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The Squash and Gourd Bees—
Genera *Peponapis* Robertson and
Xenoglossa Smith—
Inhabiting America North of Mexico
(Hymenoptera: Apoidea)

Paul D. Hurd, Jr., and E. Gorton Linsley

Bees of the genera *Peponapis* and *Xenoglossa* gather pollen exclusively from species of *Cucurbita* (squashes, gourds, pumpkins) and are represented in America north of Mexico by 11 species. The results of this study indicate that these bees are important and efficient pollinators. Since they are active before or shortly after sunrise, their role in the pollination of early morning flowering cucurbits has been poorly understood and scarcely appreciated. Nearly all species in the United States collect pollen from domestic as well as native species of *Cucurbita*, and in some instances their original distribution has been significantly altered following the development and introduction of domestic squashes by aboriginal man. The restriction of some of these bees to the pollen of certain species of *Cucurbita* suggests that the indigenous *Cucurbita foetidissima* may be involved in some way with the development of the domestic varieties by primitive man.

This study is a systematic revision of the bees of the genera *Peponapis* and *Xenoglossa* known to inhabit America north of Mexico and contains keys and descriptions for the identification of the species. Distributional, biological and synonymical data are provided together with discussions of the taxonomy and pollen sources of the species concerned.

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Frontispiece. Male of *Xenoglossa strenua* (top) and female of *X. angustior* (bottom) in staminate flowers of *Cucurbita foetidissima*.

The Squash and Gourd Bees—
Genera *Peponapis* Robertson and
Xenoglossa Smith—
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(Hymenoptera: Apoidea)¹

INTRODUCTION

THIS STUDY is intended primarily as a revision of the species belonging to the genera *Peponapis* and *Xenoglossa* known to inhabit America north of Mexico. These bees, whose females obtain pollen solely from the indigenous and domestic species of the genus *Cucurbita*, occur only in the Americas. The majority of the species of both bee genera are found in Mexico and Central America, presumably because the genus *Cucurbita* reaches its maximum development there. A few species of these bees are known from South America, but only the genus *Peponapis* occurs as far south as Argentina. No species of either genus has been discovered in the West Indies or for that matter on any of the other islands.

Although there is some evidence to support the contention of Cockerell (1906a: 104, 106; 1912: 265; *et seq.*) that *Peponapis* is a subgenus of *Xenoglossa*, we have followed recent classifications which treat these as independent genera (Michener, 1944, 1954; Moure and Michener, 1955; and La Berge, 1957). Almost certainly a more thorough knowledge of the Mexican and Central American species will contribute importantly to a solution of this problem.

Two species of *Peponapis* considered in the present study, *P. crassidentata* and *P. timberlakei*, exhibit certain features in the male which seem to indicate a very close relationship with *Xenoglossa*. These structures are discussed in the accounts of those species.

Although Jones and Rosa (1928) and Pammel and King (1930) regard the introduced honey bee as the most important pollinator of squashes and other species of *Cucurbita*, these claims are not supported by the field investigations which have led to the present report. Since the species of *Peponapis* and *Xenoglossa* obtain their pollen only from the genus *Cucurbita*, and since they forage early in the morning often before sunrise, their role in the pollination of these plants has been largely unappreciated (Bohart and Todd, 1961: 245). Several species are remarkably similar in appearance to the honey bee and when their bodies are dusted with *Cucurbita* pollen the resemblance is even more striking. It seems worthwhile to mention that the males of *Peponapis* and *Xenoglossa*, because of their curious habit of sleeping in closed, mostly staminate flowers of *Cucurbita*, are often liberally covered with pollen. This pollen is sometimes transported the fol-

¹ Submitted for publication August 5, 1963.

lowing morning to open flowers, including the pistillate flowers, as the males seek the females of their species. Whether such pollen is viable remains to be determined, but we do know that males visit flowers of both sexes on the morning on which they open, and there is no reason to doubt that the pollen attached to their body hairs is available to effect pollination.

In the United States, a number of investigators have found that one or more species of *Peponapis* or *Xenoglossa* are perhaps the most important pollinators of the genus *Cucurbita* in various localities (Smith, J. B., 1910:

694; Viereck, 1916:734; Fronk and Slater, 1956; and Linsley, 1960:13-17). Holmberg (1884:204) discovered long ago in Argentina that *Peponapis fervens* (Smith) is a regular visitor to the flowers of the Zapallo (*Cucurbita pepo*) and uses the pollen of that plant to provision the cells of its nest.

Since the squashes, pumpkins and other cultivated *Cucurbita* have been widely introduced into other parts of the world (Whitaker and Davis, 1962), a greater yield and higher quality of fruit might result in these areas if some of the bees of the genera *Peponapis* and *Xenoglossa* could also be introduced.

BIOLOGY

There is a surprising amount of biological information recorded in the literature about the bees of the genera *Peponapis* and *Xenoglossa*. Unfortunately much of this information is fragmentary and not infrequently it is hidden as a few sentences in various taxonomic treatments. A serious attempt has been made to retrieve, as it were, this information and incorporate it into the present report.

Patton (1879:473) was the first to determine the affinity of this group of bees for the pollen of the genus *Cucurbita*. He remarked: "The loose scopa [of *Peponapis pruinosa*] seems particularly adapted to retain the large, spiny globes which form the pollen of the pumpkin. In the blossoms of this plant these bees delight to revel." A few years later, Holmberg (1884:203) reported that *Eclectica cucurbitae* (currently *Peponapis fervens*) obtained pollen from the Zapallo (*Cucurbita pepo*). During a trip to Rio Lujan, Argentina, he found upon excavating a nest of this bee that the cell was provisioned with the pollen of *Cucurbita pepo*. Since that time, all of the species thus far studied of the genera *Peponapis* and *Xenoglossa* have been shown to collect pollen only from domestic and indigenous spe-

cies of the genus *Cucurbita*. The present study has revealed no exception to this pattern.

In an investigation of the insect pollinators of the family Cucurbitaceae, Nevkryta (1937) concluded that the adaptive features of the *Cucurbita* for insect pollination include: (1) heavy, large and adhesive pollen grains, (2) an adhesive stigma, (3) a large amount of high quality nectar, and (4) a large, showy corolla.

Unlike many insect-pollinated plants, species of *Cucurbita* make their pollen available very early, permitting exploitation in the morning hours preceding or just after sunrise. In addition, the period of pollen availability on any given day may be limited since the flowers wither and close more rapidly in relation to an accelerated increase of temperature. Since the pollen grains of *Cucurbita* are large, they require special manipulation for successful collection. The resultant set of circumstances has provided the parameters for the evolution of the specialized bees of the genera *Peponapis* and *Xenoglossa*. Bees of these genera share in common a number of adaptive features. These include the ability to fly at low temperatures and low light intensities, the successful

extraction and transport of *Cucurbita* pollen, and the derivation of their primary economy—both as adults and larvae—from the nectar and pollen of these plants.

The genera *Peponapis* and *Xenoglossa* often fly while it is still dark and apparently are initially oriented to the *Cucurbita* by olfaction. It is thought that this initial orientation is in response to the foetid odor emitted by most, if not all, *Cucurbita*. On a number of occasions foraging *Peponapis* and *Xenoglossa* have been heard in flight and located by flashlight as they explored plants which were not in bloom. However, at the same low light intensity, when visiting a plant which is in blossom, they fly rapidly and directly without hesitation from flower to flower. Thus at close range, apparently other senses are involved: probably visual, possibly auditory, and no doubt olfactory. It may be significant that to humans the leaves and stems smell foetid, but a collection of bees taken while gathering nectar or pollen or both emits a pleasant odor.

It is a common habit of squash and gourd bees, especially the males, to spend most of the day and a good part of the night in the wilted and closed flowers. As far as we have been able to determine, the bees seek shelter in a new flower each day before it wilts and closes completely. It is not unusual for them to cut, tear or force their way out of the flowers on very hot days. This is particularly evident when the closed blossoms containing these bees are not well shaded. Often it is expedient when searching for bees in the closed flowers to select wilted blossoms in the more shaded areas of the planting. In Mexico we have found that the milpas with the taller varieties of corn often provide the deepest shade and have a greater number of bees in closed squash flowers than are to be found in the blossoms of an open or sparsely shaded planting. Not infrequently we have been able to find bees during the heat of the day in closed

flowers situated well below the leaf surfaces of native and domestic *Cucurbita* which otherwise are fully exposed to the sun.

Cockerell (1896a:191–192) was the first to report that the bees of the genera *Peponapis* and *Xenoglossa* are to be found within the closed flowers of the genus *Cucurbita*. In opening the flowers of *Cucurbita foetidissima* at Mesilla, New Mexico, on a very hot and rather cloudy morning (June 21, 1896), he found that each fresh flower contained a single bee. Three species were represented in that collection which was made about 8:45 a.m. On the following day he returned to the locality about an hour earlier and found the bees active in the open flowers. In subsequent years these and other species of these bees have been found sleeping in the closed flowers of domestic and native species of *Cucurbita* (Bequaert, 1918:126; Bequaert, in Bradley, 1919:419; Bequaert, 1920:12; Cockerell, 1901:130; Linsley, 1960:16; Smith, J. B., 1910:694; and Viereck, 1916:734).

Most of the bees which spend the day and much of the night in closed flowers are males. At the beginning of the season and before nesting activities are commenced it is also not unusual to encounter females in the closed flowers. However, after nesting commences it is indeed rare to find them there. In exceptional cases two or more bees and sometimes males and females occupy a single closed flower, but the general situation is one male bee per flower. Sometimes in female flowers, two bees are found, one each in the upper and lower chamber separated by the pistillodium.

The closed flower seems to afford a readily available shelter except under the most rigorous environmental conditions. As mentioned earlier the flower can be rendered uninhabitable by high temperatures. On one occasion near Tehuacan, Mexico, a very heavy rainfall caused many of the males in the closed flowers to leave and seek protection from the rain in the pendant and tubu-

lar corollas of a *Proboscidea*. After the storm a number of males were found drowned in the closed squash flowers.

When *Peponapis* and *Xenoglossa* first emerge in the season, they seek nectar from *Cucurbita* after sunrise and settle into the base of the flower, curled around the staminate column in the male flowers or the style in the female flowers. Thus, early in the season before they construct nests, some non-pollen-collecting females may accumulate concentrations of pollen in the scopa.

It appears from the available data that some species of the genera *Peponapis* and *Xenoglossa* exhibit a preferential selection for the pollens of certain species of *Cucurbita* (tables 1, 2). It is interesting that nearly all the species of *Peponapis* and *Xenoglossa* in America north of Mexico collect pollen from most, if not all, species of domestic *Cucurbita*. It is equally interesting that a number of species of *Peponapis* (*P. crassidentata*, *P. michelbacherorum*, *P. pruinosa* and *P. utahensis*) apparently accept the pollen of the domestic *Cucurbita* in preference to the pollens of other than their normal native *Cucurbita* sources. Thus *P. pruinosa*, whose females appear to use only the pollen of the native *Cucurbita foetidissima*, readily gather the pollen of the various domestic *Cucurbita*, but apparently are unable to use those of the native *C. digitata* and *C. palmata* even though these plants occur abundantly within the geographic range of *P. pruinosa*. Similarly, *P. timberlakei*, which apparently does not collect pollen from the flowers of domestic *Cucurbita*, appears to be limited to the pollens of the native *C. digitata* and *C. palmata*. Our present evidence suggests that *P. timberlakei* will not use the pollen of *C. foetidissima* even when that plant occurs within its range. Two species of *Xenoglossa*, *X. angustior* and *X. strenua*, apparently are not so restricted. Both freely use the pollen of any native or domestic *Cucurbita* growing within their geographic ranges.

Although there is no documented information available, the geographic ranges of *Peponapis pruinosa*, *Xenoglossa kansensis* and *X. strenua* appear to have been altered significantly since the development of the domestic *Cucurbita*. All three freely use the pollen of the native *C. foetidissima* as well as that of the domestic *Cucurbita*. Two species (*P. pruinosa* and *X. kansensis*) appear to be limited to pollens of *C. foetidissima* and the domestic *Cucurbita*. Neither is known to utilize the pollens of other native *Cucurbita* even though some of these occur within their geographic ranges. This suggests that before the advent of the domestic *Cucurbita* both *P. pruinosa* and *X. kansensis* obtained their pollen only from the indigenous *C. foetidissima*. Since there are no *Cucurbita* native to the eastern United States (except *C. okeechobeensis* in Florida), it seems almost certain that the bees (*P. pruinosa*, *X. kansensis* and *X. strenua*) extended their eastern geographic limits from the eastern periphery of the range of *C. foetidissima* in the midwest to the eastern coast of the United States following the introduction of domestic *Cucurbita* in that region. In a similar fashion, *P. pruinosa* has moved northward beyond the geographic limits of native *Cucurbita*.

It appears significant that all species of *Peponapis* and *Xenoglossa* which use pollen of the native *Cucurbita foetidissima* are also able to freely utilize the pollen of domestic *Cucurbita*. This relationship suggests that *C. foetidissima* may be closely related to the domestic *Cucurbita*. The fact that *P. timberlakei*, which uses the pollens of the native *C. digitata* and *C. palmata*, is apparently unable to utilize the pollen of the domestic *Cucurbita* seems to strengthen this view.

The apparent restriction of *P. pruinosa* to the pollens of the native *C. foetidissima* and the domestic *Cucurbita* suggests that this bee has been associated with this gourd for a very long time. It appears from the data that the

TABLE 1
KNOWN POLLEN SOURCES OF THE SPECIES OF *XENOGLOSSA*
IN AMERICA NORTH OF MEXICO

Species of bee	Domestic <i>Cucurbita</i>	<i>Cucurbita</i> <i>foetidissima</i>	<i>Cucurbita</i> <i>digitata</i>	<i>Cucurbita</i> <i>palmata</i>
<i>X. angustior</i>	+	+	+	+
<i>X. crawfordi</i>	+	—	—	*
<i>X. kansensis</i>	+	+	*	*
<i>X. patricia</i>	?	+	—	*
<i>X. strenua</i>	+	+	+	+

* The plant does not occur within the known geographic range of the bee.

TABLE 2
KNOWN POLLEN SOURCES OF THE SPECIES OF *PEPONAPIS*
IN AMERICA NORTH OF MEXICO

Species of bee	Domestic <i>Cucurbita</i>	<i>Cucurbita</i> <i>foetidissima</i>	<i>Cucurbita</i> <i>digitata</i>	<i>Cucurbita</i> <i>palmata</i>
<i>P. crassidentata</i>	+	—	—	*
<i>P. limitaris</i>	+	*	*	*
<i>P. michelbacherorum</i>	+	—	—	*
<i>P. pruinosa</i>	+	+	—	—
<i>P. timberlakei</i>	—	—	+	+
<i>P. utahensis</i>	+	—	—	*

* The plant does not occur within the known geographic range of the bee.

present distribution of *P. pruinosa* is coextensive with *C. foetidissima* and exceeds the range of that gourd only through utilization of domestic *Cucurbita* plantings. Presumably in earlier times when the climate of western North America was less arid, *C. foetidissima* was much more uniformly and continuously distributed. It appears that during the formation of the deserts of the southwestern United States, the California and adjacent Baja California populations of *C. foetidissima* became geographically separated from the more eastern populations of that gourd. If this is so, it may explain certain observable differences between the populations of *P. pruinosa* in these two areas. It appears likely that the associated bee populations evolved in isolation to form the *P. angelica* population in California and the contemporary *P. pruinosa* population in the other areas. Geographic isolation of the bee populations apparently ended with the appearance of domestic *Cucurbita* in the region between Cali-

fornia and Utah. All evidence indicates that the domestic *Cucurbita* have provided the requisite pollen avenues which exist today between these formerly isolated populations. Even though there doubtless existed, as today, other indigenous *Cucurbita* in the deserts of California and Arizona, the bees were precluded because of their restriction to the pollen of *C. foetidissima*. Now that domestic *Cucurbita* are grown sparsely in some parts of this area there are already indications that a link will be established between the geographically separated *P. pruinosa* populations of *C. foetidissima*. As the records show, the California form of *P. pruinosa* has been collected in the desert at Westmorland. This may indicate that domestic *Cucurbita* plantings are providing an avenue of dispersal across a former pollen barrier. Likewise, recent collections of the California form of *P. pruinosa* in Nevada from domestic squash indicate another extension beyond the range of *C. foetidissima*.

As far as we have been able to determine, the occurrence of *P. pruinosa* beyond the northern limits of *C. foetidissima* is also a consequence of domestic *Cucurbita* plantings. For example, in California these bees are present in the north coast district. Since there are no native *Cucurbita* in this area, and since the bees are obtaining their pollen from domestic *Cucurbita*, we can only conclude that they moved northward in response to these cultivated plantings.

It is obvious from the foregoing discussion that a thoroughly detailed knowledge of the distribution and pollen sources of the bees belonging to the genera *Peponapis* and *Xenoglossa* is important. For this reason, in the species accounts, we have presented as completely as possible, a documentation of these data. Without this basis, future interpretive analyses could well be meaningless.

In a study of the bees of Panamá, Michener (1954:7) comments: "The Panamá list [of bees] contains several strictly oligolectic bees which belong to genera, the members of which collect pollen only from certain flowers. Thus all species of *Ancyloceles* and *Melitoma* of which the habits are known obtain pollen only from *Ipomoea*, while all species of *Peponapis* obtain pollen from *Cucurbita*. It may be worth the suggestion that these oligolectic bees arose in more arid regions, where competition for pollen is more intense, and later spread into the moist tropics."

There are numerous records in the literature which reveal that a wide variety of flowers—in addition to the genus *Cucurbita*—are visited by individuals of several species of the genera *Peponapis* and *Xenoglossa*. In our experience such flowers are visited for nectar only, but nevertheless these visits, by either the male or female bee, may result in the pollination of certain flowers. This occurs when the pollen of a nectar-visited flower comes into contact and incidentally adheres to the body, the vestiture or the appendages

of the visiting bee and is deposited later upon a receptive stigma. Although flowers with a wide range of structure and shape are visited for nectar, a significant proportion of our records for individual bees involves deep-corolla flowers, such as *Convolvulus*, *Ipomoea*, *Hibiscus*, and *Proboscidea*.

In North America, the flowers of the following plants are known to be visited, presumably for nectar, by males and/or females of one or more of the species of the genus *Peponapis*: *Althaea rosea*, *Asclepias speciosa*, *A. sullivanti*, *A. syriaca*, *Blephilia hirsuta*, *Canna* sp., *Cephalanthus occidentalis*, *Convolvulus arvensis*, *C. occidentalis*, *C. sepium*, *Cosmos bipinnatus*, *Cynara cardunculus*, *Eupatorium rugosum*, *Helenium hoopesii*, *Helianthus annuus*, *H. petiolaris*, *Hibiscus moscheutos*, *Ipomoea hederacea*, *I. pandurata*, *I. purpurea*, *Lactuca* sp., *Lagenaria siceraria*, *Luffa cylindrica*, *Medicago sativa*, *Mentha spicata*, *Momordica* sp., *Petalostemum* sp., *Pontederia* sp., *Proboscidea* spp., *Silphium integrifolium*, *Tecoma stans*, and *Verbena stricta*.

In South America, *Peponapis fervens* (Smith), which presumably collects pollen from domestic squash (*Cucurbita pepo*) (Holmberg, 1884:204; Jensen-Haarup, 1908:102; Jörgensen, 1909:61; 1912b:152; 1912a:318), has been recorded as visiting the flowers of: *Baccharis marginalis* var. *coerulescens*, *Justicia tweediana*, *Priva laevis* and *Salvia gilliesii*.

The species of *Xenoglossa*, except *X. kansensis* and *X. strenua*, apparently rarely visit flowers of plants other than *Cucurbita*. These rare visits to other flowers (*Citrus limonia*, *Helmia salicifolia*, *Mandevilla foliosa*, *Melilotus alba*, *Salvia amarissima*, *Tamarix gallica*, *Tecoma stans* and *Verbesina encelioides*) are known only for the males of *X. angustior* and *X. fulva*. However, *X. kansensis* and *X. strenua*, perhaps because of their greater diurnal period of activity, have been found at the flowers of the following plants presumably in

search of nectar: *Amorpha canescens*, *Asclepias cornuti*, *A. syriaca*, *Astragalus* sp., *Cirsium arvense*, *Citrullus vulgaris*, *Convolvulus* spp., *Cucumis* sp., *Ipomoea nil*, *I. pandurata*, *I. purpurea*, *Lagenaria siceraria*, *Melilotus officinalis*, *Proboscidea louisianica* and *P. proboscidea*.

Several species of the genera *Peponapis* and *Xenoglossa* have been taken on a number of occasions in different types of light traps. Most such collections were made in traps operated with ultraviolet light and presumably most, if not all, employed cyanide as the killing agent. Chandler (1961:128) has suggested from his investigations that the odor of cyanide may be an adjunct attractant to such bees as *P. pruinosa* and *X. strenua*. He found that these bees were taken almost daily in freshly cyanide-charged light traps whose lights were not operating.

As is detailed in the species accounts, *Xenoglossa angustior*, *X. patricia*, *X. strenua*, *Peponapis pruinosa* and *P. utahensis* have been collected in one or more of the following: Berlese Funnel Trap (ultraviolet), Pink Bollworm Light Trap (ultraviolet), Japanese Beetle Trap, unspecified type of mosquito trap, and simply "light trap." It is of interest that nearly all of those collected in ultraviolet traps are females and the majority of these usually have at least partly completed *Cucurbita* pollen loads.

Although there is no published information on the nesting habits of these bees in America north of Mexico, some nests of the South American *Peponapis fervens* (Smith) have been described (Holmberg, 1884:204; Michener and Lange, 1958:85-86), and the burrows and some aspects of the nesting habits of the Mexican *Xenoglossa fulva* Smith have been characterized by Linsley, MacSwain and Smith (1955:128-137). All were situated in flat ground and at most not much more than 50 meters from the pollen source (domestic squash). Unlike those of most antho-

phorids, the burrows of *X. fulva* were located in an extremely dense grassy area. It is not clear whether the nest sites of *P. fervens* occupied bare or vegetated areas.

Like other bees of the tribe Eucerini, the cells in the nests of *P. fervens* and *X. fulva* are elongate, vertical and are arranged singly. They are lined with a thin wax-like substance which does not include the cap. The pollen stores form a rather soft mass which fills the bottom of the cell. The egg is placed on top of the provisions. The feces of the larvae are deposited at the cap end of the cell and a thin cocoon with multiple layers at the anterior end is spun by the larva.

During field investigations in Mexico, a number of nests of several species of *Peponapis* were located in the bare, flat ground under the vines of the domestic *Cucurbita moschata*. Since J. W. MacSwain observed a female of *P. crassidentata* (Cockerell) excavating a burrow in an adobe bank 2 miles east of Tuxtla Gutierrez, Chiapas, Mexico, on July 25, 1956, it may be that at least one species nests in vertical banks.

Only one parasite, a wasp of the family Mutillidae, is known to be parasitic in the nests of these bees. In his original description of the Argentine *Ecplectica cucurbitae* (currently *Peponapis fervens*) Holmberg (1884:204) states that "*Mutilla sumptuosa* Gerstaecker... persigue los nidos de esta *Ecplectica*." Linsley, MacSwain and Smith (1955:137) observed several females of *Pseudomethoca ravula* (Cameron), a mutillid, searching over the nesting area of the Mexican *Xenoglossa fulva*. They found three additional females in the earth removed during excavation of fresh burrows. As those authors comment, these circumstances and the large size of the individuals of *P. ravula* suggest a host-parasite relationship with *X. fulva*.

As far as we are aware, the only record of predation upon the adults of these bees involves the capture of an adult male *Peponapis pruinosa* by a

spider. Rau (1922:34-35) remarks that a yellow flower-spider, *Runcinia aleatoria* Hentz, was hidden in the yellow corolla of a pumpkin blossom where its

high degree of protective coloration made it invisible. He extracted the bee with forceps and was surprised to pull out the spider clinging to it.

SYSTEMATICS

The bees of the genera *Peponapis* and *Xenoglossa* (fig. 1) are considered by Michener (1944), Moure and Michener (1955) and LaBerge (1957) as independent genera of the tribe Eucerini. Cockerell (1906a:104, 106) did not believe that these genera should be separated and throughout his subsequent investigations he regarded *Peponapis* as a subgenus of *Xenoglossa*. In their classification of the Neotropical Eucerini, Moure and Michener (1955:246) conclude that the genera *Melissodes*, *Svastra* and *Peponapis* form a group characterized principally by the much reduced inner plates of the seventh sternum of the male. They comment, however, that these three genera perhaps are not closely related and may have arisen independently by reduction of the inner plates from different groups within the Eucerini. Although LaBerge (1957) revised the genera of the Eucerini in North and Central America, he does not discuss the relationship of *Xenoglossa*. On the evidence of the alignment of genera in that study, it appears that *Xenoglossa* and *Peponapis* are thought to be related to quite different elements of the tribe Eucerini.

Five species of the genus *Xenoglossa* and six species of the genus *Peponapis* are now known to inhabit America north of Mexico. All of these species, except *X. kansensis* Cockerell, occur also south of the border. Only three species, *P. pruinosa* (Say), *X. kansensis* Cockerell, and *X. strenua* (Cresson),

range into the eastern United States. As is discussed elsewhere in this study, the presence of these species in the eastern United States is thought to be related to the development and introduction there of the domestic *Cucurbita*. Two species, *P. pruinosa* and *X. strenua*, are distributed transcontinentally in the United States. The largest number of species of both genera are present in Arizona. These include three species of *Xenoglossa*: *X. angustior*, *X. crawfordi* and *X. strenua*, and five species of *Peponapis*: *P. crassidentata*, *P. michelbacherorum*, *P. pruinosa*, *P. timberlakei* and *P. utahensis*. One species of each genus, *P. pruinosa* and *X. strenua*, ranges nearly to the northern border of the United States. However, several species of both genera (*P. crassidentata*, *P. limitaris*, *P. michelbacherorum* and *X. crawfordi*) do not range very far north of the Mexican border. In the United States, the greatest number of species (7) have been collected at Nogales, Arizona. It seems likely that one or more additional species will be discovered there. Like other groups with similar faunal affinities, depletion in numbers of species is correlated, in a general way, with an increase in elevation or latitude.

LaBerge's key (1957) is useful to distinguish *Peponapis* and *Xenoglossa* from the other genera of the tribe Eucerini in North and Central America. The following key will serve to separate the genera *Peponapis* and *Xenoglossa*.

Fig. 1. Squash and gourd bees (males, left; females, right), dorsal view. Upper pair: *Peponapis pruinosa* (Say). Center pair: *Xenoglossa strenua* (Cresson). Lower pair: *Xenoglossa angustior* Cockerell.

KEY TO THE GENERA *PEPONAPIS* AND *XENOGLLOSSA*

1. Males (antennae thirteen-segmented; metasoma composed of seven visible segments) 2
- Females (antennae twelve-segmented; metasoma composed of six visible segments) 3
2. Antennae short, not surpassing tegulae; first flagellar segment elongate, nearly twice as long as succeeding segment (fig. 2, bottom, but see couplet below); mandible with a sub-basal tooth or prominent angle on upper margin (fig. 3) *Xenoglossa* (p. 384)
- Antennae longer, much surpassing tegulae; first flagellar segment usually much shorter than succeeding segment (fig. 2, middle), rarely longer (fig. 2, top), in which case sixth metasomal tergum is without gradular teeth at sides; mandible without a sub-basal tooth or prominent angle on upper margin *Peponapis* (p. 425)
3. Mandible with a prominent sub-basal tooth on upper margin (as in fig. 3); eyes obviously divergent below; clypeus frequently maculated with yellow *Xenoglossa* (p. 384)
- Mandible without a prominent sub-basal tooth on upper margin; eyes sub-parallel, not obviously divergent below; clypeus not maculated with yellow *Peponapis* (p. 425)

Genus *Xenoglossa* Smith

The species of this genus are mostly large, robust bees often clothed with thick pubescence (fig. 1). The integument of several species is largely ferruginous, as is the vestiture. The clypeus and sometimes the adjacent parocular and supraclypeal areas are maculated with yellow in both sexes. The males of the known species have

short, female-like antennae whose first flagellar segment is longer than the succeeding segment (fig. 2, top). The mandibles of both sexes have a sub-basal tooth on the upper margin (fig. 3), which in *X. kansensis* is scarcely evident. The gradulus of the sixth metasomal tergum in the male terminates on each side as a strongly projected tooth.

Fig. 2. Basal antennal segments, males: *Peponapis timberlaki* (top), *P. pruinosa* (middle), and *Xenoglossa fulva* Smith (bottom).

Fig. 3. Mandible of *Xenoglossa fulva* Smith, male.

The genus *Xenoglossa* is composed of nine species which are distributed between northern South America and the northern border of the central United States. Five of the nine species are known to occur in the United States. All of these except *X. kansensis* are also present in Mexico. *X. angustior* and *X. patricia*, which are known from the more arid areas of the southwestern United States, occur as well in the drier parts of northern Mexico. *X. crawfordi* is chiefly distributed in Mexico, but has been collected in the flowers of domestic squash on two occasions at Nogales,

Arizona. *X. strenua* is transcontinentally distributed in the United States and ranges from Durango, Mexico, to northwestern Wisconsin.

The other four species of the genus occur in Baja California (*X. mustelina*), central Mexico (*X. fulva*), Costa Rica (*X. gabbi*) and Venezuela (*X. fuliginosa*). Since *X. fulva* was recorded, apparently erroneously, from Arizona by Cresson (1879:226), and since Fox (1894:118) thought *X. mustelina* was a synonym of *X. fulva*, we have included these in this study and in the following key.

KEY TO THE SPECIES OF THE GENUS *XENOGLOSSA* IN AMERICA
NORTH OF MEXICO

1. Males 2
- Females 8
- 2(1) Vestiture and often the integument chiefly ferruginous or fulvous 3
- Vestiture and integument not chiefly ferruginous or fulvous 6
- 3(2) First flagellar segment more than twice as long as succeeding segment; sixth metasomal sternum with converging pair of lateral carinae tuberculately produced apically and basally (figs. 4, 5, 6, bottom) 4
- First flagellar segment much less than twice as long as succeeding segment (fig. 2, bottom); sixth metasomal sternum with lateral carinae not tuberculately produced (fig. 7, bottom) *fulva* (p. 403)
- 4(3) Pygidial plate narrow, much longer than maximum apical width (figs. 4, 5, top), apical margin not reflexed 5
- Pygidial plate broad, much shorter than maximum apical width (fig. 6, top), apical margin strongly reflexed *mustelina* (p. 401)
- 5(4) Pygidial plate shallowly constricted before slightly expanded and subtruncate apex (fig. 5, top); lateral ocellus separated from inner eye margin by more than its maximum diameter *patricia* (p. 396)
- Pygidial plate tapering to evenly rounded apex (fig. 4, top); lateral ocellus separated from inner eye margin by less than its maximum diameter *angustior* (p. 386)
- 6(2) Discal surfaces of first two metasomal terga entirely pale pubescent; ocelli small, minimum distance between lateral ocellus and median ocellus greater than basal thickness of first flagellar segment 7
- Discal surfaces of first metasomal tergum and basal half of second tergum black pubescent; ocelli enlarged, minimum distance between lateral ocellus and median ocellus much less than basal thickness of first flagellar segment *crawfordi* (p. 408)
- 7(6) Clypeus chiefly yellow, narrowly black at base and sides; sixth metasomal sternum with converging pair of lateral carinae strongly curved apically (fig. 11, bottom); polished area below median ocellus deeply impressed, Y-shaped (fig. 9, right) *kansensis* (p. 421)
- Clypeus maculated with yellow, but broadly black at base and sides; sixth metasomal sternum with converging pair of lateral carinae not curved apically (fig. 10, bottom); polished area below median ocellus

- shallow, triangular in outline (fig. 9, left) *strenua* (p. 411)
- 8(1) Integument and vestiture chiefly ferruginous 9
- Integument and vestiture not chiefly ferruginous 12
- 9(8) Second metasomal tergum largely glabrous, not thickly and uniformly pubescent 10
- Second metasomal tergum thickly and uniformly pubescent . *fulva* (p. 403)
- 10(9) Clypeus, as seen from side, less protuberant than maximum width of eye as measured in that position 11
- Clypeus, as seen from side, slightly more protuberant than maximum width of eye as measured in that position *mustelina* (p. 401)
- 11(10) Lateral ocellus near inner eye margin, minimum separation scarcely more than half transverse diameter of anterior ocellus . *angustior* (p. 386)
- Lateral ocellus well removed from inner eye margin, minimum separation nearly as great as transverse diameter of anterior ocellus *patricia* (p. 396)
- 12(8) Thorax pale pubescent; minimum distance between lateral and anterior ocellus greater than minimum thickness of first flagellar segment 13
- Thorax black pubescent; minimum distance between lateral ocellus and anterior ocellus less than minimum thickness of first flagellar segment *crawfordi* (p. 408)
- 13(12) Discal punctures of second metasomal tergum shallow, interspaces tessellate, surface dull; polished area below anterior ocellus Y-shaped (as in fig. 9, right); clypeus with yellow maculation usually occupying apical half or more *kansensis* (p. 421)
- Discal punctures of second metasomal tergum discrete, interspaces smooth, shining; polished area below anterior ocellus triangular (as in fig. 9, left); clypeus with yellow maculation reduced, usually occupying much less than apical half *strenua* (p. 411)

***Xenoglossa angustior* Cockerell,
new status**

(Figs. 1, 4, frontispiece)

Xenoglossa patricia angustior Cockerell, 1900, Entomologist, 33:64–65, ♂ (Arizona: Buckeye, at flowers of *Cucurbita palmata* in October); Cockerell, 1902, Ent. News, 13:103, [♂] (California: Los Angeles, in flowers of *C. foetidissima* on July 22, 1901); Cockerell, 1903, Psyche, 10:77, [♂] (California: Los Angeles); Cockerell, 1906, Trans. Amer. Ent. Soc., 32:74, 102, [♂] (California and Arizona: Congress Junction, July; flowers *Cucurbita*); Cockerell, 1906, Trans. Amer. Ent. Soc., 32:314, [♂] (Arizona: Buckeye); Cockerell, 1912, Proc. U. S. Natl. Mus., 43:265; Cockerell, 1914, Ann. Mag. Nat. Hist., (8)14:365, [♂] (California: Fresno, August 19); Lutz and Cock-

erell, 1920, Bull. Amer. Mus. Nat. Hist., 42:625.

Xenoglossa patricia, Bradley, 1919, Sci. Monthly, 8:419, ♂ (Arizona: Bonita . . . males sleeping in flowers of *C. foetidissima*); Michener, 1951, U. S. Dept. Agric. Monogr. 2:1221, ♂ (Arizona and California records only); Linsley, 1960, Jour. New York Ent. Soc., 68:15, 16, 17 (Arizona: Southwestern Research Station, 5 mi W of Portal, ♀ collecting pollen at 5:25 a.m. MST from flowers of *C. foetidissima* on July 21, 1959 and two ♀♀ collecting pollen at 5:22 a.m. and 5:23 a.m. at same site on July 28, 1959; 2 mi NE of Portal, August 2, 1959, three ♂♂ from wilted flowers of *C. foetidissima* at 9:00 a.m. and two ♂♂ and two ♀♀ without pollen were taken at same site on August 3. New Mexico: 5 mi S of Rodeo, ♀♀ actively collecting pollen between

Fig. 4. *Xenoglossa angustior* Cockerell, male: dorsal view of seventh metasomal tergum (top) and ventral view of sixth metasomal sternum (bottom).

5:00 a.m. and 6:40 a.m. on July 31, 1959 from flowers of *C. digitata* and *C. foetidissima*; ♂♂ appeared at 5:15 a.m. and cruised flowers as long as females were available; on August 4 at same site ♀♀ collecting pollen at 4:45 a.m. and 5:15 a.m.).

Male. Length, 18–23 mm. Length of forewing including tegula, 14–15 mm. Body and legs chiefly ferruginous; head, dorsum and sides of thorax black or dark mahogany red; clypeus chiefly yellow, narrowly bordered apically with ferruginous, not infrequently stained with ferruginous laterally and basally; supraclypeal area and parocular areas adjacent to clypeus variably stained or tinged with ferruginous; labrum yellow, narrowly ferruginous apically; mandibles broadly yellow at base, outwardly suffused with red, consequently yellow coloration tapers and terminates near middle of mandible beyond which an irregular transverse black band connects with black-edged margins and encloses apically an elongate dull orange marking; antennae chiefly ferruginous on scape, pedicel and basal two flagellar segments, becoming dark mahogany red thereafter and often piceous dorsally; tegulae ferruginous or reddish; wings lightly infuscated, not violaceous; veins variably piceous and dark mahogany red; tibial spurs ferruginous; claws black apically.

Vestiture chiefly ferruginous, whitish on sides of thorax and head behind, thickest on thorax, hind margins of head, disc and anterior face of first metasomal tergum; pubescence on metasomal terga II–VII chiefly short, tomentose and appressed, covering lateral sides of terga II and III, and most of terga IV–VII, not disposed in distinct fasciae.

Eyes markedly diverging below (47:65); ocelli conspicuously enlarged, each ocellus much larger than an antennal socket; minimum distance between lateral ocellus and anterior ocellus slightly less than basal diameter of first flagellar

segment; lateral ocellus separated from inner eye margin by less than its longitudinal diameter; polished area below anterior ocellus Y-shaped; first flagellar segment slender, elongate, approximately twice as long as succeeding segment (23:12); impunctate apical margin of first metasomal tergum widest medially, much more broadly impunctate than apical margins of second and succeeding terga, the nearest medial punctures being separated from apical rim by more than maximum thickness of first flagellar segment; discal punctures of first metasomal tergum sparser medially than those on disc of second metasomal tergum; discal punctures of second metasomal tergum discrete but crowded, interspaces feebly tessellate, surface shining; pygidial plate (fig. 4, top) and sixth metasomal sternum (fig. 4, bottom) as illustrated.

Female. Length, 18–22 mm. Forewing including tegula, 13–14 mm. Similar to male in appearance. Coloration of body including facial markings, pubescence and appendages essentially as in male.

Eyes as markedly diverging below as male (43:59); ocelli more prominently enlarged than male; minimum distance between lateral ocellus and anterior ocellus much less than basal diameter of first flagellar segment; lateral ocellus greatly elongated longitudinally, separated from inner eye margin by considerably less than its longitudinal diameter, but separated by scarcely more than one-half transverse diameter of anterior ocellus; polished ocellar area, first flagellar segment, and punctuation of first and second metasomal terga essentially as in male; clypeus, as seen from side, less protuberant than maximum width of eye as measured in that position.

Location of type. U. S. National Museum, No. 20231.

Geographic range. Central and southern California, northern Baja California, Arizona, southwestern New Mexico and Sonora, Mexico.

SPECIMENS EXAMINED²

United States

Arizona:

Cochise Co.: Apache, 10 ♂♂, 2 ♀♀, VIII-17-61, in flowers of *Cucurbita foetidissima* (AEM & MM).

Apache Pass, 1 ♂, VIII-22-61, in flower of *C. foetidissima* (AEM & MM).

Benson, 1 ♂, VII-12-40 (S & S).

Benson, 5 mi W, 1 ♂, VII-12-52 (R. H. and L. D. Beamer, W. E. LaBerge and C. Liang, KU).

Bernardino, 8 ♂♂, VIII-17-61, in flowers of *C. foetidissima* (AEM & MM).

Bowie, 7 mi E, 3 ♂♂, 1 ♀, VIII-1-61, in flowers of *C. digitata* (EGL); 2 ♂♂, 3 ♀♀, VIII-1-61, in flowers of *C. foetidissima* (EGL).

Cave Creek, 5 mi W of Portal, 1 ♂, VII-28-55, in flower of *C. foetidissima* (PHT).

Cazador, 1 ♀, VIII-17-61, in flower of *C. foetidissima* (AEM & MM); 1 ♀, VIII-17-61, in flower of *C. digitata* (AEM & MM).

Cochise, 5 ♂♂, VIII-26-61, in flowers of *C. foetidissima* (AEM & MM); 4 ♂♂, VIII-26-61, in flowers of *C. digitata* (AEM & MM).

Cochise Memorial Park, 9 ♂♂, 3 ♀♀, in flowers of *C. foetidissima* (EGL).

Dos Cabezas, 1 ♂, VIII-1-61, in flower of *C. foetidissima* (EGL); 3 ♂♂, 1 ♀, VIII-22-61, same data (AEM & MM).

Douglas, 1 ♂, IX-1-25 (WWJ); 1 ♂, 1 ♀, VIII-25-26 (WWJ-UCR); 1 ♂, VIII-3-38 (WWJ); 1 ♂, 1 ♀, VIII-17-61, in flowers of domestic squash (AEM & MM); 5 ♂♂, 2 ♀♀, VIII-17-61, in flowers of *C. foetidissima* (AEM & MM); 4 ♂♂, VIII-17-61, in flowers of *C. digitata* (AEM & MM); 1 ♂, 4 ♀♀, VIII-24-61, in flowers of *C. foetidissima* (AEM & MM); 1 ♂, VI-6-62, in closed flower of *C. foetidissima* at 3:05 p.m. (AEM & MM).

Douglas (collected by MAC), 1 ♂, 1 ♀, VI-13-62, in staminate flowers of *C. foetidissima*, 9:42 to 10:45 a.m.; 3 ♂♂, VI-14-62, in staminate flowers of *C. foetidissima*, 9:19 to 10:30 a.m.; 1 ♂, 2 ♀♀, VI-16-62, in open flowers of *C. foetidissima* at 7:52 a.m., females collecting pollen; 1 ♂, VI-17-62, in open flower of *C. foetidissima*, sometime between 7:00 and 8:00 a.m.; 3 ♂♂, 4 ♀♀, VI-24-62, in open flowers of *C. foetidissima*, 6:30 to 7:30 a.m., females collecting pollen during this period; 4 ♂♂, VI-25-62, in open flowers of *C. foetidissima*, 6:20 to 7:10 a.m.; 2 ♀♀, VI-26-62, collecting pollen in open flowers of *C. foetidissima*, 6:20 to 6:40 a.m.; 1 ♂, VI-28-62, in open flower of *C. foetidissima* sometime between 5:50 and 6:00 a.m.; 8 ♂♂, 4 ♀♀, VII-3-62, in open flowers of *C. foetidissima*, 6:00 to 7:30 a.m., females collecting pollen from 6:10 to 7:30 a.m.; 2 ♂♂, 5 ♀♀, VII-4-62, in open flowers of *C. foetidissima*, 5:50 to 7:50 a.m., females collecting pollen from 5:50 to 6:20 a.m.; 6 ♂♂, 3 ♀♀, VII-6-62, in open flowers of *C. foetidissima*, 6:00 to 7:10 a.m., females collecting pollen from 6:00 to 6:20 a.m.; 3 ♂♂, 1 ♀, VII-7-62, in open flowers of *C. foetidissima*, 6:00 to 6:50 a.m., female collecting pollen between 6:20 and 6:30 a.m.; 10 ♂♂, 1 ♀, VII-9-61, in open flowers of *C. foetidissima*, 5:40 to 6:50 a.m., female collecting pollen sometime between 6:10 and 6:20 a.m.; 9 ♂♂, 7 ♀♀, VII-10-62, in open flowers of *C. foetidissima*, 5:30 to 8:00 a.m., females collecting pollen from 5:40 to 7:30 a.m.; 2 ♀♀, VII-20-62, in black light trap, both females with partly completed pollen loads; 1 ♀, VII-24-62, in black light trap with partly completed pollen load; 1 ♀, VIII-15 to 16-62, in black light trap with partly completed pollen load.

Douglas, 1 mi E (collected by MAC), 14 ♂♂, 7 ♀♀, VII-15-62, in closed flowers of *C. foetidissima*, 6:30 to 7:15 p.m.; 6 ♂♂, 7 ♀♀, VII-16-62, in open

² Abbreviations of collectors' names and institutions are used in some cases. Full names are given on inside back cover.

flowers of *C. foetidissima*, 9:00 to 9:45 a.m., females not collecting pollen; 4 ♂♂, VII-16-62, in closed flowers of *C. foetidissima*, 4:30 to 5:00 p.m.; 2 ♂♂, 2 ♀♀, VII-17-62, in open flowers of *C. foetidissima*, 9:00 to 9:20 a.m., females not collecting pollen; 3 ♂♂, 7 ♀♀, VII-18-62, in closed flowers of *C. foetidissima*, 1:00 to 1:35 p.m.; 2 ♂♂, 6 ♀♀, VII-19-62, in flowers of *C. foetidissima*, 10:30 to 11:00 a.m.; 2 ♂♂, 4 ♀♀, VII-20-62, in open flowers of *C. foetidissima*, 6:00 to 7:00 a.m., females collecting pollen from 6:00 to 7:00 a.m.; 10 ♂♂, 3 ♀♀, VII-23-62, in closed flowers of *C. foetidissima*, 9:30 to 10:40 a.m.; 8 ♂♂, VII-28-62, holding on above rain-water level in flowers of *C. foetidissima*, 10:20 a.m. to 12:10 p.m.; 7 ♂♂, 4 ♀♀, VIII-7-62, in open flowers of *C. foetidissima*, 9:17 to 10:30 a.m., females not collecting pollen; 1 ♂, 2 ♀♀, VIII-8-62, in open flowers of *C. foetidissima*, 6:15 to 6:45 a.m., females collecting pollen; 6 ♀♀, VIII-8-62, collecting pollen in open flowers of *C. digitata*, 6:25 to 6:27 a.m.; 1 ♂, 2 ♀♀, VIII-9-62, females collecting pollen in open flowers of *C. digitata*, 6:20 to 6:30 a.m.; 2 ♀♀, VIII-9-62, collecting pollen in open flowers of *C. foetidissima*, 6:20 to 6:27 a.m.; 1 ♂, VIII-9-62, in flower of *C. foetidissima* at 9:32 a.m.; 2 ♀♀, VIII-11-62, collecting pollen in open flowers of *C. digitata*, 6:15 to 6:30 a.m.; 1 ♀, VIII-11-62, collecting pollen in open flower of *C. foetidissima* some time between 6:15 and 6:30 a.m.; 1 ♀, VIII-16-62, observed flying in darkness at 7:30 p.m., landed on flower of *Verbesina*.

Douglas, 6 to 10 mi N, 4 ♂♂, 1 ♀, VIII-26-61, in flowers of *C. foetidissima* (AEM & MM).

Elfrida, 3 ♂♂, VIII-26-61, in flowers of *C. foetidissima* (AEM & MM).

Elfrida, 14 mi W, 1 ♂, VIII-1-61, in flowers of *C. foetidissima* (EGL).

Elfrida, 18 mi N, 3 ♂♂, 1 ♀, VIII-1-61, in flowers of *C. foetidissima* (EGL).

Green Brush Draw, 8 ♂♂, 8 ♀♀,

VII-13-62, in closed flowers of *C. foetidissima*, 1:15 to 1:40 p.m. (MAC).

Hereford, 2 ♂♂, 2 ♀♀, VII-13-62, in closed flowers of *C. foetidissima*, 2:00 to 2:10 p.m. (MAC); 2 ♂♂, VII-14-62, in closed flowers of *C. foetidissima*, 1:00 to 1:15 p.m. (MAC).

Kansas Settlement, 14 ♂♂, 7 ♀♀, VIII-1-61, in flowers of *C. foetidissima* (EGL); 6 ♂♂, VIII-3-61, in flowers of *C. foetidissima* (EGL); 4 ♂♂, VIII-22-61, in flowers of *C. foetidissima* (AEM & MM).

Kansas Settlement, 1 mi E, 12 ♂♂, 5 ♀♀, VIII-22-61, in flowers of *C. digitata* (AEM & MM).

Kansas Settlement, 12 mi S, 26 ♂♂, 15 ♀♀, VIII-1-61, in flowers of *C. digitata* (EGL).

McNeal, 6 ♂♂, VIII-1-61, in flowers of *C. foetidissima* (EGL).

McNeal, 1.5 mi N, 1 ♂, 1 ♀, VIII-26-61, in flowers of *C. digitata* (AEM & MM); 1 ♂, VIII-31-61, in flower of *C. foetidissima* (AEM & MM).

Paul Spur, 2 ♂♂, VIII-24-61, in flowers of *C. foetidissima* (AEM & MM).

Pearce, 4 ♂♂, 1 ♀, VIII-26-61, in flowers of *C. digitata* (AEM & MM).

Pearce, 4 mi N, 2 ♂♂, VIII-26-61, in flowers of *C. foetidissima* (AEM & MM).

Pearce, 15 mi W, 15 ♂♂, 2 ♀♀, VIII-22-61, in flowers of *C. digitata* (AEM & MM); 8 ♂♂, 1 ♀, VIII-22-61, in flowers of *C. foetidissima* (AEM & MM).

Pinery Canyon (mouth), Chiricahua Mountains, 1 ♂, VIII-12-61, in flower of *C. foetidissima* (MAC-AMNH); 3 ♂♂, 2 ♀♀, VIII-22-61, in open flowers of *C. foetidissima* at 10:00 a.m., females collecting pollen (AEM & MM).

Portal, 1 ♂, VII-26-55, in flower of *C. foetidissima* (PHT); 3 ♂♂, VII-28-55, in flowers of *C. foetidissima* (PDH); 1 ♂, VII-31-55, in flower of *C. foetidissima* (PDH).

Portal (collected by AEM & MM), 1 ♂, 3 ♀♀, VII-29-61, in open flowers of *C. foetidissima*, 6:00 to 9:00 a.m., one

female collecting pollen between 6:00 and 7:00 a.m.; 1 ♂, VIII-23-61, in flower of domestic squash; 2 ♂♂, IX-1-61, in flowers of domestic squash; 1 ♀, IX-6-61, collecting pollen in open flower of *C. digitata* at 9:30 a.m.; 1 ♂, IX-15-61, in closed flower of *C. foetidissima* sometime between 3:00 and 4:00 p.m.; 5 ♂♂, 15 ♀♀, IX-16-61, in open flowers of *C. foetidissima*, 5:55 to 10:30 a.m., females collecting pollen from 5:55 to 6:55 a.m.; 7 ♂♂, 2 ♀♀, IX-18-61, in open flowers of *C. foetidissima*, 6:00 to 10:00 a.m., females collecting pollen from 6:00 to 8:00 a.m.; 1 ♀, IX-22-61, found dead in domestic squash planting; 3 ♂♂, 6 ♀♀, IX-22-61, in open flowers of *C. foetidissima*, 6:00 to 9:00 a.m., females collecting pollen; 4 ♀♀, IX-23-61, collecting pollen in open flowers of *C. foetidissima*, 6:00 to 9:00 a.m.; 4 ♀♀, IX-24-61, in open flowers of *C. foetidissima*, 6:00 to 10:00 a.m., collecting pollen from 6:00 to 9:00 a.m.; 4 ♀♀, IX-25-61, collecting pollen in open flowers of *C. foetidissima*, 6:00 to 8:00 a.m.; 1 ♂, IX-28-61, in flower of *C. digitata*; 1 ♂, IX-28-61, in open flower of *C. foetidissima* sometime between 9:00 and 10:00 a.m.

Portal, 1.6 mi N, 10 ♂♂, 7 ♀♀, VII-23-61, in wilted flowers of *C. foetidissima* at 9:30 a.m. (EGL); 6 ♂♂, VII-24-61, in wilted flowers of *C. foetidissima* at 9:00 a.m. (EGL); 3 ♂♂, 5 ♀♀, VII-24-61, in wilted flowers of *C. foetidissima* at 9:10 a.m., females without pollen loads (EGL); 2 ♂♂, VII-26-61, in flower of *C. foetidissima* at 8:40 a.m. (EGL).

Portal, 2.5 mi N, 4 ♂♂, VII-24-61, in wilted flowers of *C. foetidissima* at 9:15 a.m. (EGL); 2 ♂♂, 1 ♀, VII-25-61, in wilted flowers of *C. foetidissima* at 9:20 a.m. (EGL); 1 ♂, VII-26-61, in flower of *C. foetidissima* at 9:00 a.m. (EGL).

Portal, 1.5 mi NE, 9 ♂♂, 3 ♀♀, VIII-31-61, in flowers of *C. foetidissima* (AEM & MM); 4 ♂♂, 2 ♀♀, IX-1-61, in flowers of *C. foetidissima* (AEM & MM); 3 ♂♂, IX-8-61, in flowers of *C.*

foetidissima (AEM & MM).

Portal, 2 mi NE, 3 ♂♂, VII-2-59, in flowers of *C. foetidissima* at 9:00 a.m. (EGL); 2 ♂♂, 2 ♀♀, VIII-3-59, in flowers of *C. foetidissima* (EGL).

San Pedro R.W., Hereford, 1 ♂, VI-30-50, in flower of *C. foetidissima* (RFS-AMNH).

San Simon, 3 ♂♂, VIII-15-61, in closed flowers of *C. foetidissima* at 3:00 p.m. (AEM & MM).

Silver Creek, Cazadera, 15 mi E of Douglas, 1 ♂, VI-26-52, in flower of *C. digitata* (WWJ).

Skeleton Canyon, 6 mi SE of Apache, 1 ♂, IX-4-58, in closed flower of *C. digitata* (PDH).

Southwestern Research Station, 5 mi SW of Portal, 1 ♂, VII-26-56, at flower of *Melilotus alba* (E. Ordway, AMNH); 1 ♀, VII-20-58 (MAC-AMNH); 2 ♀♀, VII-28-59, collecting pollen in open flowers of *C. foetidissima* at 5:22 and 5:23 a.m., respectively (EGL); 1 ♀, VII-21-61, sucking nectar in open flower of *C. foetidissima*, 4:55 to 5:22 a.m. (EGL); 2 ♀♀, VII-25-61, collecting pollen in open flowers of *C. foetidissima* at 5:07 and 5:12 a.m., respectively (EGL); 1 ♀, VIII-1-61, collecting pollen in open flower of *C. foetidissima* at 4:50 a.m. (EGL).

Willcox, 6 mi SE, 3 ♂♂, 3 ♀♀, VIII-26-61, in flowers of *C. digitata* (AEM & MM).

Graham Co.: Aravaipa, 1 ♀, VIII-21-33 (O. Bryant, CAS).

Pima, 1 ♂, VIII-25-61, in flower of *C. foetidissima* at 12:30 p.m. (AEM & MM).

Safford, 1 ♀, VII-1-54 (F. G. Werner, S & S); 1 ♂, VIII-15-61, in flower of *C. foetidissima* (AEM & MM).

Thatcher, 1 ♀, VI-28-50 (E. J. Taylor, UCD); 2 ♀♀, VIII-13-50 (E. J. Taylor, UCD).

Maricopa Co.: Aguila, 2.6 mi W, 1 ♂, VII-10-62, in flower of *C. digitata* at 8:46 a.m. (EGL).

Buckeye, 1 ♂, October, in flower of *C. palmata* (T.D.A. Cockerell, USNM).

Pima Co.: Baboquivari Mountains,

1 ♀, VI-29-24 (O. C. Poling, CAS); 1 ♀, IX-15-28 (J. D. Gunder, CAS).

Continental, 2 ♂♂, VIII-24-59 (K. V. Krombein, USNM).

Cortaro, 2 ♂♂, IX-20-61 in open flowers of *C. digitata* at 8:35 a.m. (AEM & MM).

Santa Catalina Mountains, 1 ♂, VII-15-25 (A. A. Nichol, USNM).

Tucson, 1 ♂, IX-1931 (A. I. Irvin, CAS); 1 ♀, IX-5-32 (S & S); 3 ♂♂, VIII-22-62, in closed flowers of *C. digitata* (AEM & MM).

Tucson, 16 mi S, 1 ♀, VIII-11-24 (E. P. Van Duzee, CAS).

Tucson, 20 mi SE, 2 ♂♂, IX-19-61, in closed flowers of *C. digitata* at 3:00 p.m. (AEM & MM).

Pinal Co.: Florence Junction, 3.1 mi S, 1 ♂, IX-3-61, in closed flower of *C. digitata* (PDH).

Stanfield, 2 mi E, 1 ♀, VII-13-62, in closed flower of summer squash (PDH).

Stanfield, 15 mi W, 15 ♂♂, 4 ♀♀, VIII-22-62, in closed flowers of *C. digitata* between 12:15 to 1:00 p.m. (AEM & MM).

Santa Cruz Co.: Coronado National Monument, 1 mi E, 25 ♂♂, 8 ♀♀, VII-13-62, in closed flowers of *C. foetidissima*, 12:30 to 1:00 p.m. (MAC).

Lochiel, 10 ♂♂, VII-13-62, in flowers of *C. foetidissima*, 9:30 to 10:00 a.m. (MAC).

Lochiel, 5 mi E, 4 ♂♂, 2 ♀♀, VII-13-62, in flowers of *C. foetidissima*, 9:45 to 10:05 a.m. (MAC).

Lochiel, 12 mi E, 20 ♂♂, 13 ♀♀, VII-13-62, in flowers of *C. foetidissima*, 10:30 to 11:30 a.m., most females with a trace of pollen (MAC).

Nogales, 1 ♂, VI-17-62, in closed flower of *C. foetidissima* at 6:00 p.m. (AEM & MM); 8 ♂♂, 5 ♀♀, VI-18-62, in open flowers of *C. foetidissima*, 6:40 to 9:15 a.m., females collecting pollen (AEM & MM); 2 ♂♂, VI-19-62, in open flowers of *C. foetidissima* sometime between 6:20 and 8:00 a.m. (AEM & MM); 1 ♂, 1 ♀, VII-11-62, in wilting flowers of *C. foetidissima* at 9:45 a.m. (PDH); 1 ♂, 1 ♀, same data (EGL);

5 ♂♂, 1 ♀, VII-11-62, in closed flowers of *C. foetidissima* (PDH).

Nogales, 5 mi N, 16 ♂♂, 2 ♀♀, VII-12-62, in open flowers of *C. foetidissima*, 8:30 to 8:50 a.m., females collecting pollen (MAC); 2 ♂♂, 1 ♀, same data (PDH); 1 ♂, 2 ♀♀, same data (EGL); 1 ♂, VII-12-62, in open flower of *C. foetidissima* at 4:50 a.m. (EGL); 7 ♂♂, 2 ♀♀, VII-12-62, in closed flowers of *C. foetidissima*, 2:00 to 2:30 p.m. (MAC).

Nogales, 8 mi N, 1 ♂, VII-12-62, in flower of *C. foetidissima* (MAC); 2 ♂♂, 1 ♀, VII-12-62, in flowers of *C. foetidissima* at 11:15 a.m. (PDH).

Nogales, 9 mi N, 1 ♂, VIII-8-40, in flower of *C. digitata* (PHT-KU).

Nogales, 10 mi N, 1 ♂, VIII-8-40 (CDM).

Nogales, 22 mi N, 1 ♀, VI-17-62, collecting pollen in open flower of *C. foetidissima* at 5:20 a.m. (AEM & MM).

Nogales, 6 mi NW, 9 ♂♂, 1 ♀, VII-11-62, in open flowers of *C. foetidissima*, 5:25 to 5:35 a.m., female sucking nectar (PDH); 2 ♂♂, same data (EGL); 1 ♂, 1 ♀, VII-11-62, in open flowers of *C. digitata*, 5:20 to 5:30 a.m., female collecting pollen (EGL).

Patagonia, 1 ♂, 1 ♀, VI-18-62, in closed flowers of *C. foetidissima*, 1:30 to 2:30 p.m. (AEM & MM); 3 ♂♂, VII-11-62, in open flowers of zucchini squash, 6:45 to 7:00 a.m. (PDH); 1 ♂, VII-11-62, in open flower of crookneck squash sometime between 6:45 and 7:00 a.m. (EGL); 1 ♀, VII-11-62, collecting pollen in open flower of *C. foetidissima* at 6:30 a.m. (PDH); 2 ♂♂, VII-11-62, in open flowers of *C. foetidissima*, 7:30 to 7:40 a.m. (PDH); 1 ♂, 1 ♀, VII-12-62, in open flowers of crookneck squash, 5:45 to 5:55 a.m., female collecting pollen (MAC); 4 ♀♀, VII-12-62, collecting pollen in open flowers of zucchini squash, 5:45 a.m. to 6:15 a.m. (PDH); 1 ♀, VII-12-62, in open pistillate flower of *C. foetidissima*, 6:45 to 7:10 a.m., scopae pollen-laden (MAC); 4 ♀♀, same data (PDH); 1 ♂, same data (EGL).

Patagonia, 2 mi SW, 1 ♂, 1 ♀, VII-11-62, in open flowers of *C. foetidissima* at 6:15 a.m. (PDH).

Patagonia, 4 mi SW, 2 ♂♂, VII-11-62, in open flowers of *C. foetidissima* at 6:00 a.m. (PDH); 1 ♂, same data (EGL).

Patagonia, 5 mi NE, 18 ♂♂, 2 ♀♀, VII-11-62, in closed, mostly pistillate, flowers of *C. foetidissima* (MAC).

Patagonia, 10 mi NE, 13 ♂♂, 3 ♀♀, VII-11-62, in closed, mostly pistillate, flowers of *C. foetidissima* (MAC).

Pena Blanca Canyon, Oro Blanco Mountains, 1 ♂, 1 ♀, VIII-6-60 (L. M. Martin, LACM); 1 ♀, VIII-8-60 (L. M. Martin, LACM).

Tubac, 17 ♂♂, 7 ♀♀, in open flowers of *C. digitata*, 7:20 to 9:20 a.m., females collecting pollen (AEM & MM).

Yavapai Co.: Congress Junction, 1 ♂, July (F. H. Snow, KU).

Congress Junction, 8 mi W, 3 ♂♂, IX-10-59, in flowers of *C. digitata* (RFS).

Cottonwood, 1 ♂, VIII-30-61, in flower of *C. digitata* (AEM & MM).

Prescott, 8 mi N, 1 ♂, VII-2-32, in flower of *C. foetidissima* (PHT-CIS).

Yuma Co.: Wellton, 2 ♂♂, 2 ♀♀, VIII-22-62, in closed flowers of *C. palmata* at 4:00 p.m. (AEM & MM).

Wenden, 12.5 mi E, 1 ♂, in flower of *C. digitata* at 8:30 a.m. (EGL).

Yuma, 1 ♂, 1 ♀, VI-19-18, "wild squash" (G. F. Ferris, CAS); 1 ♂, VI-21-53, in flower of squash (RRS).

California:

Fresno Co.: 1 ♀, (E. C. Van Dyke, CAS).

Biola, 1 ♂, VII-8-62, in closed flower of *C. foetidissima* (CDJ); 1 ♂, VII-17-62, in closed flower of *C. foetidissima* (CDJ).

Fresno, 1 ♂, VIII-19-14 (UCR); 1 ♂, VIII-1-36 (B. E. White, CAS); 2 ♂♂, 1 ♀, VII-2-62, in closed flowers of *C. foetidissima* (CDJ); 2 ♂♂, VII-9-62, same data (CDJ); 3 ♂♂, VII-24-62, same data (CDJ); 1 ♂, VIII-4-62, same data (CDJ); 1 ♂, VIII-21-62, same data (CDJ).

Friant, 1 ♂, 1 ♀, VII-4-62, in closed flowers of *C. foetidissima* (CDJ).

Herndon, 1 ♂, VII-17-62, in closed flower of *C. foetidissima* (CDJ).

Tranquility, 1 ♂, VII-17-62, in closed flower of *C. foetidissima* (CDJ).

Imperial Co.: Palo Verde, 2 mi S, 1 ♂, 3 ♀♀, VII-9-62, in open flowers of *C. palmata*, 4:19 to 4:45 a.m., females collecting pollen (PDH); 2 ♀♀, VII-9-62, collecting pollen in open flowers of *C. palmata* at 4:16 and 4:21 a.m., respectively (EGL); 1 ♂, VII-15-62, loudly buzzing about flowers of *Tamarix gallica* at 5:30 p.m. (PHD); 9 ♂♂, 8 ♀♀, VII-16-62, in open flowers of *C. palmata*, 4:20 to 5:20 a.m., females collecting pollen (PDH); 3 ♀♀, VII-16-62, collecting pollen in open flowers of *C. palmata*, 4:20 to 5:10 a.m. (PHT).

Kern Co.: Bakersfield, 1 ♀, VII-27-51 (L. W. Isaak, UCD).

Kern Park, 1 ♀, VII-28-46 (F. A. Ehrenford, CIS).

Shafter, 1 ♂, X-5-35 (G. F. Smith, CIS); 1 ♀, VIII-4-48 (G. F. Smith, CIS).

Los Angeles Co.: Gorman, 9 mi E, 1 ♂, VII-17-62, in open flower of *C. foetidissima* at 9:40 a.m. (PDH).

Gorman, 12 mi E, 3 ♂♂, VII-17-62, in open flowers of *C. foetidissima* at 9:30 a.m. (PDH).

Los Angeles, 1 ♂, VII-22-01, in flower of *C. foetidissima* (USNM); 1 ♀, VIII-1-16 (V. Duran, CAS).

Rivera, 1 ♂, 1 ♀, VIII-20-26 (H. M. Armitage, UCR).

Sierra Madre, 1 ♂, 1 ♀, VII-31 to VIII-1911 (J. I. Carlson, CAS).

Madera Co.: Chowehilla, 1 ♂, VIII-1-60, in flower of *C. foetidissima* (RRS).

Lane's Bridge, Highway 41 at San Joaquin River, 1 ♂, VI-27-62, in closed flower of *C. foetidissima* (CDJ); 2 ♂♂, VI-29-62, same data (CDJ).

Madera, 1 ♂, VII-19-57 (RRS).

Madera, 4.5 mi S, 1 ♀, VII-29-60, in flower of *Cucurbita* (RRS); 2 ♂♂, VIII-1-60, in flower of *Cucurbita* (RRS).

Madera, 5 mi S, 1 ♀, VII-26-60, in pink bollworm ultraviolet light trap, scopae heavily laden with *Cucurbita* pollen (RRS); 1 ♀, VII-27-60, in pink bollworm ultraviolet light trap (RRS); 1 ♀, VIII-18-60, pink bollworm ultraviolet light trap (RRS).

Merced Co.: Merced, 13 mi S, 2 ♂♂, VIII-2-60, in flowers of *Cucurbita* (RRS).

Riverside Co.: Anza, 7 ♂♂, VI-24-56, in flowers of *C. foetidissima* (A. Menke, Jr., LACM); 6 ♂♂, VI-24-56 (G. I. Stage, S & S); 1 ♂, VI-24-56 (L. A. Stange, LACM); 3 ♂♂, 1 ♀, VII-3-56 (B. M. Bartosh, UCD); 13 ♂♂, 10 ♀♀, VII-3-56 (R. C. Bechtel, UCD); 5 ♂♂, VII-3-56 (R. W. Bushing, UCD); 9 ♂♂, 3 ♀♀, VII-3-56, in flowers of *C. foetidissima* (H. R. Moffitt, UCD); 1 ♂, VII-3-56, in flower of *C. foetidissima* (L. W. Shainberg, UCD); 2 ♂♂, VII-3-56 (G. I. Stage, S & S); 8 ♂♂, 2 ♀♀, VII-3-56 (L. A. Stange, LACM); 1 ♂, VII-5-56 (B. M. Bartosh, UCD); 8 ♂♂, 1 ♀, VII-5-56 (R. M. Bohart, UCD); 2 ♀♀, VII-5-56 (H. W. Michalk, S & S); 1 ♂, VII-5-56 (G. I. Stage, S & S).

Anza, 2 mi E, 13 ♂♂, 3 ♀♀, VII-7-56, in closed flowers of *C. foetidissima* (PDH); 18 ♂♂, 8 ♀♀, VII-14-56, in closed flowers of *C. foetidissima* (M. S. Wasbauer, CIS).

Blythe, 1 ♂, 3 ♀♀, VII-29-35 (C. M. Dammers, UCR); 1 ♀, XI-2-36 (C. M. Dammers, UCR); 1 ♂, VII-5-38 (C. M. Dammers, LACM); 1 ♂, VII-15-38, in flower of *C. palmata* (PHT); 1 ♂, VI-23-45, in flower of "coyote melon" (J. W. MacSwain, CIS); 1 ♂, VI-10-46 (RFS).

Blythe, 2 mi W, 4 ♂♂, VII-16-62, in partly closed flowers of *C. palmata* at 7:45 a.m. (PDH).

Cathedral City, 1 ♂, VII-16-50 (J. W. MacSwain, CIS); 10 ♀♀, VII-19-50 (L. W. Isaak, UCD).

Corona, 1 ♂, VIII-1910 (CIS).

Hemet, 2 ♂♂, VII-7-46 (J. W. MacSwain, CIS); 1 ♀, VII-9-46 (J. W. MacSwain, CIS); 5 ♂♂, 3 ♀♀, VIII-

23-62, in partly closed flowers of *C. foetidissima*, 11:30 a.m. to 12:15 p.m. (AEM & MM); 2 ♂♂, 8 ♀♀, VIII-24-62, in open flowers of *C. foetidissima*, 5:00 to 7:50 a.m., females collecting pollen from 5:00 to 6:30 a.m. (AEM & MM).

Indio, 3 ♂♂, 1 ♀, VI-27-36 (MAC-CIS & AMNH); 1 ♂, VI-27-36 (GEB).

Oasis, 1 ♂, 2 ♀♀, VI-17-62, in open flowers of *C. palmata* at 6:00 a.m., females collecting pollen (AEM & MM); 4 ♂♂, VIII-23-62, in open flowers of *C. palmata*, 6:50 to 8:20 a.m. (AEM & MM).

Riverside, 1 ♀, VII-1-27, in flower of *C. foetidissima* (PHT); 2 ♂♂, VII-25-27 (PHT); 2 ♂♂, VII-26-27, in flowers of *C. foetidissima* (PHT); 5 ♂♂, VII-19-28, in flowers of *C. foetidissima* (PHT); 1 ♀, VI-28-28, in flower of *C. foetidissima* (PHT); 2 ♂♂, 1 ♀, VI-15-34, in flowers of pumpkin (CAS, CIS, UCR).

Temecula, 1 ♂, VII-4-50 (EGL).

San Bernardino Co.: Ontario, 1 ♂, VIII-4 (R. E. Snodgrass, CIS).

Yucaipa, 1 ♂, VI-25-52 (R. H. and L. D. Beamer, W. E. LaBerge, C. Liang, C. Weiner and A. Wolf, KU).

San Diego Co.: Jacumba, 1 ♂, VII-14-62, in closed flower of *C. foetidissima* (EGL).

San Pauma Valley, 1 ♂, IV-23-56, in flowers of gourd (B. Bailey, SDMNH); 2 ♂♂, VI-23-56, in flowers of gourd (B. Bailey, CIS).

Warner Springs, 2 mi N, 1 ♀, VII-4-56 (H. R. Moffitt, UCD); 1 ♀, VII-8-56 (R. M. Bohart, UCD).

Tulare Co.: Porterville, 1 ♀, VIII-11-35 (E. Daybell, UCR).

Strathmore, 1 ♀, VII-31-59, in pink bollworm ultraviolet light trap (RRS).

New Mexico:

Grant Co.: Separ, 2 mi NW, 6 ♂♂, VII-30-62, in flowers of *C. foetidissima*, 10:15 to 10:30 a.m. (MAC).

Wilna, 1 ♂, VII-30-62, in flower of *C. foetidissima* sometime between 11:30 and 11:40 a.m. (MAC).

Hidalgo Co.: Cienega, 7 ♂♂, VIII-16-61, in flowers of *C. foetidissima* (AEM & MM).

Cotton City, 1 ♂, 1 ♀, VIII-25-61, in flowers of domestic squash (AEM & MM).

Highway 9, 2 mi E of junction at Highway 80, 1 ♂, VIII-25-61, in flower of *C. foetidissima* (AEM & MM).

Post Office Canyon, Peloncillo Mountains, 1 ♂, VIII-19-61, in flower of *C. digitata* (AEM & MM).

Rodeo, 15 ♂♂, 1 ♀, VII-30-61, in flowers of *C. foetidissima* at 9:00 a.m. (EGL).

Rodeo (collected by AEM & MM), 8 ♂♂, 1 ♀, VIII-16-61, in flowers of *C. foetidissima*; 2 ♂♂, VIII-16-61, in flowers of *C. digitata*; 8 ♂♂, 1 ♀, VIII-18-61, in flowers of *C. foetidissima*; 1 ♂, VIII-18-61, in flower of domestic squash; 3 ♂♂, VII-21-61, in flowers of *C. foetidissima*; 1 ♂, IX-2-61, in flower of domestic squash; 2 ♂♂, IX-4-61, in flowers of domestic squash; 2 ♂♂, 1 ♀, IX-4-61, in flowers of *C. digitata*, 8:10 to 9:45 a.m., female collecting pollen at 9:45 a.m.; 1 ♂, 1 ♀, IX-4-61, in flowers of *C. foetidissima*; 1 ♂, 5 ♀♀, IX-7-61, in open flowers of *C. digitata*, 9:00 to 10:45 a.m.; 1 ♂, IX-6-61, in flower of *C. digitata*; 3 ♂♂, IX-7-62, in flowers of *C. foetidissima*; 3 ♂♂, 1 ♀, IX-9-61, in flowers of *C. digitata*; 1 ♂, 1 ♀, IX-9-61, in flowers of domestic squash at 10:15 a.m., female sucking nectar; 1 ♂, IX-11-61, in flower of *C. digitata*; 2 ♂♂, IX-12-61, in pistillate flower of *C. digitata*; 1 ♂, 1 ♀, IX-13-61, in flowers of *C. digitata*; 1 ♂, 11 ♀♀, IX-14-61, in open flowers of *C. digitata*, 6:05 to 7:05 a.m., females collecting pollen; 1 ♂, 4 ♀♀, IX-15-61, in open flowers of *C. digitata*, 5:50 to 6:50 a.m., females collecting pollen; 1 ♂, IX-23-61, in flower of *C. digitata* at 11:00 a.m.

Rodeo, 2.5 mi NW, 1 ♂, VII-23-61, in wilted flower of *C. digitata* at 10:00 a.m. (EGL); 7 ♂♂, 3 ♀♀, VII-23-61, in wilted flowers of *C. foetidissima* at 10:00 a.m. (EGL); 4 ♂♂, 5 ♀♀, VII-

24-61, in wilted flowers of *C. foetidissima* at 10:00 a.m. (EGL); 2 ♂♂, 4 ♀♀, VII-25-61, in wilted flowers of *C. foetidissima* at 10:20 a.m. (EGL); 1 ♂, VII-26-61, in flower of *C. foetidissima* at 11:00 a.m. (EGL).

Rodeo, 5 mi S, 11 ♂♂, 7 ♀♀, VII-31-59, in open flowers of *C. digitata*, 5:04 to 6:40 a.m., females collecting pollen (EGL); 3 ♂♂, 7 ♀♀, VII-31-59 in open flowers of *C. foetidissima*, 6:02 to 6:20 a.m., females collecting pollen (EGL); 2 ♂♂, VIII-4-59, in closed flowers of *C. foetidissima* at 3:00 p.m. (EGL); 13 ♂♂, 6 ♀♀, VIII-5-59, in open flowers of *C. digitata*, 4:50 to 6:00 a.m., females collecting pollen from 4:50 to 5:52 a.m. (EGL); 2 ♂♂, 2 ♀♀, IX-7-59, in cucurbit flowers (G. I. Stage, CIS).

Rodeo, 5.6 mi S, 1 ♂, VIII-14-61, in flower of *C. foetidissima* (AEM & MM); 3 ♂♂, VIII-17-61, in flowers of *C. digitata* at 9:15 a.m. (AEM & MM); 14 ♂♂, VIII-17-61, in flowers of *C. foetidissima* at 9:15 a.m. (AEM & MM).

Luna Co.: Gage, 2 mi E, 5 ♂♂, 1 ♀, VII-30-62, in flower of *C. foetidissima* sometime between 12:15 and 12:30 p.m. (MAC).

Mexico

Sonora:

Agua Prieta, 1 ♂, X-5-44 (WWJ-UCR); 7 ♂♂, VIII-24-61, in flowers of *C. foetidissima* (AEM & MM); 2 ♂♂, 2 ♀♀, VII-15-62, in closed flowers of *C. foetidissima*, 12:45 p.m. to 1:15 p.m. (MAC); 1 ♂, 3 ♀♀, VII-16-62, in closed flowers of *C. foetidissima*, 1:00 to 2:00 p.m. (MAC); 2 ♂♂, 1 ♀, VII-17-62, in closed flowers of *C. foetidissima*, 1:00 to 1:45 p.m. (MAC); 1 ♀, VIII-21-62, in flower of winter squash (EGL).

Agua Prieta, 20 mi SE, 1 ♂, VIII-25-57 (J. C. Schaffner, KU).

Benjamin Hill, 1 ♀, IX-19-61, in flower of *C. digitata* (AEM & MM); 30 ♂♂, 20 ♀♀, VIII-21-62, in open flowers of *C. digitata*, 7:20 to 9:15 a.m., females collecting pollen (AEM & MM).

Hermosillo, 35 mi W, on road to Kino

Bay, 1 ♂, VIII-20-62, in closed flower of squash (AEM & MM).

Imuris to Casita, 3 ♀ ♀, VIII-21-62, in closed flowers of *C. digitata*, 10:45 to 11:30 a.m. (AEM & MM).

Mexicali, 41 km SE, 1 ♀, in flower of squash (RRS).

Nogales, about 15 mi S, 1 ♂, 1 ♀, VIII-21-62, in nearly closed flowers of domestic squash sometime between 11:45 a.m. and 12:15 p.m. (AEM & MM).

Nogales, 20 mi S, 2 ♂ ♂, VI-19-62, in flowers of *C. foetidissima* (AEM & MM).

Pollen sources. *Xenoglossa angustior* uses the pollens of the native *C. digitata*, *C. foetidissima* and *C. palmata* as well as most, if not all, domestic *Cucurbita* grown within its geographic range.

Flight period. ♂ ♂, June 10 to October 5; ♀ ♀, June 13 to November 2.

Cockerell (1900:64) originally named this species as a variety of *Xenoglossa patricia* but subsequently considered it subspecifically distinct. Timberlake (*in* Michener, 1951:1221) placed it as a synonym of *X. patricia*. However, our examination of such structural features as the genitalia of the male, the pygidial plate of the male (fig. 4, top) and the position of the lateral ocelli in relation to the inner eye margins of both sexes, reveals that *X. angustior* is a distinct species.

X. angustior appears to be most closely related to *X. patricia*, but also shares a number of features in common with *X. mustelina*. These three species are more nearly related to each other than they are to other species of the genus. Very possibly they have been derived from a common ancestor. Our present knowledge of their distributions indicates that these species are allopatric. This suggests that these species may have arisen in response to environments which geographically replace one another.

Since *X. angustior*, *X. mustelina* and *X. patricia* share a number of similarly

derived features—the chiefly ferruginous integument and similarly colored vestiture, the greatly enlarged ocelli, the similarly constituted sixth metasomal sterna of the males (figs. 4 to 6, bottom)—it is suggested that these species were evolved from an ancestor not unlike the contemporary *X. fulva*. That species, which is widely distributed over much of central Mexico, shares with *X. crawfordi* (Mexico), *X. gabbi* (Costa Rica), and *X. fuliginosa* (Venezuela) a set of features (dark body coloration, thick and often dark colored pubescence, similarly constituted genitalia and male pygidial plates, figs. 7, 8, top, very similarly modified sixth metasomal sterna, figs. 7, 8, bottom, comparatively smaller ocelli, etc.), which when contrasted with the features of *X. angustior*, *X. mustelina*, and *X. patricia* appear to indicate the more generalized condition. It is our interpretation that *X. fulva* is more nearly annectant between these two groups and that its ancestor most likely was also ancestral to *X. angustior*, *X. patricia* and *X. mustelina*.

X. angustior is readily recognized in the male by the shape of the pygidial plate (fig. 4, top), and its female is easily distinguished by the ocellar feature presented in the key.

Xenoglossa patricia Cockerell (Fig. 5)

Xenoglossa patricia Cockerell, 1896, Canadian Ent., 28:191-192, 193, ♂ (New Mexico: Mesilla, a male in closed flower of *Cucurbita perennis* containing great numbers of *Diabrotica 12-punctata* at about 8:45 a.m. on June 21, 1896; 2 ♂ ♂, 1 ♀ in open flowers of *C. perennis* from about 7:45 to 8:05 a.m. on June 22); Cockerell, 1898, Bull. Univ. New Mexico, 1:67 (New Mexico: Mesilla Valley and Gila River); Michener, 1951, U. S. Dept. Agric., Monogr., 2:1221, ♂ ♀ (Texas and New Mexico records only).

Xenoglossa patricia patricia, Cockerell, 1900, Entomologist, 33:64; Cock-

Fig. 5. *Xenoglossa patricia* Cockerell, male: dorsal view of seventh metasomal tergum (top) and ventral view of sixth metasomal sternum (bottom).

erell, 1905, Trans. Amer. Ent. Soc. 31:328; Cockerell, 1906, Trans. Amer. Ent. Soc., 32:102 (New Mexico, *nec* Arizona record; flowers of *Cucurbita*); Cockerell, 1906, Trans. Amer. Ent. Soc., 32:310 (New Mexico: Mesilla Valley); Cockerell, 1908, Proc. Ent. Soc. Washington, 9:73 (Texas: Del Rio, from flowers of *C. foetidissima* on May 1, 1907), Cockerell, 1912, Proc. U. S. Natl.

Mus., 43:265 (New Mexico: Mesilla, visits flowers of *Cucurbita*); Lutz and Cockerell, 1920, Bull. Amer. Mus. Nat. Hist., 42:625, ♂ ♀ (New Mexico: Mesilla and Gila River, June, at *C. perennis* [= *C. foetidissima*]).

Male. Length, 19–24 mm. Length of forewing including tegula, 14–16 mm. Body and legs chiefly ferruginous; head, dorsum and sides of thorax black or dark mahogany red; clypeus chiefly yellow, narrowly bordered apically with ferruginous, not infrequently stained with ferruginous laterally and basally; supraclypeal area and parocular areas adjacent to clypeus variably stained or tinged with ferruginous; labrum yellow, occasionally stained with ferruginous laterally and apically; mandibles broadly yellow at base, outwardly suffused with red, consequently yellow coloration tapers and terminates near middle of mandible beyond which an irregular transverse black band connects with black-edged margins and encloses apically an elongate dull orange marking; antennae chiefly ferruginous on scape, pedicel and basal two flagellar segments, becoming dark mahogany red thereafter and often piceous dorsally; tegulae ferruginous or reddish; wings lightly infuscated, not violaceous; veins variably piceous and dark mahogany red; tibial spurs ferruginous; claws black apically.

Vestiture chiefly ferruginous, whitish on sides of thorax and head behind, thickest on thorax, hind margins of head, disc and anterior face of first metasomal tergum; pubescence on metasomal terga II–VII chiefly short, tomentose and appressed, covering lateral sides of terga II and III, and most of terga IV–VII, not disposed in distinct fasciae.

Eyes markedly diverging below (52:81); ocelli conspicuously enlarged, each ocellus much larger than an antennal socket; minimum distance between lateral and anterior ocellus slightly less than basal diameter of first flagellar segment; lateral ocellus separated from

inner eye margin by more than its longitudinal diameter; polished area below anterior ocellus Y-shaped; first flagellar segment slender, elongate, somewhat more than twice as long as succeeding segment (26:12); impunctate apical margin of first metasomal tergum widest medially, much more broadly impunctate than apical margins of second and succeeding terga, the nearest medial punctures being separated from apical rim by more than maximum thickness of first flagellar segment; discal punctures of first metasomal tergum sparser medially than those on disc of second metasomal tergum; discal punctures of second metasomal tergum discrete but crowded, interspaces feebly tessellate, surface shining; pygidial plate (fig. 5, top) and sixth metasomal sternum (fig. 5, bottom) as illustrated.

Female. Length, 18–23 mm. Forewing including tegula, 14–16 mm. Similar to male in appearance. Coloration of body including facial markings, pubescence and appendages essentially as in male.

Eyes as markedly diverging below as male (44:62); ocelli slightly more prominently enlarged than male; minimum distance between lateral ocellus and anterior ocellus much less than basal diameter of first flagellar segment; lateral ocellus elongated longitudinally, separated from inner eye margin by much less than its longitudinal diameter, but separated by nearly transverse diameter of anterior ocellus; clypeus, as seen from side, much less protuberant than maximum width of eye as measured in that position.

Location of type. Unknown.

Geographic range. New Mexico and Texas southward into Durango, Mexico.

SPECIMENS EXAMINED

United States

New Mexico:

Dona Ana Co.: Garfield, 1 ♂, VII-30-62, in closed flower of *Cucurbita foetidissima* at 6:25 p.m. (MAC).

Hatch (north side), 2 ♂♂, 2 ♀♀, VII-30-62, in closed flowers of *C. foetidissima*, 5:45 to 6:00 p.m. (MAC).

Hatch, 2 mi S, 4 ♂♂, VII-30-62, in closed flowers of *C. foetidissima*, 5:25 to 5:30 p.m. (MAC).

Hatch, 5 mi W, 1 ♂, VIII-1-62, in closed flower of *C. foetidissima* at 2:17 p.m. (MAC).

Las Cruces, 1 ♂, VIII-8-50 (J. W. MacSwain, CIS); 2 ♂♂, VII-15-52, in flowers of gourd (R. H. and L. D. Beamer, W. E. LaBerge, and C. Liang, KU); 1 ♀, VIII-8-55, at light (UNM); 1 ♀, VIII-31-55, at light (UNM); 1 ♀, VI-20-58 (G. L. Nielsen, USNM).

Las Cruces, 1 mi N, 1 ♂, VII-30-62, in closed flower of *C. foetidissima* at 3:15 p.m. (MAC).

Las Cruces, 10 mi N, 1 ♂, VII-30-62, in closed flower of *C. foetidissima* at 4:07 p.m. (MAC).

Las Cruces, 14 mi N, 1 ♂, VII-30-62, in closed flower of *C. foetidissima* at 4:15 p.m. (MAC).

Las Cruces, 5 mi E, 2 ♂♂, VII-15-52, in flowers of gourd (R. H. and L. D. Beamer, W. E. LaBerge and C. Liang, KU).

Mesilla Park, 1 ♂, 1 ♀, VI-22-96, in flowers of *C. perennis* (T.D.A. Cockerell, USNM); 1 ♂, VII-22, in flower of *C. perennis* (T.D.A. Cockerell, AM NH); 1 ♀, VIII-24, in flower of *C. perennis* (T.D.A. Cockerell, KU); 1 ♀, VII-13-97, in flower of *C. foetidissima* (T.D.A. Cockerell, KU); 1 ♂, VII-15-52, in flower of gourd (R. H. and L. D. Beamer, W. E. LaBerge and C. Liang, KU); 1 ♂, IX-14-57, in flower of *C. foetidissima* (R. C. Dickson, UCR).

Organ, 2 mi E, 4 ♂♂, VIII-1-62, in closed flowers of *C. foetidissima* at 12:15 p.m. (MAC).

Organ, 6 mi E, 2 ♂♂, VIII-1-62, in closed flower of *C. foetidissima* at 12:00 noon (MAC).

Organ, 8 mi E, 4 ♂♂, VIII-1-62, in closed flowers of *C. foetidissima* at 11:55 a.m. (MAC).

Radium Springs, 4 ♂♂, VII-30-62,

in closed flowers of *C. foetidissima* at 4:40 p.m. (MAC).

Radium Springs, 10 mi N, 1 ♂, VII-30-62, in closed flower of *C. foetidissima* at 4:55 p.m. (MAC).

Radium Springs, 12 mi N, 4 ♂♂, VII-30-62, in closed flowers of *C. foetidissima*, 5:05 to 5:15 p.m. (MAC).

Salem, 1 ♂, VII-30-62, in closed flower of *C. foetidissima* at 6:11 p.m. (MAC).

Salem, 1 mi W, 1 ♂, VII-30-62, in closed flower of *C. foetidissima* at 6:37 p.m. (MAC).

Lincoln Co.: 1 ♂, VII-16, taken on squash (KU).

Carrizozo, 9 mi W, 3 ♂♂, VII-31-62, in closed flowers of *C. foetidissima* at 4:21 p.m. (MAC).

Carrizozo, 11 mi S, 1 ♂, VII-31-62, in closed flower of *C. foetidissima* at 5:05 p.m. (MAC).

Oscuro, 3 ♂♂, VII-31-62, in closed flowers of *C. foetidissima* at 5:30 p.m. (MAC).

Luna Co.: Deming, 3 mi NE, 5 ♂♂, 1 ♀, VIII-1-62, in closed flowers of *C. foetidissima* at 5:34 p.m. (MAC).

Deming, 5 mi NE, 2 ♂♂, VIII-1-62, in closed flowers of *C. foetidissima* at 5:17 p.m. (MAC).

Deming, 7 mi W, 3 ♂♂, VII-30-62, in closed flowers of *C. foetidissima*, 1:05 to 1:15 p.m. (MAC); 1 ♂, VIII-1-62, in closed flower of *C. foetidissima* at 5:45 p.m. (MAC).

Deming, 15 mi E, 1 ♂, VII-30-62, in closed flower of *C. foetidissima*, 2:15 to 2:25 p.m. (MAC).

Florida, 2 ♂♂, VIII-1-62, in closed flowers of *C. foetidissima* at 4:40 p.m. (MAC).

Florida, 4 mi SW, 2 ♂♂, 1 ♀, VIII-1-62, in closed flowers of *C. foetidissima* at 5:00 p.m. (MAC).

Nutt, 4 ♂♂, VIII-1-62, in closed flowers of *C. foetidissima* at 3:47 p.m. (MAC).

Nutt, 1 mi SW, 3 ♂♂, VIII-1-62, in closed flowers of *C. foetidissima* at 4:10 p.m. (MAC).

Nutt, 1 mi E, 1 ♂, VIII-1-62, in closed flower of *C. foetidissima* at 3:30 p.m. (MAC).

Nutt, 3 mi NE, 1 ♂, VIII-1-62, in closed flower of *C. foetidissima* at 3:10 p.m. (MAC).

Nutt, 5 mi NE, 1 ♂, VIII-1-62, in closed flower of *C. foetidissima* at 2:47 p.m. (MAC).

Otero Co.: Alamogordo, 2 ♂♂, VIII-1-62, in flowers of *C. foetidissima* at 9:16 a.m. (MAC).

Alamogordo, 7 mi W, 1 ♂, VIII-1-62, in flower of *C. foetidissima* at 9:20 a.m. (MAC).

Alamogordo, 35 mi W, 3 ♂♂, VIII-1-62, in flowers of *C. foetidissima* at 10:35 a.m. (MAC).

Alamogordo, 39 mi W, 2 ♂♂, VIII-1-62, in flowers of *C. foetidissima* at 11:08 a.m. (MAC).

Three Rivers, 1 ♂, VII-31-62, in closed flower of *C. foetidissima* at 6:00 p.m. (MAC).

Tularosa, 10 mi N, 6 ♂♂, VII-31-62, in closed flowers of *C. foetidissima* at 6:40 p.m. (MAC).

White Sands National Monument, 13 mi W of Alamogordo, 10 ♂♂, 1 ♀, VIII-1-62, in flowers of *C. foetidissima*, 9:55 to 10:05 a.m. (MAC).

Sandoval Co.: Bernalillo, 4 mi NW, 1 ♂, VII-8-59, in flower of *C. foetidissima* (RFS).

Sierra Co.: Arrey, 1 mi N, 1 ♂, VII-31-62, in flower of *C. foetidissima* at 9:03 a.m. (MAC).

Arrey, 2 mi S, 3 ♂♂, VII-31-62, in flowers of *C. foetidissima* at 8:30 a.m. (MAC).

Arrey, 4 mi S, 5 ♂♂, 1 ♀, VII-30-62, in closed flowers of *C. foetidissima*, 6:55 to 7:05 p.m. (MAC).

Derry, 2 ♂♂, VII-30-62, in closed flowers of *C. foetidissima* at 6:39 p.m. (MAC).

Derry, 1 mi N, 2 ♂♂, VII-30-62, in closed flowers of *C. foetidissima* at 6:47 p.m. (MAC).

Caballo Dam, 7 ♂♂, 2 ♀♀, VII-31-62, in flowers of *C. foetidissima*, 9:20 to 10:00 a.m. (MAC).

Gila River, 1 ♀ (Tinsley, UCR).

Truth or Consequences, 21 mi N, 1 ♂, VII-31-62, in closed flower of *C. foetidissima* at 12:25 p.m. (MAC).

Socorro Co.: San Antonio, 11 mi S, 2 ♂♂, 1 ♀, VII-31-62, in closed flowers of *C. foetidissima*, 1:00 to 1:10 p.m. (MAC).

San Antonio, 25 mi S, 1 ♂, VII-31-62, in closed flower of *C. foetidissima* at 12:25 p.m. (MAC).

San Antonio, 25 mi E, 11 ♂♂, 1 ♀, VII-31-62, in closed flowers of *C. foetidissima*, 2:40 to 2:45 p.m. (MAC).

Texas:

Brewster Co.: Marathon, 16 mi S, 1 ♂, VII-17-50, in flower of *C. foetidissima* (RFS-AMNH).

Strobel, 8 mi E of Alpine, 1 ♂, VII-20-50 (RFS-AMNH).

Hudspeth Co.: Sierra Blanca, 1 ♂, VII-5-41 (R. H. Crandall, USNM).

Del Rio, 1 ♂, V-1-07, in flower of *C. foetidissima* (F. C. Pratt, USNM).

Webb Co.: Laredo, 1 ♂, III-13-55 (C. H. Hinojosa, CIS).

Mexico

Chihuahua:

Ciudad Juarez, 239 km S, 2 ♂♂, VII-1-47, in flowers of *Cucurbita* sp. (CDM-AMNH).

Parral, 9 mi S, 5,300 feet, 2 ♂♂, VII-26-53, in flowers of *Cucurbita* (KU Mexican Expedition, KU).

Samalayuca, 6 ♂♂, VI-24-47, in flowers of *Cucurbita* (CDM-AMNH).

Santa Barbara, Santa Barbara District, 7,500 feet, 1 ♂, VII-18-47, in flower of *Cucurbita* (CDM-AMNH); 1 ♀, VII-20-47 (CDM-AMNH).

Villa Ahumada, 10 mi S, 3 ♂♂, 4 ♀♀, VII-4-54 (J. W. MacSwain, CIS); 4 ♂♂, 1 ♀, same data (E. I. Schlinger, CIS).

Coahuila:

La Rosa, 1 ♂, VIII-22-47 (CDM-AMNH).

Durango:

Durango, 1 ♂, VIII-7-51, in closed flower of *C. foetidissima* (PDH).

Pollen sources. *Xenoglossa patricia* uses the pollen of the indigenous *C. foetidissima* and most likely the pollens of the various domestic *Cucurbita* although there are no records to substantiate this.

Flight period. ♂♂, March 13 to September 14; ♀♀, June 20 to August 31.

Xenoglossa patricia is very similar in appearance to *X. angustior* in the coloration of the integument and vestiture. It seems likely that this close correspondence led Timberlake (in Michener, 1951:1221) to place *X. angustior* as a synonym of *X. patricia*. The most conspicuous structural features which distinguish these species are the shape of the pygidial plates of the males (figs. 4, 5, top) and the ocellar differences of the females as detailed in the key to the species. *X. patricia* is apparently most closely related to *X. angustior* but also shares a number of structural features in common with *X. mustelina*. Details of these relationships are discussed in the account of *X. angustior*.

***Xenoglossa mustelina* (Fox)**

(Fig. 6)

Centris mustelina Fox, 1893, Proc. California Acad. Sci., (2)4:24-25, ♀ ♂ (Lower California: San José del Cabo); Fox, 1894, Proc. California Acad. Sci., (2)4:118.

Xenoglossa fulva, Cockerell, 1896, Canadian Ent., 28:193 (Lower California record only), *teste* Cockerell, 1905:328.

Xenoglossa mustelina, Cockerell, 1905, Trans. Amer. Ent. Soc., 31:328 (Lower California); Cockerell, 1906, Trans. Amer. Ent. Soc., 32:102 (Lower California); Cockerell, 1912, Proc. U. S. Natl. Mus., 43:265, ♀ ♂ (Lower California: San José del Cabo); Lutz and Cockerell, 1920, Bull. Amer. Mus. Nat.

Hist., 42:625, ♀ ♂ (Lower California: San José del Cabo).

Male. Length, 17-21 mm. Length of forewing including tegula, 12-14 mm. Body and legs chiefly ferruginous; head, dorsum and sides of thorax black or dark mahogany red; clypeus chiefly yellow, narrowly bordered apically with ferruginous, occasionally stained with ferruginous laterally and basally; supraclypeal area and parocular areas adjacent to clypeus variably stained or tinged with ferruginous; labrum yellow, narrowly ferruginous apically; mandibles broadly yellow at base, outwardly suffused with red, consequently yellow coloration tapers and terminates near middle of mandible beyond which an irregular transverse black band connects with black-edged margins and encloses apically an elongate dull orange marking; antennae chiefly ferruginous on scape, pedicel and basal two flagellar segments, becoming dark mahogany red thereafter and often piceous dorsally; tegulae ferruginous; wings lightly infuscated, not violaceous; veins chiefly ferruginous, occasionally stained with black; tibial spurs ferruginous; claws black on apical half.

Vestiture chiefly ferruginous, not whitish on sides of thorax or head behind, thickest on thorax, hind margins of head, disc and anterior face of first metasomal tergum; pubescence on metasomal terga II-VII chiefly short, tomentose and appressed, covering lateral sides of terga II and III, and most of terga IV-VII, not disposed in distinct fasciae.

Eyes markedly diverging below (62:88); ocelli conspicuously enlarged, each ocellus much larger than an antennal socket; minimum distance between lateral ocellus and anterior ocellus conspicuously less than basal diameter of first flagellar segment; lateral ocellus separated from inner eye margin by less than its longitudinal diameter; polished area below anterior ocellus Y-shaped; first flagellar segment slender, elongate, approximately twice as long

Fig. 6. *Xenoglossa mustelina* (Fox), male: dorsal view of seventh metasomal tergum (top) and ventral view of sixth metasomal sternum (bottom).

as succeeding segment (22:10.5); impunctate apical margin of first metasomal tergum widest medially, much more broadly impunctate than apical margins of second and succeeding terga,

the nearest medial punctures being separated from apical rim by more than maximum thickness of first flagellar segment; discal punctures of first metasomal tergum sparser medially than

those on disc of second metasomal tergum; discal punctures of second metasomal tergum discrete, but crowded, interspaces feebly tessellate, surface shining; pygidial plate (fig. 6, top) and sixth metasomal sternum (fig. 6, bottom) as illustrated.

Female. Length 16–20 mm. Forewing including tegula 13–14 mm. Similar to male in appearance. Coloration of body including facial markings, pubescence and appendages essentially as in male.

Eyes as markedly diverging below as male (64:83); ocelli more prominently enlarged than male; minimum distance between lateral ocellus and anterior ocellus much less than basal diameter of first flagellar segment; lateral ocellus scarcely elongated longitudinally, separated from inner eye margin by slightly less than its longitudinal diameter, but separated by much more than one-half transverse diameter of anterior ocellus; polished ocellar area, first flagellar segment, and punctation of first and second metasomal terga essentially as in male; clypeus, as seen from side, slightly more protuberant than maximum width of eye as measured in that position.

Location of type. California Academy of Sciences, No. 281.

Geographic range. Apparently endemic in Baja California, Mexico.

SPECIMENS EXAMINED

Mexico

Baja California:

"L. Cal." [= San José del Cabo], 1 ♂ (holotype, CAS); 2 ♂♂ (Timberlake Collection, UCR).

Comondu, 11 ♂♂, 2 ♀♀, VII-22-38 (A. E. Michelbacher and E. S. Ross, CAS).

Pollen sources. Unknown, but presumably native and domestic species of *Cucurbita*.

Flight period. Unknown, but presumably the summer months.

This species was described by Fox (1893:24–25) on the basis of one female and eight males which had been collected at San José del Cabo, Baja California, Mexico. In the following year, Fox (1894:118) placed it as a synonym of *Xenoglossa fulva* Smith, a species of central Mexico. However, Cockerell (1905:328) reported, after a study of the type of *X. fulva*, that *X. mustelina* is a valid species. Subsequently, Cockerell (1912:265) reaffirmed this position and stated that he had in his possession cotypes of both species. Since no type specimen has been selected from the original cotype series, we now designate a male specimen which is labeled "Lectotype," presumably by E. P. Van Duzee, and is number 281 in the entomology type collection of the California Academy of Sciences. The unique female specimen of the cotype series could not be located in the collections of that institution.

X. mustelina is most closely related to *X. angustior* and *X. patricia*. From the few specimens available for study it appears to be the smallest of these species and may be endemic in Baja California. Its male is easily recognized by the distinctive shape of the pygidial plate (fig. 6, top). The female is readily distinguished from *X. angustior* and *X. patricia* by the features outlined in the accompanying key.

Xenoglossa fulva Smith

(Figs. 2, 3, 7)

Xenoglossa fulva Smith, 1854, Catalogue of hymenopterous insects in the ... British Museum, 2:315, ♀ ♂ (Mexico:Puebla); Cresson, 1879, Trans. Amer. Ent. Soc., 7:226, ♂ ♀ (Arizona and Mexico); Patton, 1879, Bull. U. S. Geol. Surv., 5:473; Gribodo, 1882, Ann. Mus. Civ. Genova, 18:269, 270, 271, 272, 273, ♀ ♂ (Mexico); Cresson, 1887, Trans. Amer. Ent. Soc., suppl. vol., p. 305 (Arizona and Mexico); Cockerell, 1896, Canadian Ent., 28:191, 192, 193, ♂ ♀ ("...ranges from Lower California to Arizona and southward to

Puebla, Mexico"); Cockerell, 1905, Trans. Amer. Ent. Soc., 31:328; Cockerell, 1906, Trans. Amer. Ent. Soc., 32: 102 (Mexico); Cockerell, 1912, Proc. U. S. Natl. Mus., 43:265 (Mexico: Puebla); Lutz and Cockerell, 1920, Bull. Amer. Mus. Nat. Hist., 42:624, ♀ ♂ (Arizona and Mexico: Puebla); Linsley, MacSwain, and Smith, 1955, Bull. Southern California Acad. Sci., 54:128-141, 3 pls., ♀ ♂ (Mexico: "... a campsite 11 miles southwest of Acambaro, Guanajuato, and 3½ miles northeast of Zinapecuaro, near the border between the states of Guanajuato and Michoacan ... 6,900 ft." Nesting activities as observed on August 18 and 19, 1954, are described for both sexes; pollen source was domestic squash; nectar sources in addition to domestic squash were *Helmia salicifolia*, *Mandevilla foliosa*, and *Salvia amarissima*).

Anthophora holopyrrha Dours, 1869, Mem. Soc. Linn. Nord France, 2:89-90, ♀ ♂ ("Mexique"), *teste* Cresson, 1879: 226; Gribodo, 1882:273; Cockerell, 1912:265; and Lutz and Cockerell, 1920:624.

Eucera fulva, Dalla Torre, 1896, Cat. Hymen., 10:233, ♀ ♂ (Mexico).

Male. Length, 20-24 mm. Length of forewing including tegula, 16-18 mm. Body and legs chiefly ferruginous; head, dorsum and sides of thorax black or dark mahogany red; clypeus chiefly yellow, narrowly bordered apically with ferruginous, not infrequently stained with ferruginous laterally and basally; supraclypeal area yellow, but usually stained with ferruginous; parocular areas adjacent to clypeus black, occasionally reddened; labrum yellow, narrowly margined apically with ferruginous; mandibles broadly yellow at base, outwardly suffused with red, consequently yellow coloration tapers and terminates near middle of mandible beyond which an irregular transverse black band connects with black-edged margins and encloses apically an elongate dull orange marking; antennae chiefly black, but usually reddened on

scape, pedicel and first and apical flagellar segments; tegulae ferruginous, sometimes tinged with black; wings heavily infuscated, violaceous; veins black or dark mahogany red; tibial spurs dark reddish-brown; claws chiefly black on at least apical half.

Vestiture chiefly fulvous, paling to almost white on ventral surface of thorax and head below, thickest on thorax, hind margins of head and first metasomal tergum; pubescence on metasomal terga II-VII chiefly short, tomentose and appressed, densely and uniformly covering tergal surfaces, not disposed in fasciae.

Eyes moderately diverging below (71:87); ocelli enlarged, each ocellus much larger than an antennal socket; minimum distance between lateral ocellus and anterior ocellus distinctly less than basal diameter of first flagellar segment; lateral ocellus separated from inner eye margin by less than its longitudinal diameter; polished area below anterior ocellus broadly Y-shaped; first flagellar segment moderately thickened, not greatly elongate, much less than twice as long as succeeding segment (32:23); impunctate apical margin of first metasomal tergum widest medially, much more broadly impunctate than apical margins of second and succeeding terga, the nearest medial punctures being separated from apical rim by more than maximum thickness of first flagellar segment; discal punctures of first metasomal tergum somewhat sparser medially than those on disc of second metasomal tergum; discal punctures of second metasomal tergum fine, discrete, but crowded; interspaces tessellated, surface shining; pygidial plate (fig. 7, top) and sixth metasomal sternum (fig. 7, bottom) as illustrated.

Female. Length 18-23 mm. Forewing including tegula 15-18 mm. Similar to male in appearance. Coloration of body including facial markings, pubescence and appendages essentially as in male. Eyes somewhat more divergent below than male (75:95); ocelli more promi-

Fig. 7. *Xenoglossa fulva* Smith, male: dorsal view of seventh metasomal tergum (top) and ventral view of sixth metasomal sternum (bottom).

nently enlarged than male; minimum distance between lateral ocellus and anterior ocellus much less than basal diameter of first flagellar segment; lateral ocellus conspicuously elongated longi-

tudinally, separated from inner eye margin by much less than its longitudinal diameter, but separated by scarcely more than one-half transverse diameter of anterior ocellus; polished ocellar

area, first flagellar segment, and punctation of first and second metasomal terga essentially as in male; clypeus, as seen from side, much less protuberant than maximum width of eye as measured in that position.

Location of type. *fulva*: British Museum (Natural History); *holopyrrha*: Muséum National d'Histoire Naturelle, Paris.

Geographic range. Central Mexico (Guanajuato to Oaxaca).

SPECIMENS EXAMINED

Mexico

Guanajuato:

Acambaro, 11 mi SW, 30 ♂♂, 1 ♀, VIII-17-54, in flowers of domestic squash (E. G. Linsley, J. W. MacSwain and Ray F. Smith, CIS); 2 ♀♀, VIII-18-54, in flowers of domestic squash (E. G. Linsley, J. W. MacSwain and Ray F. Smith, CIS).

Irapuato, 7 ♂♂, 1 ♀, VIII-10-62, in open flowers of domestic squash, 7:15 to 7:55 a.m., female collecting pollen (AEM & MM).

Léon, 3 ♂♂, VIII-10-62, in flowers of domestic squash, 10:25 to 10:40 a.m., flowers starting to close (AEM & MM).

Roque, 1 ♂, XI-10-61, "Frijol" (H. Velasco P., INIA).

Silao, 1 ♀, VIII-10-62, collecting pollen in open flower of domestic squash, 9:30 to 10:00 a.m. (AEM & MM).

Valle de Santiago, 3 ♂♂, 1 ♀, X-13-62, "hospedera plantas silvestre" (D. Perez, INIA).

Mexico:

Atlatlahuacan, 1 ♂, VIII-18-62, in flower of domestic squash at 10:30 a.m. (JKD).

Michoacan:

Ciudad Hidalgo, 5 ♂♂, 1 ♀, VII-11-62, in open flowers of domestic squash, 10:45 to 11:10 a.m. (AEM & MM); 22 ♂♂, 4 ♀♀, VII-11-62, in open flowers of domestic squash, 11:25 to 11:45 a.m. (AEM & MM).

Morelia, 1 ♂, (USNM); 1 ♂, VII-

17-53 (KU Mexican Expedition, KU); 25 ♂♂, VII-9-62, in closed flowers of domestic squash, 5:00 to 6:00 p.m. (AEM & MM); 173 ♂♂, 22 ♀♀, VII-10-62, in open flowers of domestic squash, 6:00 to 7:30 a.m., females collecting pollen (AEM & MM).

Tuxpan, 5 ♂♂, 1 ♀, VII-11-51, in closed flowers of native *Cucurbita foetidissima* or closely related species (PDH); 8 ♂♂, 1 ♀, VII-11-62, in closed flowers of native *Cucurbita*, 12:15 to 1:00 p.m. (AEM & MM); 3 ♂♂, IX-1-62, in open flowers of domestic squash (*C. pepo*) at 8:15 a.m. (DHJ).

Tuxpan, 3 mi W, 12 ♂♂, 2 ♀♀, IX-2-62, in open flowers of domestic squash (*C. pepo*) at 9:14 a.m., females collecting pollen (DHJ).

Tuxpan, 4 mi W, 5 ♂♂, 1 ♀, IX-2-62, in open flowers of domestic squash (*C. pepo*) at 8:30 a.m., female collecting pollen (DHJ).

Tuxpan, 5 mi N, 5,500 feet, 16 ♂♂, 1 ♀, VII-16-53 (KU Mexican Expedition, KU).

Morelos:

Amayuca, 2 ♂♂, VIII-18-62, in closed flowers of domestic squash (*C. pepo*), 11:40 to 11:55 a.m. (JKD); 2 ♂♂, same data (PHD); 1 ♂, same data (RFS).

Cuautla, 4 ♂♂, VII-24-62, in closed flowers of domestic squash, 12:00 to 12:30 p.m. (AEM & MM).

Cuautla, 9 km NE, 6 ♂♂, VIII-18-62, in closed flowers of domestic squash (*C. mixta*), 10:45 to 11:05 a.m. (JKD); 9 ♂♂, same data (PDH); 1 ♂, 1 ♀, same data, but female with pollen (RFS).

Cuernavaca, 2 ♂♂, VII-28-57, at flowers of lemon (W. W. Gibson, INIA); 13 ♂♂, VII-16-62, in open flowers of domestic squash, 6:30 to 8:05 a.m. (AEM & MM); 1 ♂, same data, but collected at 3:00 p.m. (AEM & MM); 12 ♂♂, 2 ♀♀, VII-24-62, in open flowers of domestic squash, 5:45 to 10:25 a.m., females collecting pollen (AEM & MM).

Cuernavaca, 4 km E, 1 ♀, VIII-19-62, collecting pollen in open flower of domestic squash (*C. mixta*) sometime between 6:15 and 7:00 a.m. (JKD); 3 ♂♂, VIII-19-62, in open flowers of domestic squash (*C. mixta*), 6:15 to 7:00 a.m. (PDH).

Cuernavaca, 6 km E, 3 ♂♂, VIII-2-62, in open but wilted flowers of domestic squash (*C. maxima* and *C. mixta*), 9:00 to 9:45 a.m. (JKD); 13 ♂♂, same data (PDH).

Jalastoc, 1 ♂, VIII-9-52 (D. Perez Ruiz, INIA).

Oaxaca:

Huajuapán, 1 ♀, XII-15-47 (M. Marquis, CAS).

Mitla, 38 ♂♂, 12 ♀♀, VII-28-62, in open flowers of domestic squash, 8:45 to 9:50 a.m., females collecting pollen (AEM & MM).

Nochistlan, 3 mi NW, 19 ♂♂, 1 ♀, VII-5-53, in flowers of native gourd (KU Mexican Expedition, KU).

Oaxaca, 23 ♂♂ (USNM); 1 ♂, IX-1929 (E. G. Smyth, KU).

Oaxaca (collected by AEM & MM), 4 ♂♂, VII-25-62, in closed flowers of domestic squash, 6:00 to 6:10 p.m.; 186 ♂♂, 64 ♀♀, VII-26-62, in open flowers of domestic squash, 5:50 to 7:50 a.m., females collecting pollen; 13 ♂♂, 1 ♀, same data, but 10:05 to 10:25 a.m.; 1 ♂, same data, but in closed flower at 1:00 p.m.; 47 ♂♂, 9 ♀♀, VII-27-62, in open flowers of domestic squash, 8:10 to 9:10 a.m., females collecting pollen.

Puebla:

Izucar de Matamoros, 1 ♂, VIII-12-03 (W. L. Tower, KU).

Molinos, 1 ♀, VIII-13-03 (W. L. Tower, KU).

Puebla, 1 ♂, VIII-14-03 (W. L. Tower, KU); 4 ♂♂, VIII-7-62, in flowers of domestic squash (AEM & MM); 2 ♂♂, 1 ♀, VIII-31-62, in open flowers of domestic squash (*C. pepo*), 5:30 to 6:10 a.m., female collecting pollen sometime between 5:30 and 6:00 a.m. (DHJ).

San Martin Texmelucan, 3 ♂♂, VIII-8-62, in flower of domestic squash (AEM & MM).

San Martin Texmelucan, 7 km W, 1 ♂, VIII-16-62, in open flower of domestic squash (*C. pepo*), 8:25 to 8:40 a.m. (JKD); 1 ♂, same data (PDH).

Tehuacan, 4 ♂♂, VIII-6-62, in open flowers of domestic squash, 9:15 to 9:30 a.m. (AEM & MM).

Tehuacan, 2 km W, 1 ♂, VIII-16-62, in closed flower of domestic squash (*C. pepo*) sometime between 4:15 and 4:30 p.m. (JKD); 3 ♂♂, 1 ♀, same data (PDH); 2 ♂♂, same data (RFS).

Tehuacan, 37 mi W, 1 ♂, 1 ♀, VII-11-62, sucking nectar at noon in flowers of *Tecoma stans* (DHJ).

Tepanco, 73 ♂♂, 2 ♀♀, VIII-6-62, in open flowers of domestic squash, 9:35 to 10:35 a.m., females collecting pollen (AEM & MM).

Querétaro:

Querétaro, 2 ♂♂, 2 ♀♀, VIII-9-62, in open flowers of *C. foetidissima*, 8:15 to 9:45 a.m., females collecting pollen (AEM & MM).

Veracruz:

Cordoba, 3.9 mi E, 1 ♂, VIII-7-62, in open flower of domestic squash (*C. moschata*) sometime between 8:30 and 9:30 a.m. (PDH); 1 ♂, same data (RFS).

Fortin de las Flores, 1 ♂, VIII-5-62, in open flower of domestic squash sometime between 6:10 and 7:10 a.m. (AEM & MM).

Orizaba, 1 ♂, VIII-5-62, in flower of domestic squash (AEM & MM).

Pollen sources. Apparently *Xenoglossa fulva* freely utilizes the pollens from the various domestic species of *Cucurbita*, but its use of the pollens of the native cucurbits is poorly known. On several occasions the females have been observed collecting pollen from unidentified native species of the genus *Cucurbita*, and only once have the females of *X. fulva* been observed to collect pollen from the native *C. foetidissima*.

Flight period. ♂♂ July 5 to November 10; ♀♀, July 5 to December 15.

Although *X. fulva* was recorded from Arizona by Cresson (1879:226; 1887:305) and subsequently cited from there by Cockerell (1896a:193), it seems likely that the record probably was based upon a specimen of the then undescribed *X. angustior*. *X. angustior* is superficially similar to *X. fulva* in the coloration of the vestiture and is the only species of *Xenoglossa* known to occur in Arizona which conceivably might be confused with *X. fulva*. The northernmost specimens of *X. fulva* that we have examined were collected at León, Guanajuato, Mexico, well south of the United States. As Cockerell (1905b:328; 1912:265) and Lutz and Cockerell (1920:624) have shown, the record of *X. fulva* from Baja California is incorrect. Fox (1894:118) occasioned this confusion since he believed that the *Xenoglossa*, described by him in the preceding year as *Centris mustelina*, from Baja California was a synonym of *X. fulva*.

The distribution of *X. fulva* is apparently centered chiefly in the mountainous region of central Mexico. Throughout most of its range it is the only species of *Xenoglossa* present. It does occur with the much more darkly pubescent *X. crawfordi* in the states of Guanajuato, Michoacan and Morelos. In the chiefly ferruginous coloration of the integument and vestiture *X. fulva* is similar to *X. angustior*, *X. patricia* and *X. mustelina*. *X. fulva*, in addition to its larger size and darker fulvous coloration, is easily separated from these species by the structure of the sixth metasomal sternum of the male (fig. 7) and the disposition of the ocelli in the female. Its nearest relative, as discussed in the accounts of *X. angustior* and *X. crawfordi*, seems to be *X. crawfordi*.

Linsley, MacSwain and Smith (1955) have provided an account of the nesting habits of this species.

Xenoglossa crawfordi Cockerell (Fig. 8)

Xenoglossa crawfordi Cockerell, 1910, Ann. Mag. Nat. Hist., (8)5:367-368, ♂ (Mexico:Guadalajara); Cockerell, 1912 Proc. U. S. Natl. Mus., 43:265; Cockerell, 1917, Ann. Mag. Nat. Hist., (8)19:481, ♂ (Mexico:Guanajuato); Lutz and Cockerell, 1920, Bull. Amer. Mus. Nat. Hist., 42:624.

Xenoglossa dugesi Cockerell, 1919, Proc. U. S. Natl. Mus., 55:194, ♀ (Mexico: Guanajuato); Lutz and Cockerell, 1920, Bull. Amer. Mus. Nat. Hist., 42:624. New synonymy.

Male. Length, 20-24 mm. Length of forewing including tegula, 16-17 mm. Head, body and legs chiefly black, often stained with dark mahogany red; apices of metasomal terga and sterna characteristically a clear ferruginous; clypeus chiefly yellow, narrowly bordered apically with ferruginous and irregularly, though rather broadly, stained darkly along upper sides and basally with brownish-black; supraclypeal and parocular areas black; labrum yellow, but stained laterally with ferruginous or dark mahogany red; mandibles broadly yellow at base, outwardly suffused with red, consequently yellow coloration tapers and terminates near middle of mandible beyond which an irregular transverse black band connects with black-edged margins and encloses apically an elongate dull orange marking; antennae chiefly black, often paling on scape, pedicel, and most apical flagellar segments to dark mahogany red; tegulae piceous, occasionally tinged externally with ferruginous; wings heavily infuscated, weakly violaceous; veins variably piceous and dark mahogany red; tibial spurs reddish-brown; claws black apically.

Vestiture chiefly ochraceous, thickest and longest on thorax, anterior face of metasoma, and hind margins of head; densely tomentose and richly ochraceous on most discal and lateral surfaces

Fig. 8. *Xenoglossa crawfordi* Cockerell, male: dorsal view of seventh metasomal tergum (top) and ventral view of sixth metasomal sternum (bottom).

of metasomal terga II–VII, paling to nearly pure white on anterior femora, lower surfaces of genae, parocular areas, and pleural sides of thorax; vestiture elsewhere a dark chocolate brown.

Eyes moderately diverging below (66:81); ocelli enlarged, each ocellus much larger than an antennal socket; minimum distance between lateral ocellus and anterior ocellus much less than

basal diameter of first flagellar segment; lateral ocellus separated from inner eye margin by approximately its longitudinal diameter; polished area below anterior ocellus broadly Y-shaped; first flagellar segment moderately thickened, not greatly elongate, much less than twice as long as succeeding segment (31:22); impunctate apical margin of first metasomal tergum much more broadly

impunctate than apical margins of second and succeeding terga, the nearest medial punctures being separated from apical rim by more than maximum thickness of first flagellar segment; discal punctures of second metasomal tergum distinct, densely crowded, interspaces clearly tessellate, surface feebly shining; pygidial plate (fig. 8, top) and sixth metasomal sternum (fig. 8, bottom) as illustrated.

Female. Length 20–23 mm. Forewing including tegula 15–16 mm. Similar in appearance to male, except ochraceous pubescence of head, thorax, and anterior femora largely replaced with black or brownish-black pubescence; clypeus black, often tinged with dark mahogany red. Eyes more divergent below than in male (72:92); ocelli more prominently enlarged than male; minimum distance between lateral ocellus and anterior ocellus much less than basal diameter of first flagellar segment; lateral ocellus slightly elongated longitudinally, separated from inner eye margin by much less than its longitudinal diameter, but separated by much more than one-half transverse diameter of anterior ocellus; polished ocellar area, first flagellar segment, and punctuation of first and second metasomal terga essentially as in male; clypeus, as seen from side, much less protuberant than maximum width of eye as measured in that position.

Location of types. *crawfordi*: Timberlake Collection, Riverside, California; *dugesi*: U. S. National Museum, No. 21660.

Geographic range. Central Mexico (Morelos), northwestwardly to southern Arizona (Nogales).

SPECIMENS EXAMINED

Mexico

Guanajuato:

Guanajuato, 1 ♂, 1 ♀ (A. Duges, USNM); 1 ♀ (A. Duges, UCR).

Jalisco:

Chapala, 1 ♂, VII-7-62, in flower of

domestic squash between 6:45 a.m. and 8:45 a.m. (AEM & MM); 1 ♂, VIII-30-62 (R. Johnson, S & S).

Guadalajara, 1 ♂ (D. L. Crawford, 7106, UCR).

Michoacan:

Apatzingan, 11 mi E, 1 ♂, VIII-20-54 (E. G. Linsley, J. W. MacSwain, and Ray F. Smith, CIS).

Cojumatlan, 10 ♂♂, VII-9-62, in flowers of domestic squash, 9:10 a.m. to 9:40 a.m., pollen already depleted at start of survey (AEM & MM); 1 ♂, same date, in flower of native gourd at 10:00 a.m., pollen depleted (AEM & MM).

Zamora, 15 mi E, 1 ♀, VIII-14-57 (J. A. Chemsak and B. J. Rannells, CIS).

Morelos:

Cuernavaca, 3 ♂♂, VII-24-62, in flowers of domestic squash, 6:15 to 6:45 a.m. (AEM & MM).

Jalastoc, 2 ♂♂, VIII-4-52 (D. Perez Ruiz, INIA); 2 ♂♂, VIII-7-52 (D. Perez Ruiz, INIA).

Nayarit:

Ixtlan del Rio, 9 mi N, 1 ♂, 2 ♀♀, IX-2-62, in flowers of *C. pepo* at 6:15 a.m. (DHJ).

Ixtlan del Rio, 10 mi N, 3 ♀♀, IX-2-62, in flowers of *C. pepo* at 6:25 a.m. (DHJ).

Tepic, 1 mi N, 1 ♂, 7 ♀♀, IX-1-62, in flowers of *C. pepo* at 7:30 a.m. (DHJ).

Sinaloa:

La Reforma, 4 ♂♂, 2 ♀♀, VIII-18-62, in flowers of a presumably native gourd, 6:35 to 6:45 a.m. (AEM & MM).

Mazatlan, 30 to 35 mi N, 19 ♂♂, VIII-17-62, in flowers of a native gourd, 6:30 to 8:30 a.m. (AEM & MM).

Kilometer 1175 on Highway 40 in State of Sinaloa not far from Palmito, Durango, 1 ♂, VIII-15-62, in fully open flower of a domestic squash or gourd, 11:30 a.m. to 12:00 noon (AEM & MM).

Sonora:

Nogales, approximately 15 mi S, 35 ♂♂, 4 ♀♀, VIII-21-62 (AEM & MM).

United States**Arizona:**

Nogales, 1 ♂, IX-21-61, in flower of domestic squash, 10:30 a.m. to 11:00 a.m. (AEM & MM); 1 ♀, VIII-21-62, in closed flower of domestic squash at 6:00 p.m. (AEM & MM); 2 ♂♂, 1 ♀, VIII-22-62, in open flowers of domestic squash, 5:50 a.m. to 6:50 a.m. (AEM & MM).

Pollen sources. Apparently *Xenoglossa crawfordi* freely utilizes the pollens from the various domestic species of *Cucurbita*, but its use of the pollens of the native cucurbits is virtually unknown. On two occasions it has been observed in the flowers of an unidentified native gourd presumably of the genus *Cucurbita*.

Flight period. ♂♂, July 7 to September 21; ♀♀, August 14 to September 2.

Unlike the other known species of the genus *Xenoglossa* in Mexico, the sexes of this species differ strikingly in the coloration of the pubescence on the head and thorax. In the male this pubescence is chiefly pale while in the female it is largely black or brownish-black.

This species, whose sexes were characterized as separate species, was previously known from only two localities in central Mexico. It was first described by Cockerell (1910:367-368) as *X. crawfordi* on the basis of a single male collected by D. L. Crawford at Guadalajara. The female was described several years later by Cockerell (1919:194) as *X. dugesi* from two specimens collected at Guanajuato. In our preliminary studies, the present association of the sexes was suggested by a distributional analysis of the *Xenoglossa* fauna of Mexico. The first field evidence which supported this association was made by A. E. and Martha Michelbacher, who collected the sexes together on two oc-

casions in northwestern Mexico during August of 1962. In the preceding year they established the presence of this species in the United States when they collected a male on September 21 from the flowers of a domestic squash growing in a home garden in Nogales, Arizona. Upon revisiting the location on August 21 and 22, 1962, they obtained two additional males and two females. It would appear that these collections substantiate the proper association of the sexes and accordingly *X. dugesi* is placed as a synonym of *X. crawfordi*. It also appears likely that these collections are from or near the northern distributional limits of the species. Repeated collections in the Nogales area have thus far failed to establish the presence of this species in the flowers of the native *Cucurbita*. It may be that *X. crawfordi* has extended its distribution northward into Arizona by utilizing domestic squash plantings.

X. crawfordi shares with *X. fulva* a number of structural features. In the male these include such similarly constituted structures as the pygidial plate (figs. 7, 8, top), the sixth metasomal sternum (figs. 7, 8, bottom) and the first flagellar segment. Although the coloration of the vestiture differs in these species, it is quite similar in nature, disposition and density. As nearly as can be determined from the description of *X. gabbii* (Cresson, 1878:220, ♀♂ Costa Rica), it seems likely that *X. crawfordi* may be closely related to that species. A close relationship would also appear to exist with *X. fuliginosa* Gribodo (1882:273) of Venezuela. Moure (1960:8), in his examination of the unique type of *X. fuliginosa*, finds that species to correspond almost exactly to *X. gabbii* and comments that perhaps *X. fuliginosa* is only a southern variety of *X. gabbii*.

***Xenoglossa strenua* (Cresson)**

(Figs. 1, 9, 10, frontispiece)

Melissodes strenua Cresson, 1878,

Fig. 9. Diagrammatic frontal view of heads of *Xenoglossa strenua* (Cresson) (left) and *X. kansensis* Cockerell (right), both males.

Proc. Acad. Nat. Sci. Philadelphia, 30:213-214, ♀ ♂ ("*Hab.* Georgia, Texas, New Mexico"); Cresson, 1879, Trans. Amer. Ent. Soc., 7:226.

Eucera strenua, Dalla Torre, 1896, Cat. Hymen., 10:247, ♀ ♂ (Texas, Georgia and New Mexico).

Xenoglossa strenua, Cockerell, 1898, Bull. Univ. New Mexico, 1:67 (New Mexico: Mesilla Valley); Robertson, 1902, Canadian Ent., 34:324, 325, ♀ ♂; Cockerell, 1903, Psyche, 10:77 (California); Robertson, 1905, Trans. Amer. Ent. Soc., 31:365, 366, ♀ ♂; Mitchell, 1962, North Carolina Agric. Exp. Sta. Tech. Bull., 152:246, 248-249, figs. 73, 74, table 8, ♀ ♂ ("California, Virginia, North Carolina, Georgia and Florida. The type locality is Texas. It is in flight during June, July and August... flowers of *Cucurbita*." Two females were found in a light trap at Clayton, North Carolina, on July 5, 1956).

Xenoglossa strenua strenua, Cockerell, 1906, Canadian Ent., 37:266 (Texas: Fedor); Cockerell, 1906, Trans. Amer. Ent. Soc., 32:102 (New Mexico, Texas, Iowa, Illinois and Georgia; flowers of *Cucurbita*); Cockerell, 1912, Proc. U.S. Natl. Mus., 43:266 (Georgia, Texas, New Mexico); Lutz and Cockerell, 1920, Bull. Amer. Mus. Nat. Hist., 42:626 (Texas, Georgia, and New Mexico); Cockerell, 1928, Univ. Colorado Studies, 16:113 (Colorado: Sterling, in flowers of squash); Michener,

1951, U.S. Dept. Agric. Monogr., 2:1221 (North Carolina, Georgia, Wisconsin, Illinois, Iowa, Mississippi, Kansas, Colorado, New Mexico, Texas and California; flowers of *Cucurbita*); Fronk and Slater, 1956, Jour. Kansas Ent. Soc., 29:143, 144, 145 (Iowa: Ames, role in the pollination of *Cucurbita maxima*, *C. pepo* and *Lagenaria siceraria*); Linsley, 1960, Jour. New York Ent. Soc., 68:16, ♂ (Arizona: 2 miles northeast of Portal, Cochise County, wilted flowers of *C. foetidissima* at 9:00 a.m., MST, contained two males on August 2, 1959, and one male on August 3); Chandler, 1961, Proc. Indiana Acad. Sci., 71:128 (Indiana: six miles northeast of La Porte, apparently attracted by odor of cyanide gas).

Xenoglossa strenua [*strenua*], Cockerell, 1908, Proc. Ent. Soc. Washington, 9:71 (Texas: Del Rio, May 1, 1907, from flowers of *Cucurbita foetidissima*); Graenicher, 1911, Bull. Public Mus. Milwaukee, 1:226, 247, ♂ ♀ (Wisconsin: Hudson, St. Croix County, on flowers of *Cirsium arvense*); Robertson, 1928, Flowers and Insects, Lancaster, Pa., Science Press, pp. 8, 33, 98, 99, 106 ♂ ♀ (Illinois: Carlinville ♀ "with pollen on pulvillus on *Asclepias syriaca*"; males and females abundant on *Ipomoea pandurata*; females on *I. purpurea*; a male visited *Cucurbita melopepo*; males and females abundant, sucking nectar and collecting pollen on *C. pepo*); Michener, 1947, Amer. Mid-

Fig. 10. *Xenoglossa strenua* (Cresson), male: dorsal view of seventh metasomal tergum (top) and ventral view of sixth metasomal sternum (bottom).

land Nat., 38:453 ♂ ♀ (Mississippi: Hattiesburg, on flowers of *Ipomoea* in August); Bohart, 1962, Medd. Sveriges Fröodlareförbund, 7:183.

Xenoglossa brevicornis Robertson,

1892, Bot. Gazette, 17:65, ♂ ♀ (Illinois: Metropolis, from flowers of *Martynia proboscidea* on August 14). MS name, *teste* Robertson, 1899:215.

Xenoglossa cucurbitarum Cockerell,

1896, Canadian Ent., 28:192, 193, ♂ ♀ (New Mexico: Mesilla, 3 ♂ ♂ in closed flowers of *Cucurbita perennis* containing great numbers of *Diabrotica 12-punctata* at about 8:45 a.m. on June 21, 1896; 4 ♂ ♂, 4 ♀ ♀, in open flowers of *C. perennis* from about 7:45 a.m. to 8:05 a.m. on June 21); Robertson, 1899, Bot. Gazette, 28:215 (Illinois: Carlinville, collecting pollen from *Cucurbita pepo* and also visiting flowers of *Citrullus vulgaris*, *Asclepias cornuti*, *Ipomoea nil* and *I. pandurata*; at Metropolis, in flowers of *Martynia proboscidea*. Iowa: Ames, in flowers of summer squash. New Mexico: Mesilla, in flowers of *Cucurbita perennis*); Fowler, 1902, Rept. Agric. Exp. Sta. Univ. Calif., 1:322, ♀ (California: Riverside in May).

Male. Length, 14–17 mm. Length of forewing including tegula 12–14 mm. Head and body chiefly black, paling to dark mahogany red on apical margins of metasomal sterna; legs ferruginous; clypeus broadly maculated with yellow, but with much black at base and sides, apical margin narrowly ferruginous; supraclypeal and parocular areas black; labrum yellow; mandibles broadly yellow at base, outwardly suffused with red, consequently yellow coloration tapers and terminates near middle of mandible beyond which an irregular transverse black band connects with black-edged margins and encloses apically an elongated dull yellowish-orange marking; antennae black, fulvo-testaceous beneath; tegulae yellowish hyaline; wings fusco-hyaline, not violaceous; veins brownish-fusca; tibial spurs testaceous; claws dark reddish-brown or black apically.

Vestiture chiefly fulvo-ochraceous on thorax, griseous on head and ochraceous on metasoma, thickest on thorax, hind margins of head, disc and anterior face of first metasomal tergum; legs chiefly clothed with fulvo-ochraceous pubescence, that on anterior femora nearly white; pubescence on metasomal terga

II–VII chiefly short, tomentose and appressed, forming evident basal and subapical bands on terga II and III.

Eyes conspicuously but not markedly diverging below (67:78); ocelli not greatly enlarged, each ocellus not much larger than an antennal socket; minimum distance between lateral ocellus and anterior ocellus somewhat less than basal diameter of first flagellar segment; lateral ocellus separated from inner eye margin by considerably more than its maximum diameter; polished area below anterior ocellus shallow, triangular in outline (fig. 9, left); first flagellar segment slender basally, thickened apically, not greatly elongate, more than twice as long as succeeding segment (16:9); impunctate apical margin of first metasomal tergum widest at either side of middle, much more broadly impunctate than apical margins of second and succeeding terga, the nearest medial punctures being separated from apical rim by more than maximum thickness of first flagellar segment; discal punctures of first metasomal tergum about as sparse medio-apically as those medially on disc of second metasomal tergum; discal punctures of second metasomal tergum deep, distinct, sparsest medially, interspaces smooth and shining; pygidial plate (fig. 10, top) and sixth metasomal sternum (fig. 10, bottom) as illustrated.

Female. Length 14–18 mm. Forewing including tegula 12–14 mm. Similar to male in appearance. Coloration of head, body, appendages and pubescence essentially as in male; clypeus chiefly black, but usually stained subapically with ferruginous or yellowish ferruginous; pubescence on last two terga longer and more brightly fulvo-ochraceous than male.

Eyes about as weakly diverging below as male (69:80); ocelli somewhat more prominent than male; minimum distance between lateral ocellus and anterior ocellus somewhat greater than basal diameter of first flagellar segment;

ocelli essentially circular in outline, lateral ocellus separated from inner eye margin by considerably more than either its maximum diameter or that of the anterior ocellus; polished ocellar area, first flagellar segment and punctuation of first and second metasomal terga essentially as in male; clypeus, as seen from side, less protuberant than maximum width of eye as measured in that position.

Location of types. *strenua*: Academy of Natural Sciences, Philadelphia, No. 2341; *cucurbitarum*: University of Colorado Museum, Boulder.

Geographic range. Transcontinental from Maryland and Florida west to southern California and south into northern Mexico (Durango).

SPECIMENS EXAMINED

United States

Arizona:

Cochise Co.: Apache, 1 ♂, VIII-17-61, in flower of *Cucurbita foetidissima* (AEM & MM).

Apache, 1 mi E, 2 ♂♂, VI-21-57, in flowers of *C. foetidissima* (RFS).

Bernardino, 1 ♂, VIII-17-61, in flower of *C. foetidissima* (AEM & MM).

Bowie, 7 mi E, 1 ♂, VIII-1-61, in flower of *C. foetidissima* (EGL).

Cochise, 7 ♂♂, 2 ♀♀, VIII-26-61, in flowers of *C. foetidissima* (AEM & MM).

Cochise, 2 mi N, 1 ♂, IX-8-59, in flower of *Cucurbita* (J. R. Powers, CIS).

Coronado National Memorial, 1 mile from entrance, 2 ♂♂, 2 ♀♀, VII-13-62, in flowers of *C. foetidissima*, 12:30 to 1:00 p.m. (MAC).

Dos Cabezas, 2 ♂♂, 1 ♀, VIII-22-61, in flowers of *C. foetidissima* (AEM & MM).

Douglas, 1 ♂, VIII-25-26 (WWJ); 1 ♂, VIII-21-44 (WWJ); 4 ♂♂, 1 ♀, VIII-17-61, in flowers of *C. foetidissima* (AEM & MM); 2 ♂♂, VIII-17-61, in flowers of domestic squash (AEM &

MM); 12 ♂♂, 2 ♀♀, VIII-24-61, in flowers of *C. foetidissima* (AEM & MM); 2 ♂♂, IX-21-61, in closed flowers of *C. foetidissima*, 5:30 to 6:00 p.m. (AEM & MM).

Douglas (collected by MAC), 4 ♂♂, VI-13-62, in staminate flowers of *C. foetidissima*, 9:42 to 10:45 a.m.; 2 ♂♂, VI-14-62, in male flowers of *C. foetidissima*, 9:19 to 10:30 p.m.; 3 ♂♂, 7 ♀♀, VI-16-62, in open flowers of *C. foetidissima*, 7:00 to 9:00 a.m., females collecting pollen; 3 ♀♀, VI-17-62, collecting pollen in open flowers of *C. foetidissima*, 7:00 to 8:00 a.m.; 2 ♀♀, VI-18-62, collecting pollen in open flowers of *C. foetidissima*, 6:45 to 7:55 a.m.; 3 ♂♂, 7 ♀♀, VI-24-62, in open flowers of *C. foetidissima*, 6:30 to 8:20 a.m., females collecting pollen; 2 ♂♂, VI-25-62, in open flowers of *C. foetidissima* at 6:20 to 6:30 a.m. and 8:20 to 8:30 a.m., respectively; 4 ♂♂, 1 ♀, VI-26-62, in open flowers of *C. foetidissima*, 6:20 to 7:00 a.m., female collecting pollen from 6:40 to 6:50 a.m.; 1 ♂, 3 ♀♀, VI-28-62, in open flowers of *C. foetidissima*, 5:50 to 6:10 a.m., females collecting pollen; 2 ♂♂, 1 ♀, VI-29-62, in open flowers of *C. foetidissima*, 6:20 to 7:40 a.m., female collecting pollen from 7:30 to 7:40 a.m.; 1 ♂, 3 ♀♀, VII-3-62, in open flowers of *C. foetidissima*, 6:10 to 7:00 a.m., females collecting pollen from 6:10 to 6:30 a.m.; 2 ♀♀, VII-4-62, collecting pollen in open flowers of *C. foetidissima*, 5:50 to 6:00 a.m. and 7:30 to 7:40 a.m., respectively; 3 ♂♂, VII-6-62, in open flowers of *C. foetidissima*, 6:40 to 7:50 a.m.; 3 ♀♀, VII-7-62, collecting pollen in open flowers of *C. foetidissima*, 6:10 to 6:20 a.m. and 7:20 to 7:30 a.m.; 1 ♂, VII-9-62, in open flower of *C. foetidissima*, 6:40 to 6:50 a.m.; 2 ♂♂, VII-10-62, in open flowers of *C. foetidissima*, 6:30 to 6:40 a.m. and 7:10 to 7:20 a.m. respectively.

Douglas, 1 mi E (collected by MAC), 1 ♂, VII-16-62, in closed flower of *C. foetidissima*, 4:30 to 5:00 p.m.; 1 ♀, VII-20-62, collecting pollen in open

flower of *C. foetidissima*, 6:10 to 6:20 a.m.; 1 ♂, VIII-7-62, in open flower of *C. foetidissima*, 9:17 to 10:38 a.m.; 1 ♂, VIII-8-62, in open flower of *C. foetidissima*, 6:15 to 6:45 a.m.

Douglas, 6 to 10 mi N, 4 ♂♂, VIII-26-61, in flowers of *C. foetidissima* (AEM & MM).

Elfrida, 1 ♂, VIII-26-61, in flower of *C. foetidissima* (AEM & MM).

Fry, 10 mi N, 1 ♀, VI-29-50, in flower of *C. foetidissima* (RFS-AMNH).

Green Brush Draw, 30 ♂♂, 2 ♀♀, VII-13-62, in closed flowers of *C. foetidissima*, 1:15 to 1:40 p.m. (MAC).

Hereford, 1 ♂, VIII-7-44 (WWJ); 1 ♂, IX-17-45 (WWJ); 1 ♂, VII-6-49 (S & S); 7 ♂♂, VII-13-62, in closed flowers of *C. foetidissima*, between 2:00 and 2:10 p.m. (MAC); 1 ♂, VII-14-62, in closed flower of *C. foetidissima*, 11:00 to 1:15 p.m. (MAC).

Kansas Settlement, 7 ♂♂, 1 ♀, VIII-1-61, in closed flowers of *C. foetidissima* (EGL); 5 ♂♂, VIII-3-61, in flowers of *C. foetidissima* (EGL); 4 ♂♂, VIII-22-61, in closed flowers of *C. foetidissima* (AEM & MM).

Paul Spur, 5 ♂♂, 1 ♀, VIII-24-61 in flowers of domestic squash (AEM & MM); 4 ♂♂, VIII-24-61, in flowers of *C. foetidissima* (AEM & MM).

Pearce, 15 mi W, 1 ♂, VIII-22-61, in flower of *C. foetidissima* (AEM & MM).

Pinery Canyon (mouth), Chiricahua Mountains, 1 ♂, VIII-12-61, in flower of *C. foetidissima* (MAC); 3 ♂♂, 1 ♀, VIII-22-61, in flowers of *C. foetidissima* at 10:00 a.m. (AEM & MM); 1 ♂, VIII-28-61, in flower of *C. foetidissima* (AEM & MM).

Portal (collected by AEM & MM), 1 ♂, VIII-23-61, in flower of domestic squash; 1 ♂, VIII-23-61, in flower of *C. foetidissima*; 1 ♂, IX-1-61, in flower of *C. digitata*; 1 ♀, IX-10-61, sucking nectar in flower of domestic squash at 10:40 a.m.; 8 ♀♀, IX-16-61, six females collecting pollen, 5:55 to 6:30 a.m., and two females sucking nectar, 8:30 to 10:30 a.m., in open flowers of *C. foetidissima*; 1 ♂, 8 ♀♀, IX-18-61, seven

females collecting pollen 6:00 to 8:00 a.m., and one female sucking nectar, 9:00 to 10:00 a.m., in open flowers of *C. foetidissima*; 3 ♀♀, IX-22-61, collecting pollen, 6:00 to 8:00 a.m., in open flowers of *C. foetidissima*; 1 ♂, 2 ♀♀, IX-23-61, females collecting pollen in open flowers of *C. foetidissima*, 7:00 to 8:00 a.m.; 3 ♀♀, IX-24-61, collecting pollen in open flowers of *C. foetidissima*, 7:00 to 8:00 a.m.; 2 ♀♀, IX-25-61, collecting pollen in open flowers of *C. foetidissima*, 6:00 to 8:00 a.m.; 1 ♀, IX-29-61, collecting pollen from *C. foetidissima*, 7:00 to 8:00 a.m.

Portal, 1.5 mi NE, 11 ♂♂, 4 ♀♀, VIII-31-61, in flowers of *C. foetidissima* (AEM); 5 ♂♂, IX-1-61, in flowers of *C. foetidissima* (AEM & MM); 1 ♂, IX-8-61, in flower of *C. foetidissima* (AEM & MM).

Portal, 2 mi NE, 2 ♂♂, VIII-2-59, in flowers of *C. foetidissima* at 9:00 a.m. (EGL); 1 ♂, VIII-3-59, in flower of *C. foetidissima* (EGL).

Portal, 2.5 mi N, 1 ♀, VII-28-61, in flower of *C. foetidissima* (EGL).

St. David, 1 ♀, IX-19-61, in flower of domestic squash, 12:15 a.m. to 1:00 p.m. (AEM & MM).

San Simon, 2 mi W, 1 ♂, IX-7-59, in cucurbit blossom (G. I. Stage, S & S).

Graham Co.: Pima, 1 ♂, VIII-25-61, in flower of *C. foetidissima* (AEM & MM).

Safford, 1 ♂, VIII-15-61, in flower of *C. foetidissima* (AEM & MM).

Pima Co.: Santa Rita Mountains, 1 ♀, VII-10-52 (R. H. and L. D. Beamer, W. E. LaBerge and C. Liang, KU).

Pinal Co.: Stanfield, 2 mi. E, 5 ♂♂, VII-13-62, in closed male flowers of domestic summer squash (PDH).

Santa Cruz Co.: Lochiel, 5 mi E, 1 ♂, VII-13-62, in flower of *C. foetidissima*, 9:45 to 10:05 a.m. (MAC).

Nogales, 1 ♂, 1 ♀, VI-18-62, in open flowers of *C. foetidissima*, 6:40 to 9:15 a.m., female collecting pollen (AEM & MM).

Patagonia, 2 ♂♂, 1 ♀, VII-11-62, in open flowers of zucchini squash, 6:45

to 7:00 a.m. (PDH); 1 ♂, 2 ♀ ♀, VII-11-62, in open flowers of zucchini squash, 6:45 to 7:00 a.m. (EGL); 1 ♂, 5 ♀ ♀, VII-12-62, females collecting pollen in open flowers of domestic crookneck squash, 5:45 to 6:35 a.m. (MAC); 2 ♀ ♀, VII-12-62, collecting pollen in open flowers of domestic zucchini squash, 5:45 to 5:55 a.m. (PDH); 2 ♂ ♂, 5 ♀ ♀, VII-12-62, females collecting pollen in open flowers of domestic zucchini and crookneck squash, 5:45 to 6:35 a.m. (EGL).

Yuma Co.: Fort Yuma, 1 ♂ (AM-NH).

California:

Orange Co.: Costa Mesa, 2 ♂ ♂, VII-23-53, in flowers of domestic squash (PHT).

Newport Beach (upper bay), 38 ♂ ♂, 41 ♀ ♀, VI-16-62, in open male flowers of *C. foetidissima*, 6:50 to 9:20 a.m., PDT (Pacific Daylight Time), most females collecting pollen (AEM & MM); 37 ♂ ♂, 14 ♀ ♀, VI-16-62, in open female flowers of *C. foetidissima*, 6:50 to 9:20 a.m., PDT, most females with a trace of pollen on scopa (AEM & MM); 11 ♂ ♂, 5 ♀ ♀, VI-16-62, in open male and female flowers of *C. foetidissima*, 6:50 to 9:20 a.m., PDT, most females collecting pollen (AEM & MM).

Seal Beach, 1 ♂, VII-16-28, in flower of domestic squash (PHT).

Riverside Co.: Blythe, 1 ♀, VII-29-35 (C. M. Dammers, UCR).

Blythe, 3 mi W, 1 ♂, VII-16-62, in closed flower of domestic zucchini squash at 8:00 a.m. (PDH).

Gilman Hot Springs, 1 ♂, VI-16-62, in closed flower of *C. foetidissima*, 1:00 to 2:00 p.m., PDT (AEM & MM).

Hemet, 4 ♂ ♂, 2 ♀ ♀, VII-9-46 (J. W. MacSwain, CIS); 1 ♂, VII-22-46 (RFS); 2 ♂ ♂, VIII-23-62, in partly closed flowers of *C. foetidissima*, between 12:30 and 1:15 p.m., PDT (AEM & MM); 1 ♀, VIII-24-62, collecting pollen in open flower of *C. foetidissima*, 7:00 to 7:30 a.m., PDT (AEM & MM); 1 ♂, VIII-24-62, in open flower of do-

mestic squash, 7:50 to 8:50 a.m., PDT (AEM & MM).

Oasis, 15 ♂ ♂, 2 ♀ ♀, VIII-23-62, in open flowers of *C. palmata*, 7:50 to 9:20 a.m., PDT, pollen already depleted at start of observations (AEM & MM).

Riverside, 1 ♂, VII-13-34, in flower of *C. foetidissima* (PHT); 1 ♂, IX-18-42, in flower of domestic squash (PHT).

Temecula, 1 ♂, 1 ♀, VII-4-50 (EGL).

San Bernardino Co.: Yucaipa, 1 ♂, VI-25-52 (R. H. and L. D. Beamer, A. Wolf, W. E. LaBerge, C. Liang and C. Weiner, KU).

San Diego Co.: La Jolla (USDA Horticultural Field Station), 1 ♂, VII-14-62, in closed flower of domestic squash at 4:10 p.m. (PDH); 1 ♂, XI-14-62, in open flower of domestic squash, 11:00–11:30 a.m. (AEM).

Oceanside, 3 ♂ ♂, 2 ♀ ♀, VII-15-34 (I. McCracken, CAS).

Warner Springs, 2 mi N, 2 ♂ ♂, VII-4-56 (G. I. Stage, S & S).

Colorado:

Prowers Co.: Lamar, 1 ♂, VII-22-50, in flower of *Ipomoea* (CDM).

Georgia:

Dade Co.: Rising, 1 ♂, VII-9-50 (T. Cohn, P. Boone, and M. A. Cazier, AM-NH).

Floyd Co.: Rome, 3 ♀ ♀, VIII-25-62, in flowers of *Ipomoea* (TBM); 1 ♀, VII-21-52, in flower of domestic squash (TBM).

Illinois:

Champaign Co.: Champaign, 1 ♂, V-24-11 (T. H. Frison, KU).

Indiana:

Tippecanoe Co.: Lafayette, 1 ♀, VII-16-42 (H. E. Milliron, UCR).

Iowa:

Story Co.: Ames, 1 ♂, VIII-27-52 (W. D. Fronk, WDF); 1 ♀, VIII-5-53 (W. D. Fronk, WDF); 1 ♂, VIII-12-53 (W. D. Fronk, WDF); 1 ♀, VIII-23-53 (W. D. Fronk, WDF).

Kansas:

Barber Co.: Medicine Lodge, 13 mi W, 1 ♂, VI-16-62, in flower of *Cucurbita* (CDM and party, KU); 1 ♂, VI-17-62, at flowers of *Melilotus officinalis* (CDM and party, KU).

Barton Co.: Great Bend, 1 ♂, VII-22-50, in flower of *Cucurbita foetidissima* (CDM).

Comanche Co.: elevation 2,089 feet, 1 ♂, 1916 (R. H. Beamer, KU).

Douglas Co.: elevation 900 feet, 1 ♀, (KU).

Lawrence, 3 ♂♂, VIII-10-50, in flowers of *Cucurbita* (CDM); 4 ♂♂, 1 ♀, VII-16-51, in flowers of domestic squash (CDM); 5 ♂♂, 1 ♀, VII-19-51, in flowers of domestic squash (CDM); 3 ♂♂, VIII-1-51 (CDM).

Kearney Co.: Lakin, 1 ♂, VII-16-51 (CDM).

Thomas Co.: elevation 3,150 feet, 1 ♂, 1 ♀ (F. X. Williams, KU).

Maryland:

Prince George Co.: 2 ♂♂, 1 ♀, VIII-2-59, in flowers of *Cucurbita pepo* (G. E. Bohart, GEB).

Mississippi:

Forrest Co.: Hattiesburg, 2 ♂♂, 1 ♀, VIII-6-44 (CDM-CIS); 3 ♀♀, VIII-13-44 (CDM-KU, UCR); 1 ♂, VIII-20-44 (CDM-UCR).

Missouri:

Hickory Co.: Wheatland, 1 ♂, VII-15-52, in flower of *Ipomoea* (CDM).

Nebraska:

Red Willow Co.: McCook, 1 ♀, VIII-9-01, in flower of *Convolvulus* (M. A. Carriker, Jr., UN).

McCook, 3 mi W, 1 ♂, 1 ♀, VII-8-54, in flowers of *Cucurbita* (W. E. LaBerge, UN).

New Mexico:

Bernalillo Co.: Isleta, 1 ♂, VII-17-52, in flower of gourd (R. H. and L. D. Beamer, W. E. LaBerge and C. Liang, KU).

Chaves Co.: Caprock, Mescalero

Sands, 1 ♂, VII-9-54 (M. A. Cazier and W. J. Gertsch, AMNH).

Roswell, 10 mi W, 1 ♂, VII-22-52 (R. H. and L. D. Beamer, W. E. LaBerge and C. Liang, KU).

Dona Ana Co.: Garfield, 3 ♂♂, VII-16-52 (R. H. and L. D. Beamer, W. E. LaBerge and C. Liang, KU); 2 ♂♂, VII-30-62, in closed flowers of *Cucurbita foetidissima* at 6:25 p.m. (MAC).

Hatch (north side), 2 ♂♂, VII-30-62, in closed flowers of *C. foetidissima*, 5:45 to 6:00 p.m. (MAC).

Hatch, 2 mi S, VII-30-62, in closed flowers of *C. foetidissima*, 5:25 to 5:30 p.m. (MAC).

Las Cruces, 10 mi N, 3 ♂♂, VII-30-62, in closed flowers of *C. foetidissima* at 4:07 p.m. (MAC).

Mesilla, 1 ♂, VI-3 and 1 ♀, VI-22, in flowers of *C. perennis* (T.D.A. Cockerell, KU); 1 ♂, VII-15-52, in flower of gourd (R. H. and L. D. Beamer, W. E. LaBerge and C. Liang, KU).

Radium Springs, 1 ♂, VII-30-62, in closed flower of *C. foetidissima* at 4:40 p.m. (MAC).

Radium Springs, 10 mi N, 2 ♂♂, 1 ♀, VII-30-62, in closed flowers of *C. foetidissima* at 4:55 p.m. (MAC).

Grant Co.: Separ, 2 mi NW, 7 ♂♂, 2 ♀♀, VII-30-62, in open flowers of *C. foetidissima*, 10:15 to 10:30 a.m. (MAC).

Separ, 3 mi SE, 9 ♂♂, 1 ♀, VII-30-62, in open flowers of *C. foetidissima*, 10:45 to 11:25 a.m. (MAC).

Guadalupe Co.: Vaughn, 2 ♂♂, VII-20-52, in flowers of gourd (R. H. and L. D. Beamer, W. E. LaBerge and C. Liang, KU); 1 ♂, VII-20-52, at flower of *Cirsium* (R. H. and L. D. Beamer, W. E. LaBerge and C. Liang, KU).

Hidalgo Co.: Cienega, 1 ♂, VIII-16-61, in flower of *C. foetidissima* (AEM & MM).

Cloverdale, 6 mi NE, 1 ♂, VIII-30-61, in flower of *C. foetidissima* (AEM & MM).

Cotton City, 7 ♂♂, 1 ♀, VIII-25-61, in flowers of domestic squash (AEM & MM).

Rodeo, 2 ♂♂, 4 ♀♀, VII-30-61, in flowers of *C. foetidissima* at 9:00 a.m. (EGL).

Rodeo (collected by AEM & MM), 4 ♂♂, VIII-16-61, in flowers of *C. foetidissima*; 4 ♂♂, VIII-18-61, in flowers of several varieties of domestic squash; 1 ♂, VIII-18-61, in flower of *C. foetidissima*; 1 ♂, VIII-21-61, in flower of *C. foetidissima*; 12 ♂♂, 2 ♀♀, IX-2-61, in flowers of domestic squash; 3 ♂♂, IX-2-61, in flowers of *C. foetidissima*; 3 ♂♂, 2 ♀♀, IX-4-61, in flowers of domestic squash; 4 ♂♂, 1 ♀, IX-4-61, in flowers of *C. foetidissima*; 3 ♂♂, IX-7-61, in flowers of domestic squash; 1 ♂, IX-7-61, in flower of *C. foetidissima*; 2 ♂♂, 1 ♀, IX-9-61, in flowers of domestic squash at 10:15 a.m.; 2 ♂♂, IX-11-61, in flowers of domestic squash; 2 ♀♀, IX-14-61, collecting pollen in open flowers of domestic squash at 8:15 a.m.; 1 ♀, IX-14-61, collecting pollen in open flower of domestic squash at 9:00 a.m.; 1 ♀, IX-15-61, collecting pollen in open flower of *C. digitata*, 5:50 to 6:50 a.m.; 1 ♂, IX-15-61, in open flower of *C. digitata* at 8:10 a.m.; 1 ♀, IX-15-61, collecting pollen in open flower of domestic squash at 9:05 a.m.; 1 ♂, IX-15-61, in flower of *C. foetidissima*; 1 ♀, IX-24-61, in flower of domestic squash at 10:30 a.m.

Rodeo, 2.5 mi NW, 1 ♂, VII-24-61, in wilted flower of *C. foetidissima* at 10:00 a.m. (EGL); 1 ♂, VII-25-61, in wilted flower of *C. foetidissima* at 10:20 a.m. (EGL).

Rodeo, 5.6 mi SW, 1 ♂, VIII-14-61, in flower of *C. foetidissima* (EGL).

Lincoln Co.: 1 ♂, 1 ♀, VII-16, in flowers of *Cucurbita* (KU).

Carrizozo, 11 mi S, 1 ♂, VII-31-62, in closed flower of *C. foetidissima* at 5:05 p.m. (MAC).

Luna Co.: Deming, 5 mi N, 2 ♂♂, 1 ♀, in closed flowers of *C. foetidissima* at 5:17 p.m. (MAC).

Deming, 14 mi E, 2 ♂♂, VII-30-62, in closed flowers of *C. foetidissima* between 2:35 and 2:40 p.m. (MAC).

Deming, 7 mi W, 2 ♂♂, 1 ♀, VII-

30-62, in closed flowers of *C. foetidissima*, 1:05 to 1:15 p.m. (MAC); 1 ♂, VIII-1-62, in closed flower of *C. foetidissima* at 5:45 p.m. (MAC).

Deming, 8.3 mi W, 1 ♂, VIII-15-62, in closed flower of *C. foetidissima* at 4:46 p.m. (MAC).

Gage, 1 mi E, 1 ♂, VII-30-62, in closed flower of *C. foetidissima* at 12:05 p.m. (MAC).

Nutt, 1 ♂, VIII-1-62, in closed flower of *C. foetidissima* at 3:47 p.m. (MAC).

Nutt, 3 mi NE, 1 ♂, VIII-1-62, in closed flower of *C. foetidissima* at 3:10 p.m. (MAC).

Nutt, 5 mi NE, 5 ♂♂, VIII-1-62, in closed flowers of *C. foetidissima* at 2:47 p.m. (MAC).

Otero Co.: Alamogordo, 1 ♂, VIII-1-62, in flower of *C. foetidissima* at 9:16 a.m. (MAC).

Alamogordo, 35 mi W, 1 ♂, VIII-1-62, in flower of *C. foetidissima* at 10:35 a.m. (MAC).

Sierra Co.: Arrey, 4 mi S, 1 ♂, VII-30-62, in closed flower of *C. foetidissima* at 6:55 p.m. (MAC).

Arrey, 2 mi S, 9 ♂♂, 1 ♀, VII-31-62, in open flowers of *C. foetidissima* at 8:30 a.m. (MAC).

Arrey, 1 mi N, 1 ♂, VII-31-62, in flower of *C. foetidissima* at 9:03 a.m. (MAC).

Caballo Dam, 9 ♂♂, VII-31-62, in flowers of *C. foetidissima*, 9:20 to 10:00 a.m. (MAC).

Derry, 1 ♂, VII-30-62, in closed flower of *C. foetidissima* at 6:39 p.m. (MAC).

Socorro Co.: San Antonio, 11 mi S, 8 ♂♂, VII-31-62, in closed flowers of *C. foetidissima*, 1:00 to 1:10 p.m. (MAC).

Union Co.: Grenville, 14.5 mi NW, 6,400 feet, 1 ♂, VII-15-59, in flower of *C. foetidissima* (RFS).

North Carolina:

Buncombe Co.: Swannanoa, 1 ♂, VIII-5-22 (TBM).

Duplin Co.: Faison, 1 ♂, VII-1-52, in flower of squash (TBM).

Johnston Co.: Central Crops Research Station, Clayton, 9 ♂♂, 3 ♀♀, VII-4-59, in flowers of *Cucurbita* (TBM). 9 ♂♂, VII-18-59, in flowers of *Cucurbita* (TBM).

Clayton, 2 ♀♀, VII-5-56, in light trap (UNC).

McDowell Co.: Marion, 1 ♀, VIII-16-38 (TBM).

Wake Co.: Raleigh, 1 ♂, VII-11-34 (TBM).

Texas:

Bexar Co.: San Antonio, 2 ♂♂, (KU).

Brazos Co.: College Station, 1 ♂, VII-15-55, in flower of *Martynia louisianica* (A. H. Alex, UCR).

Brewster Co.: Alpine, 2 ♂♂, VII-2-42 (E. C. Van Dyke, CAS).

El Paso Co.: El Paso, 1 ♂, IX-20-42 (R. W. Strandtmann, GEB).

Hudspeth Co.: Dell City, 7 mi NE, 1 ♂, VII-31-50, in flower of *Cucurbita foetidissima* (RFS-AMNH).

Oldham Co.: Adrian, 10 mi W, 4,000 feet, 1 ♂, VII-14-50 (T. Cohn, P. Boone and M. A. Cazier, AMNH).

Mexico

Baja California:

Ejido Campeche, 1 ♂, 1 ♀, VII-17-53, in flowers of *Cucurbita* and 1 ♂ at flower of *Cucumis* (RRS).

La Puerta, 1 ♂, VII-3-53, in flower of squash (RRS).

La Puerta, 6 km E, 1 ♂, VII-7-53, in flower of *Cucurbita* (RRS).

Mexicali, 10 km W, 2 ♂♂, 1 ♀, VII-7-53, in flowers of squash (RRS).

Polvora, 2 km NE, 4 ♂♂, 1 ♀, VII-17-53, in flowers of *Cucurbita* (RRS).

Chihuahua:

Samalayuca, 1 ♂, 3 ♀♀, VI-24-47, in flower of *Cucurbita* (CDM-AMNH).

Villa Ahumada, 8 ♂♂, VII-4-54 (J. W. MacSwain, CIS).

Durango:

La Zarca, 34 mi NW, 5,800 feet, 1 ♂, VII-25-52 (KU Mexican Expedition, KU).

Nuevo León:

Vallecillo, 2 ♂♂, VI-2 to 5-51 (PDH).

Sinaloa:

La Reforma, 3 ♂♂, VIII-18-62, in open flowers of an unidentified but possibly native gourd, 6:35 to 6:45 a.m. (AEM & MM).

Sonora:

Agua Prieta, 1 ♂, VIII-17-44 (WWJ); 2 ♂♂, VIII-14-46 (WWJ-UCR); 3 ♂♂, 1 ♀, VIII-24-61, in flowers of domestic squash (AEM & MM); 4 ♂♂, 2 ♀♀, VIII-24-61, in flowers of *Cucurbita foetidissima* (AEM & MM); 25 ♂♂, 1 ♀, VII-15-62, in flowers of *C. foetidissima*, 12:45 to 1:15 p.m. (MAC) 26 ♂♂, 2 ♀♀, VII-16-62, in closed flowers of *C. foetidissima*, 1:00 to 2:50 p.m. (MAC); 6 ♂♂, 1 ♀, VII-17-62, in closed flowers of *C. foetidissima*, 1:00 to 1:45 p.m. (MAC); 5 ♂♂, VIII-21-62, in flowers of domestic winter squash (MAC); 2 ♂♂, same data (EGL).

Benjamin Hill, 1 ♂, 1 ♀, VIII-21-62, in open flowers of *C. digitata* sometime between 7:20 and 9:15 a.m., female collecting pollen (AEM & MM).

Pollen sources. *Xenoglossa strenua* uses the pollens of the indigenous *Cucurbita digitata*, *C. foetidissima* and *C. palmata* as well as most, if not all, domestic *Cucurbita*. Whether the pollen of the introduced gourds of the genus *Lagenaria* is used has not been determined. It seems almost certain that *Xenoglossa strenua* extended its eastern geographic limits from the midwest to the eastern coast of the United States following the advent of the domestic *Cucurbita* in that region.

Flight period. ♂♂, May 24 to November 14; ♀♀, June 16 to September 29.

Xenoglossa strenua and *X. kansensis* are very closely related species whose affinities with other species of the genus *Xenoglossa* appear to be remote. At the time Cockerell (1905a:104) described

X. kansensis he considered it to be a somewhat larger and differently colored variety of *X. strenua*. Until very recently, these species have been considered by most investigators as subspecies. It is especially interesting that LaBerge (*in litt.*), Mitchell (1962:246–249) and we each independently concluded that *X. strenua* and *X. kansensis* are distinct species. In addition to the differences incorporated in the accompanying key, the males of these species are easily separated by the shape of the pygidial plate (figs. 10, 11, top) and the structure of the sixth metasomal sternum (figs. 10, 11, bottom). In the female of *X. strenua* the sub-basal tooth on the upper margin of the mandible is strongly developed. A redescription of *X. strenua* has been recently provided by Mitchell (1962:248–249).

A study of the holotype of *X. cucurbitarum*, which lacks the head, reveals that it is a synonym of *X. strenua* as Cockerell (1903:77; 1906a:102; 1912:265) believed it to be. The species is transcontinental in distribution and Graenicher (1911:247) has recorded it as far north as Hudson in St. Croix County, Wisconsin.

Xenoglossa kansensis Cockerell

(Figs. 9, 11)

Xenoglossa strenua var. *kansensis* Cockerell, 1905, Canadian Ent., 37:266 [♂] (Kansas); Cockerell, 1905, Psyche 12:104, ♂ (Kansas: Clark County, 1,962 ft.; Morton County, 3,200 ft.; and Wallace County, 3,000 ft.).

Xenoglossa strenua kansensis, Cockerell, 1906, Trans. Amer. Ent. Soc., 32: 102 (Kansas); Cockerell, 1912, Proc. U. S. Natl. Mus., 43:266, ♂ (Kansas: Clark Co.); Lutz and Cockerell, 1920, Bull. Amer. Mus. Nat. Hist., 42:626, ♂ (Kansas: Clark County, 1,962 ft.; Morton County, 3,200 ft.; and Wallace County 3,000 ft., June); Cockerell, 1928, Univ. Colorado Studies, 16:113 (Colorado: Boulder, in squash flowers); Michener, 1951, U. S. Dept. Agric., Monogr. 2:1221.

Xenoglossa kansensis, Mitchell, 1962, North Carolina Agric. Exp. Sta. Tech. Bull., 152:246, 247–248, figs. 73, 74, table 8, ♀ ♂ (Kansas to North Carolina and Georgia, May to July; flowers of *Cucurbita* and *Ipomoea*).

Male. Length, 14–18 mm. Length of forewing including tegula, 12–14 mm. Head and body chiefly black, paling to dark mahogany red on apical margins of metasomal sterna; legs brownish-black or black; clypeus chiefly yellow, narrowly black at base and sides, apical margin narrowly ferruginous; supra-clypeal and parocular areas black; labrum yellow; mandibles broadly yellow at base, outwardly suffused with red, consequently yellow coloration tapers and terminates near middle of mandible beyond which an irregular transverse black band connects with black-edged margins and encloses apically an elongate dull yellowish-orange marking; antennae black, fulvo-testaceous beneath; tegulae yellowish-hyaline; wings fusco-hyaline, not violaceous; veins brownish-fusca; tibial spurs testaceous.

Vestiture chiefly fulvo-ochraceous on thorax, griseous on head and grayish-white on metasoma, thickest on thorax, hind margins of head, disc and anterior face of first metasomal tergum; legs chiefly clothed with fulvo-ochraceous pubescence, that on anterior femora nearly white; pubescence on metasomal terga II–VII chiefly short, tomentose and appressed forming evident basal and subapical bands on at least terga II and III.

Eyes conspicuously but rather weakly diverging below (67:74); ocelli not greatly enlarged, each ocellus not much larger than an antennal socket; minimum distance between lateral ocellus and anterior ocellus somewhat less than basal diameter of first flagellar segment; lateral ocellus separated from inner eye margin by considerably more than its maximum diameter; polished area below anterior ocellus deeply impressed, Y-shaped (fig. 9, right); first flagellar

segment slender basally, thickened apically, not greatly elongate, less than twice as long as succeeding segment (17:10); impunctate apical margin of first metasomal tergum narrow, scarcely wider on either side of median line, not much, if any more, broadly impunctate than apical margins of second and succeeding terga, nearest medial punctures being separated from apical rim by not more than maximum thickness of first flagellar segment; discal punctures of first metasomal tergum about as crowded as those on disc of second terga; discal punctures of second metasomal tergum shallow, interspaces dull and finely tessellate; pygidial plate (fig. 11, top) and sixth metasomal sternum (fig. 11, bottom) as illustrated.

Female. Length 14–18 mm. Forewing including tegula 12–14 mm. Similar to male in appearance. Coloration of head, body, appendages and pubescence essentially as in male; clypeus usually maculated on apical half or more with yellow, apical margin narrowly stained with ferruginous; pubescence on last two terga longer and usually more brightly fulvo-ochraceous than male.

Eyes about as weakly diverging below as male (59:68); ocelli somewhat more prominent than male; minimum distance between lateral ocellus and anterior ocellus much greater than basal diameter of first flagellar segment; ocelli essentially circular in outline, lateral ocellus separated from inner eye margin by considerably more than either its maximum diameter or that of the anterior ocellus; polished area, first flagellar segment and punctuation of first and second metasomal terga essentially as in male; clypeus, as seen from side, less protuberant than maximum width of eye as measured in that position.

Location of type. Snow Entomological Museum, University of Kansas, No. 1032.

Geographic range. Colorado and New Mexico eastward to North Carolina and Georgia.

SPECIMENS EXAMINED

United States

Colorado:

Boulder Co.: Boulder, 1 ♀, VII-1908 (KU); 1 ♀, VIII-7 to 12-19 (AMNH).

Iowa:

Story Co.: Ames, 1 ♂, VIII-5-53, 1 ♀, VIII-22-53 (W. D. Fronk, WDF).

Kansas:

Barber Co.: Medicine Lodge, 7 mi W, 1 ♂, VI-16-62, in flower of *Cucurbita* (CDM & party, KU).

Sun City, 15.6 mi S, 2 ♂ ♂, VI-16-62, in flowers of *Cucurbita* (CDM & party, KU).

Barton Co.: elevation 1,816 feet, 1 ♂, VI-22-12 (F. X. Williams, KU).

Clark Co.: elevation 1,962 feet, 1 ♂ (F. H. Snow, UCR).

Comanche Co.: elevation 2,089 feet, 1 ♂, 1916 (R. H. Beamer, KU).

Decatur Co.: elevation 2,500 feet, 1 ♂ (F. X. Williams, KU).

Douglas Co.: Lawrence, 1 ♂, VII-16-51, in flower of domestic squash (CDM); 1 ♀, VII-19-51, in flower of domestic squash (CDM).

Harper Co.: Attica, 1 ♂, 1 ♀, VI-11-52 (C. D. Michener and A. Wille, KU).

Kiowa Co.: 1 ♀, VII-5-23 (L. C. Woodruff, KU).

Morton Co.: elevation 3,200 feet, 1 ♂, VI-1902 (F. H. Snow, KU).

Ness Co.: elevation 2,260 feet, 1 ♂, VII-7-12 (F. X. Williams, KU).

Pratt Co.: elevation 1,900 feet, 1 ♀, VI-27-11 (F. X. Williams, KU).

Sawyer, 3 mi S, 1 ♂, VI-16-62, at flowers of *Amorpha canescens* (CDM & party).

Reno Co.: Hutchinson, 6 mi N, 1 ♂, VI-13-52, at flowers of *Astragalus* (C. D. Michener and A. Wille, KU).

Rooks Co.: Stockton, 1 ♂, 1 ♀, VII-3-51, in flowers of *Cucurbita foetidissima* (CDM).

Fig. 11. *Xenoglossa kansensis* Cockerell, male: dorsal view of seventh metasomal tergum (top) and ventral view of sixth metasomal sternum (bottom).

Saline Co.: 1 ♀, VII-16-23 (C. H. Martin, KU).

Scott Co.: 1 ♂, VI-18-25 (H. Deay, KU).

Scott City, 12 mi N, 5 ♂♂, 3 ♀♀, VI-18-50, in flowers of *C. foetidissima* (CDM).

Sheridan Co.: elevation 2,650 feet (F. X. Williams, KU).

Sumner Co.: 1 ♂, VI-11-52, in flower of *C. foetidissima* (C. D. Michener and A. Wille, KU).

Wallace Co.: elevation, 3,000 feet (F. H. Snow, KU).

Georgia:

Fulton Co.: Atlanta, 2 ♂♂, VII-8-36 (P. W. Fattig, UCR).

Missouri:

St. Louis Co.: St. Louis, 1 ♂, IX-8-49 (E. R. Oatman, CIS).

Nebraska:

Cuming Co.: West Point, 1 ♂, VIII-2-03 in flower of squash (J. C. Crawford, UN); 1 ♀, VI-26, on flower of *Asclepias* (UN).

Dundy Co.: Benkelman, 4 mi E, 2 ♂♂, 4 ♀♀, VII-9-60 (W. E. LaBerge, UN).

Keya Paha Co.: Carns, 1 ♂, at flower of thistle (W. D. Pierce, UN).

Lancaster Co.: Lincoln, 1 ♀, VII-7-11, in large-flowered white morning glory (UN); 1 ♂, VII, at flowers of *Petalostemon* (UN).

Red Willow Co.: McCook, 3 mi W, 2 ♂♂, 1 ♀, VIII-8-54, in flowers of *Cucurbita* (W. E. LaBerge, UN).

Thomas Co.: Halsey, 1 ♂, VII-11-09, sucking nectar in flower of *C. undulatus* (M. H. Swenk, UN).

New Mexico:

Guadalupe Co.: Vaughn, 1 ♂, VIII-14-62, in wilted flower of *Cucurbita foetidissima* (EGL).

Mora Co.: La Cueva, 10 mi SE, 3 ♂♂, VII-9-59, in flowers of *C. foetidissima* (RFS).

Watrous, 1 mi N, 2 ♂♂, VII-9-59, in flowers of *C. foetidissima* (RFS).

San Miguel Co.: Las Vegas, 1 ♂, VII-13-59, in flower of *C. foetidissima* (RFS).

Rowe, 6 mi NW, 1 ♂, VII-14-59, in flower of *C. foetidissima* (RFS).

Santa Fe Co.: Santa Fe, 10 mi SE, 1 ♂, VIII-14-62, in wilted flower of *C. foetidissima* at 11:15 a.m. (EGL).

North Carolina:

Duplin Co.: Faison, 2 ♂♂, VI-9-52, in open flowers of squash (TBM); 2 ♂♂, VI-17-52, in flowers of squash (TBM); 11 ♂♂, 1 ♀, VII-1-52, in flowers of squash, (TBM—UNC, S & S).

Henderson Co.: Hendersonville, 2 ♂♂, 1 ♀, VI-29-53, in flowers of squash (H. F. Howden, UNC).

Johnston Co.: Central Crops Research Station, Clayton, 10 ♂♂, 1 ♀, VII-4-59, in flowers of *Cucurbita* (TBM); 2 ♂♂, VII-18-59, in flowers of *Cucurbita* (TBM).

Moore Co.: Southern Pines, 1 ♂, VI-4-18 (AMNH); 7 ♂♂, 2 ♀♀, VI-13-18 (AMNH).

Pender Co.: Willard, 1 ♂, VII-6-22, in flower of *Cucurbita* (UNC).

Wake Co.: Raleigh, 1 ♀, VI-16-22, in flower of *Cucurbita* (C. S. Brimley, UNC); 1 ♂, V-28-33 (UNC); 2 ♂♂, VII-11-34 (UNC).

Wayne Co.: 1 ♀, VI-29-59, in flower of *Ipomoea* (TBM).

Pollen sources. Although no documented information is available, the records suggest that originally the females of *Xenoglossa kansensis* utilized solely the pollen of the native *Cucurbita foetidissima*. The records further indicate that *X. kansensis* now utilizes the pollens of the various domestic species of *Cucurbita*, possibly to such an extent that its original distributional limits have been extended in this way to the eastern coast of the United States.

Flight period. ♂♂, June 4 to September 8; ♀♀, June 11 to August 22.

Unlike *X. strenua*, its nearest relative, this species is not transcontinentally distributed and apparently does not occur in Mexico. As is explained in the account of *X. strenua*, this species has been until quite recently considered to be a color variety or subspecies of *X. strenua*. The chief morphological features which distinguish these species are the shape of

the polished area below the anterior ocellus (fig. 9) and the structure in the males of the pygidial plate (figs. 10, 11, top) and the sixth metasomal sternum (figs. 10, 11, bottom). In *X. kansensis*, the sub-basal tooth on the upper margin of the mandible is scarcely produced. This species was recently redescribed by Mitchell (1962:247-248).

Genus *Peponapis* Robertson

Included in this genus are a group of species which are about the size of the common honey bee (fig. 1). The integument of most species is chiefly dark, but the antennae, the mandibles, the tegulae, the legs and the ventral body surfaces are frequently ferruginous or reddish in coloration. Unlike the females of several species in the genus *Xenoglossa*, the clypeus of the females of this genus is not maculated with yellow. The clypeus of the males is often at least partly maculated with yellow; however, the clypeus in the males of some species is entirely dark. In the males of certain species, like *Peponapis pruinosa* (Say), the small yellow maculation of the clypeus is sometimes scarcely evident and occasionally it is absent. Rarely, as in the males of *P. timberlakei*, is the clypeus extensively maculated with yellow. The vestiture, usually thickest on the thorax, is most frequently yellowish or reddish. In many worn or aged specimens the color of the vestiture is chiefly whitish. The metasomal terga of most species bear one or more bands of pale tomentose pubescence.

The species of this genus lack a sub-basal tooth on the upper margin of the mandible and the antennae of the males are usually longer relatively than those of the genus *Xenoglossa*. The first flagellar segment is much shorter than the succeeding segment in all males except *P. timberlakei* where it is longer (fig. 2, top). The sixth metasomal tergum of all males, except *P. crassidentata*, lacks the lateral teeth which are present in males of *Xenoglossa*.

Since the generic positions of a num-

ber of eucerine bees have not been investigated in recent times, and since there apparently are several new species of *Peponapis* in Mexico and Central America, it is difficult to determine the number of species in the genus. As nearly as we can tell from the literature and the available specimens, the genus probably contains about 30 species.

The genus *Peponapis* ranges from southern Argentina (Schrottky, 1909:270; Jörgensen, 1912a:318) to near the northern border of the United States (Idaho, Michigan and New York). Most of the species occur or are centered in Central America and Mexico. The genus has been divided into two subgenera by Moure (1948:342; Moure and Michener, 1955:298-301) primarily on the basis of whether the maxillary palpus is five-segmented (*Peponapis*, s. str.) or four-segmented (*Colocynthophila*). The latter subgenus contains such South American species as: *P. catamarcensis* (Bertoni and Schrottky, 1910:575) from Argentina, *P. fervens* (Smith, 1879:112) from Argentina, Brazil, Paraguay and Uruguay, and *P. gyrosa* (Smith, 1879:111) from "Ega [= Tefé], on the Amazons." It apparently does not occur in Central or North America. The subgenus *Peponapis* includes all the known species from North and Central America and apparently two species in South America (Ecuador and Peru). However, the species from Peru (*Tetralonia peponis* Friese, 1925:22), according to LaBerge (1957:31), may belong to the genus *Loxoptilus*. LaBerge and Moure (1962:9) state that the type of *P. fervens* (Smith) is "from Santiago

(del Estero), Argentina," thus clarifying the original type locality ("Mendoza and Santiago"), which suggested that the species occurred in Argentina and Chile.

The Mexican and Central American species of the genus *Peponapis* have scarcely been studied since their original description. A few of these may still be assigned to the genus *Tetralonia* in the broad sense. In addition to several undescribed species, eleven species of the genus *Peponapis* are now known from Central America, Mexico and the United States. Five of these—*P. apiculata* (Cresson, 1878:220), *P. atrata* (Smith, 1879:115), *P. howardi* (Cockerell, 1918:420), *P. pernigra* (Cockerell, 1896b:289), and *P. tenuimarginata* (Friese, 1921:78)—apparently do not range into the United States, but conceivably some may possibly be junior or senior synonyms.

Six species of the genus *Peponapis* are currently recognized from the United States by us and all range below the border. Three of these species are widely distributed in North America. Thus, *P. pruinosa*, which occurs transcontinentally in the United States, ranges from the latitude of Idaho and

New York south into Mexico. *P. crassidentata*, which is widely distributed over much of Mexico, ranges from Costa Rica into Arizona and Texas. Similarly, *P. utahensis* ranges from El Salvador to Arizona and may occur as far north as Utah. In contrast, *P. limitaris*, *P. michelbacherorum* and *P. timberlakei* do not appear to occupy such large geographic areas. *P. limitaris* is known to occur from the Yucatan Peninsula to extreme southern Texas and apparently does not extend inland beyond the eastern slopes of the Sierra Madre Oriental. *P. michelbacherorum* seems to inhabit the more arid parts of northwestern Mexico (Sinaloa and Sonora) and Arizona (Nogales). *P. timberlakei* appears to be chiefly centered in the Sonoran deserts of California, Arizona and Sonora, Mexico, but it is also known from southern Nevada and southwestern New Mexico. It is interesting that five of the six species known to occur in the United States have been collected in Arizona. Only one species of *Peponapis*, the wide ranging *P. pruinosa*, occurs to the east of the Mississippi River.

The six species of this genus known to occur in the United States may be separated in the following key.

KEY TO THE SPECIES OF *PEPONAPIS* IN AMERICA NORTH OF MEXICO

- 1 Males 2
- Females 7
- 2(1) First flagellar segment of antenna with greatest length one-third or less than that of succeeding segment (as in fig. 2, middle); clypeus black or ferruginous, yellow maculation, if present, confined to apical half 3
- First flagellar segment of antenna with greatest length longer than that of succeeding segment (fig. 2, top); clypeus chiefly or entirely yellow *timberlakei* (p. 428)
- 3(2) Sixth metasomal tergum without a strong tooth on each side; second metasomal tergum with an apical or subapical band of pale pubescence; malar area short, minimum length much less than minimum thickness of first flagellar segment 4
- Sixth metasomal tergum with a strong tooth on each side; second metasomal tergum with only a basal band of pale pubescence; malar area long, minimum length approximately equal to minimum thickness of first flagellar segment *crassidentata* (p. 431)
- 4(3) Second metasomal tergum with only a basal band of pale pubescence;

- clypeus broadly maculated on apical third or more and often stained with ferruginous; sixth metasomal sternum with converging pair of lateral carinae strongly sinuate or markedly bowed outward (figs. 14, 15, bottom) 5
- Second metasomal tergum with an apical or subapical band of pale pubescence in addition to a basal band of pale pubescence; clypeus, if maculated at all, usually with a small subapical median spot; sixth metasomal sternum with converging pair of lateral carinae not strongly sinuate or markedly bowed outward (figs. 17, 18, bottom).... 6
- 5(4) Clypeal maculation clear yellow, not suffused with ferruginous, sharply though irregularly delimited above; sixth metasomal sternum with lateral carinae strongly sinuate (fig. 14, bottom); femora chiefly brownish-black *micelbacherorum* (p. 437)
- Clypeal maculation not wholly yellow, strongly suffused with ferruginous above, not sharply delimited; sixth metasomal sternum with lateral carinae markedly bowed outward (fig. 15, bottom)..... *utahensis* (p. 440)
- 6(4) Clypeus usually maculated with a small yellow subapical median spot (which occasionally occupies apical half of clypeus); pale pubescent bands of metasomal terga broad; sixth metasomal sternum with pair of converging lateral carinae at most feebly bowed inward, weakly elevated apically (fig. 17) *pruinosa* (p. 448)
- Clypeus black; pale pubescent bands of metasomal terga narrow, much reduced; sixth metasomal sternum with pair of converging lateral carinae conspicuously bowed inward, strongly lamelliform apically (fig. 18, bottom) *limitaris* (p. 468)
- 7(1) Second metasomal tergum with only a basal band of pale pubescence.. 8
- Second metasomal tergum with an apical or subapical band (sometimes incomplete medially) of pale pubescence in addition to a basal band of pale pubescence 10
- 8(7) Apical margin of second metasomal tergum narrowly impunctate medially, the nearest punctures there being separated from apical margin by much less than maximum thickness of second flagellar segment; scopal hairs chiefly pale 9
- Apical margin of second metasomal tergum broadly impunctate medially, the nearest punctures there being separated from apical margin by more than maximum thickness of second flagellar segment; scopal hairs chiefly black *crassidentata* (p. 431)
- 9(8) Dorsum of thorax uniformly pale pubescent; anterior ocellus separated from lateral ocellus by more than basal thickness of first flagellar segment *micelbacherorum* (p. 437)
- Dorsum of thorax not uniformly pale pubescent, intermixed with much black pubescence; anterior ocellus separated from lateral ocellus by less than basal thickness of first flagellar segment... *utahensis* (p. 440)
- 10(7) Inner hind tibial spur conspicuously longer than outer one, its distal apex much surpassing that of outer spur; apical margin of second metasomal tergum broadly impunctate medially, the nearest punctures there being separated from apical margin by more than maximum thickness of second flagellar segment 11
- Inner and outer hind tibial spurs of approximately equal length, the inner spur scarcely surpassing the outer one; apical margin of second metasomal tergum narrowly impunctate medially, the nearest punctures there being separated from apical margin by more than maximum thickness of second flagellar segment 12

- tures there being separated from apical margin by less than maximum thickness of second flagellar segment. *timberlakei* (p. 428)
- 11(10) Third metasomal tergum chiefly pale pubescent. *pruinosa* (p. 448)
- Third metasomal tergum with pale pubescence limited to a narrow, transverse median band *limitaris* (p. 468)

***Peponapis timberlakei* Hurd & Linsley, new species**

(Figs. 2, 12)

Male. Length, 12–14 mm. Length of forewing including tegula, 9–10 mm. Face above clypeus, hind margins of head and thorax black; metasoma, legs and antennae ferruginous, although metasomal terga of some specimens marked irregularly with black; clypeus chiefly yellow, apical margin narrowly ferruginous, base and sides moderately and irregularly ferruginous or brownish-black; supraclypeal area usually stained with ferruginous; parocular areas black; labrum yellow or variously stained with ferruginous; mandibles chiefly ferruginous, with a small dull yellowish-orange spot apically; tegulae pellucid testaceous; wings chiefly whitish-hyaline, faintly infuscated; veins testaceous; tibial spurs testaceous; claws marked with black apically.

Vestiture of head, body and legs chiefly pale ochraceous, nearly white on face, genae, sides of thorax, and legs; thickest on head, thorax and anterior face of first metasomal tergum, darkest on dorsum of thorax; pubescence of metasomal terga mostly fine and appressed, more or less uniformly covering terga III–VII, but expressed on tergum II as a complete basal band and usually a medially interrupted subapical band; pubescence on terga III indistinctly separated into a basal and a subapical band.

Eyes feebly diverging below (56:59); malar area short, linear, much shorter than minimum thickness of first flagellar segment; first flagellar segment longer than succeeding segment (fig. 2, top); apical margin of second metasomal tergum narrowly impunctate, nearest medial punctures separated from apical

rim by less than maximum thickness of second flagellar segment; inner and outer hind tibial spurs approximately of equal length, inner spur scarcely surpassing outer one; sixth metasomal tergum without a tooth on each side; pygidial plate and sixth metasomal sternum (as in fig. 12, top and bottom).

Female. Length, 11–13 mm. Forewing including tegula, 10–11 mm. Similar to male in appearance, but somewhat more robust. Coloration of integument, appendages and vestiture essentially as in male, except clypeus and labrum not maculated with yellow; pubescence of metasomal terga similar in color and pattern to that of male.

Eyes as feebly diverging below as male (61:67); malar area, margin of second metasomal tergum and hind tibial spurs as in male.

Location of types. Holotype male and allotype, collected at two miles south of Palo Verde, Imperial County, California, on July 16, 1962, in open flowers of *Cucurbita palmata* between 4:30 and 5:30 a.m. by P. D. Hurd, Jr., are deposited in the entomological collection of the California Academy of Sciences.

Geographic range. Deserts of Arizona, California, Nevada, New Mexico and Sonora, Mexico.

SPECIMENS EXAMINED (PARATYPES)

United States

Arizona:

Cochise Co.: Benson, 1 ♂, VII-12-52, in flower of gourd (R. H. and L. D. Beamer, W. E. LaBerge and C. Liang, KU).

Cochise, 1 ♂, VIII-26-61, in flower of *Cucurbita digitata* (AEM & MM).

Douglas, 1 ♂, VIII-17-61, in flower of *C. digitata* (AEM & MM); 1 ♂, VIII-

Fig. 12. *Peponapis timberlakei*, new species, male: dorsal view of seventh metasomal tergum (top) and ventral view of sixth metasomal sternum (bottom).

24-61, in flower of *C. digitata* (AEM & MM).

Douglas, 1 mi E, 2 ♀♀, VII-8-62, collecting pollen in open flowers of *C. digitata*, 6:25 to 6:37 a.m. (MAC); 1 ♀, VIII-11-62, collecting pollen in open flower of *C. digitata*, 6:15 to 6:30 a.m. (MAC).

Kansas Settlement, 1 mi E, 4 ♂♂, 1 ♀, VIII-22-61, in flowers of *C. digitata* (AEM & MM).

Kansas Settlement, 12 mi S, 5 ♂♂, 1 ♀, VIII-1-61, in flowers of *C. digitata* (EGL).

Pearce, 15 mi W, 2 ♂♂, 1 ♀, VIII-22-61, in flowers of *C. digitata* (AEM & MM); 2 ♂♂, VIII-22-61, in flowers of *C. foetidissima* (AEM & MM).

Portal, 1 ♂, IX-16-61, in flower of *C. foetidissima* sometime between 5:55 and 8:30 a.m. (AEM & MM).

Portal, 1.5 mi NE, 1 ♂, VIII-31-61, in flower of *C. foetidissima* (AEM & MM).

Portal, 1.6 mi N, 1 ♂, VII-23-61, in wilted flower of *C. foetidissima* at 9:30 a.m. (EGL); 1 ♂, 1 ♀, VII-24-61, in wilted flowers of *C. foetidissima* at 9:00 a.m. (EGL); 1 ♂, VII-25-61, in wilted flower of *C. foetidissima* at 9:10 a.m. (EGL); 1 ♂, VII-26-61, in flower of *C. foetidissima* at 8:40 a.m. (EGL).

Tombstone, 8.5 mi E, 1 ♀, VIII-13-40, in flower of *C. digitata* (PHT).

Gila Co.: Globe, 1 ♀, in flower of *C. digitata* (AEM & MM).

Graham Co.: Pima, 1 ♂, VIII-25-61, in flower of *C. foetidissima* at 12:30 p.m. (AEM & MM).

Pima Co.: Brown's Canyon, Baboquivari Mountains, 1 ♂, VII-29 to 30-52 (H. B. Leech and J. W. Green, CAS).

Tucson, 20 mi SE, 1 ♂, IX-19-61, in closed flower of *C. digitata* at 3:00 p.m. (AEM & MM).

Pinal Co.: Stanfield, 19 ♂♂, 9 ♀♀, VIII-22-62, in closed flowers of *C. digitata*, 12:15 to 1:00 p.m. (AEM & MM).

Santa Cruz Co.: Lochiel, 1 ♂, VII-

13-62, in flower of *C. foetidissima*, 9:30 to 10:00 a.m. (MAC).

Nogales, 6 mi NE, 1 ♂, VII-11-62, in open flower of *C. foetidissima*, 5:25 to 5:35 a.m. (EGL); 1 ♂, VII-11-62, in open flower of *C. digitata*, 5:20 to 5:30 a.m. (EGL).

Tubac, 6 ♂♂, 2 ♀♀, VIII-22-62, in open flowers of *C. digitata*, 7:20 to 9:20 a.m., females collecting pollen (AEM & MM).

Yavapai Co.: Congress, 8 mi W, 1 ♀, IX-10-59 (RFS).

Yuma Co.: Wellton, 1 ♂, VIII-22-62, in closed flower of *C. palmata* at 4:00 p.m. (AEM & MM).

Yuma, 1 ♂, VI-19-18, in flower of "wild squash" (G. F. Ferris, CAS).

California:

Imperial Co.: Palo Verde, 2 mi S, 1 ♂, IX-16-61, in closed flower of *C. palmata* at 3:30 p.m. (PDH); 2 ♀♀, VII-16-62, in open flowers of *C. palmata*, 4:30 to 5:10 a.m. (PDH); 2 ♀♀, VII-16-62, collecting pollen in open flowers of *C. palmata*, 4:50 to 5:10 a.m. (PHT); 2 ♂♂, VII-16-62, in closed flowers of *C. palmata*, 8:15 to 8:30 a.m. (PDH).

Riverside Co.: Blythe, 2 ♂♂, 1 ♂, VII-29-35 (C. M. Dammers, LACM, UCR); 1 ♀, VII-5-38, in flower of *C. palmata* (PHT); 2 ♂♂, 1 ♀, VII-16-38, in flowers of *C. palmata* (PHT); 10 ♂♂, VII-23-45, in flowers of *C. palmata* (J. W. MacSwain, UCR).

Blythe, 2 mi W, 1 ♂, VII-16-62, in partly closed flower of *C. palmata* at 7:45 a.m. (PDH).

Palm Springs, 1 ♂, VI-24-52, in flower of *C. palmata* (PHT).

San Bernardino Co.: Ludlow, 6 mi W, 1 ♂, X-17-51, in flower of *C. palmata* (RFS).

Twentynine Palms, 4 ♂♂, VIII-29-34, in flowers of *C. palmata* (CDM); 2 ♂♂, 1 ♀, IX-5-46, in flowers of *C. palmata* (PHT).

Nevada:

Clark Co.: Davis Dam, 2 mi W, 1 ♂,

1 ♀, IX-11-59, in flowers of *C. palmata* (RFS).

Searchlight, 15 mi S, 1 ♂, IX-11-59, in flower of *C. palmata* (RFS).

New Mexico:

Hidalgo Co.: Cotton City, 1 ♂, VIII-25-61, in flower of domestic squash (AEM & MM).

Post Office Canyon, Peloncillo Mountains, 1 ♂, VIII-19-61, in flower of *C. digitata* (AEM & MM).

Rodeo, 1 ♀, IX-9-61, in flower of *C. digitata* (AEM & MM).

Rodeo, 2.5 mi NW, 1 ♀, VII-25-61, in wilted flower of *C. foetidissima* at 10:20 a.m. (EGL).

Rodeo, 5 mi S, 1 ♂, VII-31-59, in open flower of *C. foetidissima* between 6:02 and 6:20 a.m. (EGL); 1 ♀, VIII-4-59, sleeping in closed flower of *C. foetidissima* at 3:00 p.m. (EGL); 2 ♂♂, VIII-5-59, in open flowers of *C. digitata* at 5:20 and 5:45 a.m., respectively (EGL).

Rodeo, 5.6 mi SW, 1 ♂, VIII-17-61, in flower of *C. digitata* at 9:15 a.m. (AEM & MM); 2 ♂♂, 1 ♀, VIII-17-61, in flowers of *C. foetidissima* at 9:15 a.m. (AEM & MM).

Mexico

Sonora:

Benjamin Hill, 52 ♂♂, 15 ♀♀, VIII-21-62, in open flowers of *C. digitata*, 7:20 to 9:15 a.m., some females collecting pollen (AEM & MM).

Pollen sources. From the records it appears that this species utilizes only the pollens of *C. digitata* and *C. palmata*. A number of specimens of both sexes (14 ♂♂, 3 ♀♀) have been collected from the flowers of *C. foetidissima* and only one specimen, a male, from the flowers of domestic squash. However, there is no evidence which thus far demonstrates that this species uses the pollen of these plants.

Flight period. ♂♂, June 18 to October 17; ♀♀, July 5 to September 16.

Peponapis timberlakei, named for P. H. Timberlake of the University of California at Riverside, may be easily recognized in the male by the unusually elongated first flagellar segment (fig. 2, top). This segment exceeds the length of the succeeding segment and is therefore quite similar in this respect to the males of the genus *Xenoglossa*. The inner and outer hind tibial spurs of the female of *P. timberlakei* are very nearly equal in length. In this feature they are unlike any known species of the genus *Peponapis*. Apart from these unique characteristics, *P. timberlakei* is structurally related to such species as *P. pruinosa*, *P. utahensis* and *P. michelbacherorum*. Such structures as the sixth metasomal sternum of the male (fig. 12, bottom) the pygidial plate of the male (fig. 12, top), and the disposition of the ocelli of the female suggest that *P. timberlakei* comes from the same ancestry that has led to the formation of *P. pruinosa*.

Peponapis crassidentata

(Cockerell)

(Fig. 13)

Xenoglossa pruinosa, Cockerell, 1906, Trans. Amer. Ent. Soc., 32:115, [♀] (Lee County, Texas record only), in part, *nec* Say, 1837, Boston Jour. Nat. Hist., 1(4):405.

Melissodes crassidentata Cockerell, 1949, Proc. U. S. Natl. Mus., 98:466, ♂ (Honduras:Zamorano; three specimens, the type taken in latter part of October).

Peponapis crassidentata, LaBerge, 1956, Univ. Kansas Sci. Bull., 37:1179.

Male. Length, 11–12 mm. Length of forewing including tegula, 10–11 mm. Head, body and legs black, metasomal tergal and sternal apices dark mahogany red; clypeus black, not maculated; supraclypeal and parocular areas black, not maculated or stained with ferruginous; labrum black, not maculated or stained with ferruginous; mandibles black, except an elongate dull orange maculation on apical half; antennae

Fig. 13. *Peponapis crassidentata* (Cockerell), male: dorsal view of seventh metasomal tergum (top) and ventral view of sixth metasomal sternum (bottom).

black, often with slight traces of dark mahogany red; tegulae pellucid testaceous; wings faintly infumated, veins dark brownish-black; tibial spurs dark testaceous; claws dark reddish-brown on apical half.

Vestiture of head, thorax and anterior portion of first metasomal tergum thick, chiefly fulvo-ochraceous, whitish on genae and hind margins of head; pubescence of metasomal terga II–VII chiefly black, but transversely banded with appressed white tomentose hairs on terga II–V as follows: terga II and III at sides and base; terga IV and V at sides and subapically, usually incomplete medially; pubescence of legs variable, usually chiefly pale, but that on hind basitarsi usually brownish-black or black.

Eyes scarcely diverging below (60:65); malar area long, approximately equal to minimum thickness of first flagellar segment; first flagellar segment much less than one-half as long as succeeding segment; apical margin of second metasomal tergum broadly impunctate, nearest medial punctures separated from apical rim by considerably more than maximum thickness of second flagellar segment; inner hind tibial spur conspicuously longer than outer spur, its distal apex much surpassing that of outer spur; sixth metasomal tergum with a strong tooth on each side; pygidial plate (fig. 13, top) and sixth metasomal sternum (fig. 13, bottom) as illustrated.

Female. Length, 14–16 mm. Forewing including tegula, 12–13 mm. Head, thorax and metasoma chiefly black, metasomal tergal and sternal apices dark testaceous, legs dark reddish-brown almost black on some external surfaces of tibiae and tarsi; mandibles reddish-brown, except an elongate dull orange maculation extending subapically to before middle of mandible; antennae dark reddish brown; tegulae, wings, veins, tibial spurs and claws colored as in male.

Vestiture of head, thorax and anterior face of first metasomal tergum thick, chiefly pale pubescent, but vestiture on vertex and much of that on dorsum of thorax black or brownish-black; pubescence of face and genae mostly white; remainder of pubescence on thorax and anterior face of first metasomal tergum fulvo-ochraceous, pubescence of metasomal terga II–IV chiefly black, but transversely banded with appressed white tomentose hairs as follows: tergum II at sides and base, terga III and IV at sides and subapically, usually broadly incomplete medially; terga V and VI densely clothed with short depressed brownish hairs; pubescence of legs mostly pale pubescent, but that on hind tibiae and tarsi brownish-black.

Eyes as weakly diverging below as male (65:72); anterior ocellus separated from lateral ocellus by more than basal thickness of first flagellar segment; apical margin of second metasomal tergum broadly impunctate, nearest medial punctures separated from apical rim by considerably more than maximum thickness of second flagellar segment; inner hind tibial spur conspicuously longer than outer spur, its distal apex much surpassing that of outer spur.

Location of type. U. S. National Museum, No. 52851.

Geographic range. Costa Rica north into the southwestern United States (Texas).

SPECIMENS EXAMINED

Costa Rica

Guanacaste:

Playa del Coco, 10 ♂♂, VIII-2-62 (Alvaro Wille, AW and CIS).

El Salvador

Quezaltepeque, 2 mi E, 1 ♂, VII-18-61 (M. E. Irwin, UCD); 1 ♀, VII-24-61 (M. E. Irwin, UCD).

Mexico

Campeche:

Seybaplaya, 12 km S, 2 ♂♂, VIII-11-62, in closed flowers of domestic

squash (*Cucurbita pepo*) sometime between 11:20 and 11:45 a.m. (JKD); 2 ♂♂, 1 ♀, same data (PDH); 1 ♂, 11 ♀♀, VIII-14-62, in open flowers of domestic squash (*C. pepo*), 7:15 to 8:00 a.m., females collecting pollen (JKD); 2 ♂♂, 14 ♀♀, same data (PDH); 1 ♂, 8 ♀♀, same data (RFS).

Chiapas:

Tuxtla Gutierrez, 2 ♂♂, 9 ♀♀, VII-30-62, in nearly closed flowers of domestic squash, 9:45 to 10:00 a.m., females collecting pollen (AEM & MM).

Tuxtla Gutierrez, 2 mi E, 1 ♀, VII-25-56, excavating burrow in adobe bank (J. W. MacSwain, CIS).

Coahuila:

Guadalupe, 1 ♂, VIII-23-47, in flower of *Cucurbita* (CDM-AMNH).

Colima:

Valle Verde, 1 ♂, VII-31-54 (M. A. Cazier, W. J. Gertsch and Bradts, AMNH).

Guerrero:

Acapulco, 4 ♂♂, VII-18-62, in flowers of domestic squash (AEM & MM); 5 ♀♀, VII-19-62, collecting pollen in open flowers of domestic squash, 5:50 to 6:20 a.m. (AEM & MM); 1 ♂, 1 ♀, VII-19-62, in open flowers of domestic squash sometime between 7:20 and 7:50 a.m., female collecting pollen (AEM & MM).

Michoacan:

Cojumatlan, 1 ♂, VII-9-62, in open flower of domestic squash sometime between 9:00 and 9:40 a.m. (AEM & MM).

Morelos:

Tepaltzingo, 1 ♂, VIII-18-62, in closed flower of domestic squash (*Cucurbita moschata*), 12:15 to 12:30 p.m. (PDH.)

Nayarit:

Ixtlan del Rio, 5 mi N, 2 ♂♂, 1 ♀, IX-2-62 (DHJ).

Oaxaca:

Oaxaca, 1 ♂, VII-25-33 (GEB); 1 ♂, VII-25-62, in closed flowers of domestic squash (AEM & MM); 1 ♂, VII-26-62, in flower of domestic squash sometime

between 7:20 and 7:50 a.m. (AEM & MM); 1 ♂, VII-27-62, in flower of domestic squash sometime between 8:10 and 8:40 a.m. (AEM & MM).

Tehuantepec, 4 ♂♂, 5 ♀♀, VII-28-62, in closed flowers of domestic squash at 4:00 p.m. (AEM & MM); 44 ♂♂, 204 ♀♀, VII-29-62, in open flowers of domestic squash, 5:50 to 8:20 a.m., most females collecting pollen (AEM & MM); 9 ♂♂, 26 ♀♀, VIII-1-62, in open flowers of domestic squash, 6:20 to 7:00 a.m., most females collecting pollen (AEM & MM).

Puebla:

Acatlan, 2 ♂♂, VII-25-62, in open flowers of domestic squash at 9:15 a.m. (AEM & MM).

Chila, SE of Puebla, 1 ♂, 1 ♀, VII-25-62, in closed flowers of domestic squash at 11:30 a.m. (AEM & MM).

Tehuacan, 2 km W, 8 ♂♂, 1 ♀, VIII-16-62, female and two males in closed flowers of domestic squash (*Cucurbita pepo*), 4:15 to 4:30 p.m., and six males in purple-flowered *Proboscidea* (PDH).

San Luis Potosí:

Tamazunchale, 1 ♂, VI-22-53 (KU Mexican Expedition, KU).

Sinaloa:

Los Mochis, 1 ♂, 1 ♀, VI-26-62, in flowers of domestic squash (AEM & MM).

Los Mochis, 35 mi S, 47 ♂♂, 4 ♀♀, VIII-18-62, in open flowers of domestic squash, 8:00 to 8:45 a.m., females collecting pollen (AEM & MM).

Mazatlan, 204 ♂♂, 27 ♀♀, VIII-16-62, in open flowers of a native gourd (*Cucurbita* sp.), 6:00 to 8:00 a.m., females collecting pollen (AEM & MM); 2 ♂♂, 2 ♀♀, VIII-16-62, in closed flowers of domestic squash growing near seashore (AEM & MM); 1 ♂, 3 ♀♀, VIII-17-62, in not fully open flowers of domestic squash, 5:45 to 5:55 a.m., females collecting pollen (AEM & MM).

Mazatlan, 20 mi N, 1 ♂, VIII-17-62, in flower of native gourd (*Cucurbita* sp.) (AEM & MM).

Mazatlan, approximately 30 to 35 mi N, 18 ♂♂, 3 ♀♀, VIII-17-62, in open flowers of a native gourd (*Cucurbita* sp.), 6:30 to 8:30 a.m., females collecting pollen some time during this period (AEM & MM).

Sonora:

Agua Prieta, 4 ♂♂, VIII-24-61, in flowers of domestic squash (AEM & MM); 1 ♂, VIII-21-62, in flower of domestic winter squash (MAC).

Alamos, 1 ♂, 1 ♀, IX-2-60 (R. L. Westcott, LACM).

Navajoa, 3 ♂♂, 1 ♀, VIII-18-62, in closed flowers of domestic squash at 7:00 p.m. (AEM & MM); 61 ♂♂, 12 ♀♀, VIII-19-62, in open flowers of domestic squash, 5:45 to 8:50 a.m., females collecting pollen (AEM & MM).

Nogales, about 15 mi S, 3 ♂♂, 1 ♀, VIII-21-62, in nearly closed flowers of domestic squash, 11:45 a.m. to 12:15 p.m. (AEM & MM).

Tabasco:

Cardenas, 5 km E, 1 ♂, 1 ♀, VIII-9-62, in wilting flowers of domestic squash (*Cucurbita moschata*) sometime between 9:30 and 9:45 a.m., female collecting pollen (PDH).

Cardenas, 50 km W, 1 ♂, VIII-9-62, in open flower of domestic squash (*C. moschata*) sometime between 7:30 and 8:00 a.m. (JKD); 1 ♂, same data (PDH).

Villahermosa, 5 km S, 1 ♂, VIII-15-62, in open flower of domestic squash sometime between 6:45 and 7:30 a.m. (PDH).

Veracruz:

Catemaco, 1 ♂, VIII-2-62, in open but wilting flower of domestic squash sometime between 8:20 and 9:25 a.m. (AEM & MM).

Catemaco, 1.5 km N, 2 ♂♂, VIII-8-62, in open flowers of domestic squash sometime between 10:45 and 11:00 a.m. (JKD).

Ciudad Aleman, 1 ♂, VIII-21-62, resting in open flower of domestic squash (*Cucurbita moschata*) at 7:30 a.m. (DHJ).

Ciudad Aleman, 2 mi W, 5 ♀♀, VIII-22-62, collecting pollen in open flowers of domestic squash (*C. pepo*), 6:17 to 6:47 a.m. (DHJ).

Coatzacoalcos, 13 km E, 1 ♂, 1 ♀, VIII-9-62, in open flowers of domestic squash, 6:20 to 6:35 a.m., female collecting pollen (JKD); 2 ♂♂, 4 ♀♀, VIII-9-62, in open flowers of domestic squash 6:20 to 6:35 a.m., females collecting pollen, one pair observed copulating in flower (PDH); 1 ♂, VIII-9-62, in open flower of domestic squash sometime between 6:20 and 6:35 a.m. (RFS).

Cordoba, 2 ♀♀, VIII-4-62, in flowers of domestic squash (AEM & MM).

Cordoba, 3.9 mi E, 1 ♀, VIII-7-62, collecting pollen in open flower of domestic squash (*C. moschata*) sometime between 8:30 and 9:30 a.m. (PDH); 1 ♂, VIII-7-62, resting in open flower of domestic squash (*C. moschata*) sometime between 8:30 and 9:30 a.m. (RFS).

Cotaxtla Experiment Station (collected by DHJ), 30 ♂♂, 4 ♀♀, VIII-7-62, in closed flowers of domestic squash (*C. pepo*), 5:00 to 6:30 p.m.; 8 ♂♂, 1 ♀, VIII-8-62, in flowers of domestic squash (*C. pepo*), 7:15 to 8:20 a.m. 1 ♂, VIII-8-62, at flower of *Momordica* sometime between 6:40 and 6:50 a.m.; 17 ♂♂, 10 ♀♀, VIII-9-62, in open flowers of domestic squash (*C. pepo*), 7:15 to 8:30 a.m., females collecting pollen; 8 ♂♂, 22 ♀♀, VIII-10-62, in open flowers of domestic squash, 6:30 to 6:50 a.m., females collecting pollen; 2 ♂♂, 13 ♀♀, VIII-11-62, in open flowers of domestic squash (*C. pepo*), 7:00 to 8:30 a.m., females collecting pollen; 1 ♀, VII-11-62, observed to force way into closed flower; 6 ♂♂, 1 ♀, VIII-11-62, in half-closed flowers of domestic squash (*C. pepo*), 9:30 to 9:45 a.m.; 2 ♂♂, 16 ♀♀, VIII-12-62, in open flowers of domestic squash (*C. pepo*), 7:00 to 7:30 a.m.; 5 ♂♂, 33 ♀♀, VIII-13-62, in open flowers of domestic squash (*C. pepo*), 7:15 to 8:30 a.m.; 6 ♂♂, 8 ♀♀, VIII-15-62, in open flowers of domestic squash (*C. pepo*),

7:15 to 8:30 a.m.; 1 ♂, 4 ♀ ♀, VII-16-62, in open flowers of domestic squash (*C. pepo*), 5:50 to 6:20 a.m.; 5 ♂ ♂, 19 ♀ ♀, VIII-16-62, in open flowers of domestic squash (*C. pepo*), 7:15 to 8:30 a.m.; 6 ♂ ♂, 82 ♀ ♀, VIII-18-62, in open flowers of domestic squash (*C. moschata* and *C. pepo*), 5:30 to 8:00 a.m., females collecting pollen; 2 ♀ ♀, VIII-21-62, collecting pollen in open flowers of domestic squash, 6:57 to 7:37 a.m.; 1 ♂, 4 ♀ ♀, VIII-28-62, in flowers of domestic squash; 1 ♂, 17 ♀ ♀, IX-8-62, in open flowers of domestic squash, 5:55 to 6:35 a.m., females collecting pollen.

Cotaxtla Experiment Station, 4.3 mi W, 2 ♂ ♂, 2 ♀ ♀, VIII-11-62, in flowers of domestic squash (*C. pepo*), 10:00 to 10:20 a.m. (DHJ).

Cotaxtla Experiment Station, 12.2 mi W, 15 ♂ ♂, 3 ♀ ♀, VIII-11-62, in closed flowers of domestic squash (*C. pepo*) at 11:00 a.m. (DHJ).

Isla, 29 km N, 1 ♂, VIII-16-62, in open flower of domestic squash (*C. moschata*) (PDH).

Juan Diaz Covarrubias, 1 km E, 1 ♂, 2 ♀ ♀, VIII-8-62, in open flowers of domestic squash (JKD); 9 ♂ ♂, 1 ♀, VIII-8-62, in closed staminate flowers of an unidentified native *Cucurbita* (plant E) approximately 1:00 p.m. (PDH); 1 ♂, same data, but collected on VIII-15-62 (JKD).

Las Tinajas, 29.3 mi S, 5 ♂ ♂, VIII-22-62, in wilting flowers of domestic squash at 9:30 a.m. (DHJ).

Palo Gacho, 1 ♀, VIII-6-62, in wilting flowers of domestic squash (JKD); 1 ♂, same data (PDH); 1 ♂, same data, (RFS).

San Andreas Tuxtla, 4 km SE, 3 ♂ ♂, VIII-8-62, in open flowers of *Luffa cylindrica* at 10:45 a.m. (PDH).

Santecomapan, 18 km E, 1 ♂, VIII-16-62, in open flower of domestic squash (*C. moschata*) at 7:30 a.m. (JKD); 1 ♂, 1 ♀, VIII-16-62, in open flowers of domestic squash (*C. moschata*) at 7:30 a.m., female collecting pollen (PDH).

Santiago Tuxtla, 10 km NW, 2 ♂ ♂,

VIII-8-62, in open flowers of domestic squash (*C. moschata*), 9:00 to 9:15 a.m. (PDH).

Santiago Tuxtla, 30 km NW, 1 ♂, VIII-8-62, in open flower of domestic squash at 9:30 a.m. (JKD); 4 ♂ ♂, 1 ♀, same data, but female collecting pollen (PDH).

Tierra Blanca, 11.6 mi N, 4 ♂ ♂, VIII-21-62, in open flowers of domestic squash (*C. pepo*) at 8:30 a.m. (DHJ).

Tlacotalpan, 14 mi W, 1 ♀, VIII-21-62, collecting pollen in open flower of domestic squash at 7:30 a.m. (DHJ).

Tlacotalpan, 19 mi W, 1 ♂, 5 ♀ ♀, VIII-21-62, in open flowers of domestic squash, 6:25 to 6:45 a.m., females collecting pollen (DHJ).

Tlacotalpan, 19.8 mi W, 4 ♀ ♀, VIII-22-62, collecting pollen in open flowers of domestic squash (*C. pepo*), 6:05 to 6:25 a.m. (DHJ).

Tlacotalpan, 20 mi W, 5 ♂ ♂, VIII-20-62, in partly open flowers of domestic squash (*C. moschata*) at 5:30 a.m. (DHJ).

Tlacotalpan, 22.1 mi W, 2 ♂ ♂, 1 ♀, VIII-21-62, in open flowers of domestic squash (*C. pepo*), 6:58 to 7:18 a.m., female collecting pollen sometime between 6:58 and 7:08 a.m. (DHJ).

Veraacruz, 9 ♂ ♂, 5 ♀ ♀, VIII-4-62, in open flowers of domestic squash, 8:00 to 9:15 a.m. (AEM & MM); 3 ♂ ♂, 16 ♀ ♀, VIII-9-62, in open flowers of domestic squash (*C. moschata* and *C. pepo*), 5:50 to 7:15 a.m., females collecting pollen throughout this period (DHJ); 2 ♀ ♀, VIII-10-62, in open flowers of domestic squash (DHJ); 33 ♂ ♂, 42 ♀ ♀, VIII-14-62, in open flowers of domestic squash (*C. moschata* and *C. pepo*), 5:40 to 7:50 a.m., most females collecting pollen (DHJ); 10 ♂ ♂, 30 ♀ ♀, VIII-29-62, in open flowers of domestic squash (*C. pepo*), 5:42 to 7:12 a.m., females collecting pollen throughout this period (DHJ).

Yucatan:

Hoctun, 18 km W, 1 ♂, 2 ♀ ♀, VIII-12-62, in open flowers of domestic squash (*C. moschata*), females collect-

ing pollen (JKD); 3 ♂♂, 2 ♀♀, same data (PDH); 1 ♂, same data (RFS); 1 ♂, 1 ♀, VIII-13-62, in open flowers of domestic squash (*C. moschata*), 5:45 to 6:30 a.m., female collecting pollen (PDH); 1 ♀, VIII-13-62, in purple-flowered *Proboscidea*, scopa with pollen of *Cucurbita*, sometime between 5:45 and 6:30 a.m. (RFS).

United States

Texas:

Cameron Co.: Brownsville, 1 ♂, VIII-2-62 (P. A. Glick, S & S).

Lee Co.: 1 ♀, VIII-10-07 (UCR); 1 ♂, VIII-26-07 (UCR).

Pollen sources. The records suggest that *Peponapis crassidentata* freely utilizes the pollens of the various species of domestic *Cucurbita*, but its use of the pollens of the native *Cucurbita* is poorly known. The females have been observed on only two occasions collecting pollen from unidentified native species of the genus *Cucurbita*.

Flight period. ♂♂, June 22 to September 8; ♀♀, June 26 to September 26.

This species, which was described from Zamorano, Honduras, by Cockerell (1949:466) is now known to occur from Costa Rica to the United States (Texas). It is widely distributed in Mexico and probably occurs in Arizona. A. E. and Martha Michelbacher collected four males at Agua Prieta in Sonora, a few miles south of Douglas, Arizona, in the flowers of domestic squash on August 24, 1961. Upon revisiting this locality on August 21, 1962, Mont A. Cazier obtained an additional male.

Peponapis crassidentata appears to possess a number of structural features which link the genera *Peponapis* and *Xenoglossa*. The head of the males, especially the antennae and the mandibles, is essentially commensurate with the generic definition of *Peponapis* as provided by Moure and Michener (1955: 298-300). However, unlike any other

species of *Peponapis* known to us, many of the diagnostic features of the male metasoma are shared by the genus *Xenoglossa* and other genera of the tribe Eucerini. The seventh metasomal tergum is produced into a strong angle on each side of the pygidial plate (fig. 13). In addition, the gradulus of the sixth metasomal tergum terminates on each side as a strongly projected tooth. The malar area of the male is appreciably longer than in any of the other species currently included in either genus *Peponapis* or *Xenoglossa*. The minimum length of this area is approximately equal to the minimum thickness of the first flagellar segment. The female of *P. crassidentata* does not exhibit as strikingly modified features as does its male. In appearance and structure it is clearly a member of the genus *Peponapis*. It is the only species in America north of Mexico whose scopal hairs are chiefly dark brown or black. We are unable at this time to determine the relationships of *P. crassidentata* with other species included in the genus *Peponapis*.

On July 25, 1956, J. W. MacSwain observed a female of this species excavating a burrow in an adobe bank.

Peponapis michelbacherorum Hurd & Linsley, new species

(Fig. 14)

Male. Length, 13-14 mm. Length of forewing including tegula, 9-10 mm. Head, except clypeus, body, coxae, trochanters, and femora chiefly black; tibiae and tarsi testaceous or dark reddish-brown; metasomal sterna variably tinged with dark mahogany red; clypeus black, broadly maculated with yellow on apical half, not suffused with ferruginous, maculation sharply though irregularly delimited above, apical margin narrowly ferruginous; supra-clypeal and parocular areas black, not maculated or stained with ferruginous; labrum yellow, stained with ferruginous, mandibles black basally, rufo-testa-

ceous on middle third, with an elongated dull orange maculation situated subapically on apical third and enclosed by an irregular black marking; antennae chiefly black dorsally, reddish ventrally; tegulae pellucid testaceous; wings faintly infumated, veins dark brown or brownish-black; tibial spurs testaceous; claws dark reddish-brown or black apically.

Vestiture of head, thorax and anterior portion of first metasomal tergum thick, chiefly fulvo-ochraceous, whitish on genae, hind margins of head and between antennal sockets; pubescence of metasomal terga II-VI black, but transversely banded with appressed white tomentose hairs on terga II-VI as follows: tergum II at sides and base, tergum III at sides, basally and subapically, thus forming two bands, terga IV and V at sides and subapically, tergum VI apically; pubescence of legs chiefly pale, mostly whitish on exterior surfaces and on coxae, trochanters and femora.

Eyes scarcely diverging below (54:56); malar area short, linear, much shorter than minimum thickness of first flagellar segment; first flagellar segment much less than one-half as long as succeeding segment; apical margin of second metasomal tergum narrowly impunctate, nearest medial punctures separated from apical rim by less than maximum thickness of second flagellar segment; inner hind tibial spur considerably longer than outer spur, its distal apex much surpassing that of outer spur; sixth metasomal tergum without a strong tooth on each side; pygidial plate (fig. 14, top) and sixth metasomal sternum (fig. 14, bottom) as illustrated.

Female. Length, 13-15 mm. Forewing including tegulae, 9-10 mm. Head and body chiefly black, but ventral surfaces largely testaceous; legs chiefly testaceous or ferruginous, often with much black on coxae, trochanters and femora; labrum black; mandibles black or dark reddish-brown basally and with a greatly elongated dull orange maculation situated subapically and extending

to near basal third of mandible; antennae, tegulae, wings, tibial spurs and claws essentially colored as in male.

Vestiture essentially colored and disposed as in male, except pubescence on metasomal terga V and VI chiefly ferruginous.

Eyes as feebly diverging below as male (58:65); anterior ocellus separated from lateral ocellus by more than basal thickness of first flagellar segment; apical margin of second metasomal tergum narrowly impunctate, nearest medial punctures separated from apical rim by much less than maximum thickness of second flagellar segment; inner hind tibial spur conspicuously longer than outer spur, its distal apex much surpassing that of outer spur.

Location of types. Holotype male and allotype, collected at Nogales, Santa Cruz County, Arizona, on August 22, 1962 in open flowers of domestic squash sometime between 5:50 and 6:50 a.m. by A. E. and Martha Michelbacher, are deposited in the entomological collection of the California Academy of Sciences.

Geographic range. Extreme southern Arizona (Nogales) southward into the State of Sinaloa, Mexico.

SPECIMENS EXAMINED (PARATYPES)

Mexico

Sinaloa:

La Reforma, 2 ♂♂, 1 ♀, VIII-18-62, in open flowers of unidentified wild gourd (*Cucurbita* sp.), 6:35 to 6:45 a.m., female collecting pollen (AEM & MM).

Mazatlan, 1 ♂, 5 ♀♀, VIII-16-62, in open flowers of unidentified wild gourd (*Cucurbita* sp.), 6:00 to 8:00 a.m., females collecting pollen (AEM & MM); 1 ♂, 1 ♀, VIII-16-62, in closed flowers of domestic squash growing near seashore (AEM & MM); 6 ♀♀, VIII-17-62, collecting pollen in open flowers of domestic squash growing near sea beach (AEM & MM).

Mazatlan, about 30 to 35 mi N, 1 ♂, VIII-17-62, in open flower of an unidentified wild gourd (*Cucurbita* sp.) be-

Fig. 14. *Peponapis michelbacherorum*, new species, male: dorsal view of seventh metasomal tergum (top) and ventral view of sixth metasomal sternum (bottom).

tween 6:30 and 8:30 a.m. (AEM & MM).

Sonora:

Navajoa, 5 ♂♂, 1 ♀, VIII-19-62, in open flowers of domestic squash, 6:25 to 7:25 a.m., female collecting pollen (AEM & MM).

Pollen sources. From the few collection records it appears that this species uses the pollen of both native and domestic *Cucurbita*. It has not been associated, however, with any identified native species of the genus *Cucurbita*.

Flight period. Unknown, but presumably the summer months.

Peponapis michelbacherorum superficially resembles *P. pruinosa*, but appears to be most closely related to *P. utahensis*. This relationship is suggested by such similarly constituted structures of the male as the pygidial plates (figs. 14, 15) and the sixth metasomal sternum (figs. 14, 15). The females of these species are structurally more similar to each other than they are to any of the other known species.

We wish to dedicate this species to A. E. and Martha Michelbacher, whose indefatigable field investigations of the genera *Peponapis* and *Xenoglossa* have provided a considerable foundation of data and specimens upon which this report is based. Previous to their efforts this species was not represented in collections and was not known to occur in the United States.

Peponapis utahensis (Cockerell)

(Fig. 15)

Xenoglossa utahensis Cockerell, 1905, Proc. Biol. Soc. Washington, 18:182-183, ♀ (Utah); Cockerell, 1906, Trans. Amer. Ent. Soc., 32:90, 102 (Utah); Cockerell, 1912, Proc. U. S. Natl. Mus., 43:266, ♀ (Utah); Lutz and Cockerell, 1920, Bull. Amer. Mus. Nat. Hist., 42: 626 (Utah).

Peponapis utahensis, Michener, 1951, U. S. Dept. Agric. Monogr., 2:1221 (Utah, Arizona and northern Mexico).

Male. Length, 13-15 mm. Length of forewing including tegula, 9-10 mm. Head and thorax black, metasoma dark reddish-brown; legs bright ferruginous; clypeus maculated with yellow, strongly suffused with ferruginous peripherally and thus maculation not sharply delimited; supraclypeal and parocular areas black, rarely stained with ferruginous; labrum ferruginous; mandibles broadly ferruginous at base, outwardly suffused with red, consequently ferruginous coloration tapers and terminates near middle of mandible beyond which an irregular transverse black band connects with black-edged margins and encloses apically an elongate dull yellowish-orange marking; antennae dark reddish-brown, palest ventrally; tegulae ferruginous; wings yellowish, veins ferruginous or dark brown; tibial spurs bright ferruginous; claws dark reddish-brown or black apically.

Vestiture of head, thorax and anterior portion of first metasomal tergum thick, chiefly pale ochraceous, but whitish on face, labrum, genae, hind margins of head, thorax at sides and most ventrally exposed surfaces of thorax and metasoma; pubescence of metasomal terga II-VII pale ochraceous, golden, or whitish, chiefly disposed as transverse bands as follows: tergum II at sides and base, terga III and IV at sides, basally and subapically thus forming two bands, terga V and VI covering most of exposed discal surface; pubescence of legs chiefly ochraceous, but becoming whitish ventrally.

Eyes scarcely diverging below (57: 62); malar area short, linear, much shorter than minimum thickness of first flagellar segment; first flagellar segment much less than one-half as long as succeeding segment; apical margin of second metasomal tergum narrowly impunctate, nearest medial punctures separated from apical rim by less than maximum thickness of second flagellar segment; inner hind tibial spur considerably longer than outer spur, its distal apex much surpassing that of outer

Fig. 15. *Peponapis utahensis* (Cockerell), male: dorsal view of seventh metasomal tergum (top) and ventral view of sixth metasomal sternum (bottom).

spur; sixth metasomal tergum without a strong tooth on each side; pygidial plate (fig. 15, top) and sixth metasomal sternum (fig. 15, bottom) as illustrated.

Female. Length 13–16 mm. Forewing including tegula 9–11 mm. Head, thorax, basal metasomal terga, and large areas of metasomal sterna black, elsewhere dark reddish-brown; clypeus frequently stained with ferruginous; labrum usually ferruginous; mandibles black or dark reddish-brown basally and with a greatly elongated dull-orange maculation situated subapically and extending to near basal third of mandible; antennae, tegulae, wings, tibial spurs and claws essentially colored as in male.

Vestiture similar to that of male, but thicker and longer than that on dorsum of thorax, not uniformly pale pubescent but intermixed with much black pubescence as is that on upper sides of thorax and head; pale pubescent bands of metasomal terga disposed as in male, but somewhat broader and more richly ochraceous.

Eyes as feebly diverging below as male (63:67); anterior ocellus separated from lateral ocellus by less than basal thickness of first flagellar segment; apical margin of second metasomal tergum narrowly impunctate, nearest medial punctures separated from apical rim by much less than maximum thickness of second flagellar segment; inner hind tibial spur conspicuously longer than outer spur, its distal apex much surpassing that of outer spur.

Location of type. Philadelphia Academy of Natural Sciences, No. 10706.

Geographic range. Central America (El Salvador) north into the United States (Arizona, New Mexico and ? Utah).

SPECIMENS EXAMINED

United States

Arizona:

Cochise Co.: Douglas, 2 ♂♂, VIII-21-44 (WWJ-UCR); 1 ♀, IX-20-44 (WWJ-UCR); 1 ♀, 1949 (WWJ-UCR).

Douglas (collected by MAC), 1 ♀, VIII-8-62, in black light trap with completed *Cucurbita* pollen load; 2 ♀♀, VIII-10-62, in black light trap, both females with completed *Cucurbita* pollen loads; 1 ♂, 2 ♀♀, VIII-11 to 12-62, in black light trap, both females with completed *Cucurbita* pollen loads; 2 ♀♀, VIII-13 to 14-62, in black light trap, both females with completed *Cucurbita* pollen loads; 1 ♀, VIII-14 to 15-62, in black light trap with completed *Cucurbita* pollen load; 1 ♀, VIII-19 to 20-62, in black light trap, without pollen load; 1 ♀, VIII-20 to 21-62, in black light trap with a trace of *Cucurbita* pollen on scopa.

Hereford, 2 ♂♂, VIII-7-44 (WWJ-UCR); 1 ♂, VIII-14-44 (WWJ-UCR); 6 ♂♂, VIII-21-44 (WWJ-UCR).

St. David, 5 ♂♂, IX-19-61, in flowers of domestic squash, 12:15 to 1:00 p.m. (AEM & MM).

Pima Co.: Tucson, 1 ♂, VII-19-53, in flowers of domestic squash (G. D. Butler, S & S).

Santa Cruz Co.: Nogales, 4 ♂♂, 3 ♀♀, IX-21-61, in flowers of domestic squash, 10:30 to 11:00 a.m., females collecting pollen (AEM & MM); 1 ♂, 8 ♀♀, VIII-22-62, in flowers of domestic squash, 5:50 to 6:50 a.m., females collecting pollen (AEM & MM).

Patagonia, 1 ♀, IX-8-28 (E. R. Leach, UCR); 1 ♀, VIII-8-40, in flower of *C. foetidissima* (PHT); 7 ♂♂, 1 ♀, VIII-9-40 (E. S. Ross, CAS); 1 ♂, VII-12-62, in open flower of zucchini squash, 5:45 to 5:55 p.m. (EGL).

New Mexico:

Hidalgo Co.: Rodeo, 1 ♂, VIII-18-61, in flower of domestic squash (AEM & MM); 1 ♂, IX-2-61, in flower of domestic squash (AEM & MM); 1 ♂, IX-4-61, in flower of domestic squash (AEM & MM); 1 ♂, IX-9-61, in flower of domestic squash at 10:15 a.m. (AEM & MM); 1 ♀, IX-26-61, in open pistillate flower of domestic squash, 6:00 to 7:00 a.m. (AEM & MM).

Sierra Co.: Arrey, 2 mi S, 1 ♀, VII-

31-62, taking nectar in open flower of *C. foetidissima* at 8:30 a.m. (MAC).

El Salvador

Los Chorros National Park, 1 ♂, VIII-28-61 (M. E. Irwin, UCD).

Quetzaltepeque, 2 mi W, 1 ♂, VII-14-61 (M. E. Irwin, UCD).

Guatemala

Antigua, 5,000 feet, 1 ♂, VIII-15-47 (C. & P. Vaurie, AMNH).

Mexico

Aguascalientes:

Aguascalientes, 1 ♂, 4 ♀ ♀, VIII-11-62, in open flowers of domestic squash, 6:25 to 7:05 a.m., females collecting pollen (AEM & MM); 9 ♂ ♂, 1 ♀, VIII-11-62, in open flowers of *C. foetidissima*, 8:30 to 10:30 a.m., female collecting pollen sometime between 9:30 and 10:00 a.m. (AEM & MM).

Campeche:

Ciudad de Carmen, 20 km NE, 1 ♂, 1 ♀, VIII-11-62, in open flowers of domestic squash (*C. moschata*) 7:40 to 7:55 a.m., female collecting pollen (JKD); 1 ♂, same data (PDH).

Seybaplaya, 12 mi S, 1 ♂, VIII-14-62, in open flower of domestic squash (*C. pepo*) sometime between 7:15 and 8:00 a.m. (PDH); 1 ♂, same data (RFS).

Chiapas:

Tuxtla Gutierrez, 5 ♂ ♂, VII-30-62, in nearly closed flowers of domestic squash, 9:45 to 10:00 a.m. (AEM & MM).

Durango:

Durango, 5 ♂ ♂, 7 ♀ ♀, VIII-13-62, in open flowers of domestic zucchini squash, 6:35 to 7:35 a.m., females collecting pollen (AEM & MM); 4 ♂ ♂, 25 ♀ ♀, VIII-14-62, in open flowers of domestic zucchini squash, 6:20 to 7:50 a.m., females collecting pollen (AEM & MM); 2 ♂ ♂, VIII-15-62, in open flowers of *C. foetidissima* sometime between 6:55 and 7:05 a.m. (AEM & MM). Durango, 30 km SW on Highway 40, 1 ♂, VIII-15-62, in flower of *C. foetidissima* sometime between 7:20 and 8:00 a.m. (AEM & MM).

Guanajuato:

Irapuato, 13 ♂ ♂, 4 ♀ ♀, VIII-10-62, in open flowers of domestic squash, 7:15 to 7:55 a.m., females collecting pollen (AEM & MM).

Leon, 13 mi SE, 6,000 feet, 1 ♂, VIII-19-54 (CDM).

Silao, 17 ♂ ♂, 27 ♀ ♀, VIII-10-62, in open flowers of domestic squash, 9:30 to 10:00 a.m., females collecting pollen (AEM & MM).

Guerrero:

Acapulco, 14 ♂ ♂, 18 ♀ ♀, VII-19-62, in open flowers of domestic squash, 5:50 to 7:50 a.m., females collecting pollen throughout period (AEM & MM).

Jalisco:

Chapala, 2 ♂ ♂, 1 ♀, VII-5-62, in closed flowers of domestic squash at 6:30 p.m. (AEM & MM); 1 ♂, VII-6-62, in open flower of domestic squash sometime between 7:00 and 8:15 a.m. (AEM & MM); 1 ♀, VII-7-62, collecting pollen in open flower of domestic squash sometime between 6:45 and 8:45 a.m. (AEM & MM).

Encarnacion de Diaz, 3 ♂ ♂, VII-28-51, in closed flowers of *C. foetidissima* (PDH); 4 ♀ ♀, VIII-10-62, in closed flowers of *C. foetidissima* during late afternoon (AEM & MM).

Guadalajara (collected by AEM & MM), 8 ♂ ♂, VII-2-62, in closed flowers of domestic squash, 3:45 to 7:00 p.m.; 18 ♂ ♂, 11 ♀ ♀, VII-3-62, in open flowers of domestic squash, 6:25 to 8:15 a.m., females collecting pollen, 6:25 to 7:45 a.m.; 2 ♂ ♂, 1 ♀, VII-4-62, in open flowers of domestic squash, 7:00 to 8:30 a.m., female collecting pollen sometime between 7:20 and 8:30 a.m.; 3 ♂ ♂, VII-4-62, in closed flowers of domestic squash at 5:30 p.m.

Lagos de Moreno, 1 ♂, 10 ♀ ♀, VIII-10-62, in not completely closed flowers of *C. foetidissima*, 12:00 to 1:30 p.m., females collecting pollen (AEM & MM).

San Juan de Lagos, 8 mi SW, 1 ♂, VIII-4-54 (J. W. MacSwain, CIS).

Michoacan:

Tuxpan, 3 ♂ ♂, IX-1-62, in open flowers of squash at 8:15 a.m. (DHJ).

Morelos:

Amayuca, 5 ♂♂, VIII-18-62, in closed flowers of domestic squash (*C. pepo*), 11:40 to 11:55 a.m. (JKD); 13 ♂♂, same data (PDH); 5 ♂♂, same data (RFS).

Cuautla, 1 ♂, 1 ♀, VII-24-62, in closed flowers of domestic squash, 12:00 to 12:30 p.m. (AEM & MM).

Cuautla, 9 km NE, 11 ♂♂, 1 ♀, VIII-18-62, in mostly closed flowers of domestic squash (*C. mixta*), 11:45 to 11:50 a.m., female apparently collecting pollen (JKD); 9 ♂♂, same data (PDH); 4 ♂♂, same data (RFS).

Cuernavaca, 1 ♂, VII-15-62, in closed flower of domestic squash at 6:15 p.m. (AEM & MM); 34 ♂♂, 3 ♀♀, VII-16-62, in open flowers of domestic squash, 6:30 to 8:05 a.m., females collecting pollen 7:25 to 8:05 a.m. (AEM & MM); 48 ♂♂, 12 ♀♀, VII-24-62, in open flowers of domestic squash, 5:45 to 10:45 a.m., females collecting pollen throughout period (AEM & MM).

Cuernavaca, 4 km E, 14 ♀♀, VIII-19-62, collecting pollen in open flowers of domestic squash (*C. mixta*), 6:15 to 7:00 a.m. (JKD); 6 ♂♂, 12 ♀♀, same data (PDH); 1 ♂, 13 ♀♀, same data (RFS).

Cuernavaca, 6 km E, 12 ♂♂, 1 ♀, VIII-2-62, in open but wilting flowers of domestic squash (*C. maxima* and *C. mixta*), 9:00 to 9:45 a.m. (JKD); 15 ♂♂, 1 ♀, same data (PDH).

Jalastoc, 1 ♂, VIII-5-52 (D. Perez Ruiz, INIA).

Teteleingo, 1 ♂, VIII-2-62, in open flower of domestic squash (*C. maxima*) at 11:00 a.m. (JKD); 3 ♂♂, 1 ♀, same data, but female collecting pollen (PDH).

Tepalteingo, 2 ♂♂, VIII-18-62, in closed flowers of domestic squash (*C. moschata*), 12:15 to 12:30 p.m. (JKD).

Nayarit:

Ixtlan del Rio, 5 mi N, 18 ♂♂, 4 ♀♀, IX-2-62, in open flowers of domestic squash (*C. pepo*) at 5:30 a.m., females collecting pollen (DHJ).

San Blas, 2 ♂♂, VII-1-62, in open flowers of domestic squash, 8:00 to 8:15 a.m. (AEM & MM).

Tepic, 1 ♀, VII-2-62, collecting pollen in open flower of domestic squash at 7:00 a.m. (AEM & MM).

Tepic, 1 mi N, 9 ♂♂, 2 ♀♀, IX-2-62, in open flowers of domestic squash (*C. pepo*) at 7:30 a.m., females collecting pollen (DHJ).

Oaxaca:

Mitla, 13 ♂♂, 8 ♀♀, VII-28-62, in open flowers of domestic squash, 8:45 to 9:50 a.m., females collecting pollen (AEM & MM).

Oaxaca, 3 ♂♂, VII-12-53 (KU Mexican Expedition, KU); 7 ♂♂, 5 ♀♀, VII-26-62, in open flowers of domestic squash, 5:50 to 7:50 a.m., females collecting pollen, 6:20 to 6:50 a.m. (AEM & MM); 1 ♂, same data but 10:05 to 10:25 a.m. (AEM & MM); 4 ♂♂, 1 ♀, VII-27-62, in open flowers of domestic squash, 8:10 to 9:40 a.m., female not collecting pollen (AEM & MM).

Tehuantepec, 33 ♂♂, 66 ♀♀, VII-29-62, in open flowers of domestic squash, 5:50 to 8:20 a.m., females collecting pollen throughout this period (AEM & MM); 10 ♂♂, 13 ♀♀, VIII-1-62, in open flowers of domestic squash, 6:20 to 7:00 a.m., females collecting pollen throughout period (AEM & MM).

Puebla:

Chila, SE of Acatlan, 2 ♂♂, VII-25-62, in closed flowers of domestic squash at 11:30 a.m. (AEM & MM).

San Luis Potosí:

Tamazunchale, 2 ♂♂, VI-11-51, in closed flower of unidentified native *Cucurbita* (PDH).

Sinaloa:

Mazatlan (collected by AEM & MM), 14 ♂♂, 3 ♀♀, VIII-16-62, in open flowers of native gourd (*Cucurbita* sp.), 6:00 to 8:00 a.m., most females collecting pollen; 1 ♀, VIII-16-62, in closed flower of domestic squash growing near seashore; 1 ♂, VIII-17-62, in open flower of domestic squash sometime between 5:45 and 5:55 a.m.

Mazatlan, 30 to 35 mi N, 10 ♂♂, 1 ♀, VIII-17-62, in open flowers of a native gourd (*Cucurbita* sp.) 6:30 to 8:30 a.m., female collecting pollen (AEM & MM).

Sonora:

Agua Prieta, 1 ♂ (WWJ-UCR); 1 ♂, VIII-14-? (WWJ-UCR); 1 ♂, 1 ♀, X-5-44 (WWJ-UCR); 10 ♂♂, VIII-13-46 (WWJ-UCR); 2 ♂♂, VIII-14-46 (WWJ-UCR); 1 ♀, VIII-24-61, in flower of domestic squash (AEM & MM); 1 ♂, VII-15-62, in closed flower of *Cucurbita foetidissima* sometime between 12:45 and 1:15 p.m. (MAC); 1 ♂, VII-16-62, in closed flower of *C. foetidissima* sometime between 1:00 and 2:00 p.m. (MAC); 2 ♂♂, VIII-21-62, in flowers of domestic winter squash (MAC); 5 ♂♂, same data (EGL).

Alamos, 1 ♂, 1 ♀, IX-9-57, in flowers of domestic squash (PHT); 1 ♂, IX-14-57, in flower of domestic squash (PHT); 1 ♀, IX-19-57, in flower of domestic squash (PHT); 1 ♀, IX-20-57 (R. C. Dickson, UCR).

Navajoa, 7 ♂♂, 2 ♀♀, VIII-19-62, in open flowers of domestic squash, 5:45 to 7:25 a.m., females collecting pollen (AEM & MM).

Nogales, about 15 mi S, 12 ♂♂, 1 ♀, VIII-21-62, in nearly closed flowers of domestic squash, 11:45 a.m. to 12:15 p.m. (AEM & MM).

Tabasco:

Cardenas, 5 km E, 12 ♂♂, 2 ♀♀, VIII-9-62, in wilting flowers of domestic squash (*Cucurbita moschata*), 9:30 to 9:45 a.m., females collecting pollen (JKD); 21 ♂♂, 2 ♀♀, same data (PDH).

Cardenas, 50 km W, 5 ♂♂, 2 ♀♀, VIII-9-62, in open flowers of domestic squash (*C. moschata*), 7:30 to 8:30 a.m., females collecting pollen (JKD); 14 ♂♂, 10 ♀♀, same data (PDH); 5 ♂♂, 2 ♀♀, same data (RFS); 1 ♂, 3 ♀♀, VIII-9-62, in open flowers of domestic squash (*C. moschata*), 7:30 to 8:00 a.m., females collecting pollen (JKD); 2 ♂♂, 2 ♀♀, same data (PDH); 1 ♂, same data (RFS).

Frontera, 1 ♂, VIII-14-62, in closed flower of domestic squash at 6:15 p.m. (JKD).

Frontera, 7 km SW, 1 ♂, VIII-10-62, in closed flower of domestic squash (*C. moschata*), 1:15 to 1:20 p.m. (PDH).

Frontera, 34 km SW, 2 ♂♂, 1 ♀, VIII-10-62, in closed flowers of domestic squash (*C. moschata*), 11:30–12:00 N. (PDH).

Teapa, 1 ♂, VIII-9-62, in closed flower of domestic squash (*C. moschata*) at 12:15 p.m. (PDH).

Villahermosa, 5 km S, 1 ♂, VIII-9-62, in wilted flower of domestic squash (*C. moschata*), 11:00 to 11:15 a.m. (PDH); 5 ♂♂, VIII-15-62, in open flowers of domestic squash (*C. moschata*), 6:45 to 7:30 a.m. (JKD); 4 ♂♂, same data (PDH); 1 ♂, same data (RFS).

Veracruz:

Catemaco, 15 ♂♂, 3 ♀♀, VIII-2-62, in open, but wilting flowers of domestic squash, 8:20 to 9:25 a.m., females collecting pollen (AEM & MM).

Ciudad Aleman, 4 ♂♂, VIII-21-62, in closed flowers of domestic squash (*C. moschata*) at 12:00 noon (DHJ).

Ciudad Aleman, 2 mi W, 2 ♂♂, 4 ♀♀, VIII-22-62, in open flowers of domestic squash (*C. pepo*), 6:17 to 6:57 a.m., females collecting pollen (DHJ).

Coatepec, 3 km E, 1 ♀, VIII-5-62, in closed flower of domestic squash (*C. moschata*) at 11:00 a.m. (JKD).

Coatepec, 7 km S, 2 ♂♂, VIII-5-62, in closed flowers of domestic squash (*C. moschata*) at 10:30 a.m. (JKD); 2 ♂♂, same data (RFS).

Coatzacoalcas, 13 km E, 1 ♀, VIII-9-62, collecting pollen in open flower of domestic squash sometime between 6:20 and 6:35 a.m. (PDH).

Cordoba, 3.9 mi E, 1 ♂, VII-23-62, in flower of domestic squash (DHJ); 1 ♀, VIII-7-62, collecting pollen in open flower of domestic squash (*C. moschata*) sometime between 8:30 and 9:30 a.m. (JKD); 1 ♂, 2 ♀♀, same data (PDH); 2 ♀♀, same data (RFS); 1 ♂, 7 ♀♀, VIII-16-62, in open flower

of domestic squash (*C. moschata*), 6:00 to 7:00 a.m., females collecting pollen (JKD); 1 ♂, 2 ♀♀, same data (PDH); 1 ♂, 2 ♀♀, same data (DHJ); 6 ♀♀, same data (RFS).

Cotaxtla Experiment Station (collected by DHJ), 22 ♂♂, 3 ♀♀, VII-31-62, at flowers of *Momordica*, 5:55 to 6:45 a.m., females not collecting pollen; 21 ♂♂, 6 ♀♀, VII-31-62, in corollas of yellow-flowered shrub, 6:30 to 11:00 a.m., females not collecting pollen; 22 ♂♂, 5 ♀♀, VIII-1-62, at flowers of *Momordica*, 5:30 to 6:30 a.m., females not collecting pollen; 2 ♂♂, VIII-1-62, in corollas of yellow-flowered shrub at 11:30 a.m.; 1 ♀, VIII-2-62, in corolla of yellow-flowered shrub; 1 ♂, VIII-4-62, in closed flower of domestic squash (*C. pepo*); 79 ♂♂, 17 ♀♀, VIII-7-62, in closed flowers of domestic squash (*C. pepo*) at 3:00 p.m. and between 5:00 and 6:30 p.m.; 26 ♂♂, 1 ♀, VIII-8-62, at flowers of *Momordica*, 5:30 to 6:52 a.m., female not collecting pollen; 138 ♂♂, 5 ♀♀, VIII-8-62, in open flowers of domestic squash (*C. pepo*), 7:15 to 8:30 a.m.; 168 ♂♂, 18 ♀♀, VIII-9-62, in flowers of domestic squash; 35 ♂♂, 19 ♀♀, VIII-10-62, in open flowers of domestic squash, 5:50 to 6:55 a.m., females collecting pollen; 127 ♂♂, 9 ♀♀, VIII-10-62, in open flowers of domestic squash (*C. pepo*), 7:15 to 8:30 a.m., females collecting pollen; 96 ♂♂, 109 ♀♀, VIII-11-62, in open flowers of domestic squash (*C. pepo*), 7:15 to 9:45 a.m., females collecting pollen; 23 ♂♂, 33 ♀♀, VIII-12-62, in open flowers of domestic squash (*C. pepo*), 7:00 to 7:30 a.m.; 70 ♂♂, 71 ♀♀, VIII-13-62, in flowers of domestic squash (*C. pepo*), 7:15 to 8:30 a.m.; 73 ♂♂, 38 ♀♀, VIII-15-62, in open flowers of domestic squash; 9 ♂♂, 19 ♀♀, VIII-16-62, in open flowers of domestic squash (*C. pepo*), 5:50 to 6:20 a.m., females collecting pollen; 30 ♂♂, 45 ♀♀, VIII-16-62, in open flowers of domestic squash (*C. pepo*), 7:15 to 8:30 a.m., females collecting pollen; 60 ♂♂, 100

♀♀, VIII-18-62, in open flowers of domestic squash, 5:30 to 8:00 a.m., females collecting pollen; 50 ♂♂, 31 ♀♀, VIII-18-62, in open flowers of domestic squash (*C. pepo*), 7:15 to 8:30 a.m., females collecting pollen; 3 ♂♂, 1 ♀, VIII-21-62, in open flowers of domestic squash, 6:57 to 7:37 a.m., female collecting pollen; 1 ♂, VIII-28-62, in open flower of domestic squash (*C. moschata*) at 6:35 a.m.; 17 ♂♂, 7 ♀♀, VIII-28-62, in open flowers of domestic squash (*C. pepo*), 7:10 to 8:30 a.m., females collecting pollen; 5 ♂♂, 28 ♀♀, IX-8-62, in open flowers of domestic squash, 5:45 to 6:35 a.m., females collecting pollen.

Cotaxtla Experiment Station, 4.3 mi W, 9 ♂♂, VIII-11-62, in flowers of domestic squash (*C. pepo*), 10:00 to 10:20 a.m. (DHJ).

Cotaxtla Experiment Station, 12.2 mi W, 12 ♂♂, VIII-11-62, in closed flowers of domestic squash (*C. pepo*) at 11:00 a.m. (PDH).

Isla, 29 km N, 4 ♂♂, VIII-16-62, in open flowers of domestic squash (*C. moschata*) (PDH).

Jalapa, 2 mi SE, 1 ♂, 3 ♀♀, VIII-6-62, in open flowers of domestic squash (*C. moschata*), 6:00 to 7:30 a.m., females collecting pollen (JKD); 3 ♀♀, VIII-6-62, collecting pollen in open flowers of domestic squash (*C. moschata*), 6:10 to 7:30 a.m. (PDH); 3 ♀♀, same data (RFS); 1 ♀, VIII-6-62, collecting pollen from open flower of a native gourd (*C. martinezi*) sometime between 6:00 and 7:00 a.m. (RFS).

Jalapa, 8 km S, 1 ♀, VIII-5-62, in closed flower of domestic squash (*C. moschata*) about noon (PDH).

Las Tinajas, 29.3 mi S, 12 ♂♂, VIII-22-62, in wilting flowers of domestic squash at 9:30 a.m. (DHJ).

Orizaba, 1 ♂, VIII-5-62, in flower of domestic squash (AEM & MM).

Palo Gacho, 2 ♂♂, VIII-6-62, in wilting flowers of domestic squash (JKD); 7 ♂♂, 1 ♀, same data, but

female collecting pollen (PDH); 5 ♂♂, VIII-6-62, in wilting flowers of domestic squash (RFS).

Santecomapan, 18 km E of Catemaco, 2 ♂♂, 1 ♀, VIII-16-62, in open flowers of domestic squash (*C. moschata*) at 7:30 a.m., female collecting pollen (JKD); 3 ♂♂, same data (PDH).

Santiago Tuxtla, 6 ♂♂, VIII-2-62, in wilting flowers of domestic squash at 10:45 a.m. (AEM & MM).

Santiago Tuxtla, 10 km NW, 5 ♂♂, VIII-8-62, in open flowers of domestic squash (*C. moschata*), 9:00 to 9:15 a.m. (JKD); 11 ♂♂, 1 ♀, same data (PDH).

Santiago Tuxtla, 30 km NW, 5 ♂♂, VIII-8-62, in open flowers of domestic squash (*C. moschata* and *C. pepo*) at 9:30 a.m. (JKD); 3 ♀♀, same data, but females collecting pollen (PDH).

Sayula, 1 ♂, VIII-1-62, in closed flower of domestic squash at 12:00 noon (AEM & MM).

Tlacotalpan, 1 ♀, VIII-12-62, in closed flower of domestic squash (*C. pepo*) at 3:00 p.m. (DHJ).

Tlacotalpan, 14 mi W, 2 ♀♀, VIII-21-62, collecting pollen in open flowers of domestic squash (*C. pepo*) at 7:50 a.m. (DHJ).

Tlacotalpan, 19 mi W, 1 ♂, 1 ♀, VIII-21-62, in open flowers of domestic squash (*C. pepo*), 6:35 to 6:45 a.m., female collecting pollen (DHJ).

Tlacotalpan, 19.8 mi W, 5 ♂♂, 21 ♀♀, VIII-22-62, in open flowers of domestic squash (*C. pepo*) 5:35 to 7:21 a.m., females collecting pollen (DHJ).

Tlacotalpan, 22.1 mi W, 12 ♂♂, 9 ♀♀, VIII-21-62, in open flowers of domestic squash (*C. pepo*), 6:58 to 7:18 a.m., females collecting pollen (DHJ).

Veracruz, 33 ♂♂, 6 ♀♀, VIII-4-62, in open flowers of domestic squash, 8:00 to 9:15 a.m., females collecting pollen (AEM & MM); 5 ♂♂, 4 ♀♀, VIII-4-62, in open flowers of a native gourd (*Cucurbita* sp.) at 6:50 a.m., females collecting pollen (AEM & MM); 1 ♀, VIII-8-62, resting in dead *Asclepias*

flower at 9:00 a.m. (DHJ); 58 ♂♂, 57 ♀♀, VIII-9-62, in open flowers of domestic squash (*C. moschata* and *C. pepo*), 5:30 to 7:15 a.m., females collecting pollen (DHJ); 2 ♂♂, VIII-10-62, in closed flowers of domestic squash (*C. pepo*) at noon (DHJ); 59 ♂♂, 59 ♀♀, VIII-14-62, in open flowers of domestic squash (*C. moschata* and *C. pepo*), 5:35 to 7:50 a.m., most females collecting pollen (DHJ); 13 ♂♂, 26 ♀♀, VIII-29-62, in open flowers of domestic squash (*C. pepo*), 5:42 to 7:12 a.m., females collecting pollen (DHJ).

Yucatan:

Hoctun, 18 km W, 5 ♀♀, VIII-12-62, collecting pollen in open flowers of domestic squash (*C. moschata*) (JKD); 1 ♂, 4 ♀♀, same data (PDH); 3 ♂♂, 10 ♀♀, VIII-13-62, in open flowers of domestic squash (*C. moschata*) 5:45 to 6:30 a.m., females collecting pollen (JKD); 1 ♂, 4 ♀♀, same data (PDH); 3 ♀♀, same data (RFS).

Pollen sources. The records suggest that this species freely utilizes the pollens of the various species of domestic *Cucurbita*, but its use of the pollens of the native species of *Cucurbita* is scarcely known. On several occasions the females have been observed to collect pollen from unidentified native species of the genus *Cucurbita*. Two miles southeast of Jalapa, Mexico, Ray F. Smith captured a single female collecting pollen in the flower of *C. martinezi*, a native gourd.

Flight period. ♂♂, June 11 to October 5; ♀♀, June 24 to October 5.

Although *Peponapis utahensis* was described by Cockerell (1905a:182-183) from "Utah" on the basis of a single female specimen, we have been unable to locate or collect specimens of this species north of Tucson, Arizona. Since *P. utahensis* was described prior to the admission of Arizona and New Mexico into the Union (1912), and since the type specimen apparently came from the Cresson Collection (see below),

there is a possibility that it had been collected even before Utah gained statehood (1896). An examination of the labels attached to the pin of the type specimen reveals only: "Utah, Cresson Collection."

P. utahensis is widely distributed in Mexico and has been collected as far south as El Salvador in Central America. It may be that one or more of the species described by Cresson (1878) and Friese (1916, 1925) from Costa Rica in the genus *Tetralonia* are equivalent to *P. utahensis*. An examination of these types was not possible during the present investigation.

The chief differences which distinguish *P. utahensis* from the other species of the genus are employed in the accompanying key. Its nearest relative appears to be *P. michelbacherorum*.

Peponapis pruinosa (Say)

(Figs. 1, 2, 16, 17)

Macrocera pruinosa Say, 1837, Boston Jour. Nat. Hist., 1:405, ♂ ♀ ("Inhab. United States"); LeConte, 1859, The complete writings of Thomas Say, 2:781.

Melissodes pruinosa, Smith, 1854, Catalogue of hymenopterous insects in the . . . British Museum, 2:309 (Ohio: Mount Pleasant); Cresson, 1876, Proc. Davenport Acad. Nat. Sci., 1:209 (Utah: Spring Lake); Cresson, 1879, Trans. Amer. Ent. Soc., 7:226, ♂ ♀ (Eastern, middle, southern and western United States).

Xenoglossa pruinosa, Patton, 1879, Bull. U. S. Geol. Surv., 5:473 ([United States]: "The loose scopa seems particularly adapted to retain the large, spiny globes which form the pollen of the pumpkin. In the blossoms of this plant these bees delight to revel."); Gribodo, 1882, Ann. Mus. Civ. Genova, 18:274, ♂ (Arizona); Cresson, 1887, Trans. Amer. Ent. Soc., suppl. vol., p. 305 (United States); Robertson, 1891, Trans. St. Louis Acad. Sci., 5:574, 581, ♂ ♀ (Illinois: Carlinville, a male dead on

flowers of *Asclepias sullivanti* and males and females at flowers of *Ipomoea pandurata* between July 11 and August 6); Cockerell, 1896, Canadian Ent., 28:192, 193, ♂ ♀ (New York, Pennsylvania and New Mexico: Mesilla, 4 ♂ ♂, June 21, 1896 in closed flowers of *Cucurbita perennis* containing great numbers of *Diabrotica 12-punctata* at about 8:45 a.m., and 5 ♂ ♂ on June 21 from open flowers of *C. perennis* between 7:45 a.m. and 8:05 a.m.); Cockerell, 1898, Bull. Univ. New Mexico, 1:67 (New Mexico: Mesilla Valley in flowers of *Cucurbita*); Cockerell, 1899, Entomologist, 32:156 (New Mexico: Mescalero Indian Agency on Tularosa Creek in July, 1898); Robertson, 1899, Bot. Gazette, 28:36, ♀ (Illinois: Carlinville, visiting flowers of *C. pepo* for nectar and pollen); Cockerell, 1901, Ann. Mag. Nat. Hist., (7) 7:130, ♂ ♀ (New Mexico: Las Vegas, July 13 and 15, males asleep in flowers of *C. foetidissima* at 7:45 p.m. and a female on July 22 at flowers of *Asclepias speciosa*); Fowler, 1902, Rept. Agric. Exp. Sta. Univ. Calif., 1:322, ♂ ♀ (California: Redlands, Pomona, Los Angeles, and Ventura; numerous specimens collected in wild gourd [*Cucurbita foetidissima*] and morning-glory blossoms [*Ipomoea*]); Viereck, 1903, Ent. News, 14:119, ♂ (Maryland: College Park, July 14, 1898); Cockerell, 1906, Trans. Amer. Ent. Soc., 32:74, 102, 115 (Eastern United States to Arizona on flowers of *Cucurbita*; Lee County, Texas record is *Peponapis crassidentata*, q. v.); Cockerell, 1906, Trans. Amer. Ent. Soc., 32:310 (New Mexico: Las Vegas, Pecos, Mescalero and Mesilla Valley); Smith, 1910, Annual Rept. New Jersey State Museum [1909], p. 694, fig. 289-k, ♂ (New Jersey: "Throughout the state, July to September; visits flowers of cucurbits by preference and is one of the most effective agents in their pollination. The bees often spend the night in the closed flowers."); Cockerell, 1911, Canadian Ent., 43:390 (Massachusetts: Woods Hole);

Fig. 16. *Peponapis pruinosa* (Say), males: dorsal views of seventh metasomal terga drawn from specimens collected in Connecticut (top), Utah (middle) and California (bottom).

Cockerell, 1914, Ann. Mag. Nat. Hist., (8)13:286 (New Mexico: Santa Fe, August 2); Weiss and Dickerson, 1919, Jour. New York Ent. Soc., 27:67 (New Jersey: Springfield, August 3; South Orange, August 12; at flowers of *Hibiscus moscheutos*, but by preference visits flowers of cucurbits.); Bequaert, 1920, Psyche, 27:12, ♂ ♀ (Massachusetts: Forest Hills, "... a common visitor of the flowers of cultivated squash between 6 and 8 a.m., the flowers close by 9 a.m., but the males can often be found during the day, sleeping inside the corolla."); Rau, 1922, Trans. St. Louis Acad. Sci., 24:34-35, ♂ (Missouri: Wickes, a male from the flower heads of white snakeroot [*Eupatorium rugosum*] on August 1, 1917, and a male from the grasp of the spider, *Runcinia aleatoria*, hidden by protective coloration in the yellow corolla of a pumpkin); Pammel and King, 1930, Iowa Geol. Surv. Bull., 7: 652,656 (Iowa: Ames, visiting flowers of pumpkin, *Cucurbita pepo* and squash, *C. maxima*); Pammel, 1930, *ibid.*, p. 943 (Iowa: Ames, in flowers of pumpkin and squash).

Eucera pruinosa, Dalla Torre, 1896, Cat. Hymen., 10:244, ♀ ♂ (United States).

Peponapis pruinosa, Robertson, 1902, Canadian Ent., 34:324, 325, ♀ ♂ (Illinois: Carlinville); Robertson, 1905, Trans. Amer. Ent. Soc., 31:365, 366, ♀ ♂; Robertson, 1925, Ecology, 6:417, 427 (Illinois: Carlinville, flowers of Heliantheae and Cynarieae); Robertson, 1928, Flowers and insects, pp. 8, 32, 33, 98, 99, 106, 114, 176, 217, ♂ ♀ (Illinois: Carlinville, males at flowers of *Asclepias sullivanti*, *A. syriaca*, *Ipomoea hederacea*, *I. pandurata*, *I. purpurea*, *Cucurbita pepo*, *Blephilia hirsuta*, *Cephalanthus occidentalis*, and *Verbena stricta*; females at flowers of *Asclepias syriaca*, *Convolvulus sepium*, *Ipomoea pandurata*, *I. purpurea*; females are an oligolege of *Cucurbita pepo*); Bohart, Knowlton and Bailey, 1950, Utah State Agric. Exp. Sta. (mimeo series), 371:6

(Utah: Logan, July 28, 1932; Millville, August 10, 1949, on *Cucurbita pepo*); Bohart, 1962, Medd. Sveriges Föredläreförbund, 7:183.

Xenoglossa pruinosa pruinosa, Cockerell, 1906, Ann. Mag. Nat. Hist., (7) 18:73; Cockerell, 1912, Proc. U. S. Natl. Mus., 43:265 (Virginia: Falls Church, west to Colorado); Lutz and Cockerell, 1920, Bull. Amer. Mus. Nat. Hist., 42: 625-626, ♂ ♀ (United States); Cockerell, 1923, Canadian Ent., 55:205, ♀ ♂; Cockerell, 1928, Univ. Colorado Studies, 16:113 (Colorado).

Xenoglossa (Peponapis) pruinosa, Viereck, 1916, State [Connecticut] Geol. Nat. Hist. Surv. Bull., 22:733-734 (Connecticut: New Haven, July 31, 1905, and Bristol, July 28, 1906; visits flowers of the pumpkin and other Cucurbitaceae and is perhaps the most important agent in pollinizing these plants.).

Peponapis pruinosa pruinosa, Michener, 1951, U. S. Dept. Agric., Monogr., 2:1221 (Massachusetts to North Carolina, west to Ohio and Illinois, south to Texas, Utah and Arizona; on flowers of *Cucurbita*); Fronk and Slater, 1956, Jour. Kansas Ent. Soc., 29:143, 144, 145 (Iowa: Ames; role in pollination of *Cucurbita maxima*, *C. pepo*, and *Lagenaria siceraria*); Linsley, 1960, Jour. New York Ent. Soc., 68:14, 15, 17, ♂ ♀ (Arizona: Southwestern Research Station, Chiricahua Mountains, 5 miles west of Portal, July 18, 21, 28, 1959, early morning pollination activities at flowers of *C. foetidissima*); Chandler, 1961, Proc. Indiana Acad. Sci., 71:128 (Indiana: six miles northeast of LaPorte; apparently attracted by odor of cyanide gas); Mitchell, 1962, North Carolina Agric. Exp. Sta. Tech. Bull., 152:244-246, figs. 71, 72, table 8, ♀ ♂ (Utah and Arizona, eastward to the New England States and Georgia, June to September; flowers of *Cucurbita* and *Pontederia*).

Xenoglossa spruina Howard, 1902, The insect book, pl. III, fig. 1, ♂ [*pruinosa*]; pl. VII, fig. 2, ♂ [*spruina*]

Fig. 17. *Peponapis pruinosa* (Say), males: ventral views of sixth metasomal sterna drawn from specimens collected in Connecticut (top), Utah (middle) and California (bottom).

Howard, 1904, *ibid.*, 2nd edition, pl. III, fig. 1, ♂ [*pruinosa*] pl. VII, fig. 2, ♂ [*pruinosa*]; *lapsus calami, teste* Viereck, 1916:733.

Xenoglossa angelica Cockerell, 1902, Ent. News, 13:103, ♂ ♀ (California: Los Angeles, in flowers of *Cucurbita foetidissima*, July 22, 3 ♀ ♀, 8 ♂ ♂; County Farm, Los Angeles County, at flowers of *Ipomoea*, 3 ♂ ♂, July 15; also a male taken at San Diego, August 10, at flowers of *Ipomoea*); Cockerell, 1903, Psyche, 10:77; Cockerell, 1906, Trans. Amer. Ent. Soc., 32:102 (Southern California; flowers of *Cucurbita*); Cockerell, 1912, Proc. U. S. Natl. Mus. 43: 265 (California: Los Angeles); Cockerell, 1914, Ann. Mag. Nat. Hist., (8) 14:365 (California: Fresno, on July 19; Orange County); Lutz and Cockerell, 1920, Bull. Amer. Mus. Nat. Hist., 42: 623-624, ♂ ♀; LaBerge, 1956, Univ. Kansas Sci. Bull., 38:50, ♂ (California: cotype K.U. #4435). New synonymy.

Peponapis angelica, Michener, 1951, U. S. Dept. Agric., Monogr., 2:1221 (California).

Xenoglossa pruinosa, var. *lutzi* Cockerell, 1923, Canadian Ent., 55:205, ♀ ♂ (Colorado: Grand Junction, approximately 4,500 ft., August 3, 1920); Cockerell, 1928, Univ. Colorado Studies, 16: 113 (Colorado).

Male. Length, 11-14 mm. Length of forewing including tegula, 9-11 mm. Head and body chiefly black; legs largely reddish-brown but usually with much black on external surfaces; apices of metasomal terga sometimes narrowly subhyaline; clypeus black, usually maculated with a small yellow subapical median spot which occasionally may occupy nearly apical half of clypeus; supraclypeal and parocular areas black, rarely stained with ferruginous; labrum usually black or largely so, sometimes with a small yellow or ferruginous spot of variable size; mandibles black or dark reddish-brown basally, but apically occupied by an elongate dull orange maculation; antennae usually chiefly black, reddish below; tegulae testaceous or

bright ferruginous; wings subhyaline, occasionally whitish-hyaline, veins variable in color often brownish-black or reddish-brown, but sometimes nearly ferruginous; tibial spurs testaceous or even pale yellowish; claws black or dark reddish-brown apically.

Vestiture of head, thorax and anterior portion of first metasomal tergum thick, quite variably colored in different populations, usually fulvo-ochraceous with much white hair on face, hind margin of head, cheeks and sides of thorax, sometimes nearly bright fulvous on dorsum of thorax or even largely white pubescent; pubescence of metasomal terga II-VI black; but transversely banded with appressed whitish, yellowish or fulvous tomentose hairs as follows: tergum II basally and subapically, terga III-IV subapically, terga V-VI apically; pale bands of metasomal terga usually broad, those on terga III and IV nearly as broad medially as terminal flagellar segment; pubescence of legs chiefly whitish or pale ochraceous.

Eyes scarcely diverging below (64: 67); malar area short, linear, much shorter than maximum thickness of first flagellar segment; first flagellar segment considerably less than one-half as long as succeeding segment; apical margin of second metasomal tergum broadly impunctate, nearest medial punctures separated from apical rim by much more than maximum thickness of second flagellar segment; inner hind tibial spur much longer than outer spur, its distal apex much surpassing that of outer spur; sixth metasomal tergum without a strong tooth on each side; pygidial plate (fig. 16) and sixth metasomal sternum (fig. 17) as illustrated.

Female. Length, 12-15 mm. Forewing including tegula, 9-11 mm. Head and body integument essentially colored as in male, but often more reddish or ferruginous on ventral surfaces and occasionally on tergal apices; legs often with more extensive reddish coloration and usually brighter than those of male; labrum most frequently black, some-

times stained with ferruginous especially at sides and base; mandibles, tegulae, antennae, wings, tibial spurs and claws essentially colored as in male, though mandibles are frequently more extensively pale.

Vestiture essentially colored and disposed as in male, but thicker on head, thorax and legs; pubescence on dorsum of thorax usually brighter than that on male and occasionally nearly red; pale metasomal tergal bands disposed as in male, but generally more variable in coloration, frequently nearly all white in the eastern United States and nearly or entirely velvety golden-orange in California, many intermediate coloration forms between these extremes.

Eyes as feebly diverging below as male (67:70); anterior ocellus separated from lateral ocellus by more than basal thickness of first flagellar segment; apical margin of second metasomal tergum broadly impunctate, nearest medial punctures separated from apical rim by much more than maximum thickness of second flagellar segment; inner hind tibial spur conspicuously longer than outer spur, its distal apex much surpassing that of outer spur.

Location of types. *angelica*: unknown; *pruinosa*: presumably destroyed; *spruina*: U. S. National Museum.

Geographic range. Transeontinental from Maine and Georgia to Idaho, California and south into Mexico.

SPECIMENS EXAMINED

United States

Arizona:

Cochise Co.: Apache, 3 ♂♂, VIII-17-61, in flowers of *Cucurbita foetidissima* (AEM & MM).

Apache, 1 mi E, 1 ♂, VI-21-57, in flower of *C. foetidissima* (RFS).

Bisbee, 4 ♂♂, VIII-24-61, in flowers of *C. foetidissima* (AEM & MM).

Bowie, 2 ♂♂, VIII-16-38, in flowers of *C. pepo* (PHT).

Cave Creek, 5 mi W of Portal, 3 ♂♂, 2 ♀♀, VII-29-55, in flowers of *C. foeti-*

dissima (PHT); 2 ♂♂, 2 ♀♀, VII-29-55, same data (PHT).

Cochise, 7 ♂♂, VIII-26-61, in flowers of *C. foetidissima* (AEM & MM).

Cochise, 2 mi N, 1 ♂, IX-8-59, in flower of *Cucurbita* (J. R. Powers, S & S); 1 ♀ same data (G. I. Stage, CIS).

Coronado National Memorial, 1 mile from entrance, 12 ♂♂, VII-13-62, in flowers of *C. foetidissima*, 12:30 to 1:00 p.m. (MAC).

Dos Cabezas, 1 ♂, VIII-1-61, in flower of *C. foetidissima* (EGL); 2 ♂♂, 1 ♀, VIII-22-61, same data (AEM & MM).

Douglas, 3 ♂♂, VII-13-33 (WWJ—CIS, UCR); 1 ♀, VII-8-38 (WWJ); 2 ♂♂, VIII-17-61, in flowers of domestic squash (AEM & MM); 8 ♂♂, VIII-17-61, in flowers of *C. foetidissima* (AEM & MM); 22 ♂♂, 1 ♀, VIII-24-61, in flowers of *C. foetidissima* (AEM & MM); 7 ♂♂, IX-21-61, in closed flowers of *C. foetidissima*, 5:30 to 6:00 p.m. (AEM & MM).

Douglas (collected by MAC), 1 ♂, VI-13-62, in staminate flower of *C. foetidissima* sometime between 9:42 and 10:45 a.m.; 4 ♂♂, 3 ♀♀, VI-16-62, in open flowers of *C. foetidissima* at 7:52 a.m., females collecting pollen; 1 ♂, VI-16-62, in open flower of *C. foetidissima* sometime between 8:00 and 9:00 a.m.; 5 ♂♂, 1 ♀, VI-18-62, in open flowers of *C. foetidissima*, 6:45 to 7:55 a.m., female collecting pollen; 6 ♂♂, 3 ♀♀, VI-24-62, in open flowers of *C. foetidissima*, 6:40 to 8:10 a.m., females collecting pollen; 1 ♂, 6 ♀♀, VI-25-62, in open flowers of *C. foetidissima*, 6:20 to 7:30 a.m., females collecting pollen; 3 ♀♀, VI-26-62, collecting pollen in open flowers of *C. foetidissima*, 6:20 to 6:50 a.m.; 2 ♂♂, 4 ♀♀, VI-28-62, in open flowers of *C. foetidissima*, 6:10 to 7:00 a.m., females collecting pollen; 2 ♀♀, VI-29-62, collecting pollen in open flowers of *C. foetidissima* sometime between 6:20 and 7:10 a.m.; 3 ♂♂, 7 ♀♀, VII-3-62, in open flowers of *C. foetidissima*, 6:10 to 7:20 a.m., females collecting pollen from 6:20 to 7:20 a.m.; 1 ♀, VII-3-62,

in closed flower of *C. foetidissima* at 4:45 p.m.; 5 ♀♀, VII-4-62, collecting pollen in open flowers of *C. foetidissima*, 5:40 to 7:10 a.m.; 1 ♂, 7 ♀♀, VII-6-62, in open flowers of *C. foetidissima*, 6:10 to 8:00 a.m., females collecting pollen; 1 ♂, 2 ♀♀, VII-7-62, in open flowers of *C. foetidissima*, 6:40 to 7:30 a.m., females collecting pollen; 1 ♂, 5 ♀♀, VII-9-62, in open flowers of *C. foetidissima*, 6:00 to 7:30 a.m., females collecting pollen; 2 ♀♀, VII-10-62, collecting pollen in open flowers of *C. foetidissima*, 5:30 to 5:40 a.m. and 7:40 to 7:50 a.m., respectively; 1 ♂, VII-17-62, in flower of *C. foetidissima* at 2:00 p.m.

Douglas, 1 mi E (collected by MAC), 2 ♂♂, VII-16-62, in flowers of *C. foetidissima*, 9:00 to 9:45 a.m.; 1 ♂, VII-17-62, in flower of *C. foetidissima*; 2 ♂♂, 1 ♀, VII-18-62, in flowers of *C. foetidissima*, 1:00 to 1:35 p.m.; 1 ♀, VII-19-62, in flower of *C. foetidissima* between 10:30 and 11:00 a.m.; 2 ♂♂, VII-20-62, in open flowers of *C. foetidissima* between 6:10 and 6:30 a.m.; 1 ♂, VII-23-62, in closed flower of *C. foetidissima* between 9:30 and 10:40 a.m.; 5 ♂♂, VIII-8-62, in open flowers of *C. foetidissima*, 6:15 to 6:45 a.m.

Elfrida, 6 ♂♂, VIII-26-61, in flowers of *C. foetidissima* (AEM & MM).

Elfrida, 14 mi N, 1 ♂, VIII-1-61, in flower of *C. foetidissima* (EGL).

Elfrida, 18 mi N, 1 ♂, VIII-1-61, in flower of *C. foetidissima* (EGL).

Hereford, 2 ♂♂, 1 ♀, V-7-44 (WWJ-CIS, UCR); 1 ♂, VII-13-62, in closed flower of *C. foetidissima*, 2:00 to 2:10 p.m. (MAC); 1 ♀, VII-14-62, in closed flower of *C. foetidissima* between 11:00 a.m. and 1:15 p.m. (MAC).

Kansas Settlement, 10 ♂♂, VIII-1-61, in flowers of *C. foetidissima* (EGL); 4 ♂♂, 1 ♀, VIII-3-61, in flowers of *C. foetidissima* (EGL); 3 ♂♂, 1 ♀, VIII-22-61, in flowers of *C. foetidissima* (AEM & MM).

Miller Canyon, Palmerlee, 1 ♂, VI-29-50, in flower of *C. foetidissima* (RFS-AMNH).

Paradise, 2 ♂♂, VIII-21-61, in flowers of *C. foetidissima* (AEM & MM).

Paul Spur, 3 ♂♂, VIII-24-61, in flowers of domestic squash (AEM & MM); 1 ♂, VIII-24-61, in flower of *C. foetidissima* (AEM & MM).

Pearce, 15 mi W, 1 ♂, VIII-22-61, in flower of *C. digitata* (AEM & MM); 2 ♂♂, VIII-22-61, in flowers of *C. foetidissima* (AEM & MM).

Pinery Canyon (mouth), 5 ♂♂, 1 ♀, VII-12-61, in flowers of *C. foetidissima* (MAC-AMNH); 47 ♂♂, 15 ♀♀, VIII-22-61, in open flowers of *C. foetidissima* at 10:00 a.m., females collecting pollen (AEM & MM).

Portal, 1 ♂, VII-28-55, in closed flower of *C. foetidissima* (PDH).

Portal (collected by AEM & MM), 11 ♂♂, 1 ♀, VIII-23-61, in flowers of domestic squash; 6 ♂♂, VIII-23-61, in flowers of *C. foetidissima*; 3 ♂♂, 2 ♀♀, VIII-29-61, in flowers of domestic squash; 6 ♂♂, VIII-29-61, in flowers of *C. foetidissima*; 1 ♂, IX-1-61, in flower of *C. foetidissima*; 1 ♂, 1 ♀, IX-3-61, in flowers of domestic squash; 2 ♂♂, IX-3-61, in flowers of *C. foetidissima*; 2 ♀♀, IX-10-61, sucking nectar in open flowers of domestic squash at 10:30 a.m. and 10:40 a.m., respectively; 1 ♀, IX-11-61, in flower of *C. digitata*; 1 ♀, IX-12-61, sucking nectar in open flower of *C. digitata* at 9:10 a.m.; 2 ♂♂, IX-15-61, in closed flowers of *C. foetidissima* between 3:00 and 4:00 p.m.; 3 ♂♂, 7 ♀♀, IX-16-61, in open flowers of *C. foetidissima*, 5:55 to 10:30 a.m., females collecting pollen throughout this period; 3 ♂♂, 7 ♀♀, IX-18-61, in open flowers of *C. foetidissima*, 7:00 to 11:00 a.m., females collecting pollen from 7:00 to 9:00 a.m.; 2 ♀♀, IX-22-61, in flowers of *C. foetidissima* at 11:00 a.m., 3 ♀♀, IX-23-61, collecting pollen in open flowers of *C. foetidissima*, 7:00 to 9:00 a.m.; 3 ♀♀, IX-24-61, collecting pollen in open flowers of *C. foetidissima*, 6:00 to 10:00 a.m.; 2 ♀♀, IX-25-61, collecting pollen in open

flowers of *C. foetidissima*, 9:00 to 10:00 a.m.; 1 ♂, 2 ♀♀, IX-29-61, in open flowers of *C. foetidissima* between 7:00 and 9:00 a.m., females collecting pollen.

Portal, 1.5 mi NE, (collected by AEM & MM), 12 ♂♂, 6 ♀♀, VIII-31-61, in flowers of *C. foetidissima*; 3 ♂♂, 3 ♀♀, IX-1-61, in flowers of *C. foetidissima*; 4 ♂♂, 1 ♀, IX-8-61, in flowers of *C. foetidissima*.

Portal, 1.6 mi N, 2 ♂♂, VII-24-61, in flowers of *C. foetidissima* at 9:00 a.m. (EGL); 1 ♀, VII-25-61, in flower of *C. foetidissima* at 9:10 a.m. (EGL); 1 ♂, VII-26-61, in flower of *C. foetidissima* at 8:40 a.m. (EGL).

Rustler's Park, Chiricahua Mountains, 1 ♀, VII-30-55, at flower of *Heliconium hoopesii* (PDH).

San Ramon, 2 mi W, 1 ♂, IX-7-59, in flower of *Cucurbita* (G. I. Stage, S & S).

San Simon, 1 ♂, VIII-15-61, in closed flower of *C. foetidissima* at 3:00 p.m. (AEM & MM).

Southwestern Research Station, 1 ♂, VII-28-55, in flower of *C. foetidissima* (PDH); 5 ♂♂, VII-29-55, in flowers of *C. foetidissima* (PDH); 1 ♂, VIII-1-55, in flower of *C. foetidissima* (PDH); 1 ♂, VIII-2-58, in flower of *C. foetidissima* (PDH); 4 ♂, VIII-3-58, in flowers of *C. foetidissima* (PDH); 1 ♂, 7 ♀♀, VII-21-59, in flowers of *C. foetidissima*, 4:55 to 5:22 a.m., females collecting pollen (EGL); 1 ♀, same data, but 5:37 a.m. (EGL); 1 ♀, same data, but 9:00 a.m. (EGL); 5 ♀♀, VII-28-59, collecting pollen in open flowers of *C. foetidissima*, 4:50 to 5:15 a.m. (EGL); 1 ♀, same data, but 5:29 a.m. (EGL); 1 ♂, VII-28-59, in open flower of *C. foetidissima* at 5:34 a.m. (EGL); 1 ♀, VII-28-59, collecting pollen in open flower of *C. foetidissima* at 5:37 a.m. (EGL); 3 ♂♂, 1 ♀, VIII-5-59, in open flowers of *C. foetidissima* at 6:30 a.m., female sucking nectar (EGL); 1 ♀, IX-4-59, in flower of *Cucurbita* (G. I. Stage, S & S); 1 ♂, 11 ♀♀, VII-18-61, in flowers of *C.*

foetidissima, 5:00 to 6:15 a.m., females collecting pollen (EGL); 1 ♀, VII-23-61, in wilted flower of *C. foetidissima* at 8:30 a.m. (EGL); 1 ♀, VII-25-61, collecting pollen in open flower of *C. foetidissima* at 5:26 a.m. (EGL); 1 ♂, VII-25-61, in open flower of *C. foetidissima* at 5:56 a.m. (EGL); 2 ♂♂, VII-25-61, cruising about open flowers of *C. foetidissima* at 8:00 a.m. (EGL); 2 ♀♀, VII-30-61, collecting pollen in open flowers of *C. foetidissima* at 5:26 and 5:33 a.m., respectively (EGL); 3 ♂♂, VII-30-61, in open flower of *C. foetidissima*, 6:50 to 6:59 a.m. (EGL); 1 ♀, VIII-1-61, collecting pollen in open flower of *C. foetidissima* at 5:31 a.m. (EGL); 3 ♀♀, VIII-16-61, collecting pollen in open flowers of *C. foetidissima* at 7:10, 7:15 and 7:30 a.m., respectively (AEM & MM); 1 ♀, VIII-17-61, in open flower of *C. foetidissima* (AEM & MM); 2 ♀♀, VIII-18-61, collecting pollen in open flowers of *C. foetidissima* (AEM & MM); 2 ♀♀, VIII-19-61, collecting pollen in open flowers of *C. foetidissima* at 9:25 a.m. (AEM & MM); 1 ♂, VIII-20-61, in flower of *C. foetidissima* (AEM & MM); 2 ♀♀, VIII-26-61, in flowers of *C. foetidissima* (AEM & MM); 1 ♂, VIII-31-61, in flower of *C. foetidissima* (AEM & MM).

Coconino Co.: Oak Creek Canyon, 6,000 feet, 1 ♂, (F. H. Snow, KU).

Supai, Grand Canyon, 19 ♂♂, VIII-2-34 (F. E. Lutz, AMNH).

Graham Co.: Pima, 1 ♂, VIII-25-61, in flower of *C. foetidissima* at 12:30 p.m. (AEM & MM).

Navajo Co.: Forestdale, 3 ♂♂, 2 ♀♀, VIII-15-61, in flowers of *C. foetidissima* at 8:10 a.m. (AEM & MM).

Snowflake, 10 ♂♂, VIII-15-61, in open flowers of *C. foetidissima* at 7:15 a.m. (AEM & MM).

Pima Co.: Pepper Sauce Canyon, Santa Catalina Mountains, 8 ♂♂, VIII-14-40, in flowers of *C. foetidissima* (PHT).

Santa Rita Mountains, 17 ♂♂, 3

♀ ♀, VII-10-52 (R. H. and L. D. Beamer, W. E. LaBerge, C. Liang, KU).

Santa Cruz Co.: Lochiel, 7 ♂ ♂, VII-13-62, in flowers of *C. foetidissima*, 9:30 to 10:00 a.m. (MAC).

Lochiel, 5 mi E, 4 ♂ ♂, VII-13-62, in flowers of *C. foetidissima*, 9:45 to 10:05 a.m. (MAC).

Lochiel, 12 mi E, 31 ♂ ♂, 5 ♀ ♀, VII-13-62, in flowers of *C. foetidissima*, 10:30 to 11:30 a.m. (MAC).

Nogales (collected by AEM & MM), 1 ♀, IX-21-61, sucking nectar in open flower of *C. digitata*; 3 ♂ ♂, VI-17-62, in closed flower of *C. foetidissima* at 8:00 p.m.; 70 ♂ ♂, 17 ♀ ♀, VI-18-62, in open flowers of *C. foetidissima*, 6:40 to 9:15 a.m., females collecting pollen; 1 ♂, VI-18-62, in closed flower of *C. foetidissima* at 1:00 p.m.; 21 ♂ ♂, 3 ♀ ♀, VI-18-62, in closed flowers of *C. foetidissima*; 37 ♂ ♂, 4 ♀ ♀, VI-19-62, in open flowers of *C. foetidissima*, 6:20 to 8:00 a.m., females collecting pollen; 12 ♂ ♂, VI-19-62, in closed flowers of *C. foetidissima*.

Nogales, 1 ♂, VII-11-62, in open flowers of *C. foetidissima* at 9:30 a.m. (PDH); 2 ♂ ♂, same data (EGL); 1 ♂, VII-11-62, in wilting flower of *C. foetidissima* at 9:45 a.m. (PDH); 16 ♂ ♂, 1 ♀, VII-11-62, in closed flowers of *C. foetidissima* (PDH); 1 ♂, 2 ♀ ♀, VII-12-62, in open flowers of domestic squash, 4:50 to 5:20 a.m., females collecting pollen (MAC); 4 ♂ ♂, 12 ♀ ♀, VII-12-62, in open flowers of zucchini squash, 4:50 to 5:20 a.m., females collecting pollen (PDH); 3 ♂ ♂, 1 ♀, VIII-2-62, in closed flowers of *C. foetidissima* (AEM & MM); 6 ♂ ♂, VIII-21-62, in closed flowers of domestic squash at 6:00 p.m. (AEM & MM); 14 ♂ ♂, 12 ♀ ♀, VIII-22-62, in open flowers of domestic squash, 5:50 to 6:50 a.m., females collecting pollen (AEM & MM).

Nogales, 5 mi N, 2 ♂ ♂, 5 ♀ ♀, VII-12-62, in open flowers of *C. foetidissima*, 8:30 to 8:50 a.m., females collecting pollen (MAC); 5 ♂ ♂, 4 ♀ ♀, same data (PDH); 1 ♂, 3 ♀ ♀, same data

(EGL); 3 ♂ ♂, 2 ♀ ♀, in closed flowers of *C. foetidissima*, 2:00 to 2:30 p.m. (MAC).

Nogales, 6 mi NW, 4 ♂ ♂, VII-11-62, in open flowers of *C. foetidissima*, 5:25 to 5:35 a.m. (PDH); 1 ♂, 1 ♀, VII-11-62, in open flowers of *C. digitata*, 5:20 to 5:30 a.m., female apparently taking nectar (EGL).

Patagonia, 1 ♂, VIII-7-38 (E. R. Leach, CAS); 1 ♂, VIII-16-38, in flower of *C. foetidissima* (PHT); 1 ♂, VIII-9-40 (E. S. Ross, CAS); 1 ♂, VIII-8-40, in flower of *C. foetidissima* (PHT); 1 ♂, VIII-9-40, in flower of *Ipomoea* (PHT); 1 ♂, VI-18-62, in closed flower of *C. foetidissima* at 1:00 p.m. (AEM & MM); 1 ♂, VII-11-62, in open flower of *C. foetidissima* at 6:30 a.m. (PDH); 2 ♂ ♂, same data (EGL); 8 ♂ ♂, 18 ♀ ♀, VII-11-62, in open flowers of zucchini squash, 6:45 to 7:00 a.m., females collecting pollen (PDH); 2 ♂ ♂, 9 ♀ ♀, same data (EGL); 1 ♂, VII-11-62, in open flower of crookneck squash sometime between 6:45 and 7:00 a.m. (EGL); 2 ♂ ♂, 3 ♀ ♀, VII-11-62, in open flowers of *C. foetidissima*, 7:30 to 7:40 a.m., females collecting pollen (EGL); 8 ♂ ♂, 12 ♀ ♀, VII-12-62, in open flowers of crookneck squash, 5:45 to 6:35 a.m., females collecting pollen (MAC); 3 ♂ ♂, 10 ♀ ♀, same data, but in flowers of zucchini squash (PDH); 3 ♂ ♂, 6 ♀ ♀, same data as preceding (EGL); 1 ♂, 2 ♀ ♀, VII-12-62, in pistillate flowers of *C. foetidissima*, 6:45 to 7:10 a.m. (MAC); 4 ♂ ♂, 5 ♀ ♀, same data (PDH); 5 ♂ ♂, same data (EGL).

Patagonia, 5 mi NE, 3 ♂ ♂, VII-11-62, in closed flowers of *C. foetidissima* (MAC).

Patagonia, 10 mi NE, 10 ♂ ♂, 2 ♀ ♀, VII-11-62, in closed flowers of *C. foetidissima* (MAC).

California:

Alameda Co.: Berkeley, 4 ♂ ♂, 1 ♀, IX-5-46, in closed flowers of pumpkin (PDH); 54 ♂ ♂, 4 ♀ ♀, VI-25-47, in closed flowers of pumpkin (PDH); 2

♀ ♀, VI-27-47, in closed flowers of pumpkin (PDH); 8 ♂ ♂, VI-28-47, in closed flowers of pumpkin (PDH); 5 ♀ ♀, VI-29-47, in closed flowers of pumpkin (PDH); 6 ♂ ♂, VIII-16-61, in open flowers of *Ipomoea purpurea* (J. A. Chemsak, CIS); 1 ♂, VI-28-62, in flower of zucchini squash (J. A. Chemsak, CIS).

San Lorenzo, 1 ♀, in open flower of *I. purpurea* (PDH).

Butte Co.: Biggs, 2 mi NE, 2 ♂ ♂, 4 ♀ ♀, IX-12-62, in open flowers of domestic squash at 10:10 a.m., females collecting pollen (AEM & MM).

Biggs, 3 mi E, 1 ♂, IX-12-62, in open flower of domestic squash at 10:00 a.m. (AEM & MM).

Chico, 2 mi W, 5 ♂ ♂, IX-12-62, in closed flowers of domestic squash at 6:00 p.m. (AEM & MM).

Chico, 3 mi W, 8 ♀ ♀, IX-13-62, collecting pollen in open flowers of domestic squash, 5:30 to 6:00 a.m. (AEM & MM).

Chico, 4 mi W, 1 ♀, IX-13-62, collecting pollen in open domestic squash flower, 6:05 to 6:10 a.m. (AEM & MM).

Gridley, 2 mi E, 24 ♂ ♂, 18 ♀ ♀, IX-12-62, in open flowers of pumpkin, 9:15 to 9:45 a.m., females collecting pollen (AEM & MM); 37 ♂ ♂, 206 ♀ ♀, IX-21-62, in open flowers of pumpkin, 5:45 to 9:05 a.m., females still collecting pollen at close of observations (EGL, AEM & PDH-CIS).

Gridley, 3 mi SE, 21 ♂ ♂, 34 ♀ ♀, IX-12-62, in open flowers of pumpkin 8:45 to 9:10 a.m., females collecting pollen (AEM & MM).

Colusa Co.: Colusa, 11 mi N, 1 ♀, IX-21-62, collecting pollen in open flower of zucchini squash at 10:40 a.m. (EGL).

Grimes, 6 ♂ ♂, 8 ♀ ♀, IX-13-62 in open flowers of domestic squash, 10:35 to 10:45 a.m., females collecting pollen (AEM & MM).

Sycamore, 6 ♂ ♂, VII-11-16 (R. Stinchfield, CIS); 2 ♀ ♀, VII-15-16 (R. Stinchfield, CIS).

Contra Costa Co.: El Cerrito, 1 ♂,

VI-28-62, in open flower of zucchini squash at 6:30 a.m. (P. B. Jenna, CIS); 1 ♀, VII-5-62, collecting pollen in open flower of zucchini squash (P. B. Jenna, CIS); 1 ♂, 1 ♀, VII-29-62, in open flowers of zucchini squash (V. Steen, CIS).

Richmond, 1 ♂, VII-2-62, in open flower of banana squash at about 8:00 a.m. (T. C. Wozniak, CIS).

Walnut Creek, 1 ♂, VII-7-62, in open flower of Hubbard squash at 8:00 a.m. (J. A. Powell, CIS)

Fresno Co.: Biola (collected by CDJ), 9 ♂ ♂, VI-21-62, in flowers of *C. foetidissima*; 8 ♂ ♂, VII-8-62, in flowers of *C. foetidissima*; 6 ♂ ♂, VII-17-62, in flowers of *C. foetidissima*.

Centerville, 14 ♂ ♂, 1 ♀, VI-20-62, in flowers of *C. foetidissima* (CDJ); 4 ♂ ♂, 2 ♀ ♀, VI-28-62, in flowers of *C. foetidissima* (CDJ); 2 ♂ ♂, VII-3-62, in flowers of *C. foetidissima* (CDJ); 1 ♂, VII-24-62, in flower of *C. foetidissima* (CDJ).

Fresno, 1 ♂, VII-9-14 ("C.D.D.," UCR).

Fresno (collected by CDJ), 5 ♂ ♂, VI-21-62, in flowers of domestic squash; 9 ♂ ♂, 1 ♀, VI-25-62, in flowers of *C. foetidissima*; 1 ♀, VI-27-62, in flower of domestic squash; 1 ♀, VI-28-62, collecting pollen in domestic squash; 2 ♂ ♂, 1 ♀, VII-2-62, in flowers of *C. foetidissima*; 1 ♀, VII-9-62, in flower of *C. foetidissima*.

Friant, 4 ♂ ♂, VII-4-62, in flowers of *C. foetidissima* (CDJ).

Herndon, 9 ♂ ♂, 2 ♀ ♀, VII-8-62, in flowers of *C. foetidissima* (CDJ); 1 ♂, 1 ♀, VII-17-62, in flowers of *C. palmata* (CDJ); 4 ♂ ♂, VII-17-62, in flowers of *C. foetidissima* (CDJ).

Kirch Flat Camp, 20 mi E of Trimmer, 1 ♂, VII-18-62, in *C. foetidissima* (CDJ).

Sanger, 3 ♂ ♂, VII-3-62, in flowers of *C. foetidissima* (CDJ); 1 ♂, VII-10-62, in flower of *C. foetidissima* (CDJ).

Glenn Co.: Artois, 10 mi E, 1 ♀, VII-10-62, in flower of domestic squash (J.

W. MacSwain, CIS); 1 ♂, 1 ♀, same data (R. W. Thorp, CIS).

Glenn, 8 mi N by 3 mi W, 6 ♀ ♀, IX-13-62, collecting pollen in open flowers of pumpkin and domestic squash, 7:20 to 7:43 a.m. (AEM & MM).

Hamilton City, 7 mi S, 1 ♂, IX-12-62, in flower of domestic squash at 12:30 p.m. (AEM & MM); 2 ♀ ♀, IX-13-62, collecting pollen in open flowers of domestic squash, 6:50 to 7:00 a.m. (AEM & MM).

Imperial Co.: Westmorland, 1 ♀, V-19-30 (H. Gentry, GEB).

Inyo Co.: Glacier Lodge near Big Pine, 1 ♀, VI-20-37 (W. C. Reeves, AMNH).

Kern Co.: Bakersfield, 19 mi N, 6 ♂ ♂, 6 ♀ ♀, VI-15-62, in flowers of *C. foetidissima*, 11:00 to 11:30 a.m. (AEM & MM).

Lake Co.: Blue Lakes, 8 mi N, 1 ♂, 1 ♀, IX-19-62, in open flowers of domestic squash, 9:20 to 9:30 a.m., female collecting pollen (AEM & MM).

Lakeport, 1 ♀, IX-19-61, collecting pollen in open flower of domestic squash sometime between 11:05 a.m. and 11:35 a.m. (AEM & MM).

Lakeport, 4 mi N, 4 ♂ ♂, 8 ♀ ♀, IX-19-62, in open flowers of domestic squash 10:25 to 10:40 a.m., females collecting pollen (AEM & MM).

Laurel Dell, Blue Lakes, 1 ♂, IX-19-62, in open flower of domestic squash, 9:50 to 10:00 a.m. (AEM & MM).

Los Angeles Co.: 5 ♂ ♂, 2 ♀ ♀, VI-8-35 (K. Holland, LACM).

Baldwin Park, 2 ♂ ♂, VIII-7-34 (F. R. Platt, GEB, UCD).

Castaic, 5 ♂ ♂, 2 ♀ ♀, VIII-25-62 in open flowers of domestic squash, 7:45 to 9:10 a.m., females collecting pollen (AEM & MM).

Castaic Junction, 48 ♂ ♂, 8 ♀ ♀, VI-5-62, in open flowers of *C. foetidissima*, 1:15 to 1:45 p.m., some females collecting pollen (AEM & MM).

Claremont, 1 ♂, (C. W. Metz, AMNH); 1 ♀, (C. F. Baker, CIS); 1 ♂, VI-23-29 (D. W. Clancy, UCR).

East Whittier, 1 ♂, IX-9-25, in flower of domestic squash (PHT).

Glendale, 1 ♀, III-26-47 (E. I. Schlinger, UCD).

Gorman, 2 mi E of Junction Highway 138, 2 ♀ ♀, VII-9-62, in closed flowers of *C. foetidissima*, 12:35 to 12:40 p.m. (PDH); 1 ♂, 1 ♀, VII-17-62, in open flowers of *C. foetidissima*, 9:55 to 10:05 a.m., female collecting pollen (PDH).

Huntington, 1 ♂, VI-30-40 (A. Bauman, LACM).

Los Angeles, 1 ♂, 1894 (LACM); 1 ♂, July 6, in flowers of *C. foetidissima* (T. D. A. Cockerell, AMNH); 1 ♂, co-type, July 22 (T. D. A. Cockerell, KU); 1 ♂, VIII-25-17 (R. May, CIS).

Pasadena, 1 ♂, VII-31-30 (CDM); 2 ♂ ♂, 1 ♀, VI-27-34, in flowers of domestic squash (CDM); 2 ♂ ♂, 1 ♀, VI-28-34 in open flowers of domestic squash at 7:00 a.m. (CDM); 1 ♀, VI-29-34, in flowers of domestic squash at 6:30 a.m. (CDM); 4 ♂ ♂, VIII-6-34, in flowers of domestic squash (CDM); 2 ♂ ♂, VI-18-52 (G. I. Stage, S & S).

Redondo Beach, 1 ♂, VII-25-38 (CIS).

Reseda, 5 ♂ ♂, VI-21-50 (R. G. Howell, CIS).

Rivera, 1 ♂, August, in flower of *C. foetidissima* (T. D. A. Cockerell, CAS).

Sawtelle, 2 ♂ ♂, VIII-17-56 (R. P. Allen, CIS).

Sierra Madre, 1 ♂, VII-31 to VIII-8-11 (J. I. Carlson, CAS).

Whittier, 1 ♀, (L. L. Muchmore, LACM); 11 ♂ ♂, 2 ♀ ♀, VI-29-25, in flowers of domestic squash (PHT); 1 ♂, VII-30-26, in flower of *Convolvulus occidentalis* (PHT).

Madera Co.: Lane's Bridge, Highway 41 at San Joaquin River, 1 ♂, VI-27-62, in flower of *Cucurbita foetidissima* (CDJ); 13 ♂ ♂, 1 ♀, VI-29-62, in flowers of *C. foetidissima* (CDJ).

Madera, 9 ♂ ♂, 3 ♀ ♀, VI-15-62 in open flowers of *C. foetidissima*, 8:00 to 9:00 a.m., females collecting pollen (AEM & MM).

Madera, 4.5 mi S, 1 ♀, VII-29-60, in

flower of *Cucurbita* (RRS); 1 ♀, VIII-1-60, in flower of *Cucurbita* (RRS).

Madera, 3.5 mi SE, 1 ♂, VI-18-62, in flower of *C. foetidissima* (R. W. Thorp, CIS).

Marin Co.: Novato, 1 ♀, VIII-20-62, in flower of domestic squash (D. C. Rentz, S & S); 3 ♀ ♀, IX-9-62, in flowers of domestic squash, 11:45 to 12:00 noon (AEM & MM).

Mendocino Co.: Hopland, 2 ♂ ♂, 2 ♀ ♀, IX-18-62, in open flowers of domestic squash, 9:45 to 9:55 a.m., females collecting pollen (AEM & MM); 2 ♀ ♀, same data, but collected 10:05 to 10:15 a.m. (AEM & MM).

Potter Valley, 5 ♂ ♂, IX-18-62, in closed flowers of domestic squash, 3:00 to 3:40 p.m. (AEM & MM); 5 ♀ ♀, IX-19-62, collecting pollen in open flowers of domestic squash, 7:30 to 8:30 a.m. (AEM & MM).

Ukiah, 2 ♀ ♀, IX-18-62, collecting pollen in open flowers of domestic squash, 10:50 to 11:15 a.m. (AEM & MM).

Willits, 1 ♂, IX-18-62, in flower of domestic squash sometime between 12:45 and 1:15 p.m. (AEM & MM); 2 ♂ ♂, 1 ♀, same data, but collected, 1:40 to 1:50 p.m. (AEM & MM).

Orange Co.: Costa Mesa, 2 ♂ ♂, VI-25-39, in flowers of domestic squash (PDH).

Laguna, 1 ♂, VII-9-33, at flowers of *Cynara cardunculus* (CDM).

Newport Bay, 1 ♂, VI-26-41, in flower of *Cucurbita foetidissima* (PDH); 34 ♂ ♂, 2 ♀ ♀, VI-16-62, in open staminate flowers of *C. foetidissima*, 5:50 to 8:20 a.m. (AEM & MM); 17 ♂ ♂, same data, but in pistillate flowers (AEM & MM); 13 ♂ ♂, 3 ♀ ♀, same data, but in pistillate and staminate flowers (AEM & MM).

Santa Ana, 1 ♂, VII-19-35 (LACM); 3 ♂ ♂, VII-5-35, in flowers of *Cucurbita* sp. (LACM); 3 ♂ ♂, 1 ♀, VII-12-42, in flowers of domestic squash (PDH).

Seal Beach, 1 ♂, VIII-14-27, in flower of domestic squash (PHT); 1 ♂,

VI-16-28, in flower of domestic squash (PHT); 1 ♂, VII-16-28, in flower of domestic squash (PHT); 1 ♂, 1 ♀, VII-20-28, in copulo in flower of domestic squash (PHT).

Plumas Co.: Quincy, about 15 mi S, 1 ♀, VI-18-62 (C. Slobodchikoff).

Riverside Co.: Anza, 3 ♂ ♂, 1 ♀, VI-24-56, in flowers of *C. foetidissima* (A. S. Menke, Jr., LACM); 15 ♂ ♂, 3 ♀ ♀, VI-24-56, in flowers of *C. foetidissima* (G. I. Stage, S & S); 3 ♂ ♂, 1 ♀, VI-24-56, in flowers of *C. foetidissima* (L. A. Stange, LACM); 8 ♂ ♂, 2 ♀ ♀, VII-3-56 (B. H. Bartosh, UCD); 29 ♂ ♂, 10 ♀ ♀, VII-3-56, in flowers of *C. foetidissima* (R. C. Bechtel, UCD); 3 ♂ ♂, VII-3-56 (R. M. Bohart, UCD); 7 ♂ ♂, 2 ♀ ♀, VII-3-56 (T. W. Bushing, UCD); 2 ♂ ♂, 1 ♀, VII-3-56 (A. S. Menke, Jr., LACM); 7 ♂ ♂, 2 ♀ ♀, VII-3-56, in flowers of *C. foetidissima* (H. R. Moffitt, UCD); 1 ♂, VII-3-56 (G. I. Stage, S & S); 7 ♂ ♂, VII-3-56 (L. A. Stange, LACM); 7 ♂ ♂, 2 ♀ ♀, VII-3-56 (C. L. Wiley, CIS, UCD); 4 ♂ ♂, 1 ♀, VII-5-56 (B. H. Bartosh, UCD); 4 ♂ ♂, 1 ♀, VII-5-56 (R. M. Bohart, UCD).

Anza, 2 mi E, 15 ♂ ♂, 6 ♀ ♀, VII-7-56, in closed flowers of *C. foetidissima* (PDH); 18 ♂ ♂, 4 ♀ ♀, same data (M. S. Wasbauer, CIS).

Cranston Ranger Station, 5 mi E of Hemet, 13 ♂ ♂, 6 ♀ ♀, VI-16-62, in flowers of *C. foetidissima* at 1:15 p.m. (AEM & MM).

Gilman Hot Springs, 36 ♂ ♂, 4 ♀ ♀, VI-16-62, in flowers of *C. foetidissima*, 12:00 to 1:00 p.m. (AEM & MM).

Hemet, 1 ♂, 1 ♀, VI-27-38 (J. R. Warren, AMNH); 5 ♂ ♂, VI-29-45, in flowers of *C. foetidissima* (G. H. Vansell, UCR); 1 ♀, VII-4-46, sweeping flowers of alfalfa (J. W. MacSwain, CIS); 27 ♂ ♂, 16 ♀ ♀, VII-9-46 (J. W. MacSwain, CIS); 1 ♂, VIII-6-46, sweeping flowers of alfalfa (J. W. MacSwain, CIS); 1 ♂, VIII-21-46, same data (J. W. MacSwain, CIS); 36 ♂ ♂, 11 ♀ ♀, VIII-23-62, in flowers of *C.*

foetidissima, 11:30 a.m. to 12:15 p.m. (AEM & MM); 2 ♂♂, VIII-23-62, in open flowers of domestic squash at 12:00 noon (AEM & MM); 2 ♂♂, 24 ♀♀, VIII-24-62, in open flowers of *C. foetidissima*, 5:00 to 6:30 a.m., females collecting pollen (AEM & MM).

Live Oak Canyon, near Badlands, 1 ♀, VI-23-34, in flower of *C. foetidissima* (PHT).

Mira Loma, 5 ♂♂, VI-29-52, at flowers of *Helianthus* (R. H. and L. D. Beamer, W. E. LaBerge, C. Liang, C. Weiner and A. Wolf, KU).

Riverside (collected by PHT), 1 ♀, VI-7-22, in flower of domestic squash; 1 ♂, VII-27-24, in flower of domestic squash; 2 ♂♂, VI-21-25, in flowers of domestic squash; 2 ♂♂, VI-22-25, in flowers of domestic squash (AMNH, UCR); 2 ♂♂, VI-23-25, in flowers of domestic squash; 7 ♂♂, 1 ♀, VII-4-25, in flowers of domestic squash; 2 ♂♂, 1 ♀, VII-11-25, in flowers of domestic squash (CIS, UCR); 6 ♂♂, VIII-30-25, in flowers of domestic squash; 1 ♂, V-30-26, in flower of domestic squash; 2 ♂♂, VI-7-26, in flowers of domestic squash; 1 ♂, VI-7-26, at flower of *Cosmos*; 1 ♂, VI-1-27, in flower of *C. foetidissima* (CIS); 3 ♂♂, VI-10-27, in flowers of domestic squash; 3 ♂♂, VI-10-27, in flowers of *C. foetidissima*; 11 ♂♂, 3 ♀♀, VII-1-27, in flowers of *C. foetidissima*; 1 ♂, VII-5-27, in flower of *C. foetidissima*; 1 ♂, 1 ♀, VII-8-27, in flowers of *C. foetidissima*; 2 ♂♂, 1 ♀, VII-25-27, in flowers of *C. foetidissima*; 2 ♂♂, IX-18-27, in flowers of domestic squash; 2 ♂♂, VI-9-28, in flowers of domestic squash; 1 ♂, VI-18-28, in flower of *C. foetidissima* (CIS); 1 ♂, VI-28-28, in flower of *C. foetidissima*; 1 ♂, VI-18-29, in flower of *C. foetidissima*; 1 ♂, VII-2-29, in flower of *Canna*; 3 ♂♂, VII-24-32, in flowers of domestic squash.

Riverside, 4 ♂♂, VII-7-33, in flowers of *C. foetidissima* (H. L. McKenzie, CIS); 12 ♂♂, 2 ♀, VII-27-33, in flowers of *Ipomoea* (C. M. Dammers, CIS, UCR); 16 ♂♂, 1 ♀, VI-13-34, in

flowers of *C. foetidissima* (PHT-CAS); 1 ♂, VI-14-35, in flower of *C. foetidissima* (PHT-CIS); 2 ♂♂, VI-17-36, in flowers of *C. foetidissima* (PHT); 1 ♂, VI-22-36, in flower of *C. foetidissima* (PHT); 4 ♂♂, 4 ♀♀, VI-23-36 (W. C. Reeves, AMNH, CIS); 4 ♂♂, 1 ♀, VII-22-36, in flowers of *C. foetidissima* (C. M. Dammers, UCR); 1 ♂, VI-23-38, in flower of *C. foetidissima* (PHT); 1 ♀, IX-5-38 (C. M. Dammers, LACM); 1 ♂, 1 ♀, X-15-38, in flowers of domestic squash (PHT); 2 ♂♂, IX-18-42, in flowers of domestic squash (PHT); 1 ♀, IX-21-42, in flower of domestic squash (PHT); 3 ♂♂, 4 ♀♀, VII-29-51, in flowers of domestic squash (PHT); 1 ♂, VII-30-51, in flower of domestic squash (PHT); 1 ♂, 1 ♀, VIII-1-51, in flowers of domestic squash (C. A. Fleschner, UCR).

Temecula, 3 ♀♀, VII-4-50 (EGL); 2 ♂♂, VII-7-56, in flowers of *C. foetidissima* (PDH); 1 ♀, VII-14-62, in closed flower of *C. foetidissima* (PDH).

Sacramento Co.: 1 ♂, VII-7-29 (R. H. Beamer, KU).

Sacramento, 1 ♂, VII-20-30, at flower of *Helianthus* (H. H. Keifer, UCR); 3 ♂♂, VIII-3-51 (H. F. Robinson, UCD).

Sherman Island, 1 ♂, VIII-28-25 (F. H. Wymore, UCD).

San Bernardino Co.: Hesperia, 6 mi SE, 1 ♂, VI-27-52 (R. H. and L. D. Beamer, W. E. LaBerge, C. Liang, C. Weiner and A. Wolf, KU).

Ontario, 1 ♂, VIII-4 (R. E. Snodgrass, CIS).

Redlands, 1 ♂, VII-3-18 (H. A. Scullen, GEB).

Rialto, 2 ♂♂, VIII-12-38, in flowers of domestic squash (PDH).

Yucaipa, 13 ♂♂, VI-25-52 (R. H. and L. D. Beamer, W. E. LaBerge, C. Liang, C. Weiner and A. Wolf, KU); 1 ♀, same data and collectors, but taken in flower of gourd (KU).

San Diego Co.: 1 ♂, V-30-85 (F. E. Blaisdell, CAS).

Bonsall, 3 ♂♂, VII-14-62, in closed flowers of *C. foetidissima* (PDH).

Chula Vista, 1 ♀, IX-4-35 (F. T. Thorne, UCR).

East San Diego, 2 ♂♂, VI-17-48 (G. A. Marsh, CIS).

Jacumba, 1 ♂, 1 ♀, VII-14-62, in closed flowers of *C. foetidissima* (PDH); 3 ♂♂, same data (EGL).

La Mesa, 1 ♂, IX-6-53, in flower of domestic squash (F. X. Williams, CAS).

Oak Grove, 2 ♂♂, VI-6-40, in flowers of *Cucurbita* (CDM-CIS); 1 ♂, VII-4-56 (L. A. Stange, LACM).

Oak Grove, 3 mi S, 1 ♀, VII-3-56 (B. J. Adelson and H. Ruckes, Jr., CIS).

Oceanside, 3 ♂♂, VII-15-39 (I. McCracken, CAS).

Poway, 1 ♀, IX-5-84 (F. E. Blaisdell, CAS); 1 ♂, IX-15-84 (F. E. Blaisdell, CAS); 1 ♂, V-20-85 (F. E. Blaisdell, CAS); 1 ♂, 1 ♀, V-30-85 (F. E. Blaisdell, CAS); 4 ♂♂, V-31-85 (F. E. Blaisdell, CAS).

Rancho Santa Fe, 2 mi SW, 1 ♂, VIII-14-62, in closed flower of *C. foetidissima* (R. W. Thorp, CIS); 3 ♂♂, VIII-16-62, same data (R. W. Thorp, CIS).

San Pauma Valley, 3 ♂♂, 1 ♀, IV-23-62, in flowers of wild gourd (B. Bailey, SDNMH); 2 ♂♂, VI-23-62, in flowers of wild gourd (B. Bailey, SDNMH).

Warner Springs, 3 ♂♂, VII-12-58 (H. R. Moffitt, UCD).

Warner Springs, 2 mi N, 1 ♂, 3 ♀♀, VII-4-56, in flowers of *C. foetidissima* (R. C. Bechtel, UCD); 2 ♀♀, same data (H. R. Moffitt, UCD); 4 ♂♂, 4 ♀♀, in flowers of *C. foetidissima* (R. M. Bohart, UCD).

USDA Horticultural Field Station near La Jolla, 1 ♂, 1 ♀, VII-14-62, in closed flowers of domestic squash (PDH); 1 ♀, VIII-14-62, collecting pollen in open flower of *C. moschata* at 5:27 a.m. (R. W. Thorp, CIS); 1 ♀, VIII-14-62, collecting pollen in open flower of *C. pepo* at 5:35 a.m. (R. W. Thorp, CIS); 1 ♀, VIII-16-62, collected at her burrow at 5:40 a.m. (R. W. Thorp, CIS).

San Francisco Co.: San Francisco (salt marsh), 1 ♂, VII-17-07, in flower of domestic squash (CAS).

San Joaquin Co.: Lodi (near), 1 ♂, VIII-25 (F. E. Blaisdell, CAS); 20 ♀♀, VIII-1-12 (F. E. Blaisdell, CAS); 4 ♂♂, 8 ♀♀, VIII-2-12 (F. E. Blaisdell, CAS).

Manteca, 2 mi E, 2 ♀♀, X-3-62, collecting pollen in open flowers of domestic squash, 10:15 to 10:30 a.m. (AEM & MM).

Manteca, 5.5 mi E, 6 ♂♂, 41 ♀♀, X-3-62, in open flowers of domestic squash, 10:40 to 11:00 a.m., females collecting pollen (AEM & MM).

Manteca, 4 mi W, 3 ♀♀, X-3-63, in flowers of banana squash, 9:30 to 10:00 a.m. (AEM & MM).

Stockton, 8 ♂♂, VI-11-16, in flowers of cultivated cucurbit (R. Stinchfield, CIS).

Tracy, 2 ♂♂, VI-21-49 (RFS); 1 ♂, VIII-1-49 (PDH).

Vernalis, 1 ♀, VI-30-49, at flowers of *Helianthus* (T. F. Leigh, CIS).

San Mateo Co.: Redwood City, 2 ♂♂, VIII-2-59 (P. H. Arnaud, Jr., S & S); 1 ♀, VII-17-60 (P. H. Arnaud, Jr., S & S); 1 ♂, 1 ♀, VII-23-60 (P. H. Arnaud, Jr., S & S).

Santa Barbara Co.: Carpinteria, 2 ♂♂, VII-21-37 (B. E. White, CAS).

Goleta, 3 ♂♂, VI-4-27, at flowers of *Althaea rosea* (PHT).

Santa Barbara, 1 ♂, VI-15-31 (F. E. Blaisdell, CAS).

Santa Clara Co.: Alum Rock Park, 1 ♀ (CIS).

Evergreen, 2 ♀♀, VI-19-47 (S. R. Piazza, KU); 2 ♂♂, 1 ♀, VII-9-49, in flowers of domestic squash (S. R. Piazza, KU).

Mountain View, 5 ♂♂, VI-18-39 (K. Frick, CIS); 1 ♀, VI-30-39 (K. Frick, CIS).

Pacheco Pass, 1 ♀, VI-28-58 (D. J. Burdick, GEB).

Palo Alto (salt marshes), 12 ♂♂, VIII-19-17 (CIS).

San Jose, 5 ♂♂, 1 ♀, VI-15-46 (E. G. Meyers, CIS, KU).

Stanford University Campus, 13 ♂♂, 5 ♀♀, VIII-19-18, in flowers of summer squash (I. McCracken, CIS); 1 ♀, VIII-19-19 (I. McCracken, CIS).

Santa Cruz Co.: Santa Cruz, 4 ♂♂, 1 ♀, VI-1-36 (GEB, UCD); 5 ♂♂, VII-18-42 (K. Frick, CIS).

Santa Cruz Mountains, 1 ♂, VI-8-34 (G. E. and R. M. Bohart, GEB).

Shasta Co.: Anderson, 1 ♀, IX-30-62, in flower of domestic squash, 10:00 to 10:05 a.m. (AEM & MM).

Sonoma Co.: Cloverdale, 1 ♀, IX-18-62, collecting pollen in open flower of domestic squash sometime between 8:40 and 9:00 a.m. (AEM & MM).

Healdsburg, 1 ♀, VII-17-57 (S. F. Bailey, UCD); 4 ♀♀, IX-18-62, collecting pollen in open flowers of domestic squash, 7:15 to 7:35 a.m. (AEM & MM).

Santa Rosa, 2 ♂♂, 5 ♀♀, IX-9-62, in open flowers of domestic squash, 10:00 to 10:10 a.m., females collecting pollen (AEM & MM).

Sonoma, 2 ♂♂, 1 ♀, IX-7-62, in open flowers of domestic squash at 10:00 a.m., female collecting pollen (AEM & MM); 2 ♂♂, IX-7-62, in open flowers of domestic squash (AEM & MM).

Stanislaus Co.: Modesto, 1 ♂, VI-7-36 (J. D. Vertrees, GEB).

Modesto, 6 mi S, 3 ♂♂, 1 ♀, VI-18-62, in flowers of *C. foetidissima* (J. W. MacSwain, CIS).

Modesto, 10 mi W, 9 ♂♂, VII-6-62, in flowers of *C. foetidissima* (CDJ).

Patterson, 1 ♀, VII-4-49, at flower of *Helianthus* (T. F. Leigh, CIS).

Turlock, 1 ♂, VI-20-51, in flower of *Cucurbita* (RRS); 1 ♂, VIII-11-51 (G. I. Stage, S & S); 1 ♂, VIII-18-51, in flower of domestic squash (RRS-CAS); 1 ♂, 2 ♀♀, VIII-22-51, in flowers of domestic squash (RRS-CAS, S & S); 3 ♂♂, VI-9-52 (G. I. Stage, S & S); 1 ♂, VI-10-52, in flower of squash (RRS); 11 ♂♂, 3 ♀♀, VI-13-52 (G. I. Stage, S & S); 1 ♂, VI-15-52 (RRS-CIS); 7 ♂♂, VI-17-52 (G. I. Stage, S & S); 3 ♂♂, 4 ♀♀, VI-18-52 (RRS); 2 ♂♂, 4 ♀♀, VI-19-52 (R. R. Snelling

and G. I. Stage, S & S); 4 ♂♂, 4 ♀♀, VI-20-52 (G. I. Stage, S & S); 1 ♂♂, 6 ♀♀, VI-21-52 (G. I. Stage, S & S); 1 ♂, VI-22-52 (RRS-CIS); 1 ♂, VI-25-52, in flower of Cucurbitaceae (RRS); 1 ♂, VIII-10-52, in flower of domestic squash (RRS); 1 ♀, VI-23-54, at flowers of *Helianthus petiolaris* (RRS-CIS).

Westley, 1 ♂, 1 ♀, VI-22-49 (T. F. Leigh, CIS).

Sutter Co.: Live Oak, 38 ♂♂, 4 ♀♀, IX-12-62, in open flowers of domestic squash, 7:20 to 7:30 a.m., females collecting pollen (AEM & MM); 6 ♂♂, 15 ♀♀, IX-12-62, in open flowers of pumpkin, 7:40 to 8:15 a.m., females collecting pollen (AEM & MM).

Live Oak, 9 mi N, 1 ♂, 4 ♀♀, IX-12-62, in open flowers of pumpkin, 8:00 to 8:40 a.m., females collecting pollen (AEM & MM).

Yuba City, 6 ♀♀, IX-12-62, collecting pollen in open flowers of pumpkin, 7:00 to 7:10 a.m. (AEM & MM).

Tehama Co.: Red Bluff, 2 mi S, 1 ♀, IX-30-62, collecting pollen in open flower of domestic squash at 8:00 a.m. (AEM & MM).

Richfield, 1 ♀, IX-30-62, collecting pollen in open flower of domestic squash sometime between 7:00 and 7:40 a.m. (AEM & MM).

Tulare Co.: Exeter, 16 mi E, 1 ♂, VII-11-62, in flower of *C. foetidissima* (CDJ).

Poplar, 1 ♀, VIII-6-59, found in pink bollworm light trap; no pollen load (S & S).

Tulare, 9 ♂♂, 1 ♀, VII-1-62, in flowers of domestic squash (CDJ); 5 ♂♂, 1 ♀, VII-14-62, in flowers of domestic squash (CDJ).

Visalia, 1 ♂, VI-20-38 (F. T. Scott, UCR); 2 ♂♂, 1 ♀, VI-25-38 (F. T. Scott, UCR).

Tuolumne Co.: Rawhide, 1 ♂, VII-25-12 (R. Stinchfield, CIS); 2 ♂♂, 2 ♀♀, VIII-10-15, in flowers of domestic squash (R. Stinchfield, CIS).

Sonora, 1 ♂, VII-11-51 (R. C. Bechtel and E. I. Schlinger, CIS); 1 ♀, VII-

13-51 (R. C. Bechtel and E. I. Schlinger, CIS).

Ventura Co.: Oxnard, 1 ♂, VII-7-59 (E. I. Schlinger, UCD).

Santa Paula, 2 ♂♂, VII-23 (D. Burke, CIS); 7 ♂♂, VI-5-27, in flowers of *C. foetidissima* (PHT).

Saticoy, 6 ♂♂, 2 ♀♀, VI-2-26 (L. M. Smith, CIS, UCD); 1 ♂, VII-30-26 (L. M. Smith, UCD); 1 ♂, VIII-1-26 (L. M. Smith, UCD).

Sespe Canyon, 1 ♂, VI-27-26 (CIS).

Yolo Co.: Davis, 1 ♂, VI-19-36 (GEB); 4 ♂♂, VII-6-48, in flowers of squash (H. F. Robinson, UCD); 1 ♂, 1 ♀, IX-26-48, in flowers of squash (E. Jaycox, GEB); 1 ♀, VII-10-52 (E. I. Schlinger, UCD); 1 ♀, VII-14-62 (E. I. Schlinger, UCD); 1 ♂, VII-11-53 (E. I. Schlinger, UCD).

Esparto, 1 ♂, IX-21-62, in closed flower of Hubbard squash at 1:40 p.m. (AEM).

Yolo, 2 ♀♀, IX-12-62, collecting pollen in open flowers of domestic squash, 6:00 to 6:15 a.m. (AEM & MM); 1 ♂, IX-13-62, in flower of domestic squash at 11:45 a.m. (AEM & MM).

Yuba Co.: Rio Oso, 3 mi N, 1 ♀, VI-9-62, in closed flower of zucchini squash (W. W. Middlekauff, CIS).

Colorado:

Boulder Co.: Boulder, 1 ♂, 2 ♀♀, VIII-7 to 12-19 (AMNH); 2 ♂♂, VIII-6-35, in flowers of domestic squash (CDM); 3 ♀♀, IX-4-51 (Helen Shinn, AFS).

Mesa Co.: Grand Junction, 1500 feet, 26 ♂♂, 2 ♀♀, VIII-3-20 (F 4758 B, AMNH).

Yuma Co.: Wray, 2 ♀♀, VIII-17 to 19-19 (AMNH).

Connecticut:

Fairfield Co.: Westport, 3 ♂♂, VIII-8-25 (L. Lacey, AMNH).

Hartford Co.: Southington, 1 ♀ (W. H. Patton, KU).

Tolland Co.: Storrs, 1 ♂, 6 ♀♀, IX-5-52, in flowers of domestic squash (R. H. Beamer, KU).

Idaho:

Bingham Co.: Fort Hall, 4 ♂♂, VII-21-34, in flowers of morning glory (L. Ireland, CAS, KU); 1 ♂, VIII-27-34 in flower of morning glory (L. Ireland, KU).

Iowa:

County #19, 1 ♂, VII-19-36 (H. Knutson, S & S).

Story Co.: Ames, 1 ♂, VIII-22-52 (W. D. Fronk, WDF).

Kansas:

Douglas Co.: Lawrence, 2 ♂♂, VII-16-51, in flowers of domestic squash (CDM); 4 ♂♂, VII-19-51, in flowers of domestic squash (CDM); 4 ♂♂, 1 ♀, VII-21-51, in flowers of domestic squash (CDM); 6 ♂♂, VIII-1-51, in flowers of domestic squash (CDM).

Geary Co.: Junction City, 1 ♀, VIII-28-52 (CDM).

Harvey Co.: Newton, 2 ♂♂, VII-25-51, in flowers of *Ipomoea* (CDM).

Sedgwick Co.: Wichita Airport, 1 ♀, VII-20-54, in Japanese beetle trap (KU).

Thomas Co.: 1,700 feet elevation, 2 ♂♂ (F. X. Williams, KU).

Maryland:

Prince George Co.: Beltsville, 1 ♂, VIII-3-57, in flower of *Cucurbita pepo* (G. E. Bohart, GEB); 2 ♂♂, 4 ♀♀, VIII-7-57, in flowers of *C. pepo* (G. E. Bohart, GEB).

Massachusetts:

Barnstable Co.: Cotuit, 3 ♂♂, VIII-21-99 (J. L. Zabriskie, AMNH).

Middlesex Co.: Lowell (near), 1 ♂, 1 ♀, VIII-3-31, at flowers of thistle (PHT).

Michigan:

Oakland Co.: Pontiac, 11 ♂♂, 5 ♀♀, IX-12-52, in flowers of domestic squash (R. H. Beamer, KU); 1 ♂, IX-12-52, at flowers of spearmint (R. H. Beamer, KU).

Missouri:

Dallas Co.: Buffalo, 1 ♀, VI-8-52, in flower of *Ipomoea* (CDM).

Nebraska:

Cass Co.: Louisville, 1 ♀, VII-26-14, at flower of *Silphium integrifolium* (E. G. Anderson, KU).

Cuming Co.: West Point, 1 ♂, VII-25-03, in flower of domestic squash (J. C. Crawford, AMNH); 1 ♀, VIII-10-03, in flower of domestic squash (J. C. Crawford, AMNH); 1 ♀, VIII-18-03, in flower of domestic squash (J. C. Crawford, S & S).

Lancaster Co.: Lincoln, 1 ♀, VIII-16-01, at flower of *Lactuca* (M. H. Carriker, Jr., UN); 1 ♂, VIII-26-04, at flower of thistle (UN); 1 ♂, VIII-19-12 (M. H. Swenk, UN); 1 ♀, VIII-19-12, in flower of domestic squash (M. H. Swenk, UN).

Nevada:

Churchill Co.: Fallon, 7 ♂♂, 1 ♀, VII-27-62, in flowers of domestic squash, 1:00 to 1:30 p.m. (F. D. Parker, CIS, NDA); 8 ♀♀, VII-31-62, collecting pollen in open flowers of domestic squash, 5:15 to 7:30 a.m. (R. C. Bechtel and F. D. Parker, CIS, NDA); 27 ♂♂, VII-31-62, in open flowers of domestic squash, 6:00 to 8:30 a.m. (R. C. Bechtel and F. D. Parker, CIS, NDA).

Lincoln Co.: Alamo, 83 ♂♂, 3 ♀♀, VII-22-62, in flowers of domestic squash, 9:30 to 10:00 a.m. (R. C. Bechtel and F. D. Parker, CIS, NDA).

Washoe Co.: Reno, 2 ♂♂, IX-3-62, flying about flowers of domestic squash at 9:00 a.m. (R. C. Bechtel and F. D. Parker, CIS, NDA).

Wadsworth, 9 ♂♂, VII-31-62, flying in and about open flowers of domestic squash, 9:30 to 9:45 a.m. (R. C. Bechtel, CIS, NDA).

New Jersey:

Camden Co.: Haddon Heights, 1 ♂, IX-19-32 (L. J. Bottimer, GEB).

Middlesex Co.: 1 ♂, July (KU).

New Brunswick, 2 ♂♂, 1 ♀, VIII-10 (AMNH).

South Orange, 1 ♂, VIII-12 (E. L. Dickerson, AMNH); 1 ♂, IX-5 (AMNH).

Monmouth Co.: 1 ♂, VIII-2 (H. B. Weiss, AMNH).

Morris Co.: Chester, 1 ♂, VIII-7 (AMNH).

Union Co.: Springfield, 1 ♂, VIII-3 (E. L. Dickerson, AMNH).

New Mexico:

Dona Ana Co.: Garfield, 2 ♂♂, VII-30-62, in closed flowers of *Cucurbita foetidissima* at 6:25 p.m. (MAC).

Hatch (northside), 8 ♂♂, VII-30-62, in closed flowers of *C. foetidissima*, 5:45 to 6:00 p.m. (MAC).

Hatch, 2 mi S, 3 ♂♂, VII-30-62, in closed flowers of *C. foetidissima*, 5:25 to 5:30 p.m. (MAC).

Las Cruces, 14 mi N, 2 ♂♂, VII-30-62, in closed flowers of *C. foetidissima* at 4:15 p.m. (MAC).

Mesilla, 1 ♂, June 21, in flower of *C. perennis* (T. D. A. Cockerell, KU); 3 ♂♂, 1 ♀, VII-15-52 (R. H. and L. D. Beamer, W. E. LaBerge and C. Liang, KU); 1 ♂, VII-15-52, in flower of *Convolvulus* (R. H. and L. D. Beamer, W. E. LaBerge, and C. Liang, KU); 3 ♂♂, 2 ♀♀, VII-15-52, in flowers of gourd (R. H. and L. D. Beamer, W. E. LaBerge and C. Liang, KU).

Organ, 2 mi W, 1 ♂, VIII-1-62, in closed flower of *C. foetidissima* at 12:15 p.m. (MAC).

Radium Springs, 6 ♂♂, VII-30-62, in closed flowers of *C. foetidissima* at 4:40 p.m. (MAC).

Radium Springs, 12 mi N, 14 ♂♂, 1 ♀, VII-30-62, in closed flowers of *C. foetidissima*, 5:05 to 5:15 p.m. (MAC).

Grant Co.: Cienega, 1 ♂, VIII-16-61, in flower of *C. foetidissima* (AEM & MM).

Separ, 2 mi NW, 2 ♂♂, 5 ♀♀, VII-30-62, in open flowers of *C. foetidissima*, 10:15 to 10:30 a.m., females collecting pollen (MAC).

Separ, 3 mi SE, 23 ♂♂, 12 ♀♀, VII-30-62, in open flowers of *C. foetidissima*, 10:45 to 11:25 a.m., females collecting pollen (MAC).

Guadalupe Co.: Vaughn, 1 ♂, VIII-14-62, in wilted flower of *C. foetidissima* (EGL).

Hidalgo Co.: Cloverdale, 6 mi NE, 1 ♂, 1 ♀, VIII-30-61, in flowers of *C. foetidissima* (AEM & MM).

Cotton City, 3 ♂♂, VIII-25-61, in flowers of domestic squash (AEM & MM).

Highway 9, 2 mi E of junction with Highway 80, 2 ♂♂, VIII-25-61, in flowers of *C. foetidissima* (AEM & MM).

Rodeo (collected by AEM & MM), 12 ♂♂, 1 ♀, VII-30-61, in open flowers of *C. foetidissima* at 9:00 a.m., female sucking nectar; 16 ♂♂, VIII-18-61, in flowers of several varieties of domestic squash; 5 ♂♂, 1 ♀, VIII-18-61, in flowers of *C. foetidissima*; 6 ♂♂, 1 ♀, VIII-21-61, in flowers of domestic squash; 3 ♂♂, VIII-21-61, in flowers of *C. foetidissima*; 2 ♂♂, IX-2-61, in flowers of domestic ornamental gourd; 1 ♂, 1 ♀, IX-2-61, in flowers of domestic squash; 1 ♂, IX-2-61, in flower of *C. foetidissima*; 3 ♂♂, IX-4-61, in flowers of domestic squash; 4 ♂♂, IX-4-61, in flowers of *C. foetidissima*; 1 ♂, IX-7-61, in flower of domestic squash; 2 ♂♂, 1 ♀, IX-7-61, in flowers of *C. foetidissima* at 11:30 a.m.; 1 ♂, 1 ♀, IX-9-61, in flowers of domestic squash; 2 ♂♂, 1 ♀, IX-11-61, in one flower of domestic squash at 11:15 a.m.; 1 ♂, IX-11-61, in flower of *C. foetidissima*; 1 ♀, IX-14-61, collecting pollen in flower of domestic gourd at 9:15 a.m.; 1 ♂, IX-24-61, in flower of domestic squash at 10:30 a.m.; 1 ♀, IX-21-61, in flower of domestic gourd at 11:00 a.m.; 2 ♀♀, IX-26-61, collecting pollen in open flowers of domestic squash sometime between 7:00 and 9:00 a.m.

Rodeo, 2.5 mi NW, 1 ♂, VII-24-61, in wilted flower of *C. foetidissima* at 10:00 a.m. (EGL).

Rodeo, 5.6 mi SW, 4 ♂♂, VIII-17-61,

in flowers of *C. foetidissima* at 9:15 a.m. (AEM & MM).

Lincoln Co.: Carrizozo, 9 mi W, 5 ♂♂, VII-31-62, in closed flowers of *C. foetidissima* at 4:21 p.m. (MAC).

Carrizozo, 11 mi S, 1 ♂, VII-31-62, in closed flower of *C. foetidissima* at 5:05 p.m. (MAC).

Luna Co.: Deming, 3 mi NE, 2 ♂♂, VIII-1-62, in wilted flowers of *C. foetidissima* at 5:34 p.m. (MAC).

Deming, 7 mi W, 3 ♂♂, VIII-30-62, in closed flowers of *C. foetidissima*, 1:05 to 1:15 p.m. (MAC).

Deming, 8.3 mi W, 3 ♂♂, VIII-15-62, in wilted flowers of *C. foetidissima* (EGL).

Deming, 10 mi E, 1 ♀, VII-5-50, in flower of *C. foetidissima* (RFS).

Deming, 14 mi E, 1 ♂, VII-30-62, in closed flower of *C. foetidissima*, 2:35 to 2:40 a.m. (MAC).

Florida, 3 ♂♂, VIII-1-62, in wilted flowers of *C. foetidissima* at 4:46 p.m. (MAC).

Gage, 2 mi E, 2 ♂♂, in wilted flowers of *C. foetidissima*, 12:15 to 12:30 p.m. (MAC).

Nutt, 5 ♂♂, VIII-1-62, in wilted flowers of *C. foetidissima* at 3:47 p.m. (MAC).

Nutt, 1 mi E, 3 ♂♂, VIII-1-62, in closed flowers of *C. foetidissima* at 3:30 p.m. (MAC).

Nutt, 1 mi SW, 3 ♂♂, VIII-1-62, in wilted flowers of *C. foetidissima* at 4:10 p.m. (MAC).

Nutt, 3 mi NE, 7 ♂♂, VIII-1-62, in closed flowers of *C. foetidissima* at 3:10 p.m. (MAC).

McKinley Co.: Gallup, 6,510 ft., 1 ♂, VII-7-59, in flower of *C. foetidissima* (RFS).

Mora Co.: Mora, 2 mi E, 1 ♀, VII-13-59, in flower of *C. foetidissima* (RFS).

Otero Co.: Alamogordo, 39 mi W, 1 ♂, VIII-1-62, in flower of *C. foetidissima* at 11:08 a.m. (MAC).

Tularosa, 1 ♂, VII-31-62, in flower of *C. foetidissima* at 6:40 p.m. (MAC).

San Miguel Co.: Las Vegas, 2 ♂♂, VII-13-59, in flowers of *C. foetidissima* (RFS).

Santa Fe Co.: Galisteo, 5 mi E, 1 ♀, VIII-14-62, in wilted flower of *C. foetidissima* at 11:38 a.m. (EGL).

Sierra Co.: Arrey, 1 mi N, 2 ♂♂, VII-31-62, in flowers of *C. foetidissima* at 9:03 a.m. (MAC).

Arrey, 2 mi S, 12 ♂♂, 1 ♀, VII-31-62, in open flowers of *C. foetidissima* at 8:30 a.m., female collecting pollen (MAC).

Arrey, 4 mi S, 5 ♂♂, VII-30-62, in closed flowers of *C. foetidissima*, 6:55 to 7:05 p.m. (MAC).

Caballo Dam, 6 ♂♂, 1 ♀, VII-31-62, in flowers of *C. foetidissima*, 9:20 to 10:00 a.m. (MAC).

Derry, 1 ♂, VII-30-62, in closed flower of *C. foetidissima* at 6:39 p.m. (MAC).

Derry, 1 mi N, 1 ♂, VII-30-62, in closed flower of *C. foetidissima* at 6:47 p.m. (MAC).

Socorro Co.: San Antonio, 11 mi S, 1 ♂, VII-31-62, in closed flower of *C. foetidissima* at 1:00 to 1:10 p.m. (MAC).

San Antonio, 13 mi S, 1 ♂, VII-31-62, in closed flower of *C. foetidissima* at 12:45 p.m. (MAC).

San Antonio, 37 mi E, 1 ♂, VII-31-62, in closed flower of *C. foetidissima* at 3:05 p.m. (MAC).

New York:

Cattaraugus Co.: Gowanda, 1 ♀, VIII-22-09 (M. C. Van Duzee, GEB).

Little Valley, 1 ♂, VII-29-32 (M. C. Van Duzee, CAS); 3 ♂♂, 1 ♀, VIII-29-32 (M. C. Van Duzee, CAS).

Chautauqua Co.: Falconer, 1 ♀, VII-26-50 (H. J. Grant, Jr., AFS); 1 ♀, VIII-6-50 (H. J. Grant, Jr., AFS).

Eire Co.: Lancaster, 3 ♂♂, VII-20-08 (M. C. Van Duzee, CAS).

Greene Co.: New Baltimore, 5 ♂♂, 1878 (J. L. Zabriskie, AMNH).

Kings Co.: Flatbush, 1 ♀, IX-11-93 (J. L. Zabriskie, AMNH); 6 ♂♂, 3

♀♀, VIII-29-07 (J. L. Zabriskie, AMNH).

Richmond Co.: Staten Island, 3 ♂♂, 1 ♀, VIII-2, sleeping in flower of bindweed (W. T. Davis, AMNH).

Rockland Co.: Nyack, 1 ♀, 1885 (AMNH).

Suffolk Co.: Cold Spring Harbor, 1 ♂, VIII-1 (AMNH); 3 ♀♀, VII-20-00 (AMNH); 1 ♂, 2 ♀♀, VII-31-00 (AMNH); 1 ♀, VIII-2-00 (AMNH); 2 ♂♂, 1 ♀, July-August, 1950 (E. Mayr, AMNH).

Fisher's Island, 1 ♂, VIII-28-90 (J. L. Zabriskie, AMNH); 1 ♂, VIII-20-91 (J. L. Zabriskie, AMNH).

Quogue, 1 ♀, IX-1-06 (J. L. Zabriskie, AMNH); 3 ♀♀, IX-4-06 (J. L. Zabriskie, AMNH).

Warren Co.: Lake George, 2 ♀♀, VIII-19-93 (J. L. Zabriskie, AMNH); 4 ♀♀, VIII-22-93 (J. L. Zabriskie, AMNH); 1 ♀, VIII-30-93 (J. L. Zabriskie, AMNH); 1 ♀, VIII-23-94 (J. L. Zabriskie, AMNH).

North Carolina:

Buncombe Co.: Swannanoa, 1 ♀, VIII-5-22 (TBM); 1 ♀, VIII-2-23 (TBM).

Caldwell Co.: Hickory, 1 ♂, VIII-12-22 (TBM).

Columbus Co.: Bolton, 1 ♀, VI-23-28, at flowers of *Pontederia* (TBM).

Duplin Co.: Faison, 1 ♂, VI-17-52, in flower of domestic squash (TBM); 8 ♂♂, 3 ♀♀, VII-1-52, in flowers of domestic squash (TBM); 3 ♂♂, 1 ♀, VI-9-53, in closed flower of domestic squash (TBM).

Henderson Co.: Hendersonville, 8 ♂♂, VI-29-53, in flowers of domestic squash (H. F. Howden, UNC).

Johnston Co.: Central Crops Research Station, 2 ♂♂, 5 ♀♀, VII-4-59, in flowers of domestic *Cucurbita* (TBM); 4 ♂♂, VII-18-59, same data (TBM).

Moore Co.: Southern Pines, 2 ♂♂, 1 ♀, VI-13-18 (accession 5306, AMNH).

Swain Co.: Bryson City, 1 ♂, VII-1-

23, in flowers of domestic squash (J. C. Crawford, UNC).

Wake Co.: Raleigh, 1 ♂, VIII-19-23 (J. E. Eckert, UNC); 1 ♂, VII-24-31 (UNC); 1 ♂, VII-9-34 (UNC); 1 ♂, VII-10-34 (UNC); 1 ♀, VII-11-34 (TBM); 1 ♂, VII-3-35 (UNC); 1 ♂, VI-18-37 (UNC).

Pennsylvania:

Bradford Co.: Wilawana, 1 ♂, 1937 (R. H. Crandall, S & S); 1 ♀, VII-30-39 (R. H. Crandall, S & S).

Tennessee:

Sevier Co.: Gatlinburg, 2 ♂♂, VII-20-51, in flowers of morning glory (R. H. Beamer, Price and Wood, KU).

Texas:

Brazos Co.: 1 ♀, VI-16-55, in flower of domestic squash (A. H. Alex, UCR).

Comal Co.: New Braunfels, 2 ♂♂, 1 ♀, VI-16 (H. F. Wickham, AMNH).

Jeff Davis Co.: Davis Mountains, 2 ♂♂, VII-16-46 (E. C. Van Dyke, CAS).

Lee Co.: 1 ♀, VIII-10-07 (CAS).

Utah:

Cache Co.: Logan, 1 ♂, VII-28-32 (J. S. Stanford, GEB); 2 ♂♂, VII-13-34 (C. J. Sorenson, GEB); 1 ♂, IX-19-49 (G. V. Bruce, GEB); 1 ♂, VIII-2-50 (K. E. Wolf, GEB); 1 ♂, VIII-5-50 (C. H. Yoon, GEB); 1 ♀, VIII-25-52 (G. F. Knowlton, GEB).

Millville, 3 ♂♂, VIII-17-49, in flowers of *Cucurbita pepo* (G. E. Bohart, GEB); 18 ♂♂, 4 ♀♀, VIII-26-49, same data (G. E. Bohart, GEB).

North Farm, 14 ♂♂, 4 ♀♀, IX-12-53 (G. E. Bohart and E. A. Cross, GEB).

Emery Co.: Utah Agricultural Experiment Station, 1 ♀, IX-11-37 (W. W. Henderson, GEB).

Kane Co.: Glendale, 14 ♂♂, 3 ♀♀, VIII-13-61, in closed flowers of banana and crookneck squash at 1:00 p.m. (AEM & MM).

Mt. Carmel, 1 ♂, VIII-13-61, in closed flower of domestic squash at 1:15 p.m. (AEM & MM).

Millard Co.: Hineckley, 2 ♂♂, VII-23-14, at flowers of alfalfa (GEB).

Uintah Co.: Fort Duchesne, 1 ♀, VI-28-49 (G. F. Knowlton and S. L. Wood, GEB).

Gusher, 1 ♂, VI-14-36 (GEB).

Washington Co.: Santa Clara, 3 ♂♂, 1 ♀, VI-21-50, in flowers of domestic *Cucurbita* (G. F. Knowlton, GEB).

Weber Co.: Ogden, 2 ♂♂, VIII-14-08 (E. G. Titus, GEB); 1 ♂, V-5-59, in mosquito light trap (G. F. Knowlton and L. E. Fronk, GEB).

Virginia:

Alexandria Co.: Barcroft, 1 ♂, VII-5-31 (PHT).

Pollen sources. On the basis of present records *Peponapis pruinosa* appears to utilize the pollen not only of the native *Cucurbita foetidissima* but also of most, if not all, domestic *Cucurbita*. Although one or both sexes of *P. pruinosa* have been taken from the flowers of the native *C. digitata* on five occasions in Arizona, there is no evidence to suggest that the four females involved were collecting pollen.

Flight period. ♂♂, May 5 to September 29; ♀♀, June 8 to September 29.

Peponapis pruinosa is the most widely distributed species of either genus of squash and gourd bees in America north of Mexico. It occurs from coast to coast and from the latitude of Idaho and New York south into Mexico. In the western United States, the vestiture of *P. pruinosa* is quite variable in coloration and the apical margins of the male metasomal terga are often broadly yellowish hyaline and translucent. In California and Nevada, the pubescence of the metasomal terga of the females is chiefly ferruginous. Cockerell (1902:103) described the California form (*P. angelica*) as a species, but remarked that

structurally it agreed in all particulars with the eastern United States form (*P. pruinosa*). Since we have been unable to find any structural features which could be used to distinguish *P. angelica* from *P. pruinosa*, and since there are a number of intermediate colorational forms in the western United States which suggest that the variation is clinal in nature, we have placed *P. angelica* as a synonym of *P. pruinosa*. One such intermediate population is that described by Cockerell (1923:205) from Colorado (*P. lutzi*), and another, which seems to be almost midway between the color forms of the eastern and western United States, is an unnamed population in Utah. It is nonetheless interesting that the California and Nevada specimens are strikingly different in coloration from those of the eastern United States. The probable origin of this variation is discussed in the biological account of the present study.

Although we have studied numerous specimens of *P. pruinosa* from Mexico, we have not cited these because there appears to be a complex of closely related forms in Mexico. As nearly as we are able to determine, *P. pruinosa* is associated in Mexico with the same pollen sources as in the United States (*C. foetidissima* and domestic *Cucurbita*). Our so-called *P. pruinosa* complex of Mexico, which ranges into southern Mexico, may prove, with sufficient material, to be a single, colorationally variable species. An assessment of the relationships of *P. pruinosa* with other species in the genus should become possible when the composition of the *P. pruinosa* complex is better understood.

P. pruinosa is easily distinguished from the other species of the genus in America north of Mexico by the features outlined in the accompanying key. Over much of the United States, except the southwestern region, it is the only species of the genus present.

***Peponapis limitaris* (Cockerell)**
new status
 (Fig. 18)

Xenoglossa pruinosa limitaris Cockerell, 1906, Ann. Mag. Nat. Hist., (7) 18:73, ♂ (Texas: Brownsville, in June); Cockerell, 1912, Proc. U. S. Natl. Mus., 43:266, ♂ (Texas: Brownsville); Lutz and Cockerell, 1920, Bull. Amer. Mus. Nat. Hist., 42:625, ♂ (Texas: Brownsville, in June); LaBerge, 1956, Univ. Kansas Sci. Bull., 38:50.

Peponapis pruinosa limitaris, Michener, 1951, U. S. Dept. Agric., Monogr., 2:1221 (Southern Texas).

Male. Length, 12–13 mm. Length of forewing including tegula, 9–10 mm. Head and body chiefly black; legs largely red, but with some black on coxae, trochanters and femora; apices of metasomal terga and sterna dark reddish-brown; clypeus black, not maculated with yellow; supraclypeal and parocular areas black, not maculated or stained with ferruginous; labrum largely ferruginous, often edged with black; mandibles black, except an elongated dull orange maculation near apex; antennae chiefly black, reddish below; tegulae pellucid testaceous; wings faintly yellowish-brown, veins brownish-black; tibial spurs testaceous; claws black or dark reddish-brown apically.

Vestiture of head, thorax and anterior portions of first metasomal tergum thick, fulvo-ochraceous on dorsum of thorax and first metasomal tergum, chiefly whitish on head and sides of thorax but intermixed with cinereous or black hairs on face, vertex and sides of thorax; pubescence of metasomal terga II–VI black, but transversely banded with appressed whitish or yellowish tomentose hairs as follows: tergum II basally and subapically, terga III–VI subapically; metasomal tergal bands of pale pubescence narrow and occasionally the subapical band on tergum

Fig. 18. *Peponapis limitaris* (Cockerell), male: dorsal view of seventh metasomal tergum (top) and ventral view of sixth metasomal sternum (bottom).

II interrupted medially; pubescence of legs chiefly whitish or pale ochraceous.

Eyes scarcely diverging below (63:67); malar area short, linear, much shorter than maximum thickness of first flagellar segment; first flagellar segment considerably less than one-half as long as succeeding segment; apical margin of second metasomal tergum broadly impunctate, nearest medial punctures separated from apical rim by much more than maximum thickness of second flagellar segment; inner hind tibial spur considerably longer than outer spur, its distal apex much surpassing that of outer spur; sixth metasomal tergum without a strong tooth on each side; pygidial plate (fig. 18, top) and sixth metasomal sternum (fig. 18, bottom) as illustrated.

Female. Length 12–14 mm. Forewing including tegula 9–10 mm. Head and body integument essentially colored as in male, but usually more reddish on ventrally exposed surfaces; legs more brightly reddish than those of male, usually marked less with black; labrum often nearly entirely black, often with a small apical spot of ferruginous or yellowish color; mandibles, tegulae, antennae, wings, tibial spurs and claws essentially colored as in male.

Vestiture essentially colored and disposed as in male, but thicker on head, thorax and legs; pubescence of dorsum of thorax often more brightly fulvo-ochraceous and sometimes intermixed with black or cinereous hairs; pale metasomal tergal bands as in male, but usually brighter on apical terga.

Eyes as feebly diverging below as male (64:67); anterior ocellus separated from lateral ocellus by more than basal thickness of first flagellar segment; apical margin of second metasomal tergum broadly impunctate, nearest medial punctures separated from apical rim by much more than maximum thickness of second flagellar segment; inner hind tibial spur conspicuously longer than outer spur, its distal apex much surpassing that of outer spur.

Location of type. Snow Entomological Museum, University of Kansas, No. 1031.

Geographic range. Yucatan Peninsula of Mexico northward to extreme southern Texas.

SPECIMENS EXAMINED

United States

Texas:

Cameron Co.: Brownsville, 1 ♂, June (KU).

Southmost, 3 ♂♂, IV-19-50 (R. H. and L. D. Beamer, C. D. Michener, J. G. and B. Rozen and W. P. Stephen, KU); 1 ♂, III-2-51 (L. D. Beamer, KU); 3 ♂♂, III-27-51 (L. D. Beamer, KU); 1 ♂, 1 ♀, IV-16-52 (C. D. Michener, R. H. Beamer, W. E. LaBerge and A. Wille, KU).

Mexico

Campeche:

Seybaplaya, 12 km S, 1 ♂, VIII-11-62, in closed flower of domestic squash (*Cucurbita pepo*) sometime between 11:20 and 11:45 a.m. (JKD); 2 ♂♂, same data (PDH); 1 ♂, 1 ♀, VIII-14-62, in open flowers of domestic squash (*C. pepo*) sometime between 7:15 and 8:00 a.m., female collecting pollen (JKD); 3 ♂♂, 2 ♀♀, same data (PDH); 1 ♀, same data (RFS).

Chiapas:

Ocosingo, 1 ♀, III-8-53 (R. C. Bechtel and E. I. Schlinger, CIS).

San Luis Potosí:

Tamazunchale, 2 ♀♀, III-31-51, at flowers of thistle (W. P. Stephen, KU).

Tabasco:

Cardenas, 5 km E, 1 ♂, VIII-9-62, in wilting flower of domestic squash (*Cucurbita moschata*) sometime between 9:30 and 9:45 a.m. (PDH).

Cardenas, 50 km W, 1 ♂, 1 ♀, VIII-9-62, in open flowers of domestic squash (*C. moschata*) sometime between 7:30 and 8:00 a.m., female collecting pollen (JKD); 1 ♂, same data (PDH); 1 ♂,

1 ♀, VIII-10-62, in open flowers of domestic squash (*C. moschata*) sometime between 7:30 and 7:45 a.m., female collecting pollen (JKD); 1 ♂, same data (PDH); 1 ♀, same data (RFS).

Villahermosa, 5 km S, 3 ♂♂, VIII-9-62, in wilted flowers of domestic squash (*C. moschata*), 11:00 to 11:15 a.m. (PDH); 3 ♂♂, 2 ♀♀, VIII-15-62, in open flowers of domestic squash (*C. moschata*), 6:45 to 7:30 a.m., females collecting pollen (JKD); 1 ♂, 1 ♀, same data (RFS).

Veracruz:

Catemaco, 10 ♂♂, 5 ♀♀, VIII-2-62, in open but wilting flowers of domestic squash, 8:20 to 9:25 a.m., females collecting pollen (AEM & MM).

Ciudad Aleman, 1 ♂, VIII-21-62, resting in open flower of domestic squash (*C. moschata*) at 7:30 a.m. (DHJ).

Ciudad Aleman, 2 mi W, 1 ♂, 1 ♀, VIII-22-62, in open flowers of *C. pepo*, 6:27 to 6:37 a.m., female collecting pollen (DHJ).

Coatepec, 3 km E, 1 ♂, VIII-5-62, in closed flower of domestic squash (*C. moschata*) at 11:00 a.m. (JKD); 1 ♂, same data (PDH); 1 ♂, same data (RFS).

Coatepec, 7 km S, 1 ♂, VIII-5-62, in closed flowers of domestic squash (*C. moschata*) at 10:30 a.m. (JKD); 1 ♀, VIII-5-62, collecting pollen in open flower of domestic squash (*C. moschata*) at 10:30 a.m. (RFS).

Cordoba, 3.9 mi E, 1 ♂, VII-23-62, in flower of escaped domestic squash (*C. moschata*) (DHJ); 12 ♂♂, 5 ♀♀, VIII-7-62, in open flowers of escaped domestic squash (*C. moschata*), 8:30 to 9:30 a.m., females collecting pollen (JKD); 1 ♂, 11 ♀♀, same data (PDH); 14 ♀♀, same data (RFS); 2 ♂♂, 7 ♀♀, VIII-16-62, in open flowers of domestic squash (*C. moschata*), 6:00 to 7:00 a.m., females collecting pollen (JKD); 1 ♂, 7 ♀♀, same data (PDH); 2 ♂♂, 6 ♀♀, same data (DHJ); 1 ♂, 3 ♀♀, same data (RFS).

Coscomatepec, 1 ♂, VIII-6-62, in closed flower of domestic squash (*C. moschata*) (PDH).

Cotaxtla Experiment Station, 1 ♂, VIII-16-62, in open flower of domestic squash (*C. pepo*) sometime between 7:15 and 8:30 a.m. (DHJ).

Fortin de las Flores, 2 ♂♂, 2 ♀♀, VIII-5-62, in open flowers of domestic squash, 6:10 to 7:10 a.m., females collecting pollen (AEM & MM).

Fortin de las Flores, 2 mi W, 1 ♀, VII-23-62, collecting pollen in open staminate flower of a native gourd (*C. martinezi*) at 7:15 a.m. (DHJ); 1 ♀, VII-25-62, collecting pollen in staminate flower of a native gourd (*C. martinezi*) at 8:07 a.m. (DHJ).

Jalapa, 2 mi SE, 1 ♂, VIII-5-62, in closed flower of domestic squash (*C. moschata*) sometime between 1:30 and 2:00 p.m. (PDH); 6 ♀♀, VIII-6-62, collecting pollen in open flowers of domestic squash (*C. moschata*), 6:00 to 7:00 a.m. (JKD); 3 ♂♂, 4 ♀♀, in open flowers of domestic squash (*C. moschata*), 6:00 to 7:30 a.m., females collecting pollen between 6:00 and 6:30 a.m. (PDH); 2 ♀♀, VIII-6-62, collecting pollen in open flowers of a native gourd (*C. martinezi*) sometime between 6:00 and 7:30 a.m. (RFS); 1 ♂, 1 ♀, VIII-6-62, in open flowers of domestic squash (*C. moschata*) between 6:00 and 7:00 a.m., female collecting pollen sometime during this period (RFS).

Tlacotalpan, 19 mi W, 2 ♂♂, 1 ♀, VIII-21-62, collecting pollen in open flower of domestic squash (*C. pepo*), sometime between 6:35 and 6:45 a.m. (DHJ).

Tlacotalpan, 19.8 mi W, 1 ♂, VIII-22-62, in open flower of domestic squash (*C. pepo*) between 5:55 and 6:05 a.m. (DHJ).

Tlacotalpan, 22.1 mi W, 3 ♂♂, VIII-21-62, in open flowers of domestic squash (*C. pepo*), sometime between 6:58 and 7:18 a.m. (DHJ).

Veracruz, 1 ♂, VIII-14-62, in open flower of domestic squash, 6:30 to 6:40 a.m. (DHJ).

Yucatan:

Hoctun, 18 km W, 4 ♂♂, 4 ♀♀, VIII-12-62, in open flowers of domestic squash (*C. moschata*), females collecting pollen (JKD); 4 ♂♂, 9 ♀♀, same data (PDH); 4 ♂♂, 4 ♀♀, VIII-13-62, in open flowers of domestic squash (*C. moschata*), 5:45 to 6:30 a.m., females collecting pollen (JKD); 8 ♂♂, 3 ♀♀, same data (PDH); 1 ♀, same data (RFS).

Piste, 22 km E, 1 ♂, VIII-12-62, in closed flower of domestic squash (*C. moschata*), 10:30 to 10:45 a.m. (JKD); 1 ♂, same data (PDH).

Pollen sources. So far as is known, the females of *Peponapis limitaris* use the pollen of the native *C. martinezi*, as well as that of several species of domestic *Cucurbita*.

Flight period. ♂♂, March 2 to August 22; ♀♀, March 8 to August 22.

At the time Cockerell (1906b:73) described *Peponapis limitaris* as a subspecies of *P. pruinosa* he commented that it looked like a distinct species but he could not find any supporting structural features. Our investigation of such

features as structure of the sixth metasomal sternum of the male (fig. 18), and more particularly the arrangement and configuration of its lateral carinae, convinces us that *P. limitaris* is distinct. On the average it is a smaller-sized species than *P. pruinosa*. It is apparently most closely related to that species (or complex) and may have been derived from the same ancestor. Its geographic range is allopatric to that of *P. pruinosa*.

Previously, *P. limitaris* was known only from the southernmost portion of Texas. It is now known to occur as far south as the Yucatan Peninsula. It apparently occupies most of the Gulf Coast lowlands and extends inland to moderate elevations on the eastern slopes of the Sierra Madre Oriental (Fortin de las Flores and Jalapa).

The coloration of the pale pubescence on the metasomal terga is somewhat variable. In some populations and notably those from the Yucatan Peninsula, this pubescence is frequently a golden yellow. However, since the sexes in any locality thus far studied may exhibit either white or yellowish pubescence on these terga, no taxonomic significance is attached.

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specimen of *Xenoglossa cucurbitarum* Cockerell, and Dr. Rodeck kindly permitted us to study it.

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LITERATURE CITED

- BEQUAERT, J.
 1918. On new and interesting bees, chiefly from Arizona. Jour. New York Ent. Soc. 26:126.
 1920. Hymenoptera collected near Boston, Mass., with description of a new variety of *Bombus affinis*. Psyche 27:6-12.
- BERTONI, A. DE WINKELRIED
 1918. Contribución al conocimiento de las Tetralonias sudamericanas. Hym. An. Cient. Paraguayos (2)3:210-218.
- BERTONI, A. W., and C. SCHROTTKY
 1910. Beitrag zur Kenntnis der mit *Tetralonia* verwandten Bienen aus Südamerika. Zool. Jahrb., Abt. f. Syst., Geogr. u. Biol. Tiere 29:563-596, pl. 18.
- BOHART, GEORGE E., and FRANK E. TODD
 1961. Pollination of seed crops by insects. U. S. Dept. Agric. Yearbook, 1961:240-246.
- BRADLEY, J. CHESTER
 1919. An entomological cross-section of the United States. Sci. Monthly 8:356-377, 403-420, 514-526 [reprinted as pp. 1-54].
- CHANDLER, LELAND
 1961. Light trap collections of the nocturnal bee, *Sphecodogastra texana* (Cresson) (Hymenoptera, Halictidae). Proc. Indiana Acad. Sci. 71:124-129, 4 figs., 2 tables.
- COCKERELL, T. D. A.
 1896a. New bees of the genera *Xenoglossa* and *Podalirius* (Anthophora). Canadian Ent. 28:191-197.
 1896b. Contributions from the New Mexico Biological Station—I. Descriptions of new bees collected by Prof. C. H. Townsend in the State of Veracruz. Ann. Mag. Nat. Hist. (6) 18:282-295.
 1900. New insects from Arizona, and a new bee from Mexico. Entomologist 33:61-66.
 1901. Contributions from the New Mexico Biological Station.—X. Observations on bees collected at Las Vegas, New Mexico, and in the adjacent mountains. II. Ann. Mag. Nat. Hist. (7)7:125-131.
 1902. The bee-genus *Xenoglossa* in California. Ent. News 13:103.
 1903. A catalogue of the bees of California. Psyche 10:74-78.
 1905a. New American bees. Proc. Biol. Soc. Washington 18:177-184.
 1905b. Notes on some bees in the British Museum. Trans. Amer. Ent. Soc. 31:309-364.
 1905c. Some new eucerine bees from the west. Psyche 12:98-104.
 1906a. The North American bees of the family Anthophoridae. Trans. Amer. Ent. Soc. 32:63-116.
 1906b. Descriptions and records of bees.—XII. Ann. Mag. Nat. Hist. (7)18:69-75.
 1910. Descriptions and records of bees.—XXVII. Ann. Mag. Nat. Hist. (8)5:361-369.
 1912. Names applied to the eucerine bees of North America. Proc. U. S. Natl. Mus. 43:261-273.
 1918. Descriptions and records of bees.—LXXXI. Ann. Mag. Nat. Hist. (9)2:418-425.
 1919. Bees in the collection of the United States National Museum.—3. Proc. U. S. Natl. Mus. 55:167-221.
 1923. Some Colorado bees. Canadian Ent. 55:205-206.
 1949. Bees from Central America, principally Honduras. Proc. U. S. Natl. Mus. 98:429-490.
- CRESSON, E. T.
 1878. Descriptions of new species of North American bees. Proc. Acad. Nat. Sci. Philadelphia 30:181-221.
 1879. Catalogue of North American Apidae. Trans. Amer. Ent. Soc. 7:215-232.
 1887. Synopsis of the families and genera of the Hymenoptera of America, north of Mexico, together with a catalogue of the described species, and bibliography. Trans. Amer. Ent. Soc., suppl. vol., vi + 350 pp.
- FOX, WILLIAM J.
 1893. Report on some Mexican Hymenoptera principally from Lower California. Proc. California Acad. Sci. (2)4:1-25.
 1894. Second report on some Hymenoptera from Lower California, Mexico. Proc. California Acad. Sci. (2)4:92-121.

FRIESE, H.

- 1916. Zur Bienenfauna von Costa Rica (Hym.). Stettiner Ent. Zeitg. 77:287-348.
- 1921. Nachtrag zur Bienenfauna von Costa Rica. Stettiner Ent. Zeitg. 82:74-98.
- 1925. Neue neotropische Bienenfauna, zugleich II. Nachtrag zur Bienenfauna von Costa Rica. (Hym.). Stettiner Ent. Zeitg. 86:1-41.

FRONK, W. DON, and JAMES A. SLATER

- 1956. Insect fauna of cucurbit flowers. Jour. Kansas Ent. Soc. 29:141-145.

GRAENICHER, S.

- 1911. Bees of northwestern Wisconsin. Bull. Public Mus. Milwaukee 1:221-249.

GRIBODO, GIOVANNI

- 1882. Sul genere *Xenoglossa*, Smith. Ann. Mus. Civ. Genova 18:269-274.

HOLMBERG, EDUARDO L.

- 1884. Himenópteros de la República Oriental del Uruguay. An. Soc. Cienc. Argentina 18:201-228.

JENSEN-HAARUP, A. C.

- 1908. Biological researches amongst the Argentine bees with special reference to flowers they visit. Beiheft d. "Deutsch. Entomol. Zeitschr." 1908 (Silkeborg Ny Bogtrykkeri, Johansen and Jørgensen), pp. 95-107.

JONES, H. A., and J. T. ROSA

- 1928. Truck crop plants. McGraw-Hill, New York, xiv + 538 pp.

JÖRGENSEN, P.

- 1909. Beobachtungen über blumenbesuch, biologie, verbreitung u.s.w. der Bienen von Mendoza. (Hym.). Deutsche Ent. Zeitschr., pp. 53-65.
- 1912a. Los Crisididos y los Himenópteros Aculeatos de la Provincia de Mendoza. An. Mus. Nac. Buenos Aires, ser. 3., 22(15):267-338(1911).
- 1912b. Revision der Apiden der Provinz Mendoza, Republica Argentina (Hym.). Zool. Jahrb. Abt. Syst. 32:89-162, 8 text figs.

LABERGE, WALLACE E.

- 1957. The genera of bees of the tribe Eucerini in North and Central America (Hymenoptera, Apoidea). Amer. Mus. Novitates 1837:1-44.

LABERGE, WALLACE E., and PE. J. S. MOURE

- 1962. Type specimens of American eucerine bees deposited in the British Museum. Boletín da Univ. Paraná, Curitiba, Zool. 11:1-12.

LINSLEY, E. GORTON

- 1958. The ecology of solitary bees. Hilgardia 27:543-599.
- 1960. Observations on some maternal bees at flowers of *Cucurbita*, *Ipomoea* and *Datura* in desert areas of New Mexico and southeastern Arizona. Jour. New York Ent. Soc. 68:13-20.

LINSLEY, E. G., J. W. MACSWAIN, and RAY F. SMITH

- 1955. Biological observations on *Xenoglossa fulva* Smith with some generalizations on biological characters of other eucerine bees (Hymenoptera:Anthophoridae). Bull. Southern California Acad. Sci. 54:128-141, 3 pls.

LUTZ, FRANK E., and T. D. A. COCKERELL

- 1920. Notes on the distribution and bibliography of North American bees of the families Apidae, Meliponidae, Bombidae, Euglossidae, and Anthophoridae. Bull. Amer. Mus. Nat. Hist. 42:491-641.

MICHENER, CHARLES D.

- 1944. Comparative external morphology, phylogeny, and a classification of the bees (Hymenoptera). Bull. Amer. Mus. Nat. Hist. 82:157-326, 246 figs., 13 diagrams.
- 1951. Genera *Peponapis* and *Xenoglossa*. In Muesebeck, C.F.W., et al., Hymenoptera of America north of Mexico. Synoptic Catalog. U. S. Dept. Agric. Monograph 2:1221.
- 1954. Bees of Panamá. Bull. Amer. Mus. Nat. Hist. 104:1-176, 155 figs., 3 tables.

MICHENER, CHARLES D., and RUDOLF B. LANGE

- 1958. Observations on the ethology of neotropical anthophorine bees (Hymenoptera: Apoidea). Univ. Kansas Sci. Bull. 39:69-96, 24 figs.

MITCHELL, THEODORE B.

1962. Bees of the eastern United States. Volume II. North Carolina Agric. Exp. Sta. Tech. Bull. 152:1-557, 134 figs., 18 tables.

MOURE, PE. J. S., C. M. F.

1948. Notas sobre algumas abelhas de Tacanas, Tucumán, Argentina (Hymenopt. Apoidea). Rev. Ent., Rio de Janeiro, 19:313-346.
1960. Abelhas da região Neotropical descritas por G. Gribodo (Hymenoptera-Apoidea). Bol. Univ. Paraná, Curitiba, Zool. 1:1-18.

MOURE, PE. J. S., and C. D. MICHENER

1955. A contribution toward the classification of Neotropical Eucerini (Hymenoptera, Apoidea). Dusenía 6:239-331, 35 figs.

NEVKRYTA, A.

1937. On the fauna and ecology of insect pollinators of the family Cucurbitaceae. Acad. Sci. R.S.S. Ukraine Inst. Zool. Biol. 14:231-258.

PAMMEL, L. H., and C. M. KING

1930. Cucurbitaceae, gourd family. In Honey plants of Iowa. Iowa Geol. Surv. Bull. 7:650-662.

PATTON, W. H.

1879. Generic arrangement of the bees allied to *Melissodes* and *Anthophora*. Bull. U. S. Geol. Surv. 5:471-479.

RAU, PHIL

1922. Ecological and behavior notes on Missouri insects. Trans. Acad. Sci. St. Louis 24:1-71, pls. V-VIII.

SCHROTTKY, C.

1909. Himenopteros de Catamarca. An. Soc. Cienc. Argentina 68:233-272.

SMITH, FREDERICK

1879. Descriptions of new species of Hymenoptera in the collection of the British Museum. Trustees of the British Museum. London, xxi + 240 pp.

SMITH, J. B.

1910. Annual report of the New Jersey State Museum [1909] including a report of the insects of New Jersey. Trenton, MacCrellish and Quigley, 888 pp.

VIERECK, HENRY LORENZ (AND OTHERS)

1916. Guide to the insects of Connecticut. Part III, the Hymenoptera, or wasp-like insects of Connecticut. State [Connecticut] Geol. Nat. Hist. Survey Bull. 22:824 pp., 15 figs., 10 pls.

WHITAKER, THOMAS W., and GLEN W. DAVIS

1962. Cucurbits—botany, cultivation, and utilization. World crops books. London (Leonard Hill [Books] Limited) and New York (Interscience Publishers Inc.) xii + 249 pp. 20 pls., 19 text figs., 29 tables.

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The following abbreviations are used to designate the institutions the collectors were affiliated with at the time the collections were made or to indicate private collections:

AFS Alvin F. Shinn

AMNH American Museum of Natural History

CAS California Academy of Sciences

CIS California Insect Survey

GEB George E. Bohart

INIA Instituto Nacional de Investigaciones Agrícolas

KU University of Kansas

LACM Los Angeles County Museum

NDA Nevada Department of Agriculture

S & S Snelling and Stage

SDMNH San Diego Museum of Natural History

UCD University of California, Davis

UCR University of California, Riverside

UN University of Nebraska

UNC University of North Carolina

UNM University of New Mexico

USNM United States National Museum

WDF W. D. Fronk

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