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THE CARPENTER BEES OF CALIFORNIA

(Hymenoptera: Apoidea)

BY
PAUL D. HURD, JR.
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THE CARPENTER BEES OF CALIFORNIA

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Introduction

Two groups of wood-boring or carpenter bees are known to occur in California. They have been placed by some workers in separate families, the Ceratinidae and the Xylocopidae, and more recently have been regarded as tribal elements of the subfamily Xylocopinae in the family Apidae (Michener 1944: 288). The tribe Xylocopini occurs in the tropical and temperate regions of the earth with the greater diversity of species being found in the Old World. In America north of Mexico the tribe is represented by seven species of the genus *Xylocopa,* which is composed of robust, often brilliantly metallic-colored, medium- to large-sized bees, some of which are as large and perhaps larger than many of our bumblebees. This study deals exclusively with carpenter bees of the genus *Xylocopa.* These may be distinguished from the small carpenter bees by their much larger size, the strongly papillate distal parts of the wings, and the greatly reduced or virtually absent pterostigmata.

Three species of *Xylocopa* occur in California, two of which are of widespread distribution in the mountainous regions of the Pacific slope. Of these species, *Xylocopa californica* is phenotypically divisible into three subspecies and a possible polytopic form (Hurd, 1954:199). One of these subspecies, *arizonensis,* appears to occur in widely discontinuous populations throughout much of the southern Great Basin, Mojave and Colorado deserts, and south through Arizona, New Mexico, and Texas into Mexico. Another widespread species, *Xylocopa tabaniformis,* which ranges from South America northward into the United States, is represented by the subspecies *orpifex* throughout much of the mountainous regions of cismontane California and Oregon and by the subspecies *androleuca* in the Great Basin mountains of eastern California, Nevada, Arizona, and Utah. The third species present in California is *Xylocopa brasilianorum,* a neotropical species which ranges from Brazil northward into the United States and westward into California. There are apparently a number of phenotypically segregable populations evident throughout the range of *brasilianorum.* A critical study of this complex has not been possible owing to the paucity of material. Nonetheless, the terminal part of the range of *brasilianorum* in western Arizona and California contains populations which are phenotypically distinguishable from those of eastern Arizona and Texas, and therefore are regarded as subspecifically distinct.

Distributional maps have been prepared for all the species known to occur in America north of Mexico, and keys have been provided to these species since it is possible that they may be received in shipments of lumber and in other similar sources. Although there has been no definite record of this type of introduction into California, there are indications among the specimens studied that this may have occurred. For example, in 1948 a shipment of balsa wood from Hawaii was found on arrival at San Francisco to contain the work and adults of the Hawaiian subspecies of *Xylocopa brasilianorum.* This is of further interest, since the bee had been introduced at an earlier date into Hawaii where it became successfully established.

There is some indication by *Xylocopa tabaniformis orpifex* has extended its nesting activities into areas of lower elevation than those formerly occupied by the species. Such local range extensions are probably attributable to the creation of suitable nesting sites in the form of structural timbers placed by man in these areas previously unavailable to the bee. Similar range extensions have been noted by Grinnell and Miller (1944:353) for the western robin, *Turdus migratorius propinquus.*

It is for this and certain other obvious reasons that complete distributional information for each of the species occurring in California is given. Without this specific data, it would be very difficult, if at all possible, to assess the data on this group in the future.

Those species of the genus *Xylocopa* occurring in the United States were last revised by Ackerman (1916). Other helpful studies on the systematics of the North American forms are by Smith (1874), Pérez (1901), and Maidl (1912). The subgeneric groupings of the North American *Xylocopa* as defined by Michener (1954:155) are especially helpful.

Nesting Habits

Xylocopa construct their tunnel-like nests in various dead or partly dead native and some introduced softwoods. As indicated in the accompanying tables (1, 2, 3) of the California forms, their nesting sites are not limited to standing trees or shrubs, but often are found in various structural timbers and the like. It is apparently true that of the California forms, *Xylocopa tabaniformis orpifex* is more responsible for damage to structural timbers through its nesting activities than are any of the other species. There are but two definite records of other California species nesting in structural timbers. It is not surprising that *X. brasilianorum varipuncta* has not been found utilizing man's buildings since the species seems to prefer decaying wood.

Fence posts, bridge timbers, telephone poles, porch railings, wooden water tanks, and building timbers such as rafters, joists, studdings, door and window frames, and sidings are frequently used for nesting purposes, especially by *Xylocopa tabaniformis orpifex*. Occasionally old, uninhabited, or little used buildings in mountainous regions may become so riddled with nesting tunnels that they collapse. In general, however, the continued nesting of carpenter bees within structural timbers causes little more than a great deal of noise and incidental damage. In certain instances, when the construction of nesting tunnels in redwood water-storage tanks occurs during the season of the year when the tanks are full of water the damage has been reported as serious. Control measures usually can be taken in accordance with the situation. Often it is sufficient merely to plug the tunnel entrance. Where the bees are persistent and continue to work, it may become necessary to utilize a repellant or an insecticide.

The usefulness of these bees in the pollination of various native and introduced plants may well offset the local and often sporadic damage caused by their nesting activities. Moreover, those trees and shrubs which are frequently chosen for nesting sites are either at least partially or completely dead.

Certain aspects of the biologies of some of the American species have been studied. Nininger (1916:158-165) made observations on the biology of *Xylocopa tabaniformis orpifex* during one year in San Dimas Canyon in the San Gabriel Mountains of California. The bees were nesting in the timbers of a small deserted cabin. This species showed a decided preference for nesting in sound redwood; however, in one or two instances sound douglas fir had been selected. The tunnel entrance was generally made in a vertical or slanting surface. When a slanting or horizontal surface was chosen, the entrance was always made on the under surface of the timber. From the entrance the burrow continued a short distance at or nearly at right angles to the surface and, with but few exceptions, turned upward. The tunnels were found to vary in length from one to twelve inches. In only a few examples studied were they short and haphazard in position. The average burrow length was found to be from four to six inches. Burrows of greater length apparently are the result of more than one season's work. Considerable time is required for the construction of one burrow. Nininger found that it required six days' work by one female to lengthen her burrow about one inch. He found that it is evidently the vibration set up by the burrowing female that guides the course of the tunnel. In no instance did a female break through to the surface even when the timber was but five-eighths of an inch thick. On the contrary, the tunnel was found to be almost always equidistant from the two surfaces. In the boring process the female turns slowly in the burrow, requiring thirty minutes per cycle. There is no uniformity or regularity in the rate or direction of turning.

Nininger states that he found the species always nesting in reasonably large aggregations. Whenever a new site was chosen by a single female the locality was soon sought out by other females "until almost every available timber is honey combed with tunnels, although this may have been due to the scarcity of redwood in the study area." Since from a single surface entrance there are usually several tunnels leading away, Nininger speculated that this custom doubtless serves to reduce the labor of construction as well as to reduce the danger from enemies. Additionally, he points out that still another advantage is the mutual protection against changes of temperature during the winter. He found these tunnels on cold days, literally packed full; in many instances two rows of bees were lying side by side in the same tunnel. Except for these points no indication of social or community life was found. No food is stored for adult consumption, but on days of temperatures of 20-21°C the bees will come forth in search of food.

The life history of *Xylocopa tabaniformis orpifex* as given by Nininger *(ibid.)* may be summarized as follows: Upon completion of the burrow the female provisions the distal cell with pollen and regur-

Table 1

Nesting Woods Utilized by *Xylocopa tabaniformis* Smith

Subspecies of bee	Nesting wood	Locality	Authority
androleuca	Douglas fir[a]	Surprise Canyon, Panamint Mtns., Calif.	New record
orpifex	Alder	Placerville, Calif.	New record
	Douglas fir[a]	San Dimas Canyon San Gabriel Mtns., Calif.	Nininger, (1916:158)
		Ryan Creek, Calif.	New record
		San Jose, Calif.	New record
		Santa Cruz, Calif.	New Record
	Incense cedar	Nippinawasee, Calif.	Linsley, (1943:122)
		Forest Home, San Bernardino Mtns.,	New record
		Mill Creek, San Bernardino Mtns., Calif.	New record
		Placerville, Calif.	New record
	Coast redwood[a]	San Dimas Canyon, San Gabriel Mtns., Calif.	Nininger, (1916:158)
		Deerwood, Calif.	Leach, (1921:55)
		Placerville, Calif.	New record
		Ryan Creek, Calif.	New record
		Banning, Calif.	New record
		Alma, Calif.	New record
	Giant redwood	Giant Forest, Calif.	New record

[a] Nesting in structural timbers

Table 2

Nesting Woods Utilized by *Xylocopa brasilianorum* (Linnaeus)

Subspecies of bee and nesting wood	Locality	Authority
brasilianorum		
Unknown		
varipuncta		
Alder	Glendale, Calif.	New record
Apple tree	Elsinore and Whittier, Calif.	New records
Apricot	Elsinore, Calif.	New record
Chinese paper plant	Riverside, Calif.	New record
Cottonwood	Palm Springs, Calif.	New record
Eucalyptus	San Gabriel Mtns., Calif.	Nininger (1916:158)
Oak (live)	San Gabriel Mtns., Calif.	Nininger (1916:158)
Pepper tree	San Gabriel Mtns., Calif.	Nininger (1916:158)
Walnut (English)	Ventura Co., Calif.	New record
Yucca	"California"	New record

Table 3

Nesting Woods Utilized by *Xylocopa californica* Cresson

Subspecies of bee	Nesting wood	Locality	Authority
arizonensis	*Agave* sp.	40 miles S.E., Chihuahua, Mexico	New record
	Agave nevadensis	Clark Mt., Calif.	New record
	Dasylinon	"B'more" canyon, Ariz.	New record
	Populus fremontii	Mesilla, New Mexico	New record
	Redwood [a]/	Tucson, Ariz.	New record
	Yucca sp.	Ajo (near), Ariz.	New record
		Douglas, Ariz.	New record
	Yucca elota	Las Cruces, New Mexico	New record
californica	Incense cedar	Fish Camp, Calif.	New record
		Fort Jones, Calif.	New record
		Pinecrest, Calif.	New record
		Three Rivers, Calif.	New record
		Yreka, Calif.	Cockerell, (1914:102)
	Giant redwood	Giant Forest, Calif.	New record
diamesa	*Yucca whipplei*	Beaumont, Calif.	New record
		Santa Ana River, Calif.	New record
		Camp Baldy, Calif.	New record

[a]/ Nesting in structural timbers.

gitated nectar. When the pollen ball approximately equals the mass of the bee's abdomen, an egg is laid upon it. The cell is then closed with a partition of chips of wood cemented together in the form of a spiral. Five or six such cells are thus provisioned and sealed in as many days; each cell is about five-eighths of an inch in length. The eggs hatch successively after an incubation period of about one week. The newly hatched larva of about 7 mm. in length feeds slowly at first, then more rapidly, and consumes all, or nearly all, of its food in from 22 to 28 days. During the ensuing 15 to 19 days the larva shows little change. At the end of this period the larval period ends, and the pupal stage commences. Approximately 40-45 days are spent in this stage, and at the conclusion the adult emerges. The newly emerged bee will remain for some time within its cell if remnants of larval food are available. If not, the bee may destroy the cell partition separating it from the next cell in the burrow series, although this cell and the others between it and the tunnel entrance have not been vacated. In some instances the emerging bee may await the emergence of bees from the cells ahead of it, but this is apparently not the rule.

The first activity upon emergence from the cell series is the quest for food. After searching through their own tunnel and consuming what fragments remain, the bees enter adjoining burrows and feed upon such pollen mass remnants as may be present.

Nininger found that bombyliid fly *Spongostylum delila* Loew accounted for about 10 per cent parasitism of the cell series examined. About half the bee broods were parasitized by one bombyliid larva. Only in one case was there more than one bombyliid larva in the same bee brood. A phycitid moth and a tenebrionid beetle, *Tribolium brevicornis* (Le Conte), occasionally were observed to feed at first upon pollen masses, but when this supply was exhausted the immature stages of the bee were eaten. Mites of the genus *Trichotarsus* infested a few burrow series and in some cases destroyed developing bees.

It is interesting that a nest series of *Xylocopa tabaniformis orpifex* from an old incense-cedar log studied by Linsley (1943:122) contained cells infested with a number of insects. Linsley (*ibid.*) states that the series of cells was infested with the tenebrionid *Tribolium brevicornis* (Le Conte) and two species of dermestids, *Attagenus* sp. (*piceus?*) and *Trogoderma* (*ajax?*), and the dried fruit moth, *Vitula serratilineella*. He further states that it was not possible definitely to determine on what the moths were feeding, but that it probably was pollen.

Another carpenter bee partially studied by Nininger (*op. cit.*) was the large neotropical species, *Xylocopa brasilianorum*. He made some observations on the subspecies *varipuncta* apparently in the lower foothill region of the San Gabriel Mountains near Claremont, California. He found that *varipuncta* shows a preference for wood that is partially decayed. Several kinds of wood are used for nesting, such as pepper and eucalyptus, but most often live oak is chosen. The tunnels are generally from five to twelve inches in length and seem to follow the grain of the wood. Hence, they are sometimes far from straight. Nininger states that the nesting habits are similar to those described for *X. tabaniformis orpifex*, though *varipuncta* are not inclined to live in groups. In one case, however, he found that several females were using a common surface entrance from which each constructed a separate tunnel. The developmental periods of the immature stages are slightly in excess of those for *X. tabaniformis orpifex*. The mite, *Trichotarsus*, was found also associated with this carpenter bee, but apparently destroyed only a small percentage of developing bees.

Rau (1933:227-266) has reported and illustrated in some detail the ethology of *Xylocopa virginica* of the eastern United States. Space does not permit here a summary of this work or his earlier studies, but since it is the most complete account on a species of the new world, it should be consulted. The excellence of the work lies in Rau's keen insight into the problems of the economy of the species in relation to its environment.

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Discussion of Species

Seven species belonging to the carpenter bee genus *Xylocopa* are known to occur in America north of Mexico. They may be separated by means of the following key.

Key to the Species of *Xylocopa* in America North of Mexico

1. Males (antennae thirteen segmented; metasoma composed of seven visible segments) . . 2
   Females (antennae twelve segmented; metasoma composed of six visible segments) . . 8

2(1). Inner eye margins strongly convergent above, virtually enclosing the ocelli, separated on vertex by considerably less than the distance across the posterior ocelli 3
   Inner eye margins subparallel or somewhat convergent above, separated on vertex by considerably more than the distance across the posterior ocelli 5

3(2). Antennal scape with a yellow line on ventral surface; metasomal sterna largely testaceous 4
   Antennal scape wholly dark; metasomal sterna largely dark except along apical margins . . . . . *virginica* (p. 50)

4(3). Dorsum of thorax, legs, and first metasomal tergum with pale reddish, yellow, or golden pubescence; ultimate tarsal segment of hind leg with lateral fringes of long bristlelike hairs . . . . . *micans* (p. 63)
   Dorsum of thorax except anteriorly, legs, and first metasomal tergum with black pubescence; ultimate tarsal segment of hind leg without lateral fringes of hairs . . . *loripes* (p. 63)

5(2). Body predominantly dark in coloration; antennal scape wholly dark 6
   Body predominantly yellowish or testaceous throughout; antennal scape with a yellow line on ventral surface . . . . . *brasilianorum* (p. 59)

6(5). Seventh metasomal tergum rounded or somewhat angulate along posterior margin, not modified as below 7
   Seventh metasomal tergum with posterior margin produced into a pair of well-separated acute teeth . . . . . *tabaniformis* (p. 51)

7(6). Face above clypeus wholly dark; body brilliantly green or blue in coloration . . . . . *californica* (p. 42)

Face above clypeus along inner eye margin with a broad yellow stripe which terminates at or near the posterior margin of vertex; body black with only slight metallic sheen . . . . . *artifex* (p. 62)

8(1). Sixth metasomal tergum with the two rows of spines widely divergent anteriorly, nearly forming a right angle 9
Sixth metasomal tergum with the two rows of spines scarcely diverging anteriorly, forming a very acute angle 10

9(8). Interantennal crest in the form of a small acute tooth immediately anterior of which is a small pit densely filled with hair . . . . . *californica* (p. 42)
Interantennal crest elevated in the form of large rounded, laterally compressed carina; without a pit anteriorly. . . . . *virginica* (p. 50)

10(8). Integument black, occasionally with very faint metallic reflections 11
Integument blue or green brilliantly metallic 13

11(10). First metasomal sternum entire, not emarginate medioapically; metasomal sterna rather strongly keeled mediolongitudinally 12
First metasomal sternum deeply emarginate medioapically; metasomal sterna not keeled mediolongitudinally. . . . . *tabaniformis* (p. 51)

12(11). Small species (less than 20 mm.); metasoma finely punctured throughout . . . *artifex* (p. 62)
Larger species (usually much more than 20 mm.); metasoma not finely punctured throughout . . . . . *brasilianorum* (p. 59)

13(10). Fifth and sixth metasomal segments laterally with conspicuous tufts of white hair; small species . . . . . *micans* (p. 63)
Fifth and sixth metasomal segments without lateral tufts of white hairs; large species . . . . . *loripes* (p. 63)

Subgenus *Xylocopoides* Michener

Included in this subgenus (Michener, 1954:155) are those species in which the female has the scale of the posterior tibia foveate and the male has the gonoforceps thick apically as viewed from the side; the penis valves are separated by a well-developed, broad spatha.

This subgenus, however, appears to contain two diverse elements, and perhaps each of these should be considered as subgenerically distinct. Those species such as *X. californica* and *X. virginica,* which in the female have the two rows of spines on the sixth metasomal tergum widely divergent anteriorly and nearly forming a right angle with each other just before the posteriorly projecting flat-topped spine, form a compact group. The males have the gonoforceps broadly thickened and trunicated apically as seen from the side. The other group, which includes the *X. tabaniformis* complex, has the integument black and not metallic. Further, the two rows of spines on the sixth metasomal tergum scarcely diverge anteriorly and thus form a very acute angle with each other just before the posteriorly projecting flat-topped spine. The scale of the posterior tibia of the female is scarcely if at all foveate. Additionally the gonoforceps of the male is quite unlike that of the *X. californica* group.

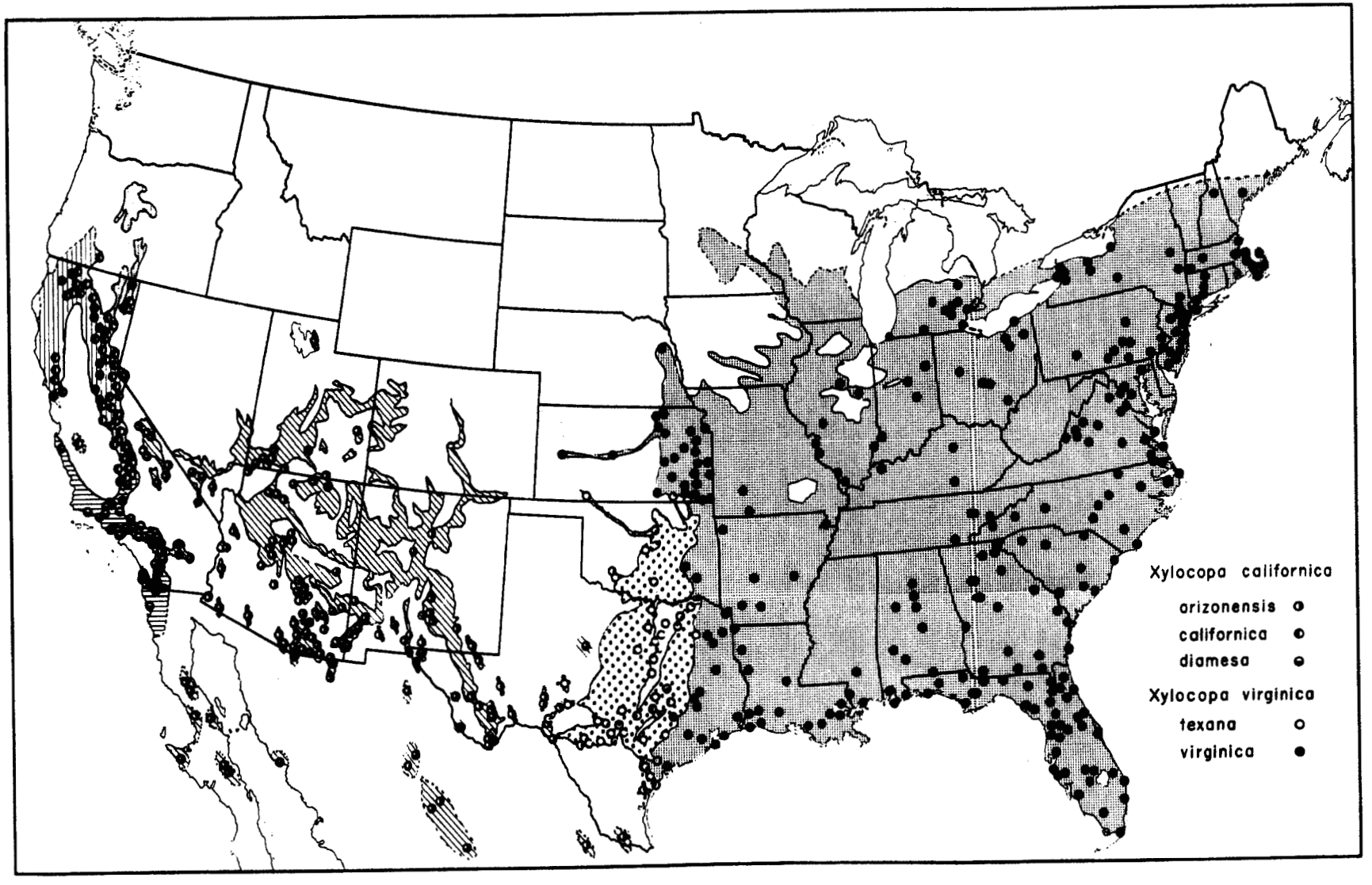
Xylocopa californica Cresson

Xylocopa californica Cresson, 1864, Proc. Ent. Soc. Phila., 3:40, ♀.

Geographic range: Arizona, California, Mexico, Nevada, New Mexico, Oregon, Texas, and Utah (see map 1).

Discussion:

This species is widely distributed throughout much of western North America, excepting the central and northern Rocky Mountains. It has been recorded from Colorado and South Dakota. The South Dakota record (Ackerman, 1916:228) is based upon a female labeled from "Volga, S. D. lot 22" contained in the collections of the Academy of Natural Sciences of Philadelphia. It is referable to the subspecies *X. californica arizonensis* and in my opinion is either mislabeled or represents a specimen which emerged from a shipment of lumber or the like. It is very doubtful if the species occurs much beyond the northeastern periphery indicated in the accompanying map.



Map 1. Distributions of *Xylocopa californica* Cresson and *Xylocopa virginica* (Linnaeus).

Maidl (1912:309) first reported the species from Colorado. No additional material has been studied from this area; however, it appears very likely that the subspecies *X. californica arizonensis* may well occur in at least southwestern Colorado (see map 1).

On the basis of coloration, *Xylocopa californica* contains three readily recognizable subspecies which geographically replace one another (Hurd, 1954:200). Each subspecies uses different softwoods in which to nest. The subspecies *californica* proper nests in redwood and incense cedar; *diamesa* nests principally in *Yucca whipplei;* and *arizonensis* uses various desert agaves and yuccas. From the high mountain localities in southern California (San Bernardino and San Jacinto mountains) several specimens are available which are phenotypically very like *californica* proper and suggest the possibility of a high mountain population which is using the isolated stands of incense cedar in which to nest. If this is true it is possible that these bees are either of polytopic origin, having been derived from the yucca-using *diamesa,* or they may be isolates of *californica* proper which have remained associated with these now isolated stands of incense cedar. It is significant, however, that the available specimens from these high mountain southern California localities are not phenotypically equivalent to the sierra populations of *californica* proper. It is of further interest that some specimens labeled from the Santa Catalina and Patagonia mountains of Arizona are also phenotypically similar to these individuals from the high mountain localities of southern California, especially since they are wholly encompassed in their occurrence by the subspecies *arizonensis.* A critical field study of these isolated populations is needed if an understanding of their origins and relationships is to be achieved. In each of these isolated geographic situations the phenotypy expressed by the existing specimens strongly favors a polytopic interpretation.

The clypeus of most males of this species is wholly dark. However, occasionally certain individuals may have the clypeus partially or completely marked with yellowish-white or yellow. Since this variation appears to occur independently of geography and, further, is not segregable on a population basis, it may be regarded as a color variant if so desired. Pérez (1901:112) has proposed the name *Xylocopa amblardi* for such a specimen from "California." Perhaps the single largest collection of such males are in the collection of the University of Kansas. Most of these were collected in southern Arizona and Oak Creek Canyon, Arizona. On the basis of the material utilized in the present study a number of males with varying degrees of yellowish coloration on the clypeus were seen from several localities in Arizona, New Mexico, California, and Mexico.

The currently recognized and defined subspecies of *Xylocopa californica* may be separated in the following key.

Key to the Subspecies of *Xylocopa californica* Cresson

1. Males 2
   Females 4

2(1). Abdomen predominantly blue in color; fourth metasomal tergum without a medially interrupted fringe of whitish hairs 3
   Abdomen predominantly green in color; fourth metasomal tergum with a medially interrupted fringe of whitish hairs. North Coast Ranges and Sierra Nevada of California and southern Cascade Mountains of Oregon . . . . . *californica* (p. 46)

3(2). Wings heavily infuscated with black and strongly violaceous; abdomen dark blue. Deserts of California, Arizona, Nevada, New Mexico, Utah, Texas, and Mexico. *arizonensis* (p. 45)
   Wings paler, not heavily infuscated with black, less strongly violaceous; abdomen blue, often blue with traces of green. Mountains of cismontane southern California northward to Monterey County . . . . . *diamesa* (p. 48)

4(1). Abdomen predominantly blue 5
   Abdomen predominantly green. North Coast Ranges and Sierra Nevada of California and southern Cascade Mountains of Oregon . . . . . *californica* (p. 46)

5(4). Wings heavily infuscated with black and strongly violaceous; abdomen dark blue. Deserts of California, Arizona, Nevada, New Mexico, Utah, Texas, and Mexico. *arizonensis* (p. 45)
Wings paler, not heavily infuscated with black, less strongly violaceous; abdomen blue, often blue with traces of green. Mountains of cismontane southern California northward to Monterey County . . . . . *diamesa* (p. 48)

Xylocopa californica arizonensis Cresson

Xylocopa arizonensis Cresson, 1879, Trans. Amer. Ent. Soc., 7:212, ♂♀. Type ♀, Arizona (A.N.S.P.).
Geographic range: Arizona, California, Mexico, Nevada, New Mexico, Texas, and Utah (see map 1).
California records:

Inyo Co.: Antelope Springs, ♂, VII-17-53, flowers *Chrysothamnus* (J. W. MacSwain, C.I.S.). Argus Mountains, 2 ♂, V-1891 (C. V. Riley, U.S.N.M.). Furnace Creek, Death Valley National Monument, 2 ♂, IV-1-51, flowers *Larrea glutinosa* (P. D. Hurd, Jr., C.I.S.): 3 ♀, same data (E. G. Linsley, C.I.S.). Inyo Mountains, 2 ♀, V-23-37 (W. C. Reeves, C.I.S.). Kearsarge (near), ♀, V-25-37 (E. C. Van Dyke, C.A.S.). Lone Pine, ♀, V-23-37 (N. W. Frazier); ♀, V-25-37 (N. W. Frazier, A.M.N.H.); ♂, VI-4-37 (A. E. Meier, C.I.S.); ♂, VI-11-37 (R. Husbands, C.I.S.); 2 ♂, VI-13-37 (A. E. Meier, C.I.S.); ♂, VI-18-37 (K.U.); ♂, VI-19-37 (K.U.). Mazourka Canyon, 8 ♂, VII-2-53 (W. D. McLellan, U.C.D.). Panamint Mountains, 7 ♂, ♀, IV-1891 (C. V. Riley, U.S.N.M.); ♀, ♂, V-29-37 (G. E. Bohart). Panamint Valley, ♂, IV-1891 (C. V. Riley, U.S.N.M.). Round Valley, ♀, VI-22-37 (N. W. Frazier, A.M.N.H.). Surprise Canyon, Panamint Mountains, ♂, IV-28-53 (G. A. Marsh, C.I.S.); 13 ♂, 4 ♀, IV-29-53, flowers *Larrea glutinosa* (P. D. Hurd, Jr., C.I.S.). Tuber Canyon, Panamint Mountains, ♂, VI-19-37 (C. D. Michener, K.U.). Westgard Pass, ♀, V-27-37 (W. C. Reeves, C.I.S.); ♂, VI-2-37 (C.I.S.); ♂, VII-10-53, flowers *Nama parryi* (E. G. Linsley, C.I.S.). Westgard Pass, 5 mi. w., ♀, VI-16-54 (C. D. MacNeill, C.I.S.). Westgard Pass, 7 mi. w., 3 ♂, 2 ♀, VI-26-53 (W. D. McLellan, U.C.D.); ♂, same data (H. Washburn); ♂, 2 ♀, VII-19-53 (J. W. MacSwain, C.I.S.). Wild Rose Canyon, Panamint Mountains, 7,500 ft., ♂, VI-19-37 (C. D. Michener, K.U.); same but, 8,000 ft., ♂, VI-19-37, flowers *Lupinus magnificus* (C. D. Michener, K.U.).

Mono Co.: Paradise Camp, 5,000 ft., 2 ♀, VI-16-54 (C. D. MacNeill, C.I.S.).

Riverside Co.: Andreas Canyon, near Palm Springs, ♂, ♀, II-22-39 (P. H. Timberlake, U.C.R.); ♂, IV-10-36 (C. D. Michener, K.U.); 2 ♂, IV-11-36, flowers *Larrea glutinosa* (P. H. Timberlake, U.C.R.). Cottonwood Springs, Joshua Tree National Monument, ♂, IV-26-49 (J. E. Gillaspy, C.I.S.). Desert Center, 4 ♀, VII-4-51, flowers *Chilopsis linearis* (J. W. MacSwain and R. F. Smith, C.I.S.). La Quinta, ♂, III-5-28 (S.D.M.N.H.). Palm Desert, 2 ♂, IV-12-50 (P. D. Hurd, Jr., C.I.S.). Palm Springs, 2 ♂, 2 ♀, IV-3-25 (E. C. Van Dyke, C.A.S.); 2 ♀, (J. D. Gunder, C.A.S.); ♀, III-1928 (W. M. Wheeler, M.C.Z.).

San Bernardino Co.: Clark Mountain, ♂, VII-8-39, flowers *Agave nevadensis* (C. M. Dammers, U.C.R.); ♂, VIII-10-38, ex nest in *Agave* stem (P. H. Timberlake, U.C.R.). Parker Dam, ♀, VIII-10-46, flowers *Asclepias* (W. F. Barr, C.I.S.); ♀, same data (P. D. Hurd, Jr., C.I.S.). Twentynine Palms, ♀, VIII-4-33, flowers *Wislizenia refracta* (P. H. Timberlake, U.C.R.); ♀, VIII-29-34, flowers *Wislizenia refracta* (C. D. Michener, K.U.); ♀, same data (P. H. Timberlake, U.C.R.).

Discussion:

This subspecies has been found nesting in a variety of native softwoods. In California, P. H. Timberlake found it nesting in an *Agave* stem at Clark Mountain, San Bernardino County. In Arizona it has been found nesting in a *Yucca* stem at Douglas, in the stem of *Dasyliron* at "B'more Can," and in a redwood plank at Tucson. At the Las Jornada Experimental Range, Las Cruces, New Mexico, it was found nesting in *Yucca elata*. In the collection of the University of Colorado is a female labeled from Mesilla, New Mexico, with "burrow in *Populus fremontii*." J. D. Lattin has observed this subspecies nesting in an *Agave* stem at Nuevo Casas Grande, forty miles southeast of Chihuahua, Mexico.

Among the material in the University of Arizona collection are a male and female which are labeled by C. Wilder as "hibernating in burrow in stem of Yucca," on December 6, 1936, at Altar Valley near Ajo Road, Pima County, Arizona.

Xylocopa californica californica Cresson

Xylocopa californica Cresson, 1864, Proc. Ent. Soc. Phila., 3:40-41. Type ♀, Fort Crook, California (A.N.S.P.).

Synonym: *X. libocedri* Cockerell.

Geographic range: California, Nevada, and Arizona (see map 1).

California records:

Alpine Co.: Alpine, ♂, ♀, VI-20-13 (E. P. Van Duzee, C.I.S.). Blue Lakes, 8,500 ft., ♀, VIII-15-49 (P. C. Hutchison, C.A.S.). Carson Pass, ♀, IV-3-33 (G. E. Bohart.)

Calaveras Co.: Mokelumne Hill, ♀, VII-20-20 (F. E. Blaisdell, C.A.S.); ♀, VII-24-22 (C. L. Fox, C.A.S.). Murphys, 5 ♂, VI-6-30 (E. O. Essig, C.I.S.); IX-19 to 20-17 (F. E. Blaisdell, C.A.S.).

Contra Costa Co.: ♂, 1912 (Grundel, U.S.N.M.).

Eldorado Co.: Camino, ♂, VI-26-36 (M. A. Embury, C.I.S.). Glen Alpine, ♀, VIII-9-15 (C. L. Fox, C.A.S.). Lake Tahoe, 12 mi. S.E., ♂, VI-11-48 (F. A. Ehrenford, C.I.S.). Snowline Camp, ♂, VI-20-48 (C. Chan, U.C.D.); ♂, same data (O. E. Myers, C.I.S.); ♂, VI-22-48 (L. W. Quate, C.I.S.); ♂, VII-3-48 (P. D. Hurd, Jr., C.I.S.); 2 ♀, VII-20-48 (P. D. Hurd, Jr., C.I.S.); ♀, same data (S. A. Sher, C.I.S.); ♀, VII-23-48 (L. W. Quate, C.I.S.). Stateline, ♀, VIII-15-51 (J. W. MacSwain and R. F. Smith, C.I.S.).

Fresno Co.: Huntington Lake, 7,000 ft., ♂, 3 ♀, VII-1917, 2 ♀, VIII-1917, some on flowers of *Mentha pulegium* (I. McCracken. L. S. Jr. U.); ♀, VII-4-19, ♀, VII-5-19, ♂, 10 ♀, VII-30-19 (E. P. Van Duzee, C.A.S.); ♀, VII-6-19 (F. C. Clark, C.A.S.); 2 ♀, (F. E. Clark, Univ. Mass.). Indian Basin, Kings River Canyon National Park, ♀, VIII-23-52 (J. C. Hall, U.C.D.). Kings River Canyon, 2 ♀, VIII-19-42 (S. C. Jones, O.S.C.); ♀, VII-27-47 (R. v. d. Bosch, C.I.S.); ♀, VII-10-50, 3 ♀, VII-30-50 (S. F. Bailey and H. E. Cott, U.C.D.); same but 4,500-5,000 ft., 6 ♂, VI-18-53 (G. D. Butler, U.A.). Roger's Crossing, Kings River Canyon, ♂, V-8-32 (U.C.R.). South Fork, Kings River Canyon, 5,000 ft., 2 ♂, VII-3-10, ♂, VII-6-10 (E. C. Van Dyke, C.A.S.). Trimmer, Kings River Canyon, ♂, V-8-32 (E. L. Donohoe, U.M.S.P.).

Lake Co.: ♂, VII-1914 (L. S. Jr. U.).

Lassen Co.: Madeline, 2 ♂, ♀, VII-12-25 (U.S. N.M.). Summit Camp, ♂, VI-28-49 (W. F. Ehrhardt, U.C.D.).

Madera Co.: Coarsegold, ♂, V-5-46 (W. P. A. Cockerell, U.C.R.). Midway, 3 ♀, V-24-36 (M. A. Cazier, A.M.N.H.). Nippinnawasee, ♀, VI-1-42 (E. G. Linsley, C.I.S.). Northfork, ♂, VI-8-33 (R. P. Allen, C.A.S.); 4 ♂ same data (C.I.S., K.U.). Oakhurst, ♂, V-19-42 (W. E. Ferguson); V-19-42, flowers *Lupinus* (R. W. L. Potts, C.A.S.); 6 ♂, same data (A. J. Walz, C.I.S., U.C.R.); ♂, ♀, VI-1-42 (W. E. Ferguson). Sugar Pine, ♀, IX-14 (F. B. Herbert, C.I.S.).

Mariposa Co.: Crane Flat, Yosemite National Park, ♀, VII-1936 (J. Helfer). El Portal, ♀, V-18-38 (N. F. Hardman, C.I.S.); ♂, V-23-38 (N. F. Hardman, C.I.S.). Fish Camp 2 ♀, V-21-42 (W. E. Ferguson); ♀, V-23-42 (C.I.S.); 2 ♂, ♀, nesting in *Libocedrus decurrens* V-25-42 (E. G. Linsley, C.I.S.); 2 ♀, V-25-42 (A. J. Walz, C.I.S.); ♂, V-28-42 (W. E. Ferguson); ♂, VI-1-42 (C.I.S.); 2 ♂, ♀, VI-2-42 (C.I.S.); ♂, VI-21-42 (C.I.S.); ♀, VII-12-48 (H.M.G. and D. Townes, K.U.). Fish Camp, 7 mi. N.W., ♀ (C.I.S.). Glacier Point, Yosemite National Park, 9 mi. W., ♀, VIII-18-42 (S. C. Jones, O.S.C.). Grape Flat, Yosemite Valley, ♀, VIII-2-30 (E. C. Zimmerman, C.A.S.). Little Yosemite, ♂, VIII-1906 (H. E. Burke, U.S.N.M.). Mariposa, 6 ♂, IV-10-51 (R. P. Allen, C.I.S.). Mariposa Grove, ♀, VII-27-46 (H. P. Chandler, C.I.S.). Miami Ranger Station, ♂, V-16-42 (E. G. Linsley, U.C.R.); ♂, V-18-42, flowers *Arctostaphylos* (C.I.S.); 2 ♂, V-21-42 (C. I.S., U.C.D.); 8 ♀, V-22-42 (A. J. Walz, C.I.S., U.C.R.); 2 ♀, V-23-42 (E. G. Linsley, C.I.S.). Sand Flat, Yosemite National Park, ♀, VI-29-30 (D. W. Clancy, U.C.R.). Yosemite National Park, ♂, V-21-21 (C.I.S.); 2 ♂, VI-1926 (E. O. Essig, C.I.S.); ♂, V-28-28 (F. A. Hadden, C.I.S.); ♂, V-30-28 (F. A. Harris, C.I.S.); ♂, ♀, VII-27-28 (W. D. Edmonston, C.I.S.); 2 ♂, V-16-31 (D. W. Clancy, C.I.S.); ♂, V-30-31 (C.I.S.); ♂, VI-11-31 (D. W. Clancy, U.C.R.) 6 ♂, VI-12-31 (E. O. Essig, C.I.S.); ♀, VII-10-32 (R. H. Beamer, K.U.); 3 ♂, V-25-38 (N. F. Hardman, C.I.S.); ♀, VI-20-38 (C.I.S.); 2 ♂, 2 ♀, VIII-12-46 (R. O. Schuster, (C.I.S.). Yosemite, 3,880-4,000 ft., ♂, VI-9-31 (E. G. Linsley, G.E.B.); ♂, V-25-38 (C.I.S.); 4 ♂, V-25-39 (N. F. Hardman, C.I.S.); 3 ♂, 6 ♀, VIII-21-46 (B. Adelson). Yosemite Valley, ♂, 4 ♀, VII-3-15, flowers *Penstemon breviflorus* (L.S. Jr. U.); ♂, V-26-21, 2 ♂, VI-10-21 (E. C. Van Dyke, C.A.S.); 3 ♀, VII-1-19 (A.M.N.H.); ♂, 2 ♀, VI-27-26 (P. H. Timberlake, U.C.R.); ♂, VI-21-02 (A.N.S.P.); ♂, ♀, VII-20-05 (J. McFarland, A.N.S.P.).

Modoc Co.: Davis Creek, 2 ♀, VII-15-23 (J. E. Cottle, C.A.S.). Eagle Lake, ♀, VII-8-34 (J. T. Howell, C.A.S.). Fandango Pass, ♂, VII-10-48, flowers *Asclepias* (P. D. Hurd, Jr., and R. F. Smith, C.I.S.); ♂, VII-6-50 (U.C.D.). Goose Lake, ♀, VII-23-22 (C. L. Fox, C.A.S.).

Napa Co.: Calistoga, ♀, III-28-26 (C.I.S.). St. Helena, ♀, V-3-46 (T. O. Thatcher, C.I.S.); ♀, IX-11-48, flowers *Solidago* (P. D. Hurd, Jr., C.I.S.).

Nevada Co.: Truckee, ♂, June (C.A.S.). Bear Valley, ♀, VIII-3-51 (N. A. Lewis, S.J.S.).

Placer Co.: Alta, ♀, VI-25-33 (G. E. Bohart, G.E.B.); 2 ♂, ♀, VI-15-51 (E. I. Schlinger, U.C.D.). Cisco, ♀, VI-1920 (H. E. Ricksecker, C.A.S.). Dutch Flat, ♀, VII-1940 (J. Tomich, C.I.S.). Emigrant Gap, 2 ♂, VI-1930 (K.U.). Green Valley, 2 ♀, V-30-49 (H. A. Hunt, U.C.D.).

Plumas Co.: Bucks Lake, ♀, VII-14-49 (E. L. Atkinson, C.I.S.); ♀, same data (R. C. Bechtel, U.C.D.); 2 ♀, same data (E. O. Essig, C.I.S.); ♀, same data (W. W. Middlekauff, C.I.S.); 6 ♀, same data (J. N. Simons, C.I.S.); ♂, 19 ♀, same data (R. L. Sisson, C.I.S.). Greenville, ♀, VIII-1-52 (W. C. Bentinck, C.I.S.). Keddie, ♂, ♀, V-7-18 (A.M.N.H.); 2 ♂, VI-15-40 (T. G. H. Aitken and M. A. Cazier, A.M.N.H.). Lake Almanor, ♀, VII-8-49 (E. L. Atkinson, C.I.S.); ♂, ♀, same data (R. L. Sisson, C.I.S.). Meadow Valley, ♀, VI-20-24 (C.I.S.); ♂, VI-24-24 (C.I.S.). Meadow Valley, 3,500-4,000 ft., ♀, VI-13-24 (E. C. Van Dyke, C.A.S.); ♂, VI-21-24 (E. C. Van Dyke, C.A.S.). Meadow Valley, ♀, VI-30-24, 2 ♀, VII-3-24, ♀, VIII-8-24 (E. C. Van Dyke, C.A.S.). Meadow Valley, 6,000-7,000 ft., 2 ♂, VI-21-24 (E. C. Van Dyke, C.A.S.). Onion Valley, 8 ♀, VII-7-49 (W. F. Ehrhardt, U.C.D.); ♀, same data (F. Morishita, C.I.S.); ♂, same data (E. I. Schlinger, U.C.D.). Quincy, 4 mi. W., ♂, VI-21-49 (P. D. Hurd, Jr., C.I.S.); ♂, VI-22-49 (P. D. Hurd, Jr.); ♂, same data (R. L. Sisson, C.I.S.); ♂, VI-24-49 (R. C. Bechtel, U.C.D.); ♀, VI-25-49 (J. W. MacSwain, C.I.S.); ♂, VI-25-49 (R. L. Sisson, C.I.S.); ♂, same data (C. I. Smith, C.I.S.); ♀, VI-29-49 (J. W. MacSwain, C.I.S.); ♀, VI-30-49 (R. C. Bechtel, U.C.D.); ♂, same data (F. Morishita, C.I.S.); ♂, same data (E. I. Schlinger, U.C.D.); ♀, VII-2-49 (W. H. Wade, C.I.S.); ♀, VII-9-49 (C. I. Smith, C.I.S.); ♀, VII-12-49 (C.I.S.); ♀, VII-19-49 (J. N. Simons, C.I.S.). Tobin, ♀, V-19-49 (J. W. Mac Swain, C.I.S.).

San Benito Co.: Idria, ♀, VI-29-54 (J. D. Lattin, C. D. MacNeill, and J. G. Rozen, C.I.S.).

San Francisco Co.: San Francisco, ♀, (L. E. Ricksecker, A.N.S.P.).

Shasta Co.: Burney, ♂, VI-21-41, flowers *Ranunculus* (C.I.S.). Burney, 5 mi. E., VI-9-41, flowers *Phacelia* (C. W. Anderson, C.I.S.). Castella, ♀, VII-1912 (J. A. Kusche, C.A.S.). Cayton, ♂, 2 ♀, VII-11-18 (E. P. Van Duzee, C.A.S.). Hat Creek, ♂, VI-1-41, flowers *Phacelia* (C. D. Michener, C.I.S.); ♂, VI-1-41 (K.U.); 6 ♂, VI-11-41, flowers *Phacelia* (C. W. Anderson, C.I.S.). Hat Creek, 3 mi. N., ♂, VI-5-41, flowers *Phacelia* (C.I.S.). Lake Eiler, ♂, VII-9-47 (R. L. Usinger, C.I.S.). Mt. Lassen, 7,500 ft., ♂, VII-18-49 (E. L. Atkinson, C.I.S.). Viola, ♂, V-20-41 (C.I.S.). Upper Soda Springs, ♀, July (Behrens, A.N.S.P.).

Sierra Co.: Gold Lake, ♀, VI-18-21, 5 ♀, VII-12-21, ♀, VII-16-21, ♂, VII-19-21 (C. L. Fox, C.A.S.). Goodyear Creek, ♀, VII-10-26 (E. H. Nast, C.A.S.).

Siskiyou Co.: Ft. Jones, 9 ♀, V-22-27, ex dead fire scar in live *Libocedrus decurrens* (L. H. Weld, U.S.N.M.). Mt. Shasta District, ♂ (A.M.N.H.). Sawyers Bar, 2 ♂, VI-1937, flowers *Epigonia* (T. D. A. Cockerell, C.A.S.). Shasta Springs, 5 ♂, 2 ♀, VII-1914 (C. L. Fox, C.A.S.); ♀, VI-9-20 (C. L. Fox, C.A.S.). Sisson, 2 ♀, VIII-14-08 (J. C. Bradley, C.U.); ♀, VII-26-18 (E. P. Van Duzee, C.A.S.). Yreka, ♂, ♀, III-25-12, ex nests in *Libocedrus decurrens* (H. E. Burke, U.C.R., U.S.N.M.).

Sonoma Co.: Glen Ellen, 5 ♀, June (J. E. Cottle, C.A.S.).

Trinity Co.: Carrville, 3 ♂, ♀, V-16-34 (G. E. Bohart, G.E.B.); ♂, V-23-34 (B. J. Hall, U.C.R.); 2 ♂, V-23-34, flowers *Aesculus californica* (F. R. Platt, A.M.N.H.); ♂, V-28-34 (E. C. Van Dyke, C.A.S.); 2 ♀, VI-1-34 (B. J. Hall, U.C.R.); ♀, VI-8-34 (B. J. Hall, U.C.R.); ♂, VI-9-34 (B. J. Hall, U.C.R.); 2 ♀, VI-1934 (S. S. Smith, U.C.R.); ♂, VI-29-13 (E. C. Van Dyke, U.C.M.). Eagle Creek, 3 ♂, VII-13-49 (A. T. McClay, U.C.D.). Scott Mountain, 5,358 ft., 2 ♂, VII-14-49 (A. T. McClay, U.C.D.). Trinity Alps Road, 7 ♂, VI-1937 (I. Mc Cracken, C.A.S.).

Tulare Co.: California Hot Springs, 4,000-5,000 ft., 2 ♂, ♀, VI-14-53 (G. D. Butler, U. A.). Chimney Meadow, south fork Kern River, ♀, X-3-35 (F. B. Foley, O.S.C.). Giant Forest, Sequoia National Park, ♀, VII-21 to 26-07 (J. C. Bradley, C.U.); ♀, VIII-22-17 (R. C. Shannon, C.U.); ♀, V-1918, working in *Sequoia gigantea* (J. M. Miller, C.F.R.E.S.); ♀, VIII-20-21, ex *Sequoia gigantea* (J. M. Miller, U.S.N.M.); ♀, VII-28-29 (L. D. Anderson, K.U.); same, but 6,400-7,000 ft., ♂, 9 ♀, VIII-9 to 13-27 (J. C. Bradley, C.U.). Holsted Creek, Sequoia National Park, 4 ♀, VIII-20-43 (S. C. Jones, O.S.C.). Johnsondale, ♀, VI-15-51 (T. F. Leigh, C.I.S.). Lower Dome, Sequoia National Park, ♀, VIII-8-35 (Evans, K.U.). Marble Fork, Kings River Trail, Giant Forest, Sequoia National Park, 3 ♀, VII-24-07 (J. C. Bradley, C.U.). Mineralking, 2 ♀, VII-31-23 (C. L. Fox, C.A.S.). Painter's Place, Sequoia National Park, ♂, VII-29-35 (Evans, K.U.). Porterville, ♂, VII-8-35 (M. A. Cazier, A.M.N.H.). Potwisha, Sequoia National Park, ♂, V-17-29 (E. C. Van Dyke, C.A.S.); ♂, ♀, IV-24-49, ♀, IV-24-51 (R. C. Bechtel, U.C.D.); ♂, VI-14-53 (E. E. Gilbert, C.I.S.); ♀, (E. G. Linsley, G.E.B.). Redwood

Meadows, Sequoia National Park, 2 ♂, VIII-3-23 (C. L. Fox, C.A.S.). Sequoia National Park, 3 ♂, 3 ♀, VI-25-29 (C.I.S.). Three Rivers, ♂, VII-16-07 (J. C. Bradley, C.U.); 2 ♀, V-1918, ex *Libocedrus decurrens* (A. W. Wagoner, U.S.N.M.); 3 ♀, VII-1918, ex *Libocedrus decurrens* (C.F.R.E.S.).

Tuolumne Co.: Columbia, 5 ♀, VI-1917, ♀, VIII-1917 (I. McCracken, L. S. Jr. U.). Cow Creek, ♂, VI-18-51 (C. A. Downing, C.I.S.). Dorst Camp, ♂, 6 ♀, VII-23-49 (L. L. Jensen, C.I.S.). Eleanor Lake, 7 ♂, 5 ♀, VII-2-51 (O. R. Ali, C.I.S.); 2 ♂, same data (P. D. Ashlock, C.I.S.); ♀, same data (P. D. Ashlock, C.I.S.); ♀, same data (C. A. Downing, C.I.S.); 5 ♂, 4 ♀, same data (S. M. Kappos, C.I.S., U.C.D.); 2 ♂, ♀, VII-2-51 (R. W. Morgan, C.I.S.). Hetch Hetchy, ♀, VII-11-29 (C.A.S.); ♀, VII-28-48 (C. A. Downing, U.C.D.). Mather, 5 ♂, 3 ♀, VII-1937 (W. E. Ferguson). Mather (near), ♀, VII-12-29, ♂, VII-10-30, 2 ♂, VII-13-30, ♀, VII-16-30 (E. C. Zimmerman, C.A.S.). Pinecrest, ♂, VIII-2-48, ♀, VII-10-48 (P. H. Arnaud, Jr.); 2 ♀, VIII-4-48 (P. D. Hurd, Jr., and J. W. MacSwain, C.I.S.); ♂, VI-19-51, at burrow in *Libocedrus decurrens* (R. R. Snelling, U.S.N.M.); ♂, VI-19-51, flowers *Lupinus* (R. R. Snelling, U.S.N.M.); ♂, VIII-1 (Johnson, O.S.C.). Sonora, ♀, VI-27 (G. Heid, C.A.S.). Sonora Pass, 10,000-11,000 ft., ♀, VII-11-51 (J. W. MacSwain, C.I.S.). Strawberry, 2 ♂, VI-22-51 (A. T. MacClay, U.C.D.); 3 ♂, 2 ♀, VI-23-51 (R. W. Morgan, C.I.S.); ♂, VI-25-51 (D. P. Lawfer, U.C.D.); 2 ♀, VI-30-51 (D. P. Lawfer, U.C.D.); ♀, VII-1-51 (J. J. Drea); ♀, same data (S. M. Kappos, U.C.D.); ♂, ♀, same data (D. P. Lawfer, U.C.D.); 2 ♂, ♀, same data (R. L. Usinger, C.I.S.); ♀, VII-2-51 (D. P. Lawfer, U.C.D.); ♂, VII-9-51 (C. A. Downing, C.A.S.); ♀, VI-18-53 (J. G. Rozen, C.I.S.). Tuolumne, ♂, V-30-53 (J. G. Rozen, C.I.S.).

Discussion:

This is the common green carpenter bee of the Sierra Nevada and north Coast Ranges of California. It is intimately associated with the distributions of the incense cedar and at least the sierra redwood since these trees apparently are preferred for nesting purposes. Almost certainly this subspecies nests in the coast redwood, but records to substantiate this are lacking.

Xylocopa californica diamesa Hurd

Xylocopa californica diamesa Hurd, 1954, Pan-Pacific Ent., 30:202 ♂, ♀. Type ♂, Crystal Lake, San Gabriel Mountains, Los Angeles County, California (C.A.S.).

Geographic range: California, Lower California (see map 1).

California records:

Kern Co.: Ft. Tejon, 3 ♂, ♀, V-14-28, flowers *Asclepias* (E. C. Van Dyke, C.A.S.). Glennville, ♂, 2 ♀, VII-10-51 (T. R. Haig, C.I.S.). Kernville, ♀, VII-24-40 (D. E. Hardy, K.U.). Tehachapi, ♂, VII-10-26 (C.I.S.).

Los Angeles Co.: Altadena near Mt. Wilson, 2,400 ft., 5 ♀, VII-28-97 (A. P. Morse, M.C.Z.). Arroyo Seco, San Gabriel Mountains, ♂, VII-6-12 (F. Grinnell, Jr., M.C.Z.). Big Pines, ♂, VI-16-28, flowers *Asclepias* (P. H. Timberlake, U.C.R.); ♀, VIII-27-42 (S. C. Jones, O.S.C.). Big Pines Camp, 2 ♀, VII-16-27, ♀, VI-16-28 (P. H. Timberlake, U.C.R.). Camp Baldy, 3 ♀, VII-4-28 (F. B. Foley, O.S.C.); ♂, ♀, VI-26-50, flowers *Fremontia* (P. D. Hurd, Jr., C.I.S.); ♀, VII-11-50 (H. L. Hansen, C.I.S.); ♀, same data (P. D. Hurd, Jr., C.I.S.); ♀, same data (J. D. Paschke, C.I.S.). Claremont, ♂ (C.U.); 3 ♂, ♀ (Metz, A.M.N.H.); 4 ♂ (A.M.N.H.); ♂ (Baker, U.C.R.). Claremont (Palmer Canyon), ♂ (M. H. Hatch, U.M.). Crystal Lake, ♀, VII-7-34 (C. D. Michener, K.U.); ♂, VII-7-34, flowers *Asclepias* (C. D. Michener, K.U.); ♀, VI-28-50 (W. A. MacDonald, U.C.L.A.); 2 ♀, VI-29-50 (W. C. Bentinck, C.I.S., G.E.B.); ♂, ♀, same data (J. W. MacSwain, C.I.S.); ♀, same data (A. T. McClay, U.C.D.); ♀, same data (M. J. Stebbins, U.C.D.); ♀, same data (H. N. Yokoyama, U.C.D.); 4 ♀, VII-9-52 (R. L. Anderson, U.C.D.); ♀, same data (R. M. Bohart, C.I.S.); 2 ♀, same data (E. M. Evans, U.C.D.); 3 ♀, same data (A. Gregarick, U.C.D.); ♂, 2 ♀, same data (C.A.S., C.I.S.); 2 ♀, same data (H. L. Mathis, U.C.D.); 2 ♀, same data (S. Miyagawa, C.I.S.); 2 ♀, same data (A. T. Mac Clay, U.C.D.); 4 ♀, same data (J. H. Nakata, U. C.D.). Laurel Canyon, Santa Monica Mountains, ♀, VII-1918 (J. C. Bridwell, U.S.N.M.). Little Rock, ♂, IV-10-36 (G. E. Bohart, G.E.B.). Lone Pine Canyon, San Gabriel Mountains, ♀, VII-21-36, flowers *Stanleya pinnata* (P. H. Timberlake, U.C. R.). Monrovia, ♀, VII-17-13 (I. Wilson, K.U.). Neenach (near), 2 ♀, IV-9-39 (I. Wilson, K.U., U.C.L.A.). Palmdale, ♂, X-15-36 (E. G. Linsley, C.I.S.). Pasadena, ♀, VI-3-93, ♀, VI-5-95, ♀, VI-6-95 (R. W. Doane, L.S.Jr. U., W.S.C.); ♀, VII-18-99 (C.U.). Swartout Valley, ♀, 1928 (M. Foreland, U.M.S.P.). Tanbark Flat, San Dimas Experimental Forest, San Gabriel Mountains, ♀, VII-3-50 (H. M. Graham, C.I.S.). Venice, 2 ♀, V-12 to 21-13 (H. H. Newcomb, M.C.Z.). Voltaire, ♂, IX-5-23 (J. D. Grundel, C.A.S.). West Hollywood Hills, 2 ♂, VI-25-50 (R. G. Howell, C.I.S.). Wrightwood, 8 ♂,

VI-29-52 (R. H. and L. D. Beamer, W. LaBerge, A. Wolf, C. Liang, C. Weiner, K.U.).

Monterey Co.: Tassajara Hot Springs, ♂, V-24-20 (L. S. Slevin, C.A.S.).

Riverside Co.: Anza, 20 mi. S.E., ♂, IX-15-49 (R. P. Allen, C.I.S.). Banning, ♀, V-28-28 (E. C. Van Dyke, C.A.S.); ♀, VII-16-50 (H. L. Hansen, C.I.S.). Banning Canyon, ♂, VII-16-50 (J. C. Hall, U.C.D.); ♂, V-19-51 (R. C. Bechtel, U.C.D.). Banning-Idyllwild Road, 2 ♀ (P. H. Timberlake, U.C.R.). Beaumont, ex nest in *Yucca whipplei* ♂, ♀, (T. D. A. Cockerell, U.C.M.). Dutch Flat, San Jacinto Mountains, ♂, VIII-13-34, flowers *Stachys* (C. D. Michener, K.U.). Hemet Valley, San Jacinto Mountains, 2 ♂, VIII-15-34, flowers *Asclepias mexicana* (C. D. Michener, K.U.). Herkey Creek, San Jacinto Mountains, ♂, VI-20-40 (C. G. Lewis, C.I.S.). Idyllwild, ♂, VII-3-30 (P. H. Timberlake, U.C.R.); ♀, VIII-3-35 (E. I. Beamer, K.U.); ♀, same data (J. Russell, K.U.); ♂, VI-26-36 (G. E. Bohart, G.E.B.); ♂, VI-1936 (E. S. Ross, C.A.S.); ♂, VI-26-38 (M. A. Cazier, C.I.S.); ♂, V-25-39 (J. H. Dorman, C.I.S.); 2 ♂, VI-1-39 (B. Brookman, C.I.S.); 2 ♂, VI-4-39 (E. S. Ross, C.I.S.); ♂, V-2-40 (H. T. Reynolds, C.I.S.); ♂, V-29-40, flowers *Asclepias* (C.I.S.); 2 ♂, VI-9-40, *Penstemon* (C.I.S.); 4 ♂, VI-17-40, flowers *Dicentra* (C.I.S.); ♂, V-29-50, flowers *Asclepias* (D. J. Raski, C.I.S.); 3 ♂, VII-5-50 (B. Adelson); ♂, ♀, VIII-6-50, flowers *Asclepias* (J. C. Hall, U.C.D.); ♀, VII-6-50 (R. O. Schuster, C.I.S.); ♂, VII-2-52 (A. R. Maggenti, C.I.S.). Idyllwild Inn, ♀, VI-21-37 (C. D. Duncan, S.J.S.). Keen Camp, San Jacinto Mountains, ♀, VI-1-39, flowers *Penstemon* (B. Brookman, C.I.S.); 3 ♂, VI-10-39, flowers *Penstemon* (R. F. Smith, C.I.S.); ♀, VII-29-46, flowers *Asclepias* (W. F. Barr, C.I.S.). Keen Camp, 8 mi. W., ♂, VI-1-39 (E. S. Ross, C.I.S.). Marion Mountain Camp, San Jacinto Mountains, ♀, VII-1-52 (W. V. Garner, C.I.S.). Mt. Thomas, 4 mi. W. Anza, ♂, VI-26-36 (W. P. Medlar, S.D.M.N.H.). Pine Cove, San Jacinto Mountains, ♂, VI-4-39, flowers *Ceanothus* (E. S. Ross, C.I.S.). Ribbonwood, San Jacinto Mountains, ♂, V-21-40, flowers *Penstemon* (C. D. Michener, C.I.S.), Riverside, ♀, VII-21-36 (A. E. Pritchard, U.M.S.P.). San Jacinto Mountains, 2 ♀, VII-21-29 (R. H. Beamer, K.U.); ♀, same data (L. D. Anderson, K.U.); 4 ♂ same data (P. W. Oman, K.U.); 3 ♂, ♀, VI-2-40 (C.I.S.). Santa Rosa Mountains, 6,400 ft., ♂, ♀, VI-1-40, flowers *Lupinus* (C.I.S.); same, but 7,500 ft., ♀, VI-17-40 (C.I.S.). Whitewater, ♀, VIII-17-27 (C.U.); ♂, ♀, IX-24-33 (C. M. Dammers, U.C.R.); 2 ♂, III-14-34 (C. M. Dammers, U.C.R.); ♂, VII-9-50 (E. G. Linsley, C.I.S.).

San Bernardino Co.: Barton Flats, San Bernardino Mountains, ♂, IX-8-46 (N. Crickmer, K.U.). Big Bear Dam, San Bernardino Mountains, ♀, VII-6-34 (P. H. Timberlake, U.C.R.). Big Bear Lake, ♀, VII-26-32 (R. H. Beamer, K.U.); same but 5 mi. S., ♂, VII-6-34, flowers yellow *Dicentra* (I. Mc Cracken, C.A.S.). Big Bear Lake Road, ♂, 4 ♀, VII-9-34 (I. McCracken, C.A.S.). Big Bear Valley, ♀, VIII-9-33, flowers *Penstemon* (P. H. Timberlake, U.C.R.); ♂, VI-10-33 (C. M. Dammers, U.C.R.); ♀, VII-9-33 (P. H. Timberlake, U.C.R.); ♀, VII-4-38, 2 ♀, VII-8-34 (P. H. Timberlake, U.C.R.). Camp Baldy, ♂, VII-7-52 (A. R. Maggenti, C.I.S.). Cajon Pass, ♂, VII-2-34, flowers *Stanleya pinnata* (I. Mc Cracken, C.A.S.); ♂, VI-26-49 (L. W. Isaak, U.C.D.). Cushenbury Springs, 2 ♀, VIII-19-32 (C. D. Michener, K.U.). Forest Home, San Bernardino Mountains, ♀, VI-16-28, ♀, VI-18-28, ♂, VI-19-28 (E. C. Van Dyke, C.A.S.); 8 ♂, 5 ♀, IV-1932 (Bollinger, U.C.R.); ♂, 2 ♀, V-18-34, flowers *Lupinus* (P. H. Timberlake, U.C.R.). Gold Mountain, San Bernardino Mountains, ♀, VII-4-35, flowers *Lupinus latifolius* var. *parishii* (P. H. Timberlake, U.C.R.). Lake Arrowhead Toll Road, 2 ♂, VII-25-32 (R. P. Allen, C.A.S.). Little Bear, ♀, VIII-1919 (C.I.S.). Lytle Creek, ♂, V-7-28, ♂, VI-6-28 (E. C. Van Dyke, C.A.S.). Mill Creek, San Bernardino Mountains, ♂, IX-29-46 (G. H. and J. L. Sperry, K.U.); 4 ♂, IX-19-37, some on flowers *Chrysothamnus* (P. H. Timberlake, U.C.R.). Mohave River (West Fork) ♀, X-17-37 (E. G. Anderson, U.M.S.P.) Morongo, IX-14 (E. D. A. Cockerell, U.C.M.). Morongo Valley, ♂, IV-19-51 (E. J. Taylor, U.C.D.). Mountain Home, San Bernardino Mountains, 2 ♂, IX-12-53 (E. I. Schlinger, U.C.D.). Ontario, ♂, III-14-32 (U.C.R.). Redlands, 2 ♂ (F. R. Cole, U.S.N.M.). San Bernardino Mountains, ♀ (C. C. Zeus, U.S.N.M.). Seeley Hills, ♂, ♀, VII-8-17 (H. Klotz, L.S.Jr.U.). Santa Ana River (upper), ♂, ♀, IX-29-46 ex nest in *Yucca whipplei* (G. H. & J. L. Sperry, K.U.). Seven Oaks, San Bernardino Mountains, V-1-36 (C.I.S.). Strawberry Flats, San Bernardino Mountains, ♂, VII-13-17 (R. May, L.S.Jr.U.). Valley of the Falls, San Bernardino Mountains, ♀, VII-28-34 (P. H. Timberlake, U.C.R.).

San Diego Co.: Cuyamaca, 4 ♂, X-10-40, flowers *Applopappus parishii* (C. F. Harbison, S.D.M.N.H.). Cuyamaca Lake, ♂, ♀, VII-7- to 14-19 (A.M.N.H.). Cuyamaca Mountains, ♀, VI-10 to 12-20 (S.D.M.N.H.); 3 ♂, VI-8- to 14-20 (S.D.M.N.H.). Del Mar, ♀, VIII-15-17 (J. Bequaert, M.C.Z.). Descanso, ♀, VIII-14-17 (J. Bequaert, M.C.Z.). Dulzura, 4 ♂, III-23 to 25-17 (A.M.N.H.). Jacumba, ♀, VIII-12-17 (J. Bequaert, M.C.Z.). Laguna Mountains, ♂, VI-29-21 (S.D.M.N.H.). Mt. Laguna, 8 ♂, 2 ♀, VII-16-50

(D. Cox. C.I.S.). Mt. Palomar, VI-19-50 (F. X. Williams, C.A.S.). San Diego, 6 ♂, (S.D.M.N.H.). San Felipe Valley, 2 ♂, ♀, VI-24-28-20 (S.D.M.N. H.). Warner Springs, 6 ♂, ♀, V-7-38 (W. P. Medlar, S.D.M.N.H.); 3 ♂, IV-19-50 (J. W. MacSwain, C.I.S.). Warner's, VIII-1915 (W. S. Wright, A.M.N.H.); 4 ♀, VIII-14-17 (M. Wheeler, M.C.Z.); 2 ♂, VI-1921 (S.D.M.N.H.); 3 ♂, VII-1919 (G. H. Field, S.D.M. N.H.).

Santa Barbara Co.: Santa Barbara, ♂, VII-7-07 (J. S. Hine, O.S.U.).

Ventura Co.: Mt. Pinos, 9 ♀, VII-26-31 (I. Wilson, K.U., U.C.L.A.). Santa Paula, ♀ (C.U.). Sespe Canyon, ♂, V-13-34 (E. G. Anderson, U.M.S.P.). Ventura, 34 mi. N., ♂, ♀, VI-21-52 (R. H. and L. D. Beamer, A. Wolf, C. Liang, C. Weiner, and W. La Berge, K.U.).

Discussion:

This subspecies is the common bluish carpenter bee of the mountainous regions of the southern and central coast areas of cismontane California. The wings are much paler than the subspecies *arizonensis*, but darker than *californica* proper. The integument, though predominantly blue in color, may often show varying degrees of greenish reflections. As the name implies, *diamesa* is intermediate in its characters between the subspecies *californica* proper and *arizonensis*. For details see Hurd (1954:199).

Xylocopa virginica (Linnaeus)

Apis virginica Linnaeus, 1771. Syst. Nat. Appendices Zool. (issued as appendix to Mant. Plant. II), p. 540.

Geographic range: Maine to Florida westward to Nebraska and Texas (see map 1).

Discussion:

Xylocopa virginica is widely distributed over the eastern United States. It has been recorded from Cuba, but during the course of the present study no material has been seen from there.

The species is divisible into two subspecies and may be separated by the following key.

Key to the Subspecies of *Xylocopa virginica* (Linnaeus)

1. Metasoma predominantly green (often with blue) in color; fourth metasomal tergum of male with a medially interrupted subapical fringe of whitish hairs . . . . . *texana* (p. 51)
   Metasoma largely black; fourth metasomal tergum of male without a medially interrupted subapical fringe of whitish hairs. . . . . *virginica* (p. 50)

Xylocopa virginica virginica (Linnaeus)

Apis virginica Linnaeus, 1771, Syst. Nat. Appendices Zool. (issued as appendix to Mant. Plant. II), p. 540. Type ♀. Habitat in Virginia.

Synonyms: *Apis virginica* Drury, *A. griseo-collis* Degeer, and *Centris carolina* Fabricius.

Geographic range: Maine to Florida westward to Nebraska and Texas (see map 1).

Discussion:

This is the common carpenter bee of the eastern United States. It ranges southward into the Gulf states where it occurs with *X. micans*. In the southwestern part of its range (see map 1) it is geographically replaced by the subspecies *texana*.

It visits a wide variety of flowers and has been reported in Massachusetts as puncturing some flowers in order to gain ready access to the nectar.

In Kansas it has been taken on flowers of *Pedicularis canadensis* and *Ceanothus ovatus;* in Louisiana on flowers of *Cyrella racemiflora;* in Maine on blossoms of *Barbarea barbarea, Phlox divaricata, Trifolium incarnatum,* and *Vaccinium vacillans;* in New Jersey on flowers of *Eupatorium perfoliatum;* in New York on flowers of *Asclepias* and *Solidago canadensis;* in Texas on flowers of *Monarda;* in Virginia on flowers of *Asclepias* and *Sassafras.*

This bee constructs its nests in a number of different types of wood. Reference should be made to the works of Rau, especially that of 1933. Specimens in the collection of the U.S. National Museum from Veitch, Virginia, are labeled as having been reared from *Pinus strobus* and those from Falls Church, Virginia, were reared from *Pinus virginiana.*

Ackerman (1916:216) discusses the name of this species: "Drury described and figured this species (Ill. Nat. Hist., I, p. 96, Pl. 43, f. 1, male, 1770) without a name in 1770. During the following year (Mant. Plant. II) Linneaus gave the name *Apis virginica* to this insect. Drury (Ill. Nat. Hist. II, 1773) furnished an appendix of names covering his descriptions in Volumes I and II. In 1806 Illiger placed this species in the genus *Xylocopa* . . ."

Xylocopa virginica texana Cresson, new status

Xylocopa texana Cresson, 1872, Trans. Amer. Ent. Soc., 4:283, ♂, ♀, Type ?, Texas (A.N.S.P.).
Geographic range: Kansas, Oklahoma, and Texas (see map 1).
Discussion:

A critical morphological study of this form has demonstrated that the characters separating *texana* from *virginica* are of subspecies magnitude. Moreover, an analysis of the distributions (see map 1) favors this interpretation.

Perhaps the most striking differences are the color of the integument and the presence in the male of pale pilosity on the abdomen. The genitalia of the males of *virginica* and *texana* are virtually identical, though there are suggestions of incipient differences. However, when all the differences separating these forms are viewed with reference to the degree of differences exist-between the other species of the genus, it is apparent that *texana* and *virginica* have not attained the evolutionary level of "species."

Xylocopa tabaniformis Smith

Xylocopa tabaniformis Smith, 1854, Cat. Hymen. Insects, Brit. Museum, Part II, p. 362. Type ♀, Mexico [British Museum (Natural History).]
Geographic range: Arizona, California, Nevada, New Mexico, Oregon, Texas, Utah, and southward into South America (see map 2).
Discussion:

This species is about the size of our larger *Anthophora* and is the smallest of the *Xylocopa* occurring in America north of Mexico. It is the only species in which the male has the posterior margin of the last metasomal tergum produced into a pair of well-separated acute teeth. The species was originally described from Oaxaca, Mexico. *X. tabaniformis* is apparently divisible into a number of geographically segregable populations on the basis of colorational differences. These differences are principally evident in the nature and extent of pale pilosity on the head, thorax, and abdomen. Several Mexican forms which have been considered as species or varieties are most probably subspecies of *Xylocopa tabaniformis*. However, a critical study of this complex must await the acquisition of larger population samples.

A detailed study of *androleuca, orpifex,* and *parkinsoniae* has revealed that all are virtually identical in structure. The morphological differences existing among them are chiefly those resident in the nature, placement, and amounts of pale pilosity. There are, however, indications of incipient change, but when these are contrasted with the differences existing among the other forms regarded as species in the genus, a subspecies interpretation best represents the situation and they are so treated here. Moreover, in their distribution these forms geographically replace one another, thus tending to confirm the morphological interpretation.

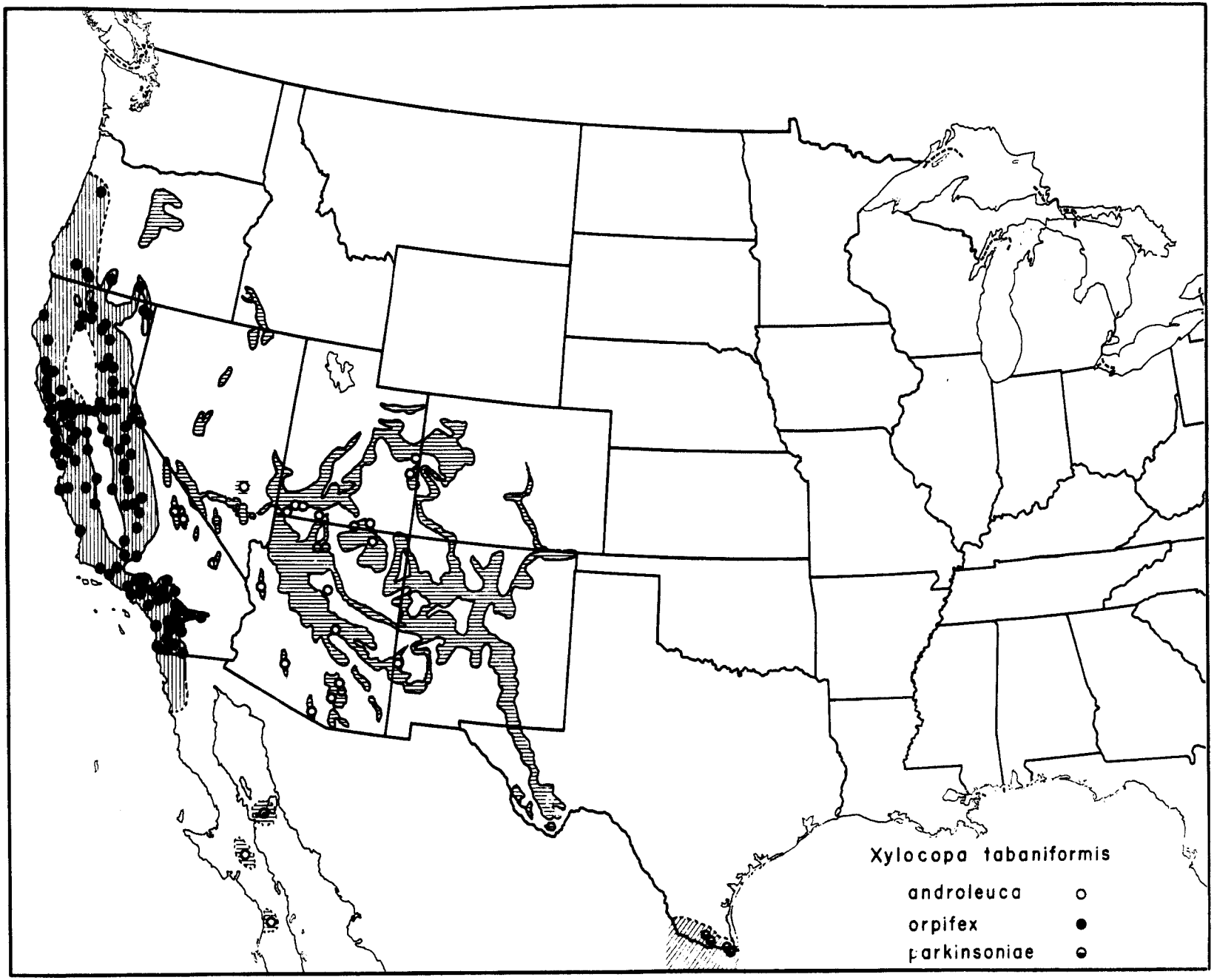
Key to the Subspecies of *Xylocopa tabaniformis* Occurring in America North of Mexico

1. Males 2
   Females 4

2(1). Fourth metasomal tergum with medially interrupted subapical fringe of pale hairs, often present also on metasomal terga 2-6 3
   Metasoma entirely black pubescent (Pacific slope of California and Oregon) . *orpifex* (p. 53)

3(2). Metasomal terga 2-6 with medially interrupted subapical fringe of pale cream-colored hairs (southeastern Texas) . . . . . *parkinsoniae* (p. 53)
   Metasomal terga 4-5 with medially interrupted subapical fringe of whitish hairs (southern Great Basin, Arizona, and New Mexico) . . . . . *androleuca* (p. 58)

4(1). Metasomal terga 2-5 with medially interrupted subapical fringe of cream-colored hairs (southeastern Texas) . . . . . *parkinsoniae* (p. 53)
   Metasoma entirely black pubescent . . . . . *androleuca* (p. 58), *orpifex* (p. 53)



Map 2. Distribution of *Xylocopa tabaniformis* Smith.

Xylocopa tabaniformis parkinsoniae Cockerell

Xylocopa tabaniformis parkinsoniae Cockerell, 1917, Jour. N.Y. Ent. Soc., 25:192, ♀. Type ♀, San Benito, Texas, flowers *Parkinsonia aculeata* (U.C.R.).

Geographic range: Texas, Mexico (see map 2).

Discussion:

This subspecies is perhaps best recognized by the lateral cream-colored fringes of the metasomal terga. The vestiture of the head, especially that of the cheeks, and of the thorax is more nearly black than that of *tabaniformis* proper.

The subspecies *parkinsoniae* is at present known from but four or five localities in the extreme southeastern part of Texas. Apart from the type collection which was made on flowers of *Parkinsonia aculeata,* the only other known floral record is for a female collected on flowers of *Verbesina encelioides* at Brownsville.

Xylocopa tabaniformis orpifex Smith, new status

Xylocopa orpifex Smith, 1874, Trans. Ent. Soc. London, p. 298, ♂, ♀. Type ♀, California. [British Museum (Natural History).]

Geographic Range: California, Mexico (Lower California), and Oregon (see map 2).

California records:

Alameda Co.: Livermore Mountains, 2 ♂, V-2-36 (A.M.N.H.). Mission San Jose, ♂, VI-13-15, ♂, VI-20-15 (C. L. Fox. C.A.S.).

Alpine Co.: Alpine, ♀, VII-6-29 (P. W. Oman, K.U.). Woodfords, ♀, VI-1-50 (K. W. Tucker, U.C.D.).

Calaveras Co.: Mokelumne Hill, ♂, ♀, VII-28-21 (F. E. Blaisdell, C.A.S.). Murphys, ♂, V-7-41, 2 ♂, ♀, IV-30-46 (F. E. Blaisdell, C.A.S.).

Contra Costa Co.: Antioch, ♂, IV-11-36 (A.M. N.H.). Clayton, ♂, IV-23-49 (R. F. Smith, C.I.S.). Mt. Diablo, ♀, VII-8-41 (C. W. Anderson, C.I.S.); ♀, IX-6-48 (C. D. MacNeill, C.I.S.); ♀, VII-30-50 (C. D. MacNeill, C.I.S.); 2 ♂, V-11-52 (E. I. Schlinger, U.C.D.); ♂, VII-14-52 (F. X. Williams, C.A.S.). Pittsburg, ♀, VII-20-41 (C.I.S.). Tassajara, ♀, VIII-15-39 (G. E. Bohart, G.E.B.).

Eldorado Co.: Camino, 3 mi. S., 4 ♀, VI-26-48 (C. Chan, C.I.S.; U.C.D.); ♀, VI-23-48 (L. W. Quate, C.I.S.); ♀, VI-23-48 (S. A. Sher, C.I.S.). Placerville, 2 ♂, ♀, II-13-14, ex *Alnus rhombifolia* (F. B. Herbert, C.F.R.E.S., C.I.S.); ♀, V-3-54 ex incense-cedar timber under house (E. Swift, C.I.S.). Pollock Pines, ♀, VI-27-48 (S. A. Sher, C.I.S.). Snowline Camp, ♂, VI-19-48, flowers *Vicia* (P. D. Hurd, Jr., C.I.S.); ♂, VI-19-48 (J. W. MacSwain, C.I.S.); 2 ♀, VI-20-48 (P. D. Hurd, Jr., C.I.S.); ♂, 2 ♀, same data (J. W. MacSwain, C.I.S.); (gynandromorph), same data (J. W. MacSwain, C.I.S.); ♀, VI-29-48 (S. A. Sher, C.I.S.); ♀, VI-22-48 (L. W. Quate, C.I.S.); ♀, VI-24-48 (O. E. Myers, C.I.S.); ♀, VI-25-48 (P. D. Hurd, Jr., C.I.S.); ♂, ♀, VI-27-48 (C. Chan, U.C.D.); ♀, VI-27-48, flowers *Phacelia* (P. D. Hurd, Jr., C.I.S.); 2 ♀, VI-29-48 (K. W. Tucker, C.I.S.); ♀, VII-7-48 (P. D. Hurd, Jr., C.I.S.); ♀, same data (J. W. MacSwain, C.I.S.); 2 ♀, VII-22-48 (J. W. MacSwain, C.I.S.).

Fresno Co.: Auberry, 6 ♂, IV-13-49 (R. Craig, C.I.S.). Coalinga, ♂, VI-1 to 3-07 (J. C. Bradley, C.U.). Fresno, ♀ (C. D. Duncan, S.J.S.). Kings Canyon, ♂, ♀, VII-27-47, flowers *Asclepias* (R. v. d. Bosch, C.I.S.). Oxalis, ♀, VIII-13-49, flowers *Medicago sativa* (V. M. Stern, C.I.S.).

Humboldt Co.: Ft. Seward, ♀, V-24-35 (E. O. Essig, C.I.S.); ♂, V-20-38 (H. J. Rayner, G.E.B.).

Kern Co.: Frazier Park, ♂, ♀, V-18-40 (R. M. Bohart, U.C.D.). Kern County Park, ♀, VII-18-46 (F. A. Ehrenford, C.I.S.). Tehachapi (Cockerell, 1904:87). Tejon Canyon, ♂, V-12-27 (E. C. Van Dyke, C.A.S.).

Lake Co.: Anna Springs, 3 ♀, VIII-14-22 (J. E. Cottle, C.A.S.). Lakeport, ♂, V-18-36 (U.C.D.). Laurel Dell, ♀, VIII-2-16 (E. P. Van Duzee, C.A.S.).

Los Angeles Co.: Altadena, ♂, III-16-35, flowers *Lotus scoparius* (C. D. Michener, K.U.); ♂, IV-18-35, flowers *Salvia mellifera* (C. D. Michener, K.U.); ♀, VI-26-35 flowers *Hugelia virgata* (C. D. Michener, K.U.); ♂, I-5-36 (H. M. Rigden) same, but Sunset Ridge, ♂, III-5-39, flowers *Ceanothus crassifolius* (C. D. Michener, K.U.). Angelus Camp, 2 ♀, VI-28-52 (R. H. Beamer, K.U.). Arroyo Seco, San Gabriel Mountains, ♂, VI-17-13 (U.S.N.M.); ♀ (U.S.N.M.). Big Dalton Dam, ♀, VI-27-50 (M. J. Stebbins, U.C.D.). Big Rock Canyon, ♂, VI-22-49 (H. E. Cott, U.C.D.). Big Rock Creek, ♂, IV-25-46, flowers *Phacelia distans* (P. H. Timberlake, U.C. R.). Big Pines Camp, 4 ♀, VII-13-27 (P. H. Timberlake, U.C.R.). Burbank, 11 ♂, 7 ♀, 1934 (R. Dunibace, S.J.S.). Camp Baldy, 3 ♀, VIII-14-29 (E. G. Anderson, U.M.S.P.); 2 ♂, 3 ♀ (1 pair *in copulo*), VI-26-50 (W. C. Bentinck, C.I.S.); 3 ♀, same data (H. L. Hansen, C.I.S.); ♂, 6 ♀, same data (J. D. Paschke, C.I.S.); ♀, same data (M. J. Stebbins, U.C.D.); ♂, ♀, VI-26-50, flowers *Fremontia* (H. N. Yokoyama, U.C.D.); ♀, VI-28-50 (W. A. MacDonald, U.C.L.A.); ♂, ♀, VII-2-50 (R. O. Schuster, C.I.S.); 2 ♀, VII-3-50 (C.I.S.); ♀, VII-11-50 (R. O. Schuster, C.I.S.); 2 ♀, same data (K. G. Whitesell, U.C.D.); ♀, VII-7-52 (R. L.

Anderson, U.C.D.). Claremont, ♂ (C. H. Muzzall, C.A.S.); 15 ♂, 4 ♀ (Metz, A.M.N.H.); ♂ (T. Craig, C.A.S.); ♀, V-14-26 (M. Pijon, C.A.S.); same, but mountains near, 2 ♀ (C. F. Baker, U.C.M., U.C.R.). Claremont (Palmer Canyon), 2 ♂ (C.U.); ♂, 2 ♀ (M. H. Hatch, U.M.). Claremont (San Dimas Canyon), ♀ (C.U.). Crystal Lake, 2 ♂, ♀, VI-29-50 (T. R. Haig, C.I.S.); 2 ♂, same data (J. C. Hall, U.C.D.); 2 ♂ same data (J. W. MacSwain, C.I.S.); 6 ♂, ♀, same data (K. G. Whitesell, C.I.S., U.C.D.); 3 ♀, VII-9-52 (R. L. Anderson, U.C.D.); ♂, 6 ♀, same data (D. E. Barcus, U.C.D.); ♀, same data (E. M. Evans, U.C.D.); ♀, same data (W. V. Garner, C.I.S.); 4 ♀, same data (A. A. Gregarick, C.I.S., U.C.D.); ♀, same data (J. K. Hester, C.I.S.); ♂, 8 ♀ same data (Joan Linsley, C.I.S.); 2 ♀, same data (A. T. MacClay, C.I.S.); 5 ♀, same data (H. L. Mathis, U.C.D.); ♀, same data (S. Miyagawa, U.C.D.); 2 ♀, same data (J. H. Nakata, U.C.D.). Fern Canyon, San Gabriel Mountains, 2 ♂, XII-1925 (T. Craig, C.A.S.). Griffith Park, Los Angeles, ♀, IV-16-36 (E. Harold, U.C.L.A.). Hollywood, ♀, VI-10-28, flowers sweet pea (A. T. MacClay, C.I.S.). La Crescenta, ♂, IV-19-36, flowers *Eriodictyon* (E. G. Linsley, C.I.S.); ♂, IV-20-35 (C. D. Michener, K.U.). Los Angeles, ♀, VIII-14-16, ♀, VI-9-17, 3 ♀, V-11-48 (R. May, L.S.Jr.U.). Monrovia Canyon, San Gabriel Mountains, ♂, 4 ♀, V-11-30, ♀, V-18-30, ♀, VII-12-30, ♀, VII-18-30, ♀, VII-21-30, and ♀, VII-26-30 (I. Wilson, U.C.L.A.); 2 ♀, VIII-3-30 (R. H. Painter, and T. F. Winburn, U.M.S.P.). Mt. Baldy, 2 ♀, IX-9-27 (T. Craig, C.A.S.). Mt. Wilson, 2 ♀, IX-14-08 (J. C. Bradley, C.U.). Ontario, ♂, IV-7 (R. Snodgrass, L.S.Jr.U.). Pasadena, ♀, VI-8-95 (R. W. Doane, L.S.Jr.U.); ♀, VII-1-98 (F. Grinnell, Jr., C.U.); ♂, VII-18-06 (F. Grinnell, Jr., C.U.); ♂, III-26-32, flowers pink legume (C. D. Michener, K.U.); ♀, VIII-7-33 (C. D. Michener, K.U.); ♀, IV-20-35 (C. D. Michener, K.U.); ♂, ♀, flowers *Fuchsia* (C. D. Michener, K.U.). Pomona, ♂, VII-10-33 (U.C.R.). Rock Creek, ♀ (Davidson, U.C.M.). San Antonio Canyon, San Gabriel Mountains, 5,300 ft., 3 ♂, VI-20-31 (H. A. Scullen, O.S.C.); same but 6,500 ft., 2 ♀, same data (H. A. Scullen, O.S.C.). San Dimas, ♀, VIII-28-40 (C.I.S.). Santa Monica, ♂, ♀, XI-15 (F. C. Clark, C.A.S.). Tanbark Flat, San Dimas Experimental Forest, ♀, VI-21-50 (K. G. Whitesell, U.C.D.), ♀, VI-22-50 (P. D. Hurd, Jr., C.I.S.); ♂, VI-25-50 (F. X. Williams, C.A.S.); ♂, 2 ♀, VI-27-50 (T. R. Haig, C.I.S.); ♀, same data (F. X. Williams, C.A.S.); ♀, VI-30-50 (P. D. Hurd, Jr., C.I.S.); ♀, same data (F. X. Williams, C.A.S.); 2 ♀, VI-2-50 (H. L. Hansen, C.I.S.); ♂, ♀, VII-7-50 (H. N. Yokoyama, U.C.D.); ♀, VII-11-50 (W. O. Marshall, U.C.D.); 2 ♀, VII-14-50 flowers *Salvia* (M. J. Stebbins, U.C.D.); ♀, VII-2-52 (S. Miyagawa, C.I.S.). Venice, ♀, IV-12 to 21-13 (H. H. Newcomb, M.C.Z.). Voltaire, ♂, ♀, IX-5-23 (J. D. Gunder, C.A.S.). West Hollywood Hills, ♂, V-19-39 (G. F. Smith, A.M.N.H.); 2 ♂, IV-24-50 (R. G. Howell, C.I.S.); ♂, IV-29-50 (R. G. Howell, C.I.S.); ♀, VIII-8-50 (R. G. Howell, C.I.S.). Westwood Hills, ♀, IX-24-30 (I. Wilson, U.C.L.A.). Whittier, ♀, IX-21-23 (A. J. Basinger, U.C.R.); ♀, VII-4-30 (L. C. Pife, U.M.S.P.). Wrightwood, ♂, VI-20-52 (R. H. Beamer, K.U.).

Madera Co.: Bass Lake, ♂, VI-8-42 (C.I.S.). Nippiniwassee, ♂, 7 ♀, VI-1-42 nesting in old incense cedar log (E. G. Linsley, C.I.S., U.C.R.). Oakhurst, ♀, VI-1-42 (E. G. Linsley, C.I.S.); 4 ♂, same data (C.I.S.); ♂, VI-2-42 (C.I.S.); 2 ♀, VI-6-42 (A. J. Walz, C.I.S.); ♂, VI-8-42 (E. G. Linsley, U.C.R.).

Marin Co.: Fairfax, ♂, V-16-17, 2 ♂, V-25-20, 2 ♂, V-22-21, ♂, VI-5-21 (C. L. Fox, C.A.S.). Kentfield, ♂, III-27-53 (H. L. Mathis, U.C.D.). Lagunitas, 2 ♂, V-11-24 (E. P. Van Duzee, C.A.S.). Lake Lagunitas, 2 ♂, IV-28-18 (C. L. Fox, C.A.S.). Mill Valley, ♀, VI-1-49 (F. O. Leech, C.A.S.); VI-11-49 (A. Bartel, C.I.S.). Mt. Tamalpais, 2 ♀, V-20-04 (Thompson, L.S. Jr. U.). Tamalpais, VI-20-26, flowers *Diplacus* (P. H. Timberlake, U.C.R.). Tomales Bay near Marshall, ♂, IV-25-49, flowers *Brassica* (C. I. Smith, C.I.S.). Ross, 2 ♂, IV-28-18 (J. C. Bradley, C.U.).

Mariposa Co.: Bridal Veil Meadow, Yosemite National Park, ♀, X-1894 (J. B. Lembert, U.S.N.M.). El Portal, 3 ♂, V-23-38 (N. F. Hardman, C.I.S.). Harden Lake (near), Yosemite National Park, ♂, VII-20-30 (E. C. Zimmerman, C.A.S.). Pleasant Valley, ♀, V-1915 (L.S.Jr.U.). Sand Flat, Yosemite National Park, ♂, VI-7-30 (D. W. Clancy, U.C.R.). Yosemite, 3,880-4,000 ft., ♂, VI-25-26, flowers *Penstemon* (P. H. Timberlake, U.C.R.); ♀, V-17-28 (E. O. Essig, C.I.S.); ♂, VI-26-28 (E. O. Essig, C.I.S.); ♂, V-25-28 (N. F. Hardman, C.I.S.); ♀, VIII-21-46 (B. Adelson). Yosemite Valley, ♀, VIII-3-19 (A.M.N.H.); ♀, VI-3-21 (E. C. Van Dyke, C.A.S.); ♀, VI-21-21 (E. C. Van Dyke, C.A.S.); ♂, VI-30-21 (E. C. Van Dyke, C.A.S.); ♀, VII-19-29 (E. C. Zimmerman, C.A.S.); ♀, VI-27-36 (P. H. Timberlake, U.C.R.); ♂ (A.N.S.P.).

Mendocino Co.: Potter Valley, ♀ (W. C. Bentinck). Ryan Creek, 4 ♂, 2 ♀, IV-17-38 (N. F. Hardman, C.I.S.); ♀, IV-13-41 (C.I.S.); ♀, VII-7-46 (R. Craig, C.I.S.); ♀, V-30-49 (R. Craig, C.I.S.); 4 ♂, ♀, VI-19-49 (R. Craig, C.I.S.); ♂, III-8-54, ex nest in Douglas fir rafter (P. D. Hurd, Jr., C.I.S.); ♂, 3 ♀, III-8-54, ex nests in redwood siding and roof

sheathing (P. D. Hurd, Jr., C.I.S.); Sherwood, ♂, VII-1-07 (C.U.). Ukiah, 3 mi. S., ♀, VII-6-51 (R. R. Snelling, U.S.N.M.). Willits, ♂, IX-22-50 (W. C. Bentinck, C.I.S.); 3 ♂, 3 ♀, VII-4-52 (W. C. Bentinck. C.I.S.). Yorkville, ♂, V-17-29 (E. P. Van Duzee, C.A.S.).

Mono Co.: Topaz Lake, ♀, VIII-16-51 (A. T. McClay, U.C.D.).

Monterey Co.: Bixby, ♀, VIII-14-48 (M. Wasbauer, C.I.S.). Hastings Natural History Reservation near Jamesburg, ♀, V-25-38, ♀, VI-12-38 (C. D. Michener, K.U.). Paradise Canyon near Prunedale, ♂, VI-14-49 (P. H. Arnaud, Jr.). Paraiso Hot Springs, ♀, IX-25-19, ♀, IX-28-22, ♀, IX-30-22, ♂, VI-2-23, 10 ♀, VIII-27-24, 2 ♀, IX-1-24, ♀, IX-23-24, ♀, VI-26-26, 2 ♀, IX-12-30, 2 ♀, IX-14-30, 2 ♀, XI-2-30, ♀, IX-28-34 (L. S. Slevin, C.A.S.); ♀, VIII-29-24 (C. L. Fox, C.A.S.); ♂, 4 ♀, IV-8-39 (E. C. Van Dyke, C.A.S.). Sur, 2 ♀, VIII-11-04 (E. J. Newcomer, L.S. Jr. U.). Tassajara Hot Springs, 2 ♀, V-25-20 (L. S. Slevin, C.A.S.).

Modoc Co.: Davis Creek, ♀, VII-15-23 (J. E. Cottle, C.A.S.). Lake City, ♀, VII-29-22 (C. L. Fox, C.A.S.).

Napa Co.: Lake Curry, ♀, VII-23-50, ♀, VII-29-50, ♀, VIII-6-50 (J. N. Simons, C.I.S.). Monticello, 4 ♀, IV-9-30 (C.I.S.); ♂, IV-25-48 (R. M. Bohart, G.E.B.); ♂, IV-16-49 (R. M. Bohart, G.E.B.). Mt. St. Helena, 2 ♂, V-31-15 (C. L. Fox, C.A.S.); ♀, VI-8-18 (E. P. Van Duzee, C.A.S.); 10 ♂, 2 ♀, VI-9-18 (E. P. Van Duzee, C.A.S.); ♀, V-12-26 (M. C. Van Duzee, C.A.S.). Napa, 2 ♂, 2 ♀, IX-5-36 (W. E. Ferguson); 2 ♀, VII-25-52 (D. P. Lawfer, U.C.D.). St. Helena, ♀, IX-11-48, flowers *Solidago* (P. D. Hurd, Jr., C.I.S.).

Nevada Co.: Donner Pass, ♀, VI-5-49 (R. C. Bechtel, U.C.D.).

Orange Co.: Irvine Park, ♀, VIII-4-38 (J. Russell, K.U.). Mt. Santiago, ♀, IX-19-26 (P. H. Timberlake, U.C.R.).

Placer Co.: Alta, ♂, VI-25-33 (G. E. Bohart, G.E.B.). Dutch Flat, VII-1940 (J. Tomich, C.I.S.). Penryn, ♀, X-18-30 (C.I.S.).

Plumas Co.: Lake Almanor, 2 ♀, VI-18-49 (C. I. Smith, C.I.S.); ♂, 2 ♀, VII-8-49 (E. L. Atkinson, C.I.S.); ♀, same data (P. D. Hurd, Jr., C.I.S.). Meadow Valley, ♀, VI-26-24 (C.I.S.); same but 4,000-5,000 ft., 2 ♀, VI-30-24, 2 ♀, VII-4-24, ♀, VII-5-24 (E. C. Van Dyke, C.A.S.). Quincy, 4 mi. W., ♀, VI-19-49 (J. W. MacSwain, C.I.S.); ♂ VI-21-49 (W. F. Ehrhardt, U.C.D.); ♀, same data (W. R. Schreader, U.C.D.); ♀, VI-22-49 (W. R. Schreader, U.C.D.); ♂, VI-25-49 (W. F. Ehrhardt, U.C.D.); ♂, same data (H. A. Hunt, U.C.D.); ♀, same data (W. R. Schreader, U.C.D.); ♂, same data (J. N. Simons, C.I.S.); ♀, VI-29-49 (A. S. Deal, U.C.D.); ♀, same data (J. W. MacSwain, C.I.S.); ♂, VII-2-49 (J. W. MacSwain, C.I.S.); ♀, VII-3-49 (R. L. Sisson, C.I.S.); ♀, VII-7-49 (R. L. Sisson, C.I.S.); ♀, same data (W. H. Wade, C.I.S.); ♀, VII-12-49 (J. N. Simons, C.I.S.). Tobin, ♂, V-13-49 (W. W. Middlekauff, C.I.S.).

Riverside Co.: Banning, 2 ♀, VI-26-33, nesting in redwood (Winslow, U.C.R.); ♂, V-19-51 (E. J. Taylor, U.C.D.). Cathedral City, ♀, VII-16-50 (J. D. Paschke, C.I.S.). Corona, 2 ♀, VII-1910 (C.I.S.). Cottonwood Springs, Joshua Tree National Monument, ♀, IV-26-49, flowers *Larrea* (J. E. Gillaspy, C.I.S.). Dark Canyon, San Jacinto Mountains, ♀, VI-21-40 (H. T. Reynolds, C.I.S.). Dutch Flat, San Jacinto Mountains, ♀, VIII-13-34, flowers *Stachys* (C. D. Michener, K.U.). Idyllwild, 2 ♀, VI-23-28, ♀, VII-1-28, ♀, VII-4-28 (E. C. Van Dyke, C.A.S.); ♂, ♀, VI-1932 (E. E. Seibert, C.I.S.); ♂, VI-4-39, flowers *Penstemon* (E. S. Ross, C.I.S.); ♀, V-23-40, flowers *Cirsium* (C. D. Michener, C.I.S.); ♂, VI-9-40, flowers *Lupinus* (C.I.S.); 3 ♀, VI-16-40, flowers *Rhododendron occidentale* (C.I.S.); ♀, VI-17-40 (E. P. Van Duzee, C.A.S.). Keen Camp, ♂, VI-6 to 12-17 (E. P. Van Duzee, C.A.S.); ♀, V-31-51 (E. G. Linsley, C.I.S.). Palm Desert, ♀, IV-11-59 (P. D. Hurd, Jr., C.I.S.). Palm Springs, ♂, III-26-16, ♀, IV-6-16 (C. L. Fox, C.A.S.); ♂, X-30-38 (R. M. Bohart, C.I.S.). Palm Springs, 5 mi. N., ♀, X-27-34 (P. H. Timberlake, U.C.R.). Piñon Flat, San Jacinto Mountains, ♂, IV-23-50 (C. D. MacNeill, C.I.S.). Riverside, 5 ♀, VII-5-93 (C.U.); ♀, IX-14-27 (P. H. Timberlake, U.C.R.); ♂, V-6-28, flowers *Lonicera japonica* (P. H. Timberlake, U.C.R.); ♂, VI-2-28, flowers *Cestrum* (P. H. Timberlake, U.C.R.); ♂, VI-26-28, flowers *Mirabilis* (P. H. Timberlake, U.C.R.); ♂, IV-29-28, flowers *Phacelia distans* (P. H. Timberlake, U.C.R.); ♂, VI-13-29 (P. H. Timberlake, U.C.R.); ♂, VII-8-29, flowers *Mirabilis* (P. H. Timberlake, U.C.R.); ♂, ♀, VII-15-29 flowers *Mirabilis* (P. H. Timberlake, U.C.R.); ♀, VIII-15-29, flowers *Mirabilis* (P. H. Timberlake, U.C.R.); ♂, V-24-30, flowers *Althaea rosea* (P. H. Timberlake, U.C.R.); ♂, VI-18-32, flowers *Lonicera japonica* (P. H. Timberlake, U.C.R.); ♀, VII-20-32, flowers squash (P. H. Timberlake, U.C.R.); ♀, VII-27-34 (P. H. Timberlake, U.C.R.); ♂, X-4-36, *Lepidospartum squamatum* (P. H. Timberlake, U.C.R.). San Jacinto, ♀, V-30-40 (C. D. Michener, C.I.S.). San Jacinto Mountains, ♂, VII-1912 (J. C. Bridwell, U.S.N.M.); 4 ♀, VI-21-29 (L. D. Anderson, R. H. Beamer, P. W. Oman, K.U.). San Jacinto Mountain Trail, ♂, 4 ♀, VII-1-52 (A. R. Maggenti, C.I.S.); ♂, 3 ♀, same data (D. E. Barcus, U.C.D.); ♀, same

data (E. M. Evans, U.C.D.); ♂, same data (A. T. MacClay, U.C.D.); San Jacinto River, 3,000 ft., San Jacinto Mountains, ♀, VIII-11-34 (C. D. Michener, K.U.). Santa Rosa Mountain, 7,500 ft., ♂, VI-1-40 (C.I.S.). Snow Creek, ♀, VII-18-38 (W. P. Medlar, S.D.M.N.H.). Soboba Hot Springs, 2 ♀, V-31-17, 2 ♀, VI-5-17 (E. P. Van Duzee, C.A.S.). Strawberry Valley, San Jacinto Mountains, 6,000 ft., 2 ♂, VII-1918 (F. Grinnell, Jr., U.C.M.). Whitewater, 5 ♂, X-10-33 (C. M. Dammers, U.C.R.).

Sacramento Co.: Fair Oaks, 2 ♀, V-7-49 (W. F. Ehrhardt, U.C.D.). Folsom, 2 ♀, IV-12-39, ♀, VI-17-39 (Q. Tomich, C.I.S.). Sacramento, ♀, IV-39-50, flowers *Phacelia* (T. R. Haig, U.C.D.); 4 ♂, V-19-51 (H. F. Robinson, U.C.D.); 3 ♂, V-11-53 (S. Miyagawa, U.C.D.); ♀, X-10-50 (S.J.S.).

San Benito Co.: Idria, ♂, VI-29-54 (J. D. Lattin, C. D. MacNeill, J. G. Rozen, C.I.S.).

San Bernardino Co.: Barton Flats, San Bernardino Mountains, ♂, IX-23-46 (N. Crickmer, K.U.). Big Bear Valley, ♀, VII-6-34, flowers *Penstemon* (P. H. Timberlake, U.C.R.); ♀, VII-8-34, flowers *Penstemon* (P. H. Timberlake, U.C.R.). Bluff Lake, San Bernardino Mountains, ♀, July (M.C.Z.). Cajon Valley, ♀, V-17-33, 3 ♂, 2 ♀, VI-20-33, ♂, V-27-35 (C. M. Dammers, U.C.R.). Forest Home, San Bernardino Mountains, ♀, VI-11-28, ♂, VI-12-28, 2 ♂, VI-13-28, ♂, VI-16-28, 2 ♂, VI-17-28, ♂, VI-19-28 (E. C. Van Dyke, C.A.S.); ♂, ♀, VIII-1-30 (C. D. Michener, K.U.); ♀, VII-11-33, ex *Libocedrus decurrens* (L. E. Bell, U.S.N.M.); ♀, V-18-34, flowers *Lupinus* (P. H. Timberlake, U.C.R.); ♂, V-29-34 (C. M. Dammers, U.C.R.); ♂, V-10-35 (P. H. Timberlake, U.C.R.); ♂, IX-22-35, flowers *Chrysothamnus* (P. H. Timberlake, U.C.R.); ♀, IX-22-35 (P. H. Timberlake, U.C.R.); ♂, IX-2-39 (C. M. Dammers, U.C.R.); ♂, VI-17-50 (G. P. Taylor, G.E.B.). Lytle Creek, San Gabriel Mountains, ♂, ♀, VI-6-28, 2 ♀, VI-7-28 (E. C. Van Dyke, C.A.S.). Mill Creek, San Bernardino Mountains, 2 ♂, VI-20-36, flowers *Penstemon grinnellii* (P. H. Timberlake, U.C.R.); ♀, IX-27-36, flowers *Lepidospartum squamatum* (P. H. Timberlake, U.C.R.); ♀, IX-5-37 (P. H. Timberlake, U.C.R.); ♂, IV-21-42, flowers *Penstemon grinnellii* (P. H. Timberlake, U.C.R.); ♂, IV-28-46 (P. H. Timberlake, U.C.R.); ♀, IV-23-50, flowers *Phacelia* (P. H. Timberlake, U.C.R.). Mill Creek, road to Big Bear, San Bernardino Mountains, 5,000 ft., ♀, VIII-12-30 (I. Wilson, U.C.L.A.). Mountain Home, San Bernardino Mountains, ♀, VIII-15-34, flowers *Penstemon* (P. H. Timberlake, U.C.R.). Pachalka Springs, 2 ♂, ♀ (U.C.L.A.). Redlands, 3 ♂, ♀ (F. R. Cole, U.S.N.M.). San Bernardino, ♀, VI-21-34 (E. Harold, U.C.L.A.). Snow Crest Camp, ♂, VII-7-52 (D. E. Barcus, U.C.D.); ♀, VII-7-52 (A. T. MacClay, U.C.D.). Strawberry Flats, San Bernardino Mountains, ♀, VII-6-17 (R. May, L.S.Jr.U.). Upland (Cucumonga Canyon), 2 ♀, XII-21-17 (C.U.). Victorville, ♂, IV-30-18 (J. C. Bradley, C.U.).

San Diego Co.: Anza, 20 mi. S.E., ♂, IX-14-49 (R. P. Allen, C.I.S.). Borego, ♀, IV-25-49 (J. E. Gillaspy, C.I.S.). Camp Pendleton, ♀, IV-22-46 (P. H. Timberlake, U.C.R.). Cuyamaca, ♀, VIII-5-27 (S.D.M.N.H.); ♂, 3 ♀, X-10-40, flowers *Aplopappus parishii* (C. F. Harbison, S.D.M.N.H.). Descanso, ♀, VII-14-14 (W. S. Wright, C.I.S.). Dulzura, ♀, VI-15-17, ♀, VI-16-17, 2 ♀, VI-21-17, ♀, VI-23 and 24-17 (A.M.N.H.). Escondido, ♀, V-27-31 (S.D.M.N.H.); 4 ♂, 3 ♀, I-2-34 (A.M.N.H.). Jacumba, ♂, VIII-12-17 (J. Bequaert, M.C.Z.). Lake Henshaw, ♀, IX-13-35 (A. Smith, S.D.M.N.H.). Mt. Palomar, 5,500 ft., 2 ♀, IX-15-53 (F. X. Williams, C.A.S.). Ramona, ♂, IV-18-38 (E. P. Van Duzee, C.A.S.). Riverview, ♀, VII-19-14 (U.C.R.). San Diego, ♂, ♀ (S.D.M.N.H.). San Felipe Valley, ♀, VI-24 to 28-20 (S.D.M.N.H.). Sentenac Canyon, ♂, III-22-53 (R. Mackie, S.D.M.N.H.). South Indian Canyon, Anza State Park, 2 ♀, VII-9-48 (G. A. Marsh, C.I.S.); ♀, VII-10-48 (G. A. Marsh, C.I.S.). Warner's 7 ♀, VIII-1915 (W. S. Wright, A.M.N.H.); ♂, 2 ♀, IX-1920 (G. H. Field, S.D.M.N.H.). Warner Springs, 7 ♂, IV-19-50 (J. W. MacSwain, C.I.S.).

San Joaquin Co.: Stockton, ♀, VI-19-03 (L.S. Jr.U.).

San Luis Obispo Co.: San Luis Obispo, ♀, VI-17-38 (I. McCracken, C.A.S.); ♂, 2 ♀, I-13-16 (Univ. of Mass.).

San Mateo Co.: Corte Madera Creek, ♂, IV-30-16, flowers *Solanum umbelliferum* (R. Stinchfield, L.S.Jr.U.); ♂, same data, flowers *Lupinus* (R. Stinchfield, L.S.Jr.U.). Half Moon Bay, ♂, V-12-34 (J. Applegarth, S.J.S.). Portola, ♀, IX-25-10 (L.S.Jr.U.). Redwood City, ♂, VI-27-22 (F. X. Williams, C.A.S.); ♂, VI-5-46, IV-19-54, 5 ♂, IV-20-50 flowers *Wisteria* (P. H. Arnaud). San Mateo, ♀, X-1909 (C.U.). Sierra Morena, ♀, VII-1917 (Thompson, L.S.Jr.U.).

Santa Barbara Co.: Santa Barbara, 13 ♀, VIII-1951 (C. A. Downing).

Santa Clara Co.: Alma, 3 ♀, V-16-46, ex redwood (C.I.S.). Alma Dam, VI-16-29 (U.C.D.). Alum Rock Park, ♂, IV-15-36 (C. A. Hamsher, U.C.D.). Los Gatos, ♀, XII-14-16 (H. E. Burke, C.I.S.); ♀, VII-1933 (C. A. Hamsher, U.C.D.); ♀, VIII-1948 (R. Whitney, O.S.C.). Cupertino, ♂, IV-24-41 (H. E. Cortani, S.J.S.). Los Altos, ♂, IV-17-37 (C. A. S.). Lyndon Gulch near Los Gatos, 2 ♀, I-11-20 (Hartmann, C.I.S.). Morgan Hill, 2 ♂, V-23-32

(E. O. Essig, C.I.S.); ♀, IX-5-39, ♀, IX-6-39 (C. E. Mickel, U.M.S.P.). Mountain View, ♂, IV-4-39, ♂, VI-10-39, ♀, VII-17-39, ♂, IV-18-40, ♀, VII-11-41 (all K. Frick, C.I.S.); 2 ♂ (Ehrhorn, U.C.M.). Mt. Hamilton, 3 ♂, V-19-40 (A.M.N.H.). Palo Alto, ♀, VI-22-93 (C.U.); ♀, II-1915 (L.S. Jr.U.); 2 ♂, IV-18-21 (C. D. Duncan, S.J.S.); 3 ♂, IV-19-21 (C. D. Duncan, S.J.S.). San Jose, ♀, III-22-97 (U.S.N.M.); 2 ♂, IV-15-97, ♂, IV-18-97 (L.S.Jr.U.); ♂, V-23-27 (C.I.S.); ♂, IV-7-28 (C.I.S.); ♂, V-26-33 (O. H. Schwab, A.M.N.H.); ♂, V-30-35 (J. Applegarth, S.J.S.); ♂, VI-3-35 (J. Applegarth, S.J.S.); ♀, V-27-38 (M. Green, S.J.S.); ♀, IV-15-39 (M. Green); ♀, V-19-39 (R. Grube, S.J.S.); ♂, V-5-41 (S.J.S.); ♂, V-11-41 (G. Sunia, S.J.S.); ♀ V-5-44 (S.J.S.). San Jose State College Campus, ♂, II-24-40 (G. S. Mansfield). Saratoga, ♂, ♀, VI-3-15 (L.S.Jr.U.); ♂, ♀, VI-20-15 (L.S.Jr.U.); 2 ♀, VII-8-15 (L.S.Jr.U.). Leland Stanford, Jr., University campus, ♂, V-3-00 (L.S.Jr.U.); ♀, IX-1909 (U.C.R.); 3 ♀, X-1914, ♀, III-1915, ♂, V-20-16 (L.S.Jr.U.); ♀, VII-1919 (I. McCracken, L.S.Jr.U.); 2 ♂, V-1923 (L.S.Jr.U.); ♀, V-4-43 (C. D. Duncan, S.J.S.). Stevens Creek, ♀, VIII-5-15 (L.S.Jr.U.).

Santa Cruz Co.: Alma, ♂, ♀, V-26-16, ♂, V-29-16 (C. L. Fox, C.A.S.). Alma (mountains back of), ♂, V-25-19 (E. A. Dodge, C.A.S.). Boulder Creek, 4 mi. N.W., ♂, VI-17-52 (R. H. Beamer, K.U.). Felton, 2 ♂, ♀, V-15 to 19-07, ♂, ♀, V-20 to 25-07 (J. C. Bradley, C.U.); ♂, V-17 to 18-47 (P. H. Arnaud). Freedom, 2 ♀, V-23-45 (W. Colwell, C.I.S.). Mt. Hermon, ♀, IV-18-48 (W. E. Hazeltine, C.I.S.). Santa Cruz, ♂, VI-2-19 (E. P. Van Duzee, C.A.S.); ♂, 2 ♀, V-14-26, ♂, V-17-26, 2 ♂, 2 ♀, V-20-26, 2 ♂, V-28-26, ♂, VI-10-26, ♀, VI-15-26 (C.I.S.); 2 ♀, VI-10-26 (F. J. Spruijt, Univ. Mass.); 4 ♀, VI-23-40 (S.J.S.). Santa Cruz Mountains, 3 ♂, V-14-95 (L.S.Jr.U.); 2 ♂, IV-17-10 (L.S.Jr.U., U.C.R.). Scott Valley, ♂, V-5-40, ♀, V-12-40 (D. Murphy). Soquel, 2 ♀, VI-22-24-50 (M. T. James, W.S.C.). Waddell Creek, 4 mi. N.W., ♂, VI-17-52 (R. H. Beamer, K.U.).

Shasta Co.: Burney, ♂, VI-4-41 (C. W. Anderson, C.I.S.). Castella, 3 ♂, June (J. E. Cottle, C.A.S.). Cayton, ♂, VII-11-18 (E. P. Van Duzee, C.A.S.). Hat Creek, 4 mi. S., 3 ♂, VI-4-41 (P. D. Hurd, Jr., C.I.S.); ♂, VI-1-41, flowers *Wyethia* (C. D. Michener, C.I.S.). Hat Creek Ranger Station, ♀, VII-4-47 (D. W. Adams, C.I.S.). Old Station, ♂, V-17-41 (C.I.S.). Soda Springs, ♂, ♀ (A.N.S.P.).

Sierra Co.: Goodyear Creek, ♀, VII-10-21 (E. H. Nast, C.A.S.). St. Charles Hill, ♀, VII-7-21 (E. H. Nast, C.A.S.).

Siskiyou Co.: Mt. Shasta, ♀, VI-29-35 (E. I. Beamer, K.U.). Mt. Shasta District, 2 ♀, (A.M. N.H.). Shasta Springs, ♂, VI-6-20, ♂, VI-15-20, ♂, VI-17-20, ♂, VII-14-24 (all C. L. Fox, C.A.S.).

Solano Co.: Benecia, ♀ (U.S.N.M.). Green Valley, VI-9-33 (P. H. Timberlake, U.C.R.); ♂, 2 ♀, III-20-36 (R. M. Bohart, G.E.B.); 5 ♂, IV-22-50 (J. N. Simons, C.I.S.); ♀, V-3-50 (Bowers, C.I.S.). Mix Canyon, 2 ♂, IV-5-51 (J. C. Hall, U.C.D.).

Sonoma Co.: Cazadero, ♀, IX-2-18 (E. P. Van Duzee, C.A.S.); ♂, III-29-34 (G. E. Bohart, G.E.B.). Glen Ellen, ♂, VII-25-08 (E. G. Titus, G.E.B.); ♀, IV-28-46 (W. F. Barr, C.I.S.). Santa Rosa, ♂, IV-2-01 (L.S.Jr.U.); ♀, V-20-47 (B. Stevens, U.C.D.). Sebastopol, ♀, V-20-23 (B. C. Cain, S.J.S.). Skaggs Springs, ♀, VII-22-12 (L. Hagenkamp, C.A.S.). Sobre Vista, ♂, IV-29-10, ♀, VI-10-10, 5 ♀, VI-1-11 (all J. A. Kusche, C.A.S.); ♀, June, ♀, July (J. E. Cottle, C.A.S.). The Geysers, 2 ♂, V-10-38 (E. C. Johnson, C.A.S.); ♀, VIII-26-31 (C. D. Duncan, S.J.S.). Watson, ♀, VI-1908 (C.U.).

Stanislaus Co.: Del Puerto Canyon, ♀, VII-16-46 (P. D. Hurd, Jr., C.I.S.). Patterson, 3 ♂, VI-17-53 (W. W. Middlekauff, C.I.S.).

Trinity Co.: Carrville, ♂, ♀, V-25-34 (G. E. Bohart, G.E.B.); ♂, VI-1934 (S. S. Smith, U.C.R.). Trinity Center, 2 ♀, VII-18-53 (A. T. & M. F. McClay, U.C.D.). Trinity River (east fork) ♂, X-2-49 (R. L. Sisson, C.I.S.).

Tulare Co.: Ash Mountain, Sequoia National Park, ♂, ♀, IV-27-50 (L. W. Isaak, U.C.D.). California Hot Springs, ♂, VI-3-39 (E. C. Van Dyke, C.A.S.). Giant Forest, ♀, VIII-22-17 (R. C. Shannon, C.U.); 53 ♀, VIII-9 to 13-27 (J. C. Bradley, C.U.); ♀, III-20-28, ex *Sequoia gigantea* (J. M. Miller, U.S.N.M.); ♀, VII-28-29 (L. D. Anderson, K.U.); 2 ♀, IX-3-32 (P. H. Timberlake, U.C.R.). Kaweah, 5 ♀, VI-10-37 (R. W. Dawson, U.M.S.P.); ♂, ♀, V-20-40 (F. T. Scott, C.I.S.). Loma, ♀, VIII-15-53 (J. C. Downey, U.C.D.). Mineralking, ♀, VIII-4-23 (C. L. Fox, C.A.S.). Old Colony Mill Ranger Station, Sequoia National Park, ♀, VIII-27-33, flowers *Penstemon breviflorus* (C. D. Michener, K.U.). Potwisha, Sequoia National Park, ♀, V-15-29, 2 ♂, V-17-29, ♀, VI-13-29, ♀, VI-2-29, ♀, VI-13-29 (all E. C. Van Dyke, C.A.S.); ♂, VI-14-53 (E. E. Gilbert, C.I.S.). Sequoia National Park, ♀, VI-2-29 (C.I.S.); ♀, V-19-30 (C.I.S.). 2 ♀, VIII-6-40 (L. J. Lipovsky, K.U.). ♀, IV-24-49 (R. C. Bechtel, U.C.D.). Springville, 3 mi. N., ♂, IV-30-47 (P. H. Timberlake, U.C.R.). Three Rivers, 5 ♀, VII-12 to 14-07 (C.U.); ♀, IV-10-52 (J. W. Hinerman, C.I.S.). Visalia, 2 ♂, 6 ♀, XI-13-34 (R. P. Allen, C.A.S.); ♀, VI-20-51 (R. C. Bechtel, U.C.D.). Woodlake, ♂, V-2-47 (N. W. Frazier, C.I.S.).

Tuolumne Co.: Buck Meadow, ♀, VIII-17-52 (J. C. & E. M. Hall, U.C.D.). Eleanor Lake, ♀,

VII-2-51 (S. M. Kappos, U.C.D.); ♂, same data (R. W. Morgan, C.I.S.). Harding Mill Flat, ♀, VIII-17-52 (J. C. & E. M. Hall, U.C.D.). Jamestown, 2 ♀, IV-1915 (L.S.Jr.U.). Lake Eleanor, 2 ♀, VII-24-30 (E. C. Zimmerman, C.A.S.). Pinecrest, ♀, VII-19-48 (P. H. Arnaud, Jr.); 2 ♀, VIII-4-48 (P. D. Hurd, Jr., & J. W. MacSwain, C.I.S.). Rawhide, ♀, VIII-10-15 (L.S.Jr.U.). Strawberry ♀, VII-1-51 (S. M. Kappos, U.C.D.); ♀, same data (D. P. Lawfer, U.C.D.); ♂, VII-12-51 (J. T. Drea, C.I.S.). Tuolumne City, ♂, V-30-53 (J. G. Rozen, C.I.S.).

Ventura Co.: Santa Paula, ♀, VI-9-20 (C.I.S.); ♀, VI-13-26 (C.I.S.); ♀, VII-16-26 (C.I.S.); 2 ♀, VIII-29-26 (U.C.R.); ♂, ♀, VII-23 (D. Burke, C.I.S.); ♀, (C. F. Roesling, U.C.R.). Saticoy, ♀, V-13-25 (C.I.S.); ♀, V-21-21 (C.I.S.). Sespe Canyon, 2 ♀, VIII-12-23 (S. E. Flanders, U.C.R.). Sespe Valley, ♀, VI-9-26 (C.I.S.). Ventura, ♂, ♀, VI-23-26 (C.I.S.).

Yolo Co.: Davis, 2 ♂, VI-1925 (C.I.S.); ♂, VI-11-28 (F. H. Wymore, U.C.D.); ♀, 1930 (F. H. Wymore, U.C.D.); ♂, V-20-46 (U.C.D.); ♀, V-2-40 (K.U.); ♂, IV-10-47 (B. Stevens, U.C.D.); ♀, VII-5-49 (K. W. Tucker, C.I.S.); 2 ♀, IX-49 (J. C. Hall, U.C.D.); ♂, ♀, IV-1950 (J. C. Hall, U.C.D.); ♀, IV-1-50 (A. T. McClay, U.C.D.); ♂, V-1950 (J. C. Hall, U.C.D.); ♀, V-2-51 (F. Phillips, U.C.D.); ♂, V-24-51 (F. Phillips, U.C.D.); ♀, V-25-51 (F. Phillips, U.C.D.); ♂, V-20-53 (W. D. McLellan, U.C.D.). Putah Canyon, ♂, III-14-47 (E. I. Schlinger, U.C.D.); ♂, III-28-49 (E. I. Schlinger, U.C.D.); ♀, IV-21-49 (R. C. Bechtel, U.C.D.); ♂, same data (W. F. Ehrhardt, U.C.D.); 3 ♂, ♀, IV-16-50 (R. C. Bechtel, U.C.D.); ♂, IV-19-50 (J. C. Hall, U.C.D.). Putah Creek, 3 ♂, VII-10 (J. E. Cottle, C.A.S.).

Discussion:

This subspecies is widely distributed in the mountainous regions of California and southern Oregon. It nests in a number of native softwoods, but in northern California seems to prefer redwood. It is the form that is most often reported as nesting in buildings, fence posts, and other such structures. In general its damage is more of an incidental nature, but occasionally serious damage has been reported. During the summer of 1954, while investigating the biologies of certain anthophorine bees in Mexico, Drs. E. Gorton Linsley, Ray F. Smith, and J. W. MacSwain found *Xylocopa tabaniformis rufina* Maidl nesting in a fire-scarred, moss-covered, rotting pine stump eight miles northeast of Uruapan, Michoacán, on August 22, 1954. The details of the burrow structure are shown in plate 5, figure 7.

The nesting habits of the subspecies *orpifex* are discussed in the introduction of this paper. Additional information will be found in the account of that form.

In the United States there are three recognized geographic segregates of *Xylocopa tabaniformis*. Each of these is considered as a subspecies and may be separated in the preceding key.

Several male specimens from the eastern side of the San Jacinto Mountains of southern California very closely approach *X. tabaniformis androleuca* in appearance. The pale vestiture of the head and thorax of these specimens is strikingly like that of *androleuca*. The vestiture of the abdomen, however, is unlike that of *androleuca*. The close approximation of phenotypic expression to this subspecies may have arisen as an environmental response, since the eastern slopes of the San Jacinto Mountains are much like those of the Great Basin Montane.

The Nevada record is based upon a female taken at Minden, August 24, 1952, by Dr. R. M. Bohart.

An interesting account of certain phases of the biology of this subspecies has been discussed by Leach (1921: 47-49, 55). Observations were made at Deerwood, Mendocino County, California, and Mt. Diablo, Contra Costa County, California. At the Deerwood locality the bees were observed nesting in a redwood post. At Mt. Diablo Leach (*ibid.*) found the bee puncturing the blossoms of *Salvia* in order to obtain the nectar.

Xylocopa tabaniformis androleuca Michener, new combination

Xylocopa orpifex androleuca Michener, 1940, Bull. South. Calif. Acad. Sci., 39: 127. Type ♂, Kayenta, Navajo County, Arizona (C.A.S.).

Geographic range: Arizona, California (Great Basin Montane), Nevada, New Mexico, and Utah (see map 2).

California records:

Inyo Co.: Panamint Valley, 2 ♂, IV-1891 (C. V. Riley, U.C.M., U.S.N.M.). Surprise Canyon, Panamint Mountains, ♂, IV-29-53 (G. A. Marsh, C.I.S.); 2 ♂, IV-29-53 (R. O. Schuster, C.I.S.). Wildrose Springs, Panamint Mountains, 2 ♂, IV-16-38 (J. W. Johnson, K.U.).

Discussion:

This subspecies most probably has developed in response to the environmental conditions prevailing in the Great Basin Montane. The vestiture of the head and thorax in the male is very pale and quite extensive. The females are indistinguishable from those of *orpifex*, but may be placed geographically.

Nothing is known of its nesting habits under natural conditions. I found it nesting in a douglas fir porch studding of a mountain home in Surprise

Canyon, Panamint Mountains, California. The entrance to the burrow was on the vertical surface, and owing to its location further observations could not be made. The only known flower record for this subspecies is one provided by Dr. G. E. Bohart, who found five males visiting the flowers of a scarlet *Penstemon* at Zion National Park, Utah, on May 5, 1948.

Subgenus *Neoxylocopa* Michener

This subgenus is composed of those species in which the males often are yellowish, fulvous, or testaceous in coloration. The face markings are usually quite extensive so that large areas of the clypeus, frons, and lateral parts of the face adjacent to the inner eye margins are yellowish. By contrast the females are predominantly black, and many forms have strongly violaceous tints on the wings. In the male the gonoforceps are not bifid but are attenuate distally with the apices somewhat expanded.

The scale of the posterior tibia of the female is not foveate. Further details will be found in Michener (1954:157).

Two species are present in the Nearctic area. One, *Xylocopa brasilianorum* (Linnaeus), in which the sexes are strongly dichromatic is known to extend in distribution from the Brazilian region northward into the southwestern United States. The other, *X. artifex* Smith, apparently occurs in the higher mountain areas of southern Arizona and southward into Argentina and Brazil.

Xylocopa brasilianorum (Linnaeus)

Apis brasilianorum Linnaeus, 1767, Syst. Nat. 12, p. 961 [♂].

Geographic range: South America north to southwestern United States; a form which is apparently identical to the subspecies *varipuncta* has become established in the Hawaiian Islands.

Discussion:

This neotropical species occurs throughout much of southwestern United States. There are a number of closely related forms recorded from the Americas, and a critical study of this complex is greatly needed. At present there is not sufficient material to permit an interpretation of the *brasilianorum* complex for those forms known to occur in Mexico. The males are poorly represented in collections and apparently are not often encountered in the field. However, there is sufficient material to substantiate the interpretation of two subspecies in America north of Mexico. The females of these subspecies are easily separable by the wing coloration, but no consistent differences have been noted apart from geography, which may be used to distinguish the males.

Key to the Females of *Xylocopa brasilianorum* Occurring in America North of Mexico

1. Wings heavily infuscated, upper surfaces strongly violaceous and with reflections of blue and purple . . . . . *brasilianorum* (p. 59)
   Wings not heavily infuscated except apically, upper surfaces bronzy with reflections of violet . . . . . *varipuncta* (p. 61)

Xylocopa brasilianorum brasilianorum (Linnaeus)

Apis brasilianorum Linnaeus, 1767, Syst. Nat., 12, p. 961 [♂]. Type ♂. "Habitat in America."

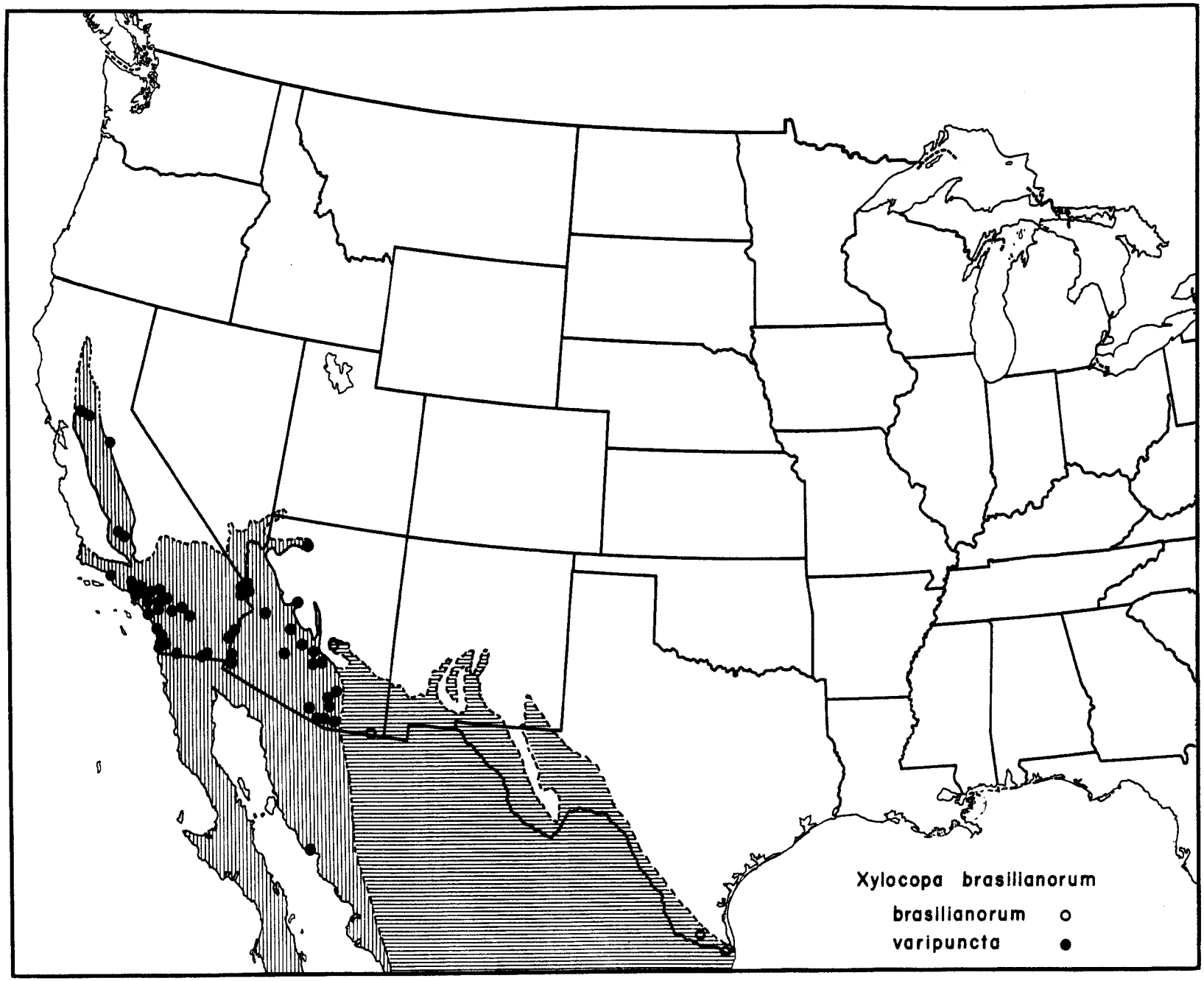
Synonyms: *Xylocopa mexicanorum* Cockerell. *X. wilmattae* Cockerell and *X. wilmattae gualanensis* Cockerell are possible synonyms of the nominate subspecies.

Geographic range: South America north to Texas and eastern Arizona (see map 3).

Discussion:

The females of this subspecies may be readily placed by use of the accompanying key. Only a few males are known, and a study of these has failed to demonstrate any character which might be used to distinguish them from the subspecies *varipuncta*.

A review of the Mexican material used during the preparation of this study suggests that some of the forms currently considered as synonyms or possible synonyms are most likely best considered as subspecies. However, since there are relatively so few specimens available for study, any interpretation at this time would be premature.



Map 3. Distribution of *Xylocopa brasilianorum, s. str.*, and *X. brasilianorum varipuncta* Patton.

Xylocopa brasilianorum varipuncta Patton

Xylocopa varipuncta Patton, 1879, Canad. Ent. 11:60, ♀, Type ♀, Arizona (U.S.N.M.).

Geographic range: Arizona, California, Mexico (see map 3).

California records:

Imperial Co.: Bard, 2 ♀, 1918 (H. R. Reed, U.S. N.M.); ♂, 1919, flowers cowpea (H. R. Reed, U.S. N.M.); ♀, VIII-19-20, flowers *Medicago sativa* (H. R. Reed, U.S.N.M.). Calexico, ♀, VII-31-31 (H. W. Capps, K.U.). Heber, 7 mi. E., ♀, VII-21-50 (K. W. Tucker, U.C.D.). Holtville, ♀, IV-6-49 (P. D. Hurd, Jr., C.I.S.). Palo Verde, 3 ♀, VIII-27-46, flowers *Sesbania* (P. D. Hurd, Jr., C.I.S.). Yuma, ♀, VII-8 (U.S.N.M.).

Kern Co.: Bakersfield, 2 ♀, VI, VII-1938 (C.I.S.). Kern Park, ♀, VII-9-46, ♀, VII-18-46, ♀, VII-24-46, (F. A. Ehrenford, C.I.S.). Poso Creek, ♀, IV-20-50 (R. M. Bohart, U.C.D.). Shafter, ♂, II-5-37 (G. L. Smith, C.I.S.).

Los Angeles Co.: Annandale, ♀, VIII-9-17 (R. May, L.S.Jr.U.). Beverly Hills, ♀ (O. P. Medsger, A.M.N.H.). Claremont, ♂, 4 ♀, 1916 (M. H. Hatch, U.M.); ♀, IX-19-27 (T. Craig, C.A.S.); ♂, 2 ♀ (C. F. Baker, C.U., U.C.R.); ♀ (P. Blanchard, C.U.); ♀ (E. O. Essig, U.C.R.); 2 ♀ (Metz, A.M.N.H.); ♀ (C. H. Muzzall, C.A.S.); 2 ♀ (E. P. Stone, I.N. H.S.); ♂ (O.S.C.). Eagle Rock Park, 2 ♂, IV-14-33 (C. D. Michener, K.U.). El Monte, ♂, May (U.S. N.M.); 4 ♀, VII-28-48 (W. E. Kelson, C.I.S.). Etiwanda, ♀, VII-12-38 (R. Scott, O.S.C.). Glendale, ♀, VI-6, boring in *Alnus* (H. H. Keifer); 2 ♂, III-1930 (F. B. Foley, O.S.C.); 3 ♀, IV-6-30 (F. B. Foley, O.S.C.); ♀, IV-11-30 (F. B. Foley, O.S.C.); ♀, VII-12-41 (E. I. Schlinger, U.C.D.); ♂, VI-18-46 (E. I. Schlinger, U.C.D.). Hollywood, ♂, VII-1-30 (C.I.S.); ♂, V-23-50 (C.I.S.). Huntington Park, ♀, IX-6-49 (R. L. Langston, C.I.S.). Laurel Canyon, ♂, V-6-17 (R. May, L.S.Jr.U.). Los Angeles, ♀, VI-30-12 (J. C. Bridwell, U.S.N.M.); ♀, IV-1916 (R. May, L.S.Jr.U.); ♀, VII-18-16 (R. May, L.S.Jr.U.); ♂, III-19-17 (H. Klotz, L.S.Jr.U.); ♀, VII-1922, flowers *Datura metaloides* (T. D. A. Cockerell, U.C.M.); ♀, VII-1931 (E. S. Ross, C.A. S.); 4 ♀, IV-19-34 (C. A. Schroeder, U.C.L.A.); ♀, VI-1934 (G. Grant, U.M.); ♀, IV-20-36 (R. Burns, U.C.L.A.); ♀, IV-21-36 (R. Burns, U.C.L.A.); ♀, V-11-36 (H. W. Deitz, U.C.L.A.); ♀, III-5-36 (C.I. S.); ♀, VI-10-50 (G. P. Taylor, U.S.A.C.); ♀ (D. Coquillett, U.S.N.M.); 11 ♂, 3 ♀ (A.M.N.H.). Ontario, ♀, VI-23, (R. E. Snódgrass, L.S.Jr.U.); ♀, VII-4-? (R. E. Snodgrass, L.S.Jr.U.). Pasadena, ♀, VI-21-91 (R. W. Doane, L.S.Jr.U.); ♂, IV-23-98 (F. Grinnell, Jr., C.U.); ♀, III-29-18 (C.U.); ♂, VII-11-27 (C. D. Michener, K.U.); ♀, VIII-13-29 (E. G. Anderson, U.M.S.P.); 2 ♀, VIII-1930 (C. D. Michener, K.U.); ♀, VII-10-32 (C. D. Michener, K.U.); ♀, II-20-33 (C. D. Michener, K.U.); ♀, III-3-33, flowers *Buddlea* (C. D. Michener, K.U.); ♂, V-1933 (C. D. Michener, K.U.); ♀, VII-29-33, flowers Palo Verde (C. D. Michener, K.U.); ♀, VIII-7-33, flowers *Vetix* (C. D. Michener, K.U.); ♂, IX-9-34 (C. D. Michener, K.U.); 2 ♂, 14 ♀ (A.M. N.H.). Puente Creek, ♂ (J. D. Maple, U.C.R.). Puente Hills, ♂, XI-3-29 (P. H. Timberlake, U.C. R.). San Dimas, ♀, II-5-38 (K. Frick, C.I.S.). San Fernando Valley, 4 ♀, VI-1917 (D. Barry, L.S.Jr. U.). San Marino, ♀, VII-23-52 (D. E. Barcus, U.C. D.). Silver Lake, ♀, VII-24-33 (A. L. Olson, U.M.). South Gate, ♀, IV-30-52 (J. W. Hinerman, C.I.S.). Upland, ♂ (T. Craig, C.A.S.). Tarzana, ♀, VIII-4-49 (U.C.D.). Westwood Hills, ♂, 3 ♀, IV-1935 (U.C.L.A.); ♀, V-6-39 (G. F. Smith, A.M.N.H.); ♀, V-15-39 (G. F. Smith, A.M.N.H.); ♀, VI-26-35 (E. G. Linsley, C.I.S.). Whittier, ♂, II-15-11 (U.C. R.); 3 ♂, ♀, VII-4-30 (L. C. Fife, U.M.S.P.); ♂, 11-29-44, ex nest in apple tree (O. Marshburn, U.C.R.); ♀, VIII-20-50 (H. M. Graham, C.I.S.).

Orange Co.: El Toro, ♀, VIII-14-40 (C.I.S.). Laguna Beach, ♀ (M. Cate, C.U.). Santa Ana, ♀, X-20-31 (A. T. MacClay, C.I.S.); 3 ♀, III-29-42, flowers *Wisteria* (P. D. Hurd, Jr., C.I.S.). Yorba Linda, ♀, X-28-28, flowers *Brassica campestris* (P. H. Timberlake, U.C.R.).

Riverside Co.: Blythe, ♀, VIII-20-27 (C.U.); ♀, XI-22-36, flowers *Sphaeralcea emoryi* (P. H. Timberlake, U.C.R.); ♀, VII-15-38, flowers *Medicago sativa* (P. H. Timberlake, U.C.R.); ♂, III-7-39 (K. E. Stager, U.C.D.); ♀, VI-22-45, flowers *Medicago sativa* (E. G. Linsley, C.I.S.); ♀, VI-17-46 (C.I.S.); ♀, VII-5-46 (C.I.S.); ♀, VII-26-46 (W. F. Barr, C.I.S.); ♀, VIII-9-46, flowers *Sesbania macrocarpa* (P. D. Hurd, Jr., C.I.S.); 21 ♀, VIII-20-46, flowers *Sesbania macrocarpa* (J. W. Mac Swain, C.I.S.); 4 ♀, VIII-28-46, flowers *Sesbania macrocarpa* (P. D. Hurd, Jr., C.I.S.); ♀, V-21-47 (E. G. Linsley, C.I.S.); ♀, VI-19-47 (J. W. Mac Swain, C.I.S.). Cathedral City, ♀, X-9-36 (E. G. Linsley, C.I.S.). Elsinore, ♀, XI-11-18, in apricot and apple wood (H. J. Quayle, U.S.N.M.); ♀, XI-24-18 same data (U.C.R.). Hemet, ♀, VII-2-46 (C.I.S.); ♀, VII-9-46, flowers *Medicago sativa* (J. W. MacSwain, C.I.S.). Indio, ♀, VII-6-40 (A. T. MacClay, U.C.D.). Palm Springs, 2 ♂, 7 ♀, II-24-97 "ex cottonwood logs" (H. G. Hubbard, U.S.N.M.); ♂, III-30-16 (C. L. Fox, C.A.S.); ♀, III-31-16 (C. L. Fox, C.A.S.); ♀, IV-1-16 (C. L. Fox, C.A.S.); ♀, V-21-17 (E. P. Van Dyke, C.A.S.); ♀, IV-18-21 (C. A. Hill, C.A.S.); ♂, V-24-40 (H. T. Reynolds,

C.I.S.); ♀, V-4-44 (C.U.); 4 ♂, ♀, 1945 (U.C.R.); ♂, II-21-54, ♀, II-23-54 (P. H. Arnaud, Jr.). Riverside, ♀, XII-23-22, "ex Chinese paper plant" (C. F. Stahl, U.C.R.); ♀, VIII-28-24, flowers *Trichostema lanceolatum* (P. H. Timberlake, U.C.R.); ♀, IX-24-24, same flower (P. H. Timberlake, U.C.R.); ♀, VI-12-25, flowers passion flower (P. H. Timberlake, U.C.R.); ♀, VII-4-25 (P. H. Timberlake, U.C.R.); ♂, V-30-26 (P. H. Timberlake, U.C.R.); ♀, VI-22-26 (Woodley, U.C.R.); ♀, V-28-27, flowers *Astragalus parishii* (P. H. Timberlake, U.C.R.); ♀, VI-8-27, flowers *Salvia* (P. H. Timberlake, U.C.R.); ♀, III-30-28, flowers *Eschscholtzia californica* (P. H. Timberlake, U.C.R.); ♂, IV-14-28 (P. H. Timberlake, U.C.R.); ♀, VI-20-28, flowers *Solanum douglasii* (P. H. Timberlake, U.C.R.); ♀, VII-1-28 (P. H. Timberlake, U.C.R.); ♀, IV-29-29, flowers *Lonicera* (P. H. Timberlake, U.C.R.); ♀, I-19-33, flowers *Lantana* (P. H. Timberlake, U.C.R.); ♀, V-20-33, flowers *Lathyrus odoratus* (P. H. Timberlake, U.C.R.); ♂, V-27-34 (C. M. Dammers, U.C.R.); ♀, X-13-34 (N. Shamel, U.A.); ♀, VI-27-35 (P. H. Timberlake, U.C.R.); 3 ♀, VII-13-36 (W. C. Reeves, C.I.S.); ♂, IV-10-39 (E. P. Van Duzee, C.A.S.); ♀, II-24-40 (P. H. Timberlake, U.C.R.); ♂, IX-26-42 (P. H. Timberlake, U.C.R.); ♀, XI-25-43, "ex nest block of wood" (P. H. Timberlake, U.C.R.); ♂, II-13-44, "ex nest stick of wood" (P. H. Timberlake, U.C.R.); ♂, III-29-44 (P. H. Timberlake, U.C.R.); ♂, IV-2-44 (P. H. Timberlake, U.C.R.); ♂, IV-14-48 (P. H. Timberlake, U.C.R.); ♀, VII-15-48, flowers tomato (J. W. Lesley, U.C.R.); ♀, VIII-14-48 (M. A. Cazier, A.M.N.H.). San Jacinto, ♂, ♀, I-8-38 (J. R. Warren, A.M.N.H.). Soboba Hot Springs, 2 ♀, V-31-17 (E. P. Van Duzee, C.A.S.); ♂, 3 ♀, VI-3-17 (E. P. Van Duzee, C.A.S.); ♀, VI-5-17 (E. P. Van Duzee, C.A.S.).

Sacramento Co.: Sacramento, ♀, VI-21, (H. H. Keifer).

San Bernardino Co.: Cajon Pass, 3 ♀, VI-26-49 (L. W. Isaak, U.C.D.). Colton, ♀, III-22, IV-7 (F. A. Eddy, M.C.Z.). Glen Ivy (trail above), San Bernardino Mountains, 2 ♀, V-13-28 (P. H. Timberlake, U.C.R.). Needles, 19 ♀, IV-1 to 7-18 (J. C. Bradley, C.U.); ♀, IX-27-21 (J. A. Kusche, C.A.S.); ♀, V-19-40 (C.I.S.). Needles, 20 mi. S., ♀, VIII-25-46, flowers *Asclepias* (P. D. Hurd, Jr., C.I.S.). Redlands, 3 ♀, VII-10-10 (U.C.R.); ♀, IX-30-14 (F. R. Cole, U.S.N.M.); ♀, (F. R. Cole, U.S.N.M.).

San Diego Co.: Camp Pendleton, ♂, IV-22-46 (P. H. Timberlake, U.C.R.). Campo, ♀, IV-27-39 (R. M. Bohart, U.C.L.A.). Carlsbad, ♂, IV-27-51 (T. R. Haig, C.I.S.). East San Diego, ♀, V-11-48 (G. A. Marsh, C.I.S.). Escondido, ♀, V-27-32 (S.D. M.N.H.). Fairmont Canyon, ♂, IV-25-48 (G. A. Marsh, C.I.S.). Flinn Springs, 4 ♀, VII-4-31 (S.D. M.N.H.). Julian, ♀, IV-17-46 (W.S.C.). Lakeside, ♀, V-29-53 (R. Mackie, S.D.M.N.H.) Mt. Helix. 4 ♀, VII-3-31 (S.D.M.N.H.) San Diego, ♀, VI-30-37 (F. W. Furry, U.M.); ♀, IX-1947 (T. F. Thorne, U.C.R.); ♀, VI-14-36 (S.D.M.N.H.) ♂, VI-12-15 (G. H. Field, S.D.M.N.H.); ♂, III-28-24 (S.D.M. N.H.); ♂, V-25-36 (Miss Allen, S.D.M.N.H.); ♂, 2 ♀ (W. S. Wright, S.D.M.N.H.).

Tuolumne Co.: Columbia, ♀, VIII-1917 (I. Mc Cracken, L.S.Jr.U.).

Ventura Co.: Oxnard, ♀, IV-20-24, ♂, VI-29-29 (S. E. Flanders, U.C.R.). Santa Paula, ♀, VI-1-23 (D. Burk, C.I.S.); ♂, II-10-26 (C. T. Dodds, C.A.S.) ♀, IV-8-27 (A. S. Harrison, C.I.S.); ♀, IV-8-29 (A. S. Harrison, C.I.S.); ♂, E. O. Essig, U.C.R.). Saticoy, ♂, VIII-2-26 (C.I.S.); 2 ♀, VII-24-27 (T. Craig, C.A.S.).

Yolo Co.: Davis, ♂, IX-9-48, ♀, IX-15-48 (E. I. Schlinger, U.C.D.).

Discussion:

The females of this subspecies are frequently encountered in large numbers flying about the flowers of various native and introduced plants. In southern California I have frequently observed large congregations of them about the blossoms of *Wisteria*. Along the Colorado River similarly large numbers of females have been seen at the flowers of *Sesbania macrocarpa*. The males are rarely seen since they do not frequent the flowers as do the females, and also there are indications that the males are not as long lived as are the females.

Leach (1921:47) found this subspecies quite commonly at Palm Springs. He remarks that "holes in logs, fence posts and other dead wood, into which a person could insert a finger, made by these bees are frequently seen." The burrows, he stated, are about a foot deep and "in the farther part [the bee] makes lateral cells for the accomodation of their [*sic!*] young."

Xylocopa artifex Smith

Xylocopa artifex Smith, 1874, Trans. Ent. Soc. London, pp. 289-290, ♀, Type ♀, "South Brazil" (British Museum [Natural History].)

Synonym: *Xylocopa erratica* Smith.

Geographic range: Argentina north into the mountains of southern Arizona.

Discussion:

This species has been not previously reported from the United States. It belongs to a complex of little understood forms which appear to center their distribution in South America.

Brèthes (1916:411) considered the two species described by Smith (1874), *X. artifex* and *X. erratica*, to be sexes of the same species and accordingly synonymized them, choosing the name *X. artifex* for the species. Brèthes further stated that those females which several previous authors had regarded as *Xylocopa colona* Lepeletier (and therefore both *X. artifex* and *X. erratica* as synonyms of *X. colona*) were not assignable to the species *X. colona* as described by Lepeletier. In the absence of a critical study of the species in this complex, the interpretation made by Brèthes has been followed.

In the collections of the University of Arizona are five males which were taken on November 27, 1916, at Tucson, Arizona. There is no indication of the collector. A single male labeled "Baboquivari Mts., Ariz., Sept. 23, 1933, Bryant, Lot 241" is in the collections of the California Academy of Sciences. No females were recognized in any of the material collected within the United States.

The female of *X. artifex* is strikingly similar to those of the subgenus *Neoxylocopa*, but is much smaller and has the abdomen finely punctured throughout. In general, the female superfically looks like a small specimen of *X. brasilianorum*.

Subgenus *Schönherria* Lepeletier

This subgenus is represented in the Nearctic region by two very distinctive species, *Xylocopa loripes* Smith and *X. micans* Lepeletier, the latter of which is the type of *Schönherria*.

The subgenus is composed chiefly of bright, metallic-colored species. The ventral surface of the abdomen is, in many of the males, largely yellowish or testaceous. The scale of the posterior tibia of the female is not foveate. Moreover, the sixth metasomal tergum of the female has the two rows of spines scarcely diverging anteriorly so that they form near the apex of the tergum a very acute angle in relation to each other.

In the male the gonoforceps are each provided with a projection on the inner surface so that when viewed dorsally the gonoforceps appear to be bifid. For further details consult Michener (1954:156).

Xylocopa micans Lepeletier

Xylocopa micans Lepeletier, 1841, Hist Nat. Ins. Hymen., 2:208. Type ♂, "Caroline" (Europe).

Synonyms: *Apis nasuta* Christ, 1791, is possibly the name of this species. *Xylocopa purpurea* Cresson and *X. vidua* Lepeletier are synonyms of *X. micans* Lepeletier.

Geographic range: Alabama, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Texas and south to Guatemala (see map 4).

Discussion:

This is the very strikingly metallic-colored bee of the southeastern United States. In the collections of the Philadelphia Academy of Natural Sciences there is a female specimen bearing the label "Cala."

It is very unlikely that this species occurs under natural conditions in California, but it is of course possible that it may have been received or emerged in shipment or is mislabeled.

Scarcely anything is known of the biology. One female specimen in the collections of Cornell University bears the information that it was taken "from a nest in stick" on July, 1912, at Billy's Island, Okefenoke Swamp, Georgia.

Graenicher (1930:165) records that the following flowers are visited by this species in Florida: *Serenoa serrulata, Sabal Palmetto, Philibertella clausa, Solanum bahamense, S. Wendlandi, Chamaecrista brachiata, Crotalaria pumila, Dalbergia ecastophyllum,* and *Bidens leucantha*. One additional Florida record is *Lythrum*. In Texas it has been taken on cotton and *Parkinsonia*.

Xylocopa loripes Smith

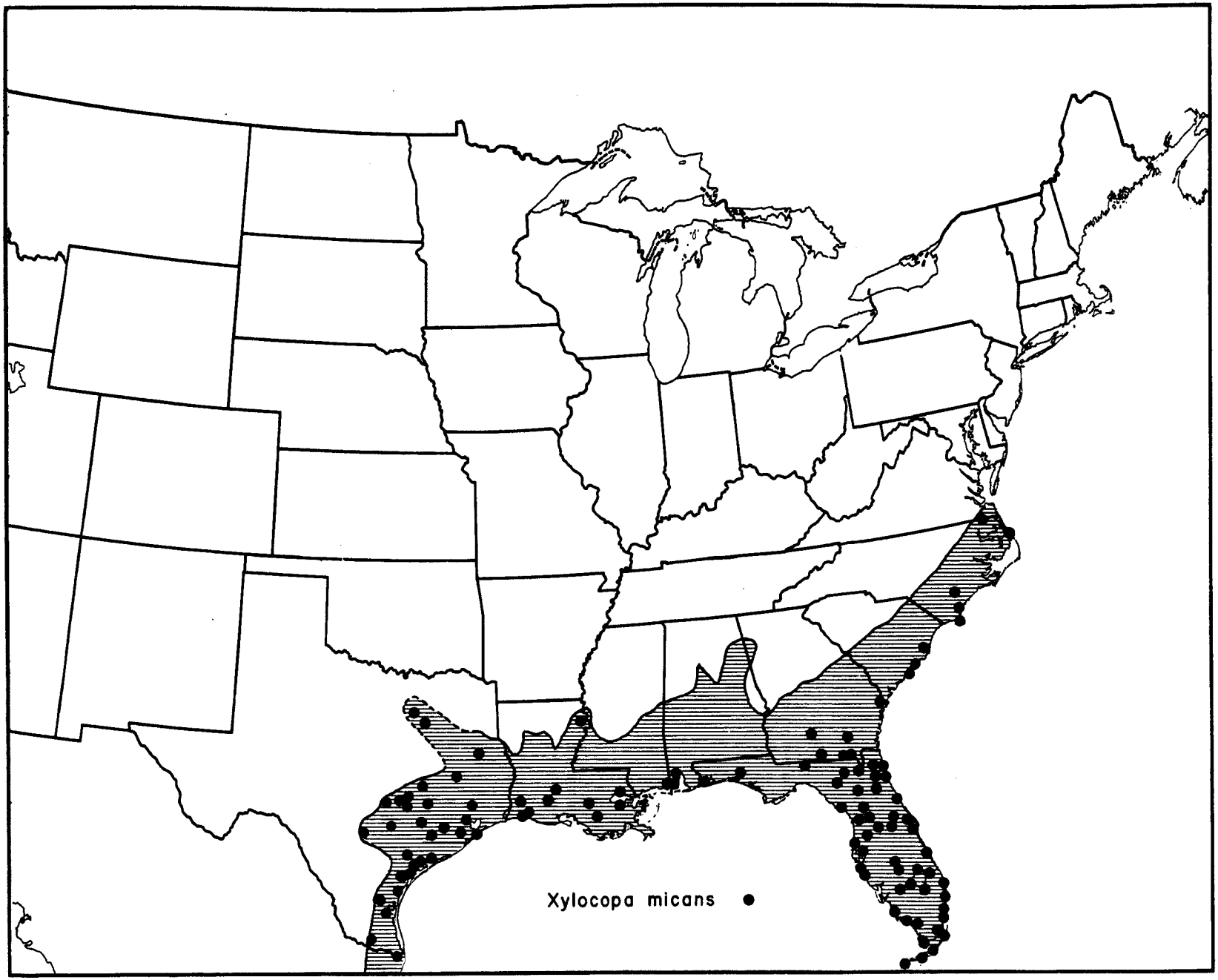
Xylocopa loripes Smith, 1874, Trans. Ent. Soc. London, pp. 298-299, ♂. Type ♂, "Mexico (Oajaca)." [British Museum (Natural History).]

Synonym: *Xylocopa formosa* Smith, 1874, *op cit.*, pp. 299-300, ♀ (Mexico). New synonymy.

Geographic range: Arizona and Mexico.

Discussion:

This species, the sexes of which were described as separate species, has previously been known from but a few Mexican specimens. In the collections of the Museum of Comparative Zoölogy, Harvard, are four specimens from southeastern Arizona. Three of these, two males and a female, were collected in the Santa Rita Mountains, September 5th, by F. M. Carpenter. The other male is labeled "Palmerlee, Ariz., May, Banks Collec-



Map 4. Distribution of *Xylocopa micans* Lepeletier.

tion." One additional female is in the Ohio State University collection and is from "Ramsey Canyon, Huachuca Mountains, Arizona, W. H. Mann."

Cockerell (1920:168) in recording a female from Mexico, D.F., Mexico, remarked that this specimen appeared to be large for the species, but otherwise agreed with the characters enumerated by Maidl (1912:319). Cockerell also intimated that *X. loripes* and *X. formosa* represented the sexes of the same species. Since the Arizona material suggests that this association is correct, I consider *Xylocopa formosa* Smith as a synonym of *Xylocopa loripes* Smith.

The male of *X. loripes* has the posterior tibia deeply notched on the exterior surface near the apex. In this characteristic it is unlike any other species known from the Nearctic region.

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PLATES

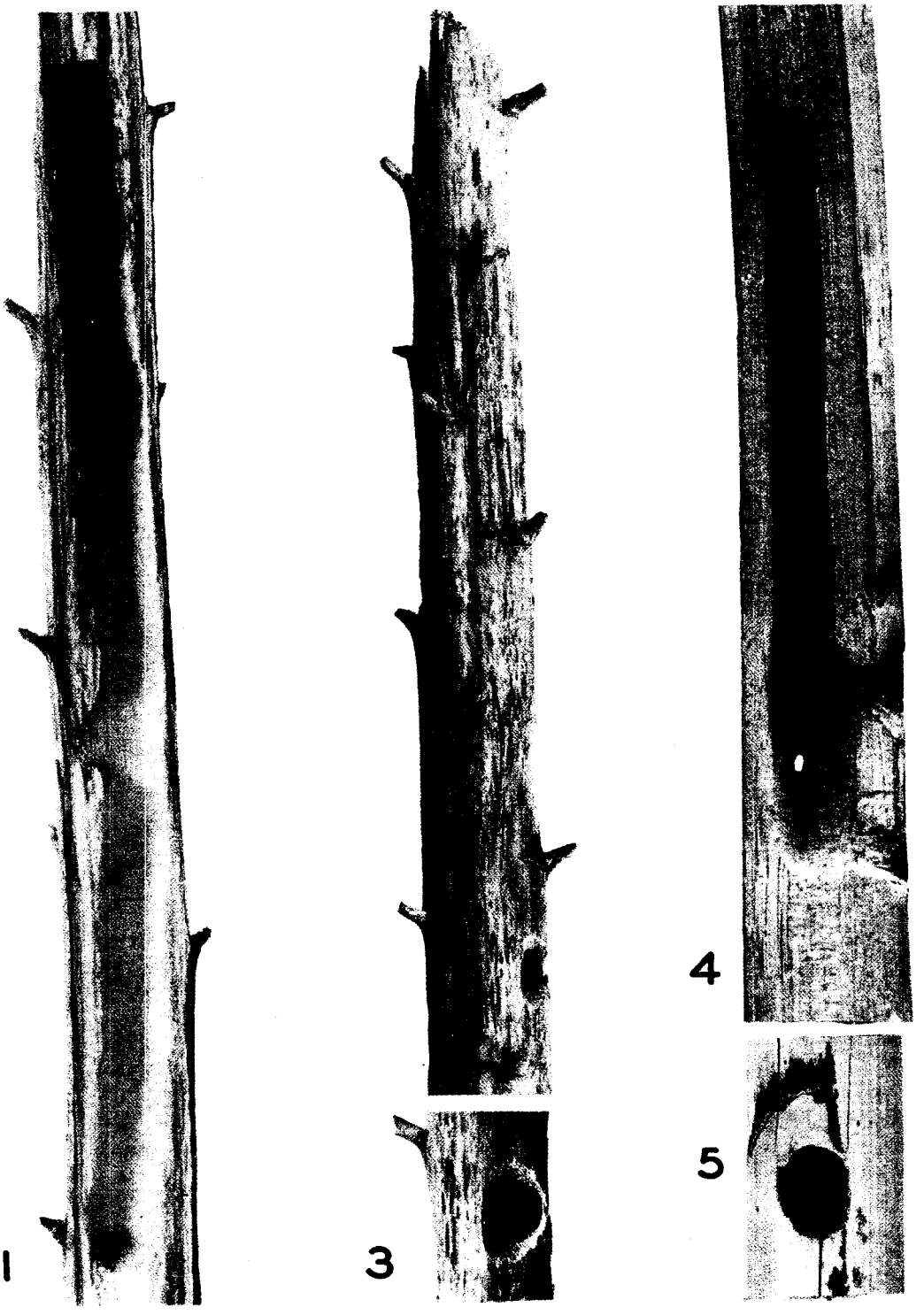

Plate 3

Nest entrances and burrows of *Xylocopa californica* Cresson.
Fig. 1. Longitudinal section of the nest of the subspecies *diamesa* in *Yucca whipplei*.
Figs. 2, 3. Details of the nest entrance of that shown in fig. 1.
Fig. 4. Longitudinal section of the nest of the subspecies *arizonensis* in *Agave*.
Fig. 5. Details of the nest entrance of that shown in fig. 4.

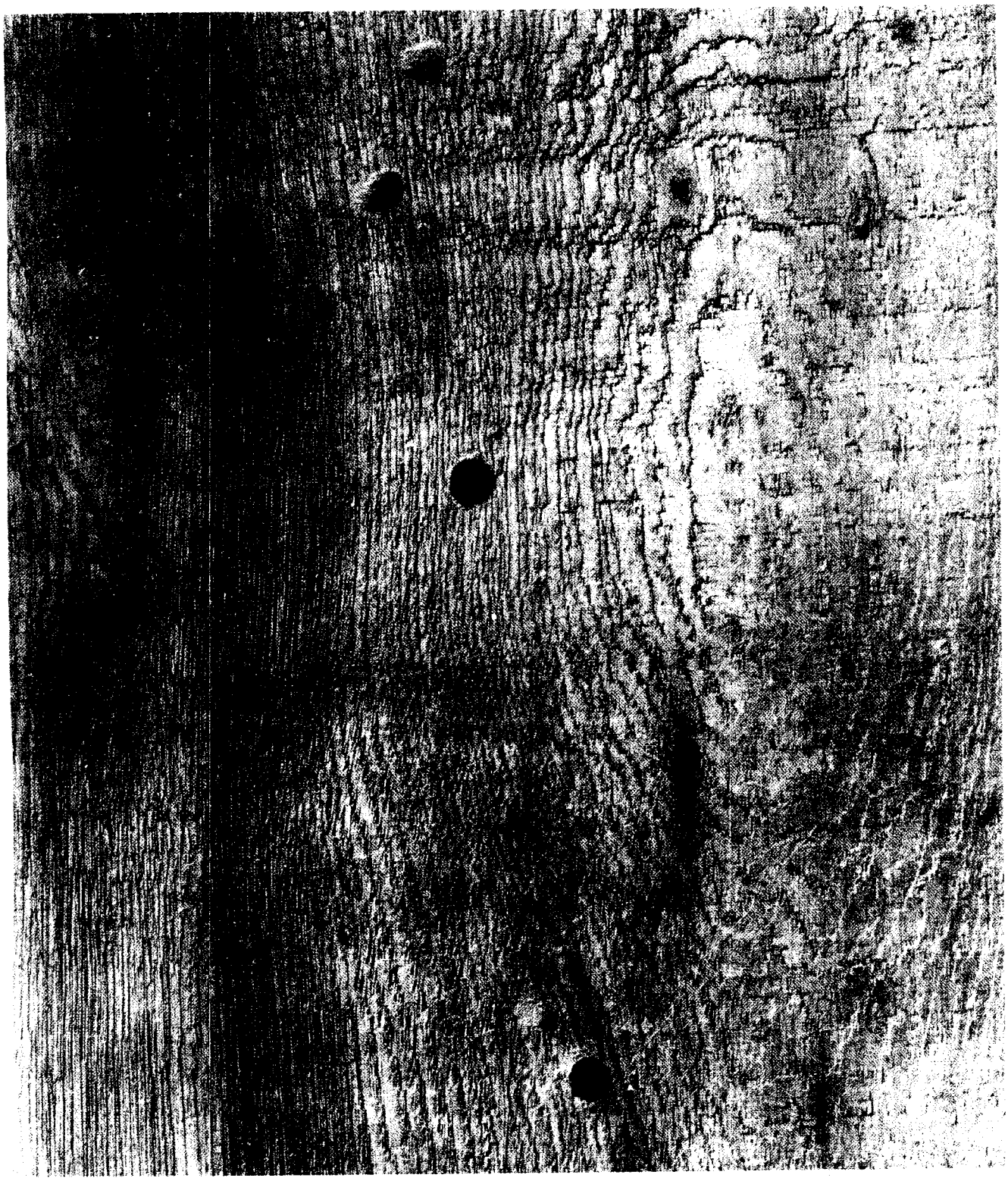

Plate 4

An example of the attempts of entrance borings of a female of *Xylocopa tabaniformis orpifex* in a coast redwood board.

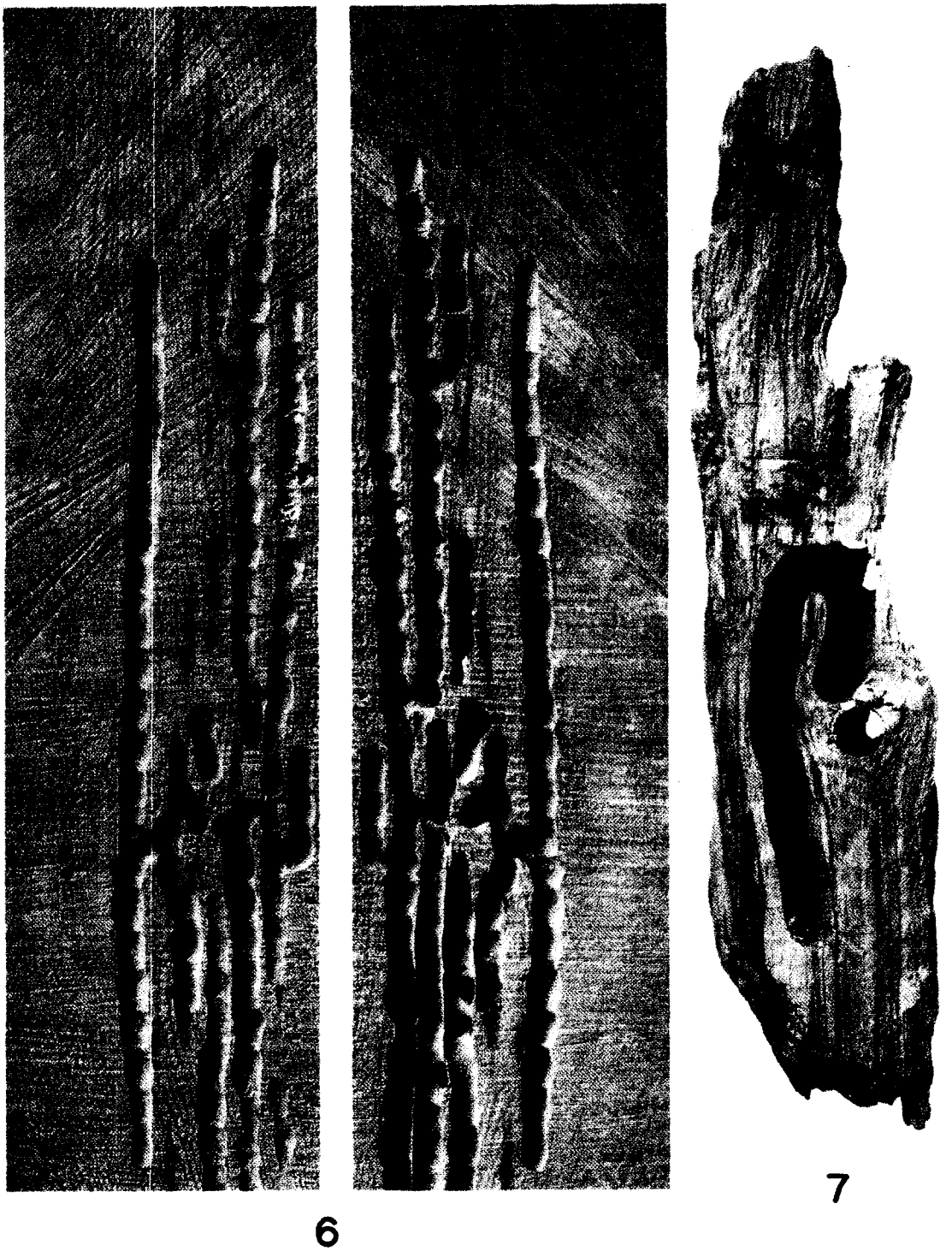

Plate 5

Details of nesting burrows of *Xylocopa tabaniformis* Smith.

Fig. 6. Companion longitudinal sections of the nesting burrows of the subspecies *orpifex* in a coast redwood board.

Fig. 7. Longitudinal section of the burrow of the subspecies *rufina* from a decaying pine stump.

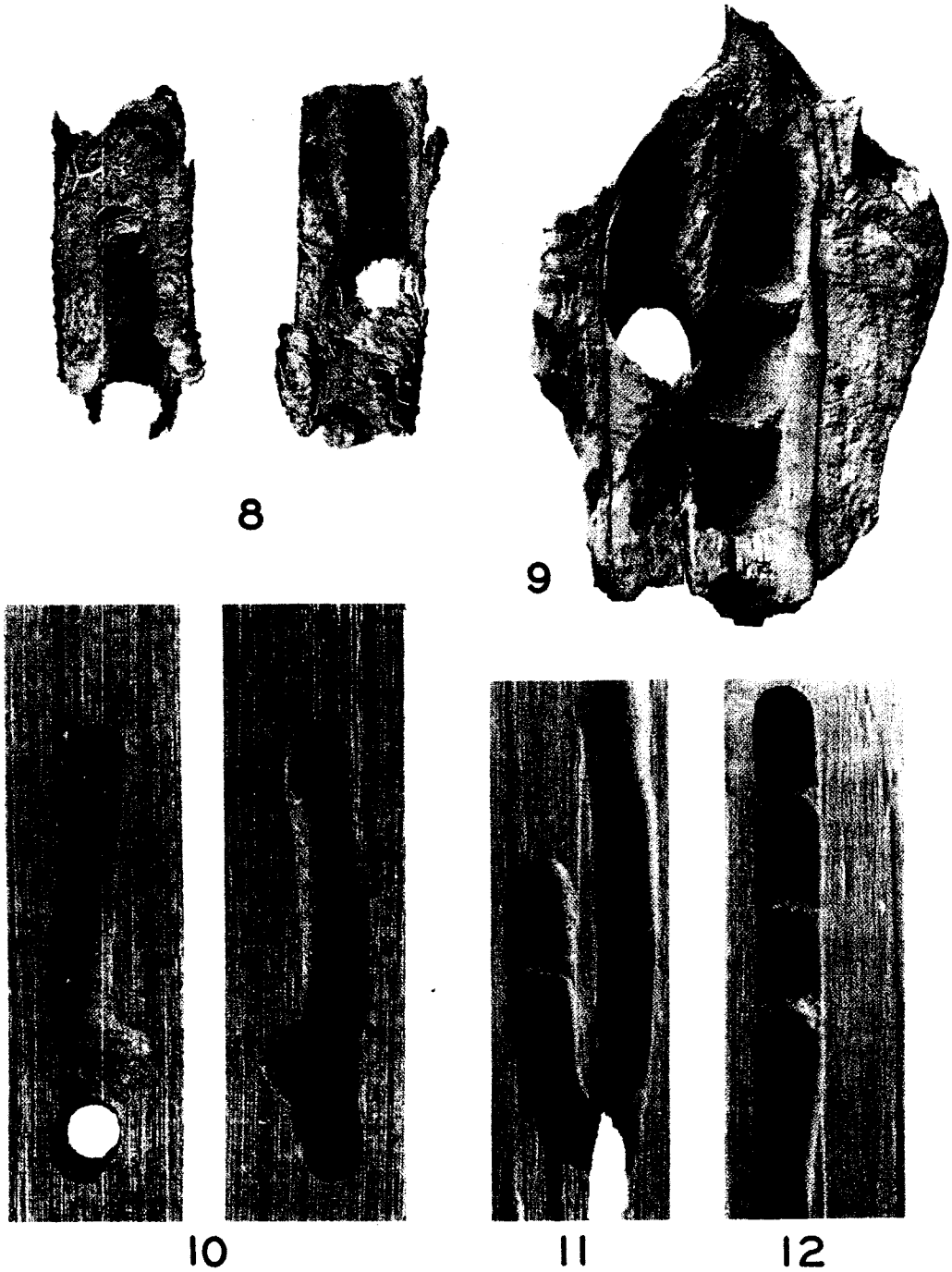

Plate 6

Details of nesting burrows and cells of *Xylocopa tabaniformis orpifex* (figs. 8, 10, 11, 12) and of *Xylocopa brasilianorum varipuncta* (fig. 9).

Fig. 8. Companion longitudinal sections of a nest of the subspecies *orpifex* in alder.

Fig. 9. Part of the nest of the subspecies *varipuncta* from a decaying cottonwood log.

Figs. 10, 11, 12. Burrow and cell detail of three first-year nests of the subspecies *orpifex* in structural coast redwood.