mandibles nearly as broad as eye; distal parts of forewings with minute papillae, median parts with very few hairs Dasyosmia (p. 75) Apices of mandibles much narrower than eye; wings finely hairy throughout, without papillae

Alcidamea (p.

## Subgenus Hoplitina Cockerell

## Discussion:

The species of Hoplitina may readily be separated from all our species of Hoplitis except $H$. rufina by the red or partly red abdomen. Hoplitina has the thorax more elongate than in most Hoplitis, almost as in Robertsonella. The unmodified male antennae suggest a relationship
with the subgenera Formicapis and Robertsonella. All the species are small, the largest deing 8 mm . in length.

The six species of Hoplitina are all found in California, three of them in the deserts and three in cismontane California. Except for H. howardi, which is sometimes rather abundant, they are scarce, being far less common than the similarly colored small bees in the genera Asbmeadiella and Proteriades.

## Key to the California species of Hoplitina

## Males

1. First flagellar segment about twice as long as broad (as in pl. 14, fig. 31); sixth metasomaltergum without lateral teeth (as in pl. 16, fig. 45) (sometimes with weak angle at eachside)2
First flagellar segment little longer than broad (pl. 14, fig. 29); sixth metasomal tergum with a tooth at each side (as in pl. 16, fig. 42) . ..... 3
2(1). Clypeus with disc uniformly punctate ..... linsdalei (p. 52)
Clypeus with upper median part nearly impunctate and strongly protuberant.
bullifacies ( p . ..... 52)
3(1). Seventh metasomal tergum with distinct median apical emargination. (pl. 16, fig. 42). bowardi (p. 49)
Seventh metasomal tergum subtruncate (as in pl. 16, fig. 43), the margin very weakly concave ..... 4medially (or not concave)
4(3). Clypeus with basal, median, longitudinal keeled elevation bunocephala (p. ..... 49)
Clypeus evenly convex basally mazourka (p. ..... 52)

## Females

1. Clypeus gently convex and uniformly punctate throughout, except for the apical margin . . bowardi (p. ..... 49)
Clypeus with a partly impunctate prominence or with upper part conspicuously convex andshining, impunctate or nearly so2
2(1). Upper two-thirds of clypeus evenly convex ..... 3
Clypeus with a high, basal, median, longitudinally keeled prominence bunocepbala (p. ..... 49)
3(2). Clypeal truncation demarked by distinct angles. bullifacies (p. ..... 52)
Clypeal truncation rounded laterally so that it is not clearly demarked . mojavensis ( p . ..... 52)

## Hoplitis howardi (Cockerell)

(Pl. 14, fig. 29; pl. 16, fig. 42; pl. 18, fig. 66)
Ashmeadiella bowardi Cockerell, 1910, Ann. Mag. Nat. Hist., (8)5:22, $P^{( } \delta^{\top}$ is Ashmeadiella salviae). Type $\xlongequal{\circ}$, San Gabriel Mountains, California (U.S. Nat. Mus.).
Synonyms: pentamera (Cockerell), 1910 ; besperia (Crawford), 1916.
Geographic range: California (see map 17).
California records:
Contra Costa Co.: Rock City, Mt. Diablo, $4 \mathrm{\delta}^{\prime}$, ㅇ, V-24-40 (Michener, 1947:274, C.A.S., K.U.). Mt. Diablo, ${ }^{\text {J/, V }}$ V-12-52 (F. X. Williams, C.A.S.). Las Trampas Ridge, west of Danville, $1,500 \mathrm{ft}$., ㅇ, V-24-49 (F. X. Williams, C.A.S.).

Kern Co.: Frazier Mountain, ${ }^{\circ}$ ', VI-2-38 (V. K. Wilt, U.C.R.).

Los Angeles Co.: Altadena, 2 §', V-13-34, flowers Lotus scoparius (C. D. Michener, C.I.S., G.E.B.) 7 б', 9, VI-1-35 (C. D. Michener, C.I.S., K.U., O.S.C.); ${ }^{\text {P, VI-28-35 (C. D. Michener, }}$ U.C.R.); 9, V-2-36, flowers Lotus scoparius (C. D. Michener, K.U.); $\delta$, 9, VI-14-36 (C. D. Michener, G.E.B., K.U.); ㅇ, VI-16-36 (Michener, 1947:274, K.U.). Claremont (Michener, 1947:274). Eagle Rock, 9 ठ, 2 ㅇ, V-9-36, flowers Lotus scoparius (Michener, 1947:274). La Crescenta (Michener, 1947:274). Los Angeles (Michener, 1947:274). Newhall, $\sigma^{\prime}$, IV-20-40 (R. M. Bohart, G.E.B.). Pasadena, $\delta, \quad \mathrm{V}-5-10$ (F. Grinnell, U.C.R.); $\delta$, VI-6-26 (C.I.S.). Puente Hills, 2 预, V-9-26, flowers Cryptantha intermedia (P. H. Timberlake, U.C.R.); o', V-11-30, flowers Lotus scoparius (P. H. Timberlake, U.C.R.). San Gabriel Mountains (Michener, 1947:274). Tanbark Flat, San Dimas Experimental Forest, 9 , VI-19-50 (J. W. MacSwain, C.I.S.). ㅇ, VI-20-50, flowers Lotus (P. D. Hurd, Jr., C.I.S.); 우, VI-21-50 (J. D. Paschke, C.I.S.); ㅇ, VI-22-50, ㅇ, VI-23-50 (F. X. Williams, C.A.S.); ㅇ, VI-24-50 (P. D. Hurd, Jr., C.I.S.); , VI-25-50 (P. D. Hurd, Jr., C.I.S.); ㅇ, VI-27-50 (A. T. McClay, U.C.D.); + , VII-20-50, flowers Lotus (P. D. Hurd, Jr., C.I.S.); Y, VII-3-50 (F. X. Williams, C.A.S.); Hall, U.C.D.); ${ }^{\prime}$, VII-5-52 (R. M. Bohart, U.C.D.); ㅇ, VII-12-52 (H. L. Mathis, U.C.D.).

Monterey Co.: Hastings Natural History Reservation, near Jamesburg, $7, \mathrm{~V}-26-38$, ㅇ, VI-3-38, f, VI-1 0-38 (Michener, 1947:274, K.U.).

Riverside Co.: Mt. San Jacinto, 4,000 ft., $P$ VI-6-42 (R. M. Bohart, G.E.B.). Murrieta, $2 \delta$, IV-18-50 (J. W. MacSwain, C.I.S.). Perris, $11 / 2 \mathrm{mi}$. W., ठ, V-27-38, flowers Salvia (P. H. Timberlake, U.C.R.). Riverside, , IV-14-25, flowers Lotus
glaber; 와, IV-21-26, flowers L. glaber, ㅇ, IV-2326, flowers $L$. glaber; ㅇ, V-4-26, flowers $L$. strigosus; $\delta$, IV-21-27; ㄱ, IV-16-28, flowers $L$. scoparius; , IV-18-28, flowers L. scoparius; ㅇ, IV-28-28, flowers L. scoparius; 9 , IV-27-34, flowers L. scoparius; 2 \&, IV-16-35, flowers $L$. glaber(all collected by P. H. Timberlake, U.C.R.); +, VI-I-39 (P. DeBach, U.C.R.). San Jacinto River, 4,000 ft., ${ }^{\delta}$, V-30-40 (Michener, 1947:274). Temecula, ठ, $\mathcal{Y}$, IV-11-50 (P. D. Hurd, Jr., K.U.). Temecula, 10 mi . S.E., 우, IV-18-50, flowers Lotus (E. G. Linsley, C.I.S.). The Gavilan, ㅇ, V-18-51 (E. I. Schlinger, U.C.D.).

San Bernardino Co.: Redlands (Michener, 1947:274). Trail above Glen Ivy, San Bernardino Mountains, o', 2 ㅇ, V-13-28, flowers Lotus scoparius (P. H. Timberlake, U.C.R.). Verdemont, S, V-1-46 (P. H. Timberlake, U.C.R.).

San Diego Co.: Campo, 2 아, VI-28-39 (R. M. Bohart, U.C.D.). Mt. Palomar, ס', VI-19-50 (F. X. Williams, C.A.S.).

Santa Clara Co.: Alum Rock Park, $\sigma^{\prime}$, IV-2151 (J. W. MacSwain, C.I.S.); ס', V-24-52 (D. Burdick).

Tulare Co.: Potwisha, Sequoia National Park, 우, VI-2-29 (Michener, 1947:274, C.A.S.).
Discussion:
This is the common Hoplitina of cismontane California. It appears to visit principally the flowers of Lotus, especially L. scoparius.

## Hoplitis bunocephala Michener

(Pl. 16, fig. 43)
Hoplitis (Hoplitina) bunocephala Michener, 1947, Bull. Amer. Mus. Nat. Hist., 89:276, $\delta$, 9. Type ${ }^{\text {P. Mt. Diablo, Contra Costa County, }}$ California, on flowers Lotus (Amer. Mus. Nat. Hist.).
Geographic range: California (see map 18).
California records:
Amador Co.: Ione, f, V-16-37, flowers Lotus (Michener, 1947:276, U.C.R.). Ione, 5 mi . N., $\delta$, 우, V-16-37, flowers Lotus (Michener, 1947:276, K.U.).

Contra Costa Co.: Mt. Diablo, ठ', ㅇ, IV-26-37, one on flowers Lotus (Michener, 1947:276, U.C.R.); $\delta_{\text {, }} \mathrm{IV}-24-37$ (G. E. and R. M. Bohart, G.E.B.); $\delta$, V-8-38 (G. E. and R. M. Bohart, G.E.B.). Rock City, Mt. Diablo, $\delta$, V-24-40 (Michener, 1947:277, C.A.S.).

Napa Co.: Mt. St. Helena, $\delta^{\lambda}$, ㅇ, V-15-51 (J. C. Hall and E. I. Schlinger, U.C.D.).



Tuolumne Co.: Tuolumne City, $\delta$, VI-8-53, $\delta^{\prime \prime}$, VI-14-53 (J. G. Rozen, C.I.S.). Discussion:

This species is easily distinguished in both sexes from all other Hoplitis by the very high and longitudinally keeled prominence of the clypeus.

## Hoplitis mojavensis Michener

Hoplitis (Hoplitina) mojavensis Michener, 1947, Bull. Amer. Mus. Nat. Hist. 89:275, 9. Type f, 11 miles south of Victorville, California, on flowers Pbacelia fremontii (Timberlake collection, U.C.R.).
Geographic range: California (see map 19).
California records:
Inyo Co.: West of Lone Pine, 6,000 ft., V-1937, flowers Phacelia (Michener, 1947:276, K.U.).

San Bernardino Co.: Victorville, 11 mi. S., 9, IV-27-37, flowers Pbacelia fremontii (Michener, 1947:276, A.M.N.H.).

San Diego Co.: Borego, ${ }^{\text {P, IV-2-53, flowers }}$ Cryptantha barbigera (P. D. Hurd, Jr., C.I.S.). Discussion:

A single female specimen from Morongo, California, on Nama demissum, April 19, 1937 (P. H. Timberlake, U.C.R.), apparently represents another species close to mojavensis, differing by having the clypeal truncation feebly defined, the frons not swollen, and the mesoscutum conspicuously more finely punctate than the vertex.
H. mojavensis is our smallest species of Hoplitis, being only 4.5 mm . long. It is closely related to another desert species, H. bullifacies, both of which have a rounded prominence on the upper part of the clypeus (instead of a keeled one as in H. bunocephala). H. mojavensis differs most conspicuously from bullifacies by the rounded clypeal margin and the coarsely punctate lower part of the clypeus in the female.

## Hoplitis bullifacies Michener

(Pl. 16, fig. 44)
Hoplitis (Hoplitina) bullifacies Michener, 1947, Bull. Amer. Mus. Nat. Hist., 89:274, 9 , not §. Type 9,4 miles west of Lone Pine, Inyo County, California (Amer. Mus. Nat. Hist.). Geographic range: California (see map 20). California records:

Inyo Co.: Lone Pine, 4 mi . W., $9, \mathrm{~V}-19-37$ (Michener, $1947: 275$, K.U.). Lone Pine Creek,

P, V-19-47 (R. M. Bohart, U.C.D.). Big Pine
 VI-17-42, 3 Y, VI-20-42, 3 ㅇ, VI-27-42 (R. M. Bohart, C.I.S., G.E.B., K.U.). Cartago, \&, V-2- $^{\text {V }}$ 27, flowers Pbacelia aff. fremontii (Michener, 1947:275).

San Bernardino Co.: Cactus Flat, San Bernardino Mountains, $\delta$, 9 , IV-28-50, flowers Phacelia (T. F. Leigh, C.I.S.). Kramer Junction, ס', V-1-53 (G. A. Marsh, C.I.S.).

Discussion:
The male tentatively associated with this species when it was first described is now known to belong to another species, H. mazourka. The true male of bullifacies was described in another paper (Michener, 1954a). In its long antennae and edentate sixth metasomal tergum, the male agrees with $H$. linsdalei, the female of which may therefore be expected to resemble bullifacies in some respects. The female of bullifacies is most similar to $H$. mojavensis, from which it differs most strikingly in the larger size and the clearly defined clypeal truncation.

## Hoplitis mazourka Michener

Hoplitis (Hoplitina) mazourka Michener, 1954, Pan-Pacific Ent., 30:38, o'. Type ơ', Mazourka Canyon, Inyo Mountains, Inyo County, California, 7,500 feet altitude, on flowers Phacelia, (Univ. of Kansas).
Geographic range: California (see map 21).
California records:
San Bernardino Co.: Kramer Junction, ô, IV-30-53 (Michener, 1954:38).
Discussion:
This species, known only from two specimens, was originally described as the probable male of H. bullifacies. With the discovery of the true male of that species, H. mazourka was named. It is similar to $H$. bunocepbala in many features, but differs by the uniformly convex clypeus which is punctured throughout.

## Hoplitis linsdalei Michener

 (Pl. 14, fig. 31; pl. 16, fig. 45)Hoplitis (Hoplitina) linsdalei Michener, 1947 , Bull. Amer. Mus. Nat. Hist., 89:277, ${ }^{\top}$. Type $\delta$, Hastings Natural History Reservation, near Jamesburg, Santa Lucia Mountains, Monterey County, California, elevation 1,900 to 2,700 ft. (Amer. Mus. Nat. Hist.).


Map 21. Distribution of Hoplitis mazourka Michener.


Map 22. Distribution of Hoplitis linsdalei Michener.

Geographic range: California (see map 22). Discussion:

This is the largest species of the subgenus and is known from a single male specimen. It most closely resembles $H$. bullifacies, but differs strikingly from that species by the uniformly punctate and nonprotuberant clypeus.

## Subgenus Formicapis Sladen

## Discussion:

This northern and montane subgenus, previously regarded as a distinct genus, contains a single small black species. This is readily recognized by the large head of the female, the clypeus of which bears a short median apical snout, and by the four-lobed seventh metasomal tergum of the male. The mandible of the female has a greatly broadened apex that bears two sharp teeth, above which is an undulate margin; these undulations appear to make the mandible either four- or five-toothed, depending upon the interpretation. A character used in previous studies on genera in this group (Michener, 1941 , $1944 a$ ) involves the position of the first recurrent vein. In Formicapis it is usually interstitial with the first transverse cubital or a short distance on either side of it, whereas in other megachilids the first recurrent is usually distinctly distad to the first transverse cubital. This character breaks down completely, however, since in a few specimens of Hoplitis albifrons and cylindrica, the veins are interstitial.

## Hoplitis clypeata (Sladen)

Formicapis clypeata Sladen, 1916, Canad. Ent., 48:271, ㅇ. Type $ㅇ, B a n f f, ~ A l b e r t a . ~(C a n a d . ~$ Nat. Collection, Ottawa).
Geographic range: Alaska, Northwest Territories,

British Columbia, Alberta, Saskatchawan, Colorado, Montana, Oregon, California (see map 23).
California records:
Shasta Co.: Mt. Lassen, $O$, VII-30-47 (R. M. Bohart, G.E.B.).
Discussion:
H. clypeata has been collected on flowers of Taraxacum at Fort Resolution, Great Slave Lake, Canada. No other floral records are known to us.

## Subgenus Alcidamea Cresson

Discussion:
This is our largest subgenus of Hoplitis, containing nine American species, and is the only one that occurs in the Palearctic as well as the Nearctic regions. It consists of black species with white, gray, or yellowish pubescence which forms transverse fasciae on the metasomal terga. The robust antennae with acutely pointed apices are nearly diagnostic of the males of this subgenus. The subgenus Cyrtosmia has pointed antennae, but they are long and slender; one species of Dasyosmia has pointed antennae but it is readily distinguished by the enormous projection on the first metasomal sternum (projections on the second are common in Alcidamea); some males of $H$. (Monumetha) albifrons have pointed antennae but are readily distinguished by the characters mentioned in the key to subgenera. Females are superficially similar to certain species of the genus Asbmeadiella but can be distinguished at once by the lack of a carina between the anterior and the lateral faces of the mesepisterna. Species of Dasyosmia are larger and more robust than those of Alcidamea.

## Key to the California Species of Alcidamea

## Males

1. Seventh metasomal tergum truncate or subtruncate (pl. 16, figs. 46, 48); second metasomal sternum without protuberance or projection.
Seventh metasomal tergum pointed or rarely narrowly rounded (as in pl. 16, fig. 50); second metasomal sternum with median protuberance or projection . . . . . . . . . 3
2(1). Subapical breadth of seventh metasomal tergum less than one-half of distance between lateral teeth of sixth metasomal tergum (pl. 16, fig. 48); first flagellar segment broader


Map 23. Distribution of Hoplitis clypeata (Sladen).
than long or at least as broad as long . . . . . . . . . . . . sambuci (p. 57)
Subapical breadth of seventh metasomal tergum over half of distance between lateral teeth of sixth metasomal tergum (pl. 16, fig. 46); first flagellar segment longer than broad
truncata ( p .
3(1). Head longer than broad, produced noticeably above summits of eyes . elongaticeps (p. 67)
Head not, or rarely very slighty, longer than broad, not produced noticeably above summits
of eyes . . . . . . . . . . . . . . . . . . . . . . . . . . 4

4(3). Antennal scape more than 2.5 times as long as broad (as in pl. 15, fig. 37); fringe of third metasomal sternum with dense median section so that there appears to be a median tuft, longer hairs of this tuft bent near the middle, so that distal part of tuft is directed toward the body or parallel to it

5
Antennal scape greatly thickened, markedly less than 2.5 times as long as broad (as in pl. 15, fig. 38); fringe of third metasomal sternum variable but hairs not bent as described above.

6
5(4). Projection of second metasomal sternum large and high, one-third to one-fifth as high as dorsoventral thickness of metasoma; margins of projection as seen in profile meeting in a strongly acute angle if projected

- grinnelli (p. 69)

Projection of second metasomal sternum small and low, only about one-seventh as high as thickness of metasoma; margins of projection as seen in profile meeting in a right angle or slightly acute angle if projected . . . . . . . . . . . brachyodonta (p. 74)
6(4). Projection of second metasomal sternum small, only about one-seventh as high as dorsoventral thickness of metasoma; maxillary galeae at least as long as length of head (measured in side view from apex of clypeus to summit of vertex) . . . . . . colei (p. 67)
Projection of second metasomal sternum larger, usually more than one-seventh as high as thickness of metasoma; maxillary galeae shorter than head
7(6). Length 9 mm . or more . . . . . . . . . . . . . . . . . . uvulalis (p. 69)

Females

1. Metasomal terga two to four each with deep transverse basal furrow behind gradulus (not visible if metasoma is elevated and segments retracted); rather robust, coarsely punctate species
Metasomal terga with basal furrows less deep, that of fourth segment nearly absent; usually more slender, more finely punctate species
2(1). Punctures of sixth metasomal tergum very fine, contrasting strongly with those of fifth
Punctures of sixth metasomal tergum as coarse as those of fifth, at least medially . .

3(1). Head markedly longer than broad; length 5.5 mm . or less . . . . . elongaticeps (p. 67)
Head at least as broad as long, rarely very little longer than broad in colei; length usually more than 5.5 mm .

4
4(3). Maxillary galeae at least as long as head (measured in side view from apex of clypeus to summit of vertex); clypeal truncation broad, gently convex, weakly emarginate medially

Maxillary galeae shorter than head; clypeal margin with shallow median emargination . 5
5(4). Fifth metasomal tergum with apical fascia of white pubescence . . . .grinnelli (p. 69)
Fifth metasomal tergum not fasciate

6(5).
Length 9 mm . or more; punctures of sixth metasomal tergum fine and close so that the tergum appears rather dull
Length almost always less than 9 mm ., punctures of sixth metasomal tergum somewhat coarser, tergum less dull
.producta (p. 62)

## Hoplitis sambuci Titus

(Pl. 15, fig. 41; pl. 16, fig. 48)
Hoplitis sambuci Titus, 1904, Proc. Ent. Soc. Wash., 6:101, ${ }^{7}$, 아. Type 오, Pullman, Wash. (U.S. Nat. Mus.).

Geographic range: British Columbia, California, Idaho, Nevada, Oregon, Utah, and Washington (see map 24).
California records:
Butte Co.: Feather River Highway, 2 ㅇ, VI-14-40 (T. H. G. Aitken and M. A. Cazier, C.A.S.). Richardson Spring, 2 Y, V-21-44 (E. C. Van Dyke, C.A.S.).

Calaveras Co.: Mokelumne Hill, 2 ㅇ, (F. E. Blaisdell, C.A.S.); $\delta$, VI-6-46 (F. E. Blaisdell, C.A.S.).

Contra Costa Co.: Antioch, 오, V-6-39 (J. W. MacSwain, C.I.S.); ㅇ, V-24-49, flowers Lotus (P. D. Hurd, Jr., C.I.S.); $4 \delta^{3}$, IV-29-50 (P. D. Hurd, Jr., C.I.S.); ㅇ, V-15-52 (J. G. Rozen); VI-1 5-52 (R. H. and L. D. Beamer, W. LaBerge, C. Liang, A. Wolfe, C. Winer, K.U.). Mt. Diablo, 2 ठ, ㅇ, VI-25-39 (E. C. Van Dyke, C.A.S.); 2 ㅇ, VI-1 5-49 (C.I.S.).

Inyo Co.: Oak Creek, north fork near Independence (Michener, 1947:282). Independence, ${ }^{\circ}$ ', VI-2-37 (W. C. Reeves, U.C.R.); ${ }^{\text {T, VI-11-37 (U.C.R.). }}$ Big Pine Creek, 7,500 ft., VI-27-42, reared from twigs of Sambucus (R. M. Bohart, G.E.B.).

Eldorado Co.: Camino, 3 mi . S., $2 \mathrm{~J}^{\mathrm{\prime}}, \mathrm{VI}-23-48$, flowers Compositae (P. D. Hurd, Jr., C.I.S.); $\delta$, VI-23-48 (J. W. MacSwain, C.I.S.); $\bar{\delta}$, VI-26-48, flowers Phacelia (P. D. Hurd, Jr., K.U.); 5 ठ, 2 ㅇ, VI-26-48, flowers Vicia (P. D. Hurd, Jr., C.I.S.). Chile Bar, $\mathrm{\sigma}^{\text {d, }}$ VII-5-48 (C. Chan, U.C.D.). Kyburz, 우, VII-10-50 (W. F. Ehrhardt, C.I.S.).

Los Angeles Co.: Acton, ㅇ, III-14-36, flowers Salix (E. G. Linsley, C.I.S.). Altadena, 아, VI-24-35 (C. D. Michener, K.U.); 3 ठ, , V-2-36, flowers Lotus scoparius (C. D. Michener, K.U.). Arroyo Seco, 2 ㅇ, VI-25-40, flowers Lotus (J. W. MacSwain, C.I.S.). Big Dalton Dam, $\delta^{\prime}$, VI-27-50 (H. F. Robinson, U.C.D.). Eagle Rock, J', IV-736, flowers Salvia mellifera (C. D. Michener, K.U.). La Crescenta, 9 , V-5-34, flowers Eriodictyon crassifolium (C. D. Michener, K.U.); + VII-21-39 (R. M. Bohart, U.C.D.). Lone Pine

Canyon, San Gabriel Mountains, ${ }^{2}, 2$ 아, VI-1 6-28, flowers Stanleya pinnata (P. H. Timberlake, U.C.R.). Pasadena, $2 \delta^{\prime \prime}$, II-8-28 (C. H. Hicks, U.C.R.); $\delta^{\prime}$, V-22-25 (C.I.S.). Puddingstone Canyon, , V, V-8-34 (C. D. Michener, K.U.). Tan- $^{\text {( }}$ bark Flat, San Dimas Experimental Forest, $\hat{\sigma}$, VI-17-50 (A. T. McClay, U.C.D.); $\delta$, VI-19-50 (J. C. Hall, U.C.D.); $\delta, 6$ ㅇ, VI-19-50, flowers Lotus (P. D. Hurd, Jr., C.I.S., K.U.); 3 d, 2 9, VI-19-50, some on flowers Lotus (E. G. Linsley, K.U.); 2 む', 5 ㅇ, VI-1 9-50 (J. W. MacSwain, C.I.S., K.U.); $\delta$, VI-19-50 (W. O. Marshall, U.C.D.); 3 早, VI-20-50, flowers Eriogonum (W. C. Bentinck, C.I.S.); 2 ㅇ, VI-20-50 (J. C. Hall, U.C.D.); ㅇ, VI-20-50 (H. L. Hansen, C.I.S.); 5 d, 19 f, VI-20-50, flowers Lotus (P. D. Hurd, Jr., C.I.S.); 우, VI-20-50 (W. O. Marshall, U.C.D.); $\delta$, , 20-50 (J. D. Paschke, C.I.S.); ㅇ, VI-21-50, flowers Lotus (W. C. Bentinck, C.I.S.); 9 , VI-21-50 (J. C. Hall, U.C.D.); ㅇ, VI-21-50 (J. D. Paschke, C.I.S.); ㅇ, VI-21-50 (K. G. Whitesell, U.C.D.); ㅇ, VI-22-50 (H. L. Hansen, C.I.S.); $2 \delta^{2}$, 2 ㅇ, VI-22-50 (P. D. Hurd, Jr., C.I.S.); ठ, VI-2540 (J. W. MacSwain, C.I.S.); ${ }^{\prime}$ ', VI-25-50 (A. T. McClay, U.C.D.); ㅇ, VI-25-50 (R. O. Schuster, C.I.S.); ㅇ, VI-26-50 (A. T. McClay, U.C.D.); ठ', VI-27-50 (P. D. Hurd, Jr., C.I.S.); ${ }^{\circ}, 4$ ㅇ, VI-27-50 (A. T. McClay, U.C.D.); ㅇ, VI-27-50 (W. O. Marshall, U.C.D.); + , VI-27-50 (K. G. Whitesell, U.C.D.); $\delta$, VI-28-50 (K. G. Whitesell, U.C.D.); $\mathrm{o}^{\hat{2}} 7$ ㅇ, VI-30-50, flowers Helianthus (P. D. Hurd, Jr., C.I.S.); 3 ㅇ, VI-30-50 (A. T. McClay, U.C.D.); 3 ठ, 7 ㅇ, VII-2-50 (A. T. Mc Clay, U.C.D.); 11 ㅇ, VII-2-50, flowers Lotus (E. G. Linsley, C.I.S.); ㅇ, VII-3-50 (P. D. Hurd, Jr., C.I.S.); ठ, VII-9-50 (J. C. Hall, U.C.D.); 2 ㅇ, VII-13-50 (J. C. Hall, U.C.D.); 2 ㅇ, VII-13-50 (A. T. McClay, U.C.D.); ㅇ, VI-29-52 (R. L. Anderson, U.C.D.); 3 P, VII-7-52 (A. T. McClay, U.C.D.); 2 ㅇ, VII-8-52 (Joan Linsley, C.I.S.); 2 ㅇ, VII-8-52 (A. T. McClay, U.C.D.); + , VII-11-52 (A. T. McClay, U.C.D.); 아, VII-13-52 (A. T. McClay, U.C.D.); ㅇ, VII-17-52 (A. T. McClay, U.C.D.). Tujunga Wash, $\delta^{\prime}$, IV-17-27, flowers Layia glandulosa (P. H. Timberlake, U.C.R.). West Hollywood Hills, $\delta$ ', VI-25-50 (R. G. Howell, C.I.S.). Westwood Hills, $\mathcal{P}$, VIII-11-35 (E. G. Linsley, C.I.S.); ㅇ, VI-1 0-39(G. F. Smith, U.C.R.).


Map 24. Distributions of Hoplitis sambuci Titus, indicated by solid circles; and Hoplitis truncata (Cresson), the subspecies truncata indicated by open circles, the subspecies mescalerium indicated by half solid circles.

Marin Co．：Tamalpais，+ ，VI－20－26，flowers silvery Lupinus（P．H．Timberlake，U．C．R．）．

Mariposa Co．：El Portal， 8 ơ＇，V－30－38（R．M． Bohart，G．E．B．）；Y，V－23－38（N．F．Hardman， C．I．S．）．Indian Flat，$\sigma^{\prime}, 2$ ㅇ，V－23－38（R．M． Bohart，G．E．B．）．Yosemite， $3,880-4,000 \mathrm{ft} ., \delta^{\lambda}$ ， VI－15－38，flowers Rubus leucodermis（R．M． Bohart，G．E．B．）；ㅇ，V－29－31（E．O．Essig，C．I．S．）； む，VI－1－38（J．R．Warren，U．C．R．）；đ， 3 个，VI－2－ 38 （J．R．Warren，U．C．R．）．

Mendocino Co．：Twin Rocks， P，VII－1 0－29 $^{\text {0 }}$ （E．C．Van Dyke，K．U．）．

Modoc Co．：Lake City，o＇，VII－9－46，flowers Medicago sativa（P．D．Hurd，Jr．，C．I．S．）．

Monterey Co．：Arroyo Seco，+ ，VII－23－49（C． D．MacNeill，C．I．S．）．Bryson， 3 d＇，V－18－20（E．P． Van Duzee，C．A．S．）．Hastings Natural History Reservation，near Jamesburg，${ }^{\text {P，VI－4－38（C．D．}}$ Michener，K．U．）； 2 ठ＇，VI－14－38，flowers Lotus scoparius（C．D．Michener，K．U．）．

Napa Co．：Pope Valley， 8 mi．N．， $\mathrm{O}^{1}, \mathrm{~V}-1$ 5－51 （E．I．Schlinger，U．C．D．）．Putah Canyon， $2 \delta^{\circ}$ ， V－25－51（R．C．Bechtel and E．I．Schlinger， U．C．D．）．Samuel Spring，$\delta$ ，V－15－51（J．C．Hall， U．C．D．）；$\delta$ ，V－25－51（R．C．Bechtel，U．C．D．）；+ V－27－51（E．I．Schlinger，U．C．D．）．

Orange Co．：El Toro，${ }^{\text {P，}}$ V－28－47，flowers Lotus scoparius（P．H．Timberlake，U．C．R．）．

Plumas Co．：Quincy， 4 mi ．W．， 2 ठ＇，VI－25－49 （E．L．Atkinson，C．I．S．）；$\delta$ ，VI－22－49，flowers Phacelia（P．D．Hurd，Jr．，C．I．S．）；$\delta$ ，VI－25－49 （H．A．Hunt，U．C．D．）．

Riverside Co．：Corona， 9,1915 （C．I．S．）．Hemet Reservoir，San Jacinto Mountains，ㅇ，V－22－40， flowers Penstemon spectabilis（C．D．Michener， C．I．S．）．Herkey Creek，San Jacinto Mountains， Y，VI－14－40，flowers Amorpha fruticosa（C．D． Michener，C．L．S．）．Idyllwild，J，VI－23－28（E．C． Van Dyke，C．A．S．）； 3 P，VI－26－36（M．A．Cazier， （．I．S．，U．C．R．）； 2 f，VII－2－36，flowers Asclepias eriocarpa and Dicentra chrysantha（P．H．Timber－ lake，U．C．R．）；ㅇ，VII－1936（E．S．Ross，C．A．S．）； \％＇，V－25－39，flowers Cryptantha（E．G．Linsley， C．I．S．）；ס，VI－3－39，flowers Lupinus（W．C．Bush， C．I．S．）；$\delta^{2}$ ，VI－8－40，flowers Dicentra chrysantha （C．D．Michener，C．I．S．）；ㅇ，VI－17－40，flowers Dicentra cbrysantha（H．T．Reynolds，C．I．S．）； 2 $\delta^{\prime}$ ， $\mathrm{P}, \mathrm{V}$ V－15－41（E．C．Van Dyke，C．A．S．）．Keen Camp，San Jacinto Mountains，ㅇ，V－31－39，flowers Cirsium（E．G．Linsley，C．I．S．）； 2 ot，VI－1－39， flowers Penstemon（E．S．Ross，C．A．S．，C．I．S．）； $\delta^{\prime}$ ，VI－10－39，flowers Penstemon（E．G．Linsley， C．I．S．）； 2 ठ，same data（E．S．Ross，C．I．S．）． Keen Camp， 8 mi. W．， 2 ㅇ，V－16－39，flowers Cirsium（E．G．Linsley，C．I．S．）．Piñon Flat，San

Jacinto Mountains，$\delta$ ，ㅇ，IV－23－50（C．D．Mac Neill，C．I．S．）．Riverside，$\delta^{\top} \delta$ ， V－23－36，flowers Lotus glaber，L．scoparius，and Lupinus paynei（P．H．Timberlake，K．U．，U．C．R．）． Santa Rosa Mountain，$\delta$＇，V－31－40（R．Husbands， C．I．S．）；same locality，6，200 ft．， 2 o＇t $^{\prime \prime}$ 아，V－31－40， flowers Lotus（Michener，1947：282，C．I．S．）． Santa Rosa Peak，8，000 ft．，ㅇ，VI－22－40（E．C． Van Dyke，C．A．S．）．Saunders Meadows，San Jacinto Mountains，$\delta$ ，V－26－39（R．F．Smith， C．I．S．）．Soboba Hot Springs， 8 ，VI－1－17，$\delta^{\prime}$ ，VI－3－ 17 （E．P．Van Duzee，C．A．S．）．Temecula， 10 mi ． S．E．，+ ，IV－18－50，flowers Lotus（E．G．Linsley， C．I．S．）．The Gavilan， 2 Y，VI－20－38， 2 Y，VI－24－ 38，flowers Lotus scoparius（P．H．Timberlake， U．C．R．）；ㅇ，V－17－51（R．C．Bechtel，U．C．D．）． Vandevanter Flat，San Jacinto Mountains，오， VI－4－39，flowers Astragalus antisellii（P．H． Timberlake，U．C．R．）．

San Bernardino Co．：Cajon Valley，ㅇ，VII－4－ 33，flowers Trichostema ovatum（P．H．Timber－ lake，U．C．R．）．Cajon Wash， 2 ，VI－16－28，flowers Lotus scoparius（P．H．Timberlake，U．C．R．）． Crestline， 2 ठ，V－13－34，flowers Potentilla glandulosa（P．H．Timberlake，U．C．R．）．Deep Creek，ㅇ，V－16－37，flowers Lupinus formosus （P．H．Timberlake，U．C．R．）．Redlands， $\mathrm{\delta}^{\text {on }}$ ，V－1 5－36， flowers Cryptantha（C．D．Michener，K．U．）．Sheep Creek Canyon，3，500 ft．，$\delta$＇，VI－3－28；flowers Stanleya pinnata（P．H．Timberlake，U．C．R．）． San Diego Co．：Warner Springs，$\delta^{\prime}$ ，V－9－36， flowers Lupinus formosus（P．H．Timberlake， U．C．R．）．

Santa Barbara Co．：Sunset Valley， 9, VII－14－ 38 （M．A．Cazier，U．C．R．）．

Santa Clara Co．：Gilroy，$\delta$ ，VI－16－22（E．O． Essig，C．I．S．）．Mt．Hamilton，ㅇ，V－19－40（B． Brookman，C．I．S．）．San Antonio Valley，$ㅇ$, ，VI－ 25－49（T．F．Leigh，C．I．S．）．Stevens Creek，$\delta^{\prime}$ ， V－28－52（D．Burdick）．

Shasta Co．：Hat Creek，Lassen National Park， ठ，VI－4－41（C．I．S．）．

Siskiyou Co．：Walker，ㅇ，VI－3－20（C．L．Fox， C．A．S．）．

Trinity Co．：Big Flat，Coffee Creek， $\mathcal{P}$ ，VI－1－ 34 （T．H．G．Aitken，K．U．）．Carrville， $2,400-$ 3，000 f．，$\delta^{\prime \prime}, \mathrm{V}-16-34, \delta^{\prime}, \mathrm{V}-24-34, \delta^{2}, \mathrm{VI}-2-34$（G． E．Bohart，G．E．B．）．

Tulare Co．：Ash Mountain，d，IV－26－50（E．I． Schlinger，U．C．D．）．Badger， 2 \＆，VI－26－29，flowers Lonicera interrupta（P．H．Timberlake，U．C．R．）． Coffee Camp， 2 б，ㅇ，VI－11－25，flowers Lotus glaber（P．H．Timberlake，U．C．R．）．Potwisha， Sequoia National Park， 2 列，V－18－20（E．C．Van Dyke，C．A．S．）．

Tuolumne Co.: Pinecrest, $\delta$, VII-12-53 (J. G. Rozen, C.I.S.). Strawberry, $\sigma^{\prime \prime}$ VI-1 8-51 (J. W. MacSwain, C.I.S.). Tuolumne City, $\sigma$, VI-22-53 (J. G. Rozen, C.I.S.).

Discussion:
This is the common large, coarsely punctate Alcidamea found principally in cismontane California, but occurring also where mesic conditions exist on the eastern slopes of the Sierra Nevada. It occurs in both Upper Sonoran and Transition (perhaps Canadian) zone habitats, from nearly sea level to 8,000 feet altitude in southern California. H. sambuci is closest to $H$. truncata (Cresson), but is not closely related to any other California form.

In Utah it has been taken on flowers of Vicia at Ogden, and in Washington on flowers of Sambucus glauca at Pullman. No floral records are a vailable from other parts of its geographic range.

## Hoplitis truncata mescalerium Cockerell

Hoplitis mescalerium Cockerell, 1910 , Entomologist, 43:90. Type ㅇ, Mescalero, N.M. (U.S. Nat. Mus.).
Geographic range: Arizona, Colorado, New Mexico. The nominate subspecies ranges from Florida and Maine westward to North Dakota and Colorado (see map 24).
Discussion:
The subspecies truncdia is not rare in the eastern and middle states, but the subspecies mescalerium of the southern Rocky Mountain area and Arizona is little known. It appears to intergrade with truncata proper in a broad area from South Dakota and western Nebraska to the foot of the Rocky Mountains.

This species has not been found in California, but occurs at Williams, Arizona, and may therefore be expected in eastern California.

The subspecies mescalerium has been found at flowers of Gilia near Elbert, Colorado. The nominate subspecies was reported by Michener (1947:281) to visit flowers of Baptisia, Oenothera, Penstemon, Pogonia graminifolia, Rubus, and Tephrosia virginiana (many specimens). An additional floral record for truncata, s. str., is Cleome.

## Hoplitis producta (Cresson)

Alcidamea producta Cresson, 1864, Proc. Ent. Soc. Phila., 2:386, ${ }^{\text {ó. }}$

Hoplitis (Alcidamea) producta, Michener, 1947, Bull. Amer. Mus. Nat. Hist., 89:285.
Geographic range: Nova Scotia to Georgia, west to British Columbia and California (see map 25).

Discussion:
This species is found throughout the country except along the southern border and in the desert areas. As shown by Michener (1947a), it is divisible into six subspecies (see map 25). The morphological differences between certain of these subspecies are much greater than the differences between some of the subspecies of H. producta and allied but distinct species, such as H. uvulalis.

The three subspecies of producta occurring in California are representatives of two of the three somewhat distinct stocks: (1) the Pacific coast stock, containing subgracilis of the northwest and represented in California by the subspecies gracilis; (2) the Rocky Mountain stock, containing interior of the mountain states and represented in restricted regions of southern and eastern California by the subspecies bernardina and panamintana; and, (3) the eastern stock, containing producta proper of the plains and the east. The subspecies bernardina occurs in the southern California mountains in company with the subspecies gracilis. The two forms do not intergrade and hence presumably do not interbreed, although they are connected by the intermediate and intergrading subspecies interior Michener of the Rocky Mountain region and subgracilis Michener of the northwest. Thus there is a ring of four subspecies (gracilis - subgracilis - interior-bernardina), the terminal members of which behave as distinct species.

The other California subspecies of the Rocky Mountain stock (panamintana) is restricted, so far as is known, to the Panamint Mountains of eastern California. It may also occur in other Great Basin ranges. The two records from such ranges shown as the subspecies interior in map 25 and another from the Inyo Mountains of California shown as panamintana on the same map are based on one or two female specimens each and are actually indeterminate as to subspecies. The subspecies panamintana is separated by a narrow belt of desert (the Owens Valley) from the range of gracilis, but it is evident that gene flow across this desert occurs or has done so, since some specimens in the nearby gracilis populations exhibit certain of the characters of panamintana, notably the rounded, rather than pointed, apex of the seventh metasomal tergum

Map 25. Distribution of Hoplitis producta (Cresson), the subspecies bemardina indicated by left half solid circles, the subspecies interior by open circles, the subspecies gracilior by lower half
 by right half solid circles, and the subspecies producta by solid circles.
in the male. Thus it is evident that at this latitude, merging of Rocky Mountain and Pacific coast stocks has occurred, although in southern California it has not.

For the three subspecies of $H$. producta which do not occur in California, the following records of floral visitations are available. The nominate subspecies has been taken in Kansas on flowers of Amorpha fruticosa (Douglas County); in Maine on flowers of Solidago (South Portland); in Maryland on flowers of Penstemon birsutus (Catochin); in Nebraska on flowers of Astragalus (Badlands, mouth of Monroe Canyon, Pine Ridge), Erigeron philadelphicus(Ashland and Souch Bend), Medicago sativa (Norfolk), Melilotus (Omaha), Melilotus officinalis (Sowbelly Canyon, Sioux County), Mentha canadensis (Glenn), and Penstemon (Warbonnet Canyon, Sioux County); in New Hampshire on flowers of raspberry (Lancaster), Trifolium (Lancaster), and has been reared from sumac stems at Lancaster; in North Carolina on flowers of Craetegus (Raleigh), and Tephrosia virginiana
(Bryson City); in Texas on flowers of Lesquerella ( 10 miles north of Mason); and in Virginia on flowers of Tephrosia virginiana (Bancroft), Geranium maculatum (Difficult Run and Great Falls); Phacelia dubia (Great Falls), and Rubus argutus (Dawson's Beach and Ft. Humphreys). In addition, Michener ( $1947: 289$ ) has recorded it from Gilia.
H. producta interior has been taken in Colorado on flowers of Astragalus (Cuchara Camp), Monarda pectinata (White Rock), Helianthus petiolaris (Artesia), and Pbacelia (Eldora); and in Utah on flowers of Achillea millefolium and Phacelia linearis (Logan). A female specimen from Kyle Canyon, Charleston Mountains, Nevada, on Penstemon cannot be placed subspecifically with either interior or panamintana. No flower records are known to us for $H$. producta subgracilis. Those for the subspecies of $H$. producta which occur in California are enumerated on the following pages.

Key to the California Subspecies of Hoplitis producta

## Males

1. Eye as broad as genal area; penultimate antennal segment usually broader thán long; apical fringe of fifth sternum consisting of hairs about half as long as those of fourth
Eye broader than genal area seen from side; penultimate antennal segment often longer than broad; apical fringe of fifth metasomal sternum usually consisting of hairs at least threefourths as long as those of fourth .
gracilis (p. 62)
2(1). Median process of seventh metasomal tergum tapering, pointed . . . . bernardina (p. 65) Median process of seventh tergum with sides subparallel near apex, the latter rounded (pl. 16, fig. 49)
panamintana (p. 65)

## Females

1. Length 5 to 7 mm .; shallow emargination of clypeus rather narrow, usually less than half as broad as distance from lowermost point of clypeal margin to lateral angle of clypeus

Length 7 to 9 mm ; shallow emargination of clypeus broader, well over half as broad as distance from lowermost point of clypeal margin to lateral angle of clypeus.

Hoplitis producta gracilis (Michener)
(PI. 18, fig. 69)
Osmia gracilis Michener, 1935 , Pan-Pacific Ent., 11:183, 9 . Type 9 , Mill Valley, Marin County,

Calif. (Calif. Acad. Sci.).
Geographic range: California, Nevada, and Oregon (see map 25).
California records:
Alameda Co.: Berkeley, ठ', V-1 9-39 (C.I.S.);

ㅇ, IV-15-39 (J. W. MacSwain, C.I.S.). Livermore Mountains, ${ }^{\text {P, }}$ V-2-36 (E. S. Ross, C.A.S.). Oakland, + , V -1 936 (E. S. Ross, C.A.S.).

Alpine Co.: Carson, 우, IX-11-38 (M. A. Cazier, U.C.R.). Hope Valley, $\delta$ ', VII-9-48 (J. W. Mac Swain, C.I.S.); P, VII-1 8-48 (P. D. Hurd, Jr., C.I.S.); ${ }^{2}$, 9 , VII-18-48 (K. W. Tucker, C.I.S.).

Butte Co.: Yankee Hill, 2 ठ, V-12-49 (J. W. MacSwain, C.I.S., K.U.).

Calaveras Co.: Mokelumne Hill, $\mathrm{\sigma}^{\prime}$, April (F. E. Blaisdell, C.A.S.).

Contra Costa Co.: Antioch, 우, IV-4-39, flowers Pbacelia (G. E. Bohart, G.E.B.). Byron, $\mathrm{J}^{\prime}$, V-1820 (E. P. Van Duzee, K.U.). Mc. Diablo, ${ }^{\text {ot, }}$ IV-29-39 (M. A. Cazier, U.C.R.); 2 d, 2 ㅇ, IV-29-39 (J. w. MacSwain, C.I.S.); same locality, 1,500 ft., ㅇ, VI-14-33, flowers Lotus scoparius (P. H. Timberlake, U.C.R.). Rock City, Mt. Diablo, $\boldsymbol{\sigma}^{2}$, V-24-40 (E. G. Linsley, C.A.S.).

Eldorado Co.: Camino, 3 mi . S., ס', VI-26-48, flowers Phacelia (P. D. Hurd, Jr., C.I.S.). Echo Lake, ठ', VIIl-1 0-40 (D. E. Hardy, K.U.); 2 ㅇ, VII-13-51 (W. W. Middleka uff, C.I.S.); same locality, 7,400 ft., ㅇ, VI-26-52 (w. W. Middlekauff, C.I.S.). Fallen Leaf Lake, $\delta^{*}$, VII-1 931 (O. H. Swezey, U.C.R.). Kyburz, $\delta$, VII-1-50, flowers Penstemon spectabilis (C. D. Michener, K.U.); 2 ठ', VII-11-50 (W. F. Ehrhardt, C.I.S.). Placerville, $\delta$ ', V-4-37 (U.C.R.). Pollock Pines, $\delta$, IV-24-38 (A. T. McClay, U.C.D.); ठ, VI-24-38 (K.U.).

Fresno Co.: Coalinga, $\delta$, VI-8-41 (R. M. Bohart, U.C.D.). Huntington Lake, $\delta^{\top}$, VII-4-19, f, VII-12-19 (E. P. Van Duzee, C.A.S.).

Glenn Co.: Artois, 우, VI-3-53(J. W. MacSwain, C.I.S.).

Inyo Co.: Glacier Lodge, near Big Pine, 아, VI-20-37 (W. C. Reeves, U.C.R.). Lone Pine (Michener, 1947:286, K.U.); ㅇ, V-24-37 (U.C.R.); ㅇ, VI-9-37 (W. C. Reeves, U.C.R.); ㅇ, VI-16-37 (U.C.R.).

Lake Co.: Cobb Mountain, ठ, V-7-36 (R. M. Bohart, U.C.D.).

Lassen Co.: Bridge Creek Camp, 아, VII-9-49 (E. I. Schlinger, U.C.D.).

Los Angeles Co.: Altadena, ㅇ, V-18-35, flowers Lotus scoparius (C. D. Michener, K.U.); $\delta$, VI-7-35 (C. D. Michener, K.U.). Arroyo Seco, ㅇ, VI-25-40 (J. W. MacSwain, C.I.S.). Big Daltor Dam, 2 ㅇ, VI-25-50 (D. C. Blodger, U.C.D., U.C.L.A.). Camp Baldy, $2 \delta^{\circ}$, VI-26-50 (H. L. Hansen, C.I.S., K.U.). Griffith Park, $\delta^{\prime}$, IV-5-36, flowers Nemophila (E. G. Linsley, C.I.S.). La Crescenta, $\delta$, IV-1 9-36, flowers Eriodictyon (E. G. Linsley, C.I.S.). Puente Hills, + , V-1 0-26 flowers Pbacelia distans (P. H. Timberlake,
U.C.R.). Saugus, ${ }^{\prime}$, IV-13-34, flowers Cryptantha (R. M. Bohart, G.E.B.). Tanbark Flat, San Dimas Experimental Forest, ㅇ, VI-20-50, flowers Lotus (P. D. Hurd, Jr., C.I.S.); ㅇ, VI-20-50 (K. G. Whitesell, U.C.D.); 우, VI-23-50 (F. X. Williams, C.A.S.); $\hat{\delta}$, VI-25-50 (F. X. Williams, C.A.S.); 2 ㅇ, VII-5-52 (J. F. Powers, U.C.D., U.C.L.A.); 3 오, VII-6-52 (Joan Linsley, C.I.S.); 우, VII-8-52 (Joan Linsley, C.I.S.). Topanga Canyon, $2 \delta$, V -20-51 (U.C.D., U.C.L.A.).

Madera Co.: Bass Lake, ㅇ, V-7-38 (N. F. Hardman, C.I.S.); $\delta$, VI-6-38 (R. M. Bohart, G.E.B.).

Marin Co.: Mt. Tamalpais, + , V-28-21 (C. L. Fox, C.A.S.).

Mariposa Co.: Briceburg, ठ, VI-7-38 (N. F. Hardman, C.I.S.). El Portal, 5 ठ, V-1 8-38 (R. M. Bohart, G.E.B., U.C.D., U.C.L.A.); 5 б, V-23-38 (R. M. Bohart, G.E.B.); $\delta$, ㅇ, same data (C.I.S.); ठ, V-30-38 (R. M. Bohart, G.E.B.). Fish Camp, f, VI-10-42(E. G. Linsley, C.I.S.). Pohono Trail, Yosemite, उJ ${ }^{\circ}$, 우우, VI-26-26, flowers Collinsia torreyi (P. H. Timberlake, U.C.R.); 2 d, 2 ㅇ, VI-26-26, flowers Lupinus breweri (P. H. Timberlake, U.C.R.). Yosemite Valley Cur, $3 \delta$, 아, VI-24-26, flowers Collinsia tinctorum (P. H. Timberlake, U.C.R.); $\delta$, VI-24-26, flowers Lotus nevadensis (P. H. Timberlake, U.C.R.). Yosemite, 3,880-4,000 ft., ${ }^{2}$, V1-7-28 (E. O. Essig, C.I.S.); ठ, VI-8-37 (N. F. Hardman, C.I.S.); ס, V-31-38 (R. M. Bohart, G.E.B.); ${ }^{\gamma}$, VI-1 5-38, flowers Rubus leucodermis (R. M. Bohart, G.E.B.).

Modoc Co.: Davis Creek (Michener, 1947:286).
Mono Co.: Leevining Canyon, 7,500 ft., $\mathrm{P}, \mathrm{VI}-24-$ 37, flowers Salix (C. D. Michener, K.U.). Mammoth, ㅇ, VII-25-36 (G. E. and R. M. Bohart, G.E.B.). Mammoth Lakes, ㅇ, VII-14-33, ㅇ, VII-27-36, ㅇ, VIII-5-37 (G. E. and R. M. Bohart, G.E.B.). Sardine Creek, $8,500 \mathrm{ft}$., ㅇ, VII-11-51 (A. T. McClay, U.C.D.).

Monterey Co.: Bryson, $2 \delta^{\prime}, \mathrm{V}-18-20$ (E. P. Van Duzee, C.A.S.). Hastings Natural History Reservation, near Jamesburg, $\delta$, $\mathrm{V}-22-38$ (C. D. Michener, K.U.).

Napa Co.: Pope Valley, 8 mi. N., 2 ठ, V-15-51 (E. I. Schlinger, U.C.D.).

Nevada Co.: Blue Canyon, $\delta$, ㅇ, VI-15-51 (E. I. Schlinger, U.C.D.). Hobart Mills (near), IX-8-52 (R. M. Bohart, U.C.D.). Truckee, $\delta$, VI-17-27, 3 ठ, VI-20-27, $\delta^{\prime}$, VI-21-27, $\delta$, VII-5-27 (E. P. Van Duzee, C.A.S.).

Placer Co.: Brockway, 3 ठ', VII-1 941 (G. E. Bohart, G.E.B.). Donner Lake, ${ }^{\text {P, VIII-24-16 }}$ (L. Bruner, U.N.).

Plumas Co.: Bucks Lake, $\delta$, VI-23-49 (J. W. MacSwain, C.I.S.); $\delta, 4$ f, VII-1-49 (J. W. Mac

Swain，K．U．）；ס，VII－14－49（J．W．MacSwain， C．I．S．）．Keddie，Y，VI－26－49（C．I．Smith，C．I．S．）． Meadow Valley，6，000－7，000 ft．， 9, VI－19－24（E． C．Van Dyke，C．A．S．）．Quincy， 4 mi ．W．，$\%$ ，VI－ 21－49，flowers Phacelia（P．D．Hurd，Jr．，K．U．）； $4 \delta, 10$ f，VI－24－49（P．D．Hurd，Jr．，C．I．S．）．if， VI－25－49（P．D．Hurd，Jr．，K．U．）； 2 ס，same data （J．W．MacSwain，C．I．S．，K．U．）； 2 ㅇ，VI－26－49 （W．F．Ehrhardt，U．C．D．）； 50 ， 9 ，same data（P． D．Hurd，Jr．，C．I．S．，K．U．）；$P$ ，same data（J．W． MacSwain，C．I．S．）； 2 ㅇ，VI－30－49，flowers Phacelia （P．D．Hurd，Jr．，C．I．S．）；§＇，VII－2－49（P．D．Hurd， Jr．，C．I．S．）；$\delta^{\prime \prime}$ ，same data（J．W．MacSwain，C．I．S．）； 2 个，VII－16－49（P．D．Hurd，Jr．，C．I．S．，K．U．）．

Riverside Co．：Herkey Creek，San Jacinto Mountains（Michener，1947：286）．Keen Camp，San Jacinto Mountains，ㄱ，V－16－39，flowers Sidalcea （E．G．Linsley，C．I．S．）； $9, \mathrm{~V}-31-39$ ，flowers Penstemon（E．G．Linsley，C．I．S．）．Marion Moun－ tain Camp，San Jacinto Mountains， 6 9，VII－1－52 （J．W．MacSwain，C．I．S．）．Piñon Flat，Y，V－18－39 （C．I．S．）．Riverside， $9, \mathrm{~V}-15-33$ ，flowers Pbacelia distans（P．H．Timberlake，U．C．R．）；Y，V－18－41， nesting in rose twig（P．H．Timberlake，U．C．R．）． San Jacinto Mountain Trail，$\sigma$, ，, VII－1－52（J．W． MacSwain，C．I．S．）．The Gavilan，$\delta^{\prime}$ ，IV－8－37（E． G．Linsley，C．I．S．）；ㅇ，IV－18－37，flowers Astraga－ lus（E．G．Linsley，C．I．S．）．

San Bernardino Co．：Big Pine Camp，San Bernardino Mountains， 9, VII－2－34（I．McCracken， C．A．S．）．Crestline，$\delta$ ，V－23－36，flowers Lotus （E．G．Linsley，C．I．S．）；$\delta$ ， $9, \mathrm{~V}-23-36$ ，flowers Lotus davidsonii（P．H．Timberlake，U．C．R．）． Deep Creek，${ }^{\text {J̌，}}$ IV－26－36（E．G．Linsley，C．I．S．）． Mill Creek，San Bernardino Mountains，4，800 ft．， $\sigma$ ，V－13－40，flowers Pbacelia davidsonii（P．H． Timberlake，U．C．R．）；$\delta$ ， 9 ，V－13－40，flowers Gilia exilis（P．H．Timberlake，U．C．R．）．San Bernardino Forest（5205203x）， $2 \sigma^{\circ}$ ，（U．C．D．， U．C．L．A．）．

San Diego Co．：Campo，$\delta$＇，IV－28－39（R．M． Bohart，U．C．D．）．

San Francisco Co．：San Francisco（sand dunes）， $\begin{gathered}\text { T，} \\ \text { V－2－28（C．L．Fox，C．A．S．）．}\end{gathered}$

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

San Mateo Co．：Corte Madera Creek，${ }^{\circ}$, IV－30－ 16 （R．Stinchfield，L．S．，Jr．，U．）．

Santa Clara Co．：Alum Rock Park， $4 \delta$ ，IV－21－ 51 （J．W．MacSwain，C．I．S．）．San Antonio Ranger Station， 7 mi ．S．， 9 ，VI－27－53（C．D．MacNeill， C．I．S．）．

Shasta Co．：Burney， 5 mi ．E．，$\delta$ ，VI－9－41 （C．I．S．）．Hat Creek，Lassen National Park， $\mathcal{P}$ ， VI－4－41，flowers Castilleia（C．D．Michener，

C．I．S．）； 2 Y，VI－4－41，flowers Penstemon（C．D． Michener，C．I．S．）．Summit Lake，Mt．Lassen， $6,700 \mathrm{ft}$ ．VI－21 and 22－37．（F．X．Williams，U．C．R．）．

Sierra Co．：Gold Lake，$\sigma^{\prime}$ ，VII－14－21， 9 ，VII－ 17－21，$\delta$, ㅇ，VII－21－21，$\delta$ ，VII－22－21（C．L．Fox， C．A．S．）；Y，VII－13－34，${ }^{\text {Y，VI－20－34（L．S．Rose，}}$ C．A．S．）．Weber Lake，${ }^{\prime}$ ，VII－21－51（E．I．Schlinger， U．C．D．）．

Siskiyou Co．：Shasta Springs， $2 \sigma^{\circ}$ ，VI－8－20 （C．L．Fox，C．A．S．）．

Solano Co．：Green Valley，$\delta^{\prime}$ ，VI－9－33，flowers Clarkia elegans（P．H．Timberlake，U．C．R．）．

Stanislaus Co．：Adobe Creek，ơ，V－6－48， flowers Pbacelia（R．F．Smith，C．I．S．）．

Trinity Co．：Carrville， $2,400-2,500 \mathrm{ft} ., \delta$, V－17－34（G．E．B．）；Y，VI－20－31（E．C．Van Dyke， C．A．S．）．Scott Mountain，5，358 ft．，\＆，VII－1 4－49 （A．T．McClay，U．C．D．）．Trinity River Camp，${ }^{\text {ơ，}}$ VI－3－51（A．T．McClay，U．C．D．）．

Tulare Co．：California Hot Springs， 2 ，VI－ 2－39（E．C．Van Dyke，C．A．S．）．Coffee Camp， 3 9，VI－8－25，flowers Trifolium variegatum（P．H． Timberlake，U．C．R．）； 3 ㅇ，VI－25－29，flowers Sidalcea calycosa（P．H．Timberlake，U．C．R．）． General Grant National Park， 5 J＇，VI－27－29， flowers Gayophytum diffusum（P．H．Timberlake， U．C．R．）； ，VI－27－29，flowers Calyptridium um－ bellatum（P．H．Timberlake，U．C．R．）； $3 \delta$, VI－28－29，flowers Potentilla glandulosa（P．H． Timberlake，U．C．R．）．Giant Forest，${ }^{\prime}$ ，VII－22－23 （C．L．Fox，C．A．S．）．Potwisha，Sequoia National Park，2，000－5，000 ft．，P，V－17－20（E．C．Van Dyke，C．A．S．）；$\delta, ~ V-18-20$（E．C．Van Dyke， C．A．S．）．

Tuolumne Co．：Dorst Camp，ㅇ，VII－23－49（L． L．Jensen，C．I．S．）．Mather（near），$\delta$, VII－9－29 （E．C．Zimmerman，C．A．S．）．Pinecrest， 9 ，VII－ 12－53（J．G．Rozen，C．I．S．）．Strawberry，${ }^{\prime}$ ，VI－ 18－51（J．W．MacSwain，C．I．S．）；才，$\uparrow$ ，VI－1 9－51 （J．W．MacSwain，C．I．S．）； $2 \delta$, VI－21－51（E．G． Linsley and J．W．MacSwain，C．I．S．，K．U．）；+ VI－22－51（E．G．Linsley and J．W．MacSwain， C．I．S．）；$\widehat{\delta}$ ，same data（A．T．McClay，U．C．D．）； $2 \delta$ ，same data（J．W．MacSwain，C．I．S．）；+ ，same data（E．L．Silver，U．C．D．）；P，VII－14－51（J．W． MacSwain，C．I．S．）； 2 \＆，VII－15－51（J．W．Mac Swain，C．I．S．）；$\delta^{\prime}$ ，VII－5－53（J．G．Rozen，C．I．S．）； む，VII－14－53（J．G．Rozen，C．I．S．）； 6 §＇，VII－1 5－53， flowers Mimulus（J．G．Rozen，C．I．S．）．Tuolumne City，${ }^{\text {o，}}$ VI－8－53， 9, VI－22－53（J．G．Rozen，C．I．S．）．

Ventura Co．：$\delta^{\prime}$, V－8－40（R．M．Bohart，U．C．D．）． Discussion：

This common small bee is widespread in cismontane California and in areas of mesic
conditions on the eastern slopes of the Sierra Nevada. In Nevada it has been collected only at Kingsburg Grade, Douglas County. Two males taken on the flowers of Phacelia linearis at Logan, Utah, represent the sole record for that state. Whether they are mere variants of the interior population there or indicate that gracilis extends across the northern Great Basin is not clear.
H. producta gracilis has been collected as far north as Corvallis, Oregon, where it begins to approach the subspecies subgracilis in its characters.

In addition to the floral visitations listed on the preceding pages, gracilis has been also recorded visiting flowers of Astragalus bolanderi, Glycyrrbiza lepidota, and Vicia americana (Michener, 1947:286).

## Hoplitis producta bernardina Michener

Hoplitis producta bernardina Michener, 1947, Bull. Amer. Mus. Nat. Hist., 89:287, $\bar{\delta}$, ${ }^{\circ}$. Type $\bar{\delta}$, Mill Creek, San Bernardino Mountains, California, 4,800 ft., on Gilia exilis (Timberlake Collection, U.C.R.).
Geographic range: California (see map 25).
California records:
Los Angeles Co.: Alpine Inn, Mt. Lowe, San Gabriel Mountains, $5,000 \mathrm{ft}$. (Michener, 1947: 287). Arroyo Seco, , VI-25-40, flowers Dicentra (J. W. MarSwa in, C.I.S.). Crystal Lake, P, VI-29-50 (T. R. Haig, C.I.S.). Lone Pine Canyon, San Gabriel Mountains, 4,500 ft., 3 ¢, VI-16-38, flowers Penstemon spectabilis; + , VII-4-33, flowers $P$. spectabilis (Michener, 1947:287, U.C.R.). Puente Hills, ㅇ, V-11-30 (Michener, 1947:287). Tanbark Flat, San Dimas Experimental Forest, 5 P, VI-20-50, flowers Lotus and Penstemon (P. D. Hurd, Jr., C.I.S., K.U.); 오, VI-2050 (J. W. MacSwa in, C.I.S.); O, VI-22-50 (P. D. Hurd, Jr., C.I.S.); 9, VI-30-50, flowers Helianthus (P. D. Hurd, Jr., C.I.S., K.U.); 2 f, VI-30-50 (A. T. McClay, U.C.D.); Y, VII-2-50, flowers Lotus (P. D. Hurd, Jr., C.I.S., K.U.); 9, VII-2-50 (A. T. McClay, U.C.D.); 2 \&, VII-7-50 (H. F. Robinson, U.C.D.); ㅇ, VII-7-52 (A. T. McClay, U.C.D.); ㅇ, VII-8-52 (A. T. McClay, U.C.D.).

Riverside Co.: Keen Camp, ㅇ, V-17-39 (E. S. Ross, C.I.S.); , V, VII-11-39, flowers Eriogonum (R. F. Smith, C.I.S.); ㅇ, VI-9-39, flowers Penstemon (C.I.S.). Keen Camp, 7 mi . W., P , V-1 7-39, flowers Eriogonum (Michener, 1947:287). Idyllwild, 아, flowers Astragalus parishii (Michener,

1947:287); ㅇ, VI-9-40, flowers Penstemon (C. D. Michener, C.I.S.). Murrieta, 1 mi . N., (E. G. Linsley, C.I.S.). Piñon Flat, San Jacinto Mountains, + , V-18-39 (E. G. Linsley, C.I.S.); ㅇ, V-18-39, flowers Penstemon (E. S. Ross, C.I.S.); 9 , VI-18-41 (Michener, 1947:287, C.A.S.). Ribbonwood, 9, V-21-40 (C. D. Michener, C.I.S.). Riverside, \&, IV-8-36 (E. G. Linsley, C.I.S.). San Jacinto River, 4,000 ft., $\delta$, $O$, V. $30-46$, flowers Penstemon (C. D. Michener, C.I.S.).

San Bernardino Co.: Cajon Pass, 9 , VII-2-34, flowers white Phacelia (Michener, 1947:287). Forest Home, 9 , VI-1 8-28 (Michener, 1947:287, C.A.S.). Mill Creek, San Bernardino Mountains, 4,400 ft., V-30-38, flowers Mimulus fremontii (Michener, 1947:287); same locality, 4,800 ft., 2 ठ, 9 , V-13-40, flowers Gilia exilis (Michener, 1947:287, U.C.R.); same locality, $6,000 \mathrm{ft}$., V-26-38, flowers Penstemon grinnellii (Michener, 1947:287); same locality, $\delta$, VI-29-42 (R. M. Bohart, G.E.B.). Mountain Canyon Creek, $\bar{\delta}$, IV-25-36 (E. G. Linsley, C.I.S.). Mounta in Home Creek, San Bernardino Mountains, 우, VI-4-35, flowers Penstemon cordifolius (Michener, 1947: 287).

San Diego Co.: Buckman Springs (near), $2 \delta^{\circ}$, V-7-53, flowers Penstemon (F. X. Williams, C.A.S.). Campo, ㅇ, IV-27-39 (R. M. Bohart, U.C.D.).

Tulare Co.: Springville, 3.7 mi N.E., ${ }^{\text {P, }}$, IV-30-47, flowers Eriodictyon californicum (P. H. Timberlake, U.C.R.).
Discussion:
This subspecies, which is usually conspicuously larger than gracilis, occurs with gracilis in the southern California mountains.

## Hoplitis producta panamintana Michener

(Pl. 16, fig. 49)
Hoplitis producta panamintana Michener, 1947, Bull. Amer. Mus. Nat. Hist., 89:287, ${ }^{2}$. Type $\delta^{2}$, Tuber Canyon, Panamint Mountains, Inyo County, California, $8,000 \mathrm{ft}$. (Amer. Mus. Nat. Hist.).
Geographic range: California (see map 25).
California records:
Inyo Co.: Tuber Canyon, Panamint Mountains, 8,000 ft., $\delta$, VI-18-37 (Michener, 1947:287, U.C.R.). Wild Rose Canyon, Panamint Mountains, 7,000 ft., が, V-27-37, flowers Phacelia (Michener, 1947:287).
Discussion:
This subspecies, known only in the male, is


Map 26. Distribution of Hoplitis colei (Crawford).


Map 27. Distribution of Hoplitis elongaticeps Michener.
approximately the size of bernardina. It is known only from the semidesert ranges of eastern California.

A female not distinguishable from interior or bernardina, from the summit of Westgard Pass, Inyo County, California, June 15, 1937 (C. D. Michener), has been tentatively associated with panamintana (Michener, 1947:288).

## Hoplitis colei (Crawford)

Alcidamea colei Crawford, 1916 , Proc. Ent. Soc. Wash., $18: 127, \delta$.'. Type $\delta$, Redlands, California (U.S. Nat. Mus.).

Geographic range: California, Nevada (see map 26).

California records:
Contra Costa Co.: Mt. Diablo, 2 б, , (P. D. Hurd, Jr., C.I.S.).

Fresno Co.: Coalinga Pass, ㅇ, VI-8-41 (R. M. Bohart, U.C.D.).

Los Angeles Co.: Altadena, $\mathrm{O}, \mathrm{V}-5-34$ (Michener, 1947:289, K.U.); 9 , VI-28-35, flowers Hugelia virgata (P. H. Timberlake, U.C.R.). Camp Baldy, ठ', VI-26-50 (P. D. Hurd, Jr., C.I.S.); \&, VII-7-52 (R. L. Anderson, U.C.D.). La Crescenta, $P$, V-8-34 (C. D. Michener, K.U.). Lone Pine Canyon, San Gabriel Mountains, 9, VII-4-33, flowers Eriodictyon trichocalyx (P. H. Timberlake, U.C.R.). Tanbark Flat, San Dimas Experimental Forest, $O$, VI-27-50 (F. X. Williams, C.A.S.); $9, \mathrm{VII}-7-52$ (A. T. McClay, U.C.D.). Mariposa Co.: Indian Flat, ㅇ, V-23-38 (R. M. Bohart, G.E.B.).

Monterey Co.: Hastings Natural History Reservation, near Jamesburg, $\delta$ ', VI-1-38 (C. D. Michener, K.U.).

Riverside Co.: Andreas Canyon, Palm Springs, \%, IV-24-32, flowers Eriodictyon trichocalyx (Michener, 1947:289, U.C.R.); ס', 2 ㅇ, IV-11-36, flowers Eriodictyon trichocalyx (Michener, 1947: 289, U.C.R.); F. IV-21-51 (R. C. Bechtel, U.C.D.). $^{\text {I }}$ Palm Canyon, O', IV-14-38 (G. E. and R. M. Bohart, G.E.B.). Soboba Hot Springs, 2 q, V-16-41 (Michener, 1947:289, C.A.S.). Tahquitz Canyon, San Jacinto Mountains, $\bar{\delta}$, IV-16-38, flowers Lotus (G. E. Bohart, G.E.B.).

San Bernardino Co.: Lytle Creek, San Gabriel Mountains, 9, V-6-28 (E. C. Van Dyke, C.A.S.); VII-4-33 (Michener, 1947:289). Mountain Home, San Bernardino Mountains, 2 ㅇ, VI-17-34, flowers Eriodictyon trichocalyx (Michener, 1947:289, U.C.R.). Snowcrest Camp, San Bernardino Mountains, ${ }^{\text {P, VII-7-52 (A. T. McClay, U.C.D.). }}$

Twentynine Palms, 7.5 mi . S., $\mathcal{Y}, \mathrm{V}-7-48$, flowers Nama demissum (P. H. Timberlake, U.C.R.).

Shasta Co.: Delta, 10 mi. S., $9, \mathrm{~V}-29-52$ (J. G. Rozen, C.I.S.).

Tulare Co.: Ash Mountain River, Sequoia National Park, 9 , IV-27-50(R. C. Bechtel, U.C.D.).

Yolo Co.: Putah Canyon, 3 Y, V-21-50 (R. C. Bechtel, U.C.D.).
Discussion:
This species is similar to $H$. producta gracilis but differs in the longer proboscis, the galeae being as long as the head and the second segment of each labial palpus being more than twice as long as the first. It is also smaller than any form of gracilis, and the male has the projection of the second metasomal sternum smaller but acute when seen in profile. The female lacks the weak clypeal emargination characteristic of gracilis or has the emargination weaker than usual in that form.

Female specimens from central California usually have the head slightly longer than broad, unlike those from southern California, and sometimes have a feeble median clypeal emargination, unlike those from southern California. The number of specimens now a vailable is small; if these differences are consistent when large series have been collected, the northern form may warrant a subspecific name.

The range broadly overlaps that of $H$. producta gracilis, from which colei may well be derived. The long mouth parts are perhaps an adaptation to the flowers of Eriodictyon; Cbelostoma cockerelli, the form of that genus which visits Eriodictyon flowers, also has long mouth parts. The significance of this is not obvious, however, for these bees crawl into the flowers instead of reaching into them with their long proboscides.
H. colei has been taken in Nevada only at Kyle Canyon, Charleston Mountains, 7,500 ft., July 25, 1942.

## Hoplitis elongaticeps Michener

Hoplitis (Alcidamea) elongaticeps Michener, 1947, Bull. Amer. Mus. Nat. Hist., 89:290, 9 , $\sigma^{\prime}$. Type 9,4 miles west of Lone Pine, Inyo County, California (Amer. Mus. Nat. Hist.). Geographic range: California (see map 27).

## California records:

Inyo Co.: Lone Pine, 4 mi . W., ㅇ, V-19-37 (Michener, 1947:290, K.U.). Mazourka Canyon, Inyo Mountains, ㅇ, V-25-37, flowers Dalea fremontii (Michener, 1947:290). Westgard Pass, 7


Map 28. Distribution of Hoplitis uvulalis (Cockerell).
mi. W., Y, VI-26-53, flowers Dalea (J. W. Mac Swain, C.I.S.).

Los Angeles Co.: Mojave Desert, Highway 128, 3,500 ft., $\delta$, V-13-44, flowers Mimulus (Michener, 1947:290, U.C.R.).

San Bernardino Co.: Adelanto, $10 \mathrm{mi} . \mathrm{S}_{\mathrm{S}},{ }^{\circ}$, V-3-39 (Michener, 1947:290, U.C.R.).
Discussion:
Like $H$. colei, this species is similar to $H$. producta gracilis. It is probably a xeric derivative of that form, and is the only strictly desert species of Alcidamea. H. elongaticeps is smaller than any form of producta and differs from that species by having the head of both sexes, but particularly the female, longer than broad. As in H. colei, the projection of the second metasomal sternum of the male is small, although acute in profile

## Hoplitis uvulalis (Cockerell)

Alcidamea uvulalis Cockerell, 1902, Bull. So. Calif. Acad. Sci., 1:139, $\sigma^{*}$. Type $\sigma^{\prime \prime}$, supposedly from Lancaster, Mojave Desert, California (U.S. Nat. Mus.).
Geographic range: California, Idaho, Oregon, and Utah (see map 28).
California records:
Alpine Co.: Sonora Pass, VI-21-37 (Michener, 1947:290); ㅇ, VI-21-37 (U.C.R.).

Fresno Co.: Huntington Lake, 7,000 ft., VII-19-19 (Michener, 1947:290); ㅇ, VII-7-19 (E. P. Van Duzee, U.C.R.). Wood Creek, 8,000 ft., + VI-22-10 (Michener, 1947:290, C.A.S.).

Inyo Co.: Alabama Hills, ס̃, V-24-37 (G. E. Bohart, G.E.B.). Big Pine Creek, $7,500 \mathrm{ft} .$, , VI-27-42, emerged from Sambucus twigs (R. M. Bohart, G.E.B.); same locality, 9,500 ft., $\delta$, VI-22-42 (R. M. Bohart, G.E.B.). Bishop Creek (north fork), 8,500 ft., VI-22-37 (Michener, 1947 : 290).

Modoc Co.: Davis Creek, ${ }^{\text {P, VII-13-22 (C. L. }}$ Fox, C.A.S.).

Mono Co.: Leavitt Meadows, $\delta$ ', VI-26-37 (G. E. and R. M. Bohart, G.E.B.); P, VI-26-37 (Michener, 1947:290). Walker Lake, VII-23-1 5 (Michener, $1947: 290$ ). West Walker River, $7,200 \mathrm{ft} ., \delta$, ${ }^{\text {, }}$, VI-25-37 (Michener, 1947:290, K.U.).

Nevada Co.: Truckee, $\delta$, VI-14-27 (E. P. Van Duzee, K.U.); 2 ㅇ, VI-21-27 (E. P. Van Duzee, K.U., C.A.S.); $\mathbf{\sigma}^{2}$, VII-4-27 (Michener, 1947:290, C.A.S.).

Placer Co.: Brockway, $\delta^{\prime}$, VII-1 941 (G. E.

Bohart, G.E.B.). Fallen Leaf Lake, ठ', VI-23-15 (E. C. Van Dyke, C.A.S.).

Plumas Co.: Meadow Valley, 3,500-5,000 ft., VI-1 6-24 (Michener, 1947:290, C.A.S.).

Shasta Co.: Hat Creek, $\delta$, VI-1- 41 (P. D. Hurd, Jr., C.I.S.); 3 ठ, VI-4-41, flowers Castilleia (C. D. Michener, C.I.S.).

Sierra Co.: Gold Lake, 2 б, VII-1 2 and 19-21 (Michener, $1947: 290$, C.A.S.).

Tulare Co.: Mineralking, $\delta, 2$ ㅇ, VII-1 0-39, emerged from Sambucus twigs (G. E. Bohart, C.I.S.); same locality, $8,000 \mathrm{ft} ., \mathrm{J}^{\prime}, \mathrm{VII}-7-42$ (R. M. Bohart, G.E.B.).

Tuolumne Co.: Tioga Pass, J', VII-3-33 (G. E. Bohart, G.E.B.).
Discussion:
This species is almost certainly a derivative of the Rocky Mountain stock of H. producta. It is larger than any producta forms ( 9 to 11.5 mm .); ocher differences from the subspecies interior and bernardina are of a very minor nature. It occurs in the mountains surrounding the Great Basin, from California to Utah (American Fork Canyon, Logan, and Mt. Timpanogos), Idaho (Willow Flat, $6,000 \mathrm{ft} .$, Franklin County), and Oregon (Wallowa and Queen Mine, Cornucopia). Thus it overlaps the ranges of three subspecies of producta (gracilis, subgracilis, and interior) without intergrading with them. It has been collected at the same localities, and on the same dates, as specimens of two of these subspecies. It is primarily a high montane form although the type locality, if correct, is in the desert, and the Alabama Hills in Inyo County are desert.

## Hoplitis grinnelli (Cockerell)

(Pl. 15, fig. 37)
Alcidamea grinnelli Cockerell, 1910, Ann. Mag. Nat. Hist., (8) 5:22, 9.
Hoplitis grinnelli Michener, 1947, Bull. Amer. Mus. Nat. Hist., 89:291, $\delta$,
Geographic range: Arizona, British Columbia, California, Idaho, Mexico, Nevada, Oregon, Utah, Washington (see map 29).
Discussion:
This species is superficially very similar to producta, but is clearly differentiated by the characters given in the keys. It occurs with various subspecies of producta throughout the Pacific coast region. It is represented by two subspecies.


Map 29. Distribution of Hoplitis grinnelli (Cockerell), the subspecies grinnelli indicated by open circles, the subspecies septentrionalis by solid circles.

Key to the Subspecies of Hoplitis grinnelli

1. Tegulae pale testaceous . . . . . . . . . . . . . . . . . grinnelli (p. 71)

Tegulae dark testaceous to blackish . . . . . . . . . . . septentrionalis (p. 72)

## Hoplitis grinnelli grinnelli (Cockerell)

Alcidamea grinnelli Cockerell, 1910, Ann. Mag. Nat. Hist., (8) 5:22, ㅇ. Type 9 , San Gabriel Mountains near Pasadena, California (U.S. Nat. Mus.).
Geographic range: Mexico (Sonora and Lower California), Arizona, California, and Nevada (see map 29).
California records:
Alameda Co.: Alameda Foothills, $O_{\text {(W }}$. M. Giffard, C.A.S.). Tesla, ${ }^{\text {ö, IV }}$ IV-27-50(J. E. Gillaspy, C.I.S.).

Butte Co.: Yankee Hill, $\mathrm{\delta}^{\prime}, \mathrm{V}-12-49$ (P. D. Hurd, Jr., C.I.S.).

Contra Costa Co.: Mt. Diablo, $\bar{\delta}$, IV-26-37 (Michener, 1947:291, K.U.).

Fresno Co.: Coalinga, ㅇ, IV-26-50 (R. M. Bohart, U.C.D.).

Inyo Co.: Owens Lake (Michener, 1947:291). Westgard Pass, (Michener, 1947:291). Surprise Canyon, Panamint Mountains, $\delta^{2}$, IV-29-53, flowers Cryptantha racemosa (P. D. Hurd, Jr., C.I.S.); $\delta^{\text {on, }}$ same data (G. A. Marsh, C.I.S.); flowers Eucnide urens (P.H. Timberlake, U.C.R.). Kern Co.: Bakersfield, , IV-1-37 (U.C.D.). Los Angeles Co.: Altadena, 2 J, IV-19-35 (C. D. Michener, U.C.D. U.C.L.A.); + , VI-1-35 (C. D. Michener, K.U.); , VI-28-35 (C. D. Michener, K.U.); 3 O, VI-28-35, flowers Hugelia virgata (P. H. Timberlake, U.C.R.); $2 \delta^{\prime}, 3$ ㅇ, V-2-36, flowers Lotus scoparius (C. D. Michener, K.U.); ㅇ, V-23-36, flowers Lotus scoparius (C. D. Michener, K.U.); , VI-24-36 (C. D. Michener, K.U.); 2 ㅇ, VII-3-36 (C. D. Michener, K.U.). Claremont, $4 \delta$, V-4-45, flowers Cryptantba intermedia (P. H. Timberlake, U.C.R.). Eagle Rock, d', IV-7-36, flowers Salvia mellifera (C. D. Michener, K.U.); đ, V-4-36, flowers Cryptantha (C. D. Michener, K.U.); ${ }^{6}$, V-8-36 (C. D. Michener, K.U.); 4 ठ, 3 ㅇ, V-9-36, flowers Cryptantba (C. D. Michener, K.U.); 3 P, IV-9-36, flowers Cryptantha (C. D. Michener, K.U.). Littlerock, ㅇ, IV-1036 (G.E.B.). Newhall, 2 o, ㅇ, IV-20-40 (R. M. Bohart, G.E.B.). Pasadena, ${ }^{\circ}$ ', III-8-28 (C. H. Hicks, U.C.R.). Puente Hills, ㅇ, V-10-26, flowers Lotus glaber (P. H. Timberlake, U.C.R.); 2 ㅇ, V-11-30, flowers Chorizanthe staticoides and

Lotus glaber (P. H. Timberlake, U.C.R.). Tanbark Flat, San Dimas Experimental Forest, 2 ㅇ, VI-20-50, flowers Lotus (P. D. Hurd, Jr., C.I.S., K.U.); , , VI-24-50 (P. D. Hurd, Jr., K.U.); $^{( }$, VI-25-50 (P. D. Hurd, Jr., C.I.S.); ${ }^{\text {ond }}$, same data (J. W. MacSwain, C.I.S.); $\delta$, same data (H. F. Robinson, U.C.D.); ㅇ, VI-24-50 (P. D. Hurd, Jr., K.U.); ㅇ, VII-3-50 (P. D. Hurd, Jr., C.I.S.); VII-30-S0 (R. O. Schuster, C.I.S.); ${ }^{\text {P, VII-11-52 }}$ (A. T. McClay, U.C.D.); ㅇ, VII-19-52 (A. T. McClay, U.C.D.).

Madera Co.: San Joaquin Experimental Range near O'Neals, ㅇ, IV-18-53, flowers Phacelia platyloba (P. D. Hurd, Jr., C.I.S.).

Mariposa Co.: Yosemite Valley Cut, $\delta$, VI-2626, flowers Collinsia torreyi (P. H. Timberlake, U.C.R.).

Mono Co.: Mammoth Lakes, $\delta$, , 9, VII- 25 and 27-36 (G. E. and R. M. Bohart, U.C.D.).

Monterey Co.: Hastings Natural History Reservation, near Jamesburg, $\delta$, VI-1-38, flowers Eriogonum (C. D. Michener, K.U.), $\delta$, same data (C. D. Michener, K.U.).

Riverside Co.: Hemet (near), ㅇ, VI-7-42, flowers Lotus scoparius (P. H. Timberlake, U.C.R.). Keen Camp, San Jacinto Mountains, 우, V-17-39 (T. E. Lanningham). Murrieta, 1 mi . N., ㅇ, IV-18-50 (E. G. Linsley, C.I.S.); $\delta$, ㅇ, same data (J. W. MacSwain, C.I.S.). Palm Canyon, $\delta$, IV-14-38 (G. E. and R. M. Bohart, G.E.B.); ㅇ, IV-15-38 (G.E.B.). Perris 1.5 mi . W., $\mathrm{\delta}^{2}$, IV-27-38, flowers Lotus scoparius (P. H. Timberlake, U.C.R.). ${ }^{\prime}$,, \&, V-29-46, flowers Cryptantha inter media (P. H. Timberlake, U.C.R.). Piñon Flat, San Jacinto Mountains, $\mathcal{P}$, VI-4-39, flowers Lupinus concinnus (P. H. Timberlake, U.C.R.). Riverside, ㅇ, IV-18-25, flowers Lotus strigosus; 3 ㅇ, v-22-25, flowers Lotus glaber, 아, V-26-25, flowers Lotus scoparius; ㅇ, III-29-26, flowers Lotus glaber, ㅇ, V-16-29, flowers Melilotus indica; IV-7-32, flowers Lotus scoparius, $\delta$, , flowers Cryptantha intermedia; + , IV-18-34, flowers Phacelia ramosissima; + , IV-19-34, flowers Marrubium vulgare; 3 ㅇ, IV-26-34, flowers Cryptantha intermedia and Lotus scoparius; $\delta$, ㅇ, IV-27-34, flowers Lotus glaber and L. scoparius, + , V-2-34, flowers Lotus scoparius; 아,

V-3-34, flowers Cryptantba intermedia; ㅇ, V-935, flowers Lotus scoparius, ${ }^{\text {on }}$, V-8-35, flowers Cryptantha intermedia; ㅇ, V-7-35, flowers Lotus scoparius; + , V-17-35, flowers Lotus scoparius; 3 ㅇ, V-21-35, flowers Lotus scoparius; 2 d, IV-20-37, flowers Lotus scoparius, $\delta$, IV-15-39, flowers Cryptantba intermedia; $\sigma^{\prime}$, IV-11-40, flowers Lotus scoparius; 9 , IV-11-46, flowers Phacelia distans; $\delta, 2$ ㅇ, IV-11-51, flowers Lotus scoparius (all collected by P. H. Timberlake, U.C.R.). These Riverside records represent a random selection of a great many specimens. San Jacinto River, 3,000 ft., ㅇ, V-30-40 (C. D. Michener, C.I.S.). Temecula, $\delta$, IV-11-50 (P. D. Hurd, Jr., K.U.); 2 ㅇ, IV-18-50, flowers Lotus (E. G. Linsley, K.U.). Temecula, 6 mi. E., 아, V-9-36, flowers Lotus scoparius (P. H. Timberlake, U.C.R.). Temecula, 10 mi. S.E., $\delta^{\hat{\prime}}, 5$ f, IV-18-50, flowers Lotus (E. G. Linsley, C.I.S.). The Gavilan, $\delta$, IV-16-39, flowers Cryptantha intermedia (P. H. Timberlake, U.C.R.); $\delta$,, IV-20-39, flowers Lotus scoparius (P. H. Timberlake, U.C.R.) $\delta^{\prime \prime}$, IV-1 0-46, flowers Cryptantha intermedia (P. H. Timberlake, U.C.R.); 2 б', IV-16-50, flowers Lotus scoparius (P.H. Timberlake, U.C.R.), ㅇ, V-12-50, flowers Eriogonum fasciculatum (P. H. Timberlake, U.C.R.).

San Bernardino Co.: Cajon, 2 d, IV-13-36 (G.E.B.). Cajon Pass, ㅇ, VI-11-41 (E. C. Van Dyke, C.A.S.). Deep Creek, + , V-16-37, flowers Lotus scoparius (P. H. Timberlake, U.C.R.). Glen Ivy (trail above), 2 ㅇ, V-13-28, flowers Lotus scoparius (P. H. Timberlake, U.C.R.). Kramer Hills, ㅇ, V-3-39 (Michener, 1947:291, U.C.R.). Kramer Jct., P, V-1-53 (P. D. Hurd, Jr., C.I.S.). Mill Creek, San Bernardino Mountains, 4,500 ft., $\mathrm{\delta}^{2}$, V-30-38, flowers Cryptantha intermedia (P. H. Timberlake, U.C.R.); same locality, 4,800 ft., 3 ㅇ, V-13-40, flowers Lotus strigosus (P. H. Timberlake, U.C.R.). Morongo Valley, ㅇ, IV-19-37, flowers Pbacelia distans (Michener, 1947:291, U.C.R.); + , V-23-41 (E. C. Van Dyke, C.A.S.). Redlands, $\delta, 2$ ㅇ, V-15-36, flowers Cryptantha (C. D. Michener, K.U.). San Bernardino Mountains, $3,900 \mathrm{ft}$., $\mathrm{P}, \mathrm{v}-15-37$, flowers Ceanothus (E. G. Linsley, C.I.S.). Seven Oaks, San Bernardino Mountains, $\delta$, VI-14-50, flowers Cryptantha intermedia (P. H. Timberlake, U.C.R.). Verdemont, ठ', V-17-46, 2 ठ', V-1-46 (P. H. Timberlake, U.C.R.). Victorville, 3.5 mi . S.W., P , V-12-39, flowers Astragalus fremontii (P. H. Timberlake, U.C.R.). Vidal Jct., $7 \mathrm{mi} . \mathrm{N} ., \delta, \mathrm{IV}-3-51$ (P. D. Hurd, Jr., C.I.S.).

San Diego Co.: Dulzura (Michener, 1947:291).
San Mateo Co.: San Mateo, $\delta^{\prime}$, VI-20-35 (G. E. Bohart, G.E.B.).

Santa Clara Co.: Alum Rock Park, $\delta$, IV-21-51 (P. D. Hurd, Jr., C.I.S.).

Trinity Co.: Carrville, $2,400-2,500 \mathrm{ft} ., \delta, \mathrm{V}$ -22-34 (G. E. and R. M. Bohart, U.C.D.); O, VI1934 (G. E. Bohart, G.E.B.).

Tulare Co.: Badger, ס, VI-26-29, flowers dwarf red Mimulus (P. H. Timberlake, U.C.R.). Coffee Camp, ㅇ, VI-8-25, flowers Lotus glaber (P. H. Timberlake, U.C.R.); $\delta^{\prime}$, VI-11-25 (P. H. Timberlake, U.C.R.).
Discussion:
This subspecies of grinnelli extends well into the desert of southern California but is rare there. It is abundant in cismontane California, and there are records for the eastern slope of the Sierra Nevada and a single record for the Panamint Mountains.

It has been collected at flowers of Sphaeralcea ambigua in Nevada (Las Vegas, 22 miles south), and at flowers of Prosopis in Lower California (El Mayor). Michener (1947:291) has listed the following floral records which are in addition to those given in the foregoing account; Larrea glutinosa, Rhamnus crocea, Dalea fremontii and Trifolium.

It is superficially, but readily, distinguished from H. producta by the pale testaceous tegulae, so that it is not ordinarily necessary to use the more difficult specific characters to separate California grinnelli from producta.
P. H. Timberlake has reared a female from a pupa collected in a weed stem at Riverside, California, on July 17, 1929. The bee emerged the following spring. The cocoon case is translucent white, somewhat papery, with a hard packed brownish substance at its base.

## Hoplitis grinnelli septentrionalis Michener

Hoplitis grinnelli septentrionalis Michener, 1947, Bull. Amer. Mus. Nat. Hist., 89:291, ${ }^{2}$, 우. Type ${ }^{\prime}$ ', Salmon Arm, British Columbia (Canadian National Collection).
Geographic range: British Columbia, Idaho, Oregon, Utah, and Washington (see map 29).
Discussion:
This subspecies has been found at Klamath Lake, Oregon, and it seems very likely that it enters northern California at least in appropriate ecological situations and perhaps over broad areas. As its tegulae are the same color as those of $H$. producta, it is not so readily distinguished from that species as is grinnelli proper.

The subspecies septentrionalis has been taken on the flowers of Linum and Penstemon cyanan-


thus (Cub River Canyon, Franklin, Idaho), and Pbacelia linearis (Logan, Utah).

## Hoplitis brachyodonta (Cockerell)

Alcidamea brachyodonta Cockerell, 1933, Ent. News, 44:205, $\delta$. Type $\delta$, Pasadena, California (U.S. Nat. Mus.).

Geographic range: California (see map 30).
California records:
Imperial Co.: Holtville (near), $\delta^{\prime \prime}$, UII-24-30, flowers Heliotropium curassavicum (Michener, 1947:292, U.C.R.).

Los Angeles Co.: Tanbark Flat, San Dimas Experimental Forest, ${ }^{\circ}$ ', VI-22-50 (J. C. Hall, C.I.S.).

Riverside Co.: Riverside, ${ }^{\text {on, }}$ IV-2-29, flowers Cbaenactis glabriuscula (Michener, 1947:292, U.C.R.).

Discussion:
H. brachyodonta is probably a synonym of $H$. grinnelli grinnelli. It is based upon a single reared specimen rescued as a larva from the attack of a Chrysidid larva. A very few similar specimens have been taken in nature. They differ from grinnelli only in their smaller size and in the unusually low projection of the second metasomal sternum.

The correlation between small total size and the small sternal process is evidently merely a result of allometry. In each species of Alcidamea the process is proportionately largest in large individual, and among the various species the largest (uvulalis) has the largest process whereas small forms (colei, elongaticeps) have very small processes.

## Subgenus Cyrtosmia Michener

## Discussion:

This subgenus contains a single large species which superficially resembles the subgenus Monumetha in the abundant black pubescence. The male is distinguishable from all of our other subgenera by the tridentate mandibles (pl. 18, fig. 67) and by the long, slender antennae which reach the scutellum and are acutely pointed at the apices (pl. 15, fig. 36). The female is unique in having basically tridentate mandibles with a weak convexity between the second and third teeth.

Hoplitis bypocrita (Cockerell)
(Pl. 15, fig. 36; pl.16, fig. 47; pl. 18, figs. 63, 67)
Osmia bypocrita Cockerell, 1906, Canad. Ent., 38:160, ㅇ. Type ㅇ, Boulder, Colorado (Timberlake Collection, U.C.R.).
Geographic range: Arizona, British Columbia, California, Colorado, Idaho, Montana, Nevada, Oregon, Utah (see map 32).
California records:
Contra Costa Co.: Antioch, ठ', V-6-39 (J. W. MacSwain, C.I.S.); $\delta$, IV-5-52 (J. G. Rozen, C.I.S.); $\delta$, V-12-53 (J. C. Hall, U.C.D.); $\delta$, same data (A. D. Telford, U.C.D.). Mt. Diablo, $\delta$, IV-21-34 (G.E.B.); J', IV-25-36 (M. A. Cazier, K.U.); ठ, IV-24-37 (M. A. Cazier, K.U.).

Eldorado Co.: Meyers, ${ }^{\text {on, }}$ V-27-39 (T. H. G. Aitken, M. A. Cazier, J. Downes, P. C. Ting, U.C.R.).

Fresno Co.: Coalinga, ơ, 아, V-14-38 (M. A. Cazier, K.U.).

Kern Co.: Mojave, ठ', IV-10-36 (G. E. and R. M. Bohart, G.E.B.).

Lake Co.: Clear Lake (near), ㅇ, V-14-47 (R. M. Bohart, U.C.D.).

Los Angeles Co.: Acton, 5 ठ, III-19-36, flowers Salix (C.I.S., K.U.). Altadena, flowers Lotus scoparius (C. D. Michener, K.U.); +, V-2-36, same flowers (C. D. Michener, K.U.). Big Pine Camp, 9 , VII-2-34, flowers Lotus crassifolius (P. H. Timberlake, U.C.R.). Claremont, \&, IV-30-47 (U.C.R.); U.C.R.). Lone Pine Canyon, $5,900 \mathrm{ft}$. , ㅇ, VI-1628, flowers Stanleya pinnata (P. H. Timberlake, U.C.R.). Palmdale, 3 d, IV-11-36 (G. E. and R. M. Bohart, G.E.B., U.C.D.). Puente Hills, $P_{\text {, }}$ V-12-40, flowers Lotus scoparius (P. H. Timberlake, U.C.R.). Rock Creek (grade above), $2 \sigma^{6}$, V-9-38, flowers Salvia carnosa (P. H. Timberlake, U.C.R.). Tanbark Flat, San Dimas Experimental Forest, , VI-20-50, flowers Lotus (P. D. Hurd, Jr., C.I.S.).

Madera Co.: Nippinawasee, 오, V-24-36 (M. A. Cazier, U.C.R.).

Mariposa Co.: El Portal, $\mathrm{d}^{\prime}$, V-18-38 (R. M. Bohart, G.E.B.). Yosemite, $3,000-4,000 \mathrm{ft}$., 우, V-22-38 (J. R. Warren, U.C.R.).

Modoc Co.: altitude 4,500 ft., $P_{\text {, VI-11-39 }}$ (C.I.S.).

Monterey Co.: Hastings Natural History Reservation, near Jamesburg, $\bar{\sigma}$, VI-2-38, flowers Trifolium (C. D. Michener, K.U.); + , VI-8-38 (C. D. Michener, K.U.); ㅇ, VI-14-38, flowers

Lotus scoparius (C. D. Michener, K.U.).
Placer Co.: Dutch Flat, $\widehat{\sigma}$, VI-15-51 (E. I. Schlinger, U.C.D.).

Riverside Co.: Glen Avon, $\boldsymbol{\sigma}^{\prime}$, III-8-33, flowers Amsinckia douglasiana (P. H. Timberlake, U.C.R.). Idyllwild, ㅇ, VI-23-28, ס, VI-24-28, ㅇ, VI-29-28 (E. C. Van Dyke, C.A.S.); $\delta^{\prime}$, V-25-39, flowers Astragalus (E. G. Linsley, C.I.S.). Lake Elsinore, ${ }^{\text {б, }}$ IV-4-49 (P. D. Hurd, Jr., C.I.S.). Perris, 1.5 mi . W., $\delta, \mathrm{V}-4-38$, reared from stem (P. H. Timberlake, U.C.R.); 2 mi. W., $\delta^{\prime}, \mathrm{III}-19-$ 36, flowers Astragalus pomonensis (P. H. Timber-
 III-1-34, III-5-34, III-14-34, IV-2-36, IV-8-36, V-10-36, IV-7-37, IV-27-37, V-11-37, flowers Amsinckia douglasiana, Astragalus parisbii, Lotus scoparius, Lupinus paynei, Medicago sativa (P. H. Timberlake, U.C.R.); + , IV-1930, reared from Salvia stem (P. H. Timberlake, U.C.R.). San Jacinto Mountains, $\sigma$, VII-21-29 (P. W. Oman, K.U.). The Gavilan, ${ }^{\text {P, }}$ IV-18-37, flowers Sambucus (E. G. Linsley, C.I.S.); ${ }^{\prime}$, IV-18-37, flowers Astragalus tener (P. H. Timberlake, U.C.R.). Vandevanter Flat, San Jacinto Mountains, $\delta$, VI-4-39, flowers Astragalus antisellii (P. H. Timberlake, U.C.R.). Wineville ( = Mira Loma), 2 ठ, IIl-8-33, flowers Amsinckia douglasiana and Brassica campestris (P. H. Timberlake, U.C.R.).

San Bernardino Co.: Loma Linda, $4 \delta^{\circ}$, III-2033 (A. J. Basinger, U.C.R.). Sheep Creek, ठ', IV-22-33 (C. M. Dammers, U.C.R.).

San Diego Co.: Dulzura (Michener, 1947:293).
Santa Cruz Co.: Santa Cruz, J', June (G.E.B.).
Shasta Co.: Burney, ơ, VI-9-41 (C. D. Michener, K.U.). Neiubieber (mountains west of), 2 \&,VI-4-38 (E. C. Van Dyke, C.A.S.).

Solano Co.: Putah Canyon, ơ, IV-21-49 (W. F. Ehrhardt, U.C.D.). Rio Vista, $\delta$, V-24-49, flowers Lotus (P. D. Hurd, Jr., C.I.S.); $\delta$, same data (J. W. MacSwain, C.I.S.).

Trinity Co.: Trinity Center, ©, VII-18-47, flowers Penstemon (A. T. McClay, U.C.D.).

Tulare Co.: Coffee Camp, + , VI-11-25, flowers Lotus glaber (P. H. Timberlake, U.C.R.). Pot-
wisha, Sequoia Narional Park, 3,000-5,000 ft., ơ, V-18-20 (E. C. Van Dyke, C.A.S.). Springville, 3.7 mi . N.E., Y, IV-30-47, flowers Eriodictyon californicum (P. H. Timberlake, U.C.R.).
Discussion:
In California this species is found principally in brushy or tree covered regions from sea level to at least 6,000 feet altitude, primarily west of the main cordilleran divides. It has been collected, however, east of the Sierra Nevada, at Carson City, Nevada, and on the western margin of the Mojave Desert, at several localities (Mojave, Palmdale, and Rock Creek).

In Idaho it has been taken on flowers of Astragalus (Webb, Nez Perce County) and Penstemon leonardi (Cub River Canyon, Franklin, $5,500 \mathrm{ft}$.). In Utah it has been found on flowers of Astragalus (Logan), Grindelia (Green, Cache County), Medicago sativa (Newton), and Vicia (Logan and Ogden). In addition to the floral records cited in the foregoing account of bypocrita, Michener (1947:294) lists Astragalus goniatus and Latbyrus as being visited by this bee.

## Subgenus Dasyosmia Michener

Discussion:
This subgenus consists of large, robust black species, sometimes having red legs, and with abundant entirely pale pubescence. It is distinguished from other subgenera by the papillate distal portions of the wings and the largely bare discal parts. Dasyosmia is probably most closely related to Cyrtosmia from which it is easily distinguished by the broad but clearly tridentate mandibles in the female (as in pl. 18, fig. 64), and the more robust antennae of the male (pl. 14, figs. 33, 35), with acute apices as in Cyrtosmia and Alcidamea in one species.

Dasyosmia contains two species, both of which occur in the deserts of California, one ranging eastward to Texas.

Key to the Species of Dasyosmia

1. Legs red; last antennal segment of male rounded (fig. 33); seventh metasomal tergum of male with a single median point . . . . . . . . . . . . . . . paroselae (p. 77)
Legs black; last antennal segment of male pointed (fig. 35); seventh metasomal tergum of male tridentate . . . . . . . . . . . . . . . . . . biscutellae (p. 77)


Map 32. Distributions of Hoplitis biscutellae (Cockerell), indicated by open circles, and Hoplitis bypocrita (Cockerell), indicated by solid circles.

Hoplitis paroselae Michener
(Pl. 14, fig. 33; pl. 17, fig. 59; pl. 18, fig. 60).
Hoplitis (Dasyosmia) paroselae Michener, 1947, Bull. Amer. Mus. Nat. Hist., 89:296, ơ, 9. Type $\sigma^{\circ}$, Westgard Pass, Inyo County, California, on flowers of Dalea fremontii (Amer. Mus. Nat. Hist.).
Geographic range: California (see map 31 ). California records:

Inyo Co.: Big Pine, 9, VI-8-37, flowers Dalea polyadenia (Michener, $1947: 298$, A.M.N.H., K.U.). Westgard Pass, $\delta^{\prime \prime}$, + , V-27-37, flowers Dalea fremontii (Michener, 1947:298, U.C.R.); $\delta$ ', VI-3-37 (Michener, 1947:298, C.A.S.).
Discussion:
The red legs distinguish this species from all other American Hoplitis. Among closely related genera only Anthocopa timberlakei and $A$. nitidivitta have similar coloration of the legs.

## Hoplitis biscutellae (Cockerell)

(Pl. 14, fig. 35; pl. 17, fig. 58; pl. 18, fig. 64).
Alcidamea biscutellae Cockerell, 1897, Ann. Mag. Nat. Hist. (6) 19:400, $\delta$. Type $\delta^{\circ}$, Mesilla Valley, New Mexico (U.S. Nat. Mus.).
Geographic range: Arizona, California, Nevada, New Mexico, Texas, and Utah (see map 32). California records:

Inyo Co.: Big Pine, $\delta^{\prime}$, VI-1-37 (W. C. Reeves, U.C.R.). Death Valley, $\uparrow$, III-20-51 (D. Burdick). Furnace Creek, Death Valley National Monument, ס, IV-8-39, flowers Larrea (E. G. Linsley, C.I.S.); oे, $\quad$, III-15-47 (A. T. McClay, U.C.D.); 21 ס', 17 O, IV-1-51, flowers Larrea (P. D. Hurd, Jr., C.I.S., K.U.); $\delta, 3$ ㅇ, III-29-53 (J. W. MacSwain, C.I.S.); 6 ot, 3 个, III-31-53 (R. F. Smith, C.I.S.); 5 才, 14 9, IV-1-53, flowers Larrea (R. F. Smith, C.I.S.). Inyo Mountains, ${ }^{\top}$, $\mathrm{V}-25-37$ (C.I.S.). $\mathrm{J}^{2}$, V-25-37 (W. C. Reeves, U.C.R.); 11 б', V1-1-37 (E. C. Van Dyke, C.A.S.). Kearsarge (near), ${ }^{\pi}$, V-25-37 (Michener, 1947:296, C.A.S.). Lone Pine, 2 б', V-24-37 (Michener, 1947:296, C.A.S.); ${ }^{\circ}$, VI-1-37 (N. W. Frazier, G.E.B.). Mazourka, Inyo Mountains, 4 ס', V-25-37 (N. W. Frazier, G.E.B., K.U., U.I.); ${ }^{2}$, V-25-37 (C. A. Hamsher, U.I.); $3 \delta^{\sigma}$, , 9 , VI-1-37, flowers Encelia farinosa (Michener, 1947:296, K.U.). Stovepipe Wells, Death Valley National Monument, $\delta^{\top}$, , Larrea (P. D. Hurd, Jr., C.I.S.); 2 б, III-31-51 (J. W. MacSwain, C.I.S.). Surprise Canyon, Panamint Mountains, 2 ot, III-31-51 (J. W. MacSwain, C.I.S.).

Kern Co.: Inyokern, ㅇ, IV-26-49, flowers Larrea (E. G. Linsley, J. W. MacSwain, R. F. Smith, U.C.D.).

Los Angeles Co.: Lovejoy Buttes, 6 \%, VII-11-44, Larrea glutinosa (P. H. Timberlake, U.C.R.). Mojave Desert, Highway 138, J, V-9-44, flowers Stenotopsis linearifolius (P. H. Timberlake, U.C.R.). Piute Butte, 8 §, V-11 and 12-44, flowers Larrea glutinosa (P. H. Timberlake, U.C.R.).

Riverside Co.: Blythe, ㅇ, IV-2-41 (J. W. Mac Swain, C.I.S.). Cathedral City, + IV-10-36, flowers Larrea (E. G. Linsley, C.I.S.); $\delta, 2$, IV-1 0-36, flowers Larrea (Michener, 1947:296, K.U.). Cottonwood Springs, Joshua Tree National Monument, $2 \delta$, IV-12-50 (P. D. Hurd, Jr., C.I.S.). Eagle Mountains, ㅇ, V-15-41 (C.I.S.). El Centro, 5 mi. E., IV-2-52 (R. A. Flock, U.C.R.). Hemet, 9, V-10-36, flowers Larrea (E. G. Linsley, C.I.S.). Hopkins Well, 9, IV-28-49, flowers Geraea canescens (J. E. Gillaspy, C.I.S.). Indio, 20 mi . E., (Michener, 1947:296). La Quinta, $\delta^{\circ} \delta^{\circ}$, $\%$ ㅇ, III-17-34, flowers Larrea glutinosa and Hyptis emoryi (Michener, 1947:296, U.C.R.). Mecca, 10 mi. S., 9, III-28-36, flowers Larrea glutinosa (P. H. Timberlake, U.C.R.). Oasis, 2 mi. S., $Y$, III-7-36, flowers Larrea (E. G. Linsley, C.I.S.); 9. III-28-36, flowers Larrea glutinosa (P. H. Timberlake, U.C.R.). Palm Canyon, 2 , IV-14 and 15-38 (G. E. and R. M. Bohart, G.E.B.). Palm Desert, 2 \&, IV-11-50 (P. D. Hurd, Jr., C.I.S.). Palm Springs, ㅇ, IV-10-32, flowers Larrea glutinosa (P. H. Timberlake, U.C.R.); ठ, III-9-44, flowers Larrea glutinosa (P. H. Timberlake, U.C.R.); $\sigma$, III-29-45, flowers Larrea glutinosa (P. H. Timberlake, U.C.R.); $\delta^{\top}$ IV-6-4S, flowers Larrea glutinosa (P. H. Timberlake, U.C.R.). Tahquitz Canyon, San Jacinto Mountains, $3 \delta^{\prime}$, IV-16-38, flowers Larrea glutinosa (G.E.B., U.C.D., U.C.L.A.).

San Bernardino Co.: Hesperia, 3 mi. E., $\delta$, V-15-36, Larrea glutinosa (P. H. Timberlake, U.C.R.). Kramer Hills, $\delta$, VI-1-53 (G. A. Marsh, C.I.S.). Manix, 22 mi . N., 3 Y, IV-26-53, flowers Larrea (P. D. Hurd, Jr., C.I.S.); 2 f, same data (G. A. Marsh, C.I.S.); $P$, same data (R. O. Schuster, C.I.S.). Morongo Valley, $\delta$, V-7-39, flowers Larrea glutinosa (P. H. Timberlake, U.C.R.). Renoville, $2 \delta$, IV-2-51, flowers Larrea (P. D. Hurd, Jr., C.I.S.); $2 \delta^{\prime}$, same data (E. G. Linsley, C.I.S.). San Gorgonio Pass, $\delta, \mathrm{V}-10-46$, flowers Larrea glutinosa (P. H. Timberlake, U.C.R.). Twentynine Palms, , III-27-47, flowers Larrea glutinosa (P. H. Timberlake, U.C.R.). Windmill Station, ${ }^{\prime}$ ', IV-6-53, flowers Sphaeralcea
(E. G. Linsley, C.I.S.). Yermo, Y, IV-22-49 (R. v.d. Bosch, C.I.S.).

San Diego Co.: Borego, , IV-5-49, flowers Larrea (P. D. Hurd, Jr., K.U.); 4 ơ, IV-5-40 (U.C.D., U.C.L.A.); ס, IV-10-52 (J. W. MacSwain, C.I.S.); Y, IV-1-53 (P. D. Hurd, Jr., C.I.S.).

Discussion:
The strongly tridentate apex of the male metasoma (pl. 17, fig. 58) distinguishes this species from all other American Hoplitis. It has been taken in Arizona on flowers of a yellow composite ( 25 miles west of Casa Grande); in Nevada on flowers of an unidentified composite and Sphaeralcea ambigua ( 22 miles south of Las Vegas); and in Texas on flowers of Prosopis chilensis glandulosa (Hot Springs, Big Bend National Park).

## Subgenus Acrosmia Michener

Discussion:
This subgenus is readily recognizable in the male by the laterally expanded apical antennal segment, and by the presence of rather long hairs on some of the flagellar segments. The females all have the upper part of the clypeus protuberant, and they have more slender mandibles than do most Hoplitis. The rather robust body is suggestive of Anthocopa, and one of the species was first described in that genus. In both sexes the integument is black or the abdomen red; the pubescence is pale.

Acrosmia is known from three rare species, all of which occur in California, although at least two of them range eastward to Utah. The significant flower records are all either Nemophila or Pbacelia; it is therefore possible that the species of Acrosmia are oligolectic on these Hydrophyllaceae.

Key to the Species of Acrosmia

## Males

1. Metasoma largely red . . . . . . . . . . . . . . . . . . rufina (p. 81) Metasoma black

2(1). Emargination of seventh metsomal tergum semicircular or deeper (pl. 17, fig. 55); median apical process of sixth metasomal sternum round. . . . . . . .plagiostoma (p. 81)
Emargination of seventh metasomal tergum shallow (pl. 17, fig. 56); median apical process of sixth metasomal sternum acutely pointed . . . . . . . . laevibullata (p. 78)

## Females

1. Metasoma red . . . . . . . . . . . . . . . . . . . . . rufina (p. 81)

Metasoma black . . . . . . . . . . . . . . . . . . laevibullata (p. 78)

Hoplitis laevibullata (Michener)
(Pl. 15, fig. 39; pl. 17, fig. 56)

Anthocopa (Eremosmia) laevibullata Michener, 1943, Ann. Ent. Soc. Amer., 36:68, ㅇ. Type, Truckee, California (Calif. Acad. Sci.).
Synonym: Hoplitis perissocera Michener, 1947, Bull. Amer. Mus. Nat. Hist., 89:299, $\sigma^{7}$ (new synonym).
Geographic range: California, Utah (see map 33).
California records:
Alpine Co.: Hope Valley, 2 ㅇ, VII-9-48 (Mich-
ener, 1951:52, C.I.S., K.U.); ㅇ, VII-18-48 (P. D. Hurd, Jr., K.U.).

Eldorado Co.: Tallac (Michener, 1949:54).
Fresno Co.: Huntington Lake, O , VII-17 (I. McCracken, C.A.S.).

Nevada Co.: Lake Spaulding, VI-1938, flowers Calyptridium umbellatum (Michener, 1943:69).

Sierra Co.: Gold Lake, ${ }^{\circ}$, VII-17-21 (Michener, 1947:300, C.A.S.).

Tuolumne Co.: Dardanelles, $\delta^{\sigma}$, VII-13-51 (W. H. Lange, U.C.D.). Pinecrest, of, ㅇ, VII-16-52, on flowers Nemophila (R. R. Snelling and J. I. Stage, K.U.); VI-29-52 (J. I. Stage, K.U.).


Map 33. Distribution of Hoplitis laevibullata (Michener).



Discussion:
This rare species, which is known in California only from the Sierra Nevada, is listed in the revision of Hoplitis (Michener, 1947a) as H. perissocera Michener. Recently the sexes of this species have been collected together by Roy Snelling, and it is apparent that perissocera is a synonym of laevibullata. The species has been taken at flowers of Phacelia in Utah (Logan).

## Hoplitis plagiostoma Michener <br> (Pl. 15, fig. 40; pl. 17, fig. 55)

Hoplitis (Acrosmia) plagiostoma Michener, 1947, Bull. Amer. Mus. Nat. Hist., 89:298, $\delta$. Type $\delta$, Sonora Pass, Alpine County, California (Amer. Mus. Nat. Hist.).
Geographic range: California, Oregon (see map 34).

California records:
Alpine Co.: Sonora Pass, $10,000-11,000 \mathrm{ft}$., $\delta^{\prime}$, VII-11-51 (B. Puttler, C.I.S.); ${ }^{\hat{\prime}}$,-same data (J. W. MacSwain, C.I.S.).

Discussion:
This species, known from only three specimens collected at the same place (two, eleven years later than the other) and from a single specimen from Fish Lake, Steens Mountains, Oregon, is clearly distinct from laevibullata, although related to it. In addition to the characters listed in the key, it differs by its larger size, the smaller number of long hairs on the antennal flagellum, the more rounded lateral projection of the last flagellar segment, and the gradually increasing width of the flagellum from the base to the middle (more nearly parallel sided in laevibullata).

## Hoplitis rufina Michener

(Pl. 17, fig. 57; pl. 18, fig. 65)
Hoplitis (Acrosmia) rufina Michener, 1954, PanPacific Ent., 30:40, $0^{\pi}$, ㅇ. Type 7 , Madera County, 3,000 ft., California (Cal. Acad. Sci.). Geographic range: California, Oregon, and Utah (see map 36).
California records:
Inyo Co.: Big Pine Creek, 7,500 ft., ${ }^{2}$, VI-1242 (Michener, 1954:42).

San Bernardino Co.: Terley Park, $9, \mathrm{~V}-23-36$, flowers Nemophila (Michener, 1954:42).

Tulare Co.: Pine Flat, $\mathcal{Y}, \mathrm{V}-3-47$, flowers Viola purpurea (Michener, 1954:42).
Discussion:
H. rufina has been collected at a single locality in Oregon (Camp Abbot, Deschutes County) and at another locality in Utah (Logan Canyon).

## Subgenus Monumetha Cresson

Monumetha contains moderate-sized to large, elongate forms with some black pubescence, at least in females. The mandibles of the female are clearly quadridentate (fig. 70), a feature that separates this subgenus from other subgenera known from California. The first and second metasomal sterna of the male both have a median apical spine or angle.

This subgenus is here used to include not only the single species previously placed in Monumetha but also the brilliantly metallic species usually placed in Cblorosmia Sladen. The resulting group is unified, clearly recognizable, and contains only four species. The characters previously used to separate Chlo rosmia were superficial, color being the principal one.

Key to the Species of the Subgenus Monumetha

## Males

1. Body black; clypeal pubescence short, appressed, silvery. . . . . . albifrons (p. 83) Body orilliantly metallic green or blue; clypeal pubescence long, suberect
2(1). Antennal flagellum at least slightly thicker medially than basally; seventh metasomal tergum with median apical point (pl. 14, figs. 27, 30).
Antennal flagellum of uniform thickness; seventh metasomal tergum with apex broad, not pointed (pl. 14, fig. 28) . . . . . . . . . . . . . . . . . fulgida (p. 90)
3(2). Flagellum greatly thickened medially, its segments five to nine at least as broad as long (pl. 14, fig. 27). . . . . . . . . . . . . . . . . . . . louisae (p. 88)


Map 36. Distribution of Hoplitis rufina Michener.

Flagellum but little thickened, all segments longer than broad (pl. 14, fig. 30). viridimicans ( p .

## Females

1. Body brilliantly metallic green or blue ..... 2
Body black ..... 83)
2(1). Metasomal terga with broad metallic impunctate posterior margins ..... 3
Metasomal terga with impunctate posterior margins almost lacking . . viridimicans (p. ..... 90)
3(2). Length less than 12 mm . fulgida(p. ..... 90)
Length more than 12 mm . louisae (p. ..... 88)

Hoplitis albifrons (Kirby)
(Pl.14, fig. 32; pl. 17, fig. 54; pl. 18, figs. 62, 70)
Chelostoma albifrons Kirby, 1837, in Richardson, Fauna Boreali-Americana, $4: 270$, $\delta^{\circ}$.
Hoplitis (Monumetha) albifrons, Michener, 1947,
Bull. Amer. Mus. Nat. Hist., 89:301, $\sigma^{\prime}$, ㅇ; Evolution, 1:172-185.
Geographic range: Nova Scotia to Alaska; south to California and New Mexico (see map 37).
Discussion:
This large black species is represented in California by two subspecies which between
them occupy virtually the entire state, except for the deserts and the Great Valley. A third subspecies, albifrons proper, ranges from Nova Scotia and New York to Alaska and the Yukon. The subspecies are relatively easily distinguishable only in the female sex; the males may be assigned to subspecies principally on the basis of geographic distribution. An analysis of geographical variation in this species was presented earlier (Michener, 1947b). Curiously, pointed antennae in males of this species are known only in the regions where the subspecies maura and argentifrons merge.

## Key to the California Subspecies of Hoplitis albifrons

## Females

1. Pubescence entirely black . . . . . . . . . . . . . . . . . maura (p. 85) Pubescence partly white . argentifrons ( p .

## Hoplitis albifrons argentifrons (Cresson)

Monumetha argentifrons Cresson, 1864, Proc. Ent. Soc. Phila., 2:387, ठ. Type $\delta$, Pikes Peak, Colorado (Acad. Nat. Sci. Phila.).
Geographic range: Alberta south to New Mexico and Arizona, west to British Columbia and Oregon, southward along Sierra Nevada, California (see map 37).
California records:
Alpine Co.: Hope Valley, $\delta$, VII-9-48 (C. Chan, U.C.D.); $\delta, 3$ \&, same data (J. W. Mac Swain, C.I.S.); , VII-18-48 (A. Bartel, C.I.S.); Y, same data (P. D. Hurd, Jr., C.I.S.); 2 ㅇ, same data (J. W. MacSwain, C.I.S.); Y, same data (S. A. Sher, C.I.S.). Winnemucca Lake, $\delta$ ', VII-16-48 (R. M. Bohart, U.C.D.).

Fresno Co.: Huntington Lake, 7,000 ft., $\mathrm{O}^{*}, 2$ 7, VII-4-19 (E. P. Van Duzee, C.A.S.). Lone Indian Lake, ס', VIII-20-49 (E. I. Schlinger, U.C.D.). Kings River Canyon, $P$, VII-8-1 0 (E. C. Van Dyke, C.A.S.).

Inyo Co.: Bishop, $q$, VI-22-20 (E. P. Van Duzee, C.A.S.). Bishop Creek, ó, , Y, VI-22-37 (U.C.R.). Glacier Lodge, Big Pine, 3 ठ, VI-20-37 (W. C. Reeves, U.C.R.). Independence, $\delta$, VI-1137 (U.C.R.). Lone Pine, 厄́, VI-15-37 (U.C.R.); §', VII-22-37 (G. E. and R. M. Bohart, G.E.B.). Mount Whitney, $\delta^{\prime}$, VI-1 2-37 (Michener, 1947:303, U.C.R.). Rock Creek, 2 す, $\%$, VI-23-37 (A. E. Meier, C.I.S.). Whitney Portal, 3 ठ', VII-3-53 (H. Wasburn, C.I.S.).

Lassen Co.: Bridge Creek Camp, $\delta, \%$, VI-2849 (J. W. MacSwain, C.I.S.); õ, VII-9-49 (R. C.


Map 37. Distribution of Hoplitis albifrons (Kirby), the subspecies albifrons indicated by solid circles, the subspecies argentifrons by open circles, and the subspecies maura by half solid circles.

Bechtel, U.C.D.); \&, same data (D. Cox, C.I.S.); ô, 3 \&, same data (W. F. Ehrhardt, U.C.D.); $\bar{\delta}$, same data (J. E. Gillaspy, C.I.S.); 5 б, same data (E. I. Schlinger, U.C.D.); $\delta$, same data (W. R. Schreader, U.C.D.). Summit Camp, $\delta$, ㅇ, VI-28-49 (W. F. Ehrhardt, U.C.D.); 2 d, same data (F. Morishita, C.I.S.); \&, same data (W. H. Wade, C.I.S.); f, VII-9-49 (C. I. Smith, C.I.S.). Susan River Camp, $\delta$, VII-10-49 (E. L. Atkins on, C.I.S.); $\delta^{\prime}$, same data (W. F. Ehrhardt, U.C.D.); $\delta, 3$ f, same data (J. E. Gillaspy, C.I.S., K.U.).

Mariposa Co.: El Portal, ó, V-30-38 (R. M. Bohart, G.E.B.). Indian Flat, $4 \mathrm{O}^{\lambda}, \mathrm{V}-23-38$ (R. M. Bohart, G.E.B.). Mariposa, ${ }^{\circ}$, VI-13-38, flowers Cirsium (R. M. Bohart, G.E.B.). Miami Ranger Station, ot, VI-14-42 (E. G. Linsley, U.C.R.). Porcupine Flat, 8,100 ft., VII-1-15, flowers Arctostaphylos nevadensis (L. S., Jr., U.). Snow Creek Trail, Yosemite National Park, 9, VII-2136 (G.E.B.). Tuolumne Meadows, + , VII-19-15 (C. L. Fox, C.A.S.); $\delta$, VII-31-15 (C. L. Fox, C.A.S.); Yosemite, 3,880-4,000 ft., ठ', VI-2-38 (J.R. Warren, U.C.R.). Yosemite Valley, $\mathrm{f}, \mathrm{V}$-21-21 (E. C. Van Dyke). (Note: These records assigned to argentifrons on basis of females which are all referable here on basis of subspecific differences.)

Mono Co.: Blanco's Corral, White Mountains, $10,000 \mathrm{ft} .$, ㅇ, VII-7-53 (J. W. MacSwain, C.I.S.). Coleville, ơ, V-28-39 (T. H. G. Aitken, J. Downes, M. A. Cazier, P. C. Ting, U.C.R.). Leavitt Meadows, $\delta$, VI-25-37 (E. C. Van Dyke, C.A.S.). Mammoth, ${ }^{\prime}$, V-8-33 (G. E. and R. M. Bohart, U.C.D.); + , VII-4-33 (G. E. and R. M. Bohart, U.C.D.); ठ, 9 , VII-9-33 (G. E. and R. M. Bohart, G.E.B.). Sardine Creek, 8,500 ft., ${ }^{\text {ond }}$ VI-28-51 (R. W. Morgan, C.I.S.); ㅇ, VII-16-51 (A. T. Mc Clay, U.C.D.). Walker Lake, $2 \delta^{6}$, VII-23-15 (I. McCracken, L.S., Jr., U. ).

Nevada Co.: Donner Pass, 9 , VI-18-40 (T. H. G. Aitken and M. A. Cazier, U.C.R.). Truckee, $2 \delta^{\circ}$, VI-17-27 (E. P. Van Duzee, C.A.S.); 3 9, VI-2127 (E. P. Van Duzee, C.A.S.); 3 Y, VII-4-27 (E. P. Van Duzee, C.A.S.). (Note: The female from Donner has the subspecific charateristics of maura.)

Placer Co.: Alta, 2 ठ, VI-25-33 (G. E. and R. M. Bohart, G.E.B.). Colfax, $3 \delta$, V-20-52 (R. M. Bohart, U.C.D.); 7 б, same data (E. I. Schlinger, U.C.D.). Emigrant Gap, $\sigma^{\circ} \cdot$ 우, VI-13-39 (U.C.R.). Fallen Leaf Lake, 9 , VII-1 915 (L. S. Rosenbaum, C.A.S.). Glen Alpine, Lake Tahoe, ㅇ, VI-29-29 (E. P. Van Duzee, C.A.S.). Lake Forest, Lake Tahoe, , , VII-16-49 (E. G. Linsley, C.I.S.). Lake Tahoe, ,

County Summit, 7,000 ft., (W. M. Giffard, C.A.S.). Tahoe, f, VII-1925 (F. X. Williams, U.C.R.). (Note: The female from Emigrant Gap has the subspecific characters of maura.)

Sierra Co.: Gold Lake, ô, VII-26-21 (C. L. Fox, C.A.S.).
Discussion:
This subspecies occurs from the Rocky Mountain states to British Columbia and southward through Washington and Oregon. In the latter states, most populations are highly variable, with some individuals almost as dark as maura (see Michener, 1947b). In California, argentifrons occurs at high altitudes in the Sierra Nevada and down on the eastern slopes of these mountains to their bases. On the western slopes, below 4,000 to 5,000 feet, it is replaced by the subspecies maura.

The subspecies argentifrons has been collected in Arizona on flowers of Mertensia franciscana (White Mountains); in British Columbia on flowers of Spiraea sorbifolia (Vernon); in Colorado on flowers of Geranium fremontii (Cuchara Camp), Gilia (Hubbard Ranch, Elbert), Phacelia (Pingree Park), Phacelia glandulosa (Salida), and Potentilla glandulosa; in Nebraska on flowers of Astragalus (Badlands, mouth of Monroe Canyon, Sioux County), and a borage (Warbonnet Canyon); in New Mexico on flowers of Opulaster (Sandia Mountains); in Oregon on flowers of Cleome serrulata (Baker), and Pbacelia (Drake Peak, $7,500 \mathrm{ft}$. ); in Utah on flowers Allium (Pass Creek Mountains), Cirsium (Eureka), Pbacelia (Timpanogos Peak), Senecio (Bryce National Park), and Vicia (Logan); in Washington on flowers of Phacelia leucophylla (American River); and in Wyoming on flowers of Apocynum and Geranium (Grand Teton National Park).

In addition, Michener (1947:304) lists Erigeron, Nama rothrockii, Opuntia, Pedicularis groenlandica, and Rosa as flowers visited by this bee.

## Hoplitis albifrons maura (Cresson)

Osmia maura Cresson, 1878, Trans. Amer. Ent. Soc., 7:104, ㅇ. Type ㅇ, "California" (Acad. Nat. Sci., Phila.).
Synonymy: besperius (Cockerell), 1903.
Geographic range: California, Oregon (see map 37).

California records:
Alameda Co.: Midway, + , V-24-36 (M. A. Cazier, U.C.R.).

Butte Co.: Feather River Highway,- 9, VI-14-

40 (T. H. G. Aitken and M. A. Cazier, K.U.).
Contra Costa Co.: Antioch, $\mathrm{O}^{2}, \mathrm{~V}-24-49$, flowers Lotus (P. D. Hurd, Jr., C.I.S.); 2 o, IV-29-50 (P. D. Hurd, Jr., C.I.S. ) 2 б', 9, V-8-50 (P. D. Hurd, Jr., C.I.S., K.U.). Marsh Creek, $\frac{9}{}$, VI-5-49 (E. C. Van Dyke, C.A.S.). Mt. Diablo, ơ, V-18-47 (P. D. Hurd, Jr., C.I.S.); 9, V-25-39 (E. C. Van Dyke, C.A.S.); \&, VI-14-52 (L. D. and R. H. Beamer, K.U.). Rock City, Mt. Diablo, ${ }^{\top}$, Y, V-24-40 (E. G. Linsley, C.A.S.).

El Dorado Co.: Camino, 3 mi. S., ©, VI-23-48 (A. Bartel, C.I.S.); $\delta$, same data (L. W. Quate, C.I.S.); $2 \delta$, same data (J. W. MacSwain, C.I.S.); $\pi$, VI-26-48 (P. D. Hurd, Jr., C.I.S.). Chile Bar, 4 §, VII-5-48 (A. Bartel, C.I.S.); $\%$, same data (D. Carter, C.I.S.); $2 \delta^{\circ}$, same data (C. Chan, U.C.D.); $\delta$, same data (L. W. Quate, C.I.S.); ${ }^{\prime}$, same data (S. A. Sher, C.I.S.). China Flat, $2 \delta^{\prime}$, VI-28-48 (A. Bartel, C.I.S.); ${ }^{\prime}$, VI-28-48, flowers Pbacelia (P. D. Hurd, Jr., C.I.S.); $\delta$ ', VI-28-48 (J. W. MacSwain, C.I.S.); $\delta$, same data (O. E. Myers, C.I.S.); $\delta$, VII-5-48 (J. W. MacSwain, C.I.S.). Echo Lake, $\sigma$, VII-21-48 (A. Bartel, C.I.S.); Y, VI-26-52 (W. W. Middleka uff, C.I.S.); $\delta$, VII-8-53 (W. W. Middlekauff, C.I.S.). Pyramid Lake, $\delta$, VII-12-48 (C. D. MacNeill, C.I.S.). Snowline Camp, $\delta^{\top}$, VI-20-48 (S. A. Sher, C.I.S.); o', VI-25-48 (P. D. Hurd, Jr., C.I.S.); Y, same data (J. W. MacSwain, C.I.S.); 9 , VI-27-48 (C. Chan, U.C.D.); $\delta$, same data (P. D. Hurd, Jr., C.I.S.); \&, same data (J. W. MacSwain, C.I.S.); ㅇ, VI-30-48 (S. A. Sher, C.I.S.); 우, VII-4-49 (P. D. Hurd, Jr., C.I.S.); 3 ㅇ, VII-7-48 (A. Bartel, C.I.S.); $2 \delta$, 9, VII-7-48, flowers Phacelia (P. D. Hurd, Jr., C.I.S.); + , VII-7-48 (J. W. Mac Swain, C.I.S.); 9, VII-20-48 (P. D. Hurd, Jr., C.I.S.). Strawberry Valley, ${ }^{\text {P, VIII-5-1 } 2 \text { (E. C. }}$ Van Dyke, C.A.S.). (Note: Some of the females from Snowline Camp and Echo Lake have the subspecific characters of argentifrons.)

Lake Co.: Clear Lake (near), 9, V-14-47 (R. M. Bohart, U.C.D.).

Los Angeles Co.: Big Pines Camp, $\delta$, 9 , VII-12-27, flowers Pbacelia beterophylla (P. H. Timberlake, U.C.R.); ㅇ, VII-13-27, same flowers (P. H. Timberlake, U.C.R.); ${ }^{\text {T, }}$, V, VII-1 6-27, same flowers (P. H. Timberlake, U.C.R.); $\delta, \mathrm{V}-$ 16-28 (O. H. Swezey, U.C.R.); + , VII-2-34, flowers Phacelia beterophylla (P. H. Timberlake, U.C.R.); + , VII-17-37, same flowers (P. H. Timberlake, U.C.R.); $\delta^{\top}$, VI-16-36 (P. H. Timberlake, U.C.R.). Camp Baldy, ㅇ, VI-26-50 (W. C. Bentinck, C.I.S.); 2 ㅇ, same data (H. L. Hansen, C.I.S.); 9, same data (A. T. McClay, U.C.D.); ㅇ, same data (R. O. Schuster, C.I.S.); $\delta$, same
data (K. G. Whitesell, U.C.D.); , VII-11-50 (P. D. Hurd, Jr., C.I.S.); ㅇ, VII-9-52 (U.C.L.A.). Crystal Lake, $\sigma^{\top}$, VI-29-50, flowers Eriodictyon (P. D. Hurd, Jr., C.I.S.). Crystal Lake Road, 4,700 ft., $\delta^{\prime \prime}$, VII-9-52 (E. M. Evans, U.C.D.). Griffith Park, IV-5-36, flowers Nemophila (E. G. Linsley, C.I.S.). Lone Pine Canyon, 5,900 ft., $\delta^{\prime}$, VI-16-28, flowers Stanleya pinnata (P. H. Timberlake, U.C.R.). Tanbark Flat, San Dimas Experimental Forest, ${ }^{\text {4, VI-18-50 (A. T McClay, }}$ U.C.D.); + , VI-19-50, flowers Lotus (P D. Hurd, Jr., C.I.S.); 2 ㅇ, VI-19-50 (J. W. MacSwain, C.I.S.) ; $\delta$, VI-20-50 (J. C. Hall, U.C.D.); $\delta, 3$, VI-20-50, flowers Lotus (P. D. Hurd, Jr., C.I.S.); Y, VI-20-50 (R. O. Schuster, C.I.S.); Y, same data (K. G. Whitesell, U.C.D.); Y, VI-21-50 (H. L. Hansen, C.I.S.); ㅇ, VI-21-50, flowers Lotus (W. C. Bentinck, C.I.S.); 2 \&, VI-22-50 (J. D. Paschke, C.I.S.); Y, VI-23-50 (R. L. Anderson, U.C.D.); ㅇ, VI-23-50, flowers Lotus (H. F. Robinson, U.C.D.); + , VI-25-50 (W. O. Marshall, U.C.D.); 9 , same data (A. T. McClay, U.C.D.); Y, same data (F. X. Williams, C.A.S.); 2 Y, VI-26-50, 3 \&, VI-27-50 (W. C. Bentinck, C.I.S.); ס', same data (P. D. Hurd, Jr., C.I.S.); ㅇ, VII-3-50 (W.. O. Marshall, U.C.D.); Y, VII-4-50 (P. D. Hurd, Jr., C.I.S.); Y, VII-12-52 (D. E. Barcus, U.C.D.); ${ }^{\text {P, same data (J. H. Nakata, C.I.S.). }}$ Tejon Pass, $\delta$, V-15-39 (E. C. Van Dyke, C.A.S.).

Madera Co.: Bass Lake, 5 ơ, 3 Q, VI-6-38 (R. M. Bohart, G.E.B., U.C.D., U.C.L.A.). Oakhurst, $\delta$, V-19-42 (E. G. Linsley, C.I.S.). Nippinawasee, $4 \delta^{\top}, \mathrm{V}-24-36$ (M. A. Cazier, U.C.R.); ㅇ, V-24-36 (E. S. Ross, C.A.S.). Northfork P, $^{\text {P, }}$ VI-11-23 (R. P. Allen, C.A.S.). Yosemite Fork, Y, VI-8-40 (T. H. G. Aitken, B. Brookman, M. A. Cazier, U.C.R.).

Marin Co.: Mill Valley, ${ }^{\text {P, V-2-26 (C. L. Fox, }}$ C.A.S.).

Mendocino Co.: Mendocino Pass, 6,000 ft., $\delta$, VI-1 9-48 (R. M. Bohart, U.C.D.). Ryan Creek, す, VI-1-52 (R. Craig, C.I.S.). Twin Rocks, + VII-1 0-29 (E. C. Van Dyke, C.A.S.).
 VII-1 7-22 (C.A.S.).

Monterey Co.: Hastings Natural History Reservation, near Jamesburg, $9, V-28-38$, $\delta$, VI-1-38, ठ, VI-4-38, ठ', VI-14-38, flowers Eriogonum and Lotus scoparius (C. D. Michener, K.U.).

Napa Co.: Chiles Valley, 2 ? V-7-39 (E. C. Van Dyke, C.A.S.). Mint Canyon, $2 \delta^{\circ}, \mathrm{V}-22-49$ (R. C. Bechtel, U.C.D.). Putah Canyon, $\delta$, V-2551 (R. C. Bechtel, U.C.D.). Samuel Spring, 2 ס, V-28-53 (R. M. Bohart, U.C.D.); 2 ¢, V-30-53 (J. C. Hall, U.C.D.).

Plumas Co.: Bucks Lake, ठ', VI-23-49 (A. S. Deal, U.C.D.); $\delta$, same data (W. F. Ehrhardt, U.C.D.); ${ }^{\hat{\prime}}$, same data (J. W. MacSwain, K.U.); O., VII-14-49 (L. W. Isaak, U.C.D.). Butte Lake, ${ }_{9}$, VI-10-51 U.C.D.). Caribou, ${ }^{\prime}$, VII-6-32 (U.C.D.); ㅇ, VII-7-32 (U.C.D.). Meadow Valley, $\mathcal{Y}$, VI-1224, ㅇ, VI-16-24, 2 ㅇ, VI-21-24 (W. H. Nelson, C.I.S.). Meadow Valley, $3,500-4,000 \mathrm{ft} ., 2$ ㅇ, VI-1-24, ㅇ, VI-7-24, ठ, 3 ㅇ, VI-15-24; same but 4,000-5,000 ft., ס', VI-21-24, 2 if, VII-11-24; same but $5,000-6,000 \mathrm{ft} ., 2$ ? 2 , VI-21-24, $\mathcal{P}$, VII-2-24, 4 ㅇ, VII-6-24, 5 ㅇ, VII-8-24 (all collected by E. C. Van Dyke, C.A.S.). Quincy, 4 mi. W., 5 \&, VI-21-49, flowers Phacelia (P. D. Hurd, Jr.,
 VI-22-49, flowers Phacelia (P.. D. Hurd, Jr., C.I.S., K.U.); 9 , VI-25-49(R. C. Bechtel, U.C.D.);
 same dara (J. W. MacSwain, C.I.S.); 4 Y, same data (F. Morishita, C.I.S.); Y, VI-26-49 (W. F. Ehrhardt, U.C.D.); ${ }^{\text {P }}$, same data (E. I. Schlinger, U.C.D.); 2 早, VI-30-49 (P. D. Hurd, Jr., C.I.S., K.U.); 2 \&, same data (J. W. MacSwain, K.U.); ㅇ, VII-2-49 (E. L. Atkinson, C.I.S.); 9 , VII-8-49 (J. E. Gillaspy, C.I.S.). Tobin, $\delta^{\top}$, V-18-49 (J. W. MacSwain, C.I.S.).

Riverside Co.: Banning, ㅇ, V-28-28 (E. C. Van Dyke, C.A.S.). Hemet, ${ }^{\prime}$, V-10-36 (E. G. Linsley, C.I.S.). Idyllwild, $\delta$, VI-23-28 (E. C. Van Dyke, C.A.S.); 2 , $\xlongequal{\text {, VI-25-28 (E. C. Van }}$ Dyke, C.A.S.); P, VII-3-30, flowers Phacelia californica (P. H. Timberlake, U.C.R.); \& Y, VI-6-37, flowers Lotus davidsonii (P. H. Timberlake, U.C.R.); ©, ?, VI-22-41 (E. C. Van Dyke, C.A.S.); ㅇ, VI-19-51 (G. C. Bechtel, U.C.D.). Keen Camp, San Jacinto Mountains (Michener, 1947:304); ${ }^{\text {S }}$, VI-6 to 12-17 (E. P. Van Duzee, C.A.S.); $\mathrm{o}^{\prime}, \mathrm{V}$ -17-39, flowers Eriodictyon (E. G. Linsley, C.I.S.). Piñon Flat, San Jacinto Mountains, $\delta$, IV-23-50 (C. D. MacNeill, C.I.S.). San Jacinto Mountains, ㅇ, VI-30-33 (R. H. Beamer, K.U.). Saunders Meadows, San Jacinto Mountains, 9 , VI-9-40, flowers Pbacelia californica (P. H. Timberlake, U.C.R.). Vandevanter Flat, San Jacinto Mountains, $\delta$,, , VI-4-39 (E. G. Linsley, C.I.S.).

Sacramento Co.: Folsom, ठ', V-30-52 (T. R. Haig, C.I.S.).

San Bernardino Co.: Big Bear Valley, f, VII-7-34 (C. M. Dammers, U.C.R.); 3 ¢, VII-7-34, flowers Pbacelia beterophylla (P. H. Timberlake, U.C.R.). Camp Baldy, $\ddagger$, VII-7-52 (A. A. Greigarick, U.C.D.); 4, VII-9-52 (U.C.D.). Cajon Valley, O, 3 O, V-8-34 (C. M. Dammers, U.C.R.). Crestline, $\delta$, V-13-34, flowers Nemophila Menziesii var. integrifolia (P. H. Timberlake, U.C.R.); $0^{n}$,

V-23-36 (E. G. Linsley, C.I.S.); 2 ot, V-23-36, flowers Lotus davidsonii (P. H. Timberlake, U.C.R.). Deep Creek, $\bar{\sigma}$, IV-26-36, flowers Mirabilis laevis (E. G. Linsley, C.I.S.). Forest Home, o', VI-16-28 (E. C. Van Dyke, C.A.S.); ㅇ, VI-637, flowers Eriodictyon trichocalyx (P. H. Timberlake, U.C.R.). Lytle Creek, 3 \&, V-10-36 (W. C. Reeves, U.C.R.). Mill Creek, San Bernardino Mountains, $\bar{\delta}$, V-30-38, flowers Pbacelia distans (P. H. Timberlake, U.C.R.); same locality, $3,000 \mathrm{ft} 2 \mathrm{Y},. \mathrm{V}-18-34$, flowers Eriodictyon trichocalyx (P. H. Timberlake, U.C.R.); same locality, $4,400 \mathrm{ft} ., \delta \bar{\delta}$, ㅇ, V-30-38, flowers Phacelia distans (P. H. Timberlake, U.C.R.); same locality, $4,500 \mathrm{ft} ., 2 \mathrm{~d}$, Y, V-30-38, flowers Cryptantha intermedia; 9 , V1-20-52, flowers Phacelia ramosissima (P. H. Timberlake, U.C.R.); same locality, 4,800 ft., $20^{\pi}$, V-13-40, flowers Cryptantha intermedia (P. H. Timberlake, U.C.R.). Mounta in Home Creek, San Bernardino Mountains, 5,000 fr., $\mathrm{o}^{\hat{2}}$ VI-17-34, flowers Eriodictyon trichocalyx (P. H. Timberlake, U.C.R.); $\delta$, VII-4-38, flowers Phacelia distans (P. H. Timberlake, U.C.R.). Rock Creek, north side San Bernardino Mounta ins (Michener, 1947:304). Seeley Flats, San Bernardino Mountains, + , VII-5-17 (L. S., Jr., U.). Snow Crest Camp, ơ, VII-7-52 (A. T. McClay, U.C.D.). Tetley Mountain Camp, $\delta$ ', V-14, flowers Iris missouriensis (C. D. Michener, K.U.). Tetley Park, San Bernardino Mountains, $\delta$ ', V-16-36, flowers Nemophila integrifolia ( P , H. Timberlake, U.C.R.); $\delta$, V-23-36 (E. G. Linsley, C.I.S.). Vivian Greek Trail, San Bernardino Mountains, $6,600 \mathrm{ft} ., 2$ \&, VI-6-46, flowers Eriodictyon trichocalyx (P. H. Timberlake, U.C.R.).

San Diego Co.: Warner Springs, ס', IV-19-50 (J. W. MacSwain, C.I.S.).

San Luis Obispo Co.: Paso Robles, 28 (L. S. Slevin, C.A.S.).

Santa Clara Co.: Alum Rock Park, $\delta$, 25-50 (J. W. MacSwain, C.I.S.); + , V-27-50 (S. F. Bailey and R. M. Bohart, U.C.D.). Los Gatos, §, VIII-G-33 (J. A. Kusche, C.A.S.). Mt. Hamilton, d, 3 Y, V-25-50 (P. D. Hurd, Jr., C.I.S.).

Shasta Co.: Burney, ס', VI-9-41 (C. W. Anderson, C.I.S.); same locality, 5 mi . E., ㅇ, VI, VI-9-41 (C. W. Anderson, C.I.S.). $2 \delta$, VI-9-41 (C. D. Michener), $\delta$, 8, VI-9-41, flowers Ranunculus (C.I.S.); same locality, 7 mi . E., $\delta$, V-30-52, flowers Phacelia(J. G. Rozen, C.I.S.). Hat Creek (Michener, 1947:304), $\mathcal{P}$, VI-4-41, flowers Phacelia (E. G. Linsley, C.I.S.); same locality, 3 mi . N., ó, VI-1-41 (P. D. Hurd, Jr., C.I.S.); $\delta, 3$ ㅇ, VI-5-41, flowers Phacelia (P. D. Hurd, Jr., C.I.S.). Lassen National Park, $\dot{\delta}$, IX-9-41 (E. C. Van

Dyke, C.A.S.). Mr. Lassen, $\sigma^{2}$, VII-30-47 (R. M. Bohart, G.E.B.); same locality, 6,700 ft., $;$ VI-21 to 22-17 (F. X. Williams, U.C.R.); same locality, 7,000 ft., Y, VII-30-47 (R. M. Bohart, G.E.B.); same loculity, 7,500 ft., $\delta$, VI-22-37 (F. X. Williams, U.C.R.). Nubieber (mountains west of), 5 9, VI-4-38 (E. C. Van Dyke, C.A.S.). (Note: Females from Mt. Lassen and Hat Lake approach argentifrons in subspecific characters.)

Siskiyou Co.: Mt. Bradley, 9 , VII-14 (C. L. Fox, C.A.S.). Mt. Shasta, ${ }^{\top}, \mathrm{V}-29-52$ (J. G. Rozen, C.I.S.). Shasta Springs, $2 \delta^{\prime \prime}$, $q$, VI-20-20 (C. L. Fox, C.A.S.).

Solano Co.: Green Valley, $q$, VI-4-33 (G. E. and R. M. Bohart, G.E.B.); 5 f, VI-9-33, flowers Clarkia elegans and Phacelia (P. H. Timberlake, U.C.R.). Gates Canyon, 8 , V-21-50 (A. T. Mc Clay, U.C.D.).

Stanislaus Co.: Adobe Creek, $\delta$, V-28-48 (R. v. d. Bosch, C.I.S.).

Trinity Co.: Big Flat, Coffee Creek, $\delta^{\prime \prime}$, VI-21-34 (G. E. Bohart, G.E.B., U.C.D.); Y, VI-22-34 (E. C. Van Dyke, C.A.S.). Carrville, 2,400 2,500 ft., $\delta, ~ V-29-34 ~(E . ~ C . ~ V a n ~ D y k e, ~ C . A . S) ;$. ס', VI-11-34. (G. E. Bohart, G.E.B.); Y, VI-22-31 (E. C. Van Dyke, C.A.S.); 2 ㅇ, VI-24-31 (E. C. Van Dyke, C.A.S.). East Fork Trinity River, $\sigma^{\circ}$, V-31-51 (A. T. McClay, U.C.D.). (Note: One female from Big Flat has characters of argentifrons.)

Tulare Co.: Badger, $2 \sigma^{\circ}$, ㅇ, V-26-29, flowers Clarkia elegans and Lonicera interrupta (P. H. Timberlake, U.C.R.). California Hot Springs, 9 , V-3-39, , VI-3-39 (E. C. Van Dyke, C.A.S.). Crabtree Meadow, 9 , VII-20-35 (Evans, K.U.). Giant Forest, ठ̃, VII-22-28 (C. L. Fox, C.A.S.). Kaweah, , VI-1936 (F. T. Scott, U.C.R.). Mineralking, , VIII-2-35 (G. E. Bohart, U.C.D.). Potwisha, Sequoia National Park, 2,000-5,000 ft., б, V-17-20, $\sigma^{\prime}$, V-18-20, 오, V-28-29, 3 ㅇ, VI-13-29 (Michener, 1947:304). Redwood Meadows, ${ }^{\circ}$, VIII-3-23 (C. L. Fox, C.A.S.). Wolverton, Sequoia National Park, 7,000-9,000 fr., Y, VI-13-29 (E. C. Van Dyke, C.A.S.). (Note: The females from Crabtree and Mineralking have characters of argentifrons.)

Tuolumne Co.: Cow Creek, ó, 9, VI-27-37 (E. C. Van Dyke, C.A.S.); ơ, VI-25-51 (A. T. McClay, U.C.D.). Dardanelles, 2 \&, VI-26-51 (E. L. Silvers, U.C.D., U.C.L.A.). Dodge Ridge, $q$, VII-1 5-51 (A. T. McClay, U.C.D.). Mill Creek Camp, + , VII-13-51 (R. C. Bechtel, U.C.D.). Pinecrest, $\hat{o}^{\wedge}$, 우, VII-12-53, $\sigma^{\prime}$, VII-18-53 (J. G. Rozen, C.I.S.); same locality, $5,400 \mathrm{ft.}$,2 d , $\%$, VIII-1-52, flowers Eriogonum (R. R. Snelling).

Sonora Pass, 9,624 ft., 2 J, VI-27-51 (C. A. Downing, C.I.S.); $\delta$, same data (R. W. Morgan, C.I.S.); same locality, $9,000-10,000 \mathrm{ft} ., 9$ VII-16-51 (A. T. McClay, U.C.D.); $\delta$, VII-16-51 (B. Puttler, C.I.S.); 2 б', VII-11-51 (E. L. Silvers, U.C.D., U.C.L.A.); same locality, $10,000-11,000$ ft., ठ, VII-11-51 (B. Puttler, C.I.S.). Strawberry, 7 ठ, 2 Y, VI-18-51, flowers Phacelia (E. G. Linsley, C.I.S.); 3 ठ, VI-18-51 (J. W. MacSwain, C.I.S.); $\delta$, VI-19-51 (S. M. Kappos; U.C.D.); $\delta$, same data (D. P. Lawfer, U.C.D.); $ㅇ$, same data (E. G. Linsley and J. W. MacSwain, C.I.S.); ઠ, same data (Joan Linsley, C.I.S.); $\delta$, same data (B. Puttler, C.I.S.); $2 \delta$, VI-20-51 (E. L. Silvers, U.C.D., U.C.L.A.); 9, VI-21-51 (S. M. Kappos, U.C.D.); 2 ठ, same data (D. P. Lawfer, U.C.D.); $\delta$, same data (A. T. McClay, U.C.D.); $\delta$, VI-22-51 (S. M. Kappos, U.C.D.); 3 , same data (D. P. Lawfer, U.C.D.); 7 , same data (E. G. Linsley and J. W. MacSwain, C.I.S.); $\delta^{\prime}$, same data (A. T. McClay, U.C.D.); $\delta$, VI-23-51 (C. A. Downing, C.I.S.); $\delta$, same data (S. M. Kappos, U.C.D.); $\delta$, same data (R. W. Morgan, C.I.S.); $2 \delta$, same data (E. L. Silvers, U.C.D.); ó, VI-24-51 (E. I. Schlinger, U.C.D); $2 \sigma^{\prime}$, VI-25-51 (A. T. McClay, U.C.D.); $\hat{\delta}$, same data (B. Puttler, C.I.S.); $\delta$, VI-29-51 (S. M. Kappos, U.C.D.); $\delta$, VII-1-51 (J. C. Hall, U.C.D.); $3 \delta_{\text {, VII-4-51 (A. T. McClay, U.C.D.); }}$
 (J. G. Rozen, C.I.S.). Tioga Pass, 4, VII-3-33 (G.E.B.). Tuolumne City, $\delta$, VI-22-53 (J. G. Rozen, C.I.S.). (Note: Females from Mill Camp, Dodge Ridge, Sonora Pass, Dardanelles, Tioga Pass, and Pinecrest have characters of argenti(rons.)

Yolo Co.: Putah Canyon, 2 б, VI-5-49 (R. C. Bechtel, U.C.D.).

Yuba Co.: Camptonville, ơ, VI-24-21 (C.I.S.). Discussion:

This subspecies occurs in cismontane California and southern Oregon at lower altitudes than the subspecies argentifrons. As shown in details elsewhere (Michener, 1947b) it merges with that subspecies on the western slopes of the Sierra Nevada and over broad areas of Oregon and Washington.

Hoplitis louisae (Cockerell) (Pl. 14, fig. 27; pl. 17, fig. 52)

Osmia louisae Cockerell, 1934, Amer. Mus. Novitates, 679:14, 7 . Type 9 , Craters of the Moon, Idaho (Amer. Mus. Nat. Hist.).
Geographic range: British Columbia, Washington,


Map 38. Distributions of Hoplitis louisae (Cockerell) indicated by solid circles, and Hoplitis viridimicans (Cockerell) by open circles.

Oregon, Idaho, California, and Utah (see map 38).

## California records:

Eldorado Co.: Fallen Leaf Lake, $\delta$, VII-15-15 (Michener, 1947:310, U.C.R.).

Lassen Co.: Summit Camp, $\delta$, VI-28-49 (W. H. Wade, K.U.).

Mono Co.: Sardine Creek, 8,500 ft., , VI-28-51 (J. J. Drea).

Nevada Co.: Truckee, 9 , VII-4-27 (E. P. Van Duzee, C.A.S.).

Placer Co.: Lake Tahoe (Michener, 1947:310).
Tuolumne Co.: Sonora Pass, $\sigma^{\prime}$, Y, VII-11-51 (J. W. MacSwain, C.I.S.); 2 \&, same data (R. W. Morgan, C.I.S., K.U.); P, VII-13-51 (J. W. Mac Swain, K.U.).
Discussion:
This is the largest of the green species of Monumetha. Structurally the female is very like the much more common smaller species, fulgida, although the male is abundantly distinct because of the thickened flagellum and other characters (fig. 27). In California this species is found at high altitudes in the Sierra Nevada. Nothing is known of its floral habits.

## Hoplitis viridimicans (Cockerell)

(Pl. 14, fig. 30)
Osmia viridimicans Cockerell, 1897, Proc. Acad.
Nat. Sci. Phila., p. 334, ㅇ. Type 우, Olympia,
Washington (U.S. Nat. Mus.).
Geographic range: Oregon, Washington (see map 38).

Discussion:
This species is not known to occur in California, but since it occurs on the Pacific slope of Oregon and Washington, it very possibly occurs also in northwestern California. No records of its floral visitations are known to us.

## Hoplitis fulgida platyura (Cockerell)

(Pl. 14, fig. 28; pl.17, figs. 51, 53; pl. 18, fig.61)
Osmia platyura Cockerell, 1911, Ann. Mag. Nat. Hist., (8) 8:765, $\sigma$, ㅇ. Type $\sigma$, Claremont, California (U.S. Nat. Mus.).
Synonym: lawae (Michener), 1936.
Geographic range: Oregon, California (see map 39).

California records:
Alpine Co.: Hope Valley, $q$, VII-9-48 (A. Bartel, C.I.S.); $\delta$, same data (C. Chan, U.C.D.);

3 б, 2 Y, same data (C. D. MacNeill, C.I.S.); 3 Y, same data (J. W. MacSwain, C.I.S.); $\mathcal{Y}$, same data (S. A. Sher, C.I.S.); 9 , VII-18-48 (A. Bartel, C.I.S.); $\delta$, same data (D. Carter, C.I.S.); 8 Y, same data (J. W. MacSwain, C.I.S.); $\mathcal{Y}$, same data (O. E. Myers, C.I.S.); O , same data (K. W. Tucker, C.I.S.).

Amador Co.: Clipper Gap, 9 , VI-5-30 (E. C. Van Dyke, C.A.S.).

Contra Costa Co.: Mt. Diablo, ©, IV-24-37 (G. E. and R. M. Bohart, G.E.B.); 2 o', IV-28-39 (M. A. Cazier, U.C.R.).

Eldorado Co.: Camino, 3 mi. S., 9, VI-26-48 (A. Bartel, C.I.S.); Y, VI-26-48, flowers Pbacelia (P. D. Hurd, Jr., C.I.S.); 9, VI-26-48, flowers Eriodictyon (J. W. MacSwain, C.I.S.); 9, VI-26-48 (L. W. Quate, C.I.S.). Echo Lake, $\delta$, VII-21-48 (A. Bartel, C.I.S.); Y, VII-11-51 (W. W. Middlekauff, C.I.S.); same locality, $7,400 \mathrm{ft} ., \delta^{2}, \mathrm{VI}-26-$ 52 (W. W. Middlekauff, C.I.S.); $\delta$, VII-21-48 (K. W. Tucker, C.I.S.). Fallen Leaf Lake, 9, VII1931 (O. H. Swezey, U.C.R.). Pollock Pines, ㅇ, VI-16-52 (E. I. Schlinger, U.C.D.). Pyramid Peak, 8,000 ft., VIII-8-12 (E. C. Van Dyke, C.A.S.). Pyramid Ranger Station, $3 \sigma^{\circ}$, VII-1 2-48 (C. D. MacNeill, C.I.S.). Snowline Camp, $\delta$, VI-20-48 (A. Bartel, C.I.S.); $\delta, ~$, same data (P. D. Hurd, Jr., C.I.S.); Y, same data (J. W. MacSwain, C.I.S.); 9, VI-22-48 (S. A. Sher, C.I.S.); ${ }^{\circ}$, VI-26-48 (P. D. Hurd, J r., C.I.S.); Y, VI-27-48 (A. Bartel, C.I.S.); $\delta$, same data (P. D. Hurd, Jr., C.I.S.); $\delta$, VI- $30-48$ (P. D. Hurd, Jr., C.I.S.); $q$, VII-7-48 (C. Chan, U.C.D.). Strawberry, 9 , VII-1-50 (C. D. Michener, K.U.). Tallac, 6,000 ft., $2 \hat{\sigma}$, (W. M. Giffard, C.A.S.).

Fresno Co.: Huntington Lake, $\delta$, VIl-7-19, 9 , VII-15-19(F. E. Blaisdell, C.A.S.); 2 o, 9, VII-17 (I. McCracken, L.S., Jr., U.).

Inyo Co.: Big Pine, $\delta$, VI-20-37 (W. C. Reeves, U.C.R.). Big Pine Creek, 7,500 ft., ot, ㅇ, VI-1242 (R. M. Bohart, G.E.B.). Glacier Lodge, Big Pine, $\delta$, VI-20-37 (W. C. Reeves, U.C.R.); $4 \delta^{\prime}$, f. VI-23-37 (E. C. Van Dyke, C.A.S., K.U.). Bishop Creek, 2 §, 5 \&, VI-22-37 (N. W. Frazier, U.C.R.); ठ, VI-22-37 (C. D. Michener, K.U.). Lone Pine, $\delta$, VI-22-37 (C.I.S.).

Lake Co.: Cobb Mountain, $2 \delta^{\sigma}$, V-7-36 (R. M. Bohart, U.C.D., U.C.L.A.).

Lassen Co.: Bridge Creek Camp, 9 , VII-9-49 (R. C. Bechtel, U.C.D.); Y, same dara (D. Cox, U.C.D.). Hallelujah Jct., ㅇ, VII-4-49 (L. W. Isaak, U.C.D.). Summit Camp, ó, VI-28-49 (A. S. Deal, U.C.D.); $\delta$, + , same data (W. F. Ehrhardt, U.C.D.); 2 o', same data (J. W. MacSwain, K.U.); 2 §, $\%$, same data (F. Morishita, U.C.D.). Susan


Map 39. Distribution of Hoplitis fulgida (Cresson), the subspecies fulgida indicated by solid circles, and the subspecies platyura by open circles.

River Camp, $\delta$, VII-10-49 (E. L. Atkinson, C.I.S.).
Los Angeles Co.: Acton, $\delta$, IV-10-36 (E. G. Linsley, C.I.S.). Aliso Canyon, ס, V-3-31 (C. D. Michener, K.U.). Altadena, $\mathcal{A}$, IV-18-35, flowers Phacelia ramosissima (C. D. Michener, K.U.); $\delta$, V-11-15, flowers Phacelia tanacetifolia (C. D. Michener, K.U.); ㅇ, same data (P. H. Timberlake, U.C.R.). Big Pines Camp, 7,300 ft., 3 ㅇ, VII-1427, flowers Sphaeralcea fasciculatum (P. H. Timberlake, U.C.R.); 2 Y, VII-16-27, flowers Pbacelia beterophylla (P. H. Timberlake, U.C.R.). Griffith Park, 4 ©', IV-5-36, flowers Nemophila (E. G. Linsley, C.I.S.). Pasadena, ס, IV-10-33 (C. D. Michener, K.U.). Puente Hills, , V-10-36, flowers Phacelia distans (P. H. Timberlake, U.C.R.). Swartout Valley, ס, $ㅇ$, VI-3-28, flowers Phacelia beteropbylla (P. H. Timberlake, U.C.R.). Tanbark Flat, San Dimas Experimental Forest, 9, VI-20-50 (K. G. Whitesell, U.C.D.); 2 \&, VI-21-50 (D. C. Blodget, U.C.D., U.C.L.A.); ㅇ, VI-22-50 (R. O. Schuster, C.I.S.); ${ }^{\text {P, VII-1-50 (H. L. }}$ Hansen, K.U.); $q$, VI-23-52 (R. L. Anderson, U.C.D.).

Madera Co.: Bass Lake, $\sigma^{\prime}$, III-6-38 (N. F. Hardman, C.I.S.); 2 o, , , VI-6-38 (R. M. Bohart, G.E.B.). Oakhurst, $\delta$, $9, V-19-42$ (E. G. Linsley, C.I.S., U.C.R.); $\delta$, V-1 9-42, flowers Mimulus (G. E. Bohart, G.E.B.); $\delta, 2$ ㅇ, VI-1-42 (E. G. Linsley, U.C.R.). San Joaquin Experimental Range, near O'Neals, 2 ㅇ, IV-18-53, flowers Nemophila maculata (P. D. Hurd, Jr., C.I.S.).

Mariposa Co.: El Portal, $\bar{\sigma}, \mathrm{V}-18-38$, flowers Trifolium (R. M. Bohart, G.E.B.). Fish Camp, $\sigma^{\prime}$, V-10-42 (E. G. Linsley, U.C.R.). Indian Flats, f, V-23-38 (J. R. Warren, U.C.R.). Pohono Trail, Yosemite, $\delta^{\prime}$, VI-26-26 (P. H. Timberlake, U.C.R.). Yosemite, $\widehat{\delta}, \mathrm{V}-23-38$, flowers Cryptantha (R. M. Bohart, U.C.D.); $\delta$, V-25-38 (U.C.D.). Yosemite Valley, $\delta$, VII-5-21 (E. C. Van Dyke, C.A.S.).

Mendocino Co.: Ryan Creek, $\delta$, , $\mathrm{C}, \mathrm{V}-30-49$ (R. Craig, C.I.S.).

Modoc Co.: Paynes Ranch, 9, V1-15-34 (Michener, 1947:308, C.A.S.).

Mono Co.: Coleville, $4 \delta^{\sigma}$, V-28-39 (T. H. G. Aitken, M. A. Cazier, J. A. Downes, P. C. Ting, U.C.R.). Leavitt Meadows, 7 ס', VI-26-37 (N. W. Frazier, U.C.R.). Mammorh, P , VII-5-34 (G.E.B.). Mono Lake, ${ }^{\prime}$ ', VI-15-17 (Michener, 1947:308, C.A.S.).

Nevada Co.: Hobart Mills, 4 mi . N.W., 9 , VI-5-51 (R. C. Bechtel, U.C.D). Truckee, ס, VI-13-27, 2 б, VI-14-27, ㅇ, VI-15-27, 2 ㅇ, VI-17-27, ㅇ, VI-20-27, $\sigma, 2$ ㅇ, VI-21-27 (E. P. Van Duzee, C.A.S.).

Placer Co.: Alta, $\delta$, $\mathcal{Y}$, VI-25-33 (G. E. and
R. M. Bohart, G.E.B.). Angora Lake, Tahoe, $\delta^{\prime}$, 2 و. VII-4-15 (E. P. Van Duzee, C.I.S.). Colfax, $2 \delta$, V-20-52 (R. M. Bohart, U.C.D.); $\delta$, same data (J. C. Hall, U.C.D.); $2 \delta$, $\%$, same data (E. I. Schlinger, U.C.D.). Emigrant Gap, 3 ठ', VI-2637 (M. A. Cazier, U.C.R.). Gold Run, Y, VI-1838 (M. A. Embury, U.C.R.). Lake Forest, Lake Tahoe, 2 Y, VII-16-49 (E. G. Linsley, C.I.S.). Lake Tahoe, 6,225 ft., 2 \&, VII-17-49 (E. G. Linsley, C.I.S.). Lake Tahoe, P , VI-1-36 (R. M. Bohart, G.E.B.). Summit, 7,000 ft., 3 ס', (W. M. Giffard, C.A.S.).

Plumas Co.: Bucks Lake, 3 o', VI-23-49 (A. S. Deal; U.C.D.); $\delta$, same data (J. W. MacSwain, C.I.S.); $\delta$, same data (F. Morishita, C.I.S.); $\delta$, same data (C. I. Smith, C.I.S.); $\delta$, VII-1-49 (E. I. Schlinger, U.C.D.). Lake Almanor, $\dot{+}, \mathrm{VI}-28-4 \mathrm{C}$ (J. W. MacSwain, C.I.S.); 3 , VII-8-49 (R. C. Bechtel, U.C.D.). Meadow Valley, 3,000-4,000 ft., ठ', 9, VI-7-24 (E. C. Van Dyke, C.A.S.); same locality, 4,000-5,000 ft., ㅇ, VI-7-24 (E. C. Van Dyke, C.A.S.). Onion Valley, + , VII-7-49 (E. I. Schlinger, U.C.D.). Quincy, 4 mi. W., 6 б', ㅇ, VI-23-49 (J. W. MacSwain, C.I.S.); + , VI-2549 (F. Morishita, C.I.S.); ¢ VI-29-49 (J. W. MacSwain, C.I.S.); 2 9, VI-30-49 (W. F. Ehrhardt, U.C.D.); + , VI-30-49, flowers Phacelia (P. D. Hurd, Jr., C.I.S.); $\sigma$, VI-30-49 (W. R. Schreader, U.C.D.); $\delta^{\top}$ ) 9 , VII-1-49 (J. W. MacSwain, C.I.S.); б', VII-2-49 (J. W. MacSwain, C.I.S.).

Riverside Co.: Banning, $9, \mathrm{~V}-28-28$, $9, \mathrm{~V}-17-$ 41 (E. C. Van Dyke, C.A.S.). Corona, ${ }^{\top}$, IV-1912 (C.I.S.). Idyllwild, $\delta^{\prime}$, VI-10-39 (E. G. Linsley, C.I.S.); $\delta$, V-20-39, flowers Cryptantha (E. G. Linsley, C.I.S.). Keen Camp, San Jacinto Mountains, , VI-5-39 (B. Brookman, C.I.S.). Ribbonwood, San Jacinto Mountains (Michener, 1947: 308); ठ', V-20-39 (E. G. Linsley, C.I.S.); 2 \&, V-20-39, flowers Collinsia (E. S. Ross, C.I.S.). Riverside, , IV-7-30, 9, IV-3-34, 2 7, IV-16-36, flowers Phacelia distans (P. H. Timberlake, U.C.R.); $9, \mathrm{~V}-12-36$, flowers Cryptantha inter media (P. H. Timberlake, U.C.R.). Temecula, ㅇ, IV-11-50 (W. F. Barr, U.I.); 2 d, ㅇ, same data (P. D. Hurd, Jr., C.I.S.) ; $\delta$ ', 9 , IV-18-50 (J. W. MacSwain, C.I.S.); ㅇ, IV-24-51 (E. I. Schlinger, U.C.D.). The Gavilan, $\delta$, III-19-36, flowers Rhus trilobata (P. H. Timberlake, U.C.R.); ס', IV-27-38, ㄱ, IV-20-39, ס, IV-6-50, ठ', IV-10-50, $\boldsymbol{\sigma}^{2}$, ㄱ, IV-16-50,, , IV-16-52, flowers Cryptantha intermedia (P. H. Timberlake, U.C.R.); $\bar{\sigma}$, IV-18-37 (E. G. Linsley, C.I.S.); ㅇ, V-8-50, flowers Mentzelia albicaulis (P. H. Timberlake, U.C.R.); \&, IV-16-50, flowers Marrubium vulgare (P. H. Timberlake, U.C.R.). Vandevanter Flat, San Jacinto

Mountains，${ }^{\text {P，VI－11－39（E．S．Ross，C．I．S．）．}}$
San Benito Co．：Pinnacles National Monument，个，V－3－46（P．D．Hurd，Jr．，C．I．S．）；ठ̄，IV－24－48， flowers Phacelia（P．D．Hurd，Jr．，C．I．S．）； 2 ठ， IV－24－48（J．W．MacSwain；C．I．S．）．

San Bernardino Co．：Big Bear Valley，ó，VI－ 10－33（C．M．Dammers，U．C．R．）．Crestline（near）， 3 ó， 3 ＋，V－13－34，flowers Nemophila Menziesii var．integrifolia（P．H．Timberlake，U．C．R．）．Mill Creek，San Bernardino Mountains， $9, V-30-38$ ， flowers Phacelia distans（P．H．Timberlake， U．C．R．）．Morongo Valley（Michener，1947：308）． Seven Oaks，San Bernardino Mountains， $3 \sigma^{\top}$ V－ 30－36（W．C．Reeves，U．C．R．）．Tetley Mountain Camp，San Bernardino Mountains， $9, V-16$ ，flowers Nemophila（C．D．Michener，K．U．）．Tetley Park， 3 个，V－10－36，$\delta, ~ V-16-36,2$ ，${ }^{\prime}$ ，VI－23－36，flowers Nemophila Menziesii var．integrifolia（P．H． Timberlake，U．C．R．）； 2 ㅇ，V－23－36，flowers Potentilla（E．G．Linsley，C．I．S．）．

San Diego Co．：Cuyamaca，ㅇ，IV－20－50（J．W． MacSwain，K．U．）．Warner Springs，IV－20－50， flowers Cryptantba intermedia（P．H．Timberlake， U．C．R．）．

San Luis Obispo Co．：Atascadero， $4 \delta^{\prime}$, IV－26－ 19 （E．P．Van Duzee，C．A．S．）．Paso Robles，+ V－24－28（L．S．Slevin，C．A．S．）．

Santa Clara Co．：Calero Reservoir near Coyote， б，IV－5－52（L．Gunter）．

Shasta Co．：Hat Creek，$\delta$ ，VI－1－41（C．D． Michener，C．I．S．）；same locality， 3 mi. N．， $2 \sigma^{\sigma}$ ， VI－5－41，flowers Phacelia（P．D．Hurd，Jr．， C．I．S．）．Lassen National Park，7，000 ft．， 2 б＇， VII－30－47（R．M．Bohart，G．E．B．，U．C．D．）．Round Mountain，$\delta$ ，V－23－46（R．M．Bohart，U．C．D．）． Summit Lake，Mr．Lassen，6，700 ft．，$\delta$, ，+ Vi－21 to 22－37（F．X．Williams，U．C．R．）．Mt．Lassen， 7，000 ft．，$\delta$ ，VII－30－47（R．M．Bohart，G．E．B．）．

Sierra Co．：Gold Lake，${ }^{+}$，VII－10－21，$\sigma^{\top}$ ，VII－
 15－21，$\delta$, VII－18－21，$\delta^{\prime}$ ，VII－19－21，$\delta^{*}$ ，VII－20－21， 4 б＇， 6 个，VII－26－21（C．L．Fox，C．A．S．）．Sierra－ ville， 12 mi ．S．E．，$\delta^{\prime}$ ，VII－4－53（U．C．D．）．

Siskiyou Co．：Shasta Springs， $2 \delta$ ，q，VI－6－20 （C．L．Fox，C．A．S．）．Weed，${ }^{\text {Y，VI－13－36（I．Mc }}$ Cracken，C．A．S．）．

Sonoma Co．：The Geysers，$\delta$ ，VI－3－38（E．C． Johnson，C．A．S．）．

Stanislaus Co．：Turlock，$\delta$ ，IV－9－36（G．E．and R．M．Bohart，G．E．B．）；$\delta$ ，V－10－52，flowers Pha－ celia（R．R．Snelling）．

Trinity Co．：Big Flat，Coffee Creek， 9 ，VI－ 21－34（G．E．Bohart，G．E．B．，U．C．R．）．Carrville， 2，400－2，500 ft．，ㅇ，V－30－34（G．E．B．）；ㅇ，VI－11－34 （E．C．Van Dyke，C．A．S．）．Zenia，ס＇，VI－19－35 （H．J．Rayner，G．E．B．）．

Tulare Co．：Alta Meadows，Giant Forest， 9，100 ft．，$\delta^{\top}$ ，VII－19－26（C．L．Fox，C．A．S．）．Giant Forest，$\delta$ ，VII－11－23，ㅇ，VII－26－23（C．L．Fox， C．A．S．）．Lemoncove，ठ，IV－14－50，flowers Phacelia （E．G．Linsley，C．I．S．）．Redwood Meadows， Sequoia National Park， 2 ठ́，VIII－3－23（C．L．Fox， C．A．S．）．Sequoia National Park，+ ，IV－24－49（R． C．Bechtel，U．C．D．）．Woodlake，$\delta^{\prime}, \mathrm{X}-15-51$ ， flowers Centromadia（E．G．Linsley，C．I．S．）．

Tuolumne Co．：Cow Creek，ठ＇，VI－27－37（E．C． Van Dyke，C．A．S．）；${ }^{\prime}$ ，VI－24－51（E．I．Schlinger， U．C．D．）．Dodge Ridge， Y，VII－13－51（E．J．Taylor， U．C．D．）； 9, VII－19－51（A．T．McClay，U．C．D．）． Pinecrest，$\delta$ ，VII－12－53（B．L．Rozen，C．I．S．）； む，VI－19－53， 3 б，VII－12－53，ס，ㅇ，VII－18－53（J． G．Rozen，C．I．S．）；same locality， $5,400 \mathrm{ft} ., \delta$ ， VI－1 9－51，flowers Nemophila（R．R．Snelling）； o＇，VI－19－51，flowers Mimulus（J．I．Stage）．Sonora Pass，10，000 ft．，P，VII－11－51（J．＇W．MacSwain， C．I．S．）．Strawberry，$\delta$, VI－18－51（J．W．MacSwain， C．I．S．）； 2 §，VI－19－51（S．M．Kappos，U．C．D．）； J，VI－20－51（S．M．Kappos，U．C．D．）； 3 ס，VI－21－51 （D．P．Lawfer，U．C．D．）；$\delta$ ，same data（R．W． Morgan，C．I．S．）； $2 \delta^{\prime}$ ，same data（E．L．Silvers， U．C．D．）； 9, VI－22－51（S．M．Kappos，U．C．D．）； 5 $\delta^{\prime}$ ，same data（D．P．Lawfer，U．C．D．）；$\delta$ ，same data（R．W．Morgan，C．I．S．）； 3 §，VI－23－51（C．A． Downing）； ，same data（S．M．Kappos，U．C．D．）； $\delta, 2$ ，, same data（D．P．Lawfer，U．C．D．）；${ }^{\prime}$ ， VI－29－51（S．M．Kappos，U．C．D．）；$\delta$ ，same data （J．W．MacSwain，C．I．S．）；ㅇ，VII－8－51（S．M． Kappos，U．C．D．）；$\delta$ ，VII－9－51（D．P．Lawfer， U．C．D．）； 9, VII－14－51（J．W．MacSwain，C．I．S．）． Strawberry Lake， 9, VI－23－51（J．W．MacSwain， C．I．S．）．Tioga Pass，$\delta$ ，VI－3－33（G．E．and R．M． Bohart，G．E．B．）；ㅇ，VII－3－33（G．E．and R．M． Bohart，G．E．B．）．

Ventura Co．：Frazier Park， $2 \delta^{\top}$, V－18－40（R． M．Bohart，U．C．D．，U．C．L．A．）．

Yuba Co．：Ca mptonville，${ }^{\circ}$ ， 9 ，VI－24－21（C．I．S．）． Discussion：

This is the California subspecies of the wide－ spread and common western bee，Hoplitis fulgida （Cresson）．In southern Oregon，the intergradation with fulgida proper occurs．In California，platyura occurs in all regions except the deserts and the Great Valley，and even reaches the desert mar－ gins as at Morongo Valley，San Bernardino County． It has been collected from near sea level to 10,000 feet altitude，appearing in March at lower altitudes and in May at higher altitudes，flying through July and even into August and September．

In addition to the floral records enumerated above，platyura has been reported by Michener （1947：308）to visit the flowers of Lappula sp． and Stachys californica．The nominate subspecies
has been taken on flowers of Gentiana parryi, Geranium caespitosum, Fragaria vesca, Potentilla, Rosa, and Rubus deliciosus (Michener, 1947a, ibid.). Other records obta ined during the preparation of the present paper include: Prunus melanocarpa (Florissant, Colorado), Geranium (Rock Creek R.S., Minadoka N.F., Idaho), Allium diehlii, Convolulus, Phacelia leucophylla, P. linearis, and Ranunculus (Logan, Utah).

## Genus Anthocopa Lepeletier

Like Hoplitis, Anthocopa is a rather large genus of bees. It is divisible into several subgenera, three of which occur in North America. Others are found in Eurasia and even Africa. In the Western Hemisphere, most of the 26 known species occur in California, and none are known east of the Great Plains. The limited distribution of Anthocopa in America and the great diversity in Eurasia suggest an Old World origin for Anthocopa.

Anthocopa consists of robust bees having the form of Osmia, from which they differ by the linear parapsidal lines, the presence of a carina (often weak) along the inner ventral angle of each hind coxa, and the usually nonmetallic coloration. Confusion between Anthocopa and Hoplitis is easy, particularly among the Old World groups, and the continued recognition of Anthocopa as a separate genus will probably
prove impossible. However, if Anthocopa is placed with Hoplitis, the same treatment for Proteriades and Ashmeadiella may seem logical, although it would be unfortunate, since these are well-marked groups of rather large size. Anthocopa differs from Hoplitis principally by the broadly concave anterior surface of the first metasomal tergum, the sculpturing of this surface changing abruptly at an impressed line or feeble carina to the coarser sculpturing of the dorsal surface. In Anthocopa the sixth metasomal tergum is ordinarily not toothed at the sides.

The American species of Anthocopa were revised by Michener (1943). One of the subgenera, Xerosmia, then included in Anthocopa has been transferred to Proteriades. In 1943 it was suggested that the common characters exhibited by Xerosmia and Proteriades result from convergence; now that more is known about Proteriades it is obvious that they indicate close relationship and that Xerosmia is an integral part of Proteriades.

Nesting habits of American species of Anthocopa are entirely unknown. The flower-visiting behavior is comparatively well known, however. Thus the subgenus Eremosmia contains one group which collects pollen from Compositae, whereas the others collect from Hydrophyllaceae and Leguminosae; Atoposmia uses Penstemon, and Hexosmia uses Hydrophyllaceae such as Nemophila and Pbacelia.

Key to the American Subgenera of Antbocopa

## Males

1. Mouth parts, when folded, hardly reaching fore coxae . . . . . . . . . . . . 2

Mouth parts long, when folded reaching well behind anterior coxae. (Posterior coxae with carina along inner ventral angle feeble) . . . . . . . . . . . Atoposmia (p. 96)


## Females

1. Mouth parts shorter, in repose scarcely reaching anterior coxae . . . . . . . . . 2

Mouth parts long, in repose reaching well behind anterior coxae. (Posterior coxae with carina along inner ventral angle feeble.) . . . . . . . . . . . . . Atoposmia (p. 96)
2(1). Body with feeble metallic luster; posterior coxae with inner ventral carinae weak . . .
Hexosmia (p. 107)
Body nonmetallic; posterior coxae each with strong carina along inner ventral angle .


Plate 8. Lateral view of Antbocopa copelandica albomarginata (Cockerell), male.

## Subgenus Atoposmia Cockerell

This subgenus may be distinguished by the elongate mouthparts from all other American subgenera of Anthocopa. The reason for the elongation is not entirely evident, since these bees usually crawl into the rubular flowers of Penstemon, which they often visit in association with species of other groups (e.g., Osmia) which do not have unusually elongate mouthparts. The situation is comparable to that of the seemingly needlessly long mouthparts of the species of

Hoplitis (colei) and Chelostoma (cockerelli)which visit Eriodictyon.

Atoposmia is the most difficult group of Anthocopa. It is made particularly difficult by the rarity of many of the species in collections, owing, perhaps, in part, to their early seas on of activity at very high altitudes and in part, perhaps, to actual scarcity in nature. Most species of this subgenus occur in the higher mountains; none inhabit the desert except an undescribed species known from a single specimen.

## Key to the California Species of Atoposmia

## Males

1. Posterior margin of third metasomal sternum with a more or less strong emargination, if shallow, made conspicuous by the fringe which is long laterally so that the apical margin of the fringe is strongly emarginate
Posterior margin of third metasomal sternum with a but feebly emarginate, fringed median section
panamintensis (p. 103)
2(1). Posterior basitarsi about 2.5 times as long as broad; punctation of face, vertex, and dorsum of thorax fine, without interspaces between punctures in most areas. . . bebitis (p. 107)
Posterior basitarsi 3 to 4 times as long as broad; punctation coarser, with interspaces between punctures
3(2). Maxillary palpi five-segmented, fully as long as first segment of labial palpi; lateral margins of sixth metasomal tergum usually but feebly convex or slightly sinuate
Maxillary palpi apparently four-segmented, much shorter than first segment of labial palpi; lateral margins of sixth metasomal tergum convex. . . . . . . pycnognatha(p. 106)
4(3). Truncation of clypeus not produced, usually more than three times as long as distance from end of truncation to lateral angle of clypeus
Truncation of clypeus slightly produced, but little longer than distance from end of truncation to lateral angle of clypeus
elongata (p. 103)
5(4). Seventh metasomal tergum with lateral lobes exceeding median tooth
Seventh metasomal tergum with median tooth exceeding lateral lobes - anthodyta (p. 99),oregona (p. 101)

6(5) Punctures of upper posterior parts of genal areas finer, or at least closer, than those of middle of vertex; emargination of third metasomal sternum about half as wide as total width of sternum along exposed posterior margin
.triodonta (p. 103)
Punctures of upper posterior parts of genal areas neither finer nor closer than those of middle of vertex; emargination of third metasomal sternum less than half as wide as total width of sternum . . . . . . . . . . . . . . . . . . . . . abjecta (p. 97)

## Females

1. Mandibles tridentate (as in pl. 19, fig. 75); apex of clypeus simple or slightly sinuate. . 2 Mandibles quadridentate as a result of distad projection of the subapical dorsal swelling (pl. 19, fig. 72); apex of clypeus with a small, deep, median emargination between a pair of submedian teeth.
panamintensis (p. 103)

|  | Face, vertex, and dorsum of thorax finely and closely punctate with no interspaces between punctures; hind basitarsi closely punctured, dull, 2.3 times as long as broad. orsum of thorax rather coarsely punctate with distinct interspaces between punctures; hind basitarsi shining, 2.5 to 3 times as long as broad |
| :---: | :---: |
| 3(2) | Maxillary palpi about equal in length to first segment of labial palpi, five-segmented; mandibles at least slightly more than three times as long as shortest. width . <br> Maxillary palpi shorter than first segment of labial palpi, apparently four-segmented; mandibles about three times as long as shortest width . . . . . . . pycnognatha (p. 106) |
| 4 | Cheeks finely and densely punctate, more finely so above than middle of vertex, and furnished with numerous rather short, depressed, anteriorly directed hairs (which are inconspicuous if dark in color); clypeus closely punctate, punctures about as fine as those of frons. <br> Cheeks as coarsely punctate as or more coarsely punctate than vertex, punctures not dense, pubescence sparse and less depressed than in above; clypeus usually more coarsely and less closely punctate than frons |
|  | Scopa long, hairs of second metasomal sternum usually about twice as long as sternum Scopa short, hairs of second metasomal sternum little if at all longer than sternum |
| 6 | Mandible less narrowed medially, its width at narrowest point about one-third of length of mandible along lower margin <br> Mandible much narrowed medially, its width at narrowest point about one-fourth of length of mandible along lower margin (pl. 19, fig. 71) |
| 7(6). | Coarsely punctured portion of mesoscutum extending nearly to parapsidal lines . $\begin{array}{r} \text { abjecta }(\mathrm{p} . \\ \text { elongata }(\mathrm{p} .103) \end{array}$ |

## Anthocopa abjecta (Cresson)

Osmia abjecta Cresson, 1878, Trans. Amer. Ent. Soc., 7:103, ㄱ.
Geographic range: California, Colorado, Oregon, Utah, and Wyoming (see map 40).
Discussion:
A. abjecta can be distinguished from other Atoposmia by the coarsely punctured mesoscutum,
the central part with the punctures separated by two or more puncture widths in most individuals, the coarse and rather widely separated punctures extending out virtually to the parapsidal lines in females. A. anthodyta and oregona also have coarsely punctured mesoscuta but the punctures are closer; both also have noticeably more narrowed mandibles in the females.

## Key to the Subspecies of Antbocopa abjecta

1. Scopa black or reddish black; metasomal terga with black or dark fuscous hairs in both sexes

Scopa light brown; metasomal terga without black hairs and with but little fuscous hair .
alta (p. 99)


Map 40. Distribution of Anthocopa abjecta (Cresson), the subspecies abjecta indicated by solid circles, and the subspecies alta by open circles.

## Anthocopa abjecta abjecta (Cresson)

Osmia abjecta Cresson, 1878, Trans. Amer. Ent. Soc., 7:103, 9. Type 9 , "Colorado" (Acad. Nat. Sci. Phila.).
Synonymy: mesae (Cockerell), 1930; nigrior Michener, 1943, + , not $\delta^{\prime}$.
Geographic range: California, Colorado, Oregon, Utah, and Wyoming (see map 40).
California records:
Mono Co.: Blanco's Corral, White Mountains, $10,000 \mathrm{ft} ., \delta^{\prime \prime}, \mathrm{VI}-30-53$ (S. Mitoma, C.I.S.); $2 \delta^{\prime \prime}$, VII-5-53 (H. Nakakihara, C.I.S.); $\uparrow$, VII-7-53 (J. W. MacSwa in, C.I.S.); Y, VII-8-53 (H. Nakakihara, C.I.S.). Cottonwood Creek, White Mountains, 10,000 ft., $\delta$, VII-14-53 (J. W. MacSwain, C.I.S.). Discussion:

This subspecies has been found in California only in Mono County, but is widespread in Oregon and eastward to the Rocky Mountains. It may well occur in northern California. As explained under alta, California specimens show an approach to alta in their characters and might be included in that subspecies except for the brownish black scopa of the females.

## Anthocopa abjecta alta (Michener)

Osmia alta Michener, 1936, Canad. Ent., 68:41, ㅇ. Type 9 , Garnet Lake, California, elevation $10,000 \mathrm{ft}$. (Univ. Kansas).
Geographic range: California (see map 40).
California records:
Eldorado Co.: Echo Lake, 7,400 ft., Y, VI-26-52 (W. W. Middlekauff, C.I.S.). Mt. Tallac, + VII-22-31 (O. H. Swezey, U.C.R.).

Inyo Co.: Argus Mountains, $9, \mathrm{~V}-22-37$ (E. C. Van Dyke, K.U.). Lone Pine Canyon, ㅇ, VI-1940 (I. McCracken, K.U.); same locality, 8,500 ft., d, 9 , VI-11-37 (Michener, 1943:59, K.U.). Mountain Springs Canyon, Argus Mountains, + , V-22-37 (C. D. Michener, K.U.).

Lassen Co.: Summit Camp, $2 \sigma^{\top}$ VI-28-49 (R. C. Bechtel, U.C.D.); $5 \delta^{\lambda}$, $\uparrow$, same data (A. S. Deal, K.U., U.C.D.); $\delta$, same data (F. Morishita, K.U.); O, same data (C. I. Smith, C.I.S.); $\delta^{2}$, VII-9-49 (C. I. Smith, C.I.S.).

Mono Co.: Leavitt Meadows, $\&$, VII-6-51 (A. T. McClay, U.C.D.); $\sigma^{\prime}$, VI-28-51 (J. W. MacSwain, C.I.S.). Mammoth Lakes, $\delta$, VII-27-33 (G. E. and R. M. Bohart, G.E.B.).

Nevada Co.: Hobart Mills, 4 mi. N.W., $\delta, 9$, VII-5-51 (E. I. Schlinger, U.C.D.). Truckee, $\sigma^{\circ}$, VII-5-27 (E. P. Van Duzee, C.A.S.).

Placer Co.: Brockway, ó, VII-1941 (G. E. Bohart, G.E.B.).

Plumas Co.: Bucks Lake, ${ }^{\top}$, VII-1-49 (W. R. Schreader, U.C.D.). Quincy, 4 mi . W., 9 . VI-3049 (E. I. Schlinger, C.I.S.); đ, VII-2-49 (W. R. Schreader, U.C.D.).

Sierra Co.: Gold Lake, $2 \delta, \quad$, VII-31-21 (Michener, 1943:59, C.A.S., K.U.); 3 ठ, VII-10-21, $2 \delta$, VII-20-21, $\delta$, VII-26-21 (C. L. Fox, C.A.S.).

Tulare Co.: Crabtree Meadow, $\delta$, VII-20-35 (G. E. Bohart, G.E.B.). Mineralking, ㅇ, IX-3-33 (C. D. Michener, K.U.); 2 , VIII-5-35 (G. E. Bohart, G.E.B., K.U.). White Chief, Mineralking, $4,000 \mathrm{ft} ., \delta$, VIII-1-23 (C. L. Fox, C.A.S.).

Tuolumne Co.: Sonora Pass, 9,624 ft., 7, VII-13-51 (S. M. Kappos, K.U.); same locality, 9,000$10,000 \mathrm{ft} .$, ,, VII-16-51 (A. T. McClay, U.C.D.). Strawberry, $\mathrm{P}, \mathrm{VI}-29-51$ (J. W. MacSwain, C.I.S.). Discussion:

This form is evidently a pale California subspecies of abjecta. The population from the White Mountains, Mono County, shows this especially well. Although it has been placed in abjecta proper, specimens have much less black hair, especially on the terga of both sexes, than do specimens from the Rocky Mountains (see Michener, 1954a). The placement of alta as a subspecies of abjecta is supported by the fact that specimens of alta from Lassen County, California, have abundant fuscous pubescence between the metasomal fasciae. This pubescence is largely pale in most specimens from more southern localities in California. In Oregon typical abjecta occurs, and ranges thence to Wyoming and Colorado. The situation is complicated by two males from Mount Hood, Oregon, which appear to be alta. It is further complicated by the record of alta from Pagosa Junction, Colorado (Michener, 1949a). Presumably these Oregon and Colorado records of alta are based on unusual specimens of the populations of abjecta proper from those regions or on local pale populations within the range of the generally dark abjecta proper.

## Antbocopa anthodyta anthodyta Michener (Pl. 19, fig. 71; pl. 20, fig. 83)

Anthocopa (Atoposmia) anthodyta Michener, 1943, Ann. Ent. Soc. Amer., 36:60, $\delta$, ㅇ. Type ㅇ, Lone Pine Canyon, Inyo County, 8,500 ft. (Calif. Acad. Sci.).
Geographic range: California, Idaho, Lower California, Oregon (another subspecies, bequaerti


Map 41. Distribution of Anthocopa anthodyta Michener, the subspecies antbodyta indicated by solid circles, and the subspecies bequaerti by open circles.

Michener, occurs in southern Arizona). (See map 41.)
California records:
Inyo Co.: Lone Pine Canyon, $8,500 \mathrm{ft} ., 4 \mathrm{\delta}_{\text {, }}$ 7 O, VII-11-37 (Michener, 1943:61, K.U.). Mt. Whitney, $\delta$, ㅇ, VII-12-37 (Michener, 1943:61, G.E.B.).

Lassen Co.: Bridge Creek Camp, ${ }^{\text {T, VII }}$ V-49 (J. W. MacSwain, C.I.S.). Summit Camp, 3 㛡, 오, VI-28-49 (J. W. MacSwain, C.I.S., K.U.); $\delta$, same data (C. I. Smith, C.I.S.); ${ }^{\text {d, }}$ VII-9-49 (P. D. Hurd, Jr., C.I.S.).

Los Angeles Co.; Crystal Lake, $\mathrm{P}, \mathrm{VI}$-29-50 (W. C. Bentinck, K.U.); ㅇ, same data (T. R. Haig, C.I.S.); 2 f, same data (J. W. MacSwain, C.I.S.).

Nevada Co.: Truckee, 아, VII-4-27 (E. P. Van Duzee, K.U.).

Riverside Co.: Piñon Flat, San Jacinto Mountains, ${ }^{\text {f, V-18-39 (T. E. Laningham, C.I.S.). }}$ Ribbonwood, San Jacinto Mountains, $P$, V-21-40 (C. D. Michener, K.U.).

San Bernardino Co.: Big Bear Valley, ठ, 3 아, VII-4-34, flowers Penstemon palmeri (P. H. Timberlake, U.C.R.). Mill Creek, San Bernardino Mountains, 7 ㅇ, VI-20-36, $\delta$, VI-6-37, 9 d, 6 ㅇ, VI-20-37, 우, VI-27-37, $\delta$ ', 6 우, VI-26-38, 우, VIII-30-40, 오, VII-2-44, 2 오, VI-14-47, $\boldsymbol{\sigma}^{2}$, ㅇ, VII-3-49, ㅇ, VI-20-50, flowers Penstemon grinnellii (Michener, 1943:61, K.U., U.C.R.). Snow Crest Camp, ㅇ, VII-7-S2 (R. M. Bohart, U.C.D.).

Shasta Co.: Mr. Lassen, 7,500 ft., $\mathrm{\delta}^{7}$, VII-18-49 (E. L. Atkinson, C.I.S.).

Tuolumne Co.: Sonora Pass, 10,000-11,000 ft., §, VII-11-51 (J. W. MacSwain, C.I.S.).

Ventura Co.: Frazier Park, $\delta, 2$ ㅇ, V-18-40 (R. M. Bohart, K.U., U.C.D., U.C.L.A.). Discussion:
A. anthodyta superficially resembles $A$. abjecta alta, differing in the usually paler scopa (pale yellowish in anthodyta, usually quite brown in alta) and the closer punctation of the disc of the mesoscutum, the punctures being separated by less than a puncture width. The much narrowed mandibles of the female are characteristic of anthodyta and close relatives (pl. 19, fig. 71), but differ from abjecta. In A. anthodyta the length of the female mandible along its lower margin is about four times its breadth at the narrowest point. This is also true of oregona, and the mandible of panamintensis is nearly as narrow. Other species have the mandible of the female less conspicuously narrowed, and its length little if any more than three times its breadth at the narrowest point.

A useful feature in recognizing the male of anthodyta is the apical fringe of the fourth metasomal sternum which consists of quite long, white hairs. This character is shared with oregona, but other species have the fringe made up of shorter reddish, fuscous, or black hairs.

As suggested above, anthodyta is very close to oregona. A. anthodyta is the larger and commoner of the two species. The males seem indistinguishable except by average size (anthodyta usually more than 7.5 mm . in length, oregona usually under this size). The character of the third mandibular tooth (Michener, 1943) used to distinguish them previously is useless because of its variability. The females of the two species differ likewise in average size, but differ conspicuously only in the length of the scopa, that of oregona being short, the longest hairs of the second metsomal sternum little longer than the length of the sternum, that of anthodyta being about twice as long.

Outside of California, anthodyta, s. str. is known from single localities in Idaho (Bloomington Lake), and Oregon (McKenzie Pass, 5,000 ft.).

## Anthocopa oregona Michener

Anthocopa oregona Michener, 1943, Ann. Ent. Soc. Amer., 36:53. Type 9 , McKenzie Pass, $5,000 \mathrm{fr}$. , Oregon (Calif. Acad. Sci.).
Geographic range: California and Oregon (see map 35).
California records:
Eldorado Co.: Fallen Leaf Lake, ㅇ, VI-10-16, ㅇ, VI-2G-16 (A. C. Browne, C.A.S., K.U.).

Fresno Co.: Hart Lake, 10,500 ft., ㅇ, IX-1-52 (E. I. Schlinger, U.C.D.).

Inyo Co.: Mr. Whitney, 2 ㅇ, VI-12-37 (G.E.B., K.U.).

Mono Co.: Tioga Lake, ㅇ, VII-15-51 (K. W. Tucker, K.U.).

Plumas Co.: Bucks Lake, $\delta$, VII-1-49 (J. W. MacSwain, C.I.S.).

Sierra Co.: Gold Lake, $\delta$, ㅇ, VII-13-21, 아, VII-20-21 (C. L. Fox, C.A.S.).
Discussion:
As indicated in the discussion under antbodyta, this species is very closely related to that form. Indeed, it is possible that oregona represents merely a more northern form of anthodyta, although the two occur in the same general areas in the Sierra Nevada.

It has been collected at Cloud Gap and Mt. Hillman near Crater Lake, Oregon. The type is from McKenzie Pass, Oregon.


Map 42. Distribution of Antbocopa elongata (Michener).

## Anthocopa elongata (Michener)

Osmia elongata Michener, 1936, Canad. Ent., 68: 41, ․ Type 우, Bluff Lake, San Bernardino Mountains, California (Univ. of Kansas).
Geographic range: California, Colorado, Montana, and Washington (see map 42).
California records:
Alpine Co.: Hope Valley, ㅇ, VII-9-48 (C. Chan, U.C.D.).

Inyo Co.: Bishop Creek (north fork), 8,500 ft., 2 Y, VI-22-37, flowers Pbacelia (Michener, 1943:62). Glacier Lodge near Big Pine, $\delta$, VI-23-37 (Michener, 1943:62, C.A.S.). Whitney Portal, 4 P, VIII-6-48 (P. D. Hurd, Jr., and J. W. MacSwain, C.I.S., K.U.).

Mariposa Co.: Paradise Valley, 2 , VII-25-38 (E. G. Linsley, C.I.S., K.U.).

Mono Co.: Mammoth, + , VII-25-36 (Michener, 1943:62).

Nevada Co.: Truckee, ${ }^{\prime}$, VI-17-27 (Michener, 1943:62, K.U.).

San Bernardino Co.: Mill Creek, San Bernardino Mountains, 7,400 ft., + , VI-29-42 (R. M. Bohart, G.E.B.).

Shasta Co.: Lake Eiler, 3 mi. E., 아, VII-22-47 (T. F. Leigh, C.I.S.).

Sierra Co.: Gold Lake, Fox, K.U.).

Tulare Co.: Alta Meadows, Giant Forest, 9,100 ft., ㅇ, VII-19-23 (C. L. Fox, K.U.). White Chief, Mineralking, + , VIII-1-23 (C. L. Fox, K.U.). Tuolumne Co.: Pinecrest, $\mathcal{P}$, VII-7-52 (J. I. Stage, K.U.).
Discussion:
A. elongata is the smallest and most slender species in the subgenus, the male differing conspicuously from all others by the clypeal margin, the truncation of which is only about one and one-half times as long as the distance from the end of the truncation to the lateral angle of the clypeus.

The female, except for its size, is very like that of A. abjecta alta, from which it differs in the closer mesoscutal punctures which are mostly separated by less than a puncture width. In this characteristic, elongata resembles anthodyta, which differs by the narrower female mandibles and other characters. In a previous paper (Michener, 1943), the female is said to differ from $A$. abjecta alta by having the inner hind tibial spur
straight rather than curved apically. In general, this feature distinguishes these species, but larger series now available show that it is unreliable. The fringe of the fourth metasomal sternum of the male is neither so long nor so white as in anthodyta, but is longer and paler than in most other Atoposmia. The tegulae in both sexes are usually more coarsely punctured than in other Atoposmia.
A. elongata is known also from Colorado (Science Lodge; Minnehaha; and Wilkerson Pass), Montana (Lake St. Marys, Glacier National Park), and Washington (Sunrise, Mt. Rainier).

## Anthocopa panamintensis Michener

(Pl. 19, fig. 72; pl. 20, fig. 88)

Anthocopa (Atoposmia) panamintensis Michener, 1943, Ann. Ent. Soc. Amer., 36:65, ठ', 아. Type ㅇ, Tuber Canyon, Panamint Mountains, Inyo County, California, 8,000 ft. (Calif. Acad. Sci.).
Geographic range: California (see map 43).
California records:
Inyo Co.: Wild Rose Canyon, Panamint Mountains, 7,500 ft., $\delta^{\prime \prime}$, VI-18-37 (Michener, 1943:66). Discussion:

As indicated in the key to species, A. panamintensis is abundantly distinct from other Atoposmia, the clypeal margin of the female and the third metsomal sternum of the male possess especially conspicuous features.

## Antbocopa triodonta (Cockerell)

Osmia (Atoposmia) triodonta Cockerell, 1935, Pan-Pacific Ent., 11:50, 0 , 우.
Anthocopa (Atoposmia) triodonta, Michener, 1943, Ann. Ent. Soc. Amer., 36:62, ${ }^{\prime}$,
Geographic range: California (see map 44). Discussion:

This is a moderate-sized to large, finely punctate species found largely in the Upper Sonoran life zone. Its fine punctation (clypeus of female as finely punctate as the frons, upper parts of genal areas more finely punctate than middle of vertex) places it near the group of py cnognatha and bebitis from which it differs by the black hind tibial spurs and dark tegulae, and by the long and five-segmented maxillary palpi.


Map 43. Distribution of Antbocopa panamintensis Michener.


Map 44. Distribution of Anthocopa triodonta (Cockerell), the subspecies shastensis indicated by solid circles, the subspecies triodonta by half solid circles, and the subspecies usingeri by open circles.

Key to the Subspecies of Anthocopa triodonta


#### Abstract

Males 1. Metasoma with abundant fuscous or black pubescence shastensis ( p .106 ) Metasoma with pubescence pale 2(1). Punctures of upper parts of genal areas distinctly finer than those of middle of vertex usingeri (p. 105) Punctures of upper parts of genal areas little if any finer than those of middle of vertex. triodonta (p. 106)


## Females

1. Pubescence white to pale brown or pale fuscous; scopa yellowish white . . . . . . 2 Clypeus and metasoma with abundant black pubescence; scopa brown, sometimes black posteriorly . . . . . . . . . . . . . . . . . . . . shastensis(p. 106)

2(1). Punctures of upper parts of genal areas distinctly finer than those of middle of vertex . usingeri (p. 105)
Punctures of upper parts of genal areas scarcely finer than those of middle of vertex.
.triodonta (p. 106)

## Antbocopa triodonta usingeri Michener

Antbocopa triodonta usingeri Michener, 1943, Ann. Ent. Soc. Amer., $36: 63, \delta$, ㅇ. Type $\delta^{\prime}$, Santa Rosa Mountain, San Jacinto Mountains, California, 5,800 ft., flowers Penstemon spectabilis (Calif. Acad. Sci.).
Geographic range: California (see map 44).
California records:
Kern Co.: Frazier Park, $\delta$, V-1 8-40 (R. M. Bohart, U.C.D.).

Los Angeles Co.: Cajon Valley, San Gabriel Mountains, 9, VI-3-29 (Michener, 1943:63). Lone Pine Canyon, 5,900 ft., 12 个, VI-16-28, flowers Nama parryi and Penstemon spectabilis (Michener, 1943:63). Angeles Camp, ㅇ, VI-28-52 (R. H. Beamer, K.U.). Big Pines Camp, 9, VII-13-27, flowers Penstemon labrosus (P. H. Timberlake, U.C.R.). Tanbark Flat, San Dimas Experimental Forest, 2 Y, VII-2-50 (A. T. McClay, U.C.D.).

Riverside Co.: Santa Rosa Mountain, 6,200 ft., V-31-40, flowers Nama parryi (Michener, 1943:63); same data VI-11-40, flowers Nama parryi (Michener, 1943:63); same locality, 8,000 ft., $\delta, 3$ \&, VI-20-40 (E. C. Van Dyke, C.A.S.). Vandevanter Flat, San Jacinto Mountains, VI-11-40, flowers Penstemon spectabilis (Michener, 1943:63); ठ, same data, VI-4-40, flowers Penstemon spectabilis (C. D. Michener, C.I.S.).

Ribbonwood, San Jacinto Mountains, V-21-40, flowers Penstemon spectabilis (Michener, 1943: 63) ; $\delta$, VI-20-39 (E. G. Linsley, C.I.S.). Keen Camp, San Jacinto Mountains, $\sigma^{\prime \prime}$, V-31-39, flowers Penstemon (E. G. Linsley, C.I.S.); Y, VI-1 0-39, flowers Penstemon (B. Brookman, C.I.S.); $\delta^{\top}, \mathrm{V}$ -31-39, flowers Penstemon (R. F. Smith, C.I.S.). Hemet Reservoir, San Jacinto Mountains, $\delta_{,}^{\lambda}$, V-22-40, flowers Penstemon spectabilis (C. D. Michener, C.I.S.). Herkey Creek, San Jacinto Mountains, f , VI-14-40, flowers Penstemon spectabilis (C. D. Michener, C.I.S.). San Jacinto River, $4,000 \mathrm{fr} .$, ㅇ, V-30-40, flowers Penstemon (C. D. Michener, C.I.S.). Idyllwild, ㅇ, VI-4-39 (E. S. Ross, C.I.S.); f, VII-26-36, flowers Penstemon spectabilis (P. H. Timberlake, U.C.R.); $3 \delta^{\prime}$, ㅇ, VI-9-40, flowers Penstemon spectabilis (P. H. Timberlake, U.C.R.); 9 , VI-17-40, ${ }^{\prime}$, VI-16-40, $\delta$, VI-16-41 (E. C. Van Dyke, C.A.S.); $\delta$, VI-1 9-51 (G. C. Bechtel, U.C.D.). Piñon Flat, ㅇ, V-30-39 (B. Brookman, C.I.S.). Banning, ठ', VI-19-41 (E. C. Van Dyke, C.A.S.). San Jacinto Mountains, + , VI-20-33 (R. H. Beamer, K.U.).

San Diego Co.: Palm Canyon, Borego, $9, \mathrm{~V}$ -22-41 (R. C. Dickson, U.C.R.).

Discussion:
The record from Mariposa County (Michener, $1951 a$ ) is an error.

## Anthocopa triodonta triodonta (Cockerell)

(Pl. 19, fig. 75; pl. 20, fig. 86)
Osmia (Atoposmia) triodonta Cockerell, 1935, Pan-Pacific Ent., 11:50, $\delta$, ${ }^{2}$. Type $\delta$, Mt. Diablo, California, about $3,800 \mathrm{ft}$., flowers Penstemon beterophyllus (Timberlake collection, U.C.R.).
Geographic range: California (see map 44).
California records:
Contra Costa Co.: Mt. Diablo, 9 , VI-22-47 (C.I.S.); ס', VI-14-33 (G. E. and R. M. Bohart, G.E.B.).

Inyo Co.: Argus Mountains, ${ }^{\text {on, V }}$ V-22-37 (W. C. Reeves, U.C.R.); $\delta$, V-22-37 (E. C. Van Dyke, C.A.S.); Y, VI-4-39 (R. M. Bohart, U.C.D.). Lone Pine, ơ, V-23-37 (E. C. Van Dyke, K.U.). Lone Pine Creek, 4,500 ft., 2 o', V-19-47 (R. M. Bohart, U.C.D., K.U.).

Placer Co.: Tahoe City, 3 б, VI-24-43 (P. H. Arnaud, U.C.R.).

## Anthocopà triodonta shastensis (Cockerell)

Osmia shastensis Cockerell, 1935, Pan-Pacific Ent., 11:46, ㅇ. Type ${ }^{\circ}$, Shasta County, California (Timberlake collection, U.C.R.).
Geographic range: California, Oregon (see map 44).

California records:
Mono Co.: Leavitt Meadows, $9, \mathrm{VI}-25-37$ (G. E. and R. M. Bohart, G.E.B.).

Plumas Co.: Lake Almanor, 9 , VII-22-37 (Michener, 1943:64). Quincy, 4 mi . W., 2 ㅇ, VII-2-49 (H. A. Hunt, K.U., U.C.D.).

Shasta Co.: Summit Lake, Mt. Lassen, 6,700 ft., 2 ô, VI-21 to 22-37 (Michener, $1943: 64$, K.U., U.C.R.). Burney, 5 mi. E., $\delta$, VI-9-41 (P. D. Hurd, J r., C.I.S.).

Trinity Co.: Carrville, 2,400 to $2,500 \mathrm{ft} ., \delta$, VI-31-34 (Michener, 1943:64).

Tuolumne Co.: Strawberry, $\uparrow$, VI-20-51 (J. W. MacSwain, C.I.S.).

## Discussion:

Specimens of shastensis, because of their abundant black pubescence, are superficially similar to $A$. abjecta abjecta. They differ by the
finer punctation, especially of the mesoscutum. Except for a small median area, less than onethird the width of the mesoscutum, the punctures are not coarser than those of the vertex; in the small median area they are coarser and more widely separated.

The name sbastensis is here placed as a subspecies of triodonta for the first time, although the possibility of this treatment has been suggested previously (Michener, 1943). Specimens from Plumas and Tuolumne counties show considerably less black than others and thus approach triodonta. The darkest specimen available comes from Leavitt Meadows, Mono County. It has black pubescence on the entire head (except for pale hairs around the antennal bases) and sides of thorax; the only pale metasomal fascia is on the first metasomal tergum, the rest of the tergal pubescence being black. Even the mesoscutum has many blackish hairs interspersed among paler ones. A single female from Cloud Gap, Coopers Spur, Mr. Hood, 6,000 ft., August, 1927 (H. A. Scullen), is the only record of shastensis for Oregon.

## Anthocopa pycnognatha Michener

Antbocopa (Atoposmia) pycnognatha Michener, Ann. Ent. Soc. Amer., 36:64, $\widehat{0}$, + .
Geographic range: California (see map 45). Discussion:

This large species differs from all other Atoposmia in the short, four-segmented maxillary palpi. Useful recognition characters, shared also with bebitis, are the ferruginous rather than blackish tibial spurs and regulae. In its large size and fine punctation (upper parts of genal areas more finely punctate than middle of vertex, clypeus of female no more coarsely punctate than frons, mesoscutum little more coarsely punctate than vertex), this species and bebitis resemble triodonta. A. pycnognatha differs from bebitis by the coarser punctation with small shining interspaces between the punctures as well as by other characters indicated in the discussion of that species.

## Key to the Subspecies of Anthocopa pycnognatha

## Males

1. Length 8 to 9 mm .; genal areas more finely punctate . . . . . . pycnognatha (p. 107)

Length 7.5 to 8 mm .; genal areas more coarsely punctate . . . . . . . solata (p. 107)

## Females

1. Anterior ocellus about midway between antennal bases and posterior margin of vertex pycnognatha (p. 107)
Anterior ocellus behind midpoint between antennal bases and posterior margin of vertex. solata (p. 107)

Anthocopa pycnognatha pycnognatha Michener
Anthocopa (Atoposmia) pycnognatha Michener, 1943, Ann. Ent. Soc. Amer., 36:64, o, Y. Type , Oak Creek Canyon, near Independence, Inyo County, California, flowers Penstemon breviflorus (Calif. Acad. Sci.).
Geographic range: California (see map 45).
California records:
Inyo Co.: Independence, $\delta^{\sigma}$, 9 , VI-11-37, flowers Penstemon breviflorus (Michener, $1943:$ 65); ㅇ, VII-11-37 (U.C.D.).

## Anthocopa pycnognatba solata Michener

Anthocopa (Atoposmia) pycnognatha solatus Michener, 1949, Jour. Kans. Ent. Soc., 22:48, $\delta$, . 7 . Type 9 , The Gavilan, California, flowers of Penstemon antirrbinoides (Timberlake collection).
Geographic range: California (see map 45).
California records:
Mariposa Co.: Mariposa, ㅇ, VI-13-38 (R. M. Bohart, K.U.); $\delta$, same data (R. W. Lichty, K.U.). Riverside Co.: Perris, $11 / 2 \mathrm{mi}$. W., 2 ㅇ, V-4-38, one on flowers of Salvia columbariae (Michener, 1949:48). Corona, , VI-1911(K.U.). The Gavilan, ㅇ, V-12-51 (E. I. Schlinger, U.C.D.); ठ̃, V-29-46, flowers Penstemon antirrbinoides (Michener, 1949:48, U.C.R.).

## Anthocopa bebitis Michener

Anthocopa bebitis Michener, 1954, Pan-Pacific Ent., $30: 44, ~ \delta, ~ Y . ~ T y p e ~ Y, ~ M i n e r a l k i n g, ~$ Tulare County, California (Calif. Acad. Sci.).

Geographic range: California (see map 46). California records:

Fresno Co.: Huntington Lake, ơ, VIII-1917 (I. McCracken, C.A.S.).
Discussion:
This species is related to $A$. pyonognatha with which it agrees in the short maxillary palpi (although a minute fifth segment is present in bebitis) and in the ferruginous tegulae and tibial spurs. It differs from pycnognatha and from all other Atoposmia in the exceedingly fine and close punctation of the face, vertex, and dorsum of the thorax, there being no interspaces between punctures. It also differs from all other Atoposmia in the hind basitarsi. In the female they are finely and closely punctured, dull, and almost 2.3 times as long as broad. In the male they are somewhat less dull, 2.5 times as long as broad. In all other species the hind basitarsi are shining, rather coarsely punctured, and comparable ratios are 2.7 to 3.0 for females, 3.0 to 4.0 for males. In the male of bebitis the lateral margins of the sixth metasomal tergum are relatively straight, not convex as in pycnognatha.

## Subgenus Eremosmia Michener

This subgenus consists primarily of desert bees, only one species, $A$. bemizoniae, occurring in the coastal parts of California.

Pbaeosmia is here placed as a synonym of Eremosmia. Among the species available when the genus Anthocopa was revised (Michener, 1943), the separation of the two groups on the basis of the number of mandibular teeth in the


Map 45. Bistribution of Anthocopa pycnognatha Michener, the subspecies pyonognatha indicated by open circles, and the subspecies solata by solid circles.


Map 46. Distribution of Anthocopa bebitis Michener.
male seemed sound. Correlated with this character were several others, including the width of the mandible of the female. It is now obvious that the principal male character is more deceptive than valuable in indicating relationships. Thus A. bypostomalis is clearly rather closely related to $A$. robusta and $A$. segregata, as shown by a number of characters. Yet bypostomalis would fall in Pbaeosmia because of bidentate male mandibles, whereas the others would fall in Eremosmia because of tridentate male mandibles.

The species in the subgenus Eremosmia (s.l.) may be grouped as follows:
Group I. Moderate-size forms not using pollen
of Compositae; sixth metasomal tergum of
female without fascia and with flange rather small and not strongly projecting.
a. Mandibles long and slender, those of male tridentate: beameri Michener, nitidivitta Michener, robustula (Cockerell), rupestris
(Cockerell), segregata Michener, timberlakei (Cockerell)
b. Mandibles more robust, those of male bidentate: bypostomalis Michener
c. Mandibles robust, those of male bidentate; clypeus carinate: daleae Michener
Group II. Rather large forms using pollen of Compositae; sixth metasomal tergum of female with subapical fascia hiding small flange; mandibles of male bidentate, except in mirifica, in which they are tridentate: anodontura (Cockerell), enceliae (Cockerell), bemizoniae (Cockerell), mirifica Michener, viguierae (Cockerell)
Group III. Small forms not using pollen of Compositae; sixth tergum of female with very conspicuous flange, no fascia; mandibles of male bidentate: burdiana Michener, maryae Michener, namatopbila Michener, rubrella Michener

## Key to the California Species of Eremosmia

Males

1. Mandibles tridentate (as in pl. 20, fig. 84) ..... 2
Mandibles bidentate (as in pl. 20, fig. 89) ..... 5
2(1). Eyes diverging below; mandibles slender, lower margin at least two-thirds as long as eye ..... 3
Eyes converging below; mandibles robust, lower margin half as long as eye . mirifıca (p. 117)
3(2). Penultimate antennal segment broader than long; mandibles with apices of teeth nearly equidistant ..... rlyPenultimate antennal segment longer than broad; mandibles with distance between apices offirst two teeth nearly twice distance between apices of second and third teeth
4(3). Femora red; punctures of cheeks and mesepisternum about equally coarserobustula (p. 112)

- n
Femora black; punctures of cheeks much finer than those of mesepisternum
rupestris (p. 112)
5(1). Metasoma largely red; second and third metasomal sterna subequal in size, their posterior margins gently rounded ..... 9
Metasoma black; second metasomal sternum much larger than third, margin of latter withbroad deep emargination.6
6(5). Mandibles narrowed apically so that breadth at apex of inner tooth is markedly less thanbreadth a short distance basad of that point (fig. 89) . . . . . . . enceliae (p. 117)
Mandibles not narrowed apically, breadth at apex of inner tooth but little less than breadthbasad of that point7
7(6). Sixth metasomal tergum with a sublateral emargination on each side setting off a lateral ..... 8apical lobe; seventh tergum produced to blunt median apical angle.
Sixth metasomal tergum with no lateral lobes or emarginations; seventh tergum broadlyemarginate apicallybypostomalis (p. 115)
8(7). Pubescence of dorsum ochraceous; punctures of median area of mesoscutum little if any larger than largest punctures of vertex . . . . . . . . . . . bemizoniae (p. 121)
Pubescence of dorsum white and pale fuscous; punctures of median area of mesoscutum distinctly larger than largest punctures of vertex
viguierae (p. 119)
9(5). Inner margins of eyes subparallel. . . . . . . . . . . . . . . rubrella (p. 121)
Inner margins of eyes converging below. . . . . . . . . . . . .burdiana (p. 123)


## Females

1. Metasoma black or largely so . . . . . . . . . . . . . . . . . . . . 2

Metasoma red . . . . . . . . . . . . . . . . . . .. . . . . . 12
2(1). Femora red . . . . . . . . . . . . . . . . . . . . . . . . . . 3
Femora black . . . . . . . . . . . . . . . . . . . . . . . . . 4
3(2). Metasoma largely covered with appressed white pubescence; clypeus without a longitudinal median impunctate area . . . . . . . . . . . . . . . . timberlakei (p. 112)
Metasoma with white pubescence primarily confined to posterior margins of terga; clypeus with longitudinal median impunctate band . . . . . . . . . . nitidivitta (p. 112)

4(2). Eyes slightly diverging below, or inner margins parallel . . . . . . . . . . . 5
Eyes converging below . . . . . . . . . . . . . . . . . . . . . . 7
5(4). Hypostomal region of usual shape so that longitudinal parts of hypostomal carinae are longer than transverse parts; hypostomal carinae low; median ocellus farther from antennal bases than from posterior edge of vertex.
Hypostomal region short so that longitudinal parts of hypostomal carinae are no longer than transverse parts, these carinae elevated posteriorly; median ocellus midway between antennal bases and posterior edge of vertex
bypostomalis (p. 115)
6(5). Upper part of clypeus markedly more coarsely punctate than rest of head; inner subapical swelling of mandible low and rounded (pl. 19, fig. 76) . . . . . . segregata (p. 115)
Upper part of clypeus no more coarsely punctate than vertex; inner subapical swelling of mandible truncated apically (pl. 19. fig. 74). . . . . . . . . . robustula (p. 112)
7(4). Apical margins of metasomal terga broadly translucent brown, sparsely punctate or impunctate; clypeal truncation margined with red; sixth tergum without apical band of hairs
Apical margins of terga not or narrowly brown, not translucent, densely punctured to apices or only very narrowly impunctate; clypeal truncation black; sixth metasomal tergum with apical white hairs dense, forming an apical band .
8(7). Length less than 5 mm .; distance between posterior ocelli much greater than distance from one of them to posterior edge of vertex . . . . . . . . . . .namatophila (p. 121)
Length more than 6 mm .; distance between posterior ocelli equal to or less than distance from one of them to posterior edge of vertex
.rupestris (p. 112)
9 (7). Mandibles robust, length along lower margin littie if any more than three times shortest breadth; clypeus usually without indications of a longitudinal impunctate space. . . 10
Mandibles narrowed medially so that length along lower margin is nearly or quite four times as long as shortest breadth; upper part of clypeus with punctures well separated and often with at least indications of a shining longitudinal impunctate space (pl. 19, figs. 78, 81)
. enceliae (p. 117)
10(9). Tegulae black or fuscous, sometimes reddish posteriorly; clypeal truncation about as long as distance from its end to lateral angle of clypeus; ends of truncation broadly rounded . 11
Tegulae red; clypeal truncation about two-thirds as long as distance from its end to lateral angle of clypeus; ends of truncation marked by distinct, although narrowly rounded angles
mirifica(p. 117)


11(10). Apex of clypeus gently concave between broad rounded lobes which form the ends of truncation; scopa yellowish white . . . . . . . . . . . . . . . bemizoniae (p. 121)
Apex of clypeus not or very slightly emarginate; scopa usually brownish yellow
viguierae (p. 119)
12(1). Truncation of clypeus with a pair of median projecting lobes, so that in conjunction with projecting ends of truncation clypeus appears four-lobed . . . . . . rubrella (p. 121)
Truncation of clypeus simple . . . . . . . . . . . . . . . . burdiana (p. 123)

## Antbocopa timberlakei (Cockerell)

Osmia timberlakei Cockerell, 1935, Pan-Pacific Ent., 11:41, ${ }^{\text {P. Type }}$, opposite sand dunes, road to Palm Springs, California, on flowers Palafoxia linearis (Timberlake collection, U.C.R.).

Geographic range: California (see map 47).
California records:
Riverside Co.: Edom, 9 , III-28-36, flowers Astragalus (P. H. Timberlake, U.C.R.).

San Bernardino Co.: Adelanto, IV-25-37, flowers Astragalus fremontii (Michener, 1943:70).
Discussion:
This species and $A$, nitidivitta are our only Anthocopa in which the body is black and the femora red. They are readily separated by the characters given in the key.

## Anthocopa nitidivitta Michener <br> (Pl. 19, fig. 82; pl. 20, fig. 85)

Anthocopa (Eremosmia) nitidivitta Michener, 1943, Ann. Ent. Soc. Amer., 36:70, $\delta$, 9 . Type $P$, six miles north of Wild Rose Canyon, Panamint Mountains, Inyo County, California, 5,000 feet elevation, flowers Pbacelia (Calif. Acad. Sci.).
Geographic range: California (see map 48). California records:

Inyo Co.: Westgard Pass, west side, 2 ó, 아, V-27-37, flowers Dalea fremontii (Michener, 1943: 71). Kearsarge, $q, V-25-37$ (Michener, 1943:71). Wild Rose Canyon, Panamint Mountains, 7,000 ft., $\delta$ ', $9, \mathrm{~V}-27-37$ (Michener, 1943:71).

San Bernardino Co.: Adelanto, 9 mi . N., 2 ㅇ, IV-25-37, flowers Astragalus fremontii (Michener, 1943:71).

Anthocopa rupestris (Cockerell)
(Pl. 19, fig. 79; pl. 20, fig. 90)
Osmia rupestris Cockerell, 1935, Pan-Pacific

Ent., 11:47, ㅇ. Type 9 , Big Rock Creek, California, flowers Phacelia distans (Timberlake collection, U.C.R.).
Geographic range: California (see map 49).
California records:
Inyo Co.: Mazourka Canyon, Inyo Mountains, 9,500 ft., 3 o', VI-1-37 (Michener, 1943:73).

Riverside Co.: Tahquitz Canyon, near Palm Springs, $\widehat{\text { § }}$, III-24-36, flowers Larrea glutinosa (Michener, 1943:73); ${ }^{(1)}$ IV-16-38 (C.I.S.). Mecca, 10 mi. E., + , IV-14-35 (Michener, 1943:73). Andreas Canyon near Palm Springs, flowers Eriodictyon trichocalyx (Michener, 1943: 73); Y, IV-7-40 (R. M. Bohart, U.C.L.A.). Palm Springs, \&, III-25-37 (G. E. and R. M. Bohart, G.E.B.).

San Bernardino Co.: Twentynine Palms, 71/2 mi. S., 2 Y, V-7-48, flowers Pbacelia distans and Nama demissum (P. H. Timberlake, U.C.R.). Adelanto, 10 mi . S., ㄱ, V-3-39 (P. H. Timberlake, U.C.R.).

Discussion:
Both sexes in this species are readily recognized by the almost entirely red mandibles and tegulae, reddish apices of the femora, bases and apices of the tibiae, and hind basitarsi. The clypeal margin is red in the female. The lower margin of the mandible of the female is more than four times as long as the least breadth, of the male about six times. The inner orbits of the female converge below, but in the male they diverge strongly as in $A$. nitidivitta, a species with red femora. They are slightly divergent in males of robustula and bypostomalis.

Anthocopa robustula (Cockerell)
(Pl. 19, fig. 74; pl. 20, fig. 84)
Osmia robustula Cockerell, 1935, Pan-Pacific Ent., 11:44, Y. Type Y, north of Indio, California, flowers Lupinus odoratus (Timberlake collection, U.C.R.).
Geographic range: California, Nevada (see map 50).



California records:
Inyo Co.: Big Pine, IV-8-37, flowers Dalea polyadenia (Michener, 1943:72); ס, 3 9, VI-8-37 (E. C. Van Dyke, C.A.S.); 9, VI-23-37 (E. C. Van Dyke, C.A.S.). Kearsarge (near), 2 ㅇ, V-25-37 (E. C. Van Dyke, C.A.S.). Lone Pine, VI-15-37, flowers Dalea polyadenia (Michener, 1943:72); ठ, VI-4-37 (G.E.B.); 2 , VI-9-37 (C.I.S.); 3 ठ, f, same data (W. C. Reeves, U.C.R.); Y, VI-1 237 (G.E.B.); ㅇ, VI-13-37 (W. C. Reeves, U.C.R.); 5 б', 2 \&, same data (E. C. Van Dyke, C.A.S.); $\delta$, same data (U.S.A.C.). Westgard Pass, 2 , V-27-37, flowers Dalea fremontii (C. D. Michener, K.U.). Mazourka Canyon, Inyo Mountains, 2 , V-25-37, flowers Dalea fremontiii (C. D. Michener, K.U.).

Riverside Co.: Cathedral City, IV-10-36, flowers Dalea scbottii (Michener, 1943:72); + V-1 936, flowers Dalea schottii (W. P. Cockerell, C.A.S.). Whitewater Canyon, 2 Y, IV-26-36, flowers Dalea californica (P. H. Timberlake, U.C.R.). La Quinta, 2 \&, IV-24-38, flowers Cercidium floridum (P. H. Timberlake, U.C.R.). Edom, $2 \sigma^{\top}$, 9, III-28-36, flowers Palafoxia linearis (P. H. Timberlake, U.C.R.); $\delta$, V-28-36, flowers Astragalus (P. H. Timberlake, U.C.R.); ㅇ, IV-1 7-37 (E. G. Linsley, U.C.R.). Edam, 4 mi. E., , IV-17-37, flowers Dalea schottii (P. H. Timberlake, U.C.R.). Edom, $41 / 2 \mathrm{mi}$. N.W., IV-1 $0-$ 37, Astragalus coulteri (P. H. Timberlake, U.C.R.).

San Bernardino Co.: Victorville, $3 \mathrm{mi} . S ., \delta$, 8 ㅇ, V-12-39, flowers Dalea saundersii (P. H. Timberlake, U.C.R.).

San Diego Co.: Borego Springs, $\delta$, IV-8-49 (R. M. Bohart, U.C.D.).

Discussion:
This is one of the commoner Eremosmia in the deserts of southern California. The inner orbits diverge slightly in the male, very slightly or not at all in the female. The tegulae are largely red, but otherwise this species lacks the reddish areas characterizing the three preceding species. The punctation is finer than that of the similar bypostomalis and segregata, especially that of the clypeus, as indidated in the key.
A. robustula has been collected on two occasions in Nevada, a female from near Arden, June 6, 1941 (E. P. Van Duzee) and a female from twenty-two miles south of Las Vegas, April 3, 1953 (J. W. MacSwain).

## Antbocopa segregata Michener

(Pl. 19, fig. 76)
Anthocopa segregata Michener, 1954, Pan-Pacific Ent., 30:48, ㅇ. Type 우, Mazourka Canyon, Inyo Mountains, Inyo County, California (Univ. of Kansas).
Geographic range: California (see map 51).
California records:
Inyo Co.: Kearsarge, $9, \mathrm{~V}-25-37$ (E. C. Van Dyke, C.A.S.).

## Discussion:

This species, known from but two specimens, is close to robustula, agreeing with it in reddish tegulae, diverging inner orbits, and so on, but differing in the more coarsely punctate upper part of the clypeus and the gently rounded rather than angulate subapical inner swelling of the mandible.

## Anthocopa bypostomalis Michener

Anthocopa (Phaeosmia) bypostomalis Michener, 1949, Jour. Kansas Ent. Soc., 22:50, 9. Type ${ }^{7}$, Cabazon, Riverside County, California (Calif. Acad. Sci.).
Geographic range: California (see map 52).
California records:
Inyo Co.: Kearsarge (near), V-25-37 (Michener, 1943:72) as robustula. Surprise Canyon, Panamint Mountains, $\sigma^{\sigma}$, IV-28-53, flowers Dalea fremontii (P. D. Hurd, Jr., C.I.S.). Westgard Pass, Y, V-27-37, flowers Dalea fremontii (C. D. Michener, K.U.); same locality, $7 \mathrm{mi} . W ., 2$ \&, VI-26-53, flowers Dalea (J. W. MacSwain, C.I.S.).

Riverside Co.: Box Canyon, ${ }^{\text {P, IV-26-52 (G. }}$ A. Marsh, K.U.); , same data (P. D. Hurd, Jr., C.I.S.). Eagle Mountains, + , V-15-41 (K.U.). Indio, 20 mi. E., J', IV-1-41 (K.U.). Palm Desert, Y. IV-11-50 (W. F. Barr, C.I.S.); 7 Y, IV-11-50 (Michener, 1951:52, C.I.S.); 5 \&, IV-11-50 (L.W. Quate, K.U., U.C.R.); , IV-12-50 (P. D. Hurd, Jr., K.U.). Palm Springs, $\sigma^{\sigma}$, III-30-45, flowers Cryptantha barbigera (P. H. Timberlake, U.C.R.).

San Diego Co.: Borego, ס', IV-8-39 (R. M. Bohart, G.E.B.). The Narrows, Sentenac Canyon, ס, IV-22-51 (E. J. Taylor, U.C.D.).
Discussion:
In form, in the reddish color of the tegulae, in the punctation, and in most structural features


Map 53. Distribution of Anthocopa mirifica Michener.


Map 54. Distribution of Antbocopa enceliae (Cockerell), the subspecies enceliae indicated by open circles, and the n...hnnnuinn mantonh h.. mild niunln
this species seems closely related to robustula and segregata, particularly the latter. It is unique among American Anthocopa, however, in the short broad hypostomal areas, with the transverse parts of the hypostomal carinae as long as the longitudinal parts, the posterior parts of these carinae elevated in both sexes. Another unusual feature is that in both sexes the distance between the posterior ocelli is far less than that from one of them to the posterior edge of the vertex. The male differs markedly from that of robustula (that of segregata is unknown) in having bidentate mandibles.

## Antbocopa mirifica Michener

(Pl. 20, fig. 87)
Anthocopa mirifica Michener, 1954, Pan-Pacific Ent., 30:51, ${ }^{\prime}$, ㅇ. Type ${ }^{\circ}$, Mazourka Canyon, Inyo Mountains, Inyo County, California (Univ. of Kansas).
Geographic range: California (see map 53).
California records:
Inyo Co.: Darwin Falls (near), Argus Mountains, \&, V-30-37 (C. D. Michener, K.U.). Surprise Canyon, Panamint Mountains, $\delta 8$, IV-28 and 29-53, flowers Cbaenactis brachypappa (P. D. Hurd, Jr., and P. H. Timberlake, C.I.S. and U.C.R.). Westgard Pass, $\uparrow$, VI-15-37, flowers Encelia farinosa (C. D. Michener, K.U.); same locality, 7 mi . W., 18 ㅇ, VI-26-53, some on Encelia farinosa (D. D. Linsdale, J. W. MacSwain, N. Nakakihara, C.I.S.).

Riverside Co.: Box Canyon, 9 , IV-21-52, flowers Chaenactis carphoclinia (P. H. Timberlake, U.C.R.).
Discussion:
This species can be promptly recognized in
the female by the short clypeal truncation, as indicated in the key. The male has not been collected with the female. Therefore some doubt must remain about the association of the sexes, but it seems very probably correct. The male is unique among our Eremosmia in having the mandibles tridentate (fig. 87) but short, only about half as long as the eye, as in species with bidentate mandibles.

The females placed under $A$. mortua by Michener in 1943 are mirifica.

## Anthocopa enceliae (Cockerell)

Osmia enceliae Cockerell, 1935, Pan-Pacific Ent., 11:43, 7. Type , Andreas Canyon, Palm Springs, California, flowers Encelia farinosa (P. H. Timberlake collection, U.C.R.). Geographic range: California (see map 54).

## Discussion:

This species differs from others of its group in the slender mandibles of the female, which are narrowed medially so that the width at the narrowest point is about one-fourth the length along the lower margin. Another distinctive feature is the clypeus of the female, which is distinctly convex above (and coarsely punctate); the lower third, or slightly less, is flat and projecting at an angle to the lower part of the convex part.

In addition to the characters mentioned in the key, the male differs from similar forms such as viguierae by the scarcely discernible sublateral emarginations of the sixth metasomal tergum and by the coarser punctation of the middle of this tergum. In viguierae and bemizoniae the median part of this tergum is very much more finely punctate than the lateral parts.

Key to the Subspecies of Anthocopa enceliae

## Females

1. Mandibles at narrowest point more than one-fourth as wide as length along lower margin; upper part of clypeus uniformly punctate.
Mandibles at narrowest point less than one-fourth as wide as length along lower margin; upper part of clypeus usually with small median impunctate space or line . mortua (p. 119)


## Anthocopa enceliae enceliae (Cockerell)

(Pl. 19, fig. 81; pl. 20, fig. 89)
Osmia enceliae Cockerell, 1935, Pan-Pacific Ent. 11:43, ㅇ, ठ'. Type + , Andreas Canyon, Palm Springs, California, flowers Encelia farinosa (Timberlake collection, U.C.R.).
Synonymy: See Michener, 1943, Ann. Enc. Soc. Amer., 36:80 (ㅇ, not $\delta^{\prime}$ ).
Geographic range: California (see map 54).
California records:
Riverside Co.: Andreas Canyon near Palm Springs, ㅇ, IV-10-36, flowers Encelia farinosa (Michener, 1943:80, K.U.); 오, IV-7-40 (R. M. Bohart, U.C.L.A.). Palm Canyon, $2 \mathrm{\delta}^{\text {T, }}$ IV-15-38, flowers Encelia farinosa (G. E. and R. M. Bohart, G.E.B., K.U.).

San Diego Co.: Borego, ơ, IV-5-40 (R. M. Bohart, U.C.L.A.); same locality, Tub Canyon, ㅇ, II-28-47 (G. H. and J. L. Sperry, K.U.).
Discussion:
This form is rather uniform in size, 7 to 8 mm . in length.

The male associated with it by Michener (1943:80) is apparently the male of viguierae as Cockerell believed when he described the species. The females of both, but only males of one, are known from the type locality. The association of the sexes of the subspecies mortua is clear, however, and indicates that the males from Andreas Canyon belong to viguierae. Two males of enceliae have recently been studied from nearby Palm Canyon.

## Anthocopa enceliae mortua (Cockerell)

(Pl. 19, fig. 78)
Osmia viguierae, var. mortua Cockerell, 1935, Pan-Pacific Ent., 11:44, ठ. Type ס', Townsend Pass (or Emigrant Pass?) 3,000 ft. altitude, Death Valley, Inyo County, California, flowers Encelia actoni(Timberlake collection, U.C.R.). Synonymy: Anthocopa mallognatha Michener, 1943, Ann. Ent. Soc. Amer., 36:67, \& (new synonym). Geographic range: Arizona, California, and Ne vada (see map 54).
California records:
Inyo Co.: Lone Pine, 7 mi. W., ㅇ, VI-2-37 (C. D. Michener). Mazourka Canyon, Inyo Mountains, ó, V-25-37 (N. W. Frazier, K.U.). Westgard Pass, ${ }^{\text {, }}$ VI-15-37 (A. E. Meier, C.I.S.); ㅇ, VI-2-37 (N. W. Frazier, G.E.B.); same locality, west side, V1-3-37, flowers Encelia farinosa (Michener, 1943:79); same locality, plateau, 2 ㅇ, VI-3-37
(E. C. Van Dyke, C.A.S.); same locality, 7 mi. W., $\uparrow, \mathrm{VI}-26-53$, flowers Encelia (J. W. MacSwain, C.I.S.).

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

Discussion:
This subspecies is highly variable in size, ranging from 6 to 9 mm . in length even at a single locality. The subspecific characters indicated in the above key are most evident in specimens from Arizona and Nevada.

The female placed with mortua by Michener (1943) does not belong there, but is a different species, recently described as mirifica. The association of sexes made in 1943 was based on a pair of specimens from Mazourka Canyon. The male was mortua, the female is now called mirifica. The proper association of sexes of mortua is indicated by series from Arizona (twenty and twenty-five miles west of Casa Grande, and Maricopa Mountains) and Nevada (six and twenty-two miles south of Las Vegas).

## Anthocopa viguierae (Cockerell)

Osmia viguierae Cockerell, 1935, Pan-Pacific Ent., 11:44, ㅇ. Type ${ }^{\text {P, Andreas Canyon, }}$ Palm Springs, California, flowers Viguiera parishii (Timberlake collection, U.C.R.).
Synonymy: See Anthocopa enceliae, Michener, 1943, Ann. Ent. Soc. Amer., 36:80 ( $\delta^{\text {, }}$, not 9 ). Geographic range: California (see map 55). California records:

Imperial Co.: Beals Well, ㅇ, IV-13-49, flowers Hyptis emoryi (P. H. Timberlake, U.C.R.).

Inyo Co.: Surprise Canyon, Panamint Mountains, 아아, IV-29-53, flowers Enceliopsis argophylla, var. grandiflora (G. A. Marsh, C.I.S.). Wild Rose Canyon, Panamint Mountains, 3,500 ft., $\delta$ ', 9, V-28-37 (C. D. Michener, K.U.).

Riverside Co.: Andreas Canyon near Palm Springs, ठ, III-2-34, flowers Viguiera parishii (P. H. Timberlake, U.C.R.); ठ', IV-1 0-36, flowers Encelia farinosa (C. D. Michener, K.U.); ${ }^{\text {N, }}$, IV-11-36, same flower (P. H. Timberlake, U.C.R.); $\delta^{\prime}$, IV-7-40 (M. R. and R. M. Bohart, G.E.B.). Lost Palms Canyon, 3 ठ', IV-21-37 (C. M. Dammers, U.C.R.). Palm Canyon, ${ }^{\alpha}$, IV-16-38 (K.U.).
 IV-5-45, 우, IV-20-45, ठ, V-30-45, 우, III-27-46, all on flowers Encelia farinosa (T. D. A. Cockerell, K.U., U.C.R.). Tahquitz Canyon, San Jacinto Mountains, $2 \delta^{\prime \prime}$, ㅇ, IV-16-38, flowers


Map 57. Distribution of Antbocopa namatophila Michener.


Map 58. Distribution of Antbocopa burdiana Michener.

Encelia farinosa (G. E. and R.M. Bohart, G.E.B.); 7, IV-1 6-38 (U.C.D.); す', IV-1 6-38 (U.C.L.A.).

San Bernardino Co.: Twentynine Palms, 14 mi. S., 9, IV-14-35, flowers Encelia farinosa (P. H. Timberlake, U.C.R.).

San Diego Co.: Borego, ${ }^{\top}$, IV-21-51 (C. D. MacNeill, C.I.S.).
Discussion:
The discussions under the headings of $A$. enceliae and $A$. enceliae enceliae contain information about viguierae, males of which have been sometimes placed with enceliae in the past.

## Anthocopa bemizoniae (Cockerell)

Osmia bemizoniae Cockerell, 1935, Pan-Pacific Ent., 11:47, ㅇ. Type 9 , Riverside, California, flowers Hemizonia paniculata (Timberlake collection, U.C.R.).
Geographic range: California (see map 56).
California records:
Los Angeles Co.: Santa Monica, 5 9, VI-26-35 (Michener, 1943:79, C.I.S., K.U., U.C.R.). Westwood, 9 , VII-4-35 (E. G. Linsley, U.C.R.).

Riverside Co.: The Gavilan, $\delta^{\prime}$, VI-9-50, flowers Helianthus gracilentus (P.H. Timberlake, U.C.R.).

Discussion:
This is the only species of Eremosmia found outside of the desert area. It is a close relative of A. viguierae, differing from it principally by its larger size, yellowish pubescence, and other minor characters mentioned in the key.

## Anthocopa namatophila Michener

(Pl. 19, fig. 73)
Anthocopa namatophila Michener, 1954, PanPacific Ent., 30:47, $\&$ Type $i$, seven and one-half miles south of Twentynine Palms, California, on Nama demissum (Timberlake collection, U.C.R.).
Geographic range: California (see map 57).
Discussion:
This is our smallest black Eremosmia, being about the same size as the forms with a red abdomen, rubrella and burdiana. It is known only from the type series of four females, all collected at the type locality.

## Anthocopa rubrella Michener

(Pl. 19, fig. 80)
Anthocopa rubrella Michener, 1949, Jour. Kansas Ent. Soc., 22:51, ㅇ, $\sigma^{\prime}$.
Geographic range: California, Mexico, Nevada, and Texas (see map 59).
Discussion:
This species differs from our other species of Antbocopa, except burdiana, in the largely red abdomen. It is unique among Eremosmia in having the clypeal truncation modified, being provided with two small median lobes with a notch between them. A. rubrella is divisible into three subspecies, two of which occur in California. The nominate subspecies is known from western Texas (Cooper's Store, Big Bend National Park, Dryden; Marathon; and Sanderson). A single male from San Carlos Bay, Lower California, is probably rubrella proper.

## Key to the California Subspecies of Anthocopa rubrella

1. Mandibles except bases and apices, clypeal margin and tegulae red in both sexes.

> rubrior (p. 123)

Mandibles except bases and apices, clypeal margin, and tegulae black, or largely so .
macswaini (p. 121)

Antbocopa rubrella macswaini Michener
Anthocopa rubrella macswaini Michener, 1954, Pan-Pacific Ent., 30:45, $\delta$, 9. Type 9,2 miles south of Baker, San Bernardino County, California (Univ. of Kansas).
Geographic range: California and Nevada (see map 59).

California records:
San Bernardino Co.: Baker, 2 mi. S., $9 \delta, 9$, IV-4-53 (Michener, 1954:46, C.I.S., K.U.). Vidal Jct., 7 mi. N., $\delta^{\prime}$, IV-3-51 (P. D. Hurd, Jr., C.I.S.). Discussion:

This subspecies is very similar to the typical rubrella from Texas and Mexico. It differs strikingly in coloration and slightly in structure from


Map 59. Distribution of Antbocopa rubrella Michener, the subspecies macsuaini indicated by solid circles, the subspecies rubrella by open circles, and the subspecies rubrior by half solid circles.
the other California subspecies, rubrior. These two forms have not been taken together, but they do occur in the same general region. It is therefore possible that rubrior represents a distinct species. The subspecies macswaini is known from Nevada ( 22 mi. S., Las Vegas) by a single male collected on April 3, 1953, by J. W. MacSwain.

## Anthocopa rubrella rubrior Michener

Anthocopa rubrella rubrior Michener, 1954, PanPacific Ent., 30:46, 厄', ㅇ. Type 9 , Hopkins Well, Riverside County, California (Univ. of Kansas).
Geographic range: California (see map 59).
California records:
Riverside Co.: Blythe, $18 \mathrm{mi} . W .$, Y, IV-30-52, flowers Dalea mollis (Michener, 1954:46, U.C.R.). Hopkins Well, 2 J', IV-29-52 (Michener, 1954:46, C.I.S., K.U.). Indio, $24 \mathrm{mi} . ~ S ., ~ Y, ~ I I I-25-33$, flowers Dalea mollis (Michener, 1954:46, U.C.R.).

San Diego Co.: Anza State Park, (Michener, 1954:46, U.C.D.). Borego, $O$, V-2-52 (Michener, 1954:46, C.I.S.).
Discussion:
This subspecies differs from typical rubrella and from macswaini not only in the characters mentioned in the key but in the greater amount of red coloration on other parts of the body, in
the denser and whiter pubescence, and in the broader median lobes of the clypeal margin.

## Anthocopa burdiana Michener

Antbocopa burdiana Michener, 1954, Pan-Pacific Ent., 30:47, ơ, Я. Type $\uparrow$, Surprise Canyon, Inyo County, California, on flowers Dalea fremontii (Univ. of Kansas).
Geographic range: California (see map 58).
California records:
Inyo Co.: Surprise Canyon, Panamint Mountains, $\delta$, $Y$, IV-28-52, flowers Dalea fremontii (Michener, 1954:47, C.I.S., K.U.).
Discussion:
This species is superficially very like $A$. rubrella macswaini. The striking differences are those mentioned in the keys, although other minor differences exist.

## Subgenus Hexosmia Michener

This subgenus differs from all our other Antbocopa in the weak greenish luster and in the complete invagination of the seventh metasomal tergum of the male, so that but six terga are exposed. The species are similar in appearance, rather small ( 6 to 8 mm . in length). Both species occur in California, one of them ranging eastward to Colorado.

## Key to the Species of Hexosmia

1. Distance between first and second mandibular teeth of female distinctly greater than that between second and third; maxillary palpi three-segmented . . . .phaceliarum (p. 126) Distance between first and second mandibular teeth of female about equal to distance between second and third (fig. 77); maxillary palpi four-segmented . . .copelandica (p. 123)

## Anthocopa copelandica (Cockerell)

(Pl. 19, fig. 77; pl. 20, fig. 91)
Osmia copelandica Cockerell, 1908, Entomologist, 41:59, 9.
Geographic range: British Columbia, California, Colorado, Idaho, Montana, Nevada, Oregon, Utah, Washington, and Wyoming (see map 60).

## Discussion:

This species is divisible into three subspecies, two of which occur in California. The
typical subspecies is found from the Rocky Mountains (including Utah) to British Columbia and Oregon. It is characterized by the broad genal areas, broader than the eye in the female and about as broad as the eye in the male. There is a gradual gradient through Oregon and California toward the subspecies albomarginata; this gradient reaches its culmination in southern California, whence the type of albomarginata comes. It is a matter for judgment to decide where the boundary between the subspecies should be


Map 60. Distribution of Anthocopa copelandica (Cockerell), the subspecies albomarginata indicated by solid circles, the subspecies arefacta by half solid circles, and the subspecies copelandica by open circles.
drawn. Previously (Michener, 1943), only the southern California populations were termed albomarginata. With more abundant material now a vailable, it seems better to regard all populations occurring in California and southern Oregon as albomarginata, which can be characterized by having the genal areas of the female about as wide as the eyes, those of the male narrower than the eyes, and by slightly denser metasomal punctation in most specimens.

The third subspecies, arefacta, characterized by reddish testaceous tegulae, is found in typical form, not in the wooded transition zone habitats
such as copelandica and albomarginata usually prefer, but in the desert border regions around Pa!m Springs. At the higher altitudes in the Mojave desert, intergrades toward albomarginata occur. The subspecies arefacta has broader genal areas than in most specimens of albomarginata, and in this characteristic resembles typical copelandica.

We have seen a male from six miles southwest of Mountain City, Cobb Creek, Elko County, Nevada, 6,500 ft., collected on July 24, 1935 (P. H. Baldwin), which appears to belong to the subspecies albomarginata.

Key to the California Subspecies of Anthocopa copelandica

1. Tegulae brownish black . . . . . . . . . . . . . . . . albomarginata (p. 125) Tegulae rufotestaceous . . . . . . . . . . . . . . . . . . arefacta (p. 126)

Anthocopa copelandica albomarginata (Cockerell)
Osmia albomarginata Cockerell, 1935, Pan-Pacific Ent., 11:49, б, ㅇ. Type ${ }^{\text {, }}$, Swartout Valley, California, on flowers Pbacelia beteropbylla (Timberlake collection, U.C.R.).
Geographic range: California, Oregon (see map 60).

California records:
Alameda Co.: Oakland Hills, $P$, VI-20-47 (P.
D. Hurd, Jr., C.I.S.).

Alpine Co.: Hope Valley, $f$, VII-18-48 (J. W. MacSwain, C.I.S.).

Contra Costa Co.: Mt. Diablo, $\delta$, IV-24-37
(G. E. and R. M. Bohart, K.U.); ס, IV-29-39 (C.I.S.).

Eldorado Co.: China Flat, $\sigma^{\top}$, VI-28-48, flowers
Pbacelia (P. D. Hurd, Jr., C.I.S.); $\delta$, VI-28-48
(J. W. MacSwain, C.I.S.). Echo Lake, o', VII-21-48
(A. Bartel, C.I.S.); ㅇ, VII-12-53 (W. W. Middlekauff, C.I.S.); same locality, $7,400 \mathrm{ft} .$, P, VII-2-51 (W. W. Middlekauf, C.I.S.).

Fresno Co.: Huntington Lake, $\delta^{\top}$, VII-13-17, flowers Collinsia wrightii (I. McCracken, C.A.S.). Inyo Co.: Argus Mountains, V-22-37 (Michener, 1943:76). Independence Creek, 8,000 ft., VI-1737 (Michener, 1943:76). Bishop Creek (North fork), 8,500 ft., VI-22-37 (Michener, 1943:76). Mr. Baldy, Panamint Mountains, VI-19-37, flowers Phacelia (Michener, 1943:76). Whitney Portal, f, VIII-G-48 (P. D. Hurd, Jr., and J. W. MacSwa in, C.I.S.).

Kern Co.: Woody, ㅇ, IV-24-49 (E. G. Linsley, K.U.).

Lassen Co.: Bridge Creek Camp, $\delta$, ㅇ, VII-9-49 (W. F. Ehrhardt, U.C.D.); đ, 3 \&, same data (J. E. Gillaspy, C.I.S.). Hallelujah Jct., VI-27-49 (D. Cox, C.I.S.). Summit Camp, $\delta$, VI-28-49 (E. L. Atkinson, C.I.S.); \&, same data (H. A. Hunt, U.C.D.); ס', same data (P. D. Hurd, Jr., C.I.S.); 3 f, same data (J. W. MacSwain, C.I.S., K.U.); ㅇ, same data (F. Morishita, C.I.S.); + , VII-9-49 (P. D. Hurd, Jr., C.I.S.); 2 f, same data (E. G. Linsley, C.I.S., K.U.). Susan River Camp, 2 \&, (J. E. Gillaspy, C.I.S.).

Los Angeles Co.: Big Pines, ${ }^{\text {+ }, ~ V I I-12-27, ~}$ 4 ㅇ, VII-13-27, 7, VII-16-27, ,, VII-17-27, flowers Pbacelia beterophylla (P. H. Timberlake, U.C.R.). Puente Hills, 2 ㅇ, V-10-26, flowers Pbacelia distans (Michener, 1943:77, U.C.R.). Swartout Valley, 2 ठ', 3 9, VI-3-28, flowers Pbacelia distans (Michener, $1943: 77$, U.C.R., C.I.S.).

Mono Co.: Blanco's Corral, White Mountains, $10,000 \mathrm{ft} .$, Y, VII-6-53 (H. Nakakihara, C.I.S.); б', VII-8-53 (S. Mitoma, C.I.S.). Leavitt Meadows, VI-21-37 (Michener, $1943: 76$ ); , VI-26-37 (G.E.B.). Mammoth Lake, O, VIII-5-36 (Michener, $1943: 76, ~_{\text {(M) }}$ G.E.B.). Sardine Creek, 8,500 ft., VI-28-51 (S. M. Kappos, U.C.D.).

Nevada Co.: Fallen Leaf Lake, ㅇ, VI-29-15 (Michener, $1943: 76$, C.A.S.). Truckee, $\delta$, VI-1227, $\sigma^{\prime}$, VI-13-27, 2 ठ, VI-1 5-27, , VI-1 7-27, 2 б, VI-19-27, $\delta$, VI-21-27, , V, VII-5-27 (Michener, $1943: 76$, C.A.S., K.U.).

Placer Co．：Brockway， 2 9，VII－1 941 （G．E．B．， K．U．）．Donner Lake，f，VIII－24－16（L．Bruner， U．Ni：）．Lake Tahoe，$\delta$ ，VI－22－25（Michener，1943： 76，C．A．S．）；\＆，VII－23－16（L．Bruner，U．N．）．

Plumas Co．：Bucks Lake，3 ${ }^{\top}$ ，VI－23－49（J．W． MacSwain，C．I．S．，K．U．）； 3 ठ，VII－1－49（J．W． MacSwain，C．I．S．）．Meadow Valley，$\delta^{\prime}, 2$ 早，VI－ 1－24（W．H．Nelson，C．I．S．）；same locality，3，500－ 4，000 fr．， 3 ㅇ，VI－1－24（W．H．Nelson，C．I．S．）； 우，VI－5－24（Michener，1943：76，C．A．S．）；same locality，4，000－5，000 ft．，ㅇ，VI－8－24， $\mathcal{P}$ ，VII－6－24 （E．C．Van Dyke，C．A．S．）．Nelson Point， 2 \＆， VII－5－52（R．C．Bechtel，U．C．D．）．Onion Valley， J＇， P ，VII－7－49（E．I．Schlinger，U．C．D．）．Quincy． 4 mi．W．，${ }^{\text {P，VI－25－49，（J．W．MacSwain，K．U．）}}$ 2 ㅇ，VI－29－49，flowers Phacelia（P．D．Hurd，Jr．， C．I．S．）； 4 早，VI－30－49，same flower（P．D．Hurd， Jr．，C．I．S．）．

San Bernardino Co．：Big Bear Lake，오，VII－ 6－34（I．McCracken，C．A．S．）．Big Bear Valley，우， VII－6－34，flowers Phacelia beterophyila（P．H． Timberlake，U．C．R．）．Crestline（near）， $2 \delta^{\circ}, \mathrm{V}-13-$ 34，flowers Nemophila Menziesii var．integrifolia （P．H．Timberlake，U．C．R．）．Tetley Park，${ }^{0}$ ，VII－ 11－41（E．C．Van Dyke，C．A．S．）；V－16，flowers Nemophila（Michener，1943：77）．

San Francisco Co．：San Francisco（sand
 （Michener，1943：76，C．A．S．）．

Santa Clara Co．：Mt．Hamilton， $\mathrm{O}^{\prime}$ ，IV－1 5－47， flowers Pbacelia（G．E．Bohart，C．I．S．）．

Shasta Co．：Burney， 8 mi ．E．，VI－9－41，flowers Phacelia（C．D．Michener，C．I．S．）．Hat Creek，©， VI－4－41，flowers Pbacelia（C．D．Michener，C．I．S．）； same locality， 3 mi ．N．，$\overline{\mathrm{o}}$ ，VI－1－41（P．D．Hurd， Jr．，C．I．S．）；${ }^{0}$ ，VI－4－41，flowers Phacelia（C．D． Michener，C．I．S．）．Lassen National Park， 9 ，IX－ 9－41（E．C．Van Dyke，C．A．S．）．

Sierra Co．：Gold Lake，$\delta$ ，VII－21－21（C．L． Fox，C．A．S．）；ㅇ，VIII－4－21（Michener，1943：76， C．A．S．）．

Siskiyou Co．：Shasta Springs，$\circ$ （Michener，1943：76，C．A．S．）；${ }^{( }+\mathrm{VI}-20-20$（C．L． Fox，C．A．S．）．

Trinity Co．：Big Flat，Coffee Creek， $\mathrm{Y}^{\text {，}}$ VI－ 20－34（Michener，1943：76，G．E．B．）．

Tulare Co．：General Grant Park，ó， 2 ㅇ，VI－ 27－29，flowers Phacelia bydrophylloides（P．H． Timberlake，U．C．R．）．

Tuolumne Co．：Dodge Ridge， ㅇ，VII－13－51（E． I．Schlinger，U．C．D．）；+ ，VII－15－51（A．T．McClay， U．C．D．）．Mill Creek Camp，${ }^{\text {P，VII－13－51（R．C．}}$ Bechtel，U．C．D．）．Sonora Pass，J＇，V－27－37
（U．C．R．）；same locality，8，500 ft．，$\delta^{\prime}$ ，VII－7－48 （H．M．G．and D．Townes，K．U．）．Strawberry， 8 ， VI－18－51，flowers Pbacelia（E．G．Linsley， C．I．S．）；$\hat{\delta}, \mathrm{VI}-22-51$（E．G．Linsley and J．W． MacSwain，C．I．S．）．Pinecrest， 3 ô， 2 f，VII－12－53 （B．L．and J．G．Rozen，C．I．S．）．

Ventura Co．：Mt．Pinos，ô，V－13－42（R．M． Bohart，U．C．L．A．）．

## Anthocopa copelandica arefacta（Cockerell）

Osmia arefacta Cockerell，1935，Pan－Pacific
 California，flowers Phacelia distans（Timber－ lake collection，U．C．R．）．
Geographic range：California（see map 60）．
California records：
Kern Co．：Mojave，ó，IV－11－38（G．E．and R． M．Bohart，G．E．B．）．

Los Angeles Co．：Lancaster， 2 б，VI－1 0－36 （Michener，1943：76）；ô，IV－20－36（G．E．and R．M． Bohart，U．C．D．）．Llano，O，V－2－37，flowers Pbacelia distans（P．H．Timberlake，U．C．R．）．

Riverside Co：：Andreas Canyon near Palm Springs， 9, IV－10－36，flowers Pbacelia（Michener， 1943：76，C．I．S．）；f，IV－10－32，flowers Phacelia distans（P．H．Timberlake，U．C．R．）．Palm Canyon， 2 우，IV－1 5－38，flowers Pbacelia（U．C．D．，G．E．B．）． Palm Springs， 2 ㅇ，III－24－33，flowers Pbacelia distans（P．H．Timberlake，U．C．R．）；ठ＇，中，III－ 30－45，flowers Cryptantha intermedia（P．H． Timberlake，U．C．R．）；ㅇ，IV－6－45，flowers Mala－ cothrix glabrata（T．D．A．Cockerell，U．C．R．）；ㅇ， IV－3－46（C．I．S．）．Tahquitz Canyon，San Jacinto Mountains， 3 d， 4 ㅇ，IV－16－38，flowers Phacelia （G．E．and R．M．Bohart，G．E．B．，U．C．D．，U．C．L．A．）． Discussion：

The two specimens from Lancaster appear to be intermediate between arefacta and copelandica （Michener，1943：76－77）．

## Anthocopa phaceliarum（Cockerell）

Osmia phaceliarum Cockerell，1935，Pan－Pacific Ent．，11：45，ㅇ．Type ㅇ，Puente Hills，Cali－ fornia，on flowers Phacelia distans（Timber－ lake collection，U．C．R．）．
Geographic range：California（see map 61）．
California records：（Known only from the type）．


Map 61. Distribution of Anthocopa phaceliarum (Cockerell).


Map 62. Distribution of Proteriades remotula(Cockerell), indicated by solid circles and Proteriades inca. scens (Cockerell), the subspecies incanescens indicated by right half solid circles, the subspecies nevadensis by open


Plate 9. Lateral view of Proteriades semirubra (Cockerell), male.

## Genus Proteriades Titus

This is a genus of small bees that can ordinarily be recognized by a single character, namely, the presence of hooked or wavy bristles on the short galeae and labial palpi. Only in males of $P$. remotula and incanescens is this character weak, the bristles being scarcely hooked at their apices or many of them straight. Species of Proteriades are without metallic coloration and most species have red areas on the metasoma. The metanotum and basal zone of the propodeum slope posteriorly. The anterior face of the first metasomal tergum is feebly concave with a usually inconspicuous longitudinal median depression and without any sharp line between the sculpturing of the anterior and the dorsal surfaces. In this characteristic, Proteriades resembles Hoplitis more than Anthocopa, although it is intermediate between typical representatives of each. The inner ventral margin of each hind coxa is carinate, an Antbocopa-like fearure. There are seven exposed metasomal terga in the male, the sixth angulate or dentate laterally, a Hoplitis-like feature.

The genus Proteriades was revised by Timberlake and Michener (1950).

All the known species of the genus, except Proteriades jacintana and the nominate subspecies of $P$. incanescens, have been found only in California and occur from near sea level to 10,000 feet altitude in the mountains. The species jacintana has been found recently in Oregon, and incanescens ranges in distribution from eastern California into Nevada and Arizona. Presumably other species will be found also to occur in these states. This distributional pattern parallels that of certain other megachilid bees which for some reason do not range nearly as far eastward and southward as does the desert habitat in which they occur in California (see Michener, 1943, 19446, 1951 b).

Of the twenty-two species now recognized, eighteen are known in both sexes, with the sexes in most cases allocated with certainty. Two species are known only in the female sex, and two only in the male sex. Several species are known to be widely distributed in California, whereas others remain known from one or a few localities. Timberlake has collected ten species, almost half of the known species of the genus, on or in the immediate vicinity of the grounds of the Citrus Experiment Station in Riverside, California. This was done during a period of
more than twenty years, and one species (similis) was found but once and another (seminigra) only during one year. Thus, any locality where suitable conditions exist may continue to yield additional species for many years. A good proportion of the species are known, but there certainly must be others still unseen. It is evident that much more material needs to be collected, and that many years may elapse before a full understanding of the genus is achieved.

It seems unquestionably true that all species of Proteriades collect pollen exclusively from flowers of the boraginaceous genus Cryptantha. The mouth parts (galeae and labial palpi) are provided with stiff curled hairs, especially in the female. These serve to pull the pollen from the stamens which are hidden in the throats of the flower. These flowers are too small to permit the bees to enter bodily and collect pollen in the usual way. From the curled or hooked hairs of the mouth parts, the pollen is transferred for carrying to the hairs of the scopa on the under side of the abdomen.

Thus far, there is no evidence whatever to suggest that the different species of Proteriades are restricted to different species of Cryptantha. Several species of Proteriades have been collected on more than one species of Cryptantba, and the indications are that a species of Proteriades will utilize whatever Cryptantha species are available in the neighborhood. All ten species of Proteriades found at Riverside were on Cryptantha intermedia.

There is no evident relationship between speciation in Cryptantha and that in Proteriades. Not only are the Proteriades species not restricted to particular species of Cryptantha, but the distribution of the plant is far wider than that of the bee, extending eastward to the Great Plains and southward far into Mexico and even to South America. In this connection, it should be pointed out that in the vicinity of Riverside, where ten species of Proteriades are competing with one another, visiting the same flowers at the same season in the same place, the season of flight of the bees does not even coincide with the main bloom of the Cryptantha plants. These plants appear in great numbers, especially in bare and disturbed soils, and are at the height of their bloom in March. Many of them may dry up before the end of that month. Other plants, more favorably situated, as on a north slope or at the edge of a boulder or wherever the soil retains its moisture longer than in exposed places, may bloom through April and May into

June. It is mainly such plants which support the Proteriades populations.

However, at high altitudes in the Inyo Mountains, the Proteriades are on the wing a few days before the first Cryptantha flowers are in bloom. Here the situation is wholly different from that in coastal southetn California (Riverside), for in these high desert ranges, the season is extremely short, and probably no Cryptantha plant survives the aridity to bloom for more than a few weeks.

Since the females collect pollen at flowers, and since they doubtless have a much longer season of flight than males, females are easy to capture in comparis on with the males. The males, on the other hand, have the habit of sunning
themselves on the ground, or on a convenient stone or stick, from which they make periodic sorties over the Cryptantha flowers apparently in search of mates, only occasionally lingering at the flowers to feed.

Only fragmentary information on the nesting habits of Proteriades is available, but presumably all species nest in the ground. As reported by Michener (1943), P. xerophila was reared from old nests of Anthophora linsleyi Timberlake which were dug from the ground by $\mathrm{Dr}_{\mathrm{r}}$ G. E. Bohart. P. remotula and P. deserticola have been observed entering burrows in the ground. Additional information on these last two species will be found in the accounts of those species in the present paper.

## Key to the Species of Proteriades

## Males

1. Mandible, measured along lower margin, equal to or shorter than front tibia, bidentate; clypeus without longitudinal carina; seventh metasomal tergum, if bilobed, with emargination between lobes broad and shallow (e.g., pl. 22, figs. 103, 104, 108) (except in remotula and incanescens, pl. 22, fig. 109) . . . . . . . . . . . . . . . . . . . 2
Mandible, measured along lower inargin, much longer than front tibia, with subapical dorsal angle so that it is virtually tridentate; clypeus with longitudinal median carina; emargination between lobes of seventh metasomal tergum deeply U-shaped (pl. 22, fig. 110).
.jacintana (p. 151)
2(1). Seventh metasomal tergum truncate (pl. 22, fig. 106), bidentate (pl. 22, fig. 103), or bilobed (pl. 22, fig. 102); sixth metasomal sternum without projecting lobes on either side of base of median fold
Seventh metasomal tergum tridentate (pl. 22, fig. 111); sixth metasomal sternum with two small but strongly projecting lobes on either side of base of median fold .

3(2). Mandible, measured along lower margin, shorter than front tibia; metasoma usually with red, at least basally.


Mandible, measured along lower margin, as long as front tibia (outer mandibular tooth far exceeding the short inner tooth); metasoma without red areas . . . . palmarum (p. 139)
4(3). Seventh metasomal tergum bidentate at apex, the teeth small, separated by at least four times the width of a tooth (pl. 22, figs. 103, 104).
Seventh metasomal tergum truncate or bilobed medially, the teeth or lobes in that case at least one-third as broad as the space between them (pl. 22, figs. 101, 102, 108) . . . 6
$5(4)$. Teeth of seventh metasomal tergum separated by a crescentiform emargination (pl. 22, fig. 104); second metasomal sternum with a broad, subapical, transverse ridge; fifth metasomal sternum fringed; metasoma with broad white apical hairbands . . . . deserticola (p. 149)
Teeth of seventh metasomal tergum separated by a quadrate emargination (pl. 22, fig. 103); second metasomal sternum with an oblique swelling on each side subapically; fifth metasomal sternum not fringed, its posterior margin broadly transparent, without hairs; metasoma without hairbands . . . . . . . . . . . . . . . bidenticauda (p. 145)

8(7). Process of first metasomal sternum narrowing to transverse truncate, thin-edged ape $\mathbf{x}$, its posterior face flat and perpendicular; seventh metasomal tergum truncate at apex
. . . . . . . . . . . . . . . . . . . . . .ryptanthae (p. 145) rocess of first metasomal sternum thick, trunklike, ending bluntly, its posterior face convex; second to fifth metasomal sterna each with an apical fringe; seventh metasomal tergum strongly emarginate at apex, the two lobes a little less wide than the median emargination (pl. 22, fig. 101)
caudex (p. 145)
$9(7)$. Seventh metasomal tergum no longer than preceding one; second metasomal sternum without a protuberance on each side
Seventh metasomal tergum much lengthened, the apical part convex above, concave beneath, broadly truncate at apex, its lateral margins nearly straight and unarmed; second metasomal sternúm with a protuberance on each side subapically . . . . . . truicauda(p. 147)
10(9). Margin of clypeus emarginate or not but without median tooth, often crenulate; angles demarking clypeal truncation obtuse
Margin of clypeus broadly emarginate, impunctate, with a small median protuberance or tooth; angles demarking clypeal truncation.acute.
semirubra (p. 150)
11(10). Posterior coxal carinae normal; flagellar segments shorter, at least subapical ones broader than long or rarely as long as broad (longer than broad in incanescens)
Posterior coxal carinae elevated to form a lamella which is abruptly terminated at its apex; flagellar segments longer than broad . . . . . . . . . . . . . boharti (p. 149)
12(11). First metasomal sternum nearly nude, or thinly and uniformly hairy . . . . . . . . 13
First metasomal sternum with a triangular medioapical area densely covered with white hair, which also fringes the margin (length at least 5 mm ., middle coxae not toothed).

13(12). Maxillary palpi five-segmented; seventh metasomal tergum with a deep emargination separating lobes whose apices are one-third to one-half as wide as emargination (as in pl. 22, fig. 109) .
Maxillary palpi three- or four-segmented; seventh metasomal tergum truncate or with shallow emargination separating lobes which are at least as wide as emargination (as in pl. 22, figs. 106, 107) . . . . . . . . . . . . . . . . . . . . . . . . 15
14(13). Emargination of seventh metasomal tergum evenly rounded; third metasomal sternum with fringe of long hairs extending to sides of sternum and therefore visible laterally even when central part is hidden by preceding sternum.
remotula (p. 134)
Emargination of seventh metasomal tergum quadrate (pl. 22, fig. 109); third metasomal sternum with fringe of long hairs only medially where it is entirely hidden by preceding sternum in repose.
incanescens (p. 134)
15(13). Large species, 5 to 7 mm . long; middle coxae each with a ventral angle or tooth in front of base of trochanter (lateral margins of sixth metasomal tergum strongly angulated; teeth of mandibles equal or subequal, except in seminigra) . . . . . . . . . . . 16
Small species, about 3 to 4.5 mm . long; middle coxae not toothed . . . . . . . . 18

[^2]16(15). First metasomal sternum nearly evenly and weakly convex across the apex; metasoma black dorsally on most or all of the terga
First metasomal sternum with a definite shining medioapical protuberance; metasoma almost wholly red, infuscated apically . . . . . . . . . . . . . basingeri (p. 141)
17(16). Seventh metasomal tergum with hardly a trace of a median notch; first three or more metasomal terga with red .
seminigra (p. 137)
Seventh metasomal tergum definitely notched to form two rounded lobes; red confined to sides of first two metasomal terga . . . . . . . . . . . . . tristis (p. 135)
18(15). Metasoma with extensive red areas; lateral margins of sixth metasomal tergum obtusely angulate
Metasoma without red areas or with them limited to first and sides of second terga; lateral margins of sixth tergum strongly angulate . . . . . . . . . . . nigrella (p. 137)
19(18). Carina of inner ventral angle of posterior coxa weak, absent distally where coxa is beveled; distance from posterior ocellus to extreme posterior margin of vertex little more than diameter of ocellus; genal areas little more than half as wide as eyes seen from side; pubescence dense and brilliantly white, obscuring sculpturing of face up nearly to level of ocelli . . . . . . . . . . . . . . . . . . . . . . .pygmaea (p. 143)
Carina of inner ventral angle of posterior coxa conspicuous and complete, coxa not beveled; distance from posterior ocellus to extreme margin of vertex nearly twice diameter of ocellus; genal areas much more than half as wide as eyes seen from side; pubescence dull white, not obscuring facial sculpturing above level of antennal bases . . nanula (p. 141)

## Females

1. Clypeus without longitudinal ridge and without carina except in palmarum; mandible tridentate; genal areas at most but little broader than eye
Clypeus with longitudinal median carinate ridge; mandible with apical tooth, basad of which is a notch, followed by a long straight margin; genal area twice as broad as eye seen from side
jacintana (p. 151)
2(1). Clypeus produced on each side (next to base of mandibles) as much as, or more than, in the middle, and not overhanging base of labrum or doing so only medially . . . . . . 3
Clypeus distinctly more produced in middle than at the sides and overhanging base of labrum

3(2). Clypeal margin more produced at sides than the middle, which is much elevated and perpendicularly declivous, the margin strongly arched as seen from beneath and leaving base of labrum fully exposed; mandibular teeth nearly equal . . . . . . . . evansi (p. 151)
Clypeal margin about equally produced at sides and in the middle, with a short median process that is moderately elevated over base of labrum; mandibles with inner apical tooth reduced to an angle and much shorter than the two acute outer teeth . . . . deserticola (p. 149)
4(2). Clypeus truncate or rounded at apex; mandibles not broadened medially . . . . . . 5
Clypeus with median lobe strongly produced and with two fingerlike divergent processes between which is a small acute tooth; mandibles very broad at middle, deeply excavated on inner margin toward the base, and a little narrowed to apex . . . semirubra (p. 150)
5(4). Clypeal margin in middle more or less thin-edged and strongly projecting over base of labrum, not or feebly crenulate.
Clypeal truncation thick-edged, crenulate with four or six small blunt teeth, and but little produced over base of labrum . . . . . . . . . . . . . . cryptanthae (p. 145)
6(5). Clypeus with upper half or two-thirds strongly swollen and shining and nearly impunctate medially; maxillary palpi five-segmented
Clypeus more uniformly convex with the punctures moderately dense to crowded (a median impunctate line in palmarum); maxillary palpi with two to four segments . . . . . 8

8(6). Metasoma black, or at most with a small amount of red on first tergum and sides of second;
terga always with distinct white hairbands; clypeal margin broadly truncate, or emarginate-
truncate . . . . . . . . . . . . . . . . . . . . . . . . . . 9
Metasoma with much red on the three basal segments, the hairbands well developed or not; clypeal margin usually less distinctly truncate; sometimes plainly rounded

12
9(8). Distance between posterior ocelli less than distance from one of them to eye margin; length 5.6 to 8 mm .

Distance between posterior ocelli subequal to distance from one of them to eye margin; length 3.5 to 6 mm .
10(9). Metasoma with first one or two segments red laterally; clypeal punctation not coarser than that of mesoscutum . . . . . . . . . . . . . . . . . . tristis (p, 135)
Metasoma without red; clypeal punctation much coarser than that of mesoscutum
xerophila (p. 147)
11(9). Punctures of clypeus close except sometimes for longitudinal raised line and not coarser than those of mesoscutum
palmarum (p. 139)
Punctures of clypeus widely separated, coarser than those of mesoscutum . nigrella (p. 137)
12(8). Clypeal margin broadly rounded, with a very obruse sublateral angulation far to each side; species about 3.0 to 4.6 mm . long $\qquad$
Clypeal margin more or less distinctly truncate in middle, that is, with rounded angles demarking truncation in addition to sublateral angles; length about $5 \mathrm{~mm} . \quad . \quad . \quad . \quad . \quad 15$
13(12). Clypeus with interspaces between punctures; rounded prominences in front of ocelli not or
scarcely more sparsely punctate than vertex and rest of frons . . . . . . . . . 14
Clypeus without interspaces between punctures; prominences in front of ocelli shining and distinctly more sparsely punctate than vertex and rest of frons . . . . similis (p. 139)
14(13). Small desert species, with pubescence white and unusually abundant on face, cheeks, sides of thorax and margins of mesoscutum; hairbands of metasoma broad and dense, disc of last three terga covered with white hair; punctures of mesoscutum about a puncture width apart; length usually not more than 4 mm .
pygmaea (p. 143)
Slightly larger montane and coastal species with pubescence less clear white, less dense on face and thorax; disc of fourth metasomal tergum well exposed, that of fifth and sixth terga with sparse white hair; punctures of mesoscutum mostly less than a puncture width apart; length 3.5 to 4.5 mm . . . . . . . . . . . . . . . . nanula (p. 141)
15(12). Clypeus with apical margin not distinctly concavely arcuate on each side of the truncation
Clypeus with apical margin rather distinctly but shallour . 16
Clypeus with apical margin rather distinctly but shallowly emarginate on each side of the rather narrow truncation, the sublateral angulation strong, but obtuse. (Punctures of clypeus close, those of mesoscutum rather coarse and almost uniformly less than a puncture width apart)
caudex (p. 145)
16(15). Frons, especially the slightly prominent areas just anterior to the lateral ocelli, with the punctures more or less separated . . . . . . . . . . . . . . . . . . 17
Frons uniformly and very closely punctured, the surface appearing more dullish . . . 19
17(16). Metasoma with first three terga and generally most of the fourth, red; metasomal hairbands weak; some what smaller species, about 4.5 to 5.5 mm long . . . . . . . . . 18
Metasoma black, the sides of all terga red, but decreasingly so toward apex; metasomal terga 1 to 5 conspicuously pallid at apices; terga 1 to 4 each with a dense white hairband.

Length 5.5 to 6 mm . (Sublateral angulations of clypeal margin very obtuse, so that the margin appears rather broadly rounded)
truicauda (p. 147)
18(17). Maxillary palpi short, indistinctly two- or three-segmented; apical truncation of clypeus rather distinct and about equal to the oblique sides, which have the sublateral angulation very obtuse. . . . . . . . . . . . . . . . . . . . . . . reducta (p. 143)
Maxillary palpi four-segmented and usually distinctly longer than in reducta, clypeal margin usually distinctly although minutely notched (the notch bearing a seta) just inside the lateral angulations, so that the latter are produced to form small blunt teeth .
bidenticauda (p. 145)
19(16). Clypeal truncation distinctly less in width than the oblique sides of the apical margin; punctures of clypeus at least a puncture width apart; punctures of mesoscutum close, but rather more separated than those of frons; first three metasomal terga, and sometimes a large part of fourth, red.
bamulicomis (p. 147)
Clypeal truncation about equal to width of oblique sides of the apical margin; punctures of clypeus rather less than a puncture width apart; punctures of mesoscutum about equaling those of frons in density; basal metasomal terga more or less black in middle, the first sometimes only narrowly so, the fourth either entirely black or red at sides
seminigra (p. 137)

## Proteriades remotula (Cockerell)

Osmia remotula Cockerell, 1910 , Canad. Ent., 42:170, ${ }^{\text {+. Type } 9 \text {, Claremont, Los Angeles }}$ County, California (U.S. Nat. Mus.).
Geographic range: California (see map 62). California records:

Contra Costa Co.: Rock City, Mt. Diablo, , $^{\text {, }}$ V-24-40 (Timberlake and Michener, 1950:397, C.I.S.).

Los Angeles Co.: La Crescenta, 9 , V-5-35, flowers Cryptantha intermedia (Timberlake and Michener, 1950:397, U.C.R.). Newhall, 9 , IV-20-40 (Timberlake and Michener, 1950:397, U.S.A.C.).

Modoc Co.: Fandango Pass, $\uparrow$, VII-1 0-46, flowers Asclepias (Timberlake and Michener, 1950:397, C.I.S.). Adin, $\delta$, V-30-52 (J. G. Rozen).

Riverside Co.: Riverside, 2 ㅇ, IV-6-45, flowers Cryptantha intermedia (Timberlake and Michener, 1950:397, U.C.R.). The Gavilan, ㅇ, IV-6-50, flowers Cryptantha intermedia (P. H. Timberlake, U.C.R.).

San Benito Co.: Pinnacles National Monument, §, ㅇ, IV-24-48, flowers Cryptantha (Timberlake and Michener, 1950:397, C.I.S.).

Tuolumne Co.: Chinese Camp, $2 \mathrm{mi} . W_{\text {., }}$ ㅇ, IV-26-52 (R. R. Snelling).
Discussion:
This species is not common, and only a few specimens are known. The female can easily be recognized by the bulging upper half of the clypeus and the depressed lower half, as well
as by the broadly rounded margin. It differs from other species, except incanescens, by the fivesegmented maxillary palpi. The male differs from other species of Proteriades in the almost semicircular emargination of the seventh metasomal tergum.

The specimen from near Chinese Camp, Tuolumne County, was collecred as it was entering a hole in the ground. The clypeus of this individual is truncate medially, but without distinct angles at the ends of the truncation. This may suggest intergradation with $P$. incanescens, but the scutal punctation is even finer than usual in remotula, not coarser as is often the case in incanescens. The scape is slightly longer than in remotula but not as long as in incanescens. The locality is in the vicinity where $P$. incanescens tota has been taken.

## Proteriades incanescens (Cockerell)

Hoplitina incanescens Cockerell, 1922, Amer. Mus. Novitates, 40:7.
Geographic range: Arizona, California, Nevada (see map 62).
Discussion:
$P$. incanescens is a medium-size or large species, the female of which has the upper part of the clypeus strongly convex, shining, with punctures separated by more than their diameters. In this characteristic it resembles remotula and
to some extent bamulicornis. Both of these species are smaller, and neither has the strongly produced and clearly truncate clypeal margin which characterizes incanescens. Another distinctive feature of incanescens is the long antennal scape, which is almost five times as long as broad and longer than the distance between the inner margins of the antennal sockets. In other species, the scape is usually less than
four times as broad as long and scarcely longer than the distance between the inner margins of the antennal sockets.

The male of this species is unique among known Proteriades in having the second metasomal sternum enlarged and covering the median part of the third, as in many species of Anthocopa and Osmia. P. remotula, however, closely approaches incanescens in this respect.

## Key to the California Subspecies of Proteriades incanescens

1. Metasoma with extensive red areas . . . . . . . . . . . . . nevadensis (p. 135) Metasoma black . . . . . . . . . . . . . . . . . . . . . tota (p. 135)

## Proteriades incanescens nèvadensis Timberlake and Michener

 (Pl. 22, fig. 109)Proteriades incanescens nevadensis Timberlake and Michener, 1950, Univ. Kansas Sci. Bull., 33:399, ㅇ. Type 9 , Kyle Canyon, Charleston Mountains, Nevada (Calif. Acad. Sci.).
Geographic range: Nevada, California (see map 62).

California records:
Mono Co.: Owens Valley, 7,000 ft., P, V-31-41 (Timberlake and Michener, 1950:399). Blanco's Corral, White Mountains, $10,000 \mathrm{ft} ., \delta, \mathrm{VI}-29-53$, ㅇ, VI-30-52, $6 \mathbf{\sigma}^{\circ}$, VII-7-53, $4 \mathbf{\sigma}^{\circ}$, VII-8-53 (Michener, 1954:72, C.I.S., K.U.). Crooked Creek, White Mountains, $9,000 \mathrm{ft}$., $\delta$, VI-20-53 (J. W. MacSwain, C.I.S.).

San Bernardino Co.: Deep Creek, 9, V-9-36 (Timberlake and Michener, $1950: 399$ ).
Discussion:
The specimen from Deep Creek "has the clypeus less clearly truncate than in incanescens, and has the interocular and interocellar distances more as in remotula. It probably represents either a new species, or more likely, an intergrade between nevadensis and remotula. If the latter interpretation is correct, incanescens and nevadensis should both be considered subspecies of remotula." (Timberlake and Michener, 1950:399). The subspecies is represented from Nevada by a single female which is the type.

## Proteriades incanescens tota Michener

Proteriades incanescens tota Michener, 1954, Jour. Kansas Ent. Soc., 27:72, ㅇ. Type ${ }^{\circ}$,

Strawberry, Tuolumne County, California (Univ. of Kansas).
Geographic range: California (see map 62). California records:

Tuolumne Co.: Pinecrest, 9, VII-12-53 (Michener, 1954:72, C.I.S.).
Discussion:
This subspecies differs most conspicuously from the preceding in the lack of red metasomal markings.

## Proteriades tristis Michener

Proteriades tristis Michener, 1936, Bull. So. Calif. Acad. Sci., 35:92, + , Type ㅇ, Eagle Rock Hills, Los Angeles County, California (Calif. Acad. Sci.).
Geographic range: California (see map 63). California records:

Los Angeles Co.: La Crescenta, (Timberlake and Michener, 1950:401); б', 9, IV-19-36 (E. G. Linsley, C.I.S.). Altadena, (Timberlake and Michener, 1950:401).

Riverside Co.: Idyllwild; Ribbonwood; Vandevanter Flat, Santa Rosa Mt., 6, 400-7,000 ft., (Timberlake and Michener, 1950:401). Riverside, Y, VII-10-36 (E. G. Linsley, C.I.S.). Mt. San Jacinto, 4,000 ft., 2 \&, VI-6-42 (R. Bohart, U.S.A.C.).

San Bernardino Co.: Mill Creek, San Bernardino Mountains (Timberlake and Michener, 1950:401). San Bernardino, + , V-28-36 (E. G. Linsley, C.I.S.).

## Discussion:

This is a rather large species, black with the red confined to the first two metasomal segments. It thus resembles the structurally very different


Map 63. Distribution of Proteriades tristis Michener.


Map 64. Distribution of Proteriades nigrella Michener, the subspecies attonita indicated by open circles, and the subspecies nigrella by solid circles.'
P. jacintana. According to Timberlake and Michener ( $1950: 401$ ), tristis has been collected at flowers of Cryptantha intermedia and C. micrantha. Males have been collected on dates ranging from April 19 to June 18, females April 19 to June 19.

## Proteriades nigrella Michener

Proteriades nigrella Michener, 1954, Jour. Kansas Ent. Soc., 27:72.
Geographic range: California (see map 64).

Discussion:
This species is very small, like pygmaea and nanula, but differs from them in lacking red markings or in having them confined to the first two metasomal terga; in the much coarser punctation, the large and widely separated punctures of the clypeus of the female being especially conspicuous; in the strongly angulate sides of the sixth metasomal tergum of the male; in the more nearly equal mandibular teeth of the male; and in the more definitely truncate clypeus of the female.

## Key to the Subspecies of Proteriades nigrella

1. Metasoma without red areas; length of females 3.5 to 4 mm. . . . . . nigrella (p. 137)

Metasoma with sides of first two terga red; length of females $5 \mathrm{~mm} . \quad$. . attonita (p. 137)

## Proteriades nigrella nigrella Michener

Proteriades nigrella nigrella Michener, 1954, Jour. Kansas Ent. Soc., 27:73, \&. Type ${ }^{\text {, }}$, Box Canyon, Riverside County, California, flowers Cryptantha angustifolia (Timberlake collection, U.C.R.).
Geographic range: California (see map 64).
California records:
Riverside Co.: Box Canyon, 7 \&, IV-17-52, flowers Cryptantha angustifolia (Michener, 1954 : 73).

San Bernardino Co.: Manix, $22 \mathrm{mi} . \mathrm{N}_{\mathrm{L}}$, Y, IV-26-53, flowers Cryptantha angustifolia (Michener, 1954:73).

## Proteriades nigrella attonita Michener

Proteriades nigrella attonita Michener, 1954, Jour. Kansas Ent. Soc., 27:73, $\mathcal{Y}$, ${ }^{\top}$.' Type $\mathcal{Y}$, Surprise Canyon, Panamint Mountains, Inyo County, California, flowers Cryptantha racemosa (Univ, of Kansas).
Geographic range: California (see map 64).

California records:
Inyo Co.: Surprise Canyon, Panamint Mountains, $\sigma$, 9 , IV-29-53, flowers Cryptantha racemosa (Michener, 1954:73).

## Proteriades seminigra Timberlake and Michener

Proteriades seminigra Timberlake and Michener, 1950 , Univ. Kansas Sci. Bull., 33:401, ס', ㅇ. Geographic range: California (see map 65).

## Discussion:

This is one of the smaller species of generalized structure. The male is similar to that of tristis, but smaller, with much more red on the metasoma, and the apex of the seventh metasomal tergum is not bilobed. The female agrees with bamulicornis in having the punctures of the frons almost uniformly close, but differs in having less red on the metasoma and the punctures of the mesoscutum about as close as those of the frons. The metasomal sterna are usually largely black, whereas in other species they are usually reddened.

Key to the Subspecies of Proteriades seminigra

## Males

1. Inner orbits converging below; distance between posterior ocelli subequal to distance from one of them to eye margin . . . . . . . . . . . . . . . seminigra ( p . 139)
Inner orbits with lower parts slightly diverging below; distance between posterior ocelli less than distance from one of them to eye margin . . . . . . . . yosemitensis (p. 139)


Map 65. Distribution of Proteriades seminigra Timberlake and Michener, the subspecies seminigra indicated by solid circles, and the subspecies yosemitensis by open circles.


Map 66. Distribution of Proteriades palmarum (Cockerell).

## Females

1. Black occupying middle third of second metasomal tergum. . . . . . seminigra (p. 139)

Black limited to small median area on second metasomal tergum . . yosemitensis (p. 139)

## Proteriades seminigra seminigra Timberlake and Michener

Proteriades seminigra seminigra Timberlake and Michener, 1950, Univ. Kansas Sci. Bull., 33: 403, $\delta$, ㅇ. Type $\delta$, Riverside, California, flowers Cryptantha intermedia (Timberlake collection, U.C.R.).
Geographic range: California (see map 65).
California records:
Los Angeles Co.: La Crescenta, 9, IV-19-36, flowers Cryptantba intermedia (Timberlake and Michener, 1950:403).

Riverside Co.: Riverside, ó, IV-21-38, ㅇ, V-6-38, flowers Cryptantha intermedia (Timberlake and Michener, 1950:403). Piñon Flat, San Jacinto Mountains, , IV-26-53 (F. X. Williams, C.I.S.).

## Proteriades seminigra yosemitensis Timberlake and Michener

Proteriades seminigra yosemitensis Timberlake and Michener, 1950 , Univ. Kansas Sci. Bull., 33:404, ठ', ㅇ. Type $\delta$, Yosemite, California, 3,880-4,000 ft. (Calif. Acad. Sci.).
Geographic range: California (see map 65).
California records:
Inyo Co.: Big Pine Creek, 7,500 ft., ठ, 2 \&, VI-1 2 to 17-42 (Timberlake and Michener, 1950 : 414, G.E.B.).

Los Angeles Co.: Palmdale, ơ, IV-11-36 (Timberlake and Michener, 1950:404, G.E.B.).

Mariposa Co.: Yosemite, $3,880-4,000 \mathrm{ft} ., 5 \delta^{\lambda}$, 7 Y, V-25 and V-31-1938, some on Cryptantha (Timberlake and Michener, 1950:404).

## Proteriades palmarum (Cockerell)

Osmia palmarum Cockerell, 1935, Pan-Pacific Ent., $11: 48$, ․ Type + , Palm Springs, California, flowers Cryptantha (Timberlake collection, U.C.R.).
Synonymy: Proteriades nigra Timberlake and Michener, 1950.
Geographic range: California (see map 66).
California records: Imperial Co.: Kane Springs, 19 mi . W., III-25-

53, flowers Cryptantba angustifolia (Timberlake and Michener, 1950:405, U.C.R.).

Riverside Co.: Palm Springs, $\mathrm{O}, \mathrm{III}-30-45$, flowers Cryptantha barbigera (Timberlake and Michener, 1950:405). Desert Center, 18 mi . E., ㅇ, IV-13-49, flowers Cryptantha barbigera (P. H. Timberlake, U.C.R.).

San Diego Co.: Borego, む, 2 ㅇ, III-31 and IV-1-53, flowers Cryptantha barbigera (P. D. Hurd, Jr., C.I.S. ).
Discussion:
This is our only moderately small ( 6 mm . long) Proteriades without red on the abdomen. The other species without red are the large xerophila and the minute nigrella nigrella. The range of variation in palmarum is sufficient so that $P$. nigra Timberlake and Michener is considered as a probable synonym of palmarum. The number of specimens (5) in collections is so small that positive conclusions on this point are difficult to reach. P. nigra has been reported from three desert localities in Riverside County: 18 miles east of Desert Center; 4 miles east of Edom (the holotype); and Palm Springs.

## Proteriades similis Timberlake and Michener

Proteriades similis Timberlake and Michener, 1950, Univ. Kansas Sci. Bull., 33:406, 8. Type 9 , Riverside, California, flowers Cryptantha intermedia (Timberlake collection, U.C.R.).

Geographic range: California (see map 67).
California records: (known only from the type) Discussion:

This species differs in the female from any of the other smaller species, except bidenticauda, in having the punctures of the clypeus dense enough to dull the surface. It differs from bidenticauda in having the punctures of the clypeus more rounded, the clypeal margin a little notched on each side, the antennae shorter, and the punctures of the frons finer and denser. Superficially it resembles a large specimen of nanula, from which it differs in the clypeal punctation, among other characters. $P$. similis may be the female of basingeri.


Map 67. Distribution of Proteriades similis
Timberlake and Michener.


Map 68. Distribution of Proteriades basingeri
Timberlake and Michener.

## Proteriades basingeri Timberlake and Michener

Proteriades basingeri Timberlake and Michener, 1950, Univ. Kansas Sci. Bull., 33:413, ठ'. Type $\delta$, Riverside, California (Timberlake collection, U.C.R.).
Geographic range: California (see map 68).
California records:
Riverside Co.: Riverside, $\delta$, IV-4-39 (Timberlake and Michener, 1950:414, U.C.R.); $\delta^{3}$, III-2029, flowers Cryptantha intermedia (Timberlake and Michener, 1950:414, U.C.R.). Temecula, 6 mi. E., õ, IV-11-50 (Michener, 1951:51, C.I.S.). Discussion:

The male of basingeri differs from others, except $P$. boharti, in having a low rounded protuberance at the apex of the first metasomal sternum. It differs from bobarti in having shorter antennae and a shining punctureless border at the apex of the clypeus, as well as by lacking lamellae on the posterior coxae. It is quite possible that this is the male of similis, but basingeri has never been collected with that species, although they are from the same locality.

Circumstances suggesting the association of the two as sexes of one species are their small size, and the fact that each is known only from the environs of Riverside where both are very rare.

Proteriades nanula Timberlake and Michener
Proteriades nanula Timberlake and Michener, 1950, Univ. Kansas Sci. Bull., 33:408, ơ, ㅇ. Geographic range: California (see map 69).
Discussion:
$P$. nanula is distinguishable from other species, except pygmaea, by its small size and by having the margin of clypeus of the female more completely rounded out. The almost equally small $P$. similis differs by having the clypeus very densely and finely punctured. The males of nanula and pygmaea have the lateral margins of the seventh tergum feebly angulated, with only a slight emargination before the apical truncation (fig. 106). $P$. nanula differs from pygmaea by being larger and less hairy and by having the wings duskier.

## Key to the Subspecies of Proteriades nanula

1. Wing length not more than 2.8 mm .; black areas of first three metasomal terga of female not reaching brownish margins of terga and occupying one-fourth or less of tergal width

> Wing length gerga

## Proteriades nanula nanula

Timberlake and Michener
(Pl. 22, fig. 106)
Proteriades nanula nanula Timberlake and Michener, 1950, Univ. Kansas Sci. Bull., 33:409, $\sigma^{\circ}$, 9. Type $\delta^{\prime \prime}$, Riverside, California, flowers Cryptantha intermedia (Timberlake collection, U.C.R.).

Geographic range: California (see map 69).
California records:
Los Angeles Co.: Claremont, $9, V-4-45$, flowers Cryptantha intermedia (Timberlake and Michener, 1950:410, U.C.R.).

Riverside Co.: Riverside, 9 , IV-26-37, $7 \sigma^{\prime}$,

9 ㅇ, III-1 2 to V-9, flowers Cryptantha intermedia (Timberlake and Michener, 1950:410); \&, IV-1151, all on flowers Cryptantha intermedia (P. H. Timberlake, U.C.R.). Perris, $1 \frac{1}{2} \mathrm{mi}$. W., 2 ㅇ, IV-27-38 and V-4-38, flowers Cryptantha inter media (Timberlake and Michener, 1950:410, U.C.R.). The Gavilan, 2 우, IV-16-39 and IV-1838, flowers Cryptantha intermedia (Timberlake and Michener, 1950:410, U.C.R.); 2 O, IV-6-50, flowers Cryptantha intermedia (P. H. Timberlake, U.C.R.); Y, III-29-50, flowers Cryptantha intermedia (P. H. Timberlake, U.C.R.). Piñon Flat, San Jacinto Mountains, , IV-21-53 (F. X. Williams, C.A.S.). Murrieta, $\delta^{\top}$, IV-18-50 (J. W. MacSwa in, C.I.S.).


Map 69. Distributions of Proteriades nanula Timberlake and Michener, the subspecies nanula indicated by half solid circles, and the subspecies sparsa by solid circles;


Map 70. Distribution of Proteriades reducta Timberlake and Michener

## Proteriades nanula sparsa

Timberlake and Michener

Proteriades nanula sparsa Timberlake and Michener, 1950, Univ. Kansas Sci. Bull., 33:410, $\delta$, ㅇ. Type $\delta$, Hastings Natural History Reservation, near Jamesburg, Santa Lucia Mountains, Monterey County, California, 1,9002,700 ft., flowers Cryptantha (Univ. of Kansas). Geographic range: California (see map 69). California records:

Fresno Co.: Coalinga (near), 2 , VI-8-41 (Timberlake and Michener, 1950:410).

Inyo Co.: Lone Pine Canyon, 2 ot, 5 ㅇ, VI-11-37, flowers Cryptantha (Timberlake and Michener, $1950: 410$, K.U.). Big Pine Creek, 4 ; VI-12-42 (Timberlake and Michener, 1950:410). Bishop Creek, north fork, 8,500 ft., ס', VI-22-37 (Timberlake and Michener, 1950:410, U.C.R.). Surprise Canyon, 9, IV-29-53, flowers Cryptantha inaequata (P. D. Hurd, Jr., C.I.S.).

Mariposa Co.: Yosemite, 3,880-4,000 ft., ${ }^{( }$, V-25-38 (Timberlake and Michener, 1950:410); $3 \delta$, ㅇ, V-25 and 31-1938, flowers Cryptantha (Timberlake and Michener, 1950:410).

Monterey Co.: Hastings Natural History Reservation, near Jamesburg, Santa Lucia Mountains, б, VI-4-38, 3 P, VI-6-38 (Timberlake and Michener, 1950:410, U.C.R.).

San Bernardino Co.: Mill Creek, San Bernardino Mountains, $6,000 \mathrm{ft}$., ㅇ, VII-2-44, flowers Cryptantha micrantha, var. lepida (Timberlake and Michener, 1950:410, U.C.R.); 2 ㅇ, V-28-50, flowers Cryptantha micrantha, var. lepida (P. H. Timberlake, U.C.R.). Manix, 22 mi. N., $9, I V-$ 26-53, flowers Cryptantha angustifolia (P. D. Hurd, Jr., C.I.S.).

Tulare Co.: Badger, 9, VI-26-29, flowers Cryptantba flacicida (Timberlake and Michener, 1950:410, U.C.R.). Discussion:

The specimens from Manix, San Bernardino County, and Surprise Canyon, Panamint Mountains, Inyo County, are small enough to be nanula proper and evidently represent intergrades toward that form.

## Proteriades pygmaea Timberlake and Michener

 (Pl. 21, fig. 93; pl. 22, fig. 107)Proteriades pygmaea Timberlake and Michener, 1950 , Univ. Kansas Sci. Bull., 33:411, ס, ㅇ. Type $\delta$, La Quinta, west of Indio, Riverside

County, California, flowers Cryptantha barbigera (Timberlake collection, U.C.R.).
Geographic range: California (see map 69). California records:

Inyo Co.: Panamint Springs, $\delta$, IV-7-38, flowers Cryptantha (Timberlake and Michener, 1950:413).

Riverside Co.: Palm Springs, 9, III-30-45, flowers Cryptantha barbigera (Timberlake and Michener, 1950:412, U.C.R.). Cathedral City, 2 mi. S., $\delta, 4$, 4 , IV-10-36, flowers Cryptantha (Timberlake and Michener, 1950:413, K.U.); same locality but 5 mi . E., 우, IV-10-36, flowers Cryptantha (Timberlake and Michener, 1950:413). La Quinta, $\delta, 3$ ㅇ, III-4-36, flowers Cryptantha barbigera (Timberlake and Michener, 1950:413, U.C.R.).

San Bernardino Co.: Twentynine Palms, 71/2 mi. S., V-7-48, flowers Nama demissum (Timberlake and Michener, 1950:413, U.C.R.). Vidal Junction, 9 , IV-3-51 (P. D. Hurd, Jr., C.I.S.).

San Diego Co.: Borego, ㅇ, V-2-52, flowers Eriogonum (P. D. Hurd, Jr., C.I.S.); $\delta$, + , III-31-53, flowers Cryptantha barbigera (P. D. Hurd, Jr., C.I.S.); 5 す', 2 9, IV-2-53, flowers Cryptantha barbigera (P. D. Hurd, Jr., C.I.S.).
Discussion:
This species is similar to nanula but is slightly smaller, with abundant white pubescence, broad white hairbands on metasoma, and clearer wings. In both sexes, the head is declivous closer behind the ocelli than in nanula so that the posterior ocelli are closer to the posterior margin of the vertex.

## Proteriades reducta Timberlake and Michener

Proteriades reducta Timberlake and Michener, 1950, Univ. Kansas Sci. Bull., 33:414, ס, ㅇ. Type $\delta$, Riverside, California, flowers Cryptantha intermedia (Timberlake collection, U.C.R.). Geographic range: California (see map 70). California records:

Riverside Co.: Riverside, 9 , IV-15-39, flowers Cryptantha intermedia (Timberlake and Michener, 1950:416, U.C.R.); $\sigma$, V-15-26; flowers Cryptantha intermedia (Timberlake and Michener, 1950:416, U.C.R.); + , IV-26-26, flowers Cryptantba intermedia (Timberlake and Michener, 1950:416, U.C.R.). Perris, $11 / 2 \mathrm{mi}$. W., 9, V-14-46, flowers Cryptantha intermedia (Timberlake and Michener, 1950:416, U.C.R.). The Gavilan, + , IV-6-50, flowers Cryptantha intermedia (P. H. Timberlake, U.C.R.); 9, V-7-51, flowers Cryptantha intermedia (P. H. Timberlake, U.C.R.).


Map 71. Distributions of Proteriades caudex Timberlake and Michener, indicated by open circles, and Proteriades


Map 72. Distribution of Proteriades bidenticauda
Timberlake and Michener.

## Discussion:

The male of reducta is distinguishable from similar middle-size species by having the middle of the first metasomal sternum covered with conspicuous white hair and by lacking the ventral tooth of the middle coxa which is present in allied species. The female differs from truicauda in the slightly smaller size and by having the first three terga entirely red and the clypeal margin more truncate medially. From bidenticauda it differs in having the maxillary palpi shorter, with only two or three indistinct segments, and the clypeal margin without a notch just within the lateral angulations. These three species differ from bamulicornis and seminigra in having the frons more shining and less closely punctured.

## Proteriades cryptanthae Timberlake and Michener

Proteriades cryptanthae Timberlake and Michener, 1950, Univ. Kansas Sci. Bull., 33:416, す, $\%$. Type ó, Riverside, California, flowers Cryptantha intermedia(Timberlake collection, U.C.R.).
Geographic range: California (see map 71 ).
California records:
Los Angeles Co.: Claremont, 2 ㅇ, V-4-45, flowers Cryptantha intermedia (Timberlake and Michener, 1950:418). Newhall, , IV-20-41 (Timberlake and Michener, 1950:418).

Riverside Co.: Riverside, ㅇ, IV-23-28, flowers Cryptantha intermedia (Timberlake and Michener, 1950:418); $9 \delta$, III-21 to V-1, flowers Cryptantha intermedia (Timberlake and Michener, 1950:418); 8 ㅇ,IV-20 to VI-17, flowers Cryptantha intermedia (Timberlake and Michener, 1950:418). The Gavilan, \&, IV-16-39, flowers Cryptantha inter media (Timberlake and Michener, 1950:418); $\delta$, 4 Y, IV-6 to V-8-1950, flowers Cryptantha intermedia (P. H. Timberlake, U.C.R.); 2 o', IV-22-52, flowers Cryptantha intermedia (P. H. Timberlake, U.C.R.). Temecula, 6 mi. E., $9, \mathrm{~V}-9-36$, flowers Cryptantha intermedia (Timberlake and Michener, 1950:418). Murrieta, 1 mi . N., ${ }^{\prime}$, IV-18-50 (J. W. MacSwain, C.I.S.).
Discussion:
This species is nearly of the same size and color as semirubra. It is easily distinguished in the male from all other species except caudex by having a large hornlike process on the apical middle of the first metasomal sternum. The male differs from caudex in the larger size and in having the ventral process thin-edged and truncate at apex. From semirubra the female differs
in having the hairbands of metasoma little developed, and the clypeal margin without fingerlike processes.

## Proteriades caudex Timberlake and Michener

(Pl. 21, fig. 94; pl. 22, fig. 101)
Proteriades caudex Timberlake and Michener, 1950, Úniv. Kansas Sci. Bull., 33:418, ס, ㅇ. Type $\delta$, Idyllwild, San Jacinto Mountains, California (Univ. of Kansas).
Geographic range: California (see map 71 ).
California records:
Riverside Co.: Idyllwild, 5 б, V-26-40 (Timberlake and Michener, 1950:420); 9, VI-3-39, flowers Cryptantha lepida (Timberlake and Michener, 1950:420, U.C.R.). Pine Flat, near Idyllwild, ㅇ, VI-15-40, flowers Cryptantha micrantha (Timberlake and Michener, 1950:420, K.U.); 7 \&, VI-15-40, flowers Cryptantha (Timberlake and Michener, 1950:420). Herkey Creek, $\widehat{\delta}$, VI-4-40 (Timberlake and Michener, 1950:420, K.U.). Keen Camp, $4 \delta$, 오, V-1 6-39 (Timberlake and Michener, 1950:420). Santa Rosa Mountain, 2 , VI-8 and 31-40, flowers Cryptantha micrantha (Timberlake and Michener, 1950:420, K.U.). San Jacinto Mountains, 9,1912 (Timberlake and Michener, 1950:420). San Jacinto Mountain Trail, 19 §, 9 ¢, VII-1-52 (J. W. MacSwa in, C.I.S., K.U.).
Discussion:
In the male, caudex resembles the considerably larger cryptanthae and differs in having the process of the first metasomal sternum thick and stumplike instead of flattened anteroposteriorly and thin-edged at apex. The posterior coxae are lamellate, a character not shared by cryptanthae. The female is far less distinctive but can be recognized by the narrow truncation of the clypeus, on each side of which is a distinct concavity between the end of the truncation and the sublateral angle.

Proteriades bidenticauda Timberlake and Michener (Pl. 21, fig. 95; pl. 22, fig. 103)

Proteriades bidenticaudaTimberlake and Michener, 1950, Univ. Kansas Sci. Bull., 33:420, ס, ㅇ. Type $\delta^{\circ}$, Mazourka Canyon, Inyo Mountains, Inyo County, California, $9,500 \mathrm{ft}$. (Univ. of Kansas).
Geographic range: California (see map 72).
California records:
Inyo Co.: Mazourka Canyon, Inyo Mountains,


Map 73. Distribution of Proteriades truicauda
Timberlake and Michener.


Map 74. Distribution of Proteriades hamulicornis
Timberlake and Michener.

9,500 ft., 7 웅 우, VI-1-37 (Timberlake and Michener, 1950:422); same data, $8,000 \mathrm{ft} ., 2$ ठे, V-2237 (Timberlake and Michener, 1950:422); same data, $7,500 \mathrm{ft} ., 7$ §, 2 f, V-21-37, one on flowers Cryptantha (Timberlake and Michener, 1950:422); same data, $7,000 \mathrm{ft} ., 4$ ठ', 오, V-21-37, flowers Cryptantha (Timberlake and Michener, 1950:422); same data, no elevation specified, 2 行, V-21-37 (Timberlake and Michener, 1950:422); $6 \delta^{\circ}$, $\mathrm{V}-25-$ 37 (C.I.S.). Wild Rose Canyon, Panamint Moun-
 Michener, 1950:422). Tuber Canyon, Panamint Mountains, 8,000 ft., 우, VI-18-37 (Timberlake and Michener, 1950:422). Inyo Mountains, $2 \delta^{\text {o }}$, VI-1-37 (Timberlake and Michener, 1950:422). Silver Canyon, White Mountains, ${ }^{\prime}$, V-11-26 (Timberlake and Michener, 1950:422). Lone Pine Creek, 6,500 ft., ठ̃, V-1947 (R. Bohart, G.E.B.). Discussion:

The male of this species is readily recognized among species of Proteriades by the seventh metasomal tergum, the two lobes of which have become two blunt teeth separated by a long straight margin (pl. 22, fig. 103). A superficially similar configuration occurs in the unrelated species deserticola, but in that form the teeth are separated by a concave margin. The female is similar to several other species such as bamulicornis, from which it differs in the closely punctured clypeus, among other characters.

## Proteriades truicauda Timberlake and Michener

Proteriades truicauda Timberlake and Michener, 1950, Univ. Kansas Sci. Bull., 33:423, ${ }^{\text {ox }}$, ㅇ. Type $\delta^{2}$, Santa Rosa Mountain, San Jacinto Mountains, Riverside County, California, flowers Cryptantha micrantha(Univ. of Kansas). Geographic range: California (see map 73). California records:

Riverside Co.: Santa Rosa Mountain, 2 §, 3 ㅇ, VI-18-40, flowers Cryptantha micrantha (Timberlake and Michener, 1950:425); 0 , ㅇ, V-31-40, flowers Cryptantha micrantha (Timberlake and Michener, 1950:425); $\sigma^{2}$, 우, VI-8-40, flowers Cryptantha micrantba (Timberlake and Michener, 1950:425).
Discussion:
In this moderate-size species the male is very readily recognized by the much produced, scoopshaped seventh metasomal tergum which is not at all bilobed and not angulate on the sides. The female is markedly smaller than the male and differs from a series of structurally rather
similar species such as tristis and reducta by having the red coloration restricted to the sides of the metasomal terga but extending back to the fifth or sixth tergum.

Proteriades bamulicornis Timberlake and Michener (Pl. 21, fig. 92; pl. 22, fig. 108)

Proteriades bamulicornis Timberlake and Michener, 1950, Univ. Kansas Sci. Bull., 33:425, ठ', ㅇ. Type ${ }^{\circ}$ ', Mazourka Canyon, Inyo Mountains, Inyo County, California, $7,500 \mathrm{ft}$., on flowers Cryptantha (Univ. of Kansas).
Geographic range: California (see map 74).
California records:
Inyo Co.: Mazourka Canyon, Inyo Mountains, 7,500 ft., 8 , V-21-37, flowers Cryptantha (Timberlake and Michener, 1950:427); same locality, 7,000 ft., ठ', V-20-37, flowers Cryptantha (Timberlake and Michener, 1950:427); same locality, $9,500 \mathrm{ft} ., \mathrm{o}$, $9, \mathrm{VI}-1-37$ (Timberlake and Michener, 1950:427). Inyo Mountains, $\delta$, VI-1-37 (Timberlake and Michener, 1950:427). Wildrose Canyon, Panamint Mountains, $7,000 \mathrm{ft}$. , $\mathrm{f}, \mathrm{V}-27-37$, flowers Cryptantha (Timberlake and Michener, 1950:427). Discussion:

The male of hamulicornis is easily recognized by numerous characters such as the very broad face with the inner orbits diverging below, the sharply pointed last antennal segment (fig. 92) suggestive of this structure in Hoplitis, subgenus Alcidamea, and the spined posterior coxae. By contrast, the female, which is apparently to be associated with these males, is unspecialized in structure and similar to several other species such as bidenticauda. It differs in having the rounded prominences in front of the ocelli densely punctured without shining interspaces and in the widely separated punctures of the convex upper part of the clypeus.

## Proteriades xerophila (Cockerell)

(Pl. 22, fig. 111)
Osmia xerophila Cockerell, 1935, Pan-Pacific Ent., 11:45, ot, ㅇ. Type ㅇ, Palm Springs, California, flowers Cryptantha (Timberlake collection, U.C.R.).
Geographic range: California (see map 75).
California records:
Imperial Co.: Palo Verde, $3 \mathrm{mi} . \mathrm{S} .$, , + , IV-8-49 (Michener, 1951:51, C.I.S.). Inyo Co.: Grape Vine Canyon, 10 mi . S. Little


Map 75. Distributions of Proteriades jacintana (Cockerell), indicated by solid circles; and Proteriades xerophila (Cockerell), indicated by open circles.


Map 76. Distrioutions of Proteriades boharti Timberlake and Michener, indicated by upper half solid circles; Proteriades deserticola Timberlake and Michener, indicated by open circles; Proteriades evansi Michener, indicated by lower half solid circles; and Proteriades semirubra (Cockerell), indicated by solid circles.

Lake, on east side of Sierra Nevada, north of Walker Pass, $\delta$, + , reared from old nests of Anthophora linsleyi (Michener, 1943:83).

Riverside Co.: Palm Springs, ${ }^{\circ}{ }^{\circ}, \mathrm{III}-22$ to III-30; 아, III-21 to IV-16, many on Cryptantha barbigera (Timberlake and Michener, 1950:429); d, V-21-32, flowers Malva parviflora (P. H. Timberlake, U.C.R.).

San Bernardino Co.: Cronese Valley, ${ }^{\text {J, }}$, IV-4-53, flowers Larrea (J. W. MacSwain, C.I.S.). Kramer Junction, ㅇ, V-1-53 (P. D. Hurd, Jr., C.I.S.).

San Diego Co.: Borego, II-28; III-6-47 (Michener, 1949:54); 우, 11I-31-53 (P. D. Hurd, Jr., C.I.S.). Tub Canyon, Borego,, , II-28-47 (Timberlake and Michener, 1950:429, U.C.R.).
Discussion:
This species may be readily recognized by its large size ( 6.5 to 8.8 mm .), lack of red coloration, and the strongly tridentate condition of the seventh metasomal tergum of the male (pl. 22, fig. 111).

## Proteriades boharti Timberlake and Michener

(Pl. 21, fig. 96; pl. 22, fig. 105)
Proteriades boharti Timberlake and Michener, 1950, Univ. Kansas Sci. Bull., 33:429, ס. Type ${ }^{\circ}$ ', Carrville, Trinity County, California, 2,400 to $2,500 \mathrm{ft}$. (Calif. Acad. Sci.).
Geographic range: California (see map 76).
California records:
Trinity Co.: Carrville, $2,400-2,500 \mathrm{ft}$. , $\bar{\delta}$, VI-18-34 (Timberlake and Michener, 1950:430). Little Bear Gulch, ${ }^{\circ}$, V-31-51 (A. T. McClay, C.I.S.).

Discussion:
P. bobarti is distinguishable at once from all other known Proteriades, except caudex, by the male posterior coxae, the inner ventral carina of each of which is expanded posteriorly into a lamella. This species differs from caudex by the absence of a large protuberance on the first sternum.

Proteriades deserticola Timberlake and Michener (Pl. 22, fig. 104)

Proteriades deserticola Timberlake and Michener, 1950, Univ. Kansas Sci. Bull., 33:430, ס', ㅇ. Type $\delta$, Palm Springs, Riverside County, California, flowers Cryptantha barbigera (Timberlake collection, U.C.R.).

Geographic range: California (see map 76). California records:

Imperial Co.: San Felipe Creek, $2 \delta$, 아, IV-8-39 (Timberlake and Michener, 1950:433). Kane Springs, 19 mi . W., ㅇ, III-25-33, flowers Cryptantha angustifolia (Timberlake and Michener, 1950:433).

Riverside Co.: Palm Springs, ㅇ, III-30-45, flowers Cryptantba barbigera (Timberlake and Michener, 1950:432); 8 ठ, 34 ㅇ, III-21, 26-32, III-24-33, III-30-45, flowers Cryptantha barbigera (Timberlake and Michener, 1950:432); ${ }^{6}$, 9 ㅇ, IV-16-39 (Timberlake and Michener, 1950:432); ㅇ, IV-4-42 (R. M. Bohart, G.E.B.). Indio, ठ, III-25-37 (Timberlake and Michener, 1950:433). Andreas Canyon, Palm Springs, 6 סJ, 2 ㅇ, IV-7-40 (Timberlake and Michener, 1950:433). Edom, 4 mi. E., IV-17-37 (Timberlake and Michener, 1950: 433). Thousand Palm Canyon, 2 ㅇ, IV-10-37, flowers Cryptantha angustifolia (Timberlake and Michener, 1950:433); $\delta$, 우, III-9-40 (Timberlake and Michener, 1950:433). Desert Center, 18 mi. E., 2 ㅇ, IV-13-49, flowers Cryptantha barbigera (P. H. Timberlake, U.C.R.). Box Canyon, ㅇ, IV-27-52, flowers Cryptantha angustifolia (P. H. Timberlake, U.C.R.). Sha vers Well, 3 mi . N., $3 \mathrm{o}^{*}$, 오, IV-9-52 (J. W. MacSwain, C.I.S.).

San Bernardino Co.: Vidal Junction, 7 mi . N., 4 ㅇ, IV-3-S1 (P. D. Hurd, Jr., C.I.S.). Cronese Valley, 9 , IV-4-53 (J. W. MacSwain, C.I.S.).

San Diego Co.: Borego, ${ }^{\kappa}$, ㅇ, I, IV-8-39 (Timberlake and Michener, 1950:433); $6 \delta, 17$ O, III-3153, flowers Cryptantba barbigera (P. D. Hurd, Jr., C.I.S.); $\delta, 3$ Y, IV-2-53, same flowers (P. D. Hurd, Jr., C.I.S.); 4 ठ', 2 9, IV-2-53, flowers C. angustifolia (P. D. Hurd, Jr., C.I.S.). Borego Valley, 2 \&, V-2-52, flowers C. angustifolia ( P. H. Timberlake, U.C.R.).

## Discussion:

This is a robust, medium-size species with abundant pale pubescence. It is at least superficially similar to bidenticauda in having two teeth on the seventh metasomal tergum of the male (pl. 22, fig. 104). It seems probable, in view of the differences between both males and females, that this condition arose independently in the two species and that the bidentate male metasoma does not indicate close relationship. In deserticola, the two teeth are separated by a broad crescentiform emargination and in bidenticauda by an equally broad quadrate emargination. The female of deserticola has a very distinctive clypeal margin some what similar to that of evansi, but with the median lobe less arched and more projecting over the base of the labrum, so that the margin is about equally produced at sides and in the middle.

Small series of this species from seven miles north of Vidal Junction, San Bernardino County, and three miles north of Shavers Well, Riverside County, and a single female from Palm Springs, Riverside County, and another single female from Cronese Valley, San Bernardino County, differ from typical deserticola in having the median apical part of the female clypeus three toothed, suggesting the three larger processes of the female of semirubra. These specimens are probably variants of deserticola; no differences are evident in males or in other characteristics.

Some of the females collected at Borego, San Diego County, on April 2, 1953, were taken as they were entering or leaving burrows in hardpacked sandy loam soil. One of the burrows that was excavated extended downward for six and one-half inches and had one cell with a partly provisioned pollen mass. This female had been observed to make two trips to a near-by patch of Cryptantba barbigera in a half hour.

## Proteriades semirubra (Cockerell)

(Pl. 21, figs. 97, 99; pl. 22, fig. 102)
Heriades semirubra Cockerell, 1898, Trans. Amer. Ent. Soc., 25:198, ó. Type ò, southern California (Acad. Nat. Sci. Phila.). Geographic range: California (see map 76). California records:

Fresno Co.: Coalinga (Timberlake and Michener, $1950: 436$ ); near same locality, $\uparrow, V_{1}-8-41$ (R. M. Bohart, G.E.B.).

Los Angeles Co.: Newhall (Timberlake and Michener, 1950:436); $\sigma^{2}, 2$ O, IV-20-40 (R. M. Bohart, G.E.B.). Tanbark Flat, San Dimas Experimental Forest, ${ }^{\text {P, VI-16-50 (J. C. Hall, }}$
 VI-22-50 (P. D. Hurd, Jr., C.I.S., K.U.); ㅇ, same data (J. W. MacSwain, C.I.S.); ${ }^{\text {P, VI-23-S0 (J. W. }}$ MacSwain, C.I.S.); \&, VI-25-50 (P. D. Hurd, Jr., K.U.); 2 ?, same data (J. W. MacSwain, C.I.S.); 9, VI-29-52 (J. W. MacSwain, C.I.S.).

Monterey Co.: Jamesburg, Santa Lucia Mountains, ${ }^{\circ}{ }^{\circ}$, as late as June 4 , 웅, as late as June 8 (Timberlake and Michener, 1950:436).

Riverside Co.: Andreas Canyon near Palm Springs (Timberlake and Michener, 1950:436). Mt. San Jacinto, 4,000 ft., ס', 3 \&, VI-6-42 (R. M. Bohart, G.E.B.). Palm Springs, 2 ठ', IV-16-39 (R. M. Bohart, G.E.B., U.C.D.). Perris (Timberlake and Michener, $1950: 436$ ). Perris, $11 / 2 \mathrm{mi}$. W., б, IV-27-38, 4 ㅇ, V-18-39, + , IV-7-40, ㅇ, III-27-46, $\delta$, V-14-48, all on flowers Cryptantha
intermedia (P. H. Timberlake, U.C.R.). Perris, 3 mi . W., 2 ठ, IV-20-39, flowers Cryptantha intermedia (P. H. Timberlake, U.C.R.). San Jacinto River, San Jacinto Mountains, 4,000 ft., (Timberlake and Michener, 1950:436). Temecula, 2 f, IV-24-51 (E. I. Schlinger, U.C.D.). Temecula, 6 mi . E., 2 \&, V-7-36, flowers Cryptantha intermedia (Timberlake and Michener, 1950:436, U.C.R.). The Gavilan (Timberlake and Michener,
 ס, 7 ㅇ, IV-20-39, + , IV-14-40, 2 ㅇ, IV-18-40, 2 ㅇ, IV-30-40, $\sigma$, IV-10-46, 9 , IV-16-51, all on flowers Cryptantha intermedia (P. H. Timberlake, U.C.R.); + V-17-51 (E. I. Schlinger, U.C.D.). Riverside (Timberlake and Michener, $1950: 436$ ); 5 ㅇ, IV-6-34, ㅇ, V-5-34, $2 \delta, 12$ ㅇ, V-8-35, ㅇ, V-21-35, $\sigma, ~ V-4-36$, , V-6-37, $\delta$, VIII-5-37, $\delta$, VIII-6-37, $\delta$, IV-1 5-38, 5 б', V-6-38, 6 б', IV-5-39, 3 个, V-2-39, ס, IV-10-45, all on flowers Cryptantba intermedia (P. H. Timberlake, U.C.R.); $\uparrow$, VII-10-36 (E. G. Linsley, C.I.S.); Eriophyllum multicaule (P. H. Timberlake, U.C.R.).

San Benito Co.: Pinnacles National Monument, 9, IV-24-48 (Timberlake and Michener, 1950:436).

San Bernardino Co.: Mill Creek, San Bernardino Mountains, $4,400 \mathrm{ft}$., $9, \mathrm{~V}-30-38$, floweirs Cryptantha intermedia (Timberlake and Michener, 1950: 436, U.C.R.). Redlands, 9, V-1 5-36 (Timberlake and Michener, 1950:436, K.U.). Verdemont, ${ }^{\circ}$, V-17-46, flowers Cryptantha intermedia (Timberlake and Michener, 1950:436, U.C.R.).

San Diego Co.: La Mesa, $\delta$, III-30-53 (F. X. Williams, C.A.S.). Ramona, 3 ¢, IV-19-50 (E. G. Linsley, C.I.S., K.U.). Warner Springs, $9, \mathrm{~V}-9-36$, flowers Cryptantha intermedia (Timberlake and Michener, 1950:436, U.C.R.).

San Luis Obispo Co.: Atascadero, 9 , (Timberlake and Michener, 1950:436). Discussion:

This species may be immediately recognized in the female by the two long fingerlike processes projecting downward from the clypeal margin. The male is far less distinctive, but can be recognized by the small median prominence of the clypeal margin (a feature shared with deserticola), which has the apex of the male metasoma bidentate (pl. 22, fig. 102).

Timberlake and Michener (1950:436) state that at Riverside it frequents spots only where Cryptantba intermedia is growing, and the female obtains its pollen exclusively from the flowers of this plant. All the specimens examined, and for which complete flower records exist, were on Cryptantha intermedia, some labeled as "Cryp" taniba" may have been taken on other species of the genus.

## Proteriades evansi Michener

Proteriades evansi Michener，1936，Bull．So． Calif．Acad．Sci．，35：92，ㅇ․ Type ㅇ，Lloyds （Sierra Nevada Mountains），Tulare County， California（Calif．Acad．Sci．）．
Geographic range：California（see map 76）． California records：

Kern Co．：Woody， 2 ㅇ，IV－24－49（E．G．Linsley， C．I．S．，K．U．）．

Tulare Co．：Coffee Creek， 5 아，VI－11－25， flowers Cryptantha flaccida（Timberlake and Michener，1950：434）．
Discussion：
$P$ ．evansi is most closely related to deserti－ cola from which it differs，among other characters， in the less extensive red areas，the acute inner mandibular tooth，and the unproduced median apical part of the clypeus which does not over－ hang the base of the labrum．The male of this species is unknown．

## Proteriades jacintana（Cockerell）

 （Pl．21，figs．98，100；pl：22，fig．110）Chelostoma（Cephalapis）jacintana Cockerell， 1910，Ann．Mag．Nat．Hist．，（8）5：23，$\delta$ ．Type d，Kensworthy，San Jacinto Mountains，Cali－ fornia（Timberlake collecrion，U．C．R．）．
Geographic range：California，Oregon（see map 75）．
California records：
Alameda Co．：Midway，ㅇ，V－24－36（E．S．Ross， K．U．）．

Inyo Co．：Big Pine Creek， $7,500 \mathrm{ft}$ ．，（Timber－ lake and Michener，1950：439）； $5 \mathrm{o}^{2}, 2$ ㅇ，VI－1 2－42， 2 ㅇ，VI－1 6－42， 2 ठ，VI－17－42， 3 ठ， 5 우，VI－20－42 （R．M．Bohart，G．E．B．）．Lone Pine Creek，6，500 ft．，$\delta^{2}$ ，V－19－47（R．M．Bohart，G．E．B．）．

Los Angeles Co．：Arroyo Seco，o＇，f，VI－25－40 （J．W．MacSwain，C．I．S．）．Claremont，+ ，V－4－45， flowers Cryptantha intermedia（Timberlake and Michener，1950：438，U．C．R．）．Crystal Lake，San Gabriel Mountains， $4,700 \mathrm{ft}$ ．， 9 ，VII－9－52（R．M． Bohart，U．C．D．）．Eagle Rock，ㅇ，V－9－36（Timber－ lake and Michener，1950：438，K．U．）．La Crescenta， f，IV－19－36（E．G．Linsley，C．I．S．）．Newhall， 3 8， 7 ，IV－20－40（Timberlake and Michener，1950： 438）．Tanbark Flat，San Dimas Experimental Forest，ㅇ，VI－19－50（J．W．MacSwa in，K．U．）；${ }^{\text {，}}$ VI－20－50，flowers Eriogonum（W．C．Bentinck， C．I．S．）；+ ，V－20－50（P．D．Hurd，Jr．，C．I．S．）； 5 ㅇ， VI－22－50，flowers Cryptantha（P．D．Hurd，Jr．， C．I．S．，K．U．）； 2 ㅇ，VI－23－50（P．D．Hurd，Jr．，

K．U．）；${ }^{\text {P }}$ ，same data（F．X．Williams，C．A．S．）； $2 \delta, 5$ 早，VI－25－50（J．W．MacSwain，C．I．S．，K．U．）； $\delta^{\prime}$ ，same data（P．D．Hurd，Jr．，C．I．S．）；$\delta$ ， ，，same data（F．X．Williams，C．A．S．）； Hurd，Jr．，C．I．S．）；O，VII－3－50（P．D．Hurd，Jr．， C．I．S．）； 2 \＆，VII－10－50（F．X．Williams，C．A．S．）； 2 ㅇ，VII－1－52（Joan Linsley，C．I．S．）；ㅇ，VII－5－52 （R．M．Bohart，U．C．D．）；ㅇ，same data（A．A． Greigarick，U．C．D．）； 4 ㅇ，same data（H．L． Mathis，U．C．D．）；$\delta^{\prime}, 5$ ㅇ，same data（S．Miyagawa： U．C．D．）； 2 ㅇ，same data（J．F．Powers，U．C．D．， U．C．L．A．）； 3 ㅇ，VII－13－52（J．W．MacSwain， C．I．S．）； 16 早，VII－16－52（A．T．McClay，U．C．D．）．

Madera Co．：Midway， $3,000 \mathrm{ft}$ ．（Timberlake and Michener，1950：438）．

Mariposa Co．：Mariposa，ㅇ，VI－7－40（T．H．G． Aitken，B．Brookman，M．A．Cazier，U．C．D．）．Big Meadows，Yosemite National Park，3，880－4，000 ft．， 3 ठ＇，VI－1－38（R．M．Bohart，G．E．B．，U．C．D．， U．C．L．A．）．Yosemite National Park，3，880－4，000 ft．， 3 ठ， 2 우，V－25－38，males on flowers Cryptantha （R．M．Bohart，G．E．B．，U．C．D．）； 3 万， 2 ㅇ，V－31－38 （Timberlake and Michener，1950：438，G．E．B．）．

Mono Co．：Rock Creek，8，500 ft．， 2 万， 3 우， VI－23－37（Timberlake and Michener，1950：439， K．U．）．

Monterey Co．：Jamesburg，Santa Lucia Moun－ tains，V－22－38（Timberlake and Michener，1950： 438，K．U．）．Bryson，${ }^{\text {br，}}$ V－18－20（E．P．Van Duzee， C．A．S．）．

Riverside Co．：Ortega Highway overlooking Elsinore（Timberlake and Michener，1950：438）． Riverside（Timberlake and Michener，1950：438）． Keen Camp，ㅇ，VI－3－39，flowers Cryptantha inter－ media（P．H．Timberlake，U．C．R．）；ס＇，ㅇ，V－10－39 （E．G．Linsley，C．I．S．）； 5 d，f，V－16－39（E．G． Linsley，C．I．S．）．The Gavilan，ㅇ，IV－16－50， flowers Cryptantha intermedia（P．H．Timberlake， U．C．R．）； 2 \＆，V－8－50，flowers Cryptantha inter－ media（P．H．Timberlake，U．C．R．）．Saunders Meadow，San Jacinto Mountains，오，V－25－39（B． Brookman，C．I．S．）．Ribbonwood（Timberlake and Michener，1950：438）；$\delta$ ，V－20－39（E．S．Ross， C．I．S．）．Herkey Creek（Timberlake and Michener， 1950：438）；ठ，VI－12－39（B．Brookman，C．I．S．）； ठ，VI－11－39（E．S．Ross，C．I．S．）．Hemet Reservoir， ठ，VI－13－39（E．S．Ross，C．I．S．）．Idyllwild，${ }^{\prime}$ ， V－25－39（E．G．Linsley，C．I．S．）；©， 2 O，V－26－39 （E．S．Ross，C．I．S．，K．U．）； 2 早，VI－13－41（E．C． Van Dyke，C．A．S．，K．U．）； 4 ㅇ，VI－15－41（E．C． Van Dyke，C．A．S．，K．U．）；ㅇ，VI－16－41（E．C．Van Dyke，K．U．）； 2 个，VI－18－41（E．C．Van Dyke， K．U．）．Mount Santa Rosa， $7,500 \mathrm{ft}$ ．， $2 \delta$ ， ㅇ，VI－8－ 40，flowers Cryptantba micrantha（ P ．H．Timber－ lake，U．C．R．）；${ }^{\prime}$ ，VI－8－40（C．D．Michener，C．I．S．）．


Plate 10. Lateral view of Ashmeadiella californica (Ashmead), male.

Stone Creek, Keen Camp, 4,000 ft., $\delta$, 오, VI- 21 and 22-40, flowers Cryptantha muricata var. denticulata (Timberlake and Michener, 1950:438). Poppet Flat, 2 mi. E., San Jacinto Mountains (Timberlake and Michener, 1950:438). Vande vanter Flat, 2 ㅇ, VI-4-40, flowers Cryptantha (Timberlake and Michener, $1950: 438$, O.S.C.). Mt. San Jacinto, $4,000 \mathrm{ft}$. , ${ }^{\circ}$, 3 9, V-28-39 (R. M. Bohart, G.E.B., U.C.L.A.); $3 \delta^{\prime}, \notin$, VI-6-42 (R. M. Bohart, G.E.B.). Piñon Flat, San Jacinto Mountains, ${ }^{9}$, IV-21-53 (F. X. Williams, C.A.S.). Banning, $\bar{\delta}$, V-28-28 (E. C. Van Dyke, C.A.S.).

San Benito Co.: Pinnacles National Monument, 8 ठ, IV-24-48 (Timberlake and Michener, 1950: 438).

San Bernardino Co.: San Bernardino, ㅇ, V-2836 (E. G. Linsley, C.I.S.). Deep Creek, ${ }^{\text {P, }}$ V-936 (E. G. Linsley, C.I.S.). Mill Creek, San Bernardino Mountains, 4,400-4,700 ft., 4 d', 13 年, V-30-37, flowers Cryptantba intermedia (Timberlake and Michener, 1950:438, U.C.R.). Mill Creek, San Bernardino Mountains, $4,800 \mathrm{ft}$., $\hat{\delta}, 2$ ㅇ, V-13-40, flowers C. intermedia (P. H. Timberlake, U.C.R.). Seven Oaks, San Bernardino Mountains, 2 \&, VI-14-50, flowers C. intermedia (P. H. Timberlake, U.C.R.). Forest Home (Timberlake and Michener, 1950:438).

San Diego Co.: Warner's Hot Springs, (Timberlake and Michener, 1950:438).

Trinity Co.: Carrville, $2,400-2,500 \mathrm{ft}$., 아, VI-18-34, $\delta$ ', V-21-34 (Timberlake and Michener, 1950:439, G.E.B.). Coffee Creek, $\bar{\delta}$, VI-7-34 (Timberlake and Michener, 1950:438, G.E.B.). Discussion:

Timberlake and Michener (1950:439) state that the flower visited in southern California is usually Cryptantba intermedia, but it also has been collected on C. micrantha var. lepida. The flower records for the more northern collections are given as Cryptantha. These authors state that the dates of collection for males range from April 20 to June 23, for the females from April 20 to July 5 .

In the collection of the University of California, Davis, there are two specimens (male and female) from Copco, Jackson County, Oregon, which were collected by C. Fitch on June 1, 1951. This record is the first for that state of the genus Proteriades.

This species is very easily recognized by its elongate form, broad genal areas, the keeled clypeus, the large and virtually tridentate male mandibles (fig. 100), and the long and nearly straight margin between the upper two teeth of the female mandibles (fig. 98).

## Genus Ashmeadiella Cockerell

This is a large, strictly American genus related to Antbocopa but differing from that genus, as well as from all our other megachilines, by the presence of a carina separating the shining, weakly punctate anterior face of each mesepisternum from the more coarsely punctate lateral face (pl. 2, fig. 2). A more noticeable character in the males is the strongly quadridentate sixth metasomal tergum (pl. 24, figs. 132-141). The species of Ashmeadiella are of small to moderate size, robust in form, and nonmetallic. The first metasomal tergum has the anterior face broadly concave and bounded by a carina.

The genus Asbmeadiella was revised by Michener (1939). Since that time a few new species have been described and a few nomenclatorial changes made. These are indicated under the appropriate species below.

The genus Asbmeadiella ranges from Canada to southern Mexico and from the Atlantic to the Pacific. However, it is common only in the more or less arid parts of the continent. In spite of its abundance in many places, little is known of its nesting habits. Some species (A. californica californica, A. aridula astragali) nest in twigs or stalks of plants. A. femorata has been reared from a nest of Pseudomasaris, one section of which must have been taken over by the bee. An undetermined species was apparently reared from the shell of a snail in Texas.

Although most species of Asbmeadiella fly principally in spring and early summer, some remain active well into the fall. For example, $A$. californica has been collected at Riverside, California, from April 11 to November 1. Other species, principally the oligotropic forms in the more specialized subgenera, have relatively restricted seasons of flight in any one place, although climatic variations connected with differences of altitude and latitude may give them a rather long season from the standpoint of the entire range.

The species of the genus have widely different flower-visiting habits. Certain forms, perhaps the majority of those in the subgenus Ashmeadiella, s. str., visit flowers of many species of plants. For example, bigeloviae is found regularly on flowers of several families, and bucconis and californica visit many Compositae. However, opuntiae appears to be oligotropic on cactus, and prosopidis on Prosopis. In the other subgenera, the majority of the species
seem to be restricted in their regular pollencollecting visits to a single genus of plants. For example, erema visits chiefly Dalea; timberlakei,
small legumes such as Lotus and Astragalus; salviae, Salvia; and australis, Penstemon.

## Key to the Subgenera of Asbmeadiella


#### Abstract

Males ${ }^{4}$ 1. Mandibles tridentate . . . . . . . . . . . . . . . . . . Cbilosima (p. 213)

Mandibles bidentate $$
2
$$

2(1). Lateral margins of sixth metasomal tergum distinctly and rather evenly convex throughout, lateral teeth broad, apices nearly right angles

Cubitognatha (p. 195, 215), Corythochila (p. 195, 211), Arogochila (p. 195) Lateral margins of sixth tergum straight, feebly convex, or sinuate; lateral teeth with apices usually acute

Ashmeadiella (p. 155), Titusella (p. 155, 192)


## Females

1. Outer side of mandible, measured along lower carina, more than twice as long as scape; clypeus, if produced over base of labrum, not truncate, or if so with margins laterad to ends of truncation, sinuate or lobed ${ }^{5}$.
Outer side of mandible, measured along lower carina, at most twice as long as scape; clypeus produced well over base of labrum, its apex with the usual truncation (sometimes concave) found in many other small megachilines. (Clypeus usually punctate throughout; mandibles tridentate) . . . . . . . . . . . . . . . . . . . Asbmeadiella (p. 155)
2(1). Mandibles rather slender, distance from first tooth to inner apical angle less than half length of mandible

$$
3
$$

Apices of mandibles greatly broadened, distance from first tooth to inner apical angle at least half length of mandible. (Clypeus in California species partly impunctate).

Titusella (р. 192)
3(2). Mandibles not elbowed, three- or four-toothed; clypeus punctured throughout, upper margin not protuberant.
Mandibles elbowed, bidentate; clypeus impunctate, upper margin protuberant (pl. 24, fig. 129)
Cubitognatha (p. 215)
4(3). Clypeus with apex irregularly rounded or not produced much beyond lower ends of eyes, in the latter case with strong lateral angles; mandibles quadridentate (except in occasional specimens of A. rbodognatha)
Clypeus with apical margin produced and usually variously lobate, the minimum projection being a median, abruptly projecting truncation on either side of which is a shoulder (foxiella, pl. 23, fig. 116) or small lobe (leachi); mandibles usually tridentate

Arogochila (p. 195)
5(4). Apex of clypeus broadly, irregularly rounded, without lateral angles, produced well below lower ends of eyes (pl. 24, fig. 128) . . . . . . . . . . . . Chilosima (p. 213)
Apex of clypeus with prominent, projecting lateral angles, scarcely produced below lower ends of eyes (pl. 24, figs. 126, 127) .

Corythochila (p. 211)

[^3]
## Subgenus Ashmeadiella Cockerell

Females of this subgenus may be easily recognized by the somewhat produced, truncated clypeus, similar to that of females of many Osmia (subgenera Acanthosmioides and Nothosmia), with a pair of brushes of orange hair beneath the margin. In all known species of this subgenus, the apex of the labrum is rounded, and the hypostomal carinae are low and unmodified. The mandibles are relatively short and robust, twice as long as the antennal scape or slightly less. In most species the sixth metasomal ster-
num bears a transverse depression which is usually more coarsely and less closely punctate than the rest of the sternum.

This is the largest and most widely distributed subgenus of Ashmeadiella. It contains numerous closely related species and differentiation of them is at times difficult. A considerable number of specimens remain unidentified in collections because it seems undesirable to describe new species from only one or two specimens, and because as more material is collected it sometimes is possible to place these odd specimens as variants of previously known forms.

## Key to the California Species of the Subgenus Asbmeadiella

## Males

(Including those of the Subgenus Titusella)

1. Proboscis short, not extending beyond proboscidial fossa in repose; maxillary palpi very short, shorter than basal width of galea; tarsi testaceous to reddish brown . . . . 2
Proboscis normal, extending well beyond proboscidial fossa in repose; maxillary palpi longer than basal width of galea; tarsi usually concolorous with rest of legs . . . . . . 3
2(1). Anterior ocellus with anterior margin at mid-point between antennal bases and posterior edge of vertex; posterior ocellus, seen in profile, with horizontal space twice its diameter behind it, before vertex begins to slope steeply posteriorly; maxillary palpi four segmented

Anterior ocellus well behind mid-point between antennal bases and posterior edge of vertex; posterior ocellus seen in profile with horizontal space as wide as its diameter behind it, before vertex begins to slope steeply posteriorly; maxillary palpi two-segmented
rufitarsis (p. 166)
3(1). Hind tibial spurs short, robust, and rather strongly curved, inner one with about three coarse teeth on outer side. (Median teeth of sixth metasomal tergum considerably longer than basal widths)
Hind tibial spurs longer, more slender, straight or little curved, with numerous fine teeth. . 5
4(3). Tegulae light rufotestaceous . . . . . . . . . . . . . . . . . titusi (p. 172)
Tegulae infuscated . . . . . . . . . . . . . . . . . . . femorata (p. 170)
5(3). Median teeth of sixth metasomal tergum short, less than one and one-half times as long as broad (as in pl. 24, fig. 134); median concavity of sixth tergum usually shorter than a semicircle
Median teeth of sixth metasomal tergum long, one and one-half times as long as broad (as in pl. 24, fig. 137) except in some cases where they are broadened basally; median concavity of sixth tergum longer than a semicircle . . . . . . . . . . . . . . . 14
6(5). Metasoma and legs black to brown, or if legs partly red, metasoma also partly red . . . 7
Metasoma black or nearly so; legs with considerable red coloration. . . bigeloviae (p. 172)
7(6). Anterior ocellus slightly (or considerably) closer to posterior margin of vertex than to antennal bases (pl. 24, fig. 130); body less coarsely punctate . . . . . . . . . 8
Anterior ocellus slightly (or considerably) farther from posterior margin of vertex than from antennal bases (fig. 131); body very coarsely punctate
.bucconis (p. 166)
8(7). Upper part of clypeus with punctures much finer than those of frons ..... 9
Upper part of clypeus with punctures nearly as coarse as those of frons or coarser ..... 12
9(8). Anterior ocellus with anterior margin behind mid-point between antennal bases and posterior margin of vertex (as illustrated in pl. 24, fig. 130) ..... 10
Anterior ocellus with anterior margin at mid-point between antennal bases and posteriormargin of vertex. (Titusella) cubiceps (p. 192)
10(9). Mesoscutal punctures not coarser than those of vertex and rarely separated by as much as a puncture width; anterior margin of mesoscutum without dense pubescence or with a pair of densely pubescent spots. ..... 11
Mesoscutal punctures markedly coarser than those of vertex and separated by almost their diameters; anterior margin of mesoscutum with a broad transverse band of dense white pubescence leucozona (p. 177)
11(10). Shortest distance between eyes about two-thirds the length of an eye; metasoma without red areas prosopidis (p. 161)
Shortest distance between eyes more than two-thirds the ingth of an eye; metasoma, inCalifornia subspecies, partly red. gillettei (p. 179)
12(8). Punctation of upper part of clypeus about as coarse as the punctation of frons . ..... 13Punctures of upper part of clypeus coarser than the fine and extraordinarily dense punctationof frons13(12). Genal areas at least two-thirds as wide as eye seen from side; front part of mesoscutummuch more finely punctate than rear part, punctures of latter as coarse as those of vertex
Genal areas little more than half as wide as eye seen from side; front part of mesoscutumnot much more finely punctate than rear part, punctures of latter finer than those of vertex
14(5). Distance from posterior ocelli to posterior edge of vertex hardly more than and often less than distance between posterior ocelli ..... 15
Distance from posterior ocelli to posterior edge of vertex nearly one and one-half, or more,times distance between posterior ocelli . . . . . . . . . . . . opuntiae (p. 192)
15(14). Median ocellus much less than twice as far from antennal bases as from posterior edge of vertex; length 5 mm . or more ..... 16
Median ocellus about twice as far from antennal bases as from posterior edge of vertex (fig.130); length 4.5 mm . or less . . . . . . . . . . . . . . . sonora (p. 163)
16(15). Legs dark (or hind femora sometimes red in difugita); mesoscutum without band of dense white pubescence across front margin ..... 17
Legs largely red; mesoscutum with broad anterior transverse band of dense white pubescence
rufipes (p. 175)
$17(16)$. Hairs in vicinity of subapical angle of genital coxopodite about as long as width of coxopodite at that point; body usually more finely punctate ..... 18
Hairs in vicinity of subapical angle of coxopodite about half as long as width of coxopoditeat that point; body usually more coarsely punctate19
18(17). Clypeus about as coarsely punctate as frons, the two projections of apical margin separatedby distance nearly equal to distance from one of them to eye margin; hind femora some-times red. . . . . . . . . . . . . . . . . . . . . . difugita (p. 180)Clypeus usually more finely punctate than frons, the two projections of apical margin lesswidely separated; hind femora black . . . . . . . . . . . . califormica (p. 186)
19(17). Tegulae pale brown or testaceous; punctures of upper part of clypeus finer than those offronsaridula (p. 183)
Tegulae black or nearly so; punctures of upper part of clypeus as coarse as those of frons

## Females

1. Proboscis short, not extending beyond proboscidial fossa in repose; maxillary palpi very short, shorter than basal width of galea, tarsi testaceous to reddish brown . . . . 2
Proboscis normal, extending well beyond proboscidial fossa in repose; maxillary palpi longer than basal width of galea; tarsi usually concolorous with rest of legs . . . . . . 3
2(1). Maxillary palpi two-segmented; clypeal punctation similar to that of frons .rufitarsis (p 166)
Maxillary palpi four-segmented; clypeal truncation much finer than that of frons
3(1). Anterior margin of clypeus with shining, smooth, or some what roughened, apical margin . 4
Anterior part of clypeus finely and closely punctate, without smooth apical margin. (Me soscutum more finely punctate than vertex)
.cactorum (p. 159)

4(3). Anterior ocellus at or behind mid-point between bases of antennae and posterior margin of vertex (pl. 24, fig. 130); truncation of clypeus not sinuate.
Anterior ocellus in front of mid-point between bases of antennae and posterior margin of vertex (pl. 24, fig. 131); truncation of clypeus slightly sinuate because of weak notch on either side of middle .
.bucconis (p. 166)
5(4). Truncation of clypeus equal to or shorter than distance from end of truncation to lateral angle of clypeus (pl. 24, fig. 113); end of truncation narrowly rounded
Truncation of clypeus longer than distance from end of truncation to lateral angle of clypeus (pl. 24, fig. 114); ends of clypeal truncation marked by small but slightly produced angles
. opuntiae (p. 192)
Q(5). Genal area narrower than eye, seen from side 7
Genal area as wide as eye, seen from side. (Distance from first to third mandibular tooth greater than length of last three antennal segments taken together) . . californica (p. 186)
7(6). Hind tibial spurs short, robust, and curved; outer margin of inner spur with about six very
large teeth. (Posterior femora usually red) . . . . . . . . . . . . . . . 8
Hind tibial spurs longer, slender, little curved; outer margin of inner spur with eight or more fine teeth or with teeth very low and oblique


8(7). Clypeal truncation distinctly angularly emarginate; middle femora black; tibial spurs black
. femorata (p. 170)
Clypeal truncation slightly, evenly concave; middle femora red; tibial spurs red
titusi (p. 172)
9(8). Punctures of mesoscutum separated by less, usually much less, than a puncture width . 10 Punctures of mesoscutum large and separated by more than a puncture width
leucozona (p. 177)
10(9). Legs partly red (at least hind femora); metasoma black . . . . . . . . . . . 11
Legs black, or if partly red, metasoma also partly red . . . . . . . . . . . . 13
11(10). Distance between posterior ocelli greater than distance to eye margin; middle femora red; anterior margin of mesoscutum with pair of densely pubescent spots or broad densely pubescent band. . . . . . . . . . . . . . . . . . . . . . . . 12
Distance between posterior ocelli equal to distance to eye margin; middle femora black; anterior margin of mesoscutum without densely pubescent areas . . . . difugita (p. 180)
12(11). Clypeus with somewhat shiny apical margin of truncation rather broad and roughened by shallow depressions; punctation coarse . . . . . . . . . . . bigeloviae (p. 172)
Clypeus with apical margin of truncation very narrowly smooth and appearing minutely reflexed; punctation fine
rufipes (p. 175)
13(10). Sixth metasomal sternum without a transverse depression or with a shallow one which is not so coarsely pitted; posterior part of sixth sternum finely punctured like rest of body . 14


Map 77. Distribution of Ashmeadiella cactorum (Cockerell), the subspecies basalis indicated by open circles; and the subspecies cactorum by solid circles.

Sixth metasomal sternum with a broad, deep, transverse depression, the surface of which is exceedingly coarsely pitted; smooth surface with scattered pits reaching posterior margin of sternum at least medially.
foveata (p. 177)
14(13). Genal area over half width of eye seen from side; polished area of propodeum smaller so
that punctures nearly reach sides of at least the sublateral propodeal pits . . . 15
Genal area half the width of eye or less seen from side; polished area of propodeum large so that punctured areas do not approach sides of median pit or lower sublateral pits of propodeum
sonora (p. 163)
15(14). Distance between posterior ocelli not much greater than distance from one of them to eye margin; more robust species with finer punctation, usually without irregular smooth spaces among punctures of depression of sixth sternum
Distance between posterior ocelli usually markedly greater than distance from one of them to eye margin; slender black species with coarse punctation, ordinarily with rather extensive irregular polished areas (some of them about a puncture width in diameter) among coarse punctures of depression of sixth metasomal sternum . . . . prosopidis (p. 161)
16(15). Metasoma black; sixth stemum with concavity shallow, usually not broader (measured along axis of insect) than convexity behind it.

17
Metasoma largely red (in California subspecies); sixth metasomal sternum with transverse concavity distinct, rather deep, and broader (measured along long axis of insect) than convexity behind it . . . . . . . . . . . . . . . . . . gillettei (p. 179)
17(16). Mesoscutum rather coarsely punctured with more shining space between punctures; punctures of upper part of clypeus not or scarcely coarser than those of frons . . . . . . . 18
Mesoscutum more finely and densely punctured; punctures of upper part of clypeus much coarser than those of frons. (In known specimens of the subspecies which runs here, the clypeal truncation has a small median emargination demarked by projecting angles)
difugita (p. 180)
18(17). Tegulae black; clypeus more convex above, its coarsest punctures as large as those of me soscutum.
. meliloti (p. 182)
Tegulae testaceous; clypeus flatter, its coarsest punctures much finer than those of mesoscutum
aridula (p. 183)

## Ashmeadiella cactorum (Cockerell)

Heriades cactorum Cockerell, 1897, Ann. Mag. Nat. Hist. (6) 20:140, ㅇ..
Geographic range: Arizona, British Columbia, California, Colorado, Montana, Mexico, Oregon, Texas, Utah, Washington, and Wyoming (see map 77).
Discussion:
This is the species listed as curriei Titus in the revision (Michener, 1939). The name cactorum is now known to be an older name for the same species (see Michener, 1942).
A. cactorum is a small species, the female
of which can be separated from all other California Asbmeadiella by the absence of the usual impunctate anterior margin of the clypeus. The clypeal punctation becomes progressively finer toward the entirely dull margin. The male possesses no such distinctive feature, but among the small species cactorum is the only one in which the upper part of the clypeus is as coarsely punctate as the rest of the face or more coarsely so.

The sixth metasomal sternum of the female is slightly depressed and coarsely punctate basally, more finely and closely punctate in the convex apical half of the sternum.

## Key to the Subspecies of Ashmeadiella cactorum

1. Metasoma black . . . . . . . . . . . . . . . . . . . .cactorum (p. 160)

Metasoma red basally . . . . . . . . . . . . . . . . . . basalis (p. 160)

## Ashmeadiella cactorum cactorum (Cockerell)

(Pl. 24, fig. 112)
Heriades cactorum Cockerell, 1897, Ann. Mag. Nat. Hist., (6) 20:140, ㅇ. Type ${ }^{\text {f, Santa Fe, }}$ New Mexico (U.S.N.M.).
Synonymy: curriei Titus, 1904; echinocerei Cockerell, 1911; ${ }^{6}$ nigra Michener, 1936.
Geographic range: Arizona, British Columbia, California, Colorado, Montana, Mexico, New Mexico, Oregon, Texas, Utah, Washington, and Wyoming (see map 77).
California records:
Inyo Co.: Bishop, , VII-28-40 (D. E. Hardy, K.U.). Bishop Creek, 8,000 ft., VI-22-37, flowers Nama rotbrockii (Michener, 1939:16). Inde pendence, 2 f, VI-1-37 (W. C. Reeves, U.C.R.). Little Lake, ठ', VII-25-40 (D. E. Hardy, K.U.). Lone Pine Canyon, $8,000 \mathrm{ft} ., \delta$,, , flowers Cryptantha (Michener, 1939:16). Mazourka Canyon, Inyo Mountains, V-25-37 (Michener, 1939:16).

Lassen Co.: Bridge Creek Camp, ㅇ, VII-9-49 (P. D. Hurd, Jr., C.I.S.).

Mono Co.: Mammoth, VI-21-36 (Michener, 1939: 16); 우, VII-21-36 (G.E.B.).

Plumas Co.: Bucks Lake, ठ, VI-23-49 (J. W. MacSwain, C.I.S.). Quincy, 4 mi. W., ㅇ, VI-25-49 (F. Morishita, U.I.).

Riverside Co.: Dos Palmos, + , III-28-34 (Michener, 1939:16).

San Bernardino Co.: Cedar Canyon, Providence Mountains, , V, V-27-50 (H. E. Cott, U.C.D.).

Shasta Co.: Mt. Lassen, d, VII-21 to 22-37 (Michener, 1939:16, U.C.R.).

Trinity Co.: Big Flar, Coffee Creek, ${ }^{\hat{\prime}}$, VI-20-34 (Michener, 1939:16, G.E.B.). Carrville, 2,400-2,500 ft., ㅇ, VI-1 934 (G. E. Bohart, G.E.B.).

Tuolumne Co.: Dodge Ridge, $\delta$, VII-15-51 (A. T. McClay, C.I.S.). Pinecrest, $\bar{\delta}$, VII-1 8-53 (J. G. Rozen, C.I.S.). Stra wberry, ${ }^{\text {f, VI-23-51 }}$ (C. A. Downing); $\mathcal{Y}$, VI-21-51 (E. G. Linsley and J. W. MacSwain, C.I.S.); ס', VI-23-53 (J. W. Mac Swain, C.I.S.).
Discussion:
This is the widespread subspecies of cactorum, ranging east to Texas and north to British Columbia. In California it occurs in the northern part of the state and in the arid regions east of the principal divides, occasionally even in strictly desert regions.

Throughout its range, this subspecies varies considerably. From Texas to the deserts of southern California, most of the specimens have the tegulae brownish and the mesoscutum conspicuously more finely punctate than the vertex. North of this region, that is, from Colorado and Idaho to British Columbia and northern California, the mesoscutum is usually about as coarsely punctured as the vertex. The name curriei Titus might be used for this northern form. However, the two merge indistinguishably, and an anomalous situation exists because the southernmost known specimens (San Bernardo, Sonora) have the mesoscutum as coarsely punctured as the vertex. For this reason, only a single black subspecies of cactorum is here recognized. Populations of particularly finely punctured specimens occur in the Sierra Nevada of California.

In Arizona cactorum proper has been collected on flowers of Asclepias tuberosa at Flagstaff; on Cpuntia at Carrizo Creek and Flagstaff; and on blue Penstemon at Flagstaff. In Oregon it has been taken on flowers of Phacelia at Crater Lake. In Texas it has been recorded (Michener, 1951:66) from flowers of Dalea argyraea at 25 miles southeast of Dryden and on D. pogonathera at Quemada.

## Asbmeadiella cactorum basalis Michener

Asbmeadiella basalis basalis Michener, 1936, Amer. Mus. Novitates, 875:6, ${ }^{6}$, ㅇ. Type ${ }^{2}$, Altadena, California (Amer. Mus. Nat. Hist.). Geographic range: California (see map 77).
California records:
Alameda Co.: Arroyo Mocho, 25 mi . S., Livermore, $\delta^{\prime \prime}$, VII-30-49 (J. E. Gillaspy, K.U.).

Inyo Co.: Surprise Canyon, 2 ㅇ, IV-28-53, flowers Dalea fremontii (P. D. Hurd, Jr., C.I.S.); 2 ठ, IV-29-53, flowers Cryptantha inaequata (P. D. Hurd, Jr., C.I.S.). Westgard Pass, V-26-37 (Michener, 1942:49); 3 ㅇ, VII-10-53, flowers Cryptantha (E. G. Linsley, C.I.S.); same locality, 3 mi . W., 2 ó, 6 f, VI-25-53 (J. W. MacSwain, C.I.S.).

Los Angeles Co.: Big Pines Camp, VII-13-27, VII-14-27, flowers Cordylanthus nevinii, Mimulus, and Phacelia ramosissima (Michener, 1939:17). Lone Pine Canyon, San Gabriel Mountains, ô,

[^4]VII-21-36 (Michener, 1939:17, U.C.R.). Swartout Valley, $\delta$, VI-3-28, flowers Pbacelia heterophylla (P. H. Timberlake, U.C.R.).

Marin Co.: San Rafael, 2 (Michener, 1939: 17, U.C.R.).

Napa Co.: Wing Canyon, $950 \mathrm{ft} ., \delta$, , + , VIII-10-35 (P. H. Baldwin, K.U.).

Placer Co.: Applegate, $\mathrm{\delta}^{\prime}$, VI-24-51 (J. C. Hall, U.C.D.).

Plumas Co.: Quincy, 4 mi . W., ס', VI-22-49 (W. F. Ehrhardt, U.C.D.); ठ', ㅇ, VI-24-49 (P. D. Hurd, Jr., C.I.S.); + , VI-25-49 (F. Morishita, C.I.S.); $\delta$, ㅇ, VII-2-49 (J. E. Gillaspy, C.I.S., K.U.); , , VII-3-49 (P. D. Hurd, Jr., C.I.S.); 3 ठ, ㅇ, VII-16-39 (R. M. Bohart, U.C.D.); 8 d, VII-16-49 (P. D. Hurd, Jr., C.I.S., K.U.).

Riverside Co.: Hidden Lake, San Jacinto Mountains, $\sigma^{7}$, VII-23-28, flowers Lotus nevadensis (Michener, 1939:17, U.C.R.). Idyllwild, VII-14-12 (Michener, 1939:17, U.C.R.); VII-12-33, flowers Lotus argophyllus (Michener, 1939:17, U.C.R.); VI-25-28 (Michener, 1939:17, C.A.S.). Palm Springs, 3 mi. S., 9 , VIII-29-51, flowers Cbilopsis linearis (P. H. Timberlake, U.C.R.). Riverside, III-19 to V-28, flowers Encelia farinosa, Hosackia rosea, Hugelia virgata, Lotus glaber, $L$. scoparius, and Pbacelia ramosissima (Michener, 1939:17, U.C.R.). Santa Rosa Mountain, 6,0007,500 ft., V-31-40, VI-8-40, Vi-16-40; flowers Lotus davidsonii (Michener, 1942:49, K.U.).Vandevanter Flat, San Jacinto Mountains, ó, VI-11-39 (E. S. Ross, C.I.S.). Whitewater, ㅇ, VII-9-50 (H. L. Hansen, C.I.S.).

San Bernardino Co.: Big Bear Valley, San Bernardino Mountains, $O$, VII-7-34, flowers Pbacelia beterophylla (Michener, 1939:17, U.C.R.). Cajon Valley, VII-14-33, flowers Trichostema lanatum (Michener, 1939:17, U.C.R.). Clark Mountain, 4,000 ft., ㅇ, VII-7-38, flowers Baileya multiradiata (Michener, 1939:17, U.C.R.); same locality, $5,000 \mathrm{ft} ., \delta$, VII-8-38, flowers Salvia pachyphylla (Michener, 1939:17, U.C.R.). Forest Home, San Bernardino Mountains, $\delta$, VII-25-28, flowers Eriogonum fasciculatum (W. H. Thorpe, U.C.R.). Mill Creek, San Bernardino Mountains, 6,000 ft., ठ', VI-20-37, flowers Penstemon grinnellii; 3 ठ, VII-23-39, flowers Castilleia and Eriogonum wrightii subscaposum; $\sigma^{\prime}$, VII-2-44, flowers Cryptantha micrantiba var. lepida; $\sigma^{2}, 2$ ㅇ, VIII-25-44, flowers Cordylanthus nevinii; ㅇ, VIII-14-45, flowers Eriogonum wrightii subscaposum; $\delta, \frac{9}{}$, VIII-3-47, same flower; $2 \delta$, VII-15-51, flowers Cordylanthus nevinii and Monardella linoides var. stricta (all collected by P. H. Timberlake, U.C.R.). Mill Creek, 6,200
ft., 3 ठ, VII-7-46, flowers Erigeron divergens (P. H. Timberlake, U.C.R.). Mountain Home Creek, 11 ㅇ, VIII-14-34, flowers Phacelia ramosissima (P. H. Timberlake, U.C.R.); 3 f, VIII-15-34, flowers Penstemon ternatus (P. H. Timberlake, U.C.R.). Rim of the World, 5 miles from Big Bear Dam, $\mathrm{O}^{2}$, VII-6-34, flowers Cryptantha (P. H. Timberlake, U.C.R.). Santa Ana River, San Bernardino Mountains, 6,200 ft., VIII-23-52, flowers Gutierrezia californica (P. H. Timberlake, U.C.R.). Upper Santa Ana River, 9 , VII-27-46 (G. H. and J. L. Sperry, K.U.).

San Diego Co.: Descanso Junction and Japatul Road, $\delta$, vill-16-46, flowers Gutierrezia california (P. H. Timberlake, U.C.R.).

Santa Clara Co.: Searsville Lake, near Stanford University, VIII-2-37 (Michener, 1939:17).

Tulare Co.: Coffee Camp, VI-8-25, flowers Phacelia (Michener, 1939:17, U.C.R.).

Yolo Co.: Davis, 2 + + VII-17-51 (E. I. Schlinger, U.C.D.).
Discussion:
This subspecies is found in cismontane central and southern California. There are also apparently isolated populations of this form on some of the desert ranges (Clark, Inyo, and Panamint mountains) of eastern California; these isolated populations are presumably surrounded by populations of typical cactorum. The situation is the more remarkable since in these locations the principal subspecific character is accentuated, specimens from these regions often having more red than specimens from coastal California. A long series from Westgard Pass, Inyo County, includes every intergrade from completely black cactorum-like specimens to specimens with red on every metasomal segment and with the first three terga largely red. Since more than 75 per cent of the specimens from this locality have at least some red, the Westgard Pass population is indicated as basalis on the map.

## Asbmeadiella prosopidis (Cockerell)

(Pl. 24, fig. 132)
Heriades prosopidis Cockerell, 1897, Ann. Mag. Nat. Hist. (6) $20: 140, ~ ㅇ\left(\sigma^{\prime}\right.$ is a misidentification). Type $?$, Mesilla, New Mexico.
Synonymy: subangusta Cockerell, 1924; Ashmeadiella schwarzi Titus, 1904, Proc. Ent. Soc. Wash. 6:98, 子, $\delta^{7}$ (new synonym).


Map 78. Distribution of Ashmeadiella prosopidis (Cock erell).

Geographic range: Arizona, California, Mexico, New Mexico, Texas (see map 78).
California records:
Imperial Co.: Potholes, IV-7-28 (Michener, 1939:34, C.A.S.). Westmorland, V-25-30, flowers Salix nigra (Michener, 1939:34, U.C.R.). Coachella Valley, , VI-12-32 (M. Cook, U.C.R.).

Inyo Co.: Furnace Creek, Death Valley, 39 ô, 57 Q, IV-8-39, flowers Prosopis (E. G. Linsley, C.I.S., K.U., U.C.R.); $76 \sigma^{\top}, 67$ Y, IV-1-51, flowers Heliotropium (J. W. MacSwa in, C.I.S., K.U.); $4 \delta$, 9, III-31-53 (J. W. MacSwain, C.I.S.); ô, $q$, IV-7-39 (E. C. Van Dyke, C.A.S.). Furnace Creek Camp, Death Valley, IV-14-38, flowers Pluchea sericea (Michener, 1939:34).

Riverside Co.: Indio, ô, IV-5-51 (P. D. Hurd, Jr., C.I.S.). Indio, 5 mi . W., IV-1 0-36, flowers Prosopis chilensis glandulosa (Michener, 1939 : 34); ${ }^{\circ}$, IV-22-50, flowers Melilotus (E. G. Linsley, C.I.S.). Indio, $6 \mathrm{mi} . W ., 3$ ó, 8 +, IV-30-49, flowers Melilotus (E. G. Linsley, R. F. Smith, and J. W. MacSwain, C.I.S., K.U.). Andreas Canyon near Palm Springs, IV-10-36, flowers Prosopis chilensis glandulosa (Michener, 1939: 34). Mecca, 2 +, IV-21-35 (G.E.B.). Mecca (near), 9, IV-13-34, flowers Heliotropium curassavicum (Michener, $1939: 34$ ). Coachella, IV-23-27, flowers Prosopis chilensis glandulosa (Michener, 1939 : 34). Box Canyon, IV-13-34, flowers Acacia greggii (Michener, 1939:34). Palm Springs, \&, V-11-35, flowers Acacia greggii (P. H. Timberlake, U.C.R.). Palm Desert, oे, IV-12-50 (P. D. Hurd, Jr., C.I.S.). Blythe, 3 ơ, V-20-47 (J. W. MacSwain, C.I.S.); 7, V-8-47, flowers Prosopis (E. G. Linsley, C.I.S.); $\delta^{\pi}, \mathrm{V}-7-48$ (E. G. Linsley, C.I.S.). Palm Canyon, ơ, IV-15-38, flowers Acacia greggii (G.E.B.). Tahquitz Canyon, San Jacinto Mountains, $\delta$, IV-16-38 (G.E.B.).

San Bernardino Co.: Kramer Junction, 15 mi . E., Y, VII-6-51 (J. W. MacSwain and R. F. Smith, K.U.). Twentynine Palms, $\delta^{2}$, IV-14-38 (G. E. and R. M. Bohart, G.E.B.). Yermo, Y, V-23-40 (G. E. Bohart, G.E.B.).

San Diego Co.: Borego, ${ }^{2}$, IV-29-52 (J. G. Rozen, C.I.S.); $\bar{\delta}$, ,, III-31-53, flowers Cryptantha barbigera (P. D. Hurd, Jr., C.I.S.). Discussion:

Most individuals of this species can be distinguished from orher similar small black forms by having the posterior ocelli in both sexes separated by a distance much greater than the distance from one ocellus to the eye margin. The finely and closely punctate clypeus of the male also separates this species from certain similar forms. The sixth metasomal sternum of
the female has a broad transverse depression in which the punctures are larger than elsewhere and well separated; the punctures are well separated although smaller almost to the posterior margin of the sternum medially.

A large series of males from Furnace Creek, Death Valley, shows considerable variation in head shape, a few of the specimens having the broader-than-usual head of $A$. schwarzi Titus. The latter is therefore to be regarded as a synonym of prosopidis.
A. prosopidis has been taken in Lower California on flowers of Larrea at 20 miles south of Palacio, on Prosopis chilensis glandulosa at El Mayor, and on Sphaeralcea ambigua at 15 miles south of Palacio. Michener (1951:65) has recorded it as visiting flowers of Prosopis cbilensis glandulosa at Hot Springs, Big Bend National Park, Texas.

## Ashmeadiella sonora Michener

(Pl. 24, fig. 130)
Asbmeadiella (Asbmeadiella) sonora Michener, 1939, Amer. Midland Nat., 22:35, ठ', Y. Type $\delta$, Guaymas, Sonora, Mexico (Calif. Acad. Sci.). Geographic range: Arizona, California, Mexico, and Utah (see map 79).
California records:
Glenn Co.: Orland, $6 \mathrm{mi} . W ., \delta^{\lambda}, 2$ Y, VII-2-52, flowers Asclepias (H. L. Hansen, C.I.S.); ô, 2 \&, same data (R. F. Smith, C.I.S.).

Inyo Co.: Panamint Mountains, $q$, IV-7-38 (E. G. Linsley, K.U.).

Riverside Co.: Shavers Well, $\delta$, IV-8-34 (Michener, $1939: 37$, U.C.R.). Box Canyon, ㄱ, IV-12-34, flowers Olneya tesota (Michener, 1939:37, U.C.R.). Palm Springs, 6 mi . S., VI-8-37, flowers Hugelia virgata (Michener, 1939:37, U.C.R.). Desert Center, 3.7 mi . E., ठ, ㅇ, X-23-51, flowers Euphorbia polycarpa var. birtella (P. H. Timberlake, U.C.R.); $2 \delta^{\text {t, }}$ same data (P. D. Hurd, Jr., C.I.S.). Rancho Mirage, $2 \mathrm{mi} . N ., 8$ б, 6 ¢, VII-27-50, flowers Eriogonum trichopes (P. H. Timberlake, U.C.R.). Palm Desert, ${ }^{\prime}$,, IV, 12-50 (W. F. Barr, U.I.). Magnesia Canyon, ס', VI-28-52 (J. K. Hester, U.C.D.).

San Bernardino Co.: Morongo Valley, IV-20 (Michener, $1939: 37$, K.U.). Vidal, ${ }^{( }$, VII-6-51, flowers Pectis papposa (J. W. MacSwain, C.I.S.). San Diego Co.: Tub Canyon, Borego, $\bar{\delta}$, II-2847 (G. H. and J. L. Sperry, C.I.S.).

Shasta Co.: Redding, 9 , VII-6-18 (E. P. Van Duzee, C.A.S.).


Map 79. Distribution of Ashmeadiella sonora Michener.




Map 80. Distribution of Asbmeadiella altadenae Michener.

Tulare Co.: Wood Lake, V-21, VI-12, 18-1 947 (Michener, $1951: 52$ ).

## Discussion:

This small species which occurs in the desert and in the Great Valley of California is similar to $A$. prosopidis, from which it differs in the long median teeth of the sixth tergum of the male and in the narrow genal areas of the female, which are less than half as wide as the width of the eye seen from the side. The sixth metasomal sternum of the female has a shallow transverse depression with punctures coarser than elsewhere and somewhat separated from one another.

Specimens from the Great Valley of California average slightly more finely punctate than those from the deserts and tend to have pale brownish rather than white pubescence.

In Arizona, $A$. sonora has been recorded (Michener, 1951:52) as visiting flowers of Baileya multiradiata at Casa Grande.

## Asbmeadiella altadenae Michener

Ashmeadiella altadenae Michener, 1936, PanPacific Ent., 12:63, $\sigma$. Type $\delta$, Altadena, California (Calif. Acad. Sci.).
Geographic range: California (see map 80).
California records:
Los Angeles Co.: Altadena, $\delta$, V-12-34 (C. D. Michener, U.C.R.). Arroyo Seco, San Gabriel Mountains, , V, VII-6 (K.U.).

Monterey Co.: Hastings Natural History Reservation, near Jamesburg, VI-8, 14, 24-1938, flowers Adenostoma fasciculatum and Lotus scoparius (Michener, 1939:37, K.U.).
Discussion:
This species and $A$. rufitarsis are remarkable in having short proboscides, not extending beyond the proboscidial fossa in repose, and in having maxillary galeae with a row of hairs along their outer margins. The maxillary palpi are very short, although four-segmented in altadenae as in other Ashmeadiella; they are twosegmented in rufitarsis. In both species, the tarsi are brown, paler than the rest of the legs. In altadenae (both sexes) the median ocellus is not very far behind the mid-point between the antennal bases and the posterior margin of the vertex; in rufitarsis the median ocellus is well behind this point. The sixth metasomal sternum of the female is as in rufitarsis.

## Asbmeadiella rufitarsis Michener

Ashmeadiella (Asbmeadiella) rufitarsis Michener, 1939 , Amer. Midland Nat., 22:37, ס, ㄱ. Type ㅇ, Mt. Diablo, Contra Costa County, California, 3,800 fr., flowers Eriogonum gracile (Timberlake collection, U.C.R.).
Geographic range: California (see map 81).
California records:
Butte Co.: Pulga, VIII-1 9-39, flowers Eriogonum gracile (Michener, $1951: 54$, K.U.).

Contra Costa Co.: Mt. Diablo, $3,800 \mathrm{ft}$., V-14-33, flowers Eriogonum gracile (Michener, 1939:39, U.C.R.).

Monterey Co.: San Lucas, VIII-20-35, flowers Eriogonum gracile (Michener, 1939:39, U.C.R.).

Riverside Co.: Perris, $11 / 2 \mathrm{mi}$. W., VI-21-38 (Michener, 1939:39, U.C.R.).

San Bernardino Co.: Camp Baldy, ㅇ, VII-7-52 (R. M. Bohart, C.I.S.).

Discussion:
For comments concerning the peculiar features of this species, see the discussion of A. altadenae and also Michener (1951a). The sixth metasomal sternum of the female has a shallow median depression in which the punctures are a little larger and considerably more widely separated than elsewhere on the sternum, but the ground between the punctures is exceedingly dull, owing to fine roughening, so that the depression is not shining as in most species.

## Asbmeadiella bucconis denticulata (Cresson)

Heriades ? denticulatum Cresson, 1878, Trans. Amer. Ent. Soc., 7:108, ठ'. Type $\bar{\sigma}$, Colorado (Acad. Nat. Sci. Phila.).
Synonymy: rotundiceps (Cresson), 1879; wislizeni Cockerell, 1922.
Geographic range: Arizona, British Columbia, California, Colorado, Idaho, Mexico, Montana, Nebraska, Nevada, New Mexico, Oregon, Texas, Utah, Washington, and Wyoming. The nominate subspecies ranges to the east of this subspecies into Indiana and Wisconsin (see map 82).
California records:
Calaveras Co.: Mokelumne Hill, 9, VII-28-31 (Michener, 1 939:20, C.A.S.).

Eldorado Co.: Snowline Camp, $\uparrow$, VII-1 9-48, flowers Grindelia camporum (P. D. Hurd, Jr., C.I.S.).



Inyo Co.: Big Pine, on, $^{2}$ 아, VII-17 to 20-29 (Michener, 1939:20, C.A.S.); ㅇ, VI-17-51 (R. C. Bechtel, U.C.D.); same locality, 3 mi. E., 우, VII-10-53 (H. Washburn, C.I.S.). Bishop, ㅇ, VI-20-28 (Michener, 1939:20, C.A.S.). Inde pendence, 2 ô, VI-11-29 (R. L. Usinger, C.A.S.). Olancha, 3 mi. S., 3 ㅇ, VIII-6-48 (P. D. Hurd, Jr., and J. W. MacSwain, C.I.S.). Westgard Pass, 7 mi. W., ㅇ, VI-19-53, flowers Encelia, ㅇ, VI-24-53, 2 ㅇ, VI-24-53, flowers Encelia (J. W. MacSwain, C.I.S.).

Lassen Co.: Bridge Creek Camp, 우, VII-9-49 (J. W. MacSwain, C.I.S.).

Los Angeles Co.: Altadena, ㅇ, VIII-2-34, flowers Senecio douglasii (C. D. Michener, C.I.S.). Big Pines Camp, VI-17-27, flowers Erigeron foliosus var. stenophyllus (Michener, 1939:20, U.C.R.). Crystal Lake, San Gabriel Mountains, ,, VI-29-50 (A. T. McClay, U.C.D.). Palmdale, VIII-1-35 (Michener, 1939:20, K.U.). Puente Hills, VII-31-27, flowers Encelia californica (Michener, 1939:20, U.C.R.). Tanbark Flat, San Dimas Experimental Forest, 2 f, VI-30-50 (D. C. Blodget, U.C.D., U.C.L.A.); VII-20-52 (C.I.S.).

Mariposa Co.: Mariposa, 와, VI-13-38 (Michener, 1939:20, G.E.B.); ${ }^{\text {d, }}$ VI-13-38, flowers Navarretia viscidula (R. M. Bohart, G.E.B.).

Modoc Co.: Buck Creek, 4 , , VII-21 and 25-22 (Michener, 1939:20, C.A.S.). Canby (near), ㅇ, VIII-1-38, flowers Helianthus (E. C. Van Dyke, C.A.S.). Davis Creek, , V, VII-13-22 (Michener, 1939:20, C.A.S.). Lake City, ㅇ, VII-31-2 2 (Michener, 1939:20, C.A.S.). Lassen Creek, ${ }^{\text {P, VII- }}$ 22-22 (Michener, 1939:20, C.A.S.).

Mono Co.: Grant Lake, ${ }^{\text {P, VIII-5-48 (P. D. }}$ Hurd, Jr., and J. W. MacSwain, C.I.S.). Mammoth, ठ', VII-24-33 (Michener, 1939:20, G.E.B.).

Orange Co.: Yorba Linda, ㅇ, VIll-14-20, flowers Grindelia (Michener, 1939:20, U.C.R.).

Placer Co.: Alta, $\mathrm{P}, \mathrm{VI}-15-51$ (E. I. Schlinger, U.C.R.). American River, ㅇ, VIII-20-16 (L. Bruner, U.N.).

Plumas Co.: Quincy, 4 mi . W., ㅇ, VI-25-49 (W. F. Ehrhardt, U.C.D.); 2 ठ, VI-26-49 (P. D. Hurd, Jr., C.I.S.); $\mathbf{\delta}^{\prime}$, VII-2-49 (P. D. Hurd, Jr., C.I.S.).

Riverside Co.: Cabazon, ㅇ, X-26-52 (E. G. Linsley and R. F. Smith, C.I.S.). Hemet, $\delta$, VII-5-50 (E. G. Linsley and J. W. MacSwa in, C.I.S.). Idyllwild, 早, VII-7-28 (Michener, 1939:20, C.A.S.); 2 ô, ㅇ, VI-10-39 (E. G. Linsley, C.I.S.); ơ, VI-19-40 (E. G. Linsley, C.I.S.). Keen Camp, San Jacinto Mountains, P, VI-10-39 (E. G. Linsley, C.I.S.); \&, same data (E. S. Ross, C.I.S.). Pine Meadows, San Jacinto Mountains, $q$ (C.A.S.).

Piñon Flat, San Jacinto Mountains, ס, V-24-39, flowers Encelia (E. S. Ross, C.I.S.); ㅇ, V-30-39 (E. G. Linsley, C.I.S.). Ripley, 2 \&, VIII-19-46, flowers Aster (P. D. Hurd, Jr., C.I.S.); same locality, 7 mi . S., $9, \mathrm{X}-19-51$, flowers Aster tephrodes (P. H. Timberlake, U.C.R.). Riverside, ठ', 웅, V-17 to LX-14, flowers Cbaenactis glabriuscula, Coreopsis lanceolata, Encelia farinosa, Erigeron foliosus var. stenophyllus, Gutierrezia californica, Heterotheca grandiflora, Senecio douglasii, and Solidago californica (Michener, 1939:20, U.C.R.). San Jacinto River, San Jacinto Mountains, 2,500 fr., ㅇ, VI-13-40, flowers Encelia farinosa (C. D. Michener, C.I.S.). Santa Ana Mountains, above Elsinore, IV-1 8-34, flowers Cryptantba intermedia (Michener, 1939: 20, U.C.R.). The Gavilan, V-15-30, hiding in yucca stem (Michener, 1939:20, U.C.R.). Vandevanter Flat, ㅇ, VI-11-39 (E. S. Ross, C.I.S.).

San Bernardino Co.: Apple Valley, ㅇ, X-21-51, flowers Cbrysothamnus (P. H. Timberlake, U.C.R.). Cedar Canyon, Providence Mountains, ठ', V-27-50 (C. D. MacNeill, C.I.S.). Clark Mountains, 4,000 ft., VII-2-38, flowers Baileya multiradiata (Michener, 1939:20, U.C.R.). Hinkley, ㅇ, X-7-28, flowers Isocoma acradenia (Michener, 1939:20, U.C.R.). Mill Creek, San Bernardino Mountains, ㅇ, VIII-1-46, flowers Erigeron divergens (P. H. Timberlake, U.C.R.). Mill Creek Canyon, San Bernardino Mountains, 9, IX-24-23 (Michener, 1939:20, C.A.S.). Morongo, $\delta$, ㅇ, IX-11-40, flowers Gutierrezia lucida (P. H. Timberlake, U.C.R.). Oro Grande, 2 个, IX-14-35, flowers Isocoma veneta (C. D. Michener, K.U.). Redlands, ठ, ㅇ, V-15-36, flowers Encelia farinosa (Michener, 1939:20, K.U.). Twentynine Palms, ㅇ, IX-3-46, flowers Pectis papposa (P. H. Timberlake, U.C.R.); same locality, 17.5 mi . W., ot, IX-5-46, flowers Baileya. multiradiata (P. H. Timberlake, U.C.R.); same locality, 20 mi . W., flowers Baileya multiradiata (Michener, 1939:20, U.C.R.). Vivian Creek Trail, San Bernardino Mountains, VII-21-35, flowers Erigeron foliosus var. stenophyllus (Michener, 1939:20, U.C.R.). Warmers Well, Mojave Desert, X-22-27, flowers Ericameria teretifolia (Michener, 1939:20, U.C.R.). Yermo, ㅇ, V-23-30 (M. A. Cazier, W. C. Reeves, P. C. Ting, U.C.R.). Yucca Valley, 9 , IX-30-44, flowers Gutierrezia lucida ( P . H. Timberlake, U.C.R.). Daggett to Needles, ${ }^{\text {P, VI-9-42 (E. C. }}$ Van Dyke, C.A.S.). Upper Santa Ana River, 9 , IX-2-46 (G. H. and J. L. Sperry, C.A.S.).

San Diego Co.: Campo, f, VIII-10-35 (Michener, 1939:20, K.U.). Jacumba, ㅇ, X-3-25 (Michener, 1939:20, C.A.S.). Pine Hills, , VIII-8-51, flowers Grindelia (P. H. Timberlake, U.C.R.).


Shasta Co.: Cayton, ${ }^{\text {f, VII-13-1 } 8 \text { (Michener, }}$ 1939:20, C.A.S.).

Solano Co.: Rio Vista, ㅇ, VIII-16-50 (J. E. Gillaspy, C.I.S.).

Stanislaus Co.: Adobe Creek, ㅇ, IX-14-48 (P. D. Hurd, Jr., C.I.S.).

Trinity Co.: Trinity River Camp, ${ }^{\circ}$, VII-18-53 (A. T. McClay, U.C.D.).

Tulare Co.: Coffee Camp, VI-25-29, flowers Senecio douglasii (Michener, 1939:20, U.C.R.). Kaweah, VI-1936 (Michener, 1939:20).

Tuolumne Co.: Pinecrest, 9 , VIII-4-48 (P. D. Hurd, Jr., and J. W. MacSwain, C.I.S.); ㅇ, VII-
 1937 (F. E. Blaisdell, C.A.S.).
Discussion:
This is the most coarsely punctate member of the genus Ashmeadiella and after some experience can be distinguished by this feature alone. It may also be distinguished from other species, except for some Titusella, by having the anterior ocellus (pl. 24, fig. 131) farther from the posterior margin of the vertex than from the antennal bases. The sixth metasomal sternum of the female is feebly depressed basally, but everywhere closely punctured and but little more coarsely so in depressed region than elsewhere.

As shown by the above records, this species has a long season of flight and visits many flowers. However, it appears to collect pollen principally from the Compositae. Although not primarily a desert species, it occurs in various localities in the desert as well as west of the principal divides in California (see map 82). It has been collected as far south as Nombre de Dios in Durango, Mexico.

The subspecies denticulata has been taken in Arizona on flowers of Baileya (Turner), and on a yellow composite at Pepper Sauce Canyon, Santa Catalina Mountains. At Harrison, Nebraska, it has been found on flowers of Grindelia and Helianthus. In Oregon the following floral records are available: Cbrysothamnus (Hereford, Prairie City, and Prineville), Grindelia nana (Ontario), and Solidago (Baker, Juntura, and North Powder). At Petersboro, Utah, it has been collected on Grindelia.

The nominate subspecies has been collected in Arkansas at flowers of Anthemis cotula (De Queen); in Kansas on flowers of Helianthus petiolaris (Arkansas City) and Monarda (Medicine Lodge); in Nebraska on flowers of Brauneria (Springville Bridge, Brown County), Callirrböe involucrata (Red Cloud), Helianthus (Carns and Warbonnet Canyon, Sioux County), Heliopsis
belianthoides (Carns), Petalostemon (Lincoln) and Sideranthus (Halsey); in New Mexico on flowers of Helenium laciniatum (Carrizoza); in North Dakota on flowers of Brauneria pallida (Mott), Grindelia squarrosa (Carpio and Fargo), Lactuca pulchella (Kathryn), and Solidago (Beach); in Texas on flowers of Ambrosia psilostachya (Grand Prairie), Gaillardia pulchella (Denton), and Tetragonotheca ludoviciana (Kerrville).

## Asbmeadiella femorata (Michener)

(PI. 24, fig. 133)
Osmia femorata Michener, 1936, Bull. So. Calif. Acad. Sci., 35:91, i. Type ㅇ, Ten miles east of Borego Valley, California (Calif. Acad. Sci.).
Geographic range: Arizona, California, and Nevada (see map 83).
California records:
Imperial Co.: Andrade, III-6, flowers Larrea (Michener, 1939:24, U.C.R.).

Inyo Co.: Mazourka Canyon, Inyo Mountains, V-25-37, flowers Dalea fremontii (Michener, 1939: 24, K.U.). Olancha, 6 mi . S., VI-20-37 (Michener, 1939:24). Surprise Canyon, Panamint Mountains, ठ', IV-29-53, flowers Larrea (R. O. Schuster, C.I.S.). Westgard Pass, 3 ㅇ, VI-3-37 (E. C. Van Dyke, C.A.S., K.U.).

Riverside Co.: Andreas Canyon near Palm Springs, ㅇ, IV-7-40 (M. R. and R. M. Bohart, G.E.B.). Box Canyon, 2 б', 아, III-31-34, IV-13-24, flowers Cercidium torreyanum (Michener, 1939: 24, U.C.R.). Cathedral City, IV-10-36, flowers Larrea glutinosa (Michener, 1939:24). Cottonwood Springs, Joshua Tree National Monument, 5 ठ', IV-12-50 (P. D. Hurd, Jr., C.I.S., K.U.). Dos Palmos, 오, III-19-34, ㅇ, HII-28-34 (Michener, 1939:24, G.E.B.). La Quinta, ठ', III-2-34, ठ', III-17-34, flowers Larrea glutinosa (Michener, 1939: 24, U.C.R.); 2 ठ', ㅇ, III-4-36, flowers Hyptis emoryi (Michener, 1939:24, U.C.R.); ס, ㅇ, IV-24-38, flowers Cercidium floridum (P. H. Timberlake, U.C.R.). Oasis, 2 mi . S., $\mathrm{\delta}^{\prime}$, IV-1 9-25, flowers Cercidium torreyanum (Michener, 1939: 24, U.C.R.); $\delta$, III-8-36, flowers Larrea glutinosa (Michener, 1939:24, U.C.R.). Painted Canyon, IV-18-25, flowers Cercidium torreyanum (Michener, 1939:24, U.C.R.). Palm Canyon, ठ', IV-525, flowers Larrea glutinosa (Michener, 1939:24, U.C.R.). Palm Desert, 2 ㅇ, IV-11-50, (W. F. Barr, U.I.); 2 ㅇ, IV-12-50 (P. D. Hurd, Jr., C.I.S., K.U.); 2 오, IV-24-50 (C. D. MacNeill,


Map 85. Distribution of Ashmeadiella bigeloviae (Cockerell).
C.I.S.); same locality, 1 mi. S., $\delta^{\circ}$, III-16-50, flowers Larrea glutinosa (P. H. Timberlake, U.C.R.). Palm Springs, Y, IV-1 6-39 (R. M. Bohart, G.E.B.); 9 , IV-3-44, flowers Larrea glutinosa (P. H. Timberlake, U.C.R.). Tahquitz Canyon, San Jacinto Mountains, 2 f, IV-16-38, flowers Larrea glutinosa (Michener, 1939:24, G.E.B.).

San Bernardino Co.: Vidal Junction, 7 mi . N., IV-3-51 (P. D. Hurd, Jr., C.I.S.).

San Diego Co.: Ocotillo, 8 mi . W., 9 , IV-27-41, flowers Larrea glutinosa (P. H. Timberlake, U.C.R.).

Discussion:
This species, known only from the desert regions, is the commonest of the little group in which the hiad tibial spurs are robust and strongly curved. This group includes the remarkable species truncativentris Michener, recently described from Texas, which has a peculiarly enlarged and truncate sixth metasomal sternum in the female, and titusi from California. The latter differs from femorata in having the middle as well as the hind femora red, in having paler tegulae, and a gently concave rather than medially angulate clypeal apex. The sixth metasomal sternum of the female of femorata is slightly depressed medially, but little more coarsely punctate in depression than elsewhere.

Two males and a female of this species from La Quinta, Riverside County, and two females from Westgard Pass, Inyo County, differ from others in having the legs entirely without red.
A. femorata has been taken at flowers of Cercidium torreyanum in Arizona near Cave Creek, north of Phoenix.

## Ashmeadiella titusi Michener

Ashmeadiella (Ashmeadiella) titusi Michener, 1939, Amer. Midland Nat., 22:25, $\delta$, ․ . Type f, Riverside, California, flowers Lotus scoparius (Timberlake collection, U.C.R.).
Geographic range: California (see map 84). California records:

Los Angeles Co.: Tanbark Flat, San Dimas Experimental Forest, ㅇ, VII-17-52 (A. T. McClay, U.C.D.).

Riverside Co.: Riverside, ㅇ, V-22-29, flowers Phacelia ramosissima (Michener, 1939:26); V-24-28, flowers Lotus scoparius (Michener, 1939: 26). San Jacinto River, San Jacinto Mountains, $3,000 \mathrm{ft} ., \delta{ }^{\prime}, \mathrm{V}-30-40$ (C. D. Michener, K.U.).

San Bernardino Co.: Mill Creek, San Bernardino Mountains, 2,000 ft., $\delta$, flowers Helianthus
gracilentus (Michener, 1939:26).
Discussion:
Unlike its closest relative, A. femorata, this species is unknown in the deserts but is found in cismontane southern California, where it is apparently quite rare.

## Ashmeadiella bigeloviae (Cockerell)

(Pl. 24, fig. 134)
Heriades bigeloviae Cockerell, 1897, Ann. Mag. Nat. Hist., (6) 20:136, ठ', 7. Type ס', Las Cruces, New Mexico (U.S. Nat. Mus.).
Geographic range: Arizona, California, Mexico, Nevada, New Mexico, and Texas (see map 85). California records:

Imperial Co.: Beal's Well, 2 mi. N.E., $9, \mathrm{~V}-$ 25-49, flowers Sphaeralcea ambigua (R. C. Dickson, U.C.R.). Plaster City, 2.5 mi . N., $\delta^{\prime}, ~ V-1-52$, flowers Coldenia palmeri (P. H. Timberlake, U.C.R.). Westmorland, $3 \delta$, V-31-30, flowers Heliotropium curassavicum, Sesuvium sessile, and Sphaeralcea (Michener, 1939:27, U.C.R.). Inyo Co.: Darwin Falls, ó, 9 , VII-15-53 (R. M. Bohart, U.C.D.); 4 o, 3 ㅇ, same data (E. I. Schlinger, U.C.D.). Furnace Creek, Death Valley National Monument, $5 \delta, 6$, IV-1-51, flowers Heliotropium (J. W. MacSwain, C.I.S.). Independence, $\&$, VI-2-37 (W. C. Reeves, U.C.R.). Lone Pine, V-24-37, flowers Heliotropium curassavicum (Michener, 1939:27, K.U.). Mazourka Canyon, Inyo Mountains, V-25-37, flowers Dalea fremontii (Michener, $1939: 27$, K.U.); 2 ㅇ, VII-2-53 (J. W. MacSwain, C.I.S); Y, same data (W. D. McClellan, U.C.D.); 2 9, same data (H. Nakakihara, C.I.S.); $q$, VII-3-53 (J. W. MacSwain, C.I.S.). Olancha, ठ, V-20-37 (J. W. Johnson, G.E.B.); same locality, $3 \mathrm{mi} . \mathrm{S} ., 2 \mathrm{\delta}^{*}, 7$ \&, VIII-6-48 (P. D. Hurd, Jr., and J. W. MacSwain, C.I.S., K.U.). Panamint Springs, 5 J', 9 , VII-15-53 (R. M. Bohart, U.C.D.); $24 \delta, 13$ \%, same data (E. I. Schlinger, U.C.D.). Stovepipe Wells, Death Valley National Monument, $\bar{\sigma}$ III-31-51 (J. W. MacSwain, C.I.S.). Surprise Canyon, Panamint Mountains, $0^{*}$, IV-2853, flowers Dalea fremontii (P. D. Hurd, Jr., C.I:S.).

Kern Co.: Tehachapi $\delta$, VI-17-47 (J. W. MacSwain, C.I.S.).

Los Angeles Co.: Piute Butte, $\widehat{\sigma}, \mathrm{V}-10-40$, flowers Monardella exilis (P. H. Timberlake, U.C.R.).

Monterey Co.: Priest Valley, $\begin{gathered}\text { た, } \\ \text { IV-1 0-38 (G. }\end{gathered}$ E. Bohart, G.E.B.).

Riverside Co.: Blythe, + , VI-17-46 (J. W. MacSwain, C.I.S.); $\delta, 4$ O, V-20-47 (J. W. Mac Swain, C.I.S., K.U.); same locality, $3 \mathrm{mi} . \mathrm{N}$. , 우, VI-20-46, flowers Medicago sativa (J. W. Mac Swain, C.I.S.); same locality, 18.1 mi . W.,,$f$, X-24-51, flowers Pectis papposa (P. H. Timberlake, U.C.R.); same locality, $20 \mathrm{mi} . W ., 2 \delta$, 2 P, VII-6-51, flowers Asclepias (J. W. Mac Swain and R. F. Smith, C.I.S.); same locality, 25 mi. W., $9 \delta^{\prime}$, , VI-1 937 (J. C. Elmore, O.S.C.). Box Canyon, Y, IV-13-34, flowers Acacia greggii (Michener, 1939:27, U.C.R.). Cathedral City, IV-10-36, flowers Cercidium torreyanum (Michener, 1939:27); $\delta$, V-6-46, flowers Acacia greggii (P. H. Timberlake, U.C.R.). Coachella, 5 mi . S., 6 \%, III-7-36, flowers Heliotropium curassavicum (Michener, 1939:27, U.C.R.). Cottonwood Springs, Joshua Tree National Monument, $5 \delta^{\circ}, 4$ 오, IV-12-50 (P. D. Hurd, Jr., C.I.S., K.U.); ㅇ, same data (L. W. Quate, C.I.S.). Dos Palmos, ס', III-19-34 (Michener, 1939:27, G.E.B.); $\delta$, same data (M. A. Cazier, K.U.). Edom ( $=$ Thousand Palms), $\delta^{\prime}$, V-27-36, flowers Larrea glutinosa ( P . H. Timberlake, U.C.R.). Hopkins Well, $\%$, X-1 9-51, ㅇ, X-23-51, , , X-24-51, flowers Pectis papposa (P. D. Hurd, Jr., C.I.S.). Indio, 2 栖 X-1 5-47, flowers Isocoma acradenia (P. H. Timberlake, U.C.R.). Indio, 2 mi . E., IV-1 0-36, flowers Geraea canescens (Michener, 1939:27, U.C.R.). Indio, 2 mi . N.W., 9 , X-26-52 (E. G. Linsley and R. F. Smith, C.I.S.). Indio, 5 mi. N.W., $2 \delta^{\alpha}$, X-26-52 (E. G. Linsley and R. F. Smith, C.I.S.). Indio, 6 mi. N.W., $\delta, \quad$ ㅇ, X-15-47, flowers 1 socoma acradenia (P. H. Timberlake, U.C.R.). Indio, 5 mi. W., $\delta$, IV-9-36, flowers Prosopis (P. H. Timberlake, U.C.R.); IV-10-36, flowers Cercidium torreyanum (Michener, 1939:27, K.U.); 4 J, 3 아, IV-22-50 (E. G. Linsley, C.I.S., K.U.). Indio, 6 mi . W., $\delta^{\prime}$, IV-30-49, flowers Melilotus (E. G. Linsley, J. W. MacSwain, R. F. Smith, K.U.). La Quinta, $\delta^{\prime}$, III-7-34, flowers Larrea glutinosa (P. H. Timberlake, U.C.R.); $\delta, 2$ i, IV-7-36, flowers Cercidium torreyanum and Larrea glutinosa (Michener, 1939:27, U.C.R.). Mecca (near), 9, IV-13-34, flowers Heliotropium curassavicum (P. H. Timberlake, U.C.R.). Oasis, 3 ㅇ, III-2734, flowers Cercidium torreyanum (Michener, 1939:27, U.C.R.). Oasis, 2 mi. N., d', XI-8-36, flowers Heliotropium (E. G. Linsley, K.U.). Painted Canyon, $\sigma^{\prime}$, IV-18-25, flowers Prosopis (P. H. Timberlake, U.C.R.). Palm Desert, 9 d, IV-12-50 (W. F. Barr, U.I.); ; same data (P. D. Hurd, Jr., K.U.). Palm Springs, ㅇ, IV-22-27, flowers Phacelia crenulata (P. H. Timberlake, U.C.R.); ©, VIII-28-34, flowers Petalonyx thurberi
(C. D. Michener, K.U.); $9, \mathrm{VI}-8-37$, flowers Hugelia virgata (P. H. Timberlake, U.C.R.); 3 9, VI-24-52 (L. D. and R. H. Beamer, W. La Berge, C. Liang, C. Winer, and A. Wolf, K.U.); $\delta, 4$, VI-24-52, flowers Eriogonum trichopes and Hugelia virgata (P. H. Timberlake, U.C.R.); ㅇ, VII-22-52 (D. E. Barcus, C.I.S.). Palm Springs, 4 mi . S., + , VI-25-41, flowers Hugelia virgata (P. H. Timberlake, U.C.R.). Palm Springs, 6 mi. N.W., 6 ㅇ, VI-25-41, flowers Hugelia virgata (P. H. Timberlake, U.C.R.). Palm Springs (sand Junes), $\mathbf{d}^{2}$, IV-23-33, flowers Isomeris arborea (P. H. Timberlake, U.C.R.). Rancho Mirage, 2 mi. N., $\delta^{\prime}$, VII-27-50, flowers Eriogonum trichopes (P. H. Timberlake, U.C.R.). Riverside, f, IV-19-25, flowers Gutierrezia californica (Michener, 1939:27, U.C.R.). Shavers Well, 2 ㅇ, IV-8-34 (Michener, 1939:27, U.C.R.). Stone Creek, San Jacinto Mountains, 9, V-21-40, flowers Lotus davidsonii (P. H. Timberlake, U.C.R.). Tahquitz Canyon, San Jacinto Mountains, $\delta$, IV-16-38 (G.E.B.).

San Bernardino Co.: Barstow, of, 3 ㅇ, VII-2828, flowers Cleomella obtusifolia (P. H. Timberlake, U.C.R.). Barstow, 35 mi E., ㅇ, VI-30-52 (R. H. Beamer, K.U.). Essex, 5 mi. W., 9 , VI-30-52, flowers Hymenopappus flavescens (R. H. Beamer, K.U.). Helendale, $\mathcal{f}$, IX-14-35, flowers Cleomella (C. D. Michener, K.U.). Hinkley, $\delta_{\text {, }}$ X-7-28, flowers Isocoma acradenia (Michener, 1939:27, U.C.R.). Hodge, $2 \delta$, IX-14-35, flowers Cleomella (C. D. Michener, K.U.); ${ }^{2}$, IX-14-35, flowers Cleomella obtusifolia (P. H. Timberlake, U.C.R.). Kramer Junction, ㅇ, V-1-53 (P. D. Hurd, Jr., C.I.S.). Kramer Junction, 15 mi . E., + , VII-6-51 (J. W. MacSwa in and R. F. Smith, C.I.S.). Ludlow, 6 mi. W., 8 \& canescens (P. D. Hurd, Jr., C.I.S., K.U.); 2 早, same data (R. F. Smith, K.U.). Ludlow, 14 mi . W., ㅇ, VI-30-52 (R. H. Beamer, K.U.). Oro Grande, $\delta$, X-7-28, flowers Cleomella obtusifolia (P. H. Timberlake, U.C.R.). Renoville, P , IV-2-51 (P. D. Hurd, Jr., C.I.S.). Seven Oaks, San Bernardino Mountains, $\delta$, VI-14-50, flowers Cryptantha intermedia (P. H. Timberlake, U.C.R.). Twentynine Palms, VIII-3-33, flowers Wislizenia refracta (Michener, 1939:27, U.C.R.); 4 ठै, IV-14-38 (Michener, 1939:27, G.E.B., U.C.D.); $2 \delta$, III-25-47, flowers Latrea glutinosa (P. H. Timberlake, U.C.R.). Twentynine Palms, 7.5 mi . S., 2 ㅇ, V-7-46, flowers Eriogonum fasciculatum var. polifolium (P. H. Timberlake, U.C.R.). Twentynine Palms, $10 \mathrm{mi} . \mathrm{S}$. , ㅇ, IV-13-35, flowers Isomeris arborea (Michener, 1939:27, U.C.R.). Victorville, $\hat{d}^{\prime}$, IX-14-35, flowers Cleomella (C.




D. Michener, K.U.). Vidal, ${ }^{\hat{\prime}}, \underline{\text {, }}$, VII- $6-51$, flowers Pectis papposa (J. W. MacSwain, C.I.S.). Vidal Junction, 7 mi. N., $2 \delta^{\text {§ }}$, IV-3-51 (P. D. Hurd, Jr., C.I.S.); ${ }^{\prime}$, same data (E. G. Linsley, C.I.S.). Yermo, 2 ㅇ, V1-19-39, flowers Cleomella obtusifolia (P. H. Timberlake, U.C.R.).

San Diego Co.: Anza State Park, ㅇ, IV-23-51 (E. I. Schlinger, U.C.D.). Bore go, 2 ㅇ, III-31-53, flowers Cryptantha barbigera (P. D. Hurd, Jr., C.I.S.). San Felipe Road, IV-1 8-34 (Michener, 1939:27). Ocotillo, III-6-47 (Michener, 1949:45). Discussion:

This is the most common of the group of species in which there is red on the legs but not on the body. It differs from other members of this group by the slender, gently curved hind tibial spurs, the short median teeth of the sixth metasomal tergum of the male (the concavity between them being semicircular, not deeper, pl. 24, fig. 134), the presence of red on the middle femora, and the presence of a broad shining margin across the clypeal truncation of the female. The sixth metasomal sternum of the female is depressed sub-basally, the punctures in the depression being coarser and more widely separated than elsewhere. The species is unusually variable in size. It is widespread in desert and semidesert regions of the southwest.

In Arizona it has been taken on flowers of Dalea spinosus ( 30 miles northeast of Yucca), Eriogonum (Wickenburg), E. trichopes (Beaver Dam), Heliotropium curassavicum (Buckeye), Larrea glutinosa (Picacho Pass), Verbesina auriculata ( 10 miles south of Tucson), and a yellow composite (Tucson and Wenden). In New Mexico it is known to visit flowers of Asclepias galioides (Las Cruces), Euphorbia (Hot Springs), Helenium laciniatum (Carrizozo), Marrubium vulgare (Carrizozo), Melilotus alba (Carrizozo), and Pyrrhopappus multicaulis (Carrizozo).

## Asbmeadiella rufipes Titus

(Pl. 24, fig. 135)
Ashmeadiella rufipes Titus, 1904, Proc. Ent. Soc. Wash. 6:99, ?. Type 7, San Diego County, California (U.S. Nat. Mus.).
Synonymy: Asbmeadiella baematopoda Cockerell, 1924. Proc. Calif. Acad. Sci., (4) 12:555, 子 (new synonym); Ashmeadiella rhodopus Michener, 1936, Pan-Pacific Ent., 12:59, 0 , ? (new synonym).
Geographic range: California and Mexico (see map 86).

California records:
Imperial Co.: Travertine Rock (near), $ㅇ$ V-25-33, flowers Dalea mollis (P. H. Timberlake, U.C.R.). Westmorland, $\delta$, 아, V-31-30, flowers Heliotropium currassavicum and Dalea emoryi (Michener, 1939:28, U.C.R.).

Inyo Co.: Argus Mountains, $2 \delta^{\prime}$, VI-4-39 (R. M. Bohart, U.C.D., U.C.L.A.). Lone Pine, 5 ठ, VI-2-37 (E. C. Van Dyke, C.A.S.); 2 ठ, V-4-37, E. C. Van Dyke, C.A.S.); ô, V-31-37 (E. C. Van Dyke, C.A.S.); ㅇ, VI-2-37 (E. C. Van Dyke, C.A.S.); $2 \delta$,, , VI-4-37 (E. C. Van Dyke, C.A.S., K.U.); ㅇ, VI-10-37 (A. E. Meier, C.I.S.); 2 ㅇ, VI-13-37 (U.C.D., U.C.L.A.); ठ', VII-13-37 (G. E. and R. M. Bohart, U.C.D.). Owens Lake (west shore), VI-2-37, flowers Petalonyx thurberi (Michener, 1939:28, K.U.). Panamint Springs, 32 d, 10 f, IV-28-53, flowers Petalonyx thurberi (P. D. Hurd, Jr., C.I.S.); + , same data (G. A. Marsh, C.I.S.).

Riverside Co.: Blythe, 18.1 mi . W., 오, X-2451, flowers Pectis papposa (P. H. Timberlake, U.C.R.). Dos Palmos, III-19-34 (Michener, 1939: 28). Edom, $\delta$, V-7-36, flowers Palafoxia linearis (Michener, 1939:28, U.C.R.). Indio, ${ }^{6}$, VII-19-47 (A. C. Michener, K.U.); 3 ot, 2 ㅇ, IV-5-51 (P. D. Hurd, Jr., C.I.S., K.U.). Palm Desert, 2 ㅇ, IV-12-50 (P. D. Hurd, Jr., C.I.S., K.U.). Palm Springs, s $\delta, 2$, + , VIII-28-34, flowers Petalonyx thurberi (C. D. Michener, K.U.); $\mathcal{F}$, VIII-28-39, flowers Petalonyx thurberi (P. H. Timberlake, U.C.R.); ठ', II-3-46 (C.I.S.). Ripley, $7 \mathrm{mi} . \mathrm{S} ., \mathrm{O}, \mathrm{X}-19-51$, flowers Pectis papposa (P. H. Timberlake, U.C.R.). Shavers Well, 9 , v-27-46 (R. M. Bohart, G.E.B.).

San Bernardino Co.: Baker, $\delta^{6}$, VII-27-50 (H. E. Cott, U.C.D.). Rice, 12 mi . S.W., ㅇ, IV-21-51 (C. D. MacNeill).

San Diego Co.: Borego, $\hat{o}^{\circ}$, 오, III-31-53, flowers Cryptantha barbigera (P. D. Hurd, Jr., C.I.S.). Camp Pendleton, near Santa Margarita River, $\delta^{2}$, + , IV-23-46, flowers Cryptantha intermedia (P. H. Timberlake, U.C.R.). Ocotillo, 3 mi . W., ô, IV-22-51 (R. C. BechteI, U.C.D.).
Discussion:
This species differs from others in the group with red legs and a black body in having the legs almost wholly red in most individuals, and in the abundance of snowy white pubescence. A few individuals which have the fore and middle legs partly black occur in most if not all California populations of rufipes.
A. rufipes has usually masqueraded as haematopoda Cockerell, with those individuals having dark areas on the front and middle legs being called either rbodopus Michener or rufipes Titus.


Map 88. Distribution of Ashmeadiella foveata Michener.


Map 39. Distribution of Ashmeadiella difugita Michener, the subspecies difugita indicated by open circles, and the subspecies emarginatula by solid circles.

That all three names apply to the same species is shown by the complete intergradation of the characters. As indicated previously (see Michener, 1939), the few specimens available from Baja California (rbodopus) and extreme southern California (rufipes) have the fore and middle legs partly dark and the punctation slightly coarser than most specimens from the California deserts. Some of the latter specimens, however, have partly dark legs.

Moreover, the type of baematopoda, the only known specimen from Sonora, also has this coarser punctation, although its legs are entirely red. It therefore seems evident that rhodopus and baematopoda are synonyms of rufipes, and it is possible that when adequate Mexican series are available, the finely punctate California form will be separable as a weak subspecies. All three names are based on specimens which are slightly more coarsely punctate than most California populations.
A. baematopoda and rbodopus were considered distinct from rufipes previously (Michener, 1939) by the very finely and closely punctate dorsolateral areas of the first tergum of the latter. This is a good character but applies to a considerable extent to all populations of the species as it is now understood. The two specimens (holorype and topotype) recognized as rufipes in 1939 were badly rubbed and the finely punctate areas therefore were exposed. Normally these areas are covered with white hairs so that the dense punctation is invisible and would not be suspected.

The sixth metasomal sternum of the female is very broadly and shallowly depressed, the punctures being somewhat coarser in the depression than elsewhere.

## Asbmeadiella leucozona Cockerell

Ashmeadiella leucozona Cockerell, 1924, Proc. Calif. Acad. Sci., (4) 12:556, $\delta^{2}$, ㅇ. Type $\delta$, Guaymas, Sonora (Calif. Acad. Sci.).
Geographic range: California and Mexico (see map 87).
California records:
Imperial Co.: Potholes, ${ }^{\text {f, }}$ IV-8-23 (E. P.
Van Duzee, C.A.S.).
Riverside Co.: Blythe, 18 mi. W., ㅇ, IV-30-52, flowers Teucrium depressum (P. H. Timberlake, U.C.R.). Indio, $5 \mathrm{mi} . \mathrm{N} ., \mathrm{\delta}^{\prime}$, IV-1 0-36, flowers Cercidium torreyanum (C. D. Michener, K.U.).

San Bernardino Co.: Twentynine Palms, 2 ठ, IV-14-38 (G. E. and R. M. Bohart, G.E.B., U.C.D.).

Discussion:
This species can be easily distinguished from similar ones by the shining mesoscutum with coarse punctures separated by nearly a puncture width. The sixth metasomal sternum of the female is broadly depressed, not quite so deeply as in foveata but with the depression occupying most of the exposed surface so that only a narrow convex region is behind it; almost entire sternum rather coarsely punctate with broad spaces between punctures.

## Asbmeadiella foveata Michener

Asbmeadiella (Ashmeadiella) foveata Michener, 1939, Amer. Midland Nat., 22:39, ㅇ. Type ㅇ, Tamalpais, California (Timberlake collection, U.C.R.).

Geographic range: Arizona, California, Nevada, and Utah (see map 88).
California records:
Contra Costa Co.: Mt. Diablo, ㅇ, V-30-51 (E. I. Schlinger, U.C.D.); $\delta$, V-28-52 (F. X. Williams, C.A.S.); ${ }^{\text {d, }}$ IV-21-53 (P. D. Hurd, Jr., C.I.S.).

Inyo Co.: Big Pine Creek, 4,500 ft., 우, VI-13-42 (R. M. Bohart, G.E.B.); same locality, 6,000 ft., $\delta^{\prime}$, VI-16-42 (R. M. Bohart, G.E.B.). Independence, 9, VI-2-37 (W. C. Reeves, U.C.R.). Oak Creek Canyon, near Independence, VI-11-37 (Michener, 1939:40). Westgard Pass, 0,3 ㅇ, VI-26-53, flowers Dalea (J. W. MacSwain, C.I.S.); 9, VI-26-53 (H. Nakakihara, C.I.S.).

Los Angeles Co.: Tanbark Flat, San Dimas Experimental Forest, ㅇ, VII-2-50 (Michener, 1951:54, K.U.); + , VII-8-52 (A. T. McClay, U.C.D.). Palmdale, , IV-11-36 (G. E. and R. M. Bohart, G.E.B.).

Madera Co.: San Joaquin Experimental Range, f, IV-18-53, flowers Phacelia platyloba (P. D. Hurd, Jr., C.I.S.).

Marin Co.: Tamalpais, ㅇ, VI-20-26, flowers Erigeron miser (Michener, 1939:40, U.C.R.).

Mariposa Co.: Vernal Falls, Yosemite Valley, §', VI-27-26, flowers Monardella lanceolata (P. H. Timberlake, U.C.R.). Pohono Trail, Yosemite, $\sigma^{2}$, VI-26-26, flowers Collinsia torreyi (P. H. Timberlake, U.C.R.).

Riverside Co.: Aguanga, ठ', V-9-36, flowers Prosopis (P. H. Timberlake, U.C.R.). Perris,


Map 90. Distribution of Ashmeadiella gillettei Titus, the subspecies cismontanica indicated by upper half solid circles, the subspecies gillettei by solid circles, the subspecies rubra by right half solid circles, and the subspecies rufiventris by open circles.
$11 / 2 \mathrm{mi}$. W., P , V-12-50, flowers Heliotropium curassavicum var. oculatum ( P . H. Timberlake, U.C.R.). Piñon Flat, San Jacinto Mountains, V-24-39, flowers Encelia (Michener, $1949: 46$ ).

San Bernardino Co.: Cajon Canyon (mouth of), IV-25-36, in nest under stone (Michener, 1949: 46). Cedar Canyon, Providence Mountains, V-27-50 (Michener, 1951:54, U.C.D.). Trail above Glen Ivy, San Bernardino Mountains, $\delta, ~ Y, ~ V-$ 13-28, flowers Helianthus gracilentus and Lotus scoparius (P. H. Timberlake, U.C.R.).

Solano Co.: Green Valley, VI-9-33, flowers Diplacus aurantiacus (Michener, 1939:40, U.C.R.). Discussion:

This species is easily distinguished from our other species by the deep fovea of the sixth metasomal sternum of the female. This fovea is shining and has very coarse, irregularly placed, and widely separated punctures. This type of sculpturing reaches nearly to the posterior margin of the sternum. The Texas A. vandykiella Michener is similar in this characteristic and may be only subspecifically distinct. Among California species a somewhat similar sternal fovea is found in A. leucozona, but it is shallower. A. foveata differs from leucozona by the
finely and closely punctured mesoscutum, as well as by numerous other characters.

## Ashmeadiella gillettei Titus

Ashmeadiella gillettei Titus, 1904, Proc. Ent. Soc. Wash., 6:100, ㅇ.
Ashmeadiella (Asbmeadiella) gillettei, Michener, 1951, Pan-Pacific Ent., 27:66.
Geographic range: California, Colorado, Mexico, Nebraska, New Mexico, South Dakota, and Texas (see map 90).
Discussion:
In addition to the two subspecies listed below, A. gillettei includes gillettei proper from the western Great Plains and gillettei rubra from Texas and New Mexico. These extralimital subspecies have been taken at flowers of Dalea formosa (Sanderson, Texas) and Sedum stenopetalum (Harrison, Nebraska).

In this species, the sixth metasomal sternum of the female bears a distinct transverse depression which is more coarsely punctate than the remainder of the sternum.

## Key to the California Subspecies of Asbmeadiella gillettei

1. Metasoma very largely red, last exposed meta somal tergum at least partly red

Metasoma black apically, last metasomal tergum wholly black in female
cismontanica (p. 180)

Asbmeadiella gillettei rufiventris Michener
Asbmeadiella (Ashmeadiella) rufiventris Michener, 1939, Amer. Midland Nat., 22:32, ${ }^{\prime}$, ㄱ. Type 9 , Dos Palmos, Colorado Desert, California (Calif. Acad. Sci.).
Geographic range: California and Mexico (see map 90).
California records:
Imperial Co.: Westmorland, $\sigma^{\top}$, III-23-38, flowers
Heliotropium curassavicum (Michener, 1939:33, U.C.R.).

Inyo Co.: Keeler, 2 mi . S.E., flowers Malacothrix (Michener, 1939:33). Olancha, ㅇ, V-20 37 (F. L. Blanc, G.E.B.). Olancha, 6 mi. S., VI-20-37 (Michener, 1939:33); 9 , V-20-37 (C. D. Michener, K.U.). Panamint Mountains, 9, V-2937 (N. W. Frazier, G.E.B.).

Riverside Co.: Desert Center, 4 mi. E., Y, $^{\text {C }}$ IV-5-51 (P. D. Hurd, Jr., C.I.S.). Indio, $Q$, IV-5-51 (P. D. Hurd, Jr., C.I.S.). Indio, 5 mi . W., IV-1 0-36, flowers Prosopis chilensis glandulosa (Michener, 1939:33, K.U.). Palm Springs, IV-9-36, flowers Cercidium torreyanum (Michener, 1939: 33, U.C.R.); III-26-32, flowers Pbacelia distans (Michener, $1939: 33$, U.C.R.). Edom, 2 mi . S., III-8-36, flowers Geraea canescens (Michener, 1939:33, U.C.R.).

San Bernardino Co.: Adelanto, 9 mi. N., IV-25-37, flowers Astragalus fremontii (Michener, 1939:33, U.C.R.). Twentynine Palms, IV-14-38 (Michener, 1939:33). Manix, 6 mi. N., 9 , IV-2553, flowers Stephanomeria (G. A. Marsh, C.I.S.).

San Diego Co.: Borego, $\delta^{\prime}, 2$ Y, IV-5-40 (R. M. Bohart, G.E.B.).

## Discussion:

This subspecies is known only from the desert regions of California and a single locality (El Mayor) in Lower California. Two males collected in Box Canyon (March 31, 1934, and April 27, 1952, on flowers of Cercidium torreyanum and Cbaenactis carphoclinia) and a female from Borego (March 16, 1950) appear to be morphologically different from rufiventris and have been excluded from this treatment.

## Asbmeadiella gillettei cismontanica Michener

Ashmeadiella (Ashmeadiella) gillettei cismontanica Michener, 1951, Pan-Pacific Ent., 27: 67, ㅇ. Type $+11 / 2$ miles west of Perris, California, flowers Heliotropium curassavicum var. oculatum (Timberlake collection, U.C.R.). Geographic range: California (see map 90).
California records:
Contra Costa Co.: Clayton, IV-23-49 (Michener, 1951:53, C.I.S.).

Fresno C.o.: Mendota, $2 \delta, 15$ ㅇ, IV-23-49, flowers Melilotus (Michener, 1951:52, C.I.S., K.U.). Mendota, 5 mi. E., IV-23-49, flowers Melilotus (Michener, 1951:52, C.I.S.).

Riverside Co.: Perris, $11 / 2 \mathrm{mi}$. W., V-29-46, flowers Cryptantha intermedia (Michener, 1951: 67); 12 ㅇ, V-12-50, flowers Heliotropium curassavicum var. oculatum (P. H. Timberlake, K.U., U.C.R.). Perris, $41 / 2$ miles W., V-14-48, flowers

Hugelia virgata (Michener, 1951:67).
Discussion:
This subspecies occurs in the dryer lowland areas of cismontane California and in the Great Valley. There is a possibility that the Contra Costa County record is an error.

## Ashmeadiella difugita Michener

Ashmeadiella (Ashmeadiella) difugita Michener, 1939, Amer. Midland Nat., 22:41, ठ, $\circ$.
Ashmeadiella difugita, Michener, 1951, Jour. Kansas Ent. Soc., 24:53, ठ, 아.
Geographic range: California, Idaho Nevada, and Oregon (see map 89).
Discussion:
Individuals of this species in which the posterior femora are red are easily recognized by the entirely black middle iegs and other characters. Individuals in which the legs are wholly black are more difficult to recognize. They are similar to A. aridula but markedly more finely punctate. They have a hairband on the fifth tergum of the female (as in aridula astragali) but have only scattered fine punctures on the tegulae (astragali has distinct and coarser punctures). Fortunately, all black-legged specimens known belong to the subspecies emarginatula, which has a very distinctive small clypeal emargination, not found in any other species of the genus.

Key to the Subspecies of Asbmeadiella difugita

## Females

1. Clypeal truncation entire . . . . . . . . . . . . . . . . . difugita (p. 180)

Clypeal truncation with small median emargination emarginatula (p. 182)

## Asbmeadiella difugita difugita Michener

Ashmeadiella (Asbmeadiella) difugita Michener, 1939, Amer. Midland Nat., 22:41, б, \&. Type f, Lone Pine Canyon, San Gabriel Mountains, California, flowers Eriodictyon trichocalyx
(Timberlake collection, U.C.R.).
Geographic range: California (see map 89).
California records:
Inyo Co.: Tuber Canyon, Panamint Mountains, 8,000 ft., $2 \delta^{\prime \prime}, \mathrm{VI}-18$-37 (Michener, 1939:42).

Los Angeles Co.: San Gabriel Mountains,
north of Azusa, VII-2-50 (Michener, 1951:53). Big Pines Camp, San Gabriel Mountains, ${ }^{0}$, VII-13-27, flowers Verbena (Michener, 1939:41, U.C.R.). Camp Baldy, $\delta^{*}$, VIII-21-39, flowers Eriogonum fasciculatum (Michener, 1939:42); ㅇ, VII-11-50 (Michener, 1951:53). Swartout Valley, 2 d', VI-3-28, flowers Pbacelia beterophylla and pink Gilia (Michener, 1939:42). Tanbark Flat, San Dimas Experimental Forest, 오, VII-2-50 (P. D. Hurd, Jr., K.U.).

San Bernardino Co.: Mill Creek Canyon, near falls, $6,200 \mathrm{ft}$., San Bernardino Mountains,


Map 91. Distributions of Ashmeadiella aridula Cockerell, the subspecies aridula indicated by upper half solid circles, and the subspecies astragali by solid circles; and Asbmeadiella meliloti (Cockerell), the subspecies crassa indicated by right half solid circles, and the subspecies meliloti by open circles.

VIII-15-34, flowers Chrysopsis fastigiata (Michener, 1939:41, U.C.R.). Mill Creek, San Bernardino Mountains, $\delta$, 우 (in copulo), V-28-50 (P. H. Timberlake, U.C.R.).
Discussion:
This southern California subspecies has red on the posterior femora of all known specimens. The Inyo County specimens are both males and their placement in this subspecies is provisional.

## Asbmeadiella difugita emarginatula Michener

Ashmeadiella difugita emarginatula Michener, 1951, Jour. Kansas Ent. Soc., 24:53, ㅇ. Type 우 우, Bridge Creek Camp, Lassen County, California (Calif. Acad. Sci.).
Geographic range: California, Idaho, Nevada, Oregon (see map 89).
California records:
Inyo Co.: Big Pine Creek, 6,000 ft., $\delta, 2$ ㅇ, VI-16-42 (R. M. Bohart, G.E.B.); same locality, 7,500 ft., ठ', VI-12-42, 2 ㅇ, VI-17-42 (R. M. Bohart, G.E.B.).

Lassen Co.: Bridge Creek Camp, ㅇ, VII-9-49 (Michener, 1951:53, C.I.S.); ㅇ, VII-9-49 (W. F. Ehrhardt, U.C.D.); f, same data (P. D. Hurd, Jr., C.I.S.);. ㅇ, same data (W. H. Wade, C.I.S.). Hallelujah Junction, $f$, VI-27-49 (Michener, $1951: 53$, C.I.S.). McCoy Flat, 9 , VII-8-49 (P. D. Hurd, Jr., C.I.S.).

Mono Co.: West Walker River, $7,200 \mathrm{ft} ., \delta$, VI-25-37 (C. D. Michener, K.U.).

Nevada Co.: Hobart Mills (near), ${ }^{\text {, }}$, X-8-52 (R. M. Bohart, U.C.D.). Truckee, VII-9-27 (Michener, $1951: 53$ ).
Discussion:
This subspecies, found in central and northern California and thence to Oregon (Steens Mountains) and Idaho, has red on the hind femora of about 50 per cent of known specimens. In Idaho it has been taken on flowers of Eriogonum (5 miles northeast of Midvale) and Grindelia (Coyore Grade, Nez Perce County).

## Asbmeadiella meliloti meliloti (Cockerell)

Heriades meliloti Cockerell, 1897, Ann. Mag. Nat. Hist. (6) $20: 141, \delta$, 오 Type , Santa Fe , New Mexico (U.S. Nat. Mus.).
Geographic range: Arizona, California, Mexico, New Mexico, and Texas. This species is represented by another subspecies, crassa Cockerell, in Baja California. (see map 91 ).

California records:
Inyo Co.: Big Pine, ㅇ, VI-17-51 (G. C. Bechtel, U.C.D.). Westgard Pass, $\mathrm{\delta}^{\prime}, 4$ Y, VII-10-53, flowers Cryptantha (E. G. Linsley, C.I.S.); same locality, 7 mi . W., 4 ㅇ, VI-26-53, flowers Dalea (J. W. MacSwain, C.I.S.).

Los Angeles Co.: Lovejoy Buttes, $\delta$, V-5- 40 (P. H. Timberlake, U.C.R.).

Riverside Co.: Blythe, VII-15-38, flowers Prosopis chilensis glandulosa (Michener, 1939: 43, U.C.R.). Andreas Canyon near Palm Springs, X-27-34, flowers Solidago californica (Michener, 1939:43, U.C.R.). Riverside, IX-15-32, flowers Eriogonum gracile and Phacelia ramosissima (Michener, 1939:43, U.C.R.); $4 \delta^{\pi}, 17$ ㅇ, VIII-1, IX-28, flowers Heliotropium curassavicum var. oculatum, one on Acamptopappus (P. H. Timberlake, U.C.R.). Stone Creek, San Jacinto Mountains, $\mathrm{O}^{2}$ ㅇ, VI-21-40, flowers Lotus davidsonii (P. H. Timberlake, U.C.R.). Mt. San Jacinto, 4,000 ft., ㅇ, VI-6-42 (R. M. Bohart, G.E.B.). Ribbonwood, ㅇ, V-21-40, flowers Cryptantha (C. D. Michener, K.U.).

San Bernardino Co.: Yucca Valley, ㅇ, IX-2849, flowers Hugelia virgata (P. H. Timberlake, U.C.R.). Morongo Valley, ס, IX-13-40, flowers Gutierrezia lucida (P. H. Timberlake, U.C.R.). Clark Mountains, 4,000-4,500 ft., V-7-38, flowers Baileya multiradiata ( $4,000 \mathrm{ft}$.) and Viguiera nevadensis (4,500 ft.) (Michener, 1939:43, U.C.R.).

San Diego Co.: San Felipe Creek, VI-5-36, flowers Opuntia megacarpa (Michener, 1939:43); IX-1 0-38, flowers Gutierrezia californica (Michener, 1939:43, U.C.R.).
Discussion:
This is the form listed as cactorum cactorum by Michener in 1939. As shown by the same author in 1942 , that name is applica ble to a nother species.
A. meliloti is exceedingly close to $A$. aridula and the two have, indeed, been considered as only subspecifically distinct in all recent papers. It is now evident, however, that the ranges of the two overlap broadly, at least in southern California, withour intergradation. They are, therefore, considered to be distinct species although the differences between them are slight. A. meliloti is on the average larger, and its tegulae are almost black, whereas they are brown in aridula. Certain minor but significant differences in punctation are indicated in the key to the species. The tegulae are scarcely punctured in meliloti. The fifth metasomal tergum of the female lacks an apical white pubescent fascia. The fifth metasomal sternum has a shallow depression in which the punctures are
coarser than elsewhere and separated by shining interspaces.

As the floral records listed above suggest, a wide variety of flowers are visited. Additional floral information from other parts of the range may be summarized as follows. In Arizona it has been taken on flowers of Acacia greggii (Duncan), Cbilopsis linearis (Sedona), Crusea subulata ( 5 miles north of Prescott), Lepidium montanun (Chino), Penstemon ( 5 miles north of Prescott), and Prosopis (Duncan); in New Mexico on flowers of Cbilopsis (Rincon), Cleome ( 6 miles east of Embudo), Marrubium vulgare (Carrizozo), Melilotus alba (Carrizozo), and Pyrrbopappus multicaulis (Carrizozo); and in Texas on flowers of Dalea argyraea (Marathon), D. formosa (Sanderson), and D. pogonathera (Quemada).

## Asbmeadiella aridula Cockerell

Ashmeadiella aridula Cockerell, 1910 , Entomologist, 43:91, ò.
Geographic range: California, Colorado, Idaho, Nevada, Oregon, Utah; Washington, and Wyoming (see map 91).
Discussion:
This species is a close relative of meliloti. In general it is found in less arid and more northern regions than meliloti, from which it differs principally by the testaceous or pale brown tegulae. It is on the average smaller than meliloti. The reasons for recognizing aridula and melilotias separate species are indicated in the discussion of the latter.

## Key to the Subspecies of Ashmeadiella aridula

1. Tegulae distinctly punctate; fifth metasomal tergum of female with distinct apical pubescent fascia.
astragali (p. 184)
Tegulae nearly impunctate; fifth metasomal tergum of female without apical pubescent fascia

## Asbmeadiella aridula aridula Cockerell

Asbmeadiella aridula Cockerell, 1910 , Entomologist, $43: 91$, ठ'. Type $\delta^{*}$, Rifle, Colorado (Timberlake collection, U.C.R.).
Geographic range: California, Colorado, Idaho, Nevada, Utah, Washington, and Wyoming (see map 91 ).
California records:
Imperial Co.: Holtville, III-24-30, flowers Heliotropium curassavicum var. oculatum (Michener, 1939:45, U.C.R.).

Los Angeles Co.: Arroyo Seco, $2 \hat{\sigma}, 2$ ㅇ, VI-25-40, flowers Cryptantha, Lotus, and Nama parryi (J. W. MacSwa in, C.I.S.). Lovejoy Buttes, +, V-11-44 (P. H. Timberlake, U.C.R.). Mt. Wils on Road, ס', VII-24-39 (R. M. Bohart, U.C.D.). Tanbark Flat, San Dimas Experimental Forest, ¢, VI-22-50 (J. D. Paschke, C.I.S.); ㅇ, VI-25-50 (P. D. Hurd, Jr., C.I.S.); Y, VII-8-50 (F. X. Williams, C.A.S.); Y, VII-6-52 (Joan Linsley, C.I.S.); ㅇ, VII-11-52 (A. T. McClay, U.C.D.). Whittier, VIII-13-20 (P. H. Timberlake, U.C.R.).

Riverside Co.: Banning, $\sigma^{\prime}$, V-2 8-28 (Michener, 1939:45, C.A.S.). Hemet Lake Road at Herkey

Creek, San Jacinto Mountains, $\sigma^{\top}$, VI-24-34 (Michener, $1939: 45$, C.A.S.). Herkey Creek, $\delta$, VI-24-34 (I. McCracken, C.A.S.); same locality, $4,000 \mathrm{ft} .$, flowers Lotus americanus (Michener, $1939: 45$, U.C.R.). Idyllwild, $?$, VI-2 9-28 (Michener, $1939: 45$, C.A.S.); $9, \mathrm{VI}-20-40$ (E. C. Van Dyke, C.A.S.). Pine Flat, San Jacinto Mountains, 2 ó, VI-15-40, flowers Cryptantha micrantha (C. D. Michener, C.I.S.). Piñon Flat, San Jacinto Mountains, 9, VII-29-46, flowers Eriogonum (P. D. Hurd, Jr., C.I.S.). Riverside, $\delta^{\top}$, +7 , VII-12 to IX-25, some on flowers Heliotropium curassavicum var. oculatum (Michener, 1939:45, U.C.R.). Santa Ana Mountains above Elsinore, IV-28-34, flowers Cryptantha intermedia (Michener, 1939: 45, U.C.R.). Stone Creek, San Jacinto Mountains, $\sigma^{\pi}$, 9, VI-21-40, flowers Lotus davidsonii (P. H. Timberlake, U.C.R.). Temecula, 9 , VII-4-50 (E. G. Linsley, C.I.S.).

San Bernardino Co.: Barstow, IX-12-24, flowers Cle omella obtusifolia (Michener, 1939:45, U.C.R.). Crestline, 7 , V-23-36, flowers Lotus (Michener, $1939: 45$, C.I.S.). Lytle Creek, VIl-4-28 (Michener, 1939:45). Morongo, $\delta$, , 1 , IX-13-40, flowers Gutierrezia lucida (P. H. Timberlake, U.C.R.).

Redlands (Michener, 1939:45, U.S.N.M.). Yermo, §, V-23-40 (M. A. Cazier, W. C. Reeves, P. C. Ting, U.C.R.).

San Diego Co.: Cuyamaca, ㅇ, VII-4-20 (L. D. Anderson, K.U.). Cuyamaca Park, ó, V-20-43 (E. W. Clark, C.I.S.). Escondido (Michener, 1939 , 45).

Discussion:
This subspecies, which occurs in much of the intermountain region and in southern California, intergrades with astragali. Occasional specimens, even from the San Gabriel Mountains, in southern California, have a few rather large punctures on the tegulae; in the Great Valley of California, although the tegulae are distinctly punctate as in astragali, there is every grade between the subspecies so far as the fascia of the fifth tergum is concerned.

## Ashmeadiella aridula astragali Michener

Ashmeadiella (Asbmeadiella) cactorum astragali Michener, 1939, Amer. Midland Nat., 22:44, $\delta_{2}$ ㅇ. Type 9 , Lone Pine, Inyo County, California (Calif. Acad. Sci.).
Geographic range: California, Nevada, Oregon, and perhaps Wyoming (see map 91 ).
California records:
Alameda Co.: Tesla, $\mathrm{Y}^{\text {, X-4-51 (J. G. Rozen, }}$ C.I.S.).

Alpine Co.: Hope Valley, 2 Y, VII-18-48 (K. W. Tucker, C.I.S.).

Butte Co.: Chico, 2 Y, II-16-12 (J. A. Kusche, K.U.). Oroville, ${ }^{\text {, }}$ VI-24-27 (H. H. Keifer, C.A.S.).

Calaveras Co.: Mokelumne Hill, $\delta$, June (Michener, $1939: 45$, C.A.S.). Murphys, $2,500 \mathrm{ft} .$, б, O, VI-1 938 (F. E. Bla isdell, C.A.S.).

Colusa Co.: College City, ${ }^{\text {+, VI-22-16, flowers }}$ Marrubium vulgare (R. Stinchfield, L.S., Jr., U.). Sycamore Slough, 9 , VII-11-16 (R. Stinchfield, L.S., Jr., U. ).

Contra Costa Co.: Antioch, $\delta, 9$, VIII-9-36, flowers Heliotropium (C. D. Michener, K.U.); VIII-9-36 (Michener, 1939:45); $\delta$, VIII-23-36 (Michener, 1939:45, C.A.S.); 2 \&, VIII-30-36 (E. C. Van Dyke, C.A.S.); ס', 7, IX-26-37 (G. E. and R. M. Bohart, G.E.B.); $2 \delta^{\prime}$, IX-8-48 (J. W. MacSwain, C.I.S.); \&, V-24-49, flowers Lotus (P. D. Hurd, Jr., C.I.S.); 2 ס, V-8-50 (P. D. Hurd, Jr., C.I.S.); Y, VII-8-50 (J. E. Gillaspy, C.I.S.); $\delta_{1}$ V-17-52 (G. A. Marsh, C.I.S.); $O$, VIII-12-52 (W. F. Barr, C.I.S.). Avon, $\delta, 9$, VIII-29-37 (E. C. Van Dyke, C.A.S.). Marsh Creek,

ㅇ, VIII-25-11 (Michener, $1939: 45$, K.U.).
Eldorado Co.: Chile Bar, $\delta^{*}$, VII-5-48 (L. W. Quate, C.I.S.). Placerville, 2 ㅇ, VIII-9-53 (E. I. Schlinger, U.C.D.).

Fresno Co.: Firebaugh, $\delta^{\top}$, IX-9-48 (V. M. Stern, C.I.S.); same locality, 4 mi . N.W., $\delta$, IX-9-48, flowers Solidago (R. F. - Smith, C.I.S.). Friant, 2 ठ, 9, V-24-36 (E. S. Ross, C.A.S.); V-24-36 (Michener, $1939: 45$ ). Mendota, ©, V-1936 (E. S. Ross, C.A.S.); ㅇ, IX-14-48 (V. M. Stern, C.I.S.). Fresno (Michener, $1939: 45$ U.S.N.M. ).

Humboldt Co.: Eureka and Weaverville (road between), VII-20-37 (Michener, 1939:45).

Inyo Co.: Big Pine, VI-8-37, flowers Dalea polyadenia (Michener, 1939:44, K.U.); same locality, $\dot{j} \mathrm{mi}$. E., + , VII-10-53 (W. D. McClellan, U.C.D.); 2 \&, same data (H. Nakakihara, C.I.S.). Bishop, ס, VI-21-37 (E. P. Van Duzee, C.A.S.); ס', VIII-4-37 (G. E. and R. M. Bohart, G.E.B.). Deep Springs, 9, VII-11-53 (J. W. MacSwain, C.I.S.); + , same data (H. Nakakihara, C.I.S.); 9 , VII-16-53 (R. M. Bohart, U.C.D.); $2 \delta, 4$, same data (E. I. Schlinger, U.C.D.); $\delta, 2$ \&, VII-17-53 (W. D. McClellan, U.C.D.). Independence, $\delta$, IV-14-37 (U.C.D.); $\delta$ ', 3 ㅇ, VI-14-37 (E. C. Van Dyke, C.A.S.); 9, VI-1 8-37 (U.C.D.). Lone Pine, б, $\uparrow$, V-21-37 (C.I.S.); 2 \&, VI-10-37 (A. E. Meier, C.I.S.); 9, VI-14-37 (G.E.B.); 9, Vl-1 8-37 (G.E.B.). Olancha, 우, VII-15-53 (E. I. Schlinger, U.C.D.). Owens Lake (north end), VI-4-37, flowers Trifolium (Michener, 1939:44, K.U.). Westgard, ${ }^{\lambda}$, V-26-37 (G.E.B.).

Kern Co.: Walker Pass, $\uparrow$, VI-26-49 (L. W. Isaak, U.C.D.).

Lake Co.: Middletown, 2 ㅇ, IX-11-48, flowers Trichostema laxum (P. D. Hurd, Jr., C.I.S.).

Madera Co.: Bass Lake, 9, VII-23-34 (Michener, 1939:45, C.A.S.).

Mariposa Co.: Yosemite Valley, VI-24-21, flowers Lotus (Michener, $1939: 45$ ).

Mendocino Co.: Longvale Creek, 9 , VII-27-38 (E. C. Van Dyke, C.A.S.). Ryan Creek, 3 ơ, VII-15-49 (R. Craig, C.I.S.).

Merced Co.: Dos Palos, 7 mi. E., $\delta$, VIII-6-49, flowers Lotus americanus (E. G. Linsley and R. F. Smith, C.I.S.); \&, VIII-16-49, same flower (E. G. Linsley, J. W. MacSwain, R. F. Smith, C.I.S.); same locality, $3 \mathrm{mi} . S ., \delta, \%$ VI-18-52 (R. F. Smith, C.I.S.); same locality, 8 mi. S., 2 ㅇ, VIII-10-52, flowers Heliotropium curassavicum var. oculatum (G. A. Marsh, C.I.S.). Los Banos, $2 \delta^{\circ}$, ㅇ, V-23-1 8 (Michener, 1939:45, K.U.). Modoc Co.: Lake City, + , VIII-1-22 (C. L. Fox, C.A.S.).

Mono Co.: Topaz, + , VII-17-51 (J. W. Mac


Map 92. Distributions of Asbmeadiella californica (Ashmead), the subspecies californica indicated by solid circles, the subspecies florissantensis by half-solid circles, and the subspecies sierraensis by open circles.

Swain，C．I．S．）； 2 Y，VIII－17－51（E．I．Schlinger， U．C．D．）．West Walker Canyon， 9 ，VII－9－34（E．P． Van Duzee，C．A．S．）．

Napa Co．：Knoxville， 2 P，IX－1－53（E．I． Schlinger，U．C．D．）．Pope Valley，${ }^{\prime}$ ，＇，VI－11－39 （E．C．Van Dyke，C．A．S．）．

Placer Co．：Applegate，$\delta^{\prime}$ ，VI－24－51（J．C． Hall，U．C．D．）．Auburn， 2 ס＇，VII－27－15（L．Bruner， U．N．）； 3 9，VIII－24－1 8 （L．Bruner，U．N．）．Nicolaus， ㅇ，VI－27－35（J．Beamer，K．U．）．

Plumas Co．：Bucks Lake，$\delta$＇，VII－1－49（R．G． Howell，C．I．S．）．Lake Almanor，$Y$ ，VII－8－49（D． Cox，C．I．S．）．Quincy， 4 mi．W．， 2 \＆，VII－16－49 （P．D．Hurd，Jr．，K．U．）．

Sacramento Co．：Sacramento，VII－4－14（Mich－ ener， $1939: 45$ ）；ㅇ，VIII－10－16（L．Bruner，U．N．）； 2 9，IX－29－16，flowers Melilotus alba（L．Bruner， U．N．）； $9, \mathrm{X}-10-16$（L．Bruner，U．N．）．

San Bernardino Co．：Yermo， 2 9，V－23－40（G． E．Bohart，G．E．B．）．

San Joaquin Co．：Stockton， 3 б＇，아，VIII－20－19 （Michener， $1939: 45$, C．A．S．，K．U．）．Tracy，$\&$ ， VI－7－49， 9, VI－13－49，$\delta$ ，VII－29－49（J．W．Mac Swain，C．I．S．）；P，VI－21－49（R．F．Smith，C．I．S．）．

Santa Barbara Co．：Santa Barbara， 2 万＇（W．M． Giffard，C．A．S．）．Santa Maria， 38 mi. E．， 3 ō， 4 7，VI－20－52，flowers Heliotropium curassavicum var．obovatum（L．D．Beamer，R．H．Beamer，C． Liang，W．LaBerge，A．Wolf，K．U．）．

Shasta Co．：Burney， 5 mi ．E．，$\delta$ ，VI－9－41（C． D．Michener，K．U．）；ㅇ，VII－22－46（C．I．S．）．Redding， ס，VII－6－18（E．P．Van Duzee，C．A．S．）．

Sierra Co．：Calpine，${ }^{2}$ ，VIII－27－48，flowers Solidago（E．G．Linsley，C．I．S．）．Sierraville， ，$_{\text {，}}$ VIII－26－48，flowers Solidago（R．F．Smith，C．I．S．）．

Solano Co．：Rio Vista， 2 P，V－24－49，flowers Lotus（J．W．MacSwain，C．I．S．）； 9, VI－2－49（R．S． Beal，C．I．S．）；$\delta$ ，VIII－16－50（J．E．Gillaspy， C．I．S．）．Ryer Island， 2 O ，VI－10－49，flowers Heliotropium（E．G．Linsley，C．I．S．）．

Sonoma Co．：Cloverdale， 9 ，VIII－24－53（E．I． Schlinger，U．C．D．）．

Stanislaus Co．：Patterson， 2 ㅇ，VI－22－49 （T．F．Leigh，C．I．S．，K．U．）．Turlock，むむ， $9 \%$ ， V－1 0 to VIIl－22－52，flowers Centromadia pungens and Heliotropium curassavicum var，oculatum（ R ． R．Snelling）．

Tehama Co．：Vina， 2 ס，오，IX－22－51（J．C． Holland，E．I．Schlinger，U．C．D．）．

Trinity Co．：Carrville， $2,400-2,500 \mathrm{ft}$ ．，VI－ 20－34（Michener，1939：45）；ס，VI－18－34（G．E． Bohart，G．E．B．）．

Tulare Co．：Coffee Camp，VI－8－25，flowers Lotus glaber（Michener，1939：45）．Lindsay，VI－

19－29（Michener， $1939: 45$ ）．Wood Lake， 8 7，V－5 to XI－16－47（N．W．Frazier，C．I．S．）．

Tuolumne Co．：Pinecrest，VII－20－29，flowers Solidago californica（Michener，1939：45，U．C．R．）． Rawhill， 9, VIII－10－1 2 （R．Stinchfield，L．S．，Jr．， U．）．

Yolo Co．：Davis， 9 ठ， 13 Q，VI－6 to IX－14 （R．C．Bechtel，G．E．Bohart，A．T．McClay，E． I．Schlinger，U．C．D．）．
Discussion：
This subspecies is almost unique among species of the genus in the coarseness of puncta－ tion of the tegulae．The subspecific characters are strongest in the valleys such as the Owens Valley along the east side of the Sierra Nevada． This is curious，since farther east in the inter－ mountain region typical aridula is usually found． Populations classified as astragali from cismon－ tane central and northern California and Oregon are intermediate between astragali and typical aridula．

From its presence in the intermountain region， one might assume that the species aridula is a desert bee．This is not true，for it usually occurs in local mesic situations．Probably the sub－ species aridula is found in drier situations than astragali．This may explain the anomalous dis－ tribution of the two subspecies，for the mesic situations along the east flank of the Sierra Nevada are often very moist owing to waters from the mountains，even though the area is otherwise desert or semidesert．One specimen from Wyoming（Grand Teton National Park）agrees with astragali．Here，too，is a relatively moist region．

The subspecies astragali has been taken in Oregon on flowers of Melilotus alba at Murphy and on flowers of Solidago at Juntura．

## Asbmeadiella californica（Ashmead）

（Pl．10；pl．23，fig．113；pl．24，fig．136）
Cbalicodoma californica Ashmead，1897，Proc． So．Calif．Acad．Sci．．，1（3）：1， $\mathbf{\sigma}^{\top}$ ，ㅇ．
Ashmeadiella（Ashmeadiella）californica，Mich－ ener，1939：Amer．Midland Nat．，22：48－52．
Geographic range：British Columbia，California， Colorado，Idaho，Mexico，Nevada，Oregon， Utah，and Washington（see map 92）．
Discussion：
This species is closely related to aridula and meliloti，from which males can be distin－ guished by the finer punctation，especially of
the metasoma and by the longer hairs of the gonoforceps, hairs near the angles of these structures being as long as the width of the gonoforceps at this point. Females are more clearly distinguishable because of the broad genal areas (as wide as eye, seen from side) and the broad mandibular apices. The sixth
metasomal sternum has a slight depression in which the punctures are scarcely coarser than elsewhere on this sternum.

Two of the three recognized subspecies are known from California. The third, florissantensis, has been recorded from Colorado, Idaho, and New Mexico (see map 92).

Key to the Females of California Subspecies of Ashmeadiella californica

1. Punctures of middle of second metasomal tergum fine, separated by their diameters or more

Punctures of middle of second metasomal tergum coarser, separated by less than their diameters
californica (p. 187)

## Asbmeadiella californica californica (Ashmead)

Chalicodoma californica Ashmead, 1897, Proc. So. Calif. Acad. Sci., 1(3):1, $\delta$, 9. Type near Los Angeles, Calif. (U.S. National Museum).
Synonym: coquilletti Titus, 1904.
Geographic range: British Columbia, California, Idaho, Mexico, Nevada, Oregon, Utah, and Washington (see map 92 ).
California records:
Alameda Co.: Niles Canyon, $\delta$, VII-16 (W. M. Giffard, K.U.). Oakland, J, V-27-53 (R. O. Schuster, C.I.S.).

Amador Co.: Clipper Gap, 9 , VI-5-3 0 (Michener, 1 939:49, C.A.S.).

Butte Co.: Yankee Hill, 8 , V-12-49 (P. D. Hurd, Jr., C.I.S.).

Calaveras Co.: Mokelumne Hill, ㅇ, IX-6-96 (Michener, 1939:50, C.A.S.).

Colusa Co.: College City, 2 ㅇ, VI-14-16, flowers Grindelia and Medicago sativa, 9, VI-17-16, flowers Grindelia, ઠ, VI-22-16, + , VII-1 0 16, flowers Grindelia (all collected by R. Stinchfield, L.S., Jr., U.). Maxwell, 2 ס', VIII-11-53 (E. I. Schlinger, U.C.D.). Sy camore, P, VII-1 5-16 (R. Stinchfield, L.S., Jr., U.).

Contra Costa Co.: Antioch, 9, IX-8-48 (J. W. MacSwain, C.I.S.); $\delta$, $P$, V-8-50 (R. S. Beal, Jr., C.I.S.); + , same data (P. D. Hurd, Jr., C.I.S.); 2 ¢, IX-23-51 (J. G. Rozen). Martinez, $\widehat{\delta}$, VI-22-50 (J. E. Gillaspy, C.I.S.). Mt. Diablo, VI-14-33 (Michener, 1939:50, G.E.B.); ठ, V-18-47 (P. D. Hurd, Jr., C.I.S.); ㅇ, VII-10-47 (P. D. Hurd, Jr., C.I.S.); 2 \&, VII-16-53 (A. D. Telford, U.C.D.). Oakley, ㅇ, VIII-22-37 (E. C. Van Dyke, K.U.).

Eldorado Co.: Camino, 3 mi . S., $P$, VI-26-48 (L. W. Quate, C.I.S.). Pollock Pines, 2 Y, VI-16-52 (E. I. Schlinger, U.C.D.). Snowline Camp, ㅇ, VI-24-48 (J. W. MacSwain, K.U.); 2 ㅇ, VII-448, flowers Phacelia (P. D. Hurd, Jr., C.J.S.); ㅇ. VII-7-48 (C. Chan, U.C.D.); ${ }^{\text {P, }}$ VII-14-48, flowers Grindelia camporum (P. D. Hurd, Jr., C.I.S.); $q$, VII-20-48 (P. D. Hurd, Jr., K.U.); ${ }^{\circ}$, VII-20-48 (P. D. Hurd, Jr., K.U.).

Fresno Co.: Coalinga (near), $\delta$, VI-8-41 (R. M. Bohart, G.E.B.). Friant, 9, V-24-36 (Michener, 1939:50). Mendota, $14 \delta$, $\uparrow$, IV-23-49, flowers Melilotus (E. G. Linsley, C.I.S., K.U.), same locality, 5 mi . E., 5 す', IV-23-49, flowers Melilotus (E. G. Linsley, J. W. MacSwain, R. F. Smith, C.I.S.).

Glenn Co.: Arrois, 2 ঠ, VI-3-53 (J. W. Mac Swa in, C.I.S.).

Inyo Co.: Big Creek, 7,500 ft., 9 , VI-12-42, ס, V1-17-42 (R. M. Bohart, G.E.B.). Glacier Lodge, 9 , VII-30-53 (J. G. Rozen, C.I.S.). Lone Pine, 9 , V-24-37, flowers Sesuvium sessile (C. D. Michener, K.U.); same locality, 3 mi . N., 9, VII-3-53, flowers Asclepias (J. W. MacSwa in, C.I.S.).

Lake Co.: Blue Lakes, 9 , V-16-22 (Michener, 1939:49, C.A.S.).

Lassen Co.: Bridge Creek Camp, ơ, 2 ㅇ, VII-9-49 (P. D. Hurd, Jr., C.I.S., K.U.). $2 \delta^{\prime}$, Y, same data (J. W. MacSwain, C.I.S., K.U.). Susan River Camp, $\delta$, VII-1 0-49 (R. C. Bechtel, U.C.D.); $\delta^{\prime}$, same data (J. E. Gillaspy, C.I.S.); $\delta$ ', same data (A. T. McClay, U.C.D.).

Los Angeles Co.: Altadena, $\delta$, IX-13-34, flowers Aster (C. D. Michener, K.U.). Big Pines Camp, VI-17-27, flowers Erigeron foliosus var. stenophyllus (Michener, 1939:50, U.C.R.). Eagle

Rock, 9 , VII-1-36 (C. D. Michener, K.U.). La Crescenta, $\delta$, VIII-7-38 (R. M. Bohart, C.I.S.). Pasadena, 9 , IX-13-34, flowers Stephanomeria (C. D. Michener, K.U.). Piute Butte, Y, V-1940 (P. H. Timberlake, U.C.R.). Puente Hills, $\sigma^{\prime}$, V-11 (Michener, 1939:50, U.C.R.). Santa Monica, f, VI-30-35 (Michener, 1939:50, C.I.S.); 4 ¢, VIII-15-35 (Michener, $1939: 50$, C.I.S.); $2 \delta^{\circ}$ (F. C. Clark, C.A.S.). Swartout Valley, VI-3-28, flowers Pbacelia (Michener, 1939:50, U.C.R.). Tanbark Flat, San Dimas Experimental Forest, $\delta$, VI-22-50 (H. L. Hansen, C.I.S.); ㅇ, VII-2-50 (P. D. Hurd, Jr., C.I.S.); ${ }^{\text {P, same dara (A. T. }}$ McClay, U.C.D.); $\delta$, VII-7-52 (A. T. McClay, U.C.D.) ; + , VII-13-50 (P. D. Hurd, Jr., K.U.). Westwood Hills, 2 Y, VI-3-35 (E. G. Linsley, C.I.S.); 2 Q, VII-27-35 (E. G. Linsley, C.I.S.); §, 8 ㅇ, VIII-11-35 (E. G. Linsley, C.I.S., K.U.). Whittier, $9, \quad$ VIII-13-20 (Michener, $1939: 50$, U.C.R.).

Madera Co.: Bass Lake, đ, $\%$, VI-6-38 (Michener, 1939:50, G.E.B.).

Mariposa Co.: El Portal, 2 ó, ㅇ, V-18-38 (R. M. Bohart, G.E.B.). Mariposa, 4 和, VI-13-38, flowers Navarretia viscidula (R. M. Bohart, G.E.B.); $\sigma^{2}$, VI-13-38 (J. R. Warren, K.U.); + VI-7-40 (T. H. G. Aitken, B. Brookman, M. A. Cazier, C.I.S.). Wawona, o', VI-6-42 (E. G. Linsley, C.I.S.). Vernal Falls, Yosemite, VI-2726, flowers Aster adscendens var, yosemitanus (Michener, $1939: 50$, U.C.R.).

Merced Co.: Dos Palos, $\delta$, VIII-6-50 (J. C. Hall, U.C.D.).

Modoc Co.: Davis Creek, ㅇ, VII-13-22 (Michener, 1939:49, C.A.S.).

Mono Co.: Blanco's Corral, White Mountains, $10,000 \mathrm{ft} ., \sigma^{\prime}$, 9, VII-20-53 (J. W. MacSwain, C.I.S.). Grant Lake, 2 P, VIII-5-48, flowers Chrysothamnus (P. D. Hurd, Jr., and J. W. Mac Swain, C.I.S.).

Monterey Co.: Hastings Natural History Reservation, near Jamesburg, V-21 to VI-1-38 (Michener, 1939:50). James burg, 2 q, VIII-11-38 (Jean Russel and R. I. Sailer, K.U.).

Napa Co.: Knoxville, 2 ot, 9 , IX-1-53 (E. I. Schlinger, U.C.D.). Samuel Spring, 9 , V-30-53 (J. C. Hall, U.C.D.).

Nevada Co.: Hobart Mills, 7 mi. N., 2 q, VIII-26-48, flowers Cbrysothamnus (J. W. Mac Swain, C.I.S.); 9 , same data (R. F. Smith, C.I.S.). Jackson Creek, ${ }^{\text {f. VIII-5-51 (E. I. Schlinger, }}$ U.C.D.). Nevada City, P, VI-26-49 (R. M. Bohart, U.C.D.). Sagehen, near Hobart Mills, q, VII- $^{\text {U }}$ 10-51, flowers Eupatorium occidentale (E. G. Linsley, C.I.S.); +, VIII-26-52 (R. F. Smith, C.I.S.).

Placer Co.: Auburn, $\delta$, VIII-24-18 (L. Bruner, U.N.). Brockway, J', 2 9, VII-1 941 (G. E. Bohart, G.E.B.). Cisco, VI-18-36 (Michener, 1939:50). Colfax, , V, VI-18-36 (R. M. Bohart, U.C.D.).

Plumas Co.: Bucks Lake, $\bar{\sigma}$, VII-1-49 (W. F. Ehrhardt, U.C.D.). Lake Almanor, 2 \&, VII-8-49 (R. C. Bechtel, U.C.D.).

Riverside Co.: Herkey Creek, San Jacinto Mountains, $9, \mathrm{VI}-4-39$ (E. S. Ross, C.I.S.); ${ }^{\text {P, }}$ VI-11-39 (E. S. Ross, C.I.S.). Idyllwild, VII-2235 (Michener, 1939:50, U.C.R.). Keen Camp, San Jacinto Mountains, 8, VI-1 0-39 (E. G. Linsley, K.U.); 2 , , same data (E. S. Ross, C.I.S.). Marion Mountain Camp, San Jacinto Mountains, P, VII-1-52 (J. W. MacSwa in, C.I.S.). Mt. San Jacinto, $4,000 \mathrm{ft} . \mathrm{O}^{\boldsymbol{\gamma}}, \mathrm{VI}-6-42$ (R. M. Bohart, G.E.B.). Riverside, $0^{\circ}$, 9 우, IV-1 to.XI-1, flowers Cryptantha intermedia, Encelia farinosa, Erigeron foliosus var. stenophyllus, Eriogonum fasciculatum, Gilia multicaulis, Gutierrezia californica, Hemizonia, Heterotheca grandiflora, Hugelia virgata, Lotus americanus, Stephanomeria exigua (Michener, 1939:50, U.C.R.). The Gavilan, VI-21-38, flowers Hugelia virgata (Michener, 1939:50, U.C.R.).

Sacramento Co.: Sacramento, 9 , IX-28-16 (L. Bruner, U.N.).

San Bernardino Co.: Mill Creek, San Bernardino Mountains, 9 , IX-7-38 (C. D. Michener, K.U.). Tetley Park, San Bernardino Mountains, V-23-36, flowers Potentilla glandulosa (Michener, 1939:50, U.C.R.).

San Diego Co.: Campo, \&, VIII-10-35 (E. I. Beamer, K.U.). Descanso and Ja purul Roads, $P$, VIII-16-46, flowers Gutierrizea californica (P. H. Timberlake, U.C.R.). Encinitas, $Y$ (T. D. A. Cockerell, K.U.). Julian, $P$, IX-13-49 (R. A. Flock, U.C.R.). La Jolla, 9, VIII-14-11 (Michener, 1939:50). Mission Valley, + , IX-11-27 (J. C. von Bloeker, K.U.). Oceanside, + , VIII-17-46, flowers Grindelia elata (P. H. Timberlake, U.C.R.). Pala, ${ }^{\text {Y, V-7-49 (R. M. Bohart, U.C.D.). }}$ Warner Springs, IX-22-38 (Michener, 1939:50).

San Joaquin Co.: Stockton, $\mathcal{Y}$, VI-12-16, flowers Grindelia camporum (R. Stinchfield, L.S., Jr., U.). Tracy, o', VI-3-49 (J. W. MacSwain, C.I.S.); \&, VIII-1-49 (P. D. Hurd, Jr., C.I.S.).

Santa Barbara Co.: Santa Maria, VIII-15-36, flowers Hemizonia (Michener, 1939:50). Sunset Valley, VII-14-38 (Michener, $1939: 50$ ).

Santa Clara Co.: Palo Alto (Michener, 1939: 50). San Antonio Ranger Station, 7 mi . S., $80^{\circ}$, ㅇ, VI-27-53, flowers Monardella douglasii (C. D. MacNeill, C.I.S.); 32 む̃, 9 , same data (G. A. Marsh, C.I.S.); $\delta$, same data (R. O. Schuster, C.I.S.). San Antonio Valley, 3 \&, IX-14-48 (R. v. d. Bosch, C.I.S.); 4 ㅇ, IX-14-48, flowers Eriogonum
(P. D. Hurd, Jr., C.I.S.); $\delta$, VI-21-51 (W. C. Bentinck, C.I.S.). San Francisquito Creek, Stanford University Campus, $\delta$, IX-22-15, flowers Verbena prostrata (R. Stinchfield, L.S., Jr., U.).

Solano Co.: Rio Vista, 9, V-14-49, flowers Lotus (J. W. MacSwain, C.I.S.).

Stanislaus Co.: Modesto, ㅇ, X-3 to 6-33 (J. C. Chamberlin, O.S.C.). Turlock, $\delta^{\circ} 0^{\circ}$, 9 ㅇ, V-3 to VIII-16 (R. R. Snelling).

Trinity Co.: Carrville, 2,400-2,500 ft., ठ', VI-1 934 (G.E.B.).

Tulare Co.: Badger, ㅇ, VI-26-29, flowers Lessingia leptoclada (P. H. Timberlake, U.C.R.). Coffee Camp, VI-25-53, flowers Senecio douglasii (Michener, 1939:50, U.C.R.). Wood Lake, Y, IX-6-49, 9, IX-8-48 (N. W. Frazier, C.I.S.).

Tuolumne Co.: Dodge Ridge, $\delta$, VII-13-51 (E. I. Schlinger, U.C.D.); 9, VII-15-51, 9, VII-18-51 (A. T. McClay, U.C.D.). Pinecrest, + , VIII-4-48, flowers Solidago (P. D. Hurd, Jr., and J. W. MacSwain, C.I.S.); 9 , VIII-1 9-51 (E. I. Schlinger, U.C.D.) ; 9, VI-27-52 (J. I. Stage); $\delta$, VII-12-53 (J. G. Rozen, C.I.S.). Strawberry, Y, VI-1 9-51 (E. G. Linsley, C.I.S.). Tuolumne City, $\delta$, VI-3-53, 2 ठ, VI-1 4-53, 2 б, 우, VI-22-53 (J. G. Rozen, C.I.S.). Twain-Harte, $\delta, 3$, $\mathcal{F}$, VII-1937, flowers Grindelia (F. E. Blaisdell, C.A.S.).

Yolo Co.: Davis, ठ', Yq, V-14 to VIII-30 (E. I. Schlinger, U.C.D.).

In addition to the floral records enumerated above, this subspecies has been collected in Idaho on flowers of Grindelia (Squaw Creek, 10 miles east of Emmett); and in Oregon on flowers of Aster (Scotr Lake, Three Sisters), Grindelia ( 8 miles east of Pendleton), aud G. nana (Ontario).

The subspecies florissantensis has been taken in Colorado on flowers of Aster (Cuchara Camp), and Cbrysolepis (near Monument Lake). The records of floral visitations for the subspecies sierraensis are listed in the treatment of that form.

## Asbmeadiella californica sierraensis Michener

Ashmeadiella (Ashmeadiella) californica sierraens is Michener, 1939, Amer. Midland Nat., $22: 51 \sigma$, , Type $P$, Giant Forest (Sequoia National Park), Tulare County, California (Calif. Acad. Sci.).
Geographic range: California (see map 92).
California records:
Alpine Co.: Dead Man Canyon, $8,500 \mathrm{ft} ., \delta$, VI-26-37 (C. D. Michener, K.U.). Hope Valley, \&, VII-18-48 (K. W. Tucker, C.I.S.).

Eldorado Co.: Echo Lake, 9, VII-21-48 (A. Bartel, C.I.S.); ${ }^{\text {Y, VII-14-51 (W. W. Middlekauff, }}$ K.U.). Pyramid R.S., + , VIII-1-49 (J. W. Mac Swain, C.I.S.).

Fresno Co.: Huntington Lake, 7,000 ft., VII12 (Michener, $1939: 51$ ); Y, VII-7-19 (E. P. Van Duzee, C.A.S. ); ${ }^{\text {on, VII-22-1 }} 9$ (F. C. Clark, C.A.S.).

Inyo Co.: Rock Creek Lakes, 9,700 ft., VII-9-34 (Michener, 1939:51). Bishop, Y, VII-28-49 (E. E. Kenaga, K.U.).

Mono Co.: Mammoth Lakes, VII-24 and 25-36 (Michener, 1939:51); 9 , VII-27-36 (G. E. and R. M. Bohart, G.E.B.). Mammoth, $\delta$, VII-22-36, ठ, VIII-7-36 (G. E. and R. M. Bohart, G.E.B.). Dude Lake, , V, VIII-10-37 (G. E. and R. M. Bohart, G.E.B.). East Walker River, $\cap, \mathrm{VI}-25-37$, flowers Aster (C. D. Michener, K.U.).

Nevada Co.: Truckee, VI-17-27 (Michener, (Michener, 1939:51).

Placer Co.: Donner Lake, $q$, VIII-24-16 (L. Bruner, U.N.). Lake Forest, Lake Tahoe, $P$, VII-14-49, flowers Solidago (E. G. Linsley, C.I.S.). Lake Tahoe, ${ }^{\prime}$, 9 , VIII-22-16, 9 , VIII-23-16 (L. Bruner, U.N.).

Shasta Co.: Mt. Lassen, 6,000-8,000 ft., 5 ㅇ, VIII-2-38 (E. C. Van Dyke, C.A.S., K.U.). Summit Lake, Mt. Lassen, 6,700 ft., VII-21 to 22-37 (Michener, 1 939:50).

Sierra Co.: Calpine, $\sigma, 2$ ㅇ, VIII-27-48, flowers Solidago (P. D. Hurd, Jr., C.I.S., K.U.); 9, VIII-27-48, flowers Helianthus (R. F. Smith, C.I.S.). Gold Lake, + , VII-11-21 (C. L. Fox, C.A.S.). Sierraville, , V, VIII-26-48 (J. W. MacSwa in, K.U.); 2 ㅇ, VIII-26-48, flowers Helianthus (R. F. Smith, C.I.S., K.U.).

Tulare Co.: Giant Forest, Sequoia National Park, VLI-18-23 (Michener, 1939:51); 9, VII-2-23 (C. L. Fox, C.A.S.). Mineralking, IX-3-33, flowers Aster (Michener, $1939: 51$ ); VIII-1 to 2-35 (Michener, 1939:51); 9 , VIII-5-35 (G. E. Bohart, G.E.B.); ㅇ, VIII-4-39 (C.I.S.). Tokopah Valley, Sequoia National Park, VIII-26-33, flowers Aster adscendens (Michener, 1939:51).

Tuolumne Co.: Dardanelles, $\delta$, VI-26-51 (A. T. McClay, U.C.D.); 8 , same data (R. W. Morgan, C.I.S.); P, VII-13-51 (A. T. McClay, U.C.D.). Sonora Pass, ${ }^{+}$, VII-12-51 (E. I. Schlinger, U.C.D.).

Discussion:
This subspecies is very close to californica proper and apparently intergrades completely with it. It is peculiar in occupying a range in the higher Sierra Nevada completely surrounded by the more widely distributed subspecies californica.


Map 93. Distribution of Ashmeadiella cockerelli Michener.


Map 94. Distribution of Ashmeadiella cubiceps (Cresson), the subspecies clypeata indicated by open circles, and the subspecies cubiceps by solid circles.


Map 95. Distribution of Asbmeadiella opuntiae (Cockerell).

## Asbmeadiella cockerelli Michener

Ashmeadiella cockerelli Michener, 1936, PanPacific Ent., 12:62, उ. Type o', Altadena, California (Univ. of Kansas).
Geographic range: California (see map 93 ).
California records: (known only from the type). Discussion:

It seems likely that this species, described from a single specimen, was based on an abnormal individual of $A$. califormica californica. It is smaller than most californica specimens, but equally small and otherwise typical califomica are known. Its distinctive feature is the short rather than long median teeth of the sixth tergum. Other cases are known where an occasional individual differs from the species as a whole in length of these teeth.

## Ashmeadiella opuntiae (Cockerell)

(Pl. 23, fig. 114; pl. 24, fig. 137)
Heriades opurtiae Cockerell, 1897, Ann. Mag. Nat. Hist., (6)20:139, ㅇ. Type $?$, Soledad Canyon, Otgan Mountains, New Mexico.
Synonyms: submaxima Michener, 1936; Asbmeadiella arizonens is Michener, 1939, Amer. Mus. Novitates, 875:3, ठ̋ (new synonym).
Geographic range: Arizona, California, Colorado, Mexico, New Mexico, Texas, and Utah (see map 95).
California records:
Imperial Co.: Mountain Spring, ठ', IV-21-50
(J. W. MacSwain, C.I.S.). Palo Verde, 12 mi . S., O, IV-30-52 (J. G. Rozen, C.I.S.).

Inyo Co.: Big Pine Creek, 7,500 ft., 9 , VI-20-42 (R. M. Bohart, G.E.B.).

Kern Co.: Willow Springs, ㅇ, IV-27-36 (Michener, 1939:52, 1951:54, K.U.).

Los Angeles Co.: Whittier, 3 ot, III-13-26, flowers Opuntia (Michener, 1939:52).

Mono Co.: Grant Lake, ㅇ, VIII-5-48 (P. D. Hurd, Jr., and J. W. MacSwa in, C.I.S.).

Riverside Co.: Cathedral City, $\bar{\delta}$, , flowers Echinocactus cylindraceus (Michener, 1939:52). Palm Desert, P, IV-11-50(P. D. Hurd, Jr., C.I.S.); $\delta^{\circ}$ IV-24-50 (C. D. MacNeill, K.U.). Palm Canyon, J, IV-3-25, flowers Opuntia (P. H. Timberlake, U.C.R.). Palm Springs, f, v-19-17 (E. P. Van Duzee, C.A.S.); $\delta$, IV-2-37, flowers Opuntia echinocarpa (Michener, 1939:52, K.U.). Piñon Flat, San Jacinto Mountains (E. C. Van Dyke, C.A.S.); 2 ㅇ, V-21-40, flowers Opuntia (C. D. Michener, K.U.). Riverside, ㅇ, IV-14-34, flowers

Opuntia parryi (Michener, 1939:52, U.C.R.); 2 ㅇ, IV-24-34, flowers Opuntia vaseyi (Michener, 1939:52, U.C.R.). The Gavilan, 2 d, ㅇ, V-2-52, flowers Opuntia parryi(P. H. Timberlake, U.C.R.); 2 ㅇ, V-28-52, same flower (P. H. Timberlake, U.C.R.).

San Bernardino Co.: Arrastre Canyon, 2 §', VI-20-41, flowers Echinocereus engelmannii (P. H. Timberlake, U.C.R.). Cedar Canyon, Providence Mountains, $\frac{7}{}$, V-27-50 (Michener, 1951:54, U.C.D.). Clark Mountains, $4,500 \mathrm{ft}$. , ${ }^{2}$, flowers Viguiera nevadensis (Michener, 1939:52, U.C.R.).

San Diego Co.: Banner, 2 mi. E., $\delta^{\prime}$, V-20-41 (R. C. Dickson, U.C.R.). San Felipe Creek, ㅇ, VI-5-36, flowers Opuntia megacarpa (Michener, 1939:52).

## Discussion:

This large species is easily recognized in the female by the broad clypeal truncation, the ends of which project somewhat (pl. 23, fig. 114). The male is easily recognizable because the distance from the posterior ocelli to the rear margin of the vertex is about one and one-half times the distance between the posterior ocelli. The sixth metasomal sternum of the female is feebly depressed medially, the punctures in the depression neither larger nor more widely separated than those elsewhere, the punctation becoming finer toward the posterior margin of the sternum.

This species is found principally in desert regions, although occasionally outside of them. It is probably restricted in its pollen collecting to flowers of Opuntia and other cacti.

The name arizonensis is here placed in synonymy with opuntiae for the first time, although the synonymy was suggested previously by Michener (1939). A series now available from southern Arizona shows that the supposed specific characters are nonsegregable variations.
A. opuntiae has been taken in Arizona on flowers of Echinocactus ( 5 miles west of Oracle); in Colorado on flowers of Penstemon, though the pollen on the scopa is that of Opuntia (Swissvale); and in Texas on flowers of Opuntia at Cotulla.

## Subgenus Titusella Cockerell

The females of this subgenus have the mandibles unusually broadened apically, from four- to sixtoothed, and can be distinguished by this feature alone from other subgenera. The mandibles are
not only broader but also longer than in Ashmeadiella proper, so that they are more than twice as long as the antennal scape. They also have the clypeus shortened, and in California forms, lobate or emarginate apically and partly or largely impunctate (except with scattered punctures in occasional specimens of A. cubiceps clypeata). Otherwise, Titusella is essentially as in Asbmeadiella proper, and, indeed, the gap between the two subgenera is partly bridged by A. (A.) californica, A. (A.) opuntiae, and A. (T.) biscopula. The trends in this series of species are (1) increasing mandibular breadth (threetoothed in the first two, four-toothed in the third) and (2) shortening of the clypeus and correlated increasing breadth of the clypeal truncation.

Titusella is a small subgenus containing but three species, only one of which occurs in Califoraia. The others are found in Arizona and the Rocky Mountains. The male of our species of Titusella is included in the key to males of

Ashmeadiella s. str., since there are no subgeneric characters that distinguish these subgenera in that sex.

## Asbmeadiella cubiceps (Cresson)

Heriades ? cubiceps Cresson, 1879, Trans. Amer. Ent. Soc., 7:205, 9.
Ashmeadiella cubiceps, Michener, 1939, Amer. Midland Nat., $22: 55$.
Geographic range: California, Nevada, and Oregon (see map 94).

## Discussion:

This is the only California Ashmeadiella which is all black and has a largely impunctate or sparsely punctate clypeus in the female. As in other members of the subgenus Titusella, the sixth sternum of the female has no distinct concavity or it is scarcely noticeable and the punctation is little coarser in it than elsewhere.

## Key to the Subspecies of Asbmeadiella cubiceps

1. Median apical emargination of clypeus deep; distance from mandibular apex to inner apical tooth equal to distance from latter point to base of mandible . . . . .cubiceps (p. 193) Median apical emargination of clypeus shallow; distance from mandibular apex to inner apical tooth less than distance from latter point to base of mandible . . . . . clypeata (p. 193)

## Ashmeadiella cubiceps cubiceps (Cresson)

(Pl. 23, fig. 115)
Heriades? cubiceps Cresson, 1879, Trans. Amer.
Ent. Soc., 7:205, ㅇ. Type 9 , Nevada (Acad.
Nat. Sci. Phila.).
Geographic range: California, Nevada, and Oregon (see map 94).
California records:
Alpine Co.: Hope Valley, ${ }^{\text {P, VII-1 8-48 (P. D. }}$
Hurd, Jr., C.I.S.); 9 , same data (K. W. Tucker, C.I.S.); $q$, same data (C. D, MacNeill, C.I.S.).

Eldorado Co.: Echo Lake, 9, VII-21-48 (P. D. Hurd, Jr., C.I.S.). Camp Snowline, $\uparrow$, VI-25-48 (P. D. Hurd, Jr., C.I.S.).

Lassen Co.: Bridge Creek Camp, f, VII-9-49 (W. F. Ehrhardt, U.C.D.). Summit Camp, Y, VI-28-49 (W. F. Ehrhardt, U.C.D:).

Madera Co.: Agnew Meadows, 9, VII-30-36 (Michener, 1939:56, U.C.D.).

Mono Co.: Mammoth, ㅇ, VII-1 9-33, ㄱ, VIII-536 (G. E. and R. M. Bohart, G.E.B.). Dead Man's Creek, 우, VII-28-36 (G. E. and R. M. Bohart,
G.E.B.). Sardine Creek, 8,500 ft., \&, VII-6-51 (A. T. McClay, U.C.D.).

Nevada Co.: Sagehen near Hobart Mills, $ㅇ$ VIII-26-52 (R. F. Smith, C.I.S.). Truckee, $Q$, VII-4-27 (E. P. Van Duzee, C.A.S.).

Placer Co.: Glen Alpine Creek, Lake Tahoe, ㅇ, VI-17-15 (E. P. Van Duzee, C.I.S.).

Shasta Co.: Summit Lake, Mr. Lassen, $\mathcal{Y}$, 6,700 ft., VII-21, 22-37 (Michener, 1939:56, U.C.R.).

Sierra Co.: Gold Lake, $\delta$, ㅇ, VII-25-21 (Michener, 1939:56, C.A.S.).

Tulare Co.: Monanche Meadows, VII-26-35 (Michener, 1939:56).
Discussion:
In California this subspecies is found only at rather high altitudes in the Sierra Nevada.

Asbmeadiella cubiceps clypeata (Michener)
Titusella clypeata Michener, 1936, Bull. So. Calif. Acad. Sci., 35:93, ․ Type 9 , Eagle


Rock Hills, Los Angeles County, California (Calif. Acad. Sci.).
Geographic range: California (see map 94). California records:

Inyo Co.: Westgard Pass, 8, VI-15-37 (Michener, 1939:57, G.E.B.); same locality, 7 mi . W., 2 个, VI-19-53, flowers Encelia (J. W. MacSwain, C.I.S.); 3 f, VI-24-53, (J. W. MacSwain, C.I.S.); 2 \&, VI-26-53 (H. Nakakihara, C.I.S.). Lone Pine, $P$, V-24-37 (E. C. Van Dyke, C.A.S.). Mazourka Canyon, , VII-3-53 (J. W. MacSwain, C.I.S.).

Fresno Co.: Mendota, 46 ó, 12 9, IV-23-49, flowers Melilotus (Michener, $1951: 54$, C.I.S., K.U.).

Los Angeles Co.: Mint Canyon, V-3-36, flowers Cryptantha (Michener, $1939: 57$ ). Little Rock, 2 §', IV-11-36 (Michener, 1939:57, G.E.B.). Mojave Desert, Highway $138,3,600 \mathrm{ft} ., \mathrm{Y}, \mathrm{V}-13-44$, flowers Stenotopsis linearifolius ( P . H. Timberlake, U.C.R.).

Mono Co.: Deadman Creek, VII-28-36 (Michener, 1939:36). Ma mmoth, VII-1 9-33 (Michener, 1 939:57).

Nevada Co.: Truckee, 9, VII-4-27 (Michener, 1939:57, G.E.B.).

Riverside Co.: Riverside, V-5-37, flowers Cbaenactis (Michener, 1939:57).

San Bernardino Co.: Windmill Station, Y, IV-6-53, flowers Sphaeralcea (E. G. Linsley, C.I.S.).

San Mateo Co.: Visitation Valley, Y, VI-4-23 (Michener, 1939:57, C.A.S.).

Santa Cruz Co.: Felton, + , VI-11-52, flowers Haplopappus (R. H. Beamer, K.U.).
Discussion:
This subspecies is known principally from mesic regions at low and middle altitudes. A few records are, however, from thoroughly desert
regions. It intergrades completely with cubiceps proper on the slopes of the Sierra Nevada.

## Subgenus Arogochila Michener

In the females of this subgenus, the clypeus is usually produced to a lobate or snoutlike apex, overhanging the base of the labrum. In a few rare species, the median part of the clypeus is truncate, but the construction is quite different from that of Ashmeadiella proper, for the margins laterad to the truncation are not straight and oblique as in that subgenus, but bear a small lobe, or at least a shoulder, on each side of the truncation. The brushes of orange hair beneath the clypeal margin of the female are reduced or absent. The apex of the labrum is commonly emarginate, although there are exceptions (e.g., male cazieri). The hypostomal carinae are elevated and produced at their posterior extremities in females. The mandibles of the female are slender, more than twice as long as the antennal scape, usually tridentate, but in a few rare species quadridentate. The sixth metasomal sternum of the female is not depressed and is punctate throughout.

This is a large subgenus, the females of which are quite easily identified by the excellent specific characters of the clypeus. Fifteen species are known, all from western North America.

Males of Corythochila and Cubitognatha are included in the keys below, since no subgeneric characters distinguish them from Arogochila in that sex.

## Key to the California Species of the Subgenus Arogocbila

## Males

(Including the males of the subgenera Corythochila and Cubitognatha)

1. Teeth of sixth metasomal tergum low, and rounded; lateral ones with apex a very obtuse angle, median ones generally much broader than long (fig. 139); metasoma red, or terga with small black areas medially
Teeth of sixth metasomal tergum longer, lateral ones with apices about right angular, median ones generally longer than broad; metasoma with much more black
2(1). Median teeth of sixth metasomal tergum much less than twice as long as broad . . . . 3 Median teeth of sixth metasomal tergum twice as long as broad (pl. 24, fig. 141) (anterior margin of clypeus not emarginate medially).
.australis (p. 209)
3(2). Punctures of clypeus fine and close, except for the thickened, shiny, impunctate, usually somewhat concave anterior margin
Punctures of clypeus coarse and rather widely separated; anterior margin not, or hardly,emarginate (metasoma black)foxiella (p. 197)
4(3). Distance between posterior ocelli considerably more than distance to nearest eye margin; genal areas little over half as wide as eyes, seen from side ..... 5
Distance between posterior ocelli about equal to distance to nearest eye margin; genal areasmuch more than half as wide as eyes, seen from side8
5(4). Concavity of anterior margin of clypeus narrower than distance between antennae and de- limited laterally by a distinct angle on each side. ..... 6
Concavity of margin of clypeus weak, as broad as, or broader than, distance between antennae,and not distinctly delimited laterally by angles . . . . . . . . . cazieri (p. 208)$6(5)$. Metasoma largely red; clypeus covered with white pubescence.7
Metasoma black; clypeus covered with pubescence only laterally ..... clypeodentata (p. 205)
7(6). Lower parts of cheeks and areas between eyes and lateral ocelli with punctures approximate or nearly so; hind tibial spurs strongly toothed . (Corythochila) inyoensis (p. 211, 213)
Lower parts of cheeks and areas between eyes and lateral ocelli with punctures often ratherwidely separated; hind tibial spurs nearly edentate . . . Corythochila) breviceps (p. 211)
8(4). Posterior legs black; clypeal emargination not bounded by angles ..... 9
Posterior femora largely red; clypeal emargination bounded by distinct angles ..... 10
9(8). Sixth metasomal tergum largely black; length 5 to 6 mm . ..... salviae (p. 208)
Sixth metasomal tergum red except for small central spot; length 4.5 to 5 mm .stenognatha (p. 205)10(8). Clypeal punctures at least as coarse as those of frons and vertex and separated by a littleshining ground; red of metasoma less extensive, there being a large black area on firstmetasomal tergum11
Clypeal punctures exceedingly dense and finer than those on frons and vertex, red of meta-soma extensive, there being little or no black on first tergum. (Cubitognatba) xenomastax (p. 215)
11(10). Punctures of posterior half of dorsum of second metasomal tergum separated by more thantheir diameters; red markings dark red; lateral teeth of sixth metasomal tergum black .
lateralis (p. 202)
Punctures of posterior half of dorsum of second tergum usually separated by less than theirdiameters; red markings light red; lateral teeth of sixth tergum red . . timberlakei (p. 199)

## Females

1. Median apical lobe of clypeus conspicuous, not truncate, not more than three times as broad as long
Median apical lobe of clypeus inconspicuous, broadly truncate, several to many times as broad as long9
2(1). Notches separating median from lateral lobes of clypeus deep, nearly parallel sided (if more or less V-shaped, deeper than broad); median lobe of clypeus broad, narrower basally than subapically or medially
Notches separating median from lateral lobes of clypeus variable, V-shaped, or if nearly parallel-sided, then several times as broad as deep, sometimes nearly wanting; median lobe of clypeus broadest basally, tapering apically (except in erema) . . . . . . 5
3(2). Apical part of median lobe of clypeus short, so that lobe is widest subapically; metasoma not all red

Apical part of median lobe of clypeus elongated so that lobe is widest in the middle (pl. 24, fig. 125); metasoma red

- eurynorbyncha (p. 205)

> 4(3). Emargination of median lobe of clypeus broad and shallow (pl. 23, fig. 119); lateral lobes of clypeus rounded; metasoma black. . . . . . . . . . . . . clypeodentata (p. 205) Emargination of median lobe of clypeus deep and narrow (pl. 23, fig. 120); lateral lobes of clypeus acutely pointed; metasoma red laterally . . . . . . . . stenognatha (p. 205)

5(2). Median lobe of clypeus larger and lateral lobes smaller, so that line drawn between their
apices cuts median lobe in basal half; median lobe not, or but weakly, notched at apex. 6
Line drawn between apices of lateral lobes of clypeus crosses median lobe in its apical half;
median lobe notched at apex (pl. 23, figs. 117, 118). . . . . timberlakei (p. 199)
6(5). Apex of labrum tapering to a notched or narrowly truncate apex less than half as wide as mandible at narrowest point.

7
Apex of labrum bidentate, apices of teeth separated by a distance about equal to width of mandible at narrowest point.

8
7(6). Median lobe of clypeus with lateral margins subparallel, either converging or diverging apically, its upper surface projecting at an angle of $90^{\circ}$ to $110^{\circ}$ to lower part of disc of clypeus (pl. 23, fig. 121); disc of clypeus with punctures separated by a puncture width medially .
.erema (p. 208)
Median lobe of clypeus with lateral margins strongly converging, often almost at right angles to one another, its upper surface projecting at an angle of about $135^{\circ}$ to lower part of disc of clypeus (pl. 24, fig. 123); disc of clypeus with punctures separated by less than a puncture width .
cazieri (p. 208)
8(6). Median lobe of clypeus directed forward, nearly at right angles to adjacent disc of clypeus, its margin not irregular (pl. 23, fig. 122) . . . . . . . . . . . salviae (p. 208)
Median lobe of clypeus directed downward, its margin irregularly eroded . .australis (p. 209)
9(1). Lateral lobes of clypeus mere rounded angles exceeded by median lobe . . . . . . 10
Lateral lobes of clypeus acute, exceeding median lobe (pl. 24, fig. 124), metasoma black
sculleni (p. 199)
10(9). Median lobe of clypeus projecting much beyond lateral lobes; width of median lobe about two-thirds distance from side of median lobe to lateral angle of clypeus (pl.23, fig.116). . 11 Median lobe of clypeus projecting but little beyond lateral lobes; width of median lobe slightly less than distance from side of median lobe to lateral angle of clypeus. .barberi (p. 197)
11(10). Metasoma with extensive red areas laterally . . . . . . . . . . . leachi (p. 199)
Metasoma black . . . . . . . . . . . . . . . . . . . . foxiella (p. 197)

## Ashmeadiella barberi Michener

## Asbmeadiella foxiella Michener

(Pl. 23, fig. 116)

Ashmeadiella (Arogochila) barberi Michener, 1939, Amer. Midland Nat., 22:61, ㅇ. Type Ashfork, Arizona (U.S. Nat. Mus.).
Geographic range: Arizona.
Discussion:
This species is known only from Ashfork, Arizona. It is included here since it may be discovered in eastern California. It is closely related to $A$. leachi; differentiating features are discussed under that species.

Ashmeadiella (Arogochila) foxiella Michener, 1939, Amer. Midland Nat., 22:73, ${ }^{-1}$. Type $\delta$, Eagle Ridge, Klamath Lake, Oregon (Calif. Acad. Sci.).
Synonym: washingtonensis Michener, 1939.
Geographic range: California, Idaho, Oregon, and Washington (see map 96).
California records:-
Nevada Co.: Truckee, $\delta^{\lambda,}$ VI-19-27, $2 \delta^{\lambda}$, VI-20-27 (Michener, 1939:74, C.A.S.).


Map 98. Distribution of Ashmeadiella sculleni Michener.


Map 99. Distribution of Asbmeadiella timberlakei Michener, the subspecies solida indicated by solid circles, and the subspecies timberlakei by open circles.

Shasta Co.: Hat Creek, ס. 2 우, VI-4-41, flowers whitish Penstemon (Michener, 1942:50, K.U.). Burney, 5 mi. E., 3 o', VI-8-41, flowers Pbacelia (C. D. Michener, K.U.). Discussion:

Among the Arogochila without red markings, the female of this species is unique in its lack of clypeal lobes on either side of the median clypeal truncation (pl. 23, fig. 116). The male may be distinguished from all other black species of Arogochila by the coarse and well-separated clypeal punctures. The female of this species was described in 1939 under the specific name washingtonensis Michener. The association of the sexes was established in a subsequent paper (Michener, 1942).

## Ashmeadiella leachi Michener

Ashmeadiella (Arogochila) leachi Michener, 1949 , Jour. Kansas Ent. Soc., 22:43, ㅇ. Type ㅇ, Inyo County, California (Calif. Acad. Sci.). Geographic range: California (see map 97).
California records:
San Bernardino Co.: Vidal Jct., 7 mi. N., 2 아, IV-3-51 (P. D. Hurd, Jr., C.I.S.).
Discussion:
This species, known only from two localities, is a representative of a group of species (foxiella, barberi, leachi) in which the median lobe of the clypeus of the female is short and broadly truncate, but exceeding the lateral lobes (mere shoulders in foxiella), and in which the mandibles are quadridentate. $A$. leachi is the only member of this group, known to occur in California, that has red on the metasoma. A. barberi, however, occurs in Arizona not far from the California border. A. leachi is related to barberi, but differs in its smaller size ( 4.5 mm .), in the more produced and keeled median lobe of the clypeus, and in the shorter and broader head (as long as broad, longer than broad in barberi). It is actually much more closely related to $A$. foxiella, having a clypeal margin almost exactly like that species,
but differs in its slightly finer punctation, the shorter and broader head, and the presence of red on the metasoma. A. leachi may be only a subspecies of foxiella.

## Asbmeadiella sculleni Michener

(Pl. 24, fig. 124)
Ashmeadiella (Arogochila) sculleni Michener, 1939, Amer. Midland Nar., 22:60, 9. Type 9 , Burns, Oregon (Calif. Acad. Sci.).
Geographic range: Oregon (see map 98).
Discussion:
This species is as yet known only from Burns and Cornucopia, Oregon; it may be expected, however, in northeastern California. It is a large species without red areas. It is the only species with a short, broadly truncate median clypeal projection (pl. 24, fig. 124) that has tridentate mandibles.

## Asbmeadiella timberlakei Michener

Ashmeadiella timberlakei Michener, 1936, PanPacific Ent., 12:56, ô, 9.
Ashmeadiella (Arogochila) timberlakei, Michener, 1939, Amer. Midland Nat., 22:66-68, ${ }^{3}$, 아.
Geographic range: California, Nevada, and Oregon (see map 99).
Discussion:
This is the commonest Arogochila outside the desert regions in California. The female may be recognized by the medially elevated hypostomal carinae, a character not shared by other California Ashmeadiella. The hypostomal areas are also convex medially, lateral to the elevation or angle of the carina. The related species, lutzi, from southwestern Colorado and Utah, is the only other form having this configuration of the hypostomal carinae and areas. It seems probable that timberlakei is a subspecies of lutzi, but specimens from intervening regions which might show this relationship are unknown.

Key to the Subspecies of Asbmeadiella timberlakei

[^5]
## Females

1. Median lobe of clypeus nearly three times as broad as long (pl. 23, fig. 117)
timberlakei (p. 200)
Median lobe of clypeus somewhat more than twice as broad as long (pl. 23, fig. 118).
solida (p. 202)

## Asbmeadiella timberlakei timberlakei Michener

 (Pl. 23, fig. 117)Ashmeadiella timberlakei Michener, 1936, PanPacific Ent., 12:56, $\delta$, ?. Type 9 , Altadena, California (Calif. Acad. Sci.).
Geographic range: California (see map 99).
California records:
Los Angeles Co.: Altadena, 2 ?, VII-3-36, flowers Phacelia ramosissima (C. D. Michener, K.U.). Big Pines Camp, + , VII-12-27, flowers Pbacelia beterophylla (Michener, 1939:67); 9, VII-13-27, flowers Pbacelia ramosissima (P. H. Timberlake, U.C.R.). Claremont, $\delta$, V-4-45, flowers Cryptuntha intermedia (P. H. Timberlake, U.C.R.). Crystal Lake, 7, VI-29-50 (P. D. Hurd, Jr., C.I.S.). Lone Pine Canyon, 4,000 ft., VI-6-22, flowers Lotus scoparius (Michener, 1939: 67); ㅇ, VI-16-28, flowers Lotus scoparius (P. H. Timberlake, U.C.R.). Mint Canyon, $\delta$, V-3-36, flowers Chaenactis (E. G. Linsley, K.U.). Mt. Wilson, + , Aug. (K.U.). Palmdale, IV-11-36 (Michener, 1939:68). Puente Hills, V-11-30 (Michener, $1939: 67$, U.C.R.). Sheep Creek, San Gabriel Mountains, VI-3-28, flowers Lotus scoparius (Michener, 1939:67, U.C.R.). Swartout Valley, VI-3-28, flowers Phacelia davidsonii (Michener, 1939:67, U.C.R.). Tanbark Flat, San Dimas Experimental Forest, 2 \&, VI-22-50 (P. D. Hurd, Jr., C.I.S.); \&, VI-23-50 (J. C. Hall, U.C.D.); ㅇ, VI-25-50 (T. R. Haig, C.I.S.); $\mathcal{P}$, same data (P. D. Hurd, Jr., K.U.); 2 q, same data (J. W. MacSwa in, C.I.S.); 5 Y, same data (F. X. Williams, C.A.S.); 3 个, VI-30-50 (A. T. McClay, U.C.D.); 2 Y, VII-2-50, flowers Lotus (P. D. Hurd, Jr., C.I.S.); Y, VII-3-50 (P. D. Hurd, Jr., C.I.S.); 3 f. VII-7-52 (A. T. McClay, U.C.R.); Y, VII-11-52 (R. M. Bohart, U.C.D.).

Riverside Co.: Andreas Canyon near Palm Springs, IV-11-36, flowers Eriodictyon trichocalyx (Michener, 1939:67). Dark Canyon, San Jacinto Mountains, $\delta$, VI-15-40 (C.I.S.); 3 ㅇ, VI-21-40, flowers Lotus scoparius (P. H. Timberlake, U.C.R.). Fern Basin, San Jacinto Mountains, $6,000 \mathrm{ft} ., 0$,, , VI-15-40, flowers Lotus davids onii (C. D. Michener, C.I.S., K.U.). Herkey Creek, San Jacinto Mountains, $Y$, VI-10-40, flowers

Lotus (C. D. Michener, K.U.). Keen Camp, ${ }^{\circ}$, VI-6 to 12-17 (Michener, 1939:67, C.A.S.); same locality, 8 mi . W., , V, V-17-39 (E. S. Ross, C.I.S.). Idyllwild, 9, VI-25-28 (Michener, $1939: 67$, C.A.S.); ठ, VII-22-33, flowers Lotus argopbyllus (P. H. Timberlake, U.C.R.); 9, VI-5-40, flowers Lotus (C. D. Michener, K.U.); $\delta, 3$ O, VI-1 9-40 (E. C. Van Dyke, C.A.S.). Marion Mountain Camp, San Jacinto Mountains, $4 \delta$, 9 , VII-1-52 (J. W. Mac Swain, C.I.S.). Mt. San Jacinto, 4,000 ft., 2 ס,个, VI-6-42 (R. M. Bohart, G.E.B.). Murrieta, 3 ó, IV-18-50 (J. W. MacSwain, C.I.S.). Palm Canyon, ㅇ, IV-15-38 (G.E.B.). Perris, $11 / 2 \mathrm{mi}$. W., $\delta^{2}$, V-14-48, flowers Lotus scoparius (P. H. Timberlake, U.C.R.). Pine Cove, San Jacinto Mountains, $ㅇ$ VI-3-39, flowers Lotus davidsonii (P. H. Timberlake, U.C.R.). Piñon Flat, San Jacinto Mountains, 5 9, VI-4-39, flowers Lupinus concinnus (P. H. Timberlake, U.C.R.). Riverside, $\delta^{\top} \sigma^{\prime}$, + ㅇ, III-19 to V-24, flowers Lotus glaber, and L. scoparius (Michener, 1939:67, U.C.R.). San Jacinto River, $\sigma^{\prime}$, V-30-40, flowers Pbacelia (C. D. Michener, K.U.). Santa Rosa Mountain, 6,000-7,500 ft., V-31-40, flowers Lotus davidsonii (C. D. Michener, K.U.). Stone Creek, San Jacinto Mountains, 2 ó, 3 9, VI-21-40, flowers Lotus scoparius (P. H. Timberlake, U.C.R.). Temecula to Warners, 9 , V-20-41 (R. C. Dicks on, U.C.R.). Temecula, 10 mi. S.E., 9, IV-18-50, flowers Lotus (E. G. Linsley, C.I.S.). The Gavilan, VI-24-38, fiowers Lotus scoparius (Michener, 1939:67, U.C.R.).

San Bernardino Co.: Big Bear Lake, ơ, VII-2-34 (I. McCracken, C.A.S.). Cajon Valley, VII-4-33, flowers Lotus scoparius (Michener, 1 939:67, U.C.R.). Green Valley, VI-9-33, flowers Lotus scoparius (Michener, 1939:67, U.C.R.). Lake Arrowhead, VII-20-35 (Michener, $1939: 67$, U.C.R.). Morongo, 8 , IV-19-37, flowers Lotus arizonicus (Michener, $1939: 68$, U.C.R.); ${ }^{\text {S }}$, IV-20 (T. D. A. Cockerell, K.U.); 9, V-7-39, flowers Dalea californica (P. H. Timberlake, U.C.R.).

San Diego Co.: Campo, $\mathrm{O}_{\mathrm{N}}$, VI-20-39 (R. M. Bohart, U.C.D.). La Mesa, + , IV-2-53 (F. X. Williams, C.A.S.).

San Luis Obispo Co.: San Luis Obispo, $ㅇ$ VI-1 5-38, flowers blue Phacelia (I. McCracken, C.A.S.).


Map 100. Distribution of Ashmeadiella lateralis Michener.


Map 101. Distribution of Ashmeadiella eurynorbyncha Michener.

Asbmeadiella timberlakei solida Michener （Pl．23，fig．118；pl．24，fig．138）

Ashmeadiella（Arogochila）timberlakei solida Michener，1939，Amer．Midland Nat．，22：68， $\sigma^{*}$, ㅇ．Type $0^{n}$ ，Lone Pine，Inyo County，Cali－ fornia（Calif．Acad．Sci．）．
Geographic range：California，Nevada，and Oregon （see map 99）．
California records：
Contra Costa Co．：Antioch，б， （G．E．and R．M．Bohart，K．U．）；ס，V－11－37（G． E．and R．M．Bohart，G．E．B．）；IV－18，IV－21，V－5 （Michener，1939：67）；$\delta$ ，IV－29－50（P．D．Hurd， Jr．，C．I．S．）；$\delta$, V－8－50（P．D．Hurd，Jr．，C．I．S．）． Mt．Diablo， 2 ס，，，V－7－39（C．I．S．，K．U．）．

Eldorado Co．：China Flat， 0 ，VI－28－48（K．W． Tucker，C．I．S．）．Snowline Camp， 9, VI－25－48 （J．W．MacSwain，K．U．）；${ }^{\text {＋，VII－20－48（P．D．}}$ Hurd，Jr．，C．I．S．）．Strawberry，ơ， 3 ㅇ，VII－1－50 （C．D．Michener，K．U ）．

Fresno Co．：Coalinga（near）， $2 \delta$ ，VI－8－41 （R．M．Bohart，G．E．B．）．Delpiedra， 5 mi ．W．，$\delta$ ， IV－25－53，flowers Trifolium（H．L．Hansen， C．I．S．）．Huntington Lake，7，000 ft．，$\frac{\text { ，VII－4－19 }}{}$ （Michener 2 1939：67，C．A．S．）．

Inyo Co．：Big Pine，Glacier Lodge，$\delta, 2$ ㅇ， VI－23－37（E．C．Van Dyke，K．U．）．Bishop Creek， 8，000 ft．，VI－22－37，flowers Nama rotbrockii （Michener，1939：68，K．U．）．Glacier Lodge， $11 / 2$ mi．E．，VI－21－37（Michener，1939：68）．Lone Pine， б才， 4 ㅇ，V－19－37，V－24－37，VI－5－37，flowers Astragalus bolanderi（Michener， $1939: 68$, C．A．S．， K．U．）；ठ＇，V－24－37（G．E．B．）；+ ，VI－6－37（E．C． Van Dyke，K．U．）．Westgard Pass， 3 mi ．W．， 2 ？， VI－19－53，flowers Astragalus（J．W．MacSwain， C．I．S．）．

Lake Co．：Cobb Mountain， 2 б，ㅇ，V－7－36 （Michener，1939：67，G．E．B．）．

Madera Co．：Bass Lake， 4 © ，VI－6－38（Michener， 1939：67，G．E．B．，U．C．R．）．

Marin Co．：Tamalpais，VII－20－36，flowers Lotus glaber（P．H．Timberlake，U．C．R．）．

Mariposa Co．：El Portal， 2 đ，V－23－38（Mich－ ener，1939：67，G．E．B．，U．C．D．）．Yosemite，3，880－ 4，000 ft．， 3 ठ̃，VI－16－38（R．M．Bohart，G．E．B．）； V－31－38（Michener，1939：67）．

Mono Co．：Blanco＇s Corral，White Mountains， 10，000 ft．，ㅇ，VII－23－53（J．W．MacSwain，C．I．S．）．

Monterey Co．：Hastings Natural History Reser－ vation，near Jamesburg，2，000 ft．， $\mathcal{Y}$ ，V－22－38， Q，VI－1－38（Michener，1939：67，K．J．）．

Napa Co．：ס， 2 ㅇ，VIII－6－39（C．D．Michener， K．U．）．Putah Canyon，ס＇，V－25－51（E．I．Schlinger， U．C．D．）．

Nevada Co．：Nevada City， $\mathrm{F}, \mathrm{VI}-26-49$（R．M． Bohart，U．C．D．）．

Placer Co．：Brockway，$\delta$ ，VII－1941（G．E． Bohart，G．E．B．）．

Plumas Co．：Quincy， 4 mi. W．， Y ，VI－22－49 （W．F．Ehrhardt，U．C．D．）；${ }^{\sigma}$ ，VI－24－49（P．D． Hurd，Jr．，C．I．S．）；ठ＇， 9, VI－26－49（W．F．Ehrhardt， U．C．D．）； 9 ，same data（E．I．Schlinger，U．C．D．）； ㅇ，VI－29－49，flowers Phacelia（P．D．Hurd，Jr．， C．I．S．）； 9, VI－30－49（W．F．Ehrhardt，U．C．D．）； 3 9，VI－30－49，flowers Phacelia（P．D．Hurd， Jr．，C．I．S．，K．U．）；\＆，VII－6－49（J．W．MacSwain， C．I．S．）．

Santa Clara Co．：Alum Rock Park， 2 q，V－22－ 52 （D．Burdick）．San Antonio Ranger Station，$ㅇ$ VI－27－53（G．A．Marsh，C．I．S．）．

Santa Cruz Co．： 9 ，VI－1－36（G．E．B．）．
Shasta Co．：Burney， 5 mi. E．， 2 \＆，VI－8－41， flowers Pbacelia（Michener， $1942: 50$ ，K．U．）．

Tulare Co．：Badger，VI－26－29，flowers Lotus nevadensis（Michener，1939：67，U．C．R．）．Coffee Camp，VI－8－25，flowers Lotus glaber（Michener， 1939：67）；VI－25－29，flowers Trifolium variegatum （Michener，1939：67）．Giant Forest， 2 9，VII－22－23 （Michener，1939：67，C．A．S．）．Mineralking，8，000 ft．，ㅇ，VII－7－42（R．M．Bohart，G．E．B．）；$\delta$ ，VIII－ 1－35（Michener，1939：67，G．E．B．）．

Tuolumne Co．：Pinecrest， 2 ㅇ，VII－2－52， flowers Solidago californica（J．I．Stage）．Straw－ berry，$\delta, ~ ㅇ, ~ V I-21-51, ~ \delta, ~ 2 ~ ㅇ, ~ V I-23-51, ~ 2 ~ \delta, ~ 2 ~ ㅇ ㅏ, ~$ VI－18－51， 2 ふ，VII－15－51， ，VII－14－51（J．W． MacSwain，C．I．S．，K．U．）；$\delta$, VI－1 9－51，$\delta$ ，VI－23－51 （A．T．McClay，U．C．D．）； 2 q，VII－5－53， 2 む，VII－ 10－53，flowers Lotus（J．G．Rozen，C．I．S．）．
Discussion：
The name solida is here interpreted in a broader sense than previously．It was based on series of large specimens from east of the Sierra Nevada，characterized further by the slightly longer median clypeal lobe of the females（pl． 23，fig．118）and the not，or scarcely，emarginate labrum of the males．All cismontane populations were then called timberlakei proper．It is now evident that cismontane populations of central and northern California are intermediate between solida and typical timberlakei from southern California．They have been assigned rather arbitrarily to the subspecies solida．

## Asbmeadiella lateralis Michener

Ashmeadiella lateralis Michener，1936，Pan－ Pacific Ent．，12：60，J．Type $\sigma^{\top}$ ，Eagle Rock Hills，Los Angeles County，California（Univ． of Kansas）．


Map 102. Distribution of Asbmeadiella clypeodentata Michener, the subspecies clypeodentata indicated by solid circles, the subspecies simplicior by open circles.


Geographic range: California (see map 100). Discussion:

This species is known from the unique male holotype. A reëxamination of the type supports the suspicion expressed previously (Michener, 1939) that lateralis is a synonym of timberlakei. Nonetheless, in a large series of that species available, no specimen exists that matches the peculiar characters of lateralis. These characters are the darkness of the red coloration, its limitation to the sides of the metasoma (the lateral teeth at the apex of the metasoma are dark red), the coarse punctation of the scutum compared to that of the vertex, and especially the narrower median truncation of the apex of the clypeus, which is not broadly concave as in timberlakei.

## Ashmeadiella clypeodentata clypeodentata Michener

(Pl. 23, fig. 119)
Ashmeadiella clypeodentata Michener, 1936, PanPacific Ent., 12:57, ㅇ. Type ㅇ, Puerto Refugio, Angel de la Guarda Island, Gulf of California (Calif. Acad. Sci.).
Geographic range: California and Mexico. A subspecies, simplicior Michener, has been recently described from Arizona and western Texas (see map 102).
California records:
Imperial Co.: Kane Springs, 6.2 mi. S.E., $\mathrm{P}^{\text {, }}$ IV-15-49, flowers Dalea emoryi (P. H. Timberlake, U.C.R.). Mexicali, $20 \mathrm{mi} . W .$, Y, IV-1 9-39, flowers Prosopis (C. D. Michener, K.U.).

Riverside Co.: Indio, 5 mi . W., IV-1 0-36, flowers Prosopis chilensis glandulosa (Michener, 1939:65). Dos Palmos (Michener, $1939: 65$ ). Box Canyon, ㅇ, III-3-34, flowers Cercidium torreyanum (Michener, $1939: 65$ ); 9 , IV-14-35, flowers Cercidium torreyanum (Michener, 1939:65). Painted Canyon, 2 ठ', IV-18-25, flowers Cercidium torreyanum and Prosopis chilensis glandulosa (Michener, 1939:65). Palm Springs, 7, IV-9-36, flowers Cercidium torreyanum (Michener, 1939 : 65). Banning, $\delta$, V-3-25, flowers Pbacelia bispida (P. H. Timberlake, U.C.R.).

San Bernardino Co.: Bennett Wash, Parker Dam, ㅇ, IV-22-51 (C. D. MacNeill, C.I.S.).

San Diego Co.: The Narrows, Anza State Park, 2 mi . W., $\delta$, $\mathrm{C}, \mathrm{IV}-22-51$ (R. C. Bechtel, U.C.D.). Discussion:

This is our only desert species of Arogochila which lacks red marking.

Asbmeadiella eurynorbyncha Michener
(Pl. 24, figs. 125,139 )
Ashmeadiella (Arogocbila) eurynorbyncha Michener, 1939 , Amer. Midland Nat., 22:62, $\delta$, ㅇ. Type $q$, west of Lone Pine, Inyo County, California, 6,500 ft. (Calif. Acad. Sci.).
Geographic range: California (see map 101 ).
California records:
Inyo Co.: Argus Mts., V-28-37 (Michener, 1939:63). Independence, 9 , VII-2-37 (G.E.B.). Lone Pine (west of), $3 \delta, 5$ ㅇ, V-19-37, on sand (Michener, $1939: 63$ ). Lone Pine, V-19-37 (Michener, 1939:63); $O$, V-21-37 (C.I.S.). Mazourka Canyon, Inyo Mountains, V-25-37, flowers Dalea fremontii (Michener, 1939:63). Westgard Pass, ㅇ, V-18-47 (R. M. Bohart, U.C.D.); same locality, 7 mi . W., 2 ㅇ, VI-26-53, flowers Dalea (J. W. MacSwain, C.I.S.).

Riverside Co.: Cottonwood Springs, Joshua Tree National Monument, $\%$, IV-12-50 (W. F. Barr, U.I.).
Discussion:
The metasoma of this small desert species is largely or wholly red. This species differs further from $A$. stenognatha in having the median lobe of the clypeus not, or scarcely, notched (fig. 125).

## Ashmeadiella stenognatha Michener

(Pl. 23, fig. 120)

Ashmeadiella (Arogocbila) stenognatha Michener, 1939, Amer. Midland Nat., 22:63, ㅇ. Type $\ominus^{\prime}$, east side of Mt. Baldy, Panamint Mountains, Inyo County, California, $9,000 \mathrm{ft}$. (Calif. Acad. Sci.).
Geographic range: California (see map 103).
California records:
Madera Co.: San Joaquin Experimental Range near O'Neals, 2 ó, IV-1 8-53, flowers Pbacelia platyloba (P. D. Hurd, Jr., C.I.S.).
Discussion:
This species, known only from two localities, is black with the metasoma partly red. It is probably most closely related to A. eurynorbyncha, but differs in having a shorter, broader face. The median lobe of the clypeus of the female is broad, with a narrow median apical notch (pl. 23, fig. 120).


Map 105. Distribution of Ashmeadiella erema Michener.


## Ashmeadiella erema Michener <br> (Pl. 23, fig. 121)

Ashmeadiella (Arogochila) erema Michener, 1939, Amer. Midland Nat., 22:65, 9 . Type 9 , west side of Westgard Pass, Inyo County, California, flowers Dalea fremontii (Calif. Acad. Sci.).
Geographic range: Arizona, California, and Texas (see map 105).
California records:
Inyo Co.: Mazourka Canyon, Inyo Mountains, 8, V-25-37, flowers Dalea fremontii (Michener, 1939:66). Westgard Pass (west side), 2 f, VI-15-37, flowers Dalea fremontii (Michener, 1939: 66); same locality, $7 \mathrm{mi} . W ., 4$ Y, VI-26-53, flowers Dalea (J. W. MacSwain, C.I.S.).

## Discussion:

This is a species with the metasoma largely red. It is most closely related to eurynorbyncha and stenognatha, from which the female is easily distinguished by the broad space between the median and the lateral lobes of the clypeus (fig. 121). The male is unknown. The clypeus of the female is unusually variable in the shape of the median lobe. In the original series from Westgard Pass, the lateral margins of this lobe diverge apically. In a series from seven miles west of Westgard Pass, it is evident that these margins may also be parallel or even distinctly convergent apically. In these specimens the median lobe of the clypeus is broader than long, as it is also in the single known specimen from Texas.

In a series from an intermediate locality, Grand Canyon, Arizona, 7,000 feet altitude, June 6, 1940 (R. M. Bohart), the median lobe, although highly variable, is much narrower; therefore it is longer than broad. A specimen from Sierrita Mountains, Arizona, March 5 to 25 (C. T. Vorhies) is intermediate in this characteristic.

In an earlier work (Michener, 1939), specimens with a tapering median clypeal lobe key to salviae, from which they differ by the narrow apex of the labrum.

## Ashmeadiella cazieri Michener

(Pl. 24, fig. 123)
Ashmeadiella (Arogochila) cazieri Michener, 1939, Amer. Midland Nat., 22:72, $\delta$, . Type ㅇ, Dos Palmos, Riverside County (Colorado Desert), California (Calif. Acad. Sci.).
Geographic range: Arizona and California (see map 104).

California records:
Inyo Co.: Inyo Mountains, $\delta$, V-23-37 (W. C. Reeves, K.U.). Mazourka Canyon, Inyo Mountains, V-25-37, flowers Dalea fremontii (Michener, 1939:73). Surprise Canyon, Panamint Mountains, 2 ठ, 8 ㅇ, IV-28-53, flowers Dalea fremontii (P. D. Hurd, Jr., C.I.S.). Westgard Pass (west side), V-27-37, flowers Dalea fremontii (Michener, 1939: 73, same locality, 7 mi . W., 4 f, VI-26-53, flowers Dalea (J. W. MacSwain, C.I.S.).

Riverside Co.: Box Canyon, III-31-29, flowers Cercidium torreyanum (Michener, 1939:73). Dos Palmos, $\sigma, 2$ ㅇ, III-28-34 (Michener, 1939:73, G.E.B.). Edom, $P$, IV-17-37 (E. G. Linsley, C.I.S.). Painted Canyon, IV-18-25, flowers Cercidium torreyanum (Michener, 1939:73). Palm Desert, ?, IV-11-50 (W. F. Barr, U.I.). Whitewater, $\delta, V-20-51$ (E. I. Schlinger, U.C.D.).

San Bernardino Co.: Warrens Well, ō, VI-1-37 (S. C. Varley, U.C.R.).

Discussion:
Among the species with the metasoma largely red, this species is readily recognized by the snoutlike, narrowly truncated, median apical lobe of the clypeus of the female (pl. 24, fig. 123). The narrowly truncated labrum and less abruptly projecting median lobe of the clypeus distinguish this species from salviae in the female. The male is distinguished from salviae by the more finely punctate clypeus.

## Ashmeadiella salviae Michener

(Pl. 23, fig. 122; pl. 24, fig. 140)
Asbmeadiella (Arogochila) salviae Michener, 1939, Amer. Midland Nat., 22:69, $\sigma$, Y. Type ㅇ, Eagle Rock, California (Calif. Acad. Sci.). Geographic range: California (see map 106).
California records:
Contra Costa Co.: Byron, Y, V-18-20 (E. P. Van Duzee, K.U.). Mr. Diablo, 3 \&, VI-25-39 (Michener, 1942:51, C.A.S., K.U.); 우, V-7-39 (G. E. Bohart, G.E.B.); + , VI-30-52 (F. X. Williams, C.A.S.); same locality, $2,000 \mathrm{ft} ., \quad$, VI-14-49 (F. X. Williams, C.A.S.).

Fresno Co.: Coalinga (near), O , VI-8-41 (R. M. Bohart, G.E.B.).

Inyo Co.: Westgard Pass, VI-3-37 (Michener, 1939:70, C.A.S., K.U.); same locality, 7 mi . W.,个, VI-26-53, flowers Dalea (J. W. MacSwain, C.I.S.).

Los Angeles Co.: Altadena, ó, 2 9, VII-3-36, flowers Salvia mellifera (Michener, 1939:70, C.A.S., K.U., U.C.R.). Big Dalton Dam, 2 \&,

VI-25-50 (D. C. Blodget, U.C.D., U.C.L.A.). Eagle Rock, IV-7-36, V-9-36, flowers Salvia mellifera (Michener, 1939:70); IV-14-33, flowers Rhamnus crocea (Michener, 1939:70). Monte bello, ㅇ, V-1-34 (Michener, 1939:70, G.E.B.). Mt. Wilson, San Gabriel Mountains, $3,000 \mathrm{ft}$., V-28-10 (Michener, 1939:70). Santa Monica Mountains, $2 \delta$, V-20-50 (U.C.D., U.C.L.A.). Tanbark Flat, San Dimas Experimental Forest, $\mathcal{P}$, VI-20-50, flowers Brassica (W. C. Bentinck, C.I.S.); $\delta, 2$, 2 , VI-20-50 (P. D. Hurd, Jr., C.I.S., K.U.); ס, ㅇ, VI-24-50 (P. D. Hurd, Jr., C.I.S.); 4 d', VI-25-50 (J. W. MacSwain, C.I.S.); $P$, same data (F. X. Williams, C.A.S.); ㅇ, VII-7-52 (A. T. McClay, U.C.D.); ${ }^{*}$, VII-8-52 (R. M. Bohart, U.C.D.); ${ }^{2}$, VII-11-52 (R. M. Bohart, U.C.D.); 오, VII-13-52 (A. T. McClay, U.C.D.); 3 f, VII-15-52 (J. W. MacSwain, C.I.S.).

Monterey Co.: Bryson, $2 \mathrm{~d}^{\pi}$, V-1 8-20 (Michener, 1939:70, C.A.S.).

Riverside Co.: Palms to Pines Highway, San Jacinto Mountains, Y, V-24-39 (E. S. Ross, C.I.S.).

San Bernardino Co.: Ontario, ㅇ, VI-22-18 (Michener, 1939:70).

Ventura Co.: Santa Paula, đ', $\%$, VI-5-27, flowers Salvia mellifera (Michener, 1939:70, U.C.R.).

Discussion:
This is primarly a cismontane species which is ordinarily recognizable in the female by the very abruptly projecting median lobe of the clypeus (pl. 23, fig. 122). Some females of $A$. erema, however, have an almost equally abruptly protruding lobe. The black hind femora distinguish this species from several others which have red on the metasoma. This species is apparently restricted to Salvia mellifera in its pollen collecting.

## Ashmeadiella australis (Cockerell)

(Pl. 24, fig. 141)
Chelostoma $\cdot$ australis Cockerell, 1902, Bull. So. Calif. Acad. Sci., 1:139, P. Type $^{+}$, near Los Angeles, California.
Synonym: nana (Cockerell), 1925.
Geographic range: California, Nevada, and Utah (see map 107).
California records:
Calaveras Co.: Camp Wolfboro, ㅇ, VIII-1-39 C.I.S.).

Eldorado Co.: Pilot Hill, ठ', VI-14-53 (R. M. Bohart, U.C.D.).

Inyo Co.: Whitney Portal, ㅇ, VIII-6-48 (P. D. Hurd, Jr., and J. W. MacSwain, C.I.S.). Oak Creek Canyon near Independence, flowers Penstemon breviflorus (Michener, 1939:72).

Los Angeles Co.: Crystal Lake, 8 , VI-29-50 (W. C. Bentinck, C.I.S.); 2 f, same data (T. R. Haig, C.I.S.); , same data (J. C. Hall, U.C.D.); 3 ㅇ, same data (J. W. MacSwain, C.I.S., K.U.); 2 ㅇ, VII-9-52 (R. M. Bohart, U.C.D.); data (J. K. Hester, C.I.S.); Linsley, C.I.S.). San Antonio Canyon, north of Ontario, ㅇ, VI-20-31 (Michener, 1939:72, O.S.C.).

Madera Co.: Bass Lake, ${ }^{\circ}$, VI-6-38 (R. M. Bohart, G.E.B.).

Mariposa Co.: Briceburg, d, VI-3-38 (R. M. Bohart, G.E.B.). Tenaya Lake Trail, Yosemite National Park, ठ̂, VII-21-36 (Michener, 1939:72). Yosemite Valley, ơ, VI-19-21 (Michener, 1939:71, C.A.S.).

Mono Co.: Benton Station, $2 \delta$, VII-25-50 (H. A. Hunt, K.U., U.C.D.). Leevining, d, VII-29-53 (J. G. Rozen, C.I.S.). Mammoth, ठ', VII-6-33 (G. E. and R. M. Bohart, U.C.D.).

Riverside Co.: Marion Mountain Camp, San Jacinto Mountains, ㅇ, VII-1-52 (J. W. MacSwain, C.I.S.).

Sacramento Co.: Folsom, $\mathrm{d}^{2}$ V-30-52 (T. R. Haig, C.I.S.).

San Bernardino Co.: Bear Valley, San Bernardino Mountains, ô, VIII-1913 (F. C. Clark, C.A.S.); \&, VIII-9-33, flowers Penstemon grinnellii (Michener, 1939:72, U.C.R.). Big Bear Lake, San Bernardino Mountains, 3 ㅇ, VII-7-34 (I. McCracken, K.U.). Forest Home, San Bernardino
 Green Valley Lake, San Bernardino Mountains, ㅇ, VII-15-50 (C. D. Michener, K.U.). Mill Creek, San Bernardino Mountains, $6,000 \mathrm{ft}$., $\delta \delta \widehat{\prime}, 9 \%$, V 30 to VIII-9, flowers Penstemon grinnellii (one早 on Monardella linoides var. stricta) ( $\mathrm{P} . \mathrm{H}$. Timberlake, U.C.R.); same locality, $6,300 \mathrm{ft} .$, б', VII-6-46, flowers Penstemon grinnellii (P. H. Timberlake, U.C.R.); same locality, $7,400 \mathrm{ft}$., ठ', VI-29-42 (R. M. Bohart, G.E.B.).

Tuolumne Co.: Pinecrest, ㅇ, VI-20-29, flowers Solidago californica (P. H. Timberlake, U.C.R.). Tuolumne City, ${ }^{\text {th}}$, VI-22-53 (J. G. Rozen, C.I.S.). Ventura Co.: Frazier Park, ठ', V-1 8-40 (R. M. Bohart, G.E.B.).
Discussion:
This large and easily recognized species is apparently restricted to Penstemon in its pollencollecting habits. Outside California it has been

collected at Connors Pass, White Pine County, Nevada, on Penstemon, and at Red Rock Canyon, near Paragonah, and Beaver Canyon in Utah.

## Subgenus Corythochila Michener

This small subgenus is related to Arogochila, but differs from most species by the quadridentate female mandibles. The short, unproduced, and characteristically lobed clypeus is also characteristic of females, as is the proboscidial
fossa which is narrowed posteriorly. The male is essentially indistinguishable from that of Arogochila. The brushes of orange hair beneath the clypeal margin are absent. The apex of the labrum is emarginate. The hypostomal carinae are elevated and produced at their posterior extremities in females. The mandibles of the females are slender, more than twice as long as the antennal scape. The sixth metasomal sternum of the female is not depressed and is punctate throughout.

The subgenus contains but two species, both inhabitants of desert areas. They are small species with the metas oma largely red.

## Key to the Species of the Subgenus Corytbocbila

## Males

1. Lower parts of cheeks and areas between eyes and lateral ocelli with punctures approximate or nearly so; hind tibial spurs strongly toothed
inyoensis (p. 213)
Lower parts of cheeks and areas between eyes and lateral ocelli with punctures often rather widely separated; hind tibial spurs nearly edentate breviceps (p. 211)

## Females

1. Apex of clypeus with small, rounded, median projection (pl. 24, fig. 127). . inyoensis (p. 213) Apex of clypeus with small, emarginate, median projection, often so reduced as to be hardly distinguishable (pl. 24, fig. 126). breviceps (p. 211)

## Asbmeadiella breviceps Michener

(Pl. 24, fig. 126)

Ashmeadiella (Corythochila) breviceps Michener, 1939, Amer. Midland Nat., 22:77, ō, ㅇ. Type ㅇ, Cathedral City, Riverside County, California (Calif. Acad. Sci.).
Geographic range: Arìzona, California, Mexico, and Nevada (see map 108).
California records:
Inyo Co.: Death Valley, $q$, III-20-51 (D. Burdick). Stovepipe Wells, 5 o, 2 ㅇ, III-31-51, flowers Larrea (P. D. Hurd, Jr., C.I.S., K.U.). Riverside Co.: Cathedral City, IV-10-36, flowers Larrea glutinosa (Michener, 1939:78). Cottonwood Springs, Joshua Tree National Monument, $\delta$, , IV-12-50 (W. F. Barr, U.I.); 3 す', IV-1 2-50 (P. D. Hurd, Jr., C.I.S., K.U.). Dos Palmos, III-1 9-34 (Michener, 1939:78). Edom, 2 mi . W., III-26-36, flowers Larrea glutinosa (Michener, 1939:78); same locality, 5 mi . W., ठ',

IV-1 0-37, flowers Larrea glutinosa (Michener, 1939:78, U.C.R.). La Quinta, III-17-34, V-2-34, III-4-36, flowers Hyptis emoryi and. Larrea glutinosa (Michener, 1939:78, U.C.R.).

San Bernardino Co.: Kramer Hills, 9, V-3-39, flowers Larrea glutinosa (P. H. Timberlake, U.C.R.). Manix, 6 mi . N., 9, IV-25-53, flowers Stephanomeria (G. A. Marsh, C.I.S.); same locality, 22 mi. N., 2 \&, IV-26-53, flowers Larrea (P. D. Hurd, Jr., C.I.S.); $\mathcal{F}$, same data (R. O. Schuster, C.I.S.). Twentynine Palms, 5 ơ, IV-1 938 (G. E. and R. M. Bohart, G.E.B.).

San Diego Co.: Borego, ő, IV-2-53, flowers Cryptantha barbigera (P. D. Hurd, Jr., C.I.S.). Discussion:

In their general areas of distribution, this species and the next overlap broadly and in spite of their similarity do not intergrade. In Nevada, breviceps has been taken at flowers of Dipetalia linifolia at Las Vegas, and in Lower California (El Mayor, and 20 miles west of Mexicali) on flowers Prosopis.

Map 111. Distribution of Ashmeadiella xenomastax Michener.


Ashmeadiella inyoensis Michener
(Pl. 24, fig. 127)
Asbmeadiella (Corythochila) inyoensis Michener, 1939, Amer. Midland Nat., 22:75, $\delta$, ㅇ. Type 9 , Lone Pine, Inyo County, California (Calif. Acad. Sci.).
Geographic range: California (see map 109). California records:

Inyo Co.: Lone Pine, $2 \delta^{\prime}, \underline{2}$ ㅇ, VI-9-37, flowers Dalea polyadenia (Michener, 1939:76, C.A.S.); 2 ㅇ, VI-9-37 (A. E. Meier, C.I.S.); ${ }^{\prime}$, 우, VI-13-37 (E. C. Van Dyke, C.A.S., C.I.S.); VI-15-37, flowers Dalea polyadenia (Michener, 1939:76, K.U.); ${ }^{\text {oै, VI-1 } 9-37 \text { (G.E.B.). }}$

Riverside Co.: Edom, 5 mi. E., ${ }^{\text {P, }}$ IV-10-37, flowers Dalea schottii (Michener, 1939:76, U.C.R.).

## Subgenus Chilosima Michener

This is a subgenus immediately recognizable in the male by the tridentate rather than bidentate mandibles. The female, except for a few unusual specimens in which the third mandibular tooth is undeveloped, have quadridentate mandibles. The clypeus of the female is very broadly, irregularly rounded, projects well over the base of the labrum, and lacks orange brushes beneath the margin. The apex of the labrum is rounded or subtruncate. The hypostomal carinae are low and not produced posteriorly.

The mandibles of the female are slender, more than twice as long as the antennal scape. The sixth metasomal sternum of the female is not depressed and is punctate throughout.

This subgenus contains only a single California species. There is but one other species in the subgenus (boltii Cockerell), for the form described as A. (Cbilosima) washingtonensis Michener (1939) proves to be the female of $A$. (Arogochila) foxiella (see Michener, 1942).

## Ashmeadiella rbodognatba Cockerell

(Pl. 24, fig. 128)
Ashmeadiella rbodognatha Cockere 11, 1924, Proc. Calif. Acad. Sci., (4) 12:557, ㅇ. Type 9 , San Jose Island, Gulf of California (Calif. Acad. Sci.).
Geographic range: California, Mexico, Nevada, and Texas (see map 110).

California records:
Inyo Co.: Big Pine, 아, VI-8-37 (W. C. Reeves, U.C.R.). Furnace Creek, Death Valley National Monument, IV-14-38, flowers Pluchea sericea (Michener, 1939:79); 5 §', IV-7-39 (E. C. Van Dyke, C.A.S.); 52 d, 5 9, IV-8-39, flowers Prosopis (E. G. Linsley, C.I.S., K.U., U.C.R.); 3 §', 5 ㅇ, IV-1-51, flowers Heliotropium (J. W. MacSwain, C.I.S.). Lone Pine, ㅇ, VI-9-37, flowers Dalea polyadenia (C. D. Michener, K.U.); + , VI-9-37 (G.E.B.); 3 ó, polyadenia (Michener, 1939:79, C.A.S., K.U.); ㅇ, VI-13-37 (E. C. Van Dyke, G.E.B.). Mazourka Canyon, Inyo Mountains, 2 \&, V-25-37, flowers Dalea fremontii (C. D. Michener, K.U.). Surprise Canyon, Panamint Mountains, $\delta$, ㅇ, IV-28-53, flowers Dalea fremontii (P. D. Hurd, Jr., C.I.S.). Westgard Pass, ठ, V-27-37, flowers Dalea fremontii (C. D. Michener, K.U.); same locality, 7 mi . W., , P , VI-26-53, flowers Dalea (J. W. Mac Swain, C.I.S.).

Riverside Co.: Box Canyon, III-31-34, IV-1334, flowers Cercidium torreyanum (Michener, 1939:79); $\delta^{3}$, IV-26-52 (G. A. Marsh, C.I.S.); 우, IV-27-52, flowers Cryptantha angustifolia (P. H. Timberlake, U.C.R.). Cathedral City, 2 \&, IV-10-36, flowers Cercidium torreyanum and Dalea schottii (Michener, 1939:79). Dos Palmos, + III-2 8-34 (G. E. Bohart, K.U.). Edom, 4 mi. E., ô, IX-17-37, flowers Dalea schottii (Michener, 1939:79, U.C.R.). Indio, Prosopis (J. C. Elmore, O.S.C.); same locality, 5 mi. W., + , IV-9-36, flowers Prosopis chilensis glandulosa (E. G. Linsley, K.U.); same locality, $5 \frac{1}{2} \mathrm{mi}$. N.W., IV-9-36, flowers Prosopis chilens is glandulosa (Michener, 1939:79); same locality, 6 mi . W., 5 ㅇ, IV-30-49, flowers Melilotus (E. G. Linsley, J. W. MacSwain, R. F. Smith, C.I.S.). Oasis (near), IV-19-25, flowers Cercidium torreyanum (Michener, 1939:79, U.C.R.). Painted Canyon, IV-1 8-25, flowers Cercidium torreyanum (Michener, 1939:79, U.C.R.). Palm Desert, 3 ㅇ, IV-11-50 (W. F. Barr, U.I.); $\delta, 3$ 오, IV-12-50 (P. D. Hurd, Jr., C.I.S., K.U.); ㅇ, IV-24-50 (C. D. MacNe ill, C.I.S.). Palm Springs, 2 ㅇ, IV-24-40, (R. M. Bohart, U.C.D., U.C.L.A.). Shavers Well, d, IV-26-52, flowers Dalea (G. A. Marsh, C.I.S.).

San Bernardino Co.: Morongo, 4 P, V-7-39, flowers Dalea californica (P. H. Timberlake, U.C.R.). Morongo Valley, ㅇ, V-24-41 (E. C. Van Dyke, C.A.S.).

San Diego Co.: Borego, ठ', IV-9-S0 (L. W. Quate, C.I.S.).


Plate 11. Lateral view of Diceratosmia subfasciata subfasciata.(Cresson), male.

## Discussion:

This is a short, robust, black species with much white pubescence. This form is perhaps only subspecifically distinct from $A$. boltii, a structurally similar species with the legs and metasoma largely red. A. boltii is known from Arizona and New Mexico; rbodognatha from California, Lower California, Nevada, and Texas. In Lower California, it has been taken on flowers of Prosopis chilensis glandulosa at El Mayor and 20 miles west of Mexicali. In Nevada (Reno, 29 mi. E.) it has been found at flowers of Dalea polyadenia, and Michener (1951:71) has recorded it from flowers of Dalea neomexicana at Cooper's Store, Big Bend National Park, Texas.

## Subgenus Cubitognatha Michener

This remarkable monotypic subgenus differs in the female from all the other subgenera by the elbowed bidentate mandibles (fig. 129). The clypeus of the female is not produced over the base of the labrum and lacks orange brushes; the upper margin of the largely impunctate clypeus is strongly protuberant. The proboscidial fossa is greatly narrowed posteriorly in the female; the hypostomal carinae are produced posteriorly in the female much as in Arogochila. The labrum is emarginate at the apex in both sexes. The sixth metasomal sternum of the female is not depressed and is punctate throughout. The male agrees in most respects with that of Arogochila, but the lateral margins of the sixth metasomal tergum are not so uniformly convex; they are slightly sinuate, the lateral teeth not as broad as in Arogochila, yet broader than usual in Ashmeadiella proper.

## Asbmeadiella xenomastax Michener <br> (Pl. 24, fig. 129)

Ashmeadiella (Cubitognatha) xenomastax Michener, 1939, Amer. Midland Nat., 22:81, 우. Type 9, Big Pine, Inyo County, California, flowers Dalea polyadenia (Calif. Acad. Sci.). .Geographic range: California, Nevada, and Mexico (see map 111).
California records:
Inyo Co.: Big Pine, 4 , VI-8-37, flowers Dalea polyadenia (Michener, 1939:82, C.A.S., K.U., U.C.R.). Lone Pine, 3 Y, VI-1 5-37, flowers Dalea polyadenia (Michener, 1939:82, K.U.); $\{$,

VI-6-39, flowers Eriogonum fasciculatum (R. M. Bohart, U.C.D.). Olancha, + , V-20-37 (J. W. Johnson, G.E.B.).

Riverside Có: Edom, $5 \mathrm{mi} . E .$, , IV-1 0-37, flowers Dalea schottii (Michener, 1939:82, U.C.R.).

San Bernardino Co.: Arrastre Canyon (near), $\delta$, V-20-41 (P. H. Timberlake, U.C. R.). Kramer Hills ㅇ, V-1-53 (R. O. Schuster, C.I.S.). Kramer Junction, ${ }^{\text {P, V-1-53 (P. D. Hurd, Jr., C.I.S.). Manix, }}$ 8 mi. N., 9, IV-25-53 (R. O. Schuster, C.I.S.). Morongo Valley, $\circ$, V-7-39, flowers Dalea californica (P. H. Timberlake, U.C.R.). Victorville, 3 mi. S.W., ó, 5 \&, V-12-39, flowers Dalea saundersii, one on Phacelia distans (Michener, 1942:51, K.U., U.C.R.); $\delta$, V-9-41, flowers Chaenactis xantiana (P. H. Timberlake, U.C.R.); same locality, $8 \mathrm{mi} . \mathrm{S} .$, ㅇ, V-22-32, flowers Lupinus odoratus (Michener, 1939:82, U.C.R.). Discussion:
A. xenomastax is a unique desert species, the male of which was unknown in 1939 , but has been described subsequently (Michener, 1942).

## Genus Diceratosmia Robertson

This genus is closely related to Osmia and should perhaps be regarded as a subgenus of that genus. It differs, however, in a feature which is usually of generic importance elsewhere in the family, namely, the carina on the inner ventral angle of each hind coxa (pl. 2, fig. 4) which is distinct in Diceratosmia, absent in Osmia. Also the parapsidal lines are longer in Diceratosmia than in Osmia. Like Osmia, Diceratosmia contains robust bees, species occurring in the United States being metallic blue with the pubescence entirely pale. American species of the genus were revised by Michener (1949b).

Diceratosmia is a holarctic group which contains only three species in the United States, only one of which occurs in California.

## Diceratosmia subfasciata subfasciata (Cresson)

(Pl. 11; 13, figs. 24, 25)
Osmia subfasciata Cresson, 1872, Trans. Amer. Ent. Soc., 4:261, ó, ㅇ. Type $\uparrow$, Texas (Acad. Nat. Sci. Phila.).
Synonym: Osmia punctata Michener, 1936, Bull. Southern Calif. Acad. Sci., 35:85 (new synonym).


Geographic range: Arizona, California, Kansas, Louisiana, Mississippi, Oklahoma, Tennessee, and Texas. A single specimen from New Jersey is possibly erroneously labeled. Another subspecies, conjunctoides Robertson, occurs in peninsular Florida. (see map 112). California records:

Imperial Co.: Holtville, $\bar{\delta}$, III-24-30, flowers Heliotropium curassavicum oculatum (P. H. Timberlake, U.C.R.). Westmorland, $\delta^{\prime \prime}$ III-23-30, flowers Prosopis (P. H. Timberlake, U.C.R.).

Inyo Co.: Furnace Creek, Death Valley National Monument, 20 б, 37 Y, IV-7-39 (E. C. Van Dyke, C.A.S.); 49 б, 11 Y, IV-8-39, flowers Prosopis (Michener, 1949:263, C.A.S., K.U., C.I.S., U.C.R.); $\delta$, II-31-51 (E. G. Linsley, C.I.S.); 15 ठ', 2 Y, VI-1-51, flowers Heliotropium (P. D. Hurd, Jr., C.I.S.); $\delta$, same data (J. W. MacSwain, C.I.S.); 2 Y, III-31-53, some on Pluchea sericea (J. W. MacSwain, C.I.S.); ठ', III-31-53 (R. F. Smith, C.I.S.); 2 б, IV-1-53, flowers Pluchea sericea (R. F. Smith, C.I.S.); same locality, 20 mi. S., 2 o, 4 , IV-8-39, flowers Prosopis (E. G. Linsley, U.C.R.).

Riverside Co.: Blythe, 3 9, VII-12-45, flowers Medicago sativa (Linsley, 1946:24; Michener, 1949:263, C.I.S., K.U.). Coachella, , IV-20-34 (Michener, 1949:263, U.C.R.). Gilman Hot Springs, O', III-11-36, flowers Lotus scoparius (F. R. Platt, K.U.). Oasis, 2 o, III-7-36 (Michener, 1949:263, K.U.); same locality, 2 mi. N., $4 \delta$, III-7-36, flowers Heliotropium curassavicum oculatum and Palafoxia linearis (P. H. Timberlake, U.C.R.).
Discussion:
This .blue bee is widespread and locally common in the deserts of California. Since 1936 it has seemed that the California populations could be separated from populations occurring in Texas and to the eastward. In 1949 it was realized that the differences were very slight, but since the species was unknown across Arizona and New Mexico, it seemed best to recognize the California form as a subspecies. Although the range still seems disjunct, adequate series now available show no differences whatever in size or in other characters between California and Texas series. The characters ascribed (Michener, 1949b) to the California race were larger size, coarser punctation, and longer vertex. With larger series now available from Texas, it is evident that large size occurs equally frequently there and that the other characters are correlated with large size, perhaps owing to the phenomenon of allometric growth.

As will be observed from the floral records enumerated above, this bee in California appears to obtain its nectar and pollen principally from the flowers of Heliotropium and Prosopis. Linsley (1946:24) has stated that subfasciata was an effective pollinator of alfalfa in at least three fields studied in the Blythe area of California. It was observed tripping flowers at the rate of 9.5 per minute at 8:30 A.M. on a clear, warm day. The species was nesting in old burrows of woodboring beetles, especially those of bostrichids, cerambycids, and buprestids. The three fields of alfalfa studied by Linsley were in outlying areas adjacent to thickets of willow, mesquite, and other trees containing suitable burrows. Linsley (ibid) found that the populations of Diceratosmia were large, and they represented a high percentage of the effective pollinators in the fields studied.

Elsewhere in the geographic range, subfasciata has been taken on a wide variety of flowers. In Kansas it has been collected at flowers of Amorpha (Miami County) and Melilotus officinalis (Kalvesta). In Oklahoma it has been taken at flowers of Monarda citriodora at Hugo and flowers of Rubus at Ardmore.

In Texas it has been found on flowers of Acacia greggii (Alfred), Achillea (Ladonia), Amorpha fruticosa (Dallas), Machaeranthera tenacetifolium (Uvalde), Cercis canadensis (Dallas), Gaillardia (Rockport), G. pulchella (Dallas and Devil's River), Helenium tenuifolium (Wolfe City), Helianthus (Falfurrias), Lesquerella ( 10 miles north of Mason), Marilaunidium origanifolium (Devil's River), Marrubium vulgare (Kerrville and Pittsburg), Monarda (Ladonia, Mineral Well, Weatherford, and Wichita Falls), M. citriodora (Brownsville and Dallas), yellow Oxalis (Waco), Phacelia (Concan, San Benito, and 5 miles southwest of Tivoli), Prosopis (Hidalgo and Laredo), P. juliflora (Corigo Springs), Prunus (Dallas), Rhus (Devil's River), Rubus (Dallas and Waco), Salix (Luling), Spbaeralcea (San Ygnacio), and Vicia (Santa Maria).

## Genus Osmia Panzer

This genus can be distinguished from all other genera by the punctiform parapsidal lines (pl. 2, fig. 1). Each line is represented merely by a small, shining, often elevated area, sometimes no larger than one on two punctures, sometimes no more conspicuous than other unusually large
interspaces between punctures, although usually definitely different from and larger than other interspaces. Diceratosmia is similar but has somewhat longer parapsidal lines (pl. 2, fig. 3) and has carinae along the inner ventral angles of each hind coxa (pl. 2, fig. 4). Such carinae are absent in Osmia. In Osmia the body is robust, usually metallic blue or green, with the metanotum and propodeum vertical or nearly so, the latter with no horizontal basal zone. The first metasomal tergum has the anterior face broadly concave, with a distinct line or carina separating this concavity from the dorsal surface of the
tergum. There are seven exposed metasomal terga in the male, and the sixth metasomal tergum of the male is not dentate laterally.

Osmia is widely distributed in the holarctic region and contains numerous American species which have been arranged in five subgenera. A key to the subgenera is presenfed below. The genus was revised by Sandhouse (1939) and the subgenus Acanthosmioides by White (1952), but further revisional studies must be completed before the species can be treated properly. For this reason, no keys or accounts of species are included in the present study.

## Key to the American Subgenera of Osmia ${ }^{7}$

1. Malar space almost absent, lacking a depression in the female; middle femora of male without projections
Malar space at least nearly as long as pedicel, bearing a small depression in female; middle femora of male with a projection on lower margin . . . . . . . . . . . . Osmia
2(1). Metasomal terga two to six with apical impunctate bands or if hairs reach near margins, they are simple; clypeal truncation of female with only the usual two tufts of hair; apical margin of fifth metasomal sternum of male neither thickened nor transversely sulcate laterally. . 3
Metasomal terga two to six with subapical fimbriae of plumose hairs; clypeus of female with two small median tufts of hair on margin in addition to usual large tufts; apical margin of fifth metasomal sternum of male thickened and lateral parts transversely sulcate

3(2). Labrum but little longer than broad; metanotum declivous throughout; clypeus of female densely punctured; apical margin of third metasomal sternum of male usually convex, margin of fourth usually emarginate
Labrum considerably longer than wide; metanotum anteriorly with median horizontal part; clypeus of female sparsely punctate to nearly impunctate; apical margin of third and usually Qf fourth sterna, truncate . . . . . . . . . . . . . . . . . Cephalosmia
f(3). Strongly metallic, without the combination of characters below . . . . . . . . . 5
Black, or, if dark blue, head of female much broader than thorax, clypeal margin thickened and male with lateral margins of sixth and seventh metasomal terga reflexed and middle tarsal segments modified.

Melanosmia
5(4). Mandibles constricted a short distance from base, widened to apical margin which is about twice (female) or one and one-half (male) times as wide as narrow part; second metasomal sternum of male with at least longitudinal median band of bristles, usually an elevated median process. . . . . . . . . . . . . . . . . . . . Acanthosmioides
Mandibles narrow at base, apical margin not so wide as in Acantbosmioides, second metasomal sternum of male not modified as above . . . . . . . . . . . . Nothosmia

[^6]
## Genus Megacbile Latreille

This large genus can be distinguished from other genera by the absence of arolia combined with rounded axillae. The body is slender or robust, nonmetallic.

American species of this world-wide genus
were revised by Mitchell (1934-1937). Important studies on California species have not been carried on subsequently; therefore the various species are not treated further herein. One subgenus, the Palaearctic Eutricharaea, has been found recently to be established in California (Hurd, 1954). The following key (modified from that of Mitchell) will separate the subgenera.

## Key to the Nearctic Subgenera of Megachile ${ }^{\text {s }}$

Males

1. Metasoma with four exposed stema; body commonly robust . . . . . . . . . . 2

Metasoma with three exposed sterna; body slender . . . . . . . . . Cbelostomoides
2(1). Mandibles lacking inferior projection . . . . . . . . . . . . . . . . . 3
Mandibles with inferior projection . . . . . . . . . . . . . . . . . . 4
3(2). Small slender species with short pubescence; apical metasomal terga not conspicuously tomentose; disc of sixth metasomal tergum above carina subhorizontal . . .Neomegachile
Larger, more robust species with long erect pubescence; fourth and fifth metasomal terga densely covered with pale tomentum; disc of sixth metasomal tergum above carina vertical

4(2). Carina or transverse ridge of sixth metasomal tergum usually with a definite median emar-
gination, sometimes obscured by lateral denticulation . . . . . . . . . . 5 Carina or transverse ridge of sixth metasomal tergum without median emargination, though often denticulate or serrate . . . . . . . . . . . . . . . . . . . . 18

5(4). Front coxae each with a large spine . . . . . . . . . . . . . . . . . . 6
Front coxal spines vestigial or absent . . . . . . . . . . Megachile, sensu stricto
6(5). Middle tibial spurs absent . . . . . . . . . . . . . . . . . . . . . 7
Middle tibiae each with the usual apical spur . . . . . . . . . . . . . . 10
$7(6)$. Mandibles quadridentate; middle basitarsi not protuberant beneath . . . . . . . . 8
Mandibles tridentate; middle basitarsi conspicuously protuberant beneath. . . Xanthosarus
8(7). Mandible without median ventral angle; posterior face of front femur not carinate above; middle tibia without spurlike apical projection, although often angulate or protuberant. . 9
Mandible with median sharp angle or tooth on lower margin; posterior face of front femur sharply carinate above; middle tibia with spurlike apical projection. . . Pseudocentron
9(8). Middle tibiae dilated apically; front basitarsi not much produced apically, subequal in length to segments two to five together

Acentron
Middle tibiae not dilated apically, inner margin with slight angle just before apex; front basitarsi much produced apically, length along posterior margin not much exceeding length of second segment . . . . . . . . . . . . . . . . . . . . Melano sarus
10(6). Middle coxae not spined.
Middle coxae each with long, slender spine . . . . . . . . . . . . Xanthosarus
11(10). Front basitarsi dilated, usually brightly colored . . . . . . . . . . . . . . 12
Front basitarsi simple, usually dark in color . . . . . . . . . . . . . . . 13
12(11). Mandibles tridentate; metasoma rather long and slender, parallel-sided; claws usually each with a sharp basal tooth . . . . . . . . . . . . . . . . . . . Sayapis
Mandibles quadridentate; metasoma rather short and robust; claws without basal teeth
Delomegachile

[^7]13(11). Mandibles distinctly quadridentate ..... 14
Mandibles tridentate . ..... 15
14(13). Sixth metasomal tergum with apical margin (not carina) with four conspicuous teeth; front coxae more or less pubescent anteriorly and without a patch of red bristles anterior to each spine Argyropile
Sixth metasomal tergum with apical margin without conspicuous teeth; front coxae bare an-teriorly, with a dense patch of red bristles anterior to each spine . . . Delomegachile
15(13). Sixth metasomal tergum with morphological apical margin (not carina) without evident teeth; fifth metasomal tergum usually conspicuously pale tomentose. ..... 16
Sixth metasomal tergum with apical margin with either median or lateral teeth or both; fifth tergum with, at most, inconspicuous pale tomentum across base ..... 17
16(15). Sixth metasomal tergum with carina or transverse ridge entirely laterad of the definite median emargination; mandible with indistinct tooth between the definite apical and median teeth
Sixth metasomal tergum with carina usually denticulate laterally, conspicuous; mandibles definitely tridentate (Palaearctic subgenus, introduced into the United States) . Eutricharaea
17(15). Seventh metasomal tergum produced medially to conspicuous spinelike projection; lateral teeth of apical margin of sixth metasomal tergum conspicuous, median ones not evident; fifth metasomal tergum entirely lacking pale tomentum Sayapis
Seventh metasomal tergum not conspicuously protuberant medially; apical margin of sixth metasomal tergum with evident, although small, median and lateral teeth, median pair carinate, lateral ones acute; fifth metasomal tergum often with narrow band of pale tomen- tum basally . .Litomegachile
18(4). Fourth metasomal sternum with small but distinct median tubercle on apical margin; large robust species, front tarsi broadly dilated but only slightly excavated anteriorly.
Fourth metasomal sternum not tuberculate ..... 19
19(18). Proboscis very long, second segment of labial palpi 1.7 to 4 times length of first .
Megachiloides
Proboscis shorter, second segment of labial palpi at most 1.5 times length of first ..... 20
20(19). Second segment of labial palpi at least slightly longer than first; fifth metasomal sternum with a robust, basal, median, apically directed spinelike projection. . . . . DerotropisFirst and second segments of labial palpi subequal in length; fifth metasomal sternum usuallylacking in a basal median projection.Xeromegachile
Females

1. Metasoma parallel-sided; narrow, slender species ..... 2
Metasoma cordate or ovoid. ..... 3 ..... 3
2(1). Mandibles with a cutting edge between the two median teeth; claws each with a sharp basaltooth, basal grooves of metasomal terga not fasciate; apex of sixth metasomal tergumgradually concave; maxillary palpi neither densely nor conspicuously pubescent. . Sayap is
Mandibles lacking definite cutting edge; claws without sharp basal teeth; basal grooves ofmetasomal terga often fasciate; maxillary palpi densely pubescent; sixth metasomal tergumusually abruptly concave or grooved apically . . . . . . . . . . Chelostomoides
3(1). Mandibles with five well-defined teeth ..... 4
Mandibles with three or four teeth, or obscurely five dentate. ..... 7
4(3). Mandibular teeth not with two apical teeth separated from three inner ones by rather longcutting edge; middle basitarsi usually somewhat longer than middle tibiae; species withpale metasomal fasciae5

# Mandibles with two apical teeth separated from three inner ones by rather long cutting edge; middle basitarsi as long as middle tibiae, robust black species <br> Melanosarus 

5(4). Metasoma more cordate; emargination between second and third mandibular teeth much shal-
lower than that between third and fourth. . . . . . . . . . . . . . . . . . .
Metasoma more ovoid; emargination between second and third mandibular teeth as deep as,
or deeper than, that between third and fourth . . . . . . . Megachile, sensu stricto
6(5). Sixth metasomal tergum broad and short, broadly rounded apically, with pubescence erect nearly to tip; sixth sternum not at all protruding beyqnd apex of tergum . . Xanthosarus
Sixth metasomal tergum rather long, apex narrowly rounded or subtruncate, pubescence of apical half appressed; sixth sternum slightly exceeding the tergum . . . . Pbaenosarus
7(3). Mandibles distinctly or obscurely quadridentate, without a long cutting edge as in Derotropis
Mandibles tridentate, with two apical teeth and a very long cutting edge extending to the inner angle . . . . . . . . . . . . . . . . . . . . . . . Derotropis
8(7). Proboscis of usual length, second segment of labial palpus but little, if any, longer than
first; mandibles distinctly quadridentate . . . . . . . . . . . . . . . 9
Proboscis very long, second segment of labial palpus 1.7 to 4 times as long as first; third mandibular tooth vestigial, a short cutting edge between it and inner angle. Megachiloides

9(8). Innermost mandibular tooth either rounded or broadly and sharply truncate, not acute . . 10
Innermost mandibular tooth acute.
12
10(9). Larger forms ( 12 mm . or more) with much longer and denser pubescence; sixth metasomal tergum with abundant erect pubescence visible in profile
Smaller forms ( 9 mm . or less) with short pubescence; metasoma rather acutely pointed; pubescence of sixth metasomal tergum appressed in large part; with short, suberect hairs visible toward base in profile
. Neomegachile
11(10). Lateral ocelli considerably nearer to posterior edge of vertex than to eyes; innermost mandibular tooth broadly truncate

Cressoniella
Lateral ocelli usually nearer to eyes than to edge of vertex, but, if not, innermost mandibular tooth rounded . . . . . . . . . . . . . . . . . . . . Delomegachile
12(9). Metasomal sterna lacking apical fasciae
Metasomal sterna with definite pale apical fasciae beneath scopa
Eutricharaea
13(12). Emargination between third and fourth mandibular teeth slightly angulate, giving an approach to the five-toothed condition. (Pubescence of sixth metasomal tergum mostly or entirely appressed.

14
Emargination between third and fourth mandibular teeth evenly concave . . . . . . 15
14(13). Meta soma nore ovoid; sixth metasomal tergum distinctly concave in profile; clypeal margin with median incurved area

Megachile, sensu stricto
Metasoma more cordate; sixth metasomal tergum at most but slightly concave in profile, usually straight, clypeal margin straight . . . . . . . . . . . .Litomegachile
15(13). Sixth metasomal tergum distinctly concave in profile . . . . . . . . . . . . 16
Sixth meta somal tergum straight in profile . . . . . . . . . . . . . . . . 18
16(15). Sixth metasomal tergum with abundant erect pubescence visible in profile . . . . . 17
Sixth metasomal tergum with no erect hairs visible in profile, uniformly and entirely covered with fine pale tomentum
. Argyropile
17(16). Clypeal margin denticulate . . . . . . . . . . . . . . . . .Delomegachile
Clypeal margin entire . . . . . . . . . . . . . . . . . . .Litomegachile
18(15). Sixth metasomal sternum largely bare or but thinly pubescent, usually with bare rim or ridge extending beyond or above apical fringe of short hairs

Sixth metasomal sternum densely pubescent, without apical bare rim or ridge. .Xeromegachile
19(18). Apical rim of sixth metasomal sternum not reflexed upward or forward . . . . . . . 20
Apical rim of sixth metasomal sternum reflexed upward or forward . . . . . . Argyropile
20(19). Third mandibular tooth truncate, without a cutting edge between it and second tooth . . 21
Third mandibular tooth acute, an incomplete cutting edge between it and second tooth .
$P$ seudocentron
21(20). Apical rim of sixth metasomal sternum very inconspicuous; cheeks narrower than eyes, vertex very narrow behind eyes and lateral ocelli; third mandibular tooth broadly truncate

Apical rim of sixth metasomal sternum definite and rather conspicuous, cheeks below subequal in width to eyes; vertex broader behind eyes and ocelli.

Acentron

## Genus Coelioxys Latreille

Like Megachile, this genus lacks arolia, but is readily distinguished from Megachile by the produced and acute axillae. The thorax is robust, but the metasoma tapers posteriorly and is quite elongate. Additionally, Coelioxys has the eyes hairy in the American species, a character not shared by Megachile.

This genus is world-wide in distribution and is parasitic in the nests of other bees, principally those of the genus Megachile. The females lay their eggs in the Megachile cells, and the young larvae destroy the young Megachile, then feed on the stores provided by the Megachile.

There has been no recent work on the California species, but useful keys will be found in the works of Crawford (1914) and Cockerell (1925).

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6

## variolosa


13
cressoni

## occidentalis

8

micropthalma
9

10

cressoni

cressoni

micropthalma


17
variolosa
15

> carinata

## 16

occidentalis

Plate 12. Heriades. Figs. 6-10, profile of first metasomal stemum of male, with apex of the sternum to the left. Fig. 11, sixth metasomal sternum of Heriades occidentalis. Figs. 12-17, females, lower part of face.


Plate 13. Chelostoma (figs. 18-33), Diceratosmia (figs. 24, 25), and Chelostomopsis (fig. 26). Figs. 18-23, males, apex of seventh metasomal tergum. Fig. 24, female, lower part of face of Diceratosmia subfasciata subfasciata (Cresson). Fig. 25, male, apex of metasoma in dorsal view of Diceratosmia subfasciata subfasciata (Cresson). Fig. 26, head as seen from in front of female Cbelostomopsis rubifloris (Cockerell).



28 fulgida


29 howardi



34 truncata


Plate 14. Hoplitis. Figs. 27-35, antennae of males, with different views of apical segment of some. [227]



37 grinnelli



38 producta producta


Plate 15. Hoplitis. Figs. 36-41, antennae of males, with different views of apical segment of some.

howardi

bunocephala
44

bullifacies

linsdalei

hypocrita


producta panamintana

producta producta

Plate 16. Hoplitis. Figs. 42-50, males, apex of metasoma in dotsal view. [229]


albifrons

plagiostoma

laevibullata


Plate 17. Hoplitis. Figs. 51-59, males, apex of metasoma in dorsal view.


71

anthodyta anthodyta

robustula

copelandica

rubrella rubrella

72

panamintensis

75

triodonta triodonta

78

enceliae mortua

81

enceliae enceliae

73

namatophila

76

segregata

79

rupestris

82

nitidivitta

Plate 19. Anthocopa. Figs. 71-82, females, apex of mandible.


83
anthodyta


86
triodonta triodonta


89
enceliae enceliae


84
robustula


87
mirifica

90

rupestris


85 nitidivitta


88
panamintensis


## 91

copelandica

hamulicornis

94

caudex


96

boharti
jacintano


9
semirubra


万
jacintana

Plate 21. Proteriades. Figs. 92-97, antennae of males. Figs. 98-99, females, apex of mandible. Fig. 100 , male, apex of mandible.
[234]


101
caudex


102
semirubra


105
boharti



109
hamulicornis


103
bidenticauda


104
deserticola
pygmaea



107


112
cactorum cactorum


113
californica
foxiella

## cubiceps cubiceps


119
clypeodentata


118
timberlakei solida


121
erema


122
salviae

Plate 23. Asbmeadiella. Figs. 112-122, females, lower part of face.
[236]

123

cazieri

breviceps

124

sculleni
eurynorhyncha
128

rhodognatha

131

bucconis bucconis

132 nor
prosopidis

136
nos
californica

127
inyoensis

sonora

133
femorata

137
Gor
opuntiae

140 ~
salviae

141 ~

## austrolis

Plate 24. Ashmeadiella. Figs. 123-129, females, lower part of face. Figs. 130, 131, females, lateral view of head. Figs. 132-141, males, apex of seventh metasomal tergum.
[237]

# Index to the California Megachiline Bees 

## (Synonyms are in italics)

abjecta (Anthocopa), 96, 97, 99
Acanthosmioides, 155, 218
Acentron, 219, 222
Acrosmia, 8, 46, 48, 78
albicinctum (Chelostoma), 27
albifrons (Hoplitis), 46, 54, 81, 83
albomarginata (Anthocopa), 123, 125
Alcidamea, 3, 8, 46, 48, 54, 74, 75
alta (Anthocopa), 97, 99, 101, 103
altadenae (Ashmeadiella), 155, 157, 166
Andronicus, 46, 47
anodontura (Anthocopa), 109
Anthocopa, 1, 8, 10, 94, 129, 153
anthodyta (Anthocopa), 97, 99
arefacta (Anthocopa), 125, 126
argentifrons (Hoplitis), 83
Argyropile, 220, 221, 222
aridula (Ashmeadiella), 156, 159, 182, 183
arizonensis (Ashmeadiella), 192
Arogochila, 154, 195
Ashmeadiella, $1,3,8,10,48,54,94,153,154$, 155
asteris (Heriades), 14
astragali (Ashmeadiella), 153, 183, 184
Atoposmia, 3, 8, 94, 96, 103, 107
attonita (Proteriades), 137
australis (Ashmeadiella), 154, 195, 197, 209
barbatus (Heriades), 14
barberi (Ashmeadiella), 197, 199
basalis (Ashmeadiella), 159, 160
basingeri (Proteriades), 132, 139, 141
beameri (Anthocopa), 109
bequaerti (Anthocopa), 99
bernardina (Hoplitis), 60, 62, 65, 69
bernardinum (Chelostoma), 26, 29
bidenticauda (Proteriades), 130, 134, 145, 149
bigeloviae (Ashmeadiella), 153, 155, 157, 172
biscopula (Ashmeadiella), 154, 193
biscutellae (Hoplitis), 46, 75, 77
boharti (Proteriades), 131, 141, 149
brachyodonta (Hoplitis), 46, 56, 74
breviceps (Ashmeadiella), 192, 211
bucconis (Ashmeadiella), 153, 155, 157, 166
bullifacies (Hoplitis), 48, 52
bunocephala (Hoplitis), 48, 49
cactorum (Ashmeadiella), 156, 157, 160
californica (Ashmeadiella), 153, 156, 157, 186, 192
californicum (Chelostoma), 26, 27
carinata (Heriades), 14, 16, 18, 24
caudex (Proteriades), 131, 133, 145
cazieri (Ashmeadiella), 196, 197, 208
ceanothi (Chelostomopsis), 37
Cephalosmia, 218
Chalcosmia, 218
Chelostoma, 1, 8, 10, 24, 37, 96
Chelostomoides, 219, 222
Chèlostomopsis, $1,8,10,37$
Chilosima, 154, 213
Cblorosmia, 81
cismontanica (Ashmeadiella), 179, 180
clypeata (Ashmeadiella), 193
clypeata (Hoplitis), 54
clypeodentata (Ashmeadiella), 196, 197, 205
cockerelli (Ashmeadiella), 156, 192
cockerelli (Chelostoma), 26, 32, 67, 96
Coelioxys, $1,8,10,222$
colei (Hoplitis), 56, 67, 74, 96
conjunctoides (Diceratosmia), 217
copelandica (Anthocopa), 123
coquilletti (Ashmeadiella), 187
Corythochila, 154, 195, 196, 211
crassa (Ashmeadiella), 182
cressoni (Heriades), 14, 16
Cressoniella, 219, 221
cryptanthae (Proteriades), 131, 132, 145
cubiceps (Ashmeadiella), 156, 193
Cubitognatha, 154, 195, 196, 215
curriei (Ashmeadiella), 159, 160
cylindrica (Hoplitis), 46, 54
Cyrtosmia, 46, 54, 74, 75
daleae (Anthocopa), 109
Dasyosmia, 3, 8, 46, 47, 48, 54, 75
Delomegachile, 219, 220, 221
denticulata (Ashmeadiella), 166
Derotropis, 220, 221
deserticola (Proteriades), 130, 132, 149
Diceratosmia, 1, 10, 44, 215, 218
difugita (Ashmeadiella), 156, 157, 159, 180
dolichosoma (Chelostoma), 27
echinocerei (Ashmeadiella), 160
edwardsii (Chelostomopsis), 37
elongata (Anthocopa), 96, 97, 103
elongaticeps (Hoplitis), 56, 67, 69, 74
emarginatula (Ashmeadiella), 180, 182
enceliae (Anthocopa). 109, 110, 117, 119
erema (Ashmeadiella), 154, 197, 208
Eremosmia, 3, 8, 94, 107, 109
eurynorhyncha (Ashmeadiella), 195, 197, 205
Eutricharaea, 219, 220, 221
evansi (Proteriades), 132, 151
femorata (Ashmeadiella), 153, 155, 157, 170
florissantensis (Ashmeadiella), 187
Formicapis, 8, 44, 47, 48, 54
foveata (Ashmeadiella), 156, 159, 177
foxiella (Ashmeadiella), 196, 197, 199
fulgida (Hoplitis), 46, 81, 83, 90
gillettei (Ashmeadiella), 156, 159, 179
glomerans (Heriades), 18
gracilior (Heriades), 16, 18
gracilis (Hoplitis), 46, 60, 62, 67, 69
grinnelli (Hoplitis), 46, 56, 69, 71, 74
baematopoda (Ashmeadiella), 175, 177
hamulicornis (Proteriades), 131, 134, 145, 147
hebitis (Anthocopa), 96, 97, 106, 107
hemizoniae (Anthocopa), 107, 109, 110, 112, 121
Heriades, 1, 8, 10, 11, 44
besperia (Hoplitis), 49
hesperius (Andronicus), 85
Hexosmia, 8, 94, 123
holti (Ashmeadiella) 213, 215
Hoplitina, 8, 47, 48
Hoplitis, 1, 8, 10, 44, 94, 96, 129
howardi (Hoplitis), 48, 49
hurdiana (Anthocopa), 109, 110, 112, 121, 123
hypocrita (Hoplitis), 46, 74
hypostomalis (Anthocopa), 109, 110, 113
incanescens (Proteriades), 8, 129, 131, 133, 134, 135
incisuloides (Chelostoma), 36, 37, 38
incisulum (Chelostoma), 26, 27, 36
interior (Hoplitis), 60, 69
inyoensis (Ashmeadiella), 196, 211, 213
jacintana (Proteriades), 129, 130, 132, 151
laevibullata (Hoplitis), 78, 81
lateralis (Ashmeadiella), 196, 202
lawae (Hoplitis), 90
leachi (Ashmeadiella), 197, 199
Leptorachis, 220, 222
leucozona (Ashmeadiella), 156, 157, 177
linsdalei (Hoplitis), 48, 52
Litomegachile, 220, 221
louisae (Hoplitis), 81, 83, 88
macswaini (Anthocopa), 121
mallognatba (Anthocopa), 119
marginatum (Chelostoma), 26, 27, 36, 37
maryae (Anthocopa), 109
maura (Hoplitis), 46, 83, 85
mazourka (Hoplitis), 48, 52
Megachile, 1, 8, 10, 219
Megachiloides, 220, 221
Melanosarus, 219, 221
Melanosmia, 218
meliloti (Ashmeadiella), 156, 159, 182, 183
mesae (Hoplitis), 99
mescalerium (Hoplitis), 60
micropthalma (Heriades), 11, 14
minutum (Chelostoma), 26, 34
mirifica (Anthocopa), 109, 110, 117, 119
mojavensis (Hoplitis), 48, 52
Monumetha, 3, 8, 46, 74, 81
mortua (Anthocopa), 117, 119
namatophila (Anthocopa), 109, 110, 121
nanula (Proteriades), 132, 133, 141
nanus (Chelostomopsis), 209
Neomegachile, 219, 221
Neotrypetes, 11
nevadensis (Proteriades), 135
nigra (Ashmeadiella), 160
nigra (Proteriades), 139
nigrella (Proteriades), 132, 133, 137
nigrior (Anthocopa), 99
nitidivitta (Anthocopa), 109, 110, 112
Nothosmia, 155, 218
occidentalis (Heriades), 14, 16, 22
odontophora (Heriades), 14
odontura (Chelostoma), 27
opuntiae (Ashmeadiella), 153, 156, 157, 192
oregona (Anthocopa), 96, 97, 101
Osmia, 1, 8, 10, 94, 155, 215, 217, 218
palmarum (Proteriades), 130, 133, 139
panamintana (Hoplitis), 60, 62, 65
panamintensis (Anthocopa), 96, 101, 103
paroselae (Hoplitis), 75, 77
pentamera (Hoplitella), 49
perissocera (Hoplitis), 78, 81
phaceliae (Chelostoma), 26, 29
phaceliarum (Anthocopa), 123, 126
Phaenosarus, 220, 221
Phaeosmia, 107, 109
Physostetha, 11, 14
plagiostoma (Hoplitis), 78, 81
platyura (Hoplitis), 90
Prochelostoma, 8, 10, 24
producta (Hoplitis), 44, 46, 56, 57, 60, 62, 69
productus (Heriades), 14
prosopidis (Ashmeadiella), 153, 156, 159, 161
Proteriades, 1, 3, 8, 10, 48, 94, 129, 130, 153
Pseudocentron, 219, 222
punctata (Diceratosmia), 215
purpurascens (Heriades), 14
pycnognatha (Anthocopa), 96, 97, 106, 107
pygmaea (Proteriades), 132, 133, 143
reducta (Proteriades), 131, 134, 143
remotula (Proteriades), 8, 129, 131, 133, 134
rhodognatha (Ashmeadiella), 213
rhodopus (Ashmeadiella), 175, 177
Robertsonella, 8, 44, 46, 47, 48
robustula (Anthocopa), 109, 110, 112
rotundiceps (Heriades), 166
rubifloris (Chelostomopsis), 37
rubra (Ashmeadiella), 179
rubrella (Anthocopa), 109, 110, 112, 121
rubrior (Anthocopa), 121, 123
rufina (Hoplitis), 48, 78, 81
rufipes (Ashmeadiella), 156, 157, 175, 177
rufitarsis (Ashmeadiella), 155, 156, 157, 166
rufiventris (Ashmeadiella), 179
rupestris (Anthocopa), 109, 110, 112
salviae (Ashmeadiella), 154, 196, 197, 208
sambuci (Hoplitis), 46, 56, 57
Sayapis, 219, 220
schwarzi (Ashmeadiella), 161
sculleni (Ashmeadiella), 197, 199
segregata (Anthocopa), 109, 110, 115
seminigra (Proteriades), 129, 132, 134, 137, 139, 145
semirubra (Proteriades), 131, 132, 150
septentrionalis (Hoplitis), 71, 72
shastensis (Anthocopa), 105, 106
sierraensis (Ashmeadiella), 187, 189
similis (Proteriades), 129, 133, 139
simplicior (Ashmeadiella), 205
solata (Anthocopa), 107
solida (Ashmeadiella), 199, 200, 202
sonora (Ashmeadiella), 156, 159, 163
sparsa (Proteriades), 141, 143
stenognatha (Ashmeadiella), 196, 197, 205
subangusta (Ashmeadiella), 161
subfasciata (Diceratosmia), 2, 215
subgracilis (Hoplitis), 60, 69
submaxima (Ashmeadiella), 192
tetramerum (Chelostoma), 26, 29
timberlakei (Anthocopa), 109, 110, 112
timberlakei (Ashmeadiella), 154, 196, 197, 199, 200, 205
timberlakei (Heriades), 16, 18
Titusella, 154, 155, 156, 192
titusi (Ashmeadiella), 155, 157, 172
tota (Proteriades), 135
triodonta (Anthocopa), 3, 96, 97, 103, 105, 106
tristis (Proteriades), 132, 133, 135
truicauda (Proteriades), 131, 134, 145, 147
truncata (Hoplitis), 56,60
truncativentris (Ashmeadiella), 172
usingeri (Anthocopa), 105
uvulalis (Hoplitis), 56, 57, 60, 69, 74
variolosa (Heriades), 11, 14
viguierae (Anthocopa), 109, 110, 112, 119
viridimicans (Hoplitis), 83, 90
washingtonensis (Ashmeadiella), 197, 199, 213
wislizeni (Ashmeadiella), 166
Xanthosarus, 219, 221
xenomastax (Ashmeadiella), 196, 215
Xeromegachile, 220, 222
xerophila (Proteriades), 130, 133, 147
Xerosmia, 94
yosemitensis (Proteriades), 137, 139

## Index to the Floral Visitational Records

Acacia greggii, 163, 173, 183, 217
Acamptop appus, 182
Achillea millefolium, 62
Adenostoma fasciculatum, 166
Allium, 85
Allium dieblii, 94
Ambrosia psilostachya, 170
Amorpha, 14, 217
Amorpha fruticosa, 59, 62, 217
Amsinckia, 37
Amsinckia douglasiana, 75
Angelica tomentosa, 22
Anthemis cotula, 170
Apocynum, 85
Arbutus menziesii, 41
Arctostaphylos, 40, 42
Arctostaphylos drupacea, 42
Arctostaphylos nevadensis, 42, 85
Arctostaphylos patula, 42
Asclepias, 134, 163, 173, 187
Asclepias eriocarpa, 59
Asclepias galioides, 175
Asclepias syriaca, 22
Asclepias tuberosa, 160
Aster, 168, 189
Aster adscendens, 189
Aster adscendens var. yosemitanus, 188
Aster canescens, 16, 18
Aster parishii, 16
Aster tephrodes, 168
Astragalus, 62, 64, 75, 85, 112, 115, 154, 202
Astragalus antisellii, 59, 75
Astragalus bolanderi, 65, 202
Astragalus coulteri, 115
Astragalus fremontii, 72, 112, 179
Astragalus goniatus, 75
Astragalus parishii, 65, 75
Astragalus pomonensis, 75
Astragalus tener, 75
Baileya, 170
Baileya multiradiata, 161, 166, 168, 182
Baptisia, 60
Brassica, 209
Brassica campestris, 75
Brauneria, 170
Brauneria pallida, 170
Brodiaea laxa, 29
Callirrboë involucrata, 170
Calyptridium umbellatum, 64, 78

Castilleia, 42, 64, 69, 161
Ceanothus, 41, 42, 72
Ceanothus cuneatus, 42
Ceanothus integerrimus, 42
Ceanothus parvifolius, 42
Centromadia, 93
Centromadia pungens, 186
Cercidium floridum, 115, 170
Cercidium torreyanum, 170, 172, 173, 177, 179, 180, 205, 208, 213
Cercis canadensis, 217
Cercocarpus ledifolius, 42
Cbamaebatia foliolosa, 40
Chaenactis, 195, 200
Chaenactis carphoclinia, 117, 180
Cbaenactis glabriuscula, 74, 168
Chaenactis stevioides var. brachypappa, 177
Chaenactis xantiana, 215
Cbilopsis, 183
Chilopsis linearis, 161, 183
Chorizanthe staticoides, 41, 71
Cbrysolepis, 189
Cbrysopsis, 18
Chrysopsis fastigiata, 182
Chrysothamnus, 18, 168, 170, 188
Cbrysothamnus pumilis, 16, 18
Chrysothamnus viridulus, 18
Cirsium, (14), 59, 85
Clarkia elegans, 64, 88
Cleome, 60, 183
Cleome serrulata, 22, 85
Cleomella, 173
Cleomella obtusifolia, 173, 175, 183
Coldenia palmeri, 172
Collinsia 92
Collinsia bicolor, 40
Collinsia tinctorum, 63
Collinsia torreyi, 63, 71, 177
Collinsia wrighti, 125
Compositae, 40, 57, 94, 109, 153, 170, 175
Convolvulus arvensis, 18
Cordylanthus nevinii, 160, 161
Coreopsis lanceolata, 168
Craetegus, 62
Crusea subulata, 183
Cryptantha, 3, 8, 30, 34, 40, 41, 42, 59, 63, 71, $72,92,129,130,134,139,143,145,147,150$, $151,153,160,161,182,183,195$
Cryptantha angustifolia, 137, 139, 143, 149, 213
Cryptantba barbigera, 52, 115, 139, 143, 149, 150, 153, 175, 211

Cryptantha flaccida, 29, 143, 151
Gryptantha inaequata, 143, 160
Cryptantha intermedia, $24,30,32,37,41,42,49$, $71,72,87,92,93,126,129,134,137,139$, $141,143,145,150,151,153,168,173,175$, $180,183,188,200$
Cryptantha micrantha, 42, 137, 145, 147, 151, 183
Cryptantha micrantha var. lepida, 143, 153, 161
Cryptantha muricata var. denticulata, 153
Cryptantha racemosa, 71, 137
Dalea, 67, 154, 177, 182, 205, 208, 213
Dalea argyraea, 160, 183
Dalea californica, 115, 200, 213, 215
Dalea emoryi, 175, 205
Dalea formosa, 179, 183
Dalea fremontii, 67, 72, 77, 112, 115, 123, 160, 170, 172, 205, 208, 213
Dalea mollis, 123, 175
Dalea neomexicana, 215
Dalea pogonathera, 160, 183
Dalea polyadenia, 77, 115, 184, 213, 215
Dalea saundersii, 115,215
Dalea schottii, 115, 213, 215
Dalea spinosus, 175
Delpbinium, 40
Dicentra, 65
Dicentra chrysantha, 59
Dipetalia linifolia, 211
Diplacus aurantiacus, 179
Draperia systyla, 34
Echinocactus, 192
Echinocactus cylindraceus, 192
Echinocereus engelmannii, 192
Encelia, 119, 168, 179, 195
Encelia actoni, 119
Encelia californica, 168
Encelia farinosa, 77, 117, 119, 121, 161, 168, 188
Enceliopsis argophylla var. grandiflora, 119
Ericameria teretifolia, 168
Erigeron, 18, 30, 85
Erigeron divergens, 34, 161, 168
Erigeron foliosus, 18
Erigeron foliosus var. stenophyllus, 16, 30, 168, 187, 188
Erigeron miser, 177
Erigeron philadelphicus, 14, 62
Eriodictyon, 24, 32, 37, 40, 42, 63, 67, 86, 87, 90, 96
Eriodictyon californicum, 27, 42, 65, 75
Eriodictyon crassifolium, 37, 57
Eriodictyon trichocalyx, 22, 27, 32, 34, 6.7, 87, 112, 180, 200
Eriogonum, 24, 30, 57, 65, 71, 86, 88, 143, 151, $175,182,183,188$

Eriogonum elongatum, 18
Eriogonum fasciculatum, 24, 72, 161, 180, 188, 215
Eriogonum jasciculatum var. polifolium, 173
Eriogonum gracile, 166, 182
Eriogonum nudum, 16
Eriogonum trichopes, 163, 173, 175
Eriogonum wrightii subscaposum, 161
Eriophyllum, 16
Eriophyllum multicaule, 150
Eucnide urens, 71
Eupatorium occidentale; 188
Euphorbia, 175
Eupborbia albomarginata, 18
Euphorbia polycarpa var. birtella, 163
Fragaria californica, 41
Fragaria vesca, 94
Frasera parryi, 24
Gaillardia, 217
Gaillardia pulcbella, 170, 217
Gayophytum diffusum, 64
Gayophytum ramosissimum, 16
Gentiana parryi, 94
Geraea canescens, 77, 173, 179
Geranium, 85, 94
Geranium caespitosum, 94
Geranium fremontii, 85
Geranium maculatum, 62
Geranium richardsonii, 16
Gilia, 36, 40, 60, 62, 85, 180
Gilia exilis, $30,32,42,64,65$
Gilia multicaulis, 188
Gilia tricolor, 36
Glycyrrbiza lepidota, 65
Grindelia, $14,18,75,168,170,182,187,189$
Grindelia camporum, $166,187,188$
Grindelia elata, 188
Grindelia nana, 170, 189
Grindelia squarrosa, 170
Gutierrezia, 18
Gutierrezia californica, 16, 161, 168, 173, 182, 188
Gutierrezia lucida, 168, 182, 183
Gutierrezia sarothrae, 14
Haplopappus, 195
Haplopappus gracilis, 18
Helenium bigelovii, 16
Helenium laciniatum, 170, 175
Helenium tenuifolium, 217
Helianthus, 14, 22, 40, 57, 65, 168, 170, 189, 217
Helianthus gracilentus, 121, 172, 179
Helianthus petiolaris, 62, 170
Heliopsis belianthoides, 14, 170

Heliotropium, 163, 172, 173, 184, 186, 213, 217
Heliotropium curassavicum, 74, 163, 172, 173, 175, 179
Heliotropium curassavicum var. obovatum, 186
Heliotropium curassavicum var. oculatum, 179, 180, 182, 183, 184, 186, 217
Hemizonia, 188
Hemizonia paniculata, 121
Heterotheca grandiflora, 168, 188
Horkelia, 42
Hosackia rosea, 161
Hugelia virgata, 67, 71, 163, 173, 180, 182, 188
Hymenopappus flavescens, 173
Hyptis emoryi, 77, 119, 170, 211
Iris missouriensis, 87
Isocoma acradenia, 168, 173
Isocoma veneta, 168
Isomeris arborea, 173
Lactuca pulchella, 170
Lappula, 93
Larrea, 77, 78, 149, 163, 170, 211
Larrea glutinosa, 72, 77, 112, 170, 172, 173, 175, 211
Lathyrus, 75
Layia, 40
Layia glandulosa, 57
Layia platyglossa, 27
Lepidium mantanum, 183
Lesquerella, 62, 217
Lessingia leptoclada, 189
Linum, 72
Lomatium dasycarpum, 37
Lonicera int errupta, 22, 59, 88
Lotus, 30, 32, 40, 49, 57, 59, 63, 64, 65, 67, 71, $72,74,75,86,154,183,184,186,189,200,202$
Lotus americanus, 183, 184, 188
Lotus argop byllus, 161, 200
Lotus arizonicus, 200
Lotus crassifolius, 74
Lotus davidsonii, 41, 42, 64, 87, 161, 173, 182, 183, 200
Lotus glaber, 42, 49, 59, 71, 72, 75, 161, 186, 200, 202
Lotus nevadensis, 63, 161, 202
Lotus scoparius, 40, 49, 57, 59, 63, 71, 72, 74, $75,86,161,166,172,200,217$
Lotus strigosus, 49, 71, 72
Lupinus, 41
Lupinus (silvery), 59
Lupinus breweri, 63
Lupinus concinnus, 71, 200
Lupinus formosus, 59
Lupinus odoratus, 112, 215
Lupinus paynei, 59, 75

Machaeranthera tanacetifolia, 217
Malacothrix, 179
Malacothrix glabrata, 126
Malva parviflora, 149
Malva silvestris, 14
Marilaunidium origanifolium, 217
Marrubium vulgare, 71, 92, 175, 183, 184, 217
Medicago sativa, 22, 59, 62, 75, 173, 187, 217
Melilotus, 14, 22, 42, 62, 163, 173, 180, 187, 195, 213
Melilotus alba, 14, 22, 175, 183, 186
Melilotus indica, 71
Melilotus officinalis, 22, 62, 217
Mentba, 14
Mentba canadensis, 14, 22, 62
Mentzelia albicaulis, 92
Mertensia franciscana, 85
Mimulus, 32, 34, 42, 64, 69, 92, 93, 160
Mimulus (dwarf red), 72
Mimulus (yellow), 29
Mimulus fremontii, 32, 34, 42, 65
Mirabilis laevis, 87
Monarda, 14, 22, 217
Monarda citriodora, 217
Monarda pectinata, 62
Monardella douglasii, 188
Monardella exilis, 172
Monardella lanceolata, 177
Monardella linoides var. stricta, 161, 209
Nama demissum, 52, 67, 112, 121, 143
Nama parryi, 30, 32, 40, 105, 183
Nama rothrockii, 85, 160, 202
Navarretia viscidula, 168, 188
Nemophila, 29, 34, 40, 44, 63, 78, 81, 86, 92, 93, 94, 126
Nemophila maculata, 41, 92
Nemophila menziesii var. integrifolia, 27, 29, 34 41, 87, 93, 126
Nemophila pulchella, 37
Nolina parryi, 24
Oenothera, 60
Olneya tesota, 163
Opulaster, 85
Opuntia, 18, 24, 85, (153), 192
Opuntia ecbinocarpa, 192
Opuntia megacarpa, 182, 192
Opuntia parryi, 192
Opuntia vaseyi, 192
Oxalis (yellow), 217
Palafoxia linearis, 112, 115, 175, 217
Parosela. See Dalea
Parthenocissus quinquefolia, 22
Pectis papposa, 163, 168, 173, 175

Pedicularis groenlandica, 85
Penstemon, 22, 32, 41, 59, 60, 62, 64, 65, 75, 94, 96, 105, 154, 183, 192, 209, 211
Pensteman((blue), 160
Penstemon (white), 199
Penstemon antirrbinoides, 107
Penstemon breviflorus, 40, 107, 209
Penstemon cordifolius, 65
Penstemon cyananthus, 72
Penstemon grinnellii, 65, 101, 161, 209
Penstemon beterophyllus, 106
Penstemon birsutus, 62
Penstemon labrosus, 105
Penstemon laetus, 37
Penstemon leonardi, 75
Penstemon palmeri, 101
Penstemon spectabilis, 59, 63, 65, 105
Penstemon ternatus, 161
Petalostemon, 170
Petalostemon candidus, 22
Petalonyx thurberi, 173, 175
Phacelia, 24, 27, 29, 30, 32, 34, 36, 37, 40, 42, $52,57,59,62,63,64,65,78,81,85,86,87$, $88,90,92,93,94,103,112,125,126,160$,
$161,187,188,199,200,202,217$
Pbacelia (wbite), 24, 27
Pbacelia brachyloba, 42
Phacelia californica, 30, 34, 40, 87
Pbacelia crenulata, 173
Phacelia dauidsonii, 27, 29, 34, 42, 64, 200
Phacelia distans, 27, 29, 30, 32, 34, 36, 37, 63, $64,72,87,92,93,112,125,126,179,215$
Phacelia dubia, 62
Phacelia fremontii, 52
Phacelia aff. fremontii, 52
Phacelia glandulosa, 85
Phacelia beteropbylla, 34, 86, 87, 92, 125, 161, 180, 200
Phacelia bispida, 29, 30, 37, 205
Phacelia bydropbylloides, 126
Pbacelia leucophylla, 85, 94
Phacelia linearis, 34, 62, 65, 74, 94
Phacelia minor, 37
Phacelia platyloba, 27, 36, 37, 71, 177, 205
Phacelia ramosissima, 30, 34, 71, 87, 92, 160, 161, 172, 182, 200
Pbacelia tanacetifolia, 29, 92
Pbotinia arbutifolia, 16
Plagiobothrys nothofulvus, 29, 42
Pluchea sericea, 163, 213, 217
Pogonia graminifolia, 60
Polygonum scandens, 22
Potentilla, 30, 93, 94
Potentilla glandulosa, 42, 59, 64, 85, 188
Potentilla gracilis, 16

Prosopis, 71, 163, 173, 177, 183, 205, 211, 213, 217
Prosopis chilensis glandulosa, 78, 163, 179, 182, 205, 213, 215
Prosopis juliflora, 217
Prunus, 217
Prunus melanocarpa, 94
Prunus pennsylvanica, 14
Pyrrbopappus multicaulis, 175, 183
R adicula nasturtium-aquaticum, 42
$R$ anunculus, 42, 87, 94
Ratibida, 14
Rbamnus crocea, 37, 40, 72, 209
Rbus, 217
Rbus trilobata, 37, 41, 92
Ribes roezlii, 42
Rosa, 85
Rubus, 60, 217
Rubus argutus, 62
Rubus deliciosus, 94
Rubus leucodermis, 59, 63
Salix, 57, 63, 217
Salix nigra, 163
Salvia, 40, 49, 154
Salvia carnosa, 27, 40, 74
Salvia columbariae, 37, 40, 107
Salvia mellifera, 37, 40, 57, 71, 208, 209
Salvia pachypbylla, 161
Sambucus, 75
Sambucus glauca, 60
Sedum stenopetalum, 179
Senecio, 18, 42, 85
Senecio douglasii, 168, 170, 189.
Senecio ionophyllus, 18
Sesuvium sessile, 172, 187
Sidalcea, 64
Sidalcea calycosa, 64
Sidalcea malvaeflora, 22
Sideranthus, 170
Solidago, 14, 18, 22, 62, 170, 184, 186, 189
Solidago californica, 16, 18, 24, 168, 182, 186, 202, 209
Solidago confinis, 16, 18
Solidago petradoria, 16
Solidago rigida, 14
Spbaeralcea, 77, 172, 195, 217
Sphaeralcea ambigua, 72, 78, 163, 172
Sphaeralcea fasciculatum, 92
Spiraea sorbifolia, 85
Stachys californica, 93
Stanleya pinnata, 57, 59, 74, 86
Stenotopsis linearifolius, 42, 77, 195
Stephanomeria, 22, 179, 188, 211
Stephanomeria exigua, 188

Taraxacum, 54
Teucrium depressum, 177
Tephrosia virginiana, 60,62
Tetradymia canescens, 22
Tetragonotheca ludoviciana, 170
Thelesperma gracile, 14
Trichostema lanatum, 32, 161
Trichostema laxum, 184
Trichostema ovutum, 59
Trifolium, 62, 72, 74, 92, 184, 202
Trifolium melananthum, 44
Trifolium tridentatum, 40
Trifolium variegatum, 64, 202

Verbena, 180
Verbena prostrata, 40, 189
Verbesina auriculata, 175
Vernonia, 14
Vicia, 22, 57, 60, 75, 85, 217
Vicia americana, 65
Viguiera multiflora var. nevadensis, 182, 192
Viguiera parishii, 119
Viola purpurea, 81
Wislizenia refracta, 173
Wyethia, 42


[^0]:    ${ }^{1}$ Prochelostoma occurs only in eastern North America and is not further considered in this study. For further details, see Michener (1938c).

[^1]:    ${ }^{2}$ The subgenera Andronicus and Robertsonella are unknown in the California region and are not treated elsewhere in this study.

[^2]:    ${ }^{3}$ Seen from the side of the body, this projection appears as a tooth. Actually, the middle coxae is produced ventrally, mesad and basad of the base of the trochanter, to form a small transverse rounded lamella.

[^3]:    ${ }^{4}$ The male of the subgenus Cuiditognatha has the lateral margins of the sixth metasomal tergum less strongly. convex than in Arogochila and might be run to Asbmeadiella and Titusella. It differs from males of Ashmeadiella and Titusella in the strongly emarginate apex of the labrum.

    In the keys to species, that to males of Arogochila includes also the species of Corytbochila, whereas the key to the males of Asbmeadiella proper includes also the males of Titusella.
    ${ }^{5}$ Except in A. (Titusella) biscopula Michener from Arizona, in which the clypeus is somewhat produced over the labrum and has what may be considered a very broad truncation.

[^4]:    ${ }^{6}$ The name echinocerei Cockerell is a synonym of cactorum. It was tentatively regarded as a distinct subspecies in 1939, but additional material from Arizona shows that the characters upon which it was recognized at that time vary too much within populations to be useful in subspecific recognition.

[^5]:    Males

    1. Labrum distinctly emarginate apically . timberlakei (p. 200)
    Labrum but slightly emarginate apically solida (p. 202)
[^6]:    ${ }^{7}$ Modified from that of Sandhouse (1939).

[^7]:    ${ }^{8}$ Modified from that of Michener (1944) which was in turn a modification of that of Mitchell (1934).

